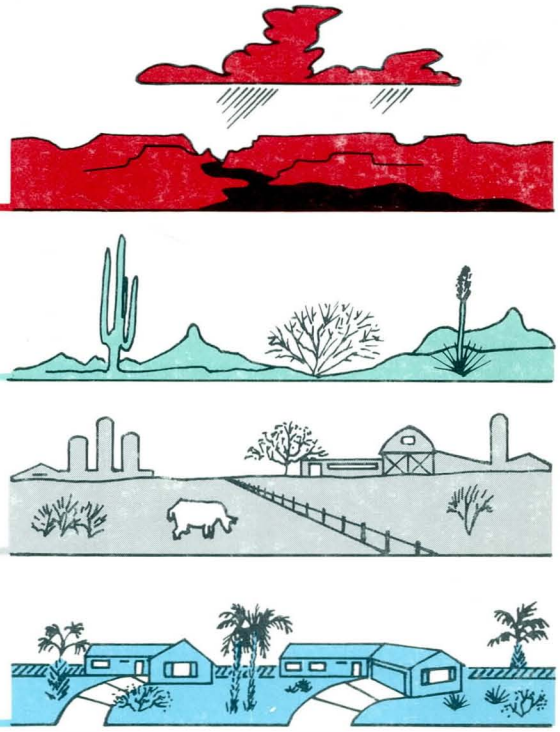


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DAM-BREAK ANALYSIS OF ADOBE DAM ON SKUNK CREEK PHOENIX, ARIZONA

Timothy E. Sutko

June 22, 1987

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

DAM-BREAK ANALYSIS OF ADOBE
DAM ON SKUNK CREEK
PHOENIX, ARIZONA

Timothy E. Sutko

June 22, 1987

INTRODUCTION

This report presents the results of an analysis of downstream flooding which would result from the failure of Adobe Dam, an earthen flood control structure located in Phoenix, Arizona. The analysis was performed by the Flood Control District of Maricopa County using the DAMBRK computer model developed by Dr. D. L. Fread of the National Weather Service. The report includes maps of the inundated area to assist in emergency planning.

PURPOSE

This study was conducted in order to determine the area which would be at substantial risk of loss of life and property in the event of a failure of Adobe Dam. Such a determination is required by the Arizona Department of Water Resources, Office of Dam Safety, under Arizona Revised Statutes 45-701 through 45-717. The inundation map prepared as a part of this study will be used to prepare warning and evacuation maps to be maintained and implemented by the Maricopa County Civil Defense and Emergency Services Departments.

LIMITATIONS

While any number of scenarios describing the failure of Adobe Dam and the downstream hydraulic regime can be conceived, an exhaustive analysis of each of them is not feasible. Inasmuch as the purpose of this analysis was to provide information on the extent of flooding which would result from a dam failure so as to prevent loss of life, only "worst case" and subjectively determined "most probable" scenarios were modeled. As such, the time of failure was assumed to be relatively short (15-60 minutes), the size of the breach was assumed to be large (a bottom width of up to 225 feet), and the reservoir was assumed to be at spillway elevation when computations commenced. The dam failure was assumed to be caused by piping.

An attempt was made to model the downstream flooding which would result from dam failure caused by overtopping of the structure. For this effort, the Probable Maximum Flood hydrograph (as determined by the U.S. Army Corps of Engineers) was used as the input to the reservoir, with the initial water surface at spillway level. The emergency spillway passed this design flow without the dam overtopping, and the resulting downstream hydrograph had a peak less than that resulting from the breached dam.

The downstream limit of the study was the Aqua Fria River. The estimated capacity of the channelized reaches of that river is 100,000 cfs, and the peak flow from the most severe case modeled is approximately 95,000 cfs.

DESCRIPTION OF AREA

Adobe Dam and basin are located on Skunk Creek in north-central Phoenix, Arizona. The main embankment is a compacted earthfill structure with a maximum height of 63 feet above the streambed. The crest of the dam at elevation 1403 feet above msl is 11.245 feet in length. The dam and impoundment area occupy approximately 3000 acres of the total 89.6 mi^2 drainage area of Skunk Creek.

The dam was designed by the U.S. Army Corps of Engineers as part of the Phoenix, Arizona and Vicinity (including New River) Flood Control Project which was authorized by the Flood Control Act of 1965. Other structures authorized under this project include New River, Cave Buttes and Dreamy Draw Dams, as well as the Arizona Canal Diversion Channel. Construction of Adobe Dam was completed in 1982. The Flood Control District of Maricopa County, the local flood control sponsor, operates and maintains the flood control features. The purpose of the structure is to provide flood protection for the primarily residential areas downstream. Adobe Dam was designed to detain water only during times of floods.

METHODOLOGY

The response of the Adobe Dam impoundment, Adobe Dam and the area downstream of this structure was modeled using the DAMBRK computer model developed by Dr. D. L. Fread, Office of Hydrology, National Weather Service, Silver Springs, Maryland. DAMBRK computes downstream water surface elevations resulting from the failure of an upstream dam. As implemented in this study, the modeling process can be envisioned as consisting of three functional steps. The first of these is the input and routing of an inflow hydrograph through the impoundment area. Three different hydrographs were used in this study: 1) the Probable Maximum Flood (PMF) hydrograph developed by the COE was used to verify the adequacy of the emergency spillway, 2) the Standard Project Flood (SPF) hydrograph, also developed by the COE, was used to establish the "sizing" of the reservoir, and 3) a hydrograph with constant flow of 2000 cfs was used for the dam failure scenarios. The flow of 2000 cfs was insignificant relative to the outflow hydrograph and was used only to maintain computational stability within the model.

In all cases the inflow hydrograph was routed through the reservoir area using the dynamic wave technique available in DAMBRK. This is a hydraulic routing technique which simulates the positive and/or negative wave(s) which would be expected to occur in a reservoir of this size, and results in a more accurate outflow hydrograph than would be obtained using hydrologic routing techniques.

In order to implement the dynamic routing technique, the area upstream of the dam site must be described in terms of elevation-top width pairs in such a way that the storage characteristics of the reservoir are reasonably well

modeled. To accomplish this, the SPF hydrograph was used as the input, and the elevation-top width pairs adjusted so that the resulting water surface elevation approximated the elevation of the emergency spillway (1377.8 feet above msl).

The second functional step is the development of the breach hydrograph, which is highly dependent upon conditions existing at the time of breach initiation, breach geometry and total time of breach formation. For this study, the water surface elevation was assumed to be at spillway level when the computations commenced.

The selection of parameters describing the breaching process and the final breach itself is a very subjective process, particularly in predictive rather than historic modeling. It is difficult to say beforehand where a breach will begin forming, how large it will ultimately become, and over how long a time period it will form. Fread (1983) reports that earthen dams do not tend to fail completely or instantaneously. Total breach widths tend to be between one and three times the depth of the water behind the dam, with the middle portion of this range being more common (Johnson and Illes, 1976). Total time of failure may range from a few minutes to a few hours, depending upon the height of the dam, type of materials used in the construction, and the degree of compaction of these materials.

For this study it was assumed that the time of failure (i.e., the period of time extending from the start of breach formation until it attains its maximum dimensions) was either 15 minutes or 60 minutes. These times are at the low end and the middle of the range of recommended failure times for well constructed earthen dams (Fread,1983). Also the breach was assumed to have a final bottom width ranging from 100 to 225 feet with 0.5:1 sloping sides. Inasmuch as Adobe Dam is 63 feet high and 11,245 feet long at the crest, the

described breach is in the range of the maximum size which should be expected. It was further assumed that the breach was located approximately at the principal outlet works of the structure (i.e., the westernmost extent of the dam). This is the point where the ponding depth behind the dam would be the greatest.

The third functional step in the DAMBRK modeling process is the routing of the outflow hydrograph through the downstream valley and the determination of peak elevations and flood discharges at points downstream. As with the reservoir routing, the dynamic wave method was used for the downstream routing. As opposed to other routing techniques available, only the dynamic wave method accounts for the acceleration effects associated with the dam-break waves and the influence of downstream unsteady backwater effects produced by channel constrictions and bridge-road embankments.

Below Adobe Dam, downstream obstructions take the form of numerous roadways across the channel. With the exception of the crossing at Grand Avenue, the capacities of Skunk Creek and New River are significantly less than the expected peak discharge resulting from a failure of the dam. It was judged that the presence of the bridges at these crossings would have a negligible effect on the timing and size of the flood wave. However, it was felt that the raised bed of the Atchison, Topeka and Santa Fe Railroad tracks at Grand Avenue would effectively act as a small earthen dam impeding flow until it was overtopped and washed out. This area was therefore also modeled as a dam.

The breach outflow hydrograph is modified as it is routed through the downstream reaches due to the effects of valley storage, frictional resistance to flow, flood wave acceleration components, and downstream obstructions and/or flow control structures. Modifications to the dam-break flood wave are manifested as attenuation of the flood peak elevation, dispersion of the flood

wave volume, and changes in the travel time of the flood wave. Consequently, the downstream routing requires a description of channel/valley cross-sections (including both effective and ineffective flow areas), hydraulic resistance coefficients and expansion coefficients.

Cross-sectional information was readily available from U.S.G.S. quadrangle maps and topographic maps developed by the COE for floodplain delineation in this area. Selection of values for ineffective flow areas and hydraulic resistance were made after numerous field trips in this area.

Appendix A contains a listing of the typical input parameters used to describe the dam site, breaching process, and downstream channel characteristics.

DISCUSSION OF RESULTS

Table 1 presents the major results of this study for three of the scenarios modeled. Figure 1 is a map of the inundated area and recommended evacuation limits for the worst of these cases (time of failure = 15 minutes; breach width = 225 feet). The following is a brief narrative expanding on these results.

The failure of Adobe Dam under the conditions modeled would result in downstream flooding of a magnitude not experienced in that area before. Peak discharges at the dam site for the least severe case modeled (107,000 cfs) would approach those generated by the PMF (119,000 cfs), that flood which would occur under the worst hydrometeorlogical conditions possible. Under the "worst case" scenario, peak discharge at Adobe Dam would be 190,000 cfs.

Flood waters escaping from a breach in the dam would flow south 0.5 - 1.0 miles before beginning to flow southwest to the New River. The maximum depth of flow in the channel will be in excess of 20 feet with flow velocities in the 10-15 fps range from the dam to the area of 59th Avenue and Union Hills Drive. Travel time to this area is estimated to be 30-45 minutes. Because of the low relief away from the channel, flow exceeding the capacity of the channel will spread laterally away from the channel for approximately 0.5 miles in each direction. This spreading will result in attenuation of the flood peak as it moves downstream. Under the most severe case modeled, the peak discharge will be reduced to nearly 85,000 cfs at the confluence with the New River. This flow, however, still exceeds the capacity of the channel.

Table 1. Summary of results of dam break analysis of Adobe Dam

	Time of Failure = 1 hr Breach width = 125 feet	Time of Failure = 1 hr Breach width = 225 feet	Time of Failure = 15 min Breach width - 225 feet
Peak Discharge at			
Adobe Dam	107,000 cfs	169,000 cfs	190,000 cfs
Bell Road	77,370 cfs	91,000 cfs	95,000 cfs
Grand Avenue	68,000 cfs	70,850 cfs	73,050 cfs
Aqua Fria River	65,200 cfs	69,150 cfs	71,200 cfs
Travel time to			
Bell Road	2.25 hrs	2.10 hrs	2.00 hrs
Grand Avenue	3.00 hrs	2.60 hrs	2.60 hrs
Aqua Fria River	4.50 hrs	4.25 hrs	4.25 hrs

Flow will pond on the upstream side of Grand Avenue, due to the raised bed of the Atchison, Topeka, and Santa Fe Railroad tracks, before overtopping and washing out portions of the railroad tracks. The ponding could cause the portion of Sun City east of 101st Avenue to be flooded. Below Grand Avenue, the peak flow will be less than 75,000 cfs, and the lateral spread of the flow away from the channel will be less than 0.5 miles.

Under any of the conditions modeled, all of the bridged and dipped crossings of Skunk Creek and New River below the dam site would be severely damaged and perhaps washed out. Channel velocities of 10-15 fps combined with water depths in excess of 15 feet will endanger the structural integrity of the bridges. Table 2 is a list of the crossings over these watercourses and the estimated travel time of the flood wave to these points. None of these crossings has a capacity of more than 50,000 cfs. Deer Valley High School and the Sierra Vista School are also likely to suffer damages from the flooding.

It will take approximately 3-4 hours for Adobe Dam to completely empty and for the flooding to recede at any given point in the channel, assuming that the initial water surface elevation was at spillway level.

Appendix A contains a summary of the input data used for the computer runs. Appendices B - E contain summaries of the output data for each of the four scenarios modeled.

Table 2. Estimated travel time of flood wave to bridged crossings below Adobe Dam.

Location	Travel Time (hrs.)
43rd Avenue/Beardsley Road	0.15 - 0.25
51st Avenue	0.75 - 1.0
59th Avenue/Union Hills Drive	1.50 - 1.75
Bell Road	2.00 - 2.25
Greenway Road	2.50 - 3.00
Thunderbird Road	3.25 - 3.50
Grand Avenue	4.00 - 4.50
Peoria Avenue	4.15 - 4.50
Olive Avenue	4.25 - 4.75
Northern Avenue	4.35 - 4.75
Glendale Avenue	4.50 - 5.00

CONCLUSIONS

This report has presented the results of an analysis of the downstream flooding which would occur following the failure of Adobe Dam. Several different scenarios were modeled for this analysis and the projected area of inundation plotted. Figure 1 is a map of the area expected to be flooded and the recommended evacuation limits.

Under any of the conditions modeled, the flood wave produced by the failure of Adobe Dam would damage and perhaps wash out all of the bridged and dip-section crossings of Skunk Creek and New River below the dam. Maximum discharges could range up to 190,000 cfs, and maximum velocities of the flow in the channel would be in the 10-15 fps range. Flow exceeding the capacity of the channel would be expected to spread 0.5 miles laterally away from Skunk Creek and New River. It is estimated that the flood wave will pass and the water depths receed after 3-4 hours.

REFERENCES

Fread, D. L., DAMBRK: The NWS Dam-Break Flood Forecasting Model, Technical Paper, Office of Hydrology, National Weather Service, Silver Springs, Maryland, July, 1983.

Johnson, F. A., and P. Illes, A Classification of Dam Failures, Water Power and Dam Construction, pp 43-45, December, 1976.

```
************************************
************************************
*****  SUMMARY OF INPUT DATA  ******
*****  FOR DAMBRK ANALYSIS OF ******
*****        ADOBE DAM        ******
************************************
************************************
```

DAR A

Adobe Dam

ON

Skunk Creek

ANALYSIS BY

Flood Control District/Maricopa County

BASED ON PROCEDURE DEVELOPED BY

DANNY L. FREAD, PH.D., RESEARCH HYDROLOGIST
HYDROLOGIC RESEARCH LABORATORY
W23, OFFICE OF HYDROLOGY
NOAA, NATIONAL WEATHER SERVICE
SILVER SPRING, MARYLAND 20910

```
*******************************
*******************************
***                         ***
***  SUMMARY OF INPUT DATA  ***
***                         ***
*******************************
*******************************
```

INPUT CONTROL PARAMETERS FOR Adobe Dam

PARAMETER	VARIABLE	VALUE
NUMBER OF DYNAMIC ROUTING REACHES	KKN	1
TYPE OF RESERVOIR ROUTING	KUI	1
MULTIPLE DAM INDICATOR	MULDAM	2
PRINTING INSTRUCTIONS FOR INPUT SUMMARY	KDMP	5
NO. OF RESERVOIR INFLOW HYDROGRAPH POINTS	ITEH	8
INTERVAL OF CROSS-SECTION INFO PRINTED OUT WHEN JNK=9	NPRT	0
FLOOD-PLAIN MODEL PARAMETER	KFLP	0
LANDSLIDE PARAMETER	KSL	0

IDAM= 3

IDAM= 12

DAM NUMBER 1

Adobe Dam RESERVOIR AND BREACH PARAMETERS

PARAMETER	UNITS	VARIABLE	VALUE
ELEVATION OF WATER SURFACE	FT	YO	1377.80
SIDE SLOPE OF BREACH		Z	.50
ELEVATION OF BOTTOM OF BREACH	FT	YBMIN	1336.25
WIDTH OF BASE OF BREACH	FT	BB	125.00
TIME TO MAXIMUM BREACH SIZE	HR	TFH	1.00
ELEVATION OF WATER WHEN BREACHED	FT	HF	1377.70
ELEVATION OF TOP OF DAM	FT	HD	1403.00
ELEVATION OF UNCONTROLLED SPILLWAY CREST	FT	HSP	1377.80
ELEVATION OF CENTER OF GATE OPENINGS	FT	HGT	1341.00
DISCHARGE COEF. FOR UNCONTROLLED SPILLWAY		CS	90.00
DISCHARGE COEF. FOR GATE FLOW		CG	.00
DISCHARGE COEF. FOR UNCONTROLLED WEIR FLOW		CDO	30360.00
DISCHARGE THRU TURBINES	CFS	QT	1200.00

DAM NUMBER 2

Adobe Dam RESERVOIR AND BREACH PARAMETERS

PARAMETER	UNITS	VARIABLE	VALUE
ELEVATION OF WATER SURFACE	FT	YO	1121.90
SIDE SLOPE OF BREACH		Z	.50
ELEVATION OF BOTTOM OF BREACH	FT	YBMIN	1116.25
WIDTH OF BASE OF BREACH	FT	BB	300.00
TIME TO MAXIMUM BREACH SIZE	HR	TFH	.50
ELEVATION OF WATER WHEN BREACHED	FT	HF	1141.00
ELEVATION OF TOP OF DAM	FT	HD	1140.00
ELEVATION OF UNCONTROLLED SPILLWAY CREST	FT	HSP	1140.00
ELEVATION OF CENTER OF GATE OPENINGS	FT	HGT	1120.00
DISCHARGE COEF. FOR UNCONTROLLED SPILLWAY		CS	90.00
DISCHARGE COEF. FOR GATE FLOW		CG	.00
DISCHARGE COEF. FOR UNCONTROLLED WEIR FLOW		CDO	30360.00
DISCHARGE THRU TURBINES	CFS	QT	1193.30

QSPILL(K, 1)	HEAD(K, 1)
0.	.0
200.	6.0
600.	11.0
800.	14.0
1200.	20.0
1400.	26.0
1600.	31.0
1800.	37.0

QSPILL(K, 2)	HEAD(K, 2)
0.	.0
200.	1.0
800.	2.0
1200.	3.0
2000.	4.0
10000.	6.0
20000.	10.0
60000.	27.0

DHF(INTERVAL BETWEEN INPUT HYDROGRAPH ORDINATES) = .00 HRS.

TEH(TIME AT WHICH COMPUTATIONS TERMINATE) = 6.0000 HRS.

INFLOW HYDROGRAPH TO Adobe Dam
****

1933.30 2000.00 2000.00 2000.00 2000.00 2000.00 2000.00 1000.00

TIME OF INFLOW HYDROGRAPH ORDINATES
****

.1000 2.5000 2.8000 3.2500 3.5000 4.5000 5.5000 6.0000

CROSS-SECTIONAL PARAMETERS FOR Skunk Creek
BELOW Adobe Dam

PARAMETER	VARIABLE	VALUE
NUMBER OF CROSS-SECTIONS	NS	17
MAXIMUM NUMBER OF TOP WIDTHS	NCS	8
NUMBER OF CROSS-SECTIONAL HYDROGRAPHS TO PLOT	NTT	5
TYPE OF OUTPUT OTHER THAN HYDROGRAPH PLOTS	JNK	4
CROSS-SECTIONAL SMOOTHING PARAMETER	KSA	0
DOWNSTREAM SUPERCRITICAL OR NOT	KSUPC	0
NO. OF LATERAL INFLOW HYDROGRAPHS	LQ	0
NO. OF POINTS IN GATE CONTROL CURVE	KCG	0

NUMBER OF CROSS-SECTION WHERE HYDROGRAPH DESIRED
(MAX NUMBER OF HYDROGRAPHS = 6)

3 9 12 13 17

CROSS-SECTIONAL VARIABLES FOR Skunk Creek
BELOW Adobe Dam

PARAMETER	UNITS	VARIABLE
LOCATION OF CROSS-SECTION	MI	XS(I)
ELEVATION (MSL) OF FLOODING AT CROSS-SECTION	FT	FSTG(I)
ELEV CORRESPONDING TO EACH TOP WIDTH	FT	HS(K,I)
TOP WIDTH CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	FT	BS(K,I)
TOP WIDTH CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	FT	BSS(K,I)
SURFACE AREA CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	ACRES	DSA(K,I)
SURFACE AREA CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	ACRES	SSA(K,I)
NUMBER OF CROSS-SECTION		I
NUMBER OF ELEVATION LEVEL		K

CROSS-SECTION NUMBER 1

XS(I) = .000 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1375.0	1380.0	1385.0	1390.0	1395.0	1400.0	1405.0	1410.0
BS ...	75.0	100.0	500.0	1500.0	2200.0	3000.0	5000.0	7500.0
BSS ...	.0	.0	.0	.0	.0	.0	.0	.0

CROSS-SECTION NUMBER 2
****

XS(I) = .600 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1360.0	1365.0	1370.0	1375.0	1380.0	1385.0	1390.0	1410.0
BS ...	75.0	100.0	3500.0	6000.0	9000.0	10000.0	11000.0	11500.0
BSS ...	.0	.0	.0	.0	.0	.0	.0	.0

CROSS-SECTION NUMBER 3
****

XS(I) = 1.700 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1338.0	1340.0	1345.0	1350.0	1375.0	1380.0	1390.0	1403.0
BS ...	75.0	130.0	235.0	750.0	6000.0	9280.0	10500.0	12200.0
BSS ...	.0	.0	.0	.0	.0	.0	.0	.0

CROSS-SECTION NUMBER 4
****

XS(I) = 1.750 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1336.3	1338.0	1340.0	1345.0	1350.0	1375.0	1390.0	1405.0
BS ...	60.0	285.0	400.0	655.0	875.0	3100.0	5700.0	6205.0
BSS ...	.0	.0	.0	.0	.0	.0	.0	.0

CROSS-SECTION NUMBER 5
****

XS(I) = 2.250 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1323.5	1325.0	1328.0	1330.0	1332.0	1335.0	1340.0	1345.0
BS ...	60.0	285.0	400.0	500.0	600.0	800.0	850.0	900.0
BSS ...	.0	.0	.0	.0	400.0	600.0	1000.0	2000.0

CROSS-SECTION NUMBER 6
****

XS(I) = 3.150 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1294.0	1300.0	1305.0	1310.0	1320.0	1322.0	1325.0	1330.0
BS ...	60.0	365.0	375.0	400.0	500.0	550.0	600.0	750.0
BSS ...	.0	.0	.0	500.0	1000.0	3000.0	7000.0	12000.0

CROSS-SECTION NUMBER 7
****

XS(I) = 3.500 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1282.0	1284.0	1285.0	1288.0	1290.0	1295.0	1300.0	1305.0
BS ...	85.0	125.0	150.0	300.0	400.0	500.0	600.0	750.0
BSS ...	.0	.0	.0	.0	.0	1000.0	7000.0	12000.0

CROSS-SECTION NUMBER 8
****

XS(I) = 4.800 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1250.5	1252.0	1254.0	1256.0	1258.0	1260.0	1265.0	1270.0
BS ...	90.0	125.0	160.0	550.0	650.0	750.0	850.0	1000.0
BSS ...	.0	.0	.0	.0	.0	500.0	1750.0	9000.0

CROSS-SECTION NUMBER 9
****

XS(I) = 6.350 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1217.0	1220.0	1222.0	1224.0	1226.0	1230.0	1235.0	1240.0
BS ...	100.0	220.0	250.0	450.0	625.0	775.0	800.0	1100.0
BSS ...	.0	.0	.0	.0	500.0	1200.0	4500.0	9000.0

CROSS-SECTION NUMBER 10
****

XS(I) = 8.150 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1167.0	1170.0	1175.0	1180.0	1182.0	1184.0	1186.0	1190.0
BS ...	80.0	100.0	140.0	175.0	300.0	500.0	750.0	800.0
BSS ...	.0	.0	.0	.0	300.0	500.0	1500.0	9000.0

CROSS-SECTION NUMBER 11
****

XS(I) = 9.450 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1140.0	1142.0	1144.0	1148.0	1150.0	1160.0	1165.0	1175.0
BS ...	100.0	150.0	175.0	250.0	300.0	400.0	500.0	600.0
BSS ...	.0	.0	.0	.0	.0	1600.0	2600.0	9000.0

CROSS-SECTION NUMBER 12
****

XS(I) = 10.750 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1118.0	1121.5	1126.0	1131.0	1136.0	1140.0	1146.0	1151.0
BS ...	125.0	220.0	300.0	340.0	350.0	400.0	500.0	900.0
BSS ...	.0	.0	.0	.0	.0	600.0	1500.0	7500.0

CROSS-SECTION NUMBER 13
****

XS(I) = 10.820 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1116.7	1119.2	1121.5	1126.5	1131.5	1136.5	1141.5	1146.5
BS ...	175.0	250.0	300.0	350.0	450.0	500.0	600.0	900.0
BSS ...	.0	.0	.0	.0	.0	500.0	1000.0	9000.0

CROSS-SECTION NUMBER 14
****

XS(I) = 11.820 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1095.0	1099.0	1100.0	1105.0	1110.0	1115.0	1120.0	1125.0
BS ...	75.0	175.0	280.0	315.0	350.0	800.0	850.0	900.0
BSS ...	.0	.0	.0	.0	.0	500.0	900.0	9000.0

CROSS-SECTION NUMBER 15
****

XS(I) = 12.850 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1078.0	1080.0	1085.0	1090.0	1095.0	1100.0	1105.0	1110.0
BS ...	75.0	220.0	280.0	320.0	360.0	500.0	600.0	750.0
BSS ...	.0	.0	.0	.0	.0	500.0	1000.0	7500.0

CROSS-SECTION NUMBER 16
****

XS(I) = 13.850 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1065.0	1066.0	1070.0	1075.0	1080.0	1085.0	1090.0	1095.0
BS ...	120.0	150.0	180.0	500.0	600.0	750.0	800.0	900.0
BSS ...	.0	.0	.0	.0	.0	750.0	1000.0	7500.0

CROSS-SECTION NUMBER 17
****

XS(I) = 15.000 FSTG(I) = .00 XSL(I) = .0 XSR(I) = .0

HS ...	1048.0	1050.0	1052.0	1054.0	1058.0	1060.0	1070.0	1072.0
BS ...	20.0	210.0	300.0	350.0	375.0	500.0	600.0	750.0
BSS ...	.0	.0	.0	.0	.0	250.0	400.0	5200.0

13A

MANNING N ROUGHNESS COEFFICIENTS FOR THE GIVEN REACHES
(CM(K,I),K=1,NCS) WHERE I = REACH NUMBER
****

REACH 1 ...	.040	.040	.040	.040	.040	.040	.040	.040
REACH 2 ...	.040	.040	.040	.040	.040	.040	.040	.040
REACH 3 ...	.080	.080	.080	.080	.080	.080	.080	.080
REACH 4 ...	.070	.070	.070	.070	.070	.070	.070	.070
REACH 5 ...	.060	.060	.060	.060	.060	.060	.060	.060
REACH 6 ...	.060	.060	.060	.060	.060	.060	.060	.060
REACH 7 ...	.050	.050	.050	.050	.050	.050	.050	.050
REACH 8 ...	.040	.040	.040	.040	.040	.040	.040	.040
REACH 9 ...	.035	.035	.035	.035	.035	.035	.035	.035
REACH 10 ...	.045	.045	.045	.045	.045	.045	.045	.045
REACH 11 ...	.045	.045	.045	.045	.045	.045	.045	.045
REACH 12 ...	.035	.035	.035	.035	.035	.035	.035	.035
REACH 13 ...	.035	.035	.035	.035	.035	.035	.035	.035
REACH 14 ...	.035	.035	.035	.035	.035	.035	.035	.035
REACH 15 ...	.035	.035	.035	.035	.035	.035	.035	.035
REACH 16 ...	.035	.035	.035	.035	.035	.035	.035	.035

CROSS-SECTIONAL VARIABLES FOR Skunk Creek
BELOW Adobe Dam

PARAMETER	UNITS	VARIABLE
MINIMUM COMPUTATIONAL DISTANCE USED BETWEEN CROSS-SECTIONS	MI	DXM(I)
CONTRACTION - EXPANSION COEFFICIENTS BETWEEN CROSS-SECTIONS		FKC(I)

REACH NUMBER	DXM(I)	FKC(I)
1	.050	.000
2	.050	.000
3	.005	.000
4	.150	.000
5	.150	.000
6	.050	.000
7	.250	.000
8	.100	.000
9	.250	.000
10	.250	.000
11	.250	.000
12	.010	-.500
13	.250	.000
14	.250	.000
15	.250	.000
16	.250	.000

DOWNSTREAM FLOW PARAMETERS FOR Skunk Creek
BELOW Adobe Dam

PARAMETER	UNITS	VARIABLE	VALUE
MAX DISCHARGE AT DOWNSTREAM EXTREMITY	CFS	QMAXD	95000.0
MAX LATERAL OUTFLOW PRODUCING LOSSES	CFS/FT	QLL	.000
INITIAL SIZE OF TIME STEP	HR	DTHM	.0000
INITIAL WATER SURFACE ELEVATION DOWNSTREAM	FT	YDN	.00
SLOPE OF CHANNEL DOWNSTREAM OF DAM	FT/MI	SOM	25.00
THETA WEIGHTING FACTOR		THETA	.00
CONVERGENCE CRITERION FOR STAGE	FT	EPSY	.050
TIME AT WHICH DAM STARTS TO FAIL	HR	TFI	.10

TOTAL NUMBER OF CROSS SECTIONS (ORIGINAL+INTERPOLATED) (N) = 121 (MAXIMUM ALLOWABLE = 400

CROSS-SECTION NO.	MILE	BOTTOM ELEVATION FEET	REACH NO.	REACH LENGTH MILES	SLOPE FT/MI	MESAGE
1	.00	1375.00				
2	.60	1360.00	1	.60	25.00	
Dam Location — 3	1.70	1338.00 —	2	1.10	20.00	
4	1.75	1336.25	3	.05	35.00	
5	2.25	1323.50	4	.50	25.50	
6	3.15	1294.00	5	.90	32.78	
7	3.50	1282.00	6	.35	34.29	
8	4.80	1250.50	7	1.30	24.23	
9	6.35	1217.00	8	1.55	21.61	
10	8.15	1167.00	9	1.80	27.78	
11	9.45	1140.00	10	1.30	20.77	
12	10.75	1118.00	11	1.30	16.92	
13	10.82	1116.70	12	.07	18.57	
14	11.82	1095.00	13	1.00	21.70	
15	12.85	1078.00	14	1.03	16.50	
16	13.85	1065.00	15	1.00	13.00	
17	15.00	1048.00	16	1.15	14.78	

```
****************************************
****************************************
******   SUMMARY OF OUTPUT DATA   ******
*** Initial Water Surface at spillway***
***     Infow Hydrograph = PMF       ***
****************************************
****************************************
```

DAT28

INFLOW HYDROGRAPH TO Adobe Dam
****

1933.30	5000.00	10000.00	100000.00	119000.00	60000.00	35000.00	1000.00

TIME OF INFLOW HYDROGRAPH ORDINATES

.1000	3.5000	4.2500	6.5000	7.5000	9.5000	11.5000	15.0000

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	FLOOD ELEV (FT)	TIME FLOOD ELEV(HR)
********	********	********	********	********	**********	**********
.000	1400.57	119000	10.875	136.62	.00	.00
.020	1399.51	118949	12.125	11.28	.00	.00
.040	1399.51	118853	12.125	10.66	.00	.00
.060	1399.50	118683	12.125	10.15	.00	.00
.080	1399.50	118437	12.125	9.71	.00	.00
.100	1399.50	118127	12.125	9.35	.00	.00
.120	1399.50	117757	12.125	8.94	.00	.00
.140	1399.50	117330	12.125	8.49	.00	.00
.160	1399.50	116849	12.125	8.02	.00	.00
.180	1399.50	116312	12.125	7.57	.00	.00
.200	1399.50	115721	12.125	7.09	.00	.00
.220	1399.50	115073	12.125	6.53	.00	.00
.240	1399.50	114370	12.125	5.95	.00	.00
.260	1399.50	113615	12.125	5.31	.00	.00
.280	1399.50	112814	12.125	4.67	.00	.00
.300	1399.50	111969	12.125	4.07	.00	.00
.320	1399.50	111076	12.125	3.54	.00	.00
.340	1399.50	110133	12.125	3.08	.00	.00
.360	1399.50	109139	12.125	2.69	.00	.00
.380	1399.50	108100	12.125	2.36	.00	.00
.400	1399.50	107015	12.125	2.08	.00	.00
.420	1399.50	105882	12.125	1.85	.00	.00
.440	1399.50	104699	12.125	1.64	.00	.00
.460	1399.50	103463	12.125	1.46	.00	.00
.480	1399.50	102177	12.125	1.30	.00	.00
.500	1399.50	100839	12.125	1.17	.00	.00
.520	1399.50	99451	12.125	1.05	.00	.00
.540	1399.50	98014	12.125	.95	.00	.00
.560	1399.50	96530	12.125	.86	.00	.00
.580	1399.50	95000	12.125	.78	.00	.00
.600	1399.50	93423	12.125	.71	.00	.00
.650	1399.50	89428	12.125	.65	.00	.00
.700	1399.50	85442	12.125	.59	.00	.00
.750	1399.50	81463	12.125	.54	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

	RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
	.800	1399.50	77489	12.125	.49	.00	.00
	.850	1399.50	73522	12.125	.45	.00	.00
	.900	1399.50	69563	12.125	.41	.00	.00
	.950	1399.50	65611	12.125	.38	.00	.00
	1.000	1399.49	61667	12.125	.35	.00	.00
	1.050	1399.49	57733	12.125	.32	.00	.00
	1.100	1399.49	53805	12.125	.29	.00	.00
	1.150	1399.49	49886	12.125	.26	.00	.00
	1.200	1399.49	45974	12.125	.24	.00	.00
	1.250	1399.49	42068	12.125	.21	.00	.00
	1.300	1399.49	38169	12.125	.19	.00	.00
	1.350	1399.49	34279	12.125	.17	.00	.00
	1.400	1399.49	30395	12.125	.15	.00	.00
	1.450	1399.49	26519	12.125	.13	.00	.00
	1.500	1399.49	22653	12.125	.11	.00	.00
	1.550	1399.49	18796	12.125	.09	.00	.00
	1.600	1399.49	15130	12.125	.07	.00	.00
	1.650	1399.49	14130	12.125	.05	.00	.00
**	1.700	1399.49	13630	12.125	.04	.00	.00
	1.705	1346.72	13630	12.125	6.99	.00	.00
	1.710	1346.21	13630	12.125	6.86	.00	.00
	1.715	1345.72	13629	12.125	6.71	.00	.00
	1.720	1345.26	13629	12.125	6.56	.00	.00
	1.725	1344.83	13629	12.125	6.42	.00	.00
	1.730	1344.41	13628	12.125	6.27	.00	.00
	1.735	1344.02	13628	12.125	6.12	.00	.00
	1.740	1343.65	13628	12.125	5.98	.00	.00
	1.745	1343.29	13627	12.125	5.84	.00	.00
	1.750	1342.96	13627	12.125	5.69	.00	.00
	2.250	1330.59	13578	12.125	5.45	.00	.00
	3.150	1301.14	13500	12.125	7.98	.00	.00
	3.500	1290.07	13477	12.125	7.70	.00	.00

** Location of Adobe Dam.

```
************************************
************************************
****  SUMMARY OF OUTPUT DATA  ******
*** Time of Failure = 60 minutes ***
***   Breach width = 125 feet    ***
************************************
************************************
```

DATA C

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	FLOOD ELEV (FT)	TIME FLOOD ELEV(HR)
.000	1379.43	2000	.000	5.94	.00	.00
.050	1378.87	2000	.000	5.98	.00	.00
.100	1378.31	2000	.000	5.99	.00	.00
.150	1377.93	2018	.000	5.73	.00	.00
.200	1377.83	2119	.000	5.31	.00	.00
.250	1377.81	2386	.000	4.50	.00	.00
.300	1377.80	2901	.000	3.82	.00	.00
.350	1377.80	3775	.000	3.50	.00	.00
.400	1377.80	5114	.000	3.29	.00	.00
.450	1377.80	6981	.000	3.14	.00	.00
.500	1377.80	9443	.000	3.01	.00	.00
.550	1377.80	12488	.000	2.91	.00	.00
.600	1377.80	16160	.000	2.63	.00	.00
.650	1377.80	20274	.000	2.65	.00	.00
.700	1377.80	24580	.000	2.66	.00	.00
.750	1377.80	29002	.000	2.68	.00	.00
.800	1377.80	33497	.000	2.70	.00	.00
.850	1377.80	38037	.000	2.72	.00	.00
.900	1377.80	42594	.000	2.75	.00	.00
.950	1377.80	47142	.000	2.77	.00	.00
1.000	1377.80	51668	.000	2.80	.00	.00
1.050	1377.80	56152	.000	2.84	.00	.00
1.100	1377.80	60582	.000	2.87	.00	.00
1.150	1377.80	64952	.000	2.92	.00	.00
1.200	1377.80	69253	.000	2.96	.00	.00
1.250	1377.80	73476	.000	3.02	.00	.00
1.300	1377.80	77605	.000	3.08	.00	.00
1.350	1377.80	81627	.000	3.15	.00	.00
1.400	1377.80	85529	.000	3.24	.00	.00
1.450	1377.80	89294	.000	3.34	.00	.00
1.500	1377.80	92911	.000	3.46	.00	.00
1.550	1377.80	96381	.000	3.54	.00	.00
1.600	1377.80	99684	.000	3.66	.00	.00
1.650	1377.80	103225	.000	4.15	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

	RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
**	1.700	1377.80	107280	.000	5.78	.00	.00
	1.705	1357.89	107280	1.050	7.51	.00	.00
	1.710	1357.72	106975	1.050	7.35	.00	.00
	1.715	1357.57	106662	1.050	7.15	.00	.00
	1.720	1357.43	106342	1.050	6.92	.00	.00
	1.725	1357.30	106019	1.050	6.68	.00	.00
	1.730	1357.18	105884	1.050	6.42	.00	.00
	1.735	1357.04	105916	1.050	6.20	.00	.00
	1.740	1356.89	105942	1.050	6.02	.00	.00
	1.745	1356.67	105959	1.050	6.20	.00	.00
	1.750	1356.28	105965	1.050	7.37	.00	.00
	1.917	1351.80	104275	1.150	7.27	.00	.00
	2.083	1347.30	102590	1.200	7.27	.00	.00
	2.250	1341.80	100771	1.300	9.44	.00	.00
	2.400	1338.13	98651	1.400	9.80	.00	.00
	2.550	1334.25	96240	1.500	10.22	.00	.00
	2.700	1330.02	94173	1.550	10.81	.00	.00
	2.850	1325.31	92867	1.600	11.46	.00	.00
	3.000	1320.55	92363	1.650	11.86	.00	.00
	3.150	1315.95	92076	1.700	12.14	.00	.00
	3.200	1314.30	91987	1.700	12.39	.00	.00
	3.250	1312.48	91889	1.700	12.64	.00	.00
	3.300	1310.43	91697	1.750	12.84	.00	.00
	3.350	1308.15	91381	1.800	13.02	.00	.00
	3.400	1305.71	90876	1.850	13.17	.00	.00
	3.450	1303.28	90125	1.950	13.21	.00	.00
	3.500	1301.24	88982	2.050	12.53	.00	.00
	3.760	1293.75	84347	2.250	11.47	.00	.00
	4.020	1286.53	81914	2.450	10.76	.00	.00
	4.280	1279.43	80523	2.600	10.32	.00	.00
	4.540	1272.70	79746	2.700	9.68	.00	.00
	4.800	1265.02	79454	2.800	10.24	.00	.00
	4.903	1262.85	79341	2.850	10.28	.00	.00
	5.007	1260.68	79233	2.850	10.31	.00	.00

2C

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
5.110	1258.51	79101	2.900	10.33	.00	.00
5.213	1256.34	78970	2.950	10.36	.00	.00
5.317	1254.16	78837	2.950	10.38	.00	.00
5.420	1251.99	78683	3.000	10.40	.00	.00
5.523	1249.81	78526	3.050	10.42	.00	.00
5.627	1247.63	78377	3.100	10.44	.00	.00
5.730	1245.45	78217	3.100	10.45	.00	.00
5.833	1243.28	78042	3.150	10.46	.00	.00
5.937	1241.10	77886	3.200	10.47	.00	.00
6.040	1238.91	77731	3.200	10.48	.00	.00
6.143	1236.72	77577	3.250	10.50	.00	.00
6.247	1234.44	77446	3.250	10.61	.00	.00
6.350	1231.32	77371	3.300	11.83	.00	.00
6.607	1225.15	77124	3.400	11.93	.00	.00
6.864	1219.03	76836	3.500	12.01	.00	.00
7.121	1213.12	76465	3.550	11.84	.00	.00
7.379	1207.01	76009	3.700	11.94	.00	.00
7.636	1201.41	75485	3.750	11.18	.00	.00
7.893	1194.42	74904	3.975	12.64	.00	.00
8.150	1190.51	72898	4.125	10.02	.00	.00
8.410	1184.92	71206	4.250	9.80	.00	.00
8.670	1179.18	70141	4.400	10.25	.00	.00
8.930	1172.96	69304	4.525	11.25	.00	.00
9.190	1166.44	68594	4.650	12.10	.00	.00
9.450	1161.38	67739	4.750	11.38	.00	.00
9.710	1156.70	67126	4.800	11.46	.00	.00
9.970	1151.94	66746	4.850	11.57	.00	.00
10.230	1147.07	66505	4.900	11.76	.00	.00
10.490	1143.07	66392	4.175	12.09	.00	.00
10.750	1141.03	68024	3.850	13.95	.00	.00
10.760	1133.09	68024	4.225	16.03	.00	.00
10.770	1132.93	68006	4.250	15.64	.00	.00
10.780	1132.78	67987	4.250	15.21	.00	.00
10.790	1132.65	67968	4.250	14.76	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
10.800	1132.53	67947	4.250	14.28	.00	.00
10.810	1132.42	67925	4.250	13.76	.00	.00
10.820	1132.33	67901	4.250	13.23	.00	.00
11.070	1127.67	67097	4.975	13.07	.00	.00
11.320	1123.26	66257	5.025	12.57	.00	.00
11.570	1118.87	66173	5.050	12.42	.00	.00
11.820	1114.92	66047	5.125	12.03	.00	.00
12.078	1110.19	65885	5.175	12.41	.00	.00
12.335	1105.17	65741	5.200	12.87	.00	.00
12.593	1100.29	65649	5.225	13.10	.00	.00
12.850	1096.25	65599	5.250	12.58	.00	.00
13.100	1092.74	65560	5.275	11.90	.00	.00
13.350	1089.10	65523	5.300	11.35	.00	.00
13.600	1085.39	65486	5.325	10.88	.00	.00
13.850	1081.66	65443	5.375	10.43	.00	.00
14.138	1077.26	65385	5.400	10.44	.00	.00
14.425	1072.88	65319	5.450	10.51	.00	.00
14.713	1068.55	65256	5.475	10.66	.00	.00
15.000	1064.25	65195	5.525	11.00	.00	.00

** Location of Adobe Dam

4c

```
************************************
************************************
****  SUMMARY OF OUTPUT DATA  ******
*** Time of Failure = 60 minutes ***
***   Breach width = 225 feet    ***
************************************
************************************
```

DATA D

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	FLOOD ELEV (FT)	TIME FLOOD ELEV(HR)
********	********	********	********	********	**********	**********
.000	1379.43	2000	.000	5.99	.00	.00
.050	1378.87	2000	.000	5.93	.00	.00
.100	1378.31	2000	.000	5.92	.00	.00
.150	1377.93	2021	.000	5.82	.00	.00
.200	1377.83	2139	.000	5.26	.00	.00
.250	1377.81	2449	.000	4.49	.00	.00
.300	1377.80	3037	.000	3.82	.00	.00
.350	1377.80	4029	.000	3.52	.00	.00
.400	1377.80	5545	.000	3.29	.00	.00
.450	1377.80	7751	.000	3.13	.00	.00
.500	1377.80	10735	.000	3.01	.00	.00
.550	1377.80	14564	.000	2.91	.00	.00
.600	1377.80	19578	.000	2.63	.00	.00
.650	1377.80	25254	.000	2.65	.00	.00
.700	1377.80	31393	.000	2.66	.00	.00
.750	1377.80	38034	.000	2.68	.00	.00
.800	1377.80	44914	.000	2.70	.00	.00
.850	1377.80	51967	.000	2.72	.00	.00
.900	1377.80	59135	.000	2.75	.00	.00
.950	1377.80	66368	.000	2.77	.00	.00
1.000	1377.80	73637	.000	2.80	.00	.00
1.050	1377.80	80911	.000	2.84	.00	.00
1.100	1377.80	88152	.000	2.87	.00	.00
1.150	1377.80	95342	.000	2.92	.00	.00
1.200	1377.80	102460	.000	2.96	.00	.00
1.250	1377.80	109473	.000	3.02	.00	.00
1.300	1377.80	116371	.000	3.08	.00	.00
1.350	1377.80	123129	.000	3.16	.00	.00
1.400	1377.80	129717	.000	3.25	.00	.00
1.450	1377.80	136115	.000	3.36	.00	.00
1.500	1377.80	142290	.000	3.51	.00	.00
1.550	1377.80	148205	.000	3.64	.00	.00
1.600	1377.80	155061	.000	3.65	.00	.00
1.650	1377.80	161974	.000	4.35	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

	RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
**	1.700	1377.80	168882	.000	6.41	.00	.00
	1.705	1361.60	168882	1.050	7.51	.00	.00
	1.710	1361.48	168447	1.050	7.36	.00	.00
	1.715	1361.38	168005	1.050	7.18	.00	.00
	1.720	1361.28	167561	1.050	6.97	.00	.00
	1.725	1361.18	167118	1.050	6.73	.00	.00
	1.730	1361.07	166681	1.050	6.49	.00	.00
	1.735	1360.95	166266	1.050	6.26	.00	.00
	1.740	1360.79	165886	1.050	6.08	.00	.00
	1.745	1360.54	165555	1.050	6.70	.00	.00
	1.750	1360.08	165283	1.050	8.15	.00	.00
	1.917	1355.56	163715	1.100	8.04	.00	.00
	2.083	1351.29	159261	1.150	7.80	.00	.00
	2.250	1345.50	154339	1.250	11.19	.00	.00
	2.400	1341.75	148813	1.350	11.58	.00	.00
	2.550	1337.85	142253	1.400	11.89	.00	.00
	2.700	1333.75	136038	1.500	12.12	.00	.00
	2.850	1329.41	130689	1.600	12.49	.00	.00
	3.000	1324.60	127622	1.600	13.00	.00	.00
	3.150	1319.39	126560	1.650	13.78	.00	.00
	3.200	1317.55	126306	1.700	14.08	.00	.00
	3.250	1315.49	125766	1.700	14.32	.00	.00
	3.300	1313.25	124900	1.750	14.52	.00	.00
	3.350	1310.85	123739	1.800	14.67	.00	.00
	3.400	1308.30	122337	1.850	14.74	.00	.00
	3.450	1305.73	120662	1.950	14.70	.00	.00
	3.500	1303.61	118519	2.000	13.94	.00	.00
	3.760	1295.75	109291	2.200	12.65	.00	.00
	4.020	1288.25	103497	2.350	11.75	.00	.00
	4.280	1280.94	99745	2.488	11.18	.00	.00
	4.540	1274.06	97337	2.588	10.43	.00	.00
	4.800	1266.24	96139	2.738	10.96	.00	.00
	4.903	1264.06	95697	2.738	10.97	.00	.00
	5.007	1261.87	95254	2.788	11.00	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	FLOOD ELEV (FT)	TIME FLOOD ELEV(HR)
********	********	********	********	********	**********	**********
5.110	1259.68	94889	2.838	11.03	.00	.00
5.213	1257.47	94516	2.838	11.06	.00	.00
5.317	1255.27	94143	2.888	11.09	.00	.00
5.420	1253.07	93841	2.938	11.12	.00	.00
5.523	1250.88	93527	2.938	11.14	.00	.00
5.627	1248.69	93185	2.988	11.16	.00	.00
5.730	1246.49	92885	3.038	11.18	.00	.00
5.833	1244.30	92542	3.038	11.19	.00	.00
5.937	1242.11	92178	3.088	11.20	.00	.00
6.040	1239.91	91857	3.138	11.21	.00	.00
6.143	1237.69	91518	3.138	11.24	.00	.00
6.247	1235.37	91224	3.138	11.36	.00	.00
6.350	1232.19	91027	3.188	12.61	.00	.00
6.607	1226.05	90440	3.288	12.66	.00	.00
6.864	1219.95	89725	3.338	12.69	.00	.00
7.121	1214.03	88899	3.438	12.43	.00	.00
7.379	1207.83	87908	3.538	12.59	.00	.00
7.636	1202.19	86634	3.588	11.74	.00	.00
7.893	1195.03	85368	3.813	13.38	.00	.00
8.150	1191.17	81896	3.938	10.12	.00	.00
8.410	1185.53	78842	4.062	10.25	.00	.00
8.670	1179.85	76867	4.187	10.56	.00	.00
8.930	1173.76	75687	4.287	11.38	.00	.00
9.190	1167.32	74564	4.437	12.31	.00	.00
9.450	1162.20	73243	4.512	11.67	.00	.00
9.710	1157.48	72202	4.587	11.71	.00	.00
9.970	1152.68	71512	4.637	11.83	.00	.00
10.230	1147.77	71098	4.687	12.01	.00	.00
10.490	1143.25	70901	3.938	12.36	.00	.00
10.750	1141.03	70855	3.613	14.26	.00	.00
10.760	1133.55	70855	4.737	16.18	.00	.00
10.770	1133.39	70854	4.737	15.77	.00	.00
10.780	1133.25	70853	4.737	15.34	.00	.00
10.790	1133.13	70852	4.737	14.88	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
10.800	1133.02	70851	4.737	14.39	.00	.00
10.810	1132.92	70850	4.737	13.87	.00	.00
10.820	1132.83	70849	4.737	13.32	.00	.00
11.070	1128.28	70779	4.762	13.11	.00	.00
11.320	1123.86	70688	4.787	12.60	.00	.00
11.570	1119.29	70618	4.812	12.44	.00	.00
11.820	1115.42	70504	4.887	12.02	.00	.00
12.078	1110.91	70282	4.937	12.42	.00	.00
12.335	1106.00	70056	4.987	12.87	.00	.00
12.593	1101.07	69894	5.012	13.13	.00	.00
12.850	1096.87	69802	5.037	12.79	.00	.00
13.100	1093.28	69733	5.062	12.12	.00	.00
13.350	1089.58	69668	5.087	11.56	.00	.00
13.600	1085.82	69602	5.137	11.09	.00	.00
13.850	1082.10	69527	5.162	10.60	.00	.00
14.138	1077.68	69431	5.212	10.64	.00	.00
14.425	1073.28	69326	5.237	10.72	.00	.00
14.713	1068.98	69225	5.287	10.88	.00	.00
15.000	1064.70	69136	5.312	11.21	.00	.00

** Location of Adobe Dam.

```
************************************
************************************
****   SUMMARY OF OUTPUT DATA   *****
***  Time of Failure = 15 minutes ***
***    Breach width = 225 feet    ***
************************************
************************************
```

DATA E

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
.000	1379.43	2000	.137	5.94	.00	.00
.050	1378.87	2000	.125	5.93	.00	.00
.100	1378.31	2012	.087	5.87	.00	.00
.150	1377.93	2088	.000	5.74	.00	.00
.200	1377.83	2403	.000	5.31	.00	.00
.250	1377.81	3144	.000	4.51	.00	.00
.300	1377.80	4535	.000	3.83	.00	.00
.350	1377.80	6837	.000	3.50	.00	.00
.400	1377.80	10280	.000	3.29	.00	.00
.450	1377.80	14933	.000	3.13	.00	.00
.500	1377.80	20829	.000	3.01	.00	.00
.550	1377.80	27937	.000	2.91	.00	.00
.600	1377.80	36459	.000	2.63	.00	.00
.650	1377.80	45905	.000	2.65	.00	.00
.700	1377.80	55465	.000	2.66	.00	.00
.750	1377.80	64933	.000	2.68	.00	.00
.800	1377.80	74095	.000	2.70	.00	.00
.850	1377.80	83492	.000	2.72	.00	.00
.900	1377.80	92735	.000	2.75	.00	.00
.950	1377.80	101481	.000	2.77	.00	.00
1.000	1377.80	109593	.000	2.80	.00	.00
1.050	1377.80	117652	.000	2.84	.00	.00
1.100	1377.80	125876	.000	2.87	.00	.00
1.150	1377.80	133373	.000	2.92	.00	.00
1.200	1377.80	140050	.000	2.96	.00	.00
1.250	1377.80	146619	.000	3.02	.00	.00
1.300	1377.80	153579	.000	3.08	.00	.00
1.350	1377.80	159593	.000	3.15	.00	.00
1.400	1377.80	164534	.000	3.23	.00	.00
1.450	1377.80	169998	.000	3.33	.00	.00
1.500	1377.80	175413	.000	3.43	.00	.00
1.550	1377.80	179442	.000	3.47	.00	.00
1.600	1377.80	183616	.000	3.65	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM ********	MAX ELEV (FT) ********	MAX FLOW (CFS) ********	TIME MAX ELEV(HR) ********	MAX VEL (FT/SEC) ********	FLOOD ELEV (FT) **********	TIME FLOOD ELEV(HR) **********
1.650	1377.80	188354	.000	4.37	.00	.00
DAM LOCATION ** 1.700 3	1377.80	190135	.000	6.41	.00	.00
1.705 4	1362.46	190135	.350	8.11	.00	.00
1.710	1362.35	188934	.350	8.04	.00	.00
1.715	1362.25	188300	.350	7.93	.00	.00
1.720	1362.15	187602	.350	7.77	.00	.00
1.725	1362.05	186858	.350	7.57	.00	.00
1.730	1361.94	186466	.350	7.36	.00	.00
1.735	1361.82	186073	.362	7.15	.00	.00
1.740	1361.65	185695	.362	6.98	.00	.00
1.745	1361.40	185347	.362	7.52	.00	.00
1.750	1360.91	185148	.362	9.21	.00	.00
1.917	1356.35	179561	.425	9.10	.00	.00
2.083	1352.09	174380	.487	8.98	.00	.00
2.250 5	1346.21	168113	.612	12.35	.00	.00
2.400	1342.45	160245	.712	12.60	.00	.00
2.550	1338.53	152195	.812	12.65	.00	.00
2.700	1334.44	144871	.912	12.73	.00	.00
2.850	1330.12	138684	.987	12.97	.00	.00
3.000	1325.32	135142	1.037	13.30	.00	.00
3.150 6	1320.03	133896	1.075	14.12	.00	.00
3.200	1318.16	133544	1.112	14.43	.00	.00
3.250	1316.07	132898	1.162	14.68	.00	.00
3.300	1313.83	131861	1.200	14.87	.00	.00
3.350 7	1311.41	130485	1.250	15.01	.00	.00
3.400	1308.82	128977	1.300	15.08	.00	.00
3.450	1306.22	127213	1.375	15.07	.00	.00
3.500	1304.09	124936	1.462	14.37	.00	.00
3.760	1296.19	114971	1.650	12.92	.00	.00
4.020	1288.65	108701	1.812	11.96	.00	.00
4.280	1281.31	104615	1.975	11.37	.00	.00
4.540	1274.39	101912	2.087	10.60	.00	.00
4.800 8	1266.55	100529	2.212	11.13	.00	.00
4.903	1264.37	100024	2.250	11.14	.00	.00

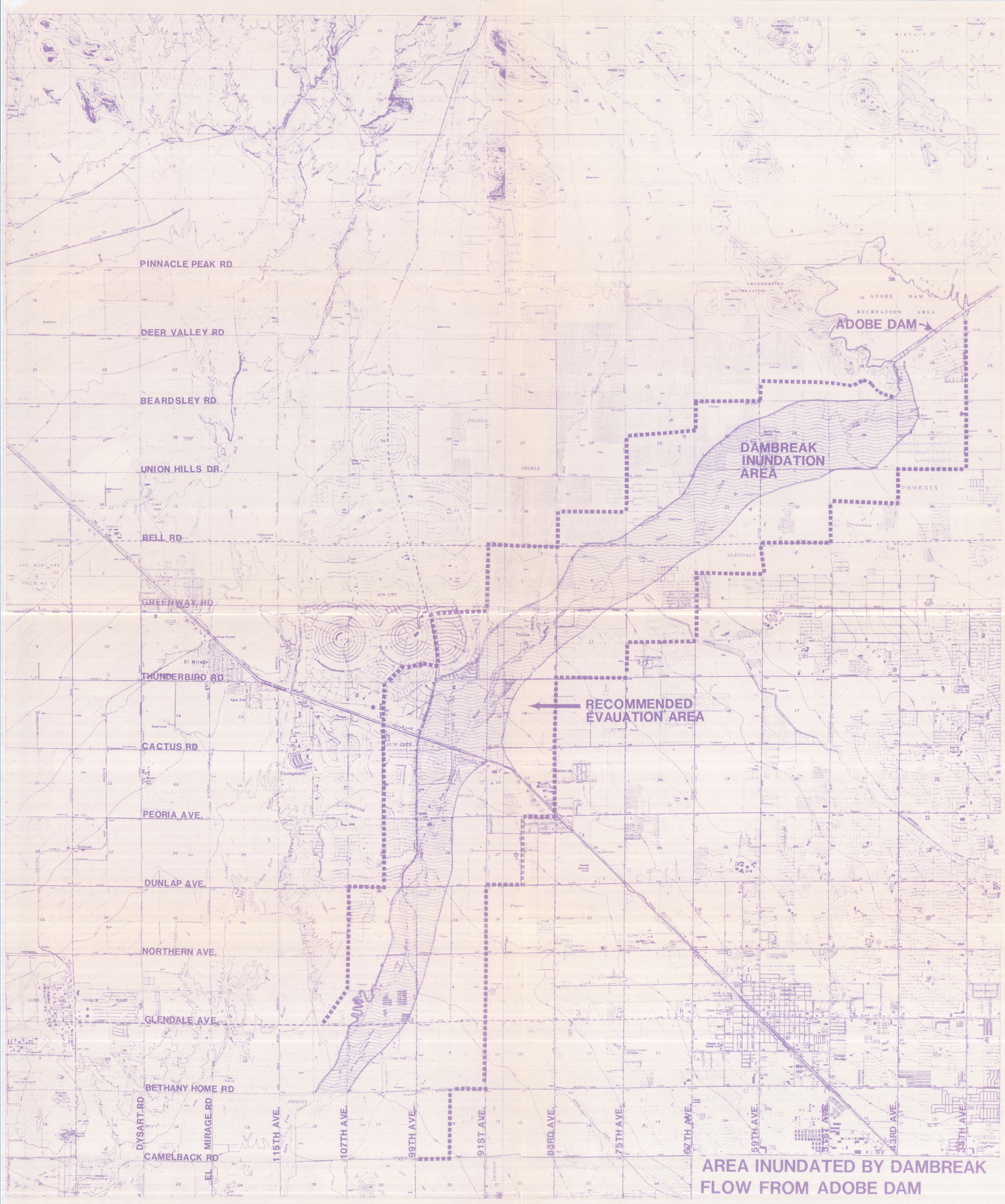
PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	FLOOD ELEV (FT)	TIME FLOOD ELEV(HR)
********	********	********	********	********	**********	**********
5.007	1262.18	99538	2.287	11.16	.00	.00
5.110	1259.99	99080	2.325	11.18	.00	.00
5.213	1257.79	98634	2.362	11.21	.00	.00
5.317	1255.58	98218	2.400	11.24	.00	.00
5.420	1253.37	97821	2.437	11.28	.00	.00
5.523	1251.16	97460	2.462	11.31	.00	.00
5.627	1248.96	97133	2.487	11.33	.00	.00
5.730	1246.77	96799	2.525	11.35	.00	.00
5.833	1244.57	96459	2.562	11.37	.00	.00
5.937	1242.38	96113	2.587	11.38	.00	.00
6.040	1240.18	95763	2.625	11.39	.00	.00
6.143	1237.96	95428	2.650	11.42	.00	.00
6.247	1235.63	95153	2.662	11.56	.00	.00
6.350 9	1232.44	94931	2.700	12.81	.00	.00
6.607	1226.31	94350	2.775	12.86	.00	.00
6.864	1220.23	93617	2.875	12.87	.00	.00
7.121	1214.31	92721	2.925	12.59	.00	.00
7.379	1208.09	91629	3.062	12.76	.00	.00
7.636	1202.44	90260	3.112	11.91	.00	.00
7.893	1195.24	88858	3.337	13.59	.00	.00
8.150 10	1191.42	85079	3.425	10.30	.00	.00
8.410	1185.78	81713	3.612	10.40	.00	.00
8.670	1180.10	79630	3.712	10.68	.00	.00
8.930	1174.07	78328	3.825	11.43	.00	.00
9.190	1167.70	77088	3.950	12.41	.00	.00
9.450 11	1162.57	75702	4.050	11.77	.00	.00
9.710	1157.85	74577	4.112	11.80	.00	.00
9.970	1153.03	73810	4.175	11.94	.00	.00
10.230	1148.10	73324	4.212	12.12	.00	.00
10.490	1143.31	73095	3.412	12.48	.00	.00
10.750 12	1141.03	73044	3.100	14.42	.00	.00
10.760	1133.78	73044	4.262	16.26	.00	.00
10.770	1133.63	73043	4.262	15.82	.00	.00
10.780	1133.50	73042	4.262	15.38	.00	.00

PROFILE OF CRESTS AND TIMES FOR Skunk Creek
BELOW Adobe Dam

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	FLOOD ELEV (FT)	TIME FLOOD ELEV(HR)
********	********	********	********	********	**********	**********
10.790	1133.37	73040	4.262	14.91	.00	.00
10.800	1133.26	73039	4.262	14.41	.00	.00
10.810	1133.17	73037	4.275	13.89	.00	.00
10.820 13	1133.09	73035	4.275	13.34	.00	.00
11.070	1128.57	72960	4.312	13.13	.00	.00
11.320	1124.14	72865	4.337	12.63	.00	.00
11.570	1119.48	72791	4.362	12.47	.00	.00
11.820 14	1115.64	72667	4.425	12.07	.00	.00
12.078	1111.24	72435	4.487	12.43	.00	.00
12.335	1106.38	72197	4.537	12.88	.00	.00
12.593	1101.45	72021	4.562	13.14	.00	.00
12.850 15	1097.16	71916	4.587	12.89	.00	.00
13.100	1093.54	71839	4.612	12.22	.00	.00
13.350	1089.82	71768	4.637	11.66	.00	.00
13.600	1086.04	71697	4.675	11.19	.00	.00
13.850 16	1082.32	71615	4.712	10.68	.00	.00
14.138	1077.89	71506	4.750	10.73	.00	.00
14.425	1073.49	71397	4.800	10.83	.00	.00
14.713	1069.20	71288	4.837	10.98	.00	.00
15.000 17	1064.94	71202	4.862	11.30	.00	.00

** Location of Adobe Dam


PINNACLE PEAK RD
DEER VALLEY RD
BEARDSLEY RD
UNION HILLS DR.
BELL RD
GREENWAY RD
THUNDERBIRD RD
CACTUS RD
PEORIA AVE.
DUNLAP AVE.
NORTHERN AVE.
GLENDALE AVE.
BETHANY HOME RD
CAMELBACK RD
DYSART RD
EL MIRAGE RD
115TH AVE.
107TH AVE.
99TH AVE.
91ST AVE.
83RD AVE.
75TH AVE.
67TH AVE.
59TH AVE.
51ST AVE.
43RD AVE.
35TH AVE.
ADOBE DAM
DAMBREAK INUNDATION AREA
RECOMMENDED EVAUATION AREA
AREA INUNDATED BY DAMBREAK FLOW FROM ADOBE DAM