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HYDROLOGIC REPORT

for

C.A.P. OVERCHUTES
AGUA FRIA FLOODPLAIN DELINEATION STUDY
MARICOPA COUNTY, ARIZONA

FCD 90-49

ACK ENGINEERS, INC.

May 1991

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HYDROLOGIC REPORT FOR C.A.P. OVERCHUTES
AGUA FRIA FLOODPLAIN DELINEATION STUDY
MARICOPA COUNTY, ARIZONA

SCOPE OF WORK

The hydrologic study presented in this report is a part of the scope of work performed by AGK Engineers, Inc. for the Flood Control District of Maricopa County under Contract FCD 90-09. The project under this contract consists of topographic mapping and floodplain/floodway delineation for Caterpillar Tank and Twin Buttes Washes, located just a mile west of the Agua Fria River, as shown in Figure 1.

The purpose of this hydrologic study is to evaluate and determine the following:

- The 100-year peak discharges for various locations within the watershed
- The effect of ponding immediately upstream of the C.A.P. Canal

WATERSHED DESCRIPTION

Caterpillar Tank and Twin Buttes Washes, tributaries to the Agua Fria River, are situated approximately 3 miles west of Lake Pleasant Road, as shown in Figure 1. The size of the watershed is approximately 12.2 square miles, of which 3.4 square miles for Caterpillar Tank Wash and 8.8 square miles for Twin Buttes Wash. Twin Buttes Wash has two major tributaries, namely, White Peak Wash and Garambullo Wash. The locations of these washes are shown on Plate 1.

The watershed drains generally from north to south. However, the natural drainage pattern of the upper watershed has been slightly altered since the Central Arizona Project (C.A.P.) Canal was constructed in the early 1980's. A portion of the runoff from the upper watershed is now intercepted by the canal and routed along the canal

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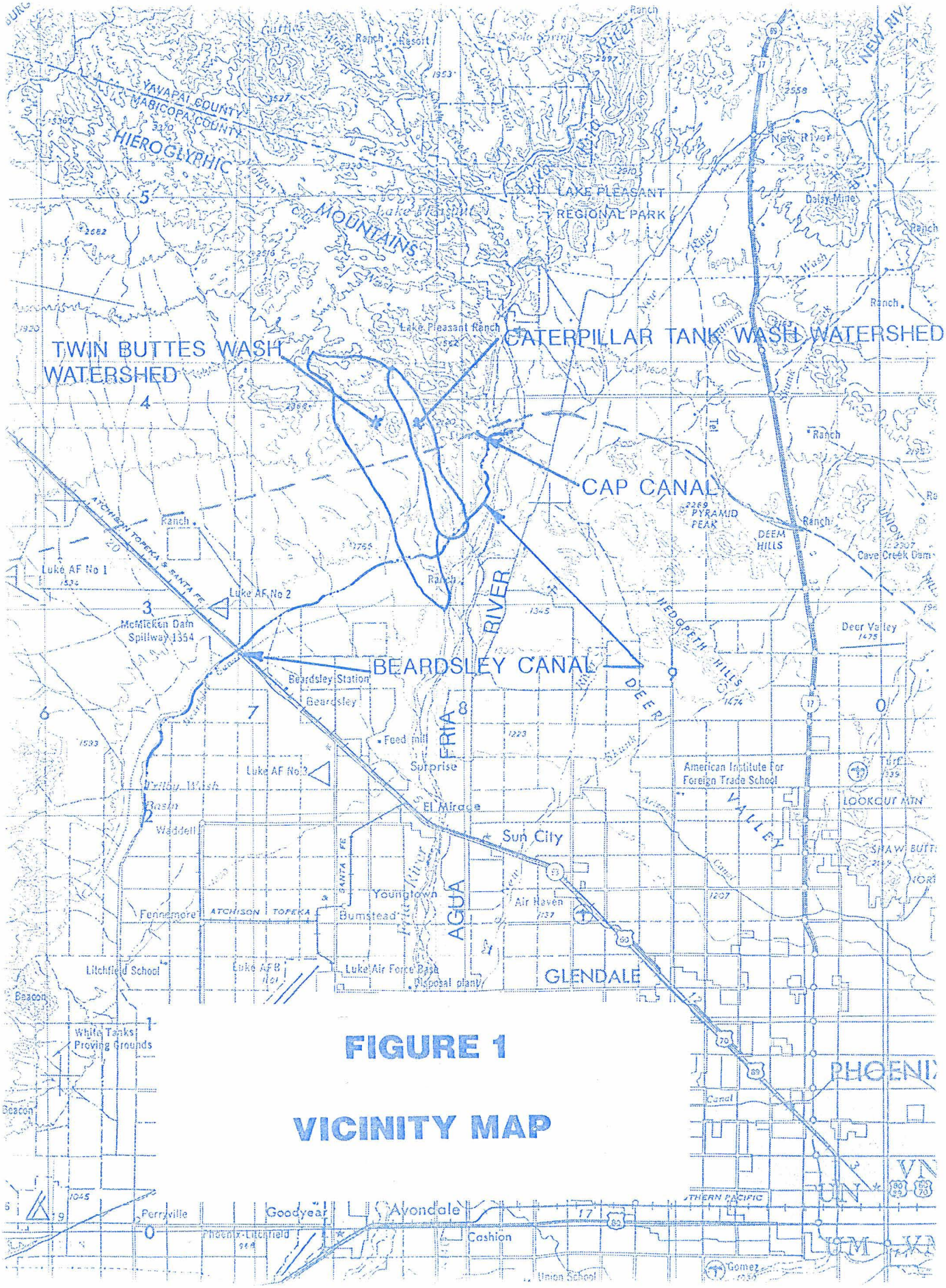


FIGURE 1

VICINITY MAP

to Caterpillar Tank and Twin Buttes Washes through 6 pipe culverts under the canal, as shown on Plate 1. The sizes and locations of the pipe culverts are as follows:

Crossing No.	C.A.P. Station	Pipe Size	Upstream Inv. Elev.	Downstream Inv. Elev.	Watershed Name
1	561+40	72"	1508.00	1505.95	Caterpillar Tank
2	549+00	30"	1513.94	1508.09	Twin Buttes
3	538+25	30"	1518.99	1510.74	Twin Buttes
4	492+30	4 - 72"	1500.13	1494.08	Twin Buttes
5	480+90	30"	1515.92	1512.09	Twin Buttes
6	459+30	30"	1519.13	1512.93	Twin Buttes

A stock pond, known as Caterpillar Tank, is located immediately south of the C.A.P. Canal to collect and store the storm runoff from Caterpillar Tank Wash for stock grazing.

Topography in the watershed is generally desert rangeland with rolling hills on the east and isolated steep bare rock hills north of the C.A.P. Canal. The predominant rock hilly terrain is known as Twin Buttes, which is located at the north central portion of the watershed.

The climate of the study area is characterized by hot summer, mild winter and infrequent rainfall. The mean annual rainfall is about 7.5 inches, falling normally in two seasons. One season, primarily resulting from local convective storms, lasts from July to mid-September; the other season, mainly formed by cyclonic (frontal) storms, extends from December through March. Of the two types of storms, the summer convective storm is considered to be the more critical flood producing event in this area.

Soils in the watershed are predominantly sandy loam and clay loam. More detailed information on soils is presented in the section of METHODOLOGY. The land within the watershed is virtually in its natural state.

Natural vegetation is sparse with plant species being typical to desert areas. Cacti, along with other desert shrubs, grow throughout the watershed. Scattered trees, such as palo verde and mesquite, exist among the shrubs. The vegetation tends to be thicker along and adjacent to the stream courses. Perennial grasses grow after winter rains.

PREVIOUS STUDIES AND REPORTS

To our best knowledge, no hydrologic study has been specifically performed for floodplain delineation purposes in this watershed.

The Bureau of Reclamation presumably had some drainage studies performed for the upper portion of the watershed when sizing the pipe culverts under the C.A.P. Canal. However, AGK Engineers was unable to obtain the drainage calculations or reports during the course of this study.

METHODOLOGY

In the absence of historical gaging data in this area, the peak flows in this study were obtained through hydrologic modeling. The hydrologic modeling was performed by means of the HEC-1 computer program as developed by the U.S. Army Corps of Engineers (Reference 1). The estimation procedures for model parameters and components were generally based on the Hydrologic Design Manual (hereinafter referred to as the Manual) published by the Flood Control District of Maricopa County (Reference 2).

1. **Subareas**

The watershed was divided into 23 subareas to form an interconnected system of stream network components, as shown in Figure 2. Boundaries of the subareas were determined based on the USGS quadrangle maps (Reference 6), and the 1" = 400' topographic maps prepared by Aerial Mapping Company (Reference 7). Field verification supplemented mapping inadequacies in the determination of subarea boundaries.

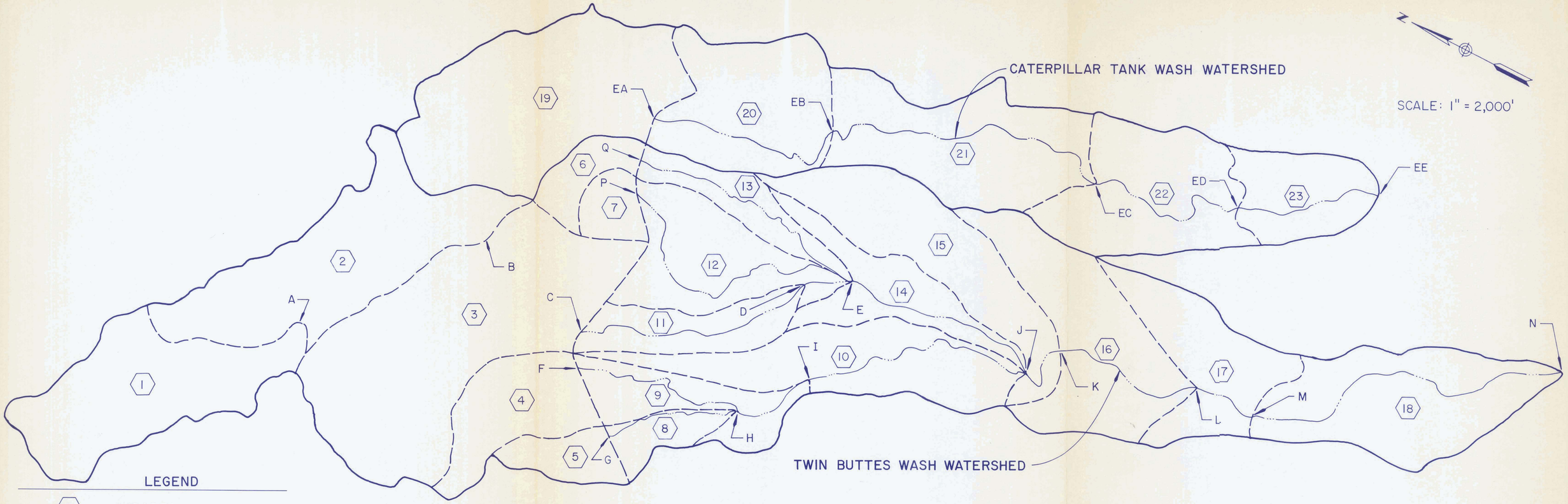
2. **Soils**

Information on soil groups was obtained from the *Soil Survey of Aguila - Carefree Area*, published by the Soil Conservation Service (SCS) in April 1986 (Reference 3). Boundaries of the soil groups are shown in Figure 3.

3. **Rainfall Input**

The estimated rainfall depths for various durations and frequencies were obtained from the charts derived from the NOAA Atlas published for Arizona (Reference 5). The 100-year, 6-hour storm was used as the input for peak flow estimation, while the 100-year, 24-hour storm was used for flow volume estimation. Rainfall depths for the 100-year, 6-hour and 24-hour storms were estimated to be 3.32 and 4.14 inches, respectively. The detailed procedure for rainfall input determination is presented in Appendix A.

The distribution and areal reduction for the 6-hour storm were obtained by use of a computer program known as MCUHP1, which was developed by the District. The SCS Type II Distribution was used for the 24-hour storm. An areal reduction of 0.987 (as obtained from NOAA HYDRO-40) was applied for the 24-hour storm.



LEGEND

(3)	SUBAREA
F	CONCENTRATION POINT
———	WATERSHED BOUNDARY
- - - - -	SUBAREA BOUNDARY
—··—	CHANNEL THALWEG

FIGURE 2
SUBAREA MAP LOCATION

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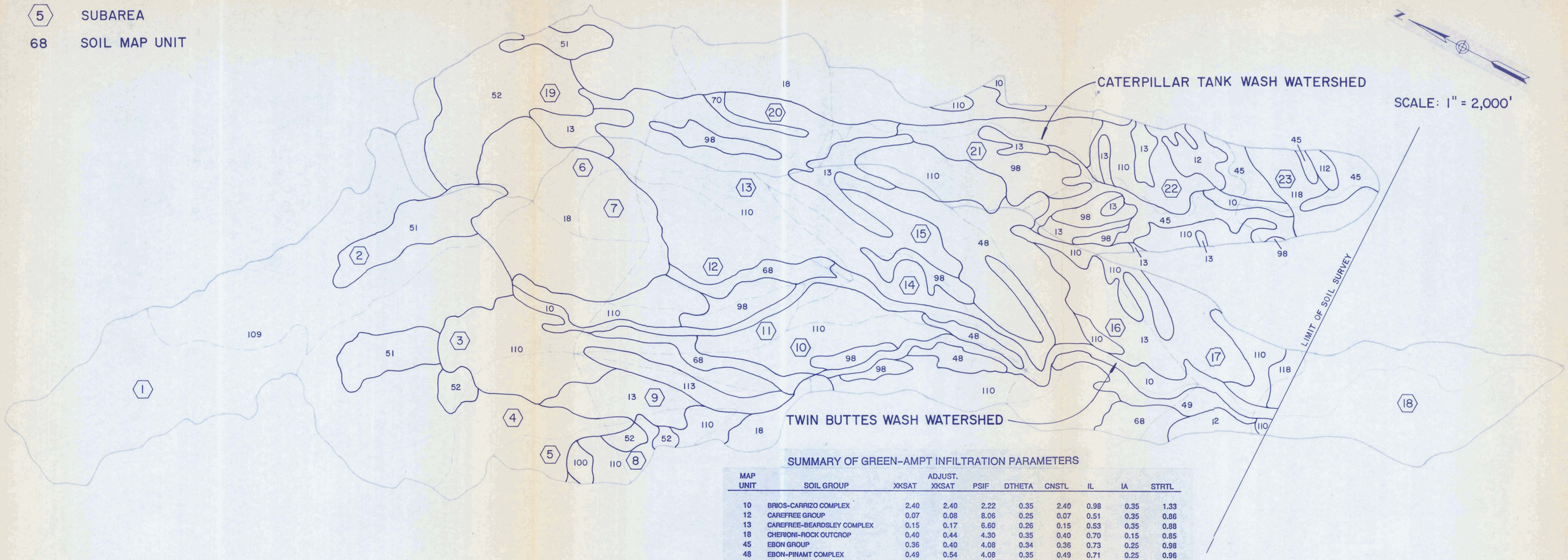
(5) SUBAREA

68 SOIL MAP UNIT



SUMMARY OF GREEN-AMPT INFILTRATION PARAMETERS

MAP UNIT	SOIL GROUP	XKSAT	ADJUST. XKSAT	PSIF	DTHETA	CNSTL	IL	IA	STRTL
10	BRIOS-CARRIZO COMPLEX	2.40	2.40	2.22	0.35	2.40	0.98	0.35	1.33
12	CAREFREE GROUP	0.07	0.08	8.06	0.25	0.07	0.51	0.35	0.86
13	CAREFREE-BEARDSLEY COMPLEX	0.15	0.17	6.60	0.26	0.15	0.53	0.35	0.88
18	CHERIONI-ROCK OUTCROP	0.40	0.44	4.30	0.35	0.40	0.70	0.15	0.85
45	EBON GROUP	0.36	0.40	4.08	0.34	0.36	0.73	0.25	0.98
48	EBON-PINAMT COMPLEX	0.49	0.54	4.08	0.35	0.49	0.71	0.25	0.96
49	EBON-PINAMT COMPLEX	0.59	0.65	3.85	0.35	0.59	0.72	0.15	0.87
51	GACHADO-LOMITAS COMPLEX	0.53	0.58	3.98	0.35	0.53	0.71	0.25	0.96
52	GACHADO-LOMITAS-ROCK OUTCROP	0.51	0.56	4.24	0.35	0.51	0.72	0.15	0.87
68	GUNSIGHT-CIPRIANO COMPLEX	0.53	0.58	4.23	0.35	0.53	0.72	0.35	1.07
70	GUNSIGHT-RILLITO COMPLEX	0.48	0.53	4.10	0.35	0.48	0.71	0.25	0.96
98	PINAMT-TREMANT COMPLEX	0.57	0.63	4.20	0.35	0.57	0.72	0.35	1.07
100	QUILOTOSA-VAIVA ROCK OUTCROP	0.40	0.44	4.30	0.35	0.40	0.70	0.15	0.85
109	SCHENCO-ROCK OUTCROP	0.38	0.42	4.20	0.35	0.38	0.70	0.15	0.85
110	SUNCITY-CIPRIANO COMPLEX	0.56	0.62	3.92	0.35	0.56	0.72	0.35	1.07
112	TREMANT GROUP	0.50	0.55	4.06	0.35	0.50	0.71	0.35	1.06
113	TREMANT GROUP	0.48	0.53	4.10	0.35	0.48	0.71	0.35	1.06
118	TREMANT-RILLITO COMPLEX	0.61	0.67	4.18	0.35	0.61	0.73	0.35	1.08

THE INFORMATION ON SOIL GROUPS WAS OBTAINED FROM THE SOIL SURVEY OF AQUILA-CAREFREE AREA, PUBLISHED BY SCS IN APRIL 1986.

FIGURE 3
SOILS MAP

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4. Rainfall Losses

Rainfall losses, which consist of surface retention loss and infiltration loss, were computed from the Green-Ampt method. The parameter estimation for the Green-Ampt method is discussed below and summarized in Table 1. The detailed procedures for estimation of rainfall losses are presented in Appendix B.

Surface Retention Loss - The surface retention loss (IA) for each soil group was estimated on the basis of land use pattern and soil slopes obtained from Reference 3, as well as the criteria given in Table 4.1 of the Manual.

Percent of Outcrop - The weighted value of percent of rock outcrop (RTIMP) for each subarea was computed according to the information obtained from Reference 3.

Infiltration Loss - The three parameters as coded in HEC-1 for infiltration loss are:

- Hydraulic conductivity at natural saturation (XKSAT)
- Wetting front capillary suction (PSIF)
- Volumetric soil moisture deficit (DTHETA)

The parameter values for various soil groups were taken from Table 4.2 of the Manual, according to soil textures. The weighted values of these parameters were subsequently computed for all the subareas. The selection of DTHETA was based on the dry antecedent soil moisture condition. In addition, the values for XKSAT were adjusted according to a vegetation cover of 20 percent for all soil groups other

TABLE 1

SUMMARY OF GREEN-AMPT INFILTRATION PARAMETERS

Watershed Subarea	Area (sq miles)	IA (in)	DTHETA (in)	PSIF (in)	Adjusted XKSAT (in/hr)	RTIMP %
TWIN BUTTES WASH WATERSHED						
1	0.74	0.15	0.35	4.20	0.42	35.00
2	0.91	0.17	0.35	4.16	0.45	27.09
3	1.38	0.20	0.35	4.11	0.51	21.47
4	0.38	0.23	0.34	4.34	0.46	21.55
5	0.15	0.21	0.35	4.13	0.48	22.72
6	0.15	0.21	0.34	4.44	0.45	11.22
7	0.12	0.15	0.35	4.29	0.44	14.77
8	0.13	0.29	0.34	4.41	0.53	8.09
9	0.31	0.30	0.32	4.96	0.40	4.24
10	0.62	0.34	0.35	3.85	0.75	2.06
11	0.29	0.35	0.35	3.68	0.96	1.50
12	0.50	0.32	0.35	4.00	0.63	3.90
13	0.22	0.35	0.35	3.89	0.66	2.87
14	0.34	0.34	0.35	3.63	0.95	1.91
15	0.64	0.31	0.34	4.23	0.60	1.37
16	0.70	0.31	0.33	4.50	0.64	0.83
17	0.46	0.34	0.30	5.31	0.51	0.76
18	0.73	0.35	0.29	3.87	0.38	0.04
CATERPILLAR TANK WASH WATERSHED						
19	1.03	0.18	0.34	4.38	0.49	15.63
20	0.61	0.26	0.35	4.14	0.53	7.67
21	0.76	0.29	0.34	4.31	0.57	4.58
22	0.63	0.32	0.33	4.73	0.49	1.34
23	0.33	0.31	0.35	4.03	0.63	0.07

than Brios-Carrizo Complex, which is composed of sands and loamy sand soils.

As shown in Figure 3, the southern tip of the watershed is located outside the detailed soil study limits. However, the *SCS General Soil Map for Maricopa County* (Reference 4), indicates that the soil in this area is basically of the Rillito-Gunsight-Pinal Association. Therefore, the values of XKSAT, PSIF, and DTHETA were still estimated from Table 4.2 of the Manual; and XKSAT was adjusted according to a vegetation cover of 20 percent.

5. Unit Hydrograph and Time of Concentration

The Clark unit hydrograph was used in the computation of peak discharges in this study because all the subareas are less than 5 square miles in size. The Clark unit hydrograph consists of three parameters:

- Time of Concentration
- Storage Coefficient
- Time-Area Relation

Time of Concentration - The Papadakis method was used for estimating the time of concentration. It is a function of length and slope of the flow path, average rainfall intensity, and the watershed resistance coefficient, which is a function of watershed type and size. The values of the parameters are shown in Table 2. The length and slope of the flow path for each subarea were obtained from the topographic map (Plate 2). A slope adjustment procedure for slopes greater than 200 feet per mile was implemented for subareas 3, 4, 5, 6, and 7. This procedure was based on Figure 5.4, of the Manual. The

TABLE 2
PARAMETERS FOR ESTIMATION OF TIME OF CONCENTRATION

TWIN BUTTES WASH WATERSHED

BASIN	BASIN AREA		BASIN LENGTH		BASIN ELEVATION			SLOPE		ADJ. SLOPE	Kb
NUMBER	Sq. Miles	Acres	Feet	Miles	Highest	Lowest	Change	Ft/Ft	Ft/Mi	Ft/Mi	
1	0.74	473.6	10680	2.02	1970	1700	270	0.025	133.5	133.5	0.043
2	0.91	582.4	12940	2.45	2040	1580	460	0.036	187.7	187.7	0.042
3	1.38	883.2	10260	1.94	1920	1500	420	0.041	216.1	210.0	0.039
4	0.38	243.2	7000	1.33	1920	1520	400	0.057	301.7	266.0	0.047
5	0.15	96.0	4000	0.76	1970	1520	450	0.113	594.0	315.0	0.053
6	0.15	96.0	4200	0.80	2190	1520	670	0.160	842.3	340.0	0.053
7	0.12	76.8	3200	0.61	2140	1520	620	0.194	1023.0	360.0	0.054
8	0.13	83.2	3760	0.71	1520	1460	60	0.016	84.3	84.3	0.054
9	0.31	198.4	7620	1.44	1520	1440	80	0.010	55.4	55.4	0.048
10	0.62	396.8	14320	2.71	1540	1365	175	0.012	64.5	64.5	0.044
11	0.29	185.6	7120	1.35	1500	1440	60	0.008	44.5	44.5	0.049
12	0.50	320.0	9000	1.70	1520	1420	100	0.011	58.7	58.7	0.046
13	0.22	140.8	7500	1.42	1520	1420	100	0.013	70.4	70.4	0.050
14	0.34	217.6	9880	1.87	1500	1365	135	0.014	72.1	72.1	0.048
15	0.64	409.6	11000	2.08	1510	1360	150	0.014	72.0	72.0	0.044
16	0.70	448.0	9500	1.80	1440	1330	110	0.012	61.1	61.1	0.044
17	0.46	294.4	6620	1.25	1392	1320	72	0.011	57.4	57.4	0.046
18	0.73	467.2	10120	1.92	1320	1235	85	0.008	44.3	44.3	0.043
TOTAL	8.77										

CATERPILLAR TANK WASH WATERSHED

BASIN	BASIN AREA		BASIN LENGTH		BASIN ELEVATION			SLOPE		ADJ. SLOPE	Kb
NUMBER	Sq. Miles	Acres	Feet	Miles	Highest	Lowest	Change	Ft/Ft	Ft/Mi	Ft/Mi	
19	1.03	659.2	9620	1.82	1730	1530	200	0.021	109.8	109.8	0.041
20	0.61	390.4	6120	1.16	1530	1460	70	0.011	60.4	60.4	0.044
21	0.76	486.4	9000	1.70	1460	1380	80	0.009	46.9	46.9	0.043
22	0.63	403.2	5500	1.04	1380	1315	65	0.012	62.4	62.4	0.044
23	0.33	211.2	4380	0.83	1315	1260	55	0.013	66.3	66.3	0.048
TOTAL	3.36										

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rainfall intensity for each subarea was automatically computed by the MCUHP1 computer program. The values for resistance coefficient were determined from Table 5.1 of the Manual. The parameters m and b were determined as -0.01375 and 0.08, respectively, based on a land classification of bare or nearly bare ground because the watershed is near bare between rainy seasons.

Storage Coefficient and Time-Area Relation - The storage coefficient is a function of time of concentration, the watershed size and the length of flow path. The time-area relation is a parameter showing the equal travel-time zones in a watershed.

The computation for time of concentration, storage coefficient and time-area relation was performed by means of trial-and-error method through the computer program of MCUHP1. The input and output values (including the ordinates of Clark unit hydrographs) are presented in Appendix C of this report. A review of the results indicated that all areas are suitable for the Clark method.

6. Runoff Modeling

The 1988 version of HEC-1 computer model (Reference 1) was used for the development of hydrologic model. A time step of 5 minutes was used in the computation. Flows through the existing culverts under the C.A.P. Canal were modeled by the level-pool reservoir routing method, as contained in the HEC-1 program. The relationships among stage, storage, and outflow at the existing C.A.P. culverts (as shown in Appendix D) were developed from the 1" = 200' topographic map (Reference 7). The normal depth routing method was used for routing flow from one concentration point to the next. Routing parameters and routing reaches are shown on Plate 2. Detailed procedures for estimation of Manning's roughness coefficients are discussed in the Hydraulics Report under separate volume. The channel cross

sections used for the normal depth routing were digitized from the topographic map base (Reference 7). The plottings of the cross sections are shown in Appendix E.

Schematic flow charts of the HEC-1 model prepared for Twin Buttes Wash Watershed and Caterpillar Tank Wash Watershed are presented in Figures 4 and 5, respectively. The existing stock pond in the Caterpillar Tank Wash Watershed was not included in the model because it was not properly engineered and certified as being constructed to withstand the 100-year flood.

7. Levee Analysis for C.A.P. Canal

The existing C.A.P. Canal was evaluated as a levee in this study. The water surface elevations resulting from ponding behind the canal were estimated by use of the level-pool reservoir routing method in the HEC-1 program. For Twin Buttes Wash, elevations resulting from both 6-hour and 24-hour storms were analyzed. For Caterpillar Tank Wash, the following three conditions were analyzed:

- Ponding elevation from a 6-hour storm with the stock pond in place and full at the beginning of the storm
- Ponding elevation from a 6-hour storm without the stock pond downstream of the 72-inch pipe culvert with assumed inlet control
- Ponding elevation from a 24-hour storm with the stock pond in place and full at the beginning of the storm, as illustrated by the schematic flow chart in Figure 6

The 6-hour storm yielded the maximum ponding elevations behind the C.A.P. Canal for the Twin Buttes Wash Watershed. On the other hand, the 6-hour storm with stock pond in place produced the maximum ponding elevation for the Caterpillar Tank Wash Watershed. The results are tabulated below:

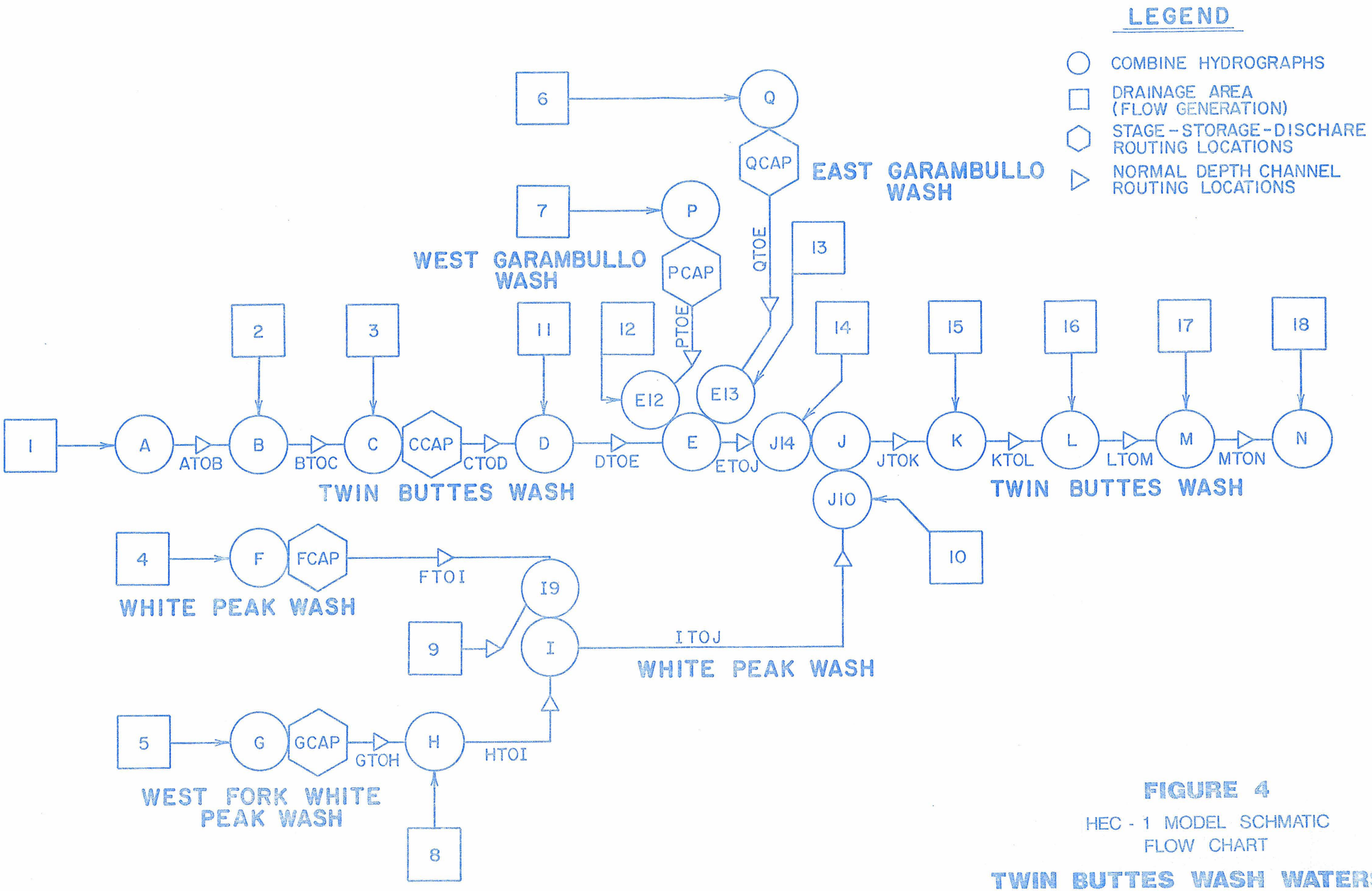

FIGURE 4

HEC - 1 MODEL SCHMATIC FLOW CHART

TWIN BUTTES WASH WATERSHED

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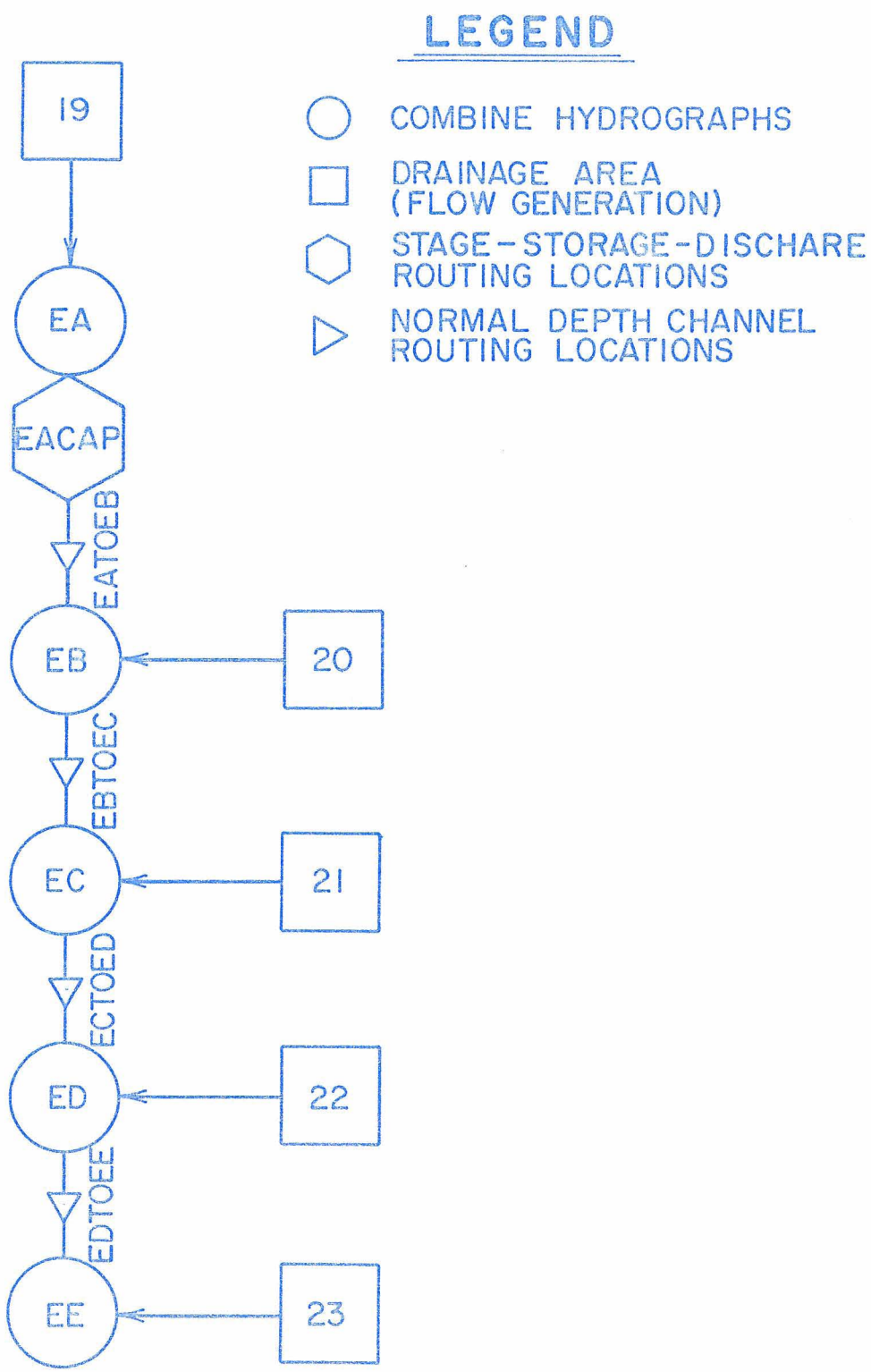

FIGURE 5

HEC - 1 MODEL SCHEMATIC
FLOW CHART

CATERPILLAR TANK WASH WATERSHED

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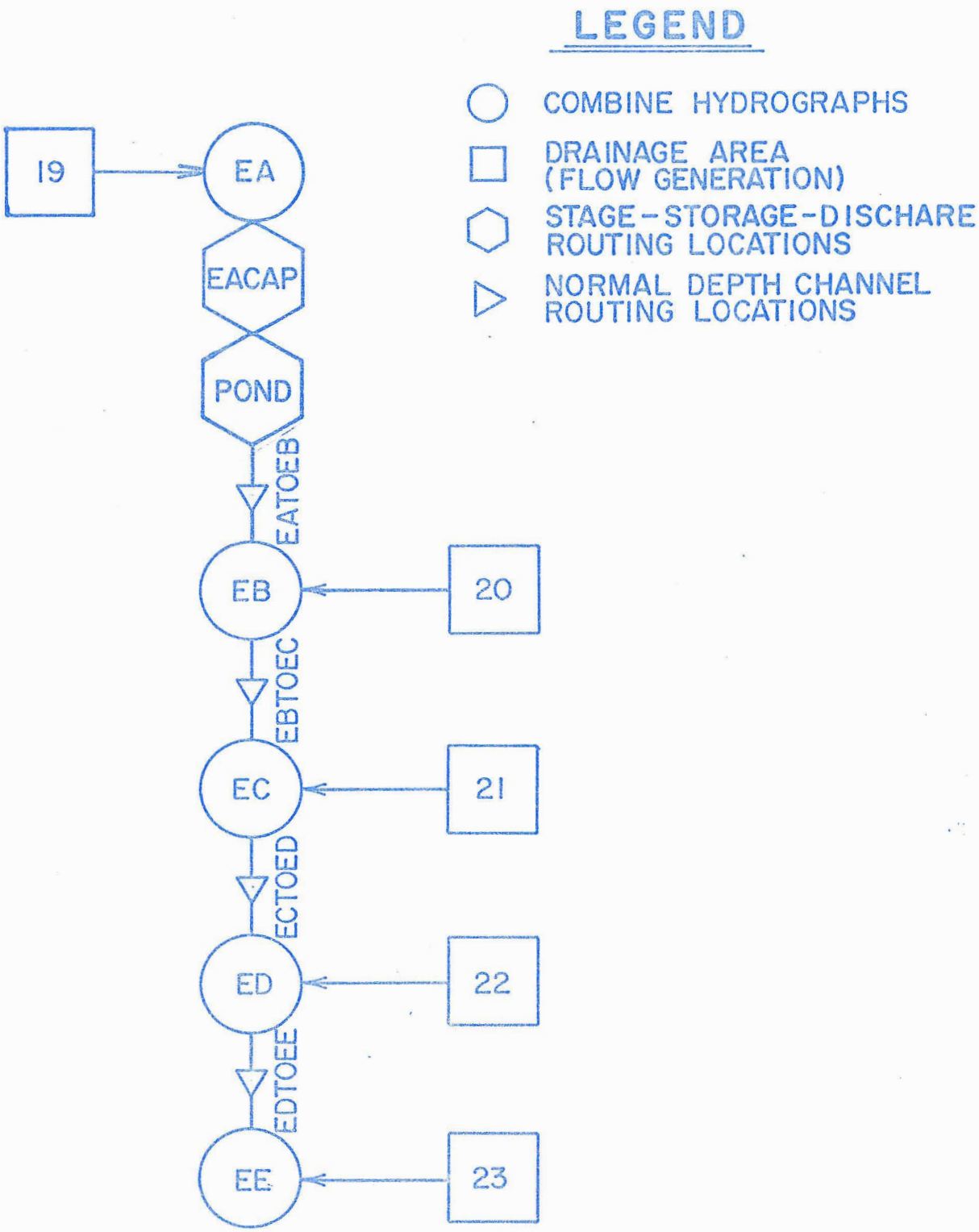

FIGURE 6

HEC - 1 MODEL SCHEMATIC
FLOW CHART

CATERPILLAR TANK WASH WATERSHED
(WITH EXISTING STOCK POND)

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TABLE 3

MAXIMUM PONDING ELEVATIONS BEHIND C.A.P. CANAL

Crossing No.	C.A.P. Station	HEC-1 I.D.	Pipe Size	Watershed Name	Upstream Inv. Elev.	Height of Lining	Top of Lining Lining Elev.	Max. Ponding Ponding Elev.
1	561+40	EACAP	72"	Caterpillar Tank	1508.00	19.5'	1534	1525.7
2	549+00	QCAP	30"	Twin Buttes	1513.94	19.5'	1537	1529.0
3	538+25	PCAP	30"	Twin Buttes	1518.99	19.5'	1542	1534.2
4	492+30	CCAP	4 - 72"	Twin Buttes	1500.13	18.6'	1526	1518.0
5	480+90	FCAP	30"	Twin Buttes	1515.92	18.6'	1538	1532.1
6	459+30	GCAP	30"	Twin Buttes	1519.13	18.6'	1541	1533.2

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The U.S. Bureau of Reclamation has certified the embankments associated with the C.A.P. construction up to the top of the concrete lining. Values for heights of lining were obtained from the Bureau of Reclamation design drawings (Reference 8). Elevations for the top of lining were computed by the following assumption, and rounded to the nearest foot:

Top of Lining Elevation	=	Upstream Invert Elevation	+	Pipe Diameter	+	1-Foot Clearance	+ Height of Lining

In view of the above tabulated values, it appears that the maximum ponding elevation at each pipe culvert is well below the top of lining of the C.A.P. Canal. Therefore, the canal was assumed to be adequate for withholding the flow resulting from a 100-year storm.

ASSUMPTIONS

The basic assumptions used for this study are as follows:

1. The vegetation cover in the watershed was assumed to be 20 percent.

2. The effect of ponding behind the C.A.P. Canal was analyzed for the Caterpillar Tank Wash Watershed on the basis of the assumption that the stock pond was in place and initially full. However, for peak discharge analysis, the existing stock pond was not included in the model because the embankment of the pond was not certified to withstand the 100-year flood.

3. The C.A.P. Canal was assumed to be adequate for withholding the 100-year flood.

4. Transmission loss was not included in this analysis because the estimated discharge values are slightly less than the average values obtained from gaging information in Maricopa County (see Figure 7).

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5. A velocity of 5 fps was used in the time-step analysis for the normal depth routing.

RESULTS

The 100-year peak discharges (resulting from both 6-hour and 24-hour storms) at each concentration point shown in Figure 2 were estimated by means of the HEC-1 computer program. The computer analysis indicated that the 6-hour storm yielded a higher peak rate at each concentration point. The peak flow rates resulting from a 100-year, 6-hour storm are tabulated in Table 4.

COMPARISON OF RESULTS WITH STREAM GAGES

As mentioned previously, historical gaging records are not available for the study area. However, the District has established a chart to describe the general relationships between peak discharge and watershed size in Maricopa County. In this study, the estimated peak discharges at major concentration points were plotted on the District's chart for comparison purposes. As indicated in Figure 7, the estimated values of peak discharges are in general agreement with the correlation curves developed by the District on the basis of gaging information in the County.

CONCLUSIONS

In the absence of historical gaging data on the watershed, the peak flows in this study were derived through hydrologic modeling. The values of peak discharges resulting from hydrologic modeling appear to be reasonable for use as input for floodplain and floodway delineation.

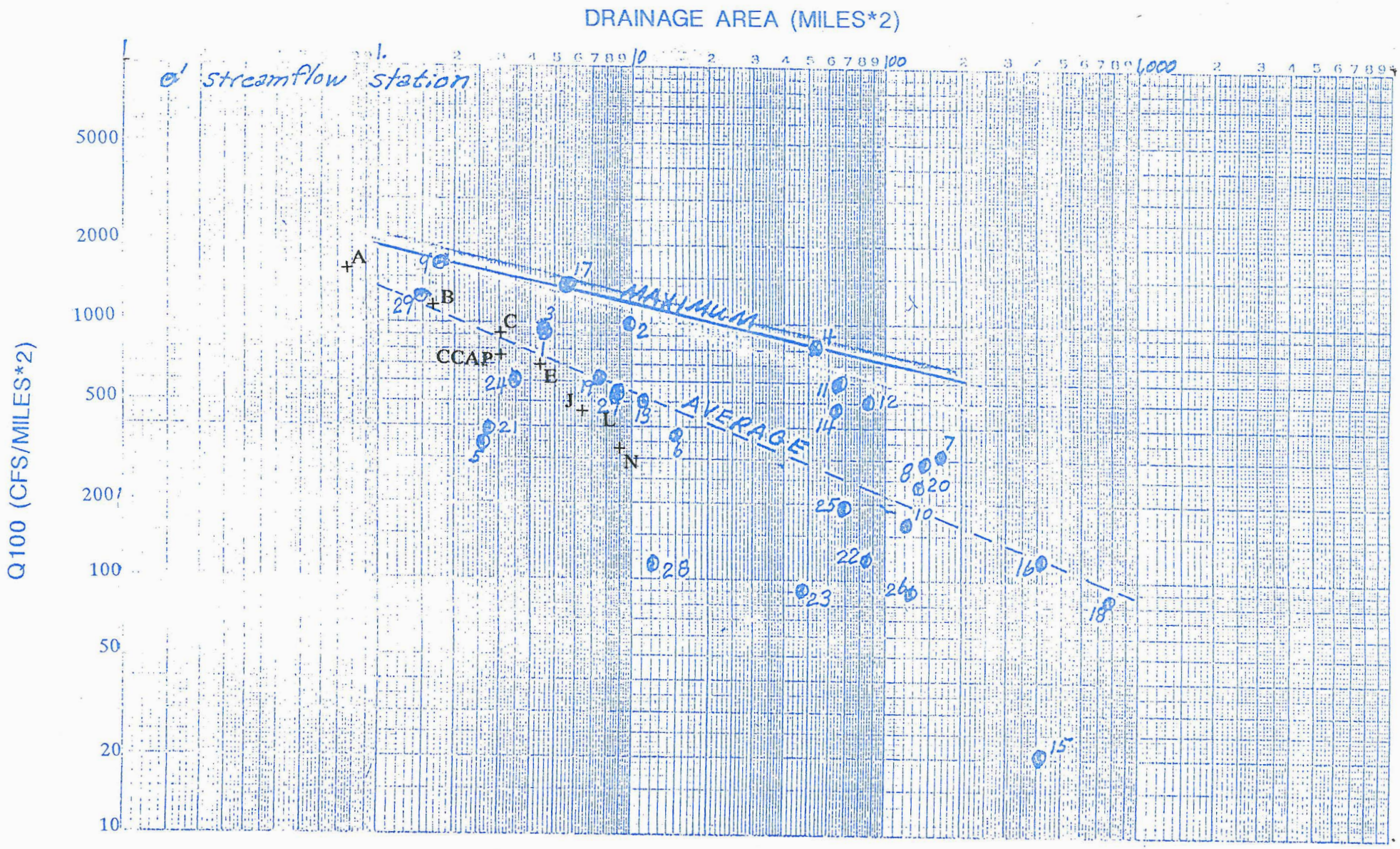

FIGURE 7

VERIFICATION OF RESULTS

REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, *Generalized Computer Program 723-X6-L2010, HEC-1 Flood Hydrograph Package*, Davis, California, February 1981, Revised August 1988.

2. Flood Control District of Maricopa County, *Hydrologic Design Manual*, September 1990.

3. U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Aguila-Carefree Area*, April 1986.

4. U.S. Department of Agriculture, Soil Conservation Service, *General Soil Map for Maricopa County*, 1973.

5. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, *Precipitation-Frequency Atlas of the Western United States, Volume VIII - Arizona*, 1973.

6. U.S. Department of the Interior, Geological Survey, *15-Minute Series Topographic Maps*, Scale 1:24,000 Contour Intervals vary: Baldy Mountain and Calderwood Butte, Maricopa County, Arizona.

7. Aerial Mapping Company, Inc., Topographic Maps for C.A.P. Overchutes, Scale 1" = 400', Contour Interval = 4 feet; Scale 1" = 200', Contour Interval = 2 feet for areas north of C.A.P. Canal; 1990.

8. U.S. Bureau of Reclamation, Design Drainages for Granite Reef Aqueduct, Reach 9, Drawing No. 344-330-1325, October 1975.

9. Sellers, W.D., Hill, H.D. and Sanderson-Rae, M., *Arizona Climate - The First Hundred Years*, University of Arizona, Undated.

10. Aldridge, B.N. and Garrett, J.M., *Roughness Coefficients for Stream Channels in Arizona*, USGS Open-File Report, Tucson, Arizona, February 1973.

11. Chow, Ven T., *Open Channel Hydraulics*, New York: McGraw-Hill Book Company, 1959.

12. Thomsen, B.W. and Hjalmarson, H.W., *Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona*, July 1990.

APPENDIX A

ESTIMATION OF RAINFALL INPUT

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SHEET _____ OF _____
BY _____ DATE _____
CHECK SEK DATE 11/90
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JOB CAP Overchutes JOB NO. 310.42

ESTIMATED RAINFALL DEPTH

Return Frequency	6-hr Duration Depth		24-hr Duration Depth	
	From Isopluvials	Adjusted Depth	From Isopluvials	Adjusted Depth
2-yr	1.32	1.32	1.66	1.66
5-yr	1.79	1.79	2.28	2.25
10-yr	2.13	2.15	2.63	2.70
25-yr	2.65	2.62	3.28	3.28
50-yr	2.95	2.98	3.67	3.69
100-yr	3.32	3.32	4.14	4.14

Notes: 1. Isopluvial information is obtained from Fig. 2.2 thru Fig. 2.13 of the Manual.

2. Rainfall depth is expressed in inches

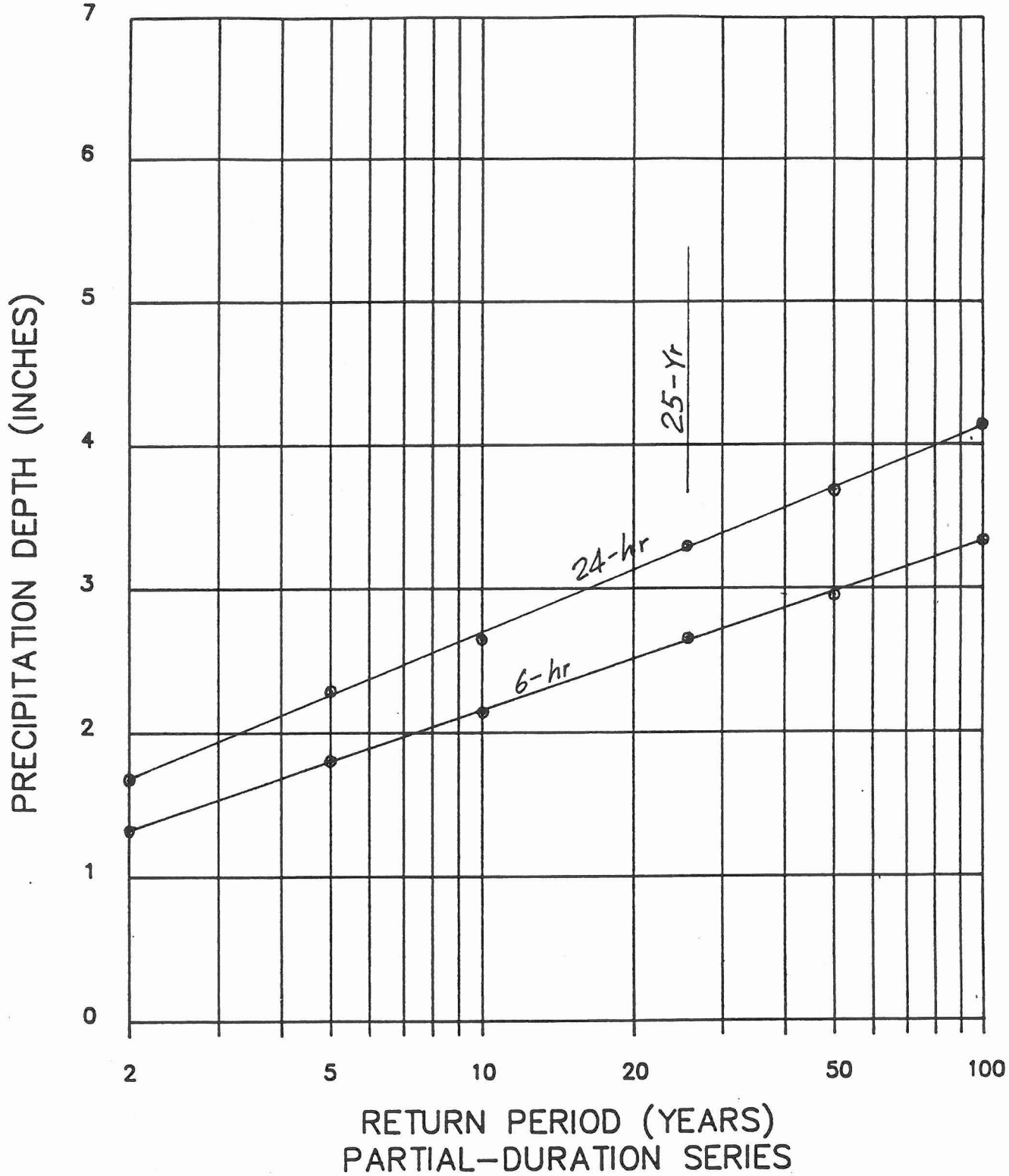
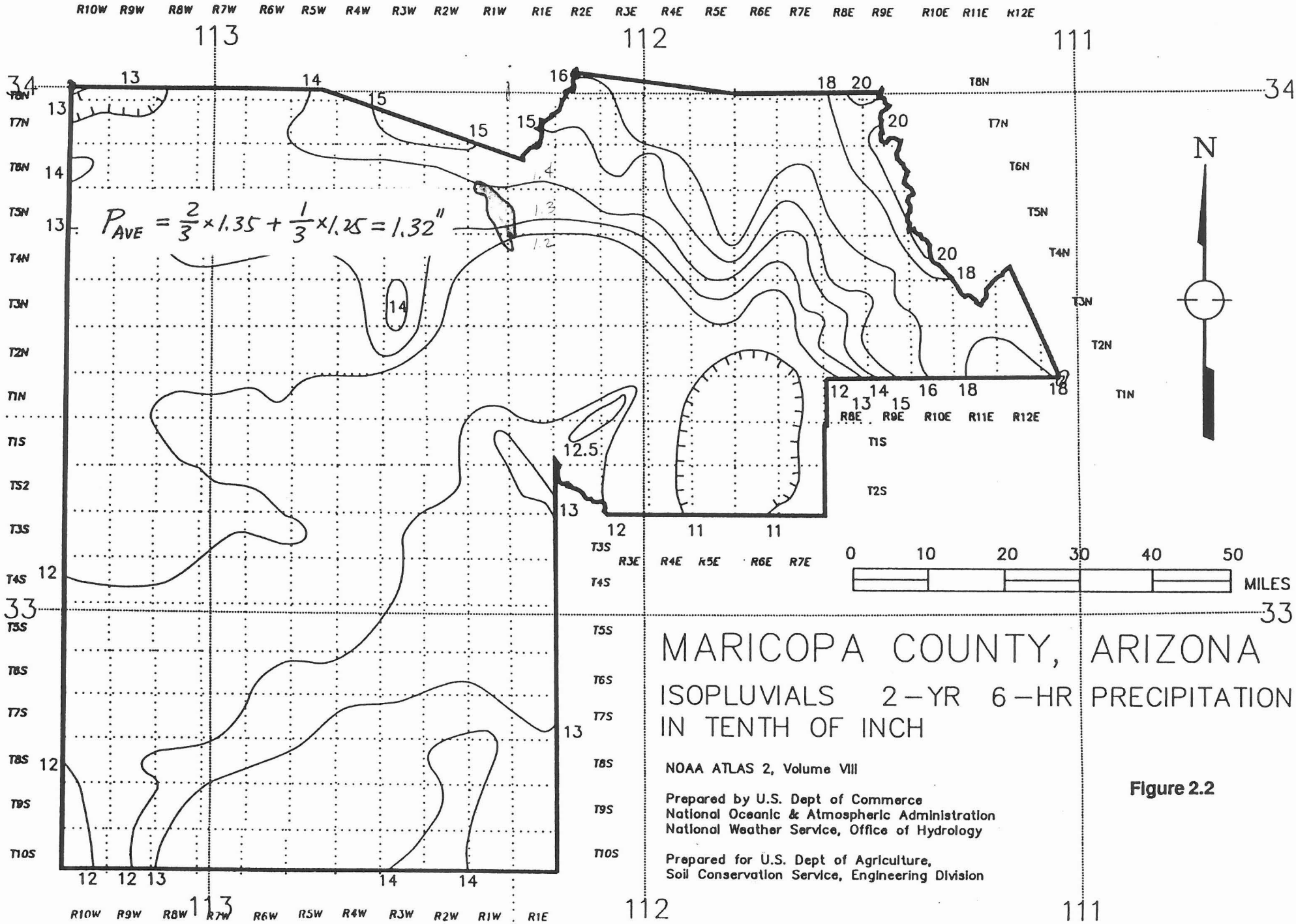


Figure 2.14
Precipitation Depth versus Return Period for Partial-Duration Series



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 2-YR 6-HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

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

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

Figure 2.2

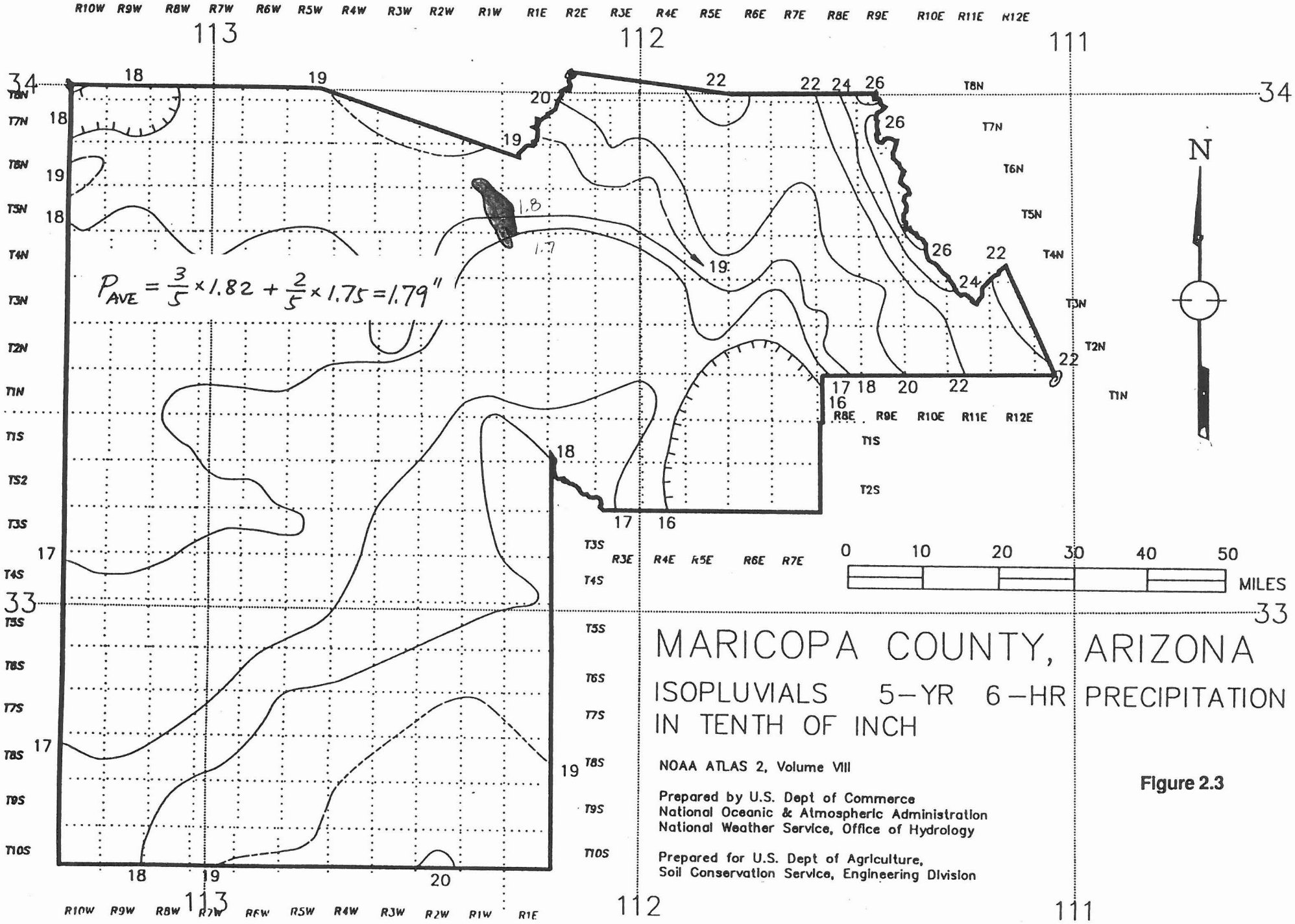
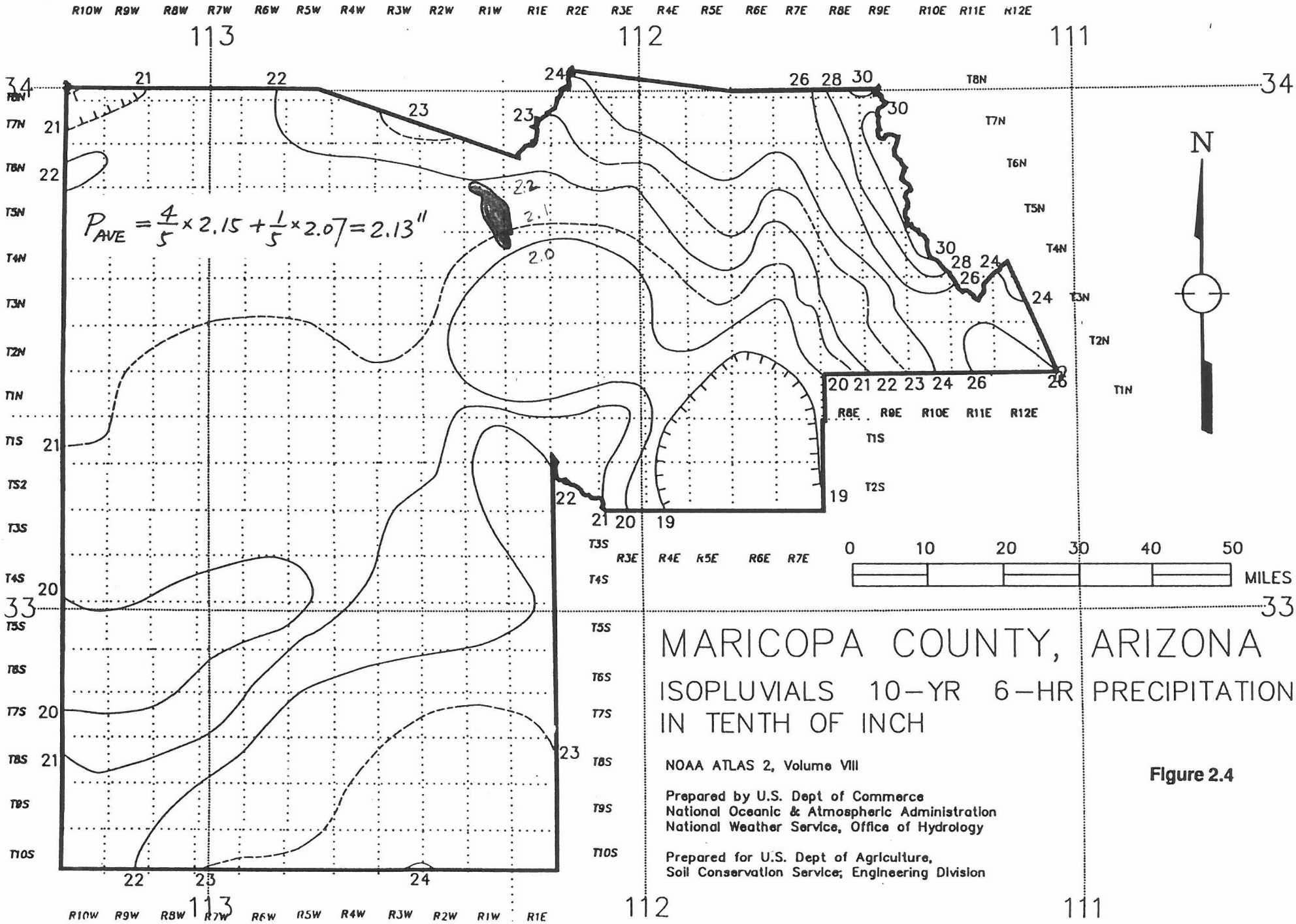

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 5-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
0 10 20 30 40 50
MILES
$P_{AVE} = \frac{3}{5} \times 1.82 + \frac{2}{5} \times 1.75 = 1.79''$
1.8
1.7
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
113 112 111
34 33

Figure 2.3



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 10-YR 6-HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

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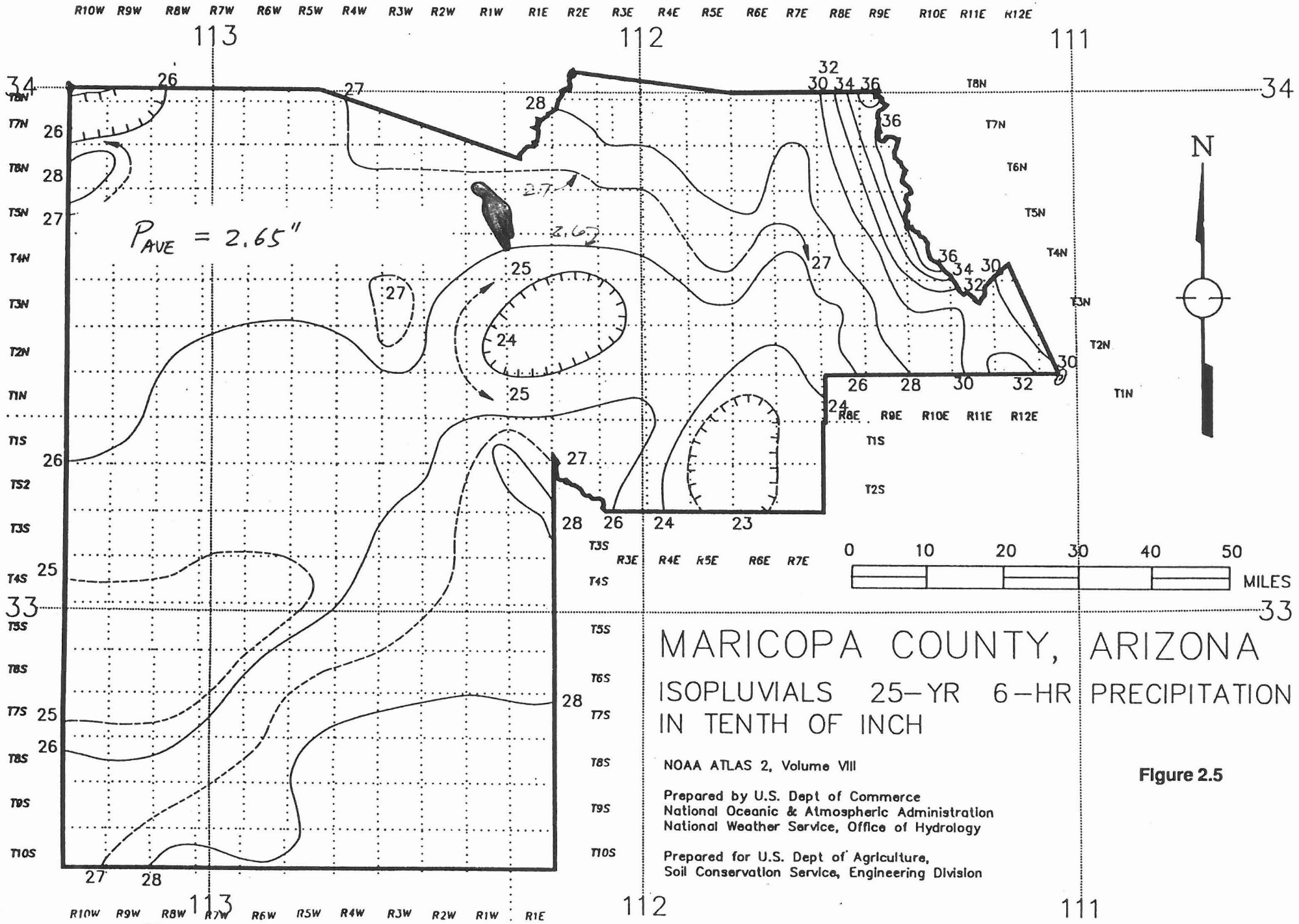
National Weather Service, Office of Hydrology

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

Figure 2.4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113
112
111
34
33
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
N
0 10 20 30 40 50
MILES
P_{AVE} = 2.65"
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 25-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
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National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
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Figure 2.5

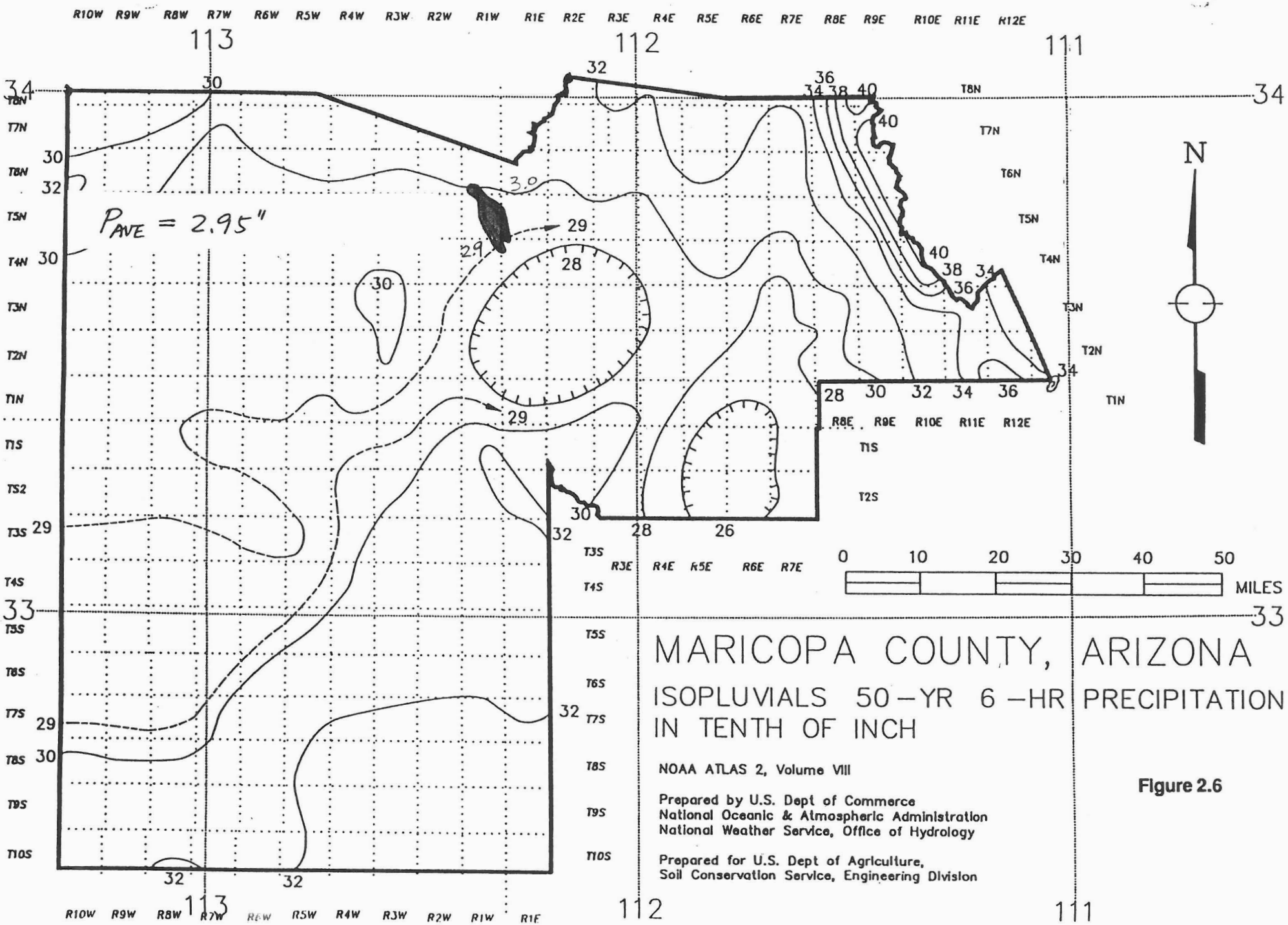
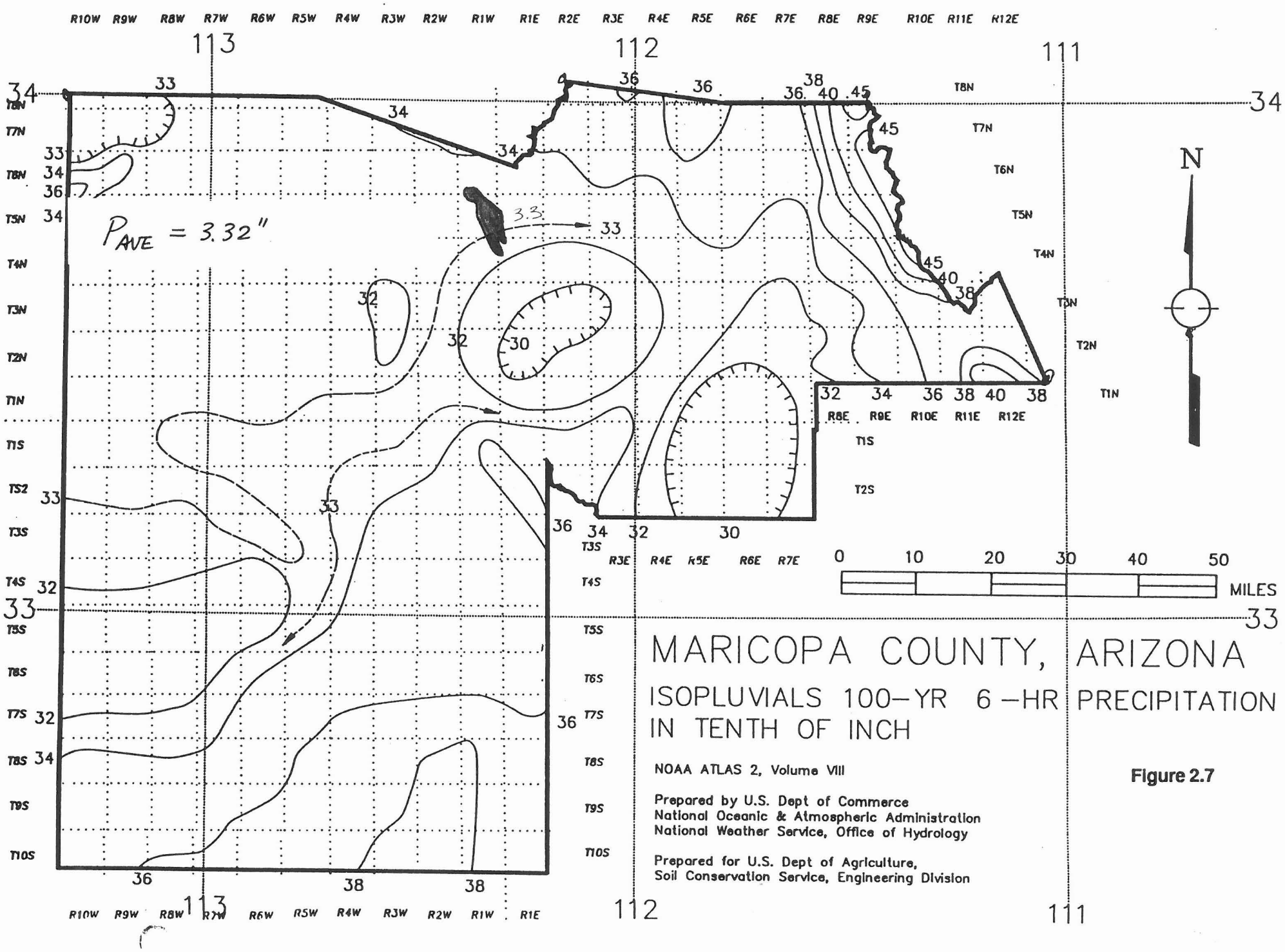

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 50-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
P_{AVE} = 2.95"
N
0 10 20 30 40 50
MILES
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
113 112 111
34 33

Figure 2.6



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100–YR 6–HR PRECIPITATION IN TENTH OF INCH

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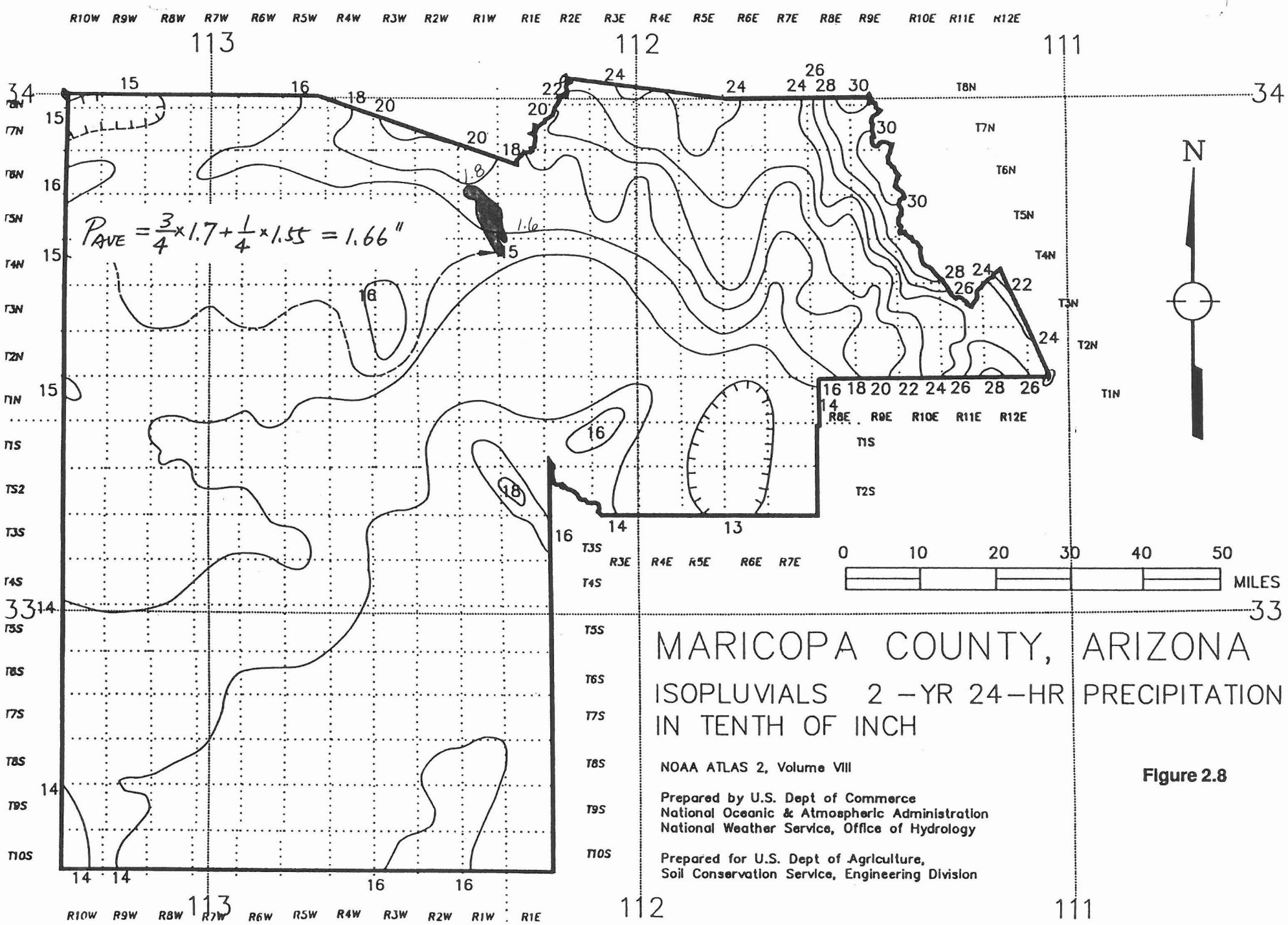
Figure 2.7



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 2 –YR 24–HR PRECIPITATION IN TENTH OF INCH

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National Weather Service, Office of Hydrology

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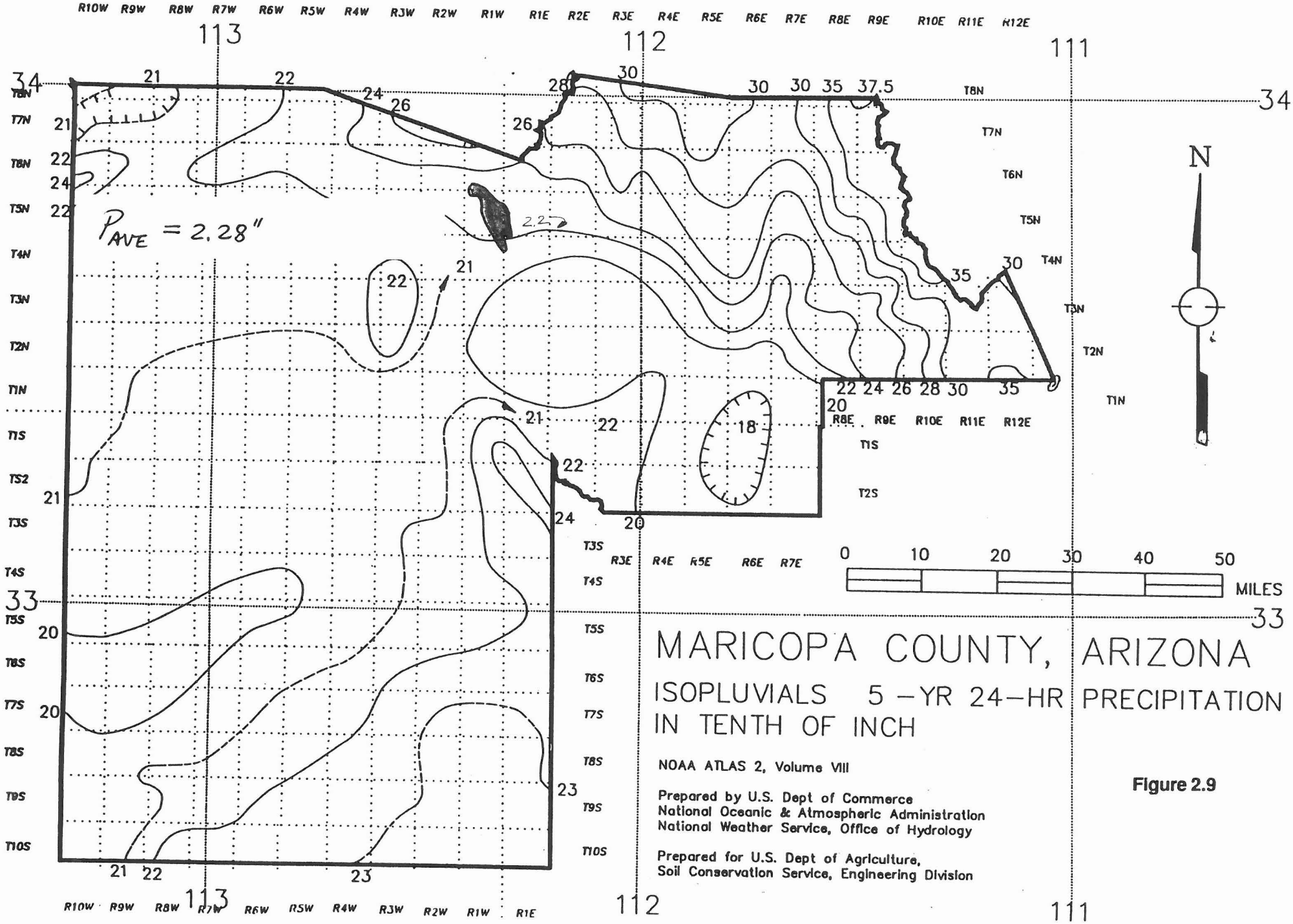
Figure 2.8



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 5 –YR 24–HR PRECIPITATION IN TENTH OF INCH

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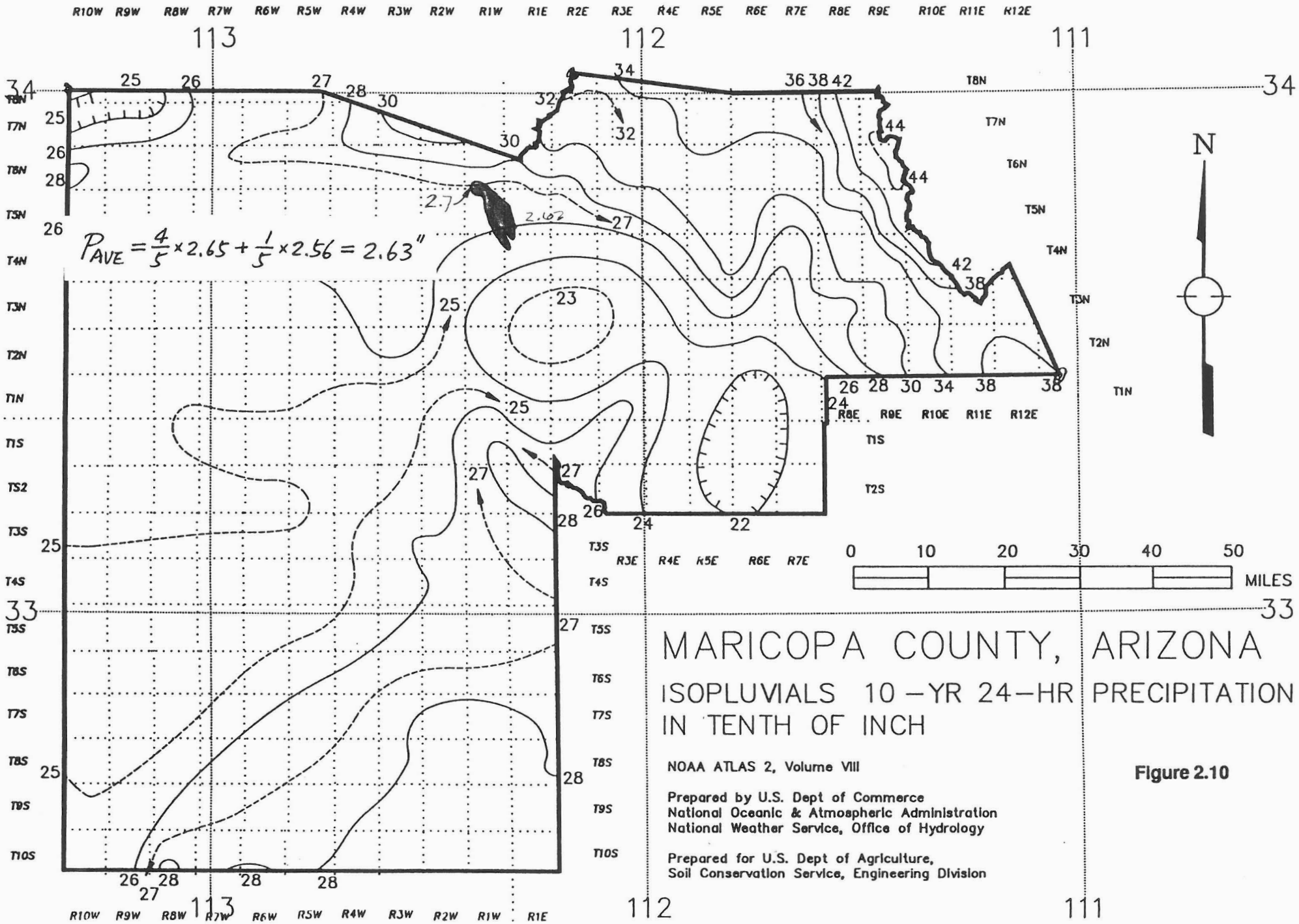
Figure 2.9



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 10-YR 24-HR PRECIPITATION IN TENTH OF INCH

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Figure 2.10

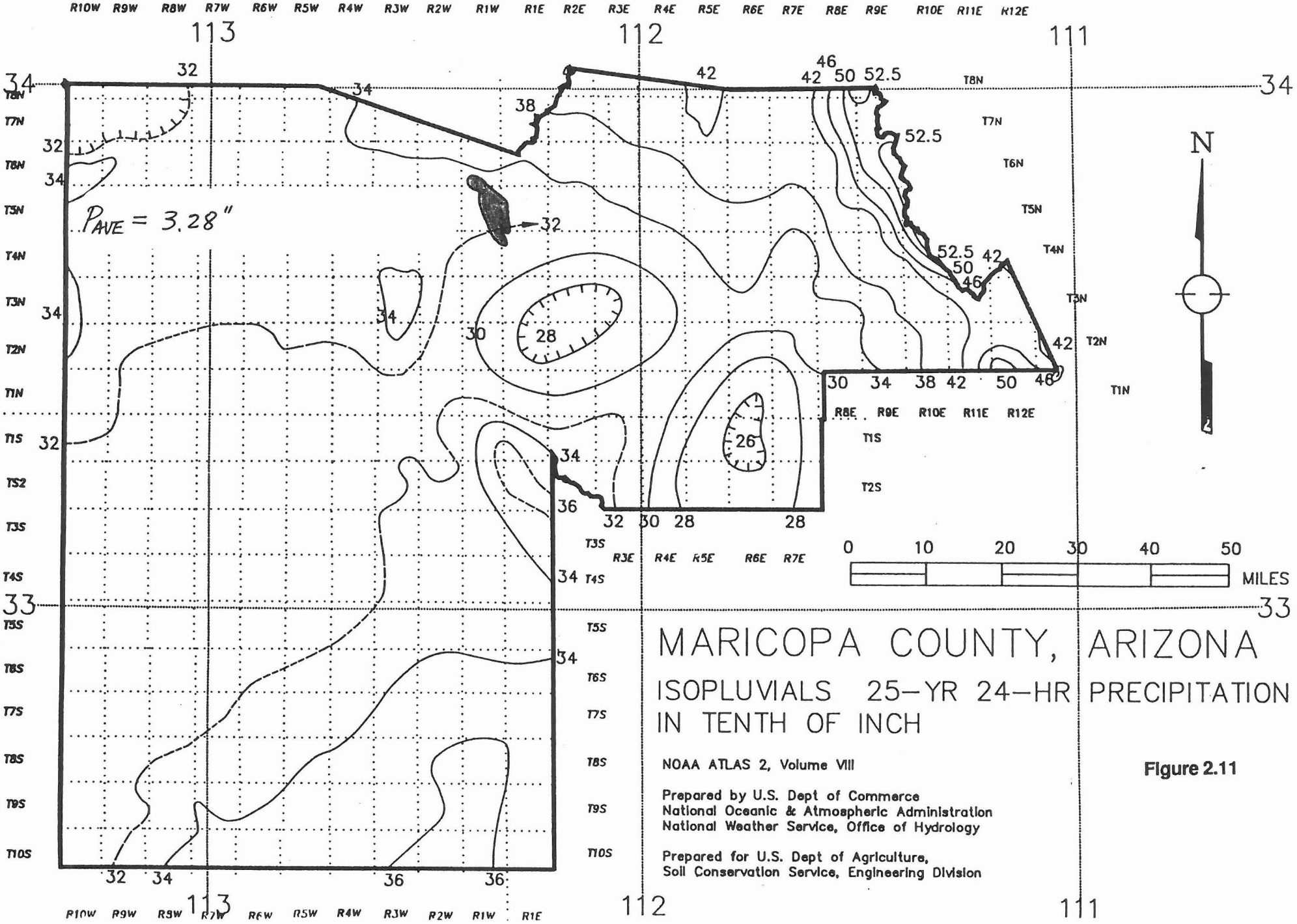
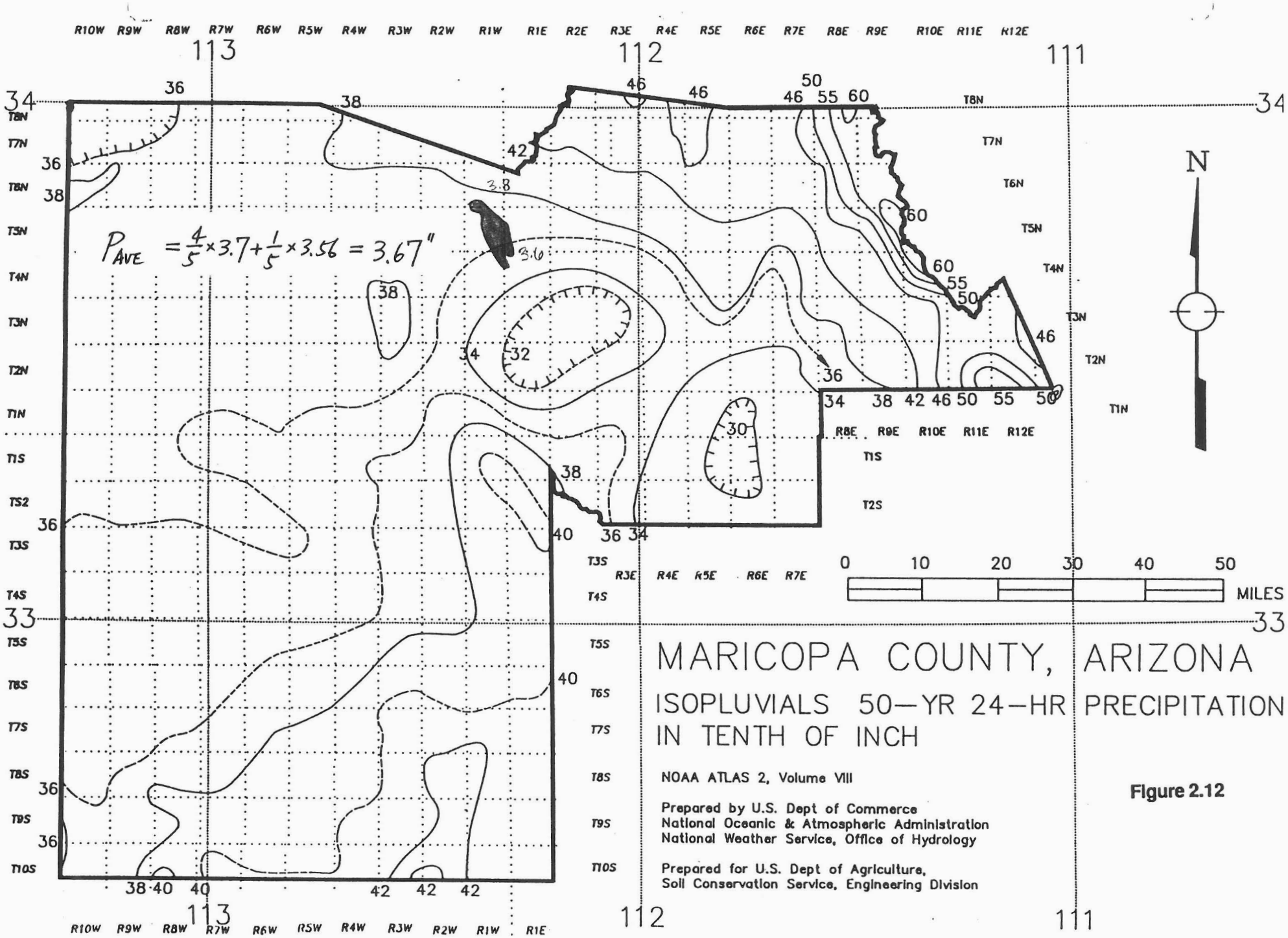

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 25-YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
P_{AVE} = 3.28"
N
0 10 20 30 40 50
MILES
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
113 112 111
34 33
32 34 36 38 42 46 50 52.5 30 28 26

Figure 2.11



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 50—YR 24—HR PRECIPITATION IN TENTH OF INCH

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Figure 2.12

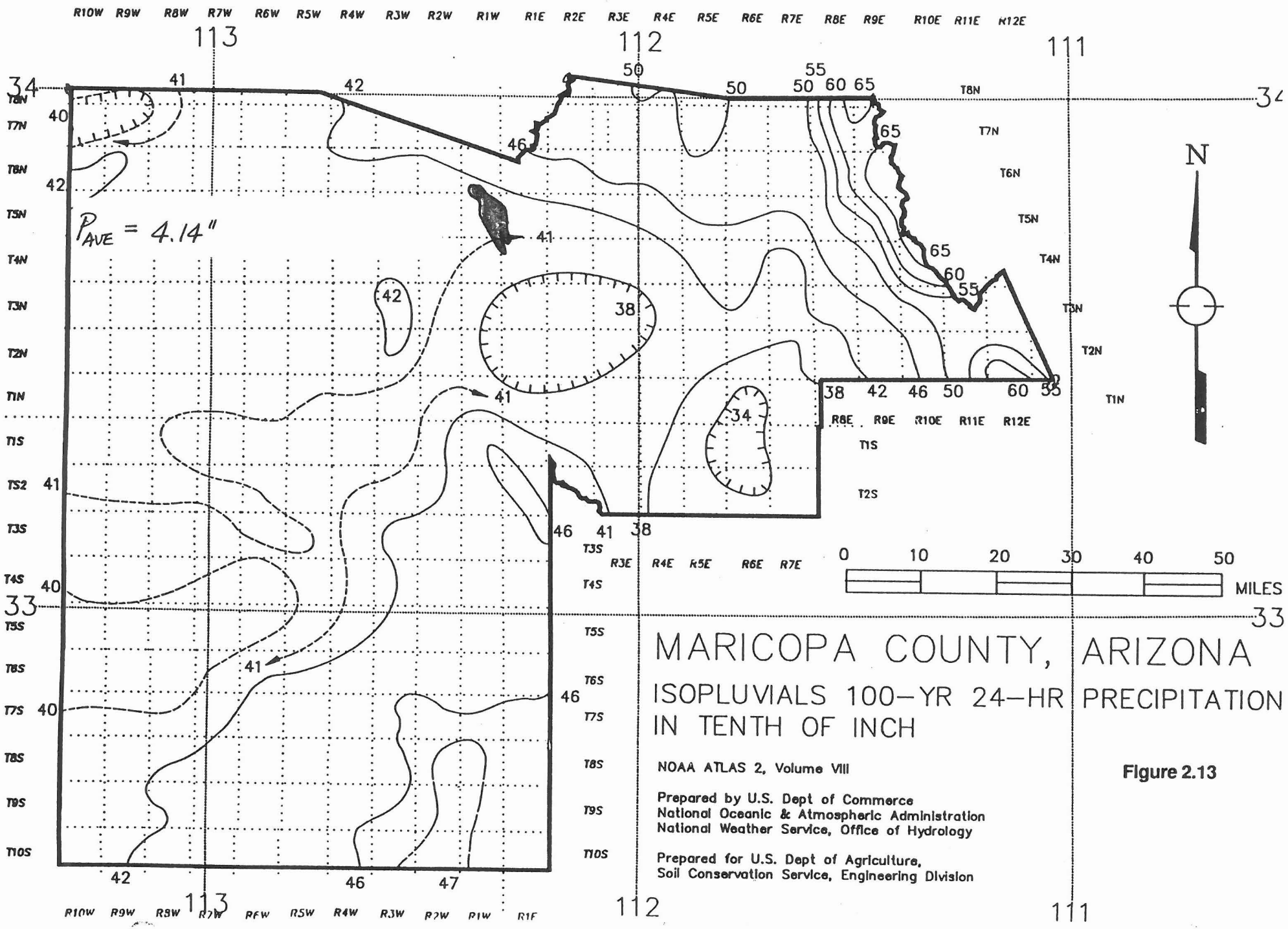
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
P_{AVE} = 4.14"
N
0 10 20 30 40 50
MILES
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S
113 112 111
34 33

Figure 2.13

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CLIENT _____
JOB _____ JOB NO. 310.42

AREAL ANALYSIS - 24 HOUR STORM

AS THE DRAINAGE AREA UNDER CONSIDERATION IS VERY SMALL (1 mile² +/-) AND NOAA-40 IS NORMALLY FOR LARGER WATERSHED AREAS, A COMPARISON OF THE VALUES FOR A 6 HOUR STORM AND 24 HOUR STORM WAS MADE.

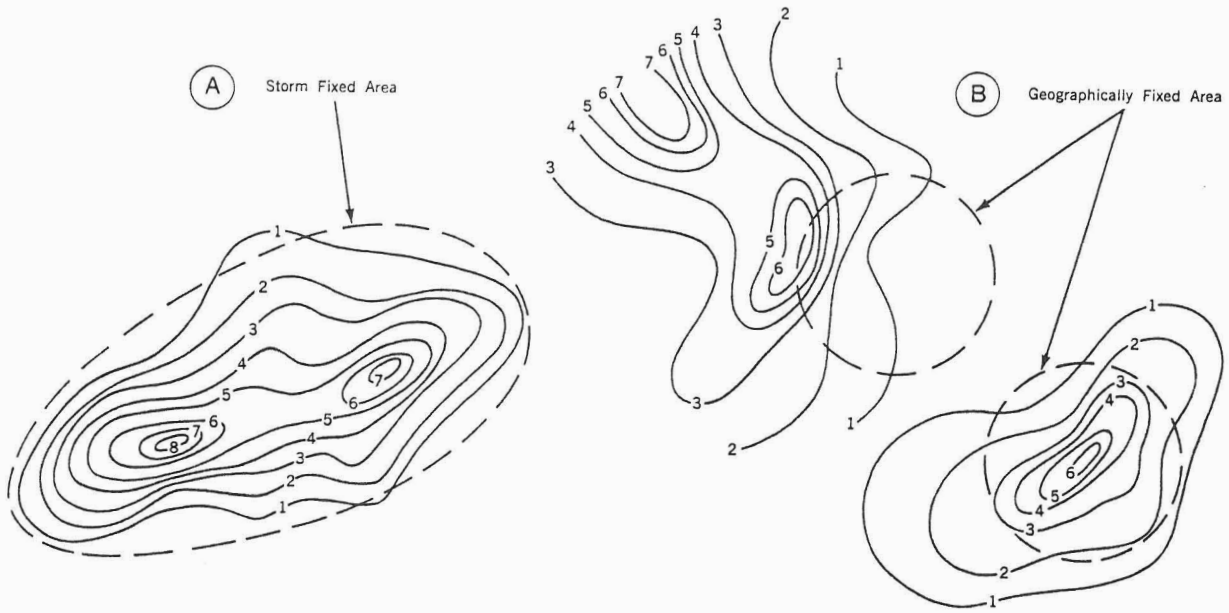
FOR THAT SMALL OF AN AREA THE DEPTH - AREA REDUCTION FACTOR FOR THE 2 LENGTHS OF DURATION ARE NEARLY IDENTICAL

THEREFORE: THE VALUE FOR 1 mile² FROM TABLE 2.1 OF 0.987 WAS USED WITHIN THE MCUHP1 PROGRAM WHEN DETERMINING THE TIME OF CONCENTRATION PARAMETERS.

Table 2.1
Depth-Area Reduction Factors for 6-Hour Duration Rainfall

Area, Square Miles	Ratio to Point of Rainfall
0	1.0
1	0.987
5	0.96
10	0.94

Figure 13. *Examples of (A) isohyetal pattern centered over basin as would be the case for storm-centered depth-area curves and (B) two possible occurrences of isohyetal patterns over a geographically fixed area as would be the case in development of curves for a geographically fixed area.*



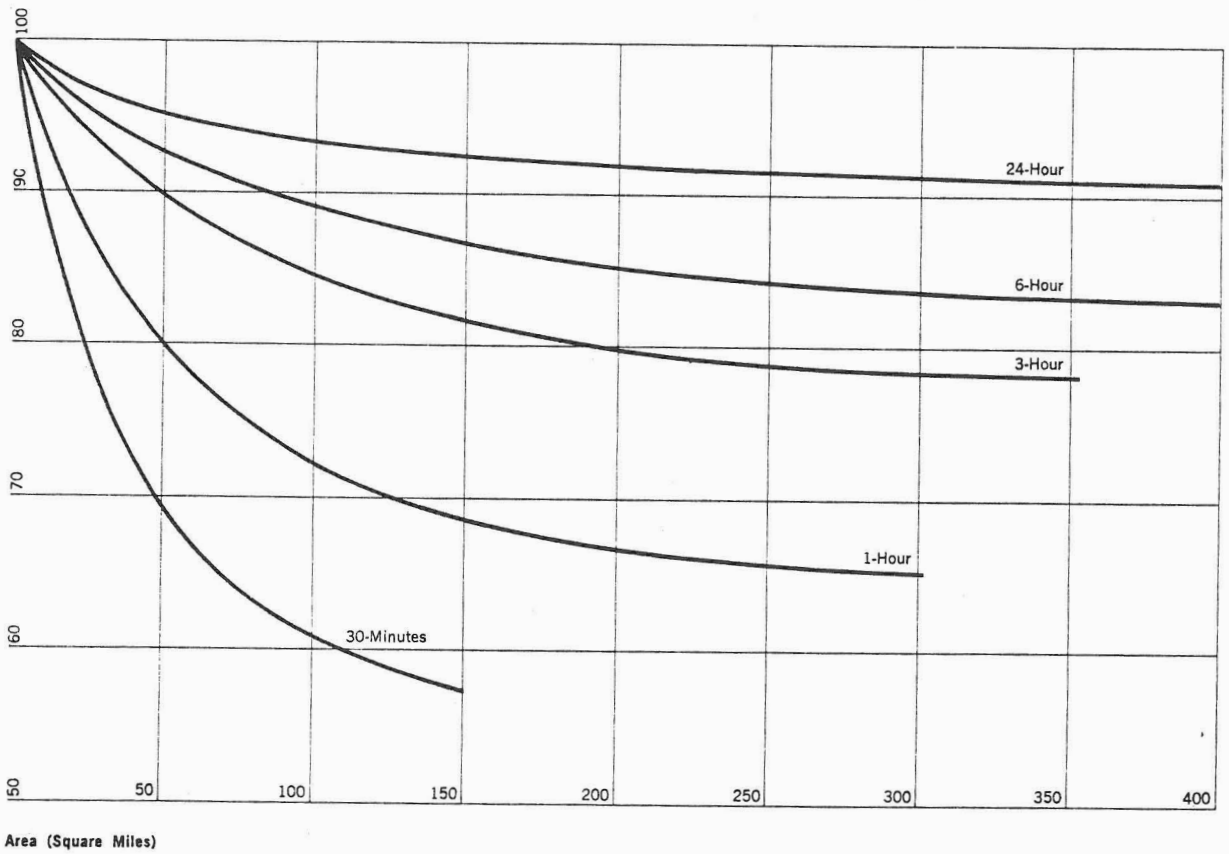


Figure 14. *Depth-Area curves.*

Interpretation of Results

Season of Occurrence

The maps in this Atlas are based upon data for the entire year. In certain sections of the West, precipitation is highly seasonal. Thus, rainy season precipitation-frequency values approach the annual values. In sections where the greatest annual *n*-hour precipitation amount may be observed in any season, seasonal precipitation-frequency maps would differ from those presented in this Atlas. In no case could the seasonal value be greater than the annual value. However, the seasonal values would be a certain percent of the annual values, with the percent varying according to the frequency of large storms during the season under investigation. Generalizations about the seasonal distribution of large storms can be obtained from ESSA, *U.S. Weather Bureau Technical Paper* No. 57 (Environmental Science Services Administration, Weather Bureau, 1966). Currently, there is no convenient manner of applying this knowledge to the maps of this Atlas, other than subjectively.

Within Vs. Among Storms

Data for the various duration maps and diagrams in this Atlas were determined independently; that is, there was no requirement that the maximum 6- or 1-hr amount for a particular year be included within the maximum 24-hr amount for that year. The maps, therefore, represent an "among" storm distribution. In regions where winter-type storms predominate, the 6-hr value for a particular return period would more closely approximate the 6-hr value within the 24-hr storm for the same return period than would generally be the case in regions where convective storms predominate. In a study for the United States east of the Mississippi River, Miller (1971) showed that the ratio between the 2-yr 1-hr value computed from the maximum 1-hr amount within the 24-hr maximum and the 2-yr 1-hr value computed using maximum 1-hr amounts varied between 0.52 and 0.91. Studies have not been undertaken of this relation in the West, but a wide range in such ratios and similar ratios for the 6-hr duration could be expected.

Point Probabilities

The maps in this Atlas are derived from and depict point probabilities; the data points are independent of each other. Precipitation over a region is variable, even in large general area storms; neighboring stations do not necessarily experience maximum annual amounts from the same storm. Thus, the individual points on these maps express individual probabilities. That a point within a particular watershed may receive an amount equal to or greater than its 50- or 100-yr value on a particular day does not affect probabilities for any other point within that watershed. A second point within the watershed may experience an amount equal to or greater than its 50- or 100-yr value within the same storm or on the next day, within the next week or at any other time.

Areal Analysis

A value read from an isopluvial map in this Atlas is the value for that point and the amount for that particular duration which will be equaled or exceeded, on the average, once during the period indicated on the individual map. In hydrologic design, engineers are more concerned with the average depth of precipitation over an area than with the depth at a particular point. Depth-area curves were developed to meet this need. The depth-area curve is an attempt to relate the average of all point values for a given duration and frequency within a basin to the average depth over the basin for the same duration and frequency.

Generally, there are two types of depth-area relations. The first is the storm-centered relation; that is, the maximum precipitation occurring when the storm is centered on the area affected (fig. 13). The second type is the geographically fixed-area relation where the area is fixed and the storm is either centered over it or is displaced so only a portion of the storm affects the area (fig. 13). We can say that storm-centered rainfall data represent profiles of discrete storms, whereas the fixed-area data are statistical averages in which the maximum point values frequently come from different storms. At times, the maximum areal value for the network is from a storm that does not produce maximum point amounts. Each type of depth-area relation is useful, but each must be applied to appropriate data. Generally, the storm-centered relations are used for preparing estimates of probable maximum precipitation, while the geographically fixed relations are used for studies of precipitation-frequency values for basins.

Dense networks of precipitation gages are required to furnish basic data used in developing depth-area relations for fixed areas. The criteria used in selecting dense networks for the determination of areal precipitation-frequencies by the National Weather Service have been:

1. A network should be composed entirely of recording gages. The use of nonrecording gages may greatly increase the number and density of stations within a network, but it involves the construction of mass curves and introduces additional subjectivity. Nonrecording gages are read at various hours, usually early morning, late afternoon, or midnight. Because of conflicting activities, a cooperative observer may not always be able to read his precipitation gage at the exact hour specified. In these cases, the exact time of the observation may not be available, so it is hard to relate the reported amounts to those of surrounding stations with the precision required for development of depth-area relations.
2. A minimum length of record should be established to ensure a reasonable estimate of the 2-yr areal precipitation.
3. Gage locations and exposures should remain consistent during the period of record analyzed.
4. Gages should be located so that there is at least one gage located within each 100 square-mile area.

The average depth-area curves in this Atlas (fig. 14) are for fixed areas and were developed from dense networks meeting the above criteria. The curves were first prepared for an earlier study (U.S. Weather Bureau 1957–60) and have since been rechecked against longer record data; no changes were needed. Application of these curves must be consistent with the manner in which they were developed. The following steps are used:

1. Estimate point values from a grid of many points over the basin of interest for the duration and return period required.
2. Compute an average of the point values obtained in step 1.
3. Use figure 14 to obtain an areal reduction factor required for the precipitation duration and size of area under consideration.
4. Multiply the average value obtained in step 2 by the ratio obtained in step 3. The value obtained in this step provides the areal value for the basin of interest for the duration and return period under consideration.

APPENDIX B

ESTIMATION OF RAINFALL LOSSES

SUB-AREA DRAINAGE BASIN SOIL PROPERTIES

BASIN NUMBER	SOIL GROUP	AREA (SQ MILES)	% TOTAL AREA	IA (IN)	DTHETA (IN)	PSIF (IN)	ADJUSTED XKSAT (IN/HR)	RTIMP %
1								
	109	0.74	100.00%	0.15	0.35	4.20	0.42	35.00%
2								
	18	0.03	3.70%	0.15	0.35	4.30	0.44	15.00%
	51	0.19	20.50%	0.25	0.35	3.98	0.58	
	109	0.69	75.80%	0.15	0.35	4.20	0.42	35.00%
	TOTAL	0.91	100.00%	0.17	0.35	4.16	0.45	27.09%
3								
	10	0.03	1.96%	0.35	0.35	2.22	2.40	
	18	0.26	18.78%	0.15	0.35	4.30	0.44	15.00%
	51	0.12	9.00%	0.25	0.35	3.98	0.58	
	52	0.03	2.23%	0.15	0.35	4.24	0.56	20.00%
	109	0.70	50.53%	0.15	0.35	4.20	0.42	35.00%
	110	0.24	17.50%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	1.38	100.00%	0.20	0.35	4.11	0.51	21.47%
4								
	13	0.03	9.21%	0.35	0.26	6.60	0.17	
	52	0.01	2.29%	0.15	0.35	4.24	0.56	20.00%
	109	0.22	57.62%	0.15	0.35	4.20	0.42	35.00%
	110	0.12	30.88%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.38	100.00%	0.23	0.34	4.34	0.46	21.55%
5								
	52	0.002	1.49%	0.15	0.35	4.24	0.56	20.00%
	100	0.03	16.68%	0.15	0.35	4.30	0.44	20.00%
	109	0.08	51.96%	0.15	0.35	4.20	0.42	35.00%
	110	0.05	29.87%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.15	100.00%	0.21	0.35	4.13	0.48	22.72%
6								
	13	0.01	9.46%	0.35	0.26	6.60	0.17	
	18	0.10	70.82%	0.15	0.35	4.30	0.44	15.00%
	110	0.03	19.72%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.15	100.00%	0.21	0.34	4.44	0.45	11.22%

BASIN NUMBER	SOIL GROUP	AREA (SQ MILES)	% TOTAL AREA	IA (IN)	DTHETA (IN)	PSIF (IN)	ADJUSTED XKSAT (IN/HR)	RTIMP %
7								
	18	0.12	98.11%	0.15	0.35	4.30	0.44	15.00%
	110	0.002	1.89%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.12	100.00%	0.15	0.35	4.29	0.44	14.77%
8								
	13	0.02	14.71%	0.35	0.26	6.60	0.17	
	52	0.03	24.74%	0.15	0.35	4.24	0.56	20.00%
	110	0.07	54.88%	0.35	0.35	3.92	0.62	3.00%
	109	0.01	4.26%	0.15	0.35	4.20	0.42	35.00%
	113	0.002	1.41%	0.35	0.35	4.10	0.53	
	TOTAL	0.13	100.00%	0.29	0.34	4.41	0.53	8.09%
9								
	13	0.10	33.85%	0.35	0.26	6.60	0.17	
	18	0.06	20.68%	0.15	0.35	4.30	0.44	15.00%
	68	0.002	0.80%	0.35	0.35	4.23	0.58	
	109	0.01	1.83%	0.15	0.35	4.20	0.42	35.00%
	110	0.05	16.50%	0.35	0.35	3.92	0.62	3.00%
	113	0.08	26.34%	0.35	0.35	4.10	0.53	
	TOTAL	0.31	100.00%	0.30	0.32	4.96	0.40	4.24%
10								
	10	0.05	8.47%	0.35	0.35	2.22	2.40	
	18	0.01	1.47%	0.15	0.35	4.30	0.44	15.00%
	48	0.05	8.50%	0.25	0.35	4.08	0.54	
	68	0.05	7.46%	0.35	0.35	4.23	0.58	
	98	0.06	8.94%	0.35	0.35	4.20	0.63	
	110	0.38	61.34%	0.35	0.35	3.92	0.62	3.00%
	113	0.02	3.82%	0.35	0.35	4.10	0.53	
	TOTAL	0.62	100.00%	0.34	0.35	3.85	0.75	2.06%
11								
	10	0.06	19.22%	0.35	0.35	2.22	2.40	
	68	0.03	11.80%	0.35	0.35	4.23	0.58	
	98	0.05	17.95%	0.35	0.35	4.20	0.63	
	110	0.14	49.84%	0.35	0.35	3.92	0.62	3.00%
	113	0.003	1.19%	0.35	0.35	4.10	0.53	
	TOTAL	0.29	100.00%	0.35	0.35	3.68	0.96	1.50%
12								
	10	0.01	2.29%	0.35	0.35	2.22	2.40	
	18	0.07	13.44%	0.15	0.35	4.30	0.44	15.00%
	68	0.07	14.29%	0.35	0.35	4.23	0.58	
	98	0.04	7.28%	0.35	0.35	4.20	0.63	
	110	0.31	62.70%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.50	100.00%	0.32	0.35	4.00	0.63	3.90%

BASIN NUMBER	SOIL GROUP	AREA (SQ MILES)	% TOTAL AREA	IA (IN)	DTHETA (IN)	PSIF (IN)	ADJUSTED XKSAT (IN/HR)	RTIMP %
13								
	10	0.01	2.30%	0.35	0.35	2.22	2.40	
	68	0.005	2.12%	0.35	0.35	4.23	0.58	
	110	0.21	95.58%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.22	100.00%	0.35	0.35	3.89	0.66	2.87%
14								
	10	0.07	19.04%	0.35	0.35	2.22	2.40	
	48	0.03	8.67%	0.25	0.35	4.08	0.54	
	98	0.03	8.46%	0.35	0.35	4.20	0.63	
	110	0.22	63.83%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.34	100.00%	0.34	0.35	3.63	0.95	1.91%
15								
	10	0.02	3.19%	0.35	0.35	2.22	2.40	
	13	0.07	11.19%	0.35	0.26	6.60	0.17	
	48	0.22	34.86%	0.25	0.35	4.08	0.54	
	49	0.004	0.60%	0.15	0.35	3.85	0.65	
	98	0.03	4.41%	0.35	0.35	4.20	0.63	
	110	0.29	45.75%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.64	100.00%	0.31	0.34	4.23	0.60	1.37%
16								
	10	0.06	8.84%	0.35	0.35	2.22	2.40	
	13	0.18	25.36%	0.35	0.26	6.60	0.17	
	45	0.002	0.24%	0.25	0.34	4.08	0.40	
	48	0.16	23.19%	0.25	0.35	4.08	0.54	
	49	0.05	7.54%	0.15	0.35	3.85	0.65	
	68	0.05	7.03%	0.35	0.35	4.23	0.58	
	110	0.20	27.81%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.70	100.00%	0.31	0.33	4.50	0.64	0.83%
17								
	10	0.03	7.09%	0.35	0.35	2.22	2.40	
	12	0.04	9.43%	0.35	0.25	8.06	0.08	
	13	0.19	40.82%	0.35	0.26	6.60	0.17	
	49	0.03	7.16%	0.15	0.35	3.85	0.65	
	68	0.02	5.01%	0.35	0.35	4.23	0.58	
	110	0.12	25.30%	0.35	0.35	3.92	0.62	3.00%
	118	0.02	5.19%	0.35	0.35	4.18	0.67	
	TOTAL	0.46	100.00%	0.34	0.30	5.31	0.51	0.76%

BASIN NUMBER	SOIL GROUP	AREA (SQ MILES)	% TOTAL AREA	IA (IN)	DTHETA (IN)	PSIF (IN)	ADJUSTED XKSAT (IN/HR)	RTIMP %
18								
	10	0.01	1.03%	0.35	0.35	2.22	2.40	
	12	0.002	0.21%	0.35	0.25	8.06	0.08	
	49	0.0005	0.06%	0.15	0.35	3.85	0.65	
	110	0.01	1.30%	0.35	0.35	3.92	0.62	3.00%
	118	0.01	1.75%	0.35	0.35	4.18	0.67	
	NON-CLASS	0.70	95.65%	0.35	0.29	3.87	0.35	
	TOTAL	0.73	100.00%	0.35	0.29	3.87	0.38	0.04%

TOTAL WEST DRAINAGE AREA
AREAS 1-18 8.76

BASIN NUMBER	SOIL GROUP	AREA (SQ MILES)	% TOTAL AREA	IA (IN)	DTHETA (IN)	PSIF (IN)	ADJUSTED XKSAT (IN/HR)	RTIMP %
19								
	13	0.07	6.82%	0.35	0.26	6.60	0.17	
	18	0.35	33.81%	0.15	0.35	4.30	0.44	15.00%
	51	0.07	7.08%	0.25	0.35	3.98	0.58	
	52	0.38	37.34%	0.15	0.35	4.24	0.56	20.00%
	98	0.0003	0.03%	0.35	0.35	4.20	0.63	
	109	0.09	8.26%	0.15	0.35	4.20	0.42	35.00%
	110	0.07	6.65%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	1.03	100.00%	0.18	0.34	4.38	0.49	15.63%
20								
	13	0.004	0.73%	0.35	0.26	6.60	0.17	
	18	0.26	42.59%	0.15	0.35	4.30	0.44	15.00%
	70	0.03	4.78%	0.25	0.35	4.10	0.53	
	98	0.06	9.09%	0.35	0.35	4.20	0.63	
	110	0.26	42.82%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.61	100.00%	0.26	0.35	4.14	0.53	7.67%
21								
	10	0.02	1.99%	0.35	0.35	2.22	2.40	
	13	0.06	8.34%	0.35	0.26	6.60	0.17	
	18	0.19	25.56%	0.15	0.35	4.30	0.44	15.00%
	45	0.02	2.24%	0.25	0.34	4.08	0.40	
	48	0.02	2.32%	0.25	0.35	4.08	0.54	
	98	0.26	34.67%	0.35	0.35	4.20	0.63	
	110	0.19	24.88%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.76	100.00%	0.29	0.34	4.31	0.57	4.58%
22	10	0.01	2.35%	0.35	0.35	2.22	2.40	
	12	0.06	9.79%	0.35	0.25	8.06	0.08	
	13	0.09	13.62%	0.35	0.26	6.60	0.17	
	18	0.01	1.38%	0.15	0.35	4.30	0.44	15.00%
	45	0.14	21.68%	0.25	0.34	4.08	0.40	
	48	0.01	1.39%	0.25	0.35	4.08	0.54	
	98	0.08	12.01%	0.35	0.35	4.20	0.63	
	110	0.24	37.79%	0.35	0.35	3.92	0.62	3.00%
	TOTAL	0.63	100.00%	0.32	0.33	4.73	0.49	1.34%
23								
	10	0.02	4.92%	0.35	0.35	2.22	2.40	
	45	0.14	43.44%	0.25	0.34	4.08	0.40	
	98	0.00	0.52%	0.35	0.35	4.20	0.63	
	110	0.01	2.42%	0.35	0.35	3.92	0.62	3.00%
	112	0.02	6.38%	0.35	0.35	4.06	0.55	
	118	0.14	42.32%	0.35	0.35	4.18	0.67	
	TOTAL	0.33	100.00%	0.31	0.35	4.03	0.63	0.07%

TOTAL EAST DRAINAGE AREA
AREAS 19–23 3.36

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JOB CAP Overchutes FCD 90-09
JOB NO. 310.42

ESTIMATION OF SURFACE RETENTION

Surface Retention, IA in inches, was estimated according to Table 4.1 as shown below. Since the land within the watershed is virtually in its natural state, the category of "Natural" was assumed for surface cover. The surface retention losses were estimated on the basis of ground slopes as shown on the next page.

Rainfall Losses

Hydrologic Design Manual
for Maricopa County

Table 4.1
Surface Retention Loss for Various Land Surfaces in Maricopa County

Land-use and/or Surface Cover (1)	Surface Retention Loss IA, Inches (2)
Natural	
Desert and rangeland, flat slope	0.35
Hillslopes, Sonoran Desert	0.15
Mountain, with vegetated surface	0.25
Developed (Residential and Commercial)	
Lawn and turf	0.20
Desert landscape	0.10
Pavement	0.05
Agricultural	
Tilled fields and irrigated pasture	0.50

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ESTIMATION OF SURFACE RETENTION

Soil Map Symbol	Ground Slope	Surface Retention IA (inches)	Assumed Land Classification
10	1-5 %	0.35	Flat Slope
12	1-8 %	0.35	Flat Slope
13	0-3 %	0.35	Flat Slope
18	5-60 %	0.15	Hillslopes
45	8-20 %	0.25	Mountain
48	3-20 %	0.25	Mountain
49	20-40 %	0.15	Hillslopes
51	8-25 %	0.25	Mountain
52	7-55 %	0.15	Hillslopes
68	1-7 %	0.35	Flat Slope
70	1-25 %	0.25	Mountain
98	1-10 %	0.35	Flat Slope
100	20-65 %	0.15	Hillslopes
109	25-60 %	0.15	Hillslopes
110	1-7 %	0.35	Flat Slope
112	0-3 %	0.35	Flat Slope
113	0-3 %	0.35	Flat Slope
118	0-3 %	0.35	Flat Slope

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GREEN - AMPT INFILTRATION PARAMETERS

Soil Type	USDA Classification	Textural Class	Parameters XKSAT	PSIF	DTHETA
Antho	Coarse loamy, well drained	Sandy loam	0.40	4.3	0.35
Beardsley	Cobbly clay loam	clay loam	✓ 0.04	8.2	0.25
Brios	Loamy sand	loamy sand	1.20	2.4	0.35
Carefree	Cobbly clay loam	clay loam	✓ 0.04	8.2	0.25
Carrizo	Gravelly sand	sand	4.60	1.9	0.35
Cherioni	Stony loam	Sandy loam	0.40	4.3	0.35
Chuckawalla	Extremely gravelly loam	Sandy loam	0.40	4.3	0.35
Cipriano	Very gravelly loam	Sandy loam	0.40	4.3	0.35
Contine	Clay loam	Clay loam	✓ 0.04	8.2	0.25
Denure	Gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Ebon	Gravelly loam	Sandy loam	0.40	4.3	0.35
Gachado	Gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Gadsden	Clay	Clay	0.01	12.4	0.15

GREEN - AMPT INFILTRATION PARAMETERS

Soil Type	USDA Classification	Textural Class	XKSAT	PSIF	DTHETA
Gilman	Coarse loamy	Sandy loam	0.40	4.3	0.35
Gunsight	Very gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Lomitas	Extremely gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Luke	Gravelly sandy clay loam	Clay loam	✓ 0.04	8.2	0.25
Maripo	Sandy loam	Sandy loam	0.40	4.3	0.35
Mohall	Clay loam	Clay loam	✓ 0.04	8.2	0.25
Momoli	Gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Pinamt	Extr. gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Quilotosa	Extr. gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Rillito	Gravelly loam	Sandy loam	0.40	4.3	0.35
Schenco	Extremely channery loam	Sandy loam	0.40	4.3	0.35
Suncity	Gravelly loam	Sandy loam	0.40	4.3	0.35
Tremant	Gravelly sandy loam	Sandy loam	0.40	4.3	0.35
Vaiva	Very gravelly loam	Sandy loam	0.40	4.3	0.35
Valencia	Sandy loam	Sandy loam	0.40	4.3	0.35
Vint	Sandy loam	Sandy loam	0.40	4.3	0.35

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GREEN-AMPT PARAMETERS

(10) BRIOS-CARRIZO COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
BRIOS	LOAMY SAND	40	1.20	0.48	2.40	0.96	0.35	0.14	1.20	0.48	0.80	0.32
CARRIZO	SAND	40	4.60	1.84	1.90	0.76	0.35	0.14	4.60	1.84	1.30	0.52
ANTHO	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
GILMAN	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
MARIPO	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
VINT	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
		100		2.40		2.58		0.35		2.40		0.98

GREEN-AMPT PARAMETERS

(12) CAREFREE

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
CAREFREE	CLAY LOAM	80	0.04	0.03	8.20	6.56	0.25	0.20	0.04	0.03	0.50	0.40
BEARDSLEY	CLAY LOAM	4	0.04	0.00	8.20	0.33	0.25	0.01	0.04	0.00	0.50	0.02
CONTINE	CLAY LOAM	4	0.04	0.00	8.20	0.33	0.25	0.01	0.04	0.00	0.50	0.02
EBON	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
SUNCITY	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
GADSDEN	CLAY	4	0.01	0.00	12.40	0.50	0.15	0.01	0.01	0.00	0.30	0.01
		100		0.07		8.06		0.25		0.07		0.51

GREEN-AMPT PARAMETERS

(13) CAREFREE-BEARDSLEY COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
CAREFREE	CLAY LOAM	50	0.04	0.02	8.20	4.10	0.25	0.13	0.04	0.02	0.50	0.25
BEARDSLEY	CLAY LOAM	40	0.04	0.02	8.20	3.28	0.25	0.10	0.04	0.02	0.50	0.20
ANTHO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
CARRIZO	SAND	2	4.60	0.09	1.90	0.04	0.35	0.01	4.60	0.09	1.30	0.03
CONTINE	CLAY LOAM	2	0.04	0.00	8.20	0.16	0.25	0.01	0.04	0.00	0.50	0.01
EBON	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
SUNCITY	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
		100		0.15		7.84		0.26		0.15		0.53

GREEN-AMPT PARAMETERS

(18) CHERIONI-ROCK OUTCROP

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
CHERIONI	SANDY LOAM	60	0.40	0.24	4.30	2.58	0.35	0.21	0.40	0.24	0.70	0.42
CIPRIANO	SANDY LOAM	6	0.40	0.02	4.30	0.26	0.35	0.02	0.40	0.02	0.70	0.04
GACHADO	SANDY LOAM	6	0.40	0.02	4.30	0.26	0.35	0.02	0.40	0.02	0.70	0.04
GUNSIGHT	SANDY LOAM	6	0.40	0.02	4.30	0.26	0.35	0.02	0.40	0.02	0.70	0.04
SUNCITY	SANDY LOAM	7	0.40	0.03	4.30	0.30	0.35	0.02	0.40	0.03	0.70	0.05
ROCK OUTCROP	15%											
		85		0.34		3.66		0.30		0.34		0.60
	WITHOUT ROCK			0.40		4.30		0.35		0.40		0.70

GREEN-AMPT PARAMETERS

(45) EBON

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
EBON	SANDY LOAM	80	0.40	0.32	4.30	3.44	0.35	0.28	0.40	0.32	0.70	0.56
CONTINE	CLAY LOAM	3	0.04	0.00	8.20	0.25	0.25	0.01	0.04	0.00	0.50	0.02
LUKE	CLAY LOAM	3	0.04	0.00	8.20	0.25	0.25	0.01	0.04	0.00	0.50	0.02
BEARDSLEY	CLAY LOAM	3	0.04	0.00	8.20	0.25	0.25	0.01	0.04	0.00	0.50	0.02
PINAMT	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
MOHALL	CLAY LOAM	3	0.04	0.00	8.20	0.25	0.25	0.01	0.04	0.00	0.50	0.02
CIPRIANO	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
GUNSIGHT	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
		100		0.36		4.77		0.34		0.36		0.68

GREEN-AMPT PARAMETERS

(48) EBON-PINAMT COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
EBON	SANDY LOAM	45	0.40	0.18	4.30	1.93	0.35	0.16	0.40	0.18	0.70	0.32
PINAMT	SANDY LOAM	35	0.40	0.14	4.30	1.51	0.35	0.12	0.40	0.14	0.70	0.25
CARRIZO	SAND	2.5	4.60	0.11	1.90	0.05	0.35	0.01	4.60	0.11	1.30	0.03
ANTHO	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
CONTINE	CLAY LOAM	2.5	0.04	0.00	8.20	0.21	0.25	0.01	0.04	0.00	0.50	0.01
LUKE	CLAY LOAM	2.5	0.04	0.00	8.20	0.21	0.25	0.01	0.04	0.00	0.50	0.01
CIPRIANO	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
GUNSIGHT	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
MOMOLI	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
TREMANT	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
		100		0.49		4.44		0.35		0.49		0.71

GREEN-AMPT PARAMETERS

(49) EBON-PINAMT COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
EBON	SANDY LOAM	45	0.40	0.18	4.30	1.93	0.35	0.16	0.40	0.18	0.70	0.32
PINAMT	SANDY LOAM	35	0.40	0.14	4.30	1.51	0.35	0.12	0.40	0.14	0.70	0.25
TREMANT	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
ANTHO	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
CARRIZO	SAND	5	4.60	0.23	1.90	0.10	0.35	0.02	4.60	0.23	1.30	0.07
LUKE	CLAY LOAM	5	0.04	0.00	8.20	0.41	0.25	0.01	0.04	0.00	0.50	0.03
		100		0.59		4.38		0.35		0.59		0.72

GREEN-AMPT PARAMETERS

(51) GACHADO-LOMITAS COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
GACHADO	SANDY LOAM	50	0.40	0.20	4.30	2.15	0.35	0.18	0.40	0.20	0.70	0.35
LOMITAS	SANDY LOAM	25	0.40	0.10	4.30	1.08	0.35	0.09	0.40	0.10	0.70	0.18
CARRIZO	SAND	3.5	4.60	0.16	1.90	0.07	0.35	0.01	4.60	0.16	1.30	0.05
CHERIONI	SANDY LOAM	3.5	0.40	0.01	4.30	0.15	0.35	0.01	0.40	0.01	0.70	0.02
CONTINE	CLAY LOAM	3.5	0.04	0.00	8.20	0.29	0.25	0.01	0.04	0.00	0.50	0.02
EBON	SANDY LOAM	3.5	0.40	0.01	4.30	0.15	0.35	0.01	0.40	0.01	0.70	0.02
DENURE	SANDY LOAM	3.5	0.40	0.01	4.30	0.15	0.35	0.01	0.40	0.01	0.70	0.02
GUNSIGHT	SANDY LOAM	3.5	0.40	0.01	4.30	0.15	0.35	0.01	0.40	0.01	0.70	0.02
TREMANT	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
		100		0.53		4.35		0.35		0.53		0.71

GREEN-AMPT PARAMETERS

(52)GACHADO-LOMITAS-ROCK OUTCROP

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
GACHADO	SANDY LOAM	45	0.40	0.18	4.30	1.93	0.35	0.16	0.40	0.18	0.70	0.32
LOMITAS	SANDY LOAM	20	0.40	0.08	4.30	0.86	0.35	0.07	0.40	0.08	0.70	0.14
CARRIZO	SAND	2	4.60	0.09	1.90	0.04	0.35	0.01	4.60	0.09	1.30	0.03
CHERIONI	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
CIPRIANO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
EBON	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
PINAMT	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
GUNSIGHT	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
SCHENCO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
VAIVA	SANDY LOAM	1	0.40	0.00	4.30	0.04	0.35	0.00	0.40	0.00	0.70	0.01
ROCK OUTCROP	20%											
		80		0.40		3.39		0.28		0.40		0.57
	WITHOUT ROCK			0.51		4.24		0.35		0.51		0.72

GREEN-AMPT PARAMETERS

(68)GUNSIGHT-CIPRIANO COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
GUNSIGHT	SANDY LOAM	45	0.40	0.18	4.30	1.93	0.35	0.16	0.40	0.18	0.70	0.32
CIPRIANO	SANDY LOAM	40	0.40	0.16	4.30	1.72	0.35	0.14	0.40	0.16	0.70	0.28
TREMANT	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
GILMAN	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
CARRIZO	SAND	3	4.60	0.14	1.90	0.06	0.35	0.01	4.60	0.14	1.30	0.04
PINAMT	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
RILLITO	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
		100		0.53		4.23		0.35		0.53		0.72

GREEN-AMPT PARAMETERS

(70) GUNSIGHT-RILLITO COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
GUNSIGHT	SANDY LOAM	40	0.40	0.16	4.30	1.72	0.35	0.14	0.40	0.16	0.70	0.28
RILLITO	SANDY LOAM	40	0.40	0.16	4.30	1.72	0.35	0.14	0.40	0.16	0.70	0.28
CARRIZO	SAND	2	4.60	0.09	1.90	0.04	0.35	0.01	4.60	0.09	1.30	0.03
CHUCKAWALLA	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
CIPRIANO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
EBON	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
PINAMT	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
MOHALL	CLAY LOAM	2	0.04	0.00	8.20	0.16	0.25	0.01	0.04	0.00	0.50	0.01
ANTHO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
TREMANT	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
GILMAN	SANDY LOAM	3	0.40	0.01	4.30	0.13	0.35	0.01	0.40	0.01	0.70	0.02
		100		0.48		4.33		0.35		0.48		0.71

GREEN-AMPT PARAMETERS

(98) PINAMT-TREMANT COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
PINAMT	SANDY LOAM	45	0.40	0.18	4.30	1.93	0.35	0.16	0.40	0.18	0.70	0.32
TREMANT	SANDY LOAM	35	0.40	0.14	4.30	1.51	0.35	0.12	0.40	0.14	0.70	0.25
CHUCHAWALLA	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
EBON	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
CARRIZO	SAND	4	4.60	0.18	1.90	0.08	0.35	0.01	4.60	0.18	1.30	0.05
GUNSIGHT	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
RILLITO	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
		100		0.57		4.20		0.35		0.57		0.72

GREEN-AMPT PARAMETERS

(100) QUILLOTOSA-VAIVA-ROCK OUTCROP

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
QUILOTOSA	SANDY LOAM	50	0.40	0.20	4.30	2.15	0.35	0.18	0.40	0.20	0.70	0.35
VAIVA	SANDY LOAM	20	0.40	0.08	4.30	0.86	0.35	0.07	0.40	0.08	0.70	0.14
SCHENCO	SANDY LOAM	10	0.40	0.04	4.30	0.43	0.35	0.03	0.40	0.04	0.70	0.07
ROCK OUTCROP	20											
		80		0.32		3.44		0.28		0.32		0.56
	WITHOUT ROCK			0.40		4.30		0.35		0.40		0.70

GREEN-AMPT PARAMETERS

(109) SCHENCO-ROCK OUTCROP COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
SCHENCO	SANDY LOAM	55	0.40	0.22	4.30	2.36	0.35	0.19	0.40	0.22	0.70	0.38
CIPRIANO	SANDY LOAM	1.5	0.40	0.01	4.30	0.06	0.35	0.01	0.40	0.01	0.70	0.01
BEARDSLEY	CLAY LOAM	1.5	0.04	0.00	8.20	0.12	0.25	0.00	0.04	0.00	0.50	0.01
GACHADO	SANDY LOAM	1.5	0.40	0.01	4.30	0.06	0.35	0.01	0.40	0.01	0.70	0.01
QUILOTOSA	SANDY LOAM	1.5	0.40	0.01	4.30	0.06	0.35	0.01	0.40	0.01	0.70	0.01
EBON	SANDY LOAM	1.5	0.40	0.01	4.30	0.06	0.35	0.01	0.40	0.01	0.70	0.01
VAIVA	SANDY LOAM	1.5	0.40	0.01	4.30	0.06	0.35	0.01	0.40	0.01	0.70	0.01
GUNSIGHT	SANDY LOAM	1	0.40	0.00	4.30	0.04	0.35	0.00	0.40	0.00	0.70	0.01
ROCK OUTCROP	35%											
		65		0.25		2.85		0.23		0.25		0.45
	WITHOUT ROCK			0.39		4.39		0.35		0.39		0.70

GREEN-AMPT PARAMETERS

(110) SUNCITY-CIPRIANO COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
SUNCITY	SANDY LOAM	55	0.40	0.22	4.30	2.36	0.35	0.19	0.40	0.22	0.70	0.38
CIPRIANO	SANDY LOAM	30	0.40	0.12	4.30	1.29	0.35	0.11	0.40	0.12	0.70	0.21
BEARDSLEY	CLAY LOAM	4	0.04	0.00	8.20	0.33	0.25	0.01	0.04	0.00	0.50	0.02
GUNSIGHT	SANDY LOAM	4	0.40	0.02	4.30	0.17	0.35	0.01	0.40	0.02	0.70	0.03
CARRIZO	SAND	4	4.60	0.18	1.90	0.08	0.35	0.01	4.60	0.18	1.30	0.05
ROCK OUTCROP	3%											
		97		0.54		4.23		0.34		0.54		0.70
	WITHOUT ROCK			0.56		4.36		0.35		0.56		0.72

GREEN-AMPT PARAMETERS

(112) TREMANT GROUP

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
TREMANT	SANDY LOAM	80	0.40	0.32	4.30	3.44	0.35	0.28	0.40	0.32	0.70	0.56
PINAMT	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
CARRIZO	SAND	2.5	4.60	0.11	1.90	0.05	0.35	0.01	4.60	0.11	1.30	0.03
ANTHO	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
MOHALL	CLAY LOAM	2.5	0.04	0.00	8.20	0.21	0.25	0.01	0.04	0.00	0.50	0.01
VALENCIA	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
DENURE	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
RILLITO	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
MOMOLI	SANDY LOAM	2.5	0.40	0.01	4.30	0.11	0.35	0.01	0.40	0.01	0.70	0.02
		100		0.50		4.34		0.35		0.50		0.71

GREEN-AMPT PARAMETERS

(113) TREMANT GROUP

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
TREMANT	SANDY LOAM	80	0.40	0.32	4.30	3.44	0.35	0.28	0.40	0.32	0.70	0.56
PINAMT	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
CARRIZO	SAND	2	4.60	0.09	1.90	0.04	0.35	0.01	4.60	0.09	1.30	0.03
ANTHO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
MOHALL	CLAY LOAM	2	0.04	0.00	8.20	0.16	0.25	0.01	0.04	0.00	0.50	0.01
VALENCIA	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
DENURE	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
RILLITO	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
MOMOLI	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
CHUCKAWALLA	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
GUNSIGHT	SANDY LOAM	2	0.40	0.01	4.30	0.09	0.35	0.01	0.40	0.01	0.70	0.01
		100		0.48		4.33		0.35		0.48		0.71

GREEN-AMPT PARAMETERS

(118) TREMANT-RILLITO COMPLEX

SOIL TYPE	CLASSIF.	PCT	XKSAT	WT. XKSAT	PSIF	WT. PSIF	DTHETA	WT. DTHETA	CNSTL	WT. CNSTL	IL.	WT. IL.
TREMANT	SANDY LOAM	45	0.40	0.18	4.30	1.93	0.35	0.16	0.40	0.18	0.70	0.32
RILLITO	SANDY LOAM	30	0.40	0.12	4.30	1.29	0.35	0.11	0.40	0.12	0.70	0.21
CIPRIANO	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
GUNSIGHT	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
CARRIZO	SAND	5	4.60	0.23	1.90	0.10	0.35	0.02	4.60	0.23	1.30	0.07
PINAMT	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
MOMOLI	SANDY LOAM	5	0.40	0.02	4.30	0.22	0.35	0.02	0.40	0.02	0.70	0.03
		100		0.61		4.18		0.35		0.61		0.73

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JOB CAP Overshoots
JOB NO. 310.42

ADJUSTMENT of PSIF Values FOR Green-Ampt Parameters

Soil Group 10 ADJUST PSIF Values

XKSAT From Table 4.2	PSIF	
4.6	1.9	find PSIF @ XKSAT = 2.4
1.2	2.4	

ADJUST By RATIO

$$\frac{1.2}{3.4} = \frac{-x}{.5} \Rightarrow x = -0.176$$

for XKSAT = 2.4, PSIF = 2.4 − .18 = 2.22

Soil Group	XKSAT	PSIF UNADJUSTED	ADJUSTED By GRAPH, INTERP, or READ	
13	0.15	7.84	6.6	READ
45	0.36	4.77	4.08	GRAPH
48	0.49	4.44	4.08	GRAPH
49	0.59	4.38	3.85	GRAPH
51	0.53	4.35	3.98	GRAPH
70	0.48	4.33	4.10	GRAPH
109	0.38	4.39	4.20	GRAPH
110	0.56	4.36	3.92	GRAPH
112	0.50	4.34	4.06	GRAPH
113	0.48	4.33	4.10	GRAPH

Check GRAPH By Interpolation

Use Soil Group 51 XKSAT = 0.53

for XKSAT = 0.40 PSIF = 4.3
for XKSAT = 1.20 PSIF = 2.4

$\Delta = 0.13$ Δ PSIF = X
$T_1 = 0.80$ Δ TOTAL = T_2 = −1.9

$$\frac{0.13}{0.80} = \frac{x}{-1.9} \Rightarrow x = -0.309 \Rightarrow \text{PSIF @ XKSAT } 0.53 = 3.99$$

READ from GRAPH = 3.98 Close enough.

» hydraulic conductivity at natural saturation (XKSAT) equal to K_s in Equation 4.1;

» wetting front capillary suction (PSIF) equal to Ψ in Equation 4.1; and

» volumetric soil moisture deficit at the start of rainfall (DTHETA) equal to θ in Equation 4.1.

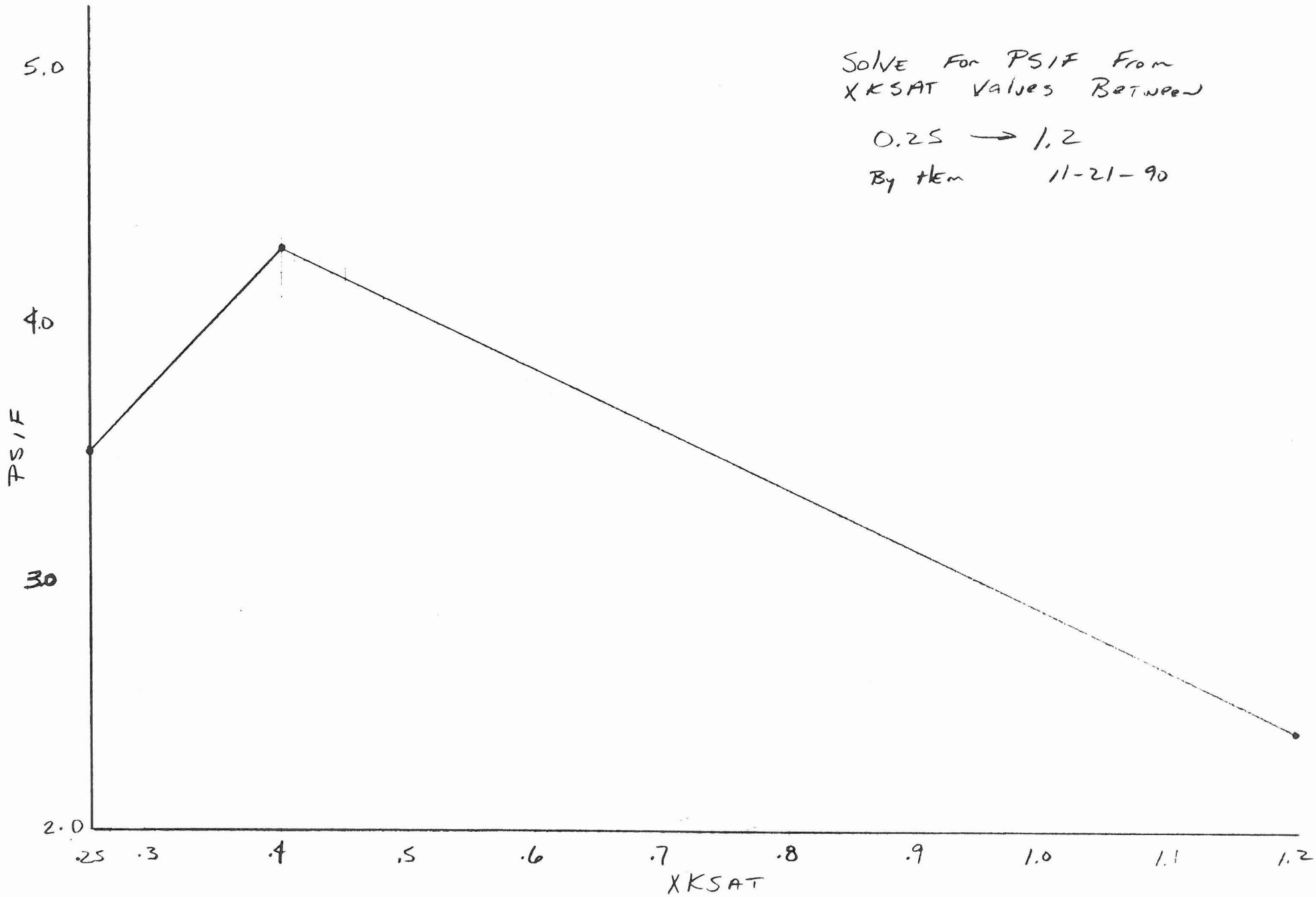
The three infiltration parameters are functions of soil characteristics, ground surface characteristics, and land management practices. The soil characteristics of interest are particle size distribution (soil texture), organic matter, and bulk density. The primary soil surface characteristics are vegetation canopy cover, ground cover, and soil crusting. The land management practices are identified as various tillages as they result in changes to soil porosity.

Values of Green and Ampt equation parameters as a function of soil characteristics alone (bare ground condition) have been obtained from published reports (Rawls and others, 1983; Rawls and Brakensiek, 1983), and average values of XKSAT and PSIF for each of the soil texture classes are shown in Columns (2) and (3) of Table 4.2. The values of XKSAT and PSIF from Table 4.2 should be used if general soil texture classification of the drainage area is available. References used to create Table 4.2 can be found in the Documentation Manual.

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	4.3	0.35	0.25	0
loam	0.25	3.5	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.


Solve For PSIF From
XKSAT Values Between
0.25 → 1.2
By Hem 11-21-90
5.0
4.0
3.0
2.0
PSIF
.25
.3
.4
.5
.6
.7
.8
.9
1.0
1.1
1.2
XKSAT

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ESTIMATION OF GREEN-AMPT PARAMETERS FOR AREAS OUTSIDE DETAILED SOIL SURVEY

1. SOIL PROPERTIES

According to SCS Soil Map for Maricopa County, the area outside the detailed soil survey limits is characterized as Rillito - Gunsight - Pinal Association which is composed of the following properties:

Soil Type	Percentage	Classification	Hydrologic Group
Rillito	35 %	Sandy Loam	B
Gunsight	25 %	Sandy Loam	B
Pinal	20 %	Loam w/ Hardpan	D
Others	20 %	~~Sandy~~ Loam	B

2. SURFACE RETENTION LOSS

Soil Slope = 1% ~15% (Flat)

$\therefore IA = 0.35''$

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3. LOSS RATE PARAMETERS

Soil Type	Percentage	XKSAT	Weighted XKSAT	PSIF	Weighted PSIF	DTHETA	Weighted DTHETA
Rillito	35%	0.40	0.14	4.3	1.51	0.35	0.12
Gunsight	25%	0.40	0.10	4.3	1.08	0.35	0.09
Pinal	20%	0.01	0.00	12.4	2.48	0.05	0.01
Others	20%	0.40	0.08	4.3	0.86	0.35	0.07
			0.32		~~5.93~~ 3.87		0.29

Adjusted XKSAT = 0.32 × 1.10 = 0.35 ADJUSTED BY RATIO FROM TABLE 4.2

(Based on the assumption of 20% vegetation cover)

4. INITIAL LOSS & UNIFORM LOSS – From Table 4.4

Soil Type	Percentage	Hydro. Group	CNSTL	Weighted CNSTL	IL	Weighted IL
Rillito	35%	B	0.25	0.09	0.5	0.18
Gunsight	25%	B	0.25	0.06	0.5	0.13
Pinal	20%	D	0.05	0.01	0.4	0.08
Others	20%	B	0.25	0.05	0.5	0.10
				0.21		0.49

STRTL = IL + IA = 0.49 + 0.35 = 0.84

Barkerville-Cabezon-Rock Outcrop association. Gently sloping to very steep, shallow to very shallow soils on mountains and low hills.

✓ - Rock outcrop areas of 200-400 acres
✓✓ - Rock outcrop areas of 400 acres or more

GENERAL SOIL MAP
MARICOPA COUNTY
ARIZONA

U.S. SOIL CONSERVATION SERVICE
in cooperation with
NATURAL RESOURCE CONSERVATION DISTRICTS
in MARICOPA COUNTY

Compiled from detailed soil surveys, and available information on soils, geology, topography, climate and vegetation.

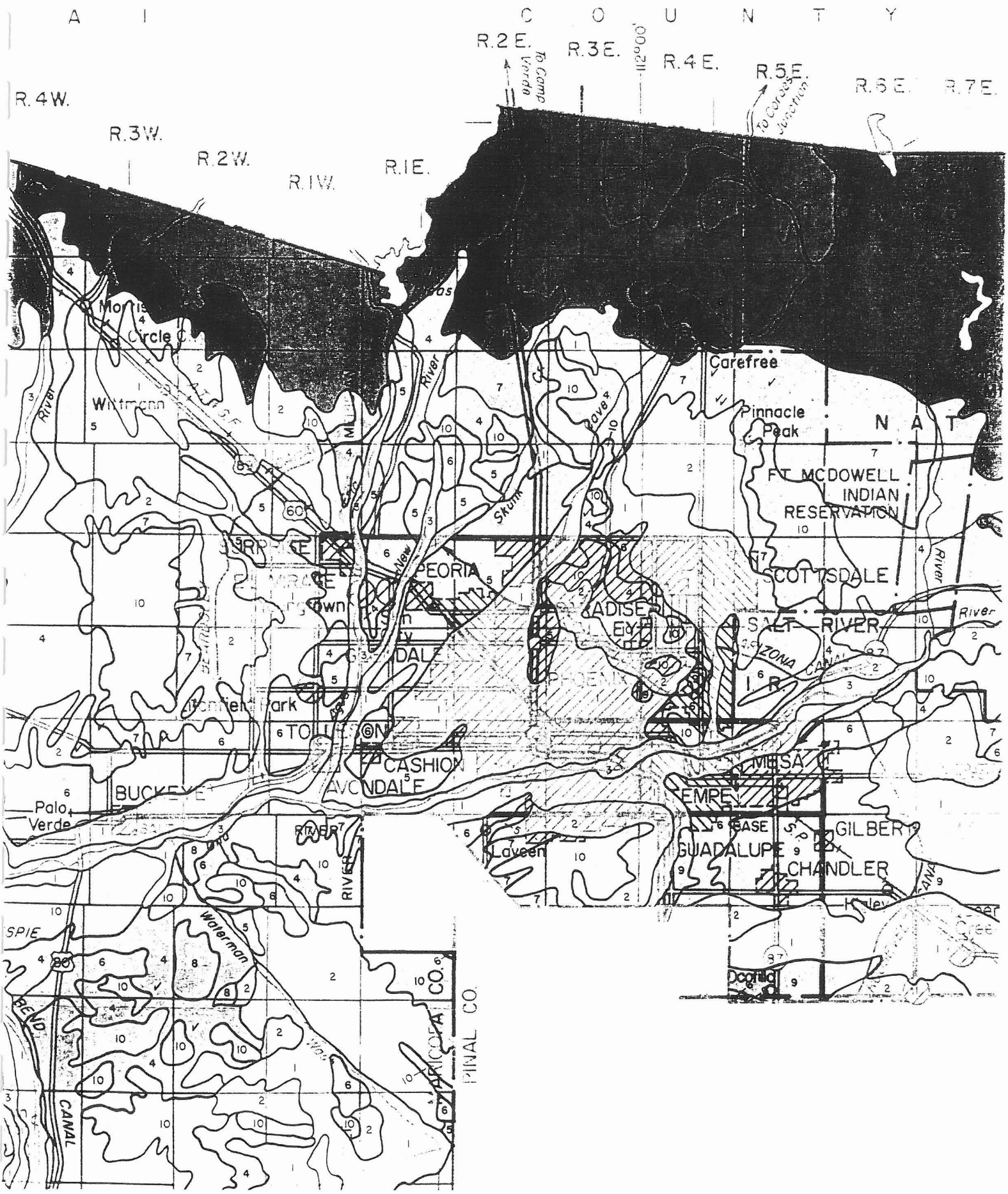
This map is intended for general planning use. On-site investigations must be made for detailed planning for a specific site or use.

NOVEMBER 1973

10 0 10 20 MILES

SCALE 1:500,000

M7-E-23123


A I
C O U N T Y
R.4W.
R.3W.
R.2W.
R.1W.
R.1E.
R.2E.
R.3E.
R.4E.
R.5E.
R.6E.
R.7E.
To Camp Verde
To Coronado Junction
Circle C.
Wittmann
Carefree
Pinnacle Peak
FT. MCDOWELL INDIAN RESERVATION
SCOTTSDALE
PEORIA
ADISER
SALT RIVER
I.R.
CASHION
AVONDALE
BUCKEYE
Palo Verde
Laveen
GUADALUPE
GILBERT
CHANDLER
Waterman
PINAL CO.
MARICOPA CO.
CANAL
River
Skunk
New
Cave

LEGEND

I. Very hot, very dry soils.

A. Soils from recent alluvium.

1 Gilman-Estrella-Avondale association. Nearly level loam soils on valley plains and flood plains.

2 Antho-Valencia association. Nearly level to gently sloping sandy loam soils on alluvial fans and valley plains.

3 Carrizo-Brios-Vint association. Nearly level sandy soils in stream channels.

B. Soils from old alluvium.

4 Rillito-Gunsight-Pinal association. Nearly level to gently sloping, gravelly to very gravelly limy soils on old alluvial fans and valley plains.

5 Mohall-Laveen association. Nearly level loam and clay loam soils on old valley plains and alluvial fans.

6 Laveen-Coolidge association. Nearly level, limy, sandy loam and loam soils on old alluvial fans and valley plains.

7 Ebon-Pinamt-Tremant association. Gently sloping to sloping, gravelly and very gravelly clay and clay loam soils on old alluvial fans at the base of mountains.

8 Casa Grande-Harqua association. Nearly level, saline-alkali, clay loam soils on old alluvial fans and valley plains.

9 Mohall-Contine association. Nearly level clay loam and clay soils on old alluvial fans and valley plains.

C. Soils of mountains and low hills.

10 Chirioni-Gachado-Rock Outcrop association. Moderately sloping to steep, shallow and very shallow soils on mountains and low hills.

II. Hot and dry soils.

A. Soils from old alluvium.

11 Continental-Pinaleno-Cave association. Gently sloping to moderately sloping clay to loam soils on old alluvial fans at the base of mountains.

12 Latene-Vekol-Anthony association. Nearly level to gently sloping, clay to sandy loam soils on valley plains and alluvial fans.

B. Soils of mountains and low hills.

13 Cellar-Lehman-Rock Outcrop association. Gently sloping to very steep, shallow to very shallow soils on mountains and low hills.

III. Warm, subhumid soils.

A. Soils of mountains and low hills.

TABLE A - Page 2

ESTIMATED PROPERTIES OF THE SOILS, OTHER FEATURES AND SOIL SUITABILITIES A/

Map Symbol and Major Soil Components	Estimated Properties of the Soils								Other Features	Suitability as a Source of:		
	Depth from Surface (in)	Tex-ture	Perme-ability (in/hr)	Available Water Capacity (profile) (in)	Shrink-Swell Potential	Soil Reaction pH	Corrosivity Uncoated Steel	Corrosivity Concrete	Hydro-logic Group	Roadfill	Sand &/or Gravel 1/	Topsoil
Vint loamy fine sand, 0-1% slopes, (15% of Unit)	0-60	lfs	6-20	3.5-5.0	Low	7.9-8.4	Moderate	Low	B	Good	Poor for sand, un-suited for gravel	Poor: sandy material
4. Rillito-Gunsight-Pinal Association												
Rillito gravelly loam, 0-5% slopes (35% of Unit)	0-60	gl	.6-2	6.5-7.5	Low	7.9-8.4	High	Moderate	B	Good	Poor: gravel excess fines	Poor: gravelly
Gunsight grav-elly loam, 0-10% slopes, (25% of Unit)	0-60	vgl,gl	.6-2	4.0-5.5	Low	7.9-8.4	High	Moderate	B	Good	Poor for gravel, unsuited for sand	Poor: gravelly
Pinal gravelly loam, 0-5% slopes, (20% of Unit)	0-12 12	gl	.6-2	1.5-2.7 Indurated pan	Low	7.9-8.4	High	Moderate	D	Poor: thin layer	Unsuited	Poor: thin source
5. Mohall-Laveen Association												
Mohall clay loam 0-1% slopes (45% of Unit)	0-10 10-37 37-60	Cl cl gsl	2-6 .2-.6 2-6	7.5-9.0	Low Moderate Low	6.6-8.4 7.9-8.4 7.9-8.4	Moderate High High	Low Low Low	B	Fair: CL soil material	Poor for sand, un-suited for gravel	Fair: clay loam
Laveen loam 0-1% slopes (30% of Unit)	0-60	l	.6-2	8.5-9.5	Low	7.9-8.4	High	Moderate	B	Fair: ML soil material	Unsuited	Good

3. Carrizo-Brios-Vint Association

This association consists of deep sandy and gravelly soils which are in or adjacent to the major streams of the area. The soils are formed in recent alluvial material derived from a wide variety of rock including acid, basic igneous and metamorphic. Slopes are less than one percent, but many short side slopes are over 3 percent. The natural vegetation is primarily salt cedar, arrowweed, creosotebush and saltbush. The vegetation is very dense in areas having a water table relatively near the surface, such as the Fred J. Weiler Greenbelt near Buckeye. The average annual rainfall is 5 to 9 inches. Mean annual air temperature is 69° to 74°F. The frost-free season is 250 to 300 days. Elevations range from 400 to 2,000 feet.

This association makes up about 2.0 percent of the county. Carrizo soils comprise about 35 percent, Brios soils about 30 percent and Vint soils about 15 percent of the association. The remaining 20 percent of the association is made up of Cashion, Gadsden, Maripo and Antho soils and riverwash.

Carrizo soils have a yellowish-brown gravelly sandy loam surface about 5 inches thick and a pale brown very gravelly sandy substratum about 55 inches thick. The soil profile is moderately alkaline and slightly calcareous. Brios soils have a brown sandy loam surface about 14 inches thick. The soil profile is moderately alkaline and slightly to strongly calcareous. Vint soils consist of 60 inches of pale brown loamy fine sand. The soil profile is moderately alkaline and slightly calcareous. Carrizo soils are in or near cutoff stream channels, while Vint and Brios soils are on low terraces adjacent to the cutoff stream channels.

The soils of this association are frequently flooded. For this reason, few areas are cultivated. A few areas are used as rangeland. One area near Buckeye has been designated the Fred J. Weiler Greenbelt, and is one of the most important nesting areas for dove and quail in the United States. Other wildlife species include cottontail and jackrabbits, lizards, rodents, roadrunners and song birds.

B. Soils From Old Alluvium

4. Rillito-Gunsight-Pinal Association

This association is composed of some deep gravelly and very gravelly loamy soils and some soils which are shallow to an indurated hardpan. They occur on nearly level to gently sloping old alluvial and valley plains. Slopes are less than one percent, but range to as much as 15 percent. The surface is undulating because of the many stream channels which are entrenched one to 20 feet within the landscape. Parent materials are derived from mixed origins, but are dominantly granite-gneiss, schist, basalt, andesite and limestone.

The vegetation is a sparse cover of creosotebush, scattered mesquite and palo verde trees, annual grasses and forbs. The average annual rainfall ranges for 5 to 9 inches. Mean annual air temperature ranges from 67° to 74°F. The frost-free season is 250 to 320 days. Elevations range from 450 to 2,500 feet.

This association makes up about 20 percent of the county. Rillito soils comprise about 35 percent, Gunsight soils about 25 percent and Pinal soils about 20 percent of the association. Harqua, Tremant, Perryville, Laveen, Coolidge and recent alluvial soils make up the remaining 20 percent of the association.

Rillito soils have a light yellowish-brown gravelly loam surface about 10 inches thick, a light brown gravelly loam subsoil about 9 inches thick and a pinkish-white to pale brown gravelly loam and gravelly sandy loam substratum about 41 inches thick. The subsoil and substratum are mottled with lime. The soil profile is moderately alkaline and strongly to very strongly calcareous. Gunsight soils have a strongly calcareous light brown and pale brown gravelly loam surface and upper subsoil about 3 inches thick, a light brown very gravelly loam lower subsoil and substratum about 57 inches thick. The lower subsoil and substratum are mottled with lime. The soil profile is moderately alkaline and strongly to very strongly calcareous. Pinal soils have a light yellowish-brown gravelly loam or cobbly loam upper layer which rests on a white indurated hardpan at about 12 inches. The soil profile is moderately alkaline and calcareous throughout. The Pinal soils usually occur on the upper end of alluvial fans nearest the marginal mountains. Gunsight soils are in intermediate positions and Rillito soils on the lower end of alluvial fans, which are furthest removed from the mountains.

These soils are used for irrigated cropland, seasonal grazing, recreation and wildlife habitat. Most of the irrigated cropland is on Rillito soils. These soils have very limited use as rangeland due to the low rainfall and high evaporation. Reseeding efforts have generally not been successful.

Important wildlife species include jackrabbits, coyotes, elf owl, kit fox and song birds.

5. Mohall-Laveen Association

This association is composed of deep clay loam and loam soils on nearly level old valley plains and old alluvial fans. Slopes are generally less than one percent. These soils formed in alluvium derived from a wide variety of parent materials. The natural vegetation is creosotebush, scattered mesquite and palo verde trees, cactus, annual grasses and forbs. The average annual rainfall is 6 to 10 inches. The mean annual air temperature is 68° to 74°F. The frost-free season is 250 to 300 days. Elevations range from 900 to 2,200 feet.

APPENDIX C

INPUT AND OUTPUT
FOR MCUHP1 COMPUTER PROGRAM

Procedures followed for MCUHP1 and Routing
CAP Overchutes Study

I. General

A. After review of the basin sizing, it was decided that the Clark unit hydrograph procedure was best suited to the watershed area. It was found that the County's MCUHP1 does not save the results shown on the screen for later printing. This was resolved by using the control print screen command to "echo" the input data on the printer.

B. The HEC-1 command files created by the program were later combined and edited by use of the COED text editor.

II. Rainfall

A. The multi-basin option with a centered rainfall in MCUHP was used. The rainfall of 3.32 inches, as submitted for review on November 21, 1990, was used with the 6-hour storm option.

B. The rainfall reduction was automatically taken care of by the MCUHP1 program.

III. Green and Ampt Parameters

A. The Subarea Drainage Basins Soil Property Table that was included in the November 21, 1990 submittal was slightly re-arranged. The Initial Abstraction (IA) has been added to the table and weighted for the basin. However, none of the values of the Green and Ampt parameters were changed.

B. The basin soil parameters were entered as required by MCUHP1 after the selection of the Green and Ampt option. The MCUHP1 program entered the values automatically on an LG record for each drainage area.

IV. Time of Concentration

A. Basin Area, Flow Path Length, and Slope were determined for each sub-drainage area. These results are included in the hydrologic data table included with this submittal.

B. Resistance coefficient - This value was determined from Table 5.1 on page 67 of the Hydrologic Design Manual. The parameters of m and b were estimated to be -0.01375 and 0.08, respectively, based on a land classification of bare or nearly bare ground.

C. A slope adjustment procedure for sub-basins with slopes greater than 200 feet per mile was implemented for sub-areas 3, 4, 5, 6, and 7. This procedure was based on Figure 5.4, contained in the manual. The adjusted data was reentered into MCUHP1.

D. A review of the results indicates that all areas are suitable for the Clark Unit Hydrograph Method. All Times of Concentration are substantially less than the 90-minute maximum value. All areas are less than the 5-square mile minimum value for use with the S-Curve Method.

V. Normal Depth Routing Parameters

A. Typical cross sections for each routing reach were taken from the digitized mapping information. Flow lengths and elevation differences between routing points were obtained from the same mapping. Slopes were calculated using the elevation differences and flow lengths obtained.

B. Each plotted cross section was reviewed and simplified to a cross section described by 8 points, because the HEC-1 program allows up to 8 points to represent a channel cross section.

C. Detailed procedures for estimation of Manning's roughness coefficients are included in the Hydraulics Report under separate volume.

D. Copies of the cross sections and the locations taken have been included in Appendix E of this report.

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BASIN SLOPE ADJUSTMENT

Basins with slopes greater than 200 ft/mile were adjusted according to Fig. 5.4 of the Manual:

1. For Slopes < 600 ft/mile, adjustments were directly based on Fig. 5.4.

2. For Slopes > 600 ft/mile, the curve shown in Fig. 5.4 was extended linearly and slopes were adjusted accordingly.

3. The results are as follows:

Basin Area No.	Estimated Slope (Ft/Mile)	Adjusted Slope (Ft/Mile)
3	216.1	210
4	301.7	266
5	594	315
6	842	340
7	1023	360

Basin Area No.	Estimated Slope (Ft./Mile)	Adjusted Slope (Ft./Mile)
3	216.1	210
4	301.7	266
5	594.0	315

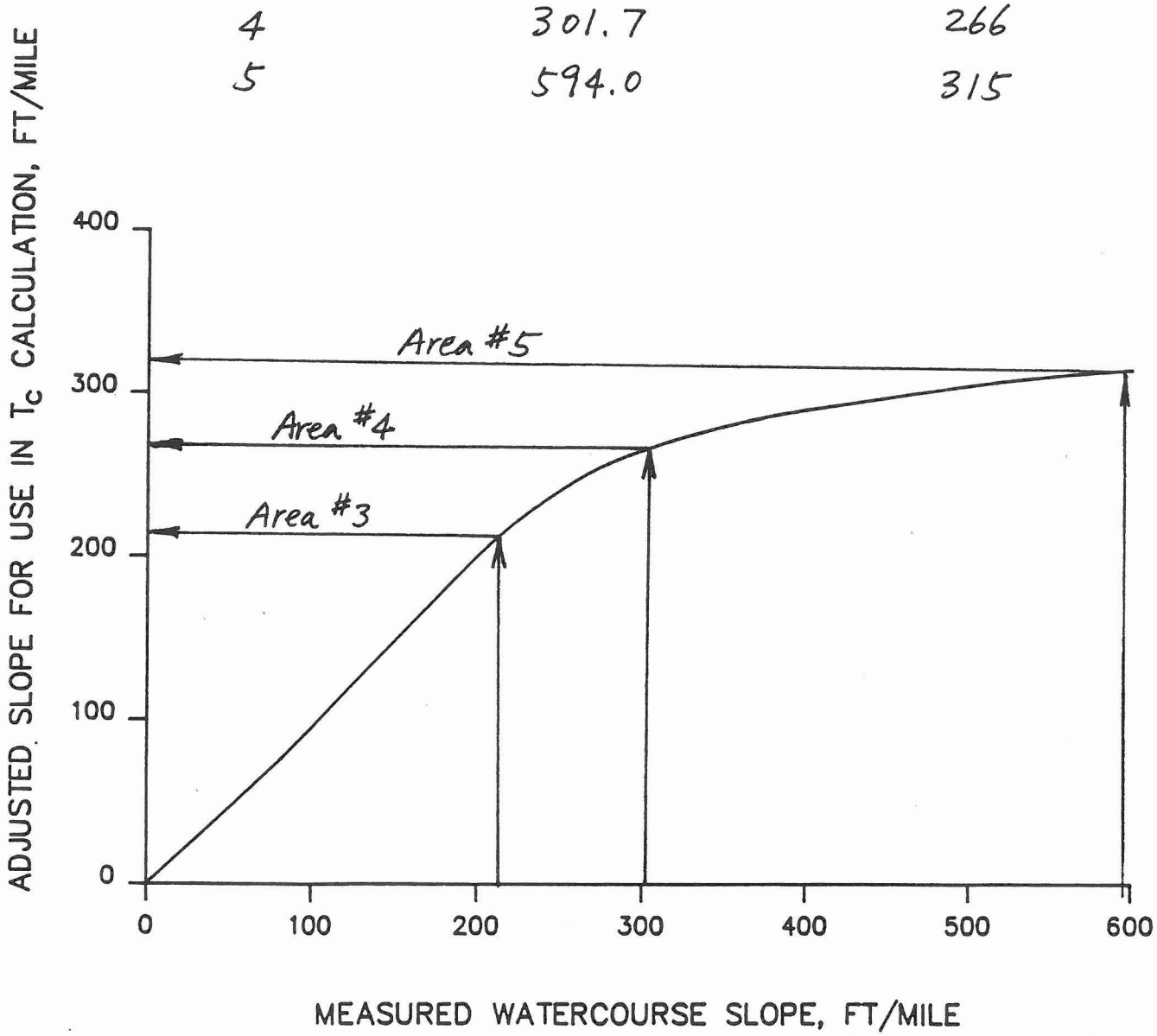

Figure 5.4
Slope Adjustment for Steep Watercourses in Natural Watersheds
(Source: *Drainage Criteria Manual*, Urban Drainage and Flood Control District, Colorado, May 1984.)

Basin Area No.	Estimated Slope (Ft./Mile)	Adjusted Slope (Ft./Mile)
6	842	340
7	1023	360

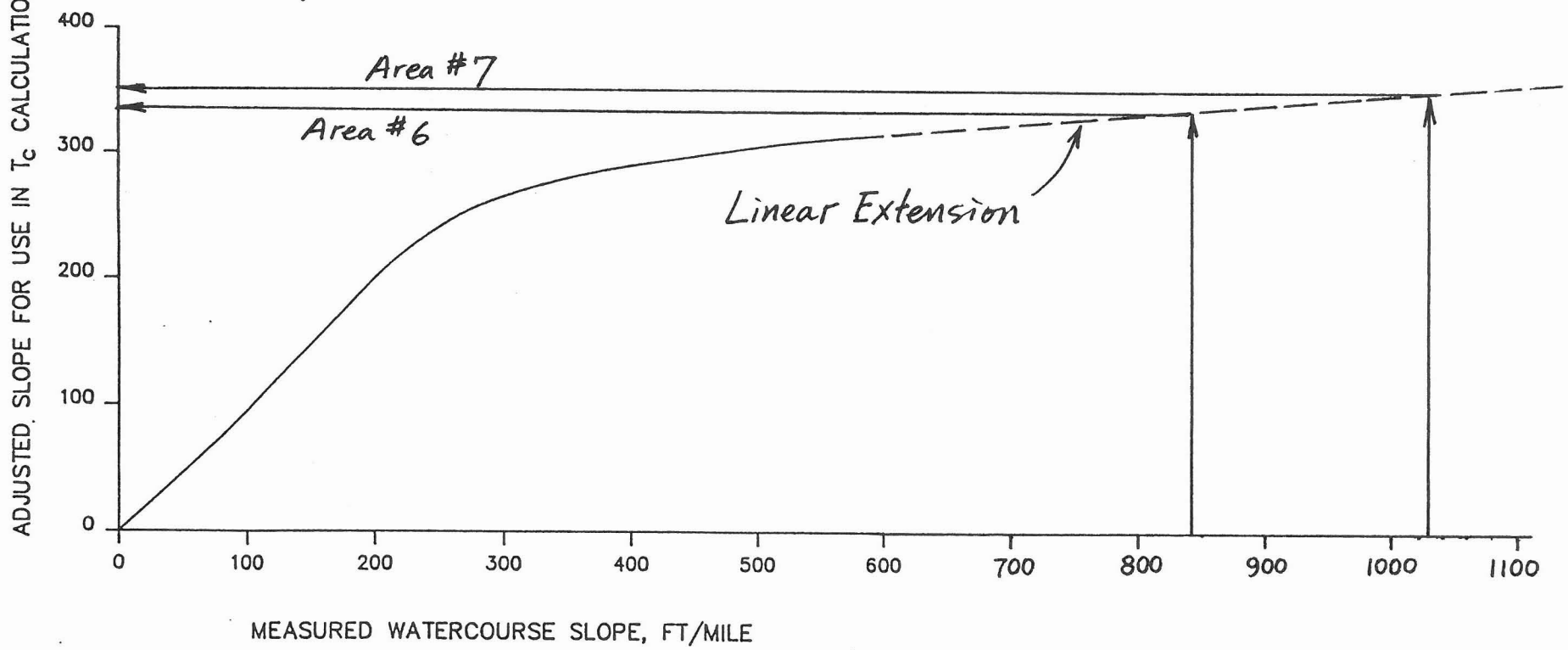

Figure 5.4
Slope Adjustment for Steep Watercourses in Natural Watersheds
(Source: *Drainage Criteria Manual*, Urban Drainage and Flood Control District, Colorado, May 1984.)

3 of 3

TWIN BUTTES WASH WATERSHED

MCUHP1 OUTPUT FILE

```
IC
IT     0                    000
IO     5
IN    15
JD  3.32    0.01
PC  .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
PC  .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
PC  .962    .972    .983    .991   1.000
JD  3.30    0.50
JD  3.25    2.80
PC  .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
PC  .087    .100    .120    .163    .252    .451    .694    .837    .900    .938
PC  .950    .963    .975    .988   1.000
JD  3.06    16.0
PC  .000    .015    .020    .030    .048    .063    .076    .090    .105    .119
PC  .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
PC  .946    .960    .973    .987   1.000
JD  2.69    90.0
PC  .000    .021    .035    .051    .071    .087    .105    .125    .143    .160
PC  .179    .201    .232    .281    .364    .500    .658    .773    .841    .888
PC  .927    .945    .964    .982   1.000
JD  1.89   500.0
PC  .000    .024    .043    .059    .078    .098    .119    .141    .162    .186
PC  .212    .239    .271    .321    .408    .515    .627    .735    .814    .864
PC  .907    .930    .954    .977   1.000
KK
KM SUB-BASIN SA01
BA  .740
LG  .150    .350   4.200    .420  35.000
UC  .467    .331
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA02
BA  .910
LG  .170    .350   4.160    .450  27.090
UC  .467    .343
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA03
BA 1.380
LG  .200    .350   4.110    .510  21.470
UC  .400    .189
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA04
BA  .380
LG  .230    .340   4.340    .460  21.550
UC  .267    .186
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA05
BA  .150
LG  .210    .350   4.130    .480  22.720
UC  .183    .133
UA    0       3       5       8      12      20      43      75      90      96
UA  100
```

```
KK
KM SUB-BASIN SA06
BA  .150
LG  .210    .340   4.440    .450  11.220
UC  .183    .139
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA07
BA  .120
LG  .150    .350   4.290    .440  14.770
UC  .167    .114
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA08
BA  .130
LG  .290    .340   4.410    .530   8.090
UC  .317    .251
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA09
BA  .310
LG  .300    .320   4.960    .400   4.240
UC  .583    .531
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA10
BA  .620
LG  .340    .350   3.850    .750   2.060
UC  .917    .979
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA11
BA  .290
LG  .350    .350   3.680    .960   1.500
UC  .717    .658
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA12
BA  .500
LG  .320    .350   4.000    .630   3.900
UC  .650    .521
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA13
BA  .220
LG  .350    .350   3.890    .660   2.870
UC  .567    .618
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN SA14
BA  .340
LG  .340    .350   3.630    .950   1.910
```

```
HC 1.417  1.662
A    0    3    5    8   12   20   43   75   90   96
A  100
HC
KM SUB-BASIN SA14
 A  .340
LG  .340   .350  3.630   .950  1.910
UC  .717   .780
 A    0     3     5     8    12    20    43    75    90    96
 A  100
KK
KM SUB-BASIN SA15
 A  .640
LG  .310   .340  4.230   .600  1.370
UC  .700   .577
 A    0     3     5     8    12    20    43    75    90    96
 A  100
KK
KM SUB-BASIN SA16
 A  .700
LG  .310   .330  4.500   .640   .830
UC  .700   .488
 A    0     3     5     8    12    20    43    75    90    96
 A  100
KK
 M SUB-BASIN SA17
 A  .460
LG  .340   .300  5.310   .510   .760
UC  .517   .331
 A    0     3     5     8    12    20    43    75    90    96
 A  100
KK
 M SUB-BASIN SA18
 A  .730
LG  .350   .290  3.870   .380   .040
UC  .717   .515
 A    0     3     5     8    12    20    43    75    90    96
 A  100
ZZ
```

```
    .157    for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA02
-----------------------------------------------------------------------------
 Drainage Area=   .910   Channel Length=  2.450  Kn=  .042  SLOPE= 107.7
 IA=  .17  DTHETA=   .35  PSIF=  4.16  XKSAT=  .45  RTIMP=  27.08
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: captbw.rev
-----------------------------------------------------------------------------
 TC =  .467 hours, which is =   28.0 minutes        R =   .343 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .33 .33 .33 .10 .07 .06 .03 .03 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
SA03

? Error: Data format error in file USER
  Error Code 1274, Status  000E
PC = 000C: 0006: SS = 2324, FP = 1E2E, SP = 6452
1

C:\HEC1>MCUHP1

*****************************************************************************
*                                                                           *
*                              PROGRAM MCUHP1                               *
*                                                                           *
*                    THE MARICOPA COUNTY HYDROLOGY MANUAL                   *
*                                                                           *
*                                                                           *
*                 FLOOD CONTROL DISTRICT OF MARICOPA COUNTY                 *
*                  3335 W. DURANGO, PHOENIX, ARIZONA 85009                  *
*                                                                           *
*                                                                           *
*   Program MCUHP1, Maricopa County Unit Hydrograph Procedure 1 computes Tc *
*   and R as required by the Clark Unit-Hydrograph option of HEC-1. It will *
*   also provide the rainfall pattern distribution.  Output will be a HEC-1 *
*   input file for immediate application.                                   *
*****************************************************************************

ENTER NAME OF OUTPUT FILE:
CAPTBW.REV

Enter 1 if single basin, 2 if multibasin design:
2

Enter 1 if  uniform rainfall over the watershed:
Enter 2 if centered rainfall (HEC-1, JD record):
2
ENTER THE SUB-BASIN NAME:
SA01
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.
```

```
.74
     FLOW PATH LENGTH (miles)
2.02
     RESISTANCE COEFFICIENT, Kb
.043
     SLOPE (feet/mile)
133.5


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.15,.35,4.2,.42,35

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA01
-----------------------------------------------------------------------------
 Drainage Area=   .740   Channel Length=  2.020  Kn=  .043  SLOPE= 133.5
 IA=  .15  DTHETA=  .35  PSIF=  4.20  XKSAT=  .42  RTIMP=  35.00
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .467 hours, which is =   28.0 minutes       R =   .331 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .37 .37 .37 .11 .08 .06 .03 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA02
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.91
     FLOW PATH LENGTH (miles)
```

```
     RESISTANCE COEFFICIENT, Kb
.042
     SLOPE (feet/mile)
187.7


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.17,.35,4.16,.45,27.09

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-------------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA02
-------------------------------------------------------------------------------
 Drainage Area=   .910   Channel Length=  2.450  Kn=  .042  SLOPE= 187.7
 IA=  .17  DTHETA=  .35  PSIF=  4.16  XKSAT=  .45  RTIMP=  27.09
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-------------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-------------------------------------------------------------------------------
 TC =  .467 hours, which is =   28.0 minutes       R =   .343 hours.
-------------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-------------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .33 .33 .33 .10 .07 .06 .03 .03 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02
-------------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-------------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA03
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
1.39
     FLOW PATH LENGTH (miles)
1.94
     RESISTANCE COEFFICIENT, Kb
.039
```

```
210

 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.2,.35,4.11,.51,21.47

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA03
-----------------------------------------------------------------------------
 Drainage Area=  1.380   Channel Length=  1.940  Kn=  .039  SLOPE= 210.0
 IA=  .20  DTHETA=  .35  PSIF=  4.11  XKSAT=  .51  RTIMP=  21.47
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .400 hours, which is =   24.0 minutes       R =   .189 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .27 .27 .27 .10 .07 .06 .04 .04 .04 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA04
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.38
     FLOW PATH LENGTH (miles)
1.33
     RESISTANCE COEFFICIENT, Kb
.047
     SLOPE (feet/mile)
266
```

```
 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.23,.34,4.34,.46,21.55

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA04
-----------------------------------------------------------------------------
 Drainage Area=   .380   Channel Length=  1.330  Kn=  .047  SLOPE= 266.0
 IA=  .23  DTHETA=  .34  PSIF=  4.34  XKSAT=  .46  RTIMP=  21.55
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .267 hours, which is =   16.0 minutes       R =   .186 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .42 .42 .42 .09 .05 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA05
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.15
     FLOW PATH LENGTH (miles)
.76
     RESISTANCE COEFFICIENT, Kb
.053
     SLOPE (feet/mile)
315


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:
```

```
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.21,.35,4.13,.48,22.72

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA05
-----------------------------------------------------------------------------
 Drainage Area=   .150   Channel Length=   .760  Kn=  .053  SLOPE= 315.0
 IA=  .21  DTHETA=  .35  PSIF=  4.13  XKSAT=  .48  RTIMP=  22.72
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .183 hours, which is =   11.0 minutes       R =   .133 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .42 .42 .42 .09 .05 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA06
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.15
     FLOW PATH LENGTH (miles)
.8
     RESISTANCE COEFFICIENT, Kb
.053
     SLOPE (feet/mile)
340


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2
```

```
.21,.34,4.44,.45,11.22

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA06
-----------------------------------------------------------------------------
 Drainage Area=    .150   Channel Length=    .800  Kn=  .053  SLOPE= 340.0
 IA=  .21  DTHETA=  .34  PSIF=  4.44  XKSAT=  .45  RTIMP=  11.22
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .183 hours, which is =   11.0 minutes       R =   .139 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .42 .42 .42 .09 .05 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA07
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.12
     FLOW PATH LENGTH (miles)
.61
     RESISTANCE COEFFICIENT, Kb
.054
     SLOPE (feet/mile)
360


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.15,.35,4.28,.44,14.77
```

```
 Enter 1 for the 6-hour MOFCD Distribution
 Enter 2 for the 2-hour MOFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA07
-----------------------------------------------------------------------------
 Drainage Area=   .120   Channel Length=   .610  Kn=  .054  SLOPE= 360.0
 IA=  .15  DTHETA=  .35  PSIF=  4.29  XKSAT=  .44  RTIMP=  14.77
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .167 hours, which is =   10.0 minutes       R =   .114 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .42 .42 .42 .10 .06 .04 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA08
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.13
     FLOW PATH LENGTH (miles)
.71
     RESISTANCE COEFFICIENT, Kb
.054
     SLOPE (feet/mile)
84.3


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.29,.34,4.41,.53,8.09

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MOFCD Distribution
```

```
Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA08
-----------------------------------------------------------------------------
 Drainage Area=   .130   Channel Length=   .710  Kn=  .054  SLOPE=  84.3
 IA=  .29  DTHETA=  .34  PSIF=  4.41  XKSAT=  .53  RTIMP=   8.09
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .317 hours, which is =   19.0 minutes       R =   .251 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .40 .40 .40 .07 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA09
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.31
     FLOW PATH LENGTH (miles)
1.44
     RESISTANCE COEFFICIENT, Kb
.048
     SLOPE (feet/mile)
55.4


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.3,.32,4.96,.40,4.24

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
```

```
3.32

 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA09
-----------------------------------------------------------------------------
 Drainage Area=   .310   Channel Length=  1.440  Kn=  .048  SLOPE=  55.4
 IA=  .30  DTHETA=  .32  PSIF=  4.95  XKSAT=  .40  RTIMP=   4.24
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .583 hours, which is =   35.0 minutes       R =   .531 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .42 .42 .42 .09 .05 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA10
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.62
     FLOW PATH LENGTH (miles)
2.71
     RESISTANCE COEFFICIENT, Kb
.044
     SLOPE (feet/mile)
64.5


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.34,.35,3.85,.75,2.06

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32
```

```
 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA10
-----------------------------------------------------------------------------
 Drainage Area=   .620   Channel Length=  2.710  Kn=  .044  SLOPE=  64.5
 IA=  .34  DTHETA=  .35  PSIF=  3.85  XKSAT=  .75  RTIMP=   2.06
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .917 hours, which is =   55.0 minutes       R =   .979 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .34 .34 .34 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA11
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.29
     FLOW PATH LENGTH (miles)
1.35
     RESISTANCE COEFFICIENT, Kb
.049
     SLOPE (feet/mile)
44.5


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.35,.35,3.68,.96,1.5

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
```

```
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA11
-----------------------------------------------------------------------------
 Drainage Area=   .290   Channel Length=  1.350  Kn=  .049  SLOPE=  44.5
 IA=  .35  DTHETA=  .35  PSIF=  3.60  XKSAT=  .96  RTIMP=   1.50
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                  HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .717 hours, which is =   43.0 minutes       R =   .658 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .35 .35 .35 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA12
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.5
     FLOW PATH LENGTH (miles)
1.7
     RESISTANCE COEFFICIENT, Kb
.046
     SLOPE (feet/mile)
58.7


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.32,.35,4,.53,3.9

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
```

DATA INPUT FOR SUB-BASIN: SA13

Drainage Area= .500 Channel Length= 1.700 Kn= .046 SLOPE= 58.7
IA= .32 DTHETA= .35 PSIF= 4.00 XKSAT= .63 RTIMP= 3.90
Rainfall Depth = 3.32
Rainfall Distribution is 100-year, 6-Hour

HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV

TC = .650 hours, which is = 39.0 minutes R = .521 hours.

EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.39	.39	.39	.05	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02

If calculated TC is much longer than the duration of the most intense portion of the excess rainfall values, consider the S-graph procedures for this basin.

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA13
ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

*Note limit basin size to about 5 square miles,
and/or Tc to less than 1.50 hours.

BASIN AREA (square miles)
.22
FLOW PATH LENGTH (miles)
1.42
RESISTANCE COEFFICIENT, Kb
.05
SLOPE (feet/mile)
70.4

ENTER METHOD OF SOIL LOSS COMPUTATIONS:

1 = Initial/Uniform, 2 = Green-Ampt
2

Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.35,.35,3.89,.66,2.87

ENTER SELECTED RAINFALL DISTRIBUTION:

Enter 1 for the 6-hour MCFCD Distribution
Enter 2 for the 2-hour MCFCD Distribution
Enter 3 for the 24-hour SCS TYPE-II distribution
1
ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32

ENTER ONE OF THE FOLLOWING (for the UA record):
(1) - for an urban watershed
(2) - for a natural watershed
(3) - for manual input
2

DATA INPUT FOR SUB-BASIN: SA13

```
 IA=  .35  DTHETA=  .35  PSIF=  3.89  XKSAT=  .66  RTIMP=   2.87
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPT8W.REV
-----------------------------------------------------------------------
 TC =  .567 hours, which is =   34.0 minutes       R =   .518 hours.
-----------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .39 .39 .39 .05 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA14
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.34
     FLOW PATH LENGTH (miles)
1.87
     RESISTANCE COEFFICIENT, Kb
.48
     SLOPE (feet/mile)
72.1


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.34,.35,3.63,.95,1.91

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA14
-----------------------------------------------------------------------
 Drainage Area=    .340   Channel Length=  1.870  Kn=  .480  SLOPE=  72.1
 IA=  .34  DTHETA=  .35  PSIF=  3.63  XKSAT=  .95  RTIMP=   1.91
 Rainfall Depth =  3.32
```

VOID

SUPERCEEDED

Rainfall Distribution is 100 year, 6-Hour

HEC-1 INPUT IS STORED IN FILE: CAPT8W.REV

VOID

TC = 1.417 hours, which is = 85.0 minutes R = 1.882 hours.
WARNING CALCULATED TC SEEMS TOO LONG. CHECK PARAMETERS.

EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.35	.35	.35	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02

If calculated TC is much longer than the duration of the most intense portion of the excess rainfall values, consider the S-graph procedures for this basin.

SUPERCEEDED

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA14
ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

*Note limit basin size to about 5 square miles,
and/or Tc to less than 1.50 hours.

BASIN AREA (square miles)
.34
FLOW PATH LENGTH (miles)
1.87
RESISTANCE COEFFICIENT, Kb
.048
SLOPE (feet/mile)
72.1

ENTER METHOD OF SOIL LOSS COMPUTATIONS:

1 = Initial/Uniform, 2 = Green-Ampt
2

Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.34,.35,3.63,.95,1.91

ENTER SELECTED RAINFALL DISTRIBUTION:

Enter 1 for the 6-hour MCFCD Distribution
Enter 2 for the 2-hour MCFCD Distribution
Enter 3 for the 24-hour SCS TYPE-II distribution
1
ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32

ENTER ONE OF THE FOLLOWING (for the UA record):
(1) - for an urban watershed
(2) - for a natural watershed
(3) - for manual input
2

DATA INPUT FOR SUB-BASIN: SA14

Drainage Area= .340 Channel Length= 1.870 Kn= .048 SLOPE= 72.1
IA= .34 DTHETA= .35 PSIF= 3.63 XKSAT= .95 RTIMP= 1.91
Rainfall Depth = 3.32
Rainfall Distribution is 100-year, 6-Hour

```
-----------------------------------------------------------------------------
 TC =  .717 hours, which is =   43.0 minutes        R =   .780 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .35 .35 .35 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA15
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.64
     FLOW PATH LENGTH (miles)
2.08
     RESISTANCE COEFFICIENT, Kb
.044
     SLOPE (feet/mile)
72


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.31,.34,4.23,.6,1.37

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA15
-----------------------------------------------------------------------------
 Drainage Area=   .640   Channel Length=  2.080  Kn=  .044  SLOPE=  72.0
 IA=  .31  DTHETA=  .34  PSIF=  4.23  XKSAT=  .60  RTIMP=   1.37
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .700 hours, which is =   42.0 minutes        R =   .577 hours.
```

```
                    EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .36 .36 .36 .06 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA15
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.7
     FLOW PATH LENGTH (miles)
1.8
     RESISTANCE COEFFICIENT, Kb
.044
     SLOPE (feet/mile)
61.1


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.31,.33,4.5,.64,.83

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------------------
                         DATA INPUT FOR SUB-BASIN: SA16
-----------------------------------------------------------------------------------------
 Drainage Area=    .700   Channel Length=  1.800  Kn=  .044  SLOPE=  61.1
 IA=  .31  DTHETA=  .33  PSIF=  4.50  XKSAT=  .64  RTIMP=    .83
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------------------
                         HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------------------
 TC =  .700 hours, which is =   42.0 minutes        R =   .488 hours.
-----------------------------------------------------------------------------------------
                    EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------------------
```

```
    .34 .34 .34 .05 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA17
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.46
     FLOW PATH LENGTH (miles)
1.25
     RESISTANCE COEFFICIENT, Kb
.046
     SLOPE (feet/mile)
57.4


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.34,.30,5.31,.51,.76

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA17
-----------------------------------------------------------------------------
 Drainage Area=   .460   Channel Length=  1.250  Kn=  .046  SLOPE=  57.4
 IA=  .34  DTHETA=  .30  PSIF=  5.31  XKSAT=  .51  RTIMP=    .76
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV
-----------------------------------------------------------------------------
 TC =  .517 hours, which is =   31.0 minutes       R =   .331 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .40 .40 .40 .07 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
```

of the excess rainfall values, consider the S-graph procedures for this basin.

```
Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA18
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.73,
     FLOW PATH LENGTH (miles)
1.92
     RESISTANCE COEFFICIENT, Kb
.043
     SLOPE (feet/mile)
44.3


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.35,.29,3.87,.38,.04

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
```

DATA INPUT FOR SUB-BASIN: SA18

```
 Drainage Area=    .730   Channel Length=  1.920  Kn=  .043  SLOPE=  44.3
 IA=  .35  DTHETA=  .29  PSIF=  3.87  XKSAT=  .38  RTIMP=    .04
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
```

HEC-1 INPUT IS STORED IN FILE: CAPTBW.REV

TC = .717 hours, which is = 43.0 minutes R = .515 hours.

EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
.38	.38	.38	.12	.08	.06	.04	.03	.03	.02	.02	.02	.02	.02	.02	.02	.02	.02

If calculated TC is much longer than the duration of the most intense portion of the excess rainfall values, consider the S-graph procedures for this basin.

```
Enter 1 for a new sub-basin, 2 to STOP
2
```

CATERPILLAR TANK WASH WATERSHED

6-HR STORM

MCUHP1 OUTPUT FILE

```
ID
IT     0                    000
IO     5
IN    15
JD  3.32    0.01
PC  .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
PC  .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
PC  .962    .972    .983    .991   1.000
JD  3.30    0.50
JD  3.25    2.80
PC  .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
PC  .087    .100    .120    .163    .252    .451    .694    .837    .900    .938
PC  .950    .963    .975    .988   1.000
JD  3.06    16.0
PC  .000    .015    .020    .030    .048    .063    .076    .090    .105    .119
PC  .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
PC  .946    .960    .973    .987   1.000
JD  2.69    90.0
PC  .000    .021    .035    .051    .071    .087    .105    .125    .143    .160
PC  .179    .201    .232    .281    .364    .500    .658    .773    .841    .888
PC  .927    .945    .964    .982   1.000
JD  1.89   500.0
PC  .000    .024    .043    .059    .078    .098    .119    .141    .162    .186
PC  .212    .239    .271    .321    .408    .515    .627    .735    .814    .864
PC  .907    .930    .954    .977   1.000
KK
KM SUB-BASIN sa19
BA 1.030
LG  .180    .340   4.380    .490  15.630
UC  .500    .272
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN sa20
BA  .610
LG  .260    .350   4.140    .530   7.670
UC  .467    .237
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN sa21
BA  .760
LG  .290    .340   4.310    .570   4.580
UC  .733    .469
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN sa22
BA  .630
LG  .320    .330   4.730    .490   1.340
UC  .533    .324
UA    0       3       5       8      12      20      43      75      90      96
UA  100
KK
KM SUB-BASIN sa23
BA  .330
LG  .310    .350   4.030    .630    .070
UC  .367    .197
UA    0       3       5       8      12      20      43      75      90      96
UA  100
```

Revised 3-7-91
Change Rainfall from 3.22 inches to 3.32 inches
Modify Reach Length and slope in Area 22

```
LPT1: not rerouted
RETRY=NONE
Code page operation not supported on this device

Status for device LPT2:
-----------------------
LPT2: not rerouted

Status for device LPT3:
-----------------------
LPT3: not rerouted

Status for device CON:
----------------------
Code page operation not supported on this device

C:\HEC1>
mcuhp1

*******************************************************************************
*                                                                             *
*                              PROGRAM MCUHP1                                 *
*                                                                             *
*                    THE MARICOPA COUNTY HYDROLOGY MANUAL                     *
*                                                                             *
*                                                                             *
*                 FLOOD CONTROL DISTRICT OF MARICOPA COUNTY                   *
*                  3335 W. DURANGO, PHOENIX, ARIZONA 85009                    *
*                                                                             *
*                                                                             *
*   Program MCUHP1, Maricopa County Unit Hydrograph Procedure 1 computes Tc   *
*   and R as required by the Clark Unit-Hydrograph option of HEC-1. It will   *
*   also provide the rainfall pattern distribution.  Output will be a HEC-1   *
*   input file for immediate application.                                     *
*******************************************************************************

ENTER NAME OF OUTPUT FILE:
capeast.22

Enter 1 if single basin, 2 if multibasin design:
2

Enter 1 if  uniform rainfall over the watershed:
Enter 2 if centered rainfall (HEC-1, JD record):
2
ENTER THE SUB-BASIN NAME:
sa19
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
1.03
     FLOW PATH LENGTH (miles)
1.82
     RESISTANCE COEFFICIENT, Kb
.041
     SLOPE (feet/mile)
109.8


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2
```

```
     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.18,.34,4.38,.48,15.63

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-------------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: sa19
-------------------------------------------------------------------------------
 Drainage Area=  1.030   Channel Length=  1.820  Kn=  .041  SLOPE= 109.8
 IA=  .18  DTHETA=  .34  PSIF=  4.38  XKSAT=  .48  RTIMP=  15.63
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-------------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: capeast.22
-------------------------------------------------------------------------------
 TC =  .500 hours, which is =   30.0 minutes       R =   .272 hours.
-------------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-------------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .31 .31 .31 .10 .07 .05 .03 .03 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02
-------------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-------------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
sa20
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.61
     FLOW PATH LENGTH (miles)
1.16
     RESISTANCE COEFFICIENT, Kb
.044
     SLOPE (feet/mile)
50.4


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
 25  35 4.14  53.7 57
```

```
 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: sa20
-----------------------------------------------------------------------------
 Drainage Area=   .610   Channel Length=  1.160  Kn=  .044  SLOPE=  60.4
 IA=  .26  DTHETA=  .35  PSIF=  4.14  XKSAT=  .53  RTIMP=   7.67
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: capeast.22
-----------------------------------------------------------------------------
 TC =  .467 hours, which is =   28.0 minutes       R =   .237 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .38 .38 .38 .08 .04 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
sa21
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.76
     FLOW PATH LENGTH (miles)
1.7
     RESISTANCE COEFFICIENT, Kb
.043
     SLOPE (feet/mile)
46.9


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.29,.34,4.31,.57,4.58

 ENTER SELECTED RAINFALL DISTRIBUTION:
```

```
 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: sa21
-----------------------------------------------------------------------------
 Drainage Area=    .760   Channel Length=  1.700  Kn=  .043  SLOPE=  46.8
 IA=  .29  DTHETA=  .34  PSIF=  4.31  XKSAT=  .57  RTIMP=   4.58
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: capeast.22
-----------------------------------------------------------------------------
 TC =  .733 hours, which is =   44.0 minutes       R =   .469 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .34 .34 .34 .07 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
sa22
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.63
     FLOW PATH LENGTH (miles)
1.46
     RESISTANCE COEFFICIENT, Kb
.044
     SLOPE (feet/mile)
66.4


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.32,.33,4.73,.49,1.34

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
```

```
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: sa22
-----------------------------------------------------------------------------
 Drainage Area=    .630   Channel Length=  1.480  Kn=  .044  SLOPE=  66.4
 IA=  .32  DTHETA=  .33  PSIF=  4.73  XKSAT=  .49  RTIMP=   1.34
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: capeast.22
-----------------------------------------------------------------------------
 TC =  .533 hours, which is =   32.0 minutes       R =   .324 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .37 .37 .37 .08 .03 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
sa23
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.33
     FLOW PATH LENGTH (miles)
.83
     RESISTANCE COEFFICIENT, Kb
.048
     SLOPE (feet/mile)
66.3


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.31,.35,4.03,.63,.07

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
3.32
```

```
 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: sa23
-----------------------------------------------------------------------------
 Drainage Area=   .330   Channel Length=   .830  Kn=  .048  SLOPE=  68.3
 IA=  .31  DTHETA=  .35  PSIF=  4.03  XKSAT=  .53  RTIMP=    .07
 Rainfall Depth =  3.32
 Rainfall Distribution is 100-year, 6-Hour
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: capeast.22
-----------------------------------------------------------------------------
 TC =  .367 hours, which is =   22.0 minutes       R =   .197 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .39 .39 .39 .05 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
2
```

MCUHP1
For SCS TYPE II
24 Hour 100 year
Rain fall
Twin Buttes Wash Watershed
ABOVE CAP

```
ID
IT     0                    000
IO     5
KK
KM SUB-BASIN SA01
BA  .740
IN    30
PB 4.140
PC  .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
PC  .068    .071    .080    .089    .098    .109    .120    .133    .147    .163
PC  .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
PC  .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
PC  .952    .959    .965    .972    .978    .984    .989    .995   1.000
LG  .150    .350   4.200    .420  35.000
UC  .517    .370
UA     0       3       5       8      12      20      43      75      90      96
UA   100
KK
KM SUB-BASIN SA02
BA  .910
LG  .170    .350   4.160    .450  27.090
UC  .517    .384
UA     0       3       5       8      12      20      43      75      90      96
UA   100
KK
KM SUB-BASIN SA03
BA 1.380
LG  .200    .350   4.110    .510  21.470
UC  .417    .198
UA     0       3       5       8      12      20      43      75      90      96
UA   100
KK
KM SUB-BASIN SA04
BA  .380
LG  .230    .340   4.340    .460  21.550
UC  .350    .252
UA     0       3       5       8      12      20      43      75      90      96
UA   100
KK
KM SUB-BASIN SA05
BA  .150
LG  .210    .350   4.130    .480  22.720
UC  .267    .202
UA     0       3       5       8      12      20      43      75      90      96
UA   100
KK
KM SUB-BASIN SA06
BA  .150
LG  .210    .340   4.440    .450  11.220
UC  .267    .210
UA     0       3       5       8      12      20      43      75      90      96
UA   100
KK
KM SUB-BASIN SA07
BA  .120
LG  .150    .350   4.290    .440  14.770
UC  .233    .166
UA     0       3       5       8      12      20      43      75      90      96
UA   100
ZZ
```

```
*****************************************************************************
*                                                                           *
*                              PROGRAM MCUHP1                               *
*                                                                           *
*                     THE MARICOPA COUNTY HYDROLOGY MANUAL                  *
*                                                                           *
*                                                                           *
*                  FLOOD CONTROL DISTRICT OF MARICOPA COUNTY                *
*                   3335 W. DURANGO, PHOENIX, ARIZONA 85009                 *
*                                                                           *
*                                                                           *
*   Program MCUHP1, Maricopa County Unit Hydrograph Procedure 1 computes Tc *
*   and R as required by the Clark Unit-Hydrograph option of HEC-1. It will *
*   also provide the rainfall pattern distribution.  Output will be a HEC-1 *
*   input file for immediate application.                                   *
*****************************************************************************

ENTER NAME OF OUTPUT FILE:
capw.24

Enter 1 if single basin, 2 if multibasin design:
2

Enter 1 if  uniform rainfall over the watershed:
Enter 2 if centered rainfall (HEC-1, JD record):
2
ENTER THE SUB-BASIN NAME:
SA01
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.74
     FLOW PATH LENGTH (miles)
2.02
     RESISTANCE COEFFICIENT, Kb
.043
     SLOPE (feet/mile)
133.5


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.15,.35,4.2,.42,35

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
```

```
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA01
-----------------------------------------------------------------------------
 Drainage Area=   .740   Channel Length=  2.020  Kn=  .043  SLOPE= 133.5
 IA=  .15  DTHETA=  .35  PSIF=  4.20  XKSAT=  .42  RTIMP=  35.00
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .517 hours, which is =   31.0 minutes       R =   .370 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .19 .19 .19 .19 .18 .18 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA02
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.91
     FLOW PATH LENGTH (miles)
2.455
     RESISTANCE COEFFICIENT, Kb
.042
     SLOPE (feet/mile)
197.7


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.17,.35,4.16,.45,27.09

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
1
```

```
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14


 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA02
-----------------------------------------------------------------------------
 Drainage Area=   .910   Channel Length=  2.450  Kn=  .042  SLOPE= 187.7
 IA=  .17  DTHETA=  .35  PSIF=  4.16  XKSAT=  .45  RTIMP=  27.09
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .517 hours, which is =   31.0 minutes       R =   .384 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .19 .19 .19 .18 .18 .17 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA03
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
1.38
     FLOW PATH LENGTH (miles)
1.94
     RESISTANCE COEFFICIENT, Kb
.039
     SLOPE (feet/mile)
210


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.2,.35,4.11,.51,21.47

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
```

```
 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA03
-----------------------------------------------------------------------------
 Drainage Area=  1.380   Channel Length=  1.940  Kn=  .039  SLOPE= 210.0
 IA=  .20  DTHETA=  .35  PSIF=  4.11  XKSAT=  .51  RTIMP=  21.47
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .417 hours, which is =   25.0 minutes       R =   .198 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .18 .18 .18 .17 .17 .16 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA04
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.38
     FLOW PATH LENGTH (miles)
1.33
     RESISTANCE COEFFICIENT, Kb
.047
     SLOPE (feet/mile)
266


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.23,.34,4.34,.46,21.55

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14
```

```
 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA04
-----------------------------------------------------------------------------
 Drainage Area=   .380   Channel Length=  1.330  Kn=  .047  SLOPE= 268.0
 IA=  .23  DTHETA=  .34  PSIF=  4.34  XKSAT=  .46  RTIMP=  21.55
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                     HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .350 hours, which is =   21.0 minutes        R =   .252 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .18 .18 .18 .17 .17 .17 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA05
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.15
     FLOW PATH LENGTH (miles)
.75
     RESISTANCE COEFFICIENT, Kb
.053
     SLOPE (feet/mile)
315


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.21,.35,4.13,.48,22.72

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14
```

```
 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                      DATA INPUT FOR SUB-BASIN: SA05
-----------------------------------------------------------------------------
 Drainage Area=    .150   Channel Length=    .760  Kn=  .053  SLOPE= 315.0
 IA=  .21  DTHETA=  .35  PSIF=  4.13  XKSAT=  .40  RTIMP=  22.72
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                      HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .267 hours, which is =   16.0 minutes       R =   .202 hours.
-----------------------------------------------------------------------------
                 EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .18 .18 .18 .17 .17 .16 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA05
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.15
     FLOW PATH LENGTH (miles)
.8
     RESISTANCE COEFFICIENT, Kb
.053
     SLOPE (feet/mile)
340


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.21,.34,4.44,.45,11.22

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14
```

```
 ENTER ONE OF THE FOLLOWING (for the UA record):
    (1) - for an urban watershed
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA06
-----------------------------------------------------------------------------
 Drainage Area=   .150   Channel Length=   .800  Kn=  .053  SLOPE= 340.0
 IA=  .21  DTHETA=  .34  PSIF=  4.44  XKSAT=  .45  RTIMP=  11.22
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .267 hours, which is =   16.0 minutes        R =   .210 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .19 .19 .19 .18 .18 .17 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
1
ENTER THE SUB-BASIN NAME:
SA07
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
.12
     FLOW PATH LENGTH (miles)
.81
     RESISTANCE COEFFICIENT, Kb
.054
     SLOPE (feet/mile)
350


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.15,.35,4.29,.44,14.77

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
1
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14


 ENTER ONE OF THE FOLLOWING (for the UA record):
```

```
    (2) - for a natural watershed
    (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: SA07
-----------------------------------------------------------------------------
 Drainage Area=   .120   Channel Length=   .610  Kn=  .054  SLOPE= 360.0
 IA=  .15  DTHETA=  .35  PSIF=  4.29  XKSAT=  .44  RTIMP=  14.77
 Rainfall Depth =  4.14
 Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                    HEC-1 INPUT IS STORED IN FILE: capw.24
-----------------------------------------------------------------------------
 TC =  .233 hours, which is =   14.0 minutes       R =   .166 hours.
-----------------------------------------------------------------------------
                EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
      5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
    .19 .19 .19 .18 .18 .17 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
2
```

```
Mcuhp1

*****************************************************************************
*                                                                           *
*                              PROGRAM MCUHP1                               *
*                                                                           *
*                     THE MARICOPA COUNTY HYDROLOGY MANUAL                  *
*                                                                           *
*                                                                           *
*                 FLOOD CONTROL DISTRICT OF MARICOPA COUNTY                 *
*                  3335 W. DURANGO, PHOENIX, ARIZONA 85009                  *
*                                                                           *
*                                                                           *
*   Program MCUHP1, Maricopa County Unit Hydrograph Procedure 1 computes Tc *
*   and R as required by the Clark Unit-Hydrograph option of HEC-1. It will *
*   also provide the rainfall pattern distribution.  Output will be a HEC-1 *
*   input file for immediate application.                                   *
*****************************************************************************

ENTER NAME OF OUTPUT FILE:
capeast.24h

Enter 1 if single basin, 2 if multibasin design:
2

Enter 1 if  uniform rainfall over the watershed:
Enter 2 if centered rainfall (HEC-1, JD record):
2
ENTER THE SUB-BASIN NAME:
Sa19
 ENTER PHYSICAL CHARACTERISTICS OF THE BASIN:

 *Note limit basin size to about 5 square miles,
  and/or Tc to less than 1.50 hours.

     BASIN AREA (square miles)
1.03
     FLOW PATH LENGTH (miles)
1.82
     RESISTANCE COEFFICIENT, Kb
.041
     SLOPE (feet/mile)
109.8


 ENTER METHOD OF SOIL LOSS COMPUTATIONS:

     1 = Initial/Uniform, 2 = Green-Ampt
2

     Enter IA, DTHETA, PSIF, XKSAT, RTIMP (0-100)
.18,.34,4.38,.49,15.63

 ENTER SELECTED RAINFALL DISTRIBUTION:

 Enter 1 for the 6-hour MCFCD Distribution
 Enter 2 for the 2-hour MCFCD Distribution
 Enter 3 for the 24-hour SCS TYPE-II distribution
3
 Enter areal reduction coefficient:
.987
 ENTER POINT RAINFALL DEPTH OF A DESIRED FREQUENCY (inches):
4.14
```

100-YR, 24-HR
ABOVE C.A.P. CANAL
CATERPILLAR TANK WASH

```
ENTER ONE OF THE FOLLOWING (for the UA record):
   (1) - for an urban watershed
   (2) - for a natural watershed
   (3) - for manual input
2
-----------------------------------------------------------------------------
                    DATA INPUT FOR SUB-BASIN: S619
-----------------------------------------------------------------------------
Drainage Area=  1.030   Channel Length=  1.820  Kn=  .041  SLOPE= 109.8
IA=  .18  DTHETA=  .34  PSIF=  4.38  XKSAT=  .48  RTIMP=  15.63
Rainfall Depth =  4.14
Rainfall Distribution is 24-Hour, SCSType II
-----------------------------------------------------------------------------
                   HEC-1 INPUT IS STORED IN FILE: capeast.24h
-----------------------------------------------------------------------------
TC =  .533 hours, which is =   32.0 minutes       R =   .282 hours.
-----------------------------------------------------------------------------
               EXCESS RAINFALL VALUES IN 5-MINUTE INTERVALS
-----------------------------------------------------------------------------
     5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80  85  90
   .18 .18 .18 .17 .17 .16 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02 .02
-----------------------------------------------------------------------------
If calculated TC is much longer than the duration of the most intense portion
of the excess rainfall values, consider the S-graph procedures for this basin.
-----------------------------------------------------------------------------

Enter 1 for a new sub-basin, 2 to STOP
2
```

APPENDIX D

STAGE, STORAGE, AND OUTFLOW RELATIONSHIPS AT C.A.P. CULVERTS

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BY Hem DATE 11-12-90

CHECK SEK DATE 4/91

CLIENT FCDMC

JOB CAP Overchutes JOB NO. 310.42

STAGE-VOLUME RELATIONSHIP

Crossing No.	C.A.P. Station	Pipe Size	Upstream Inv. Elev.	Downstream Inv. Elev.	Watershed Name
1	561+40	72"	1508.00	1505.95	Caterpillar Tank
2	549+00	30"	1513.94	1508.09	Twin Buttes
3	538+25	30"	1518.99	1510.74	Twin Buttes
4	492+30	4 - 72"	1500.13	1494.08	Twin Buttes
5	480+90	30"	1515.92	1512.09	Twin Buttes
6	459+30	30"	1519.13	1512.93	Twin Buttes

DETERMINATION OF VOLUMES

Surface area for each of the 4-ft interval contour lines was estimated from a 1" = 200' scale mapping by use of digitizing board as planimeter.

Method 1

Volume was computed by using the average of two adjacent surface areas multiplied by the elevation interval (i.e., 4 feet) between the two areas. The total volume was the sum of the incremental volumes.

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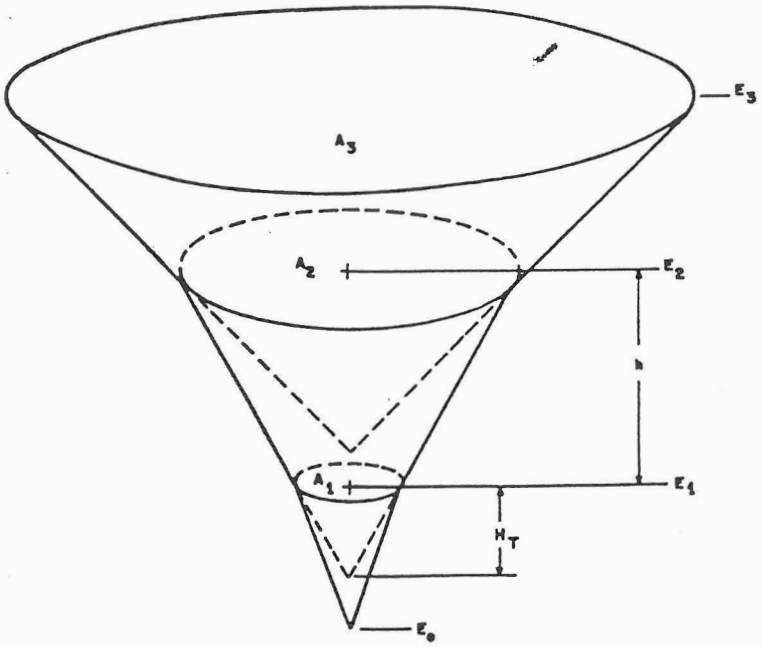
JOB

JOB NO. 310.42

Method 2

Volume was computed by the Conic Method as described in HEC-1 User's Manual (Page 36).

The difference between the two methods was less than One percent. For consistency with HEC-1 program, the Conic Method was used in this project.



$$\Delta V_{12} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

$$H_T = h/\left(\sqrt{A_2/A_1} - 1\right)$$

Where

ΔV_{12} = volume between base areas 1 and 2,

A1 = surface area of base 1,

E_1 = elevation of base 1,

h = vertical distance ($E_2 - E_1$) between bases A_1 and A_2, and

H_T = height of truncated part of cone.

Conic Method for Reservoir Volumes

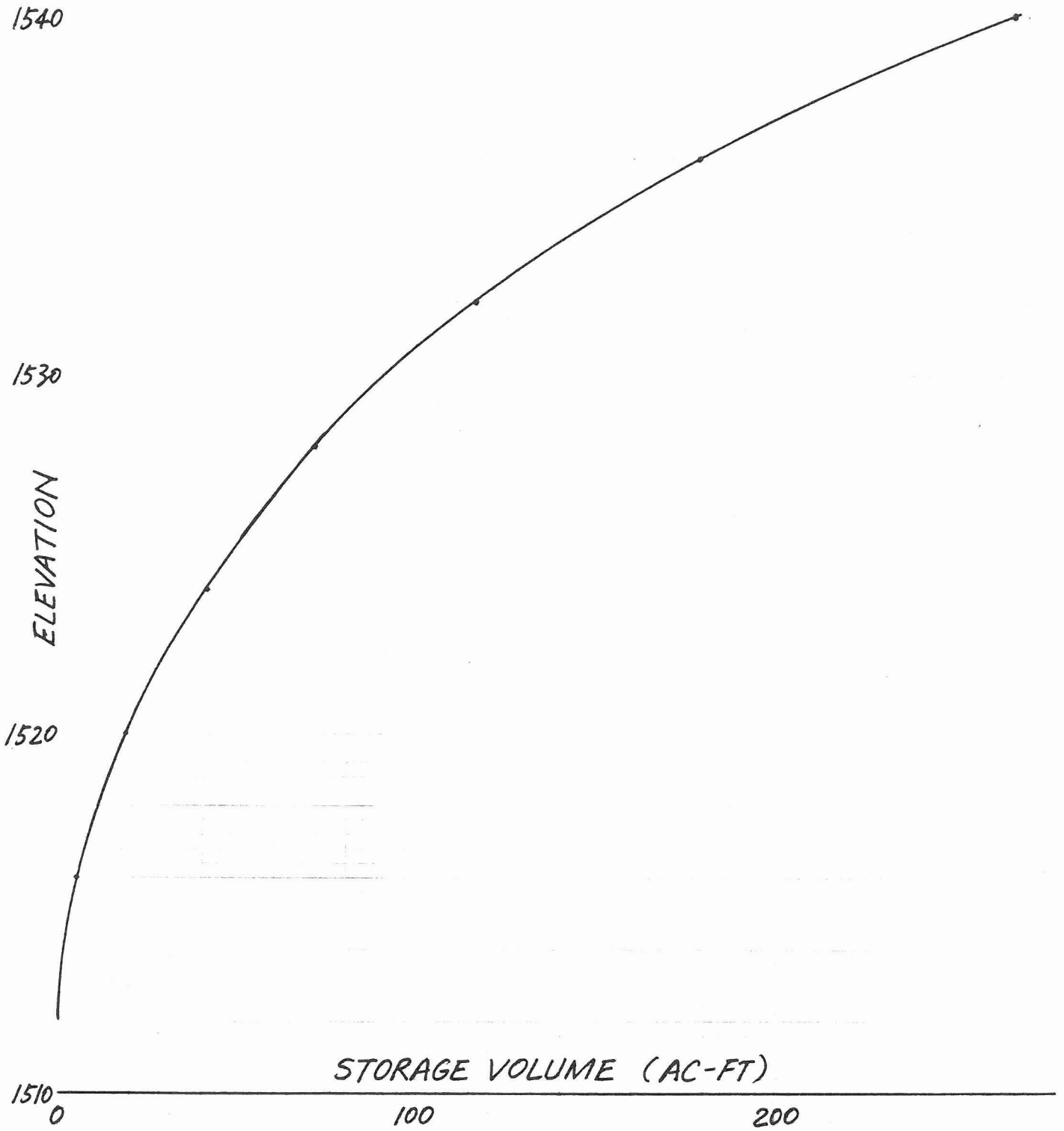
CROSSING LOCATION #1

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1512	0.5			0		0
		4	5.64		5.20	
1516	2.32			5.64		5.20
		4	13.64		13.40	
1520	4.5			19.28		18.60
		4	22.22		22.09	
1524	6.61			41.5		40.68
		4	31.18		31.06	
1528	8.98			72.68		71.74
		4	44.02		43.77	
1532	13.03			116.7		115.51
		4	62.86		62.55	
1536	18.4			179.56		178.06
		4	88.68		88.25	
1540	25.94			268.24		266.31

CAP CROSSING #1, STA. 561+40
HEC-1 I.D.: EACAP

STAGE-STORAGE RELATION



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BY HEM DATE 11-12-90

CHECK SEK DATE 4/91

CLIENT FCDMC

JOB CAP Overchutes

JOB NO. 310.42

ESTIMATION OF OUTFLOW AT CROSSING #1

Pipe Size = 72" RCP = 6' = D

Upstream Invert Elev. = 1508.00 (Based on Field Surveying)

Water Surface Elevation	Height of Water, HW	HW/D	Flow Rate * (cfs)
1508	0	0	0
1511	3'	0.5	62
1514	6'	1.0	200
1520	12'	2.0	400
1526	18'	3.0	540
1532	24'	4.0	625
1540	32'	5.33	750

* Obtained from Chart 2 as shown on next sheet.

NOTE: This outflow information is for HEC-1 input without the consideration of the stock pond downstream of the 72" pipe culvert.

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SHEET 4 OF 12
BY HEM DATE 11-12-90 Rev 3-13-91
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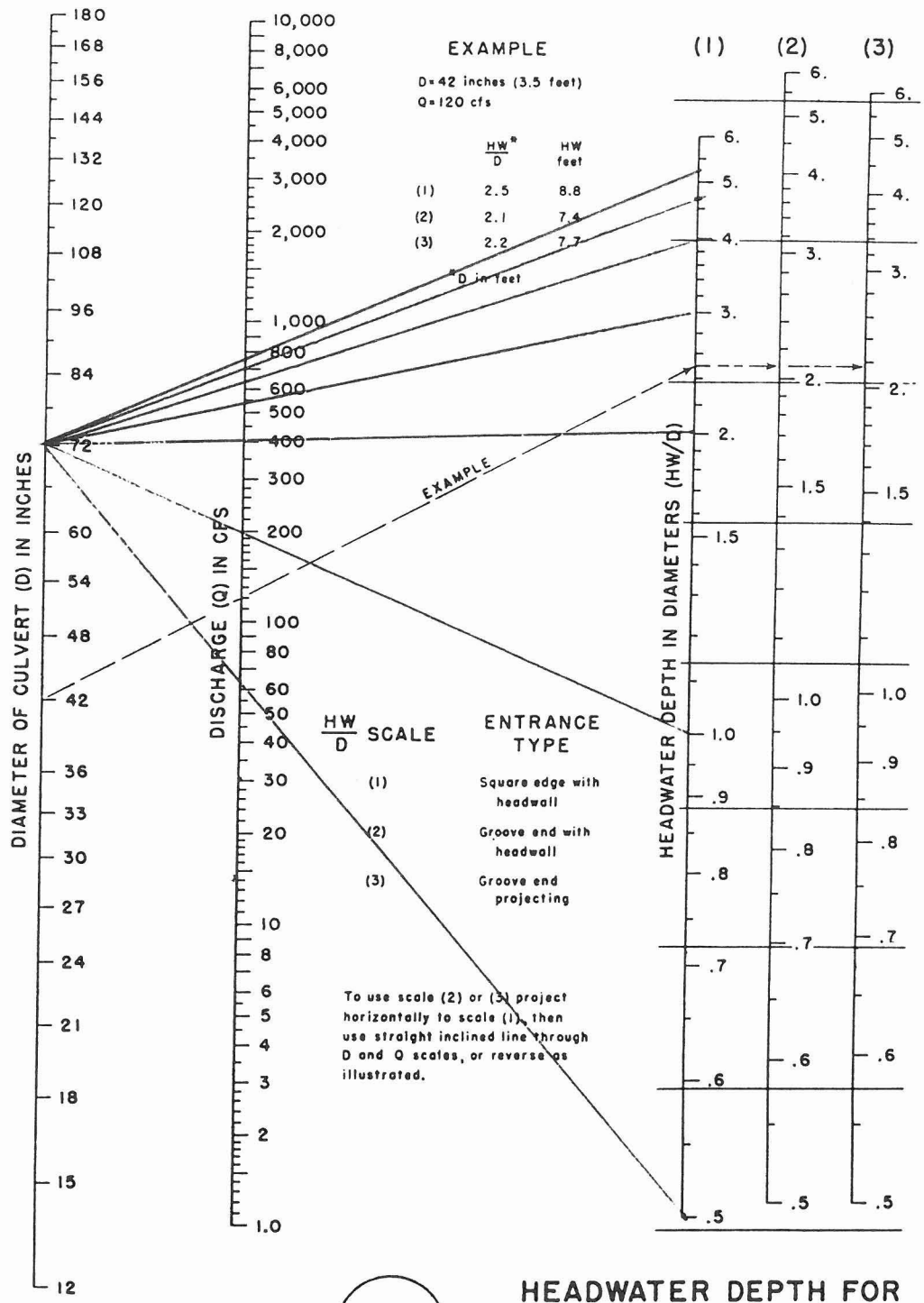
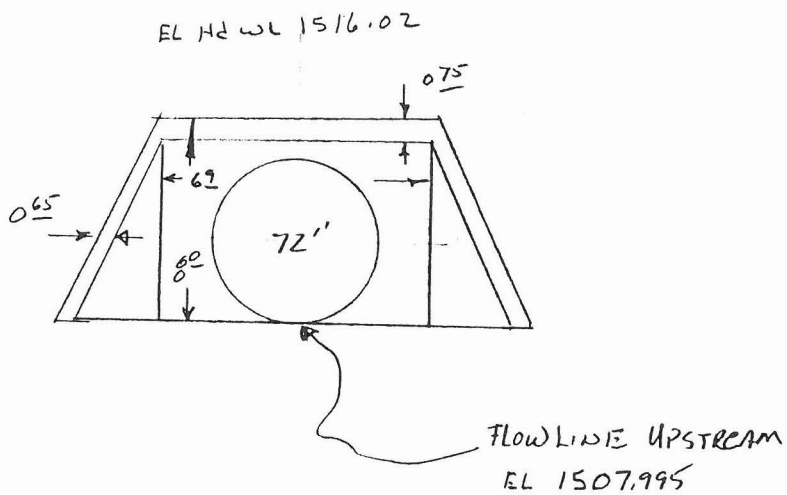
CLIENT FCDMC
JOB CAP - Crossing #1
JOB NO. 310.42

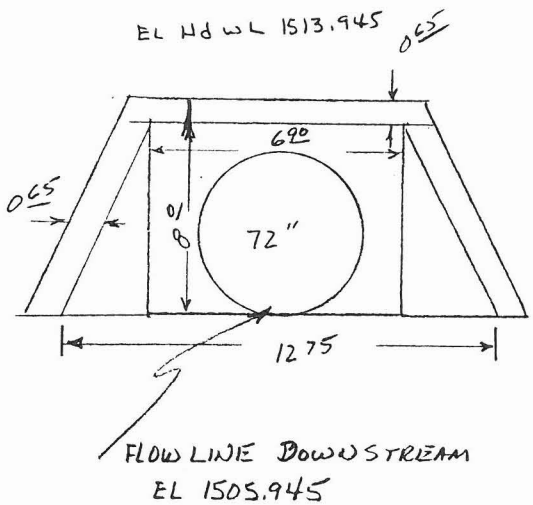
CHART 2

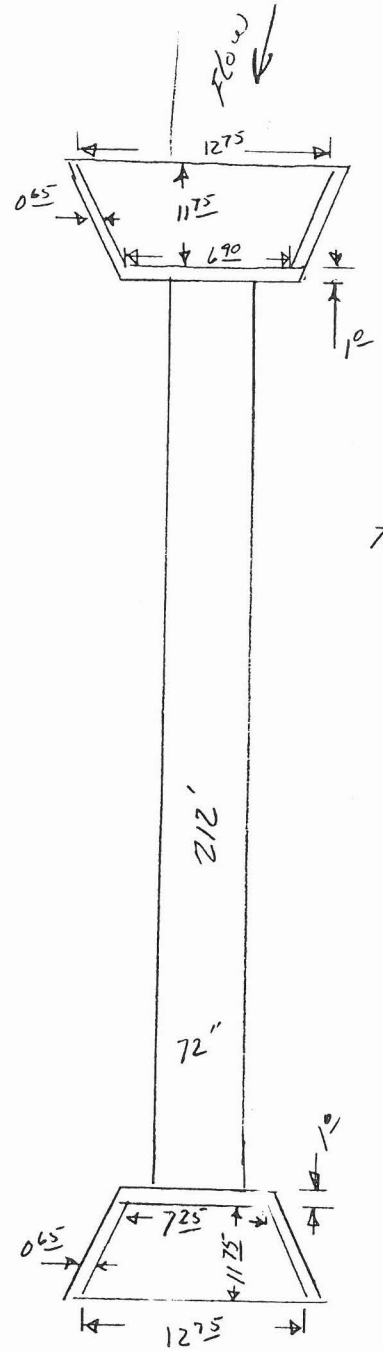


HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963







72" PIPE UNDER CAP CANAL

NEAR STA 566+25

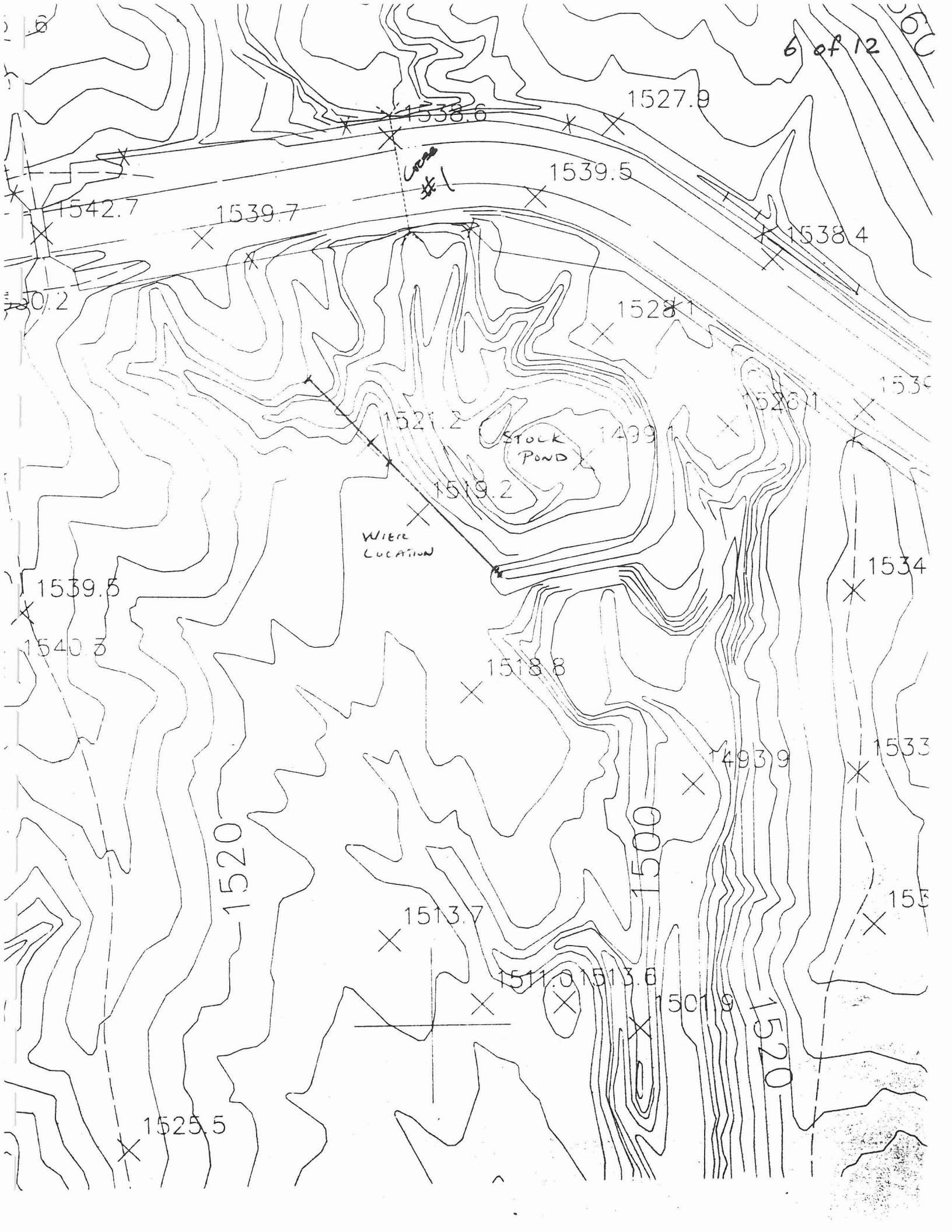
CATERPILLER WASH (TANK

First Pipe East

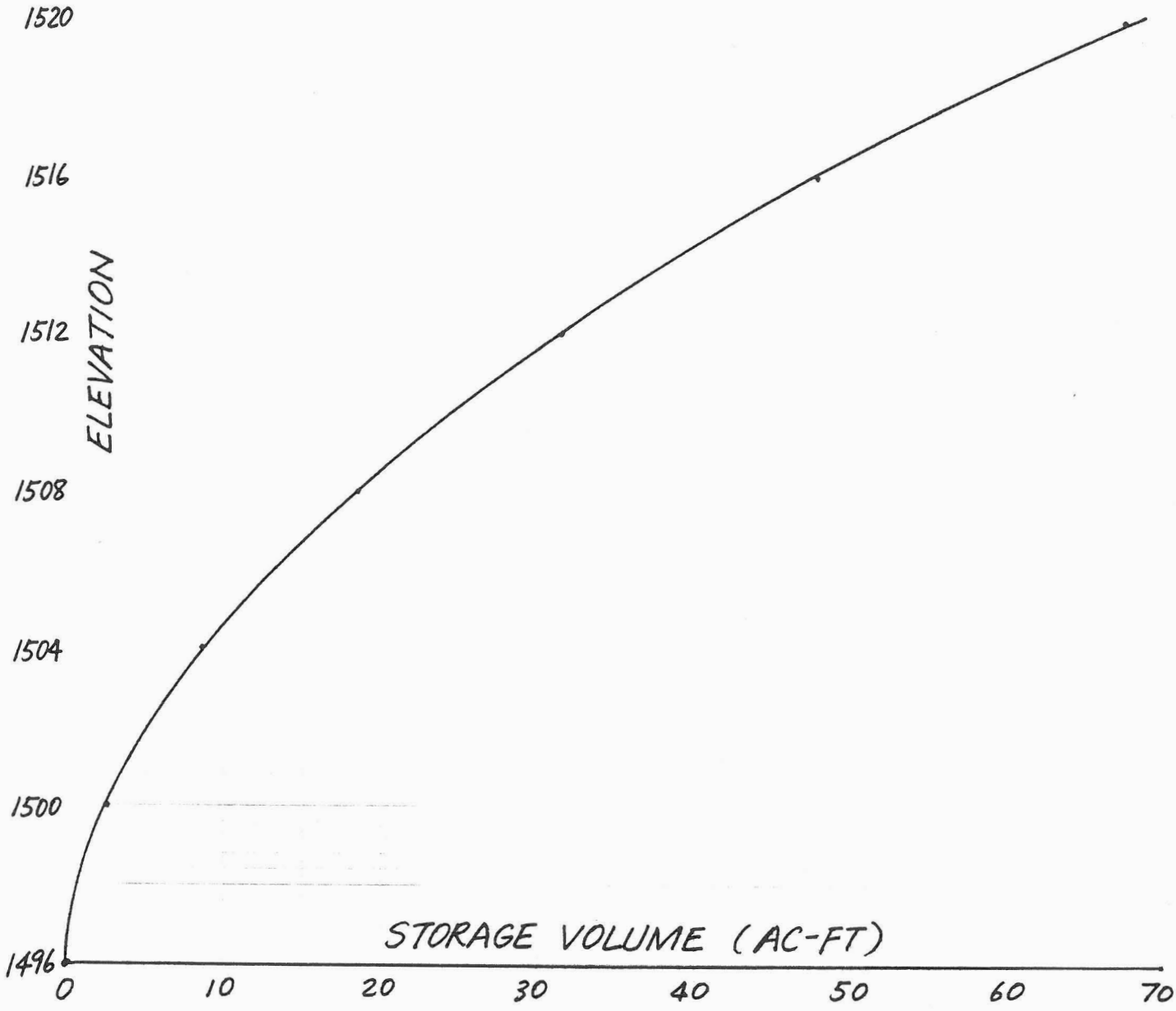
STOCK POND

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1496	0.39			0.00		0.00
		4	2.74		2.65	
1500	0.98			2.74		2.65
		4	6.00		5.88	
1504	2.02			8.74		8.53
		4	9.74		9.69	
1508	2.85			18.48		18.22
		4	12.98		12.95	
1512	3.64			31.46		31.17
		4	16.30		16.27	
1516	4.51			47.76		47.44
		4	19.68		19.66	
1520	5.33			67.44		67.09


1527.9
1538.6
Cross #1
1539.5
1542.7
1539.7
1538.4
1528.1
1521.2
STOCK POND
1519.2
WIER LOCATION
1539.5
1540.3
1518.8
1534
1533
1520
1500
1513.7
1511.0
1513.6
1501.9
1520
1525.5

STAGE-STORAGE RELATION FOR STOCK POND DOWNSTREAM OF CROSSING # 1



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BY Hem DATE 2-4-91

CHECK SEK DATE 4/91

CLIENT

JOB

JOB NO. 310.42

COMBINED STORAGE VOLUME BEHIND CAP CANAL & STOCK POND AT CROSSING #1

Water Surface Elevation	Storage Behind CAP Canal (Ac-Ft)	Storage at Stock Pond (Ac-Ft)	Combined Storage Volume (Ac-Ft)	Rounded Volume for HEC-1 Input **
1496	—	0	0	0
1500	—	2.65	2.65	
1504	—	8.53	8.53	
1508	—	18.22	18.22	18.2
1512	0	31.17	31.17	31.2
1516	5.20	47.44	52.64	52.6
1520	18.60	67.09	85.69	85.7
1524	40.68	67.09 *	107.77	107.8
1528	71.74	67.09	138.83	
1532	115.51	67.09	182.60	182.6
1536	178.06	67.09	245.15	
1540	266.31	67.09	333.40	333.4

* At Elev. 1519.2, outflow starts over the wier. Thus, the storage volume in the pond remains constant a this elevation.

** HEC-1 input can only take 8 points to describe the stage-volume relationship

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CLIENT

JOB

JOB NO. 310.42

ESTIMATED STORAGE VOLUME FOR

WATER SURFACE ELEVATION @ 1519.2

Water Surface Elevation	Storage Behind CAP Canal (Ac-Ft)
1516	5.20
1520	18.60

$$\text{Interpretted Volume} = \frac{(18.60 - 5.20) \times (1519.2 - 1516.0)}{(1520.0 - 1516.0)}$$

$$= \frac{13.4 \times 3.2}{4.0} = 10.72$$

$$\text{Combined Storage Volume} = 5.20 + 10.72 + 67.09$$

$$= 83.01$$

Say 83.00 Ac-Ft

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BY [illegible] DATE [illegible]

CHECK SEK DATE 4/91

CLIENT FLD MC

JOB CAP Detention [illegible]

JOB NO. [illegible]

Stone Pond

Location South of Crossing No 1

Det Flow By Weir

Approximate Weir Elevation = 1519.2

Weir Bottom Length = 250 @ 1520 Q = [illegible]

Assume Weir Coefficient of 3.0

Weir Top Width Varies

Elev	H	Weir Top Width	Estimated Effective Weir Length	Q
1519.2	0	250	250	0
1520	0.8	250	250	570 cfs
1521.2	2.0	310	280	[illegible]
1524	4.8	500	400	[illegible]520
1520.25	1.05	250	250	807

When Q = 800 cfs, H ≅ 1.04, Elev. = 1520.24

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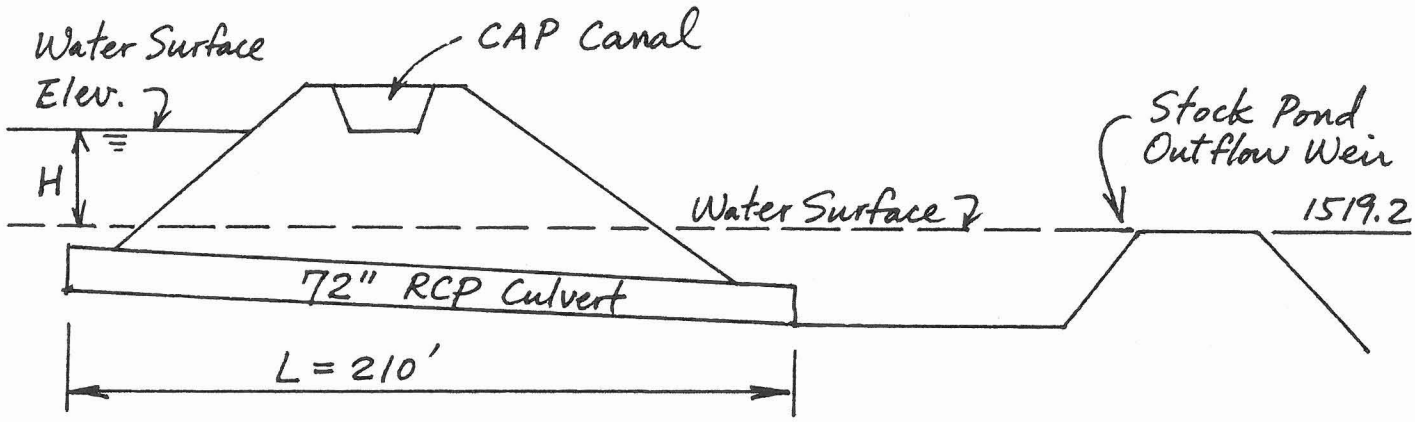
JOB

JOB NO. 310.42

CULVERT OUTFLOW AT CROSSING # 1 WHEN STOCK POND WAS CONSIDERED



Water Surface Elev. @ Outflow Weir of Pond	Outflow @ Weir (cfs)	H* (ft)	Water Surface Elev. upstream of CAP Canal
1519.2	0	0	1519.2
1520.0	540	9.5	1529.5
1520.24	800	20 ±	1540.0

* H was computed from Chart 9, as shown on next sheet, based on the outflow discharge.

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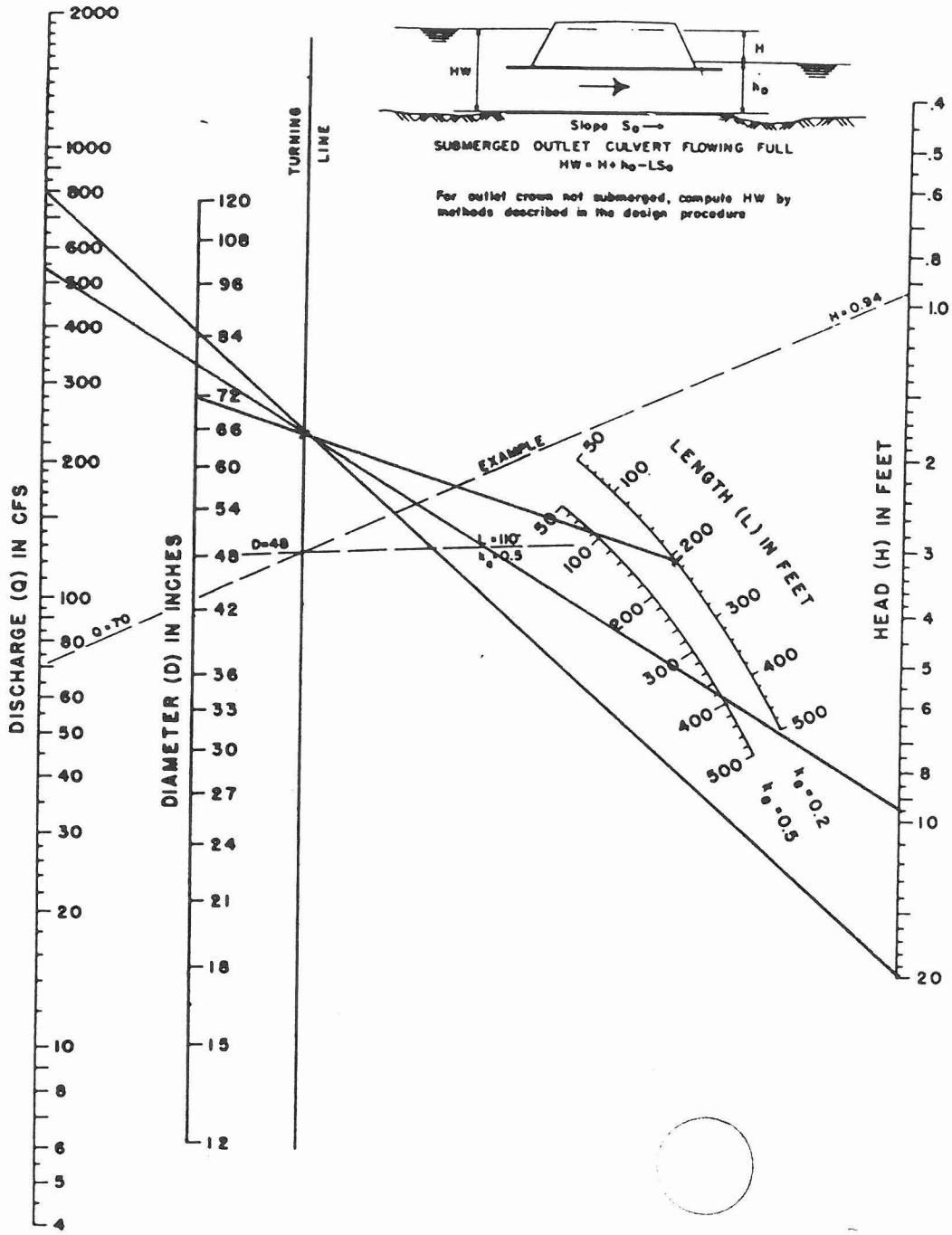
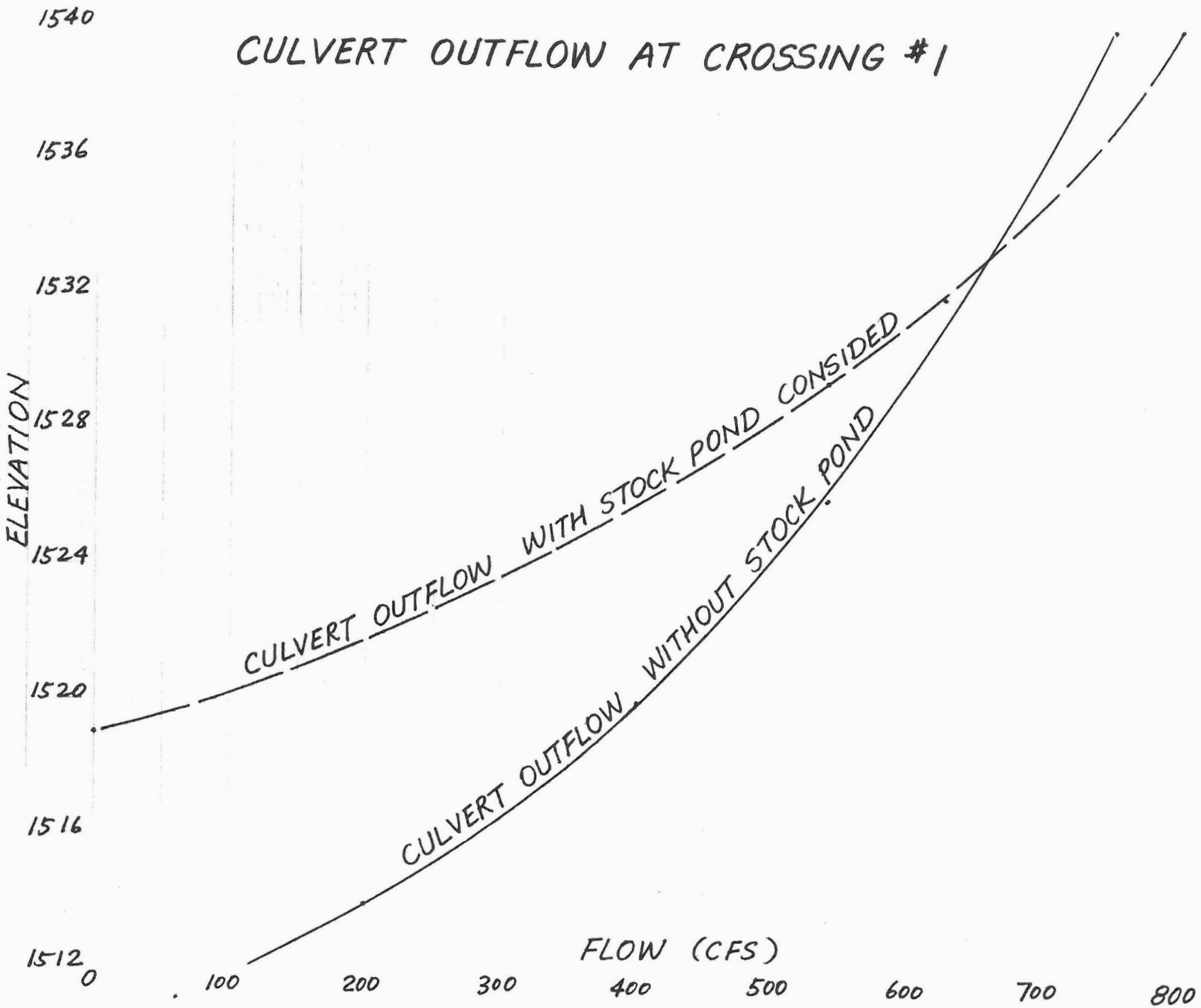
SHEET 12 OF 12
BY Hem DATE 11-12-90
CHECK SEK DATE 4/91
CLIENT
JOB
JOB NO. 310.42

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963


CULVERT OUTFLOW AT CROSSING #1
ELEVATION
1540
1536
1532
1528
1524
1520
1516
1512
0
100
200
300
400
500
600
700
800
FLOW (CFS)
CULVERT OUTFLOW WITH STOCK POND CONSIDED
CULVERT OUTFLOW WITHOUT STOCK POND

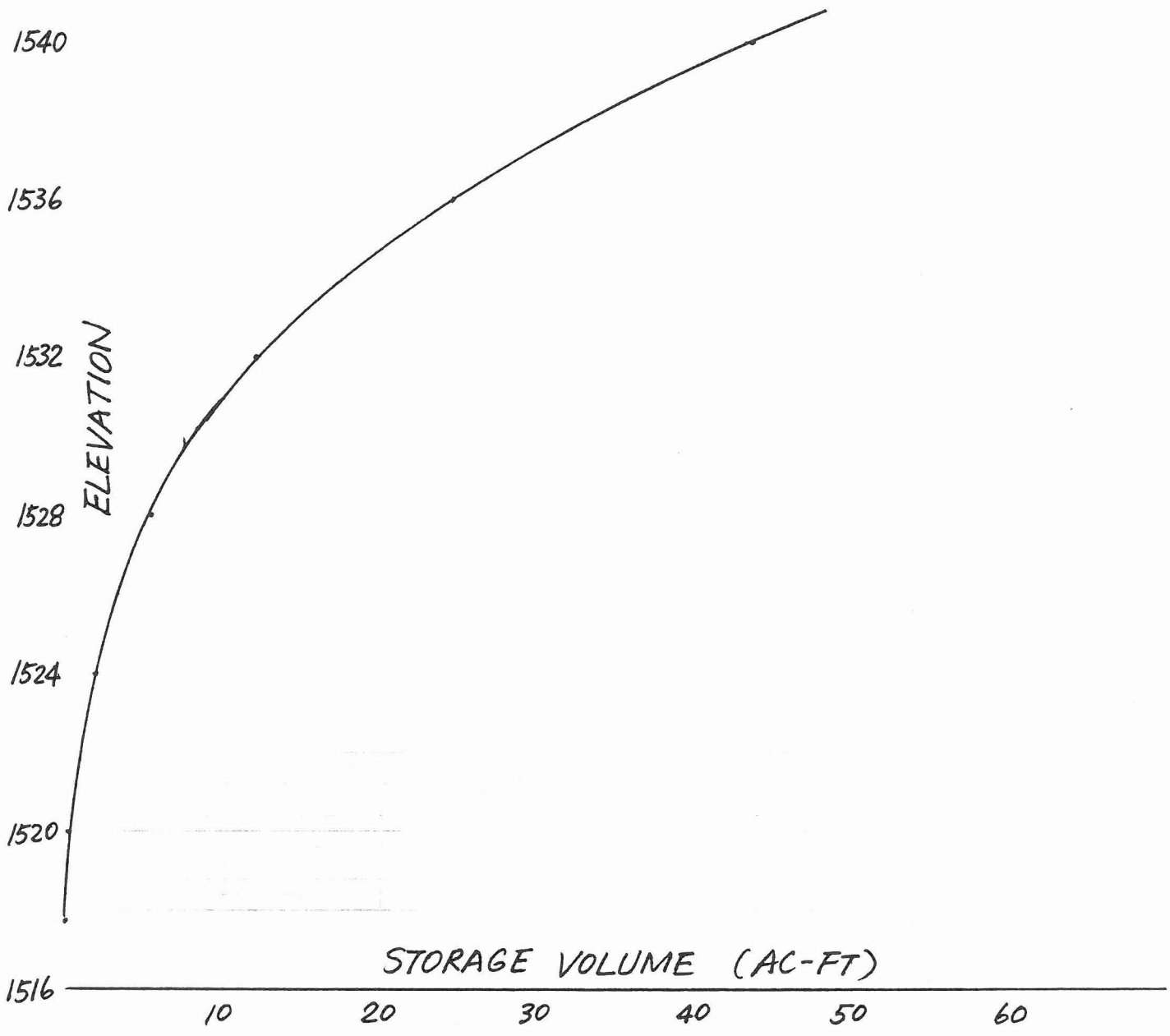
CROSSING LOCATION #2

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1516	0			0.00		0
		1.8	0.00		0.00	
1517.8	0			0.00		0.00
		2.2	0.28		0.18	
1520	0.25			0.28		0.18
		4	1.76		1.70	
1524	0.63			2.04		1.89
		4	3.50		3.45	
1528	1.12			5.54		5.34
		4	6.78		6.65	
1532	2.27			12.32		11.99
		4	12.20		12.06	
1536	3.83			24.52		24.05
		4	19.50		19.35	
1540	5.92			44.02		43.40

CAP CROSSING #2, STA. 549+00
HEC-1 I.D. : QCAP

STAGE - STORAGE RELATION



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BY HEM DATE 11-12-90

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CLIENT FCDMC

JOB CAP Overchutes

JOB NO. 310.42

ESTIMATION OF OUTFLOW AT CROSSING # 2

Pipe Size (D) = 30" RCP = 2.5'

Upstream Invert Elev. = 1513.94 (Based on Field Surveying)

Water Surface Elevation	Height of Water, HW	HW/D	Flow Rate * (cfs)
1513.9	0	0	0
1515.2	1.3	0.5	7.5
1516.4	2.5	1.0	22
1520.2	6.3	2.5	52
1524.2	10.3	4.1	72
1528.2	14.3	5.7	90
1532.2	18.3	7.3	103 **
1540	26.1	10.4	115 **

* Obtained from Chart 2 as shown on next sheet.

** Extrapolated from the Chart.

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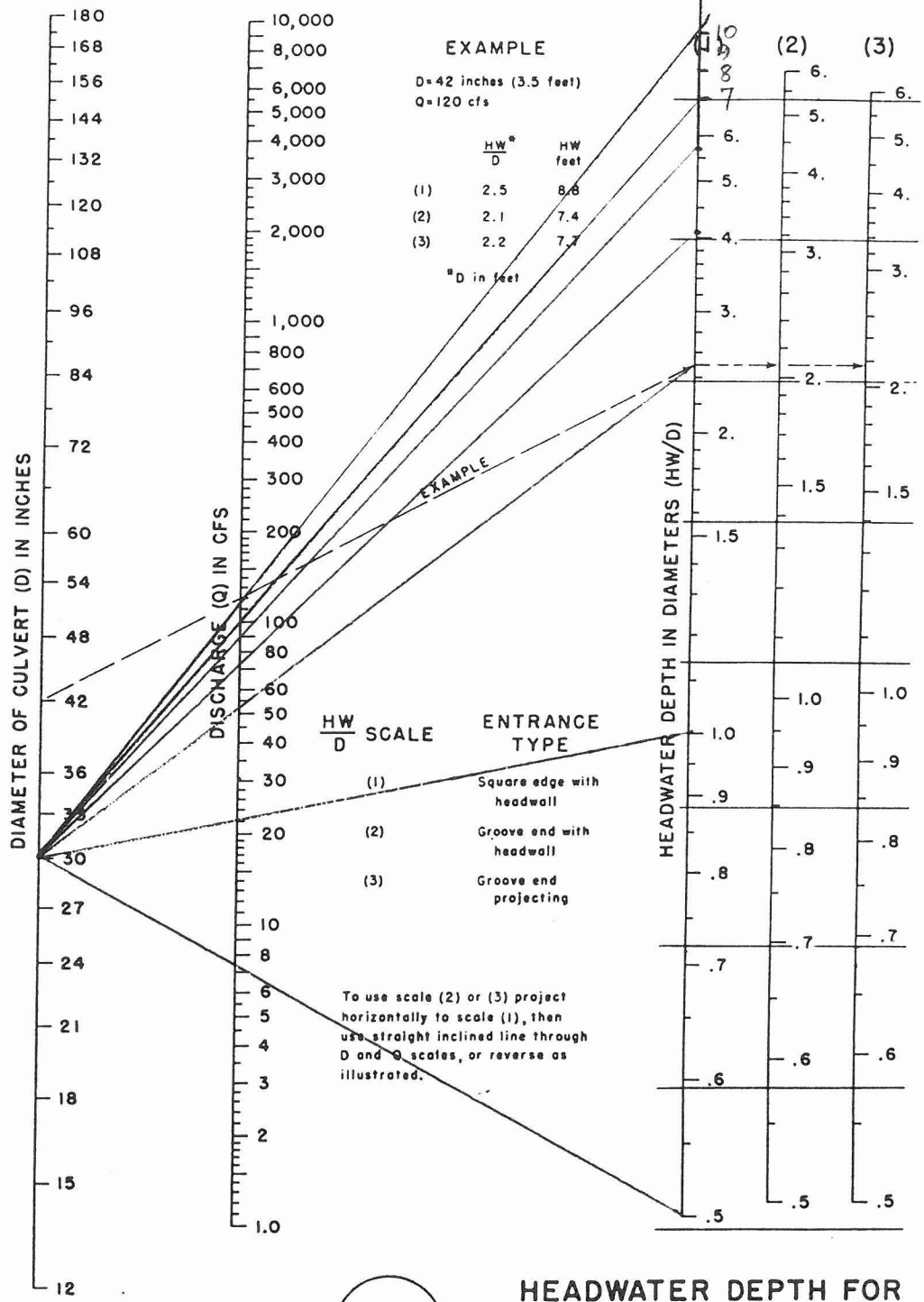
SHEET 4 OF 5
BY HEM DATE 11-12-90
CHECK SEK DATE 4/91
CLIENT FCD MC
JOB CAP - Crossing #2
JOB NO. 310.42

CHART 2



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

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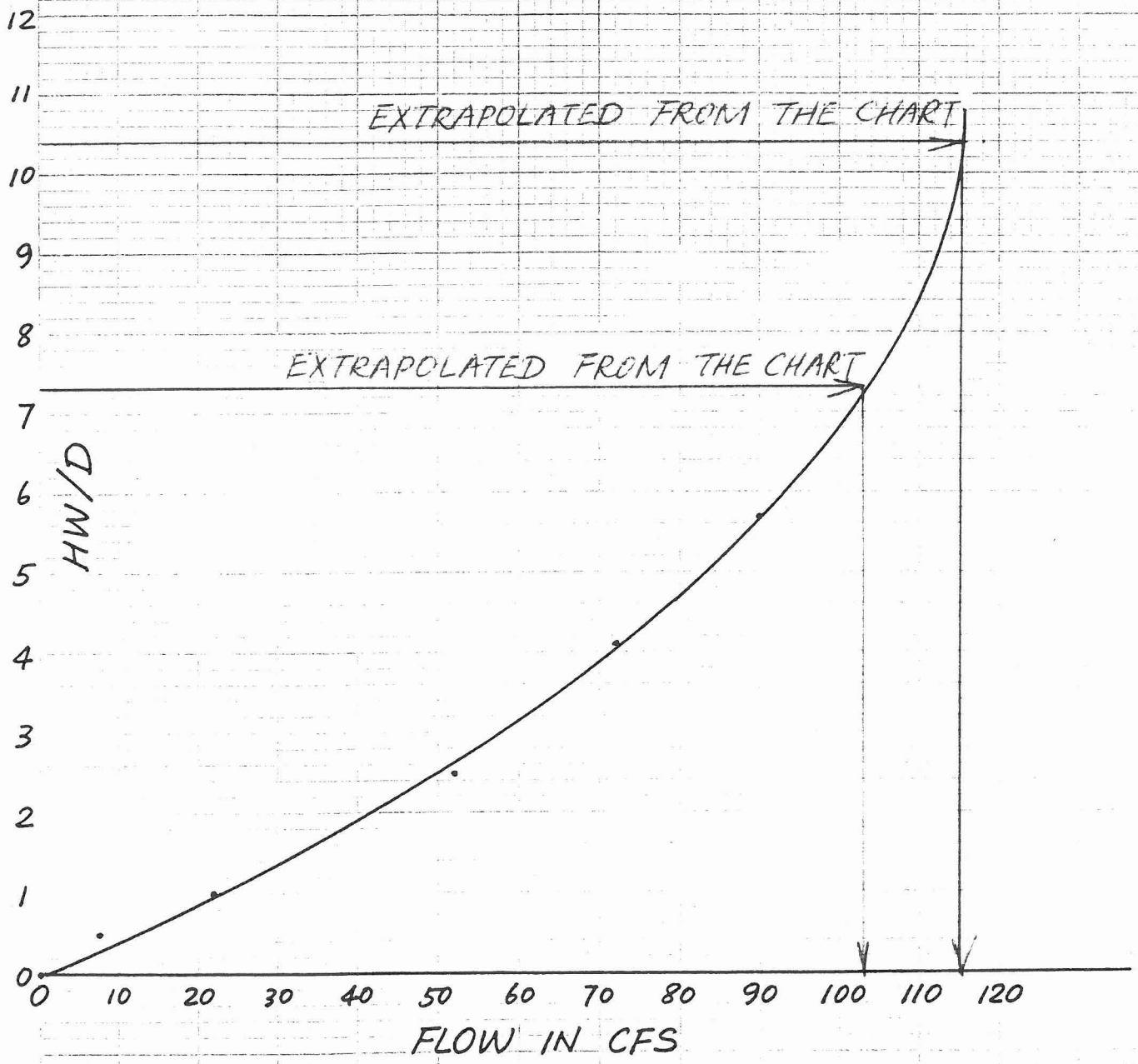
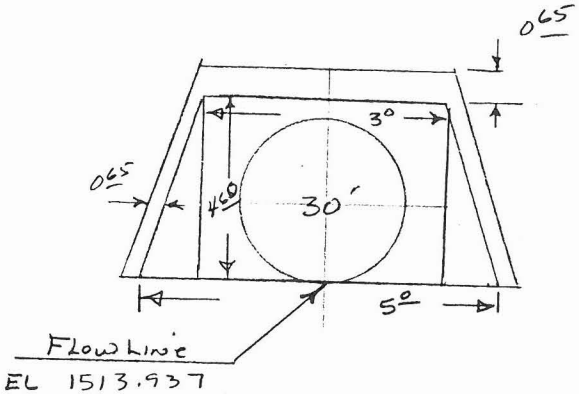
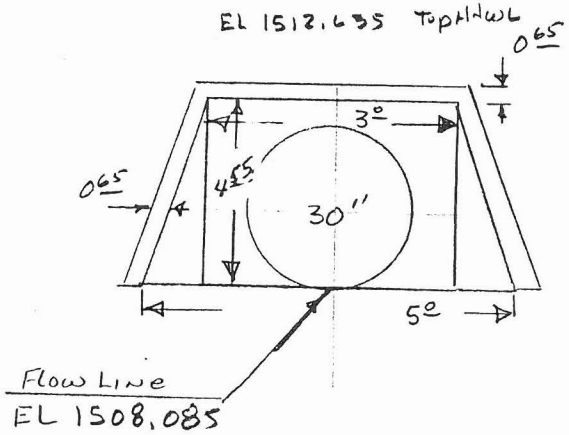
STAGE-DISCHARGE RELATIONSHIP FOR 30-INCH RCP

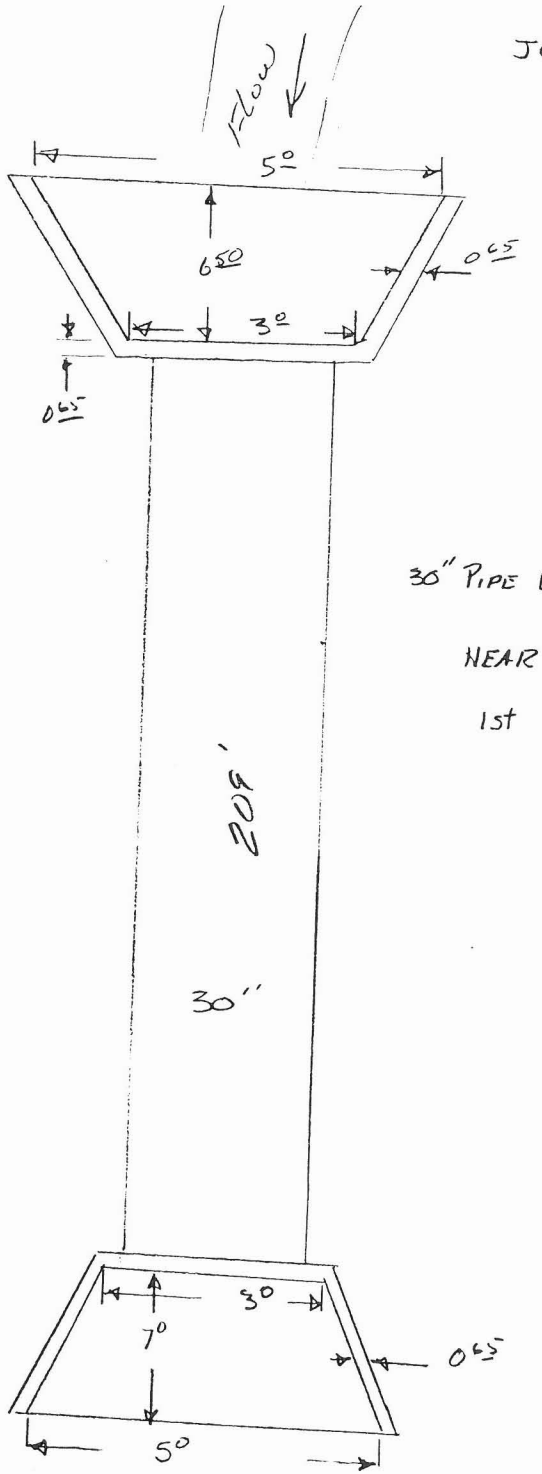


EL 1518.537 Top HdwL



EL 1512.635 Top HdwL





30" PIPE UNDER CAP CANAL

NEAR STA 541+00±

1st PIPE west Caterpill TANK Rd

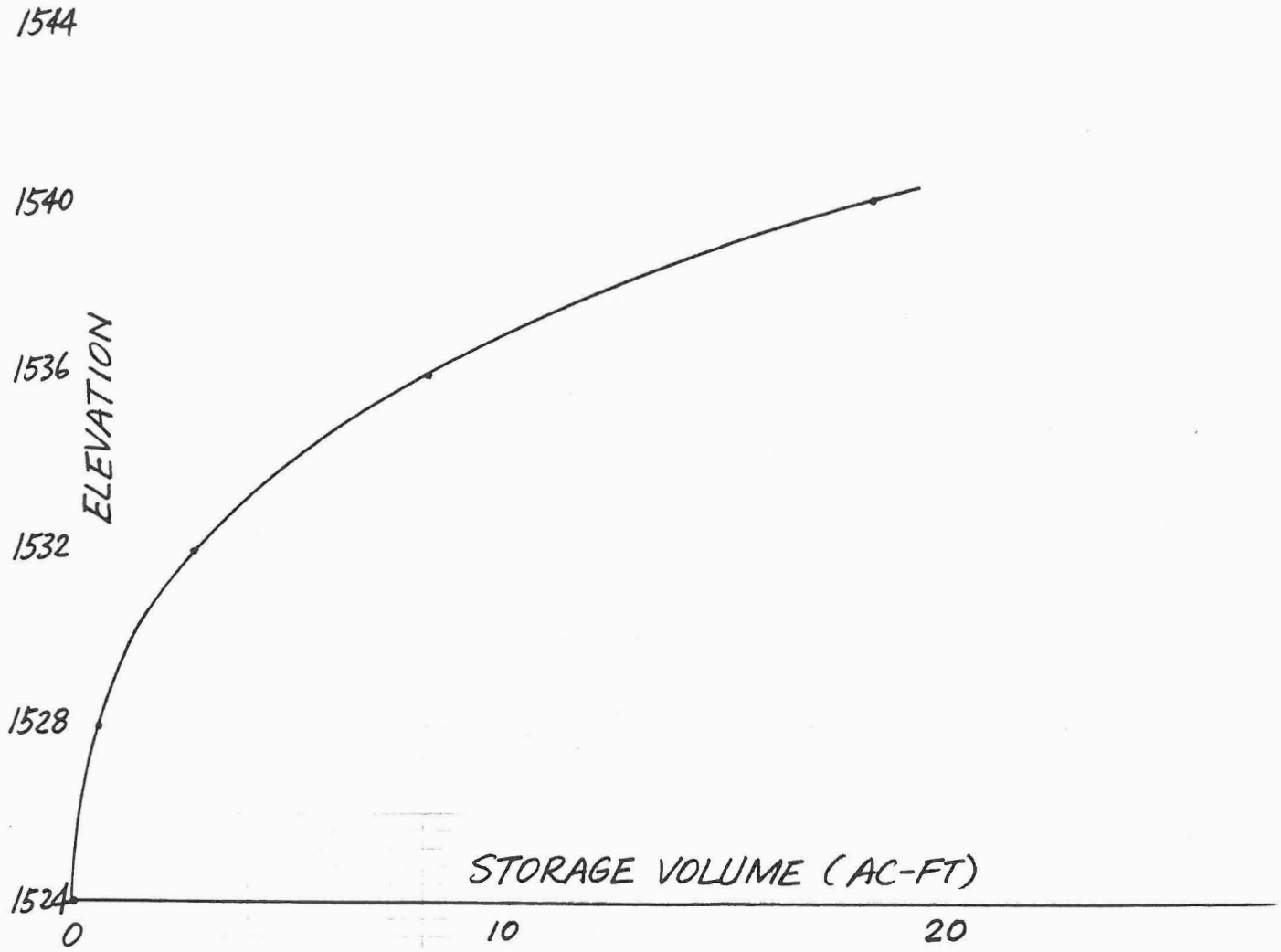
CROSSING LOCATION #3

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1524	0.05			0.00		0.00
		4	0.68		0.61	
1528	0.29			0.68		0.61
		4	2.26		2.16	
1532	0.84			2.94		2.78
		4	5.38		5.25	
1536	1.85			8.32		8.03
		4	10.36		10.22	
1540	3.33			18.68		18.24

CAP CROSSING #3, STA. 538+25
HEC-1 I.D. : PCAP

STAGE - STORAGE RELATION



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BY HWM DATE 11-12-90

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CLIENT FCDMC

JOB CAP Overchutes

JOB NO. 310.42

ESTIMATION OF OUTFLOW AT CROSSING #3

Pipe Size (D) = 30" RCP = 2.5'

Upstream Invert Elev. = 1518.99 (Based on Field Surveying)

Water Surface Elevation	Height of Water, HW	HW/D	Flow Rate * (cfs)
1519.00	0	0	0
1520.25	1.25	0.5	7.5
1521.50	2.50	1.0	22
1524.00	5.0	2.0	45
1529.00	10.0	4.0	71
1534.00	15.0	6.0	93
1540.00	21.0	8.4	110 **

* Obtained from Chart 2 as shown on next sheet.

** Extrapolated from the Chart.

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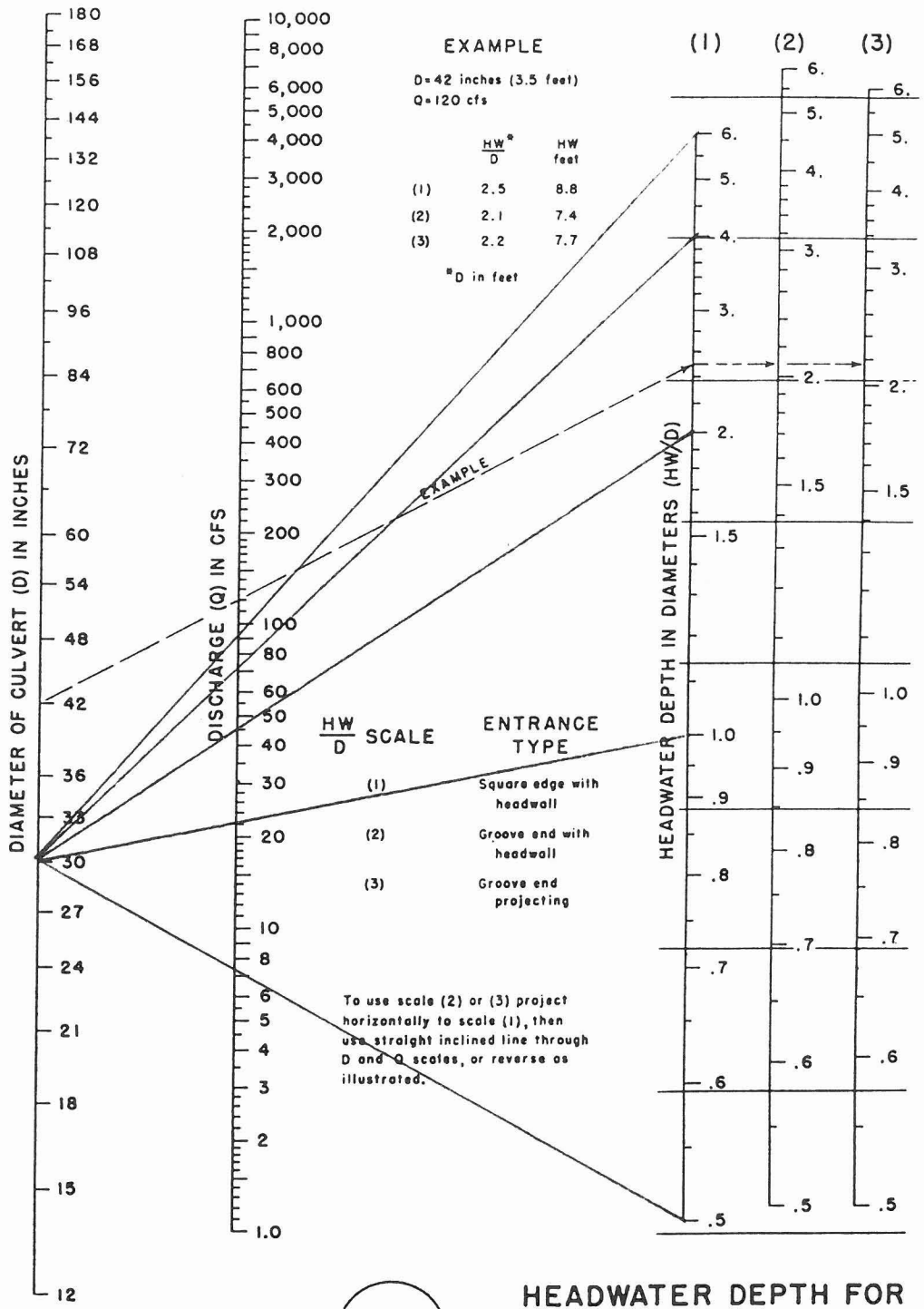
SHEET 4 OF 5
BY HEM DATE 11-12-90
CHECK SEK DATE 4/91
CLIENT FCD MC
JOB CAP - Crossing #3
JOB NO. 310.42

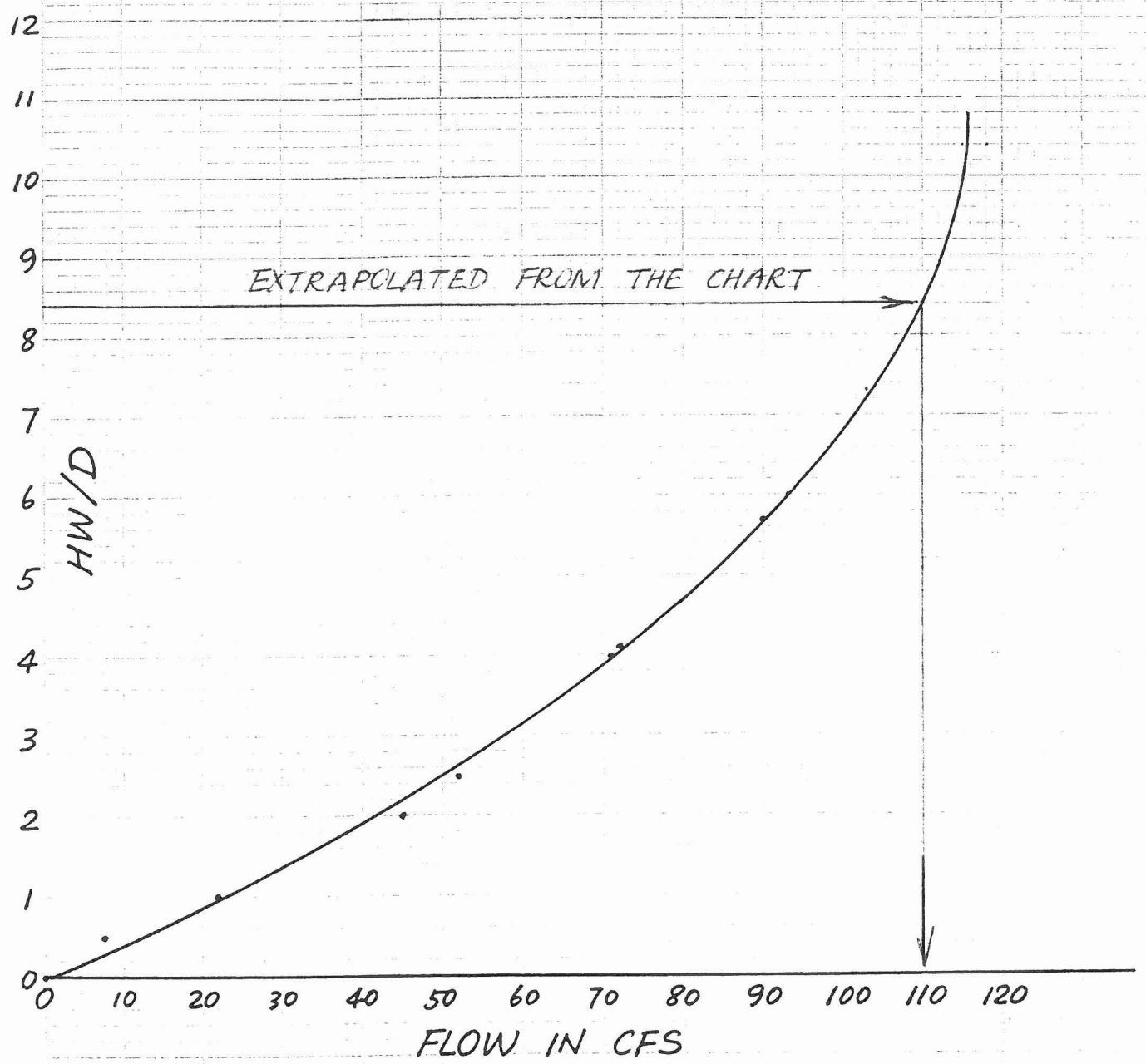
CHART 2



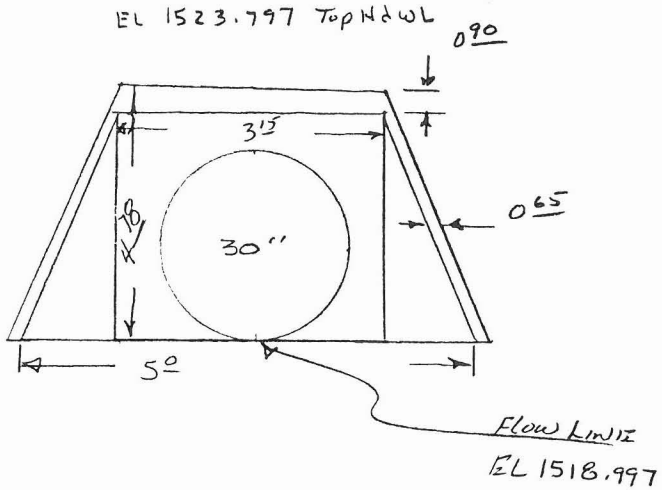
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

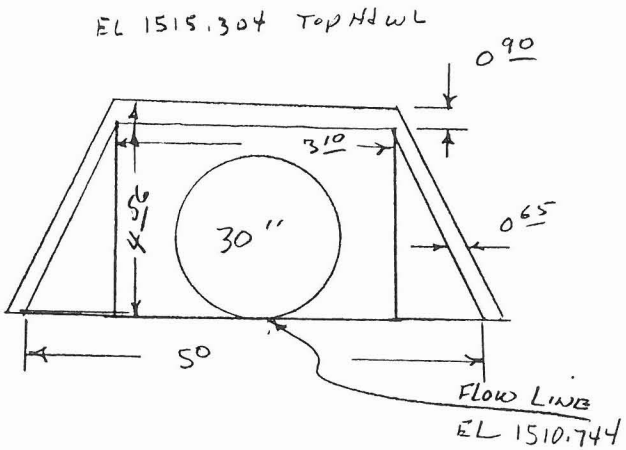
BUREAU OF PUBLIC ROADS JAN. 1963

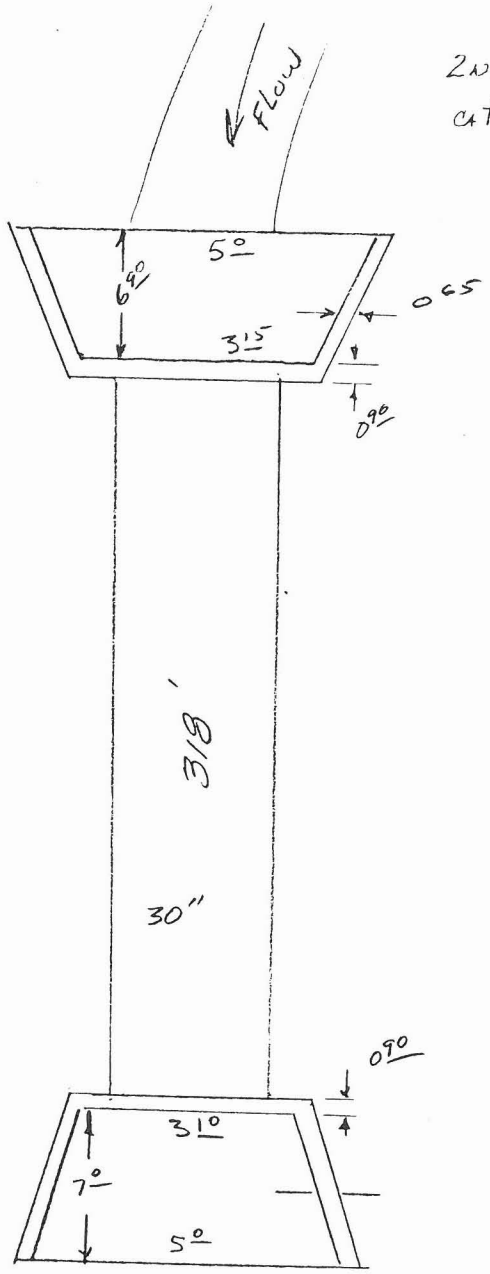
STAGE-DISCHARGE RELATIONSHIP FOR 30-INCH RCP



2nd Pipe west of Caterpillar tank Rd







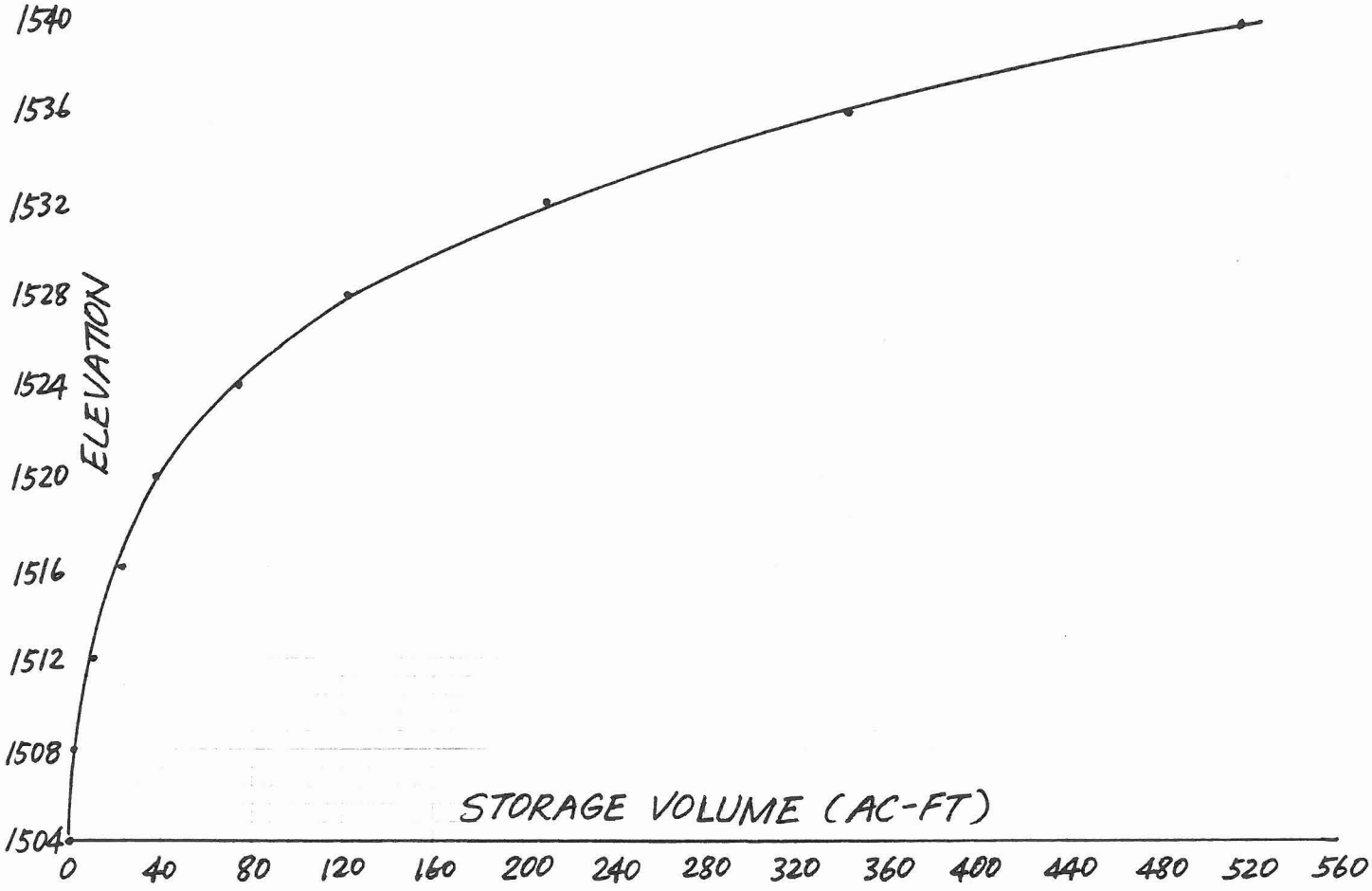
CROSSING LOCATION #4

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1504	0.21			0		0
		4	2.60		2.37	
1508	1.09			2.60		2.37
		4	7.04		6.86	
1512	2.43			9.64		9.23
		4	11.78		11.72	
1516	3.46			21.42		20.95
		4	16.80		16.71	
1520	4.94			38.22		37.67
		4	30.16		29.54	
1524	10.14			68.38		67.21
		4	56.10		55.37	
1528	17.91			124.48		122.58
		4	90.80		90.12	
1532	27.49			215.28		212.70
		4	131.24		130.66	
1536	38.13			346.52		343.36
		4	173.30		172.88	
1540	48.52			519.82		516.24

CAP CROSSING #4, STA. 492+30
HEC-1 I.D. : CCAP

STAGE-STORAGE RELATION



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BY HEM DATE 11-12-90

CHECK SEK DATE 4/91

CLIENT FCDMC

JOB CAP Overchutes

JOB NO. 310.42

ESTIMATION OF OUTFLOW AT CROSSING # 4

Pipe Size (D) = Four 72" RCP = 6'

Upstream Invert Elev. = 1500.13 (Based on Field Surveying)

Water Surface Elevation	Height of Water, HW	HW/D	Flow Rate * (cfs)
1500	0	0	0
1503	3	0.5	4 × 62 = 248
1506	6	1.0	4 × 200 = 800
1512	12	2.0	4 × 400 = 1600
1518	18	3.0	4 × 540 = 2160
1524	24	4.0	4 × 625 = 2500
1530	30	5.0	4 × 725 = 2900
1536	36	6.0	4 × 800 = 3200

* Obtained from Chart 2 as shown on next sheet.

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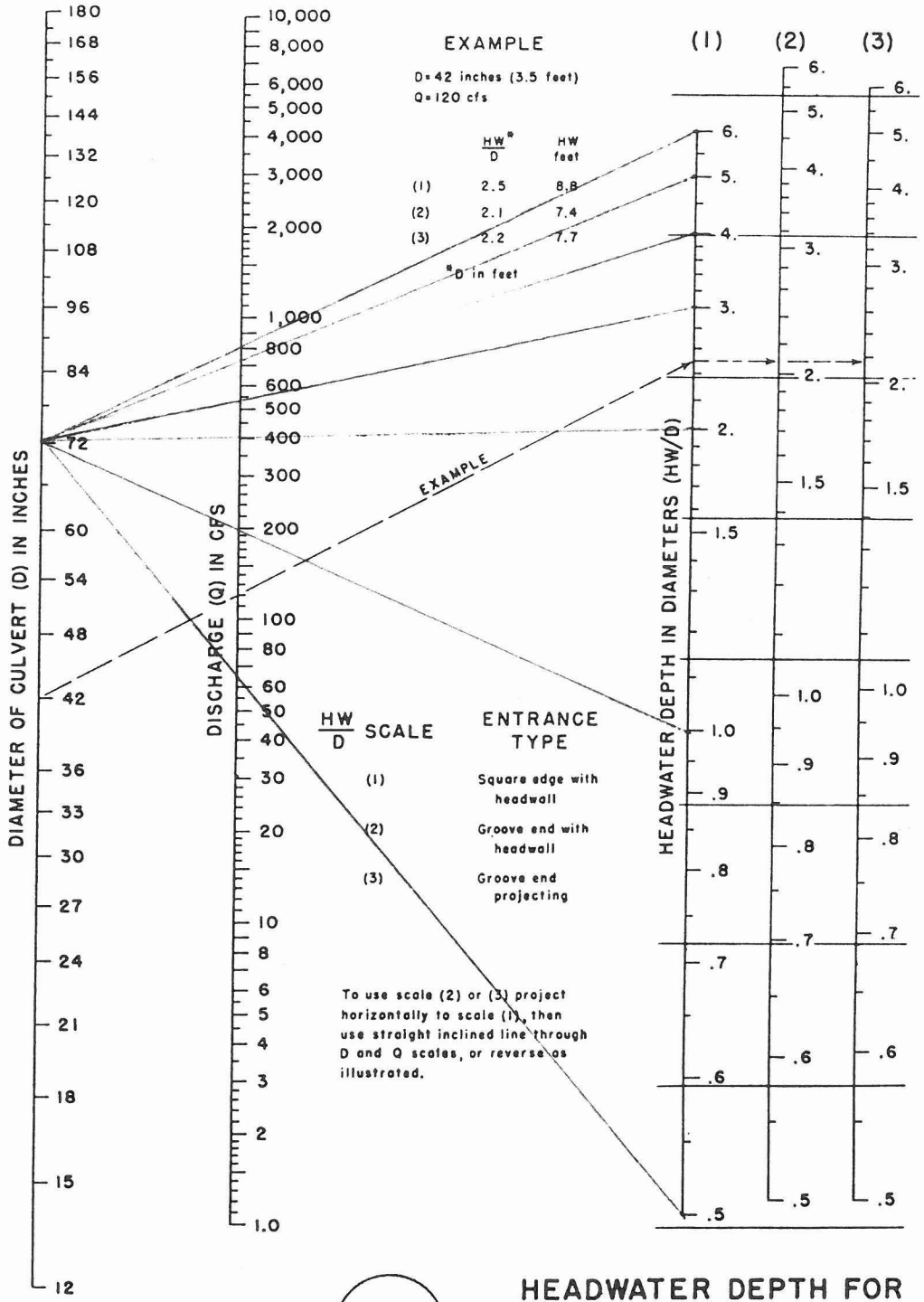
SHEET 4 OF 6
BY HEM DATE 11-12-90
CHECK SEK DATE 4/91
CLIENT FCD MC
JOB CAP CROSSING #4
JOB NO. 310.42

CHART 2

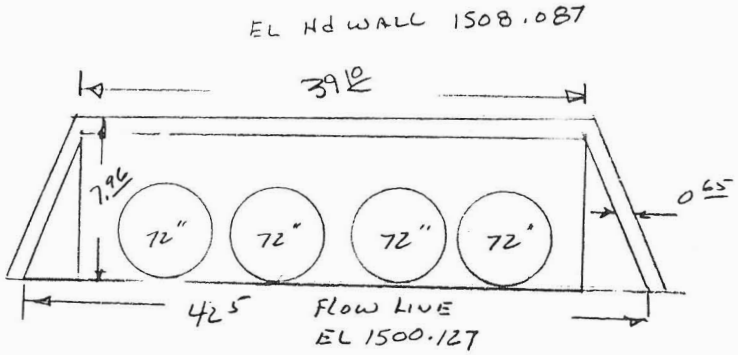


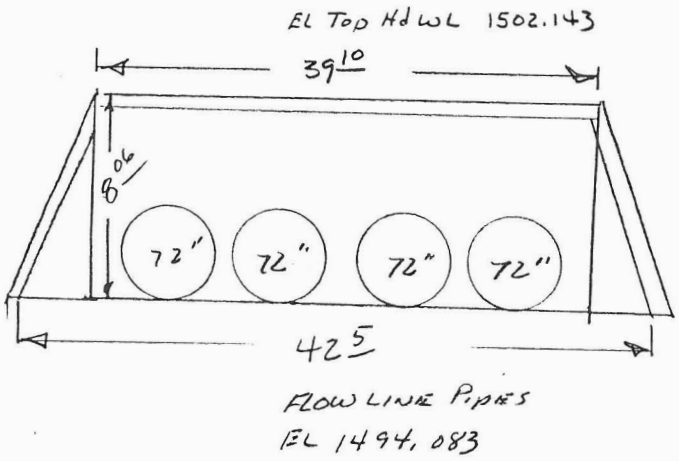
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

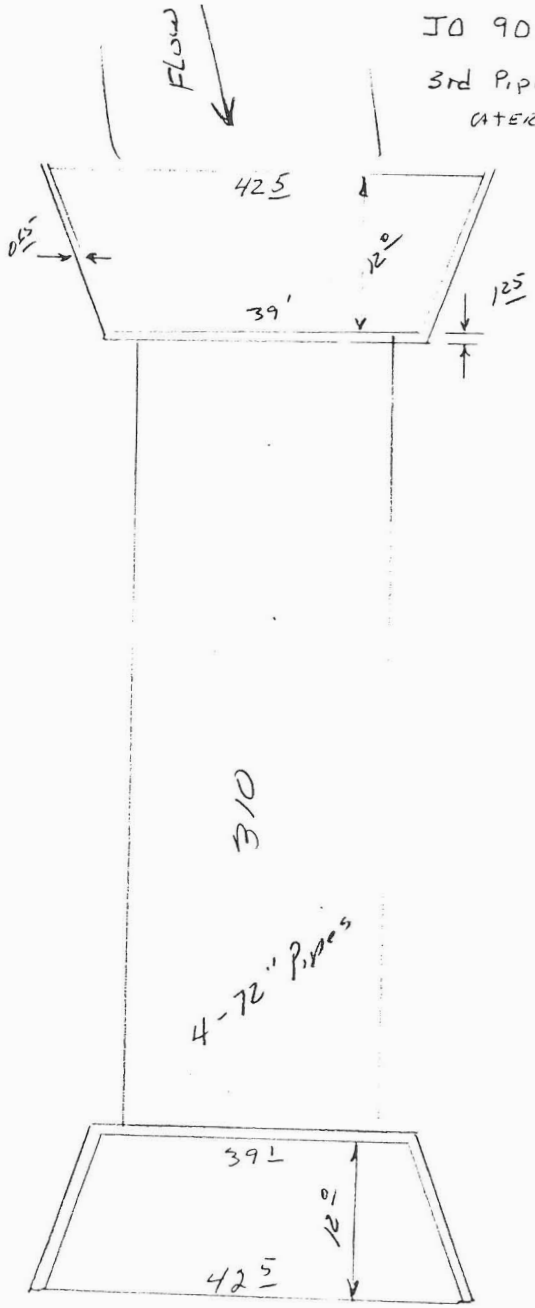
BUREAU OF PUBLIC ROADS JAN. 1963

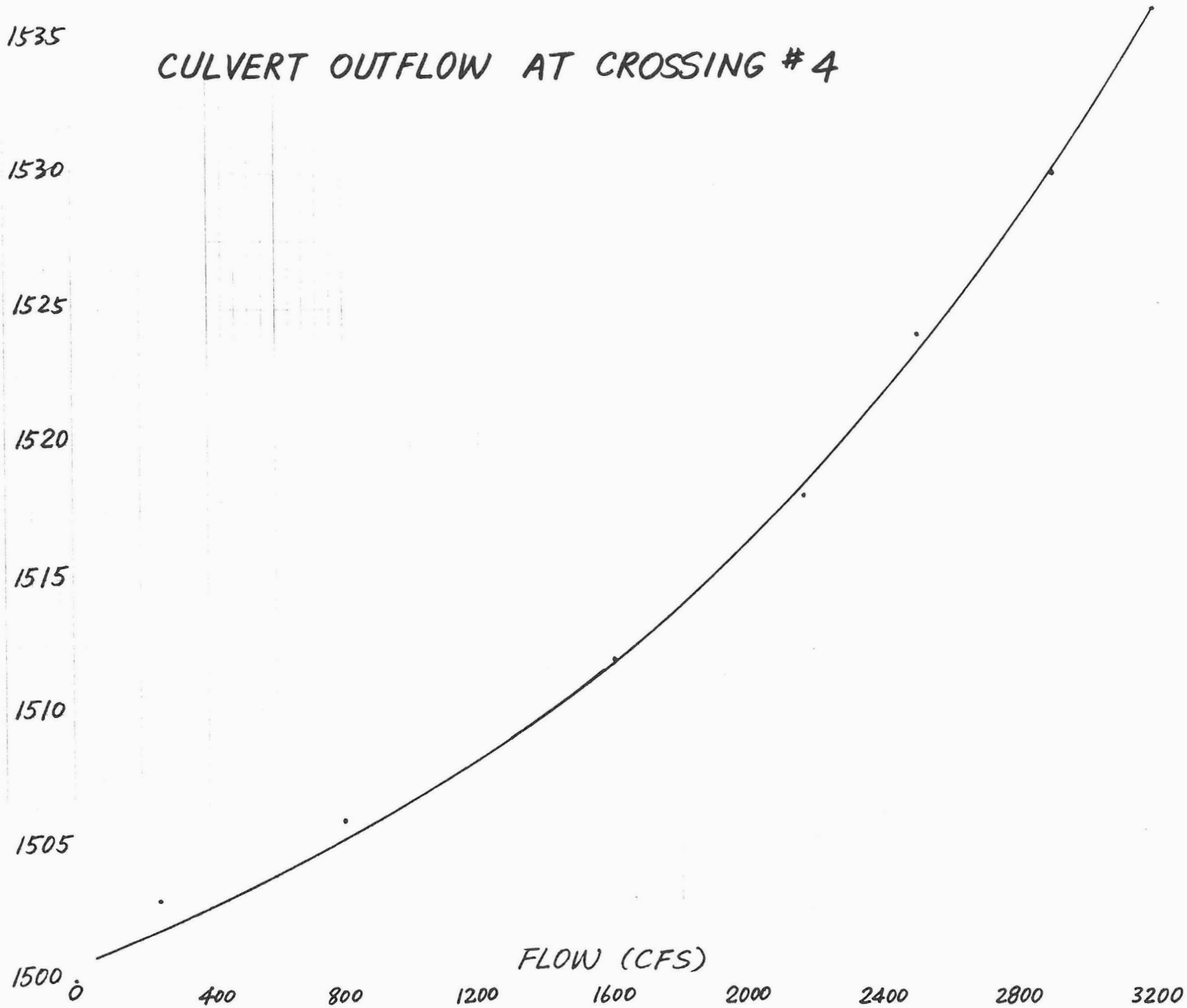
JO 90138 4

3rd Pipes west of CATERPILLER TANK RD








CULVERT OUTFLOW AT CROSSING #4
1535
1530
1525
1520
1515
1510
1505
1500
0
400
800
1200
1600
2000
2400
2800
3200
FLOW (CFS)

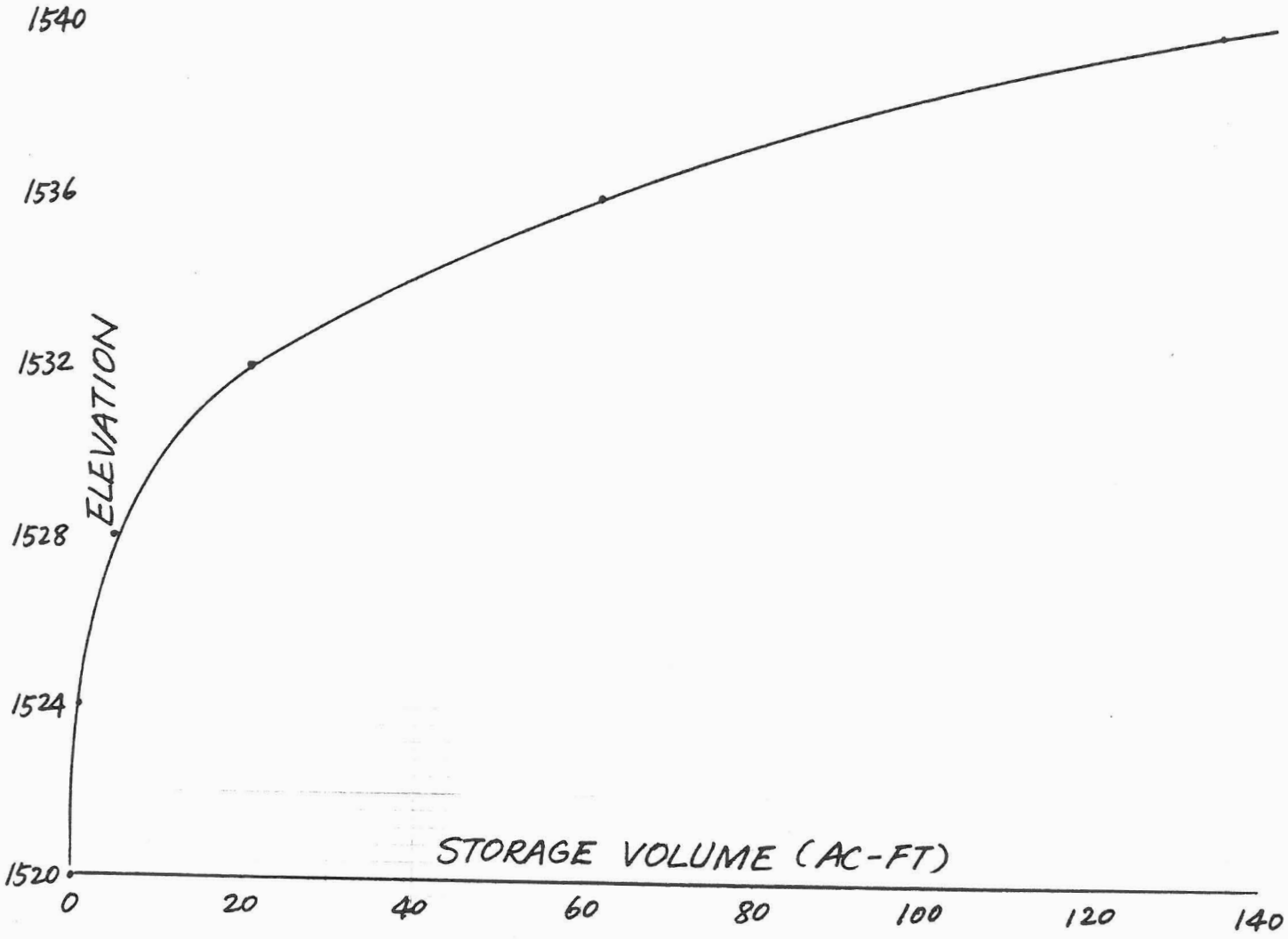
CROSSING LOCATION #5

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1520	0.07			0.00		0.00
		4	0.82		0.75	
1524	0.34			0.82		0.75
		4	4.06		3.72	
1528	1.69			4.88		4.47
		4	16.60		15.52	
1532	6.61			21.48		19.99
		4	41.84		40.86	
1536	14.31			63.32		60.85
		4	73.38		72.78	
1540	22.38			136.70		133.63

CAP CROSSING #5, STA. 480+90
HEC-1 I.D. : FCAP

STAGE - STORAGE RELATION



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BY HEM DATE 11-12-90

CHECK SEK DATE 4/91

CLIENT FCDMC

JOB CAP Overchutes

JOB NO. 310.42

ESTIMATION OF OUTFLOW AT CROSSING #5

Pipe Size (D) = 30" RCP = 2.5'

Upstream Invert Elev. = 1515.92 (Based on Field Surveying)

Water Surface Elevation	Height of Water, HW	HW/D	Flow Rate * (cfs)
1516.00	0	0	0
1517.25	1.25	0.5	7.5
1518.50	2.50	1.0	22
1521.00	5.0	2.0	45
1526.00	10.0	4.0	71
1531.00	15.0	6.0	93
1536.00	20.0	8.0	108 **
1540.00	24.0	9.6	115 **

* Obtained from Chart 2 as shown on next sheet.

** Extrapolated from the Chart.

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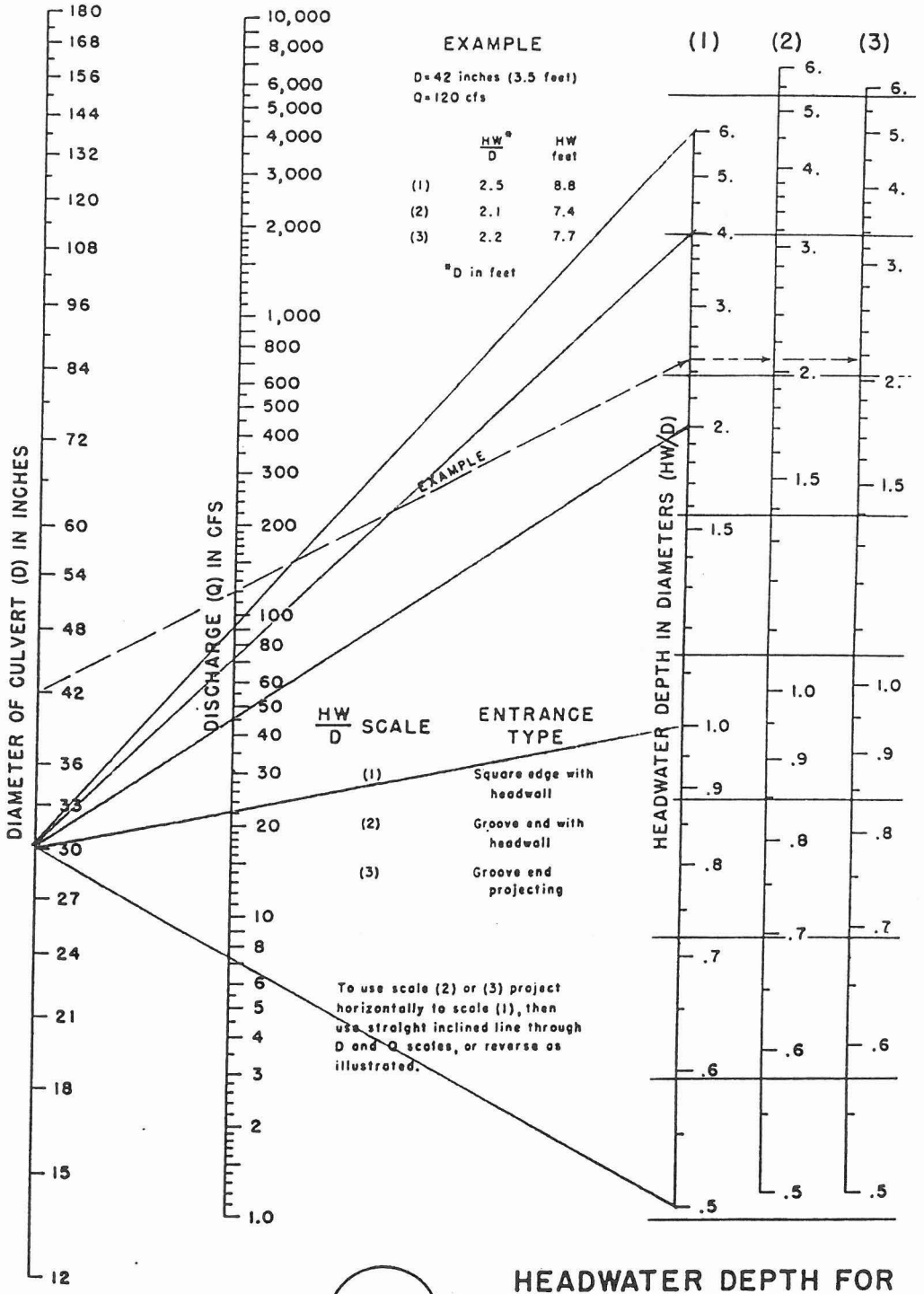
SHEET 4 OF 5
BY HEM DATE 11-12-90
CHECK SEK DATE 4/91
CLIENT FCD MC
JOB CAP - Crossing #5
JOB NO. 310.42

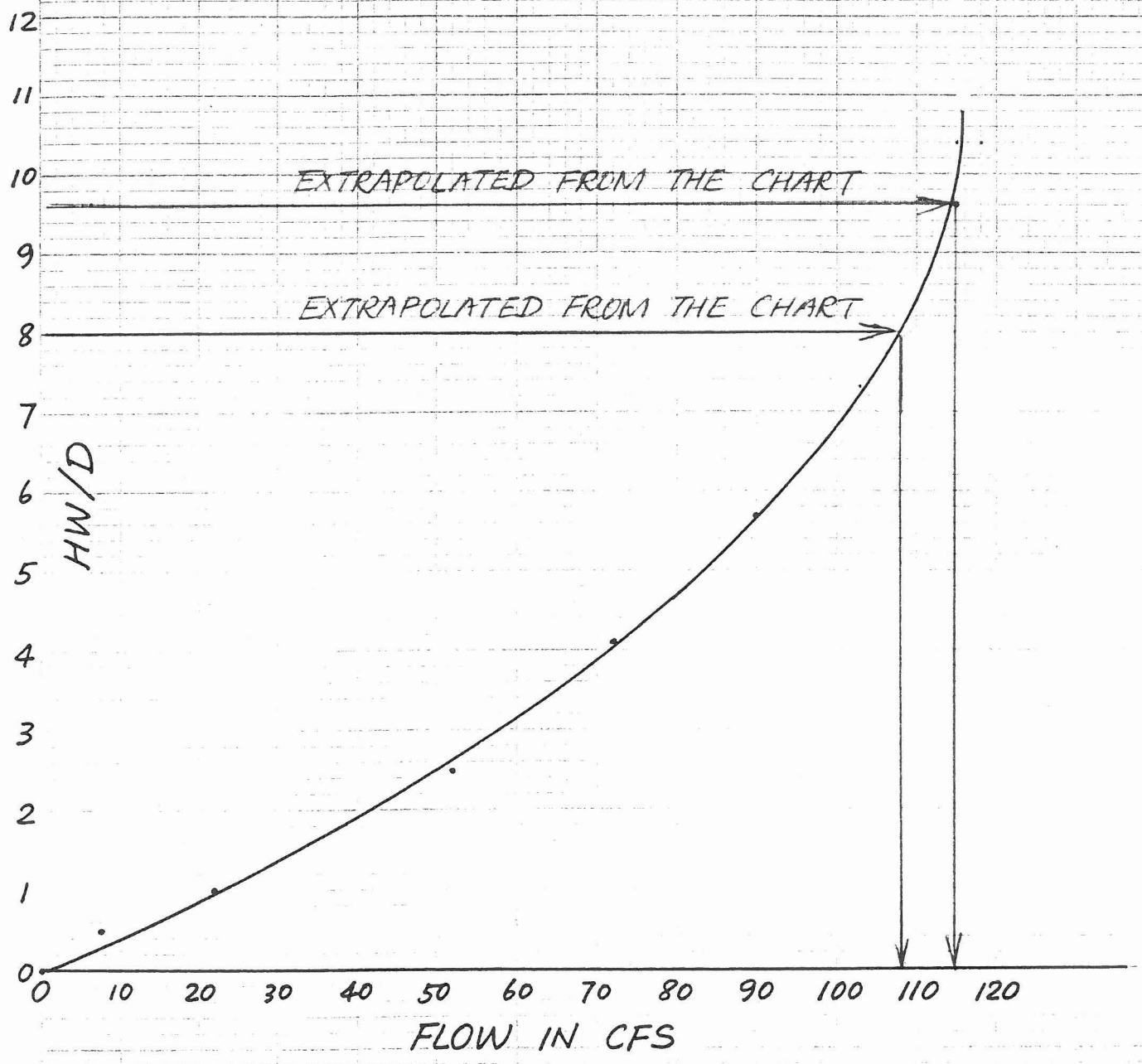
CHART 2



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

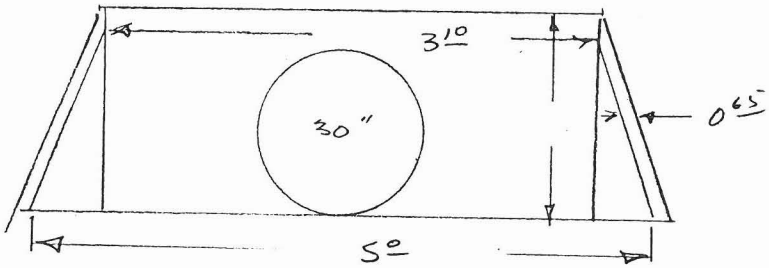
BUREAU OF PUBLIC ROADS JAN. 1963

STAGE-DISCHARGE RELATIONSHIP FOR 30-INCH RCP



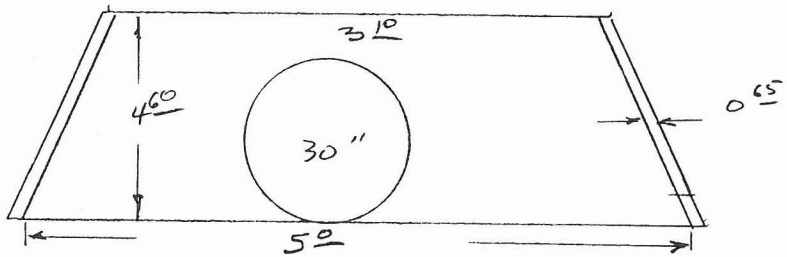
4th Pipe west of Caterpillar Tanit Rd

EL 1520.582 HDWL

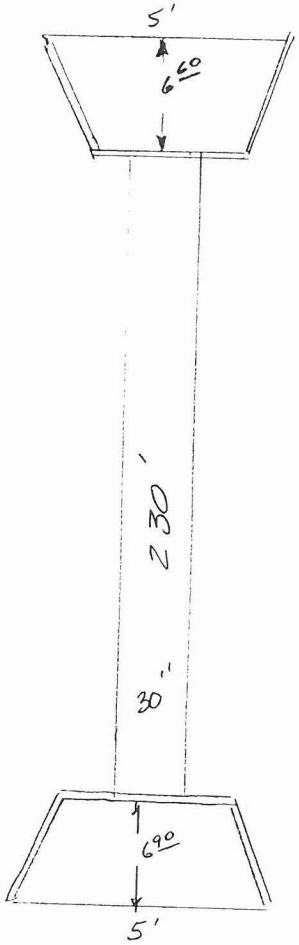


EL ⌀ 1515.922

EL 1516.692 HDWL



EL ⌀ 1512.092



5 of 5

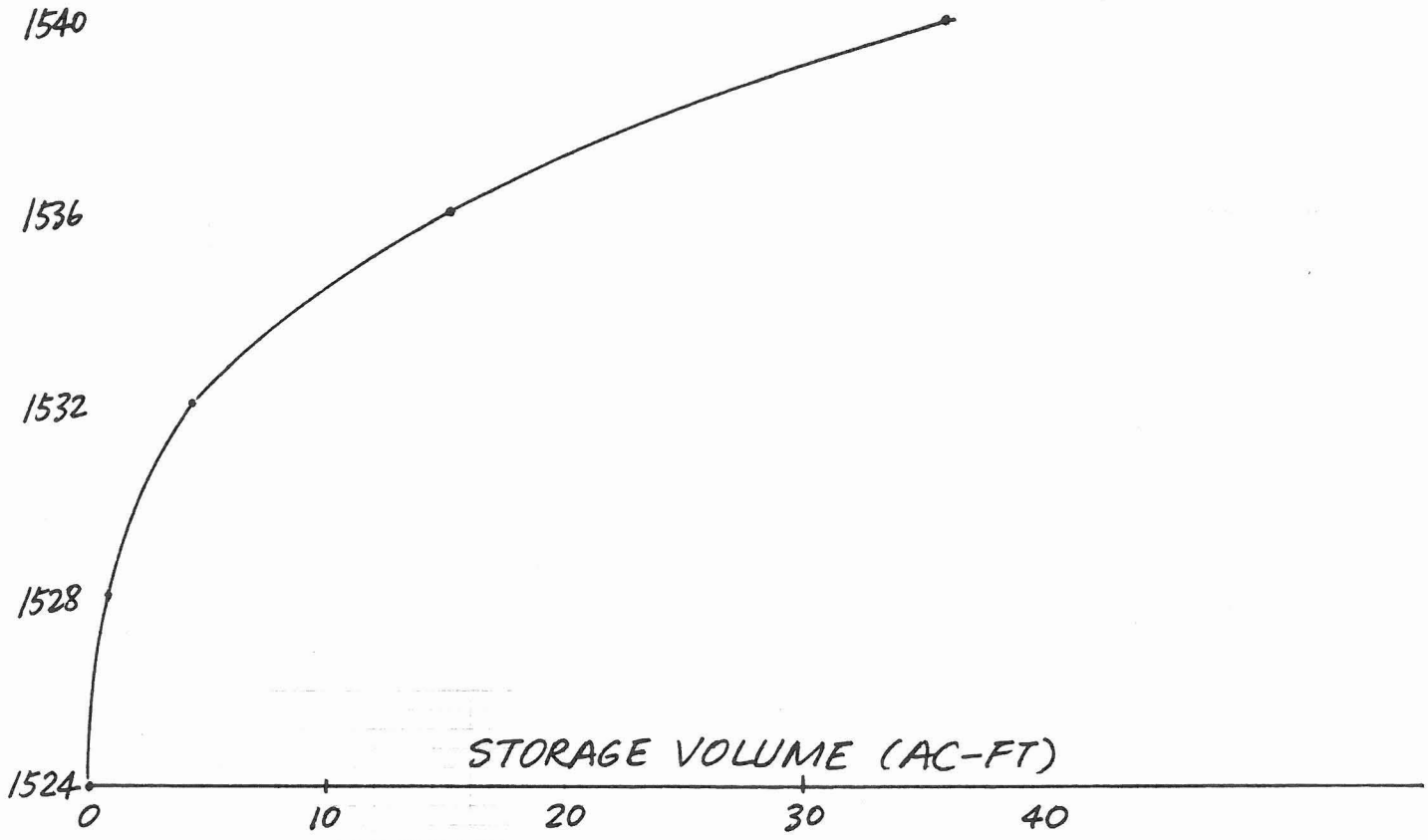
CROSSING LOCATION #6

VOLUME DETERMINATION BASED UPON MEASURED SURFACE AREA

ELEV.	AREA (ACRES)	H (FEET)	AVG AREA VOL. (ACRE-FT)	TOT. AVG VOL. (ACRE-FT.)	AVG. CONICAL VOL. (ACRE-FT)	TOT. CONICAL VOL. (ACRE-FT)
1524	0.06			0.00		0.00
		4	0.86		0.77	
1528	0.37			0.86		0.77
		4	3.86		3.59	
1532	1.56			4.72		4.36
		4	11.22		10.83	
1536	4.05			15.94		15.19
		4	20.88		20.70	
1540	6.39			36.82		35.89

CAP CROSSING #6, STA. 459+30
HEC-1 I.D. : GCAP

STAGE - STORAGE RELATION



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BY HEM DATE 11-12-90

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CLIENT FCDMC

JOB CAP Overchutes

JOB NO. 310.42

ESTIMATION OF OUTFLOW AT CROSSING # 6

Pipe Size (D) = 30" RCP = 2.5'

Upstream Invert Elev. = 1519.13 (Based on Field Surveying)

Water Surface Elevation	Height of Water, HW	HW/D	Flow Rate * (cfs)
1519.00	0	0	0
1520.25	1.25	0.5	7.5
1521.50	2.5	1.0	22
1524.0	5.0	2.0	45
1529.0	10.0	4.0	71
1534.0	15.0	6.0	93
1540.0	21.0	8.4	110 **

* Obtained from Chart 2 as shown on next sheet.

** Extrapolated from the Chart.

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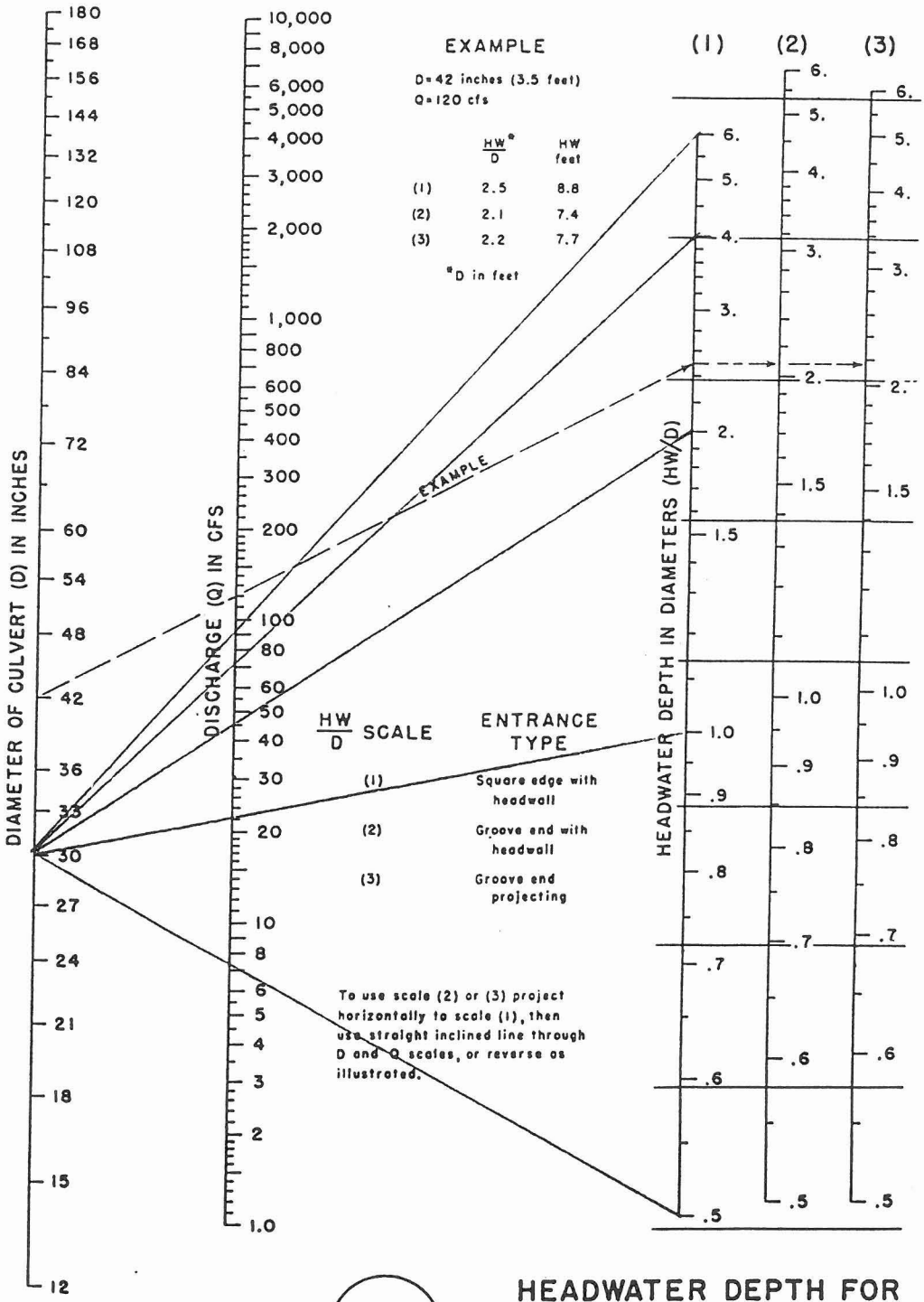
SHEET 4 OF 5
BY HEM DATE 11-12-90
CHECK _____ DATE _____

CLIENT FCD MC
JOB CAP – Crossing #6
JOB NO. 310.42

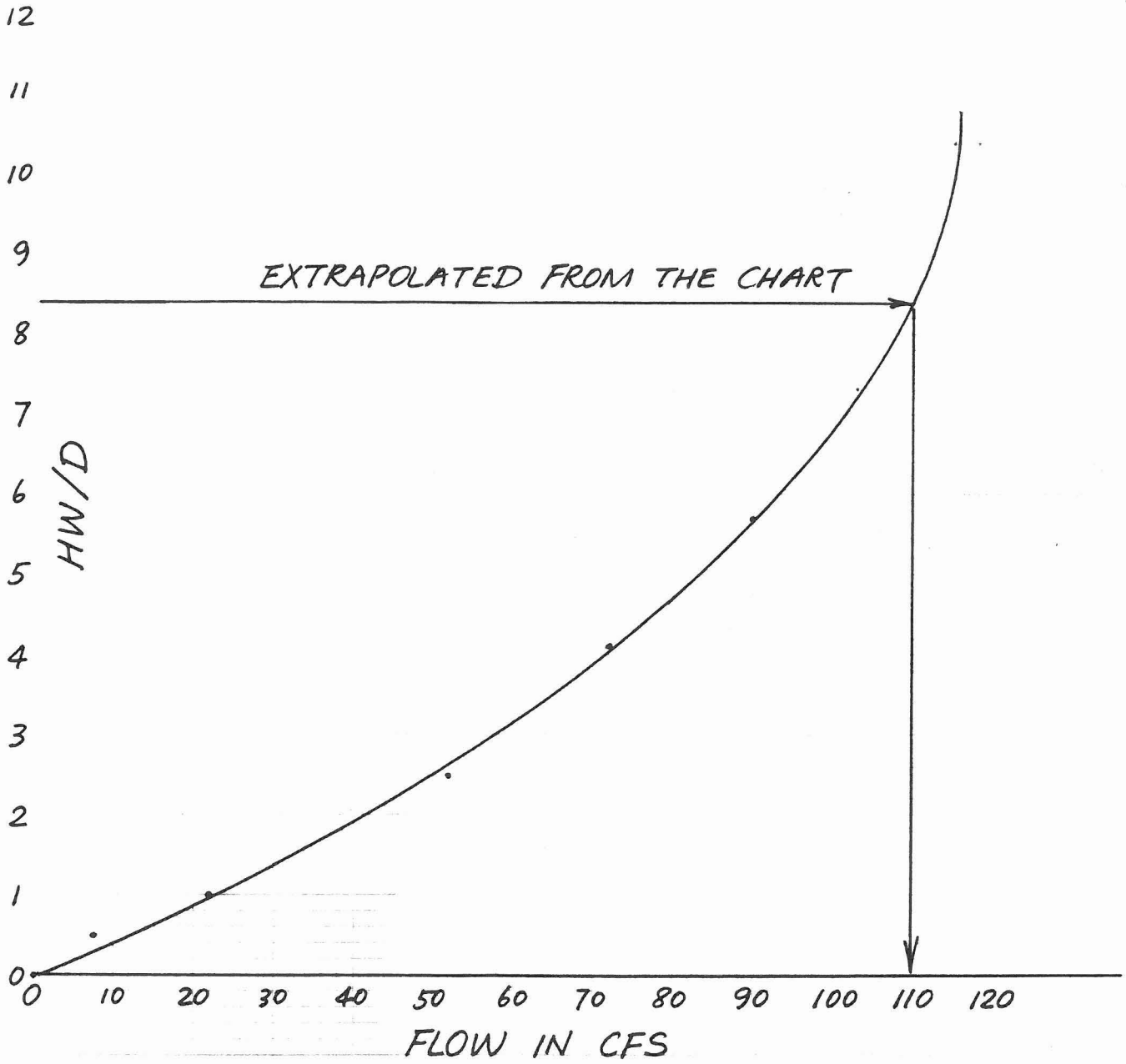
CHART 2



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

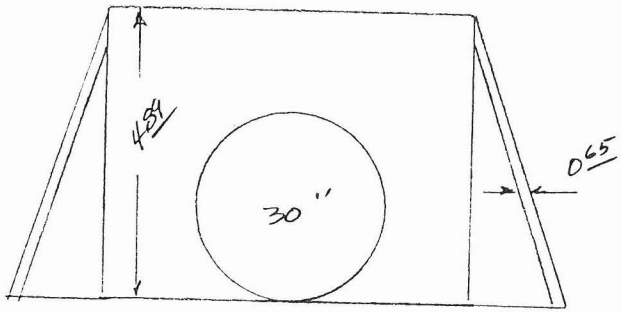
STAGE-DISCHARGE RELATIONSHIP FOR 30-INCH RCP



JD 90138 6

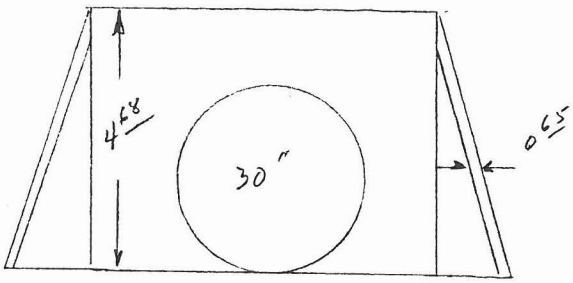
5th PIPE west of
Caterpillar TANK Rd

EL Hd WL 1524.023

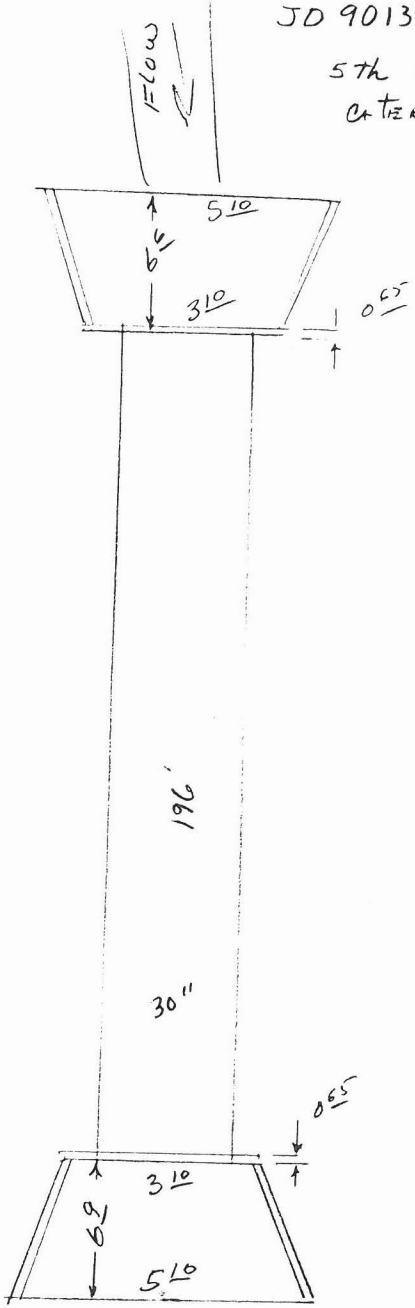


EL ⊥ 1519.133

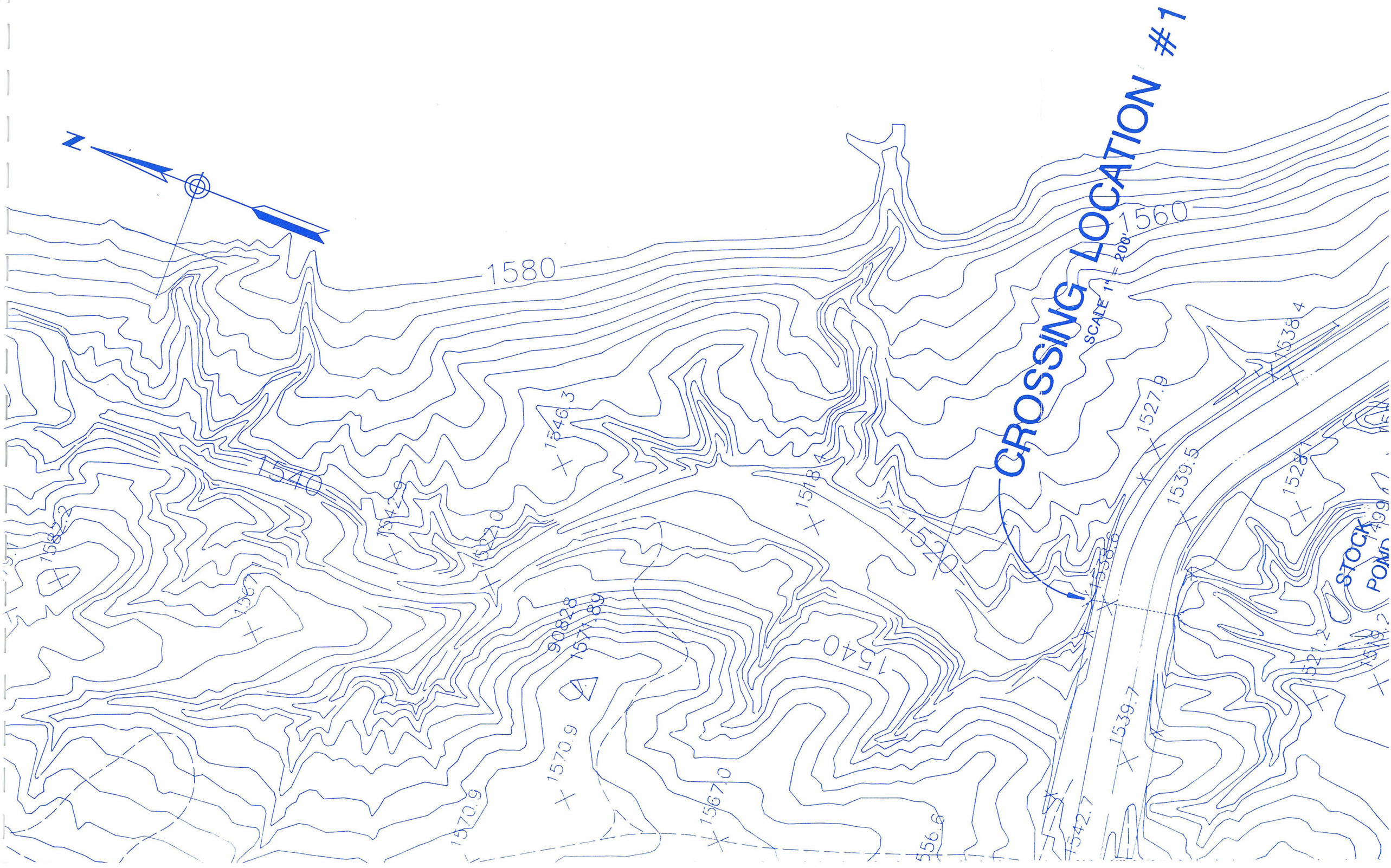
EL Hd WL 1517.613

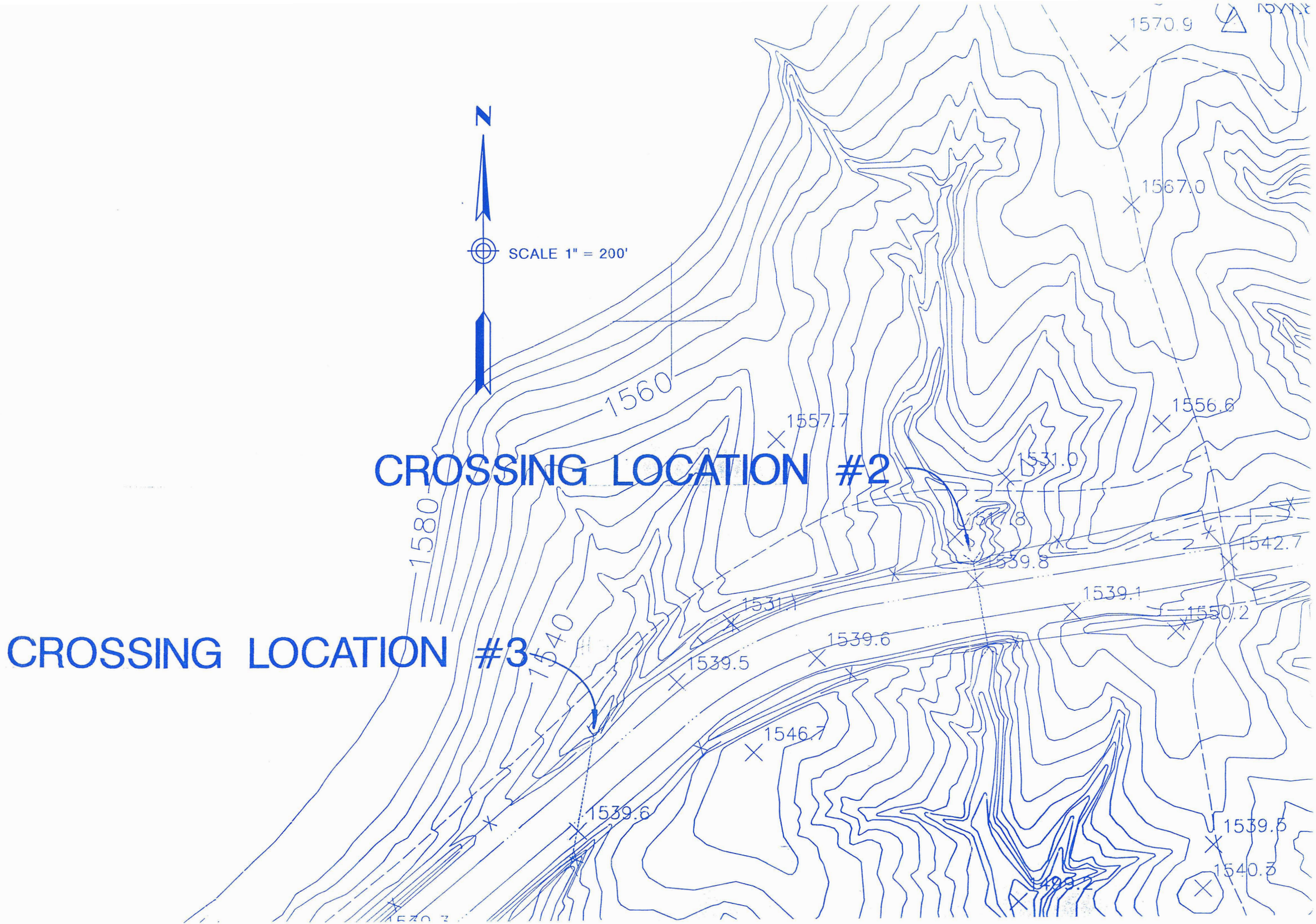


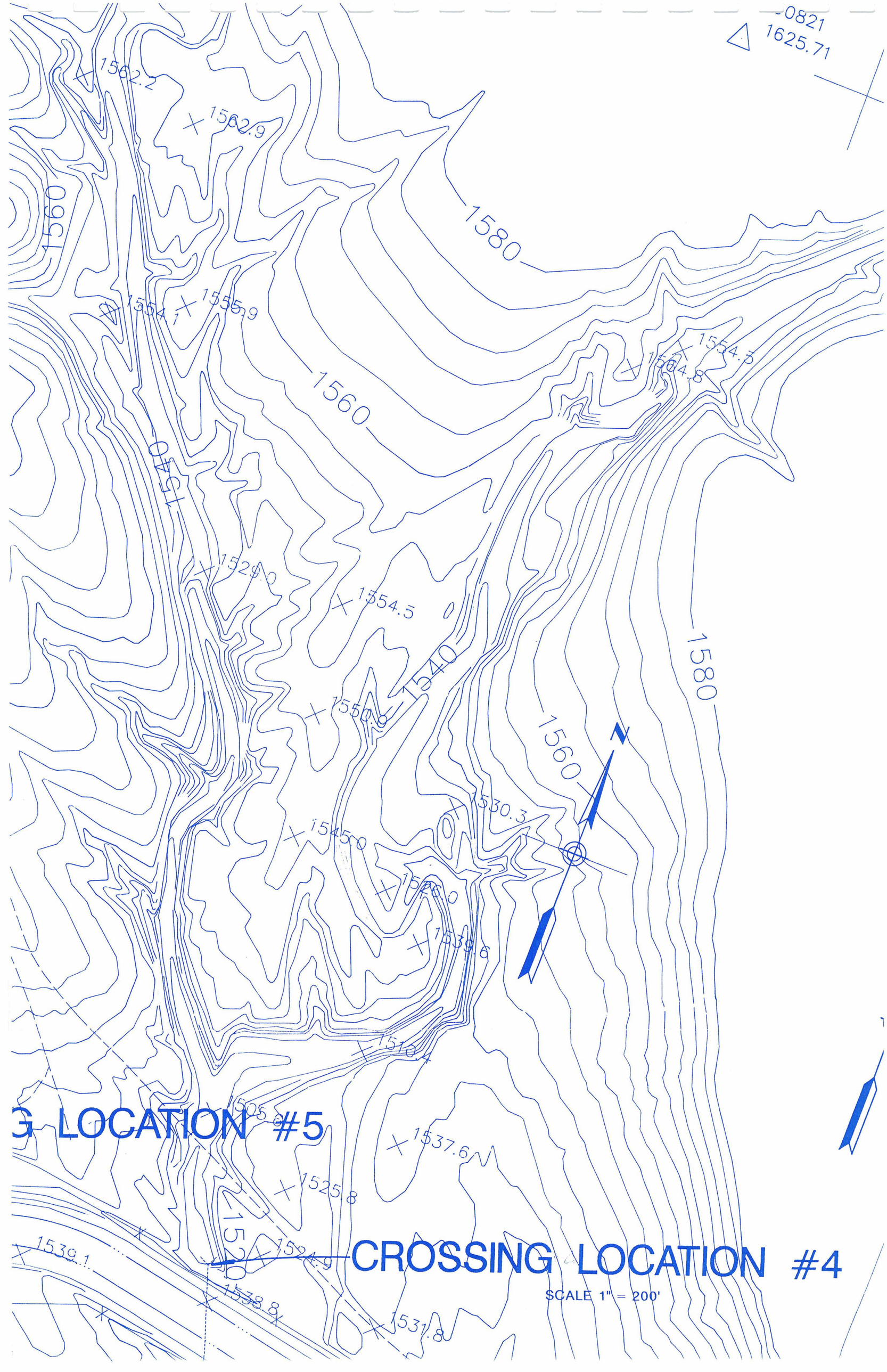
EL ⊥ 1512.933

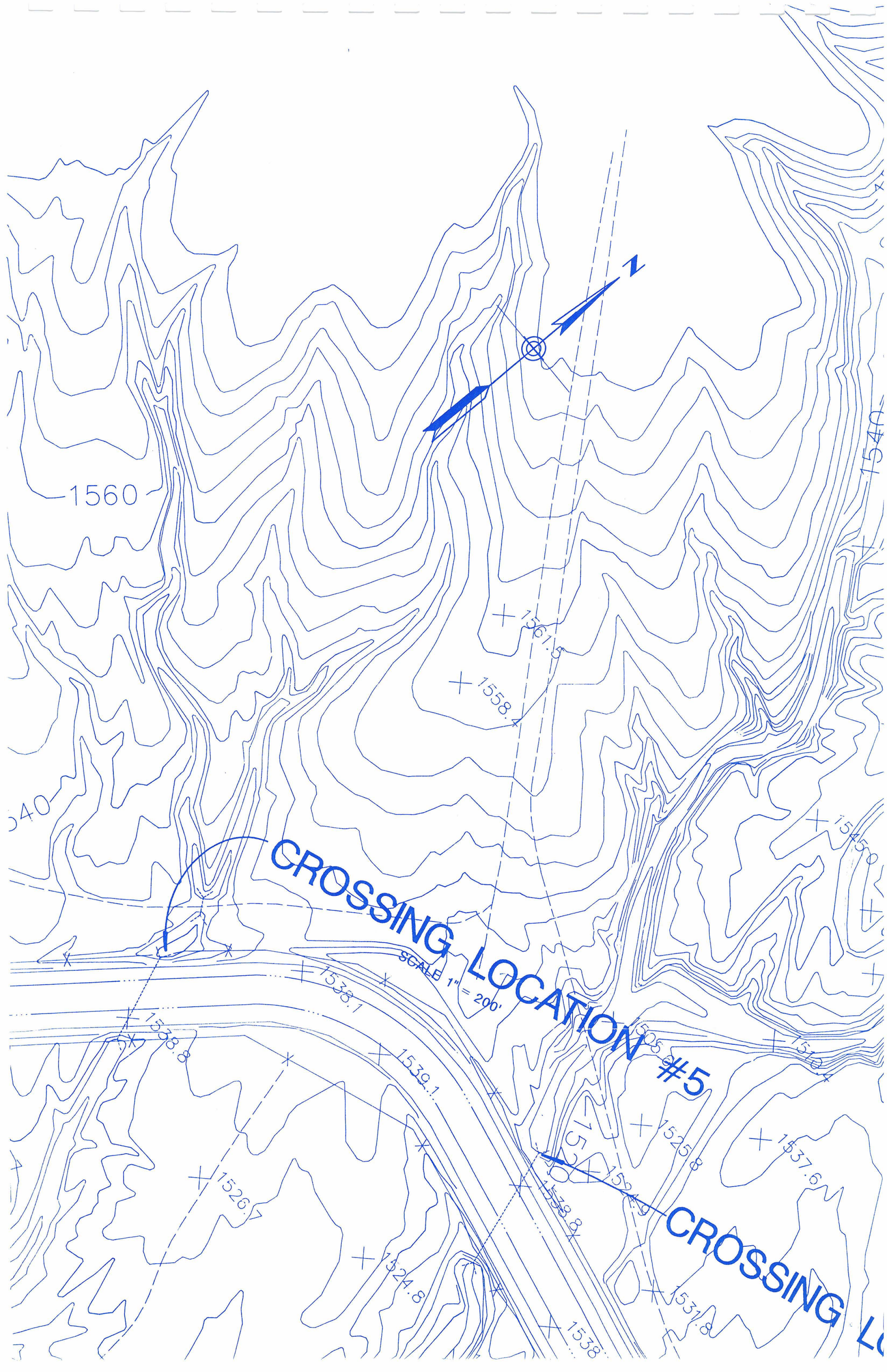


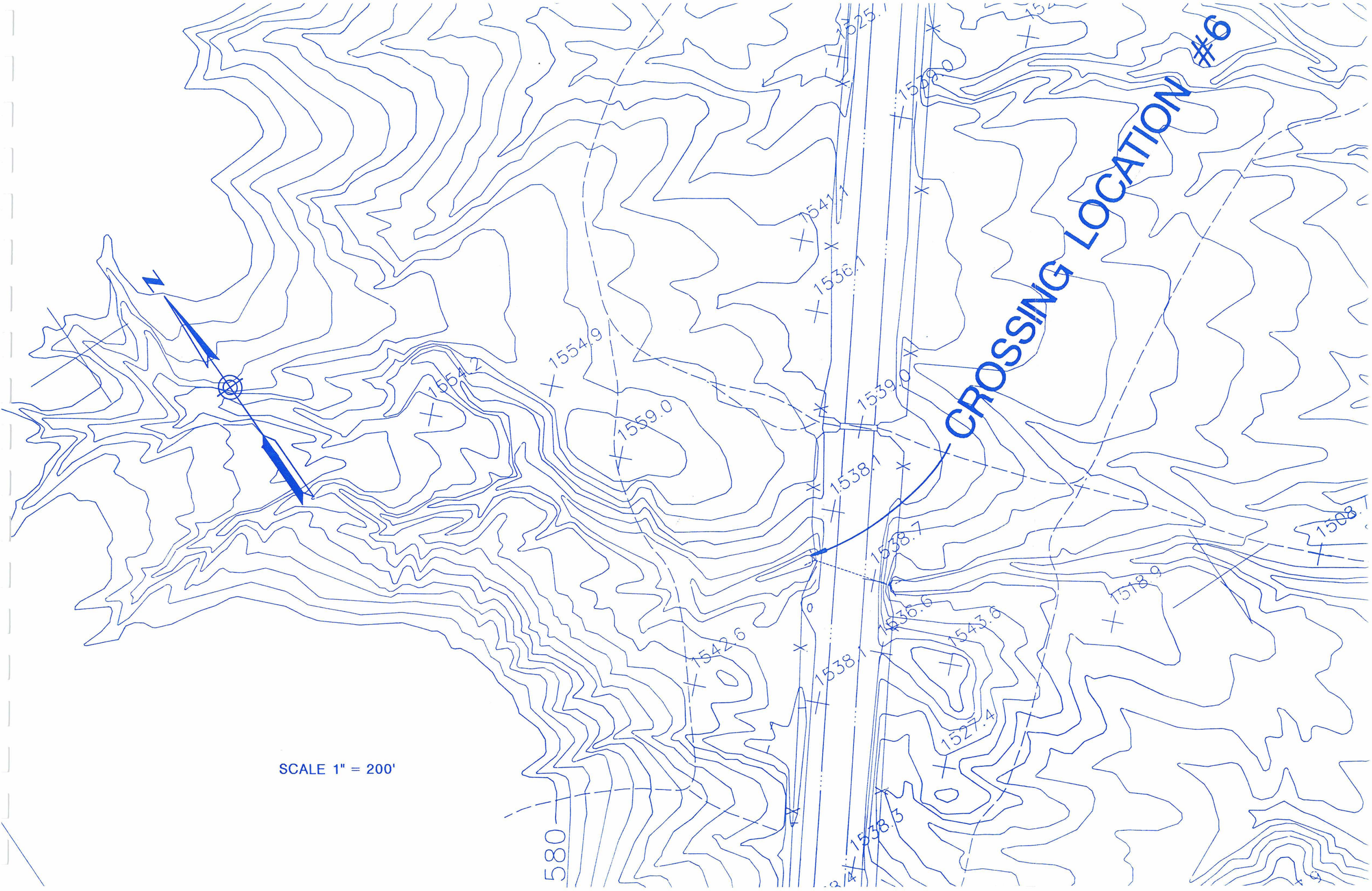
5 of 5


CROSSING LOCATION #1
SCALE 1" = 200'
N
1580
1560
1540
1520
1540
1546.3
1544.9
1524.0
1518.4
1582.2
1566
1570.9
1571.89
90828
1570.9
1567.0
1556.6
1542.7
1539.7
1538.6
1539.5
1527.8
1538.4
1528.1
STOCK POND


N
SCALE 1" = 200'
CROSSING LOCATION #2
CROSSING LOCATION #3
1570.9
1567.0
1560
1557.7
1556.6
1531.0
1580
1542.7
1539.8
1539.1
1550.2
1531.1
1540
1539.6
1539.5
1546.7
1539.6
1539.5
1540.3


0821
1625.71
1562.2
1562.9
1560
1580
1554.1
1555.9
1560
1554.5
1554.8
1540
1520.0
1554.5
1540
1550.6
1560
1580
1530.3
1545.0
1550.0
1539.6
1510
1505.0
1537.6
1525.8
1520
1524.9
1539.1
1538.8
1531.8
G LOCATION #5
CROSSING LOCATION #4
SCALE 1" = 200'


N
1560
1540
1561.5
1558.4
CROSSING LOCATION #5
SCALE 1" = 200'
1538.1
1538.8
1539.1
1526.
1524.8
1538.8
1525.8
1537.6
1531.8
1538
CROSSING LO


CROSSING LOCATION #6
N
SCALE 1" = 200'
1525.1
1509.6
1541.1
1536.1
1554.9
1554.2
1559.0
1539.0
1538.1
1538.7
1508.7
1518.9
1536.6
1543.6
1542.6
1538.1
1527.4
1538.3
580

APPENDIX E

CROSS SECTIONS USED FOR NORMAL DEPTH ROUTING

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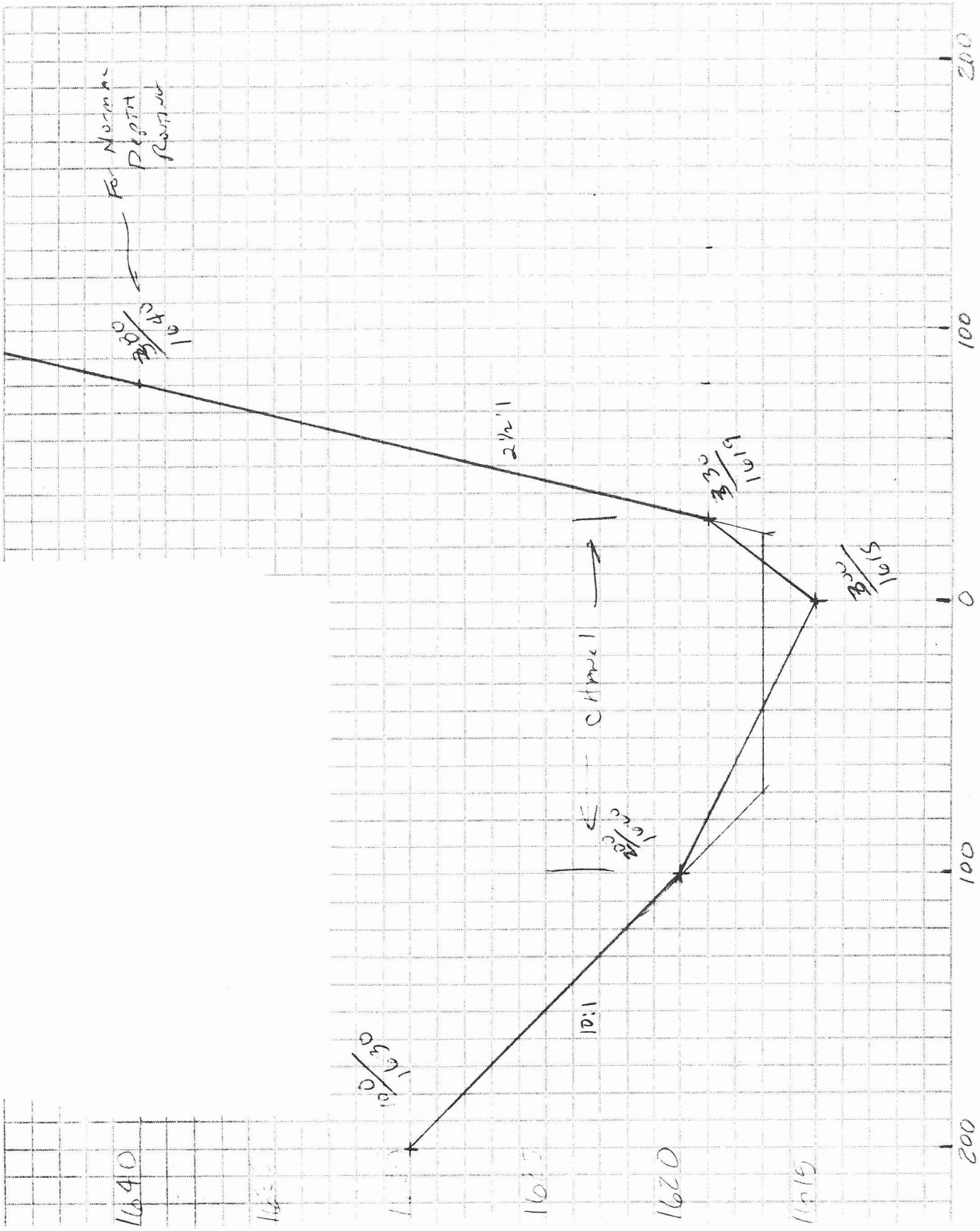
SHEET _____ OF _____
BY Snir DATE 11-29-90
CHECK _____ DATE _____

CLIENT _____
JOB X-Section of Reach Area 2 JOB NO. 310.42.



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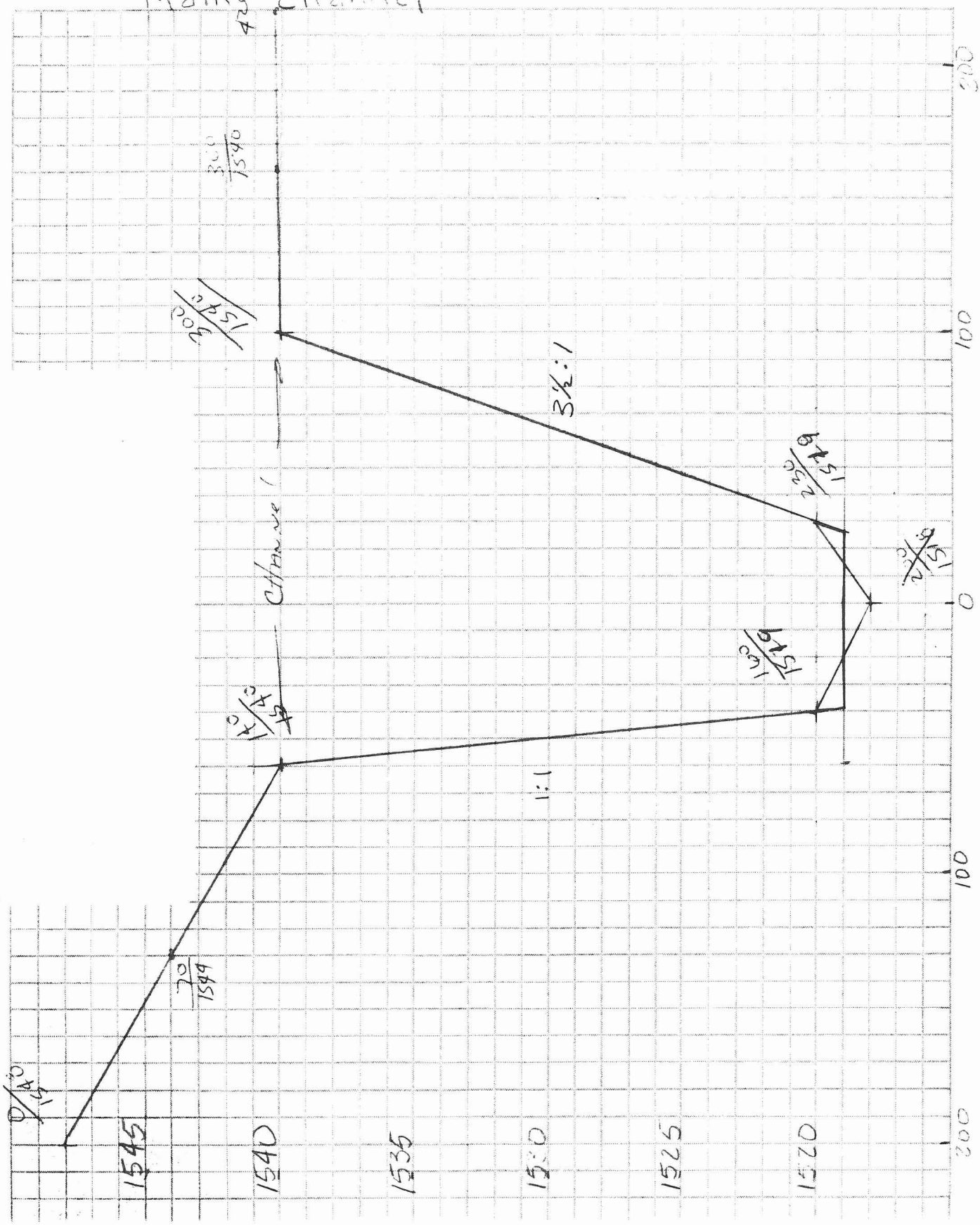
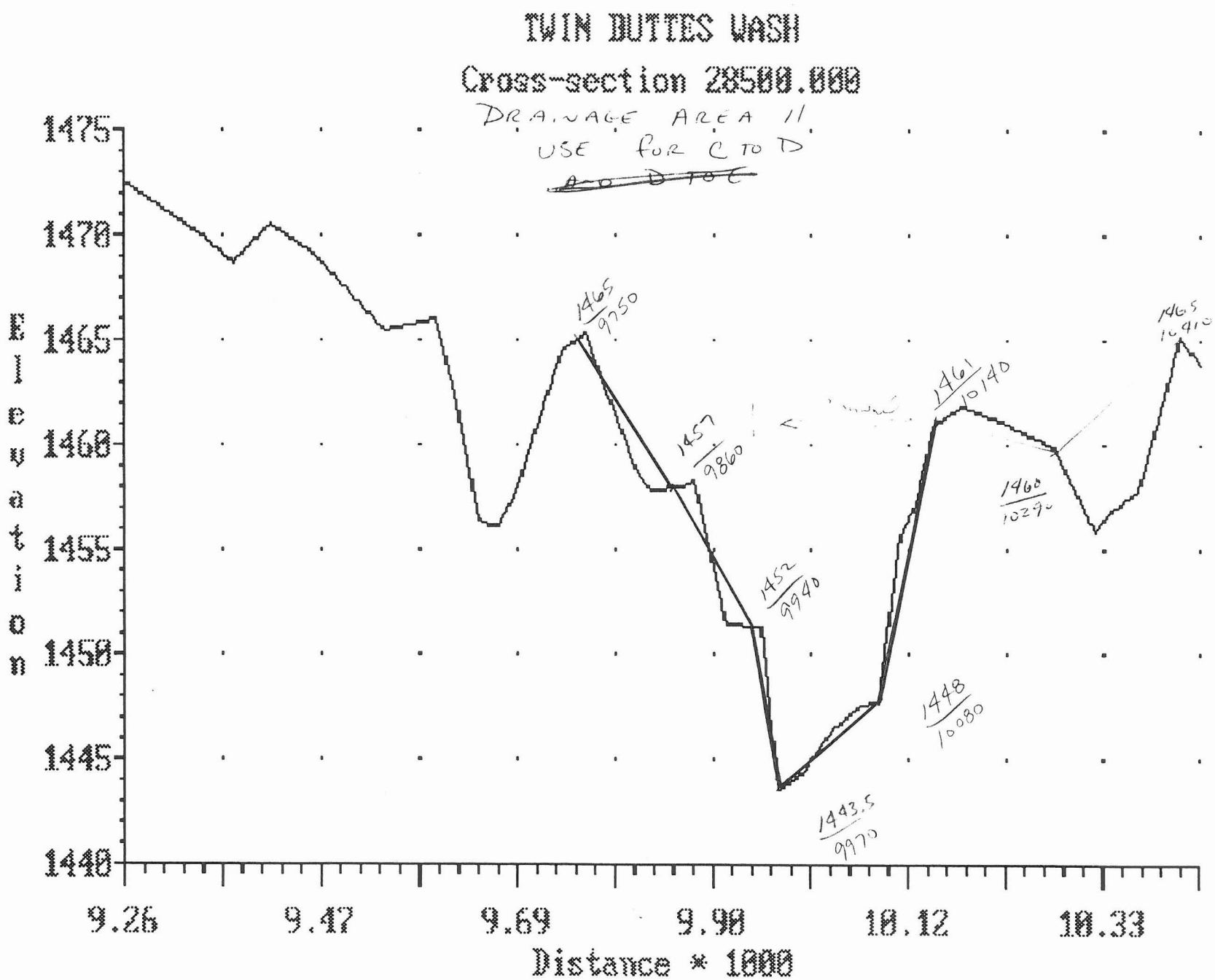
SHEET _____ OF _____
BY Snir DATE _____
CHECK _____ DATE _____

CLIENT _____
JOB X-Section of Reach Area 3 Main Channel
JOB NO. 310.42.



4

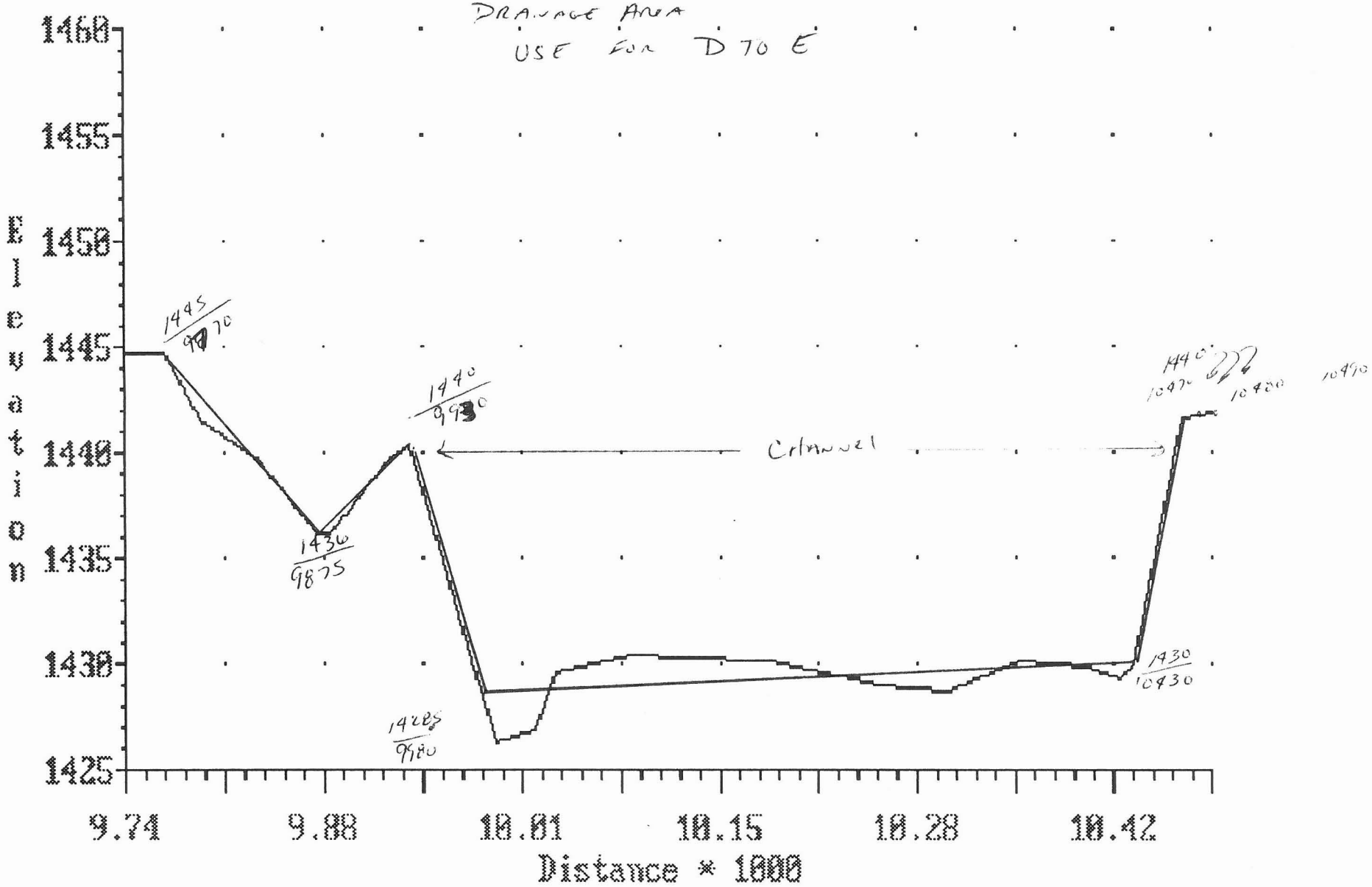

TWIN BUTTES WASH
Cross-section 28500.000
DRAINAGE AREA 11
USE FOR C TO D
~~A TO D TO E~~
1475
1470
1465
1460
1455
1450
1445
1440
Elevation
9.26
9.47
9.69
9.90
10.12
10.33
Distance * 1000
1465 / 9750
1457 / 9860
1452 / 9940
1443.5 / 9970
1448 / 10080
1461 / 10140
1460 / 10290
1465 / 10410

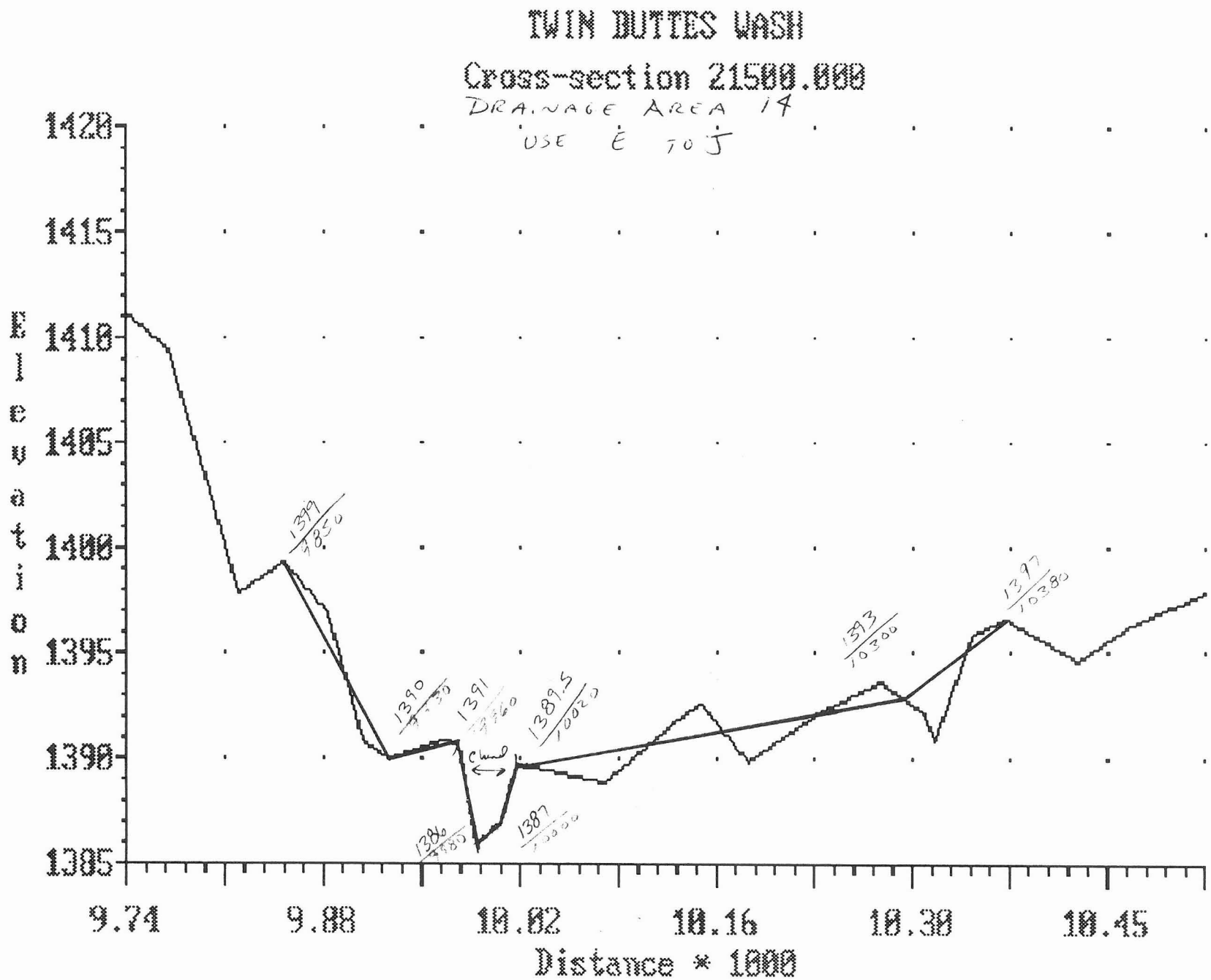
X

TWIN BUTTES WASH

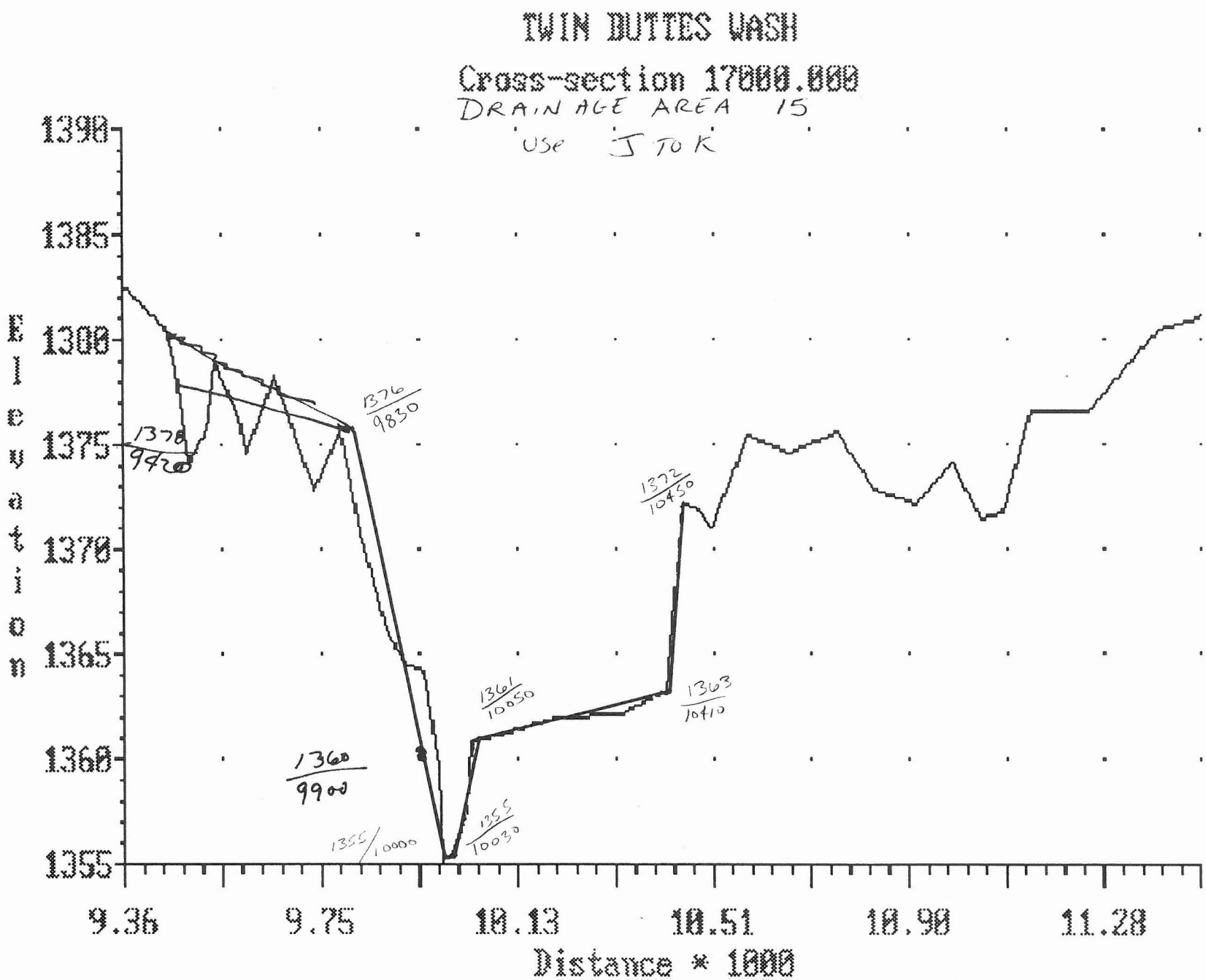
Cross-section 26500.000

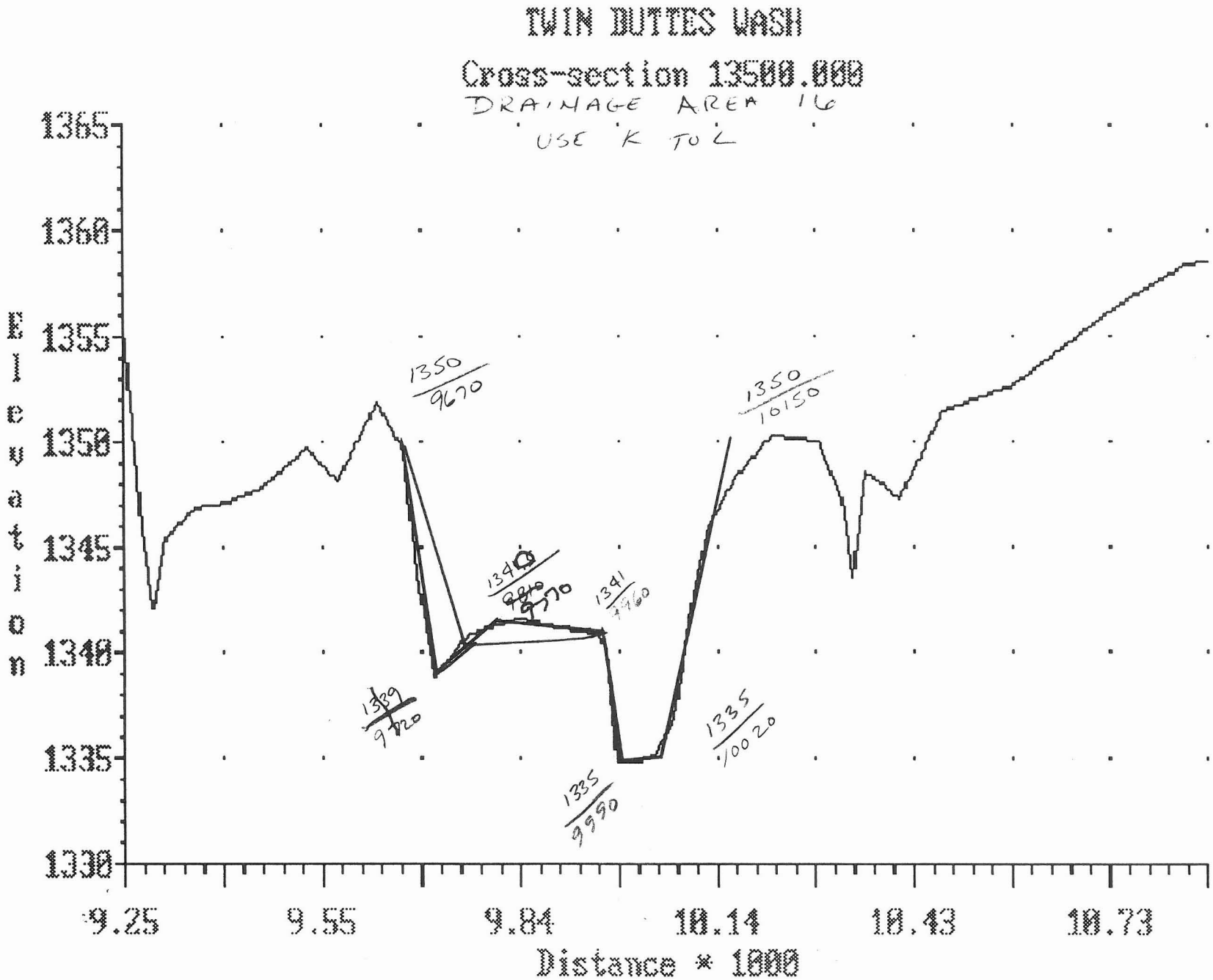
DRAINAGE AREA
USE FOR D TO E

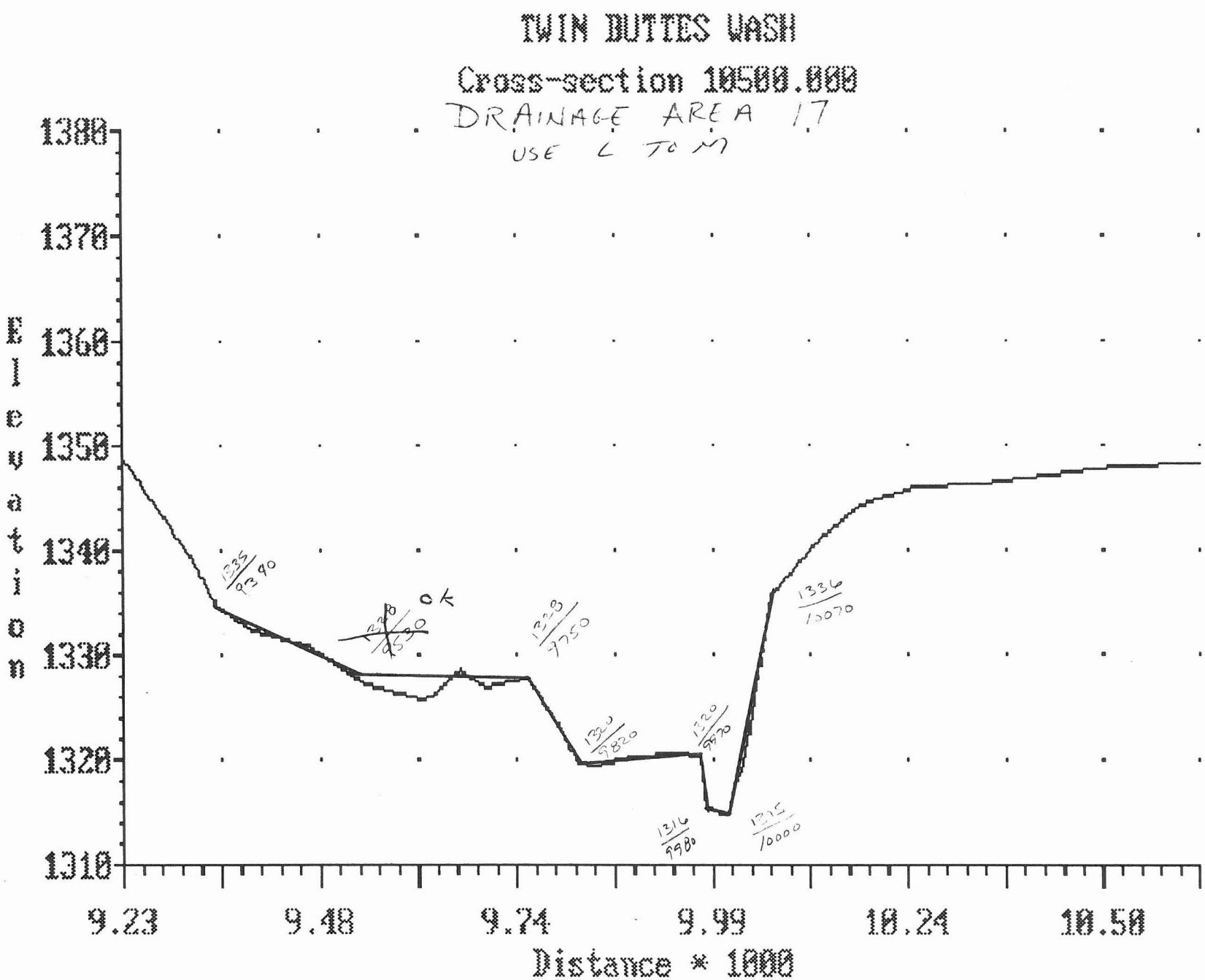


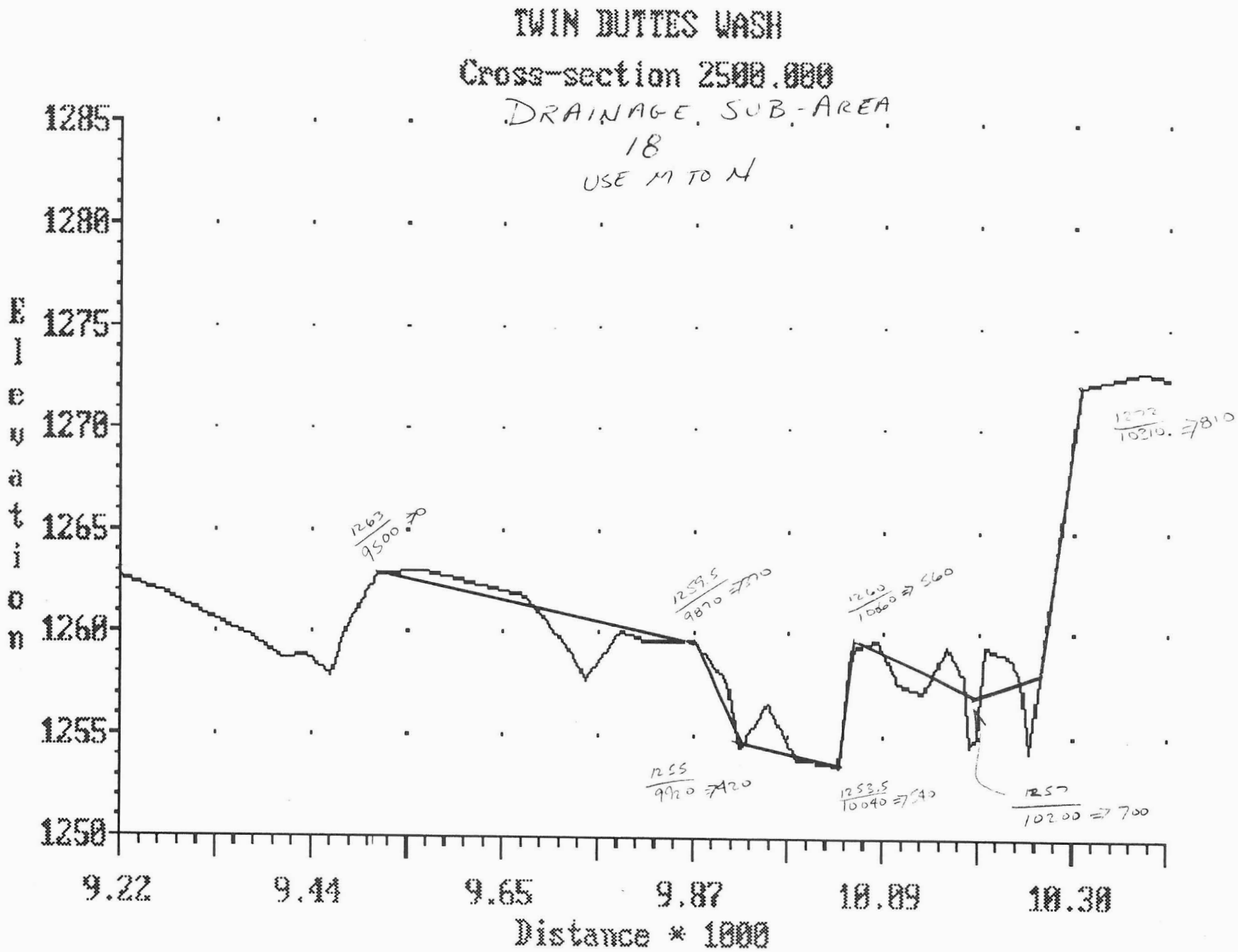

TWIN BUTTES WASH
Cross-section 21500.000
DRAINAGE AREA 14
USE E TO J
1420
1415
1410
1405
1400
1395
1390
1385
Elevation
1399
9850
1390
1391
1389.5
10020
1386
1387
10000
1393
10300
1397
10380
9.74
9.88
10.02
10.16
10.30
10.45
Distance * 1000

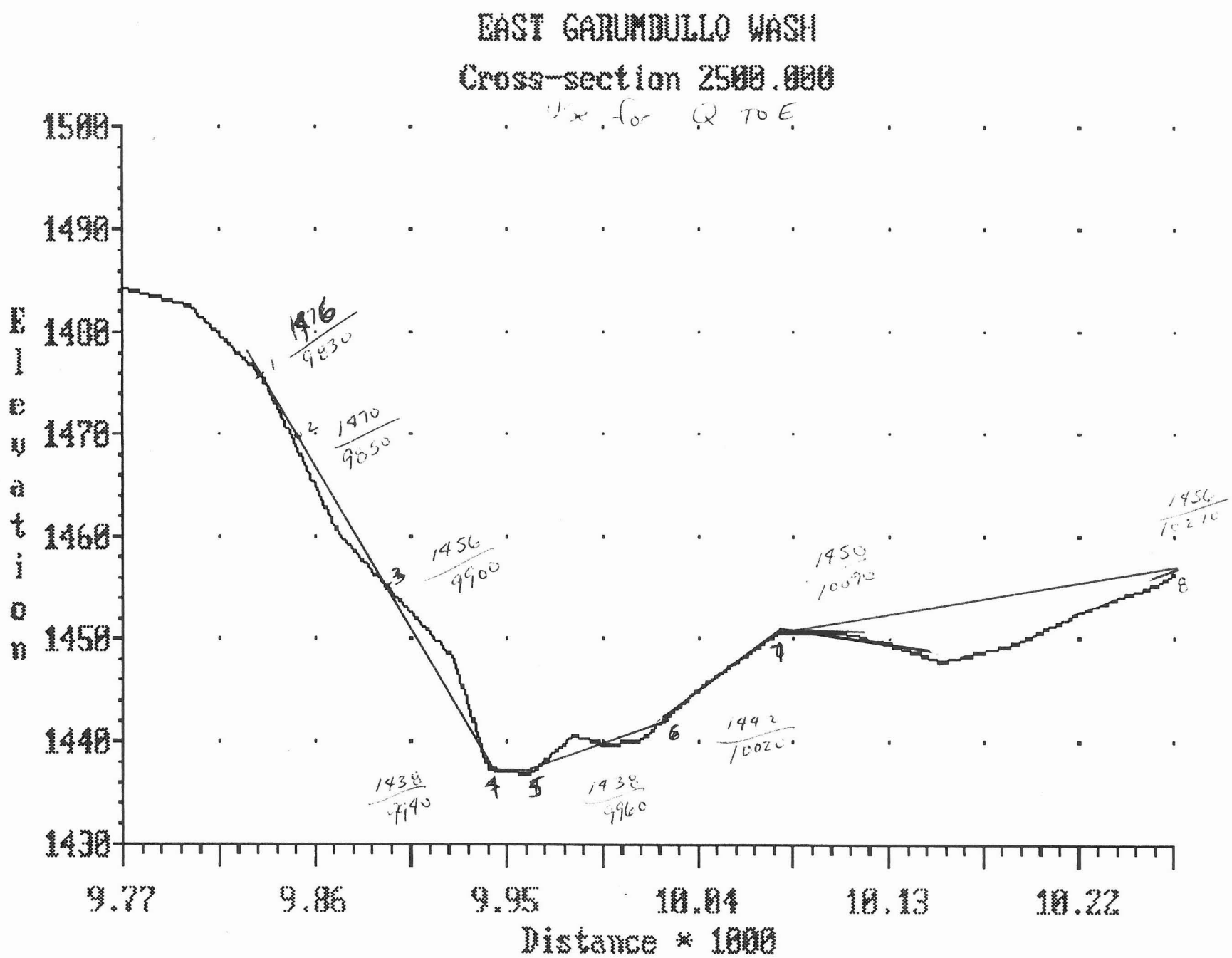
+

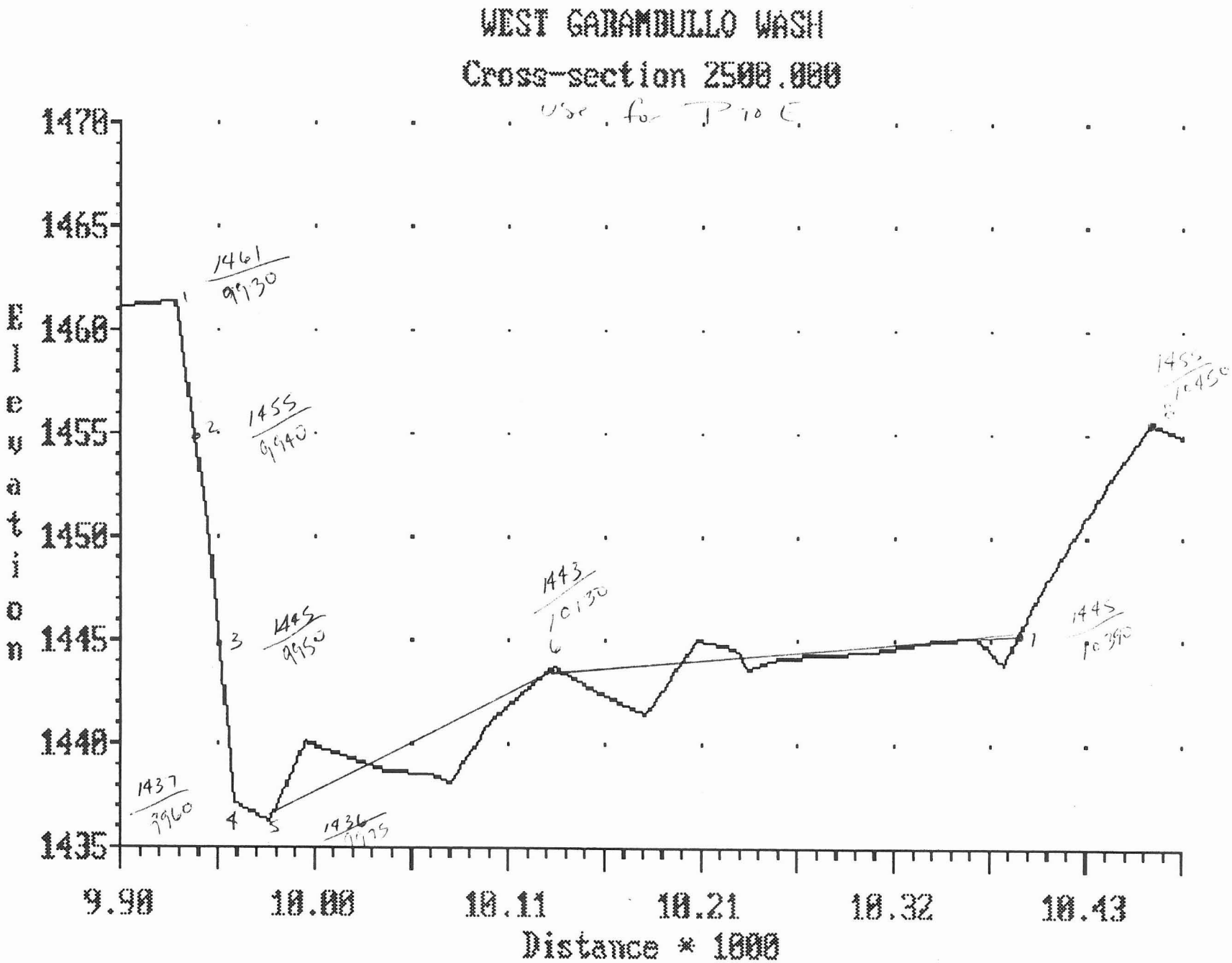

TWIN BUTTES WASH
Cross-section 17000.000
DRAINAGE AREA 15
USE J TO K
1390
1385
1380
1375
1370
1365
1360
1355
Elevation
9.36
9.75
10.13
10.51
10.90
11.28
Distance * 1000
1378/9420
1376/9830
1360/9900
1355/10000
1355/10030
1361/10050
1372/10450
1363/10410

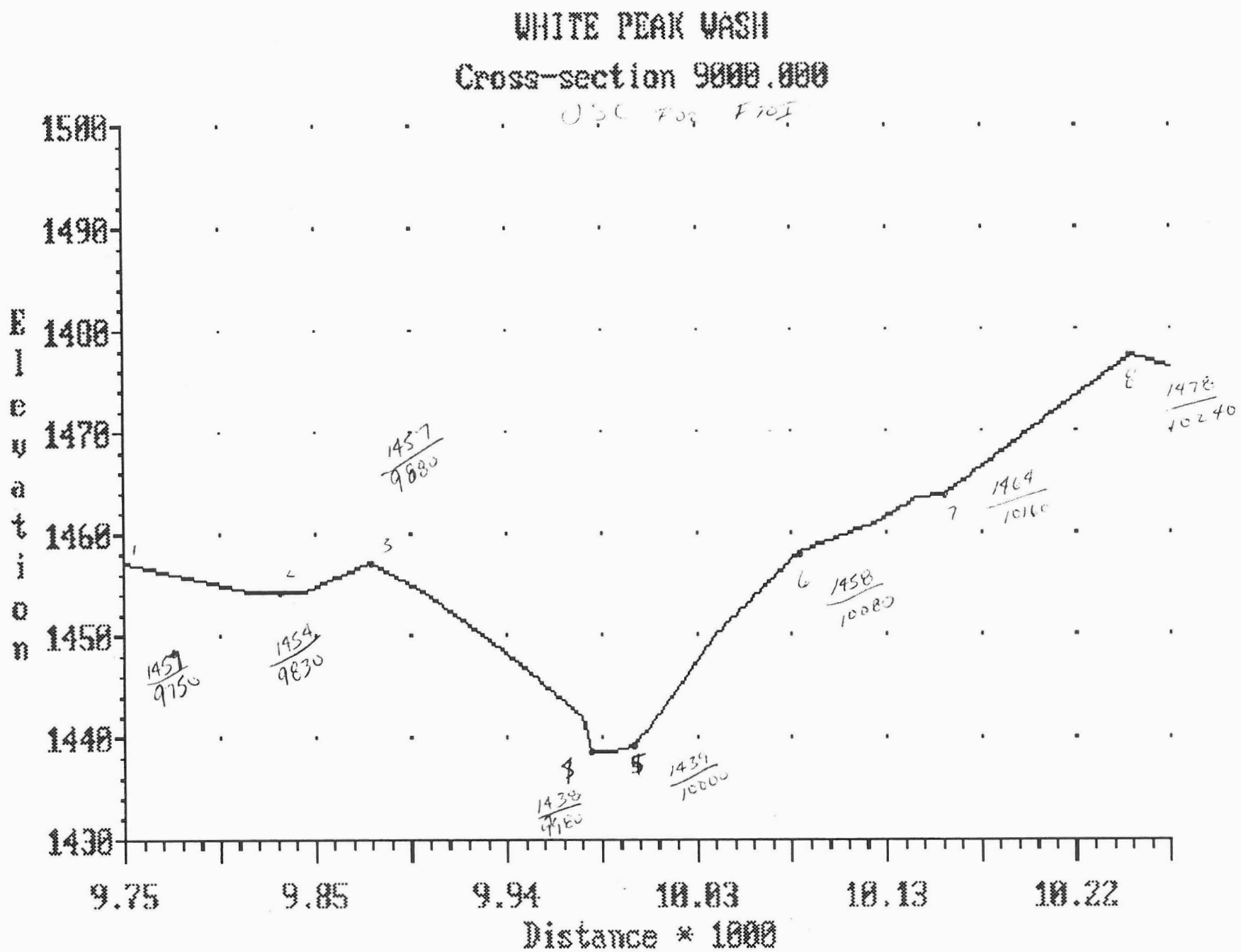

TWIN DUTTIES WASH
Cross-section 13500.000
DRAINAGE AREA 16
USE K TO L
Elevation
1365
1360
1355
1350
1345
1340
1335
1330
9.25
9.55
9.84
10.14
10.43
10.73
Distance * 1000
1350 / 9670
1350 / 10150
1341 / 9770
1341 / 9960
1339 / 9920
1335 / 9990
1335 / 10020

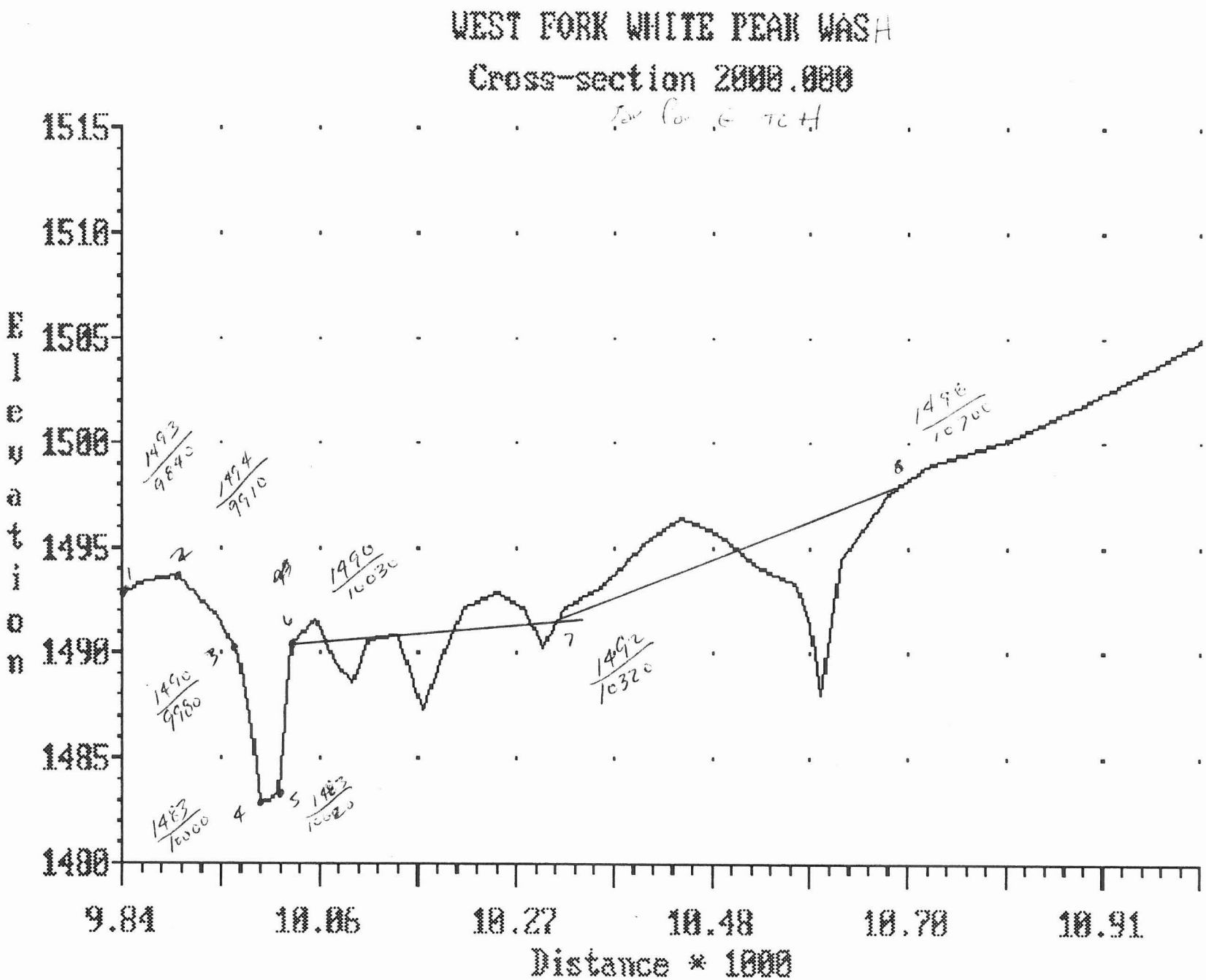

TWIN BUTTES WASH
Cross-section 10500.000
DRAINAGE AREA 1.7
USE L TO M
Elevation
1380
1370
1360
1350
1340
1330
1320
1310
9.23
9.48
9.74
9.99
10.24
10.50
Distance * 1000
1335/9340
ok
1328/7750
1320/7820
1320/9970
1316/9980
1315/10000
1336/10070

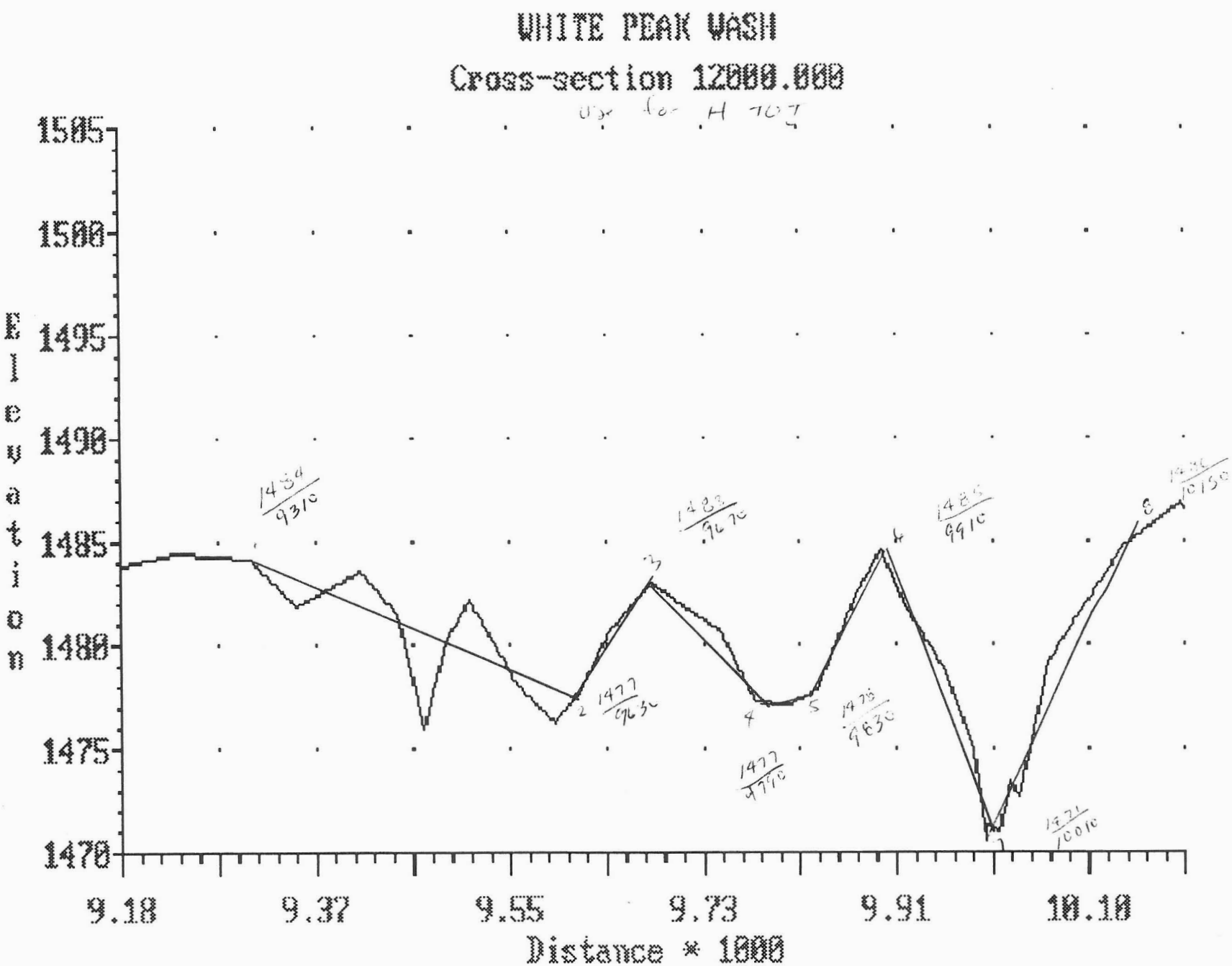

TWIN BUTTES WASH
Cross-section 2500.000
DRAINAGE SUB-AREA
18
USE M TO N
Elevation
1285
1280
1275
1270
1265
1260
1255
1250
9.22
9.44
9.65
9.87
10.09
10.30
Distance * 1000
1263 / 9500 ⇒ 70
1259.5 / 9870 ⇒ 370
1260 / 10060 ⇒ 560
1255 / 9920 ⇒ 420
1253.5 / 10040 ⇒ 540
1257 / 10200 ⇒ 700
1273 / 10210. ⇒ 810

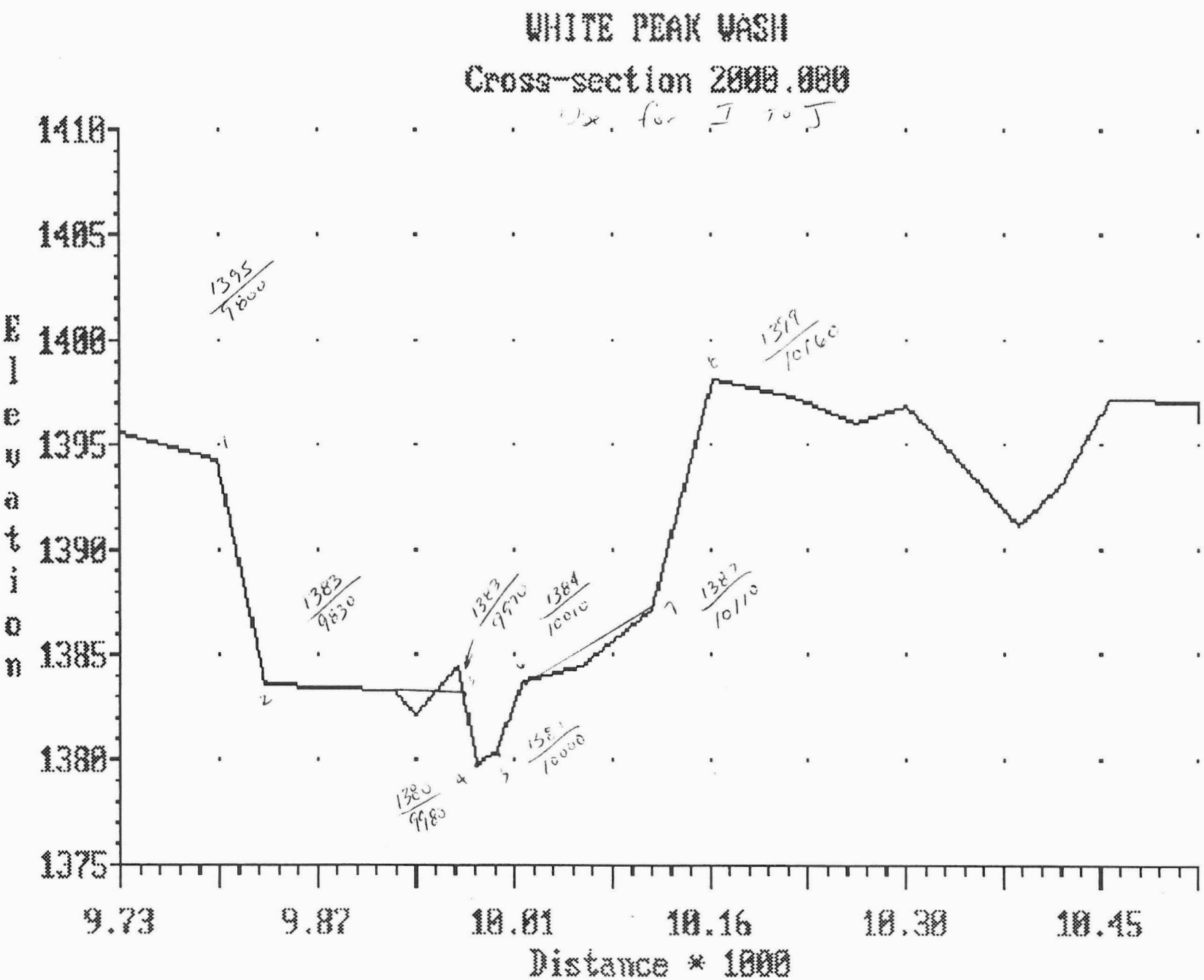

EAST GARUMBULLO WASH
Cross-section 2500.000
Use for Q TO E
1500
1490
1480
1470
1460
1450
1440
1430
Elevation
9.77
9.86
9.95
10.04
10.13
10.22
Distance * 1000
1476 / 9830
1470 / 9850
1456 / 9900
1438 / 9940
1438 / 9960
1442 / 10020
1450 / 10090
1456 / 10210
1
2
3
4
5
6
7
8

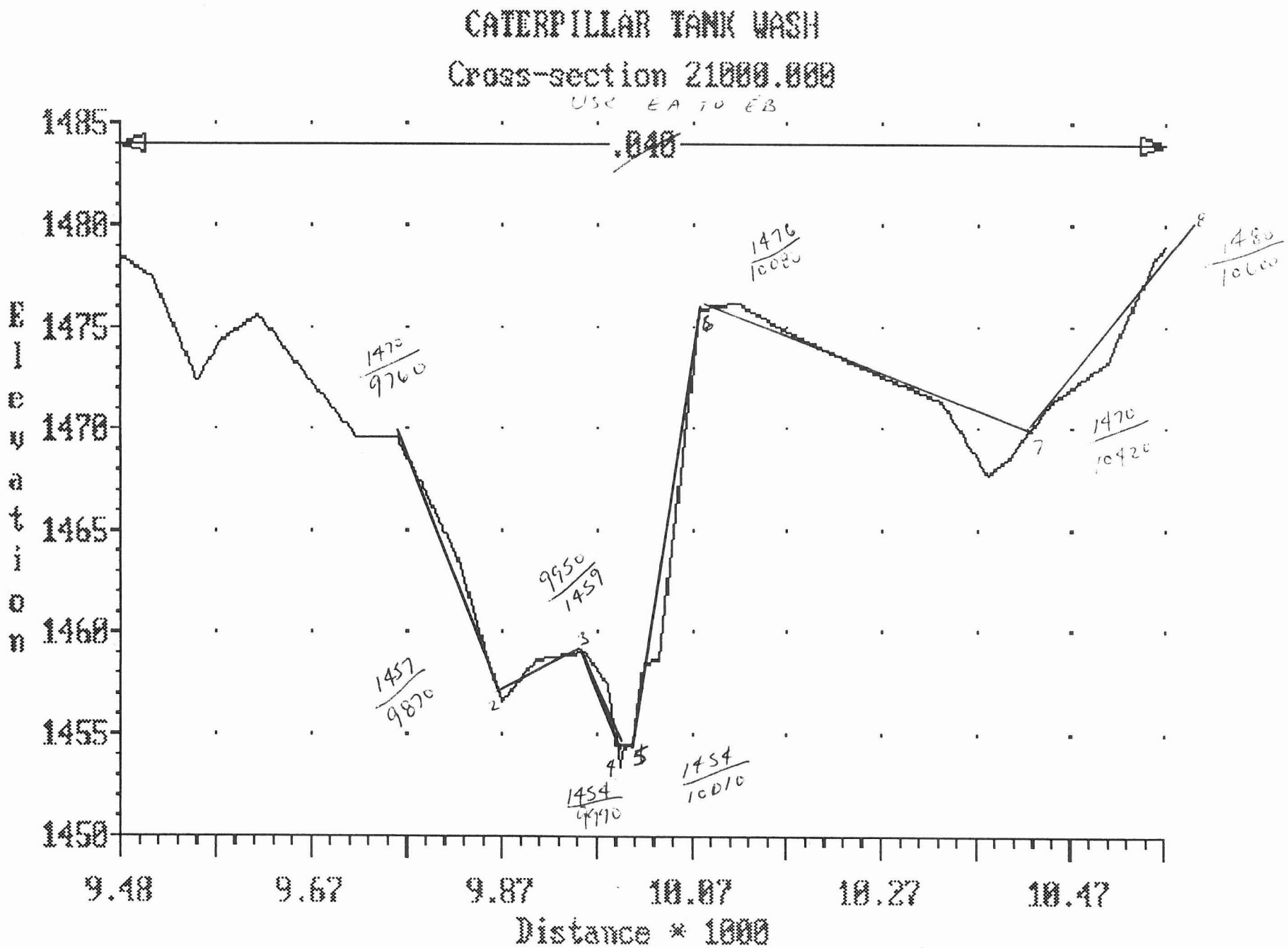

WEST GARAMDULLO WASH
Cross-section 2500.000
Use for PIOC
Elevation
1470
1465
1460
1455
1450
1445
1440
1435
9.90
10.00
10.11
10.21
10.32
10.43
Distance * 1000
1461
9930
1455
9940
1445
9950
1437
9960
1436
9975
1443
10130
1445
10390
1455
10450

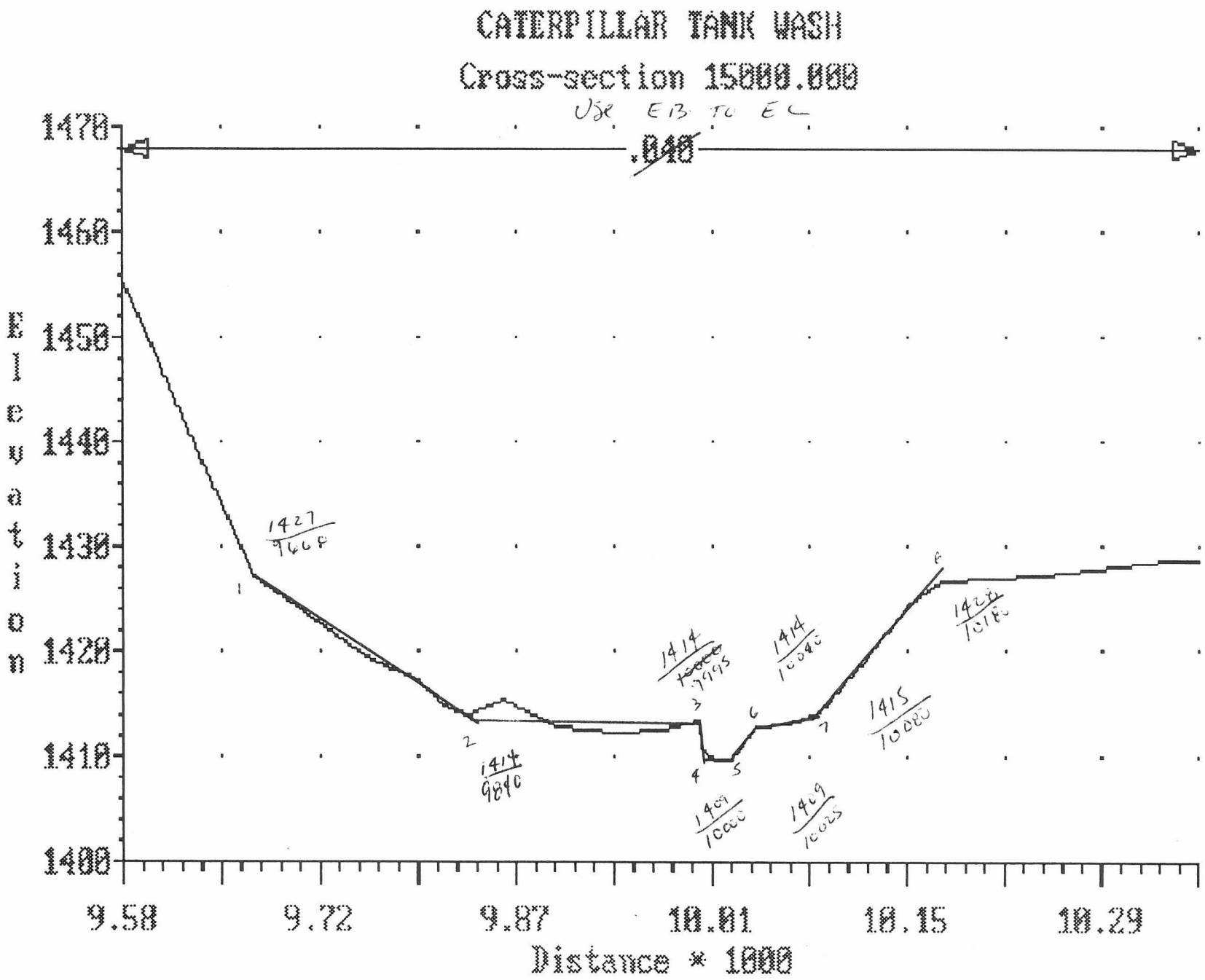

WHITE PEAK WASH
Cross-section 9000.000
1500
1490
1480
1470
1460
1450
1440
1430
Elevation
9.75
9.85
9.94
10.03
10.13
10.22
Distance * 1000
1457/9750
1454/9830
1457/9880
1438/9980
1439/10000
1458/10080
1464/10160
1478/10240

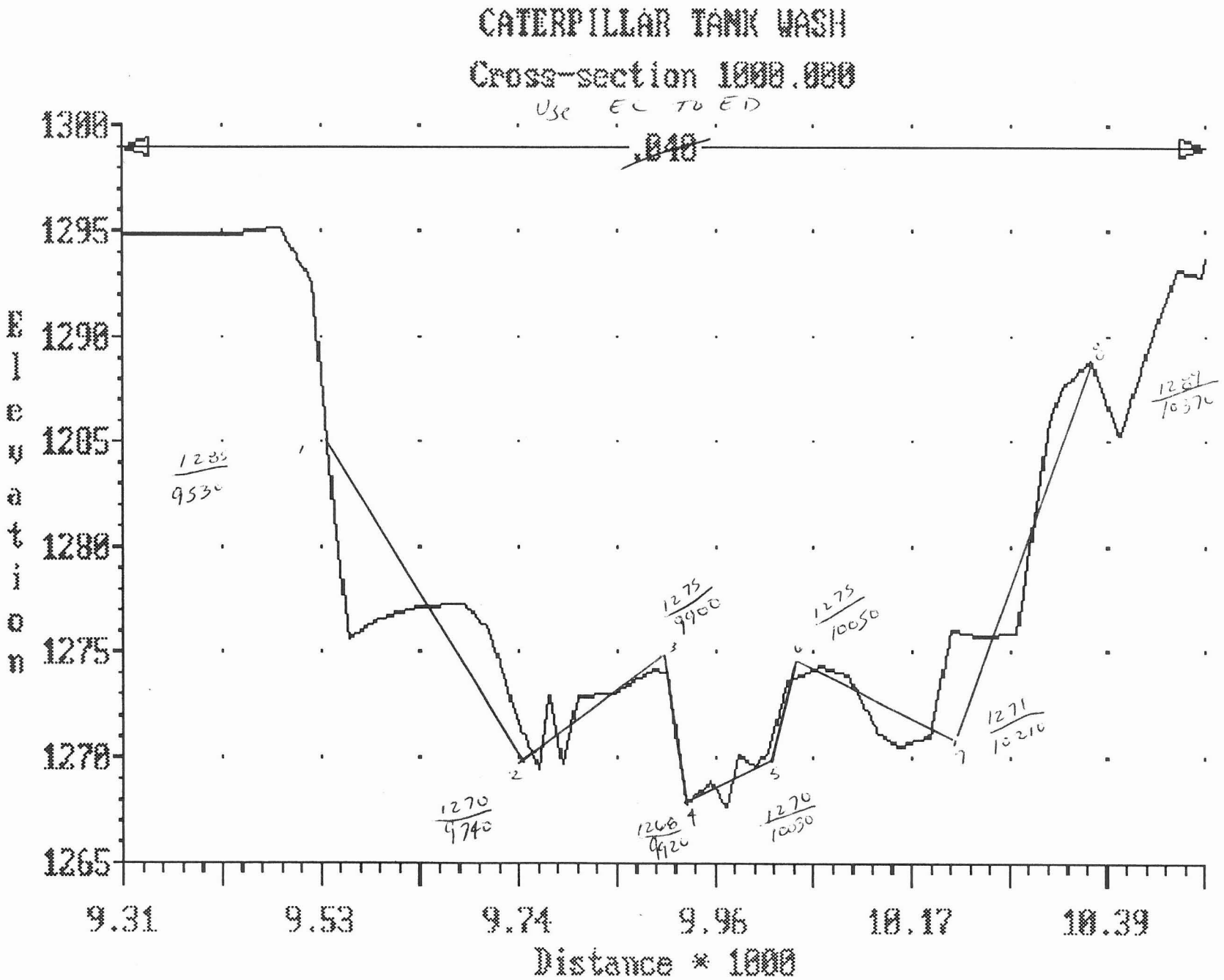

WEST FORK WHITE PEAK WASH
Cross-section 2000.000
Elevation
1515
1510
1505
1500
1495
1490
1485
1480
9.84
10.06
10.27
10.48
10.70
10.91
Distance * 1000
1493/9840
1494/9910
1490/9980
1483/10000
1483/10020
1490/10030
1492/10320
1496/10700
1
2
3
4
5
6
7
8


WHITE PEAK WASH
Cross-section 12000.000
Use for H 707
1505
1500
1495
1490
1485
1480
1475
1470
Elevation
9.18
9.37
9.55
9.73
9.91
10.10
Distance * 1000
1484/9310
1483/9670
1485/9910
1486/10150
1477/9630
1477/9770
1478/9830
1471/10010
1
2
3
4
5
6
7
8


WHITE PEAK WASH
Cross-section 2000.000
Elevation
1410
1405
1400
1395
1390
1385
1380
1375
9.73
9.87
10.01
10.16
10.30
10.45
Distance * 1000
1395/9800
1383/9830
1383/9970
1384/10010
1387/10110
1389/10160
1381/10000
1380/9980


CATERPILLAR TANK WASH
Cross-section 21000.000
USE EA TO EB
.040
1485
1480
1475
1470
1465
1460
1455
1450
Elevation
9.48
9.67
9.87
10.07
10.27
10.47
Distance * 1000
1470/9760
1457/9870
9950/1459
1454/9990
1454/10010
1476/10080
1470/10420
1480/10600

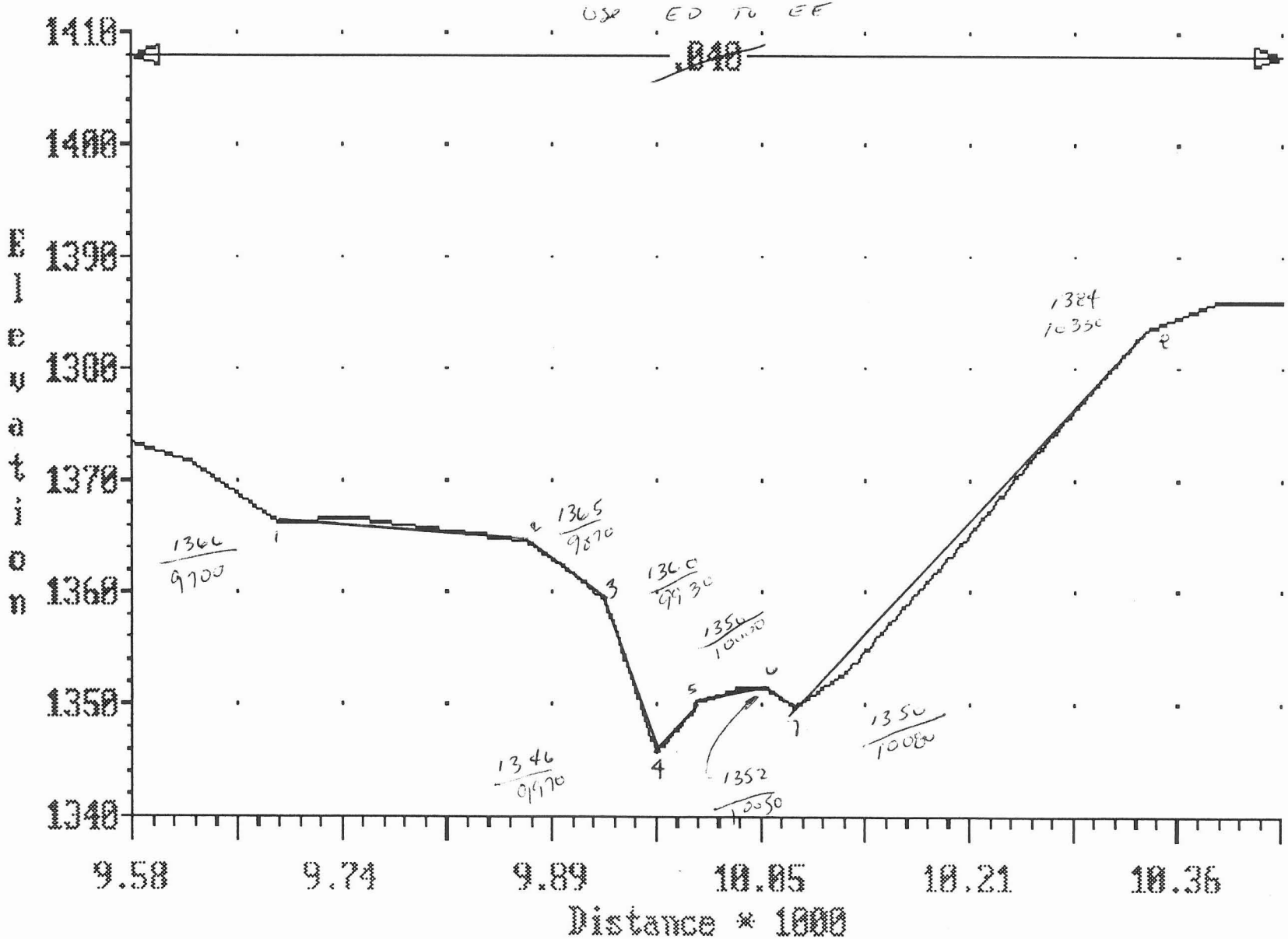

CATERPILLAR TANK WASH
Cross-section 15000.000
Use EB to EL
.040
1470
1460
1450
1440
1430
1420
1410
1400
Elevation
9.58
9.72
9.87
10.01
10.15
10.29
Distance * 1000
1427
9660
1414
9840
1414
9993
1414
10040
1415
10080
1409
10000
1409
10025
1428
10180
1
2
3
4
5
6
7
8


CATERPILLAR TANK WASH
Cross-section 1000.000
Use EC TO ED
.040
1300
1295
1290
1285
1280
1275
1270
1265
Elevation
9.31
9.53
9.74
9.96
10.17
10.39
Distance * 1000
1285/9530
1270/9740
1268/9920
1275/9900
1270/10030
1275/10050
1271/10210
1281/10370

CATERPILLAR TANK WASH

Cross-section 7500.000

USE ED TO EE



APPENDIX F

HEC-1 OUTPUT
FOR TWIN BUTTES WASH WATERSHED

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*            FEBRUARY 1981             *                    *  THE HYDROLOGIC ENGINEERING CENTER   *
*          REVISED 02 AUG 88           *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  05/07/1991  TIME  07:57:33 *                    *          (916) 551-1748              *
*                                      *                    *                                      *
****************************************                    ****************************************

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

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

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

1                                                HEC-1 INPUT                                                PAGE  1

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

        1           ID   CAP OVERCHUTES     TWIN BUTTES WASH WATERSHED       CAPWESTR.DAT
        2           ID   6 HOUR STORM - MCUHP1 USED - 3.32" RAINFALL (100)- Revised inverts & rainfall
        3           ID   BY AGK ENGINEERS, INC.     REVISED MAY, 1991  NORMAL DEPTH ROUTING
                    *DIAGRAM
        4           IT       5                      72
        5           IO       5
        6           IN      15
        7           JD    3.32    0.01
        8           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
        9           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
       10           PC    .962    .972    .983    .991   1.000
       11           JD    3.30    0.50
       12           JD    3.25    2.80
       13           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
       14           PC    .087    .100    .120    .163    .252    .451    .694    .837    .900    .938
       15           PC    .950    .963    .975    .988   1.000
       16           JD    3.06    16.0
       17           PC    .000    .015    .020    .030    .048    .063    .076    .090    .105    .119
       18           PC    .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
       19           PC    .946    .960    .973    .987   1.000

       20           KK    SA01
       21           KM   SUB-AREA 1 - CONCENTRATION AT POINT A
       22           BA    .740
       23           LG    .150    .350   4.200    .420  35.000
       24           UC    .467    .331
       25           UA       0       3       5       8      12      20      43      75      90      96
       26           UA     100
```

```
 27          KK    ATOB
 28          KM   ROUTE SA01 FLOW FROM POINT A TO POINT B
 29          RS       6    FLOW       0
 30          RC    .035    .035    .035   8440.   .0136
 31          RX       0     100     200     300     330     332     380     400
 32          RY    1640    1630    1620    1615    1619    1620    1640    1650

 33          KK    SA02
 34          KM   SUB-AREA 2 - CONCENTRATION AT POINT B
 35          BA    .910
 36          LG    .170    .350   4.160    .450  27.090
 37          UC    .467    .343
 38          UA       0       3       5       8      12      20      43      75      90      96
 39          UA     100

 40          KK       B
 41          KM   COMBINE FLOWS ATOB AND SA02
 42          HC       2

 43          KK    BTOC
 44          KM   ROUTE "B" FLOW FROM POINT B TO POINT C
 45          RS       3    FLOW       0
 46          RC    .041    .041    .041   4760.   .0168
 47          RX       0      70     140     160     230     300     360     420
 48          RY    1548    1544    1540    1519    1519    1540    1540    1540
1                                         HEC-1 INPUT                                                    PAGE  2

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


 49          KK    SA03
 50          KM   SUB-AREA 3 - CONCENTRATION AT POINT C
 51          BA   1.380
 52          LG    .200    .350   4.110    .510  21.470
 53          UC    .400    .189
 54          UA       0       3       5       8      12      20      43      75      90      96
 55          UA     100

 56          KK       C
 57          KM   COMBINE FLOWS BTOC AND SA03
 58          HC       2

 59          KK    CCAP
 60          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 4 - CAP CANAL
 61          RS       1    STOR       0
 62          SQ       0     248     800    1600    2160    2500    2900    3200
 63          SE    1500    1503    1506    1512    1518    1524    1530    1536
 64          SV       0    2.37    9.23   20.95   37.67  122.58   212.7  516.24
 65          SE    1500    1508    1512    1516    1520    1528    1532    1540

 66          KK    CTOD
 67          KM   ROUTE CCAP FLOW FROM DISCHARGE TO POINT D
 68          RS       5    FLOW       0
 69          RC    .036    .036    .036   7120.   .0098
 70          RX    9750    9860    9940    9970   10080   10140   10290   10410
 71          RY    1465    1457    1452  1443.5    1448    1461    1460    1465

 72          KK    SA11
 73          KM   SUB-AREA 11 - CONCENTRATION AT POINT D
 74          BA    .290
 75          LG    .350    .350   3.680    .960   1.500
 76          UC    .717    .658
 77          UA       0       3       5       8      12      20      43      75      90      96
 78          UA     100
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 79          KK       D
 80          KM   COMBINE FLOWS CTOD AND SA11
 81          HC       2

 82          KK    DTOE
 83          KM   ROUTE D FLOW FROM POINT D TO POINT E
 84          RS       1    FLOW       0
 85          RC    .040    .040    .040    1380   .0072
 86          RX    9770    9875    9930    9980  10430   10470   10480   10490
 87          RY    1445    1436    1440  1428.5    1430    1440    1440    1440

 88          KK    SA06
 89          KM   SUB-AREA 06 - CONCENTRATION AT POINT Q
 90          BA    .150
 91          LG    .210    .340   4.440    .450  11.220
 92          UC    .183    .139
 93          UA       0       3       5       8      12      20      43      75      90      96
 94          UA     100
1                                          HEC-1 INPUT                                          PAGE  3

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


 95          KK    QCAP
 96          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 2 - CAP CANAL
 97          RS       1    STOR       0
 98          SQ       0     7.5      22      52      72      90     103     115
 99          SE  1513.9  1515.2  1516.4  1520.2  1524.2  1528.2  1532.2    1540
100          SV       0     0.1     .18    1.89    5.34   11.99   24.05    43.4
101          SE  1513.9  1517.8    1520    1524    1528    1532    1536    1540

102          KK    QTOE
103          KM   ROUTE QCAP FLOW FROM DISCHARGE THROUGH SA13 TO POINT E13
104          RS       5    FLOW       0
105          RC    .040    .040    .040    7500   .0133
106          RX    9830    9850    9900    9940    9960   10020   10090   10270
107          RY    1476    1470    1456    1438    1438    1442    1450    1456

108          KK    SA13
109          KM   SUB-AREA 13 - CONCENTRATION AT POINT E13
110          BA    .220
111          LG    .350    .350   3.890    .660   2.870
112          UC    .567    .618
113          UA       0       3       5       8      12      20      43      75      90      96
114          UA     100

115          KK     E13
116          KM   COMBINE FLOWS QTOE AND SA13
117          HC       2

118          KK    SA07
119          KM   SUB-AREA 7 - CONCENTRATION AT POINT P
120          BA    .120
121          LG    .150    .350   4.290    .440  14.770
122          UC    .167    .114
123          UA       0       3       5       8      12      20      43      75      90      96
124          UA     100

125          KK    PCAP
126          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 3 - CAP CANAL
127          RS       1    STOR       0
128          SQ       0     7.5      22      45      71      93     110
129          SE    1519 1520.25  1521.5    1524    1529    1534    1540
130          SV       0     .61    2.78    8.03   18.24
131          SE    1519    1528    1532    1536    1540
```

```
 132          KK    PTOE
 133          KM   ROUTE PCAP FLOW FROM DISCHARGE THROUGH SA12 TO POINT E12
 134          RS       6    FLOW       0
 135          RC    .040    .040    .040    9000   .0111
 136          RX    9930    9940    9950    9960    9975   10130   10390   10450
 137          RY    1461    1455    1445    1437    1436    1443    1445    1455
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 138          KK    SA12
 139          KM   SUB-AREA 12 - CONCENTRATION AT POINT E12
 140          BA    .500
 141          LG    .320    .350   4.000    .630   3.900
 142          UC    .650    .521
 143          UA       0       3       5       8      12      20      43      75      90      96
 144          UA     100

 145          KK     E12
 146          KM   COMBINE FLOWS PTOE AND SA12
 147          HC       2

 148          KK       E
 149          KM   COMBINE FLOW DTOE, E13, AND E12
 150          HC       3

 151          KK    ETOJ
 152          KM   ROUTE E FLOW FROM POINT E THROUGH SUB-AREA 14 TO POINT J14
 153          RS       4    FLOW       0
 154          RC    .035    .035    .035    6060   .0091
 155          RX    9850    9930    9960    9980   10000   10020   10300   10380
 156          RY    1399    1390    1391    1386    1387  1389.5    1393    1397

 157          KK    SA14
 158          KM   SUB-AREA 14 - CONCENTRATION AT POINT J14
 159          BA    .340
 160          LG    .340    .350   3.630    .950   1.910
 161          UC    .717    .780
 162          UA       0       3       5       8      12      20      43      75      90      96
 163          UA     100

 164          KK     J14
 165          KM   COMBINE FLOWS ETOJ AND SA14
 166          HC       2

 167          KK    SA04
 168          KM   SUB-AREA 4 - CONCENTRATION AT POINT F
 169          BA    .380
 170          LG    .230    .340   4.340    .460  21.550
 171          UC    .267    .186
 172          UA       0       3       5       8      12      20      43      75      90      96
 173          UA     100

 174          KK    FCAP
 175          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 5 - CAP CANAL
 176          RS       1    STOR       0
 177          SQ       0     7.5      22      45      71      93     108     115
 178          SE    1516 1517.25  1518.5    1521    1526    1531    1536    1540
 179          SV     0.0    0.75    4.47   19.99   60.85  133.63
 180          SE    1520    1524    1528    1532    1536    1540
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
181          KK    FTOI
182          KM   ROUTE FCAP FLOW FROM DISCHARGE THROUGH SUB-AREA 9 TO POINT I9
183          RS       5    FLOW       0
184          RC    .035    .035    .035    7620   .0105
185          RX    9750    9830    9880    9980   10000   10080   10160   10240
186          RY    1457    1454    1457    1438    1439    1458    1464    1478

187          KK    SA09
188          KM   SUB-AREA 9 - CONCENTRATION AT POINT I9
189          BA    .310
190          LG    .300    .320   4.960    .400   4.240
191          UC    .583    .531
192          UA       0       3       5       8      12      20      43      75      90      96
193          UA     100

194          KK      I9
195          KM   COMBINE FLOWS FTOI AND SA09
196          HC       2

197          KK    SA05
198          KM   SUB-AREA 5 - CONCENTRATION AT POINT G
199          BA    .150
200          LG    .210    .350   4.130    .480  22.720
201          UC    .183    .133
202          UA       0       3       5       8      12      20      43      75      90      96
203          UA     100

204          KK   GCAP
205          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 6 - CAP CANAL
206          RS       1    STOR       0
207          SQ       0     7.5      22      45      71      93     110
208          SE    1519 1520.25  1521.5    1524    1529    1534    1540
209          SV       0     .77    4.36   15.19   35.89
210          SE    1519    1528    1532    1536    1540

211          KK    GTOH
212          KM   ROUTE GCAP FLOW FROM DISCHARGE THROUGH SUB-AREA 8 TO POINT H
213          RS       3    FLOW       0
214          RC    .035    .035    .035    3760    .016
215          RX    9840    9910    9980   10000   10020   10030   10320   10700
216          RY    1493    1494    1490    1483    1483    1490    1492    1498

217          KK    SA08
218          KM   SUB-AREA 8 - CONCENTRATION AT POINT H
219          BA    .130
220          LG    .290    .340   4.410    .530   8.090
221          UC    .317    .251
222          UA       0       3       5       8      12      20      43      75      90      96
223          UA     100
```



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


224          KK       H
225          KM   COMBINE FLOWS GTOH AND SA08
226          HC       2

227          KK    HTOI
228          KM   ROUTE H FLOW FROM POINT H TO POINT I
229          RS       2    FLOW       0
230          RC    .035    .035    .035    2380   .0084
231          RX    9310    9630    9670    9790    9830    9910   10010   10150
232          RY    1484    1477    1483    1477    1478    1485    1471    1486

233          KK       I
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 234          KM   COMBINE FLOWS I9 AND HTOI AT POINT I
 235          HC       2

 236          KK    ITOJ
 237          KM   ROUTE I FLOW FROM POINT I THROUGH SUB-AREA 10 TO POINT J10
 238          RS       5    FLOW       0
 239          RC    .040    .040    .040    7000    .0107
 240          RX    9800    9830    9970    9980   10000   10010   10110   10160
 241          RY    1395    1383    1383    1380    1381    1384    1387    1399

 242          KK    SA10
 243          KM   SUB-AREA 10 - CONCENTRATION AT POINT J10
 244          BA    .620
 245          LG    .340    .350   3.850    .750   2.060
 246          UC    .917    .979
 247          UA       0       3       5       8      12      20      43      75      90      96
 248          UA     100

 249          KK     J10
 250          KM   COMBINE FLOWS ITOJ AND SA10
 251          HC       2

 252          KK       J
 253          KM   COMBINE FLOWS J14 AND J10 AT POINT J
 254          HC       2

 255          KK    JTOK
 256          KM   ROUTE FLOW FROM POINT J THROUGH SUB-AREA 15 TO POINT K
 257          RS       1    FLOW       0
 258          RC    .040    .040    .040    1880    .0027
 259          RX    9420    9830    9900   10000   10030   10050   10410   10450
 260          RY    1378    1376    1360    1355    1355    1361    1363    1372

 261          KK    SA15
 262          KM   SUB-AREA 15 - CONCENTRATION AT POINT K
 263          BA    .640
 264          LG    .310    .340   4.230    .600   1.370
 265          UC    .700    .577
 266          UA       0       3       5       8      12      20      43      75      90      96
 267          UA     100
```



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


 268          KK       K
 269          KM   COMBINE FLOWS FROM JTOK AND SA15 AT POINT K
 270          HC       2

 271          KK   KTOL
 272          KM   ROUTE K FLOWS FROM POINT K THROUGH SUB-AREA 16 TO POINT L
 273          RS       3    FLOW       0
 274          RC    .035    .035    .035    5000    .006
 275          RX    9760    9770    9960    9990   10020   10150   10200   10300
 276          RY    1350    1340    1341    1335    1335    1350    1350    1350

 277          KK    SA16
 278          KM   SUB-AREA 16 - CONCENTRATION AT POINT L
 279          BA    .700
 280          LG    .310    .330   4.500    .640    .830
 281          UC    .700    .488
 282          UA       0       3       5       8      12      20      43      75      90      96
 283          UA     100

 284          KK       L
 285          KM   COMBINE FLOWS KTOL AND SA16 AT POINT L
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 286          HC       2

 287          KK    LTOM
 288          KM   ROUTE L FLOW FROM POINT L THROUGH SUB-AREA 17 TO POINT M AT BEARDSLY CANAL
 289          RS       1    FLOW       0
 290          RC    .040    .040    .040    2000    .005
 291          RX    9340    9530    9750    9820    9970    9980   10000   10070
 292          RY    1335    1328    1328    1320    1320    1316    1315    1336

 293          KK    SA17
 294          KM   SUB-AREA 17 - CONCENTRATION AT POINT M
 295          BA    .460
 296          LG    .340    .300   5.310    .510    .760
 297          UC    .517    .331
 298          UA       0       3       5       8      12      20      43      75      90      96
 299          UA     100

 300          KK       M
 301          KM   COMBINE FLOWS LTOM AND SA17
 302          HC       2

 303          KK    MTON
 304          KM   ROUTE M FLOWS THROUGH SUB-AREA 18 TO AGUA FRIA RIVER AT POINT N
 305          RS       7    FLOW       0
 306          RC    .036    .036    .036   10120   .0084
 307          RX    9500    9870    9920   10040   10060   10200   10270   10310
 308          RY    1263  1259.3    1255  1253.5    1260    1257    1258    1272
1                                          HEC-1 INPUT                                          PAGE  8

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


 309          KK    SA18
 310          KM   SUB-AREA 18 - CONCENTRATION AT POINT N
 311          BA    .730
 312          LG    .350    .290   3.870    .380    .040
 313          UC    .717    .515
 314          UA       0       3       5       8      12      20      43      75      90      96
 315          UA     100

 316          KK       N
 317          KM   COMBINE FLOWS MTON AND SA18 AT POINT N (AGUA FRIA RIVER CONFLUENCE)
 318          HC       2
 319          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   20       SA01
               V
               V
   27       ATOB
               .
               .
   33          .        SA02
               .           .
               .           .
   40          B............
               V
               V
   43       BTOC
               .
               .
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 49          .        SA03
             .           .
             .           .
 56          C............
             V
             V
 59       CCAP
             V
             V
 66       CTOD
             .
             .
 72          .        SA11
             .           .
             .           .
 79          D............
             V
             V
 82       DTOE
             .
             .
 88          .        SA06
             .           V
             .           V
 95          .        QCAP
             .           V
             .           V
102          .        QTOE
             .           .
             .           .
108          .           .        SA13
             .           .           .
             .           .           .
115          .         E13............
             .           .
             .           .
118          .           .        SA07
             .           .           V
             .           .           V
125          .           .        PCAP
             .           .           V
             .           .           V
132          .           .        PTOE
             .           .           .
             .           .           .
138          .           .           .        SA12
             .           .           .           .
             .           .           .           .
145          .           .         E12............
             .           .           .
             .           .           .
148          E........................
             V
             V
151       ETOJ
             .
             .
157          .        SA14
             .           .
             .           .
164        J14............
             .
             .
167          .        SA04
             .           V
             .           V
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174          .        FCAP
             .          V
             .          V
181          .        FTOI
             .          .
             .          .
187          .          .        SA09
             .          .          .
             .          .          .
194          .         I9............
             .          .
             .          .
197          .          .        SA05
             .          .          V
             .          .          V
204          .          .       GCAP
             .          .          V
             .          .          V
211          .          .        GTOH
             .          .          .
             .          .          .
217          .          .          .        SA08
             .          .          .          .
             .          .          .          .
224          .          .          H............
             .          .          V
             .          .          V
227          .          .        HTOI
             .          .          .
             .          .          .
233          .          I............
             .          V
             .          V
236          .        ITOJ
             .          .
             .          .
242          .          .        SA10
             .          .          .
             .          .          .
249          .         J10............
             .          .
             .          .
252          J............
             V
             V
255       JTOK
             .
             .
261          .        SA15
             .          .
             .          .
268          K............
             V
             V
271      KTOL
             .
             .
277          .        SA16
             .          .
             .          .
284          L............
             V
             V
287       LTOM
             .
             .
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293          .        SA17
             .          .
             .          .
300          M............
             V
             V
303        MTON
             .
             .
309          .        SA18
             .          .
             .          .
316          N............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*            FEBRUARY 1981             *                    *  THE HYDROLOGIC ENGINEERING CENTER   *
*          REVISED 02 AUG 88           *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  05/07/1991  TIME  07:57:33 *                    *          (916) 551-1748              *
*                                      *                    *                                      *
****************************************                    ****************************************
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                    CAP OVERCHUTES     TWIN BUTTES WASH WATERSHED       CAPWESTR.DAT
                    6 HOUR STORM - MCUHP1 USED - 3.32" RAINFALL (100)- Revised inverts & rainfall
                    BY AGK ENGINEERS, INC.     REVISED MAY, 1991  NORMAL DEPTH ROUTING

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ         72  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       0555  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE    5.92 HOURS

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

  7 JD          INDEX STORM NO. 1
                       STRM       3.32  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA

  8 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       .01       .01       .01       .01       .01       .01       .03
                .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00

11 JD        INDEX STORM NO. 2
                STRM        3.30  PRECIPITATION DEPTH
                TRDA         .50  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       .01       .01       .01       .01       .01       .01       .03
                .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00

12 JD        INDEX STORM NO. 3
                STRM        3.25  PRECIPITATION DEPTH
                TRDA        2.80  TRANSPOSITION DRAINAGE AREA

13 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       .01       .01       .01       .01       .01       .01       .03
                .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00

16 JD        INDEX STORM NO. 4
                STRM        3.06  PRECIPITATION DEPTH
                TRDA       16.00  TRANSPOSITION DRAINAGE AREA

17 PI          PRECIPITATION PATTERN
                .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00
1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD     BASIN    MAXIMUM    TIME OF
      OPERATION       STATION      FLOW    PEAK                                          AREA     STAGE    MAX STAGE
+                                                     6-HOUR     24-HOUR     72-HOUR

      HYDROGRAPH AT
+                       SA01      1176.    4.33        164.        164.        164.       .74

      ROUTED TO
+                       ATOB      1058.    4.58        158.        158.        158.       .74
+                                                                                        1617.41        4.58

      HYDROGRAPH AT
+                       SA02      1292.    4.33        181.        181.        181.       .91
```

	2 COMBINED AT								
+		B	1752.	4.42	320.	320.	320.	1.65	
	ROUTED TO								
+		BTOC	1736.	4.58	313.	313.	313.	1.65	
+									1521.01 4.58
	HYDROGRAPH AT								
+		SA03	2115.	4.25	238.	238.	238.	1.38	
	2 COMBINED AT								
+		C	2659.	4.33	513.	513.	513.	3.03	
	ROUTED TO								
+		CCAP	2154.	4.67	511.	511.	511.	3.03	
+									1513.15 4.58
	ROUTED TO								
+		CTOD	2145.	4.83	486.	486.	486.	3.03	
+									1447.67 4.83
	HYDROGRAPH AT								
+		SA11	195.	4.50	30.	30.	30.	.29	
	2 COMBINED AT								
+		D	2175.	4.75	493.	493.	493.	3.32	
	ROUTED TO								
+		DTOE	2163.	4.83	480.	480.	480.	3.32	
+									1430.33 4.92
	HYDROGRAPH AT								
+		SA06	384.	4.08	27.	27.	27.	.15	
	ROUTED TO								
+		QCAP	93.	4.33	27.	27.	27.	.15	
+									1524.25 4.33
	ROUTED TO								
+		QTOE	91.	4.83	25.	25.	25.	.15	
+									1438.36 4.75
	HYDROGRAPH AT								
+		SA13	188.	4.42	28.	28.	28.	.22	
	2 COMBINED AT								
+		E13	259.	4.42	52.	52.	52.	.37	
	HYDROGRAPH AT								
+		SA07	333.	4.08	23.	23.	23.	.12	
	ROUTED TO								
+		PCAP	94.	4.33	23.	23.	23.	.12	
+									1529.60 4.25
	ROUTED TO								
+		PTOE	85.	5.25	19.	19.	19.	.12	
+									1436.84 5.00
	HYDROGRAPH AT								
+		SA12	472.	4.42	66.	66.	66.	.50	
	2 COMBINED AT								
+		E12	483.	4.50	83.	83.	83.	.62	

	3 COMBINED AT								
+		E	2462.	4.83	557.	557.	557.	4.31	
	ROUTED TO								
+		ETOJ	2409.	5.08	522.	522.	522.	4.31	
+									1390.87 5.08
	HYDROGRAPH AT								
+		SA14	205.	4.50	34.	34.	34.	.34	
	2 COMBINED AT								
+		J14	2424.	5.08	529.	529.	529.	4.65	
	HYDROGRAPH AT								
+		SA04	839.	4.17	74.	74.	74.	.38	
	ROUTED TO								
+		FCAP	97.	4.67	39.	39.	39.	.38	
+									1529.85 4.67
	ROUTED TO								
+		FTOI	97.	5.17	33.	33.	33.	.38	
+									1438.77 5.17
	HYDROGRAPH AT								
+		SA09	343.	4.42	49.	49.	49.	.31	
	2 COMBINED AT								
+		I9	395.	4.42	80.	80.	80.	.69	
	HYDROGRAPH AT								
+		SA05	400.	4.08	30.	30.	30.	.15	
	ROUTED TO								
+		GCAP	90.	4.33	29.	29.	29.	.15	
+									1530.04 4.42
	ROUTED TO								
+		GTOH	90.	4.50	28.	28.	28.	.15	
+									1483.79 4.58
	HYDROGRAPH AT								
+		SA08	228.	4.17	20.	20.	20.	.13	
	2 COMBINED AT								
+		H	294.	4.17	48.	48.	48.	.28	
	ROUTED TO								
+		HTOI	280.	4.33	46.	46.	46.	.28	
+									1473.00 4.42
	2 COMBINED AT								
+		I	599.	4.42	121.	121.	121.	.97	
	ROUTED TO								
+		ITOJ	535.	4.75	108.	108.	108.	.97	
+									1382.70 4.75
	HYDROGRAPH AT								
+		SA10	310.	4.67	58.	58.	58.	.62	
	2 COMBINED AT								
+		J10	721.	4.75	147.	147.	147.	1.59	
	2 COMBINED AT								
+		J	2776.	5.00	622.	622.	622.	6.24	

	ROUTED TO								
+		JTOK	2742.	5.08	590.	590.	590.	6.24	
+								1360.46	5.17
	HYDROGRAPH AT								
+		SA15	528.	4.50	78.	78.	78.	.64	
	2 COMBINED AT								
+		K	2826.	5.08	625.	625.	625.	6.88	
	ROUTED TO								
+		KTOL	2772.	5.25	566.	566.	566.	6.88	
+								1340.00	5.25
	HYDROGRAPH AT								
+		SA16	598.	4.50	81.	81.	81.	.70	
	2 COMBINED AT								
+		L	2806.	5.25	599.	599.	599.	7.58	
	ROUTED TO								
+		LTOM	2779.	5.33	562.	562.	562.	7.58	
+								1321.53	5.33
	HYDROGRAPH AT								
+		SA17	620.	4.33	63.	63.	63.	.46	
	2 COMBINED AT								
+		M	2779.	5.33	592.	592.	592.	8.04	
	ROUTED TO								
+		MTON	2717.	5.67	423.	423.	423.	8.04	
+								1256.85	5.67
	HYDROGRAPH AT								
+		SA18	767.	4.50	114.	114.	114.	.73	
	2 COMBINED AT								
+		N	2746.	5.67	493.	493.	493.	8.77	

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

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1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  05/07/1991  TIME  07:58:57 *
*                                       *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

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1                                        HEC-1 INPUT                                                    PAGE  1

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

  1           ID   CAP OVERCHUTES     TWIN BUTTES WASH WATERSHED       CAPW24.DAT
  2           ID   24 HOUR STORM -MCUHP1 USED - 4.14" RAINFALL (100)-Tc&R revised above CAP only
  3           ID   BY AGK ENGINEERS, INC.     REVISED MAY, 1991  NORMAL DEPTH ROUTING
              *DIAGRAM
  4           IT       5                    288
  5           IO       5

  6           KK    SA01
  7           KM   SUB-AREA 1 - CONCENTRATION AT POINT A
  8           BA    .740
  9           IN      30
 10           PB   4.140
 11           PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 12           PC    .068    .071    .080    .089    .098    .109    .120    .133    .147    .163
 13           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 14           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 15           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 16           LG    .150    .350   4.200    .420  35.000
 17           UC    .517    .370
 18           UA       0       3       5       8      12      20      43      75      90      96
 19           UA     100

 20           KK    ATOB
 21           KM   ROUTE SA01 FLOW FROM POINT A TO POINT B
 22           RS       6    FLOW       0
 23           RC    .035    .035    .035   8440.   .0136
 24           RX       0     100     200     300     330     332     380     400
 25           RY    1640    1630    1620    1615    1619    1620    1640    1650
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```
 26          KK    SA02
 27          KM   SUB-AREA 2 - CONCENTRATION AT POINT B
 28          BA    .910
 29          LG    .170    .350   4.160    .450  27.090
 30          UC    .517    .384
 31          UA       0       3       5       8      12      20      43      75      90      96
 32          UA     100

 33          KK       B
 34          KM   COMBINE FLOWS ATOB AND SA02
 35          HC       2

 36          KK    BTOC
 37          KM   ROUTE "B" FLOW FROM POINT B TO POINT C
 38          RS       3    FLOW       0
 39          RC    .041    .041    .041   4760.   .0168
 40          RX       0      70     140     160     230     300     360     420
 41          RY    1548    1544    1540    1519    1519    1540    1540    1540

 42          KK    SA03
 43          KM   SUB-AREA 3 - CONCENTRATION AT POINT C
 44          BA   1.380
 45          LG    .200    .350   4.110    .510  21.470
 46          UC    .417    .198
 47          UA       0       3       5       8      12      20      43      75      90      96
 48          UA     100
1                                          HEC-1 INPUT                                          PAGE  2

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


 49          KK       C
 50          KM   COMBINE FLOWS BTOC AND SA03
 51          HC       2

 52          KK    CCAP
 53          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 4 - CAP CANAL
 54          RS       1    STOR       0
 55          SQ       0     248     800    1600    2160    2500    2900    3200
 56          SE    1500    1503    1506    1512    1518    1524    1530    1536
 57          SV       0    2.37    9.23   20.95   37.67  122.58   212.7  516.24
 58          SE    1500    1508    1512    1516    1520    1528    1532    1540

 59          KK    CTOD
 60          KM   ROUTE CCAP FLOW FROM DISCHARGE TO POINT D
 61          RS       5    FLOW       0
 62          RC    .036    .036    .036   7120.   .0098
 63          RX    9750    9860    9940    9970   10080   10140   10290   10410
 64          RY    1465    1457    1452  1443.5    1448    1461    1460    1465

 65          KK    SA11
 66          KM   SUB-AREA 11 - CONCENTRATION AT POINT D
 67          BA    .290
 68          LG    .350    .350   3.680    .960   1.500
 69          UC    .717    .658
 70          UA       0       3       5       8      12      20      43      75      90      96
 71          UA     100

 72          KK       D
 73          KM   COMBINE FLOWS CTOD AND SA11
 74          HC       2

 75          KK    DTOE
 76          KM   ROUTE D FLOW FROM POINT D TO POINT E
 77          RS       1    FLOW       0
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 78          RC    .040    .040    .040    1380   .0072
 79          RX    9770    9875    9930    9980   10430   10470   10480   10490
 80          RY    1445    1436    1440  1428.5    1430    1440    1440    1440

 81          KK    SA06
 82          KM   SUB-AREA 06 - CONCENTRATION AT POINT Q
 83          BA    .150
 84          LG    .210    .340   4.440    .450  11.220
 85          UC    .267    .210
 86          UA       0       3       5       8      12      20      43      75      90      96
 87          UA     100

 88          KK    QCAP
 89          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 2 - CAP CANAL
 90          RS       1    STOR       0
 91          SQ       0     7.5      22      52      72      90     103     115
 92          SE  1513.9  1515.2  1516.4  1520.2  1524.2  1528.2  1532.2    1540
 93          SV       0     0.1     .18    1.89    5.34   11.99   24.05    43.4
 94          SE  1513.9  1517.8    1520    1524    1528    1532    1536    1540
1                                        HEC-1 INPUT                                                    PAGE  3

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


 95          KK    QTOE
 96          KM   ROUTE QCAP FLOW FROM DISCHARGE THROUGH SA13 TO POINT E13
 97          RS       5    FLOW       0
 98          RC    .040    .040    .040    7500   .0133
 99          RX    9830    9850    9900    9940    9960   10020   10090   10270
100          RY    1476    1470    1456    1438    1438    1442    1450    1456

101          KK    SA13
102          KM   SUB-AREA 13 - CONCENTRATION AT POINT E13
103          BA    .220
104          LG    .350    .350   3.890    .660   2.870
105          UC    .567    .618
106          UA       0       3       5       8      12      20      43      75      90      96
107          UA     100

108          KK     E13
109          KM   COMBINE FLOWS QTOE AND SA13
110          HC       2

111          KK    SA07
112          KM   SUB-AREA 7 - CONCENTRATION AT POINT P
113          BA    .120
114          LG    .150    .350   4.290    .440  14.770
115          UC    .233    .166
116          UA       0       3       5       8      12      20      43      75      90      96
117          UA     100

118          KK    PCAP
119          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 3 - CAP CANAL
120          RS       1    STOR       0
121          SQ       0     7.5      22      45      71      93     110
122          SE    1519 1520.25  1521.5    1524    1529    1534    1540
123          SV       0     .61    2.78    8.03   18.24
124          SE    1519    1528    1532    1536    1540

125          KK    PTOE
126          KM   ROUTE PCAP FLOW FROM DISCHARGE THROUGH SA12 TO POINT E12
127          RS       6    FLOW       0
128          RC    .040    .040    .040    9000   .0111
129          RX    9930    9940    9950    9960    9975   10130   10390   10450
130          RY    1461    1455    1445    1437    1436    1443    1445    1455
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 131          KK    SA12
 132          KM   SUB-AREA 12 - CONCENTRATION AT POINT E12
 133          BA    .500
 134          LG    .320    .350   4.000    .630   3.900
 135          UC    .650    .521
 136          UA       0       3       5       8      12      20      43      75      90      96
 137          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 138          KK     E12
 139          KM   COMBINE FLOWS PTOE AND SA12
 140          HC       2

 141          KK       E
 142          KM   COMBINE FLOW DTOE, E13, AND E12
 143          HC       3

 144          KK    ETOJ
 145          KM   ROUTE E FLOW FROM POINT E THROUGH SUB-AREA 14 TO POINT J14
 146          RS       4    FLOW       0
 147          RC    .035    .035    .035    6060   .0091
 148          RX    9850    9930    9960    9980   10000   10020   10300   10380
 149          RY    1399    1390    1391    1386    1387  1389.5    1393    1397

 150          KK    SA14
 151          KM   SUB-AREA 14 - CONCENTRATION AT POINT J14
 152          BA    .340
 153          LG    .340    .350   3.630    .950   1.910
 154          UC    .717    .780
 155          UA       0       3       5       8      12      20      43      75      90      96
 156          UA     100

 157          KK     J14
 158          KM   COMBINE FLOWS ETOJ AND SA14
 159          HC       2

 160          KK    SA04
 161          KM   SUB-AREA 4 - CONCENTRATION AT POINT F
 162          BA    .380
 163          LG    .230    .340   4.340    .460  21.550
 164          UC    .350    .252
 165          UA       0       3       5       8      12      20      43      75      90      96
 166          UA     100

 167          KK    FCAP
 168          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 5 - CAP CANAL
 169          RS       1    STOR       0
 170          SQ       0     7.5      22      45      71      93     108     115
 171          SE    1516 1517.25  1518.5    1521    1526    1531    1536    1540
 172          SV     0.0    0.75    4.47   19.99   60.85  133.63
 173          SE    1520    1524    1528    1532    1536    1540

 174          KK    FTOI
 175          KM   ROUTE FCAP FLOW FROM DISCHARGE THROUGH SUB-AREA 9 TO POINT I9
 176          RS       5    FLOW       0
 177          RC    .035    .035    .035    7620   .0105
 178          RX    9750    9830    9880    9980   10000   10080   10160   10240
 179          RY    1457    1454    1457    1438    1439    1458    1464    1478
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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 180          KK    SA09
 181          KM   SUB-AREA 9 - CONCENTRATION AT POINT I9
 182          BA    .310
 183          LG    .300    .320   4.960    .400   4.240
 184          UC    .583    .531
 185          UA       0       3       5       8      12      20      43      75      90      96
 186          UA     100

 187          KK      I9
 188          KM   COMBINE FLOWS FTOI AND SA09
 189          HC       2

 190          KK    SA05
 191          KM   SUB-AREA 5 - CONCENTRATION AT POINT G
 192          BA    .150
 193          LG    .210    .350   4.130    .480  22.720
 194          UC    .267    .202
 195          UA       0       3       5       8      12      20      43      75      90      96
 196          UA     100

 197          KK   GCAP
 198          KM   STORAGE-DISCHARGE ROUTING AT CROSSING NO. 6 - CAP CANAL
 199          RS       1    STOR       0
 200          SQ       0     7.5      22      45      71      93     110
 201          SE    1519 1520.25  1521.5    1524    1529    1534    1540
 202          SV       0     .77    4.36   15.19   35.89
 203          SE    1519    1528    1532    1536    1540

 204          KK    GTOH
 205          KM   ROUTE GCAP FLOW FROM DISCHARGE THROUGH SUB-AREA 8 TO POINT H
 206          RS       3    FLOW       0
 207          RC    .035    .035    .035    3760    .016
 208          RX    9840    9910    9980   10000   10020   10030   10320   10700
 209          RY    1493    1494    1490    1483    1483    1490    1492    1498

 210          KK    SA08
 211          KM   SUB-AREA 8 - CONCENTRATION AT POINT H
 212          BA    .130
 213          LG    .290    .340   4.410    .530   8.090
 214          UC    .317    .251
 215          UA       0       3       5       8      12      20      43      75      90      96
 216          UA     100

 217          KK       H
 218          KM   COMBINE FLOWS GTOH AND SA08
 219          HC       2

 220          KK    HTOI
 221          KM   ROUTE H FLOW FROM POINT H TO POINT I
 222          RS       2    FLOW       0
 223          RC    .035    .035    .035    2380   .0084
 224          RX    9310    9630    9670    9790    9830    9910   10010   10150
 225          RY    1484    1477    1483    1477    1478    1485    1471    1486
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 226          KK       I
 227          KM   COMBINE FLOWS I9 AND HTOI AT POINT I
 228          HC       2

 229          KK    ITOJ
 230          KM   ROUTE I FLOW FROM POINT I THROUGH SUB-AREA 10 TO POINT J10
 231          RS       5    FLOW       0
 232          RC    .040    .040    .040    7000   .0107
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233          RX    9800    9830    9970    9980   10000   10010   10110   10160
234          RY    1395    1383    1383    1380    1381    1384    1387    1399

235          KK    SA10
236          KM   SUB-AREA 10 - CONCENTRATION AT POINT J10
237          BA    .620
238          LG    .340    .350   3.850    .750   2.060
239          UC    .917    .979
240          UA       0       3       5       8      12      20      43      75      90      96
241          UA     100

242          KK     J10
243          KM   COMBINE FLOWS ITOJ AND SA10
244          HC       2

245          KK       J
246          KM   COMBINE FLOWS J14 AND J10 AT POINT J
247          HC       2

248          KK    JTOK
249          KM   ROUTE FLOW FROM POINT J THROUGH SUB-AREA 15 TO POINT K
250          RS       1    FLOW       0
251          RC    .040    .040    .040    1880   .0027
252          RX    9420    9830    9900   10000   10030   10050   10410   10450
253          RY    1378    1376    1360    1355    1355    1361    1363    1372

254          KK    SA15
255          KM   SUB-AREA 15 - CONCENTRATION AT POINT K
256          BA    .640
257          LG    .310    .340   4.230    .600   1.370
258          UC    .700    .577
259          UA       0       3       5       8      12      20      43      75      90      96
260          UA     100

261          KK       K
262          KM   COMBINE FLOWS FROM JTOK AND SA15 AT POINT K
263          HC       2

264          KK   KTOL
265          KM   ROUTE K FLOWS FROM POINT K THROUGH SUB-AREA 16 TO POINT L
266          RS       3    FLOW       0
267          RC    .035    .035    .035    5000    .006
268          RX    9760    9770    9960    9990   10020   10150   10200   10300
269          RY    1350    1340    1341    1335    1335    1350    1350    1350
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


270          KK    SA16
271          KM   SUB-AREA 16 - CONCENTRATION AT POINT L
272          BA    .700
273          LG    .310    .330   4.500    .640    .830
274          UC    .700    .488
275          UA       0       3       5       8      12      20      43      75      90      96
276          UA     100

277          KK       L
278          KM   COMBINE FLOWS KTOL AND SA16 AT POINT L
279          HC       2

280          KK    LTOM
281          KM   ROUTE L FLOW FROM POINT L THROUGH SUB-AREA 17 TO POINT M AT BEARDSLY CANAL
282          RS       1    FLOW       0
283          RC    .040    .040    .040    2000    .005
284          RX    9340    9530    9750    9820    9970    9980   10000   10070
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285          RY    1335    1328    1328    1320    1320    1316    1315    1336

286          KK    SA17
287          KM   SUB-AREA 17 - CONCENTRATION AT POINT M
288          BA    .460
289          LG    .340    .300   5.310    .510    .760
290          UC    .517    .331
291          UA       0       3       5       8      12      20      43      75      90      96
292          UA     100

293          KK       M
294          KM   COMBINE FLOWS LTOM AND SA17
295          HC       2

296          KK    MTON
297          KM   ROUTE M FLOWS THROUGH SUB-AREA 18 TO AGUA FRIA RIVER AT POINT N
298          RS       7    FLOW       0
299          RC    .036    .036    .036   10120   .0084
300          RX    9500    9870    9920   10040   10060   10200   10270   10310
301          RY    1263  1259.3    1255  1253.5    1260    1257    1258    1272

302          KK    SA18
303          KM   SUB-AREA 18 - CONCENTRATION AT POINT N
304          BA    .730
305          LG    .350    .290   3.870    .380    .040
306          UC    .717    .515
307          UA       0       3       5       8      12      20      43      75      90      96
308          UA     100

309          KK       N
310          KM   COMBINE FLOWS MTON AND SA18 AT POINT N (AGUA FRIA RIVER CONFLUENCE)
311          HC       2
312          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   6        SA01
               V
               V
  20        ATOB
               .
               .
  26           .        SA02
               .           .
               .           .
  33           B............
               V
               V
  36        BTOC
               .
               .
  42           .        SA03
               .           .
               .           .
  49           C............
               V
               V
  52        CCAP
               V
               V
  59        CTOD
               .
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            .
 65         .        SA11
            .           .
            .           .
 72         D............
            V
            V
 75      DTOE
            .
            .
 81         .        SA06
            .           V
            .           V
 88         .        QCAP
            .           V
            .           V
 95         .        QTOE
            .           .
            .           .
101         .           .        SA13
            .           .           .
            .           .           .
108         .         E13............
            .           .
            .           .
111         .           .        SA07
            .           .           V
            .           .           V
118         .           .        PCAP
            .           .           V
            .           .           V
125         .           .        PTOE
            .           .           .
            .           .           .
131         .           .           .        SA12
            .           .           .           .
            .           .           .           .
138         .           .         E12............
            .           .           .
            .           .           .
141         E........................
            V
            V
144      ETOJ
            .
            .
150         .        SA14
            .           .
            .           .
157       J14............
            .
            .
160         .        SA04
            .           V
            .           V
167         .        FCAP
            .           V
            .           V
174         .        FTOI
            .           .
            .           .
180         .           .        SA09
            .           .           .
            .           .           .
187         .          I9............
            .           .
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              .           .
190           .           .        SA05
              .           .           V
              .           .           V
197           .           .       GCAP
              .           .           V
              .           .           V
204           .           .        GTOH
              .           .           .
              .           .           .
210           .           .           .        SA08
              .           .           .           .
              .           .           .           .
217           .           .           H............
              .           .           V
              .           .           V
220           .           .        HTOI
              .           .           .
              .           .           .
226           .           I............
              .           V
              .           V
229           .        ITOJ
              .           .
              .           .
235           .           .        SA10
              .           .           .
              .           .           .
242           .         J10............
              .           .
              .           .
245           J............
              V
              V
248        JTOK
              .
              .
254           .        SA15
              .           .
              .           .
261           K............
              V
              V
264        KTOL
              .
              .
270           .        SA16
              .           .
              .           .
277           L............
              V
              V
280        LTOM
              .
              .
286           .        SA17
              .           .
              .           .
293           M............
              V
              V
296        MTON
              .
              .
302           .        SA18
              .           .
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                .          .
  309           N............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                    *****************************************
*                                       *                    *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
*             FEBRUARY 1981             *                    *  THE HYDROLOGIC ENGINEERING CENTER    *
*           REVISED 02 AUG 88           *                    *          609 SECOND STREET            *
*                                       *                    *       DAVIS, CALIFORNIA 95616         *
*  RUN DATE  05/07/1991  TIME  07:58:57 *                    *           (916) 551-1748              *
*                                       *                    *                                       *
*****************************************                    *****************************************


                        CAP OVERCHUTES     TWIN BUTTES WASH WATERSHED       CAPW24.DAT
                        24 HOUR STORM -MCUHP1 USED - 4.14" RAINFALL (100)-Tc&R revised above CAP only
                        BY AGK ENGINEERS, INC.     REVISED MAY, 1991  NORMAL DEPTH ROUTING

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

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        2355  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   23.92 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
1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                  PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION   FLOW    PEAK                                           AREA      STAGE     MAX STAGE
+                                                     6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                         SA01    808.   12.25         139.         43.         43.       .74

        ROUTED TO
+                         ATOB    753.   12.58         139.         43.         43.       .74
+                                                                                        1617.68      12.58

        HYDROGRAPH AT
+                         SA02    929.   12.33         154.         47.         47.       .91
```

	2 COMBINED AT								
+		B	1503.	12.42	293.	89.	89.	1.65	
	ROUTED TO								
+		BTOC	1474.	12.50	293.	89.	89.	1.65	
+									1521.35 12.50
	HYDROGRAPH AT								
+		SA03	1718.	12.17	212.	63.	63.	1.38	
	2 COMBINED AT								
+		C	2548.	12.33	504.	152.	152.	3.03	
	ROUTED TO								
+		CCAP	2058.	12.50	504.	152.	152.	3.03	
+									1516.90 12.50
	ROUTED TO								
+		CTOD	2041.	12.75	504.	151.	151.	3.03	
+									1448.04 12.75
	HYDROGRAPH AT								
+		SA11	109.	12.50	20.	5.	5.	.29	
	2 COMBINED AT								
+		D	2123.	12.75	524.	156.	156.	3.32	
	ROUTED TO								
+		DTOE	2106.	12.83	524.	156.	156.	3.32	
+									1430.47 12.83
	HYDROGRAPH AT								
+		SA06	186.	12.08	21.	6.	6.	.15	
	ROUTED TO								
+		QCAP	82.	12.33	21.	6.	6.	.15	
+									1526.37 12.33
	ROUTED TO								
+		QTOE	80.	12.83	21.	6.	6.	.15	
+									1438.41 12.83
	HYDROGRAPH AT								
+		SA13	123.	12.33	22.	6.	6.	.22	
	2 COMBINED AT								
+		E13	187.	12.42	42.	11.	11.	.37	
	HYDROGRAPH AT								
+		SA07	166.	12.08	18.	5.	5.	.12	
	ROUTED TO								
+		PCAP	85.	12.25	18.	5.	5.	.12	
+									1532.16 12.25
	ROUTED TO								
+		PTOE	74.	13.17	18.	5.	5.	.12	
+									1437.00 13.17
	HYDROGRAPH AT								
+		SA12	317.	12.42	52.	14.	14.	.50	
	2 COMBINED AT								
+		E12	349.	12.42	69.	19.	19.	.62	
	3 COMBINED AT								

+	E	2514.	12.75	635.	186.	186.	4.31		
ROUTED TO									
+	ETOJ	2470.	13.00	635.	185.	185.	4.31		
+								1391.20	13.00
HYDROGRAPH AT									
+	SA14	119.	12.50	24.	6.	6.	.34		
2 COMBINED AT									
+	J14	2538.	13.00	659.	192.	192.	4.65		
HYDROGRAPH AT									
+	SA04	462.	12.17	59.	18.	18.	.38		
ROUTED TO									
+	FCAP	93.	12.75	59.	18.	18.	.38		
+								1531.11	12.75
ROUTED TO									
+	FTOI	93.	13.17	59.	18.	18.	.38		
+								1438.82	13.17
HYDROGRAPH AT									
+	SA09	238.	12.33	39.	10.	10.	.31		
2 COMBINED AT									
+	I9	306.	12.42	98.	28.	28.	.69		
HYDROGRAPH AT									
+	SA05	196.	12.08	24.	7.	7.	.15		
ROUTED TO									
+	GCAP	84.	12.42	24.	7.	7.	.15		
+								1532.02	12.42
ROUTED TO									
+	GTOH	84.	12.50	24.	7.	7.	.15		
+								1483.84	12.50
HYDROGRAPH AT									
+	SA08	138.	12.17	16.	4.	4.	.13		
2 COMBINED AT									
+	H	202.	12.17	39.	11.	11.	.28		
ROUTED TO									
+	HTOI	189.	12.33	39.	11.	11.	.28		
+								1473.30	12.33
2 COMBINED AT									
+	I	494.	12.33	137.	39.	39.	.97		
ROUTED TO									
+	ITOJ	454.	12.67	137.	39.	39.	.97		
+								1383.03	12.67
HYDROGRAPH AT									
+	SA10	220.	12.67	55.	14.	14.	.62		
2 COMBINED AT									
+	J10	673.	12.67	192.	53.	53.	1.59		
2 COMBINED AT									
+	J	3105.	12.92	850.	244.	244.	6.24		

```
        ROUTED TO
+                       JTOK    3068.   13.00     850.     244.     244.     6.24
+                                                                                  1361.16     13.00

        HYDROGRAPH AT
+                       SA15     379.   12.42      64.      16.      16.      .64

        2 COMBINED AT
+                          K    3246.   12.92     914.     260.     260.     6.88

        ROUTED TO
+                       KTOL    3183.   13.17     914.     260.     260.     6.88
+                                                                                  1340.69     13.17

        HYDROGRAPH AT
+                       SA16     430.   12.42      66.      17.      17.      .70

        2 COMBINED AT
+                          L    3299.   13.17     980.     276.     276.     7.58

        ROUTED TO
+                       LTOM    3279.   13.25     979.     276.     276.     7.58
+                                                                                  1322.08     13.25

        HYDROGRAPH AT
+                       SA17     391.   12.25      48.      12.      12.      .46

        2 COMBINED AT
+                          M    3307.   13.25    1027.     288.     288.     8.04

        ROUTED TO
+                       MTON    3244.   13.58    1025.     286.     286.     8.04
+                                                                                  1257.47     13.58

        HYDROGRAPH AT
+                       SA18     584.   12.42      92.      23.      23.      .73

        2 COMBINED AT
+                          N    3320.   13.58    1114.     309.     309.     8.77


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

APPENDIX G

HEC-1 OUTPUT
FOR CATERPILLAR TANK WASH WATERSHED

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  04/18/1991  TIME  09:05:32 *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPEAST3.DAT
  2           ID   6 hour storm - inlet control on 72" CAP Crossing- Pond Removed
  3           ID   BY AGK ENGINEERS, INC.  March, 1991  NORMAL DEPTH ROUTING  -revised invert
              *DIAGRAM
  4           IT       5                    72
  5           IO       5
  6           IN      15
  7           JD    3.32    0.01
  8           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
  9           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 10           PC    .962    .972    .983    .991   1.000
 11           JD    3.30    0.50
 12           JD    3.25    2.80
 13           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
 14           PC    .087    .100    .120    .163    .252    .451    .694    .837    .900    .938
 15           PC    .950    .963    .975    .988   1.000
 16           JD    3.06    16.0
 17           PC    .000    .015    .020    .030    .048    .063    .076    .090    .105    .119
 18           PC    .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
 19           PC    .946    .960    .973    .987   1.000

 20           KK    SA19
 21           KM   SUB-AREA 19 - CONCENTRATION AT POINT EA
 22           BA   1.030
 23           LG    .180    .340   4.380    .490  15.630
 24           UC    .500    .272
 25           UA       0       3       5       8      12      20      43      75      90      96
 26           UA     100
```

```
 27          KK   EACAP
 28          KM   STORAGE - DISCHARGE ROUTING AT CROSSING NO.1 -CAP CANAL
 29          RS       1    STOR       0
 30          SQ       0      62     200     400     540     625     750
 31          SE    1508    1511    1514    1520    1526    1532    1540
 32          SV       0     5.2    18.6    40.7    71.7   115.5   178.1   266.3
 33          SE    1508    1516    1520    1524    1528    1532    1536    1540

 34          KK  EATOEB
 35          KM   ROUTE EACAP FLOWS FROM POINT EA TO POINT EB
 36          RS       4    FLOW       0
 37          RC    .038    .038    .038    6120   .0114
 38          RX    9760    9870    9950    9990   10010   10080   10420   10600
 39          RY    1470    1457    1459    1454    1454    1476    1470    1480

 40          KK    SA20
 41          KM   SUB-AREA 20 - CONCENTRATION AT POINT EB
 42          BA    .610
 43          LG    .260    .350   4.140    .530   7.670
 44          UC    .467    .237
 45          UA       0       3       5       8      12      20      43      75      90      96
 46          UA     100
1                                          HEC-1 INPUT                                          PAGE  2

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


 47          KK      EB
 48          KM   COMBINE FLOWS EATOEB AND SA20
 49          HC       2

 50          KK  EBTOEC
 51          KM   ROUTE EB FLOWS TO POINT EC
 52          RS       6    FLOW       0
 53          RC    .041    .041    .041   9000.    .009
 54          RX    9660    9840    9995   10000   10025   10040   10080   10180
 55          RY    1427    1414    1414    1409    1409    1414    1415    1428

 56          KK    SA21
 57          KM   SUB-AREA 21 - CONCENTRATION AT POINT EC
 58          BA    .760
 59          LG    .290    .340   4.310    .570   4.580
 60          UC    .733    .469
 61          UA       0       3       5       8      12      20      43      75      90      96
 62          UA     100

 63          KK      EC
 64          KM   COMBINE FLOWS EBTOEC AND SA21
 65          HC       2

 66          KK  ECTOED
 67          KM   ROUTE FLOWS FROM POINT EC TO POINT ED
 68          RS       4    FLOW       0
 69          RC    .041    .041    .041   5500.   .0118
 70          RX    9530    9740    9900    9920   10030   10050   10210   10370
 71          RY    1285    1270    1275    1268    1270    1275    1271    1289

 72          KK    SA22
 73          KM   SUB-AREA 22 - CONCENTRATION AT POINT ED
 74          BA    .630
 75          LG    .320    .330   4.730    .490   1.340
 76          UC    .533    .324
 77          UA       0       3       5       8      12      20      43      75      90      96
 78          UA     100
```

```
  79          KK      ED
  80          KM   COMBINE FLOWS ECTOED AND SA22
  81          HC       2

  82          KK  EDTOEE
  83          KM   ROUTE ED FLOWS TO POINT EE (AT AGUA FRIA RIVER)
  84          RS       3    FLOW       0
  85          RC    .043    .043    .043    4380    .013
  86          RX    9700    9870    9930    9970   10000   10050   10080   10330
  87          RY    1366    1365    1360    1346    1350    1352    1350    1384
1                                            HEC-1 INPUT                                                    PAGE  3

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


  88          KK    SA23
  89          KM   SUB-AREA 23 - CONCENTRATION AT POINT EE ( AGUA FRIA RIVER)
  90          BA    .330
  91          LG    .310    .350   4.030    .630    .070
  92          UC    .367    .197
  93          UA       0       3       5       8      12      20      43      75      90      96
  94          UA     100

  95          KK      EE
  96          KM   COMBINE FLOWS EDTOEE AND SA23
  97          HC       2
  98          ZZ
1
```

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

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  20        SA19
               V
               V
  27       EACAP
               V
               V
  34      EATOEB
               .
               .
  40           .        SA20
               .           .
               .           .
  47          EB............
               V
               V
  50      EBTOEC
               .
               .
  56           .        SA21
               .           .
               .           .
  63          EC............
               V
               V
  66      ECTOED
               .
               .
  72           .        SA22
               .           .
               .           .
  79          ED............
               V
```

```
              V
  82      EDTOEE
              .
              .
  88          .        SA23
              .          .
              .          .
  95         EE............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  04/18/1991  TIME  09:05:32 *
*                                       *
*****************************************
```

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

```
                    CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPEAST3.DAT
                    6 hour storm - inlet control on 72" CAP Crossing- Pond Removed
                    BY AGK ENGINEERS, INC.  March, 1991  NORMAL DEPTH ROUTING  -revised invert

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ         72  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       0555  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE    5.92 HOURS

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

  7 JD          INDEX STORM NO. 1
                       STRM       3.32  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA

  8 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       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

```
                    .00

11 JD          INDEX STORM NO. 2
                     STRM        3.30  PRECIPITATION DEPTH
                     TRDA         .50  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       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00

12 JD          INDEX STORM NO. 3
                     STRM        3.25  PRECIPITATION DEPTH
                     TRDA        2.80  TRANSPOSITION DRAINAGE AREA

13 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       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00

16 JD          INDEX STORM NO. 4
                     STRM        3.06  PRECIPITATION DEPTH
                     TRDA       16.00  TRANSPOSITION DRAINAGE AREA

17 PI            PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00
1
                                                  RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
        OPERATION       STATION    FLOW    PEAK                                          AREA     STAGE    MAX STAGE
+                                                    6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                         SA19    1446.   4.33        172.        172.        172.      1.03

        ROUTED TO
+                         EACAP    489.   4.75        148.        148.        148.      1.03
+                                                                                      1519.87       4.67

        ROUTED TO
+                        EATOEB    486.   5.00        130.        130.        130.      1.03
+                                                                                      1456.05       4.92

        HYDROGRAPH AT
+                         SA20    979.   4.25         94.         94.         94.       .61
```

```
        2 COMBINED AT
+                          EB      970.   4.33       207.       207.       207.      1.64
        ROUTED TO
+                       EBTOEC     894.   4.58       177.       177.       177.      1.64
+                                                                                 1412.03        4.75
        HYDROGRAPH AT
+                         SA21     708.   4.50       100.       100.       100.       .76
        2 COMBINED AT
+                          EC     1295.   4.58       250.       250.       250.      2.40
        ROUTED TO
+                       ECTOED    1241.   4.83       220.       220.       220.      2.40
+                                                                                 1270.37        4.92
        HYDROGRAPH AT
+                         SA22     819.   4.33        87.        87.        87.       .63
        2 COMBINED AT
+                          ED     1375.   4.83       277.       277.       277.      3.03
        ROUTED TO
+                       EDTOEE    1317.   5.00       258.       258.       258.      3.03
+                                                                                 1350.61        5.08
        HYDROGRAPH AT
+                         SA23     565.   4.25        43.        43.        43.       .33
        2 COMBINED AT
+                          EE     1315.   5.00       283.       283.       283.      3.36


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

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             FEBRUARY 1981             *
 *           REVISED 02 AUG 88           *
 *                                       *
 *  RUN DATE  05/03/1991  TIME  10:33:20 *
 *                                       *
*****************************************
```

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

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

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

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


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

  1           ID   CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPEASTF.DAT
  2           ID   6 hour storm - Pond full at start of event - CAP Crossing outlet controled
  3           ID   BY AGK ENGINEERS, INC.  March,1991-      based on hieght of flow over wier
              *DIAGRAM
  4           IT       5                    72
  5           IO       5
  6           IN      15
  7           JD    3.32    0.01
  8           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
  9           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 10           PC    .962    .972    .983    .991   1.000
 11           JD    3.30    0.50
 12           JD    3.25    2.80
 13           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
 14           PC    .087    .100    .120    .163    .252    .451    .694    .837    .900    .938
 15           PC    .950    .963    .975    .988   1.000
 16           JD    3.06    16.0
 17           PC    .000    .015    .020    .030    .048    .063    .076    .090    .105    .119
 18           PC    .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
 19           PC    .946    .960    .973    .987   1.000

 20           KK    SA19
 21           KM   SUB-AREA 19 - CONCENTRATION AT POINT EA
 22           BA   1.030
 23           LG    .180    .340   4.380    .490  15.630
 24           UC    .500    .272
 25           UA       0       3       5       8      12      20      43      75      90      96
 26           UA     100
```

```
 27          KK   EACAP
 28          KM   STORAGE - DISCHARGE ROUTING AT CROSSING NO.1 -CAP CANAL AND STOCK POND
 29          RS       1    STOR   83.00
 30          SQ       0     540     800
 31          SE  1519.2  1529.5    1540
 32          SV       0    18.2    31.2    52.6    85.7   107.8   182.6   333.4
 33          SE    1496    1508    1512    1516    1520    1524    1532    1540

 34          KK  EATOEB
 35          KM   ROUTE EACAP FLOWS FROM POINT EA TO POINT EB
 36          RS       4    FLOW       0
 37          RC    .038    .038    .038    6120   .0114
 38          RX    9760    9870    9950    9990   10010   10080   10420   10600
 39          RY    1470    1457    1459    1454    1454    1476    1470    1480

 40          KK    SA20
 41          KM   SUB-AREA 20 - CONCENTRATION AT POINT EB
 42          BA    .610
 43          LG    .260    .350   4.140    .530   7.670
 44          UC    .467    .237
 45          UA       0       3       5       8      12      20      43      75      90      96
 46          UA     100
1                                          HEC-1 INPUT                                          PAGE  2

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


 47          KK      EB
 48          KM   COMBINE FLOWS EATOEB AND SA20
 49          HC       2

 50          KK  EBTOEC
 51          KM   ROUTE EB FLOWS TO POINT EC
 52          RS       6    FLOW       0
 53          RC    .041    .041    .041   9000.    .009
 54          RX    9660    9840    9995   10000   10025   10040   10080   10180
 55          RY    1427    1414    1414    1409    1409    1414    1415    1428

 56          KK    SA21
 57          KM   SUB-AREA 21 - CONCENTRATION AT POINT EC
 58          BA    .760
 59          LG    .290    .340   4.310    .570   4.580
 60          UC    .733    .469
 61          UA       0       3       5       8      12      20      43      75      90      96
 62          UA     100

 63          KK      EC
 64          KM   COMBINE FLOWS EBTOEC AND SA21
 65          HC       2

 66          KK  ECTOED
 67          KM   ROUTE FLOWS FROM POINT EC TO POINT ED
 68          RS       4    FLOW       0
 69          RC    .041    .041    .041   5500.   .0118
 70          RX    9530    9740    9900    9920   10030   10050   10210   10370
 71          RY    1285    1270    1275    1268    1270    1275    1271    1289

 72          KK    SA22
 73          KM   SUB-AREA 22 - CONCENTRATION AT POINT ED
 74          BA    .630
 75          LG    .320    .330   4.730    .490   1.340
 76          UC    .533    .324
 77          UA       0       3       5       8      12      20      43      75      90      96
 78          UA     100
```

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  79          KK      ED
  80          KM   COMBINE FLOWS ECTOED AND SA22
  81          HC       2

  82          KK  EDTOEE
  83          KM   ROUTE ED FLOWS TO POINT EE (AT AGUA FRIA RIVER)
  84          RS       3    FLOW       0
  85          RC    .043    .043    .043    4380    .013
  86          RX    9700    9870    9930    9970   10000   10050   10080   10330
  87          RY    1366    1365    1360    1346    1350    1352    1350    1384
1                                            HEC-1 INPUT                                                    PAGE  3

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


  88          KK    SA23
  89          KM   SUB-AREA 23 - CONCENTRATION AT POINT EE ( AGUA FRIA RIVER)
  90          BA    .330
  91          LG    .310    .350   4.030    .630    .070
  92          UC    .367    .197
  93          UA       0       3       5       8      12      20      43      75      90      96
  94          UA     100

  95          KK      EE
  96          KM   COMBINE FLOWS EDTOEE AND SA23
  97          HC       2
  98          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  20         SA19
              V
              V
  27        EACAP
              V
              V
  34       EATOEB
              .
              .
  40          .        SA20
              .           .
              .           .
  47          EB............
              V
              V
  50       EBTOEC
              .
              .
  56          .        SA21
              .           .
              .           .
  63          EC............
              V
              V
  66       ECTOED
              .
              .
  72          .        SA22
              .           .
              .           .
  79          ED............
              V
```

```
              V
  82      EDTOEE
              .
              .
  88          .        SA23
              .          .
              .          .
  95         EE............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  05/03/1991  TIME  10:33:20 *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
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                    CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPEASTF.DAT
                    6 hour storm - Pond full at start of event - CAP Crossing outlet controled
                    BY AGK ENGINEERS, INC.  March,1991-      based on hieght of flow over wier

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

   IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ         72  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1   0  ENDING DATE
                   NDTIME       0555  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE    5.92 HOURS

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

  7 JD        INDEX STORM NO. 1
                    STRM       3.32  PRECIPITATION DEPTH
                    TRDA        .01  TRANSPOSITION DRAINAGE AREA

  8 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      .01      .01      .01      .01      .01      .01      .03
                   .03      .03      .05      .05      .05      .15      .15      .15      .03      .03
                   .03      .01      .01      .01      .01      .01      .01      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
```

```
                    .00

11 JD          INDEX STORM NO. 2
                    STRM        3.30  PRECIPITATION DEPTH
                    TRDA         .50  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       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00

12 JD          INDEX STORM NO. 3
                    STRM        3.25  PRECIPITATION DEPTH
                    TRDA        2.80  TRANSPOSITION DRAINAGE AREA

13 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       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00

16 JD          INDEX STORM NO. 4
                    STRM        3.06  PRECIPITATION DEPTH
                    TRDA       16.00  TRANSPOSITION DRAINAGE AREA

17 PI            PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00
1
                                                  RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION        STATION     FLOW    PEAK                                            AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          SA19     1446.   4.33          172.        172.        172.       1.03

        ROUTED TO
+                          EACAP     392.   4.83          113.        113.        113.       1.03
+                                                                                            1524.36        4.83

        ROUTED TO
+                          EATOEB    388.   5.08           97.         97.         97.       1.03
+                                                                                            1455.68        5.08

        HYDROGRAPH AT
+                          SA20      979.   4.25           94.         94.         94.        .61
```

```
        2 COMBINED AT
+                          EB      767.    4.33        174.        174.        174.       1.64

        ROUTED TO
+                       EBTOEC     702.    4.58        148.        148.        148.       1.64
+                                                                                        1411.40        4.67

        HYDROGRAPH AT
+                         SA21     708.    4.50        100.        100.        100.        .76

        2 COMBINED AT
+                          EC     1100.    4.58        220.        220.        220.       2.40

        ROUTED TO
+                       ECTOED    1053.    4.83        195.        195.        195.       2.40
+                                                                                        1270.20        5.00

        HYDROGRAPH AT
+                         SA22     819.    4.33         87.         87.         87.        .63

        2 COMBINED AT
+                          ED     1199.    4.75        252.        252.        252.       3.03

        ROUTED TO
+                       EDTOEE    1143.    5.00        235.        235.        235.       3.03
+                                                                                        1350.32        5.08

        HYDROGRAPH AT
+                         SA23     565.    4.25         43.         43.         43.        .33

        2 COMBINED AT
+                          EE     1142.    5.00        261.        261.        261.       3.36


*** NORMAL END OF HEC-1 ***
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1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            FEBRUARY 1981              *
*          REVISED 02 AUG 88            *
*                                       *
*  RUN DATE  05/03/1991  TIME  10:31:15 *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*  THE HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPE24.DAT
  2           ID   FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  pond full at start
  3           ID   BY AGK ENGINEERS, INC.  REV MAY,1991- 24 hour rainfall ponding behind CAP
              *DIAGRAM
  4           IT       5                    288
  5           IO       3

  6           KK    SA19
  7           KM   SUB-AREA 19 - CONCENTRATION AT POINT EA
  8           BA   1.030
  9           IN      30
 10           PB    4.14
 11           PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 12           PC    .068    .071    .080    .089    .098    .109    .120    .133    .147    .163
 13           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 14           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 15           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 16           LG    .180    .340   4.380    .490  15.630
 17           UC    .533    .292
 18           UA       0       3       5       8      12      20      43      75      90      96
 19           UA     100

 20           KK   EACAP
 21           KM   STORAGE - DISCHARGE ROUTING AT CROSSING NO.1 -CAP CANAL AND STOCK POND
 22           RS       1    STOR   83.00
 23           SQ       0     540     800
 24           SE  1519.2  1529.5    1540
 25           SV       0    18.2    31.2    52.6    85.7   107.8   182.6   333.4
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          26          SE    1496    1508    1512    1516    1520    1524    1532    1540

          27          KK  EATOEB
          28          KM   ROUTE EACAP FLOWS FROM POINT EA TO POINT EB
          29          RS       4    FLOW       0
          30          RC    .038    .038    .038    6120    .0114
          31          RX    9760    9870    9950    9990   10010   10080   10420   10600
          32          RY    1470    1457    1459    1454    1454    1476    1470    1480
          33          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6        SA19
                V
                V
   20       EACAP
                V
                V
   27      EATOEB

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *             FEBRUARY 1981             *                    *  THE HYDROLOGIC ENGINEERING CENTER    *
 *           REVISED 02 AUG 88           *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE  05/03/1991  TIME  10:31:15 *                    *           (916) 551-1748              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************

                         CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPE24.DAT
                         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  pond full at start
                         BY AGK ENGINEERS, INC.  REV MAY,1991- 24 hour rainfall ponding behind CAP

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

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1    0  ENDING DATE
                      NDTIME        2355  ENDING TIME
                       ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   23.92 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



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


          **************
          *            *
  6 KK    *      SA19  *
          *            *
          **************
                         SUB-AREA 19 - CONCENTRATION AT POINT EA

  9 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          30  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

            SUBBASIN RUNOFF DATA

  8 BA          SUBBASIN CHARACTERISTICS
                      TAREA        1.03  SUBBASIN AREA

                PRECIPITATION DATA

 10 PB                STORM        4.14  BASIN TOTAL PRECIPITATION

 11 PI            INCREMENTAL 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       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .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       .06       .06
                     .06       .06       .06       .06       .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
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00
```

```
 16 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .18  STARTING LOSS
                        DTH         .34  MOISTURE DEFICIT
                       PSIF        4.38  WETTING FRONT SUCTION
                      XKSAT         .49  HYDRAULIC CONDUCTIVITY
                      RTIMP       15.63  PERCENT IMPERVIOUS AREA
```

```
 17 UC          CLARK UNITGRAPH
                         TC          .53  TIME OF CONCENTRATION
                          R          .29  STORAGE COEFFICIENT

 18 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                       .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                    100.0

                                                          ***

                                                   UNIT HYDROGRAPH PARAMETERS
                                            CLARK   TC=   .53 HR,       R=   .29 HR
                                           SNYDER   TP=   .45 HR,      CP=   .90

                                                      UNIT HYDROGRAPH
                                                 23 END-OF-PERIOD ORDINATES
              41.      116.      220.      590.     1137.     1315.     1114.      860.      645.      484.
             363.      273.      204.      153.      115.       86.       65.       49.       36.       27.
              21.       15.       12.

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

                        HYDROGRAPH AT STATION     SA19

    TOTAL RAINFALL =    4.14, TOTAL LOSS =    2.62, TOTAL EXCESS =    1.52

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     23.92-HR
+   (CFS)       (HR)
                          (CFS)
+    1073.     12.25                   147.         42.         42.         42.
                        (INCHES)     1.327       1.512       1.512       1.512
                         (AC-FT)      73.         83.         83.         83.

                        CUMULATIVE AREA =    1.03 SQ MI


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


            **************
            *            *
 20 KK      *     EACAP  *
            *            *
            **************
                        STORAGE - DISCHARGE ROUTING AT CROSSING NO.1 -CAP CANAL AND STOCK POND

               HYDROGRAPH ROUTING DATA

 22 RS          STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                      ITYP        STOR  TYPE OF INITIAL CONDITION
                    RSVRIC       83.00  INITIAL CONDITION
                         X         .00 WORKING R AND D COEFFICIENT

 25 SV            STORAGE          .0      18.2      31.2      52.6      85.7     107.8     182.6     333.4

 26 SE          ELEVATION     1496.00   1508.00   1512.00   1516.00   1520.00   1524.00   1532.00   1540.00

 23 SQ          DISCHARGE          0.       540.      800.

 24 SE          ELEVATION     1519.20   1529.50   1540.00
```

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	18.20	31.20	52.60	79.08	85.70	107.80	159.23	182.60	333.40
OUTFLOW	.00	.00	.00	.00	.00	41.94	251.65	540.00	601.90	800.00
ELEVATION	1496.00	1508.00	1512.00	1516.00	1519.20	1520.00	1524.00	1529.50	1532.00	1540.00

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

HYDROGRAPH AT STATION EACAP

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 334.	12.75		141.	44.	44.	44.
		(INCHES)	1.272	1.566	1.566	1.566
		(AC-FT)	70.	86.	86.	86.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (AC-FT)	(HR)				
122.	12.75	97.	85.	85.	85.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (FEET)	(HR)				
1525.57	12.75	1521.89	1520.03	1520.03	1520.03

CUMULATIVE AREA = 1.03 SQ MI

*** ***

```
              **************
              *            *
  27 KK       *    EATOEB  *
              *            *
              **************
```

ROUTE EACAP FLOWS FROM POINT EA TO POINT EB

HYDROGRAPH ROUTING DATA

```
  29 RS        STORAGE ROUTING
                    NSTPS          4  NUMBER OF SUBREACHES
                     ITYP       FLOW  TYPE OF INITIAL CONDITION
                   RSVRIC        .00  INITIAL CONDITION
                        X        .00 WORKING R AND D COEFFICIENT

  30 RC        NORMAL DEPTH CHANNEL ROUTING
                      ANL       .038  LEFT OVERBANK N-VALUE
                     ANCH       .038  MAIN CHANNEL N-VALUE
                      ANR       .038  RIGHT OVERBANK N-VALUE
                    RLNTH      6120.  REACH LENGTH
                      SEL      .0114  ENERGY SLOPE
                    ELMAX         .0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION
```

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL		------- + --- RIGHT OVERBANK ---			
32 RY	ELEVATION	1470.00	1457.00	1459.00	1454.00	1454.00	1476.00	1470.00	1480.00
31 RX	DISTANCE	9760.00	9870.00	9950.00	9990.00	10010.00	10080.00	10420.00	10600.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	5.32	13.57	28.93	58.99	94.81	133.69	175.64	220.65	268.72
OUTFLOW	.00	164.99	617.70	1493.46	3432.74	6754.86	11144.73	16576.23	23051.31	30585.14
ELEVATION	1454.00	1455.37	1456.74	1458.11	1459.47	1460.84	1462.21	1463.58	1464.95	1466.32
STORAGE	319.86	374.05	432.14	506.53	601.40	716.76	852.59	1002.20	1156.59	1315.71
OUTFLOW	39200.14	48922.91	60167.73	73870.14	89919.31	108855.40	131140.20	159372.10	191319.00	226670.30
ELEVATION	1467.68	1469.05	1470.42	1471.79	1473.16	1474.53	1475.89	1477.26	1478.63	1480.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 3433. TO 226670.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION EATOEB

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 331.	13.00		141.	43.	43.	43.
		(INCHES)	1.270	1.562	1.562	1.562
		(AC-FT)	70.	86.	86.	86.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (AC-FT)	(HR)				
2.	13.00	1.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (FEET)	(HR)				
1455.87	13.00	1454.98	1454.31	1454.31	1454.31

CUMULATIVE AREA = 1.03 SQ MI

1

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	SA19	1073.	12.25	147.	42.	42.	1.03		
+	ROUTED TO	EACAP	334.	12.75	141.	44.	44.	1.03		
+									1525.57	12.75
+	ROUTED TO	EATOEB	331.	13.00	141.	43.	43.	1.03		
+									1455.87	13.00

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

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             FEBRUARY 1981             *
*           REVISED 02 AUG 88           *
*                                       *
*  RUN DATE  04/17/1991  TIME  10:51:10 *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPE24PR.DAT
  2           ID   FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  pond removed
  3           ID   BY AGK ENGINEERS, INC.  March,1991- 24 hour rainfall ponding behind CAP
              *DIAGRAM
  4           IT       5                    288
  5           IO       3

  6           KK    SA19
  7           KM   SUB-AREA 19 - CONCENTRATION AT POINT EA
  8           BA   1.030
  9           IN      30
 10           PB    4.14
 11           PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 12           PC    .068    .071    .080    .089    .098    .109    .120    .133    .147    .163
 13           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 14           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 15           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 16           LG    .180    .340   4.380    .490  15.630
 17           UC    .533    .292
 18           UA       0       3       5       8      12      20      43      75      90      96
 19           UA     100

 20           KK   EACAP
 21           KM   STORAGE - DISCHARGE ROUTING AT CROSSING NO.1 -CAP CANAL
 22           RS       1    STOR       0
 23           SQ       0      62     200     400     540     625     750
 24           SE    1508    1511    1514    1520    1526    1532    1540
 25           SV       0     5.2    18.6    40.7    71.7   115.5   178.1   266.3
```

```
 26          SE    1508    1516    1520    1524    1528    1532    1536    1540

 27          KK  EATOEB
 28          KM   ROUTE EACAP FLOWS FROM POINT EA TO POINT EB
 29          RS       4    FLOW       0
 30          RC    .038    .038    .038    6120   .0114
 31          RX    9760    9870    9950    9990   10010   10080   10420   10600
 32          RY    1470    1457    1459    1454    1454    1476    1470    1480

 33          KK    SA20
 34          KM   SUB-AREA 20 - CONCENTRATION AT POINT EB
 35          BA    .610
 36          LG    .260    .350   4.140    .530   7.670
 37          UC    .467    .237
 38          UA       0       3       5       8      12      20      43      75      90      96
 39          UA     100

 40          KK      EB
 41          KM   COMBINE FLOWS EATOEB AND SA20
 42          HC       2

 43          KK  EBTOEC
 44          KM   ROUTE EB FLOWS TO POINT EC
 45          RS       6    FLOW       0
 46          RC    .041    .041    .041   9000.    .009
 47          RX    9660    9840    9995   10000   10025   10040   10080   10180
 48          RY    1427    1414    1414    1409    1409    1414    1415    1428
```



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

 49          KK    SA21
 50          KM   SUB-AREA 21 - CONCENTRATION AT POINT EC
 51          BA    .760
 52          LG    .290    .340   4.310    .570   4.580
 53          UC    .733    .469
 54          UA       0       3       5       8      12      20      43      75      90      96
 55          UA     100

 56          KK      EC
 57          KM   COMBINE FLOWS EBTOEC AND SA21
 58          HC       2

 59          KK  ECTOED
 60          KM   ROUTE FLOWS FROM POINT EC TO POINT ED
 61          RS       4    FLOW       0
 62          RC    .041    .041    .041   5500.   .0118
 63          RX    9530    9740    9900    9920   10030   10050   10210   10370
 64          RY    1285    1270    1275    1268    1270    1275    1271    1289

 65          KK    SA22
 66          KM   SUB-AREA 22 - CONCENTRATION AT POINT ED
 67          BA    .630
 68          LG    .320    .330   4.730    .490   1.340
 69          UC    .533    .324
 70          UA       0       3       5       8      12      20      43      75      90      96
 71          UA     100

 72          KK      ED
 73          KM   COMBINE FLOWS ECTOED AND SA22
 74          HC       2

 75          KK  EDTOEE
 76          KM   ROUTE ED FLOWS TO POINT EE (AT AGUA FRIA RIVER)
 77          RS       3    FLOW       0
```

```
 78          RC    .043    .043    .043    4380    .013
 79          RX    9700    9870    9930    9970   10000   10050   10080   10330
 80          RY    1366    1365    1360    1346    1350    1352    1350    1384

 81          KK    SA23
 82          KM   SUB-AREA 23 - CONCENTRATION AT POINT EE ( AGUA FRIA RIVER)
 83          BA    .330
 84          LG    .310    .350   4.030    .630    .070
 85          UC    .367    .197
 86          UA       0       3       5       8      12      20      43      75      90      96
 87          UA     100

 88          KK      EE
 89          KM   COMBINE FLOWS EDTOEE AND SA23
 90          HC       2
 91          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   6        SA19
               V
               V
  20       EACAP
               V
               V
  27      EATOEB
               .
               .
  33           .        SA20
               .           .
               .           .
  40          EB............
               V
               V
  43      EBTOEC
               .
               .
  49           .        SA21
               .           .
               .           .
  56          EC............
               V
               V
  59      ECTOED
               .
               .
  65           .        SA22
               .           .
               .           .
  72          ED............
               V
               V
  75      EDTOEE
               .
               .
  81           .        SA23
               .           .
               .           .
  88          EE............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                                                    ****************************************
```

```
*                                        *                                                    *                                        *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                                    *    U.S. ARMY CORPS OF ENGINEERS        *
*             FEBRUARY 1981              *                                                    *  THE HYDROLOGIC ENGINEERING CENTER     *
*           REVISED 02 AUG 88            *                                                    *          609 SECOND STREET             *
*                                        *                                                    *       DAVIS, CALIFORNIA 95616          *
*  RUN DATE  04/17/1991  TIME  10:51:10  *                                                    *           (916) 551-1748               *
*                                        *                                                    *                                        *
******************************************                                                    ******************************************


                        CAP OVERCHUTES EAST BRANCH (CATERPILLAR TANK WASH) CAPE24PR.DAT
                        FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  pond removed
                        BY AGK ENGINEERS, INC.  March,1991- 24 hour rainfall ponding behind CAP

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   23.92 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


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


          **************
          *            *
  6 KK    *      SA19  *
          *            *
          **************
                        SUB-AREA 19 - CONCENTRATION AT POINT EA

  9 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         30  TIME INTERVAL IN MINUTES
                     JXDATE      1   0  STARTING DATE
                     JXTIME          0  STARTING TIME

            SUBBASIN RUNOFF DATA

  8 BA          SUBBASIN CHARACTERISTICS
                      TAREA       1.03  SUBBASIN AREA

            PRECIPITATION DATA
```

```
10 PB                STORM        4.14  BASIN TOTAL PRECIPITATION

11 PI            INCREMENTAL 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       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .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       .06       .06
                     .06       .06       .06       .06       .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
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00

16 LG            GREEN AND AMPT LOSS RATE
                      STRTL        .18  STARTING LOSS
                        DTH        .34  MOISTURE DEFICIT
                       PSIF       4.38  WETTING FRONT SUCTION
                      XKSAT        .49  HYDRAULIC CONDUCTIVITY
                      RTIMP      15.63  PERCENT IMPERVIOUS AREA

17 UC            CLARK UNITGRAPH
                         TC        .53  TIME OF CONCENTRATION
                          R        .29  STORAGE COEFFICIENT

18 UA            ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                        .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                     100.0

                                                   ***

                                          UNIT HYDROGRAPH PARAMETERS
                                     CLARK   TC=   .53 HR,       R=   .29 HR
                                    SNYDER   TP=   .45 HR,      CP=   .90

                                              UNIT HYDROGRAPH
                                          23 END-OF-PERIOD ORDINATES
            41.      116.      220.      590.     1137.     1315.     1114.      860.      645.      484.
           363.      273.      204.      153.      115.       86.       65.       49.       36.       27.
            21.       15.       12.

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

                      HYDROGRAPH AT STATION     SA19

 TOTAL RAINFALL =    4.14, TOTAL LOSS =    2.62, TOTAL EXCESS =    1.52
```

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.92-HR
+   (CFS)       (HR)
                          (CFS)
+    1073.     12.25                147.         42.         42.         42.
                        (INCHES)   1.327       1.512       1.512       1.512
                         (AC-FT)    73.         83.         83.         83.

                        CUMULATIVE AREA =    1.03 SQ MI
```

*** ***

```
            **************
            *            *
  20 KK     *     EACAP  *
            *            *
            **************
                          STORAGE - DISCHARGE ROUTING AT CROSSING NO.1 -CAP CANAL

               HYDROGRAPH ROUTING DATA

  22 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC        .00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

  25 SV            STORAGE         .0       5.2      18.6      40.7      71.7     115.5     178.1     266.3

  26 SE          ELEVATION     1508.00   1516.00   1520.00   1524.00   1528.00   1532.00   1536.00   1540.00

  23 SQ          DISCHARGE         0.       62.      200.      400.      540.      625.      750.

  24 SE          ELEVATION     1508.00   1511.00   1514.00   1520.00   1526.00   1532.00   1540.00

                                                                  ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

            STORAGE       .00      1.95      3.90      5.20     18.60     40.70     56.20     71.70    115.50    178.10
            OUTFLOW       .00     62.00    200.00    266.67    400.00    493.33    540.00    568.33    625.00    687.50
          ELEVATION   1508.00   1511.00   1514.00   1516.00   1520.00   1524.00   1526.00   1528.00   1532.00   1536.00

            STORAGE    266.30
            OUTFLOW    750.00
          ELEVATION   1540.00

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

                        HYDROGRAPH AT STATION    EACAP

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.92-HR
+   (CFS)       (HR)
                          (CFS)
+     450.     12.67                147.         42.         42.         42.
                        (INCHES)   1.326       1.509       1.509       1.509
                         (AC-FT)    73.         83.         83.         83.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     23.92-HR
```

```
+  (AC-FT)      (HR)
      30.      12.67                    7.          2.          2.          2.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR       72-HR     23.92-HR
+   (FEET)      (HR)
   1522.15      12.67                1512.78      1509.44     1509.44      1509.44

                         CUMULATIVE AREA =    1.03 SQ MI



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


            **************
            *            *
  27 KK     *    EATOEB  *
            *            *
            **************
                          ROUTE EACAP FLOWS FROM POINT EA TO POINT EB

              HYDROGRAPH ROUTING DATA

  29 RS         STORAGE ROUTING
                      NSTPS           4  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC         .00  INITIAL CONDITION
                          X         .00 WORKING R AND D COEFFICIENT

  30 RC         NORMAL DEPTH CHANNEL ROUTING
                        ANL        .038  LEFT OVERBANK N-VALUE
                       ANCH        .038  MAIN CHANNEL N-VALUE
                        ANR        .038  RIGHT OVERBANK N-VALUE
                      RLNTH       6120.  REACH LENGTH
                        SEL       .0114  ENERGY SLOPE
                      ELMAX          .0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  32 RY        ELEVATION   1470.00   1457.00   1459.00   1454.00   1454.00   1476.00   1470.00   1480.00
  31 RX        DISTANCE    9760.00   9870.00   9950.00   9990.00  10010.00  10080.00  10420.00  10600.00

                                                          ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      5.32     13.57     28.93     58.99     94.81    133.69    175.64    220.65    268.72
          OUTFLOW        .00    164.99    617.70   1493.46   3432.74   6754.86  11144.73  16576.23  23051.31  30585.14
        ELEVATION    1454.00   1455.37   1456.74   1458.11   1459.47   1460.84   1462.21   1463.58   1464.95   1466.32

          STORAGE     319.86    374.05    432.14    506.53    601.40    716.76    852.59   1002.20   1156.59   1315.71
          OUTFLOW   39200.14  48922.91  60167.73  73870.14  89919.31 108855.40 131140.20 159372.10 191319.00 226670.30
        ELEVATION    1467.68   1469.05   1470.42   1471.79   1473.16   1474.53   1475.89   1477.26   1478.63   1480.00


*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     3433. TO   226670.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                          HYDROGRAPH AT STATION   EATOEB

 PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
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                                        6-HR        24-HR        72-HR      23.92-HR
+   (CFS)       (HR)
                            (CFS)
+     447.     12.92                    147.         42.          42.          42.
                         (INCHES)     1.326        1.507        1.507        1.507
                          (AC-FT)      73.          83.          83.          83.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR      23.92-HR
+  (AC-FT)      (HR)
       3.      12.92                      1.          0.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR      23.92-HR
+   (FEET)      (HR)
   1456.22     12.92                 1454.86     1454.26      1454.26      1454.26

                          CUMULATIVE AREA =    1.03 SQ MI


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


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            *            *
  33 KK     *      SA20  *
            *            *
            **************
                           SUB-AREA 20 - CONCENTRATION AT POINT EB

               SUBBASIN RUNOFF DATA

  35 BA          SUBBASIN CHARACTERISTICS
                       TAREA          .61  SUBBASIN AREA

                 PRECIPITATION DATA

  10 PB                STORM        4.14  BASIN TOTAL PRECIPITATION

  11 PI            INCREMENTAL 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
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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       .00       .00       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .06       .06
                      .06       .06       .06       .06       .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
                      .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

 36 LG        GREEN AND AMPT LOSS RATE
                STRTL        .26  STARTING LOSS
                  DTH        .35  MOISTURE DEFICIT
                 PSIF       4.14  WETTING FRONT SUCTION
                XKSAT        .53  HYDRAULIC CONDUCTIVITY
                RTIMP       7.67  PERCENT IMPERVIOUS AREA

 37 UC        CLARK UNITGRAPH
                   TC        .47  TIME OF CONCENTRATION
                    R        .24  STORAGE COEFFICIENT

 38 UA        ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                  .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
               100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                     CLARK   TC=   .47 HR,       R=   .24 HR
                                    SNYDER   TP=   .40 HR,      CP=   .94

                                            UNIT HYDROGRAPH
                                         19 END-OF-PERIOD ORDINATES
            32.       95.      233.      635.      921.      808.      598.      419.      294.      206.
           144.      101.       71.       50.       35.       24.       17.       12.        8.

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

                     HYDROGRAPH AT STATION     SA20

   TOTAL RAINFALL =    4.14, TOTAL LOSS =    2.91, TOTAL EXCESS =    1.23

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.92-HR
+   (CFS)       (HR)
                          (CFS)
+     643.     12.25                 74.         20.         20.         20.
                        (INCHES)    1.132       1.223       1.223       1.223
                         (AC-FT)     37.         40.         40.         40.

                        CUMULATIVE AREA =     .61 SQ MI


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


           **************
           *            *
 40 KK     *        EB  *
           *            *
           **************
                      COMBINE FLOWS EATOEB AND SA20

 42 HC        HYDROGRAPH COMBINATION
                ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

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

                        HYDROGRAPH AT STATION       EB

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     23.92-HR
+   (CFS)       (HR)
                            (CFS)
+     869.     12.33                221.        62.         62.         62.
                        (INCHES)   1.253       1.401       1.401       1.401
                         (AC-FT)   110.        123.        123.        123.

                        CUMULATIVE AREA =    1.64 SQ MI


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


            **************
            *            *
  43 KK     *    EBTOEC  *
            *            *
            **************
                          ROUTE EB FLOWS TO POINT EC

               HYDROGRAPH ROUTING DATA

  45 RS          STORAGE ROUTING
                       NSTPS           6  NUMBER OF SUBREACHES
                        ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC         .00  INITIAL CONDITION
                           X         .00 WORKING R AND D COEFFICIENT

  46 RC          NORMAL DEPTH CHANNEL ROUTING
                         ANL        .041  LEFT OVERBANK N-VALUE
                        ANCH        .041  MAIN CHANNEL N-VALUE
                         ANR        .041  RIGHT OVERBANK N-VALUE
                       RLNTH       9000.  REACH LENGTH
                         SEL       .0090  ENERGY SLOPE
                       ELMAX          .0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                      CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  48 RY        ELEVATION   1427.00   1414.00   1414.00   1409.00   1409.00   1414.00   1415.00   1428.00
  47 RX        DISTANCE    9660.00   9840.00   9995.00  10000.00  10025.00  10040.00  10080.00  10180.00

                                                          ***

                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      5.58     11.98     19.21     27.27     36.16     83.04    137.71    196.84    260.41
          OUTFLOW        .00     87.60    284.63    574.96    956.71   1431.54   2682.49   4878.72   7869.28  11613.74
        ELEVATION    1409.00   1410.00   1411.00   1412.00   1413.00   1414.00   1415.00   1416.00   1417.00   1418.00

          STORAGE     328.43    400.91    477.83    559.20    645.03    735.30    830.02    929.20   1032.82   1139.46
          OUTFLOW   16102.75  21340.20  27336.88  34107.53  41669.38  50041.18  59242.68  69294.32  80216.89  93397.06
        ELEVATION    1419.00   1420.00   1421.00   1422.00   1423.00   1424.00   1425.00   1426.00   1427.00   1428.00


*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      957. TO    93397.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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HYDROGRAPH AT STATION EBTOEC

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 807.	12.58		221.	62.	62.	62.
		(INCHES)	1.253	1.396	1.396	1.396
		(AC-FT)	110.	122.	122.	122.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (AC-FT)	(HR)				
4.	12.58	1.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (FEET)	(HR)				
1412.61	12.58	1410.37	1409.42	1409.42	1409.42

CUMULATIVE AREA = 1.64 SQ MI

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              *            *
  49 KK       *     SA21   *
              *            *
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SUB-AREA 21 - CONCENTRATION AT POINT EC

SUBBASIN RUNOFF DATA

51 BA SUBBASIN CHARACTERISTICS

TAREA .76 SUBBASIN AREA

PRECIPITATION DATA

10 PB STORM 4.14 BASIN TOTAL PRECIPITATION

11 PI INCREMENTAL 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
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.00	.00	.00	.00	.00	.00	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.06	.06
.06	.06	.06	.06	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.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

52 LG        GREEN AND AMPT LOSS RATE
                STRTL        .29  STARTING LOSS
                  DTH        .34  MOISTURE DEFICIT
                 PSIF       4.31  WETTING FRONT SUCTION
                XKSAT        .57  HYDRAULIC CONDUCTIVITY
                RTIMP       4.58  PERCENT IMPERVIOUS AREA

53 UC        CLARK UNITGRAPH
                   TC        .73  TIME OF CONCENTRATION
                    R        .47  STORAGE COEFFICIENT

54 UA        ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                  .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
               100.0

                                                  ***

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC=   .73 HR,       R=   .47 HR
                                  SNYDER   TP=   .61 HR,      CP=   .80

                                             UNIT HYDROGRAPH
                                          36 END-OF-PERIOD ORDINATES
            16.       41.       65.      105.      213.      432.      619.      649.      594.      514.
           430.      360.      301.      252.      211.      177.      148.      124.      103.       87.
            72.       61.       51.       42.       36.       30.       25.       21.       17.       15.
            12.       10.        9.        7.        6.        5.

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

                     HYDROGRAPH AT STATION     SA21

   TOTAL RAINFALL =    4.14, TOTAL LOSS =    3.06, TOTAL EXCESS =    1.08

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.92-HR
+   (CFS)      (HR)
                          (CFS)
+    527.     12.42                 84.         22.         22.         22.
                         (INCHES)  1.024       1.078       1.078       1.078
                          (AC-FT)    42.         44.         44.         44.

                         CUMULATIVE AREA =     .76 SQ MI


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


          **************
          *            *
 56 KK    *        EC  *
          *            *
          **************
                       COMBINE FLOWS EBTOEC AND SA21
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 58 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                        HYDROGRAPH AT STATION       EC

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.92-HR
+   (CFS)      (HR)
                          (CFS)
+    1302.     12.50                305.         84.         84.         84.
                       (INCHES)    1.180       1.296       1.296       1.296
                        (AC-FT)     151.        166.        166.        166.

                       CUMULATIVE AREA =    2.40 SQ MI


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


           **************
           *            *
 59 KK     *    ECTOED  *
           *            *
           **************
                         ROUTE FLOWS FROM POINT EC TO POINT ED

             HYDROGRAPH ROUTING DATA

 61 RS          STORAGE ROUTING
                      NSTPS           4  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC        .00  INITIAL CONDITION
                           X        .00 WORKING R AND D COEFFICIENT

 62 RC          NORMAL DEPTH CHANNEL ROUTING
                        ANL        .041  LEFT OVERBANK N-VALUE
                       ANCH        .041  MAIN CHANNEL N-VALUE
                        ANR        .041  RIGHT OVERBANK N-VALUE
                      RLNTH       5500.  REACH LENGTH
                        SEL       .0118  ENERGY SLOPE
                      ELMAX          .0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                         CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 64 RY        ELEVATION   1285.00   1270.00   1275.00   1268.00   1270.00   1275.00   1271.00   1289.00
 63 RX        DISTANCE    9530.00   9740.00   9900.00   9920.00  10030.00  10050.00  10210.00  10370.00

                                                                  ***

                                         COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      4.46     17.83     39.92     75.77    127.31    194.55    274.78    359.22    447.18
          OUTFLOW        .00     93.75    623.39   1940.99   4263.73   8007.33  13513.00  21795.74  32471.85  45075.64
        ELEVATION    1268.00   1269.11   1270.21   1271.32   1272.42   1273.53   1274.63   1275.74   1276.84   1277.95

          STORAGE     538.68    633.70    732.26    834.35    939.96   1049.11   1161.38   1275.17   1390.33   1506.87
          OUTFLOW   59556.23  75886.84  94055.82 114061.50 135909.40 159609.80 186287.60 215540.50 246662.00 279627.50
        ELEVATION    1279.05   1280.16   1281.26   1282.37   1283.47   1284.58   1285.68   1286.79   1287.89   1289.00
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*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 4264. TO 279627.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION ECTOED

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	23.92-HR
		(CFS)				
1232.	12.75		304.	84.	84.	84.
		(INCHES)	1.179	1.293	1.293	1.293
		(AC-FT)	151.	165.	165.	165.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	23.92-HR
7.	12.75	2.	1.	1.	1.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	23.92-HR
1270.72	12.75	1269.26	1268.40	1268.40	1268.40

CUMULATIVE AREA = 2.40 SQ MI

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*            *
*      SA22  *
*            *
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65 KK

SUB-AREA 22 - CONCENTRATION AT POINT ED

SUBBASIN RUNOFF DATA

67 BA SUBBASIN CHARACTERISTICS

TAREA .63 SUBBASIN AREA

PRECIPITATION DATA

10 PB STORM 4.14 BASIN TOTAL PRECIPITATION

11 PI INCREMENTAL 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	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.06	.06

.06	.06	.06	.06	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.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	.00	.00	.00			

68 LG GREEN AND AMPT LOSS RATE

STRTL	.32	STARTING LOSS
DTH	.33	MOISTURE DEFICIT
PSIF	4.73	WETTING FRONT SUCTION
XKSAT	.49	HYDRAULIC CONDUCTIVITY
RTIMP	1.34	PERCENT IMPERVIOUS AREA

69 UC CLARK UNITGRAPH

TC	.53	TIME OF CONCENTRATION
R	.32	STORAGE COEFFICIENT

70 UA ACCUMULATED-AREA VS. TIME, 11 ORDINATES

.0	3.0	5.0	8.0	12.0	20.0	43.0	75.0	90.0	96.0
100.0									

***

UNIT HYDROGRAPH PARAMETERS

CLARK TC= .53 HR, R= .32 HR

SNYDER TP= .46 HR, CP= .86

UNIT HYDROGRAPH

25 END-OF-PERIOD ORDINATES

23.	65.	125.	333.	645.	756.	654.	519.	401.	309.
239.	184.	142.	110.	85.	66.	51.	39.	30.	23.
18.	14.	11.	8.	6.					

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

HYDROGRAPH AT STATION SA22

TOTAL RAINFALL = 4.14, TOTAL LOSS = 3.11, TOTAL EXCESS = 1.03

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 555.	12.33		69.	17.	17.	17.
		(INCHES)	1.013	1.029	1.029	1.029
		(AC-FT)	34.	35.	35.	35.

CUMULATIVE AREA = .63 SQ MI

*** ***

****

```
          *            *
 72 KK    *        ED  *
          *            *
          ***************
                        COMBINE FLOWS ECTOED AND SA22

 74 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                       HYDROGRAPH AT STATION       ED

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     23.92-HR
+  (CFS)       (HR)
                          (CFS)
+   1427.     12.67                373.        101.        101.        101.
                       (INCHES)    1.145       1.238       1.238       1.238
                        (AC-FT)    185.        200.        200.        200.

                       CUMULATIVE AREA =    3.03 SQ MI



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


          ***************
          *            *
 75 KK    *    EDTOEE  *
          *            *
          ***************
                        ROUTE ED FLOWS TO POINT EE (AT AGUA FRIA RIVER)

             HYDROGRAPH ROUTING DATA

 77 RS          STORAGE ROUTING
                      NSTPS           3  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC         .00  INITIAL CONDITION
                          X         .00 WORKING R AND D COEFFICIENT

 78 RC          NORMAL DEPTH CHANNEL ROUTING
                        ANL        .043  LEFT OVERBANK N-VALUE
                       ANCH        .043  MAIN CHANNEL N-VALUE
                        ANR        .043  RIGHT OVERBANK N-VALUE
                      RLNTH       4380.  REACH LENGTH
                        SEL       .0130  ENERGY SLOPE
                      ELMAX          .0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                     CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 80 RY        ELEVATION   1366.00   1365.00   1360.00   1346.00   1350.00   1352.00   1350.00   1384.00
 79 RX        DISTANCE    9700.00   9870.00   9930.00   9970.00  10000.00  10050.00  10080.00  10330.00

                                                                  ***

                                     COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      2.08      8.33     26.76     57.34     92.03    130.82    173.72    222.56    279.19
          OUTFLOW        .00     80.62    511.89   1677.68   5298.25  10709.51  17895.13  26897.58  38510.98  52510.50
        ELEVATION    1346.00   1348.00   1350.00   1352.00   1354.00   1356.00   1358.00   1360.00   1362.00   1364.00
```

STORAGE	351.54	453.10	557.61	665.09	775.51	888.90	1005.24	1124.54	1246.80	1372.02
OUTFLOW	68783.66	91535.23	119130.10	151186.70	187510.30	227985.50	272539.80	321127.40	373720.70	430304.90
ELEVATION	1366.00	1368.00	1370.00	1372.00	1374.00	1376.00	1378.00	1380.00	1382.00	1384.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 1678. TO 430305.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION EDTOEE

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1358.	12.92		373.	101.	101.	101.
		(INCHES)	1.144	1.237	1.237	1.237
		(AC-FT)	185.	200.	200.	200.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (AC-FT)	(HR)				
7.	12.92	2.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (FEET)	(HR)				
1351.45	12.92	1348.80	1346.89	1346.89	1346.89

CUMULATIVE AREA = 3.03 SQ MI

*** ***

```
              **************
              *            *
  81 KK       *     SA23   *
              *            *
              **************
```

SUB-AREA 23 - CONCENTRATION AT POINT EE (AGUA FRIA RIVER)

SUBBASIN RUNOFF DATA

83 BA SUBBASIN CHARACTERISTICS
TAREA .33 SUBBASIN AREA

PRECIPITATION DATA

10 PB STORM 4.14 BASIN TOTAL PRECIPITATION

11 PI INCREMENTAL 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	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.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	.06	.06
.06	.06	.06	.06	.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
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00			

```
84 LG          GREEN AND AMPT LOSS RATE
                     STRTL         .31  STARTING LOSS
                       DTH         .35  MOISTURE DEFICIT
                      PSIF        4.03  WETTING FRONT SUCTION
                     XKSAT         .63  HYDRAULIC CONDUCTIVITY
                     RTIMP         .07  PERCENT IMPERVIOUS AREA

85 UC          CLARK UNITGRAPH
                        TC         .37  TIME OF CONCENTRATION
                         R         .20  STORAGE COEFFICIENT

86 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                      .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                   100.0

                                                   ***

                                          UNIT HYDROGRAPH PARAMETERS
                                     CLARK   TC=   .37 HR,       R=   .20 HR
                                    SNYDER   TP=   .32 HR,      CP=   .88

                                              UNIT HYDROGRAPH
                                          16 END-OF-PERIOD ORDINATES
             26.       90.      340.      578.      515.      351.      229.      149.       97.       63.
             41.       27.       17.       11.        7.        5.

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

                     HYDROGRAPH AT STATION     SA23

   TOTAL RAINFALL =    4.14, TOTAL LOSS =    3.25, TOTAL EXCESS =     .89

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     23.92-HR
+   (CFS)       (HR)
                          (CFS)
+    327.      12.17                    31.         8.          8.          8.
                        (INCHES)      .885        .886        .886        .886
                         (AC-FT)       16.         16.         16.         16.

                        CUMULATIVE AREA =     .33 SQ MI
```

*** ***

```
            **************
            *            *
  88 KK     *        EE  *
            *            *
            **************
                          COMBINE FLOWS EDTOEE AND SA23

  90 HC          HYDROGRAPH COMBINATION
                       ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                        HYDROGRAPH AT STATION       EE

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.92-HR
+  (CFS)       (HR)
                          (CFS)
+   1369.     12.92                404.        109.        109.        109.
                        (INCHES)   1.119       1.202       1.202       1.202
                         (AC-FT)   200.        215.        215.        215.

                        CUMULATIVE AREA =    3.36 SQ MI

1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION    FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                     6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                         SA19    1073.   12.25        147.        42.         42.       1.03

        ROUTED TO
+                        EACAP     450.   12.67        147.        42.         42.       1.03
+                                                                                        1522.15      12.67

        ROUTED TO
+                       EATOEB     447.   12.92        147.        42.         42.       1.03
+                                                                                        1456.22      12.92

        HYDROGRAPH AT
+                         SA20     643.   12.25         74.        20.         20.        .61

        2 COMBINED AT
+                           EB     869.   12.33        221.        62.         62.       1.64

        ROUTED TO
+                       EBTOEC     807.   12.58        221.        62.         62.       1.64
+                                                                                        1412.61      12.58

        HYDROGRAPH AT
+                         SA21     527.   12.42         84.        22.         22.        .76

        2 COMBINED AT
+                           EC    1302.   12.50        305.        84.         84.       2.40

        ROUTED TO
```

	ECTOED	1232.	12.75	304.	84.	84.	2.40		
+								1270.72	12.75
HYDROGRAPH AT									
+	SA22	555.	12.33	69.	17.	17.	.63		
2 COMBINED AT									
+	ED	1427.	12.67	373.	101.	101.	3.03		
ROUTED TO									
+	EDTOEE	1358.	12.92	373.	101.	101.	3.03		
+								1351.45	12.92
HYDROGRAPH AT									
+	SA23	327.	12.17	31.	8.	8.	.33		
2 COMBINED AT									
+	EE	1369.	12.92	404.	109.	109.	3.36		

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

APPENDIX H

LEVEE ANALYSIS FOR C.A.P. CANAL

ACK ENGINEERS, INC.
2255 N. 44th St. • Phoenix, Az. 85008 • Phone (602) 244-2566

SHEET _____ OF _____
BY Hem DATE 4/91
CHECK SEK DATE 4/91
CLIENT FCDMC
JOB CAP Overchutes
JOB NO. 310.42

LEVEE ANALYSIS FOR C.A.P. CANAL

The existing C.A.P. Canal was evaluated as a levee in this study. The water surface elevations resulting from ponding behind the canal were estimated by use of the level-pool reservoir routing method in the HEC-1 program. For Twin Buttes Wash, elevations resulting from both 6-hour and 24-hour storms were analyzed. For Caterpillar Tank Wash, the following three conditions were analyzed:

- Ponding elevation from a 6-hour storm with the stock pond in place and full at the beginning of the storm
- Ponding elevation from a 6-hour storm without the stock pond downstream of the 72-inch pipe culvert with assumed inlet control
- Ponding elevation from a 24-hour storm with the stock pond in place and full at the beginning of the storm.

Crossing No.	C.A.P. Station	Pipe Size	Upstream Inv. Elev.	Downstream Inv. Elev.	Watershed Name
1	561+40	72"	1508.00	1505.95	Caterpillar Tank
2	549+00	30"	1513.94	1508.09	Twin Buttes
3	538+25	30"	1518.99	1510.74	Twin Buttes
4	492+30	4 - 72"	1500.13	1494.08	Twin Buttes
5	480+90	30"	1515.92	1512.09	Twin Buttes
6	459+30	30"	1519.13	1512.93	Twin Buttes

CAK ENGINEERS, INC.
2255 N. 44th St. • Phoenix, Az. 85008 • Phone (602) 244-2566

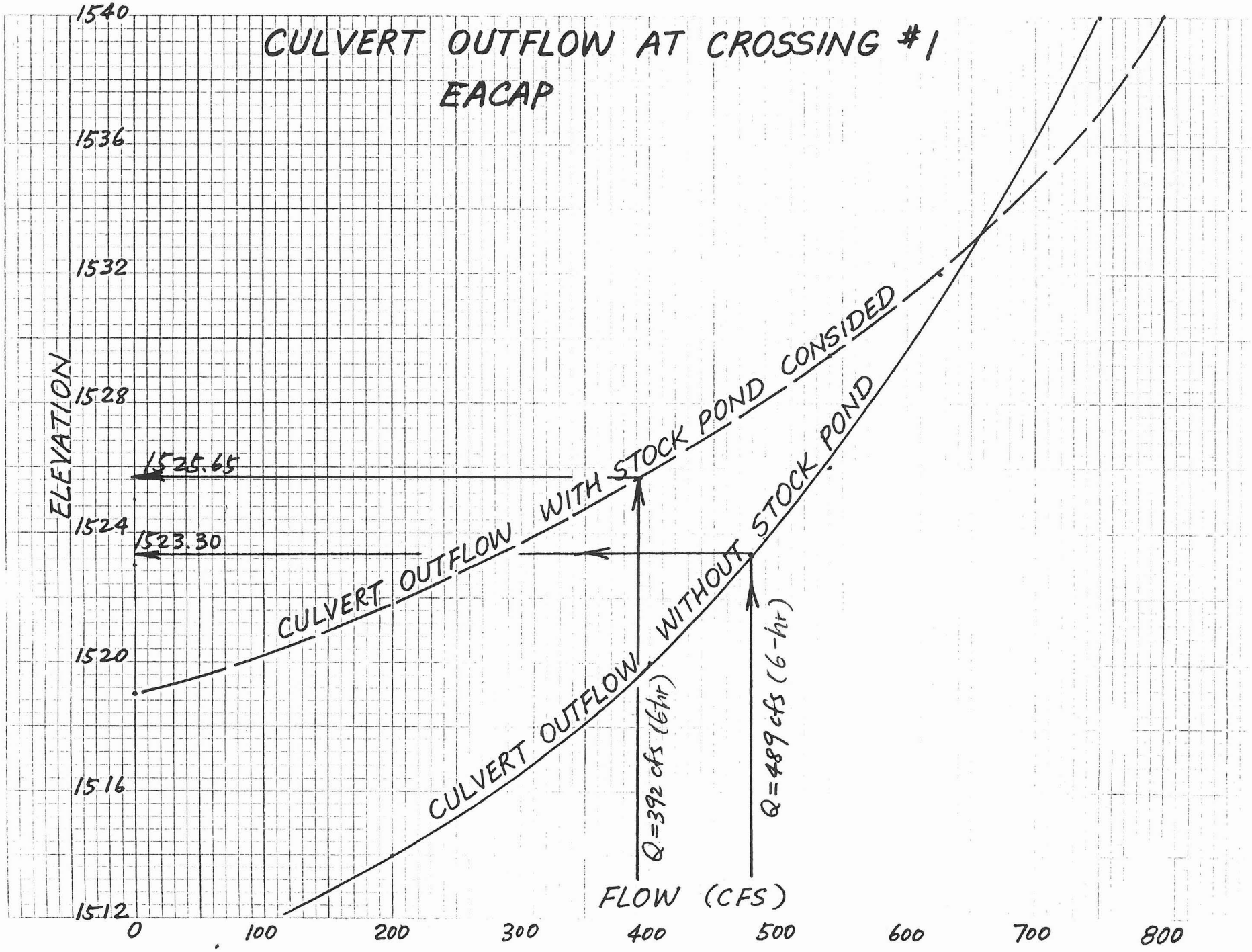
SHEET _____ OF _____
BY HEM DATE 4/91
CHECK SEK DATE 4/91
CLIENT _____
JOB _____ JOB NO. 310.42

CATERPILLAR WASH

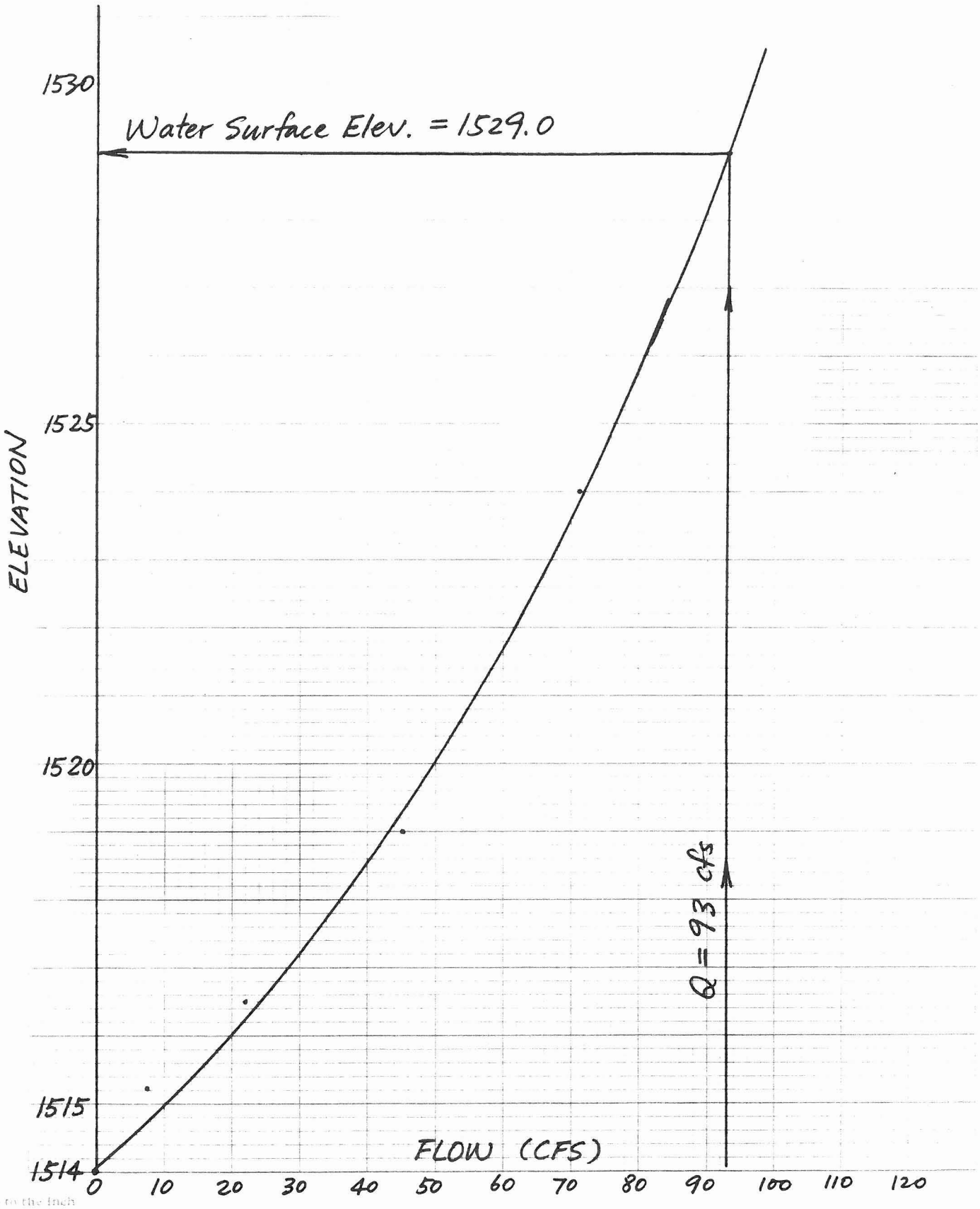
Crossing No.	Sta.	HEC-1 I.D.	Pipe Size	Water Surface Elev. Behind C.A.P. 6-hr Storm w/ Pond	6-hr Storm w/o Pond	24-hr w/ Pond	24-hr w/o Pond
1	561+40	EACAP	72"	1525.65	1523.30	1525.57	1522.15

TWIN BUTTE WASH

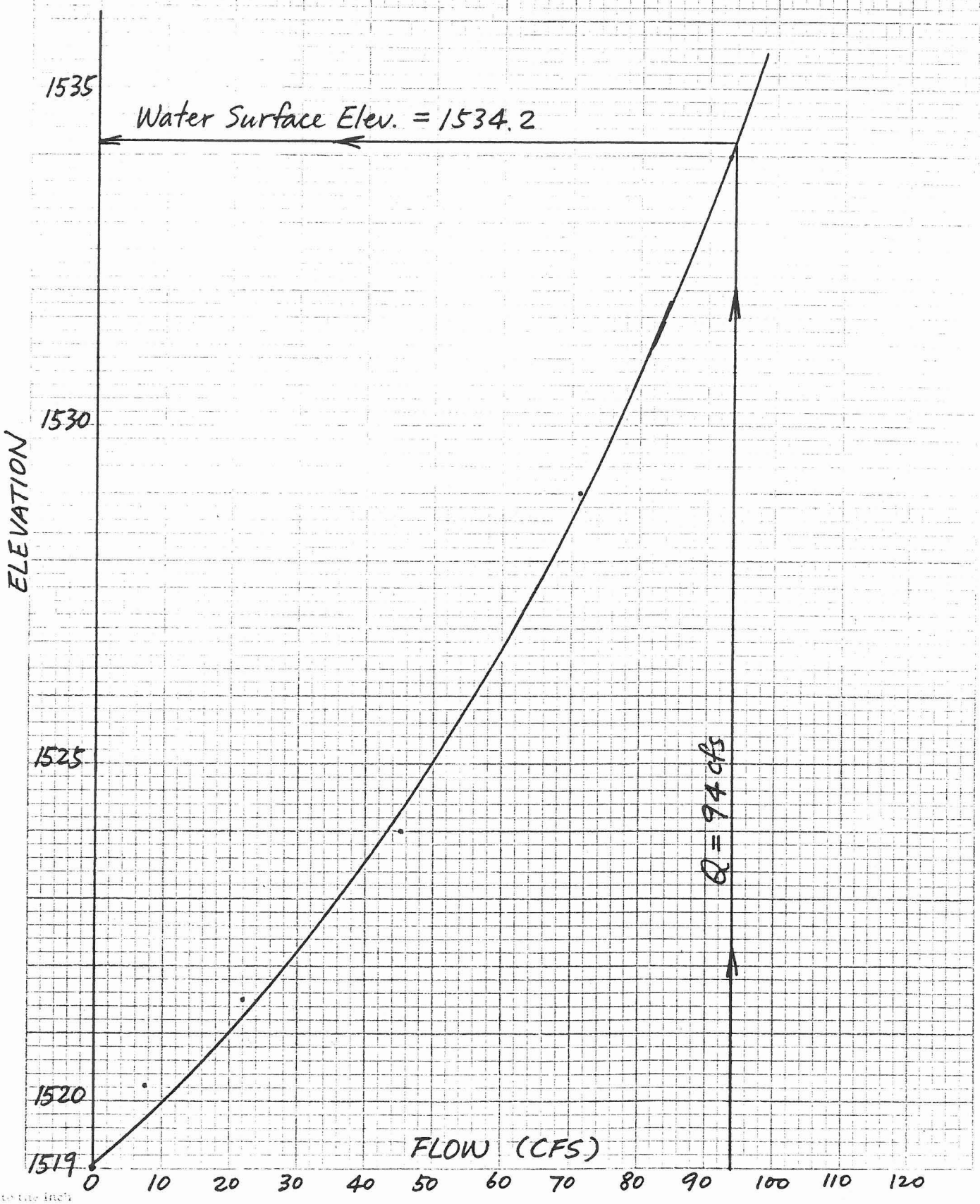
Crossing No.	Sta.	HEC-1 I.D.	Pipe Size	Water Surface Elev. Behind C.A.P. 6-hr Storm	24-hr Storm
2	549+00	QCAP	30"	1529.0	1526.3
3	538+25	PCAP	30"	1534.2	1532.2
4	492+30	CCAP	4-72"	1518.0	1516.9
5	480+90	FCAP	30"	1532.1	1531.1
6	459+30	GCAP	30"	1533.2	1532.0

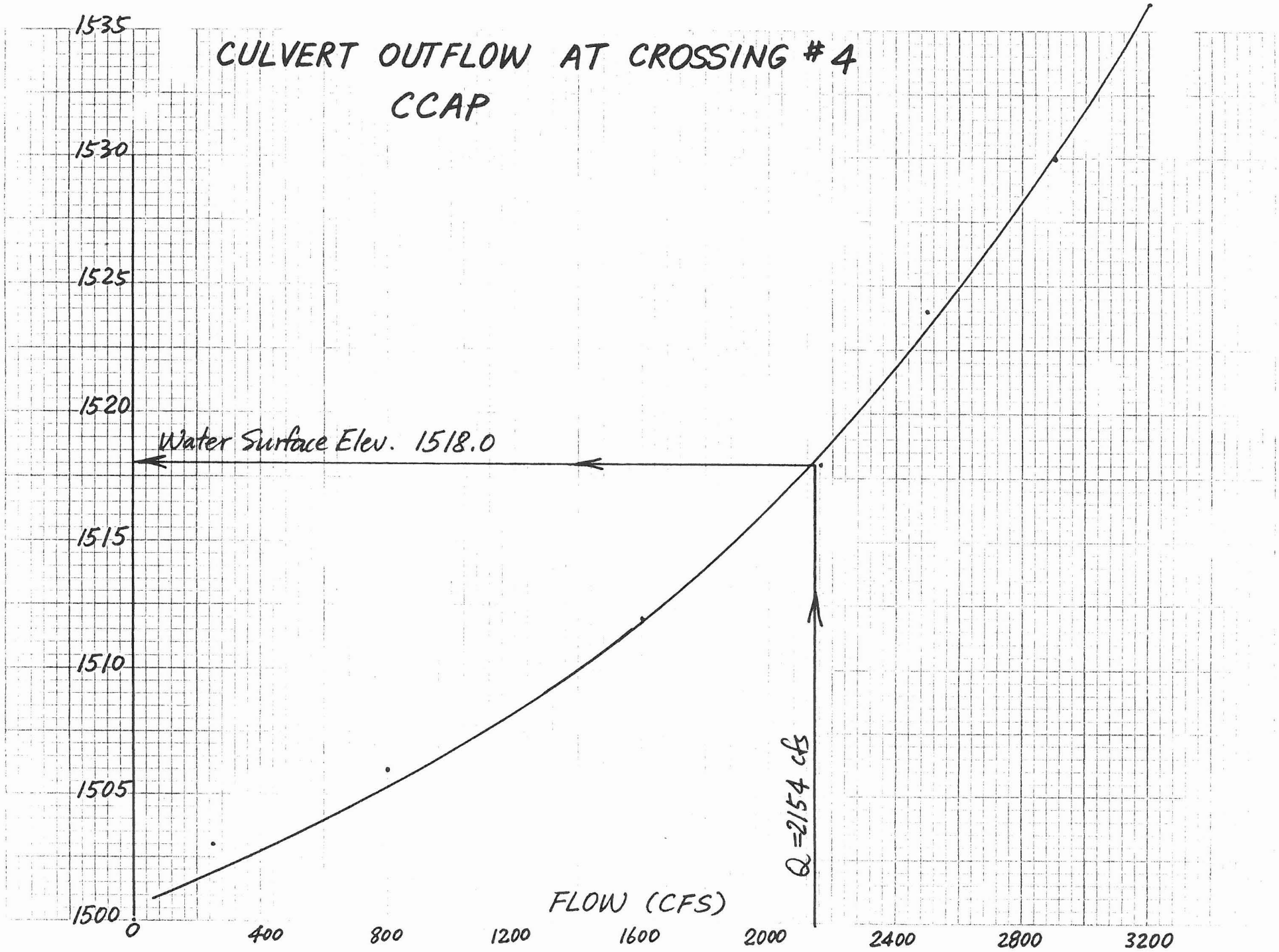

CULVERT OUTFLOW AT CROSSING #1
EACAP
ELEVATION
1540
1536
1532
1528
1525.65
1524
1523.30
1520
1516
1512
0
100
200
300
400
500
600
700
800
FLOW (CFS)
CULVERT OUTFLOW WITH STOCK POND CONSIDED
CULVERT OUTFLOW WITHOUT STOCK POND
Q=392 cfs (6-hr)
Q=489 cfs (6-hr)

CULVERT OUTFLOW AT CROSSING # 2
QCAP

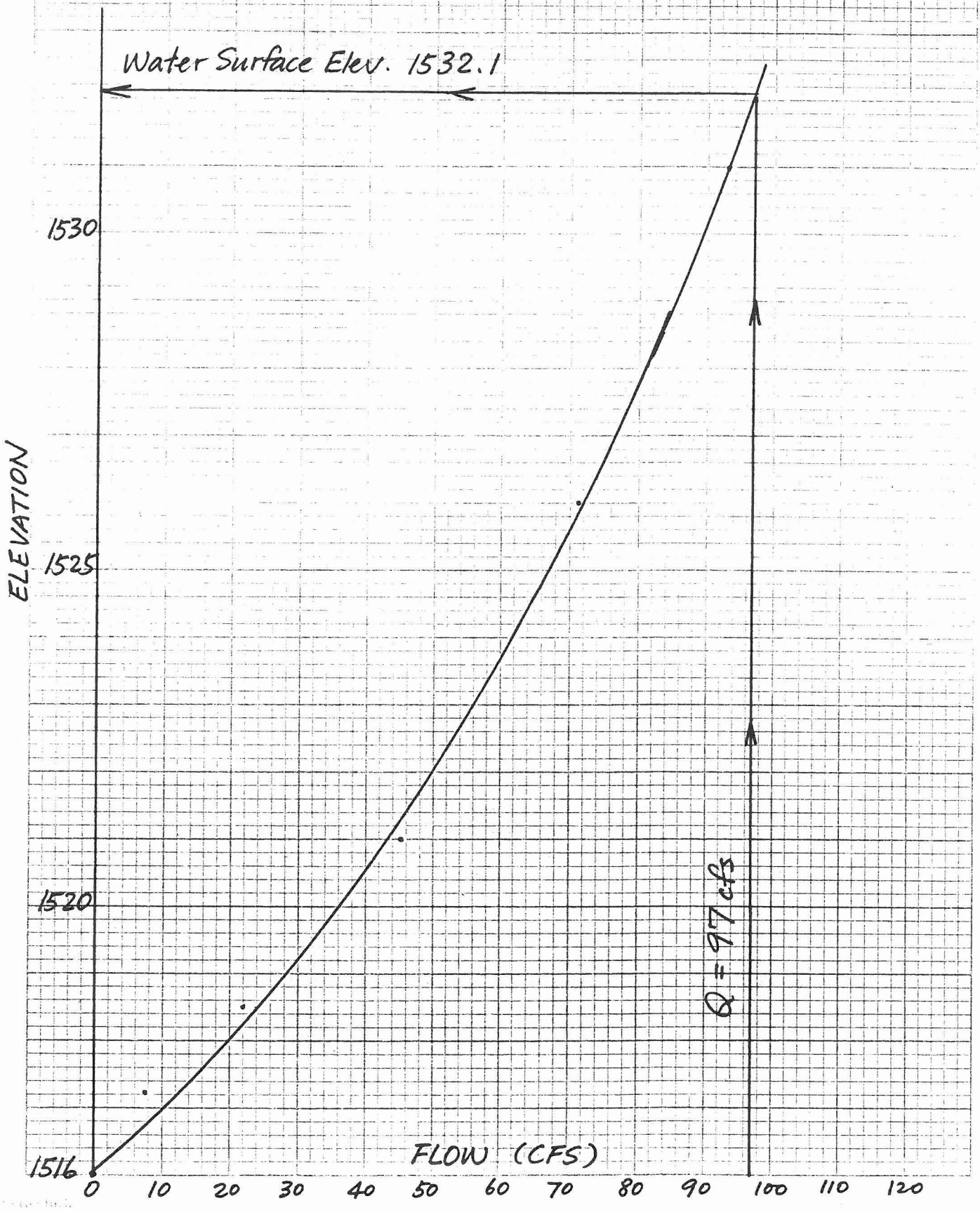


CULVERT OUTFLOW AT CROSSING #3
PCAP



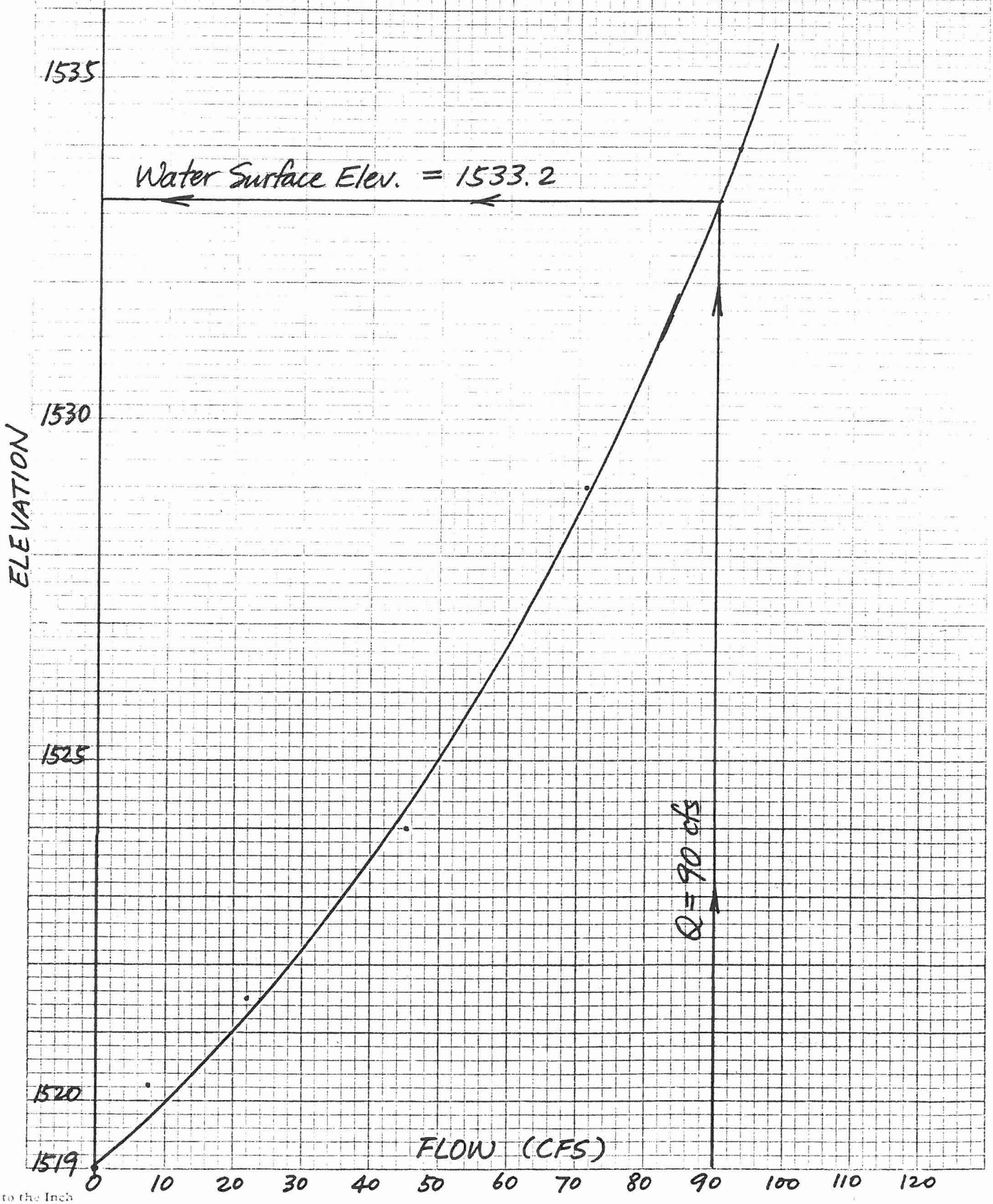

CULVERT OUTFLOW AT CROSSING #4
CCAP
1535
1530
1525
1520
1515
1510
1505
1500
Water Surface Elev. 1518.0
Q = 2154 cfs
FLOW (CFS)
0
400
800
1200
1600
2000
2400
2800
3200

CULVERT OUTFLOW AT CROSSING # 5
FCAP



CULVERT OUTFLOW AT CROSSING # 6

GCAP



10 Squares to the Inch

ACK ENGINEERS, INC.
2255 N. 44th St. • Phoenix, Az. 85008 • Phone (602) 244-2566

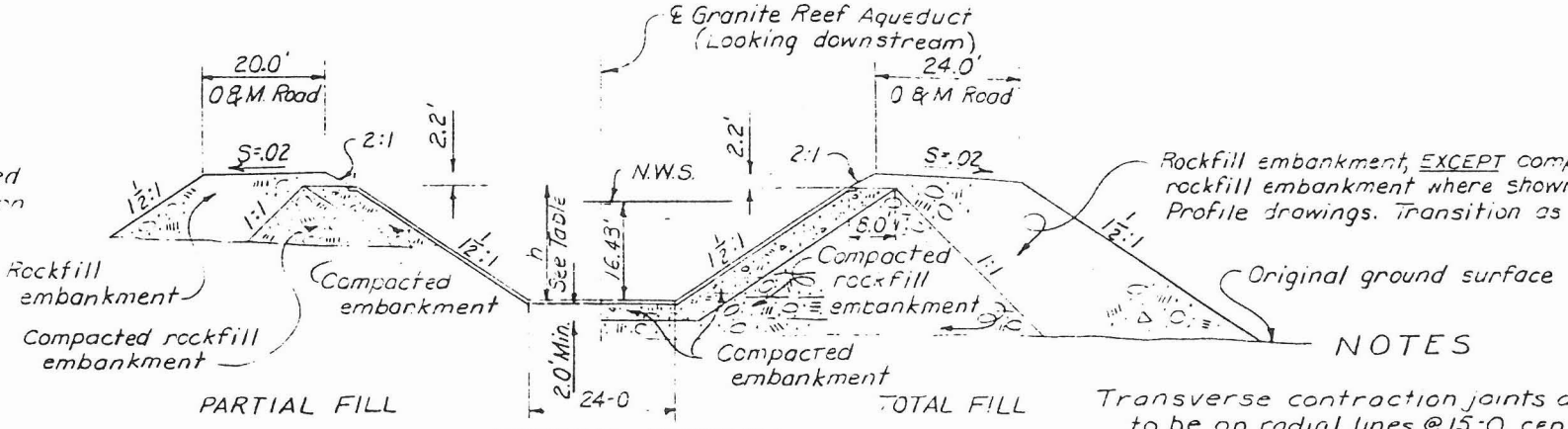
SHEET _____ OF _____
BY SEK DATE 4/91
CHECK Hem DATE 4/91
CLIENT FCDMC
JOB CAP Overchutes
JOB NO. 310.42

TOP OF LINING FOR C.A.P. CANAL

Top of Lining Elev. = Upstream Invert Elev. + Pipe Diam. + 1 Foot Clearance + Height of Lining

Crossing No.	CAP Sta.	Upstream Inv. Elev.	Pipe Dia. (Ft)	Clearance* (Ft)	Height of Lining (Ft)	Total Height (Ft)	Top of Lining Elev.
1	561+40	1508.00	6.00	1.00	19.50	26.50	1534.50
2	549+00	1513.94	2.50	1.00	19.50	23.00	1536.94
3	538+25	1518.99	2.50	1.00	19.50	23.00	1541.99
4	492+30	1500.13	6.00	1.00	18.60	25.60	1525.73
5	480+90	1515.92	2.50	1.00	18.60	22.10	1538.02
6	459+30	1519.13	2.50	1.00	18.60	22.10	1541.23

* Clearance was assumed to be 1 foot.



TYPICAL SECTION
(ROCKFILL)

NOTES

Transverse contraction joints around curves to be on radial lines @ 15'-0 centers, spaced along ℄ aqueduct.

For details of contraction joints see 344-D-577

For details and spacing of safety ladders see 40-D-6112.

Concrete lining design is based on a compressive strength of 3000 p.s.i. @ 28 days.

HYDRAULIC PROPERTIES

A	V	Q	r	n	s	b	d
799.24	3.75	3,000	9.60	.016	.00008	24.0	16.43

LINING HEIGHT TABLE

STATION	h
10+00 to 187+00	18.6
187+00 to 217+00	19.0
217+00 to 261+00	19.5
266+16.23 to 501+00	18.6
501+00 to 531+00	19.6
531+00 to 575+80.80	19.5

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION–ARIZONA

GRANITE REEF AQUEDUCT

REACH 9

TYPICAL AQUEDUCT AND DIKE SECTIONS

DESIGNED A. E. Nelson SUBMITTED Robert L. Tanner
DRAWN RECOMMENDED Forest Ritchey
CHECKED F.E.S. R.C. Haggman APPROVED R.E. Mellin
CHIEF, WATER CONVEYANCE BRAN

PHOENIX, ARIZONA OCTOBER 1975 344-330-1325

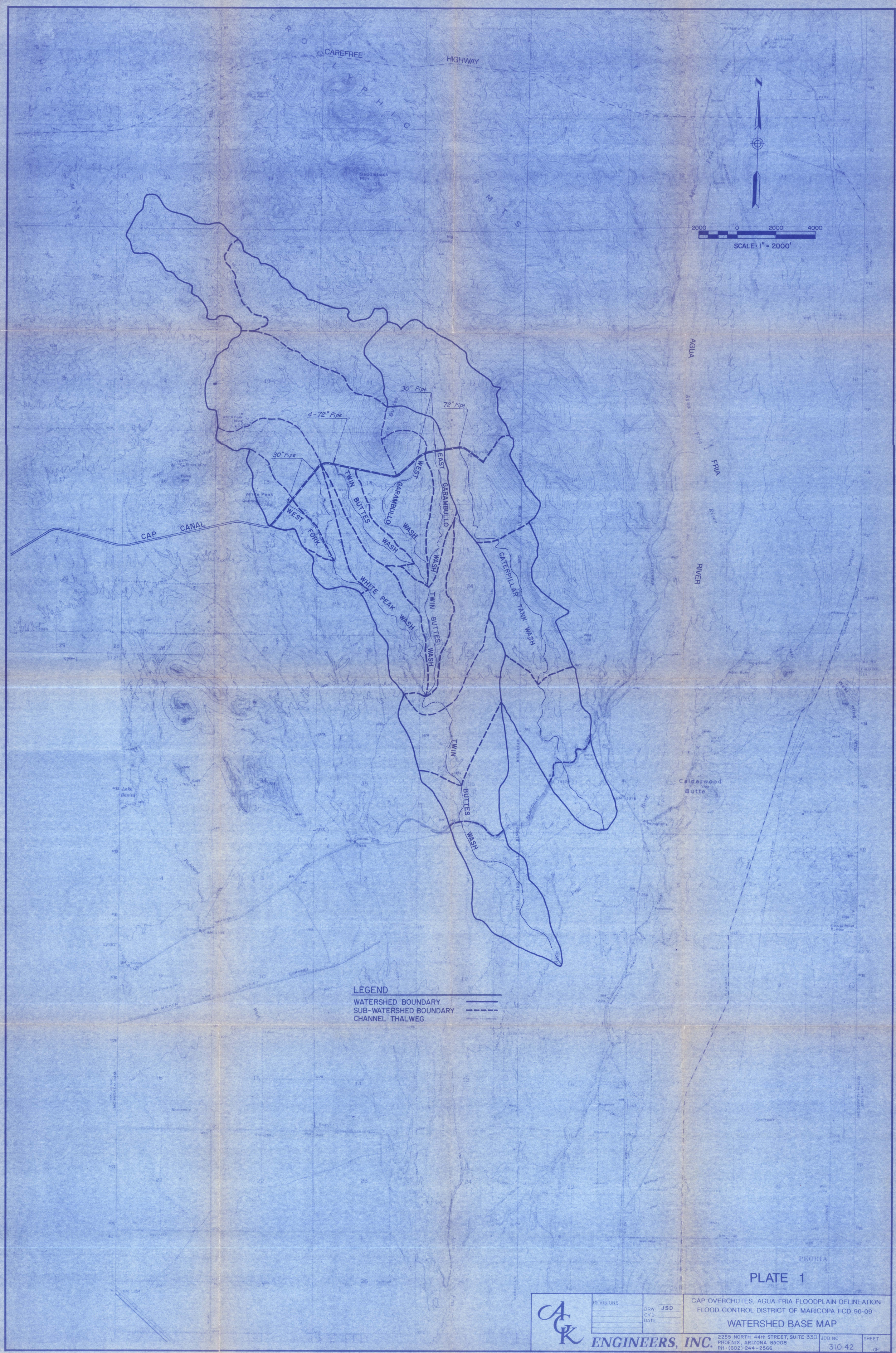


PLATE 1

ACK ENGINEERS, INC. 2255 NORTH 44th STREET, SUITE 330 PHOENIX, ARIZONA 85008 PH (602) 244-2566	REVISIONS / DRW JSD / CK'D / DATE	CAP OVERCHUTES, AGUA FRIA FLOODPLAIN DELINEATION FLOOD CONTROL DISTRICT OF MARICOPA FCD 90-09 WATERSHED BASE MAP
	JOB NO 310.42	SHEET OF

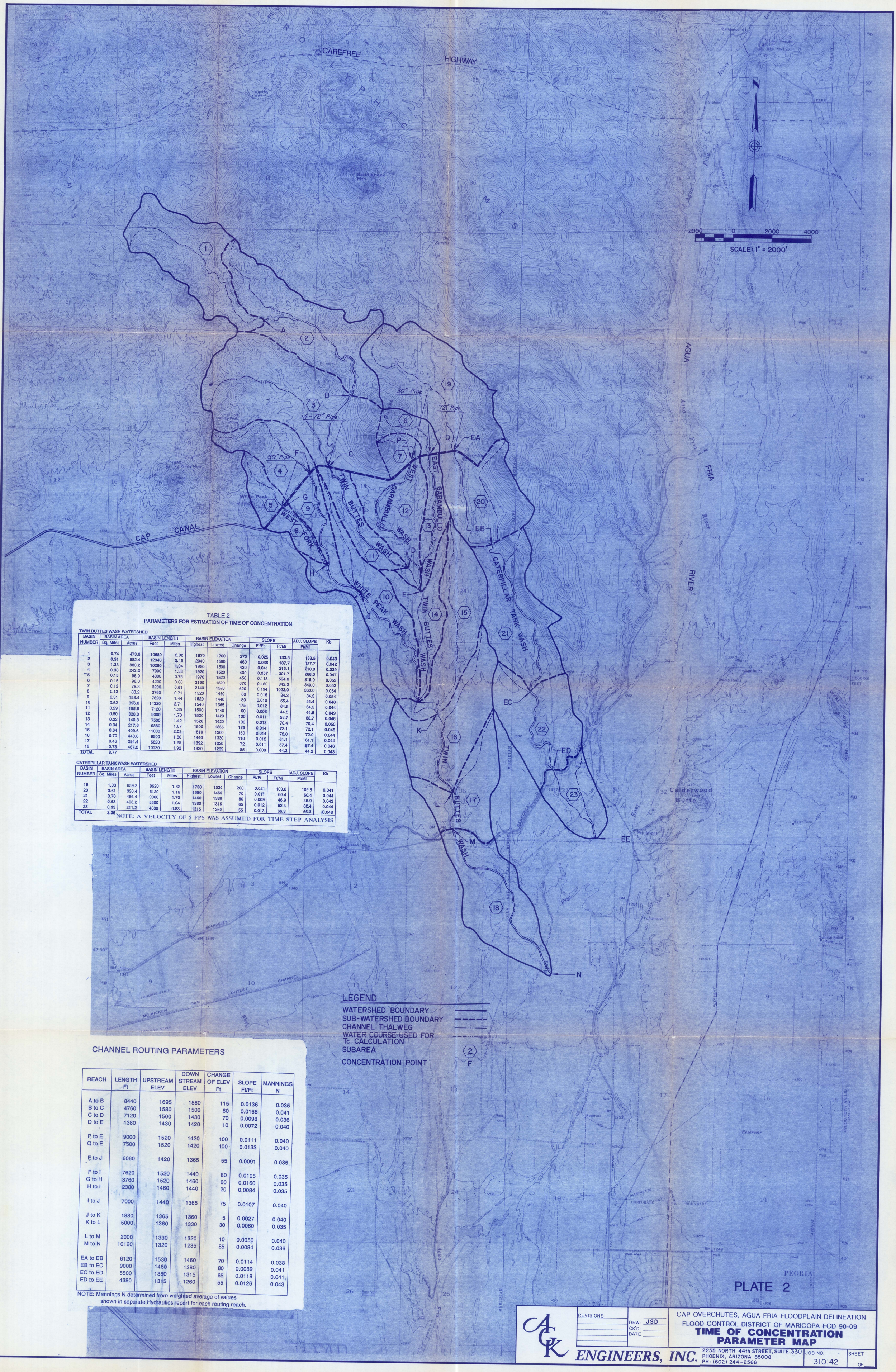


TABLE 2
PARAMETERS FOR ESTIMATION OF TIME OF CONCENTRATION

TWIN BUTTES WASH WATERSHED

BASIN NUMBER	BASIN AREA Sq. Miles	BASIN AREA Acres	BASIN LENGTH Feet	BASIN LENGTH Miles	BASIN ELEVATION Highest	BASIN ELEVATION Lowest	BASIN ELEVATION Change	SLOPE Ft/Ft	SLOPE Ft/Mi	ADJ. SLOPE Ft/Mi	Kb
1	0.74	473.6	10680	2.02	1970	1700	270	0.025	133.5	133.5	0.043
2	0.91	582.4	12940	2.45	2040	1580	460	0.036	187.7	187.7	0.042
3	1.38	883.2	10260	1.94	1920	1500	420	0.041	216.1	210.0	0.039
4	0.38	243.2	7000	1.33	1920	1520	400	0.057	301.7	266.0	0.047
5	0.15	96.0	4000	0.76	1970	1520	450	0.113	594.0	315.0	0.053
6	0.15	96.0	4200	0.80	2190	1520	670	0.160	842.3	340.0	0.053
7	0.12	76.8	3200	0.61	2140	1520	620	0.194	1023.0	360.0	0.054
8	0.13	83.2	3760	0.71	1520	1460	60	0.016	84.3	84.3	0.054
9	0.31	198.4	7620	1.44	1520	1440	80	0.010	55.4	55.4	0.048
10	0.62	396.8	14320	2.71	1540	1365	175	0.012	64.5	64.5	0.044
11	0.29	185.6	7120	1.35	1500	1440	60	0.008	44.5	44.5	0.049
12	0.50	320.0	9000	1.70	1520	1420	100	0.011	58.7	58.7	0.046
13	0.22	140.8	7500	1.42	1520	1420	100	0.013	70.4	70.4	0.050
14	0.34	217.6	9880	1.87	1500	1365	135	0.014	72.1	72.1	0.048
15	0.64	409.6	11000	2.08	1510	1360	150	0.014	72.0	72.0	0.044
16	0.70	448.0	9500	1.80	1440	1330	110	0.012	61.1	61.1	0.044
17	0.46	294.4	6620	1.25	1392	1320	72	0.011	57.4	57.4	0.046
18	0.73	467.2	10120	1.92	1320	1235	85	0.008	44.3	44.3	0.043
TOTAL	8.77										

CATERPILLAR TANK WASH WATERSHED

BASIN NUMBER	BASIN AREA Sq. Miles	BASIN AREA Acres	BASIN LENGTH Feet	BASIN LENGTH Miles	BASIN ELEVATION Highest	BASIN ELEVATION Lowest	BASIN ELEVATION Change	SLOPE Ft/Ft	SLOPE Ft/Mi	ADJ. SLOPE Ft/Mi	Kb
19	1.03	659.2	9620	1.82	1730	1530	200	0.021	109.8	109.8	0.041
20	0.61	390.4	6120	1.16	1530	1460	70	0.011	60.4	60.4	0.044
21	0.76	486.4	9000	1.70	1460	1380	80	0.009	46.9	46.9	0.043
22	0.63	403.2	5500	1.04	1380	1315	65	0.012	62.4	62.4	0.044
23	0.33	211.2	4380	0.83	1315	1260	55	0.013	66.3	66.3	0.048
TOTAL	3.36										

NOTE: A VELOCITY OF 5 FPS WAS ASSUMED FOR TIME STEP ANALYSIS

CHANNEL ROUTING PARAMETERS

REACH	LENGTH Ft	UPSTREAM ELEV	DOWN STREAM ELEV	CHANGE OF ELEV Ft	SLOPE Ft/Ft	MANNINGS N
A to B	8440	1695	1580	115	0.0136	0.035
B to C	4760	1580	1500	80	0.0168	0.041
C to D	7120	1500	1430	70	0.0098	0.036
D to E	1380	1430	1420	10	0.0072	0.040
P to E	9000	1520	1420	100	0.0111	0.040
Q to E	7500	1520	1420	100	0.0133	0.040
E to J	6060	1420	1365	55	0.0091	0.035
F to I	7620	1520	1440	80	0.0105	0.035
G to H	3760	1520	1460	60	0.0160	0.035
H to I	2380	1460	1440	20	0.0084	0.035
I to J	7000	1440	1365	75	0.0107	0.040
J to K	1880	1365	1360	5	0.0027	0.040
K to L	5000	1360	1330	30	0.0060	0.035
L to M	2000	1330	1320	10	0.0050	0.040
M to N	10120	1320	1235	85	0.0084	0.036
EA to EB	6120	1530	1460	70	0.0114	0.038
EB to EC	9000	1460	1380	80	0.0089	0.041
EC to ED	5500	1380	1315	65	0.0118	0.041
ED to EE	4380	1315	1260	55	0.0126	0.043

NOTE: Mannings N determined from weighted average of values shown in separate Hydraulics report for each routing reach.

REVISIONS:

DRW: JSD
CK'D:
DATE

CAP OVERCHUTES, AGUA FRIA FLOODPLAIN DELINEATION
FLOOD CONTROL DISTRICT OF MARICOPA FCD 90-09

TIME OF CONCENTRATION PARAMETER MAP

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JOB NO. 310.42

SHEET OF