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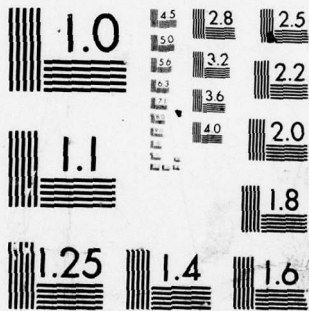
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SILVER LAKE RESERVOIR
RICHMOND COUNTY, NEW YORK
INVENTORY NO. 60

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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NEW YORK DISTRICT CORPS OF ENGINEERS

SEPTEMBER 1978

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**SILVER LAKE RESERVOIR
RICHMOND COUNTY, NEW YORK
INVENTORY NO. 60**

**PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**

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NEW YORK DISTRICT CORPS OF ENGINEERS

SEPTEMBER 1978

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SILVER LAKE RESERVOIR
INVENTORY NO. 60
PHASE I INSPECTION REPORT

CONTENTS

		<u>Page No.</u>
-	ASSESSMENT	-
-	OVERVIEW PHOTOGRAPH	-
1	PROJECT INFORMATION	1
1.1	GENERAL	1
a.	Authority	1
b.	Purpose of Inspection	1
1.2	DESCRIPTION OF THE PROJECT	1
a.	Description of the Dam	1
b.	Location	2
c.	Size Classification	3
d.	Hazard Classification	3
e.	Ownership	3
f.	Use of Dam	3
g.	Design and Construction History	3
h.	Normal Operating Procedures	3
1.3	PERTINENT DATA	3
a.	Drainage Area	3
b.	Discharge at Dam Site	3
c.	Elevation	4
d.	Reservoir	4
e.	Storage	4
f.	Dams	4
g.	Spillway	4
h.	Regulating Outlets	5
2	ENGINEERING DATA	6
2.1	DESIGN	6
2.2	CONSTRUCTION RECORDS	6
2.3	OPERATION RECORDS	6

		<u>Page No.</u>
2.4	EVALUATION OF DATA	7
3	VISUAL INSPECTION	8
3.1	FINDINGS	8
a.	General	8
b.	Embankment Dams	8
c.	Gate Chamber	9
d.	Abutments	9
e.	Reservoir Area	9
3.2	EVALUATION OF OBSERVATIONS	9
4	OPERATIONAL AND MAINTENANCE PROCEDURES	11
4.1	PROCEDURES	11
4.2	MAINTENANCE OF THE DAM	11
4.3	MAINTENANCE OF OPERATING FACILITIES	11
4.4	WARNING SYSTEMS IN EFFECT	11
4.5	EVALUATION	11
5	HYDRAULIC/HYDROLOGIC	12
5.1	DRAINAGE BASIN CHARACTERISTICS	12
5.2	SPILLWAY	12
5.3	RESERVOIR CAPACITY	12
5.4	FLOODS OF RECORD	12
5.5	DESIGN FLOOD	13
5.6	OVERTOPPING POTENTIAL	13
5.7	EVALUATION	13
6	STRUCTURAL STABILITY	15

		<u>Page No.</u>
6.1	EVALUATION OF STRUCTURAL STABILITY	15
a.	Visual Observations	15
b.	Design and Construction Data	15
c.	Operating Records	15
d.	Post Construction Changes	15
e.	Seismic Stability	15
7	ASSESSMENT/REMEDIAL MEASURES	16
7.1	DAM ASSESSMENT	16
a.	Safety	16
b.	Adequacy of Information	16
c.	Additional Investigations	16
7.2	REMEDIAL MEASURES	16

APPENDICES

- A. DRAWINGS
- B. PHOTOGRAPHS
- C. ENGINEERING DATA CHECKLIST
- D. VISUAL INSPECTION CHECKLIST
- E. HYDROLOGIC DATA AND COMPUTATIONS

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: SILVER LAKE RESERVOIR (I.D. NO. 60)
State Located: NEW YORK
County Located: RICHMOND
Date of Inspection: AUGUST 17, 1978

ASSESSMENT

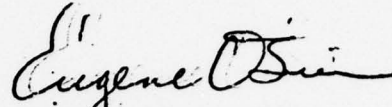
Although the Silver Lake Reservoir project has been neither maintained nor operated and virtually abandoned since 1971, examination of the available documents and visual inspection of the project features did not reveal conditions which are unsafe at the present time. The general condition of disrepair and neglect is not considered to be desirable and could, at some future date, affect the safety of the project as a result of further deterioration.

The storage capacity within the reservoir, between the spillway crest level (El 229.3) and the top of the perimeter dikes is conservatively estimated to be equal to 185 percent of the total 6-hour Probable Maximum Precipitation of 19.5 inches over the entire watershed area of 158.4 acres. On this basis the project facilities are considered adequate from a hydrologic viewpoint.

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

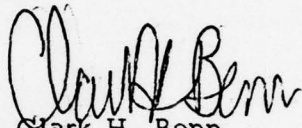
- Repair and maintain the general condition of the gate house structures. (i.e. remove debris, replace the windows with solid sturdy vandal resistant panels, repair and maintain access ladders, platforms, electrical lines, lights, etc.
- Repair and maintain, as required to operate manually, the low level outlets.
- Maintain in a clean and operable condition the waste weirs, the weir chambers and overflow wells.
- Replace corroded tie rods in the valve chamber.
- Heavy brush, shrubs and young saplings should be removed from all locations on the embankments.

- Establish a program of periodic inspections.
- Prepare an operation and maintenance manual for the project.
- Monitor periodically the wet areas on the downstream slope and at the toe of the North Dike.



Eugene O'Brien, P.E.
New York No. 29823

Approved By:



Col. Clark H. Benn
New York District Engineer

Date:

2 OCTOBER 1970



OVERVIEW OF MIDDLE DIKE

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SILVER LAKE RESERVOIR, INVENTORY NO. 60
RICHMOND COUNTY (STATEN ISLAND)

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I Inspection reported herein was authorized by the DEPARTMENT OF THE ARMY, NEW YORK DISTRICT, CORPS OF ENGINEERS 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 THE PROJECT

a. Description of the Dam

The Silver Lake Reservoir, roughly rectangular in shape and about 2400 feet long and 1200 feet wide, consists of two basins separated by a dividing dike called the Middle Dike. The western boundary of the north basin is formed by the North Dike; the south basin is bounded on the west and south by the West and South Dikes respectively. All embankments are zoned; the upstream zone is of impervious material to El 235 and the downstream zone is of random fill. The top of the North, West and South Dikes, according to the post construction drawing, is at El 238. The North Dike is provided with a 30 ft deep cut off trench, which has a 385 ft long concrete core wall into rock. The upstream slopes of all perimeter dikes are covered with riprap below El 233.

The downstream slope of the North, West and South Dikes are incorporated into the Silver Lake Golf Course which is operated and maintained by the New York City Parks Department.

The Middle Dike separating the north and south basins is constructed of homogeneous impervious material faced on each side with eight inch thick concrete panels; the panels are approximately 8.5 ft wide.

The top of the Middle Dike is at El 233.

Flow to and from the reservoir can be regulated at a gate house located at the center of the Middle Dike. When the Silver Lake reservoir was operational as part of the New York City water supply system feeding the Borough of Richmond (Staten Island), normal regulation of inflow and outflow was managed using five 48 inch gate valves leading to a common header; these valves are as follows:

- (1) Inlet gate valve, from Catskill water aqueduct
- (2) Inlet-outlet gate valve to North Basin
- (3) Inlet-outlet gate valve to South Basin
- (4) Outlet gate valve to Richmond Conduit
- (5) Outlet gate valve to South Conduit

A 36 inch x 60 inch sluice gate is located on the reservoir side of each inlet-outlet gate valve; the invert of the gate is at El 193.

In addition to the inflow-outflow regulation above, there exists for each basin a 36 inch gate valve operated low level blow-off (invert El 186.5) and a 85 inch wide waste weir (Crest El 229.3), located in the gate house. A 30 inch x 42 inch sluice gate is located on the reservoir side of each blow-off gate.

The 48 inch and 36 inch gate valves could be operated either manually or by electric motor from gate operating stands located in the operating chamber (Floor El 218) of the gate house; sluice gates were manually operated from the top-of-dam level gate house chambers. Stop-log slots are located on the reservoir side of each sluice gate. Flow over each waste weir falls into an 85 inch wide, 48 inch deep and 48 inch high chamber; a 33 inch diameter waste well riser connects this weir chamber to a common 3 ft x 2.5 ft horse-shoe shaped drain at invert El 185. The low level blow-offs also discharge into this drain.

b. Location

The reservoir is located in Silver Lake Park, approximately two miles south of St. George Ferry Terminal and west of Victory Boulevard. The south basin of the reservoir is located at the depression which formed the original Silver Lake.

c. Size Classification

The dam is considered to be of "intermediate" size; the maximum height is 55 ft and the storage capacity of both basins is 1416 acre ft (460 million gallons).

d. Hazard Classification

The dam is considered to be in the "high" hazard potential category.

e. Ownership

The dam is owned and, until 1971, operated by the New York City Bureau of Water Supply (BOWS). Since 1971 the project has been virtually abandoned.

f. Use of Dam

Until 1971, the impoundment formed by the dams was used as a holding reservoir for water delivered from the Catskill system to the Borough of Richmond. In 1971 the 460 million gallon Silver Lake Reservoir was replaced by a 100 million gallon underground storage system; since then, the Silver Lake Reservoir has been physically disconnected from New York City water supply system and virtually abandoned.

g. Design and Construction History

The dams and appurtenant structures were designed by the New York City Board of Water Supply. Construction of the project was begun in 1913 and completed in 1917.

h. Normal Operating Procedures

Prior to 1971, the reservoir was used as a short term water storage facility for the Borough of Richmond. The reservoir was filled with water from the Catskill system and regulated and released as required. Since 1971, the Catskill inlet, Richmond Conduit and South Conduit have been closed off and the Silver Lake Reservoir project virtually abandoned. Occasionally, water from the underground tanks is used to raise the level of the Silver Lake Reservoir.

1.3 PERTINENT DATA

a. <u>Drainage Area</u> , square miles	0.25
b. <u>Discharge at Dam Site</u> , cfs	
Maximum flood at site	No record
Overflow System:	
Elev 230 (Ungated spillway control)	22.6
Elev 233 (Horse shoe drain control)	73.5

Elev 238 (Horse shoe drain control) 77.1

c. Elevation (feet above M.S.L.)

Top of perimeter dikes 238
 Top of Middle Dike 233
 Spillway crest 229.3
 Streambed at center line of North Dike 173

d. Reservoir

Length of pool (spillway crest), miles 0.44
 Length of shoreline (spillway crest),
 miles 1.39
 Surface area (spillway crest), acres 57.4

e. Storage, (acre-feet)

Spillway crest 1416
 At maximum reservoir level (Elev 234) 1673

f. Dams

	<u>North</u>	<u>West</u>	<u>South</u>	<u>Middle</u>
Type	-----Earth-----			
Length, ft	1000	1400	1200	800
Crest width, ft	42+	42+	42+	29.75
Crest Elevation	238	238	238	233
Slopes (V):(H)				
Upstream	1:3	1:3	1:3	1:1.75
Downstream, Above El 218	1:3	1:5	1:2	1:1.75
Downstream, Below El 218	1:3		1:3	
Berm elevation, ft	218	None	218	None
Berm width, ft	10		10 min	
Slope Protection	-----Riprap-----		-----Conc. Slab	
Cut-off	Conc. Wall	-----None-----		

g. Spillway

Type: Ungated 85 inch long flat crest weir leading to 33 inch diameter well via 85" x 4' x 4' weir chamber. Well connects to 2-1/2' x 3' sewer.

Number Two
Crest Elevation 229.3 ft

h. Regulating Outlets

Water supply regulation = 1-48" inlet gate valve
2-48" inlet-outlet gate valves
2-48" outlet gate valves
2-36" x 60" sluice gates
Blow-off 2-36" gate valves

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The project facilities were designed by the New York City Board of Water Supply prior to 1913.

The available information on the project consists of the following:

- a. Contract Documents
 - (1) Contract 89, Contract Drawings for Construction of Silver Lake Reservoir and a portion of the Richmond Conduit, 1913
 - (2) Contract 89, Specifications, 1913
 - (3) Contract 113, Specifications for Test Pits and Borings, 1911
 - (4) Contract 132, Specifications for Borings, 1912
 - (5) Contract 144, Drawings and Specifications for Gate Chamber Superstructures, Balustrades and Brick Paving (Middle Dike) 1916
- b. Record Drawing, Sheet 133, General Plan and Elevations, Undated
- c. Reservoir Capacity Curves, included on b. above
- d. Record Drawings, Sheet C5196 and C5337, Boring Logs, Undated
- e. Record Drawing, Gate Chamber, Sheet 18686 Rev. dated May 27, 1918

The Record Drawing (Item b. above) appears to be a post construction drawing and probably represents the as-built features.

2.2 CONSTRUCTION RECORDS

The Silver Lake Reservoir was constructed by the Beaver Engineering and Contracting Company during the period from 1914 to 1917. No records of construction are available for the project.

2.3 OPERATION RECORDS

The Silver Lake Reservoir Project has not been operated as part of the New York City water supply system since 1971. There has been little or no operation or maintenance since then. Records of pool elevation have not been kept since the project was removed from operation and the water level recorder, located in the gate operating chamber, was destroyed by vandals. Water level records were maintained prior to 1971.

2.4 EVALUATION OF DATA

Existing information was available at the BOWS New York City 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 the Silver Lake Reservoir was made on Thursday, August 17, 1978. At the time of the inspection the reservoir level was at El 228.9.

b. Embankment Dams

(1) Perimeter Dams (North, West and South Dikes)

There exists on the crest of the perimeter dikes a 24+ ft wide paved roadway, a paved walkway and a chain link fence near the top of slope on the reservoir side.

There is heavy growth of brush, saplings and small trees on the upstream slopes of all perimeter dikes. The growth of trees appeared to be heavier near the north end of the North Dike. The downstream slopes, which are maintained by the New York City Parks Department, as part of the Silver Lake Golf Course, were covered only with grass except as follows: (a) there are trees having trunk diameters of 18 to 24 inches evenly spaced along and near the top of downstream slope of the West Dike; (b) there is heavy growth of brush, saplings and trees on the downstream face of the South Dike above the El 218 berm.

The stone riprap slope protection appeared to be in good condition. There were no signs of settlement, movement, sloughing or other distress visible on the crest, downstream slopes and visible portions of the upstream slopes. Cracks in and repaired areas of the roadway pavement appeared to be unrelated to the performance of the embankment dams.

No seepage was visible on either the downstream slopes, toe or area below the toe of the West and South Dikes. At the time of the inspection, there was a wet, soft area visible on the downstream berm of the North Dike; no seepage was visible at this location. There were also wet areas just below the toe of the North Dike; these areas correspond to the general vicinity of a spring which is noted on the preconstruction drawings.

(2) Middle Dike

The upstream and downstream concrete slope facing slabs are cracked at many locations; grass and brush grow from the cracks and panel joints. At several locations there appeared to be differential vertical movement between adjacent slab panels. There were no other signs of distress on the visible portions of the Middle Dike.

c. Gate Chamber

(1) Structures

The doors to the north and south gate house superstructure had been welded shut to keep out vandals; the welds had to be removed to gain access to the gate chambers. Although the windows were barred, glass panes in the window frames had been generally broken by vandals. The gate house superstructure floor (top-of-dam level), the gate operating chamber floor (el 218) and the connecting stairwells were strewn with debris, broken glass, garbage, overturned furniture, etc. All instrumentation (e.g. water level record, gate manifold pressure gages) that could be destroyed by hand, had been so damaged by vandals.

There was no evidence of structural distress, such as cracks or spalling, or the concrete walls and floors. Except for corrosion of some portions of the steel access ladders and gratings between the operating and gate chambers, walkways, railings and ladders appeared to be in good condition.

(2) Overflow Weirs (Spillway)

The north basin overflow weir was inspected. The weir, weir chamber and overflow well entrance appeared to be in good condition; however, the weir chamber was cluttered with debris, garbage, core boxes which would impede flows into the waste well.

(3) Regulating Gates

It was not determined whether the gate operating motor or drive train were operational. In general, the gate operating stands appeared to be in good condition to be operated manually. The gates themselves appeared to be in operable and in relatively good condition, even though they had been neither operated nor maintained since 1971. The condition of the exposed conduits appeared to be good. In general, the tie rods connecting gates to conduits were severely corroded.

d. Abutments

There were no signs of seepage or other unusual conditions at the abutments to the dam.

e. Reservoir Area

There was no evidence of sloughing, potentially unstable slopes or other unusual conditions which would adversely affect the dams.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not indicate serious problems which would require either immediate investigation or immediate remedial action.

On the basis of this inspection, it could not be determined whether the wet area at the berm level of the North Dike is caused by seepage or poor surface drainage; in any event it is not considered to represent an unsafe condition. The wet area at the toe of the North Dike preexisted the dam and does not appear to be related to the impoundment.

The debris in the weir chamber should be removed to prevent blockage of the overflow well. The corrosion of the tie rods is considered to be an undesirable condition.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

In 1971 the Silver Lake Reservoir was removed from the system supplying water to the Borough of Richmond. Since then there has been no operation of the system. The blow-off valves have been closed and there has been no operation of the regulating gates.

4.2 MAINTENANCE OF THE DAM

Except for those areas of the perimeter dam downstream slopes which are maintained by the Parks Department, there has been no maintenance of the dam since 1971.

4.3 MAINTENANCE OF OPERATING FACILITIES

There has been no maintenance of the operating facilities since 1971.

4.4 WARNING SYSTEMS IN EFFECT

There is no warning system in effect.

4.5 EVALUATION

The overall maintenance of the project is considered to be less than desirable; maintenance is inadequate with respect to the following areas:

- a. Control of vegetation on the dam
- b. Maintenance of the overflow weirs
- c. Maintenance of the gates, conduits and operating equipment particularly the low level outlets (blow-offs).

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE BASIN CHARACTERISTICS

Silver Lake Reservoir is located on the northeastern corner of Staten Island. The total drainage area contributing to the reservoir is 0.25 sq. mi. (158.4 acres) with a reservoir surface area of 57.4 acres at the flowline, El 229.3. The basin rises to just over 360 feet at the southeastern corner in 1800 feet, and 340 feet in the northeast over a distance of 600 feet. About 15 percent of the basin is paved streets and buildings while the remainder is the Silver Lake Park. There are no streams in the basin.

5.2 SPILLWAY

The spillway consists of two trapezoidal weirs, one for each basin, which are located in the joint gate chamber structure built on the Middle Dike. According to information received during the inspection, the flat crests of the weirs were raised in the 1930's by 1.3 feet above their original elevation (228.0). Each weir crest has an 18-inch breadth and is 85 inches long and discharges into a chamber drained by a 33-inch diameter overflow well. The contents of the two wells are discharged through a single horse-shoe shaped concrete lined drain (3.0' x 2.5') into a distant sewer. The total spillway discharge is controlled by the capacity of the horse-shoe shaped drain which is estimated to be 73.5 cfs, flowing full for an assumed length of 2800 feet.

5.3 RESERVOIR CAPACITY

The total reservoir capacity¹ corresponding to spillway crest (El 229.3) is 461.4 million gallons (1416 acre-feet), of which 38.4% is available in the North Basin and the remainder in the South. The available surcharge storage between spillway crest and the reported low point on the perimeter dikes (El 238.0), based on a straight line extrapolation of the capacity curve in Reference (1), is about 156 million gallons or 479 acre-feet. This amount of surcharge storage is equivalent to 36.3 inches of runoff from the entire contributing watershed.

5.4 FLOODS OF RECORD

There are no flood records published for Silver Lake watershed. In interviews with New York City BOWS personnel it was revealed that, based on daily records of reservoir levels, no flow over the spillway took place during the August and October 1955 rainfalls which are known to have

been severe in the general region.

5.5 DESIGN FLOOD

Based on size and hazard classifications (paragraphs 1, 2c and 1.2d) the Probable Maximum Flood (PMF) was selected as the Design Flood. Accordingly, a 6-hour Probable Maximum Precipitation (PMP) for the Staten Island area was determined² as 19.5 inches. Since the lake area is 36%³ of the watershed area and no infiltration losses will be effected in the paved 15% of the watershed, it was conservatively assumed that the overall losses would be negligible, therefore the entire PMP would be rainfall excess. Assuming that the reservoir is at spillway crest level (El 229.3) at the beginning of the PMP occurrence and that the horse-shoe shaped drain capacity is negligible, the reservoir level will rise approximately to El 234 (corresponding to 545 million gallons on the extrapolated storage capacity curve).

5.6 OVERTOPPING POTENTIAL

Under the conservative assumption made in the preceding paragraph the entire volume of the PMP over the watershed could be stored in Silver Lake and still leave 4 feet of freeboard before overtopping. It is estimated that 186% of the PMP could be stored under the same assumptions without the lake level exceeding El 238.

5.7 EVALUATION

The analysis of the potential of the perimeter dikes being overtopped was based on assumed runoff contributions from the entire natural watershed. Since the area surrounding Silver Lake is in part developed, paved and sewered in a way to prevent contamination of the water supply, a more realistic approach would have been to disregard, after a more detailed investigation, the runoff from areas outside the perimeter dikes and roads. In conclusion, the applied method is conservative as far as natural inflow contribution is concerned. In the event of the PMP occurrence under the assumed conditions the water will overtop the Middle Dike by one foot. Considering, however the conservative assumption on which this investigation was based, even this overtopping seems unlikely.

The available storage capacity has precluded the construction of an emergency spillway. Therefore the evaluation of the adequacy of the existing spillways is limited to the purpose they serve, i.e. to prevent the lake level from rising, unchecked, above El 229.3 during normal operations. To accomplish this function, it is necessary to maintain in good flow conditions and free of obstacles the weirs, the chambers, the overflow

wells, the horse-shoe drain and the sewer in which they ultimately discharge. Should lack of maintenance cause water levels to rise considerably above the spillway crest, adverse initial conditions during a hypothetical PMP occurrence may result in endangering the safety of the perimeter dikes.

References:

- 1] Storage Capacity Curve, Drawing for Silver Lake Reservoir, N.Y. City BOWS file R-3.0SL.
- 2] Weather Bureau Technical Paper No. 40.
- 3] USGS Quad Sheets: Jersey City, N.J. - N.Y., 1967 and The Narrows, N.Y. - N.J., 1966.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observation did not indicate either existing or potential problems with the dams and gate structures. The observed cracks in the concrete slabs on the upstream and downstream faces of the Middle Dike are not considered to represent an unstable or otherwise dangerous condition. The differential settlement between adjacent slabs is also not considered to represent a dangerous condition.

b. Design and Construction Data

There exist no design computations or other data regarding the structural stability of the dam.

On the basis of the performance experience of the embankment dam, visual observations and engineering judgement, the embankment sections of the dam are considered to be stable at the present time.

c. Operating Records

There has been no record of operation since 1971.

d. Post Construction Changes

It was reported that the waste weir crests were raised from El 228 to El 229.3 (actually, 229.29) sometime during the 1930's. At that time other modifications to the gate house were also made.

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

Although the Silver Lake Reservoir project has been neither maintained nor operated and virtually abandoned since 1971, examination of the available documents and visual inspection of the project features did not reveal conditions which are unsafe at the present time. The general condition of disrepair and neglect is not considered to be desirable and could, at some future date, affect the safety of the project as a result of further deterioration.

The storage capacity within the reservoir, between the spillway crest level (El 229.3) and the top of the perimeter dikes is conservatively estimated to be equal to 185 percent of the total 6-hour Probable Maximum Precipitation of 19.5 inches over the entire watershed area of 158.4 acres. On this basis the project facilities are considered adequate from a hydrologic viewpoint.

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 the dams and appurtenant structures do not appear necessary.

7.2 REMEDIAL MEASURES

No remedial measures are required at the present time.

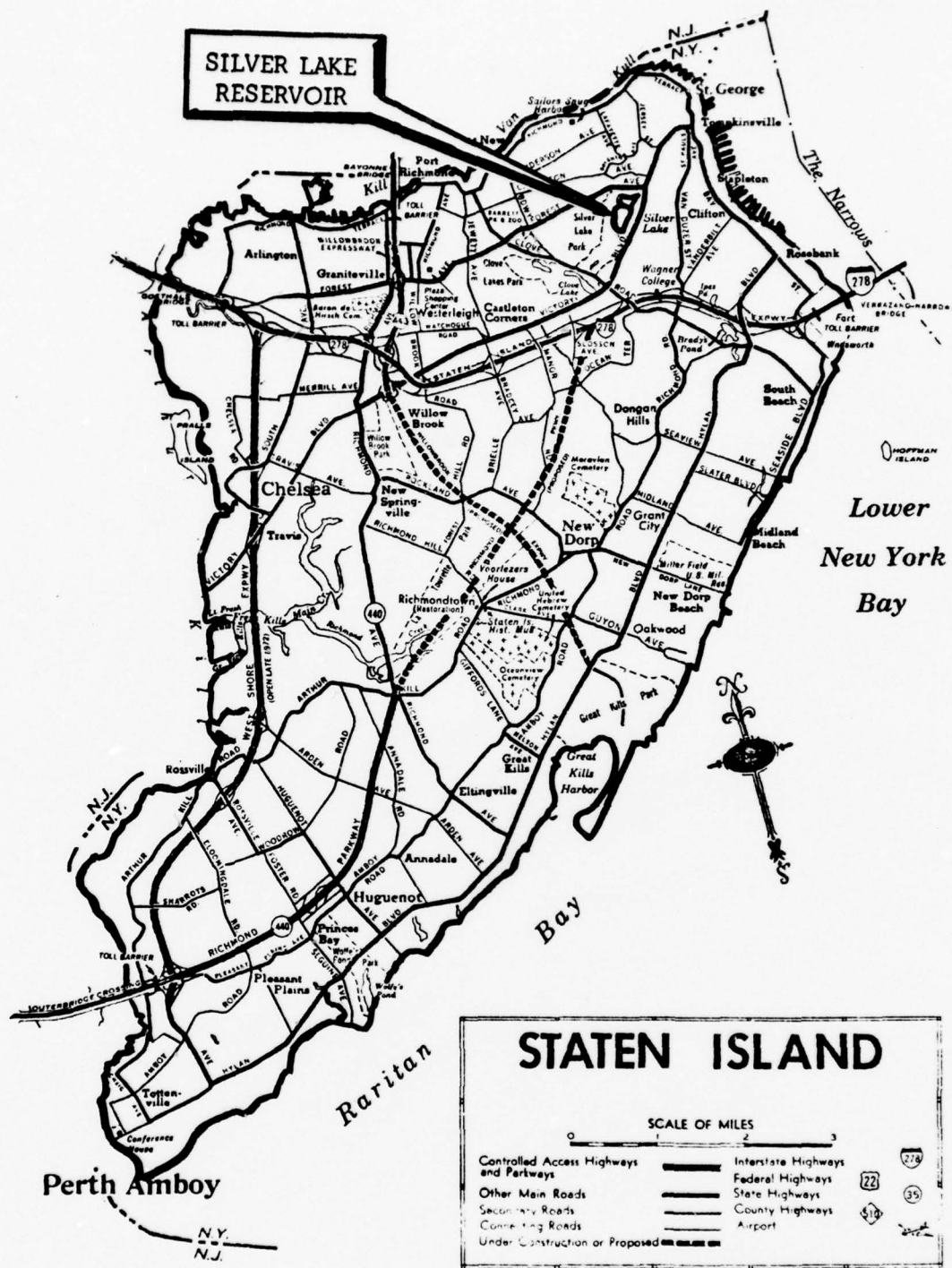
Certain measures, however, are recommended as follows:

- a. Repair and maintain the general condition of the gate house structures.
 - Remove debris
 - Replace the windows with solid sturdy vandal resistant panels
 - Repair and maintain access ladders, platforms, electrical lines, lights, etc.

- b. Repair and maintain, as required to operate manually, the low level outlets (the 36 inch blow-off gate valves and the 30" x 92" sluice gates).
- c. Maintain in a clean and operable condition the waste weirs, the weir chambers and overflow wells.
- d. Replace corroded tie rods in the valve chamber.
- e. Heavy brush, shrubs and young saplings should be removed from all locations on the embankments. Large 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 closely monitored for seepage.
- f. Establish a program of periodic inspections of the project features.
- g. Prepare an operation and maintenance manual for the project, which would include requirements for periodic inspection in "exercising" of the blow-offs.
- h. Monitor periodically the wet areas on the downstream slope and at the toe of the North Dike.

DRAWINGS

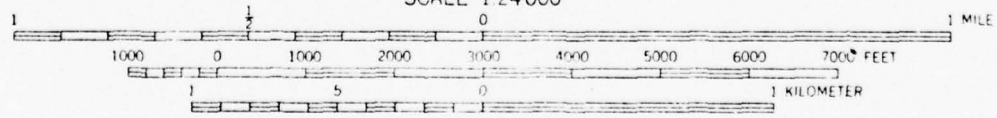
APPENDIX A



VICINITY MAP
 SILVER LAKE RESERVOIR

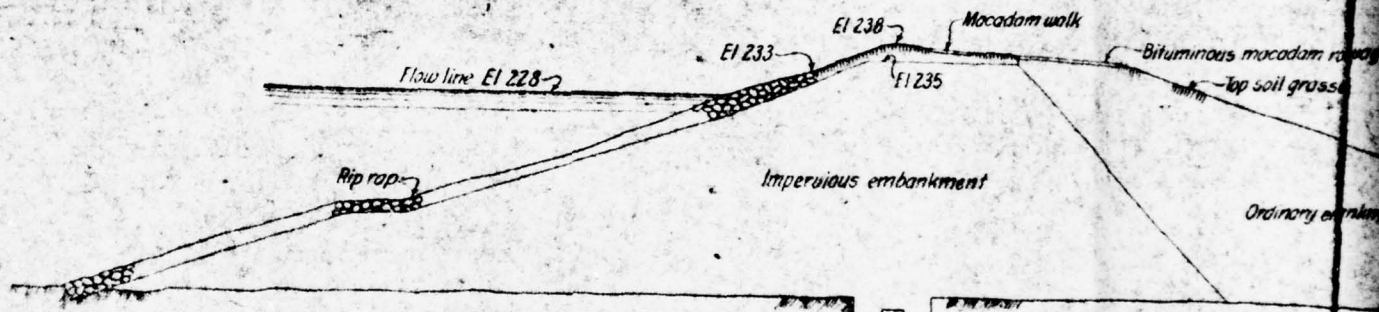


SCALE 1:24,000

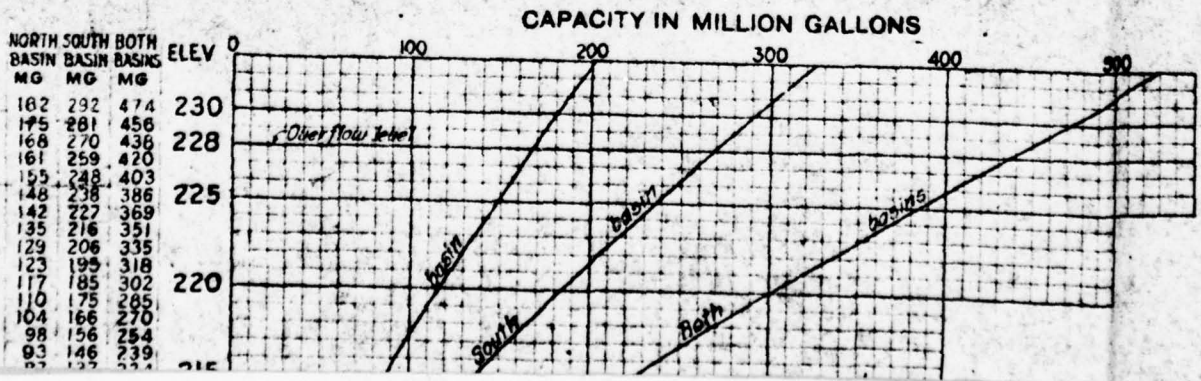
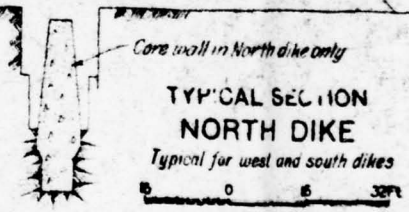


CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

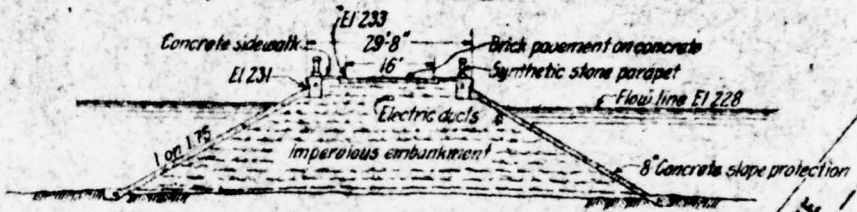
TOPOGRAPHIC MAP : SILVER LAKE RESERVOIR



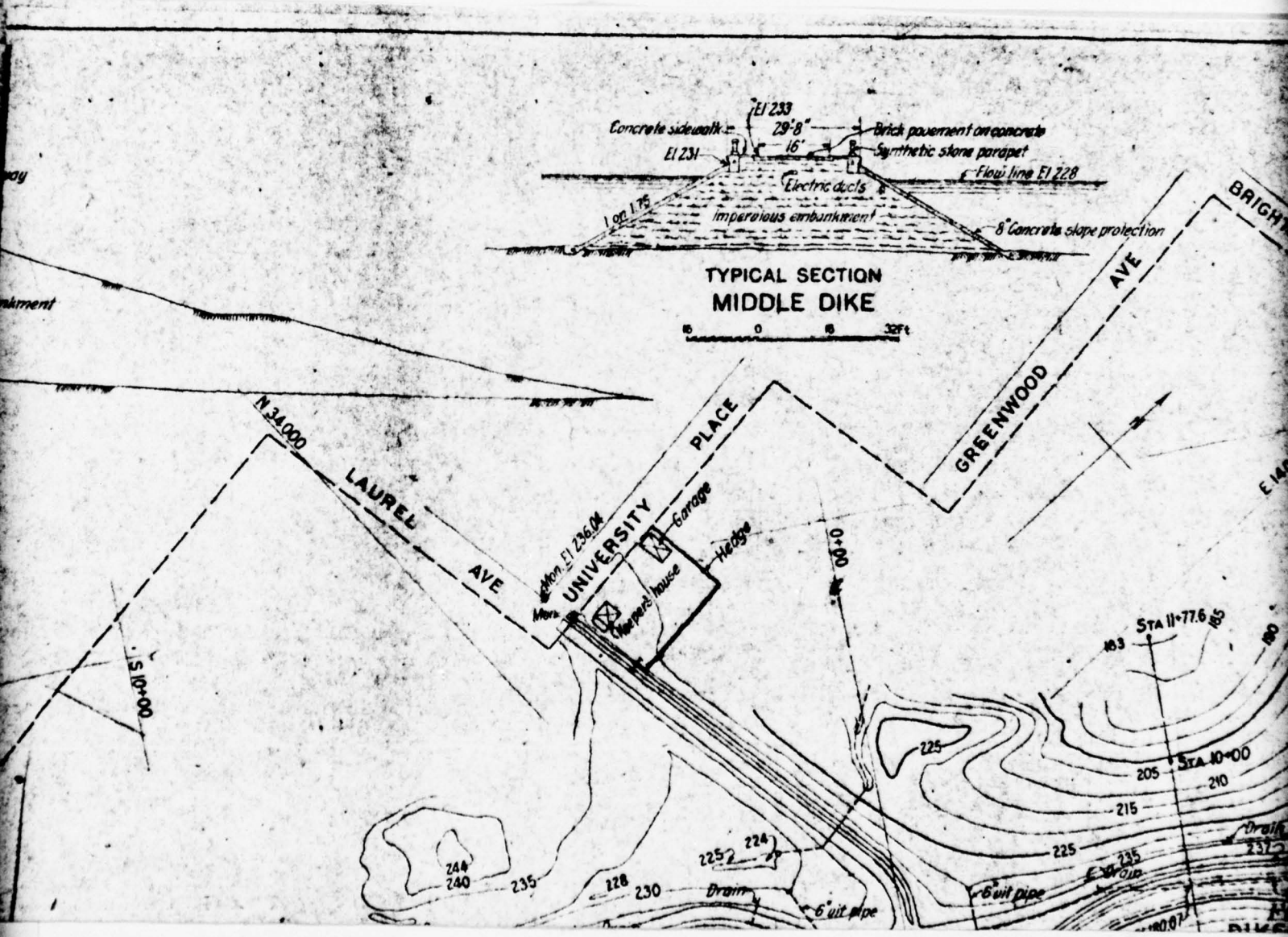
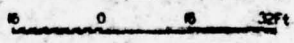
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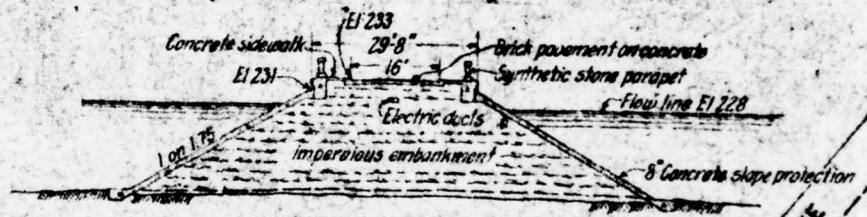


ROAD
 line

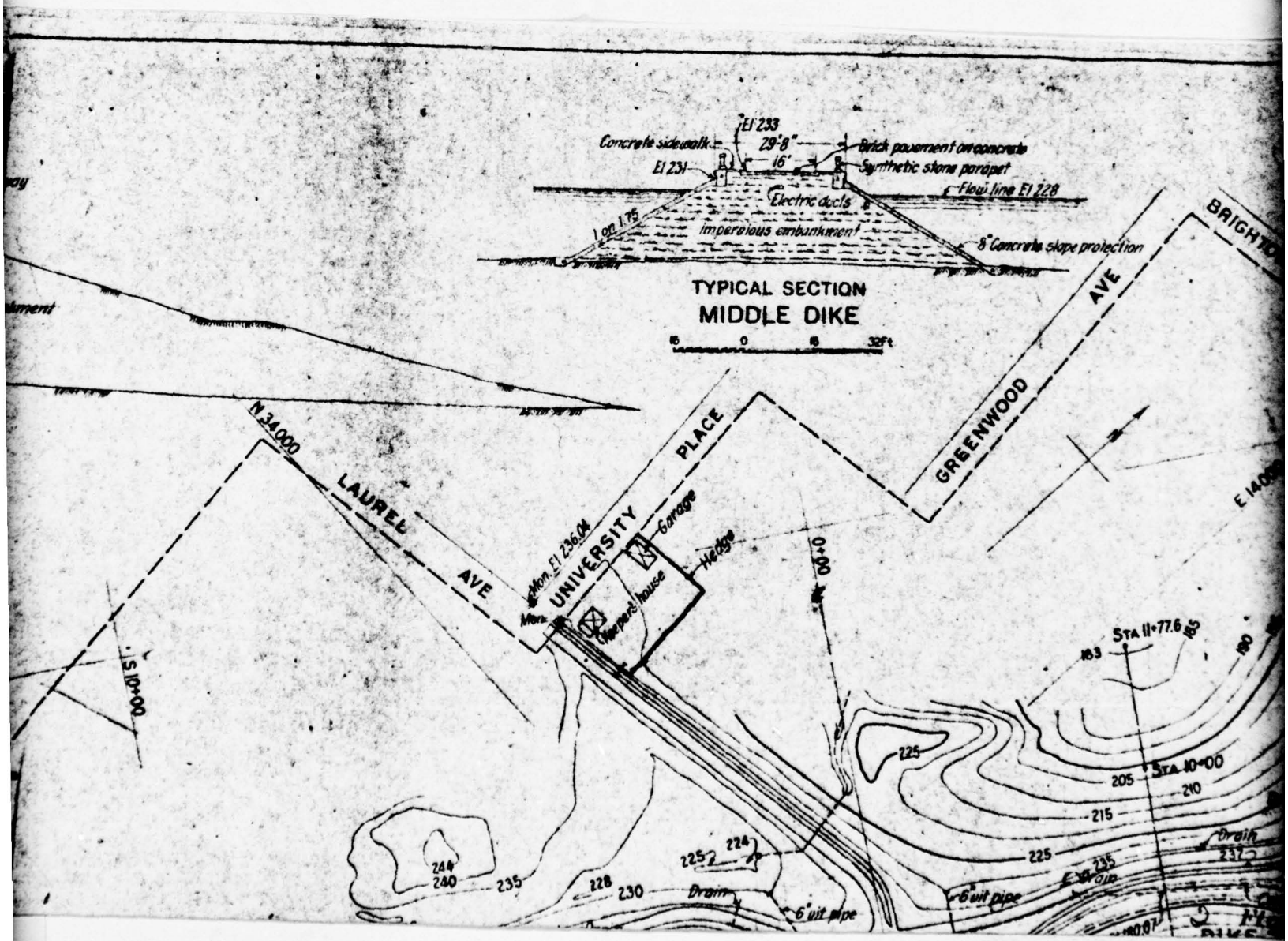


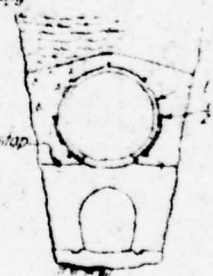
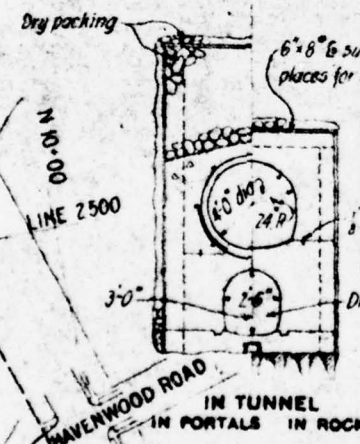
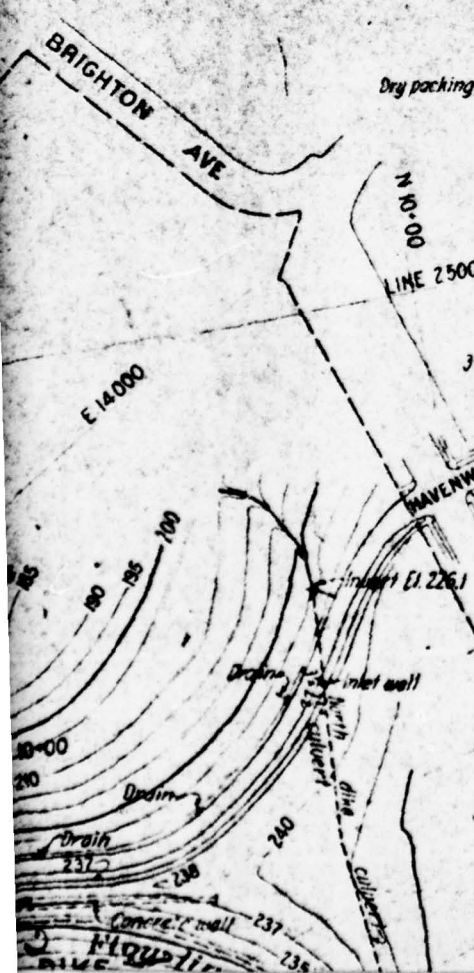
TYPICAL SECTION
MIDDLE DIKE



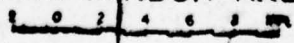


TYPICAL SECTION
MIDDLE DIKE

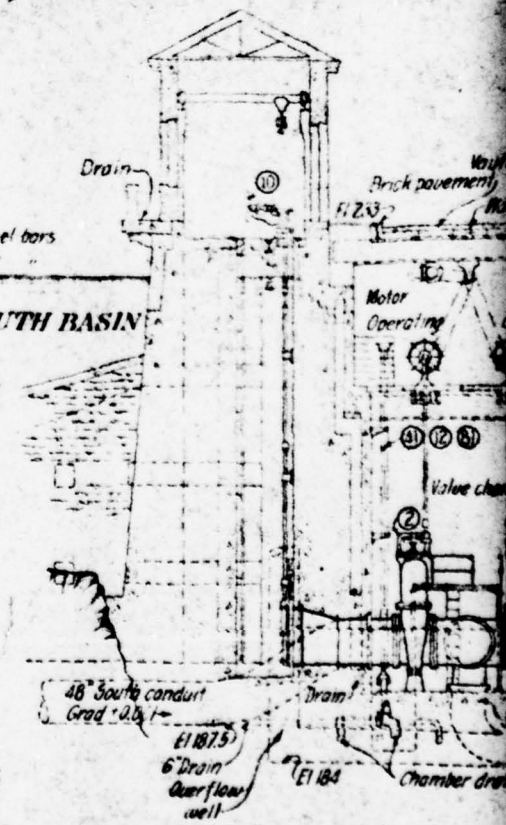




TYPICAL SECTIONS
 RICHMOND CONDUIT AND DRAIN

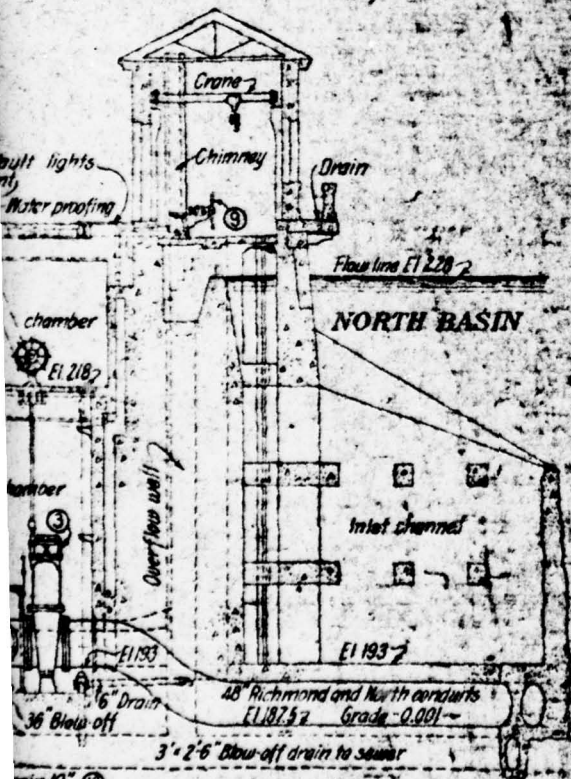


SOUTH BASIN



Datum - Mean Sea Level at Sandy Hook

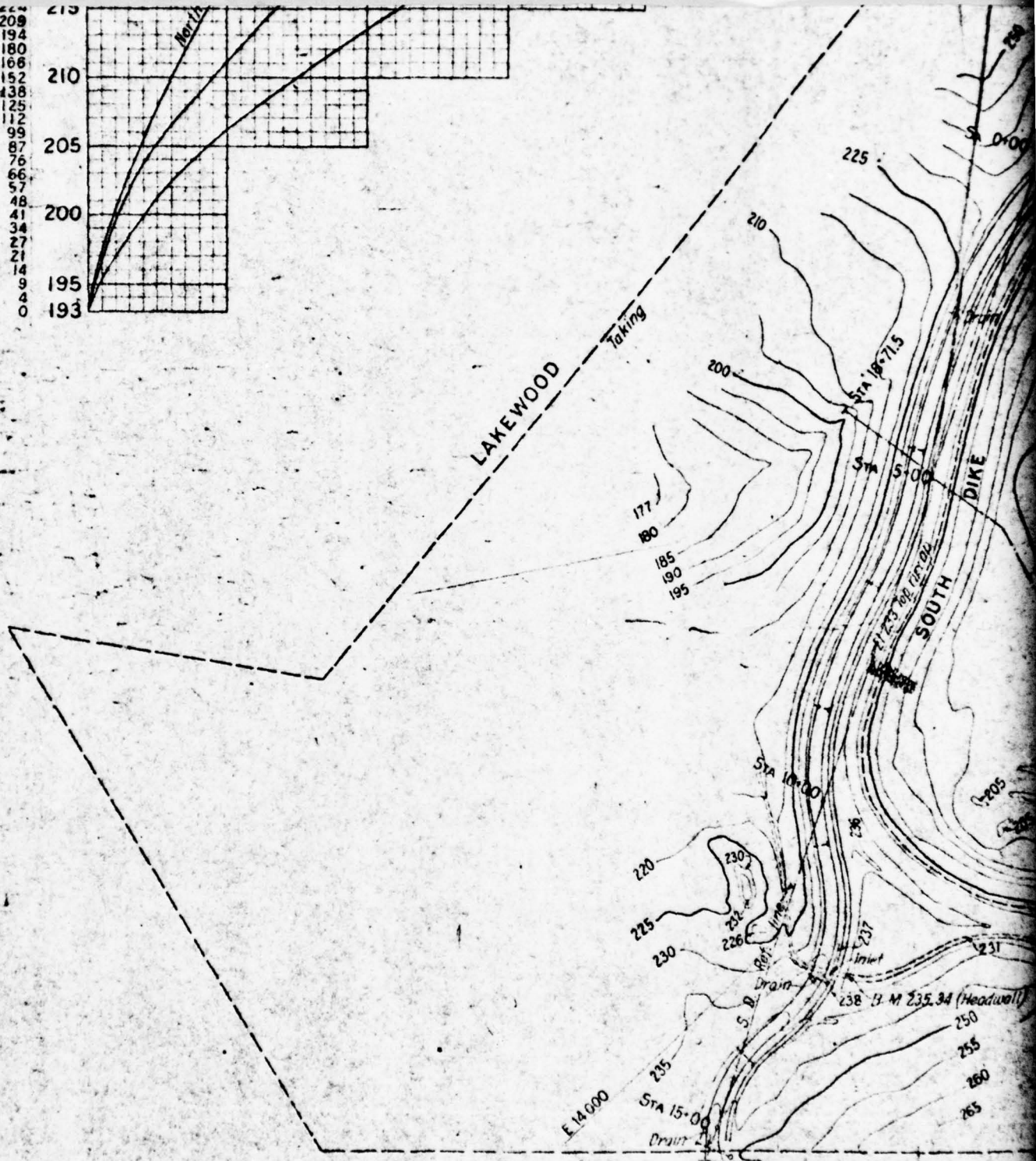
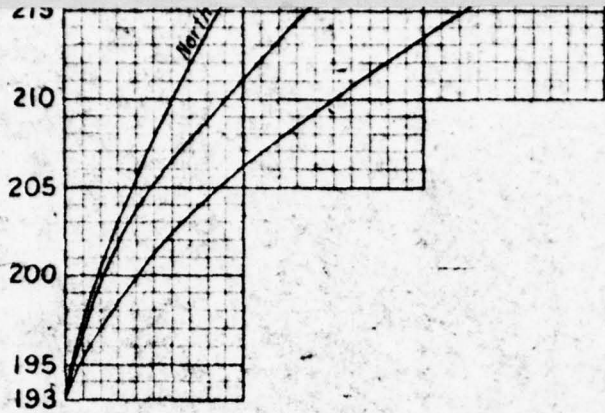
RECORD DRAWING
SHEET 139, SHEETS IN SET, 139



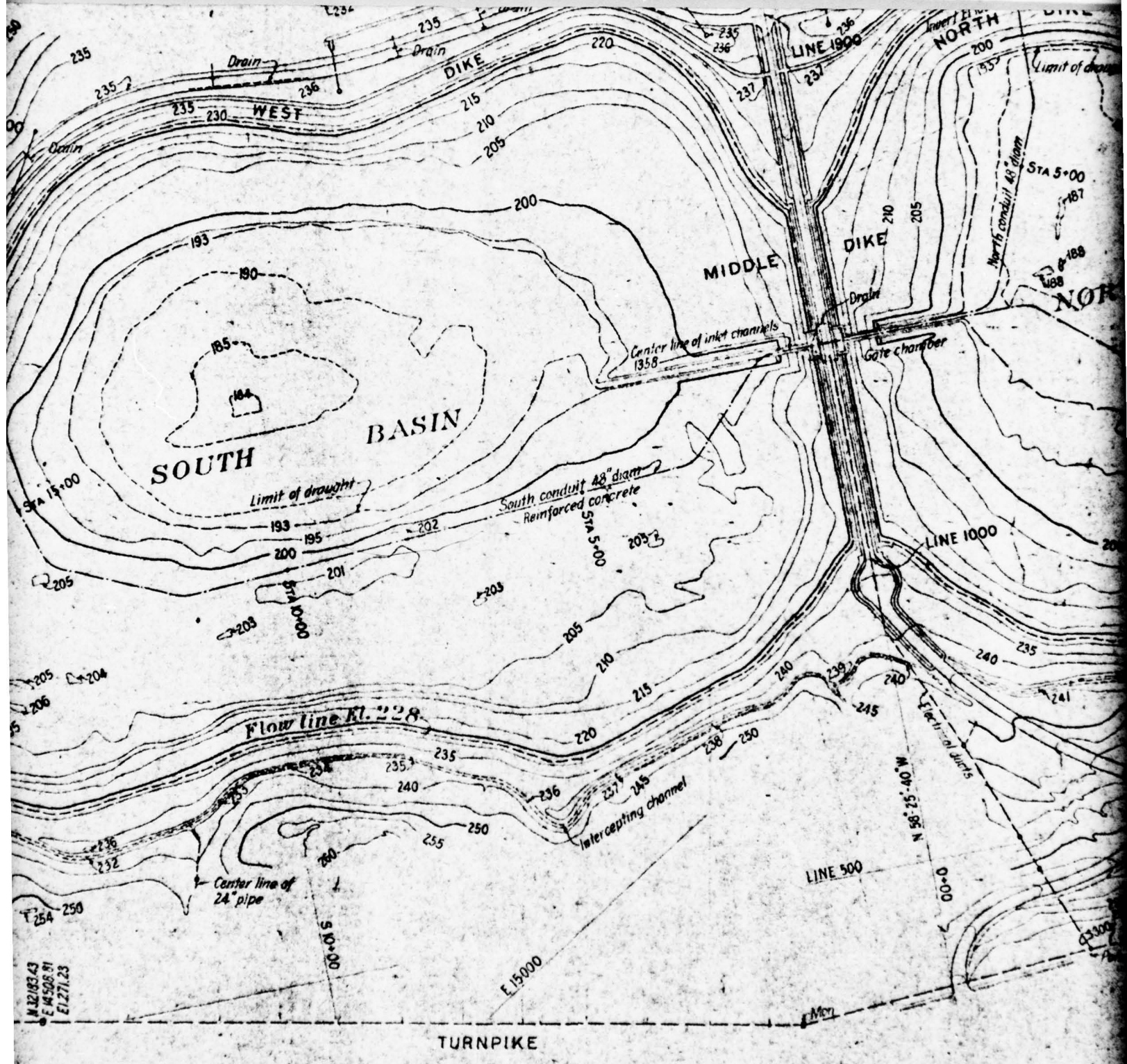
SECTION a-a

Catch basin

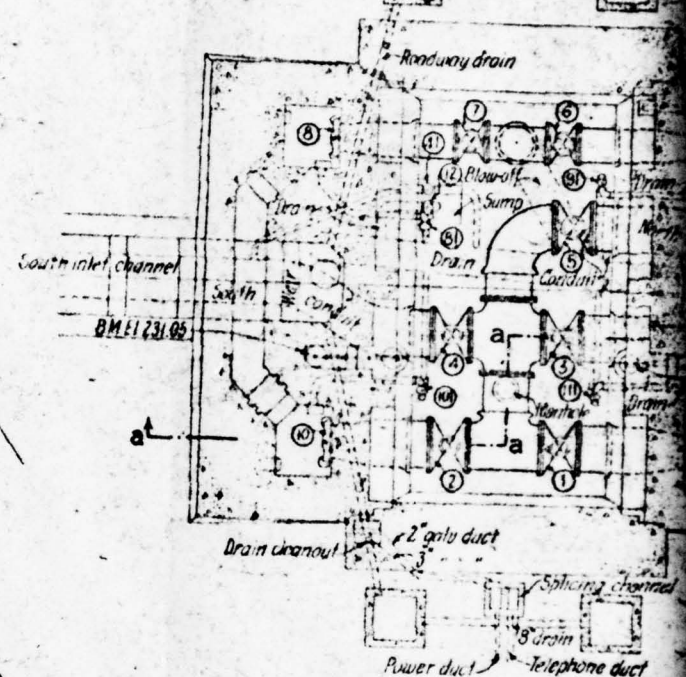
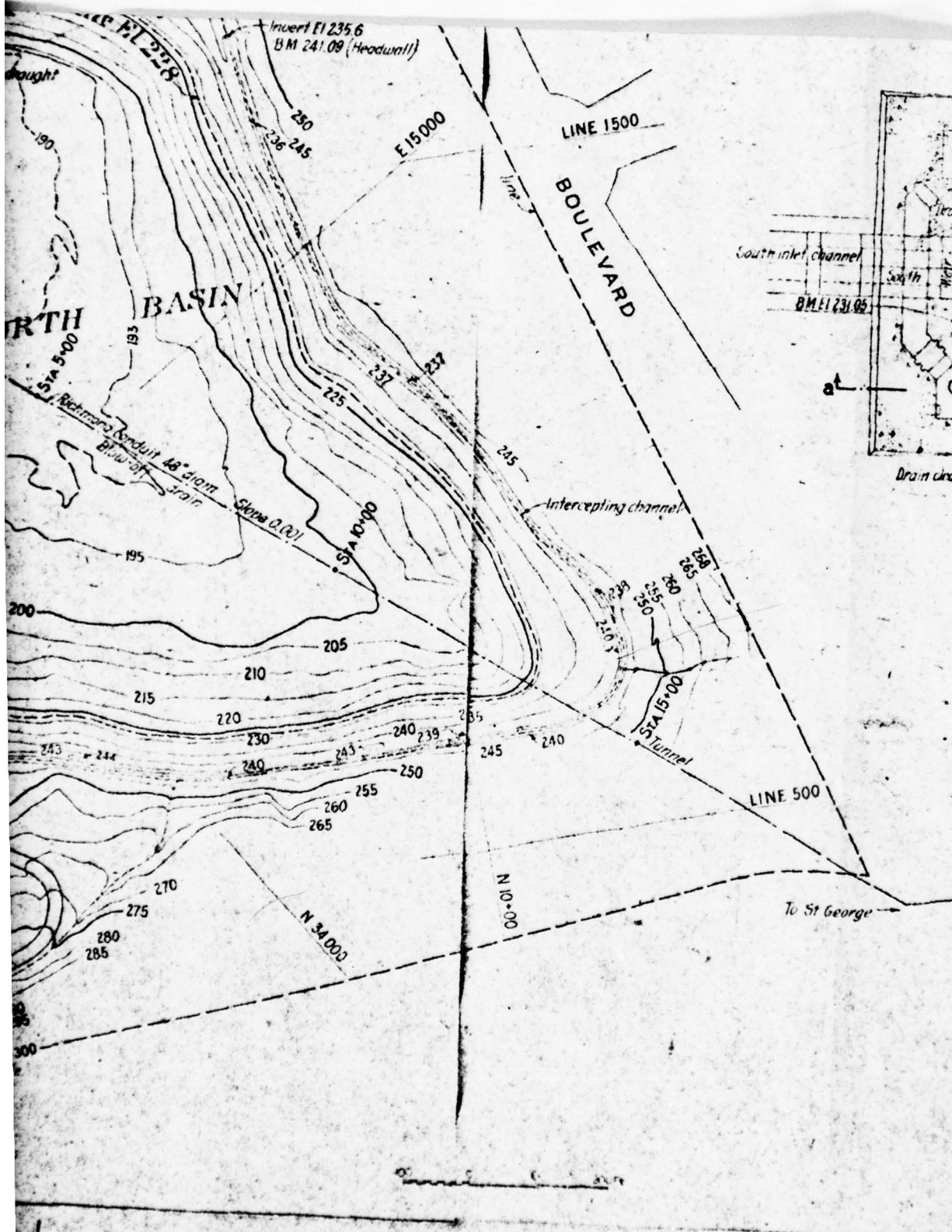
82	97	112	127	142	157	172	187	202
76	91	106	121	136	151	166	181	196
71	86	101	116	131	146	161	176	191
66	81	96	111	126	141	156	171	186
61	76	91	106	121	136	151	166	181
56	71	86	101	116	131	146	161	176
51	66	81	96	111	126	141	156	171
47	62	77	92	107	122	137	152	167
42	57	72	87	102	117	132	147	162
38	53	68	83	98	113	128	143	158
34	49	64	79	94	109	124	139	154
30	45	60	75	90	105	120	135	150
26	41	56	71	86	101	116	131	146
22	37	52	67	82	97	112	127	142
19	34	49	64	79	94	109	124	139
15	30	45	60	75	90	105	120	135
12	27	42	57	72	87	102	117	132
9	24	39	54	69	84	99	114	129
6	21	36	51	66	81	96	111	126
4	18	33	48	63	78	93	108	123
2	15	30	45	60	75	90	105	120
0	12	27	42	57	72	87	102	117



Drawn: H.C.
 Checked: W.A.
 Designed: E.M.
 Fred S. ...
 Designing Eng.



N 12183.43
E 14508.91
E 1271.23

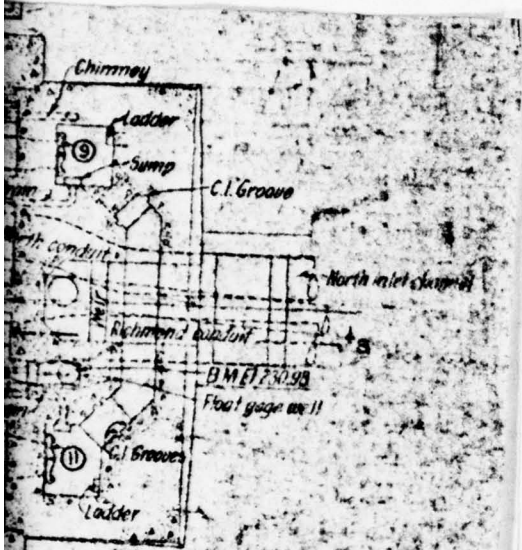


PLAN
 From omitted
GATE CHAMBER
 10 2 6 10 14 18 22 ft

REFERENCES	ACC. NO.
Dikes, typical sections	CR121
Middle dike, details	219
South dike, foundations	CR120
North dike, cut-off	CR12170, CR121
Richmond conduit & drain 19065,	CR120
North & South conduit	181
Intersecting channels	CR120
Culvert, North dike	CR120
Culvert, South dike	CR121
Culvert, Laurel Ave.	CR12178, CR120
Fencing	244
Land takings and control lines	E 490, E 491, C 1306

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SILVER



NOS	REFERENCES	ACC. NOS.
2175	Gate chamber	18686
21985	①②③④⑤ 48" gate valves	19496, 19497
22048	⑥⑦ 36" gate valves	19491
22177	⑧⑨ 30" x 42" sluice gates	19492
22001	⑩⑪ 3" x 5"	19493
20728	⑫⑬⑭⑮ 6" angle gate valves (drains)	19494
2057	⑯ 6" gate valve (drain)	19495
2044	⑰ 10" gate valve (Chamber drain)	19496
2178	Superstructures	243
2068	Electrical diets	CR130
2092		
2091		
208		

MORTCART

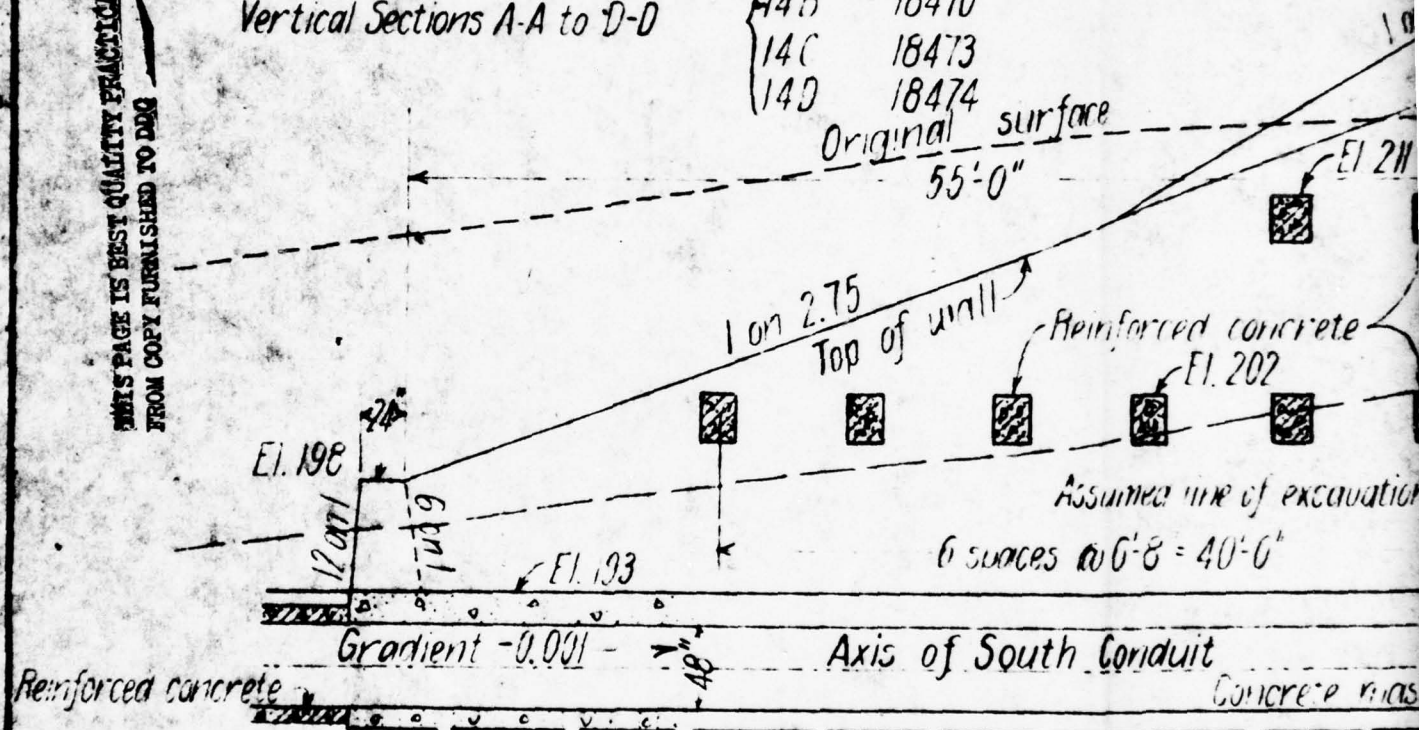
LAKE RESERVOIR

Fig. 10-10

8

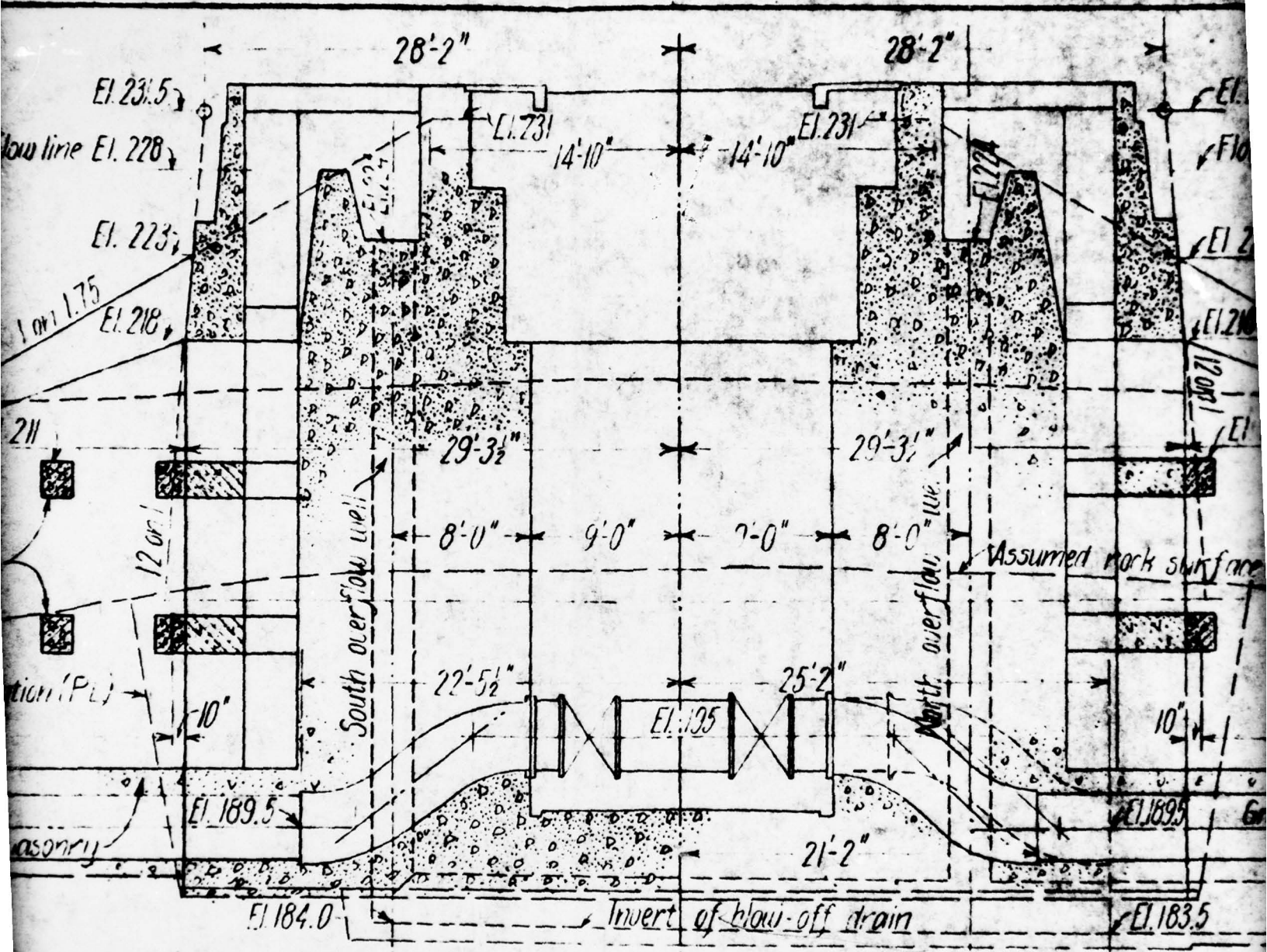
References	Sheet	Acc.
Gate Chamber -		
Elevations and Inlet		
Channel details (Sections N-N to Q-Q)	11B	18687
Masonry Plan	12A	18475
Vertical Sections A-A to D-D	14A	18469
	14B	18470
	14C	18473
	14D	18474

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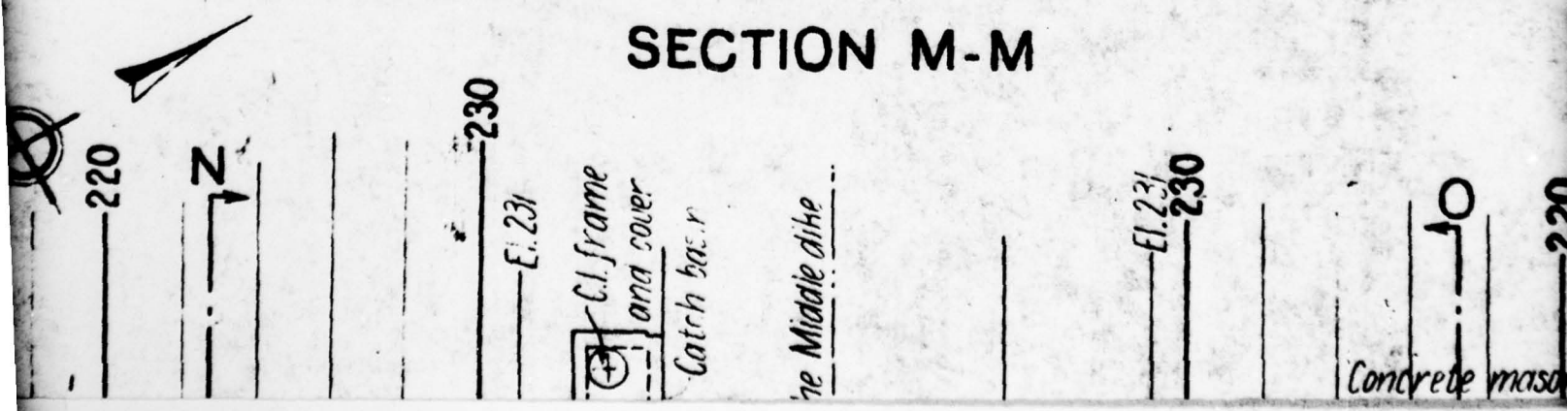


- Concrete masonry protection for steep slopes shall be laid in alternate blocks not more than 8 feet in larger dimension. Weep holes, of about 2 square inches area, shall extend entirely through concrete at positions directed.
- The gradient of the North Conduit, beyond the gate chamber inlet channel may be adapted to the general slope of the reservoir bottom.
- Limits of excavation and masonry and extent of paving and riprap shall be as shown unless modified by the Engineer to meet unexpected developments of

110



SECTION M-M



CONTRACT 89
~~WORKING~~
 RECORD

V

References

Sheet	Acc.
12B	19278
12E	19533
13A	18719
14E	19329
	CR12001
11C	21976, CR12048
	CR12065
	19489, 20975

El. 231.5

Flow line El. 228.

223

218

El. 211

face

Gradient -0.001

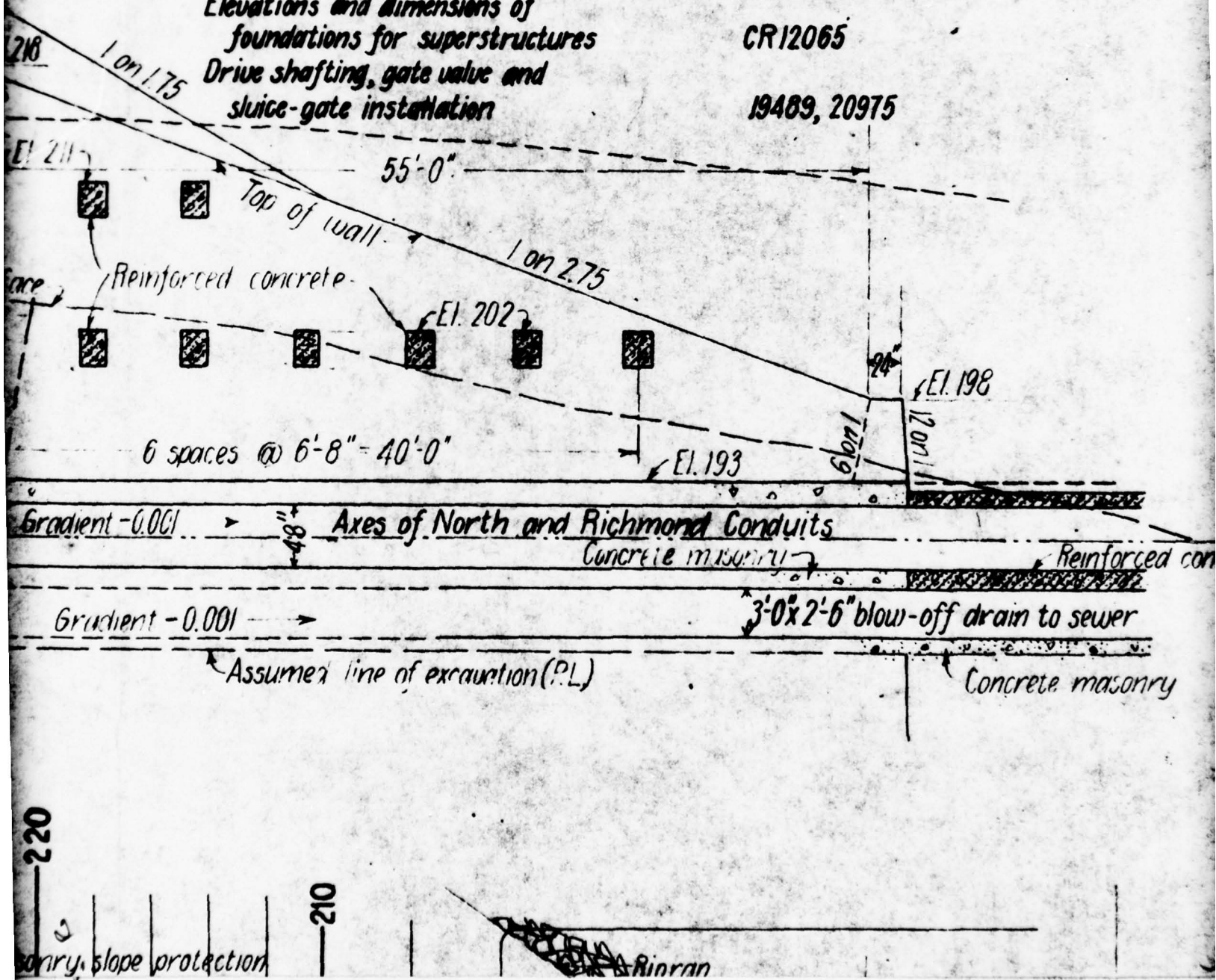
Gradient -0.001

220

210

carry, slope protection

Roadway-Plan and details
 Electric conduits
 Piping plan
 Anchor bolts and templates
 Richmond conduit-Plan and profile
 South inlet channel details
 Elevations and dimensions of
 foundations for superstructures
 Drive shafting, gate valve and
 sluice-gate installation

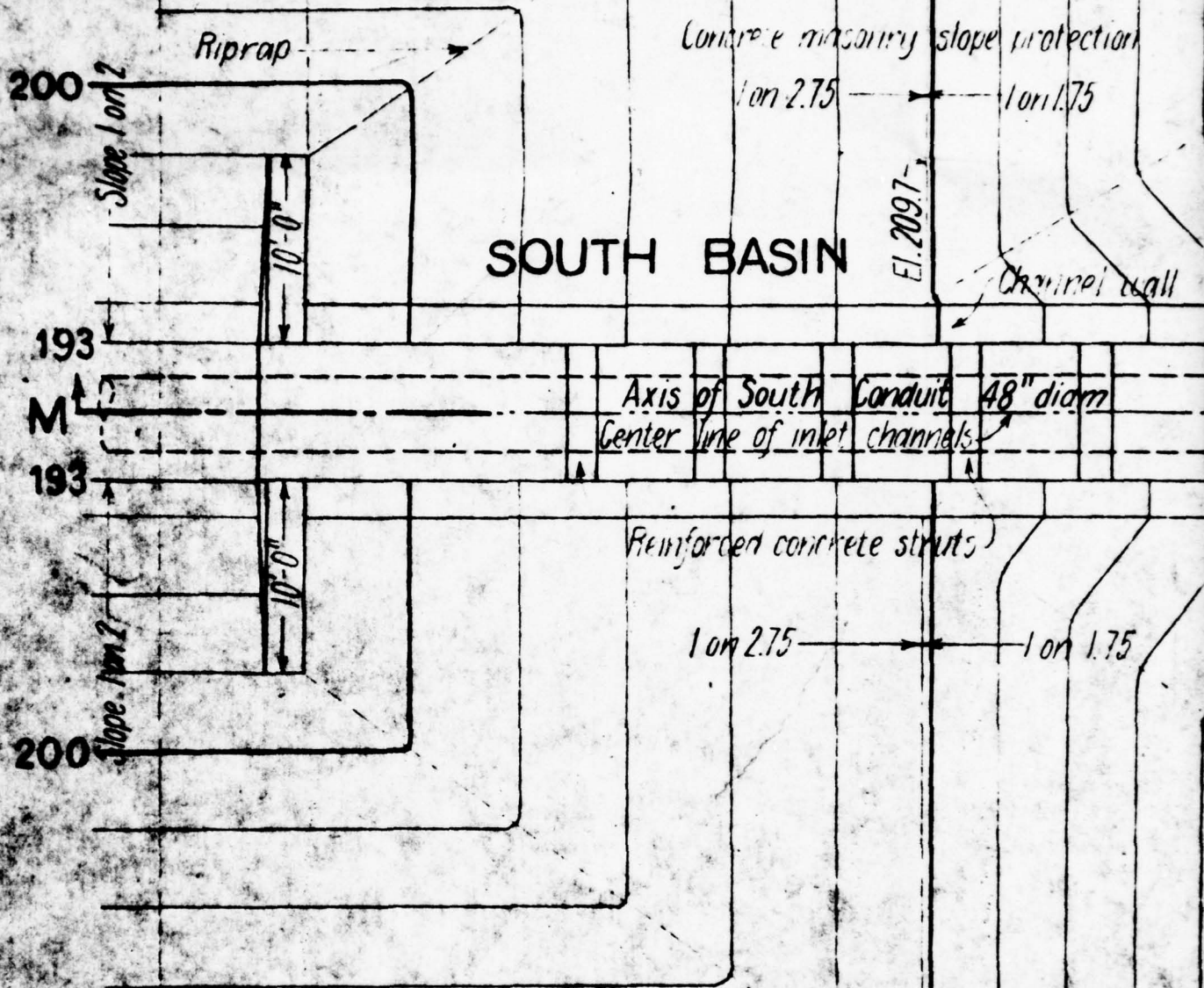


SHEET 11A
~~DRAWING~~
DRAWING V

crete

H

by the Engineer to meet unexpected developments of construction
(See note 3, Sheet 14A, Acc. 12469)



SOUTH BASIN

El. 209.7

Axis of South Conduit 48" diam
Center line of inlet channels

Reinforced concrete struts

1 on 2.75

1 on 1.75

200

193

193

200

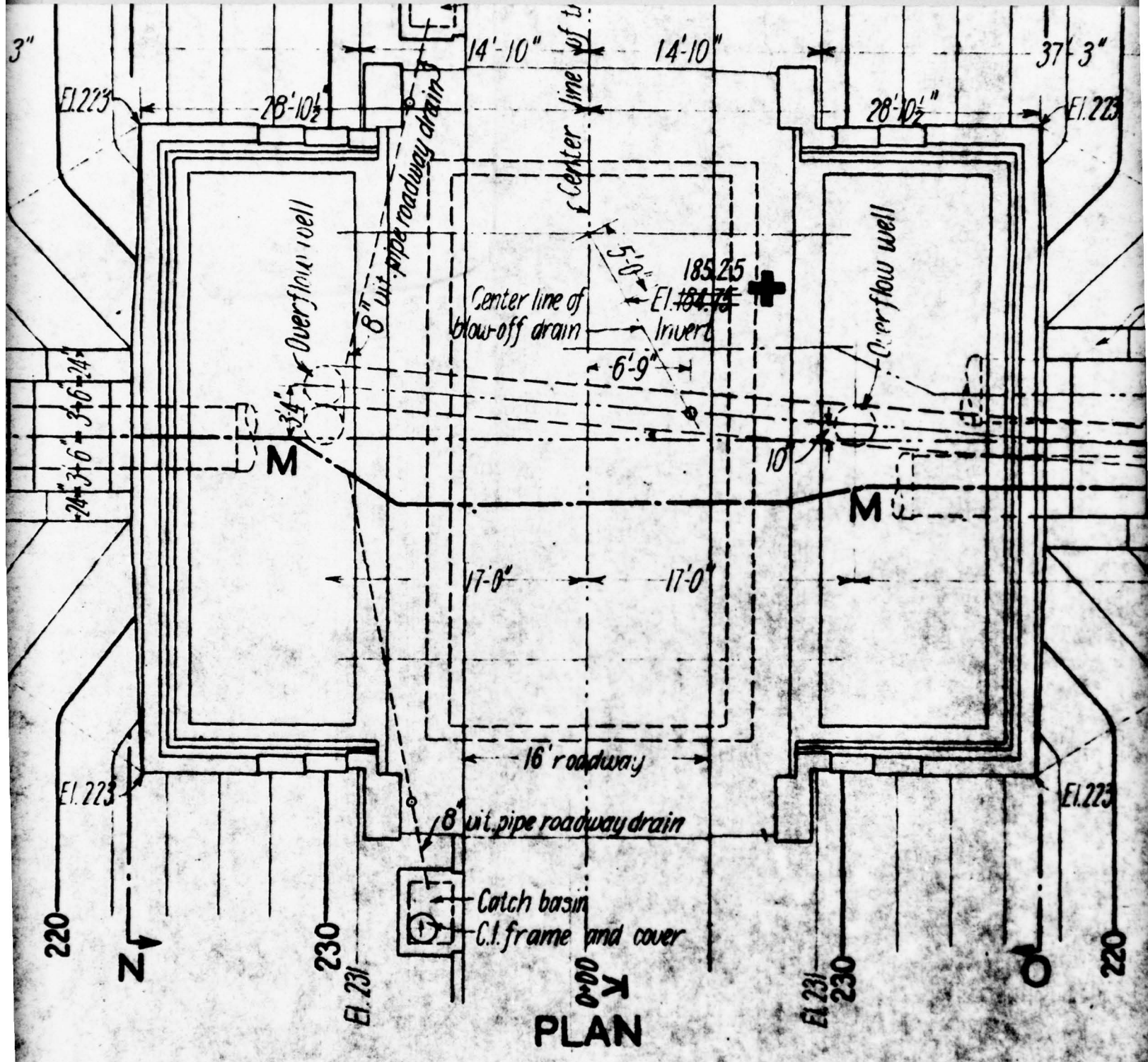
210

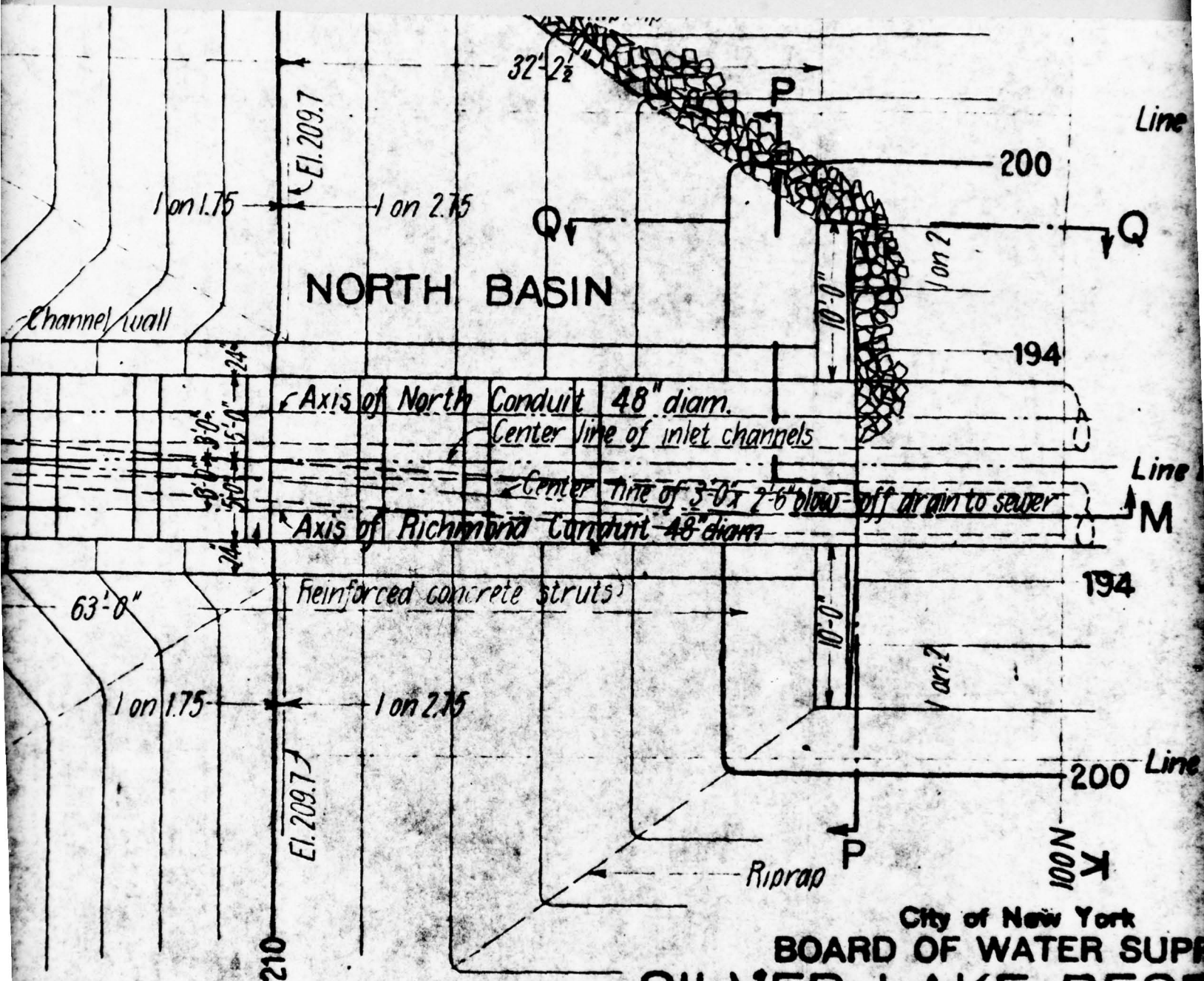
K
100.5

100.5

100.5

J. F. Moore
Designing Eng





City of New York
 BOARD OF WATER SUPPLY
SILVER LAKE RESERVOIR
 GATE CHAMBER
 GENERAL PLAN AND SECTION

Revision of MARCH 9, 1914
 shown thus +

10 2 6 10 14 18 22

AUGUST 20, 1913

Revised MAY 27, 1918

Yudt. Kimm
 Dept. Engineers and Acting Chief Eng

File No. 100-3.75

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700 V

725

740 V

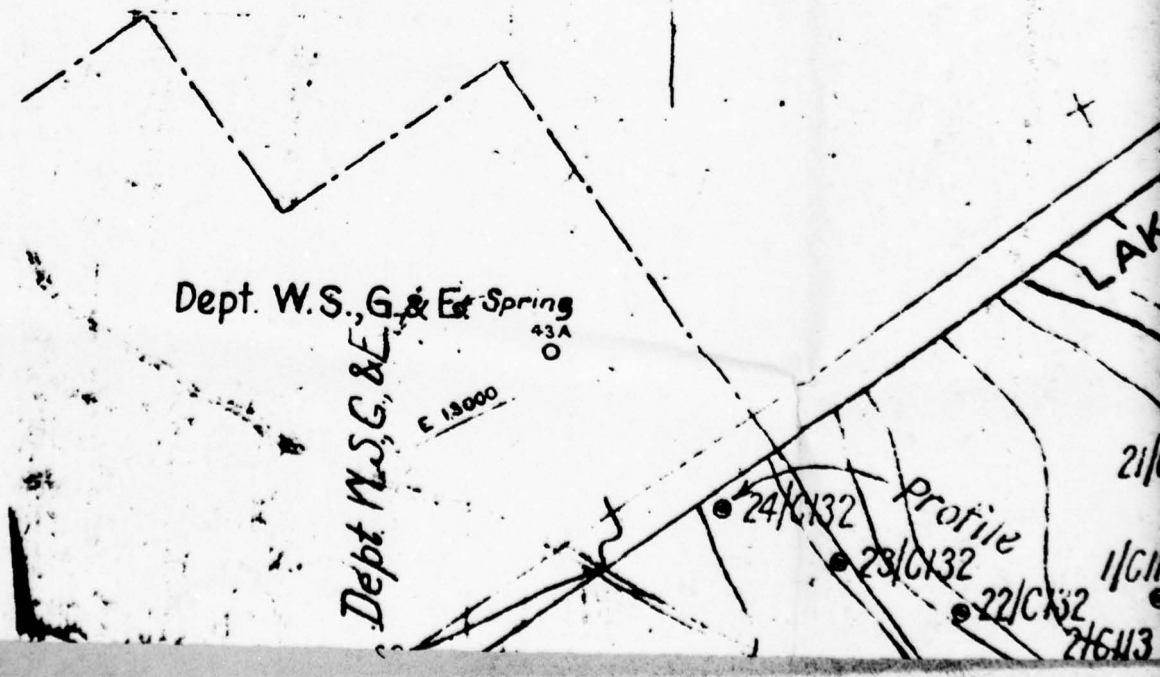
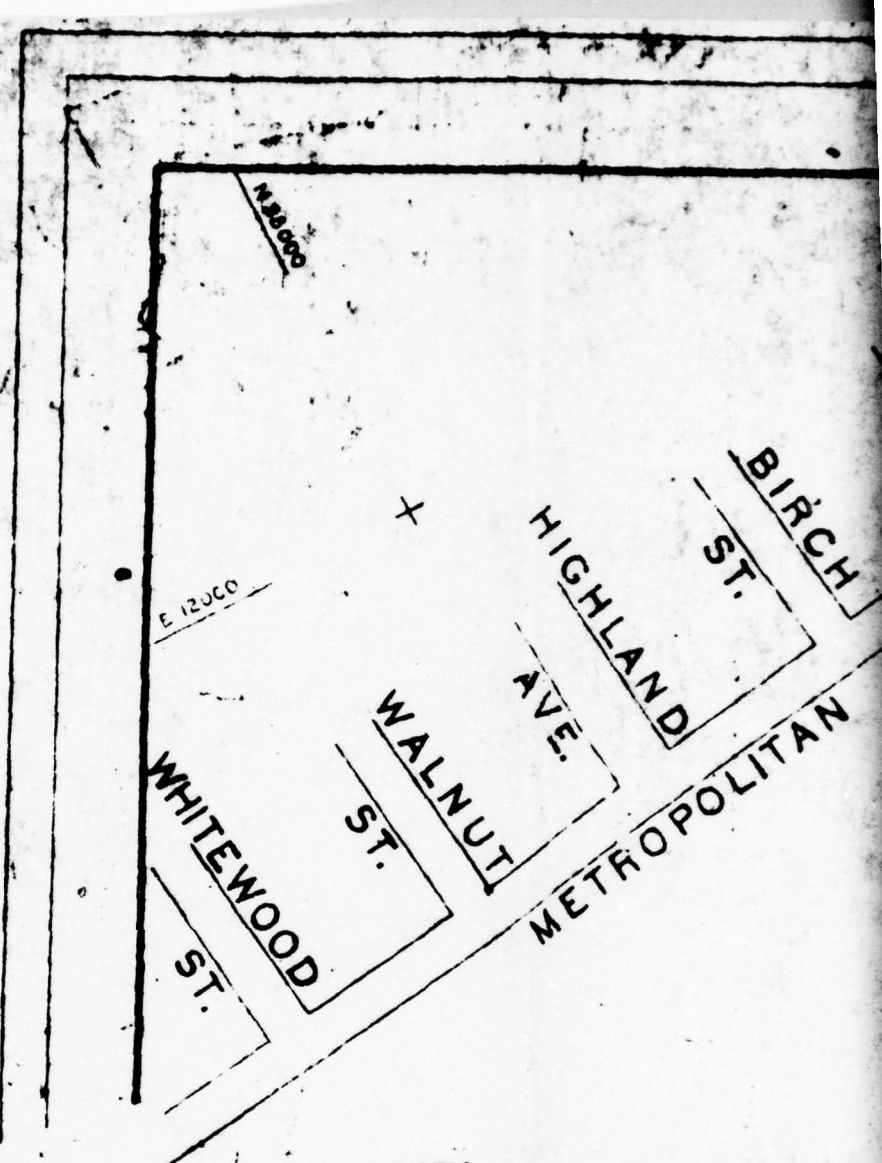
LY
RVOIR

TION

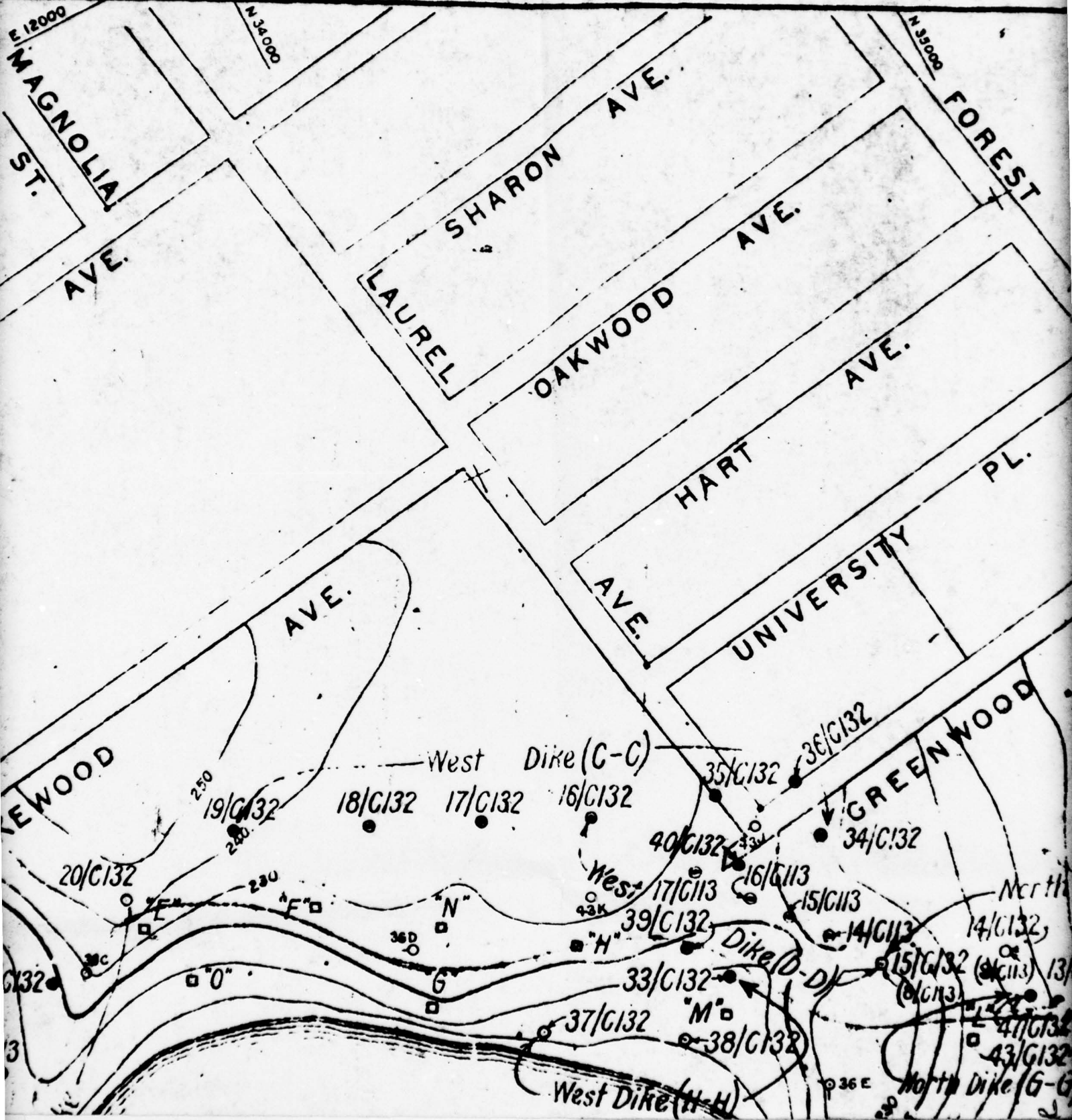
Acc 1000

8

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Dept. W.S., G. & E.



E 12000

N 3400

N 3500

MAGNOLIA ST.

SHARON AVE.

FOREST

AVE.

LAUREL

OAKWOOD AVE.

AVE.

HART

AVE.

AVE.

UNIVERSITY PL.

AVE.

WOOD

West Dike (C-C)

19/G132

18/G132

17/G132

16/G132

35/G132

36/G132

34/G132

20/G132

40/G132

"F"

"N"

West

16/G113

15/G113

North

G132

"E"

"F"

360

"H"

39/G132

14/G113

14/G132

"O"

"G"

33/G132

Dike (D-D)

15/G132 (G113)

13/G113

37/G132

"M"

38/G132

41/G132

West Dike (H-H)

36E

North Dike (G-G)

43/G132

44/G132

E. 13000

N. 36000

AVE.

BRIGHTON
AVE.

AVE. 170

HAVENWOOD
ROAD

BARRETT

Dike (F-F)

10/C113

11/C113

13/C132

1/C113

12/C113

42/C132

46/C132

32/C132

45/C132

31/C132

30/C132

TAKE

+

+

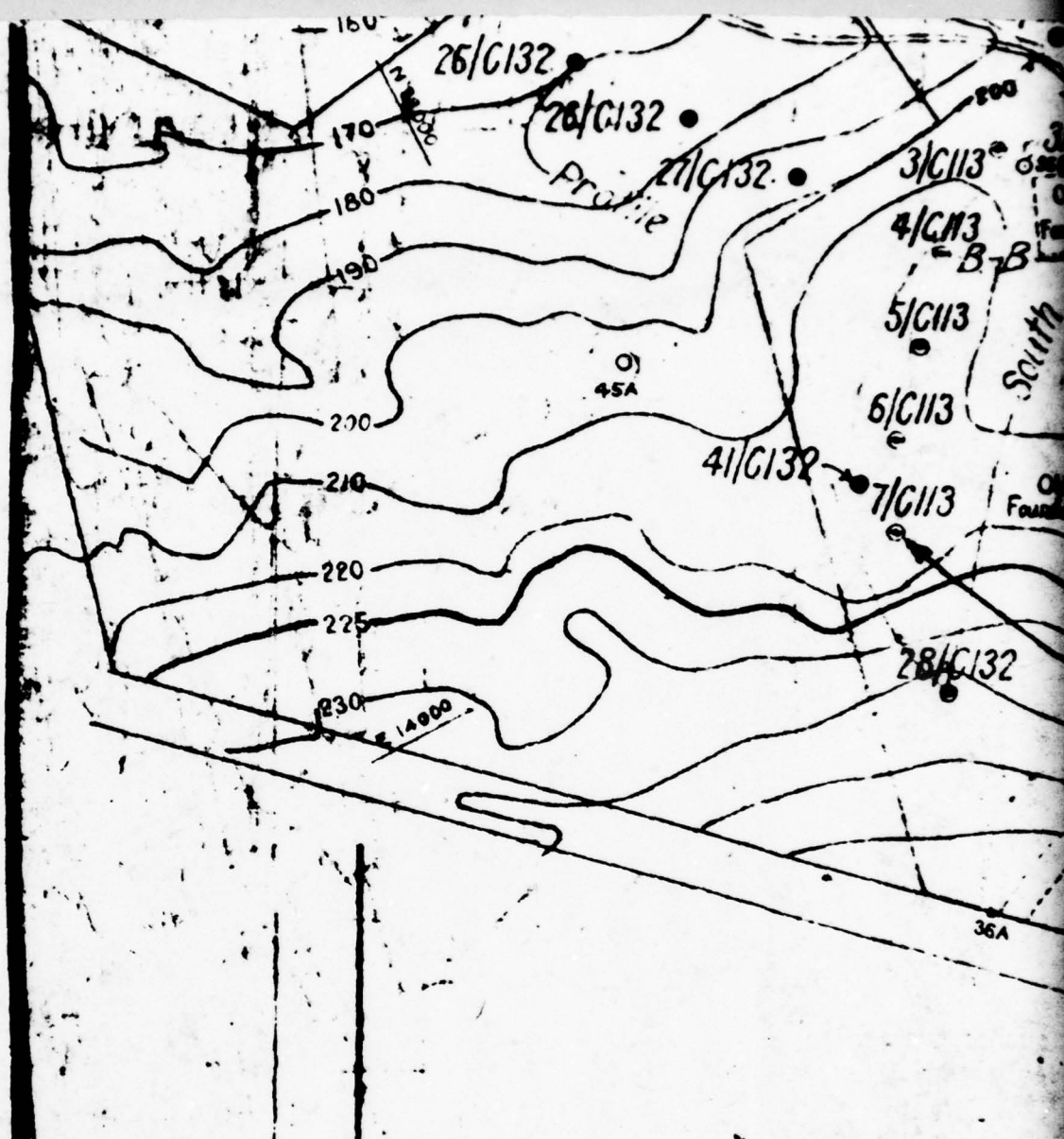
3

E 12000

+

E 18000

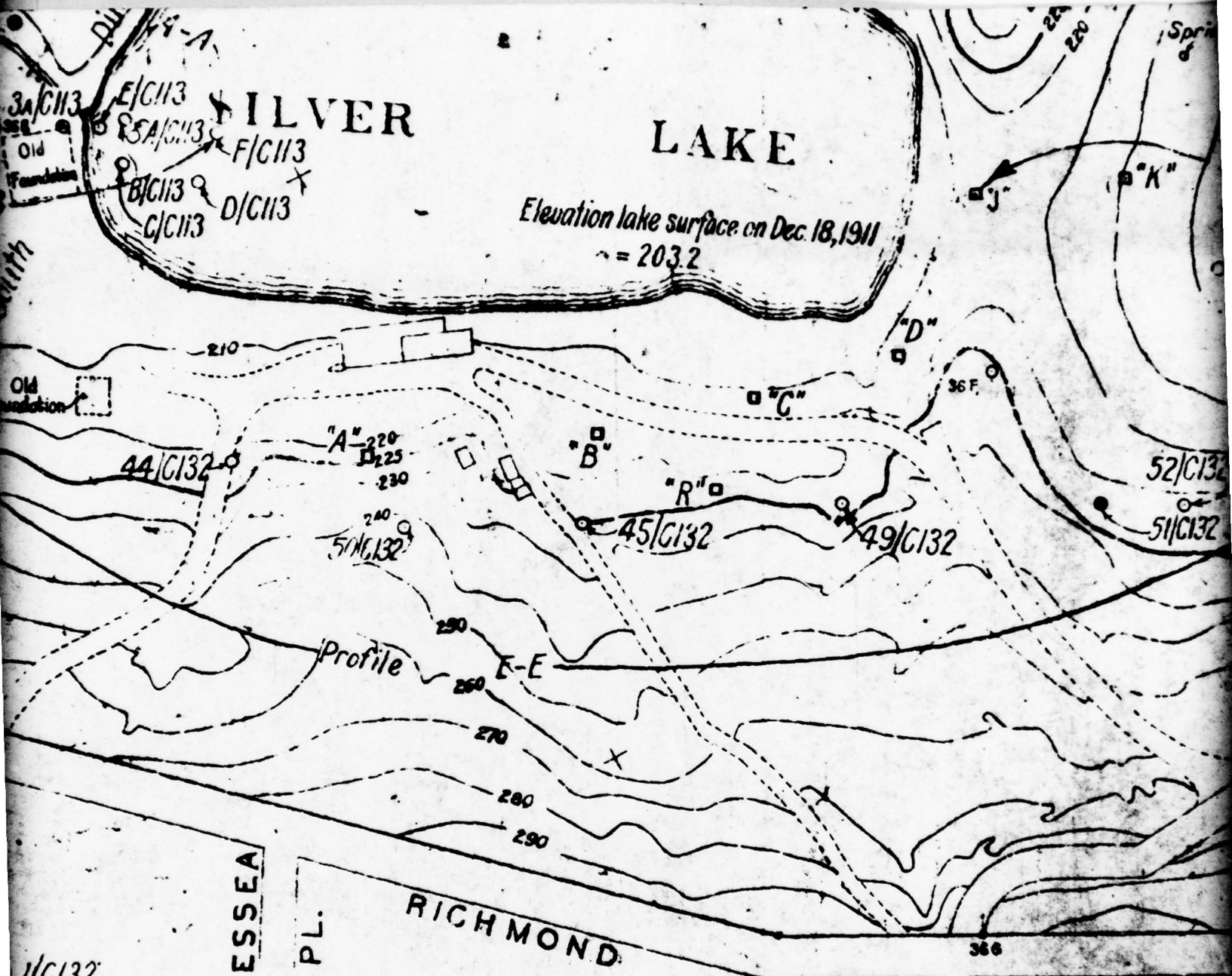
+



Core borings under Contract 132 -●- 1/
 Wash borings under Contract 132 ---○ 8/

Drawn CWC (boring)
 Traced T-1 (1)
 (Checked J.H.C. boring) 2/19/60

6



Topography based on Richmond Topographical Bureau surveys.
 Elevations reduced to Board of Water Supply datum.

EDDY ST.

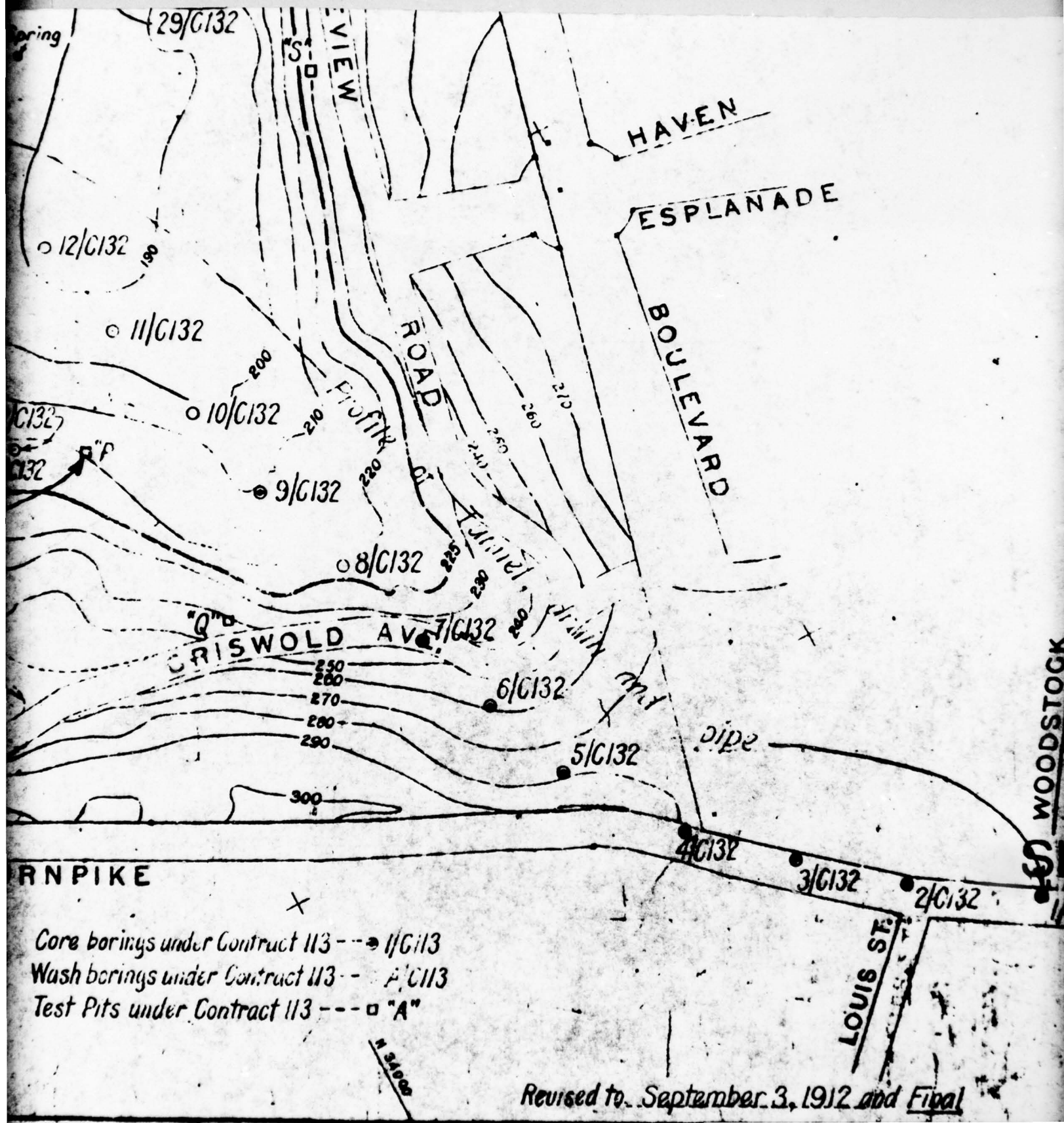
THRESSEA PL.

RICHMOND

TURI

N 2500

N 3300



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PL.
11C132

City of New York
BOARD OF WATER SUPPLY
SILVER LAKE RESERVOIR
LOCATION PLAN
BORINGS

200 0 200 400 FT.

MAY 22-1912

File Cont. 13 63031.

Acc 35

*19/G132

ELEV

Sur. El 241.3

240

- D.S. (right) — 10' G.
- D.S. (right) — 15' G. with G.
- 220 D.S. (right) — 20' G. with G.
- D.S. (right) — 25' C. with G.
- D.S. (right) — 30' C. G. & S.
- D.S. (right) — 35' Gravelly G. *1-5S & 6.
- 200 D.S. (right) — 40' Gravelly G. *1-5S & 6.
- D.S. (right) — 45' Gravelly G. *1-5S & 6.

El 189.3

14% Core

52'

180

63'

El 178.3
Core 1 3/4"

160

- D.S. (right)
- D.S. (right)
- D.S. (right)
- D.S. (right)
- D.S. (right)

D.S. (right)
El 182.0

10% Core

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#18/G132
Sur. El. 234.0

#17/G132
Sur. El. 232.8

- 10' Sandy C.
- 15' Sandy C.
- 20' Sandy C. with some #16
- 25' Clayey #3-#5 S.
- 30' #3-#6 S.&C.
- 35' #3-#6 S.&C.
- 40'
- 45'
- 50' Clayey #1-#5 S.&6
- 52'
- 62'

DS (probably tight)

DS (tight)

DS (tight)

EL 198.8

No Core

12' Clayey G.&S.

20' Clayey S.&G.

30' Sandy C.

34'

Serpentine

44'

EL 188.8

Core 1 $\frac{3}{8}$ "

EL 172.0
Core 1 $\frac{3}{8}$ "

DS (S)
EL 2

WEST DIKE (PROFILE G-C)

*16/C132
Sur El 287.5

*35/C132
Sur El 279.4

LAUREL AVE

MDN

GREENWOOD AVE

(right)
226.5
42% Gore
5' C
11' Serpentine grindings
21'
El. 216.5
Gore 1 $\frac{3}{8}$ "

D.S. (right) 10' G, S, & B.
D.S. (right) 15' G, S, & B.
D.S. (right) El. 200.4
25' Residual G.
30' Serpentine grindings
No Gore
50'
El. 190.4
Gore 1 $\frac{3}{8}$ "

*35/C132 (located approx
40' to the west)
Sur El 224.9

El. 6' Water 198.4

10' Top soil
D.S. (pervious) 15' #1 #2 G & B
D.S. (pervious) 20' #1 #2 G & B
D.S. (right) 25' G & #1 #2 G
D.S. (pervious) 30' #1 #2 G with G
D.S. (pervious) 35' #3 #4 G with trace G
D.S. (pervious) 40' #4 #5 G
D.S. (right) El. 173.9
D.S. (pervious) 45' #6 #7 G
48' #4 #5 G
Serpentine
51'
El. 163.9

(located approx
50' to the east)

ELEV

240

36/132 * 34/132

Sur-EI 2217

220

R.S. (light) 10'

Top soil
G. with some S.

R.S. (light) 15'

C. with S.S.

R.S. (light) 20'

200

7-4-5

7-5-5

R.S. (service) 25'

7-5-5

R.S. (light) 30'

180

EI 173.7

7-5-5

(Banded
Serpentine)

(Serpentine
Gore)

160

EI 163.7

ELEV Gore 1

220

200

180

160

ELEV

230 —

220 —

D.S. = Dry Sample

200 —

Clay = C

Sand = S

Boulders = B

Gravel = G

180 —

160 —

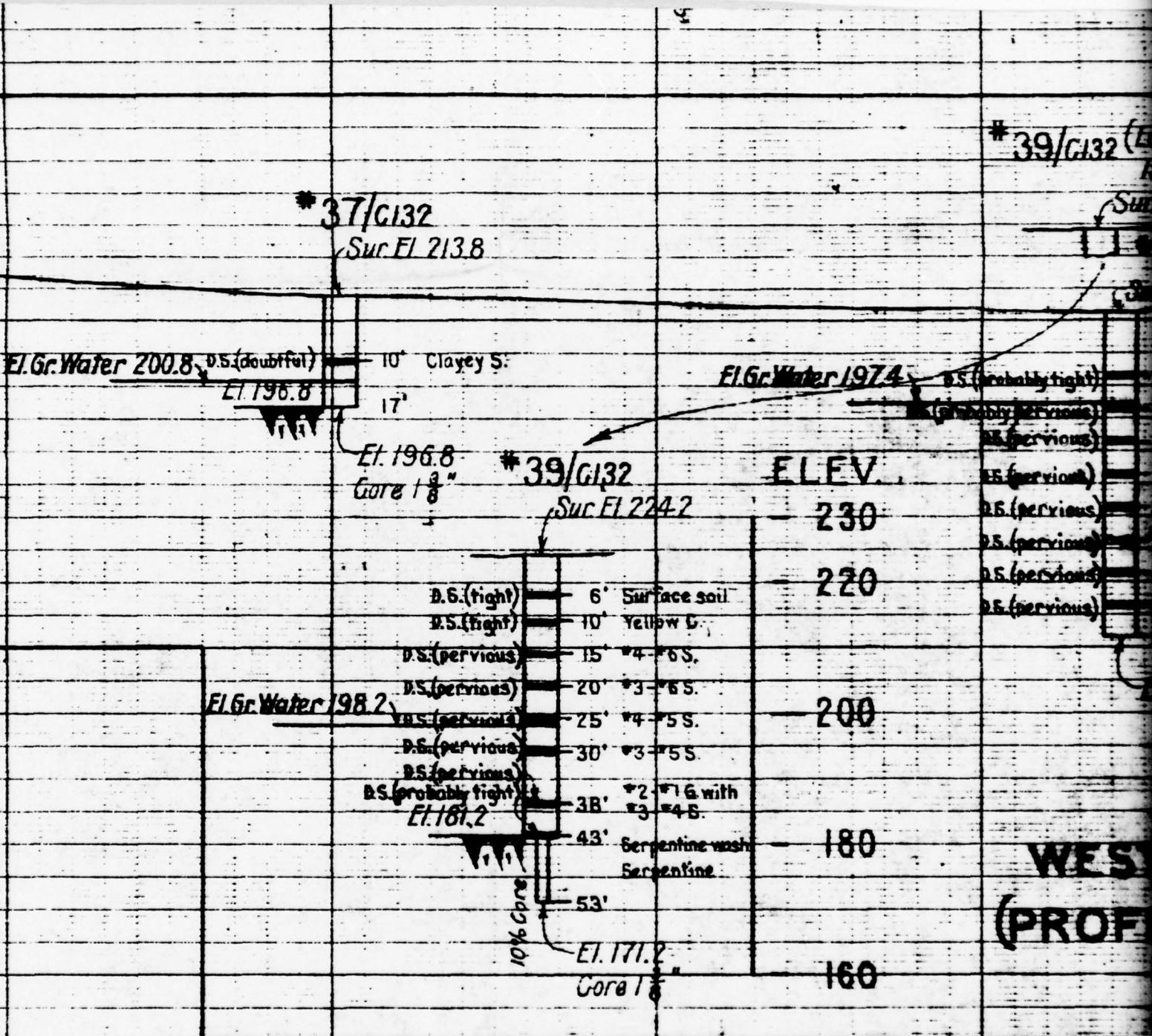
#1	Coarse Gravel	Size above	5 mm.
#2	Fine Gravel	between	5 and 1 mm.
#3	Coarse Sand		1 . . . 5 .
#4	Medium Sand		5 . . . 25 .
#5	Fine Sand		25 . . . 10 .
#6	Superfine Sand		10 . . . 05 .
#7	Rock flour and clay		05 . . . 01 .

From cut
Traced CWC
Blacked 2X3

Formation determined by JWB

6

ATCWD 11-19



Located approx.
155' to the west)
Elev. 224.2

(Located approx.
110' to the west)
*33/C132
Suc. El. 221.1

ELEV.

*38/C132
Elev. 211.4

10'	#2 - 24 S
15'	#3 - 24 with #15 & trace G
20'	#2 - 24 S. El. Gr. Water 197.1
25'	#2 - 24 S with trace G
30'	#2 S
35'	Decayed Serpentine
37'	Decayed Serpentine wash
40'	Serpentine grains
45'	
50'	

230

220

200

180

160

- #1 Coarse Gravel Size about 1/2"
- #2 Fine Gravel " between 1/2"
- #3 Coarse Sand " "
- #4 Medium Sand " "
- #5 Fine Sand " "
- #6 Superfine Sand " "
- #7 Rock flour and clay " "

El. 174.7
Core 1

El. 161.4

DIKE
ILE H-H)

City of New York

BOARD OF WATER SUPPLY
SILVER LAKE RESERVOIR

6 mm
1/8 " and 1 mm
1 " " 5 "
5 " " 25 "
25 " " 10 "
10 " " 05 "
05 " " 01 "

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RELY
ON BOHRING
AND H-H
1971

ACC. 5340

7 8

ELEV.

220 —

200 —

180 —

160 —

140 —

120 —

100 —

80 —

Hole E. Wash and dry so
" D " " "
" G " samples are
are on right of
" F. Wash samples on
are on left of ho

Traverse Sta. 36B

LAKE BORNEO (Looking west)

See Acc. C. 5196

Sur. El. 203.7

3A/G113

E/G113

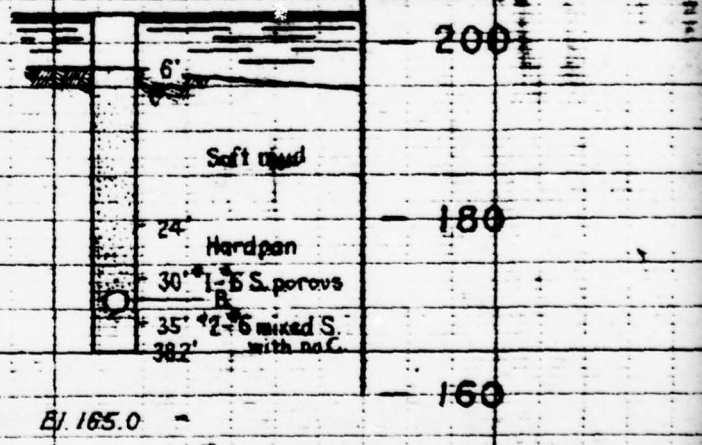
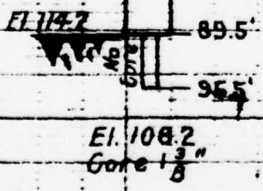
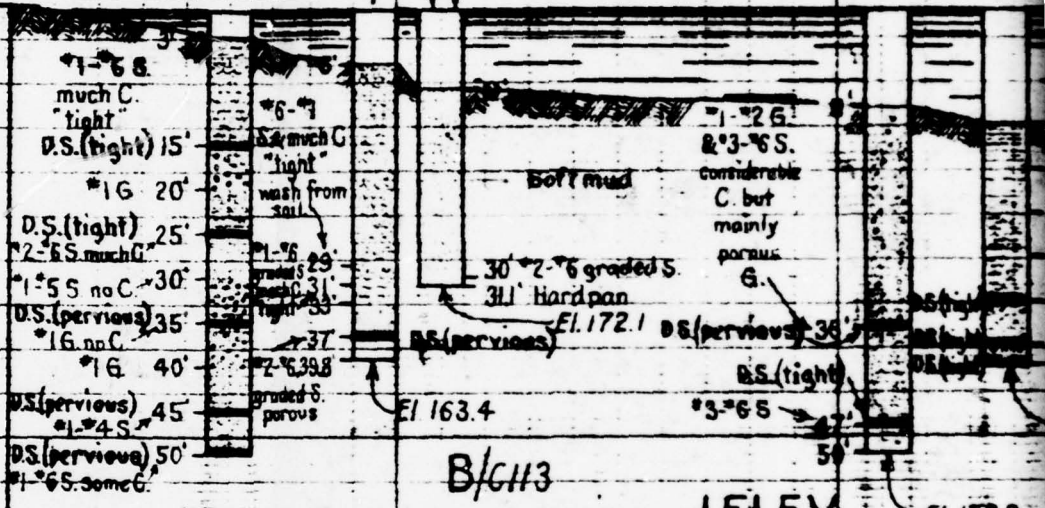
C/G113

A/G113

D/G113 F/G113

B see below.

samples are both on left of hole.
are on left, and dry samples
of hole.
s are on right, and dry samples
of hole.



El. 165.0

- 13'
- 16' Impalpable lake muck
- 23' Impalpable lake muck
- 28' Impalpable lake muck with trace G
- 33' Tight G with trace of muck
- 38' Tight G with trace of G
- 48' Clayey S & G all sizes probably tight

Bottom of Lake

EL 168.2

#15/C132

See Acc. C.51

#15/C132 (located approx 40' to the north)

ELEV.

— 220

— 200

— 180

— 160

— 140

— 120

— 100

— 80

3

5196

cont'd but

ELEV.

4

ELEV.

240

220

200

180

160

140

Et. Lo

Samples indic
and for deter
reliable than
on left of hol

D.S. = Dry so
S.S. = Settle

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Clay = G

Sand = S

Boulders = B

Gravel = G

*1 Coarse Gravel

*2 Fine Gravel

*3 Coarse Sand

*4 Medium Sand

*5 Fine Sand

*6 Superfine Sand

*7 Rock Flour and cla

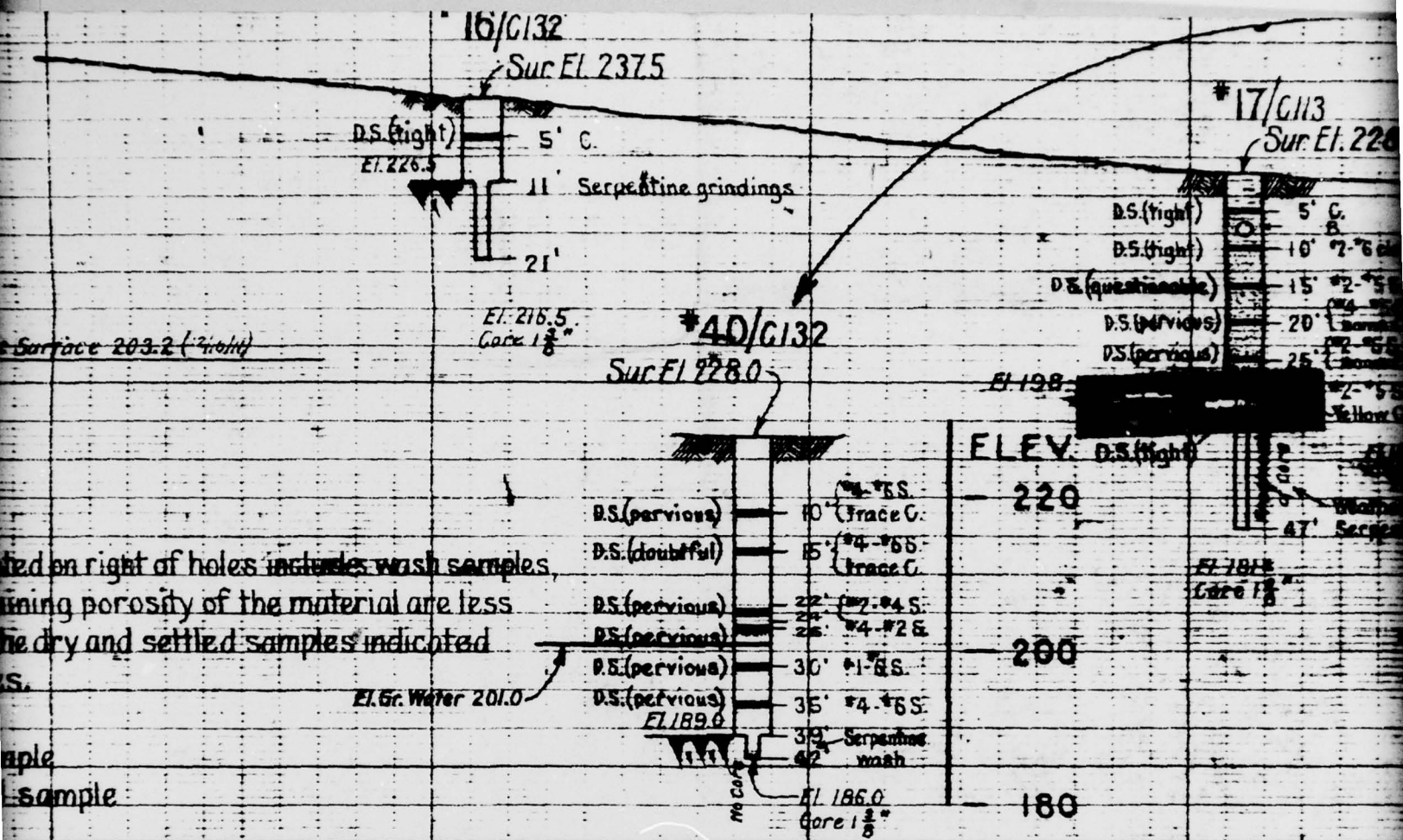
Drawn by

Legend

Checked by [unclear] P. H. P. (112)

Formation determined by [unclear]

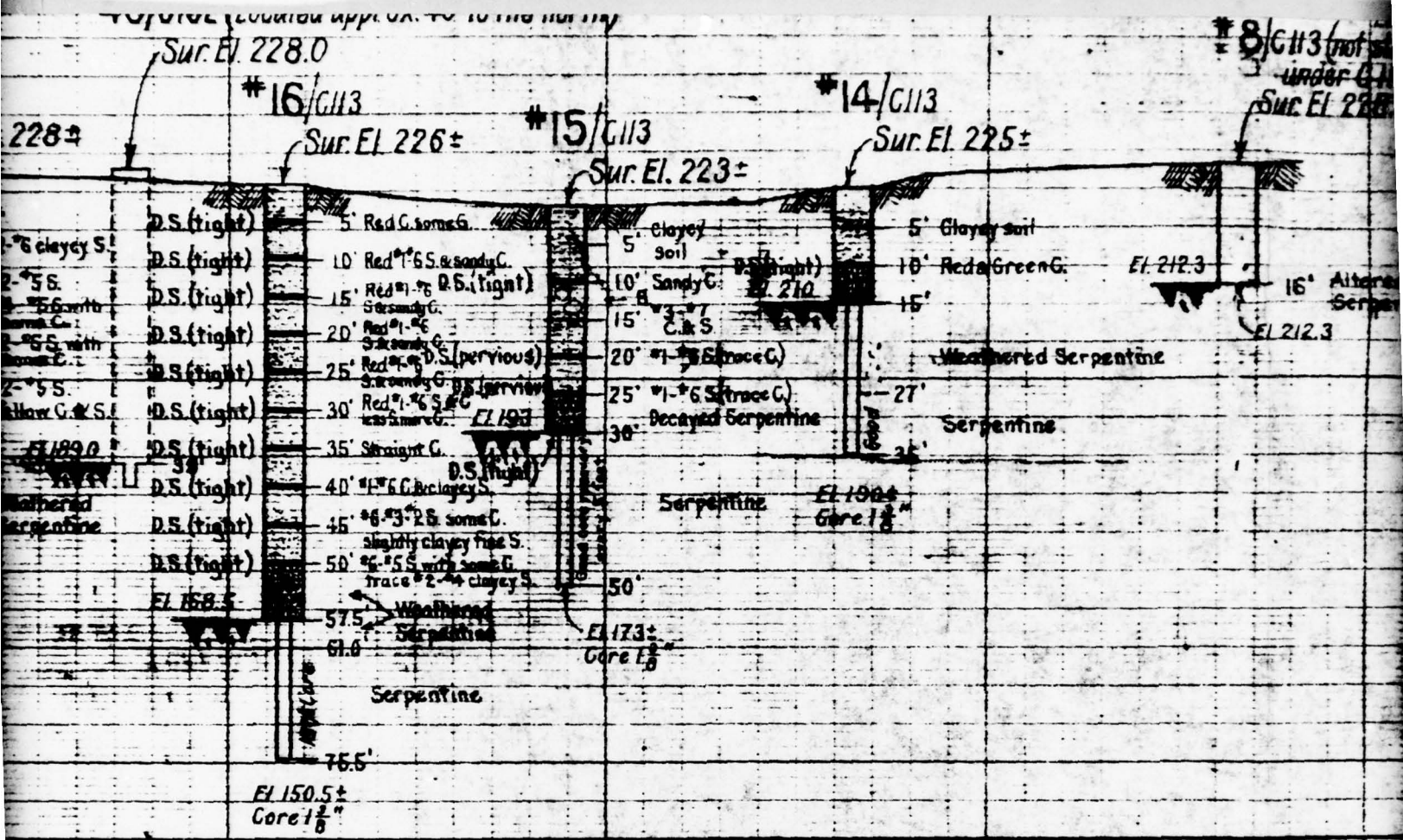
5



- Size above 5 mm
- " between 5 mm and 1 mm
- " 1 " . 5 "
- " 5 " . 25 "
- " 25 " . 10 "
- " 10 " . 05 "
- " 05 " . 01 "

WEST DIKE
(PROFILE D-D)

For plan locations see Map



City of No
BOARD OF WA
SILVER LAKE RESE
PROFILE ON CENTER LIN
LAKE BORINGS A

Revised to May 1st 1912, for Cont. H3 only

Acc. G5311

File: Cont. 113 G. 2.0 S

started
(13)
26

ELEV.

— 240

— 220

— 200

— 180

— 160

— 140

and
mine

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New York

WATER SUPPLY RESERVOIR BORINGS

LINE OF PROPOSED DIKES AND WEST DIKE

to 80 FT.

APR 26, 1911.

ACC. G-522

ELEV.

210

200

180

160

140

120

100

80

60

#25/G132

Sur. Ft. 175.9

EL Gr. Water 167.9

D.S. (tight)

D.S. (tight)

D.S. (tight)

D.S. (tight)

D.S. (tight)

EL 121.9

10' G.

15' G.

22' #3-#6 S.&G. with G.

27' #3-#6 S.&G.

32' } #1-#6 S.

36' }

38' Clayey S.&G.

43' #3-#5 S.

48' #3-#5 S.

54' Decayed Serpentine

Serpentine grindings

64'

EL 111.9

Core 1 3/8"

D.S. (tight)

D.S. (tight)

D.S. (doubtful)

D.S. (pervious)

D.S. (probably tight)

D.S. (questionable)

D.S. (tight)

EL 130.5

Samples indicated on right of holes include wash and for determining the porosity of the material less reliable than the dry and settled samples on the left of holes.

27/G132

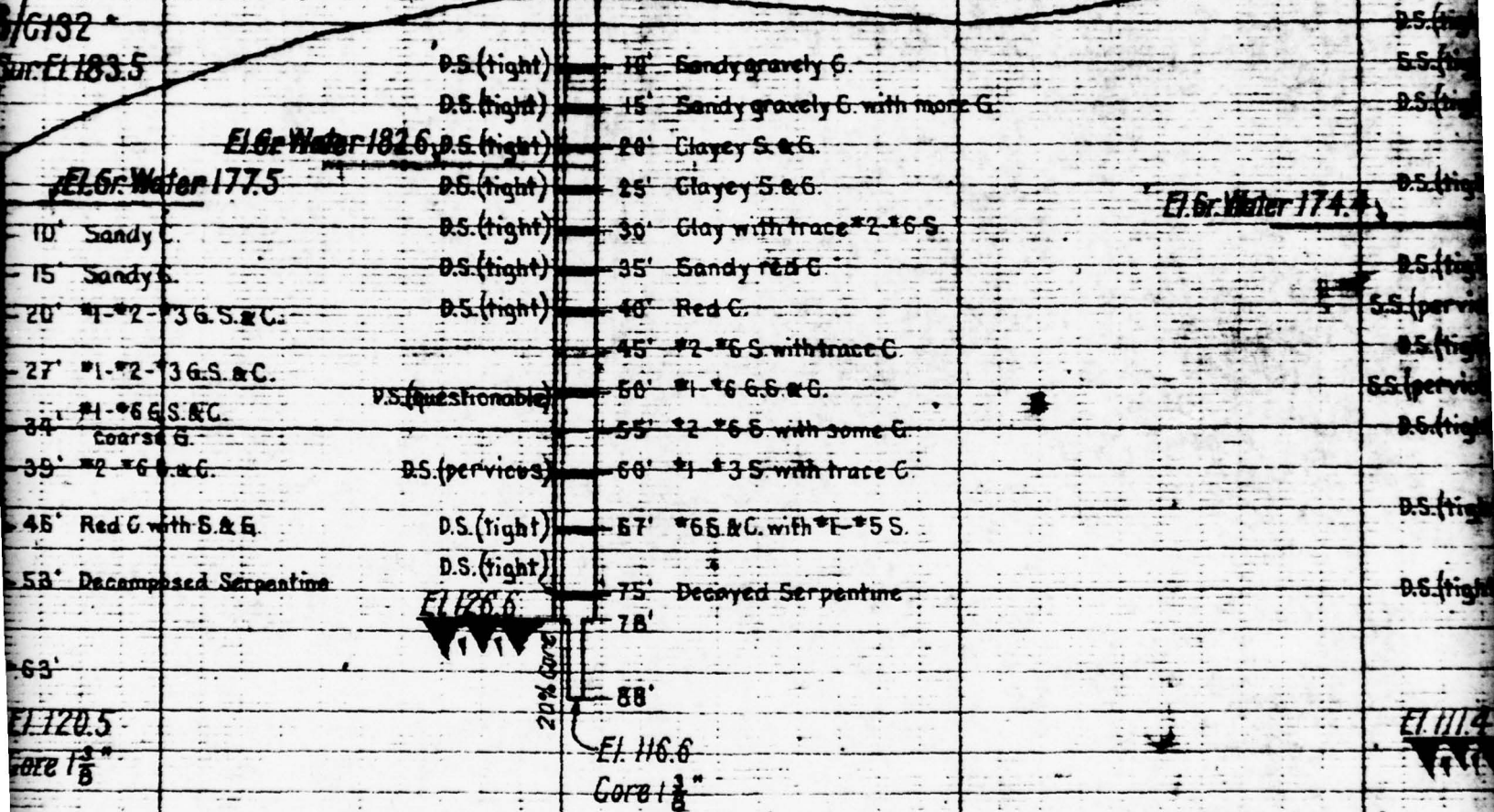
Surf El 204.6

G132
Surf El 183.5

El Gr Water 182.6

El Gr Water 177.5

El Gr Water 174.4



El 120.5
Core 1 1/8"

El 111.4
Core 1 1/8"

amples,
are
licated

PROFILE B-B

#3/G113

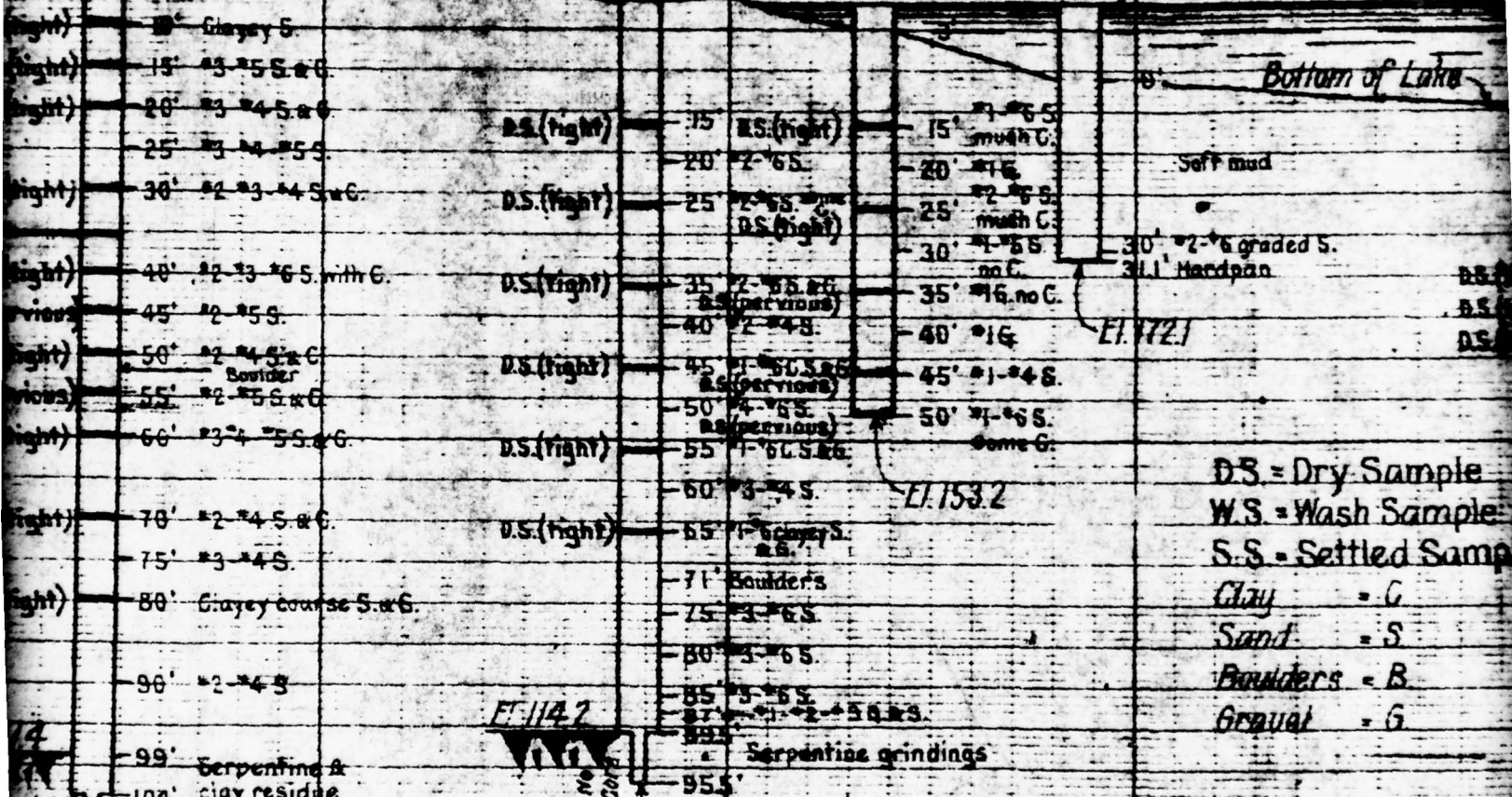
Sur El 210.4

#3A/G113

Sur El 203.7 *E/G113

*A/G113

Sur El Lake 203.2 (12/18/11)

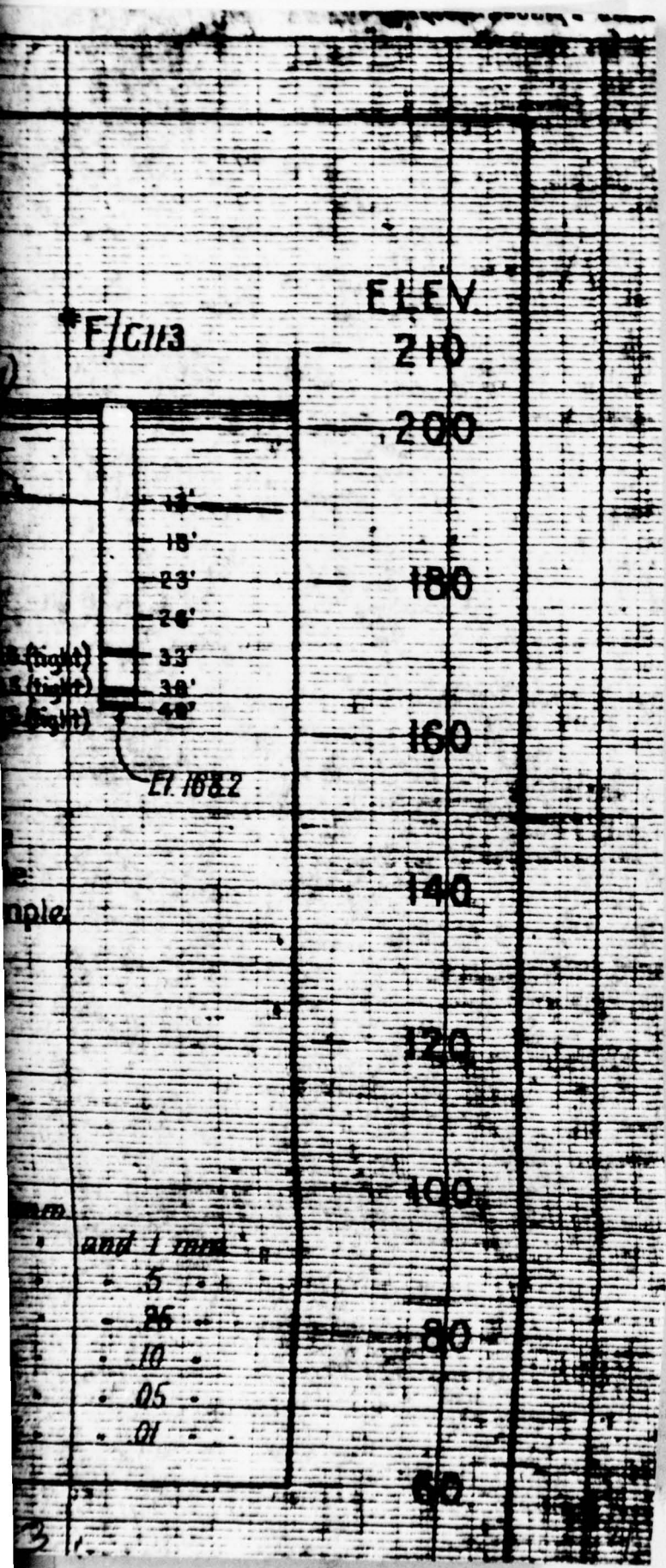


D.S. = Dry Sample
 W.S. = Wash Sample
 S.S. = Settled Sample
 Clay = G
 Sand = S
 Boulders = B
 Gravel = G

- *1 Coarse Gravel Size none - 5 mm
- *2 Fine Gravel " between 5 "
- *3 Coarse Sand " " 1 "
- *4 Medium Sand " " 5 "
- *5 Fine Sand " " 25 "
- *6 Superfine Sand " " 10 "
- *7 Rock flour and clay " " 0.5 "

1914
 Sur El 108.2

EI. 114.2
 EI. 108.2
 Core 1 3/8"



ELEV

F/C113

210

200

15'

15'

23'

26'

right

33'

right

38'

right

48'

180

160

ET. 1682

140

ple

120

100

and 1 mm

5

25

10

05

01

80

60

3

	D.S. (right)
	D.S. (right)
140	D.S. (right)
	D.S. (right)
120	D.S. (right)
	D.S. (right)
	EI. 1021
100	VVVV

#2/GH
Sur

#22/G132

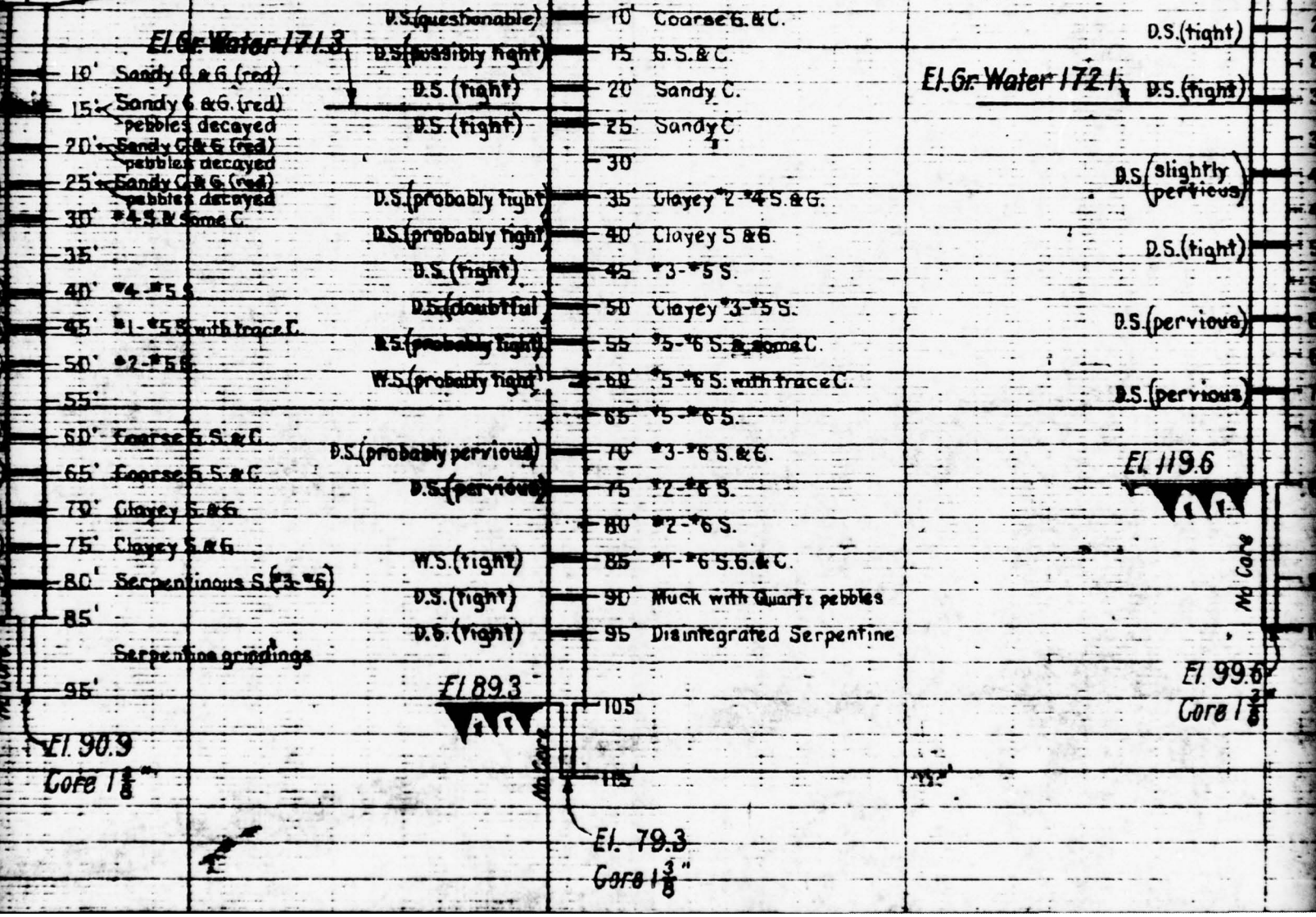
Sur El. 194.3

23/G182

Sur Ft 185.9

El. Gr. Water 171.3

El. Gr. Water 172.1



CH3

Sur Fl 202.6

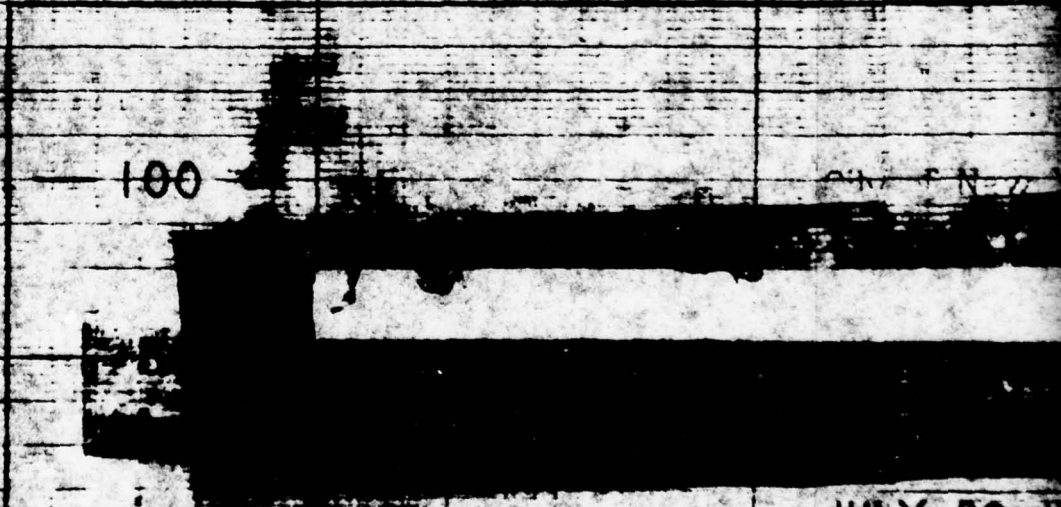
F/G

Sur Fl Lake 203.2 (12/10/11)

- ← Boulders
- 12' Clayey S.
- 20' Clayey #3-#6 S. & G.
- 25' #1-#6 S. with trace C.
- 30' #3-#5 S. & G.
- 35' #2-#5 S. & G.
- 40' #1 & #4-#5 S. & G.
- 45' #2-#4 G. & S. with trace C.
- 50' #4-#5 S. with trace G.
- 55' #1-#2 G. & #4-#6 S.
- 60' #2-#4 S. & G.
- 65' #1-#4 S. & G.
- 70' #2-#4 S.
- 75' #5-#4 S.

25 (right)
 30 (right)
 35 (right)

- 83' Serpentine grindings
- 96' Weathered Serpentine.
- 103'



100

60

JULY 30, 1911

A
Acc C.53H

File Cont. 100 G. 1091

F/113

ELEV

210

200

180

150

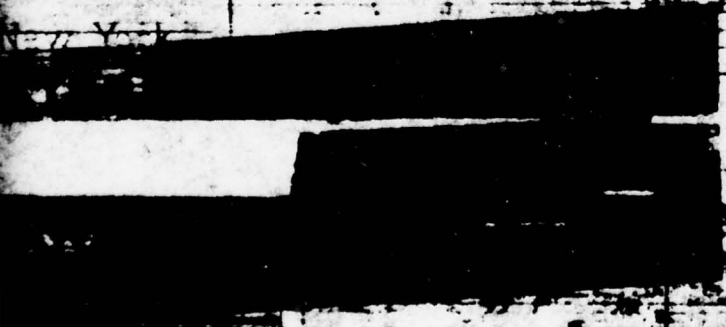
140

120

- 18' Bottom of Lake
- 16' Impalpable lake muck
- 23' Impalpable lake muck
- 20' Impalpable lake muck with trace of G
- 33' Light G with trace of muck
- 38' Light C with trace of G
- 40' Clayey S of G at sites probably light

El 163.2

THIS IS BEST QUALITY PRACTICALLY
AVAILABLE TO DAY



10, 1912.

ACE 65387

Sur. El. 245.3

- 10' D.S. (tight)
- 15' C. 25 courses
- 20' C. 25 S. & G.
- 25' Decayed Serpentine
- 29' Disintegrated Serpentine

D.S. (tight)

EI 202.3
Core 176

#41/G132

Sur. El. 217.7

ELEV
220

ELEV
220

200

180

200

160

180

140

160

120

140

100

120

80

ELEV

230

220

- D.S. (tight) 5' Soil
- D.S. (tight) 10' C. with S.
- D.S. (tight) 15' C. with S.
- D.S. (tight) 20' C. with S. & G.
- D.S. (tight) 25' C. S. & G.
- D.S. (doubtful) 30' #1-#6 G. S. & C.
- D.S. (doubtful) 35' #1-#6 G. S. & C.
- D.S. (pervious) 40' #2-#3 S. with G.
- D.S. (tight) 45' C. with S.
- 50' C. S. & G.
- D.S. (pervious) 55' #3-#6 S.
- D.S. (tight) 60' #2-#5 sandy G.
- D.S. (tight) 65' C. with #3 S.
- D.S. (doubtful) 75' #2-#6 S. with Trade G.
- 79'

EI 132.7
Core 176

Ac. Core

Serpentine grindings

EI 122.7
Core 176

EI Gr. Water 186.8

EI 139.8
Core 176

EI 75.8
Core 176

#41/G132
Sur. El. 217.3

6' Red C. with S. & G.
Boulders

8' #1-#4 S.

26' #4-#5 S.

35' #2-#6

48' #2-#4 S. (trace C.)

50' #2-#6 (trace C.)

60' #3-#4 S.

70' #2-#4 S.

77.5' #2-#4 S. with G.

Serpentine grindings

Soft altered Serpentine

100.5'

#15/G132

#8/G143 (not started under G113)

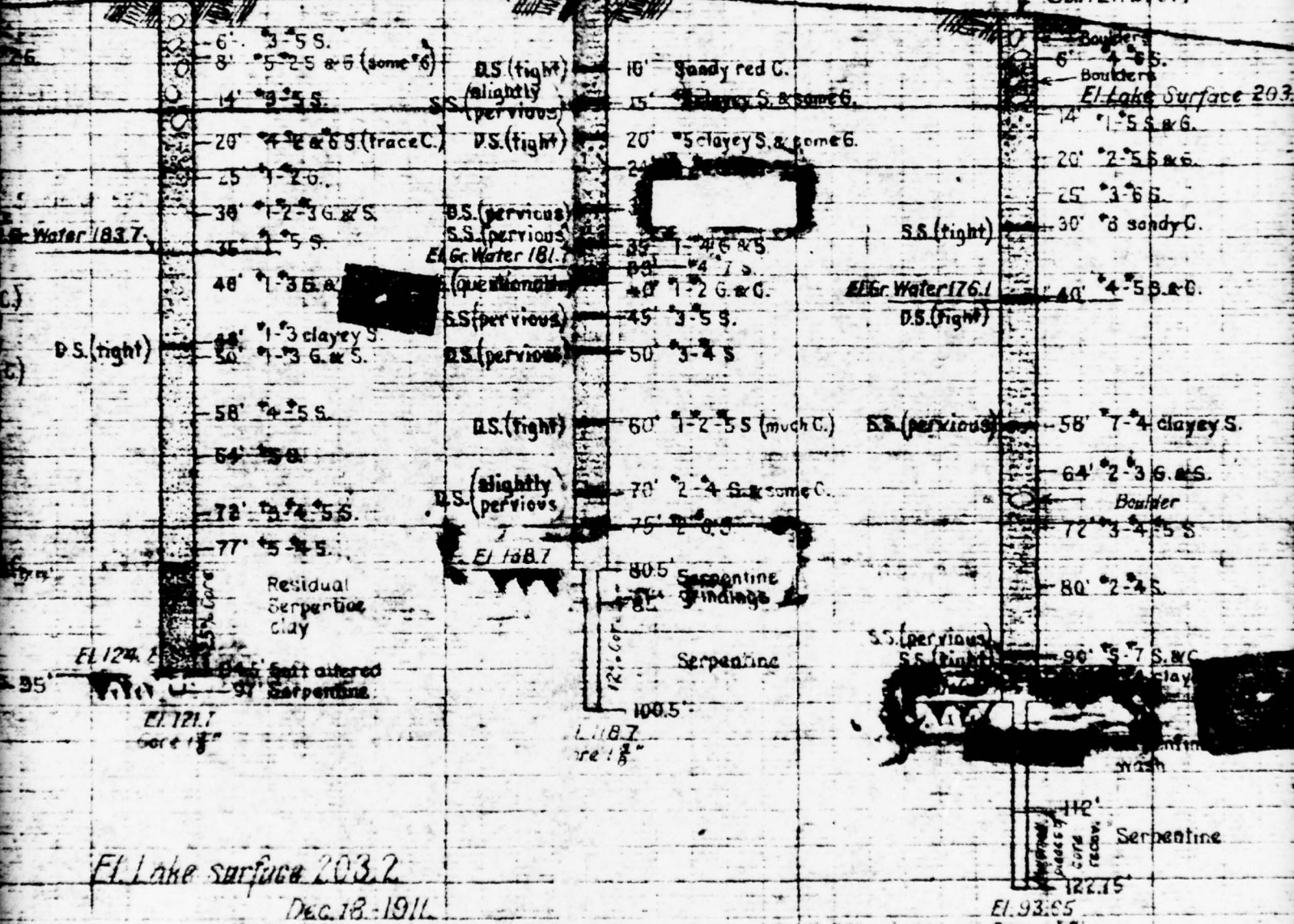
Sur. El. 228.3

Located but

132 (Located approx. 50' to the south)
 EL 212.7
 6/G113
 Sur. El. 218.7

5/G113
 Sur. El. 219.2

4/G113
 Sur. El. 216.4



SOUTH DIKE (Looking south)

14/G132

Boring 3A located approx 130' to the North

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#3/C113
Sur. El. 210.4

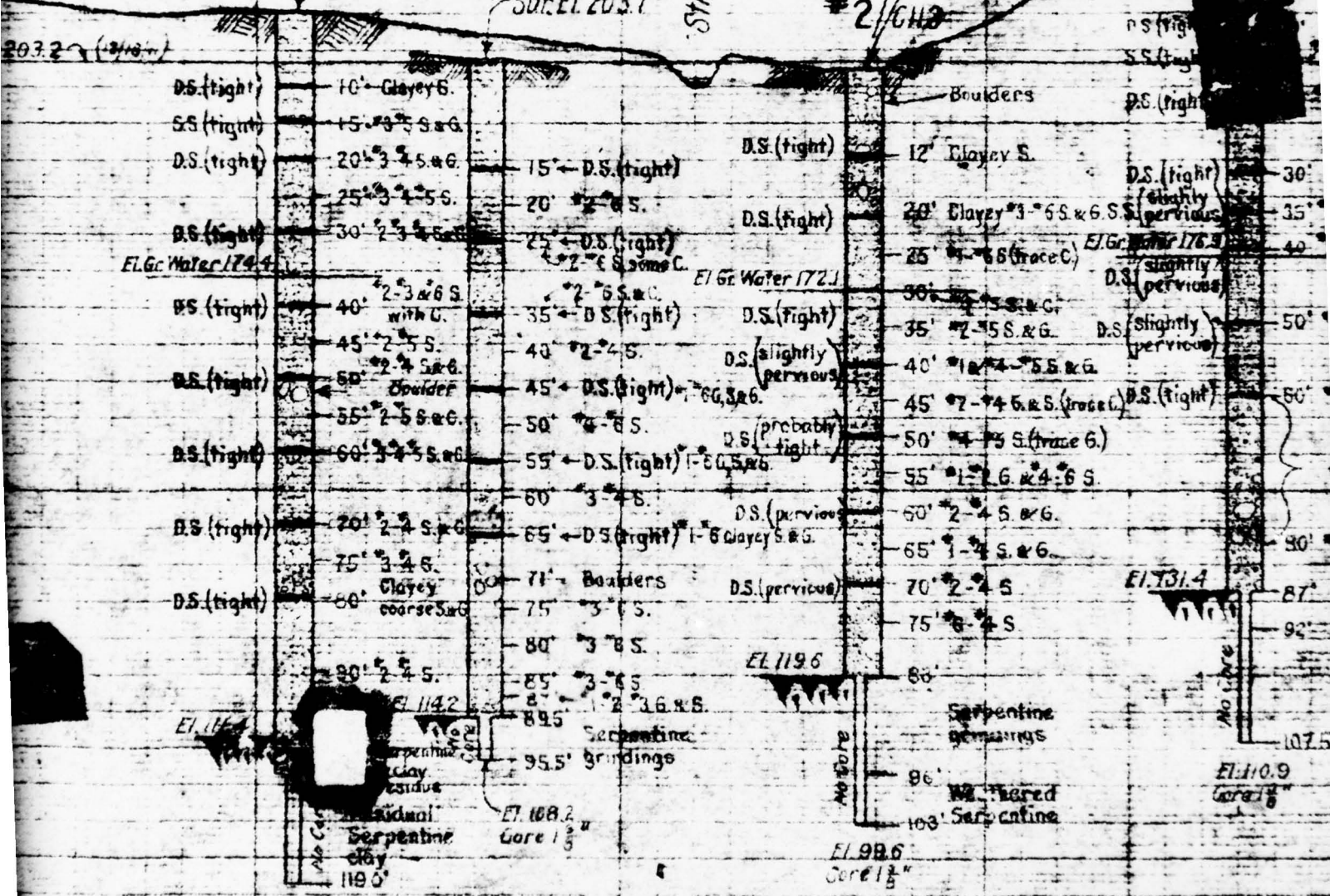
#3A/C113
Sur. El. 203.7

Sur. El. 202.6

#2/C113

#1/C113

203.2 (2/10)



El. 116.4

El. 114.2

El. 119.6

El. 131.4

El. 91.4
Core 1 1/8"

El. 108.2
Core 1 1/8"

El. 99.6
Core 1 1/8"

El. 110.9
Core 1 1/8"

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view Rd.

#13/C113

*20/0
Sur

SCALE V
SUCCESSION

21/C132
Sur. El 224.2

2184
ELEV
220
200
180
160
140
120
100
86

body C. with G.
6 S. with much G.
5 S. with much G.
lightly sandy E.
6 clayey S.
5 S. some C.
4 S. trace C. & G.
4 S. C. & G.
boulders with
4 S.
5 S. with trace C.

10' G.S. & C.
15' G.S. & C.
20' G.S. & C.
25' G.S. & C.
30' Sandy C.
35' Sandy C.
40' Sandy C.
45' Sandy C.
50' C. with G.
57' *5-6 S.
67' Clayey S. & G.
72' Less clayey *1-6 S. & G.
77' Clayey S. & G.
82' *4-6 S.
89' *4-6 S.

El. Gr. Water 177.2

D.S. (tight) 10
D.S. (tight) 15
D.S. (tight) 20
D.S. (tight) 30
D.S. (tight) 35
D.S. (tight) 40
D.S. (tight) 45
D.S. (tight) 50
D.S. (tight) 55
W.S. (tight) 60
W.S. (questionable) 55
D.S. (questionable) 71
D.S. (pervious) 75
D.S. (pervious) 85
D.S. (pervious) 86
D.S. (tight) 90
D.S. (tight) 94
El. 145.6 96
98

126.2
No core
98'
107'
El. 117.2
Core T 1/8"

SOUTH D
(Continued)

To be combined with A

7132

r. El 243.6

LEV.

240

0' G.S.

5' G.S. & C

0' Sandy C

220

ELG. Water 207.6

0' Sandy C & S

5' Sandy C & G

200

5' *4-#6 S. with C

0' *4-#6 S. with some C

5' *4-#6 S. with trace C

180

1' *3-#6 G. & C.

5' *3-#6 S. (above B)

0' *3-#4 S. (below B)

160

5' *3-#5 S.

0' *6-#3 S.

*7-#3 G. & S. with some *4-#6 S. & C.

*2-#5 S. & C.

Serpentine wash.

140

45.6

D.S. = Dry sample

W.S. = Wash sample

120

100

80

DIKE (looking south)

65 C. 5/96

5

Z1 212.3

16' Altered Serpentine

Z1 212.3

Et Lane Surface 203-216

200

180

160

140

120

100

NORTH
(PROFILE

Samples indicated on right of holes
and for determining porosity of the
reliable than the dry and settled sam
left of holes (Hole 3A shows all sampl

D.S. = Dry sample
S.S. = Settled sample

NORTH DI
(PROFILE G

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Clay = C
Sand = S
Boulders = B
Gravel = G

- *1 Coarse Gravel Size above 5 mm
- *2 Fine Gravel " between 5mm
- *3 Coarse Sand " " 1
- *4 Medium Sand " " 5
- *5 Fine Sand " " 25
- *6 Superfine Sand " " 10
- *7 Rock flour and clay " " 05

Drawn CWC
Traced CWC
Checked J. H. [unclear]
[unclear]

Formation determined by [unclear]

For plan local

6

LOG ON W/L

#9/G113 (NOT started under G113)
Sur. El. 205.3

#13/G113
Sur. El. 193.9

#10/G113
Sur. El. 185.1

10 D.S. (probably light)
10 D.S. (light)
El. 192.3
3 Sandy E.
14 Decayed serpentine
El. 191.3

10 D.S. (light)
15 D.S. (light)
20 D.S. (light)
El. 158.15
75.75
Serpentine
35.75

20 D.S. (previous)
30 D.S. (light)
35 D.S. (light)
38 El. 146.1
40 D.S. (light)

TH DIKE (Looking west)
FILE F-F)

... wash samples,
... material are less
... samples indicated on
... notes on right of hole)

#47/G132
Sur. El. 204.2

#43/G137
Sur. El. 190.1
El. Gr. Water 184.1

El. Gr. Water 184.9
El. Gr. Water 185.5

#42/G137
Sur. El. 185.3

#29/G132
Sur. El. 190.1

#31/G132
Sur. El. 184.0

#32/G137
Sur. El. 188.5
El. Gr. Water 185.3

DIKE
G-G)

10 D.S. (light)
15 D.S. (probably light)
El. 185.2
18 Serpentine
23 Serpentine
25 D.S. (previous)
28 (probably light)
El. 182
Core 1/8

10 D.S. (light)
15 D.S. (light)
20 D.S. (light)
25 D.S. (light)
30 D.S. (light)
35 D.S. (light)
40 D.S. (light)
45 D.S. (light)
50 D.S. (light)
55 D.S. (light)
60 D.S. (light)
65 D.S. (light)
70 D.S. (light)
75 D.S. (light)
80 D.S. (light)
85 D.S. (light)
90 D.S. (light)
95 D.S. (light)
100 D.S. (light)

10 D.S. (light)
15 D.S. (light)
20 D.S. (light)
25 D.S. (light)
30 D.S. (light)
35 D.S. (light)
40 D.S. (light)
45 D.S. (light)
50 D.S. (light)
55 D.S. (light)
60 D.S. (light)
65 D.S. (light)
70 D.S. (light)
75 D.S. (light)
80 D.S. (light)
85 D.S. (light)
90 D.S. (light)
95 D.S. (light)
100 D.S. (light)

10 D.S. (light)
15 D.S. (light)
20 D.S. (light)
25 D.S. (light)
30 D.S. (light)
35 D.S. (light)
40 D.S. (light)
45 D.S. (light)
50 D.S. (light)
55 D.S. (light)
60 D.S. (light)
65 D.S. (light)
70 D.S. (light)
75 D.S. (light)
80 D.S. (light)
85 D.S. (light)
90 D.S. (light)
95 D.S. (light)
100 D.S. (light)

mm. and 1 mm.
5
25
10
85
01

El. 160.1
Core 1/8

El. 160.1
Core 1/8

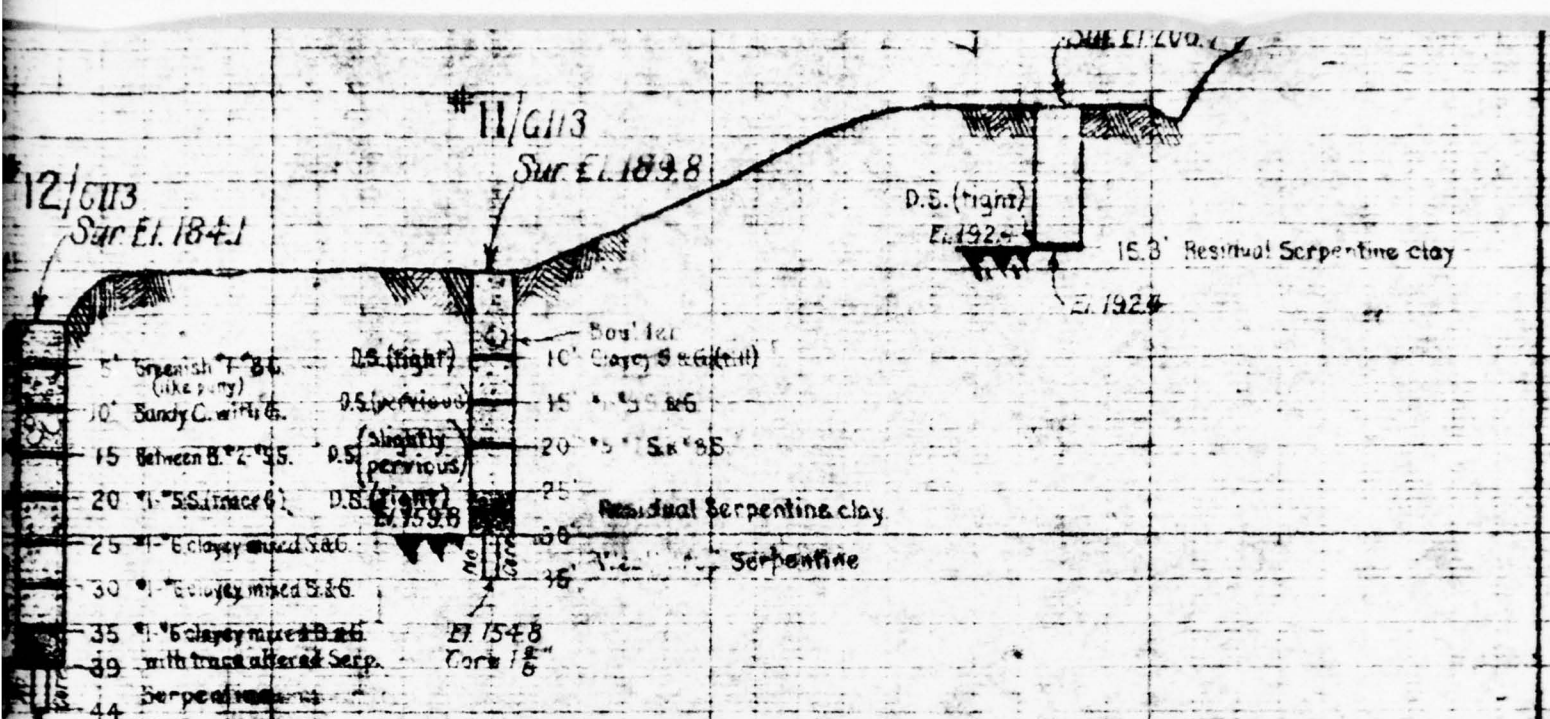
El. 149.6
Core 1/8

El. 146.5
Core 1/8

El. 152.2
Core 1/8

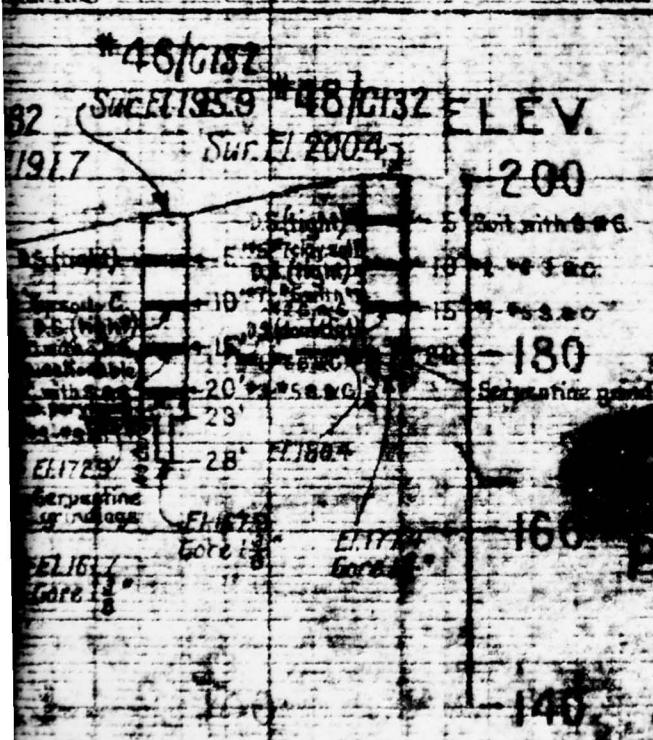
Revised

ations see Aug. 5311



Gr. Water in holes 10-11-12 rises 1 ft. above surface of ground

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City of New York
 BOARD OF WATER SUPPLY
 EVER LAKE RESERVOIR
 PROFILE ON CENTER LINE OF PROPOSED
 NORTH AND SOUTH DIKES

NOVEMBER 21, 1911

To May 1st 1912 for Cont. 113 only

File: Cont. 113 75.08

200

180

160

140

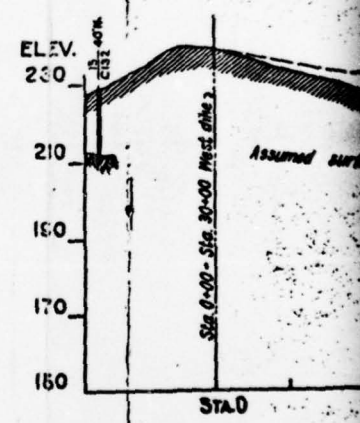
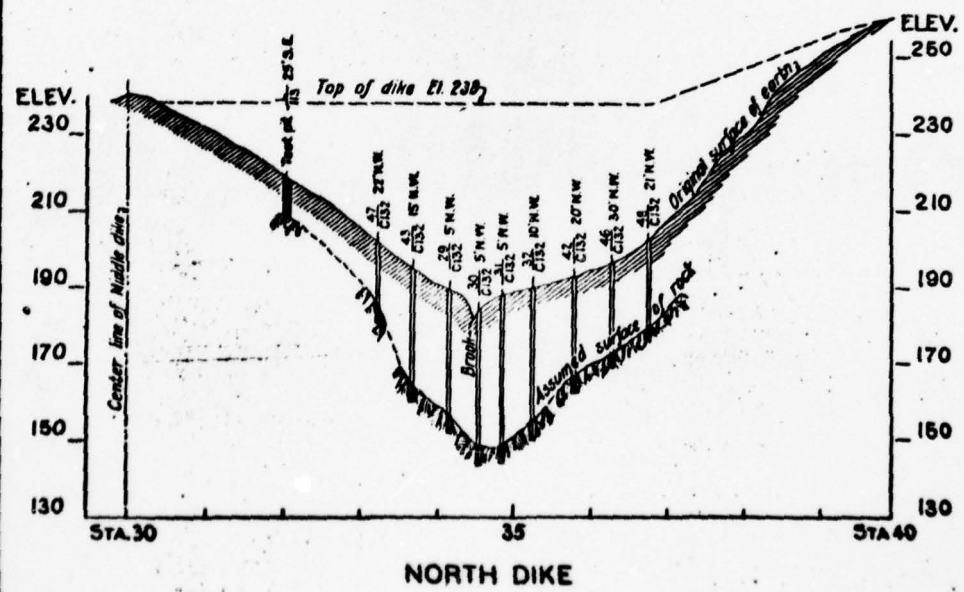
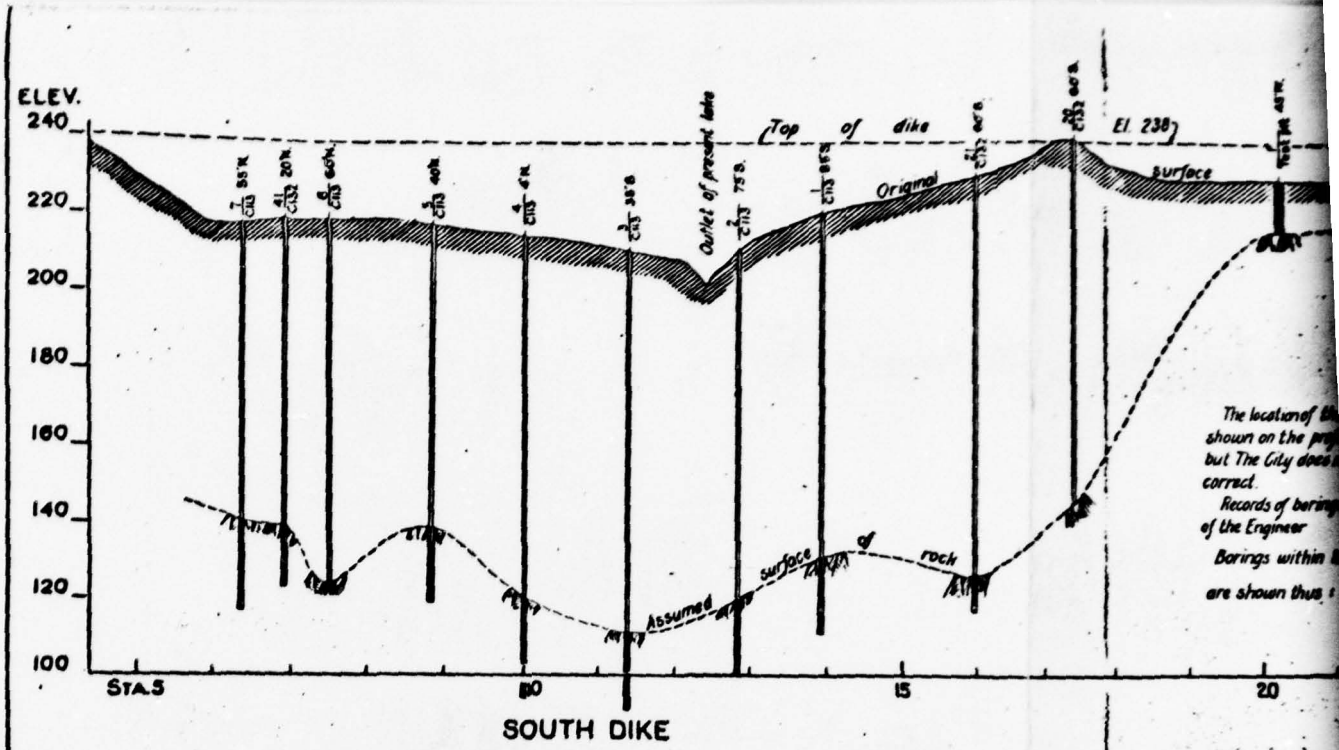
120

100

USED DIKE

#1	Coarse Gravel	Size above	5 mm.
#2	Fine Gravel	" between	5 " and 1 mm.
#3	Coarse Sand	" "	1 " " .5 "
#4	Medium Sand	" "	.5 " " .25 "
#5	Fine Sand	" "	.25 " " .10 "
#6	Superfine Sand	" "	.10 " " .05 "
#7	Rock flour and clay	" "	.05 " " .01 "

See also
 AEC with 65195



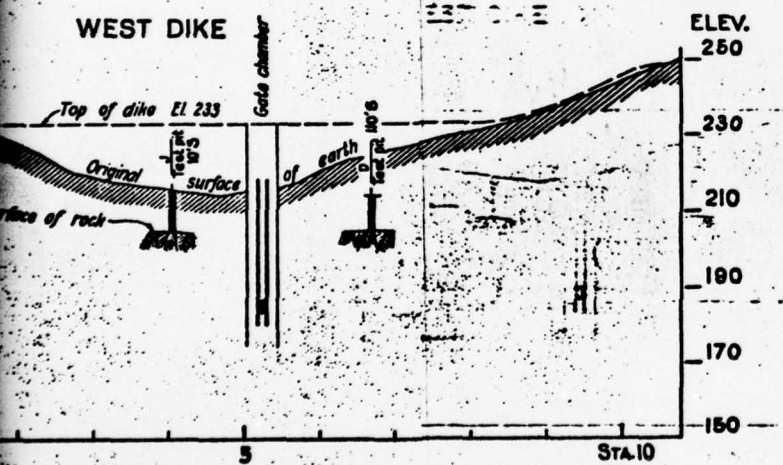
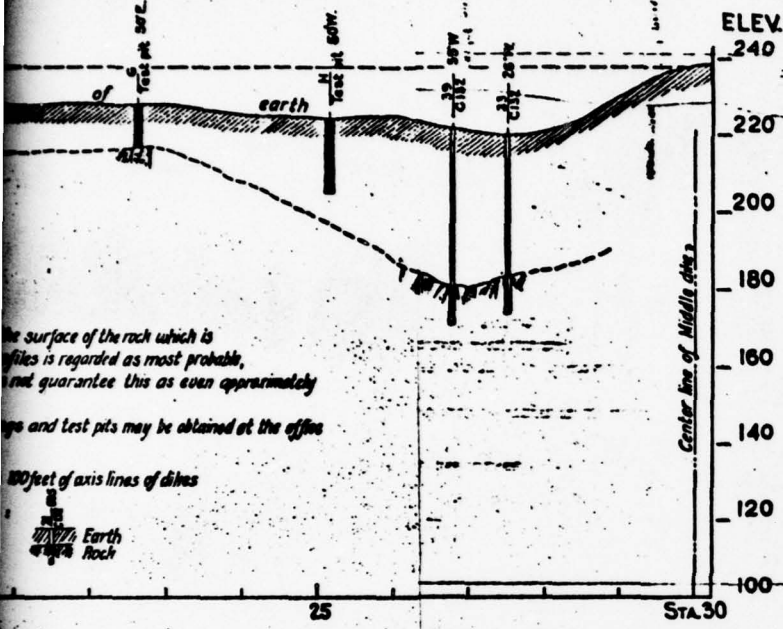
Drawn by J. H. ...
Checked by ...
Designed by ...
J. F. ...
Designing Eng.

TYPICAL SECTIONS OF EMBANKMENTS

THIS PAGE IS BEST COPY AVAILABLE

Alfred

CONTRACT 89 SHEET 8
SHEETS IN SET. 17



MIDDLE DIKE

City of New York
BOARD OF WATER SUPPLY
SILVER LAKE RESERVOIR
PROFILES OF DIKE SITES

QUALITY PRACTICABLE
ED TO DDC

0 10 20 30 40 50 60 70 80 90 100

DECEMBER 12, 1912

PROF. H. H. ...
Dep't Eng Works

2

PHOTOGRAPHS

APPENDIX B



DOWNSTREAM SLOPE OF NORTH DIKE, LOOKING SOUTH



UPSTREAM SLOPE OF NORTH DIKE,
LOOKING NORTH



WET AREA AT BERM LEVEL (EL 218⁺)
OF NORTH DIKE



DOWNSTREAM SLOPE OF WEST DIKE, LOOKING SOUTH



DOWNSTREAM SLOPE OF SOUTH DIKE, LOOKING EAST.
CREST IS NOT VISIBLE; FLAT AREA IS BERM AT EL 218±



DIFFERENTIAL SETTLEMENT OF FACING SLABS
ON NORTHWEST FACE OF MIDDLE DIKE



NORTHWEST FACE OF MIDDLE DIKE, LOOKING
EAST AT NORTH GATE HOUSE FROM WEST END OF DIKE

AD-A064 338

TIPPETTS-ABBETT-MCCARTHY-STRATTON NEW YORK

F/G 13/2

NATIONAL DAM SAFETY PROGRAM. SILVER LAKE RESERVOIR INVENTORY NU--ETC(U)

OCT 78 E O'BRIEN

DACW51-78-C-0024

NL

UNCLASSIFIED

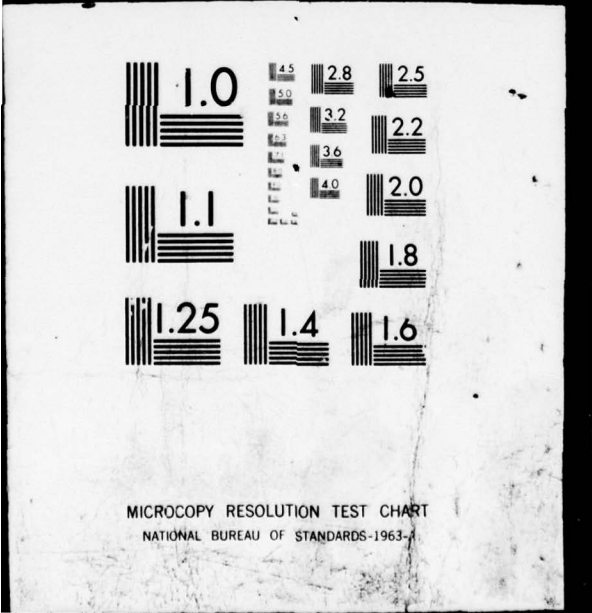
2 OF 1
AD
A064 338



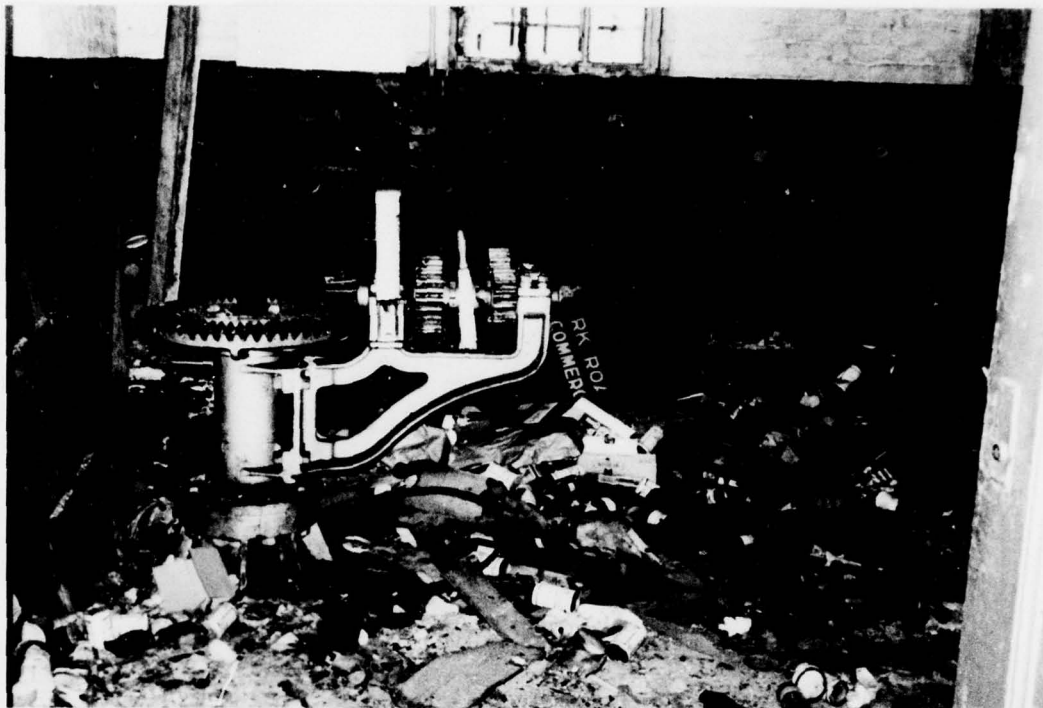
END
DATE
FILMED

4--79
DDC

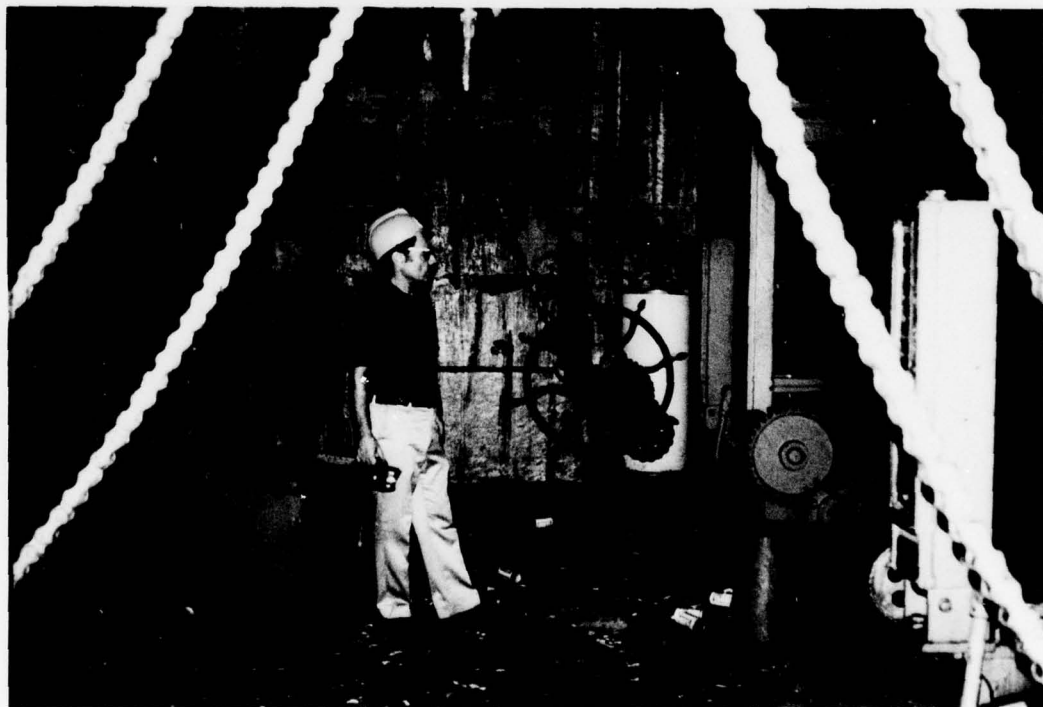
6433



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



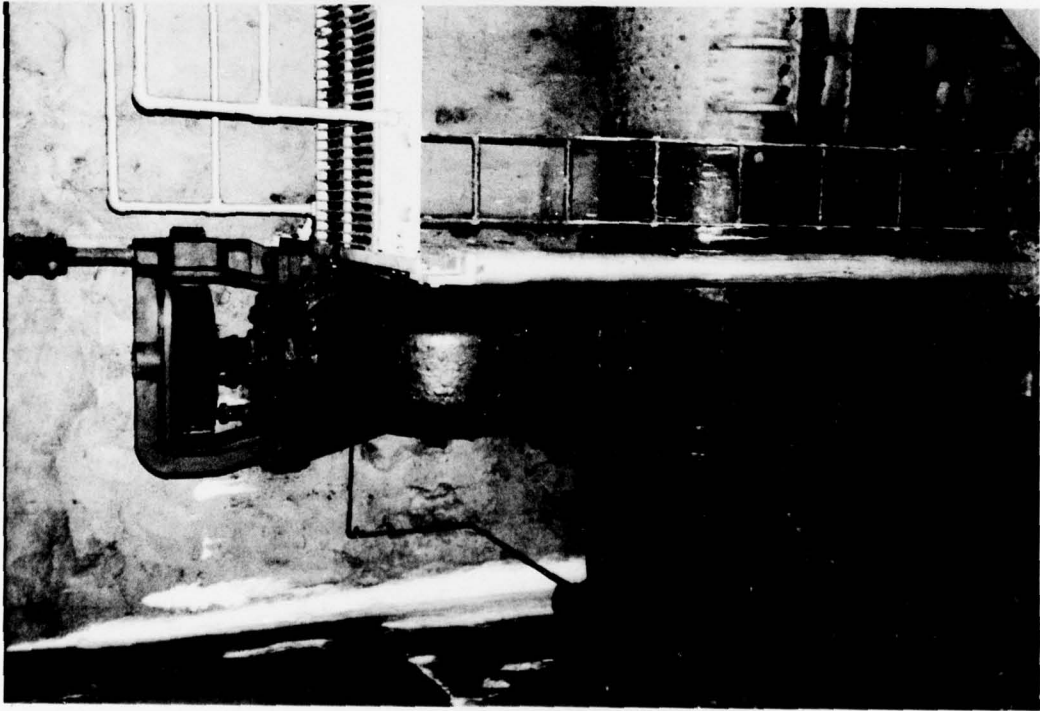
GATE OPERATING STAND FOR SOUTH
BLOW-OFF SLUICE GATE



GATE OPERATING CHAMBER; LOOKING WESTERLY.
GATE OPERATING STAND FOR NORTH BLOW-OFF.
GATE VALVE AT CENTER OF PHOTO.



CORRODED TIE RODS (TYPICAL) CON-
NECTING CONDUIT TO 48 INCH CAST
IRON MANIFOLD



SOUTH BLOW-OFF GATE VALVE,
LOCATED IN VALVE CHAMBER

ENGINEERING DATA CHECKLIST

APPENDIX C

**CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I**

NAME OF DAM SILVER LAKE DAM
ID # 60

ITEM	REMARKS
------	---------

AS-BUILT DRAWINGS	SEE DRAWING LIST
-------------------	------------------

REGIONAL VICINITY MAP	USGS MAPS : NARROWS, NEW YORK & JERSEY CITY, NEW JERSEY
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CONSTRUCTION HISTORY	Contractor Name : Brief construction history is in BOWS Annual reports of 1914, 1915 & 1916.
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TYPICAL SECTIONS OF DAM	} SEE Drawing list.
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OUTLETS-PLAN

-DETAILS

-CONSTRAINTS

-DISCHARGE RATINGS

RAINFALL/RESERVOIR RECORDS

Reservoir Records prior to 1971 is available in Staten Island office of BOWS.

ITEM

REMARKS

DESIGN REPORTS

None available

GEOLOGY REPORTS

None available

DESIGN COMPUTATIONS

None

HYDROLOGY & HYDRAULICS

None

DAM STABILITY

None

SEEPAGE STUDIES

None

MATERIALS INVESTIGATIONS

No Data Available

BORING RECORDS

LABORATORY

FIELD

POST-CONSTRUCTION SURVEYS OF DAM

No post-construction surveys of Dam

BORROW SOURCES

No Data available

ITEM

REMARKS

MONITORING SYSTEMS

None

MODIFICATIONS

None

HIGH POOL RECORDS

Available in Staten Island office of BOWS

POST CONSTRUCTION ENGINEERING

STUDIES AND REPORTS

None

PRIOR ACCIDENTS OR FAILURE OF DAM

DESCRIPTION

None recorded or reported

REPORTS

MAINTENANCE

OPERATION

RECORDS

After 1971 no maintenance done in Gate House,
therefore no maintenance operation records

ITEM

REMARKS

SPILLWAY PLAN

SEE DRAWING LIST

SECTIONS

DETAILS

OPERATING EQUIPMENT

PLANS & DETAILS

one drawing shows the operating equipment, plan & details. See drawing list.

VISUAL INSPECTION CHECKLIST

APPENDIX D

VISUAL INSPECTION CHECKLIST

1. Basic Data

a. General

Name of Dam SILVER LAKE RESERVOIR DAM Hazard Category HIGH

County RICHMOND ID# 60

Stream Name Unnamed Tributary of _____

Location 2 mi. S. of St George Ferry County Nearest Town (P.O.) West New Brighton Staten Island

Longitude _____ Latitude _____ Other Directions _____

West of Victory Blvd in Silver Lake Park

Date of Insp 8.17.78 Weather Clear, Hot Temperature 92°F Max

b. Inspection Personnel TAMS Personnel:

A. Jezierski, Head TAMS Water Resources Div
A. Dolcinascolo, Dam Insp. Coordinator
J. Patel, Geotech. Engineer

c. Persons Contacted Mr. Massacappa, NYC BOWS

d. History: Date Constructed Completed 1977

Present Owner New York City, BOWS

Designed by N.Y.C. BOWS

Constructed by Beaver Eng. & Contract.

Recent History Put out of service 1971

2. Technical Data

Type of Dam Zoned Earth Dam Drainage Area _____ Acres

Height N. DIKE 55' at C N. DIKE 1000'
W. DIKE 18' S. DIKE 35' Length W. DIKE 1400' S. DIKE 1200'

Upstream Slope * _____ Downstream Slope * _____

Crest Width 42'-45' min Freeboard at Spillway Crest 10 ft

*	<u>U/S</u>	<u>D/S</u>	<u>D/S</u>
		<u>Above EI 218</u>	<u>Below EI 218</u>
<u>North Dike</u>	<u>1 on 3</u>	<u>1 on 3</u>	<u>1 on 3</u>
<u>West Dike</u>	<u>1 on 3</u>	<u>1 on 5/6</u>	
<u>South Dike</u>	<u>1 on 3</u>	<u>1 on 2</u>	<u>1 on 3</u>
<u>Middle Dike</u>	<u>1 on 1.75</u>	<u>1.0 on 1.75</u>	

Low Level Control: (Type and Size) Blow-offs Reservoir Mainten.
2- 36" Gate valves 5- 4 8" gate valves
2- 30" x 42" Sluice Gate 2- 3' x 5" Sluice Gates

Valve Condition Fair; Out of service since 1971

Emergency Spillway Type (Material) Concrete Weir Width 2 x 85"

Side Slopes _____

Height (Crest to Top) _____

Exit Slope _____

Exit Length _____

Ponded Surface Area 57.4 Acres

Capacity (Normal Level) 1416 Acre Feet

Capacity Emergency Spillway Level _____ Acre Feet

3. Embankment

① North Dike ③ South Dike

There are 4 dikes: ② West Dike ④ Middle Dike

a. Crest Approx 44' w. 24' roadway for ①②③; 30' for ④

(1) Vertical Alignment For the most part at El 238

No evidence of settlement

(2) Horizontal Alignment Curved & irregular; no evidence of horizontal movement.

(3) Longitudinal Surface Cracks None visible on embankment; some minor cracks on roadway - not related to dam movement

(4) Transverse Surface Cracks Same as (3) above

(5) General Condition of Surface Generally good; Crest of ①②③ contains 24' wide pavement
Crest of ④ contains 16' wide pavement

(6) Miscellaneous _____

b. Upstream Slope

(1) Undesirable Growth or Debris Except for middle dike, there is heavy growth of brush, trees, saplings on U/S slopes above riprap, Esp. N. part of ①

(2) Sloughing, Subsidence, or Depressions None visible, except at one location where disturbances of riprap appears result of vandalism

(3) Slope Protection 1.5'-0.5' stone riprap below El 233 ± on ① ② & ③; 8.5' wide conc. panels on ④; conc. is 8" thick

(a) Condition of Riprap In good condition

(b) Durability of Individual Stones Good

(c) Adequacy of Slope Protection Against Waves and Runoff

Adequate

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

Relatively uniform 1.5' max size
0.5' minimum size

(4) Surface Cracks Conc. slabs on ④ are cracked with brush and small saplings growing from cracks; some differen. settlement of slabs. 1"-2"

c. Downstream Slope

(1) Undesirable Growth or Debris None on N. Dike; Row of planted trees (1.5-2.0' dia) spaced out on W. Dike; heavy brush, trees above El 218 berm on S. Dike

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

None visible

(3) Surface Cracks on Face of Slope None visible

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

None visible

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

Wet soggy area at berm level (E1218±) on N. Dike at N. third point. Area is 25-30 in extent - no seepage visible

(6) Fill Contact with Outlet Structure

No erosion or other problems visible

(7) Condition of Grass Slope Protection Except for S. Dike above E1218, grass slope on D/S slope well maintained by Parks Dept. as part of golf course

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

Wet areas approx 300± ft D/S of Crest,
just below toe; apparently an old spring
which was noted on preconst topo. - no seepage

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.

Only near springs D/S of toe

(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 Not Applicable

(8) Condition of Tailrace Channel Riprap

Not Applicable

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

Not applicable

(10) Miscellaneous

f. Drainage System No drains in embankment dam

(1) Condition of Relief Wells, Drains and Appurtenances

No drains in dam

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

4. Instrumentation

No instrumentation for embankments

(1) Monumentation/Surveys None

(2) Observation Wells None

(3) Weirs None

(4) Piezometers None

(Other)

5. Reservoir

a. Slopes No evidence of distress
or other problems; Reservoir riprapped
on east rim; Riprap is 4' max
hand placed on east rim. Not part
of original construction

b. Sedimentation Not measured; no info available

6. Spillways Two 85" x 17" concrete weirs at gate house; one drains S. pool; other, N. pool

a. Principal Spillway: Inlet Condition Weir El 228

Pipe Condition

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

Only N. Weir could be inspected. Weir flow falls into 85" x 4' x 4' chamber with 32"-33" inch diameter overflow well which leads to 3' x 2.5' blow-off drain to sewer at El 185.0

b. Emergency Spillway: General Condition Structurally good

N. Weir chamber filled with debris by vandals

Tree Growth Not applicable

Erosion Not applicable

Other Observations Metal grate

covers overflow well.

7. Structural (if required) See Attached Appendix

8. Downstream Channel

Not applicable

a. Condition (obstructions, debris, etc.)

Not applicable

b. Slopes Not applicable

c. Approximate No. Homes and Population Golf course

immediately D/S of toe; thereafter heavily populated section of Staten Island

d. General

A. Polamassolo
TEAM CAPTAIN

D-9

STRUCTURAL INSPECTION CHECKLIST

PHASE I DAM INSPECTION

1. Concrete Surfaces Concrete surfaces in gate house generally, Good
2. Structural Cracking Middle dike concrete facing slabs cracked at many locations. Of little consequence
3. Movement - Horizontal and Vertical Alignment _____
4. Junctions with Abutments or Embankments Junction between Gatehouse and Middle Dike appears to be good
5. Drains - Foundation, Joint, Face None
6. Water Passages, Conduits, Sluices Except for N. Weir Chamber, water passages not inspected
7. Seepage or Leakage None visible.
8. Monolith Joints - Construction Joints None visible
9. Foundation _____

10. Abutments _____

11. Control Gates Gate supports are in good condition

12. Approach and Outlet Channels _____

13. Stilling Basin _____

14. Intake Structure _____

15. Settlement None

16. Stability

a. Overturning _____

b. Sliding _____

c. Seismic _____

17. Instrumentation

a. Alignment _____

b. Uplift _____

c. Seismic _____

18. Miscellaneous _____

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX E

TAMS

Job No. 1487-12 Sheet _____ of _____
 Project SILVER LAKE DAM Date 09/6/78
 Subject SAFETY INSPECTION By CV
 Ch'k. by _____

- TOTAL SPILWAY CREST LENGTH $2 \times 85'' = 170'' \rightarrow 14.17'$

SINCE TRAPEZOIDAL SIDES ARE ALMOST VERTICAL ASSUMING
 BROAD CRESTED WEIR C COEFFICIENT FOR 1.5'
 BREADTH APPLICABLE (KING'S TABLE 47)

EL	H	C	$Q = 14.17 C H^{3/2}$ (cfs)	MAX H = 1.5'
229.3	0			
230	0.7	2.72	22.6	
233	3.7	3.32	334.8	NOT APPLICABLE
238	7.7	3.32	1005.0	" "

ORIFICE FLOW FOR $H > 1.5$ THROUGH
 2 RECTANGULAR OPENINGS (TOTAL $1.5 \times 14.17'$)

EL	$h_2 =$ EL-229.3	$h_1 =$ EL-230.8	$Q = \frac{2}{3} (14.17) \sqrt{2g} (h_2^{3/2} - h_1^{3/2})$
233	3.7	2.2	292.2
238	8.7	7.2	480.7

AREA OF 2 33" ϕ OVERFLOW WELLS

$$2 \left[\frac{33}{12} \cdot \frac{1}{2} \right]^2 \pi = 11.88 \text{ ft}^2$$

APPROX. AREA OF SINGLE HORSE-SHOE DRAIN

$$\frac{1}{2} \left[\frac{2.5}{2} \right]^2 \pi = 2.45$$

$$\left(3 - \frac{2.5}{2} \right) (2.5 - .25) = 3.94$$

$$6.39 < 11.88$$

EI

TAMS

Job No. 1487-12

Sheet _____ of _____

Project SILVER LAKE DAM

Date 09/18/78

Subject SAFETY INSPECTION

By CV

Ch'k. by _____

ASSUME 3' X 2.5' HORSESHOE DRAIN IS EQUIVALENT TO 34" ϕ CONC. PIPE 2800' LONG. FOR FULL FLOW

$$\text{OUTLET INV. } 184.0 - 2800 (0.001) = 181.2$$

$$\begin{aligned} \text{HEAD } H &= \text{LAKE EL.} - (181.2 + 3.0(0.85)) \\ &= \text{LAKE EL.} - 183.75 \end{aligned}$$

$$H = \left[\frac{2.5204 (1+0.5)}{\left(\frac{34}{12}\right)^4} + \frac{466.18 (0.013)^2 (2800)}{\left(\frac{34}{12}\right)^{16/3}} \right] \frac{Q^2}{102}$$

$$\text{OR } Q = \sqrt{\frac{100 H}{0.91244}}$$

EL	H	Q
229.3	45.55	70.65
230	46.25	71.20
233	49.25	73.47
238	54.25	77.11