TRIBUTARY QUATION BROOK
WHITE RIVER WATERSHED
VERMONT

CRESCENT LAKE DAM
DAM - BREAK FLOOD ANALYSIS

AUGUST 1989

US Army Corps of Engineers
New England Division

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
August 1989

3. REPORT TYPE AND DATES COVERED
Dam-Break Analysis

4. TITLE AND SUBTITLE
Crescent Lake Dam, Dam-Break Analysis

5. FUNDING NUMBERS

6. AUTHOR(S)
Hydraulic & Water Resources Engineers, Inc.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Hydraulic & Water Resources Engineers, Inc.
Waltham, MA 02154

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers, New England Division
Hydrology Engineering Section
424 Trapelo Road
Waltham, MA 02254-9149

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Performed under the Corps of Engineers' Flood Plain Management Services Authority at the request of the State of Vermont.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release
Distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This report presents the findings of two dam-break flood analysis performed for Crescent Lake Dam. The report gives pertinent features of the dam, the procedure used in the analysis, the assumed dam-break and overtopping conditions, and the resulting effect on downstream flooded areas. This study was not performed because of any known likelihood of a dam-break at Crescent Lake Dam. Its purposes were to provide quantitative information for emergency planning use, and to arrive at a dam safety hazard classification. The dam is an abandoned mill dam, located on a tributary of Quation Brook, and has a maximum height of 12 feet. The first Route 132 road crossing is the only one in the study at which water could rise significantly above the channel banks without escaping the channel and flowing parallel to the road embankment. The damming effect at this location would lead to the highway being overtopped. Upstream of this road crossing is a school building which in dam failure conditions would be flooded, with a threat of loss of more than a few lives. For these reasons, a hazard classification of "high" was assigned to Crescent Lake Dam.

14. SUBJECT TERMS
Crescent Lake Dam; Quation Brook; dams; Sharon, Vermont; floods; dam failure; White River Watershed

15. NUMBER OF PAGES
56

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
Unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

19. SECURITY CLASSIFICATION OF ABSTRACT
Unclassified

20. LIMITATION OF ABSTRACT

Preface

This investigation was performed under the Corps of Engineers' Flood Plain Management Services Authority at the request of the State of Vermont. The Flood Control Act of 1960 which authorizes the U.S. Army Corps of Engineers "... to compile and disseminate information on floods and flood damages ... and to provide engineering advice to local interests for their use in planning to ameliorate the flood hazard."

The Dam-Break Analysis study presented in this report was prepared under contract by Hydraulic & Water Resources Engineers, Inc. of Waltham, Massachusetts. Any questions concerning this report should be addressed to the Chief of the Hydrology Engineering Section of the Corps of Engineers, New England Division.

CRESCENT LAKE DAM
DAM-BREAK FLOOD ANALYSES

TABLE OF CONTENTS

PARAGRAPH	SUBJECT	PAGE
1	INTRODUCTION AND PURPOSE	1
2	DAM DESCRIPTION	1
3	PERTINENT DATA	1
4	VALLEY DESCRIPTION	3
5	MODEL DESCRIPTION	3
6	ASSUMED DAM-BREAK CONDITIONS	3
7	RESULTS	4
8	DAM SAFETY HAZARD CLASSIFICATION	5

PLATE	LIST OF PLATES
1	INDEX MAP
2	PROFILE
3	FLOOD DISCHARGE, STAGES AND TIMING

APPENDIX	TITLE
A	INPUT DATA FILE
B	OUTPUT DATA FILE
C	SUNNY DAY FAILURE INFORMATION
D	FIRST ROUTE 132 CROSSING

CRESCENT LAKE DAM
DAM-BREAK FLOOD ANALYSES

1. INTRODUCTION AND PURPOSE

This report presents the findings of two dam-break flood analyses performed for Crescent Lake Dam, located in Sharon, Vermont. The dam is owned, operated and maintained by the Estate of Mrs. Beatrice Day. Included in the report are a description of pertinent features of the dam, the procedure used in the analyses, the assumed dam-break and overtopping conditions, and the resulting effect on downstream flooded areas. This study was not performed because of any known likelihood of a dam-break at Crescent Lake Dam. Its two purposes were to provide quantitative information for emergency planning use, and to arrive at a dam safety hazard classification.

2. DAM DESCRIPTION

Name of Dam:	Crescent Lake Dam
Town:	Sharon
County and State:	Windsor, VT
Stream:	Unnamed tributary of Quation Brook

Crescent Lake Dam is in central Vermont in the town of Sharon, north of the town center. It is approximately 1.5 miles north-east of the junction of Route 132 and Interstate 89. The dam is an abandoned mill dam and has a maximum height of 12 feet. The spillway consists of a culvert leading to a stoplog-equipped concrete rectangular tower, near the center-line of the dam. From this tower, flow proceeds through a 2.2 ft wide by 3.8 ft high outlet conduit passing through the dam.

3. PERTINENT DATA

Data was taken primarily from a 1950 dam inspection report prepared by the State of Vermont Water Conservation Board (Report #167) and from a 1978 inspection report by Mr. A. Peter Barranco.

(a) Drainage Area

Crescent Lake Dam is located on a tributary of Quation Brook, shown on Plate 1. It has a drainage area of 1.44 square miles. The watershed is well wooded and mountainous, including two smaller lakes upstream of Crescent Lake.

(b) Elevation (N.G.V.D.)

(1) Top of Dam - 1,168.40
(2) Sluiceway Invert - 1,156.20
(3) Top of top stoplog - 1,165.59

(c) Reservoir

(1) Length of normal pool - 0.35 mile

(d) Storage (Acre-Feet)
(1) Top of Dam --- 160
(2) Spillway Crest - 85

(e) Reservoir Surface (Acres)

(1) Top of Dam - 42.6
(2) Top Stoplog - 30.3

(f) Dam

(1) Type	Earthfill embankment over old masonry dam
(2) Length	98 feet
(3) Height	12 feet maximum
(4) Top Width	12 feet
(5) Side Slopes	
(a) Upstream	1 on 3
(b) Downstream	1 on 1
(6) Zoning	Clay embankment over massive gravity section of unknown dimensions.
(7) Impervious Core	Masonry section of undetermined hydraulic nature.
(8) Cutoff	Details unknown.

(g) Spillway

(1) Type	Rectangular drop inlet with rectangular concrete conduit through the dam section. The vertical intake pipe currently allows flow to enter near its invert therefore a 13.7-foot high concrete stoplog structure, located near the right abutment, can be used to regulate the lake level.
(2) Length of Weir	Overflow length of stoplog 5.7 ft. (Hydraulic control for high flows likely by outlet conduit).

(3) Crest elevation
(a) Assumed normal water level (USGS Quad sheet) 1,162 ft NGVD
(b) Top stoplog at 1,165.59 ft NGVD

4. VALLEY DESCRIPTION

The river channel drops at approximately 160 feet per mile immediately downstream of the dam. The valley is initially narrow, opening out after approximately 0.5 miles into a wider flood plain area. It is, in general, thickly wooded.

There is a confluence with the Quation Brook at approximately 0.9 miles and soon thereafter there are three Route 132 crossings. These occur over the space of approximately 0.3 mile, where the Quation Brook valley is narrow and Route 132 has been constructed generally parallel to the brook. At approximately 2 miles downstream of Crescent Lake Dam, Route 132 crosses the Quation Brook. From the first to the fourth crossing, the average slope of the river is approximately 160 feet per mile.

The fourth bridge crossing marks the end of the study reach. There are fewer than ten buildings within the downstream study reach. One of these is a school building situated just upstream of the first Route 132 crossing.

5. MODEL DESCRIPTION

The Crescent Lake dam-break analysis was conducted using **Boss DamBrk**, a June 1988 version of the "National Weather Service Dam-Break Flood Forecasting Computer Model", developed by D.L.Fread, Research Hydrologist, Office of Hydrology, National Weather Service, NOAA, Silver Springs, Maryland 20910. Boss DamBrk is copyrighted by Boss Corporation, Madison, WI 53703. Input for the model consisted of: (a) storage characteristics of the reservoir, (b) selected geometry and duration of the breach development, (c) hydraulic roughness coefficients, and (d) downstream channel characteristics. Based on the input data, the model computes the dam-break outflow hydrograph and routes it downstream. The analysis provides output on the attenuation of the flood stages, and timing of the flood wave as it progresses downstream.

6. ASSUMED DAM BREAK CONDITIONS

General: This analysis was conducted for each of two situations. The first was the "Overtopping Failure" case, in which the dam was assumed to fail during an estimated flood of record condition. The second was the "Sunny Day" failure case, in which the initial lake level was assumed to be at normal lake elevation with reduced downstream streamflow conditions prior to a one-hour dam-breach formation.

The magnitude of a flood resulting from the hypothetical failure of Crescent Lake Dam is a function of many different parameters including size of breach, initial pool level and storage, rate of breach formation, channel and overbank roughness and antecedent flow conditions. Engineering

assumptions used in the analyses for the two cases are presented below.

PARAMETER	OVERTOPPING	SUNNY DAY
(1) Initial Pool Level	1,166.33 ft	1,165.60 ft NGVD
(2) Reservoir Level at Start of Failure	1,168.68 ft	1,165.50 ft NGVD
(3) Reservoir Inflow	252 cfs	30 cfs
(4) Breach Invert	1,156.2 ft	1,156.2 ft NGVD
(5) Breach Base Width	30.5 ft	30.5 ft

(6) Time to Complete Formation of Breach : 1.0 hours

(7) Downstream Channel Roughness: Manning n = 0.025 to 0.04

(8) Pre-Breach River Flows:

The Overtopping Failure case assumed a dam inflow, equivalent to the estimated flood of record conditions in the White River watershed. The estimated watershed runoff rate was 175 cfs per square mile of drainage area, which is the estimated runoff rate of the November 1927 flood. Inflow to Crescent Lake Dam was assumed to be 252 cfs. Inflow from Quation Brook was 282 cfs.

The Sunny Day Failure case assumed that the dam would fail at normal lake elevation. Therefore the initial lake level was assumed at the top stoplogs. An initial turbine flow of 41 cfs was modeled, representing a small nominal starting flow, while inflow to the reservoir was 30 cfs. Flow in the Quation Brook was 10 cfs.

7. RESULTS

The results of the Overtopping Failure analysis are discussed here and these form the basis of the hazard classification rating. Input and output data files for the Overtopping Failure analysis are presented in Appendices A and B. Data files pertaining to the Sunny Day Failure case are presented in Appendix C. Calculations describing the effect of the first Route 132 highway crossing on the computed flow depths for the Overtopping case are summarised in Appendix D.

Peak stage flood profiles are shown on Plate 2. Profiles are shown in feet above the stream invert levels as established by the Hydraulic and Water Resources Engineers survey team. Results of the Sunny Day failure computer-run indicate that normal low flows would result in flow depths only a few inches above this datum. Peak water elevations can be

determined by adding these depths of flow to the bed-slope profile elevations, or by adding the depths to field-established stream-bed elevations at points of interest. Variations in depth are attributable to changes in natural stream hydraulic capacity as well as to changes in discharge.

The peak dam-break discharge from Crescent Lake Dam for the overtopping case was 5,700 cfs producing a rise to a depth of approximately 9 feet immediately downstream of the dam. At the first Route 132 crossing, ponding upstream of a roadway culvert resulted in only slightly attenuating the DAMBRK-computed peak flows from 5,427 cfs to 5,250 cfs. More important, however, was the increase in stage. Maximum depths exceeded 20 feet as overtopping of the roadway occurred.

Downstream of this highway crossing, computed peak depths ranged between 6 and 8 feet. At the fourth Route 132 crossing, at the end of the study reach, the peak flow was attenuated to 4,900 cfs, with an associated depth of approximately 7.5 feet. Due to the steepness of the brook channel and the very little floodplain storage it is not expected that the dam break hydrograph would be significantly attenuated from mile 1.8 to the First Branch White River. Therefore the peak depths computed at mile 1.8 can be used as a guide in estimating depths further downstream along Quation Brook.

8. DAM SAFETY HAZARD CLASSIFICATION

The categories and criteria for the hazard classification of dams, as reported in "Recommended Guidelines For Safety Inspection of Dams", Department of the Army, Nov. 1976, are listed in the following table. The hazard classification pertains to the potential loss of human life or property damage in the area downstream of the dam in the event of the failure of the dam.

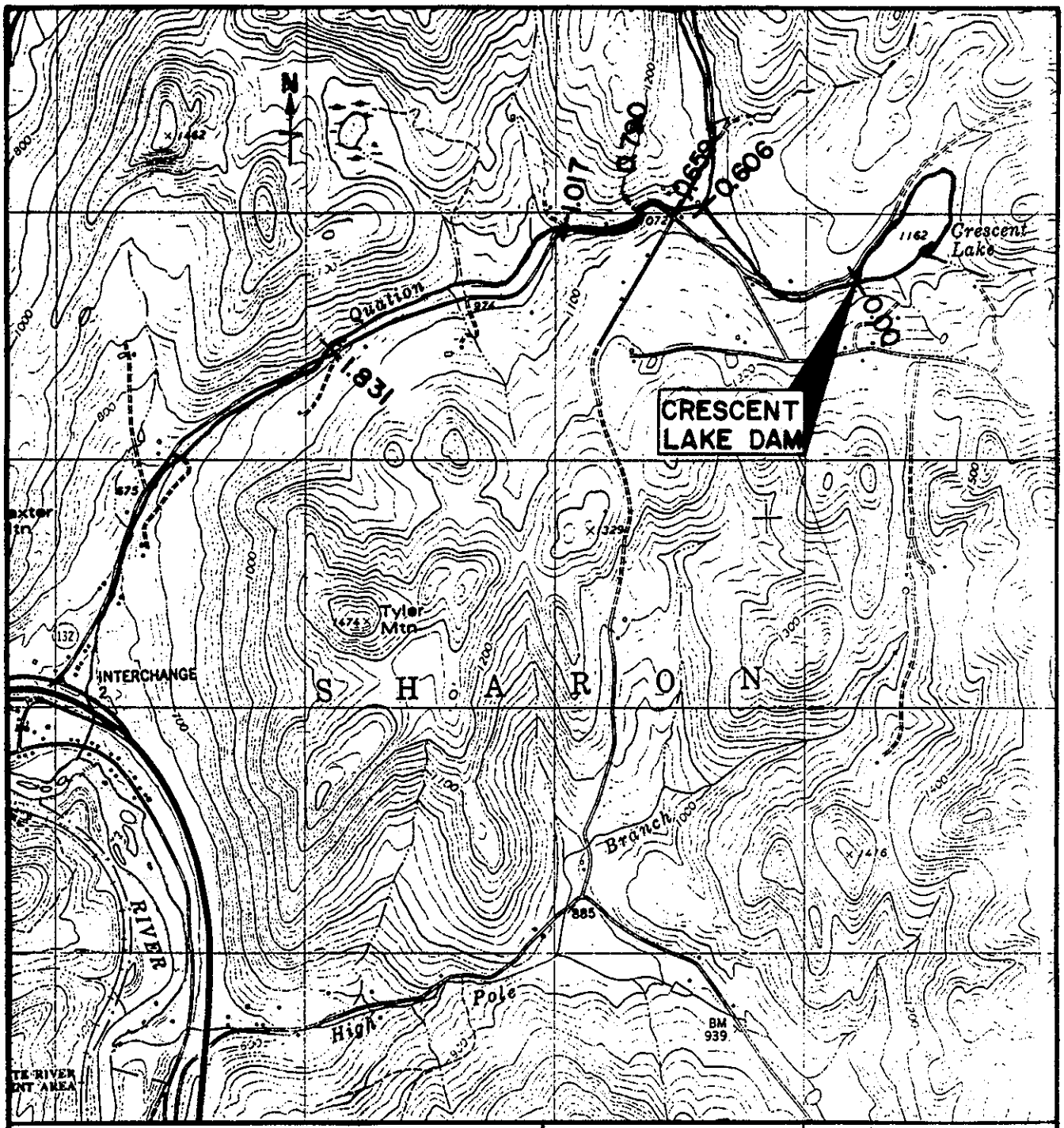
DAM HAZARD CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than few	Excessive (Extensive community, industry or agriculture)

Residential development is sparse downstream of the dam, and fewer than ten buildings could be threatened by a dam failure. In a computer simulation that discounted the effect of highway crossings, computed peak depths of flow ranged from 5 to 10 feet, while computed peak velocities exceeded 16 feet per second.

The first Route 132 road crossing is the only one in the study at which water could rise significantly above the channel banks without escaping the channel and flowing parallel to the road embankment. The damming effect at this location would lead to the highway being overtopped. Upstream of this road crossing is a school building which in dam failure conditions would be flooded, with a threat of loss of more than a few lives.

For these reasons, a hazard classification of "high" was assigned to Crescent Lake Dam.



MAP BASED UPON U.S.G.S.
SHARON, V.T. QUADRANGLE
1973
CHECKED 1975 EDITED 1981

CROSS SECTION LOCATION IN MILES BELOW DAM

SCALE IN FEET

2,000 0 2,000

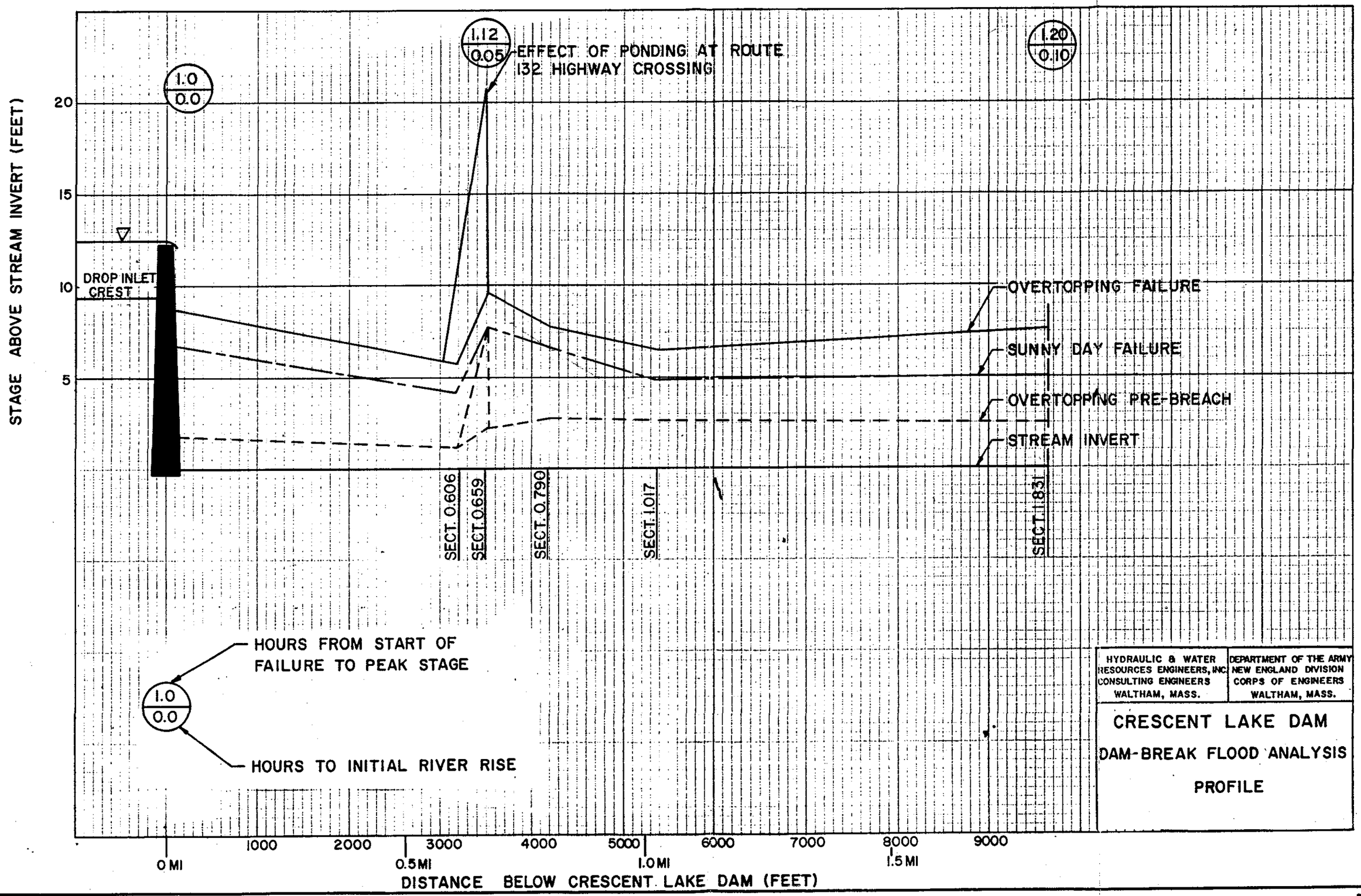
HYDRAULIC & WATER RESOURCES ENGINEERS, INC.
CONSULTING ENGINEERS
WALTHAM, MASS.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

CRESCENT LAKE DAM

DAM BREAK FLOOD ANALYSIS

INDEX MAP



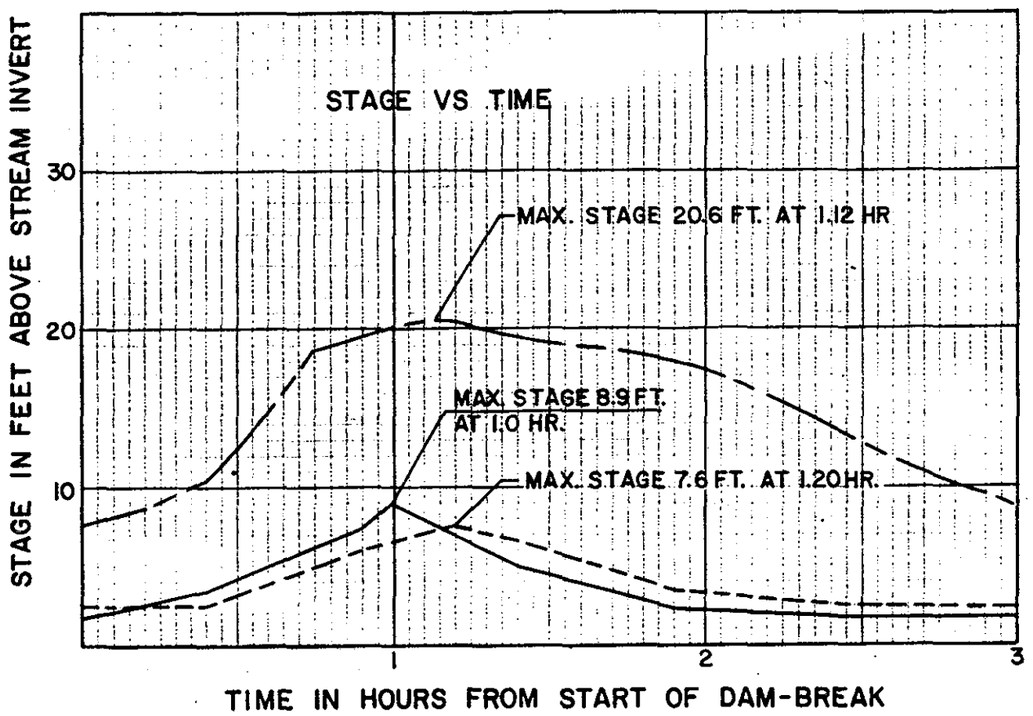
HYDRAULIC & WATER RESOURCES ENGINEERS, INC.
CONSULTING ENGINEERS
WALTHAM, MASS.

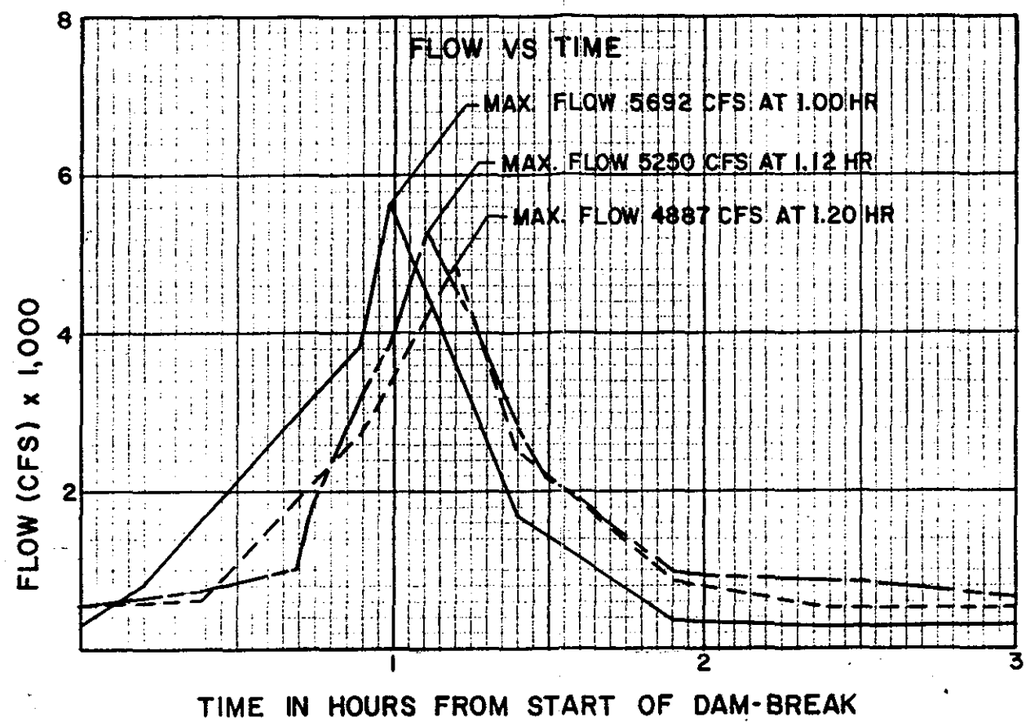
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

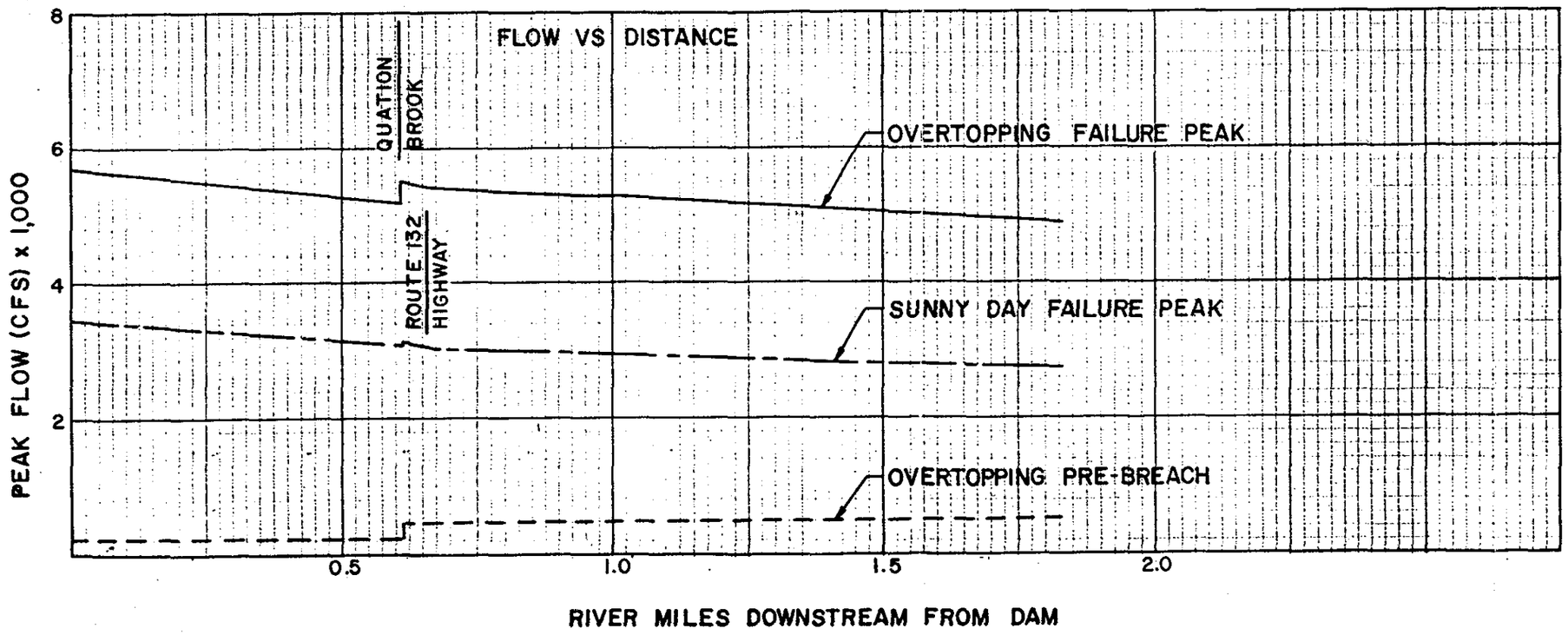
CRESCENT LAKE DAM

DAM-BREAK FLOOD ANALYSIS

PROFILE







STREAM INVERT DATUM (FT. NGVD)

STA. 1 RM. 0.00 = 1,156.2 ———
STA. 2 RM. 0.66 = 1,047.9 — — —
STA. 3 RM. 1.83 = 879.4 — — —

HYDRAULIC & WATER RESOURCES ENGINEERS, INC. CONSULTING ENGINEERS WALTHAM, MASS.	DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.

CRESCENT LAKE DAM

DAM-BREAK FLOOD ANALYSIS

BASE FLOOD DISCHARGES STAGES & TIMING

```
CRESCENT LAKE DAM  SHARON  VERMONT
OVERTOPPING FAILURE
         1         0         0         5         3         0         0         0
0111110100 0 2
      42.6      39.3      30.3       0.0
    1169.4    1168.4    1165.6    1156.2
       0.0    1167.1       1.0    1156.2      30.5       1.0    1156.2       0.0
   1168.68    1168.4   1165.59       0.0      39.3       0.0     255.0       0.0
       0.0      15.0
     252.0     252.0     252.0
       0.0       1.0      15.0
         6         4         6         9         0         1         1         0
         1         2         3         4         5         6
       0.0       0.0
    1156.2    1156.8    1167.7    1168.2       0.0       0.0       0.0       0.0
       0.0      18.0      54.0      76.0       0.0       0.0       0.0       0.0
       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
     0.606       0.0
    1057.4    1061.6    1065.6    1071.4       0.0       0.0       0.0       0.0
       9.6      80.0     432.0     584.0       0.0       0.0       0.0       0.0
       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
     0.659       0.0
    1047.9    1053.4    1060.0    1065.8       0.0       0.0       0.0       0.0
       0.0      64.0     408.0     480.0       0.0       0.0       0.0       0.0
       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
     0.790       0.0
    1037.0    1042.4    1048.0    1051.0       0.0       0.0       0.0       0.0
       0.0      34.2      65.0      97.0       0.0       0.0       0.0       0.0
       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
     1.017       0.0
     993.0    1000.5     1010.     1015.       0.0       0.0       0.0       0.0
      10.5      70.5      71.0      71.5       0.0       0.0       0.0       0.0
       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
     1.831       0.0
     879.4     883.9     888.4     890.0       0.0       0.0       0.0       0.0
       8.8      38.1     105.6     122.6       0.0       0.0       0.0       0.0
       0.0      29.1      96.6     113.6       0.0       0.0       0.0       0.0
     0.025     0.030     0.035     0.040       0.0       0.0       0.0       0.0
      0.05      0.05      0.06      0.07       0.0       0.0       0.0       0.0
      0.03      0.03      0.03      0.04       0.0       0.0       0.0       0.0
      0.03      0.03      0.03      0.03       0.0       0.0       0.0       0.0
      0.03      0.03      0.03      0.03       0.0       0.0       0.0       0.0
       0.7      0.03       0.2       0.4       1.0
       0.0       0.0       0.0       0.0       0.0
       0.0      -0.0      0.05       0.0     163.0       0.5     0.001       0.0
         2
     282.0     282.0     282.0
```

```
============================
 B O S S   D A M B R K (tm)
============================
```

Copyright (C) 1988 Boss Corporation
All Rights Reserved

Version : 1.30
Serial Number : 0001058.130

PROGRAM ORIGIN :

Boss DamBrk (tm) is an enhanced version of Professor D. L. Fread's 1984 NWS DAMBRK program.

DISCLAIMER :

Boss DamBrk (tm) is a complex program which requires engineering expertise to use correctly. Boss Corporation assumes absolutely no responsibility for the correct use of this program. All results obtained should be carefully examined by an experienced professional engineer to determine if they are reasonable and accurate.

Although Boss Corporation has endeavored to make Boss DamBrk error free, the program is not and cannot be certified as infallible. Therefore, Boss Corporation makes no warranty, either implicit or explicit, as to the correct performance or accuracy of this software.

In no event shall Boss Corporation be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of purchase or use of this software. The sole and exclusive liability to Boss Corporation, regardless of the form of action, shall not exceed the purchase price of this software.

PROJECT DESCRIPTION :

PROJECT TITLE : Crescent Lake Dam Overtopping Failure
PROJECT NUMBER : JC-127-2a Over
DESCRIPTION : Option 2 routing of dam outflow 1.8mi
ENGINEER : Patrick Blumeris
DATE OF RUN : 2/03/1989
TIME OF RUN : 10:23 am

INPUT DATA SUMMARY :

INPUT CONTROL PARAMETERS :

Number of Dynamic Routing Reaches (KKN)	1	
Type of Reservoir Routing (KUI)	0	(storage routing)
Number of multiple dams/bridges (MULDAM)	0	
No. of Reservoir Inflow Hydrograph Points (ITEH)	3	
No. of Informational Cross-Sections (NPRT)	0	
Flood-Plain Routing (KFLP)	0	(no)
Landslide Simulation (KSL)	0	(no)

RESERVOIR VOLUME DESCRIPTION :

Elevation vs. Surface Area Table

Elevation HSA(K) (ft MSL)	Surface Area SA(K) (acres)
1169.40	42.6
1168.40	36.3
1165.60	32.3
1156.20	.0
.00	.0
.00	.0
.00	.0
.00	.0

RESERVOIR and BREACH DESCRIPTION :

Initial Elevation of Reservoir Surface (YO, ft MSL)		1167.10
Bottom of Dam Elevation (DATUM, ft MSL)		1156.20
Top of Dam Elevation (HD, ft MSL)		1168.40
Water Surface Elevation at Time of Breach (HF, ft MSL)		1168.68
Breach Side Slope (Z)	1:	1.00
Breach Bottom Elevation (YBMIN, ft MSL)		1156.20
Breach Base Width (BB, ft)		30.50
Time of Breach Formation (TFH, hr)		1.00
Uncontrolled Spillway Crest Elevation (HSP, ft MSL)		1165.59
Uncontrolled Spillway Discharge Coefficient (CS)		39.30
Spillway Gate Center Elevation (HGT, ft MSL)		.00
Spillway Gate Discharge Coefficient (CG)		.00
Dam Overtopping Discharge Coefficient (CDO)		255.00
Turbine Discharge (QT, cfs)		.00

INFLOW HYDROGRAPH DESCRIPTION :

Hydrograph Time Intervals (DHF, hr)	.00
Routing Period (TEH, hr)	15.00

Time Elapsed TI(K) (hr)	Upstream Inflow QI(K) (cfs)
.00	252.0
1.00	252.0
15.00	252.0

SUMMARY OF PROGRAM CONTROL PARAMETERS :

Number of Cross-Sections Entered (NS)	6	
Number of Top Widths Entered (NCS)	4	
Number of Cross-Sectional Hydrographs to Plot (NTT)	6	
Cross-Sectional Smoothing Parameter (KSA)	0	
Downstream Supercritical Parameter (KSUPC)	1	(supercritical)
Number of Lateral Inflow Hydrographs (LQ)	1	
Number of Points in Gate Control Curve (KCG)	0	

CROSS-SECTIONS WHERE HYDROGRAPH REQUESTED :
(maximum allowed = 6)

1 2 3 4 5 6

CHANNEL-VALLEY BOUNDARY CONDITIONS :

Max Discharge at Downstream End (QMAXD, cfs)	.0
Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)	.0
Initial Time-Step Size (DTHM, hr)	.05
Time at which Dam Starts to Fail (TFI, hr)	.00
Theta Weighting Factor (F11)	.500
Stage Convergence Criterion (EPSY, ft)	.00
Initial Downstream Water Surface Elevation (YDN, ft MSL)	.00
Slope of Channel Downstream of Dam (SOM, ft/mi)	163.000

LATERAL INFLOW REACH NUMBERS (LQX) :

2

(QL(L, 1),L=1,ITEH)

282. 282. 282.

CROSS-SECTION NUMBER : 1

Cross-Section Location (XS(I), mi)	.000
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 1

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.700

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1156.20	.0	.0250	.0	.0	.0000	.0	.0000
1156.80	18.0	.0300	.0	.0	.0000	.0	.0000
1167.70	54.0	.0350	.0	.0	.0000	.0	.0000
1168.20	76.0	.0400	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 2

Cross-Section Location (XS(I), mi)	.606
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 2

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.030

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1057.40	9.6	.0500	.0	.0	.0000	.0	.0000
1061.60	80.0	.0500	.0	.0	.0000	.0	.0000
1065.60	432.0	.0600	.0	.0	.0000	.0	.0000
1071.40	584.0	.0700	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 3

Cross-Section Location (XS(I), mi)	.659
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 3

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1047.90	.0	.0300	.0	.0	.0000	.0	.0000
1053.40	64.0	.0300	.0	.0	.0000	.0	.0000
1060.00	408.0	.0300	.0	.0	.0000	.0	.0000
1065.80	480.0	.0400	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 4

Cross-Section Location (XS(I), mi)	.790
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 4

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.400

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1037.00	.0	.0300	.0	.0	.0000	.0	.0000
1042.40	34.2	.0300	.0	.0	.0000	.0	.0000
1048.00	65.0	.0300	.0	.0	.0000	.0	.0000
1051.00	97.0	.0300	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 5

Cross-Section Location (XS(I), mi)	1.017
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 5

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	1.000

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
993.00	10.5	.0300	.0	.0	.0000	.0	.0000
1000.50	70.5	.0300	.0	.0	.0000	.0	.0000
1010.00	71.0	.0300	.0	.0	.0000	.0	.0000
1015.00	71.5	.0300	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 6

Cross-Section Location (XS(I), mi)	1.831
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

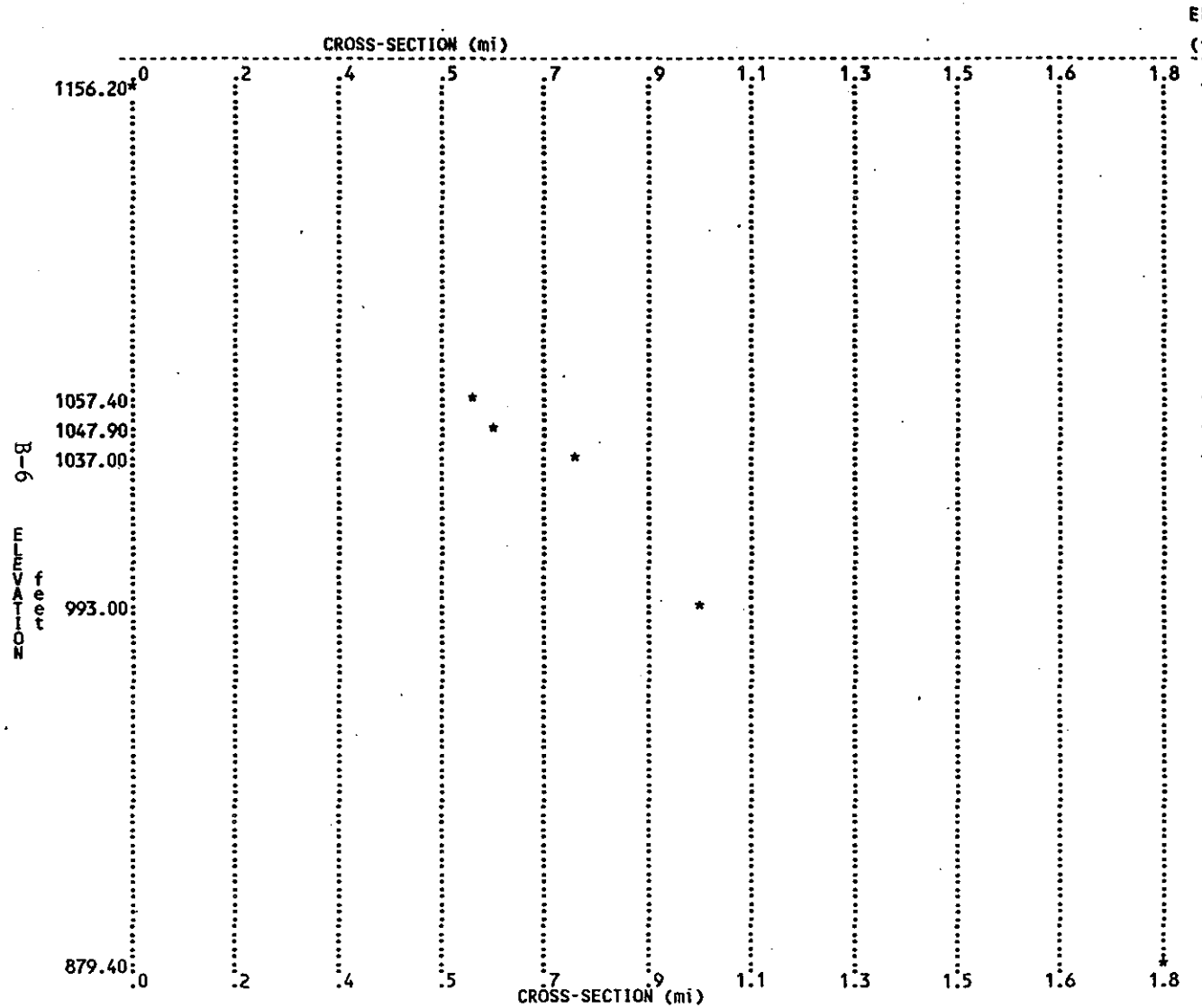
CROSS-SECTION DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Right Top Width BSR(K,I) (ft)
879.40	8.8	.0	.0	.0
883.90	38.1	29.1	.0	.0
888.40	105.6	96.6	.0	.0
890.00	122.6	113.6	.0	.0

Total number of cross-sections (original+interpolated)	6
Maximum number of cross-sections allowed	200

OUTPUT DATA SUMMARY :

SLOPE PROFILE PLOT :



Elevation (ft MSL)	Cross Section (mi)
1156.2	.0
1057.4	.6
1047.9	.7
1037.0	.8
993.0	1.0
879.4	1.8

RESERVOIR DEPLETION SUMMARY :

Total Volume in Reservoir (acre-ft) 251.0

DEFINITION OF RESERVOIR DEPLETION TABLE VARIABLES :

PARAMETER	UNITS	VARIABLE
Time step from start of analysis		I
Iterations necessary to solve flow equations		K
Elapsed time from start of analysis	hr	TTP(I)
Total outflow from dam	cfs	Q(I)
Elevation of water surface at dam	ft	H2
Elevation of breach bottom	ft	YB
Estimated depth of downstream flow	ft	D
Submergence coefficient		SUB
Velocity correction		VCOR
Total volume discharged from time of breach	ac-ft	OUTVOL
Breach width	ft	BB
Rectangular breach discharge coefficient		COFR
Inflow to reservoir	*cfs*	*QI(I)*
Breach outflow	cfs	QBRECH
Spillway outflow	cfs	QSPIL

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
1	0	.000	72	1167.10	1168.40	1157.26	1.00	1.00	.0	.0	3.10	252.	0.	73.
2	2	.100	75	1167.14	1168.40	1157.27	1.00	1.00	.0	.0	3.10	252.	0.	76.
3	1	.200	78	1167.18	1168.40	1157.29	1.00	1.00	.0	.0	3.10	252.	0.	79.
4	1	.300	81	1167.22	1168.40	1157.31	1.00	1.00	.0	.0	3.10	252.	0.	82.
5	1	.400	84	1167.26	1168.40	1157.33	1.00	1.00	.0	.0	3.10	252.	0.	85.
6	1	.500	87	1167.30	1168.40	1157.34	1.00	1.00	.0	.0	3.10	252.	0.	88.
7	1	.600	90	1167.34	1168.40	1157.36	1.00	1.00	.0	.0	3.10	252.	0.	91.
8	2	1.100	104	1167.51	1168.40	1157.44	1.00	1.00	.0	.0	3.10	252.	0.	105.
9	2	1.600	118	1167.67	1168.40	1157.51	1.00	1.00	.0	.0	3.10	252.	0.	118.
10	2	2.100	130	1167.81	1168.40	1157.57	1.00	1.00	.0	.0	3.10	252.	0.	130.
11	2	2.600	141	1167.94	1168.40	1157.62	1.00	1.00	.0	.0	3.10	252.	0.	142.
12	2	3.100	152	1168.06	1168.40	1157.67	1.00	1.00	.0	.0	3.10	252.	0.	153.
13	2	3.600	161	1168.16	1168.40	1157.71	1.00	1.00	.0	.0	3.10	252.	0.	162.
14	2	4.100	170	1168.25	1168.40	1157.75	1.00	1.00	.0	.0	3.10	252.	0.	170.
15	1	4.600	178	1168.33	1168.40	1157.79	1.00	1.00	.0	.0	3.10	252.	0.	178.
16	1	5.100	185	1168.41	1168.40	1157.82	1.00	1.00	.0	.0	3.10	252.	0.	186.
17	1	5.600	196	1168.47	1168.40	1157.87	1.00	1.00	.0	.0	3.10	252.	0.	197.
18	2	6.100	207	1168.52	1168.40	1157.90	1.00	1.00	.0	.0	3.10	252.	0.	208.
19	2	6.600	217	1168.56	1168.40	1157.94	1.00	1.00	.0	.0	3.10	252.	0.	218.
20	1	7.100	226	1168.59	1168.40	1157.98	1.00	1.00	.0	.0	3.10	252.	0.	226.
21	1	7.600	232	1168.62	1168.40	1158.00	1.00	1.00	.0	.0	3.10	252.	0.	233.
22	1	8.100	237	1168.63	1168.40	1158.02	1.00	1.00	.0	.0	3.10	252.	0.	238.
23	1	8.600	241	1168.65	1168.40	1158.03	1.00	1.00	.0	.0	3.10	252.	0.	242.
24	1	9.100	244	1168.66	1168.40	1158.04	1.00	1.00	.0	.0	3.10	252.	0.	244.
25	1	9.600	246	1168.66	1168.40	1158.05	1.00	1.00	.0	.0	3.10	252.	0.	246.
26	1	9.620	246	1168.66	1168.16	1158.06	1.00	1.01	.4	.6	3.10	252.	1.	246.
27	1	9.640	248	1168.66	1167.91	1158.06	1.00	1.01	.8	1.2	3.10	252.	4.	245.
28	1	9.660	253	1168.66	1167.67	1158.07	1.00	1.01	1.2	1.8	3.10	252.	8.	245.
29	1	9.680	259	1168.66	1167.42	1158.09	1.00	1.01	1.7	2.4	3.10	252.	13.	245.
30	1	9.700	267	1168.66	1167.18	1158.12	1.00	1.01	2.1	3.0	3.10	252.	22.	244.
31	1	9.720	278	1168.66	1166.94	1158.16	1.00	1.00	2.5	3.7	3.10	252.	36.	243.
32	1	9.740	292	1168.66	1166.69	1158.21	1.00	1.00	3.0	4.3	3.10	252.	50.	242.
33	1	9.760	305	1168.66	1166.45	1158.27	1.00	1.00	3.5	4.8	3.10	252.	68.	241.
34	1	9.780	329	1168.66	1166.20	1158.33	1.00	1.00	4.0	5.2	3.10	252.	89.	240.
35	1	9.800	352	1168.65	1165.96	1158.40	1.00	1.00	4.6	6.1	3.10	252.	113.	239.
36	1	9.820	378	1168.65	1165.72	1158.49	1.00	1.01	5.2	6.7	3.10	252.	141.	237.
37	1	9.840	407	1168.64	1165.47	1158.57	1.00	1.01	5.9	7.3	3.10	252.	173.	235.
38	1	9.860	441	1168.63	1165.23	1158.67	1.00	1.01	6.6	7.9	3.10	252.	208.	233.
39	1	9.880	477	1168.63	1164.98	1158.77	1.00	1.01	7.3	8.5	3.10	252.	248.	230.
40	1	9.900	518	1168.62	1164.74	1158.88	1.00	1.01	8.1	9.1	3.10	252.	291.	228.
41	1	9.920	562	1168.60	1164.50	1158.99	1.00	1.01	9.0	9.8	3.10	252.	338.	224.
42	1	9.940	610	1168.59	1164.25	1159.11	1.00	1.01	10.0	10.4	3.10	252.	390.	221.
43	1	9.960	662	1168.57	1164.01	1159.23	1.00	1.01	11.1	11.0	3.10	252.	445.	217.
44	1	9.980	717	1168.56	1163.76	1159.36	1.00	1.01	12.2	11.6	3.10	252.	505.	213.
45	1	10.000	777	1168.54	1163.52	1159.48	1.00	1.01	13.4	12.3	3.10	252.	569.	208.
46	1	10.020	841	1168.51	1163.28	1159.62	1.00	1.01	14.8	12.8	3.10	252.	638.	203.
47	1	10.040	909	1168.49	1163.03	1159.76	1.00	1.02	16.2	13.4	3.10	252.	711.	198.
48	1	10.060	981	1168.46	1162.79	1159.90	1.00	1.02	17.8	14.0	3.10	252.	788.	193.
49	1	10.080	1057	1168.43	1162.54	1160.04	1.00	1.02	19.5	14.6	3.10	252.	869.	188.
50	1	10.100	1139	1168.39	1162.30	1160.19	1.00	1.02	21.3	15.3	3.10	252.	955.	184.

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
51	1	10.120	1225	1168.35	1162.06	1160.34	1.00	1.03	23.2	15.9	3.10	252.	1045.	180.
52	1	10.140	1315	1168.31	1161.81	1160.49	1.00	1.03	25.3	16.5	3.10	252.	1140.	176.
53	1	10.160	1410	1168.26	1161.57	1160.64	1.00	1.04	27.6	17.1	3.10	252.	1239.	171.
54	1	10.180	1508	1168.21	1161.32	1160.80	1.00	1.04	30.0	17.7	3.10	252.	1342.	167.
55	1	10.200	1611	1168.15	1161.08	1160.95	1.00	1.05	32.6	18.3	3.10	252.	1450.	161.
56	1	10.220	1718	1168.09	1160.84	1161.11	1.00	1.05	35.3	18.9	3.10	252.	1562.	156.
57	1	10.240	1828	1168.03	1160.59	1161.27	1.00	1.06	38.3	19.5	3.10	252.	1679.	149.
58	1	10.260	1944	1167.96	1160.35	1161.42	1.00	1.07	41.4	20.1	3.10	252.	1801.	143.
59	1	10.280	2063	1167.88	1160.10	1161.58	1.00	1.08	44.7	20.7	3.10	252.	1928.	136.
60	1	10.300	2187	1167.80	1159.86	1161.74	1.00	1.09	48.2	21.3	3.10	252.	2059.	128.
61	1	10.320	2316	1167.71	1159.62	1161.90	1.00	1.10	51.9	22.0	3.10	252.	2196.	121.
62	1	10.340	2450	1167.61	1159.37	1162.06	1.00	1.11	55.9	22.6	3.10	252.	2337.	113.
63	1	10.360	2589	1167.51	1159.13	1162.23	1.00	1.12	60.0	23.2	3.10	252.	2485.	104.
64	1	10.380	2734	1167.40	1158.88	1162.39	1.00	1.14	64.4	23.8	3.10	252.	2639.	96.
65	1	10.400	2882	1167.28	1158.64	1162.56	1.00	1.16	69.1	24.4	3.10	252.	2800.	86.
66	1	10.420	3046	1167.16	1158.40	1162.74	1.00	1.18	74.0	25.0	3.10	252.	2970.	77.
67	1	10.440	3216	1167.02	1158.15	1162.91	1.00	1.20	79.2	25.6	3.10	252.	3149.	67.
68	2	10.460	3398	1166.87	1157.91	1163.09	1.00	1.24	84.6	26.2	3.10	252.	3341.	57.
69	2	10.480	3594	1166.72	1157.66	1163.28	1.00	1.27	90.4	26.8	3.10	252.	3548.	47.
70	2	10.500	3810	1166.55	1157.42	1163.49	1.00	1.32	96.5	27.4	3.10	252.	3774.	37.
71	2	10.520	4053	1166.36	1157.18	1163.71	1.00	1.38	103.0	28.1	3.10	252.	4027.	27.
72	2	10.540	4334	1166.16	1156.93	1163.96	1.00	1.46	110.0	28.7	3.10	252.	4318.	17.
73	2	10.560	4673	1165.94	1156.69	1164.25	1.00	1.57	117.4	29.3	3.10	252.	4665.	8.
74	2	10.580	5102	1165.69	1156.44	1164.60	1.00	1.74	125.5	29.9	3.10	252.	5101.	1.
75	2	10.600	5692	1165.41	1156.20	1165.06	1.00	2.00	137.4	30.5	3.10	252.	5692.	0.
76	2	10.620	6165	1165.09	1156.20	1165.40	1.00	2.00	147.2	30.5	3.10	252.	6165.	0.
77	2	10.640	5778	1164.72	1156.20	1165.49	1.00	2.00	157.1	30.5	3.10	252.	5778.	0.
78	1	10.660	5413	1164.43	1156.20	1165.12	1.00	2.00	154.1	30.5	3.10	252.	5413.	0.
79	1	10.680	5068	1164.11	1156.20	1164.84	1.00	2.00	163.3	30.5	3.10	252.	5069.	0.
80	1	10.700	4744	1163.80	1156.20	1164.57	1.00	2.00	172.0	30.5	3.10	252.	4744.	0.
81	1	10.720	4438	1163.50	1156.20	1164.31	1.00	2.00	180.1	30.5	3.10	252.	4439.	0.
82	1	10.740	4150	1163.21	1156.20	1164.05	1.00	2.00	187.7	30.5	3.10	252.	4151.	0.
83	1	10.760	3880	1162.93	1156.20	1163.80	1.00	2.00	194.8	30.5	3.10	252.	3880.	0.
84	1	10.780	3625	1162.66	1156.20	1163.55	1.00	2.00	201.4	30.5	3.10	252.	3625.	0.
85	1	10.800	3385	1162.40	1156.20	1163.31	1.00	2.00	207.6	30.5	3.10	252.	3386.	0.
86	1	10.820	3160	1162.14	1156.20	1163.07	1.00	2.00	213.4	30.5	3.10	252.	3161.	0.
87	1	10.840	2949	1161.90	1156.20	1162.85	1.00	2.00	218.8	30.5	3.10	252.	2949.	0.
88	1	10.860	2750	1161.66	1156.20	1162.62	1.00	2.00	223.9	30.5	3.10	252.	2751.	0.
89	1	10.880	2564	1161.43	1156.20	1162.40	1.00	2.00	228.6	30.5	3.10	252.	2564.	0.
90	1	10.900	2389	1161.20	1156.20	1162.19	1.00	2.00	233.0	30.5	3.10	252.	2390.	0.
91	1	10.920	2225	1160.99	1156.20	1161.98	1.00	2.00	237.1	30.5	3.10	252.	2226.	0.
92	1	10.940	2072	1160.78	1156.20	1161.78	1.00	2.00	240.9	30.5	3.10	252.	2073.	0.
93	1	10.960	1929	1160.58	1156.20	1161.59	1.00	2.00	244.4	30.5	3.10	252.	1929.	0.
94	1	10.980	1795	1160.39	1156.20	1161.39	1.00	2.00	247.7	30.5	3.10	252.	1795.	0.
95	1	11.000	1669	1160.20	1156.20	1161.21	1.00	2.00	250.8	30.5	3.10	252.	1670.	0.
96	1	11.020	1552	1160.02	1156.20	1161.03	1.00	2.00	253.7	30.5	3.10	252.	1553.	0.
97	1	11.040	1444	1159.85	1156.20	1160.86	1.00	2.00	256.3	30.5	3.10	252.	1444.	0.
98	1	11.060	1342	1159.69	1156.20	1160.69	1.00	2.00	258.8	30.5	3.10	252.	1343.	0.
99	1	11.080	1248	1159.53	1156.20	1160.53	1.00	2.00	261.1	30.5	3.10	252.	1248.	0.
100	1	11.100	1160	1159.38	1156.20	1160.37	1.00	2.00	263.3	30.5	3.10	252.	1161.	0.
						1160.22			265.3					

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
101	1	11.120	1079	1159.24	1156.20	1160.07	1.00	2.00	267.1	30.5	3.10	252.	1080.	0.
102	1	11.140	1004	1159.10	1156.20	1159.83	1.00	2.00	268.8	30.5	3.10	252.	1004.	0.
103	1	11.160	934	1158.97	1156.20	1159.80	1.00	2.00	270.4	30.5	3.10	252.	935.	0.
104	1	11.180	870	1158.85	1156.20	1159.67	1.00	2.00	271.9	30.5	3.10	252.	871.	0.
105	1	11.200	811	1158.73	1156.20	1159.55	1.00	2.00	273.3	30.5	3.10	252.	811.	0.
106	1	11.220	756	1158.62	1156.20	1159.43	1.00	2.00	274.6	30.5	3.10	252.	757.	0.
107	1	11.240	706	1158.52	1156.20	1159.32	1.00	2.00	275.8	30.5	3.10	252.	707.	0.
108	1	11.260	661	1158.42	1156.20	1159.22	1.00	2.00	277.0	30.5	3.10	252.	661.	0.
109	1	11.280	619	1158.33	1156.20	1159.12	1.00	2.00	278.0	30.5	3.10	252.	619.	0.
110	1	11.300	581	1158.24	1156.20	1159.03	1.00	2.00	279.0	30.5	3.10	252.	581.	0.
111	1	11.320	546	1158.16	1156.20	1158.94	1.00	2.00	279.9	30.5	3.10	252.	546.	0.
112	1	11.340	514	1158.09	1156.20	1158.86	1.00	2.00	280.8	30.5	3.10	252.	515.	0.
113	1	11.360	485	1158.02	1156.20	1158.78	1.00	2.00	281.6	30.5	3.10	252.	486.	0.
114	1	11.380	460	1157.96	1156.20	1158.71	1.00	2.00	282.4	30.5	3.10	252.	460.	0.
115	1	11.400	436	1157.90	1156.20	1158.65	1.00	2.00	283.2	30.5	3.10	252.	437.	0.
116	1	11.420	415	1157.84	1156.20	1158.59	1.00	2.00	283.9	30.5	3.10	252.	416.	0.
117	1	11.440	396	1157.80	1156.20	1158.53	1.00	2.00	284.5	30.5	3.10	252.	397.	0.
118	1	11.460	379	1157.75	1156.20	1158.48	1.00	2.00	285.2	30.5	3.10	252.	380.	0.
119	1	11.480	364	1157.71	1156.20	1158.44	1.00	2.00	285.8	30.5	3.10	252.	365.	0.
120	1	11.500	351	1157.67	1156.20	1158.40	1.00	2.00	286.4	30.5	3.10	252.	351.	0.
121	1	11.520	339	1157.64	1156.20	1158.36	1.00	2.00	287.0	30.5	3.10	252.	339.	0.
122	1	11.540	328	1157.61	1156.20	1158.33	1.00	2.00	287.5	30.5	3.10	252.	329.	0.
123	1	11.560	319	1157.59	1156.20	1158.30	1.00	2.00	288.0	30.5	3.10	252.	319.	0.
124	1	11.580	311	1157.56	1156.20	1158.27	1.00	2.00	288.6	30.5	3.10	252.	311.	0.
125	1	11.600	303	1157.54	1156.20	1158.24	1.00	2.00	289.1	30.5	3.10	252.	304.	0.
126	1	11.620	297	1157.52	1156.20	1158.22	1.00	2.00	289.6	30.5	3.10	252.	297.	0.
127	1	11.642	291	1157.50	1156.20	1158.20	1.00	2.00	290.1	30.5	3.10	252.	291.	0.
128	1	11.666	285	1157.49	1156.20	1158.18	1.00	2.00	290.7	30.5	3.10	252.	285.	0.
129	1	11.693	279	1157.47	1156.20	1158.16	1.00	2.00	291.3	30.5	3.10	252.	280.	0.
130	1	11.723	274	1157.46	1156.20	1158.15	1.00	2.00	292.0	30.5	3.10	252.	275.	0.
131	1	11.754	270	1157.44	1156.20	1158.13	1.00	2.00	292.7	30.5	3.10	252.	270.	0.
132	1	11.790	266	1157.43	1156.20	1158.12	1.00	2.00	293.5	30.5	3.10	252.	266.	0.
133	1	11.829	262	1157.42	1156.20	1158.10	1.00	2.00	294.3	30.5	3.10	252.	263.	0.
134	1	11.872	260	1157.41	1156.20	1158.09	1.00	2.00	295.3	30.5	3.10	252.	260.	0.
135	1	11.919	257	1157.40	1156.20	1158.09	1.00	2.00	296.3	30.5	3.10	252.	258.	0.
136	1	11.971	255	1157.40	1156.20	1158.08	1.00	2.00	297.7	30.5	3.10	252.	255.	0.
137	1	12.028	254	1157.39	1156.20	1158.08	1.00	2.00	298.4	30.5	3.10	252.	255.	0.
138	1	12.091	253	1157.39	1156.20	1158.07	1.00	2.00	299.6	30.5	3.10	252.	254.	0.
139	1	12.160	253	1157.39	1156.20	1158.07	1.00	2.00	301.3	30.5	3.10	252.	253.	0.
140	1	12.235	252	1157.39	1156.20	1158.07	1.00	2.00	302.9	30.5	3.10	252.	253.	0.
141	1	12.318	252	1157.39	1156.20	1158.07	1.00	2.00	304.7	30.5	3.10	252.	252.	0.
142	1	12.411	252	1157.39	1156.20	1158.07	1.00	2.00	306.6	30.5	3.10	252.	252.	0.
143	1	12.512	252	1157.39	1156.20	1158.07	1.00	2.00	308.7	30.5	3.10	252.	252.	0.
144	1	12.623	252	1157.39	1156.20	1158.07	1.00	2.00	311.0	30.5	3.10	252.	252.	0.
145	1	12.746	252	1157.39	1156.20	1158.07	1.00	2.00	313.6	30.5	3.10	252.	252.	0.
146	1	12.880	252	1157.39	1156.20	1158.07	1.00	2.00	316.4	30.5	3.10	252.	252.	0.
147	1	13.028	252	1157.39	1156.20	1158.07	1.00	2.00	319.4	30.5	3.10	252.	252.	0.
148	1	13.191	252	1157.39	1156.20	1158.07	1.00	2.00	322.8	30.5	3.10	252.	252.	0.
149	1	13.370	252	1157.39	1156.20	1158.07	1.00	2.00	326.6	30.5	3.10	252.	252.	0.
150	1	13.567	252	1157.39	1156.20	1158.07	1.00	2.00	330.7	30.5	3.10	252.	252.	0.

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
151	1	13.784	251	1157.39	1156.20	1158.07	1.00	2.00	335.2	30.5	3.10	252.	252.	0.
152	1	14.022	251	1157.39	1156.20	1158.07	1.00	2.00	340.1	30.5	3.10	252.	252.	0.
153	1	14.287	251	1157.39	1156.20	1158.07	1.00	2.00	345.6	30.5	3.10	252.	252.	0.
154	1	14.584	251	1157.39	1156.20	1158.07	1.00	2.00	351.6	30.5	3.10	252.	252.	0.
155	1	14.573	251	1157.39	1156.20	1158.07	1.00	2.00	358.2	30.5	3.10	252.	252.	0.
156	1	14.890	251	1157.39	1156.20	1158.07	1.00	2.00	365.5	30.5	3.10	252.	252.	0.
		15.239												

RESERVOIR FLOW SUMMARY :

Initial Flow (Q(1), cfs)	73.
Maximum Flow (Qmax, cfs)	6163.
Final Flow (Q(NU), cfs)	252.
Time to Maximum Flow (TP, hr)	10.62
Number of Time Steps or Number of Hydrograph Ordinates (NNU)	156
Total Volume Discharged from Reservoir (DISVOL, acre-ft)	365.
Number of Intermediate Cross-Sections (NN(NS))	6
Number of Time Steps (NNU)	156

Interp. Cross Section I	Water Elevation YD(I) (ft MSL)	Initial Flow QDI(I) (cfs)
1	1157.26	72.9
2	1058.81	72.9
3	1049.33	354.9
4	1021.28	354.9
5	993.55	354.9
6	882.46	354.9

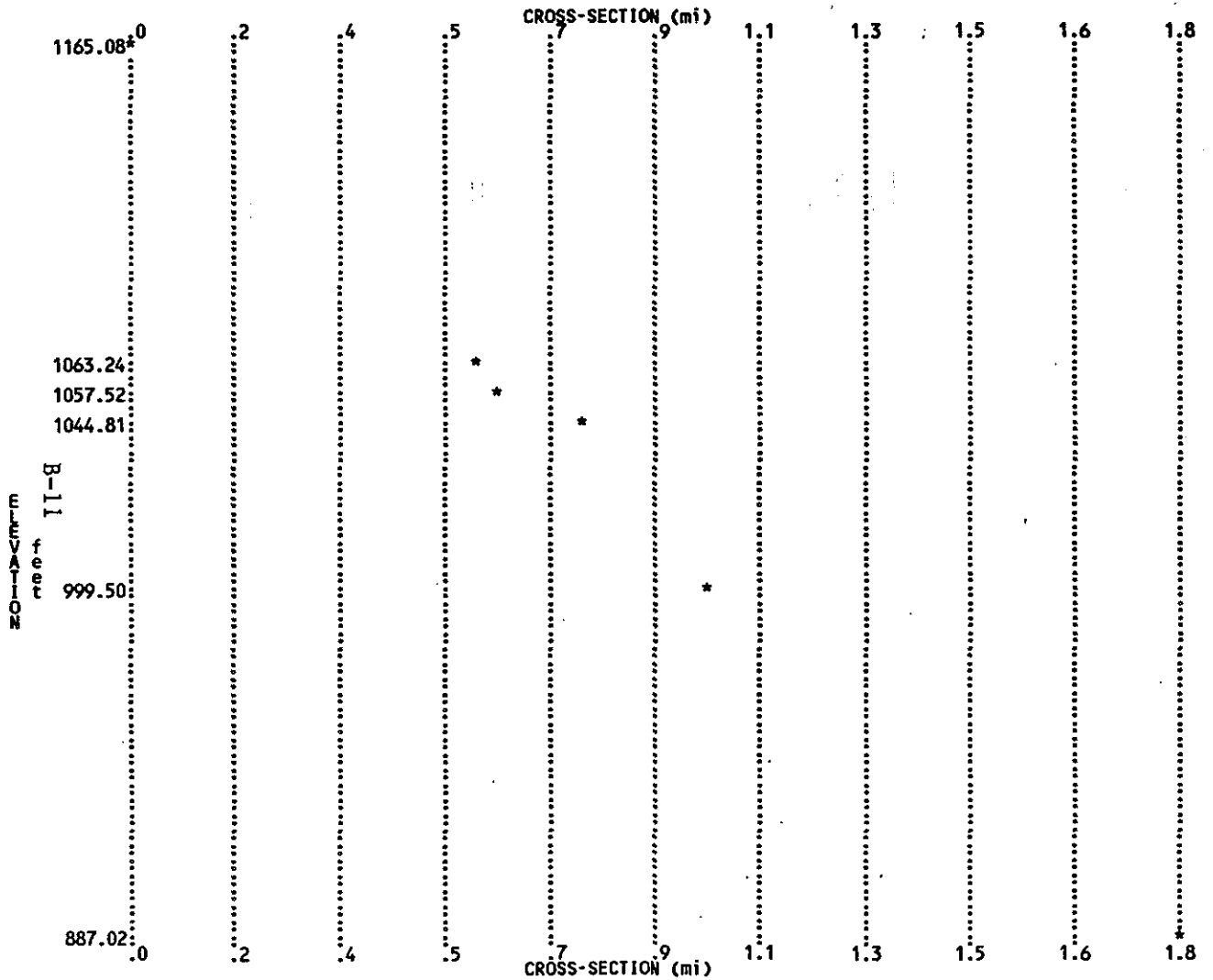
ROUTING COMPLETED :

Number of Time Steps Used (KTIME)	300
Maximum Number of Time Steps Allowed	698
Total Time of Flood Routing (TT, hr)	15.0

FLOOD CREST SUMMARY :

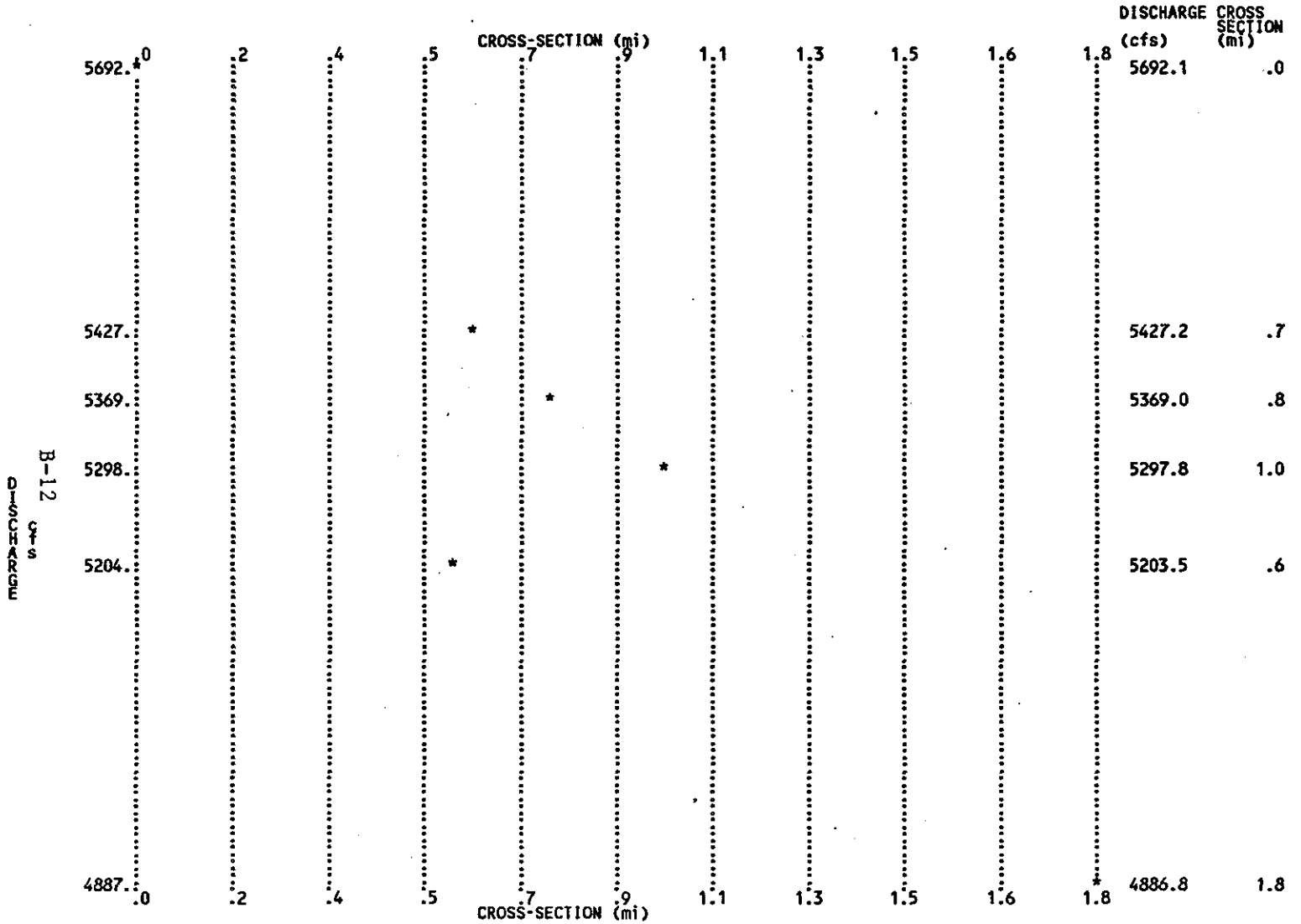
Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)
.000	1165.08	5692	10.600	21.28	.00	.00
.606	1063.24	5203	10.650	16.81	.00	.00
.658	1057.52	5427	10.700	29.79	.00	.00
.790	1044.81	5368	10.750	56.28	.00	.00
1.017	999.50	5297	10.700	51.03	.00	.00
1.831	887.02	4886	10.800	16.45	.00	.00

FLOOD CREST SUMMARY (Peak Water Surface Elevation) :

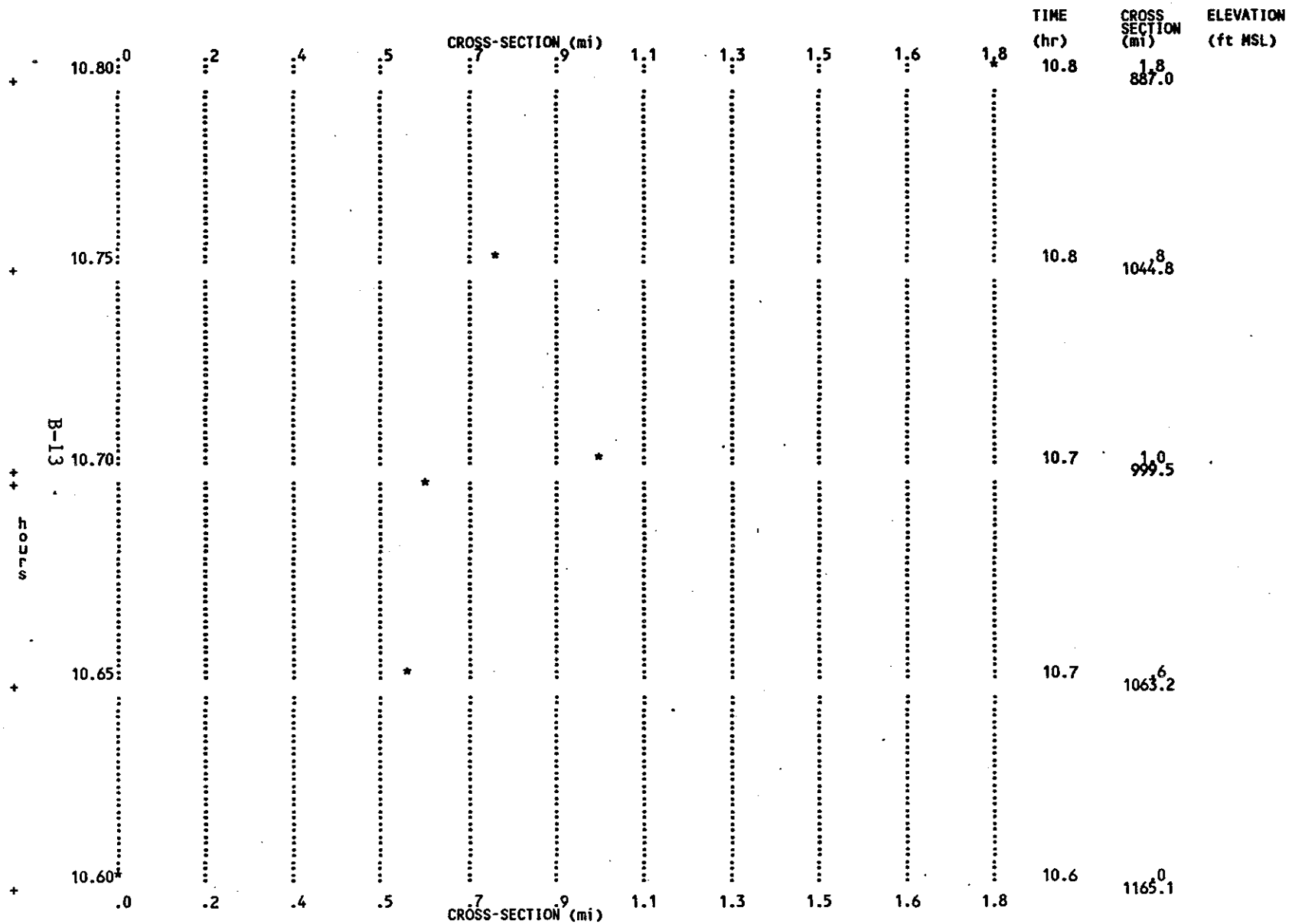


ELEVATION (ft)	CROSS SECTION (mi)
1165.1	.0
1063.2	.6
1057.5	.7
1044.8	.8
999.5	1.0
887.0	1.8

FLOOD DISCHARGE SUMMARY (Peak Water Flow) :



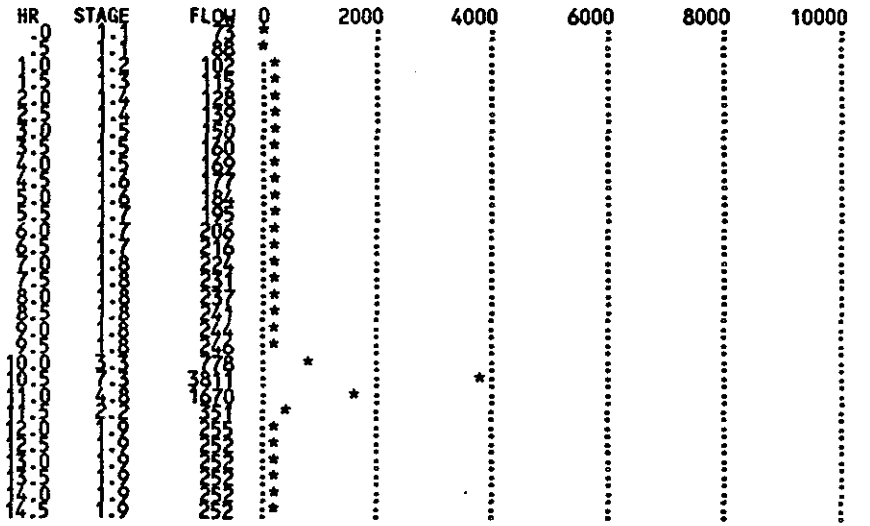
TIME TO PEAK ELEVATION PROFILE :



DISCHARGE HYDROGRAPH :

Cross-Section Number	1
Cross-Section Location (mi)	.000
Gage Zero (ft MSL)	1156.200
Max Elevation Reached by Flood Wave (ft MSL)	1165.077
Flood Stage (ft)	(not available)
Maximum Stage (ft)	8.877
at Time (hr)	10.600
Maximum Flow (cfs)	5692
at Time (hr)	10.600

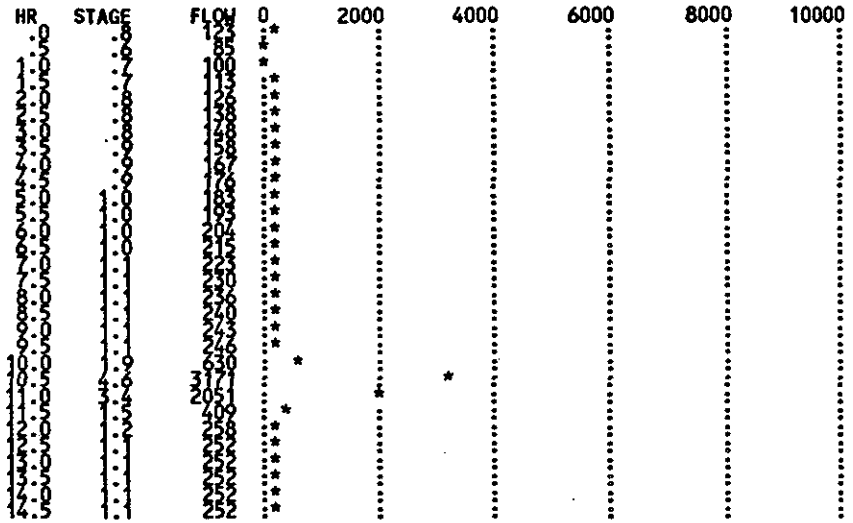
HR	STAGE	FLOW
.0	1.1	73
.5	1.1	88
1.0	1.2	102
1.5	1.3	115
2.0	1.4	128
2.5	1.4	139
3.0	1.5	150
3.5	1.5	160
4.0	1.5	169
4.5	1.6	177
5.0	1.6	187
5.5	1.7	195
6.0	1.7	206
6.5	1.7	216
7.0	1.8	224
7.5	1.8	231
8.0	1.8	237
8.5	1.8	241
9.0	1.8	244
9.5	1.8	246
10.0	3.3	778
10.5	7.3	3811
11.0	4.8	1670
11.5	2.2	321
12.0	1.9	255
12.5	1.9	252
13.0	1.9	255
13.5	1.9	255
14.0	1.9	252
14.5	1.9	252



DISCHARGE HYDROGRAPH :

Cross-Section Number	2
Cross-Section Location (mi)	.606
Gage Zero (ft MSL)	1057.400
Max Elevation Reached by Flood Wave (ft MSL)	1063.237
Flood Stage (ft)	(not available)
Maximum Stage (ft)	5.837
at Time (hr)	10.650
Maximum Flow (cfs)	5204
at Time (hr)	10.650

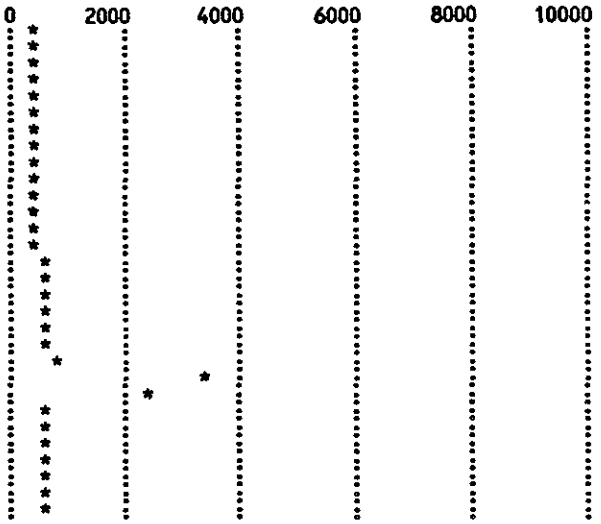
HR	STAGE	FLOW
.0	.5	123
.5	.6	85
1.0	.7	100
1.5	.7	113
2.0	.8	126
2.5	.8	138
3.0	.8	148
3.5	.9	158
4.0	.9	167
4.5	.9	176
5.0	1.0	183
5.5	1.0	193
6.0	1.0	204
6.5	1.0	215
7.0	1.1	223
7.5	1.1	230
8.0	1.1	236
8.5	1.1	240
9.0	1.1	243
9.5	1.1	246
10.0	1.9	630
10.5	4.6	3171
11.0	3.4	2051
11.5	1.5	409
12.0	1.2	258
12.5	1.1	252
13.0	1.1	252
13.5	1.1	255
14.0	1.1	252
14.5	1.1	252



DISCHARGE HYDROGRAPH :

Cross-Section Number	3
Cross-Section Location (mi)	.659
Gage Zero (ft MSL)	1047.900
Max Elevation Reached by Flood Wave (ft MSL)	1057.523
Flood Stage (ft)	(not available)
Maximum Stage (ft)	9.623
at Time (hr)	10.700
Maximum Flow (cfs)	5427
at Time (hr)	10.700

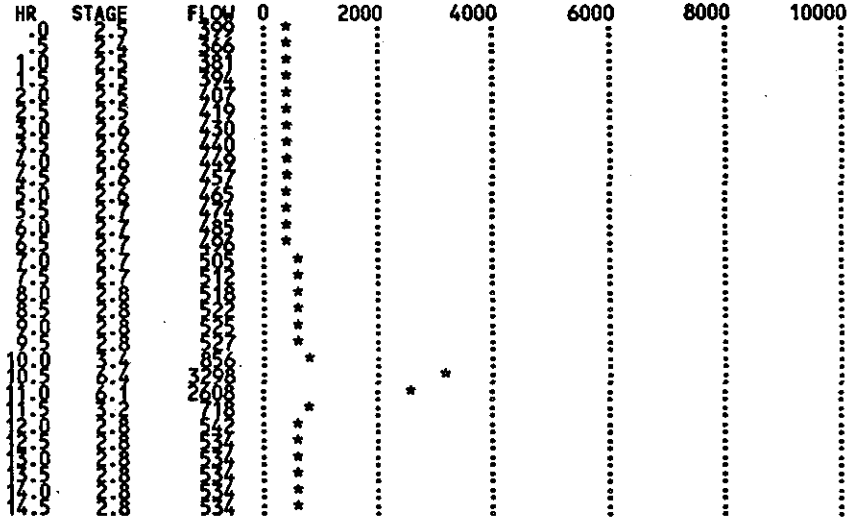
HR	STAGE	FLOW
.0	3.6	409
.5	3.6	367
1.0	3.7	381
1.5	3.7	365
2.0	3.8	408
2.5	3.8	419
3.0	3.9	430
3.5	3.9	440
4.0	3.9	449
4.5	4.0	458
5.0	4.0	465
5.5	4.0	472
6.0	4.1	486
6.5	4.1	496
7.0	4.1	505
7.5	4.2	512
8.0	4.2	518
8.5	4.2	522
9.0	4.2	525
9.5	4.2	527
10.0	5.1	864
10.5	8.3	3380
11.0	7.2	2414
11.5	4.7	699
12.0	4.2	541
12.5	4.2	534
13.0	4.2	534
13.5	4.2	534
14.0	4.2	534
14.5	4.2	534



DISCHARGE HYDROGRAPH :

Cross-Section Number	4
Cross-Section Location (mi)	.790
Gage Zero (ft MSL)	1037.000
Max Elevation Reached by Flood Wave (ft MSL)	1044.815
Flood Stage (ft)	(not available)
Maximum Stage (ft)	7.815
at Time (hr)	10.750
Maximum Flow (cfs)	5369
at Time (hr)	10.700

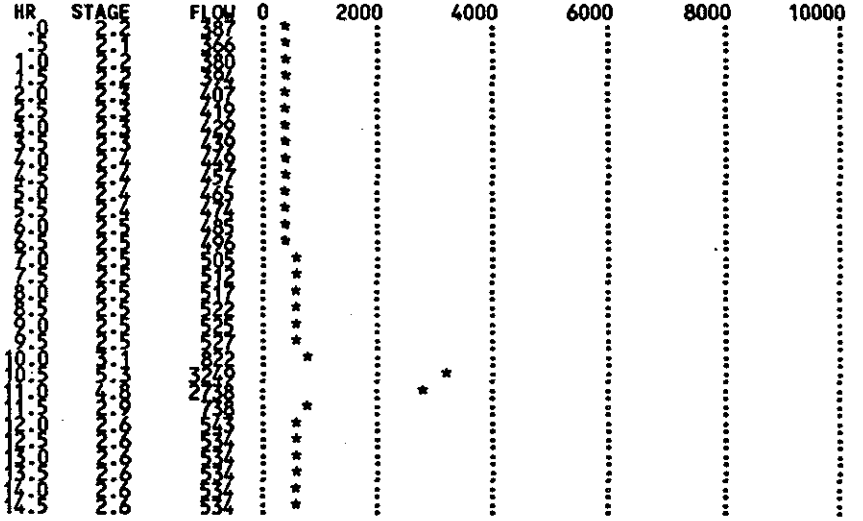
HR	STAGE	FLOW
.0	2.5	399
.5	2.7	366
1.0	2.5	381
1.5	2.5	394
2.0	2.5	407
2.5	2.5	419
3.0	2.6	430
3.5	2.6	440
4.0	2.6	449
4.5	2.6	457
5.0	2.6	465
5.5	2.7	474
6.0	2.7	485
6.5	2.7	496
7.0	2.7	505
7.5	2.7	512
8.0	2.8	518
8.5	2.8	522
9.0	2.8	555
9.5	2.8	257
10.0	3.4	856
10.5	6.4	3298
11.0	6.1	2608
11.5	3.2	718
12.0	2.8	542
12.5	2.8	537
13.0	2.8	537
13.5	2.8	534
14.0	2.8	534
14.5	2.8	534



DISCHARGE HYDROGRAPH :

Cross-Section Number	5
Cross-Section Location (mi)	1.017
Gage Zero (ft MSL)	993.000
Max Elevation Reached by Flood Wave (ft MSL)	999.497
Flood Stage (ft)	(not available)
Maximum Stage (ft)	6.497
at Time (hr)	10.700
Maximum Flow (cfs)	5298
at Time (hr)	10.700

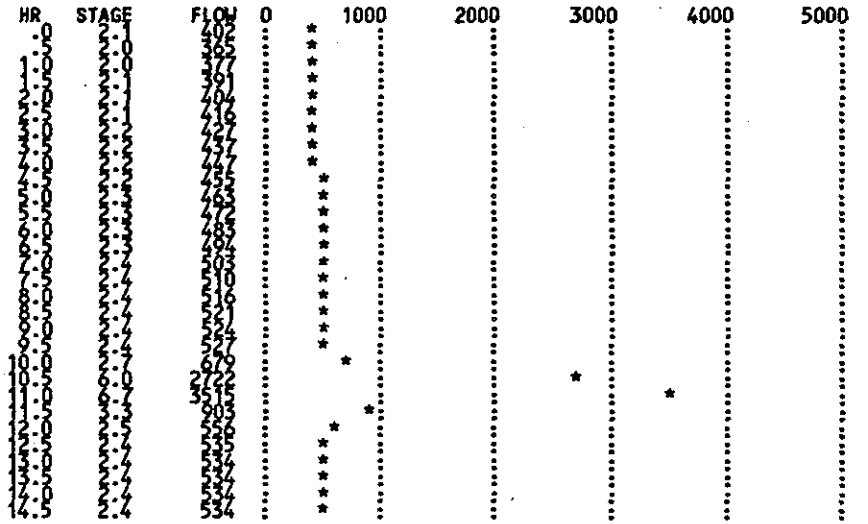
HR	STAGE	FLOW
.0	2.5	387
.5	2.1	366
1.0	2.2	380
1.5	2.5	394
2.0	2.3	407
2.5	2.3	419
3.0	2.3	429
3.5	2.3	436
4.0	2.4	442
4.5	2.4	457
5.0	2.4	465
5.5	2.4	474
6.0	2.5	485
6.5	2.5	496
7.0	2.5	505
7.5	2.5	512
8.0	2.5	517
8.5	2.5	522
9.0	2.5	525
9.5	2.5	527
10.0	3.1	822
10.5	5.3	3276
11.0	2.8	2738
11.5	2.8	738
12.0	2.6	533
12.5	2.6	537
13.0	2.6	534
13.5	2.6	532
14.0	2.6	532
14.5	2.6	534



DISCHARGE HYDROGRAPH :

Cross-Section Number	6
Cross-Section Location (mi)	1.831
Gage Zero (ft MSL)	879.400
Max Elevation Reached by Flood Wave (ft MSL)	887.015
Flood Stage (ft)	(not available)
Maximum Stage (ft)	7.615
at Time (hr)	10.800
Maximum Flow (cfs)	4887
at Time (hr)	10.800

HR	STAGE	FLOW
.0	5.1	402
.5	5.0	365
1.0	5.0	377
1.5	5.1	391
2.0	5.1	404
2.5	5.1	416
3.0	5.2	427
3.5	5.2	437
4.0	5.2	447
4.5	5.2	455
5.0	5.3	463
5.5	5.3	472
6.0	5.3	479
6.5	5.3	485
7.0	5.4	494
7.5	5.4	503
8.0	5.4	510
8.5	5.4	516
9.0	5.4	521
9.5	5.4	527
10.0	5.7	679
10.5	6.0	2722
11.0	6.7	3515
11.5	5.3	903
12.0	5.5	526
12.5	5.4	535
13.0	5.4	534
13.5	5.4	534
14.0	5.4	537
14.5	5.4	534



END OF OUTPUT

```
CRESCENT LAKE DAM VERMONT
SUNNY DAY FAILURE BY PIPING
       1        0        0        5        3        0        0        0
0111110100 0 2
    42.6     39.3     30.3      0.0
  1169.4   1168.4   1165.6   1156.2
     0.0   1165.6      1.0   1156.2     30.5      1.0   1156.2      0.0
  1165.5   1168.4  1165.59      0.0     39.3      0.0    255.0     41.0
     0.0      3.0
    30.0     30.0     30.0
     0.0      1.0      3.0
       6        4        6        9        0        1        1        0
       1        2        3        4        5        6
     0.0      0.0
  1156.2   1156.8   1167.7   1168.2      0.0      0.0      0.0      0.0
     0.0     18.0     54.0     76.0      0.0      0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.606      0.0
  1057.4   1061.6   1065.6   1071.4      0.0      0.0      0.0      0.0
     9.6     80.0    432.0    584.0      0.0      0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.659      0.0
  1047.9   1053.4   1060.0   1065.8      0.0      0.0      0.0      0.0
     0.0     64.0    408.0    480.0      0.0      0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.790      0.0
  1037.0   1042.4   1048.0   1051.0      0.0      0.0      0.0      0.0
     0.0     34.2     65.0     97.0      0.0      0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   1.017      0.0
   993.0   1000.5    1010.    1015.      0.0      0.0      0.0      0.0
    10.5     70.5     71.0     71.5      0.0      0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   1.831      0.0
   879.4    883.9    888.4    890.0      0.0      0.0      0.0      0.0
     8.8     67.0    201.0    236.0      0.0      0.0      0.0      0.0
     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.025    0.030    0.035    0.040      0.0      0.0      0.0      0.0
    0.05     0.05     0.06     0.07      0.0      0.0      0.0      0.0
    0.03     0.03     0.03     0.04      0.0      0.0      0.0      0.0
    0.03     0.03     0.03     0.03      0.0      0.0      0.0      0.0
    0.03     0.03     0.03     0.03      0.0      0.0      0.0      0.0
     0.7     0.03      0.2      0.4      1.0
     0.0      0.0      0.0      0.0      0.0
     0.0     -0.0     0.06      0.0    163.0      0.5     0.01      0.0
       2
    10.0     10.0     10.0
```


SUNNY DAY FAILURE
INPUT FILE
APPENDIX C

B O S S D A M B R K (tm)

Copyright (C) 1988 Boss Corporation
All Rights Reserved

Version : 1.30
Serial Number : 0001058.130

PROGRAM ORIGIN :

Boss DamBrk (tm) is an enhanced version of Professor D. L. Fread's 1984 NWS DAMBRK program.

DISCLAIMER :

Boss DamBrk (tm) is a complex program which requires engineering expertise to use correctly. Boss Corporation assumes absolutely no responsibility for the correct use of this program. All results obtained should be carefully examined by an experienced professional engineer to determine if they are reasonable and accurate.

Although Boss Corporation has endeavored to make Boss DamBrk error free, the program is not and cannot be certified as infallible. Therefore, Boss Corporation makes no warranty, either implicit or explicit, as to the correct performance or accuracy of this software.

In no event shall Boss Corporation be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of purchase or use of this software. The sole and exclusive liability to Boss Corporation, regardless of the form of action, shall not exceed the purchase price of this software.

PROJECT DESCRIPTION :

PROJECT TITLE : Crescent Lake Dam Sunny Day Failure
PROJECT NUMBER : JC-127-2-A Sunny Day
DESCRIPTION : Reduced Inflow, Piping Failure
ENGINEER : Patrick Blumeris
DATE OF RUN : 3/30/1989
TIME OF RUN : 8:55 am

INPUT DATA SUMMARY :

INPUT CONTROL PARAMETERS :

Number of Dynamic Routing Reaches (KKN)	1	
Type of Reservoir Routing (KUI)	0	(storage routing)
Number of multiple dams/bridges (MULDAM)	0	
No. of Reservoir Inflow Hydrograph Points (ITEH)	3	
No. of Informational Cross-Sections (NPRT)	0	
Flood-Plain Routing (KFLP)	0	(no)
Landslide Simulation (KSL)	0	(no)

RESERVOIR VOLUME DESCRIPTION :

Elevation vs. Surface Area Table

Elevation HSA(K) (ft MSL)	Surface Area SA(K) (acres)
1169.40	42.6
1168.20	36.3
1165.60	30.3
1156.20	.0
.00	.0
.00	.0
.00	.0
.00	.0

RESERVOIR and BREACH DESCRIPTION :

Initial Elevation of Reservoir Surface (YO, ft MSL)		1165.60
Bottom of Dam Elevation (DATUM, ft MSL)		1156.20
Top of Dam Elevation (HD, ft MSL)		1168.40
Water Surface Elevation at Time of Breach (HF, ft MSL)		1165.50
Breach Side Slope (Z)	1:	1.00
Breach Bottom Elevation (YBMIN, ft MSL)		1156.20
Breach Base Width (BB, ft)		30.50
Time of Breach Formation (TFH, hr)		1.00
Uncontrolled Spillway Crest Elevation (HSP, ft MSL)		1165.59
Uncontrolled Spillway Discharge Coefficient (CS)		39.30
Spillway Gate Center Elevation (HGT, ft MSL)		.00
Spillway Gate Discharge Coefficient (CG)		.00
Dam Overtopping Discharge Coefficient (CDO)		255.00
Turbine Discharge (QT, cfs)		41.00

INFLOW HYDROGRAPH DESCRIPTION :

Hydrograph Time Intervals (DHF, hr)	.00
Routing Period (TEH, hr)	3.00

Time Elapsed TI(K) (hr)	Upstream Inflow QI(K) (cfs)
.00	30.0
1.00	30.0
3.00	30.0

SUMMARY OF PROGRAM CONTROL PARAMETERS :

Number of Cross-Sections Entered (NS)	6	
Number of Top Widths Entered (NCS)	4	
Number of Cross-Sectional Hydrographs to Plot (NTT)	6	
Cross-Sectional Smoothing Parameter (KSA)	0	
Downstream Supercritical Parameter (KSUPC)	1	(supercritical)
Number of Lateral Inflow Hydrographs (LQ)	1	
Number of Points in Gate Control Curve (KCG)	0	

CROSS-SECTIONS WHERE HYDROGRAPH REQUESTED :
(maximum allowed = 6)

1 2 3 4 5 6

CHANNEL-VALLEY BOUNDARY CONDITIONS :

Max Discharge at Downstream End (QMAXD, cfs)	.0
Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)	.0
Initial Time-Step Size (DTHM, hr)	.06
Time at which Dam Starts to Fail (TFI, hr)	.00
Theta Weighting Factor (F1I)	.500
Stage Convergence Criterion (EPSY, ft)	.01
Initial Downstream Water Surface Elevation (YDN, ft MSL)	.00
Slope of Channel Downstream of Dam (SOM, ft/mi)	163.000

LATERAL INFLOW REACH NUMBERS (LQX) :

2

(QL(L, 1),L=1,ITEH)

10. 10. 10.

CROSS-SECTION NUMBER : 1

Cross-Section Location (XS(I), mi)	.000
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 1

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.700

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1156.20	.0	.0250	.0	.0	.0000	.0	.0000
1156.80	18.0	.0300	.0	.0	.0000	.0	.0000
1167.70	54.0	.0350	.0	.0	.0000	.0	.0000
1168.20	76.0	.0400	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 2

Cross-Section Location (XS(I), mi)	.606
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 2

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.030

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1057.40	9.6	.0500	.0	.0	.0000	.0	.0000
1061.60	80.0	.0500	.0	.0	.0000	.0	.0000
1065.60	432.0	.0600	.0	.0	.0000	.0	.0000
1071.40	584.0	.0700	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 3

Cross-Section Location (XS(I), mi)	.659
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 3

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1047.90	.0	.0300	.0	.0	.0000	.0	.0000
1053.40	64.0	.0300	.0	.0	.0000	.0	.0000
1060.00	408.0	.0300	.0	.0	.0000	.0	.0000
1065.80	480.0	.0400	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 4

Cross-Section Location (XS(I), mi)	.790
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 4

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	.400

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
1037.00	.0	.0300	.0	.0	.0000	.0	.0000
1042.40	34.2	.0300	.0	.0	.0000	.0	.0000
1048.00	65.0	.0300	.0	.0	.0000	.0	.0000
1051.00	97.0	.0300	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 5

Cross-Section Location (XS(I), mi)	1.017
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

DOWNSTREAM REACH NUMBER : 5

Reach Contraction-Expansion Coefficient (FKC)	.000
Minimum Distance Between Interpolated Cross-Sections (DXM, mi)	1.000

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Left Manning n CML(K,I)	Right Top Width BSR(K,I) (ft)	Right Manning n CMR(K,I)
993.00	10.5	.0300	.0	.0	.0000	.0	.0000
1000.50	70.5	.0300	.0	.0	.0000	.0	.0000
1010.00	71.0	.0300	.0	.0	.0000	.0	.0000
1015.00	71.5	.0300	.0	.0	.0000	.0	.0000

CROSS-SECTION NUMBER : 6

Cross-Section Location (XS(I), mi)	1.831
Left Flood-Plain Cross-Section Location (XSL(I), mi)	.000
Right Flood-Plain Cross-Section Location (XSR(I), mi)	.000
Flooding Elevation (FSTG(I), ft MSL)	.000
Initial Water Surface Elevation (YD, ft MSL)	.000

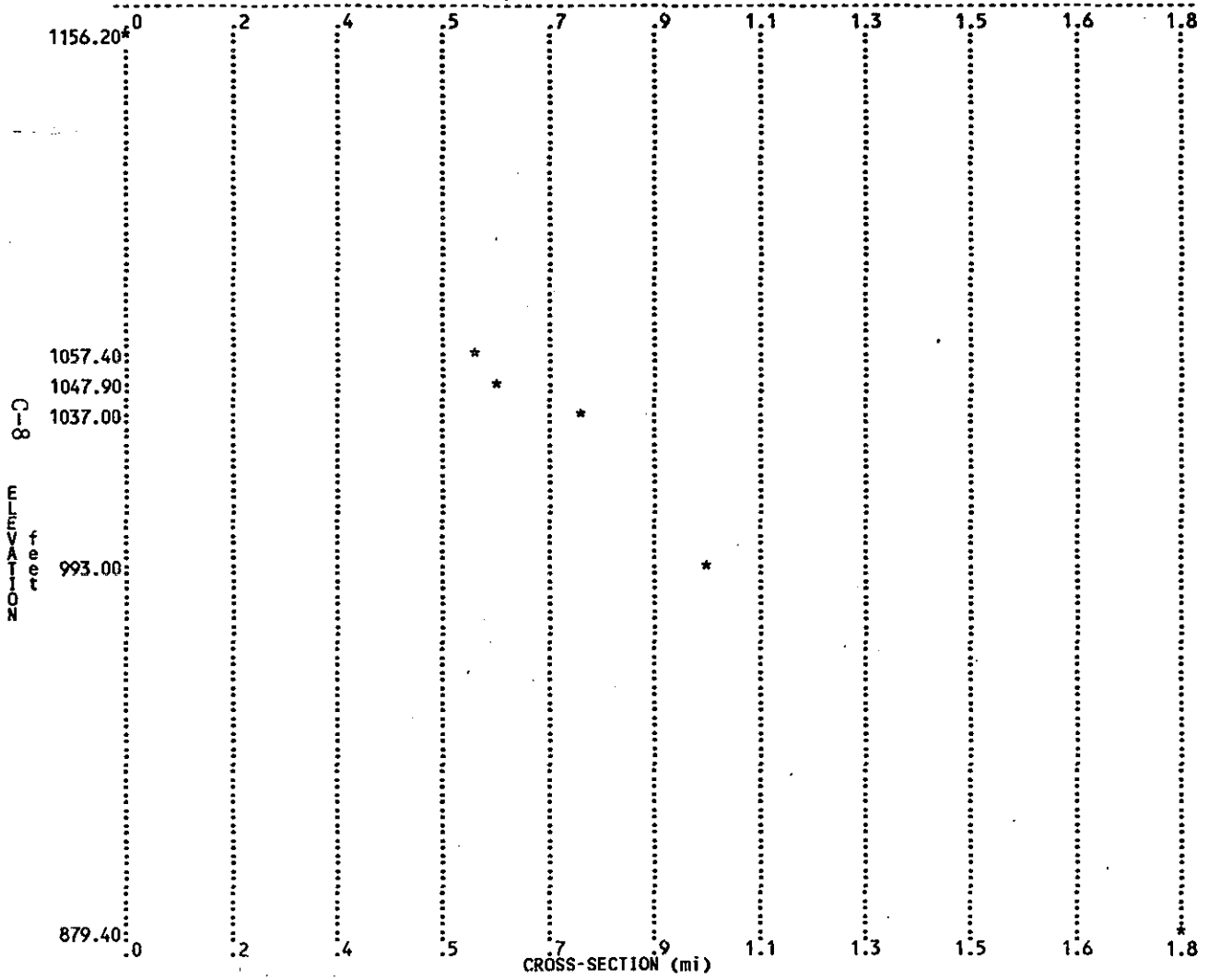
CROSS-SECTION DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Storage Top Width BSS(K,I) (ft)	Left Top Width BSL(K,I) (ft)	Right Top Width BSR(K,I) (ft)
879.40	8.8	.0	.0	.0
883.90	67.0	.0	.0	.0
888.40	201.0	.0	.0	.0
890.00	236.0	.0	.0	.0

Total number of cross-sections (original+interpolated)	6
Maximum number of cross-sections allowed	200

OUTPUT DATA SUMMARY :

SLOPE PROFILE PLOT :



Elevation (ft MSL)	Cross Section (mi)
1156.2	.0
1057.4	.6
1047.9	.7
1037.0	.8
993.0	1.0
879.4	1.8

RESERVOIR DEPLETION SUMMARY :

Total Volume in Reservoir (acre-ft) 142.4

DEFINITION OF RESERVOIR DEPLETION TABLE VARIABLES :

PARAMETER	UNITS	VARIABLE
Time step from start of analysis		I
Iterations necessary to solve flow equations		K
Elapsed time from start of analysis	hr	TTP(I)
Total outflow from dam	cfs	Q(I)
Elevation of water surface at dam	ft	H2
Elevation of breach bottom	ft	YB
Estimated depth of downstream flow	ft	D
Submergence coefficient		SUB
Velocity correction		VCOR
Total volume discharged from time of breach	ac-ft	OUTVOL
Breach width	ft	BB
Rectangular breach discharge coefficient		COFR
Inflow to reservoir	cfs	QI(I)
Breach outflow	cfs	QBRECH
Spillway outflow	cfs	QSPIL

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
1	0	.000	41	1165.60	1165.50	1157.04	1.00	1.00	.0	.0	3.10	30.	0.	41.
2	1	.020	41	1165.60	1165.31	1157.04	1.00	1.00	.1	.6	3.10	30.	0.	41.
3	1	.040	42	1165.60	1165.13	1157.05	1.00	1.00	.1	1.2	3.10	30.	2.	41.
4	1	.060	47	1165.60	1164.94	1157.07	1.00	1.00	.2	1.8	3.10	30.	4.	41.
5	1	.080	48	1165.60	1164.76	1157.09	1.00	1.00	.3	2.4	3.10	30.	7.	41.
6	1	.100	53	1165.60	1164.57	1157.13	1.00	1.00	.4	3.0	3.10	30.	12.	41.
7	1	.120	60	1165.59	1164.38	1157.17	1.00	1.00	.5	3.7	3.10	30.	19.	41.
8	1	.140	68	1165.59	1164.20	1157.23	1.00	1.00	.6	4.3	3.10	30.	27.	41.
9	1	.160	78	1165.59	1164.01	1157.29	1.00	1.00	.7	4.9	3.10	30.	38.	41.
10	1	.180	90	1165.59	1163.83	1157.36	1.00	1.00	.8	5.5	3.10	30.	50.	41.
11	1	.200	105	1165.58	1163.64	1157.44	1.00	1.00	1.0	6.1	3.10	30.	64.	41.
12	1	.220	121	1165.58	1163.45	1157.53	1.00	1.00	1.2	6.7	3.10	30.	81.	41.
13	1	.240	140	1165.57	1163.27	1157.62	1.00	1.00	1.4	7.3	3.10	30.	99.	41.
14	1	.260	159	1165.57	1163.08	1157.71	1.00	1.00	1.6	7.9	3.10	30.	120.	39.
15	1	.280	179	1165.56	1162.90	1157.79	1.00	1.00	1.9	8.5	3.10	30.	144.	36.
16	1	.300	202	1165.55	1162.71	1157.88	1.00	1.00	2.2	9.1	3.10	30.	170.	33.
17	1	.320	227	1165.54	1162.52	1157.98	1.00	1.00	2.6	9.8	3.10	30.	198.	30.
18	1	.340	255	1165.53	1162.34	1158.08	1.00	1.01	3.0	10.4	3.10	30.	229.	26.
19	1	.360	285	1165.52	1162.15	1158.19	1.00	1.01	3.4	11.0	3.10	30.	262.	23.
20	1	.380	317	1165.50	1161.97	1158.30	1.00	1.01	3.9	11.6	3.10	30.	298.	20.
21	1	.400	353	1165.48	1161.78	1158.41	1.00	1.01	4.5	12.2	3.10	30.	337.	16.
22	1	.420	391	1165.46	1161.59	1158.53	1.00	1.01	5.1	12.8	3.10	30.	378.	13.
23	1	.440	431	1165.44	1161.41	1158.64	1.00	1.01	5.8	13.4	3.10	30.	422.	10.
24	1	.460	475	1165.42	1161.22	1158.76	1.00	1.02	6.5	14.0	3.10	30.	469.	7.
25	1	.480	521	1165.39	1161.04	1158.89	1.00	1.02	7.4	14.6	3.10	30.	518.	3.
26	1	.500	569	1165.37	1160.85	1159.01	1.00	1.02	8.3	15.3	3.10	30.	570.	0.
27	1	.520	621	1165.33	1160.66	1159.14	1.00	1.02	9.3	15.9	3.10	30.	624.	0.
28	1	.540	681	1165.30	1160.48	1159.28	1.00	1.03	10.5	16.5	3.10	30.	683.	0.
29	1	.560	741	1165.26	1160.29	1159.41	1.00	1.03	11.5	17.1	3.10	30.	742.	0.
30	1	.580	804	1165.22	1160.11	1159.54	1.00	1.04	12.8	17.7	3.10	30.	805.	0.
31	1	.600	870	1165.17	1159.92	1159.68	1.00	1.04	14.2	18.3	3.10	30.	870.	0.
32	1	.620	938	1165.12	1159.73	1159.82	1.00	1.05	15.7	18.9	3.10	30.	938.	0.
33	1	.640	1009	1165.07	1159.55	1159.95	1.00	1.06	17.3	19.5	3.10	30.	1010.	0.
34	1	.660	1083	1165.01	1159.36	1160.09	1.00	1.07	19.0	20.1	3.10	30.	1084.	0.
35	1	.680	1160	1164.94	1159.18	1160.23	1.00	1.08	20.9	20.7	3.10	30.	1161.	0.
36	1	.700	1241	1164.88	1158.99	1160.37	1.00	1.09	22.8	21.3	3.10	30.	1241.	0.
37	1	.720	1325	1164.80	1158.80	1160.51	1.00	1.10	25.0	22.0	3.10	30.	1325.	0.
38	1	.740	1412	1164.72	1158.62	1160.65	1.00	1.12	27.2	22.6	3.10	30.	1413.	0.
39	1	.760	1504	1164.63	1158.43	1160.79	1.00	1.14	29.6	23.2	3.10	30.	1504.	0.
40	1	.780	1601	1164.54	1158.25	1160.94	1.00	1.16	32.2	23.8	3.10	30.	1601.	0.
41	1	.800	1703	1164.44	1158.06	1161.09	1.00	1.18	34.9	24.4	3.10	30.	1703.	0.
42	1	.820	1812	1164.33	1157.87	1161.24	1.00	1.21	37.8	25.0	3.10	30.	1812.	0.
43	1	.840	1926	1164.22	1157.69	1161.41	1.00	1.25	40.9	25.6	3.10	30.	1926.	0.
44	1	.860	2057	1164.09	1157.50	1161.58	1.00	1.29	44.2	26.2	3.10	30.	2057.	0.
45	2	.880	2199	1163.95	1157.32	1161.72	1.00	1.32	47.7	26.8	3.10	30.	2199.	0.
46	2	.900	2361	1163.80	1157.13	1161.95	1.00	1.43	51.5	27.4	3.10	30.	2361.	0.
47	2	.920	2552	1163.64	1156.94	1162.18	1.00	1.53	55.6	28.1	3.10	30.	2552.	0.
48	2	.940	2788	1163.45	1156.76	1162.45	1.00	1.68	60.0	28.7	3.10	30.	2789.	0.
49	2	.960	3100	1163.24	1156.57	1162.78	1.00	1.92	64.9	29.3	3.10	30.	3101.	0.
50	2	.980	3552	1163.00	1156.39	1163.24	1.00	2.00	70.4	29.9	3.10	30.	3552.	0.

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
51	2	1.000	3681	1162.72	1156.20	1163.36	1.00	2.00	76.3	30.5	3.10	30.	3682.	0.
52	1	1.020	3723	1162.47	1156.20	1163.13	1.00	2.00	82.2	30.5	3.10	30.	3723.	0.
53	1	1.040	3179	1162.16	1156.20	1162.87	1.00	2.00	87.7	30.5	3.10	30.	3180.	0.
54	1	1.060	2950	1161.90	1156.20	1162.62	1.00	2.00	92.7	30.5	3.10	30.	2951.	0.
55	1	1.080	2735	1161.64	1156.20	1162.39	1.00	2.00	97.4	30.5	3.10	30.	2736.	0.
56	1	1.100	2533	1161.39	1156.20	1162.16	1.00	2.00	101.8	30.5	3.10	30.	2534.	0.
57	1	1.120	2343	1161.14	1156.20	1161.93	1.00	2.00	105.8	30.5	3.10	30.	2344.	0.
58	1	1.140	2165	1160.91	1156.20	1161.71	1.00	2.00	109.5	30.5	3.10	30.	2166.	0.
59	1	1.160	1998	1160.68	1156.20	1161.49	1.00	2.00	113.0	30.5	3.10	30.	1998.	0.
60	1	1.180	1842	1160.45	1156.20	1161.28	1.00	2.00	116.2	30.5	3.10	30.	1843.	0.
61	1	1.200	1696	1160.24	1156.20	1161.07	1.00	2.00	119.1	30.5	3.10	30.	1696.	0.
62	1	1.220	1559	1160.03	1156.20	1160.87	1.00	2.00	121.8	30.5	3.10	30.	1559.	0.
63	1	1.240	1430	1159.83	1156.20	1160.67	1.00	2.00	124.2	30.5	3.10	30.	1431.	0.
64	1	1.260	1311	1159.64	1156.20	1160.48	1.00	2.00	126.5	30.5	3.10	30.	1311.	0.
65	1	1.280	1199	1159.45	1156.20	1160.29	1.00	2.00	128.6	30.5	3.10	30.	1200.	0.
66	1	1.300	1095	1159.27	1156.20	1160.10	1.00	2.00	130.5	30.5	3.10	30.	1096.	0.
67	1	1.320	999	1159.09	1156.20	1159.93	1.00	2.00	132.2	30.5	3.10	30.	999.	0.
68	1	1.340	909	1158.92	1156.20	1159.75	1.00	2.00	133.8	30.5	3.10	30.	909.	0.
69	1	1.360	825	1158.76	1156.20	1159.58	1.00	2.00	135.2	30.5	3.10	30.	826.	0.
70	1	1.380	748	1158.60	1156.20	1159.42	1.00	2.00	136.5	30.5	3.10	30.	748.	0.
71	1	1.400	676	1158.45	1156.20	1159.26	1.00	2.00	137.7	30.5	3.10	30.	677.	0.
72	1	1.420	610	1158.31	1156.20	1159.10	1.00	2.00	138.8	30.5	3.10	30.	610.	0.
73	1	1.440	549	1158.17	1156.20	1158.95	1.00	2.00	139.7	30.5	3.10	30.	550.	0.
74	1	1.460	493	1158.04	1156.20	1158.81	1.00	2.00	140.6	30.5	3.10	30.	493.	0.
75	1	1.480	442	1157.91	1156.20	1158.67	1.00	2.00	141.4	30.5	3.10	30.	442.	0.
76	1	1.500	396	1157.79	1156.20	1158.53	1.00	2.00	142.1	30.5	3.10	30.	396.	0.
77	1	1.520	354	1157.68	1156.20	1158.40	1.00	2.00	142.7	30.5	3.10	30.	355.	0.
78	1	1.540	317	1157.57	1156.20	1158.28	1.00	2.00	143.2	30.5	3.10	30.	318.	0.
79	1	1.560	284	1157.46	1156.20	1158.16	1.00	2.00	143.7	30.5	3.10	30.	284.	0.
80	1	1.580	254	1157.37	1156.20	1158.04	1.00	2.00	144.1	30.5	3.10	30.	254.	0.
81	1	1.600	227	1157.27	1156.20	1157.93	1.00	2.00	144.5	30.5	3.10	30.	227.	0.
82	1	1.620	203	1157.19	1156.20	1157.83	1.00	2.00	144.9	30.5	3.10	30.	203.	0.
83	1	1.640	182	1157.11	1156.20	1157.73	1.00	2.00	145.2	30.5	3.10	30.	182.	0.
84	1	1.660	164	1157.03	1156.20	1157.64	1.00	2.00	145.4	30.5	3.10	30.	164.	0.
85	1	1.680	148	1156.96	1156.20	1157.55	1.00	2.00	145.6	30.5	3.10	30.	148.	0.
86	1	1.700	134	1156.90	1156.20	1157.47	1.00	2.00	145.8	30.5	3.10	30.	134.	0.
87	1	1.720	122	1156.84	1156.20	1157.40	1.00	2.00	146.0	30.5	3.10	30.	122.	0.
88	1	1.740	112	1156.79	1156.20	1157.33	1.00	2.00	146.2	30.5	3.10	30.	112.	0.
89	1	1.760	103	1156.74	1156.20	1157.27	1.00	2.00	146.3	30.5	3.10	30.	103.	0.
90	1	1.780	95	1156.70	1156.20	1157.22	1.00	2.00	146.4	30.5	3.10	30.	95.	0.
91	1	1.800	88	1156.66	1156.20	1157.17	1.00	2.00	146.5	30.5	3.10	30.	88.	0.
92	1	1.820	82	1156.63	1156.20	1157.13	1.00	2.00	146.6	30.5	3.10	30.	82.	0.
93	1	1.840	77	1156.61	1156.20	1157.09	1.00	2.00	146.7	30.5	3.10	30.	77.	0.
94	1	1.860	73	1156.58	1156.20	1157.06	1.00	2.00	146.8	30.5	3.10	30.	73.	0.
95	1	1.880	69	1156.56	1156.20	1157.04	1.00	2.00	146.9	30.5	3.10	30.	69.	0.
96	1	1.900	66	1156.55	1156.20	1157.02	1.00	2.00	146.9	30.5	3.10	30.	66.	0.
97	1	1.920	63	1156.53	1156.20	1157.00	1.00	2.00	147.0	30.5	3.10	30.	63.	0.
98	1	1.940	61	1156.52	1156.20	1156.99	1.00	2.00	147.1	30.5	3.10	30.	61.	0.
99	1	1.960	59	1156.52	1156.20	1156.98	1.00	2.00	147.1	30.5	3.10	30.	59.	0.
100	1	1.980	57	1156.51	1156.20	1156.97	1.00	2.00	147.2	30.5	3.10	30.	57.	0.

RESERVOIR DEPLETION TABLE :

I	K	TTP(I)	Q(I)	H2	YB	D	SUB	VCOR	OUTVOL	BB	COFR	QI(I)	QBRECH	QSPIL
101	1	2.000	32	1156.51	1156.20	1156.96	1.00	2.00	147.2	30.5	3.10	30.	33.	0.
102	1	2.020	31	1156.50	1156.20	1156.96	1.00	2.00	147.3	30.5	3.10	30.	32.	0.
103	1	2.042	31	1156.50	1156.20	1156.95	1.00	2.00	147.3	30.5	3.10	30.	31.	0.
104	1	2.066	31	1156.50	1156.20	1156.95	1.00	2.00	147.4	30.5	3.10	30.	31.	0.
105	1	2.093	30	1156.50	1156.20	1156.95	1.00	2.00	147.5	30.5	3.10	30.	31.	0.
106	1	2.122	30	1156.49	1156.20	1156.95	1.00	2.00	147.5	30.5	3.10	30.	30.	0.
107	1	2.154	30	1156.49	1156.20	1156.95	1.00	2.00	147.6	30.5	3.10	30.	30.	0.
108	1	2.190	30	1156.49	1156.20	1156.94	1.00	2.00	147.7	30.5	3.10	30.	30.	0.
109	1	2.229	30	1156.49	1156.20	1156.94	1.00	2.00	147.8	30.5	3.10	30.	30.	0.
110	1	2.272	30	1156.49	1156.20	1156.94	1.00	2.00	147.9	30.5	3.10	30.	30.	0.
111	1	2.319	30	1156.49	1156.20	1156.94	1.00	2.00	148.0	30.5	3.10	30.	30.	0.
112	1	2.371	30	1156.49	1156.20	1156.94	1.00	2.00	148.2	30.5	3.10	30.	30.	0.
113	1	2.428	30	1156.49	1156.20	1156.94	1.00	2.00	148.3	30.5	3.10	30.	30.	0.
114	1	2.490	30	1156.49	1156.20	1156.94	1.00	2.00	148.5	30.5	3.10	30.	30.	0.
115	1	2.559	30	1156.49	1156.20	1156.94	1.00	2.00	148.6	30.5	3.10	30.	30.	0.
116	1	2.635	30	1156.49	1156.20	1156.94	1.00	2.00	148.8	30.5	3.10	30.	30.	0.
117	1	2.719	30	1156.49	1156.20	1156.94	1.00	2.00	149.0	30.5	3.10	30.	30.	0.
118	1	2.811	30	1156.49	1156.20	1156.94	1.00	2.00	149.2	30.5	3.10	30.	30.	0.
119	1	2.912	30	1156.49	1156.20	1156.94	1.00	2.00	149.5	30.5	3.10	30.	30.	0.
120	1	3.023	30	1156.49	1156.20	1156.94	1.00	2.00	149.8	30.5	3.10	30.	30.	0.

RESERVOIR FLOW SUMMARY :

Initial Flow (Q(1), cfs)	41.
Maximum Flow (Qmax, cfs)	3682.
Final Flow (Q(NU), cfs)	30.
Time to Maximum Flow (TP, hr)	1.00
Number of Time Steps or Number of Hydrograph Ordinates (NNU)	120
Total Volume Discharged from Reservoir (DISVOL, acre-ft)	150.
Number of Intermediate Cross-Sections (NN(NS))	6
Number of Time Steps (NNU)	120

Interp. Cross Section I	Water Elevation YD(I) (ft MSL)	Initial Flow QDI(I) (cfs)
1	1157.04	41.0
2	1058.47	41.0
3	1048.26	51.0
4	1038.96	51.0
5	993.26	51.0
6	880.43	51.0

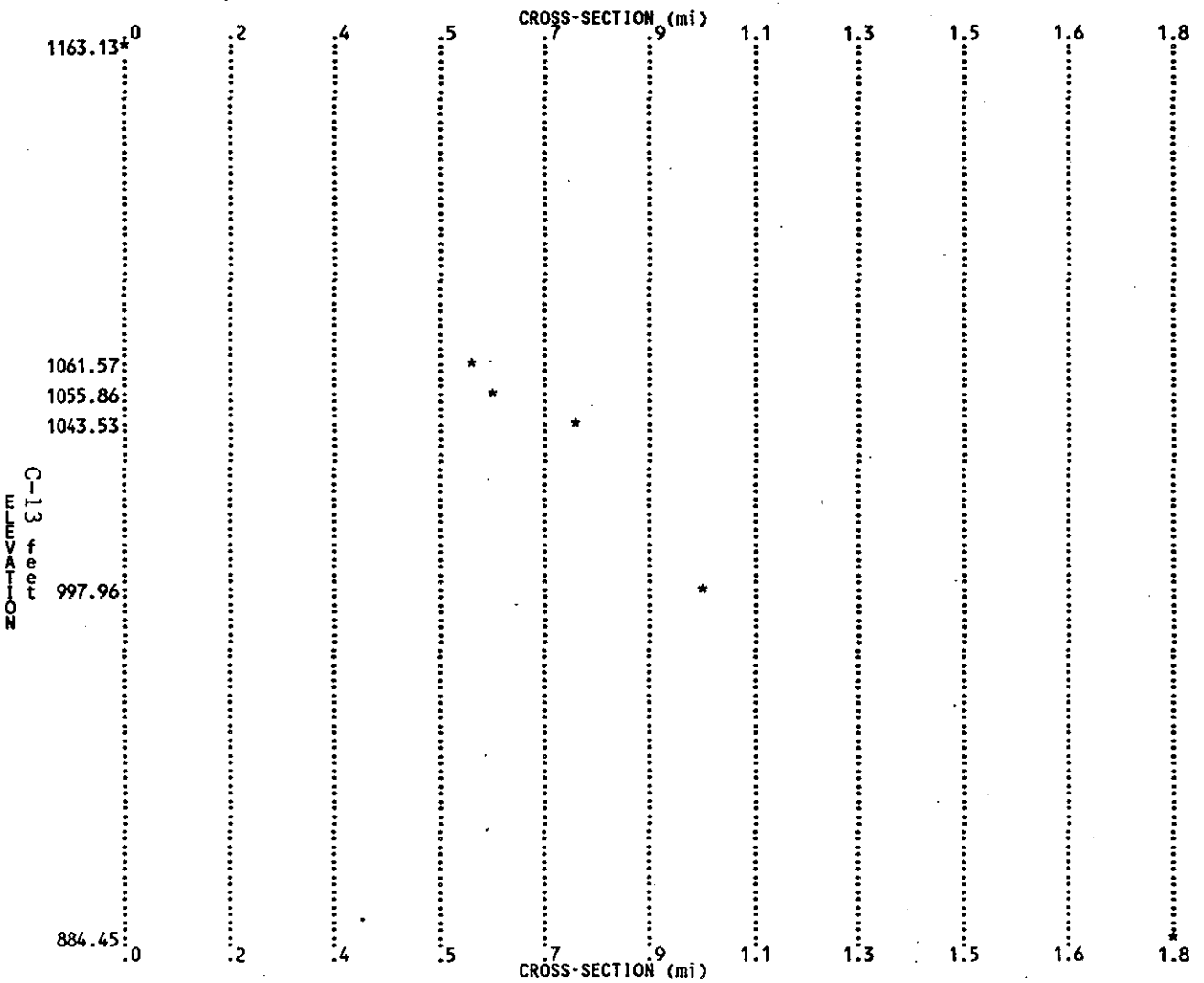
ROUTING COMPLETED :

Number of Time Steps Used (KTIME)	51
Maximum Number of Time Steps Allowed	698
Total Time of Flood Routing (TT, hr)	3.1

FLOOD CREST SUMMARY :

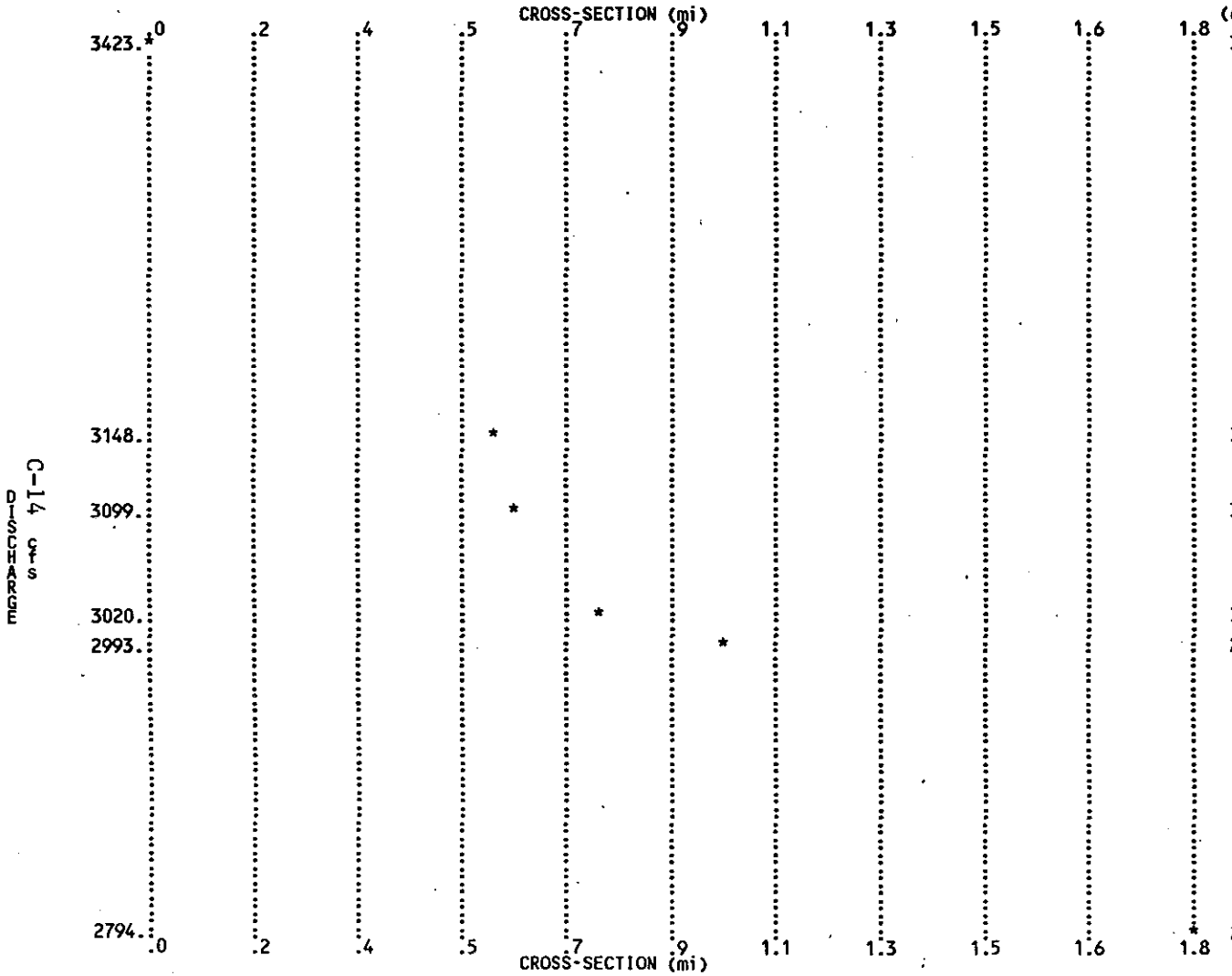
Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)
.000	1163.13	3423	1.020	18.47	.00	.00
.606	1061.57	3148	1.020	16.96	.00	.00
.659	1055.86	3098	1.020	66.34	.00	.00
.790	1043.53	3020	1.080	37.50	.00	.00
1.017	997.96	2883	1.080	19.90	.00	.00
1.831	884.45	2793	1.140	13.80	.00	.00

FLOOD CREST SUMMARY (Peak Water Surface Elevation) :



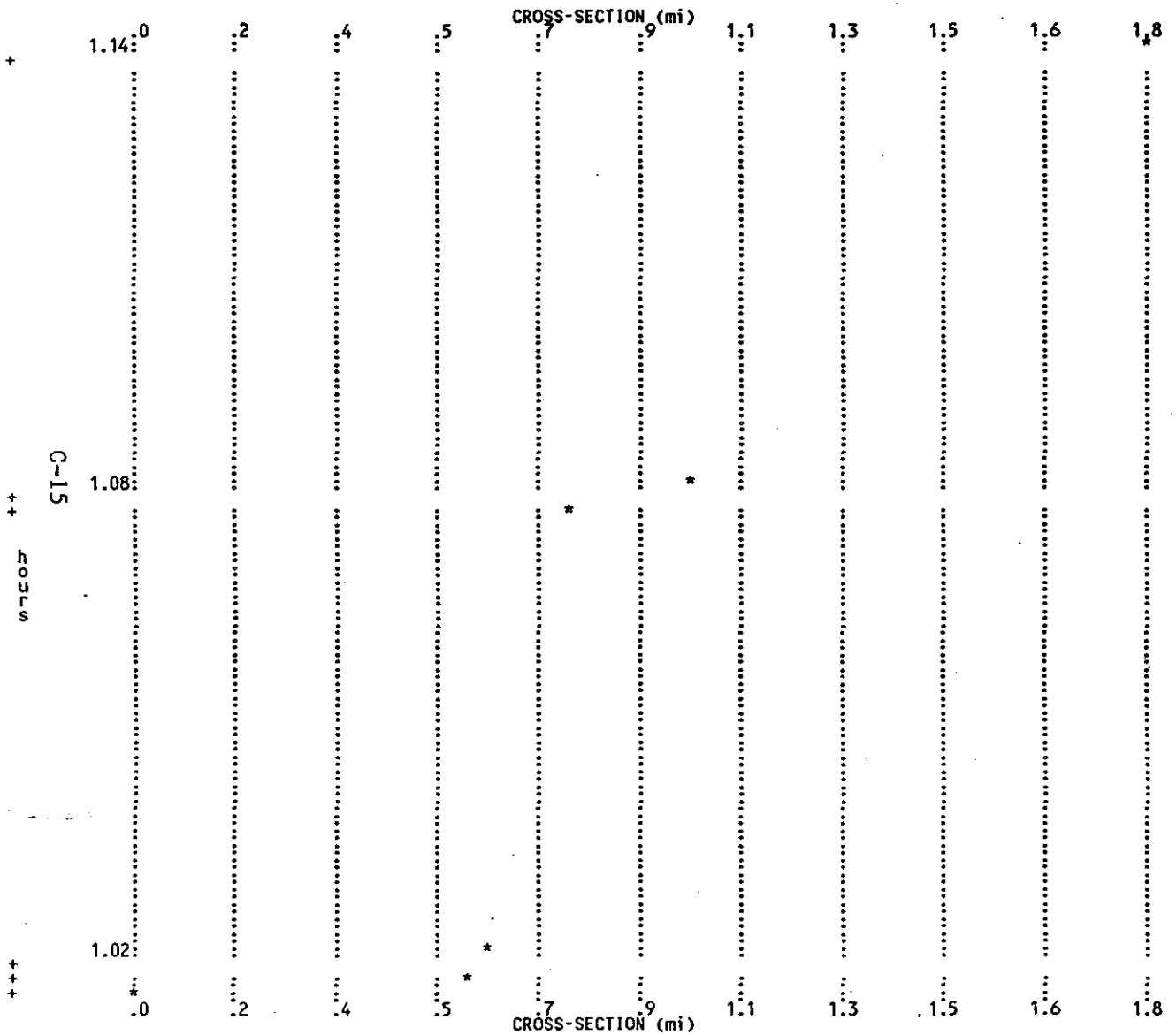
ELEVATION (ft)	CROSS SECTION (mi)
1163.1	.0
1061.6	.6
1055.9	.7
1043.5	.8
998.0	1.0
884.4	1.8

FLOOD DISCHARGE SUMMARY (Peak Water Flow) :



DISCHARGE (cfs)	CROSS SECTION (mi)
3423.2	.0
3148.3	.6
3098.6	.7
3020.2	.8
2993.4	1.0
2793.9	1.8

TIME TO PEAK ELEVATION PROFILE :

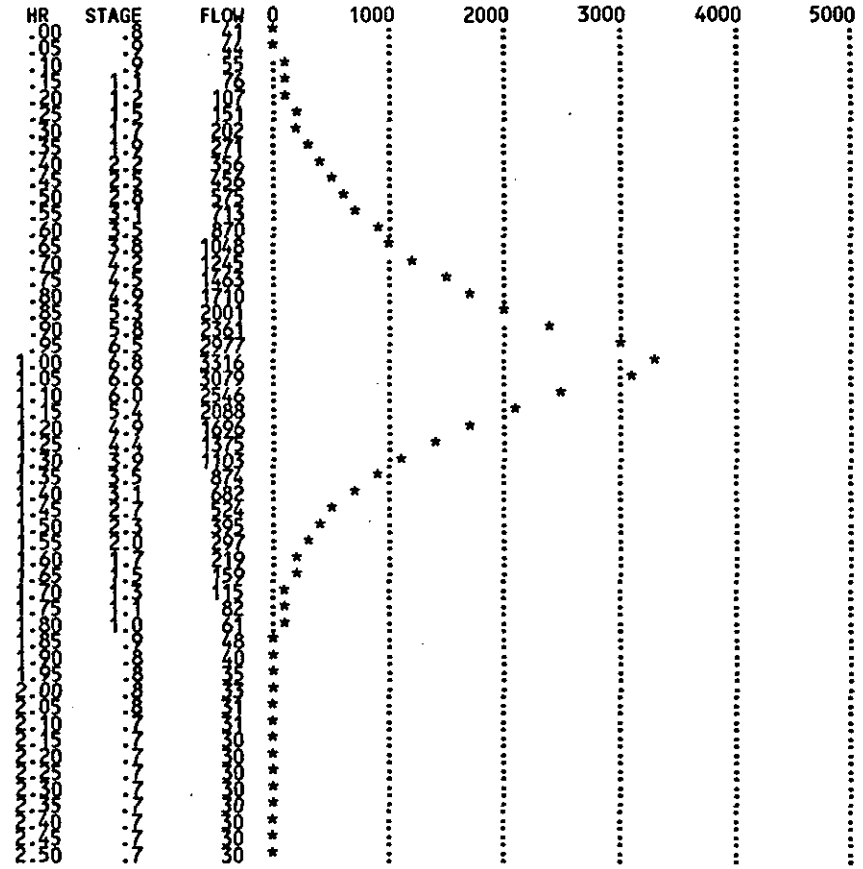


TIME (hr)	CROSS SECTION (mi)	ELEVATION (ft MSL)
1.1	1.8	884.4
1.1	1.0	998.0
1.0	.7	1055.9

DISCHARGE HYDROGRAPH :

Cross-Section Number	1
Cross-Section Location (mi)	.000
Gage Zero (ft MSL)	1156.200
Max Elevation Reached by Flood Wave (ft MSL)	1163.127
Flood Stage (ft)	(not available)
Maximum Stage (ft)	6.927
at Time (hr)	1.020
Maximum Flow (cfs)	3423
at Time (hr)	1.020

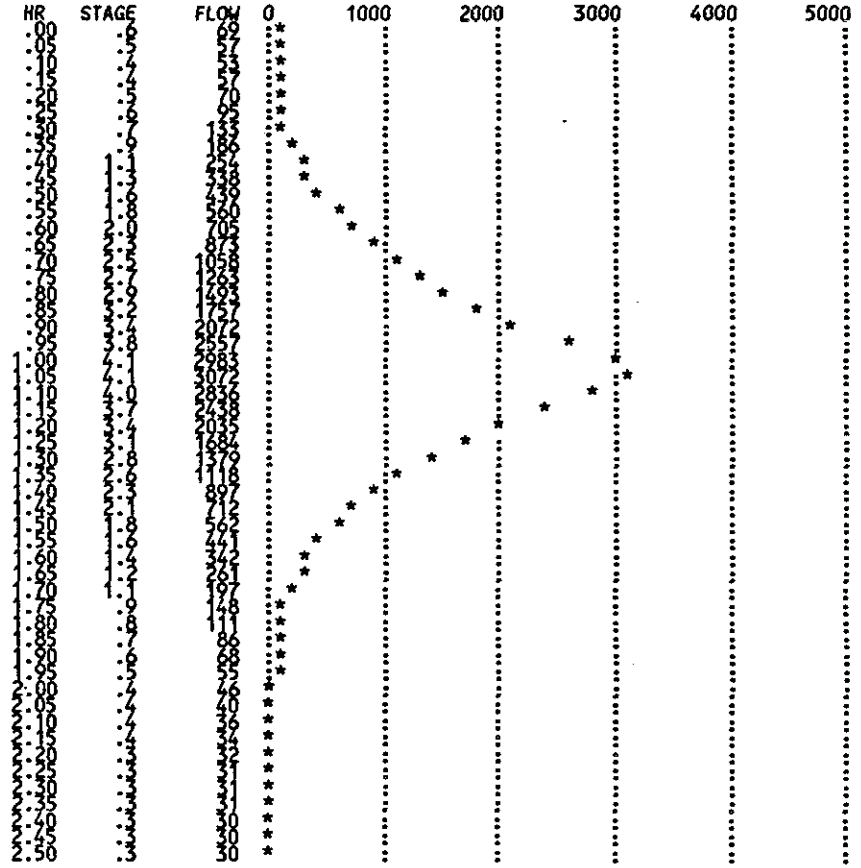
HR	STAGE	FLOW
.00	.8	41
.05	.9	44
.10	.9	55
.15	1.1	76
.20	1.2	107
.25	1.5	151
.30	1.7	202
.35	1.9	271
.40	2.2	356
.45	2.5	456
.50	2.8	565
.55	3.1	713
.60	3.5	870
.65	3.8	1048
.70	4.2	1245
.75	4.5	1463
.80	4.9	1710
.85	5.3	2001
.90	5.8	2361
.95	6.3	2777
1.00	6.8	3316
1.05	6.6	3079
1.10	6.0	2546
1.15	5.4	2088
1.20	4.9	1696
1.25	4.4	1375
1.30	3.9	1103
1.35	3.5	874
1.40	3.1	682
1.45	2.7	524
1.50	2.3	395
1.55	2.0	297
1.60	1.7	219
1.65	1.5	159
1.70	1.3	115
1.75	1.1	82
1.80	1.0	61
1.85	.9	48
1.90	.8	40
1.95	.8	35
2.00	.8	33
2.05	.8	31
2.10	.7	31
2.15	.7	30
2.20	.7	30
2.25	.7	30
2.30	.7	30
2.35	.7	30
2.40	.7	30
2.45	.7	30
2.50	.7	30



DISCHARGE HYDROGRAPH :

Cross-Section Number	2
Cross-Section Location (mi)	.606
Gage Zero (ft MSL)	1057.400
Max Elevation Reached by Flood Wave (ft MSL)	1061.568
Flood Stage (ft)	(not available)
Maximum Stage (ft)	4.168
at Time (hr)	1.020
Maximum Flow (cfs)	3148
at Time (hr)	1.020

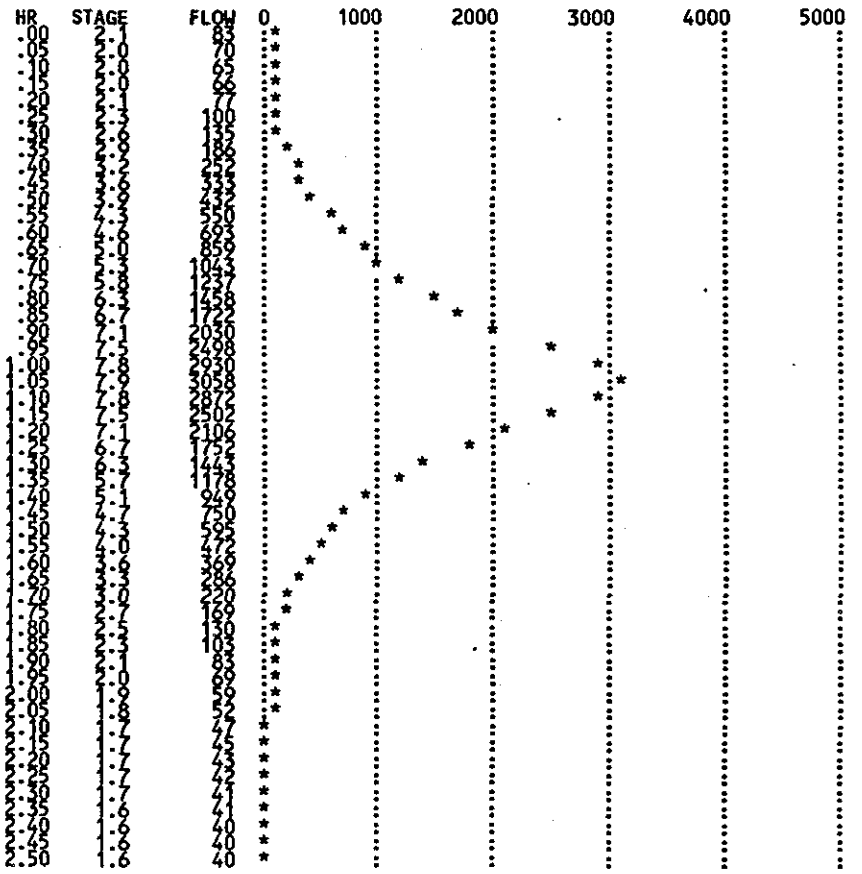
HR	STAGE	FLOW
.00	.6	69
.05	.5	57
.10	.4	53
.15	.4	57
.20	.5	70
.25	.6	95
.30	.7	133
.35	.9	186
.40	1.1	254
.45	1.3	338
.50	1.6	439
.55	1.8	560
.60	2.0	705
.65	2.2	873
.70	2.5	1058
.75	2.7	1263
.80	2.9	1493
.85	3.2	1757
.90	3.4	2072
.95	3.8	2557
1.00	4.1	2983
1.05	4.1	3072
1.10	4.0	2836
1.15	3.7	2438
1.20	3.4	2035
1.25	3.1	1684
1.30	2.8	1379
1.35	2.6	1118
1.40	2.3	897
1.45	2.1	712
1.50	1.8	562
1.55	1.6	441
1.60	1.4	342
1.65	1.2	261
1.70	1.1	197
1.75	.9	148
1.80	.8	111
1.85	.7	86
1.90	.6	68
1.95	.5	55
2.00	.4	46
2.05	.4	40
2.10	.4	36
2.15	.4	34
2.20	.3	32
2.25	.3	31
2.30	.3	31
2.35	.3	31
2.40	.3	30
2.45	.3	30
2.50	.3	30



DISCHARGE HYDROGRAPH :

Cross-Section Number	3
Cross-Section Location (mi)	.659
Gage Zero (ft MSL)	1047.900
Max Elevation Reached by Flood Wave (ft MSL)	1055.858
Flood Stage (ft)	(not available)
Maximum Stage (ft)	7.958
at Time (hr)	1.020
Maximum Flow (cfs)	3099
at Time (hr)	1.020

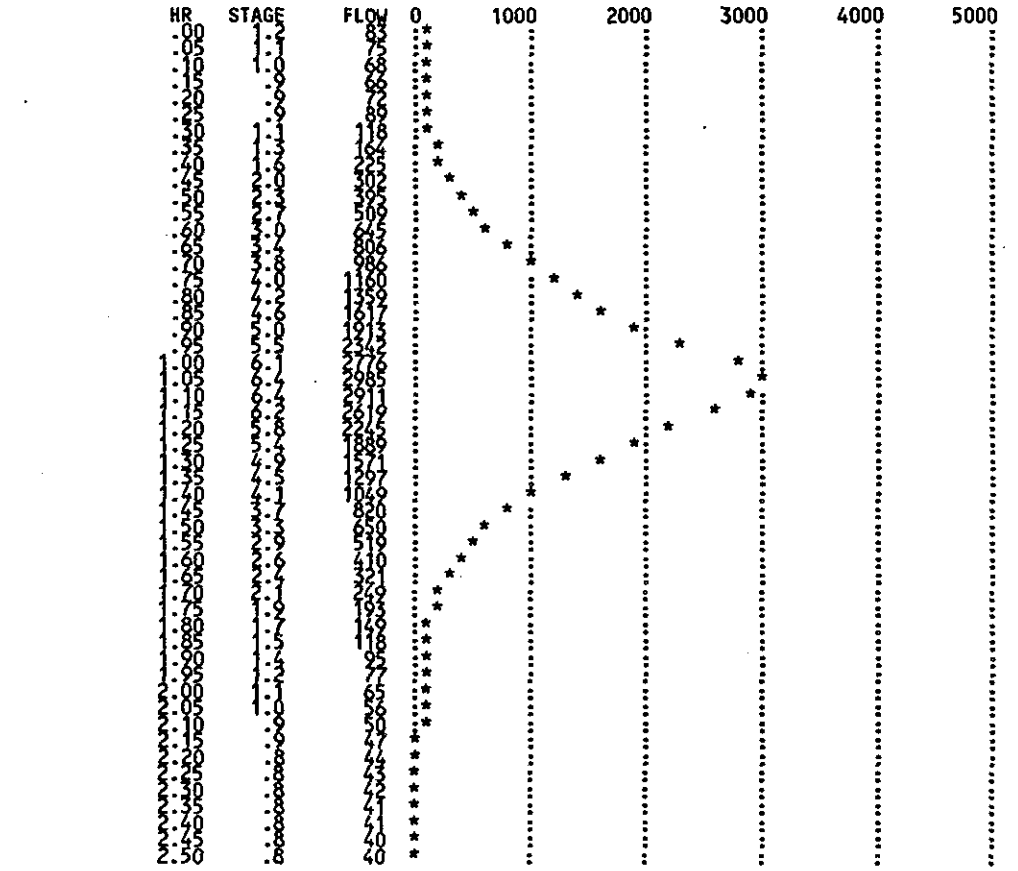
HR	STAGE	FLOW
.00	2.1	83
.05	2.0	70
.10	2.0	65
.15	2.0	66
.20	2.1	77
.25	2.3	100
.30	2.8	135
.35	2.9	186
.40	3.2	252
.45	3.6	333
.50	3.9	433
.55	4.3	550
.60	4.6	693
.65	5.0	859
.70	5.3	1043
.75	5.8	1237
.80	6.3	1458
.85	6.7	1722
.90	7.1	2030
.95	7.5	2498
1.00	7.8	2930
1.05	7.9	3058
1.10	7.8	2872
1.15	7.5	2502
1.20	7.1	2106
1.25	6.7	1752
1.30	6.3	1443
1.35	5.7	1178
1.40	5.1	948
1.45	4.7	750
1.50	4.3	595
1.55	4.0	472
1.60	3.6	368
1.65	3.3	286
1.70	3.0	220
1.75	2.7	169
1.80	2.5	130
1.85	2.3	103
1.90	2.1	83
1.95	2.0	68
2.00	1.9	56
2.05	1.8	52
2.10	1.7	47
2.15	1.7	45
2.20	1.7	43
2.25	1.7	43
2.30	1.7	41
2.35	1.6	41
2.40	1.6	40
2.45	1.6	40
2.50	1.6	40



DISCHARGE HYDROGRAPH :

Cross-Section Number	4
Cross-Section Location (mi)	.790
Gage Zero (ft MSL)	1037.000
Max Elevation Reached by Flood Wave (ft MSL)	1043.530
Flood Stage (ft)	(not available)
Maximum Stage (ft)	6.530
at Time (hr)	1.080
Maximum Flow (cfs)	3020
at Time (hr)	1.080

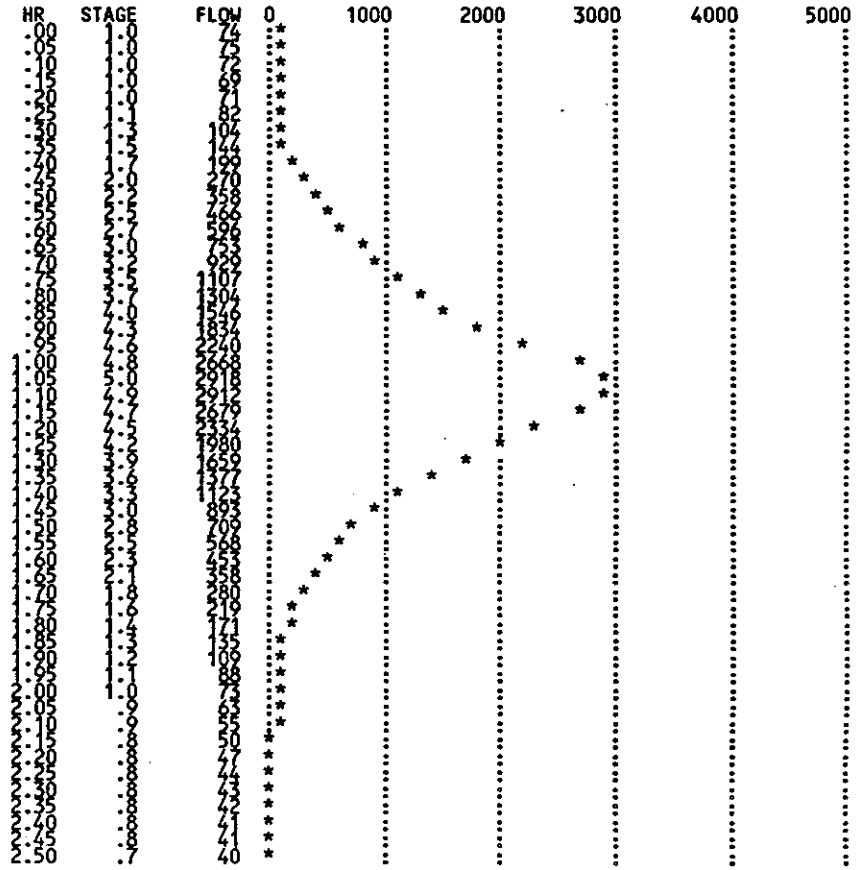
HR	STAGE	FLOW
.00	1.2	83
.05	1.1	75
.10	1.0	68
.15	.9	66
.20	.9	72
.25	.9	89
.30	1.1	118
.35	1.3	164
.40	1.6	225
.45	2.0	305
.50	2.3	395
.55	2.7	509
.60	3.0	645
.65	3.4	806
.70	3.8	986
.75	4.0	1160
.80	4.2	1359
.85	4.6	1617
.90	5.0	1913
.95	5.5	2245
1.00	6.1	2576
1.05	6.4	2885
1.10	6.4	2911
1.15	6.2	2619
1.20	5.8	2245
1.25	5.4	1886
1.30	4.9	1571
1.35	4.5	1297
1.40	4.1	1049
1.45	3.7	820
1.50	3.3	650
1.55	2.9	519
1.60	2.6	410
1.65	2.4	321
1.70	2.1	249
1.75	1.9	193
1.80	1.7	149
1.85	1.5	118
1.90	1.4	95
1.95	1.3	77
2.00	1.1	65
2.05	1.0	56
2.10	.9	50
2.15	.9	47
2.20	.8	44
2.25	.8	43
2.30	.8	42
2.35	.8	41
2.40	.8	41
2.45	.8	40
2.50	.8	40



DISCHARGE HYDROGRAPH :

Cross-Section Number	5
Cross-Section Location (mi)	1.017
Gage Zero (ft MSL)	993.000
Max Elevation Reached by Flood Wave (ft MSL)	997.958
Flood Stage (ft)	(not available)
Maximum Stage (ft)	4.958
at Time (hr)	1.080
Maximum Flow (cfs)	2993
at Time (hr)	1.080

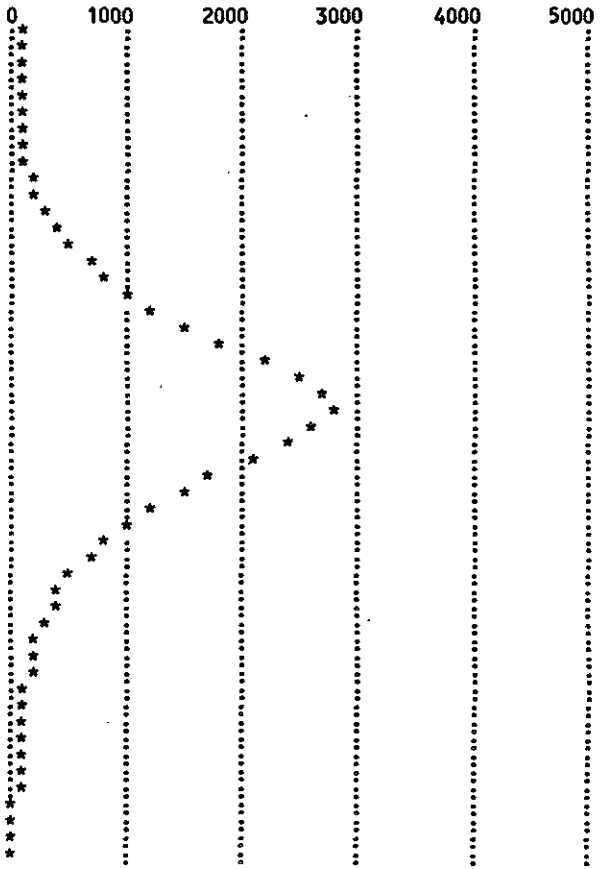
HR	STAGE	FLOW
.00	1.0	74
.05	1.0	75
.10	1.0	72
.15	1.0	66
.20	1.0	71
.25	1.1	82
.30	1.3	104
.35	1.5	144
.40	1.7	199
.45	2.0	270
.50	2.3	358
.55	2.5	458
.60	2.7	566
.65	3.0	753
.70	3.2	959
.75	3.5	1107
.80	3.7	1304
.85	4.0	1546
.90	4.3	1834
.95	4.6	2240
1.00	4.8	2668
1.05	5.0	2918
1.10	4.9	2912
1.15	4.7	2679
1.20	4.5	2332
1.25	4.2	1980
1.30	3.9	1659
1.35	3.6	1377
1.40	3.3	1123
1.45	3.0	893
1.50	2.8	709
1.55	2.5	568
1.60	2.3	453
1.65	2.1	358
1.70	1.8	280
1.75	1.6	219
1.80	1.4	171
1.85	1.3	135
1.90	1.2	109
1.95	1.1	88
2.00	1.0	73
2.05	.9	63
2.10	.9	55
2.15	.8	50
2.20	.8	47
2.25	.8	44
2.30	.8	43
2.35	.8	42
2.40	.8	41
2.45	.8	41
2.50	.7	40



DISCHARGE HYDROGRAPH :

Cross-Section Number	6
Cross-Section Location (mi)	1.831
Gage Zero (ft MSL)	879.400
Max Elevation Reached by Flood Wave (ft MSL)	884.447
Flood Stage (ft)	(not available)
Maximum Stage (ft)	5.047
at Time (hr)	1.140
Maximum Flow (cfs)	2794
at Time (hr)	1.140

HR	STAGE	FLOW
.00	.6	56
.05	.6	62
.10	.7	68
.15	.7	70
.20	.6	69
.25	.6	69
.30	.6	72
.35	.6	85
.40	.7	111
.45	.9	152
.50	1.2	211
.55	1.5	291
.60	1.8	392
.65	2.1	523
.70	2.4	677
.75	2.7	850
.80	3.0	1038
.85	3.3	1247
.90	3.6	1493
.95	4.0	1818
1.00	4.4	2197
1.05	4.8	2521
1.10	5.0	2723
1.15	5.0	2768
1.20	4.8	2636
1.25	4.5	2378
1.30	4.2	2058
1.35	3.9	1747
1.40	3.6	1468
1.45	3.3	1219
1.50	3.0	998
1.55	2.7	818
1.60	2.4	670
1.65	2.2	546
1.70	2.0	443
1.75	1.8	358
1.80	1.6	288
1.85	1.5	232
1.90	1.3	191
1.95	1.2	156
2.00	1.1	128
2.05	.9	106
2.10	.8	89
2.15	.8	76
2.20	.7	67
2.25	.6	60
2.30	.6	54
2.35	.6	50
2.40	.5	47
2.45	.5	45
2.50	.5	43



END OF OUTPUT

APPENDIX D
FIRST ROUTE 132 CROSSING

The attenuation produced at the first Route 132 road crossing was computed using for inflow the discharges computed by the DAMBRK program at River Mile 0.659.

1. VOLUMES

Based on field-surveyed cross-section information, the areas and volumes stored upstream of the road were as tabled below:

Crescent Lake Dam Route 132 culvert crossing 0.659 mile below dam

Elevation ft NGVD	Stage feet	Area of Pool sq. feet	Area of Pool acres	Volume Ponded cu. feet	Volume Ponded acre-feet
1047.90	0.00	0.00	0.00	0.0	0.00
1050.00	2.10	832.00	0.02	582.0	0.01
1057.40	9.50	40875.00	0.94	154316.0	3.54
1060.00	12.10	67056.00	1.54	294626.0	6.76
1065.80	17.90	202240.00	4.64	1075585.0	24.69
1068.50	20.60	265170.00	6.09	1706588.0	39.18

This information is adequately summarised by the equation:

$$V = 188.8 \times \text{Stage}^3$$

where water volume V is in cubic feet, and Stage is in feet above the culvert inlet invert. (1,047.9 ft NGVD)

2. DISCHARGES

(a) Culvert flows were assumed to be controlled at the entrance of a 10-foot wide by 7-foot high culvert with invert at 1,047.9 ft NGVD.

(b) Roadway overtopping flows were assumed to occur over a 300-foot length of roadway for water levels from 1,065.8 to 1,068.0 ft NGVD. At the higher of these elevations the flooded roadway length increased to 800 feet.

(c) No simple equation was found to describe the entire range of flows and stages. Linear interpolation was used to find flows in the range described by the table following:

Crescent Lake Dam
Route 132 Culvert Crossing 0.659 mile below dam

Elevation ft NGVD	Stage feet	Flow cfs
1047.9	0.0	0.0
1054.9	7.0	495.0
1056.0	8.1	568.0
1058.0	10.1	680.0
1060.0	12.1	776.0
1062.0	14.1	862.0
1064.0	16.1	952.0
1065.8	17.9	1006.0
1066.0	18.1	1087.0
1067.0	19.1	2150.0
1068.0	20.1	3820.0
1068.5	20.6	5316.0

3. INFLOWS

The inflow hydrograph assumed that failure of Crescent Lake Dam began at time datum 9.60 hour. An initial flow of 534 cfs was used.

Crescent Lake Dam-Break Analysis
Stream Discharges at River Mile 0.659

TIME minutes	DAMBRK Time hours	DAMBRK Inflow cfs
0.0	9.6	534.0
24.0	10.0	894.0
54.0	10.5	3380.0
66.0	10.7	5427.0
84.0	11.0	2414.0
114.0	11.5	699.0
144.0	12.0	541.0
174.0	12.5	534.0

4. ROUTING

Inflows, outflows, water elevations and ponded volumes were calculated for time increments varying from 1 to 12 minutes and the results are tabulated below:

Crescent Lake Dam
Dam-Break Analysis

Route 132 Crossing 0.659 miles downstream of Dam
Ponding Upstream of the Highway

TIME Minutes	TIME Seconds	INFLOW cfs	PONDED VOLUME cu. ft.	PONDED VOLUME acre-ft.	OUTFLOW cfs	STAGE ft
0.0	0.0	534.0	82552.0	1.9	534.0	7.6
6.0	360.0	624.0	93176.0	2.1	565.0	7.9
12.0	720.0	714.0	122589.0	2.8	610.0	8.7
18.0	1080.0	804.0	166917.0	3.8	662.0	9.6
24.0	1440.0	894.0	225392.0	5.2	711.0	10.6
30.0	1800.0	1391.0	364864.0	8.4	799.0	12.5
36.0	2160.0	1884.0	629951.0	14.5	950.0	14.9
39.0	2340.0	2136.0	815311.0	18.7	980.0	16.3
42.0	2520.0	2387.0	1046232.0	24.0	1000.0	17.7
43.0	2580.0	2470.0	1127240.0	25.9	1158.0	18.1
44.0	2640.0	2552.0	1195681.0	27.4	1583.0	18.5
45.0	2700.0	2635.0	1248614.0	28.7	1841.0	18.8
46.0	2760.0	2718.0	1292119.0	29.7	2063.0	19.0
48.0	2880.0	2883.0	1344328.0	30.9	2667.0	19.2
51.0	3060.0	3132.0	1388075.0	31.9	2861.0	19.4
54.0	3240.0	3380.0	1422299.0	32.7	3200.0	19.6
56.0	3360.0	3721.0	1448399.0	33.3	3271.0	19.7
58.0	3480.0	4062.0	1495069.0	34.3	3816.0	19.9
60.0	3600.0	4403.0	1535493.0	35.3	3875.0	20.1
61.0	3660.0	4574.0	1558729.0	35.8	4327.0	20.2
62.0	3720.0	4744.0	1576202.0	36.2	4409.0	20.3
63.0	3780.0	4915.0	1592711.0	36.6	4700.0	20.4
64.0	3840.0	5086.0	1607202.0	36.9	4818.0	20.4
65.0	3900.0	5257.0	1621724.0	37.2	5040.0	20.5
66.0	3960.0	5427.0	1635525.0	37.5	5184.0	20.5
67.0	4020.0	5260.0	1643128.0	37.7	5250.0	20.6
68.0	4080.0	5092.0	1641128.0	37.7	5170.0	20.6
69.0	4140.0	4925.0	1634141.0	37.5	5079.0	20.5
70.0	4200.0	4758.0	1624254.0	37.3	4933.0	20.5
71.0	4260.0	4590.0	1612943.0	37.0	4793.0	20.4
72.0	4320.0	4423.0	1598867.0	36.7	4589.0	20.4
73.0	4380.0	4255.0	1587277.0	36.4	4479.0	20.3
74.0	4440.0	4088.0	1574742.0	36.2	4285.0	20.3
75.0	4500.0	3921.0	1562215.0	35.9	4142.0	20.2

Crescent Lake Dam
Dam-Break Analysis

Route 132 Crossing 0.659 miles downstream of Dam
Ponding Upstream of the Highway

TIME Minutes	TIME Seconds	INFLOW cfs	PONDED VOLUME cu. ft.	PONDED VOLUME acre-ft.	OUTFLOW cfs	STAGE ft
76.0	4560.0	3753.0	1549380.0	35.6	3960.0	20.2
77.0	4620.0	3586.0	1536417.0	35.3	3811.0	20.1
78.0	4680.0	3418.0	1520972.0	34.9	3708.0	20.0
79.0	4740.0	3251.0	1502845.0	34.5	3565.0	20.0
80.0	4800.0	3083.0	1483339.0	34.1	3419.0	19.9
82.0	4920.0	2748.0	1448371.0	33.3	2995.0	19.7
84.0	5040.0	2414.0	1409892.0	32.4	2808.0	19.5
86.0	5160.0	2300.0	1375956.0	31.6	2471.0	19.4
88.0	5280.0	2186.0	1351984.0	31.0	2415.0	19.3
90.0	5400.0	2071.0	1332485.0	30.6	2167.0	19.2
92.0	5520.0	1957.0	1315577.0	30.2	2142.0	19.1
94.0	5640.0	1843.0	1295105.0	29.7	1999.0	19.0
96.0	5760.0	1728.0	1274823.0	29.3	1910.0	18.9
99.0	5940.0	1556.0	1247158.0	28.6	1681.0	18.8
102.0	6120.0	1385.0	1217629.0	28.0	1587.0	18.6
105.0	6300.0	1213.0	1187317.0	27.3	1348.0	18.5
108.0	6480.0	1042.0	1156786.0	26.6	1246.0	18.3
114.0	6840.0	699.0	1066606.0	24.5	995.0	17.8
120.0	7200.0	667.0	956313.0	22.0	984.0	17.2
126.0	7560.0	636.0	840586.0	19.3	962.0	16.5
132.0	7920.0	604.0	723239.0	16.6	930.0	15.6
138.0	8280.0	573.0	607635.0	13.9	889.0	14.8
144.0	8640.0	541.0	495883.0	11.4	846.0	13.8
150.0	9000.0	540.0	393896.0	9.0	802.0	12.8
162.0	9720.0	537.0	245213.0	5.6	688.0	10.9
174.0	10440.0	534.0	161477.0	3.7	616.0	9.5
180.0	10800.0	534.0	132805.0	3.0	611.0	8.9

5. SUMMARY

The water level was above the roadway from 42 minutes until 108 minutes after the start of failure of Crescent Lake Dam. The level pond extended upstream 600 feet at maximum stage of 20.6 feet. Peak flow at this road crossing was 5,250 cfs at time 67 minutes (1.12 hr), attenuated from the DAMBRK peak inflow of 5,427 cfs one minute earlier.