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NATIONAL DAM SAFETY PROGRAM. CORTLANDT LAKE DAM (INVENTORY NUMB--ETC(U)
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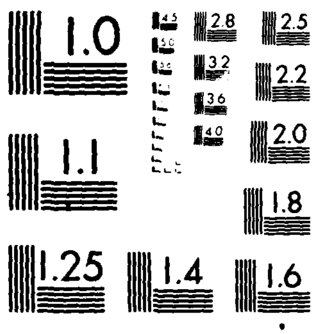

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Cortlandt Lake Dam
Westchester County
Lower Hudson River Basin

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.

Visual inspection of this dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further engineering investigations and remedial work.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The structural stability analysis performed for this report indicated that the stability of the spillway section of the dam is questionable. The analysis indicated that the dam was unstable for all conditions studied. The analysis performed was based on available information and assumptions made may not reflect actual conditions. However, the analysis does indicate that there are serious questions about the stability of this structure and further investigations are required.

The inspection revealed a semicircular wet area just beyond the downstream end of the left wingwall. There was active clear seepage in this area which had caused some sloughing.

It is recommended that within 3 months of the date of notification of the owner, investigations into the structural stability and seepage problems on this dam be commenced. The structural stability investigations should include subsurface explorations and concrete cores to obtain information about the structure and its foundation conditions. This data should then be incorporated into a detailed stability evaluation and, if necessary, modifications to the structure should then be designed. The investigation into the wet area should attempt to determine the cause of the wet area and devise methods of treatment. Remedial measures which are required based on these investigations should be completed within 18 months.

The hydrologic/hydraulic analyses performed indicate that the outflows from all storms exceeding 50% of the Probable Maximum Flood (PMF) will result in flows over the top of the dam. The dam can pass one-half the PMF with a computed freeboard of 0.03 feet. Therefore, the spillway capacity is rated as inadequate.

LOWER HUDSON RIVER BASIN

CORTLANDT LAKE DAM

WESTCHESTER COUNTY, NEW YORK
INVENTORY NO. N.Y. 85

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

JULY, 1981

10 10 19

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CORTLANDT LAKE DAM
I.D. NO. NY85
LOWER HUDSON RIVER BASIN
WESTCHESTER COUNTY, NEW YORK

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APPENDIX

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Cortlandt Lake Dam (I.D. No. NY 85)

State Located: New York

County: Westchester

Watershed: Lower Hudson River Basin

Stream: Canopus Creek

Date of Inspection: May 27, 1981

ASSESSMENT

Visual inspection of this dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further engineering investigations and remedial work.

The structural stability analysis performed for this report indicated that the stability of the spillway section of the dam is questionable. The analysis indicated that the dam was unstable for all conditions studied. The analysis performed was based on available information and assumptions made may not reflect actual conditions. However, the analysis does indicate that there are serious questions about the stability of this structure and further investigations are required.

The inspection revealed a semicircular wet area just beyond the downstream end of the left wingwall. There was active clear seepage in this area which had caused some sloughing.

It is recommended that within 3 months of the date of notification of the owner, investigations into the structural stability and seepage problems on this dam be commenced. The structural stability investigations should include subsurface explorations and concrete cores to obtain information about the structure and its foundation conditions. This data should then be incorporated into a detailed stability evaluation and, if necessary, modifications to the structure should then be designed. The investigation into the wet area should attempt to determine the cause of the wet area and devise methods of treatment. Remedial measures which are required based on these investigations should be completed within 18 months.

The hydrologic/hydraulic analyses performed indicate that the outflows from all storms exceeding 50% of the Probable Maximum Flood (PMF) will result in flows over the top of the dam. The dam can pass one-half the PMF with a computed freeboard of 0.03 feet. Therefore, the spillway capacity is rated as inadequate.

Several other deficiencies were noted on this structure. These deficiencies should be corrected within 12 months of the date of notification of the owner. Among the actions required are the following:

1. Replace the missing backfill behind the left wingwall.
2. Repair deteriorated and spalling concrete on the spillway section and wingwalls.
3. Seal the joints on both the spillway section and the wingwalls to eliminate leakage through these joints.
4. Develop an emergency action plan for the notification of downstream residents.

George Koch RW

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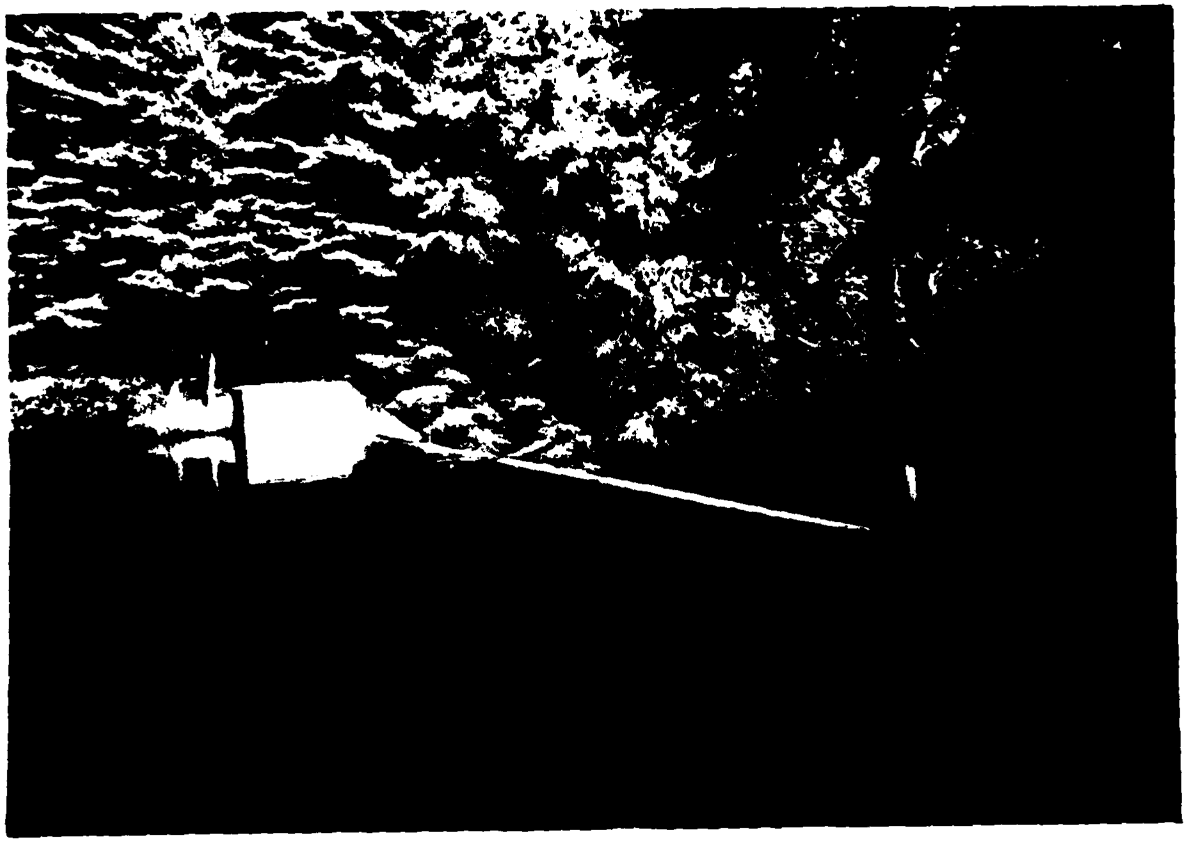
Chief, Dam Safety Section
New York State Department
of Environmental Conservation
NY License No. 45937

Approved by:

Col. W. M. Smith, Jr.
New York District Engineer

Date: 26 Aug 81



OVERVIEW
CORTLANDT LAKE DAM
I.D.NO. NY85

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CORTLANDT LAKE DAM
I.D.NO. NY-85 #213-858
LOWER HUDSON RIVER BASIN
WESTCHESTER COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority
The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection
This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam
The Cortlandt Lake Dam (formerly known as Canopus Dam) is a concrete dam with an ogee near the center of the dam. The dam is 225 feet long and a maximum of 37 feet high. The concrete gravity spillway is 120 feet long and has a crest elevation 6 feet below the top of the dam. Concrete wingwalls separate the spillway section from the remainder of the dam. Beyond the ends of the spillway, the dam is a wall section which has been backfilled both upstream and downstream of the dam.

There are two 3 foot square openings through the dam which serve as low level outlets. Flow through the openings is controlled by sluice gates. One of the openings is near the right end of the dam and has an inlet elevation 6 feet below the spillway crest. This shall be referred to as the mid-level gate. The control mechanism for this gate is on the upstream face of the dam. The other opening is at the base of the dam, 22 feet below the spillway crest, and shall be referred to as the reservoir drain. The control mechanism for this gate is supposedly on the upstream face of the spillway.

b. Location
This dam is located on Canopus Creek (which becomes Sprout Brook downstream of the dam) in the Town of Cortlandt, Westchester County. It is one quarter mile west of Sprout Brook Road. The county boundary passes through the reservoir, with half of the reservoir in Westchester County and the other half in Putnam County.

c. Size Classification

This dam is 37 feet high and has a storage capacity of 244 acre feet. Therefore, the dam is in the small size category as defined by the "Recommended Guidelines for Safety Inspection of Dams".

d. Hazard Classification

The dam is classified as "high" hazard due to the presence of substantial residential development immediately downstream of the dam.

e. Ownership

The dam is owned by the Continental Village Park District Commission, which consists of the Towns of Cortlandt, Putnam Valley and Phillipstown, New York. The district chairmanship rotates among the towns. This year's chairman is Supervisor Charles DiGiacomo. His address is Town of Cortlandt Municipal Building, Croton-on-Hudson, New York 10520.

f. Purpose of Dam

This dam is used to create an impoundment for recreational purposes.

g. Design and Construction History

This dam was designed in 1929 by Nicholas S. Hill, Jr., Consulting Engineer, from New York City. H.D. Hynds Inc., builders from New York City constructed the dam in late 1929.

h. Normal Operating Procedures

There are no prescribed operating procedures for this structure. Water flows over an ungated spillway.

1.3 PERTINENT DATA

a. Drainage Area (sq.mi.) 15.15

b. Discharge at Dam (cfs)

Spillway at Maximum High Water	6754
Mid-level Outlet (gate fully open); water @ spillcrest	92
Reservoir Drain (gate fully open); water @ spillcrest	196

c. Elevation

	DATUM (USGS)	DATUM (PLAN)
Top of Dam	102	108
Spillway Crest	96	102
	INVERT ELEVATIONS	
Mid-level Outlet:		
Inlet	90	96
Outlet	84	90
Reservoir Drain:		
Inlet	74	80
Outlet	68	74

d. Reservoir - Surface Area (acres)

Top of Dam	17.4+
Spillway Crest	17.4

e. Storage Capacity (acre-feet)

Top of Dam	244
Spillway Crest	140

f. Dam

Type - Concrete gravity spillway segment; backfilled concrete core walls at either end.

Dam Length (ft)	225
Crest Width - Wall Segment (ft)	3

g. Spillway

Type: Ungated, concrete ogee section in center of dam.

Length (ft) 120

h. Mid-Level Outlet

Type: 3 foot square opening on right abutment

Control: Vertical sluice gate with trash rack
ID plate on gate floorstand:
Wilcox Sluice Gates & Roller Bearing Standards
Coldwell- Wilcox Company
Newburgh, New York

i. Reservoir Drain

Type: 3 foot square opening through spillway

Control: Unknown

SECTION 2: ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. Geology

The Cortlandt Lake Dam is located in the Hudson Hills segment of the New England Uplands physiographic province of New York State. These hills, commonly known as the "Highlands of the Hudson", are composed of crystalline rocks similar to those in the Adirondacks. The highlands, which trend northeast-southwest, have been eroded to form very rugged terrain with summit levels reaching 1000 feet above sea level. Bedrock in the area consists of gneiss, quartzite and marble from the Precambrian era (more than 570 million years ago). A review of the "Brittle Structures Map of New York" indicates that there is a fault trace approximately 1/2 mile east of the dam. In addition, there is a shear zone of mylonite, ultramylonite or mylonite gneiss within the reservoir, several hundred feet northwest of the dam.

b. Subsurface Investigations

No records of any subsurface investigations performed for this structure could be located. The permit application for the original construction of this dam indicates that the natural soils in the vicinity of this dam are clay, sand and gravel. It also stated that the dam would be founded on bedrock.

2.2 DESIGN RECORDS

The only design records available consisted of two sheets of plans prepared by Nicholas S. Hill, Jr., Consulting Engineer, of New York City. Copies of these plans have been included in Appendix F. Some additional design information was included in the 1929 application for construction submitted to the New York State Department of Public Works.

2.3 CONSTRUCTION RECORDS

This dam is believed to have been constructed by H.D. Hynds, Inc., builders from New York City. The only construction records available was a letter from Mr. H.W. Bressler of H.D. Hynds, Inc. to the Department of Public Works which outlined the specifications which were to be used for the construction of this dam.

2.4 OPERATION RECORDS

There are no operation records available for this structure.

2.5 EVALUATION OF DATA

Data used for the preparation of this report was obtained from the Department of Environmental Conservation files. The information available appeared to be reasonably accurate.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General
Visual inspection of the Cortlandt Lake Dam was conducted on May 27, 1981. The weather was clear and the temperature was in the seventies. The water level at the time of the inspection was at the spillway crest.

b. Spillway
The spillway section comprises the biggest part of the dam. There are provisions for flashboards on the spillway although at the time of the inspection, there were no flashboards or support pins in place. Visual inspection revealed some concrete deterioration on the spillway. There was minor spalling and some concrete removal along each of the construction joints. The deterioration had also resulted in slightly irregular crest with a low area at the left end of the spillway. Water was flowing over the spillway in two low areas at the time of the inspection. Photos which were taken during an inspection in 1959 (several of these photos have been included in Appendix A), indicate that the concrete on the crest was similarly deteriorated at that time. The condition of the concrete does not appear to have worsened substantially since 1959. Photos from the 1959 inspection also showed that there was some leakage through one of the horizontal construction joints at the left end of the spillway. This was not observed during the Phase I inspection due to the water flowing over that portion of the spillway.

c. Wingwalls
There is a wingwall at either end of the spillway. The concrete forming these wingwalls was in satisfactory condition. There was some minor cracking and deterioration along the construction joints. Near the downstream end of each wall, the top surface was spalling. Several weep holes thr ough the walls were flowing at the time of the inspection. Discoloration of the concrete below these weep holes indicated that they flow frequently.

There were several other deficiencies noted in this area. The most serious of these was a wet area just beyond the downstream end of the left wingwall. There was a semi-circular area about 12 feet wide which had sloughed by as much as a foot. Clear seepage was emerging from this area at a rate of approximately one gallon per minute. It could not be determined whether this water was coming from the reservoir or if it was flowing out of the hillside. The water then flowed over a low wall and into the downstream channel. There was also some seepage noted at the downstream end of the right wingwall.

The quantity of seepage on this side was less than at the left side. Another deficiency noted was missing backfill behind the left wingwall. The problem was most severe at the upstream end of the wingwall where there was as much as 5 feet of backfill mising. The hole extended down the wall for approximately half of its length.

Also observed during the visual inspection was a submerged circular hole in the wingwall just upstream of the spillway crest. The function of this hole could not be determined. The plans make no reference to this opening. The 1959 photos show that, at that time, there was a wood cover over this hole.

d. Low Level Outlets
There are two, 3 foot square openings through the concrete on this dam which can release impounded water below the normal pool level. The control mechanism for one of these outlets is located just beyond the right end of the spillway. It appeared to be in satisfactory condition and operable although it was not operated at the time of inspection. There was minor leakage noted along the base of the outlet opening on the downstream face of the dam.

The other outlet serves as a reservoir drain. Only the top of the outlet was visible in the plunge pool area. The gate and control mechanism is reportedly on the upstream face of the spillway. It was submerged at the time of the inspection. Photos from the 1959 inspection indicate that the drain was opened at that time.

e. Reservoir
There were no signs of soil instability in the reservoir area.

f. Downstream Channel
The channel downstream of the dam was filled with rocks with occasional bedrock outcrops. There were some trees growing in the channel as well.

3.2 EVALUATION OF OBSERVATIONS

Visual observations revealed several deficiencies on this structure. The following items were noted:

1. A wet area beyond the downstream end of the left wingwall;
2. A substantial quantity of missing backfill behind the left wingwall;
3. Minor seepage beyond the downstream end of the right wingwall;
4. Deterioration and spalling of concrete on the spillway section, especially along the crest;

5. Leakage through horizontal construction joints both on the spillway and on the wingwalls;

6. Spalling of the concrete on the top surface of the wingwalls, near the downstream end.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

There are no formal operation procedures on this dam. Water flows over an ungated spillway. There are provisions for flashboards on the spillway, but at the time of the inspection, there were no flashboards or support pins in place. It appeared that flashboards are no longer used.

4.2 MAINTENANCE OF DAM

There was no formal maintenance plan for this structure.

4.3 WARNING SYSTEM IN EFFECT

No apparent warning system for the evacuation of downstream residents is present.

4.4 EVALUATION

The operation procedures for this dam are satisfactory. Increased maintenance efforts are needed to repair the deficiencies noted in Section 3.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

The delineation of the contributing watershed to this dam is indicated on the map titled "Drainage Area Map-Cortlandt Lake Dam" (Appendix C) . The irregular, long and narrow, northeast-southwest oriented watershed of some 15.15 square miles (9696 acres) is comprised of relatively undeveloped lands, primarily forests and woodlands.

No significant land development exists except for two moderate-density residential areas, one surrounding Cortlandt Lake and the other surrounding Indian Lake. Several sizeable lakes lie within the watershed,these being Canopus Lake and Pelton Pond in the upper end of the drainage basin and Indian Lake and Lake Celeste in the lower third of the basin. Numerous smaller, unnamed ponds are also interspersed throughout the watershed.

Slopes along the primary drainage paths are flat to moderate (less than 8%). However, the adjacent hillsides have steep and rocky slopes, with those hilltops forming the watershed divide ranging from 200 feet to 1200 feet in elevation above the reservoir.

There are no known flow diversions either into or out of this watershed. The inlet stream to Cortlandt Lake is known as Canopus Creek, whereas the outlet stream from the dam site is known as Sprout Brook.

5.2 ANALYSIS CRITERIA

No hydrologic/hydraulic information was available regarding the original design for this dam. Therefore, the analysis of the floodwater retarding capability of the dam was performed using the Corps of Engineer's HEC-1 computer program, Dam Safety version. The computer program develops an inflow hydrograph using the "Snyder Unit Hydrograph" method and then reservoir routes the hydrograph using the "Modified Puls" flood routing procedure. The spillway design flood selected for analysis was the Probable Maximum Flood (PMF), in accordance with the Recommended Guidelines of the U.S. Army Corps of Engineers. The PMF event is that hypothetical storm event resulting from the most critical combination of rainfall, minimum soil retention, and direct runoff to a specific site that is considered reasonably possible for a particular watershed.

The Corps of Engineers Lower Hudson River Basin study (ref. #1) was used to obtain hydrograph parameters, rainfall loss rate values of 1.5 inches (initial) and 0.1 inches per hour (constant) and base flow values. Precipitation values used in the analysis were obtained from the Weather Bureau publication, HMR 33.

5.3 SPILLWAY CAPACITY

The single, ungated, concrete ogee spillway was analyzed for weir flow using a discharge coefficient, C, varying from 3.2 to 3.83. Near the center of the spillway crest is an open slot which can provide 8 cfs additional discharge capacity. This capacity was included in the analysis. The additional discharge capacity of the 3 foot square, mid-level outlet located in the right abutment was not included in the floodwater analysis although access to the sluice gate control mechanism is possible during the occurrence of a large storm event.

The floodwater analysis performed for this dam indicates that the spillway does not have sufficient capacity for discharging the PMF. For this storm event, the peak inflow and the peak outflow are 13421 cfs. The one-half PMF peak inflow and peak outflow are 6708 cfs. The computed discharge capacity of the spillway is 6754 cfs.

5.4 RESERVOIR CAPACITY

The normal water surface is at or near the spillway crest (elevation 96-USGS). The impounded capacity at this elevation is 140 acre-feet.Surcharge storage capacity to the top-of-dam (elevation 102) adds 104 acre feet which is equivalent to a direct runoff depth of 0.13 inches over the watershed. The total storage capacity is 244 acre feet.

5.5 FLOODS OF RECORD

No data was available regarding the occurrence of the maximum known flood at this dam site.

5.6 OVERTOPPING POTENTIAL

Analyses using the PMF storm event indicates that the spillway does not have sufficient discharge capacity. The peak outflow from the PMF event will overtop the dam to a computed depth of 2.83 feet. The peak outflow from the one-half PMF event will not overtop the dam, having a computed freeboard of 0.03 feet. All storm events exceeding 50% of the PMF will result in the dam being overtopped.

5.7 EVALUATION

The spillway does not have sufficient capacity for discharging the peak outflow from the PMF. However, the spillway does have sufficient discharge capacity for passing the peak outflow from one-half the PMF. Therefore, the spillway is assessed as inadequate.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual inspection of the dam revealed several deficiencies on this structure. The most serious of these deficiencies was a wet area just beyond the downstream end of the left wingwall. There was a semi-circular area about 12 feet wide which had sloughed. Clear seepage was emerging from this area. Another deficiency noted was missing backfill behind the left wingwall. Other problems noted were related to the deterioration of concrete both on the spillway and on the wingwalls.

b. Data Review and Stability Evaluation

A stability analysis was performed for this report in accordance with the "Recommended Guidelines for the Safety Inspection of Dams." The analysis was based on a cross section of the concrete gravity spillway shown on the 1929 plans prepared by Nicholas S. Hill, Jr., Consulting Engineer, of New York City. The results of the analysis are as follows:

Case	Overturning Safety Factor	Resultant in Middle Third	Sliding Safety Factor
a. Normal conditions, water surface at spillway crest	1.31	No	0.85
b. Case a. plus ice load of 5000 lb/ft	1.10	No	0.74
c. 1/2PMF flows; water surface at top of dam	1.04	No	0.62
d. Seismic Loading, water surface at spillway crest	1.23	No	0.64

The analysis indicates that the dam is unstable. The fact that the factors of safety are below 1.0 for normal loading conditions shows that actual loading and uplift conditions are less severe than those which were assumed for the analysis. The analysis, in accordance with the Corps of Engineers' "Recommended Guidelines", assumed full uplift pressure under the upstream toe decreasing to tailwater pressure under the downstream toe. However, safety factors were below recommended values even when zero uplift pressure was assumed. Therefore, the structure must be considered to be marginally stable at best.

Further investigations are required to better assess the stability of the dam. Subsurface explorations and concrete cores are required to obtain information about the uplift forces acting on the dam and about the condition of the dam and its foundation. Revised stability analyses should then be performed using this data. Based on the results of these analyses, required modifications to the structure should be made.

c. Seismic Stability

This structure is located in Seismic Zone 1. However, since there was a fault trace in the vicinity of the dam, a seismic stability analysis was performed assuming a seismic coefficient of 0.1. The results of this analysis (shown on page 11) indicate that the safety factors are below recommended values when seismic considerations are included.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I inspection of the Cortlandt Lake Dam revealed several deficiencies on the structure. One of the most serious deficiencies was a semicircular wet area just beyond the downstream end of the left wingwall. There was active clear seepage in this area which had caused some sloughing.

The inspection also revealed that the stability of this structure is questionable. Analyses performed indicated that the dam was unstable for all conditions studied. While the uplift conditions assumed for this report may have been more severe than actually exist, the analysis does indicate that a serious stability deficiency exists on this structure.

The dam does not have sufficient spillway capacity to pass the Probable Maximum Flood (PMF). The outflows from one-half the PMF will not overtop the non-overflow segment of the dam. Therefore, the spillway capacity has been rated as inadequate.

b. Adequacy of Information

The information available for the preparation of this report was fairly complete and appeared to be reasonably accurate. The condition of the rock forming the dam's foundation was unknown, so conservative assumptions about it were made for the stability analyses performed for this report.

c. Need for Additional Investigations

Further investigation of the structural stability and seepage problems on this dam are required. The structural stability investigations should include subsurface explorations and concrete cores to obtain information about the structure and its foundation conditions. This data should then be incorporated into a detailed stability evaluation and, if necessary, modifications to the structure should then be designed.

Investigations into the causes of the wet area beyond the downstream end of the left wingwall are required. As a result of these investigations, methods of treatment should be devised and implemented.

d. Urgency

Investigations of the structural stability and seepage problems should be commenced within 3 months of the date of notification of the owner. Remedialmeasures deemed necessary as a result of these investigations should be completed within 18 months. Other deficiencies noted on the structure should be corrected within 12 months.

7.2 RECOMMENDED MEASURES

1. Modify the structure as necessary, based on the stability analysis.

2. Devise and implement a method to treat the wet area beyond the downstream end of the left wingwall.

3. Replace the missing backfill behind the left wingwall.

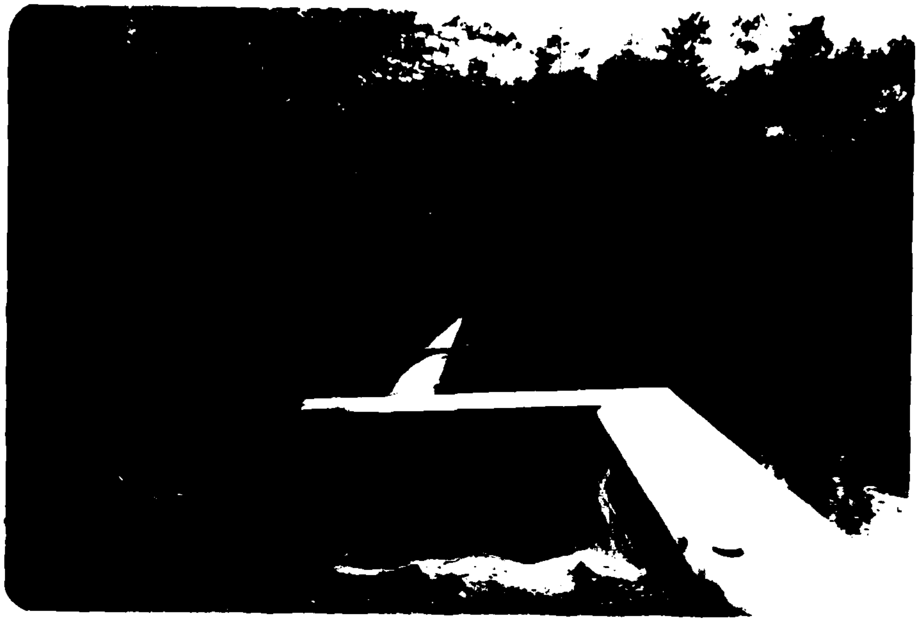
4. Repair the deteriorated and spalling concrete on the spillway section and wingwalls.

5. Seal the joints on both the spillway section and the wingwalls to eliminate leakage through these joints.

6. Develop and implement an emergency action plan for the notification of downstream residents.

APPENDIX A

PHOTOGRAPHS

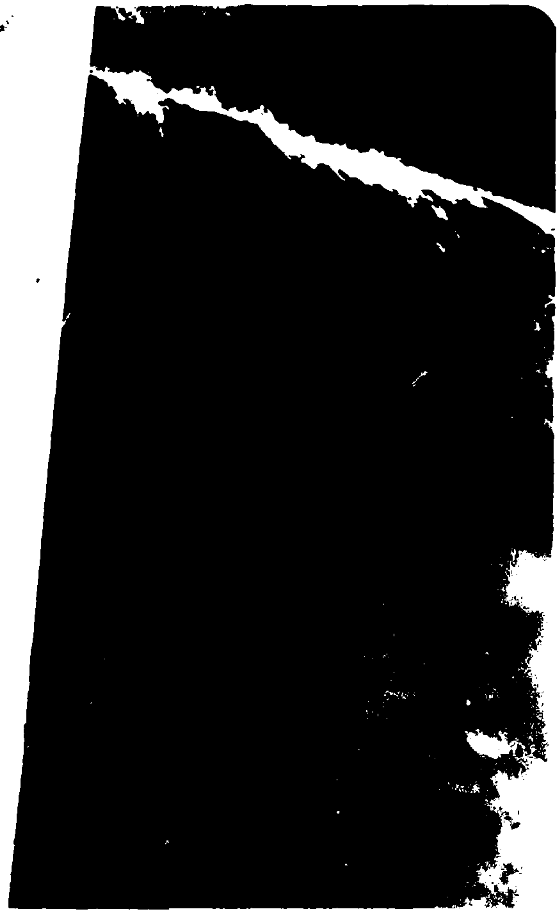


MISSING BACKFILL BEHIND WINGWALL AT LEFT END OF DAM

AREA OF MISSING BACKFILL FROM DOWNSTREAM TOE
ALSO, CONCRETE DETERIORATING ON WINGWALL

WET AREA AT DOWNSTREAM END OF LEFT WINGWALL

AREA OF SLOUGH RESULTING FROM THE WET AREA

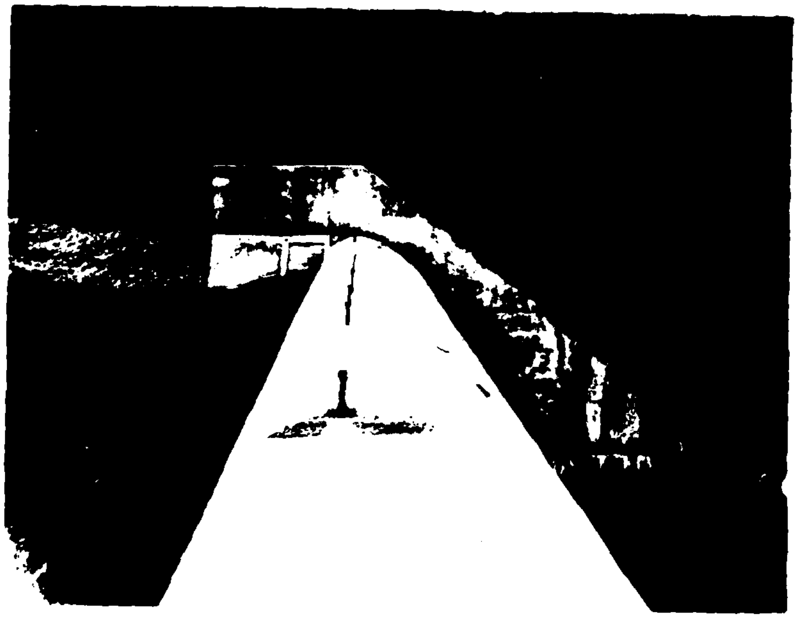


FORMED HOLE IN CONCRETE ON LEFT
WINGWALL IN RESERVOIR

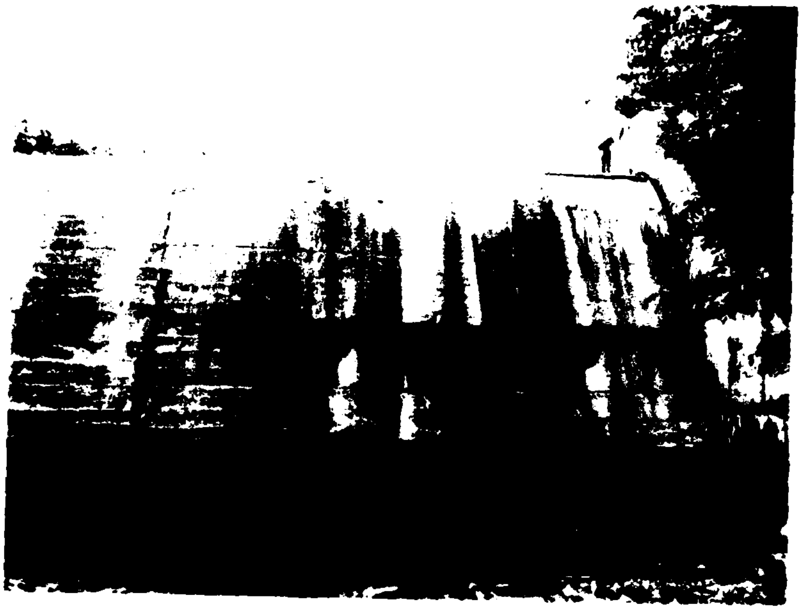
FLOW THROUGH WEEP HOLE IN
WINGWALL AT RIGHT END OF DAM

SPILLWAY SECTION
NOTE THE DETERIORATED CREST ON RIGHT SIDE

SPILLWAY SECTION
NOTE DETERIORATED CONCRETE



1959 PHOTO
CREST OF SPILLWAY WITH FLASHBOARD PINS IN PLACE
NOTE WOOD COVER OVER CIRCULAR HOLE IN WINGWALL



1959 PHOTO
LEAKAGE THROUGH THE HORIZONTAL CONSTRUCTION JOINTS

1959 PHOTO
GATE ON LOW LEVEL OUTLET OPENED

1959 PHOTO
DOWNSTREAM VIEW BOTH LOW LEVEL OUTLETS FLOWING

APPENDIX B

VISUAL INSPECTION CHECKLIST

33-15-3(9/80)

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam CORTLANDT LAKE DAM (FORMERLY CANOPUS DAM)

Fed. I.D. # NY 85 DEC Dam No. 213-858 LOWER HUDSON

River Basin LOWER HUDSON

Location: Town CORTLANDT County WESTCHESTER

Stream Name CANOPUS CREEK

Tributary of SPROUT BROOK

Latitude (N) 41° 19.6′ Longitude (W) 73° 55.2′

Type of Dam CONCRETE

Hazard Category HIGH

Date(s) of Inspection 5/27/81

Weather Conditions SUNNY 70°

Reservoir Level at Time of Inspection SPILLWAY CREST

b. Inspection Personnel R. WARRENDER W. LYNICK

c. Persons Contacted (Including Address & Phone No.)

JAMES IRISH - TOWN OF CORTLANDT ENGINEER 914-737-3713

d. History:

Date Constructed 1929 Date(s) Reconstructed

Designer NICHOLAS HILL

Constructed By

Owner CONTINENTAL VILLAGE PARK COMMISSION

2) EMBANKMENT- NO EMBANKMENT SECTION - EARTH FILL IS SIMPLY BACKFILL FOR CONCRETE SECTIONS

3) Drainage System

a. Description of System WEEP HOLES THROUGH CONCRETE WINGWALLS AT EITHER END OF SPILLWAY SECTION

b. Condition of System SATISFACTORY

c. Discharge from Drainage System FLOW THROUGH SEVERAL OF THE WEEP HOLES AT TIME OF INSPECTION - DISCOLORATION OF CONCRETE BELOW SOME OF THE WEEP HOLES INDICATES FREQUENT DISCHARGE

4) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

NONE

5) Reservoir

a. Slopes FAIRLY STEEP BUT SATISFACTORY

b. Sedimentation NONE APPARENT

c. Unusual Conditions Which Affect Dam NONE

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) SUBSTANTIAL DOWNSTREAM DEVELOPMENT & 1 ROAD (TOWN)

b. Seepage, Unusual Growth NONE

c. Evidence of Movement Beyond Toe of Dam NONE

d. Condition of Downstream Channel SOME TREES GROWING IN CHANNEL GENERALLY ROCK LINED & SATISFACTORY

7) Spillway(s) (Including Discharge Conveyance Channel)

MAIN SPILLWAY SECTION IS CONCRETE OGEE SECTION IN CENTER OF DAM. 2 LOW LEVEL OUTLET OPENNINGS FOR RELEASE BELOW SPILL CREST

a. General

OGEE SECTION HAS HOLES IN CREST FOR FLASHBOARD PINS - HOWEVER NONE WERE IN PLACE AT TIME OF THE INSPECTION

b. Condition of ~~Service~~ OGEE Spillway SOME DETERIORATION OF CONCRETE SLIGHTLY IRREGULAR CREST - FLOW OVER TWO DETERIORATED AREAS OF CREST AT TIME OF INSPECTION

SOME DETERIORATION OF CONCRETE ALONG EACH CONSTRUCTION JOINT AS WELL

c. Condition of [redacted] MID LEVEL OUTLET Spillway CONTROL MECHANISM AT RIGHT END OF SPILLWAY - DID NOT APPEAR TO HAVE BEEN OPERATED RECENTLY BUT APPEARED TO BE OPERABLE. THERE WAS SLIGHT ~~SEEPAGE~~ LEAKAGE ALONG BASE OF THE 3' SQUARE OPENING - NOTED AT OUTLET OF CHANNEL

d. Condition of Discharge Conveyance Channel SATISFACTORY

8) Reservoir Drain/Outlet - (LOWER LOW LEVEL OUTLET)

Type: Pipe ____ Conduit ____ Other ✓ 3' SQUARE OPENNING

Material: Concrete ✓ Metal ____ Other ____

Size: 3' SQUARE Length 25'

Invert Elevations: Entrance 80 Exit 74

Physical Condition (Describe): Unobservable ✓

Material: ____

Joints: ____ Alignment ____

Structural Integrity: ____

Hydraulic Capability: ____

Means of Control: Gate ✓ Valve ____ Uncontrolled ____

Operation: Operable ____ Inoperable ____ Other ____

Present Condition (Describe): CONTROL MECHANISM IN RESERVOIR UNOBSERVABLE - OUTLET PARTIALLY SUBMERGED

9) Structural

a. Concrete Surfaces SOME DETERIORATION OF CONCRETE ON SPILLWAY CREST ALSO SOME SPALLING ON DOWNSTREAM ENDS OF WINGWALLS. SOME SPALLING & DETERIORATION IN VICINITY OF [redacted] JOINTS BOTH ON WINGWALLS & SPILLWAY SECTION

b. Structural Cracking NO MAJOR CRACKING

c. Movement - Horizontal & Vertical Alignment (Settlement) ALIGNMENT SATISFACTORY

d. Junctions with Abutments or Embankments AT ENDS OF SPILLWAY CONCRETE WINGWALLS SEPARATE SPILLWAY & RETAIN BACKFILL - SUBSTANTIAL AMOUNT OF BACKFILL MISSING BEHIND LEFT WINGWALL - UP TO 5' DEEP AT CREST GOING DOWN ABOUT ½ WAY ALONG WINGWALL

e. Drains - Foundation, Joint, Face WEEP HOLES THROUGH WINGWALLS SOME OF WHICH ARE FLOWING

f. Water Passages, Conduits, Sluices SLUICES FOR LOW LEVEL OUTLETS APPEAR SATISFACTORY

g. Seepage or Leakage SATURATED AREA AT BASE OF LEFT WINGWALL AREA - SEEPAGE & SLOUGHING - SEMI-CIRCULAR AREA ABOUT 12' ACROSS HAS SLOUGHED UP TO 1' - SEEPAGE COMING OUT AT RATE OF ABOUT 1 GAL/MINUTE. - WATER FLOWS OVER THE LOW WALL AT THE BASE OF THE WINGWALL.

SOME SEEPAGE ALSO NOTED AT DOWNSTREAM END OF RIGHT WINGWALL AT ORIGINAL GROUND CONTACT

h. Joints - Construction, etc. SOME DETERIORATION & SPALLING ALONG A NUMBER OF CONSTRUCTION JOINTS - ESPECIALLY ALONG VERTICAL CONSTRUCTION JOINTS

i. Foundation SATISFACTORY

j. Abutments GOOD

k. Control Gates MIDLEVEL GATE APPEARED SATISFACTORY LOW LEVEL OUTLET UNOBSERVABLE

l. Approach & Outlet Channels SATISFACTORY

m. Energy Dissipators (Plunge Pool, etc.) NONE

n. Intake Structures FORMED CIRCULAR CONCRETE HOLE IN LEFT ABUTMENT - PURPOSE OF HOLE IS UNKNOWN

o. Stability

p. Miscellaneous

APPENDIX C

HYDROLOGIC/HYDRAULIC
ENGINEERING DATA AND COMPUTATIONS

CORTLAND LAKE DAM
NY-85

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	[USGS] Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	102	17.4+	244
2) Design High Water (Max. Design Pool)	N/A	—	—
3) Auxiliary Spillway Crest	N/A	—	—
4) Pool Level with Flashboards	N/A	—	—
5) [redacted] Spillway Crest	96	17.4	140
6) SLOT ON CREST	95.25	—	—

DISCHARGES

	[redacted] (cfs)
1) Average Daily	N/A
2) Spillway @ Maximum High Water	6754
3) Spillway @ Design High Water	N/A
4) Spillway @ Auxiliary Spillway Crest Elevation	N/A
5) Low Level Outlet (WATER @ SPILLCREST ELEV.) (FULL OPEN)	288
6) Total (of all facilities) @ Maximum High Water	7117
7) Maximum Known Flood	N/A
8) At Time of Inspection	±10

CORTLAND LAKE DAM
NY-85

CREST: USGS ELEVATION: 102

Type: CONCRETE WALL w/ EARTH BACKFILL

Width: WALL ≈ 3' TOTAL ≈ 10'-15' Length: LT ≈ 55' RT ≈ 50' Σ = 105'

Spillover SPILLWAY (WEIR)

Location @ CENTER OF DAM

SPILLWAY:

SERVICE		[redacted]
96	Elevation	
CONC. OGEE WEIR	Type	
±6'	Width	
	Type of Control	
✓	Uncontrolled	
	Controlled:	
N/A	Type (Flashboards; gate)	
N/A	Number	
120'	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
	Chute Length	
>10'	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : [redacted] USGS GAGE * 1374150

Location: ± 0.75 MI. UPSTREAM FROM LAKE @ CONTINENTAL VILLAGE

* Records: LOW FLOW / PARTIAL RECORD STA.

Date - 12/7/60 - 7/26/66

[redacted] Readings : 0.22 - 17.9 cfs

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

Method of Controlled Releases (mechanisms):

TWO 3'x3' OUTLETS THRU DAM; ONE (MID-LEVEL GATE) @ RT. ABUTMENT
OTHER THRU SPILLWAY (RESV. DRAIN)

* GAGE DATA: #1374150 (USGS)

Canopus Creek @ Continental Village
Low-flow, partial record station

DATE	DISCHARGE
7/26/66	10.3
8/5/65	6.55
9/17/64	0.22
7/1/64	1.98
3/1/63	10.9
7/18/62	0.93
6/19/62	3.63
12/7/60	17.9

DRAINAGE AREA: 9693 ACRES 15.15 SQ MILES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: FORESTS; WOODLANDS; SOME RESIDENTIAL DEVELOPMENT OF MEDIUM TO LIGHT DENSITY

Terrain - Relief: HILLY; STEEP SLOPES

Surface - Soil: ROCKY

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

NONE APPARENT

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE APPARENT

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

NONE APPARENT

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: NO

Elevation:

Reservoir:

Length @ Maximum Pool 1850' ±0.35 (Miles)

Length of Shoreline (@ Spillway Crest) 4200' ±0.8 (Miles)

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	1/		
SUBJECT: WATERSHED PARAMETERS		COMPUTED BY: WCL	DATE: 7/3/81

DRAINAGE AREA: - PLANIMETERED (1 SQ IN = 91.827 ACRES)

USGS 7.5 MIN. QUAD.	SUBBASIN		SQ. INS.	ACRES
OSCAWANA LAKE	CANOPUS LAKE NORTH END - DAM	DA =	2.33	214
		SURF A =	0.37	34
	OUTLET - CANOPUS LAKE (LOWER POND) + PELTON POND SUBBASIN	DA =	3.51	322
		SURF A =	0.67	61.5
	PELTON POND DAM	DA =	1.46	134
		SURF A =	0.09	8.26
	JOHN ALLEN POND DAM	DA =	10.29	945
		SURF A =	0.02	1.84
	MAIN STEM - CANOPUS CREEK		13.69	
			18.35	
MOHEGAN LAKE →			3.27	
WEST POINT →			10.88	
PEEKSKILL →			34.52	
			80.71	7411
WEST POINT →	DAM # 469 LH	DA =	4.90	450
WEST POINT, PEEKSKILL	INDIAN LAKE	DA =	0.67 } 1.70 }	217
		SURF A =	0.13 } 0.32 }	41.3

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	21		
SUBJECT		COMPUTED BY	DATE
WATERSHED PARAMETERS		WCL	7/6/81

DRAINAGE AREA HAVING CONTROLLED RUNOFF:

DAM	DRAINAGE AREA (ACRES)	% TOTAL	RESERVOIR SURFACE (ACRES)	H	SURCHARGE STORAGE (AC-FT)
CANOPUS LAKE NORTH END DAM	214	2.21	34 (50)	5'	170 (250)
PELTON POND	134	1.38	8.26 (8.72)	5.5'	45.4 (48)
CANOPUS LAKE LOWER (NATURAL OUTLET?)	322	3.32	61.5	—	UNKNOWN
SUBTOTAL:	670	6.91			
JOHN ALLEN POND	945	9.75	1.84 (20)	1.5'	2.76 (30)
DAM #469 LH	450	4.64	—	—	UNKNOWN
INDIAN LAKE	217	2.24	41.3	—	UNKNOWN
TOTAL:	2282	23.54			
AREA DRAINING DIRECTLY INTO CANOPUS CREEK	7411				
TOTAL WATERSHED:	9693	→ 15.15 SQ MILES			

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	3/		
SUBJECT: WATERSHED PARAMETERS		COMPUTED BY: WCL	DATE: 7/6/81

SNYDER UNIT HYDROGRAPH :

LAG TIME : $t_p = C_t(L \times L_{CA})^{0.3}$

$t_p = (2.0)(12.62 \times 5.95)^{0.3}$

$t_p = 7.31$ HRS

L = 12.62 MILES (66650')

L_{CA} = 5.95 MILES (31400')

C_t = 2.0

UNIT RAINFALL DURATION : $t_r = \frac{t_p}{5.5}$

$t_r = 1.33$

USE t_R = 1.0 HR

ADJUSTED LAG TIME :

$TP = t_p + 0.25(t_R - t_r)$

$= 7.31 + 0.25(1 - 1.33)$

TP = 7.24 HRS

PEAKING COEFFICIENT :

640 CP = 359

CP = 0.56

[REF: CORPS ENGRS LOWER HUDSON BASIN STUDY]

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	4/		
SUBJECT		COMPUTED BY	DATE
		WCL	7/6/81

PMP - RAINFALL : HRR # 33

ZONE 1 200 SQ MI / 24 HR INDEX P = 21.4"

ADJUSTMENT FOR AREA / DURATION : (HRS) 6 12 24 48

% OF INDEX → 106 119 128 137

SOIL RETENTION - RAINFALL LOSS RATES :

INITIAL = 1.5 INS
CONSTANT = 0.1 INS/HR

REF: CORPS ENGRS
LOWER HUDSON BASIN STUDY

BASE FLOW :

REF: ↑

INITIAL @ 1 cfs/SQ MI → 15 cfs

QRCSN = 0.25 RTIOR = 3.0

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	5/		
SUBJECT		COMPUTED BY WCL	DATE 7/7/81

STORAGE VOLUME :

LAKE SURFACE - PLANIMETERED @ 0.19 SQ INS → 17.4 ACRES ←

REF: 10/10/29 DAM APPLICATION → 16.9 ACRES
VOLUME @ SPILLWAY CREST → 140 AC-FT

USGS ELEV	SURF. AREA	(AC-FT) VOLUME	
±75		±10	
96	17.4	140	SPILLCREST ←

DIST. TO TOP DAM
(PLAN) = 6'
MEASURED @ 6.25' ΔVOL = 6 x 17.4 = 104.4

102	17.4	244	TOP-OF-DAM ←

PROJECTED ↓ ΔV = 4 x 17.4 = 69.6 AC-FT

106		314

DISCHARGE - SLOT IN SPILLCREST :

WEIR FLOW $Q = CLH^{3/2}$
H = 0.75'
L = 4.9'
C = 2.63

EXCEEDS BASE FLOW } Q = 8.37 cfs

DAM OVERTOPPING :

$Q = CLH^{3/2}$
L = 105'
RT ABUT - 50'
LT ABUT - 55'(±)
C = 2.63

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	6		
SUBJECT: SPILLWAY DISCHARGES		COMPUTED BY: WCL	DATE: 7/7/81

WEIR FLOW $Q = CLH^{3/2}$

WITHOUT END CONTRACTIONS

FIELD MEASURED - 5/81

CREST TO TOP DAM:

LT = 6.75'

RT = 6.25'

L = 120'

C - VARIES W/ H

REF: HANDBOOK OF HYDRAULICS
KING & BRATER
5TH ED.
TABLE 5-13

USGS ELEV.	H	C	Q		
96	—	3.2	—	(+ SLOT @ 8 cfs)	SPILLCREST
	0.5	3.22	136		
	1	3.38	405		
	1.5	3.46	762		
	2	3.51	1191		
	2.5	3.55	1684		
	3	3.58	2232		
	3.5	3.62	2844		
	4	3.68	3532		
	4.5	3.74	4284		
	5	3.83	5138		
	5.5	↓	5928		
102	6	↓	6754		TOP DAM
	8	↓	10400		PROJECTED ↓
	10	↓	14533		

00-15-1 (3/78)
Formerly GA-17

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
CORTLAND LAKE DAM	7/		
SUBJECT: DISCHARGES :		COMPUTED BY: WCL	DATE: 7/7/81

PLAN DATUM:

MID-LEVEL GATE : 3' x 3' CONC. BOX — ORIFICE FLOW

	INVERT	H
INLET @	96	6'
OUTLET @	90	12'

GATE CONTROL ACCESSABLE

$Q = CA\sqrt{2gH}$

C = 0.6
A = 9

WATER SURFACE @ SPILLCREST : Q = 92 cfs — H = 4.5'
GATE FULLY OPEN

* @ TOP DAM : Q = 140 cfs — H = 10.5
@ H = 12.5 Q = 153 cfs
@ H = 14.5 Q = 165 cfs

RESERVOIR DRAIN : 3' x 3' CONC. BOX — ORIFICE FLOW

	INVERT	H
INLET @	80	22'
OUTLET @	74	28'

GATE CONTROL INACCESSABLE

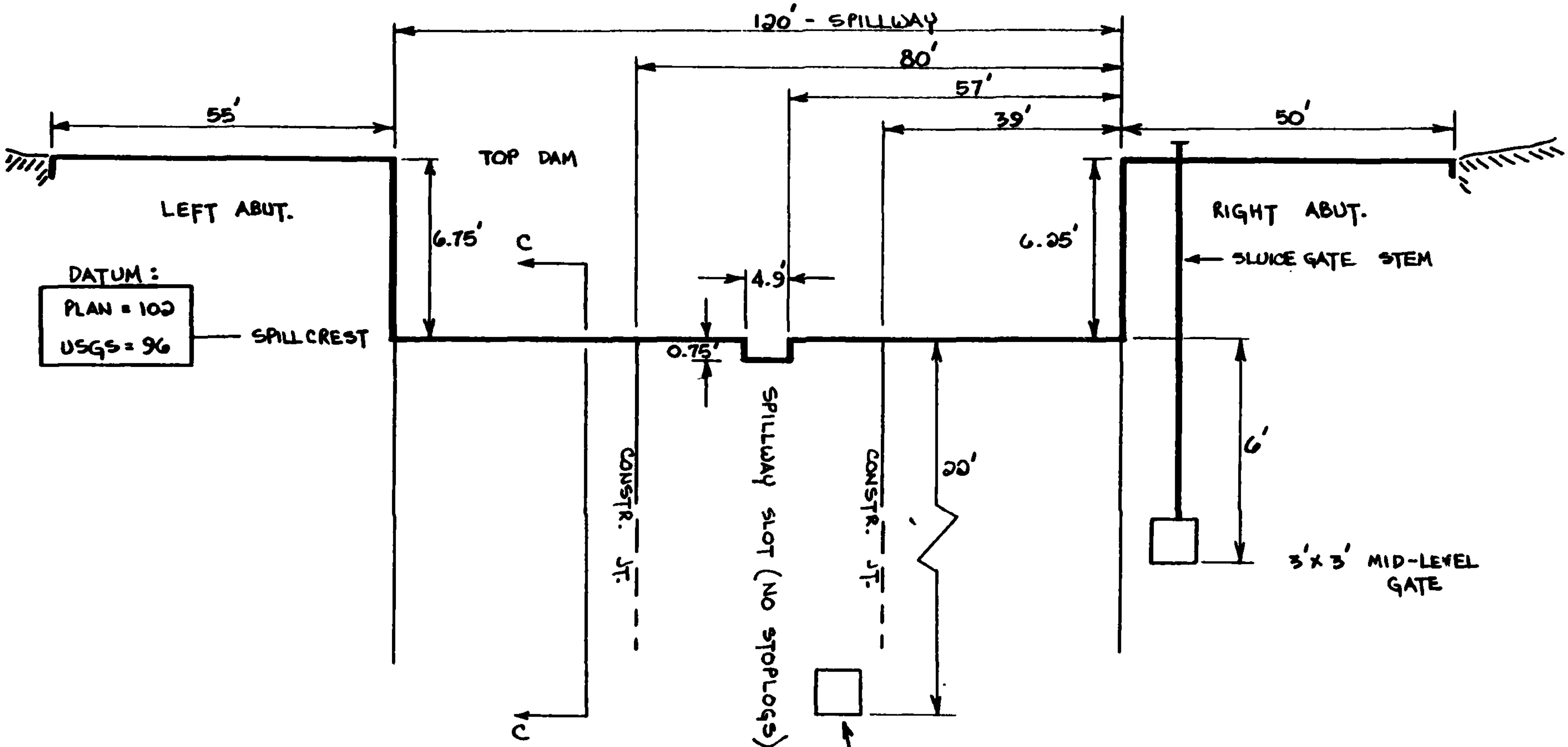
C = 0.6
A = 9

WATER SURFACE @ SPILLCREST : Q = 196 cfs — H = 20.5
GATE FULLY OPEN

@ TOP DAM : Q = 223 cfs — H = 26.5

* MID-LEVEL GATE OPENING (DURING PMF EVENT) :
START GATE OPENING WHEN FLOW DEPTH ON SPILLWAY = 3'

WATER ELEV.	GATE OPENING	Q	HEC-1 Y4/Y5 SPILLWAY Q	TOTAL Q
99	CLOSED	-0-	2232	2232
.5		23	2844	2867
100		46	3532	3578
.5		69	4284	4353
101		93	5138	5231
.5		116	5928	6044
102	FULL OPEN	140	6754	6894
104		153	10400	10553
106		165	14533	14698



SECTION C-C :
SEE OCT. 1929 DWGS.

ELEVATION
(NTS)

FIELD MEASUREMENTS - 5/1981

CORTLAND LAKE DAM
NY - 85

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FLOOD HYDROGRAPH PACKAGE (HEC-1)                                                               NEW YORK STATE
DAM SAFETY VERSION        JULY 1978                                                            DEPT OF ENVIRONMENTAL CONSERVATION
 LAST MODIFICATION  26 FEB 79                                                                  FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL APR 79
**********************************                                                             ********************************
      1                   A1   NY-85      CORTLAND LAKE DAM                              LOWER HUDSON RIVER BASIN
      2                   A2              DEC 213-858 LH -- CANOPUS CREEK                WESTCHESTER COUNTY
      3                   A3              CONTINENTAL VILL. PARK DISTR COMM.             SNYDER UH
      4                   B      120        1       0       0       0       0       0       0       0       0
      5                   B1       5

      6                   J        1        7       1

      7                   J1    0.50     0.51    0.52    0.53    0.54    0.55       1

      8                   K        0   BASIN                                        1

      9                   K1              INFLOW HYDROGRAPH - DAM

     10                   M        1        1   15.15           15.15                             1

     11                   P              21.4     106     119     128     137

     12                   T                                                       1.5     0.1

     13                   W     7.24     0.56

     14                   X       15    -0.25       3

     15                   K        1      DAM                                       1

     16                   K1              ROUTED OUTFLOW - DAM - SPILLCREST ELEV 96-USGS    [illegible]WO GATE  OPEN      <--------

     17                   Y                                 1       1

     18                   Y1       1                                              -96      -1

     19                   Y4   95.25       96    96.5      97    97.5      98    98.5      99    99.5     100

     20                   Y4   100.5      101   101.5     102     104     106

     21                   Y5       0        8     136     405     762    1191    1684    2232    2844    3532

     22                   Y5    4284     5138    5928    6754   10400   14533

     23                   $S      10      140     244     314

     24                   $E      75       96     102     106

     25                   $$      96

     26                   $D     102     2.63     1.5     105

     27                   $.      99

     28                   A

     29                   A

     30                   A
```

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*********************************                                    *********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)                                     NEW YORK STATE
DAM SAFETY VERSION      JULY 1978                                    DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION  26 FEB 79                                       FLOOD PROTECTION BUREAL
  MODIFIED FOR HONEYWELL APR 79
*********************************                                    *********************************

RUN  DATE 07/13/81
                    NY-85     CORTLAND LAKE DAM                              LOWER HUDSON RIVER BASIN
                              DEC 213-858 LH -- CANOPUS CREEK                WESTCHESTER COUNTY
                              CONTINENTAL VILL. PARK DISTR COMM.             SNYDER UH

                                              JOB SPECIFICATION
                    NQ      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
                   120        1        0        0        0        0        0        0        0        0
                                             JOPER      NWT    LROPT    TRACE
                                                 5        0        0        0

                                     MULTI-PLAN ANALYSES TO BE PERFORMED
                                        NPLAN= 1 NRTIO= 7 LRTIO= 1
                    RTIOS=    0.50    0.51    0.52    0.53    0.54    0.55    1.00


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

                                         SUB-AREA RUNOFF COMPUTATION

                              INFLOW HYDROGRAPH - DAM
                                ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                                BASIN        0        0        0        0        0        1        0        0

                                              HYDROGRAPH DATA
                    IHYDG     ILHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                        1        1    15.15       0.    15.15       0.       0.        0        1        0

                                                PRECIP DATA
                              SPFE      PMS       R6      R12      R24      R48      R72      R96
                                0.    21.40   106.00   119.00   128.00   137.00       0.       0.
TRSPC COMPUTED BY THE PROGRAM IS 0.814

                                                 LOSS DATA
               LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTICK    STRTL    CNSTL    ALSMX    RTIMP
                   0       0.       0.     1.00       0.       0.     1.00     1.50     0.10       0.       0.

                                           UNIT HYDROGRAPH DATA
                                        TP=   7.24     CP=0.56     NTA=   0

                                               RECESSION DATA
                                  STRTQ=    15.00     QRCSN=    -0.25     RTIOR= 3.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.15 AND R= 8.12 INTERVALS

                    UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG=   7.30 HOURS, CP= 0.56  VOL= 1.00
                  34.      129.      258.      406.      554.      673.      745.      765.      718.      637.
                 563.      498.      440.      389.      344.      304.      269.      237.      210.      186.
                 164.      145.      128.      113.      100.       85.       78.       69.       61.       54.
                  48.       42.       37.       33.       29.       26.       23.       20.       18.       16.
                  14.       12.       11.       10.        9.        8.        7.        6.

               0                              END-OF-PERIOD FLOW
```

563.	498.	440.	389.	344.	304.	269.	237.	210.	186.
164.	145.	128.	113.	100.	89.	78.	69.	61.	54.
48.	42.	37.	33.	29.	26.	23.	20.	18.	16.
14.	12.	11.	10.	9.	8.	7.	6.		

0

END-OF-PERICD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	0.01	0.	0.01	13.	1.03	13.00	61	0.	0.	0.	2807.
1.01	2.00	2	0.01	0.	0.01	12.	1.03	14.00	62	0.	0.	0.	2515.
1.01	3.00	3	0.01	0.	0.01	11.	1.03	15.00	63	0.	0.	0.	2253.
1.01	4.00	4	0.01	0.	0.01	10.	1.03	16.00	64	0.	0.	0.	2019.
1.01	5.00	5	0.01	0.	0.01	9.	1.03	17.00	65	0.	0.	0.	1809.
1.01	6.00	6	0.01	0.	0.01	8.	1.03	18.00	66	0.	0.	0.	1621.
1.01	7.00	7	0.03	0.	0.03	7.	1.03	19.00	67	0.	0.	0.	1452.
1.01	8.00	8	0.03	0.	0.03	6.	1.03	20.00	68	0.	0.	0.	1301.
1.01	9.00	9	0.03	0.	0.03	6.	1.03	21.00	69	0.	0.	0.	1166.
1.01	10.00	10	0.03	0.	0.03	5.	1.03	22.00	70	0.	0.	0.	1044.
1.01	11.00	11	0.03	0.	0.03	4.	1.03	23.00	71	0.	0.	0.	936.
1.01	12.00	12	0.03	0.	0.03	4.	1.04	0.	72	0.	0.	0.	838.
1.01	13.00	13	0.13	0.	0.13	4.	1.04	1.00	73	0.	0.	0.	751.
1.01	14.00	14	0.16	0.	0.16	3.	1.04	2.00	74	0.	0.	0.	673.
1.01	15.00	15	0.19	0.	0.19	3.	1.04	3.00	75	0.	0.	0.	603.
1.01	16.00	16	0.49	0.	0.49	3.	1.04	4.00	76	0.	0.	0.	540.
1.01	17.00	17	0.18	0.	0.18	2.	1.04	5.00	77	0.	0.	0.	484.
1.01	18.00	18	0.14	0.00	0.14	2.	1.04	6.00	78	0.	0.	0.	434.
1.01	19.00	19	0.01	0.	0.01	2.	1.04	7.00	79	0.	0.	0.	389.
1.01	20.00	20	0.01	0.	0.01	2.	1.04	8.00	80	0.	0.	0.	348.
1.01	21.00	21	0.01	0.	0.01	2.	1.04	9.00	81	0.	0.	0.	312.
1.01	22.00	22	0.01	0.	0.01	2.	1.04	10.00	82	0.	0.	0.	279.
1.01	23.00	23	0.01	0.	0.01	2.	1.04	11.00	83	0.	0.	0.	250.
1.02	0.	24	0.01	0.	0.01	2.	1.04	12.00	84	0.	0.	0.	224.
1.02	1.00	25	0.10	0.00	0.10	2.	1.04	13.00	85	0.	0.	0.	201.
1.02	2.00	26	0.10	0.00	0.10	2.	1.04	14.00	86	0.	0.	0.	180.
1.02	3.00	27	0.10	0.00	0.10	3.	1.04	15.00	87	0.	0.	0.	161.
1.02	4.00	28	0.10	0.00	0.10	5.	1.04	16.00	88	0.	0.	0.	145.
1.02	5.00	29	0.10	0.00	0.10	7.	1.04	17.00	89	0.	0.	0.	130.
1.02	6.00	30	0.10	0.00	0.10	10.	1.04	18.00	90	0.	0.	0.	116.
1.02	7.00	31	0.38	0.28	0.10	23.	1.04	19.00	91	0.	0.	0.	104.
1.02	8.00	32	0.38	0.28	0.10	61.	1.04	20.00	92	0.	0.	0.	93.
1.02	9.00	33	0.38	0.28	0.10	135.	1.04	21.00	93	0.	0.	0.	83.
1.02	10.00	34	0.38	0.28	0.10	248.	1.04	22.00	94	0.	0.	0.	75.
1.02	11.00	35	0.38	0.28	0.10	402.	1.04	23.00	95	0.	0.	0.	67.
1.02	12.00	36	0.38	0.28	0.10	588.	1.05	0.	96	0.	0.	0.	60.
1.02	13.00	37	1.85	1.75	0.10	844.	1.05	1.00	97	0.	0.	0.	54.
1.02	14.00	38	2.22	2.12	0.10	1255.	1.05	2.00	98	0.	0.	0.	48.
1.02	15.00	39	2.77	2.67	0.10	1898.	1.05	3.00	99	0.	0.	0.	43.
1.02	16.00	40	7.02	6.92	0.10	2993.	1.05	4.00	100	0.	0.	0.	39.
1.02	17.00	41	2.59	2.49	0.10	4536.	1.05	5.00	101	0.	0.	0.	35.
1.02	18.00	42	2.03	1.93	0.10	6700.	1.05	6.00	102	0.	0.	0.	31.
1.02	19.00	43	0.16	0.06	0.10	8919.	1.05	7.00	103	0.	0.	0.	28.
1.02	20.00	44	0.16	0.06	0.10	10369.	1.05	8.00	104	0.	0.	0.	25.
1.02	21.00	45	0.16	0.06	0.10	12506.	1.05	9.00	105	0.	0.	0.	22.
1.02	22.00	46	0.16	0.06	0.10	13327.	1.05	10.00	106	0.	0.	0.	20.
1.02	23.00	47	0.16	0.06	0.10	13337.	1.05	11.00	107	0.	0.	0.	18.
1.03	0.	48	0.16	0.06	0.10	12743.	1.05	12.00	108	0.	0.	0.	16.
1.03	1.00	49	0.	0.	0.	11642.	1.05	13.00	109	0.	0.	0.	14.
1.03	2.00	50	0.	0.	0.	10432.	1.05	14.00	110	0.	0.	0.	13.
1.03	3.00	51	0.	0.	0.	9274.	1.05	15.00	111	0.	0.	0.	12.
1.03	4.00	52	0.	0.	0.	8237.	1.05	16.00	112	0.	0.	0.	[illegible]

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1.03	1.00	49	0.	0.	0.	11542.	1.05	13.00	109	0.	0.	0.	14.
1.03	2.00	50	0.	0.	0.	10432.	1.05	14.00	110	0.	0.	0.	13.
1.03	3.00	51	0.	0.	0.	9274.	1.05	15.00	111	0.	0.	0.	12.
1.03	4.00	52	0.	0.	0.	8237.	1.05	16.00	112	0.	0.	0	10.
1.03	5.00	53	0.	0.	0.	7309.	1.05	17.00	113	0.	0.	0.	9.
1.03	6.00	54	0.	0.	0.	6478.	1.05	18.00	114	0.	0.	0.	8.
1.03	7.00	55	0.	0.	0.	5735.	1.05	19.00	115	0.	0.	0.	7.
1.03	8.00	56	0.	0.	0.	5072.	1.05	20.00	116	0.	0.	0.	7.
1.03	9.00	57	0.	0.	0.	4484.	1.05	21.00	117	0.	0.	0.	6.
1.03	10.00	58	0.	0.	0.	3963.	1.05	22.00	118	0.	0.	0.	5.
.03	11.00	59	0.	0.	0.	3504.	1.05	23.00	119	0.	0.	0.	5.
.03	12.00	60	0.	0.	0.	3133.	1.06	0.	120	0.	0.	0.	4.

SUM 23.87 19.90 3.57 197992.
(606.)(506.)(101.)(5606.51)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13397.	12386.	7202.	2745.	197982.
CMS	379.	351.	204.	78.	5606.
INCHES		7.61	17.69	20.22	20.26
MM		153.17	449.27	513.56	514.62
AC-FT		6142.	14284.	16332.	16362.
THOUS CU M		7576.	17619.	20145.	20182.

HYDROGRAPH AT STA BASIN FOR PLAN 1, RTIO 1

7.	6.	5.	5.	4.	4.	3.	3.	3.	2.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	4.	5.
11.	31.	67.	124.	201.	294.	422.	628.	949.	1491.
2318.	3350.	4459.	5484.	6253.	6664.	6699.	6371.	5821.	5216.
4637.	4118.	3654.	3239.	2867.	2536.	2242.	1982.	1752.	1567.
1404.	1258.	1127.	1009.	904.	810.	726.	650.	583.	522.
468.	419.	376.	336.	301.	270.	242.	217.	194.	174.
156.	140.	125.	112.	100.	90.	81.	72.	65.	58.
52.	47.	42.	37.	33.	30.	27.	24.	22.	19.
17.	16.	14.	12.	11.	10.	9.	8.	7.	6.
6.	5.	5.	4.	4.	3.	3.	3.	2.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6699.	6193.	3601.	1372.	98991.
CMS	190.	175.	102.	39.	2803.
INCHES		3.80	8.84	10.11	10.13
MM		96.59	224.63	256.83	257.31
AC-FT		3071.	7142.	8166.	8181.
THOUS CU M		3788.	8810.	10072.	10091.

HYDROGRAPH AT STA BASIN FOR PLAN 1, RTIO 2

7.	6.	6.	5.	4.	4.	4.	3.	3.	3.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	4.	5.
12.	31.	69.	127.	205.	300.	430.	640.	968.	1521.
2335.	3417.	4548.	5594.	6378.	6797.	6833.	6499.	5938.	5321.
4730.	4201.	3727.	3304.	2925.	2587.	2287.	2021.	1787.	1598.
1432.	1283.	1149.	1030.	923.	827.	741.	664.	594.	533.
477.	428.	383.	343.	308	276.	247.	221.	198.	178.
159.	143.	128.	114.	103.	92.	82.	74.	66.	59.
53.	48.	43.	38.	34.	31.	27.	25.	22.	20.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6699.	6193.	3601.	1372.	98991.
CMS	190.	175.	102.	39.	2803.
INCHES		3.80	8.84	10.11	10.13
MM		96.59	224.63	256.83	257.31
AC-FT		3071.	7142.	8166.	8181.
THOUS CU M		3788.	8810.	10072.	10091.

HYDROGRAPH AT STA BASIN FOR PLAN 1, RTIO 2

7.	6.	6.	5.	4.	4.	4.	3.	3.	3.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	4.	5.
12.	31.	69.	127.	205.	300.	430.	640.	968.	1521.
2365.	3417.	4548.	5594.	6378.	5797.	6833.	6499.	5938.	5321.
4730.	4201.	3721.	3304.	2925.	2587.	2287.	2021.	1787.	1558.
1432.	1283.	1145.	1030.	923.	827.	741.	664.	594.	533.
477.	428.	383.	343.	308.	276.	247.	221.	198.	178.
159.	143.	128.	114.	103.	92.	82.	74.	66.	59.
53.	48.	43.	38.	34.	31.	27.	25.	22.	20.
18.	16.	14.	13.	11.	10.	9.	8.	7.	7.
6.	5.	5.	4.	4.	3.	3.	3.	2.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6833.	6317.	3673.	1400.	100971.
CMS	193.	179.	104.	40.	2859.
INCHES		3.88	9.02	10.31	10.33
MM		98.52	229.13	261.97	262.46
AC-FT		3132.	7285.	8329.	8345.
THOUS CU M		3864.	8986.	10274.	10293.

HYDROGRAPH AT STA BASIN FOR PLAN 1, RTIO 3

7.	6.	6.	5.	5.	4.	4.	3.	3.	3.
2.	2.	2.	2.	2.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	4.	5.
12.	32.	70.	129.	209.	306.	439.	653.	987.	1551.
2411.	3484.	4638.	5704.	6503.	5930.	6967.	6626.	6054.	5425.
4823.	4283.	3800.	3368.	2982.	2637.	2331.	2061.	1822.	1629.
1460.	1308.	1172.	1050.	941.	843.	755.	677.	606.	543.
487.	436.	391.	350.	314.	281.	252.	226.	202.	181.
162.	145.	130.	117.	105.	94.	84.	75.	67.	60.
54.	48.	43.	39.	35.	31.	28.	25.	22.	20.
18.	16.	14.	13.	12.	10.	9.	8.	7.	7.
6.	5.	5.	4.	4.	3.	3.	3.	2.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6967.	6441.	3745.	1427.	102951.
CMS	197.	182.	106.	40.	2915.
INCHES		3.95	9.20	10.52	10.54
MM		100.45	233.62	267.10	267.60
AC-FT		3194.	7428.	8492.	8508.
THOUS CU M		3939.	9162.	10475.	10495.

HYDROGRAPH AT STA BASIN FOR PLAN 1, RTIO 4

7.	6.	6.	5.	5.	4.	4.	3.	3.	3.
2.	2.	2.	2.	2.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	3.	4.	5.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7369.	6812.	3961.	1510.	108870.
CMS	209.	193.	112.	43.	3083.
INCHES		4.18	9.73	11.12	11.14
MM		106.24	247.10	282.51	283.04
AC-FT		3378.	7856.	8982.	8999.
THOUS CU M		4167.	9691.	11080.	11100.

HYDROGRAPH AT STA BASIN FOR PLAN 1, RTIO 7

13.	12.	11.	10.	9.	8.	7.	6.	6.	5.
4.	4.	4.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	3.	5.	7.	10.
23.	61.	135.	248.	402.	588.	844.	1255.	1898.	2983.
4636.	6700.	8915.	10969.	12506.	13327.	13397.	12743.	11642.	10432.
9274.	8237.	7305.	6478.	5735.	5072.	4484.	3963.	3504.	3133.
2807.	2515.	2253.	2019.	1809.	1621.	1452.	1301.	1166.	1044.
936.	838.	751.	673.	603.	540.	484.	434.	389.	348.
312.	279.	250.	224.	201.	180.	161.	145.	130.	116.
104.	93.	83.	75.	67.	60.	54.	48.	43.	39.
35.	31.	28.	25.	22.	20.	18.	16.	14.	13.
12.	10.	9.	8.	7.	7.	6.	5.	5.	4.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13397.	12386.	7202.	2745.	197982.
CMS	379.	351.	204.	78.	5606.
INCHES		7.61	17.69	20.22	20.26
MM		193.17	449.27	513.66	514.62
AC-FT		6142.	14284.	16332.	16362.
THOUS CU M		7576.	17619.	20145.	20182.

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HYDROGRAPH ROUTING

ROUTED OUTFLOW - DAM - SPILLCREST ELEV 96-USGS [redacted]NO GATE OPEN

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.	0.	0.	-96.	-1

STAGE	95.25	96.00	96.50	97.00	97.50	98.00	98.50	99.00	99.50	100.00
	100.50	101.00	101.50	102.00	104.00	106.00				
FLOW	0.	8.00	136.00	405.00	762.00	1191.00	1684.00	2232.00	2844.00	3532.00
	4284.00	5138.00	5928.00	6754.00	10400.00	14533.00				

CAPACITY=	10.	140.	244.	.14.
ELEVATION=	75.	96.	102.	106.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL

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HYDROGRAPH ROUTING

ROUTED OUTFLOW - DAM - SPILLCREST ELEV 96-USGS WQ GATE OPEN

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.	0.	0.	-96.	-1

STAGE	95.25	96.00	96.50	97.00	97.50	98.00	98.50	99.00	99.50	100.00
	100.50	101.00	101.50	102.00	104.00	106.00				
FLOW	0.	8.00	136.00	405.00	762.00	1191.00	1684.00	2232.00	2844.00	3532.00
	4284.00	5138.00	5528.00	6754.00	10400.00	14533.00				

CAPACITY=	10.	140.	244.	314.
ELEVATION=	75.	96.	102.	106.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
96.0	0.	0.	0.	0.	0.	0.	0.

DAM DATA

TOPEL	COQD	EXPD	DAMWID
102.0	2.6	1.5	105.

STATION DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

8.	8.	8.	7.	7.	7.	6.	6.	5.	5.
5.	4.	4.	4.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
3.	5.	26.	79.	146.	260.	370.	561.	853.	1353.
2141.	3180.	4307.	5371.	5159.	6636.	6708.	6432.	5897.	5259.
4704.	4183.	3715.	3298.	2923.	2591.	2250.	2031.	1754.	1602.
1438.	1287.	1155.	1038.	929.	833.	747.	673.	602.	540.
485.	433.	390.	352.	315.	282.	253.	227.	203.	182.
163.	146.	133.	122.	110.	99.	89.	79.	71.	64.
57.	52.	46.	41.	37.	33.	30.	27.	24.	21.
19.	17.	15.	14.	12.	11.	10.	9.	8.	8.
8.	8.	7.	7.	7.	6.	6.	5.	5.	5.

STORAGE

140.	140.	140.	140.	139.	139.	139.	139.	139.	138.
138.	138.	138.	138.	137.	137.	137.	137.	137.	137.
137.	137.	137.	136.	13[illegible].	136.	136.	136.	136.	137.
137.	139.	141.	145.	149.	153.	156.	161.	168.	179.
191.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			

17.	17.	15.	14.	12.	11.	10.	9.	[illegible]	[illegible]
8.	8.	7.	7.	7.	6.	6.	5.	5.	5.

STORAGE

140.	140.	140.	140.	139.	139.	139.	139.	139.	138.
138.	138.	138.	138.	137.	137.	137.	137.	137.	137.
137.	137.	137.	136.	136.	136.	136.	136.	136.	137.
137.	138.	141.	145.	149.	153.	156.	161.	168.	179.
151.	205.	218.	229.	238.	243.	244.	241.	235.	228.
222.	217.	211.	206.	202.	197.	193.	189.	185.	182.
179.	176.	174.	172.	169.	167.	166.	164.	162.	161.
159.	158.	157.	156.	154.	153.	152.	152.	151.	150.
150.	149.	148.	148.	147.	146.	145.	145.	144.	144.
143.	143.	143.	142.	142.	142.	141.	141.	141.	141.
141.	141.	140.	140.	140.	140.	140.	140.	140.	140.
140.	140.	140.	139.	139.	139.	139.	138.	138.	138.

STAGE

96.0	96.0	96.0	95.9	95.9	95.9	95.8	95.8	95.8	95.7
95.7	95.7	95.6	95.6	95.6	95.5	95.5	95.5	95.5	95.5
95.5	95.5	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.5
95.5	95.8	96.1	96.3	96.5	96.7	96.9	97.2	97.6	98.2
98.9	99.7	100.5	101.1	101.6	101.9	102.0	101.8	101.5	101.1
100.7	100.4	100.1	99.8	99.6	99.3	99.0	98.8	98.6	98.4
98.3	98.1	98.0	97.8	97.7	97.6	97.5	97.4	97.3	97.2
97.1	97.0	97.0	96.9	96.8	96.8	96.7	96.7	96.6	96.6
96.6	96.5	96.5	96.4	96.4	96.4	96.3	96.3	96.2	96.2
96.2	96.2	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1
96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
96.0	96.0	95.9	95.9	95.9	95.8	95.8	95.8	95.7	95.7

PEAK OUTFLOW IS 6708. AT TIME 47.00 HOURS

RATIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6708.	6195.	3598.	1372.	99028.
CMS	190.	175.	102.	39.	2804.
INCHES		3.80	8.84	10.11	10.13
MM		96.61	224.44	256.76	257.41
AC-FT		3072.	7136.	8164.	8184.
THOUS CU M		3789.	8802.	10070.	10095.

STATION DAM, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

8.	8.	8.	7.	7.	7.	6.	6.	6.	5.
5.	4.	4.	4.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
3.	5.	27.	81.	150.	265.	378.	573.	871.	1381.
2184.	3247.	4395.	5475.	6285.	6767.	6844.	6557.	6016.	5403.
4800.	4263.	3796.	3361.	2983.	2641.	2337.	2069.	1830.	1632.
1467.	1313.	1178.	1059.	948.	849.	751.	697.	614.	550.
493.	442.	397.	359.	321.	288.	258.	231.	207.	186.
166.	149.	135.	124.	112.	101.	90.	81.	73.	65.
58.	53.	47.	42.	38.	34.	30.	27.	24.	22.
20.	18.	16.	14.	13.	11.	10.	9.	8.	8.
8.	8.	7.	7.	7.	6.	6.	5.	5.	5.

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
3.	5.	27.	81.	150.	265.	378.	573.	871.	1381.
2184.	3247.	4395.	5475.	6285.	6767.	6844.	6557.	6016.	5403.
4800.	4263.	3796.	3361.	2983.	2641.	2337.	2069.	1830.	1632.
1457.	1313.	1178.	1059.	948.	849.	761.	697.	614.	550.
453.	442.	397.	359.	321.	288.	258.	231.	207.	186.
166.	149.	135.	124.	112.	101.	90.	81.	73.	65.
58.	53.	47.	42.	38.	34.	30.	27.	24.	22.
20.	18.	16.	14.	13.	11.	10.	9.	8.	8.
8.	8.	7.	7.	7.	6.	6.	5.	5.	5.

STORAGE

140.	140.	140.	140.	139.	139.	139.	139.	139.	138.
138.	138.	138.	138.	137.	137.	137.	137.	137.	137.
137.	137.	137.	136.	136.	136.	136.	136.	136.	137.
137.	139.	141.	145.	149.	153.	156.	161.	168.	178.
191.	206.	215.	230.	239.	244.	245.	242.	236.	230.
223.	218.	212.	207.	202.	198.	193.	189.	186.	182.
180.	177.	174.	172.	170.	168.	166.	164.	162.	161.
159.	158.	157.	156.	155.	154.	153.	152.	151.	150.
150.	149.	149.	148.	147.	146.	146.	145.	144.	144.
143.	143.	143.	142.	142.	142.	142.	141.	141.	141.
141.	141.	141.	140.	140.	140.	140.	140.	140.	140.
140.	140.	140.	139.	139.	139.	139.	139.	138.	138.

STAGE

96.0	96.0	96.0	95.9	95.9	95.9	95.8	95.8	95.8	95.7
95.7	95.7	95.6	95.6	95.6	95.6	95.5	95.5	95.5	95.5
95.5	95.5	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.5
95.5	95.8	96.1	96.3	96.5	96.7	96.9	97.2	97.6	98.2
99.0	99.8	100.6	101.2	101.7	102.0	102.0	101.9	101.6	101.2
100.8	100.5	100.2	99.9	99.6	99.3	99.1	98.9	98.6	98.4
98.3	98.1	98.0	97.8	97.7	97.6	97.5	97.4	97.3	97.2
97.1	97.1	97.0	96.9	96.8	96.8	96.7	96.7	96.6	96.6
96.6	96.5	96.5	96.5	96.4	96.4	96.3	96.3	96.3	96.2
96.2	96.2	96.2	96.1	96.1	96.1	96.1	96.1	96.1	96.1
96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
96.0	96.0	95.9	95.9	95.9	95.8	95.8	95.8	95.7	95.7

PEAK OUTFLOW IS 6844. AT TIME 47.00 HOURS

RATIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6844.	6316.	3570.	1399.	101007.
CMS	194.	179.	104.	40.	2860.
INCHES		3.88	9.01	10.31	10.34
MM		98.54	228.93	261.90	262.55
AC-FT		3133.	7279.	8327.	8348.
THOUS CU M		3865.	8978.	10271.	10297.

STATION DAM, PLAN 1, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

8.	8.	8.	8.	7.	7.	6.	6.	6.	5.
5.	5.	4.	4.	4.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

STATION DAM, PLAN 1, RATIO 7

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

12.	13.	12.	11.	10.	9.	8.	8.	8.	7.
7.	7.	6.	6.	6.	5.	5.	4.	4.	4.
4.	3.	3.	3.	3.	3.	3.	3.	3.	4.
6.	22.	80.	178.	344.	527.	766.	1147.	1750.	2764.
4384.	6430.	8710.	10795.	12416.	13282.	13421.	12813.	11740.	10538.
9380.	8330.	7400.	6571.	5831.	5155.	4549.	4033.	3564.	3187.
2855.	2566.	2295.	2053.	1847.	1657.	1488.	1332.	1194.	1074.
961.	862.	772.	696.	623.	559.	500.	448.	403.	364.
326.	292.	262.	234.	210.	188.	169.	151.	136.	126.
114.	102.	92.	82.	74.	66.	59.	53.	48.	43.
38.	34.	31.	28.	25.	22.	20.	18.	16.	14.
13.	11.	10.	9.	8.	8.	8.	8.	7.	7.

STORAGE

140.	140.	140.	140.	140.	140.	140.	140.	140.	140.
139.	139.	139.	139.	139.	138.	138.	138.	138.	138.
137.	137.	137.	137.	137.	137.	137.	137.	137.	138.
139.	141.	145.	150.	155.	160.	166.	174.	184.	200.
219.	241.	260.	276.	287.	293.	253.	290.	283.	274.
266.	257.	250.	242.	234.	227.	221.	215.	210.	205.
201.	197.	193.	189.	186.	183.	180.	177.	175.	172.
170.	168.	166.	164.	163.	161.	160.	158.	157.	156.
155.	154.	153.	152.	151.	150.	150.	149.	149.	149.
147.	146.	146.	145.	144.	144.	143.	143.	143.	142.
142.	142.	142.	141.	141.	141.	141.	141.	141.	140.
140.	140.	140.	140.	140.	140.	140.	140.	140.	139.

STAGE

96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
95.9	95.9	95.8	95.8	95.8	95.7	95.7	95.7	95.6	95.6
95.6	95.6	95.5	95.5	95.5	95.5	95.5	95.5	95.6	95.6
95.8	96.1	96.3	96.6	96.9	97.2	97.5	97.9	98.6	99.4
100.6	101.8	102.9	103.8	104.5	104.8	104.8	104.6	104.2	103.7
103.2	102.8	102.3	101.9	101.4	101.0	100.7	100.3	100.0	99.7
99.5	99.3	99.1	98.8	98.6	98.5	98.3	98.1	98.0	97.5
97.7	97.6	97.5	97.4	97.3	97.2	97.1	97.1	97.0	96.9
96.9	96.8	96.7	96.7	96.6	96.6	96.6	96.5	96.5	96.5
96.4	96.4	96.3	96.3	96.3	96.2	96.2	96.2	96.2	96.1
96.1	96.1	96.1	96.1	96.1	96.1	96.0	96.0	96.0	96.0
96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	95.9	95.5

PEAK OUTFLOW IS 13421. AT TIME 47.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13421.	12390.	7197.	2744.	198005.
CMS	380.	351.	204.	78.	5607.
INCHES		7.61	17.63	20.22	20.26
MM		193.23	449.03	513.62	514.68
AC-FT		6144.	14276.	16330.	16364.
THOUS CU M		7578.	17609.	20143.	20185.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS						
OPERATION	STATION	AREA	PLAN	RATIO 1 0.50	RATIO 2 0.51	RATIO 3 0.52	RATIO 4 0.53	RATIO 5 0.54	RATIO 6 0.55	RATIO 7 1.00
HYDROGRAPH AT	BASIN	15.15 (32089.28)	1	6659. (189.69)(	6833. 193.48)(	6967. 197.27)(	7101. 201.07)(	7235. 204.86)(	7369. 208.65)(	13397. 379.37)(
ROUTED TO	DAM	15.15 (32089.28)	1	6708. (189.95)(	6844. 193.81)(	6978. 197.60)(	7111. 201.37)(	7244. 205.13)(	7378. 208.91)(	13421. 380.04)(

WITH GATE CLOSED :

CORTLAND LAKE DAM
NY-85

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	96.00	96.00	102.00
STORAGE	140.	140.	244.
OUTFLOW	8.	8.	6754.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	101.97	0.	244.	6708.	0.	47.00	0.
0.51	102.05	0.05	245.	6844.	2.00	47.00	0.
0.52	102.12	0.12	246.	6978.	2.00	47.00	0.
0.53	102.18	0.18	247.	7111.	3.00	47.00	0.
0.54	102.25	0.25	248.	7244.	3.00	47.00	0.
0.55	102.32	0.32	250.	7378.	4.00	47.00	0.
1.00	104.83	2.83	293.	13421.	11.00	47.00	0.

WITH GATE CLOSED :

CORTLAND LAKE DAM
NY-85

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**********************************                                            **********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)                                              NEW YORK STATE
DAM SAFETY VERSION      JULY 1978                                             DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION  26 FEB 79                                                FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL APR 79
**********************************                                            **********************************
       1                  A1  NY-85     CORTLAND LAKE DAM                      LOWER HUDSON RIVER BASIN
       2                  A2            DEC 213-858 LH -- CANOPUS CREEK        WESTCHESTER COUNTY
       3                  A3            CONTINENTAL VILL. PARK DISTR COMM.     SNYDER UH
       4                  B     120       1       0       0       0       0       0       0       0       0
       5                  B1      5

       6                  J       1       7       1

       7                  J1   0.50    0.51    0.52    0.53    0.54    0.55       1

       8                  K       0   BASIN                                       1

       9                  K1            INFLOW HYDROGRAPH - DAM

      10                  M       1       1   15.15           15.15                               1

      11                  P            21.4     106     119     128     137

      12                  T                                                     1.5     0.1

      13                  W    7.24    0.56

      14                  X      15   -0.25       3

      15                  K       1     DAM                                       1
                                                                                     WITH
      16                  K1            ROUTED OUTFLOW - DAM - SPILLCREST ELEV 96-USGS  [redacted] GATE  OPEN

      17                  Y                               1       1

      18                  Y1      1                                             -96      -1

      19                  Y4  95.25      56    96.5      97    97.5      98    98.5      99    99.5     100

      20                  Y4  100.5     101   101.5     102     104     106

      21                  Y5      0       8     136     405     762    1191    1684    2232    2867    3578

      22                  Y5   4353    5231    6044    6894   10553   14698

      23                  $S     10     140     244     314

      24                  $E     75      56     102     106

      25                  $$     96

      26                  $D    102    2.63     1.5     105

      27                  K      99

      28                  A

      29                  A

      30                  A
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13

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**********************************                                             **********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)                                               NEW YORK STATE
DAM SAFETY VERSION        JULY 1978                                            DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION  26 FEB 79                                                 FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL APR 79
**********************************                                             **********************************

RUN  DATE 07/13/81
                      NY-85      CORTLAND LAKE DAM                                  LOWER HUDSON RIVER BASIN
                                 DEC 213-858 LH -- CANOPUS CREEK                    WESTCHESTER COUNTY
                                 CONTINENTAL VILL. PARK DISTR COMM.                 SNYDER UH

                                               JOB SPECIFICATION
                      NQ       NHR      NMIN     IDAY      IHR     IMIN    METRC      IPLT     IPRT    NSTAN
                     120         1         0        0        0        0        0         0        0        0
                                                JOPER      NWT    LROPT    TRACE
                                                    5        0        0        0

                                          MULTI-PLAN ANALYSES TO BE PERFORMED
                                             NPLAN= 1 NRTIO= 7 LRTIO= 1
                       RTIOS=    0.50    0.51    0.52    0.53    0.54    0.55    1.00


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

                                               SUB-AREA RUNOFF COMPUTATION

                                INFLOW HYDROGRAPH - DAM
                                  ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                                  EASIN        0        0        0        0        0        1        0        0

                                                  HYDROGRAPH DATA
                      IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                          1        1    15.15       0.    15.15       0.       0.        0        1        0

                                                    PRECIP DATA
                              SPFE      PMS       R6      R12      R24      R48      R72      R96
                                0.    21.40   106.00   119.00   123.00   137.00       0.       0.
TRSPC COMPUTED BY THE PROGRAM IS 0.814

                                                      LOSS DATA
                 LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
                     0       0.       0.     1.00       0.       0.     1.00     1.50     0.10       0.       0.

                                                 UNIT HYDROGRAPH DATA
                                             TP=  7.24     CP=0.56     NTA=  0

                                                   RECESSION DATA
                                    STRTQ=    15.00    QRCSN=    -0.25    RTIOR= 3.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.15 AND R= 8.12 INTERVALS

                    UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG=   7.30 HOURS, CP= 0.56  VOL= 1.00
                  34.       128.       258.       406.       554.       673.       745.       765.       718.       637.
                 563.       458.       440.       389.       344.       304.       269.       237.       210.       186.
                 164.       145.       128.       113.       100.        85.        78.        69.        61.        54.
                  48.        42.        37.        33.        29.        26.        23.        20.        18.        16.
                  14.        12.        11.        10.         9.         8.         7.         6.

             0                                 END-OF-PERIOD FLOW
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CMS	379.	351.	234.	78.	5606.
INCHES		7.61	17.69	20.22	20.26
MM		153.17	449.27	513.66	514.62
AC-FT		6142.	14234.	16332.	16362.
THOUS CU M		7576.	17619.	20145.	20182.

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

HYDROGRAPH ROUTING

ROUTED OUTFLOW - DAM - SPILLCREST ELEV 96-USGS W/[redacted] GATE OPEN

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.	0.	0.	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.	0.	0.	-96.	-1

STAGE	95.25	96.00	96.50	97.00	97.50	98.00	98.50	99.00	99.50	100.00
	100.50	101.00	101.50	102.00	104.00	106.00				
FLOW	0.	8.00	136.00	405.00	762.00	1191.00	1684.00	2232.00	2867.00	3578.00
	4353.00	5231.00	6044.00	6894.00	10553.00	14658.00				

CAPACITY=	10.	140.	244.	314.
ELEVATION=	75.	96.	102.	106.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
56.0	0.	0.	0.	0.	0.	0.	0.

DAM DATA

TOPEL	COQD	EXPD	DAMWID
102.0	2.6	1.5	105.

STATION DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

8.	8.	8.	7.	7.	7.	6.	6.	5.	5.
5.	4.	4.	4.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
3.	5.	26.	79.	146.	260.	370.	561.	853.	1353.
2141.	3188.	4309.	5376.	6160.	6638.	6706.	6432.	5895.	5257.
4700.	4184.	3716.	3298.	2920.	2590.	2287.	2031.	1793.	1602.
1438.	1287.	1155.	1038.	929.	833.	747.	673.	602.	540.
483.	433.	390.	352.	315.	282.	253.	227.	203.	182.
163.	146.	133.	122.	110.	95.	89.	79.	71.	64.
57.	52.	46.	41.	37.	33.	30.	27.	24.	21.
19.	17.	15.	14.	12.	11.	10.	9.	8.	8.
8.	8.	7.	7.	7.	6.	6.	5.	5.	5.

STORAGE

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 0.50	RATIO 2 0.51	RATIO 3 0.52	RATIO 4 0.53	RATIO 5 0.54	RATIO 6 0.55	RATIO 7 1.00
HYDROGRAPH AT	BASIN	15.15	1	6699.	6833.	6967.	7101.	7235.	7369.	13397.
		(32089.37)		(189.69)(	193.48)(	197.27)(	201.07)(	204.86)(	208.65)(	379.37)(
ROUTED TO	DAM	15.15	1	6706.	6842.	6977.	7112.	7246.	7379.	13418.
		(32089.37)		(189.89)(	193.74)(	197.58)(	201.39)(	205.18)(	208.95)(	379.95)(

WITH GATE OPEN :

CORTLAND LAKE DAM
NY-85

SUMMARY OF DAM SAFETY ANALYSIS

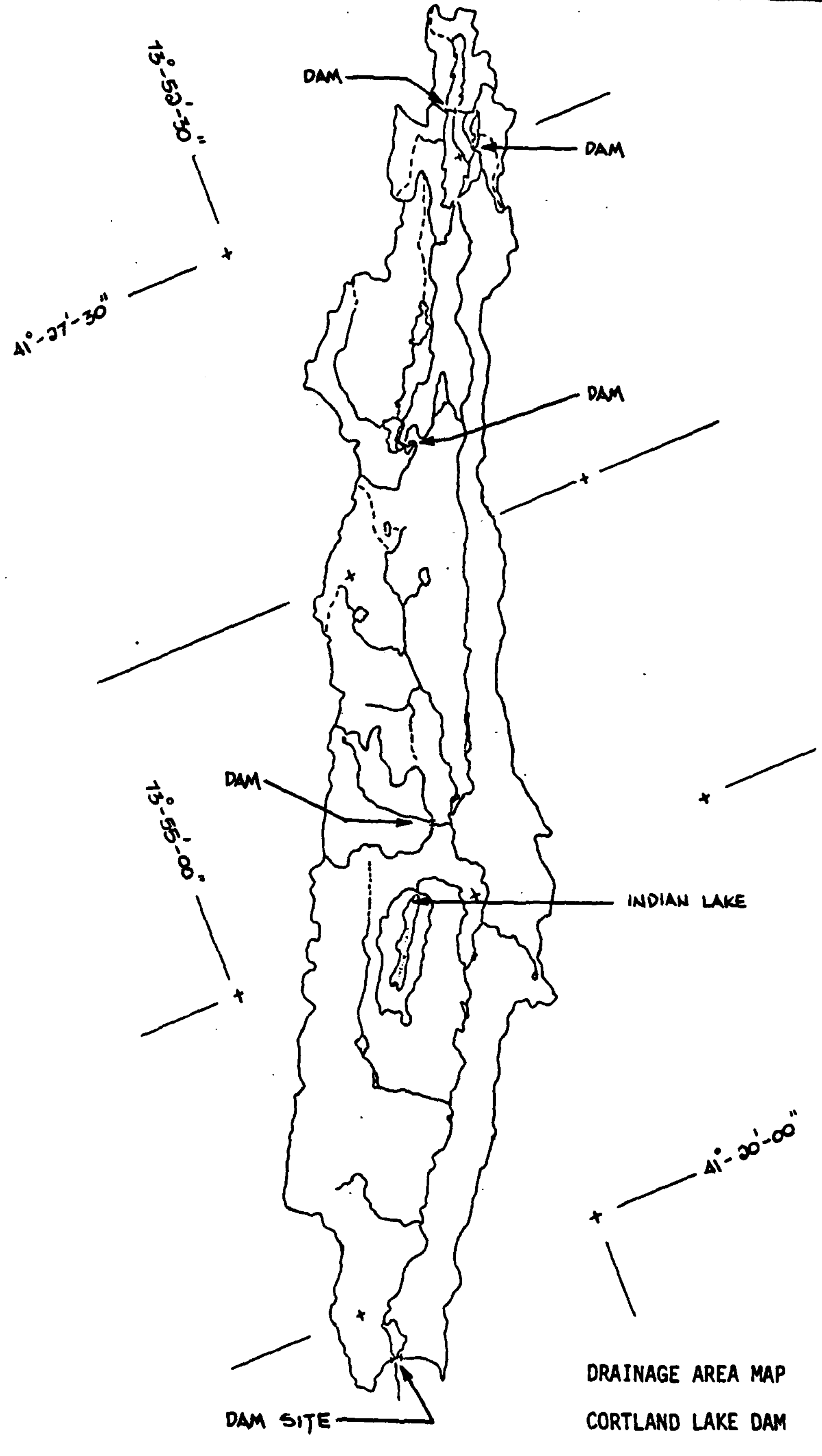
PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	96.00	96.00	102.00
STORAGE	140.	140.	244.
OUTFLOW	8.	8.	6894.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	101.89	0.	242.	6706.	0.	47.00	0.
0.51	101.97	0.	243.	6842.	0.	47.00	0.
0.52	102.04	0.04	245.	6977.	2.00	47.00	0.
0.53	102.11	0.11	246.	7112.	2.00	47.00	0.
0.54	102.18	0.18	247.	7246.	3.00	47.00	0.
0.55	102.25	0.25	248.	7379.	3.00	47.00	0.
1.00	104.77	2.77	292.	13418.	11.00	47.00	0.

WITH GATE OPEN :

CORTLAND LAKE DAM
NY-85



DRAINAGE AREA MAP

CORTLAND LAKE DAM

NY-85

Scale: Unknown

Discharge measurements made at low-flow partial-record stations during water year 1966 -- Continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements Date	Measurements Discharge (cfs)
		Hudson River basin -- Continued				
3642	Saw Kill at Sawkill, N. Y.	Lat 41°58'46", long 74°00'52", at bridge on Kingston-Sawkill road, 1.0 mile east of Sawkill, Ulster County.	41.6	1951, 1954, 1956-61, 1964, 1966	7-14-66	2.33
*3644	Plattkill Creek at Mount Marion, N. Y.	Lat 42°02'22", long 73°59'50", 400 ft downstream from bridge on town road just off Glasco Rd., 0.5 mile west of Mt. Marion, Ulster County, and 2.5 miles upstream from mouth.	36.6	1962-64, 1966	11-26-65 6-30-66	28.0 6.93
3647	Saw Kill at Rock City, N. Y.	Lat 41°58'15", long 73°49'19", at bridge on State Highway 199, at Rock City, Dutchess County.	6.01	1956-62, 1965-66	7-14-66	1.04
3668	Vernooy Kill at Wawarsing, N. Y.	Lat 41°45'28", long 74°21'30", at abandoned pump house, just off State Highway 209, 0.5 mile northwest of Wawarsing, Ulster County.	23.5	1956-61, 1964-66	6-29-66	10.6
*3720.1	Landsman Kill at Rhinebeck, N. Y.	Lat 41°55'22", long 73°54'46", at bridge on US Highway 9, at Rhinebeck, Dutchess County.	10.9	1956-62, 1964-66	7-12-66	1.11
3720.3	Fallsburg Creek near Rhinebeck, N. Y.	Lat 41°53'33", long 73°54'52", at highway bridge on Fox Hollow Road, 2.4 miles south of Rhinebeck, Dutchess County.	3.58	1956-62, 1964-66	7-12-66	a .03
*3720.4	Crum Elbow Creek at Hyde Park, N. Y.	Lat 41°47'24", long 73°55'53", at bridge on Hyde Park-East Park Road, at Hyde Park, Dutchess County, and 0.3 mile east of US Highway 9.	18.6	1956-58, 1959-62ƒ, 1964, 1966	8-[illegible]-66	.28
3726	Quassaic Creek near Newburgh, N. Y.	Lat 41°31'28", long 74°03'24", at bridge on Powder Mill Road, 0.4 mile northeast of State Highway 52 near Newburgh, Orange County.	15.5	1956-61, 1964-66	7-13-66	.28
3727	Gidneytown Creek at Newburgh, N.Y.	Lat 41°31'24", long 74°02'09", at bridge at junction of Gidney Avenue and Germantown Road, at Newburgh, Orange County.	10.1	1956-61, 1964-66	7-14-66	.28
3729.45	Clove Creek near Cold Spring, N. Y.	Lat 41°27'30", long 73°55'13", at bridge on East Mountain Road West, 50 ft east of US Highway 9, and 3.2 miles northeast of Cold Spring, Putnam County.	10.2	1962, 1964-66	7-26-66	.08
3740.98	Annsville Creek at Graymoor, N. Y.	Lat 41°20'23", long 73°55'27", at bridge on US Highway 9, 1 mile south of Graymoor, Putnam County, and 3.5 miles north of Peekskill.	1.97	1963, 1964-66	7-26-66	.04
3741.5	Canopus Creek at Continental Village, N. Y.	Lat 41°20'15", long 73°54'15", at bridge on Gallows Hill Road, three-quarters of a mile upstream from Cortland Lake, at Continental Village, Putnam County.	14.5	1954, 1960, 1962-66	7-26-66	10.3
*3744.6	South Branch Minisceongo Creek at Letchworth Village, N. Y.	Lat 41°12'15", long 74°01'54", 200 ft downstream from Letchworth Village road and pond, and 1000 ft downstream from Palisades Interstate Parkway, at Letchworth Village, Rockland County	5.83	1959-62, 1966	7-18-66	.12
3744.94	Haviland Hollow Brook near Putnam Lake, N. Y.	Lat 41°29'03", long 73°34'16", at bridge on Haviland Hollow-Putnam Lake Road, 0.6 mile upstream from mouth, and 2 miles northwest of Putnam Lake, Putnam County.	12.2	1962, 1964-66	7-26-66	.10
3745.4	Holly Stream near Brewster, N. Y.	Lat 41°22'17", long 73°38'16", at bridge on US Highway 202, 0.1 mile upstream from mouth, 1.9 miles southwest of Brewster, Putnam County, and 2.1 miles northeast of Croton Falls.	4.82	1962, 1964-66	7-26-66	.18
		Streams on Staten Island				
3765.3	Sharrots Stream near Tottenville, N. Y.	Lat 40°32'30", long 74°14'16", at culvert on Arthur Kill Road, 150 ft north of Ellis Place, near Port Socony, and 2.2 miles north-northeast of Tottenville, Richmond County.	-	1962-66	3-15-66 6-16-66 9-29-66	.66 .12 .46
3765.35	Richmond Creek at Richmond, N. Y.	Lat 40°34'20", long 74°08'46", at downstream side of Richmond Hill Road (Arthur Kill Road) at end of Richmond Road, at Richmond, Richmond County, and 7 miles northeast of Tottenville.	-	1962-66	3-15-66 6-16-66 9-29-66	1.05 .51 .41
3765.4	Springville Creek at New Springville, N. Y.	Lat 40°35'36", long 74°09'49", at downstream side of Richmond Avenue at end of Travis Avenue at New Springville, Richmond County, and 7.5 miles northeast of Tottenville.	-	1962-66	3-15-66 6-16-66 9-29-66	.41 .16 .17
3765.5	Palmers Run at Port Richmond, N. Y.	Lat 40°38'14", long 74°07'41", at culvert on Richmond Terrace at end of Rector Street at Port Richmond, Richmond County.	-	1962-66	3-15-66 6-16-66	1.57 1.40
3765.6	Lemon Creek at Prince Bay, N. Y.	Lat 40°31'03", long 74°12'05", at downstream side of Rylan Boulevard at Prince Bay, Richmond County, and 2½ miles east of Tottenville.	-	1963-66	3-15-66 6-16-66	1.31 2.82

* Also a crest-stage partial-record station
ƒ Operated as a continuous-record gaging station
a Estimated

CORTLAND LAKE DAM
NY-85

APPENDIX D

STABILITY COMPUTATIONS

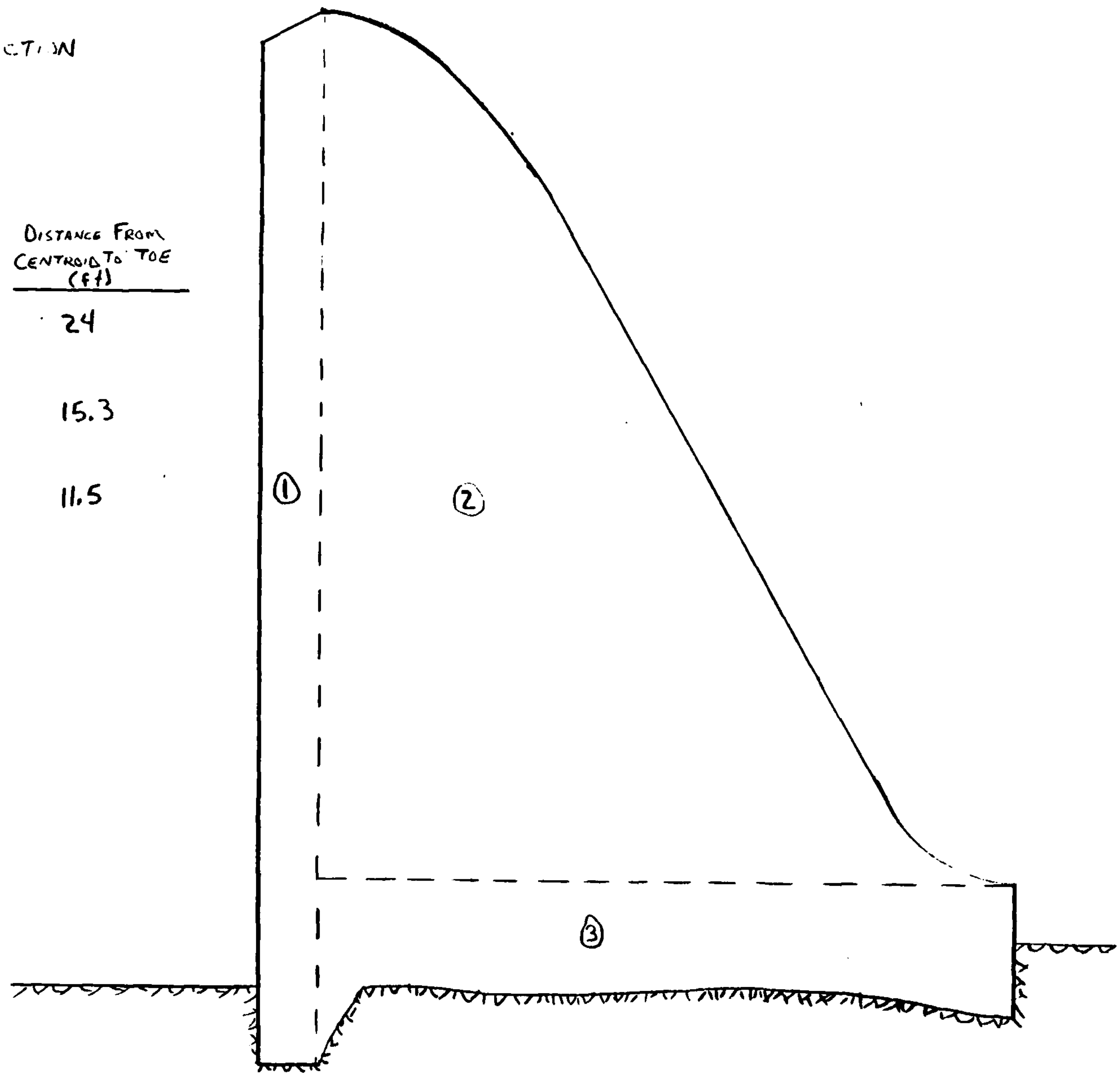
CORTLANDT LAKE DAM

I.D. No. NY 85

SPILLWAY CROSS SECTION

SCALE 1" = 5'

SEGMENT	AREA (ft²)	DISTANCE FROM CENTROID TO TOE (ft)
①	(34)(2) = 68	24
②	½(28)(23) = 322	15.3
③	(4.5)(23) = 103.5	11.5



STRUCTURAL STABILITY ANALYSIS

The analysis was based on a cross section shown on the plans. A normal analysis was performed including both overturning and sliding analysis. The analysis was performed according to Corps of Engineers guidelines and assumed full uplift pressure at the upstream toe, decreasing to tailwater pressure at the downstream toe.

ANALYSIS CONDITIONS

1. Normal conditions; water surface at spillway crest
2. Same as #1 plus ice load of 5,000 pounds per linear foot.
3. 1/2 PMF flows; water surface near or at top of dam (6.0 feet over spillway).
4. Seismic Conditions; water at spillway crest with seismic coefficient of 0.1.
5. Normal conditions but assuming Uplift Pressure = 0.

STABILITY ANALYSIS PROGRAM - WORK SHEET

INPUT ENTRY		ANALYSIS CONDITION 1	2	3	4	5
Unit Weight of Dam (K/ft^3)	0	0.15	0.15	0.15	0.15	0.15
Area of Segment No. 1 (ft^2)	1	68	68	68	68	68
Distance from Center of Gravity of Segment No. 1 to Downstream Toe (ft)	2	24	24	24	24	24
Area of Segment No. 2 (ft^2)	3	322	322	322	322	322
Distance from Center of Gravity of Segment No. 2 to Downstream Toe (ft)	4	15.3	15.3	15.3	15.3	15.3
Area of Segment No. 3 (ft^2)	5	103.5	103.5	103.5	103.5	103.5
Distance from Center of Gravity of Segment No. 3 to Downstream Toe (ft)	6	11.5	11.5	11.5	11.5	11.5
Base Width of Dam (Total) (ft)	7	25	25	25	25	0*
Height of Dam (ft)	8	34	34	34	34	34
Ice Loading (K/L ft.)	9	—	5.0	—	—	—
Coefficient of Sliding	10	0.65	0.65	0.65	0.65	0.65
Unit Weight of Soil (K/ft^3) (deduct 18)	11	0.055	0.055	0.055	0.055	0.055
Active Soil Coefficient - Ka	12	0.27	0.27	0.27	0.27	0.27
Passive Soil Coefficient - Kp	13	3.69	3.69	3.69	3.69	3.69
Height of Water over Top of Dam or Spillway (ft)	14	—	—	6.0	—	—
Height of Soil for Active Pressure (ft)	15	2.5	2.5	2.5	2.5	2.5
Height of Soil for Passive Pressure (ft)	16	4.0	4.0	4.0	4.0	4.0
Height of Water in Tailrace Channel (ft)	17	6.0	6.0	8.0	6.0	6.0
Weight of Water (K/ft^3)	18	0.0624	.0624	.0624	.0624	.0624
Area of Segment No. 4 (ft^2)	19	—	—	—	—	—
Distance from Center of Gravity of Segment No. 4 to Downstream Toe (ft)	20	—	—	—	—	—
Height of Ice Load or Active Water (ft) (does not include 14)	46	34	34	34	34	34
Seismic Coefficient (g)	50	—	—	—	0.1	—
RESULTS OF ANALYSIS						
Factor of Safety vs. Overturning		1.31	1.10	1.04	1.23	2.85
Distance From Toe to Resultant		6.47	2.50	1.23	5.18	10.24
Factor of Safety vs. Sliding		0.85	0.74	0.62	0.64	1.41

* ASSUMED 0 TO MAKE UPLIFT = ZERO

APPENDIX E

REFERENCES

APPENDIX E

REFERENCES

1) T. S. George and R. S. Taylor, Lower Hudson River Basin Hydrologic Flood Routing Model, for the Department of the Army, New York District, Corps of Engineers, Water Resources Engineers Inc. January 1977.

2) H.W. King and E. F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963

3) R.K. Linsley, Jr., M.A. Kohler, and J.L.H. Paulhus; Hydrology for Engineers, 2nd edition, McGraw-Hill, 1975.

4) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

U.S. Army Corps of Engineers:

5) HEC-1 Flood Hydrograph Package - Dam Safety Version, September 1978.

6) Engineering Manual 1110-2-1405; Flood-Hydrograph Analyses and Computations, August 1959.

7) U.S. Department of Agriculture, Soil Conservation Service; National Engineering Handbook; Section 4 - Hydrology, August 1972.

US Department of Commerce; Weather Bureau:

8) Hydrometeorological Report No. 33: Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24 and 48 Hours, April 1956.

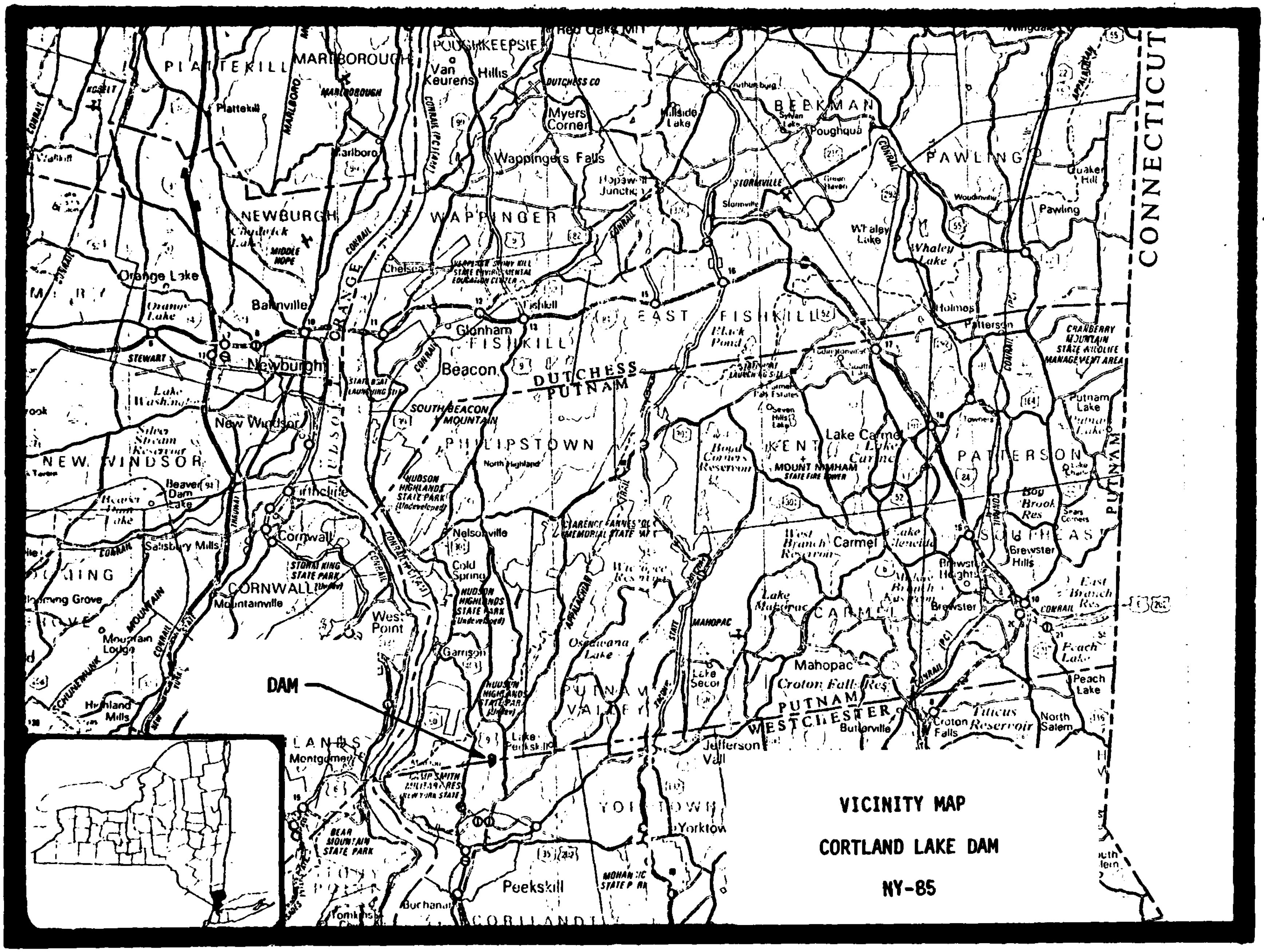
9) U.S. Department of Interior; BUREC, Design of Small Dams, 2nd edition (rev. reprint) 1977.

US Geological Survey:

10) Water Resources Data for New York - 1961: Part 1-Surface Water Records
11) " " " " " " - 1962
12) " " " " " " - 1964
13) " " " " " " - 1966

APPENDIX F

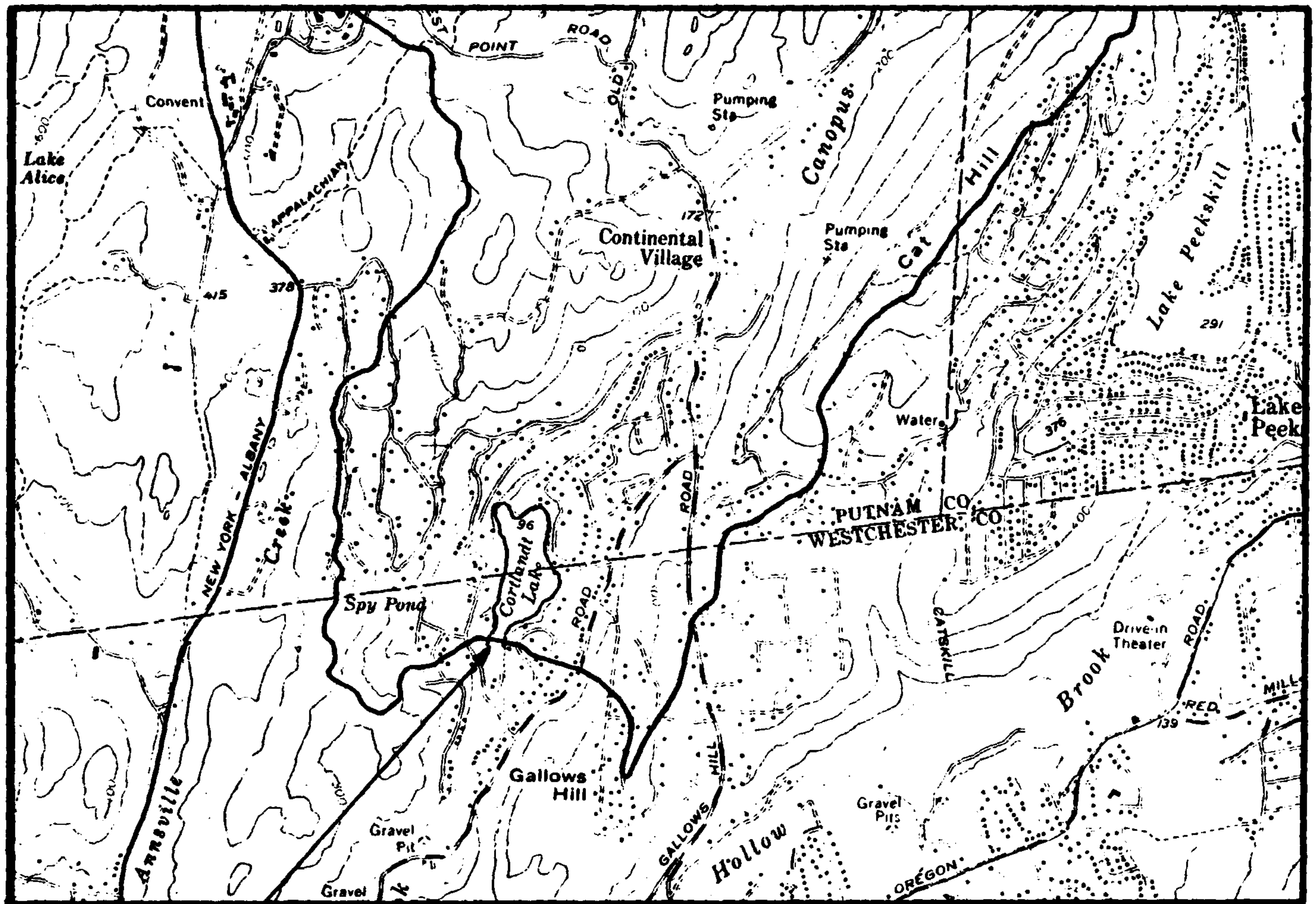
DRAWINGS



VICINITY MAP

CORTLAND LAKE DAM

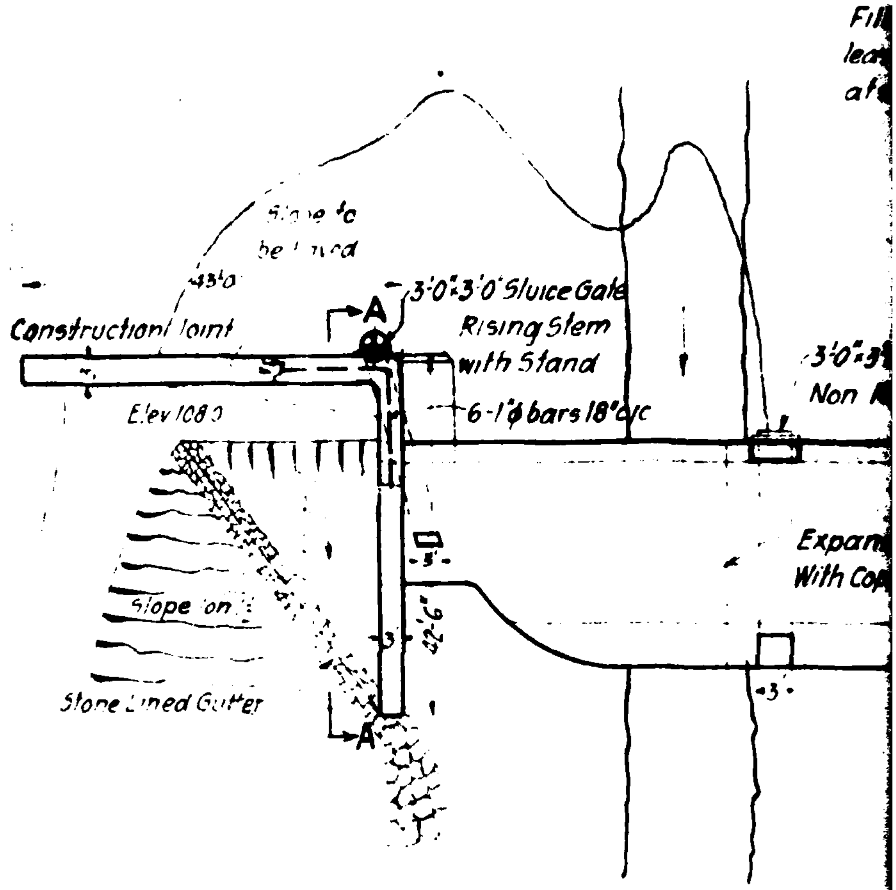
NY-85



DAM SITE

TOPOGRAPHIC MAP

CORTLAND LAKE DAM
NY-85



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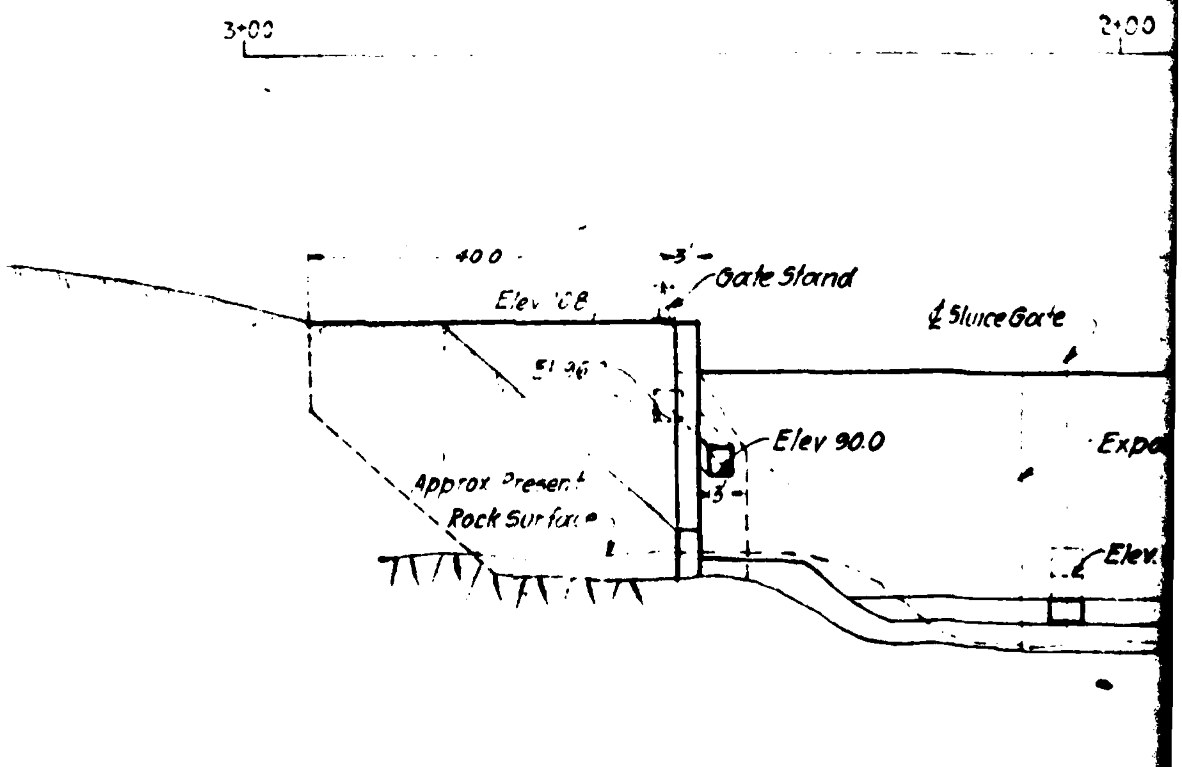
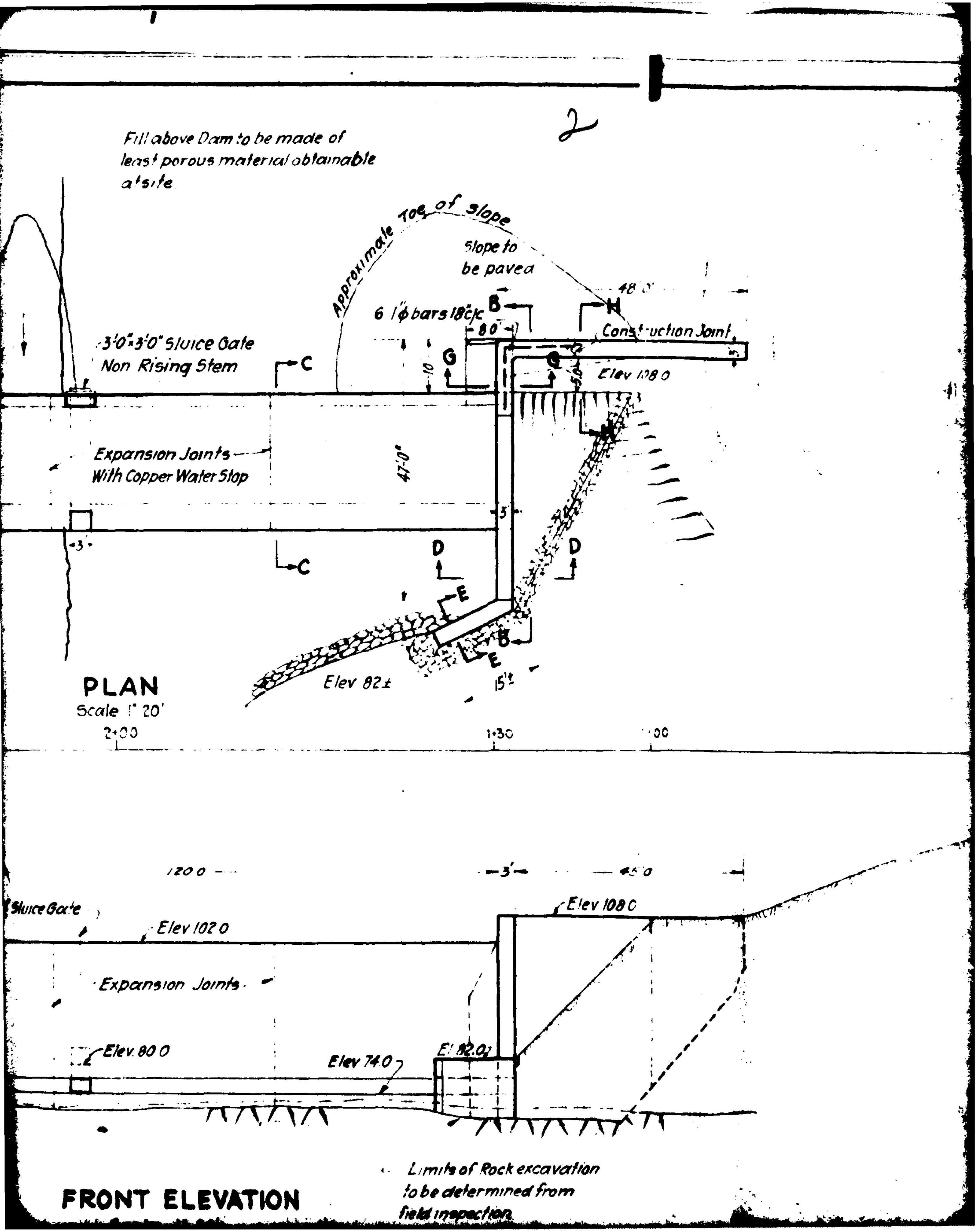
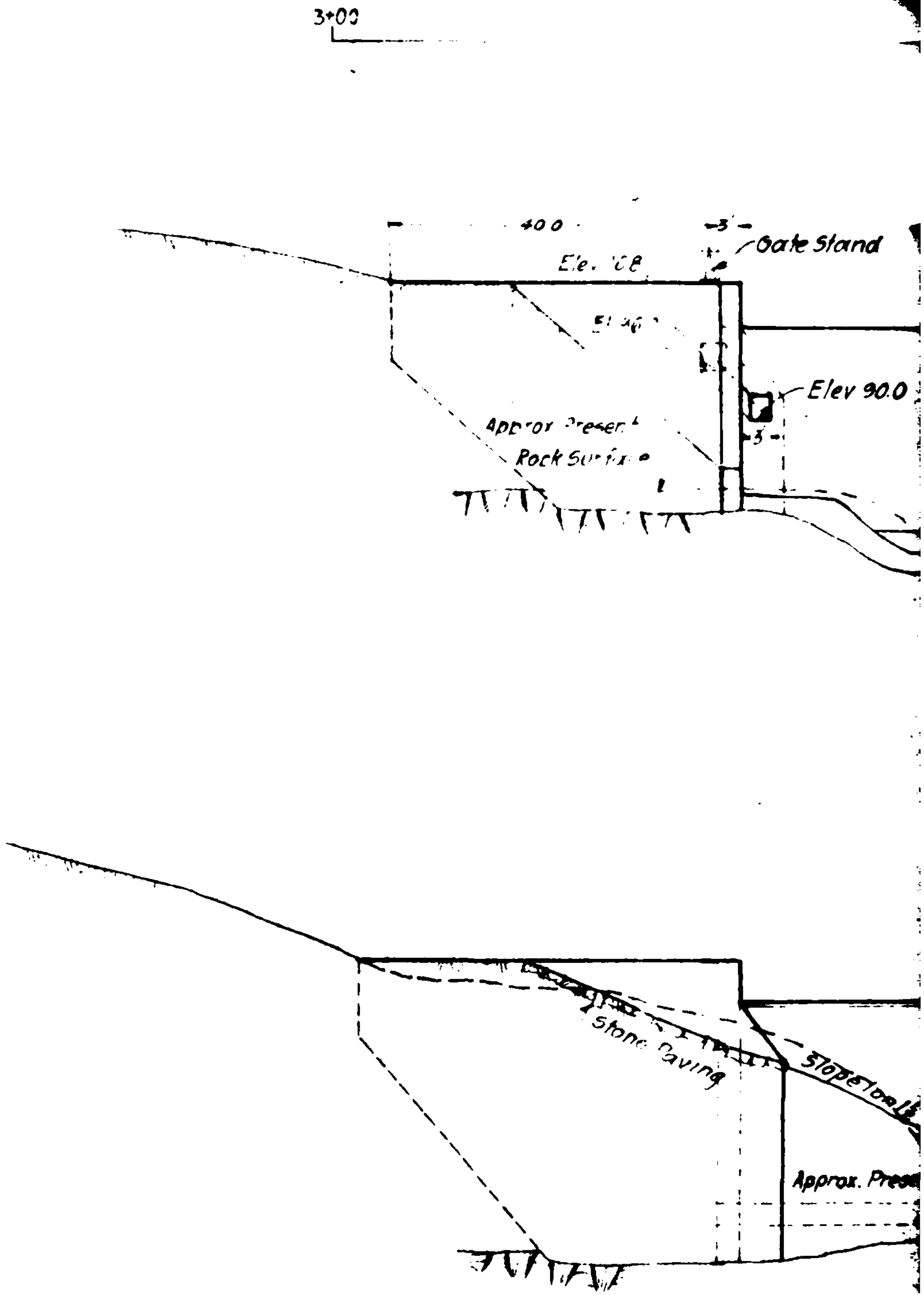


FRON


2
Fill above Dam to be made of least porous material obtainable at site
Approximate Toe of slope
Slope to be paved
48'
6 1" φ bars 18" c/c
B
H
8.0'
Construction Joint
3'0"x3'0" Sluice Gate Non Rising Stem
C
G
10
Elev 108.0
Expansion Joints With Copper Water Stop
47'-0"
3'
D
E
Elev 82±
15'±
PLAN
Scale 1" 20'
2+00
1+30
1+00
120.0
3'
45.0
Sluice Gate
Elev 102.0
Elev 108.0
Expansion Joints
Elev. 80.0
Elev 74.0
El 82.0
Limits of Rock excavation to be determined from field inspection
FRONT ELEVATION



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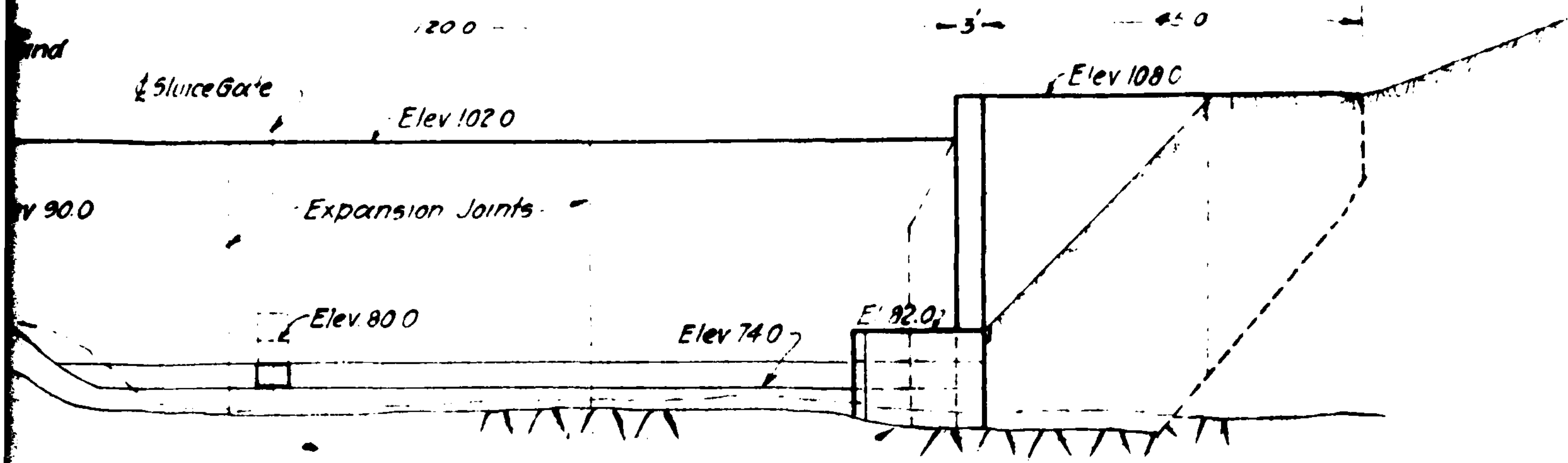
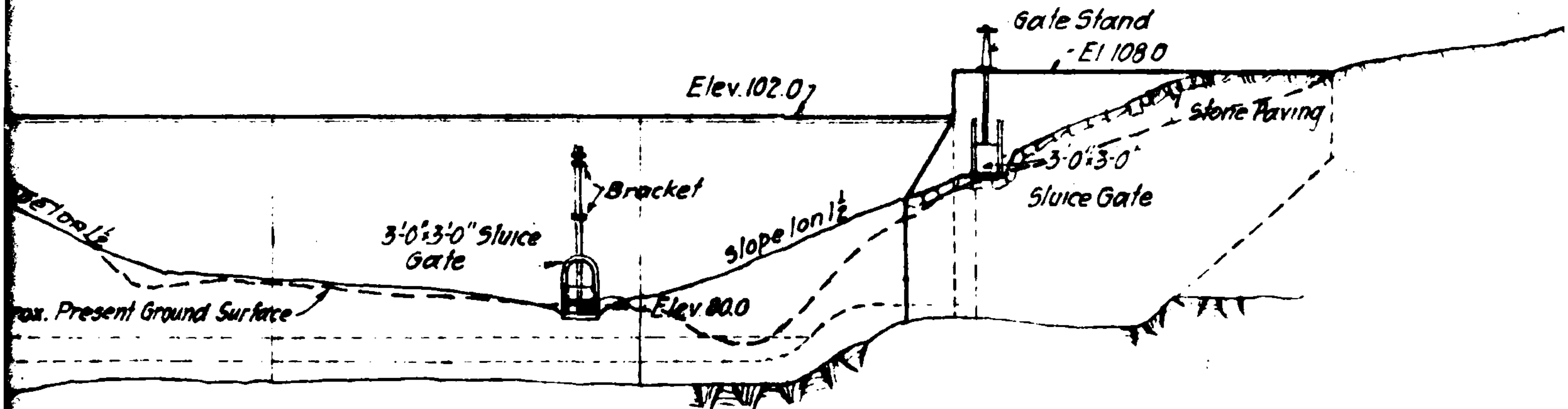


Limits of Rock excavation
to be determined from
field inspection

FRONT ELEVATION
Scale 1"=20'



REAR ELEVATION
Scale 1"=20'

4

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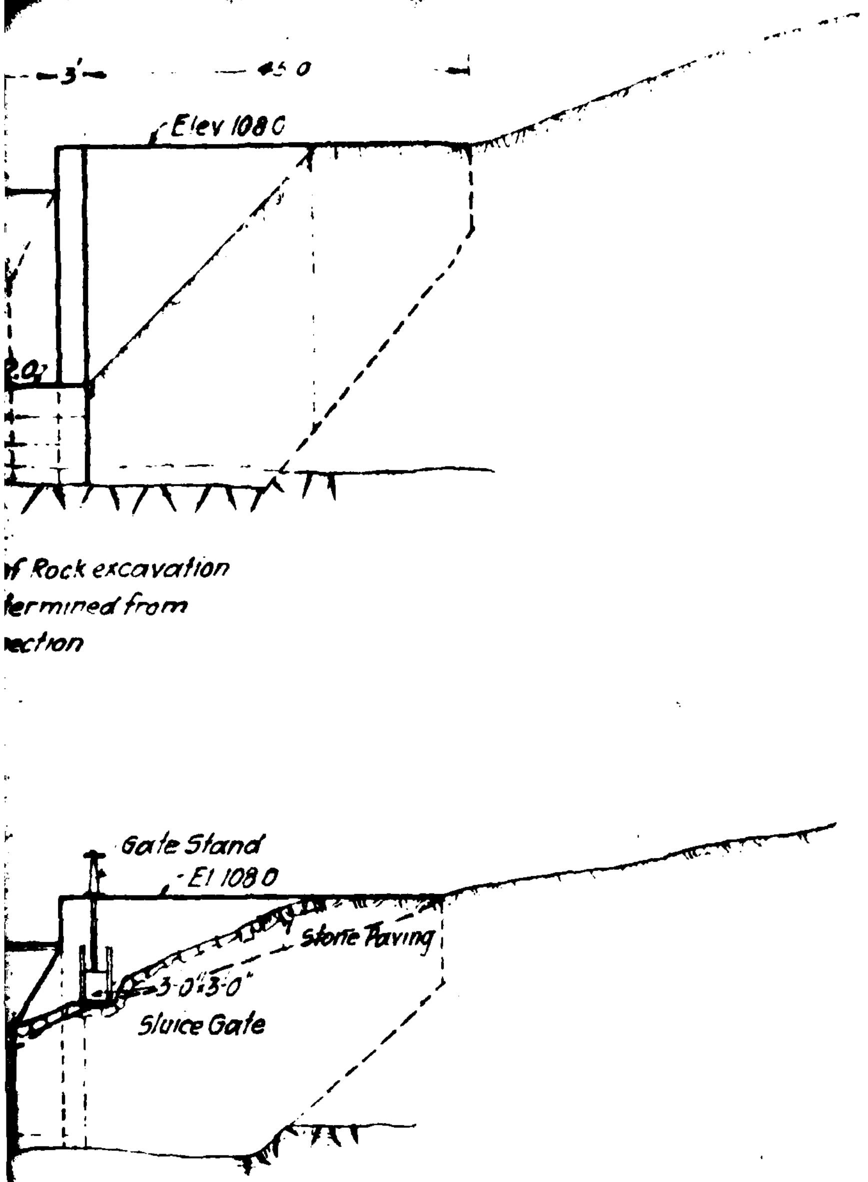
Revisions:	



5

DRAWING NO. 328-1

H D HYNDS, INC.

DAM ACROSS CANOPUS CREEK
WESTCHESTER COUNTY, N.Y.

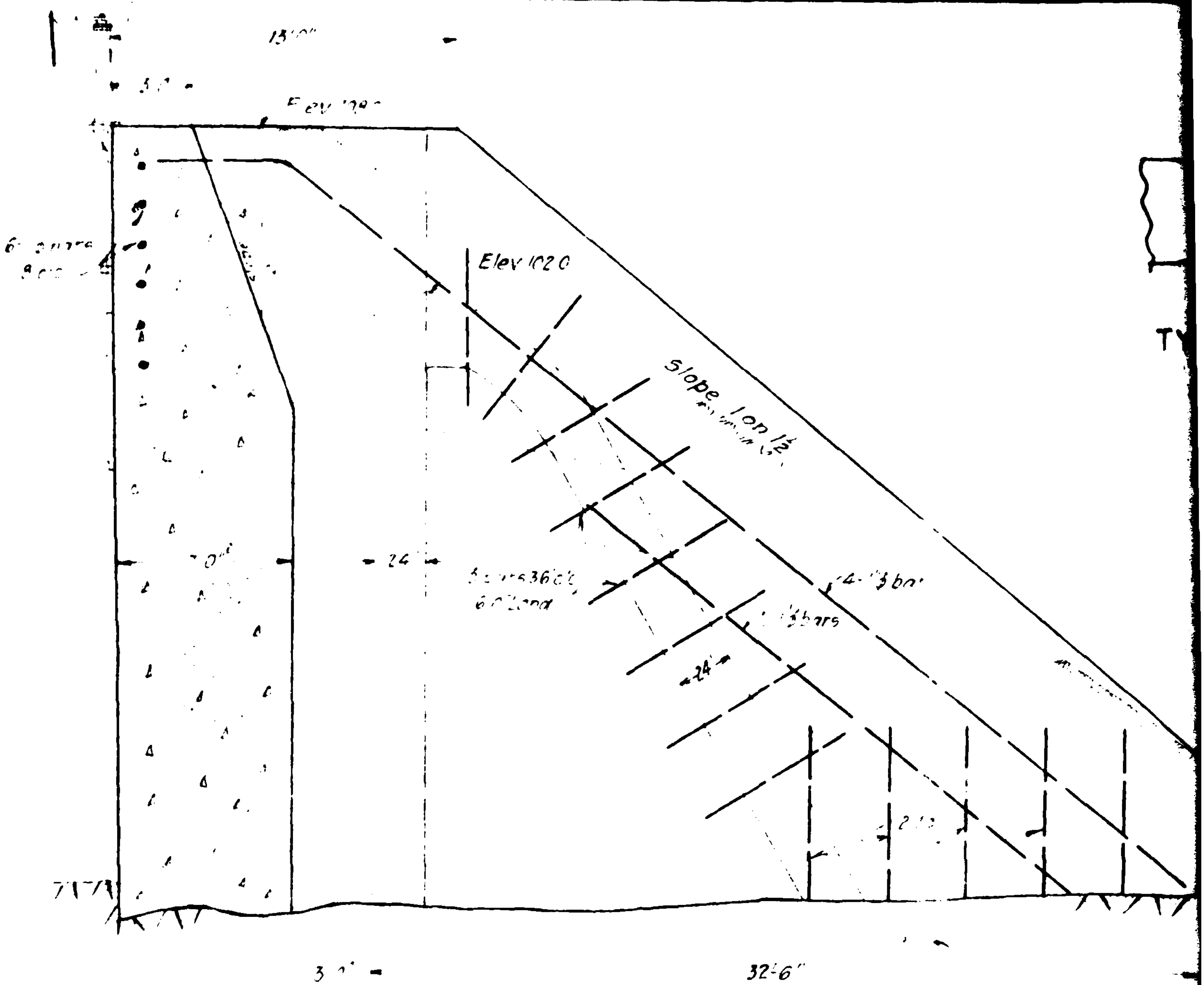
PLAN AND ELEVATIONS

Nicholas S. Hill, Jr.
Consulting Engineer
New York City

Scale: 1"=20'

October, 1929

Drawn by HF	Checked by	Examined by	Reviewed by	Approved by
Revisions				



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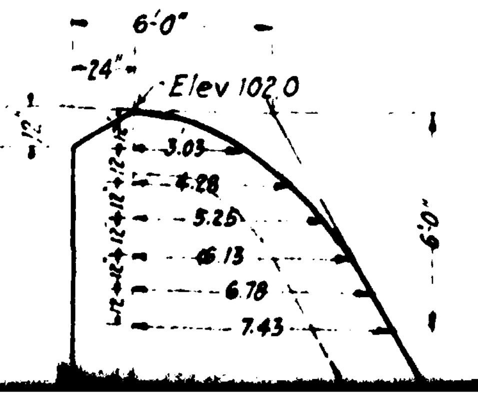

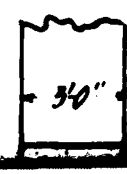

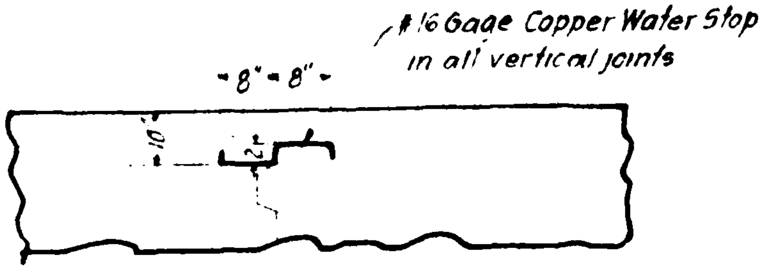

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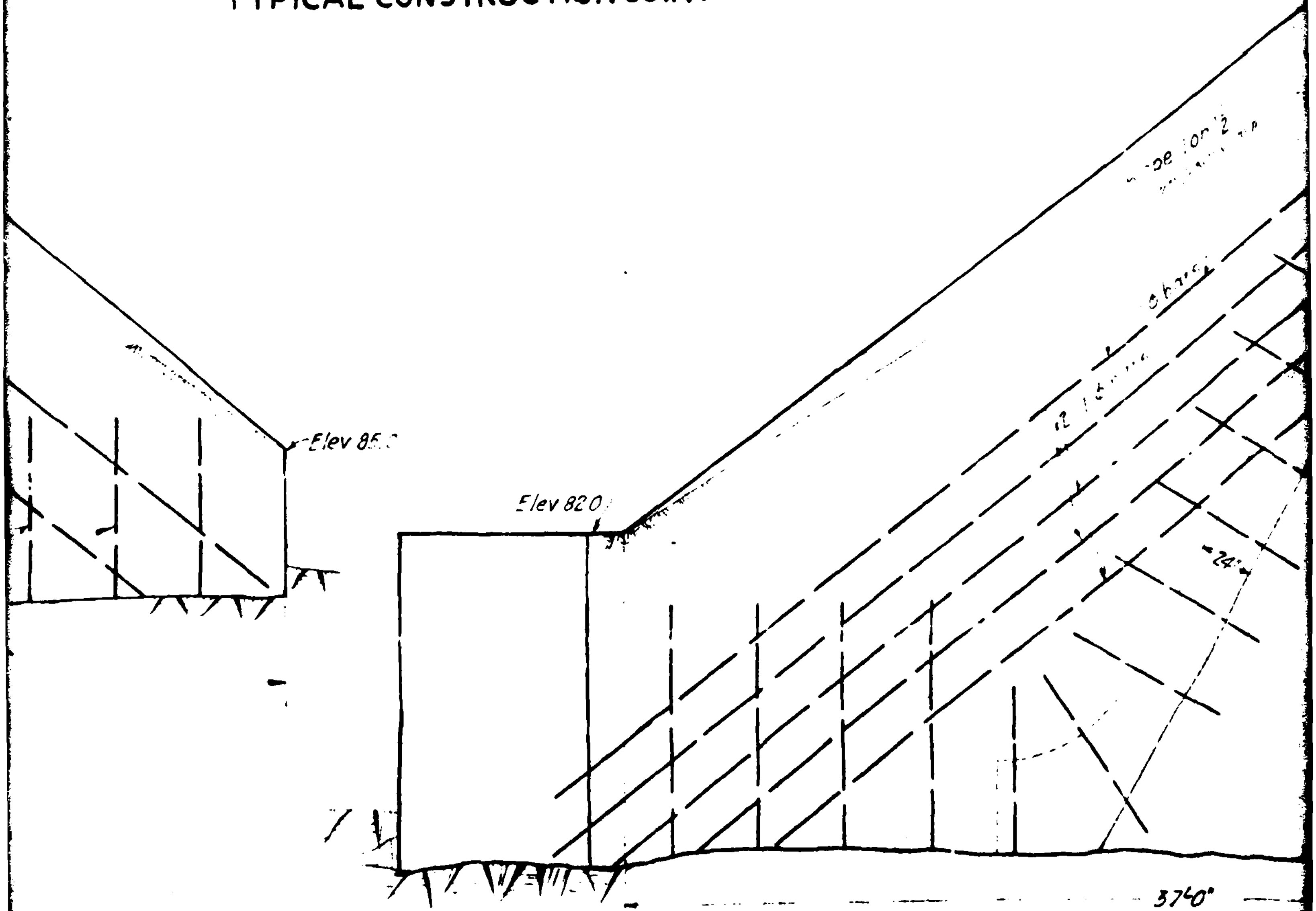

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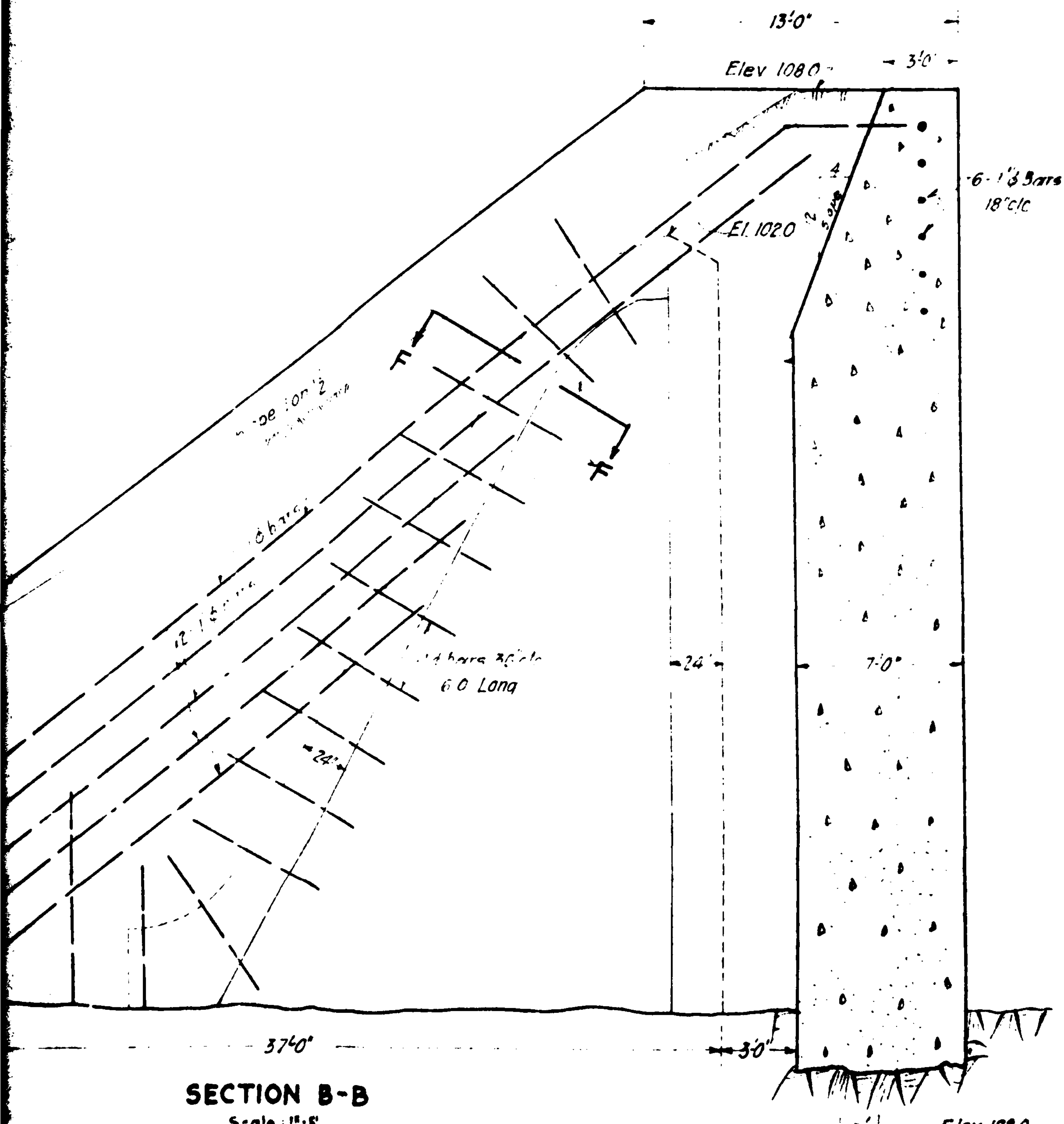

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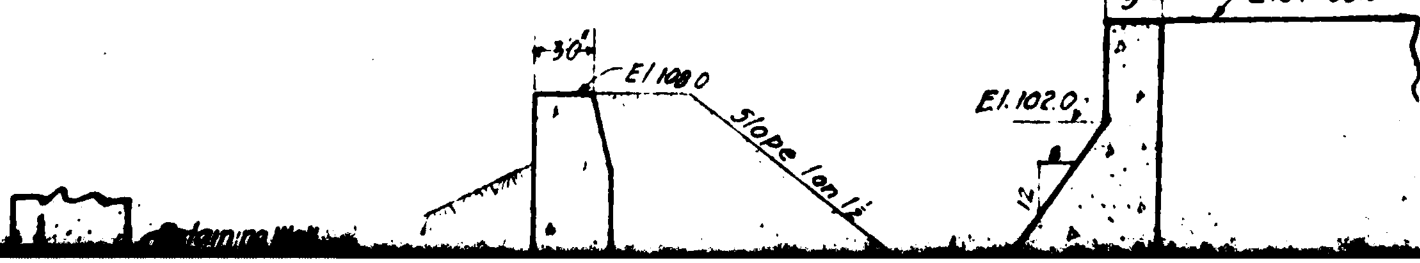

32'-6"

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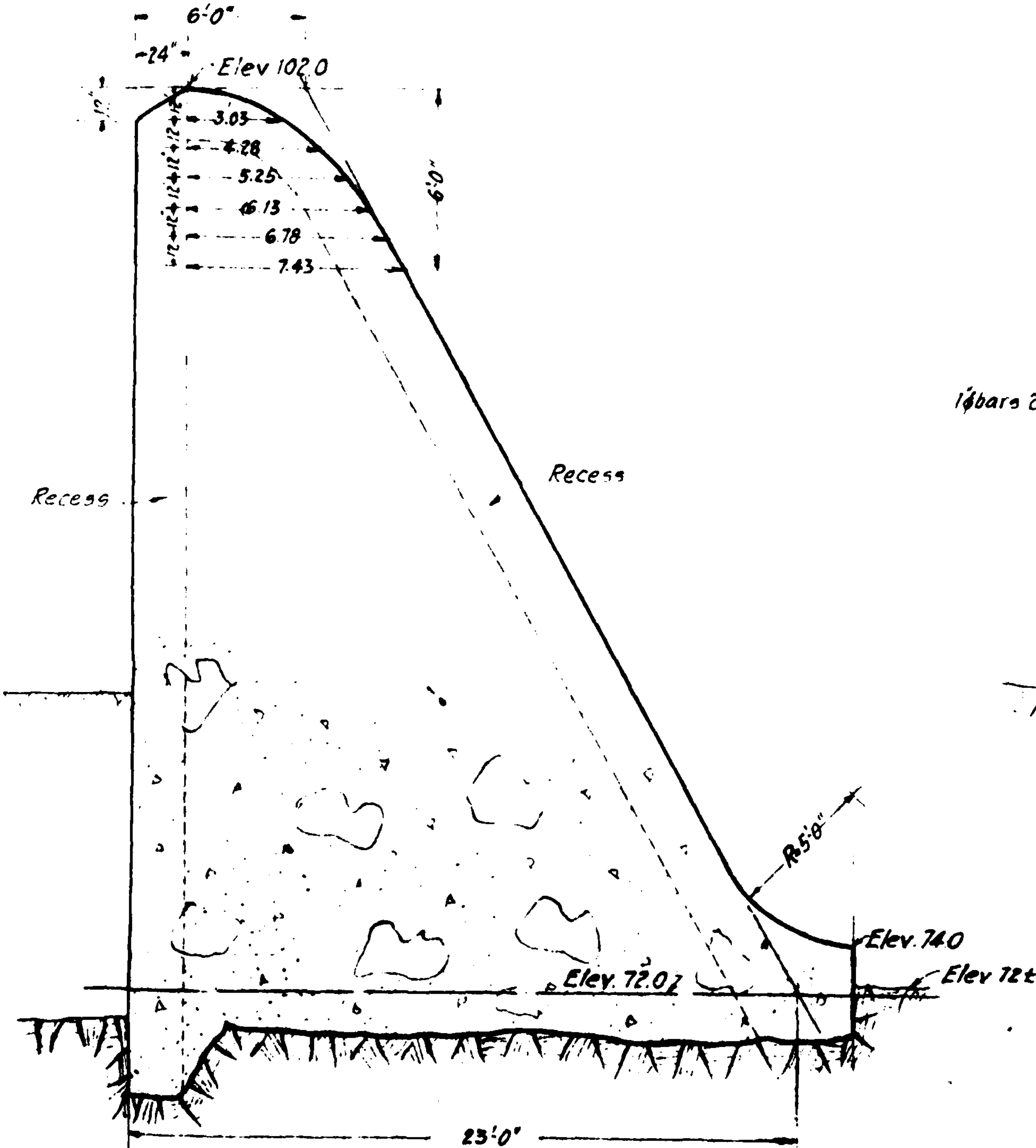

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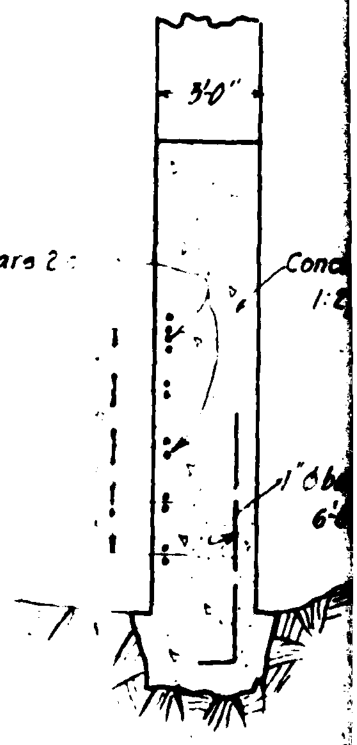

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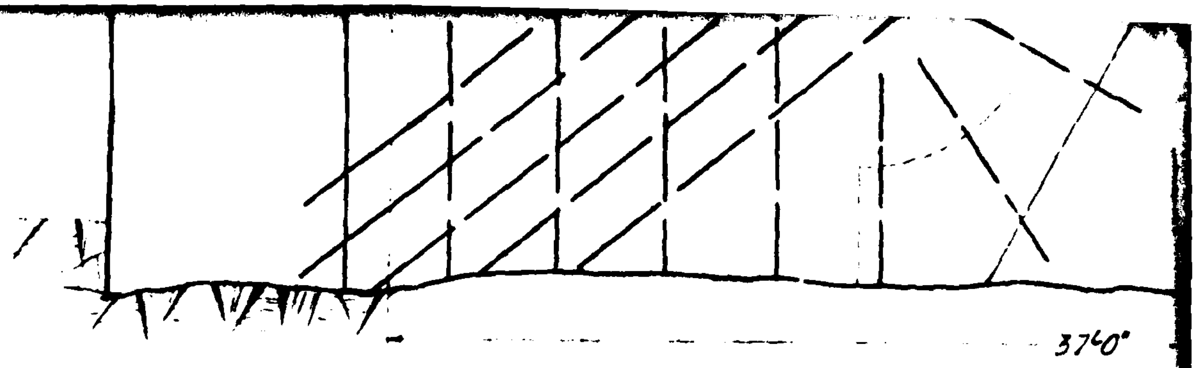

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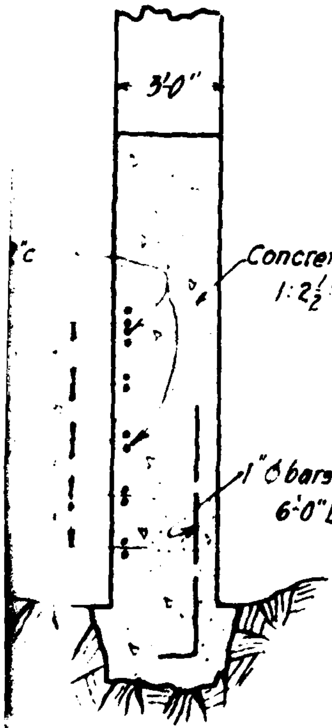

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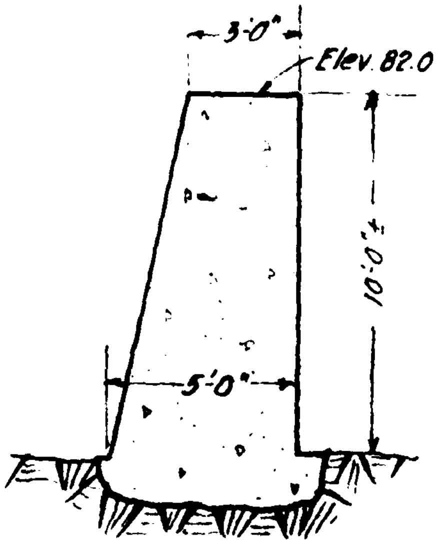

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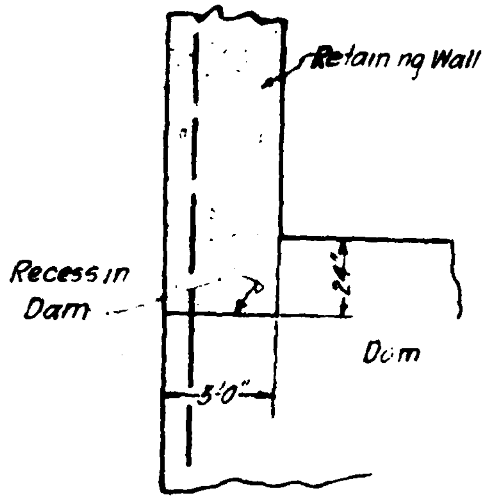

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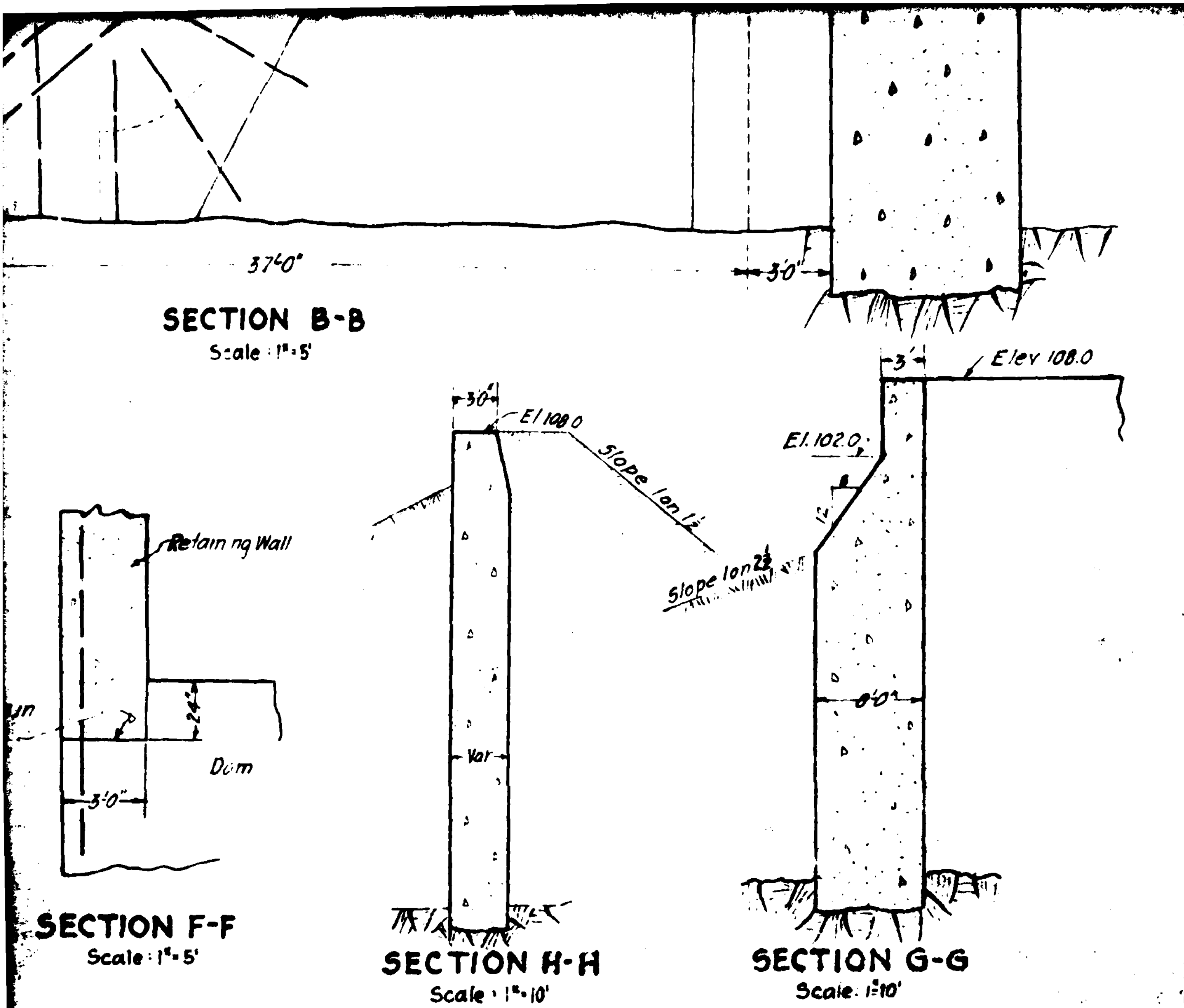

DRAWING NO. 328-2

H. D. HYNDS, INC.

DAM ACROSS CANOPUS CREEK
WESTCHESTER COUNTY, N. Y.

SECTIONS

Nicholas S. Hill, Jr.
Consulting Engineer
New York City

Scale: As shown

October, [illegible]

Drawn by H	Checked by	Examined by	Revised by	Approved by
Revisions				

DATE
FILMED
8