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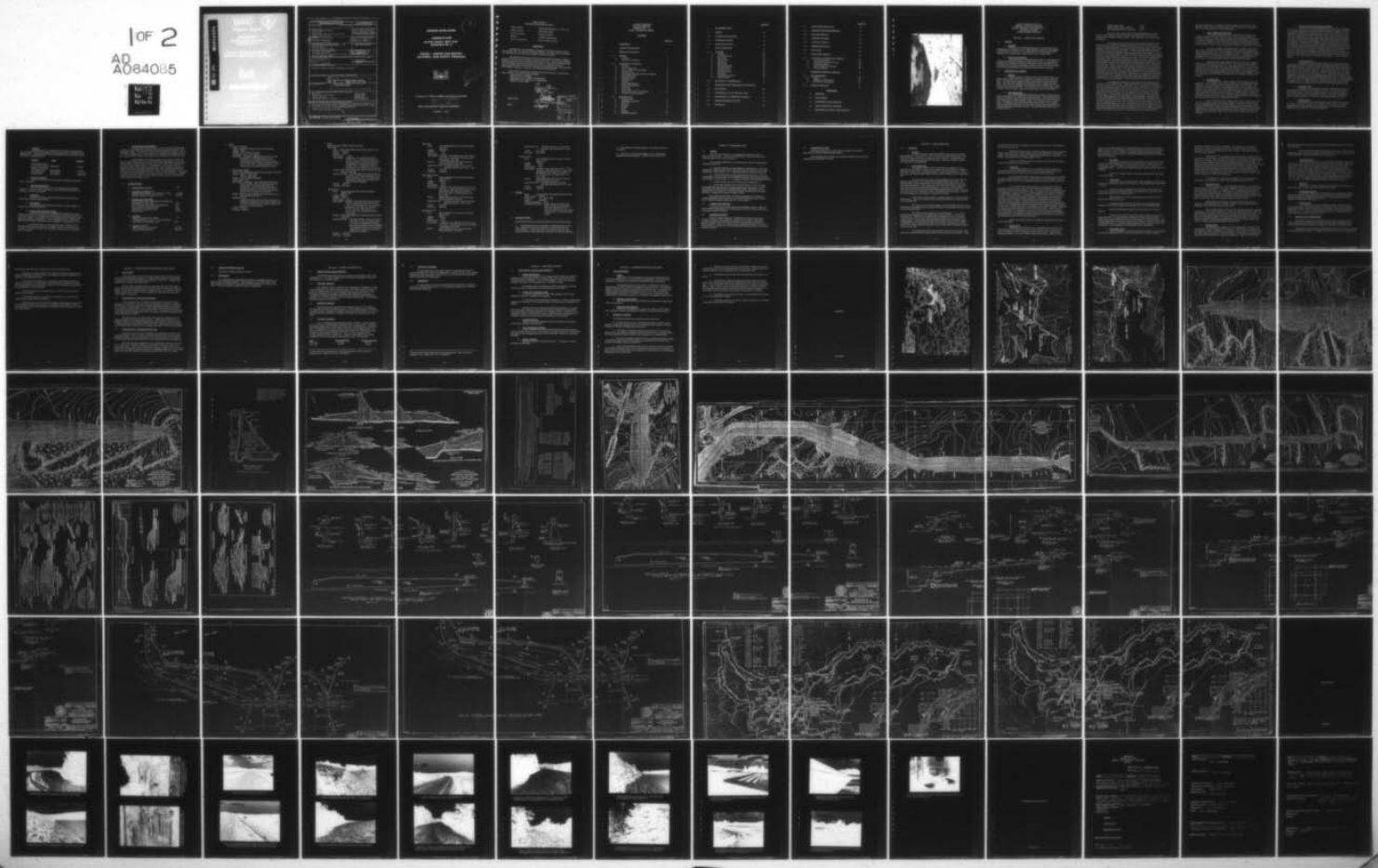

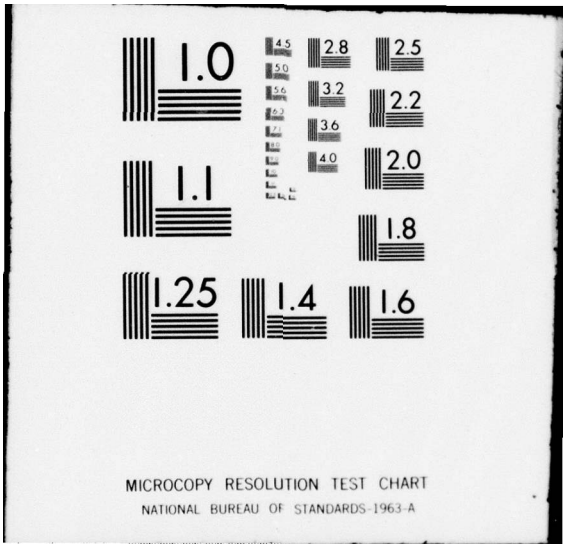
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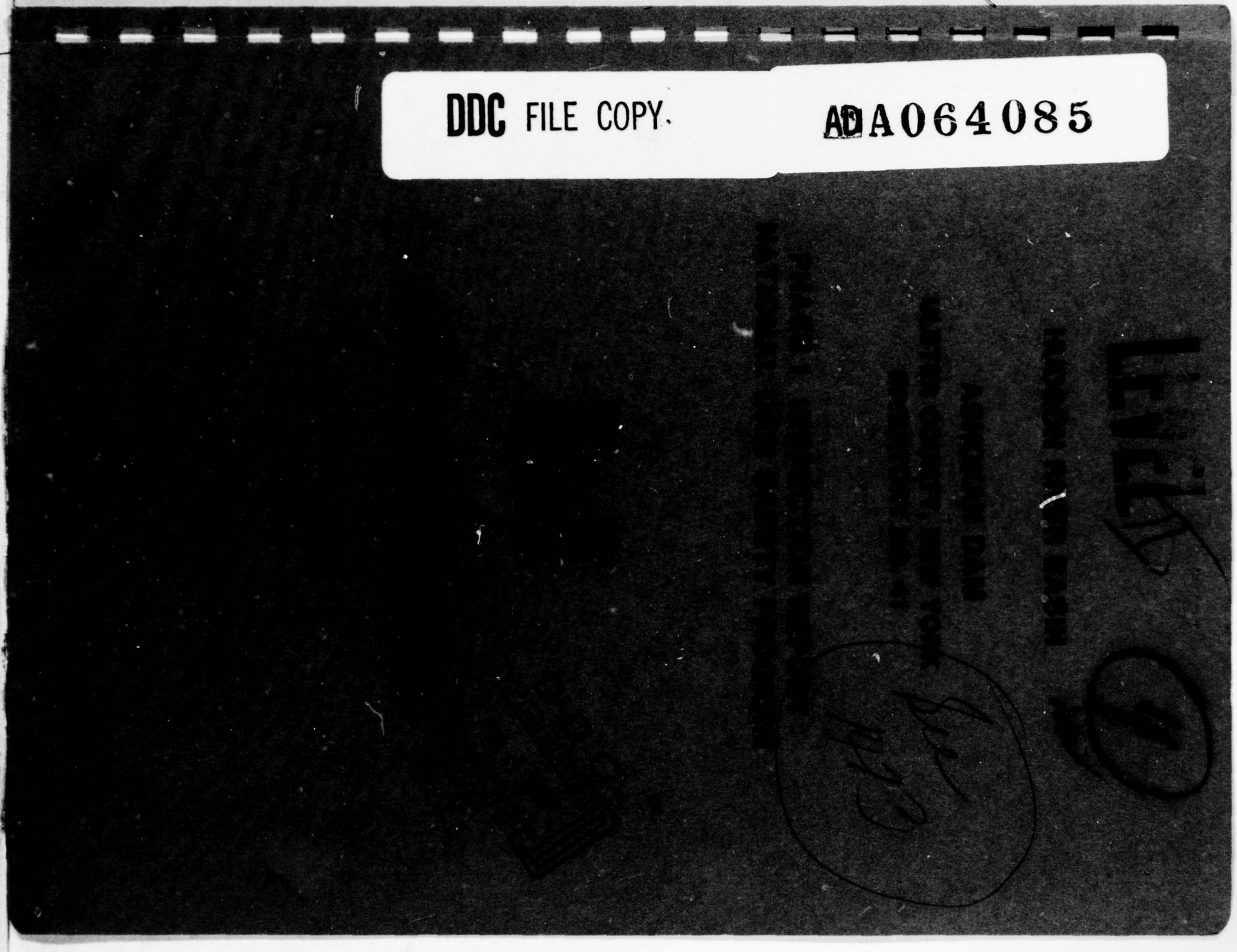

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Ashokan Dam was judged to be safe.

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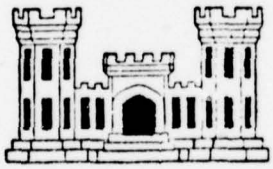
HUDSON RIVER BASIN

ASHOKAN DAM

ULSTER COUNTY, NEW YORK
INVENTORY NO. 41

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



Prepared by: TIPPETTS-ABBETT-McCARTHY-STRATTON

NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1, 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	ASHOKAN RESERVOIR (I.D. NO. 41)
State Located:	NEW YORK STATE
County Located:	ULSTER COUNTY
Stream:	HUDSON RIVER BASIN
Date of Inspection:	JULY 11 AND 12, 1978

ASSESSMENT

Examination of the available documents and visual inspection of the Olive Bridge Dam, the Ashokan Reservoir Spillway, the Dikes and the appurtenant structures did not reveal any conditions which are unsafe.

The Standard Project Flood inflow to the Ashokan Reservoir is approximately 91,300 cfs while the outflow is only 44,900 cfs. The maximum spillway discharge capacity is estimated to be 209,700 cfs. The project discharge capacity is therefore adequate according to the Corps of Engineers' adopted general principle that structures be designed for the maximum flood characteristic of the region, which is, in practice, the Standard Project Flood.

No remedial measures are required at the present time. Certain measures, however, are recommended regarding:

- Measurement of seepage
- Repairs of curbs, parapet and pavements
- Maintenance of vegetation on embankments
- Repair of a gate valve

Eugene O'Brien
New York No. 29823

Approved By: Col. Clark H. Benn
New York District Engineer

Date: 10 August 78

HUDSON RIVER BASIN
ASHOKAN RESERVOIR
INVENTORY NO. 41
PHASE 1 INSPECTION REPORT

CONTENTS

GENERAL OVERVIEW OF OLIVE BRIDGE MASONRY DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ASHOKAN RESERVOIR, INVENTORY NO. 41
HUDSON RIVER BASIN
ULSTER COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection report herein was authorized by the DEPARTMENT OF THE ARMY, NEW YORK DISTRICT, CORPS OF ENGINEERS, by letter dated 31 March 1978, in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367, 8 August 1972.

b. Purpose of Inspection

The purpose of this inspection and report is to investigate and evaluate the existing conditions of subject dam in order to: identify deficiencies and hazardous conditions; determine if they constitute hazards to human life or property; and notify the State of New York of these results along with recommendations for remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. General

Ashokan Reservoir, which is part of the Catskill System supplying water to New York City, is formed by a series of dams, weirs and dikes. The main dam on Esopus Creek is designated as the Olive Bridge Dam. The other water retaining structures are: West, Middle and East Dikes; West Hurley, Woodstock and Glenford Dikes; Dividing Weir, Dividing Weir Dike and Waste Weir. The Dividing Dike and Weir separates the reservoir into two basins, known as the East Basin and the West Basin.

b. Olive Bridge Dam

The Olive Bridge Dam consists of a cyclopean masonry gravity section extended on each side by earth embankments. The central masonry structure is 1000 ft long; the lengths of the north and south embankment sections (designated as north and south wing), are 2100 and 1550 ft, respectively. According to the documents reviewed (see Section 2) the masonry section is founded entirely on rock and faced upstream and downstream with concrete blocks lain in regular courses. The principal dimensions of the masonry dam are:

Width under coping	23 ft
Width at base (max. section)	190 ft
Maximum height above foundation	252 ft

The top of the masonry dam and earth embankments are used as a two-way highway. There are inlets in the roadway on the top of the masonry dam to drain the surface runoff. The inlets drain to the upper drainage gallery.

The masonry portion of the dam is interrupted by eleven expansion joints each of which is located at an inspection well. There are two additional inspection wells, one at each end of the masonry dam. The internal drainage system consists of the upper and lower drainage galleries which are connected by vertical inspection wells. Inclined drainage wells of hollow, porous concrete blocks drain the upper gallery into the lower gallery. Invert elevation of the upper gallery is at El 590, while the invert of the lower gallery varies by sloping toward the midpoint of the dam. Access to the upper inspection gallery used to be through manholes from the top of dam. (At present, asphalt pavement covers the original brick roadway and the manholes.) The lower gallery connects with a perpendicular access gallery which exits at the toe of the dam. There is a sluice gate at the downstream end of the access gallery which is used to drain the accumulated seepage water from the gallery into the gorge of Esopus Creek. The gate operating stem is accessible from the outside. One 10-inch low level outlet pipe passes through the dam and continues along the access gallery; it terminates in a concrete-lined valve pit at the toe of the dam. Access to the valve is through a metal trap door which is kept locked. It is reported that the outlet pipe was installed to release water for recreational purposes. It is not known if the valve was ever used.

The embankment sections on both sides of the masonry structure have a crest width of 34 ft. The crest elevation is 610 at the upstream side and slopes to El 609 at the downstream side. According to the documents reviewed the upstream slope varies from 1(V): 2(H) at top to 1(V): 2.75(H) at toe; the downstream slope varies from 1(V): 2(H) at top to 1(V): 3(H) at toe. There are 10-foot wide berms at 30 ft intervals on both upstream and downstream slopes. The upstream face below El 570 is covered with a surface layer of riprap placed on a bedding layer of rock fragments. Between El 570 and 600 the upstream face is paved with dry rubble bedded in crushed stone. A concrete masonry core wall, which extends to solid rock, is located 16 ft from the upstream edge of the crest. Its width at the top (El 596) is 4 ft; both faces are evenly battered at 1 (V): 0.05 (H) from top to the original ground surface and are vertical between ground surface and the rock foundation. On the downstream slope there is a stone and crushed rock layer of varying thickness, which is covered with 24 inches of clayey earth and 12 inches of topsoil.

On each wing there is subsurface drainage system which consists of vitrified drain pipes placed in trenches filled with broken stone and boulders. Access to the drain pipes is through manholes.

c. West, Middle and East Dikes

The crest elevation and cross section of the West Dike are identical to the south wing of the main dam. The West Dike contains a concrete masonry core wall, which, according to the documents is supported in earth for a distance of approximately 770 ft from its western end and on rock for the remaining 1020 ft. The maximum height of the Dike from bottom of core trench is 115 ft. A paved roadway runs along the full length of the dike.

The cross section of the Middle Dike is similar to that of the West Dike, except that the crest elevation is 607 along the upstream face. The concrete masonry core wall is supported on rock for a distance of approximately 3000 ft and in earth for the remaining 4,000 ft. The maximum height of Middle Dike is 195 ft where the Dike crosses the pre-glacial gorge of Beaver Kill. A paved road exists along the full length of the dike.

The East Dike is approximately 3340 ft long and its maximum height above bottom of core trench is 35 ft. The dike has a crest width of 15 ft (El 602); its upstream slope is at 1(V): 2(H) from El 602 to 595, the remainder is at 1 (V): 2.5 (H). The entire downstream slope is at 1 (V): 3 (H). The crest and the downstream slope are grass covered. The upstream face below El 595 is covered with paving stones on crushed stone bedding. There is a downstream rock toe which is covered with 2 ft of clayey earth and is grassed.

d. Dividing Weir

The Dividing Weir, which separates the West Basin from the East Basin, has a length of 1100 ft and consists of an uncontrolled overflow structure. Its cross section is ogee shaped with the crest at El 590. The height of the maximum section is approximately 30 ft. The upstream slope of the Weir is constructed as an earth embankment with a slope at 1(V): 2(H), which is paved with stone set on a crushed rock bedding layer. The downstream part of the Weir consists of cyclopean masonry with the straight portion of the slope at 1 (V): 0.6 (H). There is a highway bridge above the Weir; the bridge piers interrupt the continuity of the Weir.

At the south end of the Dividing Weir is the Dividing Weir Dike which is interrupted by the Upper Gate Chamber. The Dike ends where the West and Middle Dikes meet. The crest detail and the cross section of the Dividing Weir Dike are similar to those of the West Dike except that its downstream slope is also paved and that there is only one berm at El 570 on both upstream and downstream slopes. The crest carries a highway on a paved roadway.

e. Waste Weir (Ashokan Reservoir Spillway)

The Waste Weir is approximately 955 ft in length, S-shaped in plan and it extends in a northerly direction from the east end of East Dike to a concrete training wall at its north end. The Weir, supported on rock originally consisted of cyclopean masonry with an upstream slope of 1 (V): 2 (H) and a downstream slope of 1(V): 1(H). Only a minor part of the structure was constructed as an earth embankment with paving stone protecting the upstream slope of the embankment. The crest of the Weir is at El 587. The Weir was rehabilitated by applying a gunite surfacing to the structure. The overflow is collected in the Waste Channel located between the toe of the Weir and a concrete retaining wall which is nearly parallel with the weir. The channel widens from the south toward the north, where it makes a 90$\pm$° turn. A curved ashlar wall acting as a baffle projects into the channel from the center pier of the highway bridge (Rte 28A) which crosses over the channel.) Downstream of the bridge the Waste Channel runs on exposed bedrock into a gully which enters the Esopus Creek valley 1.4 miles from the bridge.

f. West Hurley Dike

According to the documents reviewed, the West Hurley Dike is approximately 3450 ft long and 55 ft high (at maximum section). The earth embankment includes a concrete masonry core wall which is supported on bedrock. Top of the core wall is at El 593. The crest of the Dike is at El 607 and carries a two-lane paved roadway. The upstream slope is at 1(V): 2(H) above El 587, and at 1 (V): 2.5(H) below El 587. There is a zone of rockfill of minimum 5 ft thickness on the upstream slope from El 597 to the toe. The rockfill is protected by stone paving between El 567 and 597. The downstream slope is at 1(V): 2 (H) from crest to a 10-ft wide berm at El 577, then continues at a slope of 1(V): 2-3/4(H) to the toe. Below the berm the slope consists of rockfill which is covered with 24 inches of clayey earth and is grassed.

g. Woodstock Dike

According to the documents reviewed, the Woodstock Dike is approximately 2500 ft long and maximum 30 ft high. The crest of the dike is at El 602, has a width of 15 ft and is grassed. The upstream slope is 1(V): 2(H) and 1(V): 2.5(H); downstream slope is 1(V): 3(H). The upstream slope is stone protected. The Dike has a concrete masonry core wall.

h. Glenford Dike

The Glenford Dike is approximately 2850 ft long and maximum 60 ft high. The crest is at El 607, its width is 36 ft. There is a single abandoned R.R. track along the crest of the Dike. In other respects the Glenford Dike is similar to the West Hurley Dike.

i. Location

Ashokan Reservoir is located about 14 miles west from Kingston, New York, within the drainage basin of Esopus Creek, a tributary of the Hudson River. The principal structures forming the reservoir and the nearest downstream communities are:

Facility	Town	Distance
Olive Bridge Dam; Waste Weir; West, Middle, East Dike	Marbletown	6 miles
West Hurley Dike	Stony Hollow	1+ mile
Woodstock Dike	West Hurley	0.25± mile
Glenford Dike	West Hurley	0.25± mile

j. Size Classification

The dam is more than 100 ft high and is therefore considered to be a large dam.

k. Hazard Classification

The dam and the dikes are in the "high" hazard potential category. Parts of several communities would be affected by a failure of the dam or a breach of the dikes.

l. Ownership

Ashokan Reservoir is owned and operated by the New York City Bureau of Water Supply (BOWS).

m. Use of Dam

The impoundment provided by the dam is a water storage reservoir for the City of New York.

n. Design and Construction History

The principal structures, including Olive Bridge Dam, West, Middle and East Dikes, Dividing and Waste Weirs, and appurtenances were designed by BOWS. The contract for the construction of the principal structures was awarded on September 5, 1907 to MacArthur Bros. Company and Winston and Company; construction was completed on December 20, 1916.

The Hurley Dikes, including West Hurley, Woodstock and Glenford Dikes, were designed also by BOWS. Bids for construction were opened on November 24, 1909. The contractor's name and the completion date are unknown.

o. Normal Operating Procedures

The flow into Ashokan Reservoir consists of surface runoff from the Esopus Creek watershed and water releases from Schoharie Reservoir via Shandoken Tunnel. The maximum release from Schoharie is limited to 1040 cfs (672 mgd). Between June 1 and October 30 the releases are regulated so that the combined flow in Esopus Creek below the confluence is at least 300 mgd.

Water releases from Ashokan Reservoir are passed through the upper or lower intakes located in the Dividing Weir Gate House. The upper level intakes are normally used in the summer, the lower level intakes in the winter to supply clearest water. Flow regulation is provided by the inlet regulating valves at the Upper Gate Chamber. Flow is further controlled by gate valves at the Lower Gate Chamber. Most of the water passes through screens in the Screen Chamber and then into the Catskill Aqueduct. Discharges to New York City are kept generally below 600 mgd. Excess water is directed over internal weirs at El 510 into the Waste Tunnel, then via the Beaverkill Waste Channel into Esopus Creek.

1.3 PERTINENT DATA

a. Drainage Area (sq mile)	257
b. Discharge at Damsite (cfs)	
Maximum known flood at site (March 30, 1951)	46,000
Spillway (ungated) capacity at El 602	209,000
c. Elevation (ft above MSL)	
Top of masonry dam, south wing, north wing embankments and West Dike)	610
Top of Middle, West, Hurley Glenford Dike	607
Top of East and Woodstock Dike	602
Streambed at centerline of dam	397±
Spillway crest	587.0
d. Reservoir	
Length of maximum pool, miles	12
Combined surface area at El 587 in East Basin and El 590 in West Basin, acres	8314
e. Storage (acre-feet)	
Top of spillway crest (El 587)	392,400
Top of East Dike (El 602)	512,500

f. Dam

1. Masonry Section

Type: Cyclopean masonry with cut stone facing
Length: 1000 ft
Height: 252 ft above foundation
Top width: 23.0 ft under coping
Side Slope: Upstream: Vertical from El 610 to El 500 and 1(V): 0.10 (H) from El 500 to toe.
Downstream: Curved at radius 86 ft from El 610 to El 566.2; 1(V): 0.6 (H) from El 566.2 to El 532.5; 1(V): 0.7 (H) from El 532.5 to El 500; and 1(V): 0.92 (H) from El 500 to toe.

2. Embankment Section

Type: Earth embankment with concrete masonry core wall.
Length: 1550± ft south wing
2100± ft north wing
Height: 220± ft above foundation
Crest Width: 34 ft
Side Slopes: Upstream: 1(V): 2(H) from El 610 (top of crest) to El 590; 1(V): 2.5 (H) from El 590 to El 540; 1(V): 2.75 (H) from El 540 to toe.
Downstream: 1(V): 2 (H) from El 609 (top of crest) to El 580; 1 (V): 2.75 (H) from El 580 to El 550; 1(V): 3 (H) from El 550 to toe.
Zoning: Earth dam with central vertical impervious concrete masonry core wall.
Impervious core:
Concrete masonry, top at El 596 and bottom on solid rock; top width 4 ft and sides sloping 1(V): 0.05 (H) to original ground surface and then vertical to the rock foundation.
Cutoff: Unknown
Grouting: Unknown

3. Dikes

Beaver Kill Dikes (West, Middle and East)

West Dike -

Type: Earth embankment with concrete masonry core

Length: 1790± ft

Height: 115 ft

Crest Width: 34± ft

Side Slopes: Upstream: 1(V): 2(H) from El 610 to El 590; 1(V): 2.5 (H) from El 590 to El 540; and 1(V) to 2.75 from El 540 to toe. Downstream: 1(V): 2(H) from El 609 to El 580; 1(V): 2.75 (H) from El 580 to El 550; and 1(V): 3(H) from El 550 to toe.

Zoning: Earth embankment with central vertical concrete masonry core wall.

Impervious Core: Concrete masonry, top at El 596 and bottom on solid rock; top width 4 ft; and sides battered at 1(V): 0.05 (H) to original ground surface and then vertical to earth or rock foundation.

Cutoff: Unknown

Crouting: Unknown

Middle Dike -

Type: Earth embankment with concrete masonry central core.

Length: 7000± ft

Height: 195± ft

Crest width: 34± ft

Side Slopes: Upstream: 1(V): 2(H) from El 607 to El 587; 1(V): 2.5 (H) from El 587 to El 537 and 1 (V): 2.75 (H) from El 537 to toe of dike. Downstream: 1(V): 2(H) from El 606 to El 577; 1(V): 2.75 (H) from El 577 to El 547; and 1(V) to 3(H) from El 547 to toe of dike.

Zoning: Earth embankment with central concrete masonry core wall.

Impervious Core: Concrete masonry, top at El 593 and top width 4 ft and side slopes 1(V): 0.05 (H) to original ground surface, then vertical to earth or rock foundation, except between Sta 24+25 and 25+80, where bottom section of core wall is stepped and widened.

Cutoff: Unknown

Grouting: Unknown

East Dike -

Type:	Earth embankment with concrete masonry core wall.
Length:	3340± ft
Height:	35 ft
Crest width:	15 ft
Side Slopes:	Upstream: 1(V): 2(H) from El 602 to El 595 and 1(V): 2.5 (H) from El 595 toe of dike. Downstream: 1(V): 3(H)
Zoning:	Earth embankment with central vertical concrete masonry core wall.
Impervious Core:	Concrete masonry, top at El 593 and other data same as West Dike.
Cutoff:	Unknown
Grouting:	Unknown

West Hurley Dike -

Type:	Earth embankment with concrete masonry central core.
Length:	3450± ft
Height:	55± ft
Crest Width:	34± ft
Side Slopes:	Upstream: 1(V): 2(H) from El 607 to El 587 and 1(V): 2.5 (H) from El 587 to toe of dike. Downstream: 1(V): 2(H) from El 607 to El 577 and 1(V): 2.75 (H) from El 577 to toe of dike.
Zoning:	Earth embankment with a central vertical concrete masonry core wall.
Impervious Core:	Concrete masonry, top at El 593 and other data same as West Dike.
Cutoff:	Unknown
Grouting:	Unknown

Woodstock Dike -

Type:	Earth embankment with concrete masonry central core.
Length:	2500± ft
Height:	30± ft
Crest Width:	15 ft
Side Slopes:	Upstream: 1(V): 2(H) from El 602 to El 587 and 1(V): 2.5 (H) from El 587 to toe of dike. Downstream: 1(V): 3(H)
Zoning:	Earth embankment with central vertical concrete masonry core wall.

Impervious Core: Concrete masonry, top at El 593 and other data same as West Dike.
Cutoff: Not known
Grouting: Not known

Glenford Dike -

Type: Earth embankment with concrete masonry central core.
Length: 2850± ft
Height: 60± ft
Crest Width: 36 ft
Side Slopes: Upstream: 1(V): 2(H) from El 607 to El 587 and 1(V): 2.5(H) from El 587 to toe of dike. Downstream: 1(V): 2(H) from El 605 to El 577 and 1(V): 2.75 (H) from El 577 to toe of dike.
Zoning: Earth embankment with vertical concrete masonry central core wall.
Impervious Core: Concrete masonry, top El 593 and other data same as West Dike.
Cutoff: Unknown
Grouting: Unknown

g. Spillway

Type: Ogee spillway with stepped bottom section
Length of weir: 955± ft
Crest Elev. 587 ft above MSL
Gates: Ungated
Upstream Channel: None
Downstream Channel: Waste Channel is paved with rubble to Route 28A bridge, from there the channel floor is on rock; the channel joins the Esopus Creek Valley 1.4 miles from the bridge.

h. Regulating Outlets

Regulating outlets for the Ashokan Reservoir are discussed below:

1. Catskill Aqueduct has a maximum discharge capacity of 640 mgd. Releases are limited to 600 mgd to maintain gravity flow in the Aqueduct. Some restriction to flow may result from overloaded screens but the screens are removable for cleaning purposes.

2. The maximum discharge capacity of the Waste Tunnel is 1150 mgd.

3. Excess flow would be discharged over the Waste Weir (Ashokan Reservoir Spillway). Crest of weir is at El 587.

SECTION 2: ENGINEERING DATA

2.1 DESIGN

The main dam and dikes were designed by BOWS of the City of New York prior to 1907. There are no design data or specific design memoranda available for the project features.

The available information on the main dams, dikes and appurtenant structures consist of:

a. Contract Drawings and Specifications (Contract No. 3) for construction of "Main Dams for the Ashokan Reservoir in the towns of Olive and Marbletown, Ulster County, N.Y." prepared by BOWS, dated June 20, 1907.

b. Contract Drawings and Specifications (Contract No. 60) for the construction of "Hurley Dikes for the Ashokan Reservoir in the towns of Hurley and Kingston, Ulster County, N.Y." prepared by BOWS, dated September 10,1909.

c. Various working and record drawings for Contract No. 3.

d. It has been reported that in the late sixties or early seventies the 18-inch high flash boards were removed from the Waste Weir. In 1975 the Waste Weir structure was resurfaced with gunite. The details of the modifications are shown on the drawings entitled "Rehabilitation of Ashokan Reservoir," prepared by Amman & Whitney in 1974.

The information available on subsurface conditions is limited to to rock elevations at borings which were made during design and are shown on the Contract Drawings referred to in a. and b. above.

2.2 CONTRUCTION RECORDS

No detailed construction records are available; however, there are brief narratives pertaining to the construction of the dam and other structures in the annual reports of BOWS.

2.3 OPERATION RECORDS

Records of gate operations, maintenance and repair work orders, as well as records of pool elevation, rainfall, air and water temperatures for both the Ashokan and Schoharie Reservoirs are available at the Brown Station of BOWS. There is no operation and maintenance manual for the operating facilities, but there are some operating instructions posted in each gate operation building.

2.4 EVALUATION OF DATA

Existing information was made readily available at the BOWS' New York City office and Brown Station office..

The available data reviewed are considered adequate for this Phase I inspection and evaluation of safety.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

A visual inspection of Ashokan Reservoir was made on Tuesday and Wednesday, July 11 and 12, 1978. At the time of the inspection the West Basin level was at El 590.31, East Basin level at 584.80. The weather was sunny with temperatures between 70° and 80°F. Rainfall reportedly occurred the night before the inspection.

b. Olive Bridge Dam

The masonry portion of the Olive Bridge Dam appears to be in generally good condition. There were no visible signs of distress or movement. There was some growth, including a sapling, on the downstream face. There were some spalling and minor cracks on the concrete surfaces of the downstream face.

The manholes to the upper drainage gallery were covered with asphalt and were closed. An inspection of the lower gallery was made. The drainage wells and inspection wells were observed discharging water into the lower drainage gallery. Some inspection wells were quite active, especially No 10 which was discharging approximately 3.5 gpm into the lower gallery, while No 11 and No 13 each were discharging approximately 1/3 gpm. The opening at the base of the far wall in the No 10 inspection well was about 2 inches. The total leakage from the gallery is reported as 15± gpm.

There were no visible holes or sizable cracks in the lower drainage gallery walls. Some wall surfaces were covered with deposits, especially near No 8 drainage well.

Salt used in snow removal appears to be the probable cause of some deterioration and spalling of the concrete surfaces of the parapets and upper ledges on the downstream face.

The north and south wings (earth embankments) appear to be in generally good condition; the horizontal and vertical alignments of the crest are also good. There were no visible signs of sloughing, erosion, cracking or other distress on the north and south wings except for some cracks on the paved roadway. Off the north end of the masonry dam, the curb of the roadway is damaged near the downstream wingwall and surface runoff appears to have washed out a small channel which exits at the contact with the downstream face of the masonry dam.

The downstream slope and the upper portion of the upstream slope (above the stone paving) are grass covered on both north and south wings. There

is a bush at the level of the uppermost of paving stone course on the upstream slope of the south wing.

It has been reported that in 1956 the paving stones on the upstream slope of the north wing, near the masonry dam, was damaged by heavy wave action. The damage was repaired by setting the paving stones in concrete. The length of the repaired area is approximately 150 ft.

There is no visible evidence of seepage emerging from the slopes or toes of the north and south wings.

c. West Dike

The West Dike appears to be in generally good condition; the horizontal and vertical alignments of the crest are good except for the pavement depression near the south end of the Dike as described below.

The downstream and the upper portion of the upstream slope (above the stone paving) are grass covered. There was no sign of sloughing, erosion, cracking or other distress on the upstream slope and visible portion of the riprap.

It is reported that during the winter or early spring of 1978 the downstream slope near the south end of the Dike was affected by sloughing which was caused by heavy surface runoff. It appears that the sloughing occurred downslope of an area where the roadway pavement has undergone cracking and differential settlement. The maximum settlement in the area is as much as 2 inches. From the observed signs it appears that pavement deterioration in this area may have been occurring gradually or periodically after each rainy season causing the cracks to open wider and the roadway to tilt toward the downstream slope, thereby collecting more and more surface runoff during major storms. The sloughing may have been triggered by the buildup of water pressure in the layer of crushed rock which, according to the contract drawings, underlies the topsoil and clayey earth layer on the downstream slope. Uplift pressure on the underside of the impervious soil cover would then result in sloughing. The area affected by sloughing is 100 ft wide at the top of slope and 50 ft at its downslope limit. The slope was repaired by placing fill and turf on the slope. The pavement distress has not been corrected.

There is no visible evidence of seepage emerging from the slope or toe of the Dike.

d. Middle Dike

The Middle Dike appears to be in generally good condition; the horizontal and vertical alignments of the crest are also good. There was no sign of sloughing, erosion, cracking or other distress on the upstream and downstream slopes, nor on the visible portion of the riprap. There are minor

cracks in the roadway pavement. Both longitudinal and transverse pavement grades are good. The downstream slope and the upper portion of the upstream slope are grass covered. There is no visible evidence of seepage emerging from the slope or toe of the Dike. Some flow was emerging from the subsurface drain at its low point.

e. East Dike

The East Dike appears to be in generally good condition; the horizontal and vertical alignments of the crest are also good. There was no sign of sloughing, erosion, cracking or other distress on the crest, upstream or downstream slopes. The crest and slopes are grass covered and free of bushes or shrubs.

There is no visible evidence of seepage emerging from the slopes or toe of the Dike.

f. Waste Weir

At the time of the inspection, water was not spilling over the crest. There was no evidence of distress or movement. The spillway was rehabilitated in 1976-7.

There were signs of leakage and some minor seepage from the joints of the central and northern portions of the Waste Weir, and there were at least two leaks on the southern portion.

Although most of the floor surface has been repaired there were some loose stones in the floor.

The ashlar baffle wall near the center of the spillway bridge appeared to be in good condition even though it has not been rehabilitated.

Holes for flash board supports were not restored to the crest surface.

There was no evidence of erosion along the Waste Channel, but there are areas in the rubble-paved channel floor where vegetation exists. These areas may be indicative of minor underseepage from the East Basin. The channel downstream of the Waste Channel is on bedrock. Although further away from the Weir there are trees and other vegetation in the channel, they are not considered to be an impediment to discharges from the East Basin.

g. West Hurley Dike

The Dike appears to be in generally good condition; the horizontal and vertical alignments of the crest are good except for a minor pavement

depression described in the next paragraph. There were no visible signs of sloughing, erosion or cracking on the crest or on either slope of the Dike. Some shrubs and overgrown grass exist on both slopes. The crest serves as a paved two-lane highway.

Approximately at mid-length of the Dike near the easterly edge of the roadway, the pavement is slightly depressed, even though it has been patched. Adjacent to the patch, the curb along the roadway is interrupted, probably to provide an exit for surface runoff which would pond otherwise in the low area. A shallow swale leading to the top of the downstream slope and a soft zone of 25-foot width were noticed at the toe downslope of the curb opening. Similar soggy areas were noted downslope from two other breaks in the curb and also at a location 400 ft from the north end of the Dike. It is not known if the wet conditions were due to rainfall during the previous night or to minor seepage. No sign of sloughing or distress was observed.

An estimated 3 to 5 gpm was emerging from a 14-inch cast iron pipe which is presumably the outlet of the subsurface drainage system.

h. Woodstock Dike

The Dike which has a curved alignment appears to be in generally good condition; the horizontal and vertical alignments of the crest are also good. There were no visible signs of sloughing, erosion, cracking or other distress on the crest and upstream slope. The riprap is in good condition and has not been displaced. Near the maximum curvature along the Dike there are trees and bushes as well as some debris at the level of the top riprap paving stones. The crest and the upper part of the upstream slope are grass covered.

Approximately 250 ft east of the bend in the Dike, the ground adjacent to the downstream toe is swampy. There is heavy vegetation on the downstream slope near the east end of the Dike.

West of the bend, the cross section of the Dike appears to be wider than shown on the Contract Drawings. There is an abandoned railroad track on the widened area which is 120 ft in width and about 15 ft below crest level. The track is located approximately 90 ft from the downstream edge of the widened area. The downstream slope is overgrown with trees and bushes. There is no visible evidence of seepage emerging from the slopes or toe of the Dike, but there is a small pond of stagnant water beyond the toe.

i. Glenford Dike

The Glenford Dike appears to be in generally good condition; the horizontal and vertical alignments are also good. There were no visible signs of sloughing, erosion, cracking or other distress on the crest or on either slope. The riprap slope protection is in good condition. The upstream slope above the riprap is overgrown with trees, bushes and saplings. There is a 4-foot high

masonry wall along the upstream edge of the crest approximately 10 ft from the dike centerline.

An unused single railroad track exists on the crest, which is overgrown with trees, bushes and saplings on both sides of the track. On the downstream slope there is a heavy growth of trees and bushes.

j. Regulating Gates

The regulating gates are at the Upper Gate Chamber. Eight sixty inch diameter gate valves can control the water releases; from each Basin two gate valves admit water into the Upper Aqueduct and two into the Lower Aqueduct. At the Lower Gate Chamber, Upper Aqueduct Gate Valves Nos 2 and 4 or Lower Aqueduct Gate Valves Nos 1, 3, 5 and 7 regulate water into the Screen Chamber. The water then flows into the Catskill Aqueduct; excess water is diverted into the Waste Tunnel. Gate Valves Nos 6, 9, 12 and 14 are used to bypass water into emergency turbine generators, Gate Valves Nos 8, 10, 11 and 13 to bypass water to the Aerator Gate Valves Nos 15, 16, 17, 18, 19 and 20. The bypass water then returns to the Screen Chamber.

k. Abutments

There were no signs of seepage or other unusual conditions at the abutments of the masonry dam, Dikes and the Waste Weir.

l. Downstream Channel

The channel downstream of the masonry dam is the Esopus Creek. Although the channel contained trees and dense bushes, its present condition would not impede discharges from the reservoir. The findings at waste weir channel are described in Paragraph 3.1 f.

m. Reservoir Area

In the vicinity of the Olive Bridge Dam; West, Middle and East Dikes; Waste Weir; and the Hurley Dikes, there was no evidence of sloughing, potentially unstable slopes or other unusual conditions which would adversely affect the dam. It is also reported that there have been no adverse reports by motor patrols who examine the reservoir rim.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not indicate any serious problems which would adversely affect the safety of the dam and require either immediate investigation or immediate remedial action.

The spalling of the concrete on the downstream face of the dam, including the upper ledges and parapets, is probably the result of the action of chloride ion

when snow mixed with salt is disposed of on the downstream face.

There were no visible leaks on the downstream face of the dam but the growth of vegetation and the presence of a sapling are possible indications of moisture at the downstream face.

The leaks in the masonry dam, especially in inspection well No 10, should be monitored on a regular basis and records kept to determine whether the leakage quantities are increasing. Review of the available records indicate that the leakage is relatively stable.

The heavy vegetation, especially trees, on the slopes of the dikes should be discouraged.

Local depressions and cracking of the pavements on the West Dike and West Hurley Dike should be repaired.

Gate Valve No 6 in the Lower Gate Chamber was leaking at a high rate. It is not known whether Gate Valve No 9 is operable at the present. Both of these valves are used for feeding water to emergency turbine generators in case of a power failure.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

Ashokan Reservoir stores waters from Esopus Creek along with water diverted from the Schoharie Reservoir. Maximum daily release from Schoharie, by agreement with New York State Power Authority, is 672 mg. Normally the releases vary between 500 and 600 mgd.

Releases from Ashokan Reservoir to the New York City water supply system through Catskill Aqueduct are controlled by the New York City office of BOWS. The discharge varies between 350 and 600 mgd. To supply the clearest water the upper level intakes are used normally in the summer and the lower level intakes in the winter.

4.2 MAINTENANCE OF THE DAM AND DIKES

It was reported that an operation and maintenance manual is being prepared for the project. There are motor boat patrols to examine the reservoir rim regularly. Although there is no formally established program of inspection for the masonry dam and dikes, major deficiences would be detected through the constant presence of the project staff of BOWS. The quantity of both leakage at the main dam and seepage from some of the dikes is measured periodically by BOWS engineering personnel.

The dikes and the two wings of the main dam are maintained only by periodic mowing of the grass slope protection. Maintenance of the earth embankment appears to be adequate except for the local growth of brush at the top of riprap of the south wing and the Woodstock Dike. Maintenance of the slopes of the Glenford Dike, which are not as easily accessible, is less than adequate.

4.3 MAINTENANCE OF OPERATING FACILITIES

Although there is no overall operation and maintenance manual for the operating facilities, there are some operating instructions posted at each gate operation building. These instructions do not cover procedures to be followed for preventing vibration effects and in the event equipment becomes inoperative.

The regulating gates appeared to be in operational condition at the time of the inspection. Overload condition is protected by shear pins, which are easily replaceable. Some valve packings were leaking, notably Valve No 6, which feeds water to emergency turbine generators. Regulating valves are moved approximately at three week intervals as directed by BOWS' New York City office.

4.4 WARNING SYSTEMS IN EFFECT

There are no warning systems in effect.

4.5 EVALUATION

The operational and maintenance procedures at Ashokan Reservoir, in general, are considered adequate. The maintenance of Glenford Dike is less than adequate with respect to the control of heavy growth on the slopes of the Dike. A periodic inspection program should be established.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 DRAINAGE AREA CHARACTERISTICS

The Ashokan Dam and Reservoir is located on the Esopus Creek, East of Kingston N.Y. The total drainage area of the basin contributing to the Ashokan Reservoir is 257 square miles.

5.2 SPILLWAY CAPACITY

The spillway, which is located on the East Basin, is shaped to conform to the overfall jet, and is 950.0 feet in length. The maximum head possible between the spillway crest (El 587.0 feet) and the top of the dam is 15.0 feet. No data is available on the head-discharge relationship of the spillway. In computing the spillway discharge rating table the coefficient was assumed to vary from 3.1 at 0.5 feet head to 3.8 at 5.0 feet head and above. The computed maximum discharge is 209,700 cfs.

5.3 RESERVOIR CAPACITY

The total reservoir capacity at the spillway crest (El 587.0 feet) is 127.858 billion gallons (392,400 acre-feet). It is estimated that the available surcharge storage, between the spillway crest and the top of the dam, is 120,100 acre feet which is equivalent to a depth of 8.8 inches of runoff over the entire basin.

5.4 FLOODS OF RECORD

A U.S. Geological Survey Gaging station, located 1.5 miles upstream from the reservoir, was operated from January 1914 to current year. The maximum peak discharge flow, for the period of record, was 59,600 cfs on March 30, 1951. Transposed on the basis of the square-root of the drainage areas, the estimated inflow to the Ashokan Reservoir was 71,300 cfs. The maximum head recorded at the spillway for March 1951 was 5.23 feet, equivalent to an outflow discharge of about 46,000 cfs. Data in a report made for the Corps of Engineers on the Lower Hudson River Basin[1/], give the following:

Date	Inflow Peak (cfs)	Outflow Peak (cfs)
Oct. 1955	51,679	22,742
June 1972	62,732	38,865

[1/] Lower Hudson Basin Hydrologic Flood Routing Model, Water Resources Engineers, Inc. January 1977, pg. 145 Table 14.

5.5 OVERFLOW POTENTIAL

The Standard Project Flood (SPF) inflow to the Ashokan Reservoir is given as 91,286 cfs[1/] while the outflow peak is only 44,881 cfs. The computed maximum spillway discharge of 209,700 cfs is 2.3 times the SPF inflow peak and 4.7 times the SPF outflow peak.

5.6 EVALUATION

In view of the fact that the Ashokan Reservoir Spillway is capable of passing the Standard Project Flood, it is considered adequate from a hydraulic and hydrologic viewpoint.

[1/] Lower Hudson Basin Hydrologic Flood Routing Model, Water Resources Engineers, Inc. January 1977, pg. 145 Table 14.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations did not indicate either existing or potential problems with the masonry portion of Olive Bridge Dam and the Waste Weir (Ashokan Reservoir Spillway). The observed leakage in the lower inspection gallery of the dam is not detrimental to its stability or safety.

The small amounts of seepage and leaks emerging from several locations along the Waste Weir are not detrimental to its safety.

b. Design and Construction Data

No design computations or other data regarding the structural stability of the dam or spillway are available.

On the basis of the performance experience, as well as engineering judgement the spillway and the masonry portion of the dam are considered to be stable.

Although there are no design computations available, it is likely that the masonry gravity sections were designed by engineers of the BOWS in accordance with procedures presented in E. Wegmann's text, "Design and Construction of Dams." If the masonry sections were designed accordingly, the stability of the gravity section would be considered to be adequate.

c. Operating Records

No major operational problems which would affect the stability of the dam or spillway were reported.

d. Post Construction Changes

A major rehabilitation of the Ashokan Reservoir Spillway was carried out during 1975 and 1976. The details of the major repairs and modifications are shown on the drawings prepared in 1974 by Ammann & Whitney, Consulting Engineers.

e. Seismic Stability

The dam is located in Seismic Zone No. 1, therefore no seismic analyses are warranted.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Examination of the available documents and visual inspection of the Olive Bridge Dam, the Ashokan Reservoir Spillway, the Dikes and the appurtenant structures did not reveal any conditions which are unsafe.

The Standard Project Flood inflow to the Ashokan Reservoir is approximately 91,300 cfs while the outflow is only 44,900 cfs. The maximum spillway discharge capacity is estimated to be 209,700 cfs. The project discharge capacity is therefore adequate according to the Corps of Engineers' adopted general principle that structures be designed for the maximum flood characteristic of the region, which is, in practice, the Standard Project Flood.

b. Adequacy of Information

The information and data available were adequate for performance of this investigation.

c. Additional Investigations

Additional investigations to assess the safety of Olive Bridge Dam, Spillway, Dikes and appurtenant structures do not appear necessary.

7.2 REMEDIAL MEASURES

No remedial measures are required at the present time.

It is recommended, however, that deficiences that are minor at the present be repaired or monitored to assess potential future changes in the performance of the dam and appurtenant structures:

a. The leakage occurring through joints and cracks in the masonry portion of the main dam and spillway should be measured on a systematic basis. The data obtained should be reviewed and evaluated on an ongoing basis.

b. The rate of seepage emerging from the subsurface drainage systems at the various dikes should be measured on a systematic basis and the data should be evaluated after each inspection.

c. The concrete parapet on the top of the masonry portion of the main dam should be repaired. Also a snow clearing procedure should be developed so that snow and ice mixed with de-icing salts is not disposed of on the downstream coping near the top of the dam.

d. Pavement near the south end of West Dike should be restored to original grade by reconstructing both base and surfacing. Similar repair work should be carried out in a localized area on West Hurley Dike.

e. Curb adjacent to the north end of the masonry dam should be repaired.

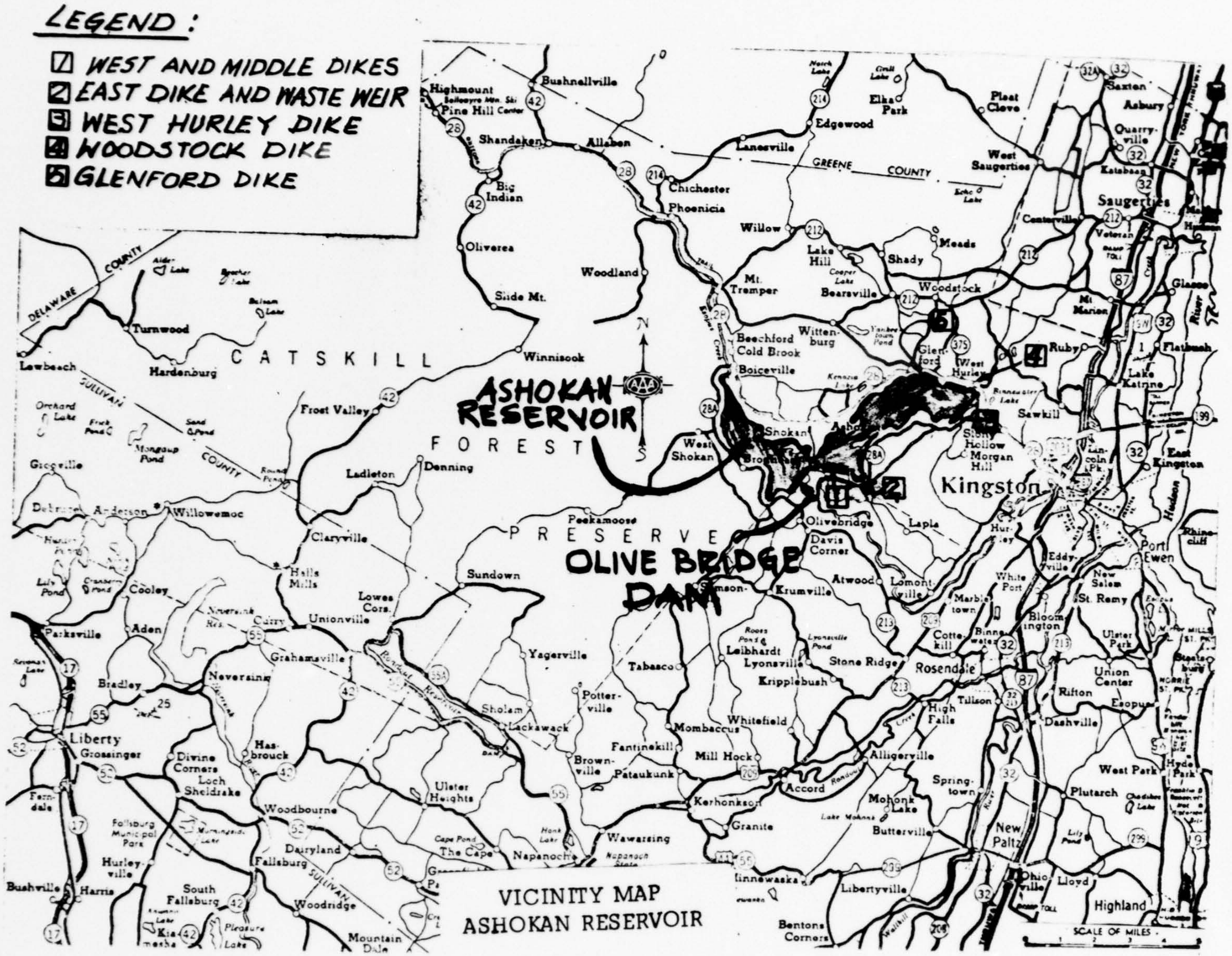
f. Heavy brush, shrubs and saplings should be removed from the slopes of the Woodstock and Glenford Dikes and the south wing of the main dam. On the downstream slope of the Glenford Dike tree growth is especially heavy. Larger conifers, but not deciduous hardwoods, should be removed. The remaining trees should be inventoried and their condition monitored. If a tree dies, the area around the tree should be monitored for seepage.

g. Appropriate action should be taken to stop leakage at Gate Valve No 6 in the Lower Gate Chamber.

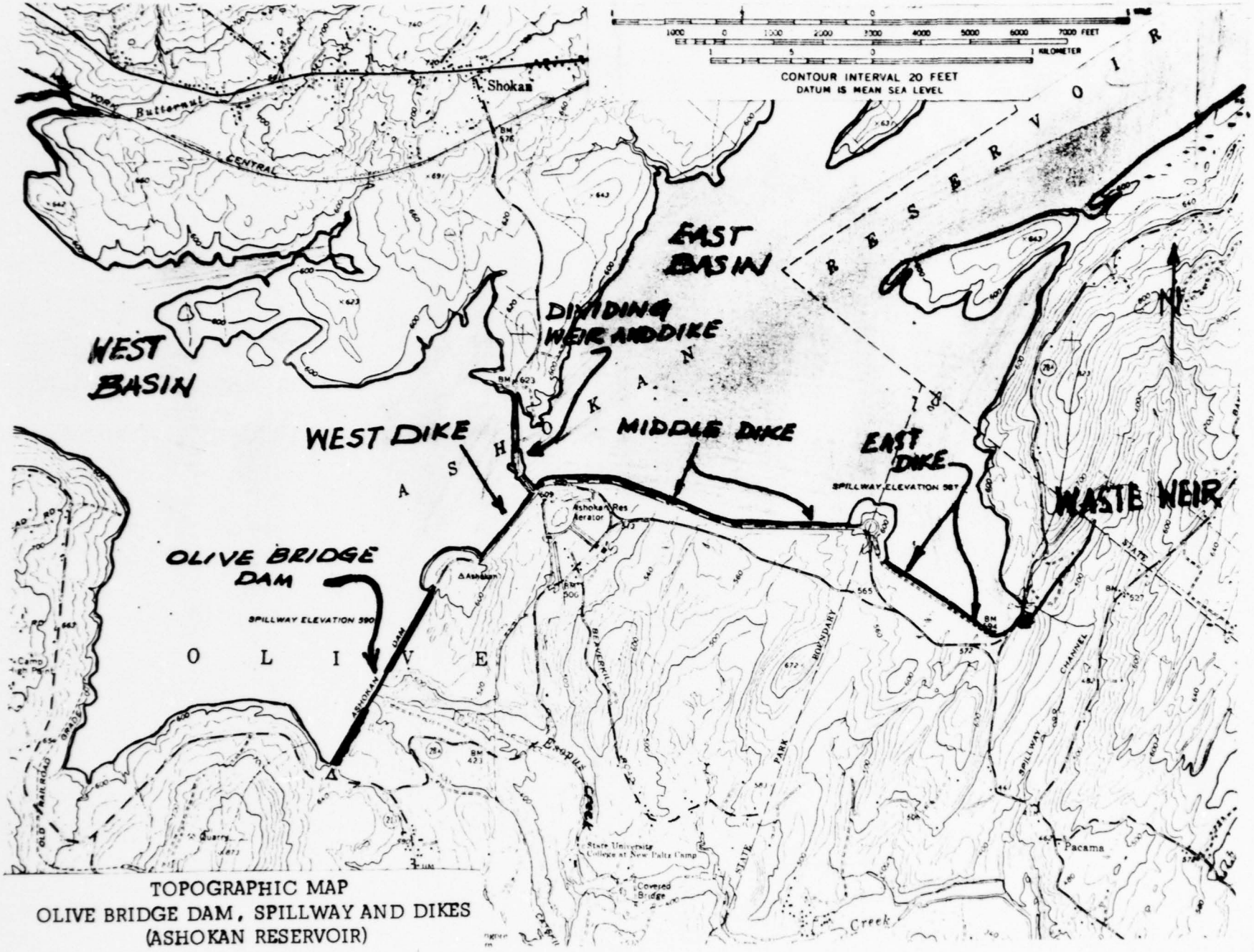
h. Vegetation growing in the Waste Channel (upstream of the Bridge) of the Waste Weir should be removed.

DRAWINGS

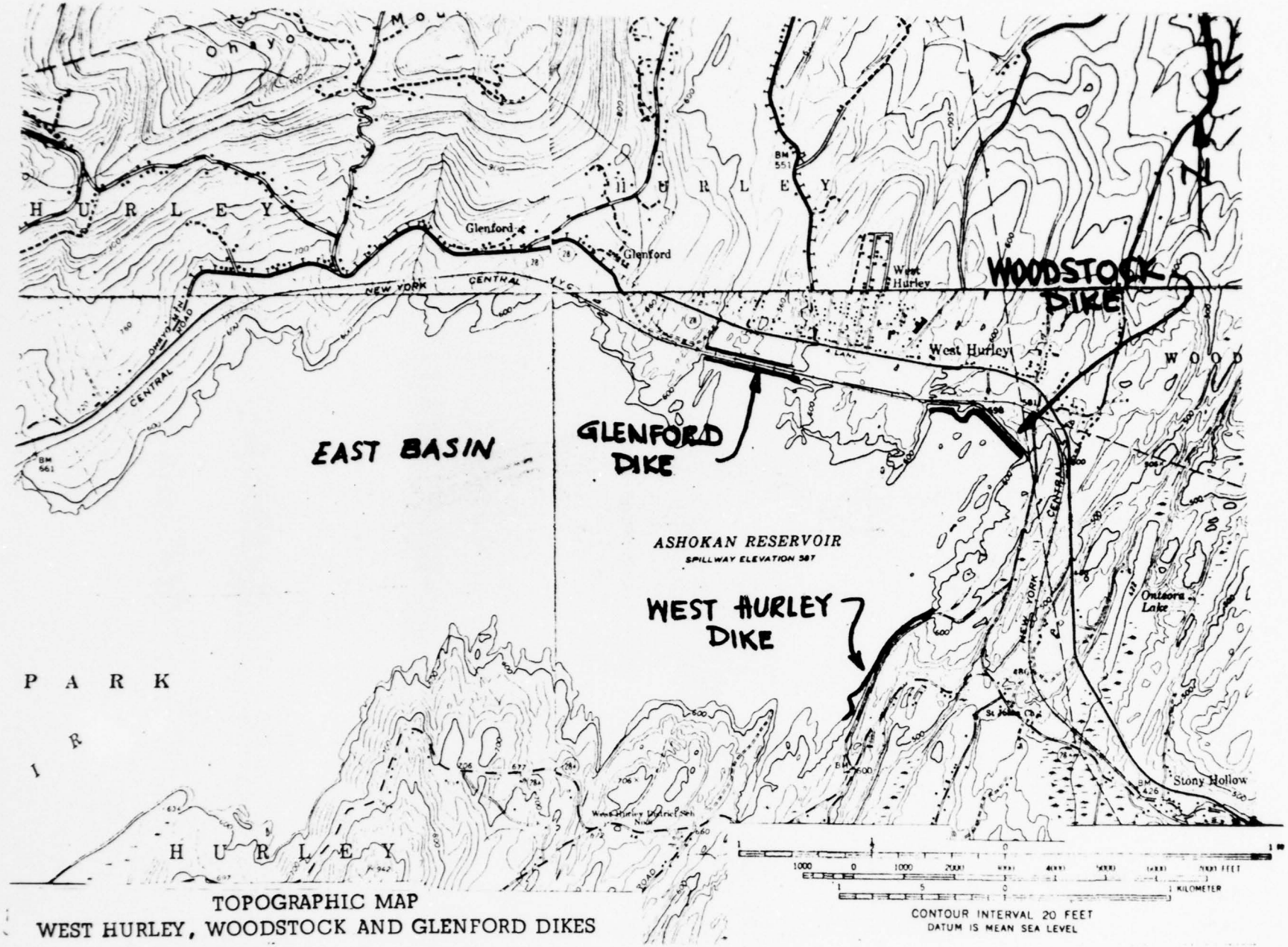
APPENDIX A



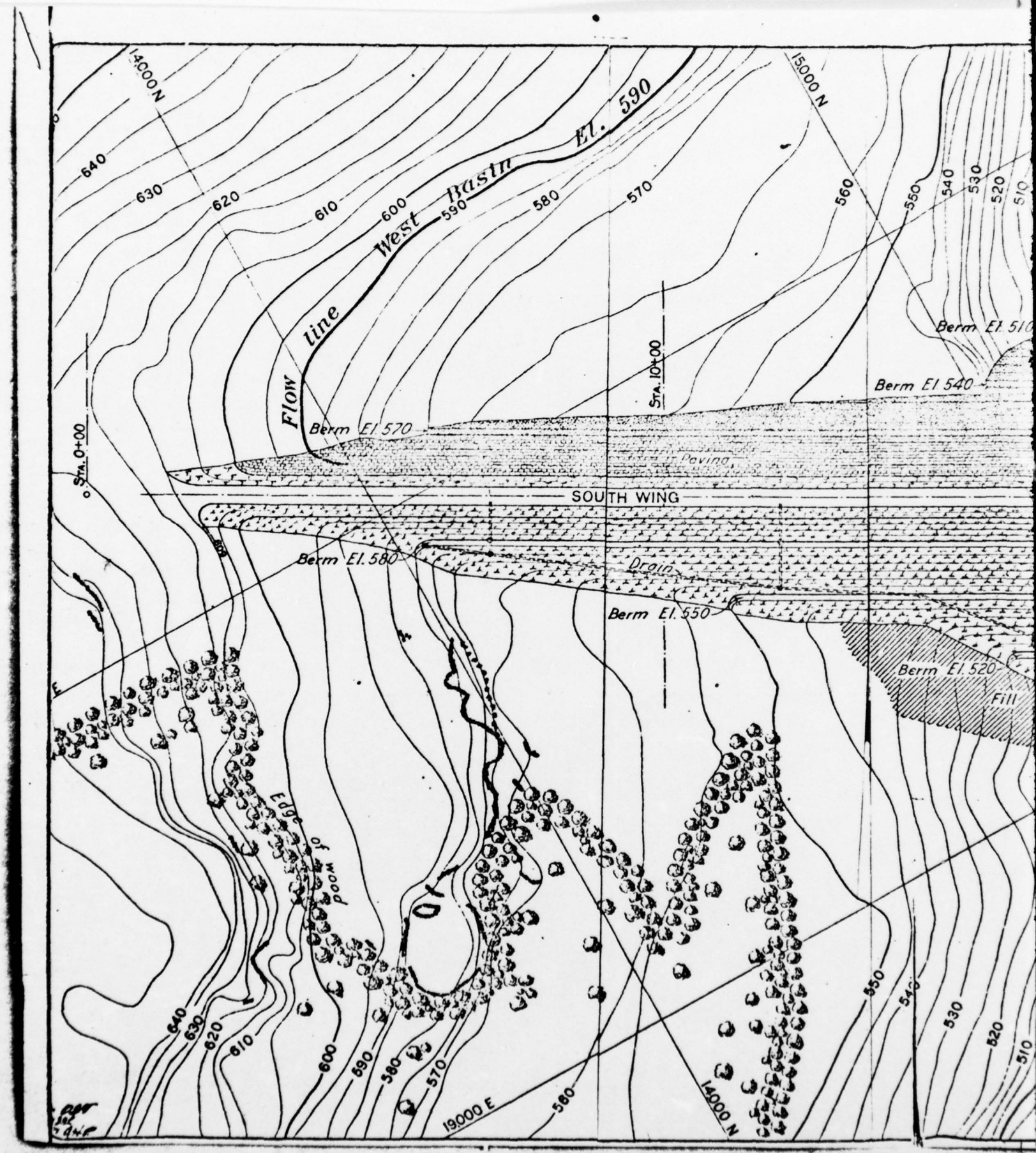
VICINITY MAP
ASHOKAN RESERVOIR

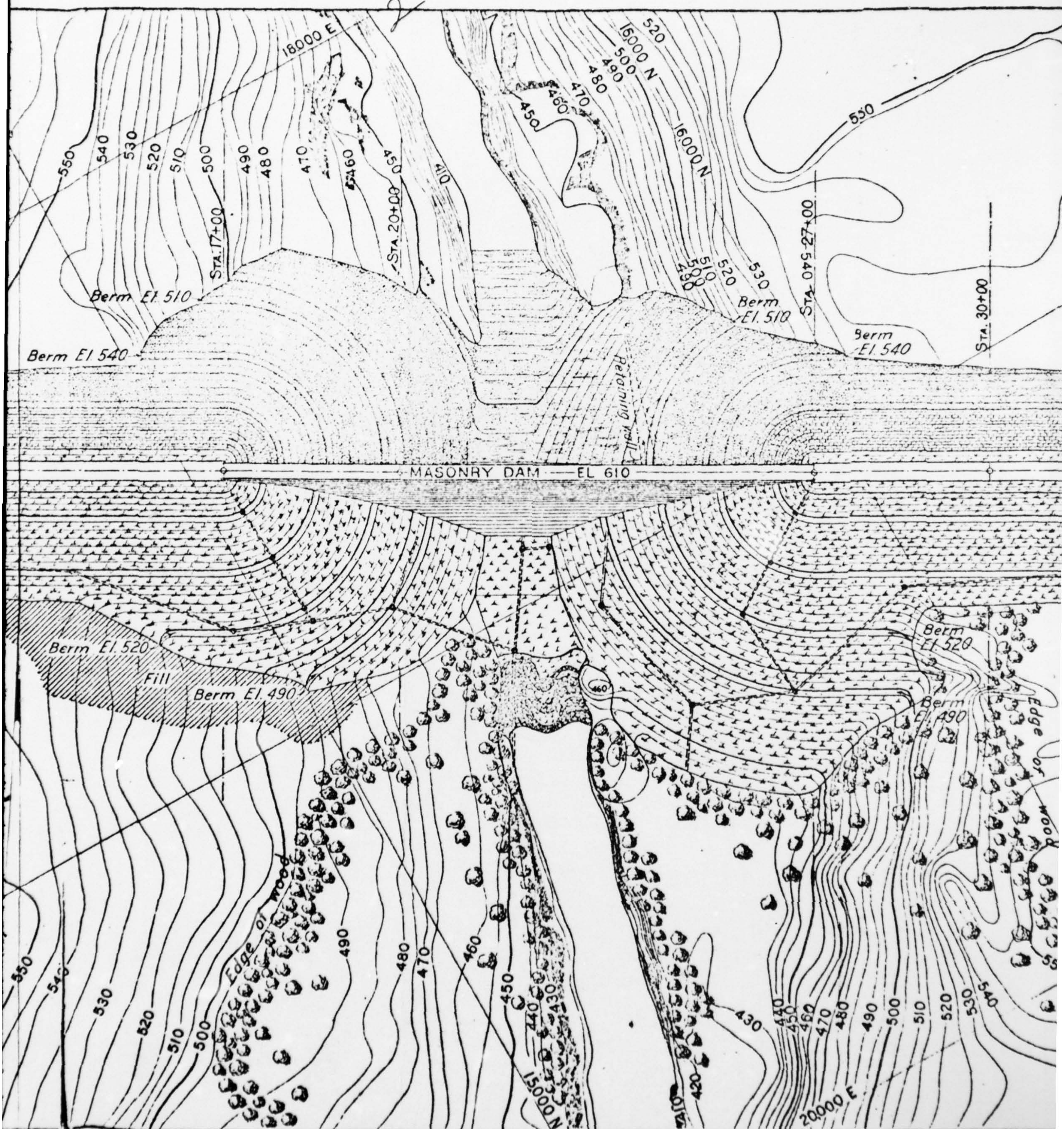


TOPOGRAPHIC MAP
OLIVE BRIDGE DAM, SPILLWAY AND DIKES
(ASHOKAN RESERVOIR)

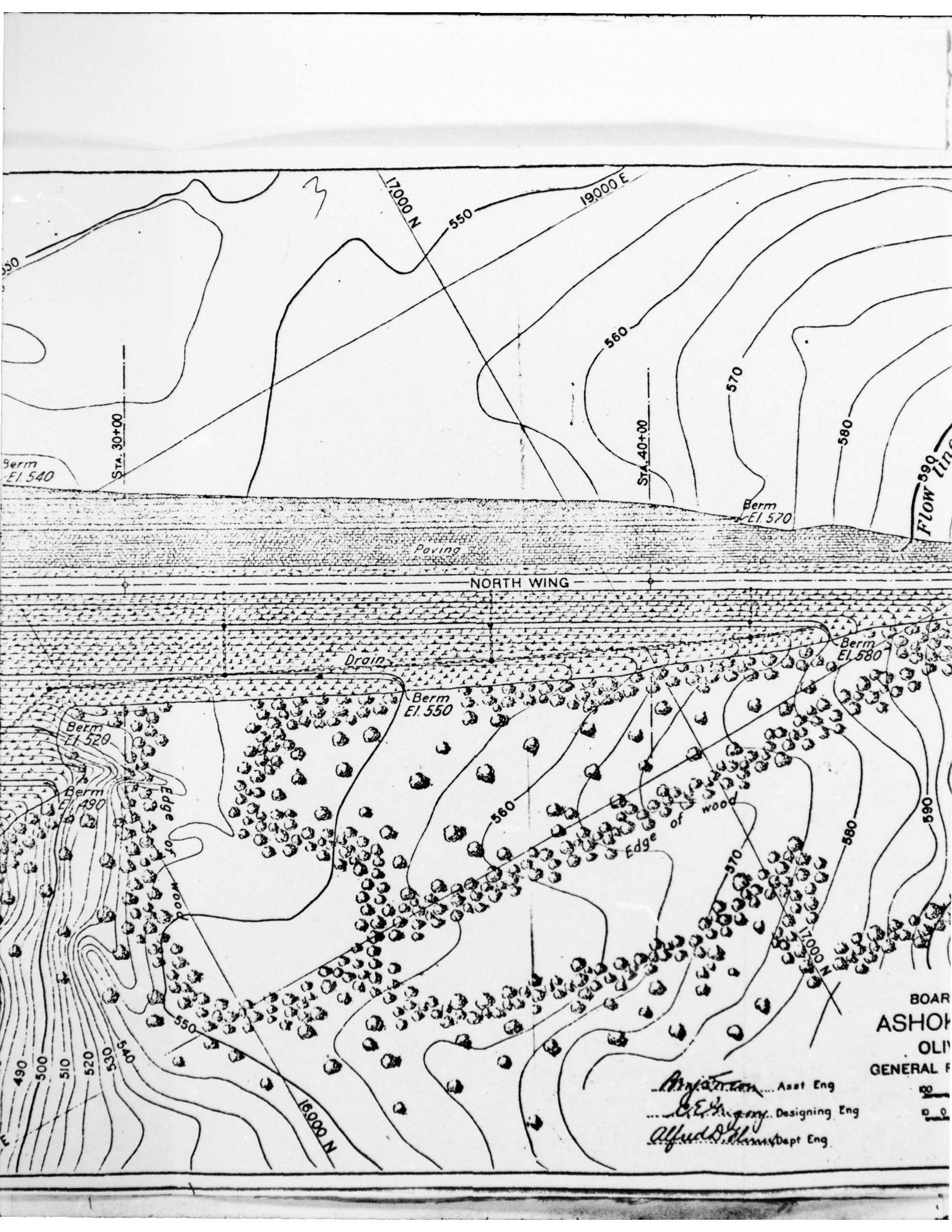


TOPOGRAPHIC MAP
WEST HURLEY, WOODSTOCK AND GLENFORD DIKES

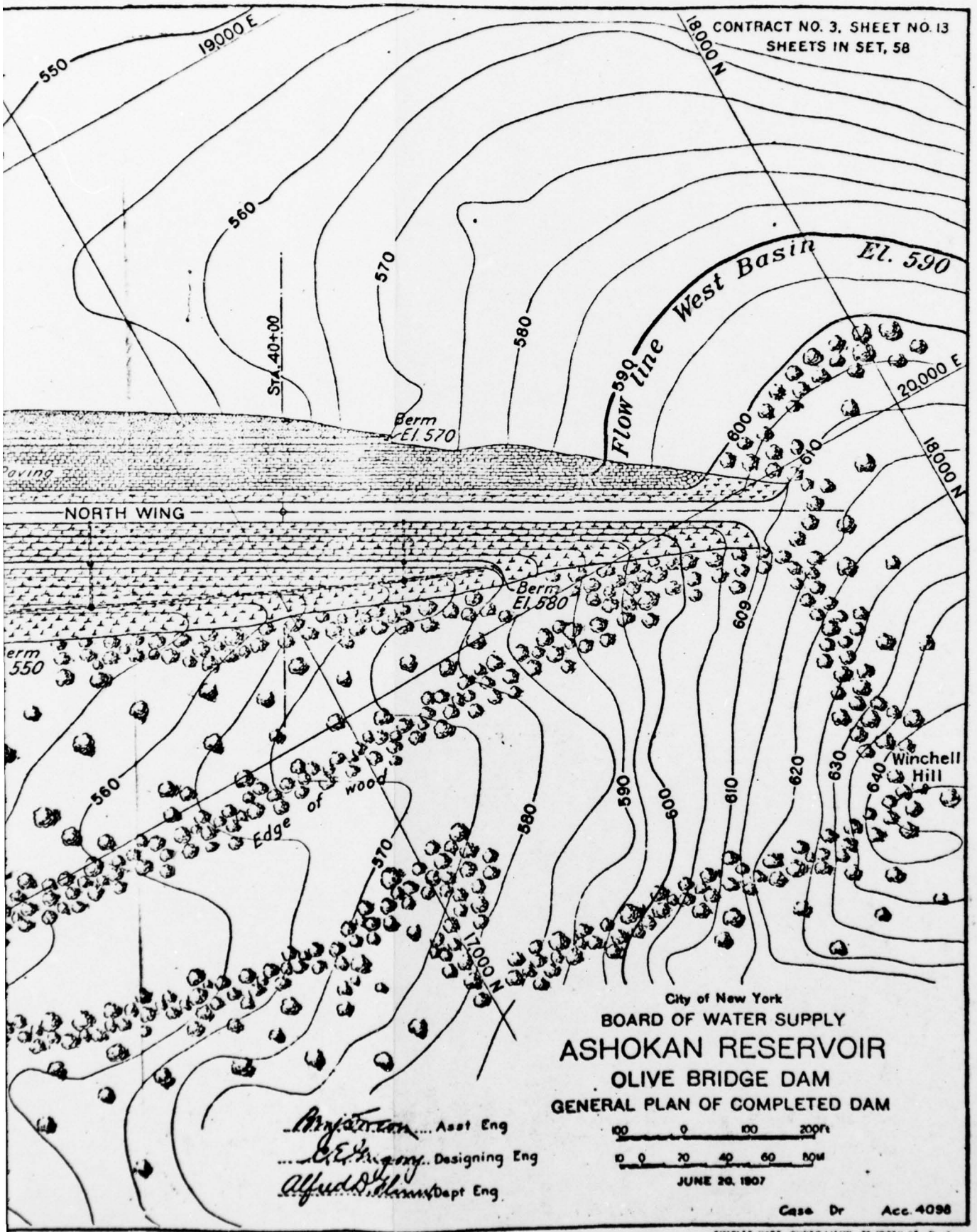

14000 N
15000 N
Flow line
West Basin El. 590
640
630
620
610
600
590
580
570
560
550
540
530
520
510
Sta. 0+00
Sta. 10+00
Berm El 570
Berm El 540
Berm El 510
Paving
SOUTH WING
Berm El. 580
Drain
Berm El. 550
Berm El. 520
Fill
Edge of moss
19000 E
14000 N



MASONRY DAM EL 610
Berm El. 510
Berm El. 540
Berm El. 520
Berm El. 490
Fill
Retaining wall
Edge of wood
STA. 17+00
STA. 20+00
STA. 0+54 27+00
STA. 30+00
18000 E
20000 E
16000 N
15000 N


17,000 N
19,000 E
550
560
570
580
590
Sta. 30+00
Sta. 40+00
Berm El. 540
Berm El. 570
Paving
NORTH WING
Drain
Berm El. 580
Berm El. 550
Berm El. 520
Berm El. 490
Edge of woods
Edge of woods
560
570
580
590
550
540
530
520
510
500
490
16,000 N
17,000 N
Asst Eng
Designing Eng
Dept Eng
BOAR
ASHOK
OLI
GENERAL F

CONTRACT NO. 3, SHEET NO. 13
SHEETS IN SET, 58



City of New York
BOARD OF WATER SUPPLY

ASHOKAN RESERVOIR

OLIVE BRIDGE DAM

GENERAL PLAN OF COMPLETED DAM

100 0 100 200ft
10 0 20 40 60 80M

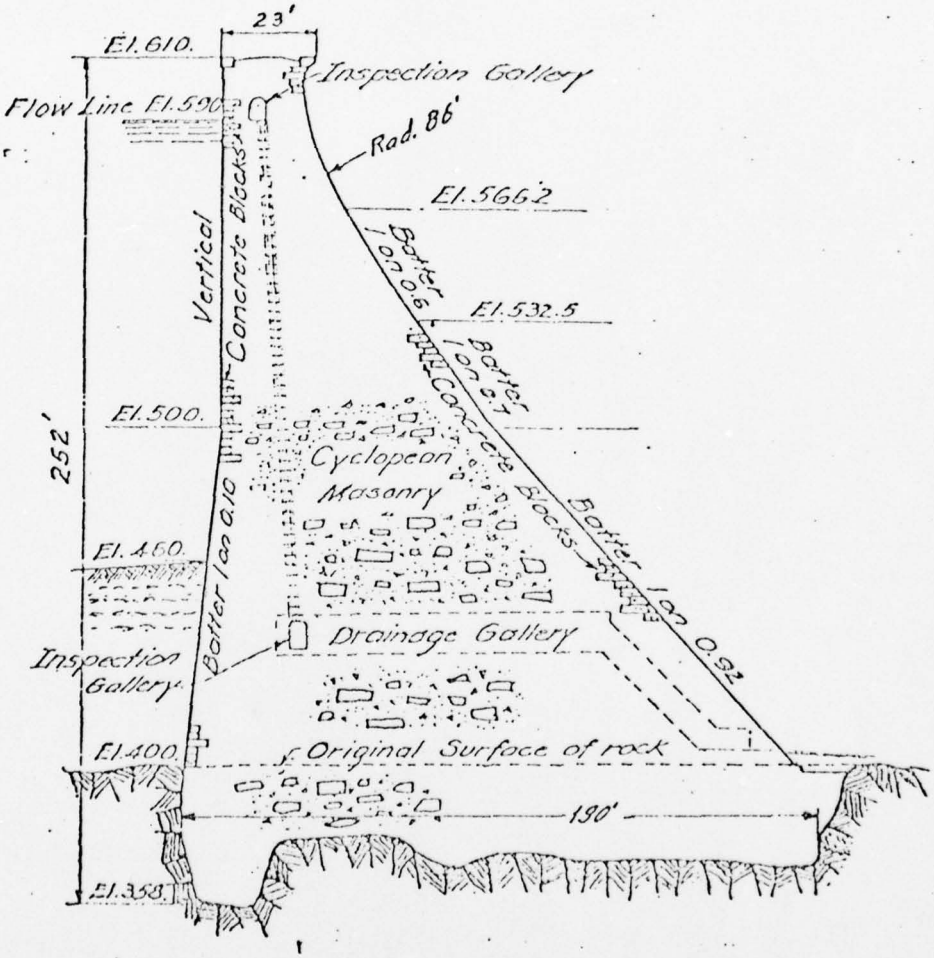
JUNE 20, 1907

Case Dr Acc. 4098

M. J. Fenton .... Asst Eng
C. E. Gregory .... Designing Eng
Alfred D. Flinn .... Dept Eng

CHARLES HART, PHOTO-LITHO. 38 VESEY ST. N. Y.

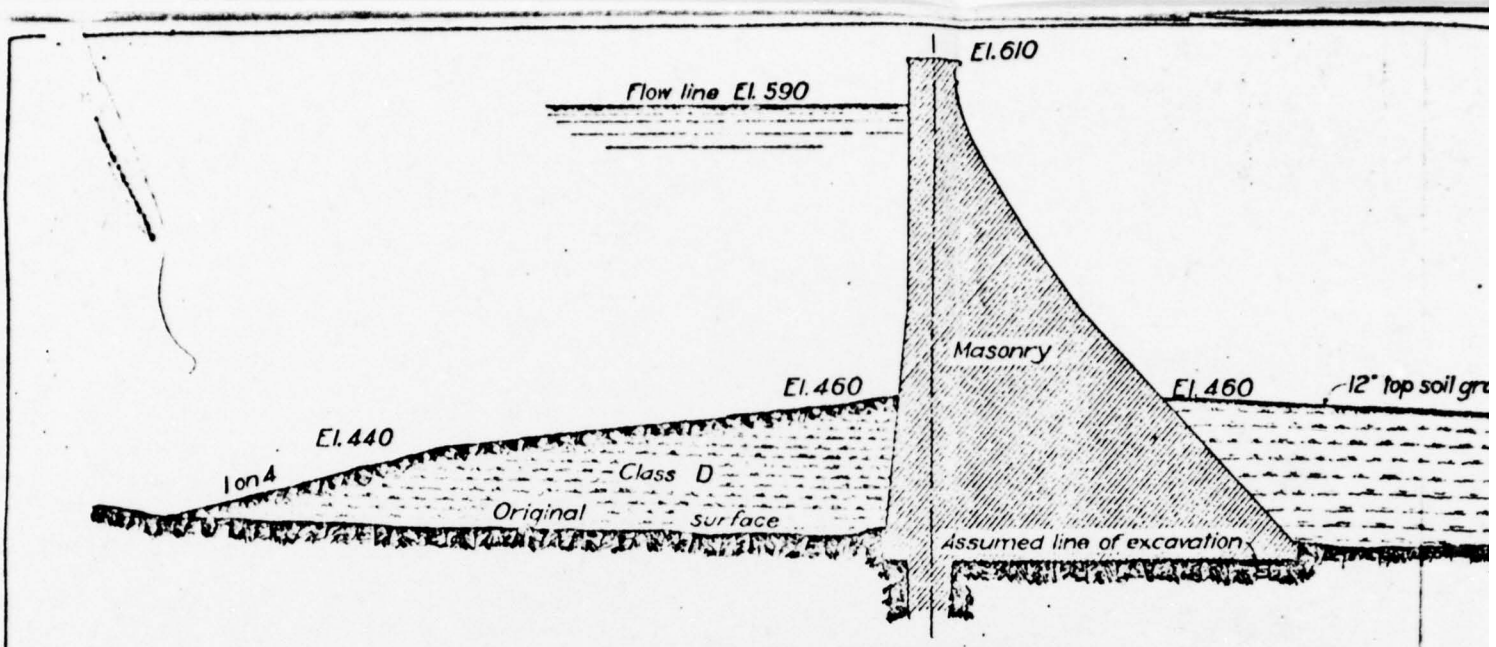
This drawing is reproduced from a publication titled "The Water Supply Of the City of New York". Prepared by Department of Water Supply, Gas and Electricity, dated January, 1950.



OLIVE BRIDGE DAM

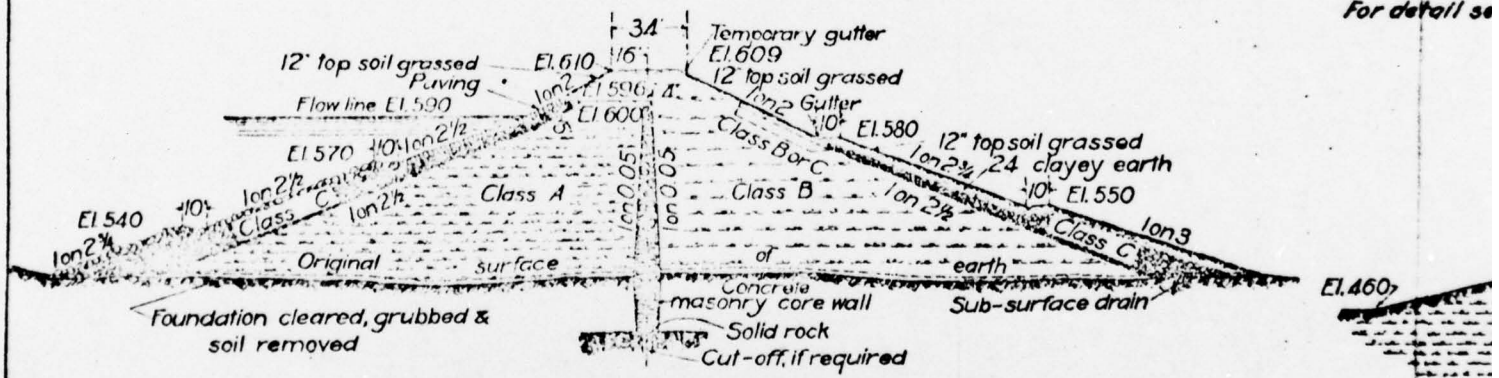
MAXIMUM SECTION

Note:—Elevations refer to mean sea level at Sandy Hook.



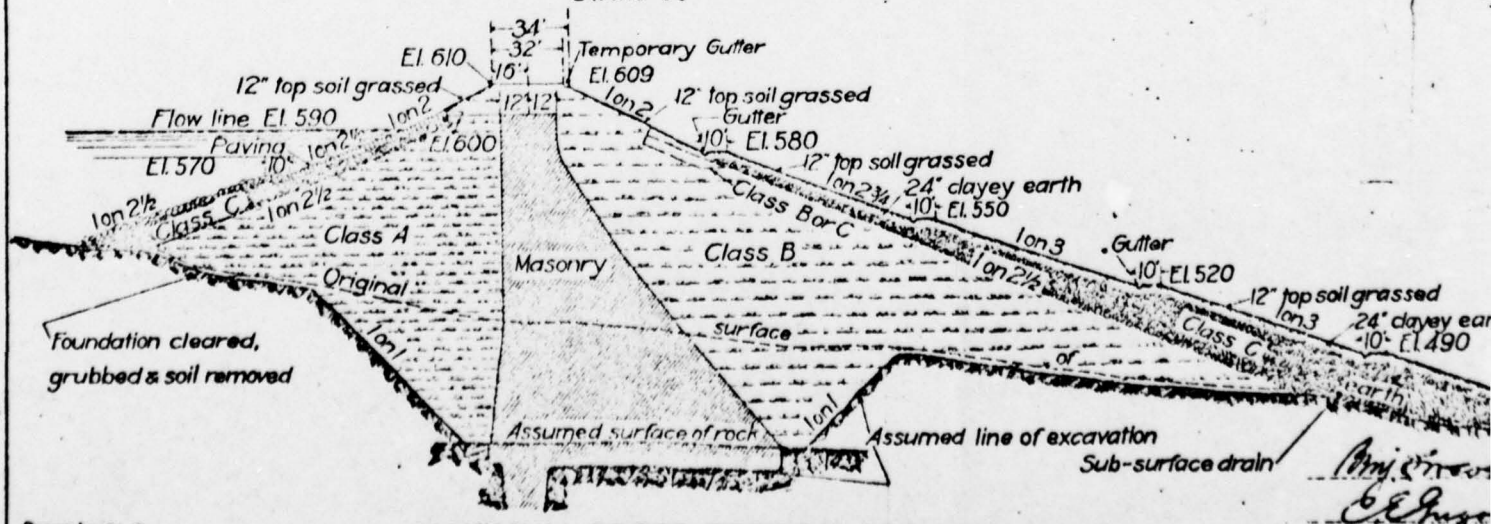
CROSS SECTION AT GORGE

For detail se



CROSS SECTION OF SOUTH WING

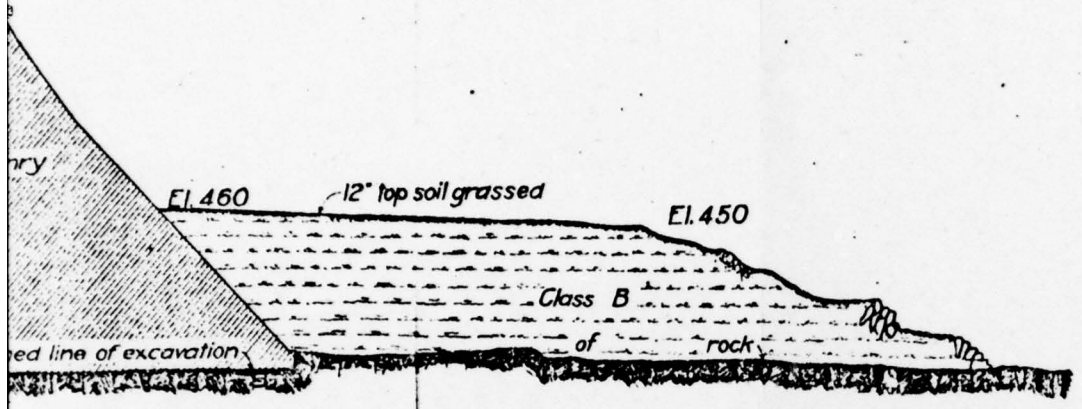
STA. 15+00



MAXIMUM CROSS SECTION OF NORTH WING

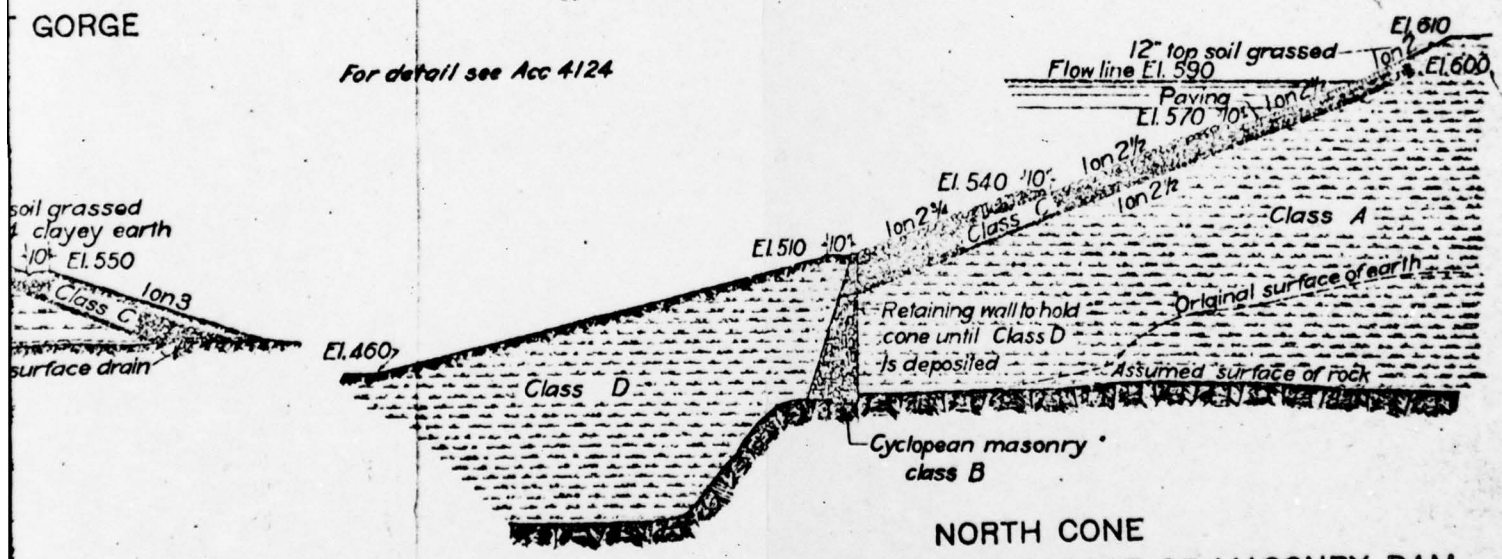
Drawn by C.L.B
Traced by C.J.H
Checked by A.H.P

CONTRACT NO. 3, SHEET NO. 19
SHEETS IN SET, 58



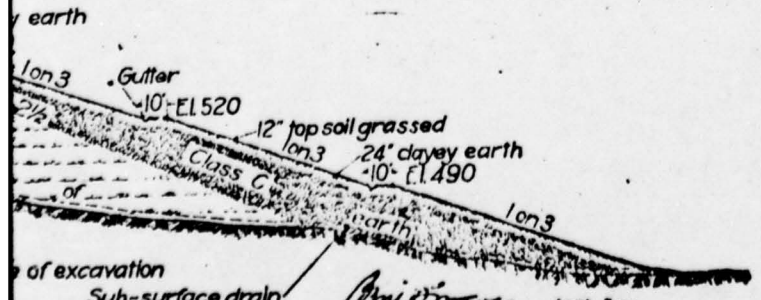
GORGE

For detail see Acc 4124



NORTH CONE

SECTION NEAR UPSTREAM FACE OF MASONRY DAM



WING

City of New York
BOARD OF WATER SUPPLY

ASHOKAN RESERVOIR

OLIVE BRIDGE DAM

CROSS SECTIONS OF EMBANKMENTS

40 0 40 80 Ft
0 0 10 20M

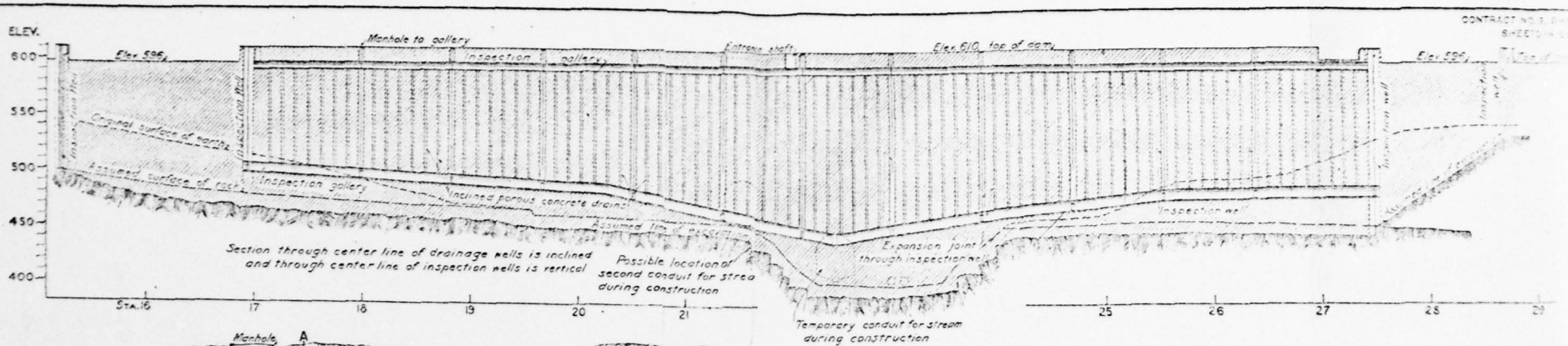
JUNE 20, 1907

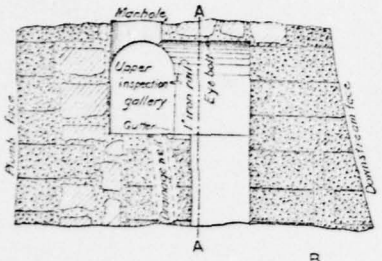
2

Asst. Eng.
C. E. Gregory Designing Eng.
Alfred D. Flinn Dept. Eng.

Cose Dr Acc. 4104

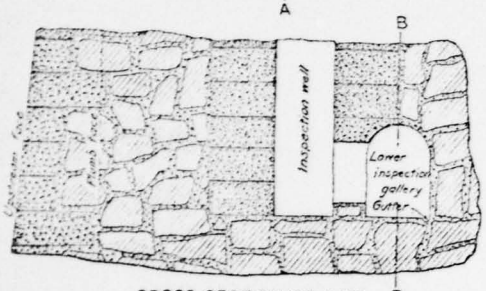
CHARLES HART, PHOTO-LITHO. 88 VESEY ST. N. Y.



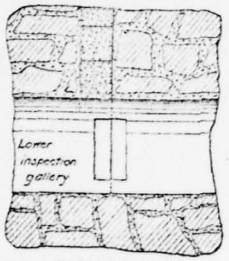


SECTION A-A Expansion joint

PART HORIZONTAL SECTION AT EXPANSION JOINT



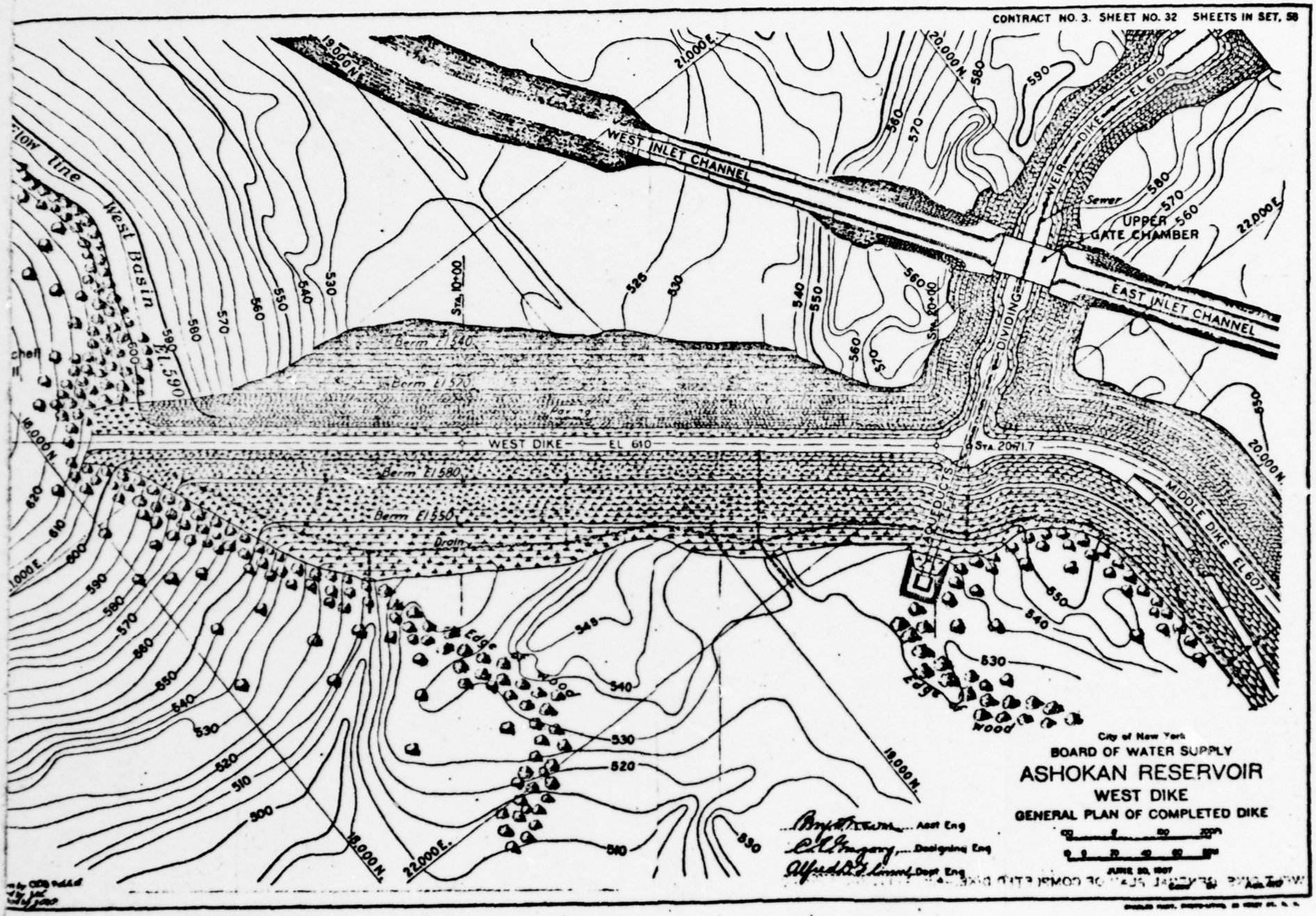
CROSS-SECTION OF DAM THROUGH INSPECTION WELL

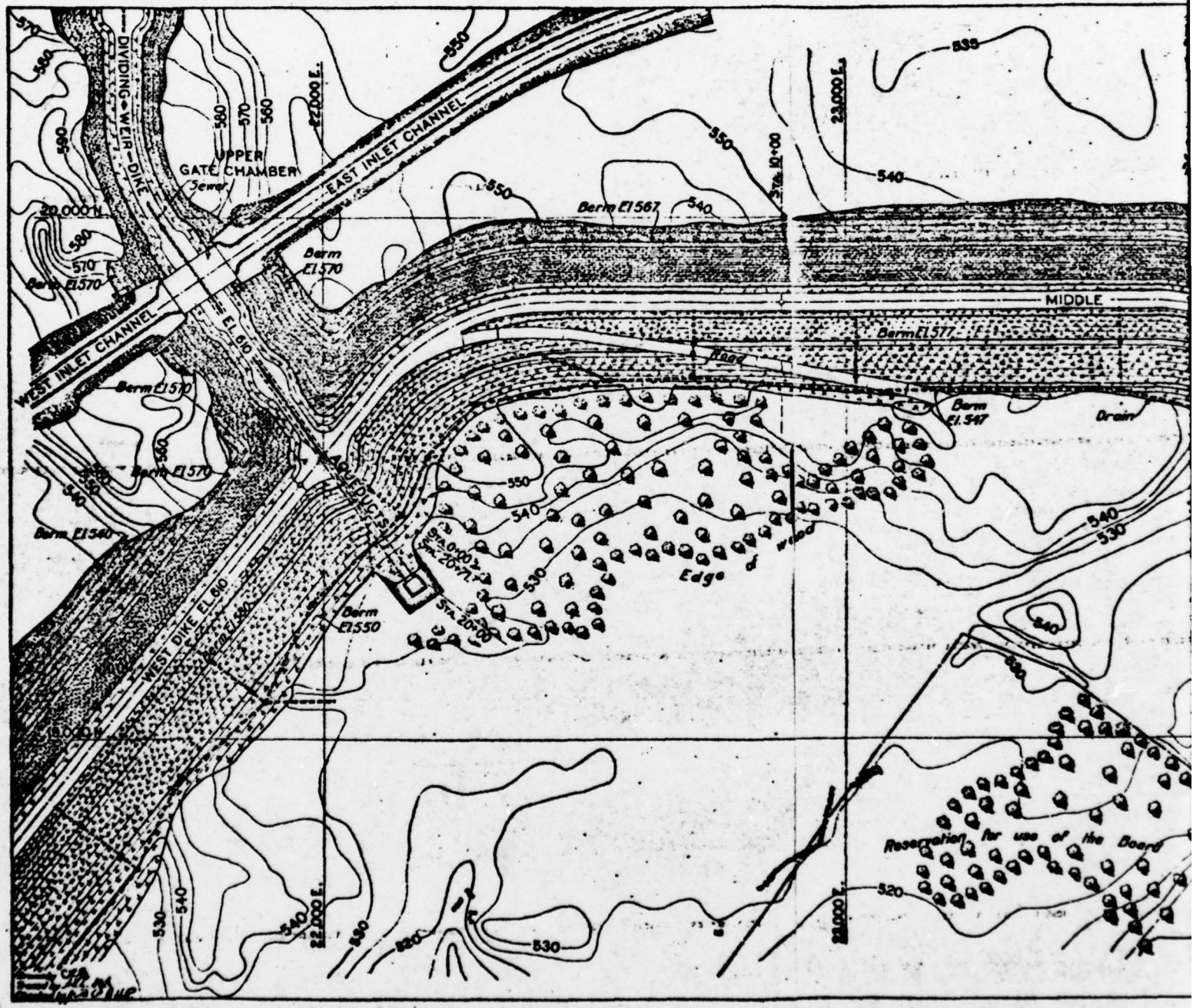


SECTION B-B

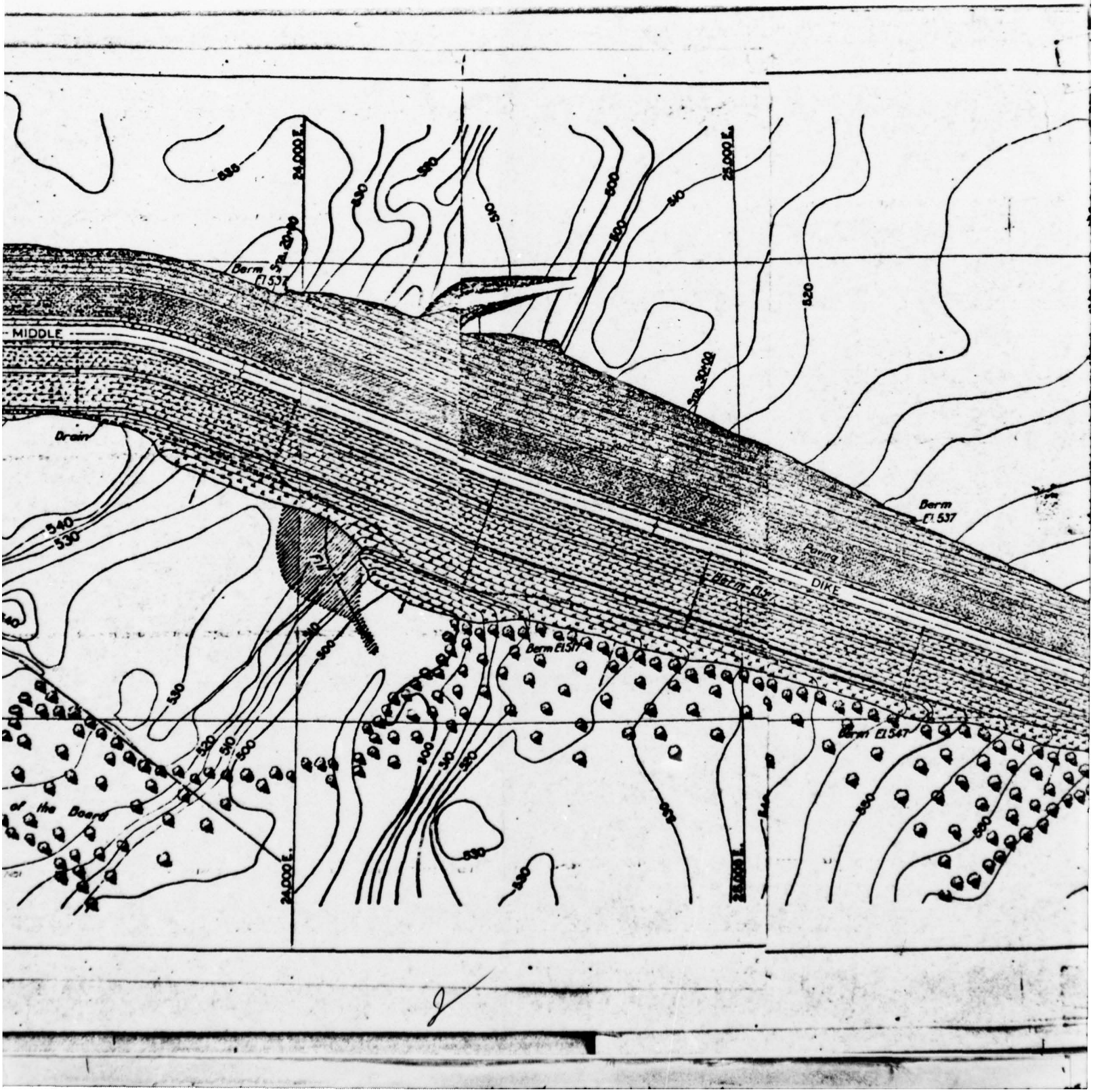
City of New York
BOARD OF WATER SUPPLY
ASHOKAN RESERVOIR
OLIVE BRIDGE DAM
SECTION ON LINE OF DRAINAGE WELL

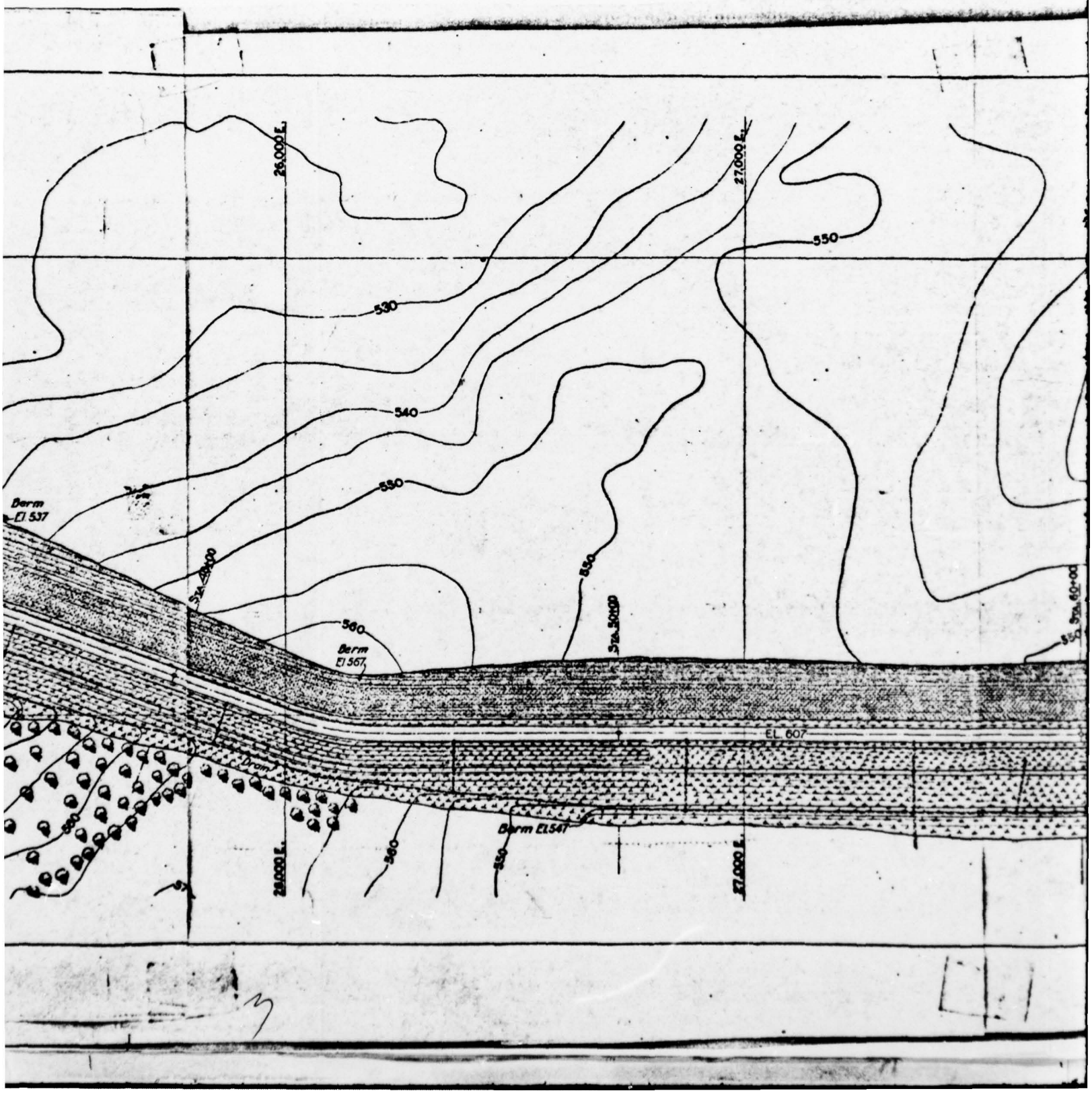
Benj. Brown ... Asst Eng
C. E. Smith ... Designing Eng
Alfred D. Flinn ... Dept Eng

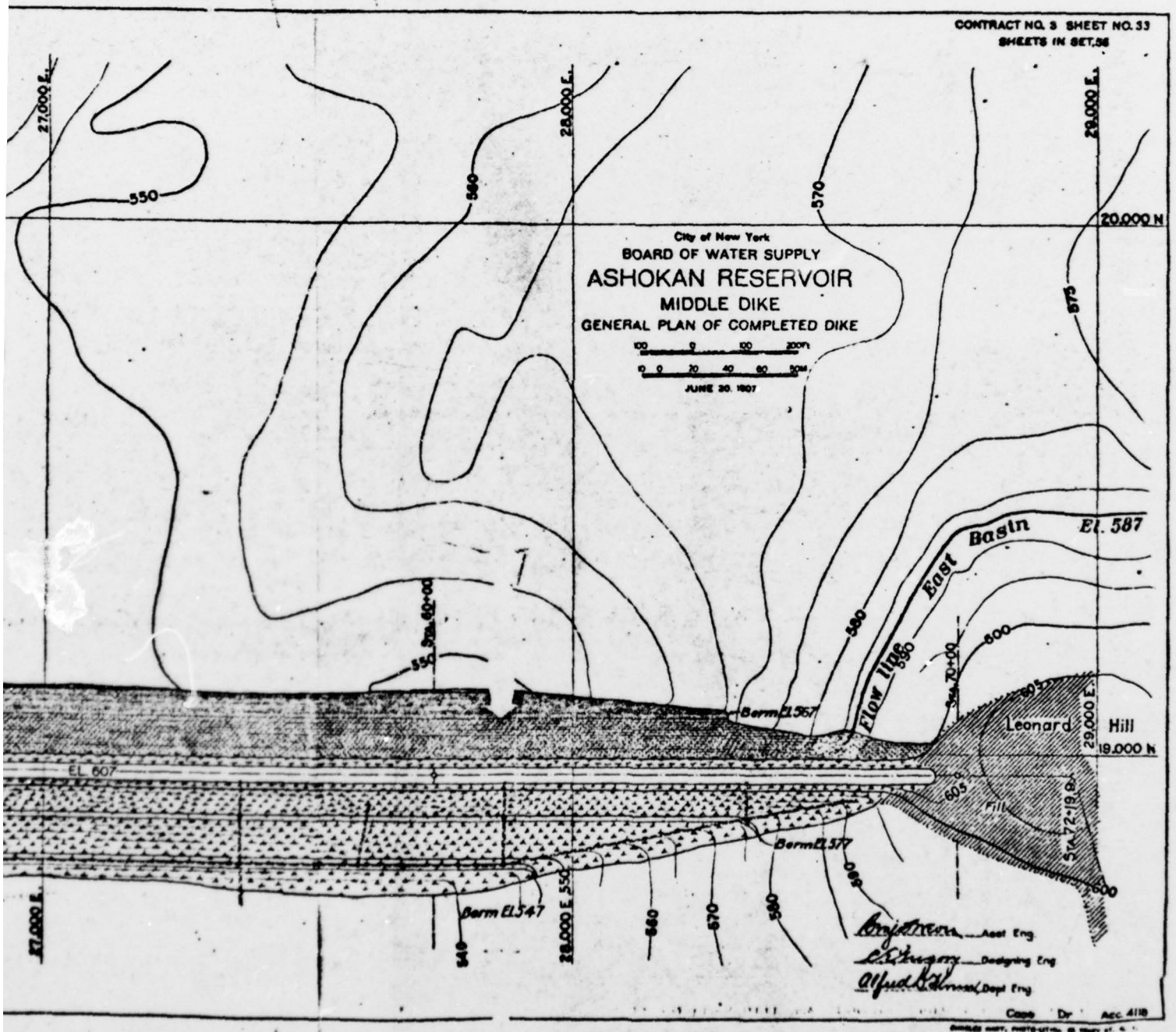

CONTRACT NO. 3. SHEET NO. 32 SHEETS IN SET, 58
WEST INLET CHANNEL
EAST INLET CHANNEL
WEST DIKE — EL 610
Berm El 540
Berm El 570
Berm El 580
Berm El 550
Drain
Sta 10+00
Sta 20+00
Sta 20+71.7
DIVIDING DIKE
WEIR
DIKE
EL 610
Sewer
UPPER GATE CHAMBER
MIDDLE DIKE EL 607
Edge of Wood
Edge
Flow line
West Basin
EL 590
19,000 N.
20,000 N.
21,000 E.
22,000 E.
16,000 N.
City of New York
BOARD OF WATER SUPPLY
ASHOKAN RESERVOIR
WEST DIKE
GENERAL PLAN OF COMPLETED DIKE
Asst Eng
Designing Eng
Dept Eng

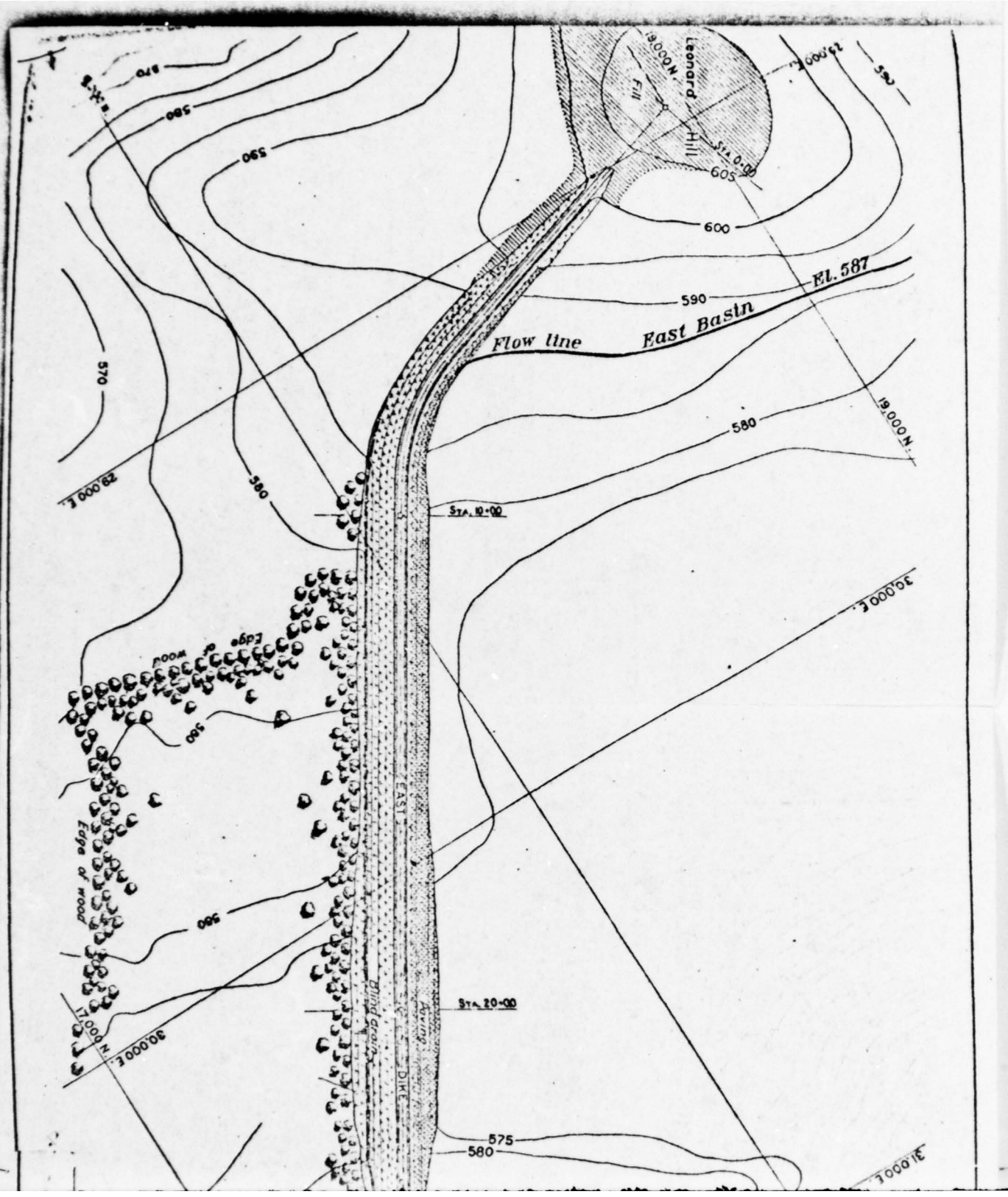


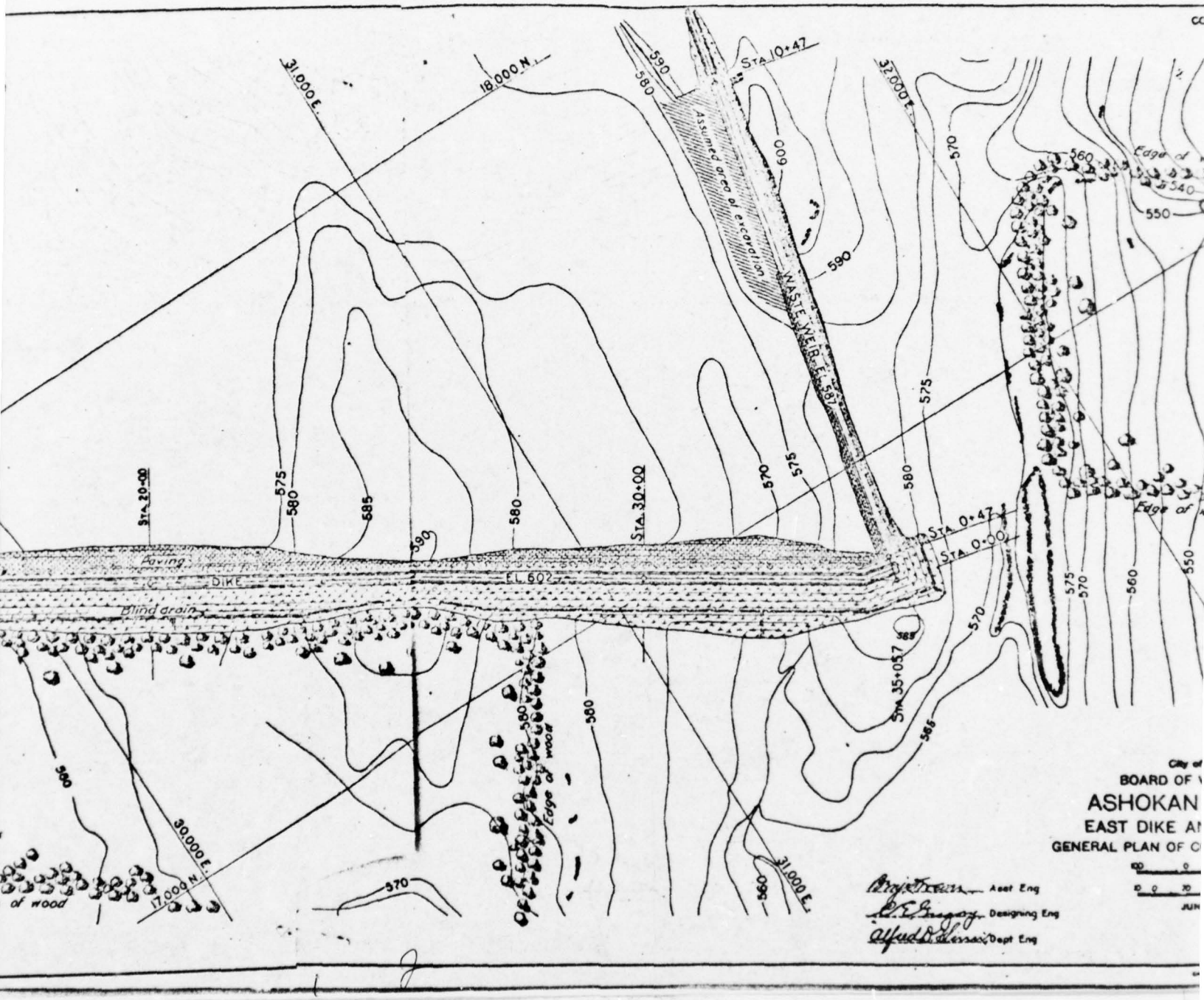
STRUCTURES, Acc. 4119, Sheet No. 34.

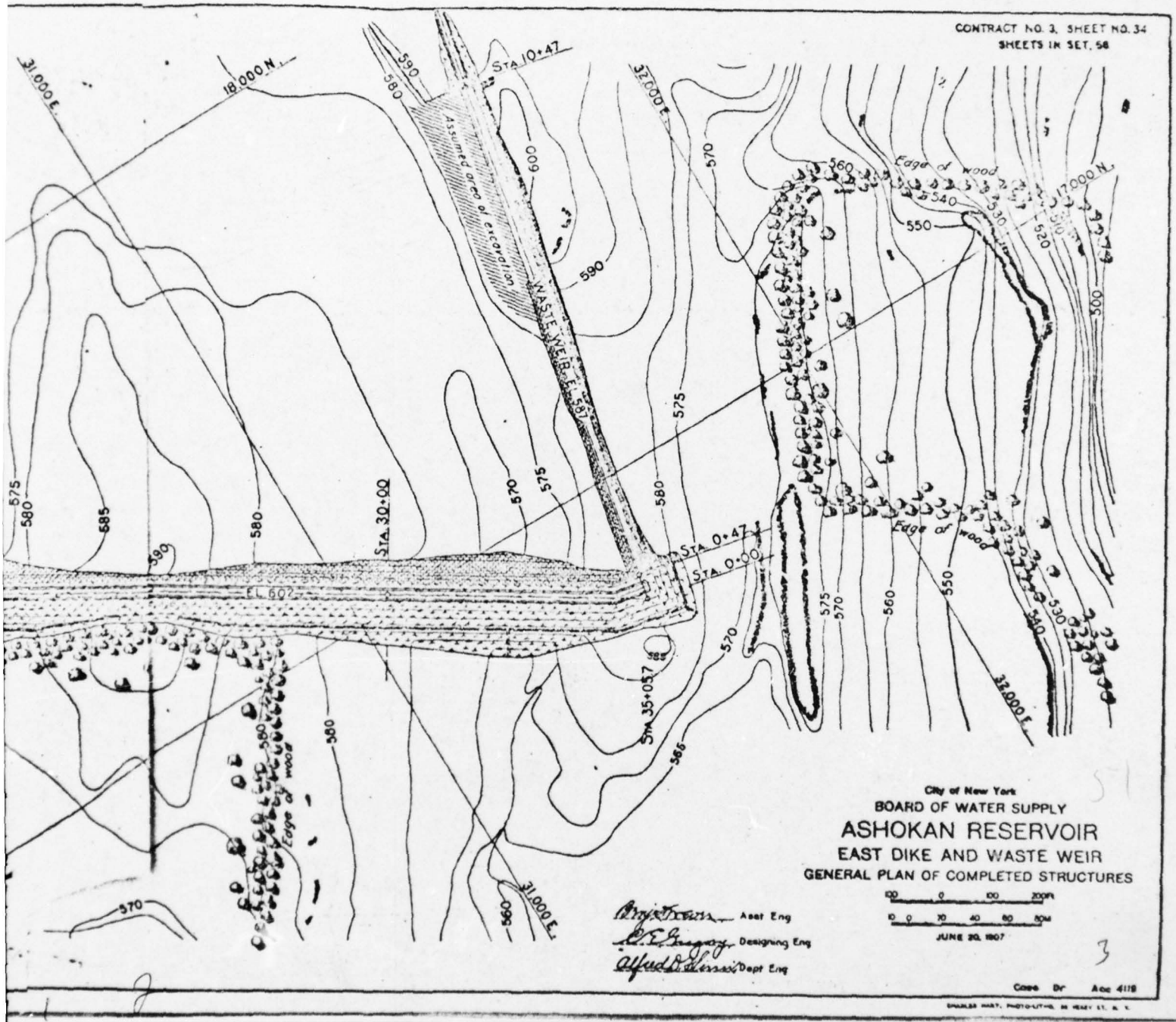

MIDDLE
Drain
Berm El 537
Paving
DIKE
Berm El 537
Berm El 537
Berm El 537
Berm El 537
of the Board
24,000 E.
25,000 E.
540
530
520

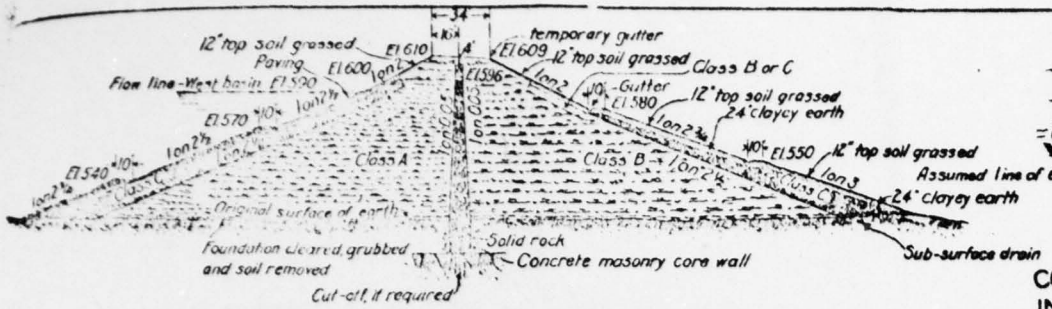

26,000 E.
27,000 E.
530
540
550
560
850
Berm El 537
Sta. 49+00
Sta. 50+00
Sta. 60+00
Berm El 567
EL 607
Berm
Berm El 547
28,000 E.
27,000 E.


CONTRACT NO. 3 SHEET NO. 33
SHEETS IN SET, 56
City of New York
BOARD OF WATER SUPPLY
ASHOKAN RESERVOIR
MIDDLE DIKE
GENERAL PLAN OF COMPLETED DIKE
JUNE 20, 1907
27,000 E.
28,000 E.
29,000 E.
20,000 N
19,000 N
550
560
570
575
580
590
600
605
East Basin
El. 587
Flow line
Sta. 60+00
Sta. 70+00
Sta. 72+19.8
Berm El. 567
Berm El. 577
Berm El. 547
EL 607
Leonard Hill
Fill
Engineer
Asst. Eng.
Designing Eng.
Dept. Eng.
Case
Dr.
Acc. 4118

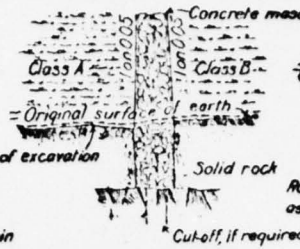

Leonard Hill
Fill
Sta. 0+00
605
600
590
El. 587
Flow line
East Basin
570
580
19,000 N.
Sta. 10+00
30,000 E.
Edge of wood
Edge of wood
Sta. 20-00
17,000 N.
Blind drain
Access
DIKE
575
580
31,000 E.


31,000 E.
18,000 N.
STA. 10+47
Assumed area of excavation
WASTE WEIR EL. 587
STA. 20+00
STA. 30+00
STA. 0+47
STA. 0+00
STA. 35+057
Paving
DIKE
EL. 602
Blind drain
Edge of wood
30,000 E.
17,000 N.
31,000 E.
590
580
600
570
575
585
560
550
540
565
Edge of
BOARD OF
ASHOKAN
EAST DIKE A
GENERAL PLAN OF
Asst Eng
Designing Eng
Dept Eng

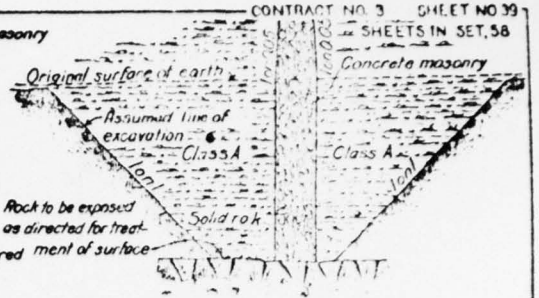

CONTRACT NO. 3, SHEET NO. 34
SHEETS IN SET, 58
31,000 E.
18,000 N.
STA 10+47
Assumed area of excavation
WASTE WEIR
STA 30+00
STA 0+47
STA 0+00
EL 602
STA 35+05.7
Edge of wood
17,000 N.
33,000 E.
31,000 E.
City of New York
BOARD OF WATER SUPPLY
ASHOKAN RESERVOIR
EAST DIKE AND WASTE WEIR
GENERAL PLAN OF COMPLETED STRUCTURES
JUNE 20, 1907
Asst Eng
Designing Eng
Dept Eng
Case Dr
Acc 4118



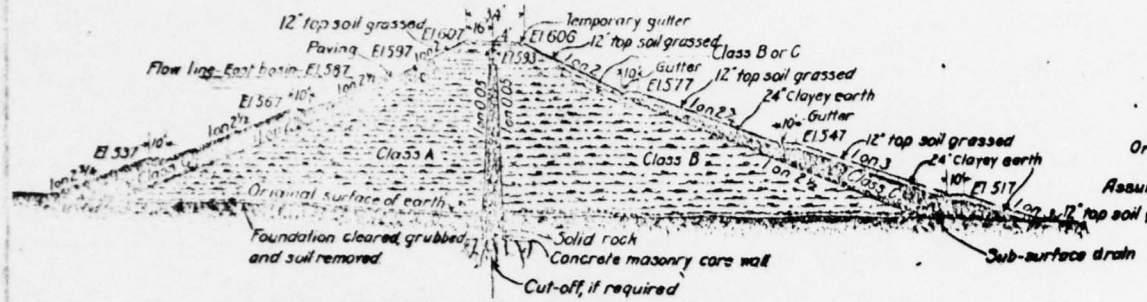
MAXIMUM CROSS SECTION OF WEST DIKE



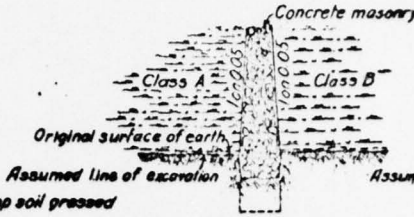
CORE WALL ON ROCK
IN NARROW TRENCH



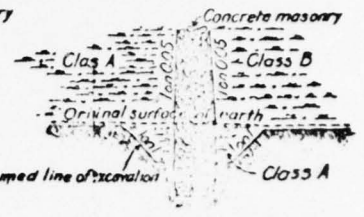
CORE WALL ON ROCK
IN SLOPED EXCAVATION



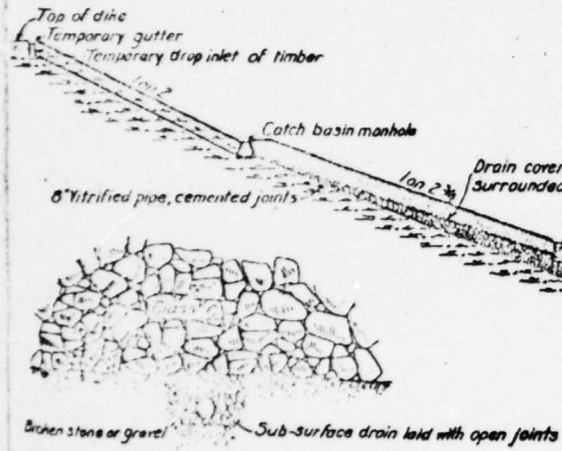
TYPICAL CROSS SECTION OF MIDDLE DIKE



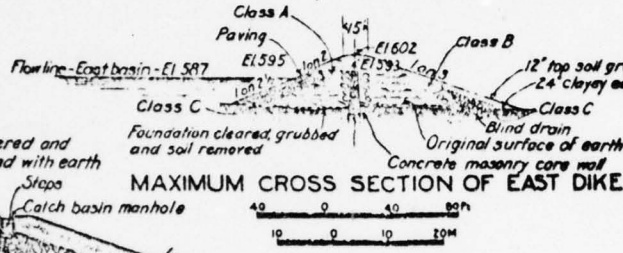
CORE WALL ON EARTH
IN NARROW TRENCH



CORE WALL ON EARTH
IN SLOPED EXCAVATION



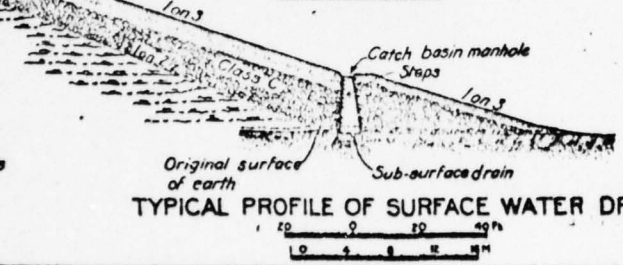
CROSS SECTION OF SUB-SURFACE DRAIN



MAXIMUM CROSS SECTION OF EAST DIKE

PAVING

CROSS SECTIONS OF BERMS



TYPICAL PROFILE OF SURFACE WATER DRAIN

City of New York
BOARD OF WATER SUPPLY

ASHOKAN RESERVOIR

WEST, MIDDLE AND EAST DIKES
CROSS SECTONS AND GENERAL DETAILS

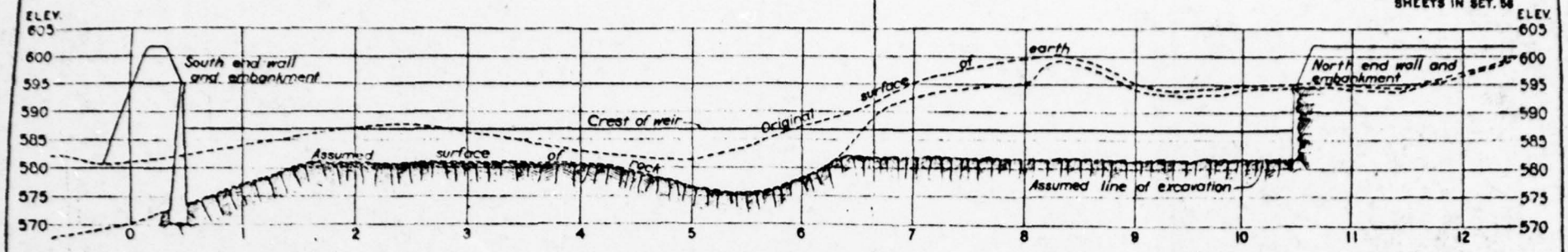
JUNE 20, 1907

Asst Eng.
Designing Eng.
Dept Eng.

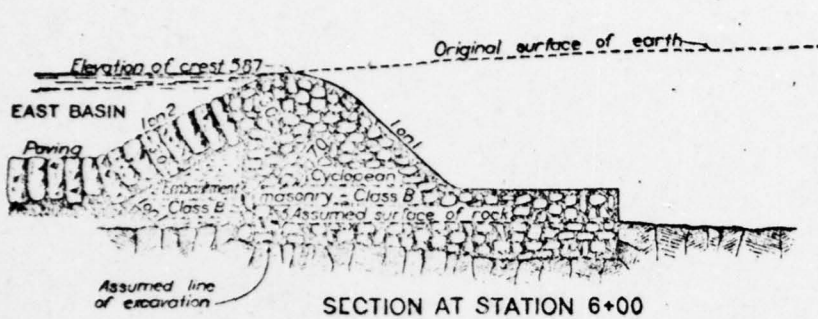
Case Dr Acc 4134

CHARLES HART, PHOTO-LITHO, 18 VESEY ST., N. Y.

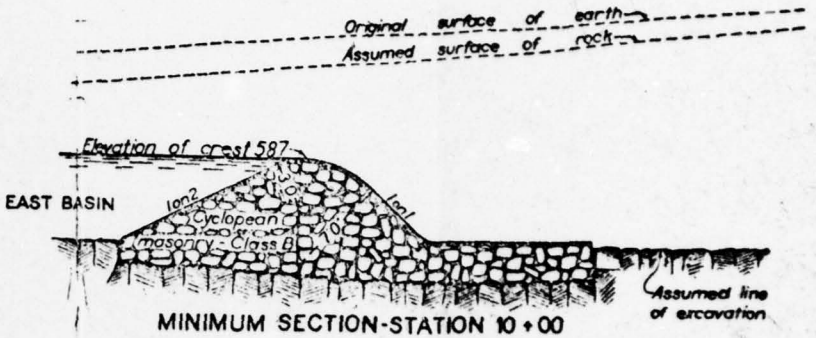
CONTRACT NO. 3, SHEET NO. 42
SHEETS IN SET, 56



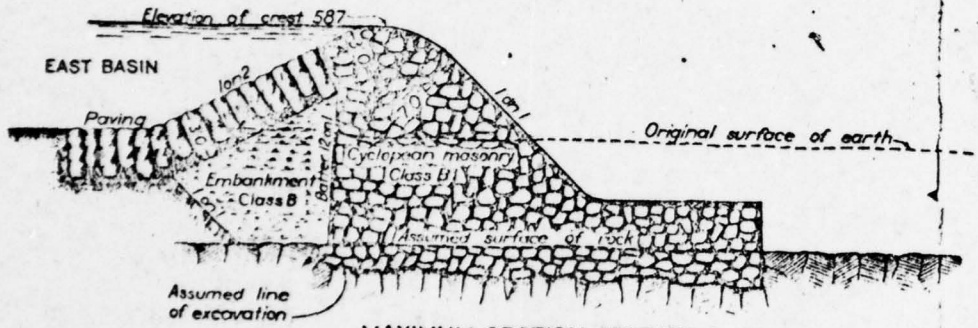
PROFILE AT WASTE WEIR



SECTION AT STATION 6+00



MINIMUM SECTION-STATION 10+00



MAXIMUM SECTION-STATION 0+50

City of New York
BOARD OF WATER SUPPLY

ASHOKAN RESERVOIR

WASTE WEIR

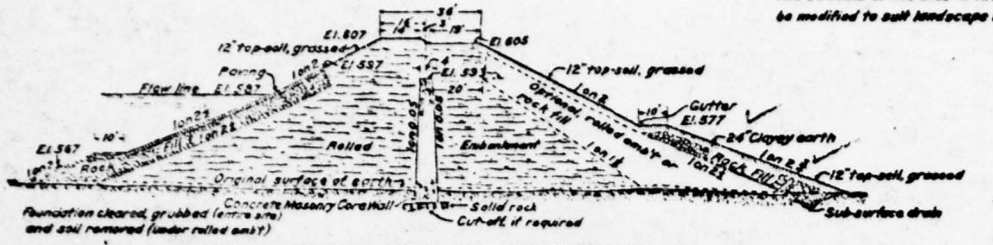
PROFILE AND CROSS SECTIONS

Brightmoor ... Asst Eng
Fred T. Mavers Designing Eng
Alfred D. Flinn Dept Eng

JUNE 20, 1907

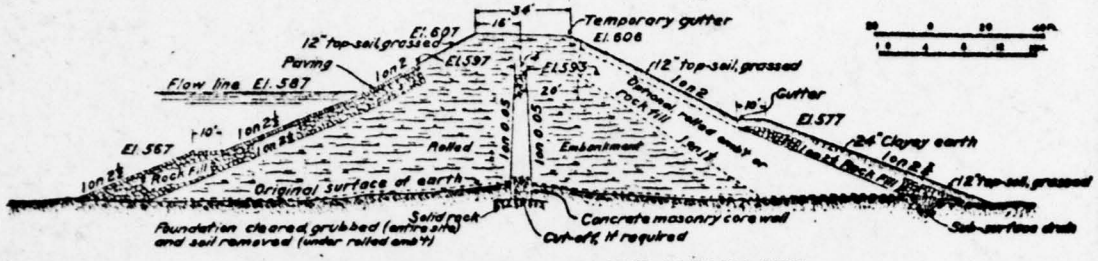
Cons Dr Acc 4127

The sections at the ends of the dikes may be modified to suit landscape treatment.

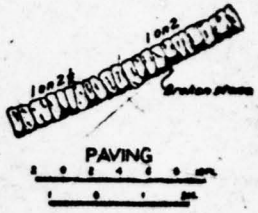


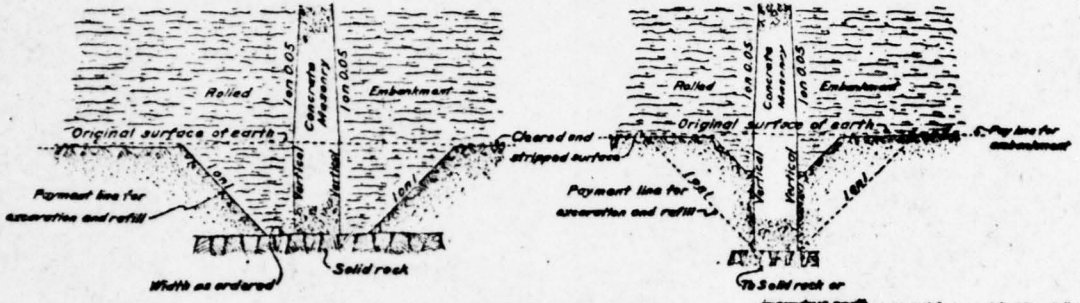
TYPICAL CROSS SECTION OF GLENFORD DIKE

TYPICAL CROSS SECTION OF WOODSTOCK DIKE



TYPICAL CROSS SECTION OF WEST HURLEY DIKE





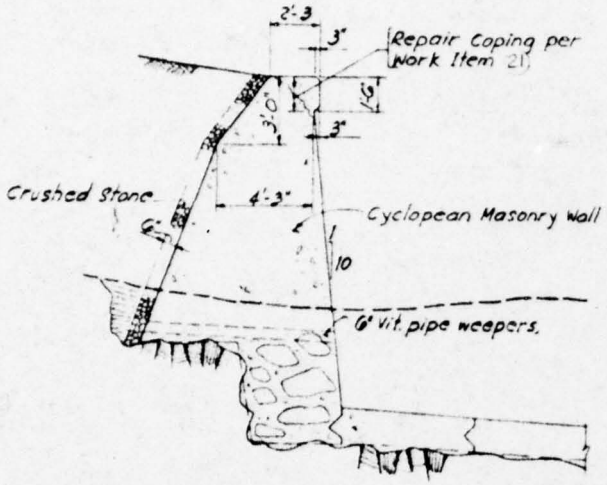
TYPICAL CORE WALL EXCAVATIONS

City of New York
BOARD OF WATER SUPPLY
ASHOKAN RESERVOIR
WEST HURLEY, WOODSTOCK AND GLENFORD DIKES
CROSS SECTIONS AND GENERAL DETAILS

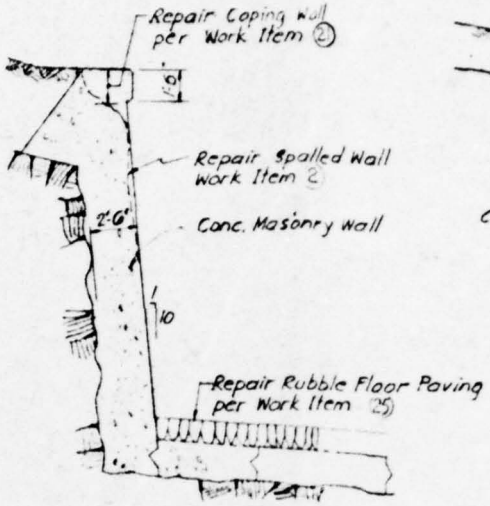
Drawn by O.E.E.
Traced by O.E.E.
Checked by A.F.R.

JACOB B. LANGTHORN
Div. Eng.

Coulton E. Harris Dist. Engr.



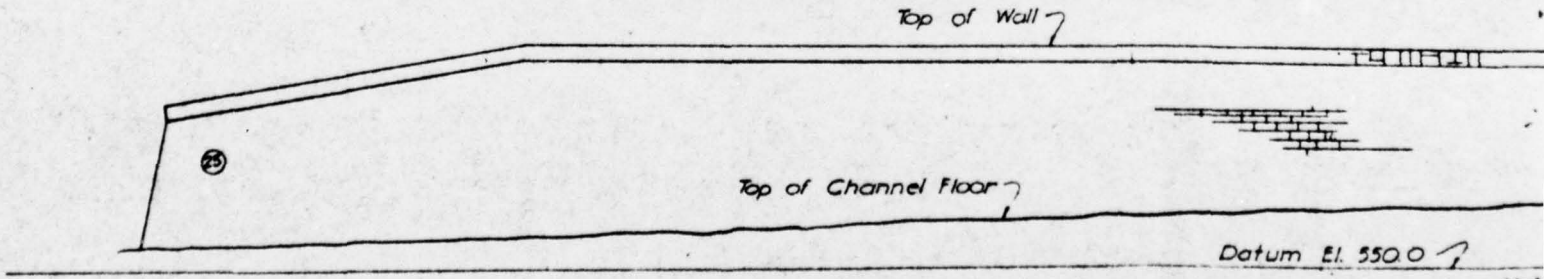
SECTION D-D



SECTION E-E

SEC

Scale: 1/4" -



Note
Exte
see

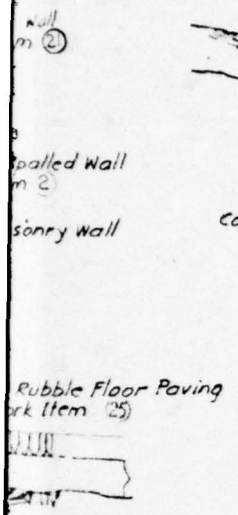
DEVELOPED ELEVATIO

ASHLAR BAFFLE WALL - NORTH FACE SHOWN

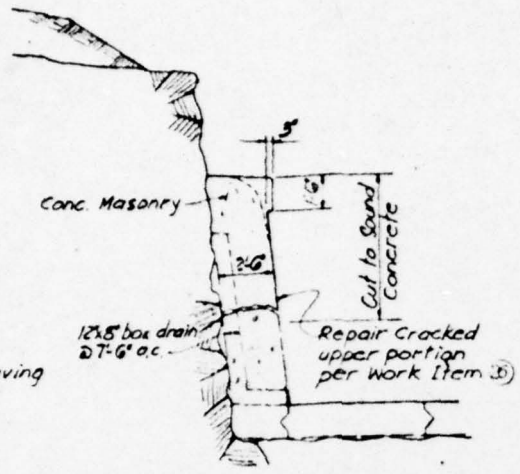
Scale: 1/8" - 1'-0"

V

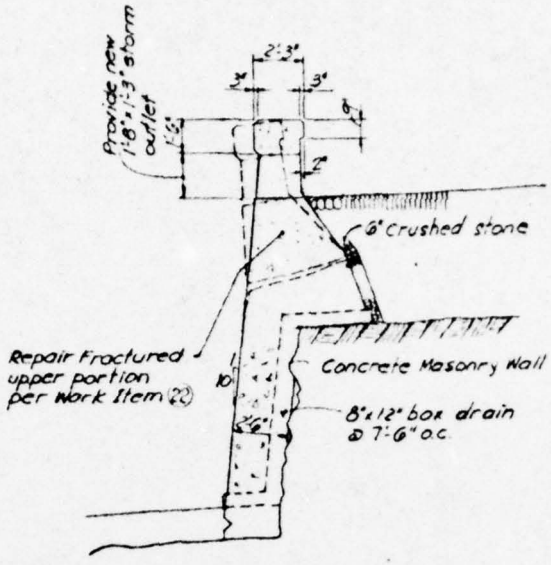
7



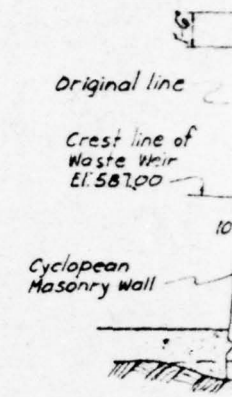
E-E



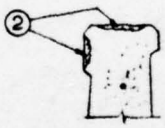
SECTION F-F



SECTION G-G

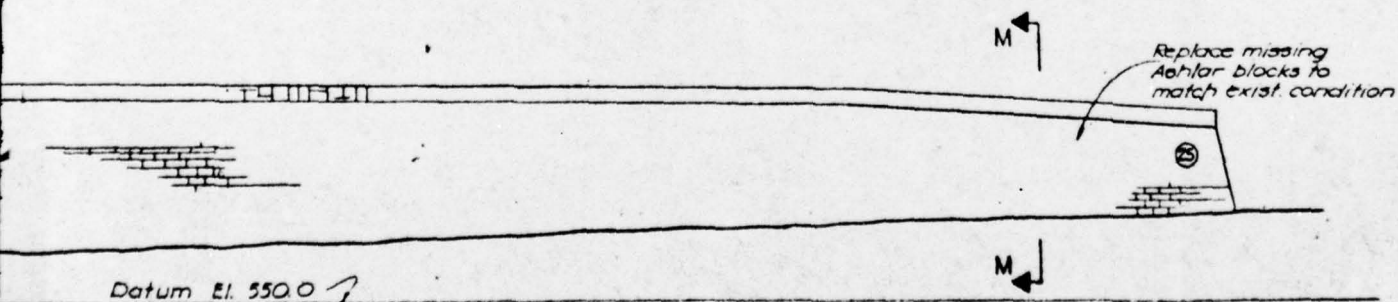


Scale: 4" = 1'-0" (Typ. all above Sections)



SECTION N-N

Scale: 3/8" = 1'-0"

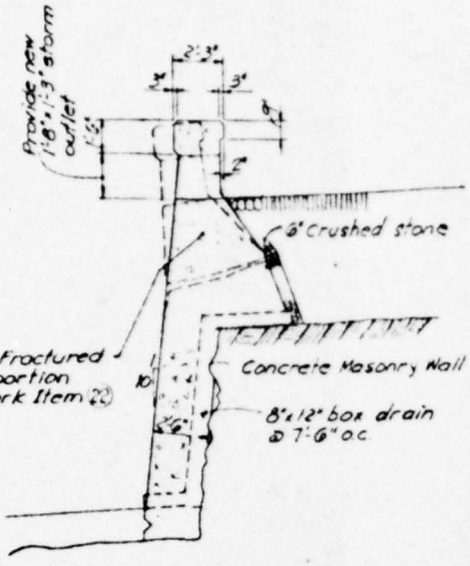


Note:
Extent of work shown is approx.
see note A Sht. 8

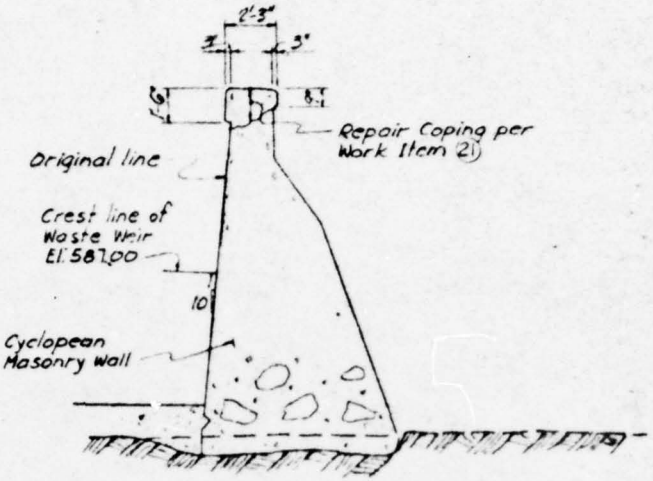
ELEVATION L-L

WALL - NORTH FACE SHOWN

ale: 1/8" = 1'-0"

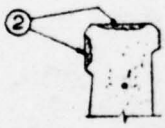


SECTION G-G



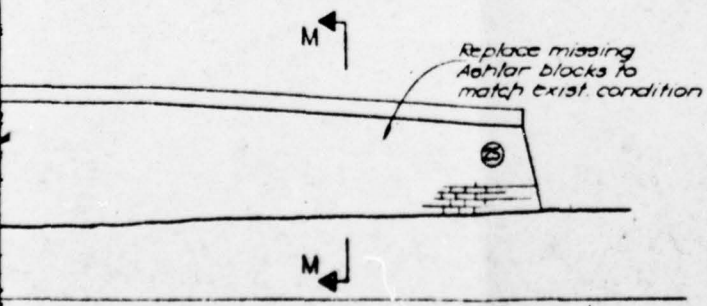
SECTION H-H

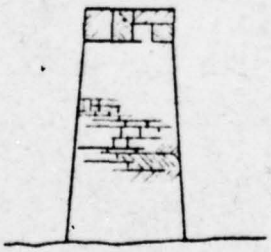
actions)



SECTION N-N

Scale: 3/8"=1'-0"





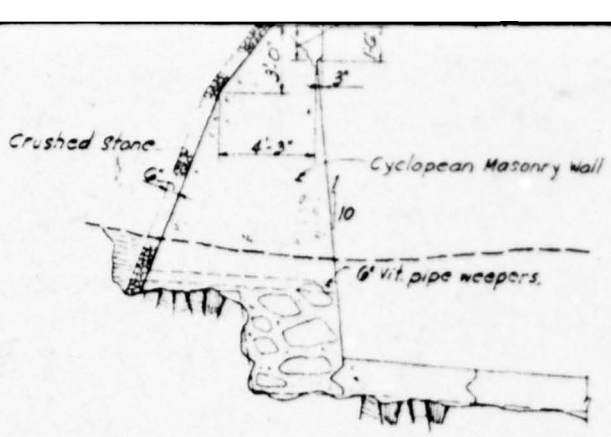
SECTION M-M

Scale 1/4"-1'-0"

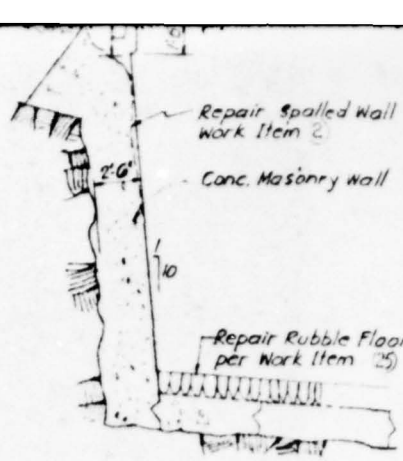
prax.

NO	DATE	DESCRIPTION	BY	CH'KD	APP'D

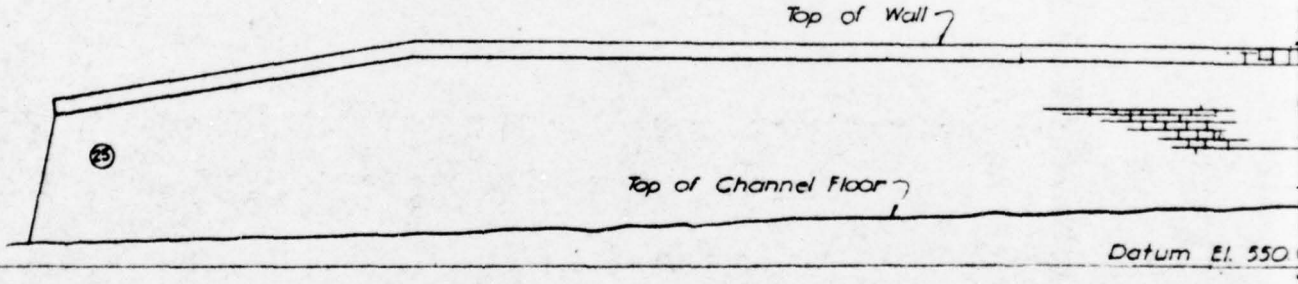
REVISIONS



SECTION D-D



SECTION E-E

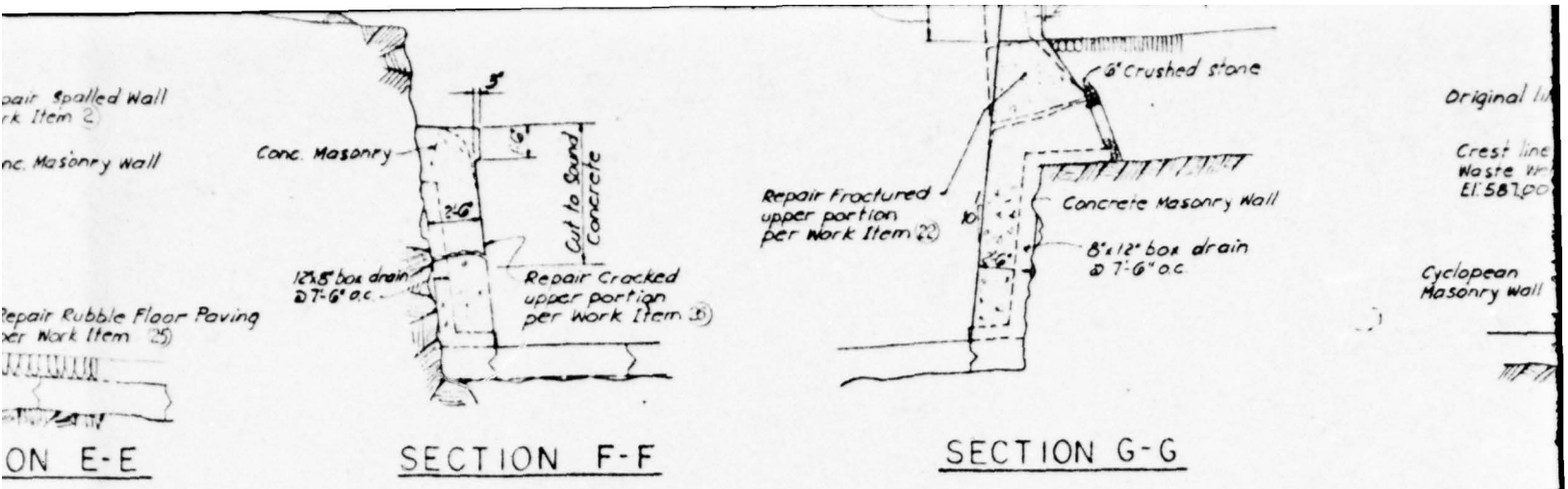


DEVELOPED ELEVAT

ASHLAR BAFFLE WALL—NORTH FAC

Scale 0"-1'-0"

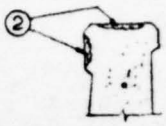
CAT-104



SECTION F-F

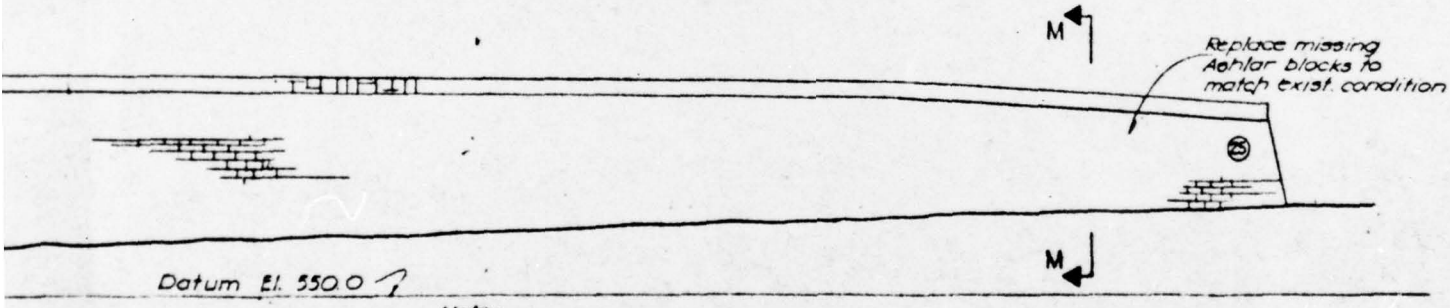
SECTION G-G

Scale: 1/4" - 1'-0" (Typ. all above Sections)



SECTION N-N

Scale: 3/8"-1'-0"



Datum El. 550.0

Note:
Extent of work shown is approx.
see note A Sht. 8

ELEVATION L-L

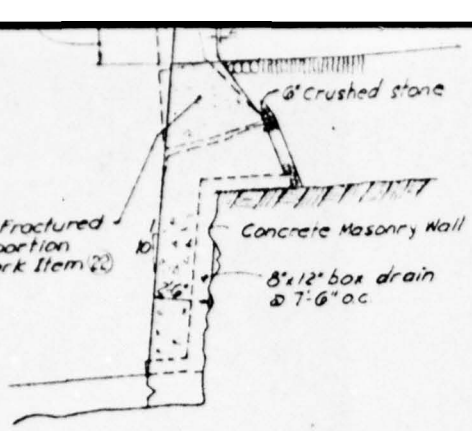
LE WALL - NORTH FACE SHOWN

Scale: 3/8" - 1'-0"

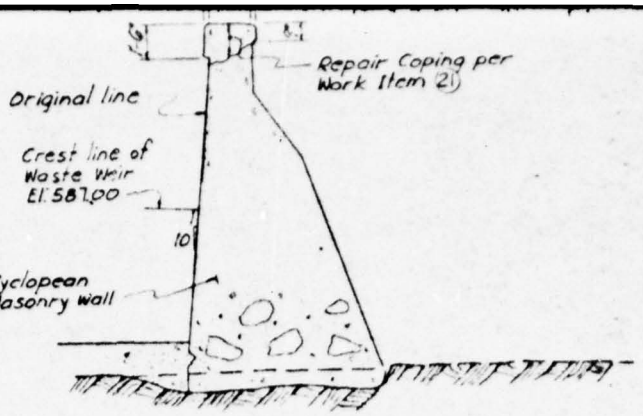
Notes:
For location of Sections D-D, E-E, F-F, G-G & H-H see Sht. # 2
For location of Elev. L-L see Sht. # 2
For Details of work items shown thus (2) see Sht. # 8
For location of Section N-N see Sh # 4

APPROVED BY
Graham
CHIEF ENGINEER
APPROVED BY
Edward C. Iskander
DEPUTY CHIEF ENGINEER

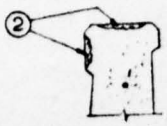
AMMANN & WHIT
CONSULTING ENGINEE
111 EIGHTH AVENUE NE



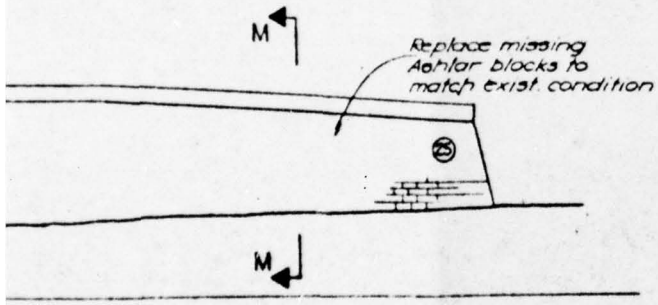
SECTION G-G

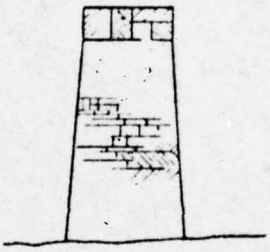


SECTION H-H



SECTION N-N
Scale: 3/8"-1'-0"





SECTION M-M
Scale 1/4"-1'-0"

ion of Sections D-D, E-E, F-F, G-G & H-H
2
ion of Elev L-L see Sht. # 2
ils of work items shown thus (2) see Sht. # 8
ion of Section N-N see Sh # 4

NO.	DATE	DESCRIPTION	BY	CH'KD	APP'D

REVISIONS

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

APPROVED BY
CHIEF ENGINEER — DATE 10/10/74

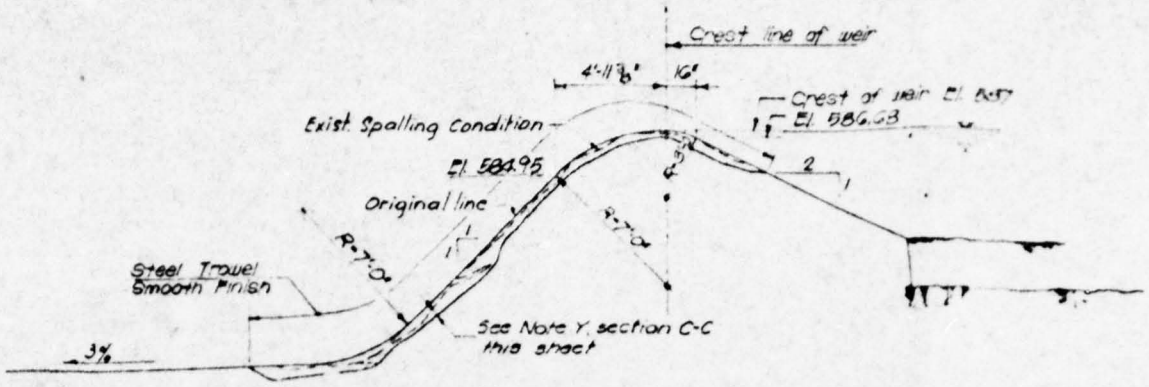
APPROVED BY
DEPUTY CHIEF ENGINEER — DATE 10/16/74

REHABILITATION OF
ASHOKAN RESERVOIR SPILLWAY
WALL SECTIONS & BAFFLE WALL ELEVATION

AMMANN & WHITNEY
CONSULTING ENGINEERS
111 EIGHTH AVENUE NEW YORK

DRAWN	E.J.	DATE	10-4-74	SHEET 7 OF 8	
TRACED	E.J.				
CHECKED	A.G.L.	SCALE	As Shown	43601-X	
APPROVED	G.P.A.				

6

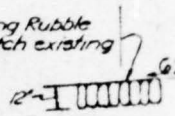


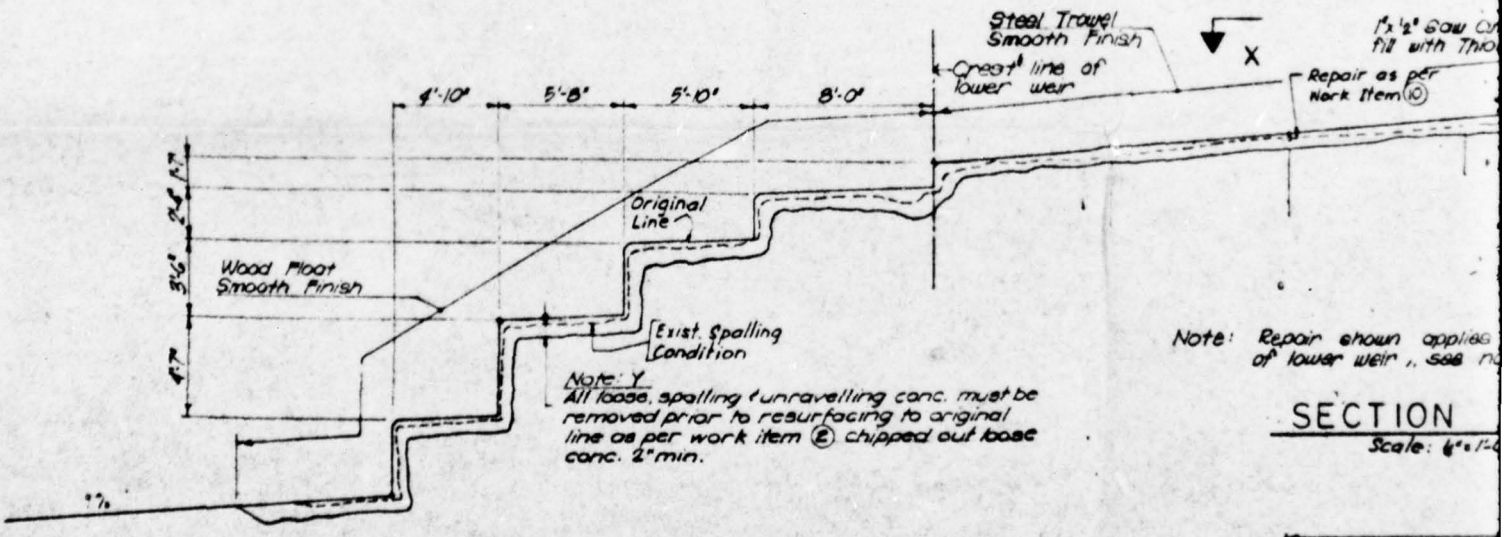
SECTION A-A

Scale: ½"=1'-0"

Note: Repair shown applies from Point "A" to Point "B" of weir see note "A" Sht # 8

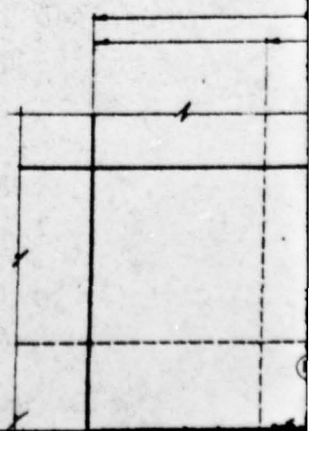
Replace missing Rubble paving to match existing condition

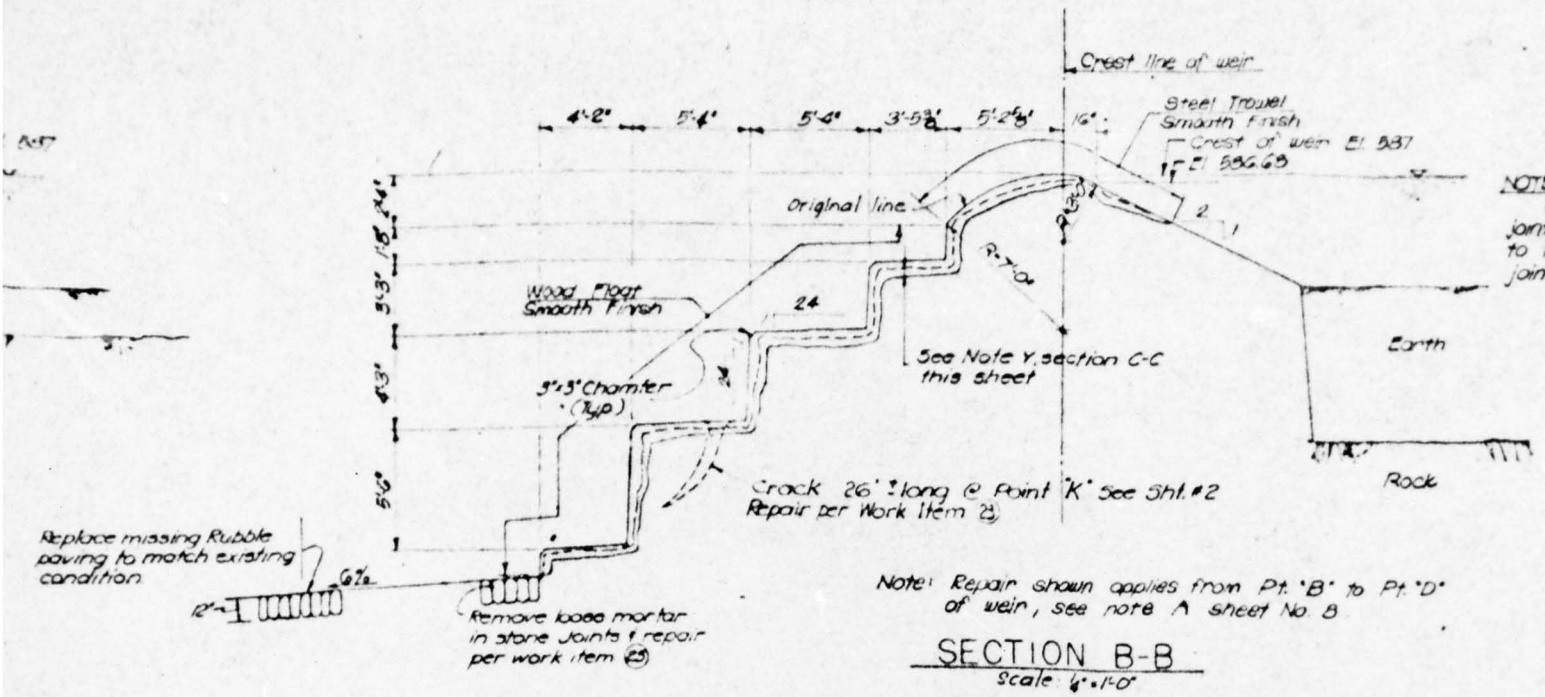




SECTION

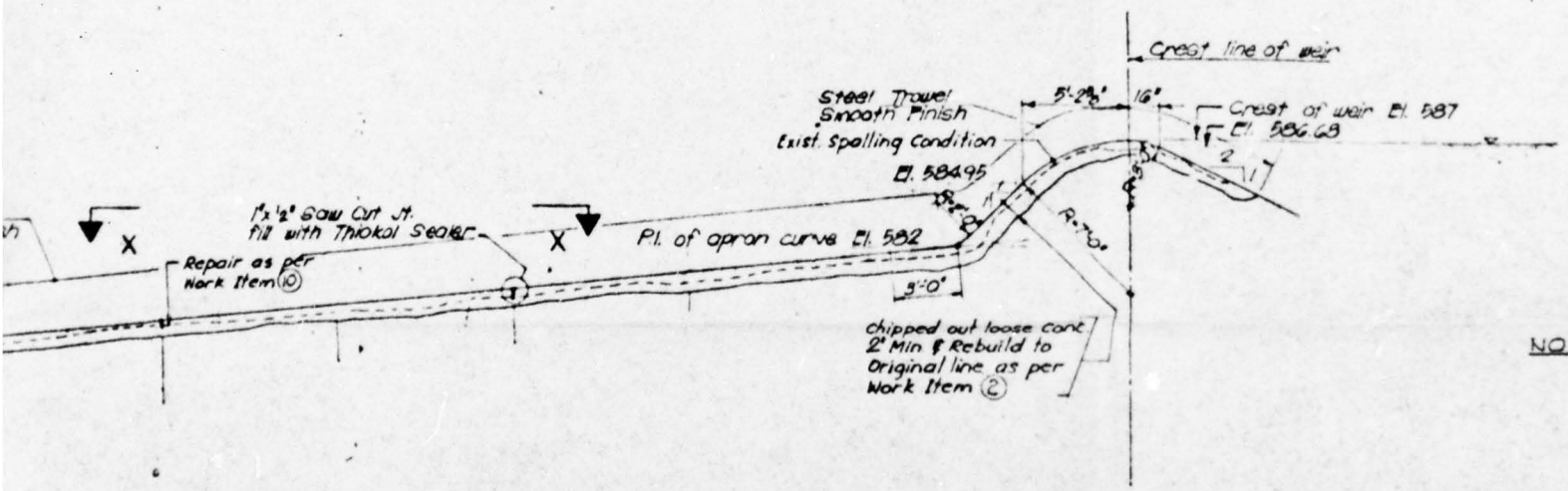
Scale: ½"=1'-0





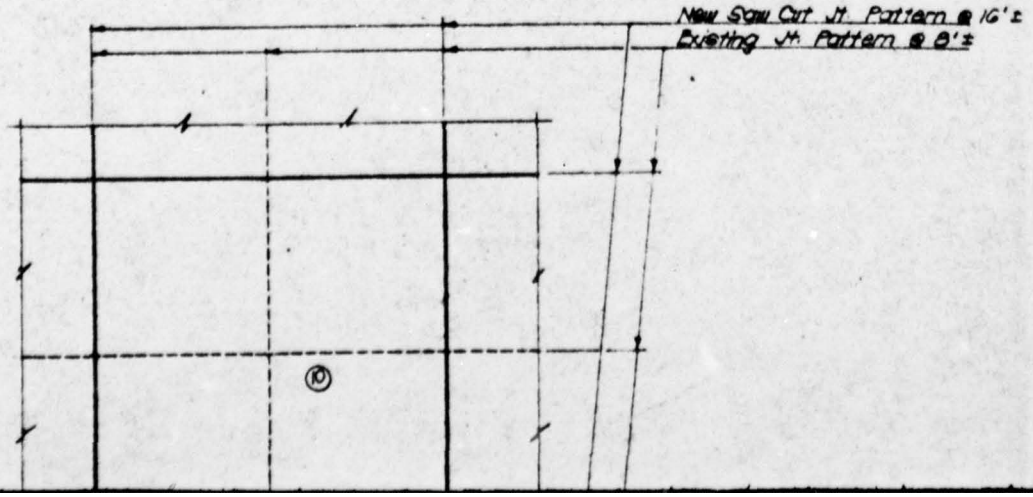
Note: Repair shown applies from Pt. 'B' to Pt. 'D' of weir, see note A sheet No. 8

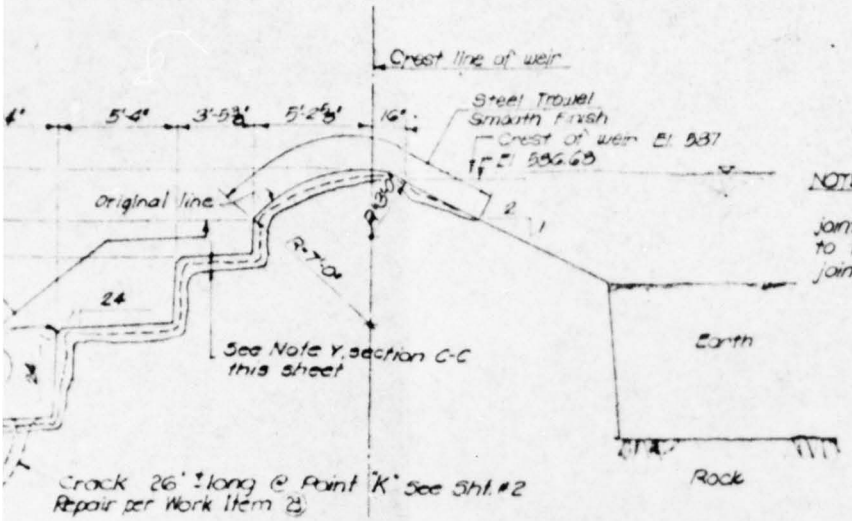
SECTION B-B
Scale: ½"=1'-0"



Note: Repair shown applies from Pt. 'D' to Pt. 'E' of lower weir, see note A Sht. 8.

SECTION C-C
Scale: ½"=1'-0"

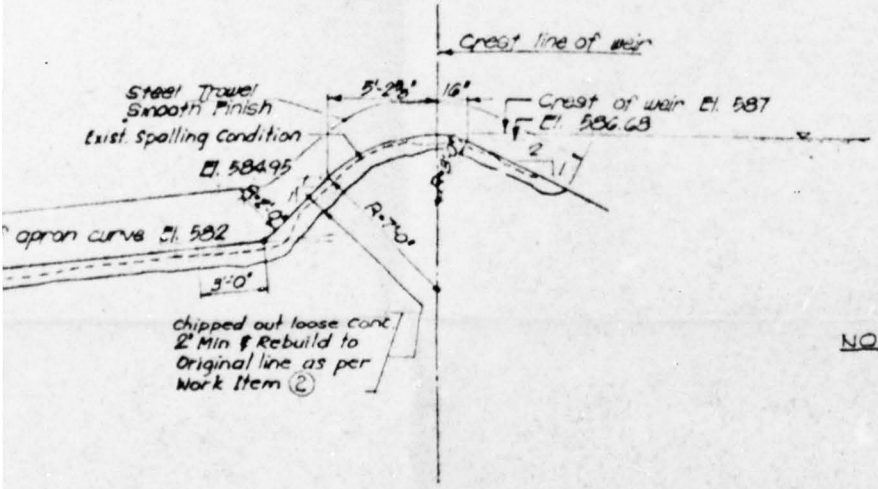




NOTE:
Provide 1"x½" saw cut transverse joints in new shotcreted surface to match location of existing joint in weir.

Note: Repair shown applies from Pt. "B" to Pt. "D" of weir, see note A sheet No. 8

SECTION B-B
Scale: ½"=1'-0"



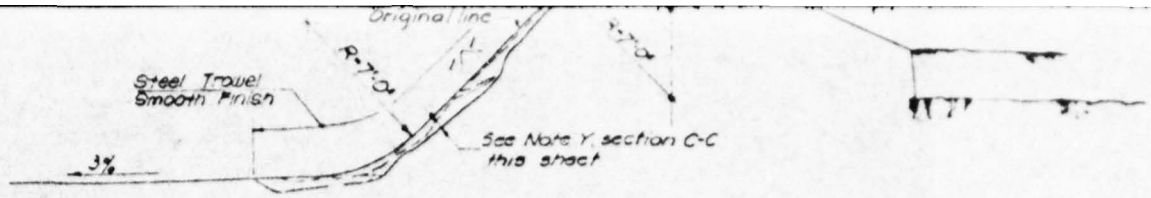
NOTES
Maintain Crest line of Weir at El. 587.
For location of Sections A-A, B-B & C-C see Sh. # 2
For Details of work items shown thus (2) see Sht # 8

New Saw Cut Jt. Pattern @ 16'±
Existing Jt. Pattern @ 8'±

NO	DATE	DESCRIPTION	BY	CH'KD	APP'D

REVISIONS

THE CITY OF NEW YORK



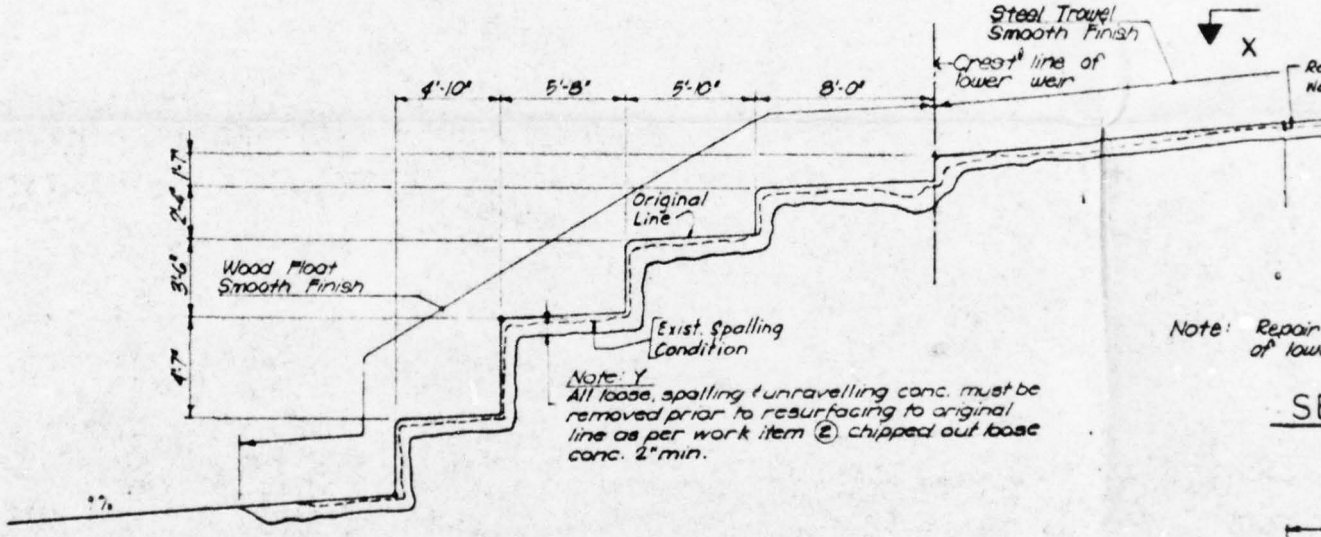
SECTION A-A

Scale: 1/4"=1'-0"

Note: Repair shown applies from Point "A" to Point "B" of weir see note "A" Sht # 8

Replace missing Rubbl
paving to match exist
condition

12"

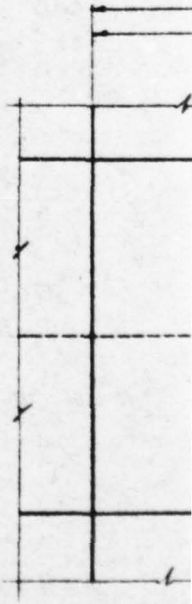


Note: Y
All loose, spalling & unravelling conc. must be removed prior to resurfacing to original line as per work item (2) chipped out loose conc. 2" min.

Note: Repair shown
of lower wei

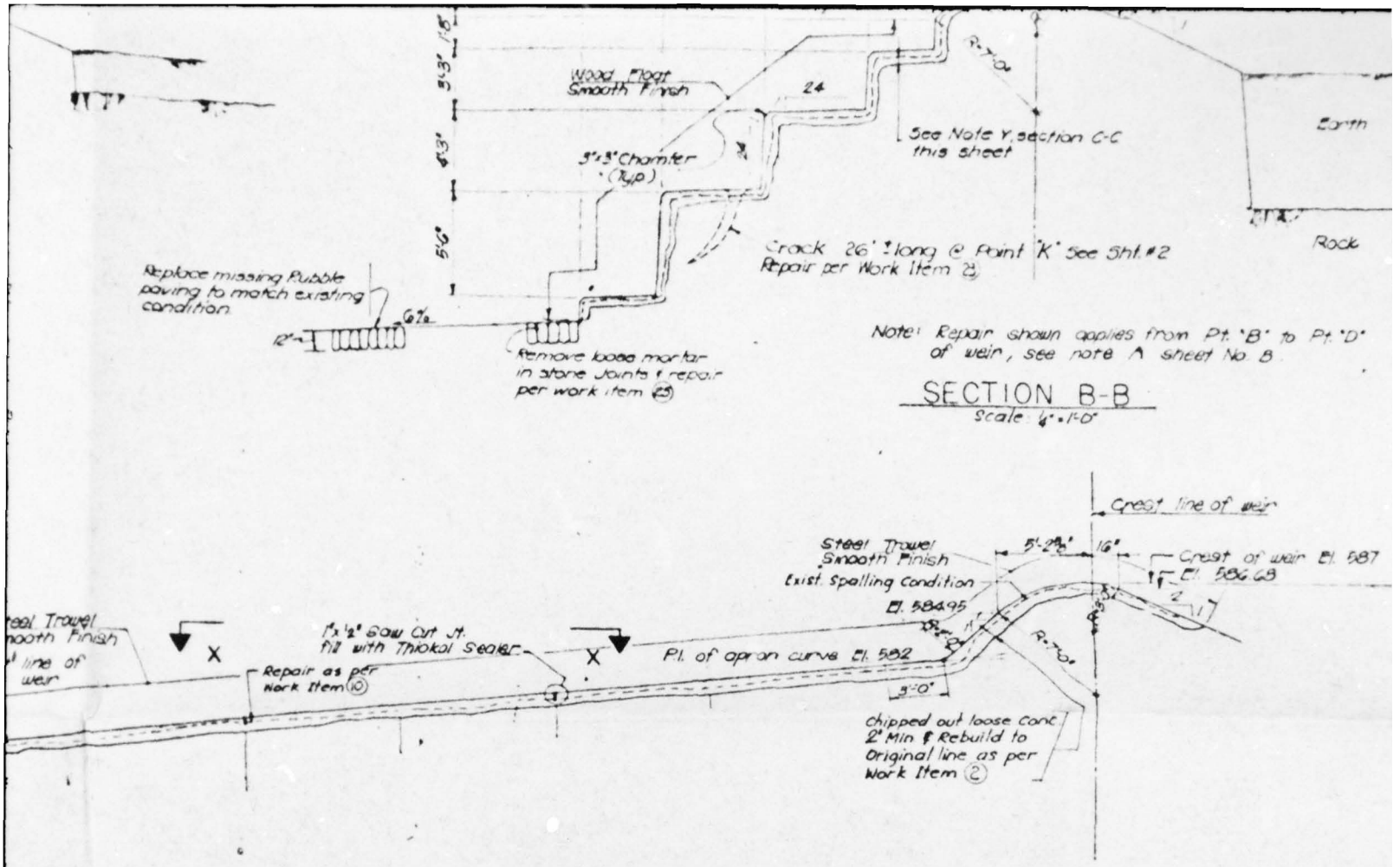
SECT

Sc



PART

CAT-104

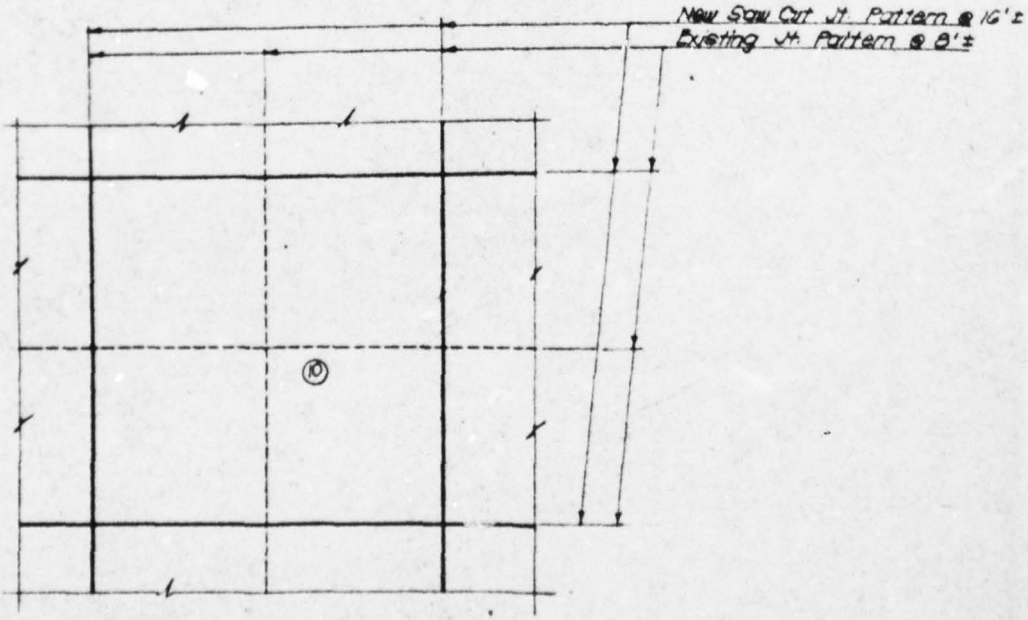


Note: Repair shown applies from Pt. "B" to Pt. "D" of weir, see note A sheet No. 8.

SECTION B-B
Scale: 1/2" = 1'-0"

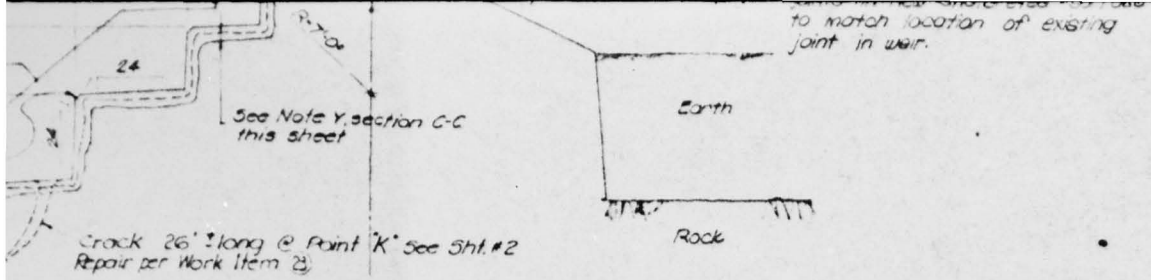
Note: Repair shown applies from Pt. "D" to Pt. "E" of lower weir, see note A Sht. 8.

SECTION C-C
Scale: 1/2" = 1'-0"



PART PLAN X-X

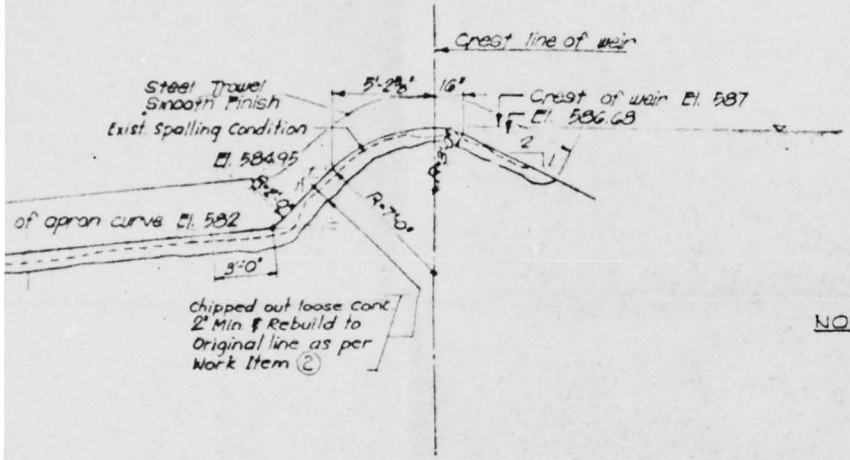
APPROVED BY
CHIEF ENGINEER
APPROVED BY
DEPUTY CHIEF ENGINEER
AMMANN & W
CONSULTING EN
111 EIGHTH AVENUE



to match location of existing joint in weir.

Note: Repair shown applies from Pt. "B" to Pt. "D" of weir, see note A sheet No. 8.

SECTION B-B
Scale 4"=1'-0"



NOTES

Maintain Crest line of Weir at El. 587.

For location of Sections A-A, B-B & C-C see Sh. # 2

For Details of work items shown thus (2) See Sht. # 8

New Saw Cut Jt. Pattern @ 16'±
Existing Jt. Pattern @ 8'±

NO	DATE	DESCRIPTION	BY	CH'KD	APP'D

REVISIONS

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

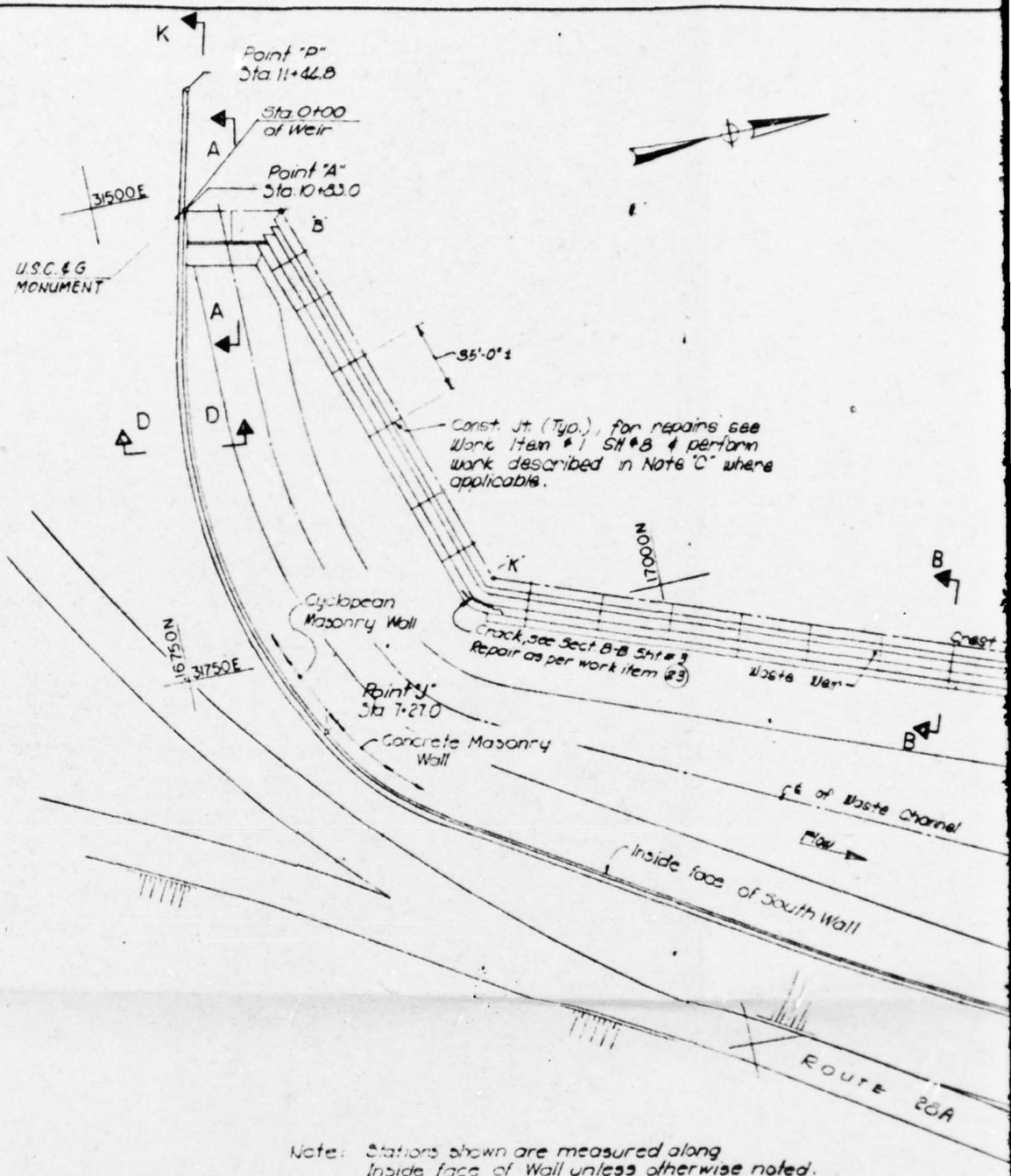
APPROVED BY
CHIEF ENGINEER — DATE 10/7/74

APPROVED BY
DEPUTY CHIEF ENGINEER — DATE 10/8/74

REHABILITATION OF
ASHOKAN RESERVOIR SPILLWAY
WEIR SECTIONS & DETAILS

AMMANN & WHITNEY
CONSULTING ENGINEERS
111 EIGHTH AVENUE NEW YORK

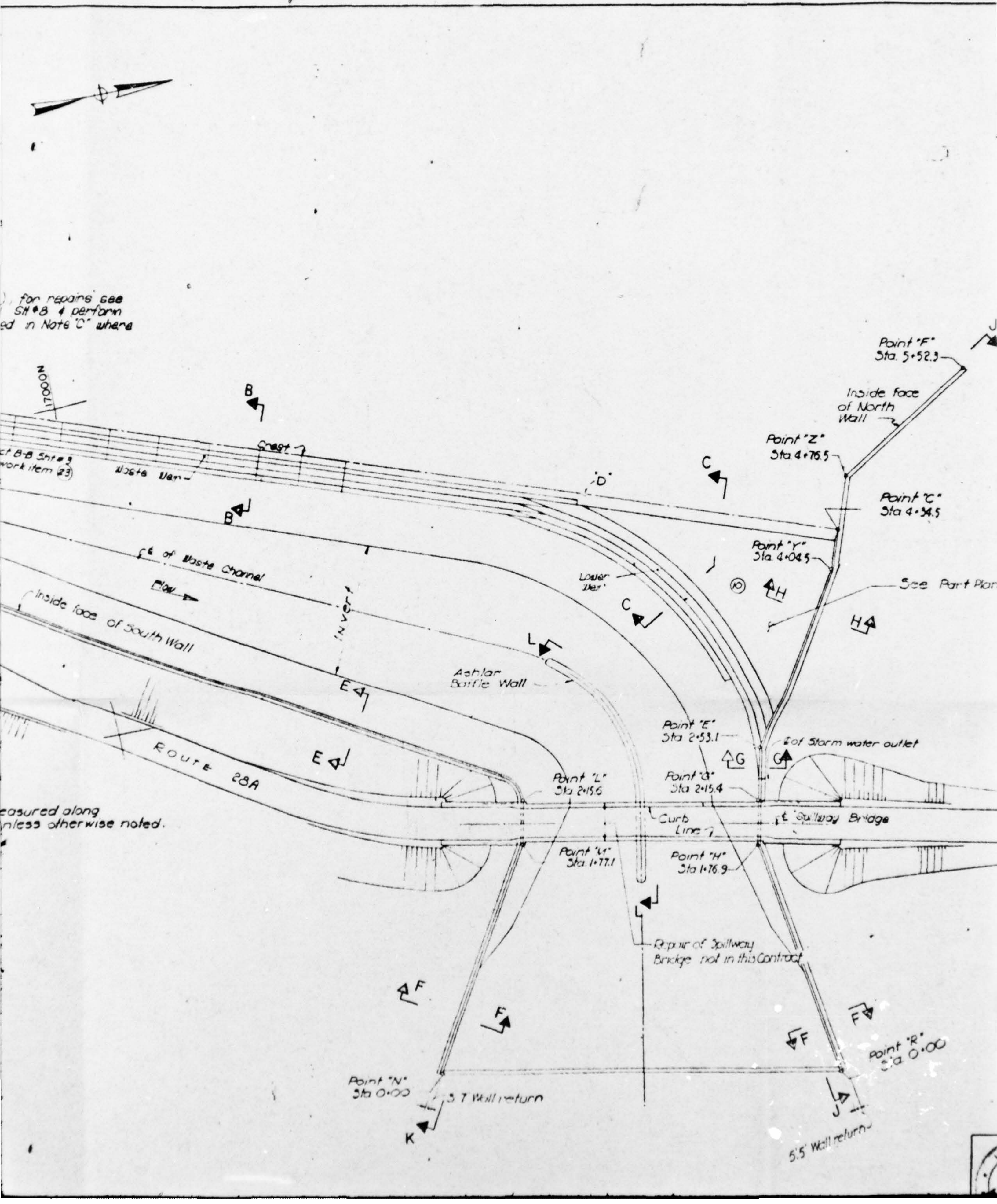
DRAWN	E.J.		DATE	10-4-74	SHEET 7 OF 8
TRACED	E.J.				
CHECKED	A.C.L.		SCALE	As shown	43597-X
APPROVED	G.P.A.				

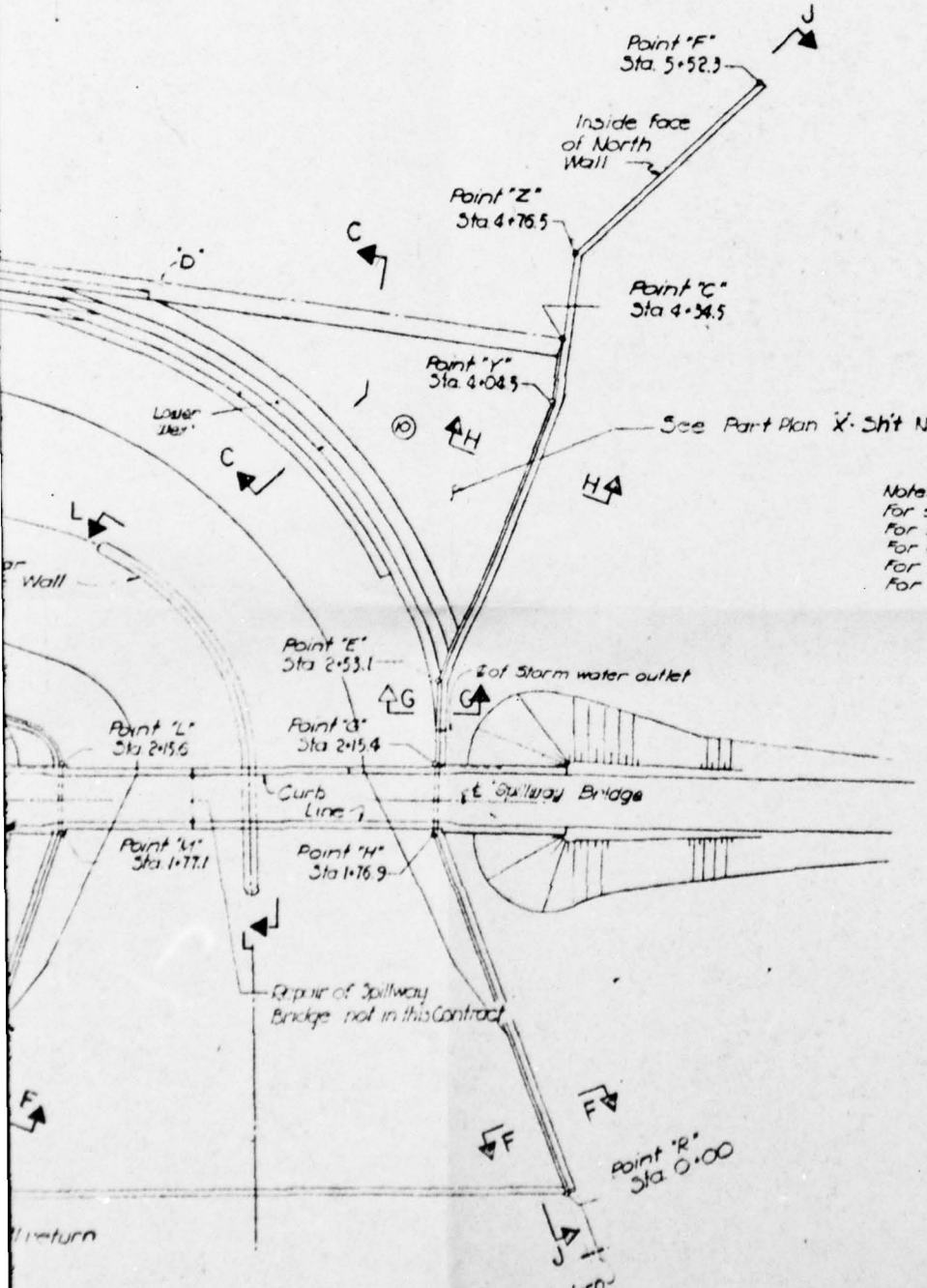


Note: Stations shown are measured along Inside face of Wall unless otherwise noted.

PLAN OF RESERVOIR SPILLWAY

12

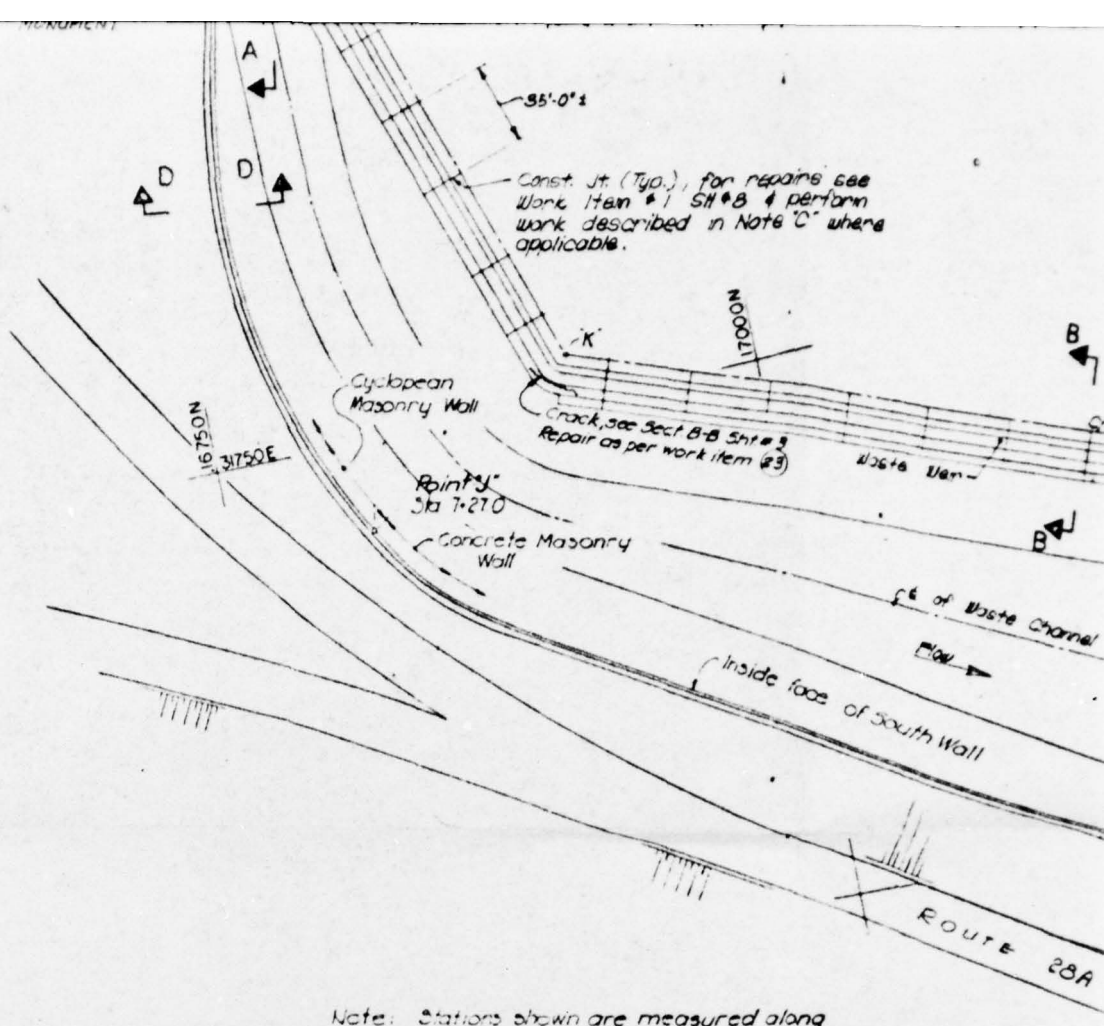

), for repairs see
Sht#8 & perform
ed in Note "C" where
17000N
B
ct B-B Sht#3
work item 23
Waste Weir
Crest
'D'
C
B
Point "F"
Sta. 5+52.3
Inside face
of North
Wall
Point "Z"
Sta. 4+76.5
Point "C"
Sta. 4+54.5
Point "Y"
Sta. 4+04.5
℄ of Waste Channel
Flow
Lower Weir
C
H
See Part Plan
H
Inside face of South Wall
INVERT
L
Ashlar
Baffle Wall
E
Route 28A
E
Point "E"
Sta 2+53.1
℄ of Storm water outlet
G
G
Point "L"
Sta 2+15.6
Point "G"
Sta 2+15.4
easured along
nless otherwise noted.
Curb
Line
℄ Spillway Bridge
Point "M"
Sta 1+77.1
Point "H"
Sta 1+76.9
L
Repair of Spillway
Bridge not in this Contract
F
F
F
F
Point "R"
Sta 0+00
Point "N"
Sta 0+00
3.7 Wall return
J
K
5.5' Wall return
J



Notes:
For sections A-A, B-B, C-C & part plan X see Sht. # 3.
For sections D-D, E-E, F-F, G-G, H-H & elev. L-L see Sht. # 7
For elev. J-J see Sht. # 4
For elev. K-K see Sht # 5 & 6
For details of work items shown thus (23) see Sht. # 8

NO	DATE	DESCRIPTION	BY	CH'KD	APP'D

REVISIONS



Note: Stations shown are measured along Inside face of Wall unless otherwise noted.

PLAN OF RESERVOIR SPILLWA

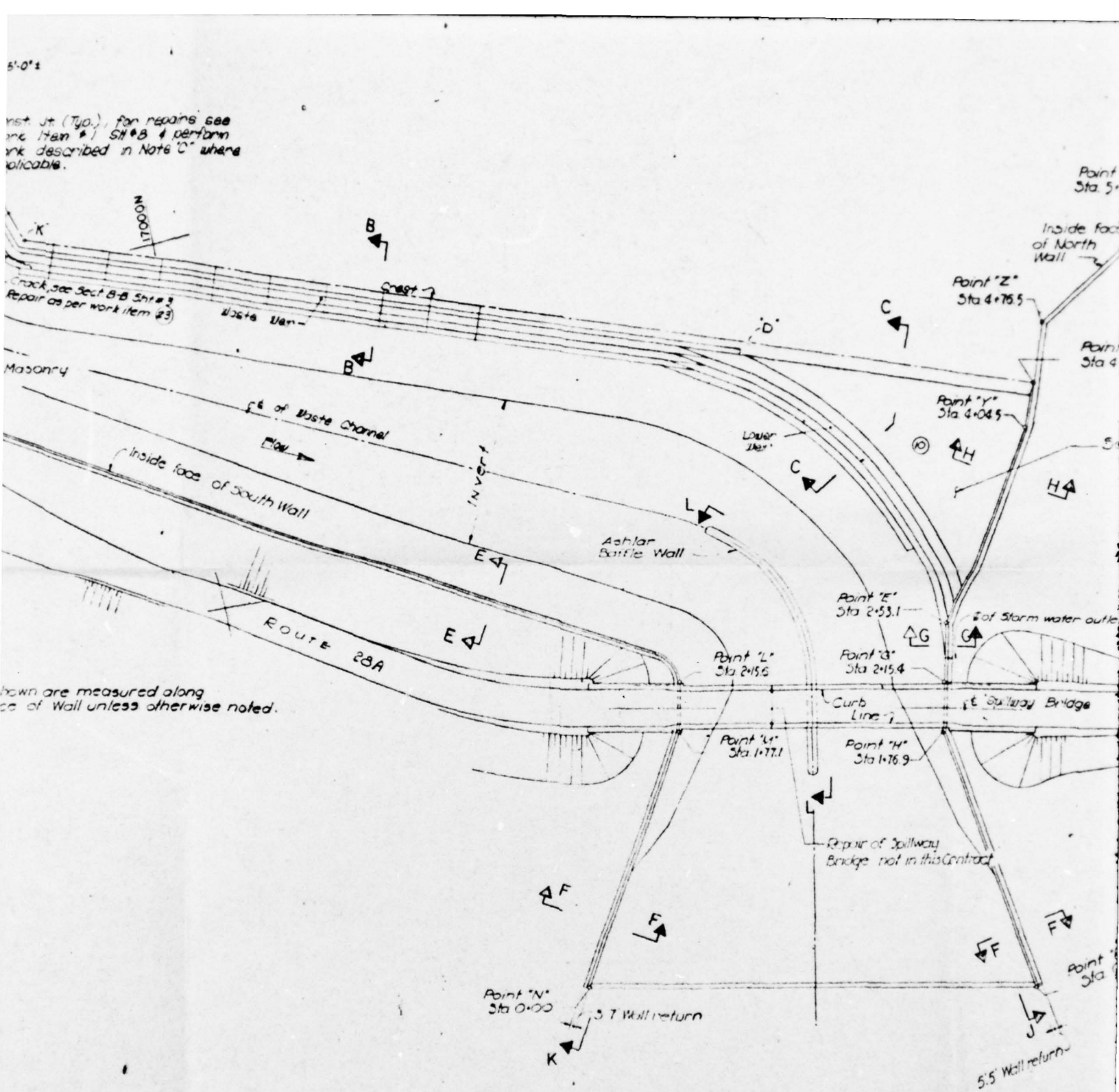
Scale: 1" = 40'-0"

CAT-104

5

5'-0"±

nst. Jt. (Typ.) for repairs see
ork Item #1 Sht #8 & perform
ork described in Note "C" where
olicable.

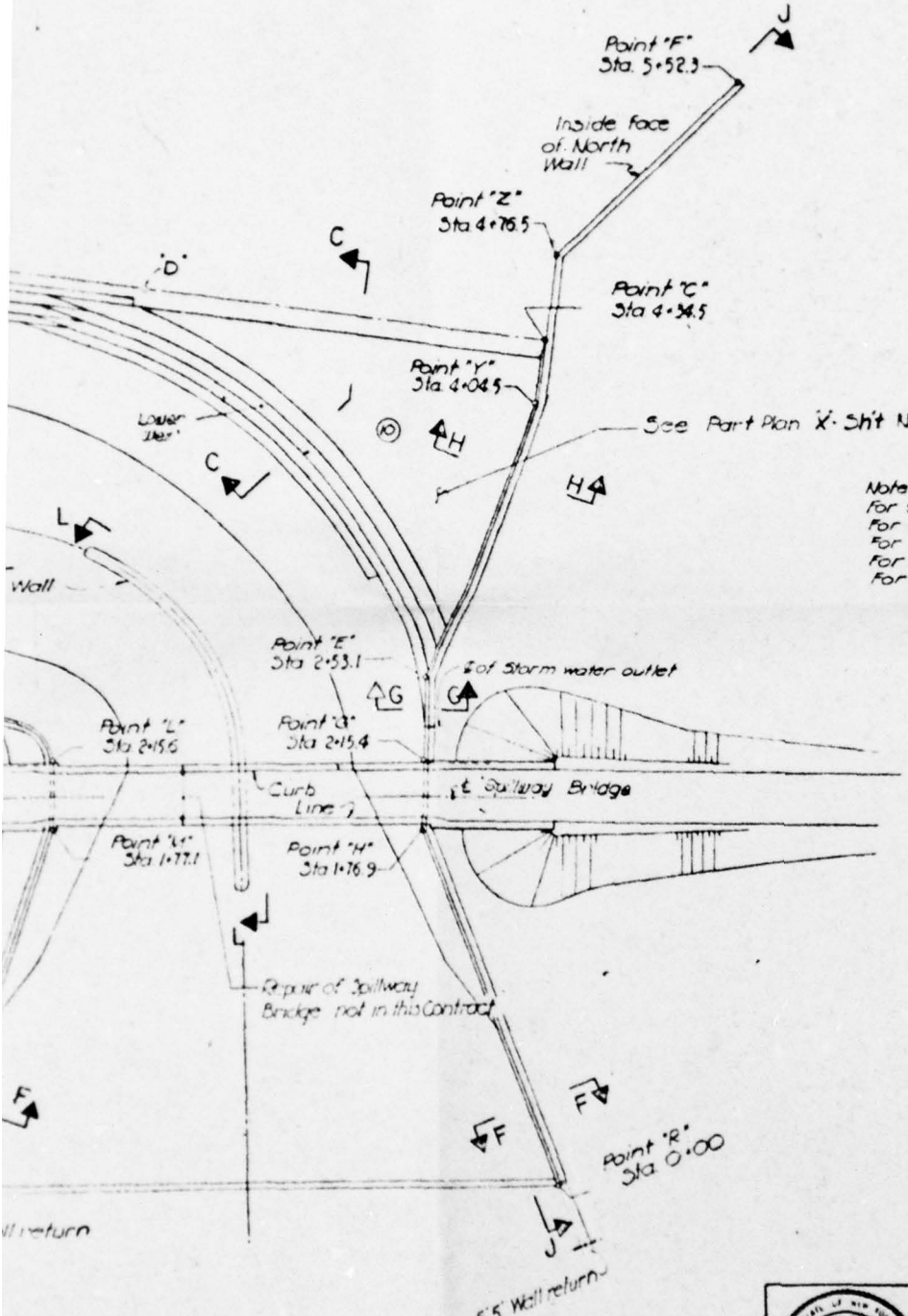


hown are measured along
ce of Wall unless otherwise noted.

LAN OF RESERVOIR SPILLWAY · AREA

Scale: 1" · 40'-0"

APPROVED
CHIEF E
APPROVED
DEPUTY
AMM
CO
III EIGH



Notes:
For sections A-A, B-B, C-C & part plan X see Sht. # 3.
For sections D-D, E-E, F-F, G-G, H-H & elev. L-L see Sht. # 7
For elev. J-J see Sht. # 4
For elev. K-K see Sht. # 5 & 6
For details of work items shown thus (23) see Sht. # 8

NO	DATE	DESCRIPTION	BY	CH'KD	APP'D

REVISIONS

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

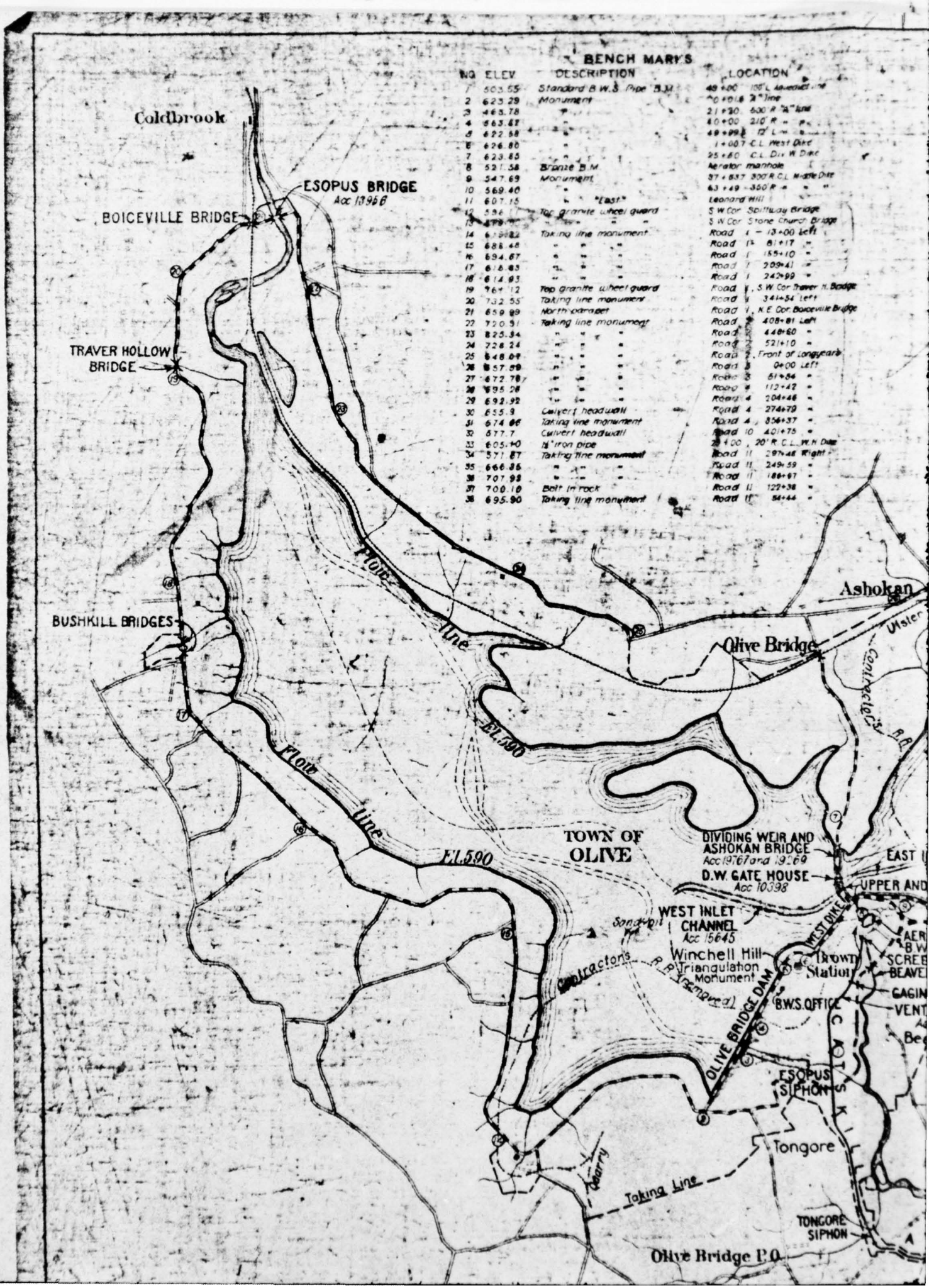
APPROVED BY
Chief Engineer — DATE 10/17/74

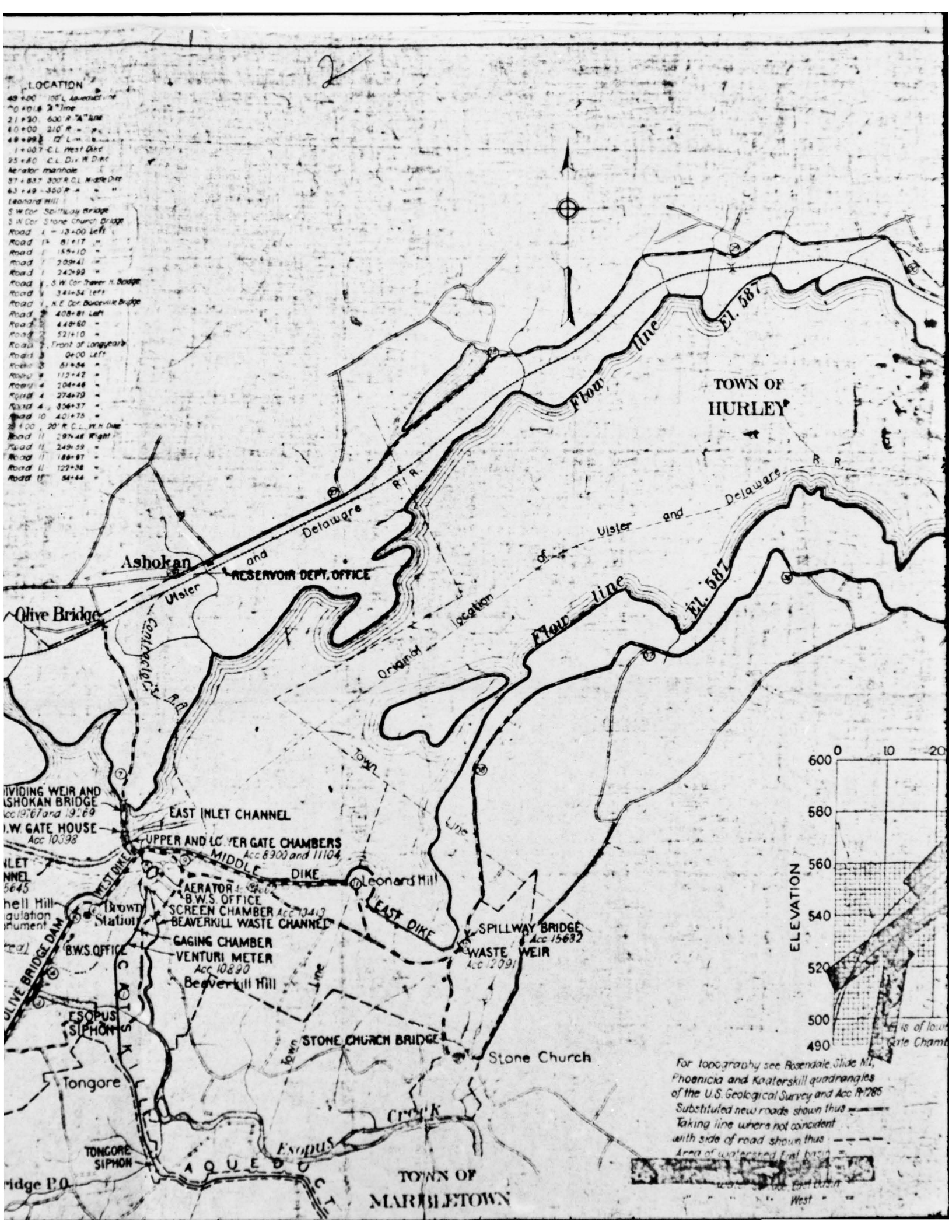
APPROVED BY
Deputy Chief Engineer — DATE 10/16/74

AMMANN & WHITNEY
CONSULTING ENGINEERS
111 EIGHTH AVENUE NEW YORK

REHABILITATION OF ASHOKAN RESERVOIR SPILLWAY GENERAL PLAN

DRAWN	J.K.	DATE	10-74	SHEET 2 OF 8	
TRACED	J.K.				
CHECKED	A.S.	SCALE	As Shown	43596-X	
APPROVED	C.P.A.				


BENCH MARKS
NO ELEV DESCRIPTION LOCATION
1 503.55 Standard B.W.S. Pipe B.M. 49+00 105' L. Aqueduct line
2 623.29 Monument 70+01.8 2" line
3 463.78 " 21+30 600' R "A" line
4 563.63 " 40+00 210' R " "
5 622.58 " 49+99.2 12' L " "
6 626.80 " 1+00.7 C.L. West Dike
7 623.85 " 25+60 C.L. Div. W. Dike
8 521.58 Bronze B.M. Aerator manhole
9 547.69 Monument 37+83.7 300' R. C.L. Waste Dike
10 569.40 " 63+49 350' R " " "
11 607.15 " "East" Leonard Hill
12 596 Top granite wheel guard S.W. Cor. Spillway Bridge
13 [illegible] " " " S.W. Cor. Stone Church Bridge
14 6[illegible]82 Taking line monument Road 1 — 13+00 Left
15 688.48 " " " Road 1 81+17 "
16 694.67 " " " Road 1 155+10 "
17 6[illegible]6.83 " " " Road 1 209+41 "
18 614.93 " " " Road 1 242+99 "
19 964.12 Top granite wheel guard Road 1, S.W. Cor. Traver H. Bridge
20 732.55 Taking line monument Road 1 341+54 Left
21 659.99 North corner pt. Road 1, N.E. Cor. Boiceville Bridge
22 720.91 Taking line monument Road 2 408+81 Left
23 825.34 " " " Road 2 448+60 "
24 728.24 " " " Road 2 521+10 "
25 648.69 " " " Road 3, Front of Longyearb
26 657.59 " " " Road 3 0+00 Left
27 672.78 " " " Road 3 61+84 "
28 695.28 " " " Road 3 112+42 "
29 692.92 " " " Road 4 204+46 "
30 655.9 Culvert headwall Road 4 274+79 "
31 674.66 Taking line monument Road 4, 856+37 "
32 677.7 Culvert headwall Road 10 401+75 "
33 605.40 ¾" iron pipe 20+00, 20' R. C.L. W.H. Dike
34 571.87 Taking line monument Road 11 297+48 Right
35 666.86 " " " Road 11 249+59 "
36 707.93 " " " Road 11 186+97 "
37 700.10 Bolt in rock Road 11 122+38 "
38 695.90 Taking line monument Road 11 54+44 "
Coldbrook
ESOPUS BRIDGE
Acc 13966
BOICEVILLE BRIDGE
TRAVER HOLLOW BRIDGE
BUSHKILL BRIDGES
Flow line
El. 590
Flow line
El. 590
Ashokan
Olive Bridge
Ulster
Contractor's R.R.
TOWN OF OLIVE
DIVIDING WEIR AND ASHOKAN BRIDGE
Acc 19767 and 19769
D.W. GATE HOUSE
Acc 10398
EAST
UPPER AND
WEST INLET CHANNEL
Acc 15645
WEST DIKE
Sandpit
Winchell Hill Triangulation Monument
Contractors R.R. (temporary)
Trough Station
AER
B.W
SCREE
BEAVE
CAGIN
VENT
B.W.S. OFFICE
OLIVE BRIDGE DAM
ESOPUS SIPHON
Tongore
Quarry
Taking Line
TONGORE SIPHON
Olive Bridge P.O.


LOCATION
49+00 105' L. Aqueduct "A" line
70+01.8 "A" line
21+30 600' R. "A" line
40+00 210' R. " "
49+99.2 12' L. " "
1+00.7 C.L. West Dike
25+60 C.L. Div. W. Dike
Aerator manhole
97+83.7 300' R. C.L. Middle Dike
63+49 350' R. " "
Leonard Hill
S.W. Cor. Spillway Bridge
S.W. Cor. Stone Church Bridge
Road 1 13+00 Left
Road 1 81+17 "
Road 1 155+10 "
Road 1 209+41 "
Road 1 242+99 "
Road 1, S.W. Cor. Shaver Pt. Bridge
Road 1 341+54 Left
Road 1, N.E. Cor. Boiceville Bridge
Road 2 408+81 Left
Road 2 448+60 "
Road 2 521+10 "
Road 2, Front of Longyears
Road 3 0+00 Left
Road 3 81+84 "
Road 4 112+42 "
Road 4 204+48 "
Road 4 274+79 "
Road 4, 356+37 "
Road 10 401+75 "
2+00, 20' R. C.L. W.H. Dike
Road 11 297+48 Right
Road 11 249+59 "
Road 11 188+97 "
Road 11 129+38 "
Road 11 54+44 "
2
TOWN OF
HURLEY
Flow line El. 587
Delaware R R
Ulster and Delaware R R
Ashokan
RESERVOIR DEPT. OFFICE
Olive Bridge
Ulster
Catskill
Original location
Flow line El. 587
Town Line
DIVIDING WEIR AND ASHOKAN BRIDGE
Acc 19767 and 19769
E.W. GATE HOUSE
Acc 10398
EAST INLET CHANNEL
UPPER AND LOWER GATE CHAMBERS
Acc 8900 and 11104
MIDDLE DIKE
WEST DIKE
Leonard Hill
AERATOR
B.W.S. OFFICE
SCREEN CHAMBER Acc 10413
BEAVERKILL WASTE CHANNEL
LEAST DIKE
SPILLWAY BRIDGE
Acc 15682
WASTE WEIR
Acc 12091
Shell Hill
Regulation
Monument
Brown Station
B.W.S. OFFICE
GAGING CHAMBER
VENTURI METER
Acc 10890
Beaverkill Hill
OLIVE BRIDGE DAM
CATSKILL
ESOPUS SIPHONS
STONE CHURCH BRIDGE
Stone Church
Tongore
Creek
Esopus
TONGORE SIPHON
AQUEDUCT
Ridge P.O.
TOWN OF
MARBLETOWN
ELEVATION
600
580
560
540
520
500
490
0
10
20
For topography see Rosendale, Slide Mt., Phoenicia and Kaaterskill quadrangles of the U.S. Geological Survey and Acc 19785
Substituted new roads shown thus
Taking line where not coincident with side of road shown thus
Area of watershed East basin
West

RECORD DRAWING
SHEET 126 SHEETS IN SET 133

3

TOWN OF
WOODSTOCK

West Hurley

GLENFORD DIKE

WOODSTOCK DIKE

TOWN OF
HURLEY

Flow line EL. 587

TOWN OF
KINGSTON

R R

Ulster and Delaware

WEST HURLEY DIKE

Town Line

Flow line EL. 587

Stony Hollow

TOWN OF
ULSTER

AVAILABLE CAPACITY
BILLION GALLONS

0 10 20 30 40 50 60 70 80 90 100

ELEVATION

600 580 560 540 520 500 490

EL 590
47237

EL 587
80521

EAST BASIN

WEST BASIN

AREA WEST BASIN

AREA EAST BASIN

EL is of lowest inlets, Upper Gate Chamber, EL 495.5

480 460

0 1000 2000 3000 4000 5000 6000

AREA - ACRES

LLWAY BRIDGE
Acc 15692
E WEIR

tone Church

For topography see Rosendale, Slide Mt., Phoenicia and Kaaterskill quadrangles of the U.S. Geological Survey and Acc Pr1786

Substituted new roads shown thus

Taking line where not coincident with side of road shown thus

Area of watershed East basin

" " " West "

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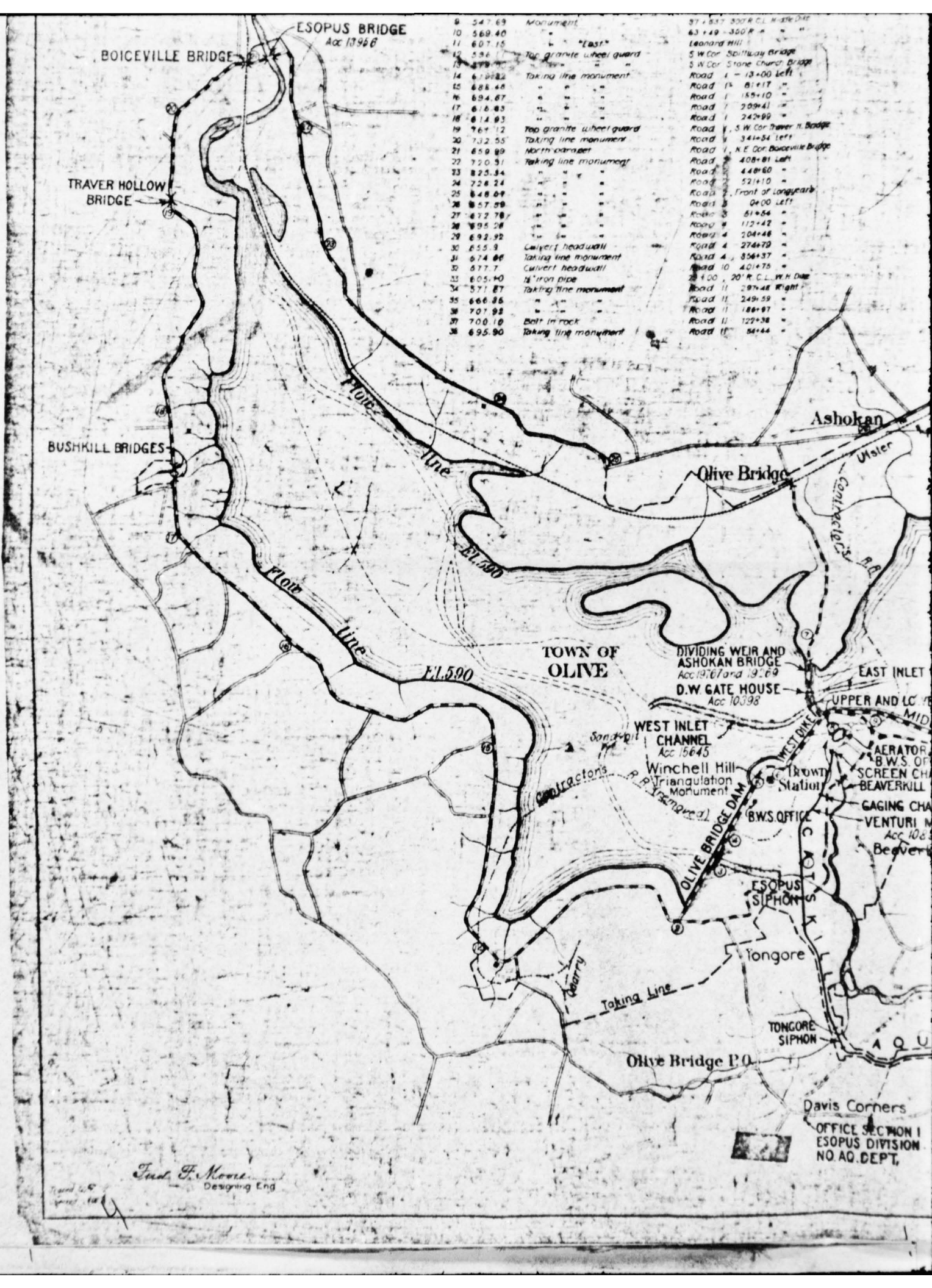
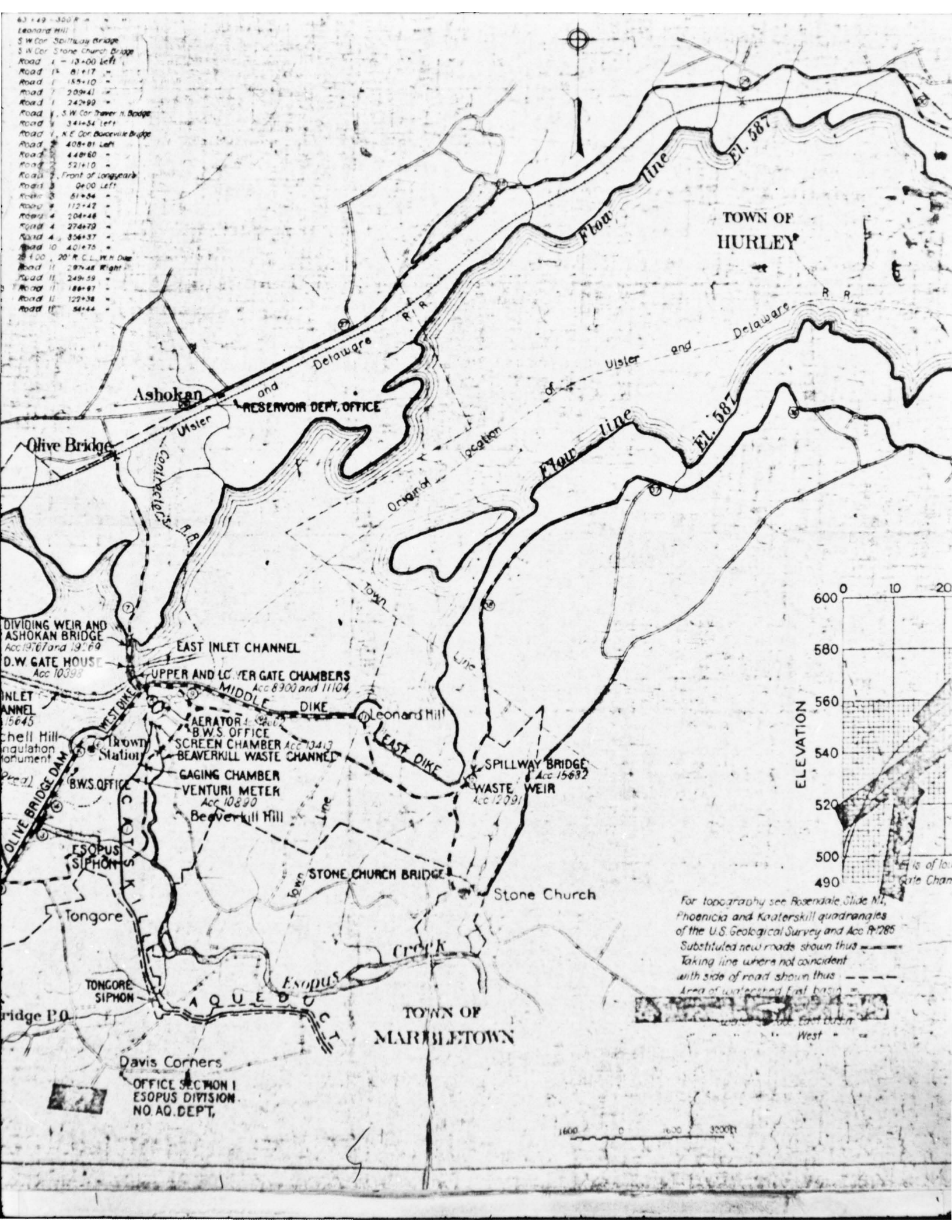

ESOPUS BRIDGE
Acc 13966
BOICEVILLE BRIDGE
TRAVER HOLLOW BRIDGE
BUSHKILL BRIDGES
Flow line
EL.590
Flow line
EL.590
TOWN OF OLIVE
Ashokan
Olive Bridge
Ulster
Contractors R.R.
DIVIDING WEIR AND ASHOKAN BRIDGE
Acc 19767 and 19769
D.W. GATE HOUSE
Acc 10398
EAST INLET
WEST INLET CHANNEL
Acc 15645
Sand pit
Contractors R.R. (Temporary)
Winchell Hill Triangulation Monument
WEST DIKE
Trout Station
AERATOR
B.W.S. OF
SCREEN CH
BEAVERKILL
GAGING CHA
VENTURI M
Acc 10
Beaver
(B.W.S. OFFICE)
OLIVE BRIDGE DAM
CATSKILL AQUEDUCT
ESOPUS SIPHON
Tongore
Quarry
Taking Line
TONGORE SIPHON
AQU
Olive Bridge P.O.
Davis Corners
OFFICE SECTION 1
ESOPUS DIVISION
NO. AQ. DEPT.
Trust F. Moore
Designing Eng
8 547.69 Monument
10 569.40 "
11 607.15 " "East"
12 596 Top granite wheel guard
13 579 " " "
14 639.82 Taking line monument
15 688.48 " " "
16 694.67 " " "
17 616.83 " " "
18 614.93 " " "
19 964.12 Top granite wheel guard
20 732.55 Taking line monument
21 659.89 North corner
22 720.91 Taking line monument
23 825.34 " " "
24 728.24 " " "
25 848.09 " " "
26 857.59 " " "
27 672.78 " " "
28 695.28 " " "
29 692.92 " " "
30 655.9 Culvert headwall
31 674.66 Taking line monument
32 677.7 Culvert headwall
33 605.40 1" iron pipe
34 571.87 Taking line monument
35 666.86 " " "
36 707.92 " " "
37 700.10 Bolt in rock
38 695.90 Taking line monument
97+837.300 R.C.L. Middle Dike
63+49.300 R. " " "
Leonard Hill
S.W. Cor. Spillway Bridge
S.W. Cor. Stone Church Bridge
Road 1 - 13+00 Left
Road 1 81+17 "
Road 1 185+10 "
Road 1 209+41 "
Road 1 242+99 "
Road 1, S.W. Cor. Traver H. Bridge
Road 1 341+34 Left
Road 1, N.E. Cor. Boiceville Bridge
Road 2 408+81 Left
Road 2 448+60 "
Road 2 521+10 "
Road 2, Front of Longyear's
Road 3 0+00 Left
Road 3 81+84 "
Road 3 112+42 "
Road 4 204+46 "
Road 4 274+79 "
Road 4 856+37 "
Road 10 401+75 "
28+00, 20' R.C.L. W.H. Dike
Road 11 287+48 Right
Road 11 249+59 "
Road 11 188+97 "
Road 11 122+38 "
Road 11 54+44 "


Leonard Hill
S.W. Cor. Spillway Bridge
S.W. Cor. Stone Church Bridge
Road 1 — 13+00 Left
Road 1A 81+17 "
Road 1 185+10 "
Road 1 209+41 "
Road 1 242+99 "
Road 1, S.W. Cor. Tower N. Bridge
Road 1 341+54 Left
Road 1, N.E. Cor. Boiceville Bridge
Road 2 408+81 Left
Road 2 448+60 "
Road 2 521+10 "
Road 2, Front of Longyear's
Road 3 0+00 Left
Road 3 81+54 "
Road 3 112+42 "
Road 4 204+46 "
Road 4 274+79 "
Road 4 856+37 "
Road 10 401+75 "
28+00, 20' R.C.L. W.H. Dike
Road 11 287+48 Right
Road 11 249+59 "
Road 11 188+87 "
Road 11 122+38 "
Road 11 54+44 "
Flow line El. 587
TOWN OF HURLEY
Ulster and Delaware R.R.
Ashokan
RESERVOIR DEPT. OFFICE
Olive Bridge
Contractors R.R.
Original location of Ulster and Delaware R.R.
Flow line El. 587
Town Line
DIVIDING WEIR AND ASHOKAN BRIDGE
Acc 19767 and 19769
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AERATOR
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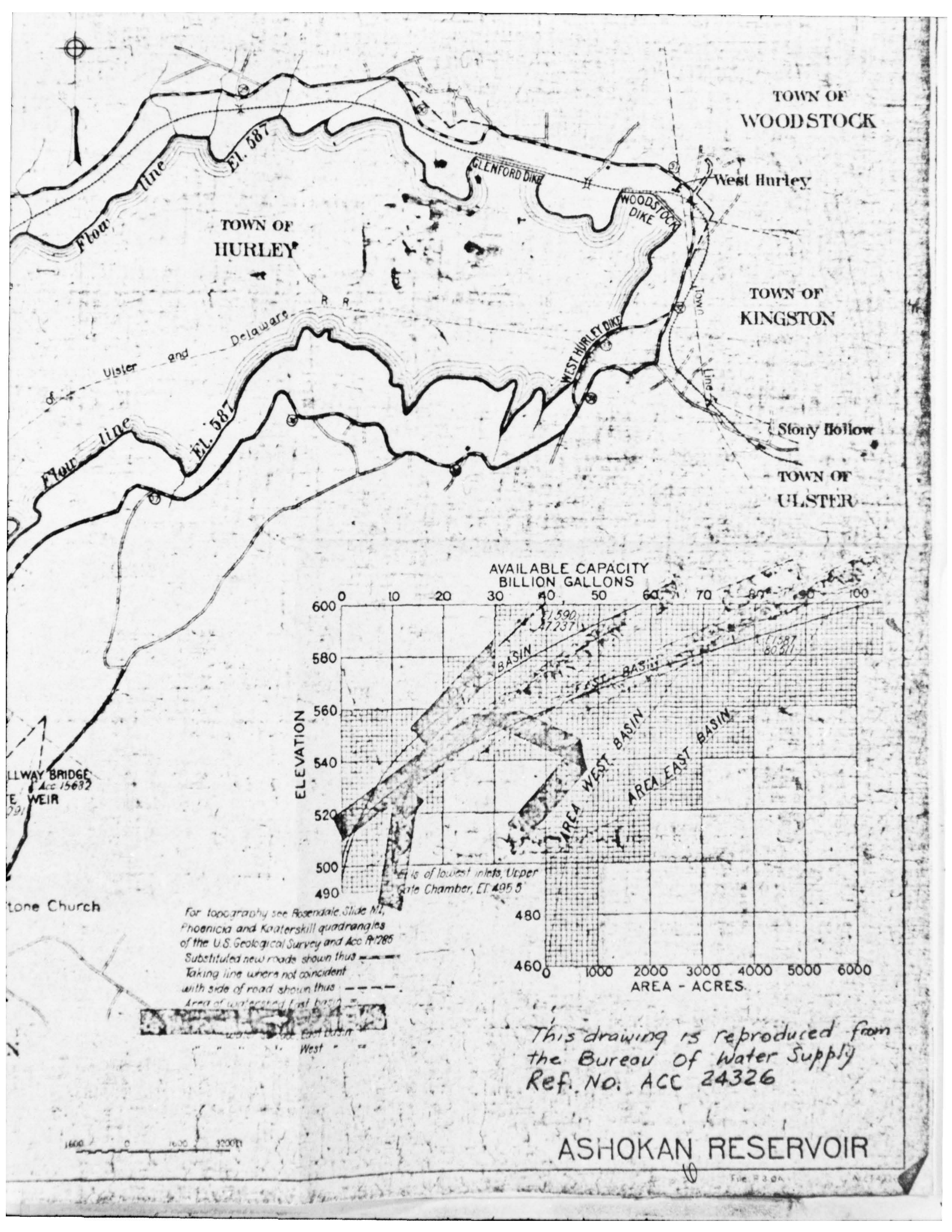
SCREEN CHAMBER Acc 10413
BEAVERKILL WASTE CHANNEL
GAGING CHAMBER
VENTURI METER
Acc 10890
Beaverkill Hill
SPILLWAY BRIDGE
Acc 15682
WASTE WEIR
Acc 12091
Trout Station
OLIVE BRIDGE DAM
B.W.S. OFFICE
ESOPUS SIPHON
CATSKILL AQUEDUCT
STONE CHURCH BRIDGE
Stone Church
Tongore
ESOPUS CREEK
TONGORE SIPHON
AQUEDUCT
TOWN OF MARBLETOWN
Davis Corners
OFFICE SECTION 1
ESOPUS DIVISION
NO. AQ. DEPT.
ELEVATION
600
580
560
540
520
500
490
0
10
20
For topography see Rosendale, Slide Mt., Phoenicia and Kaaterskill quadrangles of the U.S. Geological Survey and Acc 19785
Substituted new roads shown thus
Taking line where not coincident with side of road shown thus
West
1600
0
1600
3200ft



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PHOTOGRAPHS

APPENDIX B

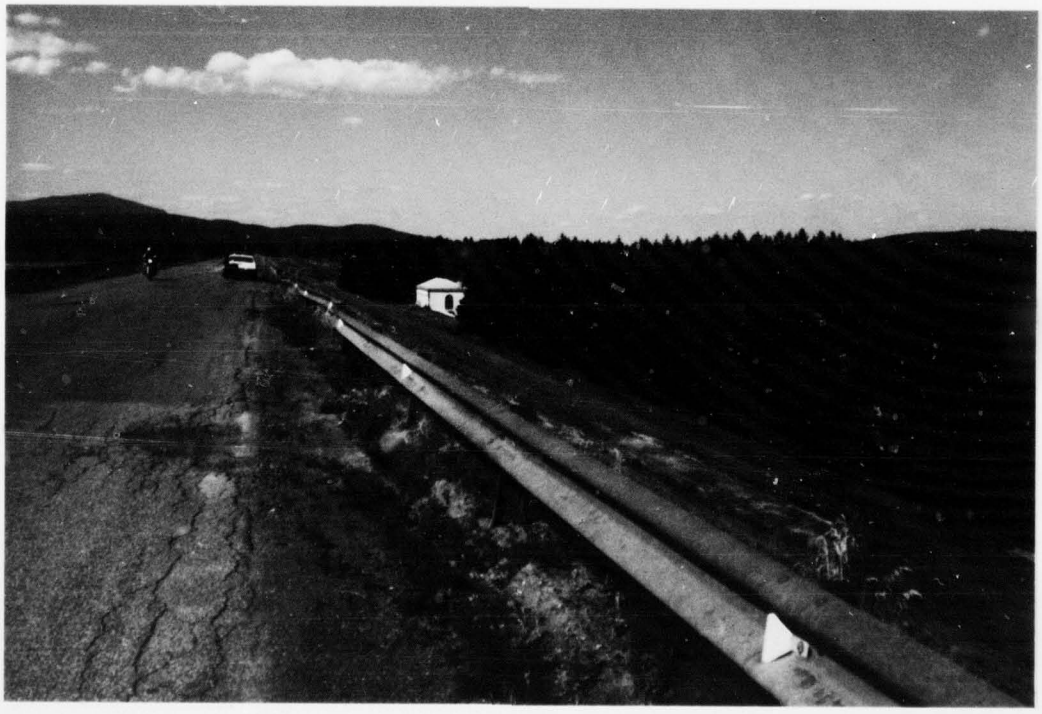
DOWNSTREAM SLOPE OF OLIVE BRIDGE DAM.(LOOKING NORTH)

UPSTREAM SLOPE OF SOUTH EMBANKMENT OF DAM.(LOOKING SOUTH)

DOWNSTREAM FACE OF MASONRY DAM.
NOTE VEGETATION AND SPALLING ON FACE

DOWNSTREAM CHANNEL (ESOPUS CREEK) OF
MASONRY DAM SHOWING VEGETATION
AND EXPOSED ROCK

CREST OF OLIVE BRIDGE MASONRY DAM



VIEW OF DOWNSTREAM SLOPE OF WEST DIKE LOOKING NORTH.
NOTE PAVEMENT FAILURE AT CREST AND REPAIR OF SLOPE

VIEW OF UPSTREAM SLOPE OF EAST DIKE. (LOOKING WEST)

VIEW OF DOWNSTREAM SLOPE OF EAST DIKE. (LOOKING WEST)

VIEW OF WEST HURLEY DIKE. (LOOKING SOUTH)

OVERVIEW OF CREST AND UPSTREAM SLOPE OF WOODSTOCK DIKE.
(LOOKING EAST) NOTE PATHWAYS AND OVERGROWN GRASS.

OVERVIEW OF CREST AND UPSTREAM SLOPE OF WOODSTOCK DIKE.
(LOOKING WEST) NOTE PATHWAYS AND OVERGROWN GRASS.

VIEW OF CREST OF GLENFORD DIKE. (LOOKING WEST)
NOTE ABANDONED RAILROAD TRACK AND HEAVY VEGETATION

UPSTREAM SLOPE OF GLENFORD DIKE. (LOOKING EAST)
NOTE RIPRAP AND HEAVY VEGETATION.

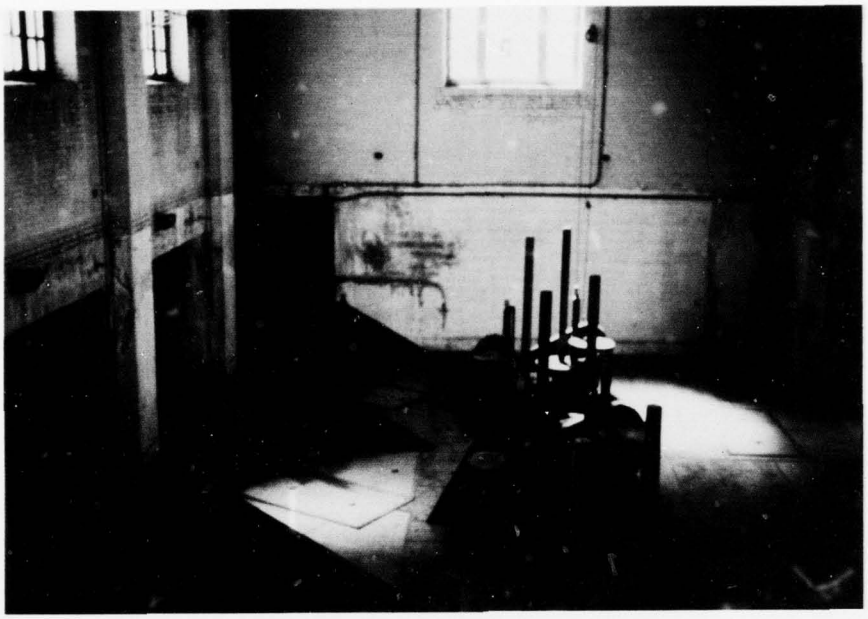
DOWNSTREAM SLOPE OF GLENFORD DIKE. (LOOKING EAST)
NOTE LOOSE ROCK PROTECTION AND HEAVY VEGETATION.

OVERVIEW OF SPILLWAY CREST AND RESERVOIR. (LOOKING NORTH)
NOTE MINOR VEGETATION.

DOWNSTREAM FACE OF SPILLWAY AND FLOOR CHANNEL
AND MASONRY WALL. (LOOKING SOUTH)

SEEPAGE AT DOWNSTREAM FACE OF SPILLWAY.
NOTE SEEPAGE FROM JOINTS

DOWNSTREAM FACE OF SPILLWAY AND FLOOR OF CHANNEL.
NOTE MINOR VEGETATION.



UPPER GATE CHAMBER - THREE 60 INCHES DIAMETER GATE VALVES AND 3 PAIRS SLUICE GATES.

ENGINEERING DATA CHECKLIST

APPENDIX C

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM ASHOKAN DAM

ID # 41

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE AVAILABLE FOR DAM AND DIKES. FOR SECTIONS AND DETAILS OF REHABILITATED SPILLWAY SEE AMMANN & WHITNEY DRAWINGS 43595-x to 43602-x Sheets 1 thru 8 FOR AVAILABLE CONTRACT DRAWINGS & SPECIFICATIONS SEE SECTION 2: ENG'G DATA
REGIONAL VICINITY MAP	USGS
CONSTRUCTION HISTORY	SEE ENGINEERING NEWS ARTICLES MAY 9, 1907 AND AUGUST 1, 1907. ALSO DATA IN PUBLICATION "ORIGIN AND ACHIEVEMENTS OF THE BOARD OF WATER SUPPLY CITY OF N.Y." DATED 1950. ADDITIONAL DATA IS FOUND IN THE ANNUAL REPORTS OF THE BOARD OF WATER SUPPLY CITY OF N.Y.
TYPICAL SECTIONS OF DAM (OLIVE BRIDGE) AND DIKES AROUND ASHOKAN RESERVOIR	SEE DRAWINGS IN APPENDIX.
OUTLETS-PLAN	
-DETAILS	
-CONSTRAINTS	
-DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	

AVAILABLE AT THE BOWS OFFICE IN NEWBURGH, N.Y. AND AT BROWN STATION, NEW YORK

ITEM	REMARKS
DESIGN REPORTS	NONE AVAILABLE
GEOLOGY REPORTS	NONE AVAILABLE
DESIGN COMPUTATIONS	NONE AVAILABLE
HYDROLOGY & HYDRAULICS	NONE AVAILABLE
DAM STABILITY	NONE AVAILABLE
SEEPAGE STUDIES	NONE AVAILABLE
MATERIALS INVESTIGATIONS	NONE AVAILABLE
BORING RECORDS	NONE AVAILABLE
LABORATORY	NONE AVAILABLE
FIELD	NONE AVAILABLE
POST-CONSTRUCTION SURVEYS OF DAM AND DIKES.	NONE AVAILABLE. SPILLWAY REHABILITATED IN 1975 - SEE AMMANN & WHITNEY DRAWINGS 43595-X to 43602-X Sheets 1 thru 8
BORROW SOURCES	INFORMATION NOT AVAILABLE

ITEM	REMARKS
MONITORING SYSTEMS	NONE USED. SEEPAGE FLOW FROM SUBSURFACE DRAIN IS ESTIMATED BY 90° V NOTCH WEIR AT MIDDLE DIKE.
MODIFICATIONS	MODIFICATIONS WERE DONE AT WASTE WEIR IN 1975. SEE AMMANN & WHITNEY DRAWINGS 43595-X to 43602-X SHEETS 1 thru 8 FOR REHABILITATION OF SPILLWAY.
HIGH POOL RECORDS	DATA SHEETS AVAILABLE AT SHOKEN OFFICE OF BOWS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	SPILLWAY REHABILITATED IN 1975 SEE AMMANN & WHITNEY DRAWINGS 43595-X to 43602 SHEETS 1 THRU 8 MADE IN 1974.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	NONE RECORDED
MAINTENANCE OPERATION RECORDS	NO OPERATION AND MAINTENANCE MANUAL IS AVAILABLE.

AD-A064 085 TIPPETTS-ABBETT-MCCARTHY-STRATTON NEW YORK F/G 13/2
NATIONAL DAM SAFETY PROGRAM. ASHOKAN DAM (NY 41), HUDSON RIVER --ETC(U)
AUG 78 E O'BRIEN DACW51-78-C-0024
UNCLASSIFIED NL

2 OF 2
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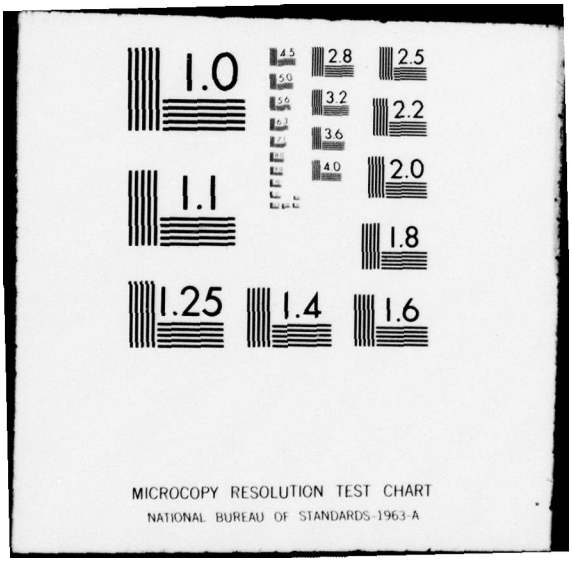
1.0
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2.0
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5.6
6.3
7.1
8.0
9.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

ITEM	REMARKS
SPILLWAY PLAN	FOR REHABILITATED SPILLWAY SECTIONS AND DETAILS SEE AMMANN & WHITNEY DRAWINGS 43595-X to 43602-X SHEETS 1 THRU 8
SECTIONS	
DETAILS	
OPERATING EQUIPMENT	
PLANS & DETAILS	

VISUAL INSPECTION CHECKLIST

APPENDIX D

VISUAL INSPECTION CHECKLIST

1. Basic Data

a. General

Name of Dam OLIVE BRIDGE ASHOKAN RESERVOIR Hazard Category HIGH

County ULSTER ID# 41

Stream Name ESOPUS CREEK Tributary of HUDSON RIVER

Location ULSTER County Nearest Town (P.O.) OLIVE BRIDGE (NEAR DAM)

Longitude 74° 13' Latitude 41° 53' Other Directions 14 MILES WEST OF KINGSTON
APPROACH TO BOWS OFFICE IS THROUGH TOWN OF SHOKAN

Date of Insp 11 & 12 JULY 78 Weather SUNNY Temperature 70-75°F (1ST DAY) 75-80°F (2ND DAY)

b. Inspection Personnel

TAMS PERSONNEL
- E. JONAS — GEOTECHNICAL ENG'R
- J. PATEL
- H. LEVENTHAL — STRUCTURAL ENG'R
- M. GRANT — MECHANICAL ENG'R

c. Persons Contacted
- L. PROPER — ADMINISTRATIVE ENG'R
- J. CAREY, W. SCULLY — ASSISTANT CIVIL ENG'R
- L. DAVIS — FORMEN - OPERATION & MAINTENAUCE

d. History:

Date Constructed DATE OF CONTRACT: SEPT. 5, 1907 DATE OF COMPLETION: DEC. 20, 1916

Present Owner BUREAU OF WATER SUPPLY N.Y.C.

Designed by B.O.W.S. [CITY OF NEW YORK]

Constructed by MAC ARTHUR BROS. CO. AND WINSTON AND CO. BROWN'S STATION, NEW YORK

Recent History ASHOKAN RESERVOIR SPILLWAY REHABILITATED IN 1975

2. Technical Data

Type of Dam MASONRY AND EARTH EMBANK. Drainage Area 165,760 Acres

Height 250 FT ± Length MASONRY LENGTH. 1000 FT ± EARTH EMBANK. 3650 FT ±

Upstream Slope BATTERED Downstream Slope BATTERED

Crest Width 23.00 FT AT MASONRY DAM (UNDER COPING) 34.00 FT AT EARTH EMBANKMENT Freeboard at Spillway Crest 3 FT

Low Level Control: (Type and Size) _____

Valve Condition _____

Emergency Spillway Type (Material) CONCRETE AND MASONRY Width _____

ONE SERVICE SPILLWAY; NO EMERGENCY SPILLWAY

Side Slopes UPPER PORTION CURVED; REMAINING PORTION STEPPED TO WASTE CHANNEL

Height (Crest to Top) _____

Exit Slope } FOR GEOMETRY OF SPILLWAY AND WASTE CHANNEL SEE DRAWINGS

Exit Length } #43595-X to 43602-X SHEETS 1 Thru 8

Ponded Surface Area 8315 Acres

Capacity (Normal Level) 392,400 Acre Feet

Capacity Emergency Spillway Level — Acre Feet

3. Embankment

SOUTH WING 1550 FT. AND NORTH WING 2100 FT.

a. Crest 34 FT WIDE; ROADWAY PAVEMENT (TWO LANES]

(1) Vertical Alignment UNIFORM WITH CREST EL. 609.5±

(2) Horizontal Alignment STRAIGHT BOTH WINGS; AND ALIGNMENT GENERALLY GOOD.

(3) Longitudinal Surface Cracks SOME CRACKS VISIBLE IN ASPHALT PAVEMENT

(4) Transverse Surface Cracks SOME CRACK VISIBLE IN ASPHALT PAVEMENT

(5) General Condition of Surface PAVEMENT SURFACE GENERALLY IN GOOD CONDITION

(6) Miscellaneous GUARD RAILS ON BOTH SIDES OF ROADWAY STRAIGHT AND IN GOOD CONDITION

b. Upstream Slope BATTER: COVERED WITH PAVING BELOW EL. 596 AND ABOVE EL. 596 TO CREST GRASSED

(1) Undesirable Growth or Debris A BUSH AT LEVEL OF THE UPPERMOST OF PAVING STONE COURSE ON THE SOUTH WING.

(2) Sloughing, Subsidence, or Depressions NONE VISIBLE

(3) Slope Protection

(a) Condition of Riprap GENERALLY GOOD.

(b) Durability of Individual Stones GOOD

(c) Adequacy of Slope Protection Against Waves and Runoff APPARENTLY GOOD — LITTLE OR NO DAMAGE

(d) Gradation of Slope Protection - Localized Areas of Fine Material UNIFORM SIZE STONE.

(4) Surface Cracks NONE VISIBLE

c. Downstream Slope BATTERED AND GRASSED

(1) Undesirable Growth or Debris NONE

(2) Sloughing, Subsidence, or Depressions; Abnormal Bulges or Non-Uniformity

NONE

(3) Surface Cracks on Face of Slope NONE VISIBLE

(4) Surface Cracks or Evidence of Heaving at Embankment Toe

NONE VISIBLE

(5) Wet of Saturated Areas or Other Evidence of Seepage on Face of Slope; Evidence of "Piping" or "Boils"

NONE

(6) Fill Contact with Outlet Structure GENERALLY GOOD WITH MASONRY DAM

(7) Condition of Grass Slope Protection GENERALLY GOOD AT NORTH WING; AND OVERGROWN ON SOUTH WING

d. Abutments

(1) Erosion of Contact of Embankment with Abutment from Surface Water Runoff, Upstream or Downstream

NONE

(2) Springs or Indications of Seepage Along Contact of Embankment with the Abutments

NONE

(3) Springs or Indications of Seepage in Areas a Short Distance Downstream of Embankment - Abutment Tie-in

NONE

e. Area Downstream of Embankment, Including Tailrace Channel

THIS AREA INCLUDES ESOPUS CREEK

(1) Localized Subsidence, Depressions, Sinkholes, Etc.

NONE VISIBLE

(2) Evidence of "Piping" or "Boils" NONE

(3) Unusual Presence of Lush Growth, such as Swamp Grass, etc.

NONE VISIBLE

(4) Unusual Muddy Water in Downstream Channel

NONE VISIBLE

(5) Sloughing or Erosion NONE VISIBLE

(6) Surface Cracks or Evidence of Heaving Beyond Embankment, Toe

NONE VISIBLE

(7) Stability of Tailrace Channel Sideslopes GENERALLY GOOD.

(8) Condition of Tailrace Channel Riprap NO RIPRAP.

(9) Adequacy of Slope Protection Against Waves, Currents and Surface Runoff

(10) Miscellaneous

f. Drainage System SUBSURFACE DRAINS ON DOWNSTREAM SLOPE OF BOTH WINGS.

(1) Condition of Relief Wells, Drains and Appurtenances NO RELIEF WELLS. DRAINS ARE SUBSURFACE THEREFORE CONDITION COULD NOT BE ASCERTAINED; GUTTERS LEADING TO & AT MANHOLES, ON BERMS ARE COVERED WITH GRASS & DEBRIS

(2) Unusual Increase or Decrease in Discharge from Relief Wells NOT APPLICABLE

4. Instrumentation

(1) Monumentation/Surveys NONE VISIBLE

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

(Other) UPSTREAM AUTOMATIC WATER LEVEL INDICATOR AT INLET TO RESERVOIR - RECORD DIRECT INFLOW (MAINTAINED BY U.S.G.S).

5. Reservoir

INSPECTED IN VICINITY OF DAM AND DIKES AND USGS MAPS

a. Slopes VISIBLE SLOPES IN VICINITY OF DAM DIKES ARE IN GENERALLY STABLE CONDITION AND ALSO IT WAS REPORTED THAT THERE WAS NO INCIDENCE OF ADVERSE CONDITION REPORTED TO MOTOR BOAT PATROL.

b. Sedimentation IT WAS REPORTED THAT SOME STUDIES HAVE BEEN PERFORMED IN WEST BASIN OF RESERVOIR

6. Spillways

ONE SPILLWAY (WASTE WEIR) WHICH IS SERVICE SPILLWAY

a. Principal Spillway: Inlet Condition

Pipe Condition

General Remarks (include information such as recently repaired, potential for debris accumulation, special items of note, etc.)

THE ORIGINAL CYCLOPEAN MASONRY SPILLWAY (WEIR) WAS REHABILITATED BY APPLYING A GUNITE SURFACING TO THE STRUCTURE. THERE WERE SOME MINOR LEAKS AND SEEPAGE FROM JOINTS OF THE WEIR. HOLES FOR FLASHBOARDS WERE NOT RESTORED TO THE CREST SURFACE. THERE WERE SOME LOOSE STONES IN THE FLOOR.

b. Emergency Spillway: General Condition

NO EMERGENCY SPILLWAY

Tree Growth

Erosion

Other Observations

7. Structural (if required) See Attached Appendix

8. Downstream Channel CONSIST OF RUBBLE-PAVED CHANNEL FLOOR (WASTE CHANNEL) UPTO ROUTE 28A BRIDGE, THEN INTO A EXPOSED BED ROCK INTO A GULLY WHICH ENTERS THE ESOPUS CREEK VALLEY 1.4 MILES FROM THE BRIDGE

a. Condition (obstructions, debris, etc.) WASTE CHANNEL CONTAINS MINOR VEGETATION. SOME DEBRIS CONTAINED IN ROCK LINED DOWNSTREAM CHANNEL AND FURTHER AWAY FROM WEIR THERE ARE TREES AND OTHER VEGETATION. DEBRIS AND VEGETATION ARE NOT CONSIDERED TO BE AN IMPEDIMENT TO DISCHARGES FROM THE EAST BASIN.

b. Slopes

c. Approximate No. Homes and Population

d. General

TEAM CAPTAIN

STRUCTURAL INSPECTION CHECKLIST

PHASE I DAM INSPECTION

1. Concrete Surfaces THE MASONRY PORTIONS OF THE OLIVE BRIDGE DAM APPEARED IN RELATIVELY GOOD CONDITION. THERE WAS SOME SPALLING AND MINOR CRACKS ON THE DOWNSTREAM FACE. THERE WERE SOME MINOR CRACKS AND "LIME" DEPOSITS ON THE WALL OF THE LOWER INSPECTION GALLERY. THE WASTE WEIR (SPILLWAY) WAS REHABILITATED IN 1975. THE CREST & WALL SURFACES APPEARED IN GOOD CONDITION. THERE WERE SOME LEAKS AND SEEPAGE FROM THE STEPPED WASTE WEIR.

2. Structural Cracking NO SIGNIFICANT STRUCTURAL CRACKING IS VISIBLE ON THE SPILLWAY OR THE OLIVE BRIDGE DAM.

3. Movement - Horizontal and Vertical Alignment THERE IS NO APPARENT CHANGE IN EITHER THE HORIZONTAL OR VERTICAL ALIGNMENT OF THE OLIVE BRIDGE DAM OR SPILLWAY

4. Junctions with Abutments or Embankments THE JUNCTIONS OF THE OLIVE BRIDGE DAM WITH THE EMBANKMENTS ARE IN GOOD CONDITION. THE JUNCTIONS AT ENDS OF THE SPILLWAY, WHICH WAS REHABILITATED IN 1975, ARE ALSO IN GOOD CONDITION

5. Drains - Foundation, Joint, Face AN INSPECTION OF THE LOWER GALLERY INDICATED THAT THE DRAINS WERE OPERATIVE. MEASUREMENTS WERE MADE OF LEAKAGE FROM INSPECTION GALLERIES. QUANTITIES OF LEAKAGE WERE SMALL EXCEPT AT NO. 10 INSPECTION WELL WHERE FLOW WAS 3.5± GPM.

6. Water Passages, Conduits, Sluices NOT ACCESSIBLE — COULD NOT BE INSPECTED.

7. Seepage or Leakage SEEPAGE AND LEAKS WERE OBSERVED IN SEVERAL AREAS ON THE STEPS OF THE SPILLWAY. A LEAK WAS OBSERVED AT THE BASE OF THE WALL IN No 10 INSPECTION GALLERY AND OTHER GALLERIES WHERE LOCATIONS COULD NOT BE ASCERTAINED

8. Monolith Joints - Construction Joints NOT VISIBLE IN DAM. SPILLWAY WALLS WERE REPAIRED IN 1975 AND APPEARED IN GOOD CONDITION

9. Foundation NOT VISIBLE — MASONRY DAM FOUNDED ON ROCK. THE SPILLWAY WAS REHABILITATED IN 1975 AND APPEARS IN GOOD CONDITION.

10. Abutments EARTH EMBANKMENTS ARE IN GOOD CONDITION. THERE ARE NO CONCRETE ABUTMENTS

11. Control Gates THERE ARE NO STRUCTURAL CONTROL GATES ON THE OLIVE BRIDGE DAM OR SPILLWAY.

12. Approach and Outlet Channels THE OUTLET CHANNEL HAS SOME VEGETATION AND A SMALL QUANTITY OF DEBRIS, OTHERWISE IT APPEARS IN RELATIVELY GOOD CONDITION.

13. Stilling Basin NOT APPLICABLE

14. Intake Structure UPPER GATE HOUSE - GENERALLY GOOD CONDITION. TRASHRACKS AND GATE VALVES ARE NOT VISIBLE - THEY ARE UNDER WATER.

15. Settlement NO APPARENT OR DIFFERENTIAL SETTLEMENT OF OLIVE BRIDGE DAM OR SPILLWAY.

16. Stability NO CALCULATIONS ARE AVAILABLE; NONE ARE REQUIRED FOR PHASE I INVESTIGATION
    a. Overturning
    b. Sliding DITTO
    c. Seismic ZONE I - NO ANALYSIS IS REQUIRED

17. Instrumentation
    a. Alignment NONE INSTALLED.
    b. Uplift
    c. Seismic

18. Miscellaneous SOME GROWTH, INCLUDING A SAPLING ON THE DOWNSTREAM FACE OF MASONRY DAM

VISUAL INSPECTION CHECKLIST
(WEST, MIDDLE AND EAST DIKES)

1. Basic Data FOR OTHER DATA SEE OLIVE BRIDGE DAM

a. General

Name of Dam _____ Hazard Category _____

County _____ ID# _____

Stream Name _____ Tributary of _____

Location _____ County Nearest Town (P.O.) _____

Longitude _____ Latitude _____ Other Directions _____

Date of Insp _____ Weather _____ Temperature _____

b. Inspection Personnel E JONAS } GEOTECHNICAL
J PATEL } ENGINEER

c. Persons Contacted _____

d. History: Date Constructed _____

Present Owner _____

Designed by _____

Constructed by _____

Recent History _____

2. Technical Data

Type of ~~Dam~~ DIKES EARTH Drainage Area 165,760 Acres

Height WEST — 115 FT. MIDDLE — 195 FT. EAST — 35 FT. Length SEE SECTION 3. EMBANKMENT OF THIS CHECKLIST

Upstream Slope BATTERED Downstream Slope BATTERED

Crest Width SEE SECTION 3. EMBANKMENT OF THIS CHECKLIST Freeboard at Spillway Crest 2 FT±

Low Level Control: (Type and Size)_____

Valve Condition_____

Emergency Spillway Type (Material)_____ Width_____

(SEE COMMENTS OLIVE BRIDGE DAM CHECKLIST)

Side Slopes_____

Height (Crest to Top)_____

Exit Slope_____

Exit Length_____

Ponded Surface Area_____ Acres

Capacity (Normal Level)_____ Acre Feet

Capacity Emergency Spillway Level____ Acre Feet

3. Embankment WEST, MIDDLE AND EAST DIKES

LENGTH: WEST DIKE 1190± FT; MIDDLE DIKE 7000± FT; AND EAST DIKE 3340± FT

a. Crest WEST & MIDDLE DIKE 34± FT.; EAST DIKE 15± FT.

(1) Vertical Alignment PAVED ROADWAY ON WEST AND MIDDLE DIKES. GRASSED EAST DIKE GENERALLY GOOD & UNIFORM EXCEPT PAVEMENT DEPRESSION NEAR SOUTH END OF WEST DIKE (DOWNSTREAM SIDE). ALSO SEE COMMENT NO. 6

(2) Horizontal Alignment STRAIGHT AND ALIGNMENT GOOD FOR ALL DIKES

(3) Longitudinal Surface Cracks SOME CRACKS VISIBLE IN ROADWAY PAVEMENTS OF WEST & MIDDLE DIKES; NONE VISIBLE ON EAST DIKE

(4) Transverse Surface Cracks SOME CRACKS VISIBLE IN ROADWAY PAVEMENTS OF WEST & MIDDLE DIKES; NONE VISIBLE ON EAST DIKE

(5) General Condition of Surface GENERALLY GOOD EXCEPT NEAR SOUTH END OF WEST DIKE WHICH IS POOR.

(6) Miscellaneous THE DEPRESSION AREA NEAR SOUTH END OF WEST DIKE HAS SETTLED ABOUT 2 INCHES.

b. Upstream Slope ALL DIKES BATTERED; COVERED WITH STONE PAVING AND GRASS COVERED ABOVE STONE PAVING TO CREST

(1) Undesirable Growth or Debris NONE

(2) Sloughing, Subsidence, or Depressions NONE VISIBLE ON ALL DIKES

(3) Slope Protection

(a) Condition of Riprap GENERALLY GOOD AT ALL DIKES

(b) Durability of Individual Stones GOOD AT ALL DIKES

(c) Adequacy of Slope Protection Against Waves and Runoff APPARENTLY GOOD - LITTLE OR NO DAMAGE

(d) Gradation of Slope Protection - Localized Areas of Fine Material UNIFORM SIZE STONES.

(4) Surface Cracks NONE VISIBLE

c. Downstream Slope ALL DIKES BATTERED; COVERED WITH GRASS

(1) Undesirable Growth or Debris NONE

(2) Sloughing, Subsidence, or Depressions; Abnormal Bulges or Non-Uniformity

NONE

(3) Surface Cracks on Face of Slope NONE VISIBLE

(4) Surface Cracks or Evidence of Heaving at Embankment Toe

NONE VISIBLE

(5) Wet of Saturated Areas or Other Evidence of Seepage on Face of Slope; Evidence of "Piping" or "Boils" AT MIDDLE DIKE, 2500± FT EAST OF LOWER GATE HOUSE THERE IS SEEPAGE EMERGING FROM SUBSURFACE DRAIN. THIS SEEPAGE IS MONITORED BY BOWS PERSONNEL.

(6) Fill Contact with Outlet Structure NO OUTLET STRUCTURES AT WEST & MIDDLE DIKES. EAST END OF DIKE IN CONTACT WITH WASTE WEIR (ASHOKAN RESERVOIR SPILLWAY) IN GENERALLY GOOD

(7) Condition of Grass Slope Protection GENERALLY GOOD EXCEPT OVERGROWN GRASS AT MIDDLE AND EAST DIKES

d. Abutments

(1) Erosion of Contact of Embankment with Abutment from Surface Water Runoff, Upstream or Downstream

NONE VISIBLE

(2) Springs or Indications of Seepage Along Contact of Embankment with the Abutments

NONE VISIBLE

(3) Springs or Indications of Seepage in Areas a Short Distance Downstream of Embankment - Abutment Tie-in

NONE VISIBLE

e. Area Downstream of Embankment, Including Tailrace Channel

(1) Localized Subsidence, Depressions, Sinkholes, Etc.

NONE VISIBLE

(2) Evidence of "Piping" or "Boils" NONE VISIBLE

(3) Unusual Presence of Lush Growth, such as Swamp Grass, etc.

NONE VISIBLE

(4) Unusual Muddy Water in Downstream Channel NONE

(5) Sloughing or Erosion NONE VISIBLE

(6) Surface Cracks or Evidence of Heaving Beyond Embankment, Toe

NONE VISIBLE

(7) Stability of Tailrace Channel Sideslopes

(8) Condition of Tailrace Channel Riprap

(9) Adequacy of Slope Protection Against Waves, Currents and Surface Runoff

(10) Miscellaneous

f. Drainage System VITRIFIED DRAINS PIPES PLACED IN TRENCH FILLED WITH BROKEN STONE AND BOULDERS. ACCESS TO THESE PIPES IS THROUGH MAN HOLES.

(1) Condition of Relief Wells, Drains and Appurtenances NO RELIEF WELLS; DRAINS ARE SUB-SURFACE THEREFORE CONDITION COULD NOT BE ASCERTAINED.

(2) Unusual Increase or Decrease in Discharge from Relief Wells

NOT APPLICABLE

4. Instrumentation

(1) Monumentation/Surveys NONE

(2) Observation Wells NONE

(3) Weirs SEEPAGE FLOW AT MIDDLE DIKE (2500± FT FROM LOWER GATE HOUSE) FROM SUBSURFACE DRAIN IS DETERMINED BY 90° V NOTCH

(4) Piezometers NONE

(Other)

5. Reservoir

SEE COMMENTS OLIVE BRIDGE DAM

a. Slopes

b. Sedimentation

6. Spillways SEE COMMENTS OLIVE BRIDGE DAM

a. Principal Spillway: Inlet Condition

Pipe Condition

General Remarks (include information such as recently repaired, potential for debris accumulation, special items of note, etc.)

b. Emergency Spillway: General Condition

Tree Growth

Erosion

Other Observations

7. Structural (if required) See Attached Appendix

SEE COMMENTS OLIVE BRIDGE DAM

8. Downstream Channel SEE COMMENTS OLIVE BRIDGE DAM.

a. Condition (obstructions, debris, etc.)

b. Slopes

c. Approximate No. Homes and Population

d. General

ERNEST JONAS, GEOTECHNICAL ENGINEER
TEAM CAPTAIN

VISUAL INSPECTION CHECKLIST
(WEST HURLEY, WOODSTOCK AND GLENFORD DIKES)

1. Basic Data

a. General (FOR OTHER BASIC DATA SEE COMMENTS ON OLIVE BRIDGE DAM)

Name of Dam _____ Hazard Category _____

County _____ ID# _____

Stream Name _____ Tributary of _____

Location _____ County Nearest Town (P.O.) _____

Longitude _____ Latitude _____ Other Directions _____

Date of Insp _____ Weather _____ Temperature _____

b. Inspection Personnel E JONAS } GEOTECHNICAL ENGINEERS
J. PATEL }

c. Persons Contacted _____

d. History: Date Constructed _____

Present Owner _____

Designed by _____

Constructed by _____

Recent History _____

2. Technical Data

Type of ~~Dam~~ DIKES EARTH Drainage Area 165,760 Acres

Height WEST HURLEY - 55± FT, WOODSTOCK - 30± FT, GLENFORD - 60± FT Length SEE COMMENTS FOLLOWING

Upstream Slope BATTERED Downstream Slope BATTERED

Crest Width SEE COMMENTS FOLLOWING Freeboard at Spillway Crest 2+ FT

Low Level Control: (Type and Size)_____

Valve Condition_____

Emergency Spillway Type (Material)_____ Width_____

(SEE COMMENTS OLIVE BRIDGE DAM)

Side Slopes_____

Height (Crest to Top)_____

Exit Slope_____

Exit Length_____

Ponded Surface Area_____ Acres

Capacity (Normal Level)_____ Acre Feet

Capacity Emergency Spillway Level____ Acre Feet

3. Embankment WEST HURLEY, WOODSTOCK, GLENFORD DIKES

LENGTH: WEST HURLEY - 3450 ± FT; WOODSTOCK - 2500 ± FT; AND GLENFORD - 2850 ± FT.

a. Crest WIDTH WEST HURLEY, WOODSTOCK GLENFORD DIKE ARE APPROXIMATELY 34, 15, and 36 FT RESPECTIVELY

(1) Vertical Alignment GENERALLY GOOD & UNIFORM ON THREE DIKES EXCEPT MINOR PAVEMENT DEPRESSION AT WEST HURLEY DIKE

(2) Horizontal Alignment STRAIGHT AND ALIGNMENT GOOD FOR ALL DIKE

(3) Longitudinal Surface Cracks NONE VISIBLE

(4) Transverse Surface Cracks NONE VISIBLE

(5) General Condition of Surface GENERALLY GOOD FOR WEST HURLEY AND WOODSTOCK DIKES. VERY POOR AT GLENFORD DIKE.

(6) Miscellaneous ON CREST IS A PAVED ROADWAY AT WEST HURLEY DIKE; GRASS COVERED AT WOOD STOCK DIKE; AND AN UNUSED SINGLE RAILROAD TRACK, MASONRY WALL (4FT HIGH) AND OVERGROWN WITH VEGETATION AT GLENFORD DIKE.

b. Upstream Slope ON ALL DIKES BATTERED ; COVERED WITH STONE PAVING AND GRASS COVERED ABOVE STONE PAVING ~~TO CREST~~

(1) Undesirable Growth or Debris SOME SHRUBS AND OVERGROWN GRASS AT WEST HURLEY DIKE. NEAR THE MAXIMUM CURVATURE ALONG THE WOODSTOCK DIKE THERE ARE TREES AND BUSHES AS WELL AS SOME DEBRIS AT LEVEL OF THE TOP OF PAVING STONE. AT GLENFORD DIKE OVERGROWN WITH TREES, BUSHES AND SAPLINGS ABOVE THE RIP RAP.

(2) Sloughing, Subsidence, or Depressions NONE VISIBLE

(3) Slope Protection

(a) Condition of Riprap GENERALLY GOOD

(b) Durability of Individual Stones GOOD AT ALL DIKES

(c) Adequacy of Slope Protection Against Waves and Runoff

APPARENTLY GOOD — LITTLE OR NO DAMAGE

(d) Gradation of Slope Protection - Localized Areas of Fine Material

UNIFORM SIZE STONES

(4) Surface Cracks NONE VISIBLE

c. Downstream Slope ON ALL DIKES BATTERED

(1) Undesirable Growth or Debris SOME SHRUBS AND OVERGROWN GRASS AT WEST HURLEY DIKE. HEAVY VEGETATION NEAR THE EAST END OF WOODSTOCK DIKE ; THE DOWNSTREAM EDGE OF WIDENED AREA, WEST OF THE BEND OF WOODSTOCK DIKE IS OVERGROWN WITH TREES AND BUSHES, HEAVY GROWTH OF TREES AND BUSHES AT GLENFORD DIKE.

(2) Sloughing, Subsidence, or Depressions; Abnormal Bulges or Non-Uniformity

NONE AT WEST HURLEY DIKE. ABOUT 250 FT EAST OF THE BEND OF WOODSTOCK DIKE, GROUND ADJACENT TO THE TOE IS SWAMPY. AT GLENFORD DIKE COULD NOT BE ASCERTAINED BECAUSE OF HEAVY VEGETATION AND RAINFALL PREVIOUS NIGHT.

(3) Surface Cracks on Face of Slope NONE VISIBLE ON WEST HURLEY AND WOODSTOCK DIKES. AT GLENFORD DIKE COULD NOT BE ASCERTAINED BECAUSE OF HEAVY VEGETATION.

(4) Surface Cracks or Evidence of Heaving at Embankment Toe NONE ON WEST HURLEY AND WOODSTOCK DIKES. AT GLENFORD DIKE COULD NOT BE ASCERTAINED BECAUSE OF HEAVY VEGETATION

(5) Wet ~~of~~ or Saturated Areas or Other Evidence of Seepage on Face of Slope; Evidence of "Piping" or "Boils" (FOR MORE COMMENT SEE BOTT. OF PAGE)

AT TOE OF WEST HURLEY DIKE, THREE AREAS WERE NOTED DOWN-SLOPE OF CURB OPENINGS AT CREST. ALSO ANOTHER AREA WAS AT 400 FT FROM NORTH END OF DIKE. IT IS NOT KNOWN IF THE WET CONDITION WAS DUE TO PREVIOUS NIGHT RAINFALL OR MINOR SEEPAGE. AT WOODSTOCK DIKE THERE IS NO VISIBLE EVIDENCE OF SEEPAGE EMERGING FROM TOE OR SLOPES, BUT THERE IS A SMALL POND OF STAGNENT WATER BEYOND TOE OF WIDENED AREA OF DIKE.

(6) Fill Contact with Outlet Structure

NO OUTLET STRUCTURES AT DIKES.

(7) Condition of Grass Slope Protection GENERALLY GOOD AT WEST HURLEY AND WOODSTOCK (EXCEPT DOWNSTREAM SLOPE OF WIDENED AREA) DIKES. POOR AT GLENFORD DIKE

d. Abutments

(1) Erosion of Contact of Embankment with Abutment from Surface Water Runoff, Upstream or Downstream

NONE VISIBLE

(2) Springs or Indications of Seepage Along Contact of Embankment with the Abutments

NONE VISIBLE.

5. CONT. AT WEST HURLEY DIKE OUTLET OF THE DRAINAGE SYSTEM (14" ϕ Cast Iron) DISCHARGES ESTIMATED 3 to 5 gpm.

(3) Springs or Indications of Seepage in Areas a Short Distance Downstream of Embankment - Abutment Tie-in

NONE VISIBLE

e. Area Downstream of Embankment, Including Tailrace Channel

(1) Localized Subsidence, Depressions, Sinkholes, Etc.

NONE VISIBLE

(2) Evidence of "Piping" or "Boils" NONE VISIBLE

(3) Unusual Presence of Lush Growth, such as Swamp Grass, etc.

NONE VISIBLE

(4) Unusual Muddy Water in Downstream Channel NONE.

(5) Sloughing or Erosion NONE

(6) Surface Cracks or Evidence of Heaving Beyond Embankment, Toe

NONE VISIBLE

(7) Stability of Tailrace Channel Sideslopes

(8) Condition of Tailrace Channel Riprap

(9) Adequacy of Slope Protection Against Waves, Currents and Surface Runoff

(10) Miscellaneous

f. Drainage System

(1) Condition of Relief Wells, Drains and Appurtenances NO RELIEF WELLS; DRAINS ARE SUB-SURFACE THEREFORE CONDITION COULD NOT BE ASCERTAINED

(2) Unusual Increase or Decrease in Discharge from Relief Wells

NOT APPLICABLE

4. Instrumentation

(1) Monumentation/Surveys NONE

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

(Other) NONE

5. Reservoir SEE COMMENTS OLIVE BRIDGE DAM

a. Slopes

b. Sedimentation

6. Spillways SEE COMMENTS OLIVE BRIDGE DAM

a. Principal Spillway: Inlet Condition

Pipe Condition

General Remarks (include information such as recently repaired, potential for debris accumulation, special items of note, etc.)

b. Emergency Spillway: General Condition

Tree Growth

Erosion

Other Observations

7. Structural (if required) See Attached Appendix

8. Downstream Channel

a. Condition (obstructions, debris, etc.) GENERALLY GOOD FOR ALL DIKES.

b. Slopes

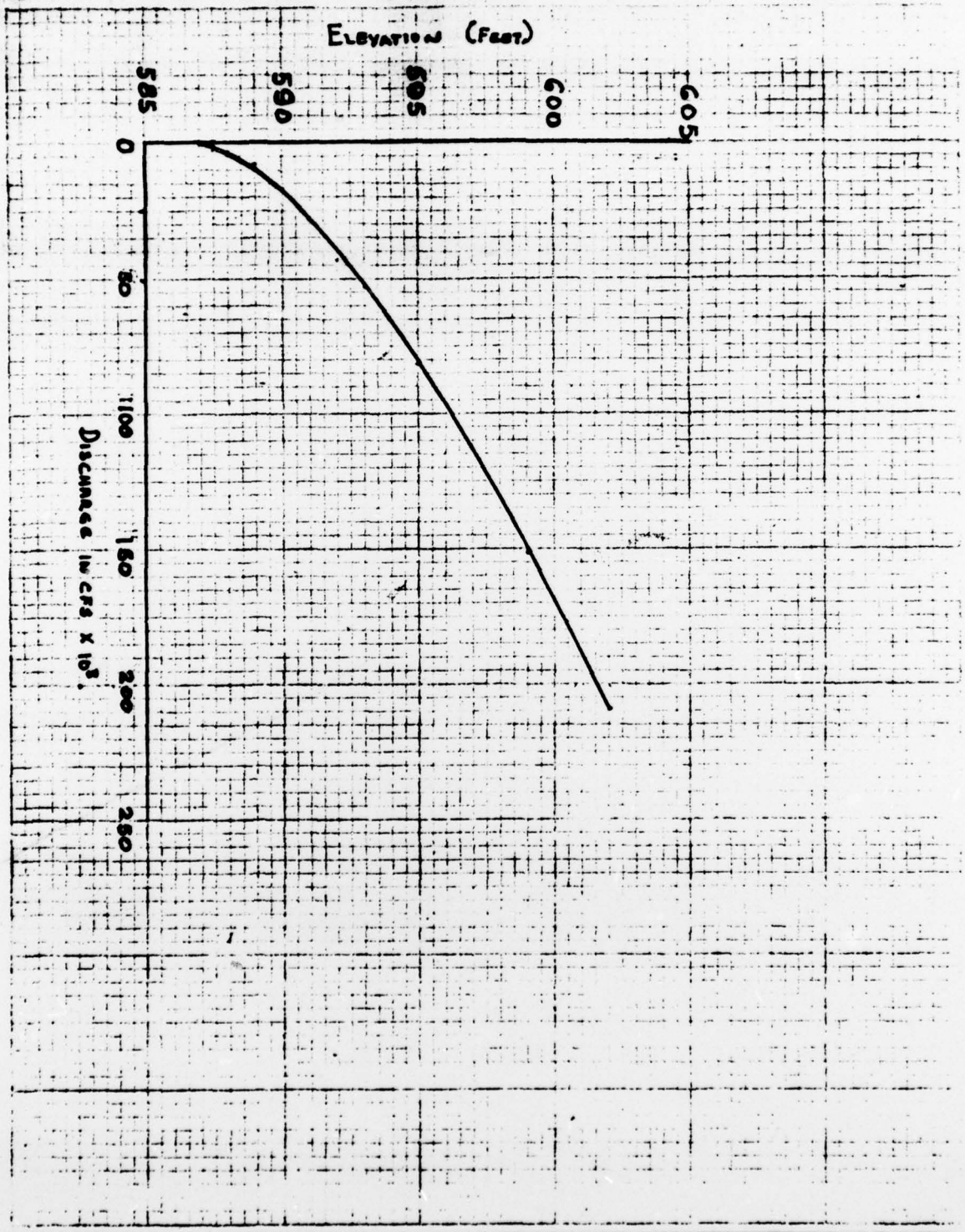
c. Approximate No. Homes and Population

d. General

ERNEST JONAS, GEOTECHNICAL ENG'R
TEAM CAPTAIN

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX E



ASHOKAN DAM.		
1487-07	SPILLWAY RATING CURVE	A.L.C. DATE 8.1.78. DRAWING NUMBER:

TAMS

Job No. 1487-07 Sheet 2 of _____

Project DAM INSPECTION Date MAY 80.

Subject ASHOKAN – SPILLWAY RATING TABLE By D L C

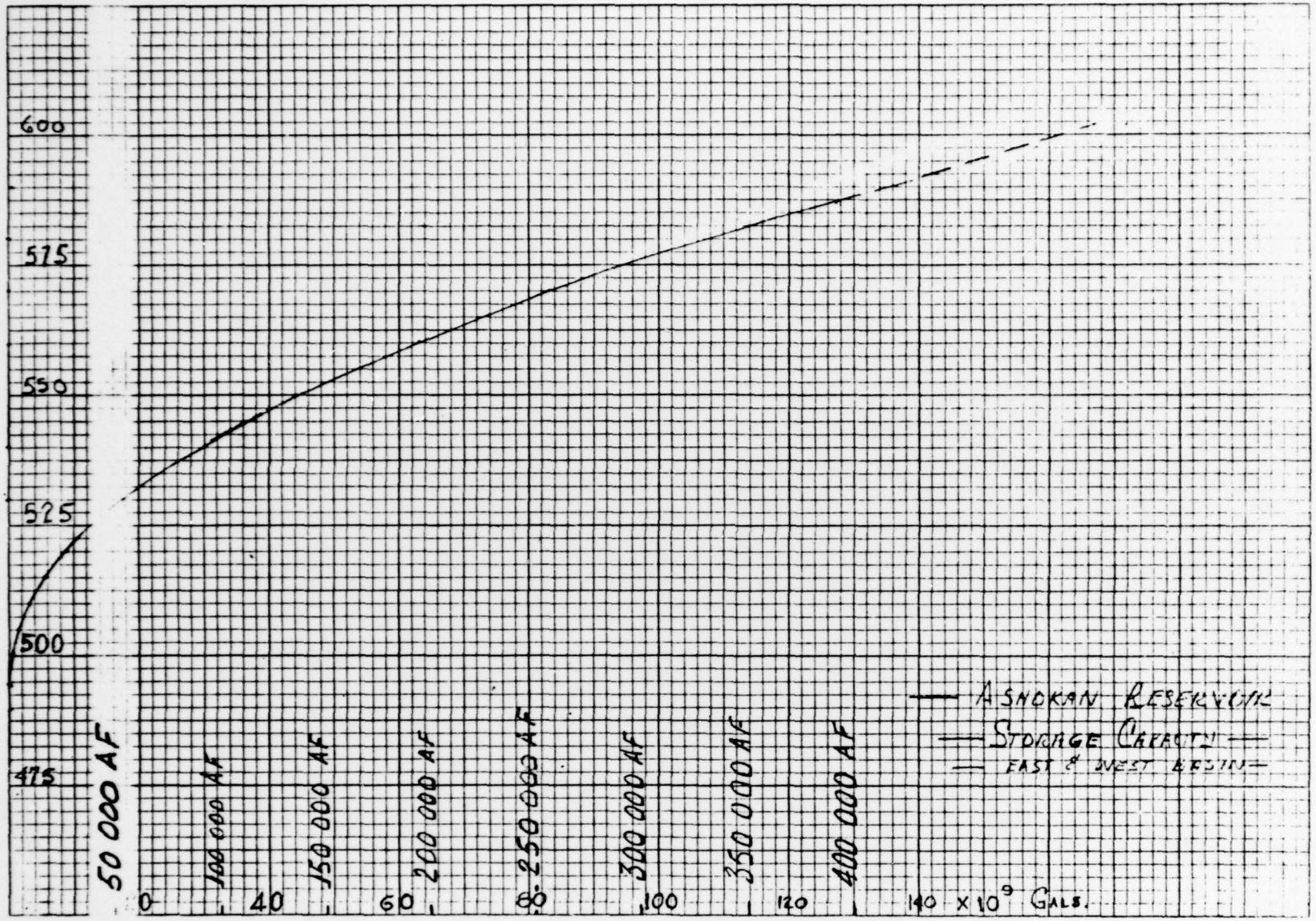
Ch'k. by _____

LENGTH = 950.0'

Spillway.

H	Elevation	C	$Q = CLH^{3/2}$
0.5	587.5	3.1	1040
1.0	588.	3.2	3040
2.0	589.	3.3	8870
3.0	590.	3.4	16800
4.0	591	3.6	27,400
5.0	592	3.8	40,400
6.0	593	3.8	53,100
8.0	595	3.8	81,700
10.0	597	3.8	114,200
12.0	599	3.8	150,100
15.0	602	3.8	209,700

TABLE 1.



Sheet 3