AD-A064 322 KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA F/G 13/2
NATIONAL DAM SAFETY PROGRAM, GILBOA DAM, MOHAWK RIVER BASIN, SC--ETC(U)
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MOHAWK RIVER BASIN

GILBOA DAM

SCHOHARIE COUNTY, NEW YORK
INVENTORY NUMBER NY 178

(18)

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

Contract: DACW51-78-C-0025 New

LEVEL II

Prepared by

L. ROBERT KIMBALL and ASSOCIATES
615 W. Highland Ave. Ebensburg, Pa.

Prepared For

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK, NEW YORK

MOHAWK RIVER BASIN

GILBOA DAM

SCHOHARIE COUNTY, NEW YORK
INVENTORY NUMBER NY 178

PHASE 1
INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Gilboa Dam, Mohawk River Basin,
Schoharie County, New York (NY 178).
Phase 1 Inspection Report,

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Description of Photographs
Gilboa Dam

Plate

1. Overall view of masonry and earth dam sections and spillway channel at toe from right abutment.

2. View of downstream slope of earth embankment section from left abutment.

APPENDIX C

3. View of masonry section from transition wall.
Note: Deterioration of downstream steps and baffles.

4. View from stilling basin area showing overflow from spillway channel to stilling basin.

5. View of immediate downstream area showing stilling basin dam at bottom of photo.

6. Close up of baffles and steps from right abutment. Baffles at left were removed.

7 & 8. Close up of downstream step deterioration from spillway channel.

9. Hillside slide downstream of stilling basin.

Phase I Report

Name of Dam: Gilboa Dam - Schoharie Reservoir

State Located: New York

County Located: Schoharie

Stream: Schoharie Creek

Date of Inspection: May 3, 1978

ASSESSMENT

The visual inspection and evaluation of the Gilboa Dam did not reveal any problems which would require emergency action.

The yellow report cover implying further action, was assigned as stability analysis under maximum water level is required. However, a recent study which was not available for our review may have included these analyses. In the event that stability analyses have been completed and the results of these most recent more detailed studies did not reveal any structural deficiencies no further action will be required.

It was our hope that the Power Authority of the State of New York would make this report available for our review prior to preparation of the final report for this dam. However, this was not the case. As we were not able to inspect the dam when no water was flowing we feel that review of this report is essential for commplete analysis of the safety of the dam.

Results of hydrologic analysis conducted for this report indicated that the spillway is adequate to pass the PMF.

Approved by R. Jeffrey Kimball
R. Jeffrey Kimball, P.E.
L. Robert Kimball & Associates
Registration No. PA 26275E

Approved by Clark H. Benn
CLARK H. BENN
Colonel, Corps of Engineers
District Engineer
30 Jun 78

PLATE 1

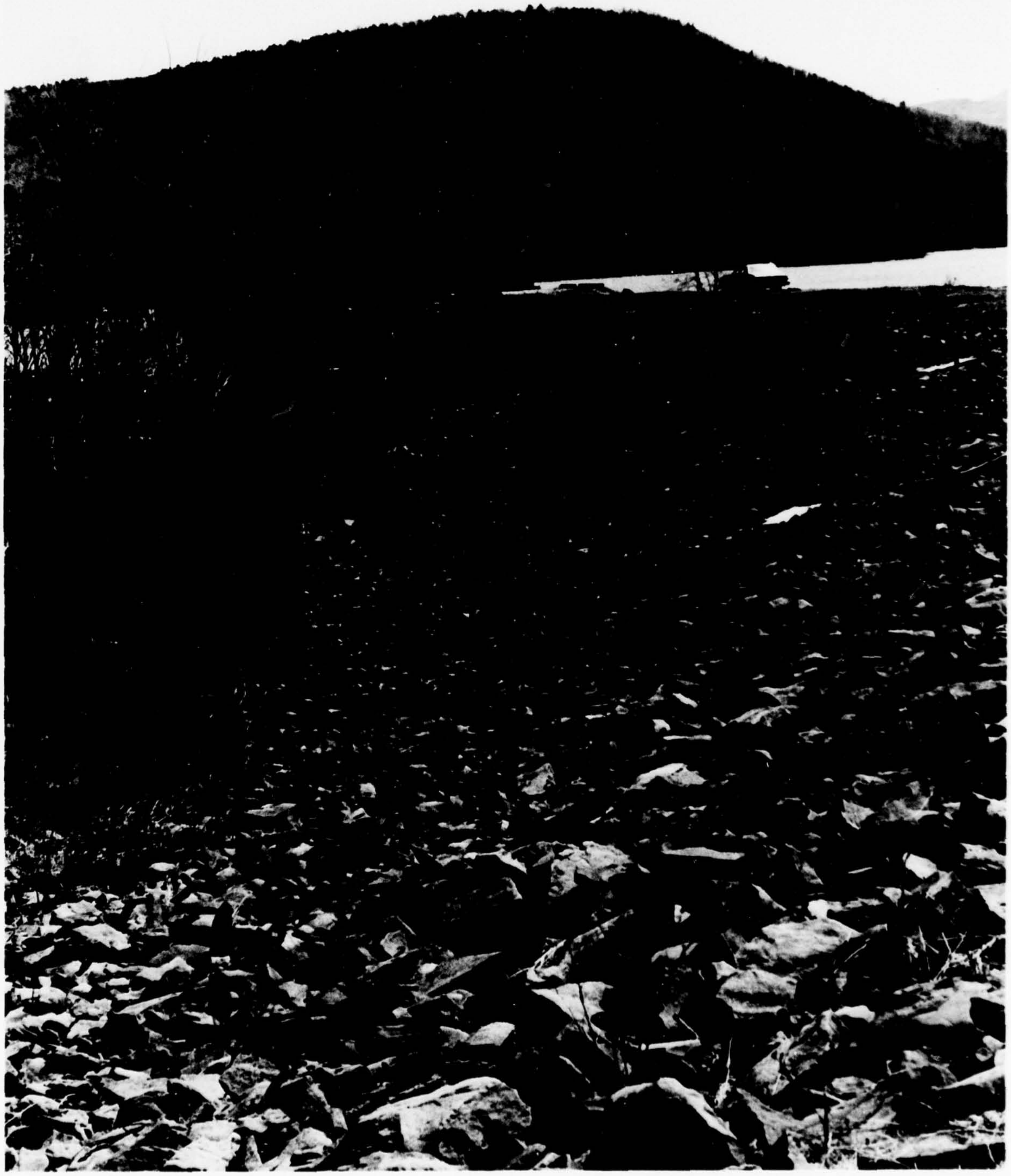
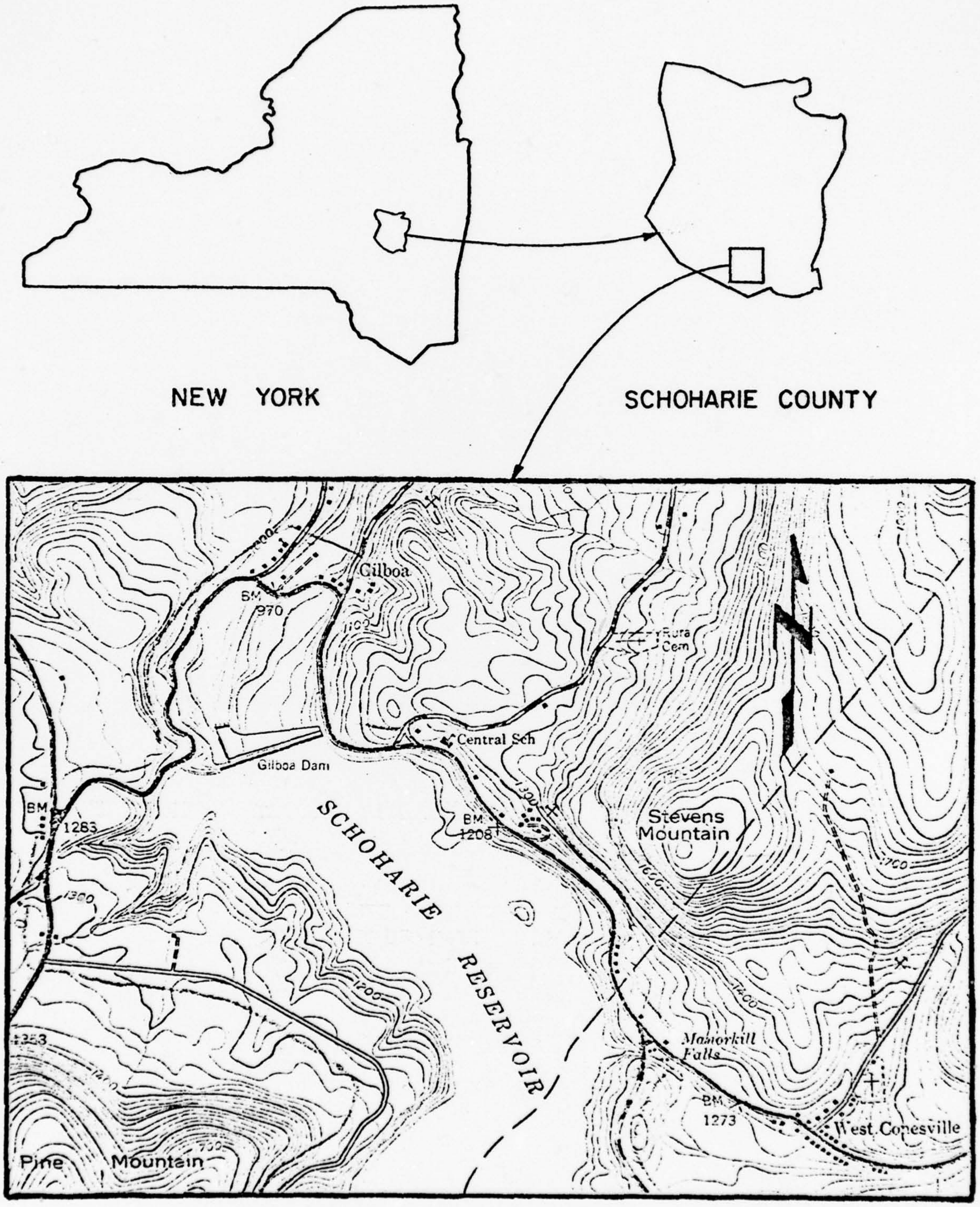


PLATE 2



Portion of U.S.G.S. 7.5 minute Gilboa Quadrangle

GILBOA DAM

SITE LOCATION MAP

SCALE : 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GILBOA DAM - SCHOHARIE RESERVOIR
NY ID No. NY 178

SECTION I PROJECT INFORMATION

1.1 General

a. Authority: Authority is provided by the National Dam Inspection Program, Public Law 92-367
Contract No. DACW51-78-C-0025

b. Purpose of Project: Evaluation of non-Federal dams to identify dams which are a threat to life and property.

1.2 Description of Project:

a. Description of Dam and Appurtenances: Cyclopean masonry overflow gravity dam with zoned earth embankment at left abutment.

The structure has a stepped downstream face. Overflow cascades down the face into a concrete paved channel. This channel flows nearly parallel to the dam crest over two steps to a stilling basin. The stilling basin is a pool formed by an old low concrete dam.

b. Location: The dam is located near Gilboa and Prattsville, Schoharie County, New York.

c. Size Classification: The dam is a large size structure with a height of 183 feet from the rock foundation and 166 feet from the stilling basin pool. The dam impounds 60,000 ac-ft at normal pool elevation (1130 feet).

d. Hazard Classification: The dam is classified as high hazard potential.

e. Ownership: The dam is owned by New York City.

f. Purpose of Dam: The impounded waters are a part of the New York City water supply system.

g. Design and Construction History: The Gilboa Dam was designed by the owner and constructed by Hugh Nawn during the period of 1917 to 1926. The dam was placed in service in 1926.

Construction drawings are available at the offices of the Design Division of the New York City Water Supply in New York City. Construction specifications are also available.

The chronology of the structure is listed briefly on the following page.

1. Construction 1917 to 1926
2. Placed in service 1926
3. Spillway exit channel paved with concrete in 1950
4. October 15, 1955, the maximum recorded overflow of 6.26 feet (elev. 1136.26) over the spillway
5. Test borings, soil sampling, masonry sampling, monitor installation, completed by UHL, Hall and Rich for the Power Authority of New York State in 1977.

h. Normal Operational Procedures: The reservoir is operated as a water supply reservoir with water supply extracted as required.

1.3 Pertinent Data

a. Drainage Areas: The Gilboa Dam impounds the waters of Schoharie Creek 6 miles downstream of Prattsville. The drainage area is 314 square miles.

b. Discharge at Dam Site:

Maximum known flood at dam site: 54,150 cfs discharge on October 15, 1955.

The total reservoir inflow during this storm was 69,062 cfs.

Normal daily outflow is approximately 400 MGD through the Shandaken Tunnel. The tunnel invert is at elevation 1050'. The maximum outflow through the tunnel is 600 MGD (928 cfs).

The maximum design discharge over the overflow section (D=13.25' water level 1143.25') is 168,000 cfs. The maximum flow at el. 1150 is 307,000 cfs.

c. Elevation: (feet above MSL)

Top of Dam: 1150.0

Maximum pool design surcharge: 1143.25

Full flood control pool: Top of Dam 1150.0' assuming stability, 1143.25 from calculations.

Normal pool: Spillway crest 1130.0

Water supply tunnel (Shandaken Tunnel) crest:
2 gates at 1050 feet, 6 gates at 1070
Tunnel invert 1050

Streambed at center line of dam: Approximately 980

Maximum tailwater elevation:
Design - 1024

d. Reservoir:

Normal pool length (at el. 1130): 22,000 feet

Length of maximum pool (at el. 1150): 31,000 feet

e. Storage: (acre feet)

Normal pool (at el. 1130): 67,510

Maximum storm storage(at el. 1143.25): 84,000

Maximum storage(at el. 1150.00): 95,575

f. Reservoir Surface: (acres)

Normal pond (at el. 1130): 1,142

Storm storage (at el. 1143.25): 1,480

Maximum storage (at el. 1150.00): 1,557

g. Dam:

Type: Cyclopean masonry with full overflow section and zoned earth embankment at left abutment.

Length: Overflow gravity section: 1324 feet
Earth embankment: 949 feet

Height: Overflow gravity section: 183 feet
Earth embankment: Approximately 135 feet

Top Width: Overflow section: 15 feet
Earth Embankment: 30 feet

Side Slopes: Overflow section: Stepped downstream
Earth embankment: 2.5:1

Cutoff: Concrete core wall cutoff.

Grout Curtain: Single line with holes spaced 5-15' apart.

h. Diversion and Regulating Tunnel:

Two 30" pipes located in reservoir at elevation 998 feet. Discharge controlled by gates within dam. Not opened in recent past as there is some speculation that they may not be able to close gates. Access to the gates is through the concrete tower at the transition from the masonry structure to the earth structure.

Normal outflow is through the Shandaken Tunnel.

i. <u>Spillway</u>:

Type: Broad crested weir, total length of masonry gravity section.

Length of Weir: 1324 feet

Crest Elevation: 1130 feet

Gates: None

Downstream Channel: The stepped overflow section flows to a side channel at the base of the structure and into a stilling basin.

j. <u>Regulating Outlets</u>: Shandaken Tunnel.

SECTION 2: ENGINEERING DATA

2.1 Design: A summary of design calculations, specifications and construction drawings are available at the Design Office of New York City Water Supply in New York City.

The calculations include evaluation of dam stability and hydraulic calculations for the spillway.

2.2 Construction: As built drawings noting construction progress are available.

2.3 Operation: A record of reservoir water level has been maintained since initial operation.

2.4 Evaluation:

a. Considerable data is available for the age of the structure.

b. The data accurately documents the construction.

SECTION 3: VISUAL INSPECTION

3.1 Findings:

a. General: The structure appeared to be in reasonably good condition for a 52 year old dam.

b. Dam:

Masonry Structure: The downstream steps are in need of minor repair to prevent further deterioration.

Earth Structure: No signs of instability, erosion, or seepage were noted. The structure appears to be stable.

c. Appurtenant Structures: The concrete channel at the base of the dam is in need of maintenance. Several of the large blocks have deteriorated to a point where reinforcing mesh is exposed. Joints between blocks are being enlarged by continuous low flow.

d. Reservoir Area: No signs of reservoir rim instability were noted or reported. Some hillside slides were noted downstream of the left abutment.

e. Downstream Channel: A slide was noted on the left hillside just downstream of the stilling basin. It did not appear to constitute a major problem relative to the safety of the dam.

3.2 Evaluation:

The visual inspection was limited by flow over the spillway which would conceal any seepage through the masonry structure. The owners personnel reported that no seepage is evident during dry peroids. Some maintenance is required for the downstream steps and the overflow channel at the toe.

No signs of instability were noted on the earth embankment portion of the dam.

Section 4: Operational Procedures

4.1 Procedures: Gilboa Dam is maintained and regulated by the staff of the Catskill Division of the New York Water Supply Department.

4.2 Maintenance of Dam: The structure appears to be well maintained and records indicate that major maintenance was performed as needed.

4.3 Maintenance of Operating Facilities: Maintenance of the emergency drawdown facilities has been lacking since the condition and operability is unknown.

4.4 Warning Systems: No formal warning system is in use.

4.5 Evaluation: Adequate major maintenance is performed on the dam when needed. Maintenance of the emergency drawdown facilities is lacking. A written warning system and evacuation program should be developed.

Section 5: Hydraulic/Hydrologic

5.1 Hydrologic Evaluation of Features

a. Design Data: Calculations performed in 1917 by New York State Conservation Commission titled "Main Dam Spillway Capacity" (see appendix E) estimated the PMF inflow = 80,000 cfs. Allowing for discharge and storage without flood routing a maximum water depth of 8.2 feet was calculated.

b. Experience Data: Reservoir water level records are kept by the owner. Inflow records are kept by the USGS gaging station located on Schoharie Creek at Prattsville.

The maximum discharge recorded at the dam site was on October 15, 1955, 6.26' of water over the spillway crest was measured. This corresponds to a discharge of 54,150 cfs(max. inflow measured that day 69,000 cfs).

The "Upper Hudson and Mohawk River Basin Hydrologic Flood Routing "Models"study prepared by the New York District Corps of Engineers modeled both 1948 and 1972 rainfall events for this reservoir. Hydrologic parameters developed in this study were used to develop the PMF for this study.

c. Visual Observations: At the time of the inspection approximately 0.1 feet of water was discharging over the spillway crest (water elevation 1130.1'). The masonry portion of the dam is an overflow section. As water was flowing over the dam a close inspection of the structure was not possible.

Deterioration of the baffles on the top step, the spillway channel at the toe of the dam and several areas on the downstream steps were noted. These items should not adversely affect spillway capacity.

A hillside slide was noted downstream of the stilling basin but it should not affect the dam or outflow capacity.

Overtopping Potential: To determine the overtopping potential for Gilboa Dam, a flood routing was conducted.

This potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF through the reservoir system. The PMF is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration losses, and concentration of run-off at a specific location, that is considered reasonably possible for a particular drainage area.

The drainage area contributing to the Gilboa Dam (Schoharie Reservoir) is approximately 314 square miles. Snyder coefficients were developed through watershed modeling done by the Corps to define the basic hydrologic working tools, the unit hydrograph. Using hydrometeorological Report No. 33, the PMP index rainfall was determined to be 20.0 inches for a 24 hour duration, 200 square mile basin. The percentages of the index rainfall applied to other durations were interpolated from the plot of drainage area versus percent of 24 hour storms, 200 square miles. The computed PMF peak flow was 150,900 CFS. After routing the PMF through the impounded storage, the peak flow was reduced to 149,500 CFS. A plot of the PMF inflow and outflow hydrographs is included in the Appendix. Assumptions made concerning the discharge-storage capacity of the dam were:

1. The reservoir pool was assumed to be at elevation 1130.0' (spillway crest).

2. It was assumed that Shandaken Tunnel inlets were closed in developing a discharge rating. This condition is possible and leads to a slightly conservative analysis.

3. A weir coefficient of 2.64 was assumed accurate from available spillway capacity data. A total spillway length of 1300' was used.

4. Elevation - Storage data was calculated using U.S.G.S. topographic maps.

The ability of the Gilboa Dam to discharge the standard project flood (SPF) was also evaluated. The SPF peak flow of 77,050 CFS was routed through the impounded storage and reduced to 76,460 CFS. The SPF outflow is indicative of a pool elevation of 1,137.9 feet above MSL, 7.9 feet above the spillway crest. The PMF outflow of 149,510 CFS is equivalent to 12.4 feet above the spillway crest.

Summary of Flood Routing
Gilboa Dam

Elevation Top of Dam = 1,150.0'

Elevation Crest of Spillway = 1,130.0'

PMF Routing

PMF Peak = 150,930 CFS

PMF After Routing through Reservoir = 149,510 CFS

Elevation of Routed PMF corresponding to 149,510 cfs = 1,142.4 feet above M.S.L.

Freeboard Remaining = 7.6 feet

Spillway Surcharge = 12.4 feet

SPF Routing

SPF Peak = 77,050 CFS

SPF After Routing through Reservoir = 76,460 CFS

Elevation of routed SPF corresponding to 76,460 cfs = 1,137.9 feet above M.S.L.

Freeboard Remaining = 12.1 feet

Spillway Surcharge = 7.9 feet

Section 6: Structural Stability

6.1 Evaluation of Structural Stability:

a. Visual Observations: No distress, settlement, or movement was noted during the field inspection.

b. Design and Construction Data: Calculations performed in 1917 indicate that the resultant of forces acting on the dam fall within the middle third with a water level of 1,140.0. Calculations show that instability of the top block is present whenever the improbable condition of a water level of 1,140.0 and an ice pressure of 27,000#/foot coincides. No calculations were made using the PMF water level (1,142.4). No stability computations were available on the earth embankment portion.

c. Operating Records: Withstood record storm - October 15, 1955; elevation 1,136.5'

d. Post Construction Changes: No post-construction changes have been made to alter the stability of the dam.

e. Seismic Stability: The structure is located in seismic zone 1. Seismic activity should not be a factor unless static conditions are unfavorable.

Section 7: Assessment/Remedial Measures

7.1 Dam Assessment:

a. Safety: This dam does not appear to present an immediate danger to life and property. Some preventative maintenance of the spillway blocks needs to be performed before the condition becomes worse. The dam does not appear to have any serious operational deficiencies.

b. Adaquacy of Information: The information available for complete analysis of the dam is inadequate. The validity of the information appears to be good.

c. Urgency: The condition of Gilboa Dam is considered to be a non-emergency situation not requiring immediate action to protect downstream development.

d. Necessity for Future Analyses: From the information obtained from the drilling and testing program conducted in 1977 the stability of the overflow and earth embankment sections should be evaluated using the PMF water level. It appears that these analyses may have been conducted however, they were not available for our review nor the drilling and testing information.

7.2 Remedial Measures:

a. The spillway steps should be repaired to prevent continued deterioration. Some of the facing blocks have deteriorated and fallen off (see appendix C, Photographs).

APPENDIX A
GEOLOGY

GILBOA DAM

The bedrock located in this region is Devonian sandstone of the Ithica series. This stone is exceptionally sound and durable which is evident by its resistance to erosion by the action of Schoharie Creek. This series of rocks lie practically horizontal. The mineral content is relatively simple. The dominant constituent is quartz which makes them an unusually good foundation material both by sample strength and relatively insolubility. In general terms, these rocks would be classified as a strong durable quartz arenite.

During the glacial period of the late Cenozoic Era, the area around the Gilboa Dam was part of the lake. Glacial blockage to the north forced the water from the retreating glacier to discharge to the south in the area of Grand Gorge. The existence of this lake lasted for several years which allowed accumulations of laminated clays to develop in the present day Schoharie Creek flood plains. These deposits are very dense and impervious to water movement.

APPENDIX B
HYDROLOGIC COMPUTATIONS

Gilboa Dam   Mohawk River.

base on "Hydrologic Flood Routing Model, Upper Hudson River Basin" C.O.E. provided by W.R.E.

subbasin Characteristics:

Subbasin No.	Snyder Coef. Lag. (hr.)	Cp	QRCSN (cfs)	RTIOR
24	9.4	.70	420	1.3
25	13.4	.74	2500	1.3
26	6.3	.69	70	1.3
127	10.9	.74	800	1.3

Subbasin No.	Initial Flow (cfs)	Initial Loss (in)	Constant Loss ("/hr)
24	51	2.0	0.075
25	320	2.0	0.075
26	10	1.5	0.075
127	115	1.5	0.075

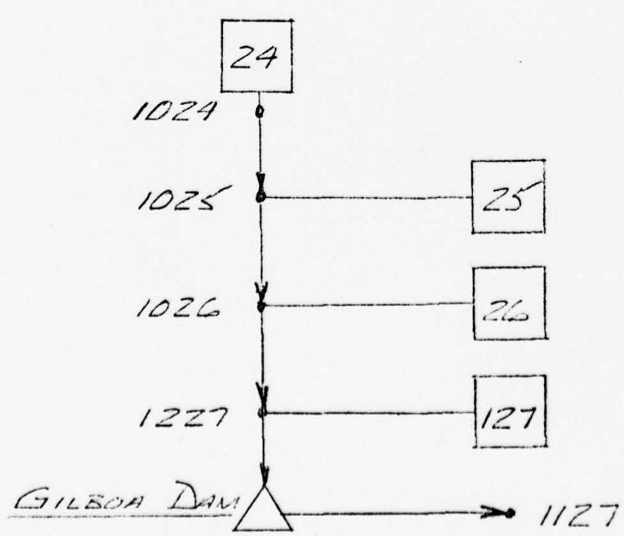
INDEX PMP 20"

GILBOA DAM IS A CYCLOPEAN MASONRY AND EARTH DAM. H = 183 FT. STORAGE = 60,660 A.F

A HEC-1 ANALYSIS IS USE TO DETERMINE SPILLWAY DISCHARGES.

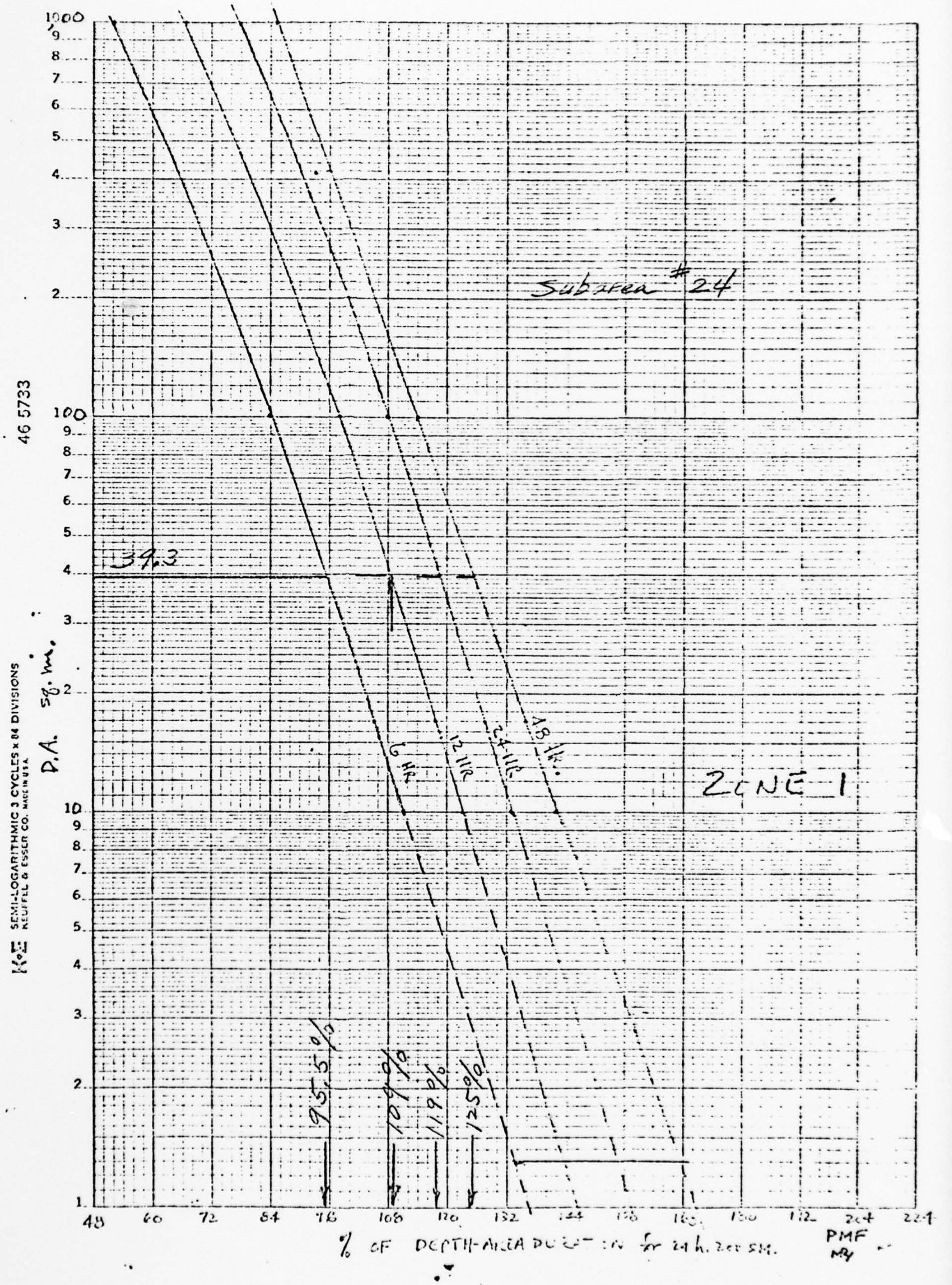
THE DRAINAGE AREA FOR THE GILBOA DAM (SCHOHARIE RESERVOIR) IS SUBDIVIDED INTO THE FOUR SUBAREAS SHOWN ON THE PRECEEDING MAP, i.e., #24, #25, #26, AND #127.

HYDROGRAPHS ARE DETERMINED, ROUTED, AND COMBINED THROUGH THE USE OF THE HEC-1 COMPUTER PROGRAM ACCORDING TO THE FOLLOWING SCHEMATIC REPRESENTATION:

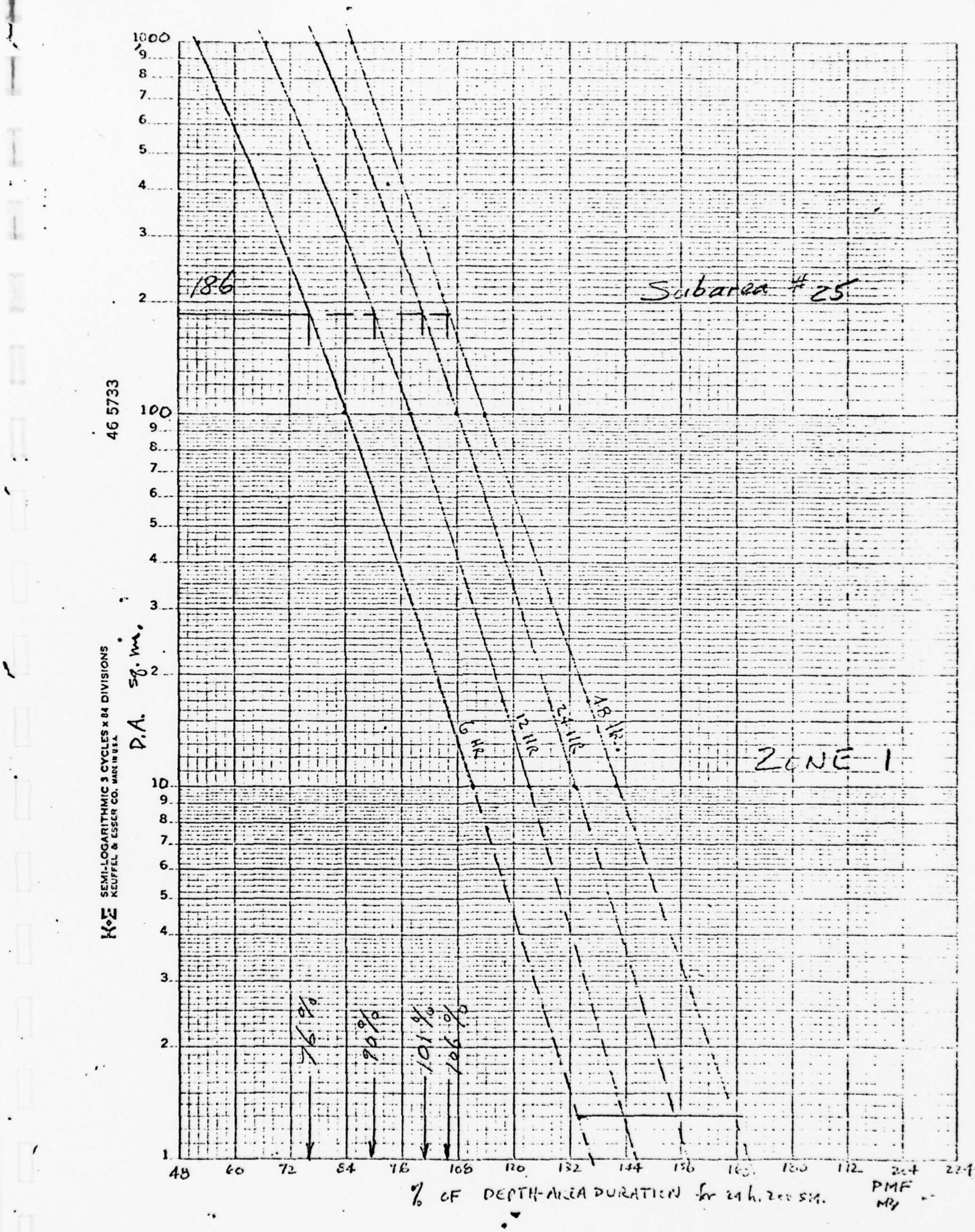


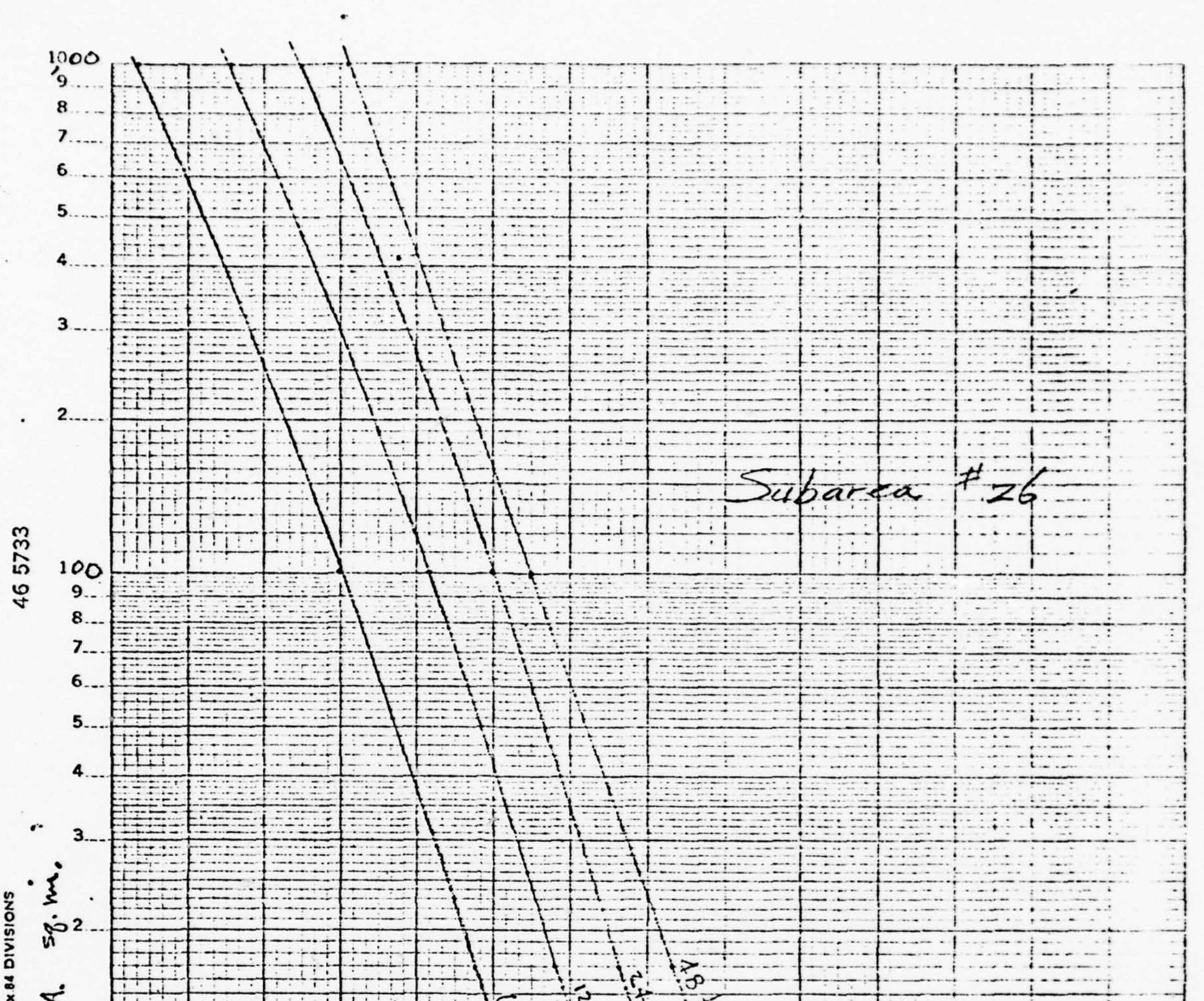
SCHEMATIC FLOW DIAGRAM

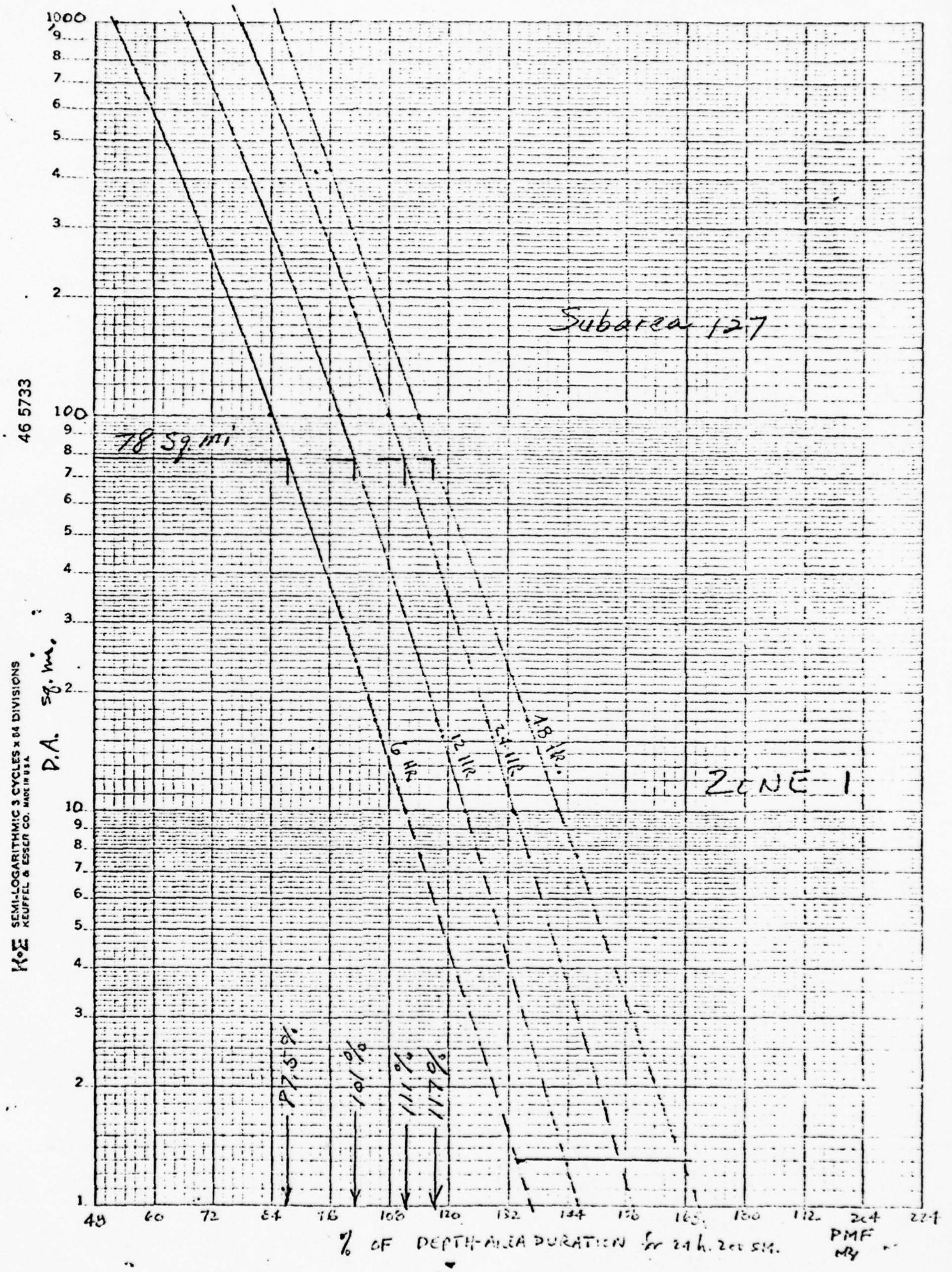
Provided by W.R.E.



Subarea #24
ZONE 1
39.3
D.A. sq. mi.
6 HR
12 HR
24 HR
48 HR
95.5%
100%
125%
46 5733
K&E SEMI-LOGARITHMIC 3 CYCLES x 84 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
% OF DEPTH-AREA DURATION
PMF


Subarea #25
ZONE 1
186
D.A. sq. mi.
6 HR
12 HR
24 HR
48 HR
76%
90%
101%
106%
% OF DEPTH-AREA DURATION for 24 h, 200 S.M.
PMF
48
60
72
84
108
120
132
144
156
K+E SEMI-LOGARITHMIC 3 CYCLES x 84 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5733


Subarea #26
ZONE 1
10.2
D.A. sq. mi.
6 HR.
12 HR
24 HR
48 HR.
111%
123.5%
133%
142%
% OF DEPTH-AREA DURATION for 24 h, 200 SM.
PMF
K+E SEMI-LOGARITHMIC 3 CYCLES x 84 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5733



Subarea 127
ZONE 1
78 Sq. mi
6 HR.
12 HR.
24 HR.
48 HR.
97.5%
101%
111%
117%
D.A. sq. mi.
% OF DEPTH-AREA DURATION for 24 h. 200 SM.
PMF
K+E SEMI-LOGARITHMIC 3 CYCLES x 84 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5733

GILBOA DAM

ELEVATION-DISCHARGE RELATIONSHIP

From Nov., 1917, calculations by New-York Conservation Commission
Spillway length = 1300' $Q = CLH^{3/2}$ $C = 2.64$
Initial Calculations for spillway discharge and stability considered 10' of head over spillway.
Spillway Crest elevation: 1130.0' Top of dam 1150.0'

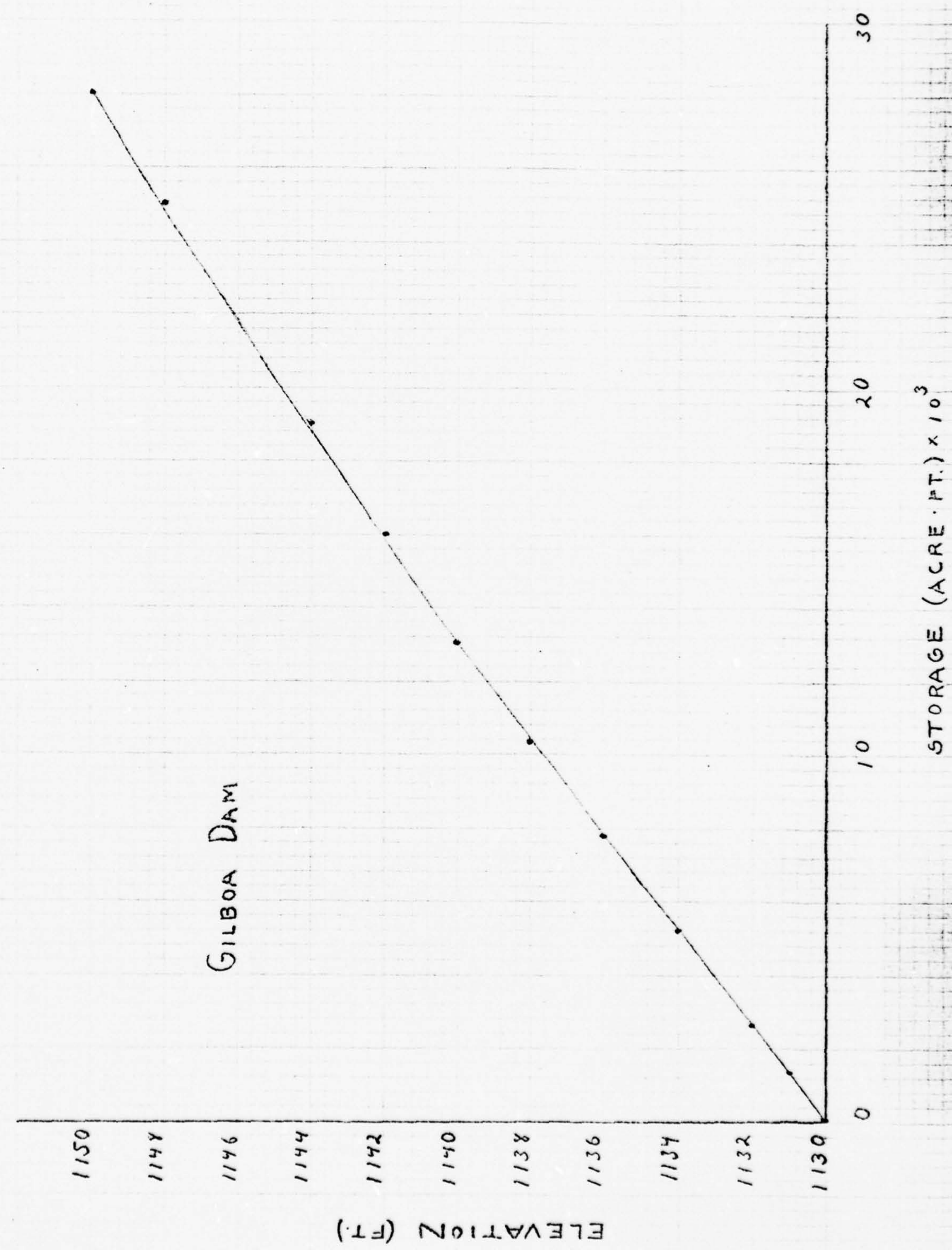
$$Q = 2.64(1300)H^{3/2}$$

ELEV. (FT.)	H	TOTAL Q (C.F.S)
1130	0	0
1131	1	3432
1132	2	9707
1133	3	17833
1134	4	27456
1135	5	38371
1136	6	50440
1138	8	77657
1140	10	108529
1142	12	142666
1144	14	179779
1146	16	219648
1148	18	262093
1150	20	306967

GILBOA DAM

ELEVATION - STORAGE RELATIONSHIP

ELEV. (FT.)	TOTAL STORAGE (ACRE·FT)	DISCHARGE TOTAL Q (C.F.S.)
1130	0	0
1131	1295	3432
1132	2590	9707
1134	5178	27456
1136	7767	50440
1138	10356	77657
1140	12945	108529
1142	15969	142666
1144	18993	179779
1148	25041	262093
1150	28065	306967


GILBOA DAM
STORAGE (ACRE · FT.) × 10³
0
10
20
30
ELEVATION (FT.)
1130
1132
1134
1136
1138
1140
1142
1144
1146
1148
1150

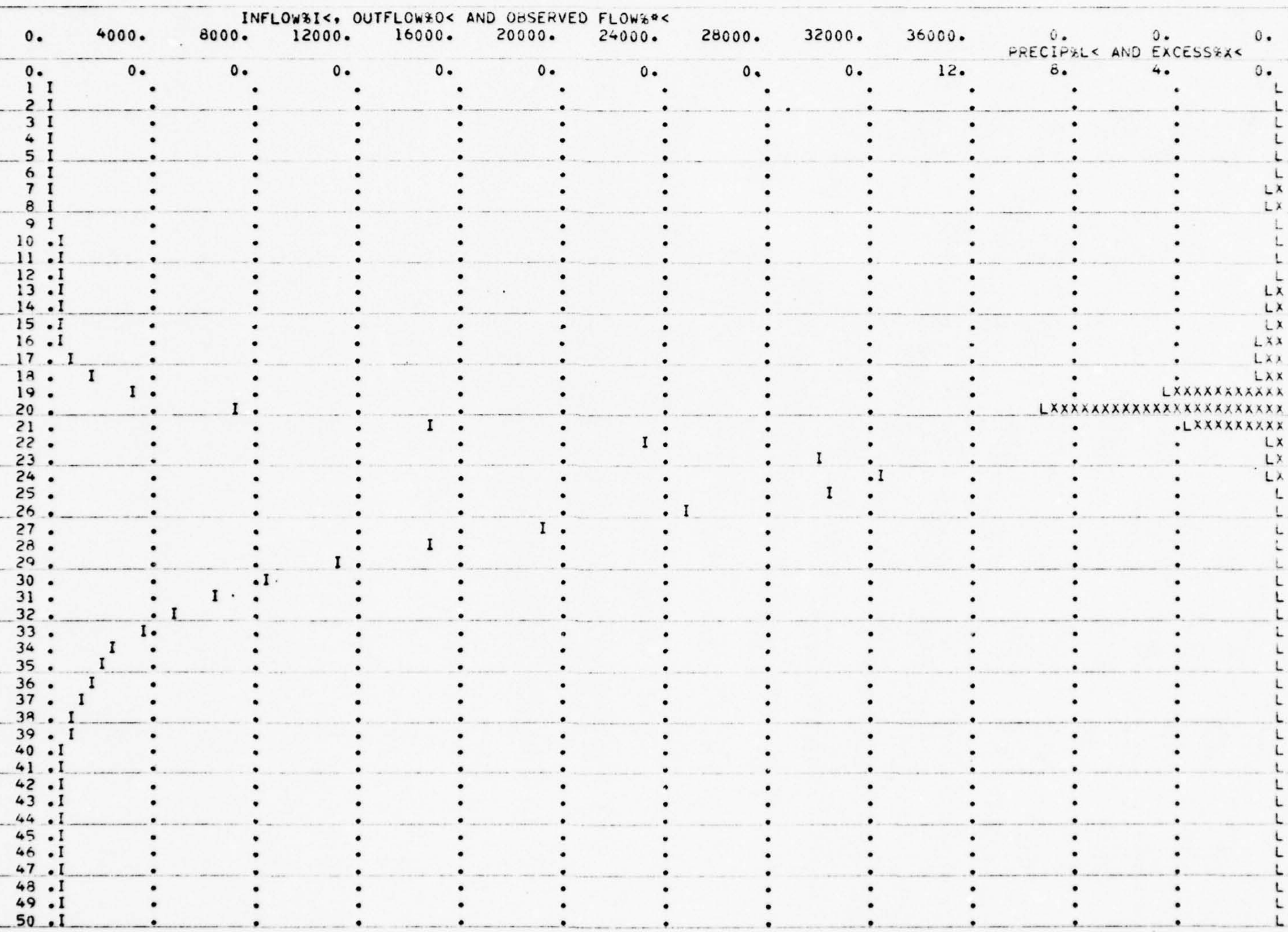
```
****************************
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
****************************
                         GILBOA DAM (SCHOHARIE RESERVOIR) PMP
                                  SCHOHARIE CREEK
                             NEW YORK CITY WATER SUPPLY

                                 JOB SPECIFICATION
              NQ   NHR  NMIN  IDAY   IHR  IMIN METRC  IPLT  IPRT NSTAN
              50     2     0     0     0     0     0     2     1     0
                                 JOPER   NWT
                                     3     0

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

                          SUB-AREA RUNOFF COMPUTATION

          SUBAREA 24 PMP
                  ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME
                      1       0       0       0      0       0       1

                                 HYDROGRAPH DATA
        IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
            1       1   39.30     0.0  314.00     0.0     0.0       0       0       0

                                   PRECIP DATA
                  SPFE     PMS      R6     R12     R24     R48     R72     R96
                   0.0   20.00   95.50  109.00  119.00  125.00     0.0     0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.891

                                    LOSS DATA
        STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
          0.0     0.0    1.00     0.0     0.0    1.00    2.00    0.07     0.0    0.18

                             UNIT HYDROGRAPH DATA
                         TP= 9.40     CP=0.70    NTA= 0

                                  RECESSION DATA
                  STRTQ=   51.00   QRCSN=  420.00   RTIOR= 1.30
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.56 AND R= 3.45 INTERVALS

         UNIT HYDROGRAPH 22 END-OF-PERIOD ORDINATES, LAG=   9.32 HOURS, CP= 0.69  VOL= 1.00
       172.      616.     1179.     1656.     1874.     1741.     1376.     1028.      768.      573.
       428.      320.      239.      179.      133.      100.       74.       56.       42.       31.
        23.       17.

                              END-OF-PERIOD FLOW
                         TIME   RAIN   EXCS     COMP Q
                            1   0.01   0.00        50.
                            2   0.01   0.00        50.
                            3   0.01   0.00        51.
                            4   0.04   0.01        55.
                            5   0.04   0.01        61.
                            6   0.04   0.01        69.
                            7   0.22   0.04        85.
                            8   0.45   0.08       123.
                            9   0.18   0.03       189.
                           10   0.02   0.00       264.
                           11   0.02   0.00       324.
```

12	0.02	0.00	347.
13	0.24	0.04	338.
14	0.24	0.04	329.
15	0.24	0.04	320.
16	0.80	0.53	417.
17	0.80	0.68	788.
18	0.80	0.68	1504.
19	4.43	4.30	3150.
20	9.02	8.90	7361.
21	3.58	3.45	14672.
22	0.36	0.23	23128.
23	0.36	0.23	29844.
24	0.36	0.23	32486.
25	0.0	0.0	30295.
26	0.0	0.0	24984.
27	0.0	0.0	19338.
28	0.0	0.0	14696.
29	0.0	0.0	11080.
30	0.0	0.0	8298.
31	0.0	0.0	6203.
32	0.0	0.0	4639.
33	0.0	0.0	3470.
34	0.0	0.0	2597.
35	0.0	0.0	1944.
36	0.0	0.0	1456.
37	0.0	0.0	1092.
38	0.0	0.0	813.
39	0.0	0.0	603.
40	0.0	0.0	446.
41	0.0	0.0	411.
42	0.0	0.0	400.
43	0.0	0.0	390.
44	0.0	0.0	380.
45	0.0	0.0	370.
46	0.0	0.0	360.
47	0.0	0.0	351.
48	0.0	0.0	342.
49	0.0	0.0	333.
50	0.0	0.0	324.
SUM	22.29	19.53	251620.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	32486.	30875.	18532.	6925.	251618.
INCHES		7.31	17.55	19.67	19.85
AC-FT		15318.	36777.	41227.	41611.

OVF

STATION 1



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*OVN*

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

                                        HYDROGRAPH ROUTING
                       ISTAQ    ICOMP    IECON    ITAPE    JPLT     JPRT   INAME
                           2        1        0        0       0        0       0
                                           ROUTING DATA
                                QLOSS    CLOSS      AVG    IRES    ISAME
                                  0.0    0.0        0.0       0        0

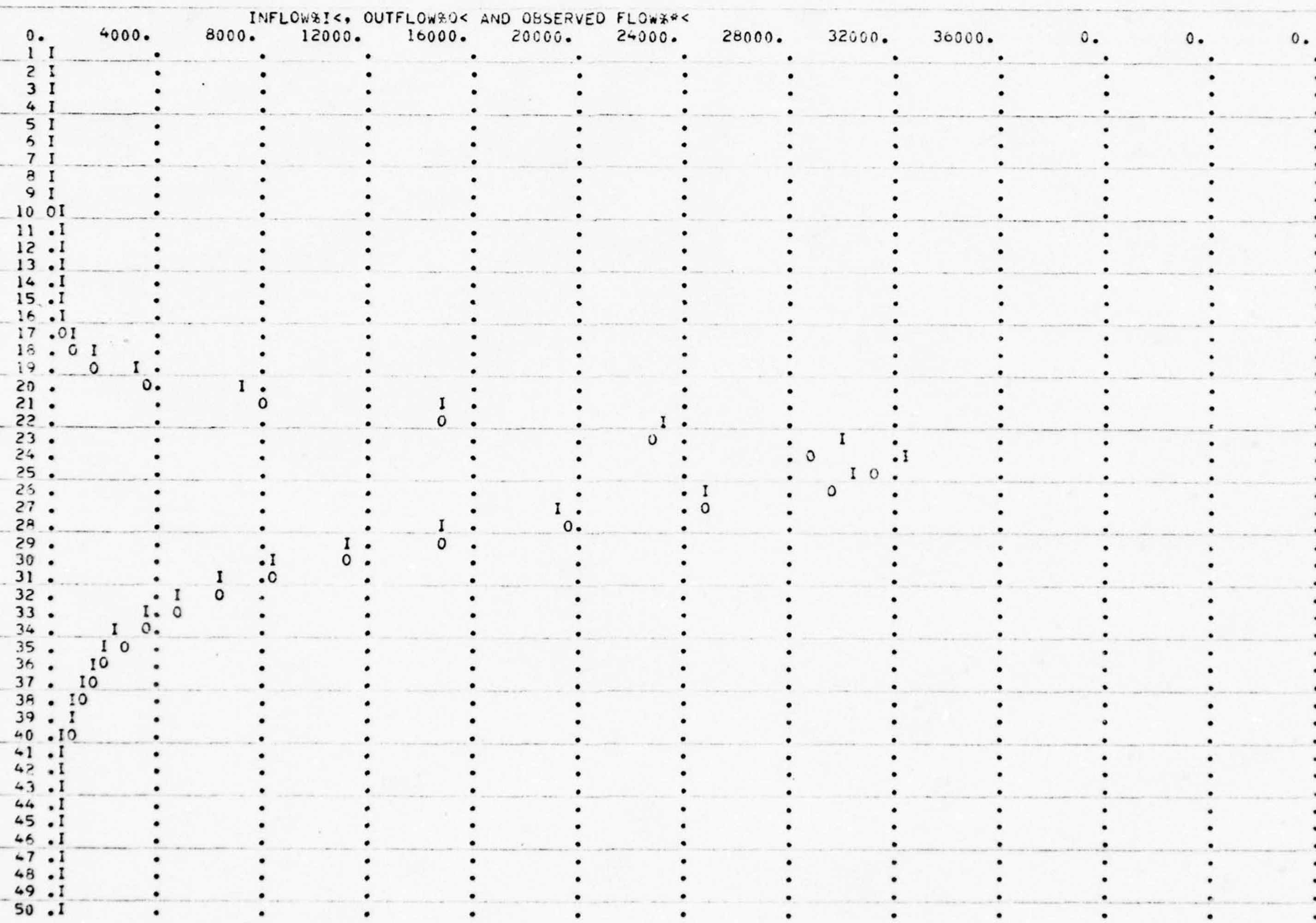
                       NSTPS    NSTDL      LAG    AMSKK       X      TSK   STORA
                           2        2        0    0.0       0.0    0.0        0.

                                      ROUTED FLOWS AT      2
         50.       50.       50.       52.       55.       61.       71.       91.      130.      191.
        260.      315.      339.      338.      329.      347.      486.      874.     1736.     3791.
       8136.    14958.    22693.    28826.    31278.    29515.    24900.    19589.    14953.    11289.
       8470.     6336.     4738.     3544.     2652.     1985.     1487.     1113.      830.      616.
        476.      417.      400.      390.      380.      370.      360.      351.      342.      333.

                               PEAK    6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                      CFS    31278.    29873.     18412.      6925.         251341.
                   INCHES                7.07      17.43      19.67           19.83
                    AC-FT              14821.     36538.     41226.          41565.
```

OVF

STATION 2



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*OVN*

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

                         SUB-AREA RUNOFF COMPUTATION

        SUBAREA 25 PMP
                   ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME
                       2       0       0       0      0      0       1

                                  HYDROGRAPH DATA
        IHYDG   IUHG   TAREA   SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
            1      1  186.50    0.0  314.00     0.0     0.0       0       0       0

                                   PRECIP DATA
                SPFE     PMS      R6     R12     R24     R48     R72     R96
                 0.0   20.00   76.00   90.00  101.00  106.00     0.0     0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.891

                                   LOSS DATA
        STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
          0.0     0.0    1.00     0.0     0.0    1.00    2.00    0.07     0.0    0.14

                              UNIT HYDROGRAPH DATA
                         TP# 13.40     CP#0.74     NTA#  0

                                 RECESSION DATA
                  STRTQ#  320.00     QRCSN# 2500.00     RTIOR# 1.30
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 8.08 AND R# 4.32 INTERVALS

        UNIT HYDROGRAPH 28 END-OF-PERIOD ORDINATES, LAG#  13.41 HOURS, CP# 0.74  VOL# 1.00
       384.     1389.     2711.     4134.     5441.     6325.     6658.     6422.     5523.     4387.
      3478.     2757.     2185.     1732.     1373.     1088.      863.      684.      542.      430.
       341.      270.      214.      170.      134.      107.       84.       67.

                              END-OF-PERIOD FLOW
                          TIME    RAIN    EXCS     COMP Q
                             1    0.01    0.00      312.
                             2    0.01    0.00      307.
                             3    0.01    0.00      304.
                             4    0.04    0.01      305.
                             5    0.04    0.01      313.
                             6    0.04    0.01      328.
                             7    0.17    0.02      357.
                             8    0.36    0.05      418.
                             9    0.14    0.02      521.
                            10    0.02    0.00      646.
                            11    0.02    0.00      773.
                            12    0.02    0.00      879.
                            13    0.26    0.04      958.
                            14    0.26    0.04     1022.
                            15    0.26    0.04     1080.
                            16    0.83    0.47     1309.
                            17    0.83    0.70     2093.
                            18    0.83    0.70     3727.
                            19    3.52    3.39     7346.
                            20    7.18    7.05    15974.
                            21    2.85    2.72    30848.
                            22    0.39    0.26    49397.
                            23    0.39    0.26    68416.
                            24    0.39    0.26    84719.
                            25    0.0     0.0     95178.
```
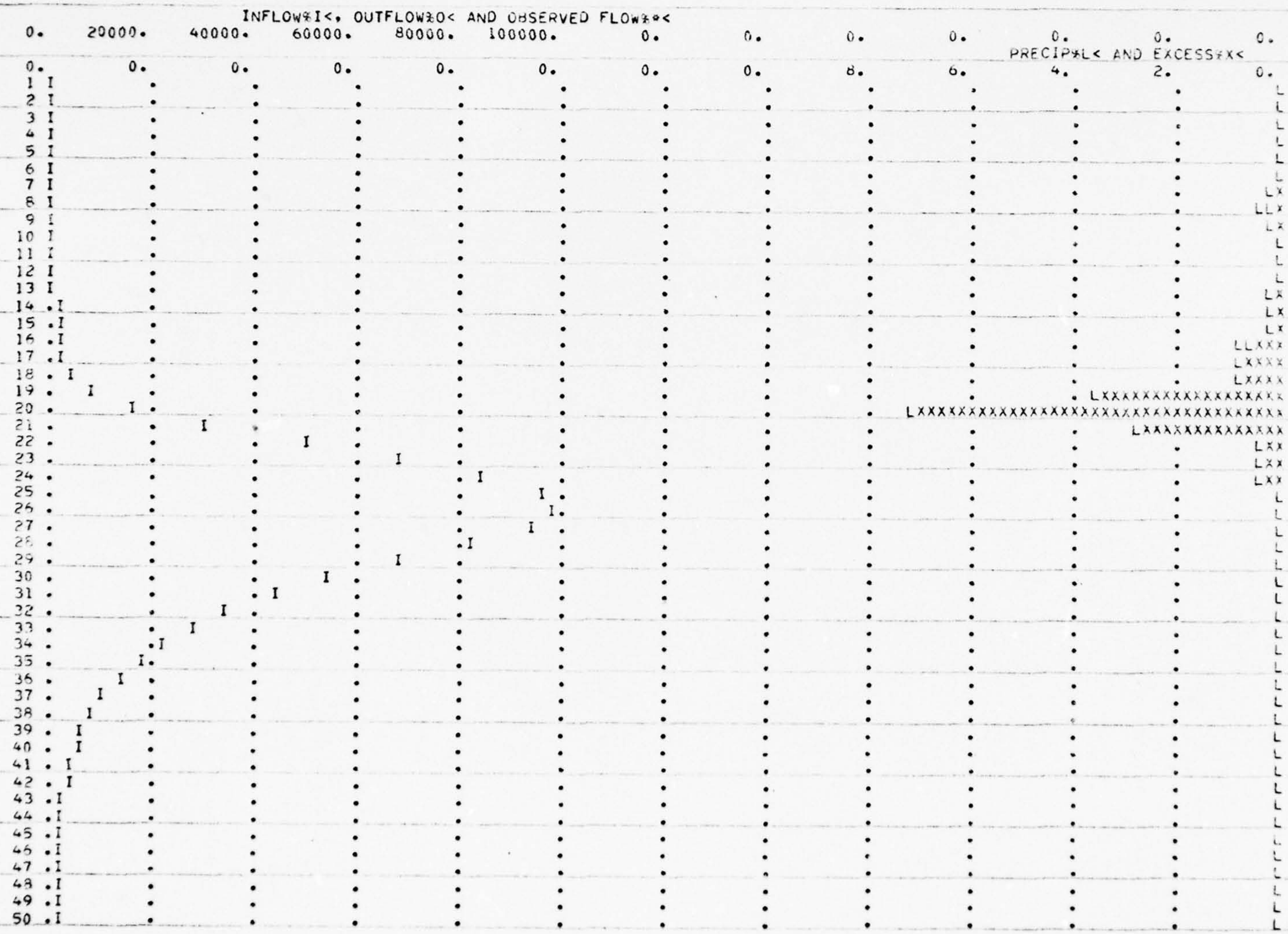

26	0.0	0.0	98248.
27	0.0	0.0	93541.
28	0.0	0.0	81898.
29	0.0	0.0	67449.
30	0.0	0.0	54364.
31	0.0	0.0	43537.
32	0.0	0.0	34652.
33	0.0	0.0	27494.
34	0.0	0.0	21818.
35	0.0	0.0	17317.
36	0.0	0.0	13747.
37	0.0	0.0	10918.
38	0.0	0.0	8676.
39	0.0	0.0	6899.
40	0.0	0.0	5489.
41	0.0	0.0	4369.
42	0.0	0.0	3481.
43	0.0	0.0	2777.
44	0.0	0.0	2466.
45	0.0	0.0	2402.
46	0.0	0.0	2340.
47	0.0	0.0	2279.
48	0.0	0.0	2220.
49	0.0	0.0	2163.
50	0.0	0.0	2107.
SUM	18.87	16.05	980185.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	98248.	95656.	66854.	27021.	980186.
INCHES		4.77	13.34	16.17	16.30
AC-FT		47457.	132671.	160867.	162098.

OVF

STATION 2



OVN

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COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	2	0	0	0	0	0

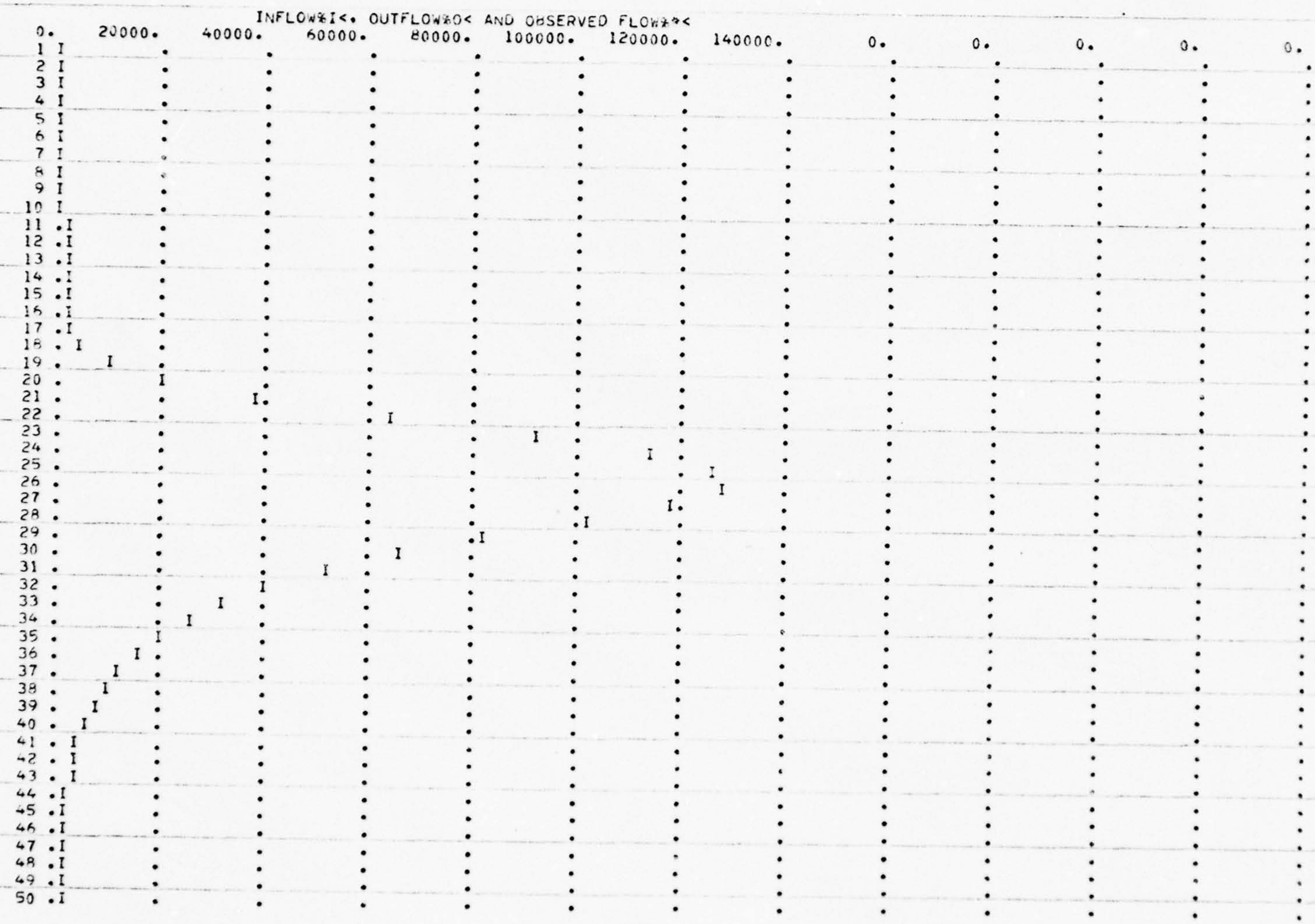
SUM OF 2 HYDROGRAPHS AT 2

362.	357.	354.	357.	368.	389.	428.	509.	651.	838.
1033.	1194.	1297.	1360.	1409.	1655.	2578.	4601.	9083.	19769.
38984.	64355.	91109.	113545.	126456.	127763.	118441.	101487.	82402.	65653.
52007.	40988.	32232.	25362.	19969.	15732.	12405.	9789.	7729.	6105.
4846.	3898.	3177.	2856.	2782.	2710.	2640.	2571.	2505.	2440.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	127763.	124220.	85266.	33945.	1231518.
INCHES		5.12	14.05	16.78	16.91
AC-FT		61628.	169209.	202090.	203662.

OVF

STATION 2



OVN

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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
3	2	0	0.0	0.0	0.0	0.

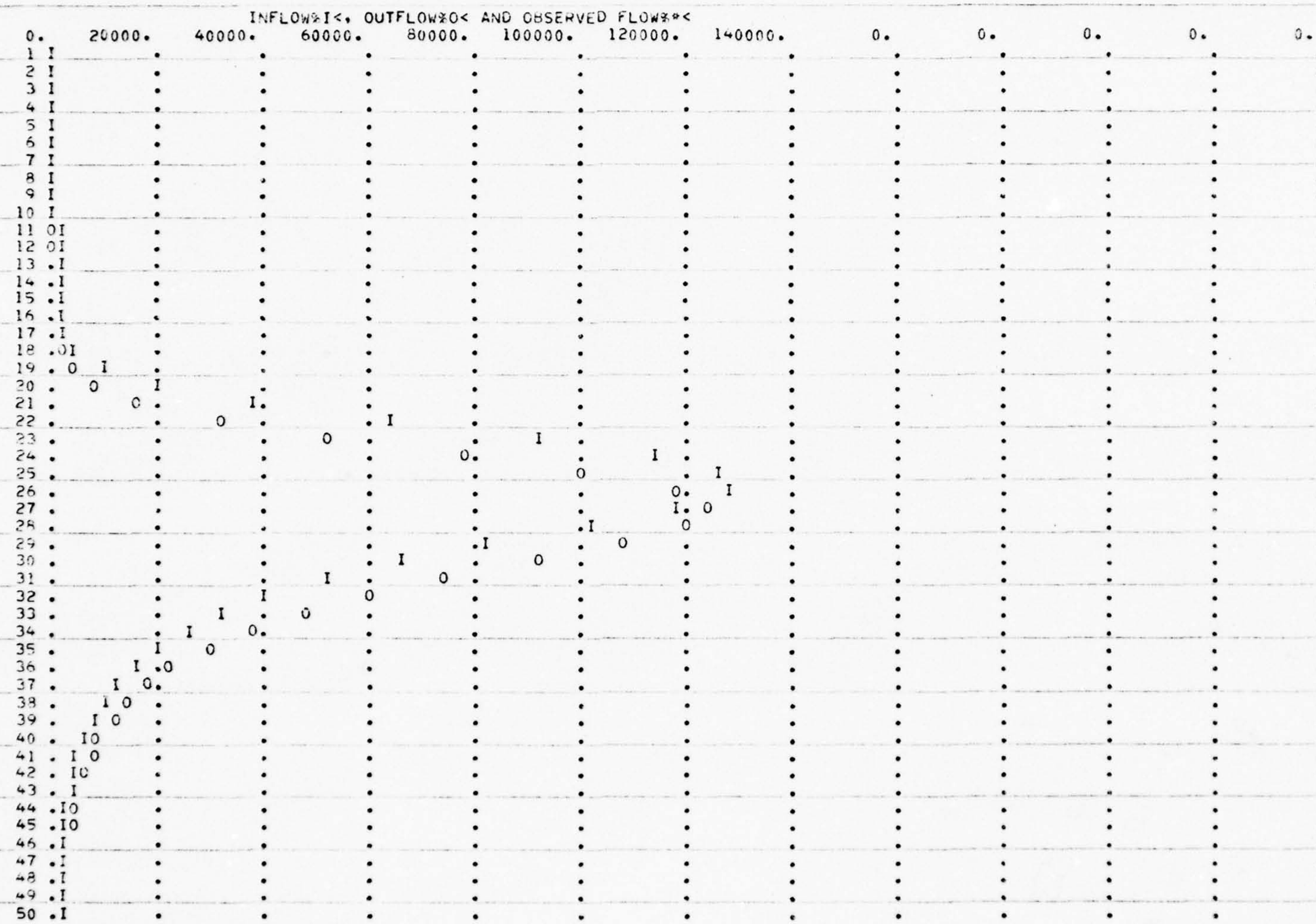
ROUTED FLOWS AT 3

362.	362.	359.	357.	357.	365.	382.	416.	481.	593.
751.	932.	1102.	1233.	1322.	1407.	1641.	2339.	4035.	7925.
16267.	31212.	52612.	77365.	100596.	117359.	124330.	120819.	108744.	91970.
74707.	59546.	47108.	37128.	29217.	22994.	18109.	14271.	11256.	8883.
7017.	5560.	4439.	3616.	3097.	2850.	2746.	2675.	2606.	2539.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	124330.	120836.	84357.	33897.	1228356.
INCHES		4.98	13.90	16.76	16.87
AC-FT		59950.	167406.	201806.	203139.

OVF

STATION 3



OVN

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

SUB-AREA RUNOFF COMPUTATION

SUBAREA 26 PMP

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	10.20	0.0	3140.00	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	20.00	111.00	123.50	133.00	142.00	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.928

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	1.50	0.07	0.0	0.0

UNIT HYDROGRAPH DATA
TP# 6.30 CP#0.69 NTA# 0

RECESSION DATA
STRTQ# 10.00 QRCSN# 70.00 RTIOR# 1.30

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 4.02 AND R# 2.22 INTERVALS

UNIT HYDROGRAPH 14 END-OF-PERIOD ORDINATES, LAG# 6.30 HOURS, CP# 0.69 VOL# 1.00

106.	367.	621.	697.	550.	348.	220.	139.	88.	56.
35.	22.	14.	9.						

END-OF-PERIOD FLOW

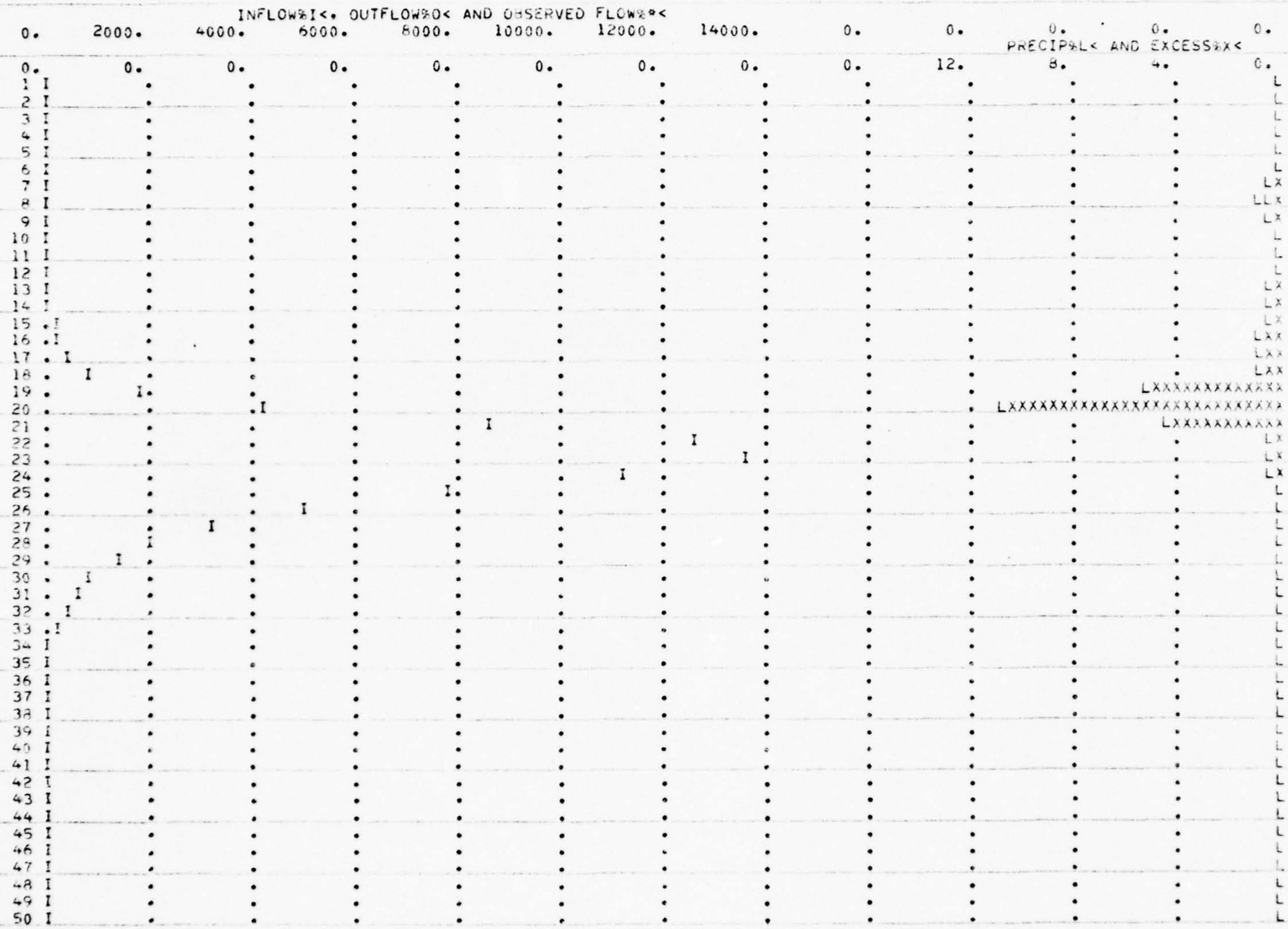
TIME	RAIN	EXCS	COMP Q
1	0.02	0.00	10.
2	0.02	0.00	9.
3	0.02	0.00	9.
4	0.05	0.00	9.
5	0.05	0.00	9.
6	0.05	0.00	9.
7	0.36	0.00	8.
8	0.74	0.00	8.
9	0.29	0.05	13.
10	0.02	0.00	25.
11	0.02	0.00	37.
12	0.02	0.00	41.
13	0.24	0.09	43.
14	0.24	0.09	64.
15	0.24	0.09	110.
16	0.77	0.62	223.
17	0.77	0.62	464.
18	0.77	0.62	827.
19	5.36	5.21	1705.
20	10.92	10.77	4285.
21	4.33	4.18	8669.
22	0.35	0.20	12599.
23	0.35	0.20	13516.
24	0.35	0.20	11156.
25	0.0	0.0	7720.
26	0.0	0.0	5050.

27	0.0	0.0	3281.
28	0.0	0.0	2100.
29	0.0	0.0	1330.
30	0.0	0.0	840.
31	0.0	0.0	529.
32	0.0	0.0	333.
33	0.0	0.0	183.
34	0.0	0.0	70.
35	0.0	0.0	68.
36	0.0	0.0	66.
37	0.0	0.0	65.
38	0.0	0.0	63.
39	0.0	0.0	61.
40	0.0	0.0	60.
41	0.0	0.0	58.
42	0.0	0.0	57.
43	0.0	0.0	55.
44	0.0	0.0	54.
45	0.0	0.0	52.
46	0.0	0.0	51.
47	0.0	0.0	50.
48	0.0	0.0	48.
49	0.0	0.0	47.
50	0.0	0.0	46.
SUM	26.35	22.94	76185.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13516.	12424.	6021.	2109.	76183.
INCHES		11.33	21.96	23.08	23.16
AC-FT		6164.	11948.	12553.	12599.

OVF

STATION 3



OVN

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

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	2	0	0	0	0	0

SUM OF 2 HYDROGRAPHS AT 3

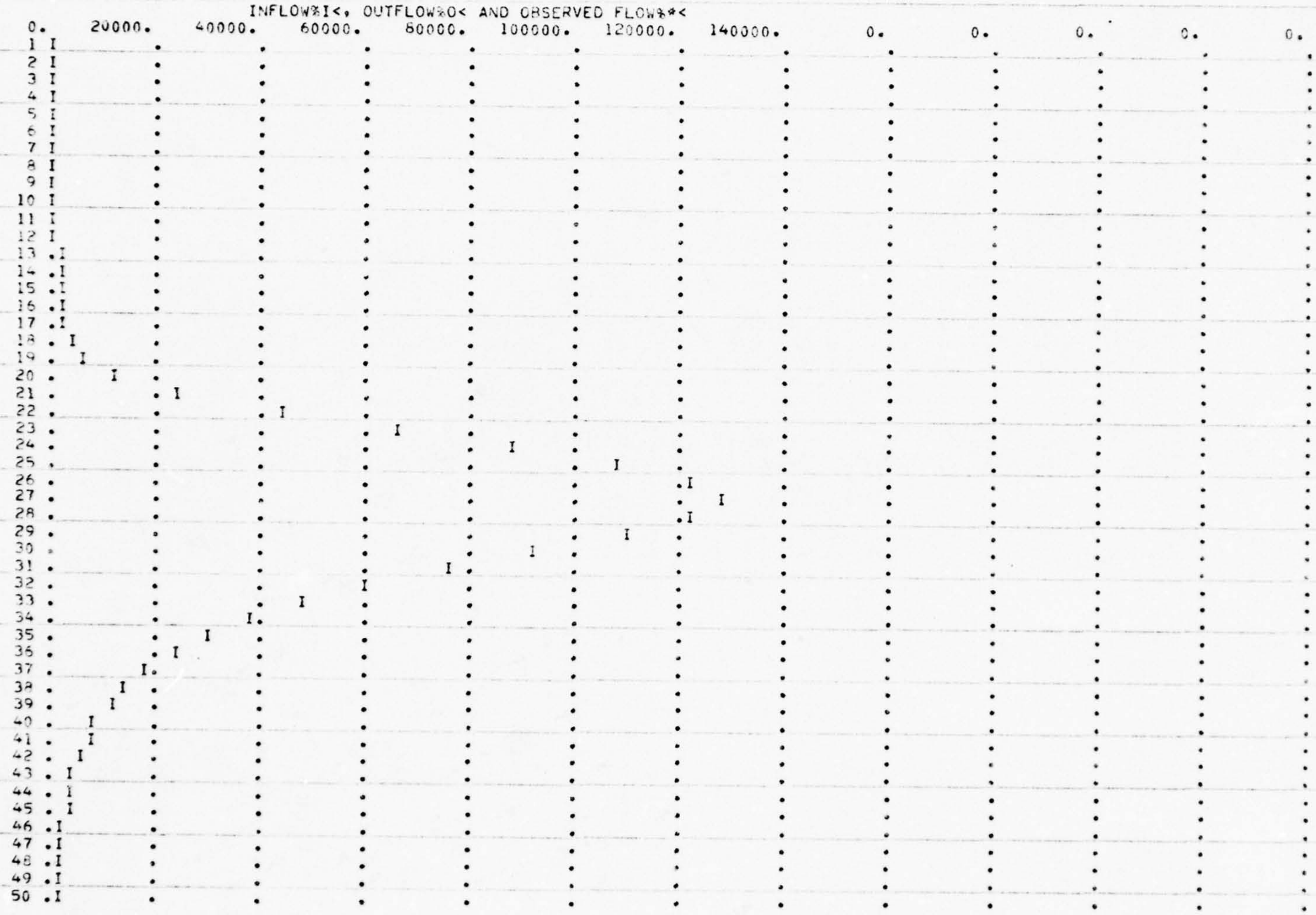
372.	371.	369.	366.	366.	374.	391.	424.	494.	619.
788.	973.	1144.	1297.	1432.	1630.	2106.	3166.	5740.	12209.
24936.	43811.	66128.	88521.	108316.	122409.	127611.	122919.	110074.	92810.
75237.	59879.	47291.	37198.	29285.	23061.	18173.	14334.	11317.	8943.
7075.	5616.	4494.	3670.	3150.	2901.	2796.	2724.	2653.	2584.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	127611.	124313.	88750.	36005.	1304539.
INCHES		4.90	13.99	17.03	17.14
AC-FT		61675.	176125.	214356.	215738.

OVF

STATION 3

INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<



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*OVN*

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

                              HYDROGRAPH ROUTING
              ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME
                  4         1         0         0         0         0         0
                                  ROUTING DATA
                        QLOSS     CLOSS       AVG      IRES     ISAME
                          0.0       0.0       0.0         0         0

              NSTPS     NSTDL       LAG     AMSKK         X       TSK     STORA
                  4         2         0       0.0       0.0       0.0        0.

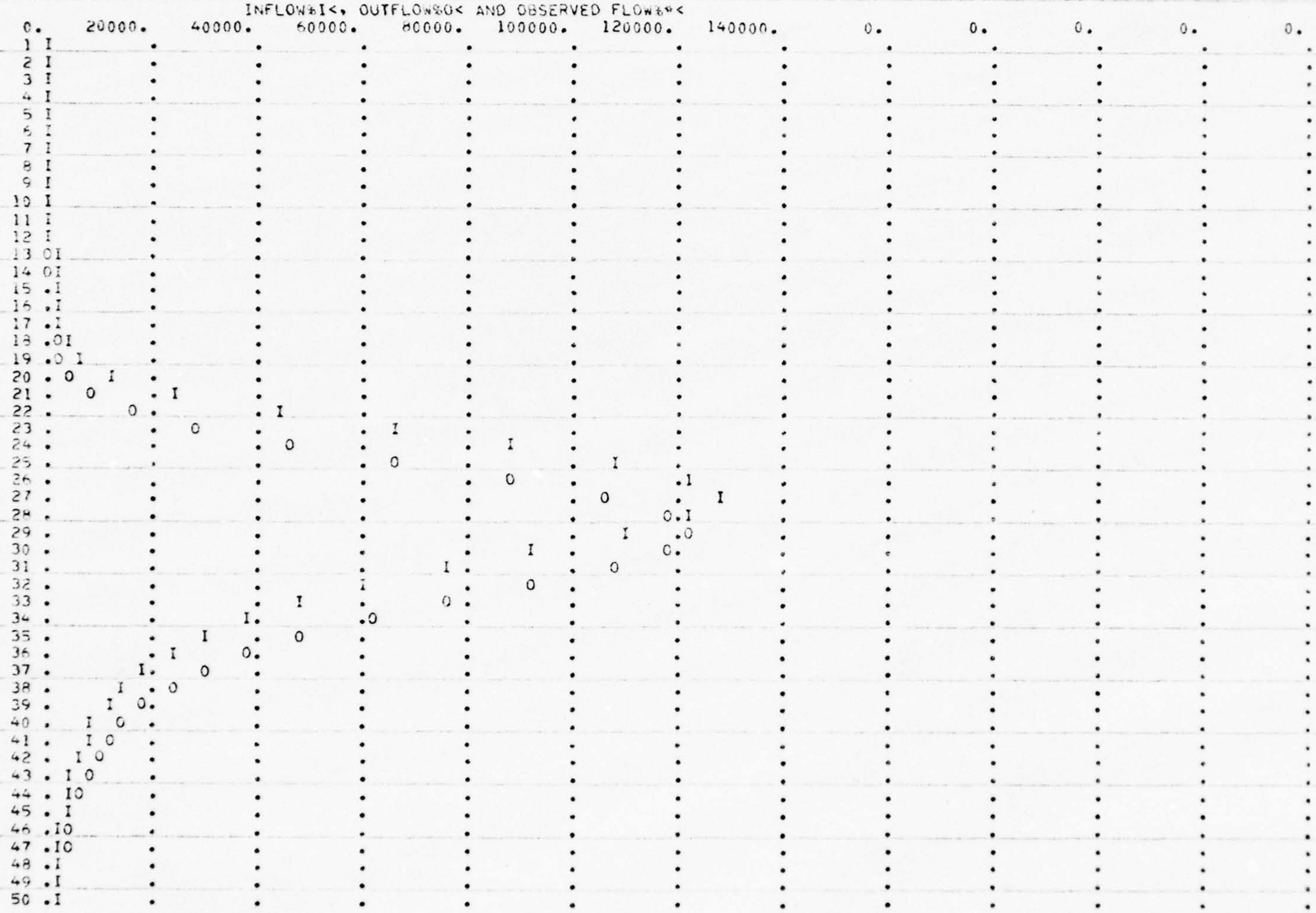
                             ROUTED FLOWS AT        4
      372.      372.      372.      371.      369.      367.      370.      379.      400.      442.
      520.      640.      796.      968.     1135.     1293.     1472.     1775.     2437.     4013.
     7686.    15184.    27848.    45491.    66209.    87195.   105460.   118100.   122835.   118967.
   107888.    92556.    76221.    61212.    48536.    38277.    30158.    23733.    18701.    14748.
    11641.     9198.     7281.     5787.     4646.     3819.     3279.     2974.     2817.     2727.

                      PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
            CFS    122835.   119967.    87556.    35924.       1300008.
         INCHES                 4.73     13.80     16.99          17.08
          AC-FT                59519.   173754.   213873.        214988.
```

OVF

STATION 4

INFLOW*I<, OUTFLOW*O< AND OBSERVED FLOW*"<



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*OVN*

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

                              SUB-AREA RUNOFF COMPUTATION

          SUBAREA 127 PMP
                       ISTAQ    ICOMP    IECON    ITAPE    JPLT    JPRT    INAME
                           4        0        0        0       0       0        1

                                     HYDROGRAPH DATA
          IHYDG    IUHG    TAREA    SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
              1       1    78.00     0.0   314.00      0.0      0.0        0        0        0

                                       PRECIP DATA
                  SPFE      PMS       R6      R12      R24      R48      R72      R96
                   0.0    20.00    87.50   101.00   111.00   117.00      0.0      0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.891

                                        LOSS DATA
        STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
          0.0      0.0     1.00      0.0      0.0     1.00     1.50     0.07      0.0     0.09

                                  UNIT HYDROGRAPH DATA
                              TP# 10.90     CP#0.74     NTA#  0

                                      RECESSION DATA
                          STRTQ#  115.00     ORCSN#  800.00     RTIOR# 1.30
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 6.87 AND R# 3.35 INTERVALS

            UNIT HYDROGRAPH 22 END-OF-PERIOD ORDINATES, LAG#  10.93 HOURS, CP# 0.74  VOL# 1.00
          256.      914.     1752.     2589.     3194.     3404.     3177.     2562.     1897.     1404.
         1040.      770.      570.      422.      312.      231.      171.      127.       94.       70.
           51.       38.

                                  END-OF-PERIOD FLOW
                             TIME    RAIN    EXCS      COMP Q
                                1    0.01    0.00        112.
                                2    0.01    0.00        110.
                                3    0.01    0.00        110.
                                4    0.04    0.00        111.
                                5    0.04    0.00        114.
                                6    0.04    0.00        120.
                                7    0.22    0.02        133.
                                8    0.45    0.04        162.
                                9    0.18    0.02        211.
                               10    0.02    0.00        270.
                               11    0.02    0.00        324.
                               12    0.02    0.00        359.
                               13    0.24    0.02        372.
                               14    0.24    0.04        373.
                               15    0.24    0.10        395.
                               16    0.80    0.67        630.
                               17    0.80    0.67       1324.
                               18    0.80    0.67       2567.
                               19    4.06    3.92       5162.
                               20    8.27    8.13      11321.
                               21    3.28    3.14      21785.
                               22    0.36    0.22      34283.
                               23    0.36    0.22      45767.
                               24    0.36    0.22      53439.
                               25    0.0     0.0       55432.
```
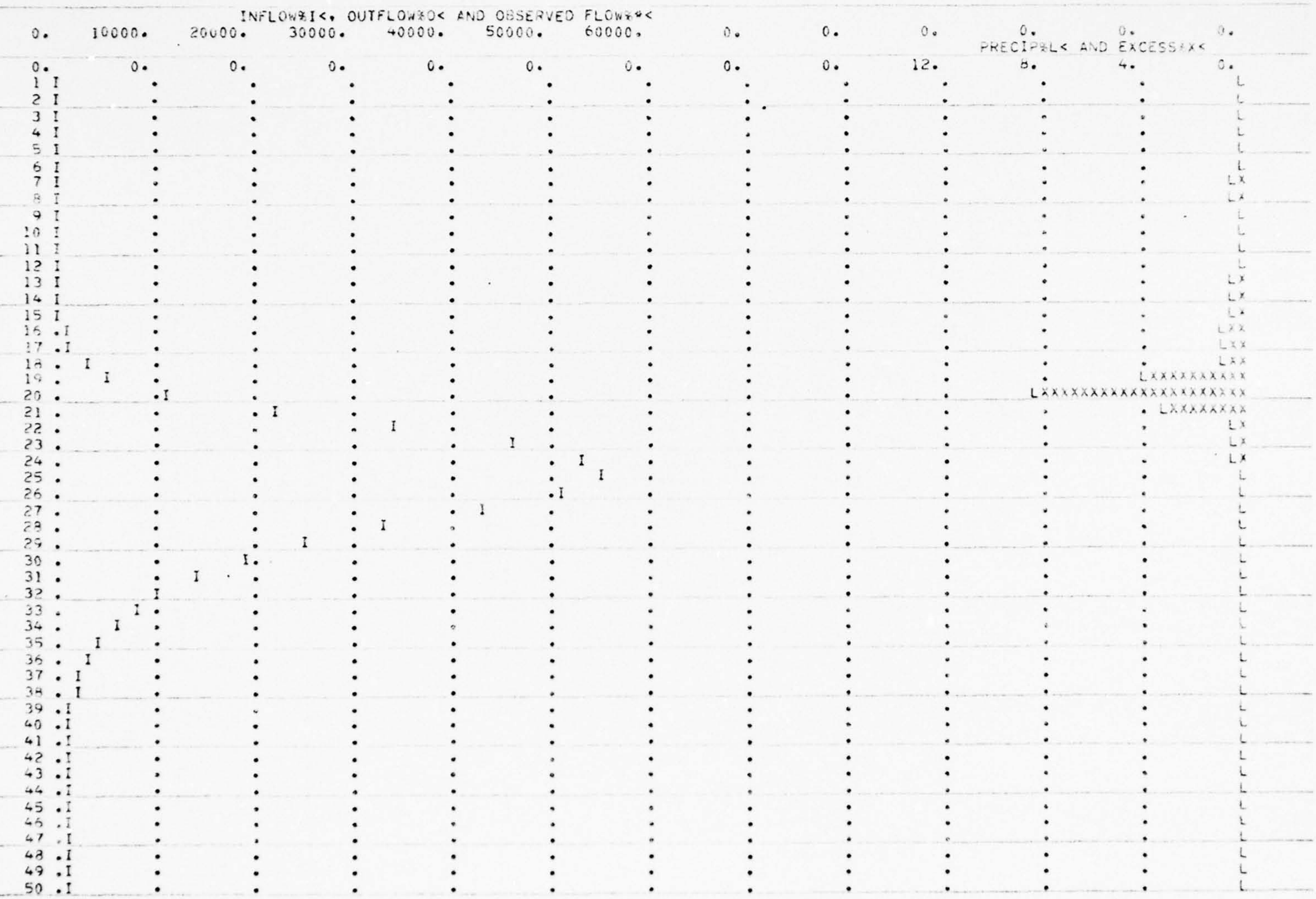

26	0.0	0.0	51286.
27	0.0	0.0	42545.
28	0.0	0.0	32824.
29	0.0	0.0	24734.
30	0.0	0.0	18515.
31	0.0	0.0	13766.
32	0.0	0.0	10204.
33	0.0	0.0	7566.
34	0.0	0.0	5613.
35	0.0	0.0	4166.
36	0.0	0.0	3094.
37	0.0	0.0	2298.
38	0.0	0.0	1693.
39	0.0	0.0	1245.
40	0.0	0.0	912.
41	0.0	0.0	786.
42	0.0	0.0	766.
43	0.0	0.0	746.
44	0.0	0.0	727.
45	0.0	0.0	708.
46	0.0	0.0	690.
47	0.0	0.0	672.
48	0.0	0.0	654.
49	0.0	0.0	637.
50	0.0	0.0	621.
SUM	20.87	18.10	462454.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	55432.	53385.	33808.	12766.	462455.
INCHES		6.37	16.13	18.27	18.38
AC-FT		26486.	67092.	76002.	76478.

OVF

STATION 4



OVN

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

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	2	0	0	0	0	0

SUM OF 2 HYDROGRAPHS AT 4

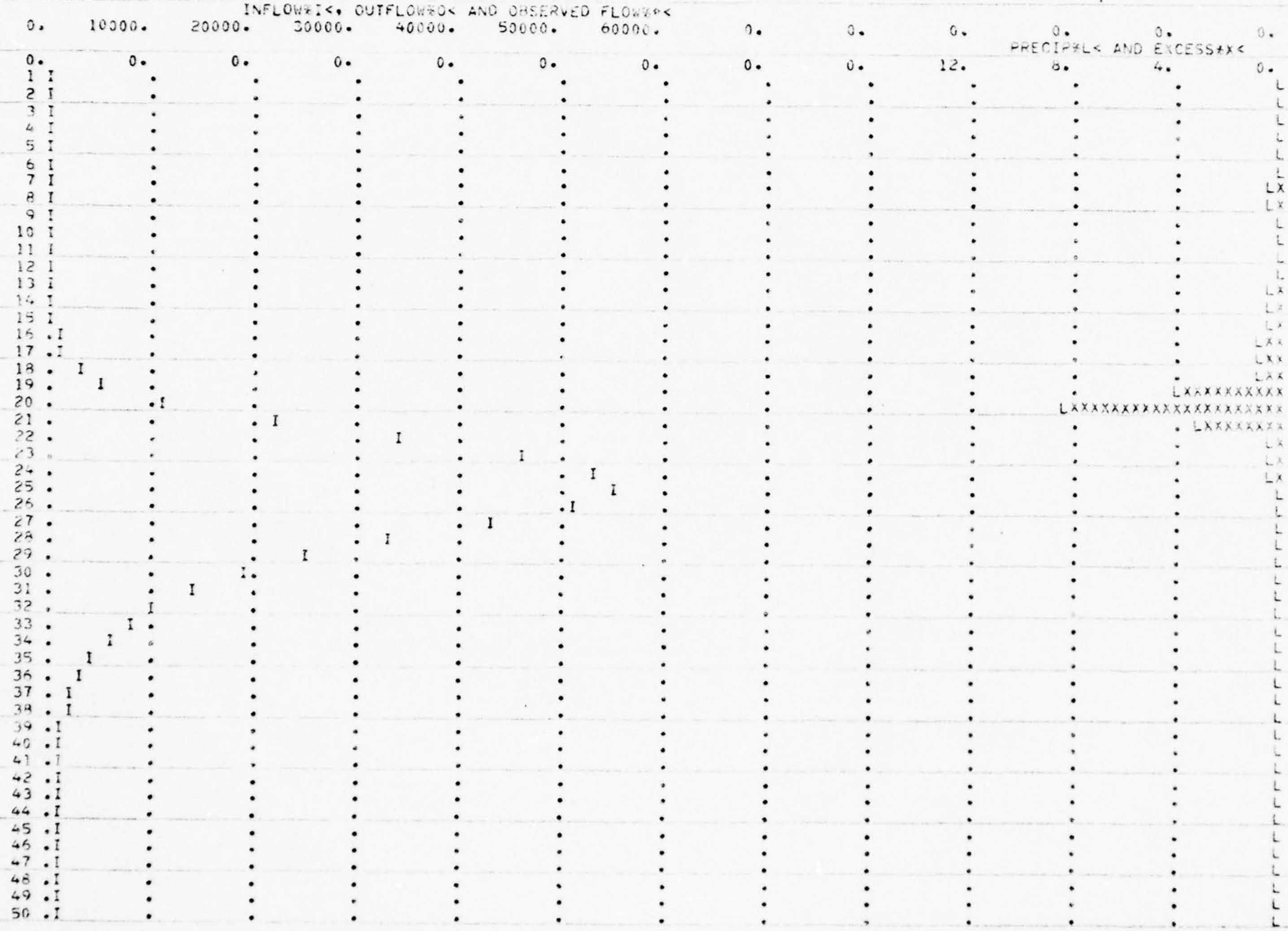
485.	483.	481.	481.	483.	488.	502.	540.	611.	712.
844.	999.	1168.	1341.	1531.	1923.	2796.	4342.	7599.	15335.
29471.	49466.	73615.	98929.	121642.	138481.	148005.	150925.	147570.	137482.
121653.	102760.	83787.	66825.	52702.	41371.	32437.	25426.	19946.	15660.
12427.	9964.	8027.	6513.	5354.	4509.	3951.	3628.	3455.	3347.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	150925.	148833.	115972.	48690.	1762462.
INCHES		4.41	13.74	17.31	17.40
AC-FT		73840.	230146.	289874.	291466.

OVF

STATION 4

INFLOW*I<, OUTFLOW*O< AND OBSERVED FLOW*<



OVN

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

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	2	0	0	0	0	0

SUM OF 2 HYDROGRAPHS AT 4

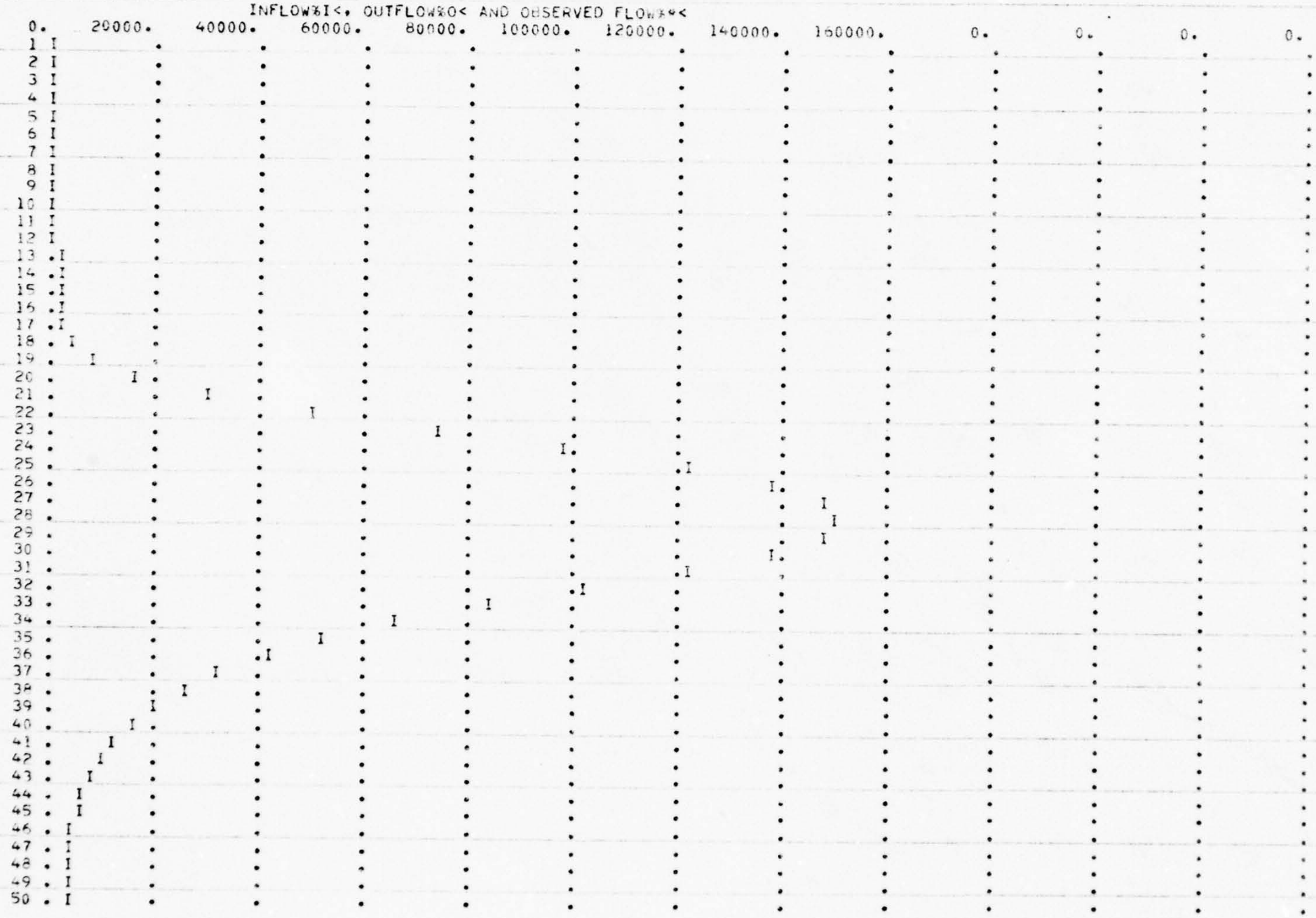
485.	483.	481.	481.	483.	488.	502.	540.	611.	712.
644.	999.	1168.	1341.	1531.	1923.	2796.	4342.	7599.	15335.
29471.	49466.	73615.	98929.	121642.	138481.	148005.	150925.	147570.	137482.
121653.	102760.	83787.	66825.	52702.	41371.	32437.	25426.	19946.	15660.
12427.	9964.	8027.	6513.	5354.	4509.	3951.	3628.	3455.	3347.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	150925.	148833.	115972.	48690.	1762462.
INCHES		4.41	13.74	17.31	17.40
AC-FT		73840.	230146.	289874.	291466.

OVF

STATION 4

INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<



OVN

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

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
5	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

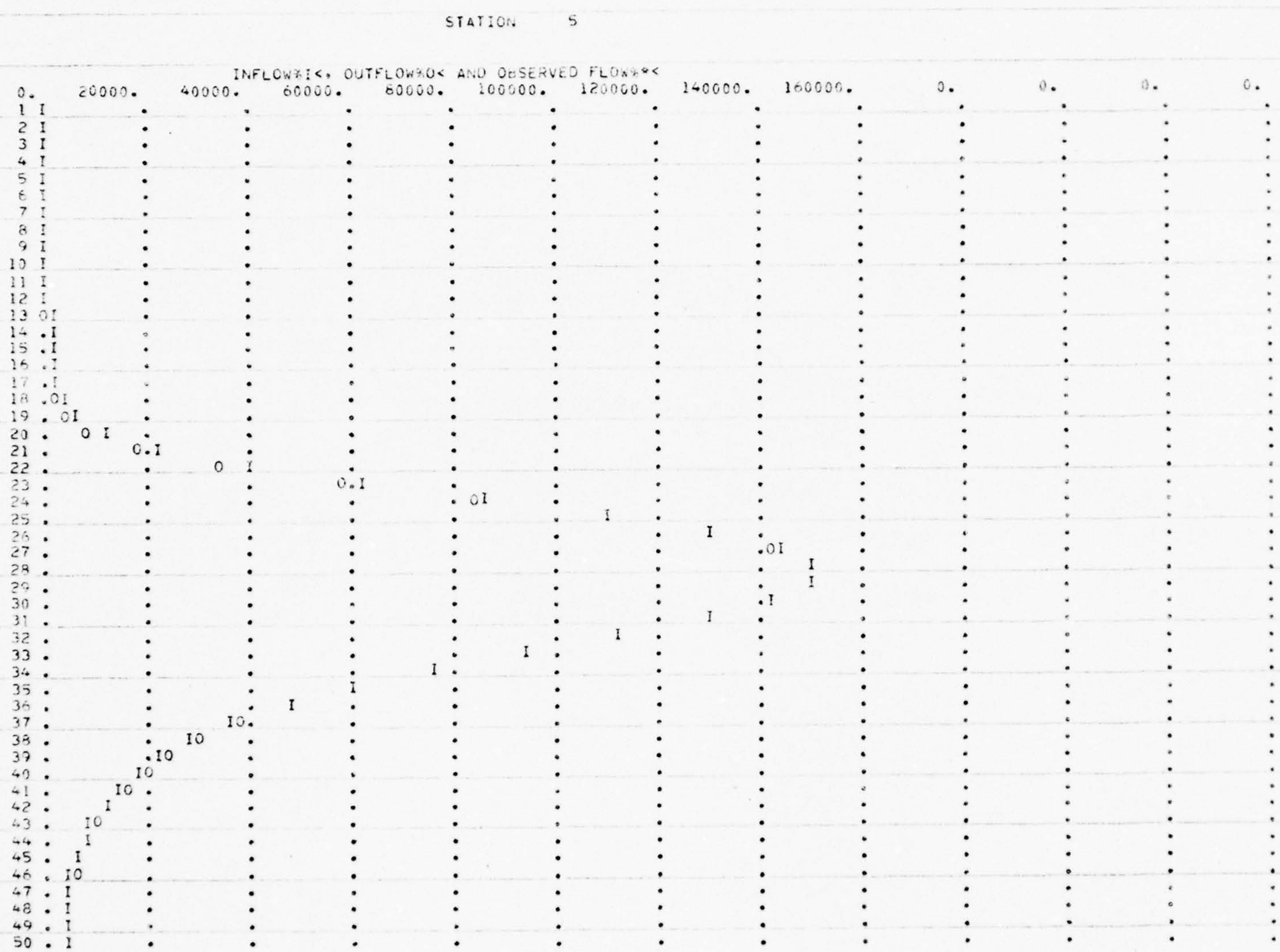
STORAGE=	0.	1295.	2590.	5178.	7767.	10356.	12945.	15969.	18993.	25041.
OUTFLOW=	0.	3432.	9707.	27459.	50440.	77657.	108529.	142666.	179779.	262093.

TIME	EOP STOR	AVG IN	EOP OUT
1	183.	485.	485.
2	183.	484.	484.
3	182.	482.	483.
4	182.	481.	483.
5	182.	482.	482.
6	182.	485.	483.
7	184.	495.	488.
8	189.	521.	500.
9	199.	575.	527.
10	217.	661.	575.
11	245.	778.	648.
12	282.	922.	746.
13	327.	1084.	868.
14	380.	1255.	1007.
15	438.	1436.	1161.
16	515.	1727.	1364.
17	650.	2360.	1722.
18	900.	3569.	2386.
19	1374.	5970.	3817.
20	2277.	11467.	8192.
21	3810.	22403.	18073.
22	5981.	39469.	34589.
23	8494.	61541.	56085.
24	10950.	86272.	84742.
25	13080.	110285.	110055.
26	14791.	130061.	129367.
27	15977.	143243.	142766.
28	16527.	149465.	149512.
29	16505.	149247.	149245.
30	15953.	142526.	142466.
31	14848.	129567.	130016.
32	13325.	112206.	112824.
33	11688.	93273.	93538.
34	10158.	75306.	75580.
35	8760.	59764.	60874.
36	7518.	47037.	48226.
37	6438.	36904.	38644.
38	5512.	28931.	30424.
39	4731.	22686.	24395.
40	4036.	17803.	19625.
41	3447.	14044.	15587.
42	2984.	11196.	12409.
43	2624.	8996.	9939.
44	2313.	7270.	8364.

45	2026.	5934.	6974.
46	1785.	4931.	5806.
47	1599.	4230.	4905.
48	1467.	3790.	4267.
49	1382.	3541.	3852.
50	1328.	3401.	3594.
SUM			1755655.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	149512.	147174.	115063.	48539.	1755655.
INCHES		4.36	13.64	17.26	17.34
AC-FT		73017.	228382.	288974.	290341.

OVF


STATION 5
INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<
0. 20000. 40000. 60000. 80000. 100000. 120000. 140000. 160000. 0. 0. 0. 0.

RUNOFF SUMMARY. AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	32486.	30875.	18532.	6925.	39.30
ROUTED TO	2	31278.	29873.	18412.	6925.	39.30
HYDROGRAPH AT	2	98248.	95656.	66854.	27021.	186.50
2 COMBINED	2	127763.	124220.	85266.	33945.	225.80
ROUTED TO	3	124330.	120836.	84357.	33897.	225.80
HYDROGRAPH AT	3	13516.	12424.	6021.	2109.	10.20
2 COMBINED	3	127611.	124313.	88750.	36005.	236.00
ROUTED TO	4	122835.	119967.	87556.	35924.	236.00
HYDROGRAPH AT	4	55432.	53385.	33808.	12766.	78.00
2 COMBINED	4	150925.	148633.	115972.	48690.	314.00
ROUTED TO	5	149512.	147174.	115083.	48539.	314.00

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******************************
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
******************************
                       GILBOA DAM ( SCHOHARIE RESERVOIR ) SPF
                            SCHOHARIE CREEK
                          NEW YORK CITY WATER SUPPLY

                            JOB SPECIFICATION
               NQ   NHR  NMIN  IDAY   IHR  IMIN METRC  IPLT  IPRT NSTAN
               50     2     0     0     0     0     0     2     1     0
                                 JOPER   NWT
                                     3     0

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

                           SUB-AREA RUNOFF COMPUTATION

         SUBAREA 24 PMP
               ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
                   1       0       0       0       0       0       1

                             HYDROGRAPH DATA
         IHYDG   IUHG  TAREA   SNAP  TRSDA  TRSPC   RATIO  ISNOW  ISAME  LOCAL
             1      1  39.30    0.0 314.00    0.0     0.0      0      0      0

                               PRECIP DATA
              SPFE     PMS      R6     R12     R24     R48     R72     R96
             13.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.891

                                LOSS DATA
        STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
          0.0    0.0   1.00    0.0    0.0   1.00   2.00   0.07    0.0   0.18

                           UNIT HYDROGRAPH DATA
                        TP# 9.40    CP#0.70    NTA#  0

                              RECESSION DATA
               STRTQ#    51.00    QRCSN#  420.00    RTIOR# 1.30
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 5.58 AND R# 3.45 INTERVALS

        UNIT HYDROGRAPH 22 END-OF-PERIOD ORDINATES, LAG#   9.32 HOURS, CP# 0.69  VOL# 1.00
      172.      616.     1179.     1656.     1874.     1741.     1376.     1028.      768.      573.
      428.      320.      239.      179.      133.      100.       74.       56.       42.       31.
       23.       17.

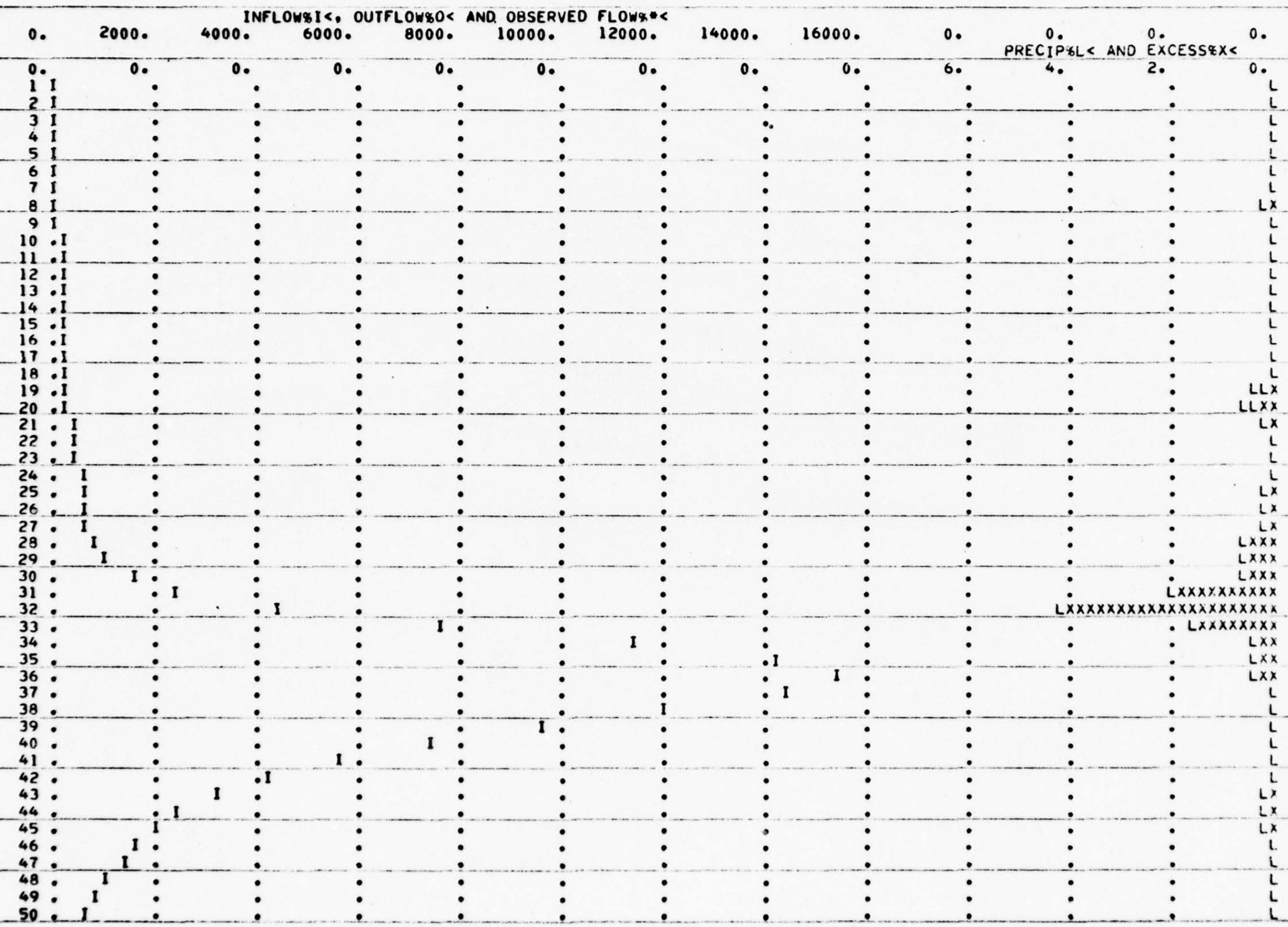
                          END-OF-PERIOD FLOW
                         TIME   RAIN   EXCS     COMP Q
                            1   0.01   0.00        50.
                            2   0.01   0.00        50.
                            3   0.01   0.00        50.
                            4   0.02   0.00        52.
                            5   0.02   0.00        54.
                            6   0.02   0.00        58.
                            7   0.07   0.01        64.
                            8   0.15   0.03        77.
                            9   0.06   0.01        98.
                           10   0.01   0.00       122.
                           11   0.01   0.00       140.
```

12	0.01	0.00	147.
13	0.04	0.01	143.
14	0.04	0.01	139.
15	0.04	0.01	135.
16	0.09	0.02	132.
17	0.09	0.02	129.
18	0.09	0.02	129.
19	0.33	0.06	152.
20	0.66	0.12	207.
21	0.26	0.06	300.
22	0.06	0.01	410.
23	0.06	0.01	499.
24	0.06	0.01	537.
25	0.22	0.10	528.
26	0.22	0.10	517.
27	0.22	0.10	553.
28	0.55	0.43	702.
29	0.55	0.43	1032.
30	0.55	0.43	1544.
31	2.03	1.91	2443.
32	4.13	4.01	4405.
33	1.64	1.52	7639.
34	0.35	0.22	11300.
35	0.35	0.22	14185.
36	0.35	0.22	15320.
37	0.01	0.00	14368.
38	0.01	0.00	12035.
39	0.01	0.00	9503.
40	0.03	0.01	7344.
41	0.03	0.01	5591.
42	0.03	0.01	4209.
43	0.13	0.02	3166.
44	0.26	0.13	2417.
45	0.10	0.02	1905.
46	0.02	0.00	1556.
47	0.02	0.00	1302.
48	0.02	0.00	1088.
49	0.0	0.0	882.
50	0.0	0.0	681.
SUM	14.05	10.30	130089.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15320.	14624.	9089.	3579.	130085.
INCHES		3.46	8.61	10.17	10.26
AC-FT		7255.	18036.	21307.	21513.

OVF

STATION 1



OVN

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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
2	2	0	0.0	0.0	0.0	0.

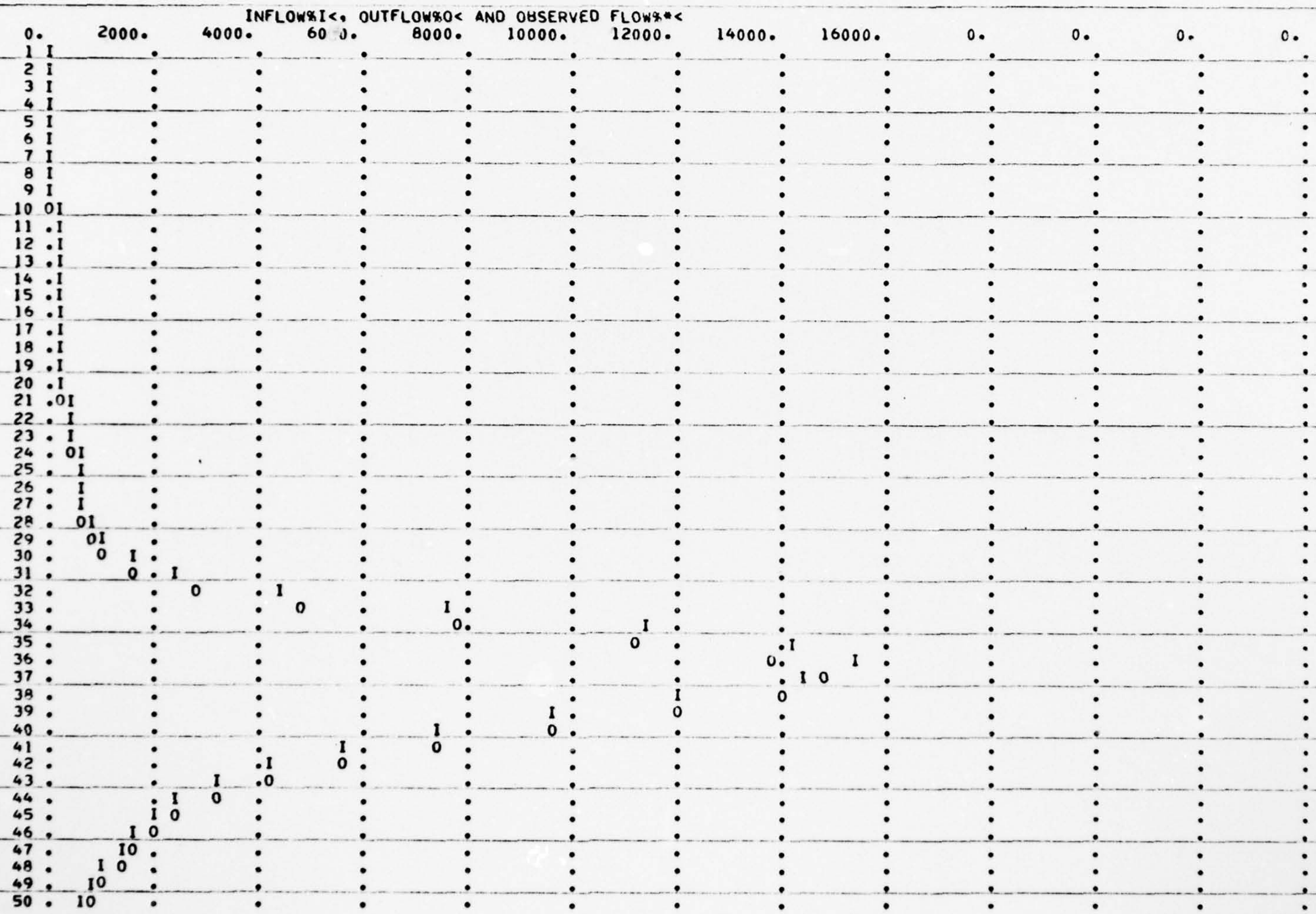
ROUTED FLOWS AT 2

50.	50.	50.	50.	52.	55.	59.	66.	79.	99.
120.	137.	144.	143.	139.	135.	132.	129.	135.	160.
216.	304.	405.	486.	525.	527.	529.	581.	747.	1077.
1641.	2709.	4723.	7746.	11106.	13747.	14798.	14023.	11985.	9596.
7446.	5684.	4294.	3239.	2476.	1946.	1580.	1312.	1090.	883.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14798.	14189.	9032.	3563.	129404.
INCHES		3.36	8.55	10.12	10.21
AC-FT		7040.	17924.	21209.	21400.

QVF

STATION 2



OVN

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

SUB-AREA RUNOFF COMPUTATION

SUBAREA 25 PMP

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	186.50	0.0	314.00	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
11.80	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.891

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	2.00	0.07	0.0	0.14

UNIT HYDROGRAPH DATA

TP# 13.40 CP#0.74 NTA# 0

RECESSION DATA

STRTQ# 320.00 QRCSN# 2500.00 RTIOR# 1.30

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 8.08 AND P# 4.32 INTERVALS

UNIT HYDROGRAPH 28 END-OF-PERIOD ORDINATES, LAG# 13.41 HOURS, CP# 0.74 VOL# 1.00

384.	1389.	2711.	4134.	5441.	6325.	6658.	6422.	5523.	4387.
3478.	2757.	2185.	1732.	1373.	1088.	863.	684.	542.	430.
341.	270.	214.	170.	134.	107.	84.	67.		

END-OF-PERIOD FLOW

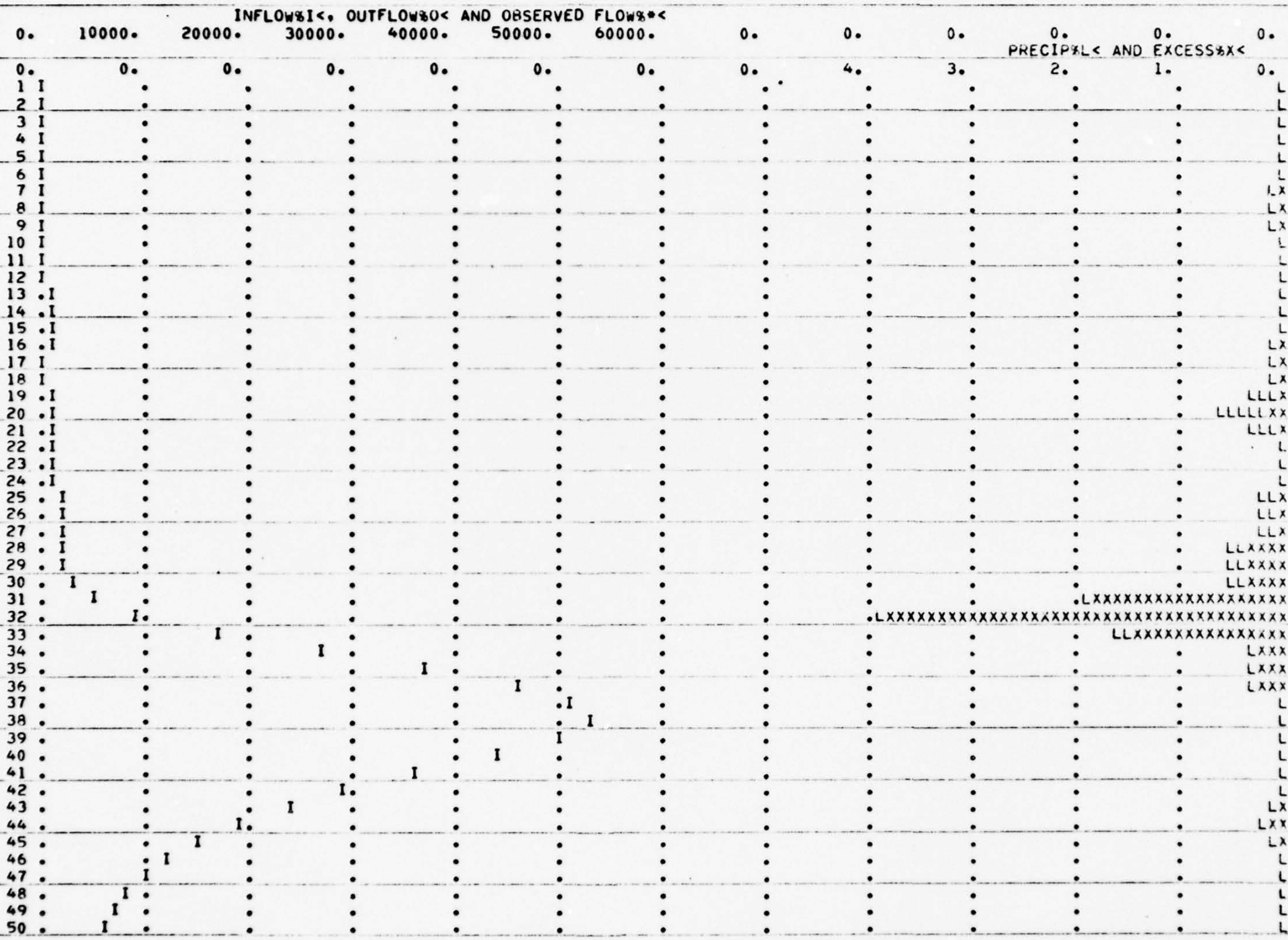
TIME	RAIN	EXCS	COMP Q
1	0.01	0.00	312.
2	0.01	0.00	305.
3	0.01	0.00	300.
4	0.02	0.00	296.
5	0.02	0.00	295.
6	0.02	0.00	297.
7	0.07	0.01	305.
8	0.14	0.02	326.
9	0.06	0.01	363.
10	0.01	0.00	409.
11	0.01	0.00	456.
12	0.01	0.00	496.
13	0.03	0.00	521.
14	0.03	0.00	529.
15	0.03	0.00	520.
16	0.07	0.01	507.
17	0.07	0.01	494.
18	0.07	0.01	481.
19	0.31	0.04	504.
20	0.63	0.09	594.
21	0.25	0.04	760.
22	0.04	0.01	971.
23	0.04	0.01	1189.
24	0.04	0.01	1376.
25	0.17	0.04	1508.

26	0.17	0.04	1590.
27	0.17	0.04	1627.
28	0.46	0.33	1743.
29	0.46	0.33	2160.
30	0.46	0.33	3007.
31	1.93	1.80	4867.
32	3.94	3.81	9371.
33	1.56	1.43	17172.
34	0.28	0.15	26913.
35	0.28	0.15	36919.
36	0.28	0.15	45504.
37	0.01	0.00	51034.
38	0.01	0.00	52690.
39	0.01	0.00	50212.
40	0.03	0.00	44008.
41	0.03	0.00	36295.
42	0.03	0.00	29310.
43	0.12	0.02	23524.
44	0.25	0.12	18825.
45	0.10	0.01	15128.
46	0.02	0.00	12270.
47	0.02	0.00	10053.
48	0.02	0.00	8313.
49	0.0	0.0	6913.
50	0.0	0.0	5748.
SUM	12.81	9.02	529310.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	52690.	51312.	36034.	14558.	529308.
INCHES		2.56	7.19	8.71	8.80
AC-FT		25457.	71509.	86672.	87534.

OVF

STATION 2



OVN

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COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	2	0	0	0	0	0

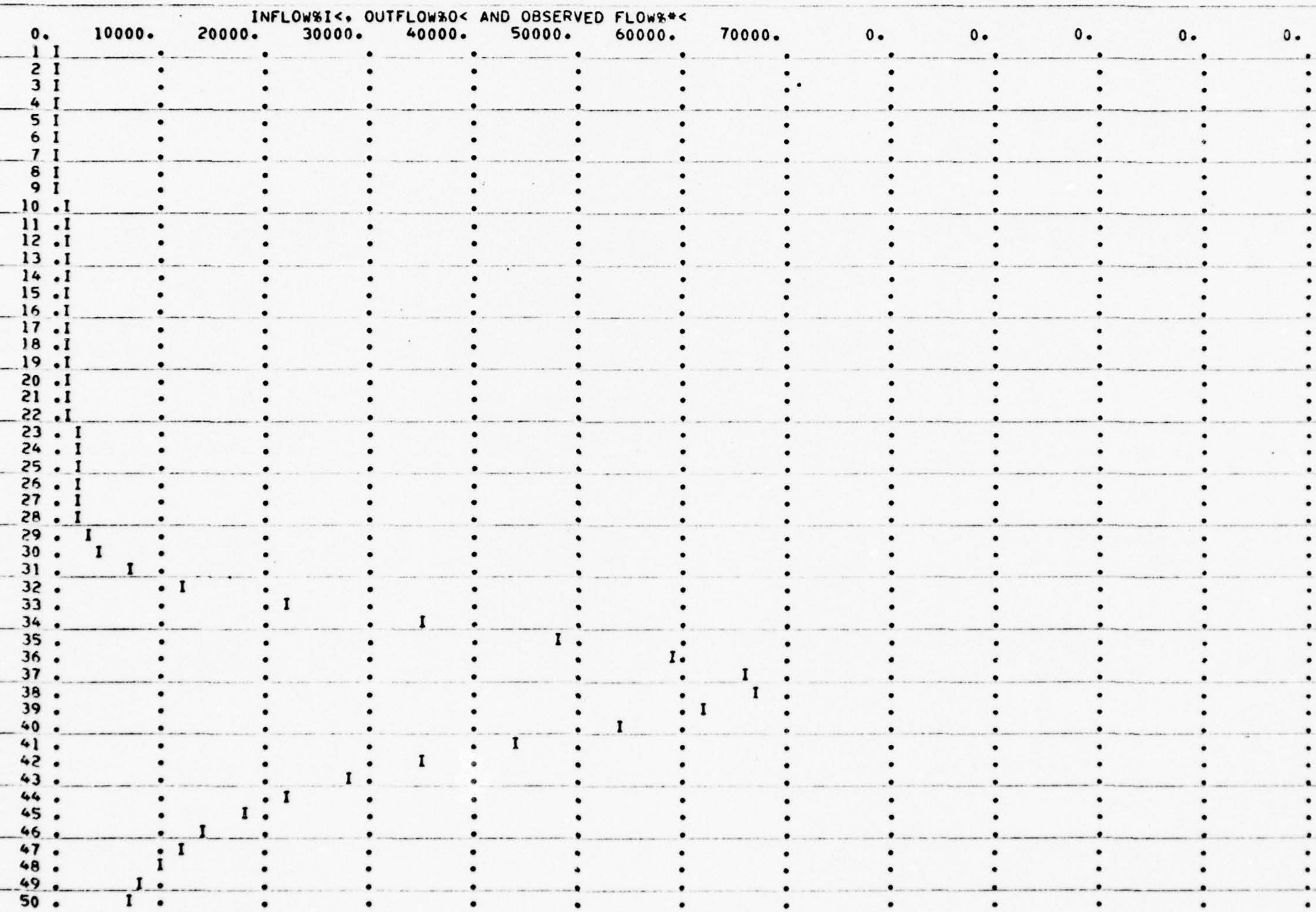
SUM OF 2 HYDROGRAPHS AT 2

362.	355.	349.	346.	347.	352.	364.	392.	442.	508.
577.	633.	665.	672.	659.	642.	625.	610.	639.	754.
977.	1276.	1594.	1862.	2033.	2117.	2156.	2324.	2908.	4084.
6508.	12080.	21895.	34659.	48025.	59252.	65832.	66712.	62197.	53604.
43741.	34993.	27818.	22064.	17604.	14216.	11633.	9625.	8002.	6631.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	66712.	64913.	45066.	18121.	658713.
INCHES		2.67	7.43	8.96	9.05
AC-FT		32205.	89433.	107882.	108934.

QVF

STATION 2



QVN

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

                          HYDROGRAPH ROUTING
              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
                  3       1       0       0       0       0       0
                                 ROUTING DATA
                      QLOSS   CLOSS     AVG    IRES   ISAME
                        0.0     0.0     0.0       0       0

              NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
                  3       2       0     0.0     0.0     0.0      0.

                          ROUTED FLOWS AT        3
     362.      361.      358.      353.      349.      348.      351.      361.      383.      422.
     477.      541.      600.      643.      663.      662.      650.      634.      624.      641.
     721.      888.     1138.     1431.     1710.     1925.     2059.     2147.     2308.     2742.
    3726.     5846.    10218.    17886.    28721.    41150.    52790.    61248.    64885.    63270.
   57232.    48653.    39703.    31780.    25280.    20130.    16145.    13097.    10749.     8893.

                  PEAK   6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
         CFS    64885.   63135.    44570.    17843.       648249.
      INCHES               2.60      7.34      8.82          8.90
       AC-FT             31323.    88449.   106227.       107204.
```
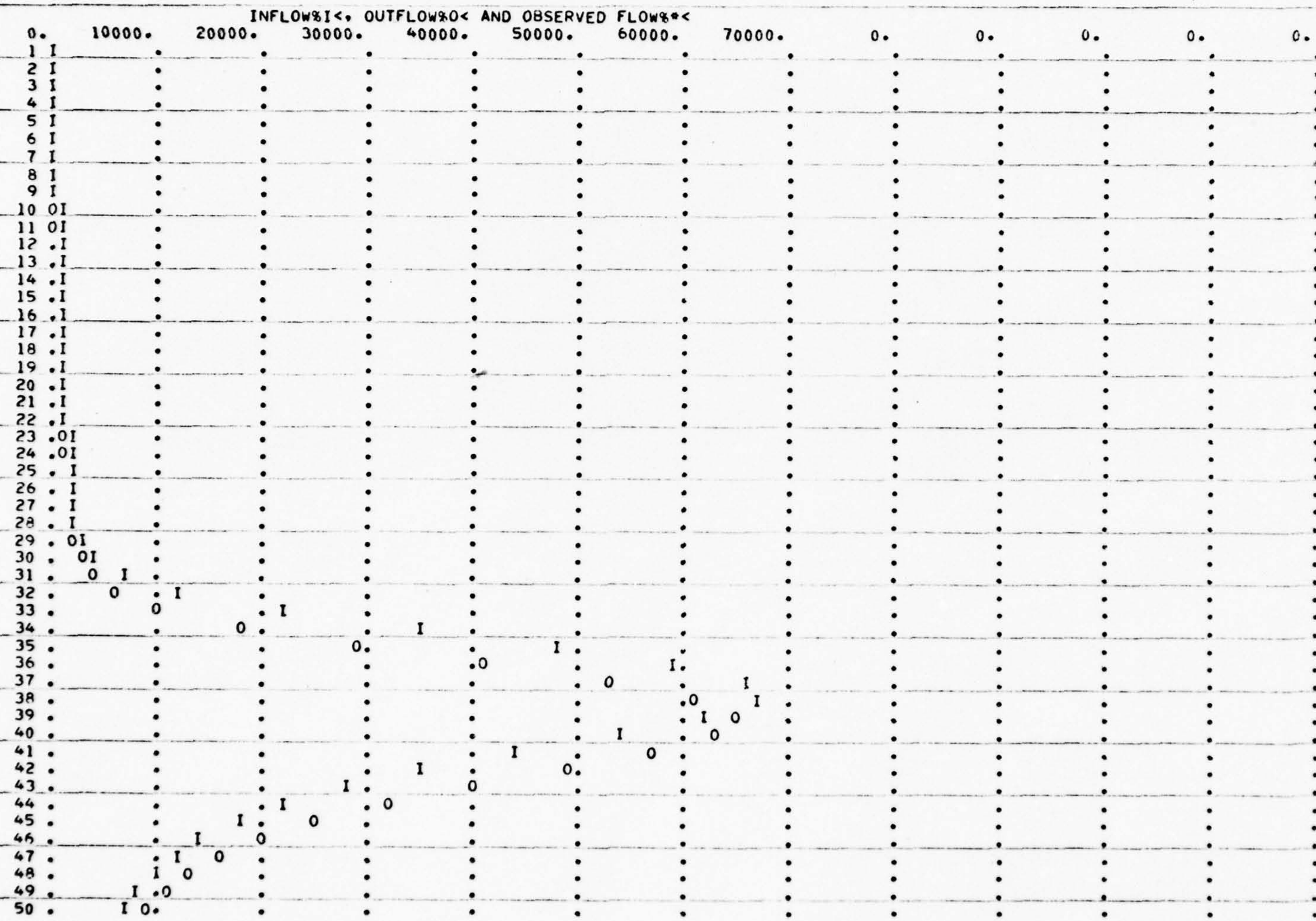

OVF

STATION 3



OWN

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SUB-AREA RUNOFF COMPUTATION

SUBAREA 26 PMP

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	10.20	0.0	3140.00	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
13.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.928

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	1.50	0.07	0.0	0.0

UNIT HYDROGRAPH DATA

TP# 6.30 CP#0.69 NTA# 0

RECESSION DATA

STRTQ# 10.00 QRCSN# 70.00 RTIOR# 1.30

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 4.02 AND R# 2.22 INTERVALS

UNIT HYDROGRAPH 14 END-OF-PERIOD ORDINATES, LAG# 6.30 HOURS, CP# 0.69 VOL# 1.00

106.	367.	621.	697.	550.	348.	220.	139.	88.	56.
35.	22.	14.	9.						

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.01	0.00	10.
2	0.01	0.00	9.
3	0.01	0.00	9.
4	0.02	0.00	9.
5	0.02	0.00	9.
6	0.02	0.00	9.
7	0.08	0.00	8.
8	0.16	0.00	8.
9	0.06	0.00	8.
10	0.01	0.00	8.
11	0.01	0.00	7.
12	0.01	0.00	7.
13	0.04	0.00	7.
14	0.04	0.00	7.
15	0.04	0.00	7.
16	0.10	0.00	7.
17	0.10	0.00	6.
18	0.10	0.00	6.
19	0.34	0.00	6.
20	0.70	0.31	39.
21	0.28	0.13	134.
22	0.06	0.00	247.
23	0.06	0.00	303.
24	0.06	0.00	267.
25	0.17	0.02	187.
26	0.17	0.02	130.

27	0.17	0.02	103.
28	0.42	0.27	119.
29	0.42	0.27	205.
30	0.42	0.27	355.
31	1.47	1.32	636.
32	3.00	2.85	1318.
33	1.19	1.04	2427.
34	0.26	0.11	3399.
35	0.26	0.11	3612.
36	0.26	0.11	3004.
37	0.02	0.00	2129.
38	0.02	0.00	1440.
39	0.02	0.00	960.
40	0.04	0.00	621.
41	0.04	0.00	394.
42	0.04	0.00	249.
43	0.13	0.00	157.
44	0.27	0.12	112.
45	0.11	0.00	101.
46	0.02	0.00	96.
47	0.02	0.00	93.
48	0.02	0.00	73.
49	0.0	0.0	68.
50	0.0	0.0	67.
SUM	11.30	6.97	23192.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3612.	3338.	1691.	641.	23192.
INCHES		3.04	6.17	7.02	7.05
AC-FT		1656.	3356.	3816.	3835.

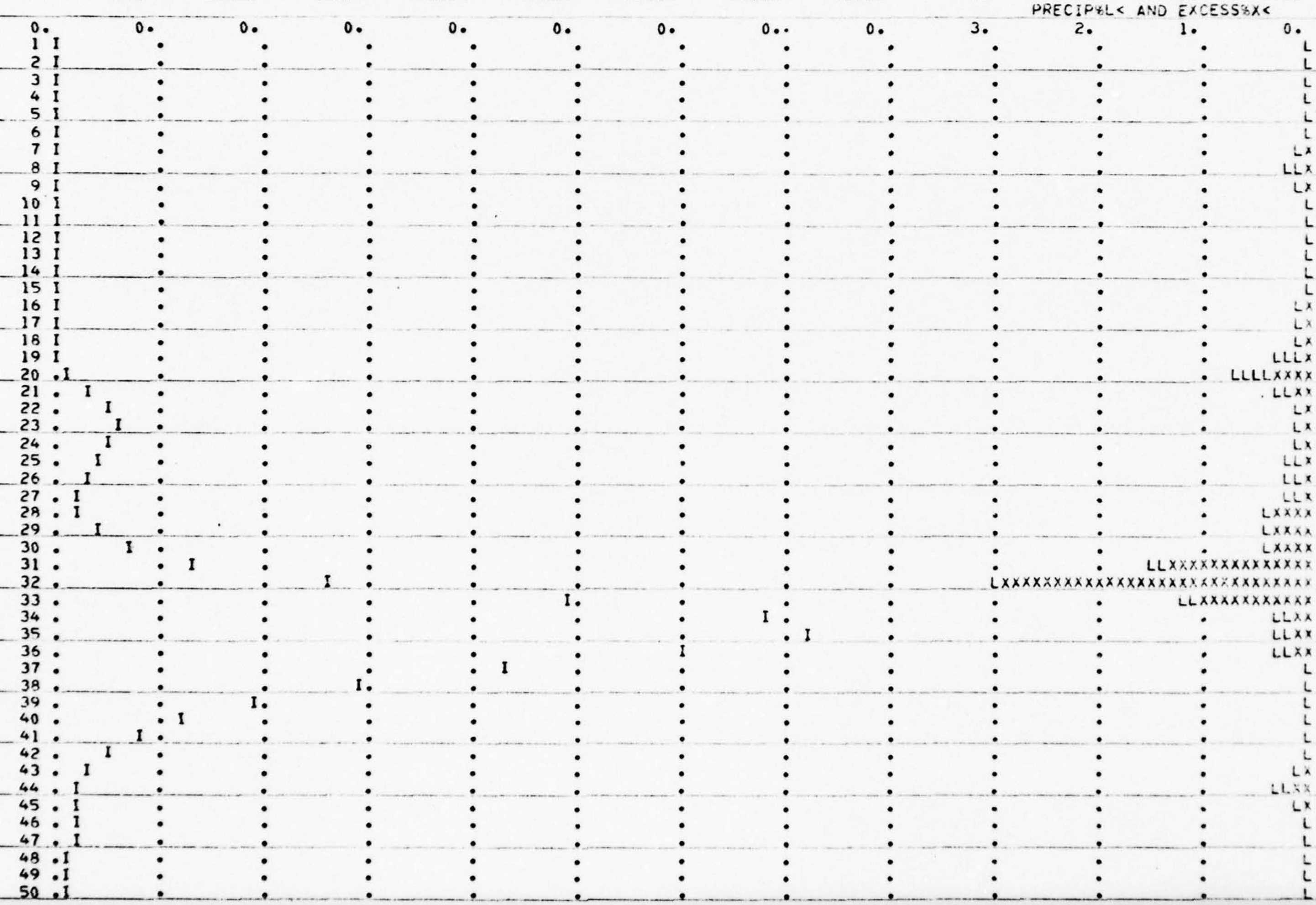
OVF

STATION 3

INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<

0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 0. 0. 0. 0.

PRECIP%L< AND EXCESS%X<



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*OVN*

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

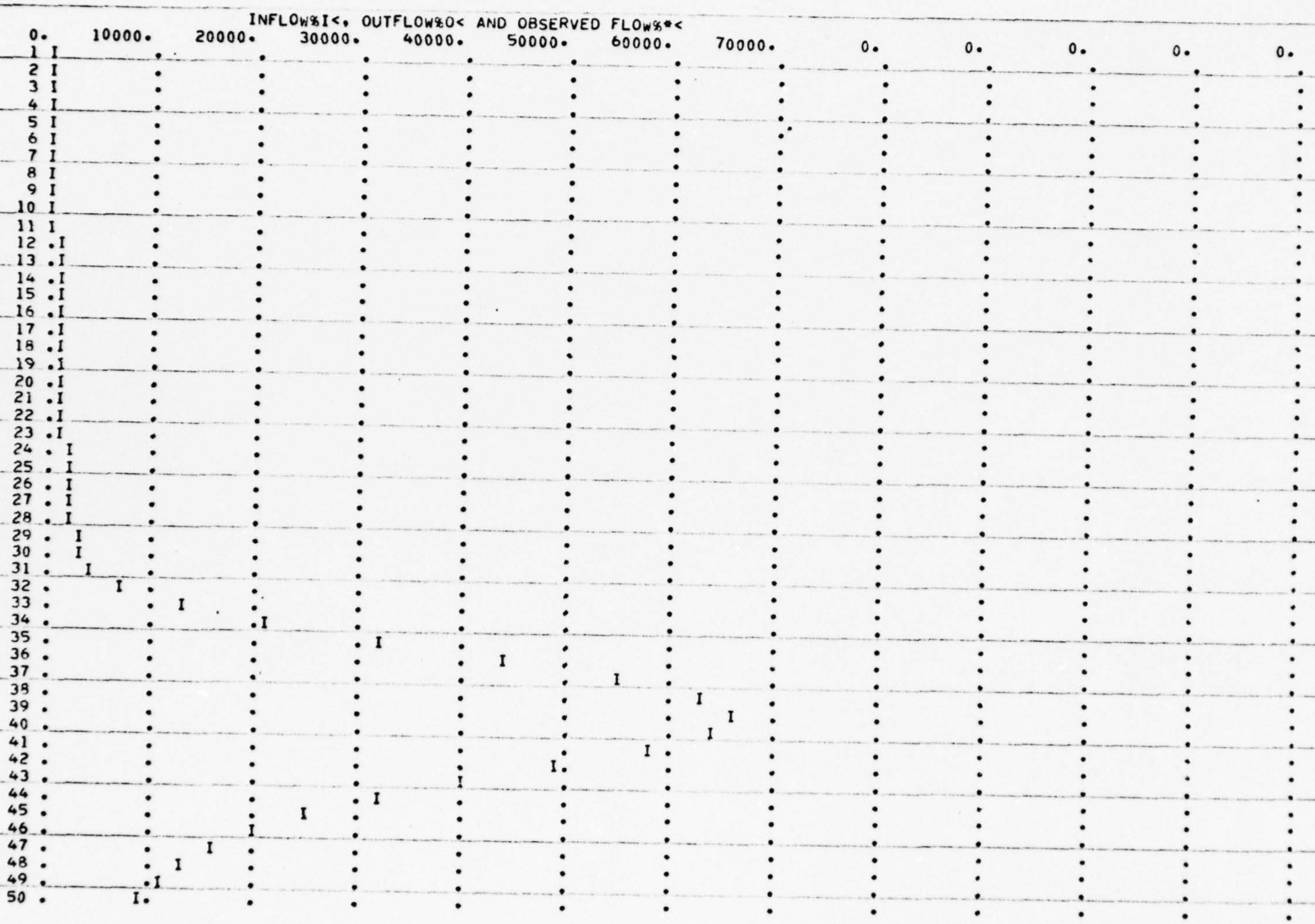
                                        COMBINE HYDROGRAPHS
                        ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME
                            3        2        0        0        0        0        0

                                      SUM OF 2 HYDROGRAPHS AT      3
       372.      371.      367.      362.      357.      356.      359.      369.      391.      429.
       485.      548.      607.      649.      669.      669.      657.      640.      630.      680.
       855.     1136.     1442.     1698.     1897.     2055.     2161.     2266.     2513.     3097.
      4362.     7164.    12644.    21285.    32332.    44153.    54919.    62689.    65845.    63891.
     57626.    48902.    39860.    31892.    25381.    20226.    16238.    13169.    10817.     8960.

                             PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                    CFS    65845.    64141.    45731.    18484.       671441.
                 INCHES               2.53      7.21      8.74          8.82
                  AC-FT              31822.    90753.   110043.       111039.
```

OVF

STATION 3



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*OVN*

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

                                          HYDROGRAPH ROUTING
                          ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME
                              4        1        0        0        0        0        0
                                              ROUTING DATA
                                   QLOSS    CLOSS      AVG     IRES    ISAME
                                     0.0      0.0      0.0        0        0

                          NSTPS    NSTDL      LAG    AMSKK        X      TSK    STORA
                              4        2        0      0.0      0.0      0.0       0.

                                         ROUTED FLOWS AT      4
        372.      372.      371.      369.      366.      362.      359.      358.      363.      375.
        399.      437.      489.      546.      599.      639.      660.      663.      655.      646.
        661.      737.      904.     1149.     1421.     1671.     1875.     2033.     2166.     2340.
       2690.     3469.     5148.     8462.    14147.    22433.    32707.    43619.    53441.    60452.
      63371.    61801.    56414.    48696.    40334.    32590.    26054.    20806.    16700.    13526.

                              PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                     CFS    63371.    61875.    45159.    17936.        651217.
                  INCHES                2.44      7.12      8.48           8.56
                   AC-FT              30697.    89618.   106779.        107695.
```
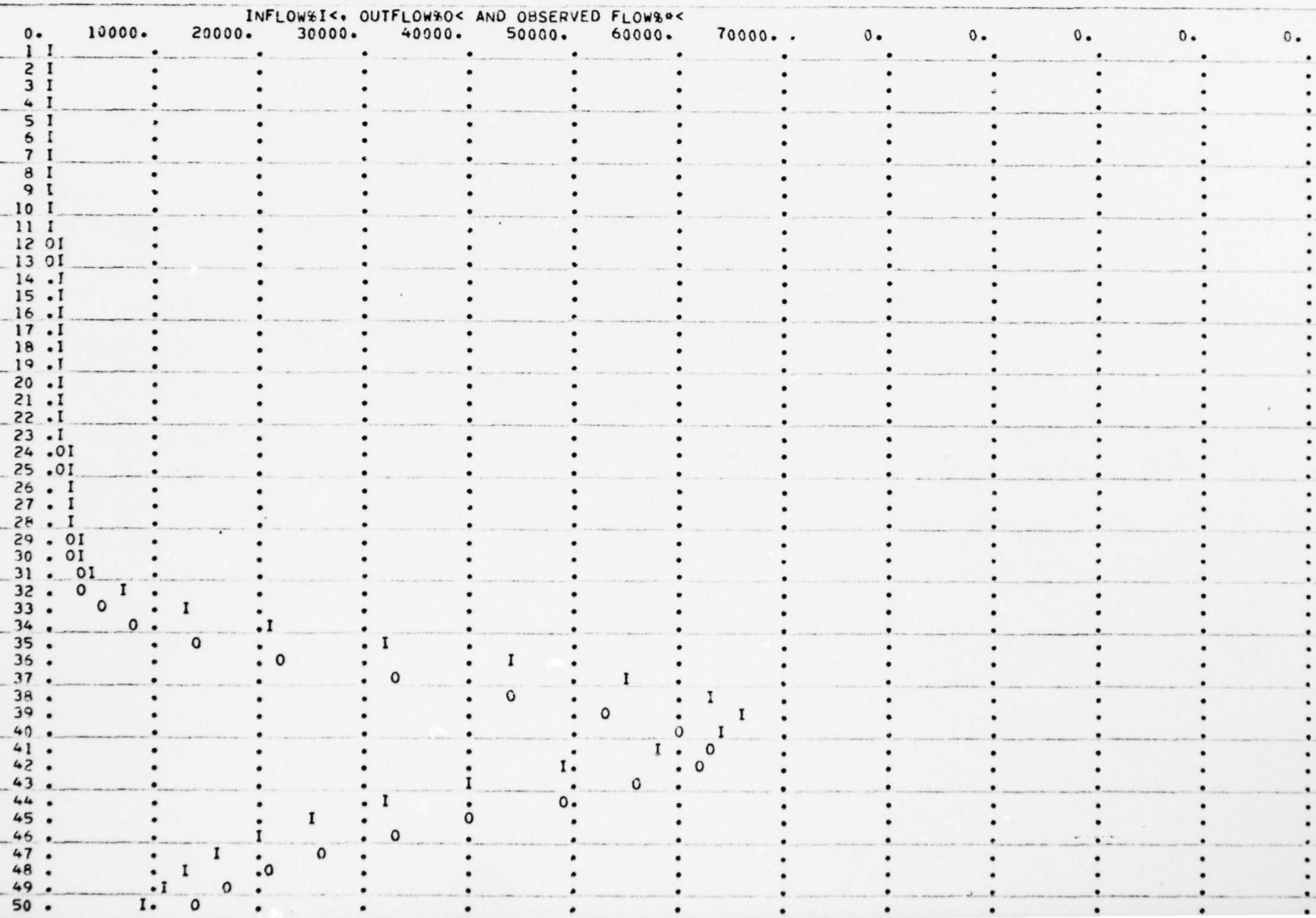

OVF

STATION 4

INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<



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

SUB-AREA RUNOFF COMPUTATION

SUBAREA 127 PMP

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	78.00	0.0	314.00	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
12.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.891

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	1.50	0.07	0.0	0.09

UNIT HYDROGRAPH DATA

TP# 10.90 CP#0.74 NTA# 0

RECESSION DATA

STRTQ# 115.00 QRCSN# 800.00 RTIOR# 1.30

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 6.87 AND R# 3.35 INTERVALS

UNIT HYDROGRAPH 22 END-OF-PERIOD ORDINATES, LAG# 10.93 HOURS, CP# 0.74 VOL# 1.00

256.	914.	1752.	2589.	3194.	3404.	3177.	2562.	1897.	1404.
1040.	770.	570.	422.	312.	231.	171.	127.	94.	70.
51.	38.								

END-OF-PERIOD FLOW

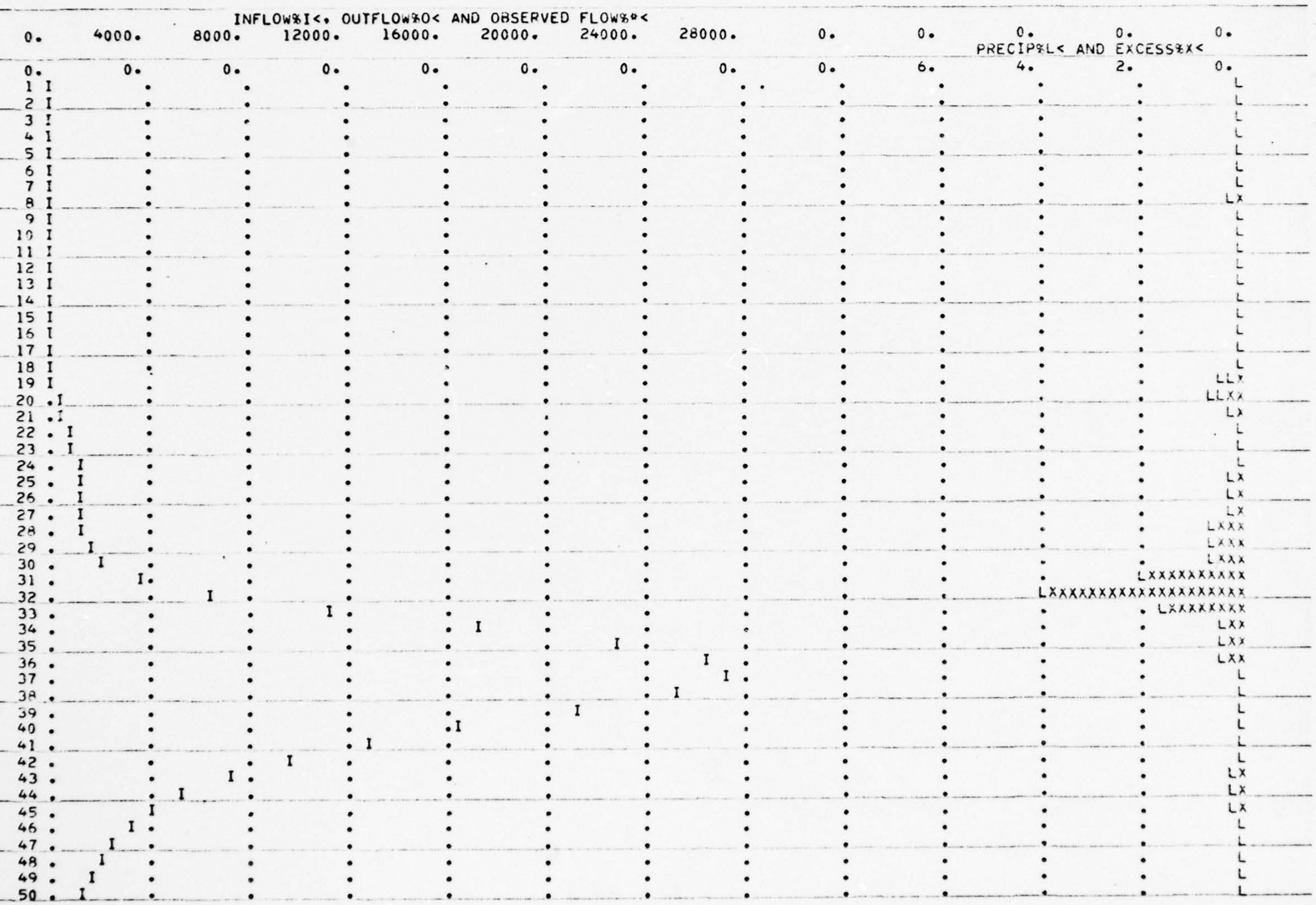
TIME	RAIN	EXCS	COMP Q
1	0.01	0.00	112.
2	0.01	0.00	110.
3	0.01	0.00	108.
4	0.02	0.00	107.
5	0.02	0.00	108.
6	0.02	0.00	109.
7	0.07	0.01	113.
8	0.15	0.01	121.
9	0.06	0.01	136.
10	0.01	0.00	154.
11	0.01	0.00	170.
12	0.01	0.00	180.
13	0.03	0.00	182.
14	0.03	0.00	177.
15	0.03	0.00	173.
16	0.08	0.01	168.
17	0.08	0.01	164.
18	0.08	0.01	159.
19	0.32	0.03	172.
20	0.65	0.20	249.
21	0.26	0.12	438.
22	0.05	0.00	707.
23	0.05	0.00	986.
24	0.05	0.00	1207.
25	0.20	0.06	1324.

26	0.20	0.06	1339.
27	0.20	0.06	1275.
28	0.51	0.37	1289.
29	0.51	0.37	1576.
30	0.51	0.37	2183.
31	1.99	1.85	3452.
32	4.05	3.92	6401.
33	1.61	1.47	11365.
34	0.32	0.18	17270.
35	0.32	0.18	22696.
36	0.32	0.18	26337.
37	0.01	0.00	27314.
38	0.01	0.00	25387.
39	0.01	0.00	21250.
40	0.03	0.00	16595.
41	0.03	0.00	12648.
42	0.03	0.00	9536.
43	0.12	0.01	7118.
44	0.25	0.12	5329.
45	0.10	0.01	4064.
46	0.02	0.00	3171.
47	0.02	0.00	2535.
48	0.02	0.00	2060.
49	0.0	0.0	1677.
50	0.0	0.0	1333.
SUM	13.50	9.62	242834.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27314.	26346.	16993.	6693.	242832.
INCHES		3.14	8.11	9.58	9.65
AC-FT		13071.	33722.	39846.	40158.

OVF

STATION 4



OVN

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

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	2	0	0	0	0	0

SUM OF 2 HYDROGRAPHS AT 4

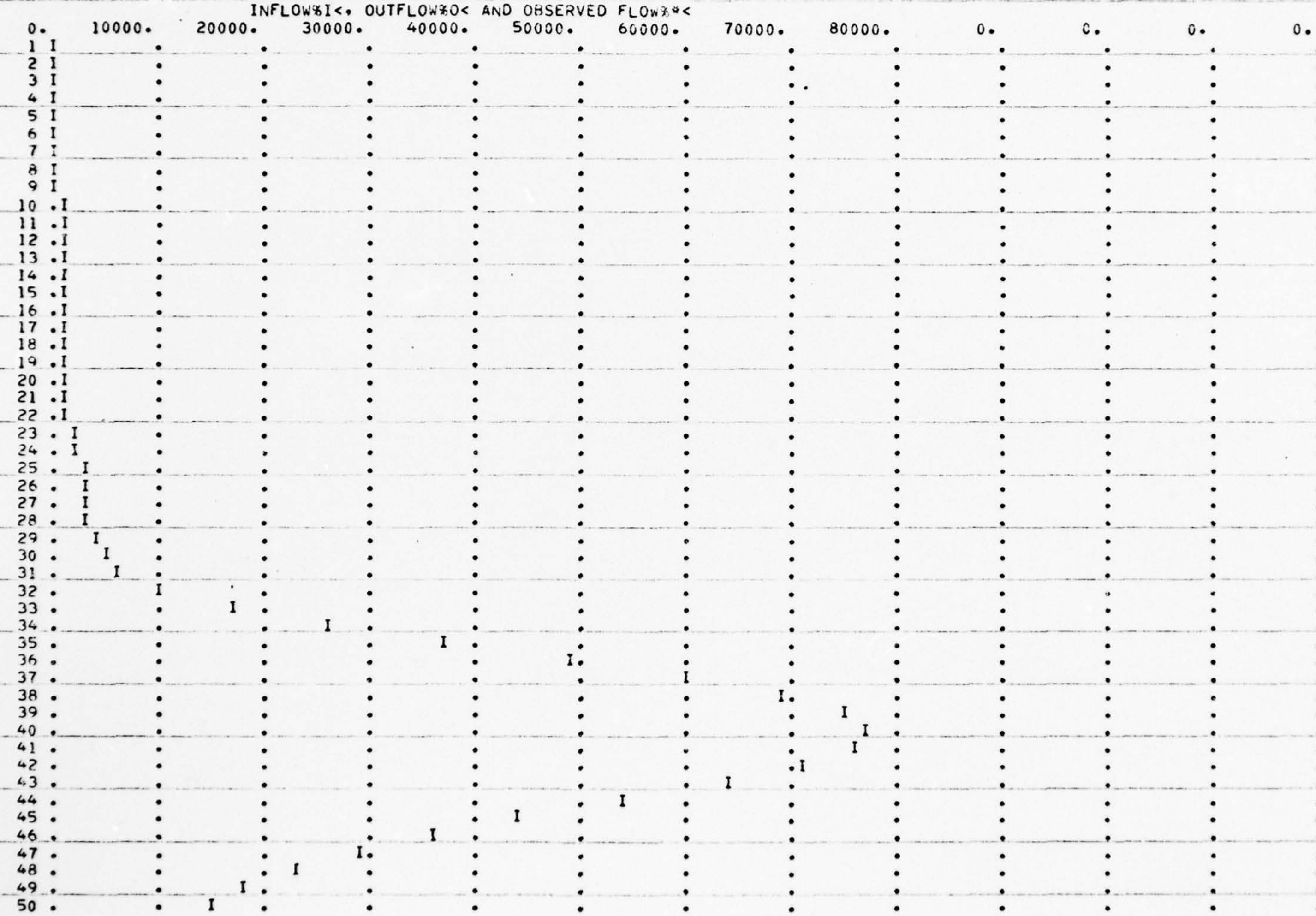
484.	482.	479.	477.	474.	471.	471.	480.	499.	529.
569.	617.	670.	723.	772.	807.	823.	822.	827.	895.
1099.	1444.	1890.	2355.	2746.	3010.	3150.	3322.	3742.	4523.
6143.	9870.	16513.	25731.	36843.	48770.	60021.	69005.	74691.	77047.
76019.	71337.	63533.	54025.	44398.	35762.	28589.	22866.	18377.	14859.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	77047.	75919.	59288.	24628.	894050.
INCHES		2.25	7.03	8.76	8.83
AC-FT		37665.	117656.	146625.	147853.

OVF

STATION 4

INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<



OVN

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

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
5	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	. STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE*	0.	1295.	2590.	5178.	7767.	10356.	12945.	15969.	18993.	25041.
OUTFLOW*	0.	3432.	9707.	27459.	50440.	77657.	108529.	142666.	179779.	262093.

TIME	EOP STOR	AVG IN	EOP OUT
1	183.	484.	484.
2	182.	483.	483.
3	182.	480.	482.
4	181.	478.	481.
5	181.	475.	479.
6	180.	473.	477.
7	179.	471.	475.
8	179.	476.	475.
9	181.	489.	480.
10	186.	514.	492.
11	193.	549.	513.
12	204.	593.	541.
13	218.	644.	578.
14	234.	697.	621.
15	251.	748.	666.
16	268.	789.	711.
17	282.	815.	748.
18	292.	823.	775.
19	299.	824.	793.
20	308.	861.	817.
21	333.	997.	882.
22	386.	1271.	1022.
23	473.	1667.	1254.
24	591.	2123.	1566.
25	724.	2550.	1920.
26	854.	2878.	2264.
27	965.	3080.	2557.
28	1057.	3236.	2801.
29	1156.	3532.	3064.
30	1300.	4133.	3457.
31	1522.	5333.	4530.
32	1932.	8006.	6518.
33	2706.	13191.	10501.
34	3826.	21122.	18186.
35	5205.	31287.	27701.
36	6646.	42807.	40485.
37	7957.	54396.	52437.
38	9025.	64513.	63665.
39	9749.	71848.	71274.
40	10155.	75869.	75546.
41	10242.	76533.	76464.
42	9996.	73678.	73873.
43	9427.	67435.	67887.
44	8621.	58779.	59419.

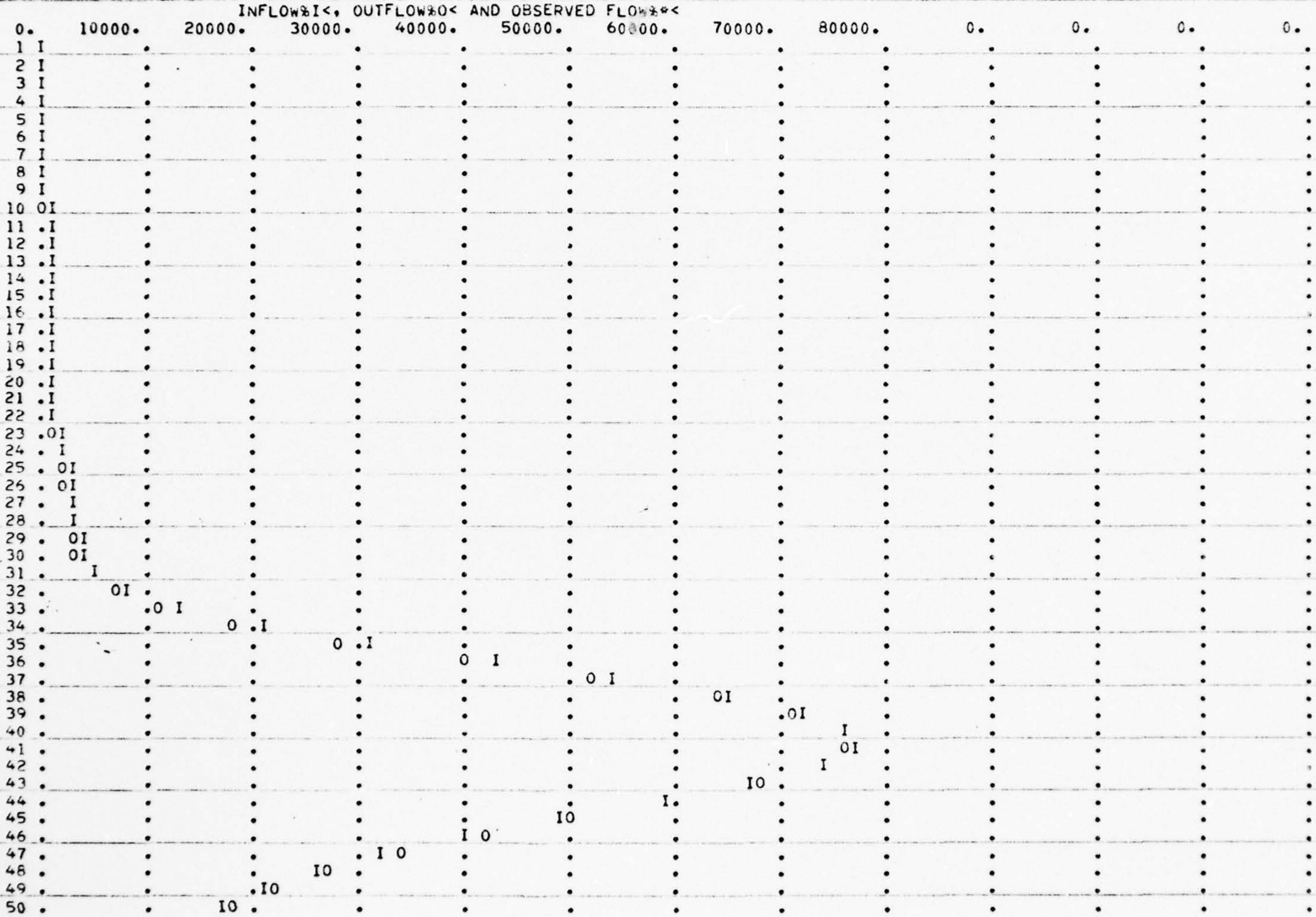
45	7714.	49211.	49974.
46	6771.	40080.	41600.
47	5872.	32175.	33624.
48	5113.	25727.	27016.
49	4439.	20622.	22389.
50	3830.	16618.	18213.
SUM			873659.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	76464.	75294.	58854.	24072.	873659.
INCHES		2.23	6.97	8.56	8.63
AC-FT		37355.	116795.	143313.	144481.

OVF

STATION 5

INFLOW%I<, OUTFLOW%O< AND OBSERVED FLOW%*<



RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	15320.	14624.	9089.	3579.	39.30
ROUTED TO	2	14798.	14189.	9032.	3563.	39.30
HYDROGRAPH AT	2	52690.	51312.	36034.	14558.	186.50
2 COMBINED	2	66712.	64913.	45066.	18121.	225.80
ROUTED TO	3	64885.	63135.	44570.	17843.	225.80
HYDROGRAPH AT	3	3612.	3338.	1691.	641.	10.20
2 COMBINED	3	65845.	64141.	45731.	18484.	236.00
ROUTED TO	4	63371.	61875.	45159.	17936.	236.00
HYDROGRAPH AT	4	27314.	26346.	16993.	6693.	78.00
2 COMBINED	4	77047.	75919.	59288.	24628.	314.00
ROUTED TO	5	76464.	75294.	58854.	24072.	314.00

APPENDIX C
PHOTOGRAPHS

Description of Photographs
Gilboa Dam

Plate

1. Overall view of masonry and earth dam sections and spillway channel at toe from right abutment.

2. View of downstream slope of earth embankment section from left abutment.

APPENDIX C

3. View of masonry section from transition wall.
   <u>Note</u>: Deterioration of downstream steps and baffles.

4. View from stilling basin area showing overflow from spillway channel to stilling basin.

5. View of immediate downstream area showing stilling basin dam at bottom of photo.

6. Close up of baffles and steps from right abutment. Baffles at left were removed.

7 & 8. Close up of downstream step deterioration from spillway channel.

9. Hillside slide downstream of stilling basin.

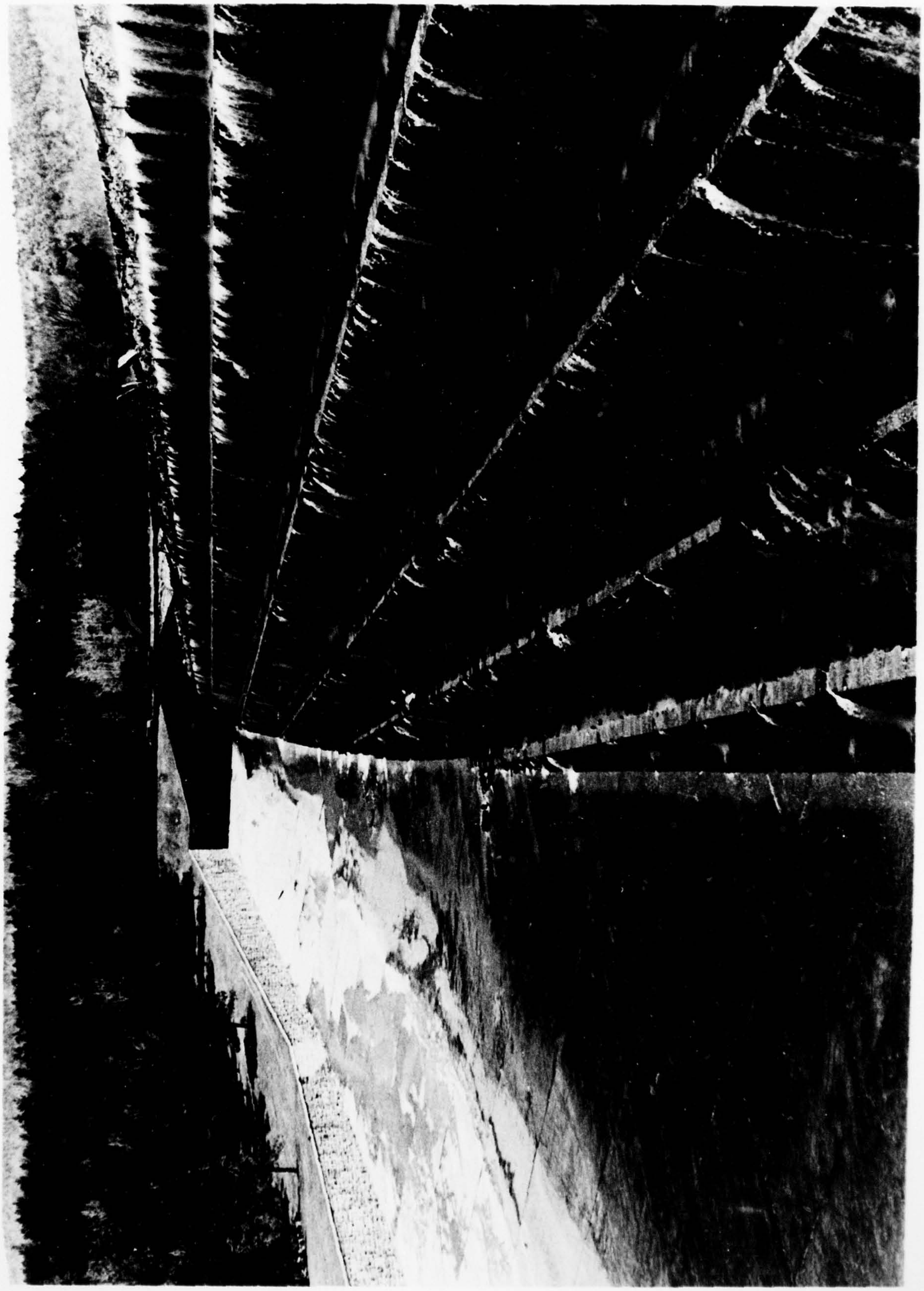


PLATE 3

PLATE 4

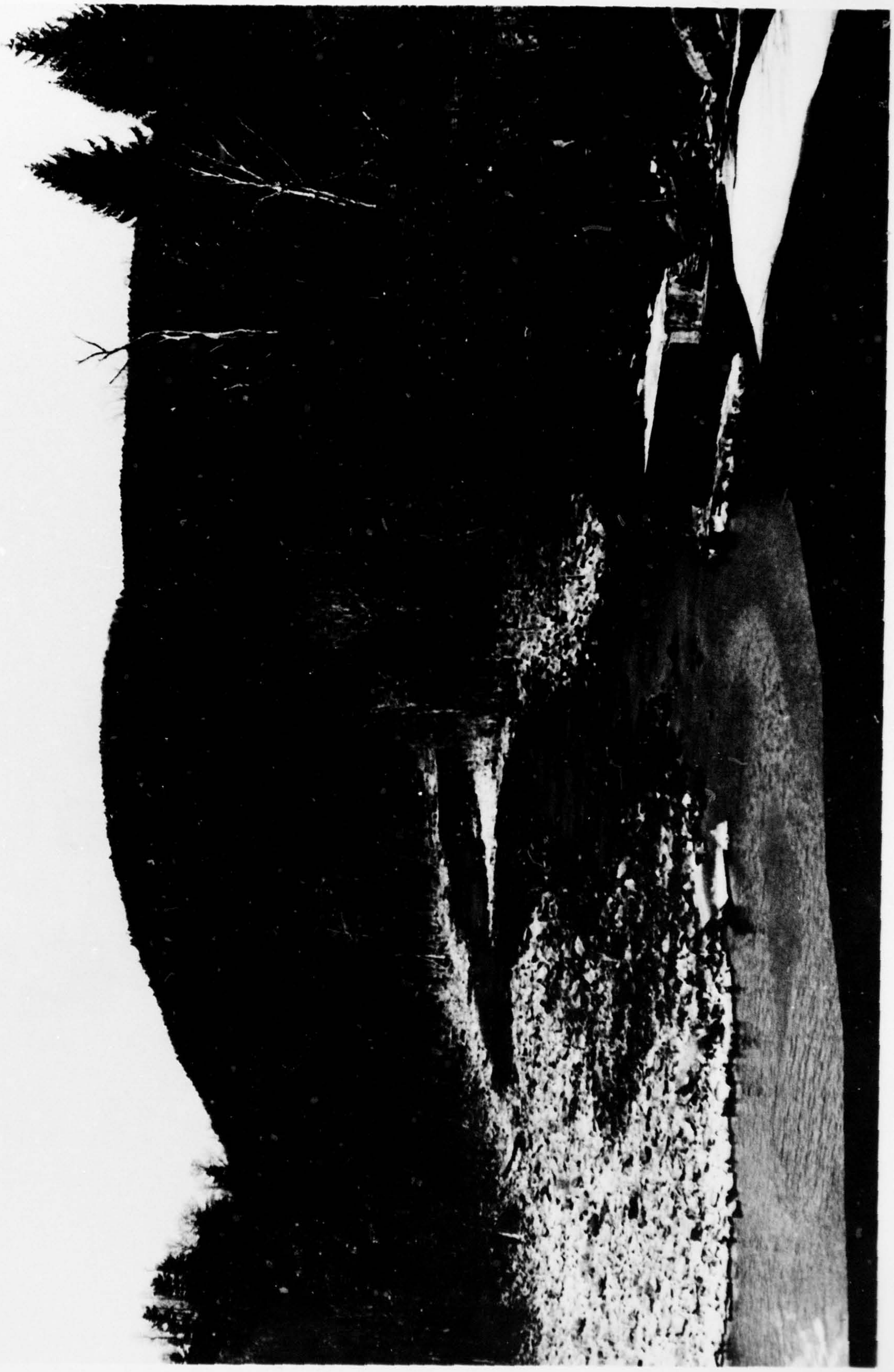
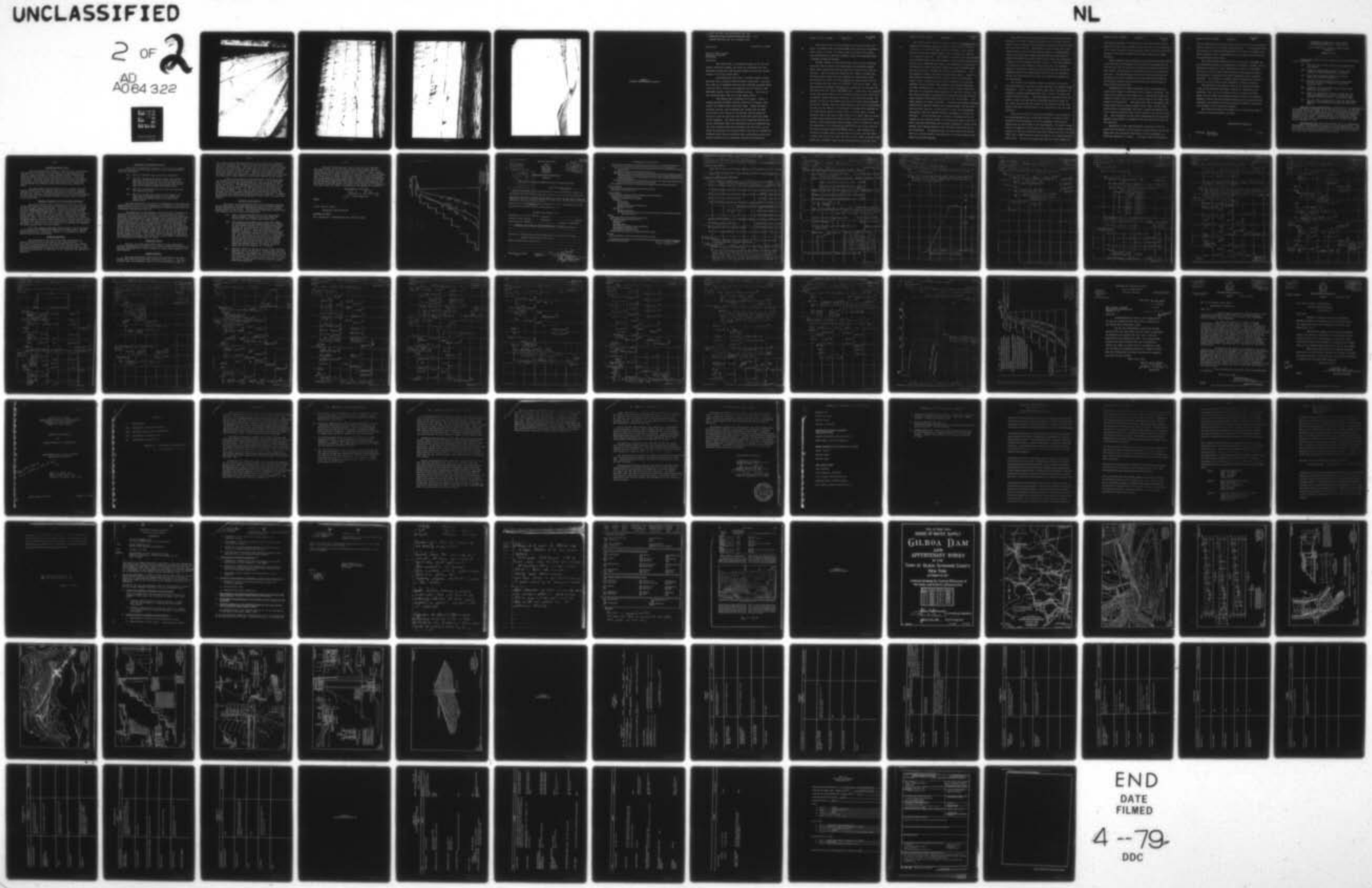


PLATE 5

AD-A064 322 KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA F/G 13/2
NATIONAL DAM SAFETY PROGRAM, GILBOA DAM, MOHAWK RIVER BASIN, SC--ETC(U)
JUN 78 R J KIMBALL DACW51-78-C-0025

UNCLASSIFIED NL

2 OF 2
AD A064 322



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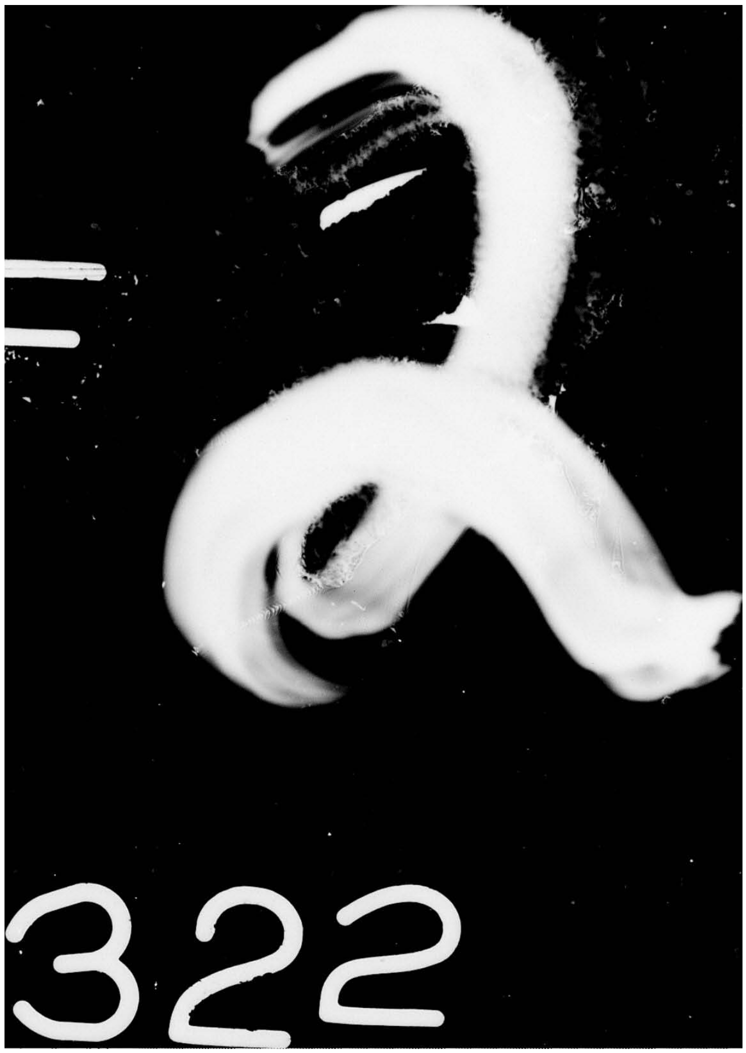
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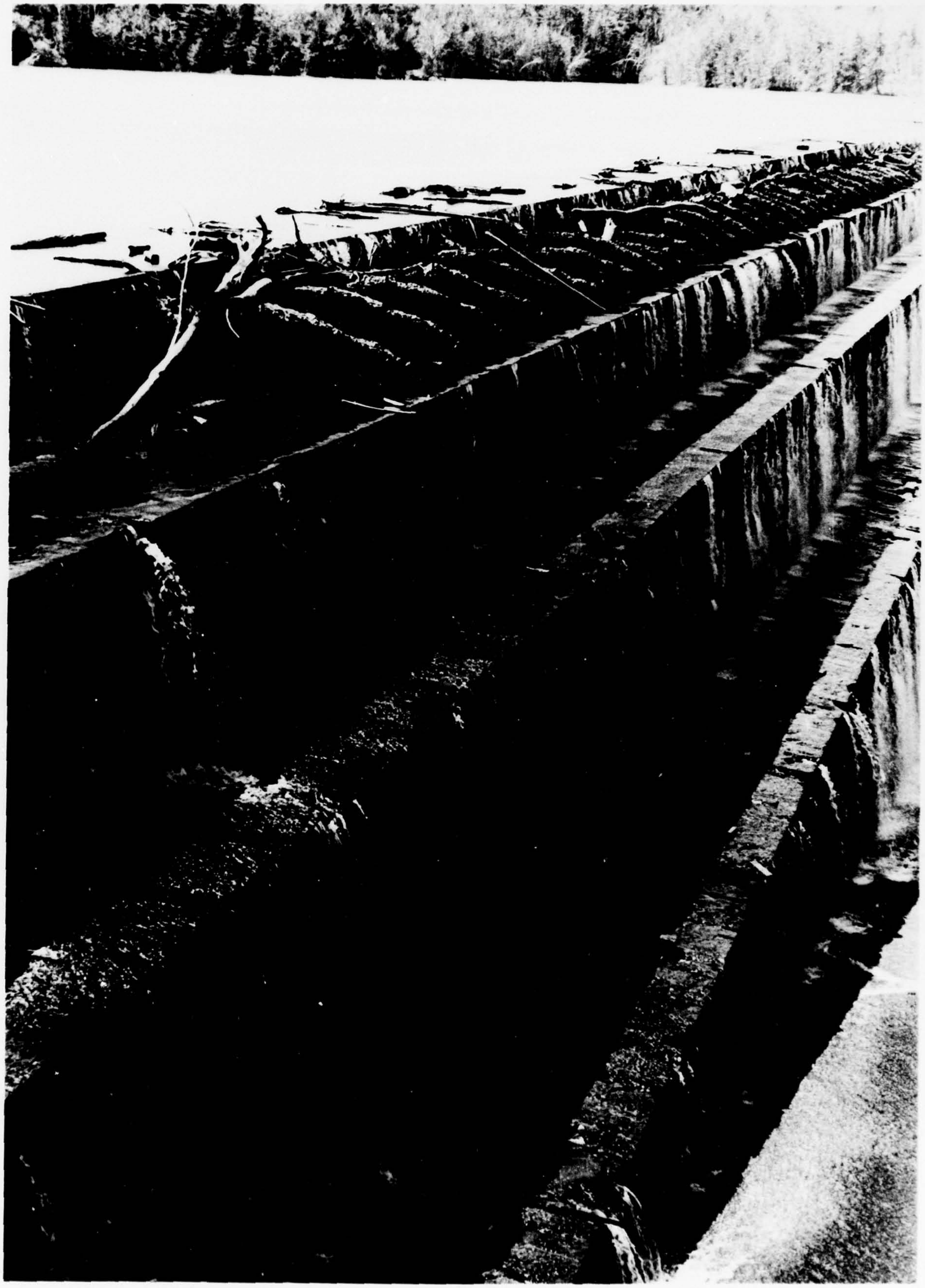


PLATE 6

PLATE 7

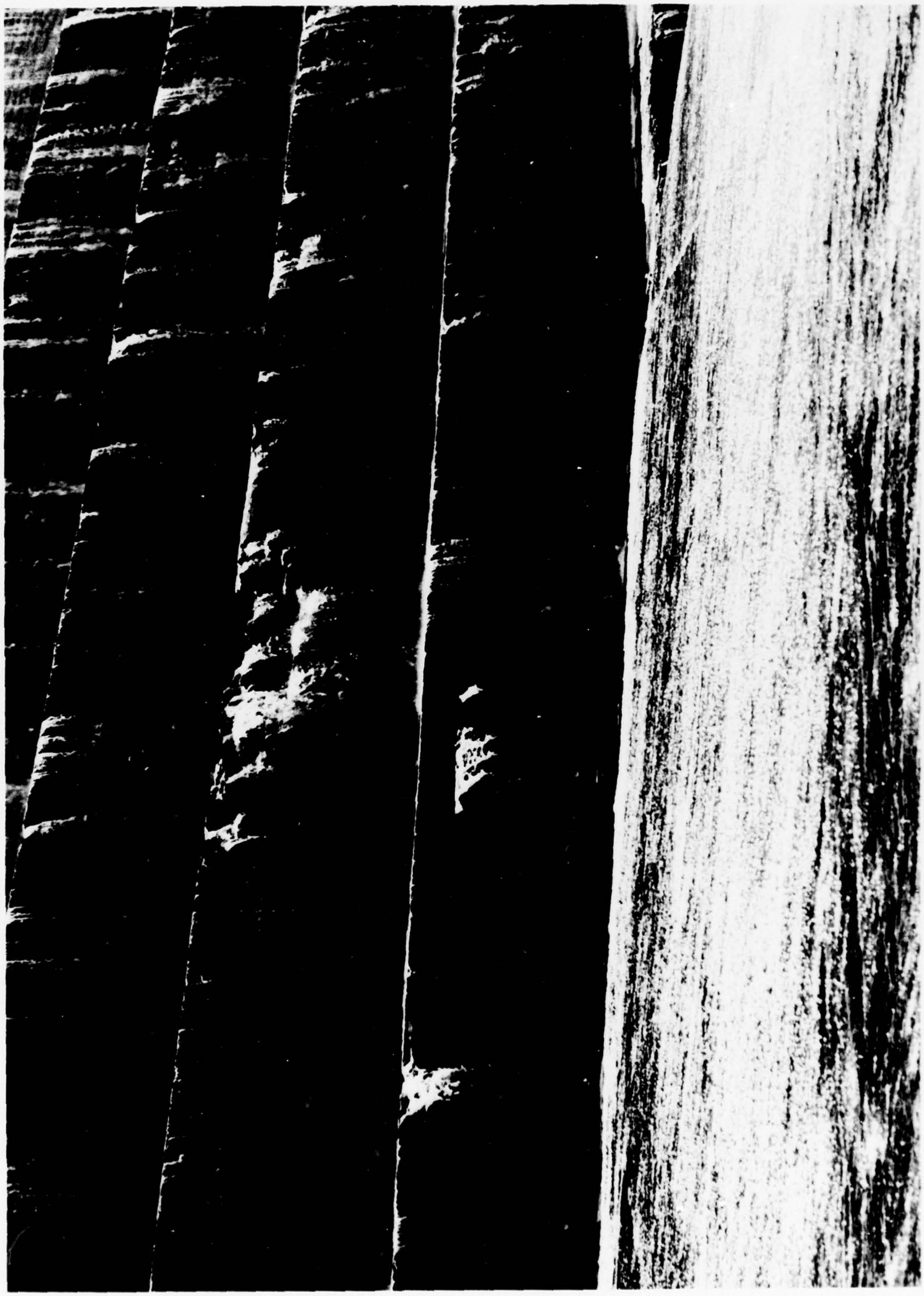


PLATE 8

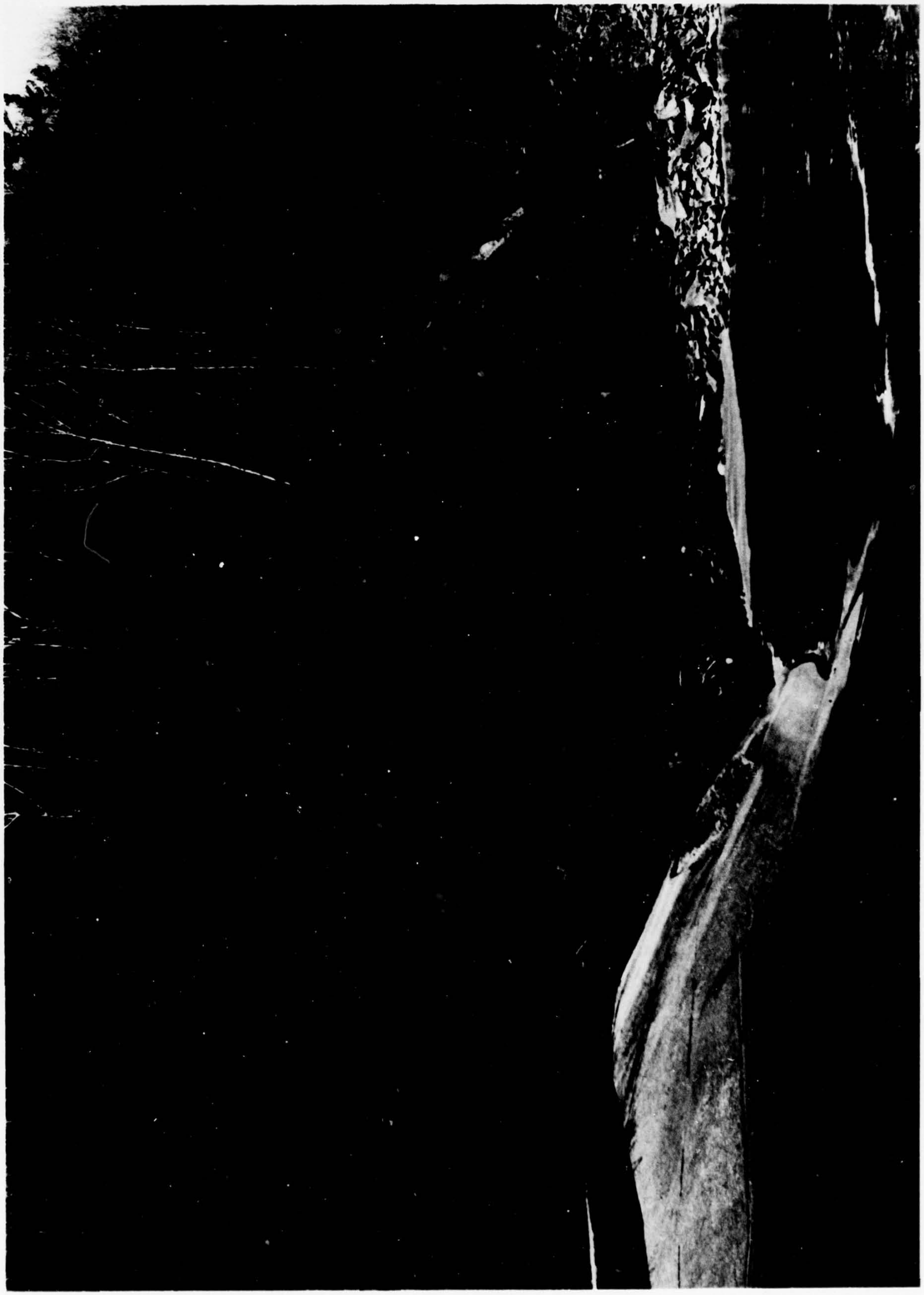


PLATE 9

APPENDIX D

PERTINENT CORRESPONDENCE AND REPORTS

NOV. 20, 1917 FOR APPROVAL OF THE
CONSERVATION COMMISSION FOR THE .Y.)
CONSTRUCTION OF THE GILBOA DAM.

Gilboa Dam. November 16, 1917.

Board of Water Supply,
Municipal Building,
Manhattan.

Gentlemen:

The Gilboa dam, on Schoharie creek, in the town of Gilboa, Schoharie county, New York, in connection with the Shandaken tunnel will develop the Schoharie watershed for the supply of the City of New York.

The Gilboa dam will form a reservoir about 6 miles long and with a maximum width of about 1-1/4 miles. Its flow line will be at elevation 1130 and its available capacity above elevation 1050, which is the elevation at the intake to the Shandaken tunnel, will be 17 billion gallons. The area of the watershed above the dam is 314 square miles.

The Gilboa dam is composed of 2 parts: First, a stepped masonry overfall section, 1300 feet in length, and, second, an earthen dike 1,000 feet long. Below the dam a spillway channel, for collecting and leading the overflow water back to the bottom of the valley, will be provided. The top of the dam and dike will be 20 feet above the crest of the spillway. The exact form of the spillway channel cannot be determined until the excavation has been completed and the rock contours have been developed, and its shape, as regards its capacity for carrying water, will not be finally determined until after a model has been constructed and the behavior of flow over it carefully studied and determined.

All exposed faces of the masonry dam and of all walls and other structures above elevation 1050, below which the reservoir will seldom - if ever - be drawn, are to be faced with stone, thus furnishing the greatest possible degree of permanence with a minimum of upkeep expense.

Careful studies of the flow of all streams in the vicinity were made for the purpose of determining the probable maximum flood which might pass down the Schoharie valley at the site of the dam. The next greatest flood in this region of which any history could be found was one which passed down Esopus creek on December 10, 1878, and from water-marks there pointed out it was evident that the depth over Bishops Falls was 12 feet. From this depth the probable discharge was computed as at the rate of 180 cubic feet per second per square mile. This rate, when applied to the 314 square miles of the Schoharie drainage area, would give a probable maximum discharge of 56,000 cubic feet per second, although, in view of the floods which have in recent years occurred in Kansas, Indiana, Ohio and North Carolina, and when consideration is given to the evidence of the local topography with relation to the sculpturing effects of flood flows, it seems that, on rare occasion, there may occur a flood from two to three times as great as that represented by the 56,000 cubic feet per second above stated. (Very approximate data indicate that on October 9, 1903, the discharge of the Schoharie at Prattsville was at the rate of 250 cubic feet per second per square mile.) The spillway was therefore designed with an ample margin of safety over and above a flood flow of 168,000 cubic feet per second, which quantity would represent a probable depth on the spillway crest of 10-1/2 feet.

The rock on which the dam is to be founded is Devonian sand-stone of the Ithaca series, of exceptionally sound and durable quality, as is well evidenced by its resistance to the erosive action of Schoharie creek which, at the dam-site, has exposed the strata in question. This Ithaca sand-stone lies in practically horizontal beds, shows the typical series of three main master joints, has relatively few seams, and, in general, by reason of its mineral content, will make [illegible] good foundation both by reason of ample strength and relative insolubility. The mineralogic makeup of the rock is relatively simple. Quartz is the dominant constituent and is represented both by original quartz grains occurring as separate individuals and as quartz granules of much smaller size occurring in original fragments of other included rocks. The total quartz content, including that due to subsequent reorganization, is from 85 to 90 per cent. The other principal constituents are sericitic mica and chlorite which together constitute about 10 per cent. of the mass. One other feature is worthy of notice. Whatever fine clayey material may have been present between the original grains when the material was laid down has, in the course of time, been thoroughly reorganized into the definite mineral aggregates, sericite and chlorite. These minerals have, moreover, intergrown with the margins of the original grains and fragments in such a way as to make a closely interlocked and somewhat crystalline, firmly bound matrix, thus adding greatly to the strength of the rock and to its durability. In general terms the rock would be classified both as a strong durable sand-stone and as a very quartzose blue-stone of the best quality.

The ancient course of the preglacial Schoharie was at some distance west from the present position of the stream and the gorge which it then cut was materially deeper than the one which has since been formed. The borings on the western end of the dam-site have shown that this ancient gorge is solidly filled with a good impervious mixture of glacial materials which is entirely overlain by a heavy blanket of as good and impervious a clay as it is probably possible to find. This clay blanket is composed of rock flour or sub-glacial till, and contains from 2 to 3 per cent. of lime, thus indicating that it was undoubtedly pushed and consolidated into its present condition by the ice sheet which passed over the limestone exposures to the north-east.

The earth in the vicinity which is available for use in the construction of the dike is that from the clay blanket above mentioned. It is a tough insoluble rock flour, homogeneous in structure, practically impervious, and, so far as has been observed, bears no water. Its resistance to exposure of air and water is well indicated by the remarkable manner in which it has stood and resisted the action of the elements for the many years which have elapsed since it was deposited in its present position.

The cross section of the masonry overfall dam is shown on an accompanying drawing, accessioned 26033, on which are also indicated the assumptions as to the magnitude of the forces acting upon it and tending to its destruction. It will be noted that the resultant of the forces falls within the "middle third", except near the top where the impossible combination of a ten foot flood and a simultaneous ice pressure places it slightly outside this limit. It is to be noted also that the cross section of the masonry overfall is of ample dimension and compares favorably with every large overfall section which has been undertaken. It is larger than any and approximates quite closely to the cross section of the high overfall dam at Yadkin Narrows, in North Carolina.

Under seepage will be guarded against by the construction of a cut-off wall, as indicated on the contract drawings, and the rock beneath the cut-off will be drilled and grouted with Portland cement, as may prove to be necessary when the excavations are made. The undermining of the toe of the dam by the overflowing water will be prevented by heavy bluestone paving in the spillway channel and by constructing the channel wall of ample height and dimension.

Sloughing of the earth embankments will be prevented by making their slopes sufficiently flat to insure stability. The slopes will nowhere be less than 2 on 1, flattening toward the bottom to about 2-3/4 on 1 with 10-foot berms on the inner side every 40 vertical feet. The water side will be protected with slope paving for the entire height of the dike. On the downstream side the embankments will have a slope not flatter than 2 on 1 and be protected with a heavy coating of loose stone riprap. The overtopping of the earth embankment has been guarded against by providing a freeboard of 20 feet above the crest of the spillway.

Inspection of the work during its construction will be under the supervision of the Engineer of your Board, and in the field under the immediate supervision of the Department and Division Engineers in charge. An ample force of inspectors will be maintained and all materials entering into the construction will be inspected at the place of manufacture. All necessary tests of materials and investigations having to do with the various features connected with an undertaking of this nature will be made at the laboratory of the Board.

The design of the Gilboa dam was made under my direction by the designing division of Headquarters Department. Messrs. John R. Freeman and William H. Burr, Consulting Engineers of the Board, have been in close touch with the work and have approved all of its features, as indicated by their signatures on the contract drawings. Dr. Charles P. Berkey, Consulting Geologist, has advised as to all of the various geological features involved.

The location of the dam is shown on the contract drawings. A map of the proposed reservoir, showing the flow lines, the buildings, etc., is to be found on the real estate sections, which show in detail the various parcels of land to be acquired. Complete working drawings showing dimensions of all parts of the structure, the borings and other essential features of the work, are contained on the contract drawings.

The nearest existing post-office to the site of the work is at Gilboa, Schoharie County, New York.

Respectfully submitted,

[illegible]

[illegible]

Attached: Blueprint,
Acc. 26033.

MEMORANDUM REGARDING DAM #465 MOHAWK
ON SCHOHARIE CREEK NEAR GILBOA, N. Y.

CITY OF NEW YORK - BOARD OF WATER SUPPLY
Applicant.

SERIAL NO. 293.

- - - - - - - - - - - - - - - -

The papers relating to the construction of this dam seem to be as follows:

(1) Nov. 20, 1917, letter transmitting application and papers.

(2) Completed application, dated Nov. 20, 1917, signed by George Featherstone, Secretary.

(3) Portfolio containing fifteen blue prints (Acc. 8379 to 8393 inclusive).

(4) Printed contract specifications and contract drawings complete, submitted in duplicate (contract 203).

(5) Portfolio of printed real estate taking maps, submitted in duplicate.

(6) Report by applicant's engineer, dated Nov. 16, 1917, accompanied by a stress diagram of the proposed overfall section - drawing Acc. 8400.

(7) Nov. 27, 1917, supplemental report by applicant's engineer, accompanied by drawings Acc. 8406 and 8407.

The site of the proposed dam, as described in the application and indicated by the plans, is on the Schoharie creek, in the town of Gilboa, Schoharie county, N. Y., at the hamlet known as Gilboa. Below such point the stream bed flows in a northerly direction and several hamlets or small villages appear on the U.S.G.S. sheets adjacent to its banks. Some houses are also indicated as being within the high water limits of the stream, or on the flat lands in the vicinity of same.

The drainage area above the proposed site, as indicated by the report by the applicant's engineer, is 314 square miles. The watershed is mountainous throughout the greater portion of its extent and such report also states that the conditions are favorable to a very rapid concentration of flood waters.

MAXIMUM PROBABLE FLOOD

The maximum probable flood, as indicated by records from streams in the vicinity, and by approximate determinations of actual floods of Schoharie creek, ranged between 15,000 cubic feet per second and 78,500 cubic feet per second. The first named value is stated in the specifications as being expected each year. The last named value was determined from the report of the applicant's engineer as to approximate data concerning the discharge of Schoharie creek at Prattsville on October 9, 1903.

The applicant's engineer expresses the opinion that the maximum flood to be expected is two or three times the largest values above stated, or possibly 168,000 cubic feet per second. He does not, however, take into consideration the equalizing effect of the reservoir, which would be about six miles long and about 1-1/4 miles wide.

SPILLING CAPACITY OF THE PROPOSED STRUCTURE.

The plans indicate that a freeboard of 20 feet is to be provided between the elevation of the spillway crest and the top of the adjacent earth embankments. By using the value of 2.64 for the coefficient "C" in Francis' formula (as recommended in U.S.G.S. Water Supply Paper 200), it would appear that the proposed spillway, about 1300 feet in length, would discharge approximately 168,000 cubic feet per second when overtopped to a depth of 13-1/4 feet. When overtopped to a depth of 8.2 feet, the discharging capacity would be about 80,000 cubic feet per second, which is equivalent to 255 cubic feet per second per square mile of drainage area. A depth of 10 feet on the crest would cause a discharge of about 108,500 cubic feet per second.

The waste channel below the proposed dam is to be designed in accordance with experiments made with an actual model, and the plans submitted are, therefore, stated by the engineer as being provisional in this particular.

EARTH EMBANKMENTS.

The elevation of the top of the earth embankments is shown as being 20 feet above that of the spillway crest. A core wall is to be provided and constructed from the rock foundation to an elevation about 3 feet above the spillway crest. The upstream and downstream slopes are to be reasonably flat and berms are to be constructed, as explained in the report by the applicant's engineer.

STABILITY OF OVERFALL SECTION.

The forces acting upon a portion of the overfall section were investigated in accordance with the usual assumptions and also the following:

(1) That ice pressure may be properly neglected.

(2) That the intensity of upward static pressure on the base of the dam may be properly assumed as that due to full head at the heel and zero at the toe, such pressure being exerted upon 50% of the area of the base and each horizontal joint.

(3) That the maximum depth of water on the crest will not exceed 8.2 feet.

(4) That the weights per cubic foot of masonry and water may be properly taken as 145 pounds per cubic foot and 62-1/2 pounds per cubic foot respectively.

As thus determined, the point of application of the resultant intersected the base of all sections ~~and~~ investigated well within the middle third of same, and the corresponding coefficients of friction to prevent sliding were very low.

The stability of the overfall section was also investigated, assuming a thrust due to ice pressure of 24,000 pounds per foot, acting at the crest and with the water surface at the same elevation. The point of application of the resultant still intersected the base at a point well within the middle third in all portions of the dam, except near the top. If it may be assumed that the structure will be built monolithic between a point below the top of the highest step of the apron and the elevation of the crest, and that the ice thrust would act at a point five feet below such crest (as indicated in the report of the applicant's engineer), the point of application of the resultant of all forces acting upon the top of the dam would seem to fall within the middle third, allowing for an ice thrust of 10,000 pounds per foot. If the ice thrust is applied at the crest, the resultant would still fall within the middle third, allowing for an ice pressure of 5000 pounds per foot.

RETAINING WALLS.

The Nov. 27, 1917 supplemental report by the applicant's engineer explained the design of the critical retaining wall sections and was accompanied by a stress diagram of same, which appears to be satisfactory.

STREAM CONTROL.

The specitifcations state that a flood at Gilboa of about 15,000 cubic feet per second may be expected each year. The plans indicate that the Schoharie creek is to be controlled by means of two concrete dams, through which two 9-foot steel pipe penstocks are to be inserted for passing the water during the preliminary stages of construction. The upper dam will have a height of about 20 feet above the stream bed, and, from the data at hand, it would seem that a flood of 15,000 cubic feet per second might overtop same to a depth of about 6 feet. Whether the masonry dam would be stable under such conditions cannot be ascertained with certainty from the small scale drawing of same which appears on the plans.

A small stream known as the Steen Kill, which flows into the Schoharie creek at the proposed dam site, is to be diverted into the reservoir immediately above the site proposed for the upper coffer dam. To accomplish this an earth embankment is to be built, which will raise the water surface of the creek to an elevation of about 1067. It will then flow down the hillside in a paved channel. The Nov. 27, 1917 supplemental report explained that the temporary embankment and diverting channel will be properly dimensioned and paved as necessity requires. A sketch (blue print Acc. 8406) showing details of such work, was also submitted.

C O N C L U S I O N S.

The plans and specifications have been carefully prepared by the applicant's engineers and the accompanying reports seem to furnish practically all the information required by our printed instructions to applicants. The statements appearing therein have been checked with the following exceptions:

(1) That a flood of 168,000 cubic feet per second would probably overtop the dam to a depth of about 13-1/4 feet rather than 10-1/2 feet.

(2) The assumptions stated on blue print Acc. 8400 in connection with the exaplanation of the design of the overfall section do not indicate the percentage of the area of the foundation or higher horizontal joints, which are considered to be exposed to uplift. They are also misleading in that the condition described is not the critical one (if the effect of the ten feet of water above the crest were neglected and only the corrected static pressure and ice thrust were considered, the moment arm of the resultant of the forces acting on that portion of the overfall section above the highest step of the apron, would be about 16 per cent shorter than before.)

(3) Referring again to the upper block of the overfall section, if an ice thrust of 27,000 pounds per foot were applied, as provided by the assumptions stated on blue print Acc. 8400, the point of application of the resultant would not intersect the base as there indicated, unless upward static pressure on such base were neglected.

From the investigations made it does not seem probable that any failure of the overfall section would occur, unless the block of masonry at the crest should be moved forward a very short distance by a great intensity of ice thrust. This, however, should not cause a menace to life and property, as the base on which such block rests is about 18-1/2 feet wider than the block itself, and, as heretofore stated, such block is stable against overturning or sliding from all conceivable forces, except an intensity of ice thrust exceeding 5000 pounds per foot applied at the elevation of the crest, or 10,000 pounds per square foot applied at the elevation of 5 feet below the crest, as assumed by the applicant's engineer.

Respectfully submitted,

John W. Henry.

Junior Engineer.

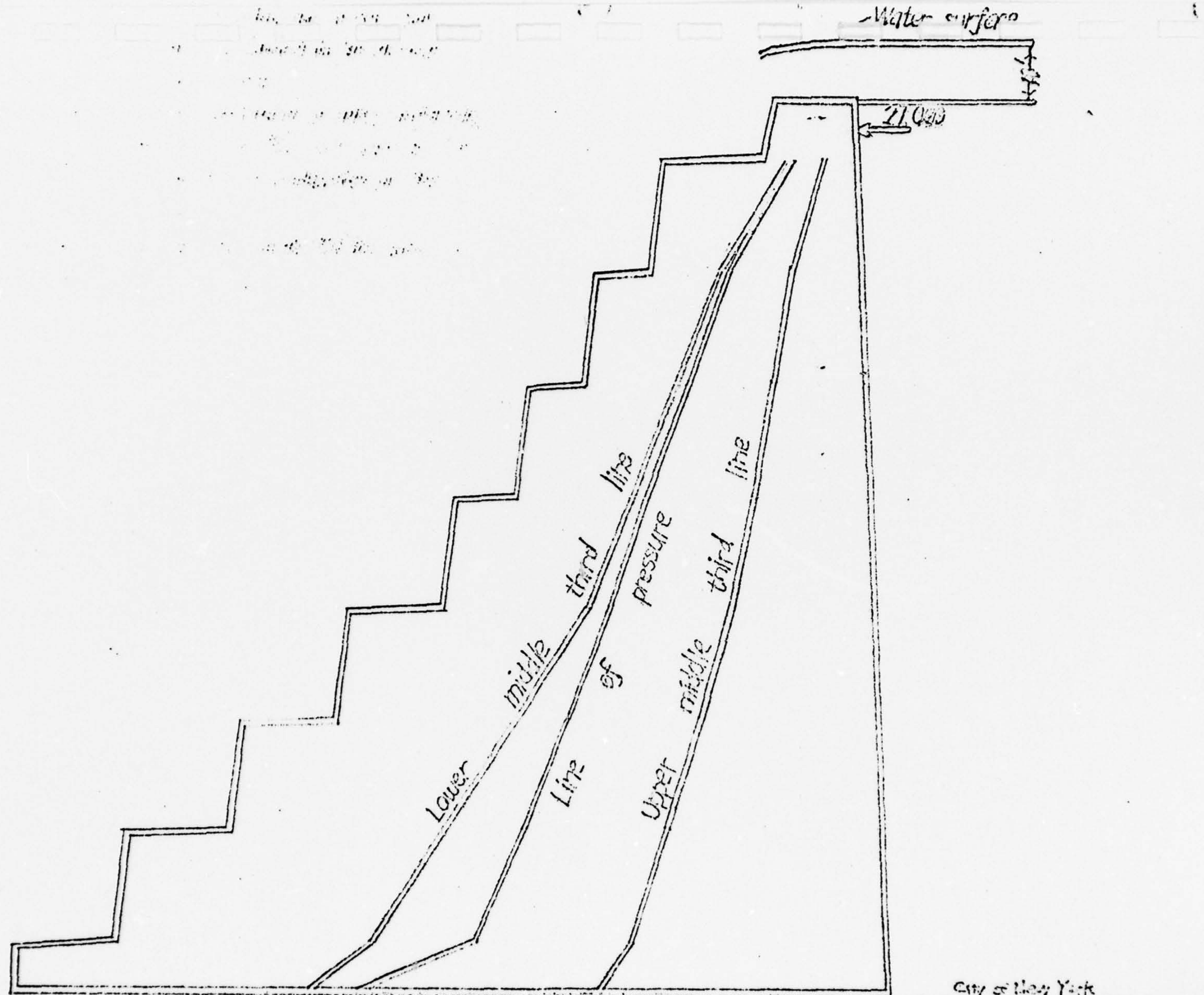
JWH/C.

To Mr. Frank H. Macy,

Assistant Civil Engineer.

December 5, 1917.

(4) (Reference - Computations Acc. M4716 et seq.)



City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
LINE OF PRESSURE

20 0 20 40 Ft

NOVEMBER [illegible]

Form No. W-91. 10-21-15-5??) (15-473)

Serial No. 51227

STATE OF NEW YORK

GEORGE D. PRATT, COMMISSIONER
ALEXANDER MACDONALD, DEPUTY COMMISSIONER
A. S. HOUGHTON, SECRETARY
MARSHALL McLEAN, DEPUTY ATTORNEY-GENERAL

DIVISION OF FISH AND GAME
LLEWELLYN LEGGE, CHIEF
DIVISION OF LANDS AND FORESTS
C. R. PETTIS, SUPERINTENDENT
DIVISION OF WATERS
A. H. PERKINS, DIVISION ENGINEER
DIVISION OF SARATOGA SPRINGS
J. G. JONES, SUPERINTENDENT, SARATOGA SPRINGS, N. Y.

CONSERVATION COMMISSION

ALBANY

APPLICATION FOR CONSTRUCTION OR RECONSTRUCTION OF A DAM

New York City, N. Y.
(Address of Applicant)

Application is hereby made to the Conservation Commission of the State of New York, in compliance with the provisions of Chap. LXV of the Consolidated Laws, the Conservation Law, for approval of the detailed specifications and plans, marked Contract 202, Board of Water Supply of the City of New York, for the construction of the Gilboa Dam, in the town of Gilboa, Schoharie County, New York, 1917,

herewith submitted for the {construction / ~~reconstruction~~} of the dam located as stated below. All provisions of law will be complied with in the erection of the said dam, whether specified herein or not.

LOCATION AND GENERAL DATA

Site of dam is on Schoharie Creek,
(Name of stream)

a branch of Mohawk River,
(Name of stream)
, within the limits of the town of Gilboa, County of Schoharie,

as shown in detail on the accompanying drawings.
(Give approximate distance from well-known bridge, dam, village or mouth of stream, so that work can be located on map of state)

Purpose of dam Development of the Schoharie Watershed for the water supply of the City of New York.

Reasons for making changes in existing structure

November 20, 1917.
(Date)

{Signature of applicant} City of New York, Board of Water Supply,
[signature]
Secretary.

INSTRUCTIONS TO APPLICANTS

Fill out the application in duplicate and send both copies to the Conservation Commission, Albany, N. Y.

Each application must be accompanied by plans of proposed structure in duplicate consisting of—

(1) Location map (U. S. Geological Survey sheet or other map with location of proposed structure indicated thereon).

(2) Map of proposed reservoir showing flow line, buildings, etc.

(3) Complete working drawings or such drawings of plan, sections and elevations as will make clear the dimensions of all parts of the structure, its connection to existing structures, if any, nature of natural foundations, etc., and stress diagrams or other analysis showing the adequacy of the strength of the structure.

(4) Each map and plan shall have a title showing names of owner and engineer, name of county and town in which dam is to be located, and nearest postoffice.

Each application must be accompanied by a report by a competent engineer, substantially as follows:

Adequacy of Spillway:

Give estimate of maximum flood and describe method of estimating.
Give resulting height on spillway crest.

Natural Foundation:

General statement of geology of vicinity as affecting the foundation of the dam.
Description and results of subsurface surveys.
Describe fully materials in natural foundation.

- (A) Rock—
  - (a) Mineralogy
  - (b) Stratification
  - (c) Seams and other physical characteristics
  - (d) Thickness of strata
- (B) Earth—
  - (a) Physical composition
  - (b) Physical characteristics (Perviousness, hardness, homogeneity, water bearing, effect of exposure to air and water, etc.)

Stability:

Describe type of dam and how destructive forces are met.
Give methods of computation and results as to—

- (a) Overturning
- (b) Sliding
- (c) Under-seepage
- (d) Undermining (sufficiency of apron and wash wall)
- (e) Sloughing of earth embankments
- (f) Overtopping of earth embankments

(Above should be given for each part of dam having different section.)

Inspection:

State how inspection of work is to be provided for during construction.

Send sample of sand and of each lot of cement to State Testing Laboratories, Albany, N. Y., using shipping tags which will be furnished you.

[illegible] letter [illegible]
Accompanied by data as listed
in letter of transmittal

City of New York, Board of Water Supply, Application Serial No. 296 SHEET 1

COMPUTER [illegible] 1917 CHECKED BY [illegible] 19

MADE IN CONNECTION WITH oral instruction by Mr. Macy

REFERENCE Plans our Acc. Nos. 8379 to 8393, Specification C203, [illegible]

Drainage Area

1916 State Engineer's report, Vol. II, p. 324, at Gilboa, - 305 Sq. Mi.

Specifications accompanying application, p. 80, - 314 " "

Maximum Probable Flood

Engineer's Report on Gilboa dam, p. 2, - 535 c.f.s. per Sq. Mile = 168,000 c.f.s.

" " , p. 2, Schoharie Cr. at Prattsville, Oct. 9, 1903, - 250 c.f.s./ " " = 78,500 c.f.s.

Kuichling's Mohawk Valley Rare Flood (Acc. R672), - 189 c.f.s./Sq. Mi. = 59,400 c.f.s.

Engr's. Rpt. p. 2, Dec. 10, 1878 flood of Esopus Creek at Bishop Falls, - 180 c.f.s./Sq. Mi. = 56,500 c.f.s.

Specifications C-203, p. [illegible], regarding stream control, estimated, - 159 c.f.s./Sq. Mi. = 50,000 c.f.s.

McKim's maximum flood formula, - 147 c.f.s./Sq. Mi. = 46,200 c.f.s.

Fuller's flood with 1000 yr. interval, without storage (coef. 100) 146.5 c.f.s./S.M. = 46,000 c.f.s.

" " " " " " (watershed coefficient of 85) 127.5 c.f.s./S.M. = 40,000 c.f.s.

" " " 100 yr. interval (" " " 100) 109.9 c.f.s./S.M. = 35,000 c.f.s.

" " " " " " (" " " 85) 94.2 c.f.s./S.M. = 30,000 c.f.s.

Kuichling's Mohawk Valley occasional flood (Acc. R672), - 110 c.f.s./Sq. Mi. = 34,600 c.f.s.

Enveloping curve C-1618 100 c.f.s./S.M. = 31,400 c.f.s.

Schoharie Cr. at Prattsville, Mar. 27, '13, - 68.8 c.f.s./S.M. = 21,600 c.f.s.

Specifications, p. 80, may be expected each year, 47.8 c.f.s./S.M. = 15,000 c.f.s.

Cofferdams

Elevation of crest at about 1,006 would impound reservoir nearly 1½ miles long during floods.

Coffer Dams

Embankments for Cofferdams About 40' High. (Acc. 83[illegible]7)

To be used for impounding the waters of Steen Kill from Elev. 1035± until they attain a depth of about 32'± when they will flow over the divide, through a masonry conduit on the side hill, and discharge into the channel of the Schoharie Creek at a point above the proposed Cofferdams.

STATE OF NEW YORK CONSERVATION ...

SUBJECT: Silva [illegible] — FILE NO. — ACC. NO. M4720

Ser. #296 — Sec Sht. 1 — SHEET 2

COMPUTER: [illegible] 21 No 1917 — CHECKED BY — [illegible] 19

MADE IN CONNECTION WITH

REFERENCE: Coffer Dams — CONT'D FROM ACC. M4716

Wasteway Capacity - Upper Coffer Dam

1 Top Elevation of upstream dam 1,006.5± (D Acc. 8386)
Length 250±
Top of rock 100 ft. upstream from ℄ 978.± (D Acc. 8386)

Approximate maximum height = 28.5±

Height as scaled from D Acc 8386 = 20' or 22'
Crest width as " " " = 5.5'±

Head on center of two, 9 ft. riveted steel pipe, = 14± (D Acc. 8386)
.037 [illegible] 37.3 [illegible]

Roughness Coefficient by Horton, Acc. C-1780 = .015±

Length, approximate, scaled from D Acc 8386 = 375±'

$r = \frac{A}{p} = \frac{63.617}{28.274'} = 2.25\pm$

$Q = 2 \text{ pipes} \times 63.617 \times 33.33^{1/532} = 4,250 \pm$ c.f.s. (? (Only 28¼ % of flood or 15,000 c.f.s. which specifications state may be expected each year.

2 × 63.617 × .815 × 8.02 × 14 = 3,120 c.f.s.

Crest length of upstream dam 250'± (D Acc. 8386)

Crest bredth " " " 5'± (" " ")

Using Coefficient of 2.64 in Francis formula: (U.S.G.S. W.S.P. 200 p.17)

Depth on Crest	Computation	Spillway		2-9 ft. pipes		Total
		"?"	c.f.s.	[illegible]	c.f.s.	c.f.s.
1 ft.	$\frac{.875}{20}$	2.6[illegible]	660±	[illegible]	4,225±	4,?35±
2 "		7.4[illegible]	1,970±	[illegible]	4,35[illegible]	6,320±
3 "		13.7	3,[illegible]25±	[illegible]	4,650±	[illegible],675±
4 "		21.1	5,275±	[illegible]	4,[illegible]	10,115±
5 "		29.5	7,375±	[illegible]	4,9[illegible]±	12,335±
6 "		38.8	9,700±	[illegible]	5,025±	14,725±
7 "		48.9	12,230	[illegible]	5,090±	17,320±

Earth Embankments (See notes on Sht. 1)

Ser. # [illegible] Ser. [illegible] ACC. NO. M 4666

SHEET 2

COMPUTER [illegible] 26th 1917 CHECKED BY [illegible] 19[illegible]

MADE IN CONNECTION WITH

REFERENCE Coffer Dams CONT'D FROM ACC. M4720

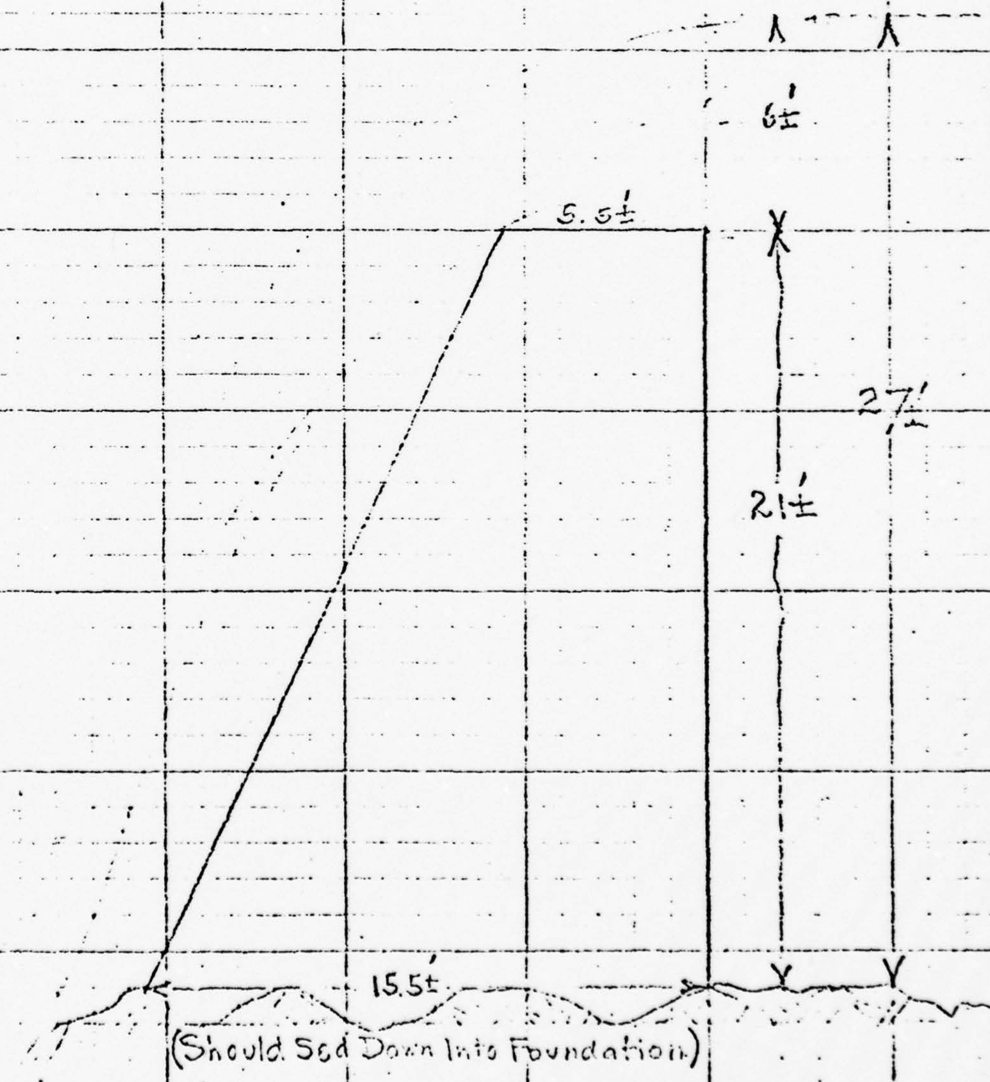
Stability of Upper Coffer Dam

Assumptions: ① That upper dam and pipe may be [illegible] when flood comes.

② That the effect of ice pressure may be properly neglected.

③ That the effect of any upward static pressure on the base of the dam or at any horizontal joint, may be safely neglected

3)



SUBJECT ____ FILE NO. ____

Serial # 236 ____ ACC. NO. M-4170

See Sht ____ SHEET ____

COMPUTER ____ 26 No 19 17 CHECKED BY ____ 19 ____

MADE IN CONNECTION WITH ____

REFERENCE Coffer Dams ____ CONT'D FROM ACC. M-4777

Stability of Upper Coffer Dam - Continued

Resisting Moments:

masonry:

$$Mr = 144^{\#} \times \frac{21}{6'} \left\{ (2 \times 15.5^2) + (2 \times 15.5 \times 5.5) - (5.5^2) \right\} \quad [481 + 170.6 - 30.25 = 621.3] = 313{,}000^{\#}$$

Overturning Mom:

$$Mo = \frac{62.5 \times 21 \times 21 (27 + 12)}{6} \quad [441,\ 39] = 179{,}500^{\#}$$

Stability

$$Ms = \quad 133{,}500^{\#}$$

$$V_E = \frac{21}{(\ldots)} \times 21 \times 144 \quad [441 \times 72] = 31{,}753^{\#}$$

$U_f = \frac{2}{4.21} \pm$ { 27.2% of width of base. Drawings may not scale accurately and thus cause such a result.

Bligh's rule gives

$$r = \frac{k}{b} = \frac{5.5'}{t}$$

(Note: [illegible]

Acc. No. M 4780

Sheet

Computer [illegible] 1917 Checked by ______ 19__

Made in Connection With

Reference — Cont'd from Acc. M 4775

MAIN DAM

Spilling Capacity:

Spillway length:

Ref-D Acc. 8384 [Sta 16+18 - (Sta 3+05)] = = 1,313'

Ref- Nov. 16, 1917 report by Applicant's Engr. = 1,300 ft±

Using value of 2.64 for "C" in Francis formula
(Ref U.S.G.S. W.S.P. 200, p. 177)

Head above Crest	"Q" per ft. of Length	Total - c.f.s.
1	2.64 c.f.s.	3,430
2	7.47	9,720
3	13.7	17,800
4	21.1	27,400
5	29.5	38,350
6	38.8	50,400
7	48.9	63,500
8	59.7	77,600
9	71.3	92,600
10	83.5	108,500

Say maximum probable flood considering compensating effect of storage above the crest of the dam equals 255± c.f.s./sq. mi. or a total of Say 80,000 c.f.s.

Resulting depth on crest = 8.2 ft.

Freeboard:

Depth below top of core wall (Acc. 8384) = 3'±

" " " " earthen embankment (Acc. 8384) = 20'±

" " " " " Slope paving (Acc. 8391) = 20'±

Top width of earth embankment (Acc. 8391) = 35'±

Waves:

$X = (1.5)\sqrt{5} + (2.5 - \sqrt[4]{5}) = 4.4'\pm$

20' - (8.2' water + 4.4' wave) = 7.4' {above high water surface.

COMPUTER ... 19 17 CHECKED BY ... 19 SHEET

MADE IN CONNECTION WITH

REFERENCE CONT'D FROM ACC.

Main Dam - Earth Embankments (D Acc. ...)

Upstream slopes scale about ... below the elevation of the crest of the dam and above that about ... to 1. ... form of ...

Top width scales about 35'

Down stream slopes scale about $2\frac{1}{2}$ to 1 for a vertical distance of ... below the top and below that, about 2 to 1.

Overfall Section - Stability (Neglecting impact)

Ice pressure assumed as 24,000# at crest elevation of ...

Dimensions scaled from D Acc. ...

Loading ... Water surface ... ; ... ...

Zone I. Coping on Masonry Crest:

Single Layer of Stone — 15' — 4' — 7.75' — 3' — Zone I, Lev. 1-23.

Enveloping rectangle: +45 — 7.5 — +337.5

Triangle at back: $15-\frac{4}{3}=$ — −3.5 — 13.67 — −47.8

Triangle at ...: −.125 — 0.17 — −0.02

−47.8

Mr = 145 × 289.7 = 41,900#

Water on Crest:

$\frac{13}{2}\times 15$ — 97.5 — 7.62 — +743.5

$15' - \frac{15(6.8+12.4)}{3(...)}$

+3.5 — 13.67 — +47.8

Mr = 62.5#/ft — +791.3 — 49,400#

ΣMr = 91,300#

CONT'D ON ACC.

SUBJECT | FILE NO. | ACC. NO. M 4782
SHEET 7
COMPUTER 30 Nov. 1917 CHECKED BY 19
MADE IN CONNECTION WITH
REFERENCE | CONT'D FROM ACC. M 4781

Main Dam — Overfall Section — Stability — Continued

Zone I ... 27.6 1,819#
Loading ... = 2,585#
Uplift:
$\frac{700^{\#}}{4} \times 15' = 2,625$
... = 10' = 26,250#

ΣM_o = 23,835#

M_s = 32,465#

Vertical Components:
41.37 x 145 = 5,990
101. x 62.5 = 6,310
+12,310
−2,625

ΣV_s 9,685#

U_s = 3.45± = 0.43 b O.K.

$f_s = \frac{\Sigma H_s}{\Sigma V_s} = \frac{1,819^{\#}}{9,685^{\#}} = 18.78\%$ O.K.

$P_s = \frac{V}{L}\left[1 + \left(\frac{6d}{L}\right)\right] = \frac{9,685}{15'} \times 1.42 = 917$

Zone I Loading I
ΣM_r = 41,900#
Static: 281.3 | 281.3
Uplift: $\frac{187.5}{4} \times 15$ = 703 | 10' 7,030
Ice: 24,000# | 3' 72,000

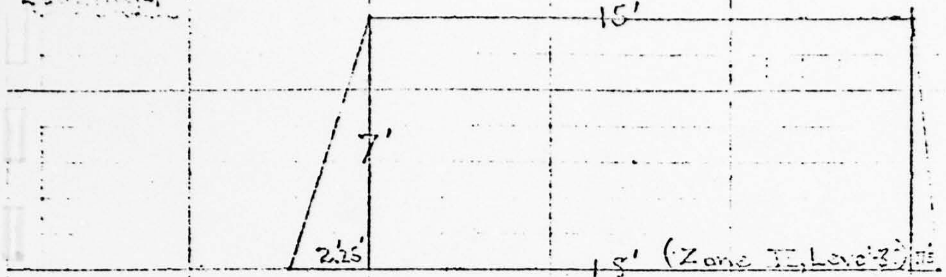
ΣM_o = 79,311#

M_s = — Unsafe — Resultant does not intersect base. Tension exists throughout

Zone I Room Empty: $M_s = \Sigma M_r$ = 41,900#
U_e = 6.98± = .466 b O.K.

Main Dam – Overfill Section – Stability – Continued

Zone II
Loading-1



Resistance

Coping, Block I.	6,000#	6.98 + 2.25 = 9.23'	55,380
Block II, $\frac{3.5}{2}$ x 7 x 145 =	16,700#		
{324 + 272.5 + 22.5} + {2.25 + 30.7} x 144			136,700
Water: $\frac{13}{2}$ x .75 x 32.5 =	306#	say 17.6± =	5,390

ΣMr = +197,470

Overturning Moments

Static:	3,125#		10,417#
Uplift: $\frac{62.5}{4}$ x 13 = 4.5	2,812.5#	12'	33,750
Ice:	24,000#	10'	240,000

ΣMo = −284,167

Ms = {See revision on shit. 15} N.B. Unsafe = 86,697

Zone II
Loading-2

Resistance: (Determined above) 137,470

Water on Coping (Block) 97.5 x 62.5 =	6,090#		
7.62 + 2.25		9.87'	60,100
3.5 x 62.5 =	2,180		
13.67 + 2.25'		15.92'	3,470
(6.8'2) Water ... 8.2 x .75 x 62.5	384	17.6±	6,760

ΣMr = 267,810

Overturning Moments:

Static: $\frac{62.5 \times 15 \times (5 + 19.4)}{2}$	7,245		
6250 x (10 + 34.6)			3[illegible]
Uplift: $\frac{112}{4}$ x 13	7,125	12.0	61,700

STATE OF NEW YORK CONSE...

SUBJECT (illegible) FILE NO.

ACC. NO. M 4759

Ser. Falls SHEET 9

COMPUTER 19 CHECKED BY 19

MADE IN CONNECTION WITH

REFERENCE CONT'D FROM ACC.

Main Dam - Overflow Section - Stability - Continued -

Zone III Loading Cont'd

$\Sigma H_e =$ 47,700#

$M_s =$ 170,110#

Vertical Components:

Block I	6,000#	
" II	16,700#	
Water on Crest	6,310#	
" at back	306#	
" " "	384#	
	29,700#	
Uplift:	- 5,135#	
$\Sigma V =$		24,565#

$U =$ 6.45' = .385 O.K.

$f = \frac{\Sigma H_e}{\Sigma V} = \frac{8,245}{24,565} = .336$, O.K.

Zone II Reservoir Empty

Resistance (Ref. Sh. 8)

Block I	6,000#	55,330#'
" II	16,700#	136,700#'
	22,700	

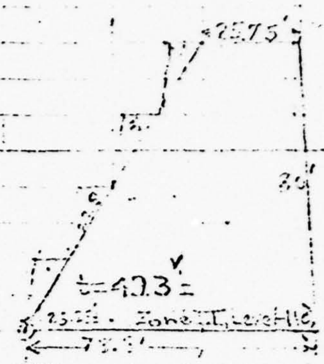
$M_{s_e} = \Sigma M_{r_e} =$ 192,030#

$U_e = \frac{192,030\#}{22,700\#} = 8.45' = .470$ O.K.

COMPUTER ...... 1917 CHECKED BY 19
MADE IN CONNECTION WITH
REFERENCE
CONT'D FROM ACC.

Mol. Dam - Overflow Section -

Zone III
loading



Resistance

Blocks I & II 22,700# x [3.48 + 57.05] 65.53' = 1,488,000'#

Block III:

Inscribed trapezoid:
$\frac{104.55}{2}$ x 80' x 145 = 606,500# 49' =29,750,000'#

In error out product corrected

x(6210 + 2030 + 663) x 49.3 (130.3) x 145

Triangles forming apron
$\frac{22.5}{2}$ x 8 x 145# = 54,500 25.25'± 1,378,000'#

Water on block
$\frac{93}{2}$ x 4.5 x 145 = 13,090# 77.1'± 1,005,000'#

Σ +Mr ...... +33,621,000'#

$\frac{2}{2}$ x .5 x 145# = - 290± Say ...... - 14,... '#

ΣMr = 33,606,130'#

Overturning Moments:

Static:
62.5 x 90 x $\frac{90}{2}$ = 253,000# 30' 7,590,000'#

Uplift
62.5 x 90 x 78.9 / 4 = 110,850# 2/3 x 78.9 = 52.54'± 5,825,000'#

Ice: 24,000# 90 2,160,000'#

ΣM_o = 15,575,000

M_s = 18,031,130'#

Vertical components:
+696,790 masonry & water
-111,140 uplift and ice

ΣV = 585,650#

U = 30.8'± = .391 Safe O.K. R = ... (2 - 3 x 3..) + 9 = 1.173

f = ... = 47.3 " O.K.

CONT'D ON ACC.

COMPUTER ... 3 Dec 1917 CHECKED BY ... SHEET ...

MADE IN CONNECTION WITH ...

REFERENCE ... CONT'D FROM ACC. ...

Main Dam - Overfall Section

Zone III Resisting forces

Loading 2 Water on Crest

Load	6,090#			
74.3' - (15 - 7.35)		= 66.9'	407,000'#	
215.5#				
74.3 - (15 - 13.67)		73.0	15,950'#	
Water at back (sec. 10)	13,090#		1,005,000'#	
4.5' x 6.5' x 62.5	1,912#			
(74.3 + 4.5)/2		= 76.6'±	146,500'#	
Masonry: Blocks I & II	22,700#		1,488,000'#	
Block III	606,500#		29,750,000'#	
Triangles on III	54,500#		1,375,000'#	
	705,010#			
Σ(Positive Moments)			34,190,450'#	
Triangle from III	290#		− 14,375'# (Sh. 19)	
Σ Mr =				34,175,580'#

Overturning Moments:

Static: 62.5 x 90 x 45/2	299,200#			
62.5 x 8100/6 x (90 + 24.6) 114.6			9,665,000'#	
Uplift: 62.5 x 98.2/4 x 78.8	121,000#			
2/3 x 78.8'		= 52.54	6,355,000'#	
Σ Mo =				16,020,000'#
Ms =				18,155,580'#

Vertical Components:

+ 705,010# ...

− 121,290# ...

ΣV = 583,720#

U = 31.1'/... = .394 OK.

CONT'D ON ACC. ...

COMPUTER .... 19 ___ CHECKED BY .... 19 ___ SHEET ___

MADE IN CONNECTION WITH ....

REFERENCE .... CONT'D FROM ACC. ___

Main Dam – Overfall Section – Stability – Cont'd.

Zone III — Empty Res.

Masonry:

Blocks I & II	= 3,700#	1,48[illegible]#
" III	606,500#	29,752,[illegible]
For apron	54,500#	1,372,[illegible]
	+683,700#	+32,61[illegible]#
From apron	– 290#	= [illegible]

$\Sigma V_E = 683,410\#$ $M_{S_E} = 32,[illegible]\#$

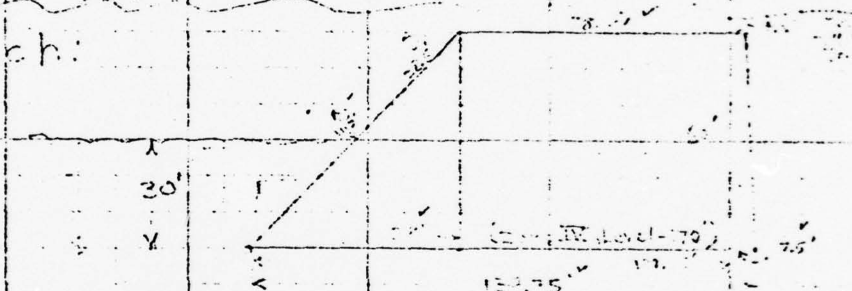
74.3, 47.7, 26.6 from Y track

$U_E = 47.7' = .605\,l \pm$ OK

$P_E = \frac{1356,200}{78.8} = (1.215 - 1) + 0 = 14,130\#$ OK

Zone IV — Loaded, pool

Sketch:



Resistances

Blocks I, II & III, 132.25 – 26.6'	683,410#	105.7'	72,200,000#
" III, inverted Trapezoid: 219.5 x 60' x 145# = 1,951,000#			
{[illegible]}		= 82.3'	78,200,000#
Triangles from apron: 3x29.5/2 x 11.5 x 145 =	71,350#	29.'	2,065,[illegible]#
58'/2			
water over back: 153'/2 x 7.5 x 62.5 =	35,900#	137.25'	4,93[illegible]
130.75 – 2.5/2			
30' Base of [illegible]	28,125#		281,[illegible]#

$\Sigma M_r =$ 157,676,250#

CONT'D ON ACC. M-4-7[illegible]

SUBJECT

ACC. NO. M 4763

SHEET

COMPUTER 19 CHECKED BY 19

MADE IN CONNECTION WITH

REFERENCE CONT'D FROM ACC.

Dam – Overfall Section – Continued

$\frac{1}{2} \times \ldots = 704{,}000$ #

$\frac{1}{3}$ | 50' | 35,2[illegible]

$139.75 \times \frac{62.5(30+150)}{2 \times 2} = 392{,}500$ #

| 85.4' | 33,500,000 '#

Ice: 24,000 # | 150' | [illegible]

$\Sigma M_o =$ 72,300,000 '#

$M_s =$ 85,376,250 '#

Vertical Components:

+1,741,660 #
− 392,500 #

$\Sigma V =$ 1,349,160 #

U = 63.4± = .454 l O.K.

$f = \frac{[illegible] - 24{,}000}{1{,}349{,}160} = .519$ O.K.

$P = \frac{2 \times 1{,}349{,}160}{139.75'}(2 - 1.362) + \frac{62.5 \times 30'}{2} = 13{,}297.5$ #/□

O.K.

COMPUTER .... 19 .... CHECKED BY .... 19 ....

MADE IN CONNECTION WITH ....

REFERENCE — CONT'D FROM ACC.

Main Dam - Overfall Section - Stability Analysis
Long IV Resistance

Loading 2			
Stacks ...	682,410 #		72,200,000 '#
" IV Inscribed trapezoid	951,000 #		78,200,000 '#
Trian. ...	71,350 #		2,065,000 '#
Water on heel	35,900 #		4,930,000 '#
Back ... 30ft (static only)	28,125 #		281,000 '#
Water on crest	6,090 #		
139.75 - 7.33		132.37 '	79...,000 '#
	219 #		
139.75 - 1.33 '		138.42 '	30,300 '#
above head			
7.5 x 6.8 x 62.5	3,190 #		
132.25 ' + 7.5/2		136 '	434,000 '#
	(+) 1,751,159 #		

$\Sigma M_r =$ = 158,946,300 '#

Overturning Moments:

Static:

$\frac{62.5 \times 150}{2}(150 + 10.4) = 780,000$ #

$62.5 \times 22,500 \times 174.6 =$ ...,... ,000 '#

Uplift:

$\frac{62.5 \times 139.75}{4}(158.2 + 30) = 411,000$ #

$139.75 - \left\{ \frac{139.75 [158.2 + 60]}{3(158.2 + 30)} \right\}$ = 85.5 '

35,200,000 '#

$\Sigma M_o =$ 76,100,000 '#

$M_s =$ 82,846,300 '#

$\Sigma V =$ 1,340,159 #

$U =$ 61.8 ' = .4426 O.K.

$f =$ 751,375 = .561 O.K.

$P = \frac{2 \times 1,340,159}{139.75}(2 - ...) + ... = 13,7..$ # O.K.

CONT'D ON ACC.

COMPUTER ... 4 Dec 1917 CHECKED BY ... SHEET ...
MADE IN CONNECTION WITH ...
REFERENCE ... CONT'D FROM ACC. ...

Main Dam—Overfall Section—Stability—Continued

Resistance

Zone IV — $\Sigma V_E = 1,705,750^{\#}$ $M_{s_E} = 152,465,000^{\prime\#}$

$U_E = 89.6' = .642l$ O.K.

$P_E = \frac{2 \times 1,705,750}{139.7'}(1.926-1) + 0 = 22,650^{\#}/\square' = 157^{\#}/\square''$ O.K.

Revision of Assumptions for Zone II

Assume that structure will be built monolithic between the elevation of the crest and a point below the highest step of the apron, and that the ice thrust acts at a point 5' below the crest.

$\Sigma M_r =$ ... 197,470$^{\prime\#}$

$U = 6' = \frac{M_s}{23,006^{\#}}$

$M_s = 138,036^{\prime\#} = 197,470 - M_o$

$M_o = 59,434^{\prime\#} = 10,417 + M_{oi}$

$M_{oi} = 49,017^{\prime\#}$

Ice Thrust = 9803.4 or about 10,000$^{\#}$

Rough Check of data on Dwg. 8400

Neglecting Uplift

Masonry
18' × 10' × 150$^{\#}$ = 27,000 — 9' — 243,000$^{\#}$

Water
15' × 10' × 62.5 = 9,375 — 10.5 (9.75) — 98,500$^{\#}$ (91,400 ? X ck)
18' − 7.5

ΣM_r = 341,500$^{\#}$ (334,400 check)

Static
62.5 × 10 × (3 − 2.5) — 9,375$^{\#}$

Ice
... — 41,600$^{\#}$

27,000 — 135,000$^{\#}$ — 171,100$^{\#}$

CONT'D ON ACC. M-17...

Rough Check of Data on D.Acc. 4400, [illegible]

$M_S =$ (155,722# given) 164,900#

$\Sigma V =$ 36,375

$U = 4.54 = .252 l$ (4.342 given) (.2412 l given) {Causing tension at back of section if assumptions are good.

$f = \frac{\Sigma H_o}{\Sigma V} = \frac{36,375\#}{36,375} = 1$ or 100%

Rough check as to whether assumptions on D.Acc. 4400 were the critical ones: Omit water above crest.

Masonry	27000#	243,000#
$\Sigma M_r =$		243,000#
Static:	3,125#	10,417#
Ice	27,000#	135,000#
$\Sigma M_o =$		145,417#
$M_s =$		97,583
$\Sigma V =$		27,000#

$U = 3.61' = .20 l$

COMPUTER [illegible] Dec. 4, 1917. CHECKED BY SHEET [illegible]

MADE IN CONNECTION WITH

REFERENCE [illegible]

Loading #1 - Water surface and ice pressure at crest elevation.

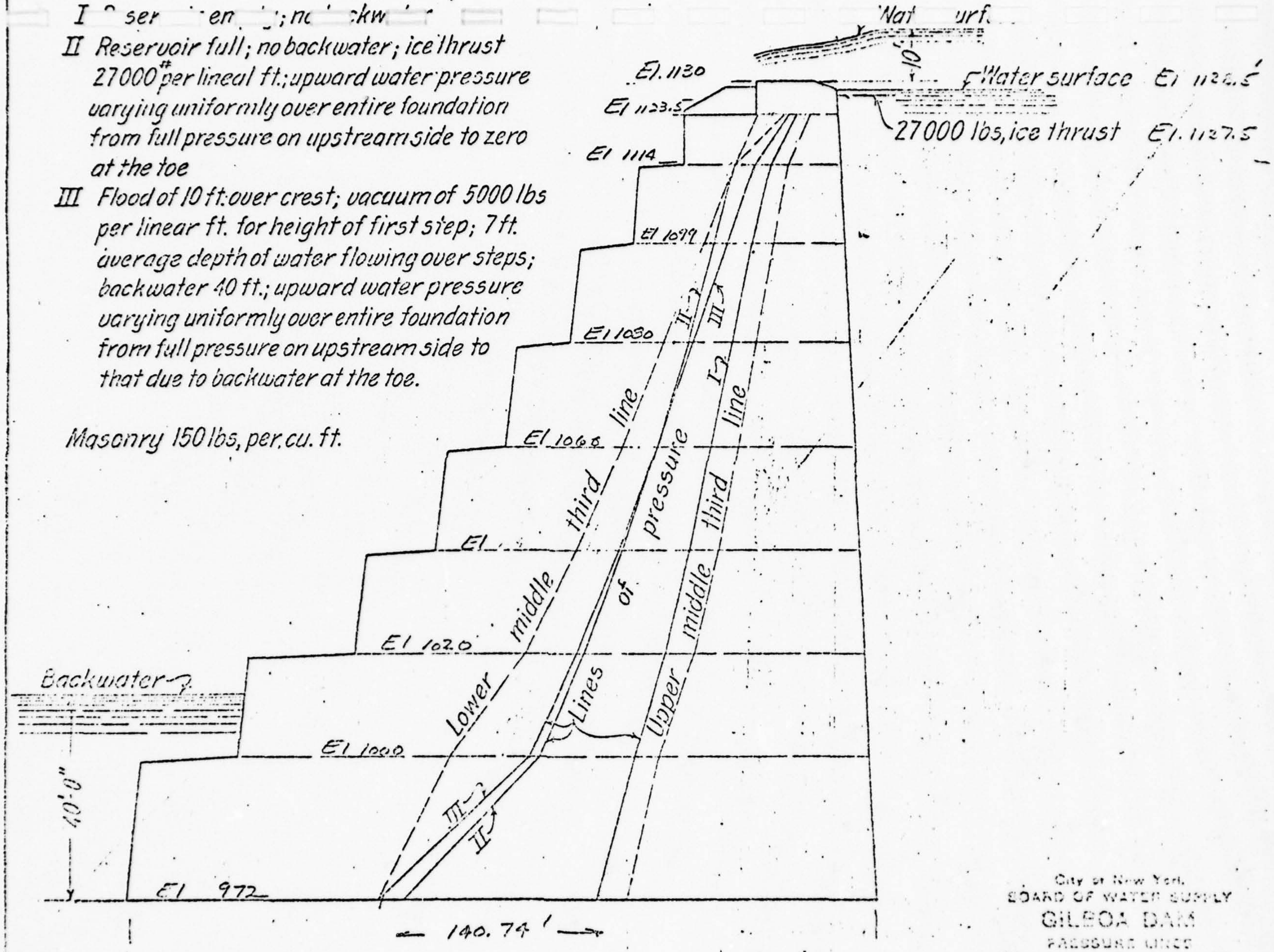
" #2 - " " at 8.2' above crest but no ice.

I [illegible] ser[illegible] en[illegible] ; n[illegible] ckw[illegible]

II Reservoir full; no backwater; ice thrust 27000# per lineal ft.; upward water pressure varying uniformly over entire foundation from full pressure on upstream side to zero at the toe

III Flood of 10 ft. over crest; vacuum of 5000 lbs per linear ft. for height of first step; 7 ft. average depth of water flowing over steps; backwater 40 ft.; upward water pressure varying uniformly over entire foundation from full pressure on upstream side to that due to backwater at the toe.

Masonry 150 lbs, per. cu. ft.



Drawn J.G.
Traced W.L.
Checked S.S.S.

City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
PRESSURE LINES

20 0 20

OCTOBER 18, 1920

Deputy Chief Eng. File Cont 203-3.4 86 Acc 27258

373767

BOARD OF WATER SUPPLY

CITY OF NEW YORK

MUNICIPAL BUILDING

ADDRESS ALL COMMUNICATIONS TO BOARD OF WATER SUPPLY

NEW YORK July 10, 1918.

RECEIVED
JUL 12 1918
CONSERVATION COMMISSION

Hon. George D. Pratt,
Conservation Commissioner,
Albany, N. Y.

Perkins

Dear Sir:

Acknowledgment is made of your communication of June 25, inquiring when work will be commenced on the Gilboa dam on Schoharie creek.

Due to the extraordinary conditions brought about by the war, this Board has not deemed it advisable to advertise the contract for this work, which was approved by you December 24, 1917. It is practically certain that this contract will not be advertised before this fall, in which case the foundations could not be ready for inspection before the middle of 1919. When the foundations have been uncovered and prepared, you will be duly advised.

Yours very truly,

BOARD OF WATER SUPPLY,

Benj. F. Einsigler

Secretary

COMMISSIONER
ALEXANDER MACDONALD.
DEPUTY COMMISSIONER
S HOUGHTON.
SECRETARY
MARSHALL MCLEAN.
DEPUTY ATTORNEY GENERAL

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY

DIVISION OF FISH AND GAME
LLEWELLYN LEGGE
DIVISION OF LANDS AND FORESTS
C.R. PETTIS. SUPERINTENDENT
DIVISION OF WATERS
A. H. PERKINS DIVISION ENGINEER
DIVISION OF SARATOGA SPRINGS
J. G. JONES SUPERINTENDENT
SARATOGA SPRINGS N.Y.

IN REPLYING PLEASE REFER TO FILE NUMBER

Dec. 8, 1917.

Mr. A. H. Perkins, Div. Engr.,

Conservation Commission.

Dear Sir:-

I beg to hand you herewith the application, plans and accompanying papers inthe matter of dam #465 Mohawk on Schoharie Creek near Gilboa, N. Y., together with memorandum by J. W. Henry, Junior Engineer.

Mr. Henry has given these plans a thorough examination, and as to his conclusions, would say, first, in regard to flood discharge and probable depth on the spillway crest which he concludes to be 13-1/4 ft. instead of 10-1/2 ft. according to the report of the Chief Engineer of the Applicant, it seems probable that with the estimated flood discharge the depth of water on the crest would never exceed 10-1/2 ft. due to the amount of pondage above the spillway crest. Second and third, it seems apparent from an analysis of the stability of the spillway section that upward water pressure was only considered on the horizontal joint at the foundation. This is probably a reasonable assumption, as the section of the dam is of monolithic construction, provided that the work shall be carried on continuously.

In regard to the point of intersection of the resultant forces acting upon the upper block or step of the spillway section falling without the middle third, assuming the forces acting thereon to be static pressure plus 27000 lbs. per ft. of ice pressure applied at a point 5 ft. from the crest, it appears probable that the vertical stability of this section was sacrificed in order to secure a proper distribution of the jet of water and break the velocity of the same as much as possible. The shearing stress induced by an ice pressure of 27000 lbs. would be about 10 lbs. per square inch distributed over the width of this upper block.

It is respectfully recommended that the application be approved.

Yours very truly,

F. H. Macy.

ASSISTANT ENGINEER.

FHM/F

Address all communications to the Conservation Commission

COMMISSIONER
ALEXANDER MACDONALD,
DEPUTY COMMISSIONER
A. L. HOUGHTON,
SECRETARY
MARSHALL McLEAN,
DEPUTY ATTORNEY GENERAL

STATE OF NEW YORK

DIVISION OF FISH AND GAME
LLEWELLYN LEGGE, CHIEF
DIVISION OF LANDS AND FORESTS
C. R. PETTIS, SUPERINTENDENT
DIVISION OF WATERS
A. H. PERKINS, DIVISION ENGINEER
DIVISION OF SARATOGA SPRINGS
J. G. JONES, SUPERINTENDENT
SARATOGA SPRINGS, N.Y.

CONSERVATION COMMISSION

IN REPLYING PLEASE REFER TO FILE NUMBER

ALBANY

Dec. 10, 1917.

Hon. Geo. D. Pratt, Commissioner,

Conservation Commission.

P R E S E N T:

Dear Sir:-

Herewith I hand you plans for dam across Schoharie Creek to be erected by the City of New York for impounding water in the Schoharie Reservoir near Prattsville, N. Y.

The spillway section of the dam is cyclopean masonry founded upon solid rock. At the western end an earthen dike is to be erected, with concrete core wall, also founded upon rock throughout a portion of its length and upon the natural earth through the rest of its length.

These plans have been very carefully examined technically in this office, and have been found to provide for ample stability in all parts of the proposed structure. I respectfully recommend their approval.

OK
Pratt

Yours very truly,

A. H. Perkins

DIVISION ENGINEER.

AHP/F

THE CITY OF NEW YORK
ENVIRONMENTAL PROTECTION ADMINISTRATION
DEPARTMENT OF WATER RESOURCES
BUREAU OF WATER SUPPLY

REPORT OF CONSULTANTS

ON

PROPOSED BORINGS IN GILBOA DAM

BREAKABEEN PUMPED STORAGE PROJECT
PRATTSVILLE ALTERNATE

Bezmont Cucolo
Power Auth of St of N.Y.

BY

Merlin D. Copen, P.E.
Jack W. Hilf, Ph.D., P.E.
Philip C. Rutledge, Sc.D., P.E.

Prattsville, New York

October 15, 1975

CONTENTS

I. Introduction

II. Conclusions and Recommendations

III. Surficial Inspection of Gilboa Dam

IV. Drill Holes in Masonry Dam

V. Drill Holes in Earth Dam

Appendix A: Participants in Discussions

B: List of Documents Reviewed

I. INTRODUCTION

The Prattsville Alternate of the Breakabeen Pumped Storage Project involves use of the Schoharie Reservoir, a feature of th Catskill Water Supply System of the City of New York. This reservoir of 22,000,000,000 gallons total capacity is impounded by the Gilboa Dam located on Schoharie Creek, 5.8 miles downstream from Prattsville, Schoharie County, New York. The dam is composed of two parts - an overfall masonry portion about 1,300 feet long with crest at Elevation 1130 feet and having a maximum height of 182 feet and a width of 158 feet at the base, and an earth section at Elevation 1150 feet, with core wall, about 700 feet long. It was constructed in 1922-1926.

In order to determine whether this 50-year old dam and reservoir could be used for pumped storage in addition to their primary water supply function, the condition of the dam must be determined. Surficial examination must be supplemented by borings within the masonry and earth portions of the structure to ascertain whether deterioration or other defects exist that have not resulted in any surface indications. The purpose of this report is to present the findings of three independent consulting engineers concerning a program of drilling in the dam proposed by Uhl, Hall & Rich Division of Chas. T. Main of New York, Inc.

On October 14, 1975, the undersigned visited the offices of Uhl, Hall & Rich in Prattsville, N.Y., offices of the Power Authority of the State of New York in Prattsville and at the Blenheim-Gilboa Pumped Storage facility, and the Gilboa Dam. In addition to personnel of these two organizations, the Divisior Engineer and Section Engineer of the Department of Water Resources of the City of New York were present. A list of participants in the discussions is given in Appendix A. The documents reviewed are listed in Appendix B.

II. CONCLUSIONS AND RECOMMENDATIONS

1. To evaluate the feasibility of using the Schoharie Reservoir for the proposed Breakabeen Pumped Storage Project, Prattsville alternate, the internal condition of Gilboa Dam must be ascertained.

2. Surficial examination of the dam indicates that it is in remarkably good condition, considering its 50 years of service in a rigorous climate. The stone surfacing in particular has withstood weathering and spillway flows with little or no damage. Routine maintenance is all that is apparently needed to continue the dam in service.

3. The drilling program in the dam consisting of 12 holes proposed in Items 1 and 2 Appendix B is minimal and essential. Several additional holes and some changes in location and details are suggested if time permits. These are discussed in Sections IV and V.

4. The type of program proposed is reasonable and proper for the intended purpose. The drilling of vertical holes in the dam in no way will impair the ability of the structure to fulfill its primary function. Moreover the information obtained will be useful to the Department of Water Resources in appraising and monitoring the condition of this important structure.

III. SURFICIAL INSPECTION OF [illegible] DAM

The masonry portion of the dam consists of cyclopean concrete founded on rock for 1300 feet of the east and central portion of the valley joining an earth dam 700 feet long on the west end of the valley. The upstream, downstream, and crest surfaces of the concrete dam are faced with random Ashlar masonry consisting of quarried bluestone or quartzite rock. Virtually the entire masonry portion of the dam is an overflow section the downstream portion of which consists of large steps from 7 to 20 feet in tread and rise. Vertical contraction joints are spaced about 75 feet along the length of the concrete dam.

Examination of the crest of the dam and upstream and downstream slopes reveals that there is very little evidence of deterioration of the stone facing; in fact, the alinement and surface of the masonry is remarkably good after 50 years of operation. Aside from a few cracked and eroded stones the only noticeable damage is the erosion of the reinforced concrete deflectors downstream from the crest of the overflow section. These deflectors do not appear to be necessary for satisfactory operation of the spillway, hence this erosion is not a significant defect.

Visual examination of the earth dam revealed that the crest and upstream and downstream slopes are in good condition. Two minor depressions in the upstream slope were the only indicated deviations from uniform conditions, except for what appeared to be an old repair of a slumped portion of the upstream riprap in the wraparound portion of the fill opposite the west end of the concrete dam. Since the latter dam is believed to be founded on rock and the earth dam founded on an impervious till, it is likely that some differential settlement had occurred in the past which was repaired by replacing riprap and using concrete to fill in the offset. There is no present indication of seepage through the dam or foundation (reservoir elevation was 1096.5 feet) and we were informed that none is present with the reservoir full.

The gate chamber of the low level outlet works in the non-overflow section of the concrete dam to the west of the spillway was inspected using the stairway from the crest of the dam. These outlets are used only for drawdown of the reservoir for inspection and repair, since no downstream releases are made. Two 30-inch diameter pipes each with guard and operating valves and by-pass pipe and valves are equipped with hydraulic operating mechanisms. The concrete in the stairway was in good condition, free of noticeable cracks. The walls of the superstructure on the crest of the dam had some diagonal tension cracks indicative of differential settlement.

IV. DRILL HOLES IN MASONRY DAM

Eight drill holes are proposed in the masonry dam as indicated on drawing number 1987-092-DH4, Rev. 0, Item 2, Appendix B. Four of these are located near the center of the crest of the dam, two on step #4, one on step #6 and one on the spillway apron. The purpose of these borings is to evaluate the internal condition of the dam.

As an initial investigation this program is satisfactory. If time permits, however, three additional holes along the crest of the dam would provide information for a more comprehensive evaluation of the dam's condition. Also by drilling the holes along the crest at a distance of approximately five feet from the upstream face, a better appraisal can be made of possible deterioration of the material in the dam.

To check for cracking in the interior of the dam, water loss measurements and/or pressure tests should be conducted during the drilling process. The core extracted from the holes should also be carefully examined for any indication of separation along lift lines or other defects in the concrete.

If indications of cracking or seepage are detected, piezometers should be installed to monitor the internal pressures in the dam. Additional holes may be required to determine the extent of such cracking.

The proposed drilling program and suggested modifications are minimal for a reasonable evaluation of the physical condition of the masonry dam, and would not in any way damage or impair the use and safety of the structure. It would, however, give the owners assurance of the continued availability and safety of the dam, and the piezometers installed would provide a means for monitoring the performance of the structure in the future.

V. DRILL HOLES IN EARTH DAM

The proposed drilling program (Item 2 of Appendix B) includes 4 NX core holes GD 9, 10, 11, and 12 within the earth fill. These are to extend 5 feet into the surface of the rock under the buried channel foundation and are to be cased through soil. Core samples for identification and testing will be obtained.

No problems arising from this program are contemplated since all holes are vertical, cased within the embankment, and can be drilled even while the spillway is operating. To obtain maximum information with these 4 holes it is suggested that GD12 be relocated to the same station as GD10 and be drilled vertically from the upper downstream berm. Likewise GD9 should be relocated to the same station as GD10 and drilled vertically on the crest about 5 feet from the upstream edge. If these holes are provided with piezometers, a phreatic surface of seepage can be obtained and monitored. Also the effectiveness of the core wall as as impervious barrier can be evaluated.

Respectfully submitted.

Merlin D. Copen, P.E.

Jack W. Hilf, Ph.D., P.E.

Philip C. Rutledge, Sc.D., P.E.

STATE OF NEW YORK
PHILIP C. RUTLEDGE
LIC. No. 26341
LICENSED PROFESSIONAL ENGINEER

CONSULTANTS

Merlin D. Copen

Jack W. Hilf

Philip C. Rutledge

DEPARTMENT OF WATER RESOURCES.
CITY OF NEW YORK

Gerald Mestyanick, Section Engineer

Lyle Proper, Division Engineer

POWER AUTHORITY OF THE STATE OF NEW YORK

Robert Burtch

William Hynes

Arnold Talgo

UHL, HALL & RICH

R.E. Burnett

C.P. Benziger, Geologist

J.J. Conway, Project Engineer

Michael Hamar, Field Geologist

R.V. Sausa, Project Manager-Field

APPENDIX B - LIST OF DOCUMENTS REVIEWED

1. Breakabeen Pumped Storage Project, Prattsville Alternate, Scope of Engineering Investigation. Uhl, Hall & Rich of Chas. T. Main of New York, Inc.

2. Drawing 1987-092-DH4, Rev. 0
Breakabeen Pumped Storage Project, Prattsville Alternate - Boring Location - Plan & Sections.

3. TRANSACTIONS ASCE - Paper No. 1509 Engineering Geology of the Catskill Water Supply by Charles P. Berkey and James F. Sanborn, presented at the meeting of October 4, 1922.

Breakabeen Pumped Storage Project

Prattsville Alternate

Scope of Engineering Investigation

Gilboa Dam and the Schoharie Reservoir were completed in 1924 as a part of the upstate reservoir system which supplies the City of New York with drinking water through the Catskill Aqueduct. It was built primarily as a stream flow regulator for diverting Schoharie Creek to the Aqueduct system.

The established Schoharie Reservoir used in combination with a pumped storage project will require investigation of foundations in the area of the proposed structures - the existing Gilboa Dam, preparation of cross-sections of the stream, upstream of the reservoir to determine backwater conditions, and verification of the existing reservoir storage capacity. For performing this work permission from WRD must be obtained to allow access to their property.

Foundation investigations will require a drilling program which will consist of two phases. The first, a subsurface exploration in the vicinity of the proposed powerplant and tailrace, will entail soil sampling and obtaining cores from the underlying rock to depths shown approximately on the accompanying drawings. The second phase will require a series of borings in the existing concrete of the masonry dam and the areas at the earth dam, in the areas of the proposed gate controlled discharge spillway.

Drilling procedures in both phases will require that drilling fluids be recycled through an enclosed system of tanks which will collect sludge and tailings from the drilling operation. The drill water and sludge will be hauled away from the reservoir area to disposal. Other procedures of drilling and sampling will be conducted in a normal manner under special permit from the WRD. Specifications for the work will include provision for restoration of the site to, as nearly as possible, its existing condition, to the satisfaction of the WRD.

Surfacial examination of the 50 year old structure found it to be in generally good condition, however, several areas warrant further investigation to guarantee its integrity for the life of the proposed project. Sampling of the existing construction materials in the Gilboa Dam will be done to determine its present physical condition. The initial program calls for approximately seven NX type cores in the masonry dam. The holes will be located in the crest and/or in the downstream spillway area. If evidence of extensive deterioration is discovered, additional cores may be drilled to confirm the extent and severity. The NX type cores would be taken throughout the total height of the dam and some distance into the bedrock on which the dam is founded.

For the testing phase of this program, one or more six inch diameter cores, approximately fifteen feet in length will be taken in locations selected after inspection of the NX cores. Following completion of the drilling program, the core holes will be filled with concrete to the surfaces from which they were drilled.

Approximately four holes will be drilled in the existing earth embankment dam and water cut-off wall area and core samples will be taken. The accompanying drawings show the locations of these holes.

Tests to be performed on the concrete samples obtained from the cores, will include determination of unit weight, compressive strength, shear values, and Young's modulus. In addition petrographic examination of representative sections will be made to examine porosity and cementation of construction materials. Copies of the laboratory results will be furnished to the WRD for their records.

Several locations for the proposed controlled spillway have been investigated. One of them being at present earthfill dam, but this location was abandoned because of the uncertainty of the location of the rock surface in this area and extensive changes proposed in the earth dam, retaining wall, and slopes of the left bank. The best location for the controlled spillway appears to be somewhere in the middle of the existing 1324 foot long spillway. This location would give moderate drop and low water velocities and cofferdaming the construction area would be somewhat less difficult. It will require a new S-N spillway tailrace channel to be excavated to discharge into the existing natural channel.

More stringent design conditions are presently being imposed by the Federal Power Commission and other agencies responsible for the safety of dam str ctures. We propose to investigate several conditions of loading for both the structure as it exists and also with the proposed controlled spillway. Basic design conditions will include: uplift varying from full headwater to tailwater over 100% of the base, ice loads, earthquake, and the effects of the maximum probable flood to the extent that Blenheim-Gilboa can discharge. Cases to be investigated are listed below:

Case I	Normal Operating Levels HWL El. 1130.0' TWL El. 983.0' Uplift Included
Case II	Normal Operating Level with Ice HWL El. 1130.0' Ice 5k/LF El. 1130.0' TWL El. 983.0' Uplift Included
Case III	Horizontal Earthquake Acceleration 0.05g under Normal Operating Levels Water Levels same as Case I Uplift Included

Case IV Flood Water Levels
HWL El. 1135.0'
TWL to be established
Uplift Included

Examination of the downstream face of the existing dam was made and shows no major defects such as cracking, excessive opening of contraction joints, extensive spalling or noteworthy leaks. There is erratic pitting of the horizontal planes of the spillway steps. Some pits are as deep as 3 feet, which however could easily be repaired. There was some visible seepage, the origin of which could not be established at this time. Two existing drains in step No. 8 were running water, the source of which was suspected to be from the hillside, but it could not be definitely established. From this aspect and the fact that the dam is 50 years old, we suggest that after all coring has been done and samples tested, that two independent authorities acceptable to the WRD be engaged, at PASNY's expense, to evaluate the structure and such computations made by Uhl, Hall & Rich to test the stability and safety of the structure.

We propose for your consideration the following experts:

Dr. Philip Rutledge Dr. Jack W. Hilf Mr. Merlin D. Copen

Profile sections of the reservoir bottom to determine the amount of siltation that has occured during the past fifty years are necessary to verify the available reservoir capacity and to form a basis for prediction of future siltation problems. A survey utilizing the so called "Sparker-Boomer" techniques has been done for this phase of the investigation. A trace of the reservoir bottom was obtained using an instrument mounted in a small powered boat propelled at a constant speed. The craft used was similiar in size to those presently allowed on the Schoharie Reservoir for fishing purposes.

To predict water levels upstream that might result from possible raising of the existing dam, cross-sections of Schoharie Creek upstream of the reservoir will be essential for backwater calculations. This work will be done by ground survey crews. It is expected that this investigation will extend from Devasego Falls to Batavia Kill.

Uhl, Hall & Rich Division of
Chas. T. Main of New York, Inc.

October 13, 1975

DEPARTMENT OF WATER RESOURCES

Bureau of Water Supply

MEMORANDUM

TO: Abraham Groopman, P.E.
Assistant Commissioner and Chief Engineer

FROM: George Mekenian, P.E.
Deputy Chief Engineer (Watersheds)

DATE: December 18, 1975

SUBJECT: Improvements to Water Supply Facilities
Schoharie Reservoir - Prattsville Pumped Storage
Power Project

* * * * * * * * * * *

The staff of the Power Authority of the State of New York (PASNY) is continuing their studies on the feasibility of developing the Prattsville Pumped Storage Power Project which proposes to use the Schoharie Reservoir for a lower pool. As you know, this has been proposed in a supplement to their application to the Federal Power Commission as an alternative to the PASNY proposed Breakabeen Project.

As we have discussed, if PASNY and the City go ahead with the Prattsville Project, part of the compensation for the use of Schoharie Reservoir in this project should be the renovated, rehabilitated and updated by PASNY of the facilities of the Schoharie Reservoir and watershed.

Therefore, for your consideration, there is listed below an outline of the various projects conceived of by the watersheds staff.

A. Gilboa Dam, Blowoff, Spillway and Waste Channel

Since the PASNY staff and consultants envision significant changes at this site, let if suffice to require that there be a

1. Complete rehabilitation of masonry spillway, earthen dike and waste channel in conjunction with proposed alterations.

2. Complete rehabilitation of blow-off system and chamber, to include new valves, electric operators, controls and flow meters.

B. Rehabilitation of Shandaken Tunnel Intake by

1. Replacement of valves and valve operating system.

2. Rehabilitation of the venturi - flow measuring system.

3. Installation of a system to tap the reservoir at selective levels.

4. Replacement of the trash racks and trash removal crane with improved design.

5. Removal of silt from intake channel and installation of system for keeping channel clear of silt.

6. Installation of a boom or other device to prevent large logs and trees from entering intake channel.

C. Improvement of Schoharie Reservoir by

1. Breaching or removing the log crib dam built during the construction of the reservoir in the 1920's.

2. Sluicing or dredging the silt deposits on the reservoir bottom, above the elevation of the intake channel floor, into the unavailable water pool.

3. Developing access roadways to various points around reservoir.

D. Additional Improvements to Shandaken Tunnel Intake Structure by

1. Rehabilitating or modernizing plumbing, heating and electrical systems.

2. Paving access road.

3. Rehabilitating roof, walls, etc.

E. Replacement of the Prattsville Section office, garage staff and shop facility, possibly at the power plant complex.

F. Development and maintenance of an erosion control program on the watershed

G. Complete takeover of the Schoharie Reservoir with the City to retain exclusive water supply rights.

The objective here is to relieve the City of its tax obligation on the dam and the water supply lands.

As you can see these items are in approximate order of acceptability to the Department and to PASNY. Certainly the first and second are

Naum Groopman, P.E.
Assistant Commissioner
and Chief Engineer

December 18, 197?

Improvements to Water Supply Facilities
Schoharie Reservoir

mandatory, the third is considered important and the last two, while bold, should be given some thought.

These improvements should take precedence over any payments for use of the reservoir.

George Makenian, P.E.
Deputy Chief Engineer
Watersheds

GM:lo

cc: Groopman
Scheader
Makenian
Proper (2)

Rutledge Groopman
J. Hilf Schuler Telman
M. Coplan Mekenian Iannuzzi

Seismicity = Minor low seismicity
.025 Stability analysis letter

Concrete Dam: Core - unusually good
concrete = Not many large aggregate
Top of dam needs replacement.
Some indication of seepage
"Dam completely safe for present usage"
Crack near upstream face -
A grouting program should be considered
in the future

Earth Section: Embankment properly
constructed - Core wall found to be
extremely effective - For Water Supply
purposes no present remedial work
is indicated

Suggestions for Remedial/Repair Work.
(1) Grouting in Concrete Section in future
(2) Earth Section - Satisfactory - Piezometers
should be watched - Preferably during
high water

3) Changes to be made for PASNY use
1) Upper 5± feet to be removed and replaced.
2) Increase crest height 10 ft to raise max elev to 1135 (now at 1130).
3) Grouting → Raising crest to maintain FOS = 4 — Grout after excavation
Grouting cracks between blocks
Grout from bottom to top = Controls necessary for uplift monitoring for horizontal cracks

Rapid drawdown = no effect on concrete Struct but will have affect on earth section
Test on pump will be most severe did.
Rock on toe and upstream face for additional stability.

[0 2]	[4 8]	[5 6]	[0 0 4 6 5]	[7 7 1 1 7 6]	[0 0 3]	[5]
RB	CTY	YR AP.	DAM NO.	INS. DATE	USE	TYPE

Stone

AS BUILT INSPECTION

[1] Location of Sp'way and outlet

[1] Elevations

[1] Size of Sp'way and Outlet

[1] Geometry of Non-overflow section

GENERAL CONDITION OF NON-OVERFLOW SECTION [1]

[1] Settlement

[1] Cracks

[1] Deflections

[1] Joints

[1] Surface of Concrete

[1] Leakage

[1] Undermining

[1] Settlement of Embankment

[1] Crest of Dam

[1] Downstream Slope

[1] Upstream Slope

[1] Toe of Slope

GENERAL COND. OF SP'WAY AND OUTLET WORKS [1]

[1] Auxiliary Spillway

[1] Service or Concrete Sp'way

[1] Stilling Basin

[1] Joints

[1] Surface of Concrete

[1] Spillway Toe

[1] Mechanical Equipment

[1] Plunge Pool

[1] Drain

[1] Maintenance

[C] Hazard Class

[3] Evaluation

[34] Inspector

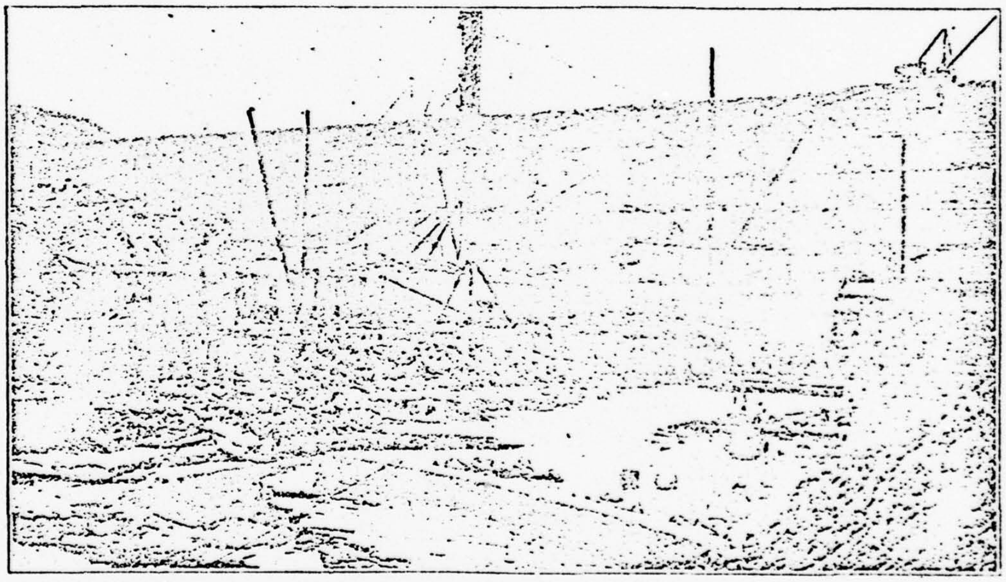
COMMENTS:

Stone dam in excellent condition
old power dam #467 is now part of the stilling
basin portion of this dam

Name of State or Province and City	Lowest Depth of Frost Penetration in City Streets, in Feet, During the Last 25 Years, Ending March, 1926.	Depth to Which Mains and Services are Now (1926) Laid in City Streets, in feet.
Washington.		
Spokane	5½ ft.	4½ ft. cover.
Everett	1½ ft.	2½ ft. cover.
Seattle	....	Mains 4 ft.; services 2 ft.
West Virginia.		
Wellsburg	....	4½ ft. cover.
Wheeling	3 ft.	3 ft. cover.
Clarksburg	3 ft.	4 ft. cover.
Bluefield	2½ ft.	4 ft. cover for mains; services 2½ ft. cover.
Parkersburg	....	3 to 6 ft. cover.
Charleston	....	3 ft. cover.
New Martinsville	....	3 ft. cover.
Wisconsin.		
Madison	6½ ft.	6 ft. cover.
Fon du Lac	....	Mains 6 to 7 ft. cover; services 5½ to 6½ ft. cover.
Milwaukee	....	6 ft. cover.
Kenosha	....	5½ ft. cover.
Cheyenne, Wyo.	....	5 ft. cover.

Water Cushion at Gilboa Dam

In order to form a permanent pool and water cushion down-stream from the highest portion of the overfall section of the main dam of the Gilboa Dam of the Schoharie Development of the Board of Water Supply of New York City, a small cyclopean masonry dam has been constructed at a point about 500 ft. north of the dam line. This small dam is curved in plan, with a radius of 240 ft., and is anchored into the abutments of the old Tri-County Light & Power Co. dam across the Schoharie creek. The length of the dam is 176 ft., its height approximately 7 ft. and its section trapezoidal, with a vertical up-stream face, a top width of 8 ft. and a bottom width of about 11½ ft. The dam is constructed on the surface of the rock ledge of the creek bottom, to which it is anchored at 5-foot intervals by 1-in. square steel rods 6 ft. in length which are grouted into holes drilled to a depth of 2 ft into the rock. Contraction-joints were formed at 20-ft. intervals and are similar in type to those of the main dam, including the copper cut-off strips.



View Taken in 1925 of the Down-Stream Face of the Gilboa Dam. Northerly End of Down-Stream Wing—Wall Is At Extreme Right. The Foreground Is the Small Curved Dam in Course of Construction. Behind It Paving of Creek Bed Was in Progress

465 Mch

APPENDIX E
CONSTRUCTION DRAWINGS

City of New York

BOARD OF WATER SUPPLY

GILBOA DAM

AND

APPURTENANT WORKS

IN THE

TOWN OF GILBOA, SCHOHARIE COUNTY,

NEW YORK

OCTOBER 25, 1917

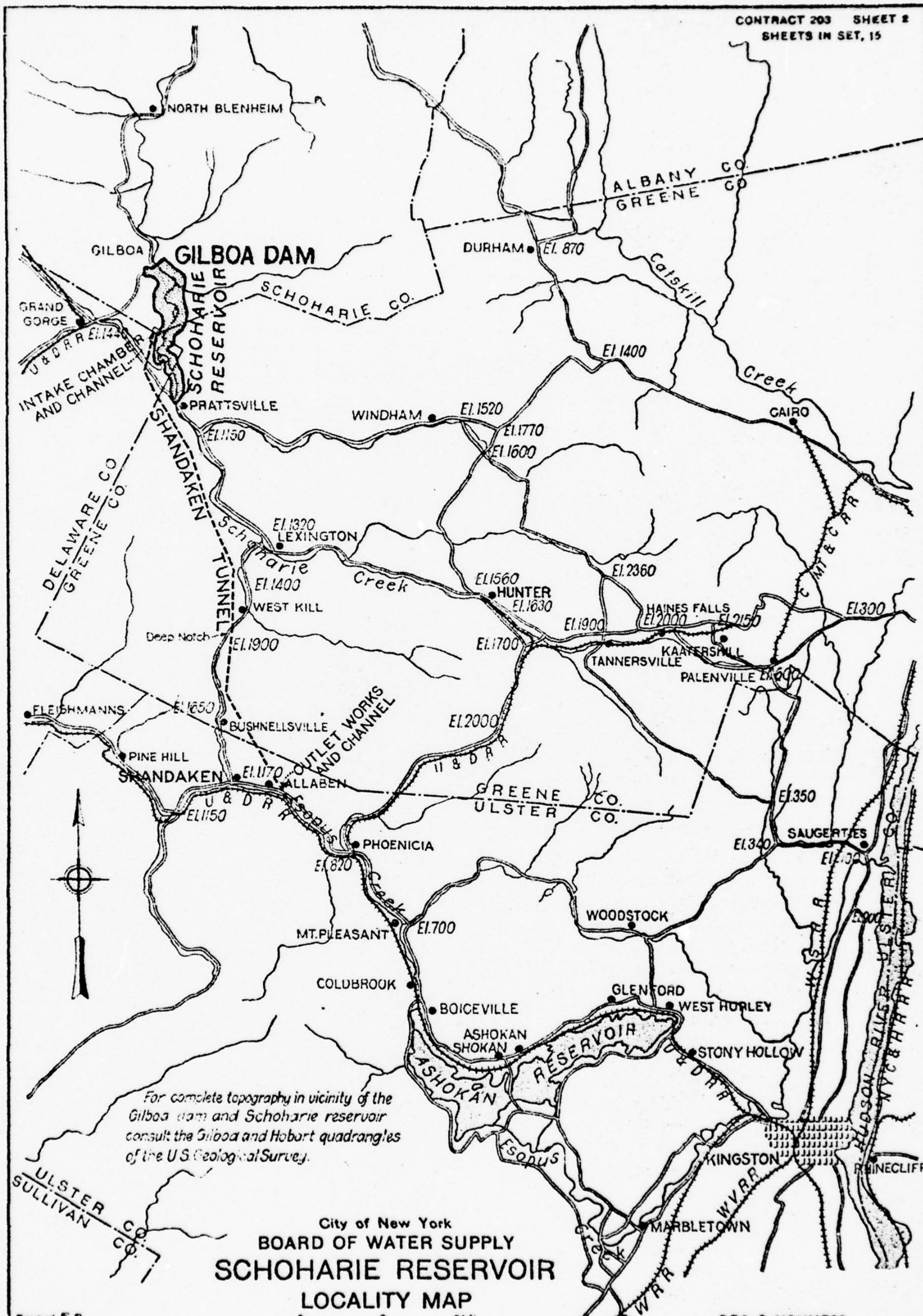
Contract drawings for Contract 203 consist of this sheet and 14 others, all listed below

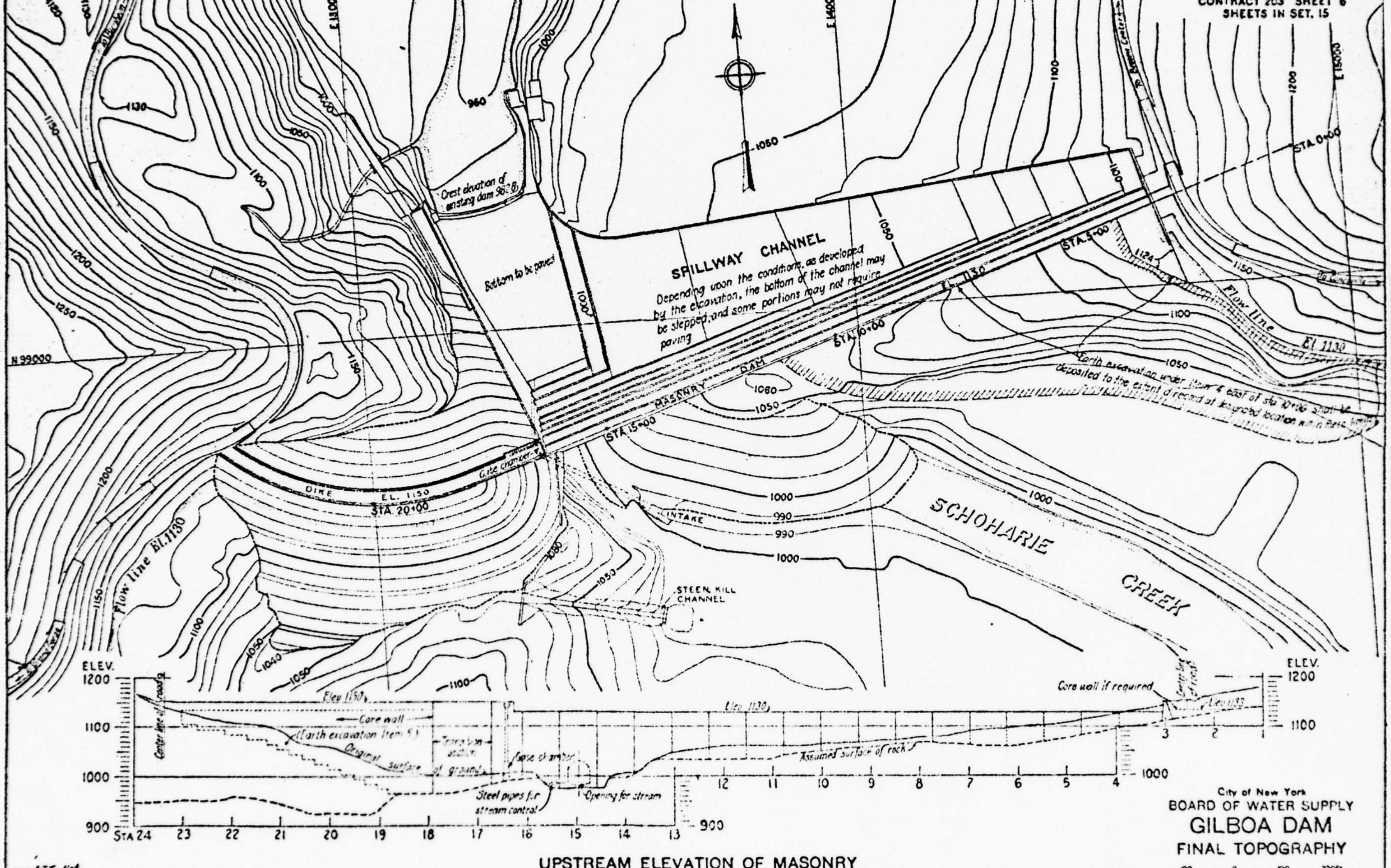
Sheet	Accession	Sheet	Accession
Title Page	25711	9	26021
2	26018	10	25705
3	25174	11	26019
4	25385	12	26020
5	25384	13	25709
6	26023	14	25713
7	25707	15	25712
8	26022		

John R. Freeman
Wm. H. Burr
} Consulting Engineers

J Waldo Smith Chief Engineer

F.D. BWS 1456 File 72.46 Acc 25711


CONTRACT 203 SHEET 2
SHEETS IN SET, 15
NORTH BLENHEIM
ALBANY CO.
GREENE CO.
GILBOA
GILBOA DAM
SCHOHARIE RESERVOIR
SCHOHARIE CO.
DURHAM
El. 870
Catskill Creek
GRAND GORGE
U & D R R
INTAKE CHAMBER AND CHANNEL
El. 1400
PRATTSVILLE
WINDHAM
El. 1520
El. 1770
El. 1600
CAIRO
El. 1150
SHANDAKEN TUNNEL
DELAWARE CO.
GREENE CO.
El. 1320
LEXINGTON
Schoharie Creek
El. 1400
WEST KILL
El. 1560
HUNTER
El. 1630
El. 2360
HAINES FALLS
El. 2000
El. 2150
El. 1900
El. 300
Deep Notch
El. 1900
El. 1700
TANNERSVILLE
KAATERSKILL
PALENVILLE
C. M T & C R R
FLEISHMANNS
El. 1650
BUSHNELLSVILLE
OUTLET WORKS AND CHANNEL
El. 2000
PINE HILL
SHANDAKEN
El. 1170
ALLABEN
U & D R R
GREENE CO.
ULSTER CO.
El. 1150
Esopus
El. 350
PHOENICIA
El. 820
SAUGERTIES
El. 340
Creek
El. 700
WOODSTOCK
MT. PLEASANT
COLDBROOK
BOICEVILLE
GLENFORD
WEST HURLEY
ASHOKAN
SHOKAN
ASHOKAN RESERVOIR
STONY HOLLOW
U & D R R
W S R R
ULSTER CO.
HUDSON RIVER
N Y C & H R R R
For complete topography in vicinity of the Gilboa dam and Schoharie reservoir consult the Gilboa and Hobart quadrangles of the U.S. Geological Survey.
Esopus Creek
KINGSTON
RHINECLIFF
ULSTER CO.
SULLIVAN CO.
W V R R
MARBLETOWN
N Y O & W R R
City of New York
BOARD OF WATER SUPPLY
SCHOHARIE RESERVOIR
LOCALITY MAP
3 0 3 Mi
OCTOBER 25, 1917
Traced
Checked
L. F. SEARLE
Asst Eng
BWS 1457
GEO. G. HONNESS
Dept Eng Res
File Cont 203-3.0S Acc 26018



City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
FINAL TOPOGRAPHY

OCTOBER 25, 1917

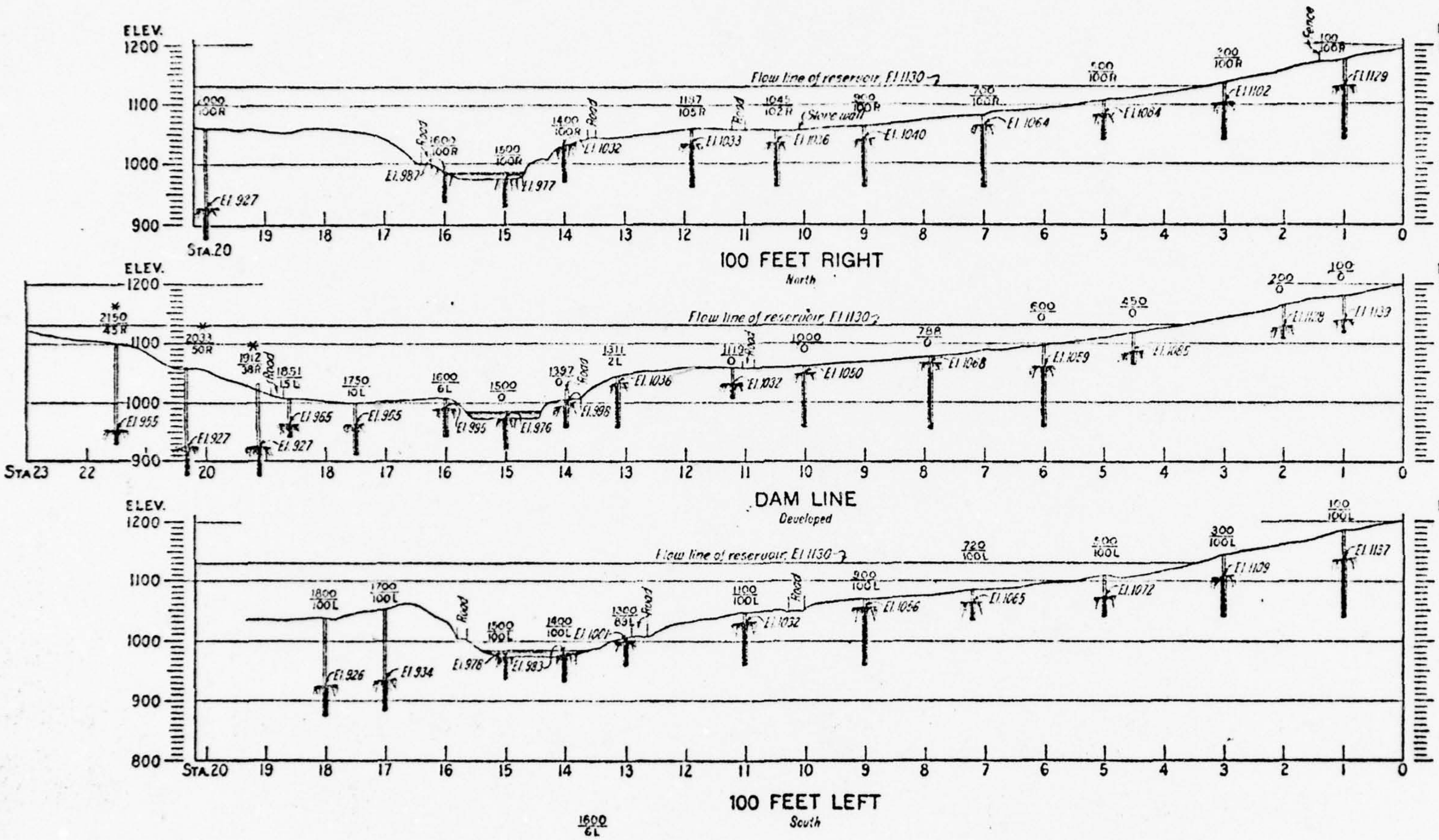
BWS 1481

Designing Eng

Dept. Eng Hdqrs

File Cont 203-3.4.5.6 Acc 26023

CONTRACT 203 SHEET 7
SHEETS IN SET, 15



Borings on or near the profile line are shown thus: Wash boring / Core boring (1600 / 6L)

Except where marked * the number above the line designates the boring and the number below the line is the distance from the dam line or dam line produced, measured right or left.
For borings marked * the number above the line designates stations along the curved prolongation of the dam line and the number below the line the radial distance from this line.

For plan of borings, see Sheet 5, Acc 25384

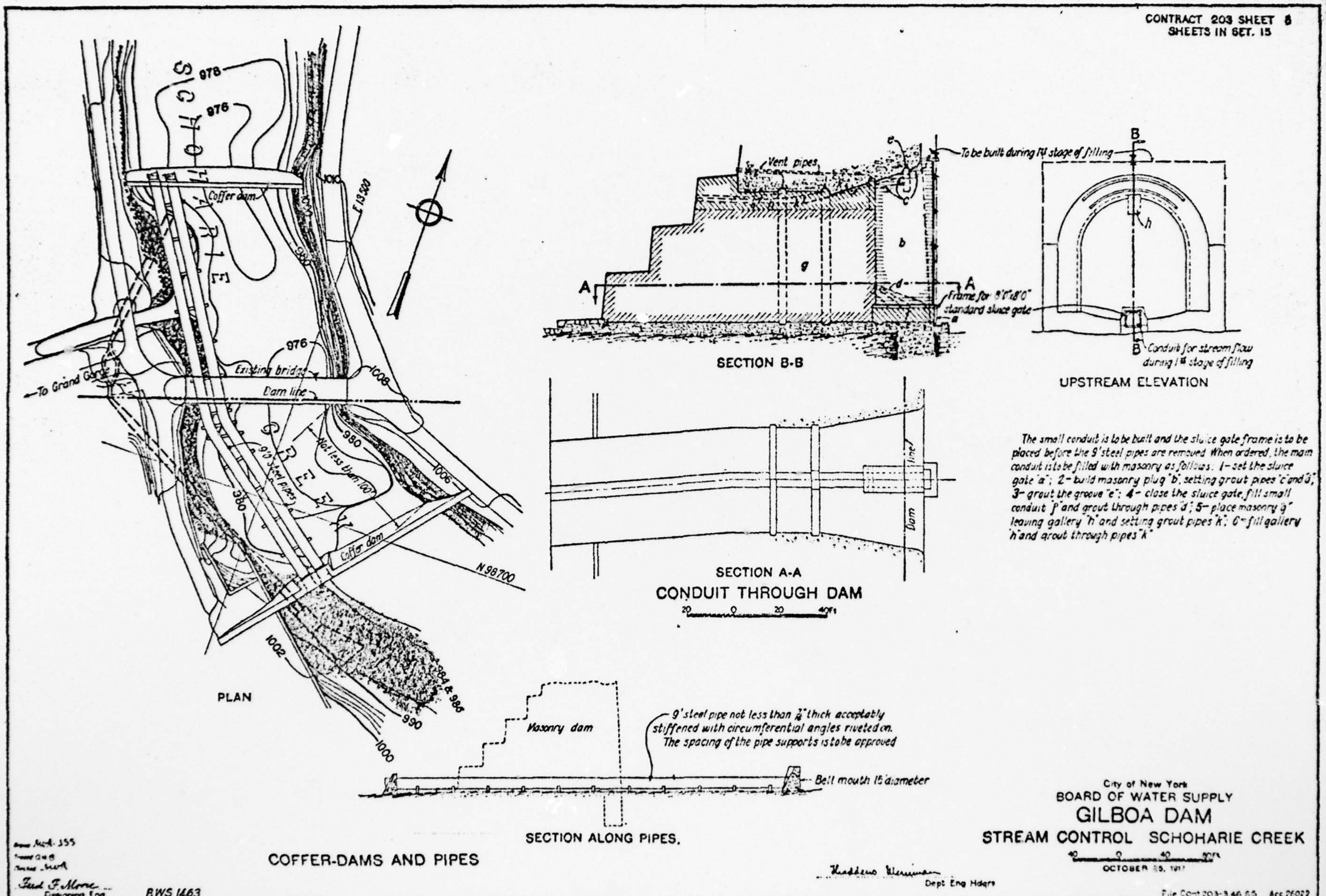
City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
ROCK PROFILES

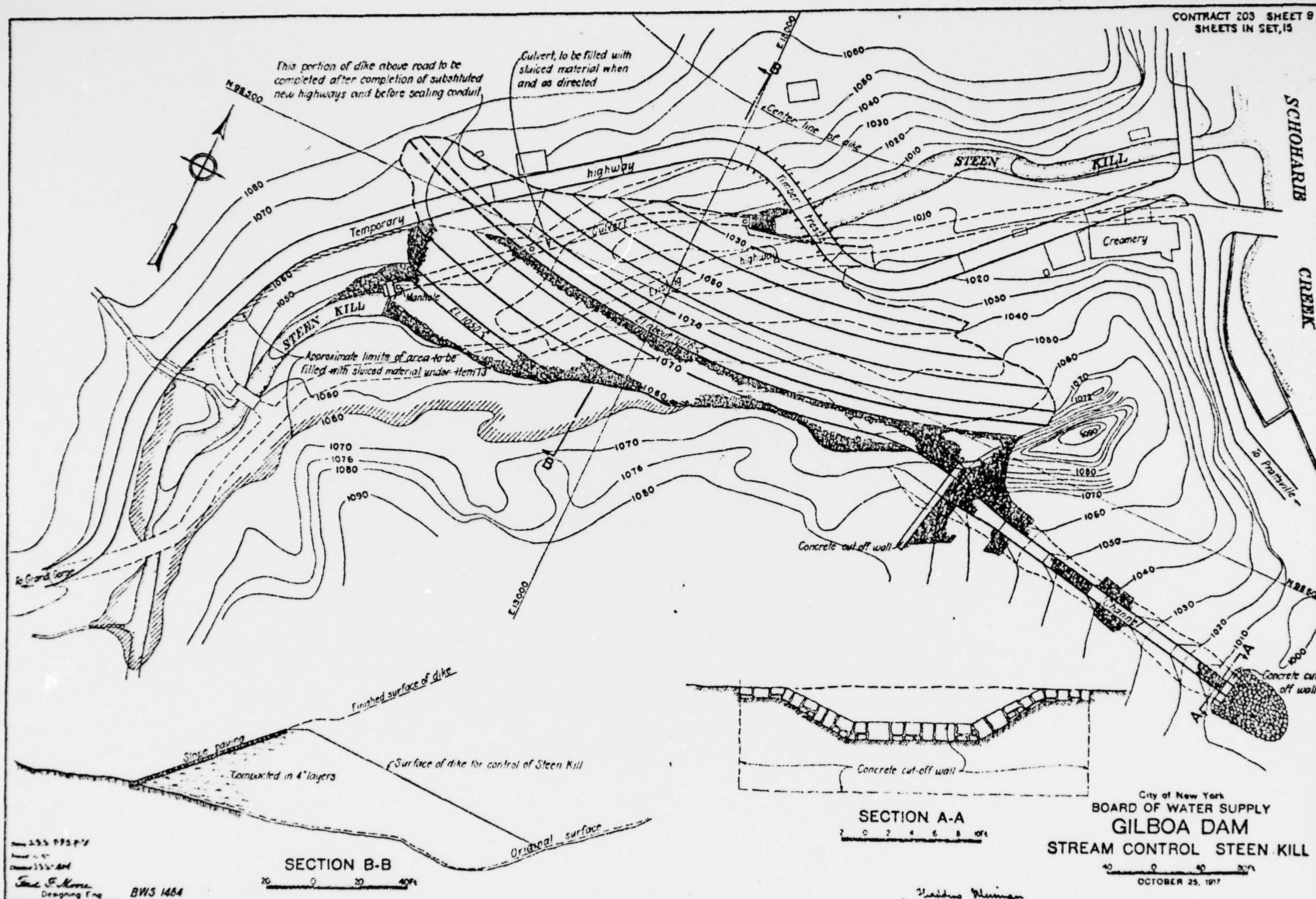
100 0 100 200 ft

OCTOBER 25, 1917

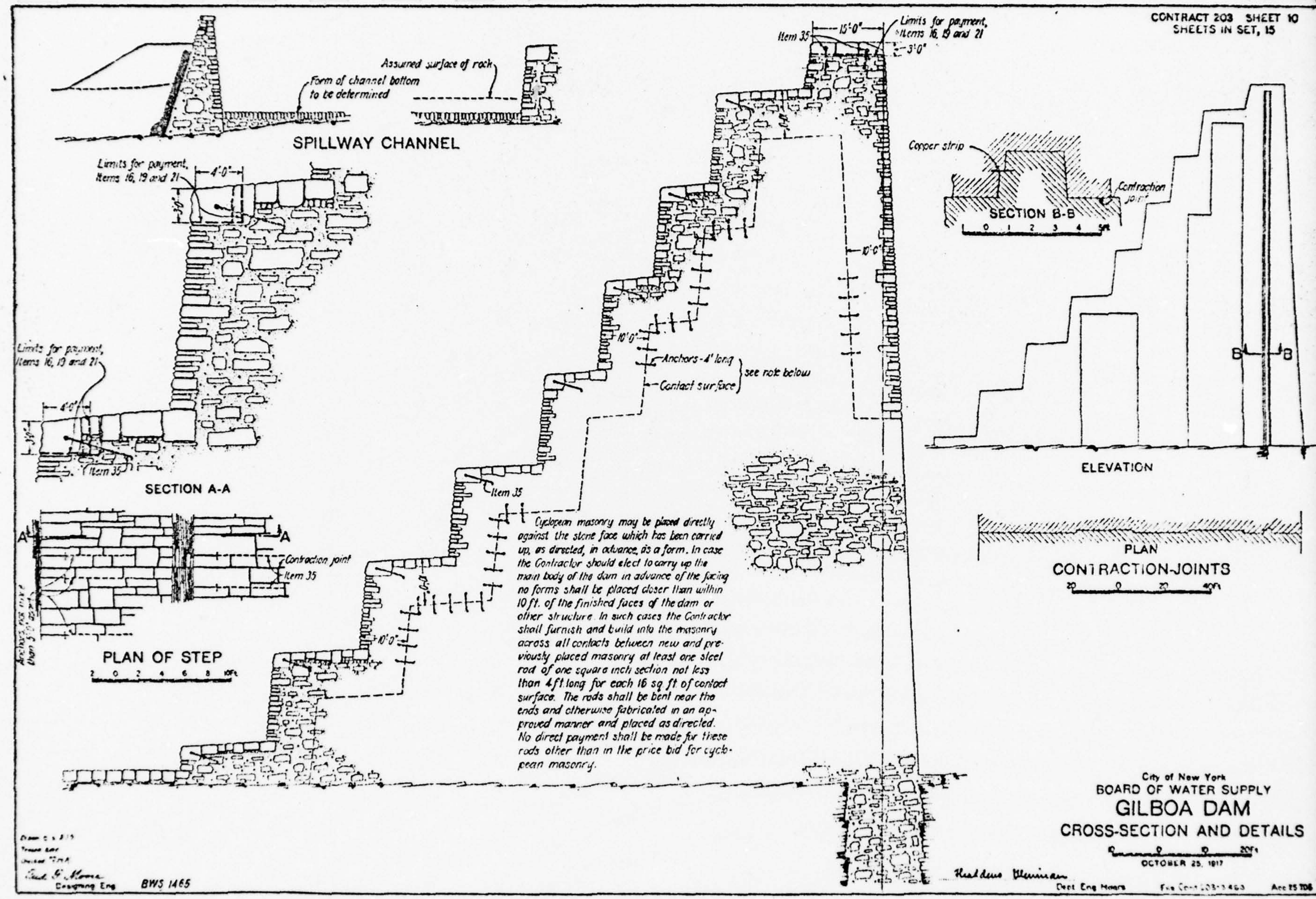
Fred F. Moore, Designing Eng — BWS 1462 — Thaddeus Merriman, Dept Eng Hdqrs

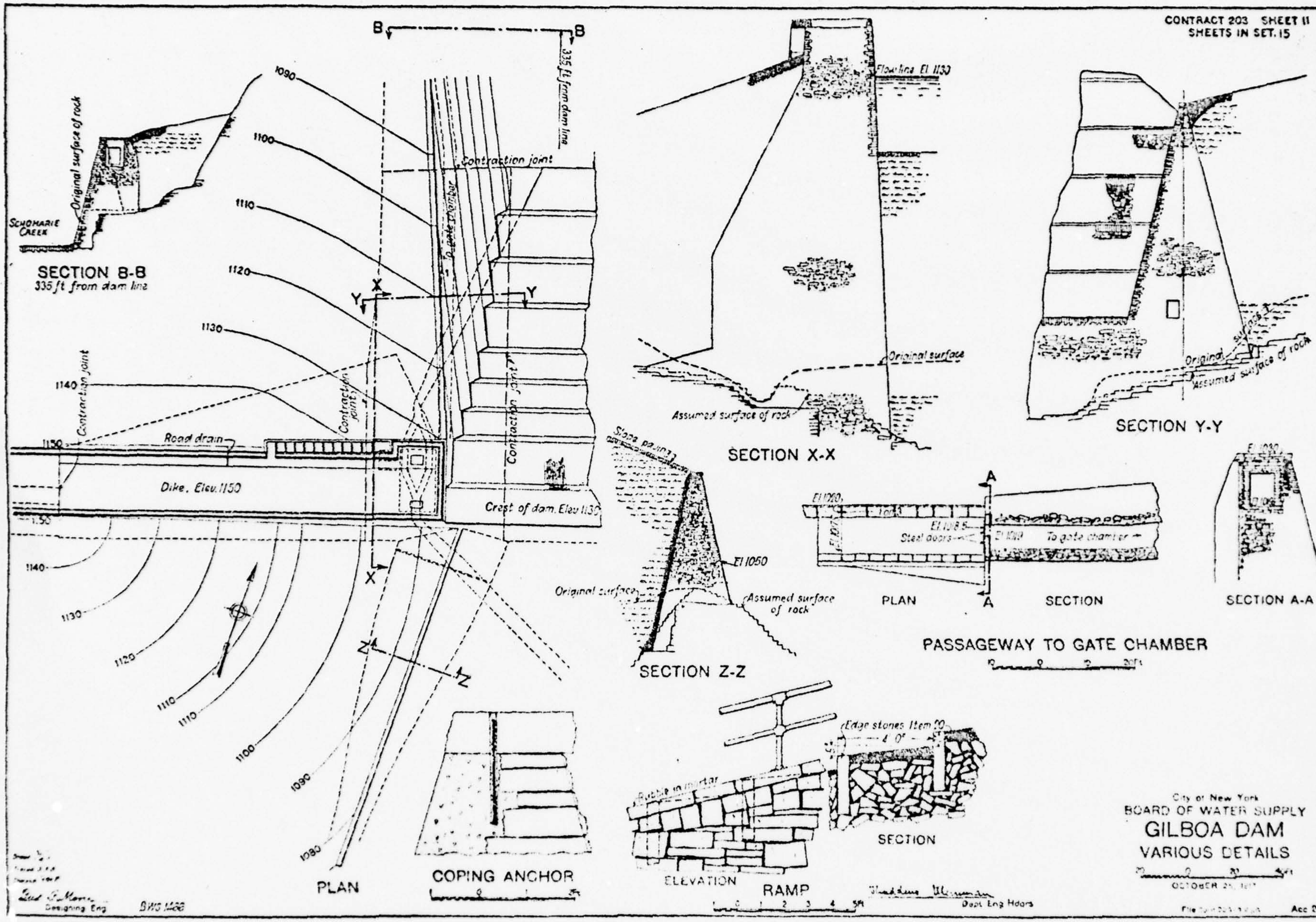
File Cont 203-3.436 Acc 25707


CONTRACT 203 SHEET 8
SHEETS IN SET. 15
PLAN
Coffer dam
Existing bridge
Dam line
9'0" steel pipes
Not less than 100'
To Grand Gorge
N 98700
E 13500
SECTION B-B
Vent pipes
To be built during 1st stage of filling
Frame for 9'0"x18'0" standard sluice gate
UPSTREAM ELEVATION
Conduit for stream flow during 1st stage of filling
SECTION A-A
CONDUIT THROUGH DAM
Dam line
The small conduit is to be built and the sluice gate frame is to be placed before the 9' steel pipes are removed. When ordered, the main conduit is to be filled with masonry as follows: 1- set the sluice gate "a"; 2- build masonry plug "b", setting grout pipes "c" and "d"; 3- grout the groove "e"; 4- close the sluice gate, fill small conduit "f" and grout through pipes "d"; 5- place masonry "g" leaving gallery "h" and setting grout pipes "k"; 6- fill gallery "h" and grout through pipes "k"
Masonry dam
9' steel pipe not less than ½" thick acceptably stiffened with circumferential angles riveted on. The spacing of the pipe supports is to be approved
Bell mouth 15' diameter
SECTION ALONG PIPES.
COFFER-DAMS AND PIPES
City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
STREAM CONTROL SCHOHARIE CREEK
OCTOBER 30, 1917
Fred F. Moore
Designing Eng
BWS 1463
Dept Eng Hdqrs
File Cont 203-3.46 85 Acc 26022

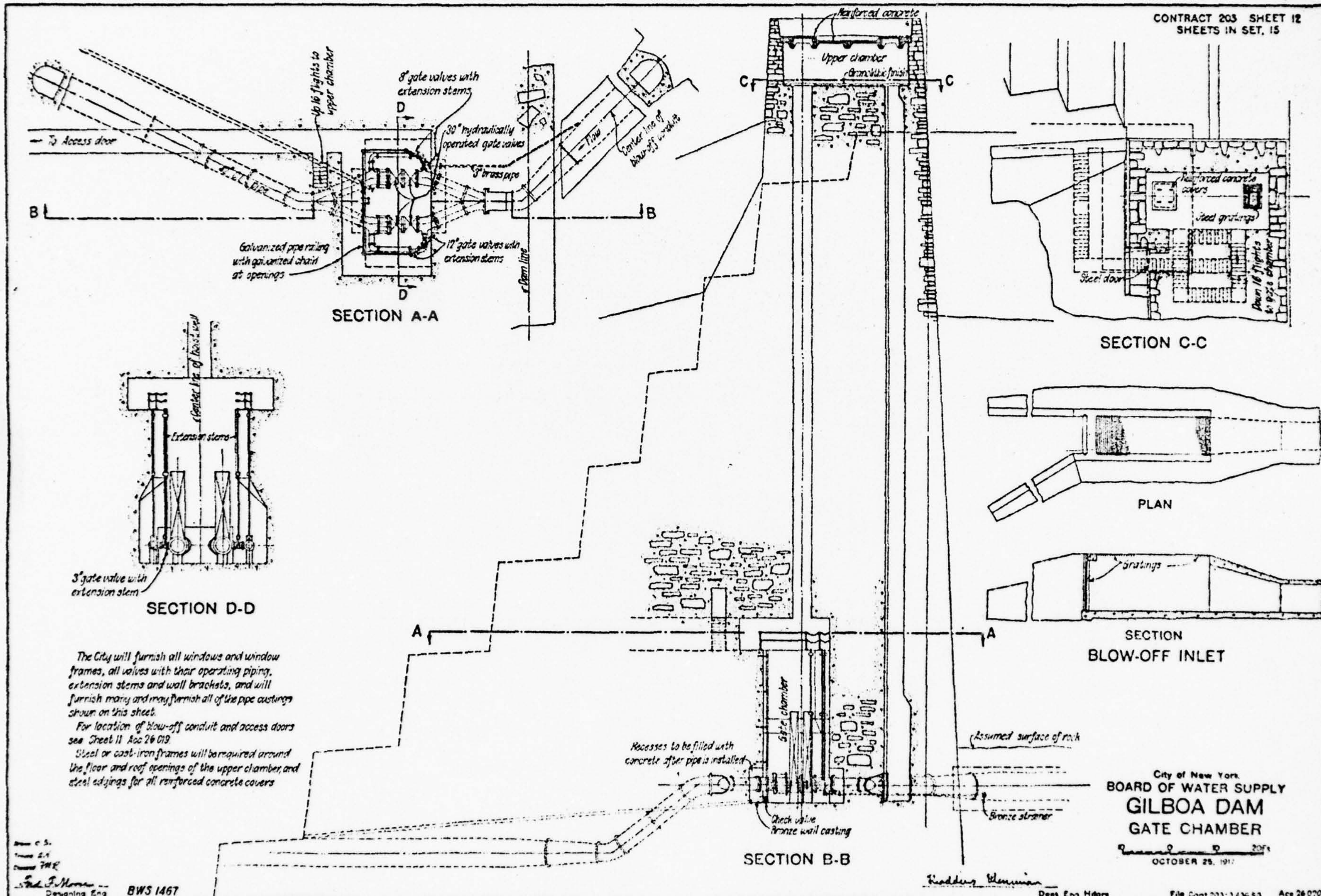


CONTRACT 203 SHEET 9
SHEETS IN SET, 15
SCHOHARIE CREEK
STEEN KILL
This portion of dike above road to be completed after completion of substituted new highways and before sealing conduit
Culvert, to be filled with sluiced material when and as directed
Center line of dike
Temporary highway
highway
Timber trestle
Culvert
Creamery
Manhole
El. 1050
Approximate limits of area to be filled with sluiced material under Item 13
Concrete cut-off wall
Concrete cut-off wall
Channel
To Prattsville
To Grand Gorge
N 98,500
N 98,600
E 13,000
Finished surface of dike
Slope paving
Compacted in 4" layers
Surface of dike for control of Steen Kill
Original surface
SECTION B-B
SECTION A-A
City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
STREAM CONTROL STEEN KILL
OCTOBER 25, 1917
Designing Eng.
BWS 1484
Dept. Eng. Hdqrs.

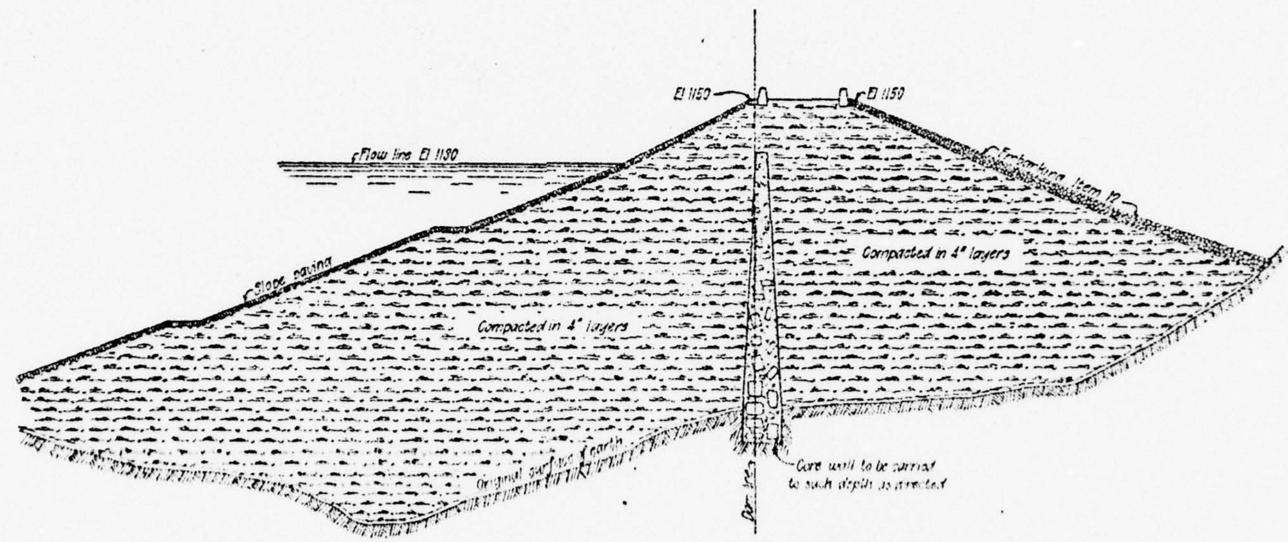

CONTRACT 203 SHEET 10
SHEETS IN SET, 15
SPILLWAY CHANNEL
Assumed surface of rock
Form of channel bottom to be determined
Limits for payment, Items 16, 19 and 21
SECTION A-A
Item 35
PLAN OF STEP
Contraction joint
Item 35
15'-0"
3'-0"
10'-0"
4'-0"
Anchors - 4' long
Contact surface
see note below
Cyclopean masonry may be placed directly against the stone face which has been carried up, as directed, in advance, as a form. In case the Contractor should elect to carry up the main body of the dam in advance of the facing no forms shall be placed closer than within 10 ft. of the finished faces of the dam or other structure. In such cases the Contractor shall furnish and build into the masonry across all contacts between new and previously placed masonry at least one steel rod of one square inch section not less than 4 ft. long for each 16 sq. ft. of contact surface. The rods shall be bent near the ends and otherwise fabricated in an approved manner and placed as directed. No direct payment shall be made for these rods other than in the price bid for cyclopean masonry.
Copper strip
Contraction joint
SECTION B-B
ELEVATION
PLAN
CONTRACTION-JOINTS
City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
CROSS-SECTION AND DETAILS
OCTOBER 25, 1917
Designing Eng
BWS 1465
Dept Eng Hdqrs



CONTRACT 203 SHEET 11
SHEETS IN SET. 15
SECTION B-B
335 ft from dam line
Original surface of rock
SCHOHARIE CREEK
335 ft from dam line
Contraction joint
To gate chamber
Road drain
Dike, Elev. 1150
Crest of dam, Elev. 1130
1090
1100
1110
1120
1130
1140
1150
1080
PLAN
COPING ANCHOR
Flow line El 1130
Original surface
Assumed surface of rock
SECTION X-X
Assumed surface of rock
SECTION Y-Y
Slope paving
El 1050
Original surface
Assumed surface of rock
SECTION Z-Z
El 1085
Steel doors
To gate chamber
PLAN
SECTION
SECTION A-A
PASSAGEWAY TO GATE CHAMBER
Edge stones Item 20
Rubble in mortar
ELEVATION
RAMP
SECTION
City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
VARIOUS DETAILS
Designing Eng
BWS 1488
Dept Eng Hdqrs
Acc 26.019


CONTRACT 203 SHEET 12
SHEETS IN SET, 15
Reinforced concrete
Upper chamber
Granolithic finish
Up 16 flights to upper chamber
8" gate valves with extension stems
30" hydraulically operated gate valves
8" brass pipe
Flow
Center line of blow-off conduit
To Access door
Galvanized pipe railing with galvanized chain at openings
12" gate valves with extension stems
Dam line
SECTION A-A
Center line of hoist well
Extension stems
3" gate valve with extension stem
SECTION D-D
Reinforced concrete covers
Steel gratings
Steel door
Down 16 flights to gate chamber
SECTION C-C
PLAN
Gratings
SECTION
BLOW-OFF INLET
Gate chamber
Recesses to be filled with concrete after pipe is installed
Check valve
Bronze wall casting
Assumed surface of rock
Bronze strainer
SECTION B-B
The City will furnish all windows and window frames, all valves with their operating piping, extension stems and wall brackets, and will furnish many and may furnish all of the pipe castings shown on this sheet.
For location of blow-off conduit and access doors see Sheet 11 Acc 26 019
Steel or cast-iron frames will be required around the floor and roof openings of the upper chamber, and steel edgings for all reinforced concrete covers
City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
GATE CHAMBER
OCTOBER 25, 1917
Designing Eng
BWS 1467
Dept Eng Hdqrs
Acc 26 020

CONTRACT 203 SHEET 13
SHEETS IN SET, 15



City of New York
BOARD OF WATER SUPPLY
GILBOA DAM
DIKE SECTION AT STATION 20+00

20 0 20 40 Ft.

OCTOBER 25, 1917

Designing Eng

BWS 1468

Dept Eng Hdqrs

File Cont 203-3 x 68 Acc 25 709

APPENDIX F

VISUAL CHECK LIST

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME DAM (Schoharie Res.) Gilboa Dam   COUNTY Schoharie   STATE New York   ID# 178

TYPE OF DAM Cyclopean Masonry   HAZARD CATEGORY High

DATE(s) INSPECTION 5-3-78   WEATHER clear & cold   TEMPERATURE 45°

POOL ELEVATION AT TIME OF INSPECTION 1130.1 M.S.L.   TAILWATER AT TIME OF INSPECTION est. 985 M.S.L.

INSPECTION PERSONNEL:

Jeffrey Kimball, P.E.   Joe Boek - New York City

James Hockensmith   Jerry Majoriack - New York City

John Pierchoski, P.E.

John Pierchoski, P.E. RECORDER

EMBANKMENT
GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	West abutment riprapped both faces, no slumping or cracks apparent.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noticeable on embankment section	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None noticeable on embankment section	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	No apparent movement	
RIPRAP FAILURES	None visable	

EMBANKMENT

GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junction with abutment appears to be good and well founded.	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
STONE WEIR	Water running over weir and down spillway steps.	At least 17 places the spillway step edge is destroyed and should be repaired. Stones are missing and one hole in the top of step is visable through the water.
APPROACH CHANNEL	No approach channel (broad crested weir)	
DISCHARGE CHANNEL	Several paving slabs in side delivery channel at bottom of spillway are surface eroded and welded wire fabric is uncovered and flapping in the water. Surfaces are very uneven. Several slabs appear dished.	1950 paving slabs poured after removing deteriorated stone paving blocks.
BRIDGE AND PIERS	No bridge or piers	

DOWNSTREAM CHANNEL
GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Not much debris but lots of trees, and brush growth outside of channel. Lots of displaced riprap.	
SLOPES	Left side downstream slope failure beyond stilling basin.	This area has a history of slope instability.
APPROXIMATE NO. OF HOMES AND POPULATION	30 structures and a campground within a 2 mile distance downstream.	

OUTLET WORKS GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	30" steel pipe Condition of Shandaken Tunnel and pipes unknown	
INTAKE STRUCTURE	a. El. 998'- 30" pipe b. Shandaken Tunnel intakes 2 @ 1050 6 @ 1070	
OUTLET STRUCTURE	Unknown	
OUTLET CHANNEL	a. Stilling basin - for 30" pipe in good condition - same basin as emergency spillway b. Condition of Shandaken Tunnel unknown	
EMERGENCY GATE	30" pipe opens but probably will not close	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

RESERVOIR
GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	No instability of slopes noted.	
SEDIMENTATION	Does not appear to have any affect on storage capacity.	

CONCRETE/MASONRY DAMS

GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	None reported however water was going over the spillway at the time of inspection.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No noticeable movement or settlement.	
DRAINS	Inside dam at valve room does not drain because of ice at bottom.	
WATER PASSAGES	None	
FOUNDATION	According to plans, masonry foundation is cut 3' to 5' into rock. Visual examination indicates no foundation settlement or movement.	

CONCRETE/MASONRY DAMS

GILBOA

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Valve chamber in west abutment has occasional cracks that are leaching lime. Overflow of spillway did not allow visual examination.	
STRUCTURAL CRACKING	None visable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Alignment appeared good.	
MONOLITH JOINTS	Appeared to be closed and sound.	
CONSTRUCTION JOINTS **STAFF GAGE OF RECORDER:**	Cannot observe water in joints since whole face is wet.	

INSTRUMENTATION
GILBOA

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	Observation wells and piezometers installed in 1977. Readings not available during insepction.	
WEIRS	None	
PIEZOMETERS	Checked west abutment downstream on natural ground. Dry at 50'. GD - 36 dry at 50'.	
OTHER		

APPENDIX G
ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Gilboa Dam (Schoharie Reservoi

ID# NY 178

ITEM	REMARKS	ITEM HELD BY
AS-BUILT DRAWINGS	Linen Originals	Design Division New York City Water Supply Department (Owner)
	Working Drawings (Linens)	Owner
	Specifications	Owner
REGIONAL VICINITY MAP	Contract Drawings (Locality Map)	Owner
CONSTRUCTION HISTORY	Record Drawings Earth Dike Masonry Section	
TYPICAL SECTIONS OF DAM	Contract Drawings (Cross-sections & Details)	Owner
OUTLETS - PLAN		
- DETAILS	Working Drawings	Owner
- CONSTRAINTS		
- DISCHANCE RATINGS	Spillway Computations	New York State Dept. of Environ Conservation
RAINFALL/RESERVOIR RECORDS	USGS Gauging Station at Bridge at Prattsville Schoharie Creek	USGS

ITEM	REMARKS	ITEM HELD BY
DESIGN REPORTS	Correspondence to Board of Water Supply, from Chief Engineer J. Waldo Smith, November 16, 1917 for application for construction of a dam to the state of New York conservation Commission serial no. 51227	New York State Department of Environmental Conservation
GEOLOGY REPORTS	Memorandum prepared by John W. Henry December 5, 1917 to Mr. Frank H. Macy	New York State Department of Environmental Conservation
	Rock Profiles	Owner
DESIGN COMPUTATIONS		
HYDROLOGY & HYDRAULICS	Computation	New York State Department of Environmental Gonservation
DAM STABILITY	Line of Pressure Computations	
SEEPAGE STUDIES	None	New York State Department of Environmental Conservation
MATERIALS INVESTIGATIONS		
BORING RECORDS	Plan of Borings	Owner
LABORATORY	UHL Hall & Rich Report	New York Power Commission
FIELD	None	UHL, Hall & Rich
POST-CONSTRUCTION SURVEYS OF DAM	UHL, Hall & Rich Report	New York Power Commission and UHL, Hall & Rich
QUARRY SOURCES	Quarry located across the highway and slightly upstream	Owner

ITEM	REMARKS	ITEM HELD BY
MONITORING SYSTEMS	UHL, Hall & Rich	
MODIFICATIONS	Floor of side spillway was originally layed stone and was replaced in 1950 by concrete paving slabs	
	Repairs to spillway channel	Owner
HIGH POOL RECORDS	Existing	Bureau of Water Supply Prattsville Office
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	UHL, Hall & Rich Proposal by Copen, Hilf, Rutledge P.E.'s for borings	New York Power Commission UHL, Hall & Rich Owner
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None	
MAINTENANCE OPERATION RECORDS	Existing	Bureau of Water Supply Prattsville Office

		REMARKS	ITEMS HELD BY
SPILLWAY PLAN			
	SECTIONS	As built drawings	Owner
	DETAILS	As built drawings	
OPERATING EQUIPMENT PLANS & DETAILS		"Gate-valves, Hydraulic cylinders, bronze Casting and appurtenances for Gilboa Dam and the Shandaken Tunnel"	Owner

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 314 Square Miles rolling wooded hills

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1130 (60,000 acre feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: 1140.0'

ELEVATION TOP DAM: 1150.0'

CREST:

a. Elevation 1130.0
b. Type Broad crested weir
c. Width 11.0
d. Length 1324.0
e. Location Spillover N/A
f. Number and Type of Gates N/A

OUTLET WORKS:

a. Type 2-30" pipes into tailwater basin
b. Location junction of concrete and embankment section
c. Entrance inverts at intake structure
d. Exit inverts Unknown
e. Emergency draindown facilities 2-30" pipes into tailwater basin.

HYDROMETEOROLOGICAL GAGES:

a. Type Stream gage (check at Shandaken Gate house)
b. Location Prattsville
c. Records Kept at field office in Prattsville

MAXIMUM NON-DAMAGING DISCHARGE 54,150 cfs - October 15, 1955

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report Gilboa Dam Mohawk River Basin, Schohaire County, New York Inventory No. N.Y. 178		5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R. Jeffrey Kimball, P.E.		8. CONTRACT OR GRANT NUMBER(s) DACW51-78-C-0025
9. PERFORMING ORGANIZATION NAME AND ADDRESS L. Robert Kimball and Associates 615 W. Highland Avenue Ebensburg, Pennsylvania		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Army 26 Federal Plaza / New York District, CofE New York, New York 10007		12. REPORT DATE 30 June 1978 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; Distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Schohaire County
Gilboa Dam
Schohaire Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Gilboa Dam was judged to be safe, although, a stability analysis was recommended.