UTAH POWER & LIGHT COMPANY
Mining Division

HYDROLOGIC ANALYSIS OF UNDISTURBED AND DISTURBED AREA RUNOFF CONTROL DITCHES, CULVERTS, SEDIMENT PONDS, AND SEDIMENT BASINS AT THE COTTONWOOD/WILBERG MINE PORTAL SITE AND THE COTTONWOOD CANYON FAN PORTAL SITE.

June, 1989

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Prepared For

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INTRODUCTION

This report and accompanying analyses have been prepared in accordance with HA&L letter proposal and scope of work dated May 9, 1989 and additional scope of work for undisturbed area bypass system dated June 5, 1987. This report summarizes the hydrology of the undisturbed bypass system and disturbed area runoff control facilities at the Cottonwood/Wilberg Mine Portal Site and hydrology of the disturbed and undisturbed area runoff control facilities at the Cottonwood/Wilberg Mine Cottonwood Canyon Fan Portal Site.

The remainder of this report is divided into four sections 1) Hydrologic Methodology, 2) Cottonwood/Wilberg Mine Portal Undisturbed Area Bypass System, 3) Cottonwood/Wilberg Mine Portal Disturbed Area Runoff Control Culverts and Sediment Ponds, and 4) Cottonwood Fan Portal Undisturbed and Disturbed Area Runoff Control Facilities.

HYDROLOGIC METHODOLOGY

This section details the methods used to estimate storm runoff volume, peak storm runoff rates, and mean sediment yield.

STORM RUNOFF VOLUME

Sediment ponds and other sediment treatment facilities are required to treat the runoff from a 10-year 24-hour storm event.

The runoff depth resulting from a given rainfall depth was determined using the runoff curve number technique, as defined by the USDA Soil Conservation Service (1972). According to the curve number methodology, the relationship between storm rainfall, soil moisture storage, and runoff can be expressed by the equations:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (1)$$

$$CN = \frac{1000}{10 + S} \qquad (2)$$

where:

Q = direct runoff depth, inches;
P = storm rainfall depth, inches;
S = maximum infiltration depth (defined as the maximum possible difference between P and Q),inches; and

CN = curve number, dimensionless.

Use of Equations 1 and 2 requires the selection of a curve number, which is a function of vegetative cover and the hydrologic soil groups. Curve numbers for the study area were selected from information provided by the USDA Soil

Conservation Service (1972), by U.S. Bureau of Reclamation (1977), and from personal hydrologic judgment following field observation. Volume weighted curve numbers were used for heterogeneous areas. More detail on Curve Number selection is given in subsequent sections of this report and in the appendix.

Values of precipitation (P) were selected for the design return periods from Volume VI-Utah of the NOAA ATLAS 2 Precipitation-Frequency Atlas of the Western United States, (Miller et. al., 1973).

Equation 1 is based on the assumption that Ia = 0.2S, where Ia is the initial abstraction from storm rainfall, defined as the rainfall which must fall before runoff begins (i.e., to satisfy interception, evaporation, and soil-water storage). Therefore, determination of runoff from Equation 1 is valid only when $P \simeq 0.2S$. Below this point, no runoff can occur. Once Q was determined from the above equation, the runoff volume was calculated by multiplying the runoff depth by the drainage area.

FLOW HYDROGRAPHS AND PEAK DISCHARGE

The regulations require that temporary facilities such as culverts and ditches which will be removed at final reclamation be sized to pass at least the peak runoff from a 10-year 6-hour storm event. Sediment pond spillways are to be designed such as to pass at least the 25-year 6-hour storm event with at least 1-foot of freeboard. The US Army Corps of Engineers' (COE) computer program "HEC-1 Flood Hydrograph Package" (COE, 1985) was used to model the 10-year and 25-year design storm events to produce hydrographs at selected locations at the Cottonwood/Wilberg Mine Portal and the Cottonwood Canyon Fan Portal sites. The model was prepared using the SCS Curve Number and dimensionless unit hydrograph technique (SCS, 1972) to compute hydrographs for each sub-basin and the kinematic wave routing routine (COE, 1985) to route hydrographs to places of confluence. The SCS 6-hour storm distribution was used in the analysis (SCS Tech. Release No. 60, revised 1985).

Input required for the SCS Curve Number and dimensionless unit hydrograph subroutine includes sub-basin area, sub-basin representative curve number, and lag time (TLAG). Sub-basin areas were determined using a polar planimeter. Curve numbers were selected for each cover type and a volume weighted curve number was computed to represent the sub-basin.

The lag time (TLAG) is defined as the time from the center of mass of rainfall excess to the peak of the runoff hydrograph. Two methods were utilized in the analysis to find TLAG. For undisturbed areas an empirical relationship for TLAG developed by the SCS was used (SCS, 1972):

$$TLAG = \frac{(h_l^{0.8})(S+1)^{0.7}}{1900\ Y^{0.5}} \quad (3)$$

where:

TLAG = watershed lag, in hours;
h_l = hydraulic length, or the length of the mainstream to the farthest divide, in feet;
S = is as previously defined; and
Y = average watershed slope, in percent.

Values of Y were obtained from methods outlined by Craig and Rankl (1977). The hydraulic length was taken from an appropriate topographic map, and S was determined from Equation 2 once the runoff curve number was estimated.

TLAG for disturbed areas was computed using the following relationship for time of concentration taken from the Denver "Urban Drainage and Flood Control Criteria Manual" (WME, 1972 revised 1984).

$$t_c = t_i + t_t \quad (4)$$

where:

t_c = time of concentration defined as the time required for flow from the hydraulically most remote point in a basin to reach the basin outlet, t_c is $\geq$ 5 minutes.

t_i = initial time or overland flow time

$$= \frac{1.8\ (1.1 - C_5)(l)^{.5}}{(s)^{.33}}$$

s = slope in percent
C_5 = rational equation runoff coefficient for 5-year return period, C_5 = 0.87 for pavement, see table in appendix.
l = overland flow length or length of initial flow.

t_t = travel time in gutter, ditch, or culvert from end of initial length to sub-basin outlet.

According to the USDA Soil Conservation Service (1972), the watershed lag is equal to 0.6 t_c.

The model input and output for the studied areas is presented in the appendix.

MEAN ANNUAL SEDIMENT YIELD

The amount of sediment to be yielded to the sediment ponds was determined from the Universal Soil Loss Equation (Israelsen et al., 1984). In accordance with this equation, soil erosion caused by water is determined from:

$$A = R \cdot K \cdot LS \cdot VM \tag{5}$$

where:

A = computed amount of soil loss, in tons/acre/year;
R = rainfall factor, in foot-tons/acre/hour;
K = soil erodibility factor, in tons/acre/year/unit of R;
LS = topographic factor (length and steepness of slope), dimensionless; and
VM = erosion control factor, dimensionless.

Values for R and K were determined from Israelsen et al. (1984). The topographic factor (LS) was determined from:

$$LS = \frac{65.41\ S^2}{S^2 + 10{,}000} + \frac{4.56\ S}{(S^2 + 10{,}000)^{0.5}} + 0.065\ (L/72.6)^m \tag{6}$$

where:

L = average overland flow length, in feet;
S = average steepness of slope, in percent; and
m = an exponent dependent upon the steepness of slope (0.3 for slopes less than 0.5%, 0.5 for slopes 0.51% to 10%, and 0.6 for slopes greater than 10%).

Values for VM were determined from the Israelsen et al. (1984) and from the Barfield et. al. (1985).

COTTONWOOD/WILBERG MINE PORTAL UNDISTURBED AREA BYPASS SYSTEM

UNDISTURBED SUB-BASIN HYDROLOGIC CHARACTERISTICS

The Cottonwood/Wilberg Mine Portal Site is located at the head of Grimes Wash Canyon 8 miles northwest of Orangeville. The mine portal site undisturbed area bypass system facilities are shown on Map 1. The tributary sub-basins associated with the undisturbed bypass system facilities are delineated on Figure 1 and Map 1. The sub-basin boundaries were defined based on topographic mapping, data provided by UP&L, and field inspection.

Sub-basin hydrologic characteristics are summarized in Table 1. About 93% of the total area tributary to the undisturbed drainage bypass system lies in Sub-basin UA-1 and Sub-basin UA-6 which are tributary to culverts CU-1 and CU-8 respectively (see Figure 1 and Map 1).

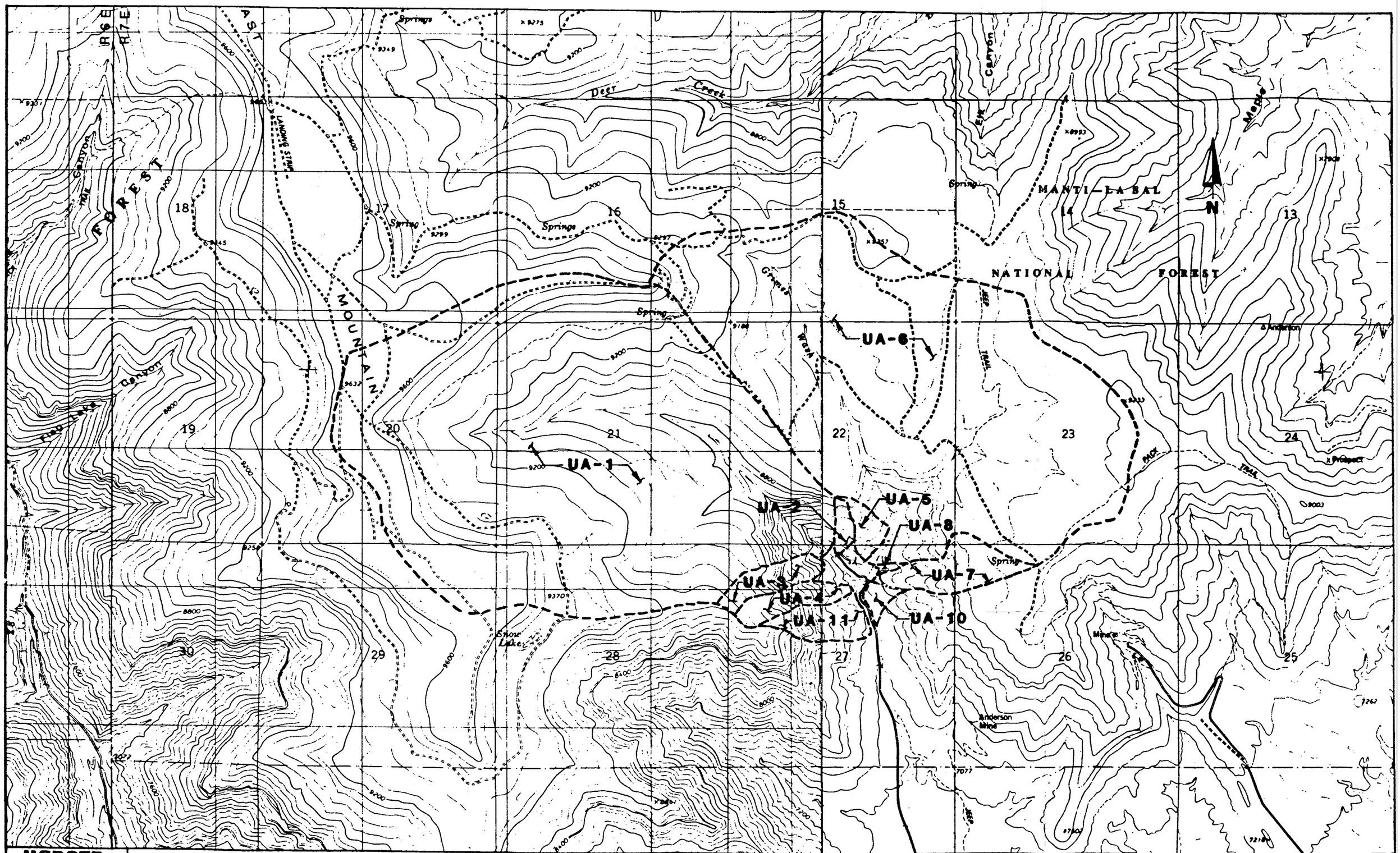
TABLE 1

COTTONWOOD/WILBERG MINE PORTAL SITE UNDISTURBED AREA SUB-BASIN CHARACTERISTICS

SUB-BASIN	AREA (acres)	VOL. WEIGHTED CURVE NUMBER	TLAG (hrs)
UA-1	1570.0	66	.76
UA-2	11.9	85	.06
UA-3	33.9	76	.10
UA-4	32.9	76	.07
UA-5	11.7	85	.06
UA-6	1295.0	73	.65
UA-7	63.0	76	.13
UA-8	3.2	76	.06
UA-9	0.9	85	.06
UA-10	9.0	76	.07
UA-11	39.7	76	.10

The volume weighted curve number for each sub-basin was defined using curve numbers based on soil type and cover density for areas of different cover within the sub-basin. See the appendix for sub-basin specific details. The following different types of cover were identified in the sub-basins tributary to the undisturbed area bypass system at the Cottonwood/Wilberg Mine Portal Site. Soils in the sub-basins are mostly hydrologic soil group B and C. Hydrologic soil group C is assumed for estimating curve numbers.

Juniper-Pine Grass Complex: In lower areas of the sub-basins tributary to the undisturbed bypass system, the south facing slopes are



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UNDISTURBED SUB-BASIN BOUNDARIES

COTTONWOOD/WILBERG PORTAL SITE

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FIGURE **1**

estimated to have a cover density of 20% with a Curve Number of 85 while west facing slopes are estimated to have a cover density of 40% and a Curve Number of 76 (see Figure 9.6 in the appendix taken from SCS, 1972).

Sage-Grass Complex: High sage-grass areas on East Mountain are estimated to have an effective cover of 50% with a Curve Number of 65. Lower sage-grass areas on west facing slopes are estimated to have an effective cover of 40% with a Curve Number of 68. Lower sage-grass areas on south facing slopes are estimated to have an effective cover of 30% with a Curve Number of 72 (see Figure 9.6 in the appendix taken from SCS, 1972).

Conifer-Aspen Grass Complex: Conifer-aspen grass areas located high on East Mountain on north and west facing slopes are estimated to have an effective cover of 80% with a Curve Number of 62. Conifer-aspen areas on south facing slopes are estimated to have an effective cover of 60% with a Curve Number of 70 (see Figure 9.6 in the appendix taken from SCS, 1972).

UNDISTURBED AREA BYPASS SYSTEM CULVERTS

The undisturbed area bypass system culverts are classified as temporary structures and are to have capacity for the 10-year 6-hour storm event. The storm runoff peak flow for the 10-year 6-hour storm event was found using the above referenced model (COE HEC-1, see input and output in Appendix) with a precipitation depth of 1.55 inches (Miller et. al., 1973). The peak flowrate from the 10-year 6-hour precipitation event at each of the selected culverts is summarized in Table 2 along with the required minimum inlet depth and the required minimum pipe slope to convey the design flow. The required inlet depth to pass the design flow was found using "Hydraulic Charts for the Selection of Highway Culverts" H.E.C. 5 (US DOT, 1965). The required minimum pipe slope for inlet flow conditions was found using the Mannings Equation (see calculations in Appendix).

All of the undisturbed bypass system culverts analyzed have head water depth requirements less than one pipe diameter and require minimum slopes less than 0.006 feet/feet. Based on the provided mapping and field inspection, all of the analyzed culverts have the required head water depth and it is assumed, based on existing topography that all culvert slopes are in excess of the minimum required. Therefore we conclude that the undisturbed bypass system culverts can convey the required peak flowrate from the design 10-year 6-hour storm event.

Culverts CU-2 and CU-15 are proposed by UP&L to intercept undisturbed drainage (Sub-basin UA-2 and Sub-basin UA-5 respectively) (see Map 1). As shown on Table 2, the predicted peak runoff rate to Culvert CU-2 is 4 cfs and to culvert CU-15 is 4.2 cfs. The recommended culvert size for both CU-2 and CU-15 is 18-inch diameter to facilitate maintenance.

TABLE 2

CULVERT DESIGN CRITERIA
UNDISTURBED AREA BYPASS SYSTEM CULVERTS
COTTONWOOD/WILBERG MINE PORTAL SITE

CULVERT	DESIGN FLOW (CFS)	PIPE DIAMETER (IN)	REQUIRED HEAD WATER DEPTH (FT)	REQUIRED MINIMUM SLOPE (FT/FT)
CU-1	26.	72	2.0	.001
CU-2	4.	18	1.2	.006
CU-3	27.	72	2.0	.001
CU-4	5.	18	1.4	.010
CU-5	28.	72	2.0	.001
CU-6	5.	30	1.0	.001
CU-7	29.	72	2.0	.001
CU-8	77.	72	3.5	.002
CU-9	9.	30	1.5	.002
CU-10	80.	72	3.6	.002
CU-11	0.5	24	0.4	.001
CU-12	0.3	24	0.3	.001
CU-13	83.	72	3.8	.002
CU-14	102.	90	4.0	.001
CU-15	4.2	18	1.3	.006

UNDISTURBED AREA BYPASS SYSTEM DITCHES

Existing ditches are used to intercept storm runoff from undisturbed areas UA-8, UA-9, UA-10, and UA-11. Proposed ditch UD-5 will intercept storm runoff from undisturbed area above the Wilberg Fan Small Area Exemption (sub-basin UA-5). The undisturbed area bypass ditches are classified as temporary structures and are to have capacity for the 10-year 6-hour storm event. The storm runoff peak for the 10-year 6-hour storm event was found using the above referenced model (COE HEC-1, see input and output in Appendix) with a precipitation depth of 1.55 inches (Miller et. al., 1973).

Table 3 presents the design criteria for the undisturbed area bypass system ditches. The channel depth shown on Table 3 includes a minimum of 0.5 feet of freeboard. Ditch hydraulics were analyzed with the Mannings flow equation. A Mannings n of 0.03 was assumed for unlined ditches. Riprap was sized with a minimum safety factor of 1.5 in accordance with the methods presented in the Barfield et. al. (1981). Ditch hydraulics are summarized on Map 1, see appendix for further detail. The ditch configurations presented in Table 3 and in the Ditch Hydraulics Table on Map 1 represent required design configurations, not existing conditions. Riprap is assumed to be needed where velocities exceed 5 feet per second. Ditch UD-3 and UD-5 require riprap on the steeper slopes. Ditch UD-4 requires riprap. A filter blanket is required beneath the riprap lining to prevent failure of the fine grained sub-soils. A 12-inch thick layer of Type II Granular Bedding under riprap linings (see gradation in Appendix) is recommended.

TABLE 3
UNDISTURBED AREA BYPASS DITCH DESIGN CRITERIA
COTTONWOOD/WILBERG MINE PORTAL SITE

CHANNEL	DESIGN FLOW (cfs)	MAXIMUM SLOPE (ft/ft)	BOTTOM WIDTH (ft)	SIDE SLOPE (H/V)	CHANNEL DEPTH (ft)
UD-1	0.5	0.05	1	2.0	1.0
UD-2	0.3	0.12	1	2.0	1.0
UD-3	1.0	0.20	1	2.5	1.0
UD-4	5.0	0.20	3	3.0	1.0
UD-5	4.2	0.10	2	2.5	1.0

Filter Blanket

UNDISTURBED AREA BYPASS SYSTEM DITCHES

Existing ditches are used to intercept storm runoff from undisturbed areas UA-8, UA-9, UA-10, and UA-11. Proposed ditch UD-5 will intercept storm runoff from undisturbed area above the Wilberg Fan Small Area Exemption (sub-basin UA-5). The undisturbed area bypass ditches are classified as temporary structures and are to have capacity for the 10-year 6-hour storm event. The storm runoff peak for the 10-year 6-hour storm event was found using the above referenced model (COE HEC-1, see input and output in Appendix) with a precipitation depth of 1.55 inches (Miller et. al., 1973).

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COTTONWOOD/WILBERG MINE PORTAL SITE

CHANNEL	DESIGN FLOW (cfs)	MAXIMUM SLOPE (ft/ft)	BOTTOM WIDTH (ft)	SIDE SLOPE (H/V)	CHANNEL DEPTH (ft)
UD-1	0.5	0.05	1	2.0	1.0
UD-2	0.3	0.12	1	2.0	1.0
UD-3	1.0	0.20	1	2.5	1.0
UD-4	5.0	0.20	3	3.0	1.0
UD-5	4.2	0.10	2	2.5	1.0

COTTONWOOD/WILBERG MINE PORTAL DISTURBED AREA RUNOFF CONTROL CULVERTS, SEDIMENT PONDS, AND SAE

The Cottonwood/Wilberg Mine Portal Site is located at the head of Grimes Wash Canyon 8 miles northwest of Orangeville. The mine portal site disturbed area runoff control facilities are shown on Map 2. The tributary sub-basins associated with disturbed area runoff control facilities are delineated on Map 2. The sub-basin boundaries were defined based on topographic mapping and data provided by UP&L and field inspection. During this study, it was decided by UP&L to intercept the majority of the undisturbed area tributary to Sub-basin DA-1 by constructing an inlet and storm drain to the undisturbed bypass system (see undisturbed sub-basin UA-2 discussed above). The following detail assumes that the new inlet is constructed.

DISTURBED SUB-BASIN HYDROLOGIC CHARACTERISTICS

Sub-basin hydrologic characteristics are summarized in Table 4.

TABLE 4

COTTONWOOD/WILBERG MINE PORTAL SITE DISTURBED AREA SUB-BASIN CHARACTERISTICS

SUB-BASIN	AREA (acres)	VOL. WEIGHTED CURVE NUMBER	TLAG (hrs)
DA-1	5.61	91.5	.064
DA-2	2.58	90.1	.067
DA-3	1.38	88.5	.065
DA-4	2.96	91.6	.05
DA-5	0.14	95.8	.05
DA-6	4.15	81.3	.063
DA-7	1.76	91.9	.059
DA-8	0.14	98.0	.05
DA-9	2.49	88.5	.079
DA-10	0.48	96.2	.05
DA-11	1.20	91.8	.05
DA-12	0.31	98.0	.065
DA-13	0.10	98.0	.05
DA-14	0.72	92.0	.056
DA-15	0.29	98.0	.05
DA-16	0.20	98.0	.05
DA-17	0.90	88.1	.107
DA-18	0.86	87.8	.062
TOTAL	26.27 ACRES		

The volume weighted curve number for each sub-basin was defined using curve numbers based on soil type and cover density for areas of different cover within the sub-basin. See the appendix for sub-basin specific details. The following different types of cover were identified in the sub-basins tributary to the sediment ponds at the Cottonwood/Wilberg Mine Portal Site.

Juniper-Pine Grass Complex: In undisturbed areas which are tributary to the sediment ponds, the south facing slopes are estimated to have a cover density of 20% with a curve number of 85 while west facing slopes are estimated to have a cover density of 40% and a curve number of 76 (see Figure 9.6 in the appendix taken from SCS, 1972).

Rock Outcrop: Horizontal areas of rock outcrop were found with the aid of an aerial map. The rock outcrops tend to be highly fractured with well developed talus slopes. A curve number of 88 is believed representative of the rock outcrop areas.

Disturbed Areas: All of the disturbed areas which are actively used within the mine portal site have been treated with either asphalt or concrete paving or are covered with gravel. Areas which have been disturbed during construction operations in the past and are not in active use have tended to naturally revegetate. Paved areas are assigned a curve number of 98 (SCS, 1972), graveled areas are assigned a curve number of 93 (SCS, 1972), and disturbed areas which are not actively used are estimated to have a curve number of 86 based on a cover density of about 10% Juniper-Grass with a Type C soil (see Figure 9.6 in the appendix taken from SCS, 1972).

DISTURBED AREA RUNOFF CONTROL CULVERTS

The disturbed area runoff control culverts are classified as temporary structures and are to have capacity for the 10-year 6-hour storm event. The storm runoff peak flow for the 10-year 6-hour storm event was found using the above referenced model (COE HEC-1, see input and output in Appendix) with a precipitation depth of 1.51 inches (Miller et. al., 1973). The peak flowrate from the 10-year 6-hour precipitation event at each of the selected culverts is summarized in Table 5 along with the required minimum inlet depth and the required minimum pipe slope to convey the design flow. The required inlet depth to pass the design flow was found using "Hydraulic Charts for the Selection of Highway Culverts" H.E.C. 5 (US DOT, 1965). The required minimum pipe slope for inlet flow conditions was found using the Mannings Equation (see calculations in Appendix).

All of the culverts analyzed have head water depth requirements less than one pipe diameter and required minimum slopes less than .01 feet/feet. Based on the provided mapping and field inspection, all of the analyzed culverts have the required head water depth and all appear to have slopes in excess of the minimum required. Therefore we conclude that all of the analyzed culverts can convey the required peak flowrate from the design 10-year 6-hour storm event.

TABLE 5

CULVERT DESIGN CRITERIA
DISTURBED AREA RUNOFF CONTROL CULVERTS
COTTONWOOD/WILBERG MINE PORTAL SITE

CULVERT	DESIGN FLOW (CFS)	PIPE DIAMETER (IN)	REQUIRED HEAD WATER DEPTH (FT)	REQUIRED MINIMUM SLOPE (FT/FT)
CD-1	4.1	24	0.8	.002
CD-2	1.8	18	0.7	.001
CD-3	0.9	12	0.7	.003
CD-4	9.0	24	1.5	.007
CD-5	9.2	24	1.6	.007
CD-6	10.5	24	1.7	.009
CD-7	1.4	16	0.9	.001
CD-8	12.0	30	1.7	.004
CD-9	13.5	30	1.8	.005
CD-10	13.8	30	1.9	.005
CD-11	14.8	30	2.0	.006
CD-12	0.3	14	0.4	.001
CD-13	0.1	16	0.1	.001
CD-14	0.6	14	0.5	.001
CD-15	0.3	12	0.1	.001
CD-16	0.2	12	0.1	.001

DISTURBED AREA RUNOFF CONTROL DITCHES

The ditches in the disturbed area runoff control system at the Cottonwood/Wilberg Mine Portal Site are utilized to contain onsite nuissance runoff to facilitate the operation of the mine. From the available mapping and site visit, it has been found that should any of the disturbed area ditches fail to contain the runoff peak flow from the design storm event, the spilled waters would still be conveyed by the existing topography to the sediment ponds. For example, the disturbed area culverts CD-1, CD-2, and CD-3 all discharge onto the upper parking area which is graded to drain to culvert CD-4 (see Map 2). There is a ditch along the north side of the upper parking area which helps to contain nuissance flooding, if the ditch capacity is insufficient for a given runoff event then the grading of the parking lot would convey spilled flows to culvert CD-4. Because the capacity of the existing disturbed area ditches does not affect the adequacy of the disturbed area runoff treatment, no further analysis of the disturbed area ditches is included in this report.

10-YEAR 24-HOUR RUNOFF VOLUMES AND MEAN ANNUAL SEDIMENT YIELD

The 10-year 24-hour rainfall depth was found in the NOAA ATLAS 2 Volume VI-Utah (Miller et. al.,1973) to be 2.40 inches for the Cottonwood/Wilberg Mine Portal Site. Based on the sub-basin characteristics (Table 4) and a precipitation of 2.40 inches the estimated runoff from the 10-year 24-hour rainstorm event from the areas tributary to the sedimentation ponds is 1.42 inches or 3.1 acre-feet. The calculated mean annual sediment yield is 0.81 acre-feet. The required sediment pond volume to contain the 10-year 24-hour storm event and the mean annual sediment yield is 3.9 acre-feet.

NORTH AND SOUTH SEDIMENT PONDS

The runoff from the disturbed areas (except for the Wilberg Fan Small Area Exemption) of the Cottonwood/Wilberg Mine Portal site is conveyed via culverts and ditches to two sediment ponds which are connected in series. Both sediment ponds utilize a 36-inch diameter corrugated metal pipe riser type spillway. The spillway from the North Sediment Pond discharges into the South Sediment Pond. The South Sediment Pond discharges into the undisturbed area bypass system and thence to the natural stream channel. Only about 5% of the total disturbed area is directly tributary to the South Sediment Pond, the rest of the tributary area is tributary through the North Sediment Pond. Figures 2 and 3 present the stage capacity curves for the North and South Sediment Ponds respectively. The curves are based on data and cross sections provided by UP&L (UP&L, 1984). The capacity of the North and South Sediment Ponds is summarized in Table 6. The combined runoff storage volume of 3.1 acre-feet is equivalent to the required runoff storage volume.

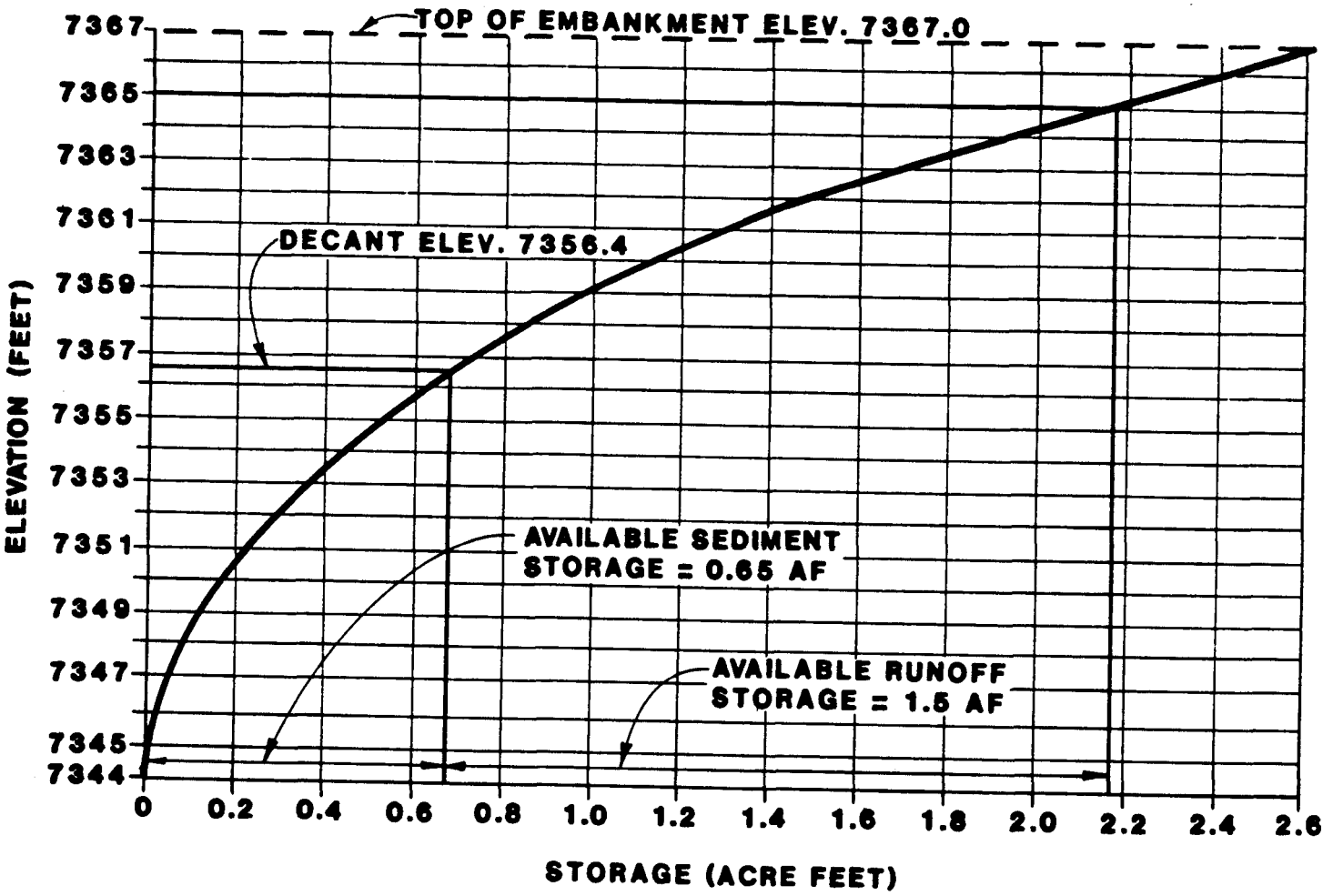

FIGURE 2.

STAGE-CAPACITY CURVE FOR NORTH SEDIMENT POND
COTTONWOOD/WILBERG MINE PORTAL SITE.

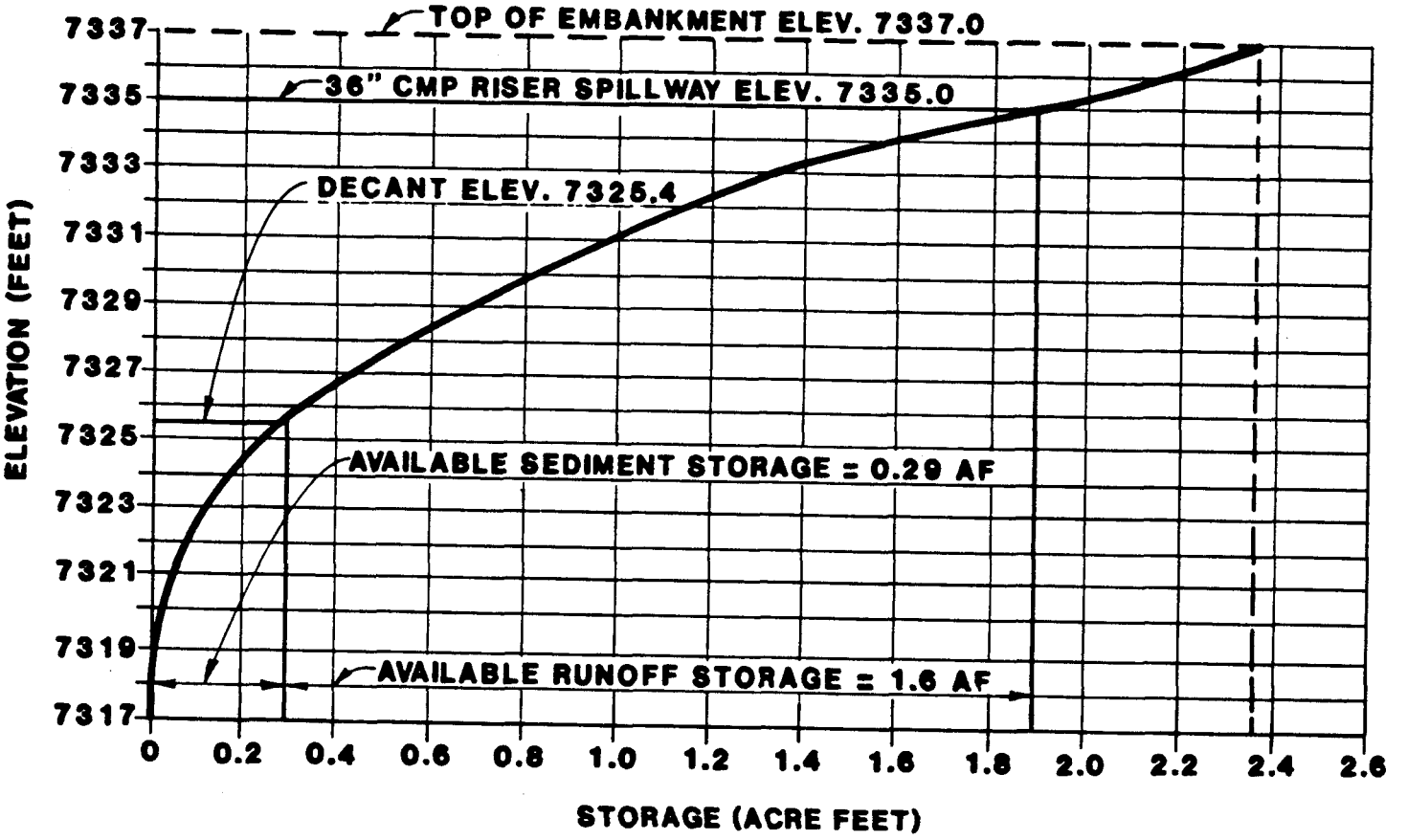

FIGURE 3.

STAGE CAPACITY CURVE FOR SOUTH SEDIMENT POND COTTONWOOD/WILBERG MINE PORTAL SITE.

TABLE 6
COTTONWOOD/WILBERG MINE PORTAL SITE
CAPACITY OF THE NORTH AND SOUTH SEDIMENT PONDS
ACRE-FEET

	NORTH POND	SOUTH POND	COMBINED
SEDIMENT STORAGE	0.65	0.29	0.94
RUNOFF STORAGE	1.50	1.60	3.10
TOTAL CAPACITY	2.15	1.89	4.04

The existing 36-inch riser type spillways in the North and South Sediment Ponds are both set 2 feet below the top of the embankment and provide a discharge capacity with one foot of freeboard of 31 cfs (see calculations and stage discharge curve in Appendix). The peak flow rate tributary to the ponds from a 25-year 6-hour storm event was modeled using the model described above with a rainfall depth of 1.81 inches (Miller et. al., 1973). The predicted peak flow into the sediment ponds is 23 cfs, therefore the existing spillways have adequate capacity for the 25-year 6-hour storm event.

WILBERG FAN SMALL AREA EXEMPTION

UP&L requests a Small Area Exemption (SAE) for the small disturbed area associated with the Wilberg Fan (see Map 2). It is our understanding that there are three criteria that must be met in order for an area to qualify as a SAE. These criteria include:

1. The area cannot be tributary to a sediment pond.
2. The summation of the areas of the SAE's must be less than ten to fifteen percent of the total disturbed area.
3. The area must have some form of a treatment structure to treat runoff from the area.

The runoff from the disturbed area associated with the Wilberg Fan is not tributary to the sediment ponds. Runoff from the SAE is tributary to the undisturbed area bypass culvert inlet above sub-basin DA-7.

The total disturbed area in the Wilberg Fan SAE is 0.9 acres which is less than 6% of the total disturbed area associated with the Cottonwood/Wilberg Mine Portal Site, which is less than the 10% criteria.

Runoff from the Wilberg Fan SAE will be treated by containing the runoff from the 10-year 24-hour precipitation event in a proposed sediment basin to be located in an existing depression in the access road. To reduce the undisturbed area presently tributary to the proposed sediment basin site, UP&L will construct

a new undisturbed area interception ditch and culvert to Grimes Wash (see discussion for undistrubed area ditch UD-5 and culvert CU-15 above). With the new undisturbed area diversion ditch in place, the tributary areas to the proposed sediment basin will consist of 0.88 acres of disturbed area and 7.0 acres of undisturbed Juniper-Grass. The computed runoff for the 10-year 24-hour precipitation event is 1.14 inches (CN = 85.7, P = 2.4 inches) for a predicted runoff volume of 0.75 acre-feet (7.88 x 1.14/12).

The proposed sediment basin will be provided with an 18-inch diameter culvert spillway to convey the peak from the 25-year 6-hour storm event (peak inflow to sediment basin predicted to be 7 cfs, see HEC-1 input and output in Appendix).

CONCLUSIONS AND RECOMMENDATIONS

Based on the above presented analysis and upon the addition of a new inlet to intercept undisturbed area drainage above sub-basin DA-1, the following conclusions are reached. The major components of the disturbed area runoff system are adequate to convey the 10-year 6-hour storm runoff event to the North and South sediment ponds. The existing sediment ponds are adequate to contain the runoff from the 10-year 24-hour storm event plus the mean annual sediment yield. The existing 36-inch pipe riser type spillways for the North and South sediment ponds have adequate capacity to discharge the peak flowrate of the 25-year 6-hour storm event.

COTTONWOOD/WILBERG MINE COTTONWOOD CANYON FAN PORTAL UNDISTURBED AND DISTURBED AREA RUNOFF CONTROL FACILITIES

The Cottonwood/Wilberg Mine Cottonwood Canyon Fan Portal is located in Section 25, Township 17 South, Range 6 East near the Old Johnson Mine. The disturbed and undisturbed runoff control facilities are shown on Map 3.

The undisturbed runoff control facilities consist of ditches UD-1 and UD-2 which convey runoff to culvert C-1 and ditch UD-3 which intercepts runoff above the Fan Portal Site and conveys runoff to the existing drainage to the south which is tributary to the existing 48" County Road culvert.

The disturbed area runoff control facilities consist of ditches which convey runoff from all disturbed areas (except DA-4) to the sediment basins. Treatment for runoff from sub-basin DA-4 is provided with sediment traps formed by gabions in ditch DD-5.

SUB-BASIN HYDROLOGIC CHARACTERISTICS

Sub-basin hydrologic characteristics are summarized in Table 7.

TABLE 7

COTTONWOOD/WILBERG MINE COTTONWOOD CANYON FAN PORTAL SITE SUB-BASIN CHARACTERISTICS

SUB-BASIN	AREA (acres)	VOL. WEIGHTED CURVE NUMBER	TLAG (hrs)
UA-1	16.9	76	.111
UA-2	74.7	74	.183
UA-3	16.3	75	.110
TOTAL	107.9		
DA-1	1.2	81.8	.067
DA-2	2.3	80.3	.080
DA-3	1.5	85.5	.086
DA-4	1.8	69.5	.066
TOTAL	6.8		

Volume weighted curve number for each sub-basin was derived using curve numbers based on soil type and cover density for areas of different cover within the sub-basin. See the appendix for sub-basin specific details. The following different types of cover were identified in the sub-basins associated with the Cottonwood/Wilberg Mine Cottonwood Canyon Fan Portal Site.

different types of cover were identified in the sub-basins associated with the Cottonwood/Wilberg Mine Cottonwood Canyon Fan Portal Site.

Juniper-Pine Grass Complex: The slopes above the Fan Portal Site are estimated to have an effective cover of 51% with a Curve Number of 72 (see Figure 9.6 in the appendix taken from SCS, 1972).

Sage-Grass complex: The sage-grass areas are estimated to have an effective cover of 54% with a Curve Number of 62 (see Figure 9.6 in the appendix taken from SCS, 1972).

Temporarily reclaimed: Areas which have been temporarily reclaimed are estimated to have 50% cover of herbs with a Curve Number of 80 (see Figure 9.5 in the appendix taken from SCS, 1972).

Disturbed areas: Areas which have been disturbed during the construction activities are assumed to have a Curve Number of 90.

RUNOFF CONTROL CULVERTS AND DITCHES

The runoff control culverts and ditches are classified as temporary structures and are to have capacity for the 10-year 6-hour storm event. The storm runoff peak for the 10-year 6-hour storm event was found using the above referenced model (COE HEC-1, see input and output in Appendix) with a precipitation depth of 1.55 inches (Miller et. al., 1973). The 10-year 6-hour peak runoff at each of the selected culverts is summarized in Table 8 along with the required minimum inlet depth and the required minimum pipe slope to convey the design flow. The required inlet depth to pass the design flow was found using "Hydraulic Charts for the Selection of Highway Culverts" H.E.C. 5 (US DOT, 1965). The required minimum pipe slope for inlet flow conditions was found using the Mannings Equation (see calculations in Appendix).

Table 9 presents the design criteria for the runoff control ditches at the Fan Portal Site. The channel depth shown on Table 9 includes 0.5 feet of freeboard. Ditch hydraulics were analyzed with the Mannings flow equation. A Mannings n of 0.03 was assumed for unlined ditches. Riprap was sized with a minimum safety factor of 1.5 in accordance with the methods presented in the Barfield et. al. (1981). Ditch hydraulics are summarized on Map 3, see appendix for further detail. The ditch configurations presented in Table 9 and in the Ditch Hydraulics Table on Map 3 represent required design configurations, not existing conditions. Riprap is assumed to be needed where velocities exceed 5 feet per second. Ditch UD-2 and the south end section of ditch UD-3 require riprap lining. A filter blanket is required beneath the riprap lining to prevent failure of the fine grained subsoils. A 12-inch thick layer of Type II granular bedding is recommended under riprap linings (see granular bedding gradation in Appendix).

TABLE 8

CULVERT DESIGN CRITERIA
COTTONWOOD/WILBERG MINE COTTONWOOD CANYON
FAN PORTAL SITE

CULVERT	DESIGN FLOW (CFS)	PIPE DIAMETER (IN)	REQUIRED HEAD WATER DEPTH (FT)	REQUIRED MINIMUM SLOPE (FT/FT)
C-1	14.0	36	2	.002
C-2	1.7	24	1	.001
C-3	.6	24	1	.001
C-4	.6	18	1	.001

TABLE 9
DITCH DESIGN CRITERIA
COTTONWOOD CANYON FAN PORTAL

CHANNEL	DESIGN FLOW (cfs)	MAXIMUM SLOPE (ft/ft)	BOTTOM WIDTH (ft)	SIDE SLOPE (H/V)	CHANNEL DEPTH (ft)
UD-1	3.1	0.13	4	2.0	1.0
UD-2	11.0	0.09	3	2.5	1.0
UD-3	2.8	0.20	3	2.5	1.0
DD-1	0.4	0.10	1	2.0	1.0
DD-2	0.6	0.18	1	2.0	1.0
DD-3	0.6	0.10	1	2.0	1.0
DD-4	0.7	0.12	1	2.0	1.0
DD-5	0.6	0.11	1	2.0	1.0

10-YEAR 24-HOUR STORM RUNOFF VOLUMES AND MEAN ANNUAL SEDIMENT YIELD TO SEDIMENT BASINS

Storm runoff from Sub-basin DA-1 is treated by the north sediment basin and runoff from Sub-basins DA-2 and DA-3 is treated by the south sediment basin. Table 10 presents a summary of the tributary drainage to the north and south sediment basins. The existing sediment basins have capacity for the runoff from the 10-year 24-hour rainfall event and the mean annual sediment yield.

TABLE 10

SEDIMENT BASIN CAPACITY, 10-YEAR 24-HOUR RUNOFF VOLUMES, AND MEAN ANNUAL SEDIMENT YIELD COTTONWOOD/WILBERG MINE COTTONWOOD CANYON FAN PORTAL SITE

SEDIMENT BASIN	TRIBUTARY AREA (acres)	10-YR 24-HR RUNOFF (acre-feet)	MEAN ANNUAL SEDIMENT YIELD (acre-feet)	BASIN CAPACITY (acre-feet)
NORTH	1.2	0.09	.01	0.11
SOUTH	3.8	0.30	0.16	0.52

CONCLUSIONS AND RECOMMENDATIONS

The existing culvert system is adequate to pass the peak flowrate of the 10-year 6-hour storm event. Ditches should be constructed or modified to reflect configuration presented in Ditch Design Criteria Table 9, with riprap in sections that exceed 5 feet per second. Riprap is required in ditch UD-3 south of the proposed fan portal site and in ditch UD-2. The existing disturbed area runoff treatment system consists of two sediment basins with adequate capacity to contain the runoff from the 10-year 24-hour storm event and the mean annual sediment yield, and road-side sediment traps formed by gabions in ditch DD-5.

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APPENDIX

HA&L ENGINEERING

CLIENT: UP&L Mining
PROJECT: Cottonwood/Wilberg Undisturbed
FEATURE: Hydrologic Computations Appendix
PROJECT NO.: 5-1-310

SHEET ___ OF ___
COMPUTED: GJP
CHECKED: ___
DATE: June 1989

Cottonwood/Wilberg Mine Portal Site
Undisturbed Area Bypass System

HYDROLOGIC COMPUTATIONS APPENIX

RAINFALL	Pages 1 to 1
Sub-basin Characteristics	Pages 1 to 7
Undisturbed Bypass Culverts	Pages 1 to 4
Undisturbed Area Ditches	Pages 1 to 4
Granular Bedding	
HEC 1 Printout 10-year 6-hour storm event	Pages 1 to 35

HANSEN ALLEN & LUCE INC

CLIENT UPSL Mining
PROJECT Cottonwood/Wilberg Mine Portal
FEATURE Undisturbed Drainage Rainfall
PROJECT NO. 5-1-310

SHEET 1 OF 1
COMPUTED GSP
CHECKED
DATE June 6, 1989

Rainfall ref: "NOAA ATLAS 2, Volume VI - Utah

10-year	6-hour	1.55 inches
25-year	6-hour	1.90 inches
50-year	6-hour	2.10 inches
100-year	6-hour	2.3 inches

SUB-BASINS UA-1 and UA-6

UA-1: - Western Wilberg Drainage

~1466 acres total

Background Data

Trail Mtn Data:

- low grass-shrub areas - 54% cover CN=62 65
- low conifer on north facing slopes - 60% cover (CN=7 CN=5
- juniper grass good 27.3+26 = 53% cover CN=72

Rilda Canyon:

- higher conifer - Aspen Conifer - 80% cover CN=62
- south facing sage-grass 40% cover CN=68

Final Reclamation Plan ⇒ CN=67

Deer Creek upper drainage ⇒ CN=69

East Mountain - Sage-grass 86 → 184 acres
50% ground cover ⇒ CN=62 use CN=65

High Conifer-Aspen west & North facing slopes 442 → 945 acres
80% cover - use Juniper-grass curve ⇒ CN=62

700
1499 acres
2 acres/number

Lower Sage-Grass - west facing 104 → 222 acres
40% cover → CN=68

Lower Sage-Grass south facing 68 → 145 acres
30% cover → CN=72

Low Juniper-grass 73 acres
40% cover ⇒ CN=76

Volume weighted CN = 66 (see attached spreadsheet)

Average Basin Slope = $\frac{89'' \times 2000' \times 80' \text{ contour int}}{1600 \quad 43560}$ = 20.4%

Hydraulic length = 12,000 feet

spread sheet

scs curve number

UP&L COTTONWOOD/WILBERG UNDISTURBED DRAINAGES

				RUNOFF IN INCHES 10-YR 6-HR	25-YR 6-HR	50-YR 6-HR
P RAINFALL				1.55	1.9	2.1
UA-1	AREA	CN	S			
HIGH SAGE	184	65	5.38	0.04	0.11	0.16
HIGH CONIFER	945	62	6.12	0.02	0.07	0.11
WEST SAGE	222	68	4.70	0.07	0.16	0.23
SOUTH SAGE	146	72	3.88	0.13	0.25	0.34
JUNIPER	73	76	3.15	0.21	0.36	0.47
TOTAL	1570					
VOL WTD Q				0.05	0.12	0.17
VOL WTD CN		66	5.15	0.05	0.13	0.18
UA-6	AREA	CN	S			
HIGH SAGE	0	65	5.38	0.04	0.11	0.16
HIGH CONIFER	461	70	4.28	0.10	0.20	0.28
WEST SAGE	0	68	4.70	0.07	0.16	0.23
SOUTH SAGE	757	72	3.88	0.13	0.25	0.34
JUNIPER	77	85	1.76	0.48	0.72	0.87
TOTAL	1295					
VOL WTD Q				0.14	0.26	0.35
VOL WTD CN		72.5	3.79	0.14	0.26	0.35

UA-2 1"=100' map ⇒ #3409 ⇒ 11.9 acres

CN = 85 - 20% cover juniper

Average Basin slope = $\frac{104.5'' \times .100 \times 50}{11.9\ (43560)}$ = 100%

hydraulic length = 1475 feet

UA-3 1"=400' 33.9 acres

West facing juniper 40% cover CN = 76

Average Basin Slope = $\frac{50.7'' \times 400 \times 50}{33.9\ 43560}$ = 69%

hydraulic length = 2800 feet

UA-4 1"=400' & 1"=100' 32.9 acres

CN = 76

A.B. slope = $\frac{63.2'' \times 400' \times 50}{32.9\ (43560)}$ = 88%

hydraulic length = 2960 feet

UA-5 1"=100' 11.7 acres w/diversion to grimes wash above Wilberg Fan Portal

11.7 acres juniper grass CN = 85

A B Slope = $\frac{37.8'' \times 400' \times 50}{19.6\ 43560}$ = 89% ok

HANSEN ALLEN & LUCE inc

CLIENT UPSL Mining
PROJECT Cottonwood / Wilberg Mine Portal
FEATURE Curve Numbers
PROJECT NO.

SHEET 4 OF 7
COMPUTED GJP
CHECKED
DATE June 6, 1989

UA-6 (East Drainage)

- lower juniper-grass 77 acres
  20% cover CN = 85

- South facing sage grass 757 acres
  30% cover CN = 72

- Upper Conifer 461 acres
  80% cover CN = 62
  60% cover CN = 70 use CN = 70 for south facing

Volume weighted $\boxed{CN = 72.5}$ use CN = 73
(see attached spread sheet)

Average Basin Slope = $\frac{[66\frac{1}{4}''(40'CI) + 7\frac{1}{4}''(200'CI) + 14''\times 80'CI]\,200\%/in}{1295\ (43560)}$

$\boxed{Y = 18.5\%}$

hydraulic length = 11,600 feet

HANSEN ALLEN & LUCE INC

CLIENT UPSL Mining
PROJECT C/W Mine Portal
FEATURE Sub-basin characteristics
PROJECT NO. 5-1-310

SHEET 5 OF 7
COMPUTED GJP
CHECKED
DATE June 9, 1989

UA-7

63 acres

CN = 76 east facing

AB Slope = $\frac{4.2'' \times 2000' \times 200'}{63 \quad 43560}$ = 61%

hydraulic length = 3800 LF

UA-8 3.2 acres

use min T_{lag} = 0.06 hrs

UA-9 1" = 100' 0.86 acres

use min T_{lag} = 0.06 hrs

UA-10 1" = 400' 2.4 acres

1" = 100' 6.6 acres

9.0 acres

A.B. Slope = $\frac{16.7'' \times 400' \times 50'}{9 \quad 43560}$ = 85%

UA-11

1" = 400' 39.7 acres CN = 76

AB. Slope = $\frac{68.5'' \times 400' \times 50'}{39.7 \quad 43560}$ = 79%

SCS curve number — UP&L COTTONWOOD/WILBERG UNDISTURBED DRAINAGES

				RUNOFF IN INCHES		
				10-YR 6-HR	10-YR 24-HR	50-YR 6-HR
P RAINFALL				1.55	2.4	2.1
UA-1	AREA	CN	S			
HIGH SAGE	184	65	5.38	0.04	0.26	0.16
HIGH CONIFER	945	62	6.12	0.02	0.19	0.11
WEST SAGE	222	68	4.70	0.07	0.35	0.23
SOUTH SAGE	146	72	3.88	0.13	0.48	0.34
JUNIPER	73	76	3.15	0.21	0.63	0.47
TOTAL	1570					
VOL WTD Q				0.05	0.27	0.17
VOL WTD CN		66	5.15	0.05	0.29	0.18
UA-5 (w/div)	AREA	CN	S			
HIGH SAGE	0	65	5.38	0.04	0.26	0.16
HIGH CONIFER	0	70	4.28	0.10	0.41	0.28
WEST SAGE	0	68	4.70	0.07	0.35	0.23
SOUTH SAGE	0	90	1.11	0.72	1.44	1.18
JUNIPER	11.7	85	1.76	0.48	1.10	0.87
TOTAL	11.7					
VOL WTD Q				0.48	1.10	0.87
VOL WTD CN		85	1.76	0.48	1.10	0.87
UA-6	AREA	CN	S			
HIGH SAGE	0	65	5.38	0.04	0.26	0.16
HIGH CONIFER	461	70	4.28	0.10	0.41	0.28
WEST SAGE	0	68	4.70	0.07	0.35	0.23
SOUTH SAGE	757	72	3.88	0.13	0.48	0.34
JUNIPER	77	85	1.76	0.48	1.10	0.87
TOTAL	1295					
VOL WTD Q				0.14	0.49	0.35
VOL WTD CN		72.5	3.79	0.14	0.50	0.35
SAE	AREA	CN	S			
HIGH SAGE	0	65	5.38	0.04	0.26	0.16
HIGH CONIFER	0	70	4.28	0.10	0.41	0.28
WEST SAGE	0	68	4.70	0.07	0.35	0.23
Disturbed	0.88	90	1.11	0.72	1.44	1.18
JUNIPER	7	85	1.76	0.48	1.10	0.87
TOTAL	7.88					
VOL WTD Q				0.51	1.14	0.90

Vol wtd CN 85.7

COAL MINING - COTTONWOOD/WILBERG MINE PORTAL
UNDISTURBED TRIBUTARY DRAINAGES
CURVE NUMBERS:

10-YEAR 6-HOUR P = 1.55

BASIN ID	RUNOFF (IN) vol wtd TOTAL AREA (acres)	CN	COMPUTED S	COMPUTED RUNOFF	AVE BSN SLOPE %	HYDRAULIC LENGTH (FEET)	TIME LAG (hrs)	TP (hrs)	TC (hrs)	RUNOFF AC-IN	AREA BASIN SQ MILES
UA-1	1570.0	66	5.15	0.05	20.4	12000	0.76	0.85	1.27	74.77	2.4531
UA-2	11.9	85	1.76	0.48	NA	NA	0.06	0.07	0.10	5.76	0.0186
UA-3	33.9	76	3.16	0.21	69.0	2800	0.10	0.11	0.16	7.01	0.0530
UA-4	32.9	76	3.16	0.21	88.0	1960	0.07	0.07	0.11	6.81	0.0514
UA-5	11.7	85	1.76	0.48	NA	NA	0.06	0.07	0.10	5.66	0.0163
UA-6	1295.0	73	3.70	0.15	18.5	11600	0.65	0.72	1.08	188.57	2.0234
UA-7	63.0	76	3.16	0.21	61.0	3800	0.13	0.15	0.22	13.04	0.0984
UA-8	3.2	76	3.16	0.21	NA	NA	0.06	0.07	0.10	0.66	0.0050
UA-9	0.86	85	1.76	0.48	NA	NA	0.06	0.07	0.10	0.42	0.0013
UA-10	9	76	3.16	0.21	85.0	1920	0.07	0.07	0.11	1.85	0.0141
UA-11	39.7	76	3.16	0.21	79.0	3200	0.10	0.11	0.17	8.21	0.0620

PROJECT : COTT/WILBERG MINE UA-1 10-YR 6-HR

AREA= 1570.0 ACRES
AVERAGE BASIN SLOPE= 20.4 PERCENT
CURVE NUMBER= 66.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 12000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .8469 HOURS QPCFS= 1401.99 CFS QPIN= .8856 INCHES
C3= 4.3650 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.71	.9951	.0000	.0000	.0	.00
2.88	1.0476	.0000	.0000	70.3	.00
3.05	1.0971	.0009	.0008	435.5	.08
3.22	1.1391	.0023	.0014	930.7	.50
3.39	1.1811	.0043	.0020	1287.0	1.57
3.56	1.2187	.0066	.0024	1402.0	3.46
3.73	1.2476	.0088	.0021	1313.3	6.06
3.90	1.2765	.0112	.0024	1108.5	8.99
4.07	1.3043	.0138	.0026	867.1	11.90
4.23	1.3306	.0165	.0027	639.8	14.61
4.40	1.3568	.0195	.0029	450.9	17.06
4.57	1.3808	.0223	.0029	306.2	19.23
4.74	1.4018	.0250	.0027	201.7	21.10
4.91	1.4228	.0278	.0028	129.4	22.59
5.08	1.4438	.0307	.0029	81.3	23.69
5.25	1.4648	.0338	.0031	50.1	24.55
5.42	1.4858	.0370	.0032	30.4	25.30
5.59	1.5055	.0401	.0031	18.1	26.04
5.76	1.5238	.0431	.0030	10.7	26.75
5.93	1.5422	.0463	.0031	6.2	27.35
6.10	1.5422	.0463	.0000	3.6	27.61
6.27	1.5422	.0463	.0000	2.1	26.61
6.44	1.5422	.0463	.0000	1.2	23.99
6.61	1.5422	.0463	.0000	.7	20.18
6.78	1.5422	.0463	.0000	.4	15.96
6.94	1.5422	.0463	.0000	.2	11.97
7.11	1.5422	.0463	.0000	.1	8.59
7.28	1.5422	.0463	.0000	.0	5.94

HYDROGRAPH PEAK= 27.61 cfs
TIME TO PEAK= 6.10 Hours
RUNOFF VOLUME= 6.05 Acre-Feet

The undisturbed drainage bypass system is temporary and will be reclaimed at time of Final Reclamation therefore the system is to be designed to pass at least the 10-year 6-hour event.

METHODS:

Inlet Control

ref: "Hydraulic Charts for the Selection of Highway Culverts" H.E.E.5, US DOT, 1965

CHART 5 "Headwater Depth for C.M. Pipe Culverts with Inlet Control"

See attached copy of CHART 5 and attached table for detail.

Minimum pipe slope to assure inlet control

Mannings Equation: $Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{S_f}$

Q = flow in cfs
n = Mannings n reference: Table 4-9 "Handbook of Steel Drainage & Highway Construction Products" American Iron and Steel Institute, 3rd Edition 1983
A = flow area = $\pi D^2/4$ for full flow
P = wetted perimeter = πD for full flow
S_f = friction slope

solve for $S_f = \left(\frac{Q}{\frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3}}\right)^2$

Culvert CU-1 72"
Q = 26 cfs (10yr-6hr) assume n = .027

$\Rightarrow S_{f\,min} = \left(\frac{26}{2040}\right)^2 = .0002$ ft/ft say .001 min

Culvert CU-2 18"
Q = 4 cfs assume n = .027

$\Rightarrow S_{f\,min} = \left(\frac{4}{50.7}\right)^2 = .006$ ft/ft OK

Culvert CU-3 72"

$Q = 27$ cfs assume $n = .027$

$\Rightarrow S_{f\,min} = \left(\frac{27}{2040}\right)^2 = .0002$ ft/ft say .001 min

Culvert CU-4 18"

$Q = 5$ cfs $n = .027$

$\Rightarrow S_{f\,min} = \left(\frac{5}{50.7}\right)^2 = .01$ ft/ft ok

Culvert CU-5 72"

$Q = 28$ cfs say .001 ft/ft min

Culvert CU-6 30"

$Q = 5$ cfs say $n = .027$

$\Rightarrow S_{f\,min} = \left(\frac{5}{198}\right)^2 = .0006$ say .001 ft/ft min

Culvert CU-7 72"

$Q = 29$ cfs $\Rightarrow S_{f\,min} < .001$ ft/ft

Culvert CU-8 72"

$Q = 77$ cfs assume $n = .027$

$\Rightarrow S_{f\,min} = \left(\frac{77}{2040}\right)^2 = .0014$ say .002 ft/ft

Culvert CU-9 30"

$Q = 9$ cfs assume $n = .027$

$\Rightarrow S_{f\,min} = \left(\frac{9}{198}\right)^2 = .002$ ft/ft ok

Culvert CU-10 72"

$Q = 80$ cfs $n = .027$

$\Rightarrow S_{f\,min} = \left(\frac{80}{2040}\right)^2 = .0015$ say .002 ft/ft min

Culvert CU-11 24"
0. cfs assume n = .027

$\Rightarrow S_{f\,min} = \left(\frac{0.5}{109.3}\right)^2 = .00002$ say .001 ft/ft min

Culvert CU-12 24"
0. cfs assume n = .027

$\Rightarrow S_{f\,min} = \left(\frac{0.3}{109}\right)^2 = .00001$ say .001 ft/ft min

Culvert CU-13 72"
83 cfs assume n = .027

$\Rightarrow S_{f\,min} = \left(\frac{83}{2040}\right)^2 = .0017$ ft/ft say .002 ft/ft

Culvert CU-14 90"
102 cfs assume n = .027

$\Rightarrow S_{f\,min} = \left(\frac{102}{3707}\right)^2 = .0008$ ft/ft say .001 ft/ft min

Culvert CU-15 (for sub-basin CA-5)

4.2 cfs
try 18" CMP
4.2 cfs
Inlet control chart 5 $\Rightarrow$ required $H_w/D = 0.85$
or $H_{w\,min} = .85(1.5) = 1.3'$ OK

$S_{f\,min} = \left(\frac{4.2}{50.7}\right)^2 = .007$ ft/ft OK

$\therefore$ use 18" CMP

TABLE 2

CULVERT DESIGN CRITERIA
UNDISTURBED AREA BYPASS SYSTEM CULVERTS
COTTONWOOD/WILBERG MINE PORTAL SITE

CULVERT	DESIGN FLOW (CFS)	PIPE DIAMETER (IN)	REQUIRED HEAD WATER DEPTH (FT)	REQUIRED MINIMUM SLOPE (FT/FT)
CU-1	26.	72	2.0	.001
CU-2	4.	18	1.2	.006
CU-3	27.	72	2.0	.001
CU-4	5.	18	1.4	.010
CU-5	28.	72	2.0	.001
CU-6	5.	30	1.0	.001
CU-7	29.	72	2.0	.001
CU-8	77.	72	3.5	.002
CU-9	9.	30	1.5	.002
CU-10	80.	72	3.6	.002
CU-11	0.5	24	0.4	.001
CU-12	0.3	24	0.3	.001
CU-13	83.	72	3.8	.002
CU-14	102.	90	4.0	.001
CU-15	4.2	18	1.3	.006

DITCH HYDRAULICS AND DESIGN METHODS:

Design Flow = 10 year 6 hour storm event

Flow Depth : Mannings Equation

$$Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{s}$$

Q = design flow in cfs
n = Mannings n : use 0.03 for unlined ditch
use $n = .0395\, D_{50}^{1/6}$ for riprap
where D_{50} = mean riprap size in feet

A = flow Area = $by + my^2$
where b = bottom width
y = flow depth
m = side slope in M Horizontal to 1 vertical

$P = b + 2Y\sqrt{m^2+1}$ = wetted perimeter
s = ditch slope
see attached spreadsheet for calculations.

Lining Criteria

Present practice in Utah Coal mine facilities is to provide erosion protection where design flow velocities exceed 5 feet per second (fps). The 5 fps is a practical guide combined with on going maintenance. It may prove necessary to line some ditches which have a velocity less than 5 fps due to specific soil conditions or flow characteristics. Therefore it is recommended that ditches with velocities which exceed 5 fps be lined and that all ditches be monitored and maintained as needed.

Riprap Design Method

reference: "Applied Hydrology and Sedimentology For Disturbed Areas" Barfield et al, 1981 see pp. 185-194

(1) $\tau_b = \gamma d s$

τ_b = maximum bed shear stress
γ = unit weight of water
d = flow depth
s = slope of ditch (friction slope)

Riprap Design Method (cont.)

(2) $\eta_b = \dfrac{21\,\tau_{max}}{\gamma(SG-1)D}$ based on Shield's diagram

η_b = stability parameter for bed

τ = shear stress

SG = Specific gravity of rip rap (normally ≈ 2.65)

D = mean stone diameter

(3) $SF_b = \dfrac{\cos\theta \tan\phi}{\sin\theta + \eta_b \tan\phi}$

θ = angle of channel bed to horizontal
$\tan^{-1} S$ S = slope in ft/ft

ϕ = angle of repose of riprap
see Figure 3.14 of Barfield et al 1981

SF_b = Safety Factor for riprap on bed

(4) $SF_s = \dfrac{\cos\alpha \tan\phi}{\eta' \tan\phi + \sin\alpha \cos\beta}$

$\eta' = \eta \dfrac{1+\sin(\lambda+\beta)}{2}$

$\beta = \tan^{-1}\left(\dfrac{\cos\lambda}{\dfrac{2\sin\alpha}{\eta\tan\phi} + \sin\lambda}\right)$

where:

$\eta = \dfrac{21\,\tau_{max\,side}}{\gamma(SG-1)D}$

$\alpha = \tan^{-1}\dfrac{1}{M}$ M = side slope M horizontal to 1 vertical

$\lambda = \theta$ for uniform flow conditions

SF_s = Safety Factor of riprap on side slope

See attached spread sheet for riprap design for ditches with velocities exceeding 5 fps

DITCH HYDRAULICS TABLE

CLIENT: UP&L MINING
PROJECT: COTTONWOOD/WILBERG MINE PORTAL SITE UNDISTURBED AREA DITCHES

CHANNEL	IDENTIFICATION	DESIGN FLOW (CFS)	SLOPE (ft/ft)	BOTTOM WIDTH (FT)	SIDE SLOPE (H/V)	MANNINGS N	DEPTH (FT)	COMPUTED FLOW (CFS)	FLOW AREA (FT2)	WETTED PERIMETER (FT)	HYDRAULIC RADIUS (FT)	VELOCITY (FPS)	
UD-1	maximum slope	0.5	0.05	1	2	0.030	0.148	0.505	0.19	1.66	0.12	2.63	riprap not required
UD-1	minimum slope	0.5	0.04	1	2	0.030	0.157	0.502	0.21	1.70	0.12	2.43	riprap not required
UD-2	maximum slope	0.3	0.12	1	2	0.030	0.086	0.302	0.10	1.38	0.07	3.00	riprap not required
UD-2	minimum slope	0.3	0.05	1	2	0.030	0.111	0.304	0.14	1.50	0.09	2.24	riprap not required
UD-3	maximum slope	1	0.20	1	2.5	0.042	0.2	1.302	0.30	2.08	0.14	4.34	USE RIPRAP D50 = 1.5'
UD-3	minimum slope	1	0.08	1	2	0.030	0.2	1.100	0.28	1.89	0.15	3.93	riprap not required
UD-4	maximum slope	5	0.20	3	3	0.042	0.25	5.133	0.94	4.58	0.20	5.48	USE RIPRAP D50 = 1.5'
UD-4	minimum slope	5	0.14	3	2.5	0.042	0.28	5.128	1.04	4.51	0.23	4.95	USE RIPRAP D50 = 1.5'
UD-5	maximum slope	4.2	0.10	2	2.5	0.042	0.34	4.321	0.97	3.83	0.25	4.46	USE RIPRAP D50 = 1.5'
UD-5	minimum slope	4.2	0.04	2	2	0.030	0.37	4.283	1.01	3.65	0.28	4.23	riprap not required

3/4

DITCH RIPRAP DESIGN TABLE

CLIENT: UP&L MINING
PROJECT:COTTONWOOD/WILBERG MINE PORTAL SITE UNDISTURBED AREA DITCHES

CHANNEL	IDENTIFICATION	RIPRAP D50 (FT)	ANGLE OF REPOSE (DEGREES)	SFs	MANNING'S N	FLOW DEPTH (FT)	MAX. TRACTIVE FORCE (LBS/FT2)	CHANNEL BED STABILITY Nb	SAFTEY FACTOR FOR BED SFb	MAX. SIDE TRACTIVE FORCE (LBS/FT2)	n	BETA (RADIANS)	CHANNEL WALL STABILITY N'	SAFTEY FACTOR FOR SIDE SFs
UD-1	maximum slope													
UD-1	minimum slope													
UD-2														
UD-2														
UD-3	maximum slope	1.5	41	1.5	0.042261	0.2	2.496	0.339	1.74	1.90	0.257	0.272510	0.187367	1.5504643
UD-3	minimum slope													
UD-4	maximum slope	1.5	41	1.6	0.042261	0.25	3.12	0.424	1.51	2.37	0.322	0.380339	0.249254	1.6160539
UD-4	minimum slope	1.5	41	1.5	0.042261	0.28	2.44608	0.333	2.01	1.86	0.252	0.274335	0.177168	1.5778937
UD-5	maximum slope	1.5	41	1.6	0.042261	0.34	2.1216	0.288	2.47	1.61	0.219	0.243999	0.146561	1.6546182

Granular Bedding for Riprap 1/5

Urban Drainage and Flood Control District

URBAN STORM DRAINAGE CRITERIA MANUAL

volume 2

WRIGHT - McLAUGHLIN ENGINEERS
Denver, Colorado March, 1969

grouted riprap or wire encased riprap applications. The second utilizes a design procedure developed by Terzaghi, which is referred to as the T-V (Terzaghi-Vicksburg) design (7)(19). The T-V filter criteria establishes an optimum bedding gradation for a specific channel soil. The latter requires channel soil information, including a gradation curve, while the Type I and Type II bedding specifications given in Table 5-3 (and Figure 5-2) are applicable whether or not soil information is available.

Table 5-3
GRADATION FOR GRANULAR BEDDING

U. S. Standard Sieve Size	Percent Weight By Passing Type I	Square Mesh Sieves By Passing Type II
3"	-	90 - 100
1-1/2"	-	-
3/4"	-	20 - 90
3/8"	100	-
#4	95 - 100	0 - 20
#16	45 - 80	-
#50	10 - 30	-
#100	2 - 10	-
#200	0 - 2	0 - 3

USE THIS

The Type I and Type II bedding specifications shown in Table 5-3 were developed using the T-V filter criteria and the fact that bedding which will protect an underlying noncohesive soil with a mean grain size of 0.045 mm will protect anything finer. Since the T-V filter criterion provides some latitude in establishing bedding gradations, it was possible to make the Type I and Type II bedding specifications conform with Colorado Division of Highways aggregate specifications. The Type I bedding in Table 5-3 is designed to be the lower layer in a two layer filter for protecting fine grained soils and has a gradation identical to Colorado Division of Highways concrete sand specification AASHTO M-6 (Section 703.01). Type II bedding, the upper layer in a two layer filter, is equivalent to Colorado Division of Highways Class A filter material (Section 703.09) except that it permits a slightly larger maximum rock fraction. When the channel is excavated in course sand and gravel (50 percent or more by weight retained on the #40 sieve), only the Type II filter is required. Otherwise, a two layer bedding (Type I topped by Type II) is required. Alternatively, a single 12 inch layer of Type II bedding can be used except at drop structures. For required bedding thickness see Table 5-4. At drop structures a combination of filter fabric and Type II bedding is acceptable as an alternative to a two layer filter. The specifications for the T-V reverse filter relate the gradation of the protective layer (filter) to that of the bed material (base) by the following inequalities:

$$D_{15(filter)} \leq 5\ d_{85(base)} \qquad \text{(Equation 5-1)}$$

$$4\ d_{15(base)} \leq D_{15(filter)} \leq 20\ d_{15(base)} \qquad \text{(Equation 5-2)}$$

$$D_{50(filter)} \leq 25\ d_{50(base)} \qquad \text{(Equation 5-3)}$$

where the capital "D" refers to the filter grain size and the lower case "d" to the base grain size. The subscripts refer to the percent by weight which is finer than the grain size denoted by either "D" or "d". For example, 15 percent of the filter material is finer than $D_{15(filter)}$ and 85 percent of the base material is finer than $d_{85(base)}$. Application of the T-V filter criteria is best described using an example (see Paragraph 5.7.1).

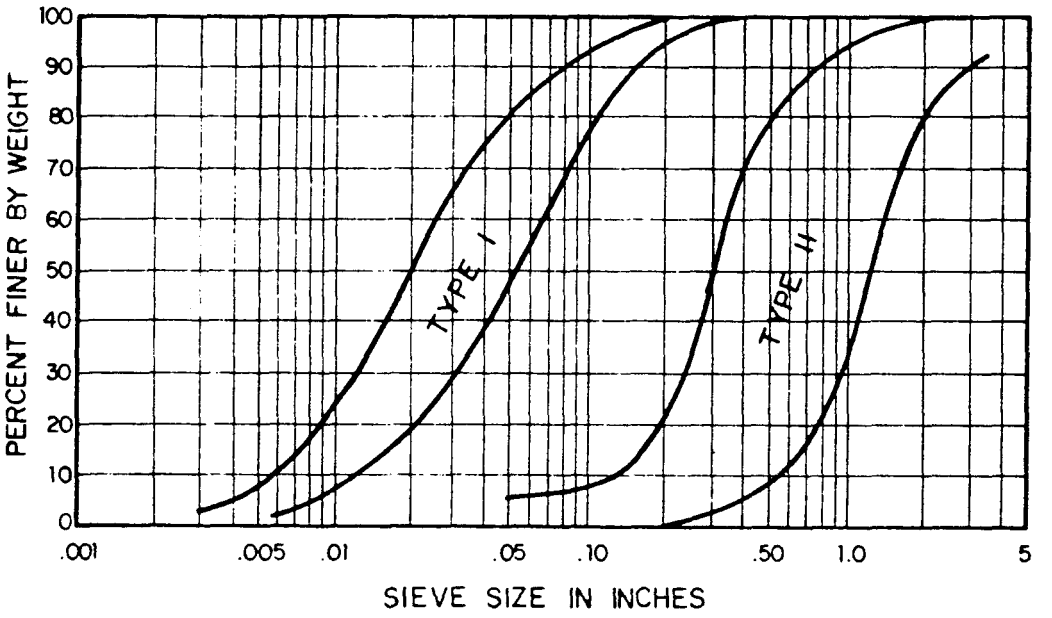

FIGURE 5-2. GRADATION CURVES FOR GRANULAR BEDDING

Table 5-4

THICKNESS REQUIREMENTS FOR GRANULAR BEDDING

Riprap Designation	Minimum Bedding Thickness (Inches)		
	Fine Grained Soils*		Course Grained Soils**
	Type I	Type II	Type II
L, G, SM	4	4	6
M	4	4	6
H $D_{50} = 1.5'$	4	6	8
VH	4	6	8

USE THIS

*May substitute one 12 inch layer of Type II bedding. Substitution of one layer of Type II bedding shall not be permitted at drop structures. Use of a combination of filter fabric and Type II bedding at drop structures is acceptable, see Section 5.3.2 for use of filter fabric at drop structures.

**Fifty percent or more by weight retained on the #40 sieve.

5.3.2 Filter Fabric

Filter fabric is not a complete substitute for granular bedding. Filter fabric provides filtering action only perpendicular to the fabric and has only a single equivalent pore opening between the channel bed and the riprap. Filter fabric has a relatively smooth surface which provides less resistance to stone movement. As a result, it is recommended the use of filter fabric be restricted to slopes no steeper than 2.5h to 1v. Tears in the fabric greatly reduce its effectiveness so that direct dumping of riprap on the filter fabric is not allowed and due care must be exercised during construction. Nonetheless, filter fabric has proven to be an adequate replacement for granular bedding in many instances. Filter fabric provides an adequate bedding for channel linings along uniform mild sloping channels where leaching forces are primarily perpendicular to the fabric.

At drop structures and sloped channel drops, where seepage forces may run parallel with the fabric and cause piping along the bottom surface of the fabric, special care is required in the use of filter

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                                        ****
          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                        ****


THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3


                                        HEC-1 INPUT                                        PAGE  1

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

      1           ID    UP&L Mining
      2           ID    Cottonwood/Wilberq Mine Portal Undisturbed Bypass Facilities
      3           ID    10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
      4           ID    by qjp Hansen, Allen & Luce  June, 1989
 FREE ***
                  *DIAGRAM
      5           IT       2       0       0     200
      6           IO       3

      7           KK    UA-1
      8           BA    2.45
      9           PB    1.55
     10           IN     30.
     11           PI      0.    .035    .045    .055    .095     .37      .1     .18    .055     .05
     12           PI     .04     .04    .035
     13           LS       0      66      0.
     14           UD    0.76

     15           KK    CU-1 ROUTE THROUGH CULVERT
     16           RK    240.     .10    .015           CIRC       6

     17           KK    UA-2
     18           BA   .0186
     19           LS       0      85       0
     20           UD     .06

     21           KK    CU-3  COMBINE AT CULVERT CU-3
     22           HC       2

     23           KK    CU-3 ROUTE THROUGH CULVERT
     24           RK    610.     .10    .015           CIRC       6

     25           KK    UA-3
```

```
26          BA    .053
27          LS      0      76       0
28          UD     .10

29          KK    CU-4 ROUTE THROUGH CULVERT
30          RK    750.     .20    .015           CIRC       2

31          KK    CU-5  COMBINE AT CULVERT CU-5
32          HC      2

33          KK    UA-4
34          BA   .0514
35          LS      0      76       0
36          UD     .07

37          KK    CU-7  COMBINE AT CULVERT CU-7
38          HC      2
```



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

39          KK    CU-7 ROUTE THROUGH CULVERT
40          RK    500.     .10    .015           CIRC       6

41          KK    UA-5
42          BA   .0183
43          LS      0      85       0
44          UD     .06

45          KK    UA-6
46          BA   2.03
47          LS      0      73       0
48          UD     .65

49          KK    CU-8COMBINE AT CULVERT CU-8
50          HC      2

51          KK    UA-7
52          BA   .0984
53          LS      0      76       0
54          UD     .13

55          KK    UA-8
56          BA    .005
57          LS      0      76       0
58          UD     .06

59          KK    UA-9
60          BA   .0013
61          LS      0      85       0
62          UD     .06
```

```
63          KK   CU-13 COMBINE AT CULVERT CU-13
64          HC       4

65          KK   CU-13 ROUTE THROUGH CULVERT
66          RK    450.     .30    .015           CIRC       6

67          KK   CU-14 COMBINE AT CULVERT CU-14
68          HC       2

69          KK   CU-14 ROUTE THROUGH CULVERT
70          RK   1000.     .10    .015           CIRC     7.5

71          KK   UA-10
72          BA   .0141
73          LS       0      76       0
74          UD     .07

75          KK   UA-11
76          BA    .062
77          LS       0      76       0
78          UD     .10
```



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


79          KKCONVENIENCE COMBINATION
80          KO       1
81          HC       3
82          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

  7         UA-1
               V
               V
 15         CU-1
               .
               .
 17            .        UA-2
               .           .
               .           .
 21         CU-3............
               V
               V
 23         CU-3
               .
               .
 25            .        UA-3
               .           V
               .           V
 29            .        CU-4
               .           .
               .           .
 31         CU-5............
               .
               .
 33            .        UA-4
               .           .
               .           .
 37         CU-7............
               V
               V
 39         CU-7
               .
               .
 41            .        UA-5
               .           .
               .           .
 45            .           .        UA-6
               .           .           .
               .           .           .
 49            .        CU-8............
               .           .
               .           .
 51            .           .        UA-7
               .           .           .
               .           .           .
```

```
55          .          .          .       UA-8
            .          .          .          .
            .          .          .          .
59          .          .          .          .       UA-9
            .          .          .          .          .
            .          .          .          .          .
63          .      CU-13.................................
            .          V
            .          V
65          .      CU-13
            .          .
            .          .
67      CU-14............
            V
            V
69      CU-14
            .
            .
71          .      UA-10
            .          .
            .          .
75          .          .      UA-11
            .          .          .
            .          .          .
79   CONVENIE......................
```

(*) RUNOFF ALSO COMPUTED AT THIS LOCATION

****

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U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

UP&L Mining
Cottonwood/Wilberg Mine Portal Undisturbed Bypass Facilities
10-YR 6-HR SCS 6-HOUR DISTRIBUTION
by gjp Hansen, Allen & Luce June, 1989

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

  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
```

```
          COMPUTATION INTERVAL     .03 HOURS
              TOTAL TIME BASE    6.63 HOURS

     ENGLISH UNITS

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

        **************
        *            *
 7 KK   *     UA-1   *
        *            *
        **************

10 IN        TIME DATA FOR INPUT TIME SERIES
                 JXMIN          30  TIME INTERVAL IN MINUTES
                JXDATE      1    0  STARTING DATE
                JXTIME           0  STARTING TIME

           SUBBASIN RUNOFF DATA

 8 BA        SUBBASIN CHARACTERISTICS
                 TAREA        2.45  SUBBASIN AREA

             PRECIPITATION DATA

 9 PB            STORM        1.55  BASIN TOTAL PRECIPITATION

11 PI          INCREMENTAL PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .02      .02      .02      .02      .02
                 .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00
```

```
13 LS          SCS LOSS RATE
                    STRTL        1.03  INITIAL ABSTRACTION
                   CRVNBR       66.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

4 UD           SCS DIMENSIONLESS UNITGRAPH
                    TLAG         .76  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                          116 END-OF-PERIOD ORDINATES
          20.      39.      76.     122.     172.     231.     290.     369.     447.     544.
         648.     760.     884.    1008.    1112.    1217.    1299.    1371.    1431.    1470.
        1509.    1515.    1522.    1519.    1513.    1494.    1455.    1415.    1369.    1324.
        1273.    1221.    1164.    1098.    1032.     954.     875.     806.     741.     683.
         637.     592.     553.     513.     479.     446.     417.     393.     369.     345.
         322.     301.     281.     262.     242.     223.     210.     197.     184.     171.
         159.     149.     139.     129.     120.     112.     105.      97.      90.      83.
          78.      74.      69.      64.      59.      56.      52.      49.      45.      42.
          40.      37.      34.      32.      30.      28.      26.      24.      22.      21.
          20.      18.      17.      16.      15.      15.      14.      13.      12.      11.
          11.      10.       9.       8.       8.       7.       6.       6.       5.       4.
           4.       3.       2.       2.       1.       0.

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

                    HYDROGRAPH AT STATION     UA-1

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.50, TOTAL EXCESS =     .05

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR      6.63-HR
+  (CFS)      (HR)
                          (CFS)
+    26.      6.60                     9.          8.          8.          8.
                         (INCHES)    .033        .033        .033        .033
                          (AC-FT)      4.          4.          4.          4.

                    CUMULATIVE AREA =    2.45 SQ MI

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

          **************
          *            *
5 KK      *     CU-1   *     ROUTE THROUGH CULVERT
          *            *
```

```
        ***************

          HYDROGRAPH ROUTING DATA

 16 RK         KINEMATIC WAVE STREAM ROUTING
                        L       240.  CHANNEL LENGTH
                        S      .1000  SLOPE
                        N       .015  CHANNEL ROUGHNESS COEFFICIENT
                       CA        .00  CONTRIBUTING AREA
                    SHAPE       CIRC  CHANNEL SHAPE
                       WD       6.00  BOTTOM WIDTH OR DIAMETER
                        Z        .00  SIDE SLOPE

                                                        ***

     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
          ALPHA        M      DT (MIN)   DX (FT)
        22.8484    1.250        .67      120.00

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

                    HYDROGRAPH AT STATION     CU-1

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      6.63-HR
+ (CFS)       (HR)
                         (CFS)
+    26.      6.60                   9.          8.          8.          8.
                      (INCHES)     .033        .033        .033        .033
                       (AC-FT)       4.          4.          4.          4.

                       CUMULATIVE AREA =    2.45 SQ MI


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

        ***************
        *             *
 17 RK  *     UA-2    *
        *             *
        ***************

          SUBBASIN RUNOFF DATA
```

```
8 BA        SUBBASIN CHARACTERISTICS
                 TAREA        .02  SUBBASIN AREA

            PRECIPITATION DATA

9 PB             STORM       1.55  BASIN TOTAL PRECIPITATION

11 PI         INCREMENTAL PRECIPITATION PATTERN
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                 .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00

19 LS       SCS LOSS RATE
                 STRTL        .35  INITIAL ABSTRACTION
                CRVNBR      85.00  CURVE NUMBER
                 RTIMP        .00  PERCENT IMPERVIOUS AREA

20 UD       SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .06  LAG

                                                  ***


                                          UNIT HYDROGRAPH
                                      11 END-OF-PERIOD ORDINATES
          43.      115.      101.       51.       26.       12.        6.        3.        2.        1.
           0.

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

                 HYDROGRAPH AT STATION     UA-2

TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.07, TOTAL EXCESS =     .48
```

```
AK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
(CFS)       (HR)
                        (CFS)
    4.      3.00                   1.          1.          1.          1.
                      (INCHES)    .483        .483        .483        .483
                       (AC-FT)     0.          0.          0.          0.

                      CUMULATIVE AREA =     .02 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

        ***************
        *             *
 21 KK  *     CU-3    *      COMBINE AT CULVERT CU-3
        *             *
        ***************

 22 HC         HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                     HYDROGRAPH AT STATION     CU-3

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
(CFS)       (HR)
                        (CFS)
   27.      6.50                  10.          9.          9.          9.
                      (INCHES)    .037        .037        .037        .037
                       (AC-FT)     5.          5.          5.          5.

                      CUMULATIVE AREA =    2.47 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

        ***************
        *             *
 23 KK  *     CU-3    *      ROUTE THROUGH CULVERT
        *             *
        ***************
```

HYDROGRAPH ROUTING DATA

4 RK KINEMATIC WAVE STREAM ROUTING

L	610.	CHANNEL LENGTH
S	.1000	SLOPE
N	.015	CHANNEL ROUGHNESS COEFFICIENT
CA	.00	CONTRIBUTING AREA
SHAPE	CIRC	CHANNEL SHAPE
WD	6.00	BOTTOM WIDTH OR DIAMETER
Z	.00	SIDE SLOPE

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
22.8484	1.250	.67	305.00

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

HYDROGRAPH AT STATION CU-3

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.63-HR
		(CFS)				
27.	6.50		10.	9.	9.	9.
		(INCHES)	.037	.037	.037	.037
		(AC-FT)	5.	5.	5.	5.

CUMULATIVE AREA = 2.47 SQ MI

*** ***

```
        **************
        *            *
25 KK   *     UA-3   *
        *            *
        **************
```

SUBBASIN RUNOFF DATA

26 BA SUBBASIN CHARACTERISTICS

```
                TAREA        .05  SUBBASIN AREA

          PRECIPITATION DATA

 9 PB           STORM       1.55  BASIN TOTAL PRECIPITATION

11 PI        INCREMENTAL PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00

27 LS        SCS LOSS RATE
                STRTL        .63  INITIAL ABSTRACTION
               CRVNBR      76.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

28 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .10  LAG

                                        ***


                                   UNIT HYDROGRAPH
                              17 END-OF-PERIOD ORDINATES
          39.     133.     212.     212.     165.      99.      62.      40.      25.      16.
          10.       6.       4.       2.       2.       1.       0.

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

                 HYDROGRAPH AT STATION     UA-3

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.34, TOTAL EXCESS =     .21

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
```

```
                                  6-HR       24-HR       72-HR      6.63-HR
+  (CFS)       (HR)
                        (CFS)
+    5.      4.00                  1.          1.          1.          1.
                      (INCHES)    .206        .206        .206        .206
                       (AC-FT)     1.          1.          1.          1.

                      CUMULATIVE AREA =     .05 SQ MI
```

*** ***

```
          ***************
          *             *
9 KK      *     CU-4    *      ROUTE THROUGH CULVERT
          *             *
          ***************

            HYDROGRAPH ROUTING DATA

0 KK          KINEMATIC WAVE STREAM ROUTING
                       L        750.  CHANNEL LENGTH
                       S       .2000  SLOPE
                       N        .015  CHANNEL ROUGHNESS COEFFICIENT
                      CA         .00  CONTRIBUTING AREA
                   SHAPE        CIRC  CHANNEL SHAPE
                      WD        2.00  BOTTOM WIDTH OR DIAMETER
                       Z         .00  SIDE SLOPE

                                                        ***


       KINEMATIC STREAM ROUTING USED FOR THIS REACH


        COMPUTED KINEMATIC PARAMETERS
           ALPHA        M      DT (MIN)   DX (FT)
          26.9061    1.250        .67      375.00

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

                     HYDROGRAPH AT STATION     CU-4

AK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
+  (CFS)       (HR)
                        (CFS)
+    5.      4.03                  1.          1.          1.          1.
```

```
                (INCHES)      .205        .205        .205        .205
                 (AC-FT)       1.          1.          1.          1.

                 CUMULATIVE AREA =     .05 SQ MI


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


        ***************
        *             *
 31 KK  *     CU-5    *      COMBINE AT CULVERT CU-5
        *             *
        ***************

 32 HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***

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

                   HYDROGRAPH AT STATION     CU-5

PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
+  (CFS)      (HR)
                    (CFS)
+    28.      6.50                 11.         10.         10.         10.
                (INCHES)      .040        .040        .040        .040
                 (AC-FT)       5.          5.          5.          5.

                 CUMULATIVE AREA =    2.52 SQ MI


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


        ***************
        *             *
 33 KK  *     UA-4    *
        *             *
        ***************

           SUBBASIN RUNOFF DATA

 34 BA        SUBBASIN CHARACTERISTICS
                 TAREA         .05  SUBBASIN AREA
```

PRECIPITATION DATA

9 PB STORM 1.55 BASIN TOTAL PRECIPITATION

11 PI INCREMENTAL PRECIPITATION PATTERN

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

5 LS SCS LOSS RATE

STRTL .63 INITIAL ABSTRACTION
CRVNBR 76.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

36 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .07 LAG

***

UNIT HYDROGRAPH
12 END-OF-PERIOD ORDINATES

84.	257.	275.	182.	91.	50.	27.	14.	8.	4.
2.	1.								

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

HYDROGRAPH AT STATION UA-4

TOTAL RAINFALL = 1.55, TOTAL LOSS = 1.34, TOTAL EXCESS = .21

PEAK FLOW TIME MAXIMUM AVERAGE FLOW

6-HR	24-HR	72-HR	6.63-HR

```
(CFS)      (HR)
                    (CFS)
   5.      4.00                 1.         1.         1.         1.
                 (INCHES)      .207       .207       .207       .207
                  (AC-FT)       1.         1.         1.         1.

                  CUMULATIVE AREA =     .05 SQ MI
```

*** ***

```
          **************
          *            *
37 KK     *     CU-7   *      COMBINE AT CULVERT CU-7
          *            *
          **************

38 HC          HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                     HYDROGRAPH AT STATION     CU-7

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR      72-HR      6.63-HR
+  (CFS)      (HR)
                    (CFS)
+   29.       6.50                 12.        11.        11.        11.
                 (INCHES)      .044       .044       .044       .044
                  (AC-FT)       6.         6.         6.         6.

                  CUMULATIVE AREA =    2.57 SQ MI
```

*** ***

```
          **************
          *            *
39 KK     *     CU-7   *      ROUTE THROUGH CULVERT
          *            *
          **************

             HYDROGRAPH ROUTING DATA
```

```
40 RK          KINEMATIC WAVE STREAM ROUTING
                         L        500.  CHANNEL LENGTH
                         S       .1000  SLOPE
                         N        .015  CHANNEL ROUGHNESS COEFFICIENT
                        CA         .00  CONTRIBUTING AREA
                     SHAPE        CIRC  CHANNEL SHAPE
                        WD        6.00  BOTTOM WIDTH OR DIAMETER
                         Z         .00  SIDE SLOPE

                                                        ***


     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
         ALPHA        M      DT (MIN)   DX (FT)
        22.8484    1.250        .67      250.00

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

                    HYDROGRAPH AT STATION     CU-7

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      6.63-HR
+ (CFS)       (HR)
                         (CFS)
+    29.      6.50                 12.         11.         11.         11.
                       (INCHES)   .043        .043        .043        .043
                        (AC-FT)     6.          6.          6.          6.

                        CUMULATIVE AREA =    2.57 SQ MI


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


          **************
          *            *
41 KK     *     UA-5   *
          *            *
          **************

            SUBBASIN RUNOFF DATA

42 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .02  SUBBASIN AREA
```

PRECIPITATION DATA

9 PB STORM 1.55 BASIN TOTAL PRECIPITATION

11 PI INCREMENTAL PRECIPITATION PATTERN

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

43 LS SCS LOSS RATE

STRTL .35 INITIAL ABSTRACTION
CRVNBR 85.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

44 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .06 LAG

***

UNIT HYDROGRAPH
11 END-OF-PERIOD ORDINATES

43. 113. 100. 50. 25. 12. 6. 3. 1. 1.
0.

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

HYDROGRAPH AT STATION UA-5

TOTAL RAINFALL = 1.55, TOTAL LOSS = 1.07, TOTAL EXCESS = .48

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.63-HR
+					

```
                    (CFS)
   4.     3.00                  1.         1.         1.         1.
                (INCHES)      .483       .483       .483       .483
                 (AC-FT)       0.         0.         0.         0.

                 CUMULATIVE AREA =     .02 SQ MI


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


        ##############
        #            #
 45 KK  #     UA-6   #
        #            #
        ##############

          SUBBASIN RUNOFF DATA

 46 BA        SUBBASIN CHARACTERISTICS
                   TAREA        2.03  SUBBASIN AREA

              PRECIPITATION DATA

 9 PB              STORM        1.55  BASIN TOTAL PRECIPITATION

 11 PI          INCREMENTAL PRECIPITATION PATTERN
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                   .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                   .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                   .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                   .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                   .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                   .00       .00       .00       .00       .00

 7 LS         SCS LOSS RATE
                   STRTL         .74  INITIAL ABSTRACTION
```

```
                CRVNBR       73.00  CURVE NUMBER
                 RTIMP        .00  PERCENT IMPERVIOUS AREA

8 UD          SCS DIMENSIONLESS UNITGRAPH
                  TLAG        .65  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          99 END-OF-PERIOD ORDINATES
          22.      44.      96.     147.     213.     279.     368.     456.     574.     691.
         831.     971.    1088.    1206.    1287.    1368.    1412.    1456.    1464.    1471.
        1464.    1456.    1412.    1368.    1316.    1265.    1206.    1147.    1074.    1000.
         912.     824.     750.     677.     625.     574.     530.     485.     449.     412.
         385.     358.     331.     304.     282.     260.     238.     216.     202.     187.
         172.     157.     146.     135.     124.     113.     105.      97.      89.      81.
          75.      70.      64.      59.      55.      51.      47.      43.      40.      37.
          34.      31.      29.      26.      24.      22.      21.      19.      18.      16.
          15.      14.      14.      13.      12.      11.      10.       9.       8.       7.
           7.       6.       5.       4.       4.       3.       2.       1.       1.

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

                  HYDROGRAPH AT STATION     UA-6

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.40, TOTAL EXCESS =     .15

AK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      6.63-HR
+ (CFS)      (HR)
                        (CFS)
+    77.     4.50                 27.         24.         24.         24.
                       (INCHES)   .122        .122        .122        .122
                        (AC-FT)    13.         13.         13.         13.

                  CUMULATIVE AREA =    2.03 SQ MI


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

        **************
        *            *
49 KK   *     CU-8   *    COMBINE AT CULVERT CU-8
        *            *
        **************

50 HC         HYDROGRAPH COMBINATION
                  ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
```

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                                                    ***

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

                    HYDROGRAPH AT STATION     CU-8

AK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
 (CFS)      (HR)
                      (CFS)
  78.       4.50                  28.         25.         25.         25.
                    (INCHES)      .126        .126        .126        .126
                     (AC-FT)      14.         14.         14.         14.

                     CUMULATIVE AREA =    2.05 SQ MI


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


        **************
        *            *
 51 KK  *     UA-7   *
        *            *
        **************

          SUBBASIN RUNOFF DATA

 2 BA       SUBBASIN CHARACTERISTICS
                TAREA         .10  SUBBASIN AREA

            PRECIPITATION DATA

 9 PB           STORM       1.55  BASIN TOTAL PRECIPITATION

 1 PI         INCREMENTAL PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

```
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00

53 LS         SCS LOSS RATE
                STRTL        .63  INITIAL ABSTRACTION
               CRVNBR      76.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

54 UD         SCS DIMENSIONLESS UNITGRAPH
                TLAG        .13  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          21 END-OF-PERIOD ORDINATES
          40.     129.     256.     321.     314.     262.     185.     123.      85.      60.
          41.      28.      19.      13.       9.       6.       4.       3.       2.       1.
           1.

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

                  HYDROGRAPH AT STATION     UA-7

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.34, TOTAL EXCESS =     .21

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      6.63-HR
+  (CFS)      (HR)
                     (CFS)
+     9.      4.03                  2.          2.          2.          2.
                   (INCHES)      .205        .205        .205        .205
                    (AC-FT)        1.          1.          1.          1.

                   CUMULATIVE AREA =     .10 SQ MI


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

        **************
        *            *
55 KK   *     UA-8   *
        *            *
        **************

           SUBBASIN RUNOFF DATA
```

```
56 BA        SUBBASIN CHARACTERISTICS
                  TAREA        .00  SUBBASIN AREA

             PRECIPITATION DATA

9 PB              STORM       1.55  BASIN TOTAL PRECIPITATION

11 PI          INCREMENTAL PRECIPITATION PATTERN
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .02      .02      .02      .02      .02
                  .02      .02      .02      .02      .02      .02      .02      .02      .02      .02
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                  .00      .00      .00      .00      .00

7 LS         SCS LOSS RATE
                  STRTL        .63  INITIAL ABSTRACTION
                 CRVNBR      76.00  CURVE NUMBER
                  RTIMP        .00  PERCENT IMPERVIOUS AREA

58 UD        SCS DIMENSIONLESS UNITGRAPH
                   TLAG        .06  LAG

                                          ***


                                     UNIT HYDROGRAPH
                                 11 END-OF-PERIOD ORDINATES
          12.      31.      27.      14.       7.       3.       2.       1.       0.       0.
           0.

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

                 HYDROGRAPH AT STATION     UA-8

TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.34, TOTAL EXCESS =     .21
```

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	6.63-HR
(CFS)	(HR)				
		(CFS)			
0.	4.00	0.	0.	0.	0.
		(INCHES) .207	.207	.207	.207
		(AC-FT) 0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

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          **************
          *            *
9 KK      *     UA-9   *
          *            *
          **************
```

SUBBASIN RUNOFF DATA

60 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

9 PB STORM 1.55 BASIN TOTAL PRECIPITATION

11 PI INCREMENTAL PRECIPITATION PATTERN

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

```
                .00       .00       .00       .00       .00

41 LS         SCS LOSS RATE
                STRTL        .35  INITIAL ABSTRACTION
               CRVNBR      85.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

Z UD          SCS DIMENSIONLESS UNITGRAPH
                TLAG        .06  LAG

                                                  ***


                                          UNIT HYDROGRAPH
                                       11 END-OF-PERIOD ORDINATES
              3.       8.       7.       4.       2.       1.       0.       0.       0.       0.
              0.

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

                  HYDROGRAPH AT STATION     UA-9

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.07, TOTAL EXCESS =     .48

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR      72-HR     6.63-HR
+ (CFS)       (HR)
                        (CFS)
+    0.       3.00                    0.         0.         0.         0.
                       (INCHES)     .483       .483       .483       .483
                        (AC-FT)       0.         0.         0.         0.

                       CUMULATIVE AREA =     .00 SQ MI


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

          **************
          *            *
3 KK      *    CU-13   *      COMBINE AT CULVERT CU-13
          *            *
          **************

4 HC          HYDROGRAPH COMBINATION
                ICOMP          4  NUMBER OF HYDROGRAPHS TO COMBINE

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

                HYDROGRAPH AT STATION    CU-13

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      6.63-HR
+ (CFS)       (HR)
                         (CFS)
+    82.      4.50                 30.         27.         27.         27.
                       (INCHES)   .130        .130        .130        .130
                        (AC-FT)    15.         15.         15.         15.

                       CUMULATIVE AREA =    2.15 SQ MI


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

        **************
        *            *
 5 KK   *    CU-13   *      ROUTE THROUGH CULVERT
        *            *
        **************

          HYDROGRAPH ROUTING DATA

 66 RK        KINEMATIC WAVE STREAM ROUTING
                     L        450.  CHANNEL LENGTH
                     S       .3000  SLOPE
                     N        .015  CHANNEL ROUGHNESS COEFFICIENT
                    CA         .00  CONTRIBUTING AREA
                 SHAPE        CIRC  CHANNEL SHAPE
                    WD        6.00  BOTTOM WIDTH OR DIAMETER
                     Z         .00  SIDE SLOPE

                                                          ***


     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
         ALPHA        M      DT (MIN)   DX (FT)
        39.5747    1.250        .67      225.00

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

                HYDROGRAPH AT STATION    CU-13
```

```
AK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
+ (CFS)     (HR)
                       (CFS)
+   82.     4.50                  30.         27.         27.         27.
                     (INCHES)    .129        .129        .129        .129
                      (AC-FT)    15.         15.         15.         15.

                     CUMULATIVE AREA =    2.15 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

        **************
        *            *
 67 MCK *    CU-14   *      COMBINE AT CULVERT CU-14
        *            *
        **************

 68 HC        HYDROGRAPH COMBINATION
                   ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                     HYDROGRAPH AT STATION    CU-14

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
+ (CFS)       (HR)
                       (CFS)
+  101.       4.60                  42.         38.         38.         38.
                     (INCHES)    .083        .083        .083        .083
                      (AC-FT)    21.         21.         21.         21.

                     CUMULATIVE AREA =    4.73 SQ MI
```

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

        **************
        *            *
 69 HX  *    CU-14   *      ROUTE THROUGH CULVERT
        *            *
        **************
```

HYDROGRAPH ROUTING DATA

0 RK KINEMATIC WAVE STREAM ROUTING

L	1000.	CHANNEL LENGTH
S	.1000	SLOPE
N	.015	CHANNEL ROUGHNESS COEFFICIENT
CA	.00	CONTRIBUTING AREA
SHAPE	CIRC	CHANNEL SHAPE
WD	7.50	BOTTOM WIDTH OR DIAMETER
Z	.00	SIDE SLOPE

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
23.7142	1.250	.67	500.00

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

HYDROGRAPH AT STATION CU-14

AK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.63-HR
+ 101.	4.60	(CFS)	42.	38.	38.	38.
		(INCHES)	.082	.082	.082	.082
		(AC-FT)	21.	21.	21.	21.

CUMULATIVE AREA = 4.73 SQ MI

*** ***

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        **************
        *            *
71 KK   *    UA-10   *
        *            *
        **************
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SUBBASIN RUNOFF DATA

72 BA SUBBASIN CHARACTERISTICS

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                TAREA        .01  SUBBASIN AREA

          PRECIPITATION DATA

 9 PB           STORM       1.55  BASIN TOTAL PRECIPITATION

 1 PI         INCREMENTAL PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00

73 LS         SCS LOSS RATE
                STRTL        .63  INITIAL ABSTRACTION
                CRVNBR     76.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

74 UD         SCS DIMENSIONLESS UNITGRAPH
                TLAG         .07  LAG

                                                  ***


                                              UNIT HYDROGRAPH
                                          12 END-OF-PERIOD ORDINATES
          23.      71.      75.      50.      25.      14.       7.       4.       2.       1.
           1.       0.

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

                HYDROGRAPH AT STATION    UA-10

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.34, TOTAL EXCESS =     .21

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
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```
                                  6-HR       24-HR       72-HR      6.63-HR
(CFS)       (HR)
                        (CFS)
  1.      4.00                     0.          0.          0.          0.
                      (INCHES)    .207        .207        .207        .207
                       (AC-FT)     0.          0.          0.          0.

                       CUMULATIVE AREA =     .01 SQ MI
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        ##############
        #            #
75 KK   #    UA-11   #
        #            #
        ##############

          SUBBASIN RUNOFF DATA

76 BA       SUBBASIN CHARACTERISTICS
                 TAREA         .06  SUBBASIN AREA

            PRECIPITATION DATA

 9 PB            STORM        1.55  BASIN TOTAL PRECIPITATION

1 PI          INCREMENTAL PRECIPITATION PATTERN
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                 .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00
```

```
7 LS          SCS LOSS RATE
                   STRTL        .63  INITIAL ABSTRACTION
                  CRVNBR      76.00  CURVE NUMBER
                   RTIMP        .00  PERCENT IMPERVIOUS AREA

78 UD         SCS DIMENSIONLESS UNITGRAPH
                    TLAG        .10  LAG

                                                  ***


                                              UNIT HYDROGRAPH
                                          17 END-OF-PERIOD ORDINATES
            46.     156.     248.     248.     193.     116.      72.      47.      29.      18.
            11.       7.       5.       3.       2.       1.       0.

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

                    HYDROGRAPH AT STATION    UA-11

  TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.34, TOTAL EXCESS =     .21

AK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR      6.63-HR
+  (CFS)      (HR)
                      (CFS)
+    5.      4.00                   1.          1.          1.          1.
                     (INCHES)      .206        .206        .206        .206
                      (AC-FT)       1.          1.          1.          1.

                     CUMULATIVE AREA =     .06 SQ MI


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


        **************
        *            *
79 KK   *  CONVENIE  *     NCE COMBINATION
        *            *
        **************

80 KO         OUTPUT CONTROL VARIABLES
                   IPRNT          1  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

1 HC          HYDROGRAPH COMBINATION
                   ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE
```

***

HYDROGRAPH AT STATION CONVENIE
SUM OF 3 HYDROGRAPHS

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0140	51	0.	1		0320	101	15.	1		0500	151	95.
1		0002	2	0.	1		0142	52	0.	1		0322	102	16.	1		0502	152	94.
1		0004	3	0.	1		0144	53	0.	1		0324	103	17.	1		0504	153	93.
1		0006	4	0.	1		0146	54	0.	1		0326	104	19.	1		0506	154	91.
1		0008	5	0.	1		0148	55	0.	1		0328	105	20.	1		0508	155	90.
1		0010	6	0.	1		0150	56	0.	1		0330	106	21.	1		0510	156	89.
1		0012	7	0.	1		0152	57	0.	1		0332	107	23.	1		0512	157	89.
1		0014	8	0.	1		0154	58	0.	1		0334	108	26.	1		0514	158	88.
1		0016	9	0.	1		0156	59	0.	1		0336	109	30.	1		0516	159	87.
1		0018	10	0.	1		0158	60	0.	1		0338	110	34.	1		0518	160	87.
1		0020	11	0.	1		0200	61	0.	1		0340	111	38.	1		0520	161	86.
1		0022	12	0.	1		0202	62	0.	1		0342	112	41.	1		0522	162	86.
1		0024	13	0.	1		0204	63	0.	1		0344	113	44.	1		0524	163	86.
1		0026	14	0.	1		0206	64	0.	1		0346	114	47.	1		0526	164	85.
1		0028	15	0.	1		0208	65	0.	1		0348	115	50.	1		0528	165	85.
1		0030	16	0.	1		0210	66	0.	1		0350	116	54.	1		0530	166	84.
1		0032	17	0.	1		0212	67	0.	1		0352	117	57.	1		0532	167	84.
1		0034	18	0.	1		0214	68	0.	1		0354	118	61.	1		0534	168	83.
1		0036	19	0.	1		0216	69	0.	1		0356	119	64.	1		0536	169	83.
1		0038	20	0.	1		0218	70	0.	1		0358	120	68.	1		0538	170	83.
1		0040	21	0.	1		0220	71	0.	1		0400	121	73.	1		0540	171	82.
1		0042	22	0.	1		0222	72	0.	1		0402	122	76.	1		0542	172	82.
1		0044	23	0.	1		0224	73	0.	1		0404	123	77.	1		0544	173	82.
1		0046	24	0.	1		0226	74	0.	1		0406	124	77.	1		0546	174	81.
1		0048	25	0.	1		0228	75	0.	1		0408	125	77.	1		0548	175	81.
1		0050	26	0.	1		0230	76	0.	1		0410	126	78.	1		0550	176	81.
1		0052	27	0.	1		0232	77	0.	1		0412	127	80.	1		0552	177	81.
1		0054	28	0.	1		0234	78	0.	1		0414	128	82.	1		0554	178	80.
1		0056	29	0.	1		0236	79	0.	1		0416	129	85.	1		0556	179	80.
1		0058	30	0.	1		0238	80	0.	1		0418	130	88.	1		0558	180	80.
1		0100	31	0.	1		0240	81	1.	1		0420	131	92.	1		0600	181	80.
1		0102	32	0.	1		0242	82	2.	1		0422	132	94.	1		0602	182	80.
1		0104	33	0.	1		0244	83	3.	1		0424	133	97.	1		0604	183	80.
1		0106	34	0.	1		0246	84	4.	1		0426	134	99.	1		0606	184	79.
1		0108	35	0.	1		0248	85	4.	1		0428	135	101.	1		0608	185	79.
1		0110	36	0.	1		0250	86	5.	1		0430	136	102.	1		0610	186	79.
1		0112	37	0.	1		0252	87	6.	1		0432	137	103.	1		0612	187	79.
1		0114	38	0.	1		0254	88	8.	1		0434	138	104.	1		0614	188	79.
1		0116	39	0.	1		0256	89	10.	1		0436	139	104.	1		0616	189	79.
1		0118	40	0.	1		0258	90	13.	1		0438	140	104.	1		0618	190	79.

1	0120	41	0.	*	1	0300	91	17.	*	1	0440	141	103.	*	1	0620	191	79.
1	0122	42	0.	*	1	0302	92	20.	*	1	0442	142	103.	*	1	0622	192	79.
1	0124	43	0.	*	1	0304	93	20.	*	1	0444	143	102.	*	1	0624	193	79.
1	0126	44	0.	*	1	0306	94	18.	*	1	0446	144	101.	*	1	0626	194	79.
1	0128	45	0.	*	1	0308	95	16.	*	1	0448	145	100.	*	1	0628	195	79.
1	0130	46	0.	*	1	0310	96	14.	*	1	0450	146	100.	*	1	0630	196	79.
1	0132	47	0.	*	1	0312	97	14.	*	1	0452	147	99.	*	1	0632	197	78.
1	0134	48	0.	*	1	0314	98	13.	*	1	0454	148	98.	*	1	0634	198	77.
1	0136	49	0.	*	1	0316	99	14.	*	1	0456	149	97.	*	1	0636	199	75.
1	0138	50	0.	*	1	0318	100	14.	*	1	0458	150	96.	*	1	0638	200	73.
				*					*					*				

****

AK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
(CFS)	(HR)					
		(CFS)				
104.	4.60		44.	39.	39.	39.
		(INCHES)	.084	.084	.084	.084
		(AC-FT)	22.	22.	22.	22.

CUMULATIVE AREA = 4.80 SQ MI

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	UA-1	26.	6.60	9.	8.	8.	2.45		
ROUTED TO	CU-1	26.	6.60	9.	8.	8.	2.45		
HYDROGRAPH AT	UA-2	4.	3.00	1.	1.	1.	.02		
2 COMBINED AT	CU-3	27.	6.50	10.	9.	9.	2.47		
ROUTED TO	CU-3	27.	6.50	10.	9.	9.	2.47		
HYDROGRAPH AT	UA-3	5.	4.00	1.	1.	1.	.05		
ROUTED TO	CU-4	5.	4.03	1.	1.	1.	.05		
2 COMBINED AT	CU-5	28.	6.50	11.	10.	10.	2.52		
HYDROGRAPH AT	UA-4	5.	4.00	1.	1.	1.	.05		
2 COMBINED AT	CU-7	29.	6.50	12.	11.	11.	2.57		
ROUTED TO	CU-7	29.	6.50	12.	11.	11.	2.57		
HYDROGRAPH AT	UA-5	4.	3.00	1.	1.	1.	.02		
HYDROGRAPH AT	UA-6	77.	4.50	27.	24.	24.	2.03		
2 COMBINED AT	CU-8	78.	4.50	28.	25.	25.	2.05		
HYDROGRAPH AT									

	UA-7	9.	4.03	2.	2.	2.	.10
HYDROGRAPH AT							
	UA-8	0.	4.00	0.	0.	0.	.00
HYDROGRAPH AT							
	UA-9	0.	3.00	0.	0.	0.	.00
4 COMBINED AT							
	CU-13	82.	4.50	30.	27.	27.	2.15
ROUTED TO							
	CU-13	82.	4.50	30.	27.	27.	2.15
2 COMBINED AT							
	CU-14	101.	4.60	42.	38.	38.	4.73
ROUTED TO							
	CU-14	101.	4.60	42.	38.	38.	4.73
HYDROGRAPH AT							
	UA-10	1.	4.00	0.	0.	0.	.01
HYDROGRAPH AT							
	UA-11	5.	4.00	1.	1.	1.	.06
3 COMBINED AT							
	CONVENIE	104.	4.60	44.	39.	39.	4.80

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

UP&L Mining
Cottonwood/Wilberg Mine Portal Undisturbed Bypass Facilities
10-YR 6-HR SCS 6-HOUR DISTRIBUTION
by gip Hansen, Allen & Luce June, 1989
UA-2, UA-5, UA-8, and UA-9 areas multiplied by 100

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	UA-2	423.	3.00	97.	87.	87.	1.86		
ROUTED TO	CU-3	420.	3.00	97.	87.	87.	1.86		
HYDROGRAPH AT	UA-5	416.	3.00	95.	86.	86.	1.83		
HYDROGRAPH AT	UA-8	46.	4.00	11.	10.	10.	.50		
HYDROGRAPH AT	UA-9	30.	3.00	7.	6.	6.	.13		
4 COMBINED AT	CONVENIE	891.	3.00	210.	190.	190.	4.32		

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

HANSEN ALLEN & LUCE INC

CLIENT UPSL Mining
PROJECT Cottonwood/Wilberg Mine Portal Site
FEATURE Hydrologic Computations Appendix
PROJECT NO. 5-1-3

SHEET ____ OF ____
COMPUTED ____
CHECKED ____
DATE May 1989

Hydrologic Computations Appendix

Mine Portal Site Disturbed Area Computations

SUB-BASIN CHARACTERISTICS Pages 1-6

Volume Weighted Curve Number Pages 1-3

10-YEAR 24-HOUR STORM RUNOFF Pages 1-1

CULVERT DESIGN Computation Pages 1-4

MEAN ANNUAL SEDIMENT YIELD Pages 1-4

HEC 1 Printouts:

- 10-YEAR 6-HOUR Pages 1-69
- 10-YEAR 6-HOUR with all Areas multiplied by 100 Pages 1-12
- 25-YEAR 6-HOUR Pages 1-13

RISER TYPE SPILLWAY HYDRAULICS Pages 1-2

WILBERG FAN SMALL AREA EXEMPTION Page 1-1

SUB-BASIN CHARACTERISTICS:

SOILS:

Soils derive from the Blackhawk and overlying formations and tend to be Soil Type B and C with D for Rock Outcrops.

ROCK OUTCROPS:

Are mostly fractured sandstone cliffs USE CN = 88
fracturing and relict provides appreciable interception

South Facing Slopes (except for rock outcrop):

Upper Areas of Sub-basins DA-1 and DA-2 vegetation cover tends to be poor consisting mostly of grasses, some brush and occasional tree

Soil type C - poor cover ≈ 20% cover ⇒ CN = 85 Fig 9.6 SCS, 1972

West Facing Slopes:

Upper Areas of Subbasins DA-1 & DA-6

better cover than south facing
soil type C ≈ 40% cover ⇒ CN = 76

Disturbed Areas: use CN = 86 for areas not actively used.
PAVED AREAS: use CN = 98

Precipitation:

Location: Sections 22 & 27 T17S R7E
111° 08' longitude 39° 19.3' latitude

		Precip
10 yr	24 hr	2.40
100 yr	24 hr	3.43
10 yr	6 hr	1.51
25 yr	6 hr	1.81
100 yr	6 hr	2.24

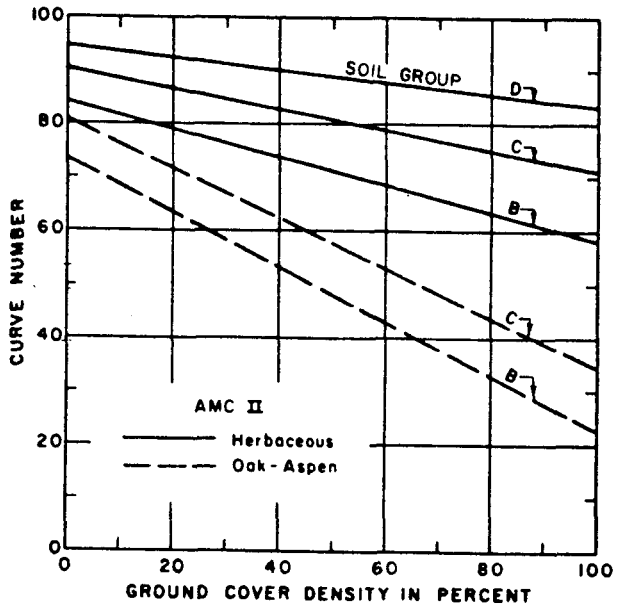


Figure 9.5.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: herbaceous and oak-aspen complexes.

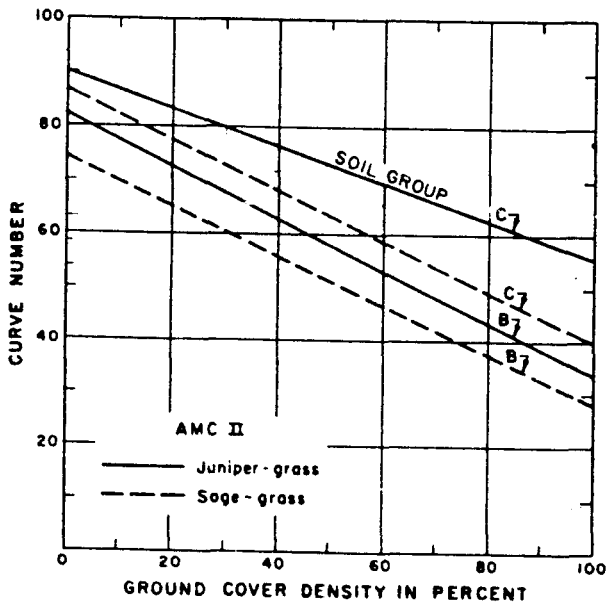


Figure 9.6.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: juniper-grass and sage-grass complexes.

HANSEN ALLEN & LUCE INC

CLIENT UPSL Mining
PROJECT Wilberg
FEATURE SUB-BASIN CHARACTERISTICS
PROJECT NO.

SHEET 2 OF 6
COMPUTED GP
CHECKED
DATE May 16, 1989

DA-1

AREA = 3.35 acres

0.45 acres Juniper CN=85
0.48 acres Rock
0.26 acres disturbed
2.16 acres paved

} Volume wtd CN = 94.5 see attached spreadsheet

T_{lag}: reference: "Urban Storm Drainage Criteria Manual" Denver Urban Drainage District, DRCOG, WME, 1969 revised 1984

$t_c = t_i + t_t$

t_i = initial inlet or overland flow time

t_t = travel time in ditch

t_c = time of concentration $= \frac{T_{LAG}}{0.6}$

overland flow $C_5 = 0.87$ paved

$$t_i = \frac{1.8(1.1-.87)\sqrt{400}}{\sqrt[3]{8\%}} = 4.14 \text{ min}$$

t_t = 600' @ 5% ⇒ V = 4.5 fps Fig 3-2 of Denver Criteria

$\therefore t_c = \frac{600}{4.5}\frac{1}{60} + 4.14 = 6.36 \text{ min} \Rightarrow T_{lag} = 0.064$ hrs

DA-2

AREA = 2.58 acres

Rock AREA =	.7 + .07	= .77 acres	CN = 88
Paved AREA =		0.67 acres	CN = 98
Some Disturbed =		0.32 acres	CN = 90
poor Juniper =		0.82 acres	CN = 85
		2.58 acres	CN_{wtd} = 91

paved area $T_c = t_i + t_t$

$$t_i = \frac{1.8(1.1-.87)\sqrt{450}}{\sqrt[3]{2.2}} = 6.7 \text{ min} \Rightarrow \boxed{T_{lag} = 0.067 \text{ hrs}}$$

DA-3

AREA = 1.38 acres

PAVED = 0.53 acres
DISTURBED = 0.14 acres
Juniper = 0.71 acres CN = 76

} $CN_{composite}$ =

$t_c = t_i + t_t$

$$t_i = \frac{1.8(1.1-C_5)\sqrt{L}}{\sqrt[3]{S}}$$

upper - 300' S = 89% C_5 = .25 ⇒ t_i = 5.93 min

t_t = 120' @ 750% + 100' @ 5% = 32 seconds

t_c = 6.5 minutes T_{lag} = 3.9 minutes = $\boxed{0.065 \text{ hrs}}$

DA-4

Area = 2.96 acres
Paved = 1.2 acres
DISTURBED = 2.96 - 1.2 = 1.76 acres

t_i across parking lot = $\frac{1.8(1.1-.87)(300)^{1/2}}{\sqrt[3]{2}}$

= 5.7 minutes

t_i undisturbed = $\frac{1.8(1.1-.25)\,100^{1/2}}{\sqrt[3]{160}}$ = 2.8 min

use t_c = 6 min ⇒ t_{Lag} = 3.6 min

t_{Lag} = 0.05 hrs

DA-5

AREA = 0.14 acres

.03 acres at CN = 85
rest paved

t_c = 400' @ 5.6%

$t_i = \frac{1.8(1.1-.87)(300)^{1/2}}{\sqrt[3]{5.6}}$ = 4.03

use t_c = 5 min t_{Lag} = 0.05 hrs

DA-6

AREA = 4.15 acres
Basin Slope = $\frac{3080\,(50)}{4.15\ \ 43560}$ = 0.85 or 85%

l = 2320'
0.32 acres Paved road + .23 AC FAN = 0.55 acres
0.37 acres disturbed

Composite CN = 82 see attached printout

$t_L = \frac{(l)^{0.8}(S+1)^{0.7}}{1900\ \ Y^{0.5}} = \frac{(2320)^{0.8}(2.19+1)^{0.7}}{1900\ \ 85^{0.5}}$ = 0.063 hrs

DA-7 AREA = 1.76 acres

Paved = 1.43 acres
rest disturbed
$CN_{wtd} = 87$

$$t_i = \frac{1.8(1.1-.87)(320)^{1/2}}{(2)^{1/3}} = 5.9 \text{ min}$$

$t_{lag} = 3.6$ min $t_{lag} = 0.059$ hrs

DA-8

all paved - Area = 0.14 ares ⇒ CN = 98

use $t_{lag} = 0.05$ hrs

DA-9 AREA = 2.49 acres

0.79 acres gravel
1.70 acres disturbed
Vol wtd CN = 89

$$t_i = \frac{1.8(1.1-.25)\,300^{1/2}}{(62.5)^{1/3}} = 6.67 \text{ min}$$

+ 250 ft @ 3% ⇒ 3.5 fps = 1.19 min

$t_c = 7.9$ min

$t_{lag} = 4.7$ min = 0.079 hrs

DA-10 AREA = 0.48 acres
0.09 acres disturbed
0.39 acres paved

$$t_i = \frac{1.8(1.1-.87)\,320^{1/2}}{15^{1/3}} = 3 \text{ minutes}$$

use $t_c = 5$ min minimum see sec 3.4.2 of DRCOG criteria
⇒ $T_{lag} = 0.05$ hrs

DA-11

AREA = 1.88 acres
Paved = 0.93 acres
Disturbed = 0.95 acres

$$t_i = \frac{1.8(1.1-.87)\,290^{1/2}}{13^{1/3}} = 3.0 \text{ min}$$

t_t = 100' @ 7% ⇒ 5.2 fps paved ⇒ 0.3 min

t_c = 3.3 min use T_{lag} = 0.05 hrs min

DA-12

AREA = 0.31 acres - all paved ⇒ $\boxed{CN = 98}$

$$t_i = \frac{1.8(1.1-.87)\,325^{1/2}}{1.5^{1/3}} = 6.5 \text{ min}$$

t_{lag} = .6 t_c = 3.9 min = $\boxed{0.065 \text{ hrs}}$

DA-13

AREA = 0.10 acres - all paved ⇒ $\boxed{CN = 98}$

$$t_i = \frac{1.8(1.1-.87)\,320^{1/2}}{1^{1/3}} = 3.33 \text{ min}$$

use T_{lag} = 0.05 hrs minimum

DA-14

AREA = 0.72 acres

0.41 acres disturbed
0.31 acres paved
} $\boxed{CN_{Vol\,wtd} = 94}$

$$t_i = \frac{1.8(1.1-.87)\,350^{1/2}}{6^{1/3}} = 4.3 \text{ min}$$

t_t = 220' @ 2% ⇒ v = 2.8 fps Fig 3-2 paved ⇒ t_t = 1.3

t_c = $t_i + t_t$ = 5.6 min ⇒ t_{lag} = 3.34 min = $\boxed{.056 \text{ hrs}}$

DA-15 Area = 0.29 acres all paved CN = 98

$t_i = \frac{1.8(1.1-.87)\,400^{1/2}}{13^{1/3}} = 3.52$ min

$l = 800'$

$t_t = 400'$ @ 11.2% ⇒ V = 6.6 FPS ⇒ $t_t = 1.0$

$t_c = 4.53$ min ⇒ $T_{lag} = .05$ hrs min.

DA-16 Area = 0.20 acres all paved CN = 98

$t_i = \frac{1.8(1.1-.87)\,500^{1/2}}{9^{1/3}} = 4.45$ min

use TLAG = .05 hrs min.

DA-17 Area = 0.90 acres

0.1 acre pond CN = 98
0.8 acre disturbed CN = 86
} CN 88.1

$t_i = \frac{1.8(1.1-.25)\,240^{1/2}}{11^{1/3}} = 10.7$ min

$t_{Lag} = 6.4$ min = 0.107 hrs

DA-18 AREA = 0.86 acres

0.08 acres pond CN = 98
0.78 acres disturbed CN = 86
} CN = 87.8

$t_i = \frac{1.8(1.1-.25)\,140^{1/2}}{25^{1/3}} = 6.2$ min

$t_{Lag} = .062$ hrs

Volume Weighted Curve Number Computation

SCS curve number

UP&L COTTONWOOD WILBERG MIN

				RUNOFF IN INCHES		
				10-YR 24-HR	25-YR 6-HR	10-YR 6-HR
P RAINFALL				2.4	1.81	1.51
DA-1	AREA	CN	S			
JUNIPER	2.71	85	1.76	1.10	0.66	0.46
ROCK	0.48	88	1.36	1.30	0.81	0.59
DISTURBED	0.26	86	1.62	1.16	0.71	0.50
PAVED	2.16	98	0.20	2.17	1.59	1.29
TOTAL AREA	5.61					
VOL WTD Q				1.53	1.03	0.79
VOL WTD CN		91.1	0.97	1.53	1.01	0.75
DA-2	AREA	CN	S			
JUNIPER	0.82	85	1.76	1.10	0.66	0.46
ROCK	0.77	88	1.36	1.30	0.81	0.59
DISTURBED	0.32	87	1.49	1.23	0.76	0.54
PAVED	0.67	98	0.20	2.17	1.59	1.29
TOTAL AREA	2.58					
VOL WTD Q				1.45	0.96	0.72
VOL WTD CN		90.1	1.09	1.45	0.94	0.70
DA-3	AREA	CN	S			
JUNIPER	0.61	76	3.15	0.63	0.32	0.19
ROCK	0.1	88	1.36	1.30	0.81	0.59
DISTURBED	0.14	86	1.62	1.16	0.71	0.50
PAVED	0.53	98	0.20	2.17	1.59	1.29
TOTAL AREA	1.38					
VOL WTD Q				1.33	0.88	0.67
VOL WTD CN		88.5	1.29	1.33	0.84	0.61
DA-4	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	1.76	86	1.62	1.16	0.71	0.50
PAVED	1.2	98	0.20	2.17	1.59	1.29
TOTAL AREA	2.96					
VOL WTD Q				1.57	1.06	0.82
VOL WTD CN		91.6	0.91	1.57	1.04	0.78
DA-5	AREA	CN	S			
JUNIPER	0.03	85	1.76	1.10	0.66	0.46
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0	86	1.62	1.16	0.71	0.50
PAVED	0.11	98	0.20	2.17	1.59	1.29
TOTAL AREA	0.14					
VOL WTD Q				1.94	1.39	1.11
VOL WTD CN		95.8	0.43	1.94	1.37	1.09

scs curve number

UP&L COTTONWOOD WILBERG MIN

				RUNOFF IN INCHES		
				10-YR 24-HR	25-YR 6-HR	10-YR 6-HR
P RAINFALL				2.4	1.81	1.51
DA-6	AREA	CN	S			
JUNIPER	3.23	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.37	86	1.62	1.16	0.71	0.50
PAVED	0.55	98	0.20	2.17	1.59	1.29
TOTAL AREA	4.15					
VOL WTD Q				0.89	0.52	0.36
VOL WTD CN		81.3	2.30	0.89	0.50	0.33
DA-7	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.33	86	1.62	1.16	0.71	0.50
GRAVEL	1.43	93	0.75	1.69	1.14	0.88
TOTAL AREA	1.76					
VOL WTD Q				1.59	1.06	0.80
VOL WTD CN		91.9	0.88	1.59	1.06	0.80
DA-9	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	1.7	86	1.62	1.16	0.71	0.50
GRAVEL	0.79	93	0.75	1.69	1.14	0.88
TOTAL AREA	2.49					
VOL WTD Q				1.33	0.85	0.62
VOL WTD CN		88.5	1.29	1.33	0.84	0.61
DA-10	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.09	86	1.62	1.16	0.71	0.50
PAVED	0.39	98	0.20	2.17	1.59	1.29
TOTAL AREA	0.48					
VOL WTD Q				1.98	1.42	1.14
VOL WTD CN		96.2	0.39	1.98	1.41	1.12
DA-11	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.25	86	1.62	1.16	0.71	0.50
GRAVEL	0.95	93	0.75	1.69	1.14	0.88
TOTAL AREA	1.2					
VOL WTD Q				1.58	1.05	0.80
VOL WTD CN		91.8	0.89	1.58	1.05	0.80

scs curve number

UP&L COTTONWOOD WILBERG MIN

				RUNOFF IN INCHES		
				10-YR 24-HR	25-YR 6-HR	10-YR 6-HR
P RAINFALL				2.4	1.81	1.51
DA-14	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.41	86	1.62	1.16	0.71	0.50
PAVED	0.31	98	0.20	2.17	1.59	1.29
TOTAL AREA	0.72					
VOL WTD Q				1.60	1.09	0.84
VOL WTD CN		92	0.86	1.60	1.07	0.81
DA-17	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.8	86	1.62	1.16	0.71	0.50
POND	0.1	100	0	2.40	1.81	1.51
TOTAL AREA	0.9					
VOL WTD Q				1.30	0.83	0.61
VOL WTD CN		88.1	1.35	1.30	0.82	0.59
DA-18	AREA	CN	S			
JUNIPER	0	76	3.15	0.63	0.32	0.19
ROCK	0	88	1.36	1.30	0.81	0.59
DISTURBED	0.78	86	1.62	1.16	0.71	0.50
POND	0.08	100	0	2.40	1.81	1.51
TOTAL AREA	0.86					
VOL WTD Q				1.28	0.81	0.59
VOL WTD CN		87.8	1.38	1.28	0.80	0.58

scs curve number 10-YEAR 24-HOUR storm runoff
COTTONWOOD/WILBERG MINE PORTAL FACILITIES
TRIBUTARY RUNOFF TO SEDIMENT PONDS
10-year 24-hour rainfall P = 2.4 inches

BASIN ID	TOTAL AREA (acres)	vol wtd CN	COMPUTED S	COMPUTED RUNOFF	RUNOFF AC-IN	AREA BASIN SQ MILES
DA-1	5.61	91.1	0.98	1.53	8.57	0.01
DA-2	2.58	90.1	1.10	1.45	3.74	0.00
DA-3	1.38	88.5	1.30	1.33	1.84	0.00
DA-4	2.96	91.6	0.92	1.57	4.64	0.00
DA-5	0.14	95.8	0.44	1.94	0.27	0.00
DA-6	4.15	81.3	2.30	0.89	3.68	0.01
DA-7	1.76	91.9	0.88	1.59	2.80	0.00
DA-8	0.14	98.0	0.20	2.17	0.30	0.00
DA-9	2.49	88.5	1.30	1.33	3.32	0.00
DA-10	0.48	96.2	0.40	1.98	0.95	0.00
DA-11	1.20	91.8	0.89	1.58	1.90	0.00
DA-12	0.31	98.0	0.20	2.17	0.67	0.00
DA-13	0.10	98.0	0.20	2.17	0.22	0.00
DA-14	0.72	92.0	0.87	1.60	1.15	0.00
DA-15	0.29	98.0	0.20	2.17	0.63	0.00
DA-16	0.20	98.0	0.20	2.17	0.43	0.00
DA-17	0.90	88.1	1.35	1.30	1.17	0.00
DA-18	0.86	87.8	1.39	1.28	1.10	0.00
TOTALS	26.27				37.4	ACRE-INCHES
					3.1	ACRE-FEET

Design flow for temporary structures = 10yr-6hr rainstorm event

METHODS:

Inlet Control

ref: "Hydraulic Charts for the Selection of Highway Culverts" H.E.C. 5, U.S.D.O.T., 1965

Chart 5 "Headwater Depth for C.M. Pipe Culverts with Inlet Control"

See attached copy of CHART 5 and attached table for Detail

MINIMUM PIPE SLOPE

Mannings Equation: $Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{S_f}$

Q = flow in cfs
n = Mannings n reference: Table 4-9 (attached) "Handbook of Steel Drainage & Highway Construction Products" American Iron and Steel Institute, 3rd Edition 1983
A = flow area = $\pi D^2/4$ for full flow
P = wetted perimeter = πD for full flow
S_f = friction slope

solve for $S_f = \left(\frac{Q}{\frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3}}\right)^2$

CULVERT CD-1 24" Ø
Q = 4.8 cfs assume n = .027

$\therefore S_{f\,min} = \left(\frac{4.8}{109.3}\right)^2 = .00019$ say <u>.0002 ft/ft</u>

Culvert CD-2 18" Dia.
Q = 1.8 cfs assume n = .027

$\therefore S_{f\,min} = \left(\frac{1.8}{50.7}\right)^2 =$ <u>.0013 ft/ft</u>

Culvert CD-3 assume 12" Dia.
Q = 0.9 cfs assume n = .027

$\therefore S_{f\,min} = \left(\frac{.9}{17.2}\right)^2 =$ <u>.003 ft/ft</u>

Culvert CD-4 24" Dia
$Q = 9.0$ cfs assume $n = .027$

$$\therefore S_{f_{min}} = \left(\frac{9.0}{109.3}\right)^2 = .0068 \text{ ft/ft}$$

Culvert CD-5 24" DIA

$$\therefore S_{f\,min} = \left(\frac{9.7}{109.3}\right)^2 = .007 \text{ ft/ft}$$

Culvert CD-6 24" Dia.
$Q = 10.5$ cfs $n = .027$

$$\therefore S_{f\,min} = \left(\frac{10.5}{109.3}\right)^2 = .009 \text{ ft/ft}$$

Culvert CD-7 16" Dia
$Q = 1.4$ cfs assume $n = .015$

$$\therefore S_f = \left(\frac{1.4}{66.7}\right)^2 = .00044 \text{ ft/ft}$$

say .001 min

Culvert CD-8 30" Dia
$Q = 12$ cfs assume $n = .027$

$$\therefore S_{f\,min} = \left(\frac{12.0}{198.1}\right)^2 = .004 \text{ ft/ft}$$

Culvert CD-9 30" DIA
$Q = 13.5$ cfs

$$S_{f\,min} = \left(\frac{13.5}{198.1}\right)^2 = .005 \text{ ft/ft}$$

Culvert CD-10 30" Dia.
$Q = 13.8$ cfs

$$S_{f\,min} = \left(\frac{13.8}{198.1}\right)^2 = .005 \text{ ft/ft}$$

Culvert CD-11 30" Dia
$Q = 14.8$ cfs

$$S_{f\,min} = \left(\frac{14.8}{198.1}\right) = .006 \text{ ft/ft}$$

based on mapping and site visit, all culverts have slopes greater than minimum required.

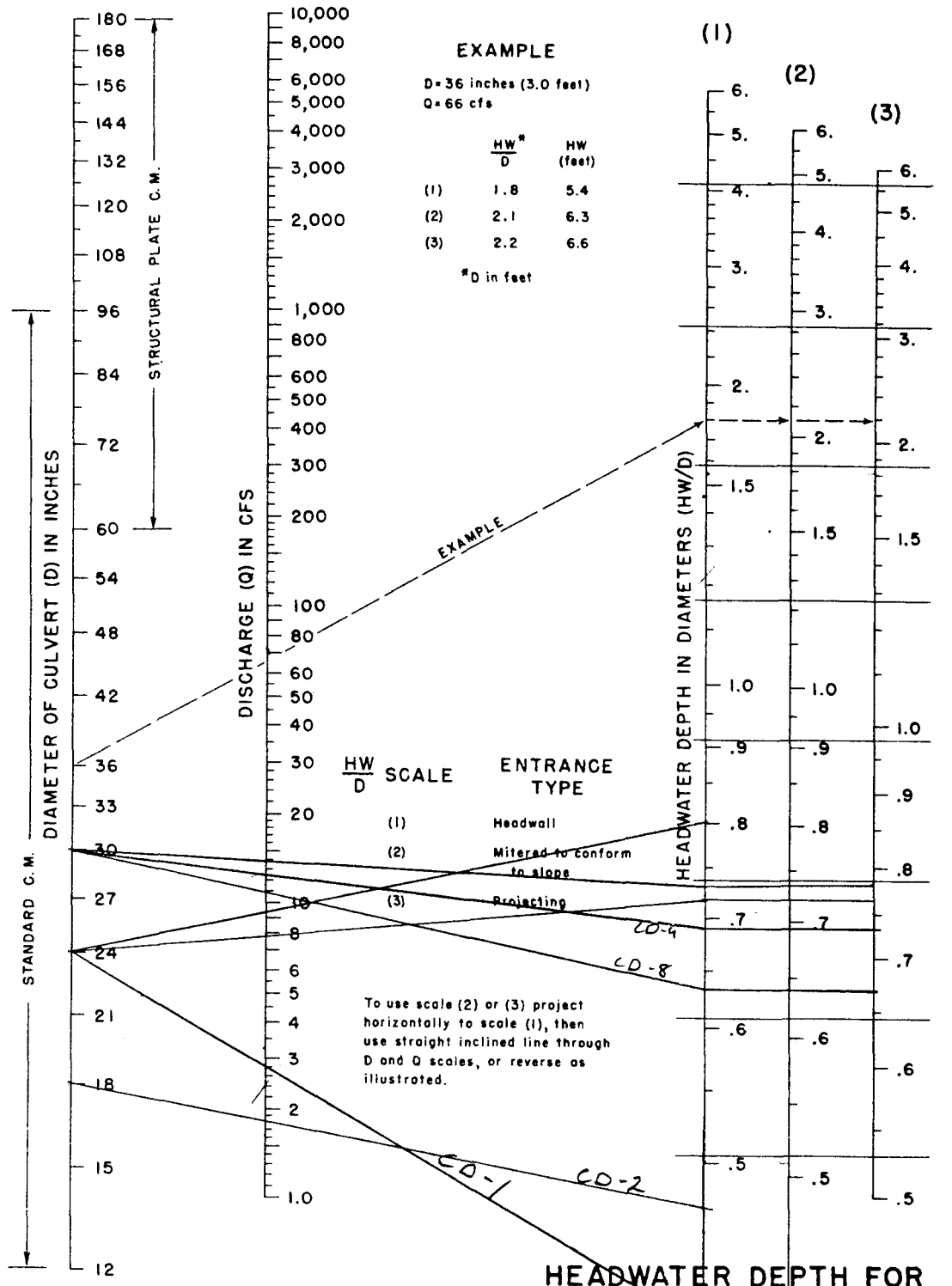
See attached table for summary

TABLE 2

CULVERT DESIGN CRITERIA
DISTURBED AREA RUNOFF CONTROL CULVERTS
COTTONWOOD/WILBERG MINE PORTAL SITE

CULVERT	DESIGN FLOW (CFS)	PIPE DIAMETER (IN)	REQUIRED HEAD WATER DEPTH (FT)	REQUIRED MINIMUM SLOPE (FT/FT)
CD-1	4.1	24	0.8	.002
CD-2	1.8	18	0.7	.001
CD-3	0.9	12	0.7	.003
CD-4	9.0	24	1.5	.007
CD-5	9.2	24	1.6	.007
CD-6	10.5	24	1.7	.009
CD-7	1.4	16	0.9	.001
CD-8	12.0	30	1.7	.004
CD-9	13.5	30	1.8	.005
CD-10	13.8	30	1.9	.005
CD-11	14.8	30	2.0	.006
CD-12	0.3	14	0.4	.001
CD-13	0.1	16	0.1	.001
CD-14	0.6	14	0.5	.001
CD-15	0.3	12	0.1	.001
CD-16	0.2	12	0.1	.001

CHART 5



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

+ 1D

BUREAU OF PUBLIC ROADS JAN. 1963

Sediment Yields

Modified Universal Soil Loss Equation

$A = R \cdot K \cdot LS \cdot VM$

reference: "Erosion and Sedimentation in Utah - A Guide for Control" Israelsen et al 1984

where: A = soil loss per unit area (tons/acre/year)
R = rainfall factor
K = soil erodibility factor
LS = topographic factor
VM = erosion control factor

R (rainfall factor)
reference: PRICE ISO-Erodent (R) Values Map 1983 from above referenced report (Israelsen et.al)

Mean Annual R = 19 @ Cottonwood/Wilberg Mine Site
111° 08' Longitude
39° 19.3' Lattitude

K soil erodibility factor
map for state of Utah (Israelsen Et AL, 1984) indicates that the Wilberg Mine Portal site is near boundary between K = 0.1 to 0.1 and K = 0.21 to 0.30
use K = 0.30

VM: erosion control factor

Juniper Grass w/ south facing slope = 20% cover VM = 0.2
w/ west facing slope = 40% cover VM = 0.1

reference "Applied Hydrology and Sedimentology for Disturbed Areas" Barfield & Warner, 1981 commonly reffered to as Red Book
see copy of Table 5.A.3 attached

Disturbed Areas w/ no treatment use VM = 1.0
Paved areas assume VM = Ø
Gravel areas:
see figure 6 of Israelsen et al 1984 ⇒ VM 0.01

Table 5.A.3. C Factors for Permanent Pasture, Rangeland, Idle Land, and Grazed Woodland.[1,5]

Vegetal Canopy			Cover that Contacts the Surface					
Type and Height of Raised Canopy[2]	Canopy Cover[3] %	Type[4]	Percent Ground Cover					
			0	20	40	60	80	95-100
No appreciable canopy		G	.45	.20	.10	.042	.013	.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush (0.5 m fall ht.)	25	G	.36	.17	.09	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.06	.031	.011	.003
		W	.17	.12	.09	.067	.038	.011
Appreciable brush or bushes (2 m fall ht.)	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees but no appreciable low brush (4 m fall ht.)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

1. All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists. Idle land refers to land with undisturbed profiles for at least a period of three consecutive years. Also to be used for burned forest land and forest land that has been harvested less than three years ago.
2. Average fall height of waterdrops from canopy to soil surface: m = meters.
3. Portion of total area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).
4. G: Cover at surface is grass, grasslike plants, decaying compacted duff or litter at least 2 inches deep.

   W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral root network near the surface), and/or undecayed residue.
5. Soil Conservation Service (1977).

HANSEN ALLEN & LUCE INC

CLIENT UPCL Mining
PROJECT Cottonwood/Wilberg Mine Portal Site
FEATURE
PROJECT NO. 5-1-3

SHEET 3 OF 4
COMPUTED CSP
CHECKED
DATE May 30, 1989

MEAN ANNUAL SEDIMENT YIELD

R = 19 K = 0.30 ⇒ R·K = 5.7

SUB AREA COVER ID	AREA (acres)	ℓ (ft)	S (%)	LS	VM	5.7(LS)VM A (t/ac/yr)	MEAN ANNUAL SEDIMENT (tons/yr)
DA-1							
Juniper	0.45	350	63	46.6	0.20	53.1	23.9
Disturbed	0.26	40	58	14	1.0	79.8	20.7
DA-2							
Juniper	0.82	200	75	43.7	0.2	49.8	40.8
Disturbed	0.32	20	90	17	1.0	96.9	31.0
DA-3							
Juniper	0.61	200	73	42	0.1	23.9	14.6
Disturbed	0.14	25	40%	6.2	1.0	35.3	4.9
DA-4							
Disturbed	1.76	140	88	44	1.0	250.8	441.4
DA-5							
Juniper	0.03	100	100	42	0.1	23.9	0.7
DA-6							
Juniper	2.36	290	75	52.6	0.1	30.0	70.8
Juniper	0.9	110	100	168	0.1	95.8	86.2
	$LS = \frac{(L\lambda_n S_{sn})\lambda_n - (L\lambda_{n-1} S_{sn})\lambda_{n-1}}{\ell_n}$ (84.49, 400; 52.6, 290; 110)						
Disturbed	.37	40	80	21.1	1.0	120.3	44.5
DA-7							
Disturbed	.33	100	100	42.2	1.0	240.5	79.4
gravel	1.43	300	3	0.40	0.01	.022	.03
DA-8							
All paved					∅	∅	∅

HANSEN ALLEN & LUCE inc

CLIENT: UPCL Mining
PROJECT: Cottonwood/Wilberg Mine Portal Site
FEATURE:
PROJECT NO.: 5-1-3

SHEET 4 OF 4
COMPUTED: CSP
CHECKED:
DATE: May 3 1989

MEAN ANNUAL SEDIMENT YIELD (CONT.)

R = 19 K = 0.30 ⇒ R·K = 5.7

SUB AREA COVER ID	AREA (acres)	ℓ (ft)	S (%)	LS	VM	5.7(LS)VM A (t/ac/yr)	MEAN ANNUAL SEDIMENT (tons/yr)
DA-9							
Disturbed	1.7	130	68	32	1.0	182.4	310.1
gravel	.79	250	4	.58	0.01	.03	.03
DA-10							
Disturbed	0.09	60	14	1.9	1.0	10.8	1.0
DA-11							
Disturbed	0.25	35	50	10.5	1.0	59.9	15.0
gravel	0.95	150	4	.47	.01	.03	.03
DA-12	ALL PAVED				∅	∅	∅
DA-13	ALL PAVED				∅	∅	∅
DA-14							
Disturbed	0.41	45	55	13.7	1.0	78.0	32.0
DA-17							
Disturbed	0.34	150	3.3	0.35	1.0	2.0	0.7
Disturbed	0.16	90	42	2) 25	1.0	142.5	22.8
	3) LS = $\frac{(20)(240)-(17)150}{90}$ =						
Disturbed	0.30	55	84	26.5	1.0	151.0	45.3
DA-18							
disturbed	0.78	110	30	8.9	1.0	50.7	39.6
							1325 tons/year

Assume 75 lb/ft³ of sediment

⇒ Mean Annual YIELD = 1325 ton/yr $\frac{2000}{75}$ $\frac{1}{43560}$ = **0.81 Acre-feet/yr**

Table 2. LS values.

Slope Ratio	Slope Gradient "s" (%)	Slope Length "l" (ft.) (λ = summation of "l" segments)																						
		10	20	30	40	50	60	70	80	90	100	150	200	250	300	350	400	450	500	600	700	800	900	1000
	0.5	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.14	0.15	0.15
100:1	1	0.08	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.14	0.14	0.15	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.19	0.19	0.20
	2	0.10	0.12	0.14	0.15	0.16	0.17	0.18	0.19	0.19	0.20	0.23	0.25	0.26	0.28	0.29	0.30	0.32	0.33	0.34	0.36	0.37	0.39	0.40
	3	0.14	0.18	0.20	0.22	0.23	0.25	0.26	0.27	0.28	0.29	0.32	0.35	0.38	0.40	0.42	0.43	0.45	0.46	0.49	0.51	0.54	0.55	0.57
	4	0.16	0.21	0.25	0.28	0.30	0.33	0.35	0.37	0.38	0.40	0.47	0.53	0.58	0.62	0.66	0.70	0.73	0.76	0.82	0.87	0.92	0.96	1.00
20:1	5	0.17	0.24	0.29	0.34	0.38	0.41	0.45	0.48	0.51	0.53	0.66	0.76	0.85	0.93	1.00	1.07	1.13	1.20	1.31	1.42	1.51	1.60	1.69
	6	0.21	0.30	0.37	0.43	0.48	0.52	0.56	0.60	0.64	0.67	0.82	0.95	1.06	1.16	1.26	1.34	1.43	1.50	1.65	1.78	1.90	2.02	2.13
	7	0.26	0.37	0.45	0.52	0.58	0.64	0.69	0.74	0.78	0.82	1.01	1.17	1.30	1.43	1.54	1.65	1.75	1.84	2.02	2.18	2.33	2.47	2.61
12½:1	8	0.31	0.44	0.54	0.63	0.70	0.77	0.83	0.89	0.94	0.99	1.21	1.40	1.57	1.72	1.85	1.98	2.10	2.22	2.43	2.62	2.80	2.97	3.13
	9	0.37	0.52	0.64	0.74	0.83	0.91	0.98	1.05	1.11	1.17	1.44	1.66	1.85	2.03	2.19	2.35	2.49	2.62	2.87	3.10	3.32	3.52	3.71
10:1	10	0.43	0.61	0.75	0.87	0.97	1.06	1.15	1.22	1.30	1.37	1.68	1.94	2.16	2.37	2.56	2.74	2.90	3.06	3.35	3.62	3.87	4.11	4.33
	11	0.50	0.71	0.86	1.00	1.12	1.22	1.32	1.41	1.50	1.58	1.93	2.23	2.50	2.74	2.95	3.16	3.35	3.53	3.87	4.18	4.47	4.74	4.99
8:1	12.5	0.61	0.86	1.05	1.22	1.36	1.49	1.61	1.72	1.82	1.92	2.35	2.72	3.04	3.33	3.59	3.84	4.08	4.30	4.71	5.08	5.43	5.76	6.08
	15	0.81	1.14	1.40	1.62	1.81	1.98	2.14	2.29	2.43	2.56	3.13	3.62	4.05	4.43	4.79	5.12	5.43	5.72	6.27	6.77	7.24	7.68	8.09
6:1	16.7	0.96	1.36	1.67	1.92	2.15	2.36	2.54	2.72	2.88	3.04	3.72	4.30	4.81	5.27	5.69	6.08	6.45	6.80	7.45	8.04	8.60	9.12	9.62
5:1	20	1.29	1.82	2.23	2.58	2.88	3.16	3.41	3.65	3.87	4.08	5.00	5.77	6.45	7.06	7.63	8.16	8.65	9.12	9.99	10.79	11.54	12.24	12.90
4½:1	22	1.51	2.13	2.61	3.02	3.37	3.69	3.99	4.27	4.53	4.77	5.84	6.75	7.54	8.26	8.92	9.54	10.12	10.67	11.68	12.62	13.49	14.31	15.08
4:1	25	1.86	2.63	3.23	3.73	4.16	4.56	4.93	5.27	5.59	5.89	7.21	8.33	9.31	10.20	11.02	11.78	12.49	13.17	14.43	15.58	16.66	17.67	18.63
	30	2.51	3.56	4.36	5.03	5.62	6.16	6.65	7.11	7.54	7.95	9.74	11.25	12.57	13.77	14.88	15.91	16.87	17.78	19.48	21.04	22.49	23.86	25.15
3:1	33.3	2.98	4.22	5.17	5.96	6.67	7.30	7.89	8.43	8.95	9.43	11.55	13.34	14.91	16.33	17.64	18.86	20.00	21.09	23.10	24.95	26.67	28.29	29.82
	35	3.23	4.57	5.60	6.46	7.23	7.92	8.55	9.14	9.70	10.22	12.52	14.46	16.16	17.70	19.12	20.44	21.68	22.86	25.04	27.04	28.91	30.67	32.32
2½:1	40	4.00	5.66	6.93	8.00	8.95	9.80	10.59	11.32	12.00	12.65	15.50	17.89	20.01	21.91	23.67	25.30	26.84	28.29	30.99	33.48	35.79	37.96	40.01
	45	4.81	6.80	8.33	9.61	10.75	11.77	12.72	13.60	14.42	15.20	18.62	21.50	24.03	26.33	28.44	30.40	32.24	33.99	37.23	40.22	42.99	45.60	48.07
2:1	50	5.64	7.97	9.76	11.27	12.60	13.81	14.91	15.94	16.91	17.82	21.83	25.21	28.18	30.87	33.34	35.65	37.81	39.85	43.66	47.16	50.41	53.47	56.36
	55	6.48	9.16	11.22	12.96	14.48	15.87	17.14	18.32	19.43	20.48	25.09	28.97	32.39	35.48	38.32	40.97	43.45	45.80	50.18	54.20	57.94	61.45	64.78
1¾:1	57	6.82	9.64	11.80	13.63	15.24	16.69	18.03	19.28	20.45	21.55	26.40	30.48	34.08	37.33	40.32	43.10	45.72	48.19	52.79	57.02	60.96	64.66	68.15
	60	7.32	10.35	12.68	14.64	16.37	17.93	19.37	20.71	21.96	23.15	28.35	32.74	36.60	40.10	43.31	46.30	49.11	51.77	56.71	61.25	65.48	69.45	73.21
1½:1	66.7	8.44	11.93	14.61	16.88	18.87	20.67	22.32	23.87	25.31	26.68	32.68	37.74	42.19	46.22	49.92	53.37	56.60	59.66	65.36	70.60	75.47	80.05	84.38
	70	8.98	12.70	15.55	17.96	20.08	21.99	23.75	25.39	26.93	28.39	34.77	40.15	44.89	49.17	53.11	56.78	60.23	63.48	69.54	75.12	80.30	85.17	89.78
	75	9.78	13.83	16.94	19.56	21.87	23.95	25.87	27.66	29.34	30.92	37.87	43.73	48.89	53.56	57.85	61.85	65.60	69.15	75.75	81.82	87.46	92.77	97.79
1¼:1	80	10.55	14.93	18.28	21.11	23.60	25.85	27.93	29.85	31.66	33.38	40.88	47.20	52.77	57.81	62.44	66.75	70.80	74.63	81.76	88.31	94.41	100.13	105.55
	85	11.30	15.98	19.58	22.61	25.27	27.69	29.90	31.97	33.91	35.74	43.78	50.55	56.51	61.91	66.87	71.48	75.82	79.92	87.55	94.57	101.09	107.23	113.03
	90	12.02	17.00	20.82	24.04	26.88	29.44	31.80	34.00	36.06	38.01	46.55	53.76	60.10	65.84	71.11	76.02	80.63	84.99	93.11	100.57	107.51	114.03	120.20
	95	12.71	17.97	22.01	25.41	28.41	31.12	33.62	35.94	38.12	40.18	49.21	56.82	63.53	69.59	75.17	80.36	85.23	89.84	98.42	106.30	113.64	120.54	127.06
1:1	100	13.36	18.89	23.14	26.72	29.87	32.72	35.34	37.78	40.08	42.24	51.74	59.74	66.79	73.17	79.03	84.49	89.61	94.46	103.48	111.77	119.48	126.73	133.59

RISER TYPE SPILLWAY HYDRAULICS

WEIR FLOW: Q=CL(H)**3/2 C= 3.27+0.4H/W

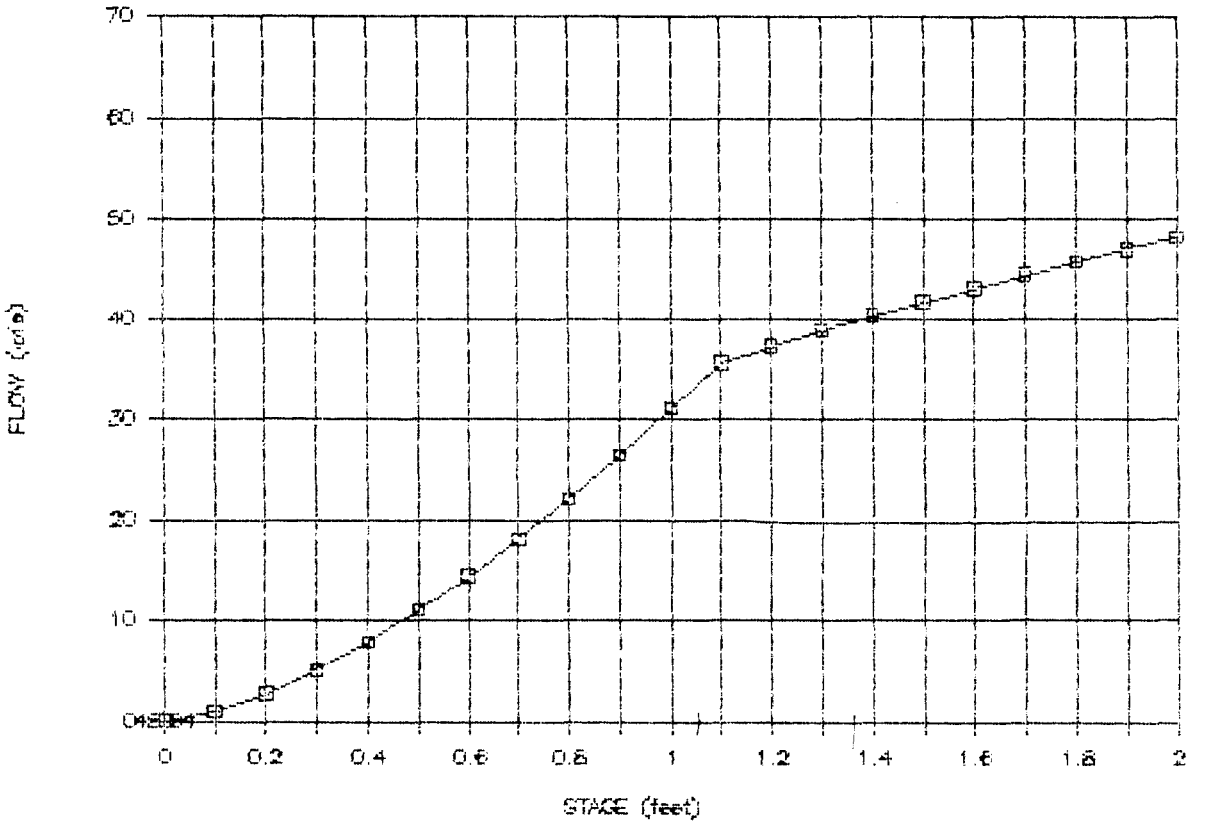
ORIFICE FLOW: Q=C'A(2gH)**1/2 C'= 0.6

D= 3

A (FT2) 7.065

STAGE	WEIR FLOW C	WEIR FLOW Q (CFS)	ORIFICE FLOW Q (CFS)	CONTOLLIN Q (CFS)
0	3.27	0	0	0
0.1	3.274	0.98	10.76	0.98
0.2	3.278	2.76	15.21	2.76
0.3	3.283	5.08	18.63	5.08
0.4	3.287	7.83	21.51	7.83
0.5	3.291	10.96	24.05	10.96
0.6	3.295	14.43	26.35	14.43
0.7	3.300	18.20	28.46	18.20
0.8	3.304	22.27	30.43	22.27
0.9	3.308	26.61	32.27	26.61
1	3.312	31.20	34.02	31.20
1.1	3.317	36.05	35.68	35.68
1.2	3.321	41.12	37.26	37.26
1.3	3.325	46.43	38.79	38.79
1.4	3.329	51.95	40.25	40.25
1.5	3.334	57.69	41.66	41.66
1.6	3.338	63.64	43.03	43.03
1.7	3.342	69.78	44.35	44.35
1.8	3.346	76.13	45.64	45.64
1.9	3.351	82.66	46.89	46.89
2	3.355	89.39	48.11	48.11
2.1	3.359	96.30	49.30	49.30
2.2	3.363	103.39	50.46	50.46
2.3	3.368	110.66	51.59	51.59
2.4	3.372	118.10	52.70	52.70
2.5	3.376	125.71	53.79	53.79
2.6	3.380	133.50	54.85	54.85
2.7	3.385	141.45	55.90	55.90
2.8	3.389	149.57	56.92	56.92
2.9	3.393	157.85	57.93	57.93
3	3.397	166.29	58.92	58.92
3.1	3.402	174.90	59.89	59.89
3.2	3.406	183.66	60.85	60.85
3.3	3.410	192.57	61.80	61.80
3.4	3.414	201.64	62.73	62.73

36-INCH CMP RISER SPILLWAY



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FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

Cottonwood/Wilberg Mine Portal Site
Disturbed Area Runoff Control Facilities
10-year 6-hours storm event

HEC-1 INPUT

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

   1           ID    UP&L Mining - Wilberg Mine Portal Facilities
   2           ID    10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
   3           ID    by gjp Hansen, Allen & Luce  May 1989
FREE ***
               *DIAGRAM
   4           IT      1      0      0    300
   5           IO      3

   6           KK   DA-1
   7           BA  .0088
   8           PB   1.51
   9           IN    30.
  10           PI     0.   .035   .045   .055   .095    .37     .1    .18   .055    .05
  11           PI    .04    .04   .035
  12           LS      0   91.1     0.
  13           UD   .064

  14           KK   CD-1 ROUTE THROUGH CULVERT
  15           RK   100.    1.0   .015          CIRC      2

  16           KK  ROUTE ROUTE THROUGH SURFACE DITCH
  17           RK   340.    .02   .025          TRAP      1      2

  18           KK   DA-2
  19           BA .00403
  20           PB   1.51
  21           LS      0     91      0
  22           UD   .067

  23           KK   CD-2 ROUTE THROUGH CULVERT
  24           RK   175.    .71   .015          CIRC    1.5

  25           KK  ROUTE ROUTE THROUGH SURFACE DITCH
  26           RK   260.    .02   .025          TRAP      1      2

  27           KK   DA-3
  28           BA  .0022
  29           PB   1.51
  30           LS      0     89      0
  31           UD   .065

  32           KK   CD-3 ROUTE THROUGH CULVERT
  33           RK    75.    .77   .015          CIRC    1.5

  34           KK  ROUTE ROUTE THROUGH SURFACE DITCH
  35           RK   400.    .02   .025          TRAP      1      2

  36           KK   DA-4
```

```
 37        BA   .0046
 38        PB    1.51
 39        LS       0      92       0
 40        UD     .05
                                HEC-1 INPUT

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


 41        KK    CD-4  COMBINE AT CULVERT CD-4
 42        HC       4

 43        KK    CD-4 ROUTE THROUGH CULVERT
 44        RK    154.     .19    .015          CIRC       2

 45        KK    DA-5
 46        BA  .00022
 47        PB    1.51
 48        LS       0      96       0
 49        UD     .05

 50        KK COMBINEAT CULVERT CD-5
 51        HC       2

 52        KK    CD-5 ROUTE THROUGH CULVERT
 53        RK     75.     .77    .015          CIRC       2

 54        KK    DA-6
 55        BA  .00648
 56        PB    1.51
 57        LS       0      82       0
 58        UD    .063

 59        KK COMBINEAT CULVERT CD-6
 60        HC       2

 61        KK    CD-6 ROUTE THROUGH CULVERT
 62        RK    140.     .36    .015          CIRC       2

 63        KK    DA-7
 64        BA  .00275
 65        PB    1.51
 66        LS       0      92       0
 67        UD    .059

 68        KK    DA-8
 69        BA  .00022
 70        PB    1.51
 71        LS       0      98       0
 72        UD     .05

 73        KK COMBINEAT CULVERT CD-8
```

```
 74        HC      2

 75        KK   CD-8 ROUTE THROUGH CULVERT
 76        RK   120.     .33    .015          CIRC    1.33

 77        KK COMBINEAT CULVERT CD-8
 78        HC      2
1                                HEC-1 INPUT

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


 79        KK   CD-8 ROUTE THROUGH CULVERT
 80        RK   160.     .03    .015          CIRC     2.5

 81        KK   DA-9
 82        BA  .00389
 83        PB   1.51
 84        LS      0      89       0
 85        UD   .079

 86        KK COMBINEAT CULVERT CD-9
 87        HC      2

 88        KK   CD-9 ROUTE THROUGH CULVERT
 89        RK   120.     .33    .015          CIRC     2.5

 90        KK  DA-10
 91        BA  .00075
 92        PB   1.51
 93        LS      0      92       0
 94        UD    .05

 95        KK COMBINEAT CULVERT CD-10
 96        HC      2

 97        KK  CD-10 ROUTE THROUGH CULVERT
 98        RK   105.     .31    .015          CIRC     2.5

 99        KK  DA-11
100        BA  .0019
101        PB   1.51
102        LS      0    92.8       0
103        UD    .05

104        KK COMBINEAT CULVERT CD-11
105        HC      2

106        KK  CD-11 ROUTE THROUGH CULVERT
107        RK   300.    .066    .015          CIRC     2.5

108        KK  DA-12
```

```
109        BA  .00048
110        PB    1.51
111        LS       0      98       0
112        UD    .065

113        KK   CD-12 ROUTE THROUGH CULVERT
114        RK     95.     .26    .015          CIRC     1.2

115        KK   DA-13
116        BA  .00016
117        PB    1.51
118        LS       0      98       0
119        UD     .05
```

HEC-1 INPUT

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


120        KK   CD-13 ROUTE THROUGH CULVERT
121        RK    100.     .06    .015          CIRC    1.33

122        KK   DA-14
123        BA  .00113
124        PB    1.51
125        LS       0      92       0
126        UD    .056

127        KK   CD-14 ROUTE THROUGH CULVERT
128        RK     60.     .16    .015          CIRC     1.2

129        KK   DA-17
130        BA  .00141
131        PB    1.51
132        LS       0    88.5       0
133        UD    .107

134        KK   NORTHCOMBINE AT NORTH POND
135        KO       1
136        HC       5

137        KK   DA-15
138        BA  .00045
139        PB    1.51
140        LS       0      98       0
141        UD     .05

142        KK   CD-15 ROUTE THROUGH CULVERT
143        RK     50.     .15    .015          CIRC       1

144        KK   DA-16
145        BA  .00031
146        PB    1.51
```

```
147          LS      0     98      0
148          UD    .05

149          KK   CD-16 ROUTE THROUGH CULVERT
150          RK    40.     .15    .015          CIRC      1

151          KK   DA-18
152          BA  .00134
153          PB   1.51
154          LS      0     88      0
155          UD   .062

156          KK   SOUTHCOMBINE AT SOUTH POND
157          KO      1
158          HC      4
159          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

  6        DA-1
             V
             V
 14        CD-1
             V
             V
 16       ROUTE
             .
             .
 18          .       DA-2
             .         V
             .         V
 23          .       CD-2
             .         V
             .         V
 25          .      ROUTE
             .         .
             .         .
 27          .         .       DA-3
             .         .         V
             .         .         V
 32          .         .       CD-3
             .         .         V
             .         .         V
 34          .         .      ROUTE
             .         .         .
             .         .         .
 36          .         .         .       DA-4
             .         .         .         .
```

```
          .         .         .         .
41      CD-4.................................
          V
          V
43      CD-4
          .
          .
45        .       DA-5
          .         .
          .         .
50    COMBINE............
          V
          V
52      CD-5
          .
          .
54        .       DA-6
          .         .
          .         .
59    COMBINE............
          V
          V
61      CD-6
          .
          .
63        .       DA-7
          .         .
          .         .
68        .         .       DA-8
          .         .         .
          .         .         .
73        .    COMBINE............
          .         V
          .         V
75        .       CD-8
          .         .
          .         .
77    COMBINE............
          V
          V
79      CD-8
          .
          .
81        .       DA-9
          .         .
          .         .
86    COMBINE............
          V
          V
88      CD-9
          .
          .
```

```
 90         .      DA-10
            .         .
            .         .
 95    COMBINE...........
            V
            V
 97      CD-10
            .
            .
 99         .      DA-11
            .         .
            .         .
104    COMBINE...........
            V
            V
106      CD-11
            .
            .
108         .      DA-12
            .         V
            .         V
113         .      CD-12
            .         .
            .         .
115         .         .     DA-13
            .         .        V
            .         .        V
120         .         .     CD-13
            .         .         .
            .         .         .
122         .         .         .     DA-14
            .         .         .        V
            .         .         .        V
127         .         .         .     CD-14
            .         .         .         .
            .         .         .         .
129         .         .         .         .     DA-17
            .         .         .         .         .
            .         .         .         .         .
134      NORTH.........................................
            .
            .
137         .      DA-15
            .         V
            .         V
142         .      CD-15
            .         .
            .         .
144         .         .     DA-16
            .         .        V
            .         .        V
149         .         .     CD-16
```

```
          .         .         .
          .         .         .
 151      .         .         .      DA-18
          .         .         .         .
          .         .         .         .
 156   SOUTH.................................

*) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                    ****
                     FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
        U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                     ****

                    UP&L Mining - Wilberg Mine Portal Facilities
                    10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
                    by gjp Hansen, Allen & Luce  May 1989

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

   IT       HYDROGRAPH TIME DATA
                  NMIN          1  MINUTES IN COMPUTATION INTERVAL
                 IDATE     1    0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE     1    0  ENDING DATE
                NDTIME       0459  ENDING TIME

            COMPUTATION INTERVAL     .02 HOURS
                 TOTAL TIME BASE    4.98 HOURS

      ENGLISH UNITS


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

       **************
       *            *
 6 KK  *     DA-1   *
       *            *
       **************

 9 IN       TIME DATA FOR INPUT TIME SERIES
                 JXMIN         30  TIME INTERVAL IN MINUTES
                JXDATE     1    0  STARTING DATE
```

JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

7 BA SUBBASIN CHARACTERISTICS

TAREA .01 SUBBASIN AREA

PRECIPITATION DATA

8 PB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

12 LS SCS LOSS RATE

STRTL .20 INITIAL ABSTRACTION

CRVNBR 91.10 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

13 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .06 LAG

***

```
                                        UNIT HYDROGRAPH
                                     21 END-OF-PERIOD ORDINATES
          7.      24.      47.      58.      56.      47.      32.      21.      15.      10.
          7.       5.       3.       2.       2.       1.       1.       1.       0.       0.
          0.

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

                 HYDROGRAPH AT STATION     DA-1

 TOTAL RAINFALL =    1.51, TOTAL LOSS =     .76, TOTAL EXCESS =     .75

PK FLOW    TIME                        MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR     4.98-HR
+ (CFS)     (HR)
                  (CFS)
+    4.     3.00                 1.         1.         1.         1.
                (INCHES)       .743       .743       .743       .743
                 (AC-FT)        0.         0.         0.         0.

                CUMULATIVE AREA =     .01 SQ MI


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


       ##############
       #            #
 14 KK #     CD-1   #     ROUTE THROUGH CULVERT
       #            #
       ##############

         HYDROGRAPH ROUTING DATA

 5 RK        KINEMATIC WAVE STREAM ROUTING
                   L       100.  CHANNEL LENGTH
                   S     1.0000  SLOPE
                   N       .015  CHANNEL ROUGHNESS COEFFICIENT
                  CA        .00  CONTRIBUTING AREA
               SHAPE       CIRC  CHANNEL SHAPE
                  WD       2.00  BOTTOM WIDTH OR DIAMETER
                   Z        .00  SIDE SLOPE

                                                  ***


    KINEMATIC STREAM ROUTING USED FOR THIS REACH
```

```
COMPUTED KINEMATIC PARAMETERS
   ALPHA       M      DT (MIN)   DX (FT)
 60.1640   1.250        .50      50.00

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

                HYDROGRAPH AT STATION     CD-1

K FLOW    TIME                        MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)   (HR)
                   (CFS)
+   4.    3.00                1.         1.         1.         1.
                (INCHES)     .743       .743       .743       .743
                 (AC-FT)      0.         0.         0.         0.

                CUMULATIVE AREA =     .01 SQ MI


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


        **************
        *            *
 6 RK   *    ROUTE   *     ROUTE THROUGH SURFACE DITCH
        *            *
        **************

          HYDROGRAPH ROUTING DATA

 7 RK       KINEMATIC WAVE STREAM ROUTING
                  L       340.  CHANNEL LENGTH
                  S      .0200  SLOPE
                  N       .025  CHANNEL ROUGHNESS COEFFICIENT
                 CA        .00  CONTRIBUTING AREA
              SHAPE       TRAP  CHANNEL SHAPE
                 WD       1.00  BOTTOM WIDTH OR DIAMETER
                  Z       2.00  SIDE SLOPE

                                                   ***

    KINEMATIC STREAM ROUTING USED FOR THIS REACH


    COMPUTED KINEMATIC PARAMETERS
       ALPHA       M      DT (MIN)   DX (FT)
     3.8526   1.338        .50     170.00
```

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

HYDROGRAPH AT STATION ROUTE

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
4.	3.02		1.	1.	1.	1.
		(INCHES)	.740	.740	.740	.740
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .01 SQ MI

*** ***

```
8 KK    ##############
        #            #
        #     DA-2   #
        #            #
        ##############
```

SUBBASIN RUNOFF DATA

19 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

0 PS STORM 1.51 BASIN TOTAL PRECIPITATION

0 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

```
21 LS        SCS LOSS RATE
                 STRTL        .20  INITIAL ABSTRACTION
                CRVNBR      91.00  CURVE NUMBER
                 RTIMP        .00  PERCENT IMPERVIOUS AREA

22 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .07  LAG

                                  ***

                                 UNIT HYDROGRAPH
                              22 END-OF-PERIOD ORDINATES
          3.     10.     20.     25.     25.     22.     16.     11.      7.      5.
          4.      3.      2.      1.      1.      1.      0.      0.      0.      0.
          0.      0.

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

                HYDROGRAPH AT STATION     DA-2

 TOTAL RAINFALL =    1.51, TOTAL LOSS =     .76, TOTAL EXCESS =     .75

 PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR      72-HR     4.98-HR
+ (CFS)        (HR)
                     (CFS)
+    2.       3.00                 0.         0.         0.         0.
                   (INCHES)      .737       .737       .737       .737
                   (AC-FT)        0.         0.         0.         0.

                 CUMULATIVE AREA =     .00 SQ MI
```

*** ***

```
        ***************
        *             *
 23 KK  *     CD-2    *     ROUTE THROUGH CULVERT
        *             *
        ***************

          HYDROGRAPH ROUTING DATA

 4 RK        KINEMATIC WAVE STREAM ROUTING
                    L       175.  CHANNEL LENGTH
                    S      .7100  SLOPE
                    N       .015  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                SHAPE       CIRC  CHANNEL SHAPE
                   WD       1.50  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                   ***


    KINEMATIC STREAM ROUTING USED FOR THIS REACH


     COMPUTED KINEMATIC PARAMETERS
        ALPHA       M      DT (MIN)   DX (FT)
      48.3217   1.250        .50      87.50

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

                 HYDROGRAPH AT STATION    CD-2

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR     4.98-HR
+ (CFS)      (HR)
                  (CFS)
+     2.     3.00                 0.         0.         0.         0.
                (INCHES)       .737       .737       .737       .737
                 (AC-FT)         0.         0.         0.         0.

                CUMULATIVE AREA =     .00 SQ MI


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

        ***************
        *             *
```

```
25 KK    *     ROUTE  *     ROUTE THROUGH SURFACE DITCH
         *            *
         **************

           HYDROGRAPH ROUTING DATA

26 RK         KINEMATIC WAVE STREAM ROUTING
                     L       260.  CHANNEL LENGTH
                     S      .0200  SLOPE
                     N       .025  CHANNEL ROUGHNESS COEFFICIENT
                    CA        .00  CONTRIBUTING AREA
                 SHAPE       TRAP  CHANNEL SHAPE
                    WD       1.00  BOTTOM WIDTH OR DIAMETER
                     Z       2.00  SIDE SLOPE

                                                          ***


      KINEMATIC STREAM ROUTING USED FOR THIS REACH



      COMPUTED KINEMATIC PARAMETERS
         ALPHA       M      DT (MIN)   DX (FT)
        3.8526    1.338        .50     130.00

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

                   HYDROGRAPH AT STATION    ROUTE

PEAK FLOW    TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR      24-HR      72-HR     4.98-HR
+ (CFS)      (HR)
                        (CFS)
+     2.     3.02                 0.         0.         0.         0.
                      (INCHES)   .733       .733       .733       .733
                       (AC-FT)     0.         0.         0.         0.

                      CUMULATIVE AREA =     .00 SQ MI


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

         **************
         *            *
 27 KK   *     DA-3   *
         *            *
         **************
```

SUBBASIN RUNOFF DATA

28 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

29 PB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

60 LS SCS LOSS RATE

STRTL .25 INITIAL ABSTRACTION

CRVNBR 89.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

31 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .06 LAG

***

UNIT HYDROGRAPH

21 END-OF-PERIOD ORDINATES

2.	6.	11.	14.	14.	12.	8.	5.	4.	3.
2.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.									

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

HYDROGRAPH AT STATION DA-3

TOTAL RAINFALL = 1.51, TOTAL LOSS = .87, TOTAL EXCESS = .64

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
1.	3.00		0.	0.	0.	0.
		(INCHES)	.628	.628	.628	.628
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

32 KK ********** * CD-3 * ROUTE THROUGH CULVERT **********

HYDROGRAPH ROUTING DATA

33 RK KINEMATIC WAVE STREAM ROUTING

L	75.	CHANNEL LENGTH
S	.7700	SLOPE
N	.015	CHANNEL ROUGHNESS COEFFICIENT
CA	.00	CONTRIBUTING AREA
SHAPE	CIRC	CHANNEL SHAPE
WD	1.50	BOTTOM WIDTH OR DIAMETER
Z	.00	SIDE SLOPE

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
50.3221	1.250	.50	37.50

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

HYDROGRAPH AT STATION CD-3

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
1.	3.02		0.	0.	0.	0.
		(INCHES)	.628	.628	.628	.628
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

```
34 KK    ##############
         #            #
         #    ROUTE   #     ROUTE THROUGH SURFACE DITCH
         #            #
         ##############
```

HYDROGRAPH ROUTING DATA

35 RK KINEMATIC WAVE STREAM ROUTING

L	400.	CHANNEL LENGTH
S	.0200	SLOPE
N	.025	CHANNEL ROUGHNESS COEFFICIENT
CA	.00	CONTRIBUTING AREA
SHAPE	TRAP	CHANNEL SHAPE
WD	1.00	BOTTOM WIDTH OR DIAMETER
Z	2.00	SIDE SLOPE

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
3.8526	1.338	.50	133.33

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

HYDROGRAPH AT STATION ROUTE

PK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
+ 1.	3.03		0.	0.	0.	0.
		(INCHES)	.622	.622	.622	.622
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

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        ##############
        #            #
 36 KK  #     DA-4   #
        #            #
        ##############
```

SUBBASIN RUNOFF DATA

37 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

38 PB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

39 LS SCS LOSS RATE

STRTL	.17	INITIAL ABSTRACTION
CRVNBR	92.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

0 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.05	LAG

***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
17 END-OF-PERIOD ORDINATES

7.	23.	37.	37.	29.	17.	11.	7.	4.	3.
2.	1.	1.	0.	0.	0.	0.			

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

HYDROGRAPH AT STATION DA-4

TOTAL RAINFALL = 1.51, TOTAL LOSS = .70, TOTAL EXCESS = .81

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
2.	3.00		0.	0.	0.	0.
		(INCHES)	.801	.801	.801	.801
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

```
              **************
              *            *
 41 KK        *     CD-4   *       COMBINE AT CULVERT CD-4
              *            *
              **************

 42 HC              HYDROGRAPH COMBINATION
                         ICOMP           4  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                   ***

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

                              HYDROGRAPH AT STATION     CD-4

  EAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR       4.98-HR
+   (CFS)       (HR)
                          (CFS)
+       9.      3.02                 2.          2.          2.           2.
                        (INCHES)   .739        .739        .739         .739
                         (AC-FT)     1.          1.          1.           1.

                         CUMULATIVE AREA =      .02 SQ MI


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

              **************
              *            *
 43 KK        *     CD-4   *      ROUTE THROUGH CULVERT
              *            *
              **************

                HYDROGRAPH ROUTING DATA

 44 RK            KINEMATIC WAVE STREAM ROUTING
                            L        154.  CHANNEL LENGTH
                            S       .1900  SLOPE
                            N        .015  CHANNEL ROUGHNESS COEFFICIENT
                           CA         .00  CONTRIBUTING AREA
                        SHAPE        CIRC  CHANNEL SHAPE
                           WD        2.00  BOTTOM WIDTH OR DIAMETER
                            Z         .00  SIDE SLOPE

                                                                  ***
```

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
26.2249	1.250	.50	77.00

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

HYDROGRAPH AT STATION CD-4

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
9.	3.02		2.	2.	2.	2.
		(INCHES)	.739	.739	.739	.739
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .02 SQ MI

*** ***

```
            **************
            *            *
5 KK        *     DA-5   *
            *            *
            **************
```

SUBBASIN RUNOFF DATA

6 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

47 PB STORM 1.51 BASIN TOTAL PRECIPITATION

0 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

8 LS SCS LOSS RATE

STRTL	.08	INITIAL ABSTRACTION
CRVNBR	96.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

49 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.05	LAG

***

NING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
17 END-OF-PERIOD ORDINATES

0.	1.	2.	2.	1.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.			

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

HYDROGRAPH AT STATION DA-5

TOTAL RAINFALL = 1.51, TOTAL LOSS = .41, TOTAL EXCESS = 1.10

K FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
0.	3.00		0.	0.	0.	0.
		(INCHES)	1.094	1.094	1.094	1.094

```
                (AC-FT)       0.         0.         0.         0.

                CUMULATIVE AREA =     .00 SQ MI


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

        **************
        *            *
 50 KK  *  COMBINE   *    AT CULVERT CD-5
        *            *
        **************

 51 HC        HYDROGRAPH COMBINATION
                   ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

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

                  HYDROGRAPH AT STATION  COMBINE

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR      72-HR     4.98-HR
+ (CFS)       (HR)
                        (CFS)
+     9.      3.02                 2.         2.         2.         2.
                       (INCHES)   .743       .743       .743       .743
                        (AC-FT)     1.         1.         1.         1.

                CUMULATIVE AREA =     .02 SQ MI


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

        **************
        *            *
 52 KK  *     CD-5   *     ROUTE THROUGH CULVERT
        *            *
        **************

          HYDROGRAPH ROUTING DATA

 53 RK        KINEMATIC WAVE STREAM ROUTING
                         L        75.  CHANNEL LENGTH
                         S      .7700  SLOPE
```

```
                N        .015  CHANNEL ROUGHNESS COEFFICIENT
               CA         .00  CONTRIBUTING AREA
            SHAPE        CIRC  CHANNEL SHAPE
               WD        2.00  BOTTOM WIDTH OR DIAMETER
                Z         .00  SIDE SLOPE

                                                  ***

KINEMATIC STREAM ROUTING USED FOR THIS REACH


COMPUTED KINEMATIC PARAMETERS
   ALPHA       M      DT (MIN)   DX (FT)
  52.7937   1.250        .50      37.50

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

              HYDROGRAPH AT STATION     CD-5

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)      (HR)
                 (CFS)
+     9.     3.02              2.         2.         2.         2.
             (INCHES)       .743       .743       .743       .743
              (AC-FT)         1.         1.         1.         1.

              CUMULATIVE AREA =     .02 SQ MI


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

        **************
        *            *
 54 KK  *     DA-6   *
        *            *
        **************

          SUBBASIN RUNOFF DATA

 55 BA        SUBBASIN CHARACTERISTICS
                   TAREA        .01  SUBBASIN AREA

              PRECIPITATION DATA

 56 PB             STORM       1.51  BASIN TOTAL PRECIPITATION
```

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

7 LS SCS LOSS RATE

STRTL	.44	INITIAL ABSTRACTION
CRVNBR	82.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

38 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.06	LAG

***

UNIT HYDROGRAPH
21 END-OF-PERIOD ORDINATES

6.	18.	36.	44.	42.	34.	23.	15.	11.	7.
5.	3.	2.	2.	1.	1.	1.	0.	0.	0.
0.									

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

HYDROGRAPH AT STATION DA-6

```
TOTAL RAINFALL =   1.51, TOTAL LOSS =   1.16, TOTAL EXCESS =    .35

K FLOW    TIME                    MAXIMUM AVERAGE FLOW
                            6-HR      24-HR      72-HR     4.98-HR
+ (CFS)    (HR)
                   (CFS)
+   1.     3.02              0.         0.         0.         0.
                (INCHES)    .344       .344       .344       .344
                 (AC-FT)     0.         0.         0.         0.

                CUMULATIVE AREA =    .01 SQ MI


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


        **************
        *            *
 59 KK  *  COMBINE   *    AT CULVERT CD-6
        *            *
        **************

 60 HC        HYDROGRAPH COMBINATION
                 ICOMP         2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

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

                 HYDROGRAPH AT STATION  COMBINE

K FLOW    TIME                    MAXIMUM AVERAGE FLOW
                            6-HR      24-HR      72-HR     4.98-HR
+ (CFS)    (HR)
                   (CFS)
+  10.     3.02              2.         2.         2.         2.
                (INCHES)    .645       .645       .645       .645
                 (AC-FT)     1.         1.         1.         1.

                CUMULATIVE AREA =    .03 SQ MI


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


        **************
        *            *
 61 KK  *     CD-6   *    ROUTE THROUGH CULVERT
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*          *
**************

  HYDROGRAPH ROUTING DATA

62 RK        KINEMATIC WAVE STREAM ROUTING
                    L       140.  CHANNEL LENGTH
                    S      .3600  SLOPE
                    N       .015  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                SHAPE       CIRC  CHANNEL SHAPE
                   WD       2.00  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                    ***

 KINEMATIC STREAM ROUTING USED FOR THIS REACH


 COMPUTED KINEMATIC PARAMETERS
    ALPHA       M      DT (MIN)   DX (FT)
  36.0984   1.250        .50      70.00

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

              HYDROGRAPH AT STATION    CD-6

AK FLOW    TIME                     MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)    (HR)
                  (CFS)
+   10.    3.02                 2.         2.         2.         2.
               (INCHES)      .645       .645       .645       .645
                (AC-FT)        1.         1.         1.         1.

               CUMULATIVE AREA =    .03 SQ MI


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

          **************
          *          *
3 NX      *     DA-7 *
          *          *
          **************

  SUBBASIN RUNOFF DATA
```

64 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

5 FB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

6 LS SCS LOSS RATE

STRTL .17 INITIAL ABSTRACTION

CRVNBR 92.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

67 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .06 LAG

***

UNIT HYDROGRAPH

20 END-OF-PERIOD ORDINATES

3.	9.	17.	20.	18.	14.	9.	6.	4.	3.
2.	1.	1.	1.	0.	0.	0.	0.	0.	0.

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

HYDROGRAPH AT STATION DA-7

TOTAL RAINFALL = 1.51, TOTAL LOSS = .70, TOTAL EXCESS = .81

AK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1.	3.00		0.	0.	0.	0.
		(INCHES)	.799	.799	.799	.799
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

68 KK

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**************
*            *
*     DA-8   *
*            *
**************
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SUBBASIN RUNOFF DATA

49 BA

SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

70 PB

STORM 1.51 BASIN TOTAL PRECIPITATION

0 PI

INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

1 LS SCS LOSS RATE

STRTL	.04	INITIAL ABSTRACTION
CRVNBR	98.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

72 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.05	LAG

***

NING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
17 END-OF-PERIOD ORDINATES

0.	1.	2.	2.	1.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.			

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

HYDROGRAPH AT STATION DA-8

TOTAL RAINFALL = 1.51, TOTAL LOSS = .22, TOTAL EXCESS = 1.29

AK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
0.	3.00		0.	0.	0.	0.
		(INCHES)	1.280	1.280	1.280	1.280
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
73 KK     *  COMBINE   *     AT CULVERT CD-8
          *            *
          **************

74 HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

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

                  HYDROGRAPH AT STATION  COMBINE

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR      72-HR      4.98-HR
+  (CFS)     (HR)
                       (CFS)
+    2.      3.00                 0.         0.         0.         0.
                     (INCHES)    .835       .835       .835       .835
                      (AC-FT)     0.         0.         0.         0.

                     CUMULATIVE AREA =     .00 SQ MI


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

          **************
          *            *
75 KK     *     CD-8   *     ROUTE THROUGH CULVERT
          *            *
          **************

            HYDROGRAPH ROUTING DATA

76 RK        KINEMATIC WAVE STREAM ROUTING
                       L       120.  CHANNEL LENGTH
                       S      .3300  SLOPE
                       N       .015  CHANNEL ROUGHNESS COEFFICIENT
                      CA        .00  CONTRIBUTING AREA
                   SHAPE       CIRC  CHANNEL SHAPE
```

```
                    WD        1.33  BOTTOM WIDTH OR DIAMETER
                     Z         .00  SIDE SLOPE

                                                   ***

    KINEMATIC STREAM ROUTING USED FOR THIS REACH


     COMPUTED KINEMATIC PARAMETERS
        ALPHA       M      DT (MIN)   DX (FT)
      32.2897   1.250        .50      60.00

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

                 HYDROGRAPH AT STATION    CD-8

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR     4.98-HR
+ (CFS)       (HR)
                     (CFS)
+     2.      3.00                0.         0.         0.         0.
                  (INCHES)      .834       .834       .834       .834
                   (AC-FT)        0.         0.         0.         0.

                 CUMULATIVE AREA =     .00 SQ MI


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

        **************
        *            *
 7 KK   *  COMBINE   *    AT CULVERT CD-8
        *            *
        **************

 8 HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

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

                 HYDROGRAPH AT STATION  COMBINE

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR     4.98-HR
+ (CFS)       (HR)
```

```
                    (CFS)
+    12.     3.02                3.        3.        3.        3.
                 (INCHES)      .664      .664      .664      .664
                  (AC-FT)       1.        1.        1.        1.

                 CUMULATIVE AREA =     .03 SQ MI


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


        **************
        *            *
 79 KK  *     CD-8   *     ROUTE THROUGH CULVERT
        *            *
        **************

          HYDROGRAPH ROUTING DATA

 80 RK        KINEMATIC WAVE STREAM ROUTING
                    L       160.  CHANNEL LENGTH
                    S      .0300  SLOPE
                    N       .015  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                SHAPE       CIRC  CHANNEL SHAPE
                   WD       2.50  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                  ***


     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
         ALPHA       M      DT (MIN)   DX (FT)
        10.8156   1.250        .50      80.00

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

                 HYDROGRAPH AT STATION     CD-8

 PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR      24-HR      72-HR     4.98-HR
+ (CFS)        (HR)
                    (CFS)
+    12.     3.02                3.        3.        3.        3.
                 (INCHES)      .663      .663      .663      .663
                  (AC-FT)       1.        1.        1.        1.
```

CUMULATIVE AREA = .03 SQ MI

*** ***

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        **************
        *            *
 B1 KK  *     DA-9   *
        *            *
        **************
```

SUBBASIN RUNOFF DATA

B2 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

B3 PB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

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          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
          .00      .00      .00      .00      .00      .00      .00      .00      .00

84 LS        SCS LOSS RATE
                 STRTL        .25  INITIAL ABSTRACTION
                CRVNBR      89.00  CURVE NUMBER
                 RTIMP        .00  PERCENT IMPERVIOUS AREA

85 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .08  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                            26 END-OF-PERIOD ORDINATES
          2.       6.      13.      19.      21.      21.      18.      14.      10.       7.
          5.       4.       3.       2.       2.       1.       1.       1.       0.       0.
          0.       0.       0.       0.       0.       0.

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

                 HYDROGRAPH AT STATION     DA-9

 TOTAL RAINFALL =    1.51, TOTAL LOSS =     .87, TOTAL EXCESS =     .64

PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR      72-HR     4.98-HR
+  (CFS)      (HR)
                      (CFS)
+    2.       3.02                  0.         0.         0.         0.
                     (INCHES)     .626       .626       .626       .626
                     (AC-FT)        0.         0.         0.         0.

                     CUMULATIVE AREA =     .00 SQ MI


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


          ************
          *          *
86 KK     *  COMBINE *     AT CULVERT CD-9
          *          *
          ************

87 HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***
```

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

                HYDROGRAPH AT STATION  COMBINE

PEAK FLOW    TIME                    MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)      (HR)
                   (CFS)
+   13.      3.02                3.         3.         3.         3.
                (INCHES)      .659       .659       .659       .659
                 (AC-FT)       1.         1.         1.         1.

                CUMULATIVE AREA =     .03 SQ MI


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

        **************
        *            *
8 KK    *     CD-9   *     ROUTE THROUGH CULVERT
        *            *
        **************

          HYDROGRAPH ROUTING DATA

9 RK         KINEMATIC WAVE STREAM ROUTING
                    L       120.  CHANNEL LENGTH
                    S      .3300  SLOPE
                    N       .015  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                SHAPE       CIRC  CHANNEL SHAPE
                   WD       2.50  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                        ***


     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
         ALPHA       M      DT (MIN)   DX (FT)
       35.8711    1.250        .50      60.00

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

                HYDROGRAPH AT STATION    CD-9
```

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
+ 13.	3.02		3.	3.	3.	3.
		(INCHES)	.659	.659	.659	.659
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .03 SQ MI

*** ***

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        ##############
        #            #
70 KK   #    DA-10   #
        #            #
        ##############
```

SUBBASIN RUNOFF DATA

91 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

72 PB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

```
3 LS        SCS LOSS RATE
                STRTL        .17  INITIAL ABSTRACTION
               CRVNBR      92.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

4 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .05  LAG

                                          ***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                     UNIT HYDROGRAPH
                                  17 END-OF-PERIOD ORDINATES
          1.      4.      6.      6.      5.      3.      2.      1.      1.      0.
          0.      0.      0.      0.      0.      0.      0.

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

               HYDROGRAPH AT STATION    DA-10

 TOTAL RAINFALL =    1.51, TOTAL LOSS =     .70, TOTAL EXCESS =     .81

PEAK FLOW    TIME                  MAXIMUM AVERAGE FLOW
                          6-HR       24-HR      72-HR      4.98-HR
+ (CFS)      (HR)
                  (CFS)
+    0.      3.00          0.         0.         0.          0.
              (INCHES)   .801       .801       .801        .801
               (AC-FT)     0.         0.         0.          0.

              CUMULATIVE AREA =     .00 SQ MI


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

      **************
```

```
        *           *
 95 KK  *  COMBINE  *    AT CULVERT CD-10
        *           *
        ***************

 96 HC        HYDROGRAPH COMBINATION
                   ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                  HYDROGRAPH AT STATION  COMBINE

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                              6-HR       24-HR      72-HR     4.98-HR
+ (CFS)      (HR)
                  (CFS)
+    14.     3.02                3.         3.         3.         3.
                 (INCHES)      .662       .662       .662       .662
                  (AC-FT)       1.         1.         1.         1.

                 CUMULATIVE AREA =     .03 SQ MI


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


        **************
        *           *
 97 KK  *    CD-10  *     ROUTE THROUGH CULVERT
        *           *
        **************

          HYDROGRAPH ROUTING DATA

 98 RK        KINEMATIC WAVE STREAM ROUTING
                    L       105.  CHANNEL LENGTH
                    S     -.3100  SLOPE
                    N       .015  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                 SHAPE       CIRC  CHANNEL SHAPE
                   WD       2.50  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                          ***

    KINEMATIC STREAM ROUTING USED FOR THIS REACH
```

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
34.7671	1.250	.50	52.50

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

HYDROGRAPH AT STATION CD-10

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
14.	3.02	(CFS)	3.	3.	3.	3.
		(INCHES)	.662	.662	.662	.662
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .03 SQ MI

*** ***

```
            ************
            *          *
99 KK       *    DA-11 *
            *          *
            ************
```

SUBBASIN RUNOFF DATA

0 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

101 PB STORM 1.51 BASIN TOTAL PRECIPITATION

0 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

```
102 LS        SCS LOSS RATE
                  STRTL        .16  INITIAL ABSTRACTION
                 CRVNBR      92.80  CURVE NUMBER
                  RTIMP        .00  PERCENT IMPERVIOUS AREA

103 UD        SCS DIMENSIONLESS UNITGRAPH
                  TLAG        .05  LAG

                                                   ***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                          UNIT HYDROGRAPH
                                     17 END-OF-PERIOD ORDINATES
          3.     10.     15.     15.     12.      7.      4.      3.      2.      1.
          1.      0.      0.      0.      0.      0.      0.

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

                 HYDROGRAPH AT STATION    DA-11

 TOTAL RAINFALL =    1.51, TOTAL LOSS =     .65, TOTAL EXCESS =     .86

PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     4.98-HR
 (CFS)       (HR)
                       (CFS)
    1.       3.00                 0.          0.          0.          0.
                     (INCHES)    .853        .853        .853        .853
                     (AC-FT)      0.          0.          0.          0.
```

```
                    CUMULATIVE AREA =     .00 SQ MI

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

          **************
          *            *
  KK      *  COMBINE   *     AT CULVERT CD-11
          *            *
          **************

  HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

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

                  HYDROGRAPH AT STATION  COMBINE

  K FLOW    TIME                      MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)     (HR)
                   (CFS)
+   125.    3.02                3.         3.         3.         3.
                (INCHES)      .672       .672       .672       .672
                 (AC-FT)       1.         1.         1.         1.

                    CUMULATIVE AREA =     .04 SQ MI

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

          **************
          *            *
  KK      *    CD-11   *     ROUTE THROUGH CULVERT
          *            *
          **************

        HYDROGRAPH ROUTING DATA

  RK        KINEMATIC WAVE STREAM ROUTING
                     L       300.  CHANNEL LENGTH
                     S      .0660  SLOPE
                     N       .015  CHANNEL ROUGHNESS COEFFICIENT
                    CA        .00  CONTRIBUTING AREA
```

```
                SHAPE       CIRC  CHANNEL SHAPE
                   WD       2.50  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                  ***

    KINEMATIC STREAM ROUTING USED FOR THIS REACH


     COMPUTED KINEMATIC PARAMETERS
        ALPHA       M      DT (MIN)   DX (FT)
      16.0421   1.250        .50      150.00

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

                 HYDROGRAPH AT STATION   CD-11

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR     4.98-HR
+  (CFS)     (HR)
                     (CFS)
+    15.     3.02                 3.         3.         3.         3.
                  (INCHES)      .671       .671       .671       .671
                   (AC-FT)        1.         1.         1.         1.

                  CUMULATIVE AREA =     .04 SQ MI


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


        **************
        *            *
 8 KK   *    DA-12   *
        *            *
        **************

          SUBBASIN RUNOFF DATA

 9 BA       SUBBASIN CHARACTERISTICS
                TAREA        .00  SUBBASIN AREA

           PRECIPITATION DATA

110 PB          STORM       1.51  BASIN TOTAL PRECIPITATION

 0 PI         INCREMENTAL PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

1 LS SCS LOSS RATE

STRTL	.04	INITIAL ABSTRACTION
CRVNBR	98.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

112 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.06	LAG

***

UNIT HYDROGRAPH
21 END-OF-PERIOD ORDINATES

0.	1.	2.	3.	3.	3.	2.	1.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.									

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

HYDROGRAPH AT STATION DA-12

TOTAL RAINFALL = 1.51, TOTAL LOSS = .22, TOTAL EXCESS = 1.29

```
AK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)     (HR)
                   (CFS)
+    0.     3.00                0.         0.         0.         0.
                (INCHES)     1.277      1.277      1.277      1.277
                 (AC-FT)       0.         0.         0.         0.

                 CUMULATIVE AREA =     .00 SQ MI


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


        **************
        *            *
113 RCX *    CD-12   *     ROUTE THROUGH CULVERT
        *            *
        **************

          HYDROGRAPH ROUTING DATA

114 RCX         KINEMATIC WAVE STREAM ROUTING
                         L        95.  CHANNEL LENGTH
                         S      .2600  SLOPE
                         N       .015  CHANNEL ROUGHNESS COEFFICIENT
                        CA        .00  CONTRIBUTING AREA
                     SHAPE       CIRC  CHANNEL SHAPE
                        WD       1.20  BOTTOM WIDTH OR DIAMETER
                         Z        .00  SIDE SLOPE

                                                    ***


     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
         ALPHA        M      DT (MIN)   DX (FT)
        28.1740    1.250        .50      47.50

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

                  HYDROGRAPH AT STATION    CD-12

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)     (HR)
                   (CFS)
```

```
+   0.     3.00                 0.        0.        0.        0.
                 (INCHES)    1.276     1.276     1.276     1.276
                  (AC-FT)       0.        0.        0.        0.

                 CUMULATIVE AREA =     .00 SQ MI


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


        **************
        *            *
115 KK  *    DA-13   *
        *            *
        **************

          SUBBASIN RUNOFF DATA

5 BA        SUBBASIN CHARACTERISTICS
                 TAREA        .00  SUBBASIN AREA

            PRECIPITATION DATA

117 PB           STORM       1.51  BASIN TOTAL PRECIPITATION

0 PI          INCREMENTAL PRECIPITATION PATTERN
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                 .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
```

```
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00

 8 LS        SCS LOSS RATE
                STRTL       .04  INITIAL ABSTRACTION
               CRVNBR     98.00  CURVE NUMBER
                RTIMP       .00  PERCENT IMPERVIOUS AREA

119 UD       SCS DIMENSIONLESS UNITGRAPH
                TLAG       .05  LAG

                                                  ***

NING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                          UNIT HYDROGRAPH
                                       17 END-OF-PERIOD ORDINATES
          0.      1.      1.      1.      1.      1.      0.      0.      0.      0.
          0.      0.      0.      0.      0.      0.      0.

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

                HYDROGRAPH AT STATION    DA-13

  TOTAL RAINFALL =    1.51, TOTAL LOSS =     .22, TOTAL EXCESS =    1.29

K FLOW     TIME                      MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)     (HR)
                 (CFS)
+    0.     2.97                0.         0.         0.         0.
               (INCHES)     1.280      1.280      1.280      1.280
               (AC-FT)        0.         0.         0.         0.

               CUMULATIVE AREA =     .00 SQ MI

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

        **************
        *            *
120 KK  *    CD-13   *     ROUTE THROUGH CULVERT
        *            *
        **************
```

HYDROGRAPH ROUTING DATA

121 RK KINEMATIC WAVE STREAM ROUTING

L	100.	CHANNEL LENGTH
S	.0600	SLOPE
N	.015	CHANNEL ROUGHNESS COEFFICIENT
CA	.00	CONTRIBUTING AREA
SHAPE	CIRC	CHANNEL SHAPE
WD	1.33	BOTTOM WIDTH OR DIAMETER
Z	.00	SIDE SLOPE

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
13.7684	1.250	.50	50.00

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

HYDROGRAPH AT STATION CD-13

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
+ (CFS)	(HR)					
		(CFS)				
+ 0.	2.93		0.	0.	0.	0.
		(INCHES)	1.279	1.279	1.279	1.279
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

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        **************
        *            *
122 KK  *    DA-14   *
        *            *
        **************
```

SUBBASIN RUNOFF DATA

123 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

4 PS STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

5 LS SCS LOSS RATE

STRTL	.17	INITIAL ABSTRACTION
CRVNBR	92.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

126 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.06	LAG

***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
19 END-OF-PERIOD ORDINATES

1.	4.	8.	8.	7.	5.	3.	2.	1.	1.

```
          1.       0.       0.       0.       0.       0.       0.       0.       0.

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

                    HYDROGRAPH AT STATION    DA-14

 TOTAL RAINFALL =    1.51, TOTAL LOSS =     .70, TOTAL EXCESS =     .81

 PEAK FLOW    TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR      24-HR      72-HR     4.98-HR
+ (CFS)       (HR)
                         (CFS)
+    1.      3.00                 0.         0.         0.         0.
                       (INCHES)   .800       .800       .800       .800
                       (AC-FT)     0.         0.         0.         0.

                     CUMULATIVE AREA =     .00 SQ MI


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


          **************
          *            *
 7 KK     *    CD-14   *     ROUTE THROUGH CULVERT
          *            *
          **************

            HYDROGRAPH ROUTING DATA

 120 RK         KINEMATIC WAVE STREAM ROUTING
                         L        60.  CHANNEL LENGTH
                         S      .1600  SLOPE
                         N       .015  CHANNEL ROUGHNESS COEFFICIENT
                        CA        .00  CONTRIBUTING AREA
                     SHAPE       CIRC  CHANNEL SHAPE
                        WD       1.20  BOTTOM WIDTH OR DIAMETER
                         Z        .00  SIDE SLOPE

                                                    ***


       KINEMATIC STREAM ROUTING USED FOR THIS REACH


        COMPUTED KINEMATIC PARAMETERS
           ALPHA       M      DT (MIN)   DX (FT)
         22.1015   1.250        .50      30.00
```

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

HYDROGRAPH AT STATION CD-14

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
+ 1.	3.00		0.	0.	0.	0.
		(INCHES)	.799	.799	.799	.799
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

129 KK

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**************
*            *
*    DA-17   *
*            *
**************
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SUBBASIN RUNOFF DATA

130 BA

SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

1 PB

STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI

INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

132 LS SCS LOSS RATE

STRTL	.26	INITIAL ABSTRACTION
CRVNBR	88.50	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

33 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.11	LAG

***

UNIT HYDROGRAPH
34 END-OF-PERIOD ORDINATES

0.	1.	2.	4.	5.	6.	6.	6.	5.	4.
3.	3.	2.	2.	1.	1.	1.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.						

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

HYDROGRAPH AT STATION DA-17

TOTAL RAINFALL = 1.51, TOTAL LOSS = .90, TOTAL EXCESS = .61

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1.	3.03		0.	0.	0.	0.
		(INCHES)	.597	.597	.597	.597
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

```
          ##############
          #            #
134 KK    #    NORTH   #    COMBINE AT NORTH POND
          #            #
          ##############

135 KO         OUTPUT CONTROL VARIABLES
                    IPRNT          1  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

136 HC         HYDROGRAPH COMBINATION
                    ICOMP          5  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ###
```

HYDROGRAPH AT STATION NORTH
SUM OF 5 HYDROGRAPHS

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0115	76	0.	1		0230	151	1.	1		0345	226	10.
1		0001	2	0.	1		0116	77	0.	1		0231	152	1.	1		0346	227	10.
1		0002	3	0.	1		0117	78	0.	1		0232	153	2.	1		0347	228	10.
1		0003	4	0.	1		0118	79	0.	1		0233	154	2.	1		0348	229	10.
1		0004	5	0.	1		0119	80	0.	1		0234	155	3.	1		0349	230	10.
1		0005	6	0.	1		0120	81	0.	1		0235	156	4.	1		0350	231	10.
1		0006	7	0.	1		0121	82	0.	1		0236	157	5.	1		0351	232	10.
1		0007	8	0.	1		0122	83	0.	1		0237	158	6.	1		0352	233	10.
1		0008	9	0.	1		0123	84	0.	1		0238	159	7.	1		0353	234	10.
1		0009	10	0.	1		0124	85	0.	1		0239	160	7.	1		0354	235	10.
1		0010	11	0.	1		0125	86	0.	1		0240	161	8.	1		0355	236	10.
1		0011	12	0.	1		0126	87	0.	1		0241	162	9.	1		0356	237	10.
1		0012	13	0.	1		0127	88	0.	1		0242	163	9.	1		0357	238	10.
1		0013	14	0.	1		0128	89	0.	1		0243	164	10.	1		0358	239	10.
1		0014	15	0.	1		0129	90	0.	1		0244	165	10.	1		0359	240	10.
1		0015	16	0.	1		0130	91	0.	1		0245	166	11.	1		0400	241	10.
1		0016	17	0.	1		0131	92	0.	1		0246	167	11.	1		0401	242	10.
1		0017	18	0.	1		0132	93	0.	1		0247	168	12.	1		0402	243	10.
1		0018	19	0.	1		0133	94	0.	1		0248	169	12.	1		0403	244	9.
1		0019	20	0.	1		0134	95	0.	1		0249	170	13.	1		0404	245	8.
1		0020	21	0.	1		0135	96	0.	1		0250	171	13.	1		0405	246	7.
1		0021	22	0.	1		0136	97	0.	1		0251	172	13.	1		0406	247	6.
1		0022	23	0.	1		0137	98	0.	1		0252	173	14.	1		0407	248	6.
1		0023	24	0.	1		0138	99	0.	1		0253	174	14.	1		0408	249	5.
1		0024	25	0.	1		0139	100	0.	1		0254	175	14.	1		0409	250	4.

1	0025	26	0.	*	1	0140	101	0.	*	1	0255	176	15.	*	1	0410	251	4.
1	0026	27	0.	*	1	0141	102	0.	*	1	0256	177	15.	*	1	0411	252	4.
1	0027	28	0.	*	1	0142	103	0.	*	1	0257	178	15.	*	1	0412	253	4.
1	0028	29	0.	*	1	0143	104	0.	*	1	0258	179	16.	*	1	0413	254	3.
1	0029	30	0.	*	1	0144	105	0.	*	1	0259	180	16.	*	1	0414	255	3.
1	0030	31	0.	*	1	0145	106	0.	*	1	0300	181	16.	*	1	0415	256	3.
1	0031	32	0.	*	1	0146	107	0.	*	1	0301	182	16.	*	1	0416	257	3.
1	0032	33	0.	*	1	0147	108	0.	*	1	0302	183	16.	*	1	0417	258	3.
1	0033	34	0.	*	1	0148	109	0.	*	1	0303	184	15.	*	1	0418	259	3.
1	0034	35	0.	*	1	0149	110	0.	*	1	0304	185	13.	*	1	0419	260	3.
1	0035	36	0.	*	1	0150	111	0.	*	1	0305	186	12.	*	1	0420	261	3.
1	0036	37	0.	*	1	0151	112	0.	*	1	0306	187	10.	*	1	0421	262	3.
1	0037	38	0.	*	1	0152	113	0.	*	1	0307	188	9.	*	1	0422	263	3.
1	0038	39	0.	*	1	0153	114	0.	*	1	0308	189	8.	*	1	0423	264	3.
1	0039	40	0.	*	1	0154	115	0.	*	1	0309	190	7.	*	1	0424	265	3.
1	0040	41	0.	*	1	0155	116	0.	*	1	0310	191	6.	*	1	0425	266	3.
1	0041	42	0.	*	1	0156	117	0.	*	1	0311	192	6.	*	1	0426	267	3.
1	0042	43	0.	*	1	0157	118	0.	*	1	0312	193	6.	*	1	0427	268	3.
1	0043	44	0.	*	1	0158	119	0.	*	1	0313	194	5.	*	1	0428	269	3.
1	0044	45	0.	*	1	0159	120	0.	*	1	0314	195	5.	*	1	0429	270	3.
1	0045	46	0.	*	1	0200	121	0.	*	1	0315	196	5.	*	1	0430	271	3.
1	0046	47	0.	*	1	0201	122	0.	*	1	0316	197	5.	*	1	0431	272	3.
1	0047	48	0.	*	1	0202	123	0.	*	1	0317	198	5.	*	1	0432	273	3.
1	0048	49	0.	*	1	0203	124	0.	*	1	0318	199	5.	*	1	0433	274	3.
1	0049	50	0.	*	1	0204	125	0.	*	1	0319	200	5.	*	1	0434	275	3.
1	0050	51	0.	*	1	0205	126	0.	*	1	0320	201	5.	*	1	0435	276	3.
1	0051	52	0.	*	1	0206	127	0.	*	1	0321	202	5.	*	1	0436	277	3.
1	0052	53	0.	*	1	0207	128	0.	*	1	0322	203	5.	*	1	0437	278	3.
1	0053	54	0.	*	1	0208	129	0.	*	1	0323	204	5.	*	1	0438	279	3.
1	0054	55	0.	*	1	0209	130	0.	*	1	0324	205	5.	*	1	0439	280	3.
1	0055	56	0.	*	1	0210	131	0.	*	1	0325	206	5.	*	1	0440	281	3.
1	0056	57	0.	*	1	0211	132	1.	*	1	0326	207	5.	*	1	0441	282	3.
1	0057	58	0.	*	1	0212	133	1.	*	1	0327	208	5.	*	1	0442	283	3.
1	0058	59	0.	*	1	0213	134	1.	*	1	0328	209	5.	*	1	0443	284	3.
1	0059	60	0.	*	1	0214	135	1.	*	1	0329	210	5.	*	1	0444	285	3.
1	0100	61	0.	*	1	0215	136	1.	*	1	0330	211	5.	*	1	0445	286	3.
1	0101	62	0.	*	1	0216	137	1.	*	1	0331	212	5.	*	1	0446	287	3.
1	0102	63	0.	*	1	0217	138	1.	*	1	0332	213	5.	*	1	0447	288	3.
1	0103	64	0.	*	1	0218	139	1.	*	1	0333	214	6.	*	1	0448	289	3.
1	0104	65	0.	*	1	0219	140	1.	*	1	0334	215	6.	*	1	0449	290	3.
1	0105	66	0.	*	1	0220	141	1.	*	1	0335	216	7.	*	1	0450	291	3.
1	0106	67	0.	*	1	0221	142	1.	*	1	0336	217	8.	*	1	0451	292	3.
1	0107	68	0.	*	1	0222	143	1.	*	1	0337	218	8.	*	1	0452	293	3.
1	0108	69	0.	*	1	0223	144	1.	*	1	0338	219	8.	*	1	0453	294	3.
1	0109	70	0.	*	1	0224	145	1.	*	1	0339	220	9.	*	1	0454	295	3.
1	0110	71	0.	*	1	0225	146	1.	*	1	0340	221	9.	*	1	0455	296	3.
1	0111	72	0.	*	1	0226	147	1.	*	1	0341	222	9.	*	1	0456	297	3.
1	0112	73	0.	*	1	0227	148	1.	*	1	0342	223	9.	*	1	0457	298	3.
1	0113	74	0.	*	1	0228	149	1.	*	1	0343	224	9.	*	1	0458	299	3.
1	0114	75	0.	*	1	0229	150	1.	*	1	0344	225	10.	*	1	0459	300	3.
				*					*					*				

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
+ 16.	3.02		3.	3.	3.	3.
		(INCHES)	.682	.682	.682	.682
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .04 SQ MI

** ***

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        ##############
        #            #
7 KK    #    DA-15   #
        #            #
        ##############
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SUBBASIN RUNOFF DATA

138 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

9 PB STORM 1.51 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

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 0 LS        SCS LOSS RATE
                STRTL        .04  INITIAL ABSTRACTION
               CRVNBR      98.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

 1 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG        .05  LAG

                                        ***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                    UNIT HYDROGRAPH
                                 17 END-OF-PERIOD ORDINATES
           1.      2.      4.      4.      3.      2.      1.      1.      0.      0.
           0.      0.      0.      0.      0.      0.      0.

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

                 HYDROGRAPH AT STATION    DA-15

  TOTAL RAINFALL =    1.51, TOTAL LOSS =     .22, TOTAL EXCESS =    1.29

 PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                               6-HR       24-HR       72-HR      4.98-HR
+  (CFS)       (HR)
                     (CFS)
+    0.        3.00            0.          0.          0.          0.
                  (INCHES)    1.280       1.280       1.280       1.280
                   (AC-FT)     0.          0.          0.          0.

                CUMULATIVE AREA =     .00 SQ MI


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

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        *           *
142 KK  *    CD-15  *     ROUTE THROUGH CULVERT
        *           *
        **************

          HYDROGRAPH ROUTING DATA

143 RK        KINEMATIC WAVE STREAM ROUTING
                    L        50.  CHANNEL LENGTH
                    S      .1500  SLOPE
                    N       .015  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                SHAPE       CIRC  CHANNEL SHAPE
                   WD       1.00  BOTTOM WIDTH OR DIAMETER
                    Z        .00  SIDE SLOPE

                                                        ***


     KINEMATIC STREAM ROUTING USED FOR THIS REACH


      COMPUTED KINEMATIC PARAMETERS
         ALPHA       M      DT (MIN)   DX (FT)
        20.7592   1.250        .50      25.00

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

                  HYDROGRAPH AT STATION   CD-15

PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                              6-HR      24-HR      72-HR     4.98-HR
+ (CFS)      (HR)
                   (CFS)
+     0.     3.00                0.         0.         0.         0.
                (INCHES)     1.280      1.280      1.280      1.280
                 (AC-FT)        0.         0.         0.         0.

                CUMULATIVE AREA =     .00 SQ MI


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


        **************
        *           *
  KK    *    DA-16  *
        *           *
        **************
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SUBBASIN RUNOFF DATA

5 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

146 PR STORM 1.51 BASIN TOTAL PRECIPITATION

0 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

147 LS SCS LOSS RATE

STRTL .04 INITIAL ABSTRACTION

CRVNBR 98.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

148 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .05 LAG

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
17 END-OF-PERIOD ORDINATES

0.	2.	2.	2.	2.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.			

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

HYDROGRAPH AT STATION DA-16

TOTAL RAINFALL = 1.51, TOTAL LOSS = .22, TOTAL EXCESS = 1.29

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
0.	3.00		0.	0.	0.	0.
		(INCHES)	1.280	1.280	1.280	1.280
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

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        **************
        *            *
149 KK  *    CD-16   *     ROUTE THROUGH CULVERT
        *            *
        **************
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HYDROGRAPH ROUTING DATA

150 RK KINEMATIC WAVE STREAM ROUTING

L	40.	CHANNEL LENGTH
S	.1500	SLOPE
N	.015	CHANNEL ROUGHNESS COEFFICIENT
CA	.00	CONTRIBUTING AREA
SHAPE	CIRC	CHANNEL SHAPE
WD	1.00	BOTTOM WIDTH OR DIAMETER
Z	.00	SIDE SLOPE

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
20.7592	1.250	.50	20.00

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

HYDROGRAPH AT STATION CD-16

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
0.	3.00		0.	0.	0.	0.
		(INCHES)	1.280	1.280	1.280	1.280
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

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1 KK    ##############
        #            #
        #    DA-18   #
        #            #
        ##############
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SUBBASIN RUNOFF DATA

2 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

153 PB STORM 1.51 BASIN TOTAL PRECIPITATION

0 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

4 LS SCS LOSS RATE

STRTL	.27	INITIAL ABSTRACTION
CRVNBR	88.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

155 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.06	LAG

***

UNIT HYDROGRAPH
21 END-OF-PERIOD ORDINATES

1.	4.	8.	9.	9.	7.	5.	3.	2.	1.
1.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.									

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

HYDROGRAPH AT STATION DA-18

TOTAL RAINFALL = 1.51, TOTAL LOSS = .92, TOTAL EXCESS = .59

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
+ (CFS)	(HR)					
		(CFS)				
+ 0.	3.00		0.	0.	0.	0.
		(INCHES)	.579	.579	.579	.579
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

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

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        *            *
156 KK  *    SOUTH   *    COMBINE AT SOUTH POND
        *            *
        **************

157 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

158 HC          HYDROGRAPH COMBINATION
                     ICOMP          4  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***
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HYDROGRAPH AT STATION SOUTH
SUM OF 4 HYDROGRAPHS

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0115	76	0.	1		0230	151	2.	1		0345	226	10.
1		0001	2	0.	1		0116	77	0.	1		0231	152	2.	1		0346	227	10.
1		0002	3	0.	1		0117	78	0.	1		0232	153	2.	1		0347	228	10.
1		0003	4	0.	1		0118	79	0.	1		0233	154	2.	1		0348	229	10.
1		0004	5	0.	1		0119	80	0.	1		0234	155	3.	1		0349	230	10.
1		0005	6	0.	1		0120	81	0.	1		0235	156	4.	1		0350	231	10.
1		0006	7	0.	1		0121	82	0.	1		0236	157	5.	1		0351	232	10.
1		0007	8	0.	1		0122	83	0.	1		0237	158	6.	1		0352	233	10.
1		0008	9	0.	1		0123	84	0.	1		0238	159	7.	1		0353	234	11.
1		0009	10	0.	1		0124	85	0.	1		0239	160	8.	1		0354	235	11.
1		0010	11	0.	1		0125	86	0.	1		0240	161	9.	1		0355	236	11.
1		0011	12	0.	1		0126	87	0.	1		0241	162	9.	1		0356	237	11.
1		0012	13	0.	1		0127	88	0.	1		0242	163	10.	1		0357	238	11.
1		0013	14	0.	1		0128	89	0.	1		0243	164	11.	1		0358	239	11.
1		0014	15	0.	1		0129	90	0.	1		0244	165	11.	1		0359	240	11.
1		0015	16	0.	1		0130	91	0.	1		0245	166	12.	1		0400	241	11.
1		0016	17	0.	1		0131	92	0.	1		0246	167	12.	1		0401	242	11.
1		0017	18	0.	1		0132	93	0.	1		0247	168	13.	1		0402	243	10.
1		0018	19	0.	1		0133	94	0.	1		0248	169	13.	1		0403	244	10.
1		0019	20	0.	1		0134	95	0.	1		0249	170	13.	1		0404	245	9.
1		0020	21	0.	1		0135	96	0.	1		0250	171	14.	1		0405	246	8.

1	0021	22	0.	*	1	0136	97	0.	*	1	0251	172	14.	*	1	0406	247	7.
1	0022	23	0.	*	1	0137	98	0.	*	1	0252	173	15.	*	1	0407	248	6.
1	0023	24	0.	*	1	0138	99	0.	*	1	0253	174	15.	*	1	0408	249	5.
1	0024	25	0.	*	1	0139	100	0.	*	1	0254	175	15.	*	1	0409	250	5.
1	0025	26	0.	*	1	0140	101	0.	*	1	0255	176	16.	*	1	0410	251	4.
1	0026	27	0.	*	1	0141	102	0.	*	1	0256	177	16.	*	1	0411	252	4.
1	0027	28	0.	*	1	0142	103	0.	*	1	0257	178	16.	*	1	0412	253	4.
1	0028	29	0.	*	1	0143	104	0.	*	1	0258	179	17.	*	1	0413	254	4.
1	0029	30	0.	*	1	0144	105	0.	*	1	0259	180	17.	*	1	0414	255	4.
1	0030	31	0.	*	1	0145	106	0.	*	1	0300	181	17.	*	1	0415	256	4.
1	0031	32	0.	*	1	0146	107	0.	*	1	0301	182	17.	*	1	0416	257	3.
1	0032	33	0.	*	1	0147	108	0.	*	1	0302	183	17.	*	1	0417	258	3.
1	0033	34	0.	*	1	0148	109	0.	*	1	0303	184	16.	*	1	0418	259	3.
1	0034	35	0.	*	1	0149	110	0.	*	1	0304	185	14.	*	1	0419	260	3.
1	0035	36	0.	*	1	0150	111	0.	*	1	0305	186	12.	*	1	0420	261	3.
1	0036	37	0.	*	1	0151	112	0.	*	1	0306	187	10.	*	1	0421	262	3.
1	0037	38	0.	*	1	0152	113	0.	*	1	0307	188	9.	*	1	0422	263	3.
1	0038	39	0.	*	1	0153	114	0.	*	1	0308	189	8.	*	1	0423	264	3.
1	0039	40	0.	*	1	0154	115	0.	*	1	0309	190	7.	*	1	0424	265	3.
1	0040	41	0.	*	1	0155	116	0.	*	1	0310	191	7.	*	1	0425	266	3.
1	0041	42	0.	*	1	0156	117	0.	*	1	0311	192	6.	*	1	0426	267	3.
1	0042	43	0.	*	1	0157	118	0.	*	1	0312	193	6.	*	1	0427	268	3.
1	0043	44	0.	*	1	0158	119	0.	*	1	0313	194	6.	*	1	0428	269	3.
1	0044	45	0.	*	1	0159	120	0.	*	1	0314	195	6.	*	1	0429	270	3.
1	0045	46	0.	*	1	0200	121	0.	*	1	0315	196	5.	*	1	0430	271	3.
1	0046	47	0.	*	1	0201	122	0.	*	1	0316	197	5.	*	1	0431	272	3.
1	0047	48	0.	*	1	0202	123	0.	*	1	0317	198	5.	*	1	0432	273	3.
1	0048	49	0.	*	1	0203	124	0.	*	1	0318	199	5.	*	1	0433	274	3.
1	0049	50	0.	*	1	0204	125	0.	*	1	0319	200	5.	*	1	0434	275	3.
1	0050	51	0.	*	1	0205	126	0.	*	1	0320	201	5.	*	1	0435	276	3.
1	0051	52	0.	*	1	0206	127	0.	*	1	0321	202	5.	*	1	0436	277	3.
1	0052	53	0.	*	1	0207	128	0.	*	1	0322	203	5.	*	1	0437	278	3.
1	0053	54	0.	*	1	0208	129	0.	*	1	0323	204	5.	*	1	0438	279	3.
1	0054	55	0.	*	1	0209	130	1.	*	1	0324	205	5.	*	1	0439	280	3.
1	0055	56	0.	*	1	0210	131	1.	*	1	0325	206	5.	*	1	0440	281	3.
1	0056	57	0.	*	1	0211	132	1.	*	1	0326	207	5.	*	1	0441	282	3.
1	0057	58	0.	*	1	0212	133	1.	*	1	0327	208	5.	*	1	0442	283	3.
1	0058	59	0.	*	1	0213	134	1.	*	1	0328	209	5.	*	1	0443	284	3.
1	0059	60	0.	*	1	0214	135	1.	*	1	0329	210	5.	*	1	0444	285	3.
1	0060	61	0.	*	1	0215	136	1.	*	1	0330	211	5.	*	1	0445	286	3.
1	0101	62	0.	*	1	0216	137	1.	*	1	0331	212	5.	*	1	0446	287	3.
1	0102	63	0.	*	1	0217	138	1.	*	1	0332	213	6.	*	1	0447	288	3.
1	0103	64	0.	*	1	0218	139	1.	*	1	0333	214	6.	*	1	0448	289	3.
1	0104	65	0.	*	1	0219	140	1.	*	1	0334	215	7.	*	1	0449	290	3.
1	0105	66	0.	*	1	0220	141	1.	*	1	0335	216	7.	*	1	0450	291	3.
1	0106	67	0.	*	1	0221	142	1.	*	1	0336	217	8.	*	1	0451	292	3.
1	0107	68	0.	*	1	0222	143	1.	*	1	0337	218	9.	*	1	0452	293	3.
1	0108	69	0.	*	1	0223	144	1.	*	1	0338	219	9.	*	1	0453	294	3.
1	0109	70	0.	*	1	0224	145	1.	*	1	0339	220	9.	*	1	0454	295	3.
1	0110	71	0.	*	1	0225	146	1.	*	1	0340	221	10.	*	1	0455	296	3.
1	0111	72	0.	*	1	0226	147	1.	*	1	0341	222	10.	*	1	0456	297	3.
1	0112	73	0.	*	1	0227	148	1.	*	1	0342	223	10.	*	1	0457	298	3.

1	0113	74	0.	*	1	0228	149	1.	*	1	0343	224	10.	*	1	0458	299	3.
1	0114	75	0.	*	1	0229	150	1.	*	1	0344	225	10.	*	1	0459	300	3.
				*					*					*				

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
+ (CFS)	(HR)					
		(CFS)				
+ 17.	3.02		4.	4.	4.	4.
		(INCHES)	.690	.690	.690	.690
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .04 SQ MI

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	DA-1	4.	3.00	1.	1.	1.	.01		
ROUTED TO	CD-1	4.	3.00	1.	1.	1.	.01		
ROUTED TO	ROUTE	4.	3.02	1.	1.	1.	.01		
HYDROGRAPH AT	DA-2	2.	3.00	0.	0.	0.	.00		
ROUTED TO	CD-2	2.	3.00	0.	0.	0.	.00		
ROUTED TO	ROUTE	2.	3.02	0.	0.	0.	.00		
HYDROGRAPH AT	DA-3	1.	3.00	0.	0.	0.	.00		
ROUTED TO	CD-3	1.	3.02	0.	0.	0.	.00		
ROUTED TO	ROUTE	1.	3.03	0.	0.	0.	.00		
HYDROGRAPH AT	DA-4	2.	3.00	0.	0.	0.	.00		
4 COMBINED AT	CD-4	9.	3.02	2.	2.	2.	.02		
ROUTED TO	CD-4	9.	3.02	2.	2.	2.	.02		
HYDROGRAPH AT	DA-5	0.	3.00	0.	0.	0.	.00		
2 COMBINED AT	COMBINE	9.	3.02	2.	2.	2.	.02		
ROUTED TO									

CD-5	9.	3.02	2.	2.	2.	.02
HYDROGRAPH AT						
DA-6	1.	3.02	0.	0.	0.	.01
2 COMBINED AT						
COMBINE	10.	3.02	2.	2.	2.	.03
ROUTED TO						
CD-6	10.	3.02	2.	2.	2.	.03
HYDROGRAPH AT						
DA-7	1.	3.00	0.	0.	0.	.00
HYDROGRAPH AT						
DA-8	0.	3.00	0.	0.	0.	.00
2 COMBINED AT						
COMBINE	2.	3.00	0.	0.	0.	.00
ROUTED TO						
CD-8	2.	3.00	0.	0.	0.	.00
2 COMBINED AT						
COMBINE	12.	3.02	3.	3.	3.	.03
ROUTED TO						
CD-8	12.	3.02	3.	3.	3.	.03
HYDROGRAPH AT						
DA-9	2.	3.02	0.	0.	0.	.00
2 COMBINED AT						
COMBINE	13.	3.02	3.	3.	3.	.03
ROUTED TO						
CD-9	13.	3.02	3.	3.	3.	.03
HYDROGRAPH AT						
DA-10	0.	3.00	0.	0.	0.	.00
2 COMBINED AT						
COMBINE	14.	3.02	3.	3.	3.	.03
ROUTED TO						
CD-10	14.	3.02	3.	3.	3.	.03
HYDROGRAPH AT						
DA-11	1.	3.00	0.	0.	0.	.00
2 COMBINED AT						
COMBINE	15.	3.02	3.	3.	3.	.04

ROUTED TO							
+	CD-11	15.	3.02	3.	3.	3.	.04
HYDROGRAPH AT							
+	DA-12	0.	3.00	0.	0.	0.	.00
ROUTED TO							
+	CD-12	0.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-13	0.	2.97	0.	0.	0.	.00
ROUTED TO							
+	CD-13	0.	2.93	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-14	1.	3.00	0.	0.	0.	.00
ROUTED TO							
+	CD-14	1.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-17	1.	3.03	0.	0.	0.	.00
5 COMBINED AT							
+	NORTH	16.	3.02	3.	3.	3.	.04
HYDROGRAPH AT							
+	DA-15	0.	3.00	0.	0.	0.	.00
ROUTED TO							
+	CD-15	0.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-16	0.	3.00	0.	0.	0.	.00
ROUTED TO							
+	CD-16	0.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-18	0.	3.00	0.	0.	0.	.00
4 COMBINED AT							
+	SOUTH	17.	3.02	4.	4.	4.	.04

*** NORMAL END OF HEC-1 ***
^Z

Because HEC-1 prints out flows to the nearest cfs, this run has been included to more precisely define the peak from the small sub-basins

1/12

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                                   ****
          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1.1985
U.S. ARMY CORPS OF ENGINEERS. THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                   ****


THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3


                                        HEC-1 INPUT                                          PAGE  1

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

       1           ID     UP&L Mining - Wilberg Mine Portal Facilities
       2           ID     10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
       3           ID     by gjo Hansen, Allen & Luce  May 1989
       4           ID     ***** ALL AREAS MULTIPLIED BY 100 ****
** FREE ***
                   *DIAGRAM
       5           IT       1       0       0     300
       6           IO       3

       7           KK    DA-1
       8           BA   00.88
       9           PB    1.51
      10           IN     30.
      11           PI      0.    .035    .045    .055    .035     .37      .1     .18    .055     .05
      12           PI     .04     .04    .035
      13           LS       0    91.1      0.
      14           UD    .064

      15           KK    CD-1 ROUTE THROUGH CULVERT
      16           RK    100.     1.0    .015            CIRC       2

      17           KK   ROUTE ROUTE THROUGH SURFACE DITCH
      18           RK    340.     .02    .025            TRAP       1       2

      19           KK    DA-2
      20           BA  00.403
      21           PB    1.51
      22           LS       0      91       0
      23           UD    .067

      24           KK    CD-2 ROUTE THROUGH CULVERT
      25           RK    175.     .71    .015            CIRC     1.5

      26           KK   ROUTE ROUTE THROUGH SURFACE DITCH
      27           RK    260.     .02    .025            TRAP       1       2
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 28          KK    DA-3
 29          BA   00.22
 30          PB    1.51
 31          LS       0      89       0
 32          UD    .065

 33          KK    CD-3 ROUTE THROUGH CULVERT
 34          RK     75.     .77    .015           CIRC     1.5

 35          KK   ROUTE ROUTE THROUGH SURFACE DITCH
 36          RK    400.     .02    .025           TRAP       1       2

 37          KK    DA-4
 38          BA   00.46
 39          PB    1.51
 40          LS       0      92       0
 41          UD     .05
1                                        HEC-1 INPUT                                          PAGE  2

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


 42          KK    CD-4  COMBINE AT CULVERT CD-4
 43          HC       4

 44          KK    CD-4 ROUTE THROUGH CULVERT
 45          RK    154.     .19    .015           CIRC       2

 46          KK    DA-5
 47          BA  00.022
 48          PB    1.51
 49          LS       0      96       0
 50          UD     .05

 51          KK COMBINEAT CULVERT CD-5
 52          HC       2

 53          KK    CD-5 ROUTE THROUGH CULVERT
 54          RK     75.     .77    .015           CIRC       2

 55          KK    DA-6
 56          BA  00.648
 57          PB    1.51
 58          LS       0      82       0
 59          UD    .063

 60          KK COMBINEAT CULVERT CD-6
 61          HC       2

 62          KK    CD-6 ROUTE THROUGH CULVERT
 63          RK    140.     .36    .015           CIRC       2

 64          KK    DA-7
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```
 65          BA  00.275
 66          PB    1.51
 67          LS       0      92       0
 68          UD    .059

 69          KK    DA-8
 70          BA  00.022
 71          PB    1.51
 72          LS       0      98       0
 73          UD     .05

 74          KK COMBINEAT CULVERT CD-8
 75          HC       2

 76          KK    CD-8 ROUTE THROUGH CULVERT
 77          RK    120.     .33    .015           CIRC    1.33

 78          KK COMBINEAT CULVERT CD-8
 79          HC       2
```



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

 80          KK    CD-8 ROUTE THROUGH CULVERT
 81          RK    160.     .03    .015           CIRC     2.5

 82          KK    DA-9
 83          BA  00.389
 84          PB    1.51
 85          LS       0      89       0
 86          UD    .079

 87          KK COMBINEAT CULVERT CD-9
 88          HC       2

 89          KK    CD-9 ROUTE THROUGH CULVERT
 90          RK    120.     .33    .015           CIRC     2.5

 91          KK   DA-10
 92          BA  00.075
 93          PB    1.51
 94          LS       0      92       0
 95          UD     .05

 96          KK COMBINEAT CULVERT CD-10
 97          HC       2

 98          KK   CD-10 ROUTE THROUGH CULVERT
 99          RK    105.     .31    .015           CIRC     2.5

100          KK   DA-11
101          BA   00.19
102          PB    1.51
```

```
103          LS       0    92.8       0
104          UD     .05

105          KK COMBINEAT CULVERT CD-11
106          HC       2

107          KK   CD-11 ROUTE THROUGH CULVERT
108          RK    300.    .066    .015           CIRC     2.5

109          KK   DA-12
110          BA  00.048
111          PB    1.51
112          LS       0      98       0
113          UD    .065

114          KK   CD-12 ROUTE THROUGH CULVERT
115          RK     95.     .26    .015           CIRC     1.2

116          KK   DA-13
117          BA  00.016
118          PB    1.51
119          LS       0      98       0
120          UD     .05
```



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

121          KK   CD-13 ROUTE THROUGH CULVERT
122          RK    100.     .06    .015           CIRC    1.33

123          KK   DA-14
124          BA  00.113
125          PB    1.51
126          LS       0      92       0
127          UD    .056

128          KK   CD-14 ROUTE THROUGH CULVERT
129          RK     60.     .16    .015           CIRC     1.2

130          KK   DA-17
131          BA  00.141
132          PB    1.51
133          LS       0    88.5       0
134          UD    .107

135          KK   NORTHCOMBINE AT NORTH POND
136          HC       5

137          KK   DA-15
138          BA  00.045
139          PB    1.51
140          LS       0      98       0
141          UD     .05
```

```
KK   CD-15 ROUTE THROUGH CULVERT
RK     50.     .15    .015           CIRC       1

KK   DA-16
BA  00.031
PB    1.51
LS       0      98       0
UD     .05

KK   CD-16 ROUTE THROUGH CULVERT
RK     40.     .15    .015           CIRC       1

KK   DA-18
BA  00.134
PB    1.51
LS       0      88       0
UD    .062

KK   SOUTHCOMBINE AT SOUTH POND
HC       4
ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
PLT
LINE     (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

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

 7         DA-1
             V
             V
15         CD-1
             V
             V
17        ROUTE
             .
             .
19           .        DA-2
             .          V
             .          V
24           .        CD-2
             .          V
             .          V
26           .       ROUTE
             .          .
             .          .
28           .          .        DA-3
             .          .          V
             .          .          V
33           .          .        CD-3
             .          .          V
             .          .          V
35           .          .       ROUTE
             .          .          .
             .          .          .
37           .          .          .        DA-4
             .          .          .          .
             .          .          .          .
42         CD-4.................................
             V
             V
44         CD-4
             .
             .
46           .        DA-5
             .          .
             .          .
51      COMBINE............
             V
             V
53         CD-5
             .
             .
55           .        DA-6
             .          .
```

```
          .          .
60   COMBINE............
          V
          V
62      CD-6
          .
          .
64        .       DA-7
          .          .
          .          .
69        .          .       DA-8
          .          .          .
          .          .          .
74        .    COMBINE............
          .          V
          .          V
76        .       CD-8
          .          .
          .          .
78   COMBINE............
          V
          V
80      CD-8
          .
          .
82        .       DA-9
          .          .
          .          .
87   COMBINE............
          V
          V
89      CD-9
          .
          .
91        .      DA-10
          .          .
          .          .
96   COMBINE............
          V
          V
98     CD-10
          .
          .
102       .      DA-11
          .          .
          .          .
105  COMBINE............
          V
          V
107    CD-11
          .
          .
109       .      DA-12
          .          V
```

```
            .          V
 114        .       CD-12
            .          .
            .          .
 116        .          .       DA-13
            .          .          V
            .          .          V
 121        .          .       CD-13
            .          .          .
            .          .          .
 123        .          .          .       DA-14
            .          .          .          V
            .          .          .          V
 128        .          .          .       CD-14
            .          .          .          .
            .          .          .          .
 130        .          .          .          .       DA-17
            .          .          .          .          .
            .          .          .          .          .
 135     NORTH.............................................
            .
            .
 137        .       DA-15
            .          V
            .          V
 142        .       CD-15
            .          .
            .          .
 144        .          .       DA-16
            .          .          V
            .          .          V
 149        .          .       CD-16
            .          .          .
            .          .          .
 151        .          .          .       DA-18
            .          .          .          .
            .          .          .          .
 155     SOUTH.................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

UP&L Mining - Wilberg Mine Portal Facilities
10-YR 6-HR SCS 6-HOUR DISTRIBUTION
by Bjo Hansen, Allen & Luce May 1989
***** ALL AREAS MULTIPLIED BY 100 ****
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									
	DA-1	406.	3.00	85.	85.	85.	.88		

ROUTED TO	CD-1	406.	3.00	85.	85.	85.	.88
ROUTED TO	ROUTE	405.	3.02	85.	85.	85.	.88
HYDROGRAPH AT	DA-2	184.	3.00	38.	38.	38.	.40
ROUTED TO	CD-2	184.	3.00	38.	38.	38.	.40
ROUTED TO	ROUTE	184.	3.02	38.	38.	38.	.40
HYDROGRAPH AT	DA-3	86.	3.02	18.	18.	18.	.22
ROUTED TO	CD-3	86.	3.02	18.	18.	18.	.22
ROUTED TO	ROUTE	86.	3.02	18.	18.	18.	.22
HYDROGRAPH AT	DA-4	230.	3.00	48.	48.	48.	.46
4 COMBINED AT	CD-4	901.	3.00	189.	189.	189.	1.96
ROUTED TO	CD-4	901.	3.00	188.	188.	188.	1.96

***** ALL AREAS MULTIPLIED BY 100 ****

HYDROGRAPH AT	DA-5	14.	3.00	3.	3.	3.	.02
2 COMBINED AT	COMBINE	915.	3.00	192.	192.	192.	1.99
ROUTED TO	CD-5	915.	3.00	192.	192.	192.	1.99
HYDROGRAPH AT	DA-6	134.	3.02	29.	29.	29.	.65
2 COMBINED AT	COMBINE	1047.	3.02	220.	220.	220.	2.63
ROUTED TO	CD-6	1047.	3.02	220.	220.	220.	2.63
HYDROGRAPH AT	DA-7	136.	3.00	28.	28.	28.	.28
HYDROGRAPH AT	DA-8	15.	3.00	4.	4.	4.	.02
2 COMBINED AT	COMBINE	152.	3.00	32.	32.	32.	.30
ROUTED TO	CD-8	151.	3.00	32.	32.	32.	.30
2 COMBINED AT	COMBINE	1197.	3.02	253.	253.	253.	2.93
ROUTED TO	CD-8	1197.	3.02	252.	252.	252.	2.93
HYDROGRAPH AT	DA-9	150.	3.02	32.	32.	32.	.39
2 COMBINED AT	COMBINE	1347.	3.02	284.	284.	284.	3.32
ROUTED TO	CD-9	1347.	3.02	284.	284.	284.	3.32
HYDROGRAPH AT	DA-10	37.	3.00	8.	8.	8.	.09

***** ALL AREAS MULTIPLIED BY 100 ****

2 COMBINED AT							
	COMBINE	1384.	3.02	292.	292.	292.	3.39
ROUTED TO							
	CD-10	1384.	3.02	292.	292.	292.	3.39
HYDROGRAPH AT							
	DA-11	100.	3.00	21.	21.	21.	.19
2 COMBINED AT							
+	COMBINE	1482.	3.02	313.	313.	313.	3.58
ROUTED TO							
+	CD-11	1482.	3.02	313.	313.	313.	3.58
HYDROGRAPH AT							
+	DA-12	34.	3.00	8.	8.	8.	.05
ROUTED TO							
+	CD-12	34.	3.00	8.	8.	8.	.05
HYDROGRAPH AT							
+	DA-13	11.	3.00	3.	3.	3.	.02
ROUTED TO							
	CD-13	11.	3.00	3.	3.	3.	.02
HYDROGRAPH AT							
	DA-14	56.	3.00	12.	12.	12.	.11
ROUTED TO							
	CD-14	56.	3.00	12.	12.	12.	.11
HYDROGRAPH AT							
	DA-17	50.	3.03	11.	11.	11.	.14
5 COMBINED AT							
+	NORTH	1632.	3.02	346.	346.	346.	3.90
HYDROGRAPH AT							
+	DA-15	32.	3.00	7.	7.	7.	.05
ROUTED TO							
+	CD-15	32.	3.00	7.	7.	7.	.05

***** ALL AREAS MULTIPLIED BY 100 ****

HYDROGRAPH AT							
	DA-16	22.	3.00	5.	5.	5.	.03
ROUTED TO							
	CD-16	22.	3.00	5.	5.	5.	.03
HYDROGRAPH AT							
	DA-18	49.	3.02	10.	10.	10.	.13
4 COMBINED AT							
	SOUTH	1732.	3.02	368.	368.	368.	4.11

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

1 ****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT

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

        1           ID     UP&L Mining - Wilberg Mine Portal Facilities
        2           ID     25-YR 6-HR  SCS 6-HOUR DISTRIBUTION
        3           ID     by gjp Hansen, Allen & Luce  May 1989
*** FREE ***
                    *DIAGRAM
        4           IT       1       0       0     300
        5           IO       3

        6           KK    DA-1
        7           BA   .0088
        8           PB    1.81
        9           IN     30.
       10           PI      0.    .035    .045    .055    .095     .37      .1     .18    .055     .05
       11           PI     .04     .04    .035
       12           LS       0    91.1      0.
       13           UD    .064

       14           KK    CD-1 ROUTE THROUGH CULVERT
       15           RK    100.     1.0    .015           CIRC       2

       16           KK   ROUTE ROUTE THROUGH SURFACE DITCH
       17           RK    340.     .02    .025           TRAP       1       2

       18           KK    DA-2
       19           BA  .00403
       20           PB    1.81
       21           LS       0      91       0
       22           UD    .067

       23           KK    CD-2 ROUTE THROUGH CULVERT
       24           RK    175.     .71    .015           CIRC     1.5

       25           KK   ROUTE ROUTE THROUGH SURFACE DITCH
```

```
26          RK    260.     .02    .025           TRAP       1       2

27          KK    DA-3
28          BA   .0022
29          PB    1.81
30          LS       0      89       0
31          UD    .065

32          KK    CD-3 ROUTE THROUGH CULVERT
33          RK     75.     .77    .015           CIRC     1.5

34          KK   ROUTE ROUTE THROUGH SURFACE DITCH
35          RK    400.     .02    .025           TRAP       1       2

36          KK    DA-4
37          BA   .0046
38          PB    1.81
39          LS       0      92       0
40          UD     .05
1                                   HEC-1 INPUT

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


41          KK    CD-4  COMBINE AT CULVERT CD-4
42          HC       4

43          KK    CD-4 ROUTE THROUGH CULVERT
44          RK    154.     .19    .015           CIRC       2

45          KK    DA-5
46          BA  .00022
47          PB    1.81
48          LS       0      96       0
49          UD     .05

50          KK COMBINEAT CULVERT CD-5
51          HC       2

52          KK    CD-5 ROUTE THROUGH CULVERT
53          RK     75.     .77    .015           CIRC       2

54          KK    DA-6
55          BA  .00648
56          PB    1.81
57          LS       0      82       0
58          UD    .063

59          KK COMBINEAT CULVERT CD-6
60          HC       2

61          KK    CD-6 ROUTE THROUGH CULVERT
```

```
 62          RK    140.     .36    .015           CIRC       2

 63          KK    DA-7
 64          BA  .00275
 65          PB    1.81
 66          LS       0      92       0
 67          UD    .059

 68          KK    DA-8
 69          BA  .00022
 70          PB    1.81
 71          LS       0      98       0
 72          UD     .05

 73          KK COMBINEAT CULVERT CD-8
 74          HC       2

 75          KK    CD-8 ROUTE THROUGH CULVERT
 76          RK    120.     .33    .015           CIRC    1.33

 77          KK COMBINEAT CULVERT CD-8
 78          HC       2
1                                   HEC-1 INPUT                                          PAGE  3

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


 79          KK    CD-8 ROUTE THROUGH CULVERT
 80          RK    160.     .03    .015           CIRC     2.5

 81          KK    DA-9
 82          BA  .00389
 83          PB    1.81
 84          LS       0      89       0
 85          UD    .079

 86          KK COMBINEAT CULVERT CD-9
 87          HC       2

 88          KK    CD-9 ROUTE THROUGH CULVERT
 89          RK    120.     .33    .015           CIRC     2.5

 90          KK   DA-10
 91          BA  .00075
 92          PB    1.81
 93          LS       0      92       0
 94          UD     .05

 95          KK COMBINEAT CULVERT CD-10
 96          HC       2

 97          KK   CD-10 ROUTE THROUGH CULVERT
```

```
 98          RK    105.     .31    .015           CIRC     2.5

 99          KK   DA-11
100          BA   .0019
101          PB    1.81
102          LS       0    92.8       0
103          UD     .05

104          KK COMBINEAT CULVERT CD-11
105          HC       2

106          KK   CD-11 ROUTE THROUGH CULVERT
107          RK    300.    .066    .015           CIRC     2.5

108          KK   DA-12
109          BA  .00048
110          PB    1.81
111          LS       0      98       0
112          UD    .065

113          KK   CD-12 ROUTE THROUGH CULVERT
114          RK     95.     .26    .015           CIRC     1.2

115          KK   DA-13
116          BA  .00016
117          PB    1.81
118          LS       0      98       0
119          UD     .05
```



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


120          KK   CD-13 ROUTE THROUGH CULVERT
121          RK    100.     .06    .015           CIRC    1.33

122          KK   DA-14
123          BA  .00113
124          PB    1.81
125          LS       0      92       0
126          UD    .056

127          KK   CD-14 ROUTE THROUGH CULVERT
128          RK     60.     .16    .015           CIRC     1.2

129          KK   DA-17
130          BA  .00141
131          PB    1.81
132          LS       0    88.5       0
133          UD    .107

134          KK   NORTHCOMBINE AT NORTH POND
```

```
HC      5

KK   DA-15
BA  .00045
PB   1.81
LS      0      98       0
UD    .05

KK   CD-15 ROUTE THROUGH CULVERT
RK    50.     .15    .015           CIRC       1

KK   DA-16
BA  .00031
PB   1.81
LS      0      98       0
UD    .05

KK   CD-16 ROUTE THROUGH CULVERT
RK    40.     .15    .015           CIRC       1

KK   DA-18
BA  .00134
PB   1.81
LS      0      88       0
UD   .062

KK   SOUTHCOMBINE AT SOUTH POND
HC      4
ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

 6        DA-1
             V
             V
14        CD-1
             V
             V
16       ROUTE
             .
             .
18           .        DA-2
             .           V
             .           V
23           .        CD-2
             .           V
             .           V
25           .       ROUTE
             .           .
             .           .
27           .           .        DA-3
             .           .           V
             .           .           V
32           .           .        CD-3
             .           .           V
             .           .           V
34           .           .       ROUTE
             .           .           .
             .           .           .
36           .           .           .        DA-4
             .           .           .           .
             .           .           .           .
41        CD-4.................................
             V
             V
43        CD-4
             .
             .
45           .        DA-5
             .           .
             .           .
50     COMBINE............
             V
             V
52        CD-5
             .
             .
```

```
54          .       DA-6
            .          .
            .          .
59    COMBINE............
            V
            V
61       CD-6
            .
            .
63          .       DA-7
            .          .
            .          .
68          .          .       DA-8
            .          .          .
            .          .          .
73          .    COMBINE............
            .          V
            .          V
75          .       CD-8
            .          .
            .          .
77    COMBINE............
            V
            V
79       CD-8
            .
            .
81          .       DA-9
            .          .
            .          .
86    COMBINE............
            V
            V
88       CD-9
            .
            .
90          .      DA-10
            .          .
            .          .
95    COMBINE............
            V
            V
97      CD-10
            .
            .
99          .      DA-11
            .          .
            .          .
104   COMBINE............
            V
            V
106     CD-11
```

```
            .
            .
 108        .      DA-12
            .         V
            .         V
 113        .      CD-12
            .         .
            .         .
 115        .         .      DA-13
            .         .         V
            .         .         V
 120        .         .      CD-13
            .         .         .
            .         .         .
 122        .         .         .      DA-14
            .         .         .         V
            .         .         .         V
 127        .         .         .      CD-14
            .         .         .         .
            .         .         .         .
 129        .         .         .         .      DA-17
            .         .         .         .         .
            .         .         .         .         .
 134      NORTH.............................................
            .
            .
 136        .      DA-15
            .         V
            .         V
 141        .      CD-15
            .         .
            .         .
 143        .         .      DA-16
            .         .         V
            .         .         V
 148        .         .      CD-16
            .         .         .
            .         .         .
 150        .         .         .      DA-18
            .         .         .         .
            .         .         .         .
 155      SOUTH.................................
```

*** RUNOFF ALSO COMPUTED AT THIS LOCATION

1 ****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

UP&L Mining - Wilberg Mine Portal Facilities
25-YR 6-HR SCS 6-HOUR DISTRIBUTION
by gjp Hansen, Allen & Luce May 1989

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

  IT        HYDROGRAPH TIME DATA
                  NMIN          1  MINUTES IN COMPUTATION INTERVAL
                 IDATE     1    0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE     1    0  ENDING DATE
                NDTIME       0459  ENDING TIME

          COMPUTATION INTERVAL     .02 HOURS
              TOTAL TIME BASE    4.98 HOURS

     ENGLISH UNITS
```

UP&L Mining - Wilberg Mine Portal Facilities
25-YR 6-HR SCS 6-HOUR DISTRIBUTION

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	DA-1	5.	3.00	1.	1.	1.	.01		
ROUTED TO	CD-1	5.	3.00	1.	1.	1.	.01		
ROUTED TO	ROUTE	5.	3.02	1.	1.	1.	.01		
HYDROGRAPH AT	DA-2	2.	3.00	1.	1.	1.	.00		
ROUTED TO	CD-2	2.	3.00	1.	1.	1.	.00		
ROUTED TO	ROUTE	2.	3.02	1.	1.	1.	.00		
HYDROGRAPH AT	DA-3	1.	3.00	0.	0.	0.	.00		
ROUTED TO	CD-3	1.	3.00	0.	0.	0.	.00		
ROUTED TO	ROUTE	1.	3.02	0.	0.	0.	.00		
HYDROGRAPH AT	DA-4	3.	3.00	1.	1.	1.	.00		
4 COMBINED AT	CD-4	12.	3.02	3.	3.	3.	.02		
ROUTED TO	CD-4	12.	3.02	3.	3.	3.	.02		
HYDROGRAPH AT	DA-5	0.	3.00	0.	0.	0.	.00		

UP&L Mining - Wilberg Mine Portal Facilities
25-YR 6-HR SCS 6-HOUR DISTRIBUTION

2 COMBINED AT							
+	COMBINE	12.	3.02	3.	3.	3.	.02
ROUTED TO							
+	CD-5	12.	3.02	3.	3.	3.	.02
HYDROGRAPH AT							
+	DA-6	2.	3.02	0.	0.	0.	.01
2 COMBINED AT							
+	COMBINE	14.	3.02	3.	3.	3.	.03
ROUTED TO							
+	CD-6	14.	3.02	3.	3.	3.	.03
HYDROGRAPH AT							
+	DA-7	2.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-8	0.	2.97	0.	0.	0.	.00
2 COMBINED AT							
+	COMBINE	2.	3.00	0.	0.	0.	.00
ROUTED TO							
+	CD-8	2.	3.00	0.	0.	0.	.00
2 COMBINED AT							
+	COMBINE	16.	3.02	3.	3.	3.	.03
ROUTED TO							
+	CD-8	16.	3.02	3.	3.	3.	.03
HYDROGRAPH AT							
+	DA-9	2.	3.02	0.	0.	0.	.00
2 COMBINED AT							
+	COMBINE	18.	3.02	4.	4.	4.	.03
ROUTED TO							
+	CD-9	18.	3.02	4.	4.	4.	.03
HYDROGRAPH AT							
+	DA-10	0.	3.00	0.	0.	0.	.00

UP&L Mining - Wilberg Mine Portal Facilities
25-YR 6-HR SCS 6-HOUR DISTRIBUTION

2 COMBINED AT							
+	COMBINE	19.	3.02	4.	4.	4.	.03
ROUTED TO							
+	CD-10	19.	3.02	4.	4.	4.	.03
HYDROGRAPH AT							
+	DA-11	1.	3.00	0.	0.	0.	.00
2 COMBINED AT							
+	COMBINE	20.	3.02	4.	4.	4.	.04
ROUTED TO							
+	CD-11	20.	3.02	4.	4.	4.	.04
HYDROGRAPH AT							
+	DA-12	0.	2.98	0.	0.	0.	.00
ROUTED TO							
+	CD-12	0.	2.98	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-13	0.	2.97	0.	0.	0.	.00
ROUTED TO							
+	CD-13	0.	2.97	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-14	1.	3.00	0.	0.	0.	.00
ROUTED TO							
+	CD-14	1.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-17	1.	3.03	0.	0.	0.	.00
5 COMBINED AT							
+	NORTH	22.	3.02	5.	5.	5.	.04
HYDROGRAPH AT							
+	DA-15	0.	2.97	0.	0.	0.	.00
ROUTED TO							
+	CD-15	0.	2.98	0.	0.	0.	.00

UP&L Mining - Wilberg Mine Portal Facilities
25-YR 6-HR SCS 6-HOUR DISTRIBUTION

HYDROGRAPH AT							
+	DA-16	0.	2.97	0.	0.	0.	.00
ROUTED TO							
+	CD-16	0.	3.00	0.	0.	0.	.00
HYDROGRAPH AT							
+	DA-18	1.	3.00	0.	0.	0.	.00
4 COMBINED AT							
+	SOUTH	23.	3.02	5.	5.	5.	.04

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

HANSEN ALLEN & LUCE inc

CLIENT UPSL Mining
PROJECT Cott/Wilberg
FEATURE SAE
PROJECT NO. 5-1-310

SHEET ___ OF ___
COMPUTED GJP
CHECKED ___
DATE June 23, 1989

Wilberg For Small Area Exemption (SAE)

1- Area does not drain to existing sediment ponds.

2- A depression in the access road will be enlarged to contain the runoff from the 10 year-6 hour event - forming a sediment basin. The tributary undisturbed area will be reduced by constructing an undisturbed area diversion ditch and culvert (see "Undisturbed..." report HASL, June 1989) A culvert spillway will be provided for the proposed sediment basin ~~to~~ with capacity for the 25-year 6-hour storm event.

3 - Disturbed area in SAE = 0.88 acres.
Total Disturbed area in Cottonwood/Wilberg Mine Portal Facilities ≈ 16.5 acres ∴ SAE = $\frac{0.88}{16.5}$ ≈ 5.3%

SAE Sediment Basin

Tributary Area:

Disturbed Area	0.88 acres	CN = 90
Undisturbed Area	7.0 acres	CN = 85
	7.88 acres	CN = 85.7

10yr 24-hr P = 2.4" ⇒ Q = 1.14 inches
R.O. Volume = $\frac{1.14}{12}$ (7.88) = 0.75 Ac-Ft

25yr-6 hr peak inflow = 7 cfs (see HEC1 printout)

Outlet culvert:
Q = 7 cfs
try 18" CMP ⇒ H_w/D_{min} = 1.17 or $H_{w_{min}}$ = 1.8'
try 24" CMP ⇒ H_w/D_{min} = 0.72 or $H_{w_{min}}$ = 1.1'

Min pipe slope for inlet control

try 18" CMP (n = .027) ⇒ $S_f = \left(\frac{7}{52}\right)^2$ = 0.02 ft/ft OK

Recommend 18" CMP

HANSEN ALLEN & LUCE INC

CLIENT: UPSL Mining
PROJECT: Cottonwood Fan Portal Site
FEATURE: Hydrologic Computations Appendix
PROJECT NO.: 5-1-3

SHEET ___ OF ___
COMPUTED: GSP
CHECKED
DATE: May 1989

HYDROLOGIC COMPUTATIONS APPENDIX

COTTONWOOD CANYON FAN PORTAL SITE

Watershed Characteristics — Pages 1-8

Culvert Design Calculations — Pages 1-3

Ditch Hydraulics — Pages 1-4

Mean Annual Sediment Yield — Pages 1-5

SEDIMENT BASINS — Pages 1-3

HEC 1 Printouts

- 10-year 6-hour — Page 1-23
- 10-year 6-hour with all areas multiplied by 100 — Pages 1-6
- 25-year 6-hour — Pages 1-6

COTTONWOOD FAN PORTAL

Vegetation Cover: (reference Trail Mountain)

Piniyon-Juniper

COVER = 25% live + 26% litter = 51%

Sage - GRASS

Sage cover = 21%
Grass cover = 33%
TOTAL 54%

SOILS (reference Trail Mountain)

Mostly
AbG - Aa-Bb complex - very stony sandy loam

Much of the soil types of the area fit a hydrologic Type B description, with some C. Assume soil type C for the analysis.

Curve Number - reference "SCS National Engineering Handbook Section 4 Hydrology" 1972

Disturbed use CN = 90

Sage-Grass COMPLEX - see Fig 9.6 of SCS, 1972

54% soil cover, Type C soil
⇒ CN = 62

SAGE-GRASS use CN = 65 for design

Juniper-Grass complex
51% cover soil type C
⇒ CN = 72

Juniper use CN = 75 for design

Areas which have been temporarily reclaimed are assumed to have a 50% cover of herbs w/ Type C soil
see Figure 9.5 SCS, 1972

Temporary Reclaimed CN = 80

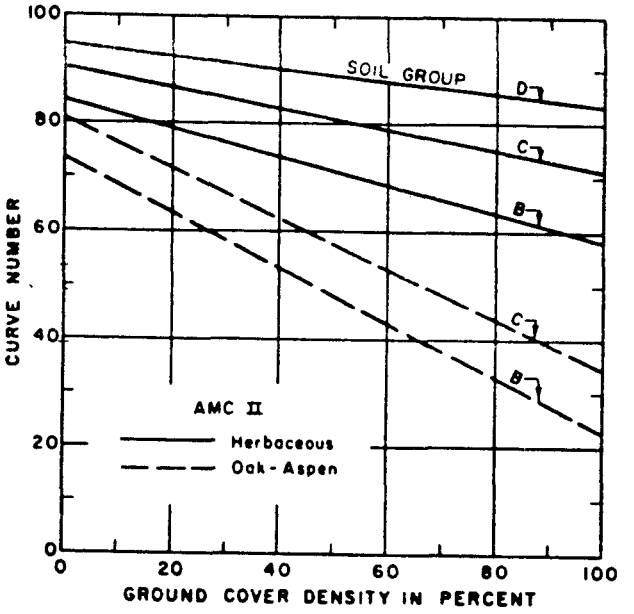


Figure 9.5.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: herbaceous and oak-aspen complexes.

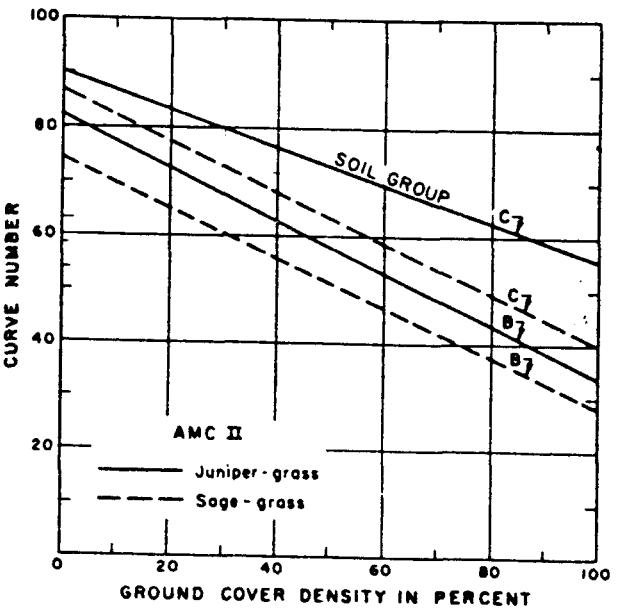


Figure 9.6.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: juniper-grass and sage-grass complexes.

Location 111° 11.3' Long 39° 19' Lattitude
T 17S R 7E SEC 19, 30
T 17S R 6E SEC 24, 26

100 yr	24 hr	3.6
10 yr	24 hr	2.4
100 yr	6 hr	2.3"
10 yr	6 hr	1.55
25 yr	6 hr	1.9

10-year 24-hour Runoff Volumes tributary to basins.
see attached CN printout for volume weighting

North Basin

DA-1: Area = 1.2 acres
Vol. weighted CN = 82 (.2ac temporary reclamation
.6ac Juniper grass
0.4 ac disturbed)

P = 2.4" ⇒ Q = 0.93 inches
∴ Volume R.O. = 0.93(1.2) = 1.1 ac-in
Total R.O. 10yr 24hr to North basin = 0.09 AF

1yr sed .01
.10

South Basin

DA-2: Area = 2.3 acres Vol. weighted CN = 80.2
P = 2.4" ⇒ Q = 0.83
Vol. R.O. = .83(2.3) = ~~1.9 ac-in~~
= 0.16 AF

DA-3: Area = 1.5 acres Vol. weight CN = 85.5
P = 2.4" ⇒ Q = 1.13
Vol. R.O. = 1.13 (1.5) = 1.70 AC-IN
= 0.14 AC-FT

Total to South Basin = 0.16 + 0.14 = 0.30 AC-FT

1yr .23
.53

Watersheds: UA-1, UA-2, & UA-3 (undisturbed areas to be bypassed around fan portal area).

ref. SCS, 1972

$$t_L = \frac{(\ell)^{0.8}(S+1)^{0.7}}{1900\ Y^{0.5}}$$

t_L = watershed lag time, hours
ℓ = hydraulic length
Y = average watershed slope, percent
S :

$$CN = \frac{1000}{10+S}$$

$$t_p = 1.11\ t_L$$

t_p = time to peak

scs curve number volume weighting
UP&L MINING - COTTONWOOD FAN PORTAL

CURVE NUMBERS:		JUNIPER	SAGE	DISTURBED							
P INCHES		75	65	90	90		P =	1.55			
1.55 RUNOFF (IN)											
BASIN ID	TOTAL AREA (acres)	JUNIPER (acres)	SAGE (acres)	DISTURBED (acres)	RUNOFF (inches)	vol wtd CN	COMPUTED S	COMPUTED RUNOFF	AVE BSN SLOPE %	HYDRAULIC LENGTH (FEET)	TIME LAG (hrs)	TP (hrs)
UA-1	16.9	16.4	0.3	0.2	0.948523	76	3.157894	0.206926	62.3	3050	0.110829	0.123143
UA-2	74.7	63.2	11.5	0	0.820669	74	3.513513	0.164628	53.8	4860	0.183368	0.203742
UA-3	16.3	16.3	0	0	0.97	75	3.333333	0.185046	64.1	2960	0.109806	0.122006

Disturbed Area Watersheds: DA-1, DA-2, DA-3, DA-4

time of concentration $= t_c = t_i + t_t$

reference: Denver Urban Storm Drainage Criteria Manual WME, 1969 revised 1984 - Urban Drainage and Flood Control District

$$t_i = \frac{1.8\,(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}}$$

t_i = initial or overland flow time (minutes)
C_5 = runoff coefficient for 5-year frequency
L = length of overland flow
S = average basin slope (percent)

Disturbed Area Watersheds Time of Concentration (cont.)

DA-1

t_i:

$C_5 = 0.25 \quad L = 130' \quad S = 42.6\%$

$$t_i = \frac{1.8(1.1 - .25)\sqrt{130}}{\sqrt[3]{42.6}} = 5 \text{ minutes}$$

$t_t = 300'$ @ $8\frac{1}{3}\%$ $\Rightarrow V \approx 3$ fps bare ground Fig 3-2

$= 1.67$ min

$t_c = 6.7$ minutes

$t_p = \frac{2}{3} t_c = 4.4$ min or $\boxed{0.07 \text{ hrs}}$

$T_{lag} = .067$

DA-2 mostly undisturbed

t_i: $C_5 = 0.25 \quad L = 150' \quad S = 71\%$

$t_i = 4.5$ min

$t_t = 375'$ @ 3.5% $\Rightarrow V = 1.8$ fps bare earth

$t_t = 3.5$ min

$\therefore t_c = 3.5 + 4.5 = 8$ minutes

$t_p = \frac{2}{3} t_c = 5.3$ min or $\boxed{0.09 \text{ hrs}}$

$T_{lag} = 0.08$

DA-3

t_i: $C_5 = 0.25 \quad L = 140' \quad S = 70\%$

$t_i = 4.4$ min

$t_t = 700'$ @ 8.1% $\Rightarrow V = 2.8$ fps bare earth

$t_t = 4.2$ min

$\therefore t_c = 8.6$ min $\quad t_p = 5.7$ min or $\boxed{0.10 \text{ hrs}}$

$T_{lag} = 0.086$ hrs

HANSEN ALLEN & LUCE INC

CLIENT UP&L Mining
PROJECT Cottonwood Fan Portal
FEATURE Tc
PROJECT NO. 5-1-3

SHEET 5 OF
COMPUTED S.J.P
CHECKED
DATE May 15, 1989

DA-4

t_i: $C_5 = 0.25$ $L = 80'$ $S = 63\%$

$$t_i = \frac{1.8(1.1 - .25)\sqrt{80}}{\sqrt[3]{63}} = 3.44 \text{ min}$$

t_t - 600' @ 11% ⇒ $V = 3.2$ fps bare ground

$t_t = 3.12$ min

$t_c = 3.44 + 3.12 = \underline{6.6 \text{ min}}$

$t_p = 2/3\ t_c = 4.4$ min or $\boxed{0.07 \text{ hrs}}$

$\boxed{T_{lag} = 0.066 \text{ hrs}}$

SCS curve number

UP&L COTTONWOOD FAN PORTAL

				RUNOFF IN INCHES 10-YR 24-HR	25-YR 6-HR	10-YR 6-HR
P RAINFALL				2.4	1.9	1.55
UA-1	AREA	CN	S			
JUNIPER	16.4	75	3.33	0.59	0.33	0.19
SAGE	0.3	65	5.38	0.26	0.11	0.04
DISTURBED	0.2	90	1.11	1.44	1.01	0.72
VOL WTD Q	16.9			0.60	0.34	0.19
VOL WTD CN		76	3.15	0.63	0.36	0.21
VOL WTD CN		75	3.33	0.59	0.33	0.19
UA-2	AREA	CN	S			
JUNIPER	63.2	75	3.33	0.59	0.33	0.19
SAGE	11.5	65	5.38	0.26	0.11	0.04
DISTURBED	0	90	1.11	1.44	1.01	0.72
VOL WTD Q	74.7			0.54	0.30	0.16
VOL WTD CN		74	3.51	0.55	0.30	0.16
VOL WTD CN		73	3.69	0.51	0.28	0.15
UA-3	AREA	CN	S			
JUNIPER	16.3	75	3.33	0.59	0.33	0.19
SAGE	0	65	5.38	0.26	0.11	0.04
DISTURBED	0	90	1.11	1.44	1.01	0.72
VOL WTD Q	16.3			0.59	0.33	0.19
VOL WTD CN		75	3.33	0.59	0.33	0.19
VOL WTD CN		75	3.33	0.59	0.33	0.19
DA-1	AREA	CN	S			
TEMP. R	0.2	80	2.5	0.82	0.50	0.31
JUNIPER	0.6	75	3.33	0.59	0.33	0.19
DISTURBED	0.4	90	1.11	1.44	1.01	0.72
VOL WTD Q	1.2			0.91	0.59	0.39
VOL WTD CN		82	2.19	0.93	0.58	0.37
VOL WTD CN		81	2.34	0.87	0.54	0.34
DA-2	AREA	CN	S			
SAGE	1.2	65	5.38	0.26	0.11	0.04
JUNIPER	0	75	3.33	0.59	0.33	0.19
DISTURBED	1.1	90	1.11	1.44	1.01	0.72
VOL WTD Q	2.3			0.83	0.54	0.37
VOL WTD CN		80	2.5	0.82	0.50	0.31
VOL WTD CN		80.2	2.46	0.83	0.51	0.32
DA-3	AREA	CN	S			
SAGE	0.4	65	5.38	0.26	0.11	0.04
JUNIPER	0	75	3.33	0.59	0.33	0.19
DISTURBED	1.1	90	1.11	1.44	1.01	0.72
VOL WTD Q	1.5			1.13	0.77	0.54

VOL WTD CN		66	1.62	1.16	0.77	0.53
VOL WTD CN		85.5	1.69	1.13	0.75	0.50
DA-4	AREA	CN	S			
SAGE	1.6	65	5.38	0.26	0.11	0.04
JUNIPER	0	75	3.33	0.59	0.33	0.19
DISTURBED	0.2	90	1.11	1.44	1.01	0.72
VOL WTD Q	1.8			0.39	0.21	0.11
VOL WTD CN		70	4.28	0.41	0.20	0.10
VOL WTD CN		69.5	4.38	0.39	0.19	0.09

Design flow for temporary structures = 10-year 6-hour rainstorm event

Methods:

Inlet Control

ref. "Hydraulic Charts for the Selection of Highway Culverts" H.E.C. 5, US DOT, 1965

CHART 5 "HEADWATER DEPTH FOR C.M. PIPE CULVERTS WITH INLET CONTROL"

see attached copy of Chart 5 for detail

recommend a minimum Hw depth of 1'

MINIMUM PIPE SLOPE

Mannings Equation: $Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{S_f}$

Q = flow in cfs

n = Mannings n reference: Table 4-9 (attached) "Handbook of Steel Drainage & Highway Construction Products" American Iron and Steel Institute, 3rd edition 1983

A = flow area = $\pi D^2/4$ for full flow

P = wetted perimeter = πD for full flow

S_f = friction slope

solve for $S_f = \left(\frac{Q}{\frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3}}\right)^2$

Culvert C-1

Q = 14 cfs D = 36" ⇒ n = .027 worst case

$\therefore S_{f_{min}} = \left(\frac{14}{321.9}\right)^2 = \underline{0.002 \text{ ft/ft minimum}}$

Culvert C-2

Q = 1.7 cfs D = 24" ⇒ n = .027 worst case

$\therefore S_f = \left(\frac{1.7}{109.3}\right)^2 = \underline{0.0002 \text{ ft/ft minimum}}$

use .001 ft/ft as min.

Culvert C-3

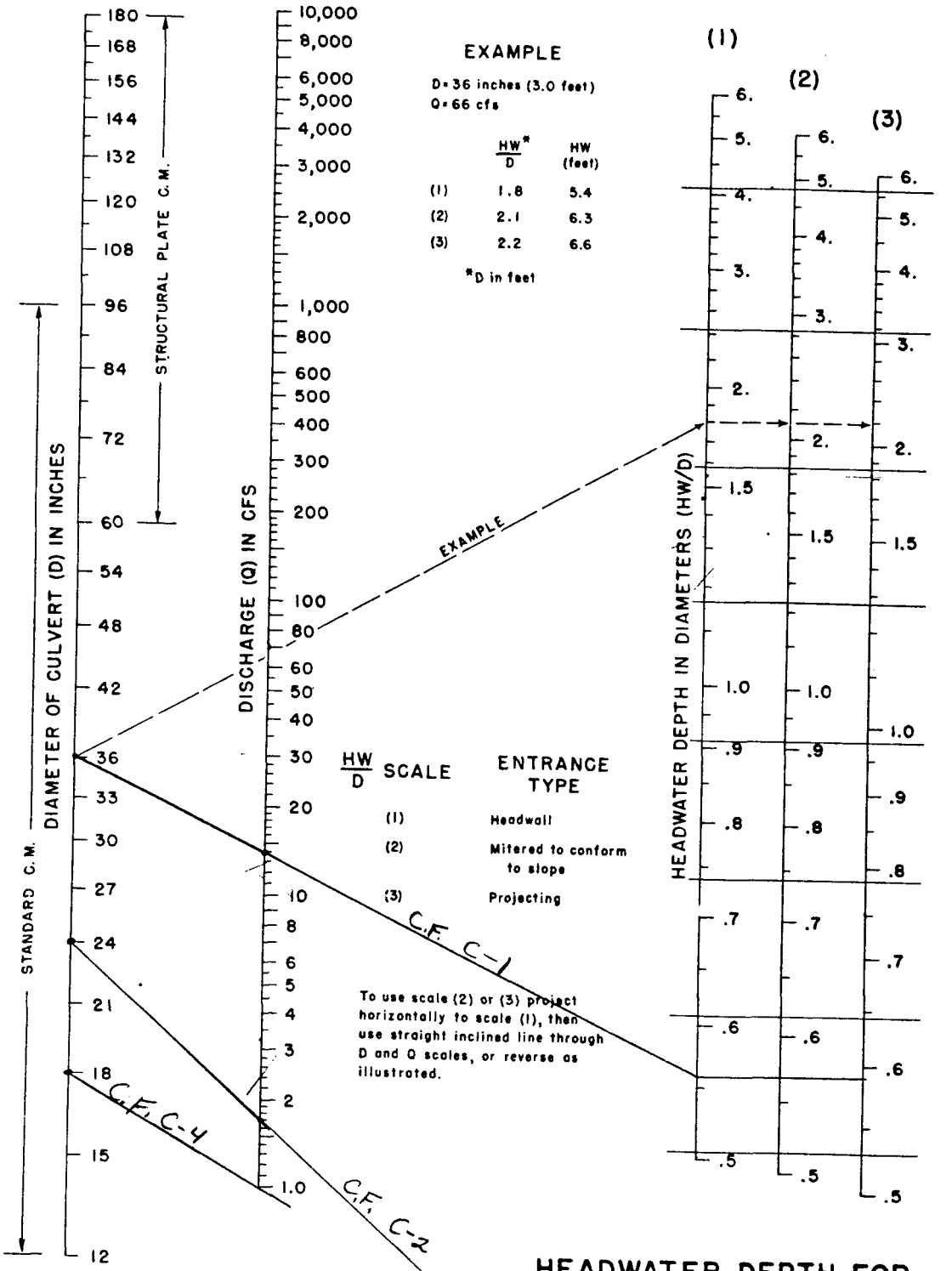
Q = 0.6 cfs D = 24" ⇒ $S_{f\,min} < .001$ ft/ft

Culvert C-4

Q = 0.6 cfs suggest use 18" culvert to facilitate maintenance ⇒ n = 0.027 worst case

$\therefore S_f = \left(\frac{0.6}{50.7}\right)^2 = 0.00014$ ft/ft min use .001

CHART 5



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

+ 10
BUREAU OF PUBLIC ROADS JAN. 1963

C.F. – Cottonwood Fan Portal of Wilberg Mine
W – Wilberg Mine Portal Facilities

CULVERT DESIGN CRITIERIA TABLE
WILBERG MINE/COTTONWOOD FAN PORTAL SITE

CULVERT	DESIGN FLOW (CFS)	PIPE DIAMETER (IN)	REQUIRED HEAD WATER DEPTH (FT)	REQUIRED MINIMUM SLOPE (FT/FT)
C-1	14.0	36	2	.002
C-2	1.7	24	1	.001
C-3	.6	24	1	.001
C-4	.6	18	1	.001

DITCH HYDRAULICS AND DESIGN METHODS:

Design Flow = 10 year 6 hour storm event

Flow Depth : Mannings Equation

$$Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{S}$$

Q = design flow in cfs
n = Mannings n : use 0.03 for unlined ditch
use $n = .0395\, D_{50}^{1/6}$ for riprap
where D_{50} = mean riprap size in feet

A = flow Area = $by + my^2$
where b = bottom width
y = flow depth
m = side slope in M Horizontal to 1 vertical

$P = b + 2Y\sqrt{m^2+1}$ = wetted perimeter
S = ditch slope
see attached spreadsheet for calculations.

Lining Criteria

Present practice in Utah Coal mine facilities is to provide erosion protection where design flow velocities exceed 5 feet per second (fps). The 5 fps is a practical guide combined with on going maintenance. It may prove necessary to line some ditches which have a velocity less than 5 fps due to specific soil conditions or flow characteristics. Therefore it is recommended that ditches with velocities which exceed 5 fps be lined and that all ditches be monitored and maintained as needed.

Riprap Design Method

reference: "Applied Hydrology and Sedimentology For Disturbed Areas" Barfield etal, 1981 see pp. 185-194

(1) $\tau_b = \gamma d s$

τ_b = maximum bed shear stress
γ = unit weight of water
d = flow depth
s = slope of ditch (friction slope)

Riprap Design Method (cont.)

(2) $\eta_b = \dfrac{21\,\tau_{max}}{\gamma(SG-1)D}$ based on Shield's diagram

η_b = stability parameter for bed

τ = shear stress

SG = Specific gravity of rip rap (normally ≈ 2.65)

D = mean stone diameter

(3) $SF_b = \dfrac{\cos\theta \tan\phi}{\sin\theta + \eta_b \tan\phi}$

θ = angle of channel bed to horizontal
$\tan^{-1} S$ S = slope in ft/ft

ϕ = angle of repose of riprap
see Figure 3.14 of Barfield et al 1981

SF_b = Safety Factor for riprap on bed

(4) $SF_s = \dfrac{\cos\alpha \tan\phi}{\eta' \tan\phi + \sin\alpha \cos\beta}$

$\eta' = \eta \dfrac{1 + \sin(\lambda + \beta)}{2}$

$\beta = \tan^{-1}\left(\dfrac{\cos\lambda}{\dfrac{2\sin\alpha}{\eta \tan\phi} + \sin\lambda}\right)$

where:

$\eta = \dfrac{21\,\tau_{max}\,\text{side}}{\gamma(SG-1)D}$

$\alpha = \tan^{-1}\dfrac{1}{M}$ M = side slope M horizontal to 1 vertical

$\lambda = \theta$ for uniform flow conditions

SF_s = Safety Factor of riprap on side slope

See attached spread sheet for riprap design for ditches with velocities exceeding 5 fps

DITCH HYDRAULICS TABLE
WILBERG MINE/COTTONWOOD FAN PORTAL SITE

CHANNEL	IDENTIFICATION	DESIGN FLOW (CFS)	SLOPE (ft/ft)	BOTTOM WIDTH (FT)	SIDE SLOPE (H/V)	MANNINGS N	DEPTH (FT)	COMPUTED FLOW (CFS)	FLOW AREA (FT2)	WETTED PERIMETER (FT)	HYDRAULIC RADIUS (FT)	VELOCITY (FPS)	
UD-1	maximum slope	3.11	0.13	4	2	0.03	0.151	3.121	0.65	4.68	0.14	4.80	riprap not required
UD-1	minimum slope	3.11	0.07	4	2	0.03	0.181	3.110	0.79	4.81	0.16	3.94	riprap not required
UD-2	maximum slope	10.98	0.09	3	2.5	0.042	0.485	11.02	2.04	5.61	0.36	5.39	USE RIPRAP D50=1.5'
UD-2	minimum slope	10.98	0.08	3	2.5	0.042	0.465	11.61	1.94	5.50	0.35	6.00	USE RIPRAP D50=1.5'
UD-3	maximum slope	2.78	0.20	3	2.5	0.042	0.178	2.789	0.61	3.96	0.15	4.55	USE RIPRAP D50=1.5'
UD-3	minimum slope	2.78	0.11	3	2	0.03	0.175	2.786	0.59	3.78	0.15	4.75	riprap not required
DD-1	maximum slope	0.41	0.1	1	2	0.03	0.109	0.416	0.13	1.49	0.09	3.14	riprap not required
DD-1	minimum slope	0.41	0.06	1	2	0.03	0.125	0.410	0.16	1.56	0.10	2.62	riprap not required
DD-2	maximum slope	0.6	0.18	1	2	0.03	0.114	0.604	0.14	1.51	0.09	4.32	riprap not required
DD-2	minimum slope	0.6	0.1	1	2	0.03	0.135	0.607	0.17	1.60	0.11	3.54	riprap not required
DD-3	maximum slope	0.6	0.1	1	2	0.03	0.135	0.607	0.17	1.60	0.11	3.54	riprap not required
DD-3	minimum slope	0.6	0.06	1	2	0.03	0.155	0.601	0.20	1.69	0.12	2.96	riprap not required
DD-4	maximum slope	0.69	0.12	1	2	0.03	0.138	0.691	0.18	1.62	0.11	3.92	riprap not required
DD-4	minimum slope	0.69	0.06	1	2	0.03	0.168	0.694	0.22	1.75	0.13	3.09	riprap not required
DD-5	maximum slope	0.62	0.11	1	2	0.03	0.133	0.620	0.17	1.59	0.11	3.68	riprap not required
DD-5	minimum slope	0.62	0.06	1	2	0.03	0.158	0.622	0.21	1.71	0.12	2.99	riprap not required

DITCH RIPRAP DESIGN TABLE

CLIENT: UP&L MINING
PROJECT:WILBERG MINE/COTTONWOOD FAN PORTAL SITE

CHANNEL IDENTIFICATION		RIPRAP D50 (FT)	ANGLE OF REPOSE (DEGREES)	MANNING'S N	FLOW DEPTH (FT)	MAX. TRACTIVE FORCE (LBS/FT2)	CHANNEL BED STABILITY Nb	SAFTEY FACTOR FOR BED SFb	MAX. SIDE TRACTIVE FORCE (LBS/FT2)	n	BETA (RADIANS)	CHANNEL WALL STABILITY N'	SAFTEY FACTOR FOR SIDE SFs
LD-2	maximum slope	1.5	41	*0.042261	0.485	2.72376	0.370	2.10	2.07	0.281	0.308504	0.195318	1.5413352
LD-2	minimum slope	1.5	41	*0.042261	0.465	2.32128	0.316	2.45	1.76	0.239	0.267173	0.160731	1.6209157
LD-3	maximum slope	1.5	41	*0.042261	0.178	2.22144	0.302	1.86	1.69	0.229	0.245224	0.163945	1.6052501

* Mannings $N = .0395\ D_{50}^{1/6}$

Sediment Volumes -

Modified Universal Soil Loss Equation

$A = R \cdot K \cdot LS \cdot VM$

reference: "Erosion and Sedimentation in Utah: A Guide for Control" Israelsen et al 1984

where:

A = soil loss per unit area (tons/acre/year)
R = rainfall factor
K = soil erodibility factor
LS = topographic factor
VM = erosion control factor

R (rainfall factor)

reference: Price Iso-Erodent (R) Values map 1983 from above referenced report (Israelsen et al)

Mean Annual R = 15 @ Cottonwood Fan Site 111°11.3' Longitude 39°19' latitude

K soil erodibility factor

map for state of Utah (Israelsen et al, 1984) indicates that the Cottonwood Fan Portal site is near boundary between k = 0 to 0.1 and k = 0.21 to 0.30 choose more conservative range:

k = 0.21 to 0.30 use 0.30

VM: undisturbed

Juniper-Grass 51% cover
Sage-Grass 54% cover (21% sage 33% grass)

ref: "Applied Hydrology and Sedimentology for Disturbed Areas" Barfield & Werner, 1981 Red Book

Table 5.A.3

Canopy of short brush - 25% canopy w/54% cover = C VM = .064
trees - grass - 25% canopy w/51% cover VM = 0.070

∴ use VM = .064 for Sage-Grass
VM = .070 for Juniper-Grass

see attached copy of table

disturbed - use VM = 1.0

Table 5.A.3. C Factors for Permanent Pasture, Rangeland, Idle Land, and Grazed Woodland.[1,5]

Vegetal Canopy			Cover that Contacts the Surface					
Type and Height of Raised Canopy[2]	Canopy Cover[3] %	Type[4]	Percent Ground Cover					
			0	20	40	60	80	95-100
No appreciable canopy		G	.45	.20	.10	.042	.013	.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush (0.5 m fall ht.)	25	G	.36	.17	.09	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.06	.031	.011	.003
		W	.17	.12	.09	.067	.038	.011
Appreciable brush or bushes (2 m fall ht.)	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees but no appreciable low brush (4 m fall ht.)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

1. All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists. Idle land refers to land with undisturbed profiles for at least a period of three consecutive years. Also to be used for burned forest land and forest land that has been harvested less than three years ago.
2. Average fall height of waterdrops from canopy to soil surface: m = meters.
3. Portion of total area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).
4. G: Cover at surface is grass, grasslike plants, decaying compacted duff or litter at least 2 inches deep.

   W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral root network near the surface), and/or undecayed residue.
5. Soil Conservation Service (1977).

North Sediment Basin

tributary area: sub-basin DA-1

1.2 acres area total

.2 acres temporary reclamation associated with top soil storage - well vegetated
use VM = 0.07

North SEDIMENT Basin
Mean Annual Sediment Loading
R=15, K=0.3 ⇒ R·K = 4.5

COVER	area (acres)	ℓ (ft)	S %	LS	VM	A (t/ac/yr) $4.5 \cdot LS \cdot VM$	MEAN ANNUAL SED. (tons/year)
Temporarily Reclaimed	0.2	100	40	12.65	0.07	4.0	0.80
Juniper-Grass	0.6	100	62	24	0.07	7.6	4.56
Disturbed	0.4	25	5	0.27	1.0	1.2	0.49
							5.85 tons/year

Assume a unit weight of sediment of 75 lb/ft³

∴ Mean Annual Sediment Volume tributary to North Sediment Basin =

$$5.85 \text{ ton/year} \times 2000 \text{ lbs/ton} \times \frac{1}{75 \text{ lb/ft}^3} \times \frac{1 \text{ AF}}{43560} = \underline{0.004 \text{ AF/year}}$$

∴ Three year sediment load = <u>0.01 Acre-feet</u>

SOUTH SEDIMENT BASIN

tributary area: sub-basins DA-2 and DA-3

- ignore deposition in conveyance channels (conservative approach)

cover	area (acres)	ℓ (ft)	S (%)	LS	VM	Y.(LS)VM A (t/ac/yr)	MEAN ANNUAL SED. YIELD (tons/year)
DA-2							
SAGE-Grass	1.2	130	77	37.8	.064	10.89	13.1
Disturbed	1.1	70	40	[1] 26.4	1.0	118.8	130.7
DA-3							
Disturbed	1.1	85	60	21.4	1.0	96.30	105.9
Sage-Grass	0.4	65	67	[2] 43.26	.064	12.46	5.0

255 tons/year

$\simeq$ 0.16 AF/year

ref p. 83 to Israelsen et al 1984 for multiple slopes LS

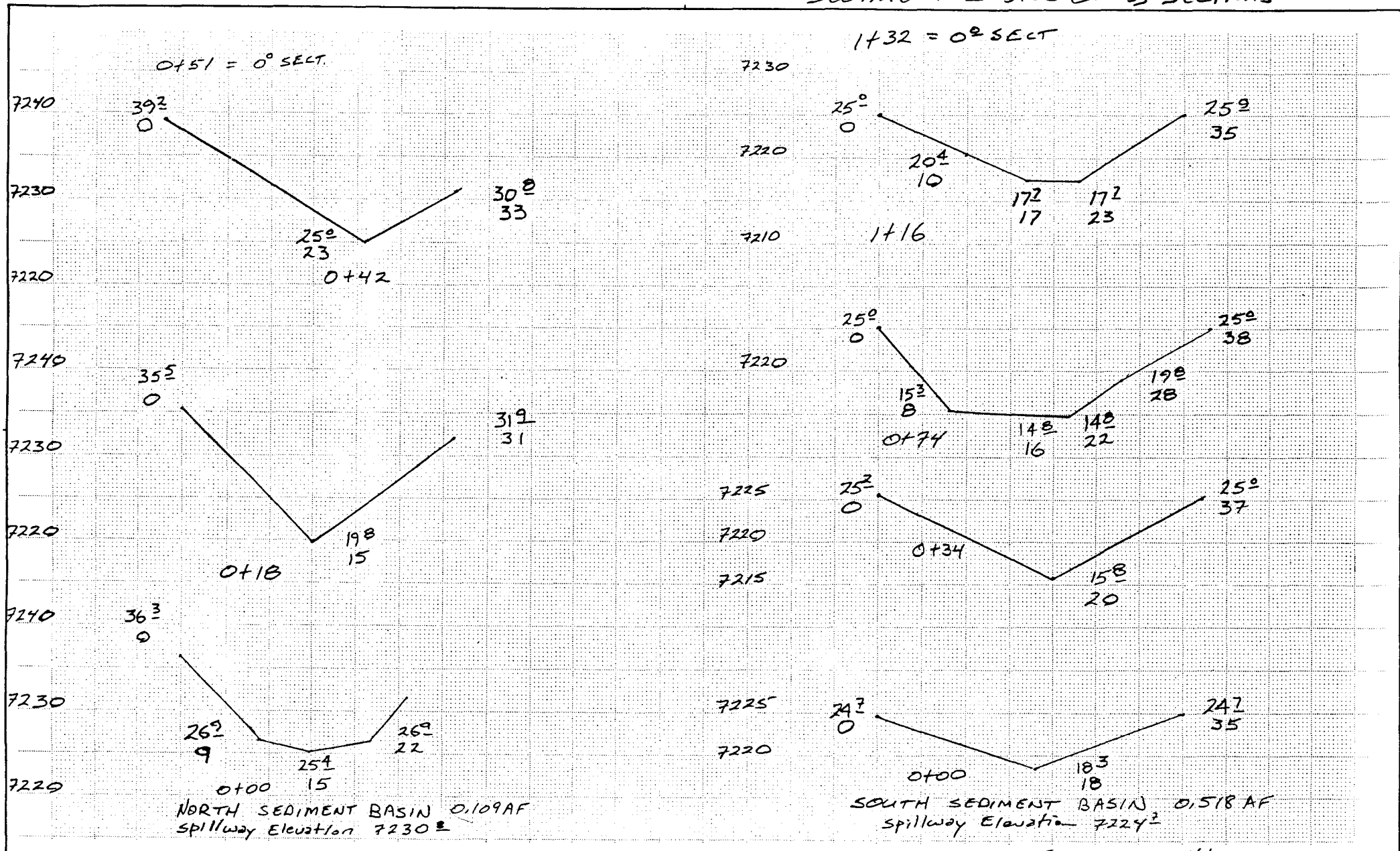
[1] $$LS = \frac{(L\lambda_n S_{s_n})\lambda_n - (L\lambda_{n-1} S_{s_n})\lambda_{n-1}}{\ell_n} = \frac{(17.89)(200) - 13.33(130)}{70}$$

$\lambda_{Disturbed} = 130 + 70 = 200$

$\lambda S_{s_n} = 200 @ 40\% \Rightarrow 17.89$

[2] $$LS = \frac{(32.68)150 - (24.59)85}{65} = 43.26$$

UP&L
Cottonwood Fan Portal
Sediment Basin Cross sections

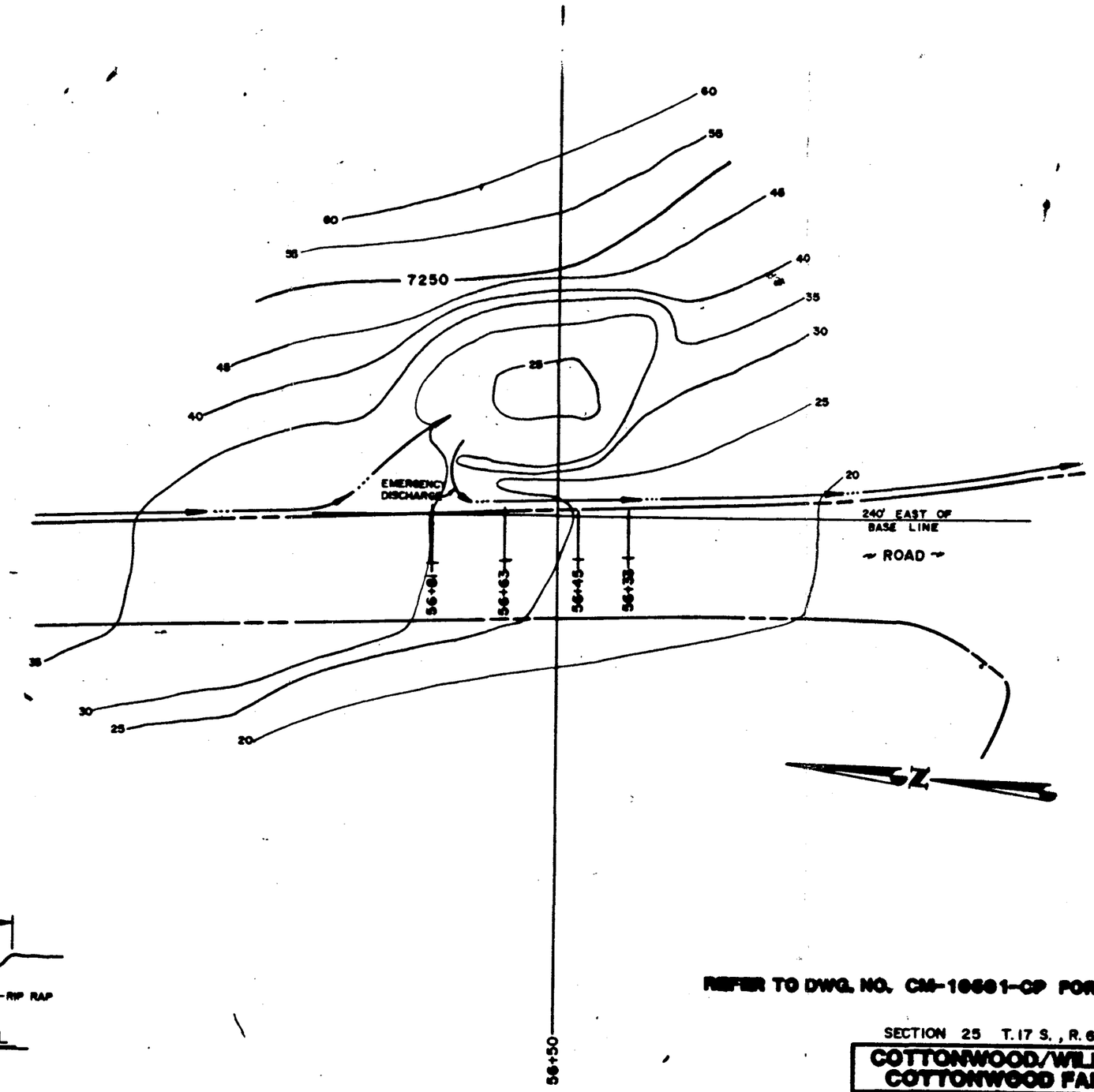


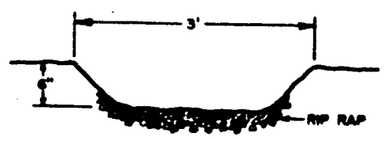
NORTH SEDIMENT BASIN 0.109 AF
spillway Elevation 7230.8

SOUTH SEDIMENT BASIN 0.518 AF
spillway Elevation 7224.7

0.09 AF R.O. 10yr 24hr
0.01 AF SED' 1yr yield
0.10 AF required

0.30 AF 10yr 24hr
0.16 AF SED
0.46 AF ∴ storage less than 1 yr sed



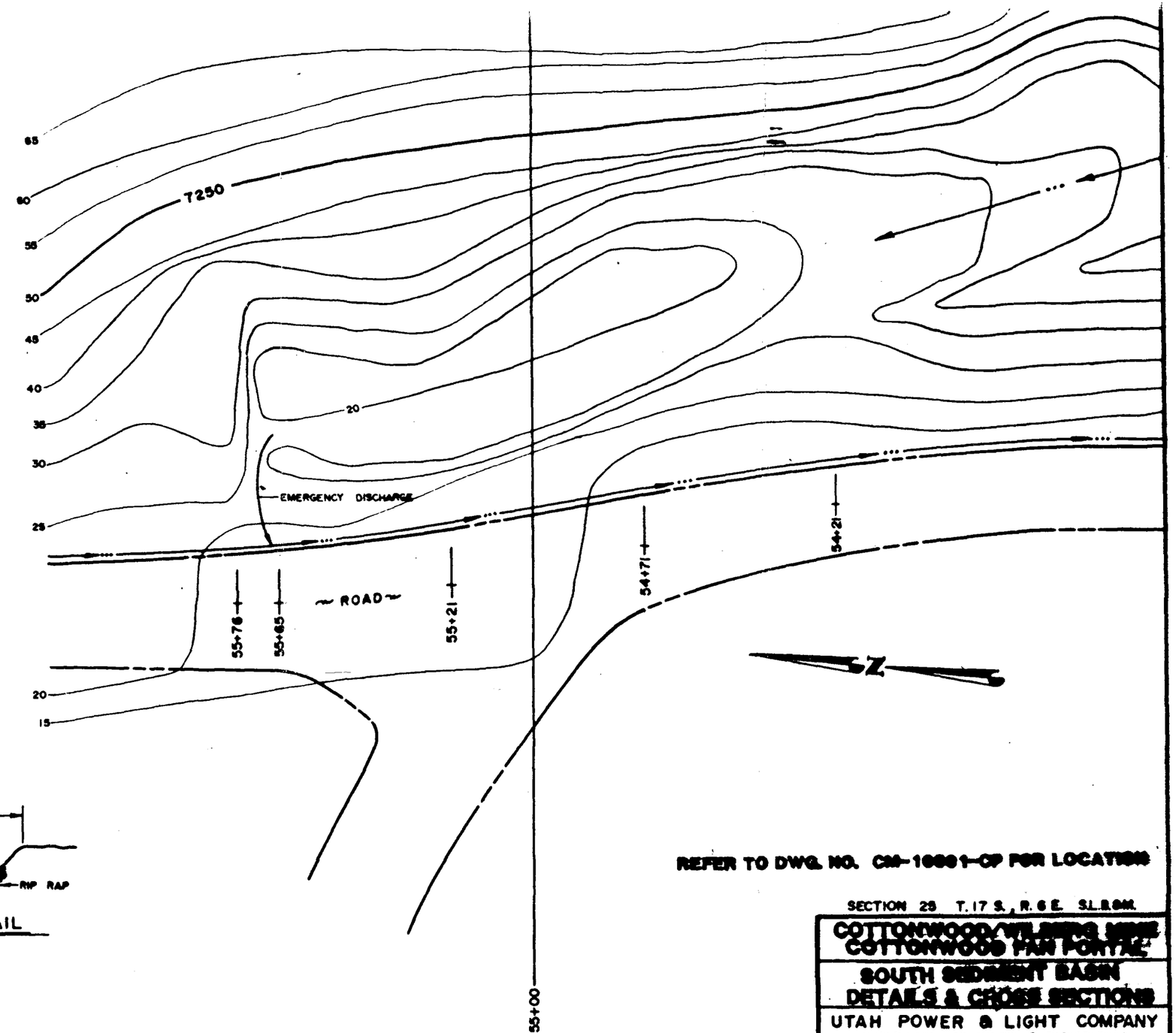


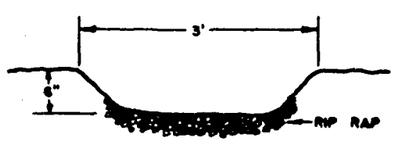
DISCHARGE DETAIL
NO SCALE

REFER TO DWG. NO. CM-10661-CP FOR LOCATIONS

SECTION 25 T. 17 S., R. 6 E. S.L.B.&M.

COTTONWOOD/WILBERG MINE COTTONWOOD FAN PORTAL		
NORTH SEDIMENT BASIN DETAILS & CROSS SECTIONS		
UTAH POWER & LIGHT COMPANY DEPARTMENT OF MINING & EXPLORATION		
SCALE: 1" = 30'	DRAWN BY: S.M.C.	DRAWING NUMBER
DATE: NOV. 20, 1980	CHECKED BY:	CM-10353-CP





DISCHARGE DETAIL

NO SCALE

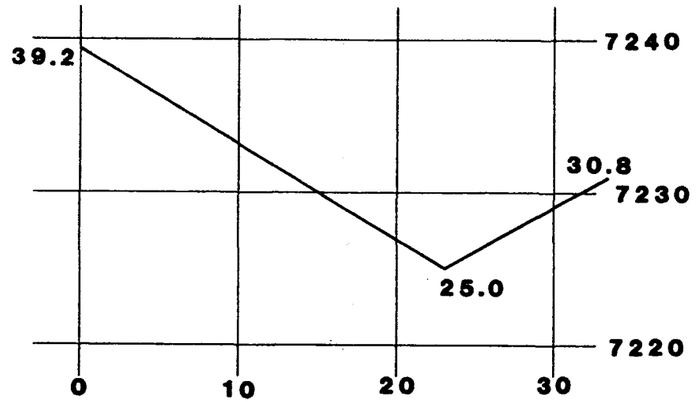
REFER TO DWG. NO. CM-10861-CP FOR LOCATION

SECTION 25 T. 17 S., R. 6 E. S.L.B.&M.

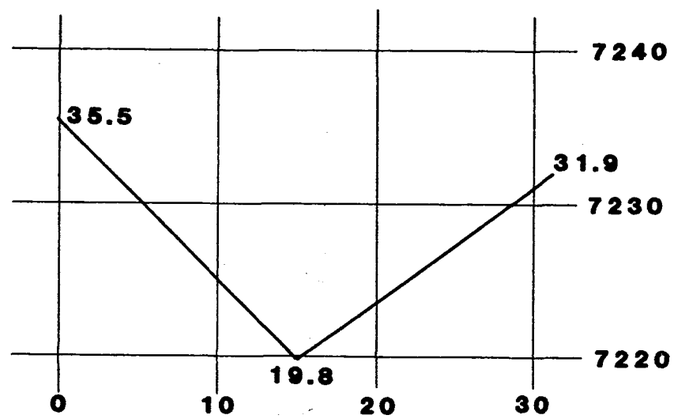
COTTONWOOD/WILBERG MINE COTTONWOOD FAN PORTAL		
SOUTH SEDIMENT BASIN DETAILS & CROSS SECTIONS		
UTAH POWER & LIGHT COMPANY DEPARTMENT OF MINING & EXPLORATION		
SCALE: 1" = 30'	DRAWN BY: S. M. C.	DRAWING NUMBER
DATE: NOV. 19, 1980	CHECKED BY:	CM-10351-CP

STA. 0+51 = 0º SECTION

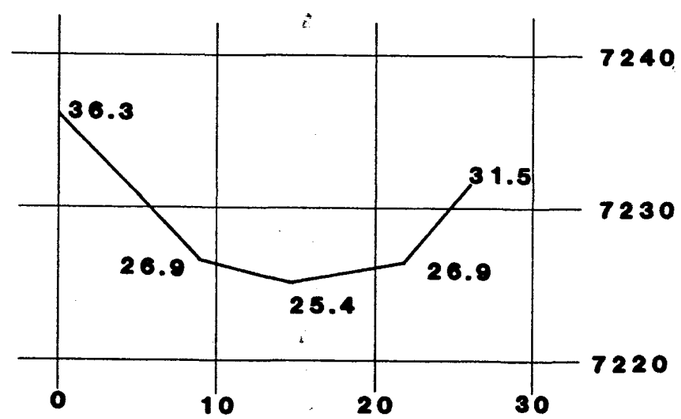
STA. 0+42



STA. 0+18



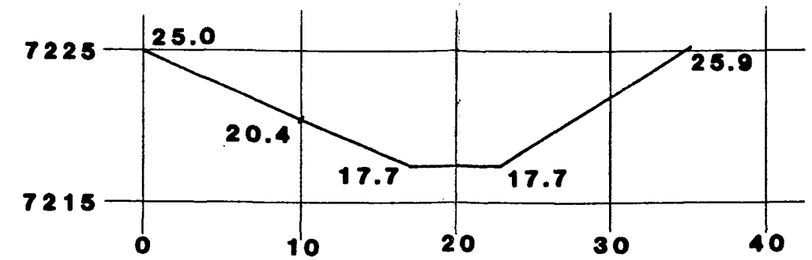
STA. 0+00



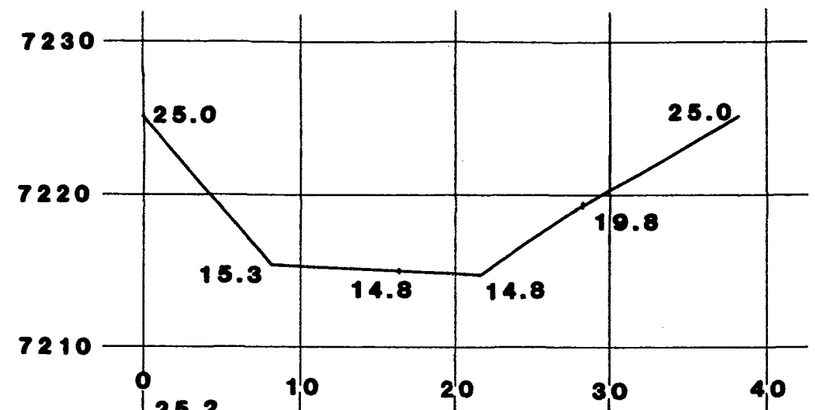
NORTH SEDIMENT BASIN 0.109 AF
SPILLWAY ELEVATION 7230.8

NOTE:
CROSS SECTIONS PROVIDED BY
UP&L, SURVEY DATED 2-21-85

STA. 1+16

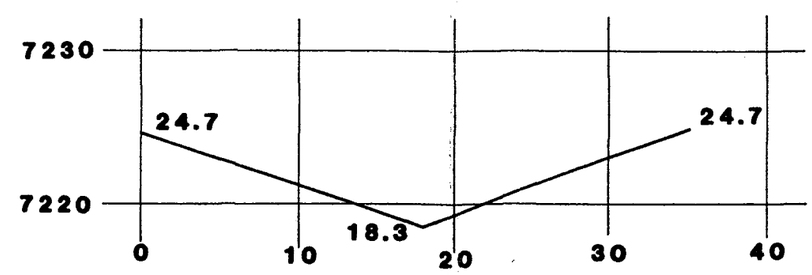


STA. 0+74



STA. 0+34

STA. 0+00



SOUTH SEDIMENT BASIN 0.518 AF
SPILLWAY ELEVATION 7224.7

COTTONWOOD CANYON FAN PORTAL
SEDIMENT BASIN
CROSS SECTIONS

1

****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

Cottonwood Fan Portal Site

10-year 6-hour

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

    1           ID     UP&L Mining - Cottonwood Fan Portal
    2           ID     10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
    3           ID     by gjp Hansen, Allen & Luce  May 1989
*** FREE ***
                #DIAGRAM
    4           IT       1       0       0     300
    5           IO       3

    6           KK    UA-1
    7           BA   .0264
    8           PB    1.55
    9           IN     30.
   10           PI      0.    .035    .045    .055    .095     .37      .1     .18    .055     .05
   11           PI     .04     .04    .035
   12           LS       0     76.      0.
   13           UD   .1108

   14           KK    UA-2
   15           BA    .117
   16           PB    1.55
   17           LS       0      74       0
   18           UD    .183

   19           KK     C-1 CULVERT C-1
   20           HC       2

   21           KK    UA-3
   22           BA   .0255
   23           PB    1.55
   24           LS       0      75       0
   25           UD    .110

   26           KK COMBINE convenience combination
   27           HC       2

   28           KK    DA-1
   29           BA  .00188
   30           PB    1.55
   31           LS       0      82       0
   32           UD    .067

   33           KK    DA-2 Tributary to Culvert C-4
   34           BA  .00359
   35           PB    1.55
   36           LS       0    80.2       0
   37           UD     .08

   38           KK   ROUTEto South Basin
```

39	RK	200.	.32	.05	TRAF	2	2

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


  40          KK    DA-3
  41          BA  .00234
  42          PB    1.55
  43          LS       0    85.5       0
  44          UD    .086

  45          KK   SOUTHDA-2 + DA-3
  46          HC       2

  47          KK     C-2
  48          HC       2

  49          KK COMBINEconvenience combination
  50          HC       2

  51          KK    DA-4 tributary to Ditch DD-5
  52          BA  .00281
  53          PB    1.55
  54          LS       0      82       0
  55          UD    .066

  56          KK COMBINE
  57          HC       2
  58          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

  6        UA-1
              .
              .
 14           .        UA-2
              .           .
              .           .
 19         C-1............
              .
              .
 21           .        UA-3
              .           .
              .           .
 26     COMBINE............
              .
              .
 28           .        DA-1
              .           .
              .           .
 33           .           .        DA-2
              .           .           V
              .           .           V
 38           .           .       ROUTE
              .           .           .
              .           .           .
 40           .           .           .        DA-3
              .           .           .           .
              .           .           .           .
 45           .           .       SOUTH............
              .           .           .
              .           .           .
 47           .         C-2............
              .           .
              .           .
 49     COMBINE............
              .
              .
 51           .        DA-4
              .           .
              .           .
 56     COMBINE............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1

****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

```
                                                  ****

                    UP&L Mining - Cottonwood Fan Portal
                    10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
                    by gjp Hansen, Allen & Luce  May 1989

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

 IT          HYDROGRAPH TIME DATA
                   NMIN          1  MINUTES IN COMPUTATION INTERVAL
                  IDATE      1    0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      1    0  ENDING DATE
                 NDTIME       0459  ENDING TIME

              COMPUTATION INTERVAL     .02 HOURS
                   TOTAL TIME BASE    4.98 HOURS

     ENGLISH UNITS


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


        **************
        *            *
 6 KK   *      UA-1  *
        *            *
        **************

 9 IN        TIME DATA FOR INPUT TIME SERIES
                  JXMIN         30  TIME INTERVAL IN MINUTES
                 JXDATE      1    0  STARTING DATE
                 JXTIME          0  STARTING TIME

           SUBBASIN RUNOFF DATA

 7 BA        SUBBASIN CHARACTERISTICS
                  TAREA        .03  SUBBASIN AREA

             PRECIPITATION DATA

 8 PB             STORM       1.55  BASIN TOTAL PRECIPITATION
```

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

12 LS SCS LOSS RATE

STRTL	.63	INITIAL ABSTRACTION
CRVNBR	76.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

13 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.11	LAG

***

UNIT HYDROGRAPH
35 END-OF-PERIOD ORDINATES

6.	18.	37.	62.	88.	102.	107.	105.	95.	84.
68.	51.	41.	32.	26.	21.	16.	13.	11.	8.
7.	5.	4.	3.	3.	2.	2.	1.	1.	1.
1.	1.	0.	0.	0.					

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

HYDROGRAPH AT STATION UA-1

TOTAL RAINFALL = 1.55, TOTAL LOSS = 1.34, TOTAL EXCESS = .21

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
3.	4.02		1.	1.	1.	1.
		(INCHES)	.198	.198	.198	.198
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .03 SQ MI

*** ***

```
         **************
         *            *
14 KK    *     UA-2   *
         *            *
         **************
```

SUBBASIN RUNOFF DATA

15 BA SUBBASIN CHARACTERISTICS

TAREA .12 SUBBASIN AREA

PRECIPITATION DATA

16 PB STORM 1.55 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

```
17 LS          SCS LOSS RATE
                    STRTL        .70  INITIAL ABSTRACTION
                   CRVNBR      74.00  CURVE NUMBER
                    RTIMP        .00  PERCENT IMPERVIOUS AREA

18 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG        .18  LAG

                                          ***

                                      UNIT HYDROGRAPH
                                 57 END-OF-PERIOD ORDINATES
          8.      24.      46.      73.     108.     152.     200.     241.     269.     287.
        294.     294.     287.     271.     252.     232.     206.     177.     149.     127.
        110.      95.      82.      73.      64.      55.      48.      41.      36.      31.
         27.      23.      20.      17.      15.      13.      11.      10.       9.       8.
          7.       6.       5.       4.       4.       3.       3.       3.       2.       2.
          2.       1.       1.       1.       1.       0.       0.

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

                 HYDROGRAPH AT STATION     UA-2

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.39, TOTAL EXCESS =     .16

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                        (CFS)
+   11.       4.07                  2.          2.          2.          2.
                      (INCHES)    .152        .152        .152        .152
                       (AC-FT)      1.          1.          1.          1.

                 CUMULATIVE AREA =     .12 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

        **************
        *            *
 19 KK  *      C-1   *      CULVERT C-1
        *            *
        **************

 20 HC         HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                     HYDROGRAPH AT STATION      C-1

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                       (CFS)
+     14.     4.05                   3.          3.          3.          3.
                    (INCHES)       .160        .160        .160        .160
                     (AC-FT)        1.          1.          1.          1.

                     CUMULATIVE AREA =     .14 SQ MI


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

        **************
        *            *
 21 KK  *     UA-3   *
        *            *
        **************

           SUBBASIN RUNOFF DATA

 22 BA         SUBBASIN CHARACTERISTICS
                    TAREA         .03  SUBBASIN AREA

               PRECIPITATION DATA

 23 PB              STORM        1.55  BASIN TOTAL PRECIPITATION

 10 PI           INCREMENTAL PRECIPITATION PATTERN
                    .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                    .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

```
24 LS          SCS LOSS RATE
                    STRTL        .67  INITIAL ABSTRACTION
                   CRVNBR      75.00  CURVE NUMBER
                    RTIMP        .00  PERCENT IMPERVIOUS AREA

25 UD          SCS DIMENSIONLESS UNITGRAPH
                    TLAG        .11  LAG

                                          ***

                                     UNIT HYDROGRAPH
                                 35 END-OF-PERIOD ORDINATES
          6.      18.      36.      61.      86.     100.     104.     101.      92.      80.
         65.      49.      39.      31.      25.      20.      15.      12.      10.       8.
          6.       5.       4.       3.       3.       2.       2.       1.       1.       1.
          1.       1.       0.       0.       0.

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

                HYDROGRAPH AT STATION     UA-3

TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.36, TOTAL EXCESS =     .19
```

```
EAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      4.98-HR
+  (CFS)      (HR)
                        (CFS)
+    3.      4.02                   1.          1.          1.          1.
                      (INCHES)     .177        .177        .177        .177
                       (AC-FT)      0.          0.          0.          0.

                       CUMULATIVE AREA =     .03 SQ MI
```

```
* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 26 KK    *   COMBINE  *      convenience combination
          *            *
          **************

 27 HC          HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                       HYDROGRAPH AT STATION  COMBINE
```

```
EAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      4.98-HR
+  (CFS)      (HR)
                        (CFS)
+   17.      4.03                   4.          4.          4.          4.
                      (INCHES)     .163        .163        .163        .163
                       (AC-FT)      1.          1.          1.          1.

                       CUMULATIVE AREA =     .17 SQ MI
```

```
* *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 28 KK    *     DA-1   *
          *            *
          **************
```

SUBBASIN RUNOFF DATA

29 BA SUBBASIN CHARACTERISTICS

TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

30 PB STORM 1.55 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

31 LS SCS LOSS RATE

STRTL .44 INITIAL ABSTRACTION

CRVNBR 82.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

2 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .07 LAG

***

UNIT HYDROGRAPH
22 END-OF-PERIOD ORDINATES

1.	5.	9.	12.	12.	10.	7.	5.	3.	2.
2.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.								

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

HYDROGRAPH AT STATION DA-1

TOTAL RAINFALL = 1.55, TOTAL LOSS = 1.18, TOTAL EXCESS = .37

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
+ (CFS)	(HR)					
		(CFS)				
+ 0.	3.02		0.	0.	0.	0.
		(INCHES)	.366	.366	.366	.366
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

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          **************
          *            *
33 KK     *    DA-2    *     Tributary to Culvert C-4
          *            *
          **************
```

SUBBASIN RUNOFF DATA

34 BA SUBBASIN CHARACTERISTICS
TAREA .00 SUBBASIN AREA

PRECIPITATION DATA

35 PB STORM 1.55 BASIN TOTAL PRECIPITATION

10 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

56 LS SCS LOSS RATE

STRTL	.49	INITIAL ABSTRACTION
CRVNBR	80.20	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

57 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	.08	LAG

***

UNIT HYDROGRAPH
26 END-OF-PERIOD ORDINATES

2.	6.	12.	17.	20.	19.	17.	13.	9.	7.
5.	4.	3.	2.	1.	1.	1.	1.	0.	0.
0.	0.	0.	0.	0.	0.				

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

HYDROGRAPH AT STATION DA-2

TOTAL RAINFALL = 1.55, TOTAL LOSS = 1.23, TOTAL EXCESS = .32

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	4.98-HR
(CFS)	(HR)					
		(CFS)				
1.	3.03		0.	0.	0.	0.
		(INCHES)	.308	.308	.308	.308
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

```
        **************
        *            *
68 KK   *    ROUTE   *    to South Basin
        *            *
        **************
```

HYDROGRAPH ROUTING DATA

```
69 RK        KINEMATIC WAVE STREAM ROUTING
                    L       200.  CHANNEL LENGTH
                    S      .3200  SLOPE
                    N       .050  CHANNEL ROUGHNESS COEFFICIENT
                   CA        .00  CONTRIBUTING AREA
                SHAPE       TRAP  CHANNEL SHAPE
                   WD       2.00  BOTTOM WIDTH OR DIAMETER
                    Z       2.00  SIDE SLOPE
```

***

KINEMATIC STREAM ROUTING USED FOR THIS REACH

COMPUTED KINEMATIC PARAMETERS

ALPHA	M	DT (MIN)	DX (FT)
7.3196	1.351	.50	100.00

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

HYDROGRAPH AT STATION ROUTE

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
		(CFS)				
1.	3.03		0.	0.	0.	0.
		(INCHES)	.307	.307	.307	.307
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

*** ***

```
        **************
        *            *
0 KK    *     DA-3   *
        *            *
        **************
```

SUBBASIN RUNOFF DATA

```
1 BA        SUBBASIN CHARACTERISTICS
                 TAREA        .00  SUBBASIN AREA

            PRECIPITATION DATA

2 PB             STORM       1.55  BASIN TOTAL PRECIPITATION

0 PI          INCREMENTAL PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00
```

```
3 LS          SCS LOSS RATE
                   STRTL        .34  INITIAL ABSTRACTION
                  CRVNBR      85.50  CURVE NUMBER
                   RTIMP        .00  PERCENT IMPERVIOUS AREA

44 UD         SCS DIMENSIONLESS UNITGRAPH
                   TLAG        .09  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          28 END-OF-PERIOD ORDINATES
            1.       3.       6.      10.      12.      12.      11.       9.       7.       5.
            4.       3.       2.       2.       1.       1.       1.       0.       0.       0.
            0.       0.       0.       0.       0.       0.       0.       0.

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

                    HYDROGRAPH AT STATION     DA-3

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.05, TOTAL EXCESS =     .50

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                      (CFS)
+    1.      3.02                    0.          0.          0.          0.
                    (INCHES)       .493        .493        .493        .493
                     (AC-FT)        0.          0.          0.          0.

                    CUMULATIVE AREA =     .00 SQ MI


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


        **************
        *            *
5 KK    *     SOUTH  *     DA-2 + DA-3
        *            *
        **************

6 HC          HYDROGRAPH COMBINATION
                   ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***

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

                    HYDROGRAPH AT STATION    SOUTH
```

```
PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                        (CFS)
+     1.      3.03                    0.          0.          0.          0.
                      (INCHES)      .380        .380        .380        .380
                       (AC-FT)       0.          0.          0.          0.

                       CUMULATIVE AREA =     .01 SQ MI
```

*** ***

```
          ************
          *          *
 47 KK    *      C-2 *
          *          *
          ************

 48 HC          HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                       HYDROGRAPH AT STATION      C-2

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                        (CFS)
+     2.      3.03                    0.          0.          0.          0.
                      (INCHES)      .377        .377        .377        .377
                       (AC-FT)       0.          0.          0.          0.

                       CUMULATIVE AREA =     .01 SQ MI
```

*** ***

```
          ************
          *          *
 49 KK    *  COMBINE *     convenience combination
          *          *
```

```
        **************

 50 HC          HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                      HYDROGRAPH AT STATION  COMBINE

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                        (CFS)
+    18.      4.03                   4.          4.          4.          4.
                     (INCHES)      .172        .172        .172        .172
                      (AC-FT)       2.          2.          2.          2.

                      CUMULATIVE AREA =     .18 SQ MI


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


        **************
        *            *
 51 KK  *     DA-4   *      tributary to Ditch DD-5
        *            *
        **************

           SUBBASIN RUNOFF DATA

 52 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .00  SUBBASIN AREA

                PRECIPITATION DATA

 53 PB               STORM        1.55  BASIN TOTAL PRECIPITATION

 10 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                     .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	

```
54 LS          SCS LOSS RATE
                    STRTL        .44  INITIAL ABSTRACTION
                   CRVNBR      82.00  CURVE NUMBER
                    RTIMP        .00  PERCENT IMPERVIOUS AREA

55 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG        .07  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         22 END-OF-PERIOD ORDINATES
            2.       7.      14.      18.      18.      15.      11.       7.       5.       4.
            2.       2.       1.       1.       1.       0.       0.       0.       0.       0.
            0.       0.

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

                   HYDROGRAPH AT STATION     DA-4

 TOTAL RAINFALL =    1.55, TOTAL LOSS =    1.18, TOTAL EXCESS =     .37

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR      4.98-HR
+ (CFS)       (HR)
                        (CFS)
+   1.       3.02                   0.          0.          0.          0.
                      (INCHES)     .366        .366        .366        .366
                       (AC-FT)      0.          0.          0.          0.
```

CUMULATIVE AREA = .00 SQ MI

*** ***

```
        **************
        *            *
6 KK    *   COMBINE  *
        *            *
        **************
```

7 HC HYDROGRAPH COMBINATION

ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

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

HYDROGRAPH AT STATION COMBINE

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	4.98-HR
19.	4.03	(CFS)	4.	4.	4.	4.
		(INCHES)	.175	.175	.175	.175
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .18 SQ MI

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	UA-1	3.	4.02	1.	1.	1.	.03		
HYDROGRAPH AT	UA-2	11.	4.07	2.	2.	2.	.12		
2 COMBINED AT	C-1	14.	4.05	3.	3.	3.	.14		
HYDROGRAPH AT									

+	UA-3	3.	4.02	1.	1.	1.	.03
2 COMBINED AT +	COMBINE	17.	4.03	4.	4.	4.	.17
HYDROGRAPH AT +	DA-1	0.	3.02	0.	0.	0.	.00
HYDROGRAPH AT +	DA-2	1.	3.03	0.	0.	0.	.00
ROUTED TO +	ROUTE	1.	3.03	0.	0.	0.	.00
HYDROGRAPH AT +	DA-3	1.	3.02	0.	0.	0.	.00
2 COMBINED AT +	SOUTH	1.	3.03	0.	0.	0.	.01
2 COMBINED AT +	C-2	2.	3.03	0.	0.	0.	.01
2 COMBINED AT +	COMBINE	18.	4.03	4.	4.	4.	.18
HYDROGRAPH AT +	DA-4	1.	3.02	0.	0.	0.	.00
2 COMBINED AT +	COMBINE	19.	4.03	4.	4.	4.	.18

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

****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1.1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

10-year 6-hour
with all areas multiplied by 100

HEC-1 INPUT

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

        1           ID     UP&L Mining - Cottonwood Fan Portal
        2           ID     10-YR 6-HR  SCS 6-HOUR DISTRIBUTION
        3           ID     by gjb Hansen, Allen & Luce  May 1989
        4           ID     ALL AREAS MULTIPIED BY 100
** FREE ***
                    *DIAGRAM
        5           IT       1       0       0     300
        6           ID       3

        7           KK    UA-1
        8           BA   02.64
        9           PB    1.55
       10           IN     30.
       11           PI      0.    .035    .045    .055    .095     .37      .1     .18    .055     .05
       12           PI     .04     .04    .035
       13           LS       0     76.      0.
       14           UD   .1108

       15           KK    UA-2
       16           BA    11.7
       17           PB    1.55
       18           LS       0      74       0
       19           UD    .183

       20           KK     D-1 CULVERT D-1
       21           HC       2

       22           KK    UA-3
       23           BA   02.55
       24           PB    1.55
       25           LS       0      75       0
       26           UD    .110

       27           KK COMBINE convenience combination
       28           HC       2

       29           KK    DA-1
       30           BA  02.188
       31           PB    1.55
       32           LS       0      82       0
       33           UD    .067

       34           KK    DA-2 Tributary to Culvert D-4
       35           BA  00.359
       36           PB    1.55
       37           LS       0    80.2       0
       38           UD     .08
```

```
 39          KK   ROUTEto South Basin
 40          RK    200.     .32     .05           TRAP       2       2
                                          HEC-1 INPUT

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


 41          KK    DA-3
 42          BA  00.234
 43          PB    1.55
 44          LS       0    85.5       0
 45          UD    .086

 46          KK   SOUTHDA-2 + DA-3
 47          HC       2

 48          KK     C-2
 49          HC       2

 50          KK COMBINEconvenience combination
 51          HC       2

 52          KK    DA-4 tributary to Ditch DD-5
 53          BA  00.281
 54          PB    1.55
 55          LS       0      82       0
 56          UD    .066

 57          KK COMBINE
 58          HC       2
 59          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

 7         DA-1
           .
           .
15         .        DA-2
           .          .
           .          .
20        C-1............
           .
           .
22         .        DA-3
           .          .
           .          .
27     COMBINE............
           .
           .
29         .        DA-1
           .          .
           .          .
34         .          .       DA-2
           .          .         V
           .          .         V
39         .          .      ROUTE
           .          .         .
           .          .         .
41         .          .         .       DA-3
           .          .         .         .
           .          .         .         .
46         .          .      SOUT-............
           .          .         .
           .          .         .
48         .        C-2............
           .          .
           .          .
50     COMBINE............
           .
           .
52         .        DA-4
           .          .
           .          .
57     COMBINE............
```

***) RUNOFF ALSO COMPUTED AT THIS LOCATION

****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

UP&L Mining - Cottonwood Fan Portal
10-YR 6-HR SCS 6-HOUR DISTRIBUTION
by Bob Hansen, Allen & Luce May 1989
ALL AREAS MULTIPIED BY 100

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

  IT        HYDROGRAPH TIME DATA
                  NMIN          1  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1    0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    ND        300  NUMBER OF HYDROGRAPH ORDINATES
               NDDATE      1    0  ENDING DATE
               NDTIME       0459  ENDING TIME

          COMPUTATION INTERVAL     .02 HOURS
               TOTAL TIME BASE    4.98 HOURS

     ENGLISH UNITS
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES
****** ALL AREAS MULTIPLIED BY 100 *******

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24--OUR	72--OUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	UA-1	311.	4.02	68.	68.	68.	2.64		
HYDROGRAPH AT	UA-2	1098.	4.07	230.	230.	230.	11.70		
2 COMBINED AT	C-1	1402.	4.05	297.	297.	297.	14.34		
HYDROGRAPH AT	UA-3	278.	4.02	58.	58.	58.	2.55		
2 COMBINED AT	COMBINE	1677.	4.03	356.	356.	356.	16.89		
HYDROGRAPH AT	DA-1	41.	3.02	9.	9.	9.	.19		
HYDROGRAPH AT	DA-2	62.	3.03	14.	14.	14.	.36		
ROUTED TO	ROUTE	62.	3.03	14.	14.	14.	.36		
HYDROGRAPH AT	DA-3	69.	3.02	15.	15.	15.	.23		
2 COMBINED AT	SOUTH	131.	3.03	29.	29.	29.	.59		
2 COMBINED AT	C-2	172.	3.02	38.	38.	38.	.78		
2 COMBINED AT	COMBINE	1817.	4.03	394.	394.	394.	17.67		
HYDROGRAPH AT	DA-4	62.	3.02	13.	13.	13.	.28		
2 COMBINED AT	COMBINE	1865.	4.03	407.	407.	407.	17.95		

1 HEC-1 INPUT PAGE 1

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

  1           ID    UP&L Mining - Cottonwood Fan Portal
  2           ID    25-YR 6-HR  SCS 6-HOUR DISTRIBUTION
  3           ID    by gjp Hansen, Allen & Luce  May 1989
*** FREE ***
              *DIAGRAM
  4           IT      1       0       0     300
  5           IO      3

  6           KK    UA-1
  7           BA   .0264
  8           PB    1.90
  9           IN     30.
 10           PI      0.    .035    .045    .055    .095     .37      .1     .18    .055     .05
 11           PI     .04     .04    .035
 12           LS       0     76.      0.
 13           UD   .1108

 14           KK    UA-2
 15           BA    .117
 16           PB    1.90
 17           LS       0      74       0
 18           UD    .183

 19           KK     C-1 CULVERT C-1
 20           HC       2

 21           KK    UA-3
 22           BA   .0255
 23           PB    1.90
 24           LS       0      75       0
 25           UD    .110

 26           KK COMBINE convenience combination
 27           HC       2

 28           KK    DA-1
 29           BA  .00188
 30           PB    1.90
 31           LS       0      82       0
 32           UD    .067

 33           KK    DA-2 Tributary to Culvert C-4
 34           BA  .00359
 35           PB    1.90
 36           LS       0    80.2       0
 37           UD     .08

 38           KK   ROUTEto South Basin
```

```
 39        RK   200.    .32    .05          TRAP      2      2
1                                   HEC-1 INPUT                                    PAGE  2

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


 40        KK   DA-3
 41        BA  .00234
 42        PB   1.90
 43        LS      0   85.5      0
 44        UD   .086

 45        KK  SOUTHDA-2 + DA-3
 46        HC      2

 47        KK    C-2
 48        HC      2

 49        KK COMBINEconvenience combination
 50        HC      2

 51        KK   DA-4 tributary to Ditch DD-5
 52        BA  .00281
 53        PB   1.90
 54        LS      0     82      0
 55        UD   .066

 56        KK COMBINE
 57        HC      2
 58        ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

```
 6      UA-1
          .
          .
14        .       UA-2
          .         .
          .         .
19       C-1............
          .
          .
21        .       UA-3
          .         .
          .         .
26    COMBINE............
          .
          .
28        .       DA-1
          .         .
          .         .
33        .         .      DA-2
          .         .        V
          .         .        V
38        .         .     ROUTE
          .         .        .
          .         .        .
40        .         .        .      DA-3
          .         .        .        .
          .         .        .        .
45        .         .     SOUTH............
          .         .        .
          .         .        .
47        .       C-2............
          .         .
          .         .
49    COMBINE............
          .
          .
51        .       DA-4
          .         .
          .         .
56    COMBINE............
```

(DA) RUNOFF ALSO COMPUTED AT THIS LOCATION

1 ****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

```
                                        ****

                    UP&L Mining - Cottonwood Fan Portal
                    25-YR 6-HR  SCS 6-HOUR DISTRIBUTION
                    by gjp Hansen, Allen & Luce  May 1989

5 ID        OUTPUT CONTROL VARIABLES
                 IPRNT          3  PRINT CONTROL
                 IPLOT          0  PLOT CONTROL
                 QSCAL         0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                  NMIN          1  MINUTES IN COMPUTATION INTERVAL
                 IDATE     1    0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
               NDDATE     1    0  ENDING DATE
               NDTIME       0459  ENDING TIME

           COMPUTATION INTERVAL     .02 HOURS
                TOTAL TIME BASE    4.98 HOURS

     ENGLISH UNITS
```

UP&L Mining - Cottonwood Fan Portal
25-YR 6-HR SCS 6-HOUR DISTRIBUTION
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	UA-1	5.	4.02	1.	1.	1.	.03		
HYDROGRAPH AT	UA-2	18.	4.05	4.	4.	4.	.12		
2 COMBINED AT	C-1	23.	4.03	6.	6.	6.	.14		
HYDROGRAPH AT	UA-3	4.	4.02	1.	1.	1.	.03		
2 COMBINED AT	COMBINE	28.	4.03	7.	7.	7.	.17		
HYDROGRAPH AT	DA-1	1.	3.02	0.	0.	0.	.00		
HYDROGRAPH AT	DA-2	1.	3.02	0.	0.	0.	.00		
ROUTED TO	ROUTE	1.	3.03	0.	0.	0.	.00		
HYDROGRAPH AT	DA-3	1.	3.02	0.	0.	0.	.00		
2 COMBINED AT	SOUTH	2.	3.03	0.	0.	0.	.01		
2 COMBINED AT	C-2	3.	3.02	1.	1.	1.	.01		
2 COMBINED AT	COMBINE	30.	4.03	7.	7.	7.	.18		
HYDROGRAPH AT	DA-4	1.	3.02	0.	0.	0.	.00		
2 COMBINED AT	COMBINE	30.	4.03	7.	7.	7.	.18		

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