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# HYDROLOGIC STUDY

# FOR

# STONERIDGE DAM (STRUCTURE NO. 19)

# AT

# FOUNTAIN HILLS, ARIZONA

February 1996

*Prepared for*

**ANDERSON-NELSON, INC.**
4441 East McDowell Road
Phoenix, Arizona 85008

TOWN OF FOUNTAIN HILLS
MAY 2 0 1996
ENGINEERING DEPARTMENT

*Prepared by*

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# HYDROLOGIC STUDY FOR STONERIDGE DAM (STRUCTURE NO.19) AT FOUNTAIN HILLS, ARIZONA

## A. PURPOSE AND SCOPE

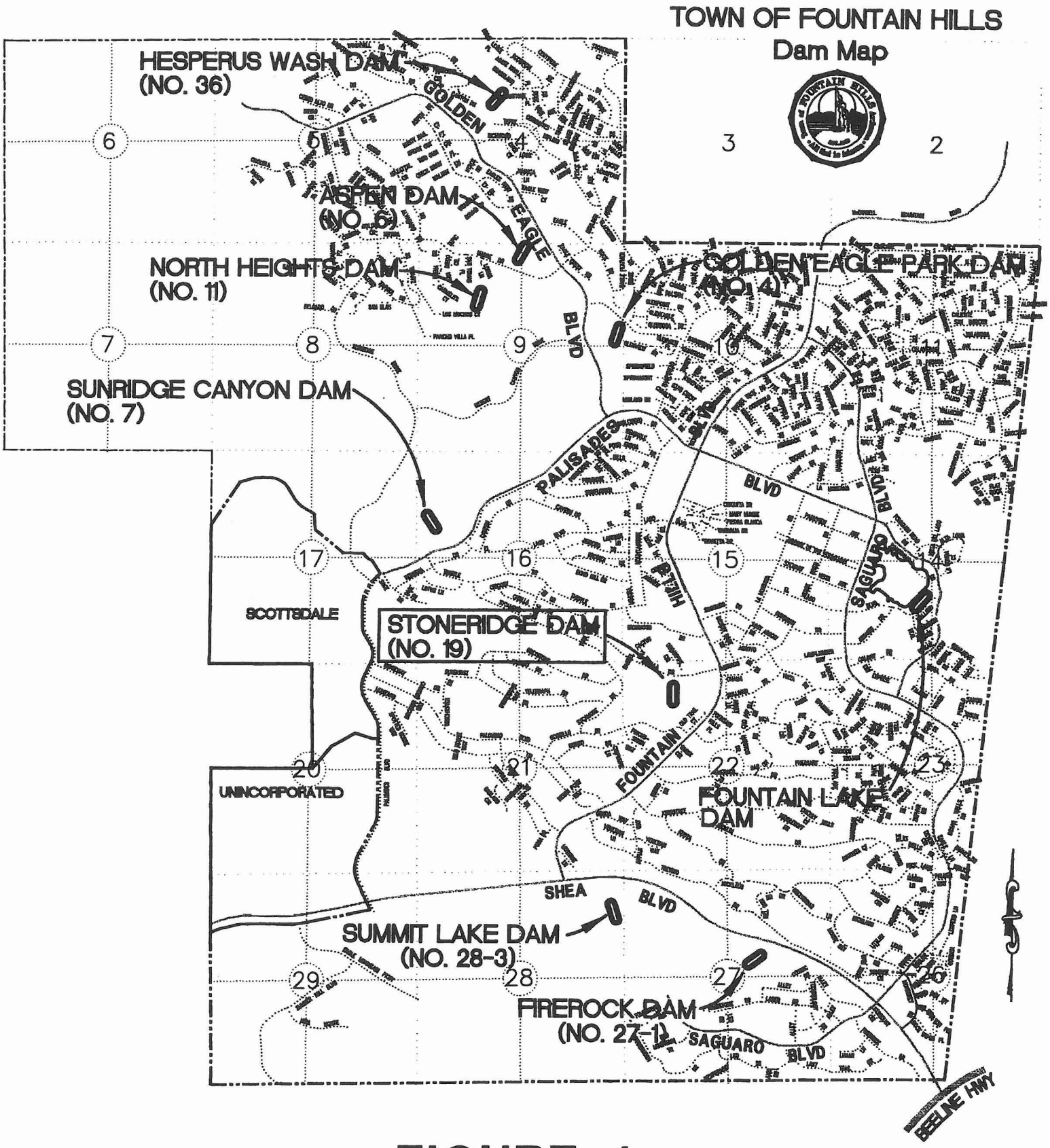
AGK Engineers, Inc. (AGK) recently performed a hydrologic study and floodplain delineation project for the southern part of the Fountain Hills area under a contract with the Flood Control District of Maricopa County (District). The study included the Colony Wash watershed within which the Stoneridge Dam (Structure No. 19) is situated. The methodology for hydrologic modeling is based on the guidelines outlined in the District's *Hydrologic Design Manual* **(Reference 1)**. Procedures of parameter estimation and results of runoff modeling have been reviewed and approved by the District at various stages of the project.

Recently, MCO Properties Inc. (MCO) has initiated procedures to bring all the jurisdictional flood retaining structures within Fountain Hills to compliance with the Arizona Department of Water Resources (ADWR) regulations. In September 1995, Anderson-Nelson Inc., a consultant to MCO, retained AGK as a subconsultant to perform a hydrologic study for Stoneridge Dam using the same methodology as required by the District for the floodplain delineation project. The scope of this study is to estimate the 100-year peak discharge and the ½ PMF at the dam site.

## B. PROJECT LOCATION

Stoneridge Dam is located within the Town of Fountain Hills, at the northwest corner of Section 22, Township 3 North, Range 6 East, Gila and Salt River Base and Meridian, Maricopa County, Arizona.

# LOCATION MAP




# FIGURE 1

## C. WATERSHED DESCRIPTION

The watershed of Stoneridge Dam is situated east of Fountain Hills Boulevard and includes three major washes: Sunburst Wash, Greystone Wash and Sycamore Wash. A large portion of the land within the watershed is still in its natural state. However, runoff modeling was conducted on the basis of future development conditions, which were derived from the zoning information of the Town.

As shown on **Plate 1**, the watershed was divided into numerous subareas according to its flow patterns. Drainage area delineation was based on the 1" = 200', 2-foot contour interval map prepared by Kenney Aerial Mapping, Inc. **(Reference 2)**, and supplemented by field verification. The size, elevation, slope, and other characteristics of each subarea are shown in **Appendix A.1**

## D. HYDROLOGIC MODELING

### 1. Methodology

Hydrologic modeling was performed by use of the 1991 version of HEC-1 computer program developed by the U.S. Army Corps of Engineers **(Reference 3)**. Estimation procedures for model parameters and components were based on the District's Manual **(Reference 1)**.

### 2. Soils and Land Use

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 4)**. Boundaries of the soil groups are shown on **Plate 2**. Information on land use was furnished by the Town of Fountain Hills. Locations of specific land use within

the watershed are also shown on **Plate 3**. As mentioned earlier, the hydrologic study was based on the future development conditions.

## 3. Rainfall Input for 100-year Frequency Storm

The estimated rainfall depths for storms up to 100-year frequency were obtained from the charts derived from the NOAA Atlas published for Arizona **(Reference 5)**. The 24-hour storm was used for flow volume estimation. Rainfall depths for the 100-year storms was estimated to be 4.0 inches. A copy of the rainfall chart is included in **Appendix B**. The SCS Type II Distribution was used for the 24-hour storm. Areal reduction for rainfall was not applied for the 24-hour storm because the study area is much less than the 10 square-mile criterion.

## 4. Probable Maximum Precipitation

The probable maximum precipitation (PMP) and its time distribution were estimated in accordance with the procedures contained in the *U.S.S Department of Commerce Hydrometeorological Report No. 49* **(Reference 6)**. Detailed computations for PMP are also included in **Appendix B**.

## 5. 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 **Appendix A.3**

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 4**, 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 4**. A spreadsheet program supplied by the District was used for calculating the effect of each soil type.

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 and computed by the District spreadsheet program known as MCUHP1. A comparison of the values obtained from the two sources yielded slight differences for PSIF and DTHETA. At the direction of the District, the values generated by their spreadsheet program were used. Weighted values of these parameters were computed for all the subareas for both the current and future development conditions. However, only the values for future development conditions were used in the modeling.

The selection of DTHETA was based on the dry antecedent soil moisture condition for open and/or unzoned areas and the normal antecedent soil moisture condition for all zoned areas. In addition, values for XKSAT were adjusted according to the vegetation cover. A 30 percent vegetation cover was used for most undeveloped and low density residential areas. Areas that are on the steep slopes or have other

zoning designations have been assigned with other percentage of vegetation cover based upon aerial photography of the specific area.

## 6. 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. Values of these parameters are shown in **Appendices A.1and A.3**. The length and slope of the flow path for each subarea were obtained from the topographic map **(Reference 2)**. A slope adjustment procedure for slopes greater than 200 feet per mile was implemented for several subareas in the watershed. This procedure was based on Figure 5.4 of the Manual. The 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.

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 A.3** of this report. A review of the results indicated that all areas are suitable for the Clark method.

## 7. Runoff Modeling

A time step of 2 minutes was used in the computation. Flows through the existing culverts 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 culverts and the dam outlet were developed from the 1" = 200' topographic map **(Reference 2)**. Elevations of the dam and spillway crest were furnished by Anderson-Nelson, Inc. through field surveying. The stage-area-discharge relationships for the dam and upstream culverts are shown in **Appendices C.1 and C.2**. The normal depth routing method was used for routing flow from one concentration point to the next.

The channel cross-sections used for normal depth routing were either digitized from the topographic base map in the case that the coincided with the location of a hydraulic analysis cross-section, or were plotted by hand from the topographic base map. Schematic flow chart of the runoff model is presented in **Figure 2**.

The estimation of ½ PMF was based on the input of the full PMP with a 50 percent reduction of all hydrograph ordinates. The "FLOW" option on the JR card was used in the HEC-1 program to expedite the computation. Results of the runoff modeling

are summarized in **Table 1**. Outputs of the HEC-1 runs for the two types of storms are presented in **Appendices D.1 and D.2**.

**TABLE 1**

**ESTIMATED PEAK FLOWS**

| Location | Estimated Peak Flows (Cfs) | |
|---|---|---|
| | 100-yr | ½ PMF |
| Inflow to Stoneridge Dam | 620 | 4923 |
| Outflow from Stoneridge Dam | 109 | 2919 |

## E. CONCLUSION

Based on the HEC-1 modeling, the maximum water surface during a 100-year storm would be 2.27 feet below the spillway crest. As for the ½ PMF condition, the maximum water surface would be 4.16 feet above the spillway crest. These results were obtained based on the assumptions and modeling methodology stated in this report. Furthermore, the analysis was based on an émpty reservoir immediately upstream of the dam.

## REFERENCES

1. Flood Control District of Maricopa County, *Hydrologic Design Manual for Maricopa County, Arizona, Vol. I-Hydrology*, Undated.

2. Kenney Aerial Mapping, Inc., *Topographic Maps for the Town of Fountain Hills, Scale 1" = 200', Contour Interval = 2 feet,* 1991.

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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 Commerce, National Oceanic and Atmospheric Administration, *Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainage,* Hydrometeorological Report No. 49, September 1977.

**FOUNTAIN HILLS**

**HEC-1 HYDROLOGY FLOW DIAGRAM**

**STRUCTURE #19 HYDROLOGY**

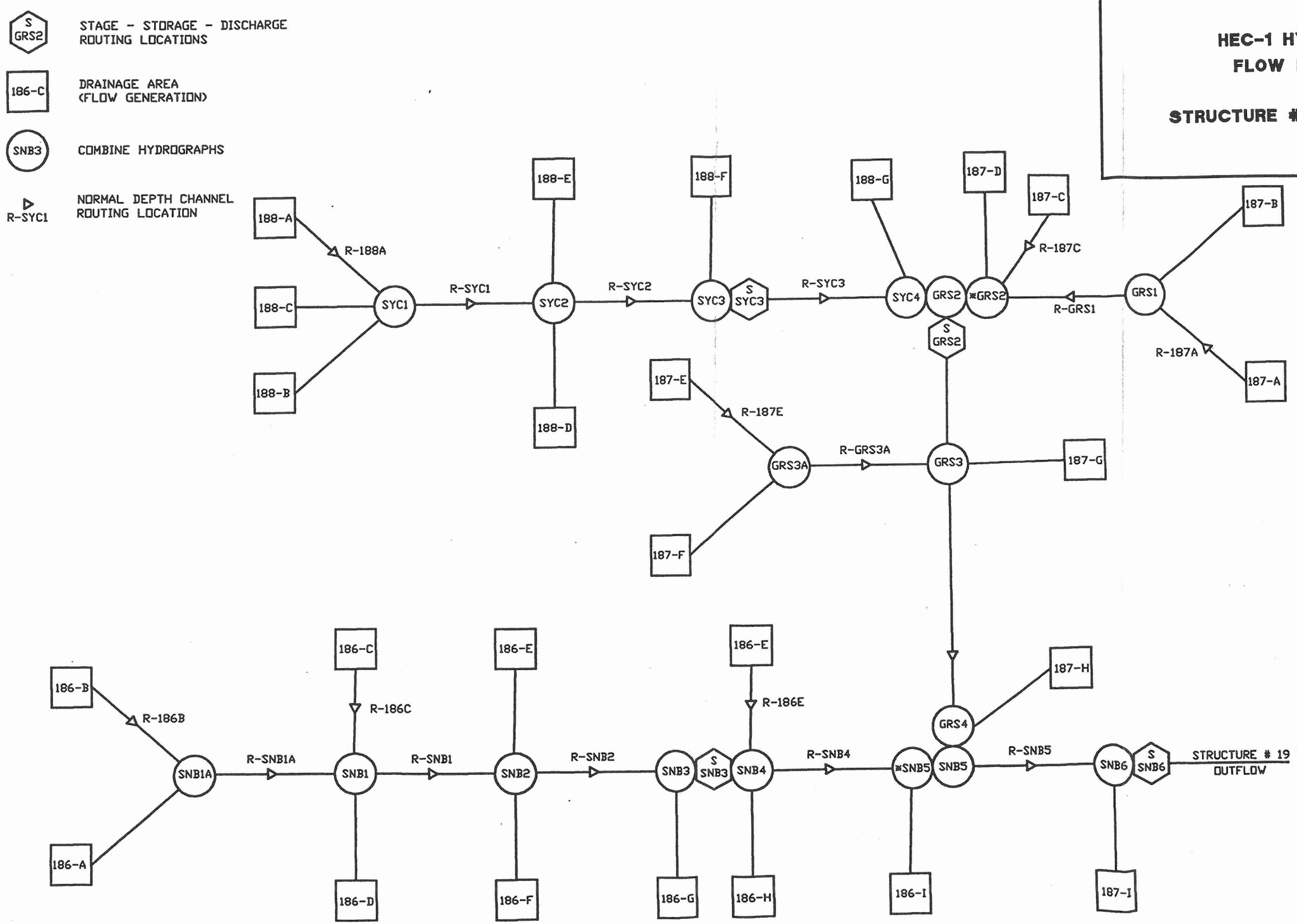



**FIGURE 2**

# APPENDIX A

# SUMMARY OF MODEL INPUT PARAMETERS

# APPENDIX A.1

# Watershed Parameters

# Table A.1 Watershed Parameters - Colony Wash (180)

| BASIN | Set | BASIN AREA | | BASIN LENGTH | | BASIN ELEVATION | | | SLOPE | | ADJ. | Land | Kb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUMBER | # | Acres | Sq. Miles | Feet | Miles | Highest | Lowest | Change | Ft/Ft | Ft/Mi | Ft/Mi | Type | |
| 186A | 220 | 63.10 | 0.099 | 3400 | 0.64 | 2190 | 1978 | 212 | 0.062 | 329.2 | 273 | C | 0.105 |
| 186B | 219 | 3.18 | 0.005 | 700 | 0.13 | 2112 | 2076 | 36 | 0.051 | 271.5 | 253 | C | 0.137 |
| 186C | 146 | 10.80 | 0.017 | 2000 | 0.38 | 2030 | 1918 | 112 | 0.056 | 295.7 | 263 | B | 0.066 |
| 186D | 231 | 51.74 | 0.081 | 3950 | 0.75 | 2075 | 1867 | 208 | 0.053 | 278.0 | 255 | C | 0.107 |
| 186E | 142 | 22.94 | 0.036 | 1863 | 0.35 | 1924 | 1784 | 140 | 0.075 | 396.8 | 288 | C | 0.116 |
| 186F | 143 | 18.35 | 0.029 | 2025 | 0.38 | 1890 | 1784 | 106 | 0.052 | 276.4 | 254 | C | 0.118 |
| 186G | 136 | 42.45 | 0.066 | 3125 | 0.59 | 1912 | 1722 | 190 | 0.061 | 321.0 | 272 | C | 0.109 |
| 186H | 137 | 15.82 | 0.025 | 4350 | 0.82 | 1890 | 1739 | 151 | 0.035 | 183.3 | - | B | 0.064 |
| 186I | 120 | 18.37 | 0.029 | 1780 | 0.34 | 1822 | 1685 | 137 | 0.077 | 406.4 | 289 | C | 0.118 |
| 187A | 232 | 5.54 | 0.009 | 600 | 0.11 | 1891 | 1859 | 32 | 0.053 | 281.6 | 256 | C | 0.131 |
| 187B | 233 | 5.19 | 0.008 | 1000 | 0.19 | 1904 | 1849 | 55 | 0.055 | 290.4 | 262 | C | 0.132 |
| 187C | 235 | 7.60 | 0.012 | 1213 | 0.23 | 1903 | 1828 | 75 | 0.062 | 326.5 | 273 | B | 0.068 |
| 187D | 234 | 45.11 | 0.070 | 3980 | 0.75 | 1904 | 1696 | 208 | 0.052 | 275.9 | 254 | C | 0.109 |
| 187E | 234 | 3.32 | 0.005 | 1668 | 0.32 | 1905 | 1845 | 60 | 0.036 | 189.9 | 190 | A | 0.037 |
| 187F | 236 | 2.13 | 0.003 | 1725 | 0.33 | 1845 | 1716 | 129 | 0.075 | 394.9 | 287 | B | 0.075 |
| 187G | 237 | 27.24 | 0.043 | 4800 | 0.91 | 1984 | 1705 | 279 | 0.058 | 306.9 | 267 | C | 0.114 |
| 187H | 119 | 2.81 | 0.004 | 675 | 0.13 | 1728 | 1685 | 43 | 0.064 | 336.4 | 275 | C | 0.139 |
| 187I | 118 | 15.30 | 0.024 | 1330 | 0.25 | 1810 | 1680 | 130 | 0.098 | 516.1 | 305 | C | 0.120 |
| 188A | 214 | 5.60 | 0.009 | 1320 | 0.25 | 2071 | 1974 | 97 | 0.073 | 388.0 | 286 | B | 0.070 |
| 188B | 213 | 42.50 | 0.066 | 2440 | 0.46 | 2072 | 1846 | 226 | 0.093 | 489.0 | 300 | C | 0.109 |
| 188C | 218 | 14.00 | 0.022 | 1790 | 0.34 | 2034 | 1846 | 188 | 0.105 | 554.5 | 308 | C | 0.121 |
| 188D | 212 | 35.26 | 0.055 | 2930 | 0.55 | 2050 | 1769 | 281 | 0.096 | 506.4 | 304 | C | 0.111 |

# Table A.1 Watershed Parameters - Colony Wash (180)

| BASIN NUMBER | Set # | BASIN AREA | | BASIN LENGTH | | BASIN ELEVATION | | | SLOPE | | ADJ. Ft/Mi | Land Type | Kb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Acres | Sq. Miles | Feet | Miles | Highest | Lowest | Change | Ft/Ft | Ft/Mi | | | |
| 188E | 211 | 33.25 | 0.052 | 3400 | 0.64 | 2032 | 1769 | 263 | 0.077 | 408.4 | 289 | C | 0.112 |
| 188F | 238 | 45.99 | 0.072 | 3400 | 0.64 | 1912 | 1702 | 210 | 0.062 | 326.1 | 273 | C | 0.108 |
| 188G | 250 | 0.87 | 0.001 | 380 | 0.07 | 1740 | 1696 | 44 | 0.116 | 611.4 | 313 | C | 0.152 |
| 160E | 123 | 2.63 | 0.004 | 1125 | 0.21 | 1871 | 1821 | 50 | 0.044 | 234.7 | 228 | B | 0.074 |
| TOTAL | 27 | 541.06 | 0.85 | | | | | | | | | | |

# APPENDIX A.2

## Soil Properties

## B.1 Soils and Land Use Information - Colony (180)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 63.10 | - | - | - | 63.10 |
| 186A | 63.10 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | RUR-43 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 5.15 | 57.95 | - | - | 63.10 |
| 0.64 | 273.0 | | PERCENT | 8% | 92% | - | - | 100% |
| LAND | | | % DEV | 100% | 0% | - | - | |
| TYPE | Kb | | % VEG | 0% | 30% | - | - | 8% |
| C | 0.105 | | I.A. | 0.05 | 0.15 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 3.18 | - | - | - | 3.18 |
| 186B | 3.18 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | RUR-43 | C-2 | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 0.04 | 2.98 | 0.16 | - | 3.18 |
| 0.13 | 253.0 | | PERCENT | 1% | 94% | 5% | - | 100% |
| LAND | | | % DEV | 100% | 0% | 0% | - | |
| TYPE | Kb | | % VEG | 0% | 30% | 30% | - | 1% |
| C | 0.137 | | I.A. | 0.05 | 0.15 | 0.15 | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 10.80 | - | - | - | 10.80 |
| 186C | 10.80 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | RUR-43 | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 6.76 | 3.70 | 0.34 | - | 10.80 |
| 0.38 | 263.0 | | PERCENT | 63% | 34% | 3% | - | 100% |
| LAND | | | % DEV | 50% | 100% | 100% | - | |
| TYPE | Kb | | % VEG | 20% | 0% | 0% | - | 69% |
| B | 0.066 | | I.A. | 0.10 | 0.05 | 0.05 | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 30.04 | 21.70 | - | - | 51.74 |
| 186D | 51.74 | | PERCENT | 58% | 42% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | RUR-43 | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 1.67 | 10.05 | 40.02 | - | 51.74 |
| 0.75 | 255.0 | | PERCENT | 3% | 19% | 77% | - | 100% |
| LAND | | | % DEV | 0% | 0% | 5% | - | |
| TYPE | Kb | | % VEG | 30% | 30% | 30% | - | 4% |
| C | 0.107 | | I.A. | 0.15 | 0.15 | 0.15 | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 22.94 | - | - | - | 22.94 |
| 186E | 22.94 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 2.77 | 20.17 | - | - | 22.94 |
| 0.35 | 288.0 | | PERCENT | 12% | 88% | - | - | 100% |
| LAND | | | % DEV | 55% | 0% | - | - | |
| TYPE | Kb | | % VEG | 20% | 30% | - | - | 7% |
| C | 0.116 | | I.A. | 0.10 | 0.15 | - | - | T.D. |

## B.1 Soils and Land Use Information - Colony (180)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 14.34 | 4.01 | - | - | 18.35 |
| 186F | 18.35 | | PERCENT | 78% | 22% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 1.17 | 17.18 | - | - | 18.35 |
| 0.38 | 254.0 | | PERCENT | 6% | 94% | - | - | 100% |
| LAND | | | % DEV | 50% | 0% | - | - | |
| TYPE | Kb | | % VEG | 25% | 30% | - | - | 3% |
| C | 0.118 | | I.A. | 0.15 | 0.15 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 42.45 | - | - | - | 42.45 |
| 186G | 42.45 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-35 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 42.45 | - | - | - | 42.45 |
| 0.59 | 272.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 5% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 5% |
| C | 0.109 | | I.A. | 0.15 | - | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 1.39 | 16.98 | - | - | 18.37 |
| 186H | 15.82 | | PERCENT | 9% | 107% | - | - | 116% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 6.16 | 9.66 | - | - | 15.82 |
| 0.82 | 183.3 | | PERCENT | 39% | 61% | - | - | 100% |
| LAND | | | % DEV | 50% | 60% | - | - | |
| TYPE | Kb | | % VEG | 10% | 10% | - | - | 56% |
| B | 0.064 | | I.A. | 0.05 | 0.05 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 40 | 41 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 1.39 | 16.98 | - | - | 18.37 |
| 186I | 18.37 | | PERCENT | 8% | 92% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-35 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 18.37 | - | - | - | 18.37 |
| 0.34 | 289.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 10% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 10% |
| C | 0.118 | | I.A. | 0.15 | - | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 3.06 | 2.48 | - | - | 5.54 |
| 187A | 5.54 | | PERCENT | 55% | 45% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | RUR-43 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 0.47 | 5.07 | - | - | 5.54 |
| 0.11 | 256.0 | | PERCENT | 8% | 92% | - | - | 100% |
| LAND | | | % DEV | 0% | 10% | - | - | |
| TYPE | Kb | | % VEG | 30% | 30% | - | - | 9% |
| C | 0.131 | | I.A. | 0.15 | 0.15 | - | - | T.D. |

## B.1 Soils and Land Use Information - Colony (180)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 3.78 | 1.41 | - | - | 5.19 |
| 187B | 5.19 | | PERCENT | 73% | 27% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 5.19 | - | - | - | 5.19 |
| 0.19 | 262.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 20% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 20% |
| C | 0.132 | | I.A. | 0.15 | - | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 7.60 | - | - | - | 7.60 |
| 187C | 7.60 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 5.23 | 2.37 | - | - | 7.60 |
| 0.23 | 273.0 | | PERCENT | 69% | 31% | - | - | 100% |
| LAND | | | % DEV | 50% | 50% | - | - | |
| TYPE | Kb | | % VEG | 25% | 25% | - | - | 50% |
| B | 0.068 | | I.A. | 0.15 | 0.15 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 44.79 | 0.32 | - | - | 45.11 |
| 187D | 45.11 | | PERCENT | 99% | 1% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 7.95 | 37.16 | - | - | 45.11 |
| 0.75 | 254.0 | | PERCENT | 18% | 82% | - | - | 100% |
| LAND | | | % DEV | 50% | 30% | - | - | |
| TYPE | Kb | | % VEG | 30% | 30% | - | - | 34% |
| C | 0.109 | | I.A. | 0.15 | 0.15 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 3.32 | - | - | - | 3.32 |
| 187E | 3.32 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 2.34 | 0.98 | - | - | 3.32 |
| 0.32 | 189.9 | | PERCENT | 70% | 30% | - | - | 100% |
| LAND | | | % DEV | 80% | 100% | - | - | |
| TYPE | Kb | | % VEG | 10% | 0% | - | - | 86% |
| A | 0.037 | | I.A. | 0.05 | 0.05 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 2.13 | - | - | - | 2.13 |
| 187F | 2.13 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-35 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 2.13 | - | - | - | 2.13 |
| 0.33 | 287.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 100% | - | - | - | |
| TYPE | Kb | | % VEG | 0% | - | - | - | 100% |
| B | 0.075 | | I.A. | 0.05 | - | - | - | T.D. |

## B.1 Soils and Land Use Information - Colony (180)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 27.24 | - | - | - | 27.24 |
| 187G | 27.24 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 19.31 | 7.93 | - | - | 27.24 |
| 0.91 | 267.0 | | PERCENT | 71% | 29% | - | - | 100% |
| LAND | | | % DEV | 45% | 50% | - | - | |
| TYPE | Kb | | % VEG | 20% | 20% | - | - | 46% |
| C | 0.114 | | I.A. | 0.10 | 0.10 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 2.81 | - | - | - | 2.81 |
| 187H | 2.81 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-35 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 2.81 | - | - | - | 2.81 |
| 0.13 | 275.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 15% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 15% |
| C | 0.139 | | I.A. | 0.15 | - | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 41 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 1.73 | 13.57 | - | - | 15.30 |
| 187I | 15.30 | | PERCENT | 11% | 89% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-35 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 15.30 | - | - | - | 15.30 |
| 0.25 | 305.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 30% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 30% |
| C | 0.120 | | I.A. | 0.15 | - | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 5.60 | - | - | - | 5.60 |
| 188A | 5.60 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | C-2 | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 3.99 | 1.53 | 0.08 | - | 5.60 |
| 0.25 | 286.0 | | PERCENT | 71% | 27% | 1% | - | 100% |
| LAND | | | % DEV | 60% | 100% | 50% | - | |
| TYPE | Kb | | % VEG | 25% | 0% | 20% | - | 71% |
| B | 0.070 | | I.A. | 0.10 | 0.05 | 0.10 | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 14.19 | 28.31 | - | - | 42.50 |
| 188B | 42.50 | | PERCENT | 33% | 67% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | RUR-43 | C-2 | TOTAL |
| Mi | Ft/Mi | | ACRES | 0.78 | 4.45 | 27.61 | 9.66 | 42.50 |
| 0.46 | 300.0 | | PERCENT | 2% | 10% | 65% | 23% | 100% |
| LAND | | | % DEV | 60% | 45% | 0% | 0% | |
| TYPE | Kb | | % VEG | 25% | 30% | 30% | 30% | 6% |
| C | 0.109 | | I.A. | 0.10 | 0.15 | 0.15 | 0.15 | T.D. |

## B.1 Soils and Land Use Information - Colony (180)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 11.34 | 2.66 | - | - | 14.00 |
| 188C | 14.00 | | PERCENT | 81% | 19% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | RUR-43 | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 1.32 | 7.73 | 4.95 | - | 14.00 |
| 0.34 | 308.0 | | PERCENT | 9% | 0.55 | 0.35 | - | 100% |
| LAND | | | % DEV | 80% | 35% | 0% | - | |
| TYPE | Kb | | % VEG | 20% | 30% | 30% | - | 27% |
| C | 0.121 | | I.A. | 0.10 | 0.15 | 0.15 | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 22.17 | 13.09 | - | - | 35.26 |
| 188D | 35.26 | | PERCENT | 63% | 37% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | RUR-43 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 35.26 | - | - | - | 35.26 |
| 0.55 | 304.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 5% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 5% |
| C | 0.111 | | I.A. | 0.15 | - | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | 63 | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 32.33 | 0.93 | - | - | 33.26 |
| 188E | 33.25 | | PERCENT | 97% | 3% | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | RUR-43 | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 4.49 | 22.10 | 6.66 | - | 33.25 |
| 0.64 | 289.0 | | PERCENT | 14% | 66% | 20% | - | 100% |
| LAND | | | % DEV | 85% | 10% | 0% | - | |
| TYPE | Kb | | % VEG | 10% | 30% | 30% | - | 18% |
| C | 0.112 | | I.A. | 0.05 | 0.15 | 0.15 | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 45.99 | - | - | - | 45.99 |
| 188F | 45.99 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 1.83 | 44.16 | - | - | 45.99 |
| 0.64 | 273.0 | | PERCENT | 4% | 96% | - | - | 100% |
| LAND | | | % DEV | 100% | 15% | - | - | |
| TYPE | Kb | | % VEG | 0% | 30% | - | - | 18% |
| C | 0.108 | | I.A. | 0.05 | 0.15 | - | - | T.D. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN | TOTAL | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| NUMBER | AREA | | ACRES | 0.87 | - | - | - | 0.87 |
| 188G | 0.87 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH | SLOPE | LAND USE: | ZONE | R1-35 | - | - | - | TOTAL |
| Mi | Ft/Mi | | ACRES | 0.87 | - | - | - | 0.87 |
| 0.07 | 313.0 | | PERCENT | 100% | - | - | - | 100% |
| LAND | | | % DEV | 0% | - | - | - | |
| TYPE | Kb | | % VEG | 30% | - | - | - | 0% |
| C | 0.152 | | I.A. | 0.15 | - | - | - | T.D. |

## B.1 Soils and Land Use Information - Colony (180)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BASIN NUMBER | TOTAL AREA | SOILS : | GROUP | 41 | - | - | - | TOTAL |
| | | | ACRES | 2.63 | - | - | - | 2.63 |
| 160E | 2.63 | | PERCENT | 100% | - | - | - | 100% |
| LENGTH Mi | SLOPE Ft/Mi | LAND USE: | ZONE | R1-8 | R1-35 | - | - | TOTAL |
| | | | ACRES | 2.22 | 0.41 | - | - | 2.63 |
| 0.21 | 228 | | PERCENT | 85% | 16% | - | - | 100% |
| LAND TYPE | | | % DEV | 60% | 80% | - | - | |
| | Kb | | % VEG | 10% | 5% | - | - | 63% |
| B | 0.074 | | I.A. | 0.10 | 0.05 | - | - | T.D. |

# APPENDIX A.3

## MCUHP1 Program Input/Output Valves

## Table A.3 MCUHP-1 Program Input/Output Values - Colony Wash (180)

| Sub-Area | AREA (sq. mi.) | LENGTH (miles) | Kb | SLOPE (ft/mile) | IA (in) | DTHETA | PSIF | XKSAT | RTIMP (%) Existing | RTIMP (%) Future |
|---|---|---|---|---|---|---|---|---|---|---|
| 186A | 0.099 | 0.640 | 0.105 | 273.00 | 0.142 | 0.250 | 5.70 | 0.203 | 1.40 | 17.45 |
| 186B | 0.005 | 0.130 | 0.137 | 253.00 | 0.149 | 0.250 | 5.70 | 0.207 | 0.19 | 19.15 |
| 186C | 0.017 | 0.380 | 0.066 | 263.00 | 0.081 | 0.250 | 5.70 | 0.175 | 25.67 | 37.20 |
| 186D | 0.081 | 0.750 | 0.107 | 255.00 | 0.150 | 0.250 | 5.80 | 0.195 | 9.32 | 26.52 |
| 186E | 0.036 | 0.350 | 0.116 | 288.00 | 0.144 | 0.250 | 5.70 | 0.205 | 1.92 | 27.41 |
| 186F | 0.029 | 0.380 | 0.118 | 254.00 | 0.150 | 0.250 | 5.80 | 0.195 | 4.82 | 30.30 |
| 186G | 0.066 | 0.590 | 0.109 | 272.00 | 0.150 | 0.250 | 5.70 | 0.207 | 1.25 | 25.00 |
| 186H | 0.025 | 0.820 | 0.064 | 183.30 | 0.050 | 0.250 | 5.70 | 0.170 | 20.54 | 34.97 |
| 186I | 0.029 | 0.340 | 0.118 | 289.00 | 0.150 | 0.250 | 5.70 | 0.207 | 2.50 | 25.00 |
| 187A | 0.009 | 0.110 | 0.131 | 256.00 | 0.150 | 0.250 | 5.80 | 0.195 | 10.81 | 26.77 |
| 187B | 0.008 | 0.190 | 0.132 | 262.00 | 0.150 | 0.250 | 5.80 | 0.195 | 12.74 | 48.74 |
| 187C | 0.012 | 0.230 | 0.068 | 273.00 | 0.150 | 0.250 | 5.70 | 0.198 | 19.38 | 38.76 |
| 187D | 0.070 | 0.750 | 0.109 | 254.00 | 0.150 | 0.250 | 5.70 | 0.207 | 9.83 | 28.65 |
| 187E | 0.005 | 0.320 | 0.037 | 189.90 | 0.050 | 0.250 | 5.70 | 0.170 | 33.62 | 39.10 |
| 187F | 0.003 | 0.330 | 0.075 | 287.00 | 0.050 | 0.250 | 5.70 | 0.170 | 25.00 | 25.00 |
| 187G | 0.043 | 0.910 | 0.114 | 267.00 | 0.100 | 0.250 | 5.70 | 0.189 | 18.02 | 39.18 |
| 187H | 0.004 | 0.130 | 0.139 | 275.00 | 0.150 | 0.250 | 5.70 | 0.207 | 3.75 | 25.00 |
| 187I | 0.024 | 0.250 | 0.120 | 305.00 | 0.150 | 0.250 | 5.70 | 0.207 | 7.50 | 25.00 |
| 188A | 0.009 | 0.250 | 0.070 | 286.00 | 0.086 | 0.250 | 5.70 | 0.185 | 28.53 | 40.18 |
| 188B | 0.066 | 0.460 | 0.109 | 300.00 | 0.149 | 0.250 | 6.00 | 0.183 | 13.07 | 44.69 |
| 188C | 0.022 | 0.340 | 0.121 | 308.00 | 0.145 | 0.250 | 5.80 | 0.194 | 9.95 | 26.99 |
| 188D | 0.055 | 0.550 | 0.111 | 304.00 | 0.150 | 0.250 | 5.80 | 0.195 | 8.64 | 22.89 |
| 188E | 0.052 | 0.640 | 0.112 | 289.00 | 0.136 | 0.250 | 5.70 | 0.202 | 5.14 | 26.22 |
| 188F | 0.072 | 0.640 | 0.108 | 273.00 | 0.146 | 0.250 | 5.70 | 0.205 | 4.64 | 25.80 |
| 188G | 0.001 | 0.070 | 0.152 | 313.00 | 0.150 | 0.250 | 5.70 | 0.207 | 0.00 | 25.00 |
| 160E | 0.004 | 0.210 | 0.074 | 228.00 | 0.092 | 0.250 | 5.70 | 0.170 | 26.39 | 41.88 |

# APPENDIX B

# RAINFALL CHARTS AND PROBABLE MAXIMUM PRECIPITATION

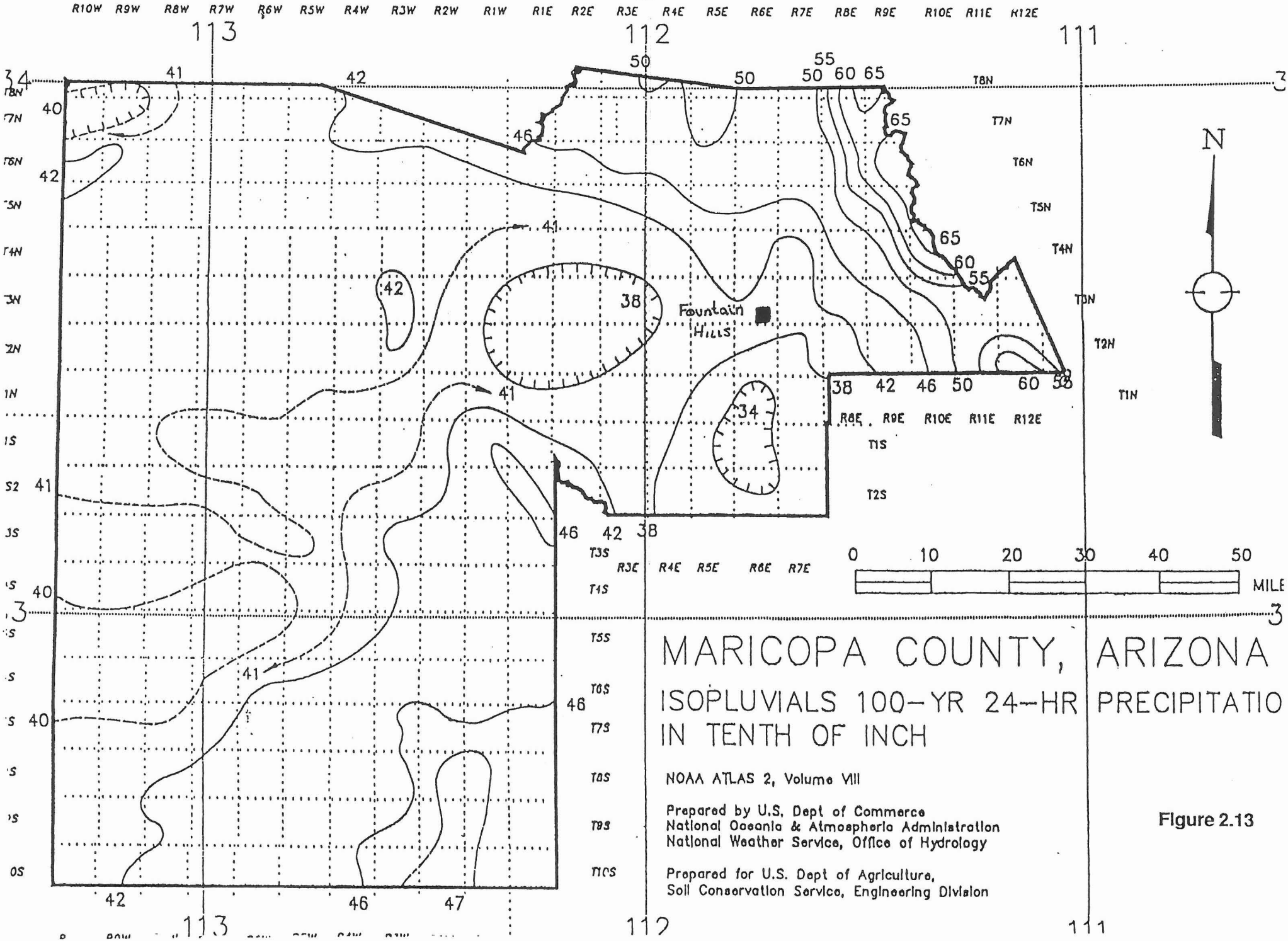

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 24-HR PRECIPITATIO
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
Fountain Hills
N
0 10 20 30 40 50
MILE
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

Figure 2.13

| | | | |
|---|---|---|---|
| Client | Anderson-Nelson, Inc. | | |
| Job | Fountain Hills (Structure #19 Hydrology) | Job # | |
| By | HAA | Date | 12-Sep-95 |
| Check | | Date | |

## PMP CALCULATIONS

| | | |
|---|---|---|
| Area | 0.84 | sq. miles |
| Latitude | 33 44' | |
| Longitude | 111 44' | |
| Elevation | 1620 | |

1 Average 1-hr 1-mi2 PMP (Figure 4.5) — 11.5 in.

2a Reduction for elevation. (No adjustment for elevations up to 5,000 feet: 5% decrease per 1,000 feet above 5,000 feet — 100 %

2b Multiply step 1 by step 2a — 11.5 in.

3 Average 6/1 ratio for drainage(figure 4.7) — 1.24

| | Duration (hr) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1/4 | 1/2 | 3/4 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 4 Duration variation for 6/1-hr ratio of step 3 (table 4.4) | 74.00 | 89.00 | 95.00 | 100.00 | 111.60 | 117.40 | 120.80 | 122.60 | 124.00 | % |
| 5 1-mi^2 PMP for indicated duration (step 2b X step 4) | 8.51 | 10.24 | 10.93 | 11.50 | 12.83 | 13.50 | 13.89 | 14.10 | 14.26 | in. |
| 6 Aeral reduction (figure 4.9) | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | % |
| 7 Aeral reduction PMP (steps 5 X 6) | 8.51 | 10.24 | 10.93 | 11.50 | 12.83 | 13.50 | 13.89 | 14.10 | 14.26 | in. |
| 8 Incremental PMP (successive Substraction in step 7) | | | | 11.500 | 1.334 | 0.667 | 0.391 | 0.207 | 0.161 | in. |
| | 8.510 | 1.725 | 0.690 | 0.575 } 15-min. increments | | | | | | |
| 9 Time sequence of incr-mental PMP according to: EMR110-2-1411 | | | | | | | | | | |
| Hourly increment (table 4.7) | | | | 0.161 | 0.391 | 1.334 | 11.5 | 0.667 | 0.207 | in. |
| Four largest 15-min. Increments (table 4.8) | | | | 8.51 | 1.725 | 0.69 | 0.575 | | | in. |

| | | | |
|---|---|---|---|
| Client | Anderson-Nelson, Inc. | | |
| Job | Fountain Hills (Structure #19 Hydrology) | Job # | |
| By | HAA | Date | 12-Sep-95 |
| Check | | Date | |

## PMP CALCULATIONS

### Cumulative Hourly and maximum 15-min PMP

| Time (Hour) | 15-min PMP | Hourly PMP | Cumulative PMP |
|---|---|---|---|
| 0 | | | 0.00 |
| 1.00 | | 0.16 | 0.16 |
| 2.00 | | 0.39 | 0.55 |
| 3.00 | | 1.33 | 1.89 |
| 3.25 | 8.51 | | 10.40 |
| 3.50 | 1.72 | | 12.12 |
| 3.75 | 0.69 | | 12.81 |
| 4.00 | 0.57 | 11.50 | 13.39 |
| 5.00 | | 0.67 | 14.05 |
| 6.00 | | 0.21 | 14.26 |

Time vrs. Cumulative PMP were ploted (Graph 1) and 15 min. values obtained from the graph. This values were entered in the shaded areas of the table below

### Cumulative PMP Distribution

| Time (hours) | Cumulative Depth (in) | Unit Cumulative Depth |
|---|---|---|
| 0.00 | 0.00 | 0.0000 |
| 0.25 | 0.01 | 0.0007 |
| 0.50 | 0.02 | 0.0014 |
| 0.75 | 0.08 | 0.0056 |
| 1.00 | 0.16 | 0.0113 |
| 1.25 | 0.22 | 0.0154 |
| 1.50 | 0.32 | 0.0224 |
| 1.75 | 0.41 | 0.0288 |
| 2.00 | 0.55 | 0.0387 |
| 2.25 | 0.75 | 0.0526 |
| 2.50 | 1.00 | 0.0701 |
| 2.75 | 1.38 | 0.0968 |
| 3.00 | 1.89 | 0.1323 |
| 3.25 | 10.40 | 0.7290 |
| 3.50 | 12.12 | 0.8500 |
| 3.75 | 12.81 | 0.8984 |
| 4.00 | 13.39 | 0.9387 |
| 4.25 | 13.56 | 0.9509 |
| 4.50 | 13.76 | 0.9649 |
| 4.75 | 13.92 | 0.9762 |
| 5.00 | 14.05 | 0.9855 |
| 5.25 | 14.17 | 0.9937 |
| 5.50 | 14.25 | 0.9993 |
| 5.75 | 14.26 | 1.0000 |
| 6.00 | 14.26 | 1.0000 |

The final distribution was ploted (Graph 2) and need to be checked for to ensure a smoth curve

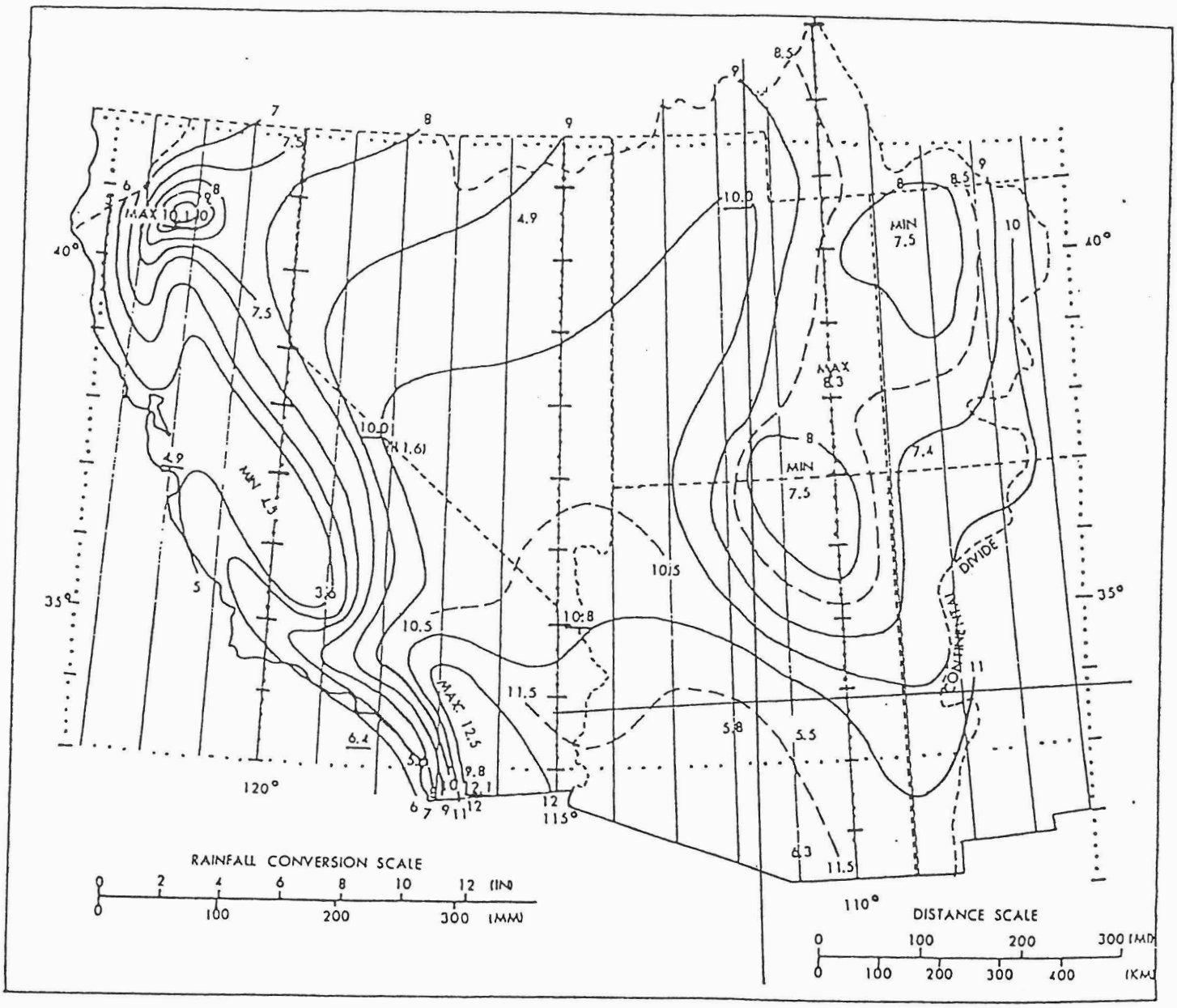



*Figure 4.5--Local-storm PMP for 1 mi$^2$ (2.6 km$^2$) 1 hr. Directly applicable for locations between sea level and 5000 ft (1524 m). Elevation adjustment must be applied for locations above 5000 ft.*

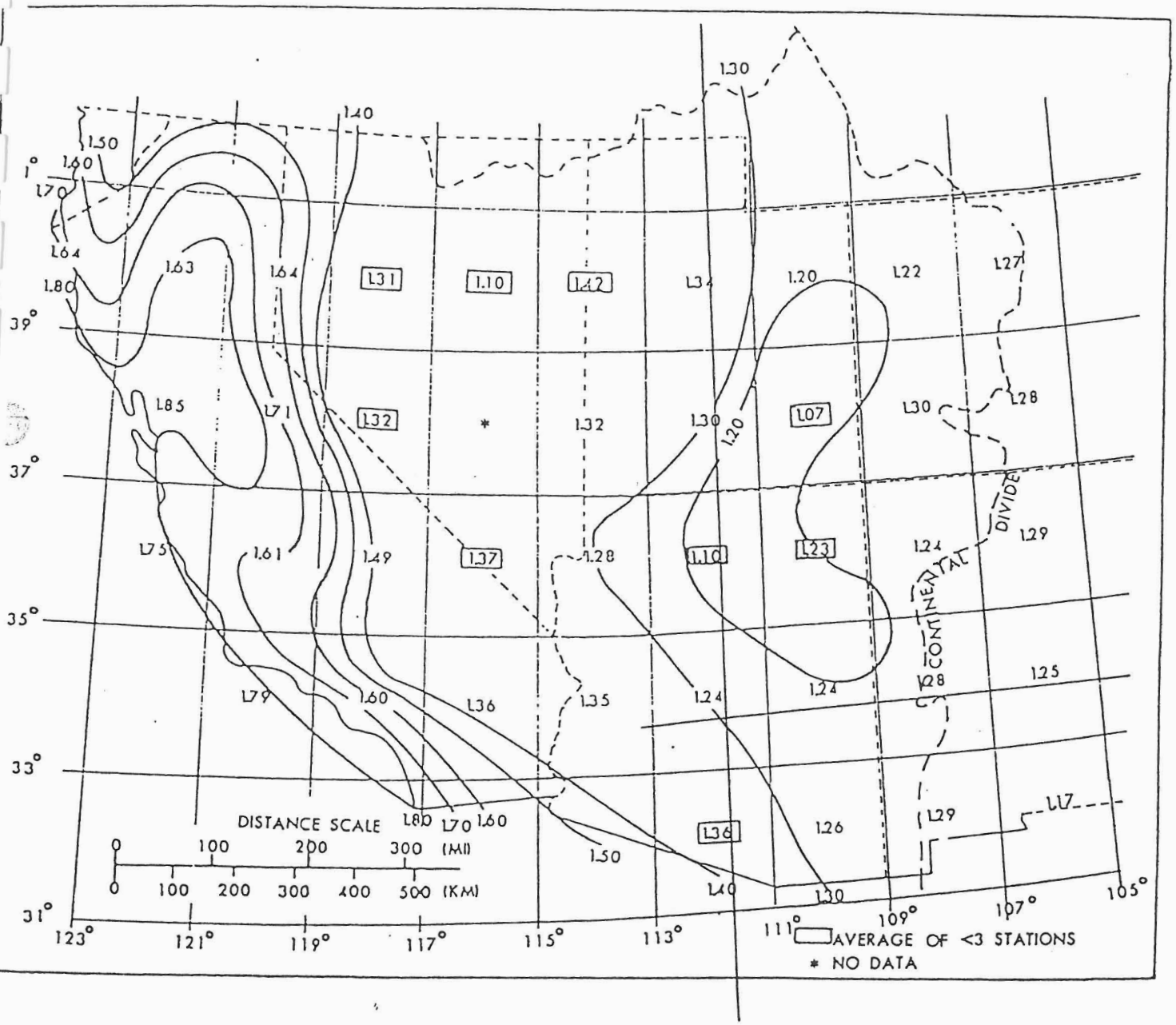



*Figure 4.7.--Analysis of 6/1-hr ratios of averaged maximum station data (plotted at midpoints of a 2° latitude-longitude grid).*

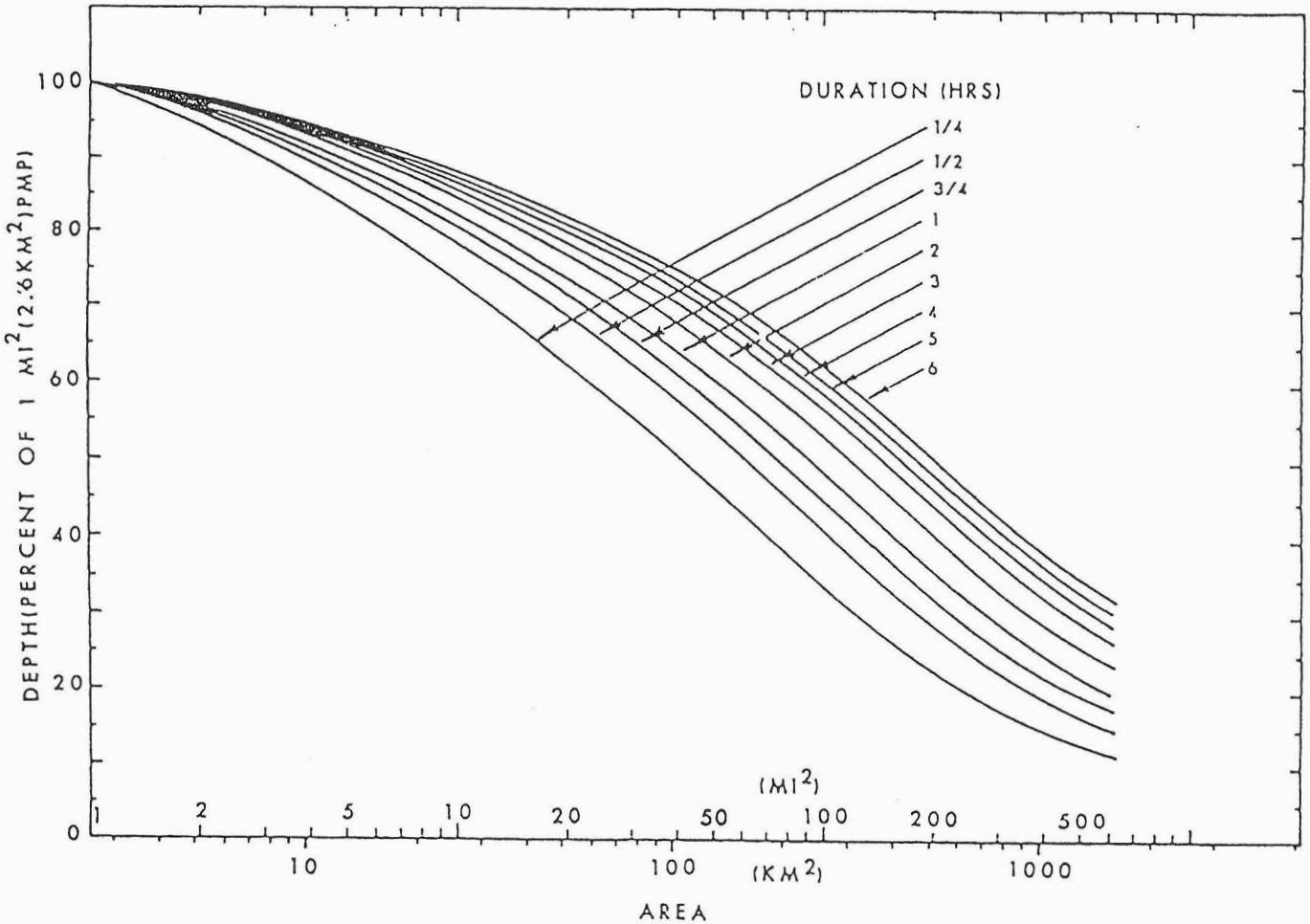
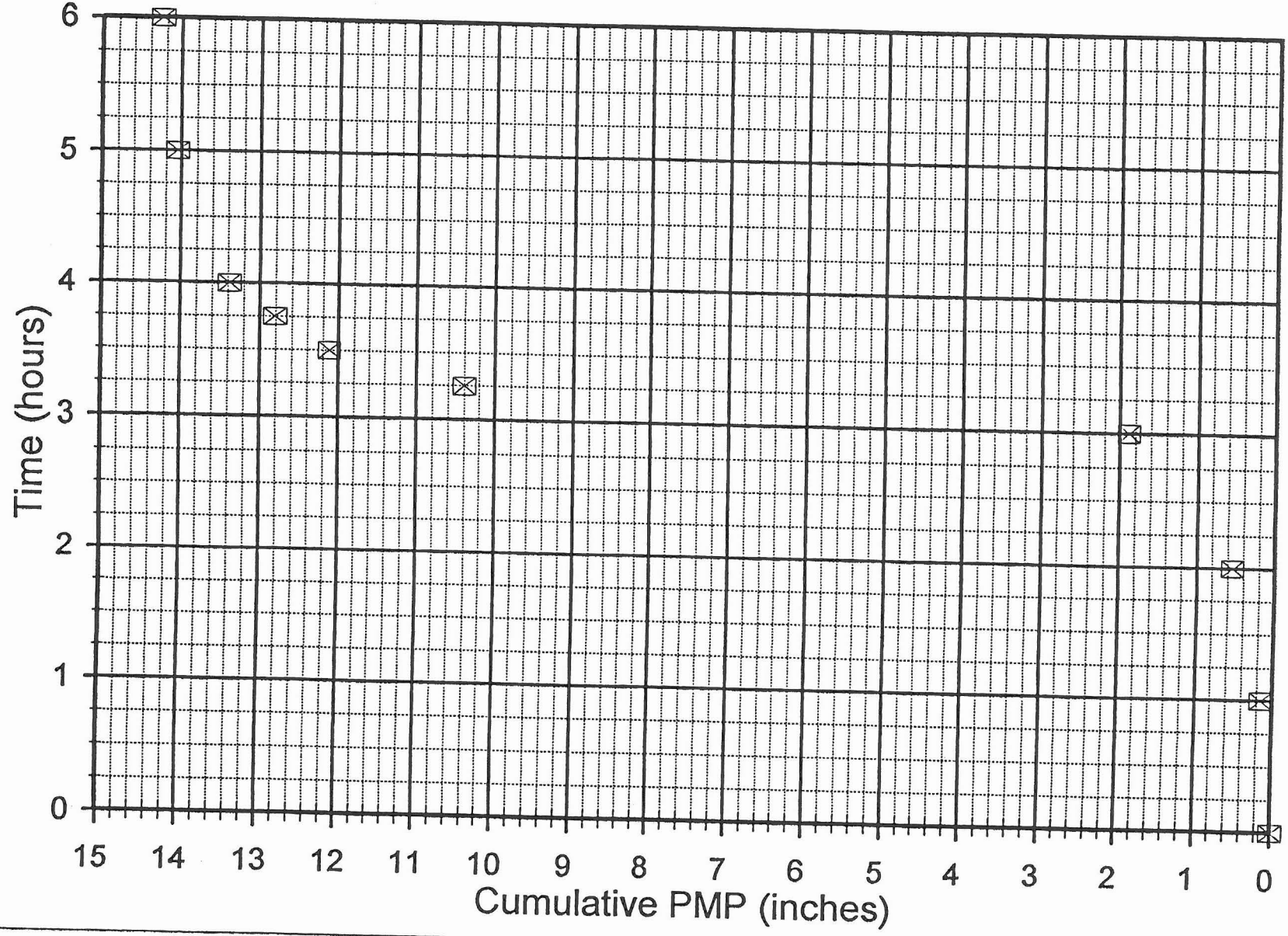
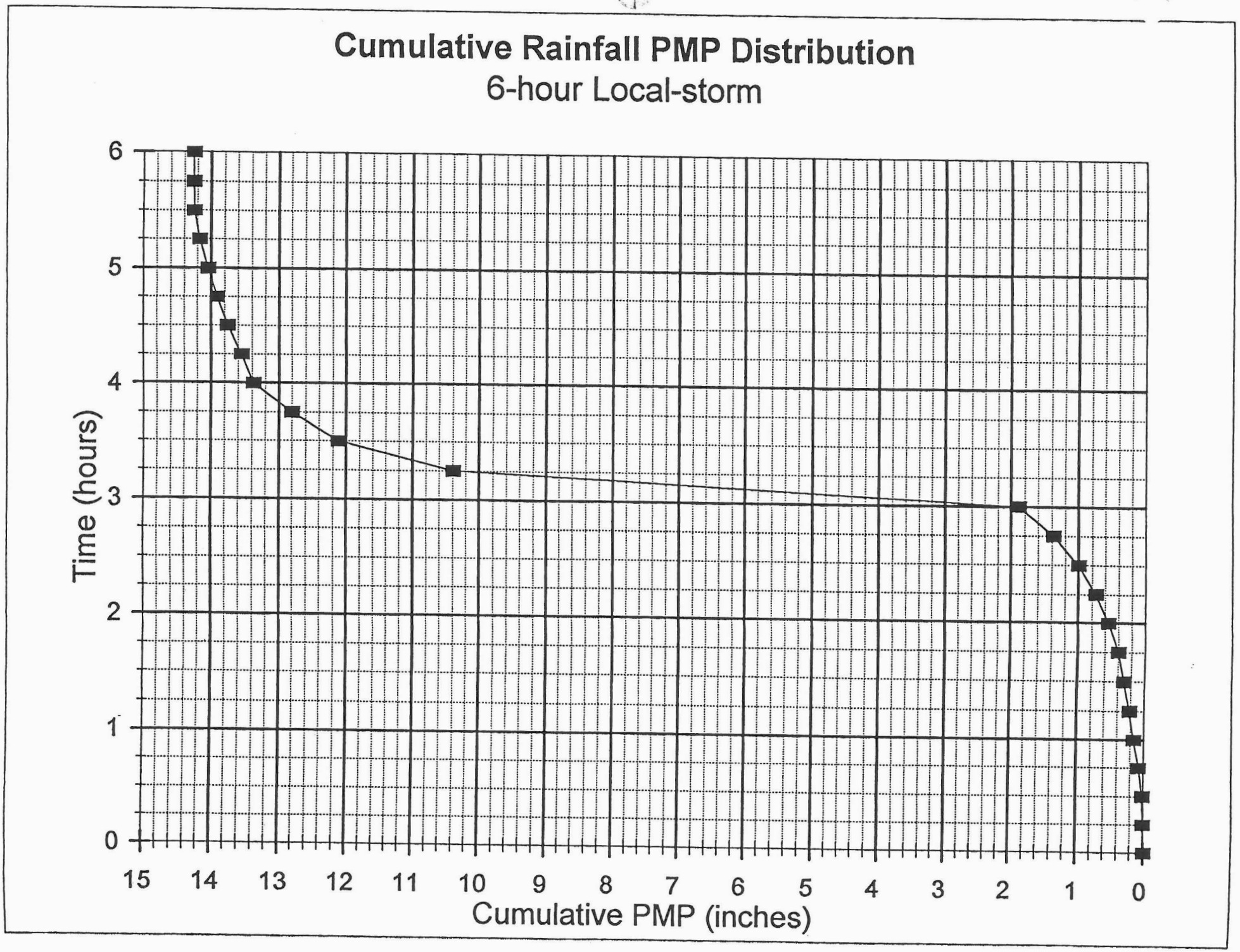



*Figure 4.9.--Adopted depth-area relations for local-storm PMP.*

## Cumulative Rainfall PMP Distribution
6-hour Local-storm




Cumulative Rainfall PMP Distribution
6-hour Local-storm
Time (hours)
0
1
2
3
4
5
6
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Cumulative PMP (inches)

# APPENDIX C

# IMPOUNDMENT AND SPILLWAY INFORMATION

# APPENDIX C.1

## Stage-Area-Discharge Relations

## for Stoneridge Dam

ACK ENGINEERS, INC.
2205 N. 44th St. Phoenix, AZ • Phone (602) 244-2066

SHEET _____ OF 0

BY HAA DATE 14-Sep-95

CLIENT: Anderson-Nelson, Inc. CHECK _____ DATE _____

JOB: Structure #19 Hydrology. Culvert rating table JOB NO. 465.14

| | | |
|---|---|---|
| **Location =** | Structure #19 outlet | |
| **Pipe size (d) =** | 30 | in |
| **Number of pipes =** | 1 | |
| **Type of Pipe =** | RPC | |
| **Culvert inlet flow-line =** | 1678.86 | |
| **Spillway elevation =** | 1702.67 | |
| **Opening Area =** | 4.91 | sq-ft |

$$Q = C\,A\,(HW/D)^{2/3}$$

| Water Surface Elevation | Height of Water HW (ft) | HW/D | Coefficient Orfice/weir C | Flow Rate Q (cfs) |
|---|---|---|---|---|
| Orifice flow only | | | | |
| 1678.86 | 0.00 | 0.00 | 0.00 | 0.0 |
| 1679.86 | 1.00 | 0.40 | 1.70 | 4.5 |
| 1680.86 | 2.00 | 0.80 | 3.80 | 16.1 |
| 1682.86 | 4.00 | 1.60 | 5.39 | 36.2 |
| 1686.86 | 8.00 | 3.20 | 5.39 | 57.5 |
| 1694.86 | 16.00 | 6.40 | 5.39 | 91.2 |
| 1698.86 | 20.00 | 8.00 | 5.39 | 105.8 |
| Orifice and weir flow | | | | |
| 1702.67 Orifice | 23.81 | 9.524 | 5.39 | 118.9 |
| weir | from crit/ener | | | 0.0 |
| | | | Total = | 118.9 |
| 1703.09 Orifice | 24.23 | 9.692 | 5.39 | 120.3 |
| weir | from crit/ener | | | 83.1 |
| | | | Total = | 203.4 |
| 1703.86 Orifice | 25.00 | 10 | 5.39 | 122.8 |
| weir | from crit/ener | | | 402.5 |
| | | | Total = | 525.3 |
| 1704.86 Orifice | 26.00 | 10.4 | 5.39 | 126.1 |
| weir | from crit/ener | | | 1025.2 |
| | | | Total = | 1151.3 |
| 1705.86 Orifice | 27.00 | 10.8 | 5.39 | 129.3 |
| weir | from crit/ener | | | 1838.1 |
| | | | Total = | 1967.4 |
| 1706.86 Orifice | 28.00 | 11.2 | 5.39 | 132.4 |
| weir | from crit/ener | | | 2821.1 |
| | | | Total = | 2953.5 |
| 1707.86 Orifice | 29.00 | 11.6 | 5.39 | 135.6 |
| weir | from crit/ener | | | 3964.1 |
| | | | Total = | 4099.6 |
| 1709.85 Orifice | 30.99 | 12.396 | 5.39 | 141.7 |
| weir | from crit/ener | | | 6694.7 |
| | | | Total = | 6836.4 |

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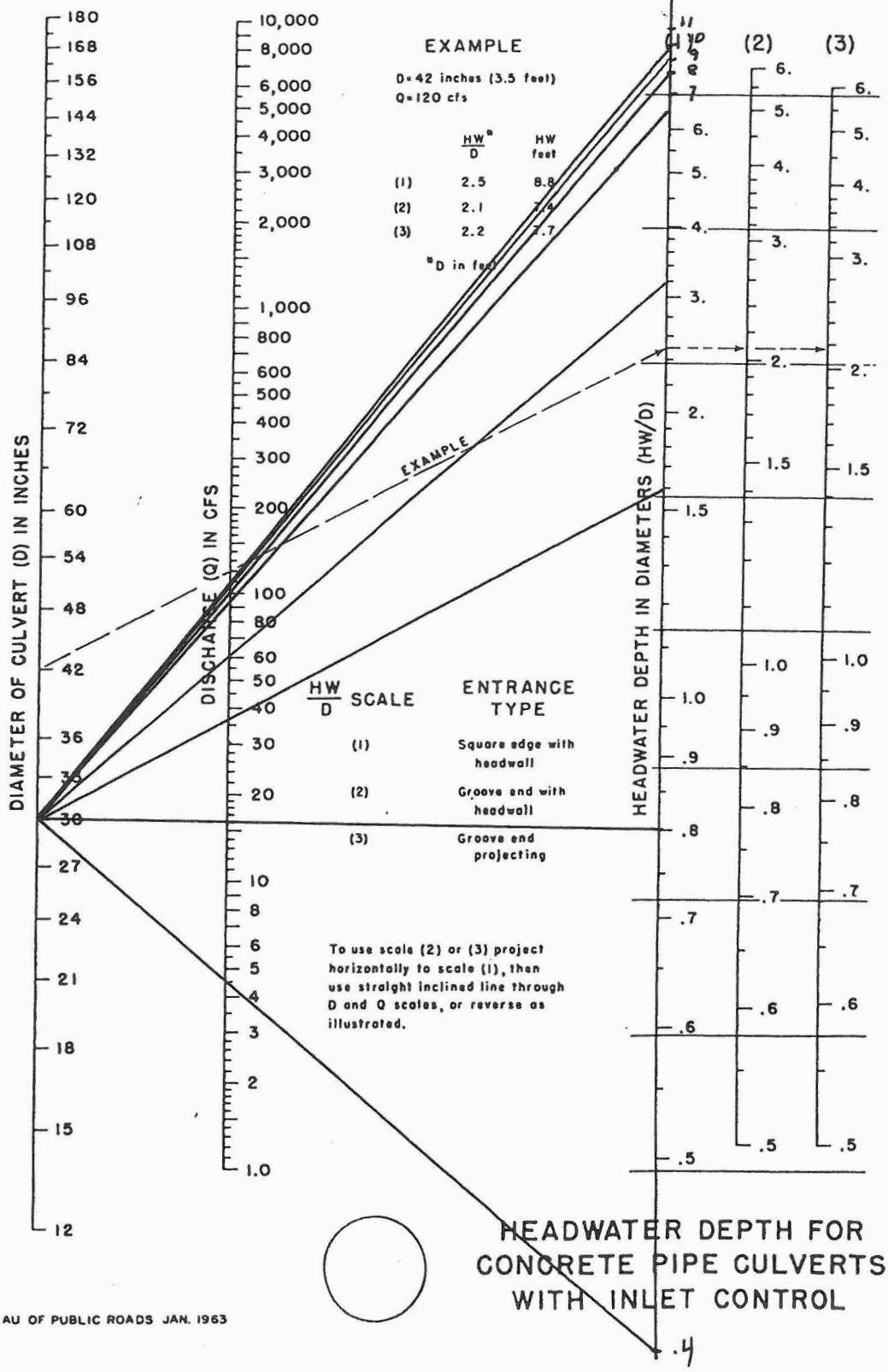
SHEET _____ OF _____
BY _____ DATE _____
CHECK _____ DATE _____
CLIENT _____
JOB _____ JOB NO. _____

# CHART 2




HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

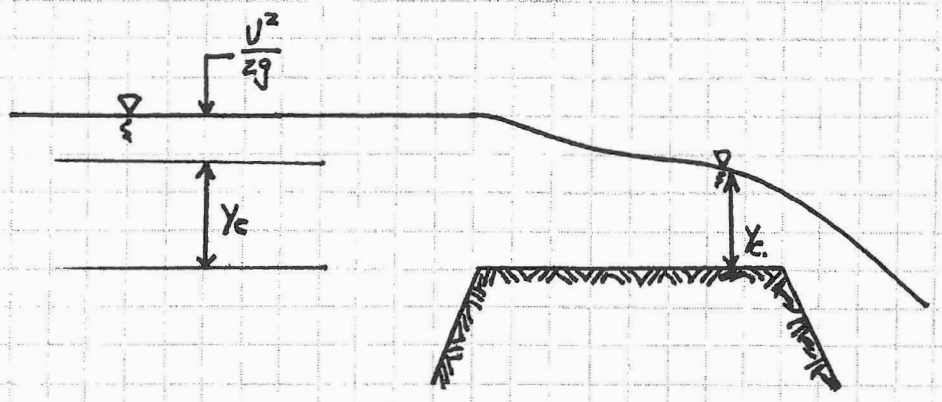
BUREAU OF PUBLIC ROADS JAN. 1963

ACK ENGINEERS, INC.
2255 N. 44th Street, Ste. 330, Phoenix, AZ 85008 Tel. (602) 244-2566

SHEET _____ OF _____
BY HAA DATE 9-14-95
CHECK _____ DATE _____

CLIENT Anderson - Nelson, Inc.
JOB NAME Fountain Hills Structure #19 JOB NO. _____

Lake Surface - Spillway Elev - Discharge Relations




1. Stage-Discharge Relation was developed by use of the critical depth formula:

$$\frac{Q^2}{g} = \frac{A^3}{T}$$

Where:

Q = Flow Rate (cfs)

A = X-sectional area ($ft^2$)

T = Top width (ft)

g = 32.2 $ft/sec^2$

2. Lake Surface Elev. = Spillway Crest Elev.
+ Critical Depth, $Y_c$
+ Spillway Velocity Head $V^2/2g$

= Spillway Crest Elev. + $Y_c$ + $V^2/2g$

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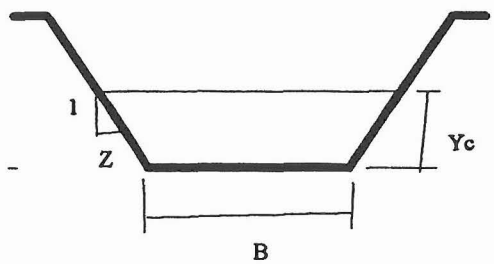
| | | | |
|---|---|---|---|
| | | SHEET | OF 0 |
| | | BY HAA | DATE 14-Sep-95 |
| CLIENT: | Anderson-Nelson, Inc. | CHECK | DATE |
| JOB: | Structure #19 Hydrology. Culvert rating table | JOB NO. 465.14 | |

## CRITICAL DEPTH/ ENERGY CALCULATIONS

| | | |
|---|---|---|
| **LOCATION** | Structure #19 | |
| Bottom width = | 98 | (ft) |
| Side slopes = | 3 | :1 |
| Flow line elevation = | 1702.67 | (ft) |




| Stage (ft) | Depth yc (ft) | Top width T (ft) | Area A (ft^2) | Velocity Head (ft) | Discharge (cfs) |
|---|---|---|---|---|---|
| 1702.7 | 0.00 | 98.00 | 0.00 | 0.00 | 0.00 |
| 1703.1 | 0.28 | 99.68 | 27.75 | 0.14 | 83.10 |
| 1703.9 | 0.80 | 102.80 | 80.27 | 0.39 | 402.53 |
| 1704.9 | 1.48 | 106.88 | 151.67 | 0.71 | 1025.21 |
| 1705.9 | 2.17 | 111.01 | 226.68 | 1.02 | 1838.09 |
| 1706.9 | 2.86 | 115.19 | 305.35 | 1.33 | 2821.08 |
| 1707.9 | 3.57 | 119.40 | 387.68 | 1.62 | 3964.06 |
| 1709.9 | 4.98 | 127.88 | 562.52 | 2.20 | 6694.72 |

DAM 19
TOP OF DAM
30" CONC. PIPE
TOP OF HEADWALL
145 L.F.
222
229
130
115
98
CONC SPILLWAY
95'
RIP RAP'IN GUNITE
GUNITE
48
Colony Wash
Roadway
Dirt
Trail

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

 188          KK   R187A
 189          KM   ROUTE 187A THROUGHT SUB-BASIN 187B TO POINT OF CON. GRS1
 190          RS       1    FLOW       0
 191          RC    0.04    0.04    0.04     445   0.022
 192          RX    9785    9845    9940    9988   10010   10030   10125   10170
 193          RY    1870    1861    1858    1852    1852    1858    1872    1876

 194          KK    187B
 195          KM   SUB-BASIN 187B
 196          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 197          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 198          BA    .008
 199          LG    .150    .250   5.800    .195  48.740
 200          UC    .162    .204
 201          UA       0       5      16      30      65      77      84      90      94      97
 202          UA     100

 203          KK    GRS1
 204          KM    GREYSTONE WASH CONCENTRATION POINT 1 - COMBINE R187A, 187B
 205          HC       2

 206          KK   RGRS1
 207          KM   ROUTE GRS1 THROUGHT SUB-BASIN 187D TO POINT OF CON. GRS2
 208          RS       6    FLOW       0
 209          RC    0.04    0.04    0.04    3514    .044
 210          RX    9920    9955    9980    9995   10005   10040   40075   10110
 211          RY    1780    1770    1760    1754    1754    1760    1770    1780

 212          KK    187C
 213          KM   SUB-BASIN 187C
 214          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 215          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 216          BA    .012
 217          LG    .150    .250   5.700    .198  38.760
 218          UC    .125    .141
 219          UA       0       5      16      30      65      77      84      90      94      97
 220          UA     100

 221          KK   R187C
 222          KM   ROUTE 187C THROUGHT SUB-BASIN 187D TO POINT OF CON. GRS2
 223          RS       4    FLOW       0
 224          RC    0.04    0.04    0.04    2181    .061
 225          RX    9920    9955    9980    9995   10005   10040   40075   10110
 226          RY    1780    1770    1760    1754    1754    1760    1770    1780

 227          KK    187D
 228          KM   SUB-BASIN 187D
 229          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 230          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 231          BA    .070
 232          LG    .150    .250   5.700    .207  28.650
 233          UC    .308    .363
 234          UA       0       5      16      30      65      77      84      90      94      97
 235          UA     100
```

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

 236          KK   *GRS2
 237          KM   GREYSTONE WASH CONCENTRATION POINT *2 - RGRS1, R187C, 187D
 238          HC       3

 239          KK    188A
 240          KM   SUB-BASIN 188A
 241          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 242          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 243          BA    .009
 244          LG    .086    .250   5.700    .185  40.180
 245          UC    .129    .185
 246          UA       0       5      16      30      65      77      84      90      94      97
 247          UA     100

 248          KK   R188A
 249          KM   ROUTE 188A THROUGH SUB-BASIN 188B TO CON. POINT SYC1
 250          RS       2    FLOW       0
 251          RC    0.04    0.04    0.04     747   0.173
 252          RX    9770    9810    9940    9960   10020   10045   10120   10180
 253          RY    1716    1711    1708    1708    1709    1712    1720    1728

 254          KK    188B
 255          KM   SUB-BASIN 188B
 256          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 257          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 258          BA    .066
 259          LG    .149    .250   6.000    .183  44.690
 260          UC    .217    .171
 261          UA       0       5      16      30      65      77      84      90      94      97
 262          UA     100

 263          KK    188C
 264          KM   SUB-BASIN 188C
 265          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 266          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 267          BA    .022
 268          LG    .145    .250   5.800    .194  26.990
 269          UC    .196    .225
 270          UA       0       5      16      30      65      77      84      90      94      97
 271          UA     100

 272          KK    SYR1
 273          KM   SYCAMORE WASH CONCENTRATION POINT 1 - COMBINE SUB-BASINS R188A, 188B, 188C
 274          HC       3

 275          KK   RSYC1
 276          KM   ROUTE SYC1 THROUGH SUB-BASIN 188D TO CON. POINT SYC2
 277          RS       4    FLOW       0
 278          RC    0.04    0.04    0.04    2280   0.034
 279          RX    9915    9950    9985   10000   10008   10020   10055   10085
 280          RY    1850    1840    1830    1826    1826    1830    1840    1850
```

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

 281          KK    188D
 282          KM   SUB-BASIN 188D
 283          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 284          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 285          BA    .055
 286          LG    .150    .250   5.800    .195  22.890
 287          UC    .242    .248
 288          UA       0       5      16      30      65      77      84      90      94      97
 289          UA     100

 290          KK    188E
 291          KM   SUB-BASIN 188E
 292          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 293          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 294          BA    .052
 295          LG    .136    .250   5.700    .202  26.220
 296          UC    .271    .328
 297          UA       0       5      16      30      65      77      84      90      94      97
 298          UA     100

 299          KK    SYR2
 300          KM   SYCAMORE WASH CONCENTRATION POINT 2 - COMBINE SUB-BASINS RSYC1, 188D, 188E
 301          HC       3

 302          KK   RSYC2
 303          KM   ROUTE SYC2 THROUGH SUB-BASIN 188F TO CON. POINT SYC3
 304          RS       6    FLOW       0
 305          RC    0.04    0.04    0.04    3003    0.02
 306          RX    9910    9935    9950    9980   10010   10060   10075   10110
 307          RY    1780    1770    1764    1760    1760    1766    1770    1780

 308          KK    188F
 309          KM   SUB-BASIN 188F
 310          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 311          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 312          BA    .072
 313          LG    .146    .250   5.700    .205  25.800
 314          UC    .271    .272
 315          UA       0       5      16      30      65      77      84      90      94      97
 316          UA     100

 317          KK    SYR3
 318          KM   SYCAMORE WASH CONCENTRATION POINT 3 - COMBINE SUB-BASINS RSYC2, 188F
 319          HC       2

 320          KK   SSYC3
 321          KM   ROUTE SYC3 THROUGH 60" CMP CULVERT AT GREYSTONE DRIVE
 322          RS       1    ELEV  1705.4
 323          SQ       0   113.9   188.3   242.5     323   551.7   781.5  1634.8  3266.1  4805.6
 324          SE  1705.4 1710.45 1713.45 1717.14 1718.25    1719  1719.5    1720    1721    1722
 325          SA       0    0.05     .60    1.29
 326          SE  1705.4    1708    1712    1717
```

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

 327          KK   RSYC3
 328          KM   ROUTE SSYC3 THROUGH SUB-BASIN 188G TO CON. POINT SYC4
 329          RS       1    FLOW       0
 330          RC    0.04    0.04    0.04     249   0.024
 331          RX    9770    9810    9940    9960   10020   10045   10120   10180
 332          RY    1716    1711    1708    1702    1702    1712    1720    1728

 333          KK    188G
 334          KM   SUB-BASIN 188G
 335          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 336          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 337          BA    .001
 338          LG    .150    .250   5.700    .207  25.000
 339          UC    .100    .176
 340          UA       0       5      16      30      65      77      84      90      94      97
 341          UA     100

 342          KK    SYR4
 343          KM   SYCAMORE WASH CONCENTRATION POINT 4 - COMBINE SUB-BASINS RSYC3, 188G
 344          HC       2

 345          KK    GRS2
 346          KM   GREYSTONE WASH POINT OF CONCENTRATION 2 - COMBINE (RGRS1,R187C,187DO,SYR4
 347          HC       2

 348          KK   SGRS2
 349          KM   ROUTE GRS2 THROUGH 2-60" AND 48" CULVERT AT SYCAMORE DRIVE TO GRS3
 350          RS       1    ELEV  1595.5
 351          SQ       0   98.77   222.9   319.5     499     531     641  1094.5  1877.6  4986.6
 352          SE  1595.5    1598  1599.5  1600.5  1603.5  1604.3    1605    1606    1607    1609
 353          SA       0    0.01    0.47    0.73     1.4
 354          SE  1595.5    1598    1600 1605.75    1609

 355          KK    187E
 356          KM   SUB-BASIN 187E
 357          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 358          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 359          BA    .005
 360          LG    .050    .250   5.700    .170  39.100
 361          UC    .121    .292
 362          UA       0       5      16      30      65      77      84      90      94      97
 363          UA     100

 364          KK   R187E
 365          KM   ROUTE 187E THROUGHT SUB-BASIN 187F TO POINT OF CON. GRS3A
 366          RS       3    FLOW       0
 367          RC    0.02    0.02    0.02    1707   0.076
 368          RX    9975    9980    9985    9986   10014   10015   10020   10025
 369          RY  1780.5  1780.5  1780.5    1810    1810  1810.5  1780.5  1780.5
```

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

 370          KK    187F
 371          KM   SUB-BASIN 187F
 372          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 373          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 374          BA    .003
 375          LG    .050    .250   5.700    .170  25.000
 376          UC    .154    .524
 377          UA       0       5      16      30      65      77      84      90      94      97
 378          UA     100

 379          KK   GRS3A
 380          KM   GREYSTONE WASH POINT OF CONCENTRATION 3A - COMBINE R187E, 187F
 381          HC       2

 382          KK  RGRS3A
 383          KM   ROUTE GRS3A THROUGHT SUB-BASIN 187G TO POINT OF CON. GRS3
 384          RS       1    FLOW       0
 385          RC    0.02    0.02    0.02     337   0.033
 386          RX    9975    9980    9985    9986   10014   10015   10020   10025
 387          RY  1710.5  1710.5  1710.5    1710    1710  1710.5  1710.5  1710.5

 388          KK    187G
 389          KM   SUB-BASIN 187G
 390          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 391          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 392          BA    .043
 393          LG    .100    .250   5.700    .189  39.180
 394          UC    .350    .643
 395          UA       0       5      16      30      65      77      84      90      94      97
 396          UA     100

 397          KK    GRS3
 398          KM   GREYSTONE WASH POINT OF CONCENTRATION 3 - COMBINE SGRS2, RGRS3A, 187G
 399          HC       3

 400          KK   RGRS3
 401          KM   ROUTE GRS3 THROUGHT SUB-BASIN 187H TO POINT OF CON. GRS4
 402          RS       4    FLOW       0
 403          RC    0.04    0.04    0.04     442   0.045
 404          RX    9705    9755    9965    9990   10030   10065   10085   10130
 405          RY    1708  1699.3  1699.3    1690    1690    1696    1700    1710

 406          KK    187H
 407          KM   SUB-BASIN 187H
 408          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 409          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 410          KO
 411          BA    .004
 412          LG    .150    .250   5.700    .207  25.000
 413          UC    .138    .186
 414          UA       0       5      16      30      65      77      84      90      94      97
 415          UA     100
```

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

 416          KK   *SNB5
 417          KM   SUNBURST WASH CONCENTRATION POINT *5 - RGRS3, 187H
 418          KO
 419          HC       2

 420          KK    SNB5
 421          KM   SUNBURST WASH CONSENTRATION POINT 5 - COMBINE (RSNB4,186I), (RGRS3, 187H)
 422          KO
 423          HC       2

 424          KK   RSNB5
 425          KM   ROUTE SNB5 THROUGH SUB-BASIN 187I  TO CON. POINT SNB6
 426          RS       1    FLOW       0
 427          RC    0.04    0.04    0.04     295    0.02
 428          RX    9685    9760    9870    9950   10005   10035   10225   10255
 429          RY    1710  1691.5  1691.5    1682    1682    1692    1700    1710

 430          KK    187I
 431          KM   SUB-BASIN 187I
 432          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 433          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 434          BA    .024
 435          LG    .150    .250   5.700    .207  25.000
 436          UC    .171    .144
 437          UA       0       5      16      30      65      77      84      90      94      97
 438          UA     100

 439          KK    SNB6
 440          KM   SUNBURST WASH CONSENTRATION POINT 6 - COMBINE RSNB5, 187I
 441          HC       2

 442          KK   SSNB6
 443          KM   ROUTE THROUGH 30" CMP UNDER DAM AT SUB-BASIN 187I
 444          RS       1    ELEV 1678.86
 445          SQ       0    16.1    36.2   118.9   203.4  1151.3  1967.4  2953.5  4099.6  6836.4
 446          SE  1678.9 1680.86 1682.86 1702.67 1703.09 1704.86 1705.86 1706.86 1707.86 1709.85
 447          SA       0    0.01    0.93    3.47    8.55   11.38
 448          SE  1678.9    1680    1686    1694    1704    1708
 449          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

  9        186A
              .
              .
 30           .        186B
              .           V
              .           V
 39           .       R186B
              .           .
              .           .
 45      SNB1A.............
              V
              V
 48     RSNB1A
              .
              .
 54           .        186C
              .           V
              .           V
 63           .       R186C
              .           .
              .           .
 69           .           .        186D
              .           .           .
              .           .           .
 78      SNB1.........................
              V
              V
 81     RSNB1
              .
              .
 87           .        186E
              .           .
              .           .
 96           .           .        186F
              .           .           .
              .           .           .
105      SNB2.........................
              V
              V
108     RSNB2
              .
              .
114           .        186G
              .           .
              .           .
123      SNB3............
              V
              V
126     SSNB3
              .
              .
133           .        186H
              .           .
              .           .
142           .           .        160E
              .           .           V
              .           .           V
151           .           .       R160E
              .           .           .
              .           .           .
157      SNB4.........................
              V
              V
160     RSNB4
              .
```

```
166          186I
175     *SNB5............
179          187A
             V
             V
188         R187A
194                 187B
203          GRS1............
             V
             V
206         RGRS1
212                 187C
                       V
                       V
221                R187C
227                           187D
236         *GRS2........................
239                 188A
                       V
                       V
248                R188A
254                           188B
263                                     188C
272                SYR1........................
                       V
                       V
275                RSYC1
281                           188D
290                                     188E
299                SYR2........................
                       V
                       V
302                RSYC2
308                           188F
317                SYR3............
                       V
                       V
320                SSYC3
                       V
```

```
                .          .          V
327             .          .      RSYC3
                .          .          .
                .          .          .
333             .          .          .        188G
                .          .          .          .
                .          .          .          .
342             .          .      SYR4............
                .          .          .
                .          .          .
345             .       GRS2............
                .          V
                .          V
348             .      SGRS2
                .          .
                .          .
355             .          .      187E
                .          .         V
                .          .         V
364             .          .     R187E
                .          .          .
                .          .          .
370             .          .          .        187F
                .          .          .          .
                .          .          .          .
379             .          .     GRS3A............
                .          .         V
                .          .         V
382             .          .    RGRS3A
                .          .          .
                .          .          .
388             .          .          .        187G
                .          .          .          .
                .          .          .          .
397             .       GRS3........................
                .          V
                .          V
400             .      RGRS3
                .          .
                .          .
406             .          .      187H
                .          .          .
                .          .          .
416             .      *SNB5............
                .          .
                .          .
420          SNB5............
                V
                V
424         RSNB5
                .
                .
430             .       187I
                .          .
                .          .
439          SNB6............
                V
                V
442         SSNB6
```

'**) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************                    *****************************************
                                        *                    *
  FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *                    *    U.S. ARMY CORPS OF ENGINEERS
              MAY   1991                *                    *    HYDROLOGIC ENGINEERING CENTER
           VERSION 4.0.1E               *                    *          609 SECOND STREET
     Lahey F77L-EM/32 version 5.01      *                    *        DAVIS, CALIFORNIA 95616
       Dodson & Associates, Inc.        *                    *           (916) 551-1748
  RUN DATE  09/14/95  TIME  16:02:41    *                    *
*****************************************                    *****************************************
```

```
*******************************************************************************
**                        STRUCTURE #19 HYDROLOGY                            **
*******************************************************************************
FUTURE DEVELOPMENT, AGK ENGINEERS, 9-11-95              FILE: D19-24F.DAT
100-Year 24-Hour storm
Time step at 2 minutes


 IT          HYDROGRAPH TIME DATA
                  NMIN          2  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1   0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        720  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      1   0  ENDING DATE
                NDTIME       2358  ENDING TIME
                 ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL    0.03 HOURS
                 TOTAL TIME BASE   23.97 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
```

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 | 186A | 144. | 12.07 | 17. | 5. | 5. | 0.10 | | |
| HYDROGRAPH AT | 186B | 8. | 12.00 | 1. | 0. | 0. | 0.00 | | |
| ROUTED TO | R186B | 8. | 12.07 | 1. | 0. | 0. | 0.00 | 1900.07 | 12.07 |
| 2 COMBINED AT | SNB1A | 152. | 12.07 | 18. | 5. | 5. | 0.10 | | |
| ROUTED TO | RSNB1A | 149. | 12.17 | 18. | 5. | 5. | 0.10 | 1893.08 | 12.17 |
| HYDROGRAPH AT | 186C | 27. | 12.03 | 4. | 1. | 1. | 0.02 | | |
| ROUTED TO | R186C | 27. | 12.03 | 4. | 1. | 1. | 0.02 | 2040.07 | 12.03 |
| HYDROGRAPH AT | 186D | 104. | 12.10 | 15. | 4. | 4. | 0.08 | | |
| 3 COMBINED AT | SNB1 | 274. | 12.10 | 37. | 11. | 11. | 0.20 | | |
| ROUTED TO | RSNB1 | 272. | 12.13 | 37. | 11. | 11. | 0.20 | 1815.85 | 12.13 |
| HYDROGRAPH AT | 186E | 57. | 12.03 | 7. | 2. | 2. | 0.04 | | |
| HYDROGRAPH AT | 186F | 43. | 12.03 | 6. | 2. | 2. | 0.03 | | |
| 3 COMBINED AT | SNB2 | 359. | 12.10 | 49. | 14. | 14. | 0.27 | | |
| ROUTED TO | RSNB2 | 357. | 12.17 | 49. | 14. | 14. | 0.27 | 1763.64 | 12.17 |
| HYDROGRAPH AT | 186G | 94. | 12.07 | 12. | 4. | 4. | 0.07 | | |
| 2 COMBINED AT | SNB3 | 440. | 12.13 | 61. | 18. | 18. | 0.33 | | |
| ROUTED TO | SSNB3 | 266. | 12.43 | 61. | 18. | 18. | 0.33 | 1738.91 | 12.43 |
| HYDROGRAPH AT | 186H | 25. | 12.10 | 5. | 2. | 2. | 0.03 | | |
| HYDROGRAPH AT | 160E | 6. | 12.03 | 1. | 0. | 0. | 0.00 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ROUTED TO | R160E | 6. | 12.07 | 1. | 0. | 0. | 0.00 | 1733.05 | 12.03 |
| 3 COMBINED AT | SNB4 | 286. | 12.43 | 67. | 20. | 20. | 0.36 | | |
| ROUTED TO | RSNB4 | 271. | 12.53 | 67. | 20. | 20. | 0.36 | 1703.18 | 12.53 |
| HYDROGRAPH AT | 186I | 45. | 12.03 | 5. | 2. | 2. | 0.03 | | |
| 2 COMBINED AT | *SNB5 | 280. | 12.50 | 73. | 21. | 21. | 0.39 | | |
| HYDROGRAPH AT | 187A | 16. | 12.00 | 2. | 1. | 1. | 0.01 | | |
| ROUTED TO | R187A | 16. | 12.00 | 2. | 1. | 1. | 0.01 | 1852.10 | 12.00 |
| HYDROGRAPH AT | 187B | 13. | 12.03 | 2. | 1. | 1. | 0.01 | | |
| 2 COMBINED AT | GRS1 | 29. | 12.00 | 3. | 1. | 1. | 0.02 | | |
| ROUTED TO | RGRS1 | 28. | 12.10 | 3. | 1. | 1. | 0.02 | 1754.23 | 12.10 |
| HYDROGRAPH AT | 187C | 21. | 12.00 | 2. | 1. | 1. | 0.01 | | |
| ROUTED TO | R187C | 20. | 12.03 | 2. | 1. | 1. | 0.01 | 1754.14 | 12.03 |
| HYDROGRAPH AT | 187D | 86. | 12.10 | 13. | 4. | 4. | 0.07 | | |
| 3 COMBINED AT | *GRS2 | 134. | 12.10 | 19. | 6. | 6. | 0.10 | | |
| HYDROGRAPH AT | 188A | 15. | 12.00 | 2. | 1. | 1. | 0.01 | | |
| ROUTED TO | R188A | 15. | 12.03 | 2. | 1. | 1. | 0.01 | 1708.02 | 12.03 |
| HYDROGRAPH AT | 188B | 110. | 12.03 | 14. | 5. | 5. | 0.07 | | |
| HYDROGRAPH AT | 188C | 33. | 12.03 | 4. | 1. | 1. | 0.02 | | |
| 3 COMBINED AT | SYR1 | 158. | 12.03 | 20. | 6. | 6. | 0.10 | | |
| ROUTED TO | RSYC1 | 156. | 12.07 | 20. | 6. | 6. | 0.10 | 1827.50 | 12.07 |
| HYDROGRAPH AT | 188D | 79. | 12.07 | 10. | 3. | 3. | 0.05 | | |
| HYDROGRAPH AT | 188E | 67. | 12.07 | 10. | 3. | 3. | 0.05 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 COMBINED AT | SYR2 | 303. | 12.07 | 40. | 12. | 12. | 0.20 | | |
| ROUTED TO | RSYC2 | 297. | 12.17 | 40. | 12. | 12. | 0.20 | 1761.27 | 12.17 |
| HYDROGRAPH AT | 188F | 100. | 12.07 | 13. | 4. | 4. | 0.07 | | |
| 2 COMBINED AT | SYR3 | 389. | 12.13 | 54. | 16. | 16. | 0.28 | | |
| ROUTED TO | SSYC3 | 238. | 12.40 | 54. | 16. | 16. | 0.28 | 1716.84 | 12.40 |
| ROUTED TO | RSYC3 | 238. | 12.40 | 54. | 16. | 16. | 0.28 | 1702.55 | 12.40 |
| HYDROGRAPH AT | 188G | 2. | 12.00 | 0. | 0. | 0. | 0.00 | | |
| 2 COMBINED AT | SYR4 | 238. | 12.40 | 54. | 16. | 16. | 0.28 | | |
| 2 COMBINED AT | GRS2 | 338. | 12.13 | 73. | 22. | 22. | 0.38 | | |
| ROUTED TO | SGRS2 | 330. | 12.23 | 73. | 22. | 22. | 0.38 | 1600.67 | 12.23 |
| HYDROGRAPH AT | 187E | 7. | 12.03 | 1. | 0. | 0. | 0.00 | | |
| ROUTED TO | R187E | 7. | 12.03 | 1. | 0. | 0. | 0.00 | 1780.52 | 12.03 |
| HYDROGRAPH AT | 187F | 3. | 12.07 | 1. | 0. | 0. | 0.00 | | |
| 2 COMBINED AT | GRS3A | 10. | 12.03 | 2. | 0. | 0. | 0.01 | | |
| ROUTED TO | RGRS3A | 10. | 12.07 | 2. | 0. | 0. | 0.01 | 1710.12 | 12.07 |
| HYDROGRAPH AT | 187G | 40. | 12.13 | 9. | 3. | 3. | 0.04 | | |
| 3 COMBINED AT | GRS3 | 376. | 12.20 | 84. | 25. | 25. | 0.43 | | |
| ROUTED TO | RGRS3 | 376. | 12.20 | 84. | 25. | 25. | 0.43 | 1691.08 | 12.20 |
| HYDROGRAPH AT | 187H | 6. | 12.00 | 1. | 0. | 0. | 0.00 | | |
| 2 COMBINED AT | *SNB5 | 380. | 12.20 | 84. | 25. | 25. | 0.43 | | |
| 2 COMBINED AT | SNB5 | 615. | 12.50 | 157. | 47. | 47. | 0.82 | | |
| ROUTED TO | RSNB5 | 615. | 12.50 | 157. | 47. | 47. | 0.82 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1683.50 | 12.50 |
| HYDROGRAPH AT | | | | | | | | |
| | 187I | 40. | 12.00 | 4. | 1. | 1. | 0.02 | |
| 2 COMBINED AT | | | | | | | | |
| | SNB6 | 620. | 12.50 | 162. | 48. | 48. | 0.85 | |
| ROUTED TO | | | | | | | | |
| | SSNB6 | 109. | 13.93 | 100. | 48. | 48. | 0.85 | |
| | | | | | | | 1700.40 | 13.93 |

** NORMAL END OF HEC-1 ***

# APPENDIX D.2

## HEC-1 Output for ½ PMF

## 6-hr. Storm

```
************************************
                                   *
.OOD HYDROGRAPH PACKAGE  (HEC-1)   *
          MAY   1991               *
       VERSION 4.0.1E              *
Lahey F77L-EM/32 version 5.01      *
  Dodson & Associates, Inc.        *
| DATE  09/14/95  TIME  16:08:23   *
************************************
```

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

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

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

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

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

  1           ID   ******************************************************************************
  2           ID   **                        STRUCTURE #19 HYDROLOGY                           **
  3           ID   ******************************************************************************
  4           ID   FUTURE DEVELOPMENT, AGK ENGINEERS, 9-11-95              FILE: D19-PMFF.DAT
  5           ID   Probable Maximum Flow
  6           ID   Time step at 2 minutes
  7           ID
  8           IT       2                     200
              *DIAGRAM
  9           JR    FLOW       1     0.5

 10           KK    186A
 11           KM   SUB-BASIN 186A
 12           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 13           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 14           IO       5
 15           IN      15
 16           PB   14.26
 17           PC    .000    .0007    .0014    .0056    .0113    .0154    .0224    .0288    .0387    .0526
 18           PC   .0701    .0968    .1323    .7290    .8500    .8984    .9387    .9509    .9649    .9762
 19           PC   .9855    .9937    .9993   1.000    1.000
 20           BA    .099
 21           LG    .142     .250    5.700     .203   17.450
 22           UC    .267     .223
 23           UA       0        5       16       30       65       77       84       90       94       97
 24           UA     100

 25           KK    186B
 26           KM   SUB-BASIN 186B
 27           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 28           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 29           BA    .005
 30           LG    .149     .250    5.700     .207   19.150
 31           UC    .138     .164
 32           UA       0        5       16       30       65       77       84       90       94       97
 33           UA     100

 34           KK   R186B
 35           KM   ROUTE R186B THROUGH SUB-BASIN 186D (PALISADES BLV)
 36           RS       3    FLOW       0
 37           RC    0.02    0.02    0.02    1349    0.08
 38           RX    9975    9980    9985    9986   10014   10015   10020   10025
 39           RY  1900.6  1900.5  1900.5    1900    1900  1900.5  1900.5  1900.6

 40           KK   SNB1A
 41           KM   SUNBURST CONCENTRATION POINT 1A - COMBINE 186A, R186B
 42           HC       2

 43           KK  RSNB1A
 44           KM   ROUTE SNB1A THROUGH SUB-BASIN 186D (WASH) TO CON. POINT SNB1
 45           RS       7    FLOW       0
 46           RC    0.04    0.04    0.04    3780   0.055
 47           RX    9850    9910    9970    9995   10005   10030   10060   10090
 48           RY    1920    1904    1899    1892    1892    1900    1910    1920
```

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

  49          KK    186C
  50          KM   SUB-BASIN 186C
  51          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  52          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
  53          BA    .017
  54          LG    .081    .250   5.700    .175  37.200
  55          UC    .158    .225
  56          UA       0       5      16      30      65      77      84      90      94      97
  57          UA     100

  58          KK   R186C
  59          KM   ROUTE 186C THROUGH SUB-BASIN 186D (MANCHESTER DR.) TO CON. POINT SNB1
  60          RS       1    FLOW       0
  61          RC    0.02    0.02    0.02     407   0.125
  62          RX  9947.5  9952.5  9957.5    9960   10040 10042.5 10047.5 10052.5
  63          RY  2040.5  2040.5  2040.5    2040    2040  2040.5  2040.5  2040.5

  64          KK    186D
  65          KM   SUB-BASIN 186D
  66          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  67          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
  68          BA    .081
  69          LG    .150    .250   5.800    .195  26.520
  70          UC    .304    .329
  71          UA       0       5      16      30      65      77      84      90      94      97
  72          UA     100

  73          KK    SNB1
  74          KM   SUNBURST WASH CONSENTRATION POINT 1 - COMBINE RSNB1A, R186C, 186D
  75          HC       3

  76          KK   RSNB1
  77          KM   ROUTE SNB1 THROUGH SUB-BASIN 186F  TO CON. POINT SNB2
  78          RS       4    FLOW       0
  79          RC    0.04    0.04    0.04    1961   0.042
  80          RX    9935    9963    9985    9997   10003   10050   10090   10125
  81          RY    1840    1830    1820    1814    1814    1820    1830    1840

  82          KK    186E
  83          KM   SUB-BASIN 186E
  84          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  85          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
  86          BA    .036
  87          LG    .144    .250   5.700    .205  27.410
  88          UC    .200    .178
  89          UA       0       5      16      30      65      77      84      90      94      97
  90          UA     100

  91          KK    186F
  92          KM   SUB-BASIN 186F
  93          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  94          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
  95          BA    .029
  96          LG    .150    .250   5.800    .195  30.300
```

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

  97          UC    .217    .235
  98          UA       0       5      16      30      65      77      84      90      94      97
  99          UA     100

 100          KK    SNB2
 101          KM   SUNBURST WASH CONSENTRATION POINT 2 - COMBINE RSNB1, 186E, 186F
 102          HC       3

 103          KK   RSNB2
 104          KM   ROUTE SNB2 THROUGH SUB-BASIN 186G  TO CON. POINT SNB3
 105          RS       5    FLOW       0
 106          RC    0.04    0.04    0.04    2408   0.026
 107          RX    9865    9930    9960    9995   10005   10040   10060   10140
 108          RY    1790    1772    1766    1762    1762    1764    1772    1790

 109          KK    186G
 110          KM   SUB-BASIN 186G
 111          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 112          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 113          BA    .066
 114          LG    .150    .250   5.700    .207  25.000
 115          UC    .258    .254
 116          UA       0       5      16      30      65      77      84      90      94      97
 117          UA     100

 118          KK    SNB3
 119          KM   SUNBURST WASH CONSENTRATION POINT 3 - COMBINE RSNB2, 186G
 120          HC       2

 121          KK   SSNB3
 122          KM   ROUTE SNB3 THROUGH 48" CULVERT AT SYCAMORE DRIVE
 123          RS       1    ELEV    1721
 124          SQ       0   .0001      67     122     176  1164.8    2195    3360  5177.6  7475.6
 125          SE    1721 1724.96 1728.96 1732.96 1738.82 1739.82 1740.32 1740.82 1741.32 1741.82
 126          SA       0    0.02    2.03
 127          SE    1721    1722    1740

 128          KK    186H
 129          KM   SUB-BASIN 186H
 130          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 131          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 132          BA    .025
 133          LG    .050    .250   5.700    .170  34.970
 134          UC    .258    .575
 135          UA       0       5      16      30      65      77      84      90      94      97
 136          UA     100

 137          KK    160E
 138          KM   SUB-BASIN 160E
 139          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 140          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 141          BA    .004
 142          LG    .092    .250   5.700    .170  41.880
 143          UC    .129    .255
 144          UA       0       5      16      30      65      77      84      90      94      97
```

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

 145          UA     100

 146          KK   R160E
 147          KM   ROUTE 160E THROUGH SUB-BASIN 186H TO CON. POINT SNB4
 148          RS       2    FLOW       0
 149          RC    0.02    0.02    0.02     700   0.174
 150          RX    9975    9980    9985    9986   10014   10015   10020   10025
 151          RY  1733.5  1733.5  1733.5    1733    1733  1733.5  1733.5  1733.5

 152          KK    SNB4
 153          KM   SUNBURST WASH CONSENTRATION POINT 4 - COMBINE SSNB3, 186H, R160E
 154          HC       3

 155          KK   RSNB4
 156          KM   ROUTE SNB4 THROUGH SUB-BASIN 186I  TO CON. POINT SNB5
 157          RS       2    FLOW       0
 158          RC    0.04    0.04    0.04    1004   0.023
 159          RX    9905    9945    9965    9990   10015   10070   10100   10140
 160          RY    1726    1716    1710    1702    1702    1704    1716    1724

 161          KK    186I
 162          KM   SUB-BASIN 186I
 163          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 164          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 165          BA    .029
 166          LG    .150    .250   5.700    .207  25.000
 167          UC    .200    .197
 168          UA       0       5      16      30      65      77      84      90      94      97
 169          UA     100

 170          KK   *SNB5
 171          KM   SUNBURST WASH CONCENTRATION POINT *5 - RSNB4, 186I
 172          KO
 173          HC       2

 174          KK    187A
 175          KM   SUB-BASIN 187A
 176          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 177          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 178          BA    .009
 179          LG    .150    .250   5.800    .195  26.770
 180          UC    .125    .092
 181          UA       0       5      16      30      65      77      84      90      94      97
 182          UA     100

 183          KK   R187A
 184          KM   ROUTE 187A THROUGHT SUB-BASIN 187B TO POINT OF CON. GRS1
 185          RS       1    FLOW       0
 186          RC    0.04    0.04    0.04     445   0.022
 187          RX    9785    9845    9940    9988   10010   10030   10125   10170
 188          RY    1870    1861    1858    1852    1852    1858    1872    1876
```

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

 189          KK    187B
 190          KM   SUB-BASIN 187B
 191          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 192          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 193          BA    .008
 194          LG    .150    .250   5.800    .195  48.740
 195          UC    .162    .204
 196          UA       0       5      16      30      65      77      84      90      94      97
 197          UA     100

 198          KK    GRS1
 199          KM    GREYSTONE WASH CONCENTRATION POINT 1 - COMBINE R187A, 187B
 200          HC       2

 201          KK   RGRS1
 202          KM   ROUTE GRS1 THROUGHT SUB-BASIN 187D TO POINT OF CON. GRS2
 203          RS       6    FLOW       0
 204          RC    0.04    0.04    0.04    3514    .044
 205          RX    9920    9955    9980    9995   10005   10040   40075   10110
 206          RY    1780    1770    1760    1754    1754    1760    1770    1780

 207          KK    187C
 208          KM   SUB-BASIN 187C
 209          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 210          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 211          BA    .012
 212          LG    .150    .250   5.700    .198  38.760
 213          UC    .125    .141
 214          UA       0       5      16      30      65      77      84      90      94      97
 215          UA     100

 216          KK   R187C
 217          KM   ROUTE 187C THROUGHT SUB-BASIN 187D TO POINT OF CON. GRS2
 218          RS       4    FLOW       0
 219          RC    0.04    0.04    0.04    2181    .061
 220          RX    9920    9955    9980    9995   10005   10040   40075   10110
 221          RY    1780    1770    1760    1754    1754    1760    1770    1780

 222          KK    187D
 223          KM   SUB-BASIN 187D
 224          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 225          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 226          BA    .070
 227          LG    .150    .250   5.700    .207  28.650
 228          UC    .308    .363
 229          UA       0       5      16      30      65      77      84      90      94      97
 230          UA     100

 231          KK   *GRS2
 232          KM   GREYSTONE WASH CONCENTRATION POINT *2 - RGRS1, R187C, 187D
 233          HC       3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 234          KK   188A
 235          KM   SUB-BASIN 188A
 236          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 237          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 238          BA    .009
 239          LG    .086    .250   5.700    .185  40.180
 240          UC    .129    .185
 241          UA       0       5      16      30      65      77      84      90      94      97
 242          UA     100

 243          KK   R188A
 244          KM   ROUTE 188A THROUGH SUB-BASIN 188B TO CON. POINT SYC1
 245          RS       2    FLOW       0
 246          RC    0.04    0.04    0.04     747   0.173
 247          RX    9770    9810    9940    9960   10020   10045   10120   10180
 248          RY    1716    1711    1708    1708    1709    1712    1720    1728

 249          KK    188B
 250          KM   SUB-BASIN 188B
 251          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 252          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 253          BA    .066
 254          LG    .149    .250   6.000    .183  44.690
 255          UC    .217    .171
 256          UA       0       5      16      30      65      77      84      90      94      97
 257          UA     100

 258          KK    188C
 259          KM   SUB-BASIN 188C
 260          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 261          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 262          BA    .022
 263          LG    .145    .250   5.800    .194  26.990
 264          UC    .196    .225
 265          UA       0       5      16      30      65      77      84      90      94      97
 266          UA     100

 267          KK    SYR1
 268          KM   SYCAMORE WASH CONCENTRATION POINT 1 - COMBINE SUB-BASINS R188A, 188B, 188C
 269          HC       3

 270          KK   RSYC1
 271          KM   ROUTE SYC1 THROUGH SUB-BASIN 188D TO CON. POINT SYC2
 272          RS       4    FLOW       0
 273          RC    0.04    0.04    0.04    2280   0.034
 274          RX    9915    9950    9985   10000   10008   10020   10055   10085
 275          RY    1850    1840    1830    1826    1826    1830    1840    1850

 276          KK    188D
 277          KM   SUB-BASIN 188D
 278          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 279          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 280          BA    .055
 281          LG    .150    .250   5.800    .195  22.890
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 282          UC    .242    .248
 283          UA       0       5      16      30      65      77      84      90      94      97
 284          UA     100

 285          KK    188E
 286          KM   SUB-BASIN 188E
 287          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 288          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 289          BA    .052
 290          LG    .136    .250   5.700    .202  26.220
 291          UC    .271    .328
 292          UA       0       5      16      30      65      77      84      90      94      97
 293          UA     100

 294          KK    SYR2
 295          KM   SYCAMORE WASH CONCENTRATION POINT 2 - COMBINE SUB-BASINS RSYC1, 188D, 188E
 296          HC       3

 297          KK   RSYC2
 298          KM   ROUTE SYC2 THROUGH SUB-BASIN 188F TO CON. POINT SYC3
 299          RS       6    FLOW       0
 300          RC    0.04    0.04    0.04    3003    0.02
 301          RX    9910    9935    9950    9980   10010   10060   10075   10110
 302          RY    1780    1770    1764    1760    1760    1766    1770    1780

 303          KK    188F
 304          KM   SUB-BASIN 188F
 305          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 306          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 307          BA    .072
 308          LG    .146    .250   5.700    .205  25.800
 309          UC    .271    .272
 310          UA       0       5      16      30      65      77      84      90      94      97
 311          UA     100

 312          KK    SYR3
 313          KM   SYCAMORE WASH CONCENTRATION POINT 3 - COMBINE SUB-BASINS RSYC2, 188F
 314          HC       2

 315          KK   SSYC3
 316          KM   ROUTE SYC3 THROUGH 60" CMP CULVERT AT GREYSTONE DRIVE
 317          RS       1    ELEV  1705.4
 318          SQ       0   113.9   188.3   242.5     323   551.7   781.5  1634.8  3266.1  4805.6
 319          SE  1705.4 1710.45 1713.45 1717.14 1718.25    1719  1719.5    1720    1721    1722
 320          SA       0    0.05     .60    1.29
 321          SE  1705.4    1708    1712    1717

 322          KK   RSYC3
 323          KM   ROUTE SSYC3 THROUGH SUB-BASIN 188G TO CON. POINT SYC4
 324          RS       1    FLOW       0
 325          RC    0.04    0.04    0.04     249   0.024
 326          RX    9770    9810    9940    9960   10020   10045   10120   10180
 327          RY    1716    1711    1708    1702    1702    1712    1720    1728
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 328          KK    188G
 329          KM   SUB-BASIN 188G
 330          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 331          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 332          BA    .001
 333          LG    .150    .250   5.700    .207  25.000
 334          UC    .100    .176
 335          UA       0       5      16      30      65      77      84      90      94      97
 336          UA     100

 337          KK    SYR4
 338          KM   SYCAMORE WASH CONCENTRATION POINT 4 - COMBINE SUB-BASINS RSYC3, 188G
 339          HC       2

 340          KK    GRS2
 341          KM   GREYSTONE WASH POINT OF CONCENTRATION 2 - COMBINE (RGRS1,R187C,187DO,SYR4
 342          HC       2

 343          KK   SGRS2
 344          KM   ROUTE GRS2 THROUGH 2-60" AND 48" CULVERT AT SYCAMORE DRIVE TO GRS3
 345          RS       1    ELEV  1595.5
 346          SQ       0   98.77   222.9   319.5     499     531     641  1094.5  1877.6  4986.6
 347          SE  1595.5    1598  1599.5  1600.5  1603.5  1604.3    1605    1606    1607    1609
 348          SA       0    0.01    0.47    0.73     1.4
 349          SE  1595.5    1598    1600 1605.75    1609

 350          KK    187E
 351          KM   SUB-BASIN 187E
 352          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 353          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 354          BA    .005
 355          LG    .050    .250   5.700    .170  39.100
 356          UC    .121    .292
 357          UA       0       5      16      30      65      77      84      90      94      97
 358          UA     100

 359          KK   R187E
 360          KM   ROUTE 187E THROUGHT SUB-BASIN 187F TO POINT OF CON. GRS3A
 361          RS       3    FLOW       0
 362          RC    0.02    0.02    0.02    1707   0.076
 363          RX    9975    9980    9985    9986   10014   10015   10020   10025
 364          RY  1780.5  1780.5  1780.5    1810    1810  1810.5  1780.5  1780.5

 365          KK    187F
 366          KM   SUB-BASIN 187F
 367          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 368          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 369          BA    .003
 370          LG    .050    .250   5.700    .170  25.000
 371          UC    .154    .524
 372          UA       0       5      16      30      65      77      84      90      94      97
 373          UA     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 374          KK   GRS3A
 375          KM   GREYSTONE WASH POINT OF CONCENTRATION 3A - COMBINE R187E, 187F
 376          HC       2

 377          KK  RGRS3A
 378          KM   ROUTE GRS3A THROUGHT SUB-BASIN 187G TO POINT OF CON. GRS3
 379          RS       1    FLOW       0
 380          RC    0.02    0.02     0.02     337   0.033
 381          RX    9975    9980     9985    9986   10014   10015   10020   10025
 382          RY  1710.5  1710.5   1710.5    1710    1710  1710.5  1710.5  1710.5

 383          KK    187G
 384          KM   SUB-BASIN 187G
 385          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 386          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .999
 387          BA    .043
 388          LG    .100    .250   5.700    .189  39.180
 389          UC    .350    .643
 390          UA       0       5      16      30      65      77      84      90      94      97
 391          UA     100

 392          KK    GRS3
 393          KM   GREYSTONE WASH POINT OF CONCENTRATION 3 - COMBINE SGRS2, RGRS3A, 187G
 394          HC       3

 395          KK   RGRS3
 396          KM   ROUTE GRS3 THROUGHT SUB-BASIN 187H TO POINT OF CON. GRS4
 397          RS       4    FLOW       0
 398          RC    0.04    0.04     0.04     442   0.045
 399          RX    9705    9755     9965    9990   10030   10065   10085   10130
 400          RY    1708  1699.3   1699.3    1690    1690    1696    1700    1710

 401          KK    187H
 402          KM   SUB-BASIN 187H
 403          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 404          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 405          KO
 406          BA    .004
 407          LG    .150    .250   5.700    .207  25.000
 408          UC    .138    .186
 409          UA       0       5      16      30      65      77      84      90      94      97
 410          UA     100

 411          KK   *SNB5
 412          KM   SUNBURST WASH CONCENTRATION POINT *5 - RGRS3, 187H
 413          KO
 414          HC       2

 415          KK    SNB5
 416          KM   SUNBURST WASH CONSENTRATION POINT 5 - COMBINE (RSNB4,186I), (RGRS3, 187H)
 417          KO
 418          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 419          KK   RSNB5
 420          KM   ROUTE SNB5 THROUGH SUB-BASIN 187I  TO CON. POINT SNB6
 421          RS       1    FLOW       0
 422          RC    0.04    0.04    0.04     400    0.02
 423          RX    9685    9760    9870    9950   10005   10035   10225   10255
 424          RY    1710  1691.5  1691.5    1682    1682    1692    1700    1710

 425          KK    187I
 426          KM   SUB-BASIN 187I
 427          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 428          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF1.000
 429          BA    .024
 430          LG    .150    .250   5.700    .207  25.000
 431          UC    .171    .144
 432          UA       0       5      16      30      65      77      84      90      94      97
 433          UA     100

 434          KK    SNB6
 435          KM   SUNBURST WASH CONSENTRATION POINT 6 - COMBINE RSNB5, 187I
 436          HC       2

 437          KK   SSNB6
 438          KM   ROUTE THROUGH 30" CMP UNDER DAM AT SUB-BASIN 187I
 439          RS       1    ELEV 1678.86
 440          SQ       0    16.1    36.2   118.9   203.4  1151.3  1967.4  2953.5  4099.6  6836.4
 441          SE  1678.9 1680.86 1682.86 1702.67 1703.09 1704.86 1705.86 1706.86 1707.86 1709.85
 442          SA       0    0.01    0.93    3.47    8.55   11.38
 443          SE  1678.9    1680    1686    1694    1704    1708
 444          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

 10         186A
              .
              .
 25           .        186B
              .          V
              .          V
 34           .       R186B
              .          .
              .          .
 40       SNB1A............
              V
              V
 43      RSNB1A
              .
              .
 49           .        186C
              .          V
              .          V
 58           .       R186C
              .          .
              .          .
 64           .          .        186D
              .          .          .
              .          .          .
 73       SNB1.........................
              V
              V
 76      RSNB1
              .
              .
 82           .        186E
              .          .
              .          .
 91           .          .        186F
              .          .          .
              .          .          .
100       SNB2.........................
              V
              V
103      RSNB2
              .
              .
109           .        186G
              .          .
              .          .
118       SNB3............
              V
              V
121      SSNB3
              .
              .
128           .        186H
              .          .
              .          .
137           .          .        160E
              .          .          V
              .          .          V
146           .          .       R160E
              .          .          .
              .          .          .
152       SNB4.........................
              V
              V
155      RSNB4
              .
```

```
161          .
             .        186I
             .          .
             .          .
170     *SNB5.............
             .
             .
174          .        187A
             .          V
             .          V
183          .       R187A
             .          .
             .          .
189          .          .        187B
             .          .          .
             .          .          .
198          .       GRS1............
             .          V
             .          V
201          .       RGRS1
             .          .
             .          .
207          .          .        187C
             .          .          V
             .          .          V
216          .          .      R187C
             .          .          .
             .          .          .
222          .          .          .        187D
             .          .          .          .
             .          .          .          .
231          .      *GRS2........................
             .          .
             .          .
234          .          .        188A
             .          .          V
             .          .          V
243          .          .      R188A
             .          .          .
             .          .          .
249          .          .          .        188B
             .          .          .          .
             .          .          .          .
258          .          .          .          .        188C
             .          .          .          .          .
             .          .          .          .          .
267          .          .       SYR1........................
             .          .          V
             .          .          V
270          .          .      RSYC1
             .          .          .
             .          .          .
276          .          .          .        188D
             .          .          .          .
             .          .          .          .
285          .          .          .          .        188E
             .          .          .          .          .
             .          .          .          .          .
294          .          .       SYR2........................
             .          .          V
             .          .          V
297          .          .      RSYC2
             .          .          .
             .          .          .
303          .          .          .        188F
             .          .          .          .
             .          .          .          .
312          .          .       SYR3............
             .          .          V
             .          .          V
315          .          .      SSYC3
             .          .          V
```

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*****************************************                    *****************************************
*                                       *                    *
*                                       *                    *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                    *   U.S. ARMY CORPS OF ENGINEERS
*                                       *                    *
*             MAY   1991                *                    *   HYDROLOGIC ENGINEERING CENTER
*                                       *                    *
*           VERSION 4.0.1E              *                    *        609 SECOND STREET
*                                       *                    *
*    Lahey F77L-EM/32 version 5.01      *                    *      DAVIS, CALIFORNIA 95616
*                                       *                    *
*      Dodson & Associates, Inc.        *                    *         (916) 551-1748
*                                       *                    *
* RUN DATE  09/14/95  TIME  16:08:23    *                    *
*                                       *                    *
*****************************************                    *****************************************
```

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                    ******************************************************************************
                    **                      STRUCTURE #19 HYDROLOGY                             **
                    ******************************************************************************
                    FUTURE DEVELOPMENT, AGK ENGINEERS, 9-11-95            FILE: D19-PMFF.DAT
                    Probable Maximum Flow
                    Time step at 2 minutes

 IT          HYDROGRAPH TIME DATA
                   NMIN          2  MINUTES IN COMPUTATION INTERVAL
                  IDATE      1    0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ        200  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      1    0  ENDING DATE
                 NDTIME       0638  ENDING TIME
                 ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL    0.03 HOURS
                 TOTAL TIME BASE    6.63 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

 JP          MULTI-PLAN OPTION
                 NPLAN           1  NUMBER OF PLANS

 JR          MULTI-RATIO OPTION
                RATIOS OF RUNOFF
              1.00      0.50
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

| PERATION | STATION | AREA | PLAN | | RATIOS APPLIED TO FLOWS RATIO 1 1.00 | RATIO 2 0.50 |
|---|---|---|---|---|---|---|
| YDROGRAPH AT | 186A | 0.10 | 1 | FLOW | 1296. | 648. |
| | | | | TIME | 3.33 | 3.33 |
| YDROGRAPH AT | 186B | 0.00 | 1 | FLOW | 79. | 40. |
| | | | | TIME | 3.30 | 3.30 |
| OUTED TO | R186B | 0.00 | 1 | FLOW | 79. | 39. |
| | | | | TIME | 3.30 | 3.33 |
| | | | ** PEAK STAGES IN FEET ** | | | |
| | | | 1 | STAGE | 1900.30 | 1900.20 |
| | | | | TIME | 3.30 | 3.33 |
| 2 COMBINED AT | SNB1A | 0.10 | 1 | FLOW | 1374. | 687. |
| | | | | TIME | 3.33 | 3.33 |
| OUTED TO | RSNB1A | 0.10 | 1 | FLOW | 1367. | 677. |
| | | | | TIME | 3.40 | 3.40 |
| | | | ** PEAK STAGES IN FEET ** | | | |
| | | | 1 | STAGE | 1895.75 | 1894.67 |
| | | | | TIME | 3.40 | 3.40 |
| YDROGRAPH AT | 186C | 0.02 | 1 | FLOW | 234. | 117. |
| | | | | TIME | 3.30 | 3.30 |
| OUTED TO | R186C | 0.02 | 1 | FLOW | 233. | 116. |
| | | | | TIME | 3.30 | 3.30 |
| | | | ** PEAK STAGES IN FEET ** | | | |
| | | | 1 | STAGE | 2040.27 | 2040.18 |
| | | | | TIME | 3.30 | 3.30 |
| YDROGRAPH AT | 186D | 0.08 | 1 | FLOW | 851. | 425. |
| | | | | TIME | 3.37 | 3.37 |
| 3 COMBINED AT | SNB1 | 0.20 | 1 | FLOW | 2417. | 1202. |
| | | | | TIME | 3.40 | 3.40 |
| OUTED TO | RSNB1 | 0.20 | 1 | FLOW | 2403. | 1198. |
| | | | | TIME | 3.43 | 3.43 |
| | | | ** PEAK STAGES IN FEET ** | | | |
| | | | 1 | STAGE | 1819.07 | 1817.77 |
| | | | | TIME | 3.43 | 3.43 |
| YDROGRAPH AT | 186E | 0.04 | 1 | FLOW | 540. | 270. |
| | | | | TIME | 3.30 | 3.30 |
| YDROGRAPH AT | 186F | 0.03 | 1 | FLOW | 381. | 190. |
| | | | | TIME | 3.33 | 3.33 |

```
3 COMBINED AT
                SNB2      0.27     1   FLOW        3206.    1574.
                                       TIME         3.40     3.40

OUTED TO
                RSNB2     0.27     1   FLOW        3195.    1561.
                                       TIME         3.43     3.47

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE     1766.40  1765.17
                                       TIME         3.43     3.47

YDROGRAPH AT
                186G      0.07     1   FLOW         813.     406.
                                       TIME         3.33     3.33

2 COMBINED AT
                SNB3      0.33     1   FLOW        3932.    1937.
                                       TIME         3.43     3.40

OUTED TO
                SSNB3     0.33     1   FLOW        3940.    1939.
                                       TIME         3.43     3.43

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE     1740.98  1740.20
                                       TIME         3.43     3.43

YDROGRAPH AT
                186H      0.03     1   FLOW         189.      95.
                                       TIME         3.40     3.40

YDROGRAPH AT
                160E      0.00     1   FLOW          52.      26.
                                       TIME         3.30     3.30

OUTED TO
                R160E     0.00     1   FLOW          52.      26.
                                       TIME         3.30     3.33

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE     1733.18  1733.12
                                       TIME         3.30     3.33

3 COMBINED AT
                SNB4      0.36     1   FLOW        4170.    2054.
                                       TIME         3.43     3.43

OUTED TO
                RSNB4     0.36     1   FLOW        4155.    2109.
                                       TIME         3.43     3.43

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE     1706.30  1705.08
                                       TIME         3.43     3.43

YDROGRAPH AT
                186I      0.03     1   FLOW         414.     207.
                                       TIME         3.30     3.30

2 COMBINED AT
                *SNB5     0.39     1   FLOW        4482.    2273.
                                       TIME         3.43     3.43

YDROGRAPH AT
                187A      0.01     1   FLOW         174.      87.
                                       TIME         3.27     3.27

OUTED TO
                R187A     0.01     1   FLOW         170.      85.
                                       TIME         3.27     3.27
```

```
                                    ** PEAK STAGES IN FEET **
                                    1   STAGE      1853.05  1852.53
                                        TIME          3.27     3.27

ſDROGRAPH AT
                187B      0.01      1   FLOW          116.      58.
                                        TIME          3.30     3.30

2 COMBINED AT
                GRS1      0.02      1   FLOW          285.     143.
                                        TIME          3.30     3.30

ɔUTED TO
                RGRS1     0.02      1   FLOW          277.     133.
                                        TIME          3.37     3.40

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE      1755.67  1755.09
                                        TIME          3.37     3.40

ſDROGRAPH AT
                187C      0.01      1   FLOW          204.     102.
                                        TIME          3.27     3.27

ɔUTED TO
                R187C     0.01      1   FLOW          199.      99.
                                        TIME          3.33     3.33

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE      1755.38  1754.69
                                        TIME          3.33     3.33

ſDROGRAPH AT
                187D      0.07      1   FLOW          694.     347.
                                        TIME          3.40     3.40

3 COMBINED AT
                *GRS2     0.10      1   FLOW         1161.     570.
                                        TIME          3.37     3.40

ſDROGRAPH AT
                188A      0.01      1   FLOW          137.      69.
                                        TIME          3.30     3.30

ɔUTED TO
                R188A     0.01      1   FLOW          137.      68.
                                        TIME          3.30     3.30

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE      1708.16  1708.08
                                        TIME          3.30     3.30

ſDROGRAPH AT
                188B      0.07      1   FLOW         1000.     500.
                                        TIME          3.33     3.33

ſDROGRAPH AT
                188C      0.02      1   FLOW          296.     148.
                                        TIME          3.33     3.33

3 COMBINED AT
                SYR1      0.10      1   FLOW         1430.     715.
                                        TIME          3.33     3.33

ɔUTED TO
                RSYC1     0.10      1   FLOW         1420.     710.
                                        TIME          3.37     3.37

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE      1830.41  1829.26
                                        TIME          3.37     3.37
```

```
'DROGRAPH AT
                188D      0.05    1   FLOW        694.     347.
                                      TIME        3.33     3.33

'DROGRAPH AT
                188E      0.05    1   FLOW        556.     278.
                                      TIME        3.37     3.37

; COMBINED AT
                SYR2      0.20    1   FLOW       2660.    1330.
                                      TIME        3.37     3.37

UTED TO
               RSYC2      0.20    1   FLOW       2627.    1307.
                                      TIME        3.40     3.43

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE    1764.08  1762.88
                                      TIME        3.40     3.43

'DROGRAPH AT
                188F      0.07    1   FLOW        852.     426.
                                      TIME        3.37     3.37

! COMBINED AT
                SYR3      0.28    1   FLOW       3455.    1702.
                                      TIME        3.40     3.43

UTED TO
               SSYC3      0.28    1   FLOW       3433.    1695.
                                      TIME        3.43     3.43

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE    1721.11  1720.04
                                      TIME        3.43     3.43

UTED TO
               RSYC3      0.28    1   FLOW       3424.    1707.
                                      TIME        3.40     3.40

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE    1705.77  1704.50
                                      TIME        3.40     3.40

'DROGRAPH AT
                188G      0.00    1   FLOW         16.       8.
                                      TIME        3.27     3.27

! COMBINED AT
                SYR4      0.28    1   FLOW       3435.    1713.
                                      TIME        3.40     3.40

! COMBINED AT
                GRS2      0.38    1   FLOW       4575.    2283.
                                      TIME        3.40     3.40

UTED TO
               SGRS2      0.38    1   FLOW       4548.    2303.
                                      TIME        3.43     3.43

                                  ** PEAK STAGES IN FEET **
                                  1   STAGE    1608.72  1607.27
                                      TIME        3.43     3.43

'DROGRAPH AT
                187E      0.00    1   FLOW         61.      30.
                                      TIME        3.30     3.30

UTED TO
               R187E      0.00    1   FLOW         60.      30.
                                      TIME        3.33     3.33
```

```
                                        ** PEAK STAGES IN FEET **
                                        1   STAGE      1780.65  1780.58
                                            TIME          3.33     3.33

YDROGRAPH AT
                    187F      0.00      1   FLOW           25.      12.
                                            TIME          3.33     3.33

2 COMBINED AT
                   GRS3A      0.01      1   FLOW           85.      43.
                                            TIME          3.33     3.33

DUTED TO
                  RGRS3A      0.01      1   FLOW           85.      43.
                                            TIME          3.33     3.33

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE      1710.41  1710.27
                                            TIME          3.33     3.33

YDROGRAPH AT
                    187G      0.04      1   FLOW          295.     147.
                                            TIME          3.47     3.47

5 COMBINED AT
                    GRS3      0.43      1   FLOW         4916.    2487.
                                            TIME          3.43     3.43

DUTED TO
                   RGRS3      0.43      1   FLOW         4938.    2514.
                                            TIME          3.43     3.43

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE      1694.59  1693.20
                                            TIME          3.43     3.43

DROGRAPH AT
                    187H      0.00      1   FLOW           60.      30.
                                            TIME          3.30     3.30

: COMBINED AT
                   *SNB5      0.43      1   FLOW         4980.    2534.
                                            TIME          3.43     3.43

 COMBINED AT
                    SNB5      0.82      1   FLOW         9461.    4807.
                                            TIME          3.43     3.43

UTED TO
                   RSNB5      0.82      1   FLOW         9494.    4796.
                                            TIME          3.43     3.43

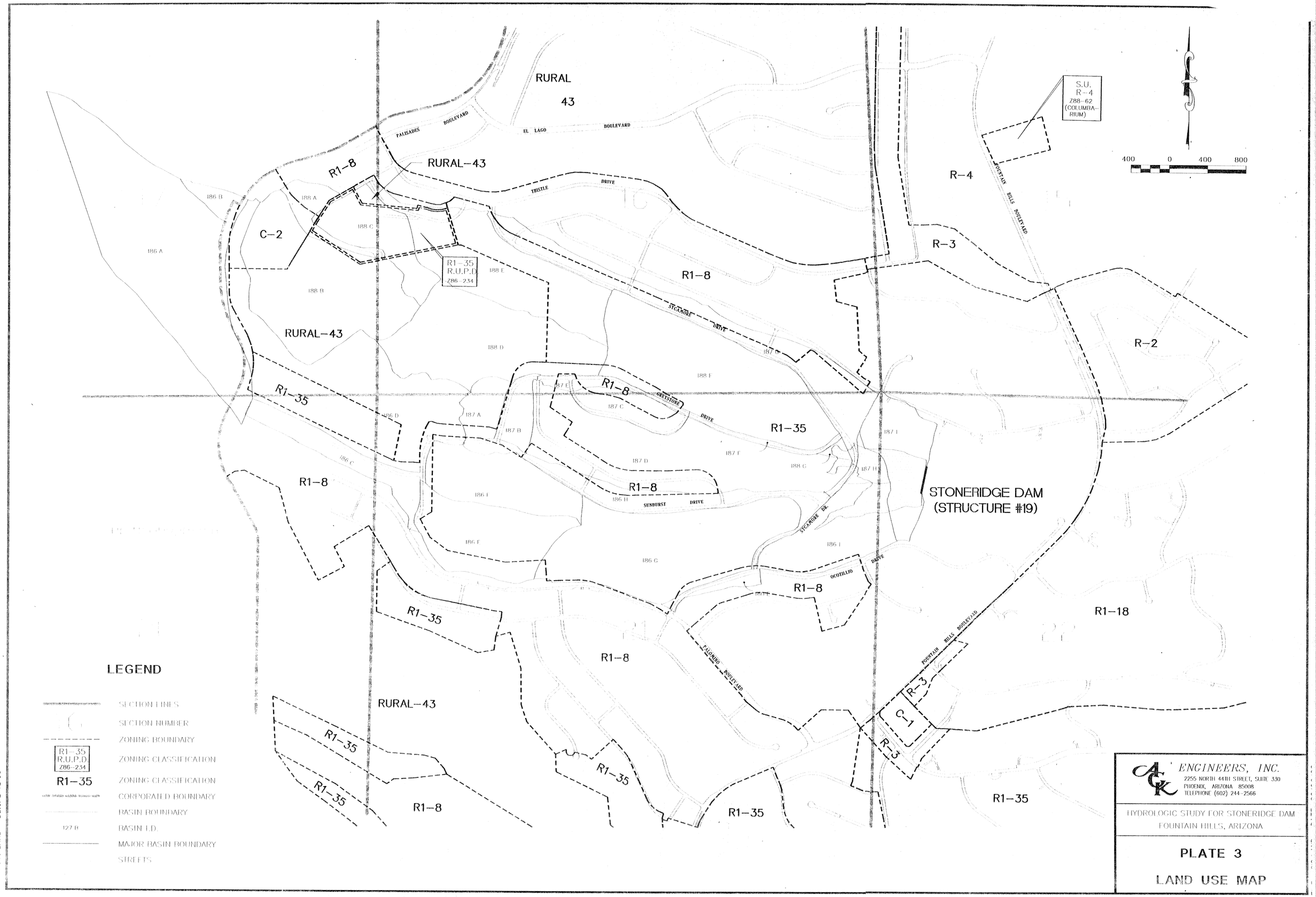
                                        ** PEAK STAGES IN FEET **
                                        1   STAGE      1688.75  1686.73
                                            TIME          3.43     3.43

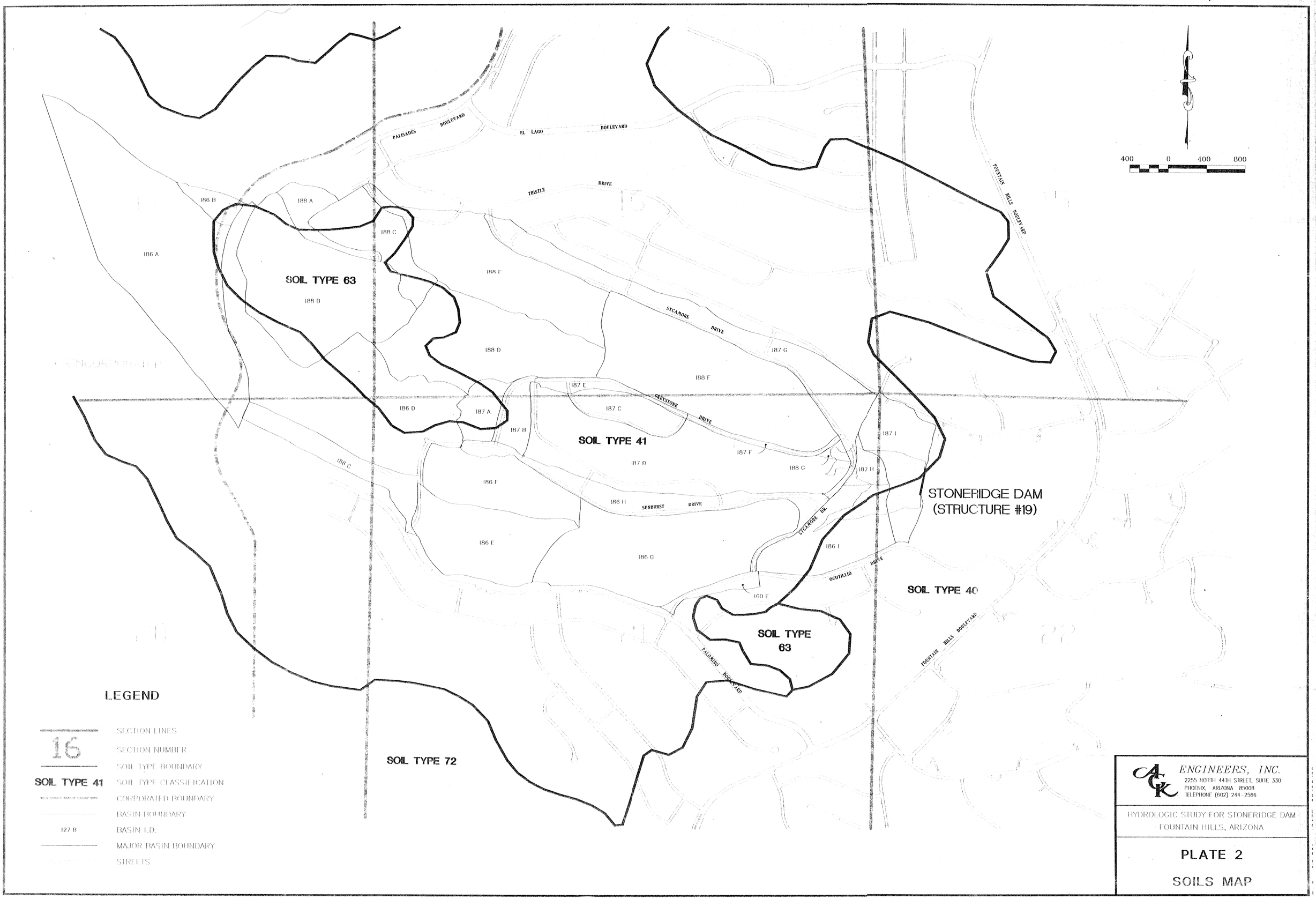
DROGRAPH AT
                    187I      0.02      1   FLOW          397.     199.
                                            TIME          3.30     3.30

 COMBINED AT
                    SNB6      0.85      1   FLOW         9750.    4923.
                                            TIME          3.43     3.43

JTED TO
                   SSNB6      0.85      1   FLOW         7710.    2919.
                                            TIME          3.60     3.73

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE      1710.49  1706.83
                                            TIME          3.60     3.73
* NORMAL END OF HEC-1 ***
```


RURAL
43
PALISADES BOULEVARD
EL LAGO BOULEVARD
R1-8
RURAL-43
TRISTLE DRIVE
C-2
R1-35
R.U.P.D.
Z86-234
RURAL-43
R1-8
SYCAMORE DRIVE
R-4
S.U.
R-4
Z88-62
(COLUMBA-
RIUM)
FOUNTAIN HILLS BOULEVARD
R-3
R-2
R1-35
R1-8
GREYSTONE DRIVE
R1-35
R1-8
SUNDURST DRIVE
STONERIDGE DAM
(STRUCTURE #19)
SYCAMORE DR.
OCOTILLIO DRIVE
R1-8
R1-35
R1-8
PALOMINO BOULEVARD
FOUNTAIN HILLS BOULEVARD
R1-18
R-3
C-1
R-3
RURAL-43
R1-35
R1-35
R1-35
R1-8
R1-35
R1-35
400 0 400 800
LEGEND
SECTION LINES
SECTION NUMBER
ZONING BOUNDARY
R1-35 R.U.P.D. Z86-234
ZONING CLASSIFICATION
R1-35
ZONING CLASSIFICATION
CORPORATED BOUNDARY
BASIN BOUNDARY
127 B
BASIN I.D.
MAJOR BASIN BOUNDARY
STREETS
ACK ENGINEERS, INC.
2255 NORTH 44TH STREET, SUITE 330
PHOENIX, ARIZONA 85008
TELEPHONE (602) 244-2566
HYDROLOGIC STUDY FOR STONERIDGE DAM
FOUNTAIN HILLS, ARIZONA
PLATE 3
LAND USE MAP
File: S19-LAND Date: 2-12-96

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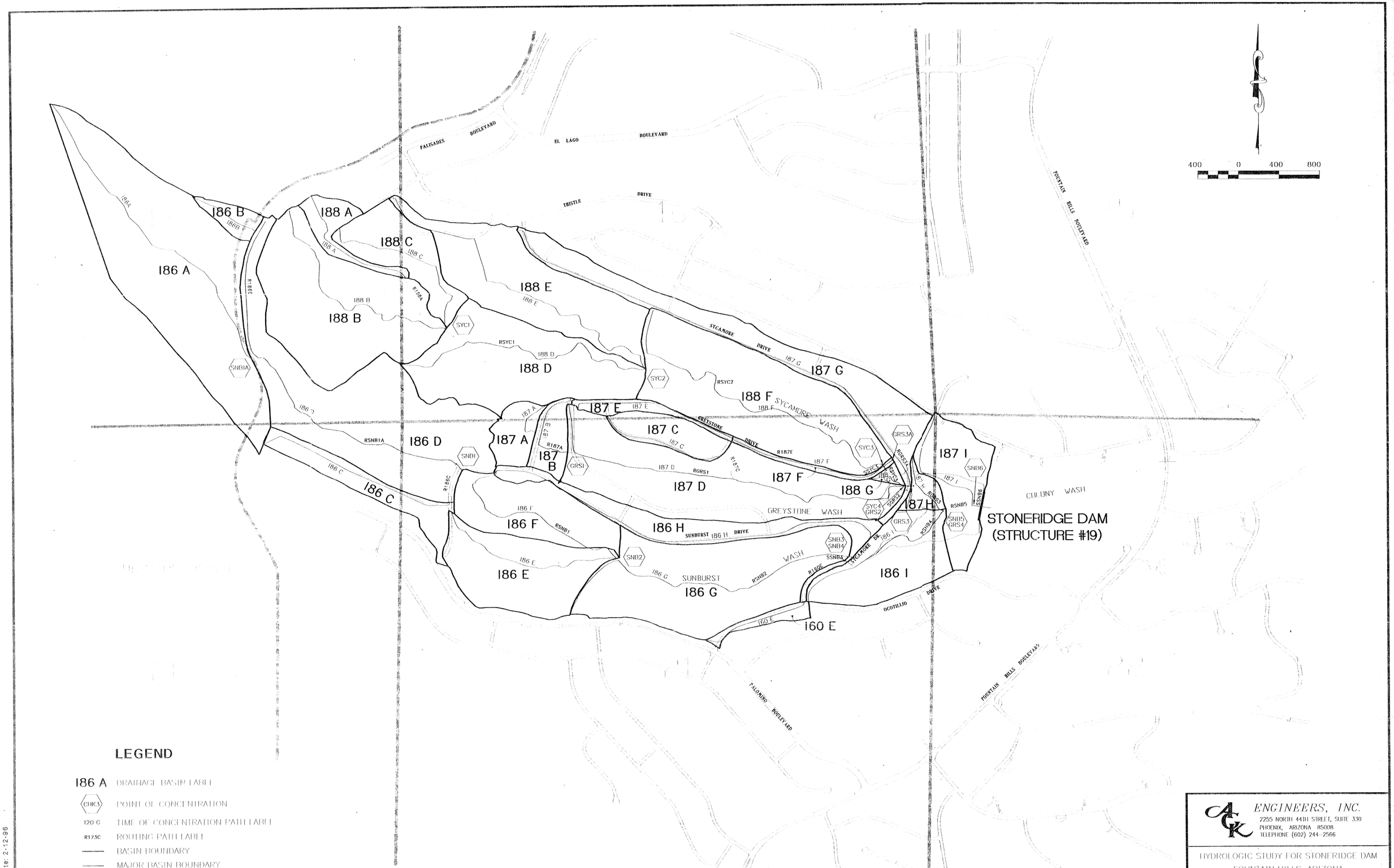
HYDROLOGIC STUDY FOR STONERIDGE DAM
FOUNTAIN HILLS, ARIZONA

**PLATE 2**

**SOILS MAP**

File: S19-SOIL Date: 2-12-96




## LEGEND

| | |
|---|---|
| 186 A | DRAINAGE BASIN LABEL |
| CHK3 | POINT OF CONCENTRATION |
| 120 G | TIME OF CONCENTRATION PATH LABEL |
| R123C | ROUTING PATH LABEL |
| —— | BASIN BOUNDARY |
| —— | MAJOR BASIN BOUNDARY |
| ····· | TIME OF CONCENTRATION PATH |
| | ROUTING PATH |
| | CORPORATED BOUNDARY |

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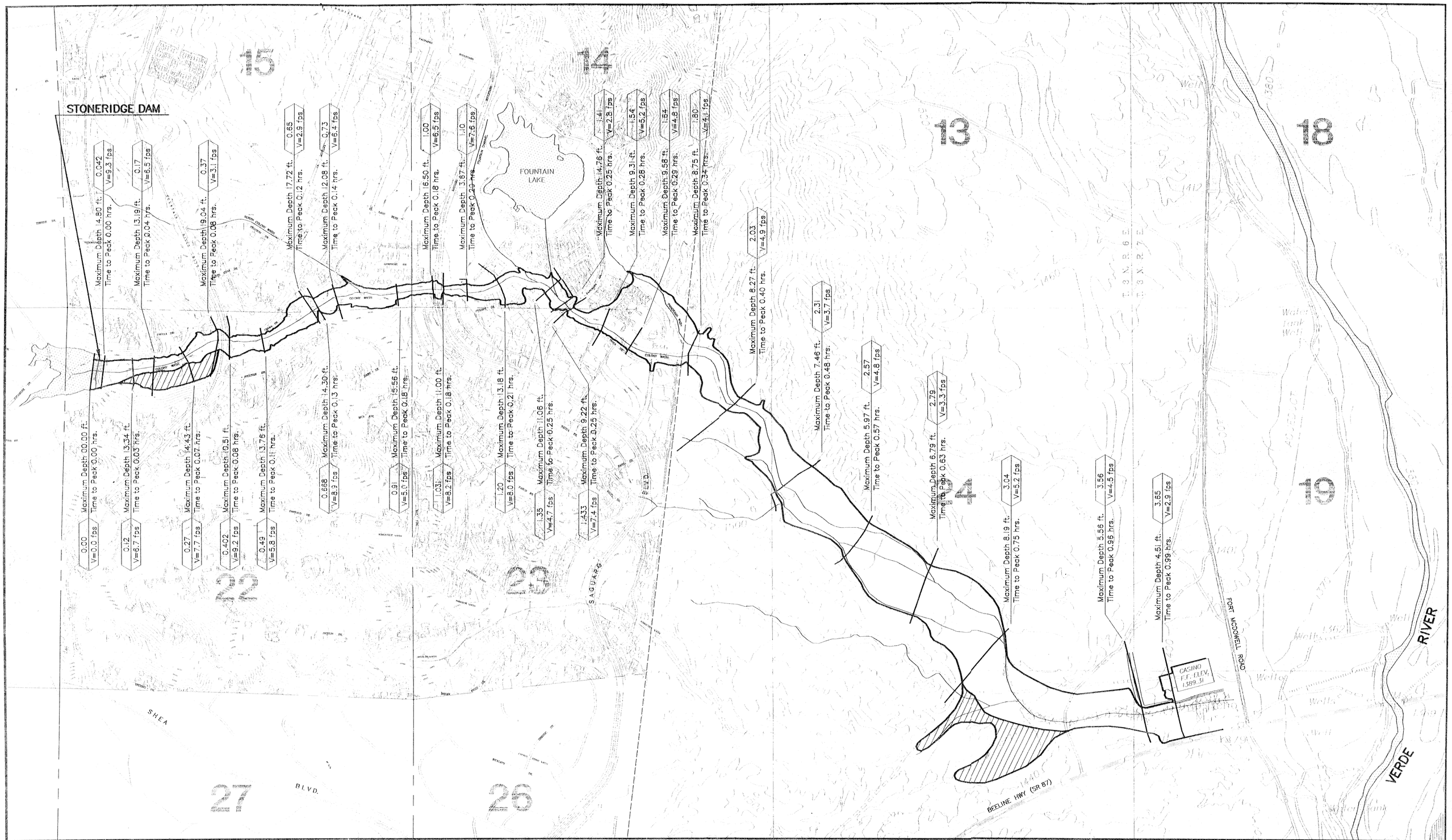
HYDROLOGIC STUDY FOR STONERIDGE DAM
FOUNTAIN HILLS, ARIZONA

**PLATE 1**

**HYDROLOGY MAP**

File: S19-HYD Date: 2-12-98

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N

600 300 0 600 1200

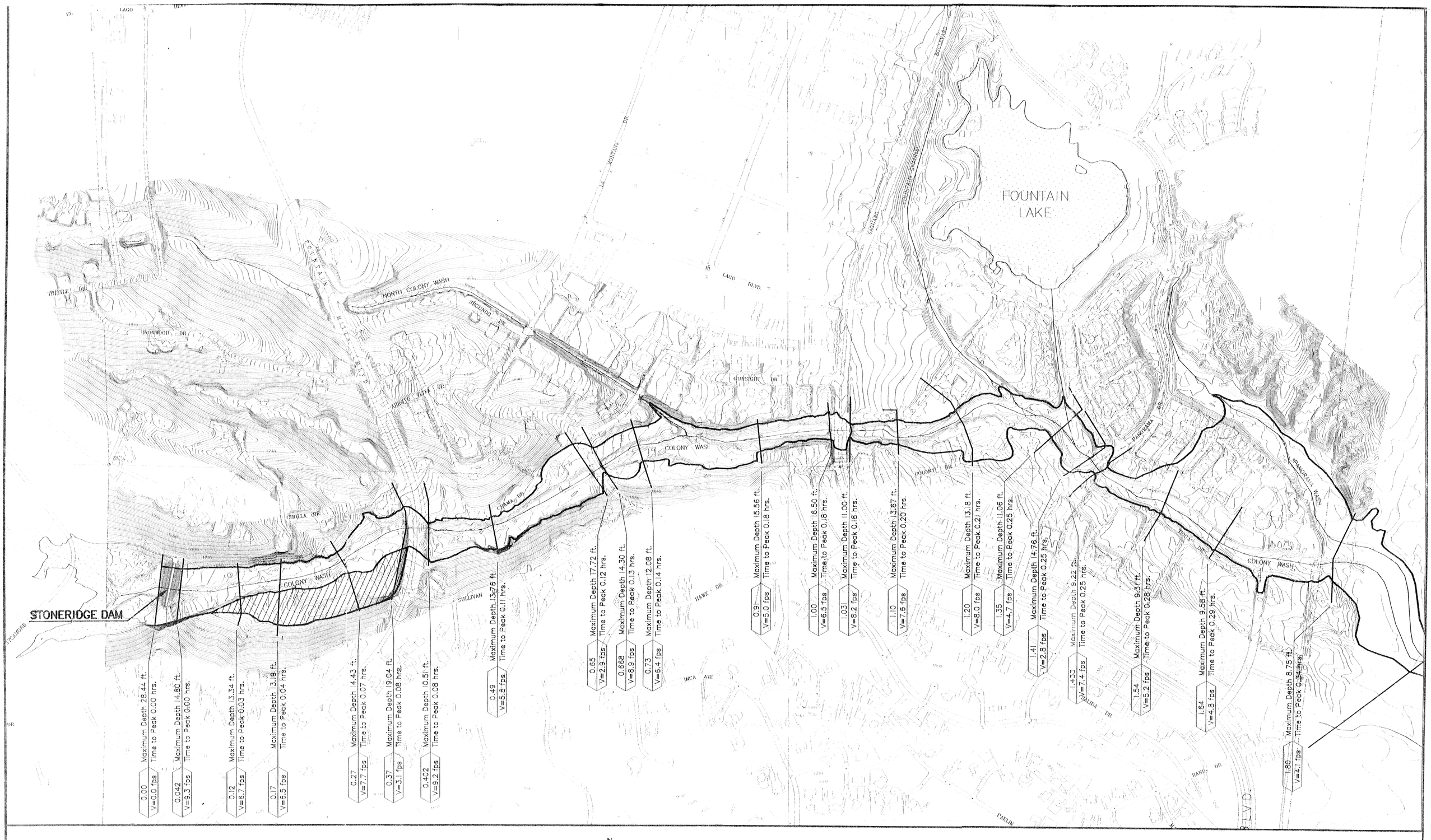
## LEGEND

Mile Station From Summit Lake Dam — 3.04

Maximum Velocity — V=5.2 fps

# PLATE 1A
# SCENARIO NO. 1
# FAILURE OF STONERIDGE DAM

FILE: 9376.A Date: 02/4/98

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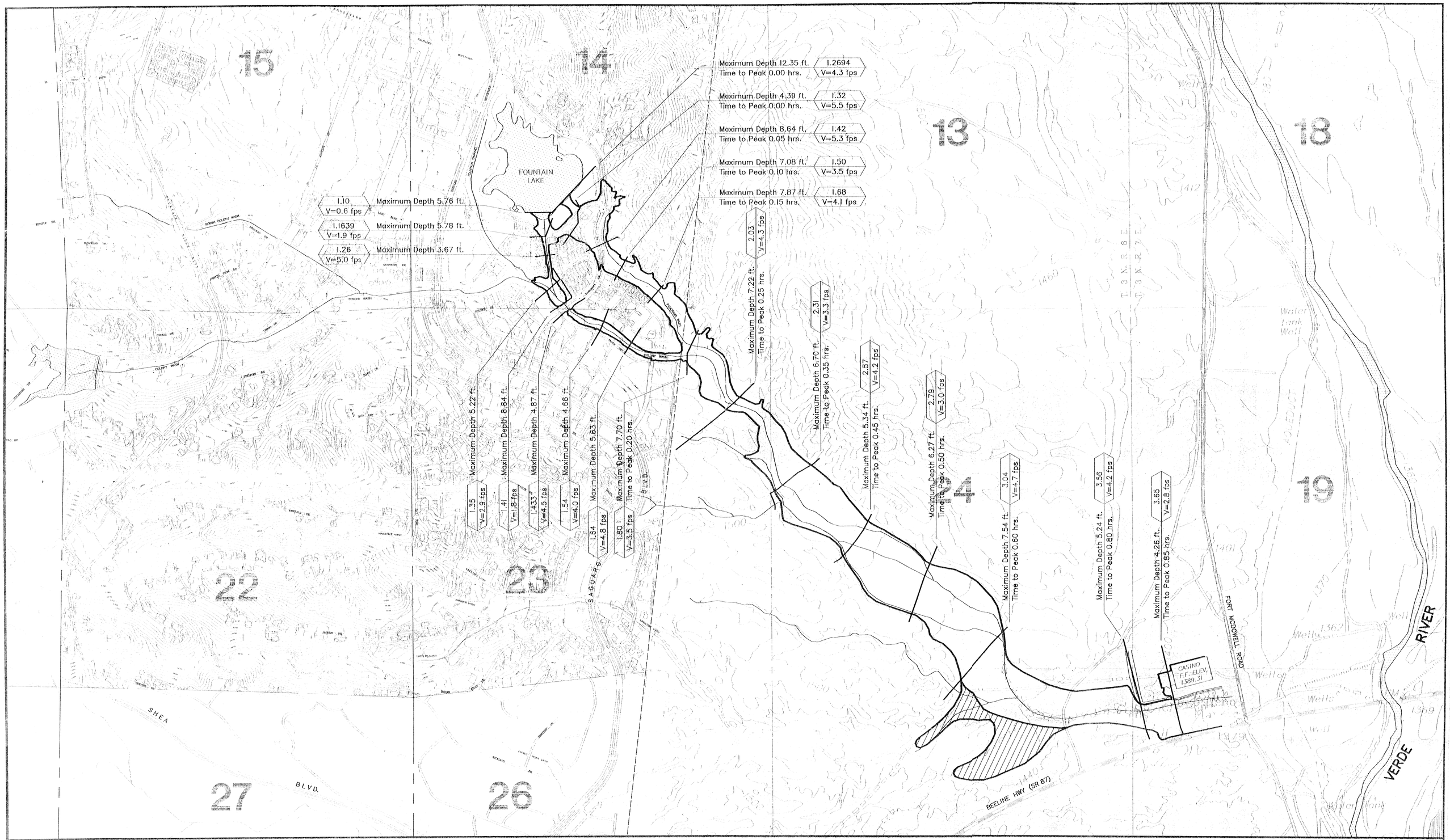
## LEGEND

Mile Station From Summit Lake Dam — 0.37

Maximum Velocity — V=3.1 fps

# PLATE 1B
# SCENARIO NO. 1
# FAILURE OF STONERIDGE DAM

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600 300 0 600 1200

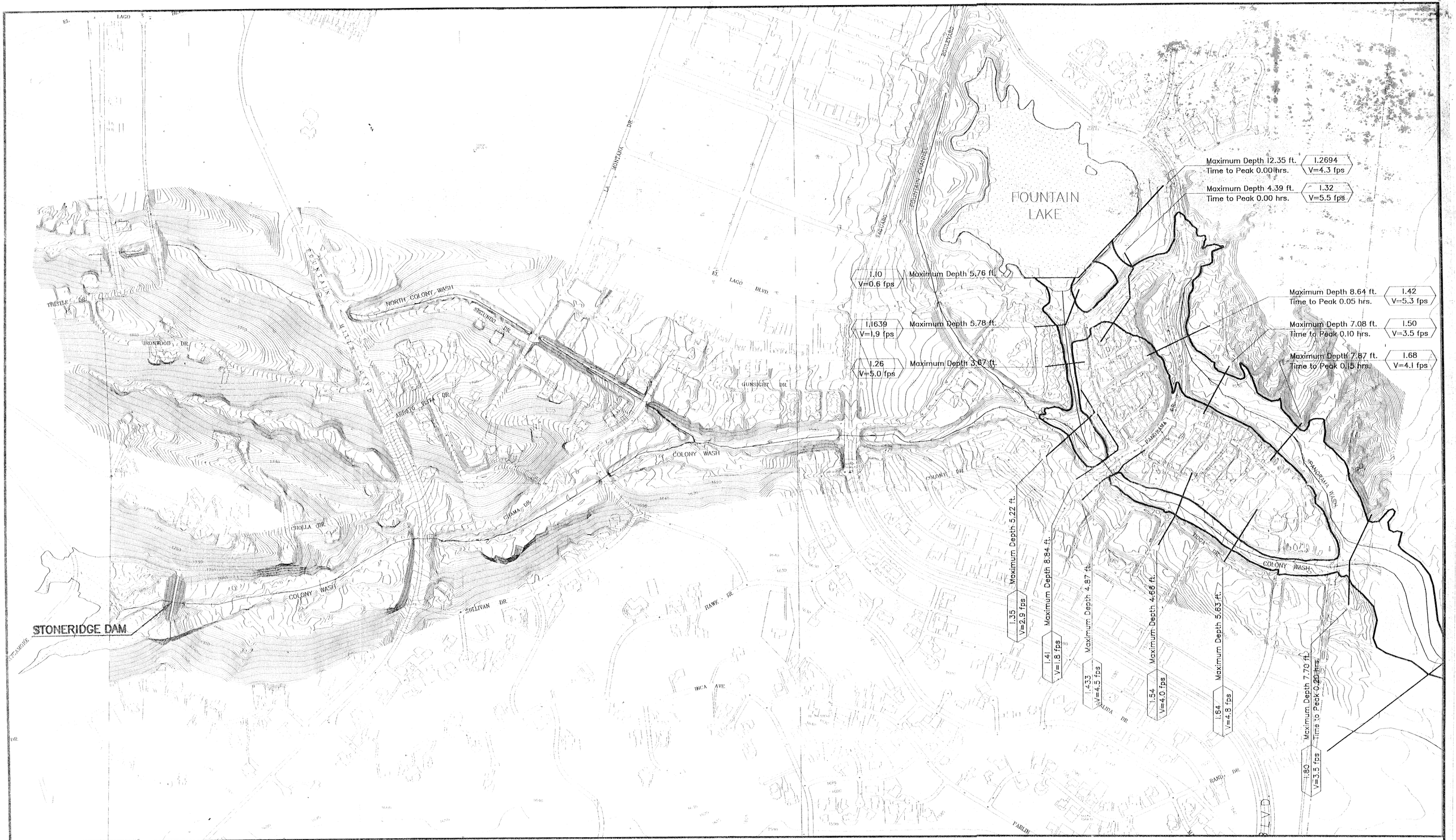
## LEGEND

Mile Station From Summit Lake Dam — 3.04

Maximum Velocity — V=4.7 fps

# PLATE 2A
# SCENARIO NO. 2
# FAILURE OF FOUNTAIN LAKE DAM

FILE: 9BRX24 Date: 02/14/96

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## LEGEND

Mile Station From Summit Lake Dam — 1.33

Maximum Velocity — V=5.5 fps

# PLATE 2B

## SCENARIO NO. 2

## FAILURE OF FOUNTAIN LAKE DAM

FILE: 193K28 Date: 02/14/96