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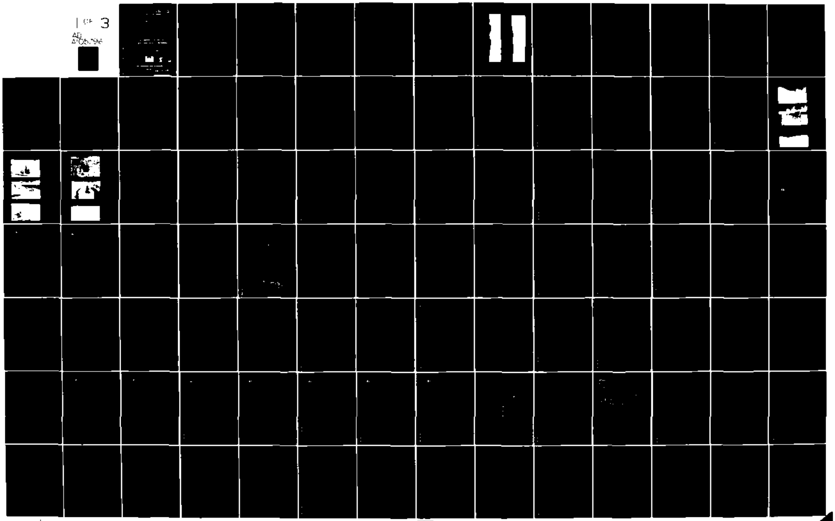

LEVEL II

②

## OSWEGO RIVER BASIN



# ONONDAGA DAM

# NEW YORK

# INVENTORY No. NY 794

# PHASE I INSPECTION REPORT
# NATIONAL DAM SAFETY PROGRAM

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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.

The Phase I Inspection of the Onondaga Dam did not indicate conditions which would constitute an immediate hazard to human life or property.


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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The hydrologic/hydraulic analysis indicates that the spillway is capable of passing the Probable Maximum Flood (PMF) with 3.7 feet of freeboard. Therefore, the spillway is assessed as adequate according to the Corps of Engineers screening criteria.

The structural stability analysis indicates that the concrete spillway structure is stable under all loading conditions investigated.

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# 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 aid 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.

## TABLE OF CONTENTS



## APPENDIX

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

| | |
|---|---|
| Name of Dam: | Onondaga Dam ID. No. NY 794 |
| State Located: | New York |
| County: | Onondaga |
| Watershed: | Oswego River Basin |
| Stream: | Onondaga Creek |
| Date of Inspection: | November 21, 1980 |

## ASSESSMENT OF GENERAL CONDITIONS

The Phase I Inspection of the Onondaga Dam did not indicate conditions which would constitute an immediate hazard to human life or property.

The hydrologic/hydraulic analysis indicates that the spillway is capable of passing the Probable Maximum Flood (PMF) with 3.7 feet of freeboard. Therefore, the spillway is assessed as adequate according to the Corps of Engineers screening criteria.

The structural stability analysis indicates that the concrete spillway structure is stable under all loading conditions investigated.

The following is a list of recommended measures to be undertaken to ensure the safety of the facility:

1. The surficial cracking of the exposed concrete of the spillway structure indicates that more serious spalling may soon occur. A protective coating designed to protect against the penetration of moisture into the concrete surfaces would serve to slow the spalling process and preserve the concrete in its present condition. This coating should be undertaken in the course of standard maintenance procedures.

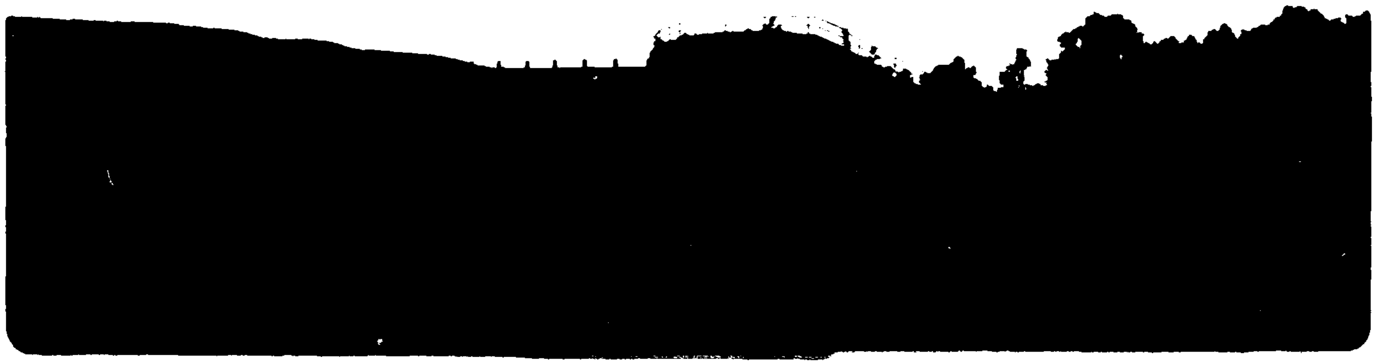
2. The operation and maintenance manual and the emergency notification system should be reviewed and updated.

Dale Engineering Company

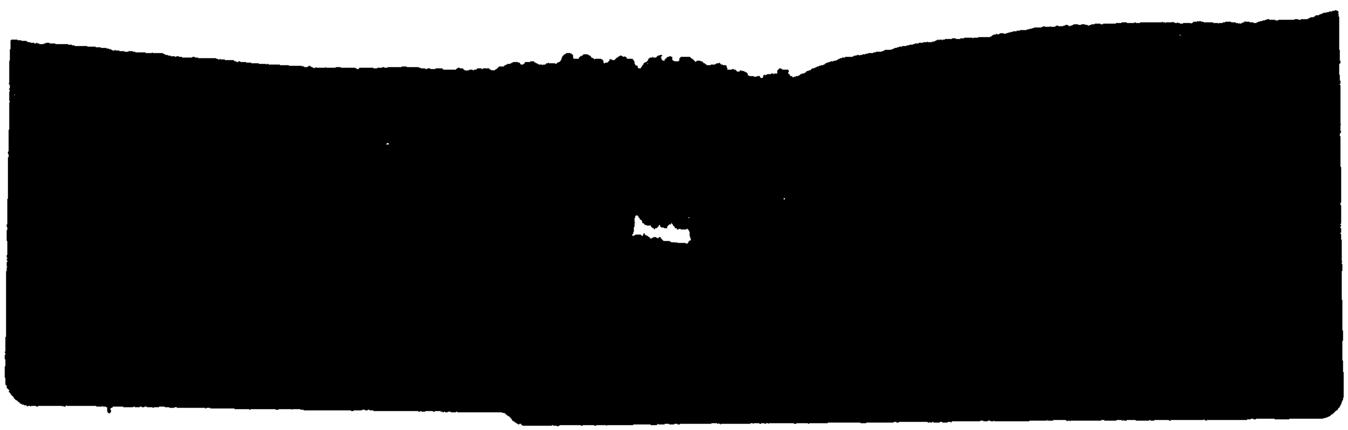
John B. Stetson, President

Approved By: Col. W. M. Smith, Jr.
New York District Engineer

Date: 30 JUN 1981



1. Overview of Onondaga Dam showing upstream slope.



2. Overview of Onondaga Dam showing upstream channel.

PHASE I INSPECTION REPORT
ONONDAGA DAM I.D. NO NY 794
OSWEGO RIVER BASIN
ONONDAGA COUNTY, NEW YORK

## SECTION 1: PROJECT INFORMATION

### 1.1 GENERAL

#### a. Authority

Authority for this report is provided by the National Dam Inspection Act, Public Law 92-367 of 1972. It has been prepared in accordance with a contract for professional services between Dale Engineering Company and the U.S. Army Corps of Engineers.

#### b. Purpose of Inspection

The purpose of this inspection is to evaluate the existing condition of the Onondaga Dam and appurtenant structures, owned by the New York State Department of Environmental Conservation, Binghamton, New York, and to determine if the dam constitutes a hazard to human life or property and to transmit findings to the U.S. Army Corps of Engineers.

This Phase I inspection report does not relieve an Owner or Operator of a dam of the legal duties, obligations or liabilities associated with the ownership or operation of the dam. In addition, due to the limited scope of services for these Phase I investigations, the investigators had to rely upon the data furnished to them. Therefore, this investigation is limited to visual inspection, review of data prepared by others, and simplified hydrologic, hydraulic and structural stability evaluations where appropriate. The investigators do not assume responsibility for defects or deficiencies in the dam or in the data provided.

### 1.2 DESCRIPTION OF PROJECT

#### a. Description of Dam and Appurtenances

The Onondaga Dam is part of a local flood protection project for the City of Syracuse, New York. The dam has an uncontrolled outlet and an ungated spillway. Hence, no regulation of outflow is possible beyond that imposed by the capacity of the outlet and spillway. Onondaga Dam is located 13.2 miles upstream from Onondaga Lake on Onondaga Creek. The dam is constructed of a rolled earth embankment 1,782 feet long and rises 67 feet above the general valley floor. The top elevation of 526 feet provides a freeboard of 5.7 feet above the spillway design flood. The dam has a top width of 25 feet with a 20 foot macadam roadway. The upstream face of the dam and downstream toe are riprapped. The outlet is an uncontrolled circular concrete conduit 6-1/2 feet in diameter through the dam near the right abutment. A stilling basin with two rows of concrete baffles is provided just below the conduit outlet. A side channel spillway with a concrete ogee weir having a crest length of 200 feet and an elevation of

504.5 feet has been built in rock at the right abutment. There are no gates or other regulatory devices on this spillway. The entire available storage capacity of Onondaga Reservoir is used for flood control. There is no provision for dead storage or a conservation pool and when stream flow is low, the reservoir is dry.

b. Location

The Onondaga Dam is located on Onondaga Creek in the Town of Lafayette, Onondaga County, New York, approximately 13.2 miles upstream from Onondaga Lake.

c. Size Classification

The maximum height of the dam is approximately 67 feet. The volume of the impoundment is approximately 48,400 acre feet to the top of dam. Therefore, the dam is in the intermediate size classification as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The impoundment provides flood protection for the City of Syracuse. A few houses are located in close proximity to the receiving stream approximately 3000 feet downstream of the dam. Further downstream, the receiving stream flows through the City of Syracuse. Therefore, the dam is in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by the State of New York Department of Environmental Conservation, Binghamton, New York

Contact: Henry C. Carroll
Regional Flood Control Engineer
New York State Department of Environmental Conservation
State Office Building
Binghamton, New York 13901
Telephone: (607) 773-7763 or
(607) 775-2545

f. Purpose of the Dam

The dam is used as a flood protection facility for the City of Syracuse.

g. Design and Construction History

The Onondaga Dam was designed by the U.S. Engineer Office, Syracuse District, in 1945 and 1946. Construction on the facility began in May 1947 by contract with S.J. Groves and Son, Minneapolis, Minnesota. The completion of the dam was effected in August of 1949. No modifications have been made to the facility since its construction.

h. Normal Operational Procedures

The rate of outflow from the facility is fixed by the design of the outlet and spillway and no regulatory devices have been provided to vary these outflows. The maximum flow through the outlet with the pool at spillway crest elevation is limited by design to 1,270 cfs. The operational objective of the facility is to limit reservoir outflow so that the outflow combined with local runoff below the reservoir will not exceed, insofar as possible, the safe channel capacity below the dam. The facility introduces sufficient lag time in peak runoff so that rises from minor tributaries below the reservoir will not be simultaneous with the mainstream crest. The facility provides sufficient warning for local interests in the flood plain below the reservoir in the event of floods of such magnitude that spillway discharges will exceed available channel capacity below the reservoir.

## 1.3 PERTINENT DATA

### a. Drainage Area

The drainage area of the Onondaga Dam is 68.1 square miles.

### b. Discharge at Dam Site

The maximum recorded elevation of 485.9 corresponds to a discharge of 950 cfs. The maximum reservoir level was reputedly at the approximate elevation of 498, which would correspond to a discharge of 1,170 cfs.

Computed Discharges:

| | | |
|---|---|---|
| Ungated Spillway, Top of Dam | 82,350 | cfs |
| Ungated Spillway, Design Flood | 48,500 | cfs |
| Control Outlet (with pool at spillway crest) | 1,270 | cfs |

### c. Elevation (feet above MSL)

| | |
|---|---|
| Top of Dam | 526.0 |
| Maximum Pool - Design Discharge | 520.3 |
| Spillway Crest | 504.5 |
| Stream Bed at Centerline of Dam | 459 |

### d. Reservoir

| | |
|---|---|
| Length of Spillway Pool | 18,000 ft. |
| Length of Normal Pool | normally dry |

### e. Storage

| | | |
|---|---|---|
| Top of Dam | 48,400 | acre feet |
| Spillway Pool | 18,200 | acre feet |

f. Reservoir Area

| | | |
|---|---|---|
| Top of Dam | 2,500 | acres |
| Spillway pool | 910 | acres |

g. Dam

Type - Rolled earth
Length - 1,782 feet
Height - 67 feet
Freeboard Between Spillway Crest and Top of Dam - 21.5 feet
Top Width - 25 feet
Side Slopes - Upstream and downstream: 2 hor.:1 vert. from top of dam to elevation 505.3, 2.5:1 elev. 505.3 to elev. 485.3, 3:1 elev. 485.3 down to toe.
Zoning - Pervious fill, with rock drain at downstream toe
Impervious Core - Impervious zone on upstream face
Grout Curtain - Where limestone is encountered

h. Spillway

Type - Uncontrolled, ogee, side channel overflow
Length - 200 feet
Crest Elevation - 504.5
Gates - None
U/S Channel - Impoundment
D/S Channel - Concrete floor discharging to rock cut channel

i. Regulating Outlets

One 6.5 foot diameter 329 feet long uncontrolled outlet

## SECTION 2: ENGINEERING DATA

### 2.1 GEOLOGY

Geologically, Onondaga Dam is located in the Southern New York section of the Appalachian Highlands, the major physiographic division. The area of the dam is in the Onondaga trough which is of glacial origin. Depth to bedrock is therefore highly variable and may be as much as 600 feet in places (Faltyn 1957). Depths to bedrock beneath the dam vary from exposure of bedrock on the east wall and in the spillway channel to no bedrock encountered at depths of more than 100 feet from the center of the dam to the west wall. Exposed bedrock is that of the Onondaga Formation of Middle Devonian age. The formation consists of several members; a series of light bluish-gray limestone layers from 1 inch to 2 feet 6 inches in thickness. Thin seams of calcareous shales are commonly present. Nodules of black chert are common in some members. Where these were encountered, the plans called for the limestone to be grouted.

The left abutment is in contact with deposits of a kame delta named by Fairchild (1909) "South Onondaga Terrace." It is considered to be the best developed of the Tully Valley kame deltas. This type of deposit consists generally of well-sorted and well-stratified silts, sands and gravel. It has a high permeability probability. The soil type here, the Palmyra, has a very rapid permeable material and is said to be subject to excessive seepage.

Plans called for the removal of unsatisfactory foundation material from the approximate center of the dam to the left abutment.

b. Subsurface Investigations

Detailed subsurface information is provided in the plans, Sheets 4 through 8, which are included in Appendix G. The soils data shows that the borrow material used for the embankment is generally composed of sands and gravels as indicated by the designation of "pervious fill" on the typical dam sections.

### 2.2 DESIGN RECORDS

No data was available regarding the design of the embankment structure. However, the plans included in Appendix G, the reservoir regulation manual, and the operation and maintenance manual which are included in Appendix F, provide much of the general information used in the design.

### 2.3 CONSTRUCTION RECORDS

Records kept during the construction were not available for review.

### 2.4 OPERATIONAL RECORDS

Samples of the operational records are included in Appendix F. Semi-annual readings are taken on the piezometers, settlement gauges, and channel wall alignment. Additional piezometer readings are taken when the impoundment pool elevation reaches 475 and immediately after drawdown from high water elevations.

## 2.5 EVALUATION OF DATA

The information presented in this report was obtained from the New York State Department of Environmental Conservation and appears to be reliable and adequate for a Phase I Inspection Report.

## SECTION 3: VISUAL INSPECTION

### 3.1 FINDINGS

#### a. General

The visual inspection of the Onondaga Dam was conducted on November 21, 1980. The Dale Engineering Company Inspection Team was accompanied on the inspection by Henry C. Carroll, Regional Flood Control Engineer, from the New York State Department of Environmental Conservation, Binghamton Sub-Office. At the time of the inspection, no water was impounded by the facility. The weather was fair, with a light snow cover on the ground.

#### b. Embankment

The earth fill embankment showed no signs of settlement, sloughing, or misalignment. The sod cover on the earthen section was mowed and no bare spots were detected. The riprap slope on the upstream face was in good condition and minor displacement of stone has occurred near the gage house. This riprap displacement is attributed to vandals. The stone toe drain at the downstream slope is uniform in slope and no signs of sloughing or displacement were noted.

#### c. Outlet Control Structure

The inlet end of the outlet control structure was free of debris and water flowed freely through the discharge pipe. The outlet of the control structure was clear and provided no obstruction to flow. The energy dissipator at the outlet was in good condition and no deterioration was noted.

#### d. Spillway

The side channel spillway was in good condition. Only minor surface cracking of the concrete surfaces was noted. No spalling or other deterioration was detected. The channel from the spillway was clear and no signs of recent erosion was noted.

#### e. Gage House

The gage house is presently in operating condition and is secure against vandalism.

#### f. Reservoir Area

The reservoir area at the spillway crest extends approximately 18,000 feet upstream from the dam. There are no known areas of bank instability in the impoundment area.

## 3.2 EVALUATION

The visual inspection revealed that the embankment is in good condition and has been properly maintained throughout its life. No conditions were detected which might indicate instability of the structure.

The surficial cracking of the exposed concrete of the spillway structure indicates that more serious spalling may soon occur. A protective coating designed to protect the structure from penetration of moisture into the concrete surfaces would serve to slow the spalling process and preserve the concrete in its present condition. This coating should be undertaken in the course of standard maintenance procedures.

## SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

### 4.1 PROCEDURES

The operation and maintenance of the Onondaga Dam is conducted in accordance with the operation and maintenance manual, which is included in Appendix F. Various modifications have been made in the procedures outlined in the manual. In general, the facility is visited on an average of twice monthly with the interval between visits being dictated by general rainfall conditions. The facility is monitored daily when the depth in the impoundment reaches elevation 475. At present, annual reports are provided to the U.S. Army Corps of Engineers in lieu of the semi-annual reports stipulated in the operation and maintenance manual. A complete and detailed inspection is conducted every five years by representatives of the Buffalo District U.S. Army Corps of Engineers in conjunction with representatives of the New York State Department of Environmental Conservation.

### 4.2 MAINTENANCE OF THE DAM

Maintenance and operation of the dam is controlled by the New York Department of Environmental Conservation. Personnel from this agency provide all maintenance and operation activities at the facility. Annual reports are provided to the U.S. Army Corps of Engineers, Buffalo District.

### 4.3 MAINTENANCE OF OPERATING FACILITY

There are no gates or control valves which require maintenance at this facility.

### 4.4 DESCRIPTION OF WARNING SYSTEM

The reservoir regulation manual for the Onondaga Dam and reservoir is included in Appendix F. This manual specifies communication channels which should be utilized if, in the judgement of the flood control engineer, spillway discharge appears to be imminent. The details of the dissemination of this information is not stipulated. However, it is assumed that appropriate notification to the public would be provided by the Buffalo District and by the U.S. Weather Bureau. The data provided by the New York State Department of Environmental Conservation showed no evidence that the list of persons to be contacted in the event of an emergency has been updated since the original publication of the document.

### 4.5 EVALUATION

The dam and appurtenances are periodically inspected by the New York State Department of Environmental Conservation. The facility is presently in good condition and properly maintained. The operation and maintenance manual should be reviewed and updated to reflect current needs. The emergency notification system should be reviewed and updated.

## SECTION 5: HYDROLOGIC/HYDRAULIC

### 5.1 DRAINAGE AREA CHARACTERISTICS

The Onondaga Dam is a flood control structure located about 4 miles south of Syracuse in the Onondaga Indian Reservation. The dam has a drainage area of 68 square miles, which is characterized by wooded and agricultural areas. The drainage area consists of a fairly wide valley bottom and moderate to steep hillsides. In the lower reaches of the basin, the main stem and the West Branch of Onondaga Creek have a shallow slope, whereas the streams in the upper reaches of the basin are steeply sloped. The dam is situated on the Onondaga Creek and has a surface area of approximately 910 acres at the spillway crest. However, due to the operation of the structure as a flood control facility, the reservoir area is normally dry.

### 5.2 ANALYSIS CRITERIA

The purpose of this investigation is to evaluate the dam and spillway with respect to their flood control potential and adequacy. This has been assessed through the evaluation of the Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the flood through the reservoir and the dam's spillway system. The PMF event is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration loss and concentration of run-off of a specific location that is considered reasonably possible for a particular drainage area.

The hydrologic analysis was performed using the unit hydrograph method to develop the flood hydrograph. Due to the limited scope of this Phase I investigation, certain assumptions based on experience and existing data, were used in this analysis and in the determination of the dam's spillway capacity to pass the PMF. In the event that the dam could not pass 1/2 the Probable Maximum Flood without overtopping, additional analyses are to be performed on potential dam failures if the dam is designated as a High Hazard Classification. This process was done with the concept that if the dam was unable to satisfy this criteria, further refined hydrologic investigations would be required.

The U.S. Army Corps of Engineers' Hydrologic Engineering Center's Computer Program HEC-1 DB using the Modified Puls Method of flood routing was used to evaluate the dam, spillway capacity, and downstream hazard.

Unit hydrographs were defined by Snyder coefficients, $C_t$ and $C_p$. Snyder's $C_t$ was estimated to be 2.0 for the drainage area and $C_p$ was estimated to be 0.625. The drainage area was divided into sub-areas to model the variability in hydrologic characteristics within the drainage basin. Run-off, routing and flood hydrograph combining was then performed to obtain the flow into the reservoir. In this analysis, the reservoir pool was assumed to be at the spillway crest elevation at the start of the storm and outflow through the low level outlet was assumed to be zero.

The Probable Maximum Precipitation (PMP) was 20.5 inches according to Hydrometeorological Report (HMR #33) for a 24-hour duration storm, 200 square mile basin, while loss rates were set at 1.0 inches initial abstraction and 0.1 inches/hour continuous loss rate. The loss rate function yielded 84 percent run-off from the PMF. The peak for the PMF inflow hydrograph was 86,904 cfs and the 1/2 PMF inflow peak was 43,232 cfs. The storage capacity of the reservoir above the spillway reduced these peak flows to 59,412 cfs for the PMF and 27,141 cfs for the 1/2 PMF flow.

## 5.3 SPILLWAY CAPACITY

The spillway is an uncontrolled ogee shaped weir 200 feet in length with a discharge capacity of 82,350 cfs at the top of dam elevation.

SPILLWAY CAPACITY

| Flood | Peak Discharge | Capacity as % of Flood Discharge |
|---|---|---|
| PMF | 59,412 cfs | 139% |
| 1/2 PMF | 27,141 cfs | 303% |

## 5.4 RESERVOIR CAPACITY

The reservoir storage capacity was obtained from the "Onondaga Dam and Reservoir Regulation Manual" (See Appendix F). The resulting estimates of the reservoir storage capacity are shown below:

| | |
|---|---|
| Top of Dam | 48,400 Acre Feet |
| Spillway Crest | 18,025 Acre Feet |

## 5.5 FLOODS OF RECORD

The maximum recorded reservoir pool was recorded as elevation 485.9 on April 1, 1960. This pool level would correspond to a discharge of about 950 cfs through the low level outlet. Prior to this runoff event the reservoir was essentially empty. The highest water level encountered during the operation of the facility was reportedly approximately at the upstream toe of the spillway. This would correspond to an elevation of about 498.

The maximum flood of record for the creek occurred in March 1920 (before the project was built) and had a peak discharge of about 6,000 cfs in Syracuse. During the operation of the structure, the Dorwin Avenue gage in Syracuse has recorded flows of 3,260 cfs on July 3, 1974 and 3,200 cfs on June 23, 1972 (References 16 and 17). The Dorwin Avenue gage is downstream of the dam and has a drainage area of 88.5 square miles as compared with a drainage area of 68 square miles at the dam.

## 5.6 OVERTOPPING POTENTIAL

The HEC-1 DB analysis indicates that the spillway can pass the PMF with 3.7 feet of freeboard and the 1/2 PMF with 10.5 feet of freeboard.

## 5.7 EVALUATION

The hydrologic/hydraulic analysis indicates that the spillway is capable of passing the Probable Maximum Flood (PMF) with 3.7 feet of freeboard. Therefore, the spillway is assessed as adequate according to the Corps of Engineers' screening criteria.

## SECTION 6: STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

#### a. Visual Observations

This flood control structure consists of an earth-filled embankment with a concrete side channel spillway. The emergency spillway comprises the rightmost section of the dam with the earthen embankment stretching from the left side of the spillway across the valley. A road is located on the crest of the embankment, providing access from the left abutment.

The upstream face of the dam is lined with riprap, whereas the downstream face is covered with sod down to the rock toe. The low level outlet, consisting of a concrete conduit, extends through the right portion of the embankment. This conduit discharges into a concrete lined stilling basin with dissipator blocks and then into a channel cut in the rock. The area around the inlet to this conduit is lined with riprap. The emergency spillway channel is cut in limestone with the portion just downstream of the spillway lined with a concrete slab and walls. The emergency spillway is formed by a concrete ogee shaped section.

The earthen embankment appeared to be in good condition with no signs of structural movement or cracking. The facility generally appears to be properly maintained with no established trees growing on the embankment, although some small brush was noted. The riprap on the upstream face and around the inlet for the low level outlet as well as the rock toe were generally in good condition. Some misplacement of riprap was noted along the stairs leading up the upstream slope to the gage house.

The concrete surfaces of the emergency spillway system and low level outlet channel were essentially intact with no spalling. However, numerous hairline cracks were observed that could lead to advanced deterioration of the concrete and spalling if left untreated. All of the construction joints were in good condition. Vegetation was growing out of the pressure relief holes in the concrete slab forming the spillway channel bottom, indicating that they are at least partially plugged.

#### b. Design and Construction Data

No information regarding the structural stability of the structure was located. Drawings included in Appendix G substantially conform to the present facility. The plans indicate that the 200 feet long concrete spillway section was cut into rock and is anchored with grouted steel bars and rail sections. The height of this section is some 19 feet with about 9 feet of this extending below the upstream rock surface. Drain holes were drilled into the rock that extend to a gravel filled drain underneath the concrete slab that extends downstream of the spillway.

The 1782 feet long earthen embankment consists of a sloping upstream impervious layer with a 5 feet deep cutoff trench, a random pervious layer, and a downstream rock toe. This impervious layer is protected by

3 feet of dumped riprap over a 12 inch layer of gravel and sand. A two feet thick layer of gravel and sand acts as a filter between the random pervious zone and the rock toe. The crest width of the dam is 25 feet and the maximum height is 67 feet. The upstream and downstream slopes are shown as 2:1 (horizontal to vertical) from the crest elevation of 526 to elevation 505, 2.5:1 down to elevation 485, and then 3:1 down to the toe. Numerous piezometers, settlement gages, and bench marks are located in the embankment (See Figure 8, Appendix G). Construction drawings for the project are dated 1945 and 1946 with the "as builts" dated 1950. Available information indicates that the facility was completed in 1949.

c. Operating Records

The facility is visited approximately twice monthly by a representative of the New York State Department of Environmental Conservation. Readings of the piezometers, settlement gages, and channel wall alignment are taken semi-annually by the Department of Environmental Conservation. Additional piezometer readings are taken when the reservoir pool elevation reaches 475 and immediately after drawdown from high water elevations. These readings are kept on record at the Department of Environmental Conservation's Binghamton, New York office, and are included in the report that is prepared annually and submitted to the U.S. Army Corps of Engineers, Buffalo District. The operation and maintenance of the facility is generally (with some modifications) in accordance with the operation and maintenance manual included in Appendix F.

d. Post Construction Changes

There is no field evidence or available information indicating post construction changes to the facility.

e. Seismic Stability

No know faults exist in the immediate vicinity of the dam. Faults, however, are present in the area. Several lineaments which may suggest fault traces are also present within one and one-half miles of the dam, the closest less than a half mile to the east and trends northeast. The others trend in varying directions. The area is located within Zone 2 of the Seimsic Probability Map. Earthquakes recorded in the area are tabulated below:

| Date | Intensity Modified Mercalli | Location Relative to Dam |
|---|---|---|
| 1925 | III | 7 miles NE |
| 1927 (2) | III | 7 miles NE |
| 1945 | III | 12 miles WNW |
| 1952 | III | 20 miles W |

## 6.2 STRUCTURAL ANALYSIS

Previous dam reports and the plans included in Appendices F and G show the plan alignment and cross-section for the dam but do not include specific engineering information on the properties of the dam and foundation material, nor stability analysis.

As part of the present study, stability evaulations have been performed for the dam's spillway section. Actual properties of the dam's construction materials and foundations were not determined as part of this study; where information on properties were necessary for computations but lacking, assumptions felt to be practical were made. The stability computations assumed a structural cross-section based on dimensions indicated in the plans included in this report.

The results of the stability computations indicate satisfactory stability for the analyzed spillway section against overturning and sliding effects for all studied loading conditions. The studied loading conditions include: pool elevations at the spillway, 1/2 PMF, and PMF levels, spillway pool with ice, and spillway pool with seismic effects. The stability computations are presented in Appendix E and the results of these computations are summarized in the table on the next page.

Critical to the analysis and resulting indication of stability are the items of uplift water pressure acting on the base of the dam and the relative permeability of the site's foundation rock. For the "normal operating conditions" case, the analysis uplift force was based on a full headwater hydrostatic pressure acting on the dam's upstream corner and a zero tailwater hydrostatic pressure acting on the dam's downstream corner. Uplift pressures were assumed to vary linearly between the dam's upstream and downstream corners, and to act upon 100 percent of the dam base.

Uplift as computed for the normal operating condition was also assigned to the flood conditions studied, assuming that uplift pressures would not increase significantly over a relatively short flood stage time period because of an expected low foundation rock permeability.

It should be noted that the plans indicate that the spillway section is anchored into the rock with grouted bars and rails and drain holes were drilled into the downstream face of the rock foundation of the spillway. Both of these features, if functioning properly, would tend to further increase the stability of the dam. For the purposes of this report, both of the features were conservatively disregarded in the analysis.

The earthen embankment appeared to be generally uniform in section with no signs of structural instability in evidence and the stability computations for the concrete spillway indicate satisfactory stability under all loading conditions. However, there are a few areas requiring maintenance repairs. The pressure relief holes in the concrete slab forming the spillway channel bottom should be cleaned so that they can function as they were designed. The concrete surfaces of the structure are presently intact, however, the numerous hairline cracks present could lead to advanced deterioration of the concrete if left untreated.

RESULTS OF STABILITY COMPUTATIONS

| | Loading Condition | Factor of Safety* Overturning | Sliding** | Location of Resultant Passing through Base*** |
|---|---|---|---|---|
| (1) | Water level at spillway elevation, uplift on base (no ice) | 2.65 | 25 | 0.50b |
| (2) | Water level at spillway elevation, uplift on base plus 7.5 kips per lineal foot ice load | 2.1 | 15 | 0.42b |
| (3) | Water levels against upstream face and downstream face based on 1/2 PMF elevations, uplift same as Case 1 | 2.5 | 12 | 0.50b |
| (4) | Water level against upstream face and downstream face based on PMF elevations, uplift same as Case 1 | 2.45 | 9 | 0.49b |
| (5) | Water level at spillway elevation, uplift on base, seismic effects applicable to Zone 2 | 2.4 | 19 | 0.48b |

* These factors of safety indicate the ratio of moments resisting overturning to those moments causing overturning, and the ratio of forces resisting sliding to those causing sliding. Upstream pool levels were obtained from HEC-1DB analysis.

** As determined applying the friction-shear method.

*** Indicated in terms of dam's base dimension, b, measured from the toe of the dam.

## SECTION 7: ASSESSMENT/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

#### a. Safety

The Phase I Inspection of the Onondaga Dam did not indicate conditions which would constitute an immediate hazard to human life or property.

The hydrologic/hydraulic analysis indicates that the spillway is capable of passing the Probable Maximum Flood (PMF) with 3.7 feet of freeboard. Therefore, the spillway is assessed as adequate according to the Corps of Engineers screening criteria.

The visual inspection did not reveal conditions which would indicate evidence of structural displacement or instability.

The following specific safety assessments are based on the Phase I visual examination and analysis of hydrology and hydraulics, and structural stability:

1. The surficial cracking of the exposed concrete of the spillway structure indicates that more serious spalling may soon occur.

2. The operation and maintenance manual and the emergency notification system do not appear to be current.

#### b. Adequacy of Information

The information available is adequate for this Phase I investigation.

#### c. Urgency

Item 1 of the safety assessment should be addressed by the Owner as a part of normal maintenance procedures.

#### d. Need for Additional Investigation

This Phase I inspection has not revealed the need for additional investigation regarding this structure.

### 7.2 RECOMMENDED MEASURES

The following is a list of recommended measures to be undertaken to insure safety of this facility:

1. A protective coating designed to protect against the penetration of moisture into the concrete surfaces would help to slow any impending spalling and preserve the concrete in its present condition. This coating should be undertaken in the course of standard maintenance procedures.

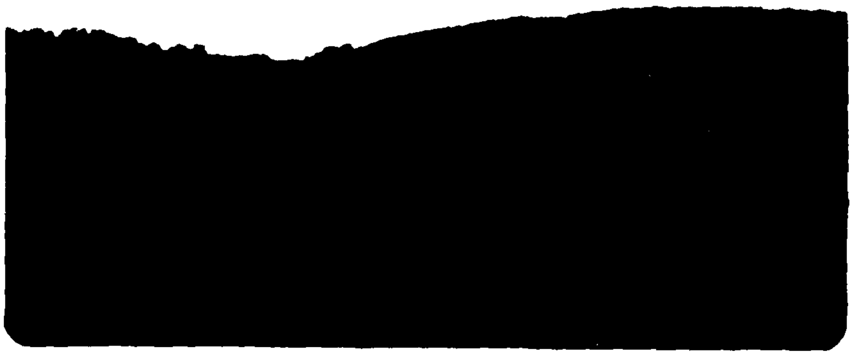
2. The operation and maintenance manual and the emergency notification system should be reviewed and updated.

# APPENDIX A

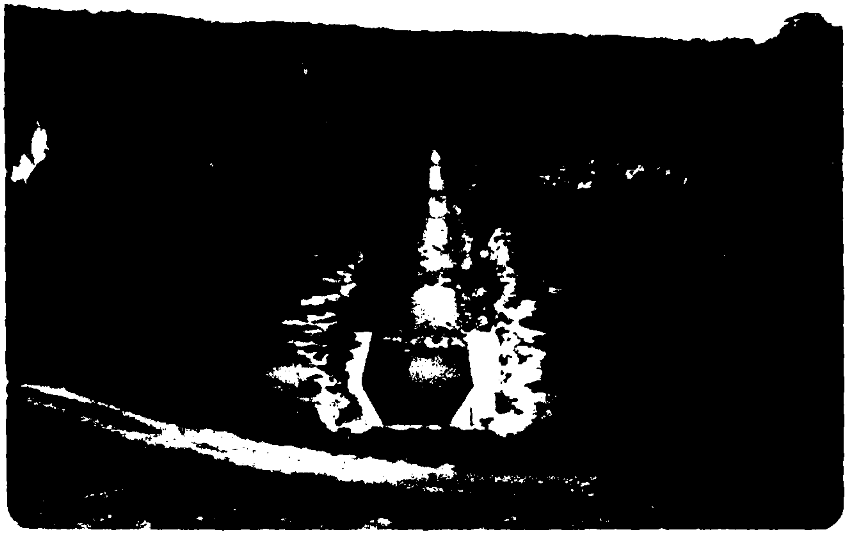
# PHOTOGRAPHS

3. Side channel spillway and discharge channel.

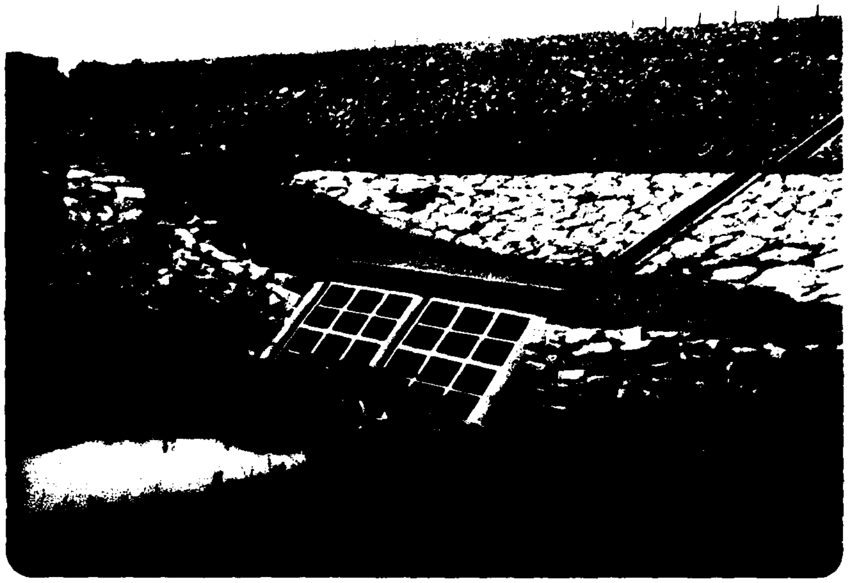
4. Rock cut of emergency spillway channel.



5. Crest of embankment, looking towards west abutment.



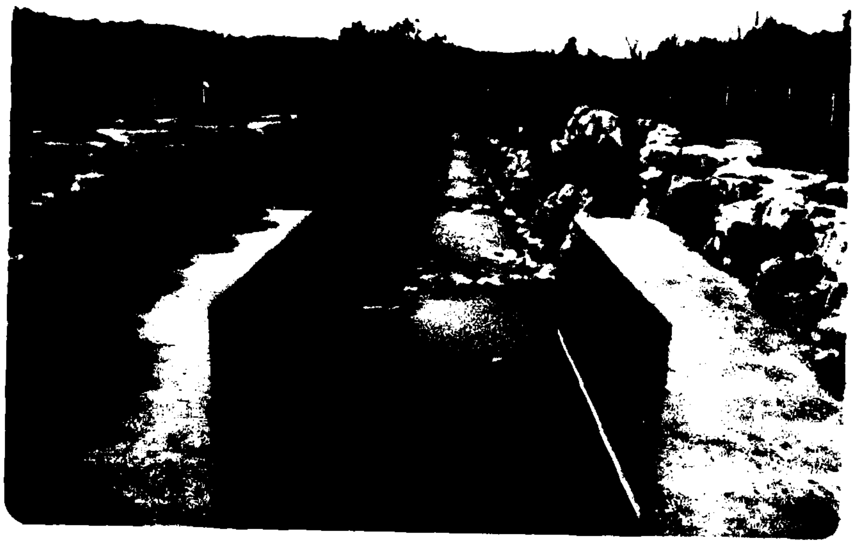
6. Outlet channel for reservoir drain.



7. Inlet to reservoir drain.

8. Outlet to reservoir drain.

9. Piezometer in toe of downstream slope.



10. Reservoir drain outlet channel, looking downstream.

11. Downstream slope. East abutment in background.

# APPENDIX B

# VISUAL INSPECTION CHECKLIST

93-15-3(9/80)

# VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam ONONDAGA DAM

Fed. I.D. # NY 794 DEC Dam No. ______

River Basin OSWEGO RIVER

Location: Town LAFAYETTE County ONONDAGA.

Stream Name ONONDAGA CREEK

Tributary of OSWEGO RIVER

Latitude (N) 44-55.9 Longitude (W) 76-10.4

Type of Dam EARTH

Hazard Category HIGH

Date(s) of Inspection NOVEMBER 21, 1980

Weather Conditions FAIR (LIGHT SNOW COVER)

Reservoir Level at Time of Inspection NO WATER IMPOUNDED

b. Inspection Personnel F.W. BYSZEWSKI, B. COLWELL, J.A. GOMEZ, H. MUSKATT - DALE ENGINEERING COMPANY, HENRY C. CARROLL NEW YORK STATE DEPT OF ENV. CONS. REGIONAL FLOOD

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

HENRY C. CARROLL
REGIONAL FLOOD CONTROL ENGINEER
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
STATE OFFICE BUILDING PHONE: 607-773-7763
775-2545
BINGHAMTON, N.Y. 13901

d. History:

Date Constructed AUGUST 1949 Date(s) Reconstructed ——

Designer US ARMY CORPS OF ENGINEERS

Constructed By S.J. GROVES AND SON MINNEAPOLIS, MINN.

Owner NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

93-15-3(9/80)

2) Embankment

a. Characteristics

(1) Embankment Material RANDOM PERVIOUS FILL

(2) Cutoff Type 5 FT. DEEP TRENCH AT UPSTREAM TOE WITH IMPERVIOUS FILL.

(3) Impervious ~~Core~~ BLANKET AT UPSTREAM FACE KEYED INTO CUTOFF TRENCH.

(4) Internal Drainage System NONE - PERVIOUS FILL

(5) Miscellaneous ROCK FILL TOE DRAIN ON SAND AND GRAVEL BED AT DOWNSTREAM TOE

b. Crest

(1) Vertical Alignment NO MISALIGNMENT NOTED IN FIELD.

(2) Horizontal Alignment NO MISALIGNMENT NOTED IN FIELD

(3) Surface Cracks NONE OBSERVED (LIGHT SNOW COVER AT TIME OF INSPECTION)

(4) Miscellaneous ———

c. Upstream Slope

(1) Slope (Estimate) (V:H) 1:3

(2) Undesirable Growth or Debris, Animal Burrows NONE OBSERVED

(3) Sloughing, Subsidence or Depressions NONE OBSERVED

93-15-3(9/80)

(4) Slope Protection DUMPED RIP RAP - GENERALLY IN GOOD CONDITION - MINOR DISPLACEMENT BY VANDALS NEAR GAGE HOUSE

(5) Surface Cracks or Movement at Toe NONE OBSERVED.

d. Downstream Slope

(1) Slope (Estimate - V:H) EARTH SLOPE 1:2 ROCK DRAIN 1:2 1/2 TO 1:3

(2) Undesirable Growth or Debris, Animal Burrows NONE OBSERVED

(3) Sloughing, Subsidence or Depressions NONE OBSERVED

(4) Surface Cracks or Movement at Toe NONE OBSERVED

(5) Seepage NONE OBSERVED - NO WATER IMPOUNDED AT TIME OF INSPECTION.

(6) External Drainage System (Ditches, Trenches; Blanket) ALL IN GOOD CONDITION - WELL MAINTAINED.

(7) Condition Around Outlet Structure GOOD CONDITION WELL MAINTAINED.

(8) Seepage Beyond Toe NONE OBSERVED.

e. Abutments - Embankment Contact

NO PROBLEM AREAS OBSERVED.

(1) Erosion at Contact NONE.

(2) Seepage Along Contact NONE OBSERVED.

3) Drainage System

a. Description of System ROCK FILL TOE DRAIN - SEE PLANS.

b. Condition of System NO INDICATION OF PROBLEMS OBSERVED IN FIELD

c. Discharge from Drainage System NOT OBSERVABLE.

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

13 PIEZOMETERS

22 SETTLEMENT GAGES.

12 BENCH MARKS.

SEE O & M MANUAL FOR PROCEDURES FOR MONITORING INSTRUMENTS.

5) Reservoir

a. Slopes NATURAL - NO EVIDENCE OF RECENT EROSION.

b. Sedimentation NONE OBSERVED

c. Unusual Conditions Which Affect Dam NONE.

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) CITY OF SYRACUSE

b. Seepage, Unusual Growth NONE OBSERVED

c. Evidence of Movement Beyond Toe of Dam NONE OBSERVED

d. Condition of Downstream Channel CLEAR, ROCK CHANNEL SEE PHOTOS

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

CONCRETE OGEE SHAPED SIDE CHANNEL SPILLWAY.

a. General GOOD CONDITION

b. Condition of Service Spillway GOOD CONDITION NO PROBLEMS OBSERVED.

c. Condition of Auxiliary Spillway GOOD CONDITION

d. Condition of Discharge Conveyance Channel CLEAR, ROCK CUT.

8) Reservoir Drain/Outlet

Type: Pipe ✓ Conduit ____ Other ____

Material: Concrete ✓ Metal ____ Other ____

Size: 6 1/2 ft DIAMETER Length 329 ft.

Invert Elevations: Entrance 457.0 Exit 456.21

Physical Condition (Describe): Unobservable ____

Material: GOOD CONDITION

Joints: NO LEAKAGE OBSERVED Alignment STRAIGHT

Structural Integrity: NO SIGNS OF STRUCTURAL DEFECTS OBSERVED.

Hydraulic Capability: 1270 CFS WITH POOL @ SPILLWAY CREST

Means of Control: Gate ____ Valve ____ Uncontrolled ✓

Operation: Operable ____ Inoperable ____ Other ____

Present Condition (Describe): ____

9) Structural - SPILLWAY

a. Concrete Surfaces MINOR SURFACE CRACKING - NO SPALLING.

b. Structural Cracking NONE

c. Movement - Horizontal & Vertical Alignment (Settlement)
NONE NOTED

d. Junctions with Abutments or Embankments NO PROBLEMS NOTED

e. Drains - Foundation, Joint, Face DRAIN AT RIGHT BANK OF DISCHARGE CHANNEL WAS DISCHARGING

f. Water Passages, Conduits, Sluices NONE

g. Seepage or Leakage NONE OBSERVED

h. Joints - Construction, etc. GOOD CONDITION

i. Foundation NO PROBLEMS OBSERVED

j. Abutments GOOD CONDITION

k. Control Gates NONE

l. Approach & Outlet Channels GOOD CONDITION EXCEPT pore pressure Relief drains in channel slab plugged by vegetation growth

m. Energy Dissipators (Plunge Pool, etc.) GOOD CONDITION

n. Intake Structures GOOD CONDITION

o. Stability NO SIGN OF INSTABILITY NOTED

p. Miscellaneous ———

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

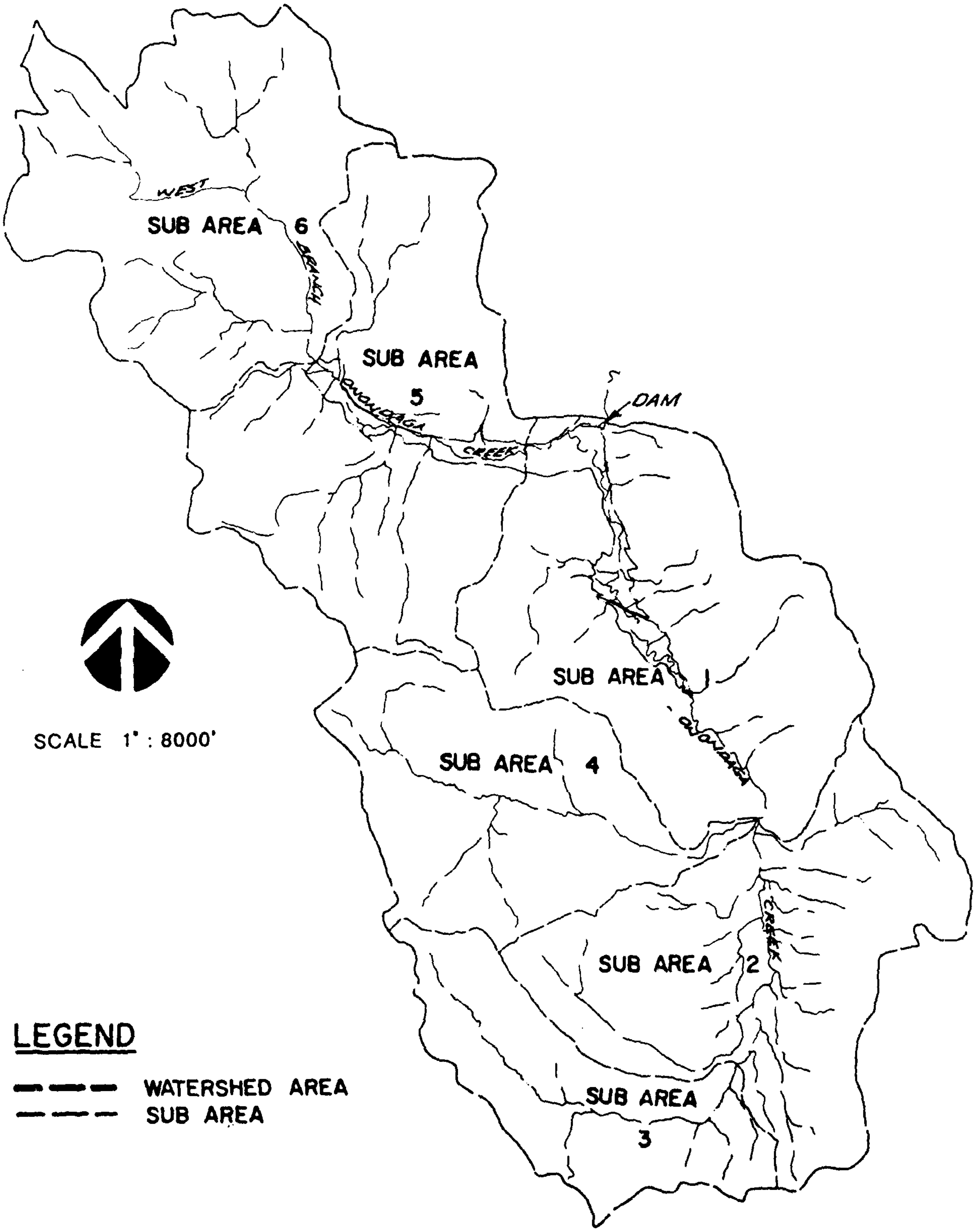
a. Description and Condition GAGE HOUSE, SECURE AND OPERATIONAL

11) Operation Procedures (Lake Level Regulation):

SEE RESERVOIR REGULATION MANUAL.

# APPENDIX C

## HYDROLOGIC/HYDRAULIC, ENGINEERING DATA AND COMPUTATIONS




**DRAINAGE BASIN**

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 DESIGN BRIEF

TEL 315-797-5800

PROJECT NAME N. Y. S. Dam Inspections - 1981 DATE

SUBJECT Onondaga Dam PROJECT NO. 2520

Subarea Hydrologic Parameters DRAWN BY JAG

| Subarea | Area | $C_t$ | $L$ | $L_{CA}$ | $t_1 = C_t (L \times L_{CA})^{0.3}$ |
|---|---|---|---|---|---|
| 1 | 14.09 mi² | 2.0 | 3.05 mi | 1.0 mi | 2.8 + 0.2* = 3.0 |
| 2 | 12.53 | 2.0 | 6.05 | 1.9 | 4.15 |
| 3 | 6.15 | 2.0 | 5.4 | 1.95 | 4.05 |
| 4 | 8.89 | 2.0 | 5.85 | 3.5 | 4.95 |
| 5 | 13.61 | 2.0 | 3.15 | 1.0 | 2.82 + 0.14* = 2.95 |
| 6 | 12.83 | 2.0 | 6.05 | 2.8 | 4.65 |

$\Sigma = 68.1\ mi^2$

* Adjustment for travel time through reservoir

$$t = \frac{\text{travel distance}}{V_w}$$

$$V_w = \sqrt{g D_m}$$

$g = 32.2\ ft/sec^2$
$D_m$ = avg. depth of reservoir

| Subarea | $D_m$ | dist. | $V_w$ | $t$ |
|---|---|---|---|---|
| 1 | 19' | 18,000' | 24.7 fps | 0.2 hr. |
| 5 | 24 | 14,000' | 27.8 | 0.14 hr. |

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 DESIGN BRIEF

PROJECT NAME N.Y.S. Dam Inspections 1981 DATE 12-19-80

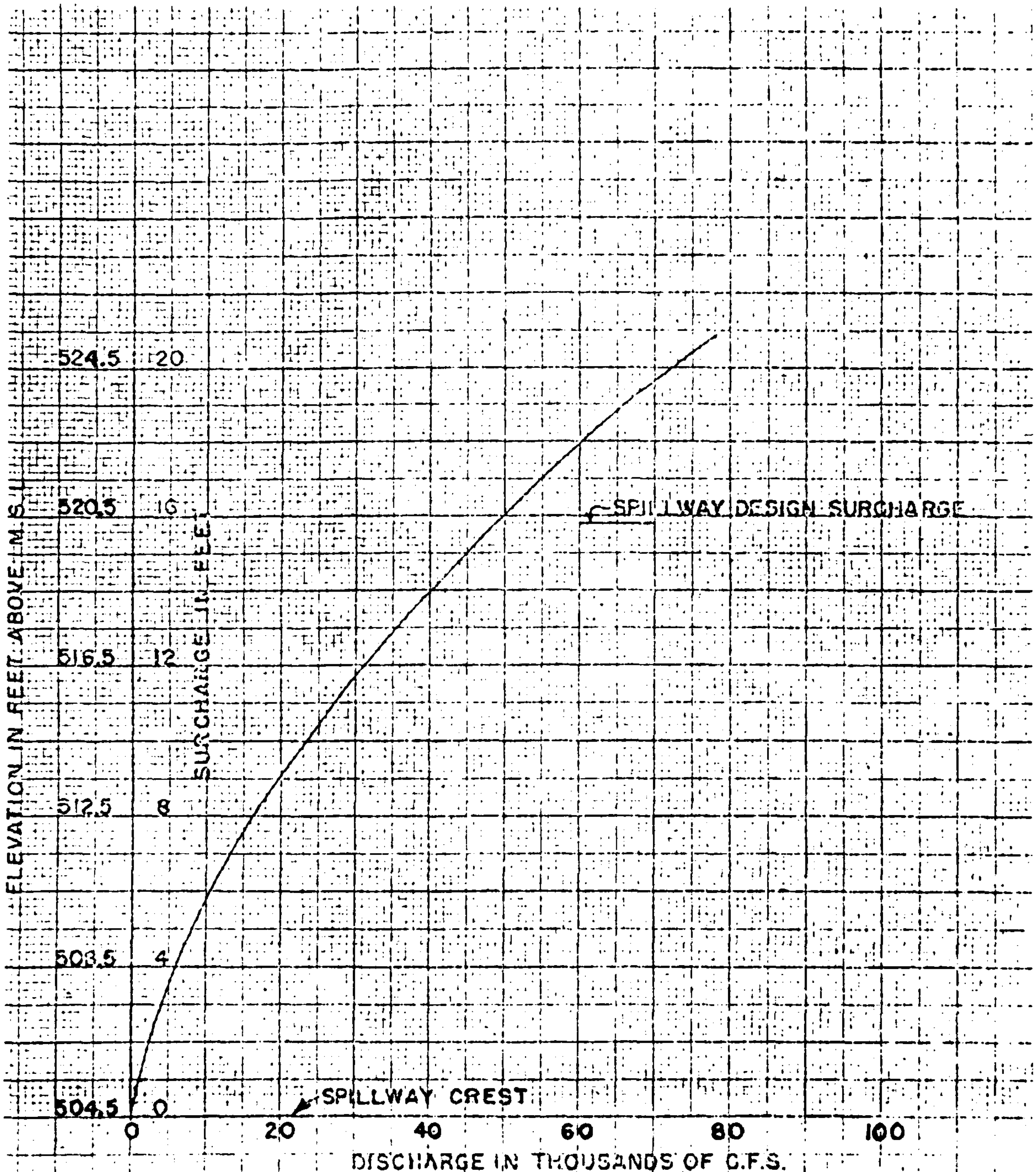
SUBJECT Onondaga Flood Control Dam, ID # 794 PROJECT NO. 2520

Depth-Area-Duration DRAWN BY JAG

PMP from HMR # 33
for Lat. ~ 42°56' Long. ~ 76°10'
Index Rainfall = 20.5" for 200 mi², 24 hr
Zone 1

| Duration | % Index* | Depth |
|---|---|---|
| 6 hrs. | 88 | 18.0" |
| 12 hrs. | 102 | 20.9 |
| 24 hrs | 112 | 23.0 |
| 48 hrs | 118 | 24.2 |

* Adjusted for site area, Drainage Area = 68 mi²

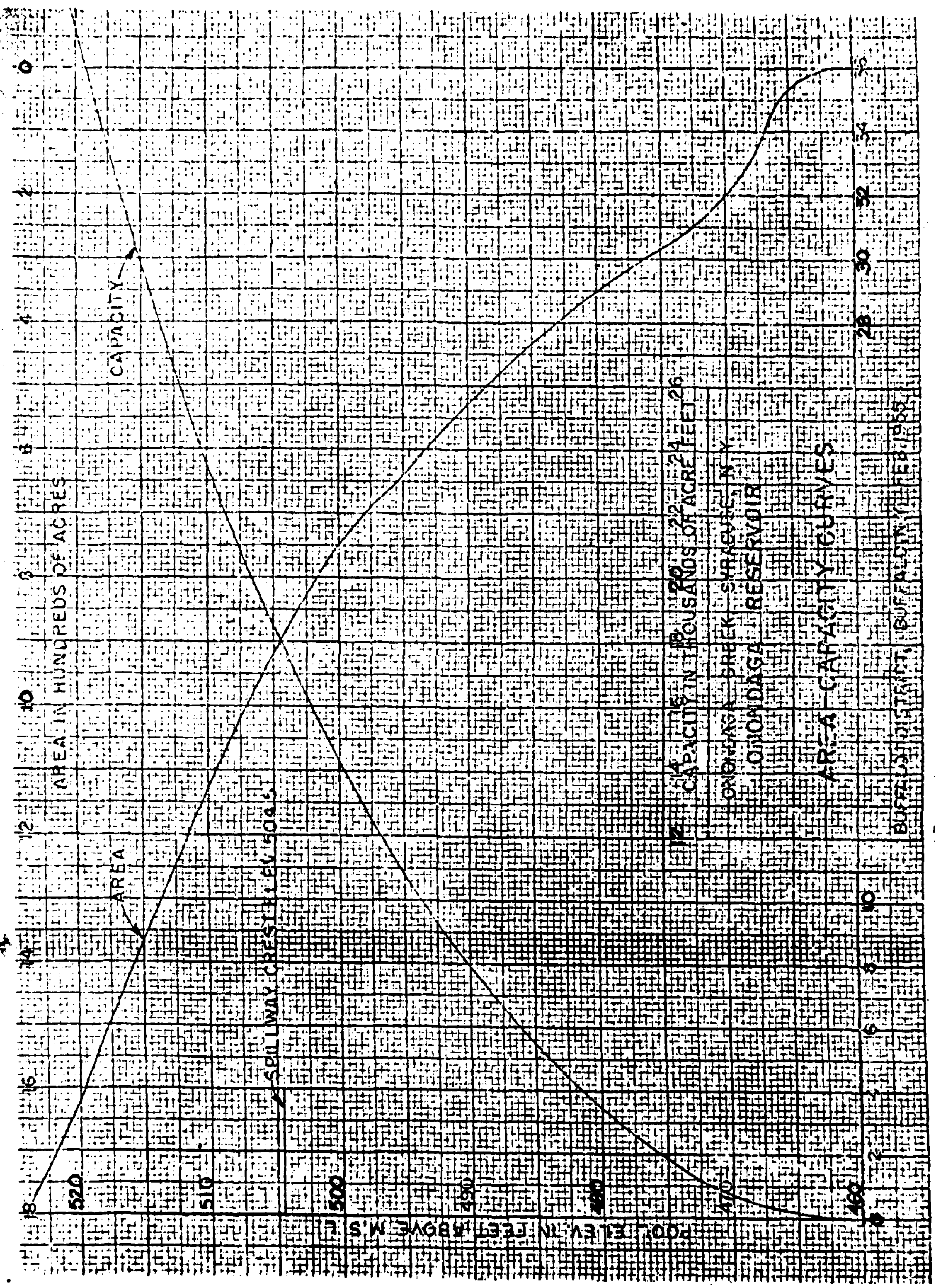



ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

SPILLWAY DISCHARGE CURVE

BUFFALO DISTRICT, BUFFALO, N.Y. FEB.

PLATE NO.



AREA IN HUNDREDS OF ACRES
CAPACITY
AREA
CAPACITY IN THOUSANDS OF ACRE FEET
POOL ELEV. IN FEET ABOVE M.S.L.
ONONDAGA RESERVOIR
AREA-CAPACITY CURVES


PLATE NO. 6

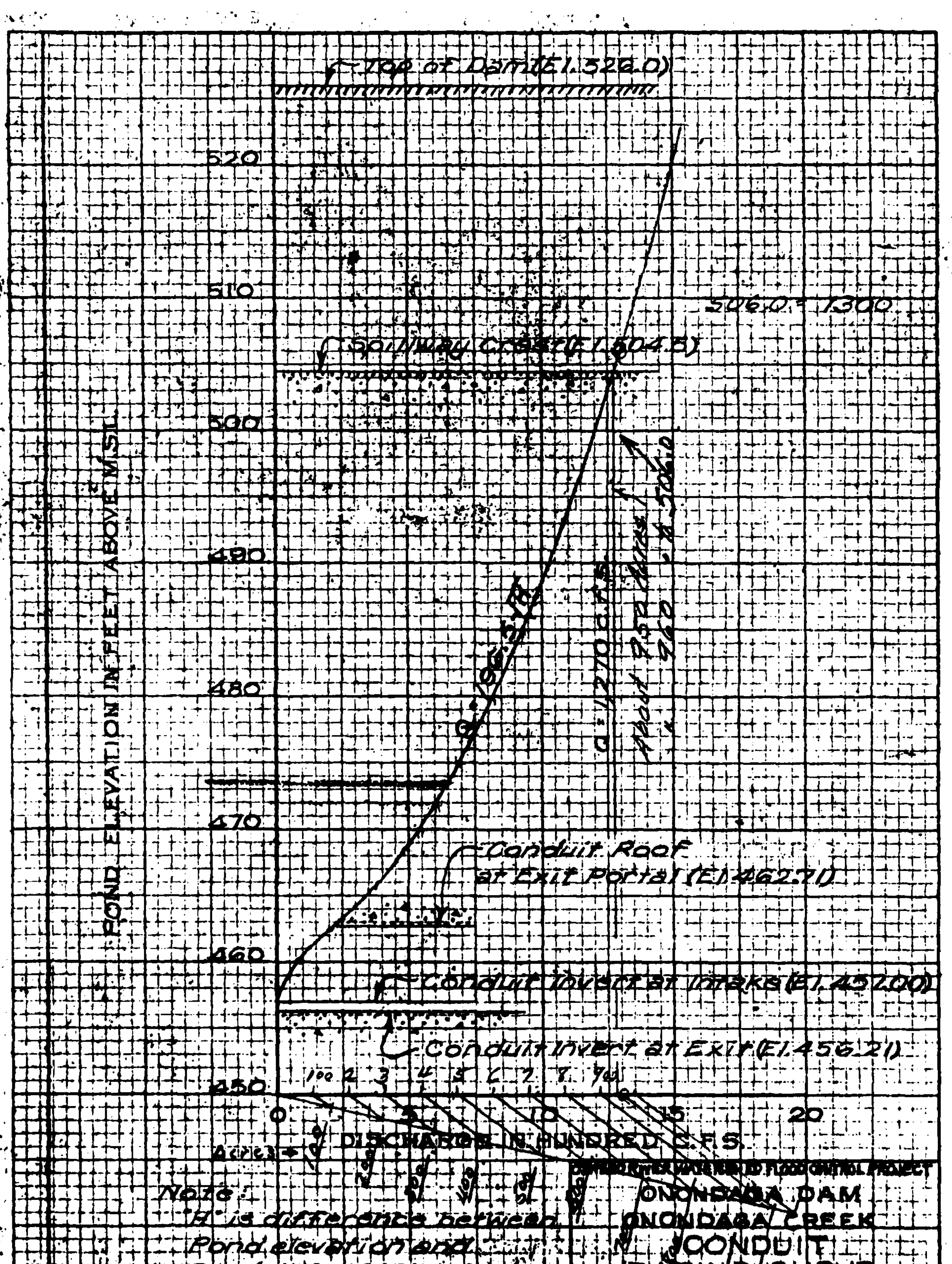

Top of Dam (El. 526.0)
Spillway Crest (El. 504.5)
Conduit Roof at Exit Portal (El. 462.71)
Conduit Invert at Intake (El. 457.00)
Conduit Invert at Exit (El. 456.21)
506.0 - 1300
POND ELEVATION IN FEET ABOVE M.S.L.
DISCHARGE IN HUNDRED C.F.S.
520
510
500
490
480
470
460
450
0
5
10
15
20
Note:
H is difference between Pond elevation and Conduit Roof (El. 462.71) at Exit Portal.
ONONDAGA DAM
ONONDAGA CREEK
CONDUIT RATING CURVE
U.S. ENGINEER OFFICE
SYRACUSE, N.Y.

Plate 4A

Onondaga Dam
NY # 794



# CHECK LIST FOR DAMS
# HYDROLOGIC AND HYDRAULIC
# ENGINEERING DATA

**AREA-CAPACITY DATA:**

| | Elevation (ft.) | Surface Area (acres) | Storage Capacity (acre-ft.) |
|---|---|---|---|
| 1) Top of Dam | 526 | 2500 | 48,400 |
| 2) Design High Water (Max. Design Pool) | 520.3 | 1640 | 38,200 |
| 3) Auxiliary Spillway Crest | N/A | — | — |
| 4) Pool Level with Flashboards | N/A | — | — |
| 5) Service Spillway Crest | 504.5 | 910 | 18,200 |

**DISCHARGES**

| | Volume (cfs) |
|---|---|
| 1) Average Daily | N/A |
| 2) Spillway @ Maximum High Water (Top of Dam) | 82,350 |
| 3) Spillway @ Design High Water | 48,500 |
| 4) Spillway @ Auxiliary Spillway Crest Elevation | N/A |
| 5) Low Level Outlet (with pool @ spillway crest) | 1270 |
| 6) Total (of all facilities) @ Maximum High Water | 83,930 |
| 7) Maximum ~~Known~~ Reputed Flood | 1170 |
| 8) At Time of Inspection | unknown |

CREST: ELEVATION: 526

Type: Rolled Earth

Width: 25' Length: 1782'

Spillover N/A

Location

SPILLWAY:

| PRINCIPAL | | EMERGENCY |
|---|---|---|
| 457 | Elevation | 504.5 |
| Circular Concrete Conduit | Type | ogee crested weir |
| 6.5'Ø, 329 feet long | Width | 200' |
| | Type of Control | |
| ✓ | Uncontrolled | ✓ |
| | Controlled: | |
| N/A | Type (Flashboards; gate) | |
| | Number | |
| | Size/Length | |
| | Invert Material | |
| | Anticipated Length of operating service | Unknown |
| N/A | Chute Length | 975' |
| N/A | Height Between Spillway Crest & Approach Channel Invert (Weir Flow) | 9' |

HYDROMETEROLOGICAL GAGES:

Type : Staff gage

Location: @ Low Level Outlet location, see Fig. 2 Appendix G

Records:

Date - 4-1-1960

Max. Reading - 485.9

FLOOD WATER CONTROL SYSTEM:

Warning System: Coordinated through Corps of Engineers, Buffalo District - not recently updated

Method of Controlled Releases (mechanisms):

Reservoir area is usually dry. Flood flows are ponded in reservoir and released through uncontrolled 6.5' Ø low level outlet.

DRAINAGE AREA: 68 $mi^2$

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Wooded & agricultural

Terrain - Relief: Lower portion has shallow slope, upper portion is steep.

Surface - Soil: Unknown

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

Unknown

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

None Known

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: N/A

Elevation:

Reservoir:

Length @ ~~[illegible]~~ Spillway Pool 3.4 ± (Miles)

Length of Shoreline (@ Spillway Crest) 12.5 ± (Miles)

```
(0001)    A1      ONONDAGA FLOOD CONTROL DAM       FILE IS ABRF
(0002)    A2      HEC1DB SNYDER PARAMETERS
(0003)    A3      PMF - DAM OVERTOPPING ANALYSIS
(0004)    B     90       1       0       0       0       0       0       0       4       0
(0005)    B1     5       0       0       0       0       0       0       0       0       0
(0006)    J      1       7       1       0       0       0       0       0       0       0
(0007)    J1   0.2     0.3     0.4     0.5     0.6     0.8     1.0       0       0       0
(0008)    K      0     300       0       0       0       0       1       0       0       0
(0009)    K1      RUNOFF SUBAREA 3
(0010)    M      1       1    6.15       0    68.1       0       0       0       1       0
(0011)    P      0    20.5      88     102     112     118       0       0       0       0
(0012)    T      0       0       0       0       0       0     1.0     0.1       0       0
(0013)    W   4.05   0.625       0       0       0       0       0       0       0       0
(0014)    X   -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0015)    K      1     200       0       0       0       0       1       0       0       0
(0016)    K1      ROUTE THRU SUBAREA 2
(0017)    Y      0       0       0       1       1       0       0       0       0       0
(0018)    Y1     1       0       0       0       0       0      -1       0       0       0
(0019)    Y6 0.060   0.035   0.060     588     620   16315  0.0092       0       0       0
(0020)    Y7   350     620     700     600     887     592     895     588     905     588
(0021)    Y7   909     592    1000     600    2500     620       0       0       0       0
(0022)    K      0     200       0       0       0       0       1       0       0       0
(0023)    K1      RUNOFF SUBAREA 2
(0024)    M      1       1   12.53       0    68.1       0       0       0       1       0
(0025)    P      0    20.5      88     102     112     118       0       0       0       0
(0026)    T      0       0       0       0       0       0     1.0     0.1       0       0
(0027)    W   4.15   0.625       0       0       0       0       0       0       0       0
(0028)    X   -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0029)    K      0     400       0       0       0       0       1       0       0       0
(0030)    K1      RUNOFF SUBAREA 4
(0031)    M      1       1    8.89       0    68.1       0       0       0       1       0
(0032)    P      0    20.5      88     102     112     118       0       0       0       0
(0033)    T      0       0       0       0       0       0     1.0     0.1       0       0
(0034)    W   4.95   0.625       0       0       0       0       0       0       0       0
(0035)    X   -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0036)    K      3     200       0       0       0       0       1       0       0       0
(0037)    K1     COMBINE 3 HYDROGRAPHS 3+2+4=2
(0038)    K      1     110       0       0       0       0       1       0       0       0
```

```
(0039)  K1     ROUTE TO DAM
(0040)  Y       0       0       0       1       1       0       0       0       0       0
(0041)  Y       1       0       0       0       0       0      -1       0       0       0
(0042)  Y6  0.060   0.035   0.060     516     560    9950   0.004       0       0       0
(0043)  Y7    100     560     300     540     600     520     608     516     618     516
(0044)  Y7    628     520    1610     540    3710     560       0       0       0       0
(0045)  K       0     600       0       0       0       0       1       0       0       0
(0046)  K1      RUNOFF SUBAREA 6
(0047)  M       1       1   12.83       0    68.1       0       0       0       1       0
(0048)  P       0    20.5      88     102     112     118       0       0       0       0
(0049)  T       0       0       0       0       0       0     1.0     0.1       0       0
(0050)  W    4.65   0.625       0       0       0       0       0       0       0       0
(0051)  X    -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0052)  K       0     500       0       0       0       0       1       0       0       0
(0053)  K1      RUNOFF SUBAREA 5
(0054)  M       1       1   13.61       0    68.1       0       0       0       1       0
(0055)  P       0    20.5      88     102     112     118       0       0       0       0
(0056)  T       0       0       0       0       0       0     1.0     0.1       0   0.048
(0057)  W    2.95   0.625       0       0       0       0       0       0       0       0
(0058)  X    -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0059)  K       2     500       0       0       0       0       1       0       0       0
(0060)  K1      COMBINE 2 HYDROGRAPHS 5+6=5
(0061)  K       0     100       0       0       0       0       1       0       0       0
(0062)  K1      RUNOFF SUBAREA 1
(0063)  M       1       1   14.09       0    68.1       0       0       0       1       0
(0064)  P       0    20.5      88     102     112     118       0       0       0       0
(0065)  T       0       0       0       0       0       0     1.0     0.1       0   0.076
(0066)  W    3.00   0.625       0       0       0       0       0       0       0       0
(0067)  X    -2.0   -0.10     1.6       0       0       0       0       0       0       0
(0068)  K       3     100       0       0       0       0       1       0       0       0
(0069)  K1      COMBINE 3 HYDROGRAPHS 5+1+2=1 TOTAL RESERVOIR INFLOW
(0070)  K       1     100       0       0       0       0       1       0       0       0
(0071)  K1      ROUTE THRU RESERVOIR AND OVER SPILLWAY
(0072)  Y       0       0       0       1       1       0       0       0       0       0
(0073)  Y1      1       0       0       0       0       0  -504.5      -1       0       0
(0074)  Y4  504.5   506.5   508.5   510.5   512.5   514.5   516.5   518.5   520.5   522.5
(0075)  Y4  524.5   525.5     526       0       0       0       0       0       0       0
(0076)  Y5      0    2500    6000   10500   16200   23200   31200   40000   50000   60300
```

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (0077) | Y5 | 72300 | 79000 | 82350 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| (0078) | $S | 0 | 71 | 18025 | 19390 | 21400 | 23590 | 25910 | 28490 | 31310 | 34270 |
| (0079) | $S | 37290 | 40340 | 43670 | 48400 | 0 | 0 | 0 | 0 | 0 | 0 |
| (0080) | $E | 457 | 470 | 504.5 | 506 | 508 | 510 | 512 | 514 | 516 | 518 |
| (0081) | $E | 520 | 522 | 524 | 526 | 0 | 0 | 0 | 0 | 0 | 0 |
| (0082) | $$ | 504.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| (0083) | $D | 526 | 2.65 | 1.5 | 1780 | 0 | 0 | 0 | 0 | 0 | 0 |
| (0084) | K | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| (0085) | A | | | | | | | | | | |
| (0086) | A | | | | | | | | | | |
| (0087) | A | | | | | | | | | | |
| (0088) | A | | | | | | | | | | |
| (0089) | A | | | | | | | | | | |

```
PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
          RUNOFF HYDROGRAPH AT          300
          ROUTE HYDROGRAPH TO           200
          RUNOFF HYDROGRAPH AT          200
          RUNOFF HYDROGRAPH AT          400
          COMBINE  3 HYDROGRAPHS AT     200
          ROUTE HYDROGRAPH TO           110
          RUNOFF HYDROGRAPH AT          600
          RUNOFF HYDROGRAPH AT          500
          COMBINE  2 HYDROGRAPHS AT     500
          RUNOFF HYDROGRAPH AT          100
          COMBINE  3 HYDROGRAPHS AT     100
          ROUTE HYDROGRAPH TO           100
          END OF NETWORK
```

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE?FRI, MAR 06 1981
     TIME?24:53:40

                    ONONDAGA FLOOD CONTROL DAM        FILE IS ABRF
                    HEC1DB SNYDER PARAMETERS
                    PMF - DAM OVERTOPPING ANALYSIS

                                 JOB SPECIFICATION
          NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
          90       1       0       0       0       0       0       0       4       0
                                 JOPER     NWT   LROPT   TRACE
                                     5       0       0       0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 7 LRTIO= 1
           RTIOS=   0.20    0.30    0.40    0.50    0.60    0.80    1.00


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

                               SUB-AREA RUNOFF COMPUTATION

            RUNOFF SUBAREA 3
                        ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                          300       0       0       0       0       0       1       0       0

                                        HYDROGRAPH DATA
           IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
               1       1    6.15    0.00   68.10    0.00   0.000       0       1       0

                                          PRECIP DATA
                    SPFE     PMS      R6     R12     R24     R48     R72     R96
                    0.00   20.50   88.00  102.00  112.00  118.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.858

                                            LOSS DATA
     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.00

                                     UNIT HYDROGRAPH DATA
                               TP=  4.05     CP=0.63     NTA=  0
```

```
                                        RECESSION DATA
                              STRTQ=    -2.00    QRCSN=    -0.10    RTIOR= 1.60

              UNIT HYDROGRAPH 21 END-OF-PERIOD ORDINATES, LAG=   4.04 HOURS, CP= 0.63  VOL= 1.00
           66.       235.       441.       590.       610.       511.       382.       286.       214.       160.
          119.        89.        67.        50.        37.        28.        21.        16.        12.         9.
            7.

                                                END-OF-PERIOD FLOW
   MO.DA  HR.MN  PERIOD   RAIN    EXCS    LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                                 SUM  20.75  17.29   3.45   80022.
                                                                                    ( 527.)( 439.)(  88.)( 2265.97)


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

                                              HYDROGRAPH ROUTING

                 ROUTE THRU SUBAREA 2
                            ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                              200        1        0        0        0        0        1        0        0
                                                    ROUTING DATA
                    QLOSS    CLOSS      AVG     IRES    ISAME     IOPT     IPMP             LSTR
                      0.0    0.000     0.00        1        1        0        0                0

                            NSTPS    NSTDL      LAG    AMSKK        X      TSK    STORA   ISPRAT
                                1        0        0    0.000    0.000    0.000      -1.        0

NORMAL DEPTH CHANNEL ROUTING
----------------------------

        QN(1)   QN(2)   QN(3)   ELNVT   ELMAX   RLNTH     SEL
        0.0600  0.0350  0.0600  586.0   620.0   16315.  0.00920

        CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
          350.00  620.00  700.00  600.00  687.00  592.00  695.00  588.00  905.00  588.00
          909.00  592.00 1000.00  600.00 2500.00  620.00

 STORAGE         0.00        7.90       18.95       39.85       95.27      187.59      316.84      483.01      709.58
              1450.57     1977.48     2596.66     3314.11     4129.83     5043.83     6056.10     7166.63     8375.45

 OUTFLOW         0.00      102.95      358.04      856.94     1874.29     3677.31     6497.74    10539.60    15473.53
             33794.66    47976.73    66135.94    88725.77   116178.05   148905.91   187306.22   231761.86   282643.69

   STAGE       586.00      589.68      591.37      593.05      594.74      596.42      598.11      599.79      601.47
               604.84      606.53      608.21      609.89      611.58      613.26      614.95      616.63      618.32
```

```
FLOW        0.00     102.95     358.04     856.94    1874.29    3677.31    6497.74   10539.60   15473.53
        33794.86   47976.73   66135.94   88725.77  116178.05  148905.91  187306.22  231761.88  282643.69

MAXIMUM STAGE IS      594.2

MAXIMUM STAGE IS      595.2

MAXIMUM STAGE IS      595.9

MAXIMUM STAGE IS      596.6

MAXIMUM STAGE IS      597.0

MAXIMUM STAGE IS      598.0

MAXIMUM STAGE IS      598.7


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

                                    SUB-AREA RUNOFF COMPUTATION

                  RUNOFF SUBAREA 2
                         ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                          200       0       0       0       0       0       1       0       0

                                         HYDROGRAPH DATA
                  IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                      1      1   12.53    0.00   68.10    0.00   0.000       0       1       0

                                           PRECIP DATA
                        SPFE     PMS      R6     R12     R24     R48     R72     R96
                        0.00   20.50   88.00  102.00  112.00  118.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.858

                                            LOSS DATA
                LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                    0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.00

                                        UNIT HYDROGRAPH DATA
                                     TP=  4.15     CP=0.63     NTA=  0

                                          RECESSION DATA
                              STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

                 UNIT HYDROGRAPH 23 END-OF-PERIOD ORDINATES, LAG=   4.16 HOURS, CP= 0.63   VOL= 1.00
              123.       440.       834.      1134.      1207.      1039.       790.       601.       458.       348.
              265.       202.       153.       117.        89.        68.        51.        39.        30.        23.
               17.        13.        10.
```

```
                                   END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                        SUM  20.75  17.29   3.45   161974.
                                                                           ( 527.)( 439.)(  88.)( 4586.59)


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

                              SUB-AREA RUNOFF COMPUTATION

              RUNOFF SUBAREA 4
                        ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                          400       0       0       0       0       0       1       0       0

                                         HYDROGRAPH DATA
              IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                  1       1    8.89    0.00   68.10    0.00   0.000       0       1       0

                                          PRECIP DATA
                        SPFE     PMS      R6     R12     R24     R48     R72     R96
                        0.00   20.50   88.00  102.00  112.00  118.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.658

                                           LOSS DATA
          LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                   0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.00

                                      UNIT HYDROGRAPH DATA
                              TP=  4.95      CP=0.63      NTA=  0

                                          RECESSION DATA
                           STRTQ=    -2.00     QRCSN=    -0.10     RTIOR= 1.60

            UNIT HYDROGRAPH 27 END-OF-PERIOD ORDINATES, LAG=    4.91 HOURS, CP= 0.62  VOL= 1.00
            60.      219.      426.      617.      724.      711.      602.      480.      383.      305.
           244.      194.      155.      124.       99.       79.       63.       50.       40.       32.
            25.       20.       16.       13.       10.        8.        7.

   0                               END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                        SUM  20.75  17.29   3.45   112044.
                                                                           ( 527.)( 439.)(  88.)( 3172.73)


          **********        **********        **********        **********        **********
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                                 COMBINE HYDROGRAPHS

                 COMBINE 3 HYDROGRAPHS 3+2+4=2
                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        210       3       0       0       0       0       1       0       0


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

                                 HYDROGRAPH ROUTING

                 ROUTE TO DAM
                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        110       1       0       0       0       0       1       0       0
                                            ROUTING DATA
                 QLOSS    CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                   0.0    0.000    0.00       1       1       0       0               0

                      NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                          1       0       0   0.000   0.000   0.000     -1.       0


NORMAL DEPTH CHANNEL ROUTING
----------------------------

        QN(1)   QN(2)   QN(3)   ELNVT   ELMAX   RLNTH     SEL
       0.0600  0.0350  0.0600   516.0   560.0   9980. 0.00400

        CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
          100.00  560.00  300.00  540.00  600.00  520.00  608.00  516.00  618.00  516.00
          626.00  520.00 1610.00  540.00 3710.00  560.00

  STORAGE       0.00      8.07     24.39    100.09    254.54    487.75    799.70   1190.40   1659.86
             2835.02   3553.37   4408.86   5405.63   6543.69   7823.03   9243.66  10805.57  12508.77

  OUTFLOW       0.00    132.15    551.58   1868.89   4963.63  10552.29  19249.22  31609.82  48148.70
            95672.67 124402.81 159191.13 202702.13 255546.69 318407.13 391986.63 476988.19 574106.00

    STAGE     516.00    516.32    520.63    522.95    525.26    527.56    529.89    532.21    534.53
              539.16    541.47    543.79    546.10    548.42    550.74    553.05    555.37    557.68

     FLOW       0.00    132.15    551.58   1868.89   4963.63  10552.29  19249.22  31609.82  48146.70
            95672.67 124402.81 159191.13 202702.13 255546.69 318407.13 391986.63 476988.19 574106.00

MAXIMUM STAGE IS     525.9

MAXIMUM STAGE IS     527.2
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MAXIMUM STAGE IS     526.3

MAXIMUM STAGE IS     529.1

MAXIMUM STAGE IS     530.0

MAXIMUM STAGE IS     531.2

MAXIMUM STAGE IS     532.4


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

                                   SUB-AREA RUNOFF COMPUTATION

               RUNOFF SUBAREA 6
                         ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                           6.0        0        0        0        0        0        1        0        0

                                        HYDROGRAPH DATA
              IHYDG    IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
                  1       1    12.83     0.00    68.10     0.00    0.000        0        1        0

                                          PRECIP DATA
                    SPFE      PMS       R6      R12      R24      R48      R72      R96
                    0.00    20.50    28.00   102.00   112.00   118.00     0.00     0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.858

                                          LOSS DATA
          LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
              1     0.00     0.00     1.00     0.00     0.00     1.00     1.00     0.10     0.00     0.00

                                     UNIT HYDROGRAPH DATA
                                TF=  4.65     CP=0.63     NTA=  0

                                        RECESSION DATA
                         STRTQ=    -2.00     QRCSN=    -0.10     RTIOR= 1.60

          UNIT HYDROGRAPH 26 END-OF-PERIOD ORDINATES, LAG=   4.67 HOURS, CP= 0.63   VOL= 1.00
          98.      356.      690.      975.     1135.     1028.      834.      661.      524.      415.
         329.      261.      207.      164.      130.      103.       82.       65.       51.       41.
          32.       26.       20.       16.       13.       10.

                                          END-OF-PERIOD FLOW
     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                                 SUM  20.75  17.29   3.45   162679.
                                                                                    ( 527.)( 439.)(  88.)( 4606.55)
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          **********          **********          **********          **********          **********

                                        SUB-AREA RUNOFF COMPUTATION

                   RUNOFF SUBAREA 5
                              ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME    ISTAGE     IAUTO
                                500         0         0         0         0         0         1         0         0

                                                 HYDROGRAPH DATA
                 IHYDG      IUHG     TAREA      SNAP     TRSDA     TRSPC     RATIO     ISNOW     ISAME     LOCAL
                     1         1     13.61      0.00     68.10      0.00     0.000         0         1         0

                                                   PRECIP DATA
                           SPFE       PMS        R6       R12       R24       R48       R72       R96
                           0.00     20.50     88.00    102.00    112.00    118.00      0.00      0.00
 TRSPC COMPUTED BY THE PROGRAM IS 0.858

                                                    LOSS DATA
              LROPT     STRKR     DLTKR     RTIOL     ERAIN     STRKS     RTIOK     STRTL     CNSTL     ALSMX     RTIMP
                  0      0.00      0.00      1.00      0.00      0.00      1.00      1.00      0.10      0.00      0.05

                                                UNIT HYDROGRAPH DATA
                                          TP=  2.95       CP=0.63      NTA=  0

                                                   RECESSION DATA
                                 STRTQ=    -2.00      QRCSN=     -0.10      RTIOR= 1.60

                 UNIT HYDROGRAPH 15 END-OF-PERIOD ORDINATES, LAG=   2.93 HOURS, CP= 0.63  VOL= 1.00
              310.      1075.      1757.      1804.      1338.       871.       567.       369.       240.       156.
              102.        66.        43.        28.        18.

                                                END-OF-PERIOD FLOW
         MO.DA  HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q        MO.DA  HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q

                                                                                            SUM  20.75   17.46    3.29   187298.
                                                                                               ( 527.)( 443.)(  84.)( 5303.68)


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

                                               COMBINE HYDROGRAPHS

                   COMBINE 2 HYDROGRAPHS 5+6=5
                              ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME    ISTAGE     IAUTO
                                500         2         0         0         0         0         1         0         0


          **********          **********          **********          **********          **********
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                              SUB-AREA RUNOFF COMPUTATION

          RUNOFF SUBAREA 1
                    ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME ISTAGE   IAUTO
                      100       0       0       0      0       0       1      0       0

                                    HYDROGRAPH DATA
        IHYDG   IUHG   TAREA    SNAF   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
            1      1   14.09    0.00   68.10    0.00   0.000       0       1       0

                                      PRECIP DATA
                  SPFE     PMS      R6     R12     R24     R48     R72     R96
                  0.00   20.50   88.00  102.00  112.00  118.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.856

                                       LOSS DATA
     LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
         0   0.00   0.00   1.00   0.00   0.00   1.00   1.00   0.10   0.00   0.08

                                  UNIT HYDROGRAPH DATA
                              TP=  3.00    CP=0.63    NTA=  0

                                      RECESSION DATA
                          STRTQ=   -2.00    QRCSN=   -0.10    RTIOR= 1.60

            UNIT HYDROGRAPH 15 END-OF-PERIOD ORDINATES, LAG=  2.96 HOURS, CP= 0.63  VOL= 1.00
         306.     1063.     1757.     1844.     1401.      924.      610.      402.      266.      175.
         116.       76.       50.       33.       22.

     0                                  END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                       SUM  20.75  17.55   3.19   194353.
                                                                           ( 527.)( 446.)(  81.)( 5503.46)


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

                                   COMBINE HYDROGRAPHS

          COMBINE 3 HYDROGRAPHS 5+1+2=1 TOTAL RESERVOIR INFLOW
                    ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME ISTAGE   IAUTO
                      100       3       0       0      0       0       1      0       0


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

                                   HYDROGRAPH ROUTING
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```
                    ROUTE THRU RESERVOIR AND OVER SPILLWAY
                         ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME  ISTAGE   IAUTO
                           100       1       0       0      0       0       1       0       0
                                              ROUTING DATA
                 QLOSS   CLOSS     AVG    IRES   ISAME   IOPT    IPMP           LSTR
                   0.0   0.000    0.00       1       1      0       0              0

                         NSTPS   NSTDL     LAG   AMSKK      X     TSK   STORA  ISPRAT
                             1       0       0   0.000  0.000   0.000   -505.     -1

   STAGE      504.50    506.50    508.50    510.50    512.50    514.50    516.50    518.50    520.50
              524.50    525.50    526.00

   FLOW         0.00   2500.00   6000.00  10500.00  16200.00  23200.00  31200.00  40000.00  50000.00
            72300.00  79000.00  82350.00

    CAPACITY=      0.       710.    18025.    19390.    21400.    23590.    25910.    28490.    31310.    34270.
              37290.    40340.    43670.    48400.

   ELEVATION=    457.      470.      505.      506.      508.      510.      512.      514.      516.      518.
                 520.      522.      524.      526.

                      CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                     504.5     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                                  DAM DATA
                                        TOPEL    COQD    EXPD   DAMWID
                                        526.0     2.6     1.5    1780.

 PEAK OUTFLOW IS     9514. AT TIME  47.00 HOURS

 PEAK OUTFLOW IS    15204. AT TIME  47.00 HOURS

 PEAK OUTFLOW IS    21139. AT TIME  47.00 HOURS

 PEAK OUTFLOW IS    27141. AT TIME  46.00 HOURS

 PEAK OUTFLOW IS    33295. AT TIME  46.00 HOURS

 PEAK OUTFLOW IS    46265. AT TIME  46.00 HOURS

 PEAK OUTFLOW IS    59412. AT TIME  46.00 HOURS


           **********        **********        **********        **********        **********
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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 | RATIO 1 0.20 | RATIO 2 0.30 | RATIO 3 0.40 | RATIO 4 0.50 | RATIO 5 0.60 | RATIO 6 0.80 | RATIO 7 1.00 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RATIOS APPLIED TO FLOWS | | | | | | |
| HYDROGRAPH AT | 300 | 6.15 | 1 | 1583. | 2374. | 3166. | 3957. | 4749. | 6332. | 7915. |
| | ( | 15.93) | ( | 44.82)( | 67.24)( | 89.65)( | 112.06)( | 134.47)( | 179.30)( | 224.12)( |
| ROUTED TO | 200 | 6.15 | 1 | 1548. | 2331. | 3109. | 3899. | 4692. | 6257. | 7860. |
| | ( | 15.93) | ( | 43.84)( | 66.00)( | 88.03)( | 110.41)( | 132.86)( | 177.19)( | 222.57)( |
| HYDROGRAPH AT | 200 | 12.53 | 1 | 3150. | 4725. | 6299. | 7874. | 9449. | 12599. | 15749. |
| | ( | 32.45) | ( | 89.19)( | 133.78)( | 178.38)( | 222.97)( | 267.57)( | 356.76)( | 445.95)( |
| HYDROGRAPH AT | 400 | 8.89 | 1 | 1989. | 2983. | 3977. | 4971. | 5966. | 7954. | 9943. |
| | ( | 23.02) | ( | 56.31)( | 84.46)( | 112.62)( | 140.77)( | 168.93)( | 225.23)( | 281.54)( |
| 3 COMBINED | 200 | 27.57 | 1 | 6686. | 10038. | 13385. | 16745. | 20106. | 26810. | 33551. |
| | ( | 71.41) | ( | 189.34)( | 284.24)( | 379.03)( | 474.15)( | 569.35)( | 759.18)( | 950.07)( |
| ROUTED TO | 110 | 27.57 | 1 | 6494. | 9745. | 13080. | 16346. | 19663. | 26338. | 33017. |
| | ( | 71.41) | ( | 183.90)( | 275.95)( | 370.38)( | 462.87)( | 556.79)( | 745.81)( | 934.94)( |
| HYDROGRAPH AT | 600 | 12.83 | 1 | 2969. | 4453. | 5937. | 7421. | 8906. | 11874. | 14843. |
| | ( | 33.23) | ( | 84.06)( | 126.09)( | 168.12)( | 210.15)( | 252.18)( | 336.24)( | 420.30)( |
| HYDROGRAPH AT | 500 | 13.61 | 1 | 4294. | 6441. | 8587. | 10734. | 12881. | 17175. | 21468. |
| | ( | 35.25) | ( | 121.58)( | 182.37)( | 243.17)( | 303.96)( | 364.75)( | 486.33)( | 607.92)( |
| 2 COMBINED | 500 | 26.44 | 1 | 7066. | 10598. | 14131. | 17664. | 21197. | 28263. | 35328. |
| | ( | 68.48) | ( | 200.08)( | 300.11)( | 400.15)( | 500.19)( | 600.23)( | 800.31)( | 1000.38)( |
| HYDROGRAPH AT | 100 | 14.09 | 1 | 4408. | 6612. | 8817. | 11021. | 13225. | 17633. | 22042. |
| | ( | 36.49) | ( | 124.83)( | 187.24)( | 249.66)( | 312.07)( | 374.49)( | 499.32)( | 624.15)( |
| 3 COMBINED | 100 | 68.10 | 1 | 17130. | 25783. | 34456. | 43232. | 51886. | 69450. | 86904. |
| | ( | 176.38) | ( | 485.07)( | 730.10)( | 975.67)( | 1224.20)( | 1469.24)( | 1966.62)( | 2460.84)( |
| ROUTED TO | 100 | 68.10 | 1 | 9514. | 15204. | 21139. | 27141. | 33295. | 46285. | 59412. |
| | ( | 176.38) | ( | 269.40)( | 430.54)( | 598.58)( | 768.54)( | 942.82)( | 1310.66)( | 1682.35)( |

PLAN 1 STATION 200

| RATIO | MAXIMUM FLOW,CFS | MAXIMUM STAGE,FT | TIME HOURS |
|---|---|---|---|
| C.20 | 1548. | 594.2 | 44.0C |
| 0.30 | 2331. | 595.2 | 44.0C |
| 0.40 | 31C9. | 595.9 | 44.0C |
| C.50 | 3899. | 596.6 | 44.00 |
| 0.60 | 4692. | 597.0 | 44.0C |
| C.80 | 6257. | 598.0 | 44.0C |
| 1.00 | 7860. | 598.7 | 44.00 |

PLAN 1 STATION 110

| RATIO | MAXIMUM FLOW,CFS | MAXIMUM STAGE,FT | TIME HOURS |
|---|---|---|---|
| 0.20 | 6494. | 525.9 | 45.00 |
| C.30 | 9745. | 527.2 | 45.0C |
| 0.40 | 13C80. | 528.3 | 44.00 |
| 0.50 | 16346. | 529.1 | 44.0C |
| C.60 | 19663. | 53C.0 | 44.0C |
| C.80 | 26338. | 531.2 | 44.00 |
| 1.00 | 33C17. | 532.4 | 44.0C |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ...............

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 504.50 | 504.50 | 526.00 |
| STORAGE | 18025. | 18025. | 48400. |
| OUTFLOW | 0. | 0. | 82350. |

| 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.[illegible] | 510.[illegible] | 0.00 | 23662. | 9514. | 0.00 | 47.00 | 0.00 |
| 0.30 | 512.15 | 0.00 | 26104. | 15204. | 0.00 | 47.00 | 0.00 |
| 0.40 | 513.91 | 0.00 | 28375. | 21139. | 0.00 | 47.00 | 0.00 |
| 0.50 | 515.49 | 0.00 | 3[illegible]584. | 27141. | 0.00 | 46.00 | 0.00 |
| 0.60 | 516.98 | 0.00 | 32755. | 33295. | 0.00 | 46.00 | 0.00 |
| 0.60 | 519.76 | 0.00 | 36923. | 46285. | 0.00 | 46.00 | 0.00 |
| 1.00 | 522.33 | 0.00 | 4[illegible]885. | 59412. | 0.00 | 46.00 | 0.00 |

# APPENDIX D

# REFERENCES

APPENDIX D

REFERENCES


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# APPENDIX E

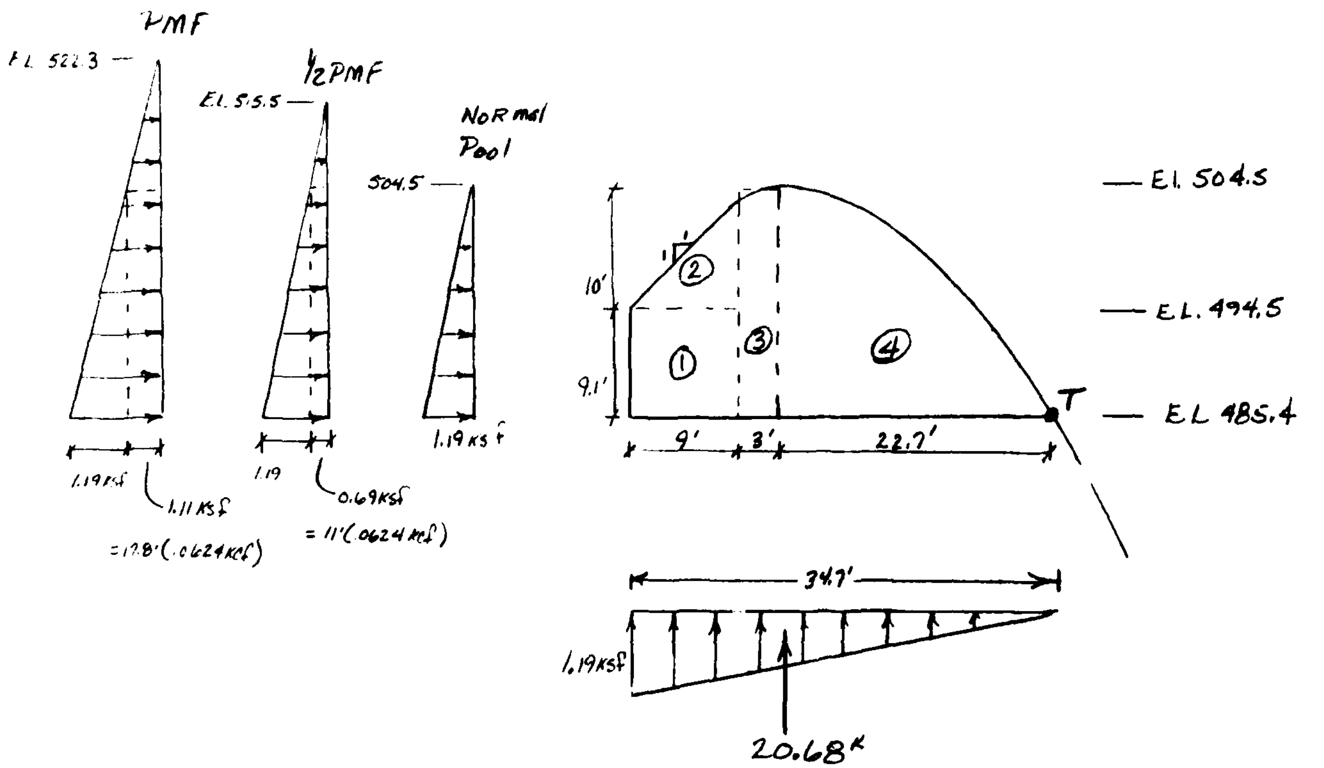
## STABILITY ANALYSIS

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800 **DESIGN BRIEF**

PROJECT NAME N.Y.S. Dam Inspections 1981 DATE

SUBJECT Oriskaga Dam PROJECT NO. 2520

Stability DRAWN BY JAG




weight of Dam

① $9' \times 9.1' \times 1' \times 0.15kcf = 12.285^k$

② $1/2\,(9')^2 \times 1' \times 0.15\ kcf = 6.075$

③ $3'\,(18.6') \times 1' \times 0.15 kcf = 8.37$

④ $2/3\,(19.1')(22.7')(1') \times 0.15 kcf = 43.357$

$70.09^k$

Resisting Moment due to wt. of dam (about "T")

$M_R = 12.285^k(25.7'+4.5') + 6.075^k(25.7'+3') + 8.37^k(22.7+1.5') + 43.357^k(5/8 \times 22.7')$

$= 371^{kk} + 174.4 + 202.6 + 615.1$

$= 1363^{kk}$

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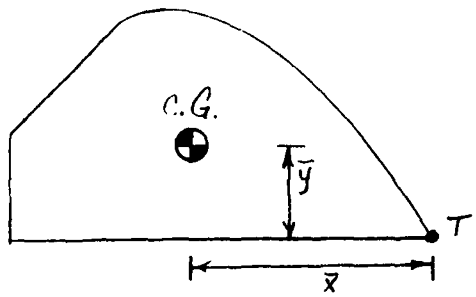
PROJECT NAME N.Y.S. Dam Inspections 1981 DATE

SUBJECT Onondaga PROJECT NO.

DRAWN BY




$$\bar{x} = \frac{1363^{1\text{-}k}}{70.09^{k}} = 19.45'$$

$$\bar{y} = \frac{12.285^{k}\left(\frac{9.1'}{2}\right) + 6.075^{k}(9.1'+3') + 8.37^{k}\left(\frac{18.6'}{2}\right) + 43.357^{k}\left(2/5 * 19.1'\right)}{70.09^{k}}$$

$$\bar{y} = 7.7'$$

Uplift Pressure

$$\text{Uplift} = 19.1'(.0624\,kcf)\left(\frac{34.7'}{2}\right)(1') = 20.68^{k}$$

Overturning Moment (about "T")

$$= 20.68^{k}\left(34.7' * \frac{2}{3}\right) = 478.4^{1\text{-}k}$$

Note: Uplift pressure is assumed to vary linearly between spillway pool head at upstream side of spillway and zero at downstream side (this neglects any pore pressure relief from the drains shown on the plans).

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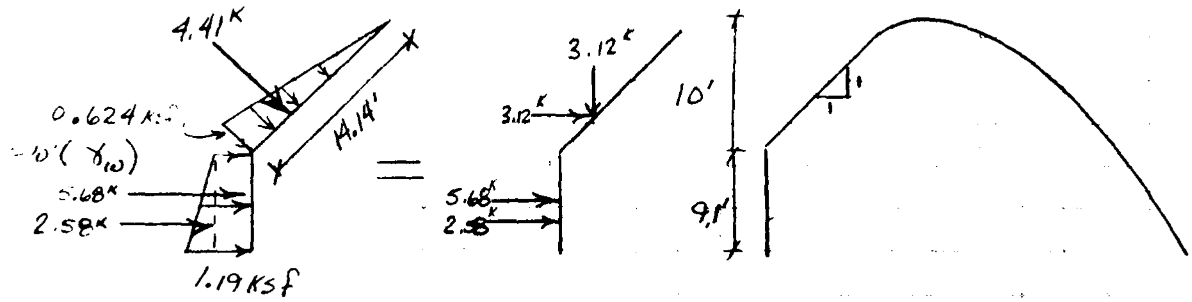
SUBJECT Onondaga Dam PROJECT NO

DRAWN BY

Case I - Normal Pool (@ Spillway Elev.)

Upstream water pressure projected onto the face of the dam




Total Horizontal Force = $11.38^K$

Contributing Overturning Moment

$= 3.12^K(9.1' + 10'/3) + 5.68^K(9.1'/2) + 2.58^K(9.1'/3) = 72.46^{l-K}$

Contributing Resisting Moment

$= 3.12^K(34.7' - 10'/3) = 97.9^{l-K}$

i) Overturning

$\Sigma M_R = 97.9^{l-K} + 1363 = 1461^{l-K}$

$\Sigma M_o = 478.4 + 72.5 = 551^{l-K}$

$F.S. = \frac{1461}{551} = 2.65$

Position of Resultant $d = \Sigma M / \Sigma V$

$d = \frac{1461 - 551}{70.09 + 3.12 - 20.68} = \frac{910^{l-K}}{52.53^K} = 17.3' = \frac{17.3}{34.7} = 0.5b$

inside middle third O.K.

ii) Sliding (shear friction method)

$$F.S. = \frac{\mu N + CA}{\Sigma H}$$

$$N = \Sigma V = 52.53^K$$

$$F.S. = \frac{0.65(52.53^K) + (0.05\,Ksi)(144\,^{in^2}/_{ft^2})(1')(34.7')}{11.38^K}$$

$$= \frac{34.1 + 250}{11.4} = 25 \pm \quad O.K.$$

Case II Normal Pool with Ice

Ice Load $7.5^K$ @ Spillway Crest

$M_o = 7.5^K(19.') = 143^{1-K}$

i) Overturning

$$F.S. = \frac{1461}{551 + 143} = 2.1$$

Position of Resultant

$$d = \frac{\Sigma M}{\Sigma V} = \frac{910 - 143^{1-K}}{52.5^K} = 14.6' = 0.42\,b$$ inside middle 1/3 O.K.

ii) Sliding

$$F.S. = \frac{34 + 250}{11.4 + 7.5} = 15 \pm \quad O.K.$$

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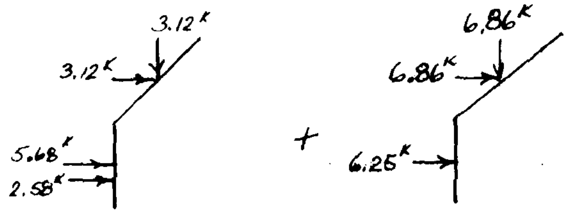
SUBJECT Onondaga Dam PROJECT NO.

DRAWN BY

Case III ½ PMF (uplift assumed to be same as Case I).

Upstream water pressure is equal to that of Case I plus an additional 0.69 ksf (uniform pressure) over the entire upstream face, as shown below




Case I add'l due to Case III

Overturning Moment Due to Upstream Water

$= 72.5^{'k} + 6.25^k(9.1'/2) + 6.86^k(9.1' + 10/3) = 186.3^{'k}$

or an additional $113.8^{'k}$

Contributing Resisting Moment

$= 6.86^k(34.7' - 10/3) + 97.9^{'k} = 313^{'k}$

or an additional $215^{'k}$

i) Overturning

$$F.S. = \frac{1461 + 215}{551 + 114} = \frac{1676}{665} = 2.5$$

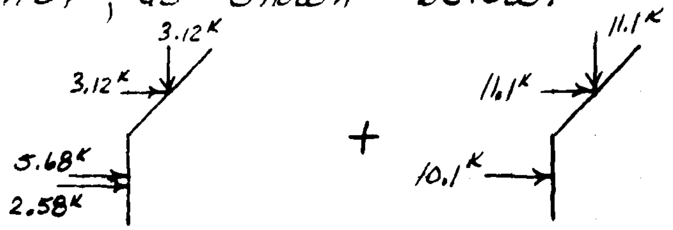
Resultant Position $d = \dfrac{1676 - 665}{52.5 + 6.9} = \dfrac{1011}{59.4} = 17' = 0.5b$ inside mid ⅓ O.K.

ii) Sliding

$$F.S. = \frac{0.65(59.4) + 250}{11.38 + 6.25 + 6.86} = 11.8$$

Case IV PMF (uplift assumed same as Case I)

Upstream water pressure is equal to that of Case I plus an additional uniform pressure of 1.11 ksf, as shown below.




Case I Add'l forces due to Case III

Add'l Overturning Moment due to Case III
$10.1^K(9.1/2) + 11.1^K(9.1' + 10/3) = 184^{l-K}$

Add'l Resisting Moment
$= 11.1^K(34.7' - 10/3) = 348^{l-K}$
Add'l Horiz. Force $= 10.1 + 11.1 = 21.2^K$

i) Overturning

$$F.S. = \frac{1461 + 348}{551 + 184} = 2.46$$

Resultant Position $d = \frac{1809 - 735}{52.5 + 11.1} = 16.9' = 0.49b$ inside mid 1/3 O.K.

ii) Sliding

$$F.S. = \frac{0.65(52.5 + 11.1) + 250}{11.38 + 21.2} = 8.9 \quad O.K.$$

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PROJECT NAME N.Y.S. Dam Inspections 1981 DATE

SUBJECT Orondaga Dam PROJECT NO.

DRAWN BY

Case V Seismic, Zone 2
Horizontal Coefficient = 0.05
Vertical Coefficient = 0.025

a) Additional overturning moment due to acceleration of gravity loads

$$0.05\,(70.09^{K})(7.7') + 0.025(1363^{1-K}) = 61^{1-K}$$

$$\text{Effective } \Sigma \text{ vertical loads} = 52.53^{K} - 0.025(70.9^{K}) = 50.76^{K}$$

b) Add'l moment due to hydrodynamic effect of the reservoir (Ref. "Design of Small Dams")

$$P_e = C\lambda w h = 0.34\,(0.05)\,(0.0624\,kcf)\,10'\,(1') = 0.0106\ ^{K}/ft$$

$$V_e = 0.726\,P_e\,y = 0.726\,(.0106\ ^{K}/ft)(10') = 0.077^{K}$$

$$M_e = V_e\,\bar{y} = 0.077^{K}(9.1' + 0.4118 * 10') = 1^{1-K}$$

i) Overturning

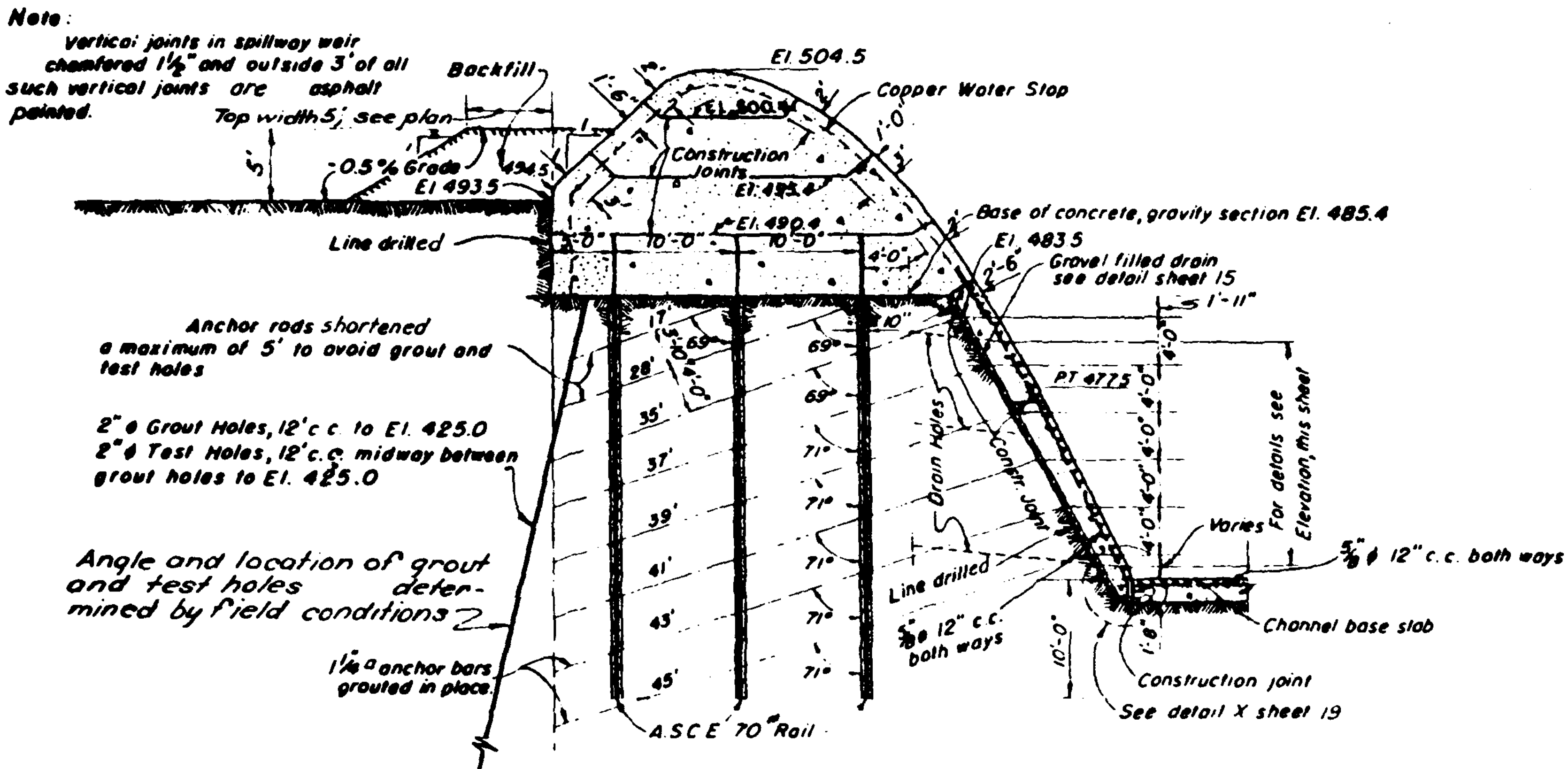
$$F.S. = \frac{1461}{551 + 1 + 61} = 2.38$$

Resultant Position

$$d = \frac{1461 - 613}{50.76} = 16.7' = 0.48\,b$$ O.K. inside base and inside mid 1/3

ii) Sliding

$$F.S. = \frac{0.65(50.76) + 250}{11.38 + .077 + .05(70.09)} = \frac{283}{14.96} = 19^{\pm}$$ O.K.




TYPICAL SECTION

APPENDIX F

PREVIOUS INSPECTION REPORTS/AVAILABLE DOCUMENTS

Syracuse Flood Control Project November 1, 1949
Onondaga Dam
Construction Data and Cost

Onondaga Flood Control Dam is located about seven miles south of Syracuse on the Onondaga Indian Reservation and was constructed by M. J. Groves & Sons Co., Contractors of Minneapolis, Minn.

Plans and Supervision by U. S. Engineers.
Right of way and Maintenance by the State of New York.
Work commenced May 5, 1947 - completed August 20, 1949. Officially accepted by State 11/4/49.

DAM

Earth of about 1800 feet in length with a concrete spillway section at the east end of the dam, an intake channel and intake structure, approach channel to spillway, a 6'-6" conduit, 340 feet through the dam to the outlet channel with stilling basin, also a spillway channel which connects with the outlet channel.

Elevation of the top of the earth dam 526.00, elevation of the spillway 504.5. Maximum height of dam about 62 feet. Its construction required 94,000 cubic yards of rock excavation; 816,000 cubic yards of earth excavation including borrow; 566,000 cubic yards of embankment which includes structure backfill and gravel lining; 63,500 cubic yards of rock fill; 42,000 cubic yards of dumped riprap; 1200 cubic yards of rock paving; 11,700 cubic yards of concrete in spillway section, approach walls and channel lining; also a gage house, 2 siphon manholes, 13 piezometers, 21 settlement gages.

Total cost of construction contract including planting of slopes . . . . . . . . . . . . . . . . . . . . . . . . . $ 2,287,379.19

State's Cost

| | | |
|---|---|---|
| Right of way, Dam Site, Flowage Area, relocation of Route 11A around the Dam also including $40,000 to the Indian Nation | $ 191,200.00 Est. | |
| Relocation of Solvay Brine Lines | 136,030.00 | |
| Relocation of Route 11A | 174,339.50 | |
| Utilities - relocation telephone lines | 5,000.00 Est. | |
| " " power lines | 3,330.00 | |
| | | $ 509,900.00 |
| Total Cost | | $ 2,797,279.19 |

Reservoir Area - On Indian Reservation 188± Acres; West Branch 449± Acres; South Branch 323± Acres (both outside of Reservation) Total 960± Acres. Capacity of Reservoir 792,792,000 cubic feet or 18,200 acre feet.

HARRY C. SMITH
Senior Civil Engineer

HCS/meh

ONONDAGA DAM AND RESERVOIR
RESERVOIR REGULATION MANUAL



Table of Contents



Feb. 1955

## SECTION IV
## RESERVOIR REGULATION



## SECTION V
## STATEMENT OF CONTINUING STUDIES



## TABLES



## PLATES

PLATES
(contd)

| No. | Description |
|---|---|
| 11. | Rating curve, U. S. G. S. gage, Dorwin Ave. |
| 12. | Rating curve, city gage, Temple St. |
| 13. | Hydrograph of March 1920 flood |
| 14. | Hydrograph of March 1950 flood |
| 15. | Sedimentation Ranges |
| 16. | Organization chart, Hydraulic-Hydrology Section |
| 17. | Normal organization chart |
| 18. | Organization chart, Flood emergency plan |
| 19. | Rule curves for reservoir |

# INTRODUCTION

Onondaga dam was built as part of a local protection project for the city of Syracuse, New York. The dam has an uncontrolled outlet and an ungated spillway, hence no regulation of outflow is possible beyond that imposed by capacity of outlet and spillway. The title to lands essential to the dam and reservoir was acquired by the State of New York and the dam has been turned over to the State Department of Public Works to be maintained in accordance with regulations prescribed by the Secretary of the Army.

PERTINENT DATA

ONONDAGA DAM AND RESERVOIR

1. General

Purpose - - - - - - - - - - - - - - - Flood Control

Drainage area above dam - - - - - - - - - 68.1 sq. mi.

Drainage area, U.S.G.S. gage (Dorwin Ave.) 88.9 sq. mi.

Drainage area, mouth of Onondaga Creek - - 108.9 sq. mi.

2. Dam

Type - - - - - - - - - - - - - - - - Rolled Earth

Length, feet - - - - - - - - - - - - - - - 1,782

Maximum height, feet - - - - - - - - - - - 67

Top width, feet - - - - - - - - - - - - - 25

Top elevation, feet above mean sea level - 526

3. Spillway

Type - - Uncontrolled ogee, side channel overflow

Crest length, feet - - - - - - - - - - - - - 200

Crest elevation, feet above mean sea level - 504.5

Surcharge, design flood, feet - - - - - - - - - 15.8

Capacity at 15.8 ft. surcharge 48,600 cfs

4. Outlet

Type - - - Uncontrolled circular conduit

Number - - - - - - - - - - - - - - - - - - One

Diameter, feet - - - - - - - - - - - - - - 6.5

Length, feet - - - - - - - - - - - - - - - 329

Location - - Under east (right) section of dam.

PERTINENT DATA

ONONDAGA DAM AND RESERVOIR (Cont'd)

4. Outlet (Cont'd)

| | |
|---|---|
| Invert elevation at intake, ft. - - - - - - - - | 457.0 |
| Invert elevation at outlet, ft. - - - - - - - - | 456.21 |
| Discharge, pool at spillway crest elevation, cfs | 1,270 |
| Minimum time required to empty reservoir from spillway crest elevation, no inflow - - | 9 days |
| with assumed base flow of 2 cfs/sq. mile | 11 days |

5. Reservoir

| | |
|---|---|
| Area, spillway crest elevation (504.5) - - | 910 acres |
| Capacity spillway crest elevation (504.5) - | 18,200 acre ft. |
| Area, 15.8 ft. surcharge - - - - - - - - - - | 1,640 acres |
| Capacity 15.8 ft. surcharge - - - - - - - - | 38,200 acre ft. |

4.97 in

## SECTION I

### HISTORY AND DESCRIPTION OF ONONDAGA DAM AND RESERVOIR PROJECT

I-1. History of Onondago Dam Project. Flood Control has been an important problem in Syracuse since the area was first settled. The first attempt to improve conditions was made in 1822 when the outlet of Onondago Lake was enlarged to lower the lake several feet. Since then no serious flooding has occurred from Onondaga Lake. Local interests have made numerous channel improvements in the city of Syracuse. A preliminary examination report, authorized by the Flood Control Acts of 10 April 1936 and 22 June 1936, was submitted by the Special Board of Officers 17 April 1937. It recommended that surveys be made for the purpose of determining flood control plans for Syracuse and other localities. The survey report for flood control in the Oswego River watershed was submitted by the Board of Officers, 25 February 1939 (revised October 1939). The Board recommended that a project be undertaken at Syracuse, New York, and at other localities subject to certain conditions of local cooperation. This report was printed as House Document No. 846, 76th Congress, 3rd Session. The Flood Control Act of 1941 (Public Law 228, 77th Congress, 1st Session) authorized construction of a project to provide flood protection for the city of Syracuse, substantially in accordance with the recommendation of the Chief of Engineers in House Document No. 846. Originally a two-reservoir plan was proposed. After investigation disclosed unfavorable foundation conditions at the two reservoir sites, they were abandoned in favor of the single reservoir site used. The project included channel improvement and levee construction with a detention reservoir to compensate for the loss of natural valley storage. Construction of the dam, outlet works and spillway commenced 5 May 1947, by contract with S. J. Groves and Son at Minneapolis, Minnesota. Completion was effected 19 August 1949. The reservoir area was cleared of brush and dead trees below elevation 480 feet. Clearing operations were accomplished by hired labor and rented plant. Plate 1 shows the watershed and vicinity maps. The area inundated when the reservoir is of spillway crest elevation of 504.5 is shown on plate 15.

I-2. Watershed. Onondaga Creek is in the Oswego River watershed in central New York. The stream is formed by the junction of the west and south branches about 1,700 feet above the dam. The main stream then flows north through the city of Syracuse and empties into Onondaga Lake at the northwestern edge of the city, 13.2 miles below the dam. The length of Onondaga Creek plus its south branch is 27.2 miles. The total drainage area of the creek is 108.9 square miles, of which 68.1 square miles lie above the dam. Elevations with respect to mean sea level vary from 364 feet at the mouth to 1,887 feet at Dutch Hill near the southern end of the watershed. Below the junction of the two branches the stream has a uniform slope of about 7 feet per mile. Above the junction, for a distance of about 6 miles on the south branch and four miles on the west branch the streams have slopes of about 14 feet per mile. In the upper reaches of the two branches the slopes are much steeper, ranging up to 500 feet per mile. The valley varies in width from one-half to one mile with the exception of a relatively narrow section extending about one-half mile downstream from the junction of the two branches, and a narrow gorge extending about one mile downstream from the southern edge of the Indian reservation (see plate 1). The valley sides rise 500 to 1,000 feet above the stream, some slopes having a 50 percent grade. Most of the slopes are wooded and are cut by small flashy streams. There are no lakes or other reservoirs in the watershed.

I-3. Description of Onondaga Dam. Onondaga Dam is located 13.2 miles upstream from Onondaga Lake on Onondaga Creek, in Onondaga County, New York, about 4 miles south of the city of Syracuse. The dam is constructed of rolled earth embankment, 1,782 feet long and rises 67 feet above the general valley floor. The top elevation of 526 feet provides a freeboard of 5.7 feet above the spillway design flood. The dam has a top width of 25 feet, with a 20-foot macadam roadway. The upstream face of the dam and downstream toe are riprapped. Plates 2 and 2c show details of the dam. A recording gage has been installed to provide a continuous record of reservoir elevations. The gage house is located at the top of the dam adjacent to the roadway. There is a slope gage on the upstream face of the dam. Plates 2a and 2b show general details of the gages.

a. Outlet. The outlet is an uncontrolled circular, concrete conduit 6.5 feet in diameter through the dam near the right abutment. The conduit is 329 feet long with invert elevations at intake and exit of 457.00 ft. and 456.21 ft. respectively. This conduit is designed to discharge 1,270 cfs with reservoir at spillway crest, elevation 504.5 ft. The outlet rating curve is shown on Plate No. 3. Entrance and exit channel for the outlet have been provided to insure its design capacity and prevent scour of the toe of the dam. The inlet is protected by trash racks. Details of the outlet are shown on plates 2d and 2c.

b. Stilling basin. A stilling basin 71 feet long with two rows of concrete baffles is provided just below the conduit outlet. This serves to dissipate the high velocities developed in the conduit, which range up to 38 ft/sec. with pool at spillway crest elevation. These velocities are reduced to eight ft./sec. in rock channel and to four ft./sec. by the time the water reaches the earth channel. Plate 2e shows details of the stilling basin.

c. Spillway. A side-channel spillway with a concrete ogee weir having a crest length of 200 feet and elevation of 504.5 feet has been built in rock in the right abutment. There are no gates or other regulatory devices. The spillway is designed to carry 48,500 cfs at a surcharge of 15.8 feet. A sill 6.25 feet high and 50 foot long has been placed in the spillway exit channel 25 feet below the weir, to stabilize flows. The spillway discharge curve is shown on Plate No. 4 and the spillway design flood hydrograph is shown on Plate No. 5.

I-4. Description of Onondage Reservoir. The entire available storage capacity of Onondage Reservoir is used for flood control. There is no provision for dead storage or a conservation pool and when stream flow is low it is a dry reservoir. Characteristics of the reservoir area for principal pool elevations are given below in Table 1.

Table 1
Onondaga Reservoir Characteristics

| Characteristic | Spillway Design Flood | Spillway Crest | Average Annual Pool |
|---|---|---|---|
| Elevation, feet m.s.l. | 520.3 | 504.5 | 478.4 |
| Capacity, acre ft. | 38,000 | 18,200 | 2,900 |
| Area, acres | 1,640 | 910 | 330 |
| Shore line, miles | 21 | 14 | 8 |
| West Branch, flooded miles | 4.2 | 2.1 | 0.6 |
| South Branch, flooded miles | 3.8 | 2.7 | 1.0 |

All brush and dead trees were cleared from the reservoir area below elevation 480 ft. approximate elevation of the average annual flood. Reservoir characteristics are shown further by area-capacity curves on Plate 6 and Plate 7, drawdown curve.

I-5. Flowage Rights. Since this is a local protection project, the State of New York secured all necessary lands and easements. Title was acquired to the land that would be flooded up to the spillway crest elevation of 504.5 ft. The land lying between elevation 504.5 ft. and surcharge pool elevation at 520.3 ft. will remain in private ownership with easements for flooding granted to the State.

I-6. Area Capacity and Rating Data. Area and capacity curves for Onondaga reservoir are shown on Plate No. 6. The outlet rating curve is shown on Plate 3 and the spillway rating curve on plate No. 4. All of those curves are based on field surveys, design information and results of model tests.

I-7. Departure from Definite Project Plans. The major modification during construction of the dam was the abandonment of a bridge across the spillway channel from the relocated highway 11A on the east, and the construction of an access road 2,570 feet long from the west.

I-8. <u>Description of Areas Subject to Inundation Below Onondaga Dam.</u> The flood plain of Onondaga Creek below the reservoir extends through the city of Syracuse, N. Y. with about 75% of the area lying within the city limits. The commercial, industrial and residential development of the area has resulted in large flood damages. The maximum flood of record which occurred in March 1920 had a peak discharge of 6,000 cfs and resulted in losses of $1,500,000. The channel improvements by local interests below Ballantyne Road, and by the Corps of Engineers from Ballantyne Road to a point approximately 1,550 feet above Dorwin Avenue, now provide a minimum channel capacity of 6,000 cfs within the city of Syracuse. With the protection afforded by the reservoir, a discharge of that magnitude would be a very infrequent occurence. The area between the city limits and the dam is subject to overflow starting at discharges of slightly over 1,000 cfs. Most of this area is woodland and pasture, with a few residential units within the flood plain at the suburban development of Nedrow, N. Y., located above the improved channel and just south of the Syracuse city limits. Flood losses are relatively small in this area and the reservoir provides protection against major floods. The first gage below the dam is the one operated by the U. S. Geological Survey at Dorwin Ave., at the upper end of the improved channel. A discharge of 1,000 cfs at this gage corresponds to a stage of

4.5 feet and a discharge of 6,000 cfs corresponds approximately to a stage of 7.4 ft. The stage for 6,000 cfs was determined by extrapolation of the rating curve. Rating curves are shown for Derwin Avenue and Temple Street gages on plates 11 and 12 respectively.

## SECTION II

## METHOD OF OPERATION

II-1. Allocation of Storage. The total storage of Onondaga reservoir is allocated to flood control. No provision is made for dead storage, conservation pool or recreation pool. An estimate or silting to be expected, using the Meyer-Peter formula for stream bed load, indicates a capacity loss of less than 0.3 inch in 100 years. The outlet elevation is such that during periods of low flow the reservoir will be dry.

II-2. General Plan of Operation. Operation of flood control storage in Onondaga reservoir will be primarily in the interest of local flood control by reduction of peak discharges in Onondaga Creek. The rates of outflow are fixed by the design of the outlet and spillway and no regulatory devices have been provided to vary these outflows. The maximum flow through the outlet with pool at spillway crest elevation is limited by design to 1,270 cfs.

II-3. Operational Objectives for Flood Control.

a. During the storage period, limit reservoir outflow so that the outflow combined with local runoff below the reservoir will not exceed, insofar as possible the safe channel capacity below the dam.

b. Introduce sufficient lag time in peak runoff so that rises from minor tributaries below the reservoir will not be synchronized with main stream crests.

c. Provide sufficient warning time for local interests in the flood plain below the reservoir in the event of floods of such magnitude that spillway discharges will exceed available channel capacity below the reservoir.

II-4. Classification of Regulation Method. The plan of regulation presented in this manual is classified in accordance with paragraph 3-02 of Engineering Manual, Part CXXXVI as approximating "Method B". Having no regulatory devices this reservoir's operation does not completely meet the manual definition.

## SECTION III

## FORECASTING ONONDAGA RESERVOIR INFLOWS AND CREEK STAGES

III-1. Basic Hydrologic Data. Current rainfall and stage data essential to Onondaga reservoir are derived from the gages shown on Plate No. 8. There are at present six precipitation gages bounding the basin, whose records are published by the U. S. Weather Bureau. The U. S. Geological Survey operates one recording stream gage on Onondaga Creek which is located just above Dorwin Avenue Bridge, about four miles below the dam. The New York State Department of Public Works maintains the recording reservoir gage which is located on the dam. Pertinent data on existing gages is given in Table No. 2. The present stream gage at Dorwin Avenue has been in operation since May 1951. The U. S. Geological Survey has operated a stream gage on Onondaga Creek since Nov. 1939 at other sites but due to tributary inflow the discharge records from other sites are not considered comparable to those from the present location. The city operates a recording gage at Temple Street. Rating curves for these gages are shown on Plates 11 and 12 respectively.

TABLE 2

HYDROLOGIC REPORTING NET (1)

| Station | Type of Report | Reporting Criteria | Observer |
|---|---|---|---|
| 1. Syracuse Airport | Precipitation | Daily | U.S.W.B. |
| 2. Baldwinsville, N.Y. | " | 1 inch in 24 hrs at 7 A.M., observation or 0.5 inch at noon or 6 P.M., since previous observation | NYS Dept. Public Works |
| 3. Marcellus, N.Y. | " | Same as item 2 | Soil Conservation Service |
| 4. Skaneateles, N.Y. | " | " " " " | Syracuse Water Board |
| 5. East Homer 2, N.Y. | " | " " " " | U. S. Geological Survey |
| 6. Truxton 5N, N.Y. | " | " " " " | Earl D. Hill |
| 7. Onondaga Dam | Reservoir Stage | Daily | NYS Dept. Public Works |
| 8. Dorwin Avenue | Creek Stage | Daily above 4 ft. and 3 times per day above 6.5 ft. | City Engineers Office Syracuse, N.Y. |
| 9. Temple Street | " " | Daily | " " " |

(1) Reports will be collected by U.S.W.B. Syracuse and relayed to Corps of Engineers, District Office, Buffalo, N.Y.

AD-A105 796 STETSON-DALE UTICA NY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. ONONDAGA DAM (INVENTORY NUMBER NY --ETC(U)
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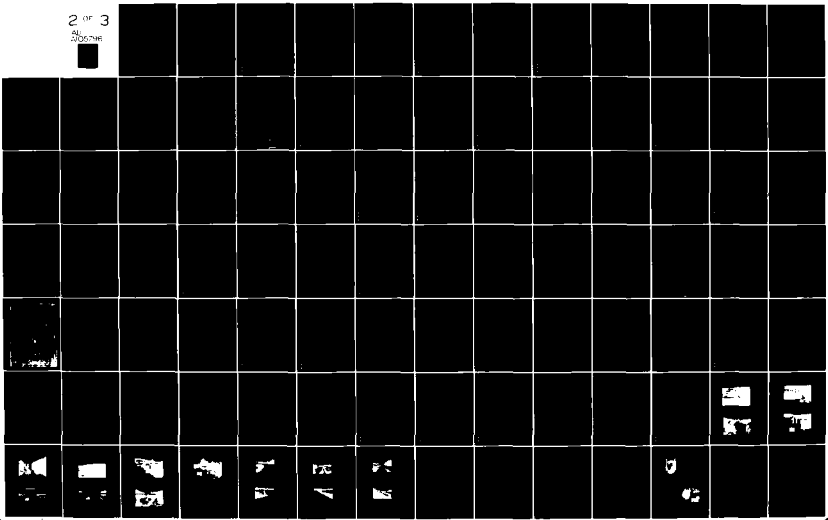


III-2. Collection of Hydrologic Data. As presented in Table 2, rainfall reports, reservoir elevations and creek stages will be collected at the U. S. Weather Bureau Office at Syracuse Airport. This data will be relayed to the District Office of the Corps of Engineers, Buffalo, N. Y. by 9.00 A.M. for analysis by the Hydrology and Hydraulic Section. The data will, of course, be available at the Syracuse Weather Bureau for the guidance of the municipal authorities and the New York State Dept. of Public Works. Collection will normally be by telephone or telegraph to the Syracuse Office of the Weather Bureau and thence by teletype and/or telephone to Buffalo. Monthly summaries of precipitation for the rainfall stations in Table 2 are published by the Weather Bureau in monthly "Climatological Data, New York." The recorder charts from the Dorwin Avenue gage are submitted weekly to the Corps of Engineers District Office at Buffalo, N. Y. by the U. S. Geological Survey and the charts from the reservoir gage are submitted weekly by the New York State Department of Public Works.

III-3. Weather Forecasts. The general weather forecasts and the quantitative precipitation forecasts for the Onondaga area will be furnished by the U. S. Weather Bureau. These forecasts will be analyzed in connection with the reported hydrologic data by the Hydrology Section, Buffalo District Office, both for precipitation and for temperature rises during periods of snow cover.

III-4. Runoff Forecasts. During periods of flood or impending flood, forecasts will be based on the unit hydrographs shown on Plate 9 and Plate 10 for the area above the dam and from the dam to Ballantyne Road respectively. Pending more detailed studies the infiltration rates as shown in Table 3 below will be used as a guide for rainfall runoff correlation. During floods the forecasts and procedures will be adjusted and modified to conform to actual observations.

TABLE NO. 3

INFILTRATION RATES

| Period | Antecedent Conditions | Infiltration Rate in inches per hour |
|---|---|---|
| Oct. - May | Wet | 0.05 |
| Oct. - May | Dry | 0.07 |
| June - Sept. | Wet | 0.15 |
| June - Sept. | Dry | 0.35 |

III-5. Reservoir Forecasts. The procedure used to forecast pool elevations and outflow from Onondaga Reservoir is as follows:

a. Average rainfall over the basin is determined from an isohyetal map plotted from reported rainfall.

b. Times of beginning and ending of rainfall as reported by observers is used to determine average duration.

c. Loss rates and unit hydrographs are used to convert this rainfall to runoff hydrograph.

d. Base flow as determined from past reservoir and creek stage reports is added to the runoff hydrograph to determine reservoir inflow. Due to short time of concentration it will not always be possible to make crest forecasts before the crests reach the reservoir.

e. From reservoir capacity curve (Plate 6) and the outlet rating curve (Plate 3) the inflow is converted to values of storage, pool elevation and outflow.

f. A rule curve has been developed (Plate 19) by which reservoir elevation and rate of rise for the past hour can be used to determine whether spillway operation is probable, and if so the approximate time from observation to beginning of spillway operation.

III-6. Creek Stage Forecasts. Except during periods of heavy rainfall the outflow from the reservoir will constitute the major flow in the creek. When heavy rains occur below the dam the same general procedure is followed as outlined in III-5, using the unit hydrograph for the area below dam, Plate 10, to determine the inflow rates from the area below the dam. To these values there are added the expected outflows from the reservoir to determine total flow at Ballantyne Road. The rating curve for the city gage, Plate 12, can be used to convert these discharges to stages. If it appears that flows below the dam will exceed channel capacity, the Hydrology Section shall so advise the Chief, Engineering Division, the District Engineer, and the Chief, Operations Division, in compliance with Sect. II-7-c, District "Flood-Emergency Plan."

III-7. Adequacy of Rainfall Reports. The coverage afforded by existing rainfall stations is not considered completely adequate. While the drainage basin is fairly well bounded by precipitation stations it would be advantageous to have at least two stations within the watershed, one located on each branch of the creek. Since this is a local flood protection project and is operated by the State Department of Public Works local cooperation will be necessary to expand the present coverage. Continuing studies will be made of this subject.

III-8. Floods of Record. Flooding has been a problem in Syracuse since its first settlement. The first flood mentioned in local histories occurred in 1807 when a mill dam was washed out. Major floods occurred in 1836, 1852, 1862, and 1865. Prior to 1902 no discharge measurements were made. The discharge of the flood on 1 March 1902 was measured, and from the data obtained the peak discharge of the 1901 flood was computed. While complete hydrographs of earlier floods are not available the city has published peak discharges for major floods, 1901 - 1927, included in Table 4 below.

TABLE NO. 4

MAJOR FLOODS

| Date | | Crest Discharge c.f.s. |
|---|---|---|
| 1901 | 15 December | 3400 |
| 1902 | 1 March | 3020 |
| 1908 | 15 February | 2150 |
| 1910 | 28 February | 2750 |
| 1913 | 26 March | 3250 |
| 1914 | 27 March | 3550 |
| 1915 | 14 September | 5500 |
| 1916 | 30 March | 2800 |
| 1918 | 26 February | 2050 |
| 1920 | 13 March | 6000 |
| 1922 | 12 June | 2930 |
| 1925 | 11 February | 5500 |
| 1926 | 17 November | 2530 |
| 1927 | 1 December | 2070 |
| 1940 | 1 April | 2320 |
| 1941 | 6 April | 2150 |
| 1942 | 9 March | 2860 |
| 1942 | 30 December | 3980 |
| 1947 | 3 June | 2540 |
| 1950 | 28 March (Reservoir in operation) | 2560 |

The March 1920 flood caused direct losses of $500,000 and indirect losses of $1,000,000 or a total of $1,500,000. Direct losses between 1862 and 1939 are estimated at $2,000,000.

## SECTION IV

## RESERVOIR REGULATION

IV-1. Responsibility. Regulation of Onondaga reservoir is fully automatic and determined by the pool elevation and corresponding capacity of the outlet and spillway. The New York State Flood Control Commission and the State Department of Public Works have accepted the responsibility of inspecting and maintaining the project and furnishing reports of such activities to the Corps of Engineers. The recording gage on the dam is maintained by the State Department of Public Works and the record of pool elevations is furnished to the Corps of Engineers. In the event of a flood or series of floods resulting in spillway operation the only method of minimizing losses in areas subject to flooding below the reservoir would be to issue timely warnings to evacuate threatened areas. This responsibility would obviously devolve upon the State Department of Public Works employee acting as superintendent or observer at the dam. To aid in issuing such advisories the Corps of Engineers has prepared a rule curve, presented on Plate 19, as a guide for the superintendent in determining the probability of spillway operation. Insofar as possible, the Corps of Engineers will endeavor to advise the State Department of Public Works when hydrologic reports and forecasts appear to indicate excessive runoff in the basin. Normal organization is shown on Plate 17, flood emergency plan organization on Plate 18, and organization of Hydraulic-Hydrology section on Plate 16.

IV-2. Communication Channels. Normal collection of hydrologic data will be by telephone to the U. S. Weather Bureau Office at Syracuse Airport and thence by teletype and/or telephone to the Corps of Engineers District Office in Buffalo, N. Y. Any special reports from the dam superintendent or from the Corps of Engineers District Office to the State Department of Public Works will be by telephone. In the event of failure of telephone communications, use of telegraph is recommended. Should both telephone and telegraph lines become inoperative during an emergency, an effort should be made to establish contact by short wave radio, either State or amateur. Recorder charts from the reservoir gage will be submitted by mail. Forecasts or warnings issued by the Hydraulic-Hydrology Section of the District Office will be routed through the Chief, Planning and Reports Branch, and Chief, Engineering Division. Normal organization chart is shown on Plate 17.

IV-3. Examples of Operation.

a. Maximum Flood of Record. The flood of 12-13 March 1920 was the maximum flood of record at Syracuse and caused the greatest damage. The crest discharge at Temple Street in Syracuse was 6,000 cfs. The inflow of the reservoir site was estimated at 4,860 cfs. Had the reservoir been in operation at that time, the maximum outflow would have been approximately 1,000 cfs. and the reservoir pool would have crested at approximate elevation 488.5 ft. or 16 ft. below the crest of the spillway. Maximum storage in the reservoir for this operation would have been approximately 7,130 acre-feet. A graphic presentation of this operation is given on Plate No. 13.

b. The spillway design flood was based on the most severe known occurrence of summer storms in inland northeastern United States. This storm was centered in north central Pennsylvania about 120 miles southwest of the reservoir site, in July 1942. As transposed to the Onondaga Creek basin, this storm had a total rainfall of 24.20 inches in 18 hours. As routed through the reservoir, this storm would have produced an inflow of 61,800 cfs. Assuming the reservoir to be filled to spillway crest elevation of 504.5 feet at the beginning of this storm and assuming the outlet to be completely blocked, the routing indicated a maximum spillway discharge of 48,500 cfs and a surcharge of 15.8 feet bringing the reservoir to elevation 520.3 feet. The hydrograph of the design flood is presented on Plate 5.

c. The flood of March 1950 was the first major rise after completion of the reservoir. Inflow has been computed as approximately 3,800 cfs while outflow did not exceed 935 cfs. Maximum pool elevation during this operation was 485.1 feet or 19.4 feet below spillway crest. Plate 14 shows a graphic presentation of this operation.

IV-4. Instructions to Superintendent. The general instructions for inspection, maintenance and reports covering the same have been covered in the "Operation and Maintenance Manual" issued by the Corps of Engineers, Buffalo District. Standing instructions to the Superintendent for reservoir regulation are outlined below:

a. The recorder chart from the reservoir gage shall be removed weekly and submitted by mail to the District Engineer, Corps of Engineers, U. S. Army, Buffalo District Office, Engineer Park, Buffalo 7, N. Y.

b. When the reservoir pool is below elevation 495 feet the 8 a.m. pool elevation shall be reported daily to the U. S. Weather Bureau office, Syracuse, N. Y. by 8:30 a.m. for relay to the Buffalo District Office, Corps of Engineers, Buffalo, N. Y.

c. When the reservoir pool is above elevation 495 foot stage report shall be submitted at 8 a.m., noon, and 4 p.m. to the U. S. Weather Bureau as outlined in subparagraph (b) above.

d. When the reservoir pool is above elevation 485 foot and the rate of rise indicates the spillway crest will be overtopped, as determined from Plate 19, immediate report shall be made to the U. S. Weather Bureau, Syracuse, N. Y. and to the Corps of Engineers, Buffalo, N. Y. During office hours, 8:30 a.m. to 5:00 p.m., Monday through Friday, such reports will be telephoned to the District Office, Hydraulic Section, telephone number Bedford 5454, Extension 54. During nights, holidays or on week ends such reports shall be telephoned to one of the following:

Joseph G. Weinrub
31 Ivy Lea, Kenmore, N. Y.
Phone: Buffalo, BEdford 7443

John P. Davis
88 Rochelle Drive
Buffalo, N. Y.

Eber J. Riley
107-A Kenville ~~Rd.~~, Buffalo
Phone: Buffalo, Parkside 1273

Thomas C. Nuttle
238 ~~Princeton~~, Buffalo
Phone: Buffalo, AMherst 3917

During major floods additional instructions or requests for special reports will be forwarded by the District Office, Corps of Engineers, Buffalo, N. Y. Prior approval of the Division Engineer, North Central Division, Corps of Engineers, will be obtained for any major changes to regulations as set forth in this manual.

## SECTION V

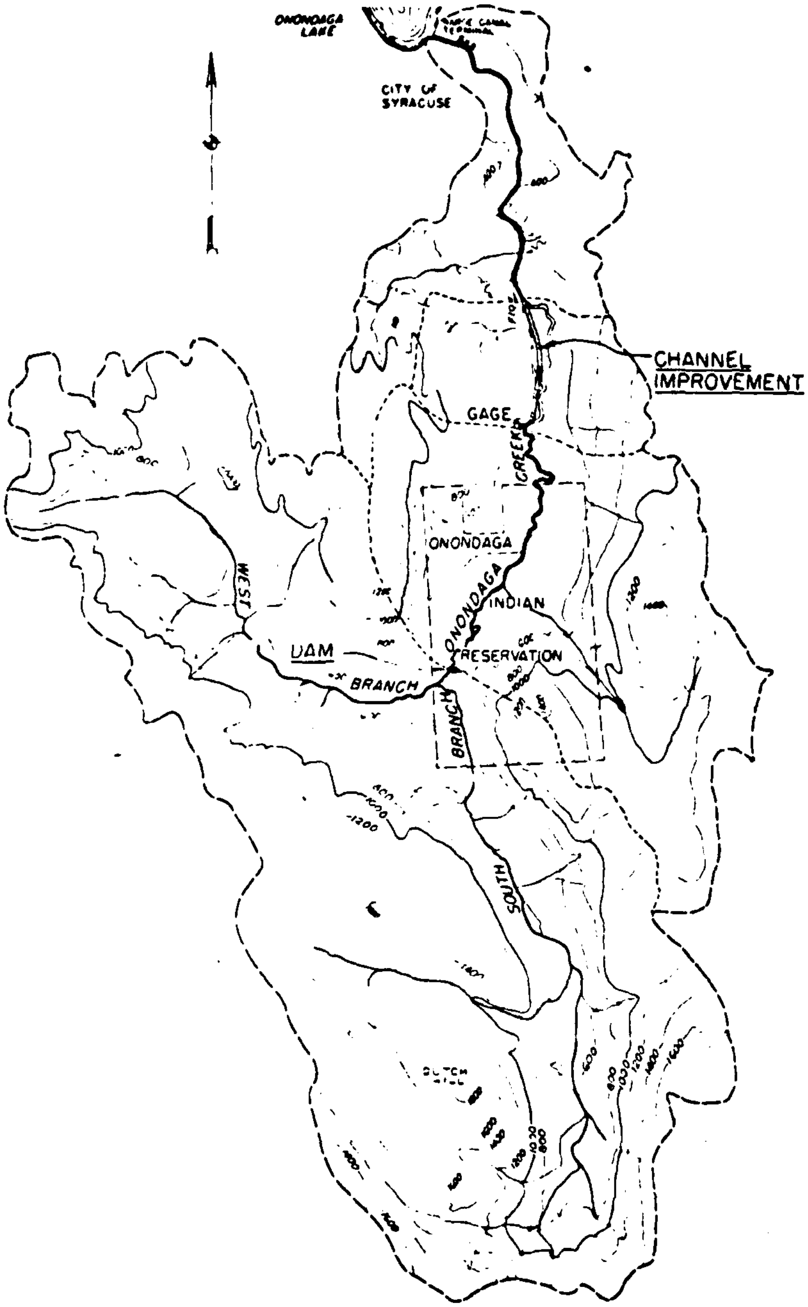
## STATEMENT OF CONTINUING STUDIES

V-1. Reporting Network. The existing hydrologic coverage is not considered entirely adequate. As shown on Plate 8, none of the present net of precipitation gages is located in the Onondaga Creek basin. Pending agreement with local interests it is considered desirable to add at least one rain gage, centrally located in the basin and preferably two, one to be located on each branch. Other additions and changes will be recommended as further study and experience indicate the need therefor. The small size of the basin and short time of concentration make the value of stream gages above the reservoir doubtful; however, further study will be made of the need for additional stream gages.

V-2. Forecasting Methods. Continuing studies will be made as time and data become available. The methods described in the manual will be tested in practice and actual storms will be studied for possible improvement in forecasting techniques.

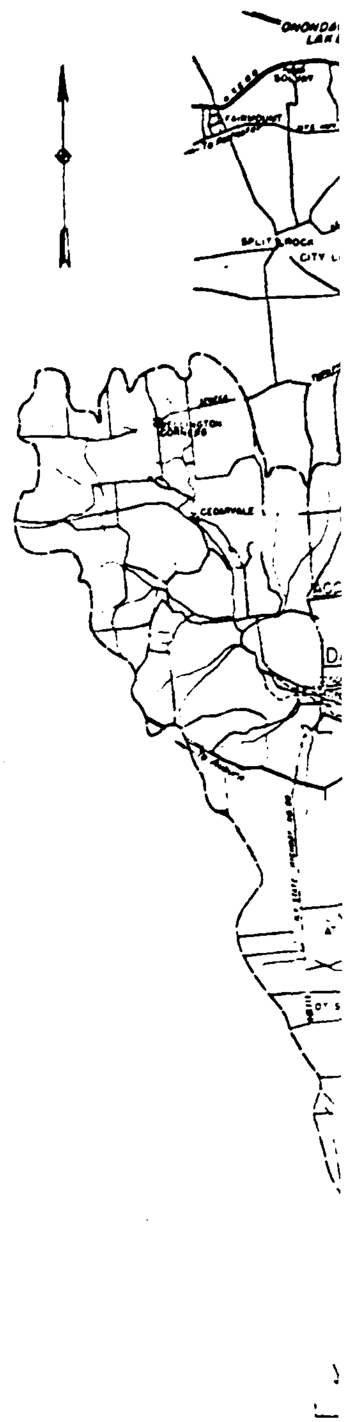
V-3. Reservoir Silting. Sedimentation ranges have been established at 21 sites in the reservoir area, as shown on Plate 14. These ranges were established in 1951 and periodic resurveys will be made to determine extent of silting and any resultant loss of storage capacity.

CORPS OF ENGINEERS

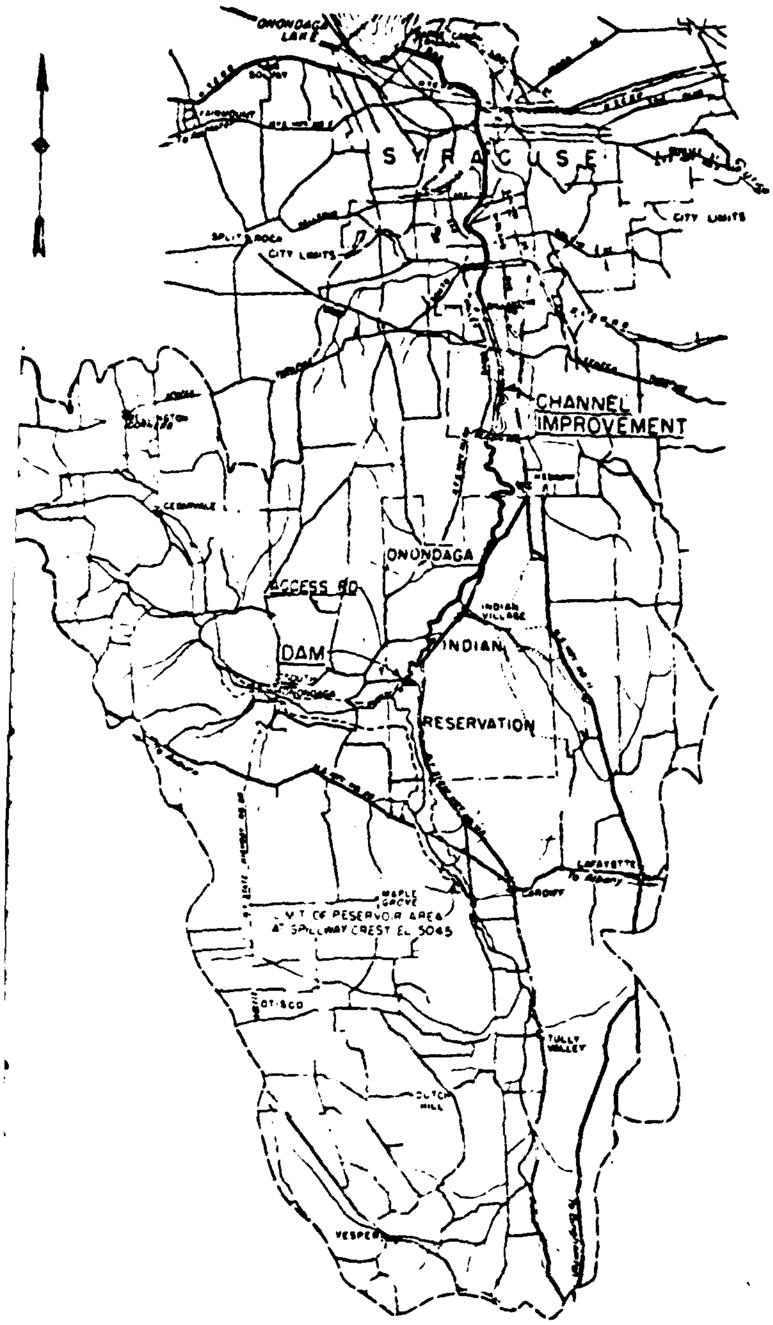



WATERSHED MAP

SCALE
0 2 MILES



U S ARMY




VICINITY MAP

SCALE

0 2 MILES


KEY MAP

SCALE

10 0 50 100 MILES

NOTE
ELEVATIONS ARE IN FEET AND REFER TO THE PLANE OF MEAN SEA LEVEL AT SANDY HOOK NEW JERSEY

ONONDAGA CREEK, SYRACUSE, N. Y.
ONONDAGA RESERVOIR
**WATERSHED & VICINITY MAPS**

IN 6 SHEETS SHEET NO. 2 SCALE: AS SHOWN

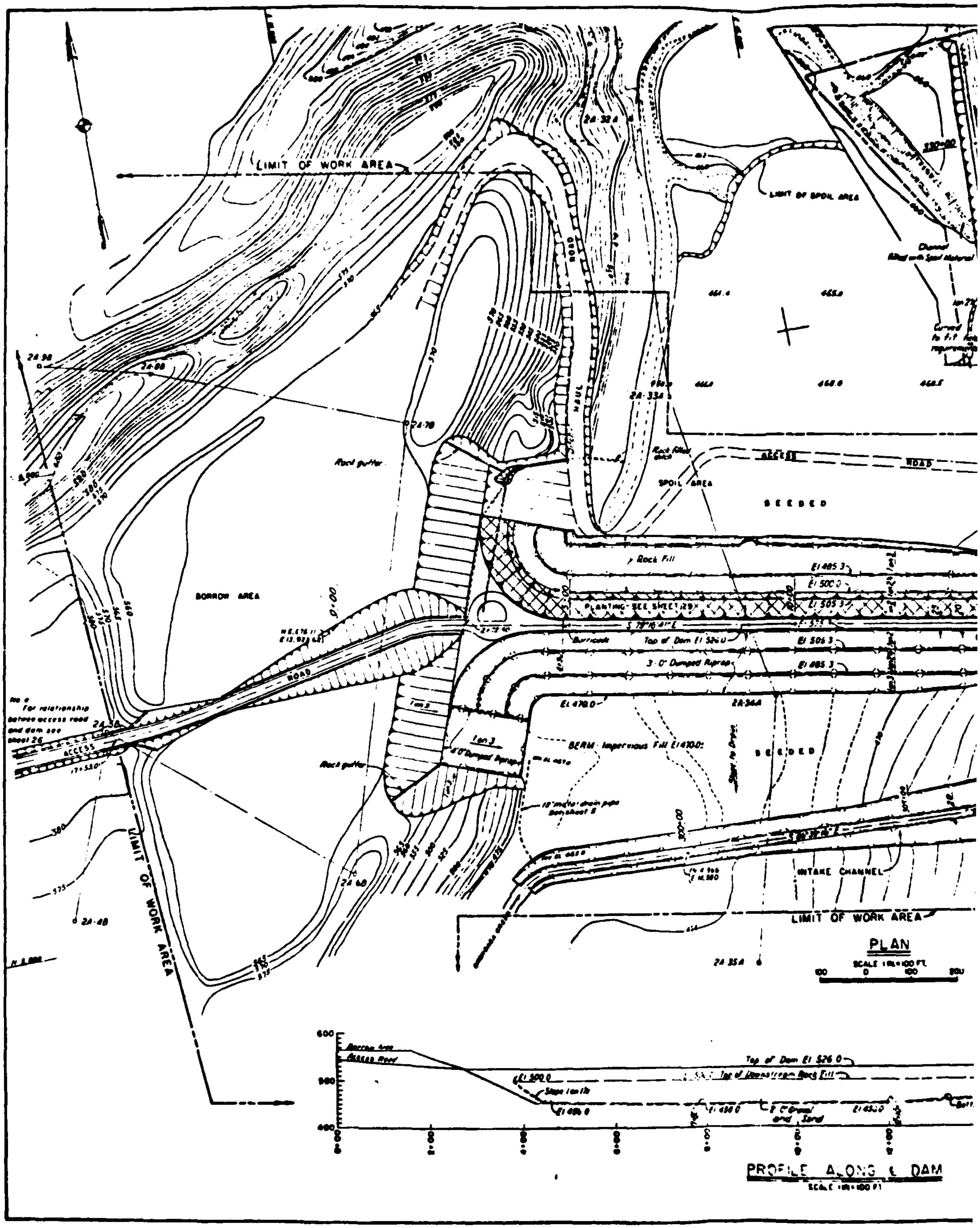
BUFFALO DISTRICT, BUFFALO, N. Y. AUG 22, 1949

SUBMITTED RECOMMENDED APPROVED

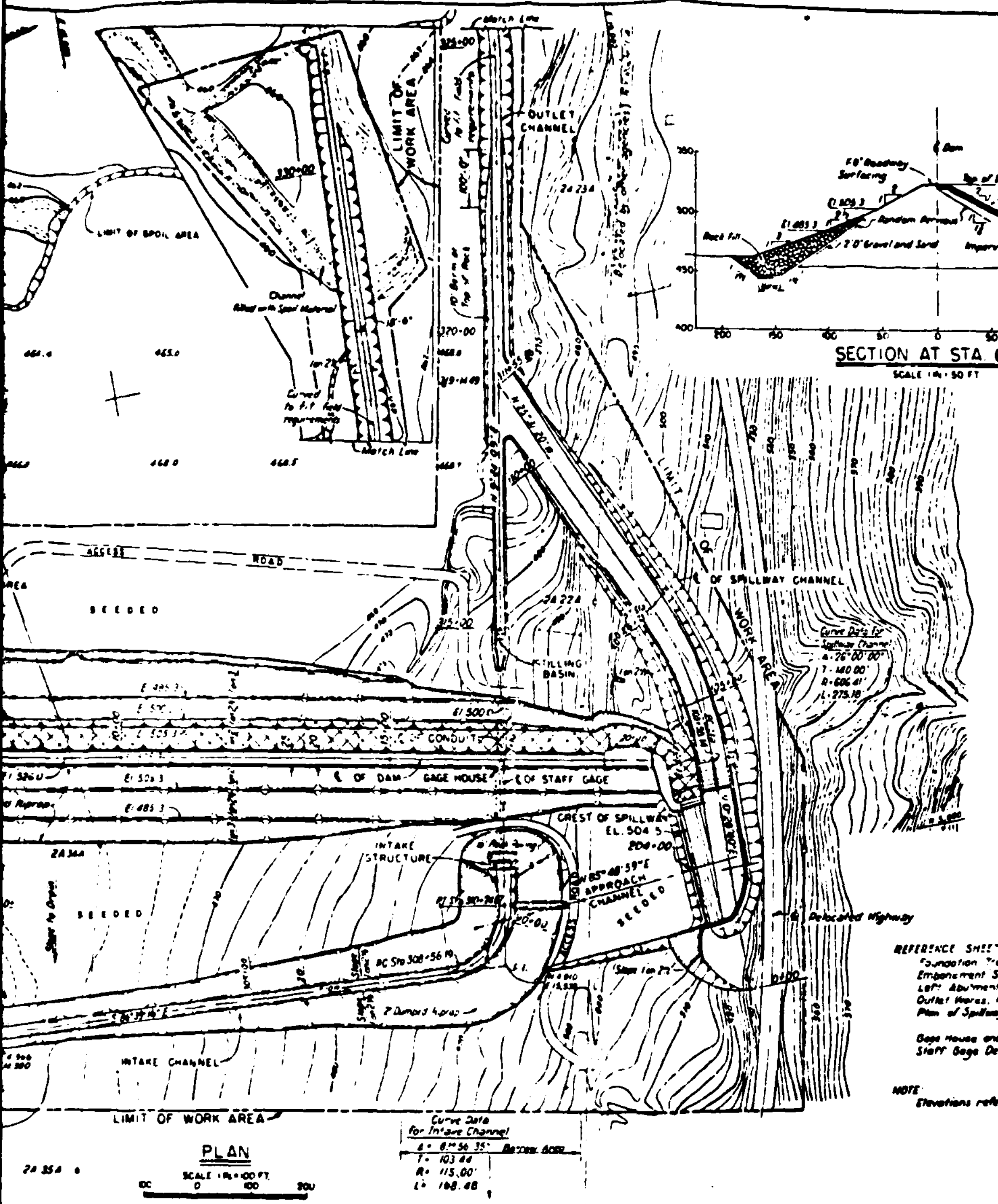
DRAWN: S.T.A.
CHECKED: R.G.M.

TO ACCOMPANY DEFINITE PROJECT REPORT
DATED: AUG 22, 1949

**PLATE NO. 1**



LIMIT OF WORK AREA
LIMIT OF SPOIL AREA
HAUL ROAD
Rock gutter
Rock filled ditch
SPOIL AREA
SEEDED
ACCESS ROAD
Rock Fill
PLANTING - SEE SHEET 129
BORROW AREA
Barricade
Top of Dam El 526.0
3'-0" Dumped Riprap
El 485.3
El 505.3
El 500.0
El 470.0
BERM - Impervious Fill El 470.0
Rock gutter
Note: For relationship between access road and dam see sheet 26
ACCESS
INTAKE CHANNEL
LIMIT OF WORK AREA
LIMIT OF WORK AREA
PLAN
SCALE 1 IN = 100 FT.
Top of Dam El 526.0
Top of Downstream Rock Fill
Borrow Area
Access Road
PROFILE ALONG ℄ DAM
SCALE 1 IN = 100 FT

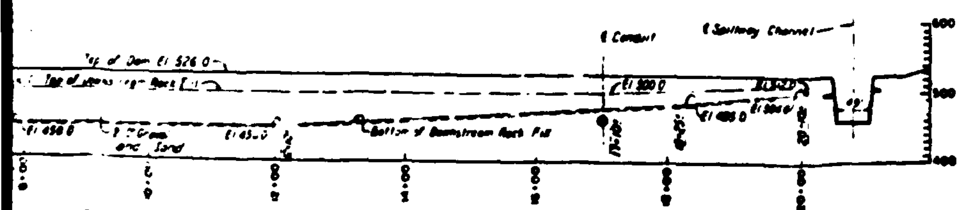



| TRAVERSE STATIONS | | |
|---|---|---|
| STATION | COORDINATES NORTH | EAST |
| 2A - 3B | 5,070.82 | 13,...'.14 |
| " 5B | 5,449.14 | 13 .. 34.18 |
| " 6B | 5,055.53 | 13,860.80 |
| " 7B | 5,96'.54 | 14,16'.67 |
| " 8B | 6,.48.59 | 13,6'5.35 |
| " 9B | 6,229.00 | 13,578.81 |
| " 21A | 4,470.79 | 15,599.65 |
| " 22A | 5,496.67 | 15,607.79 |
| " 23A | 6,187.17 | 15,964.48 |
| " 32A | 6,500.61 | 14,734.06 |
| " 33A | 5,912.21 | 14,711.3[illegible] |
| " 34A | 5,260.30 | 14,838.41 |
| " 35A | 4,707.12 | 14,691.30 |

REFERENCE SHEETS
Foundation Treatment, Sheet 3
Embankment Sections, Sheet 4
Left Abutment Details, Sheet 5
Outlet Works, Plan, Profile and Sections Sheet 6 and 7
Plan of Spillway - Piezometers, Sheet 10

Gage House and Well Details, Sheet 22
Staff Gage Details, Sheet 23

NOTE:
Elevations refer to mean sea level datum




CORPS OF ENGINEERS
U S ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO 7, NEW YORK

ONONDAGA DAM
ONONDAGA CREEK SYRACUSE, N.Y.

GENERAL PLAN
AS BUILT

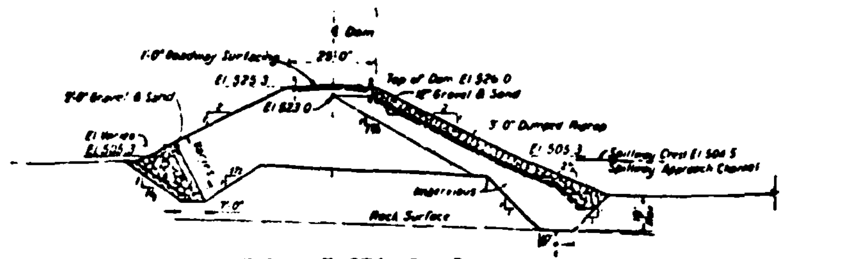
DATE APRIL 11, 1950

PLATE NO. 2

SCALE AS SHOWN

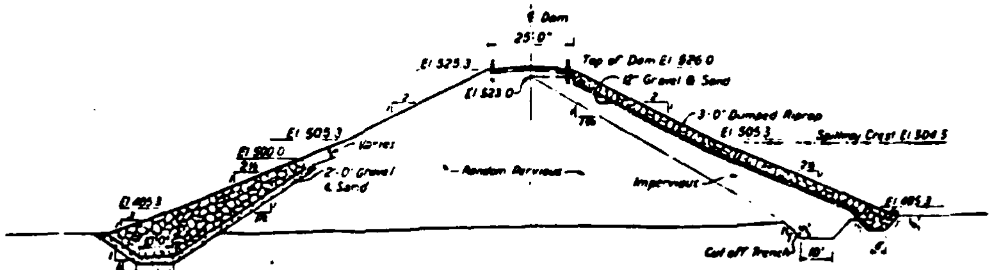
DRAWING NUMBER
E-237-A-20/7
SHEET 7 OF 23

2



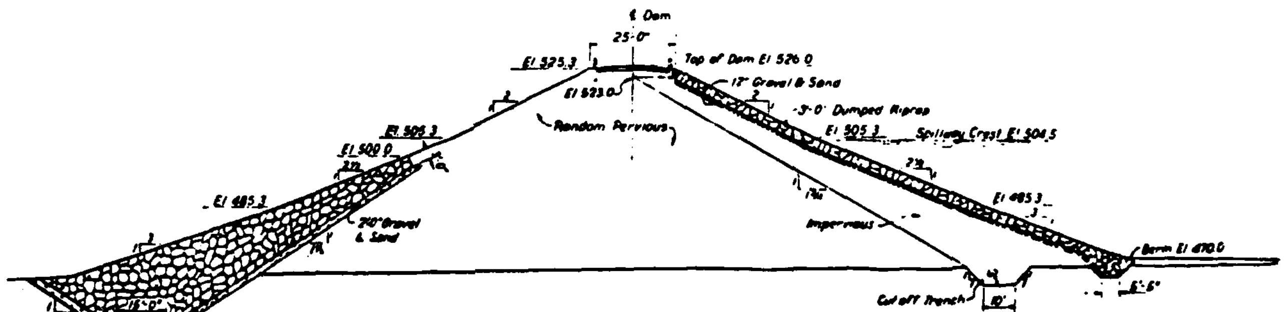

SECTION AT STA. 19+10

SCALE 1 IN = 20 FT.



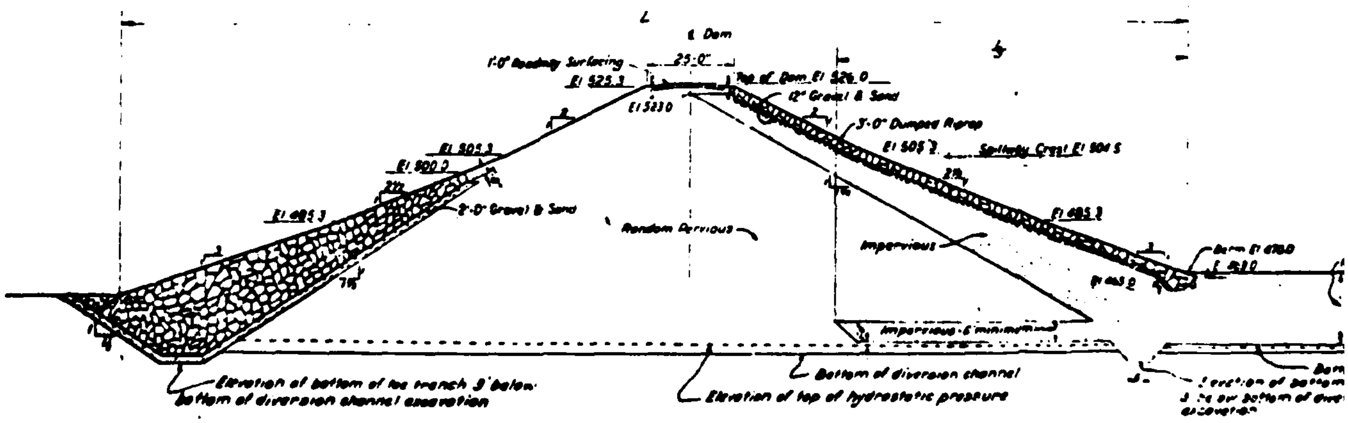

SECTION AT STA. 16+00

SCALE 1 IN = 20 FT.




SECTION AT STA. 12+10

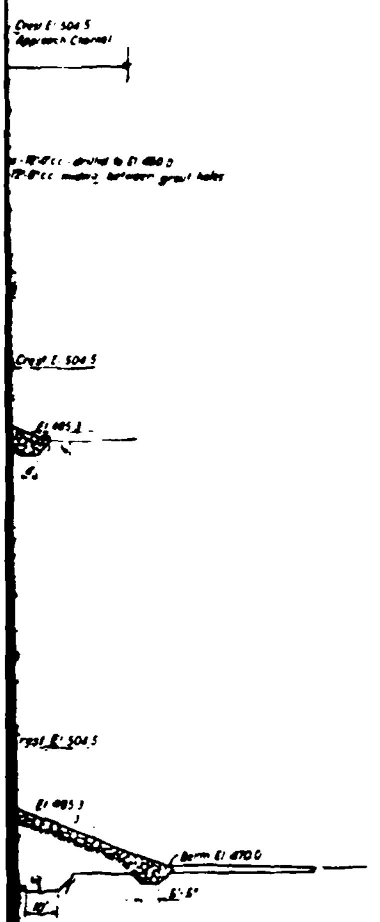
SCALE 1 IN = 20 FT.

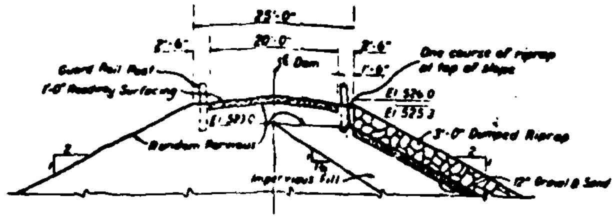



SECTION AT STA. 5+00

THROUGH DIVERSION CHANNEL

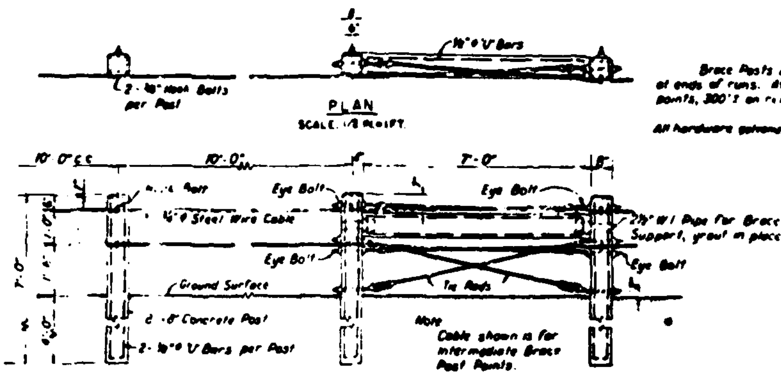
SCALE 1 INCH = 20 FEET




## DETAIL OF TOP OF DAM

SCALE 1 IN = 10 FT.




PLAN

SCALE 1/2 IN = 1 FT.

Brace Posts and one tie rod at ends of runs. At intermediate points, 300'± on center.

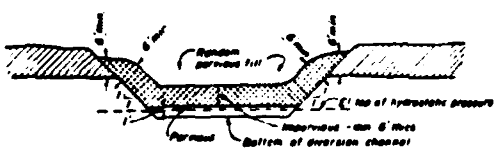
All hardware galvanized

ELEVATION

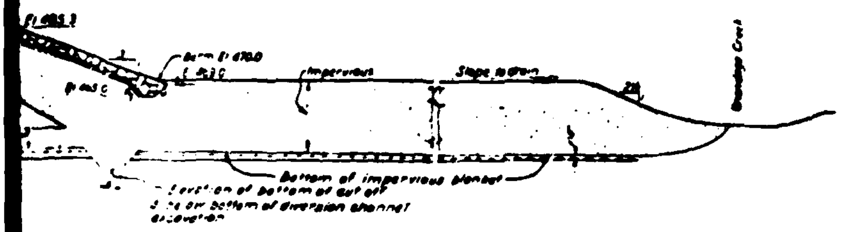
SCALE 1/2 IN = 1 FT.

## ROADWAY AND GUARD RAIL DETAILS

NOTE: Filters provided between materials of different gradations wherever the critical ratio of the diameters (15% smaller than and 85% larger than) exceeds 9.




## CROSS SECTION THRU DIVERSION CHANNEL




NOTE.
Elevations refer to mean sea level datum.

REFERENCE SHEETS
General Plan, Sheet 2.
Foundation Treatment, Sheet 3.

CORPS OF ENGINEERS
U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO 7 NEW YORK

# ONONDAGA DAM

ONONDAGA CREEK SYRACUSE, N.Y.

## EMBANKMENT SECTIONS AS BUILT

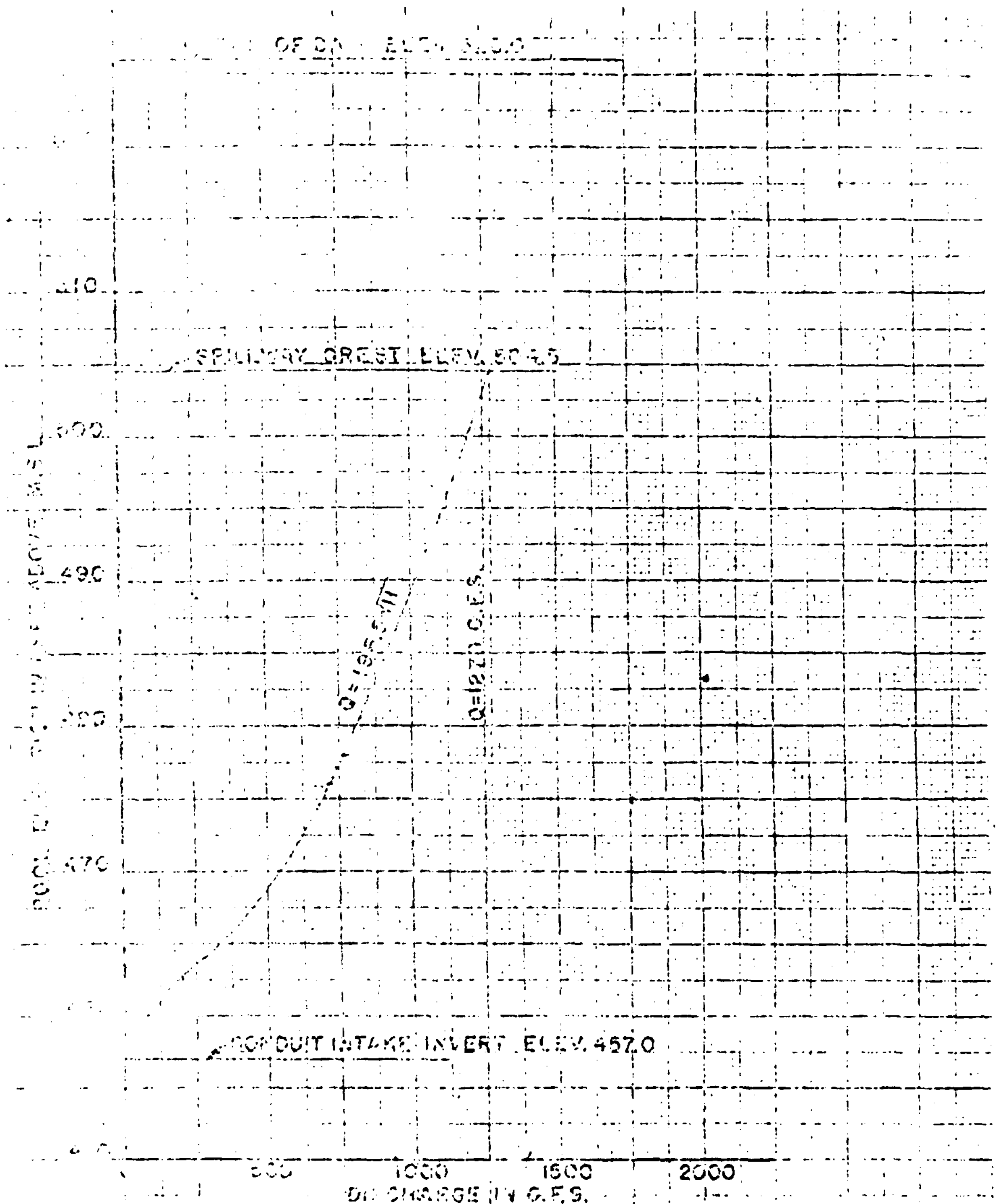
APRIL 11, 1960

SCALE AS SHOWN

PLATE NO. 2C

DRAWING NUMBER
E-237-A-20/4

2



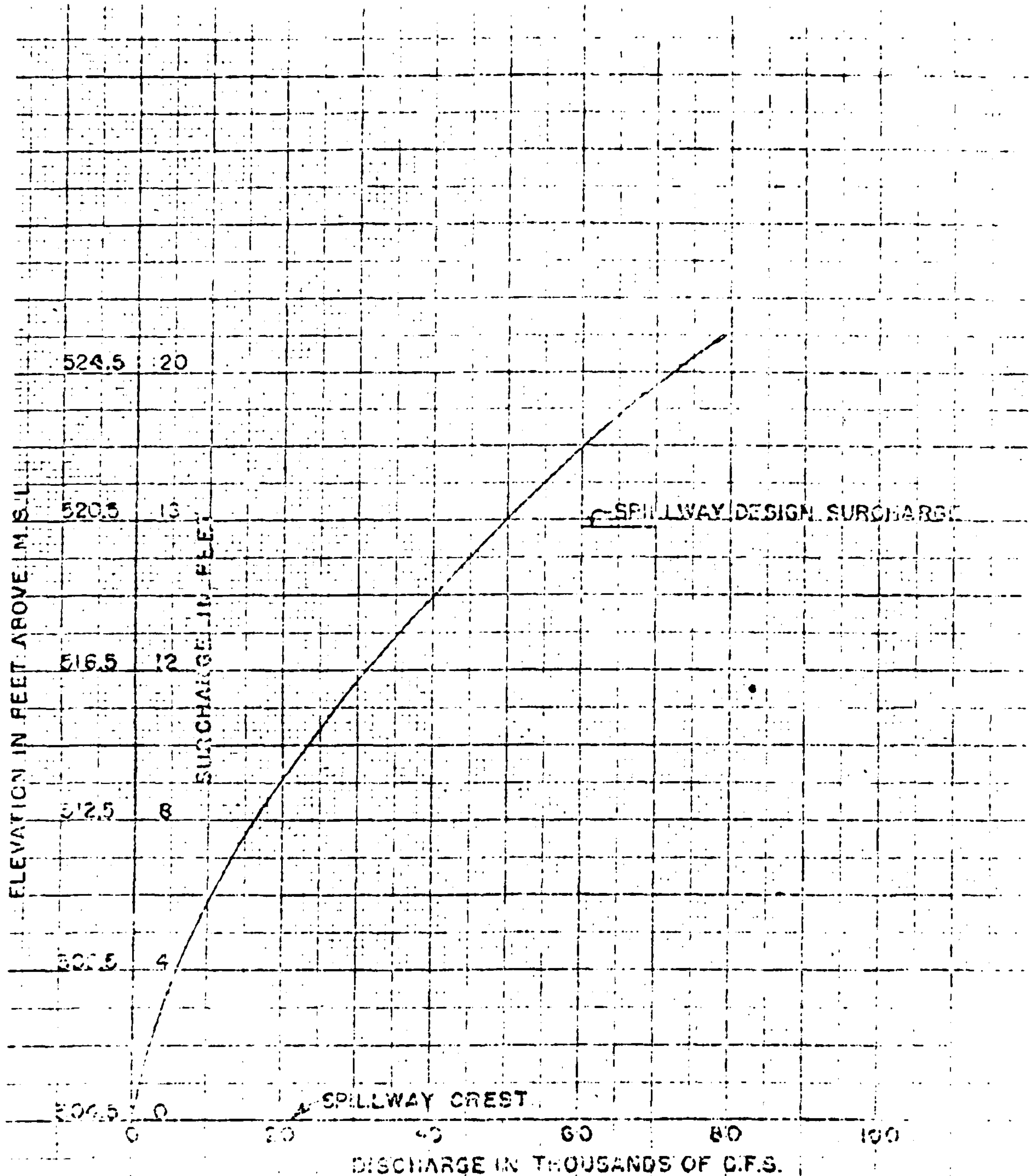

NOTE:
...ifference between Pool ...ration and Conduit Pool ... Exit. Elev. 462.71

ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

CONDUIT RATING CURVE

...ALO DISTRICT, BUFFALO, N.Y. FEB. 1955

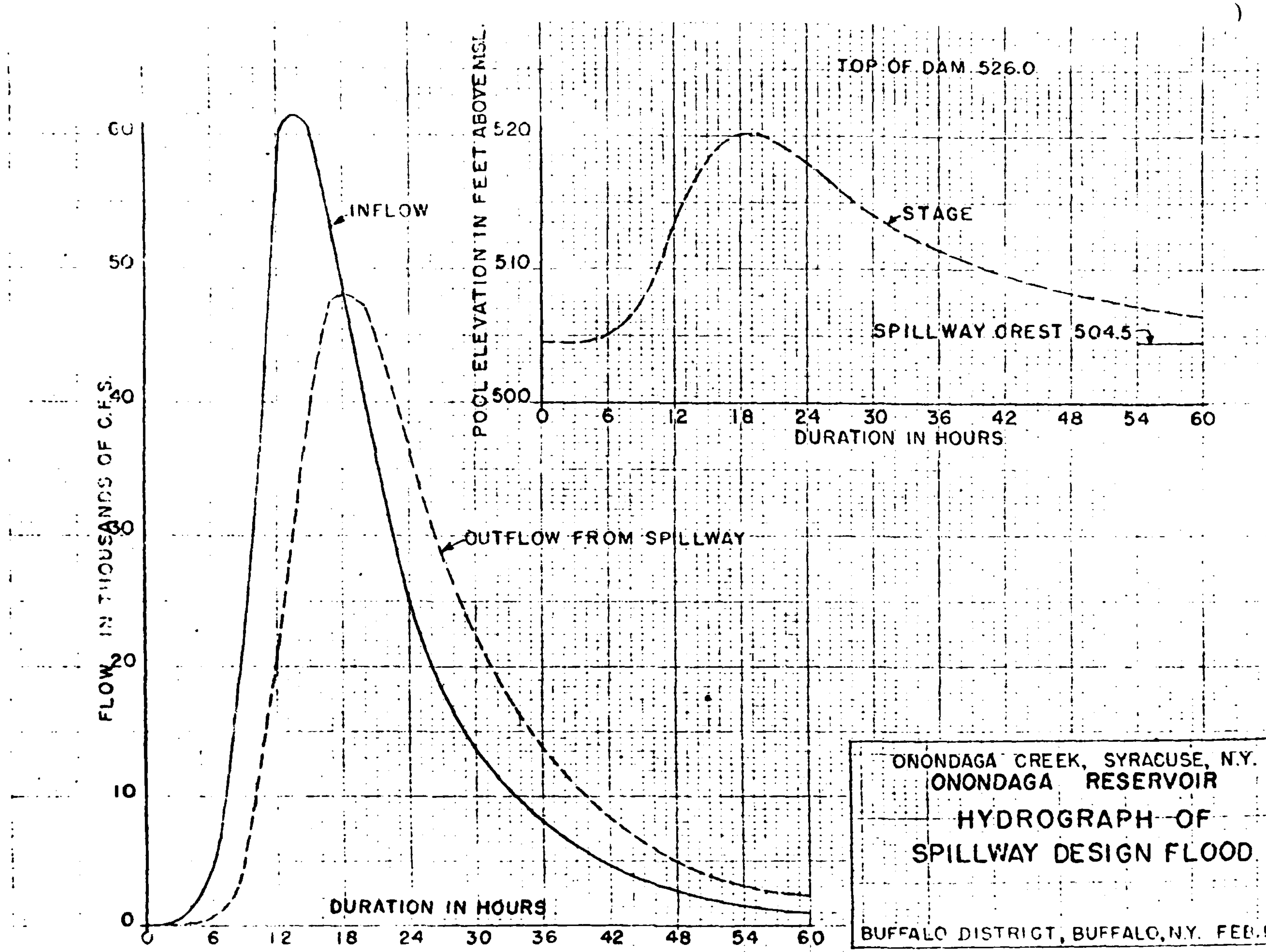
PLATE NO. 3




ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

SPILLWAY DISCHARGE CURVE

BUFFALO DISTRICT, BUFFALO, N.Y.




ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR
HYDROGRAPH OF
SPILLWAY DESIGN FLOOD

BUFFALO DISTRICT, BUFFALO, N.Y. FEB. 1955

PLATE NO 5

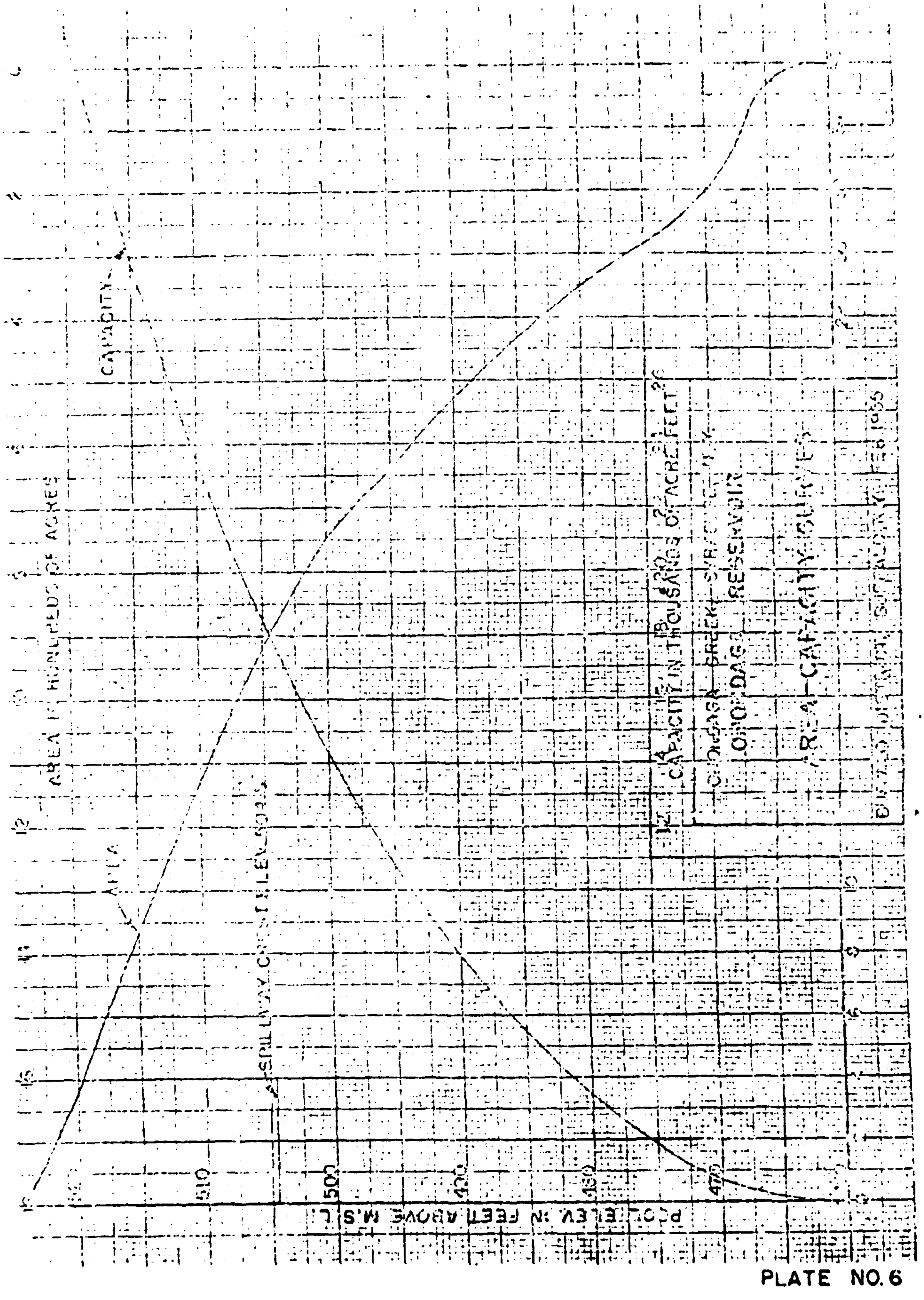
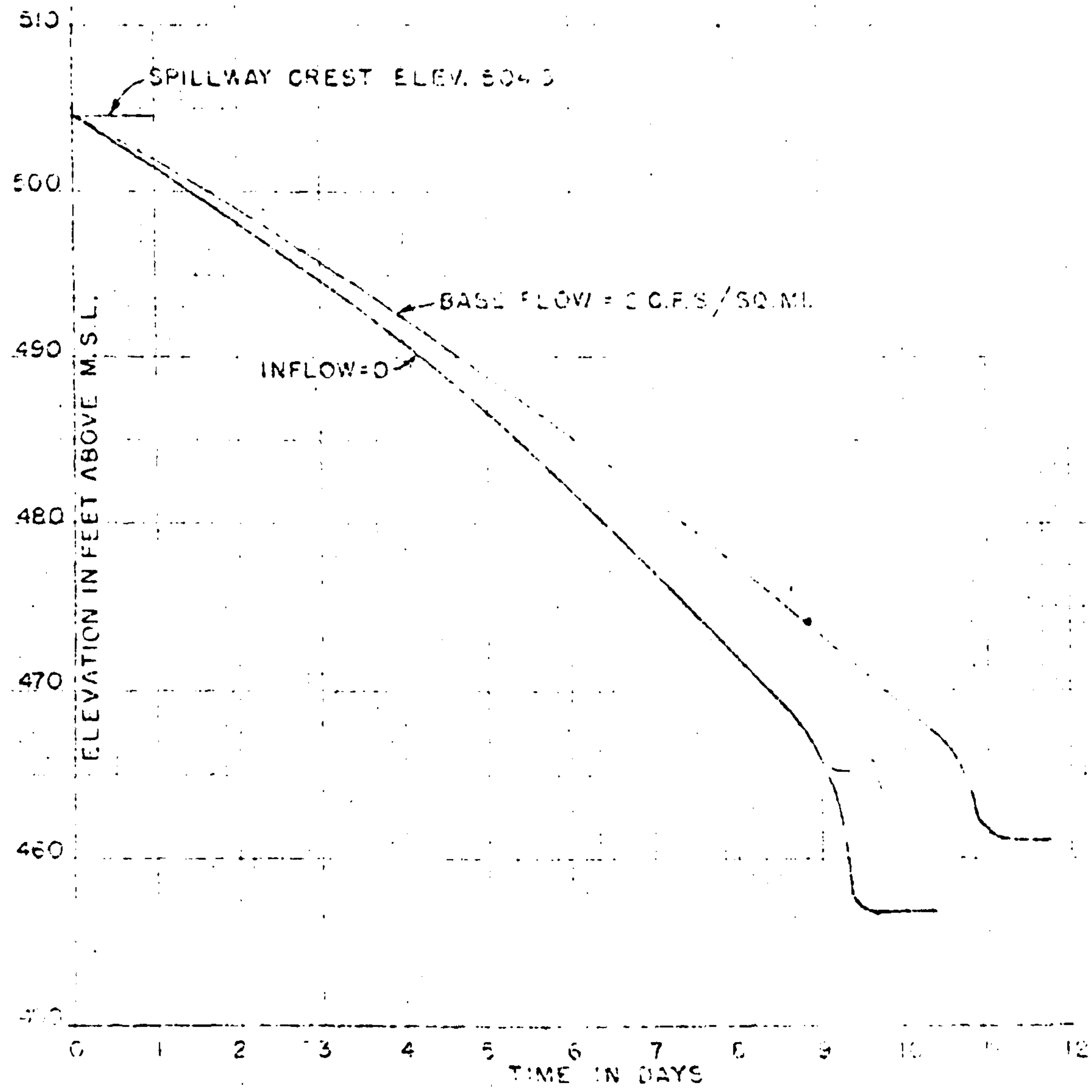

AREA IN HUNDREDS OF ACRES
CAPACITY
AREA
SPILLWAY CREST EL.
CAPACITY IN THOUSANDS OF ACRE FEET
ONONDAGA RESERVOIR
AREA-CAPACITY CURVES
POOL ELEV. IN FEET ABOVE M.S.L.

PLATE NO. 6




ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

DRAWDOWN CURVES

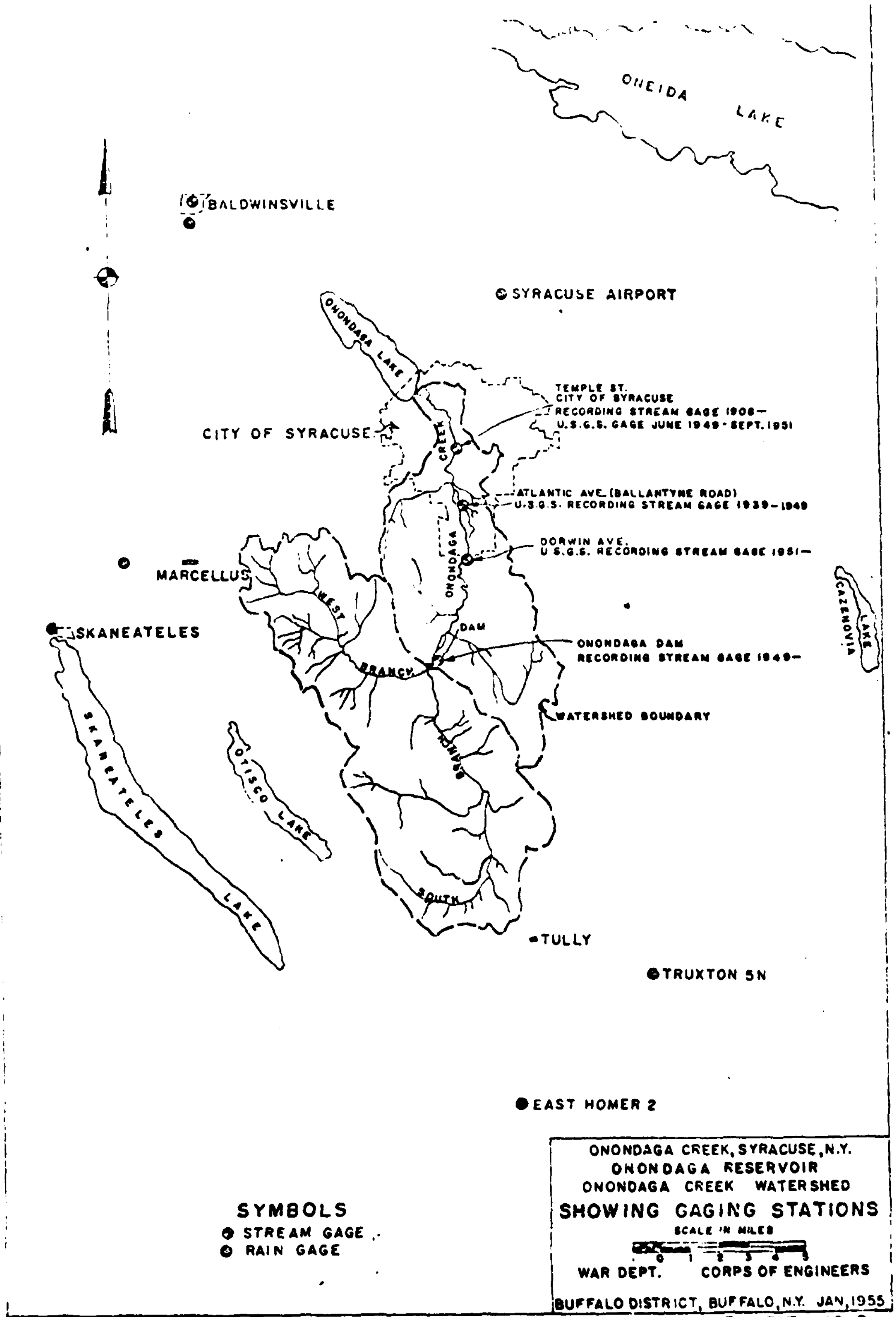
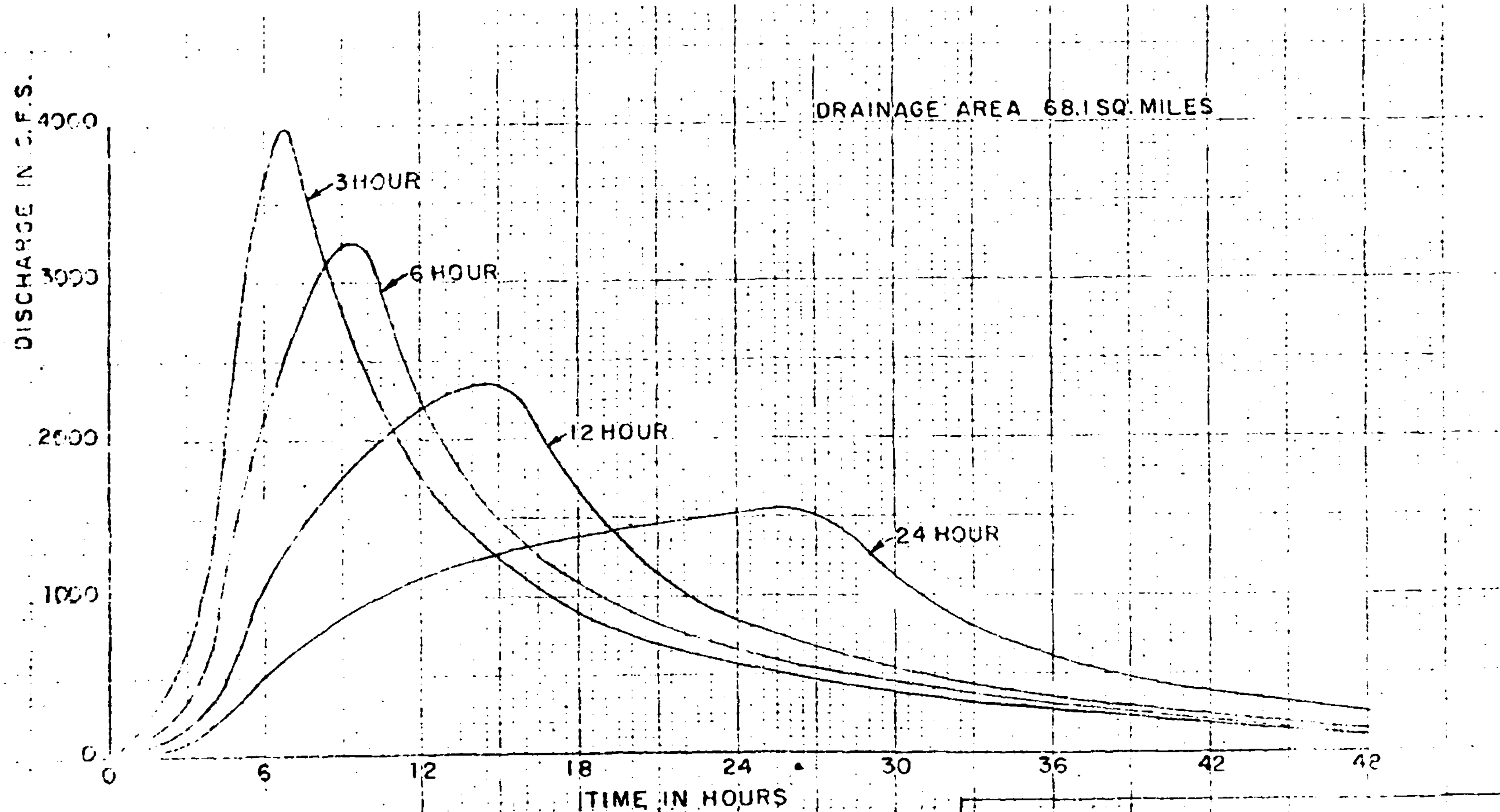

ONEIDA LAKE
BALDWINSVILLE
SYRACUSE AIRPORT
ONONDAGA LAKE
CITY OF SYRACUSE
TEMPLE ST.
CITY OF SYRACUSE
RECORDING STREAM GAGE 1908—
U.S.G.S. GAGE JUNE 1949 - SEPT. 1951
CREEK
ATLANTIC AVE. (BALLANTYNE ROAD)
U.S.G.S. RECORDING STREAM GAGE 1939—1949
DORWIN AVE.
U.S.G.S. RECORDING STREAM GAGE 1951—
ONONDAGA
MARCELLUS
WEST
DAM
SKANEATELES
ONONDAGA DAM
RECORDING STREAM GAGE 1949—
BRANCH
CAZENOVIA LAKE
WATERSHED BOUNDARY
SKANEATELES LAKE
OTISCO LAKE
BRANCH
SOUTH
TULLY
TRUXTON 5N
EAST HOMER 2
SYMBOLS
STREAM GAGE
RAIN GAGE
ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR
ONONDAGA CREEK WATERSHED
SHOWING GAGING STATIONS
SCALE IN MILES
0 1 2 3 4 5
WAR DEPT. CORPS OF ENGINEERS
BUFFALO DISTRICT, BUFFALO, N.Y. JAN, 1955

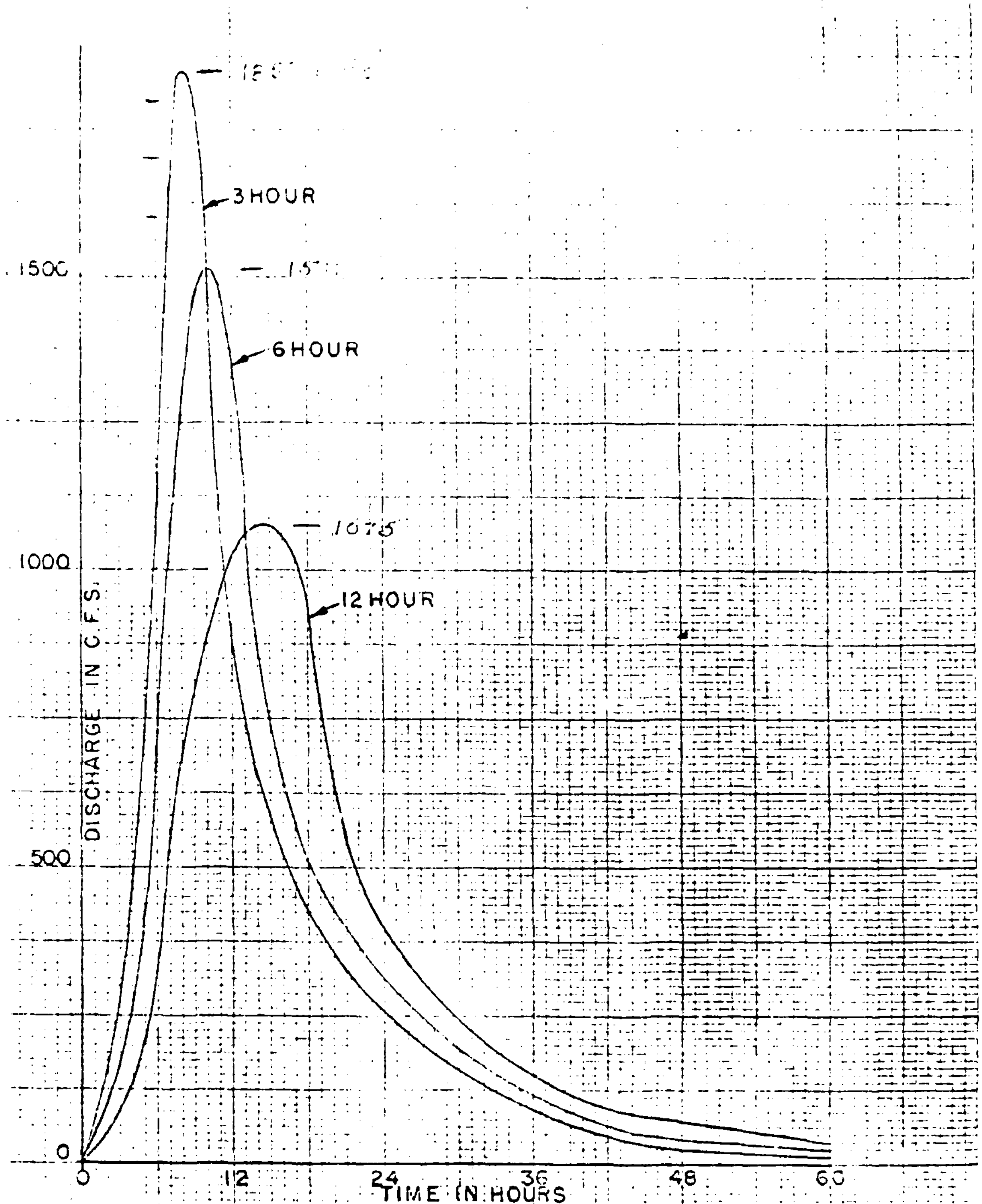
PLATE NO. 8




ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

RESERVOIR 2A
UNIT HYDROGRAPHS

BUFFALO DISTRICT, BUFFALO, N.Y. FEB. 1955

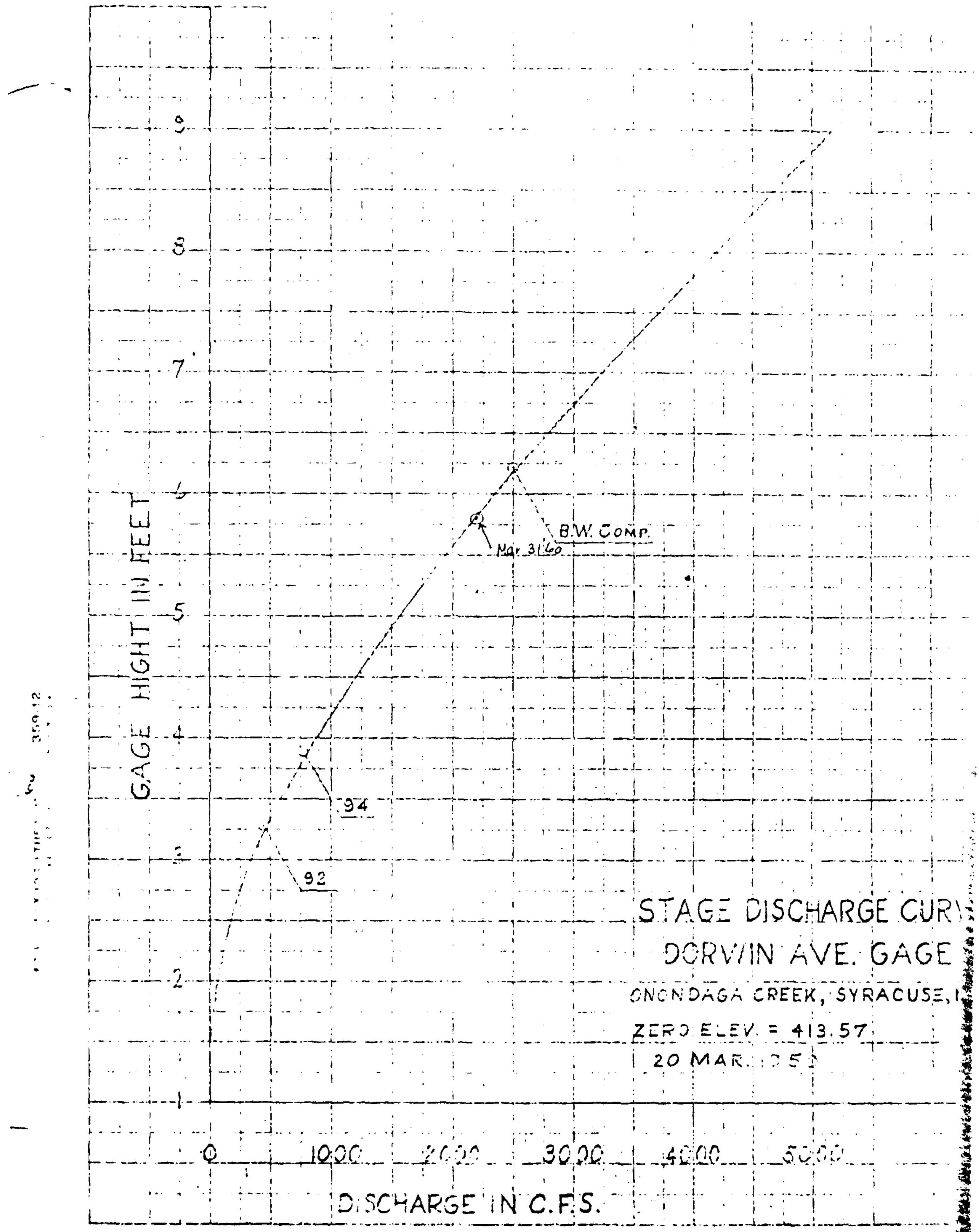


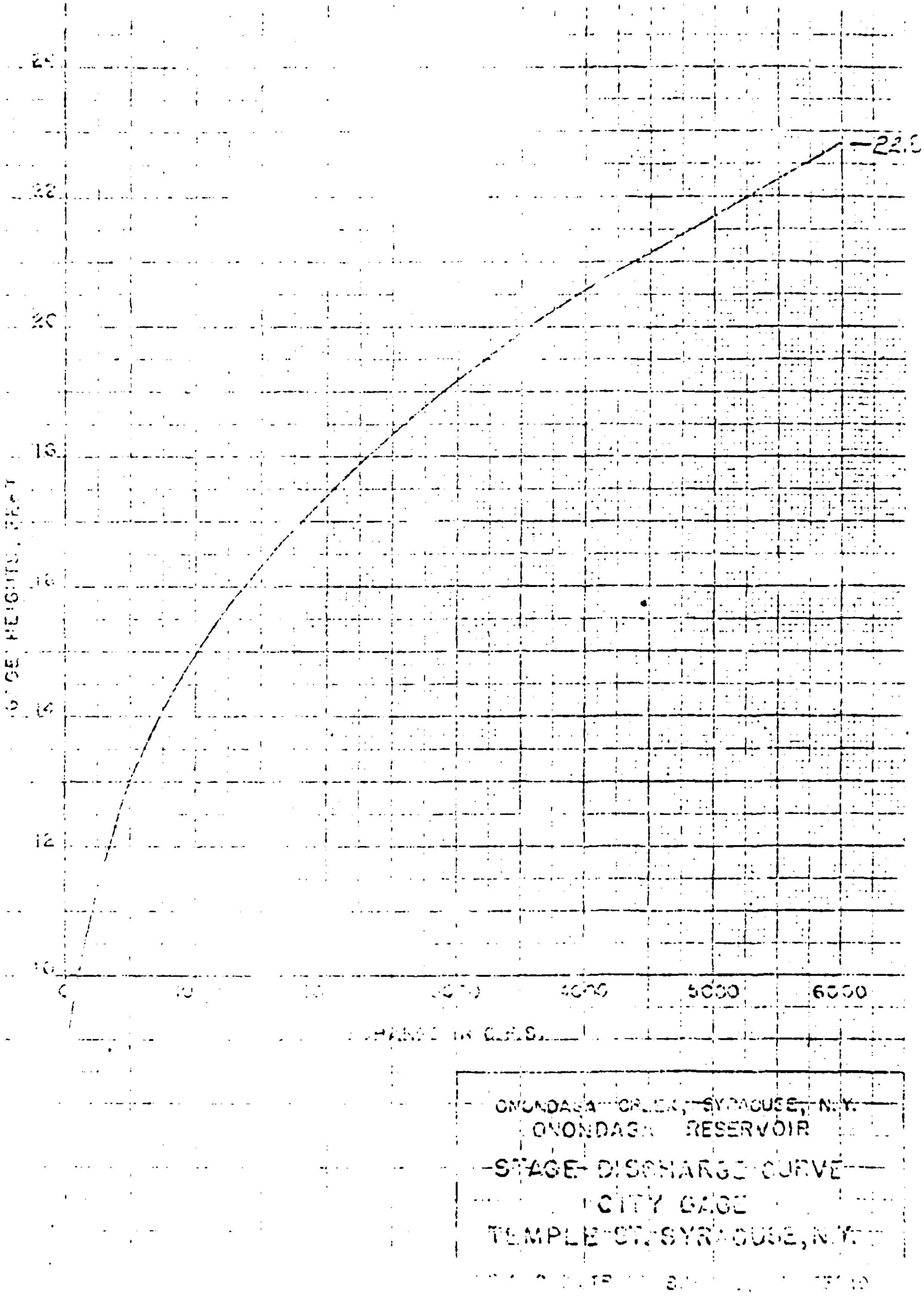

ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

UNIT HYDROGRAPHS
DAM TO BALLANTYNE ROAD

BUFFALO DISTRICT, BUFFALO, N.Y. FEB. 1955

PLATE NO. 10


STAGE DISCHARGE CURV
DORWIN AVE. GAGE
ONONDAGA CREEK, SYRACUSE, N
ZERO ELEV. = 413.57
20 MAR.
GAGE HIGHT IN FEET
DISCHARGE IN C.F.S.
B.W. COMP.
Mar. 31 '60
94
92
0
1000
2000
3000
4000
5000
1
2
3
4
5
6
7
8
9



22.0
ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR
STAGE-DISCHARGE CURVE
CITY GAGE
TEMPLE ST. SYRACUSE, N.Y.
5000
6000


PLATE NO 12

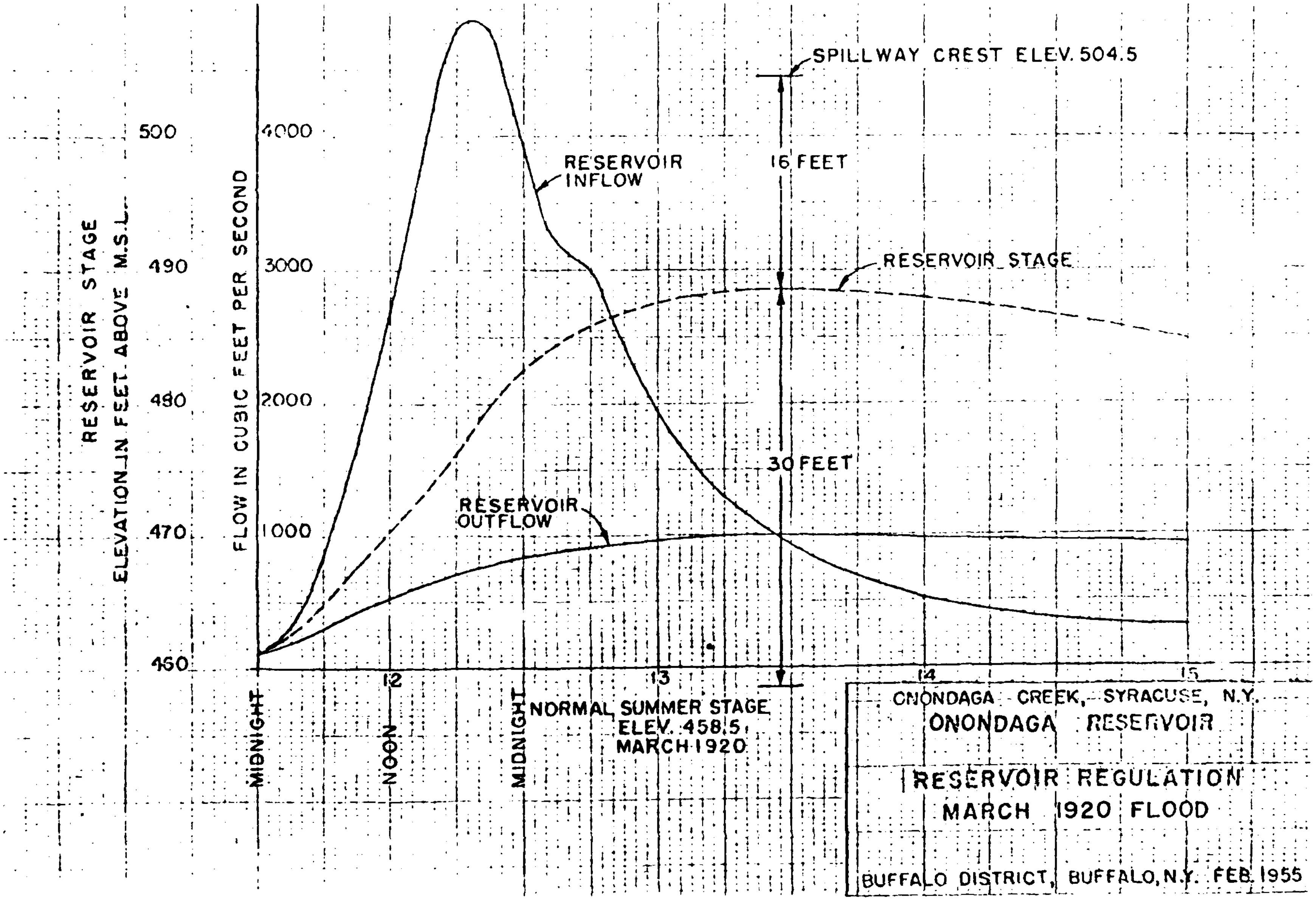

SPILLWAY CREST ELEV. 504.5
RESERVOIR STAGE
ELEVATION IN FEET ABOVE M.S.L.
500
490
480
470
460
FLOW IN CUBIC FEET PER SECOND
4000
3000
2000
1000
RESERVOIR INFLOW
RESERVOIR STAGE
RESERVOIR OUTFLOW
16 FEET
30 FEET
MIDNIGHT
NOON
MIDNIGHT
12
13
14
15
NORMAL SUMMER STAGE
ELEV. 458.5,
MARCH 1920
ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR
RESERVOIR REGULATION
MARCH 1920 FLOOD
BUFFALO DISTRICT, BUFFALO, N.Y. FEB. 1955

PLATE NO. 13

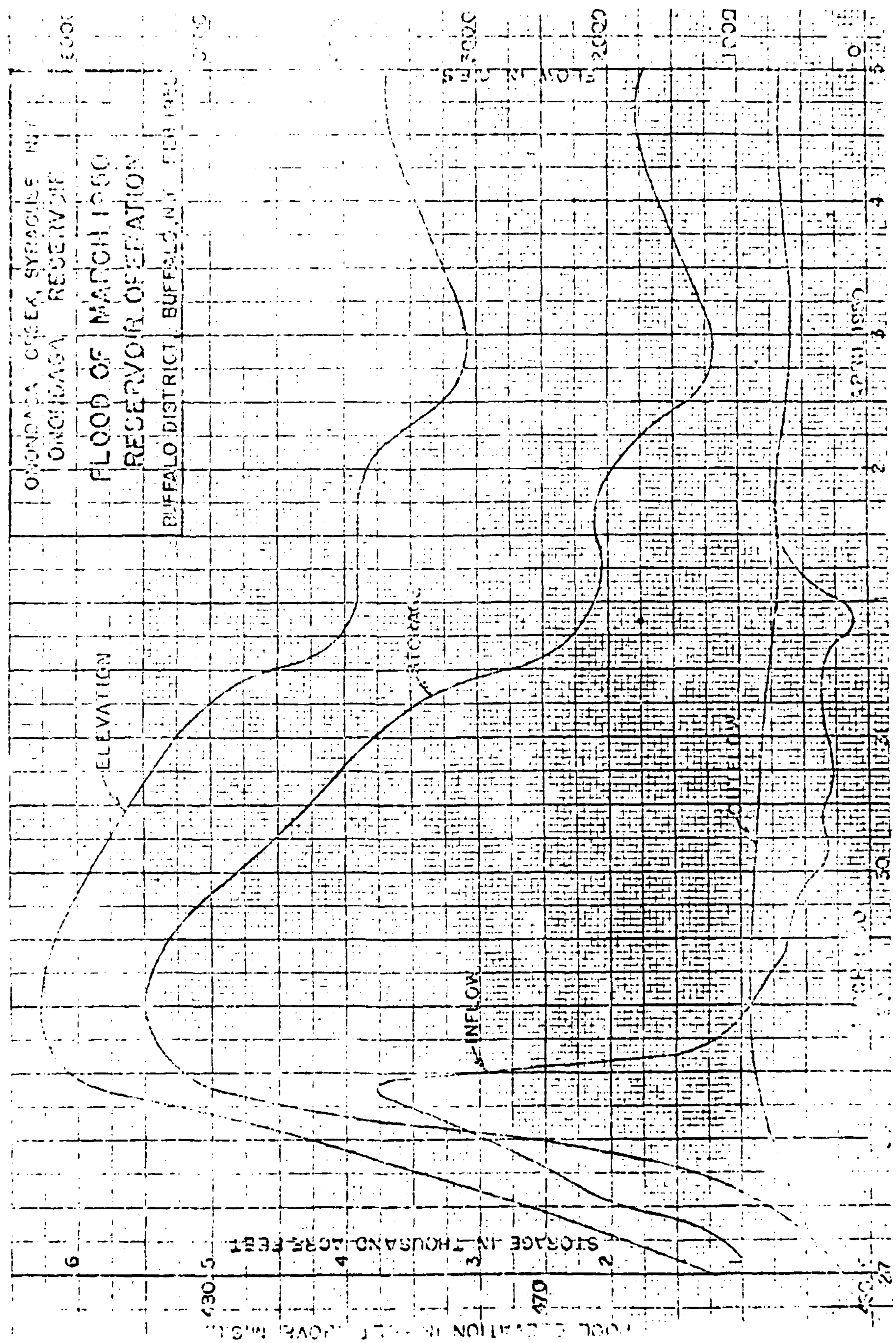
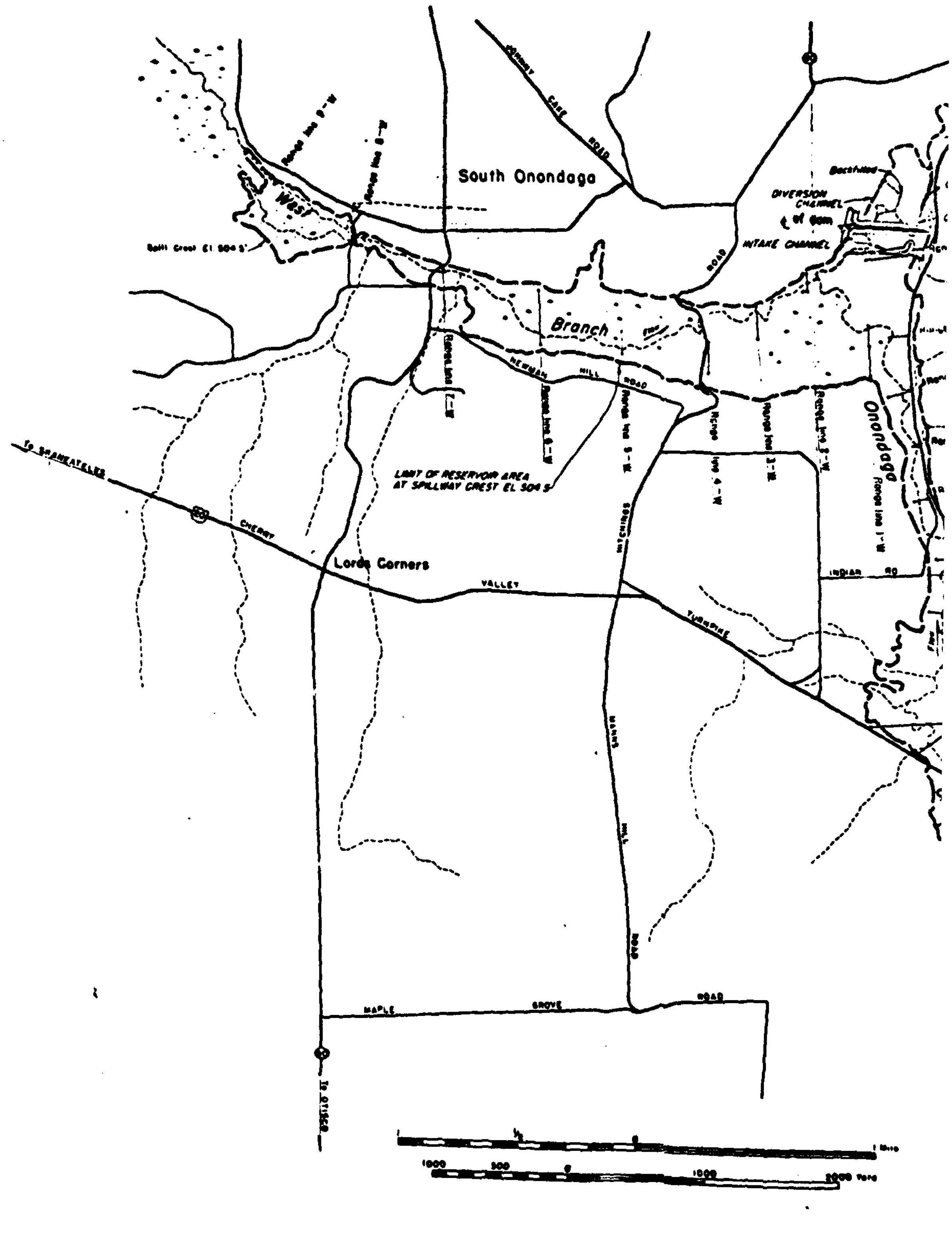
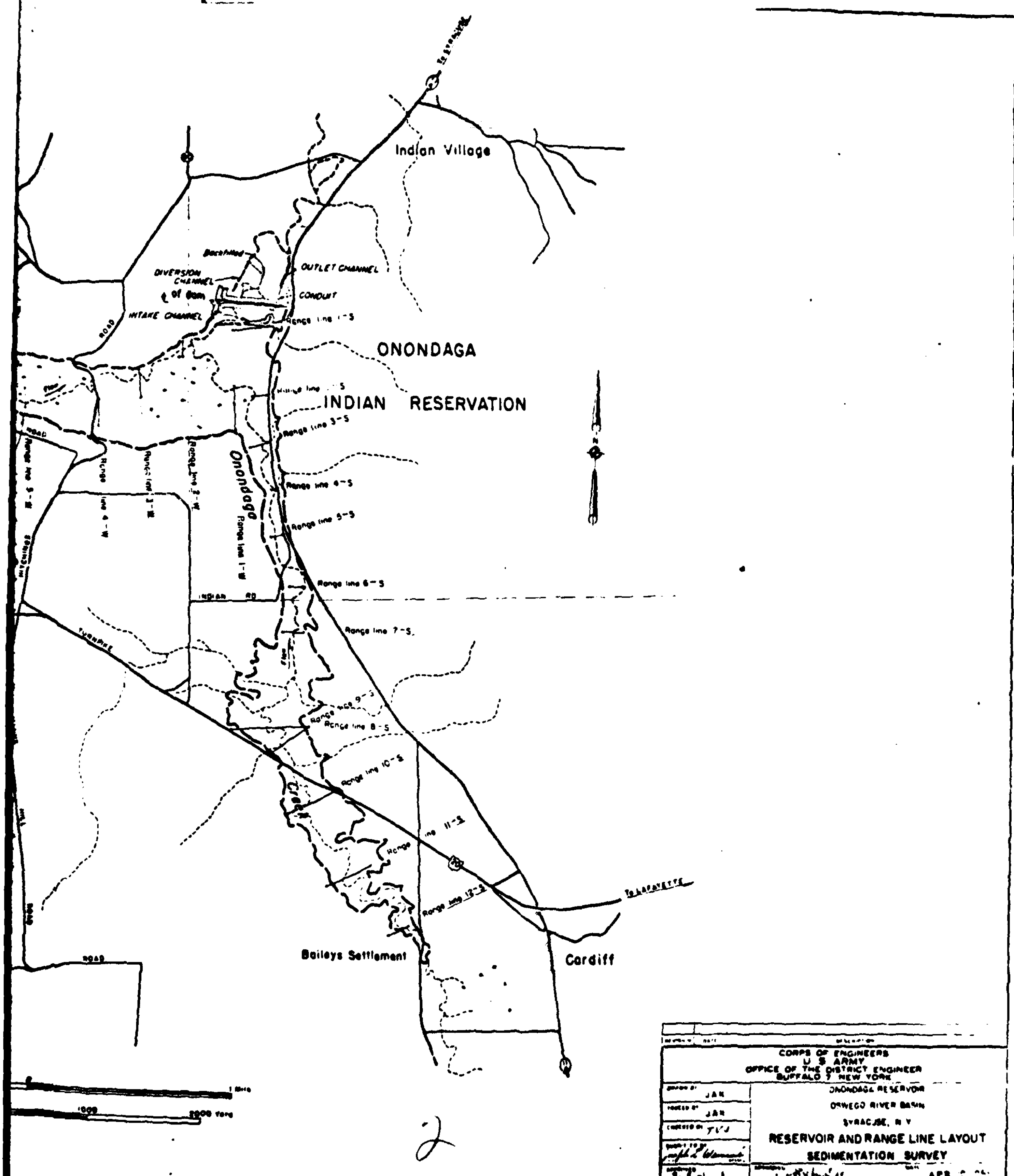

ONONDAGA CREEK, SYRACUSE N.Y.
ONONDAGA RESERVOIR
FLOOD OF MARCH 1950
RESERVOIR OPERATION
BUFFALO DISTRICT, BUFFALO, N.Y.
ELEVATION
STORAGE
INFLOW
OUTFLOW
FLOW IN C.F.S.
STORAGE IN THOUSAND ACRE FEET
APRIL 1950

PLATE NO. 14


South Onondaga
West
Branch
Onondaga
DIVERSION CHANNEL
INTAKE CHANNEL
LIMIT OF RESERVOIR AREA AT SPILLWAY CREST EL 504.5
Lords Corners
To SKANEATELES
CHERRY
VALLEY
TURNPIKE
NEWMAN
HILL
ROAD
MAPLE
GROVE
ROAD
INDIAN
RD
To OTISCO
1 Mile
1000
500
0
1000
2000 Yards




CORPS OF ENGINEERS
U S ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO 7 NEW YORK

ONONDAGA RESERVOIR
OSWEGO RIVER BASIN
SYRACUSE, N Y

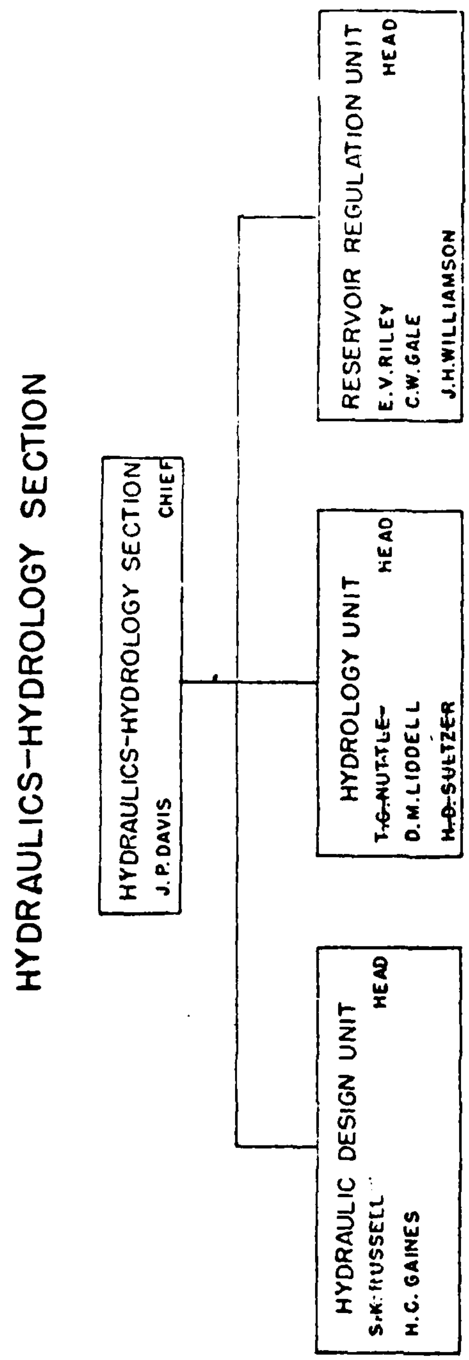
RESERVOIR AND RANGE LINE LAYOUT
SEDIMENTATION SURVEY

Drawn by JAR
Traced by JAR
Checked by TVJ

SCALE AS SHOWN

PLATE NO. 15

DRAWING NUMBER
F-237-A-21/2R0
SHEET 2 OF 2



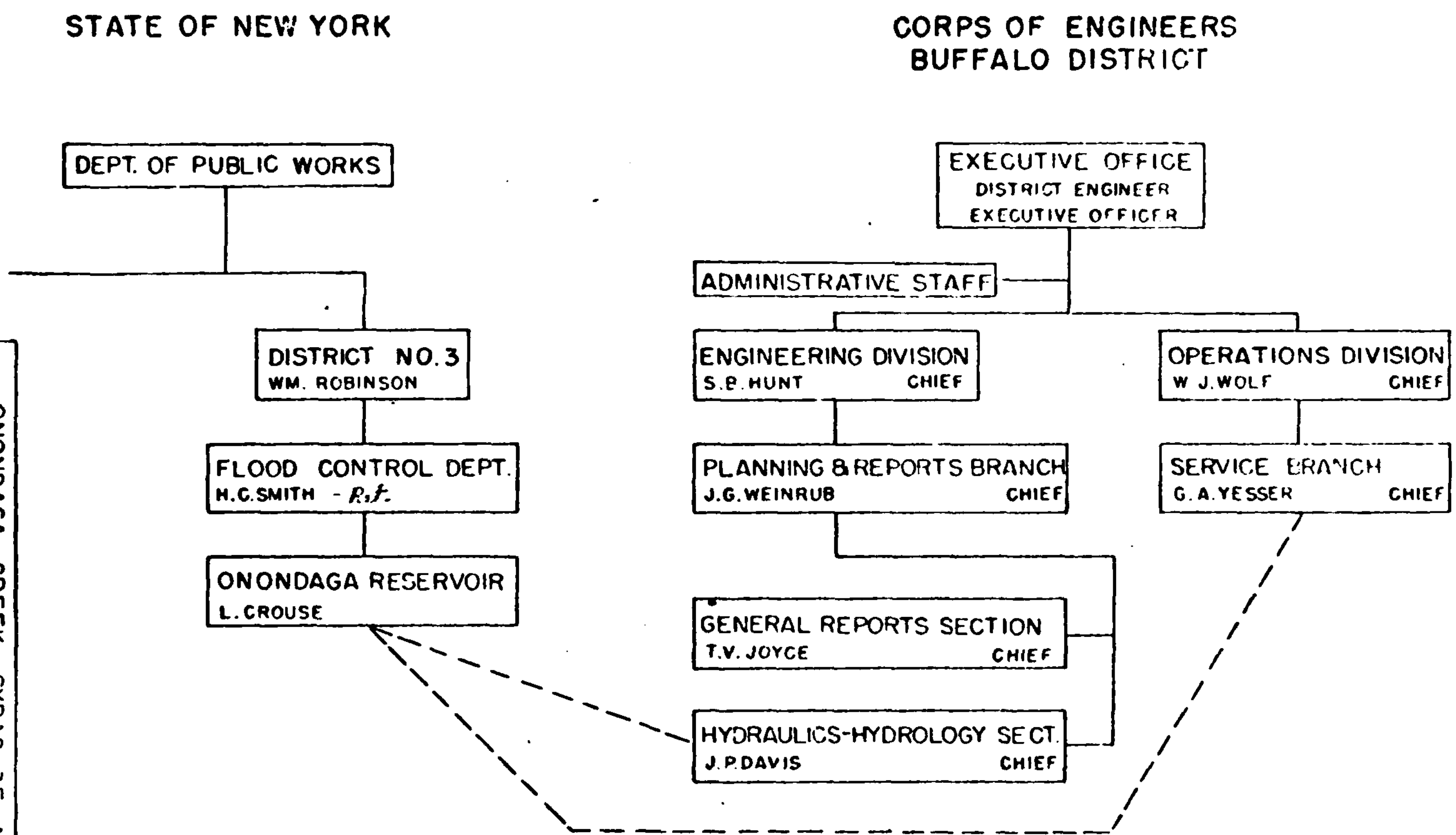

ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

ORGANIZATION CHART

BUFFALO DISTRICT, BUFFALO, N.Y. FEB. 1955

PLATE NO. 16

## NORMAL ORGANIZATION CHART




ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR

NORMAL ORGANIZATION CHART

BUFFALO DISTRICT, BUFFALO N.Y. FEB. 1955

PLATE NO. 17

FLOOD EMERGENCY ORGANIZATION CHART

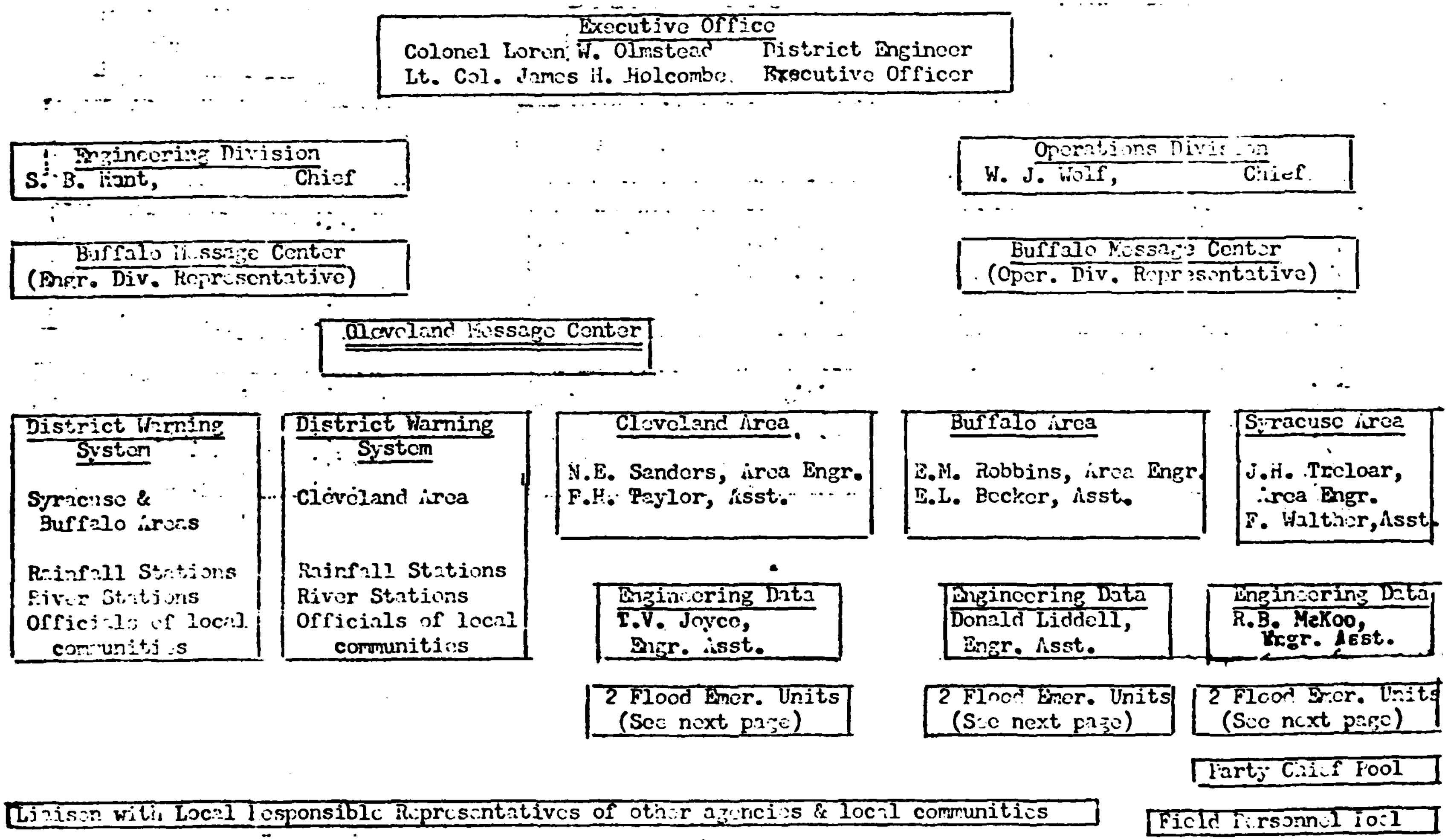



PLATE NO. 18

# FLOOD EMERGENCY ORGANIZATION CHART

## Cleveland Area

### 2 Flood Emer. Units

| | |
|---|---|
| C.L. Gilcher, | Chief |
| R. Dunlap, | Blaster |
| S. Oress, | Helper |
| H.J. Grisell, | Boatman |
| R.G. Keeling, | Boatman |

| | |
|---|---|
| A.G. Gumpher, | Chief |
| A. Teglow, | Blaster |
| F.T. Vana, | Helper |
| T.J. Sers, | Boatman |
| J.[illegible] Miller, | Boatman |

## Buffalo Area

### 2 Flood Emer. Units

| | |
|---|---|
| F.B. Kramer, | Chief |
| F.S. DiPasquale, | Blaster |
| R.C. Risk, | Helper |
| L.R. Selover, | Boatman |
| J. Shannon, | Boatman |

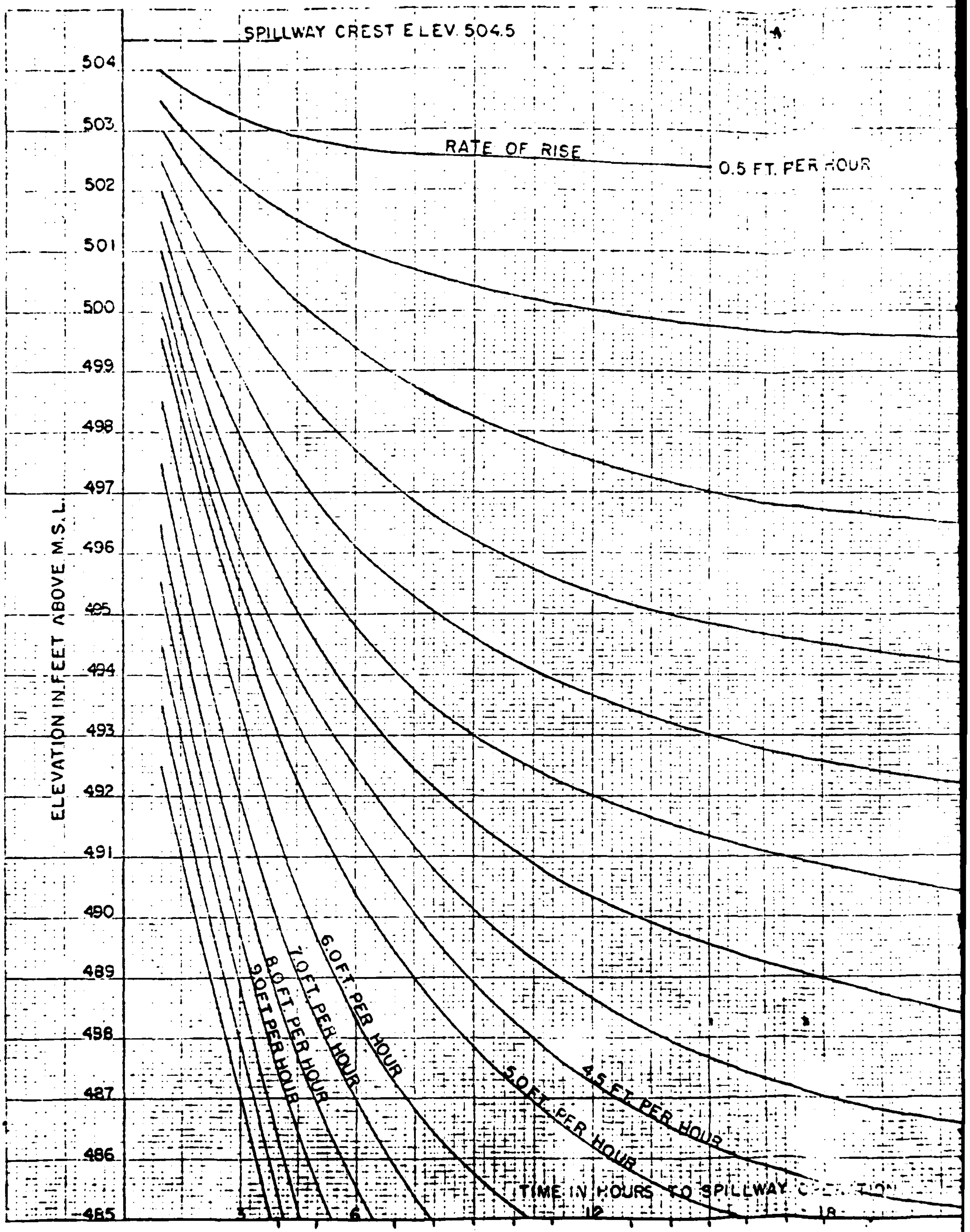
| | |
|---|---|
| J.C. Hassey, | Chief |
| H. Simonson, | Blaster |
| J.P. Shannon, | Helper |
| G. Crotty, | Boatman |
| H. Baker, | Boatman |

## Syracuse Area

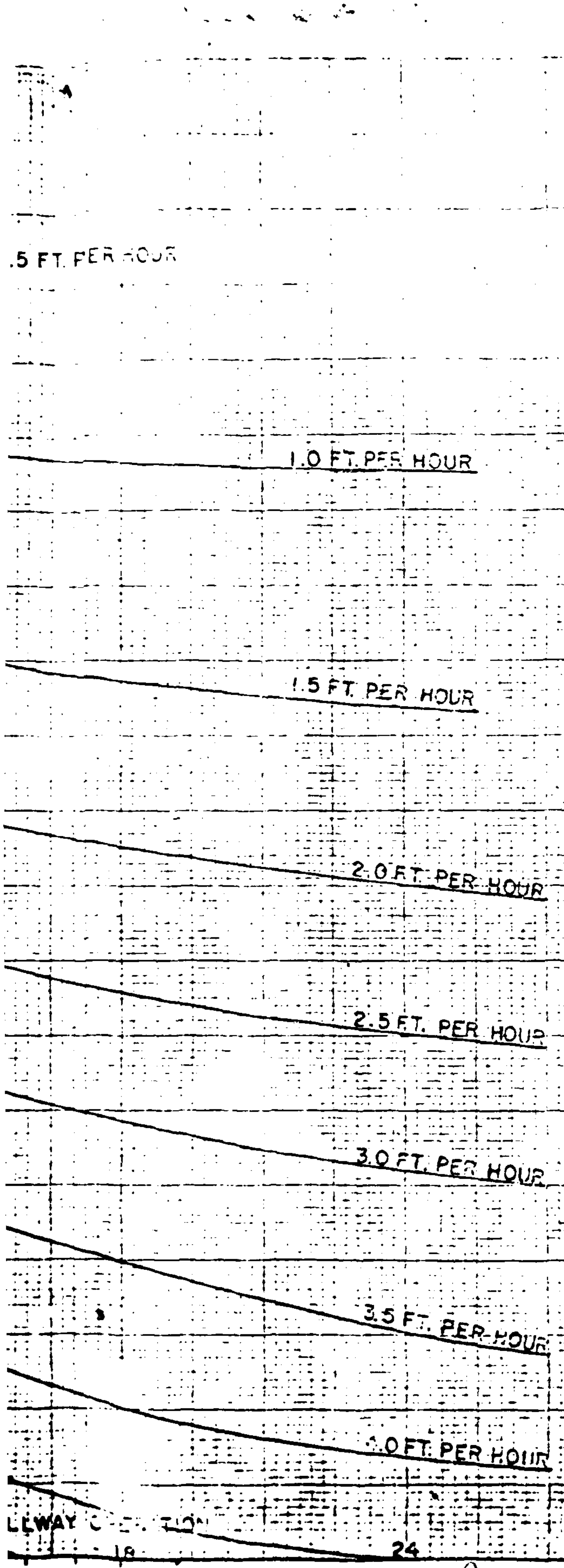
### 2 Flood Emer. Units

| | |
|---|---|
| J.H. Treloar, | Chief |
| Clarence Street, | Blaster |
| F. Walther, | Helper |
| W.H. Behan, | Boatman |
| J.F. Walders, | Boatman |

| | |
|---|---|
| L.A. Stupp, | Chief |
| C. Dintruff, | Blaster |
| M.M. Fischette, Jr. | Helper |
| L.J. Schrader, | Boatman |
| C.H. Comerford, | Boatman |



SPILLWAY CREST ELEV. 504.5
504
503
502
501
500
499
498
497
496
495
494
493
492
491
490
489
488
487
486
485
ELEVATION IN FEET ABOVE M.S.L.
RATE OF RISE
0.5 FT. PER HOUR
6.0 FT. PER HOUR
7.0 FT. PER HOUR
8.0 FT. PER HOUR
9.0 FT. PER HOUR
5.0 FT. PER HOUR
4.5 FT. PER HOUR
TIME IN HOURS TO SPILLWAY
6
12
18




INSTRUCTIONS FOR USING CURVES

(1) At the time of any observation when the reservoir is above elev. 485 m.s.l. check the rate of rise for the past hour from the recorder chart.

(2) Enter this chart at present pool elevation, and at the point where the present pool elevation line intersects the curve for rate of rise read the time shown directly below this point on the time scale. This is the probable number of hours before the spillway goes into operation.

(3) Check gage reading one hour later, or if reservoir pool has been above elev. 485 m.s.l. for an hour before first observation, check recorder chart, and determine if the situation is becoming more critical.

(4) If it appears that spillway will go into operation inform U. S. Weather Bureau Office, Syracuse, N. Y., Corps of Engineers District Office, Buffalo, N.Y., and State Dept. of Public Works, Syracuse, N.Y. by telephone. Continue hourly readings and reports until it appears there is no further danger of spillway flow.

ONONDAGA CREEK, SYRACUSE, N.Y.
ONONDAGA RESERVOIR
RULE CURVE
FOR FORECASTING
SPILLWAY OPERATION
BUFFALO DISTRICT, BUFFALO, N.Y. FEB. [illegible]

PLATE NO. 19

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 464.0 | 80 | | 466.0 | 200 | | 468.0 | 390 | |
| | | 4 | | | 8 | | | 14 |
| 464.1 | 84 | | 466.1 | 206 | | 468.1 | 404 | |
| | | 4 | | | 8 | | | 14 |
| 464.2 | 88 | | 466.2 | 216 | | 468.2 | 418 | |
| | | 4 | | | 8 | | | 14 |
| 464.3 | 92 | | 466.3 | 224 | | 468.3 | 432 | |
| | | 4 | | | 8 | | | 14 |
| 464.4 | 96 | | 466.4 | 232 | | 468.4 | 446 | |
| | | 4 | | | 8 | | | 14 |
| 464.5 | 100 | | 466.5 | 240 | | 468.5 | 460 | |
| | | 4 | | | 8 | | | 14 |
| 464.6 | 104 | | 466.6 | 248 | | 468.6 | 474 | |
| | | 4 | | | 8 | | | 14 |
| 464.7 | 108 | | 466.7 | 256 | | 468.7 | 488 | |
| | | 4 | | | 8 | | | 14 |
| 464.8 | 112 | | 466.8 | 264 | | 468.8 | 502 | |
| | | 5 | | | 8 | | | 14 |
| 464.9 | 117 | | 466.9 | 272 | | 468.9 | 516 | |
| | | 5 | | | 8 | | | 14 |
| 465.0 | 122 | | 467.0 | 280 | | 469.0 | 530 | |
| | | 7 | | | 11 | | | 18 |
| 465.1 | 129 | | 467.1 | 291 | | 469.1 | 548 | |
| | | 7 | | | 11 | | | 18 |
| 465.2 | 136 | | 467.2 | 302 | | 469.2 | 566 | |
| | | 8 | | | 11 | | | 18 |
| 465.3 | 144 | | 467.3 | 313 | | 469.3 | 584 | |
| | | 8 | | | 11 | | | 18 |
| 465.4 | 152 | | 467.4 | 324 | | 469.4 | 602 | |
| | | 8 | | | 11 | | | 18 |
| 465.5 | 160 | | 467.5 | 335 | | 469.5 | 620 | |
| | | 8 | | | 11 | | | 18 |
| 465.6 | 168 | | 467.6 | 346 | | 469.6 | 638 | |
| | | 8 | | | 11 | | | 18 |
| 465.7 | 176 | | 467.7 | 357 | | 469.7 | 656 | |
| | | 8 | | | 11 | | | 18 |
| 465.8 | 184 | | 467.8 | 368 | | 469.8 | 674 | |
| | | 8 | | | 11 | | | 18 |
| 465.9 | 192 | | 467.9 | 379 | | 469.9 | 692 | |
| | | 8 | | | 11 | | | 18 |

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 470.0 | 710 | | 472.0 | 1120 | | 474.0 | 1620 | |
| | | 19 | | | 24 | | | 28 |
| 470.1 | 729 | | 472.1 | 1144 | | 474.1 | 1648 | |
| | | 19 | | | 24 | | | 28 |
| 470.2 | 748 | | 472.2 | 1168 | | 474.2 | 1676 | |
| | | 19 | | | 24 | | | 28 |
| 470.3 | 767 | | 472.3 | 1192 | | 474.3 | 1704 | |
| | | 19 | | | 24 | | | 28 |
| 470.4 | 786 | | 472.4 | 1216 | | 474.4 | 1732 | |
| | | 19 | | | 24 | | | 28 |
| 470.5 | 805 | | 472.5 | 1240 | | 474.5 | 1760 | |
| | | 20 | | | 24 | | | 28 |
| 470.6 | 825 | | 472.6 | 1264 | | 474.6 | 1788 | |
| | | 20 | | | 24 | | | 28 |
| 470.7 | 845 | | 472.7 | 1288 | | 474.7 | 1816 | |
| | | 20 | | | 24 | | | 28 |
| 470.8 | 865 | | 472.8 | 1312 | | 474.8 | 1844 | |
| | | 20 | | | 24 | | | 28 |
| 470.9 | 885 | | 472.9 | 1336 | | 474.9 | 1872 | |
| | | 20 | | | 24 | | | 28 |
| 471.0 | 905 | | 473.0 | 1360 | | 475.0 | 1900 | |
| | | 21 | | | 26 | | | 30 |
| 471.1 | 926 | | 473.1 | 1396 | | 475.1 | 1930 | |
| | | 21 | | | 26 | | | 30 |
| 471.2 | 947 | | 473.2 | 1422 | | 475.2 | 1960 | |
| | | 21 | | | 26 | | | 30 |
| 471.3 | 968 | | 473.3 | 1448 | | 475.3 | 1990 | |
| | | 21 | | | 26 | | | 30 |
| 471.4 | 989 | | 473.4 | 1474 | | 475.4 | 2020 | |
| | | 21 | | | 26 | | | 30 |
| 471.5 | 1010 | | 473.5 | 1500 | | 475.5 | 2050 | |
| | | 22 | | | 26 | | | 30 |
| 471.6 | 1032 | | 473.6 | 1526 | | 475.6 | 2080 | |
| | | 22 | | | 26 | | | 30 |
| 471.7 | 1054 | | 473.7 | 1552 | | 475.7 | 2110 | |
| | | 22 | | | 26 | | | 30 |
| 471.8 | 1076 | | 473.8 | 1578 | | 475.8 | 2140 | |
| | | 22 | | | 26 | | | 30 |
| 471.9 | 1098 | | 473.9 | 1604 | | 475.9 | 2170 | |
| | | 22 | | | 26 | | | 30 |

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 476.0 | 2200 | 30 | 478.0 | 2810 | 33 | 480.0 | 3480 | 34 |
| 476.1 | 2230 | 30 | 478.1 | 2843 | 33 | 480.1 | 3514 | 34 |
| 476.2 | 2260 | 30 | 478.2 | 2876 | 33 | 480.2 | 3548 | 34 |
| 476.3 | 2290 | 30 | 478.3 | 2909 | 33 | 480.3 | 3582 | 34 |
| 476.4 | 2320 | 30 | 478.4 | 2942 | 33 | 480.4 | 3616 | 34 |
| 476.5 | 2350 | 30 | 478.5 | 2975 | 33 | 480.5 | 3650 | 34 |
| 476.6 | 2380 | 30 | 478.6 | 3008 | 33 | 480.6 | 3684 | 34 |
| 476.7 | 2410 | 30 | 478.7 | 3041 | 33 | 480.7 | 3718 | 34 |
| 476.8 | 2440 | 30 | 478.8 | 3074 | 33 | 480.8 | 3752 | 34 |
| 476.9 | 2470 | 30 | 478.9 | 3107 | 33 | 480.9 | 3786 | 34 |
| 477.0 | 2500 | 31 | 479.0 | 3140 | 34 | 481.0 | 3820 | 37 |
| 477.1 | 2531 | 31 | 479.1 | 3174 | 34 | 481.1 | 3857 | 37 |
| 477.2 | 2562 | 31 | 479.2 | 3208 | 34 | 481.2 | 3894 | 37 |
| 477.3 | 2593 | 31 | 479.3 | 3242 | 34 | 481.3 | 3931 | 37 |
| 477.4 | 2624 | 31 | 479.4 | 3276 | 34 | 481.4 | 3968 | 37 |
| 477.5 | 2655 | 31 | 479.5 | 3310 | 34 | 481.5 | 4005 | 37 |
| 477.6 | 2686 | 31 | 479.6 | 3344 | 34 | 481.6 | 4042 | 37 |
| 477.7 | 2717 | 31 | 479.7 | 3378 | 34 | 481.7 | 4079 | 37 |
| 477.8 | 2748 | 31 | 479.8 | 3412 | 34 | 481.8 | 4116 | 37 |
| 477.9 | 2779 | 31 | 479.9 | 3446 | 34 | 481.9 | 4153 | 37 |

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 482.0 | 4190 | 40 | 484.0 | 5010 | 45 | 486.0 | 5910 | 47 |
| 482.1 | 4230 | 40 | 484.1 | 5055 | 45 | 486.1 | 5957 | 47 |
| 482.2 | 4270 | 40 | 484.2 | 5100 | 45 | 486.2 | 6004 | 47 |
| 482.3 | 4310 | 40 | 484.3 | 5145 | 45 | 486.3 | 6051 | 47 |
| 482.4 | 4350 | 40 | 484.4 | 5190 | 45 | 486.4 | 6098 | 47 |
| 482.5 | 4390 | 40 | 484.5 | 5235 | 45 | 486.5 | 6145 | 47 |
| 482.6 | 4430 | 40 | 484.6 | 5280 | 45 | 486.6 | 6192 | 47 |
| 482.7 | 4470 | 40 | 484.7 | 5325 | 45 | 486.7 | 6239 | 47 |
| 482.8 | 4510 | 40 | 484.8 | 5370 | 45 | 486.8 | 6286 | 47 |
| 482.9 | 4550 | 40 | 484.9 | 5415 | 45 | 486.9 | 6333 | 47 |
| 483.0 | 4590 | 41 | 485.0 | 5460 | 45 | 487.0 | 6380 | 49 |
| 483.1 | 4631 | 41 | 485.1 | 5505 | 45 | 487.1 | 6429 | 49 |
| 483.2 | 4672 | 41 | 485.2 | 5550 | 45 | 487.2 | 6478 | 49 |
| 483.3 | 4713 | 41 | 485.3 | 5595 | 45 | 487.3 | 6527 | 49 |
| 483.4 | 4754 | 41 | 485.4 | 5640 | 45 | 487.4 | 6576 | 49 |
| 483.5 | 4795 | 41 | 485.5 | 5685 | 45 | 487.5 | 6625 | 49 |
| 483.6 | 4836 | 41 | 485.6 | 5730 | 45 | 487.6 | 6674 | 49 |
| 483.7 | 4877 | 41 | 485.7 | 5775 | 45 | 487.7 | 6723 | 49 |
| 483.8 | 4918 | 41 | 485.8 | 5820 | 45 | 487.8 | 6772 | 49 |
| 483.9 | 4959 | 41 | 485.9 | 5865 | 45 | 487.9 | 6821 | 49 |

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE AC-E FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 488.0 | 6870 | 49 | 490.0 | 7880 | 52 | 492.0 | 8960 | 58 |
| 488.1 | 6919 | 49 | 490.1 | 7932 | 52 | 492.1 | 9018 | 58 |
| 488.2 | 6968 | 49 | 490.2 | 7984 | 52 | 492.2 | 9076 | 58 |
| 488.3 | 7017 | 49 | 490.3 | 8036 | 52 | 492.3 | 9134 | 58 |
| 488.4 | 7066 | 49 | 490.4 | 8088 | 52 | 492.4 | 9192 | 58 |
| 488.5 | 7115 | 49 | 490.5 | 8140 | 52 | 492.5 | 9250 | 58 |
| 488.6 | 7164 | 49 | 490.6 | 8192 | 52 | 492.6 | 9308 | 58 |
| 488.7 | 7213 | 49 | 490.7 | 8244 | 52 | 492.7 | 9366 | 58 |
| 488.8 | 7262 | 49 | 490.8 | 8296 | 52 | 492.8 | 9424 | 58 |
| 488.9 | 7311 | 49 | 490.9 | 8348 | 52 | 492.9 | 9482 | 58 |
| 489.0 | 7360 | 52 | 491.0 | 8400 | 56 | 493.0 | 9540 | 62 |
| 489.1 | 7412 | 52 | 491.1 | 8456 | 56 | 493.1 | 9602 | 62 |
| 489.2 | 7464 | 52 | 491.2 | 8512 | 56 | 493.2 | 9664 | 62 |
| 489.3 | 7516 | 52 | 491.3 | 8568 | 56 | 493.3 | 9726 | 62 |
| 489.4 | 7568 | 52 | 491.4 | 8624 | 56 | 493.4 | 9788 | 62 |
| 489.5 | 7620 | 52 | 491.5 | 8680 | 56 | 493.5 | 9850 | 62 |
| 489.6 | 7672 | 52 | 491.6 | 8736 | 56 | 493.6 | 9912 | 62 |
| 489.7 | 7724 | 52 | 491.7 | 8792 | 56 | 493.7 | 9974 | 62 |
| 489.8 | 7776 | 52 | 491.8 | 8848 | 56 | 493.8 | 10036 | 62 |
| 489.9 | 7828 | 52 | 491.9 | 8904 | 56 | 493.9 | 10098 | 62 |

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 494.0 | 10160 | | 496.0 | 11470 | | 498.0 | 12840 | |
| | | 64 | | | 68 | | | 71 |
| 494.1 | 10224 | | 496.1 | 11538 | | 498.1 | 12911 | |
| | | 64 | | | 68 | | | 71 |
| 494.2 | 10288 | | 496.2 | 11606 | | 498.2 | 12982 | |
| | | 64 | | | 68 | | | 71 |
| 494.3 | 10352 | | 496.3 | 11674 | | 498.3 | 13053 | |
| | | 64 | | | 68 | | | 71 |
| 494.4 | 10416 | | 496.4 | 11742 | | 498.4 | 13124 | |
| | | 64 | | | 68 | | | 71 |
| 494.5 | 10480 | | 496.5 | 11810 | | 498.5 | 13195 | |
| | | 64 | | | 68 | | | 71 |
| 494.6 | 10544 | | 496.6 | 11878 | | 498.6 | 13266 | |
| | | 64 | | | 68 | | | 71 |
| 494.7 | 10608 | | 496.7 | 11946 | | 498.7 | 13337 | |
| | | 64 | | | 68 | | | 71 |
| 494.8 | 10672 | | 496.8 | 12014 | | 498.8 | 13408 | |
| | | 64 | | | 68 | | | 71 |
| 494.9 | 10736 | | 496.9 | 12082 | | 498.9 | 13479 | |
| | | 64 | | | 68 | | | 71 |
| 495.0 | 10800 | | 497.0 | 12150 | | 499.0 | 13550 | |
| | | 67 | | | 69 | | | 75 |
| 495.1 | 10867 | | 497.1 | 12219 | | 499.1 | 13625 | |
| | | 67 | | | 69 | | | 75 |
| 495.2 | 10934 | | 497.2 | 12288 | | 499.2 | 13700 | |
| | | 67 | | | 69 | | | 75 |
| 495.3 | 11001 | | 497.3 | 12357 | | 499.3 | 13775 | |
| | | 67 | | | 69 | | | 75 |
| 495.4 | 11068 | | 497.4 | 12426 | | 499.4 | 13850 | |
| | | 67 | | | 69 | | | 75 |
| 495.5 | 11135 | | 497.5 | 12495 | | 499.5 | 13925 | |
| | | 67 | | | 69 | | | 75 |
| 495.6 | 11202 | | 297.6 | 12564 | | 499.6 | 14000 | |
| | | 67 | | | 69 | | | 75 |
| 495.7 | 11269 | | 497.7 | 12633 | | 499.7 | 14075 | |
| | | 67 | | | 69 | | | 75 |
| 495.8 | 11336 | | 497.8 | 12702 | | 499.8 | 14150 | |
| | | 67 | | | 69 | | | 75 |
| 495.9 | 11403 | | 497.9 | 12771 | | 499.9 | 14225 | |
| | | 67 | | | 69 | | | 75 |

ONONDAGA RESERVOIR

ELEVATION vs. STAGE

8 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 500.0 | 14300 | 75 | 502.0 | 15840 | 85 | 504.0 | 17570 | 91 |
| 500.1 | 14375 | 75 | 502.1 | 15925 | 85 | 504.1 | 17661 | 91 |
| 500.2 | 14450 | 75 | 502.2 | 16010 | 85 | 504.2 | 17752 | 91 |
| 500.3 | 14525 | 75 | 502.3 | 16095 | 85 | 504.3 | 17842 | 91 |
| 500.4 | 14600 | 75 | 502.4 | 16180 | 85 | 504.4 | 17934 | 91 |
| 500.5 | 14675 | 75 | 502.5 | 16265 | 85 | 504.5 | 18025 | 91 |
| 500.6 | 14750 | 75 | 502.6 | 16350 | 85 | 504.6 | 18116 | 91 |
| 500.7 | 14825 | 75 | 502.7 | 16435 | 85 | 504.7 | 18207 | 91 |
| 500.8 | 14900 | 75 | 502.8 | 16520 | 85 | 504.8 | 18298 | 91 |
| 500.9 | 14975 | 75 | 502.9 | 16605 | 85 | 504.9 | 18389 | 91 |
| 501.0 | 15050 | 79 | 503.0 | 16690 | 88 | 505.0 | 18480 | 91 |
| 501.1 | 15129 | 79 | 503.1 | 16776 | 88 | 505.1 | 18571 | 91 |
| 501.2 | 15208 | 79 | 503.2 | 16866 | 88 | 505.2 | 18662 | 91 |
| 501.3 | 15287 | 79 | 503.3 | 16954 | 88 | 505.3 | 18753 | 91 |
| 501.4 | 15366 | 79 | 503.4 | 17042 | 88 | 505.4 | 18844 | 91 |
| 501.5 | 15445 | 79 | 503.5 | 17130 | 88 | 505.5 | 18935 | 91 |
| 501.6 | 15524 | 79 | 503.6 | 17218 | 88 | 505.6 | 19026 | 91 |
| 501.7 | 15603 | 79 | 503.7 | 17306 | 88 | 505.7 | 19117 | 91 |
| 501.8 | 15682 | 79 | 503.8 | 17394 | 88 | 505.8 | 19208 | 91 |
| 501.9 | 15761 | 79 | 503.9 | 17482 | 88 | 505.9 | 19299 | 91 |

ONONDAGA RESERVOIR

ELEVATION vs. STORAGE

9 February 1965

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 506.0 | 19390 | 97 | 508.0 | 21400 | 106 | 510.0 | 23590 | 115 |
| 506.1 | 19487 | 97 | 508.1 | 21506 | 106 | 510.1 | 23705 | 115 |
| 506.2 | 19584 | 97 | 508.2 | 21612 | 106 | 510.2 | 23820 | 115 |
| 506.3 | 19681 | 97 | 508.3 | 21718 | 106 | 510.3 | 23935 | 115 |
| 506.4 | 19778 | 97 | 508.4 | 21824 | 106 | 510.4 | 24050 | 115 |
| 506.5 | 19875 | 97 | 508.5 | 21930 | 106 | 510.5 | 24165 | 115 |
| 506.6 | 19972 | 97 | 508.6 | 22036 | 106 | 510.6 | 24280 | 115 |
| 506.7 | 20069 | 97 | 508.7 | 22142 | 106 | 510.7 | 24395 | 115 |
| 506.8 | 20166 | 97 | 508.8 | 22248 | 106 | 510.8 | 24510 | 115 |
| 506.9 | 20263 | 97 | 508.9 | 22354 | 106 | 510.9 | 24625 | 115 |
| 507.0 | 20360 | 104 | 509.0 | 22460 | 113 | 511.0 | 24740 | 117 |
| 507.1 | 20464 | 104 | 509.1 | 22573 | 113 | 511.1 | 24857 | 117 |
| 507.2 | 20568 | 104 | 509.2 | 22686 | 113 | 511.2 | 24974 | 117 |
| 507.3 | 20672 | 104 | 509.3 | 22799 | 113 | 511.3 | 25091 | 117 |
| 507.4 | 20776 | 104 | 509.4 | 22912 | 113 | 511.4 | 25208 | 117 |
| 507.5 | 20880 | 104 | 509.5 | 23025 | 113 | 511.5 | 25325 | 117 |
| 507.6 | 20984 | 104 | 509.6 | 23138 | 113 | 511.6 | 25442 | 117 |
| 507.7 | 21088 | 104 | 509.7 | 23151 | 113 | 511.7 | 25559 | 117 |
| 507.8 | 21192 | 104 | 509.8 | 23364 | 113 | 511.8 | 25676 | 117 |
| 507.9 | 21296 | 104 | 509.9 | 23477 | 113 | 511.9 | 25793 | 117 |

ONONDAGA RESERVOIR

ELEVATION vs. STORAGE

9 February 1955

| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 512.0 | 25910 | 124 | 514.0 | 28490 | 135 | 516.0 | 31310 | 147 |
| 512.1 | 26034 | 124 | 514.1 | 28625 | 135 | 516.1 | 31457 | 147 |
| 512.2 | 26158 | 124 | 514.2 | 28760 | 135 | 516.2 | 31604 | 147 |
| 512.3 | 26282 | 124 | 514.3 | 28895 | 135 | 516.3 | 31751 | 147 |
| 512.4 | 26406 | 124 | 514.4 | 29030 | 135 | 516.4 | 31898 | 147 |
| 512.5 | 26530 | 124 | 514.5 | 29165 | 135 | 516.5 | 32045 | 147 |
| 512.6 | 26654 | 124 | 514.6 | 29300 | 135 | 516.6 | 32192 | 147 |
| 512.7 | 26778 | 124 | 514.7 | 29435 | 135 | 516.7 | 32339 | 147 |
| 512.8 | 26902 | 124 | 514.8 | 29570 | 135 | 516.8 | 32486 | 147 |
| 512.9 | 27026 | 124 | 514.9 | 29705 | 135 | 516.9 | 32633 | 147 |
| 513.0 | 27150 | 134 | 515.0 | 29840 | 147 | 517.0 | 32780 | 149 |
| 513.1 | 27284 | 134 | 515.1 | 29987 | 147 | 517.1 | 32929 | 149 |
| 513.2 | 27418 | 134 | 515.2 | 30134 | 147 | 517.2 | 33078 | 149 |
| 513.3 | 27552 | 134 | 515.3 | 30281 | 147 | 517.3 | 33227 | 149 |
| 513.4 | 27686 | 134 | 515.4 | 30428 | 147 | 517.4 | 33376 | 149 |
| 513.5 | 27820 | 134 | 515.5 | 30575 | 147 | 517.5 | 33525 | 149 |
| 513.6 | 27954 | 134 | 515.6 | 30722 | 147 | 517.6 | 33674 | 149 |
| 513.7 | 28088 | 134 | 515.7 | 30869 | 147 | 517.7 | 33823 | 149 |
| 513.8 | 28222 | 134 | 515.8 | 31016 | 147 | 517.8 | 33972 | 149 |
| 513.9 | 28356 | 134 | 515.9 | 31163 | 147 | 517.9 | 34121 | 149 |

ONONDAGA RESERVOIR

ELEVATION vs. STORAGE

9 February 1955

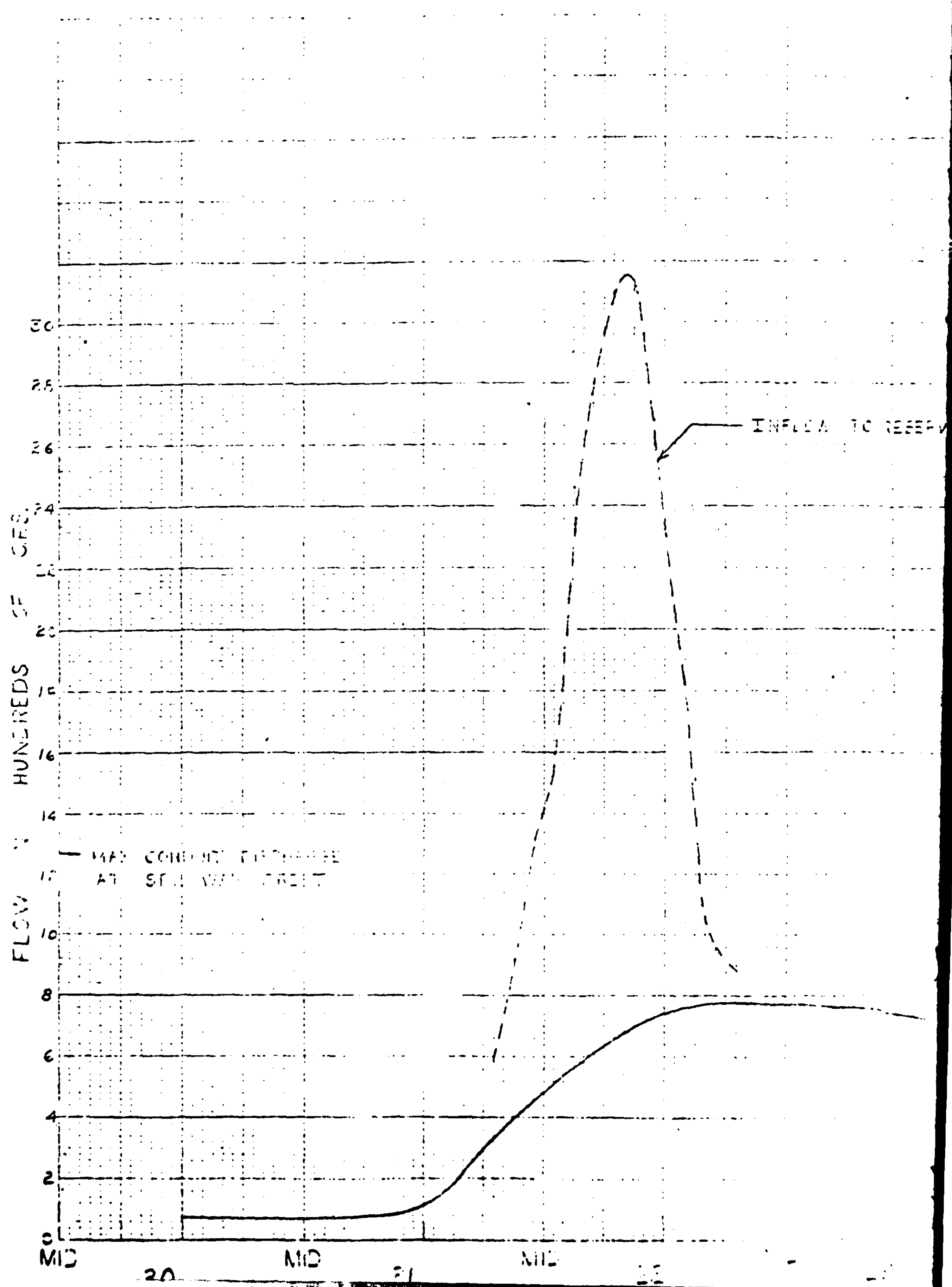
| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 518.0 | 34270 | 151 | 520.0 | 37290 | 151 | 522.0 | 40340 | 157 |
| 518.1 | 34421 | 151 | 520.1 | 37441 | 151 | 522.1 | 40497 | 157 |
| 518.2 | 34572 | 151 | 520.2 | 37592 | 151 | 522.2 | 40654 | 157 |
| 518.3 | 34723 | 151 | 520.3 | 37743 | 151 | 522.3 | 40811 | 157 |
| 518.4 | 34874 | 151 | 520.4 | 37694 | 151 | 522.4 | 40968 | 157 |
| 518.5 | 35025 | 151 | 520.5 | 38045 | 151 | 522.5 | 41125 | 157 |
| 518.6 | 35176 | 151 | 520.6 | 38196 | 151 | 522.6 | 41282 | 157 |
| 518.7 | 35327 | 151 | 520.7 | 38347 | 151 | 522.7 | 41439 | 157 |
| 518.8 | 35478 | 151 | 520.8 | 38498 | 151 | 522.8 | 41596 | 157 |
| 518.9 | 35629 | 151 | 520.9 | 38649 | 151 | 522.9 | 41753 | 157 |
| 519.0 | 35780 | 151 | 521.0 | 38800 | 154 | 523.0 | 41910 | 176 |
| 519.1 | 35931 | 151 | 521.1 | 38954 | 154 | 523.1 | 42086 | 176 |
| 519.2 | 36082 | 151 | 521.2 | 39108 | 154 | 523.2 | 42262 | 176 |
| 519.3 | 36233 | 151 | 521.3 | 39262 | 154 | 523.3 | 42438 | 176 |
| 519.4 | 36384 | 151 | 521.4 | 39416 | 154 | 523.4 | 42614 | 176 |
| 519.5 | 36535 | 151 | 521.5 | 39570 | 154 | 523.5 | 42790 | 176 |
| 519.6 | 36686 | 151 | 521.6 | 39724 | 154 | 523.6 | 42966 | 176 |
| 519.7 | 36837 | 151 | 521.7 | 39878 | 154 | 523.7 | 43142 | 176 |
| 519.8 | 36988 | 151 | 521.8 | 40032 | 154 | 523.8 | 43318 | 176 |
| 519.9 | 37139 | 151 | 521.9 | 40166 | 154 | 523.9 | 43494 | 176 |

ONONDAGA RESERVOIR

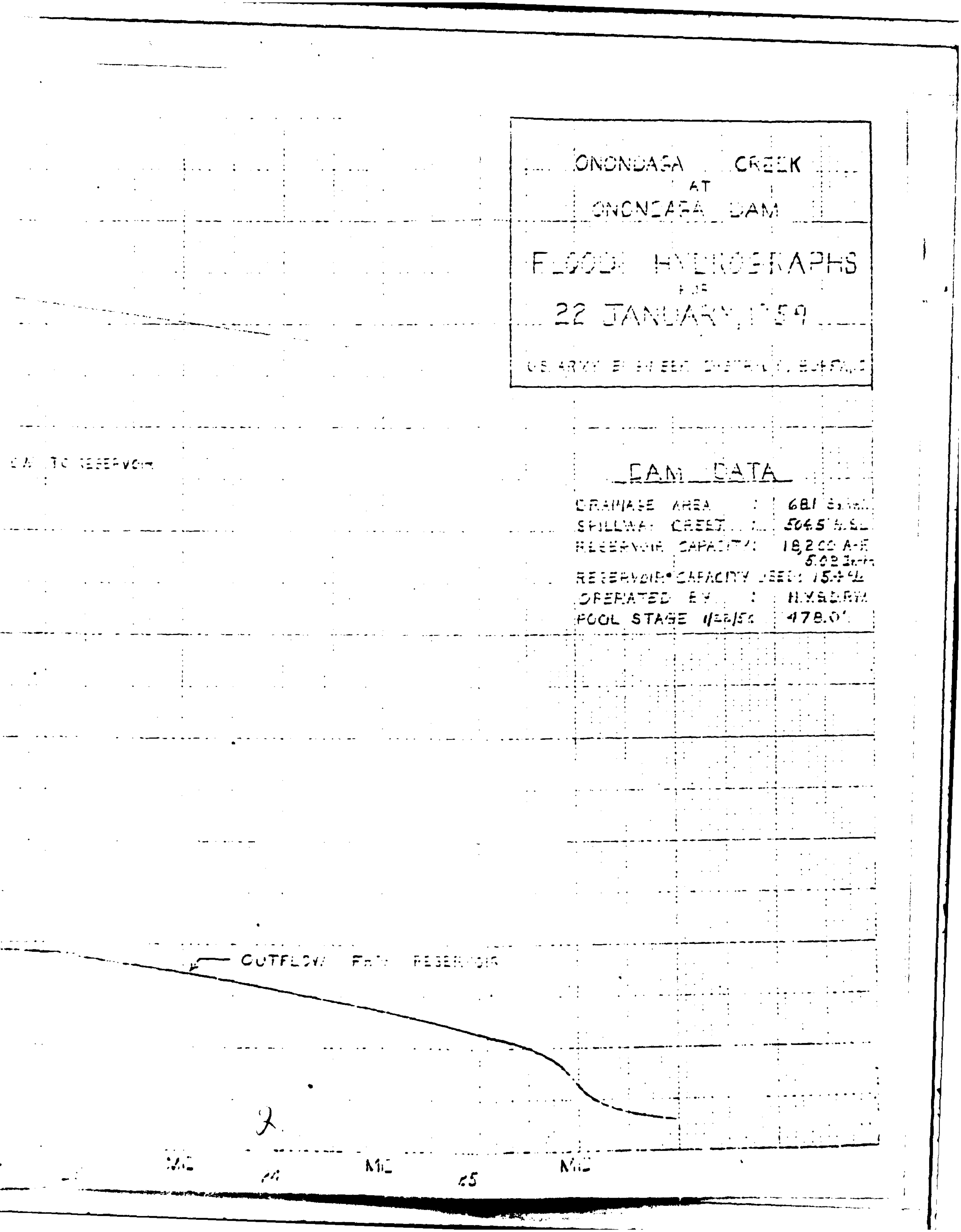
ELEVATION vs. STORAGE

9 February 1965

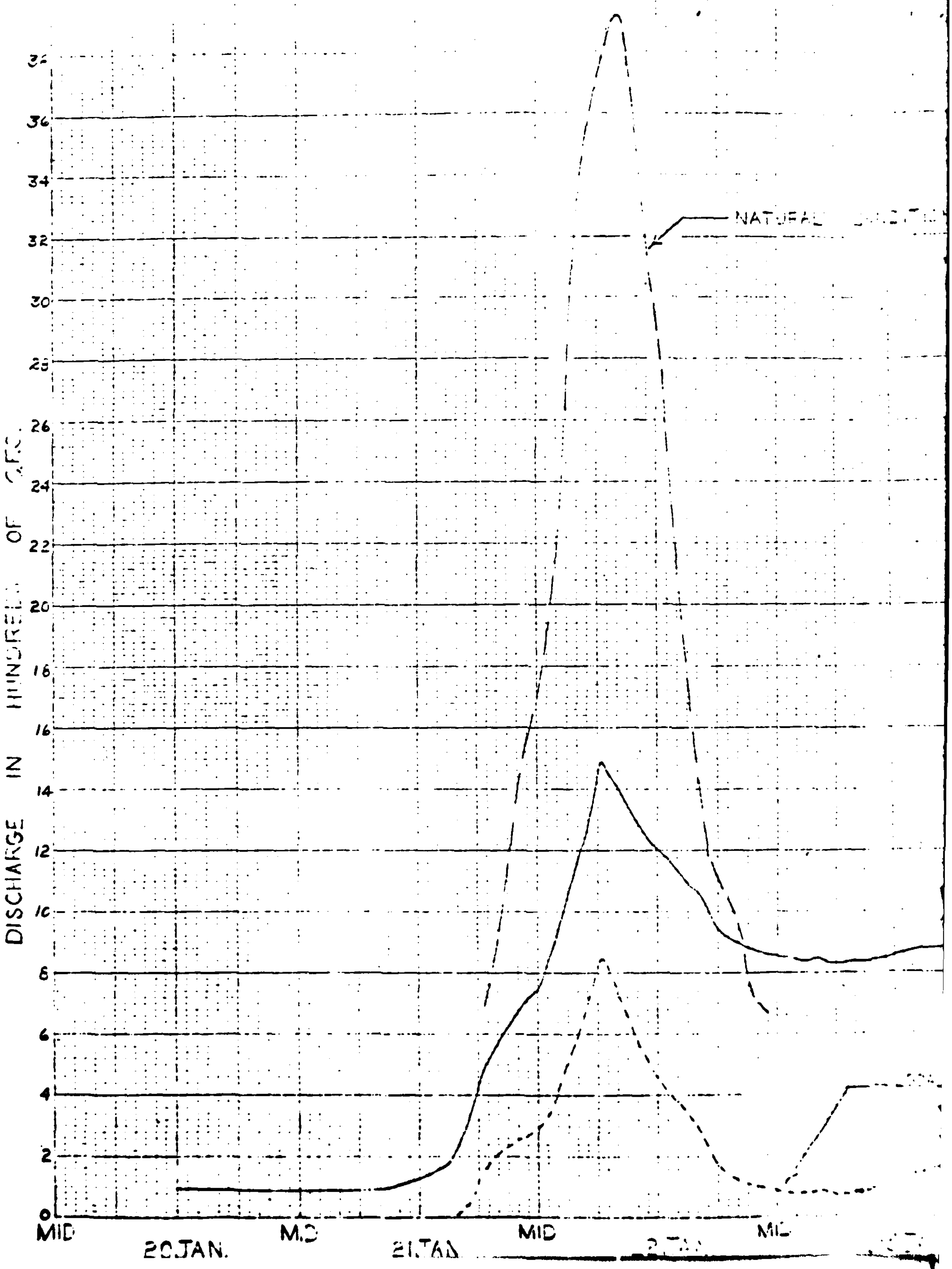
| ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE | ELEV. | STORAGE ACRE FT. | CHANGE |
|---|---|---|---|---|---|---|---|---|
| 524.0 | 43670 | | | | | | | |
| | | 224 | | | | | | |
| 524.1 | 43894 | | | | | | | |
| | | 224 | | | | | | |
| 524.2 | 44118 | | | | | | | |
| | | 224 | | | | | | |
| 524.3 | 44342 | | | | | | | |
| | | 224 | | | | | | |
| 524.4 | 44566 | | | | | | | |
| | | 224 | | | | | | |
| 524.5 | 44790 | | | | | | | |
| | | 224 | | | | | | |
| 524.6 | 45014 | | | | | | | |
| | | 224 | | | | | | |
| 524.7 | 45238 | | | | | | | |
| | | 224 | | | | | | |
| 524.8 | 45462 | | | | | | | |
| | | 224 | | | | | | |
| 524.9 | 45686 | | | | | | | |
| | | 224 | | | | | | |
| 525.0 | 45910 | | | | | | | |



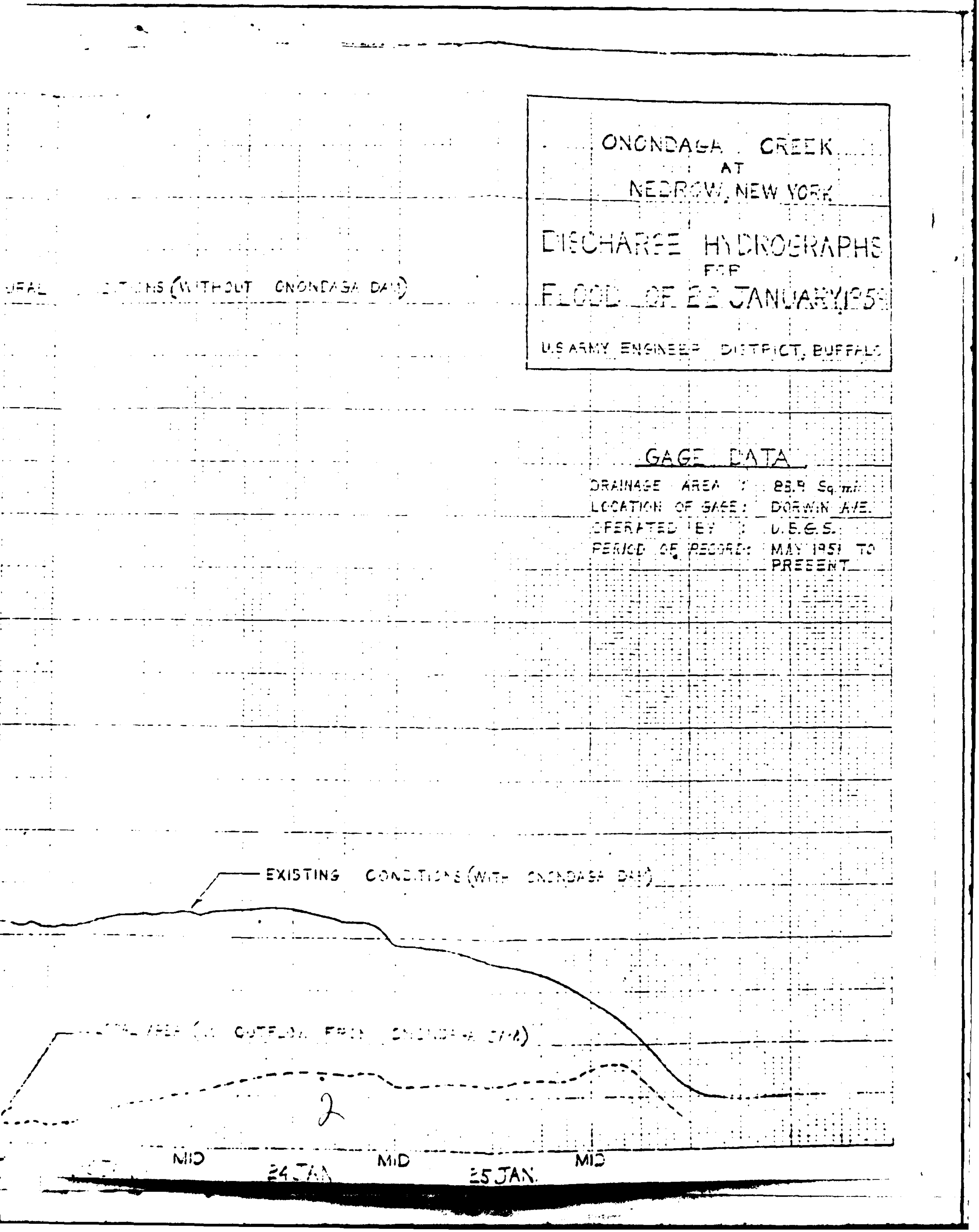
FLOW IN HUNDREDS OF CFS
30
28
26
24
20
18
16
14
10
8
6
4
2
0
MID
MID
MID
20
21
22
INFLOW TO RESERV
MAX CONDUIT DISCHARGE
AT SPILLWAY CREST

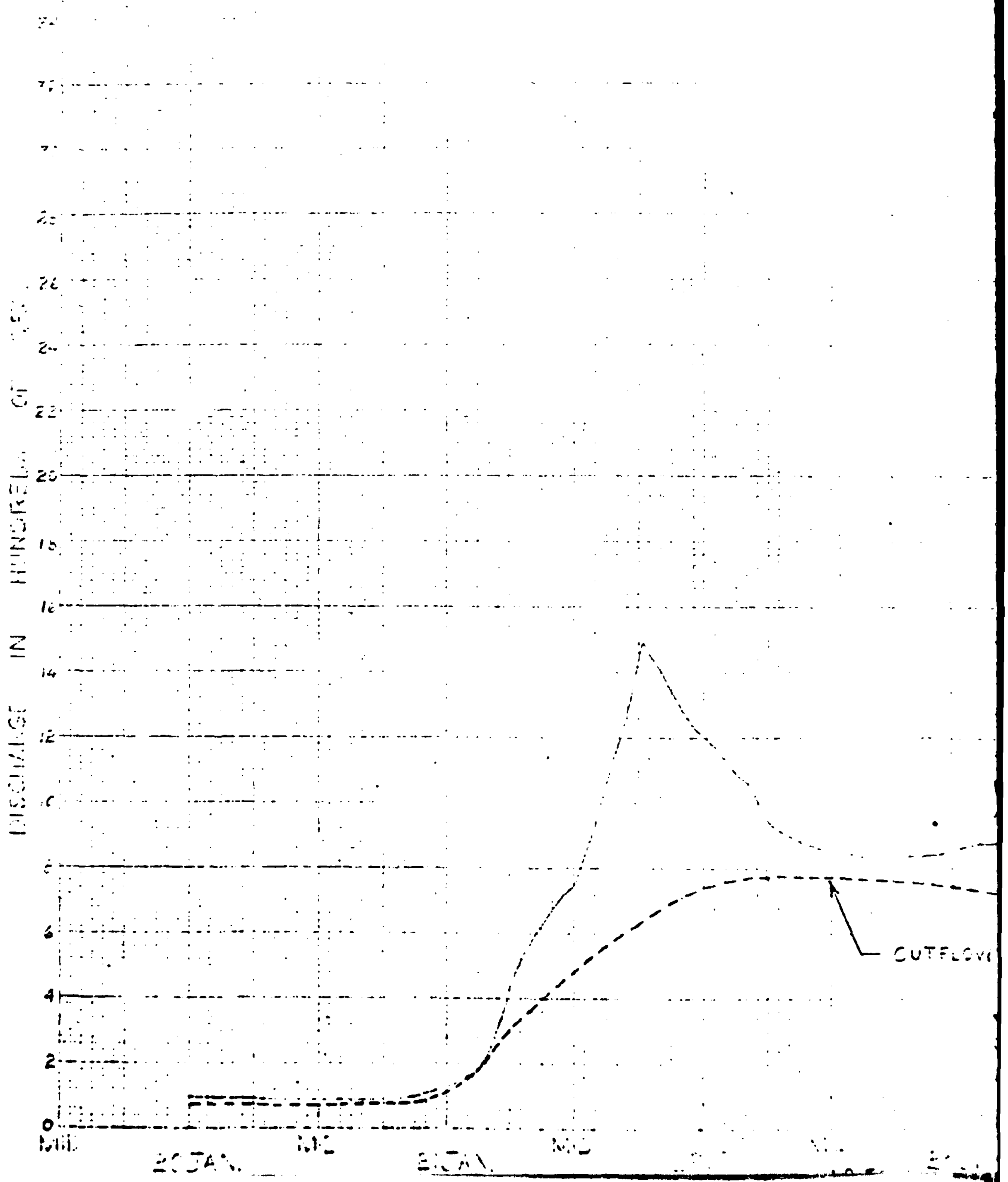


ONONDAGA CREEK
AT
ONONDAGA DAM
FLOOD HYDROGRAPHS
22 JANUARY 1959
DAM DATA
DRAINAGE AREA : 68.1
SPILLWAY CREST : 504.5
RESERVOIR CAPACITY: 18,200 A-F
RESERVOIR CAPACITY USED: 15.4%
OPERATED BY : N.Y.S.D.P.W.
POOL STAGE 1/22/59 478.0'
OUTFLOW FROM RESERVOIR
MID
MID
MID
24
25


NATURAL
DISCHARGE IN HUNDREDS OF C.F.S.
36
34
32
30
26
24
22
20
16
14
12
10
8
6
4
2
0
MID
20 JAN.
MID
MID
MI


1.


ONONDAGA CREEK
AT
NEDROW, NEW YORK
DISCHARGE HYDROGRAPHS
FOR
FLOOD OF 22 JANUARY
U.S. ARMY ENGINEER DISTRICT, BUFFALO
GAGE DATA
DRAINAGE AREA : 88.9 Sq. mi.
LOCATION OF GAGE : DORWIN AVE.
OPERATED BY : U.S.G.S.
PERIOD OF RECORD : MAY 1951 TO PRESENT
(WITHOUT ONONDAGA DAM)
EXISTING CONDITIONS (WITH ONONDAGA DAM)
OUTFLOW FROM ONONDAGA DAM)
2
MID
24 JAN.
MID
25 JAN.
MID


DISCHARGE IN
0
2
4
6
12
14
20
20 JAN.

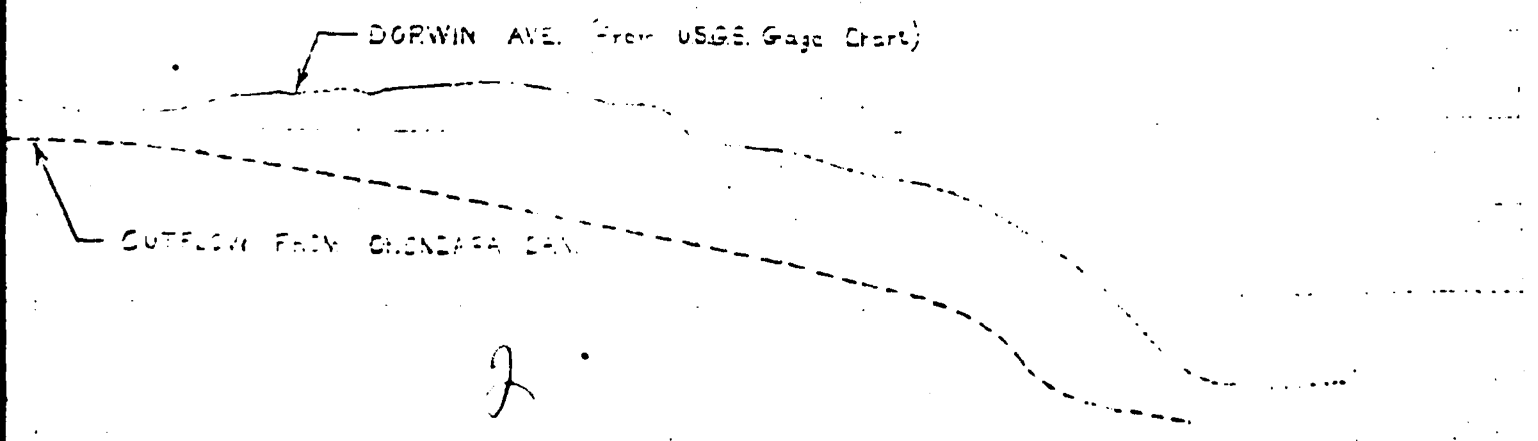
ONONDAGA CREEK
AT
NEDROW, NEW YORK

# FLOOD HYDROGRAPH
FOR
22 JANUARY, 1959

US ARMY ENGINEER DISTRICT BUFFALO

## GAGE DATA

| | |
|---|---|
| DRAINAGE AREA : | [illegible] Sq. mi. |
| LOCATION OF GAGE : | DORWIN AVE. |
| OPERATED BY | U.S.G.S. |
| PERIOD OF RECORD : | MAY [illegible] TO PRESENT. |



# ONONDAGA CREEK
# SYRACUSE, NEW YORK

## LOCAL FLOOD PROTECTION PROJECT
## OPERATION AND MAINTENANCE
## MANUAL

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO DISTRICT
ENGINEER PARK
BUFFALO 7, NEW YORK

310 O

ONONDAGA CREEK - SYRACUSE, N. Y.
OPERATION AND MAINTENANCE MANUAL

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| 11 | Check sheet for inspection of Channel improvements |
| 12 | Check sheet for inspection of Levees |
| 13 | Check sheet for inspection of Structures |
| 14 | Tide Gates - Bulletin No. 69 - Brown & Brown Inc. |
| 15 | Stem Guide Chart - Chapman Valve Mfg. Co. |
| 16 | 48" Cir. Type "M" Gate Shutter |
| 17 | 48" Cir. Type "M" Gate |
| 18 to 21 | Detail drawings for 48" Gate with type M-10 floorstand |
| 22 to 35 | "As Built" drawings of channel improvements on Onondaga Creek |
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| 67 | "As Built" drawing of weir on Onondaga Creek channel |

## APPENDIX

Report on the Fish and Wildlife Resources for the Onondaga Reservoir Project and Downstream Improvements, Onondaga Creek - by United States Department of the Interior.

ONONDAGA CREEK - SYRACUSE, N. Y.
OPERATION AND MAINTENANCE MANUAL

## I. PROJECT AUTHORIZATION

The Flood Control Act of 1941 (Public Law 228, 77th Congress, 1st Session) authorized construction of a project to provide flood protection for the city of Syracuse, N. Y., substantially in accordance with the recommendation of the Chief of Engineers in House Document No. 846, 76th Congress, 3rd Session.

## II. LOCATION

The project consists of a dam and reservoir on Onondaga Creek about 7 miles south of the city of Syracuse and improvement of the creek channel in the southern part of the city of Syracuse.

The dam is located on Onondaga Creek, in the Onondaga Indian Reservation, about 1,700 feet downstream of the confluence of the south and west branches of Onondaga Creek.

The channel improvement is located in the southerly part of the city of Syracuse, and extends from Ballantyne Road, the upstream limit of the previously improved channel, to above Dorwin Avenue, the southerly limit of the city of Syracuse.

## III. BRIEF DESCRIPTION

An earth rolled-fill, flood control retention dam, a concrete side channel spillway and an unregulated automatic outlet was constructed. Piezometers and settlement gages were constructed in the embankment of the dam and behind the east spillway wall. An automatic recording gage has been installed in a gage house on top of the dam westerly of the outlet conduit.

An access road was constructed from Hitchings Road to the west of left abutment of the dam.

The channel improvement consists of realining and straightening the Onondaga creek channel, constructing earth levees, constructing a concrete drainage structure, a concrete flume, a concrete drop structure, a steel sheet pile control weir and channel paving. Highway bridges at Seneca Turnpike and Dorwin Avenue and a footbridge midway between Seneca Turnpike and Ballantyne Road were constructed by the State of New York.

## IV. PROTECTION PROVIDED

The Onondaga Dam and downstream channel improvements are designed as flood control measures to provide additional flood protection for the city of Syracuse, New York. Onondaga Creek meanders through the city of Syracuse and in the southerly part of the city, between Ballantyne Road and Dorwin Avenue, the creek, prior to improvements, was winding and overflowed at about 1,000 c.f.s. causing damage at frequent intervals. Improvement of this channel to reduce frequency of damaging floods was necessary, but such improvement would eliminate a large amount of valley storage, and thus tend to increase flows downstream. Since a reduction in storage would be made by channel improvements, it was necessary to provide reservoir storage before extending the channel improvement farther upstream of the then existing improved channel. The new channel as re-alined and improved provides a capacity of 6,000 c.f.s. In combination with the reservoir regulation, this provides a high degree of protection to the adjacent area.

The dam has an unregulated outlet with a maximum discharge capacity of 1,270 c.f.s. The maximum discharge from the reservoir in combination with the flow from uncontrolled areas, will not cause serious flooding along the unimproved channel in the area between the dam and the improved channel in the city of Syracuse. The reservoir discharge, combined with flow from the uncontrolled area, will exceed the capacity of the improved channel at extremely rare intervals.

## V. CONSTRUCTION HISTORY

Construction of the earth, rolled-fill, flood control dam with dished side slopes, a concrete side channel spillway, an unregulated automatic outlet, and appurtenant works was commenced on 5 May 1947 by contract with S. J. Groves and Son, Minneapolis, Minnesota, and completed on 19 August 1949.

Planting of shrubs on the downstream slope of the embankment of the dam was commenced on 16 September 1949 by contract with the Saxe Construction Co. and completed on 31 October 1949.

Clearing the reservoir area of dead and diseased timber and other snags below elevation 480 commenced during October 1948 and was completed during June 1949. The clearing operations were accomplished by hired labor and rented equipment.

A contract for construction of the access road from Hitchings Road to the west abutment of the dam was awarded to the Central Highway Corp. Contract operations commenced on 3 May 1949 and were completed on 1 September 1949.

A contract for construction of the flood protection improvements on Onondaga Creek in the southerly part of the city of Syracuse was awarded to the D. W. Winkelman Co. Work began on 22 July 1949 and was completed on 6 July 1951.

Construction of a steel sheet pile weir with stone paving commenced on 28 November 1951, and was completed on 2 January 1952. The steel sheet piling was furnished by the State of New York. The construction of the weir and adjacent stone paving was accomplished by hired labor and rented equipment.

## VI. LOCAL COOPERATION

Requirements of local cooperation provide in part that "local interests give assurances satisfactory to the Secretary of the Army that they will. . .: Maintain and operate works after completion in accordance with regulations prescribed by the Secretary of the Army." Assurances of local cooperation for the project were given by the State of New York on 27 October 1943 and approved by the Secretary of the Army on 26 February 1944.

Regulations have been issued for maintenance and operation of flood control works, pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented.

## VII. GENERAL PROCEDURES

A. General. General rules for the maintenance of flood protection facilities are stated in the Regulations. Further details and suggestions for complying with these requirements are given in the following paragraphs. Location, plan and sections of the improvements are indicated on Plates 22 to 64.

B. Duties of the Superintendent. The Regulations provide that the cooperating agency will designate an official called the "Superintendent" who will be responsible for carrying out the provisions for maintenance and operations of each flood-protection project. The Department of Public Works of the State of New York will designate a Superintendent from their available personnel. In addition to the duties which are outlined in other portions of the manual, the Superintendent has a general responsibility for developing and maintaining an organization which can efficiently carry out the maintenance and operation of all structures and facilities during flood periods and the inspection and maintenance of the project works at all other times.

C. Improvements or alterations to the project. Drawings or prints of proposed improvements or alterations to the dam or appurtenant structures, required by paragraph (a) (5) of the Regulations, should be submitted, in triplicate, to the District Engineer, Corps of Engineers, Engineer Park, Buffalo 7, N. Y. Submission of drawings should be sufficiently in advance of initiation of the proposed construction to permit adequate study and consideration of the work. Drawings, in duplicate, or reproducible prints showing any improvement or alterations as finally constructed should be furnished the District Engineer, Corps of Engineers, after completion of the work.

D. Semi-annual report to Corps of Engineers. The semi-annual report required by the Regulations is to be submitted to the District Engineer, Corps of Engineers, Engineer Park, Buffalo 7, N. Y. The reports should cover inspection and maintenance of the works and should include dated copies of inspection check lists or report sheets made during the period covered by the report. In case repairs have been made, either temporary or permanent, the nature and dates of construction are pertinent and should be included. Prints of any photographs showing the protective works in operation during floods are desired whenever available.

E. Periodic inspections. Periodic inspections as required by the Regulations should be made at the following times:

1. Immediately prior to the beginning of a major flood season (generally considered to include the months of March and April).

2. Immediately following each major high water period.

3. Otherwise at periods not exceeding 90 days.

4. At such other times as may be deemed necessary by the Superintendent.

F. Joint inspections. It is desired that a joint inspection of the project works be made annually by the District Engineer, Corps of Engineers, or his authorized representatives, and the Superintendent immediately prior to the spring flood season. Arrangements for this inspection should be initiated by the Superintendent.

G. Check sheets. To facilitate inspection, either routine or emergency, there are suggested forms of check sheets shown in Plates 10 to 15. These, or similar forms, should be used for each inspection to insure that no feature of the protective system is overlooked. Any feature requiring repairs should be noted thereon; satisfactory items should be indicated by check.

## VIII. PROJECT FEATURES

A. Description of improvements constructed:

1. Dam and appurtenances.

a. Embankment. - An earth, rolled-fill embankment approximately 1,780 feet long, with a maximum height of 67 feet, providing a free board of 5.7 feet above the spillway design flood was constructed. The dam is 25 feet wide on top and has varying base widths from 140 feet to about 320 feet. The embankment slopes vary from 1 on 3 at the bottom to 1 on 2 at the top. The upstream slope of the embankment is protected from wave action and erosion by dumped stone riprap, 3 foot thick, placed on a 12-inch layer of gravel and sand. The downstream slope is protected from erosion by a rock toe of varying thickness extending approximately halfway up the slope. Above the terminus of the riprap to the top of the dam an extensive planting of Hall Japanese Honeysuckle (Lonicera Japonica Hallcane) plants was made. On top of the dam, a bituminous treated gravel surface roadway 1-foot thick and 20 feet wide was constructed. Along the bottom of the downstream slope a rock filled toe trench was provided to facilitate drainage of water. This relief toe trench connects with a diversion ditch near the left abutment of the dam which connects with and empties into the old Onondaga Creek channel approximately 750 feet downstream of the dam. A steel wire cable guard rail attached to concrete posts extends along both sides of the roadway. Plan, sections and details of construction are indicated on the "as built" drawings, plates 37 to 40, inclusive, and 64.

b. Outlet works. - A concrete outlet structure, for the release of flood waters from the reservoir, was constructed near the east end of the dam. The principal feature of the outlet works is an uncontrolled concrete conduit, 6.5 feet in diameter and approximately 329 feet long, benched into the rock of the right abutment with a concrete-lined stilling basin approximately 71 feet long at the downstream (exit) end. At the upstream (inlet) end, a concrete intake structure was built which starts at the terminus of the 6.5-foot diameter conduit and flares out to a 31 feet by 12 feet 9 inches rectangular orifice at an angle of 45° to the center line of the conduit, trash racks of black steel pipe have been installed. Rock paving 18 inches thick on a 9-inch gravel and sand base has been placed around the intake structure.

Intake and exit channels for the outlet works are open cuts. The intake channel is in earth 1,087 feet long and 20 feet wide at the bottom. The slopes of the intake channel have been lined with 2 feet of dumped riprap on a 9-inch gravel and sand base. The exit channel is unlined, 1,700 feet long, 800 feet of which is in rock and 18 feet 6 inches wide at the bottom.

Plan, sections and details of construction of the outlet works are indicated on the "as built" drawings, plates 41 to 44, inclusive.

c. Spillway and spillway channel. - A side channel spillway was constructed in the rock on the right abutment of the dam and consists of: an approach channel about 240 feet long and varying from 200 to 250 feet wide excavated partly in rock; a concrete ogee type weir having a crest length of 200 feet and a crest elevation of 504.5 feet above L.W.D.; a concrete triangular control weir 6½ feet high, 50 feet wide and 50 feet long was placed in the exit channel below the spillway weir; a concrete-lined spillway race channel generally 50 feet wide and 350 feet long; and an unlined outlet channel 50 feet wide and about 685 feet long to its intersection with the conduit outlet channel, the initial 30 feet of the unlined channel has concrete bottom paving. Two flush reinforced concrete manholes with iron frames, covers and ladders were constructed adjacent to the east and west spillway channel walls. The easterly manhole is approximately opposite the downstream end of the spillway channel control weir and the westerly manhole is located just southerly of the end of the west spillway wall. An automatic siphon and a manually-operated sluice gate have been placed in each manhole. The gate is controlled by means of a handwheel lift and screw stem located inside the manhole structure. Details of construction of manhole are indicated on Plate 47. Plan, sections and details of construction of spillway and appurtenances are indicated on the "as built" drawings, Plates 45 to 56 inclusive.

d. Gage house and gage. - On top of the embankment of the dam along the southerly edge of the road and just westerly of the center line of the outlet conduit, there was constructed a brick masonry, reinforced concrete gage house. Set into the dam embankment beneath the floor of the gage house is a 36" C.I. pipe which acts as the well for the gage. An automatic recording water level gage, which records the elevation of the pool in the reservoir behind the dam, was installed by the United States Geological Survey. Plan, sections and details of construction are indicated on the "as built" drawing, Plate 57.

e. Settlement gages. - Twenty-two (22) settlement gages consisting of lengths of 1½" steel pipe with 2' x 2' x 3/8" steel plates welded to the bottom of the pipe and caps at the top were installed. Seven (7) are located in the downstream rock toe of the dam embankment and fifteen (15) are located in 3 lines of 5 gages per line across the embankment. Location and details of the settlement gages are indicated on Plate 38 of the "as built" drawings.

f. Piezometers. - Twelve (12) piezometers consisting of lengths of 1½" steel pipe with well points and caps were installed: eight (8) located in the downstream rock toe of the dam embankment, and four (4) located behind the east spillway wall. Location and details of the piezometers are indicated on Plates 38 and 45 of the "as built" drawings.

g. Staff gage. - Set on the top of the west wall of the conduit intake structure are bronze numerals which indicate the elevations above mean sea level datum. Enameled steel marker plates indicating the elevation above mean sea level datum are affixed to the inner face of the easterly concrete stair stringer of the stairway. The stairway is located on the slope of the embankment of the dam, directly above the top of the conduit intake structure and rises to the top of the dam. Location and details of the staff gage are indicated on Plate 58 of the "as built" drawings.

2. Access road to dam. A compacted gravel, double-surface treated road 9 inches thick, 22 feet wide was constructed from Hitchings Road to the west or left abutment of the dam. The overall length of the road is 2,570 feet. The access road intersects the western terminus of the road on top of the dam embankment. Concrete gutters, catch basins and drainage facilities were installed where necessary. A reinforced concrete cattle pass, 4 feet wide and 6 feet high was constructed under the access road about 155 feet east of Hitchings Road. Plan, sections and details of the access road, miscellaneous drainage facilities and appurtenances are indicated on Plates 59 to 63, inclusive, of the "as built" drawings.

3. Reservoir. At the spillway crest level (Elev. 504.5 feet), the reservoir will flood approximately 860 acres and will extend approximately 2.7 and 2.1 miles up the south and west branches, respectively, of Onondaga Creek. The reservoir area was cleared of all dead and diseased trees and all snags below elevation 480, to which the pond will rise about once in 10 years. There are highways in the reservoir which were not raised or relocated due to the fact that they may be flooded only at rare or extreme intervals.

4. Channel improvements.

a. Creek channel. - Channel of the creek was improved and realined to various new cross sections and a new bottom profile from a point approximately 1,550 feet upstream of Dorwin Avenue northerly, or downstream, to the previously paved channel at Ballantyne Road, an overall distance of about 2.1 miles. Except for the upper portion, the channel was constructed with a dished cross-section. Spanning the approximate center of the channel is a 10-foot wide flat section, then side sloped from this point, at varying widths, to secure an elevation 3 feet above the flat section and further side sloped at a 1 on 2½ slope to existing or altered ground surfaces.

At the upstream end of the project, from about 1,550 to 920 feet upstream of Dorwin Ave., the channel was realined and a pilot channel of 10-foot in width was excavated. From the near point (920 feet above Dorwin Ave.), the channel was widened gradually to provide an overall 38-foot wide dished section with a 10-foot wide flat center channel portion, for the approach to the drop structure.

Throughout the entire length of the new channel, where general re-alinement was made, it was necessary to construct channel plugs where the old creek bed intersects the new channel. Earth-fill levee embankments were constructed as plugs for sealing the existing creek openings. At other locations, cut-off channels and paved gutters were provided to direct the flow of water, or the drainage from the adjacent areas, into the new channel. Near the lower end of the project just upstream of Ballantyne Road the channel was reduced in its overall width and confined to a narrower paved channel flume leading into the existing paved channel just downstream of Ballantyne Road. This portion of the channel is paved with pre-cast concrete blocks on the bottom and side slopes leading into the concrete flume. All details of the channel alinement, profiles, sections and appurtenances are indicated on the "as built" drawings, Plates 22 to 35, inclusive.

b. Spoil areas. - Near the upstream end of the project along the right bank the contractor secured the rights for and constructed a spoil area. Another spoil area was constructed adjacent to the left bank commencing at a point about 2,000 feet downstream of Dorwin Avenue and extending downstream to about West Seneca Turnpike. In this area, a 20-foot wide berm was established from the top of the channel bank to the toe of the spoil area bank. Downstream of West Seneca Turnpike, along the left bank, the old creek channel and the mill race were filled in and a portion of the area between the mill race and the new channel was used for a spoil area. At other locations along both banks, the old creek channel was filled in with the exception of the portion along the right bank from Ballantyne Road southerly (upstream) to approximately West Warrington Road. All of the spoil areas were graded to drain either into the new channel or into other drainage facilities. All spoil areas and their graded drainage slopes are indicated on the "as built" drawings, Plates 23, and 25 to 30, inclusive.

c. Levee embankments. - Near the downstream end of the project, just above Ballantyne Road, levee embankments were constructed along both banks of the new channel. The levee on the left bank is about 1,400 feet long and the levee on the right bank is about 1,000 feet long. The levees are earth-fill embankments 10 feet wide on top, the top surface shaped for drainage, and side slopes of 1 on 2½. On all surfaces of the levee embankments, 6 inches of topsoil has been placed and the surfaces seeded. Details and locations of the levee embankments are indicated on the "as built" drawings, Plates 23, and 25 to 30, inclusive.

d. Drop structure. - A drop structure was constructed upstream of and passing under the highway bridge at Dorwin Avenue. The drop structure consists of a $2\frac{1}{2}$-foot thick concrete-paved floor with inlet and outlet channel floors paved with a 2-foot thick precast concrete-block paving set on a 9 inch gravel base. Concrete, cantilever-type retaining walls were constructed along the left and right banks and extend along the concrete-paved flume channel and the precast concrete-block paved inlet and outlet channels of the drop structure. Slopes of the inlet and outlet channels are paved with $1\frac{1}{2}$-foot thick concrete blocks set on a 6" gravel base. Chain link fencing $3\frac{1}{2}$ feet high was erected on top of the retaining walls. Downstream of the terminus of the concrete-block paved outlet channel, additional bank protection was provided by dumping riprap on both banks of the channel. Details of the constructed features of the drop structure are indicated on the "as built" drawings, Plates 31 and 32.

e. Drainage structure. - A drainage structure was built through the levee embankment along the left bank of the channel about 800 feet upstream of Ballantyne Road. Twin 48-inch-diameter reinforced-concrete pipes were placed in the levee embankment passing through a reinforced-concrete manhole. The uncontrolled inlets of the pipes are located on the landward side of the levee. An inlet structure was provided, the apron and walls of which are paved with reinforced concrete and the adjacent banks are protected from erosion by precast concrete-block paving. Channelward of the center of the levee embankment, a reinforced concrete manhole was constructed in which the flow of water passing through the twin pipes is controlled by means of manually operated sluice gates. Twin, 48-inch diameter reinforced concrete pipes were placed through the embankment from the manhole to the top of the channel bank. Outlets of the pipes are controlled by two automatic drainage gates mounted on the wall of an outlet structure. The apron and walls of the outlet are paved with reinforced-concrete and the adjacent banks are protected from erosion by precast concrete-block paving.

The manually operated sluice gates are of cast iron, rising stem, adjustable side wedges, square frames, with circular openings and were supplied by the Chapman Valve Mfg. Co. The gates are typed by the manufacturer as "48-inch Table 5, Circular Sluice Gate Assembly." The gates are controlled by means of hand-operated floor stands mounted on the roof of the reinforced concrete manhole, at the level of the top of the levee embankment. The floor stands and the connecting stems for the gates were also supplied by the Chapman Valve Mfg. Co. and are listed as their Type M-10 floor stand with indicators to denote positions of the sluice gates.

The reinforced concrete manhole is rectangular-shaped and access is provided into the manhole structure by means of 3/8 inch thick-hinged steel cover plates set into the roof or top of the structure. Wrought iron manhole steps, 3/4 inch diameter, were set into the wall of the structure to facilitate access to the sluice gates located at the invert of the manhole.

The 48-inch diameter automatic drainage gates located at the outlet are of the circular, flap gate type supplied by Brown and Brown, Inc., Lima, Ohio, and are listed as their 48-inch diameter circular type "M" automatic drainage gates.

Location, details, sections and plan of the drainage structure are indicated on Plate 34 of the "as built" drawings. Details of the sluice gates and drainage gates are indicated on Plates 14 to 21.

f. Concrete flume. - At the downstream end of the project, the old channel paving above Ballantyne Road was removed and replaced with a shorter and wider section to provide better flow conditions. The new channel above this point is considerably wider than the paved portion and therefore an approach section and a transition section were constructed to reduce the overall channel width to the existing narrower paved portion. The approach channel is paved with 2-foot thick precast concrete-blocks, the side slopes are protected from erosion by 1½-foot thick precast concrete block paving. The transition section channel bottom and side slopes are paved with reinforced-concrete. The 21-foot wide channel portion and the adjacent slopes are paved with reinforced-concrete. Intersecting the new paved channel portion of Onondaga Creek, along the right bank, a vertical walled concrete paved flume was constructed to provide for the flow of Cold Brook, City Line Brook and local drainage. The approach channel to this flume was paved with 2-foot thick precast concrete blocks set on a 9-inch gravel base and the bank slopes were protected from erosion by precast concrete block paving terminating at the face of the wing walls. The vertical faced concrete walls were extended from the flume to provide wing walls for the approach channel and are located at the top of the bank slopes. Chain link fencing 3-foot high was placed on top of the wing walls, the flume wall and along the top of the slope paving of the new creek channel. The area behind the walls and top of banks was filled in, graded to drain and seeded. A staff gage board has been set into a recess of the right concrete flume wall approximately 4 feet upstream of the downstream end of the right flume wall at Sta. 104 + 46. Details, plan and sections of the flume are indicated on Plates 32 and 33 of the "as built" drawings. Details of the staff gage installation are indicated on Plate 35.

g. Diversion ditch. - At the upstream end of the project above Dorwin Avenue, along the left bank, a new diversion ditch was constructed to provide for the flow of water from Dorwin Spring, and the waste water from an adjacent gravel pit. This ditch joins the old creek channel which has been plugged downstream of this intersection and diverted into the improved creek channel by means of a cut-off channel thru the left bank. The diversion ditch is two feet wide at the bottom with side slopes of 1 on 2. Location, plan and profile of the Dorwin Spring diversion ditch are indicated on the "as built" drawings Plates 23 and 25.

The old creek channel located easterly of the right bank from Ballantyne Road southerly to West Warrington Road was left open to provide for the drainage from Cold Brook, City Line Brook, discharge from small storm sewers and local drainage.

h. Control weir. - At the upstream end of the project on Onondaga Creek approximately 1600 feet upstream of Dorwin Ave., a steel sheet pile weir with rock paving was constructed. The weir consists of 12-foot lengths of piling driven to provide an overall width of 81 feet 9 inches. Rock paving 3 feet thick was placed in the channel for distances of 10 feet upstream and downstream of the piling over the entire width of the weir. The plan and section of the weir are shown on the "as built" drawing, Plate 67.

5. Bridges. Two highway bridges and one foot bridge spanning the new creek alinement were constructed by local interests. The new highway bridges are located at Seneca Turnpike and Dorwin Avenue, and the foot bridge is located at the lower end of the project approximately 1,330 feet upstream of Ballantyne Road.

6. Project signs. Project signs have been placed at various locations. These signs are approximately 8 ft. wide and 4 ft. high set approximately 4 feet above ground level and imbedded 4 feet into the ground surrounded by concrete. The signs are constructed of red oak planks 2" thick and the posts are 6" x 6" solid oak. Lettering denoting the project name, etc. has been routed in the planks and enameled in white. Two lacquered sheet metal castle insignias of the Corps of Engineers have been attached to the upper corners on the face of the signs. The entire sign has been coated with linseed oil. The signs are located at the following points:

(1) At the intersection of Hitchings Road and the access road at Onondaga Dam.

(2) Along the right bank of Onondaga channel downstream of Dorwin Ave.

(3) Along the right bank of Onondaga channel upstream of West Seneca Turnpike.

(4) Along the right bank of Onondaga channel upstream of Ballantyne Road.

B. Maintenance

1. Dam and Appurtenances.

a. Embankment. - The maintenance of an earth dam is a continuing operation. The downstream slopes must be continually inspected and the repair of rain washes and erosion accomplished as quickly as possible. When the reservoir is filling or is storing water, the Superintendent shall inspect the downstream face of the dam, the abutments, and the area adjacent to the downstream face of the dam for springs, sand boils, sloughing away of embankment, or other indications of leakage through, around, or under the dam. When the reservoir is emptying, the Superintendent shall inspect the upstream face of the dam and abutments for slides or signs of impending slides. The upstream slope, which has a blanket of riprap over a gravel base, must be inspected and repairs accomplished as the need therefor arises. The Hall Japanese Honeysuckle plants on upper portion of the downstream slopes do not require any maintenance. It will be necessary to make periodic inspections and to replace any dead or dying vines in order that the primary purpose of the planting, soil stabilization, will be accomplished over the entire surface of the embankment. The bituminous treated gravel surface roadway on top of the dam embankment should be inspected and repaired as the need therefore arises. The diversion ditch located near the left abutment should be inspected and any debris or trash accumulation removed from the ditch. The steel wire cable guard rail and concrete posts along both sides of the roadway require periodic inspection and maintenance in order that their protective purpose may be completely realized.

b. Outlet works. - The inlet and exit channels of the works should be kept free of any debris or trash accumulation that might impair the free flow of water within the channels. Any excessive bank erosion or washes should be repaired and any bank slides removed from the channels as soon as possible. The concrete conduit, the concrete outlet structure and the concrete-lined stilling basin will be included in the periodic inspection. Any evidence of cracks in or spalling of the concrete, evidence of seepage and extreme abrasions should be noted and the necessary repairs made as soon as practicable in order to prevent further deterioration of the outlet works. Any major or large accumulation of debris, which tends to impound the water immediately behind the installed trash rack in the inlet structure, should be removed immediately. The rock paving around the intake structure should be inspected periodically and any displaced paving immediately replaced in order to prevent serious erosion of the embankment of the dam.

c. Spillway and spillway channel. - The spillway weir, the spillway walls and floor, and the triangular control weir, should be inspected periodically. Any cracks in or spalling of the concrete and extreme abrasions should be noted. The construction joints should be carefully examined and any displacement of the joint material that requires replacement noted. Weep holes and the drainage manholes on the banks should be inspected for proper functioning. Inspections of the unpaved portion of the spillway channel should also be made periodically to determine any accumulation of debris, bank erosion washes or slides that might impair the flow of water within the channel. All necessary repairs to the concrete structures should be made as soon as practicable to insure the overall stability of the spillway structure. Accumulations of debris, bars or other snags should be removed from the spillway channel as soon as possible. Periodic inspections should be made of the manhole structures, the sluice gates and the automatic siphons located in the manhole structures. In the fall, the sluice gates may be opened temporarily and after the water has left the manholes, the sump pits and the automatic siphons should be inspected and all debris and sediment removed from the sump pits and around the automatic siphons. After cleaning, the sluice gate should be closed and left closed for the winter. The chain link fencing on top of the walls should be inspected to make sure that it has not become loosened from its mountings in the wall, and the fencing loosened from its ties to the rail supports. The fencing should be repaired and painted, when necessary, to restore it to its original condition.

d. Gage house and gage. - The exterior and interior surfaces of the gage house walls, roof and floor should be inspected to determine any cracks due to settlement or other signs of deterioration. The interior of the gage house should be maintained in a neat and orderly fashion and any necessary repairs to the structure should be made immediately to prevent any further deterioration. The automatic recording gage will require ordinary maintenance, changing of charts and checking of equipment for efficient operation. The intake pipe should be kept clean to insure a free flow of water through the pipe leading to the gage well.

e. Settlement gages, Piezometers and Staff gage. - No maintenance is required for the settlement gages and piezometers. The bronze numerals and the enameled steel marker plates of the staff gage should be inspected periodically to make sure that they have not become loose from their mountings. Any chips in the enameled surface of the marker plates should be touched up with similar color enamel paint to prevent rusting of the metal.

f. Check sheet. - A suggested form of check sheet for reporting conditions found during periodic inspections of the dam and appurtenances is given in Plate 10.

2. Access road to dam. Periodic inspections of the roadway are required to determine any breaks or cavities in the road surface, condition of the shoulders and erosion or washes of the adjacent banks or fill embankments. Repairs should be made immediately to restore the roadway and shoulders to their original condition. Inspection of the concrete gutters and catch basins should be made and all debris that would impair the free flow of water in the gutters and catch basins should be removed immediately. Any necessary repairs should be made as soon as practicable. The reinforced concrete cattle pass should also be inspected with a view to determining its stability for maintaining the roadway over the structure.

3. Reservoir. Periodic inspections of the reservoir area are required to determine any silt deposits, debris and trash accumulations and dumping of materials. The frequency and extent of cleaning operations can be determined best by experience. The removal of dead or diseased trees in the reservoir area is imperative so that they will not be washed downstream into the outlet works or become an obstruction in the spillway channel. When the reservoir has impounded water during periods of high stages and later the drawdown has been effected, an inspection of the reservoir area should be made to determine if any isolated pools remain after the drawdown. These pools should be investigated to determine if any fish have been stranded and if possible, the fish should be caught and removed to flowing streams. The isolated pool areas should be filled and leveled to the remainder of the reservoir floor to prevent formation of similar pools during other high stage periods.

4. Channel improvements.

a. Channels and floodway.

1. Paragraph (g) (1) of the regulations pertaining to channels and floodways directs the Superintendent to make periodic inspections and take immediate steps to remedy any adverse conditions disclosed by such inspections and to provide for any periodic repairs and all cleaning that may be required to restore the channel to its improved cross section and bottom profile.

2. All debris should be cleared from the channel as it collects additional floating debris which restricts the free unobstructed flow of water. Particular attention should be given to any shoaling that may occur between restricted openings such as bridge openings. Shoals, snags and other debris should be removed from the channel and floodway annually, preferably during the latter part of the fall season, so that the channel and floodway will be utilized to its full capacity during high-water spring flows.

3. All debris such as tree stumps, trees, trash, and ashes, removed from the channel or from the floodway should be deposited in appropriate dumping grounds. Shoaled material removed from the channel may be deposited in the spoil areas described in paragraph VIII.A.4b, and graded to conform to the slope as constructed. No material shall be deposited between the top of bank and the existing levees.

4. No material of any kind shall be deposited in the floodway beyond the upstream limit of the overall improvement as any material so deposited would be washed downstream during periods of high water causing an excessive shoaling in the channel, thereby reducing its capacity and efficiency.

5. Paragraph (g) (vi) of the regulations directs the Superintendent to be certain that approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works. Weeds, debris or other obstructions should be removed from the tributary channels and ditches annually, at the same time the project works are restored to their improved conditions.

6. A suggested form of check sheet for reporting conditions found during periodic inspections is given in Plate 11.

b. Spoil areas. - Materials deposited in the spoil areas described in paragraph VIII.A.4b, may be placed to any desired elevation, but should be placed so as not to cause gullies or washes in the surface of the existing levee. All materials should be graded to conform to the existing slope to provide for drainage to the existing drainage facilities. Materials so placed and graded should be seeded.

c. Levee embankment. - The pertinent requirements for maintenance as stated in the regulations are generally self-explanatory. Should inspection disclose conditions that are potentially dangerous, immediate corrective measures should be taken to prevent further deterioration. The maintenance of sod on levees is particularly important, and activities detrimental to its growth should be discouraged. These include burning of existing grass and brush, burning of trash, burrowing of rodents, unauthorized traffic, and digging for worms by fisherman. Sod is the first line of defense against erosion and all barren spots should be reseeded as soon as practicable. Prior to seeding, it is recommended that fertilizer having an analysis of 5-10-5 be applied at the rate of 15 pounds for 1,000 square feet. A good blend of grass seed should be obtained and sown at the rate of 3 pounds per 1,000 square feet. Routine mowing of grass to a minimum height of four inches and cutting of weeds before they go to seed are beneficial to sod growth and will prevent development of serious infestations that can be corrected only by extensive renovation and reseeding. Regular maintenance and repair should be scheduled and accomplished by the Superintendent to insure that the levee will be maintained in the best possible condition. A suggested form of check sheet for reporting conditions found during periodic inspections is given in Plate 12.

d. Drop structure and concrete flume structure. - The walls and floor of both the drop structure and flume structure are constructed of reinforced concrete of varying thicknesses. These structures should be inspected periodically and notes made of any cracks or spalling of the concrete, or extreme abrasions. The construction joints should be carefully examined and any displacement of the joint material or any material that requires replacement noted and repairs thereto made as deemed necessary. Additional inspections of the walls which form a part of the structure are necessary to insure that they are being kept in the best possible conditions and that no circumstances arise which would endanger the stability of the wall. Immediate steps should be taken to eliminate encroachments, to prevent accumulation of trash and debris, to insure that no fires are being built near the wall, and to effect repairs found necessary by the inspections. The chain link fencing set into the top of the walls should be inspected to make sure that it has not become loosened from its mountings in the wall and the fencing loosened from its ties to the rail supports. The fencing should be repaired and painted, when necessary, to restore it to its original condition. The rock paved inlet and outlet channels of the drop structure, the rock paved approach channels to the concrete flume and the precast concrete block paving should also be inspected periodically. Any riprap paving or concrete block paving displaced due to undercutting, scouring, or erosion, shall be replaced so as to restore the paving or bank protection to the conditions indicated on the "as built" drawings. Any evidence of unusual undercutting, erosion or abnormal conditions of the rock or concrete block paving should be reported in order that necessary remedial measures may be taken. The staff gage should also be inspected to make sure it has not become loosened from its mountings. The condition of the face of the gage board should be noted and repaired or painted when necessary to restore it to its original condition. A suggested form of check sheet for reporting conditions found during periodic inspections is given in Plate 13.

e. Drainage structure. - Provision for maintenance of the constructed drainage facilities are given in paragraph (d) (1) of the regulations. The inspections at the intervals indicated in paragraphs VII.E. and F. of this manual are to insure that inlet and outlet channels and pipes or culverts are free from trash and debris; that the drainage gates are unobstructed, in proper alinement, and operating freely; that the pipes and headwalls are in good condition; that no erosion is occurring which will endanger the headwall structure; and that no fires are being built in pipes and structures. The regulations require that drainage "gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days". Debris and ice at outlets, which may block the automatic drainage gates in open as well as in closed position, should be removed as part of the regular maintenance. A suggested form of check sheet which provides for reporting the conditions found, is given in Plate 13.

f. Diversion ditch. - Periodic inspections of the diversion ditch and the old Onondaga Creek channel should be made. Inspections and maintenance should conform to requirements set forth in paragraph (g) (1) of the regulations pertaining to channels and floodways and the suggested means of accomplishing this work as stated in paragraph VIII.B.4.a. Report of these inspections should be included with the report for the channels. Provision has been made in item 9 of Plate 11 for reporting conditions found in the Dorwin Spring diversion ditch.

g. Control weir. - Paragraph (h) of the regulations provides for the maintenance of miscellaneous structures which were constructed as a part of the protective works and other structures which function as a part of, or affect the functioning of the protective works. The control weir should be included in the periodic inspections. Any excessive bank erosion or washes adjacent thereto should be repaired and any displaced riprap should be restored to its original location and cross section in order that the stability of the steel sheet piling will not be endangered by scouring action of the waters passing over the structure.

h. Bridges. The two highway bridges and the foot bridge constructed by local interests will also require periodic inspections. Maintenance of the highway bridges and the foot bridge do not require any extraordinary maintenance. The State of New York provided these bridges and will of necessity, maintain them in accordance with their prescribed standards for maintenance.

i. Project signs. The four project signs should be inspected annually and in the spring of each year, each sign should be washed and a coating of linseed oil placed over the entire face of the sign, the posts, and the back of the sign. Every 2 years, in conjunction with the spring maintenance, the white enamel placed in the routed lettering should be re-enameled and the castle insignias re-lacquered.

## IX. OPERATION

A. Dam, outlet works, access road and reservoir area. No operation is required for any of these features of the project works.

B. Road barricade. The road barricade, located at the intersection of the access road and the westerly end of the dam, should be kept locked to prevent unauthorized vehicles from using the road on top of the dam.

C. Gage.

1. The automatic recording water level gage, records the elevation of the pool in the reservoir behind the dam. The gage was installed by the United States Geological Survey and instruction pamphlets, and manufacturer's catalogs were placed in the gage house, as well as a tape for checking gage. It is requested that the pamphlets and catalogs remain in the gage house suitably placed so that they are available to the personnel servicing or checking the gage.

2. The Superintendent should arrange for personnel to change the charts on the gage weekly and service and check operations of the gage at the same time. The weekly charts, recording the water levels, should be mailed directly to the District Engineer, Corps of Engineers, Buffalo District, Engineer Park, Buffalo 7, New York.

D. Settlement gages.

1. Readings to ascertain the elevation of the settlement gages, in order to determine possible settlement, should be taken once every six (6) months.

2. The following bench marks can be used in determining the elevations of the settlement gages:

BENCH MARKS - ONONDAGA DAM

| | | | |
|---|---|---|---|
| USED BM No. 1 | Elevation | 583.46 | Bronze plug, Sta 5 ≁ 47 CL Dam |
| USED BM No. 3 | " | 509.40 | Bronze plug 600 ft. south of Sta 19 ≁ 00 CL Dam |
| USED BM No. 4 | " | 463.69 | Bronze plug 600 ft. south of Sta 8 ≁ 00 CL Dam |
| TBM No. 1 | " | 503.03 | Chisel mark north end of monolith #13 Sta 103 ≁ 70, spillway channel, east wall |
| TBM No. 2 | " | 517.03 | Chisel mark north end of monolith #7 Sta 102 ≁ 12.75, spillway channel, east wall |
| TBM No. 3 | " | 475.06 | Chisel mark on northwest corner of conduit manhole cover frame, Sta 314 ≁ 23 |

BENCH MARKS - ONONDAGA DAM (contd)

| | | | |
|---|---|---|---|
| TBM No. 4 | Elevation | 498.60 | Chisel mark on southwest corner of siphon manhole, west wall, Sta 104 + 56 |
| TBM No. 5 | " | 517.28 | Nail in stump 400 ft. north of Sta 2 + 72 west abutment CL Dam |
| TBM No. 6 | " | 507.89 | Chisel mark on southeast corner of head-wall for west abutment drain, 300 ft. north of Sta 3 + 75 CL Dam |
| TBM No. 7 | " | 470.36 | Nail in tree, 400 ft. north of Sta 8 + 00 |
| TBM No. 8 | " | 525.20 | Chisel mark on southeast corner of north catch basin at Sta 2 + 72.5 CL Dam |
| TBM No. 9 | " | 525.66 | Chisel mark on northwest corner of gage well house, Sta 17 + 10 CL Dam |

3. A suggested form for recording the settlement gage readings is as follows:

SEMI-ANNUAL REPORT OF SETTLEMENT GAGE READINGS

Project: Onondaga Dam                                        Report No.______________

Date of observation_____

| (1) SETTLEMENT GAGE NO. | (2) PRESENT ELEVATION (AT TOP OF PIPE) Ft. | (3) LENGTH OF PIPE Ft. | (4) PRESENT ELEVATION (BOTTOM OF PIPE) (2)-(3) Ft. | (5) INITIAL ELEVATION (BOTTOM OF PIPE) Ft. | (6) SETTLEMENT (BOTTOM OF PIPE) (5)-(4) Ft. |
|---|---|---|---|---|---|
| SG 1 | | | | | |
| Etc. | | | | | |
| | | | | | |

Remarks:

Submitted_________________

Title_________________

4. The completed forms should be submitted to the District Engineer, Corps of Engineers, U. S. Army, Buffalo 7, N. Y. Graphic records of settlement and water elevations in the gages will be maintained by the Corps of Engineers.

E. Piezometers.

1. Readings to determine the elevation of the water in the various piezometers should be taken as follows:

During normal conditions - once every six months
Peak reservoir stage - when peak stage of reservoir pool exceeds elevation 475 feet
After drawdown - immediately after drawdown to the approximate normal elevation

2. Readings to determine the ground water elevation in the settlement gages are also desired at the same intervals as stated above. The water surface can be referred to the top of the pipe and the surface elevation determined from the elevation of the top of pipe recorded in the latest semi-annual settlement gage reading.

3. The elevation of the water in the gages may be determined through the use of an electrical device, that has given satisfactory results. Personnel of the Syracuse field area office of the Corps of Engineers used this device and it is suggested that the Superintendent contact the Buffalo District office for details of construction and operation of the device and that a similar device be constructed for the use of State personnel.

4. A suggested form for recording the ground water elevation is as follows:

REPORT OF GROUND WATER ELEVATIONS IN PIEZOMETERS AND SETTLEMENT GAGES

Onondaga Dam Report No.________________

Elev. of Reservoir pool____________ Date of observation________

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| LOCATION OF GAGE NO. | ELEV. OF TOP OF PIPE: (in Feet) | SOUNDING TOP OF PIPE TO WATER (in Feet) | ELEV. OF WATER (in Feet - Col. 2 - Col. 3) |
| PZ - 1 | | | |
| PZ - 2 | | | |
| etc. | | | |
| SG - 1 | | | |
| SG - 2 | | | |
| etc. | | | |
| | | | |

Remarks:

Submitted ________________

Title ________________

F. Spillway.

1. No features of the spillway require operation. It is desired to maintain a check on the possible change in alinement of the concrete spillway channel walls. For this purpose there has been established a network of base lines, oriented in relation to the center line of the dam, and a system of measurement check points. Location and description of the survey system for the movement check are indicated on Plates 65 and 66.

2. It is suggested that the Superintendent schedule a survey party to obtain a check on the walls semi-annually.

3. Results of the survey should be forwarded to the District Engineer, Corps of Engineers, Buffalo District, immediately after they have been determined.

4. The sluice gate in each manhole should be raised to an open position during the summer season and lowered to a completely-closed position during the winter season. Raising and lowering of the sluice gate can be accomplished through the manual operation of the handwheel lift and the screw stem which have been provided inside of each manhole.

G. Channels and floodway. Paragraph (g) (2) of the Regulations provides for patrolling the channels during periods of high water. Particular attention should be given to the collection of drift materials at bridges. Such material should be promptly removed or serious damage may result. The Regulations further require that "The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, or other flood control structures repaired."

H. Levees. Among the requirements for operation given in paragraph (b) (2) of the Regulations, the provision for patrolling levees during flood periods is of prime importance. The patrolman should be alert and observant to locate possible sand boils, unusual wetness in the land slope side, indications of slides or sloughs, scouring action and low reaches of levee that may be overtopped, and to see that no other conditions exist which may endanger the structure. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section as soon as practicable.

I. Drop structure, concrete flume structure and control weir. No features of these structures require operation.

J. Drainage structure. Paragraph (d) (2) of the Regulations requires that whenever flood conditions are expected, the drainage gates will be inspected and all sticks or other obstructions which may interfere with their proper functioning shall be removed. Automatic gates shall be closely observed until it is ascertained that they are securely closed. The manually operated gates shall be closed as necessary to prevent inflow of flood water from the creek channel into the area behind the levee.

The manually operated gates are installed as a safety precaution against backwater from the creek channel if the automatic flap gates on the creek side (outlet) of the drainage structure fail to close due to obstructions. The drainage structure shall be inspected frequently during floods to determine whether seepage is taking place along the lines of its contact with the embankment. Immediate steps shall be taken to correct any adverse conditions.

K. Diversion ditch. Operation requirements for the diversion ditch are considered to be similar to the requirements for channels and floodways as stated in paragraph (g) ([illegible]) of the Regulations and paragraph IX.G of this manual.

X. HIGH WATER STAGES

A. General. The basin or drainage areas of Onondaga Creek are as follows: above the dam about 64.1 square miles; at the upper end of the channel improvements in the city of Syracuse (at Dorwin Avenue) 89.3 square miles; at the lower end of the channel improvements (at Ballantyne Road) 90.8 square miles and at the mouth of Onondaga Creek 108.9 square miles. The total drainage area is comparatively small in both length and width and it is not possible to establish flood warning facilities or an extensive flood fighting organization. It is therefore imperative that the dam and appurtenances, the reservoir, the channels, the floodways, the levees, and all of the structures be maintained in accordance with the Regulations, in order that they may efficiently serve their flood protection purpose to the full capacity of the improvements.

B. Operation. The dam and reservoir will collect the waters resulting from extreme rainfalls, snow-melt or both, over the upper portions of the watershed and discharge the waters so impounded through the unregulated outlet works at a rate which will not cause high water stages downstream, based on the rate of discharge through outlet works a flow of water will continue to pass through the area downstream of the dam after the rains have subsided. This will require an extended surveillance of the channel improvements and probable operation of the drainage structure until the reservoir has been drawn down. Rules and regulations for operation of the improvements during flood stages or high water stages have been discussed in other pertinent paragraphs of the manual. It is not intended to restrict the Superintendent, or others concerned to a rigid set of rules. Difficult conditions can usually be met by the methods suggested, together with independent initiative and action along the lines of sound engineering principles.

C. Flood-emergency plan. In accordance with the requirements of the Corps of Engineers, U. S. Army, the Buffalo District has prepared a "Flood-Emergency Plan" in which the responsibilities and procedures of the Buffalo District before, during, and after flood periods are outlined. This manual includes basic data, maps, personnel organization for flood emergencies and all information necessary to insure prompt action under flood emergency conditions. Copies of the "Flood-Emergency Plan" have been distributed to all interested and affected agencies. Additional copies may be secured from the District Engineer, Corps of Engineers, U. S. Army, Engineer Park, Niagara and Bridge Streets, Buffalo 7, New York.

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order,

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways* — (1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities* — (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWF)

[SEAL] J. A. ULIO,
*Major General,*
*The Adjutant General.*

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## TITLE 33—NAVIGATION AND NAVIGABLE WATERS

### Chapter II—*Corps of Engineers, War Department*

### PART 208—FLOOD CONTROL REGULATIONS

#### MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 638; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

**§ 208.10** *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) *A reserve supply of materials* needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

[illegible] super-intendent [illegible] report to the District [illegible] covering inspection, mainte[illegible] of the protective [illegible]

(7) The District [illegible] his authorized representatives shall have access at all times to [illegible] of the protective works.

(8) Maintenance [illegible] or repairs which the District Engineer deems necessary shall be [illegible] made.

(9) Appropriate [illegible] shall be taken by local authorities [illegible] insure that the activities of all [illegible] organizations operating public or private facilities connected with the [illegible] are coordinated with [illegible] Superintendent's organization [illegible] flood periods.

(10) The War Department will furnish local interests with [illegible] Operation and Maintenance Manual [illegible] completed project, or separate [illegible] part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) *Access roads to and on the levee* are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls.*—(1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

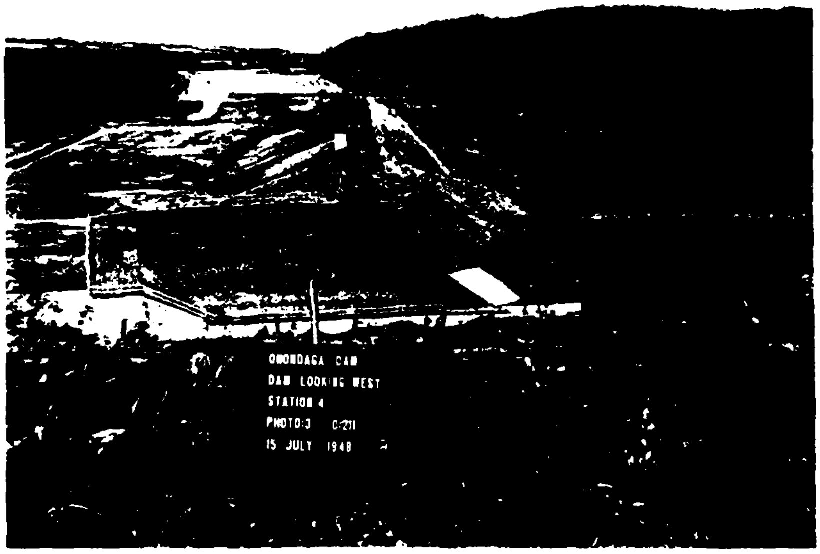
(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

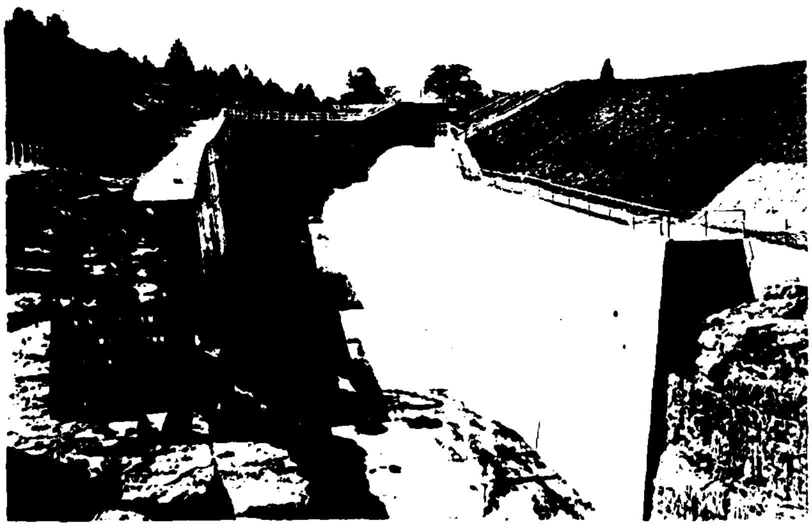
(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

DAM

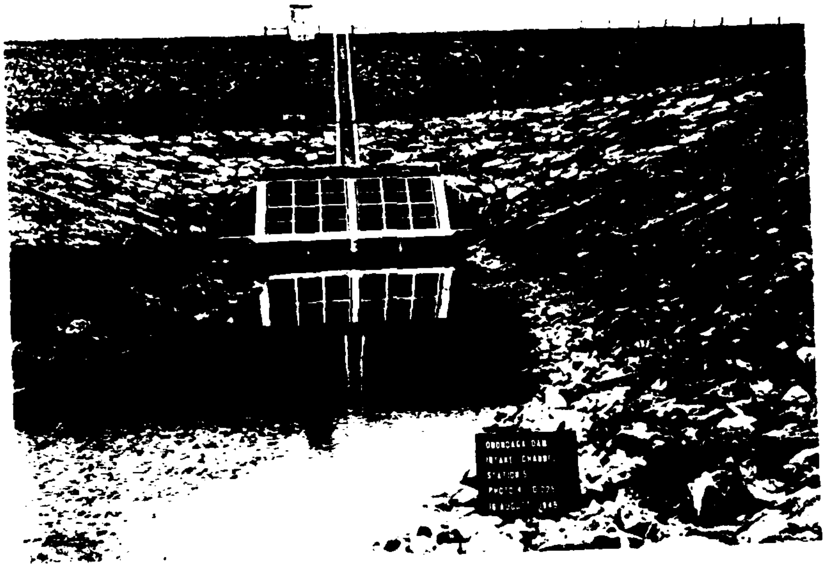



Earth dam embankment

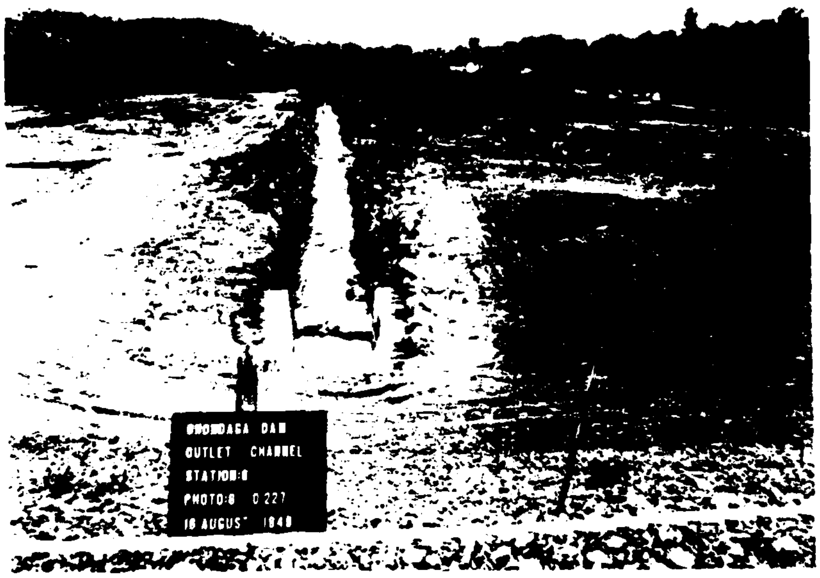


Spillway channel

DAM



Outlet works - Intake channel and structure




Outlet wor[illegible]l

Plate 2


[illegible] - [illegible]illing basin [illegible] structure

Looking east from station [illegible]


Looking west from station [illegible]

ACCESS ROAD


[illegible] gutter and catch basin

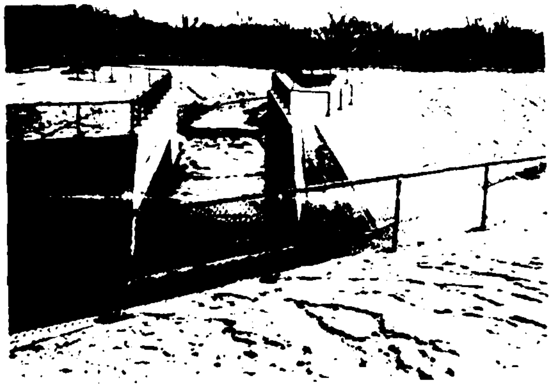
Reinforced concrete cattle pass

Plate [illegible]

CHANNEL IMPROVEMENT

## CHANNEL IMPROVEMENTS

Concrete Flume [illegible]
Looking [illegible]erly [illegible]
[illegible]
[illegible]



Concrete [illegible]
Looking [illegible]
Col[illegible] Spring Brook [illegible]
Improv[illegible] channel

CHANNEL IMPROVEMENTS

Looking upstream from
Ballantyne Road Bridge

Looking downstream towards
Ballantyne Road Bridge and
concrete flume

CHANNEL IMPROVEMENTS

Looking downstream from right bank
midway between Ballantyne Road and
West Seneca Turnpike

Looking upstream from right
bank towards new West Seneca
Turnpike highway bridge

Plate 9

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
DISTRICT NO.________

CHECK SHEET FOR INSPECTION OF ONONDAGA DAM AND RESERVOIR
LOCATED ON ONONDAGA CREEK, ABOUT 4 MILES SOUTH OF
SYRACUSE, N. Y.

Inspected by________________________________ Date ____________

| Item | Location - Conditions - Recommendations |
|---|---|
| 1. Dam and appurtenances | |
| A. Upstream slope of embankment | ______ |
| B. Riprap on upstream slope | ______ |
| C. Concrete stairway on upstream slope | ______ |
| D. Downstream slope of embankment | ______ |
| E. Rock toe on downstream slope | ______ |
| F. Hall Japanese Honeysuckle plants on downstream slope | ______ |
| G. Roadway on top of dam | ______ |
| H. Guard Rails and posts along road | ______ |
| 2. Outlet structure | |
| A. Concrete conduit | ______ |
| B. Concrete-lined stilling basin | ______ |
| C. Concrete intake structure | ______ |
| D. Trash racks | ______ |
| E. Rock paving | ______ |
| F. Intake channel | ______ |
| (1) Riprap lined slopes | ______ |
| G. Exit channel-unlined | ______ |
| 3. Spillway and spillway channel | ______ |
| A. Approach channel | ______ |
| B. Concrete weir | ______ |
| C. Concrete lines spillway race channel | ______ |
| D. Triangular control weir | ______ |
| E. Outlet channel unlined | ______ |
| (1) Concrete paved bottom portion | ______ |

PLATE 10

F. Rock lined gutters ______________________________

G. Iron guard railing on top of walls ______________________________

4. Gage House

A. Exterior ______________________________

B. Interior ______________________________

C. Gage ______________________________

5. Staff gage

A. Bronze numerals ______________________________

B. Enameled marker plates ______________________________

6. Access Road to dam

A. Roadway ______________________________

B. Shoulders ______________________________

C. Concrete gutters ______________________________

D. Catch basin ______________________________

E. Cattle pass ______________________________

7. Reservoir area ______________________________

______________________________________________

REMARKS:

PLATE 10 (Cont'd)

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
DISTRICT NO.______
CHECK SHEET FOR INSPECTION OF CHANNEL IMPROVEMENTS

Flood protection project at Onondaga Creek, Syracuse, New York

From______________________ To______________________

Inspected by______________________ Date______________________

| Item | Station or location | Conditions | Recommendations |
|---|---|---|---|
| 1. Weed & wild growth in channel | | | |
| 2. Trash, ashes, etc. dumped in channel | | | |
| 3. Structures or other unauthorized encroachment within channel right-of-way | | | |
| 4. Shoals forming in channel | | | |
| 5. Shoals forming in restricted openings | | | |
| 6. Erosion of banks | | | |
| 7. Erosion or undercutting of buildings and structures | | | |
| 8. Tributary channels and ditches: | | | |
| a. Approach channel, upstream of project | | | |
| b. Egress channel, downstream of project | | | |
| c. Tributary ditches | | | |
| 9. Diversion channels | | | |
| 10. Control weir | | | |

REMARKS:

PLATE 11

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
DISTRICT NO.______

CHECK SHEET FOR LEVEES

Flood Protection Project at Onondaga Creek, Syracuse, New York

( ) Routine
Inspection of Onondaga Creek Levee on ( ) right bank, ( ) left
( ) Emergency

From ______________________ to ______________________
Station or Street Station or Street

Inspected by ______________________ Date ____________ 19____

| Item | Location | Condition | Recommendations |
|---|---|---|---|
| 1. Settlement, loss of grade | | | |
| 2. Sloughing or caving (either side of levee) | | | |
| 3. Seepage or sand boils | | | |
| 4. Possible seepage from tree roots or animal burrows | | | |
| 5. Sod | | | |
| 6. Weeds or undesirable vegetation | | | |
| 7. Evidence of fires | | | |
| 8. Drainage of levee crown | | | |
| 9. Unauthorized encroachments of right-of-way | | | |
| 10. Unauthorized excavation or removal of sod | | | |
| 11. Unauthorized grazing or vehicular traffic | | | |
| 12. Accumulation of drift, trash and debris | | | |

REMARKS:

PLATE 12

# TIDE GATES

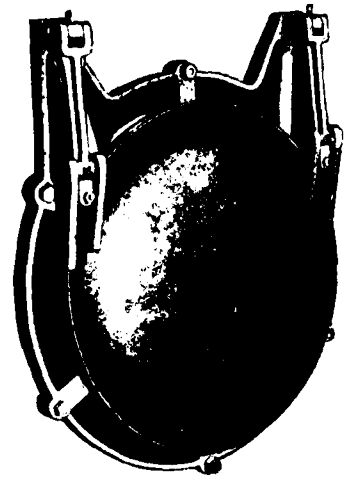
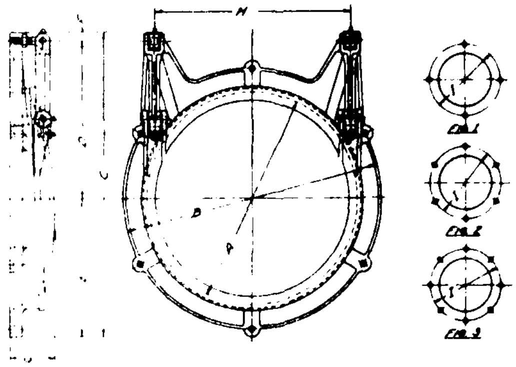


Fig. B 68. Type M [illegible] Gate




| A | B | C | D | E | F | G | H | I | BOLTING STYLE |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | 4½ | 6⅛ | 2⅜ | 2½ | 7" | 12" | FIG 1 |
| [illegible] | [illegible] | [illegible] | 6" | 6⅛ | ¾ | 3" | 8" | 12" | FIG 1 |
| [illegible] | 5" | [illegible] | 7½ | 8⅜ | ⅞ | 3⅝ | 10" | 16 | FIG 1 |
| [illegible] | [illegible] | [illegible] | [illegible] | 10" | 1" | 3¾ | 12" | 18" | FIG 1 |
| [illegible] | [illegible] | [illegible] | [illegible] | 11½ | 1" | 4¼ | 13½ | 21" | FIG 1 |
| [illegible] | [illegible] | [illegible] | 13½ | 13" | 1" | 4⅞ | 16½ | 24" | FIG 1 |
| [illegible] | [illegible] | [illegible] | 15 | 14" | 1" | 5⅜ | 18½ | 26" | FIG 2 |
| 24 | 30 | [illegible] | 8" | 16" | 1½ | 5½ | 21" | 30" | FIG 2 |
| [illegible] | 37 | [illegible] | [illegible] | [illegible] | 1¼ | 6½ | 28" | 37" | FIG 2 |
| [illegible] | [illegible] | [illegible] | [illegible] | 23" | 1¼ | 7¼ | 32" | 44" | FIG 2 |
| 42" | 50" | [illegible] | 31½ | 26⅜ | 1½ | 8" | 37" | 50" | FIG 2 |
| 48 | 57 | 68 | 36" | 30" | 2" | 8½ | 42" | 57" | FIG 2 |
| 54" | 63" | 75½ | 40½ | 33" | 2" | 9" | 48" | 63" | FIG 3 |
| 60 | 70 | 84½ | 45" | 37" | 2⅛ | 10" | 52" | 70" | FIG 3 |
| 66 | 76" | 92" | 49½ | 40" | 2½ | 12" | 56" | 76" | FIG 3 |
| 72 | 82" | 99½ | 54" | 43" | 2½ | 11½ | 61" | 82" | FIG 3 |
| 84" | 94" | 115" | 63" | 49" | 3" | 13½ | 72" | 94" | FIG 3 |

Fig. 9112—Dimensions.
See Fig. [illegible] on Reverse Side for Anchor Bolt Details.

Type M Tide Gates are designed for mounting on wall faces although other applications are readily possible. They are extremely sensitive and operate automatically with minimum head losses. This sensitive action is due to carefully balanced shutters and the link type of hinge arrangement. Frames are well ribbed to produce stiffness and strength. Shutters are dished to provide maximum strength with minimum metal thickness; hinge links are [illegible] bifurcated at top to straddle hinge posts and fitting between paired ears on the shutter at bottom to provide double shear for all hinge pins. Hinge posts are of the eye-bolt type and are screwed into and locked in position in gate frames. Hinge pins are locked in position and against turning. Seating surfaces are accurately finished to insure practical watertightness. Normally gate frames, shutters and hinge links are made of cast iron class 20 to class 60 depending upon the service required. Anchor bolts are galvanized wrought iron. Alemite lubrication is provided for. Gates are also available with bronze faces on seating surfaces with bronze anchor bolts; with bronze hinge links.

To facilitate design and manufacture the gates are offered in a classification of head groupings as follows:

**Class 1 for heads up to 12′**
**" 2 " " over 12′ to 20′**
**" 3 " " " 20′ to 30′**
**" 4 " " " 30′ to 40′**

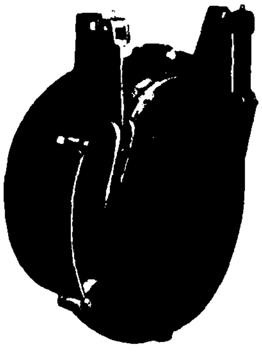


Fig. B 69. Type M Tide Gate with plain wall thimble. Also available with C. I. P. Bell Back Ends and C. I. P. Back Flanges. See Figs. 9142 and 9140 on reverse page.

Fig. B 52. One 60″ and two 42″ Type M Tide Gates.

Fig. B-54. Two 72″ and two 60″ Type M Tide Gates.



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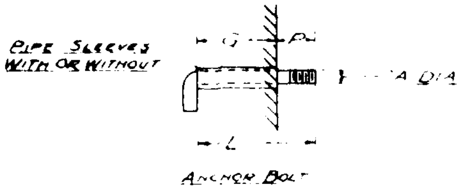
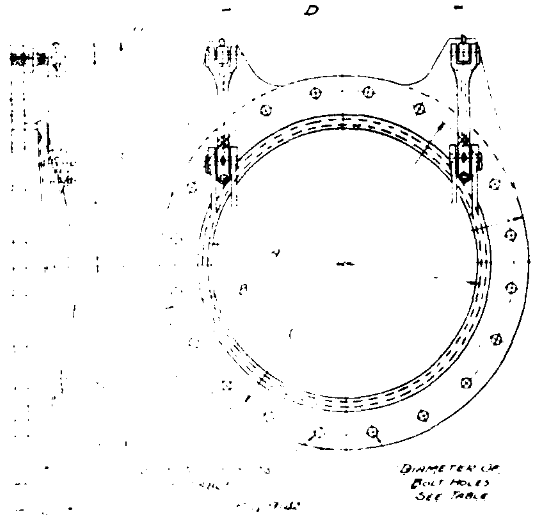
Plate No. 14



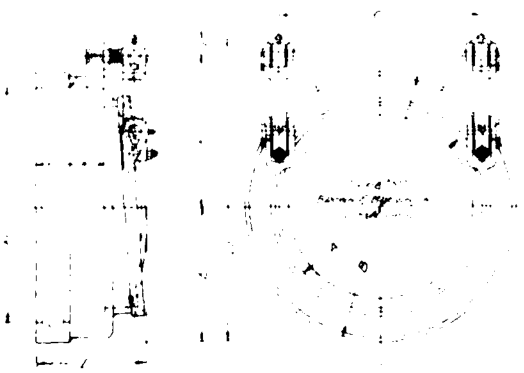




| Dia of Gate | A | L | G | P | Pipe Sleeves With or Without |
|---|---|---|---|---|---|
| 6" | [illegible] | 6¾" | [illegible] | [illegible] | Without |
| 8" | [illegible] | 7" | 5" | [illegible] | |
| 10" | [illegible] | 7" | 5" | [illegible] | |
| 12" | [illegible] | 7" | 4½" | [illegible] | " |
| 15" | [illegible] | 7" | 4¾" | [illegible] | |
| 18" | [illegible] | 7" | 4⅞" | 2¼" | |
| 20" | [illegible] | 7" | 4½" | 2½" | " |
| 24" | [illegible] | 7" | 4[illegible] | [illegible] | |
| 30" | [illegible] | 9" | 6" | 3" | With |
| 36" | [illegible] | 9" | 6" | [illegible] | |
| 42" | [illegible] | 9" | [illegible] | [illegible] | |
| 48" | [illegible] | [illegible] | 6¾" | [illegible] | |
| 54" | [illegible] | 10" | 6¾" | [illegible] | " |
| 60" | [illegible] | 12" | 8½" | [illegible] | " |
| 66" | 1" | 12" | 9[illegible] | [illegible] | " |
| 72" | [illegible] | [illegible] | [illegible] | [illegible] | " |
| 84" | 3 | [illegible] | 12" | [illegible] | " |

Type M Gate.

| No. of Bolts | Dia of Bolt Holes |
|---|---|
| 8 | ¾" |
| 12 | ¾" |
| 12 | ¾" |
| 16 | ⅞" |
| 20 | ⅞" |
| 28 | 1" |
| 32 | 1" |

Type M Tide Gates with C. I. P. Back Flanges.



| E | F | G | H | K | L |
|---|---|---|---|---|---|
| 6 | 6" | 1" | 10" | 4" | 6[illegible]" |
| 6[illegible]" | 7½" | ⅞" | 11[illegible]" | 4" | 6½" |
| 8" | 9" | 1" | 14" | 4" | 6½" |
| 11[illegible]" | 13½" | 1" | 21" | 4" | 7[illegible]" |
| 12½" | 15" | 1⅛" | 22[illegible]" | 4" | 8[illegible]" |
| 14½" | 18" | 1⅛" | 26[illegible]" | 4" | 8[illegible]" |
| 18½" | 22½" | 1¼" | 33[illegible]" | 4½" | 9½" |
| 21[illegible]" | 27" | 1¼" | 40[illegible]" | 4½" | 10½" |

Fig. 940

Type M Tide Gates with C. I. P. Bell Back Ends.

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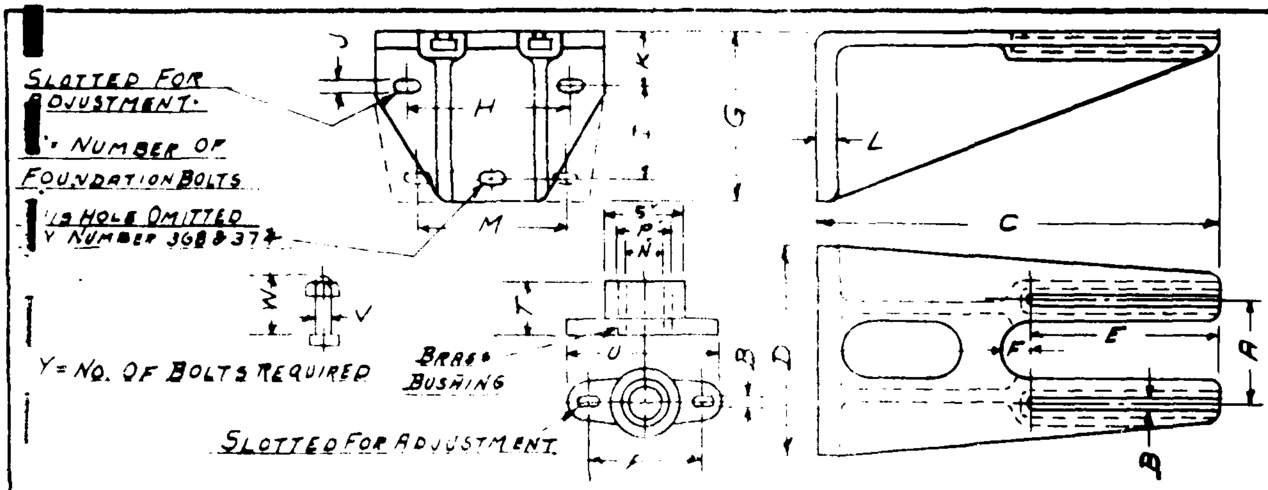



WALL BRACKET C.I.

| STEM DIA | DISTANCE OUT FROM WALL | A | B | C | D | E | F | G | H | I | J | K | L | M | R | PATT. NO. | DRWG NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UP TO 1 7/8 | 2 1/8 TO 8 | 4 1/2 | 5/8 | 9 | 10 | 6 3/4 | 1 1/4 | 6 15/16 | 7 1/2 | 3 1/4 | 1 | 2 1/16 | 3/4 | | 3 | 360 | A-12331 |
| | 7 3/4 TO 13 1/4 | 4 1/2 | 5/8 | 14 1/4 | 10 1/8 | 6 1/2 | 1 1/4 | 8 | 7 5/8 | 4 1/4 | 1 | 2 3/4 | 7/8 | | 3 | 328 | A-12330 |
| ″ | 12 TO 19 | 4 1/2 | 5/8 | 20 | 11 | 7 3/4 | 1 1/4 | 8 | 8 3/16 | 4 1/8 | 1 1/8 | 2 3/4 | 1 | | 3 | 329 | A-12332 |
| 2 TO 3 1/4 | 4 1/8 TO 11 | 6 1/4 | 3/4 | 12 1/8 | 14 1/4 | 8 | 1 7/8 | 9 | 11 1/2 | 5 3/8 | 1 1/8 | 2 1/2 | 1 | | 3 | 325 | A-12333 |
| | 9 TO 16 7/8 | 6 1/4 | 3/4 | 18 | 14 3/4 | 9 | 1 7/8 | 9 | 11 5/8 | 5 | 1 1/4 | 2 3/4 | 1 | | 3 | 327 | A-12334 |
| | 15 TO 25 3/8 | 6 1/4 | 3/4 | 26 1/2 | 15 1/8 | 11 1/2 | 1 7/8 | 11 | 11 11/16 | 6 5/8 | 1 3/8 | 3 | 1 | | 3 | 324 | A-12335 |
| 3 1/2 TO 3 3/4 | 4 1/2 TO 10 5/8 | 8 3/8 | 7/8 | 12 | 18 | 7 3/8 | 2 13/16 | 11 | 14 1/4 | 6 1/4 | 1 1/2 | 3 1/4 | 1 | | 3 | 323 | B-12336 |
| | 10 1/8 TO 18 1/8 | 8 3/8 | 7/8 | 19 1/2 | 18 | 9 1/2 | 2 13/16 | 11 | 14 1/4 | 6 1/4 | 1 1/2 | 3 1/4 | 1 | | 3 | 359 | B-12337 |
| 4 TO 5 | 4 TO 9 | 10 1/2 | 1 | 12 1/2 | 22 1/8 | 7 3/4 | 3 1/2 | 14 | 18 1/16 | 6 1/2 | 1 5/8 | 3 3/4 | 1 1/4 | 13 1/16 | 4 | 374 | A-12338 |
| ″ | 9 TO 15 | 10 1/2 | 1 | 18 1/2 | 22 1/8 | 9 3/8 | 3 1/2 | 14 | 18 1/16 | 6 1/2 | 1 5/8 | 3 3/4 | 1 1/4 | 13 1/16 | 4 | 368 | A-12339 |

*326
40
2586

STEM BEARING - C.I.

| STEM DIA 'O' | A | B | N | P | S | T | U | V | W | Y | PATT. NO | DRWG. NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UP TO 1 3/8 | 4 1/2 | 5/8 | 0 + 1/16 | 0 + 1/4 | 2 3/8 | 2 | 6 1/2 | 1/2 | 2 1/4 | 2 | P-95 | A-2306 |
| 1 1/2 TO 1 7/8 | 4 1/2 | 5/8 | ″ | ″ | 2 7/8 | 3 | 6 1/4 | 1/2 | 2 1/4 | 2 | P-94 | A-2306 |
| 2 TO 2 1/2 | 6 1/4 | 3/4 | ″ | ″ | 3 3/4 | 4 | 8 1/2 | 5/8 | 2 3/4 | 2 | P-96 | A-2306 |
| 2 3/4 TO 3 1/4 | 6 1/4 | 3/4 | ″ | ″ | 4 5/8 | 5 1/4 | 8 1/4 | 5/8 | 2 3/4 | 2 | P-97 | A-2306 |
| 3 1/2 TO 3 3/4 | 8 3/8 | 7/8 | 0 + 1/8 | 0 + 3/8 | 5 | 6 | 11 1/4 | 3/4 | 2 3/4 | 2 | P-208 | A-2696 |
| 4 TO 5 | 10 1/2 | 1 | ″ | ″ | 7 | 6 | 13 | 7/8 | 3 1/4 | 4 | P-367 | A-12339 |

THE CHAPMAN VALVE MFG. CO
INDIAN ORCHARD, MASS.

STEM GUIDE CHART

DRAWN BY FWS
TRACED BY
CHECKED BY A.R.P.
APPROVED BY W.M.B.
SCALE —
DATE 2-9-42

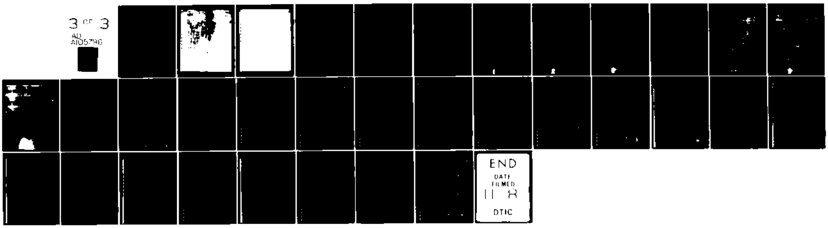
M. O. NUMBERS

E-12923

Plate No. 15

AD-A105 796 STETSON-DALE UTICA NY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. ONONDAGA DAM (INVENTORY NUMBER NY --ETC(U)
JUN 81 J B STETSON DACW51-81-0009

UNCLASSIFIED NL



CORPS OF ENGINEERS, U. S. ARMY
Office of the District Engineer
BUFFALO DISTRICT
Engineer Park
Niagara and Bridge Streets
Buffalo 7, New York

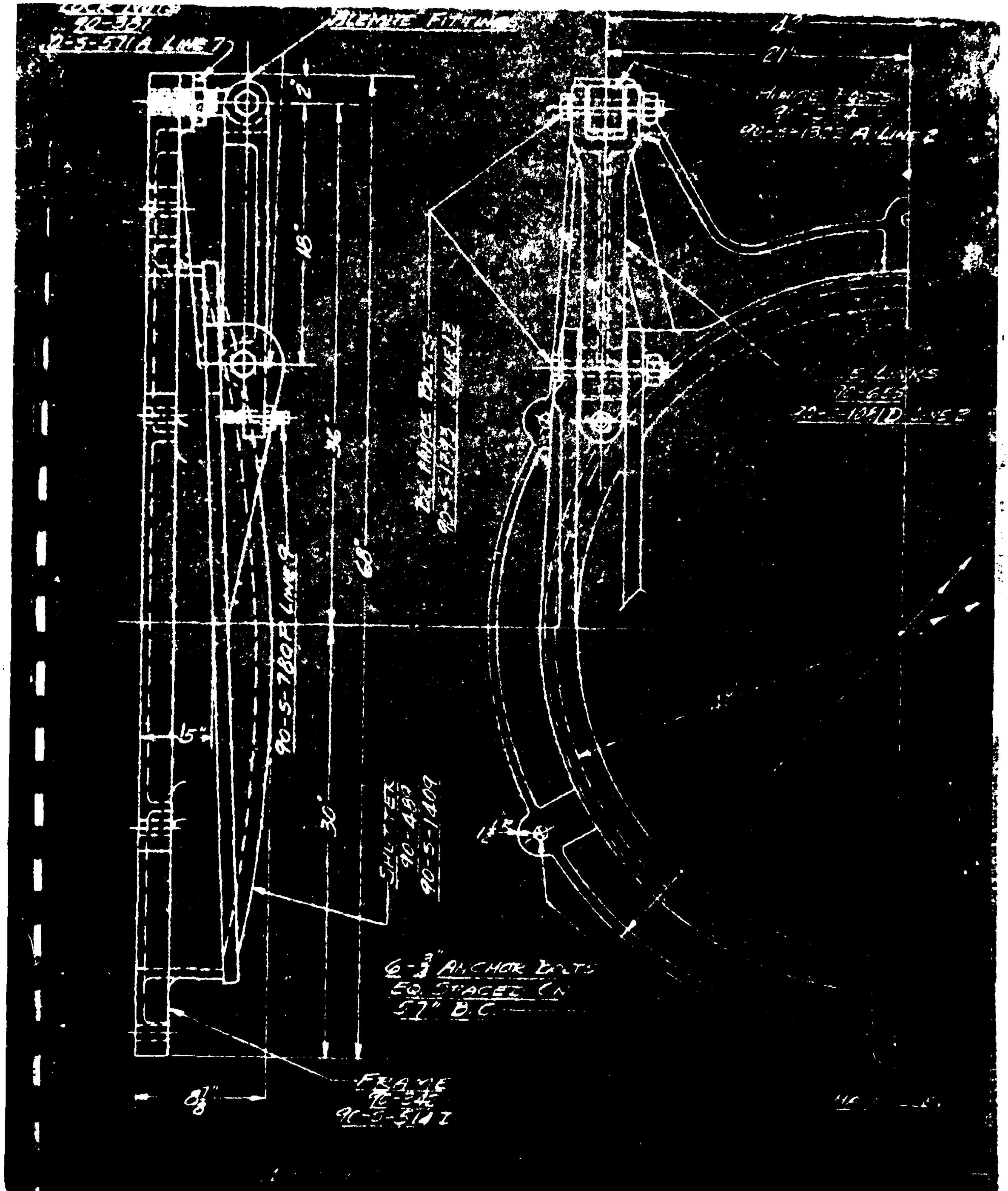
PLATES 18 TO 67 ARE REPRODUCED FULL SIZE [illegible] ARE INCLUDED

UNDER SEPARATE COVER.

INDEX

| | |
|---|---|
| PLATES 18 to [illegible] | Detail drawings for 48" Gates with type [illegible] floorstand furnished by the Chapman Valve Mfg. Co. and installed in drainage structure on Onondaga Channel |
| PLATES [illegible] to [illegible] | "As Built" drawings of channel improvements on Onondaga Creek |
| PLATES 36 to [illegible] | "As Built" drawings of Onondaga Dam and appurtenances |
| PLATES [illegible] and 66 | Movement check of spillway walls, Onondaga Dam |
| PLATE 67 | "As Built" drawing of weir on Onondaga Creek Channel |

PLATES 18 TO 67



ALEMITE FITTINGS
90-5-571 A LINE 7
4"
21"
2"
18"
36"
68"
30"
15"
8 7/8"
90-5-1322 A LINE 2
LINKS
90-655
90-5-1051 D LINE 2
BRONZE BOLTS
90-5-1373 LINE 12
90-5-780P LINE 9
SHUTTER
90-480
90-5-1409
6-3/4" ANCHOR BOLTS
EQ. SPACED ON
57" B.C.
FRAME
90-5-314 I

# APPENDIX

Report on the Fish and Wildlife Resources for Onondaga Reservoir Project and Downstream Improvements, Onondaga Creek - by United States Department of the Interior.

**NOT REPRODUCED**

Region 7, Binghamton Sub-Office
State Office Building
44 Hawley Street
Binghamton, New York 13901
(607) 773-7763

June 8, 1978

Joseph A. Foley, P.E.
Chief, Design Branch
U.S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Foley:

Enclosed are the reports for the Movement Check of the Spillway Walls, and the readings on the Settlement Gages and Piezometers.

As time allows, we will take readings on piezometers 9-12.

Sincerely,

Henry C. Carryol
Regional Flood Control Engineer

HCC/ems
Enc.

SEMI-ANNUAL REPORT

MOVEMENT CHECK - SPILLWAY CHANNEL WALLS

Project: Onondaga Dam

Report No. 35
Date 5-31-78

| EAST WALL | | | WEST WALL | | |
|---|---|---|---|---|---|
| | OFFSETS | | | OFFSETS | |
| Point No. | Aug. 8, 1949 | 5-24-78 | Point No. | Aug. 8, 1949 | 5-24-78 |
| 1-E | 2.87 | 2.84 | 1-W | 3.21 | 3.14 |
| 2-E | 2.98 | 2.97 | 2-W | 3.02 | 2.99 |
| 3-E | 3.00 | 3.00 | 3-W | 2.66 | 2.63 |
| 4-E | 3.08 | 3.06 | 4-W | 1.88 | 1.86 |
| 5-E | 3.25 | 3.28 | 5-W | 1.75 | 1.72 |
| 6-E | 3.25 | 3.28 | 6-W | 2.22 | 2.20 |
| 7-E | 1.41 | 1.41 | 7-W | 3.37 | 3.36 |
| 8-E | 0.36 | 0.33 | 8-W | 0.79 | 0.92 |
| 9-E | 0.59 | 0.62 | 9-W | 1.35 | 1.45 |
| 10-E | 0.50 | 0.61 | 10-W | 3.20 | 3.33 |
| 11-E | 0.36 | 0.41 | 11-W | 3.85 | 3.94 |
| 12-E | 0.44 | 0.51 | 12-W | 4.32 | 4.41 |
| 13-E | 1.22 | 1.30 | 13-W | 3.96 | 4.07 |
| | | | 14-W | 3.27 | 3.40 |

REPORT OF SETTLEMENT GAGE READINGS

Report No. 35

Project: Onondaga Dam

Date of Observation 5-26-78

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| SETTLEMENT GAGE NO. | PRESENT ELEVATION (TOP OF PIPE) Ft. | LENGTH OF PIPE Ft. | PRESENT ELEVATION (BOTTOM OF PIPE) (2) - (3) Ft. | INITIAL ELEVATION (BOTTOM OF PIPE) Ft. | SETTLEMENT (BOTTOM OF PIPE) (5) - (4) Ft. |
| SG 1 | 494.08 | 28.19 | 465.89 | 467.14 | 1.25 |
| 2* | 510.88 | 48.30 | 462.58 | 464.62 | 2.04 |
| 3 | 525.71 | 63.35 | 462.36 | 464.10 | 1.74 |
| 4 | 513.64 | 51.25 | 462.39 | 463.89 | 1.50 |
| 5 | 495.26 | 33.73 | 461.53 | 462.[illegible] | 1.23 |
| 6 | 494.21 | 32.61 | 461.60 | 462.36 | 0.76 |
| 7* | 512.47 | 49.79 | 462.68 | 462.84 | 0.16 |
| 8 | 526.08 | 65.09 | 460.99 | 462.10 | 1.11 |
| 9* | 512.79 | 51.58 | 461.21 | 462.50 | [illegible] |
| 10* | 495.28 | 36.36 | 458.92 | 460.37 | 1.45 |
| 11 | 494.17 | 33.55 | 460.62 | 461.19 | 0.57 |
| 12 | 511.16 | 50.36 | 460.80 | 461.51 | 0.71 |
| 13 | 526.01 | 67.20 | 458.81 | 459.67 | [illegible] |
| 14 | 512.47 | 55.21 | 457.26 | 457.91 | [illegible] |
| 15 | 494.12 | 38.23 | 455.89 | 456.30 | 0.41 |
| 16 | 470.11 | 15.78 | 454.33 | 454.53 | 0.20 |
| 17 | 470.04 | 17.68 | 452.36 | 452.58 | 0.22 |
| 18 | 469.43 | 21.27 | 448.16 | 448.32 | 0.16 |

REMARKS: Pool Elev. = 460.24'. SW corner of Outlet Headwall taken as elevation 475.00' to run SG-17 & SG-22; others from flow gage house -

Submitted- H. Carroll

Title

REPORT OF SETTLEMENT GAGE READINGS

Report No. 35

Project: Onondaga Dam

Date of Observation 5-26-78

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| SETTLEMENT GAGE NO. | PRESENT ELEVATION (TOP OF PIPE) Ft. | LENGTH OF PIPE Ft. | PRESENT ELEVATION (BOTTOM OF PIPE) (2) - (3) Ft. | INITIAL ELEVATION (BOTTOM OF PIPE) Ft. | SETTLEMENT (BOTTOM OF PIPE) (5) - (4) Ft. |
| 19 | 469.12 | 21.31 | 447.81 | 448.16 | 0.35 |
| 20 | 469.17 | 20.03 | 449.14 | 449.40 | 0.26 |
| 21 | 470.26 | 22.49 | 447.77 | 447.99 | 0.22 |
| 22 | 473.98 | 22.52 | 451.46 | 451.68 | 0.22 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

REMARKS: * SG-2 - Broken at 3.4' from top.
SG-7 - Plugged [illegible] 5' from top.
SG-9 - Broken [illegible]ace.
SG-10 - Plugge[illegible] 6' from top.

Submitted - H. Caus[illegible]

Title Sr. Hyd. Engr.

REPORT OF GROUND WATER ELEVATIONS IN PIEZOMETERS AND SETTLEMENT GAGES

Onondaga Dam

Report No. 35

Elev. of Reservoir pool 460.24'

Date of observation 5-26-78

| LOCATION OF GAGE NO. | ELEV. OF TOP OF PIPE (in Feet) | SOUNDING-TOP OF PIPE TO WATER (in Feet) | ELEV. OF WATER (in Feet - Col.2-Col.3) |
|---|---|---|---|
| SG-1 | 494.08 | 20.53 | 473.55 |
| 2 | 510.88 | broken @ 35' | — |
| 3 | 525.71 | 58.00 | 467.71 |
| 4 | 513.64 | 46.30 | 467.34 |
| 5 | 495.26 | 28.60 | 466.66 |
| 6 | 494.21 | 28.75 | 465.46 |
| 7 | 512.47 | plugged @ 11.5' | — |
| 8 | 526.08 | 61.40 | 464.68 |
| 9 | 512.79 | 48.35 | 464.44 |
| 10 | 495.28 | plugged @ 1.6' | — |
| 11* | 494.17 | 32.00 | 462.17 |
| 12* | 511.16 | 50.10 | 461.06 |
| 13 | 526.01 | plugged @ 21.7' | — |
| 14 | 512.47 | 52.6 | 459.87 |
| 15 | 494.12 | 34.97 | 459.15 |
| 16 | 470.11 | 11.20 | 458.91 |
| 17 | 470.04 | 11.00 | 459.04 |

REMARKS: * SG-11 & 12 no water apparent.

submitted H. Caudell

title

REPORT OF GROUND WATER ELEVATIONS IN PIEZOMETERS AND SETTLEMENT GAGES

Onondaga Dam — Report No. 35

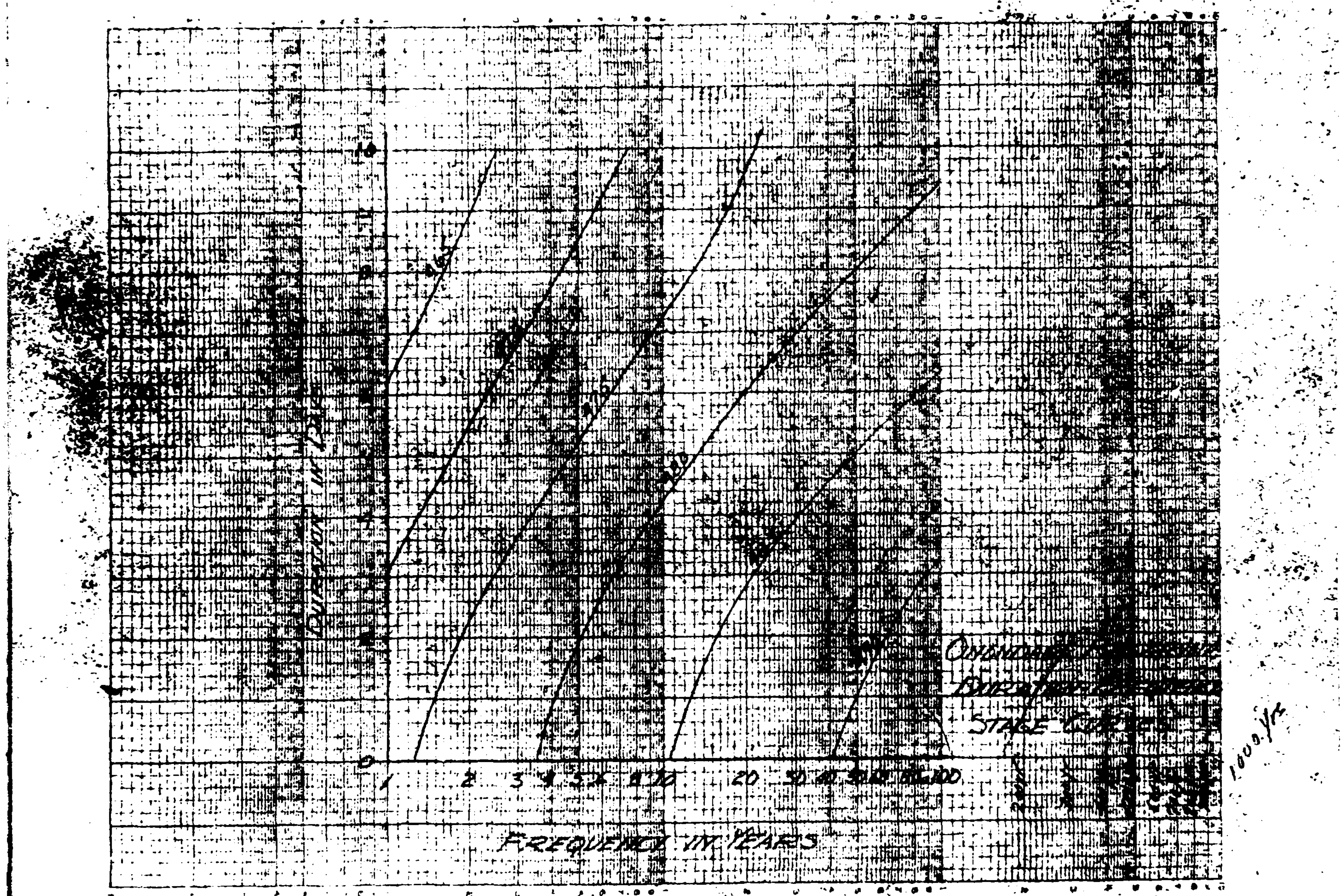
Elev. of Reservoir pool ______ — Date of observation 5-26-78

| LOCATION OF GAGE NO. | ELEV. OF TOP OF PIPE (in Feet) | SOUNDING-TOP OF PIPE TO WATER (in Feet) | ELEV. OF WATER (in Feet - Col.2-Col.3) |
|---|---|---|---|
| SG-18 | 469.43 | 9.40 | 460.03 |
| 19 | 469.12 | 9.20 | 459.92 |
| 20 | 469.17 | 9.00 | 460.17 |
| 21 | 470.26 | 9.90 | 460.36 |
| 22 | 473.98 | 13.70 | 460.28 |
| P-1 * | 472.59 | 12.00 | 460.59 |
| 2 | 470.73 | 9.60 | 461.13 |
| 3 | 469.49 | 9.40 | 460.09 |
| 4 | 469.70 | 9.70 | 460.00 |
| 5 | 469.73 | 9.50 | 460.23 |
| 6 | 470.15 | 9.80 | [illegible] |
| 7 | 473.23 | 11.30 | 461.93 |
| 9 | 474.48 | 13.00 | 461.48 |
| | | | |
| | | | |
| | | | |
| | | | |

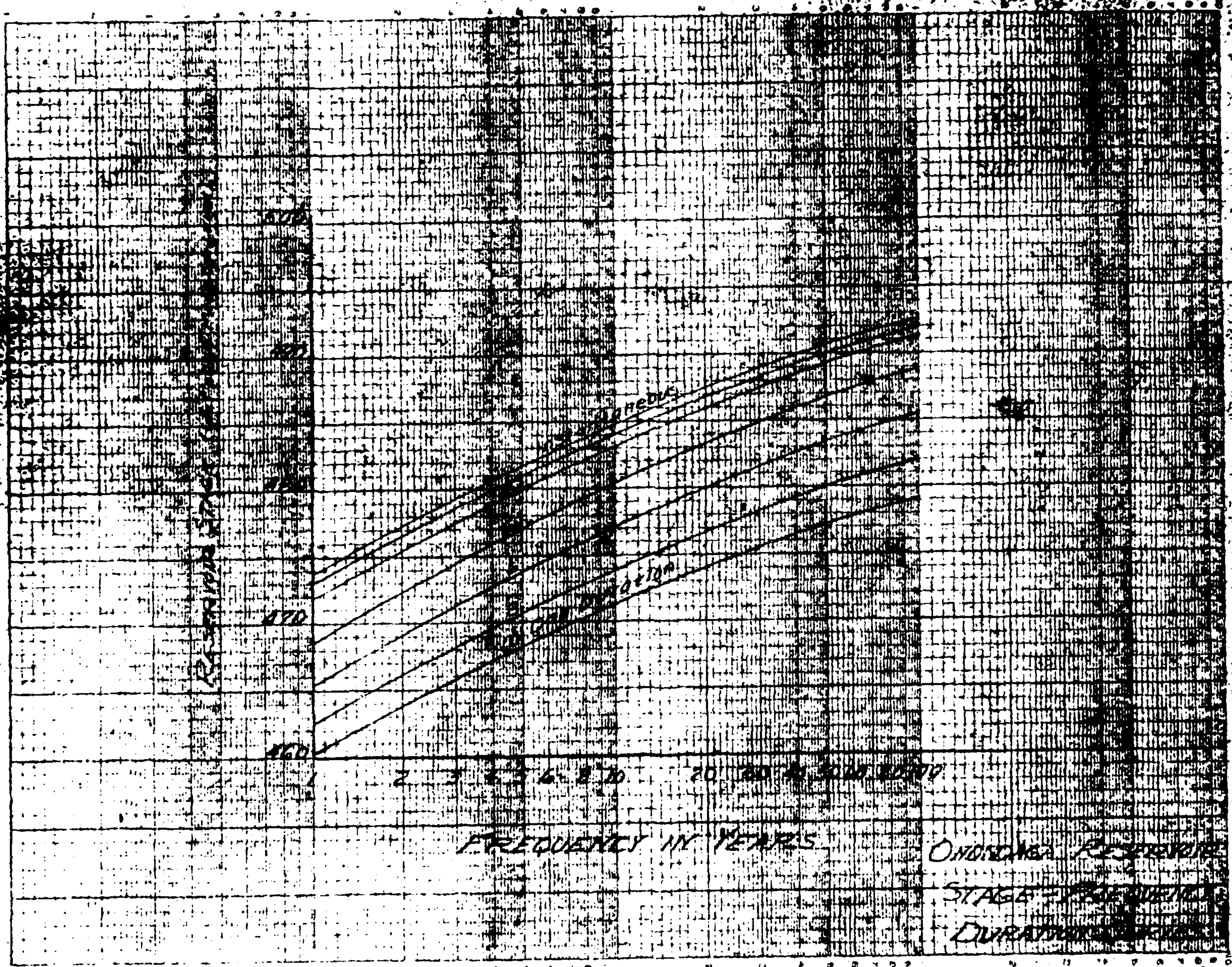
REMARKS: *P-1, pipe bent

submitted [signature]

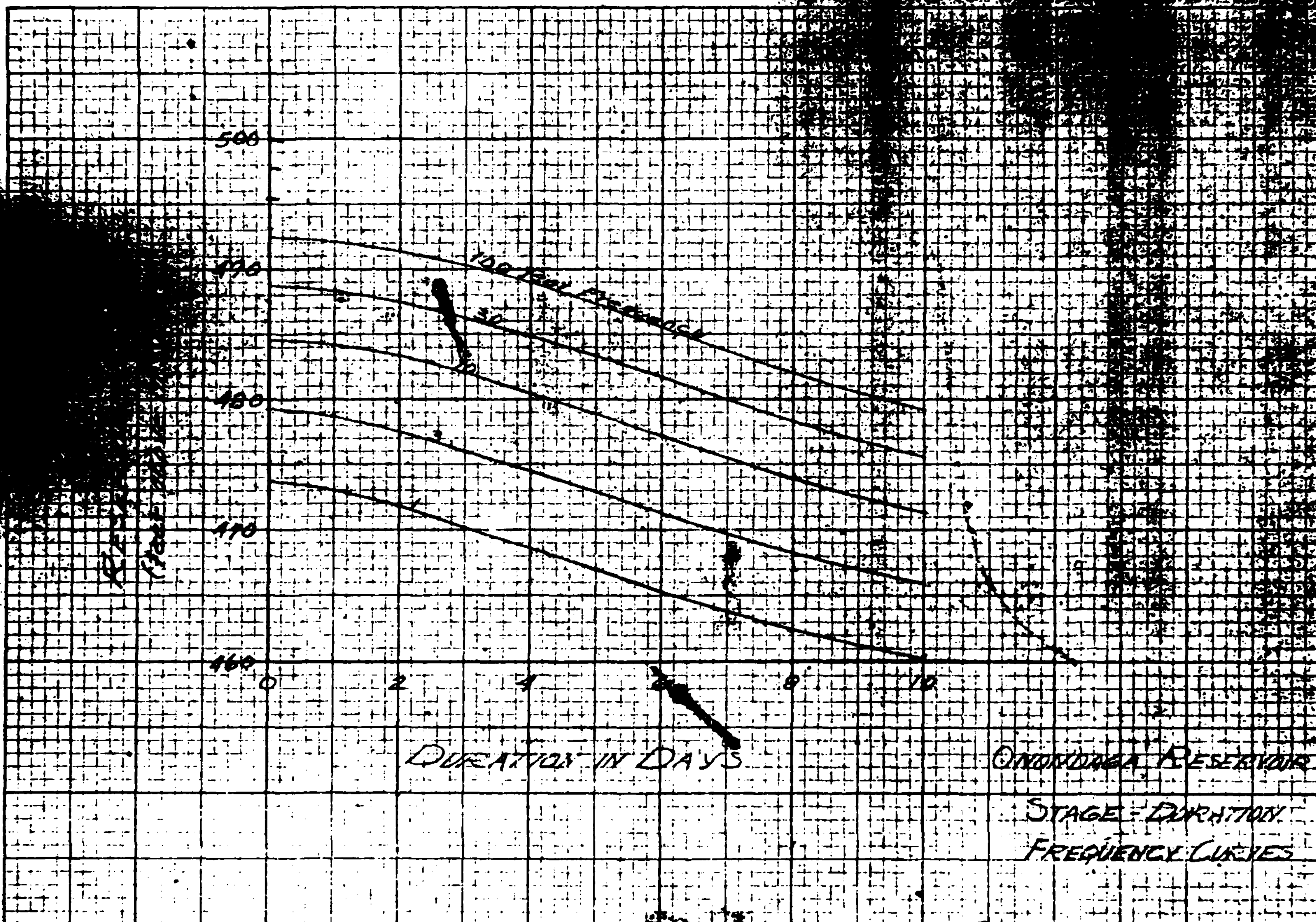
title ______



DURATION IN DAYS
FREQUENCY IN YEARS
1 2 3 4 5 6 8 10 20 30 40 50 60 80 100
0
10
STAGE
1000 YR



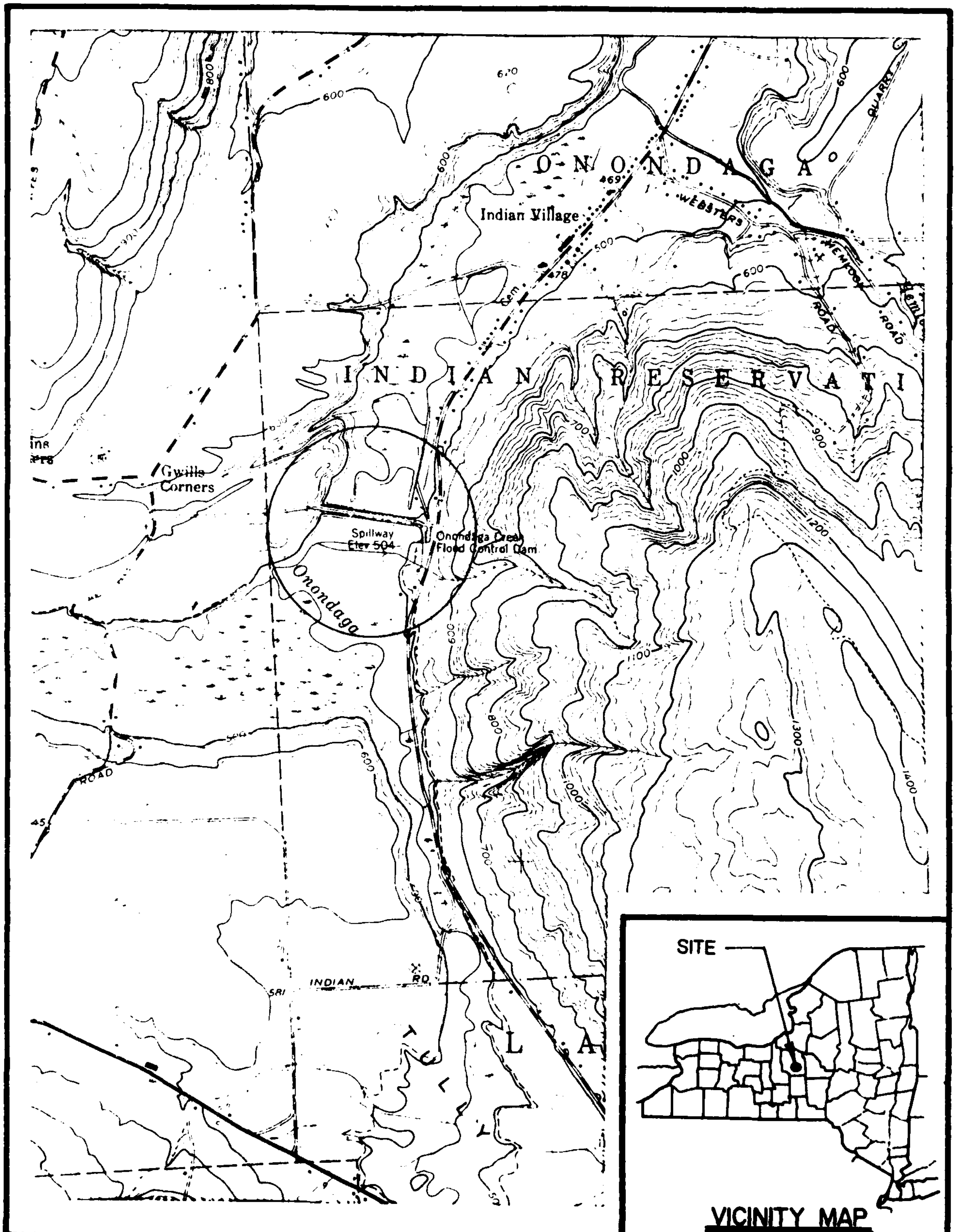
460
470
FREQUENCY IN YEARS
1 2 3 4 5 6 8 10 20
ONONDAGA
DURATION



500
490
480
470
460
100 Year Frequency
30
10
0
2
4
6
8
10
DURATION IN DAYS
ONONDAGA RESERVOIR
STAGE - DURATION
FREQUENCY CURVES

# APPENDIX G

# DRAWINGS




# LOCATION PLAN

SCALE 1:2000

1600 0 1600 2000 3000 4000

FIGURE 1

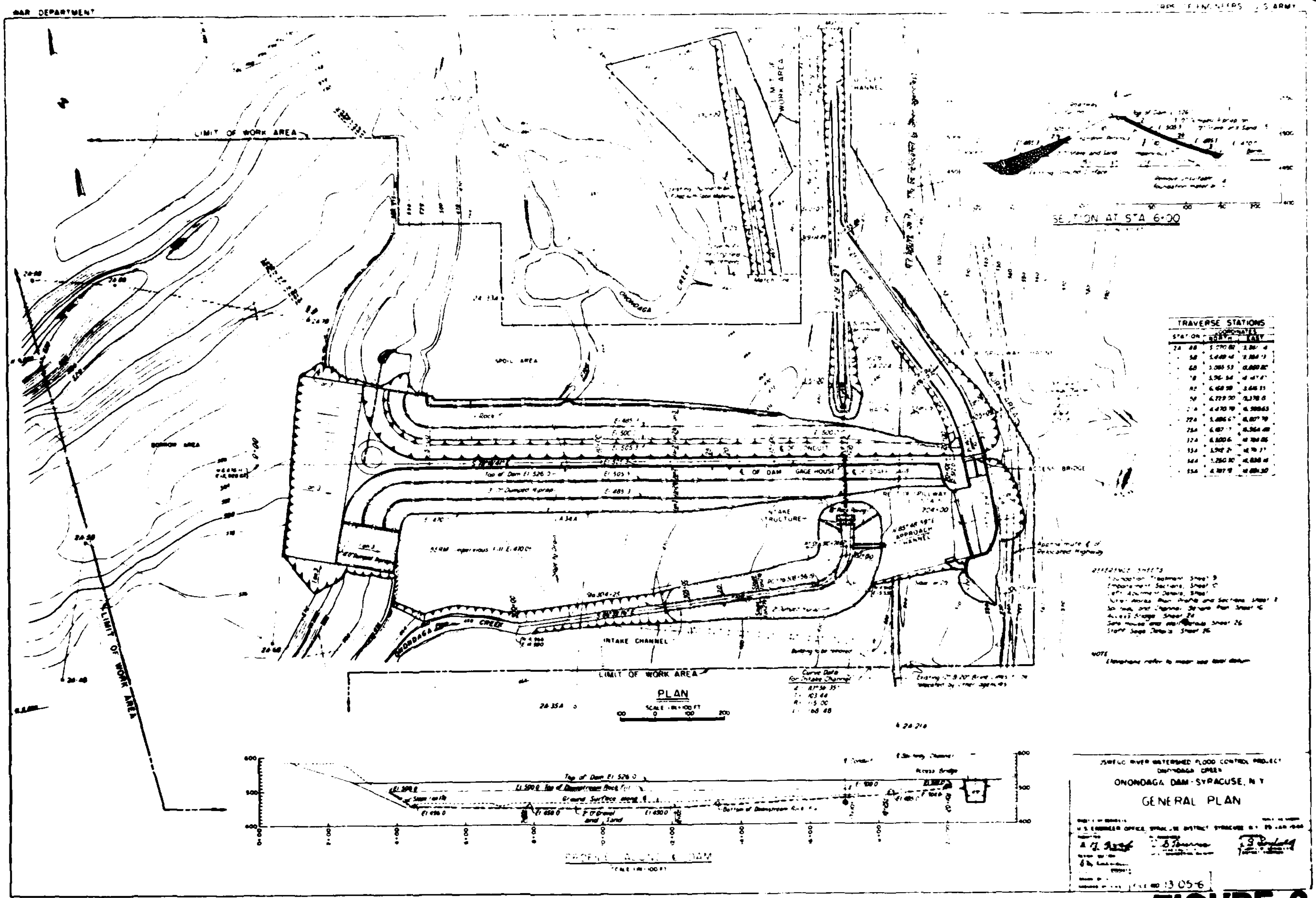

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
LIMIT OF WORK AREA
SPOIL AREA
BORROW AREA
ONONDAGA CREEK
INTAKE STRUCTURE
INTAKE CHANNEL
APPROACH CHANNEL
GAGE HOUSE
ACCESS BRIDGE
SECTION AT STA 6+00
TRAVERSE STATIONS
PLAN
PROFILE ALONG ℄ DAM
Top of Dam El 526.0
ONONDAGA DAM - SYRACUSE, N.Y.
GENERAL PLAN
13 05-6

FIGURE 2

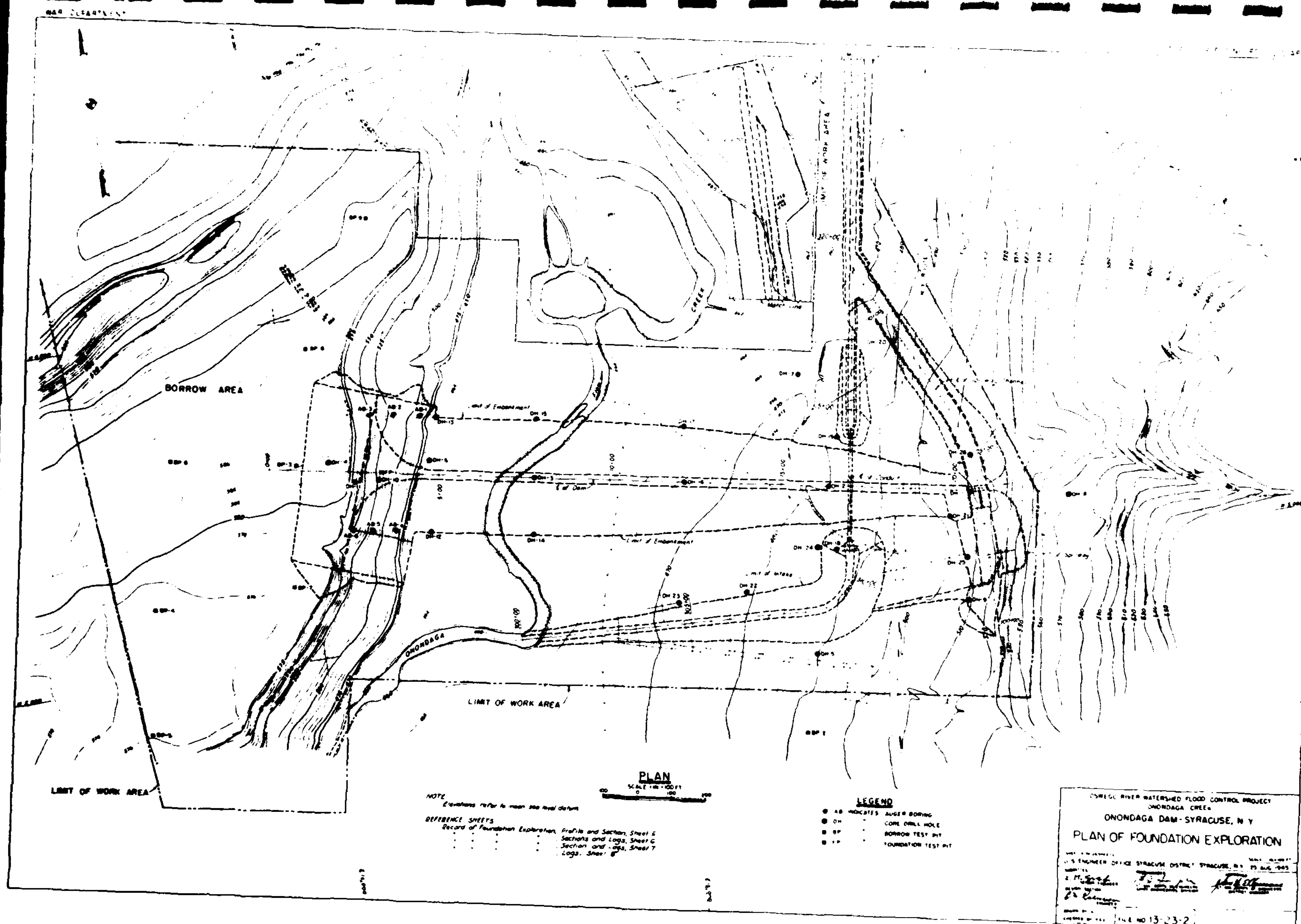

BORROW AREA
LIMIT OF WORK AREA
LIMIT OF WORK AREA
ONONDAGA
CREEK
PLAN
SCALE 1 IN = 100 FT
NOTE
Elevations refer to mean sea level datum
REFERENCE SHEETS
Record of Foundation Exploration, Profile and Section, Sheet 5
Sections and Logs, Sheet 6
Section and Logs, Sheet 7
Logs, Sheet 8
LEGEND
AB INDICATES AUGER BORING
DH CORE DRILL HOLE
BP BORROW TEST PIT
TP FOUNDATION TEST PIT
OSWEGO RIVER WATERSHED FLOOD CONTROL PROJECT
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N Y
PLAN OF FOUNDATION EXPLORATION
U.S. ENGINEER OFFICE SYRACUSE DISTRICT SYRACUSE, N.Y.
FILE NO 13-23-2

FIGURE 3 ④

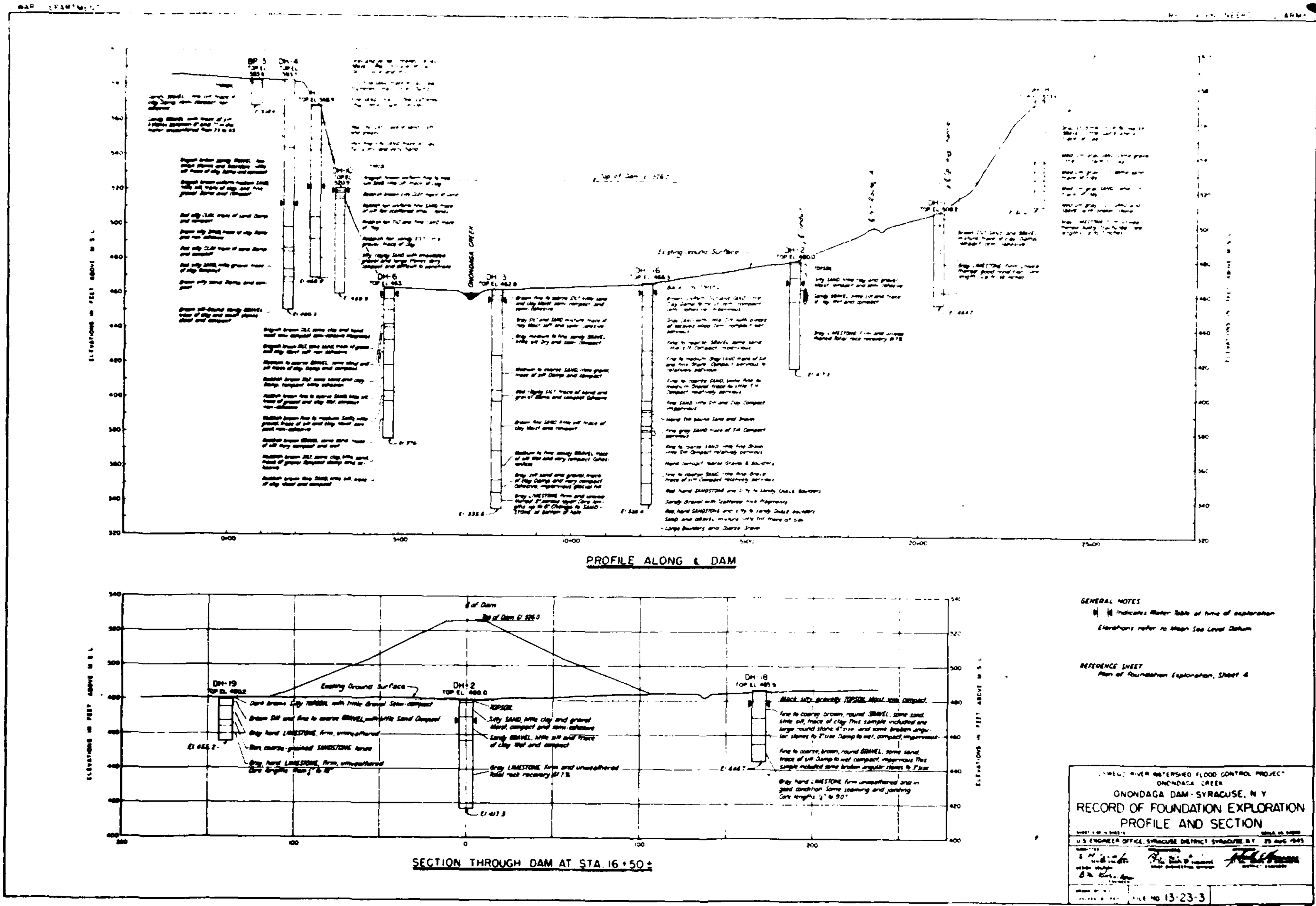

PROFILE ALONG ℄ DAM
ONONDAGA CREEK
Existing Ground Surface
DH-6
TOP EL 463
DH-3
TOP EL 462.8
DH-16
TOP EL 464.3
DH-2
TOP EL 480.0
SECTION THROUGH DAM AT STA 16+50±
℄ of Dam
Top of Dam El 526.0
DH-19
DH-18
TOP EL 485.9
TOPSOIL
El 417.3
El 444.7
ELEVATIONS IN FEET ABOVE M.S.L.
GENERAL NOTES
Indicates Water Table at time of exploration
Elevations refer to Mean Sea Level Datum
REFERENCE SHEET
Plan of Foundation Exploration, Sheet 4
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
RECORD OF FOUNDATION EXPLORATION
PROFILE AND SECTION
13-23-3

FIGURE 4

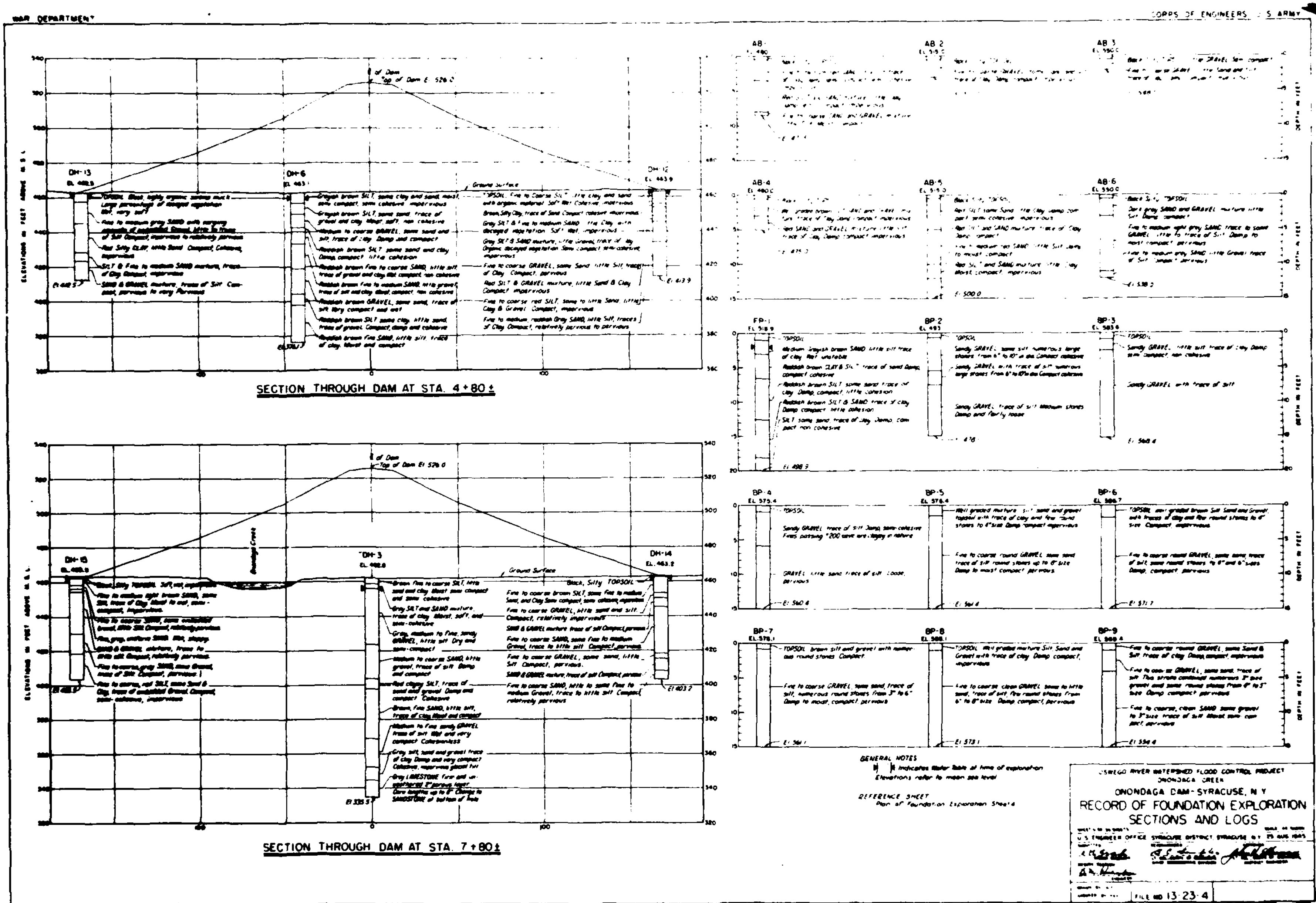

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
SECTION THROUGH DAM AT STA. 4+80±
SECTION THROUGH DAM AT STA. 7+80±
GENERAL NOTES
Indicates Water Table at time of exploration
Elevations refer to mean sea level
REFERENCE SHEET
Plan of Foundation Exploration Sheets
OSWEGO RIVER WATERSHED FLOOD CONTROL PROJECT
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
RECORD OF FOUNDATION EXPLORATION
SECTIONS AND LOGS
U.S. ENGINEER OFFICE SYRACUSE DISTRICT SYRACUSE, N.Y.
FILE NO 13-23-4

FIGURE 5

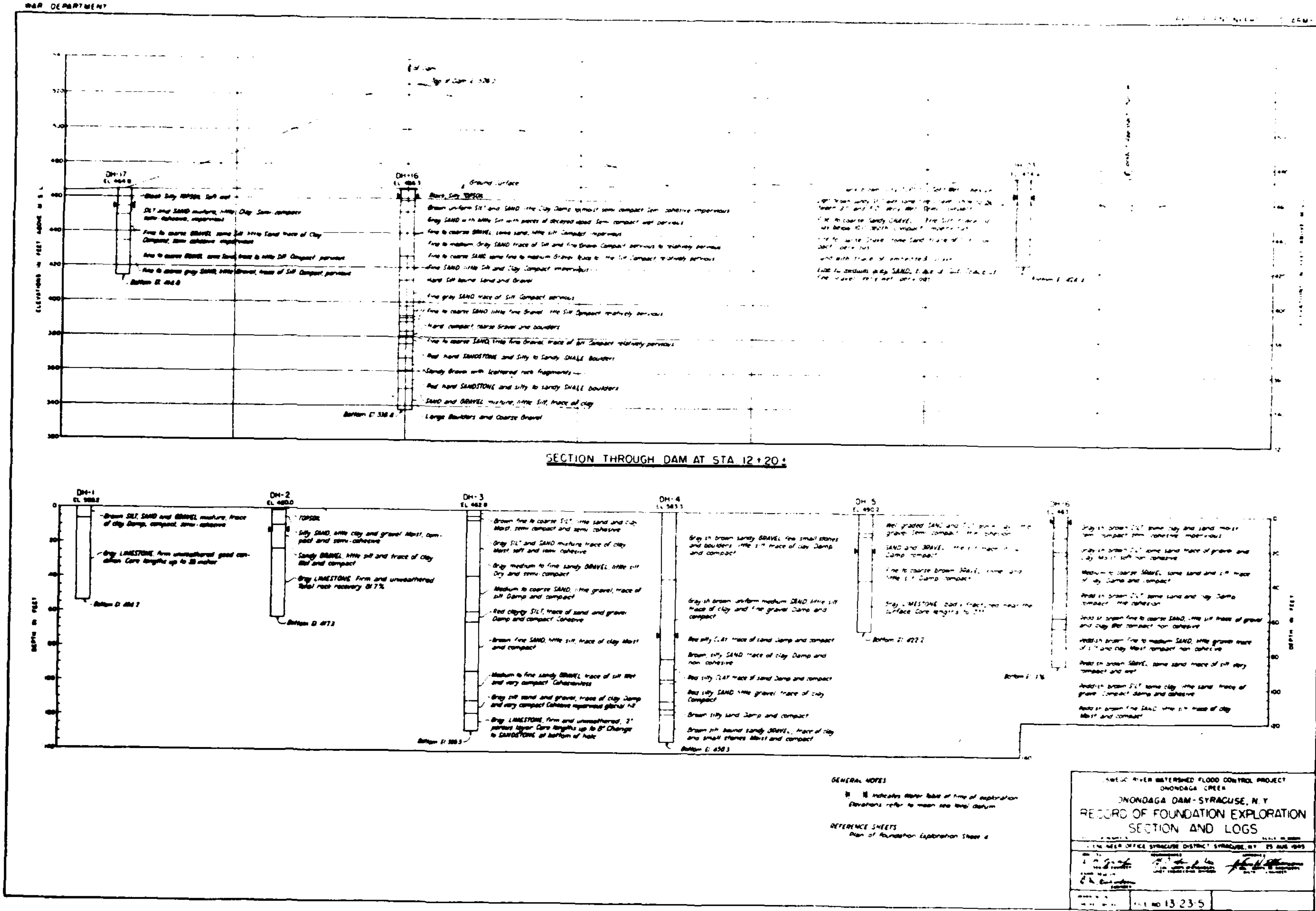

WAR DEPARTMENT
SECTION THROUGH DAM AT STA 12+20±
ELEVATIONS IN FEET ABOVE M.S.L.
DEPTH IN FEET
DH-17
DH-16
DH-1
DH-2
DH-3
DH-4
DH-5
DH-6
GENERAL NOTES
Indicates Water table at time of exploration
Elevations refer to mean sea level datum
REFERENCE SHEETS
Plan of Foundation Exploration Sheet 4
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
RECORD OF FOUNDATION EXPLORATION
SECTION AND LOGS
13-23-5

FIGURE 6

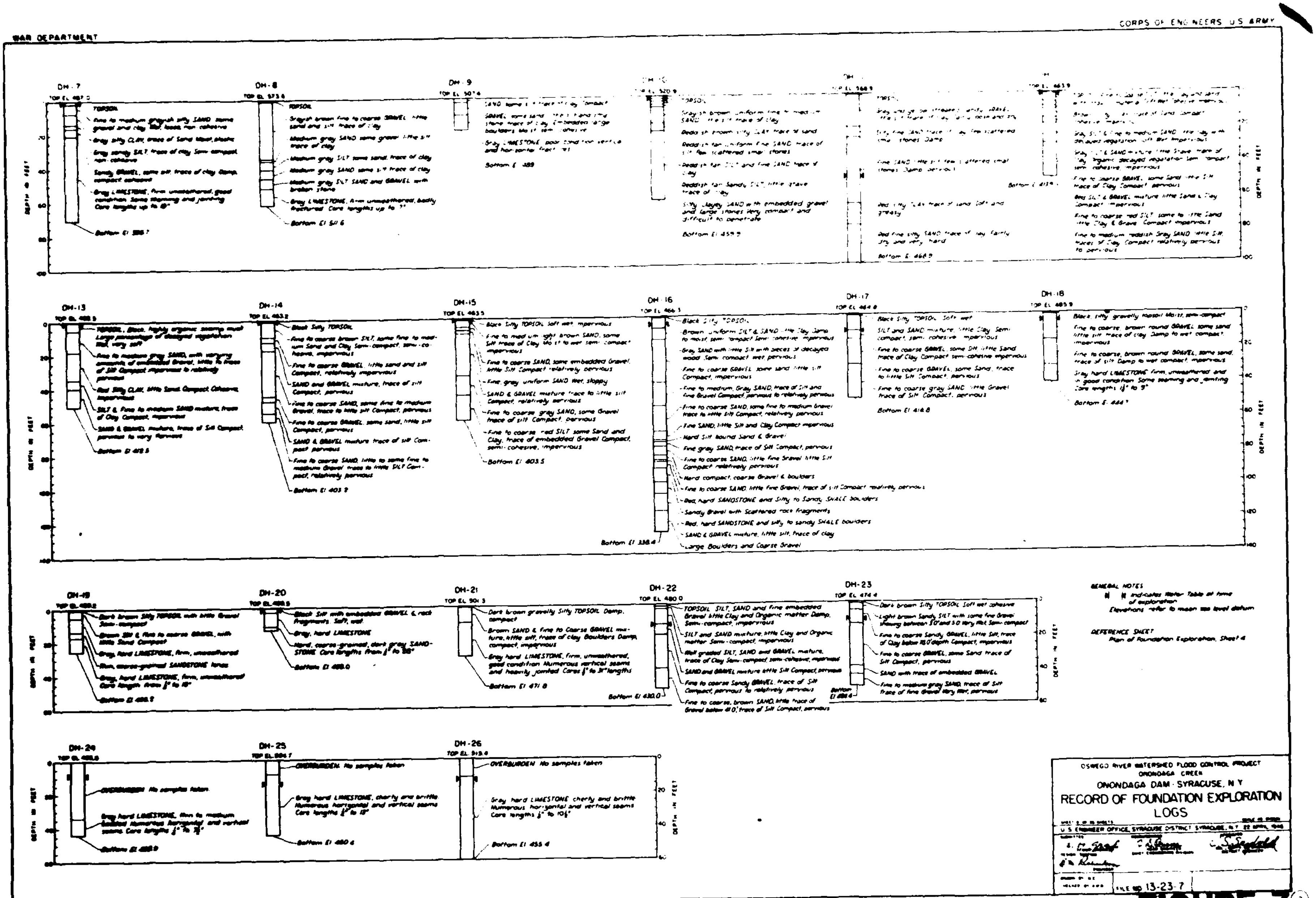

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
DH-7
DH-8
DH-9
DH-13
DH-14
DH-15
DH-16
DH-17
DH-18
DH-19
DH-20
DH-21
DH-22
DH-23
DH-24
DH-25
DH-26
DEPTH IN FEET
GENERAL NOTES
REFERENCE SHEET
OSWEGO RIVER WATERSHED FLOOD CONTROL PROJECT
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
RECORD OF FOUNDATION EXPLORATION
LOGS
U.S. ENGINEER OFFICE, SYRACUSE DISTRICT, SYRACUSE, N.Y.
FILE NO. 13-23-7

FIGURE 7

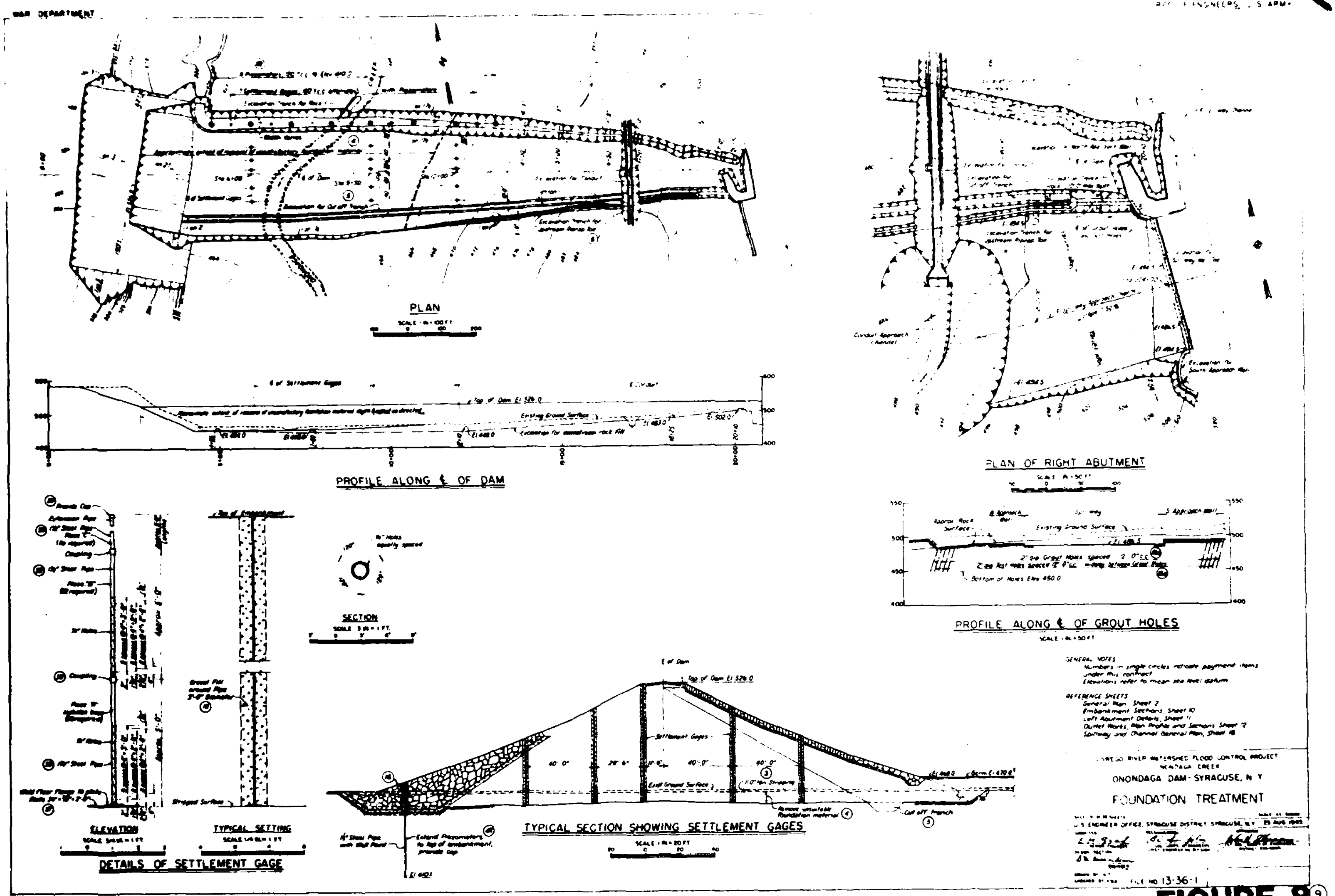

WAR DEPARTMENT
CORPS OF ENGINEERS, U.S. ARMY
PLAN
PROFILE ALONG ℄ OF DAM
PLAN OF RIGHT ABUTMENT
PROFILE ALONG ℄ OF GROUT HOLES
SECTION
ELEVATION
TYPICAL SETTING
DETAILS OF SETTLEMENT GAGE
TYPICAL SECTION SHOWING SETTLEMENT GAGES
Top of Dam El 526.0
Existing Ground Surface
GENERAL NOTES
Numbers in single circles indicate payment items under this contract
Elevations refer to mean sea level datum
REFERENCE SHEETS
General Plan, Sheet 2
Embankment Sections, Sheet 10
Left Abutment Details, Sheet 11
Outlet Works, Plan Profile and Sections, Sheet 12
Spillway and Channel General Plan, Sheet 16
OSWEGO RIVER WATERSHED FLOOD CONTROL PROJECT
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
FOUNDATION TREATMENT
U.S. ENGINEER OFFICE, SYRACUSE DISTRICT, SYRACUSE, N.Y.
FILE NO 13-36-1

FIGURE 8

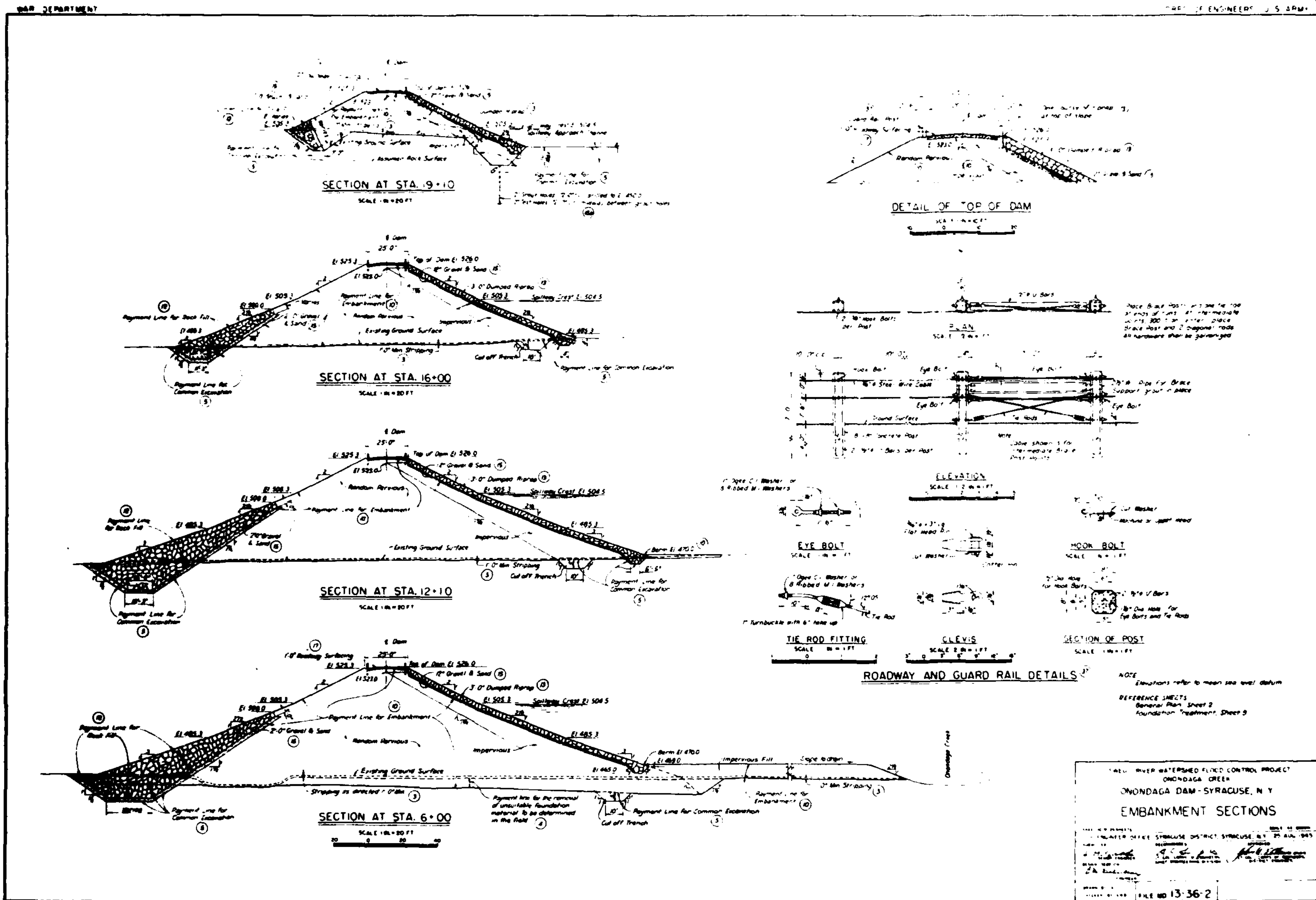

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
SECTION AT STA. 9+10
SECTION AT STA. 16+00
SECTION AT STA. 12+10
SECTION AT STA. 6+00
DETAIL OF TOP OF DAM
PLAN
ELEVATION
EYE BOLT
HOOK BOLT
TIE ROD FITTING
CLEVIS
SECTION OF POST
ROADWAY AND GUARD RAIL DETAILS
NOTE
Elevations refer to mean sea level datum
REFERENCE SHEETS
General Plan, Sheet 2
Foundation Treatment, Sheet 9
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
EMBANKMENT SECTIONS
FILE NO. 13-36-2

FIGURE 9

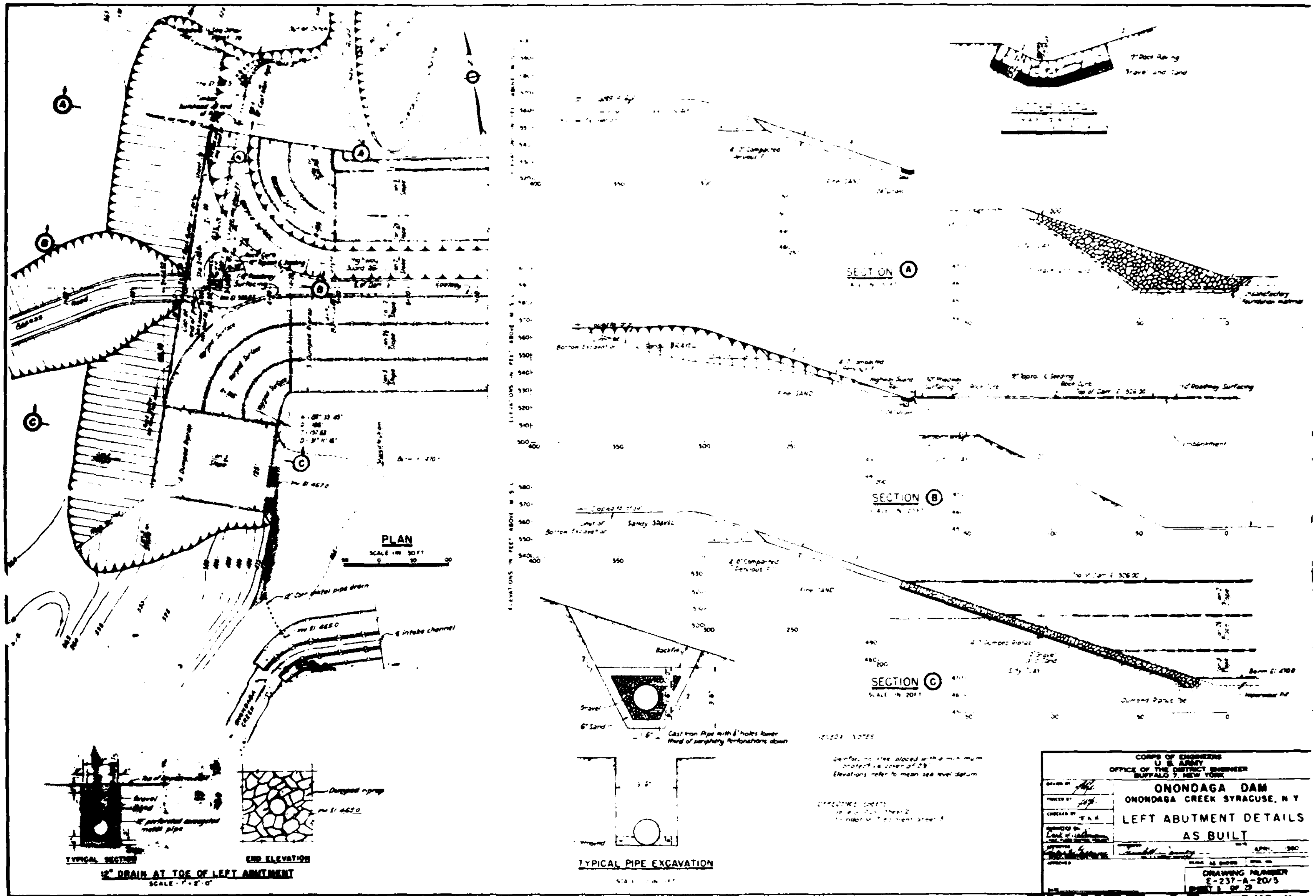

PLAN
SECTION A
SECTION B
SECTION C
TYPICAL PIPE EXCAVATION
12" DRAIN AT TOE OF LEFT ABUTMENT
TYPICAL SECTION
END ELEVATION
Dumped riprap
12" Corr. metal pipe drain
Intake channel
Backfill
Gravel
6" Sand
Cast Iron Pipe with 1/2" holes lower third of periphery perforations down
Elevations refer to mean sea level datum
CORPS OF ENGINEERS
U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO 7, NEW YORK
ONONDAGA DAM
ONONDAGA CREEK SYRACUSE, N.Y.
LEFT ABUTMENT DETAILS
AS BUILT
DRAWING NUMBER
E-237-A-20/5
PLATE NO. 40

FIGURE 10

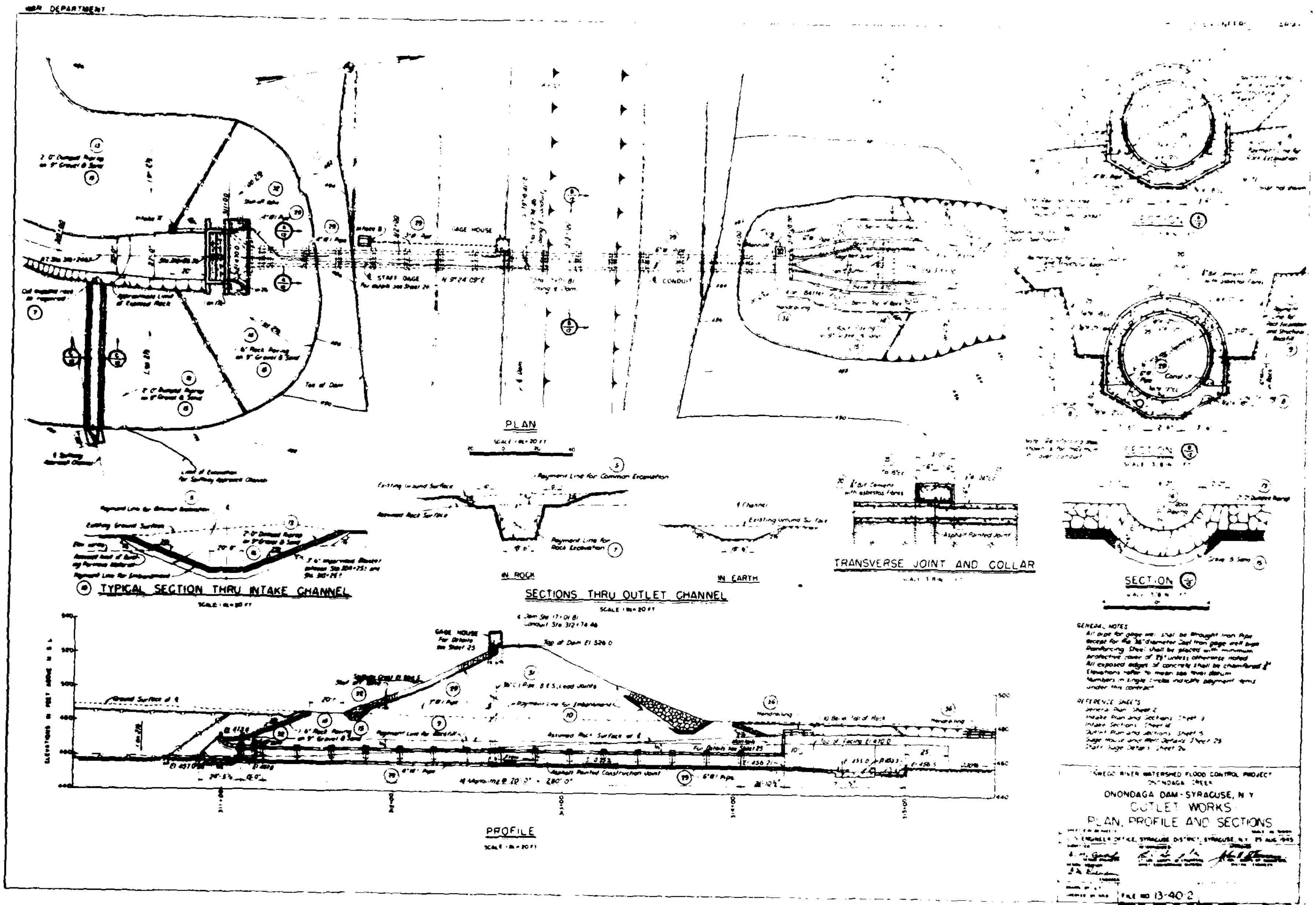
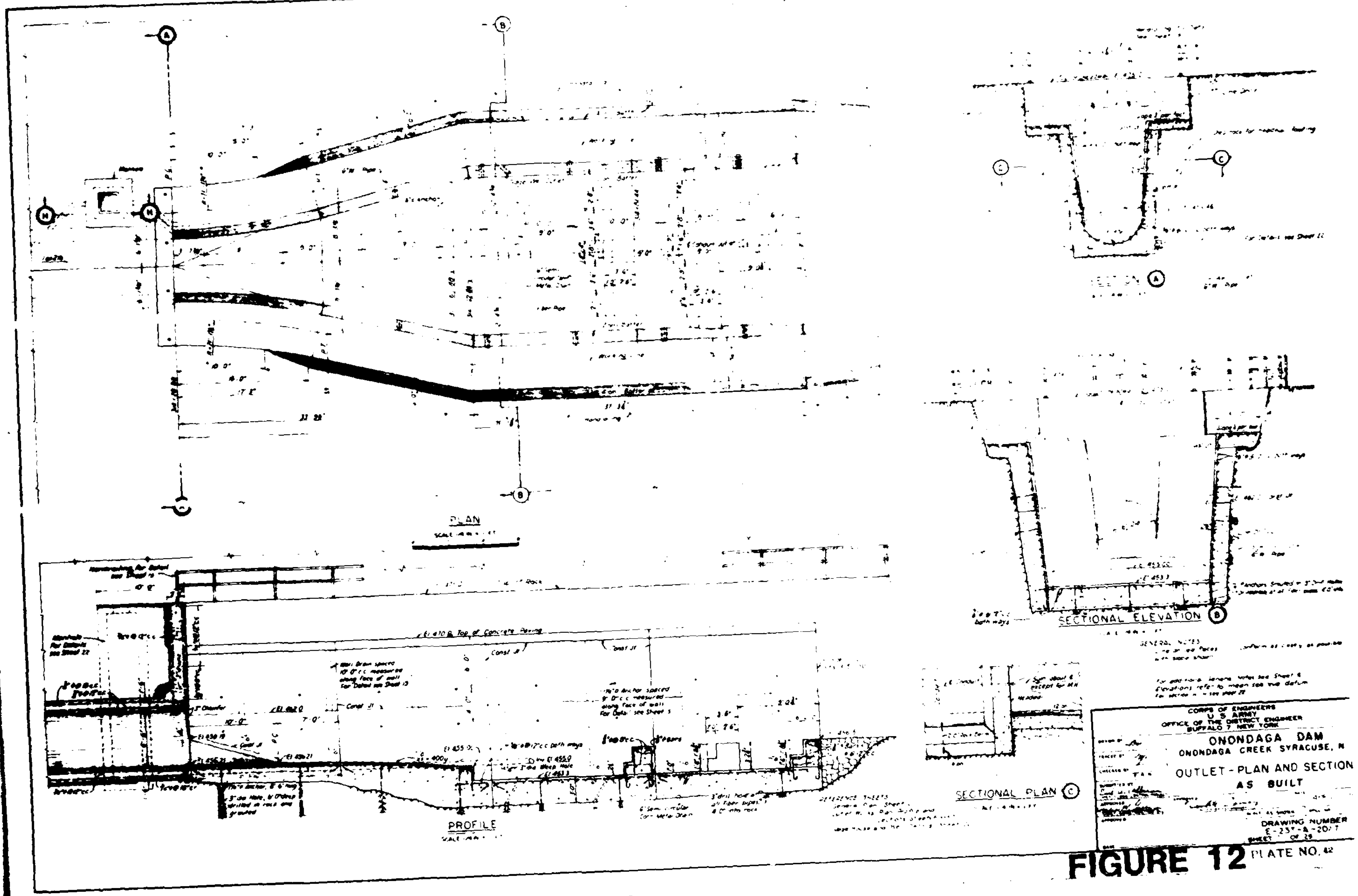

WAR DEPARTMENT
PLAN
TYPICAL SECTION THRU INTAKE CHANNEL
SECTIONS THRU OUTLET CHANNEL
IN ROCK
IN EARTH
TRANSVERSE JOINT AND COLLAR
SECTION
PROFILE
GAGE HOUSE
Top of Dam El 526.0
GENERAL NOTES
REFERENCE SHEETS
OSWEGO RIVER WATERSHED FLOOD CONTROL PROJECT
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
OUTLET WORKS
PLAN, PROFILE AND SECTIONS
FILE NO 13-40-2

FIGURE 11



PLAN
PROFILE
SECTION A
SECTIONAL ELEVATION B
SECTIONAL PLAN C
CORPS OF ENGINEERS
U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO 7, NEW YORK
ONONDAGA DAM
ONONDAGA CREEK SYRACUSE, N
OUTLET - PLAN AND SECTION
AS BUILT
DRAWING NUMBER
PLATE NO. 62


FIGURE 12

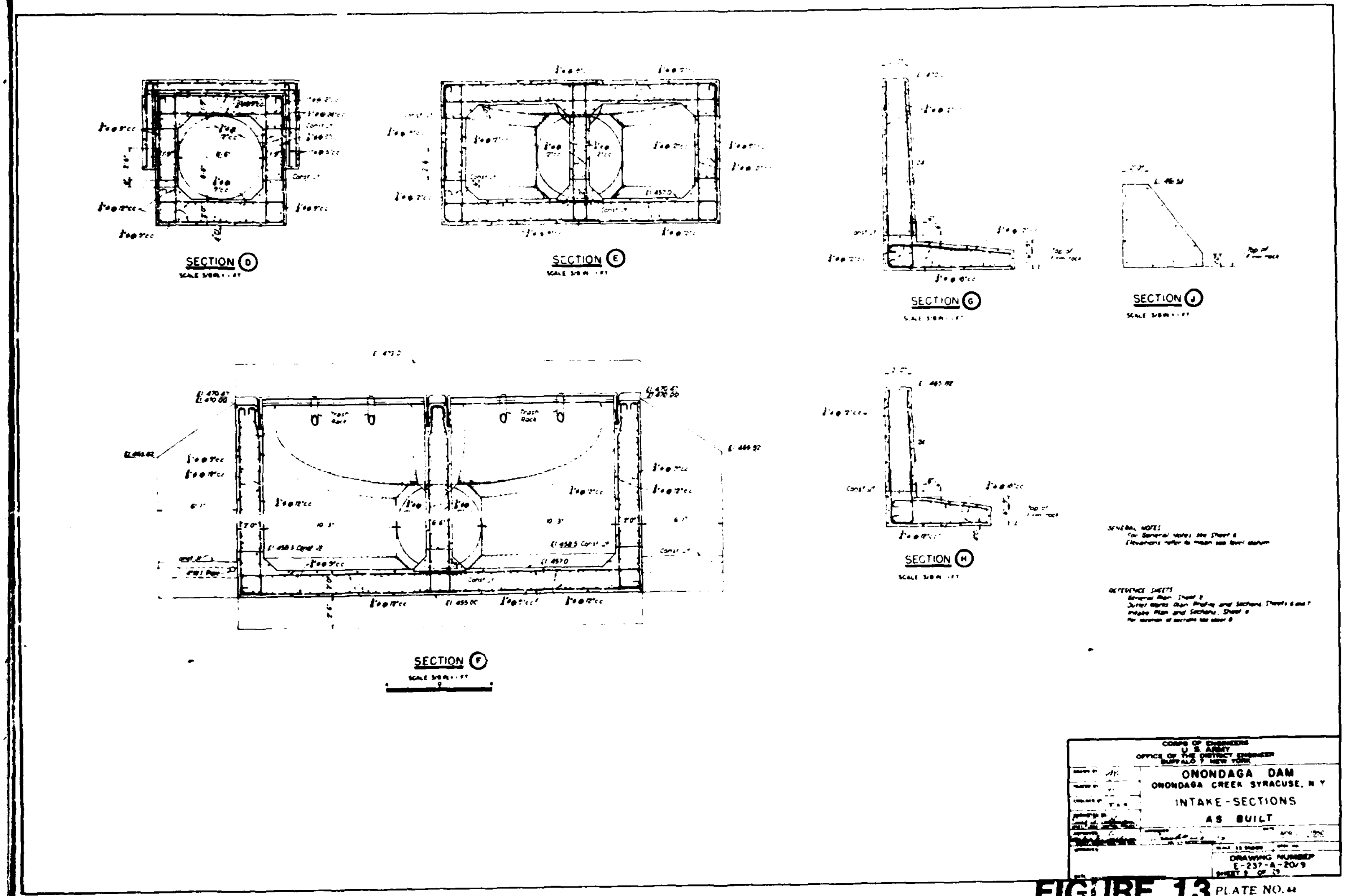



FIGURE 13 PLATE NO. 44

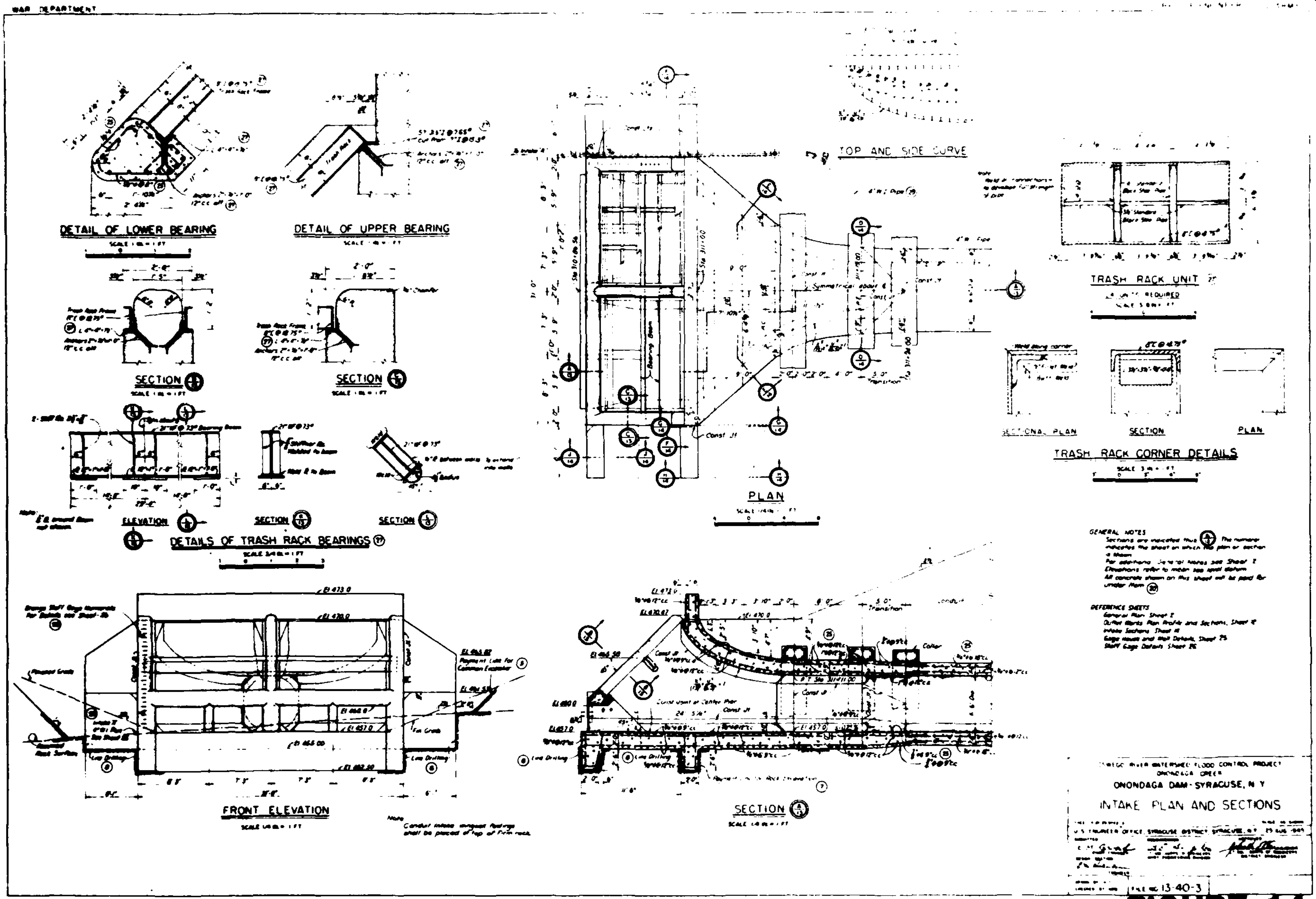

WAR DEPARTMENT
DETAIL OF LOWER BEARING
DETAIL OF UPPER BEARING
SECTION
SECTION
ELEVATION
SECTION
SECTION
DETAILS OF TRASH RACK BEARINGS
FRONT ELEVATION
Note
Conduit intake wingwall footings shall be placed at top of firm rock.
PLAN
TOP AND SIDE CURVE
TRASH RACK UNIT
SECTIONAL PLAN
SECTION
PLAN
TRASH RACK CORNER DETAILS
GENERAL NOTES
REFERENCE SHEETS
SECTION
ONONDAGA DAM - SYRACUSE, N.Y.
INTAKE PLAN AND SECTIONS
13-40-3

FIGURE 14

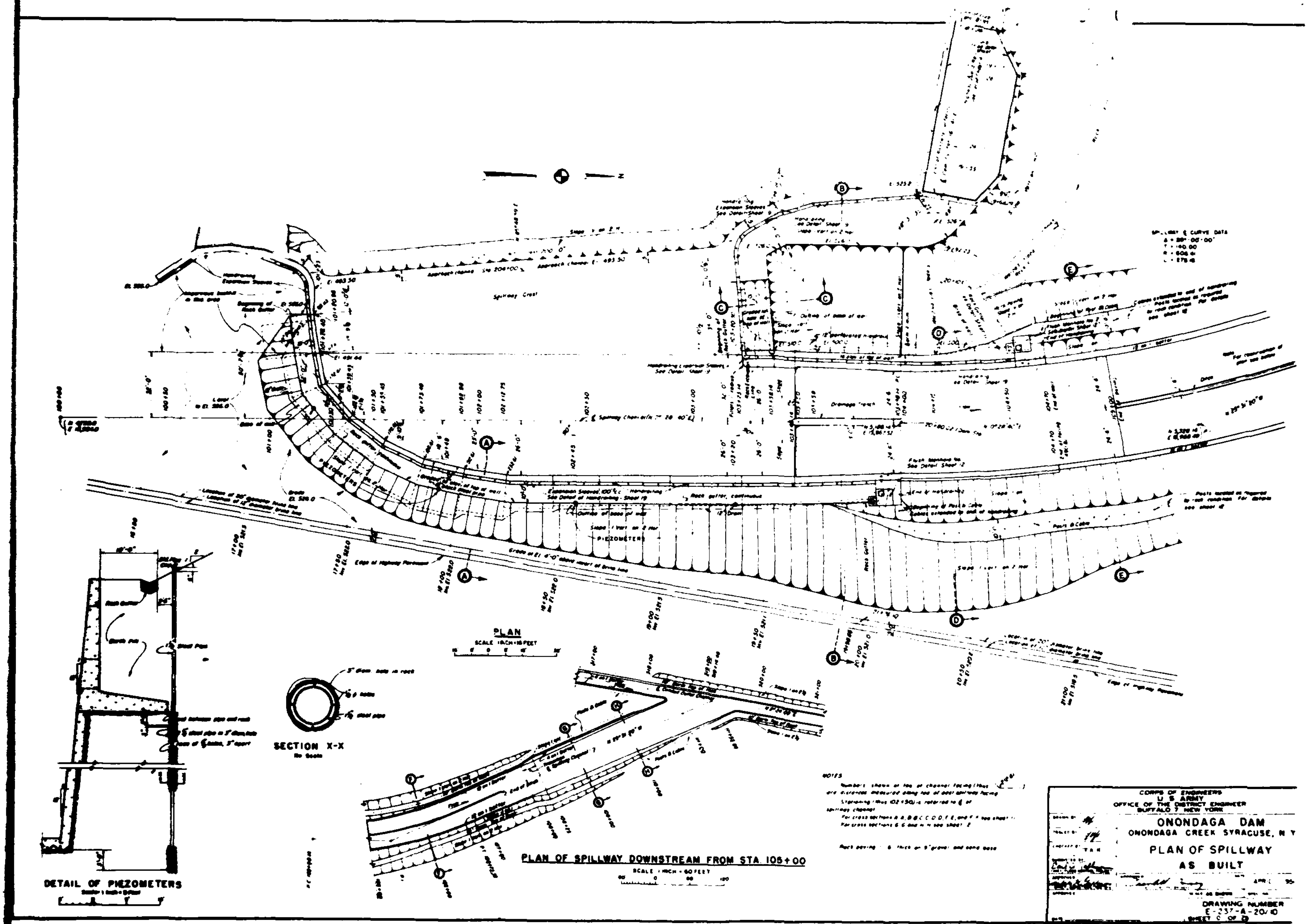
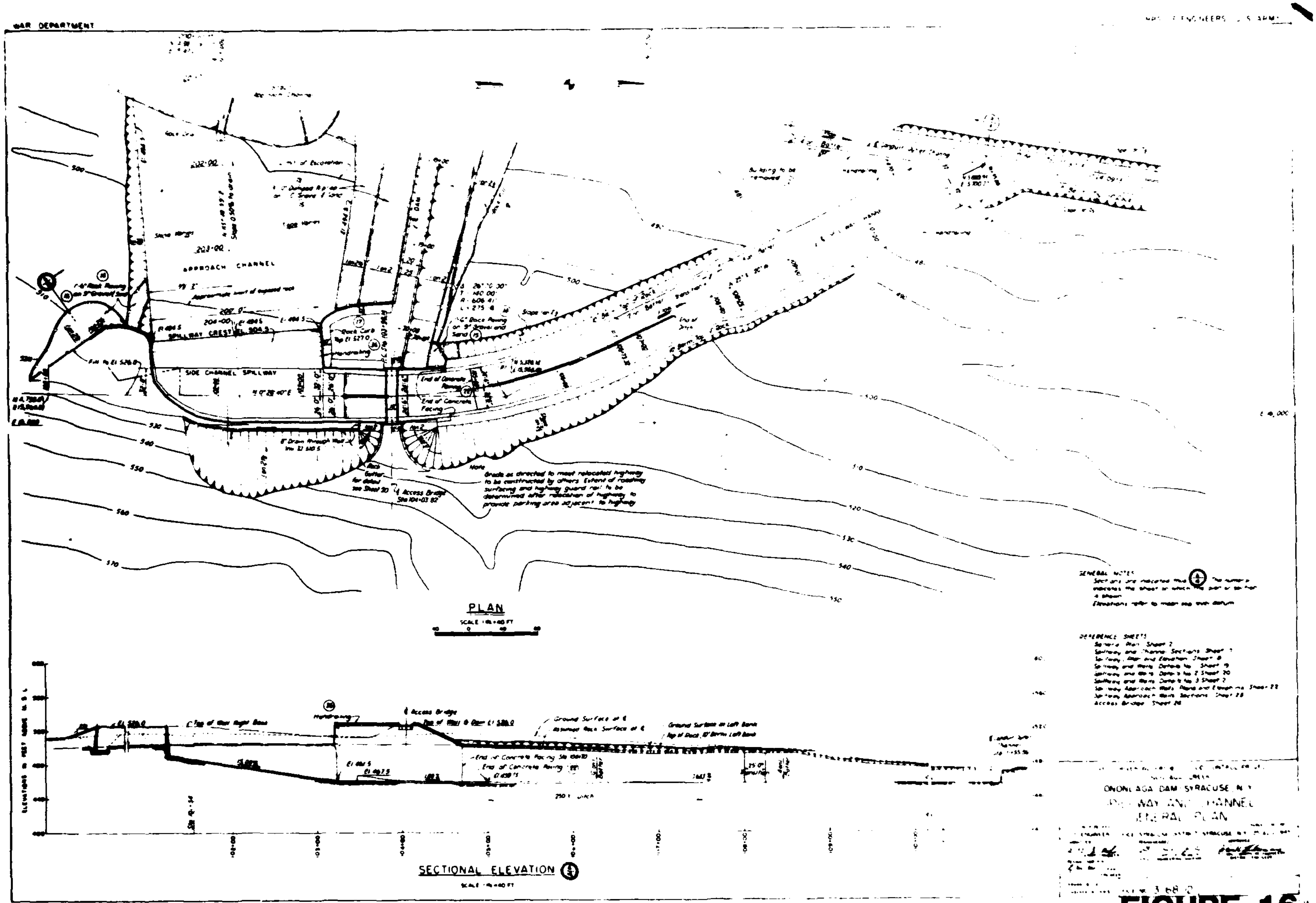



FIGURE 15

PLATE NO.



WAR DEPARTMENT
PLAN
SIDE CHANNEL SPILLWAY
APPROACH CHANNEL
SPILLWAY CREST
SECTIONAL ELEVATION
ONONDAGA DAM SYRACUSE N.Y.


FIGURE 16

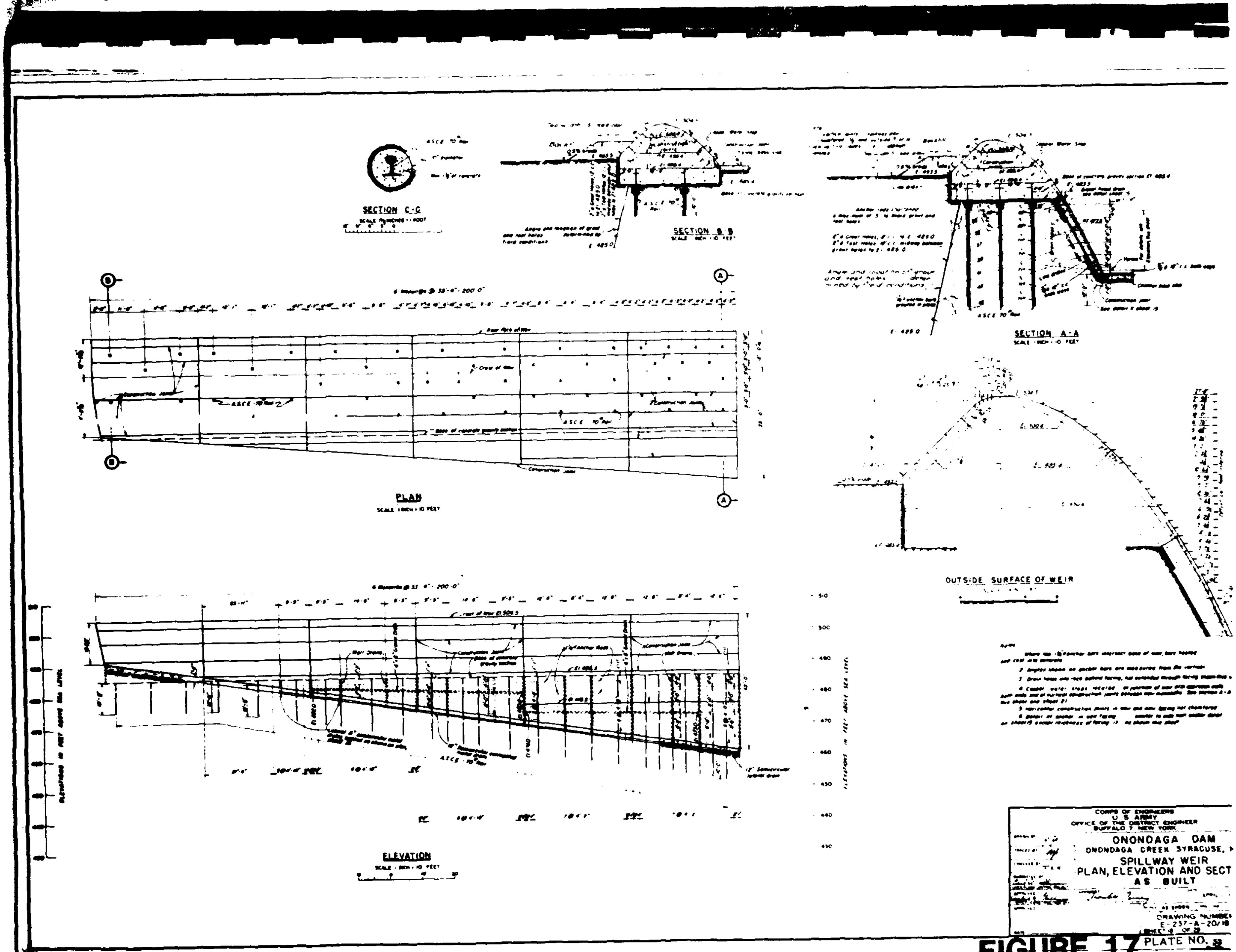

SECTION C-C
SECTION B-B
SECTION A-A
PLAN
OUTSIDE SURFACE OF WEIR
ELEVATION
CORPS OF ENGINEERS
U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
BUFFALO 7, NEW YORK
ONONDAGA DAM
ONONDAGA CREEK SYRACUSE, N
SPILLWAY WEIR
PLAN, ELEVATION AND SECT
AS BUILT
DRAWING NUMBER
E-237-A-20/18
PLATE NO.

FIGURE 17

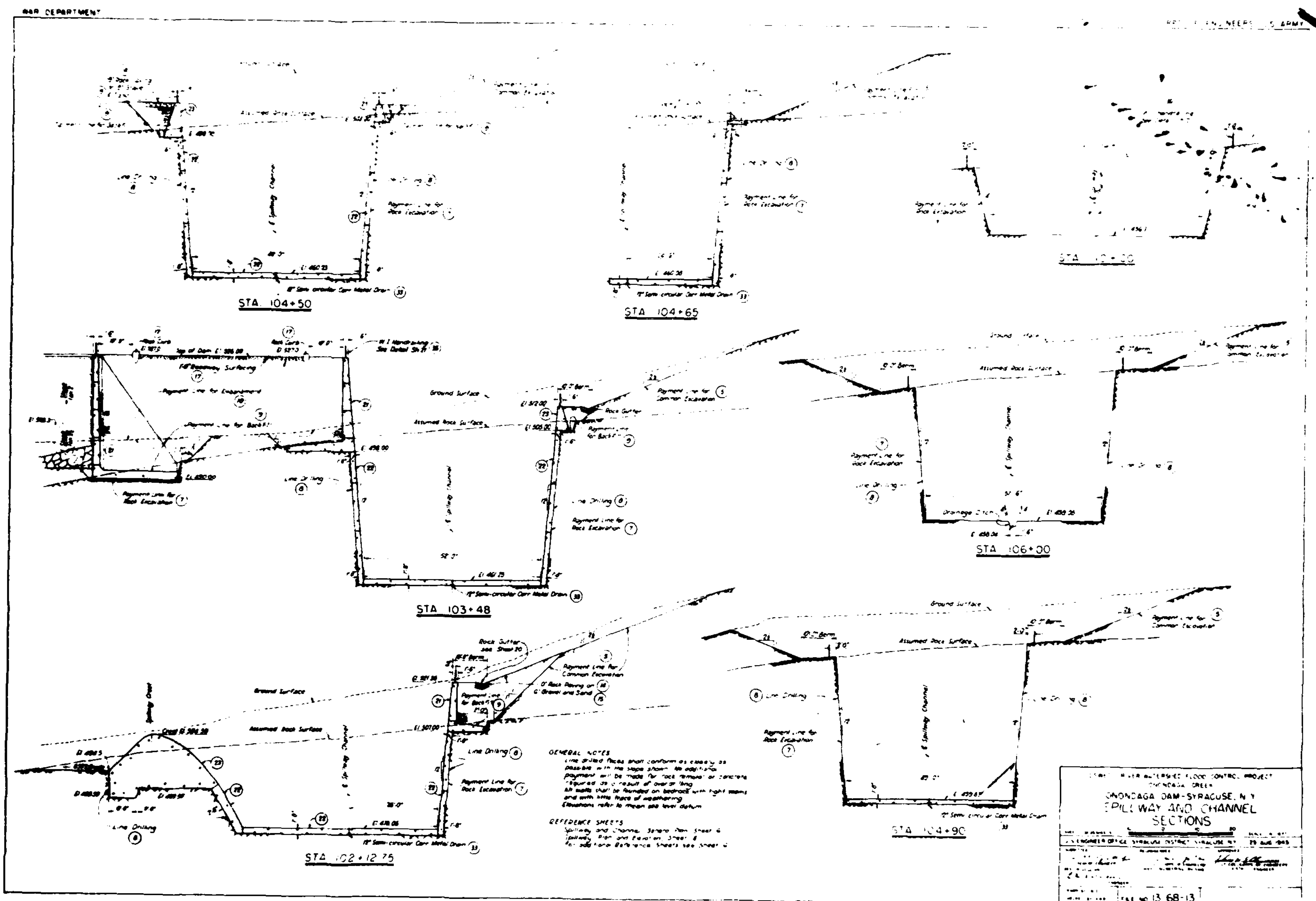

WAR DEPARTMENT
STA 104+50
STA 104+65
STA 106+00
STA 103+48
STA 102+12.75
STA 104+90
Ground Surface
Assumed Rock Surface
Line Drilling
Payment Line for Rock Excavation
Payment Line for Common Excavation
Payment Line for Backfill
Payment Line for Embankment
Rock Gutter
Top of Dam
Roadway Surfacing
Handrailing
Drainage Ditch
18" Semi-circular Corr Metal Drain
Spillway Channel
Spillway Crest
GENERAL NOTES
REFERENCE SHEETS
ONONDAGA CREEK
ONONDAGA DAM-SYRACUSE, N.Y.
SPILLWAY AND CHANNEL
SECTIONS
FILE NO 13 68-13

FIGURE 18

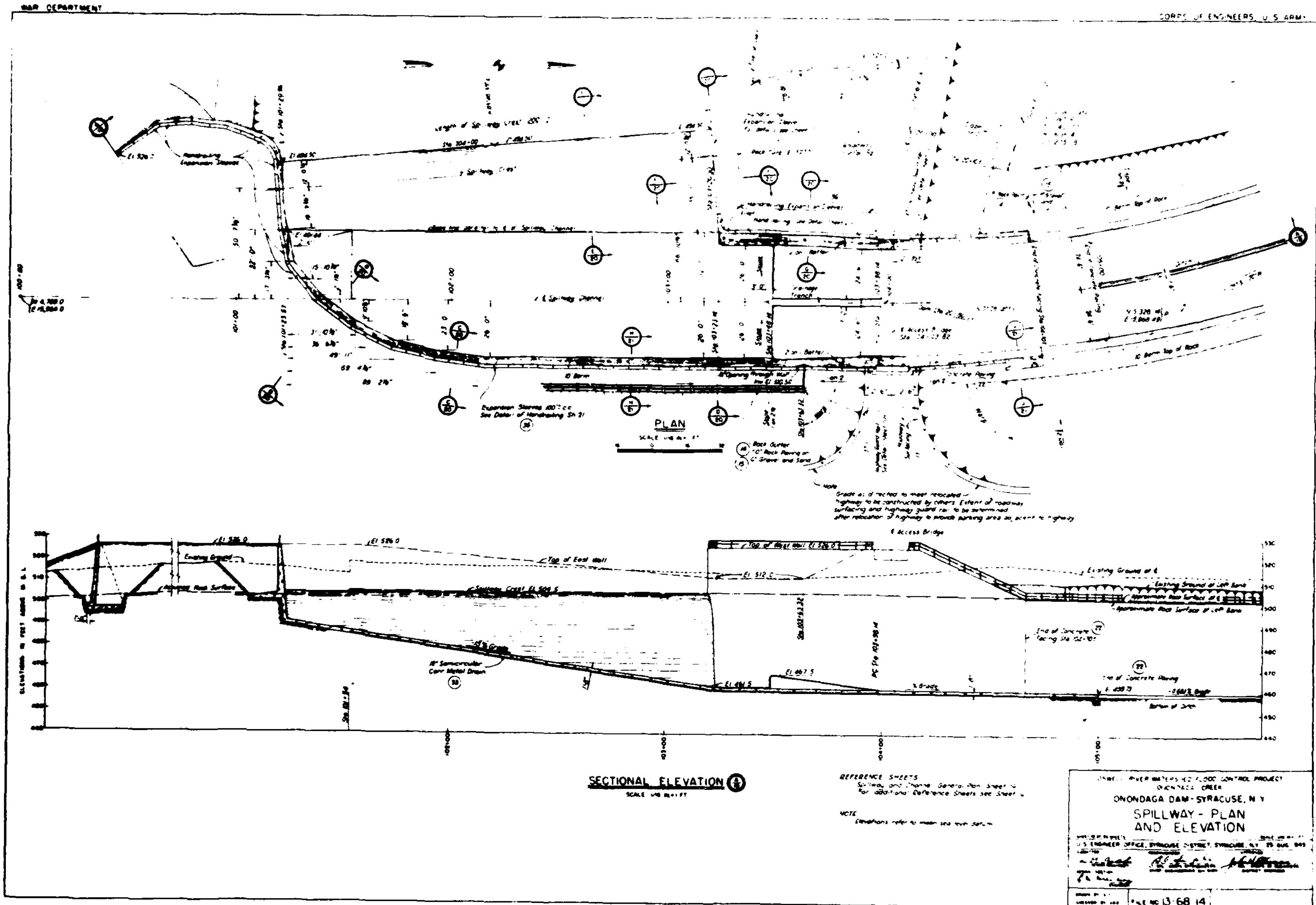
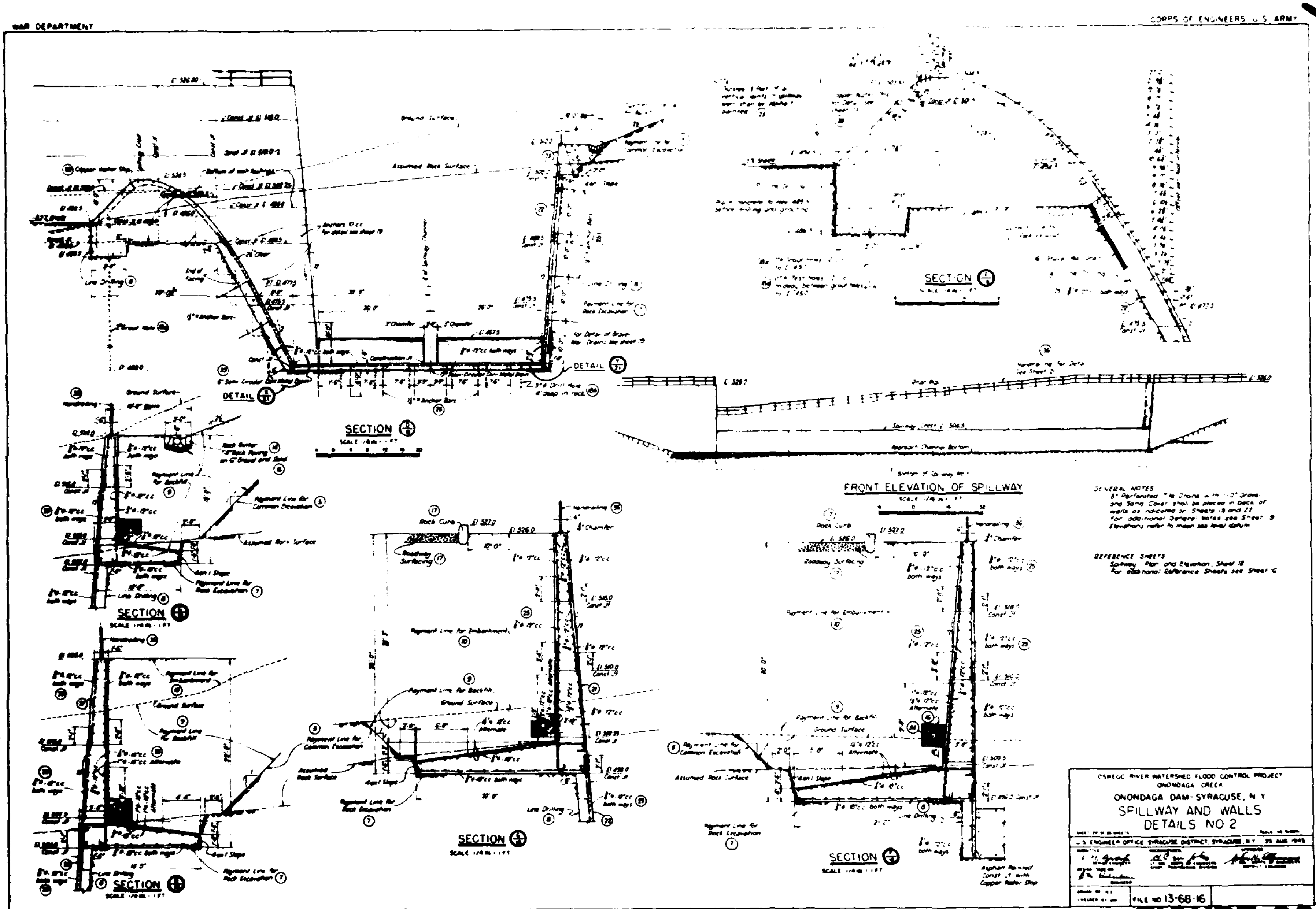

WAR DEPARTMENT
CORPS OF ENGINEERS, U.S. ARMY
PLAN
SECTIONAL ELEVATION
ONONDAGA DAM - SYRACUSE, N.Y.
SPILLWAY - PLAN AND ELEVATION
FILE NO 13-68 14

**FIGURE 19** (18)



WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
SECTION
DETAIL
FRONT ELEVATION OF SPILLWAY
Approach Channel Bottom
Ground Surface
Assumed Rock Surface
Payment Line for Embankment
Payment Line for Backfill
Payment Line for Common Excavation
Payment Line for Rock Excavation
Line Drilling
Rock Curb
Roadway Surfacing
GENERAL NOTES
8" Perforated Tile Drains with
and Sand Cover shall be placed in back of
walls as indicated on Sheets
For additional General Notes see Sheet
Elevations refer to mean sea level datum
REFERENCE SHEETS
Spillway Plan and Elevation, Sheet 18
For additional Reference Sheets see Sheet
OSWEGO RIVER WATERSHED FLOOD CONTROL PROJECT
ONONDAGA CREEK
ONONDAGA DAM - SYRACUSE, N.Y.
SPILLWAY AND WALLS
DETAILS NO 2
U.S. ENGINEER OFFICE SYRACUSE DISTRICT, SYRACUSE, N.Y.
FILE NO 13-68-16


**FIGURE 20**

END

DATE
FILMED
11-81

DTIC