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NATIONAL DAM SAFETY PROGRAM. SENECA FALLS DAM, SENECA RIVER BAS--ETC(U)
JUL 78 J J WILLIAMS DACW51-78-C-0035

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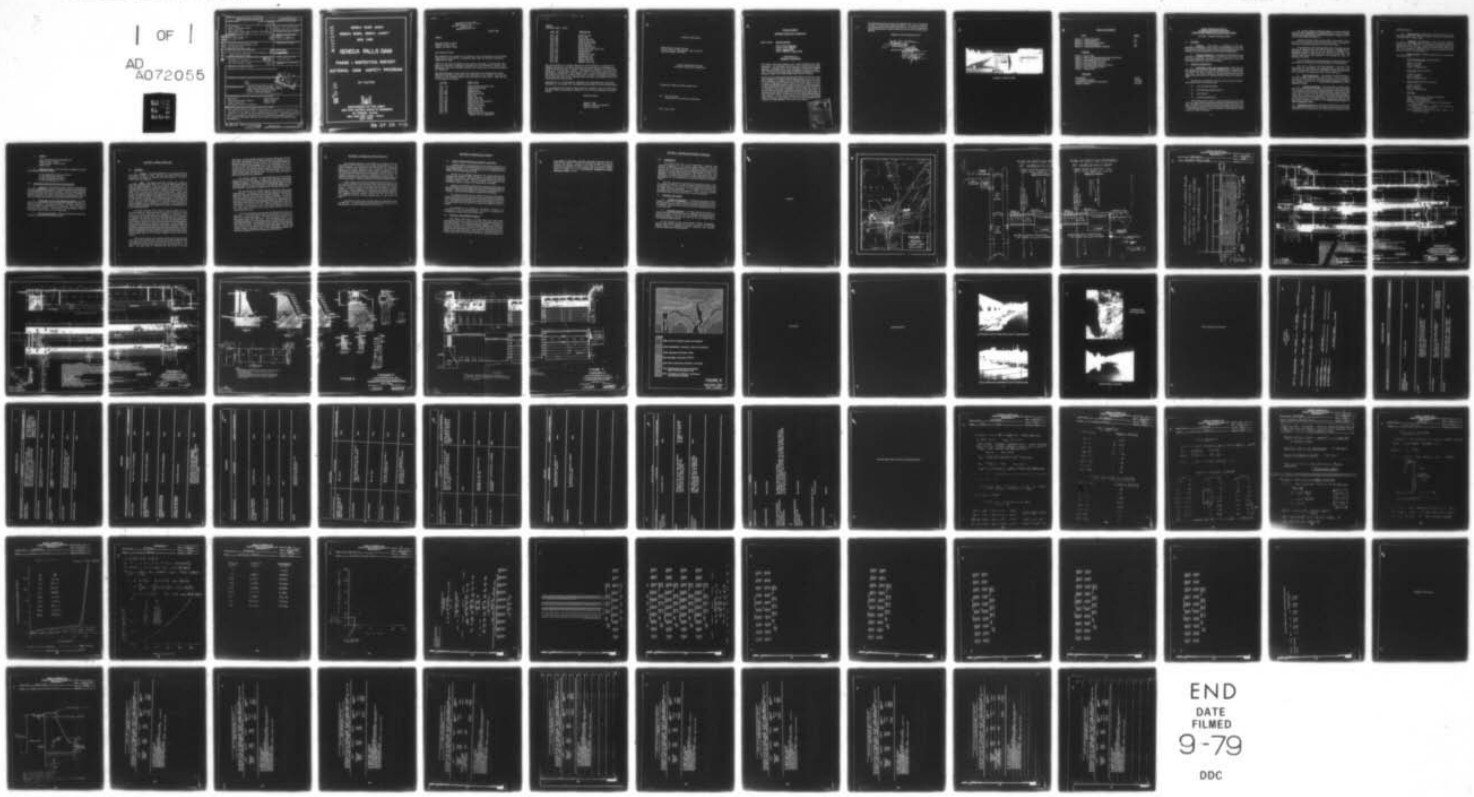

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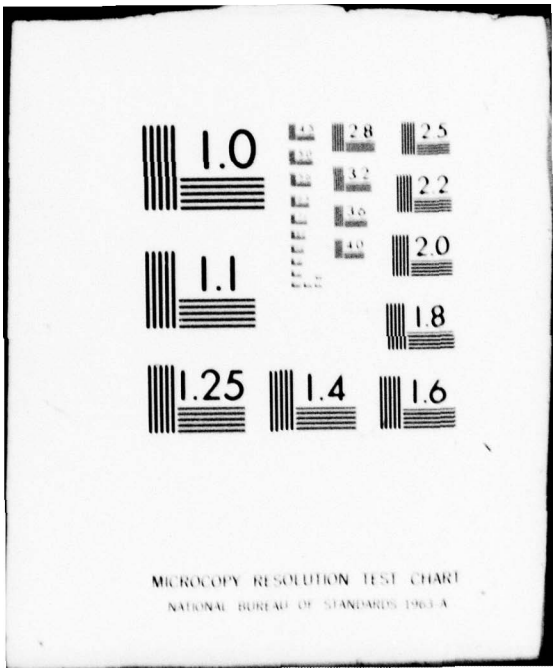
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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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7. AUTHOR(s): John J. Williams, P.E.	8. CONTRACT OR GRANT NUMBER(s): DACW-51-78-C-0035
9. PERFORMING ORGANIZATION NAME AND ADDRESS: O'Brien and Gere Engineers, Inc. 1301 Buckley Road Syracuse, New York 13221	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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National Dam Safety Program. Seneca Falls Dam, Seneca River Basin, Seneca River, Seneca County, New York. Phase I Inspection Report.

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

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Seneca Falls Dam
Seneca County
Seneca River

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. Seneca Falls Dam was found to be unsafe-non emergency due to a seriously inadequate spillway. A more detailed hydrologic analysis and corrective actions if necessary were recommended.

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SENECA RIVER BASIN

SENECA RIVER, SENECA COUNTY

NEW YORK

SENECA FALLS DAM

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NY 00708

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

JULY 1978

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, NEW YORK
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

2 OCT 1978

NANEN-F

Honorable Hugh L. Carey
Governor of New York
Albany, New York 12224

Dear Governor Carey:

The purpose of this letter is to inform you of a clarification of the guidelines used by this office in assessing dams under the National Program of Inspection of Dams.

Office of the Chief of Engineers has recently provided a clarification that dams with seriously inadequate spillways are to be assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The following dams in your state have previously been assessed as having seriously inadequate spillways, with capability to pass safely only the percentage of the probable maximum flood as noted in each report. They are now to be assessed as unsafe:

I.D. NO.	NAME OF DAM
N.Y. 59	Lower Warwick Reservoir Dam
N.Y. 4	Salisbury Mills Dam
N.Y. 45	Amawalk Dam
N.Y. 418	Jamesville Dam
N.Y. 685	Colliersville Dam
N.Y. 6	Delta Dam
N.Y. 421	Oneida City Dam
N.Y. 39	Croton Falls Dam
N.Y. 509	Chadwick Dam (Plattenkill)
N.Y. 66	Boyds Corner Dam
N.Y. 397	Cranberry Lake Dam
N.Y. 708	Seneca Falls Dam
N.Y. 332	Lake Sebago Dam
N.Y. 338	Indian Brook Dam
N.Y. 33	Lower(S) Wiccopee Dam (Lower Hudson W.S. for Peekskill)

NANEN-F
Honorable Hugh L. Carey

I.D. NO.	NAME OF DAM
N.Y. 49	Pocantico Dam
N.Y. 445	Attica Dam
N.Y. 658	Cork Center Dam
N.Y. 153	Jackson Creek Dam
N.Y. 172	Lake Algonquin Dam
N.Y. 318	Sixth Lake Dam
N.Y. 13	Butlet Storage Dam
N.Y. 90	Putnam Lake (Bog Brook Dam)
N.Y. 166	Pecks Lake Dam
N.Y. 674	Bradford Dam
N.Y. 75	Sturgeon Pool Dam
N.Y. 414	Skaneateles Dam
N.Y. 155	Indian Lake Dam
N.Y. 472	Newton Falls Dam
N.Y. 362	Buckhorn Lake Dam

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

Consequently, it is advisable to implement the recommendations previously furnished in the reports for the above-mentioned dams as soon as practicable.

It is requested that owners of these dams be furnished a copy of this letter and that copies be permanently appended to all reports previously furnished to you.

Sincerely yours,

CLARK H. BENN
Colonel, Corps of Engineers
District Engineer

SENECA RIVER BASIN

Name of Dam: Seneca Falls Dam
County and State: Seneca County, New York State
Inventory Number: NY 00708

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared by: O'Brien and Gere Engineers, Inc.

For: New York State
Department of Environmental Conservation

Date: July 5, 1978

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam: Seneca Falls Dam

State Located New York
County Located Seneca
Stream Seneca River
Date of Inspection June 5, 1978

ASSESSMENT OF GENERAL CONDITIONS

The Seneca Falls Dam appears to be in good condition and is well maintained. No significant deficiencies were noted during the visual inspection. However, based on the hydrologic analysis, the Probable Maximum Flood (PMF) would cause overtopping of the dam by about 7 feet. The concrete structures might withstand overtopping, but severe damage or failure of the earth embankments would be expected.

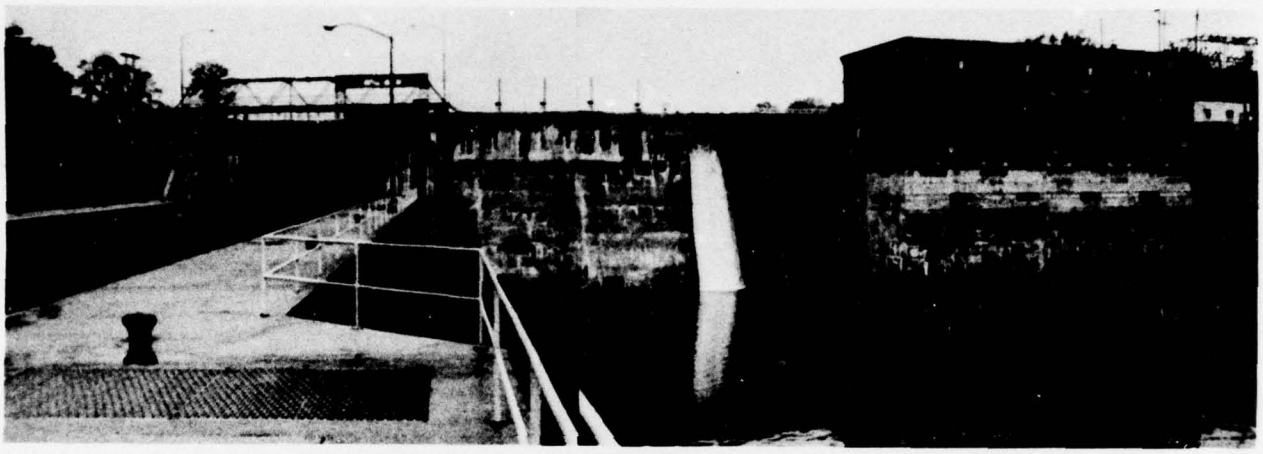
Results of the hydrologic/hydraulic analysis indicate that the dam would be overtopped by all floods exceeding approximately 11 per cent of the PMF; therefore, the spillway can be considered "seriously inadequate" as cited in Engineering Technical Letter No. 1110-2, January 25, 1978. A detailed hydrologic/hydraulic analysis of the PMF is recommended to be done immediately for this structure, taking into acccount the effects of alternative operational procedures, and including the effects of Seneca Lake and upstream regulating structures on the flood wave. If the results of the analysis confirm that the dam cannot pass at least one half of the PMF without overtopping, remedial measures should then be recommended. In the interim period, around-the-clock surveillance should be provided during periods of high flow, and a contingency plan initiated for implementation in the event of overtopping.

The steel bars blocking the ogee crest spillway (See Figure 3) should be removed to increase the discharge capacity. The additional head for the turbines can be maintained without the loss of discharge capacity by installing flashboards or Bascule-type gates for the entire length of the spillway.

O'BRIEN & GERE ENGINEERS, INC.

John J. Williams, P.E.
Vice President

Approved by: _____
Clark H. Benn
Colonel, Corps of Engineers
District Engineer
Date 28 July 72



OVERALL VIEW OF DAM

TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM SENECA FALLS DAM ID# NY 00708

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract # 1467-021 between O'Brien and Gere Engineers, Inc., and the New York State Department of Environmental Conservation.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the structural and hydraulic condition of the Seneca Falls Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 PROJECT DESCRIPTION

a. Description of Dam and Appurtenances - (from information provided by the New York State Department of Transportation) The Seneca Falls Dam is located on the Seneca River at Seneca Falls, New York. The reach of the Seneca River between Cayuga Lake and Seneca Lake, also called the Cayuga and Seneca Canal, is controlled by locks.

The dam is an integrated, concrete gravity and earth embankment structure (See Figure 2) including:

1) a concrete gravity section

2) a concrete ogee spillway section

3) a lock system

4) two earth embankments

The concrete gravity section is about 70 feet high and is provided with four gated outlets located approximately 54 feet below the top of dam. The gates can be operated either electrically or manually from the top of dam. According to the available drawings, Figures 4 through 7, the outlet openings are 5 feet horizontal by 7 feet vertical, and are spaced at 14 feet horizontally.

The concrete spillway discharge capacity has been drastically reduced by the installation of a permanent barrier. Narrow stoplog controlled openings have been provided at each end of the spillway to be used as trash sluices (See Figure 3).

Cayuga and Seneca Canal Locks number 2 and number 3 (C/S 2 and C/S 3) are located on the south side of the river. The locks are constructed in series, and provide a vertical lift of 49 feet.

The powerhouse, owned and operated by New York State Gas and Electric, is located on the north end of the Dam. According to the powerhouse foreman, each of the four 2,500 KVA turbines has a discharge capacity of about 500 cubic feet per second (cfs). The foreman also stated that operation of the turbines can drain the reservoir in 24 hours.

Earth embankments are located between the south abutment and lock number 3, and between the north abutment and the powerhouse.

The dam is jointly owned and operated. The New York Department of Transportation is responsible for all features to the south of the spillway. New York State Gas and Electric is responsible for the spillway, the powerhouse, and the north embankment.

b. Size Classification - The maximum structural height of the dam is about 70 feet, and the storage volume to the top of dam is estimated at 6,000 acre-feet. Therefore, the dam is in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

c. Hazard Classification - The community of Lehigh Valley Junction is located about 2 miles downstream of the Seneca Falls Dam. The community is set in the low lying area adjoining the western fringe of the Montezuma Marsh National Wildlife Refuge. Failure of the Dam could result in loss of life and could cause considerable damage to Lehigh Valley Junction, halt operation of the Cayuga and Seneca Canal, and flood a portion of the wildlife refuge. Therefore, the dam is in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.3 PERTINENT DATA (from information provided by the New York State Department of Environmental Conservation, the New York State Department of Transportation, and United States Geological Survey

quadrangle sheets)

a. Drainage Area - The drainage area upstream of the dam is about 850 square miles. About 770 square miles of the drainage area contribute runoff to Seneca Lake.

b. Discharges - No discharge records were made available for this site. The four 2,500 KVA turbines have a combined discharge capacity of about 2,000 cfs. The combined discharge capacity at normal pool for the four gated outlets was computed to be about 4,200 cfs. For emergency conditions, flow can be augmented through operation of gates in the lock system.

c. Reservoir Data (Storage Volumes based on assumptions noted on page A16)

Normal Operating Pool (Elevation 430.5)

Length - 4.5 miles
Area - 147 acres
Volume - 5,500 acre-feet

Top of Dam (Elevation 434.0)

Length - 4.5 miles
Area - 163 acres
Volume - 6,000 acre-feet

Maximum Pool (PMF-Elevation 441.0)

Length - 4.5 miles
Area - 250 acres
Volume - 8,300 acre-feet

d. Dam Data

Type - concrete gravity and earth embankment
Length - 450 feet (approximate)
Height - 71 feet (maximum)
Top Width - 23 feet (gravity section) and 20 feet (earth embankments)
Embankment side slopes - Variable from about 2:1 (horizontal to vertical) to 1:1
Zoning, impervious core, cutoff, grout curtain - no information available

e. Spillway

Type - concrete overflow (See Figure 3)
Length of weir - 50 feet
Crest elevation - 427.5 feet MSL
Gates - none

f. Engineering Data - The information available for review of the Seneca Falls Dam included:

1) Foundation Plan & Section of Dam 2
2) Plan and Elevation of Dam 2
3) Plan and Elevation of Lock 2
4) Plan and Elevation of Lock 3

1.4 OPERATING AND MAINTENANCE PROCEDURES

a. Operation - Powerhouse operation provides for generation of power during peak load periods. The spillway barrier was constructed to provide additional head for the turbines. The lock system is utilized as part of the New York State inland waterway system. According to operating personnel, the locks are operated on the average of once an hour. A complete operating cycle requires approximately 20 minutes.

b. Maintenance of Dam and Operating Facilities - The lock system and non-overflow gravity section have recently undergone an extensive program of concrete resurfacing. All gates, controls, and power systems have been replaced or modernized. The lock system is inspected twice annually. According to the powerhouse foreman, maintenance is performed on an "as needed basis."

c. Flood Warning System - Operating personnel stated that no flood warning system has been established.

SECTION 2 - VISUAL INSPECTION

2.1 FINDINGS

a. General - The field inspection of the Seneca Falls Dam took place on June 5, 1978. The sky was partly cloudy and the temperature was about 55 degrees during the inspection. No underwater areas were inspected.

b. Dam - The Seneca Falls Dam consists of a series of connected structures (See Figure 2). The south embankment extends from the south abutment to the south wall of the upper lock. A concrete retaining wall is constructed along the upstream face of the embankment from the lock wall for a distance of about 50 feet. The depth of the concrete wall could not be determined. Stone riprap covers the upstream slope of the embankment for the remainder of its length. The upstream slope on this portion of the embankment is about 2:1 (horizontal to vertical). The downstream slope of the embankment is about 2:1 for approximately 15 feet, followed by a wide earth fill area. The top of the embankment is a gravel roadway to the lock control building, which is adjacent to the lock wall. The embankment is grass covered and appears to be stable, due in part to the wide fill zone on the downstream side.

The lock structures (See Figures 4 and 5) appear to be in excellent condition. Operating personnel stated that extensive remedial work on the lock structures was completed in November, 1977. According to Mr. Michael LaVere, lock operator, the top 6 to 12 inches of concrete was removed from all of the lock structures, followed by resurfacing. Viewing the north lock wall from the concrete gravity section of the dam, some of the older concrete of the wall was observed to be exposed below the extent of resurfacing. Some aggregate is exposed, but the concrete appears to be in good condition. All steel walkways, railings, and structures have been recently painted. The lock system was operated during the inspection visit, and was found to be in excellent condition. The lock gates can be operated from any of three control panels located on the south walkway, or from the control building.

The concrete gravity non-overflow section of the dam abuts the north wall of the lock structure. Electrical operating assemblies for the four gated outlets are located on the top of the gravity section. The assemblies are provided with hand wheels for manual operation of the gates. The gates were not operated, but they appear to be well

maintained. At the junction of the non-overflow section and the lock wall, some deterioration of the surface concrete was observed, but it appeared to extend only one or two inches. The downstream surface of the non-overflow section appears to have been resurfaced, but not as recently as the resurfacing of the locks. Near the center of the non-overflow section, the grouted surface appears to have lifted from the downstream face leaving about an 8 foot horizontal crack. The crack is about 30 feet below the top of dam. The top of the non-overflow section has been recently resurfaced.

The concrete spillway is located between the non-overflow section and the powerhouse. A steel beam clear-span serviceway bridges the spillway. The spillway is blocked except for narrow stoplog controlled openings at each end, used for discharging debris over the dam (See Figure 3). The concrete surface of the spillway appears to be in good condition. No cracking or spalling of the concrete was detected.

The powerhouse is a massive concrete structure with a brick superstructure. A walkway at the upstream side of the powerhouse appears to have been resurfaced with macadam recently. The concrete trash rack supports have also been recently resurfaced. A concrete retaining wall extends about 75 feet downstream of the powerhouse. The wall is badly spalled and cracked, especially at the downstream end. Weep holes were observed in the retaining wall about midway from the powerhouse to the end of the wall. About one gallon per minute of clear water was discharging from a weep hole at the base of the wall. The weep holes at about 15 feet and at about 30 feet above the tailwater pool were dry.

The north embankment extends from the powerhouse to the north abutment. A concrete retaining wall is constructed at the upstream side of the earth embankment. The height of the wall could not be determined during the inspection. The downstream slope of the embankment appears to be very steep (about 1:1), and is heavily covered with brush and weeds. The steep slope extends about 15 feet vertically from the top of dam. At this point, a wide, nearly horizontal, fill area extends for about 50 feet to the natural valley slope. A stone and masonry gutter, constructed next to the powerhouse retaining wall, provides a drainage path for the embankment and fill area.

SECTION 3 - HYDROLOGY AND HYDRAULICS

The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation using standard reduction factors. The flood hydrograph was constructed from the Snyder unit hydrograph. Values of the Snyder coefficients were chosen to account for the attenuating and lagging effects of Seneca Lake on the hydrograph. The PMF computations included herein are necessarily a simplification of the complex hydrologic and hydraulic characteristics of the basin. A detailed hydrologic/hydraulic analysis considering all operating alternatives and hydrologic conditions is beyond the scope of a Phase I Report.

Flood routing was performed assuming the gated outlets to be open and the turbines to be in operation. Weir flow was assumed across the entire structure for reservoir surface elevations higher than the top of dam. The peak outflow for the PMF was calculated to be about 54,000 cfs. This corresponds to a maximum water surface elevation approximately 7 feet above the top of dam (Elevation 441.0). Results of the hydrologic/hydraulic analysis indicate that the dam would be overtopped by all floods exceeding approximately 11 per cent of the PMF.

The reservoir volume was calculated based on assumptions noted on page A16. The powerhouse foreman stated that the reservoir has been emptied in one day by operating all four turbines.

SECTION 4 - STRUCTURAL STABILITY

4.1 VISUAL OBSERVATIONS AND STABILITY ANALYSIS

Stability analyses were performed on both the non-overflow and the spillway sections of the Seneca Falls Dam, assuming each structure acting independently with no consideration given to additional lateral support from the adjoining structures.

Review of the stability analysis for the non-overflow section indicates that adequate factors of safety are present and that the foundation reaction is in the middle third of the base for all conditions analyzed, except the PMF. For this condition, the location of the foundation reaction is outside of the middle third of the base.

Review of the stability analysis for the spillway section indicated that satisfactory factors of safety are present only for the normal pool condition. Higher pool elevations and ice loading conditions cause the resultant of forces to fall outside the middle third of the base.

The stability of both the non-overflow section and the spillway section would be enhanced if adequate bond exists between the spillway and the powerhouse, and between the non-overflow section and the lock wall. An analysis that would include all structural aspects relating to the powerhouse, and lock structure is beyond the scope of a Phase I Report.

No information was available on the design, composition, or construction of the earth embankments. Therefore, no assessment of the stability of these structures could be made.

4.2 GEOLOGY AND SEISMIC STABILITY

The Seneca Falls Dam is located within the Erie-Ontario physiographic province, a relatively low, flat area bordering Lake Erie and Lake Ontario. This simple erosional topography is modified by glacial drift in the form of drumlins, shoreline deposits, and recessional moraines. Bedrock in the vicinity of the Seneca Falls Dam is a thinly bedded Silurian dolomitic shale. Relatively flat bedded outcroppings of bedrock were visible along the north abutment. The dam is located in Seismic Risk Zone 2 of the Seismic Risk Map of Contiguous States. No

earthquakes of significant magnitude have been recorded within 50 miles of this structure. Review of the stability analyses for the non-overflow and spillway sections of the dam for the recommended earthquake acceleration of .05g indicates that the stability requirements of Chapter 4 of the Recommended Guidelines for Safety Inspection of Dams are met.

SECTION 5 - ASSESSMENT/REMEDIAL MEASURES

5.1 ASSESSMENT

The Seneca Falls Dam is well maintained. However, when analyzed independent of the lateral support offered by the lock structure and the powerhouse, the non-overflow and spillway sections of the dam may not be able to provide an adequate margin of safety when subjected to extreme loading conditions. (See Stability Analyses in the Appendix). No significant deficiencies were noted during the visual inspection of the earth embankments. Further assessments relating to the stability of the embankments is beyond the scope of the Phase I Report.

The PMF was found to overtop the structure by about 7 feet. The maximum discharge of 6,400 cfs without overtopping is equivalent to approximately 11 per cent of the PMF; therefore, the spillway can be judged seriously inadequate. It is possible that the concrete structures could withstand overtopping by 7 feet, but severe damage and possible failure of the earthen sections would be expected.

5.2 REMEDIAL MEASURES

a. Detailed Investigations - A detailed hydrologic/hydraulic analysis of the PMF is recommended to be done immediately, taking into consideration the effects of alternative operational procedures, and including the effects of Seneca Lake and upstream regulating structures on the flood wave.

b. Remedial Measures - The steel channel bars shown in Figure 3 should be removed to provide an additional means of discharge. The entire length of the weir could be provided with flashboards or Bascule-type gates to maintain the added head to the turbines without sacrificing discharge capacity.

If the results of the recommended detailed investigation confirms that the dam cannot pass at least one half of the PMF, the spillway should be considered seriously inadequate and remedial measures should then be recommended.

FIGURES

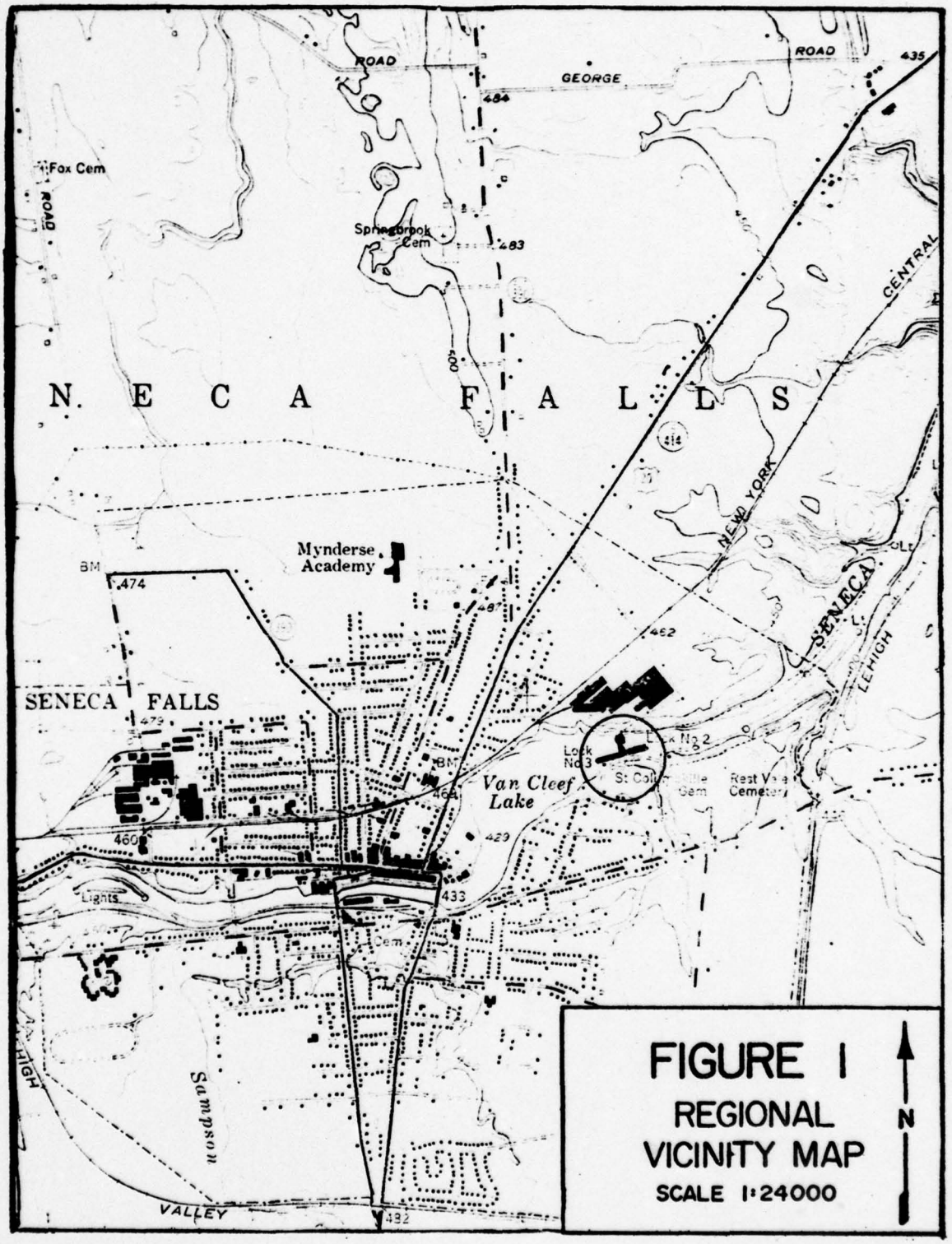


FIGURE 1

REGIONAL VICINITY MAP

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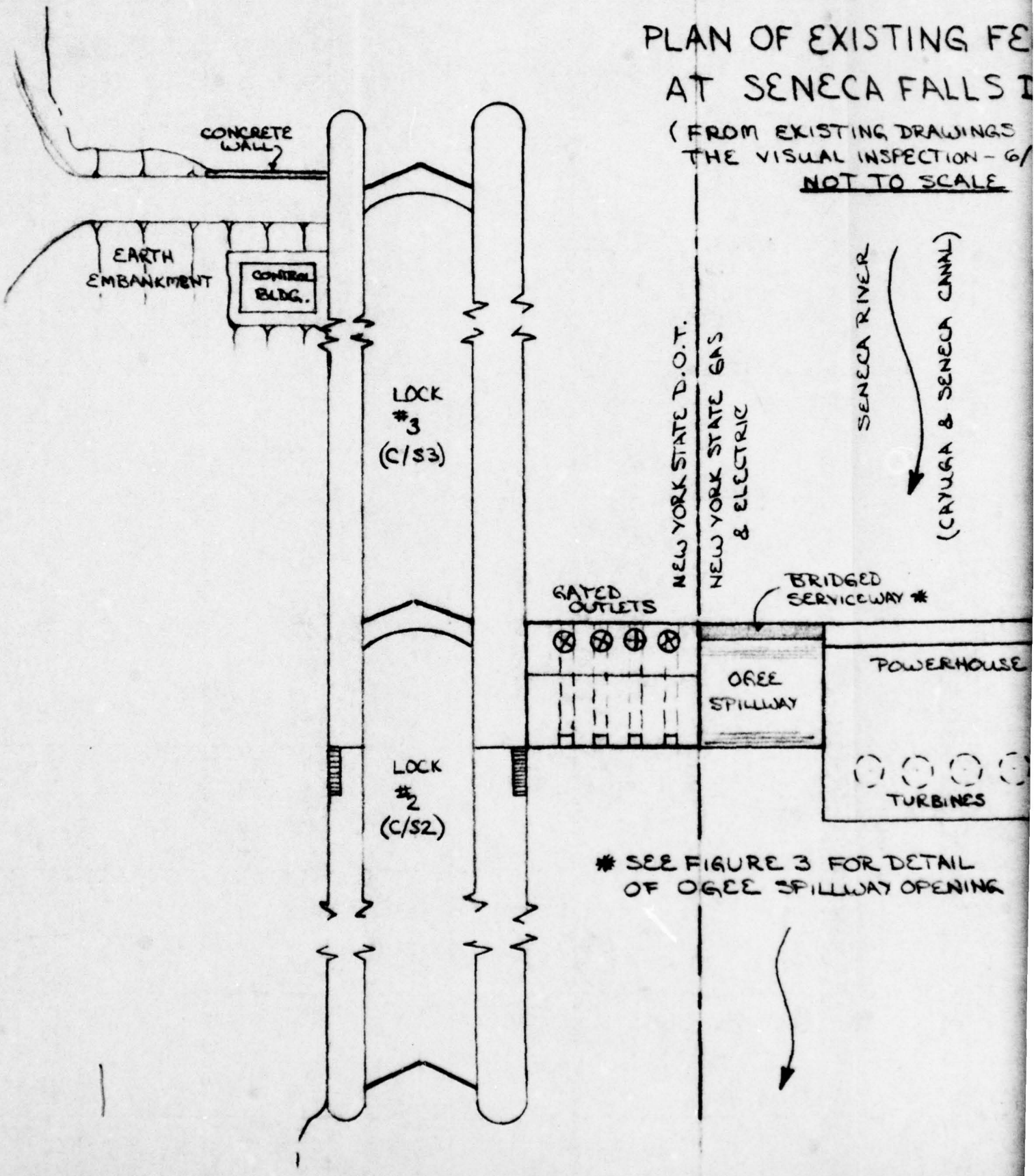
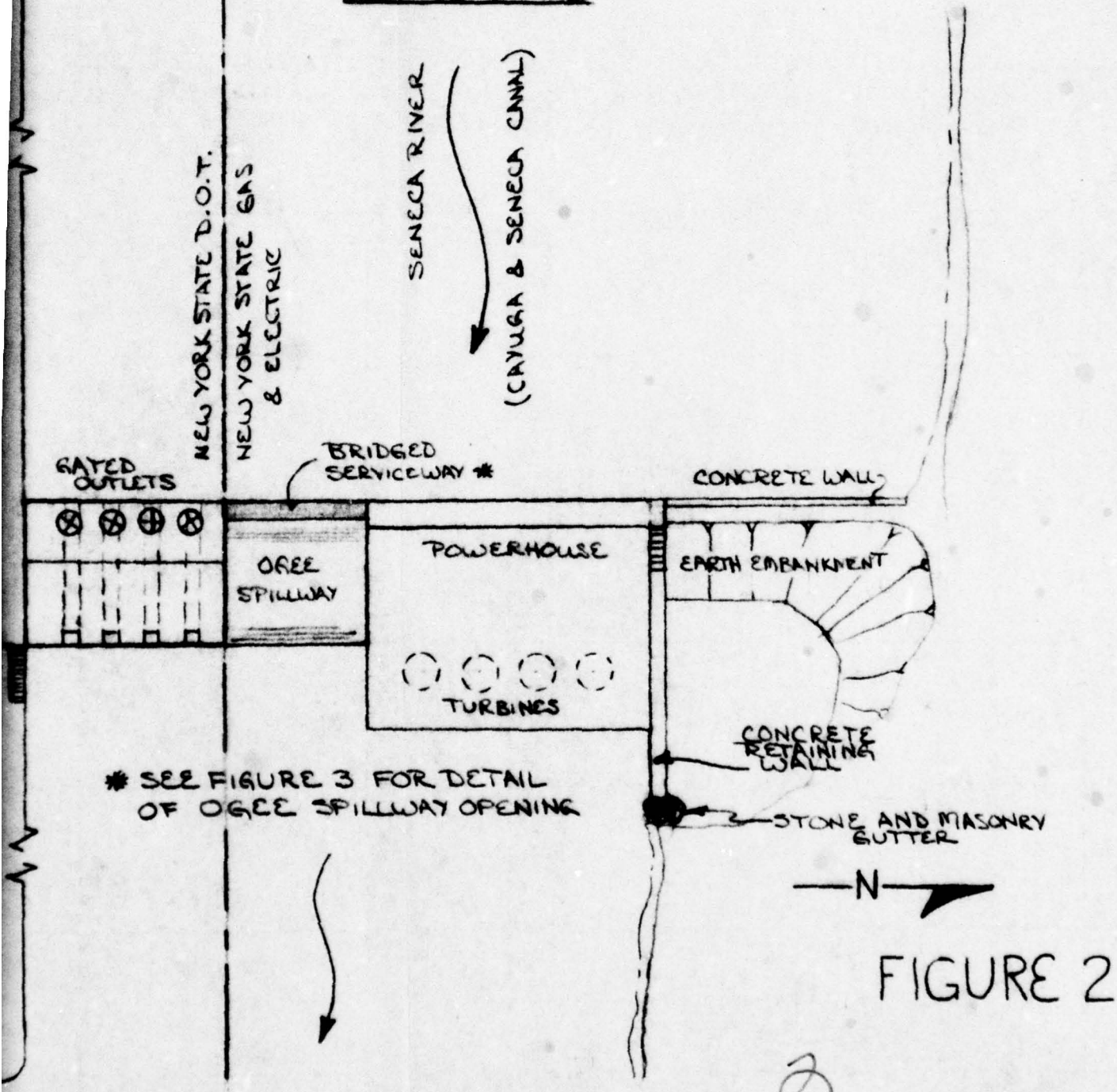

PLAN OF EXISTING FE
AT SENECA FALLS I
(FROM EXISTING DRAWINGS
THE VISUAL INSPECTION - 6/
NOT TO SCALE
CONCRETE WALL
EARTH EMBANKMENT
CONTROL BLDG.
LOCK #3 (C/S3)
LOCK #2 (C/S2)
NEW YORK STATE D.O.T.
NEW YORK STATE GAS & ELECTRIC
SENECA RIVER
(CAYUGA & SENECA CANAL)
GATED OUTLETS
BRIDGED SERVICEWAY *
OGEE SPILLWAY
POWERHOUSE
TURBINES
* SEE FIGURE 3 FOR DETAIL OF OGEE SPILLWAY OPENING

PLAN OF EXISTING FEATURES AT SENECA FALLS DAM

(FROM EXISTING DRAWINGS AND THE VISUAL INSPECTION - 6/5/78)

NOT TO SCALE



* SEE FIGURE 3 FOR DETAIL OF OGEE SPILLWAY OPENING

FIGURE 2

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

NAME OF CLIENT: N.Y.D.E.C.	SHEET NO. ____ OF ____
PROJECT: SENECA FALLS DAM	DATE: 6/1/78
	COMP. BY: DBC
	CHECKED BY:

LONGITUDINAL SECTION OF OVERFLOW SPILLWAY AT SENECA FALLS DAM SHOWING THE LOCATION OF THE STOPLOGGED OPENINGS

(SECTION LOOKING DOWNSTREAM)

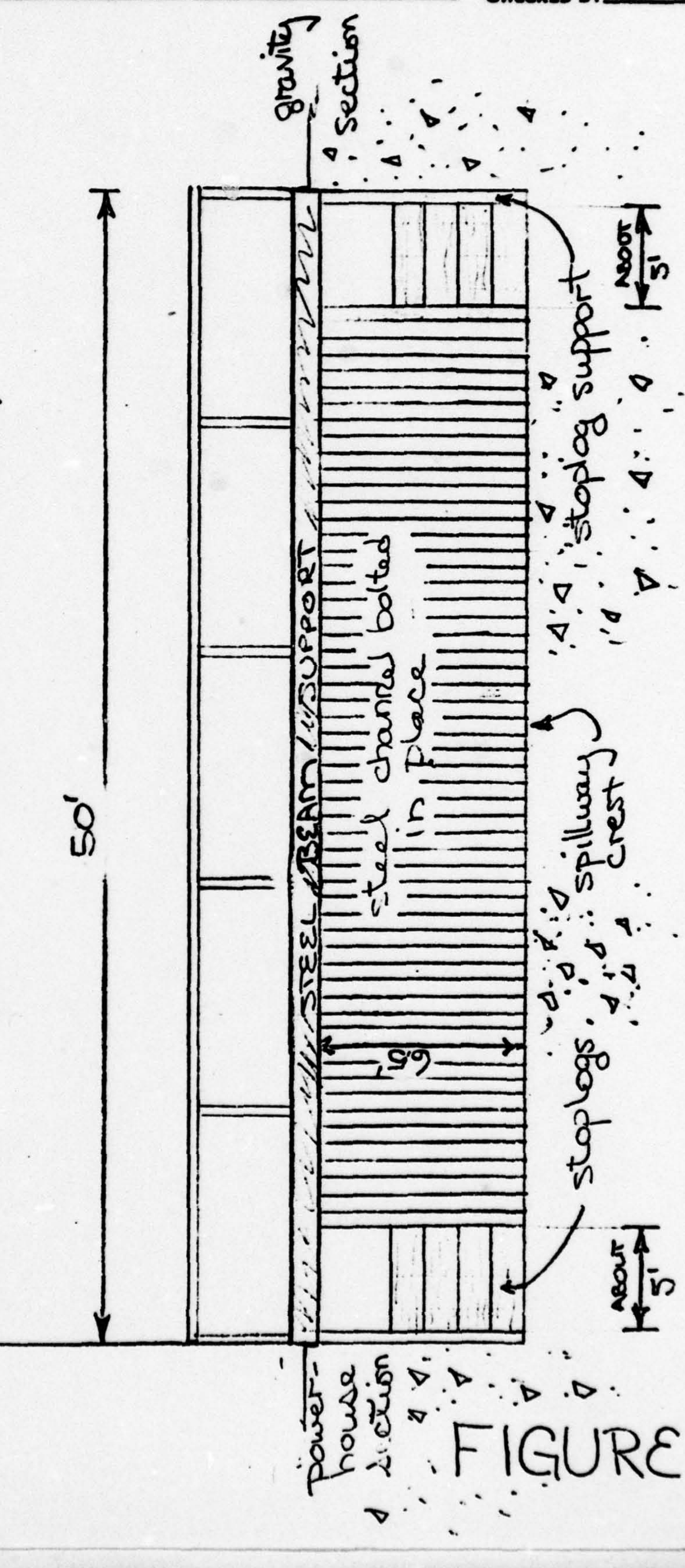
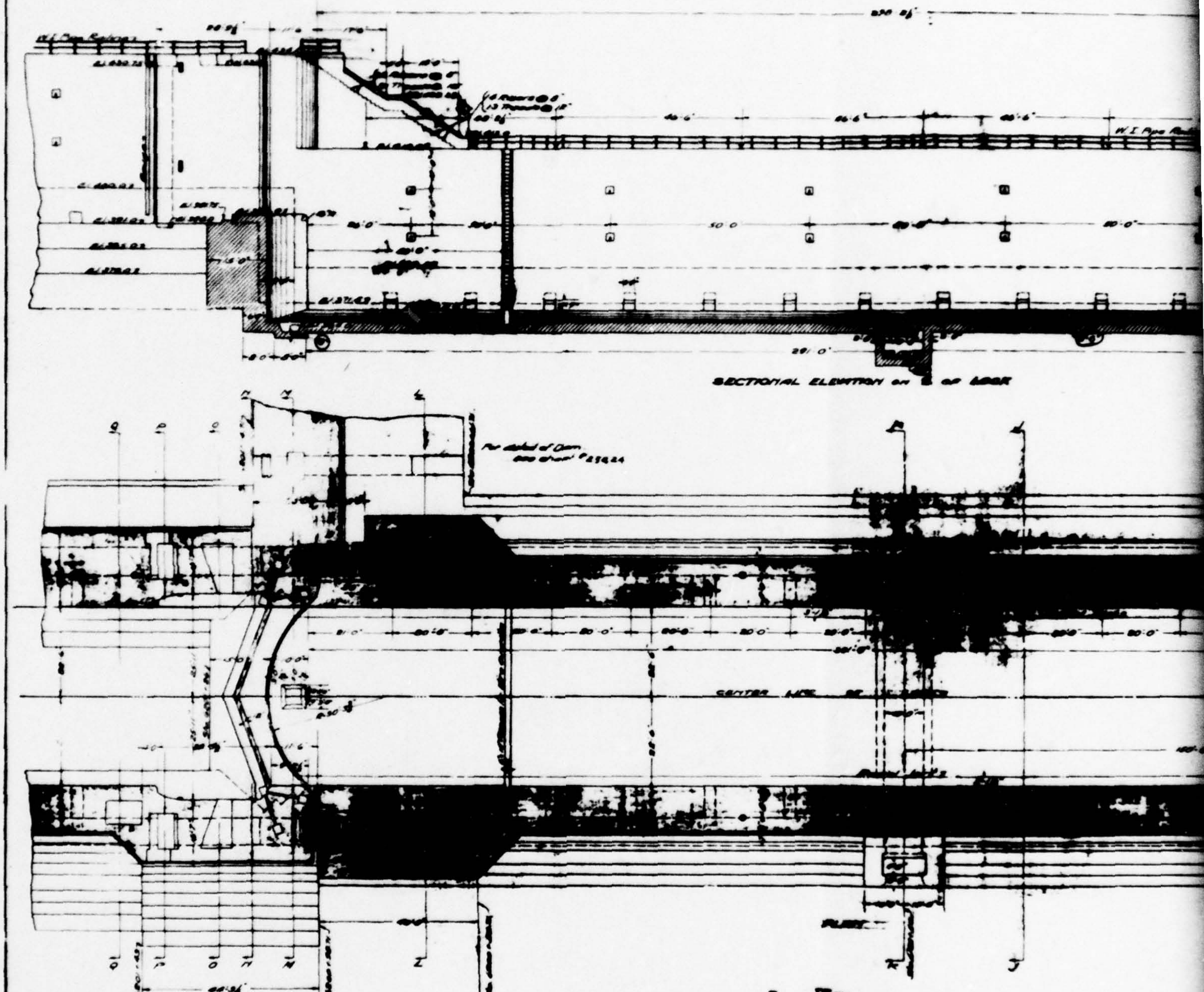


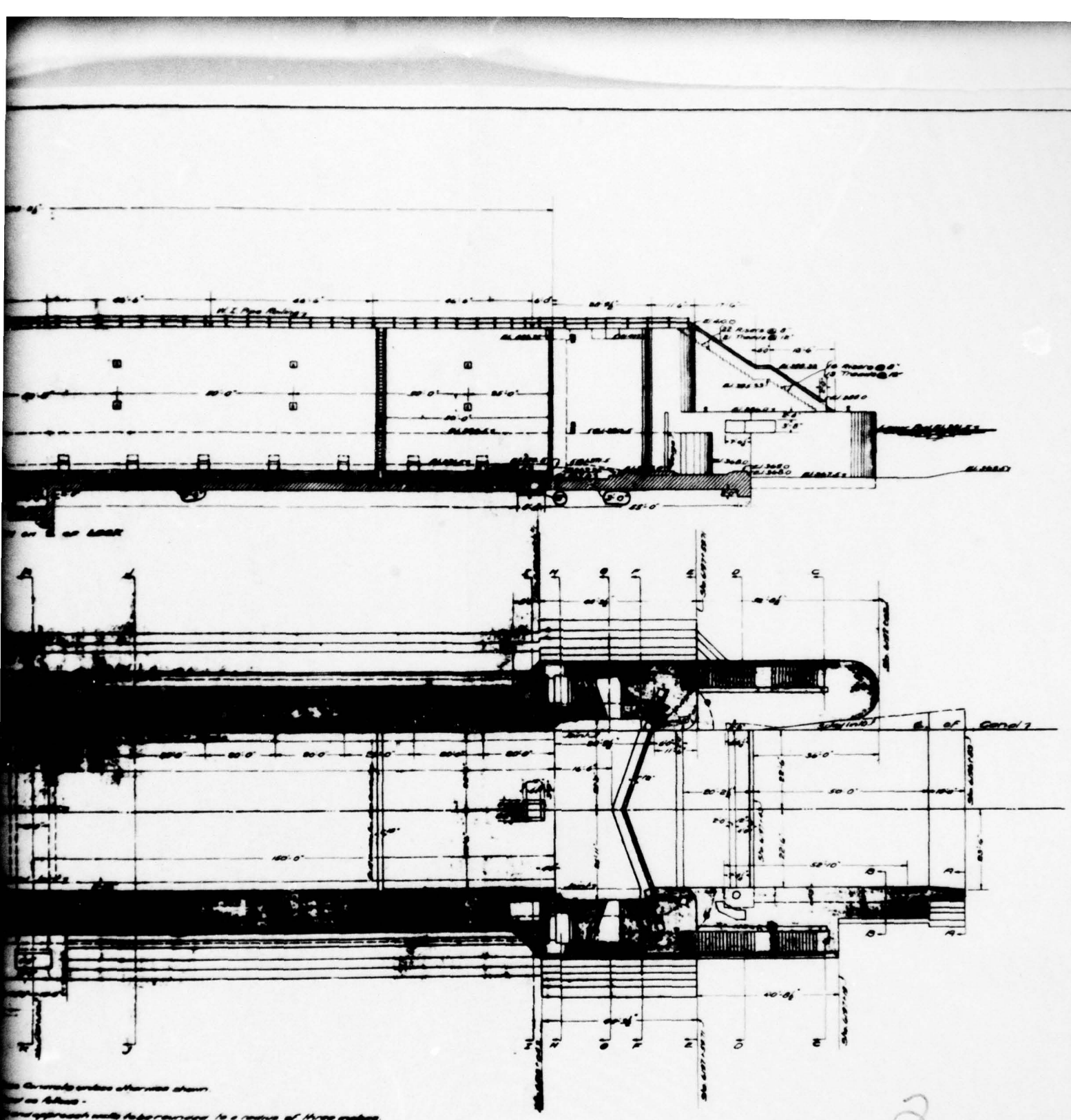
FIGURE 3



All masonry shown on this sh... 2nd Class Concrete unless otherwise shown.
All top inner edges of lock ... finished as follows -
Edges of gate recesses, ... walls and approach walls to be rounded to a radius of ...
In lock chamber from ... to gate recess, edges to be rounded to a radius of six inches
All other exposed edges ... to be rounded to a radius of two inches.
Vertical joints to be spa... forty feet apart. For detail of joints see sheet # 10
Wall reinforcement ... of minimum cross section ...
... may be changed ...
The bases of structure ...
and may be ordered ... Engineer in order to be of ...
to give a proper fo...
For detail location ... sheet # 6
Ladders to be in ...
Line hooks to b... ...ails
For sections ... sheet # 12
For Foundatio... sheet # 11
For enlarged ... and thrust posts see sheet # 14
For details o... anchorages see sheet ...
For lock ch... sheet # 15
No vertica... be allowed in ...
Sta 4300+0... 4301+20 ...
For deta... hinge, see sheet ...
Steel ... Lining at each side.

Made by ...
1st Check by ...
Traced by ...
2nd Check by ...

FI...



Contract C.

CAYUGA AND SENECA CANAL, SEC. 1.

For constructing locks, dam etc., at Seneca Falls.

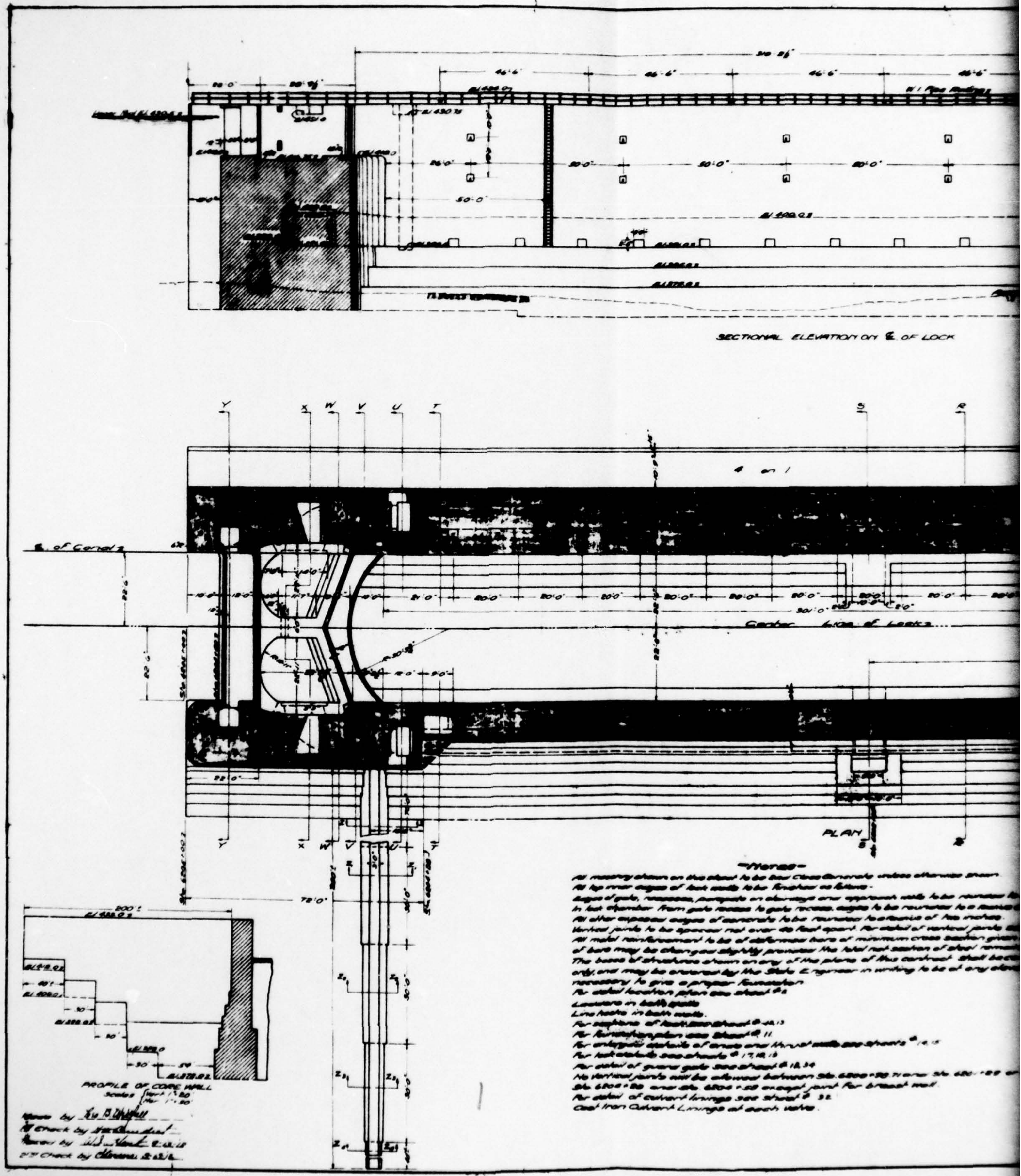
PLAN & ELEVATION LOCK 2

Scale: 16 feet to the inch

Examined and approved

Examined and approved

FIGURE 4


SECTIONAL ELEVATION ON ℄ OF LOCK
4 on 1
℄ of Canal
Center Line of Lock
PLAN
PROFILE OF CORE WALL
—Notes—
All masonry shown on the sheet to be Class Concrete unless otherwise shown.
All top inner edges of lock walls to be finished as follows -
Edges of gate, recesses, parapets on stairways and approach walls to be rounded
In lock chamber from gate recess to gate recess, edges to be rounded
All other exposed edges of concrete to be rounded to a radius of two inches.
Vertical joints to be spaced not over 40 feet apart. For detail of vertical joints
All metal reinforcement to be of deformed bars of minimum cross section
of bars may be changed slightly provided the total net section of steel
The base of structures shown on any of the plans of this contract shall be
only, and may be ordered by the State Engineer in writing to be at any
necessary to give a proper foundation.
For detail location plan see Sheet # 8
Louvers in both walls
Line hooks in both walls.
For sections of lock see Sheet # 10, 13
For foundation plan see Sheet # 11
For enlarged details of anchor and thrust walls see Sheets # 14, 15
For lock details see Sheets # 17, 18, 19
For detail of guard gate see Sheet # 18, 34
For detail of culvert linings see Sheet # 32.
Cast Iron Culvert Linings at each valve.

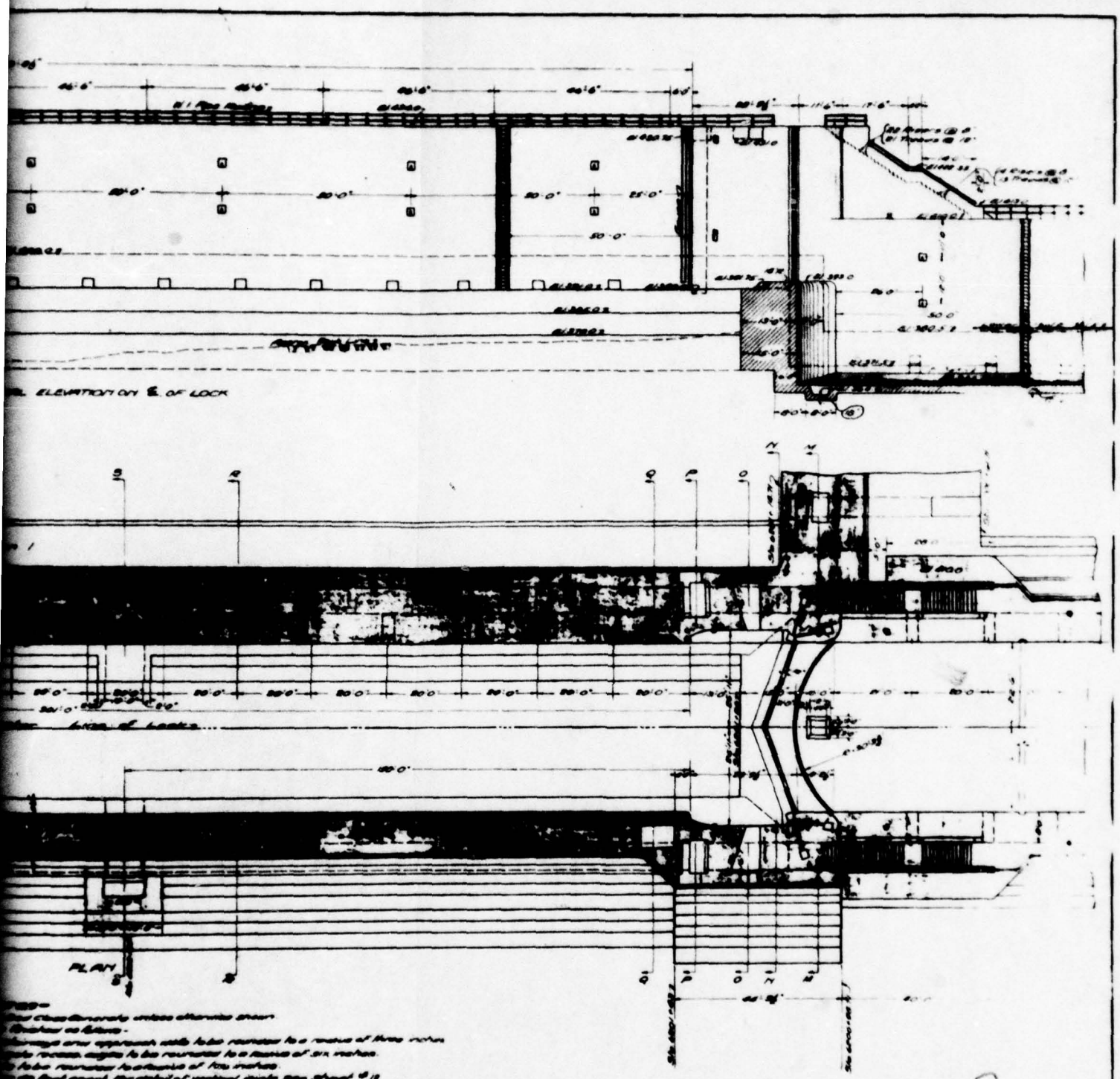


FIGURE 5

Contract C.

CAYUGA AND SENECA CANAL. SEC. I

For constructing locks, dam etc., at Seneca Fa

PLAN & ELEVATION LOCK 3

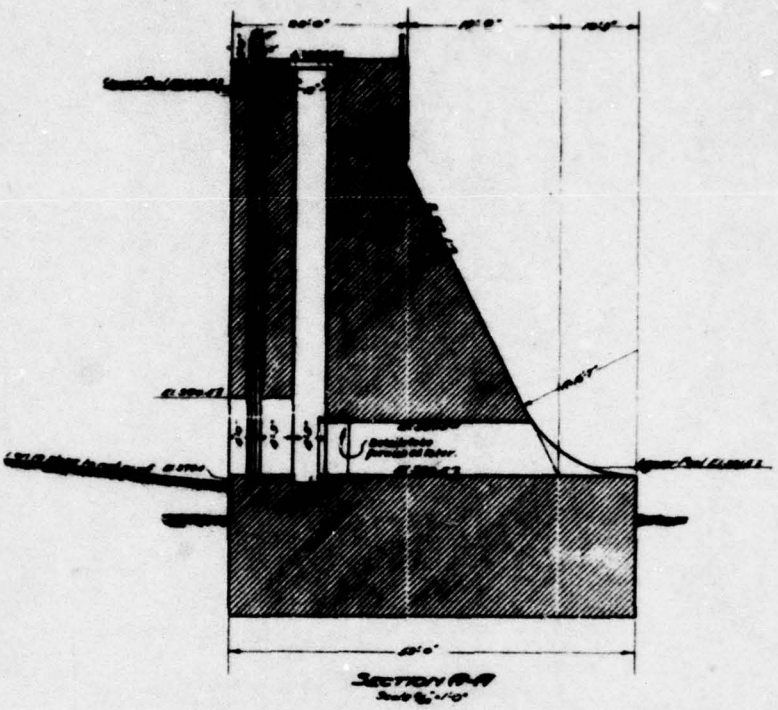
Scale: 16 feet to the inch

Examined and approved

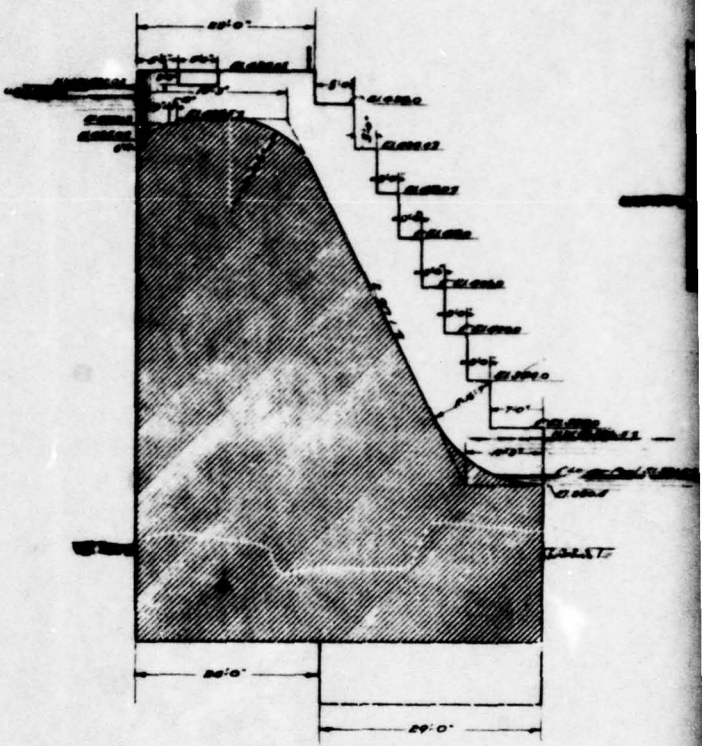
Oct 2 1912

Supervising Engineer

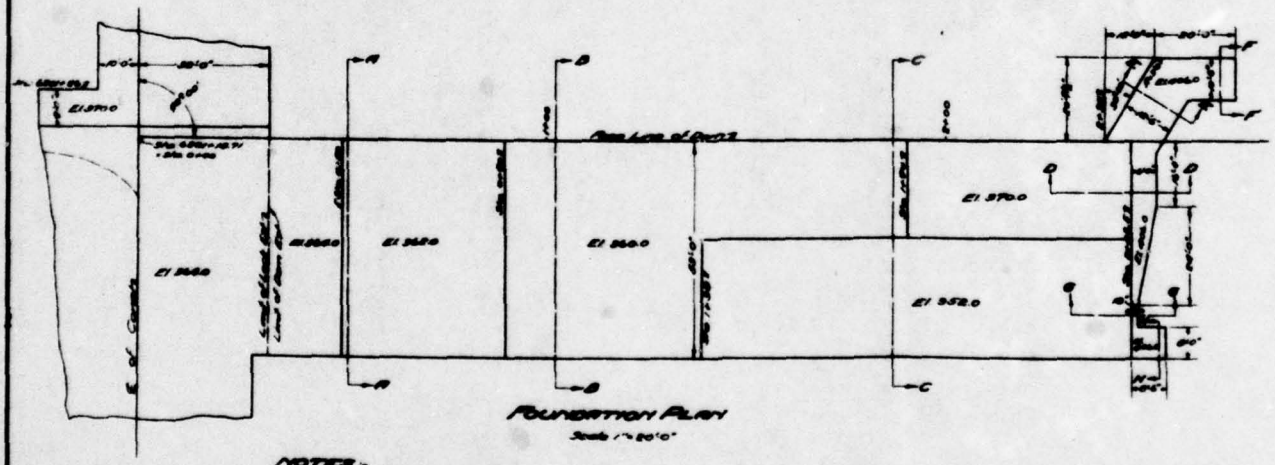
Examined and approved



SECTION A-A



SECTION B-B



FOUNDATION PLAN

NOTES:-

All masonry shown on this sheet to be 3rd Class Concrete unless otherwise stated

All exposed edges of concrete to be rounded to a radius of two inches unless otherwise shown.

The bases of the structures shown on any of the plans of this contract shall be considered as approximate only and may be ordered by the State Engineer intending to be of any dimension and of any dimensions necessary to give a proper foundation.

Made By W. Hatfield

Traced By

Checked By

Final Checked By

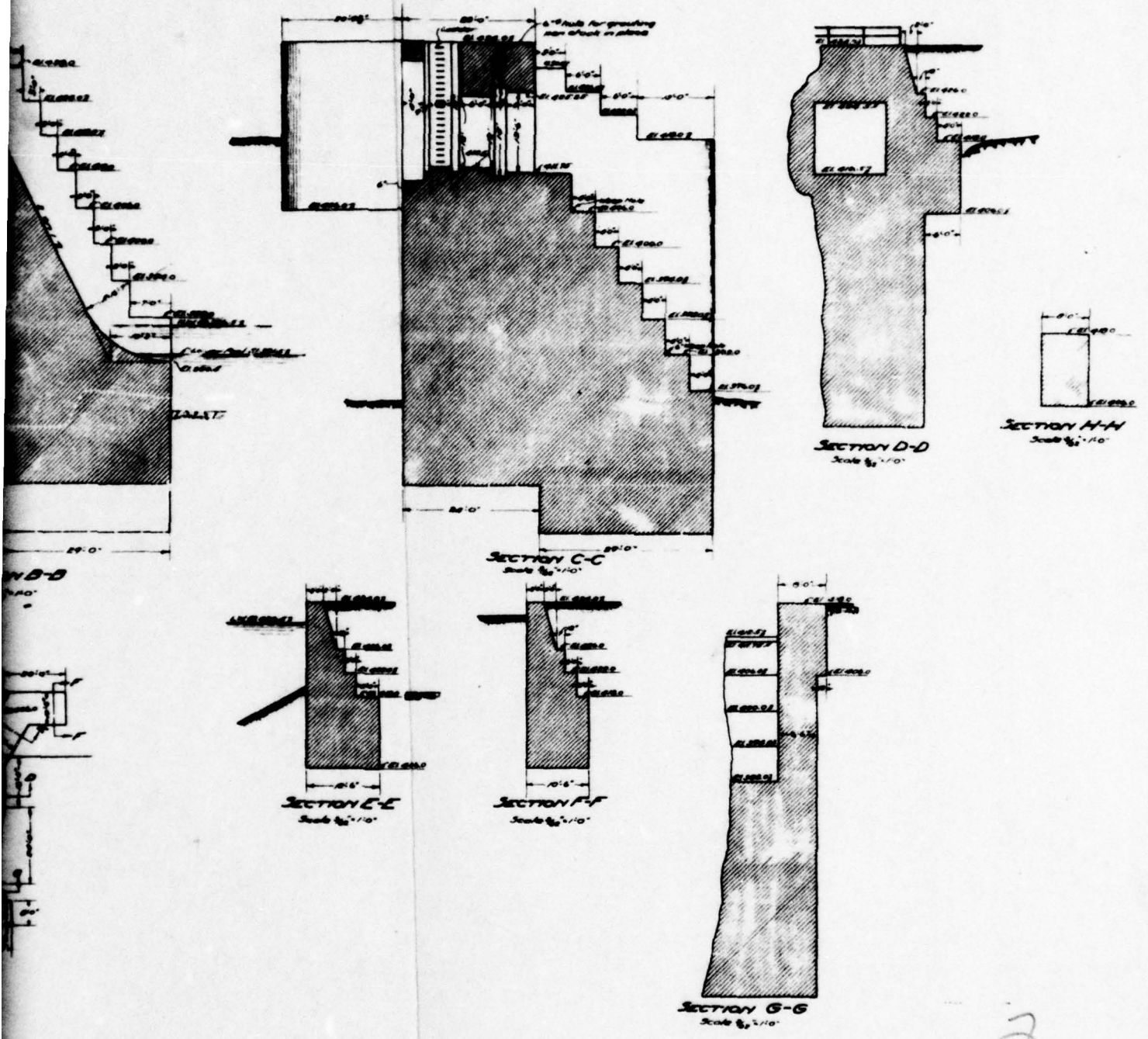


FIGURE 6

Contract C.

CAYUGA AND SENECA CANAL, SEC. I.

For constructing locks, dam etc., at Seneca Falls.

FOUNDATION PLAN & SECTIONS OF DAM 2

Scales as indicated

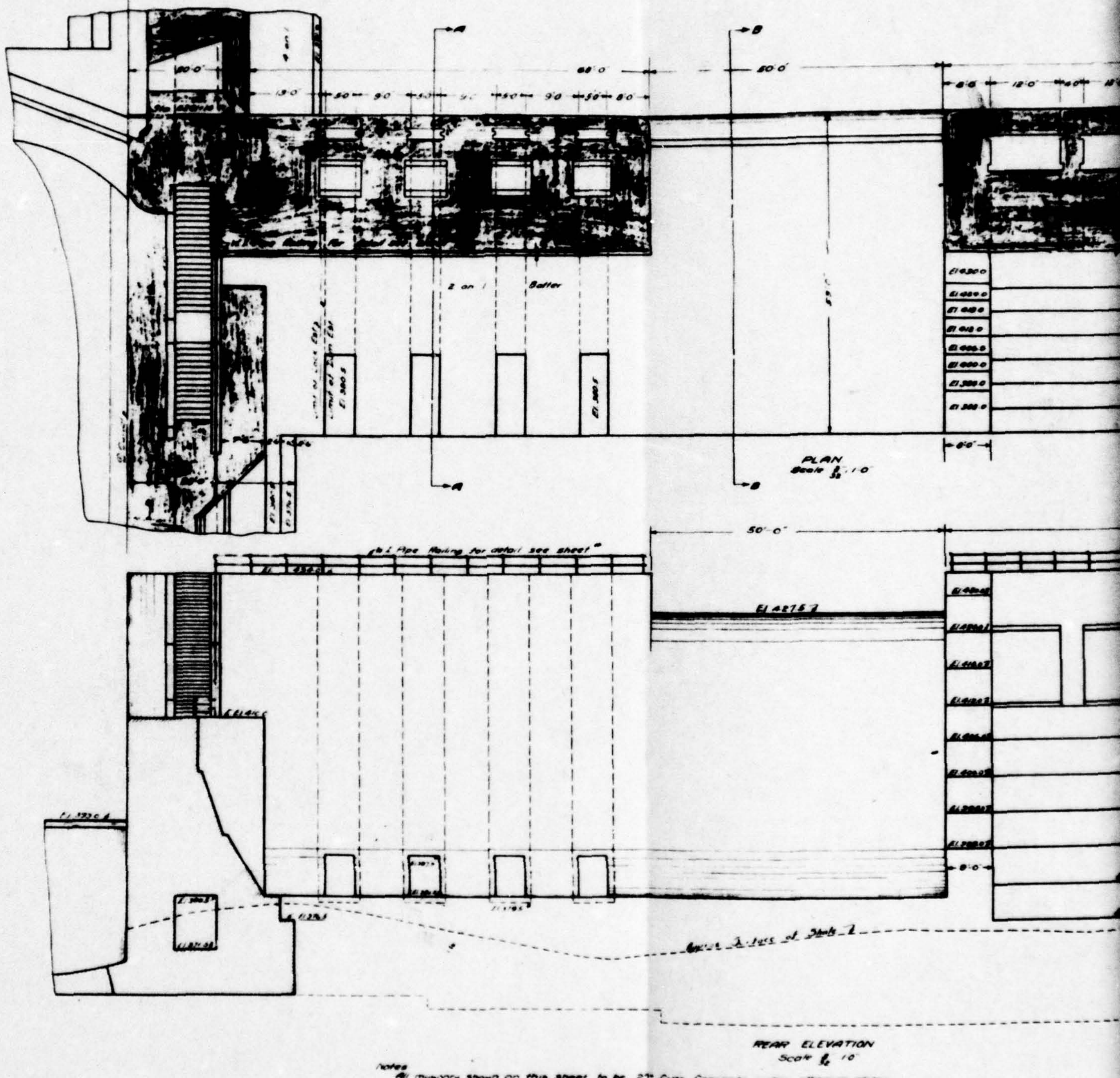
Examined and approved

Supervising Engineer

Examined and approved

Alex E. Hartt

Special Deputy State Engineer



Notes

All masonry shown on this sheet to be 2nd Class Concrete unless otherwise stated.

All exposed edges of concrete to be rounded to a radius of two inches unless otherwise shown.

The bases of structures shown on any of the plans of this contract shall be considered as approximate only and may be ordered by the State Engineer in writing to be at any elevation and of any dimensions necessary to give a proper foundation.

For sections see sheet" 20

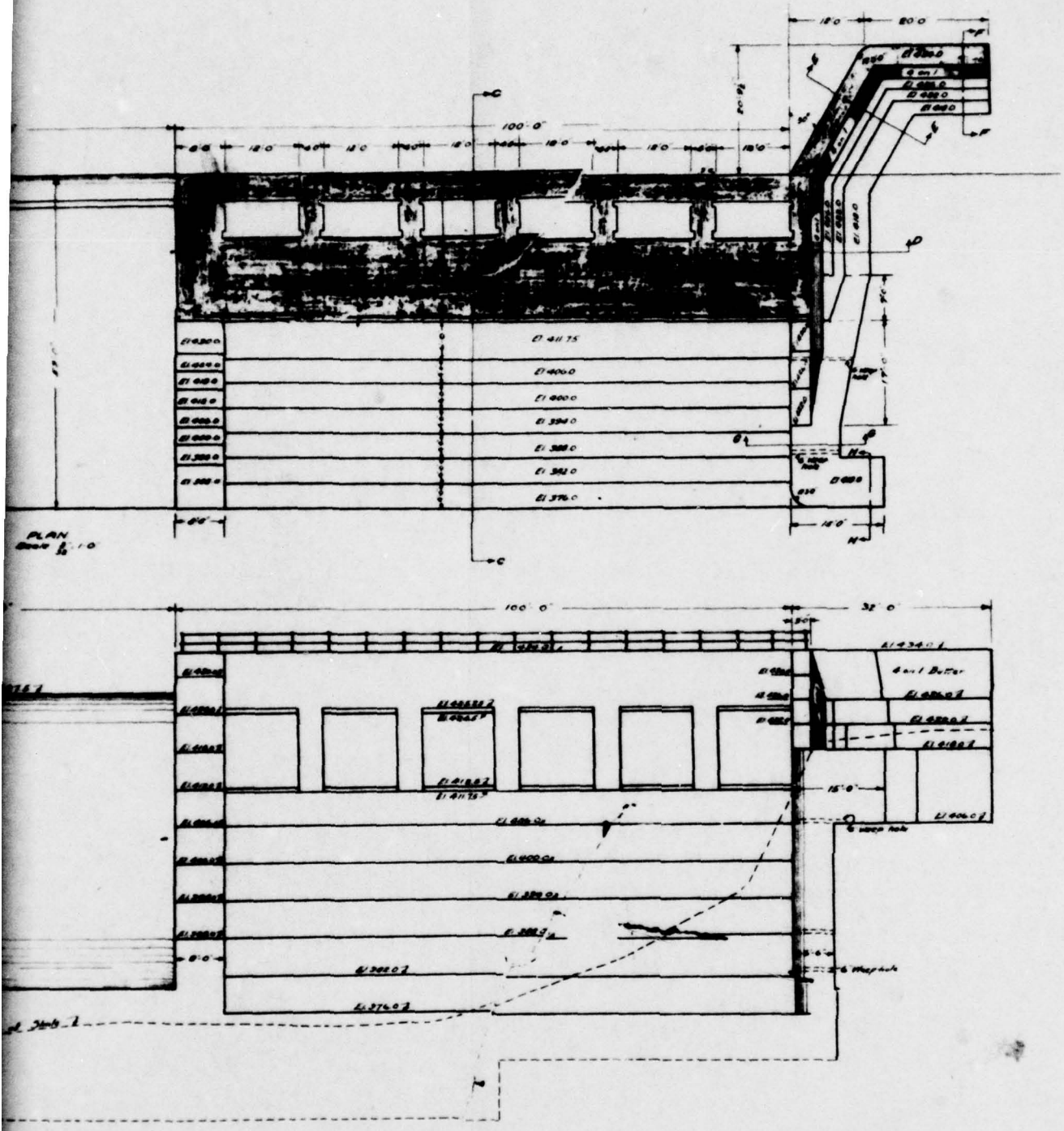


FIGURE 7
Contract C.

CAYUGA AND SENECA CANAL, SEC. I.

For constructing locks, dam etc., at Seneca Falls.

PLAN & ELEVATION OF DAM 2

2

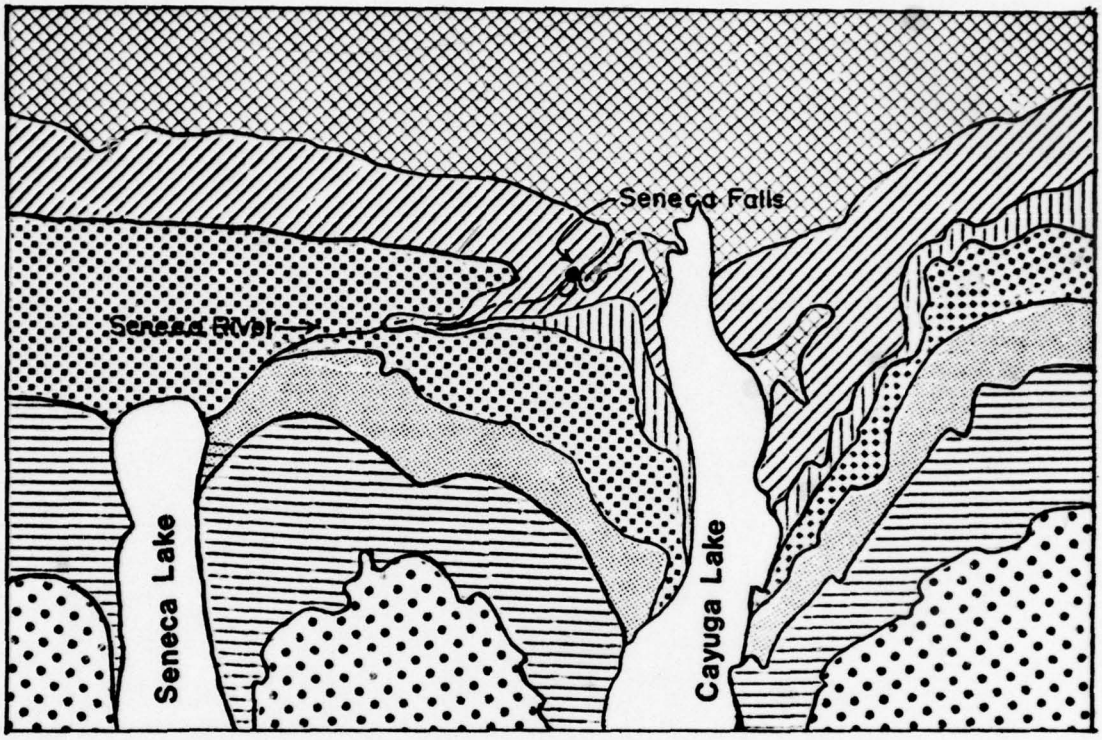
Scale: $\frac{3}{32}$ inch = 1 foot.

amined and approved

Supervising Engineer.

Examined and appr

Special Deputy State Engineer



LEGEND

- Dhld - Ludlow Formation, shale and limestone
- Dhsk - Skaneatales Formation, shale and limestone
- Dhmr - Marcellus Formation, shale
- Don - Onondago Limestone (cherty)
- Sab - Akron Dolostone, dolostone and shale
- Scy - Camillus and Syracuse Formations, shale, dolostone, gypsum, salt
- Dhy Coeymans and Manlius Limestones and Rondout Dolostone

FIGURE 8

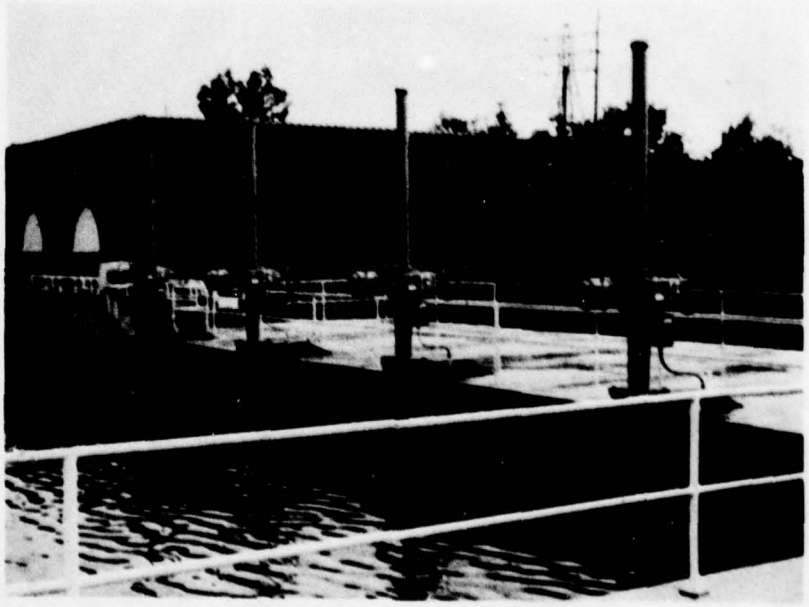
GEOLOGIC MAP

Scale 1:250000

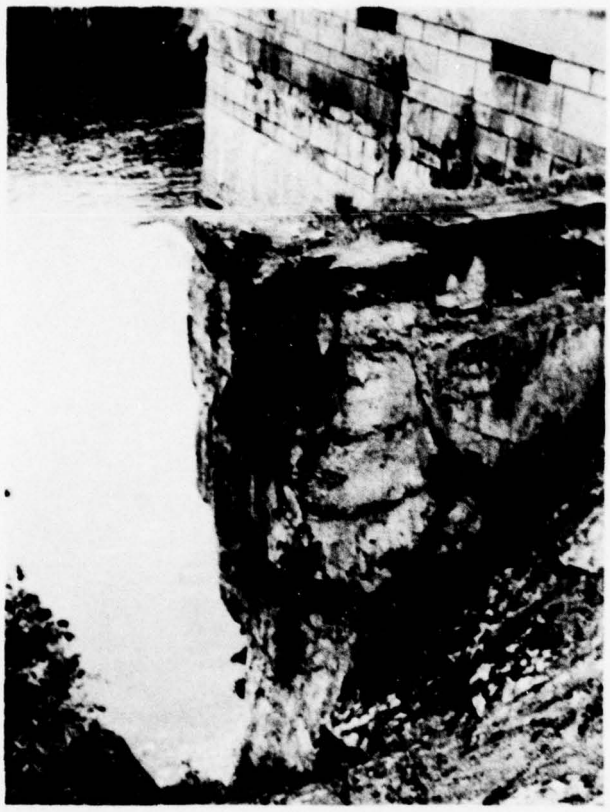
APPENDIX

PHOTOGRAPHS

UPSTREAM FACE OF DAM FROM NORTH EMBANKMENT



GATE OPERATING ASSEMBLIES AND POWERHOUSE



POWERHOUSE
RETAINING WALL

DOWNSTREAM CHANNEL

FIELD INSPECTION REPORT

Check List
Visual Inspection
Phase 1

Name Dam Seneca Falls Dam County Seneca State New York Coordinators _____

Date(s) Inspection 6/5/78 Weather Clear Temperature 60°

Pool Elevation at Time of Inspection 430 M.S.L. Tailwater at Time of Inspection 370 M.S.L.

A3

Inspection Personnel:

Mr. George C. Elias Mr. James Ryan _____

Mr. Stephen H. Snider _____ _____

Mr. David B. Campbell

Mr. David B. Campbell Recorder

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No problems noted.	None.
DRAINS	Weep holes were observed at the powerhouse retaining wall. The weep hole near the tailwater elevation was discharging about 1 gpm of clear water.	None.
WATER PASSAGES	Four 5 foot by 7 foot gated openings are located near the base of the concrete gravity section.	The gate operators are electrically or hand wheel operated.
FOUNDATION	Thinly bedded shales were noted as outcrops on the south valley wall. Figure 7 indicates that the foundation material is shale.	None.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBERSVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	General condition of concrete is good. Minor horizontal crack noted on downstream face of gravity section. Grout coating at this location appears to have pulled away from the underlying concrete.	The crack appears to be in the grout surface only, but should be re-surfaced to protect the underlying concrete.
STRUCTURAL CRACKING	No structural cracking noted in any of the project structures.	None.
VERTICAL AND HORIZONTAL ALIGNMENT	Alignment is good. No signs of structural movement.	None.
MONOLITH JOINTS	Monolith joints could be seen only on the north side of the north lock wall. No problems were noted at these joints.	None.
CONSTRUCTION JOINTS	No problems noted.	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted on either embankment.	None.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted on either embankment.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None noted on either embankment.	None.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	No problems observed.	None.
RIPRAP	Upstream face of the south embankment and a portion of the north embankment protected with a concrete wall. Remaining portion of the north embankment is protected with riprap.	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems noted.	None.
ANY NOTICEABLE SEEPAGE	None noted.	None.
STAFF GAGE AND RECORDER	None.	None.
DRAINS	Weep holes were observed on the powerhouse retaining wall.	None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None noted.	None.
INTAKE STRUCTURE	Outlet works consist of four 5 foot by 7 foot openings through the gravity section.	None.
OUTLET STRUCTURE	Same as above.	None.
OUTLET CHANNEL	Discharge through outlet works is into the tailwater pool.	None.
EMERGENCY GATE	Each outlet is provided with electrically or hand wheel operated gate assemblies.	None.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The overflow spillway appears to be in good condition. No spalling or cracking was noted. The spillway has been blocked as shown on Figure 3.	The weir should be provided with removable stoplogs or flashboards for the entire length.
APPROACH CHANNEL	None.	None.
DISCHARGE CHANNEL	Discharge is into the tailwater pool downstream of the dam.	None.
BRIDGE AND PIERS	The spillway is provided with a clearspan serviceway.	None.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes along the reservoir are moderate and well vegetated.	None.
SEDIMENTATION	No observation of reservoir sedimentation could be made.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No problems noted.	None.
SLOPES	Slopes are mild on the north and moderate to steep on the south. Outcrops of thin horizontally bedded shales were noted on the south valley wall.	The slopes do not appear to affect the safety of the dam.
APPROXIMATE NO. OF HOMES AND POPULATION	Lehigh Valley Junction is located about 2 miles downstream from the Seneca Falls Dam. The town has about 40 dwellings (about 150 people).	None.

All

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No design computations available. PMF inflow and outflow peak discharges are 52,000 cfs and 54,000 cfs respectively. The foundation reaction for extreme loading conditions is outside of the middle third of the base for both the gravity section and the overflow section.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES.	Unknown.

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

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PHILADELPHIA, PA

SHEET NO. 1 OF

NAME OF CLIENT NYDEC

DATE 6/1/78

COMP. BY DEC

PROJECT SENECA FALLS

CHECKED BY RCH

DRAINAGE AREA (BY PLANIMETER) = 850 SQ. MILES

$L = 65$ MILES $\quad L_{CA} = 32$ MILES

MODERATE SNYDER COEFFICIENTS WERE CHOSEN DUE TO THE ATTENUATING EFFECTS OF SENECA LAKE AND UPSTREAM REGULATION.

$C_p = .4 \quad C_t = 4.0$

$t_p = C_t(L \times L_c)^{.3} = 4.0(65 \times 32)^{.3} = 39.6$ HRS.

$t_r = t_p/5.5 = 7.2 \quad t_R = 6.0$

$t_{PR} = t_p + .25(t_R - t_r) = 39.6 + .25(6.0 - 7.2) = 39.3$ HOURS

---

6 HR. PMP = 21"

REDUCTION DUE TO PROBABLE MISFIT OF BASIN WITH STORM ISOHYETAL IS 10%

6 HR. PMP = 18.9"

DEPTH - AREA - DURATION FOR PMP
(ZONE 1)

6 HR. PMP	$= 18.9 \times .5 = 9.5$"	
12 HR. PMP	$= 18.9 \times .62 = 11.7$"	$11.7" - 9.5" = 2.2"$
24 HR. PMP	$= 18.9 \times .73 = 13.8$"	$13.8" - 11.7" = 2.1"$
48 HR. PMP	$= 18.9 \times .78 = 14.7$"	$14.7" - 13.8" = .9"$

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PHILADELPHIA, PA

SHEET NO. 2 OF
DATE 6/2/78
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CHECKED BY REH

NAME OF CLIENT NYDEC
PROJECT SENECA FALLS

PMF RAINFALL

TIME (HRS)		RAINFALL (INCHES)
0-6	(B)	9.5
6-12	(A)	2.2
12-18	(C)	1.1
18-24	(E)	1.0
24-30	(I)	.3
30-36	(H)	.2
36-42	(G)	.2
42-48	(J)	.2

THIRD QUARTILE DISTRIBUTION

TIME (HRS)	RAINFALL (INCHES)
0-6	.2
6-12	.2
12-18	1.0
18-24	2.2
24-30	9.5
30-36	1.1
36-42	.3
42-48	.2

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PHILADELPHIA, PA

SHEET NO. 3 OF
DATE 6/2/78
COMP. BY DEC
CHECKED BY RFH

NAME OF CLIENT NYDEC
PROJECT SENECA FALLS

CURVE NUMBER

20% IMPERVIOUS (SURFACE WATER & PAVED AREAS) CN=99
40% WOODED CN=70.
40% MEADOW CN=60

$CN_{AVG} = .2 \times 99 + .4 \times 70 + .4 \times 60 = 72$

RAINFALL - RUNOFF RELATION

PRECIP. INCR.	PRECIP. Σ	RUNOFF INCR.	RUNOFF Σ	LOSSES INCR.	LOSSES Σ	
..	.2	.0	.0	.2	.2	
.2	.4	.0	.0	.2	.4	
1.0	1.4	.1	.1	.9	1.3	
2.2	3.6	1.1	1.2	1.1	2.4	
9.5	13.1	8.2	9.4	1.3	3.7	
1.1	14.2	.0	9.4	1.1	4.8	*
.3	14.5	.0	9.4	.3	5.1	*
.2	14.7	.0	9.4	.2	5.3	*

* AFTER MINIMUM LOSS RATE OF .2 IN/HR = 1.2 IN/6 HRS.

ESTIMATED STORAGE VOLUME FROM SENECA FALLS DAM (CAYUGA AND SENECA LOCK #3) TO CAYUGA AND SENECA LOCK #4, WATERLOO, NEW YORK.

RIVER DISTANCE FROM LOCK #3 TO LOCK #4

≈ 24,000 FEET

AVERAGE WIDTH OF RESERVOIR ≈ 250 FEET

ESTIMATED AVERAGE DEPTH ≈ 40 FEET

VOLUME ≈ 24,000' x 250' x 40' ÷ 43560 #/ACRE

= 5500 ACRE-FEET

DISCHARGE CAPACITY OF GATED OUTLETS

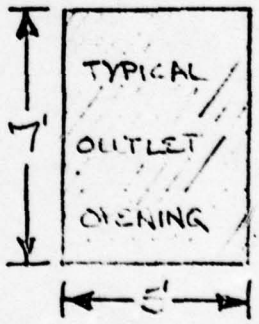
ASSUME EACH OUTLET TO ACT AS AN ORIFICE.

$C_c = .55$

$Q = C_c A \sqrt{2gH}$

$Q = .55 \times 35 \sqrt{64.4 \times H}$

$Q = 154\, H^{1/2}$



H_N (@ NORMAL POOL) = 430.5' - 384.0'
= 46.5'

$Q = 154 \times (46.5)^{1/2} = 1050$ cfs/per orifice or

$Q_T = 4 \times 1050$ cfs = 4200 cfs

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Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 5 OF _____
DATE 6/12/78
COMP. BY DRC
CHECKED BY RFH

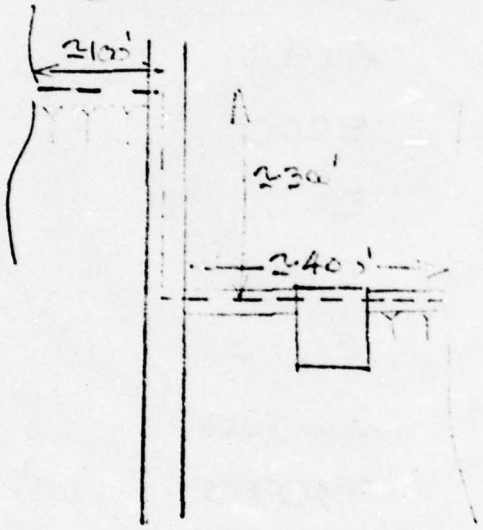
NAME OF CLIENT NYDEC
PROJECT TENBCH FALLS

FLOOD ROUTING

STAGE - DISCHARGE (OUTLET GATES OPEN AND TURBINES OPERATING)

STAGE = EL 390.

WEIR LENGTH FOR OVERTOPPING = 700'



$Q_{OT} = CLH^{3/2}$ LET C = 2.8

$Q = 2.8 \times 700 \times H^{3/2} = 1960 \times H^{3/2}$

ASSUME THE COMBINED DISCHARGE OF THE TURBINES VARIES LINEARLY WITH HEAD FROM 0 CFS @ EL. 390 TO 2000 CFS @ EL 430.

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Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

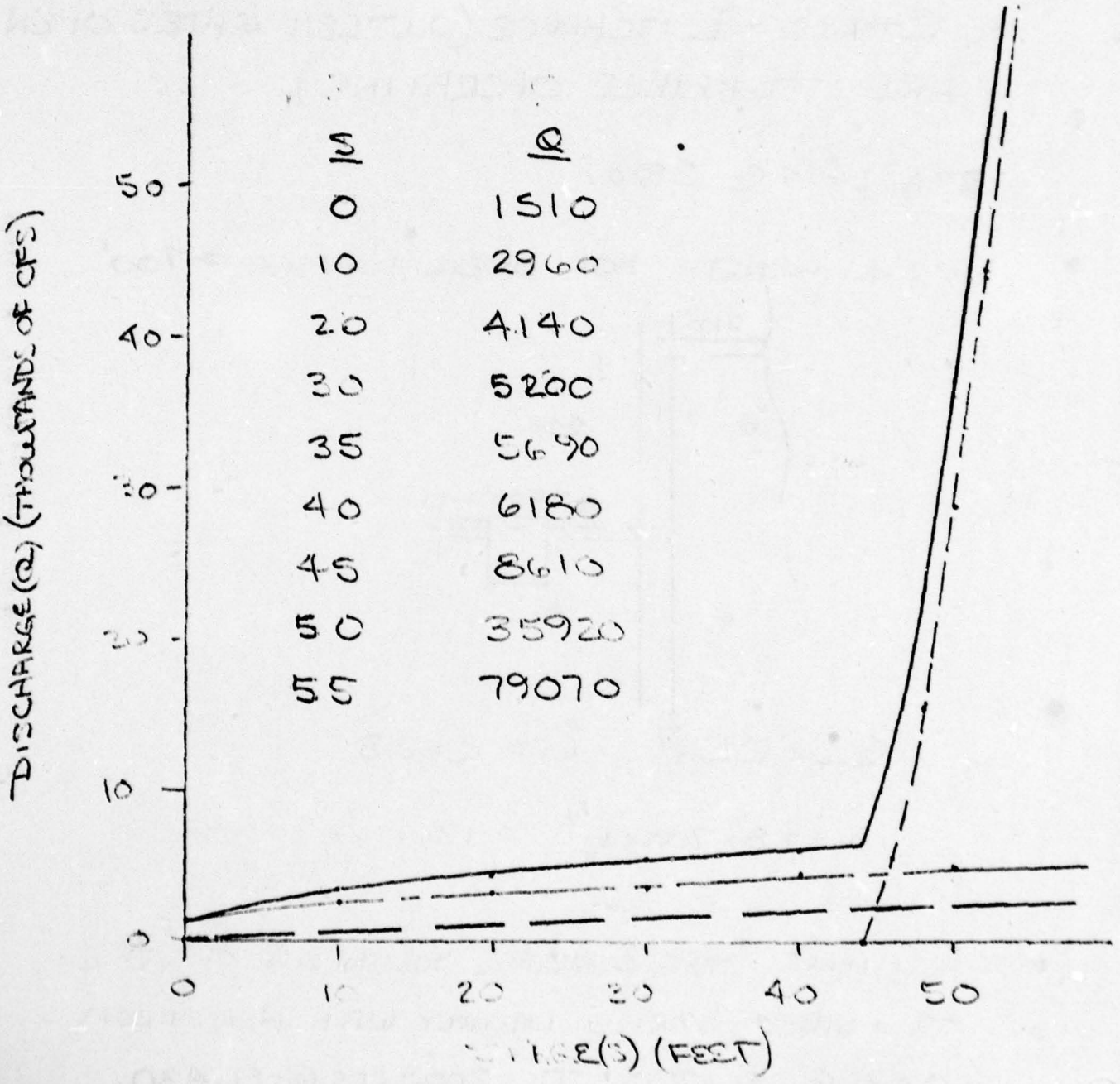
SHEET NO. 6 OF _____
DATE 6/13/78
COMP. BY DRC
CHECKED BY RFH

NAME OF CLIENT NYDEC
PROJECT SENECA HILLS

STAGE - DISCHARGE

STAGE = 0 @ 390.0

S	Q
0	1510
10	2960
20	4140
30	5200
35	5690
40	6180
45	8610
50	35920
55	79070



——— ——— TURBINES ——— - - - GATED OUTLETS

- - - - - - OVERTOPPING ——— TOTAL

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NAME OF CLIENT NYDEC

PROJECT SENECA FALLS

DATE 6/12/78

COMP. BY DEC

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STAGE(S) = 0 @ 390.0

@ S=0 , V=0 , & A = 70 ACRES (ASSUMED)

@ S=39 , V = 5500 ACRE-FEET , & A = 140 ACRES

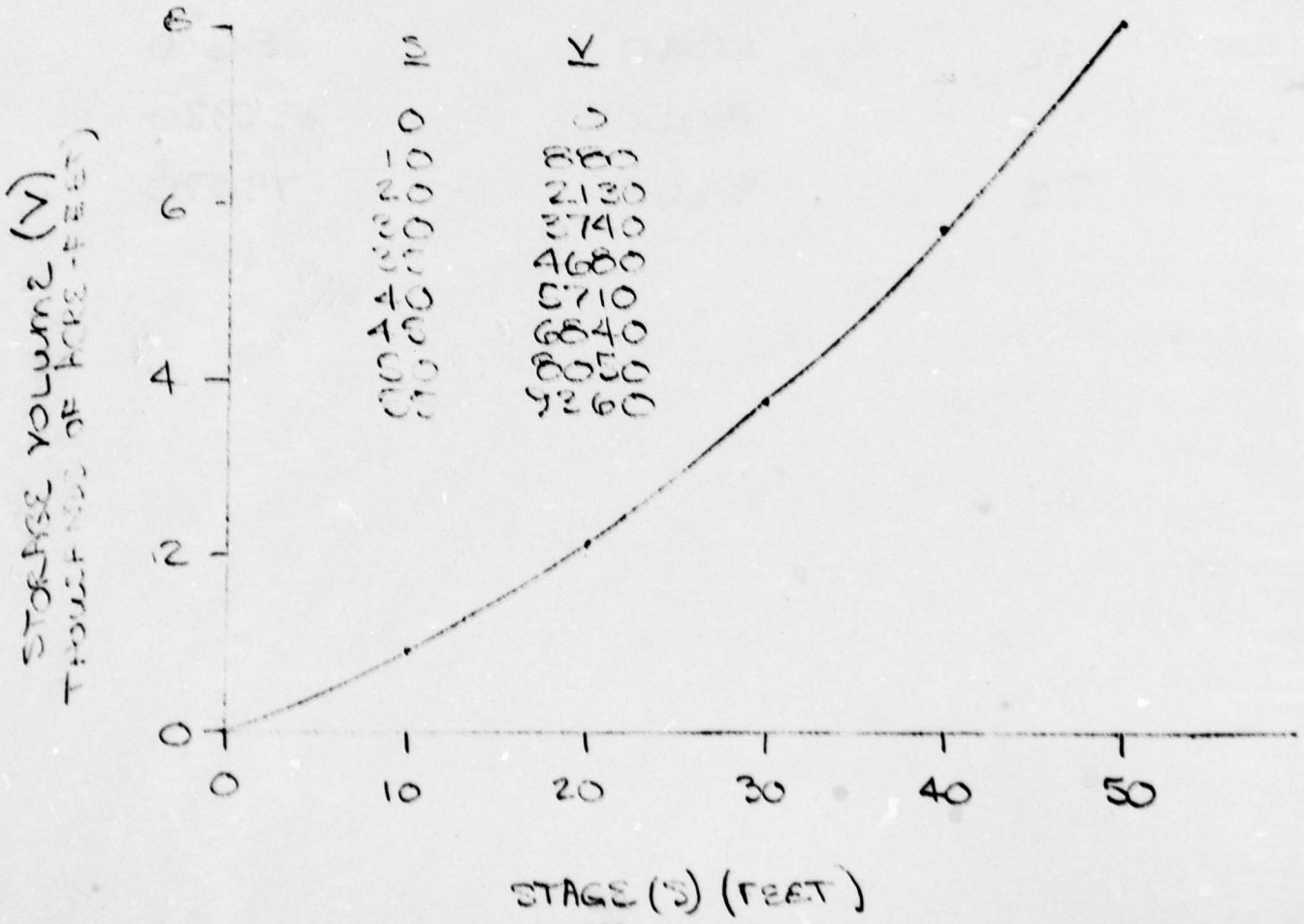
ASSUME THAT THE SURFACE AREA VARIES LINEARLY WITH STAGE.

$\therefore A = C_1 + C_2 S$ & $C_1 = 70$ SINCE $A(0) = 70$

$$V = \int_0^S A\,dS = \int_0^S (C_1 + C_2 S)\,dS = C_1 S + C_2 S^2/2$$

$V = 70S + C_2 S^2/2$ $C_2 = 3.64$ SINCE $V(39) = 5500$

S	V
0	0
10	880
20	2130
30	3740
35	4680
40	5710
45	6840
50	8050
55	9360



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Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET No. 8 OF

NAME OF CLIENT NYDEC

DATE 6/13/78

PROJECT SENECA FALLS

COMP. BY DBC

CHECKED BY RAH

STAGE	STORAGE	DISCHARGE
0	0	1510
10	880	2960
20	2130	4140
30	3740	5200
35	4680	5690
40	5710	6180
45	6840	8610
50	8050	23920
55	9360	79070

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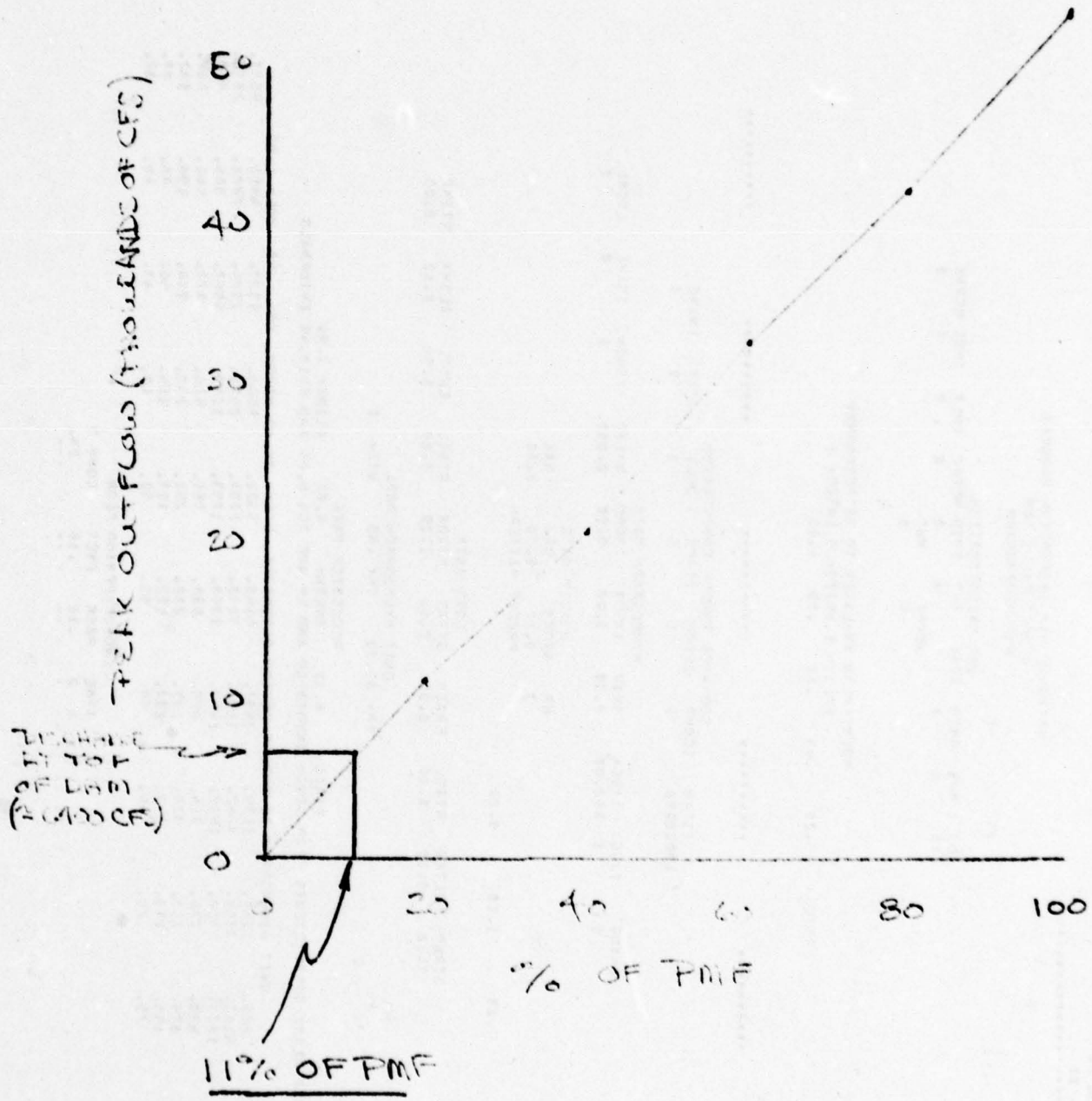
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 9 OF _____
DATE 6/20/78
COMP. BY DEC
CHECKED BY RFH

NAME OF CLIENT NYDEC
PROJECT SENECA FALLS DAM



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**********
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
**********
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NATIONAL DAM INSPECTION PROGRAM
SENECA FALLS DAM
PMF HYDROGRAPH

JOB SPECIFICATION

NQ	NMR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
58	4	0	1	0	0	0	0	2	0

JOPER	NWT
5	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .20 .40 .60 .80 1.00

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

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
10000000	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	1	850.00	0.00	0.00	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
3	0.00	0.00	0.00

PRECIP PATTERN
.10 1.10 8.20

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 39.30 CP= .40 NTA= 0

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.75 AND R=12.45 INTERVALS

UNIT HYDROGRAPH 78 END-OF-PERIOD ORDINATES, LAG= 39.30 HOURS, CP= .40 VOL= 1.00

285.	1868.	2179.	3437.	4563.	5322.	5569.	5321.	4912.	4533.
4183.	3868.	3562.	3287.	3033.	2799.	2583.	2384.	2200.	2030.
1873.	1729.	1595.	1472.	1358.	1253.	1157.	1067.	985.	909.
839.	774.	714.	659.	608.	561.	518.	479.	441.	407.
376.	347.	320.	295.	272.	251.	232.	214.	198.	182.
168.	155.	143.	132.	122.	113.	104.	96.	88.	82.
75.	70.	64.	59.	55.	50.	47.	43.	40.	37.

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	6 0	.10	.10	29.

1	18	0	8.20	8.20	3726.
2	0	0	0.00	0.00	11495.
2	6	0	0.00	0.00	22108.
2	12	0	0.00	0.00	33736.
2	18	0	0.00	0.00	43826.
3	0	0	0.00	0.00	50382.
3	6	0	0.00	0.00	52010.
3	12	0	0.00	0.00	49502.
3	18	0	0.00	0.00	45681.
4	0	0	0.00	0.00	42155.
4	6	0	0.00	0.00	38901.
4	12	0	0.00	0.00	35898.
4	18	0	0.00	0.00	33127.
5	0	0	0.00	0.00	30569.
5	6	0	0.00	0.00	28210.
5	12	0	0.00	0.00	26032.
5	18	0	0.00	0.00	24023.
6	0	0	0.00	0.00	22168.
6	6	0	0.00	0.00	20457.
6	12	0	0.00	0.00	18878.
6	18	0	0.00	0.00	17421.
7	0	0	0.00	0.00	16076.
7	6	0	0.00	0.00	14835.
7	12	0	0.00	0.00	13690.
7	18	0	0.00	0.00	12633.
8	0	0	0.00	0.00	11658.
8	6	0	0.00	0.00	10758.
8	12	0	0.00	0.00	9927.
8	18	0	0.00	0.00	9161.
9	0	0	0.00	0.00	8454.
9	6	0	0.00	0.00	7801.
9	12	0	0.00	0.00	7199.
9	18	0	0.00	0.00	6643.
10	0	0	0.00	0.00	6131.
10	6	0	0.00	0.00	5657.
10	12	0	0.00	0.00	5221.
10	18	0	0.00	0.00	4818.
11	0	0	0.00	0.00	4446.
11	6	0	0.00	0.00	4103.
11	12	0	0.00	0.00	3786.
11	18	0	0.00	0.00	3494.
12	0	0	0.00	0.00	3224.
12	6	0	0.00	0.00	2975.
12	12	0	0.00	0.00	2745.
12	18	0	0.00	0.00	2533.
13	0	0	0.00	0.00	2338.
13	6	0	0.00	0.00	2157.
13	12	0	0.00	0.00	1991.
		SUM	9.40	9.40	835127.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	52010.	52010.	49374.	40326.	835125.
INCHES		.57	2.16	5.30	9.14
AC-FT		25804.	97982.	240042.	414325.

HYDROGRAPH AT STA****** FOR PLAN 1, RTIO 1

6.	84.	745.	2299.	4422.	6767.	8765.	10060.	10402.	9980.
9136.	8431.	7780.	7180.	6625.	6114.	5642.	5206.	4805.	4434.
4091.	3776.	3484.	1715.	2967.	2738.	2527.	2332.	2152.	1985.
1832.	1691.	1560.	1440.	1329.	1226.	1131.	1044.	964.	889.
821.	757.	699.	645.	595.	549.	507.	468.	431.	399.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10402.	10402.	9875.	8065.	167025.
[illegible]					

AC-FT			5161.	19596.	48016.		82865.		

HYDROGRAPH AT STA****** FOR PLAN 1, RTIO 2

11.	168.	1498.	4598.	8843.	13495.	17530.	20121.	20804.	19801.
18272.	16862.	15560.	14359.	13251.	12228.	11284.	10411.	9609.	8867.
8183.	7551.	6968.	6430.	5934.	5476.	5053.	4663.	4303.	3971.
3664.	3382.	3121.	2880.	2657.	2452.	2263.	2088.	1927.	1779.
1641.	1514.	1397.	1290.	1190.	1098.	1013.	935.	863.	796.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20804.	20804.	19750.	16131.	334050.
INCHES		.23	.86	2.12	3.66
AC-FT		10321.	39193.	96033.	165730.

HYDROGRAPH AT STA****** FOR PLAN 1, RTIO 3

17.	252.	2236.	6897.	13265.	20242.	26295.	30181.	31206.	29701.
27409.	25293.	23340.	21539.	19876.	18342.	16926.	15619.	14414.	13301.
12274.	11327.	10452.	9645.	8901.	8214.	7580.	6995.	6455.	5956.
5497.	5072.	4681.	4319.	3986.	3678.	3394.	3132.	2891.	2667.
2462.	2272.	2096.	1934.	1785.	1647.	1520.	1403.	1294.	1195.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	31206.	31206.	29624.	24196.	501075.
INCHES		.34	1.30	3.18	5.48
AC-FT		15482.	58789.	144049.	248595.

HYDROGRAPH AT STA****** FOR PLAN 1, RTIO 4

23.	336.	2981.	9196.	17686.	26989.	35061.	40242.	41608.	39602.
36545.	33724.	31120.	28718.	26501.	24456.	22568.	20826.	19218.	17735.
16366.	15102.	13936.	12861.	11868.	10952.	10106.	9326.	8606.	7942.
7329.	6763.	6241.	5759.	5315.	4904.	4526.	4176.	3854.	3557.
3282.	3029.	2795.	2579.	2380.	2196.	2027.	1870.	1726.	1593.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	41608.	41608.	39499.	32261.	668100.
INCHES		.46	1.73	4.24	7.31
AC-FT		20643.	78386.	192066.	331460.

HYDROGRAPH AT STA****** FOR PLAN 1, RTIO 5

28.	420.	3726.	11495.	22108.	33736.	43826.	50302.	52010.	49502.
45691.	42155.	38901.	35898.	33127.	30569.	28210.	26032.	24023.	22168.
20457.	18878.	17421.	16076.	14835.	13690.	12633.	11654.	10750.	9927.
9161.	8454.	7801.	7199.	6643.	6131.	5657.	5221.	4818.	4446.
4103.	3786.	3494.	3224.	2975.	2745.	2533.	2338.	2157.	1991.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	52010.	52010.	49374.	40326.	835125.
INCHES		.57	2.16	5.30	9.14
AC-FT		25804.	97982.	240842.	414175.

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

HYDROGRAPH ROUTING

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

ROUTING DATA

QLOSS	CLOSS	AVG	IPES	ISAME
0.0	0.000	0.00	1	1

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	5420.

STORAGE= 0. 880. 2110. 3740. 4680. 5710. 6940. 8050. 9160. 0.

STATION 2, PLAN 1, RTIO 1

4749.	3178.	1691.	1593.	2618.	3862.	5077.	6034.	8624.	11213.
8498.	8822.	8199.	7699.	7145.	6606.	6156.	6001.	5791.	5531.
5241.	4881.	4531.	4200.	3888.	3441.	3134.	2817.	2483.	2241.
2049.	1882.	1733.	1598.	1474.	1368.	1255.	1158.	1069.	986.
910.	840.	775.	715.	660.	609.	562.	519.	479.	442.

STOP

3055.	1111.	110.	50.	673.	1435.	3477.	5401.	6841.	6959.
6748.	6849.	6649.	6416.	6159.	5908.	5659.	5334.	4893.	4376.
3919.	3259.	2725.	2221.	1770.	1389.	1064.	793.	591.	445.
327.	226.	136.	53.	-22.	-91.	-155.	-214.	-268.	-318.
-364.	-407.	-446.	-482.	-516.	-547.	-575.	-602.	-626.	-648.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11213.	11213.	9290.	7566.	176886.
INCHES		.12	.41	.99	1.94
AC-FT		5563.	18436.	45043.	87757.

DV4

STATION 2, PLAN 1, RTIO 2

4750.	3197.	1949.	2584.	4246.	5982.	17268.	19917.	29843.	19976.
18417.	16975.	15479.	14459.	13349.	12314.	11367.	10487.	9679.	8931.
8459.	8047.	7499.	6943.	6414.	6101.	5925.	5780.	5422.	5112.
4744.	4485.	4068.	3658.	3321.	3038.	2677.	2386.	2167.	1984.
1825.	1682.	1551.	1438.	1328.	1218.	1124.	1037.	957.	881.

STOR

3857.	1131.	266.	652.	2231.	5293.	7223.	7341.	7382.	7361.
7275.	7211.	7153.	7099.	7058.	7004.	6962.	6923.	6887.	6854.
6778.	6578.	6324.	6065.	5819.	5545.	5173.	4788.	4166.	3606.
3054.	2532.	2045.	1619.	1262.	956.	708.	532.	398.	288.
191.	104.	25.	-48.	-115.	-177.	-234.	-287.	-336.	-380.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	29843.	29843.	19776.	15916.	343395.
INCHES		.23	.87	2.89	3.74
AC-FT		18341.	19245.	94756.	178366.

STATION 2, PLAN 1, RTIO 3

4752.	3216.	2207.	3363.	5484.	15888.	28417.	28114.	32491.	29934.
24221.	25047.	23987.	21496.	20164.	18373.	17118.	15683.	14552.	13371.
12379.	11397.	10536.	9710.	8969.	8471.	8072.	7526.	6969.	6434.
6108.	5934.	5711.	5436.	5129.	4765.	4420.	4048.	3675.	3335.
3041.	2694.	2398.	2176.	1993.	1832.	1688.	1557.	1436.	1325.

STOR

3059.	1151.	423.	1306.	4132.	7162.	7718.	7704.	7898.	7745.
7709.	7568.	7513.	7411.	7352.	7273.	7217.	7153.	7103.	7051.
7007.	6963.	6925.	6889.	6856.	6775.	6598.	6336.	6077.	5838.
5559.	5194.	4724.	4192.	3632.	3079.	2556.	2066.	1637.	1277.
968.	719.	539.	404.	293.	196.	108.	24.	-45.	-112.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	32491.	32491.	29514.	24013.	509904.
INCHES		.36	1.29	3.15	5.58
AC-FT		16120.	58571.	142968.	252975.

STATION 2, PLAN 1, RTIO 4

4754.	3234.	2469.	4011.	6771.	30537.	31365.	42339.	39820.	41210.
35627.	34798.	30772.	29325.	26419.	24826.	22596.	21870.	19291.	17988.
16452.	15234.	14022.	12964.	11946.	11036.	10176.	9396.	8667.	8360.
7856.	7293.	6763.	6226.	6049.	5850.	5604.	5317.	4978.	4621.
4264.	3986.	3579.	3218.	2918.	2553.	2297.	2095.	1923.	1778.

STOR

3862.	1178.	588.	1993.	5985.	7812.	7848.	8245.	8164.	8211.
8037.	8088.	7822.	7759.	7629.	7558.	7460.	7392.	7313.	7252.
7187.	7133.	7088.	7033.	6988.	6947.	6909.	6875.	6843.	6724.
6489.	6227.	5972.	5732.	5434.	5017.	4515.	3965.	3404.	2861.
2348.	1882.	1483.	1144.	959.	633.	478.	355.	258.	154.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	42339.	42338.	39751.	32469.	676411.
INCHES		.46	1.74	4.26	7.40
AC-FT		21085.	78886.	193385.	335543.

DAM

STATION 2, PLAN 1, RTIO 5

4755.	3253.	2723.	4524.	11455.	39278.	38393.	53844.	49856.	52846.
44878.	43793.	37975.	36949.	32765.	31709.	28122.	26421.	24855.	22427.
20536.	19862.	17513.	16215.	14926.	13888.	12716.	11747.	10937.	10007.
9225.	8572.	8263.	7732.	7169.	6625.	6151.	6008.	5488.	5542.
5251.	4896.	4544.	4211.	3814.	3452.	3144.	2831.	2492.	2258.

STOR

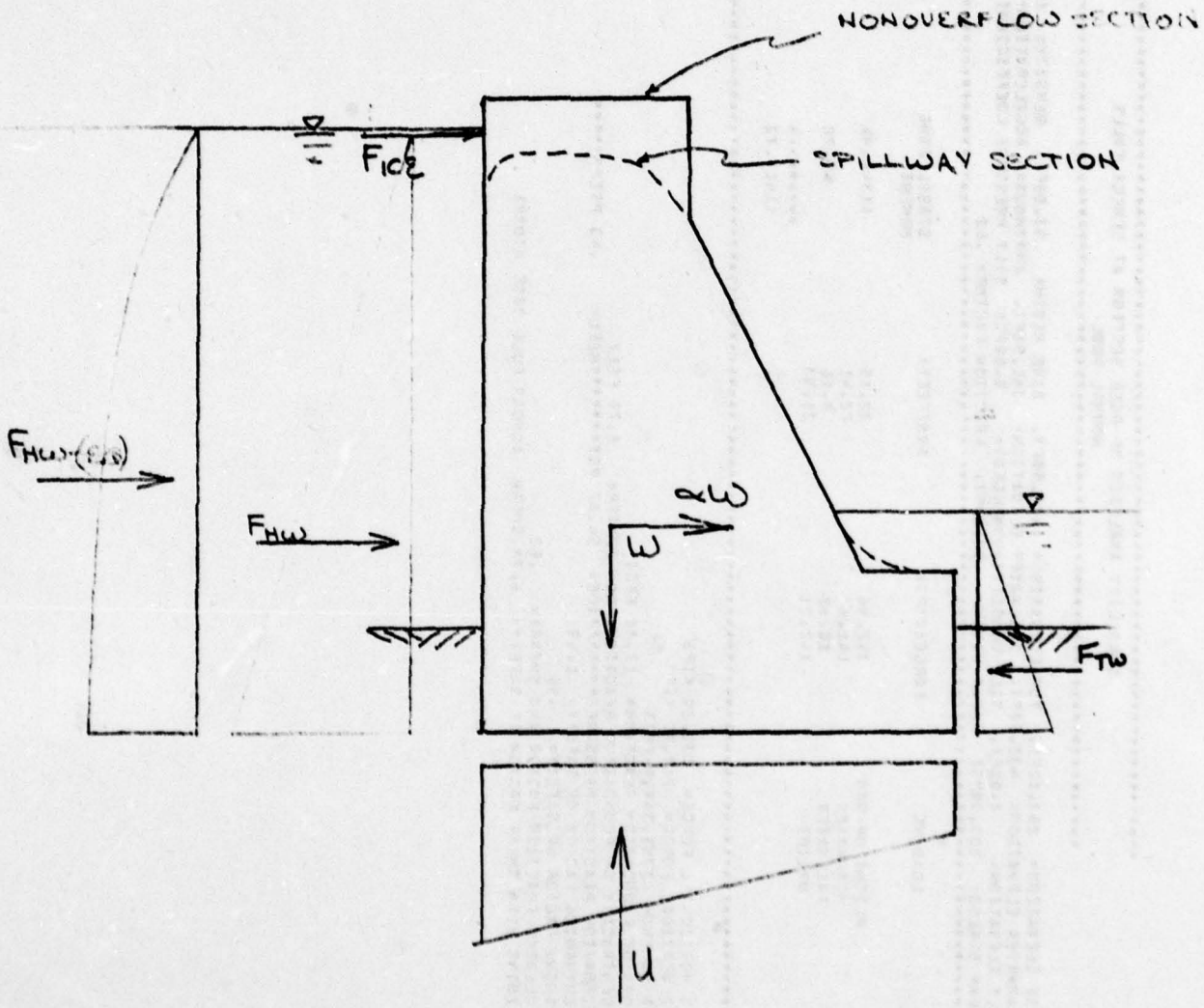
3044.	1198.	736.	2713.	6984.	8152.	8125.	8596.	8449.	8541.
8238.	8249.	8112.	8081.	7910.	7841.	7704.	7629.	7524.	7452.
7369.	7383.	7234.	7177.	7128.	7078.	7022.	6979.	6934.	6902.
6867.	6822.	6679.	6432.	6178.	5917.	5678.	5349.	4911.	4395.
3839.	3279.	2763.	2238.	1785.	1482.	1275.	881.	596.	449.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	53844.	53844.	49766.	48629.	842892.
INCHES		.59	2.18	5.34	9.22
AC-FT		26713.	98760.	241883.	418179.

PEAK FLOW SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

OPERATION	STATION	PLAN	RATIOS APPLIED TO FLOWS .20	.40	.60	.80	1.00
HYDROGRAPH AT	10000000	1	10402.	20804.	31206.	41608.	52010.
		2	0.	0.	0.	0.	0.
ROUTED TO	2	1	11213.	20843.	32491.	42338.	53844.
		2	0.	0.	0.	0.	0.

STABILITY ANALYSES



W - WEIGHT OF SECTION
F_{HW} - HEADWATER FORCE
F_{TW} - TAILWATER FORCE
$F_{HW}(EQ)$ - EARTHQUAKE INERTIAL LOAD OF HEADWATER
αW - INERTIAL LOAD OF SECTION
U - UPLIFT
F_{ICE} - ICE LOAD

STABILITY ANALYSIS OF OGEE SECTION AT SENECA FALLS
NORMAL POOL

BASE ELEVATION= 363.00FT. TOP ELEVATION= 427.50FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 430.50FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION=.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	352.96	32.15	11348.94	
HEADWATER	141.87	22.41		3180.18
TAILWATER	10.68	6.16	65.78	
UPLIFT	142.21	31.53		4484.29
			11414.72	7664.48

NET HORIZONTAL FORCE= 131.28 KIPS
NET VERTICAL FORCE= 210.75 KIPS
NET MOMENT= 3750.34KIP-FEET
X-BAR OF FOUNDATION REACTION= 17.80 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 8.70 FEET
FOUNDATION REACTION PRESSURES*******TOE= 54.82 PSI*******HEEL= .40 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.49
SLIDING FACTOR OF SAFETY= .96
DEVELOPED FRICTION FACTOR (NO SHEAR)= .62
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.78(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF OGEE SECTION AT SENECA FALLS
RESERVOIR AT TOP OF DAM

BASE ELEVATION= 363.00FT. TOP ELEVATION= 427.50FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 434.00FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	352.96	32.15	11348.94	
HEADWATER	155.96	23.30		3634.39
TAILWATER	10.68	6.16	65.74	
UPLIFT	148.00	31.68		4688.78
			11414.72	8323.18

NET HORIZONTAL FORCE= 145.28 KIPS
NET VERTICAL FORCE= 204.96 KIPS
NET MOMENT= 3091.54KIP-FEET
X-BAR OF FOUNDATION REACTION= 15.08 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 11.42 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES*******TOE= 61.56 PSI*******HEEL= -7.85 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.37
SLIDING FACTOR OF SAFETY= .85
DEVELOPED FRICTION FACTOR (NO SHEAR)= .71
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.18(SHEAR ACROSS FULL BASE WIDTH)

****

STABILITY ANALYSIS OF OGEE SECTION AT SENECA FALLS
NORMAL POOL AND ICE LOAD

****

BASE ELEVATION= 363.00FT. TOP ELEVATION= 427.50FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 430.50FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	352.96	32.15	11348.94	
HEADWATER	141.87	22.41		3180.10
TAILWATER	10.68	6.16	65.79	
UPLIFT	142.21	31.53		4484.29
ICE LOAD	5.00	57.50		287.50
			**********	**********
			11414.72	7951.88

NET HORIZONTAL FORCE= 136.28 KIPS
NET VERTICAL FORCE= 210.75 KIPS
NET MOMENT= 3462.84KIP-FEET
X-BAR OF FOUNDATION REACTION= 16.43 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 10.07 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES********TOE= 59.03 PSI********HEEL= -3.86 PSI********
OVERTURNING FACTOR OF SAFETY= 1.44
SLIDING FACTOR OF SAFETY= .93
DEVELOPED FRICTION FACTOR (NO SHEAR)= .65
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.53(SHEAR ACROSS FULL BASE WIDTH)

****

STABILITY ANALYSIS OF OGEE SECTION AT SENECA FALLS
NORMAL POOL AND EARTHQUAKE

****

BASE ELEVATION= 361.00FT. TOP ELEVATION= 427.50FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 430.50FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION***.050G (HORIZ)..000G (VERT)
SILT ELEVATION= 9.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	352.96	32.15	11348.94	
HEADWATER	141.87	22.41		3180.18
TAILWATER	10.68	6.16	65.78	
UPLIFT	142.21	31.53		4484.29
EARTHQUAKE INDUCED LOADINGS				
INERTIA-WATER	7.57	27.00		204.43
HORIZONTAL INERTIA-DAM	17.65	26.39		465.79
			**********	**********
			11414.72	8334.61

NET HORIZONTAL FORCE= 156.42 KIPS
NET VERTICAL FORCE= 218.75 KIPS
NET MOMENT= 3080.11KIP-FEET
X-BAR OF FOUNDATION REACTION= 14.67 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 11.88 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES********TOE= 64.77 PSI********HEEL= -9.54 PSI********
OVERTURNING FACTOR OF SAFETY= 1.37
SLIDING FACTOR OF SAFETY= .81
DEVELOPED FRICTION FACTOR (NO SHEAR)= .74
SLIDING WITH SHEAR FACTOR OF SAFETY= 5.69(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF OGEE SECTION AT SENECA FALLS
PROBABLE MAXIMUM FLOOD

BASE ELEVATION= 363.00FT. TOP ELEVATION= 427.50FT. BASE WIDTH= 53.00FT. DENSITY= 149.00PCF
HEADWATER ELEVATION= 461.00FT. TAILWATER ELEVATION= 410.00FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	352.96	32.15	11348.94	
HEADWATER	184.13	24.67		4542.99
TAILWATER	56.92	15.65	1078.68	
UPLIFT	286.78	28.69		5930.36
			*********	*********
			12427.62	10473.35

NET HORIZONTAL FORCE= 115.21 KIPS
NET VERTICAL FORCE= 146.26 KIPS
NET MOMENT= 1954.26KIP-FEET
X-BAR OF FOUNDATION REACTION= 13.36 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 13.14 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM******
FOUNDATION REACTION PRESSURES********TOE= 47.67 PSI********HEEL= -9.34 PSI********
OVERTURNING FACTOR OF SAFETY= 1.19
SLIDING FACTOR OF SAFETY= .76
DEVELOPED FRICTION FACTOR (NO SHEAR)= .79
SLIDING WITH SHEAR FACTOR OF SAFETY= 7.39(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF STRAIGHT GRAVITY SECTION AT SENECA FALLS
NORMAL POOL

BASE ELEVATION= 363.00FT. TOP ELEVATION= 434.00FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 430.50FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	369.47	33.27	12292.98	
HEADWATER	142.16	22.48		3195.29
TAILWATER	10.68	6.16	65.78	
UPLIFT	142.21	31.53		4484.29
			12358.66	7679.58

NET HORIZONTAL FORCE= 131.48 KIPS
NET VERTICAL FORCE= 227.26 KIPS
NET MOMENT= 4679.08KIP-FEET
X-BAR OF FOUNDATION REACTION= 20.59 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 5.91 FEET
FOUNDATION REACTION PRESSURES=======TOE= 49.78 PSI=======HEEL= 9.85 PSI=======
OVERTURNING FACTOR OF SAFETY= 1.61
SLIDING FACTOR OF SAFETY= 1.04
DEVELOPED FRICTION FACTOR (NO SHEAR)= .58
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.84(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF STRAIGHT GRAVITY SECTION AT SENECA FALLS
RESERVOIR AT TOP OF DAM

BASE ELEVATION= 363.00FT. TOP ELEVATION= 434.00FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 434.00FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	369.47	33.27	12292.88	
HEADWATER	157.28	23.64		3718.55
TAILWATER	18.68	6.16	65.78	
UPLIFT	148.00	31.68		4688.78
			**********	**********
			12358.66	8407.33

NET HORIZONTAL FORCE= 146.68 KIPS
NET VERTICAL FORCE= 221.47 KIPS
NET MOMENT= 3951.33KIP-FEET
X-BAR OF FOUNDATION REACTION= 17.84 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 8.66 FEET
FOUNDATION REACTION PRESSURES*******TOE= 57.46 PSI*******HEEL= .57 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.47
SLIDING FACTOR OF SAFETY= .91
DEVELOPED FRICTION FACTOR (NO SHEAR)= .66
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.11(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF STRAIGHT GRAVITY SECTION AT SENECA FALLS
NORMAL POOL AND ICE LOAD

BASE ELEVATION= 363.00FT. TOP ELEVATION= 434.00FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 430.50FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	369.47	33.27	12292.88	
HEADWATER	142.16	22.48		3195.29
TAILWATER	18.68	6.16	65.78	
UPLIFT	142.21	31.53		4484.29
ICE LOAD	5.00	57.50		287.50
			12358.66	7967.08

NET HORIZONTAL FORCE= 136.48 KIPS
NET VERTICAL FORCE= 227.26 KIPS
NET MOMENT= 4391.58KIP-FEET
X-BAR OF FOUNDATION REACTION= 19.32 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 7.18 FEET
FOUNDATION REACTION PRESSURES*******TOE= 53.97 PSI*******HEEL= 5.59 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.55
SLIDING FACTOR OF SAFETY= 1.00
DEVELOPED FRICTION FACTOR (NO SHEAR)= .60
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.59(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF STRAIGHT GRAVITY SECTION AT SENECA FALLS
NORMAL POOL AND EARTHQUAKE

BASE ELEVATION= 363.00FT. TOP ELEVATION= 434.00FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 430.50FT. TAILWATER ELEVATION= 381.50FT. EARTHQUAKE ACCELERATION=.0506 (HORIZ)..000. (V
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	369.47	33.27	12292.88	
HEADWATER	142.16	22.48		3195.29
TAILWATER	10.68	6.16	65.78	
UPLIFT	142.21	31.53		4484.29
EARTHQUAKE INDUCED LOADINGS				
INERTIA-WATER	7.94	27.00		214.49
HORIZONTAL INERTIA-DAM	18.47	29.25		540.32
			12358.66	8434.38

NET HORIZONTAL FORCE= 157.89 KIPS
NET VERTICAL FORCE= 227.26 KIPS
NET MOMENT= 3924.28KIP-FEET
X-BAR OF FOUNDATION REACTION= 17.27 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 9.23 FEET
FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE TENSION AT HEEL OF DAM
FOUNDATION REACTION PRESSURES TOE= 60.90 PSI HEEL= -1.34 PSI
OVERTURNING FACTOR OF SAFETY= 1.47
SLIDING FACTOR OF SAFETY= .86
DEVELOPED FRICTION FACTOR (NO SHEAR)= .69
SLIDING WITH SHEAR FACTOR OF SAFETY= 5.70(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF STRAIGHT GRAVITY SECTION AT SENECA FALLS
PROBABLE MAXIMUM FLOOD

BASE ELEVATION= 363.00FT. TOP ELEVATION= 436.00FT. BASE WIDTH= 53.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 441.00FT. TAILWATER ELEVATION= 418.00FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 100.00PSI SHEAR WIDTH= 53.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	369.47	33.27	12292.88	
HEADWATER	188.29	25.62		4823.23
TAILWATER	68.92	15.65	1078.68	
UPLIFT	286.78	20.69		5930.36
			**********	**********
			13371.56	10753.59

NET HORIZONTAL FORCE= 119.37 KIPS
NET VERTICAL FORCE= 162.77 KIPS
NET MOMENT= 2617.97KIP-FEET
X-BAR OF FOUNDATION REACTION= 16.08 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 10.42 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES********TOE= 46.48 PSI********HEEL= -3.82 PSI********
OVERTURNING FACTOR OF SAFETY= 1.24
SLIDING FACTOR OF SAFETY= .82
DEVELOPED FRICTION FACTOR (NO SHEAR)= .73
SLIDING WITH SHEAR FACTOR OF SAFETY= 7.21(SHEAR ACROSS FULL BASE WIDTH)