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25 YEAR [illegible] EVENT
w/ COMPLETE HYDROGRAPH

Q.1X.0013

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1                                                    ....
                    FLOOD HYDROGRAPH PACKAGE HEC 1 (IBM XT 512K VERSION)  OCT 1,1984
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ....


THIS HEC 1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS AND RATIOS ARE REDUCED TO 5 AND 4, RESPECTIVELY

1                                                  HEC-1 INPUT                                                    PAGE  1

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

            1           ID         ACUSHNET RIVER WATERSHED STUDY
            2           ID         NEW BEDFORD HARBOR PROJECT NO. 6002
            3           ID         JAN FEB, 1988
            4           ID
            5           ID         10 YEAR RECURRENCE EVENT
            6           ID
                        *DIAGRAM
            7           IT       15 10JAN88    1200      300
            8           IO        3

            9           KK   SUBBASIN 1
           10           KM   RUNOFF SNYDERS METHOD
           11           BA     6.8
           12           PB    6.25
           13           IN     180 10JAN88    1200
           14           PI    .781     .781     .781     .781     .781     .781     .781     .781
           15           LU     .53     .135        0
           16           US      3.      .57

           17           KK   NB RESERVOIR
           18           KM   ROUTING-MODIFIED PULS METHOD
           19           RS       1     STOR     1448        0
           20           SV    1448     2109     2770     3431     4092
           21           SQ       0      169      478      878     1352

           22           KK   SUBBASIN 2
           23           KM   ROUTING-MUSKINGUM METHOD
           24           RM      10     2.59       .2

           25           KK   SUBBASIN 2
           26           KM   RUNOFF-SNYDERS METHOD
           27           BA     8.4
           28           PB    6.25
           29           IN     180 10JAN88    1200
           30           PI    .781     .781     .781     .781     .781     .781     .781     .781
           31           LU     .53      .14        0
           32           US     3.2      .57
```

```
 32          US      3.2      .57

 33          KK    COSTATION 1-2
 34          KM    COMBINE HYDROGRAPH 1 AND 2
 35          HC        2

 36          KK    HAMLIN STREET DAM
 37          KM    ROUTING MODIFIED PULS METHOD
 38          RS        1     STOR      105        0
 39          SV      105      264      463      642      821     1000
 40          SQ        0       43      362      715     1134     1436

 41          KK    SUBBASIN 3
 42          KM    ROUTING MUSKINGUM METHOD
 43          RM        5      .88       .2
1                                        HEC 1 INPUT                                                          PAGE

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

 44          KK    SUBBASIN 3
 45          KM    RUNOFF-SNYDERS METHOD
 46          BA      2.2
 47          PB     6.25
 48          IN      180 10JAN88    1200
 49          PI     .781     .781     .781     .781     .781     .781     .781     .781
 50          LU      .53      .12       20
 51          US      1.8      .57

 52          KK    COSTATION 2-3
 53          KM    COMBINE HYDROGRAPHS 1 AND 2
 54          HC        2

 55          KK    MILL DAM
 56          KM    ROUTING-MODIFIED PULS
 57          RS        1     STOR       28        0
 58          SV       28       90      152      214      276
 59          SQ        0      333      941     1730     2664
 60          KO        1        2
 61          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE      (V) ROUTING          (    ) DIVERSION
  NO.      (.) CONNECTOR        (    ) RETURN OF DIVERTED FLOW

   9       SUBBA
               V
               V
  17       NB RE
               V
               V
  22       SUBBA
               .
               .
  25           .        SUBBA
               .           ..
               .           .
  33       COSTA............
               V
               V
  36       HAMLI
               V
               V
  41       SUBBA
               .
               .
```

```
                .
                .
   44           .       SUBBA
                .          .
                .          .
   52       COSTA............
                V
                V
   55       MILL

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                                    ....
                                FLOOD HYDROGRAPH PACKAGE HEC 1 (IBM XT 512K VERSION)  OCT 1,1984
                U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                                     ....



                                ACUSHNET RIVER WATERSHED STUDY
                                NEW BEDFORD HARBOR PROJECT NO. 6002
                                JAN-FEB, 1988

                                10 YEAR RECURRENCE EVENT


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

     II          HYDROGRAPH TIME DATA
                        NMIN           15  MINUTES IN COMPUTATION INTERVAL
                       IDATE     10JAN88  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     13JAN88  ENDING DATE
                      NDTIME        1445  ENDING TIME

                 COMPUTATION INTERVAL      .25 HOURS
                      TOTAL TIME BASE    74.75 HOURS

          ENGLISH UNITS


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


             ............
             .          .
   9 KK      .    SUBBA .     SIN 1
             .          .
             ............
                            RUNOFF-SNYDERS METHOD

  13 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         180  TIME INTERVAL IN MINUTES
                      JXDATE     10JAN88  STARTING DATE
                      JXTIME        1200  STARTING TIME

               SUBBASIN RUNOFF DATA

  11 BA          SUBBASIN CHARACTERISTICS
                       TAREA        6.80  SUBBASIN AREA

                 PRECIPITATION DATA
```

PRECIPITATION DATA

12 PB STORM 6.25 BASIN TOTAL PRECIPITATION

14 PI INCREMENTAL PRECIPITATION PATTERN

.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.07	.07	.07	.07	.07	.07				

15 LU UNIFORM LOSS RATE

STRTL .53 INITIAL LOSS
CNSTL .14 UNIFORM LOSS RATE
RTIMP .00 PERCENT IMPERVIOUS AREA

16 US SNYDER UNITGRAPH

TP 3.00 LAG
CP .57 PEAKING COEFFICIENT

SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

...

UNIT HYDROGRAPH PARAMETERS

CLARK TC 3.23 HR R 3.28 HR
SNYDER TP 3.01 HR CP .57

UNIT HYDROGRAPH
77 END OF PERIOD ORDINATES

20.	73.	150.	240.	340.	446.	555.	656.	738.	800.
841.	860.	850.	805.	746.	692.	641.	594.	550.	510.
473.	438.	406.	376.	348.	323.	299.	277.	257.	238.
221.	204.	190.	176.	163.	151.	140.	129.	120.	111.
103.	95.	88.	82.	76.	70.	65.	60.	56.	52.
48.	45.	41.	38.	35.	33.	30.	28.	26.	24.
22.	21.	19.	18.	17.	15.	14.	13.	12.	11.
10.	10.	9.	8.	8.	7.	7.			

... ...

HYDROGRAPH AT STATION SUBBA

TOTAL RAINFALL = 6.25, TOTAL LOSS = 3.50, TOTAL EXCESS = 2.75

	PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72 HR	74.75 HR
+			(CFS)			
+	548.	21.50	547.	469.	167.	161.
			(INCHES) .748	2.563	2.742	2.742
			(AC-FT) 271.	929.	994.	994.

CUMULATIVE AREA = 6.80 SQ MI

*** ***

[illegible]

[illegible] MUSKINGUM ROUTING

[illegible] 1 NUMBER OF SUBREACHES

[illegible]

[illegible] 1990.00 INITIAL CONDITION

[illegible]

[illegible]	INFLOW	1990.0	2107.0	[illegible]	[illegible]	[illegible]
[illegible]	OUTFLOW	0.	[illegible]	[illegible]	[illegible]	[illegible]

HYDROGRAPH AT STATION NO RC

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6 HR	24 HR	72 HR	144 HR
* (CFS)	(HRS)	(CFS)				
* 204.	29.00		201.	179.	117.	113.
		(INCHES)	.275	.221	.120	.120
		(MM)	7.	5.	3.	3.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6 HR	24 HR	72 HR	144 HR
* (AC-FT)	(HRS)					
2104.	29.00		2170.	2100.	1077.	1002.

CUMULATIVE AREA 0.07 SQ MI

[illegible] SUBBA STA 2

****

ROUTING-MUSKINGUM METHOD

HYDROGRAPH ROUTING DATA

24 RM MUSKINGUM ROUTING

NSTPS	10	NUMBER OF SUBREACHES
AMSKK	2.59	MUSKINGUM K
X	.20	MUSKINGUM X

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

HYDROGRAPH AT STATION SUBBA

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6 HR	24 HR	72 HR	144 HR

PEAK FLOW (CFS)	TIME (HR)		6 HR	24 HR	72 HR	74.75 HR
+		(CFS)				
+ 204.	31.50		200.	174.	114.	110.
		(INCHES)	.274	.950	1.873	1.873
		(AC FT)	94.	345.	679.	679.

CUMULATIVE AREA 6.80 SQ MI

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                ..............
                .            .
 25 KK          .    SUBBA   .      SIN 2
                .            .
                ..............
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RUNOFF-SNYDERS METHOD

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 29 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN        180  TIME INTERVAL IN MINUTES
                    JXDATE    10JAN88  STARTING DATE
                    JXTIME       1200  STARTING TIME

              SUBBASIN RUNOFF DATA

 27 BA          SUBBASIN CHARACTERISTICS
                     TAREA       8.40  SUBBASIN AREA

                PRECIPITATION DATA

 28 PB                STORM       6.25  BASIN TOTAL PRECIPITATION

 30 PI            INCREMENTAL PRECIPITATION PATTERN
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07       .07       .07       .07       .07
                     .07       .07       .07       .07       .07       .07

 31 LU          UNIFORM LOSS RATE
                     STRTL        .53  INITIAL LOSS
                     CNSTL        .14  UNIFORM LOSS RATE
                     RTIMP        .00  PERCENT IMPERVIOUS AREA

 32 US          SNYDER UNITGRAPH
                       TP       3.20  LAG
                       CP        .57  PEAKING COEFFICIENT

                SYNTHETIC ACCUMULATED AREA VS. TIME CURVE WILL BE USED
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UNIT HYDROGRAPH PARAMETERS

CLARK TC 3.46 HR R 3.50 HR

SNYDER TP 3.18 HR CP .57

UNIT HYDROGRAPH

82 END-OF-PERIOD ORDINATES

UNIT HYDROGRAPH
82 END OF PERIOD ORDINATES

21.	77.	158.	254.	359.	472.	590.	706.	806.	885.
945.	983.	997.	979.	927.	863.	804.	748.	697.	649.
604.	562.	524.	488.	454.	423.	394.	366.	341.	[illegible]
296.	275.	256.	239.	222.	207.	193.	179.	167.	155.
145.	135.	126.	117.	109.	101.	94.	88.	82.	76.
71.	66.	61.	57.	53.	50.	46.	43.	40.	37.
35.	32.	30.	28.	26.	24.	23.	21.	20.	19.
17.	16.	15.	14.	13.	12.	11.	10.	10.	9.
8.	8.								

... ...

HYDROGRAPH AT STATION SUBBA

TOTAL RAINFALL - 6.25, TOTAL LOSS - 3.61, TOTAL EXCESS 2.64

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24 HR	72 HR	74.75 HR
+		(CFS)				
+ 650.	22.75		648.	552.	198.	191.
		(INCHES)	.717	2.443	2.632	2.632
		(AC FT)	321.	1095.	1179.	1179.

CUMULATIVE AREA = 8.40 SQ MI

*** ***

33 KK COSTA TION 1-2

COMBINE HYDROGRAPH 1 AND 2

35 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

... ...

HYDROGRAPH AT STATION COSTA

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	74.75-HR
+		(CFS)				
+ 795.	24.25		777.	643.	312.	301.
		(INCHES)	.475	1.573	2.293	2.293
		(AC-FT)	385.	1275.	1858.	1859.

CUMULATIVE AREA - 15.20 SQ MI

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                .              .
 36 KK          :     HAMLI    :     N STREET DAM
                .              .
                ..............
                          ROUTING MODIFIED PUL . METHOD

            HYDROGRAPH ROUTING DATA

 38 RS          STORAGE ROUTING
                     NSTPS            1  NUMBER OF SUBREACHES
                      ITYP         STOR  TYPE OF INITIAL CONDITION
                     RSVRIC       105.00  INITIAL CONDITION
                          X          .00 WORKING R AND D COEFFICIENT

 39 SV            STORAGE        105.0      284.0      463.0      642.0      821.0     1000.0

 40 SO          DISCHARGE           0.         33.       362.       713.      1133.      1436
                                                                   ...

    ...            ...            ...            ...            ...

                    HYDROGRAPH AT STATION    HAMLI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      74.75 HR
+   (CFS)        (HR)
                              (CFS)
+     696.      26.50          677.         540.         277.         266.
                         (INCHES)        .414        1.322        2.031        2.031
                          (AC-FT)        336.        1072.        1646.        1646.

 PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      74.75 HR
+  (AC-FT)       (HR)
     634.      26.50          624.         554.         404.         393.

                         CUMULATIVE AREA =    15.20 SQ MI

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

                ..............
                .              .
 41 KK          :     SUBBA    :     SIN 3
                .              .
                ..............
                          ROUTING-MUSKINGUM METHOD

            HYDROGRAPH ROUTING DATA

 43 RM          MUSKINGUM ROUTING
                     NSTPS            5 NUMBER OF SUBREACHES
                     AMSKK          .88 MUSKINGUM K
                         X          .20 MUSKINGUM X
                                                                   ...

    ...            ...            ...            ...            ...

                    HYDROGRAPH AT STATION    SUBBA

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      74.75 HR
+   (CFS)        (HR)
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```
  PEAK FLOW      TIME
                                          6 HR        24 HR        72 HR      74.75 HR
+   (CFS)        (HR)
                             (CFS)
+     696.      27.25                     677.         540.         276.         265.
                          (INCHES)        .414        1.322        2.022        2.022
                           (AC FT)        336.        1072.        1639.        1639.

                         CUMULATIVE AREA      15.20 SQ MI


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

              **************
              *            *
  44 KK       *   SUBBA    *     SIN 3
              *            *
              **************

                          RUNOFF-SNYDERS METHOD

  48 IN           TIME DATA FOR INPUT TIME SERIES
                        JXMIN         180  TIME INTERVAL IN MINUTES
                       JXDATE     10JAN88  STARTING DATE
                       JXTIME        1200  STARTING TIME

                SUBBASIN RUNOFF DATA

  46 BA           SUBBASIN CHARACTERISTICS
                        TAREA        2.20  SUBBASIN AREA

                  PRECIPITATION DATA

  47 PB                 STORM        6.25  BASIN TOTAL PRECIPITATION

  49 PI             INCREMENTAL PRECIPITATION PATTERN
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07        .07        .07        .07        .07
                        .07        .07        .07        .07        .07        .07

  50 LU           UNIFORM LOSS RATE
                        STRTL         .53  INITIAL LOSS
                        CNSTL         .12  UNIFORM LOSS RATE
                        RTIMP       20.00  PERCENT IMPERVIOUS AREA

  51 US           SNYDER UNITGRAPH
                           TP        1.80  LAG
                           CP         .57  PEAKING COEFFICIENT

                  SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

                                                    ***

                                         UNIT HYDROGRAPH PARAMETERS
                                     CLARK    TC  2.01 HR        R  1.94 HR
                                    SNYDER    TP  1.80 HR       CP    .57

                                              UNIT HYDROGRAPH
                                         46 END OF PERIOD ORDINATES
```

46 END OF PERIOD ORDINATES

21.	79.	159.	250.	339.	409.	450.	457.	425.	374.
328.	289.	254.	223.	196.	172.	152.	133.	117.	103.
91.	80.	70.	62.	54.	48.	42.	37.	32.	28.
25.	22.	19.	17.	15.	13.	12.	10.	9.	8.
7.	6.	5.	5.	4.	4.				

... ...

HYDROGRAPH AT STATION SUBBA

TOTAL RAINFALL = 6.25, TOTAL LOSS = 2.53, TOTAL EXCESS = 3.72

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6 HR	24 HR	72 HR	74.75 HR
+ (CFS)	(HR)					
		(CFS)				
+ 232.	13.75		232.	210.	73.	70.
		(INCHES)	.982	3.549	3.700	3.700
		(AC-FT)	115.	416.	434.	434.

CUMULATIVE AREA = 2.20 SQ MI

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              **************
              *            *
   52 KK      *   COSTA    *      TION 2-3
              *            *
              **************
```

COMBINE HYDROGRAPHS 1 AND 2

54 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

...

... ...

HYDROGRAPH AT STATION COSTA

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6 HR	24-HR	72 HR	74.75 HR
+ (CFS)	(HR)					
		(CFS)				
+ 884.	24.50		843.	664.	348.	336.
		(INCHES)	.451	1.419	2.230	2.234
		(AC-FT)	418.	1317.	2070.	2074.

CUMULATIVE AREA = 17.40 SQ MI

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              **************
              *            *
   55 KK      *    MILL    *      DAM
              *            *
              **************
```

ROUTING MODIFIED PULS

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..............
                    ROUTING MODIFIED PULS

60 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          2  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

             HYDROGRAPH ROUTING DATA

57 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC      28.00  INITIAL CONDITION
                         X        .00 WORKING R AND D COEFFICIENT

58 SV            STORAGE       28.0      90.0      152.0      214.0      276.0

59 SO          DISCHARGE        0.       333.       941.      1730.      2664.
                                                              ...
```

HYDROGRAPH AT STATION MIEE

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE
10	JAN	1200	1	0.	28.00	11	JAN	1300	101	865.	144.29	-12	JAN	1400	201	212.	67.40
10	JAN	1215	2	0.	28.00	-11	JAN	1315	102	867.	144.45	12	JAN	1415	202	209.	66.95
10	JAN	1230	3	0.	28.02	11	JAN	1330	103	866.	144.38	12	JAN	1430	203	207.	66.51
10	JAN	1245	4	0.	28.06	11	JAN	1345	104	863.	144.07	12	JAN	1445	204	204.	66.07
10	JAN	1300	5	1.	28.15	11	JAN	1400	105	858.	143.56	12	JAN	1500	205	202.	65.65
10	JAN	1315	6	2.	28.31	11	JAN	1415	106	851.	142.87	12	JAN	1515	206	200.	65.24
10	JAN	1330	7	3.	28.55	11	JAN	1430	107	844.	142.06	12	JAN	1530	207	198.	64.84
10	JAN	1345	8	5.	28.87	11	JAN	1445	108	835.	141.18	12	JAN	1545	208	196.	64.44
10	JAN	1400	9	7.	29.27	11	JAN	1500	109	826.	140.26	12	JAN	1600	209	194.	64.06
10	JAN	1415	10	9.	29.75	11	JAN	1515	110	817.	139.31	12	JAN	1615	210	192.	63.68
10	JAN	1430	11	12.	30.30	11	JAN	1530	111	807.	138.36	12	JAN	1630	211	190.	63.32
10	JAN	1445	12	16.	30.94	11	JAN	1545	112	798.	137.40	12	JAN	1645	212	188.	62.96
10	JAN	1500	13	20.	31.70	11	JAN	1600	113	788.	136.44	12	JAN	1700	213	186.	62.61
10	JAN	1515	14	25.	32.61	11	JAN	1615	114	779.	135.47	12	JAN	1715	214	184.	62.26
10	JAN	1530	15	31.	33.68	11	JAN	1630	115	769.	134.50	12	JAN	1730	215	182.	61.93
10	JAN	1545	16	37.	34.92	11	JAN	1645	116	760.	133.53	12	JAN	1745	216	180.	61.60
10	JAN	1600	17	45.	36.33	11	JAN	1700	117	750.	132.55	12	JAN	1800	217	179.	61.28
10	JAN	1615	18	53.	37.88	11	JAN	1715	118	740.	131.55	12	JAN	1815	218	177.	60.96
10	JAN	1630	19	62.	39.52	11	JAN	1730	119	731.	130.55	12	JAN	1830	219	175.	60.66
10	JAN	1645	20	71.	41.23	11	JAN	1745	120	721.	129.54	12	JAN	1845	220	174.	60.35
10	JAN	1700	21	80.	42.96	-11	JAN	1800	121	711.	128.53	12	JAN	1900	221	172.	60.06
10	JAN	1715	22	90.	44.69	11	JAN	1815	122	701.	127.50	12	JAN	1915	222	171.	59.77
10	JAN	1730	23	99.	46.41	11	JAN	1830	123	691.	126.47	12	JAN	1930	223	169.	59.49
10	JAN	1745	24	108.	48.09	11	JAN	1845	124	680.	125.43	12	JAN	1945	224	168.	59.23
10	JAN	1800	25	117.	49.73	11	JAN	1900	125	670.	124.39	12	JAN	2000	225	166.	58.94
10	JAN	1815	26	125.	51.31	11	JAN	1915	126	660.	123.35	12	JAN	2015	226	165.	58.67
10	JAN	1830	27	133.	52.84	11	JAN	1930	127	650.	122.31	12	JAN	2030	227	163.	58.41
10	JAN	1845	28	141.	54.31	11	JAN	1945	128	640.	121.26	12	JAN	2045	228	162.	58.15
10	JAN	1900	29	149.	55.71	11	JAN	2000	129	629.	120.22	12	JAN	2100	229	161.	57.90
10	JAN	1915	30	156.	57.06	11	JAN	2015	130	619.	119.18	12	JAN	2115	230	159.	57.66
10	JAN	1930	31	163.	58.34	11	JAN	2030	131	609.	118.14	12	JAN	2130	231	158.	57.41
10	JAN	1945	32	170.	59.56	11	JAN	2045	132	599.	117.11	12	JAN	2145	232	157.	57.18
10	JAN	2000	33	176.	60.72	11	JAN	2100	133	589.	116.08	12	JAN	2200	233	155.	56.94
10	JAN	2015	34	182.	61.83	11	JAN	2115	134	579.	115.06	12	JAN	2215	234	154.	56.71
10	JAN	2030	35	187.	62.88	11	JAN	2130	135	569.	114.04	12	JAN	2230	235	153.	56.49
10	JAN	2045	36	193.	63.89	11	JAN	2145	136	559.	113.04	12	JAN	2245	236	152.	56.27
10	JAN	2100	37	198.	64.84	11	JAN	2200	137	[illegible]	112.04	12	JAN	2300	237	151.	56.05
10	JAN	2115	38	203.	65.75	11	JAN	2215	138	[illegible]	111.06	12	JAN	2315	[illegible]	150.	55.84
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

10	JAN	2115	38	203.	65.75	11	JAN	2215	138	539.	111.06	12	JAN	[illegible]	[illegible]	146.	[illegible]
10	JAN	2130	39	207.	66.62	11	JAN	2230	139	530.	110.08	12	JAN	2330	239	146.	[illegible]
10	JAN	2145	40	212.	67.45	11	JAN	2245	140	520.	109.12	12	JAN	2345	240	[illegible]	[illegible]
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10	JAN	2215	42	220.	69.01	11	JAN	2315	142	502.	107.23	13	JAN	0015	242	[illegible]	[illegible]
10	JAN	2230	43	224.	69.74	11	JAN	2330	143	493.	106.30	13	JAN	0030	243	[illegible]	[illegible]
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10	JAN	2315	46	238.	72.26	12	JAN	0015	146	467.	[illegible]	13	JAN	0115	246	141.	[illegible]
10	JAN	2330	47	244.	73.44	12	JAN	0030	147	458.	[illegible]	13	JAN	0130	247	140.	[illegible]
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11	JAN	0415	66	532.	110.25	12	JAN	0515	166	329.	89.33	13	JAN	0615	266	123.	50.98
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11	JAN	1015	90	795.	137.08	12	JAN	1115	190	242.	73.13	13	JAN	1215	290	107.	47.91
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11	JAN	1245	100	862.	143.94	12	JAN	1345	200	214.	67.86	13	JAN	1445	300	101.	46.81

PEAK FLOW TIME MAXIMUM AVERAGE FLOW

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6 HR	24 HR	72 HR	74.75 HR
+ (CFS)	(HR)					
		(CFS)				
+ 867.	25.25		834.	660.	345.	333.
		(INCHES)	.446	1.410	2.213	2.214
		(AC FT)	414.	1308.	2054.	2055.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6 HR	24 HR	72 HR	74.75 HR
+ (AC FT)	(HR)				
144.	25.25	141.	123.	83.	81.

CUMULATIVE AREA = 17.40 SQ MI

1

STATION MILL

```
                                    (I) INFLOW,    (O) OUTFLOW
         0.      100.      200.      300.      400.      500.      600.      700.      800.      900.        0.        0.        0.
                                                                                  (S) STORAGE
         0.        0.        0.        0.        0.        0.        0.       40.       80.      120.      160.        0.        0.
DAHRMN PER
101200   1I---------.---------.---------.---------.---------.---------.------S  .---------.---------.---------.---------.---------.
101215   2I         .         .         .         .         .         .      S  .         .         .         .         .         .
101230   3I         .         .         .         .         .         .      S  .         .         .         .         .         .
101245   4I         .         .         .         .         .         .      S  .         .         .         .         .         .
101300   5OI        .         .         .         .         .         .      S  .         .         .         .         .         .
101315   6OI        .         .         .         .         .         .      S  .         .         .         .         .         .
101330   7O I       .         .         .         .         .         .      S  .         .         .         .         .         .
101345   8O I       .         .         .         .         .         .      S  .         .         .         .         .         .
101400   9.O I      .         .         .         .         .         .      S  .         .         .         .         .         .
101415   10.O I     .         .         .         .         .         .      S  .         .         .         .         .         .
101430   11.O. I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . .
101445   12. O  I   .         .         .         .         .         .       S .         .         .         .         .         .
101500   13. O   I  .         .         .         .         .         .       S .         .         .         .         .         .
101515   14. O    I .         .         .         .         .         .       S .         .         .         .         .         .
101530   15. O     I.         .         .         .         .         .       S .         .         .         .         .         .
101545   16.  O     I         .         .         .         .         .        S.         .         .         .         .         .
101600   17.  O     . I       .         .         .         .         .        S.         .         .         .         .         .
101615   18.   O    .  I      .         .         .         .         .        S.         .         .         .         .         .
101630   19.    O   .   I     .         .         .         .         .         S         .         .         .         .         .
101645   20.     O  .    I    .         .         .         .         .         S         .         .         .         .         .
101700   21. . . O . . . I . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
101715   22.      O .      I  .         .         .         .         .         .S        .         .         .         .         .
101730   23.        O       I .         .         .         .         .         . S       .         .         .         .         .
101745   24.        .O       I.         .         .         .         .         . S       .         .         .         .         .
101800   25.        . O      I.         .         .         .         .         . S       .         .         .         .         .
101815   26.        .  O      I         .         .         .         .         .  S      .         .         .         .         .
101830   27.        .  O      .I        .         .         .         .         .  S      .         .         .         .         .
101845   28.        .   O     .I        .         .         .         .         .   S     .         .         .         .         .
101900   29.        .    O    . I       .         .         .         .         .   S     .         .         .         .         .
101915   30.        .     O   . I       .         .         .         .         .   S     .         .         .         .         .
101930   31. . . . . . O . . I . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . .
101945   32.        .      O  .  I      .         .         .         .         .    S    .         .         .         .         .
102000   33.        .       O .  I      .         .         .         .         .    S    .         .         .         .         .
102015   34.        .       O .  I      .         .         .         .         .    S    .         .         .         .         .
102030   35.        .        O.   I     .         .         .         .         .     S   .         .         .         .         .
102045   36.        .        O.   I     .         .         .         .         .     S   .         .         .         .         .
102100   37.        .         O   I     .         .         .         .         .     S   .         .         .         .         .
102115   38.        .         O    I    .         .         .         .         .     S   .         .         .         .         .
102130   39.        .         .O   I    .         .         .         .         .      S  .         .         .         .         .
102145   40.        .         .O   I    .         .         .         .         .      S  .         .         .         .         .
102200   41. . . . . . . . . . . O .I. . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . .
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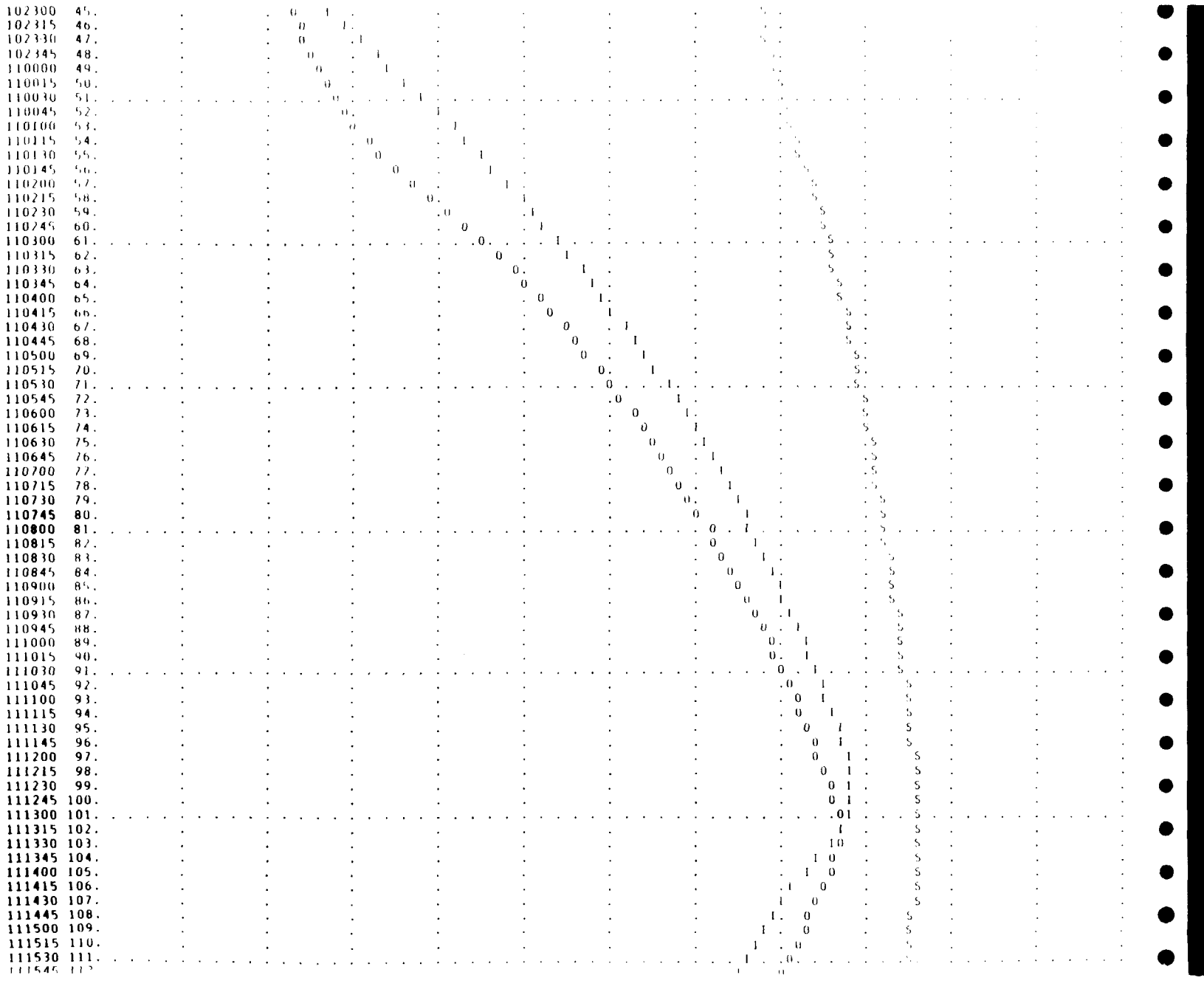
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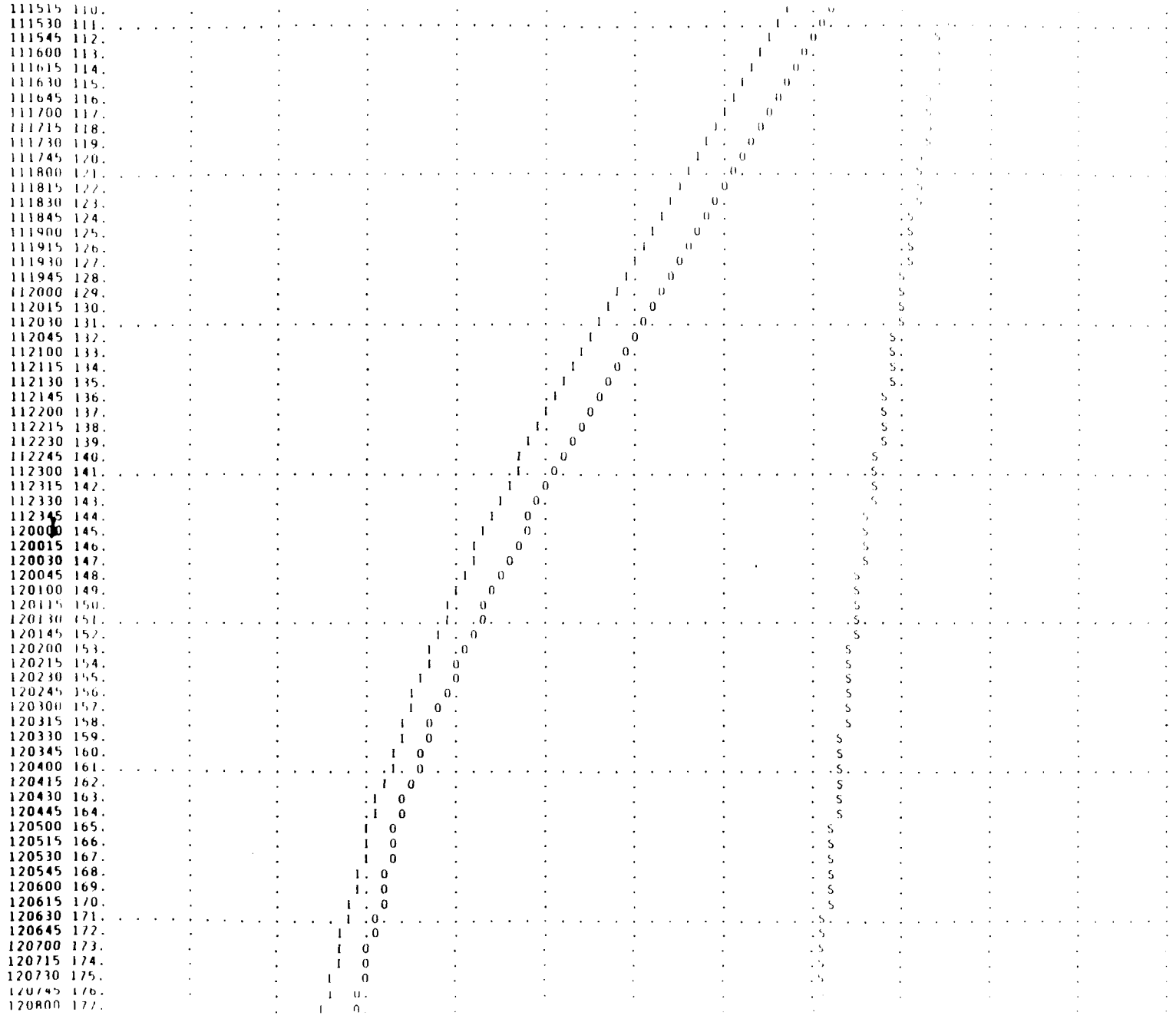
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120845 180.                I    0 .
120900 181.              I  .0.
120915 182.                I   0 .
120930 183.              I    0 .
120945 184.              I   0 .
121000 185.              I   0 .
121015 186.            I    0 .
121030 187.            I   0 .
121045 188.            I   0 .
121100 189.            I   0 .                                      S
121115 190.           .I   0 .                                      S
121130 191.           .I. 0 .                                       S
121145 192.           .I   0 .                                      S
121200 193.           .I 0 .                                        S
121215 194.           I   0 .                                       S
121230 195.           I   0 .                                       S
121245 196.           I 0 .                                       S
121300 197.           I 0 .                                       S
121315 198.           I 0 .                                       S
121330 199.          I. 0 .                                       S
121345 200.          I.0 .                                        S
121400 201.          I.0.                                         S.
121415 202.          I.0 .                                        S
121430 203.          I.0 .                                        S
121445 204.        I 0 .                                        S
121500 205.        I 0 .                                      S
121515 206.        I 0 .                                      S
121530 207.        I 0 .                                      S
121545 208.        I 0 .                                      S
121600 209.        I0. .                                      S
121615 210.       I 0. .                                      S
121630 211.       I.0. .                                      S
121645 212.       I 0. .                                      S
121700 213.       I 0. .                                      S
121715 214.       I0 . .                                      S
121730 215.       I0 . .                                    S
121745 216.      I 0 . .                                    S
121800 217.      I 0 . .                                    S
121815 218.      I 0 . .                                    S
121830 219.      I 0 . .                                    S
121845 220.      I0  . .                                    S
121900 221.      I0. . .                                    S.
121915 222.      I0  . .                                    S
121930 223.      I0  . .                                    S
121945 224.     I 0  . .                                    S
122000 225.     I 0  . .                                    S
122015 226.     I0   . .                                    S
122030 227.     I0   . .                                    S
122045 228.     I0   . .                                    S
122100 229.     I0   . .                                  S
122115 230.     I0   . .                                  S
122130 231.     I0 . . .                                  S
122145 232.     I0   . .                                  S
122200 233.    I 0   . .                                  S
122215 234.    I0    . .                                  S
122230 235.    I0    . .                                  S
122245 236.    I0    . .                                  S
122300 237.    I0    . .                                  S
122315 238.    I0    . .                                  S
122330 239.    I0    . .                                  S
122345 240.    I0    . .                                  S
130000 241.    I0. . . .                                  S
130015 242.    I0    . .                                  S
130030 243.   I0     . .                                  S
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130015 242.        .  IO
130030 243.        .  IO     .     .     .     .     .     .  S  .     .     .     .     .
130045 244.        .  IO     .     .     .     .     .     .  S  .     .     .     .     .
130100 245.        .  IO     .     .     .     .     .     .  S  .     .     .     .     .
130115 246.        .  IO     .     .     .     .     .     .  S  .     .     .     .     .
130130 247.        .  IO     .     .     .     .     .     .  S  .     .     .     .     .
130145 248.        .  IO     .     .     .     .     .     . S   .     .     .     .     .
130200 249.        .  IO     .     .     .     .     .     . S   .     .     .     .     .
130215 250.        .  IO     .     .     .     .     .     . S   .     .     .     .     .
130230 251. . . . . . IO . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . .
130245 252.        .  IO     .     .     .     .     .     . S   .     .     .     .     .
130300 253.        .  I      .     .     .     .     .     . S   .     .     .     .     .
130315 254.        .  I      .     .     .     .     .     . S   .     .     .     .     .
130330 255.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130345 256.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130400 257.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130415 258.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130430 259.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130445 260.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130500 261. . . . . . IO. . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . .
130515 262.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130530 263.        . IO      .     .     .     .     .     . S   .     .     .     .     .
130545 264.        . I       .     .     .     .     .     . S   .     .     .     .     .
130600 265.        . I       .     .     .     .     .     . S   .     .     .     .     .
130615 266.        . I       .     .     .     .     .     . S   .     .     .     .     .
130630 267.        . I       .     .     .     .     .     . S   .     .     .     .     .
130645 268.        . I       .     .     .     .     .     . S   .     .     .     .     .
130700 269.        .IO       .     .     .     .     .     . S   .     .     .     .     .
130715 270.        .IO       .     .     .     .     .     . S   .     .     .     .     .
130730 271. . . . . .IO . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . .
130745 272.        .IO       .     .     .     .     .     . S   .     .     .     .     .
130800 273.        .IO       .     .     .     .     .     . S   .     .     .     .     .
130815 274.        .IO       .     .     .     .     .     .S    .     .     .     .     .
130830 275.        .IO       .     .     .     .     .     .S    .     .     .     .     .
130845 276.        .IO       .     .     .     .     .     .S    .     .     .     .     .
130900 277.        .IO       .     .     .     .     .     .S    .     .     .     .     .
130915 278.        .I        .     .     .     .     .     .S    .     .     .     .     .
130930 279.        .I        .     .     .     .     .     .S    .     .     .     .     .
130945 280.        .I        .     .     .     .     .     .S    .     .     .     .     .
131000 281. . . . . .I. . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . .
131015 282.        .I        .     .     .     .     .     .S    .     .     .     .     .
131030 283.        .I        .     .     .     .     .     .S    .     .     .     .     .
131045 284.        IO        .     .     .     .     .     .S    .     .     .     .     .
131100 285.        IO        .     .     .     .     .     .S    .     .     .     .     .
131115 286.        IO        .     .     .     .     .     .S    .     .     .     .     .
131130 287.        IO        .     .     .     .     .     .S    .     .     .     .     .
131145 288.        IO        .     .     .     .     .     .S    .     .     .     .     .
131200 289.        IO        .     .     .     .     .     .S    .     .     .     .     .
131215 290.        IO        .     .     .     .     .     .S    .     .     .     .     .
131230 291. . . . .IO. . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . .
131245 292.        IO        .     .     .     .     .     .S    .     .     .     .     .
131300 293.        IO        .     .     .     .     .     .S    .     .     .     .     .
131315 294.        I         .     .     .     .     .     .S    .     .     .     .     .
131330 295.        I         .     .     .     .     .     .S    .     .     .     .     .
131345 296.        I         .     .     .     .     .     .S    .     .     .     .     .
131400 297.        I         .     .     .     .     .     .S    .     .     .     .     .
131415 298.        I         .     .     .     .     .     .S    .     .     .     .     .
131430 299.        I         .     .     .     .     .     .S    .     .     .     .     .
131445 300.--------I---------.-----.-----.-----.     .     .S    .     .     .     .     .
1
1
```

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

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

					6 HOUR	24 HOUR	72 HOUR	
+	HYDROGRAPH AT	SUBBA	548.	31.50	547.	469.	167.	6.80
+	ROUTED TO	NB RE	204.	29.00	201.	174.	117.	6.80
+	ROUTED TO	SUBBA	204.	31.50	200.	174.	114.	6.80
+	HYDROGRAPH AT	SUBBA	650.	22.75	648.	552.	198.	8.40
+	2 COMBINED AT	COSTA	795.	24.25	777.	643.	312.	15.20
+	ROUTED TO	HAMLI	696.	26.50	677.	540.	277.	15.20
+	ROUTED TO	SUBBA	696.	27.25	677.	540.	276.	15.20
+	HYDROGRAPH AT	SUBBA	232.	13.75	232.	210.	73.	2.20
+	2 COMBINED AT	COSTA	884.	24.50	843.	664.	348.	17.40
+	ROUTED TO	MILL	867.	25.25	834.	660.	345.	17.40

*** NORMAL END OF HEC 1 ***

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50 YEAR STORM EVENT
w/ COMPLETE HYDROGRAPH

```
1                                                    ....
                    FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) OCT 1,1984
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ....


THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS AND RATIOS ARE REDUCED TO 5 AND 4, RESPECTIVELY


1                                                HEC-1 INPUT                                                    PAGE   1

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

            1           ID         ACUSHNET RIVER WATERSHED STUDY
            2           ID         NEW BEDFORD HARBOR PROJECT NO. 6002
            3           ID         JAN-FEB, 1988
            4           ID
            5           ID         10 YEAR RECURRENCE EVENT
            6           ID
                        *DIAGRAM
            7           IT      15 10JAN88    1200     300
            8           IO       3

            9           KK   SUBBASIN 1
           10           KM   RUNOFF-SNYDERS METHOD
           11           BA     6.8
           12           PB    7.85
           13           IN     180 10JAN88    1200
           14           PI    .981    .981    .981    .981    .981    .981    .981    .981
           15           LU     .53    .135       0
           16           US      3.     .57

           17           KK   NB RESERVOIR
           18           KM   ROUTING-MODIFIED PULS METHOD
           19           RS       1    STOR    1448       0
           20           SV    1448    2109    2770    3431    4092
           21           SQ       0     169     478     878    1352

           22           KK   SUBBASIN 2
           23           KM   ROUTING-MUSKINGUM METHOD
           24           RM      10    2.59      .2

           25           KK   SUBBASIN 2
           26           KM   RUNOFF-SNYDERS METHOD
           27           BA     8.4
           28           PB    7.85
           29           IN     180 10JAN88    1200
           30           PI    .981    .981    .981    .981    .981    .981    .981    .981
           31           LU     .53     .14       0
           32           US     3.2     .57

           33           KK   COSTATION 1-2
           34           KM   COMBINE HYDROGRAPH 1 AND 2
           35           HC       2

           36           KK   HAMLIN STREET DAM
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 36          KK   HAMLIN STREET DAM
 37          KM   ROUTING-MODIFIED PULS METHOD
 38          RS       1     STOR      105        0
 39          SV     105      284      463      642      821     1000
 40          SQ       0       33      362      713     1133     1436

 41          KK   SUBBASIN 3
 42          KM   ROUTING-MUSKINGUM METHOD
 43          RM       5      .88       .2
1                                          HEC-1 INPUT                                                    PAGE   2

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


 44          KK   SUBBASIN 3
 45          KM   RUNOFF-SNYDERS METHOD
 46          BA     2.2
 47          PB    7.85
 48          IN     180 10JAN88    1200
 49          PI    .981     .981     .981     .981     .981     .981     .981     .981
 50          LU     .53      .12       20
 51          US     1.8      .57

 52          KK   COSTATION 2-3
 53          KM   COMBINE HYDROGRAPHS 1 AND 2
 54          HC       2

 55          KK   MILL DAM
 56          KM   ROUTING-MODIFIED PULS
 57          RS       1     STOR       28        0
 58          SV      28       90      152      214      276
 59          SQ       0      333      941     1730     2664
 60          KO       1        2
 61          ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION
   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED FLOW

    9       SUBBA
                 V
                 V
   17       NB RE
                 V
                 V
   22       SUBBA
                 .
                 .
   25            .        SUBBA
                 .            .
                 .            .
   33       COSTA............
                 V
                 V
   36       HAMLI
                 V
                 V
   41       SUBBA
                 .
                 .
   44            .        SUBBA
                 .            .
                 .            .
   52       COSTA............
                 V
                 V
```

THIS LOCATION

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -OCT 1,1984
S OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

ACHERNEF RIVER WATERSHED STUDY
HARBOR PROJECT NO. 6002

EVENT

CONTROL

SCALE

VAL

GRAPH ORDINATES

.25 HOURS
.75 HOURS

ITATION

.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08

.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
.08	.08	.08	.08	.08	.08				

UNIFORM LOSS RATE

STRTL	.53	INITIAL LOSS
CNSTL	.14	UNIFORM LOSS RATE
RTIMP	.00	PERCENT IMPERVIOUS AREA

SNYDER UNITGRAPH

TP	[illegible]	LAG
CP	.57	PEAKING COEFFICIENT

SYNTHETIC [illegible] TIME [illegible] WILL BE USED

...

[illegible] UNIT HYDROGRAPH PARAMETERS

[illegible] 6.23 HR R= 3.28 HR

SNYDER [illegible] 9.81 HR CP .57

UNIT HYDROGRAPH

END-OF-PERIOD ORDINATES

20.	[illegible]	[illegible]	230.	[illegible]	446.	555.	656.	738.	800.
841.	[illegible]	[illegible]	805.	748.	695.	641.	594.	550.	510.
473.	430.	408.	376.	348.	323.	299.	277.	257.	238.
221.	204.	190.	176.	163.	[illegible]	140.	129.	120.	111.
103.	95.	88.	82.	76.	[illegible]	65.	60.	56.	52.
48.	[illegible]	41.	38.	35.	[illegible]	30.	28.	26.	24.
22.	[illegible]	19.	18.	17.	[illegible]	14.	13.	12.	11.
10.	10.	9.	8.	8.	[illegible]	7.			

...

HYDROGRAPH AT STATION SUBBA

TOTAL RAINFALL = 7.85, TOTAL LOSS = 3.55, TOTAL EXCESS = 4.30

FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 6-HR (CFS)	24-HR	72-HR	74.75-HR
839.	21.00	[illegible]	[illegible]	[illegible]	251.
		[illegible]	[illegible]	4.278	4.278
		[illegible]	[illegible]	1552.	1552.

[illegible]

[illegible] METHOD

HYDROGRAPH ROUTING DATA

NSTPS 1 NUMBER OF SUBREACHES
ITYP [illegible] TYPE OF INITIAL CONDITION
RSVRIC 1448.00 INITIAL CONDITION
X .00 WORKING R AND D COEFFICIENT

STORAGE	1448.0	2109.0	2770.0	3431.0	4092.0
DISCHARGE	0.	169.	478.	878.	1352.

...

HYDR[illegible] NO 26

FLOW	TIME (HR)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] AVERAGE FLOW [illegible] 72-HR 74.75-HR

[illegible] 105. [illegible] 3.145 [illegible]

[illegible] -HR [illegible]

[illegible] SUBA SUB 2

ROUTING MUSKINGUM METHOD

HYDROGRAPH [illegible] DATA

[illegible]

[illegible] AVERAGE FLOW [illegible] 72-HR 74.75-HR

[illegible] 188. 181.
[illegible] 3.081
[illegible] 1117.

CUMULATIVE AREA [illegible] 5.60 SQ MI

[illegible] AREA = 6.80 SQ MI

SUBBA   SIN 2

RUNOFF [illegible] METHOD

TIME DATA FO[illegible]
[illegible] INTERVAL IN MINUTES
[illegible] TING [illegible]
[illegible] TING TIME

[illegible]

PRECI[illegible]

[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08
[illegible]	.08	.08	.08	.08

UNIT[illegible]

[illegible] PARAMETERS
[illegible] 3.50 HR
[illegible] .57

[illegible] HYDROGRAPH
[illegible] PERIOD ORDINATES

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	806.	885.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	649.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	318.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	193.	179.	167.	156.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101.	94.	88.	82.	76.
71.	[illegible]	[illegible]	57.	53.	50.	46.	43.	40.	37.

```
       145.      [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
        71.        66.        61.        57.        53.        50.        46.        43.        40.        37.
        35.        32.        30.        28.        26.        24.        23.        21.        20.        18.
        17.        16.        15.        14.        13.        12.        11.        10.        10.         9.
         8.         8.

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

                              HYDROGRAPH AT STATION     SUBBA

 TOTAL RAINFALL =     7.85, TOTAL LOSS =     3.66, TOTAL EXCESS =     4.19

 [illegible]AK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR          24-HR          72-HR        74.75-HR
   (CFS)       (HR)
                            (CFS)
   1009.       22.25                        1007.           868.           314.           302.
                          (INCHES)          1.114          3.845          4.167          4.167
                           (AC-FT)           499.          1722.          1867.          1867.

                             CUMULATIVE AREA =     8.40 SQ MI

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

                  **************
                  *            *
 [illegible]3 KK  *    COSTA   *      TION 1-2
                  *            *
                  **************

                             COMBINE HYDROGRAPH 1 AND 2

                      HYDROGRAPH COMBINATION
                             ICOMP          2   NUMBER OF HYDROGRAPHS [illegible]

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

                              HYDROGRAPH AT STATION     COSTA

 [illegible]K FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR          24-HR          72-HR        74.75-HR
   (CFS)        (HR)
                            (CFS)
   1285.       24.50                        1242.          1030.           501.           483.
                          (INCHES)           .760          2.521          3.680          3.681
                           (AC-FT)           616.          2043.          2983.          2984.

                             CUMULATIVE AREA =    15.20 SQ MI

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

                  **************
                  *            *
 [illegible]KK    *    HANLI   *      N STREET DAM
                  *            *
                  **************

                             ROUTING MODIFIED PULS METHOD

                      HYDROGRAPH ROUTING DATA
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                HYDROGRAPH ROUTING DATA

38 RS             STORAGE ROUTING
                       NSTPS          1  NUMBER OF SUBREACHES
                        ITYP       STOR  TYPE OF INITIAL CONDITION
                      RSVRIC     105.00  INITIAL CONDITION
                           X        .00 WORKING R AND D COEFFICIENT

39 SV               STORAGE      105.0     284.0     463.0     642.0     821.0    1000.0

40 SQ             DISCHARGE         0.        33.       362.      713.      1133.     1436.
                                                                  ...

   ...              ...            ...            ...            ...

                     HYDROGRAPH AT STATION    HAMLI

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.75-HR
+  (CFS)       (HR)
                          (CFS)
+   1151.     26.25                1123.        903.        462.        445.
                        (INCHES)    .687       2.208       3.395       3.395
                         (AC-FT)    557.       1790.       2752.       2752.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR     74.75-HR
+  (AC-FT)     (HR)
     832.     26.25                 818.        722.        498.        483.

                        CUMULATIVE AREA =   15.20 SQ MI


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

            ************
            *          *
41 KK       *   SUBBA  *     SIN 3
            *          *
            ************
                        ROUTING-MUSKINGUM METHOD

                HYDROGRAPH ROUTING DATA

43 RM             MUSKINGUM ROUTING
                       NSTPS          5 NUMBER OF SUBREACHES
                       AMSKK        .88 MUSKINGUM K
                           X        .20 MUSKINGUM X
                                                                  ...

   ...              ...            ...            ...            ...

                     HYDROGRAPH AT STATION    SUBBA

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.75-HR
  (CFS)       (HR)
                          (CFS)
   1151.     27.25                1122.        902.        461.        444.
                        (INCHES)    .686       2.208       3.383       3.383
                         (AC-FT)    556.       1790.       2742.       2742.

                        CUMULATIVE AREA =   15.20 SQ MI
```

```
                (AC-FT)      556.      1790.      2742.      2742.
                CUMULATIVE AREA =   15.20 SQ MI

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

            *************
            *           *
44 KK       *   SUBBA   *     SIN 3
            *           *
            *************
                      RUNOFF-SNYDERS METHOD

48 IN         TIME DATA FOR INPUT TIME SERIES
                JXMIN          180  TIME INTERVAL IN MINUTES
                JXDATE     10JAN88  STARTING DATE
                JXTIME        1200  STARTING TIME

            SUBBASIN RUNOFF DATA

46 BA         SUBBASIN CHARACTERISTICS
                TAREA         2.20  SUBBASIN AREA

              PRECIPITATION DATA

47 PB           STORM         7.85  BASIN TOTAL PRECIPITATION

49 PI           INCREMENTAL PRECIPITATION PATTERN
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08       .08       .08       .08       .08
                  .08       .08       .08       .08       .08       .08

50 LU         UNIFORM LOSS RATE
                STRTL          .53  INITIAL LOSS
                CNSTL          .12  UNIFORM LOSS RATE
                RTIMP        20.00  PERCENT IMPERVIOUS AREA

51 US         SNYDER UNITGRAPH
                  TP         1.80  LAG
                  CP          .57  PEAKING COEFFICIENT

              SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

                                                  ...

                                        UNIT HYDROGRAPH PARAMETERS
                                  CLARK   TC  2.01 HR        R  1.94 HR
                                 SNYDER   TP  1.80 HR       CP    .57

                                        UNIT HYDROGRAPH
                                   46 END-OF-PERIOD ORDINATES
          21.       79.      159.      250.      339.      409.      450.      457.      425.      374.
         328.      289.      254.      223.      196.      172.      152.      133.      117.      103.
          91.       80.       70.       62.       54.       48.       42.       37.       32.       28.
          25.       22.       19.       17.       15.       13.       12.       10.        9.        8.
           7.        6.        5.        5.        4.        4.
```

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                7.        6.        5.        5.        4.        4.
     ...       ...       ...       ...       ...

                    HYDROGRAPH AT STATION    SUBBA

   TOTAL RAINFALL =    7.85, TOTAL LOSS =    2.57, TOTAL EXCESS =    5.28

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     74.75 HR
+   (CFS)       (HR)
                              (CFS)
+    327.      13.25                327.        298.        104.        100.
                          (INCHES)  1.380       5.034       5.253       5.253
                           (AC-FT)  162.        591.        616.        616.

                     CUMULATIVE AREA =    2.20 SQ MI


... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...


            .............
            .           .
  52 KK     .   COSTA   .     TION 2-3
            .           .
            .............
                    COMBINE HYDROGRAPHS 1 AND 2

  54 HC          HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                          ...

                 ...       ...       ...

                    HYDROGRAPH AT STATION    COSTA

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     74.75-HR
   (CFS)        (HR)
                              (CFS)
   1415.       24.50                1355.       1086.        563.        544.
                          (INCHES)   .724       2.320       3.613       3.619
                           (AC-FT)   672.       2153.       3353.       3359.

                     CUMULATIVE AREA =   17.40 SQ MI


... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...


            .............
            .           .
   KK       .   MILL    .     DAM
            .           .
            .............
                    ROUTING-MODIFIED PULS

      OUTPUT [illegible]
                [illegible]
      IPLOT [illegible]  PLOT CONTROL
      QSCAL          0.  HYDROGRAPH PLOT SCALE
```

QSCAL 0. HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

57 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	28.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

58 SV	STORAGE	28.0	90.0	152.0	214.0	276.0
59 SQ	DISCHARGE	0.	333.	941.	1730.	2664.

...

HYDROGRAPH AT STATION MILL

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE
10	JAN	1200	1	0.	28.00	11	JAN	1300	101	1396.	187.75	12	JAN	1400	201	329.	89.24
10	JAN	1215	2	0.	28.00	11	JAN	1315	102	1397.	187.86	12	JAN	1415	202	326.	88.76
10	JAN	1230	3	0.	28.02	11	JAN	1330	103	1395.	187.69	12	JAN	1430	203	324.	88.26
10	JAN	1245	4	0.	28.08	11	JAN	1345	104	1389.	187.23	12	JAN	1445	204	321.	87.75
10	JAN	1300	5	1.	28.19	11	JAN	1400	105	1380.	186.51	12	JAN	1500	205	318.	87.22
10	JAN	1315	6	2.	28.39	11	JAN	1415	106	1368.	185.59	12	JAN	1515	206	315.	86.69
10	JAN	1330	7	4.	28.68	11	JAN	1430	107	1355.	184.53	12	JAN	1530	207	312.	86.14
10	JAN	1345	8	6.	29.09	11	JAN	1445	108	1341.	183.40	12	JAN	1545	208	309.	85.59
10	JAN	1400	9	9.	29.63	11	JAN	1500	109	1326.	182.25	12	JAN	1600	209	306.	85.03
10	JAN	1415	10	12.	30.31	11	JAN	1515	110	1311.	181.09	12	JAN	1615	210	303.	84.47
10	JAN	1430	11	17.	31.19	11	JAN	1530	111	1297.	179.95	12	JAN	1630	211	300.	83.90
10	JAN	1445	12	23.	32.29	11	JAN	1545	112	1282.	178.83	12	JAN	1645	212	297.	83.34
10	JAN	1500	13	30.	33.65	11	JAN	1600	113	1268.	177.72	12	JAN	1700	213	294.	82.77
10	JAN	1515	14	39.	35.27	11	JAN	1615	114	1254.	176.63	12	JAN	1715	214	291.	82.20
10	JAN	1530	15	49.	37.17	11	JAN	1630	115	1240.	175.53	12	JAN	1730	215	288.	81.64
10	JAN	1545	16	61.	39.29	11	JAN	1645	116	1226.	174.41	12	JAN	1745	216	285.	81.08
10	JAN	1600	17	73.	41.59	11	JAN	1700	117	1212.	173.26	12	JAN	1800	217	282.	80.52
10	JAN	1615	18	86.	44.02	11	JAN	1715	118	1196.	172.07	12	JAN	1815	218	279.	79.97
10	JAN	1630	19	99.	46.50	11	JAN	1730	119	1181.	170.84	12	JAN	1830	219	276.	79.42
10	JAN	1645	20	113.	49.01	11	JAN	1745	120	1165.	169.58	12	JAN	1845	220	273.	78.87
10	JAN	1700	21	126.	51.51	11	JAN	1800	121	1148.	168.28	12	JAN	1900	221	270.	78.33
10	JAN	1715	22	140.	53.98	11	JAN	1815	122	1131.	166.95	12	JAN	1915	222	267.	77.79
10	JAN	1730	23	152.	56.39	11	JAN	1830	123	1114.	165.60	12	JAN	1930	223	265.	77.26
10	JAN	1745	24	165.	58.73	11	JAN	1845	124	1097.	164.24	12	JAN	1945	224	262.	76.73
10	JAN	1800	25	177.	60.99	11	JAN	1900	125	1079.	162.86	12	JAN	2000	225	259.	76.21
10	JAN	1815	26	189.	63.17	11	JAN	1915	126	1061.	161.47	12	JAN	2015	226	256.	75.69
10	JAN	1830	27	200.	65.27	11	JAN	1930	127	1044.	160.07	12	JAN	2030	227	253.	75.19
10	JAN	1845	28	211.	67.27	11	JAN	1945	128	1026.	158.67	12	JAN	2045	228	251.	74.68
10	JAN	1900	29	221.	69.19	11	JAN	2000	129	1008.	157.27	12	JAN	2100	229	248.	74.19
10	JAN	1915	30	231.	71.02	11	JAN	2015	130	990.	155.88	12	JAN	2115	230	245.	73.70
10	JAN	1930	31	240.	72.77	11	JAN	2030	131	973.	154.49	12	JAN	2130	231	243.	73.23
10	JAN	1945	32	249.	74.44	11	JAN	2045	132	955.	153.11	12	JAN	2145	232	240.	72.75
10	JAN	2000	33	258.	76.02	11	JAN	2100	133	938.	151.73	12	JAN	2200	233	238.	72.29
10	JAN	2015	34	266.	77.54	11	JAN	2115	134	924.	150.32	12	JAN	2215	234	235.	71.84
10	JAN	2030	35	274.	78.99	11	JAN	2130	135	910.	148.86	12	JAN	2230	235	233.	71.39
10	JAN	2045	36	282.	80.41	11	JAN	2145	136	895.	147.36	12	JAN	2245	236	231.	70.95
10	JAN	2100	37	289.	81.89	11	JAN	2200	137	881.	145.83	12	JAN	2300	237	228.	70.52
10	JAN	2115	38	298.	83.53	11	JAN	2215	138	865.	144.29	12	JAN	2315	238	226.	70.10
10	JAN	2130	39	309.	85.45	11	JAN	2230	139	850.	142.75	12	JAN	2330	239	224.	69.68
10	JAN	2145	40	321.	87.69	11	JAN	2245	140	835.	141.20	12	JAN	2345	240	222.	69.28
10	JAN	2200	41	335.	90.21	11	JAN	2300	141	820.	139.66	13	JAN	0000	241	220.	68.88
10	JAN	2215	42	361.	92.87	11	JAN	2315	142	805.	138.12	13	JAN	0015	242	217.	68.49
10	JAN	2230	43	387.	95.54	11	JAN	2330	143	790.	136.61	13	JAN	0030	243	215.	68.10
10	JAN	2245	44	414.	98.22	11	JAN	2345	144	776.	135.14	13	JAN	0045	244	213.	67.73

10 JAN 2230	43	387.	95.54	*	11 JAN 2330	143	790.	136.61	*	13 JAN 0030	[illegible]	[illegible]	[illegible]
10 JAN 2245	44	414.	98.22	*	11 JAN 2345	144	776.	135.14	*	13 JAN 0045	244	[illegible]	[illegible]
10 JAN 2300	45	440.	100.88	*	12 JAN 0000	145	762.	133.71	*	13 JAN 0100	245	[illegible]	[illegible]
10 JAN 2315	46	466.	103.53	*	12 JAN 0015	146	748.	132.32	*	13 JAN 0115	246	[illegible]	[illegible]
10 JAN 2330	47	491.	106.15	*	12 JAN 0030	147	735.	130.98	*	13 JAN 0130	247	[illegible]	[illegible]
10 JAN 2345	48	517.	108.75	*	12 JAN 0045	148	722.	129.69	*	13 JAN 0145	248	[illegible]	[illegible]
11 JAN 0000	49	542.	111.32	*	12 JAN 0100	149	710.	128.43	*	13 JAN 0200	249	[illegible]	[illegible]
11 JAN 0015	50	567.	113.86	*	12 JAN 0115	150	698.	127.20	*	13 JAN 0215	250	[illegible]	[illegible]
11 JAN 0030	51	592.	116.37	*	12 JAN 0130	151	686.	126.01	*	13 JAN 0230	251	200.	[illegible]
11 JAN 0045	52	616.	118.86	*	12 JAN 0145	152	675.	124.84	*	13 JAN 0245	252	199.	64.46
11 JAN 0100	53	640.	121.32	*	12 JAN 0200	153	663.	123.70	*	13 JAN 0300	253	197.	64.65
11 JAN 0115	54	664.	123.76	*	12 JAN 0215	154	652.	122.58	*	13 JAN 0315	254	195.	64.34
11 JAN 0130	55	688.	126.16	*	12 JAN 0230	155	642.	121.49	*	13 JAN 0330	255	194.	64.04
11 JAN 0145	56	711.	128.52	*	12 JAN 0245	156	631.	120.41	*	13 JAN 0345	256	192.	63.74
11 JAN 0200	57	734.	130.84	*	12 JAN 0300	157	621.	119.36	*	13 JAN 0400	257	190.	63.45
11 JAN 0215	58	756.	133.12	*	12 JAN 0315	158	611.	118.33	*	13 JAN 0415	258	189.	63.16
11 JAN 0230	59	778.	135.36	*	12 JAN 0330	159	601.	117.33	*	13 JAN 0430	259	187.	62.88
11 JAN 0245	60	799.	137.54	*	12 JAN 0345	160	591.	116.34	*	13 JAN 0445	260	186.	62.60
11 JAN 0300	61	820.	139.69	*	12 JAN 0400	161	582.	115.37	*	13 JAN 0500	261	184.	62.32
11 JAN 0315	62	841.	141.78	*	12 JAN 0415	162	572.	114.42	*	13 JAN 0515	262	183.	62.06
11 JAN 0330	63	861.	143.83	*	12 JAN 0430	163	563.	113.48	*	13 JAN 0530	263	181.	61.79
11 JAN 0345	64	881.	145.83	*	12 JAN 0445	164	554.	112.57	*	13 JAN 0545	264	180.	61.53
11 JAN 0400	65	900.	147.79	*	12 JAN 0500	165	546.	111.68	*	13 JAN 0600	265	179.	61.28
11 JAN 0415	66	918.	149.70	*	12 JAN 0515	166	537.	110.80	*	13 JAN 0615	266	177.	61.03
11 JAN 0430	67	937.	151.57	*	12 JAN 0530	167	529.	109.94	*	13 JAN 0630	267	176.	60.78
11 JAN 0445	68	959.	153.38	*	12 JAN 0545	168	520.	109.09	*	13 JAN 0645	268	175.	60.54
11 JAN 0500	69	980.	155.08	*	12 JAN 0600	169	512.	108.27	*	13 JAN 0700	269	173.	60.30
11 JAN 0515	70	1001.	156.71	*	12 JAN 0615	170	504.	107.46	*	13 JAN 0715	270	172.	60.06
11 JAN 0530	71	1021.	158.27	*	12 JAN 0630	171	496.	106.66	*	13 JAN 0730	271	171.	59.83
11 JAN 0545	72	1040.	159.77	*	12 JAN 0645	172	489.	105.89	*	13 JAN 0745	272	170.	59.60
11 JAN 0600	73	1058.	161.23	*	12 JAN 0700	173	481.	105.12	*	13 JAN 0800	273	169.	59.38
11 JAN 0615	74	1076.	162.63	*	12 JAN 0715	174	474.	104.38	*	13 JAN 0815	274	167.	59.16
11 JAN 0630	75	1093.	163.98	*	12 JAN 0730	175	467.	103.65	*	13 JAN 0830	275	166.	58.94
11 JAN 0645	76	1110.	165.29	*	12 JAN 0745	176	460.	102.93	*	13 JAN 0845	276	165.	58.72
11 JAN 0700	77	1126.	166.55	*	12 JAN 0800	177	453.	102.23	*	13 JAN 0900	277	164.	58.51
11 JAN 0715	78	1142.	167.78	*	12 JAN 0815	178	446.	101.54	*	13 JAN 0915	278	163.	58.30
11 JAN 0730	79	1157.	168.96	*	12 JAN 0830	179	440.	100.87	*	13 JAN 0930	279	162.	58.09
11 JAN 0745	80	1171.	170.10	*	12 JAN 0845	180	433.	100.20	*	13 JAN 0945	280	161.	57.89
11 JAN 0800	81	1185.	171.21	*	12 JAN 0900	181	427.	99.56	*	13 JAN 1000	281	159.	57.69
11 JAN 0815	82	1199.	172.28	*	12 JAN 0915	182	421.	98.92	*	13 JAN 1015	282	158.	57.49
11 JAN 0830	83	1212.	173.32	*	12 JAN 0930	183	414.	98.30	*	13 JAN 1030	283	157.	57.30
11 JAN 0845	84	1225.	174.33	*	12 JAN 0945	184	408.	97.69	*	13 JAN 1045	284	156.	57.10
11 JAN 0900	85	1238.	175.31	*	12 JAN 1000	185	403.	97.10	*	13 JAN 1100	285	155.	56.91
11 JAN 0915	86	1250.	176.27	*	12 JAN 1015	186	397.	96.52	*	13 JAN 1115	286	154.	56.73
11 JAN 0930	87	1262.	177.20	*	12 JAN 1030	187	391.	95.94	*	13 JAN 1130	287	153.	56.54
11 JAN 0945	88	1273.	178.10	*	12 JAN 1045	188	386.	95.39	*	13 JAN 1145	288	152.	56.36
11 JAN 1000	89	1284.	178.99	*	12 JAN 1100	189	381.	94.85	*	13 JAN 1200	289	151.	56.17
11 JAN 1015	90	1295.	179.85	*	12 JAN 1115	190	375.	94.32	*	13 JAN 1215	290	150.	56.00
11 JAN 1030	91	1306.	180.70	*	12 JAN 1130	191	370.	93.81	*	13 JAN 1230	291	149.	55.82
11 JAN 1045	92	1317.	181.53	*	12 JAN 1145	192	365.	93.31	*	13 JAN 1245	292	148.	55.64
11 JAN 1100	93	1327.	182.35	*	12 JAN 1200	193	361.	92.82	*	13 JAN 1300	293	148.	55.47
11 JAN 1115	94	1337.	183.14	*	12 JAN 1215	194	356.	92.35	*	13 JAN 1315	294	147.	55.30
11 JAN 1130	95	1347.	183.93	*	12 JAN 1230	195	351.	91.88	*	13 JAN 1330	295	146.	55.13
11 JAN 1145	96	1357.	184.70	*	12 JAN 1245	196	347.	91.43	*	13 JAN 1345	296	145.	54.96
11 JAN 1200	97	1367.	185.45	*	12 JAN 1300	197	343.	90.98	*	13 JAN 1400	297	144.	54.80
11 JAN 1215	98	1376.	186.18	*	12 JAN 1315	198	338.	90.55	*	13 JAN 1415	298	143.	54.63
11 JAN 1230	99	1384.	186.85	*	12 JAN 1330	199	334.	90.12	*	13 JAN 1430	299	142.	54.47
11 JAN 1245	100	1391.	187.39	*	12 JAN 1345	200	331.	89.69	*	13 JAN 1445	300	141.	54.31

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	74.75-HR
		(CFS)				
1397.	25.25		1347.	1081.	560.	539.
		(INCHES)	.720	2.310	3.589	3.591
		(AC-FT)	668.	2144.	3331.	3332.

(INCHES)	.720	2.[illegible]	[illegible]	[illegible]
(AC-FT)	668.	2144.	3331.	3332.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	74.75-HR
+ (AC-FT)	(HR)				
188.	25.25	184.	162.	107.	104.

CUMULATIVE AREA = 17.40 SQ MI

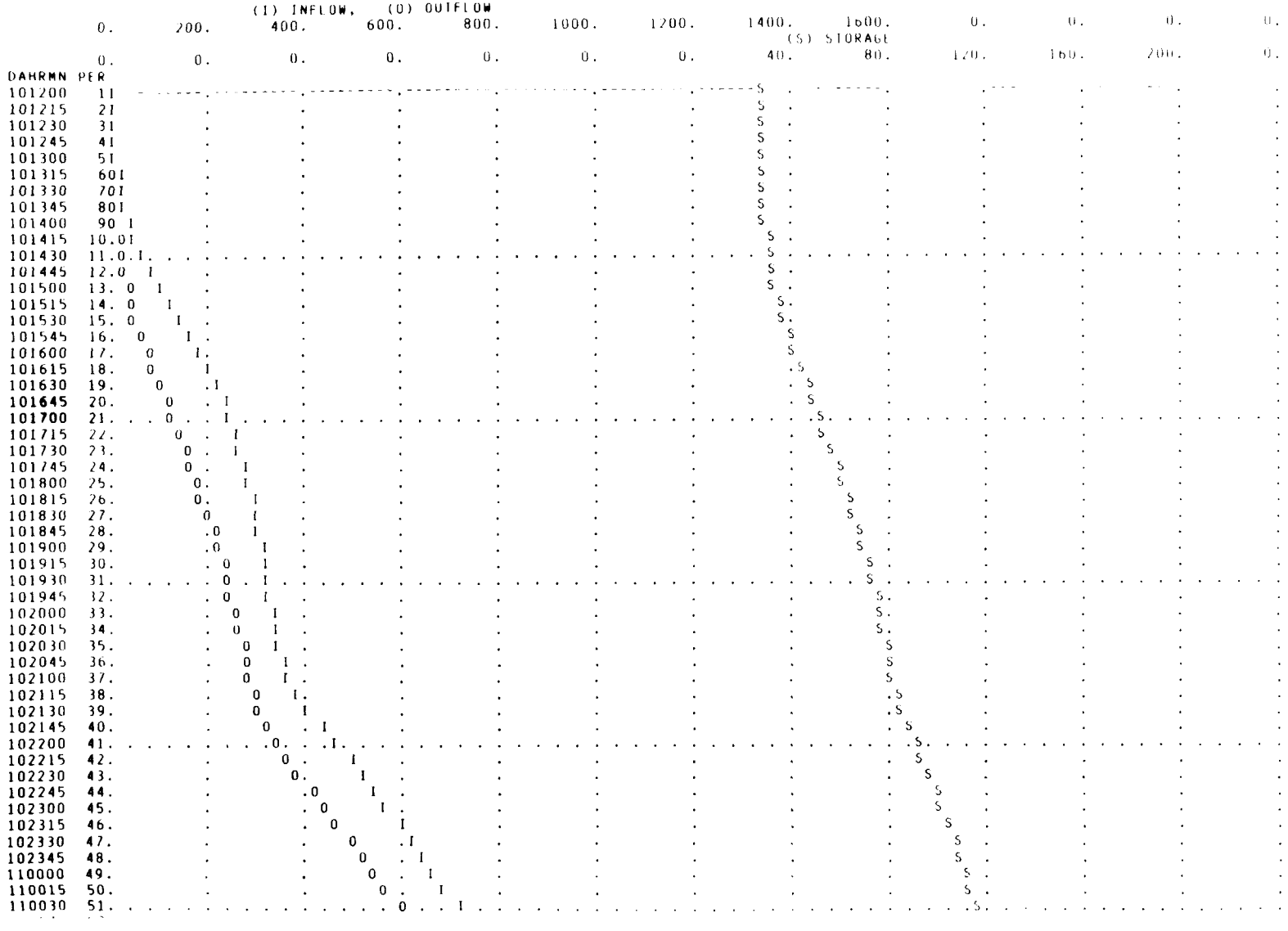
1 STATION MILL

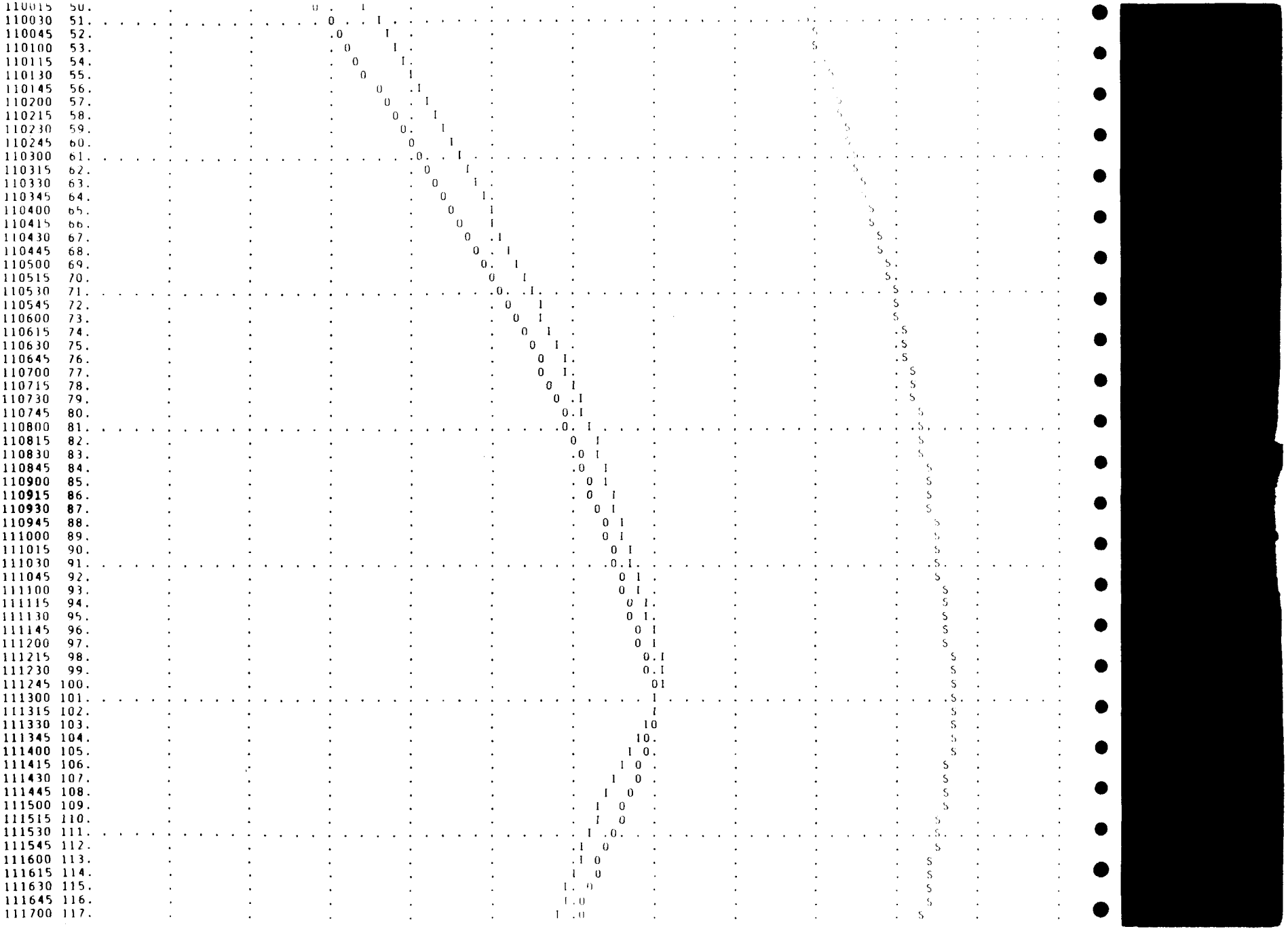
(I) INFLOW, (O) OUTFLOW

0. 200. 400. 600. 800. 1000. 1200. 1400. 1600. 0. 0. 0. 0.

(S) STORAGE

0. 0. 0. 0. 0. 0. 0. 40. 80. 120. 160. 200. 0.

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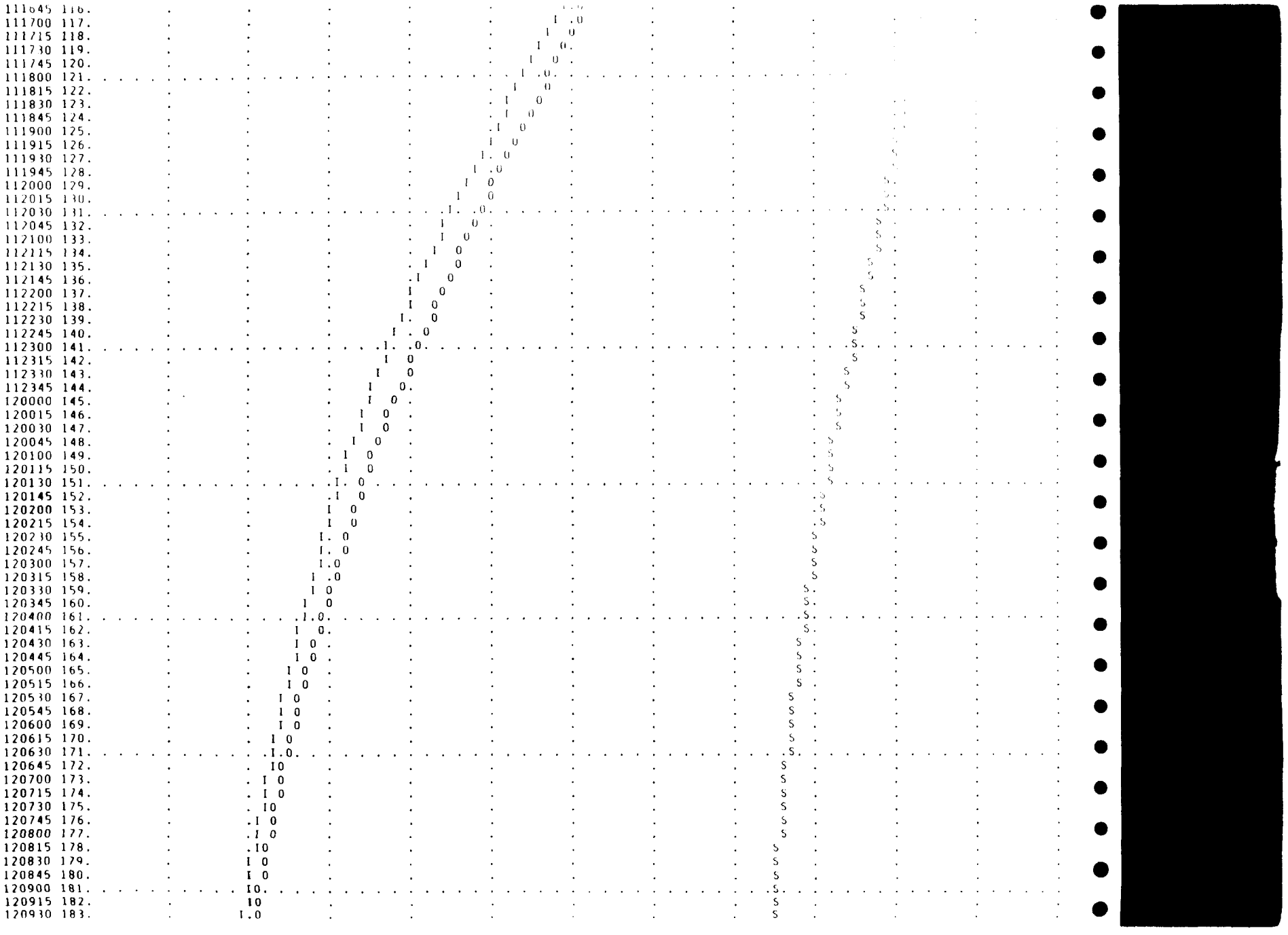
110030 51.
110045 52.
110100 53.
110115 54.
110130 55.
110145 56.
110200 57.
110215 58.
110230 59.
110245 60.
110300 61.
110315 62.
110330 63.
110345 64.
110400 65.
110415 66.
110430 67.
110445 68.
110500 69.
110515 70.
110530 71.
110545 72.
110600 73.
110615 74.
110630 75.
110645 76.
110700 77.
110715 78.
110730 79.
110745 80.
110800 81.
110815 82.
110830 83.
110845 84.
110900 85.
110915 86.
110930 87.
110945 88.
111000 89.
111015 90.
111030 91.
111045 92.
111100 93.
111115 94.
111130 95.
111145 96.
111200 97.
111215 98.
111230 99.
111245 100.
111300 101.
111315 102.
111330 103.
111345 104.
111400 105.
111415 106.
111430 107.
111445 108.
111500 109.
111515 110.
111530 111.
111545 112.
111600 113.
111615 114.
111630 115.
111645 116.
111700 117.


111645 116.
111700 117.
111715 118.
111730 119.
111745 120.
111800 121.
111815 122.
111830 123.
111845 124.
111900 125.
111915 126.
111930 127.
111945 128.
112000 129.
112015 130.
112030 131.
112045 132.
112100 133.
112115 134.
112130 135.
112145 136.
112200 137.
112215 138.
112230 139.
112245 140.
112300 141.
112315 142.
112330 143.
112345 144.
120000 145.
120015 146.
120030 147.
120045 148.
120100 149.
120115 150.
120130 151.
120145 152.
120200 153.
120215 154.
120230 155.
120245 156.
120300 157.
120315 158.
120330 159.
120345 160.
120400 161.
120415 162.
120430 163.
120445 164.
120500 165.
120515 166.
120530 167.
120545 168.
120600 169.
120615 170.
120630 171.
120645 172.
120700 173.
120715 174.
120730 175.
120745 176.
120800 177.
120815 178.
120830 179.
120845 180.
120900 181.
120915 182.
120930 183.

```
120915 182.         .         10        .         .         .         .         .         .         .         .         .         .
120930 183.         .        I.0        .         .         .         .         .         .    S    .         .         .         .
120945 184.         .        10         .         .         .         .         .         .   S     .         .         .         .
121000 185.         .        10         .         .         .         .         .         .   S     .         .         .         .
121015 186.         .       I 0         .         .         .         .         .         .   S     .         .         .         .
121030 187.         .       I 0         .         .         .         .         .         .   S     .         .         .         .
121045 188.         .       I0.         .         .         .         .         .         .   S     .         .         .         .
121100 189.         .       I0.         .         .         .         .         .         .   S     .         .         .         .
121115 190.         .       I0.         .         .         .         .         .         .   S     .         .         .         .
121130 191. . . . . . . .I.0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S. . . . . . . . . . . . . . . . . . .
121145 192.         .      I0 .         .         .         .         .         .         .  S      .         .         .         .
121200 193.         .      I0 .         .         .         .         .         .         .  S      .         .         .         .
121215 194.         .      I0 .         .         .         .         .         .         .  S      .         .         .         .
121230 195.         .     I 0 .         .         .         .         .         .         .  S      .         .         .         .
121245 196.         .     I0  .         .         .         .         .         .         .  S      .         .         .         .
121300 197.         .     I0  .         .         .         .         .         .         .  S      .         .         .         .
121315 198.         .     I0  .         .         .         .         .         .         .  S      .         .         .         .
121330 199.         .     I0  .         .         .         .         .         .         .  S      .         .         .         .
121345 200.         .     I0  .         .         .         .         .         .         . S       .         .         .         .
121400 201. . . . . . .I0 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . .
121415 202.         .    I0   .         .         .         .         .         .         . S       .         .         .         .
121430 203.         .    I0   .         .         .         .         .         .         . S       .         .         .         .
121445 204.         .    I0   .         .         .         .         .         .         . S       .         .         .         .
121500 205.         .    I0   .         .         .         .         .         .         . S       .         .         .         .
121515 206.         .   I 0   .         .         .         .         .         .         . S       .         .         .         .
121530 207.         .   I 0   .         .         .         .         .         .         . S       .         .         .         .
121545 208.         .   I0    .         .         .         .         .         .         .S        .         .         .         .
121600 209.         .   I0    .         .         .         .         .         .         .S        .         .         .         .
121615 210.         .   I0    .         .         .         .         .         .         .S        .         .         .         .
121630 211. . . . . . I0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . .
121645 212.         .  I 0    .         .         .         .         .         .         .S        .         .         .         .
121700 213.         .  I 0    .         .         .         .         .         .         .S        .         .         .         .
121715 214.         .  I 0    .         .         .         .         .         .         .S        .         .         .         .
121730 215.         .  I0     .         .         .         .         .         .         S         .         .         .         .
121745 216.         .  I0     .         .         .         .         .         .         S         .         .         .         .
121800 217.         .  I0     .         .         .         .         .         .         S         .         .         .         .
121815 218.         .  I0     .         .         .         .         .         .         S         .         .         .         .
121830 219.         . I 0     .         .         .         .         .         .         S         .         .         .         .
121845 220.         . I 0     .         .         .         .         .         .         S         .         .         .         .
121900 221. . . . . . I 0 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . .
121915 222.         . I0      .         .         .         .         .         .        S.         .         .         .         .
121930 223.         . I0      .         .         .         .         .         .        S.         .         .         .         .
121945 224.         . I0      .         .         .         .         .         .        S.         .         .         .         .
122000 225.         . I0      .         .         .         .         .         .        S.         .         .         .         .
122015 226.         . I0      .         .         .         .         .         .        S.         .         .         .         .
122030 227.         .I 0      .         .         .         .         .         .        S.         .         .         .         .
122045 228.         .I 0      .         .         .         .         .         .        S.         .         .         .         .
122100 229.         .I0       .         .         .         .         .         .        S.         .         .         .         .
122115 230.         .I0       .         .         .         .         .         .       S .         .         .         .         .
122130 231. . . . . .I0 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . .
122145 232.         .I0       .         .         .         .         .         .       S .         .         .         .         .
122200 233.         .I0       .         .         .         .         .         .       S .         .         .         .         .
122215 234.         .I0       .         .         .         .         .         .       S .         .         .         .         .
122230 235.         .I0       .         .         .         .         .         .       S .         .         .         .         .
122245 236.         I 0       .         .         .         .         .         .       S .         .         .         .         .
122300 237.         I0        .         .         .         .         .         .       S .         .         .         .         .
122315 238.         I0        .         .         .         .         .         .       S .         .         .         .         .
122330 239.         I0        .         .         .         .         .         .      S  .         .         .         .         .
122345 240.         I0        .         .         .         .         .         .      S  .         .         .         .         .
130000 241. . . . . I0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . .
130015 242.         I0        .         .         .         .         .         .      S  .         .         .         .         .
130030 243.         I0        .         .         .         .         .         .      S  .         .         .         .         .
130045 244.         I0        .         .         .         .         .         .      S  .         .         .         .         .
130100 245.         I0        .         .         .         .         .         .      S  .         .         .         .         .
130115 246.         I         .         .         .         .         .         .      S  .         .         .         .         .
130130 247.         I         .         .         .         .         .         .      S  .         .         .         .         .
130145 248.        I0         .         .         .         .         .         .      S  .         .         .         .         .
130200 249.        I0         .         .         .         .         .         .      S  .         .         .         .         .
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130145 248.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130200 249.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130215 250.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130230 251. . . . . .IO . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . .
130245 252.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130300 253.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130315 254.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130330 255.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130345 256.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130400 257.          IO        .          .          .          .          .          .  S       .          .          .          .          .
130415 258.          I.        .          .          .          .          .          .  S       .          .          .          .          .
130430 259.          I.        .          .          .          .          .          .  S       .          .          .          .          .
130445 260.          I.        .          .          .          .          .          .  S       .          .          .          .          .
130500 261. . . . . .I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . .
130515 262.          I.        .          .          .          .          .          .  S       .          .          .          .          .
130530 263.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130545 264.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130600 265.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130615 266.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130630 267.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130645 268.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130700 269.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130715 270.         IO.        .          .          .          .          .          . S        .          .          .          .          .
130730 271. . . . . IO. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . . .
130745 272.         I .        .          .          .          .          .          . S        .          .          .          .          .
130800 273.         I .        .          .          .          .          .          . S        .          .          .          .          .
130815 274.         I .        .          .          .          .          .          . S        .          .          .          .          .
130830 275.         I .        .          .          .          .          .          . S        .          .          .          .          .
130845 276.         I .        .          .          .          .          .          . S        .          .          .          .          .
130900 277.         I .        .          .          .          .          .          . S        .          .          .          .          .
130915 278.         I .        .          .          .          .          .          . S        .          .          .          .          .
130930 279.         I .        .          .          .          .          .          . S        .          .          .          .          .
130945 280.         I .        .          .          .          .          .          .S         .          .          .          .          .
131000 281. . . . .IO . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . .
131015 282.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131030 283.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131045 284.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131100 285.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131115 286.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131130 287.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131145 288.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131200 289.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131215 290.        IO .        .          .          .          .          .          .S         .          .          .          .          .
131230 291. . . . .I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . .
131245 292.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131300 293.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131315 294.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131330 295.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131345 296.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131400 297.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131415 298.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131430 299.        I  .        .          .          .          .          .          .S         .          .          .          .          .
131445 300.--------I--.---------.----------.----------.----------.----------.----------.S---------.----------.----------.----------.----------.
1
1
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	SUBBA	839.	21.00	838.	727.	261.	6.80		
+	ROUTED TO	NB RE	375.	28.25	369.	314.	192.	6.80		

+	ROUTED TO	NB RE	375.	28.25	369.	314.	192.	6.80
+	ROUTED TO	SUBBA	374.	31.00	368.	314.	188.	6.80
+	HYDROGRAPH AT	SUBBA	1009.	22.25	1007.	868.	314.	8.40
+	2 COMBINED AT	COSTA	1285.	24.50	1242.	1030.	501.	15.20
+	ROUTED TO	HAMLT	1151.	26.25	1123.	903.	462.	15.20
+	ROUTED TO	SUBBA	1151.	27.25	1122.	902.	461.	15.20
+	HYDROGRAPH AT	SUBBA	327.	13.25	327.	298.	104.	2.20
+	2 COMBINED AT	COSTA	1415.	24.50	1355.	1086.	563.	17.40
+	ROUTED TO	MILL	1397.	25.25	1347.	1081.	560.	17.40

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

ATTACHMENT B

10 YEAR STORM EVENT
W/ COMPLETE HYDROGRAPH

1

....
FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) OCT 1,1984
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
....

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS AND RATIOS ARE REDUCED TO 5 AND 4, RESPECTIVELY

1 HEC 1 INPUT PAGE 1

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

  1           ID         ACUSHNET RIVER WATERSHED STUDY
  2           ID         NEW BEDFORD HARBOR PROJECT NO. 6002
  3           ID         JAN-FEB, 1988
  4           ID
  5           ID         10 YEAR RECURRENCE EVENT
  6           ID
              *DIAGRAM
  7           IT      15 10JAN88    1200      300
  8           IO       3

  9           KK   SUBBASIN 1
 10           KM   RUNOFF-SNYDERS METHOD
 11           BA     6.8
 12           PB    4.72
 13           IN     180 10JAN88    1200
 14           PI     .59      .59      .59      .59      .59      .59      .59      .59
 15           LU     .53     .135        0
 16           US      3.      .57

 17           KK   NB RESERVOIR
 18           KM   ROUTING-MODIFIED PULS METHOD
 19           RS       1     STOR     1448        0
 20           SV    1448     2109     2770     3431     4092
 21           SQ       0      169      478      878     1352

 22           KK   SUBBASIN 2
 23           KM   ROUTING-MUSKINGUM METHOD
 24           RM      10     2.59       .2

 25           KK   SUBBASIN 2
 26           KM   RUNOFF-SNYDERS METHOD
 27           BA     8.4
 28           PB    4.72
 29           IN     180 10JAN88    1200
 30           PI     .59      .59      .59      .59      .59      .59      .59      .59
 31           LU     .53      .14        0
 32           US     3.2      .57

 33           KK   COSTATION 1-2
 34           KM   COMBINE HYDROGRAPH 1 AND 2
 35           HC       2
```

```
 36          KK   HAMLIN STREET DAM
 37          KM   ROUTING-MODIFIED PULS METHOD
 38          RS       1     STOR      105        0
 39          SV     105      284      463      642      821     1000
 40          SQ       0       33      362      713     1133     1436

 41          KK   SUBBASIN 3
 42          KM   ROUTING-MUSKINGUM METHOD
 43          RM       5      .88       .2
```



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

 44          KK   SUBBASIN 3
 45          KM   RUNOFF-SNYDERS METHOD
 46          BA     2.2
 47          PB    4.72
 48          IN     180 10JAN88     1200
 49          PI     .59      .59      .59      .59      .59      .59      .59      .59
 50          LU     .53      .12       20
 51          US     1.8      .57

 52          KK   COSTATION 2-3
 53          KM   COMBINE HYDROGRAPHS 1 AND 2
 54          HC       2

 55          KK   MILL DAM
 56          KM   ROUTING-MODIFIED PULS
 57          RS       1     STOR       28        0
 58          SV      28       90      152      214      276
 59          SQ       0      333      941     1730     2664
 60          KO       1        2
 61          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
(V) ROUTING          (--->) DIVERSION
(.) CONNECTOR        (<---) RETURN OF DIVERTED FLOW

NO.
 9      SUBBA
            V
            V
17      NB RE
            V
            V
22      SUBBA
            .
            .
25          .        SUBBA
            .           .
            .           .
33      COSTA............
            V
            V
36      HAMLI
            V
            V
41      SUBBA
            .
            .
44          .        SUBBA
            .           .
            .           .
52      COSTA............
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                V
   55        MILL

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                                                    ....
                                   FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) OCT 1,1984
                U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                                                     ....



                                   ACUSHNET RIVER WATERSHED STUDY
                                   NEW BEDFORD HARBOR PROJECT NO. 6002
                                   JAN-FEB, 1988

                                   10 YEAR RECURRENCE EVENT


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

     IT          HYDROGRAPH TIME DATA
                        NMIN          15  MINUTES IN COMPUTATION INTERVAL
                       IDATE     10JAN88  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     13JAN88  ENDING DATE
                      NDTIME        1445  ENDING TIME

                  COMPUTATION INTERVAL      .25 HOURS
                       TOTAL TIME BASE    74.75 HOURS

   [redacted]    ENGLISH UNITS

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


              .............
              .           .
   9 KK       .     SUBBA .     SIN 1
              .           .
              .............
                                RUNOFF-SNYDERS METHOD

  13 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         180  TIME INTERVAL IN MINUTES
                      JXDATE     10JAN88  STARTING DATE
                      JXTIME        1200  STARTING TIME

                SUBBASIN RUNOFF DATA

  11 BA          SUBBASIN CHARACTERISTICS
                       TAREA        6.80  SUBBASIN AREA

                 PRECIPITATION DATA

  12 PB                STORM        4.72  BASIN TOTAL PRECIPITATION

  14 PI            INCREMENTAL PRECIPITATION PATTERN
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
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```
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                    .05       .05       .05       .05       .05       .05

15 LU          UNIFORM LOSS RATE
                    STRTL          .53  INITIAL LOSS
                    CNSTL          .14  UNIFORM LOSS RATE
                    RTIMP          .00  PERCENT IMPERVIOUS AREA

16 US          SNYDER UNITGRAPH
                       TP         3.00  LAG
                       CP          .57  PEAKING COEFFICIENT

               SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

                                                   ...

                                          UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC  3.23 HR        R  3.28 HR
                                  SNYDER   TP  3.01 HR       CP    .57

                                              UNIT HYDROGRAPH
                                          77 END-OF-PERIOD ORDINATES
                 20.       73.      150.      240.      340.      446.      555.      656.      738.      800.
                841.      860.      850.      805.      746.      692.      641.      594.      550.      510.
                473.      438.      406.      376.      348.      323.      299.      277.      257.      238.
                221.      204.      190.      176.      163.      151.      140.      129.      120.      111.
                103.       95.       88.       82.       76.       70.       65.       60.       56.       52.
                 48.       45.       41.       38.       35.       33.       30.       28.       26.       24.
                 22.       21.       19.       18.       17.       15.       14.       13.       12.       11.
                 10.       10.        9.        8.        8.        7.        7.
   ...          ...       ...       ...       ...       ...

                     HYDROGRAPH AT STATION     SUBBA

    TOTAL RAINFALL =     4.72, TOTAL LOSS =     3.41, TOTAL EXCESS =     1.31

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      74.75-HR
+   (CFS)        (HR)
                                   (CFS)
+     269.      22.00              269.         225.          80.          77.
                            (INCHES)      .367       1.233       1.308       1.308
                             (AC-FT)      133.        447.        474.        474.

                            CUMULATIVE AREA =    6.80 SQ MI


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

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            .            .
17 KK       .     NB RE  .     SERVOIR
            .            .
            ..............
                     ROUTING-MODIFIED PULS METHOD
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                HYDROGRAPH ROUTING DATA

  19 RS           STORAGE ROUTING
                        NSTPS            1  NUMBER OF SUBREACHES
                         IIYP         STOR  TYPE OF INITIAL CONDITION
                       RSVRIC      1448.00  INITIAL CONDITION
                            X          .00 WORKING R AND D COEFFICIENT

  20 SV             STORAGE      1448.0    2109.0    2770.0    3431.0    4092.0

  21 SQ           DISCHARGE          0.       169.      478.      878.      1352.
                                                                  ...

      ...             ...              ...              ...              ...

                        HYDROGRAPH AT STATION    NB RE

 PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      74.75-HR
+   (CFS)       (HR)
                             (CFS)
+      91.     29.25                     90.          81.          55.          53.
                         (INCHES)      .123         .446         .908         .908
                          (AC-FT)       45.         162.         329.         329.

 PEAK STORAGE   TIME                           MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR      74.75-HR
+  (AC-FT)      (HR)
    1803.     29.25                   1799.        1767.        1664.        1656.

                        CUMULATIVE AREA =    6.80 SQ MI
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            ..............
            .            .
  22 KK     .     SUBBA  .     SIN 2
            .            .
            ..............
                        ROUTING-MUSKINGUM METHOD

                HYDROGRAPH ROUTING DATA

  24 RM           MUSKINGUM ROUTING
                        NSTPS         10 NUMBER OF SUBREACHES
                        AMSKK       2.59 MUSKINGUM K
                            X        .20 MUSKINGUM X
                                                                  ...

      ...             ...              ...              ...              ...

                        HYDROGRAPH AT STATION    SUBBA

 PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      74.75-HR
+   (CFS)       (HR)
                             (CFS)
+      91.     32.00                     90.          81.          54.          52.
                         (INCHES)      .123         .445         .885         .885
```

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                    CUMULATIVE AREA =     6.80 SQ MI

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

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 25 KK      .    SUBBA   .     SIN 2
            .            .
            ..............
                      RUNOFF-SNYDERS METHOD

 29 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         180  TIME INTERVAL IN MINUTES
                    JXDATE     10JAN88  STARTING DATE
                    JXTIME        1200  STARTING TIME

              SUBBASIN RUNOFF DATA

 27 BA          SUBBASIN CHARACTERISTICS
                     TAREA        8.40  SUBBASIN AREA

                PRECIPITATION DATA

 28 PB               STORM        4.72  BASIN TOTAL PRECIPITATION

 30 PI            INCREMENTAL PRECIPITATION PATTERN
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                     .05       .05       .05       .05       .05       .05
 31 LU          UNIFORM LOSS RATE
                     SIRTL         .53  INITIAL LOSS
                     CNSTL         .14  UNIFORM LOSS RATE
                     RIIMP         .00  PERCENT IMPERVIOUS AREA

 32 US          SNYDER UNITGRAPH
                       TP        3.20  LAG
                       CP         .57  PEAKING COEFFICIENT

                SYNTHETIC ACCUMULATED AREA VS. TIME CURVE WILL BE USED

                                                   ***

                                         UNIT HYDROGRAPH PARAMETERS
                                   CLARK   TC  3.46 HR        R  3.50 HR
                                  SNYDER   TP  3.18 HR       CP   .57

                                             UNIT HYDROGRAPH
                                         82 END-OF-PERIOD ORDINATES
            21.       77.      158.      254.      359.      472.      590.      706.      806.      885.
           945.      983.      997.      979.      927.      863.      804.      748.      697.      649.
           604.      562.      524.      488.      454.      423.      394.      366.      341.      318.
           296.      275.      256.      239.      222.      207.      193.      179.      167.      156.
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```
        71.        66.        61.        57.        53.        50.        46.        43.        40.        37.
        35.        32.        30.        28.        26.        24.        23.        21.        20.        18.
        17.        16.        15.        14.        13.        12.        11.        10.        10.         9.
         8.         8.

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

                         HYDROGRAPH AT STATION    SUBBA

     TOTAL RAINFALL =     4.72, TOTAL LOSS =     3.51, TOTAL EXCESS =     1.21

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR       74.75-HR
 +   (CFS)        (HR)
                              (CFS)
 +      306.     23.25                    304.          254.          90.           87.
                            (INCHES)      .337         1.125        1.201         1.201
                             (AC-FT)      151.          504.         538.          538.

                             CUMULATIVE AREA =     8.40 SQ MI


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

              *************
              *           *
   33 KK      *   COSTA   *     TION 1-2
              *           *
              *************
                               COMBINE HYDROGRAPH 1 AND 2

   35 HC            HYDROGRAPH COMBINATION
                          ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                         ***

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

                         HYDROGRAPH AT STATION    COSTA

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                          6 HR         24-HR        72-HR       74.75-HR
 +   (CFS)        (HR)
                              (CFS)
 +      375.     24.25                    365.          297.         144.          139.
                            (INCHES)      .223          .728        1.060         1.060
                             (AC-FT)      181.          590.         859.          859.

                             CUMULATIVE AREA =    15.20 SQ MI


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

              *************
              *           *
   36 KK      *   HAMLI   *     N STREET DAM
              *           *
              *************
                               ROUTING-MODIFIED PULS METHOD
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                HYDROGRAPH ROUTING DATA

  38 RS           STORAGE ROUTING
                        NSTPS            1  NUMBER OF SUBREACHES
                         ITYP         STOR  TYPE OF INITIAL CONDITION
                        RSVRIC       105.00  INITIAL CONDITION
                             X          .00 WORKING R AND D COEFFICIENT

  39 SV             STORAGE        105.0     284.0     463.0     642.0     821.0    1000.0

  40 SQ           DISCHARGE           0.        33.       362.      713.      1133.     1436.
                                                                   ...

     ...              ...              ...              ...              ...

                          HYDROGRAPH AT STATION    HAMLI

 PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR      74.75-HR
+   (CFS)       (HR)
                              (CFS)
+     301.     27.00                    291.        223.        113.         109.
                         (INCHES)      .178        .545        .831         .831
                          (AC-FT)      144.        442.        673.         673.

 PEAK STORAGE   TIME                           MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR      74.75-HR
+  (AC-FT)      (HR)
     430.     27.00                    424.        387.        310.         302.

                         CUMULATIVE AREA =   15.20 SQ MI


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

            ..............
            .            .
  41 KK     .     SUBBA  .     SIN 3
            .            .
            ..............
                          ROUTING-MUSKINGUM METHOD

                HYDROGRAPH ROUTING DATA

  43 RM           MUSKINGUM ROUTING
                        NSTPS          5 NUMBER OF SUBREACHES
                        AMSKK        .88 MUSKINGUM K
                            X        .20 MUSKINGUM X
                                                                   ...

     ...              ...              ...              ...              ...

                          HYDROGRAPH AT STATION    SUBBA

 PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR      74.75-HR
+   (CFS)       (HR)
                              (CFS)
+     301.     27.75                    291.        223.        113.         108.
                         (INCHES)      .178        .545        .826         .826
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                    CUMULATIVE AREA =    15.20 SQ MI

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

              ***************
              *             *
 44 KK        *    SUBBA    *     SIN 3
              *             *
              ***************
                     RUNOFF SNYDERS METHOD

 48 IN           TIME DATA FOR INPUT TIME SERIES
                      JXMIN         180  TIME INTERVAL IN MINUTES
                     JXDATE     10JAN88  STARTING DATE
                     JXTIME        1200  STARTING TIME

               SUBBASIN RUNOFF DATA

 46 BA           SUBBASIN CHARACTERISTICS
                      TAREA        2.20  SUBBASIN AREA

                 PRECIPITATION DATA

 47 PB                STORM        4.72  BASIN TOTAL PRECIPITATION

 49 PI             INCREMENTAL PRECIPITATION PATTERN
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05       .05       .05       .05       .05
                      .05       .05       .05       .05       .05       .05

 50 LU           UNIFORM LOSS RATE
                      STRTL         .53  INITIAL LOSS
                      CNSTL         .12  UNIFORM LOSS RATE
                      RTIMP       20.00  PERCENT IMPERVIOUS AREA

 51 US           SNYDER UNITGRAPH
                         TP        1.80  LAG
                         CP         .57  PEAKING COEFFICIENT

                 SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

                                                ***

                                            UNIT HYDROGRAPH PARAMETERS
                                      CLARK   TC  2.01 HR        R  1.94 HR
                                     SNYDER   TP  1.80 HR       CP   .57

                                                 UNIT HYDROGRAPH
                                            46 END-OF PERIOD ORDINATES
            21.       79.      159.      250.      339.      409.      450.      457.      425.      374.
           328.      289.      254.      223.      196.      172.      152.      133.      117.      103.
            91.       80.       70.       62.       54.       48.       42.       37.       32.       28.
            25.       22.       19.       17.       15.       13.       12.       10.        9.        8.
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...              ...              ...              ...              ...

                    HYDROGRAPH AT STATION    SUBBA

  TOTAL RAINFALL =    4.72, TOTAL LOSS      2.47, TOTAL EXCESS =    2.25

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR      74.75 HR
+  (CFS)       (HR)
                          (CFS)
+    142.     14.25                142.         127.          44.          43.
                       (INCHES)    .601        2.145        2.240        2.240
                        (AC-FT)     71.         252.         263.         263.

                       CUMULATIVE AREA =    2.20 SQ MI


... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...


            .............
            .           .
 52 KK      .    COSTA  .     TION 2-3
            .           .
            .............
                    COMBINE HYDROGRAPHS 1 AND 2

 54 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                          ...

...              ...              ...              ...              ...

                    HYDROGRAPH AT STATION    COSTA

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR      74.75-HR
+  (CFS)       (HR)
                          (CFS)
+    407.     24.50                380.         283.         156.         151.
                       (INCHES)    .203         .604        1.002        1.005
                        (AC-FT)    189.         561.         930.         933.

                       CUMULATIVE AREA =   17.40 SQ MI


... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...


            .............
            .           .
 55 KK      .    MILL   .     DAM
            .           .
            .............
                    ROUTING-MODIFIED PULS

 60 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           1  PRINT CONTROL
                     IPLOT           2  PLOT CONTROL
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HYDROGRAPH ROUTING DATA

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57 RS          STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       STOR  TYPE OF INITIAL CONDITION
                   RSVRIC      28.00  INITIAL CONDITION
                        X        .00  WORKING R AND D COEFFICIENT

58 SV            STORAGE       28.0      90.0     152.0     214.0     276.0

59 SQ          DISCHARGE         0.       333.      941.     1730.     2664.
                                                            ...
```

HYDROGRAPH AT STATION MILL

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE
10	JAN	1200	1	0.	28.00	11	JAN	1300	101	388.	95.65	12	JAN	1400	201	101.	46.78
10	JAN	1215	2	0.	28.00	11	JAN	1315	102	391.	95.92	12	JAN	1415	202	100.	46.58
10	JAN	1230	3	0.	28.01	11	JAN	1330	103	392.	96.02	12	JAN	1430	203	99.	46.37
10	JAN	1245	4	0.	28.05	11	JAN	1345	104	392.	95.97	12	JAN	1445	204	98.	46.17
10	JAN	1300	5	1.	28.12	11	JAN	1400	105	390.	95.77	12	JAN	1500	205	97.	45.98
10	JAN	1315	6	1.	28.23	11	JAN	1415	106	387.	95.46	12	JAN	1515	206	96.	45.79
10	JAN	1330	7	2.	28.41	11	JAN	1430	107	383.	95.07	12	JAN	1530	207	95.	45.60
10	JAN	1345	8	4.	28.65	11	JAN	1445	108	378.	94.62	12	JAN	1545	208	94.	45.42
10	JAN	1400	9	5.	28.96	11	JAN	1500	109	374.	94.15	12	JAN	1600	209	93.	45.24
10	JAN	1415	10	7.	29.31	11	JAN	1515	110	369.	93.67	12	JAN	1615	210	92.	45.07
10	JAN	1430	11	9.	29.71	11	JAN	1530	111	364.	93.18	12	JAN	1630	211	91.	44.90
10	JAN	1445	12	11.	30.13	11	JAN	1545	112	359.	92.70	12	JAN	1645	212	90.	44.74
10	JAN	1500	13	14.	30.58	11	JAN	1600	113	355.	92.22	12	JAN	1700	213	89.	44.57
10	JAN	1515	14	16.	31.04	11	JAN	1615	114	350.	91.74	12	JAN	1715	214	88.	44.42
10	JAN	1530	15	19.	31.55	11	JAN	1630	115	345.	91.27	12	JAN	1730	215	87.	44.26
10	JAN	1545	16	22.	32.11	11	JAN	1645	116	341.	90.81	12	JAN	1745	216	87.	44.11
10	JAN	1600	17	25.	32.74	11	JAN	1700	117	336.	90.34	12	JAN	1800	217	86.	43.96
10	JAN	1615	18	29.	33.46	11	JAN	1715	118	332.	89.88	12	JAN	1815	218	85.	43.82
10	JAN	1630	19	34.	34.25	11	JAN	1730	119	330.	89.39	12	JAN	1830	219	84.	43.67
10	JAN	1645	20	38.	35.12	11	JAN	1745	120	327.	88.86	12	JAN	1845	220	83.	43.54
10	JAN	1700	21	43.	36.05	11	JAN	1800	121	324.	88.31	12	JAN	1900	221	83.	43.40
10	JAN	1715	22	48.	37.02	11	JAN	1815	122	321.	87.72	12	JAN	1915	222	82.	43.27
10	JAN	1730	23	54.	38.01	11	JAN	1830	123	317.	87.11	12	JAN	1930	223	81.	43.13
10	JAN	1745	24	59.	39.01	11	JAN	1845	124	314.	86.48	12	JAN	1945	224	81.	43.01
10	JAN	1800	25	64.	39.99	11	JAN	1900	125	311.	85.82	12	JAN	2000	225	80.	42.88
10	JAN	1815	26	70.	40.96	11	JAN	1915	126	307.	85.15	12	JAN	2015	226	79.	42.76
10	JAN	1830	27	75.	41.90	11	JAN	1930	127	303.	84.46	12	JAN	2030	227	79.	42.64
10	JAN	1845	28	80.	42.80	11	JAN	1945	128	299.	83.76	12	JAN	2045	228	78.	42.52
10	JAN	1900	29	84.	43.68	11	JAN	2000	129	296.	83.05	12	JAN	2100	229	77.	42.40
10	JAN	1915	30	89.	44.52	11	JAN	2015	130	292.	82.32	12	JAN	2115	230	77.	42.28
10	JAN	1930	31	93.	45.33	11	JAN	2030	131	288.	81.59	12	JAN	2130	231	76.	42.17
10	JAN	1945	32	97.	46.09	11	JAN	2045	132	284.	80.85	12	JAN	2145	232	76.	42.06
10	JAN	2000	33	101.	46.82	11	JAN	2100	133	280.	80.11	12	JAN	2200	233	75.	41.95
10	JAN	2015	34	105.	47.52	11	JAN	2115	134	276.	79.36	12	JAN	2215	234	74.	41.85
10	JAN	2030	35	108.	48.17	11	JAN	2130	135	272.	78.61	12	JAN	2230	235	74.	41.74
10	JAN	2045	36	112.	48.80	11	JAN	2145	136	268.	77.86	12	JAN	2245	236	73.	41.64
10	JAN	2100	37	115.	49.39	11	JAN	2200	137	264.	77.11	12	JAN	2300	237	73.	41.54
10	JAN	2115	38	118.	49.95	11	JAN	2215	138	260.	76.36	12	JAN	2315	238	72.	41.44
10	JAN	2130	39	121.	50.48	11	JAN	2230	139	256.	75.62	12	JAN	2330	239	72.	41.34
10	JAN	2145	40	123.	50.99	11	JAN	2245	140	252.	74.87	12	JAN	2345	240	71.	41.24
10	JAN	2200	41	126.	51.47	11	JAN	2300	141	248.	74.13	13	JAN	0000	241	71.	41.14
10	JAN	2215	42	128.	51.92	11	JAN	2315	142	244.	73.40	13	JAN	0015	242	70.	41.05

10 JAN 2245	44	133.	52.77	*	11 JAN 2345	144	236.	71.95	*	13 JAN [illegible]	[illegible]	[illegible]	[illegible]
10 JAN 2300	45	135.	53.16	*	12 JAN 0000	145	232.	71.23	*	13 JAN 0100	245	69.	40.58
10 JAN 2315	46	137.	53.54	*	12 JAN 0015	146	228.	70.53	*	13 JAN 0115	246	68.	40.63
10 JAN 2330	47	139.	53.90	*	12 JAN 0030	147	225.	69.83	*	13 JAN 0130	247	68.	40.60
10 JAN 2345	48	141.	54.25	*	12 JAN 0045	148	221.	69.15	*	13 JAN 0145	248	67.	40.
11 JAN 0000	49	143.	54.58	*	12 JAN 0100	149	217.	68.47	*	13 JAN 0200	249	67.	40.4[illegible]
11 JAN 0015	50	144.	54.90	*	12 JAN 0115	150	214.	67.80	*	13 JAN 0215	250	66.	40.35
11 JAN 0030	51	146.	55.20	*	12 JAN 0130	151	210.	67.14	*	13 JAN 0230	251	66.	40.26
11 JAN 0045	52	148.	55.50	*	12 JAN 0145	152	207.	66.49	*	13 JAN 0245	252	65.	40.18
11 JAN 0100	53	149.	55.79	*	12 JAN 0200	153	203.	65.86	*	13 JAN 0300	253	65.	40.10
11 JAN 0115	54	151.	56.07	*	12 JAN 0215	154	200.	65.23	*	13 JAN 0315	254	65.	40.02
11 JAN 0130	55	152.	56.34	*	12 JAN 0230	155	197.	64.61	*	13 JAN 0330	255	64.	39.94
11 JAN 0145	56	154.	56.60	*	12 JAN 0245	156	193.	64.01	*	13 JAN 0345	256	64.	39.87
11 JAN 0200	57	155.	56.86	*	12 JAN 0300	157	190.	63.41	*	13 JAN 0400	257	63.	39.79
11 JAN 0215	58	156.	57.11	*	12 JAN 0315	158	187.	62.83	*	13 JAN 0415	258	63.	39.71
11 JAN 0230	59	158.	57.36	*	12 JAN 0330	159	184.	62.25	*	13 JAN 0430	259	63.	39.64
11 JAN 0245	60	159.	57.60	*	12 JAN 0345	160	181.	61.69	*	13 JAN 0445	260	62.	39.57
11 JAN 0300	61	160.	57.84	*	-12 JAN 0400	161	178.	61.14	*	13 JAN 0500	261	62.	39.49
11 JAN 0315	62	162.	58.07	*	12 JAN 0415	162	175.	60.60	*	13 JAN 0515	262	61.	39.42
11 JAN 0330	63	163.	58.31	*	12 JAN 0430	163	172.	60.07	*	13 JAN 0530	263	61.	39.35
11 JAN 0345	64	164.	58.57	*	12 JAN 0445	164	169.	59.55	*	13 JAN 0545	264	61.	39.28
11 JAN 0400	65	166.	58.90	*	12 JAN 0500	165	167.	59.04	*	13 JAN 0600	265	60.	39.21
11 JAN 0415	66	168.	59.33	*	12 JAN 0515	166	164.	58.54	*	13 JAN 0615	266	60.	39.14
11 JAN 0430	67	171.	59.91	*	12 JAN 0530	167	161.	58.05	*	13 JAN 0630	267	59.	39.07
11 JAN 0445	68	175.	60.61	*	12 JAN 0545	168	159.	57.58	*	13 JAN 0645	268	59.	39.00
11 JAN 0500	69	180.	61.43	*	12 JAN 0600	169	156.	57.11	*	13 JAN 0700	269	59.	38.94
11 JAN 0515	70	184.	62.35	*	12 JAN 0615	170	154.	56.65	*	13 JAN 0715	270	58.	38.87
11 JAN 0530	71	190.	63.35	*	12 JAN 0630	171	152.	56.21	*	13 JAN 0730	271	58.	38.81
11 JAN 0545	72	196.	64.42	*	12 JAN 0645	172	149.	55.77	*	13 JAN 0745	272	58.	38.74
11 JAN 0600	73	202.	65.55	*	12 JAN 0700	173	147.	55.35	*	13 JAN 0800	273	57.	38.68
11 JAN 0615	74	208.	66.72	*	12 JAN 0715	174	145.	54.93	*	13 JAN 0815	274	57.	38.61
11 JAN 0630	75	214.	67.93	*	12 JAN 0730	175	142.	54.52	*	13 JAN 0830	275	57.	38.55
11 JAN 0645	76	221.	69.17	*	12 JAN 0745	176	140.	54.13	*	13 JAN 0845	276	56.	38.49
11 JAN 0700	77	228.	70.42	*	12 JAN 0800	177	138.	53.74	*	13 JAN 0900	277	56.	38.43
11 JAN 0715	78	235.	71.69	*	12 JAN 0815	178	136.	53.36	*	13 JAN 0915	278	56.	38.37
11 JAN 0730	79	242.	72.97	*	12 JAN 0830	179	134.	52.99	*	13 JAN 0930	279	55.	38.30
11 JAN 0745	80	248.	74.25	*	12 JAN 0845	180	132.	52.63	*	13 JAN 0945	280	55.	38.24
-11 JAN 0800	81	255.	75.53	*	12 JAN 0900	181	130.	52.28	*	13 JAN 1000	281	55.	38.18
11 JAN 0815	82	262.	76.80	*	12 JAN 0915	182	129.	51.93	*	13 JAN 1015	282	54.	38.13
11 JAN 0830	83	269.	78.07	*	12 JAN 0930	183	127.	51.60	*	13 JAN 1030	283	54.	38.07
11 JAN 0845	84	276.	79.32	*	12 JAN 0945	184	125.	51.27	*	13 JAN 1045	284	54.	38.01
11 JAN 0900	85	282.	80.57	*	12 JAN 1000	185	123.	50.95	*	13 JAN 1100	285	53.	37.95
11 JAN 0915	86	289.	81.79	*	12 JAN 1015	186	122.	50.64	*	13 JAN 1115	286	53.	37.89
11 JAN 0930	87	295.	83.00	*	12 JAN 1030	187	120.	50.33	*	13 JAN 1130	287	53.	37.84
11 JAN 0945	88	302.	84.19	*	12 JAN 1045	188	118.	50.04	*	13 JAN 1145	288	53.	37.78
11 JAN 1000	89	308.	85.36	*	12 JAN 1100	189	117.	49.75	*	-13 JAN 1200	289	52.	37.73
11 JAN 1015	90	314.	86.51	*	12 JAN 1115	190	115.	49.46	*	13 JAN 1215	290	52.	37.67
11 JAN 1030	91	320.	87.64	*	12 JAN 1130	191	114.	49.19	*	13 JAN 1230	291	52.	37.62
11 JAN 1045	92	326.	88.75	*	12 JAN 1145	192	112.	48.92	*	13 JAN 1245	292	51.	37.56
11 JAN 1100	93	332.	89.83	*	-12 JAN 1200	193	111.	48.66	*	13 JAN 1300	293	51.	37.51
11 JAN 1115	94	341.	90.86	*	12 JAN 1215	194	110.	48.40	*	13 JAN 1315	294	51.	37.45
11 JAN 1130	95	351.	91.79	*	12 JAN 1230	195	108.	48.15	*	13 JAN 1330	295	50.	37.40
11 JAN 1145	96	359.	92.63	*	12 JAN 1245	196	107.	47.91	*	13 JAN 1345	296	50.	37.35
11 JAN 1200	97	366.	93.40	*	12 JAN 1300	197	106.	47.67	*	13 JAN 1400	297	50.	37.30
11 JAN 1215	98	373.	94.10	*	12 JAN 1315	198	104.	47.44	*	13 JAN 1415	298	50.	37.24
11 JAN 1230	99	379.	94.72	*	12 JAN 1330	199	103.	47.22	*	13 JAN 1430	299	49.	37.19
11 JAN 1245	100	384.	95.25	*	12 JAN 1345	200	102.	47.00	*	13 JAN 1445	300	49.	37.14

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW (CFS) 6-HR	24-HR	72-HR	74.75-HR
392.	25.50	369.	281.	155.	150.

(AC-FT)	183.	557.	923.	924.

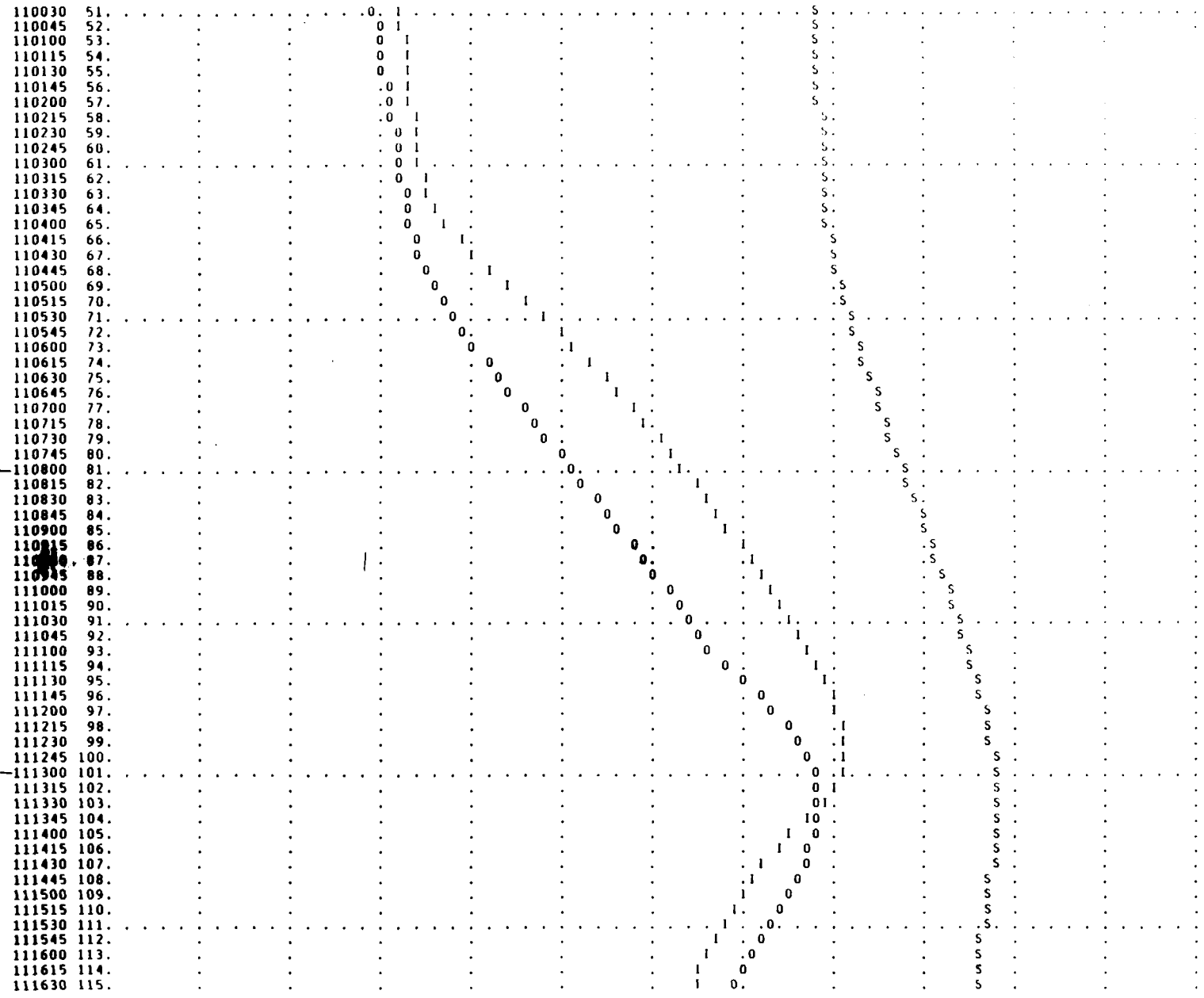
PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	74.75-HR
96.	25.50	94.	80.	57.	56.

CUMULATIVE AREA = 17.40 SQ MI

STATION MILL

(I) INFLOW, (O) OUTFLOW

		0.	50.	100.	150.	200.	250.	300.	350.	400.	450.	0.	0.	0.
										(S) STORAGE				
		0.	0.	0.	0.	0.	0.	20.	40.	60.	80.	100.	0.	0.
DAHRMN	PER													
101200	1	I							S					
101215	2	I							S					
101230	3	I							S					
101245	4	I							S					
101300	5	I							S					
101315	6	I							S					
101330	7	I							S					
101345	8.	I							S					
101400	9.	I							S					
101415	10.	I							S					
101430	11.	O I							S					
101445	12.	O I							S					
101500	13.	O I							S					
101515	14.	O I							S					
101530	15.	O I							S					
101545	16.	O I							S					
101600	17.	O I							S					
101615	18.	O I							S					
101630	19.	O I							S					
101645	20.	O I							S					
[illegible]	21.	O I							S					
101715	22.	O I							S					
101730	23.	O I							S					
101745	24.	O I							S					
101800	25.	O I							S					
101815	26.	O I							S					
101830	27.	O I							S					
101845	28.	O I							S					
101900	29.	O I							S					
101915	30.	O I							S					
101930	31.	O I							S					
101945	32.	O I							S					
102000	33.	O I							S					
102015	34.	O I							S					
102030	35.	O I							S					
102045	36.	O I							S					
102100	37.	O I							S					
102115	38.	O I							S					
102130	39.	O I							S					
102145	40.	O I							S					
102200	41.	O I							S					
102215	42.	O I							S					
102230	43.	O I							S					
102245	44.	O I							S					
102300	45.	O I							S					
102315	46.	O I							S					
102330	47.	O I							S					
102345	48.	O I							S					
110000	49.	O I							S					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110245 60.
110300 61.
110315 62.
110330 63.
110345 64.
110400 65.
110415 66.
110430 67.
110445 68.
110500 69.
110515 70.
110530 71.
110545 72.
110600 73.
110615 74.
110630 75.
110645 76.
110700 77.
110715 78.
110730 79.
110745 80.
110800 81.
110815 82.
110830 83.
110845 84.
110900 85.
110915 86.
110930 87.
110945 88.
111000 89.
111015 90.
111030 91.
111045 92.
111100 93.
111115 94.
111130 95.
111145 96.
111200 97.
111215 98.
111230 99.
111245 100.
111300 101.
111315 102.
111330 103.
111345 104.
111400 105.
111415 106.
111430 107.
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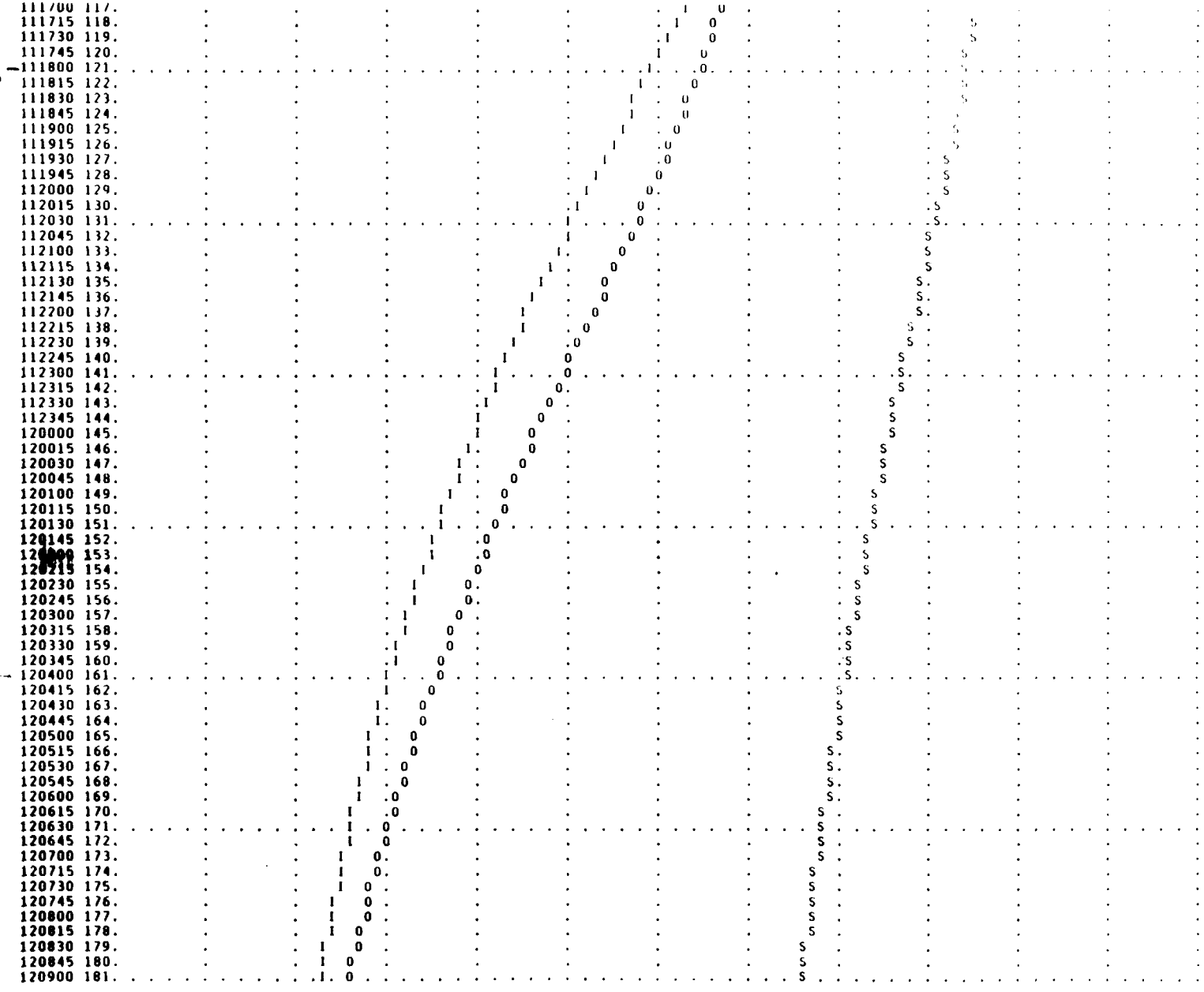
111515 110.
111530 111.
111545 112.
111600 113.
111615 114.
111630 115.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111915 126.
111930 127.
111945 128.
112000 129.
112015 130.
112030 131.
112045 132.
112100 133.
112115 134.
112130 135.
112145 136.
112200 137.
112215 138.
112230 139.
112245 140.
112300 141.
112315 142.
112330 143.
112345 144.
120000 145.
120015 146.
120030 147.
120045 148.
120100 149.
120115 150.
120130 151.
120145 152.
120215 154.
120230 155.
120245 156.
120300 157.
120315 158.
120330 159.
120345 160.
120400 161.
120415 162.
120430 163.
120445 164.
120500 165.
120515 166.
120530 167.
120545 168.
120600 169.
120615 170.
120630 171.
120645 172.
120700 173.
120715 174.
120730 175.
120745 176.
120800 177.
120815 178.
120830 179.
120845 180.
120900 181.

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120930 183.                 . I  0                                    S
120945 184.                 . I  0                                    S
121000 185.                 . I  0                                   S
121015 186.                 .I  0                                    S
121030 187.                 .I  0                                    S
121045 188.                 .I  0                                    S
121100 189.                 .I 0                                     S
121115 190.                 I  0                                     S
121130 191.                 I .0                                     .S
121145 192.                 I 0                                     S
121200 193.                 I 0                                     S
121215 194.                I. 0                                     S
121230 195.                I. 0                                     S
121245 196.                I.0                                      S
121300 197.                I.0                                      S
121315 198.                I.0                                      S
121330 199.               I .0                                      S
121345 200.               I 0                                     S
121400 201.               I 0                                     .S
121415 202.               I 0                                     S
121430 203.               I 0                                     S
121445 204.               I 0                                     S
121500 205.              I 0.                                     S
121515 206.              I 0.                                     S
121530 207.              I 0.                                     S
121545 208.              I 0.                                     S
121600 209.              I 0.                                     S
121615 210.              I0 .                                     S
121630 211.              I0                                      S
121645 212.             I 0 .                                    S
121700 213.             I 0 .                                    S
121715 214.             I 0 .                                    S
121730 215.             I0  .                                    S
121745 216.             I0  .                                    S
121800 217.             I0  .                                    S
121815 218.             I0  .                                    S
121830 219.            I 0  .                                    S
121845 220.            I 0  .                                    S
121900 221.            I.0                                      S
121915 222.           I0   .                                    S
121930 223.           I0   .                                    S
121945 224.           I0   .                                    S
122000 225.           I0   .                                   .S
122015 226.           I0   .                                   .S
122030 227.           I0   .                                   .S
122045 228.          I 0   .                                   .S
122100 229.          I0    .                                   .S
122115 230.          I0    .                                   .S
122130 231.          I0                                        .S
122145 232.          I0    .                                   .S
122200 233.          I0    .                                   .S
122215 234.          I0    .                                   .S
122230 235.          I0    .                                   .S
122245 236.          I0    .                                   .S
122300 237.          I0    .                                   .S
122315 238.         I0     .                                   .S
122330 239.         I0     .                                   .S
122345 240.         I0     .                                   .S
130000 241.         I0                                         .S
130015 242.         I0     .                                   .S
130030 243.         I0     .                                  S
130045 244.         I0     .                                  S
130100 245.         I0     .                                  S
130115 246.         I0     .                                  S
130130 247.         I0     .                                  S
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130200 249.        . I      .         .         .         .         .         S         .         .         .         .         .
130215 250.        . IO     .         .         .         .         .         S         .         .         .         .         .
130230 251. . . . . IO. . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . .
130245 252.        . IO     .         .         .         .         .         S         .         .         .         .         .
130300 253.        . IO     .         .         .         .         .         S         .         .         .         .         .
130315 254.        . IO     .         .         .         .         .         S         .         .         .         .         .
130330 255.        . IO     .         .         .         .         .         S         .         .         .         .         .
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130400 257.        . IO     .         .         .         .         .         S         .         .         .         .         .
130415 258.        . IO     .         .         .         .         .         S         .         .         .         .         .
130430 259.        . IO     .         .         .         .         .         S         .         .         .         .         .
130445 260.        . I      .         .         .         .         .         S         .         .         .         .         .
130500 261. . . . . I . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . .
130515 262.        . I      .         .         .         .         .         S         .         .         .         .         .
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130745 272.        .IO      .         .         .         .         .        S.         .         .         .         .         .
130800 273.        .I       .         .         .         .         .        S.         .         .         .         .         .
130815 274.        .I       .         .         .         .         .        S.         .         .         .         .         .
130830 275.        .I       .         .         .         .         .        S.         .         .         .         .         .
130845 276.        .I       .         .         .         .         .        S.         .         .         .         .         .
130900 277.        .I       .         .         .         .         .        S.         .         .         .         .         .
130915 278.        .I       .         .         .         .         .        S.         .         .         .         .         .
130930 279.        IO       .         .         .         .         .        S.         .         .         .         .         .
130945 280.        IO       .         .         .         .         .        S.         .         .         .         .         .
-131000 281. . . . . IO. . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . . . .
131015 282.        IO       .         .         .         .         .        S.         .         .         .         .         .
131030 283.        IO       .         .         .         .         .        S.         .         .         .         .         .
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131215 290.        I        .         .         .         .         .        S.         .         .         .         .         .
131230 291. . . . . I . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . . . .
131245 292.        I        .         .         .         .         .        S.         .         .         .         .         .
131300 293.        I        .         .         .         .         .        S.         .         .         .         .         .
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131330 295.        I        .         .         .         .         .        S.         .         .         .         .         .
131345 296.        I        .         .         .         .         .        S.         .         .         .         .         .
131400 297.       IO        .         .         .         .         .        S.         .         .         .         .         .
131415 298.       IO        .         .         .         .         .        S.         .         .         .         .         .
131430 299.       IO        .         .         .         .         .        S.         .         .         .         .         .
131445 300.--------IO--------.---------.---------.---------.---------.--------S.---------.---------.---------.---------.---------.
1
1
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	SUBBA	269.	22.00	269.	225.	80.	6.80		

	ROUTED TO						
+		NB RE	91.	29.25	90.	81.	55.	6.80
	ROUTED TO						
+		SUBBA	91.	32.00	90.	81.	54.	6.80
	HYDROGRAPH AT						
+		SUBBA	306.	23.25	304.	254.	90.	8.40
	2 COMBINED AT						
+		COSTA	375.	24.25	365.	297.	144.	15.20
	ROUTED TO						
+		HAMLI	301.	27.00	291.	223.	113.	15.20
	ROUTED TO						
+		SUBBA	301.	27.75	291.	223.	113.	15.20
	HYDROGRAPH AT						
+		SUBBA	142.	14.25	142.	127.	44.	2.20
	2 COMBINED AT						
+		COSTA	407.	24.50	380.	283.	156.	17.40
	ROUTED TO						
+		MILL	392.	25.50	369.	281.	155.	17.40

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

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PRINCIPAL

FAX (212) 243-9743

TELEPHONE: (212) 645-9898

FAX COVER SHEET

DATE: July 17 1989

JOB : N- 756

TO ATTENTION OF: Gary Garfield
BALSAM

(New Bedford PCB Project)

FAX ~~TEL~~ NO. (603) 893-6240 FAX NO: ( )

TOTAL NUMBER OF SHEETS TO FOLLOW 5

CONSISTING OF ____ pages of TEXT, plus ____ pages of

3 pages of Calculations + 2 pgs - Tables

COMMENTS:

As requested, enclosed are settlement calcs - please call if you have any questions.

CC:

FROM: CM Carr

Q.IX.0015

NEW BEDFORD HARBOR, MA

SETTLEMENT CALCS – FILLING OF UPPER ESTUARY

1. SOIL PROPERTIES

Use GEI Test Results as Being Typical for the Upper Estuary (GEI Table 5 - Attached):

Assume $\bar{w} = 100\%$ $\bar{LL} = 110\%$

$\bar{G} = 2.60$ $\bar{e}_o = G w = 2.60$

Estimate C_c from Atterberg Limits:

$C_c' \simeq .009\,[LL - 10]$ (Terzaghi + Peck Formula 1967)

$= .009\,(100) = 0.90$

$C_c \simeq .009\,w + .005\,LL$ (Koppula 1986)

$= .009\,(100) + .005\,(110) = 1.45$

$\therefore$ SAY $C_c \simeq 1.2$

GEI Fig. C3 (Attached):

$\log C_v \simeq -5.3 \rightarrow C_v = 5(10)^{-6}\ ft^2/sec$

- SEEMS TOO HIGH – USE $2(10)^{-6}$ to be conservative

$\gamma'_{silt} = \frac{G-1}{1+e}\gamma_w \simeq \frac{1.60}{3.60}(63) = 28\ PCF$

* Bowles. Foundation Analysis + Design Table 2-5 Attached.

2. SETTLEMENT FOR 10' SILT LAYER + 2' SAND FILL

$H' = 10'$ SILT LAYER, $\gamma' = 28$ PCF, Double Drainage ($H' = 5$)

SURCHARGE - SAY 2' SAND @ 55 PCF (Submerged Cond)

* Calcs for 17' Layer

$$\Delta H_{PRI} = \frac{C_c H}{1+e_o} \log\left[\frac{\bar{p}_o + \Delta p}{\bar{p}_o}\right]$$

$\bar{p}_o = 5'(28\text{ PCF}) = 140$ PSF

$p_o = 8.5 \quad 28$ PCF $= 238.0$ PSF

$\Delta p = 2'(55\text{ PCF}) = 110$ PSF

$\Delta p = 2'(55$ PCF$) = 110$ PCF

$C_c = 1.20 \qquad e_o = 2.60$

$C_c = 1.20 \qquad e_o = 2.60$

$$\Delta H = \frac{1.20(10)}{3.60} \log\left[\frac{250}{140}\right] = 0.8'$$

$$\frac{1.20(17)}{3.60} \log\left[\frac{248}{238}\right] = 0.94$$

Time for 90% Primary Settlement ($T_v = 0.848$)

$$t = T_v H'^2 / C_v$$

$$= \frac{0.848(5)^2}{.000002} \times \frac{HR}{3600\text{ SEC}} \times \frac{DAY}{24\text{ HR}} = 122 \text{ Days}$$

$$= \frac{0.848(8.5)^2}{0.000002} \times \frac{1}{3600} \times \frac{1}{24} = 354 \text{ days} \approx 1 \text{ year}$$

~ 4 MONTHS

Secondary Settlement:

$$\Delta H_{SEC} = C_\alpha [\log(t_2/t_1)] H$$

Assume $t_1 = 122$ Days

$t_2 = 1$ Year & 10 Years

$\bar{C}_\alpha = 1.2\%$ (GEI Consol Tests - FIG C1 & C2).

@ 1 Year

$$\Delta H_{SEC} = .012 \log (365/122)(10') = .06'$$

@ 10 Years

$$\Delta H_{SEC} = .012 \log (3650/122)(10) = 0.20'$$
$$.012 [\log (3650/354)](10) = 0.207'$$

TOTAL SETTLEMENT 0.8' Primary + 0.2' Secondary
0.94 + 0.207 = 1.15' in 12 MTHS
SAY 1.0' TOTAL SETTLEMENT -
- MOST WILL OCCUR IN 6 MONTHS

3. SETTLEMENT FOR 4' SILT LAYER + 2' FILL

* Calcs for 2' silt layer

$\bar{p}_o = 2'(28) = 56$ PSF $\quad \Delta p = 2(55) = 110$ PSF
(28) = 28 PSF $\quad \Delta P = 2(55) = 110$ PSF

$$\Delta H_{PRS} = \frac{1.2(4)}{3.6} \log \left[\frac{56+110}{56} \right] = 0.6'$$
$$\frac{1.2(2)}{3.6} \log \frac{28+110}{28} = 0.5'$$

$$t_{PRI} = \frac{0.848(2)^2}{.00900 2} \frac{1}{3600(24)} = 20 \text{ Days}$$
$$\frac{0.848(1)}{.000002} \frac{1}{3600 \cdot 24} = 5 \text{ days}$$

$$\Delta H_{SEC\ 10 YEARS} = .012 \log [3650/20] 4$$
$$.012 \log (3650/5) 4$$
$$= 0.1 \text{ ft}$$
$$= 0.1 \text{ FT}$$

$$\Delta H_{TOT} = 0.6' \text{ Primary} + 0.1' \text{ Secondary} = 0.7'$$

- MOST WILL OCCUR IN 1 MONTH

$\Delta H_{TOT} = 0.6 \rightarrow$ 0.5 (Pri) 0.1 (Second) in 1 week

TABLE 5 SUMMARY OF LABORATORY TESTS
New Bedford Superfund Site

Boring	Sample	Depth ft.	Natural w %	LL	PL	PI	Classification	Specific Gravity	Grain Size Fig.	Consolidation Test Fig. No.	eo	wo	CR	Q Test Fig. No.	Q Test Water Content %	Q Test Peak Deviator Stress psf	R Test Fig. No.	R Test Effective Consolidation Stress psf	R Test Water Content after Consolidation %	R Test Peak Shear Stress psf
FD27	U01	5.5-7.5	128	122	35	87	OH							C4	128	120				
FD27	U02	8.0-10.0	103	104	33	71	OH							C3	103	233				
FD27	U04	13.0-15.0	120				OH													
FD25	U02	7.5-9.5	92	83	25	58	OH		4					C6	92	105	C9	614	66	298
FD34A	U01	4.0-6.0	120				OH													
FD34A	U02	6.5-8.5	99	126	35	81	OH	2.59		C1	3.088	118.0	0.654							
FD34	U3	10.0-12.0	91	105	33	73	OH	2.66									C8	1434	57	407
FD34	U5	15.0-17.0	88	103	36	67	OH	2.56	6	C2	2.321	90.0	0.243	C5	86	519				
TP3	S1	4.0					SM		5											
TP4	S1	3.5					SM		5											

(CA x 400 5)

(GEI Rept - Table 5)

TABLE 2-5
Equations for the compression index from sources noted

Compression index	Comments	Source
$C_c = 0.009(w_L - 10)$	±30%; Clays of moderate s.	Terzaghi and Peck (1967)
$0.37(e_o + 0.003w_L + 0.0004w_n - 0.34)$	Statistical analysis	Azzouz et al. (1976)
$0.5\left(\frac{1+e_o}{G_s}\right)^{2.4}$	$e_o \leq 0.8$ (author's recommendation)	Rendon-Herrero (1980)
$-0.0997 + 0.0009w_L + 0.0014I_p + 0.0036w_n + 0.1165e_o + 0.0025C_p$	134 soils analyzed	Koppula (1981)
$0.2343e_o$	— —	Nagaraj and Murthy (1985, 1986a)
$0.009w_n + 0.005w_L$	— —	Koppula (1986)
$C_r = 0.0463w_LG_s$	recompression index	Nagaraj and Murthy (1985)

Notes: Use w_L, w_n, W_n/p as percentage and not decimal
Compute in situ void ratio $e_o = w_nG_s$
C_p = percent clay (material finer than 0.002 mm)
The ratio of C_r/C_c is 20 percent as noted by Wroth (1979) using the Nagaraj and Murthy equations.
Equations that use e_o (or w_n) and w_L are for both normally and overconsolidated soils.

FAX 5 OF 5

(Bowles - 4th Ed)

TOTAL P.07

ENVIRONMENTAL
CONCERN

Weldon S. Bosworth
Balsam Environmental Consultants, Inc.
59 Stiles Road
Salem, NH 03079

5 December 1988

Dear Weldon:

Enclosed is a short report entitled "Restrictions on the Proposed Capping Operations in New Bedford Harbor to Maintain the Viability of Existing Saltmarsh". I hope that this meets your need for the moment. If not, please let me know.

Sincerely,

EG

Edgar W. Garbisch

P.O. Box P, St. Michaels, Maryland 21663 | (301) 745-9620

Q.IX-0017

RESTRICTIONS ON THE PROPOSED CAPPING OPERATIONS IN NEW BEDFORD HARBOR TO MAINTAIN THE VIABILITY OF EXISTING SALTMARSH

Saltmarsh plant species tolerate, but do not require salt for optimum development and propagation. In fact, freshwater culture of saltmarsh species is the most practical approach for nursery propagation (Garbisch, unpublished results). The tolerance of saltmarsh plants to soil salinities is limited and salinities in excess of 50 ppt are toxic to most species. Consequently, in order to maintain the viability of existing saltmarsh during the capping operations, soil salt concentrations must be maintained well below the toxic 50 ppt level, particularly during the growing season.

Wetland plant species survive anoxic root environments through various adaptive and avoidance mechanisms, the most significant of which appears to be an avoidance mechanism in which the plant develops an oxygen transport path from aboveground to belowground parts. This produces an oxidized rhizosphere which allows aerobic root respriation as well as oxidation of sulfide toxins and supplies oxygen to mycorrhizal symbionts (Mendelssohn and Burdick 1988)

<u>Spartina</u> <u>alterniflora</u> (cordgrass) is a saltmarsh plant species that utilizes this avoidance mechanism to survive anoxic root environments during the growing season (Mendelssohn and Burdick 1988). However, during the dormant season when this oxygen transport mechanism is no longer functioning, this species will not survive continually waterlogged and flooded soils (Garbisch, unpublished results). Apparently root/rhizome respiration during the dormant period is significant and the species has no adaptive mechanismto survive anoxic soils. Consequently, in order to maintain the viability of existing saltmarsh during the capping operations, continually waterlogged or flooded soils must be avoided, particularly during the dormant season.

Two approaches to capping have been considered; dry capping and wet capping. During the dry capping operations, tidal water is excluded from the capping area by constructing a temporary dam. Freshwater inflows to the area are pumped out. In wet capping, the weir level in the dam under the Coggeshall St. Bridge is set at a level to retain a sufficient height of water over the areas to be capped in order to complete the capping operations. Itwould appear that the dry and wet capping operations would be best conducted during the dormant (November-March) and growing (May-September) seasons, respectively, in order to maintain the viability of the existing saltmarsh.

DRY CAPPING

Dry capping should not be conducted during the growing season. The problem is not so much desiccation as it is salt toxicity. With soil salt concentrations of about 25 ppt, soil water has to evaporate/evapotranspirate by only one-half before the soil salt concentrations become toxic to cordgrass and the high marsh plant species. Irrigation by saltwater does not appear to be a solution. To be effective and not aggravate the salt buildup problem, such irrigation would have to be continuous so as to maintain saturated soils with soil salt concentrations between 25 and 40 ppt. Such continuous irrigation of the saltmarsh would likely interfere with the dry capping operations.

Dry capping should be accomplished during the late fall and winter (November-March) for the following reasons. Dormant saltmarsh plants are not as sensitive to high soil salt concentrations as are the growing plants. There is no evaptranspiration during the dormant season and evaporation rates are grately reduced because of low temperatures. Also, precipitation normally is greater during the dormant than during the growing season. The low and high marsh plant species are hardy and not subject to freeze kill.

The dry capping operations during the late fall and winter probably should be shut down on a biweekly schedule in order to reintroduce unrestricted tidal water to the estuary for several days before resumption of the capping operations.

WET CAPPING

It is unknown for how long cordgrass and the high marsh plant species can tolerate waterlogged and flooded soils during the dormant season before suffocating. During the overwintering of nursery plants of these species, continuous flooding over the tops of the pots by 2-3" of water for two weeks has led to a total loss of the plants. When this degree of flooding is maintained during the entire growing season, excellent plant development results (Garbisch, unpublished results).

Wet capping probably could be accomplished successfully at any time of year if the plant tolerances to flooding during the dormant season were better understood. The advantages to wet capping during the dormant season is that the depth of water over the vegetated areas should not be a critical element. However, as details regarding plant tolerances to prolonged flooding during the dormant season are unknown, wet capping should be conducted during the growing season.

In wet capping during the growing season (May-September), it is important that all saltmarsh species emerge sufficiently from the water to effectively transport oxygen belowground. In the nursery production of cordgrass, having at least one-half the height of the plant emerge from the water is sufficient (Garbisch, unpublished results).

If the lowest elevation cordgrass is about 4 feet tall and found at approximately Mean Sea Level, the highest the weir on the dam should be set would be at Mean High Water. This would lead to a flooding of the lowest elevation cordgrass

by 1.85 feet of water during times when the tide is at MHW or below. Setting the weir above MHW would jeopardize the short high marsh herbaceous species (Spartina patens and Distichlis spicata) as well as the lower elevation cordgrass.

Wet capping operations probably should be shut down on a weekly or at least biweekly schedule. Unrestricted tidal water should be reintroduced to the capping area for several days before resumption of the capping operations.

Mendelssohn, I.A. and D.M. Burdick. 1988. The relationship of soil parameters and root metabolism to primary productivity in periodically inumdated soils. The Ecology and Management of Wetlands. Vol I. Ecology of Wetlands. D.D. Hook and others, editors. Timber Press, Portland, OR. pp. 398-428