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BAKER (MICHAEL) JR INC BEAVER PA

NATIONAL DAM SAFETY PROGRAM. EARL RESERVOIR DAM (INVENTORY NUMB--ETC(U)

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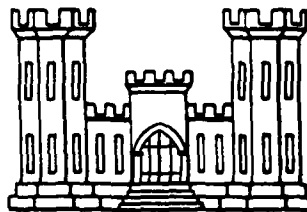
LOWER HUDSON RIVER BASIN

EARL RESERVOIR DAM

ORANGE COUNTY, NEW YORK
INVENTORY NO. N.Y. 203

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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NEW YORK DISTRICT CORPS OF ENGINEERS

JUNE 1981

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21. 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. Examination of available documents and a visual inspec- tion of the dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property.		

Using the Corps of Engineers' screening criteria, it has been determined that the dam will pass 100 percent of the Probable Maximum Flood (PMF) without overtopping the dam. The spillway is, therefore, adjudged as "adequate." No signs of embankment instability were observed; therefore, no stability analysis will be required.

Current inspection and maintenance procedures by the owner are adequate, but need to be documented. Monitoring of the reservoir levels should be expanded to include readings during peak flow periods.

The following remedial measures must be completed within one year:

1. Add riprap to the spillway discharge channel downstream of the plunge pool to prevent further undercutting of the right wing wall.
2. Point the deteriorated joints in the dam masonry core wall and spillway discharge channel wing wall.
3. Riprap or pave the eroded channel along the toe of the embankment with the right abutment to prevent further erosion.
4. Cut the small trees, near the junction of the left and right abutments with the dam, off at ground level and mow the embankment regularly.

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PREFACE

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

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

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

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

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
EARL RESERVOIR DAM
I.D. No. NY 203
DEC DAM No. 195C-453 LOWER HUDSON RIVER BASIN
ORANGE COUNTY, NEW YORK

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Earl Reservoir Dam (I.D. No. NY 203)
State: New York
County: Orange
Stream: Tributary of Woodbury Creek
Dates of Inspection: 9 January 1981
9 March 1981

ASSESSMENT

Examination of available documents and a visual inspection of the dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property.

Using the Corps of Engineers' screening criteria, it has been determined that the dam will pass 100 percent of the Probable Maximum Flood (PMF) without overtopping the dam. The spillway is, therefore, adjudged as "adequate." No signs of embankment instability were observed; therefore, no stability analysis will be required.

Current inspection and maintenance procedures by the owner are adequate, but need to be documented. Monitoring of the reservoir levels should be expanded to include readings during peak flow periods.

The following remedial measures must be completed within one year:

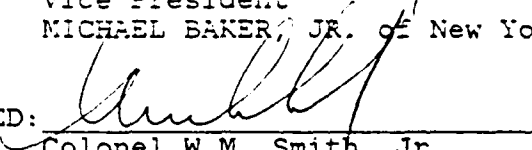
1. Add riprap to the spillway discharge channel downstream of the plunge pool to prevent further undercutting of the right wing wall.
2. Point the deteriorated joints in the dam masonry core wall and spillway discharge channel wing wall.
3. Riprap or pave the eroded channel along the toe of the embankment with the right abutment to prevent further erosion.
4. Cut the small trees, near the junction of the left and right abutments with the dam, off at ground level and mow the embankment regularly.

5. Install a staff gage to monitor reservoir levels above normal pool.

SUBMITTED: 

Granville Kester, Jr., P.E.
Vice President

MICHAEL BAKER, JR. of New York, INC.

APPROVED: 

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

DATE: 30 JUN 1981



Overall View of Dam
Earl Reservoir Dam
I.D. No. NY 203
9 March 1981

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
EARL RESERVOIR DAM
I.D. No. NY 203
DEC DAM No. 453
HUDSON RIVER BASIN
ORANGE COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

- a. Authority - The Phase I Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.
- b. Purpose of Inspection - This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances - Earl Reservoir Dam is an earthfill embankment with a masonry core wall and a 2-foot thick concrete facing on the upstream side of the masonry wall. The core wall, which has been capped with concrete, extends above the earth embankment and forms the crest of the dam. The core wall is founded a minimum of 5 feet below original ground. There is no internal drainage system for the dam.

The dam is 460 feet long and 26.3 feet high, measured from tailwater to the top of dam. The crest width varies from 3.6 feet at the left¹ side of the dam to 7.1 feet at the center to 4.2 feet at the right side of the dam. A three sided, rectangular shaped, concrete spillway is located at the center of the dam. The crest of the spillway is a concrete broad-crested weir, 110 feet long and

¹Looking downstream left to right.

8 inches wide, with an inclined upstream face and vertical downstream face. Water passing over the weir cascades down a series of concrete steps to a concrete apron. Water then flows over the apron through the dam via a culvert, 15 feet wide by 15.5 feet high. Upon leaving the culvert, water drops about 11 feet into a masonry plunge pool provided for energy dissipation and then passes into a riprapped channel and natural stream channel.

The outlet works consist of a 12-inch cast iron pipe and a 20-inch cast iron pipe placed through the right side of the dam. Slide gate controls for the pipes are located in a manhole on the downstream side of the dam, right side of the spillway discharge channel. The 20-inch cast iron pipe exits into the masonry plunge pool underneath the concrete spillway discharge channel. The 12-inch cast iron pipe exits into the natural stream channel downstream of the dam and has an additional slide gate at the outlet.

- b. Location - Earl Reservoir Dam is located in the Town of Woodbury, Orange County, New York, on an unnamed tributary of Woodbury Creek. The coordinates of the dam are N 41° 21.8' and W 74° 8.2'. The dam and reservoir are located on the USGS 7.5 minute topographic quadrangle, Monroe, New York. A Location Plan is included in Appendix E.
- c. Size Classification - Earl Reservoir Dam is 26.3 feet high and the reservoir storage capacity at the top of the dam is 172 acre-feet. Therefore, the dam is in the "small" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.
- d. Hazard Classification - Ridge Road is located about 800 feet downstream of the dam. Six homes are situated just downstream of Ridge Road. There is danger of loss of human life from large flows downstream of the dam. Therefore, Earl Reservoir Dam is considered to be in the "high" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.
- e. Ownership - The dam and reservoir are owned by the Town of Woodbury, Albany Turnpike (Route 32), Highland Mills, New York 10930. The contact person is Mr. Richard Wilson (Telephone 914-928-6707).

- 10
- f. Purpose of the Dam - The dam was originally used for water supply but now is used for recreational purposes by the Town of Woodbury.
 - g. Design and Construction History - The dam was originally constructed in 1912 by the Town of Woodbury. The dam was reconstructed in 1980 by Raimondi Associates, Monroe, New York 10950. The designer for the reconstruction was A.G. Lichtenstein and Associates, Teaneck, New Jersey 07666.
 - h. Normal Operating Procedures - The reservoir is normally maintained at the elevation of the spillway weir crest at elevation 1005.1 T.B.M.² There are no written, formal operational procedures for Earl Reservoir Dam.

1.3 PERTINENT DATA

- a. Drainage Area (Acres) - 450
- b. Discharge at Dam (c.f.s.) -
 - Spillway at Top of Dam (Minimum) 1928
 - Reservoir Drain at Normal Pool
 - Elevation = 1005.1 Feet T.B.M. 55.1
- c. Elevations (Feet T.B.M.) -
 - Top of Dam (Concrete Cap) 1008.9
 - Top of Dam (Minimum on Left Abutment) 1007.9
 - Spillway Crest 1005.1
 - Reservoir Drain Inlet Invert
 - 12-Inch Cast Iron Pipe 986.9
 - 20-Inch Cast Iron Pipe 986.9
- d. Reservoir Surface Area (Acres) -
 - Top of Dam (Minimum) 19.8
 - Spillway Crest 16.0
- e. Reservoir Storage Capacity (Acre-Feet) -
 - Top of Dam (Minimum) 172.0
 - Spillway Crest 122.0

²Temporary Bench Mark (T.B.M.) is top of manhole on the right side of the spillway, downstream side of the embankment. The assumed elevation is 1000.0 feet.

f. Dam -

Type: Earthfill embankment with a masonry and concrete core wall capped with concrete.

Length (Feet) 460

Slopes (Vertical:Horizontal)

Upstream - Embankment submerged 1:4

Downstream - 1:2.5

Crest Width (Feet)

Concrete cap at center of dam 7.1

Concrete cap at left abutment 3.6

Concrete cap at right abutment 4.2

Concrete cap and flat portion of earth embankment at center of dam 13.5

g. Spillway -

Type: Uncontrolled, three sided, rectangular shaped concrete weir

Length of Crest Perpendicular to Direction of Flow (feet) 110

Width of Crest Parallel to Direction of Flow (inches) 8

h. Reservoir Drain -

Type: A 12-inch cast iron pipe and a 20-inch cast iron pipe.

Control: Slide gate controls for both pipes are located in a manhole on the downstream side of the dam, right side of the spillway discharge channel. A second slide gate is present at the outlet of the 12-inch pipe.

i. Appurtenant Structures - An abandoned pump house is located downstream of the toe of the dam above the outlet of the 12-inch cast iron pipe.

SECTION 2: ENGINEERING DATA

2.1 GEOLOGY

Earl Reservoir Dam is located in a small eastern remnant of the "Appalachian Uplands" physiographic province of New York State. The province was formed by dissection of the uplifted but generally flat lying sandstones of the Middle Devonian Catskill Delta. Relief is high to moderate. Bedrock occurring in the immediate vicinity of the dam consists of undifferentiated sedimentary strata of the Hamilton Group, Middle Devonian Period (approximately 380 million years old), according to available geologic maps for New York State by J.G. Broughton and others (1970). Float exposed in the stream bed immediately below the dam indicates that the Skunneunk Formation, consisting of sandstone and conglomerate, may actually underlie the dam. In-place bedrock was not exposed locally for examination. Faulting is not indicated in the vicinity of the dam, according to available information. The region has been repeatedly glaciated by the major ice sheet advances which occurred during the Pleistocene Epoch. The most recent ice advance ended approximately 11,000 years ago.

2.2 SUBSURFACE INVESTIGATION

According to the available (preliminary) soils report for Orange County prepared by the USDA Soil Conservation Service, local materials consist of "Bath Silt Loam" soils. These soils are described as deep (6+ feet), well drained, yellowish brown, strongly to medium acid, medium textured soils having a firm fragipan and formed in deep glacial till derived mainly from slates, shales and sandstone. Bath soils reportedly have 2 to 2-1/2 feet of moderately permeable gravelly loam overlying 1-1/2 to 4 feet of slowly permeable, very firm gravelly silt loam.

Nine borings were completed in 1977 immediately adjacent to the dam to facilitate plans for its rehabilitation. The boring logs are included in the engineering report included in Appendix E. The locations of these borings are shown on rehabilitation plans which are included in Appendix E. The borings did not encounter bedrock and extended typically through 16 to 31 feet of clay silt having small amounts of sand and gravel.

2.3 DAM AND APPURTENANT STRUCTURES

The dam was originally constructed in 1912 by the Town of Woodbury for water supply purposes. The impoundment has not been used since approximately 1940 for water supply, but has been subsequently used for recreational purposes by the town. The original construction reportedly consisted of an earth dam with a masonry core wall and centrally located masonry spillway (refer to documentation in Appendix E). The core wall extended from 5 to 15 or 20 feet below original ground according to best available information (refer to letter of 17 October 1912 in Appendix F). A 24-inch diameter reservoir drain and 12-inch diameter water supply pipe, each with slide gate controls on the upstream side of the dam, were available.

Because of the occurrence of several significant leaks during the 1970's, apparent piping of embankment materials, and plugging of the 24-inch drain, the dam was recently rehabilitated, principally for recreational purposes. Rehabilitation consisted of installation of a larger three-sided concrete spillway (110 feet total length) on the upstream side of the dam to act as a discharge "culvert" (Photo 3). The upstream side and crest of the original core wall were faced with 2 feet of concrete bonded to the masonry work with epoxy cement to reduce leakage (Photo 3). In addition, a clay blanket was placed on most of the upstream side of the rehabilitated structure and adjacent impoundment area. New intake structures were constructed for the existing 24-inch reservoir drain and 12-inch water supply pipe. A new 20-inch pipe was placed within the 24-inch pipe. The original slide gate controls were eliminated and new slide gate controls were placed in a manhole on the right downstream side of the spillway discharge channel. A Field Sketch, which illustrates present dam conditions, is included as Plate 1 in Appendix E.

The design engineer for the rehabilitation project was A.G. Lichtenstein and Associates of Teaneck, New Jersey. The construction engineer was Raimondi Associates of Monroe, New York.

2.4 CONSTRUCTION RECORDS

A single letter is available, dated 17 October 1912, which describes features related to original construction of the dam. Specifically, the letter discusses excavation of the masonry core wall trench. The letter

is included in Appendix F. The original construction is also discussed generally in the March 1978 Engineer's Report for the Rehabilitation of Earl Reservoir. The engineering report and accompanying engineering drawings are included in Appendix E.

2.5 OPERATION RECORDS

No operation records were found during this investigation.

2.6 EVALUATION OF DATA

Engineering data were obtained from files of the New York State Department of Environmental Conservation and from Mr. Ron Rothenburg of Raimondi Associates. The available data are considered adequate and reliable for Phase I Inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

- a. General - The inspection of Earl Reservoir Dam was conducted on 9 January 1981. The weather was cloudy and cold with temperatures ranging from 10°F to 15°F. At the time of inspection, approximately 3 inches of snow covered the ground. The reservoir was frozen over and the elevation of the ice was 1005.1 T.B.M. Deficiencies found during the inspection will require remedial treatment. A Field Sketch of conditions found during the inspection is included in Appendix F. The complete Visual Inspection Checklist is presented as Appendix B. Because there was a snow cover on the dam during the initial inspection, a follow-up inspection was carried out on 11 March 1981.
- b. Spillway - At the time of inspection, the spillway, described in Section 1.2a., was found to be in excellent condition. There was no cracking or spalling observed in the concrete of the spillway and spillway apron as shown in Photos 2 and 3. However, the spillway was covered by ice and snow. The spillway discharge channel, as described in Section 1.2a., was found to be in good condition. The sides of the discharge channel are masonry wing walls which connect with the masonry core wall of the dam. Some masonry joints in the upper portion of the wing walls, near the core wall, are deteriorated. The right wing wall, downstream of the plunge pool is slightly undercut.
- c. Embankment - The embankment was covered by about 3 inches of snow at the time of inspection. Overall, the dam, as described in Section 1.2a., appears to be in good condition. The horizontal and vertical alignments are good and no surface cracks were observed. Some joints in the masonry core wall, exposed on the downstream side of the dam, are deteriorated, as shown in Photo 6. A few small trees, as shown in Photo 7, were found near the junctions of the left and right abutments with the dam. A seep of about 3 gallons per minute occurs from a 15-foot wide area located near the toe of the embankment, right of the spillway discharge channel. A drainage culvert outlets at the far right downstream side of the dam. Drainage from the culvert has eroded a 2-foot deep ditch along the junction of the right abutment with the downstream embankment.

- d. 9 March 1981 Inspection - The reservoir had risen to the spillway crest at the time of the second inspection. The only additional observation made during this inspection was that there is a saturated area covering approximately 30 square feet at the downstream toe of the dam. This area is approximately 25 feet to the right of the spillway discharge channel. There was no discernable flow from the area. This is the same area of seepage observed in the original inspection.
- e. Outlet Works - The outlet works, as described in Section 1.2a., appear to be in good condition. The inlets for the 12-inch and 20-inch pipes, although not directly observed, are new. The piping system and gates located in the manhole are newly constructed. The additional gate on the outlet of the 12-inch pipe is rusty (see Photo 5).
- f. Downstream Channel - The downstream channel is a natural stream channel which flows in a narrow valley. The side slopes of the valley are steep and wooded. The stream slope is steep, approximately 9 percent.
- g. Reservoir - The slopes immediately adjacent to the reservoir are shallow and largely covered with grass. Steep wooded slopes are present at the upper end of the reservoir. There were no reservoir monitoring instruments observed.

3.2 EVALUATION

Visual inspection revealed several deficiencies in this structure. The following items were noted:)

1. A seep is located near the toe of the embankment, right of the spillway discharge channel,)
2. (The right wing wall is undercut downstream of the plunge pool,)
3. (Some of the joints in the masonry core wall are deteriorated,)
4. (Some of the joints in the upper portion of the wing walls are deteriorated,)
5. (Drainage from a culvert at the far right downstream side of the dam has eroded a 2-foot deep ditch along the downstream toe of the dam, and)
6. (A few small trees are near the junctions of the left and right abutments with the dam.←

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The operation of the dam is an automatic function controlled by the crest of the spillway.

4.2 MAINTENANCE OF THE DAM

Maintenance of the dam is the responsibility of the owner. There are no formal inspection and maintenance procedures for Earl Reservoir Dam.

4.3 WARNING SYSTEM

There is no warning procedure or emergency action plan in the event of dam failure.

4.4 EVALUATION

It is recommended that formal inspection and maintenance procedures be developed and implemented. Maintenance items should be corrected annually. A warning system and emergency action plan should be developed and implemented.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed above Earl Reservoir Dam was made using the Monroe and Maybrook, New York USGS 7.5 minute quadrangles. The drainage basin is wooded. Slopes near the reservoir are moderate, approximately 13%, and are steep, approximately 33%, in the upper reaches of the watershed. The total drainage area is 450 acres (0.70 square miles).

5.2 ANALYSIS CRITERIA

An hydrologic analysis of the watershed and hydraulic analysis of the dam was conducted using the U.S. Army Corps of Engineers' Flood Hydrograph Package HEC-1 DB computer program (Reference 12, Appendix D). The unit hydrograph was defined using the Snyder Unit Hydrograph Method. Estimates of Snyder hydrograph coefficients were based upon average coefficients from the Hydrologic Flood Routing Model for Lower Hudson River Basin (Reference 16, Appendix D). Precipitation data was taken from Hydrometeorological Report No. 33 (Reference 8, Appendix D). Rainfall losses were estimated at an initial loss of 1.0 inch and a constant loss rate of 0.1 inch per hour thereafter. The hydraulic capacity of the dam, reservoir, and spillway was determined by incorporating the Modified Puls Routing Method. All flood routings were begun with the reservoir at normal pool level. Outlet discharge capacity was computed by hand. The Probable Maximum Flood (PMF) and 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir.

5.3 SPILLWAY CAPACITY

With the reservoir level at the minimum top of dam, the spillway capacity was determined to be 1928 cubic feet per second (c.f.s.).

5.4 RESERVOIR CAPACITY

The storage capacity of Earl Reservoir at normal pool is 122 acre-feet. The storage capacity of the reservoir at the minimum top of dam is 172 acre-feet. Therefore, flood control storage of the reservoir between the spillway crest and top of dam is 50 acre-feet. This volume represents a total of 1.34 inches of runoff from the watershed.

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5.5 FLOODS OF RECORD

No records concerning the effects of significant floods on the dam and spillway are available.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway is 1928 c.f.s. before overtopping would occur. The peak outflow of the PMF is 1778 c.f.s. and the 1/2 PMF is 883 c.f.s. Therefore, the spillway is capable of passing 100% of the PMF.

5.7 RESERVOIR EMPTYING POTENTIAL

The reservoir can be drawn down by means of a 12-inch and a 20-inch cast iron pipe, as described in Section 1.2a. Neglecting inflow, the reservoir can be drawn down from normal pool in approximately 35 hours. This is equivalent to an approximate drawdown rate of 0.5 feet per hour, based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 EVALUATION

Earl Reservoir Dam is a "small" size - "high" hazard dam requiring the spillway to pass a flood in the range of the 1/2 PMF to PMF. The PMF and 1/2 PMF were routed through the watershed and dam. It was determined that the spillway is capable of passing 100% of the PMF without overtopping the dam. The spillway is, therefore, judged to be "adequate".

Conclusions pertain to present conditions and the effect of future development on the hydrology has not been considered.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF EMBANKMENT STABILITY

- a. Visual Observations - No signs of instability were noted during the visual inspection. Minor problems observed which could potentially affect the stability of the dam include:
 1. A ditch approximately 2 feet deep has been eroded along a portion of the junction of the right abutment and downstream embankment (see Photo 7). This steepening of the foundation for the embankment could result in slumping if erosion is allowed to continue.
 2. A seep totalling approximately 3 gallons per minute occurs from a 15-foot wide area located just downstream of the left end of the right downstream embankment.
- b. Design and Construction Data - Design and rehabilitation information concerning the stability of the embankment was not available.
- c. Operating Records - Operating records are not available.
- d. Post Construction Changes - The dam was recently rehabilitated as discussed in Section 2. Rehabilitation measures that are related to the stability of the dam include:
 1. The spillway was totally reconstructed and its capacity increased, thereby reducing the possibility of overtopping.
 2. Leakage through the dam was reduced by facing the original masonry core wall with concrete and installing a clay blanket along the upstream slope of the dam and immediate reservoir area.
 3. Reconstructed embankment slopes are gentle (flatter than 1V:2.5H).
 4. The original 24-inch reservoir drain pipe, which had become inoperable, was replaced with a new 20-inch cast iron pipe grouted into the old one, thereby re-establishing the capability of rapid drawdown as necessary.

6.2 STABILITY ANALYSIS

The results of a previous stability analysis were not available for reference during this evaluation. The dam might technically be considered a diaphragm type, but is considered to be more comparable to a zoned earthfill dam. The dam is 26.3 feet high, as measured from the crest of the dam to the tailwater in the plunge pool between the wing walls. The width of the crest varies; it is widest in the center and narrower at each end. The width near the center is approximately 13.5 feet, including the width of the exposed core wall plus the flat top portions of the upstream and downstream embankments. The most narrow width is 3.6 feet at the left end of the dam where only the concrete faced masonry core wall is present, and there is virtually no embankment on either side. The core of the dam is founded in a positive cut-off trench.

The upstream embankment slope is 1V:4H, as shown on the rehabilitation plans in Appendix E. The downstream embankment slope was measured at 1V:2.5H, although it is shown as 1V:2H on the rehabilitation plans. The dam is subject to rapid drawdown (greater than 0.5 feet per day) due to the availability of the 12- and 20-inch outlets.

The slopes of the embankments are not overly steep and appeared to be stable at the time of inspection. Therefore, a stability analysis of the structure is not considered necessary at this time.

6.3 SEISMIC STABILITY

Earl Reservoir Dam is located in Seismic Zone 1 which presents no hazard from earthquakes, according to the Recommended Guidelines for Safety Inspection of Dams. This determination is contingent on the requirements that static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

- a. Safety - Examination of available documents and visual inspections of Earl Reservoir Dam did not reveal any hazardous conditions.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, it has been determined that the spillway is capable of passing 100% of the PMF without overtopping the dam. The spillway is therefore adjudged as "adequate". A stability analysis of the dam is not considered necessary at this time.

- b. Adequacy of Information - The engineering information reviewed is considered adequate for a Phase I Inspection.
- c. Need for Additional Investigation - Considering the present condition of the dam and reservoir, there is no need for additional investigation at this time.
- d. Urgency - The owner must complete the recommended corrective measures within one year of notification.

7.2 RECOMMENDED MEASURES

It is recommended that formal inspection and maintenance procedures be developed and implemented. Maintenance items should be corrected annually. A warning system and emergency action plan should be developed and implemented.

The seep near the toe of the embankment should be examined at regular intervals and after periods of heavy rain for turbidity and increase in flow, which may indicate the potential for piping of embankment material. If turbidity and increased flows are noted, a qualified geotechnical engineering firm should be retained to perform a stability check of the dam and plan remedial measures.

The following remedial measures must be completed within one year of notification:

1. Add riprap to the spillway discharge channel downstream of the plunge pool to prevent further undercutting of the right wing wall.

2. Point the deteriorated joints in the dam masonry core wall and spillway discharge channel wing wall.
3. Riprap or pave the eroded channel along the toe of the embankment with the right abutment to prevent further erosion.
4. Cut the small trees, near the junction of the left and right abutments with the dam, off at ground level and mow the embankment regularly.
5. Install a staff gage to monitor reservoir levels above normal pool.

APPENDIX A
PHOTOGRAPHS

CONTENTS

- Photo 1: Spillway Crest and Upstream Face of Dam -
9 March 1981
- Photo 2: Energy Dissipators (Steps) in Spillway -
9 March 1981
- Photo 3: Notch Through Masonry Core for Spillway -
9 March 1981
- Photo 4: 20-Inch Outlet Beneath Spillway Apron -
9 January 1981
- Photo 5: 12-Inch Outlet and Slide Gate, Abandoned
Pump House - 9 March 1981
- Photo 6: Condition of Masonry Core Wall Exposed on
Downstream Side of Dam - 9 March 1981
- Photo 7: Eroded Channel at Junction of Downstream
Embankment with Right Abutment - 9 March 1981
- Photo 8: Downstream Hazard Area - 9 March 1981

EARL RESERVOIR DAM



Photo 1. Spillway Crest and Upstream Face of Dam
9 March 1981



Photo 2. Energy Dissipators (Steps) in Spillway
9 March 1981

EARL RESERVOIR DAM



Photo 3. Notch Through Masonry Core for Spillway
9 March 1981



Photo 4. 20-Inch Outlet Beneath Spillway Apron
9 January 1981

EARL RESERVOIR DAM



Photo 5. 12-Inch Outlet and Slide Gate,
Abandoned Pump House
9 March 1981



Photo 6. Condition of Masonry Core Wall Exposed
on Downstream Side of Dam
9 March 1981

EARL RESERVOIR DAM



Photo 7. Eroded Channel at Junction of Downstream
Embankment with Right Abutment
9 March 1981



Photo 8. Downstream Hazard Area
9 March 1981

APPENDIX B
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Earl Reservoir Dam

Fed. I.D. # NY 203 DEC Dam No. 195C-453

River Basin Hudson

Location: Town Woodbury County Orange

Stream Name Unnamed

Tributary of Woodbury Creek

Latitude (N) 41°21.8' Longitude (W) 74°08.2'

Type of Dam Earth dam with a masonry/concrete core wall

Hazard Category High

Date(s) of Inspection 9 January 1981

Weather Conditions Partly cloudy, 10°F. to 15°F., 3 in. snow cover on dam

Reservoir Level at Time of Inspection Elevation 1005.1 ft. T.B.M.*

b. Inspection Personnel Jeffrey Quay, Larry Diday, David Hupe

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

<u>Richard Wilson</u>	<u>Raimondi Associates, P.C.</u>
<u>3 Ridge Place</u>	<u>110 Stage Road</u>
<u>Highland Mills, NY 10930</u>	<u>Monroe, NY 10950</u>
<u>914/928-6707 (home phone)</u>	<u>914/782-8681</u>

d. History:

Date Constructed 1912 Date(s) Reconstructed 1980

Designer (Reconstruction) A.G. Lichtenstein & Assoc., Teaneck, NJ 07666

Re-Constructed By (Construction Eng.) Raimondi Assoc., Monroe, NY 10950

Owner Town of Woodbury

*Temporary Bench Mark (T.B.M.) is top of manhole on the right side of the spillway, downstream side of the embankment. Assumed elevation is 1000.0 ft.

2) Embankment

a. Characteristics

- (1) Embankment Material Clayey silt.
- (2) Cutoff Type Core founded a minimum of 5 ft. below natural ground line.
- (3) Impervious Core Original masonry core with new 2 ft. thick upstream concrete facing bonded to masonry with epoxy cement.
- (4) Internal Drainage System None observed
- (5) Miscellaneous _____

b. Crest - Masonry core wall capped with concrete extends higher than the embankment and forms the crest.

- (1) Vertical Alignment Satisfactory
- (2) Horizontal Alignment Satisfactory
- (3) Surface Cracks None observed
- (4) Miscellaneous The concrete construction joints are tight. Expansion joint material was not used.

c. Upstream Slope

- (1) Slope (Estimate) (V:H) Could not measure; reservoir frozen over.
Design plans for dam rehabilitation indicate slope is 1V:4H.
- (2) Undesirable Growth or Debris, Animal Burrows None anticipated. The upstream slope is entirely inundated at normal pool level.

- (3) Sloughing, Subsidence, or Depressions Unknown
- (4) Slope Protection The design plans for dam rehabilitation indicate 6 in. of gravel in the vicinity of the spillway.
- (5) Surface Cracks or Movement at Toe Unknown

d. Downstream Slope

- (1) Slope (Estimate - V:H) 1V:2.5H measured during the field inspection.
- (2) Undesirable Growth or Debris, Animal Burrows None observed
- (3) Sloughing, Subsidence or Depressions The embankments appear to be in good condition. Some joints in the masonry core exposed on the downstream side of the dam are deteriorated.
- (4) Surface Cracks or Movement at Toe Refer to 2)e of this checklist
- (5) Seepage No seepage was observed on the downstream slopes.
- (6) External Drainage System (Ditches, Trenches, Blanket) None
- (7) Condition Around Outlet Structure The masonry core wall beneath the concrete spillway apron encases the 20 in. outlet adequately.

(8) Seepage Beyond Toe Seepage (total flow approx. 3 g.p.m.) occurs
from a 15 ft. wide area located near the toe of the embankment right
of the spillway.

e. Abutments - Embankment Contact A few small trees are located near the
junctions of the left and right abutments with the dam.

(1) Erosion at Contact A drainage culvert outlets at the far right end
of the dam on the downstream side. The drainage has eroded a 2 ft.
deep ditch along the junction of the right abutment with the down-
stream embankment.

(2) Seepage Along Contact None observed

3) Drainage System

a. Description of System None observed

b. Condition of System

c. Discharge from Drainage System

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs,
Piezometers, Etc.) None observed

5) Reservoir

- a. Slopes The slopes are very gentle and largely grass covered near the dam. Very steep wooded slopes are present at the upper end of the watershed.
- b. Sedimentation Unknown. The reservoir was frozen over.
- c. Unusual Conditions Which Affect Dam _____

6) Area Downstream of Dam

- a. Downstream Hazard (No. of Homes, Highways, etc.) Ridge Road is situated 800 ft. downstream. A large masonry arch culvert carries stream flow beneath the road. Just downstream of Ridge Road are six homes which are likely to be affected in the event of dam failure.
- b. Seepage, Unusual Growth None was observed.
- c. Evidence of Movement Beyond Toe of Dam None observed
- d. Condition of Downstream Channel The immediate downstream channel is narrow with steep sides.

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

- a. General The spillway consists of a 3 sided concrete weir forming a rectangular drop inlet on the upstream center of the dam. Three concrete steps exist inside the drop inlet where overflow occurs for energy dissipation. A concrete apron carries subsequent flow through a notch in the masonry core. Flows drop from the apron to a plunge pool below masonry wing walls to protect the toe of the dam.
- b. Condition of Service Spillway The spillway appears to be in excellent condition. Total length of the weir is 110 ft.
- c. Condition of Auxiliary Spillway None
- d. Condition of Discharge Conveyance Channel The discharge channel area is protected from erosion by old masonry wing walls and an old bridge foundation. The upper wing walls closest to the masonry core, which protect the downstream embankments, are deteriorated. The right wing wall (bridge foundation) furthest downstream has been undercut slightly and could cave in if undercutting continues.

8) Reservoir Drain/Outlet

Type: Pipe 2 outlets Conduit _____ Other _____
Material: Concrete _____ Metal cast iron both outlets Other _____
Size: 1 outlet 12 in., Length 170 ft. and 63 ft. respectively
1 outlet 20 in.
Invert Elevations: Entrance 12 in.-unknown (ice covered)
20 in.-unknown (ice covered)
Exit 12 in.-981.4 T.B.M., 20 in.-unknown (ice blockage)
Physical Condition (Describe): Unobservable Inlets not observed, but
are new.

Material: Good

Joints: Unknown Alignment Unknown

Structural Integrity: Structural integrity should be satisfactory. The 20 in. pipe is a new pipe grouted into the original 24 in. pipe. The existing 12 in. pipe upstream of the core wall has been encased in concrete.

Hydraulic Capability: _____

Means of Control: Gate both outlets Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable _____ Other Unknown

Present Condition (Describe): The gate at the discharge of the 12 in. outlet is rusty. The condition of the gate for the 20 in. outlet is unknown. The control is in the manhole immediately right of the spillway. The gate is new. A second gate for the 12 in. outlet is shown on the rehabilitation drawings as being controlled from the manhole.

9) Structural See Spillway

a. Concrete Surfaces _____

b. Structural Cracking _____

c. Movement - Horizontal & Vertical Alignment (Settlement) _____

d. Junctions with Abutments or Embankments _____

e. Drains - Foundation, Joint, Face _____

f. Water Passages, Conduits, Sluices _____

g. Seepage or Leakage _____

h. Joints - Construction, etc. _____

i. Foundation _____

j. Abutments _____

k. Control Gates _____

l. Approach & Outlet Channels _____

m. Energy Dissipators (Plunge Pool, etc.) _____

n. Intake Structures _____

o. Stability _____

p. Miscellaneous _____

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

a. Description and Condition An abandoned pump house is located above
the outlet of the 12 in. drain.

APPENDIX C

HYDROLOGIC/HYDRAULIC ENGINEERING
DATA AND COMPUTATIONS

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject EARL RESERVOIR DAM

S.O. No. _____

APPENDIX C - HYDROLOGIC AND

Sheet No. _____ of _____

HYDRAULIC COMPUTATIONS

Drawing No. _____

Computed by _____

Checked by _____

Date _____

<u>SUBJECT</u>	<u>PAGE</u>
CHECK LIST FOR DAMS	1
DRAINAGE AREA MAP	5
HYDROLOGIC AND HYDRAULIC DATA	6
TOP OF DAM PROFILE	8
CROSS SECTION OF DAM	9
CROSS SECTION AT SPILLWAY	10
SPILLWAY	11
SPILLWAY RATING	12
OUTLET WORKS RATING	14
OUTLET WORKS SUMMARY RATING	23
HEC-1 ANALYSIS	24

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>1007.9 T.B.M.*</u>	<u>19.8</u>	<u>172.</u>
2) Design High Water (Max. Design Pool)	<u>1007.6 T.B.M.</u>	<u>19.7</u>	<u>167.</u>
3) Auxiliary Spillway Crest	<u>-</u>	<u>-</u>	<u>-</u>
4) Pool Level with Flashboards	<u>-</u>	<u>-</u>	<u>-</u>
5) Service Spillway Crest	<u>1005.1 T.B.M.</u>	<u>16.0</u>	<u>122.</u>

DISCHARGES

	<u>Volume</u> (cfs)
1) Average Daily	<u>30</u>
2) Spillway @ Maximum High Water - Top of Dam -	<u>1,928.</u>
3) Spillway @ Design High Water	<u>1,392.</u>
4) Spillway @ Auxiliary Spillway Crest Elevation	<u>-</u>
5) Low Level Outlet	<u>-</u>
6) Total (of all facilities) @ Maximum High Water	<u>1,928.</u>
7) Maximum Known Flood	<u>-</u>
8) At Time of Inspection	<u>25</u>

*Temporary Bench Mark (T.B.M.) is top of manhole on the right side of the spillway, downstream side of the embankment. Assumed elevation is 1,000.0 ft.

CREST:

ELEVATION: 1005.1 T.B.M.

Type: Masonry core wall capped with concrete.

Width: Varies from 3.6 to 7.1 ft. Length: 460 ft.

Spillover Uncontrolled rectangular concrete weir.

Location Center of dam.

SPILLWAY:

SERVICE

AUXILIARY

1005.1 T.B.M.

Elevation None

Concrete weir

Type

Width = 8 in. length = 110 ft. Width

Type of Control

X

Uncontrolled

Controlled:

None

Type

(Flashboards; gate)

-

Number

-

Size/Length

Invert Material

Anticipated Length
of Operating Service

16.5 ft.

Chute Length

-

Height Between Spillway Crest
& Approach Channel Invert
(Weir Flow)

HYDROMETEROLOGICAL GAGES:

Type: None were observed.

Location: _____

Records:

Date: _____

Max. Reading: _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

Gate valves in a manhole, located on the downstream side of the embankment,
control a 12 in. cast iron pipe and a 20 in. cast iron pipe.

DRAINAGE AREA: 0.70 sq. mi.

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Wooded
Terrain - Relief: Moderate (13%) slopes near reservoir. Steep (33%) slopes in upper reaches of watershed.
Surface - Soil: Poor permeability.

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

None

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

Sedimentation is not expected to be a problem due to the natural wooded undeveloped watershed.

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

There are no potential backwater problem areas.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter: None

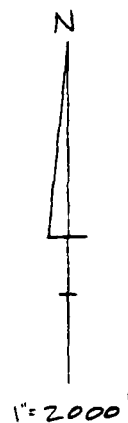
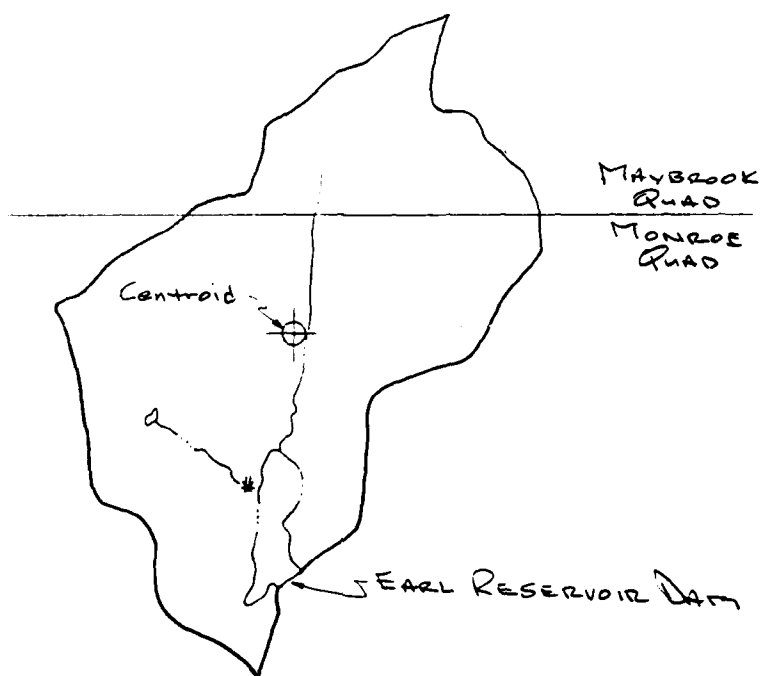
Location: _____

Elevation: _____

Reservoir:

Length @ Maximum Pool (Top of dam) 1,700 ft.

Length of Shoreline (@ Spillway Crest) 3,900 ft.



EARL RESERVOIR DAM
DRAINAGE AREA MAP

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject N.Y. Dam Insp.
EARL RESERVOIR DAM

S.O. No. 13000-00-ARA-09

Sheet No. 6 of 37

Drawing No. _____

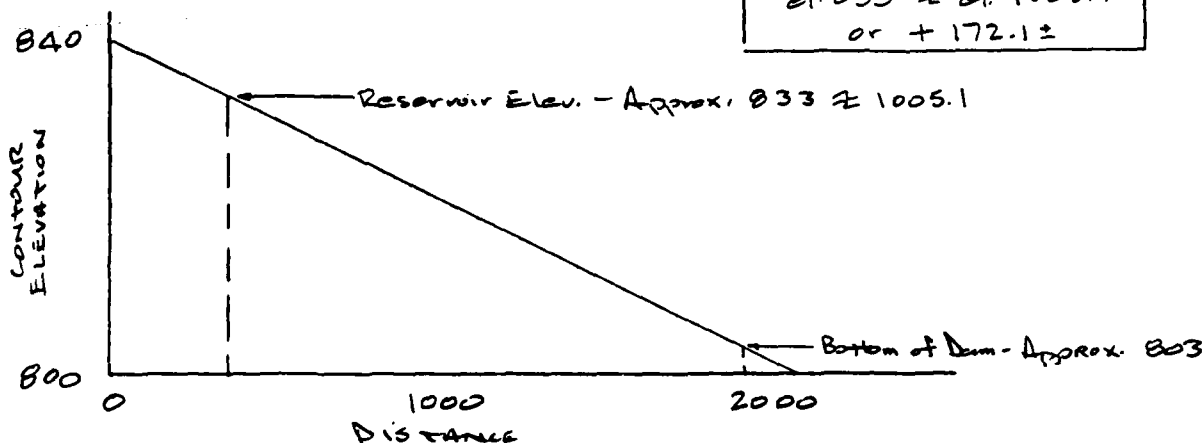
Computed by NCK/EE Checked by EE/WLS

Date 1/12/01

DRAINAGE AREA - $3.80 \pm 1.07 \text{ in}^2$ - 447.26 AC - 0.70 mi^2
LAKE AREA (elev 833±) - 0.13 in^2 - 11.94 ac - EL. 1005.1 16 AC from Design Report +
elev 840 - 0.27 in^2 - 24.79 ac EL. 1012.1
860 - 0.54 in^2 - 49.59 ac EL. 1032.1

$L = 3.5 \text{ in} - 7000 \text{ ft} - 1.33 \text{ mi}$
 $L_p = 1.4 \text{ in} - 2800 \text{ ft} - 0.53 \text{ mi}$

to convert Quad datum
to Field note datum
el. 833 ± el. 1005.1
or + 172.1 ±



From Const. Plans -
Lake bottom @ 810 ± 982.1

PRECIPITATION DATA

HMR-33 - ZONE 1

PMP 24 hr. - 200 mi^2 - 21.6 in.
D.A. - Less than 10 mi^2

Duration	%	Inches
6 hr. PMP	111	23.98
12 hr PMP	123	26.57
24 hr PMP	133	28.73
48 hr PMP	142	30.67

TP-40

100 YR - 24 hr. Rainfall = 7.5 inches
" 12 hr " 6.4 "
" 6 hr " 5.3 "

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Subject New York Dams S.O. No. _____
Earl Reservoir Dam Sheet No. 7 of 37
Snyders Coeff. & Storage Drawing No. _____
Computed by LAD Checked by JAG Date 2/4/81

Snyders Unit Hydrograph Coefficients

$$C_p = 0.63$$

$$C_T = 2.0$$

$$L = 1.33 \text{ Mi.}$$

$$L_{CA} = 0.53 \text{ Mi.}$$

$$\begin{aligned} T_p &= C_T (L \times L_{CA})^{0.3} \\ &= 2.0 (1.33 \times 0.53)^{0.3} \\ &= 1.80 \end{aligned}$$

Reservoir Storage

Design Plans		Survey (T.B.M) for HEC I
Top of Dam (conc.)	El. 832.0	El. 1008.9
Crest of Spillway	El. 828.2	El. 1005.1
Bottom of Res. (Invert of 12" & 20" Pipe Inlet)	El. 810.0	El. 986.9

From Design Report - Res. Surface Area at
Crest of Spillway = 16.0 Acres, 16 Ft.
Below Crest Surface Area 90% Reduced. = 1.6 Acres.
3.8 Ft. Above Crest Area = 21.5 Acres

Therefore: Bottom of Res. (0 Acres) = El. 986.9

$$1.6 \text{ Acres} = \text{El. } 989.1$$

*Acreage from U.S.G.S,
Quadrangle

$$16 \text{ Acres} = \text{El. } 1005.1$$

$$21.5 \text{ Acres} = \text{El. } 1008.9$$

$$*24.8 \text{ Acres} = \text{El. } 1012.1$$

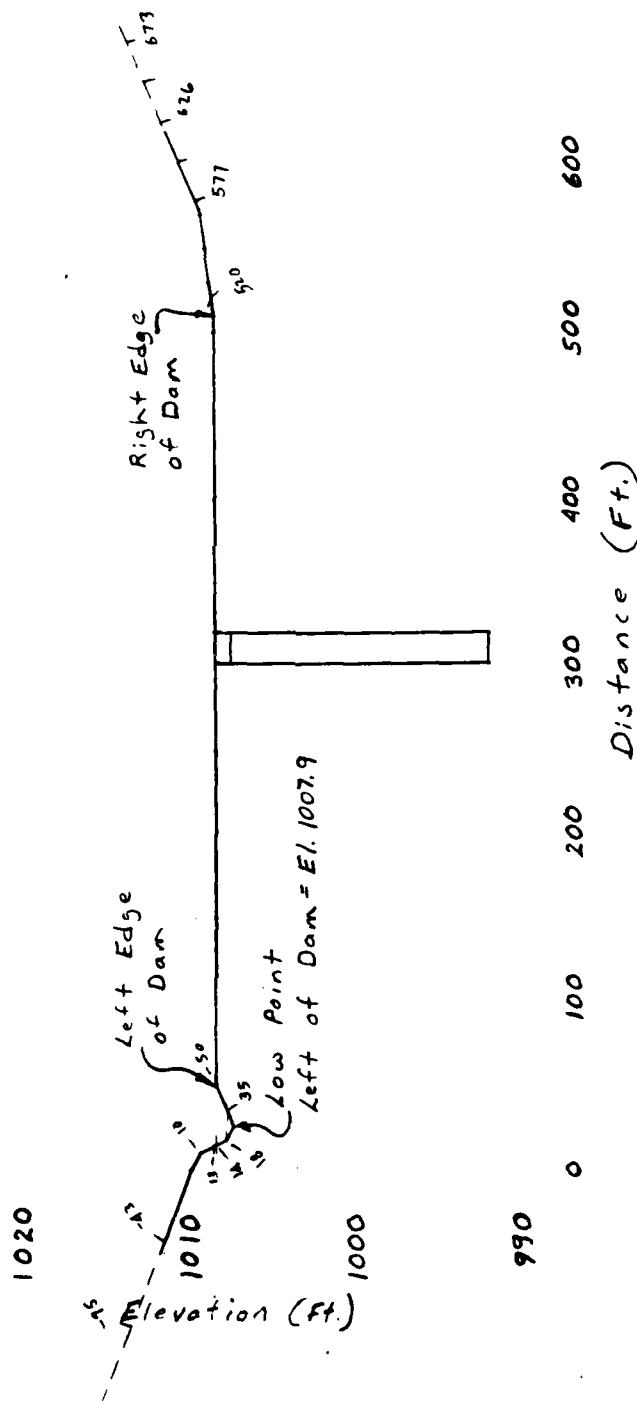
$$*49.6 \text{ Acres} = \text{El. } 1032.1$$

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Subject New York Dams S.O. No. _____
Earl Reservoir Dam Sheet No. 8 of 37
Drawing No. _____
Computed by LAD Checked by KAR Date 1/15/81

TOP OF DAM PROFILE

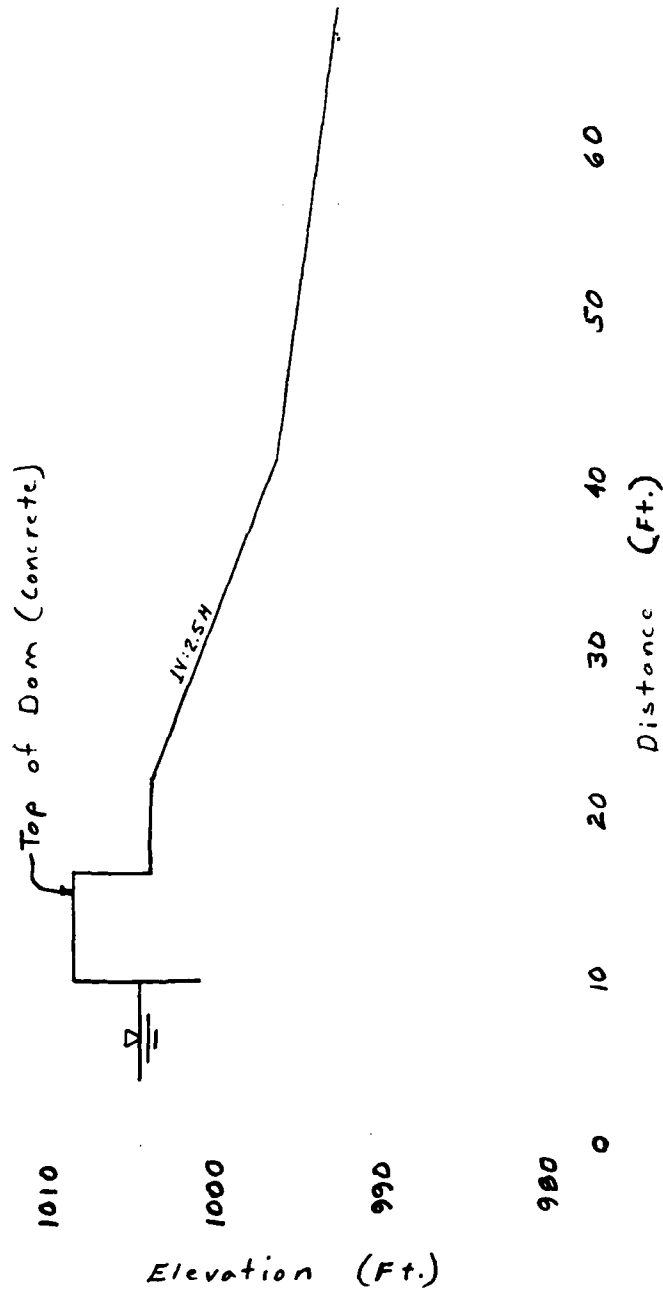


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Subject New York Dams S.O. No. _____
Earl Reservoir Dam Sheet No. 9 of 37
Drawing No. _____
Computed by GAD Checked by KAR Date 1/15/81

CROSS SECTION STA. 2+50



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Subject Earl Reservoir Dam

Cross-Section at Spillway

S.O. No. _____

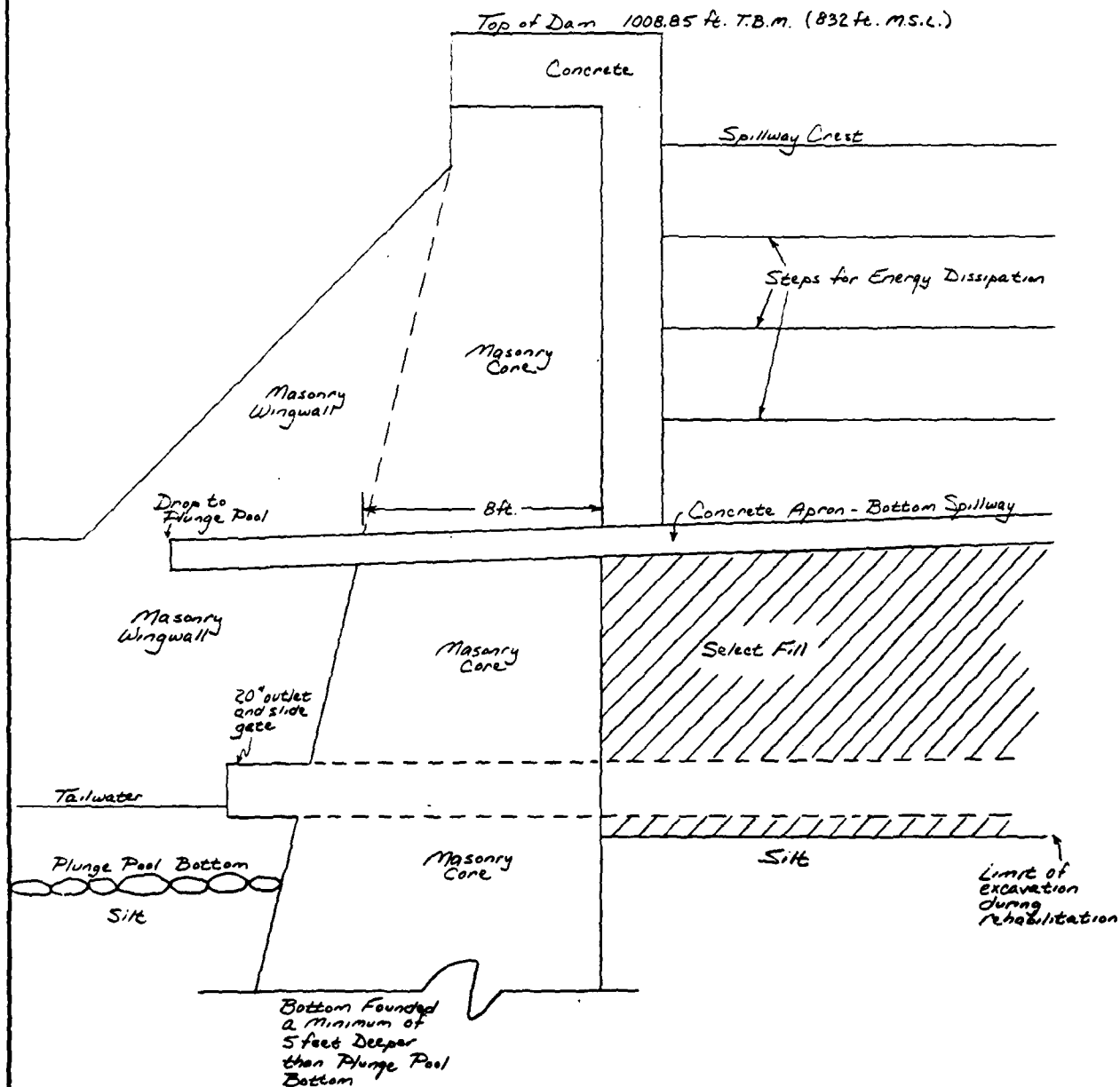
Sheet No. 10 of 37

Drawing No. _____

Computed by DWH

Checked by _____

Date 1/19/81



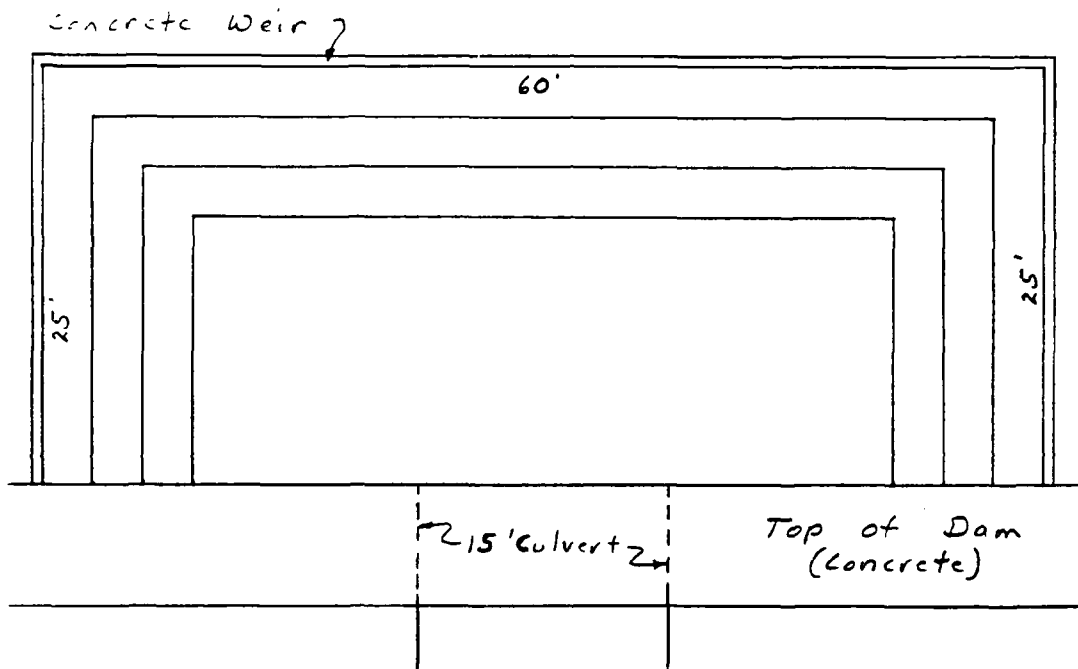
CROSS SECTION AT SPILLWAY
NOTCH THROUGH CORE WALL
Scale: 1" = 5'

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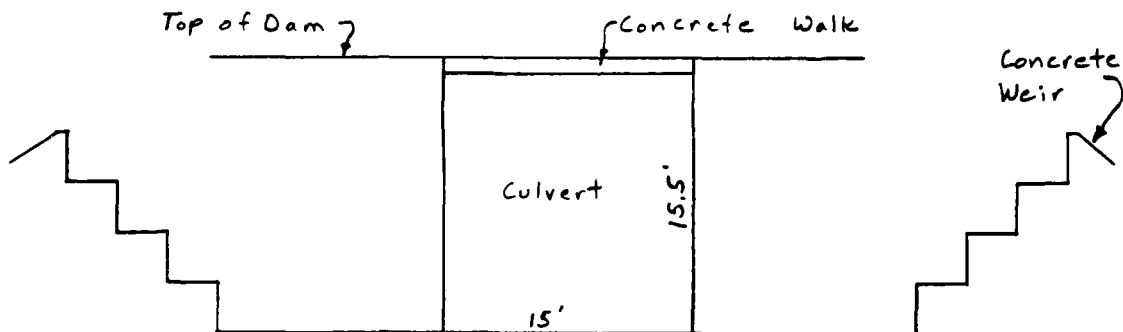
Box 280
Beaver, Pa. 15009

Subject New York Dams S.O. No. _____
Earl Reservoir Dam Sheet No. 11 of 37
Spillway Drawing No. _____
Computed by LAD Checked by KAR Date 1/15/81

Concrete Spillway - Plan, Scale 1" = 10'



Concrete Spillway - Profile, Scale 1" = 10'



Total Weir Length = 110' Breadth of Crest = 8"
Size of Culvert = 15' x 15.5'

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Box 280
Beaver, Pa. 15009Subject New York Dams

S.O. No. _____

Earl Reservoir DamSheet No. 12 of 37Spillway Rating

Drawing No. _____

Computed by LADChecked by JAGDate 1/15/81

Weir Flow over Concrete Weir

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

$$L = 110' \text{ Ft.}$$

H varies from 0.5 Ft to 8.0 Ft.

C varies with H, King and Brater
Handbook Pg 5-44 Table 5-11

Elevation (Ft.)	H (Ft.)	L (Ft.)	C	Q (cfs)
1005.1	0	110.	0.	0 ✓
1006.1	1.0	110.	3.41	375.1 ✓
1007.1	2.0	110.	3.65	1135.6 ✓
1008.1	3.0	110.	3.72	2126.3 ✓
1009.1	4.0	110.	3.73	3282.4 ✓
1010.1	5.0	110.	3.73	4587.3 ✓
1011.1	6.0	110.	3.73	6030.2 ✓
1012.1	7.0	110.	3.73	7598.9 ✓
1013.1	8.0	110.	3.73	9284.0 ✓

↓ CONTROLS

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Box 280
Beaumont, Pa. 15009

Subject New York Dams

Earl Reservoir Dam

Spillway Rating

Computed by LAD

Checked by

JHQ

S.O. No.

Sheet No. 13 of 37

Drawing No.

Date 1/15/61

Orifice Flow for Culvert

$$\begin{aligned} Q &= CA (2gH)^{1/2} \\ &= (.55)(232.5)(64.4H)^{1/2} \\ &= 1026.2 (H)^{1/2} \end{aligned}$$

$$A = 15 \times 15.5 = 232.5 \text{ Sq. Ft.}$$

$$g = 32.2 \text{ Ft./sec.}$$

$$C = 0.55 \text{ Pg 4-11 King and } \\ \text{Brater Handbook}$$

H varies from 7.75 + 12.75
Ft. and is measured from
the center of the Culvert.

Elevation (Ft.)	H (Ft.)	Q (cfs)
1008.1	7.75	2856.8 ✓
1009.1	8.75	3035.5 ✓
1010.1	9.75	3204.3 ✓
1011.1	10.75	3364.6 ✓
1012.1	11.75	3517.6 ✓
1013.1	12.75	3664.2 ✓

↓ CONTROLS

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Box 280
Beaver, Pa. 15009

Subject New York Dam

S.O. No. _____

Earl Reservoir Dam

Sheet No. 14 of 37

Outlet Works

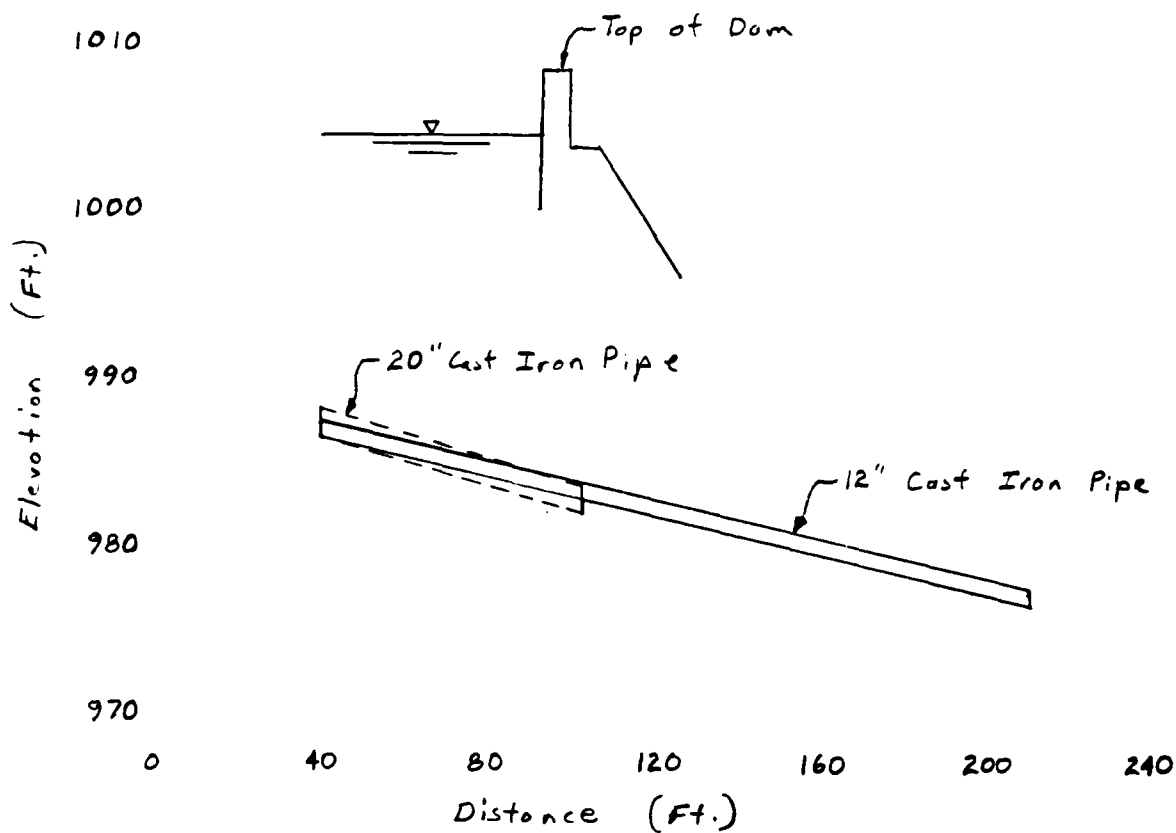
Drawing No. _____

Computed by LAD

Checked by JAC

Date 2/9/81

Profile of Outlet Works



	20" Cast Iron Pipe	12" Cast Iron Pipe
Entrance Invert	El. 986.9	El. 986.9
Outlet Invert	El. 982.4	El. 976.9
Length	63 Ft.	170 Ft.
Slope	0.0714 ✓	0.0588 ✓

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THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams

Earl Reservoir Dam

20" Pipe Rating

Computed by LFD

Checked by JHQ

S.O. No. _____

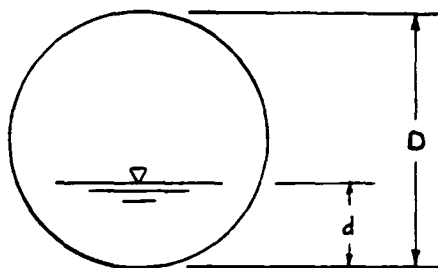
Sheet No. 15 of 37

Drawing No. _____

Date 2/9/81

Flow in Pipes Partly Full

"Design of Small Dams" Pages 558 and 559



$D = \text{Pipe Dia} = 20" = 1.67 \text{ Ft.}$

$d = \text{Depth of Flow}$

$s = \text{Slope} = 0.0714$

Pipe is Cast Iron

$n = 0.014$

$$\frac{d}{D} = \frac{.5}{1.67} = 0.30$$

$$0.5225 = \frac{Q_c}{D^{5/2}} = \frac{Q_c}{(1.67)^{5/2}} \quad Q_c = \underline{1.9 \text{ cfs}} \checkmark$$

$$\frac{d}{D} = \frac{.5}{1.67} = 0.30$$

$$0.0907 = \frac{Q n}{D^{4/3} s^{1/2}} = \frac{Q(0.014)}{(1.67)^{4/3} (.0714)^{1/2}} \quad Q = \underline{6.8 \text{ cfs}} \checkmark$$

$$\frac{d}{D} = \frac{1.0}{1.67} = 0.60$$

$$1.9773 = \frac{Q_c}{D^{5/2}} = \frac{Q_c}{(1.67)^{5/2}} \quad Q_c = \underline{7.1 \text{ cfs}} \checkmark$$

$$\frac{d}{D} = \frac{1.0}{1.67} = 0.60$$

$$0.311 = \frac{Q n}{D^{4/3} s^{1/2}} = \frac{Q(0.014)}{(1.67)^{4/3} (.0714)^{1/2}} \quad Q = \underline{23.3 \text{ cfs}} \checkmark$$

Critical Depth Controls

El. 986.9 $Q = 0 \checkmark$

El. 987.4 $Q = 1.9 \text{ cfs} \checkmark$

El. 987.9 $Q = 7.1 \text{ cfs} \checkmark$

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams S.O. No. _____
Earl C. Veir Dam Sheet No. 16 of 37
20" Pipe Rating Drawing No. _____
Computed by LAD Checked by TAQ Date 2/9/21

Pipe Flow

$$Q = \frac{A (2gH)^{1/2}}{[1 + K_0 + K_p (L)]^{1/2}}$$

$$= \frac{2.16 (64.4 H)^{1/2}}{[1 + 0.78 + .0185 (63)]^{1/2}}$$

$$= 10.10 (H)^{1/2}$$

Pipe = 20" Dia. Cast Iron

$$A = \pi r^2 = \frac{2.18}{2.16} \text{ Sq. Ft.}$$

$$g = 32.2 \text{ Ft./sec.}$$

$$L = 63 \text{ Ft.}$$

Pipe Losses

$$\text{Entrance Loss } (K_0) = 0.78$$

$$P_g 5.5-6 \text{ SCS NEH-5}$$

$$\text{Head Loss } (K_p) = 0.0185$$

$$n = 0.014 \text{ } P_g 5.5-4$$

$$\text{SCS NEH-5}$$

H varies from 4.9 Ft. to 21.0 Ft. and is measured from the Top of Pipe at Outlet = El. 984.1

Elevation (Ft.)	H (Ft.)	Q (cfs)
989.0	4.9	22.4
990.0	5.9	24.5
991.0	6.9	26.5
992.0	7.9	28.4
993.0	8.9	30.1
994.0	9.9	31.8
995.0	10.9	33.3
996.0	11.9	34.8
997.0	12.9	36.3
998.0	13.9	37.7
999.0	14.9	39.0
1000.0	15.9	40.3
1001.0	16.9	41.5
1002.0	17.9	42.7
1003.0	18.9	43.9
1004.0	19.9	45.1
1005.1	21.0	46.3

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams

S.O. No. _____

Earl Reservoir Dam

Sheet No. 17 of 37

20" Pipe Rating

Drawing No. _____

Computed by LAD

Checked by JAQ

Date 2/9/81

Orifice Flow

$$\begin{aligned}Q &= CA (2gH)^{.5} \\&= (0.6)(2.16)(64.4 H)^{.5} \\&= 10.40 (H)^{.5}\end{aligned}$$

Pipe = 20" Cast Iron

$A = \pi r^2 = 2.16 \text{ Sq. Ft.}$

$g = 32.2 \text{ Ft./sec}$

$C = 0.6$ King and Brater
Handbook Pg 4-32 Table 4-6

H varies from 1.3 Ft. to
17.4 Ft. and is measured
from the center of pipe
at inlet = El. 987.7

Elevation (Ft.)	H (Ft.)	Q (cfs)
989.0	1.3	11.9
990.0	2.3	15.8
991.0	3.3	18.9
992.0	4.3	21.6
993.0	5.3	23.9
994.0	6.3	26.1
995.0	7.3	28.1
996.0	8.3	30.0
997.0	9.3	31.7
998.0	10.3	33.4
999.0	11.3	35.0
1000.0	12.3	36.5
1001.0	13.3	37.9
1002.0	14.3	39.3
1003.0	15.3	40.7
1004.0	16.3	42.0
1005.1	17.4	43.4

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams

S.O. No. _____

Earl Reservoir Dam

Sheet No. 18 of 37

20" Pipe Rating

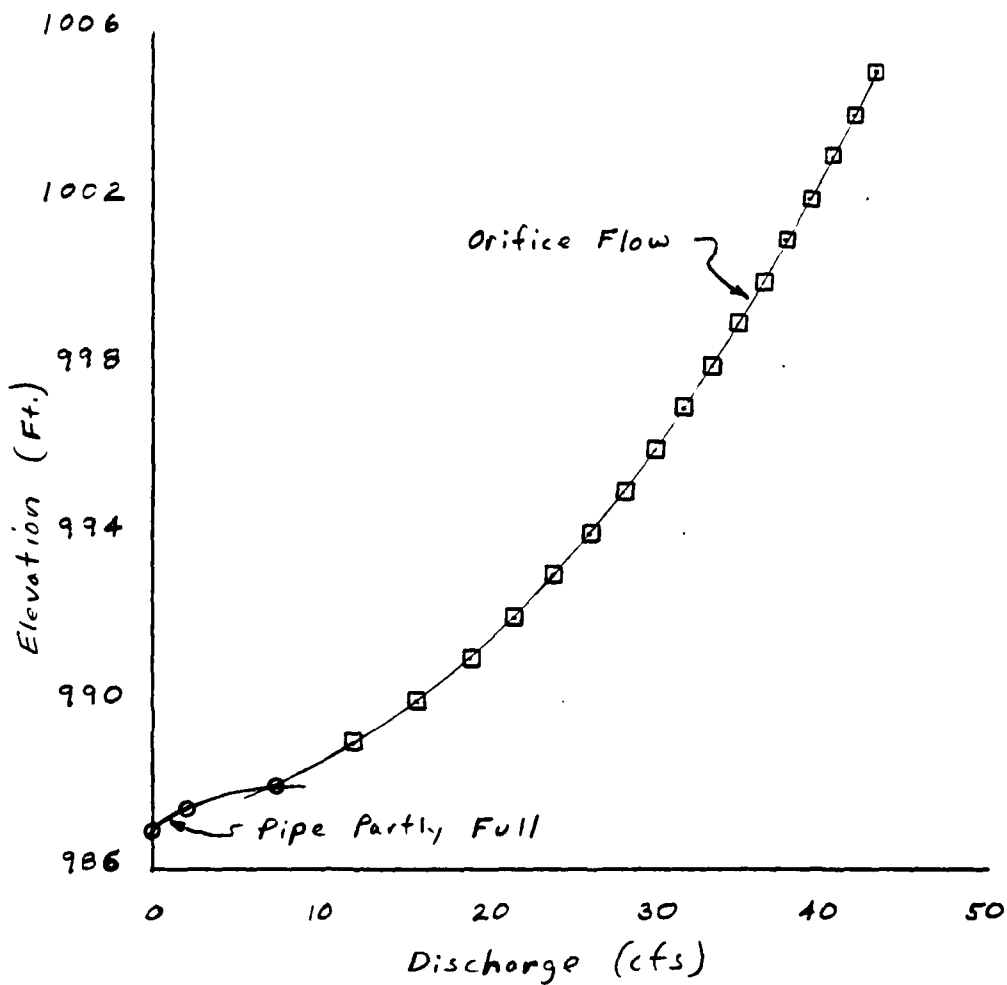
Drawing No. _____

Computed by LAD

Checked by JHQ

Date 2/9/81

RATING CURVE



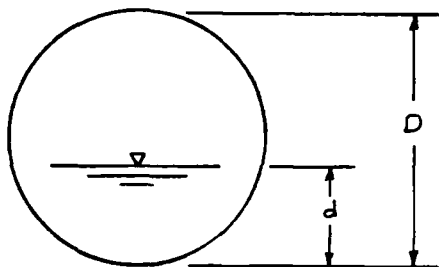
MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams S.O. No. _____
Earl Reservoir Dam Sheet No. 19 of 37
12" Pipe Rating Drawing No. _____
Computed by LAD Checked by JAQ Date 2/9/81

Flow in Pipes Partly Full

"Design of Small Dams" Pages 558 and 559



$D = \text{Pipe Dia.} = 12" = 1 \text{ Ft.}$

$d = \text{Depth of Flow}$

$S = \text{Slope} = 0.0588$

Pipe is Cast Iron

$n = 0.014$

$$\frac{d}{D} = \frac{.4}{1.0} = .4 \quad 0.9103 = \frac{Q_c}{D^{5/2}} = \frac{Q_c}{(1)^{5/2}} \quad \underline{Q_c = 0.9 \text{ cfs}} \checkmark$$

$$\frac{d}{D} = \frac{.4}{1.0} = .4 \quad 0.1561 = \frac{Q_n}{D^{4/3} S^{1/2}} = \frac{Q(0.014)}{(1)^{4/3} (0.0588)^{1/2}} \quad Q = 2.7 \text{ cfs} \checkmark$$

$$\frac{d}{D} = \frac{.7}{1.0} = .7 \quad 2.6656 = \frac{Q_c}{D^{5/2}} = \frac{Q_c}{(1)^{5/2}} \quad \underline{Q_c = 2.7 \text{ cfs}} \checkmark$$

$$\frac{d}{D} = \frac{.7}{1.0} = .7 \quad 0.388 = \frac{Q_n}{D^{4/3} S^{1/2}} = \frac{Q(0.014)}{(1)^{4/3} (0.0588)^{1/2}} \quad Q = 6.7 \text{ cfs} \checkmark$$

Critical Depth Controls

El. 986.9 $Q = 0$ ✓

El. 987.3 $Q = 0.9 \text{ cfs}$ ✓

El. 987.6 $Q = 2.7 \text{ cfs}$ ✓

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams

S.O. No. _____

Earl Reservoir Dam

Sheet No. 20 of 37

12" Pipe Rating

Drawing No. _____

Computed by LAD

Checked by JAQ

Date 2/9/81

Pipe Flow

$$Q = \frac{A(2gH)^{1/2}}{[1 + K_e + K_p(L)]^{1/2}}$$

$$= \frac{(0.79)(64.4 H)^{1/2}}{[1 + .78 + 0.0363(170)]^{1/2}}$$

$$= 2.25 (H)^{1/2} \checkmark$$

Pipe = 12" Dia. Cast Iron

$A = \pi r^2 = 0.79 \text{ Sq. Ft.}$

$g = 32.2 \text{ Ft./sec.}$

$L = 170 \text{ Ft.}$

Pipe Losses

Entrance Loss (K_e) = 0.78

Pg. 5.5-6 SCS NEH-5

Head Loss (K_p) = 0.0363

$n = 0.014$ Pg. 5.5-4

SCS NEH-5

H varies from 10.1 Ft. to 27.2 Ft. and is measured from the Top of Pipe at Outlet = El. 977.9

Elevation (Ft.)	H (Ft.)	Q (cfs)
988.0	10.1	7.2
989.0	11.1	7.5
990.0	12.1	7.8
991.0	13.1	8.1
992.0	14.1	8.4
993.0	15.1	8.7
994.0	16.1	9.0
995.0	17.1	9.3
996.0	18.1	9.6
997.0	19.1	9.8
998.0	20.1	10.1
999.0	21.1	10.3
1000.0	22.1	10.6
1001.0	23.1	10.8
1002.0	24.1	11.0
1003.0	25.1	11.3
1004.0	26.1	11.5
1005.1	27.2	11.7

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009Subject New York DamsEarl Reservoir Dam12" Pipe RatingComputed by LADChecked by JAO

S.O. No. _____

Sheet No. 21 of 37

Drawing No. _____

Date 2/9/81

Orifice Flow

$$\begin{aligned}
 Q &= CA (2gH)^{.5} \\
 &= (.6)(0.79)(64.4 H)^{.5} \\
 &= 3.80 (H)^{.5}
 \end{aligned}$$

Pipe = 12" Cast Iron

$$A = \pi r^2 = 0.79 \text{ Sq. Ft.}$$

$$g = 32.2 \text{ Ft./sec.}$$

 $C = 0.6$ King and Brater
Handbook Pg 4-32 Table 4-6

H varies from 0.6 Ft. to
17.7 Ft. and is measured
from the center of pipe
at inlet = El. 987.4

Elevation (Ft.)	H (Ft.)	Q (cfs)
988.0	0.6	2.9
989.0	1.6	4.8
990.0	2.6	6.1
991.0	3.6	7.2
992.0	4.6	8.2
993.0	5.6	9.0
994.0	6.6	9.8
995.0	7.6	10.5
996.0	8.6	11.2
1005.1	17.7	16.0

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams

S.O. No. _____

Earl Reservoir Dam

Sheet No. 22 of 37

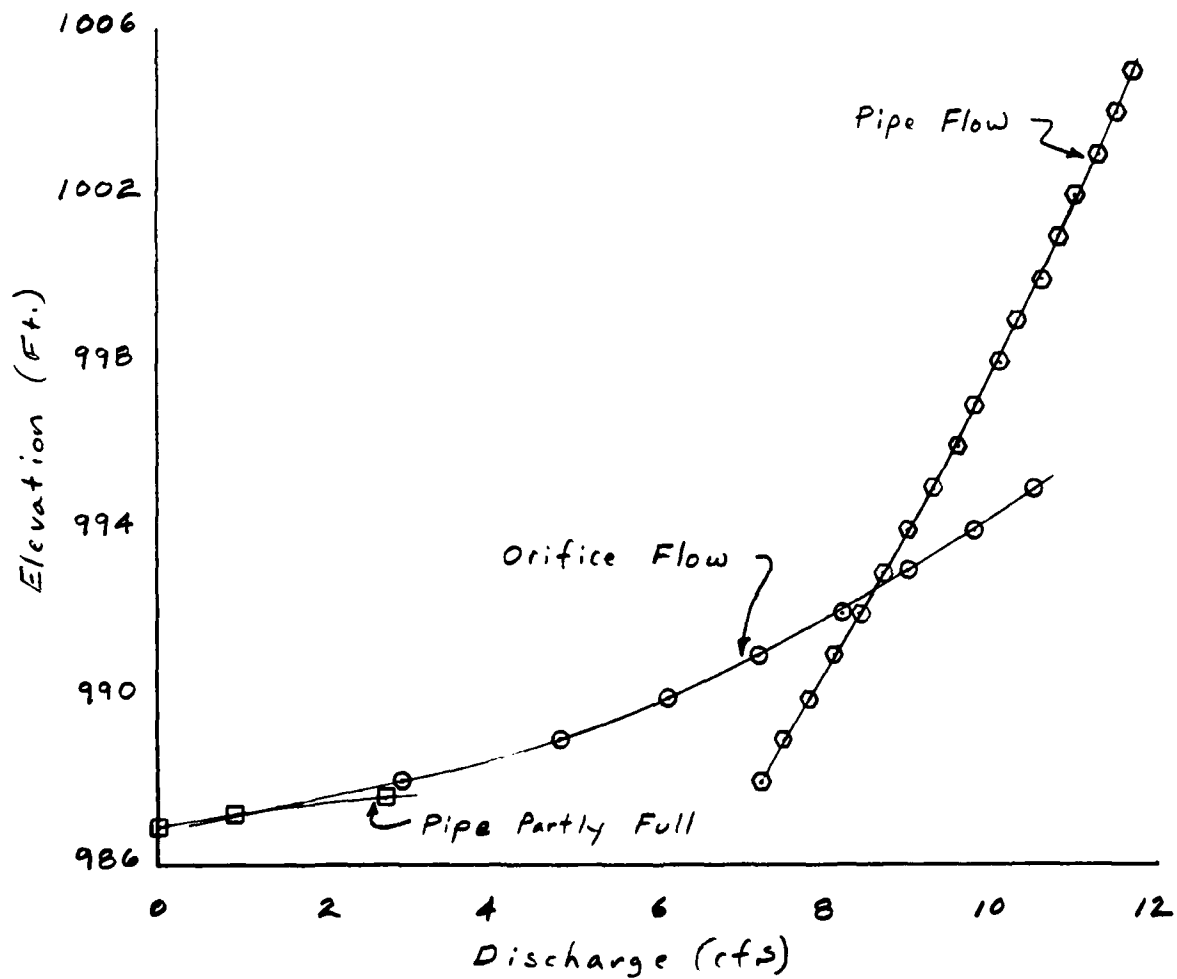
12" Pipe Rating

Drawing No. _____

Computed by LAD Checked by JHQ

Date 2/9/81

RATING CURVE



MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject New York Dams

S.O. No. _____

Earl Reservoir Dam

Sheet No. 23 of 37

Outlet Summary Rating

Drawing No. _____

Computed by LAD

Checked by _____

Date 2/9/81

Elevation (Ft.)	20" Pipe Q (cfs)	12" Pipe Q (cfs)	Total Q (cfs)
986.9	0	0	0
987.4	1.9	1.4	3.3
987.8	4.5	2.4	6.9
988.0	7.0	2.9	9.9
989.0	11.9	4.8	16.7
990.0	15.8	6.1	21.9
991.0	18.9	7.2	26.1
992.0	21.6	8.2	29.8
993.0	23.9	8.7	32.6
994.0	26.1	9.0	35.1
995.0	28.1	9.3	37.4
996.0	30.0	9.6	39.6
997.0	31.7	9.8	41.5
998.0	33.4	10.1	43.5
999.0	35.0	10.3	45.3
1000.0	36.5	10.6	47.1
1001.0	37.9	10.8	48.7
1002.0	39.3	11.0	50.3
1003.0	40.7	11.3	52.0
1004.0	42.0	11.5	53.5
1005.1	43.4	11.7	55.1

 FLOOD HYDROGRAPH PACKAGE, LREC-11
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79
 48J UPDATE 04 JUL 79

1 A1 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
 2 A2 HYDRAULIC AND HYDRAULIC ANALYSIS OF EARL RESERVOIR DAM
 3 A3 UNIT HYDROGRAPH BY SNYDER'S METHOD
 4 B 5J
 5 81 3
 6 J 1
 7 J1 1.0 0.75 0.5 0.25
 8 K
 9 K1 RUNOFF HYDROGRAPH TO DAM
 10 M 1 0.70
 11 P 21.4 111 123 133 142 1.0 0.1
 12 F
 13 W 1.83 0.63
 14 X -1.5 -0.05 2
 15 K 1
 16 K1 ROUTING FOR EARL RESERVOIR DAM
 17 Y
 18 Y1 1
 19 Y41005.1 1007.1 1008.1 1009.1 1010.1 1011.1 1012.1 1013.1
 20 Y5 0 375.1 1135.6 2126.3 3035.5 3208.3 3364.6 3517.0 3689.2
 21 8A 0 1.6 16.0 21.5 24.8 49.6
 22 9E 986.9 989.1 1005.1 1008.9 1012.1 1032.1
 23 881005.1
 24 801007.9 2.6 1.5
 25 81 0 17 36 489 549 651 750
 26 8V1007.9 1008.2 1008.5 1009.0 1010.0 1012.0 1014.0
 27 K 99

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

KURUFF HYDROGRAPH AT		1
ROUTE HYDROGRAPH TO		2
END OF NETWORK		
1		
2		
3		
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100		

SHEET 25 of 37

 FLOOD HYDROGRAPH PACKAGE (JULG-1)
 DAM SAFETY VERSION JULY 1979
 LAST MODIFICATION 26 FEB 79
 NOJ UPDATE 04 JUL 79

RUN DATE 02/10/81
 TIME 14:37

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
 HYDRAULIC AND HYDRAULIC ANALYSIS OF EARL RESERVOIR DAM
 UNIT HYDROGRAPH BY SNYDER'S METHOD

JOB SPECIFICATION

NU	N4	MIN	UDAY	THR	MIN	NETL	IPLI	IPMT	NSIAN
500	J	5	0	0	0	0	0	0	0
			JUPER	NAT	LKOPI	TRALE			
			5	0	0	0	0		

MULTI-PLAN ANALYSES TO BE PERFORMED

RIIJS= 1.00 0.75 0.50 0.25
 NPLAN= 1 NRTIO= 4 LRTIO= 1

SUB-AREA RUNOFF COMPUTATION

RUNOFF HYDROGRAPH TO DAM

1STAQ	ICOMP	IECUN	ITAPE	JPLT	JPKI	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYUG	IJUG	TAREA	SNAP	TRSDA	TRSPC	RATIU	ISHUM	ISAME	LULAL
1	1	0.70	0.0	0.70	0.0	0.0	0	1	0

PRECIP DATA

SPTE	PMS	R6	R12	R24	R48	R72	K90
0.0	21.60	111.00	123.00	133.00	142.00	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LROPT	STACK	ULTR	RTIOL	ERAIN	STRKS	RTIUK	SIRIL	LNSTL	ALYMA	KIMP
0	0.0	0.0	1.00	0.0	0.0	1.00	0.00	0.00	0.00	0.00

UNIT HYDROGRAPH DATA

FP= 1.80 CP=0.63 NFA= 0

RECESSION DATA

SIRIU= -1.50 YKCSN= -0.02 RIUK= 2.00

UNIT HYDROGRAPH END-OF-PERIOD URDINATES, LAG= 1.80 HOURS, CP= 0.63 VUL= 0.99

2.	0.	13.	21.	30.	40.	50.	60.	74.	83.
95.	107.	118.	128.	137.	143.	152.	157.	161.	163.
165.	168.	169.	170.	171.	172.	173.	174.	175.	176.
177.	178.	179.	180.	181.	182.	183.	184.	185.	186.

[illegible]

SHEET 27 of 37

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

OPERATION STATION AREA PLAN RATIO 1 RATIO 2 RATIO 3 RATIO 4
 0.50 0.75 0.50 0.25

HYDROGRAPH AT 1 2.72 1 1810 1357 905 454
 1.01 1 51.251 38.431 25.621 12.811
 ROUTED TO 2 2.72 1 1778 1323 883 435
 1.01 1 50.351 37.751 24.991 12.311

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 1005.10 122. 0.	SPILLWAY CREST 1005.10 122. 0.	TUP OF DAM 1007.90 172. 1920.	RATIO OF PWF	MAXIMUM ACSERVOIR 4-S-ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FI	MAXIMUM OUTFLOW CFS	URATION OVER TUP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1												
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SHEET 29 of 37

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT ROUTE HYDROGRAPH TO END OF NETWORK		1	2
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100
101	102	103	104
105	106	107	108
109	110	111	112
113	114	115	116
117	118	119	120
121	122	123	124
125	126	127	128
129	130	131	132
133	134	135	136
137	138	139	140
141	142	143	144
145	146	147	148
149	150	151	152
153	154	155	156
157	158	159	160
161	162	163	164
165	166	167	168
169	170	171	172
173	174	175	176
177	178	179	180
181	182	183	184
185	186	187	188
189	190	191	192
193	194	195	196
197	198	199	200
201	202	203	204
205	206	207	208
209	210	211	212
213	214	215	216
217	218	219	220
221	222	223	224
225	226	227	228
229	230	231	232
233	234	235	236
237	238	239	240
241	242	243	244
245	246	247	248
249	250	251	252
253	254	255	256
257	258	259	260
261	262	263	264
265	266	267	268
269	270	271	272
273	274	275	276
277	278	279	280
281	282	283	284
285	286	287	288
289	290	291	292
293	294	295	296
297	298	299	300
301	302	303	304
305	306	307	308
309	310	311	312
313	314	315	316
317	318	319	320
321	322	323	324
325	326	327	328
329	330	331	332
333	334	335	336
337	338	339	340
341	342	343	344
345	346	347	348
349	350	351	352
353	354	355	356
357	358	359	360
361	362	363	364
365	366	367	368
369	370	371	372
373	374	375	376
377	378	379	380
381	382	383	384
385	386	387	388
389	390	391	392
393	394	395	396
397	398	399	400
401	402	403	404
405	406	407	408
409	410	411	412
413	414	415	416
417	418	419	420
421	422	423	424
425	426	427	428
429	430	431	432
433	434	435	436
437	438	439	440
441	442	443	444
445	446	447	448
449	450	451	452
453	454	455	456
457	458	459	460
461	462	463	464
465	466	467	468
469	470	471	472
473	474	475	476
477	478	479	480
481	482	483	484
485	486	487	488
489	490	491	492
493	494	495	496
497	498	499	500
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569	570	571	572
573	574	575	576
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581	582	583	584
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613	614	615	616
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669	670	671	672
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685	686	687	688
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697	698	699	700
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705	706	707	708
709	710	711	712
713	714	715	716
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721	722	723	724
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729	730	731	732
733	734	735	736
737	738	739	740
741	742	743	744
745	746	747	748
749	750	751	752
753	754	755	756
757	758	759	760
761	762	763	764
765	766	767	768
769	770	771	772
773	774	775	776
777	778	779	780
781	782	783	784
785	786	787	788
789	790	791	792
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797	798	799	800
801	802	803	804
805	806	807	808
809	810	811	812
813	814	815	816
817	818	819	820
821	822	823	824
825	826	827	828
829	830	831	832
833	834	835	836
837	838	839	840
841	842	843	844
845	846	847	848
849	850	851	852
853	854	855	856
857	858	859	860
861	862	863	864
865	866	867	868
869	870	871	872
873	874	875	876
877	878	879	880
881	882	883	884
885	886	887	888
889	890	891	892
893	894	895	896
897	898	899	900
901	902	903	904
905	906	907	908
909	910	911	912
913	914	915	916
917	918	919	920
921	922	923	924
925	926	927	928
929	930	931	932
933	934	935	936
937	938	939	940
941	942	943	944
945	946	947	948
949	950	951	952
953	954	955	956
957	958	959	960
961	962	963	964
965	966	967	968
969	970	971	972
973	974	975	976
977	978	979	980
981	982	983	984
985	986	987	988
989	990	991	992
993	994	995	996
997	998	999	1000

SHEET 31 of 37

III

LAST NOTIFICATION 26 FEB 79
318 UPDATE 04 JAN 79

RUN DATE 02/10/81
 TIME 15.05

1. 2. 3.

100

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2000

Keywords: child sexual abuse; disclosure; social support

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1

SHEET 32 of 37

LI

LI

UNITED STATES

SHEET 34 of 37

1.01	2.00	2	2.00	0.	34.	1.01	1004.2
1.01	3.00	3	3.00	0.	34.	1.01	1004.2
1.01	4.00	4	4.00	0.	33.	1.01	1003.5
1.01	5.00	5	5.00	0.	33.	1.01	1003.6
1.01	6.00	6	6.00	0.	32.	1.01	1003.3
1.01	7.00	7	7.00	0.	31.	1.01	1003.0
1.01	8.00	8	8.00	0.	31.	1.01	1002.6
1.01	9.00	9	9.00	0.	31.	1.01	1002.3
1.01	10.00	10	10.00	0.	30.	1.01	1002.0
1.01	11.00	11	11.00	0.	30.	1.01	1001.6
1.01	12.00	12	12.00	0.	29.	1.01	1001.3
1.01	13.00	13	13.00	0.	29.	1.01	1000.9
1.01	14.00	14	14.00	0.	28.	1.01	1000.5
1.01	15.00	15	15.00	0.	27.	1.01	1000.4
1.01	16.00	16	16.00	0.	27.	1.01	999.7
1.01	17.00	17	17.00	0.	26.	1.01	999.3
1.01	18.00	18	18.00	0.	25.	1.01	998.5
1.01	19.00	19	19.00	0.	24.	1.01	998.2
1.01	20.00	20	20.00	0.	23.	1.01	998.0
1.01	21.00	21	21.00	0.	23.	1.01	997.5
1.01	22.00	22	22.00	0.	22.	1.01	997.0
1.01	23.00	23	23.00	0.	21.	1.01	996.5
1.02	0.0	24	24.00	0.	20.	1.02	996.0
1.02	1.00	25	25.00	0.	19.	1.02	995.4
1.02	2.00	26	26.00	0.	18.	1.02	994.8
1.02	3.00	27	27.00	0.	18.	1.02	994.2
1.02	4.00	28	28.00	0.	17.	1.02	993.6
1.02	5.00	29	29.00	0.	16.	1.02	992.8
1.02	6.00	30	30.00	0.	15.	1.02	992.1
1.02	7.00	31	31.00	0.	14.	1.02	991.4
1.02	8.00	32	32.00	0.	13.	1.02	990.4
1.02	9.00	33	33.00	0.	12.	1.02	989.5
1.02	10.00	34	34.00	0.	11.	1.02	988.6
1.02	11.00	35	35.00	0.	10.	1.02	988.0
1.02	12.00	36	36.00	0.	9.	1.02	986.9
1.02	13.00	37	37.00	0.	8.	1.02	986.9
1.02	14.00	38	38.00	0.	7.	1.02	986.9
1.02	15.00	39	39.00	0.	6.	1.02	986.9
1.02	16.00	40	40.00	0.	5.	1.02	986.9
1.02	17.00	41	41.00	0.	4.	1.02	986.9
1.02	18.00	42	42.00	0.	3.	1.02	986.9
1.02	19.00	43	43.00	0.	2.	1.02	986.9
1.02	20.00	44	44.00	0.	1.	1.02	986.9
1.02	21.00	45	45.00	0.	0.	1.02	986.9
1.02	22.00	46	46.00	0.	0.	1.02	986.9
1.02	23.00	47	47.00	0.	0.	1.02	986.9
1.03	0.0	48	48.00	0.	0.	1.03	986.9
1.03	1.00	49	49.00	0.	0.	1.03	986.9
1.03	2.00	50	50.00	0.	0.	1.03	986.9
1.03	3.00	51	51.00	0.	0.	1.03	986.9
1.03	4.00	52	52.00	0.	0.	1.03	986.9
1.03	5.00	53	53.00	0.	0.	1.03	986.9
1.03	6.00	54	54.00	0.	0.	1.03	986.9
1.03	7.00	55	55.00	0.	0.	1.03	986.9
1.03	8.00	56	56.00	0.	0.	1.03	986.9
1.03	9.00	57	57.00	0.	0.	1.03	986.9
1.03	10.00	58	58.00	0.	0.	1.03	986.9
1.03	11.00	59	59.00	0.	0.	1.03	986.9
1.03	12.00	60	60.00	0.	0.	1.03	986.9
1.03	13.00	61	61.00	0.	0.	1.03	986.9
1.03	14.00	62	62.00	0.	0.	1.03	986.9
1.03	15.00	63	63.00	0.	0.	1.03	986.9
1.03	16.00	64	64.00	0.	0.	1.03	986.9
1.03	17.00	65	65.00	0.	0.	1.03	986.9
1.03	18.00	66	66.00	0.	0.	1.03	986.9
1.03	19.00	67	67.00	0.	0.	1.03	986.9

PEAK DUTYFLW IS										55. AT TIME		0.0 HOURS											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
1.04	1.00	73	73.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	2.00	74	74.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	3.00	75	75.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	4.00	76	76.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	5.00	77	77.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	6.00	78	78.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	7.00	79	79.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	8.00	80	80.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	9.00	81	81.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	10.00	82	82.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	11.00	83	83.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	12.00	84	84.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	13.00	85	85.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	14.00	86	86.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	15.00	87	87.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	16.00	88	88.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	17.00	89	89.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	18.00	90	90.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	19.00	91	91.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	20.00	92	92.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	21.00	93	93.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	22.00	94	94.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.04	23.00	95	95.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.05	0.0	96	96.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.05	1.00	97	97.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.05	2.00	98	98.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.05	3.00	99	99.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
1.05	4.00	100	100.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
PEAK DUTYFLW IS																				55. AT TIME		0.0 HOURS	
LFS										55.		2.		53.		48.		20.		TOTAL VOLUME			
LMS										53.		2.		1.		48.		1.		40.			
INCHES										0.71		2.55		3.15		3.15		3.15		3.15			
MM										18.00		64.69		79.98		79.98		79.98		79.98			
AL-FI										26.		95.		117.		117.		117.		117.			
THUS CJ M										33.		117.		145.		145.		145.		145.			

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

RATIOS APPLIED TO FLUWS

OPERATION	STATION	AREA	PLAN RATIO	1
			1.00	

HYDROGRAPH AT	1	0.72	1	0.
		1.811		0.071

ROUTED TO	2	0.72	1	55.
		1.811		1.5511

[illegible]

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APPENDIX D
REFERENCES

REFERENCES

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APPENDIX E
DRAWINGS AND ENGINEER'S REPORT

CONTENTS

Location Plan

Watershed Map

Plate 1: Field Sketch

Plate 2: Plan of Dam

Plates 3,4,5: Dam Cross Sections

Plate 6: General Plan & Elevation of Spillway

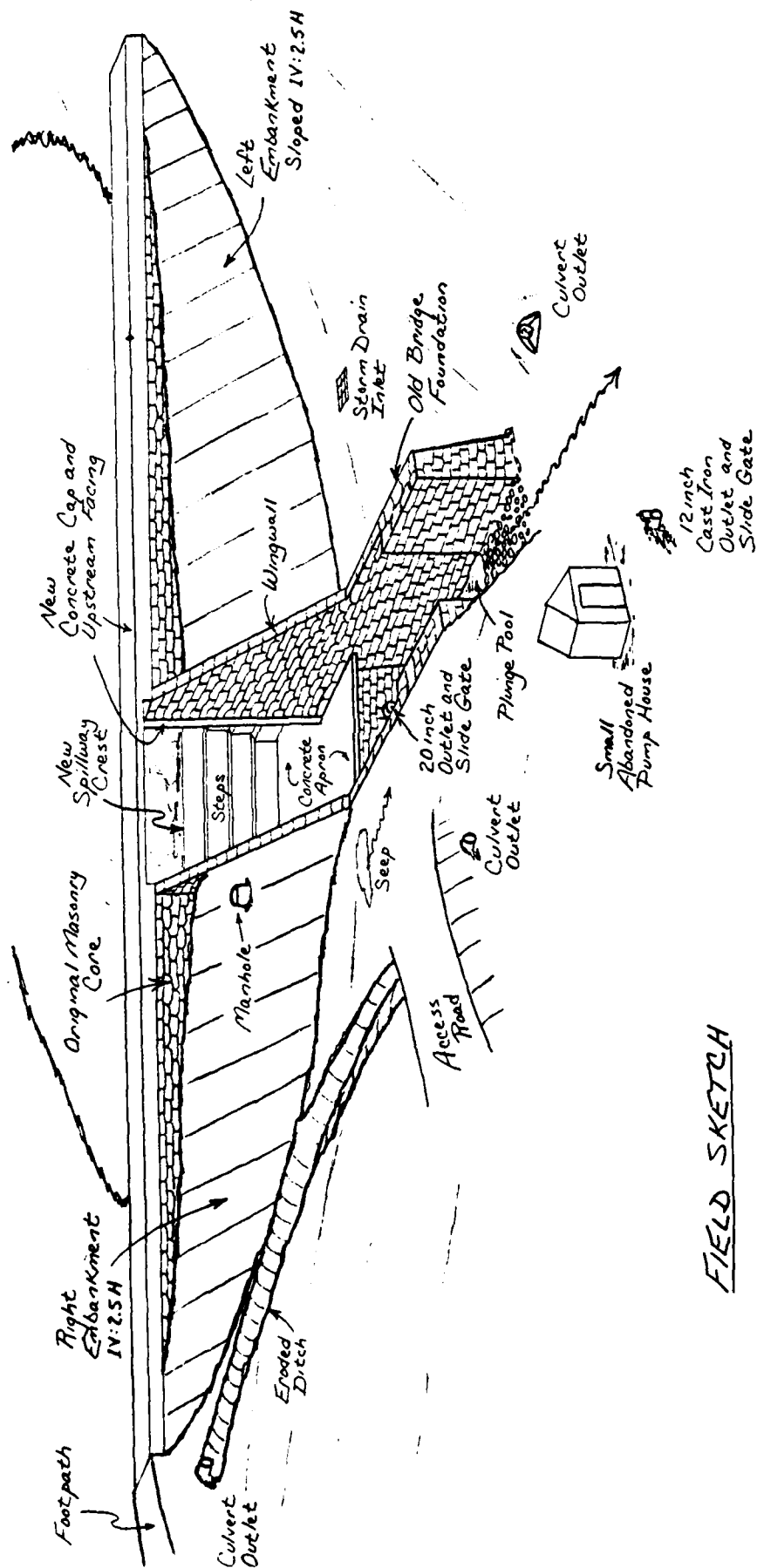
Plate 7: Clay Blanket

Plate 8: Mudgate Structure Details

Plate 9: Construction Details (Control Manhole)

Engineer's Report

- Not to Scale -



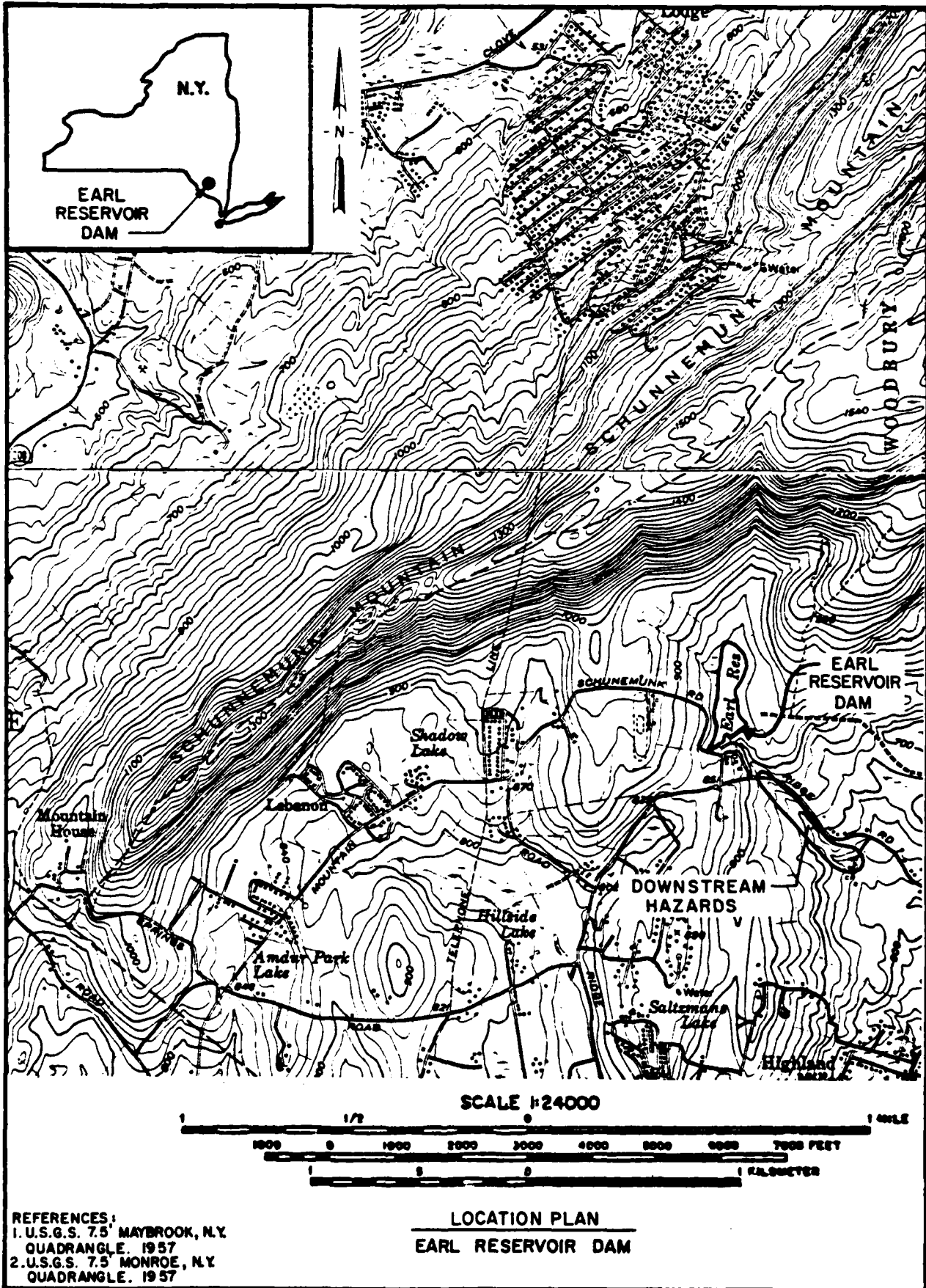
FIELD SKETCH

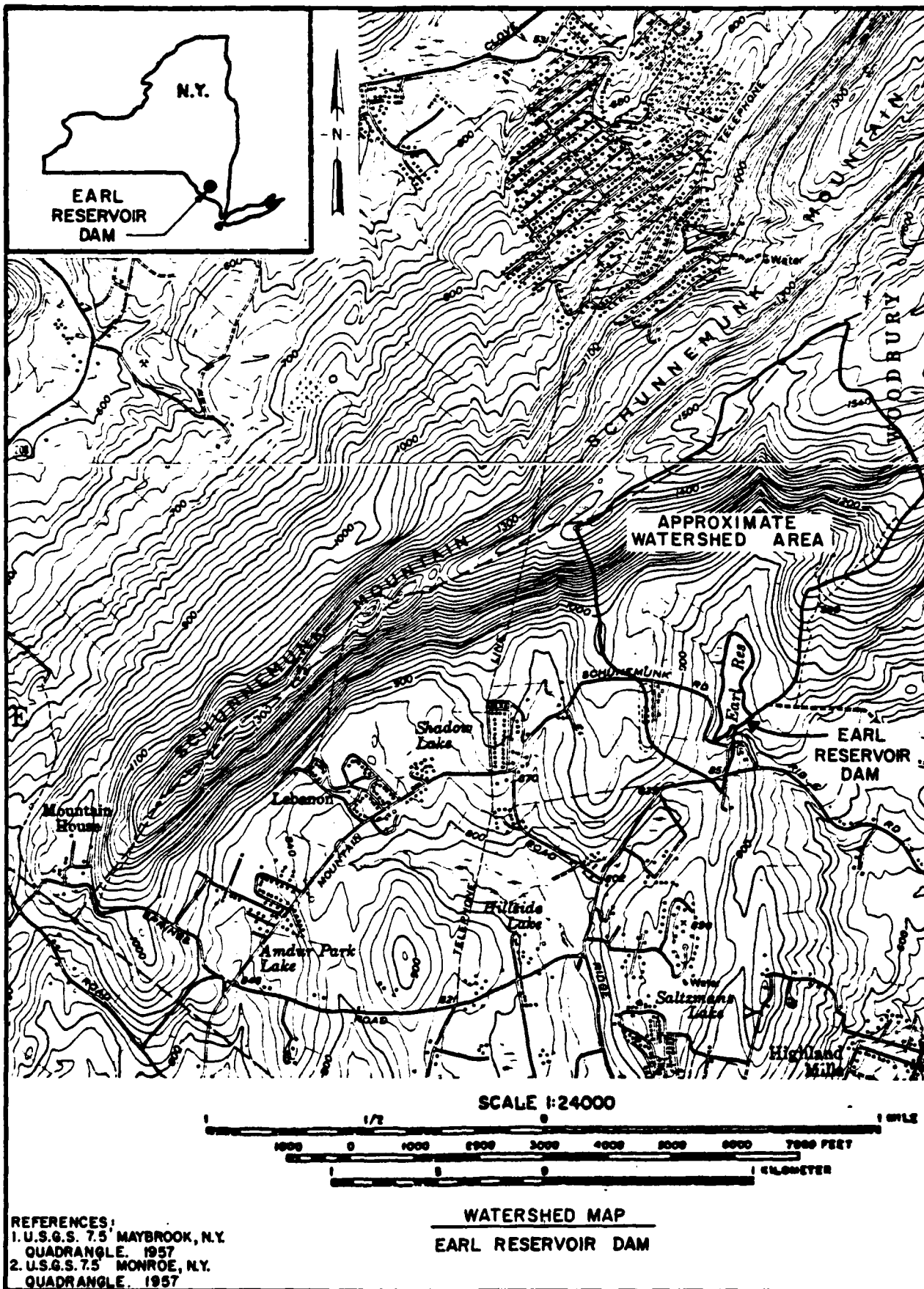
EARL RESERVOIR DAM, NEW YORK

Michael Baker, Jr., Inc.

9 January 1981

PLATE 1





DESIGN MARK:

- ① R.R. Sp. in Pole 15741 No. 7
E1 834.04 (Assumed Datum)
- ② R.R. Sp. in Pole 15741 No. 8
E1 823.00 (Assumed Datum)



PLAN
NORTH

EARL RESER

PROPOSED LAKE MUDGATE ST

PROPOSED PEDESTAL
OVERFLOW TO
EXISTING CORE W

CONST. STA. 1
CHANNEL & ST

PRO
STR

TOE OF

EXISTING WATER SUPPLY STRUCTURE
TO BE MODIFIED (SEE SPECS)

SEMI CURTAIN WALL
STA. 1+11

CONSTR. E

S. APPROACH WALK
(TYP.)

TOE OF SLOPE PROP. CONTROL MANHOLE

EXISTING BRIDGE TO BE
REMOVED TO EL 807.0

CONSTRUCT
36 L.F. 24" C.S.P. (22" x 2") 16 04
1 UNIT INLETS, TYPE A.

CONSTRUCT
96 L.F. BEAM GUIDE RAIL

EXIST. 12" Ø OUT-
FLOW PIPE TO
REMAIN

EXIST. PUMP HOUSE TO
REMAIN

EXISTING BLOW OFF
GATE VALVE TO REMAIN

PLAN
1" = 20'

CHANNEL SECTION

CHANNEL SECTION

Drive 100 1/2" truck
Past 1000 500 & 600 1/2"

Approx. Exist. Ground

Approx. Exist. Ground

Walk to meet Const. E

Channel 2

Channel 2

Channel 2

Channel 2

Channel 2

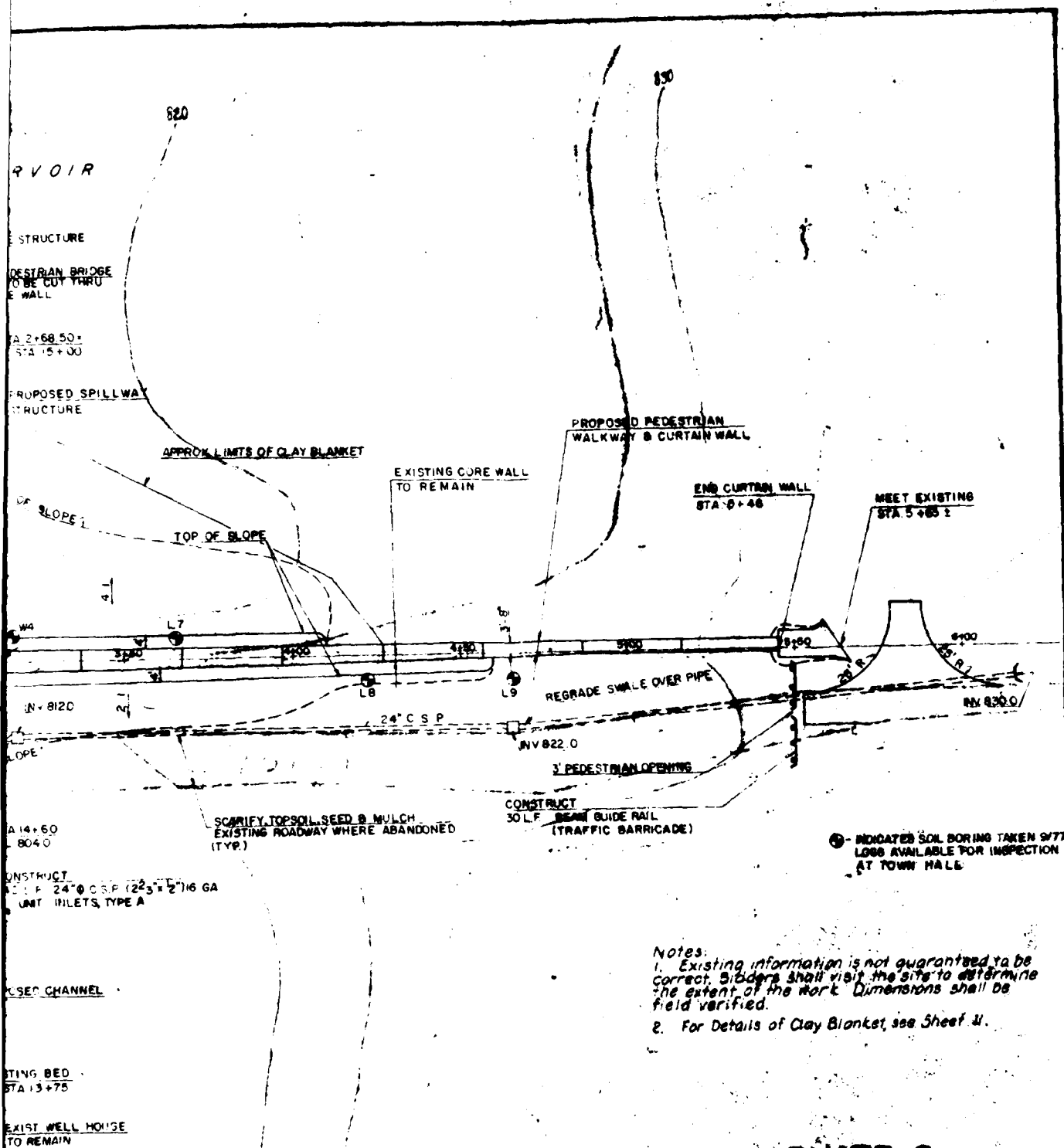
Channel 2

Channel 2

Channel 2

Channel 2

Channel 2



Notes:
 1. Existing information is not guaranteed to be correct. Bidders shall visit the site to determine the extent of the work. Dimensions shall be field verified.
 2. For Details of Clay Blanket, see Sheet 11.

PLATE 2

REHABILITATION OF EARL RESERVOIR

TOWN OF WOODBURY

ORANGE COUNTY, N.Y.

PLAN

RAIMONDI ASSOC., P.C.
 A. GLICKENSTEIN, P.E.
 CONSULTING ENGINEERS

SCALE

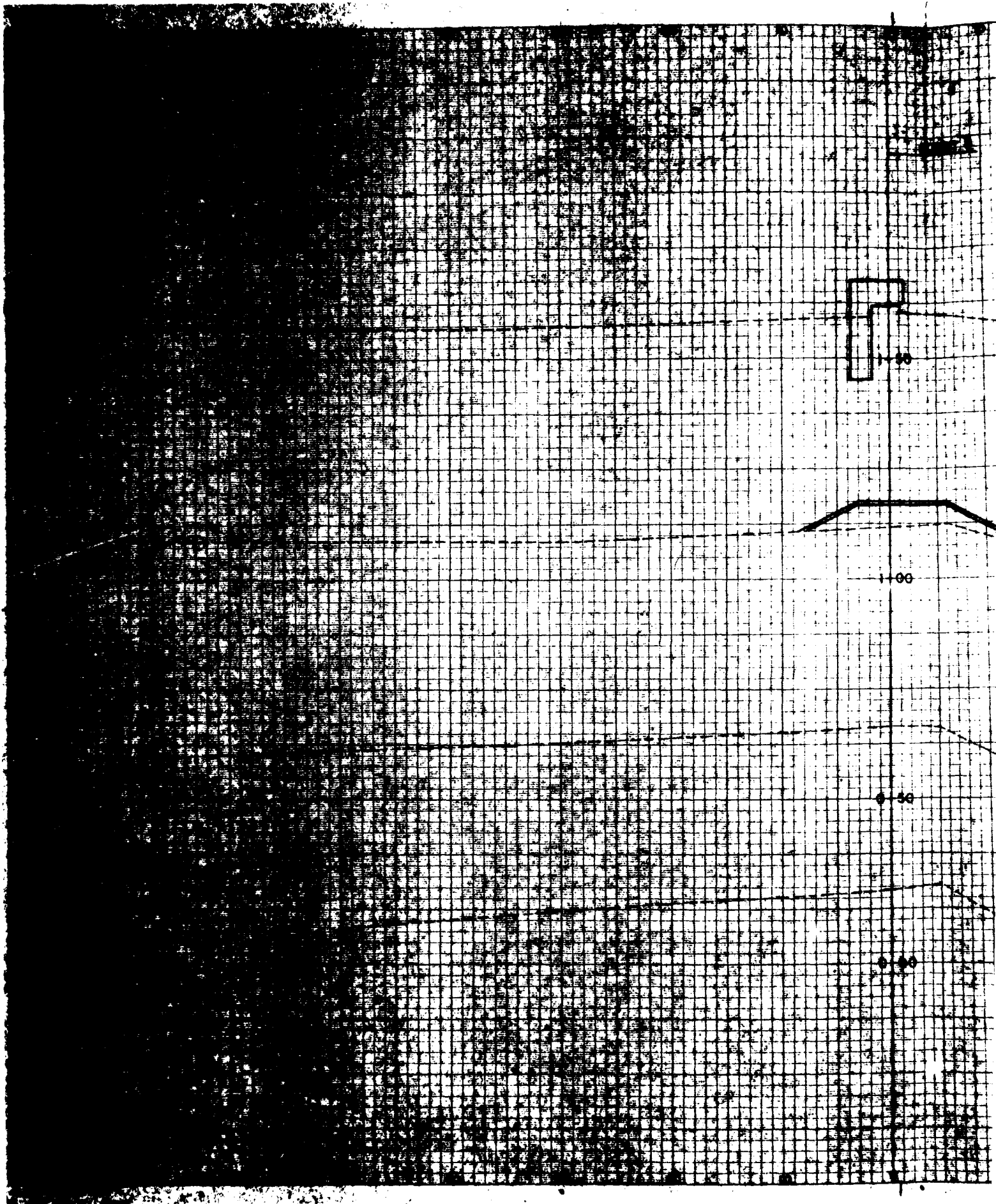
DATE

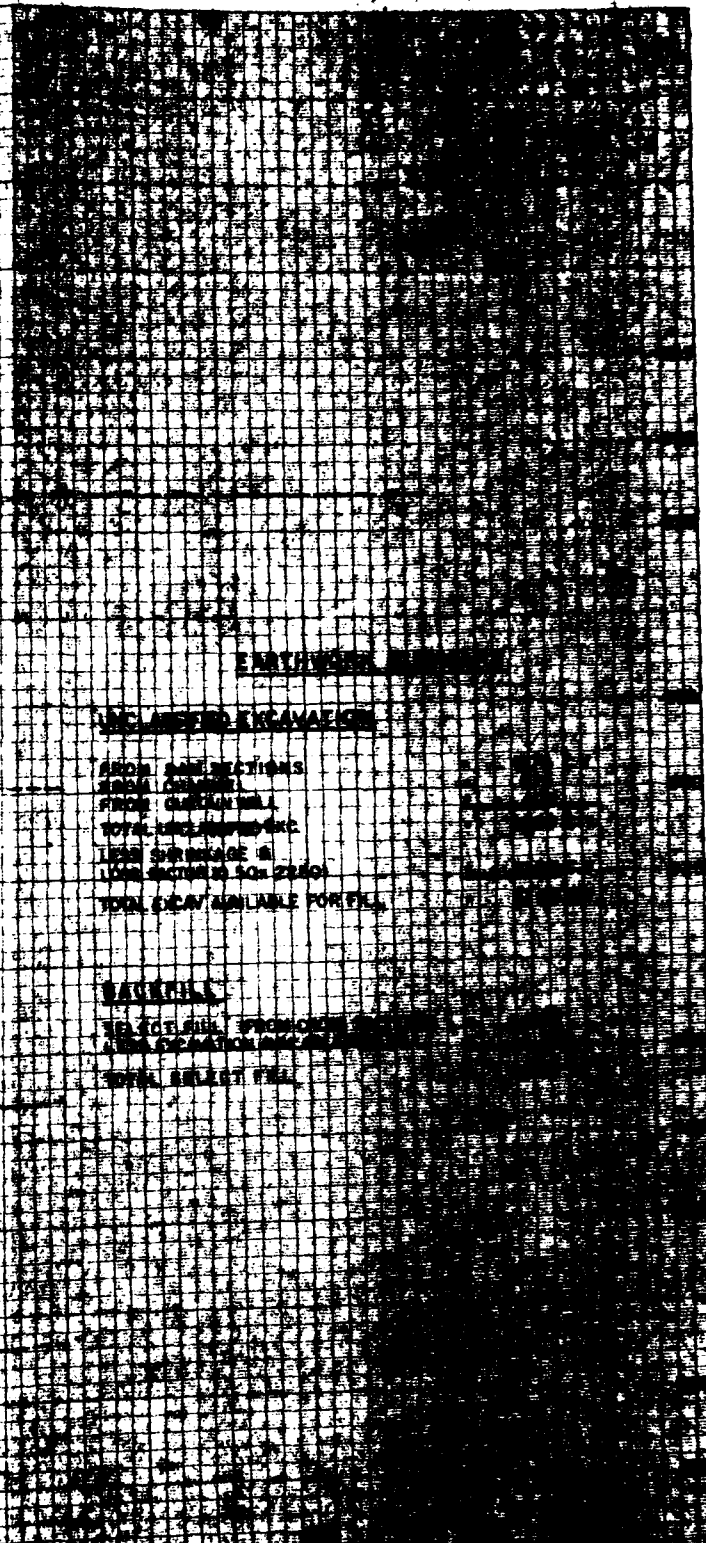
SHEET NO.

AS SHOWN

MAR. '78

2 OF 18





EARTHWORK SUMMARY

DECLASSED EXCAVATION

FROM DAM SECTIONS
 FROM CHANNEL
 FROM CULMINAL
 TOTAL DECLASSED EXCAVATION
 LESS SHRINKAGE &
 LOSS SECTION 23 FOR 22401
 TOTAL EXCAVATION AVAILABLE FOR FILL

BACKFILL

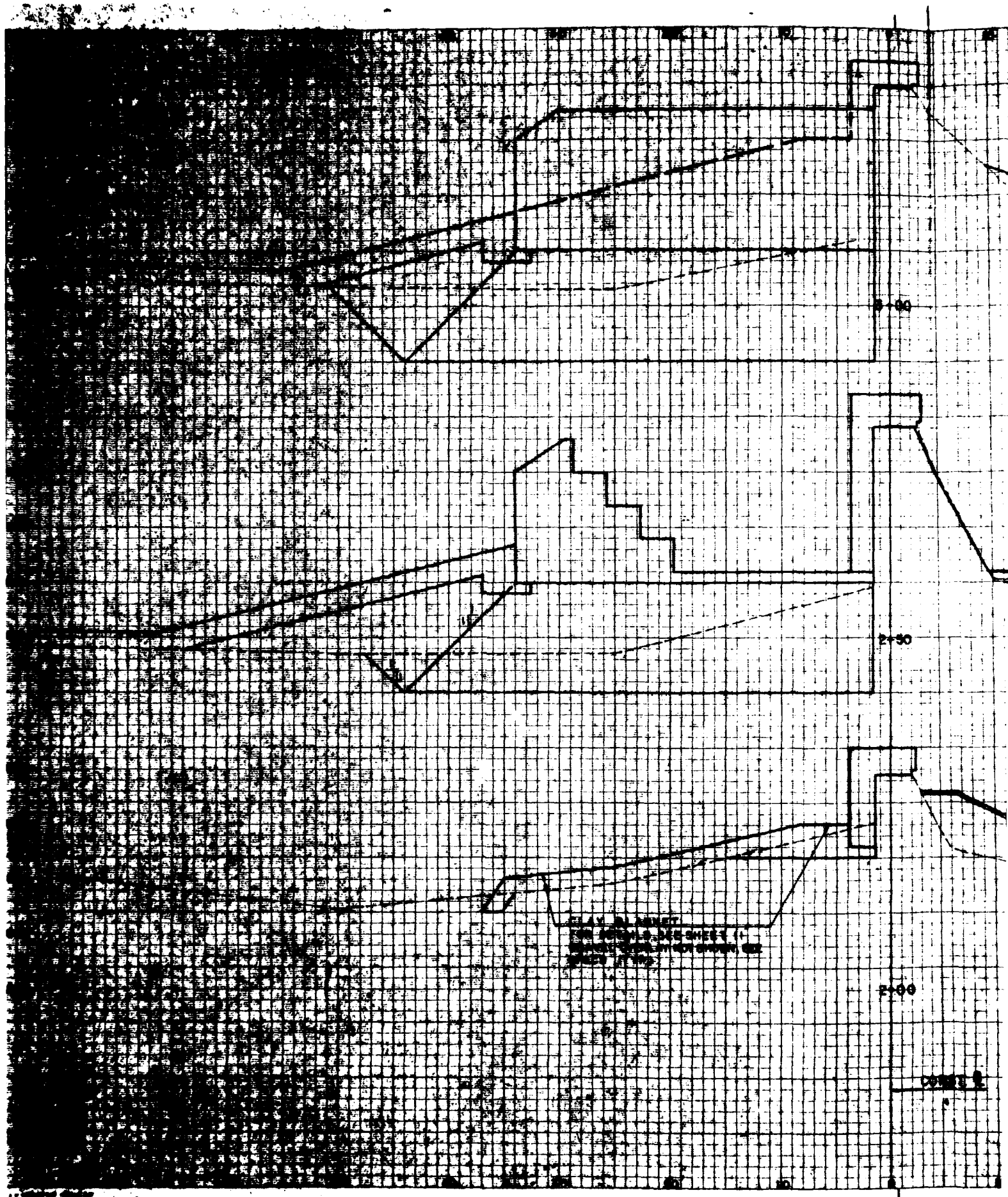
SELECTED FILL FROM CHANNEL
 AND EXCAVATION AVAILABLE
 TOTAL SELECTED FILL

REHABILITATION OF
 EARL RESERVOIR
 TOWN OF WOODBURY

DAM CROSS SECTIONS

RAYMOND1 ASSOC. P.C.
 A. L. KENTENSTEIN, P. E.
 CONSULTING ENGINEERS

1" = 5' HALL, 10-3 OF 19



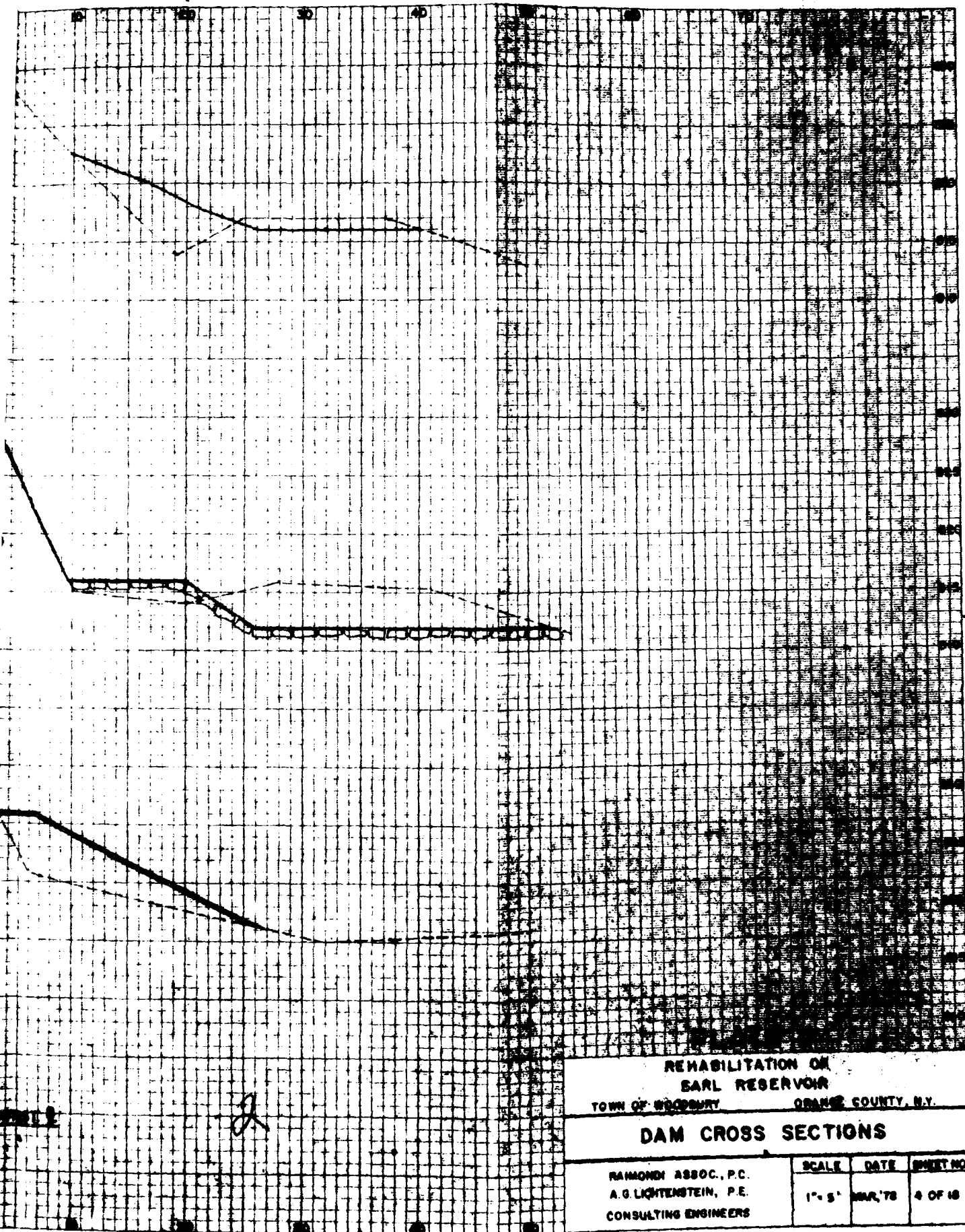
SEE PLAN SHEET
FOR DETAILS, SEE SHEET 1
FOR ELEVATION, SEE
SHEET 2 FOR SECTION

2+00

2+30

2+60

Sheet 2

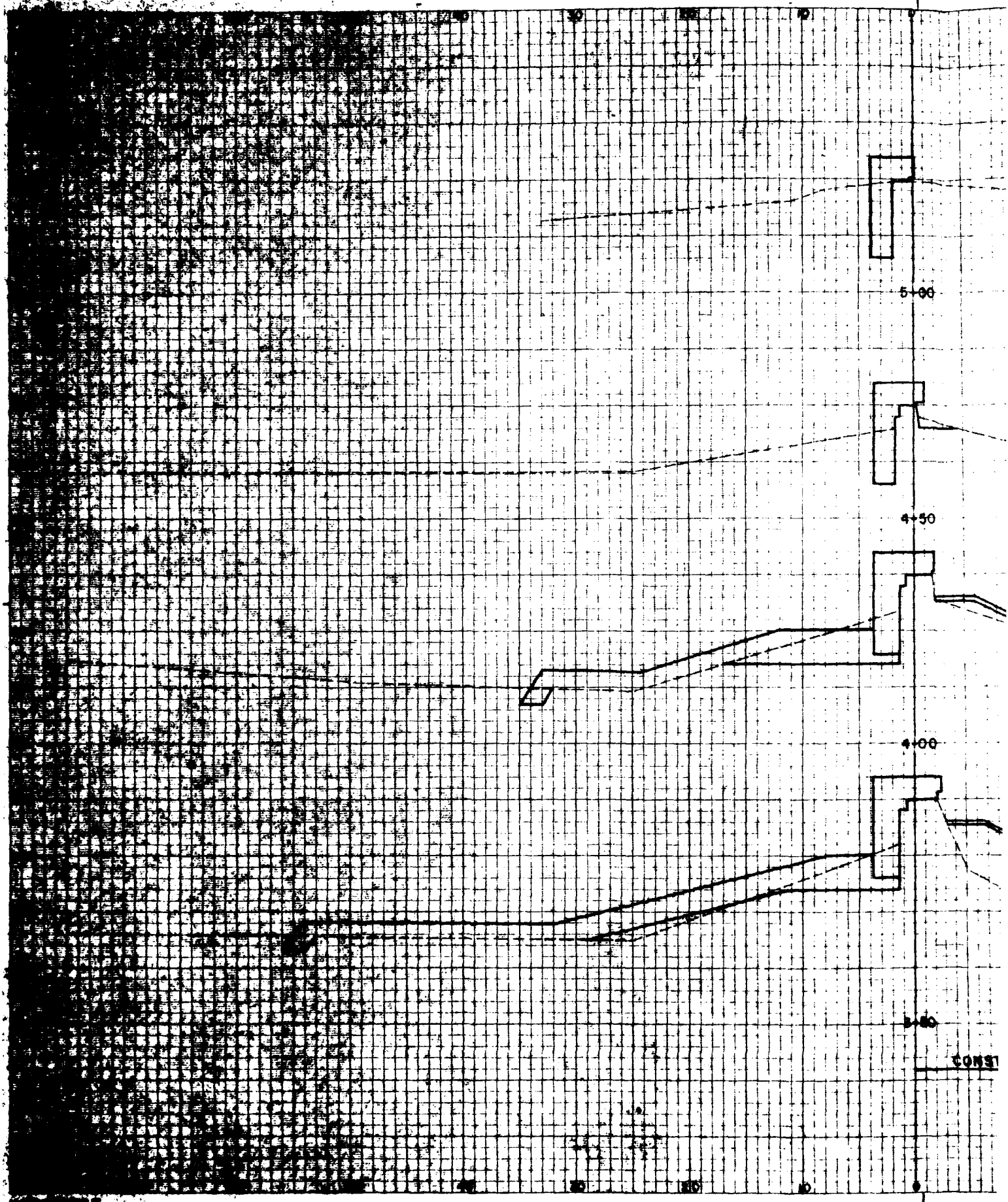


REHABILITATION OF
EARL RESERVOIR
TOWN OF WOODBURY ORANGE COUNTY, N.Y.

DAM CROSS SECTIONS

RAMOND ASSOC., P.C.
A.G. LIGHTENSTEIN, P.E.
CONSULTING ENGINEERS

SCALE	DATE	SHEET NO.
1" = 5'	MAR, '78	4 OF 18



SCARIFY TOPSOIL, SEED & MULCH EXISTING
ROADWAY WHERE ABANDONED (TYP)

CONST. 2

2

REHABILITATION OF
EARL RESERVOIR
TOWN OF WOODBURY ORANGE COUNTY, N.Y.

DAM CROSS SECTIONS

RAIMONDI ASSOC., P.C.
A. GLITCHENSTEIN, P.E.
CONSULTING ENGINEERS

SCALE	DATE	SHEET NO
1" = 5'	MAR. '78	5 OF 18

E A 1

60-0

A

Proposed Spillway

Prop. Curtain Wall

Exist. Core Wall
to remain

Exist. Curtain Wall
Sta. 1+44

Constr. @ Sta 2+64.5
Change @ Sta 2+52

PT 5+14+00

A

PLAN

10

Note: to building near by Exist. Core
wall between businesses. Include cost
in Item 2

SECTION A-A

1" = 10'

Constr. @

So. varies

El. 822.0

Level Berm @

El. 822.0

Topsoiling &
Seeding

SECTION B-B

1" = 10'

ELEVATION

1" = 10'

Prop. Spillway, apron
thru North

Prop. Spillway

Approx. Exist.
Ground

Prop. Clay Blanket
& Gravel overlay

Prop. Spillway
El. 818.5

Gravel El. 828.20

Prop. Apron
El. 816.0

El. 814.5

Exist. Bridge to be
removed
El. 814.0
Clear in North

El. 814.0

Prop. Spillway

Unclassified Escar.
Full Length of Spill-
way

Select Fill

AD-A105 743 BAKER (MICHAEL) JR INC BEAVER PA
NATIONAL DAM SAFETY PROGRAM. EARL RESERVOIR DAM (INVENTORY NUMB--ETC(U)
JUN 81 6 KESTER F/G 13/13
DACW31-81-C-0010
UNCLASSIFIED NL

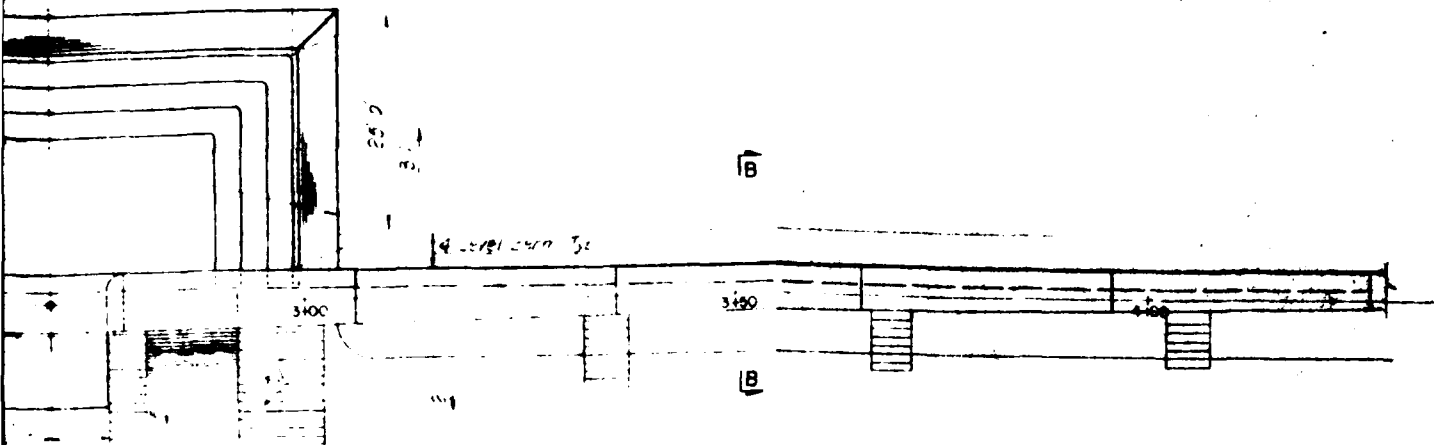
BAKER (MICHAEL) JR INC BEAVER PA F/8 13/13
NATIONAL DAM SAFETY PROGRAM. EARL RESERVOIR DAM (INVENTORY NUMB--ETC(U)
JUN 81 @ KESTER DACW51-81-C-0010
NL

UNCLASSIFIED

2 of 2
40
2105.748

END
DATE
FILED
11 R
DEC

EARL RESERVOIR



PLAN

POSSIBLE SEQUENCE OF CONSTRUCTION

1. Divert water thru existing 12" outflow pipe. Cut notch thru corewall. Excavate unnecessary material under proposed spillway. Remove existing mudgate valve. Partially backfill excavation. Construct & encase pre-mudgate structure.
2. Divert water thru mudgate structure. Reconstruct & encase 12" Main. (A gap for the 12" Main will be kept available in place of right in case of heavy rain.)
3. Divert water thru both the 12" Main & the mudgate & complete backfill under proposed spillway.
4. Construct Spillway, Apron & Surface Wall.
5. Construct Pedestrian Bridge & Railing.
6. Complete Embankment, Clay Blanket & Channel work. Remove existing bridge.
7. Complete Miscellaneous Work.

Notes:

1. This sequence of construction is suggested but does not in any way limit the contractor to his selected method of construction. Contractor shall submit his proposed method of construction to the Engineer for approval prior to start of construction for review.
2. Pedestrian & Vehicular Traffic to be detoured.

PLATE 3

REHABILITATION OF
EARL RESERVOIR

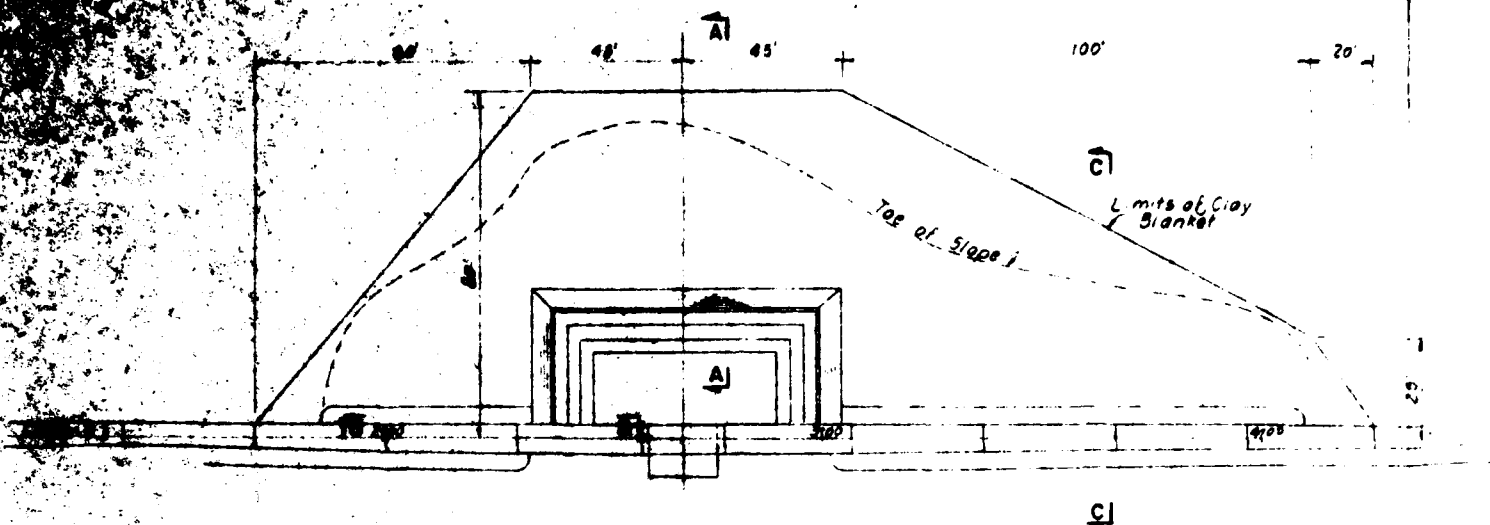
DATE OF REVISION: _____

GENERAL PLAN & ELEVATION

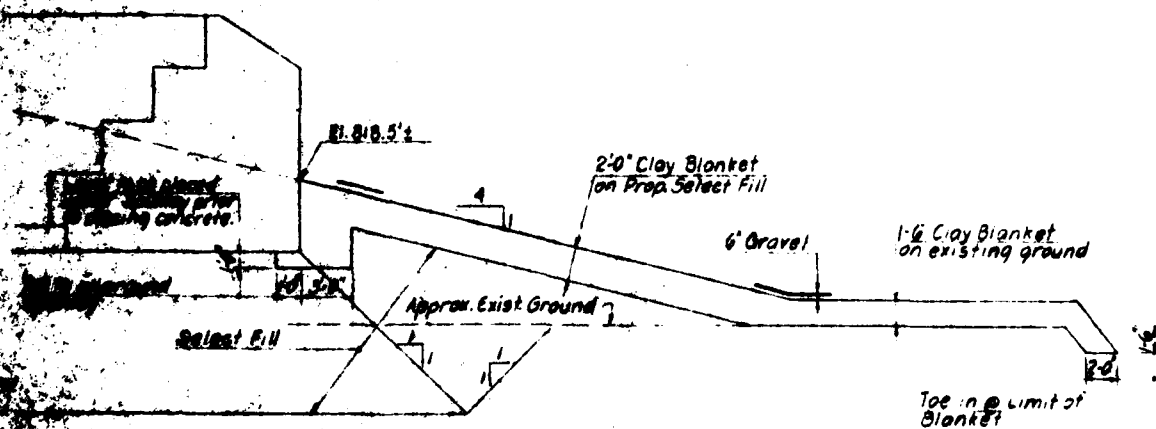
RAINBOW ASSOC. P.C.
Arlington P.E.
CONSULTING ENGINEERS

SCALE: DATE: _____
APPROVED BY: _____

2

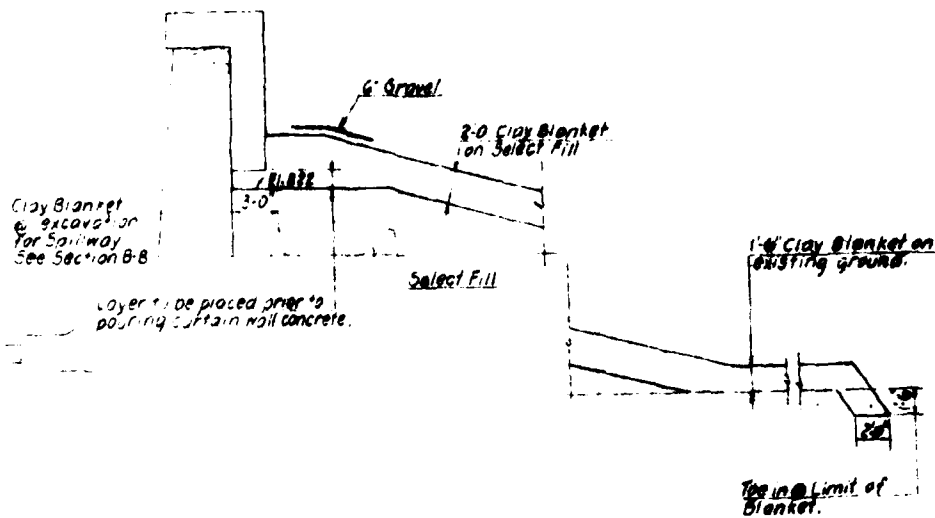


PLAN
1"=20'

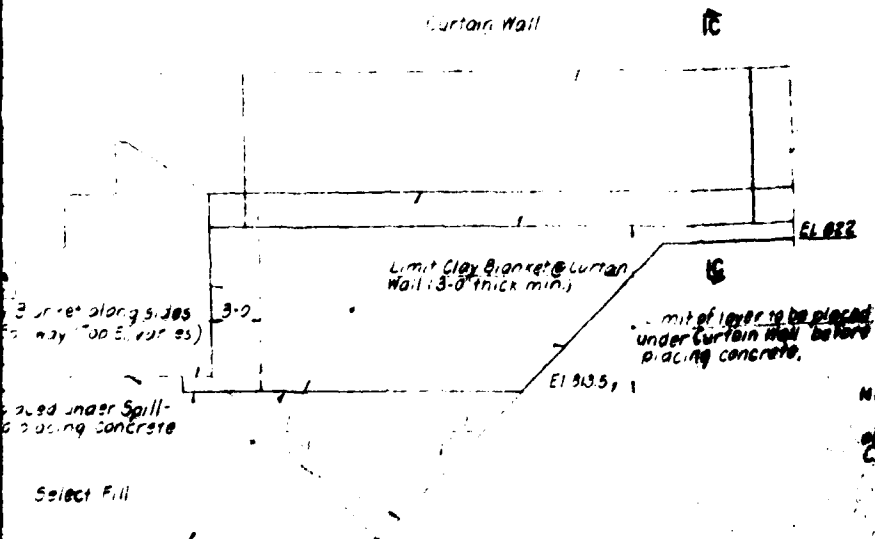


SECTION A-A
1"=5'

Clay Blanket to be placed prior to placing concrete.



SECTION C-C
1" = 5'



SECTION B-B
1" = 5'

Note:
All exposed clay blanket shall be covered with gravel 3" thick. Limit to be placed prior to Clay Blanket.

PLATE 2

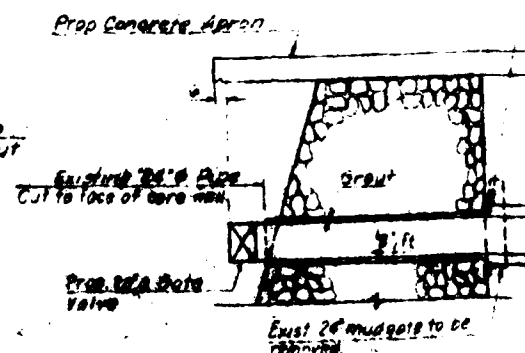
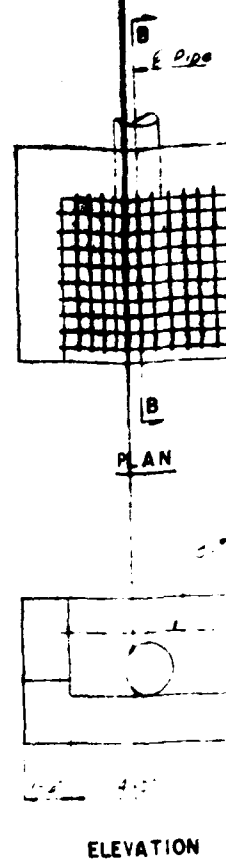
WENDELTON
EARL

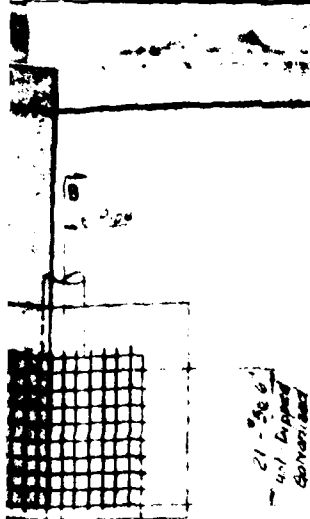
CLAY BLANKET

RAMON A. LICHENBERG, P.E.
A.E. LICHENBERG, P.E.
CONSULTING ENGINEER

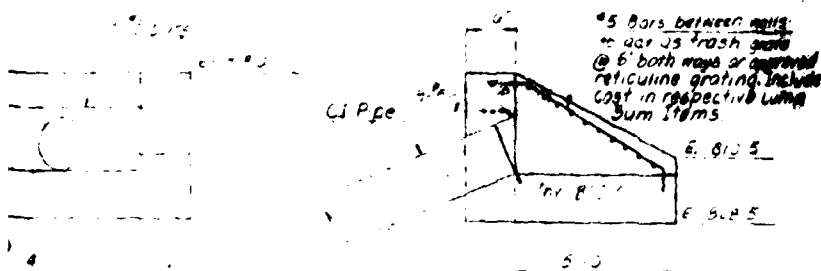
DATE	BY	CHKD BY	APP'D BY
10/1/50	WEL	WEL	WEL
10/1/50	WEL	WEL	WEL
10/1/50	WEL	WEL	WEL

2





8
PLAN



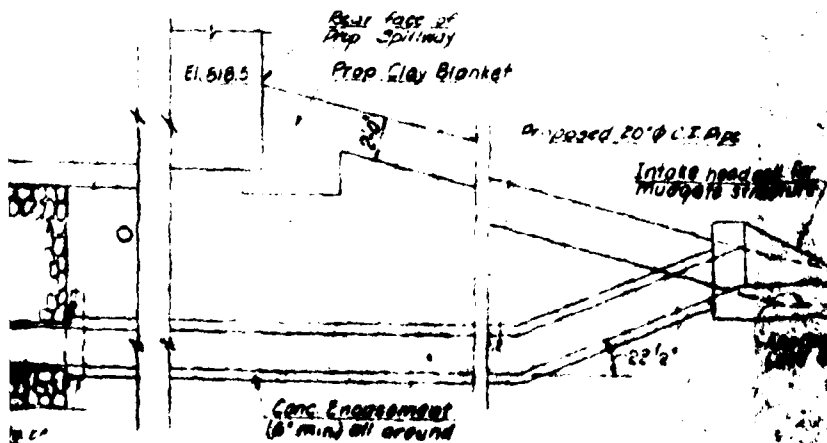
ELEVATION

SECTION B-B

INTAKE HEADWALL DETAILS

3'-10"

2'-0" x 2'-0" Boxed
Water A-Box
on ground



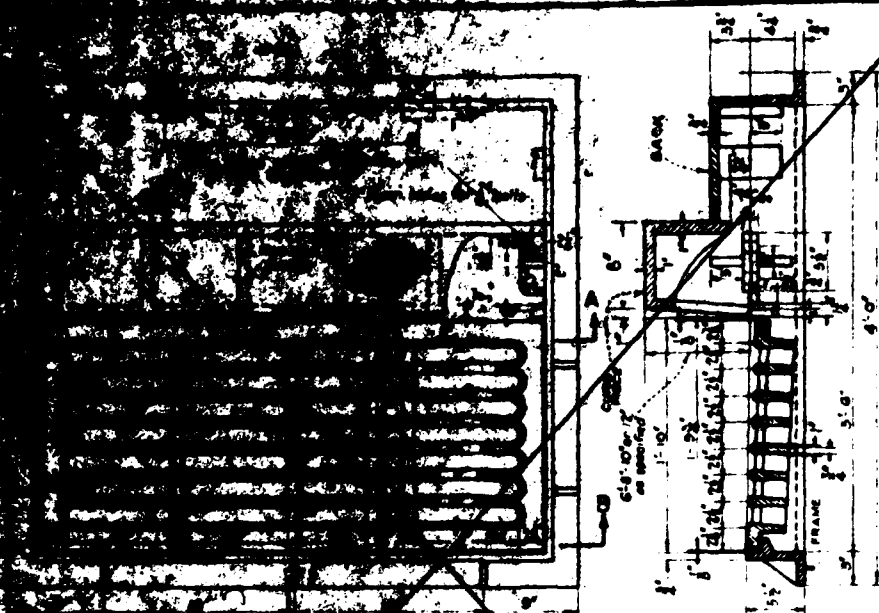
Note:
1) Check Drawings for Material
Water Supply Structure
resulting from inspection
and inspection of material
to be used with structure.

PLATE 1

SECTION A-A

4'-11"-0"

2



SECTION C-C



SECTION A-A

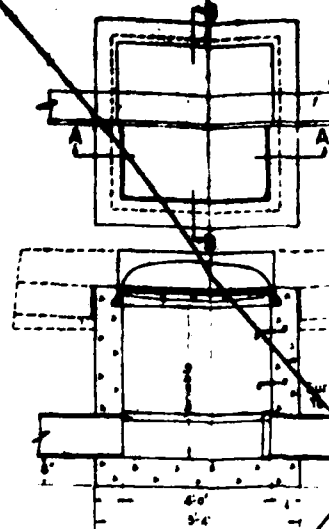


SECTION B-B

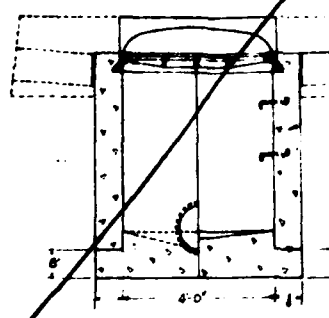
Minimum Weights

Weight of Grate	385 ⁰
Weight of Frame	372 ⁰
Weight of Back	169 ⁰
Weight of Curb Piece	6'-225 ⁰ 8'-255 ⁰ 10'-265 ⁰ 12'-322 ⁰

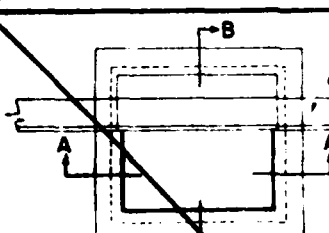
FRAME-BACK-CURB
PIECE AND GRATE
FOR
INLET TYPE B
CATCH BASIN TYPE C
Scale 1/8"=1'-0"



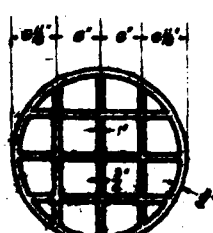
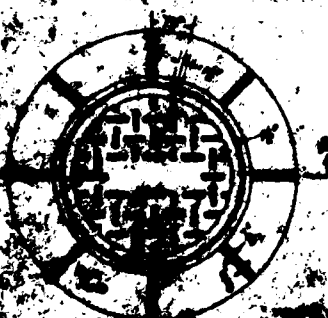
SECTION A-A



SECTION A-A



SECTION A-A



UNDERVIEW OF COVER

Weight of Grate: 372⁰
Weight of Frame: 169⁰



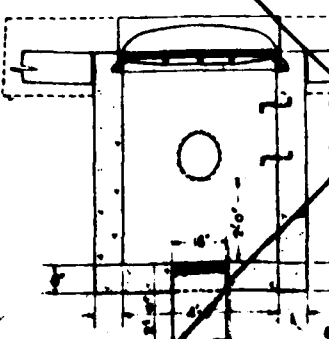
DETAIL OF SEAT

Half Size



DETAIL OF NON-USED LUG

Half Size



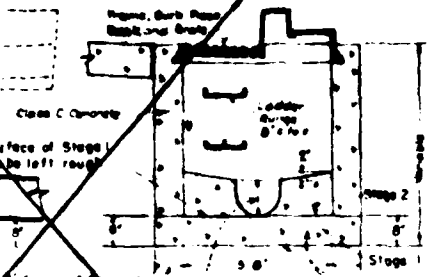
Set this piece in
position of all pieces
curb

Concrete Curb - 1/2" METAL
WHERE CURB MEETS

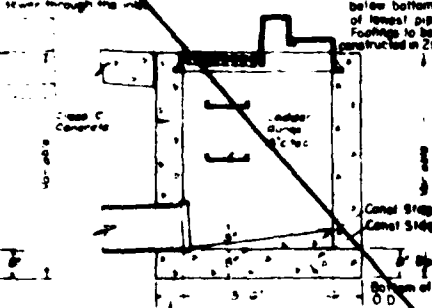
INLET TYPE B WITH C.I. CURB PIECE-BACK-FRAME AND GRATE

Scale 1/4" = 1'-0"

This inlet may be constructed of brick, concrete or concrete block. If brick or concrete block is used the bottom shall be as shown for concrete.



SECTION B-B

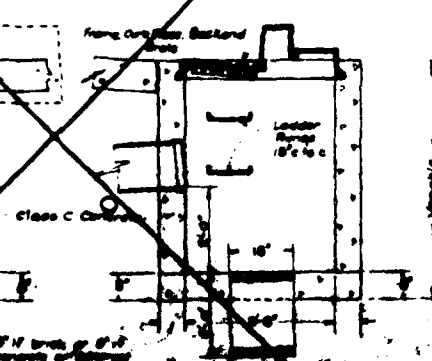


SECTION B-B

CATCH BASIN TYPE C WITH C.I. CURB PIECE-BACK-FRAME AND GRATE

Scale 1/4" = 1'-0"

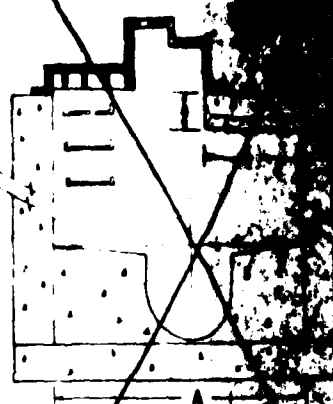
This basin may be constructed of brick, concrete or concrete block. If brick or concrete block is used the bottom shall be as shown for concrete. Alternate vertical joints of brick or block in five lower courses shall be left open. When constructed of concrete a leaching basin 18" x 18" x 2'-0" deep of 2" trap rock or approved field stone shall be constructed.



SECTION B-B

INLETS TYPE B1 & B2

Inlets Type B1 or Type B2 shall be constructed as shown for Inlet Type B except as otherwise indicated.

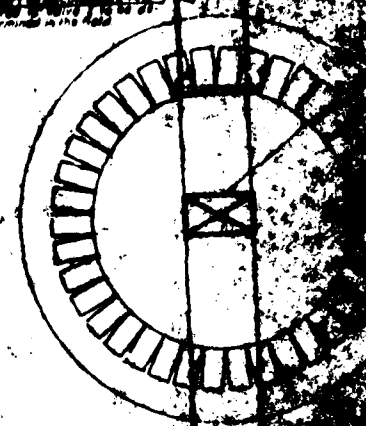


INLET TYPE	DIMENSION A	DIMENSION B
B1	4'-0"	1'-0"
B2	5'-0"	1'-0"

No Scale

GENERAL NOTES

1. Corbeling of inlet walls shall be indicated at the rate of 1/2" per 6" of height of wall. Maximum corbel 6" per wall.
2. When the item of manholes, catch basins, or catch basins, additional depth is shown in the proposal and the depth of a drainage manhole or as measured from top of edge of grate to invert of drainage structure, the top of the manhole below a depth of 8' shall be 12" thick wall. The overall horizontal dimensions of manholes shall be increased 12" and depth to rock the depth decreased to 12".
3. Except for catch basins and Inlet A manhole footings and manhole shall be indicated in the proposal, and the bottom of the footing shall be 6" below the outer wall of the manhole in laterals and 10" in manholes.
4. The item of road head and bridge raising or lowering the head of catch basins and catch basins, or the raising of manhole base footings, for a maximum of 6" in other changes in position of head casting shall be considered as reconstructed manholes or reconstructed catch basins or catch basins.
5. When curb piece height specified is greater than curb face height, adjust the grade of grate so that the top of curb plate is at the same elevation as the top of curb. (SEE DETAILS)



SECTION B-B

CONTROL

3

OD OF SETTING BASE FOR TYPE B1 & B2 HEIGHT IS 6" GREATER THAN CURB FACE

PL

ENGINEER'S REPORT
REHABILITATION OF EARL RESERVOIR

TOWN OF WOODBURY
COUNTY OF ORANGE
STATE OF NEW YORK

RAIMONDI ASSOCIATES, P.C.
110 STAGE ROAD
MONROE, NEW YORK 10950

A. G. LICHTENSTEIN & ASSOCIATES
1298 TEANECK ROAD
TEANECK, N.J. 07666

MARCH 1978

GENERAL

The Earl Reservoir is a 16 + acre pond located in the Town of Woodbury just north of Ridge Road about one mile west of the intersection of Ridge Road and New York State Route 32 (see Exhibit A). The pond is presently used as a recreational area for the residents of the Town. Up until 30 + years ago the water in the pond was used for water supply purposes although the Town still maintains the right to use the water for said use in case of emergency need.

Water is contained in the pond by a masonry and earth dam constructed 65 years ago. The dam is approximately 425 feet in length with a maximum height above the old stream bed of some 26 feet. The existing spillway is divided into three (3) parts:

1. 15' long - 0.3' deep
2. 16' long - 1.0' deep
3. 15' long - 0.8' feet (total capacity 80+ cfs)

The dam has a gated 24" emergency outlet (non-operative) as well as a 12" diameter intake for water supply purposes now used to drain most of the lake if needed.

Over the past few years several leaks in the outside face of the dam have been noted. During the summer of 1977 with little or no inflow for extended periods the lake level dropped more than 5 feet. Verification of location and magnitude of these leaks have been made by an underwater examination of the upstream face of the dam.

NOTE: A 2' diameter sinkhole near the spillway necessitated lowering of the lake beginning October, 1977. Lake level down 16' +, lake surface reduced by 90% +.

DESCRIPTION OF WATERSHED

The pond is located in a bowl shaped basin with the northern limit being the ridge of the Schunnemunk Mountains. Upstream ground slopes are quite severe, in some areas being well in excess of 30%. The predominant land use in the upstream watershed is forest with a small percent of swamp and an even smaller percent (1+) of suburban lands. Due to the shape of the basin there are several main tributaries to the pond. In developing the hydrology the drainage basin was divided into six (6) significant areas to better establish the Q100 at the spillway.

Below the dam the stream flows through a fairly steep reach for a distance of some 3000 + feet. Below this point the channel flattens and broadens considerably into a wide flood plain. There are two road crossings in the first reach namely Ridge Road about 1000 + feet downstream of the dam and Jones Road about 1700 + feet downstream. At Ridge Road the roadway is about 15 feet above the stream bed. Any flood surge should be substantially attenuated at this point. The upstream easterly bank at Ridge Road is approximately 12 feet higher than the stream. During a surge water could flow down Ridge Avenue in an easterly direction. However, this possible overflow

should not have a significant downstream effect. Between Ridge Road and Jones Road there are five dwellings in the vicinity of the channel. However, these homes are 12-15 feet higher than the stream. At Jones Road the road bed is more than 10 feet above the stream. There is one dwelling below Jones Road, however, any possible overflow should not present a serious hazard to same. Below Jones Road, there are no dwellings until the channel broadens considerably. The remaining downstream basin has scattered dwellings. Based upon our inspection of the area, it is our opinion that a hazard rating of "b" as defined by the SCS should be adequate for the design of the spillway. A review of the attached calculations should reveal that design of the proposed spillway is quite conservative with a substantial factor of safety built-in.

HYDROLOGY

The Q100 for the project was developed using the Soil Conservation Service "Soil Complex Method" as explained in Technical Release # 55. As indicated the shape of the basin necessitated dividing it up into six areas. This procedure produced a fairly high Q100 of 1258 cfs for a total tributary area of 464 acres. The general data input included a 100 year, 24 hour rainfall of 7.20", a Type II rainfall distribution, a hydrologic soil Group of C based upon 5 different soil types within the basin and a general land use conforming to woods (see calculations).

A copy of our calculations were submitted to the SCS office in Middletown. Attached and labelled Exhibit S is an endorsement by the SCS of our evaluations.

HYDRAULICS

To preserve the beauty of the existing structure it is intended to rebuild a portion of the dam upstream of the existing face. The drawings indicate the new dam to be rectangular in shape having a single spillway 110 feet in length. The spillway overflow will cascade down over a series of steps provided as an energy dissipator as well as for its aesthetics. Below the spillway an opening will be made in the existing dam to allow the flow to continue downstream. The existing bridge shown on the plans will be removed with access to the recreation site being provided from a different source.

Using 150% of Q100 for design of the spillway and a spillway length of 110 feet a routed discharge of 1392cfs has been computed. The maximum elevation of the upstream pool is 830.65 or some 2.45 feet above the spillway crest. Total storage above the spillway crest is approximately 44.82 acre feet. The existing top of the dam (elevation 829.8) to be raised to elevation 832.00 to provide necessary freeboard.

To check if the single spillway can evacuate 75% of the storage between maximum high water and the spillway crest within 48 hours we may calculate as follows. Using the falling head equation (no inflow assumed)

$$dt = A \cdot dy / C \cdot y^{3/2}$$

* - A assumed constant

Integrate between $y=H$ (2.45 ft) and $y=0$ (Spillway Crest)

$$t = 2A / C H^{1/2}$$

$$A = \text{Average Lake Area} = \frac{\text{Total Storage at Q Peak}}{\text{Depth of Flood Above Crest}} = \frac{44.82}{2.45} = 18.29 \text{ Acres}$$

$$18.29 \text{ Acres} = 796,712 \text{ Square Feet}$$

$$C = \text{Weir Coefficient} = 3.3$$

$$L = \text{Length of Spillway} = 110 \text{ feet}$$

$$t = \text{time to empty} = \frac{2(796,712)}{3.3(110)(2.45)^{1/2}} = 2805 \text{ Seconds} = 47 \frac{1}{2} \text{ Minutes}$$

No Problems to evaluate all flow above spillway Crest within 48 hours.

Similarly the criteria of being able to evacuate 90% of the storage below the lowest spillway crest within 14 days may be checked as follows:

First it must be noted that when it was decided to lower the water in the lake for safety, the existing 12" intake was utilized for this purpose. With normal inflow, it took approximately 4 to 5 days to lower the lake some 16 feet. It has already been noted that at this elevation more than 90% of the lake area is gone.

The present proposal is to reactivate the mud gate. The plans indicate that a 20 inch outlet is proposed for this purpose. It is obvious from the discussion above that the new mud gate facility would be more than adequate to meet the criteria of discharging 90% of the lake volume below the spillway crest within a 14 day period. However, to tie it down more exactly, we may calculate the following:

$$dt = A \cdot dy / C \cdot a \cdot \sqrt{2gy}$$

Integrate between $y=H$ (H_t of Spillway Crest Above ϕ of 20" outlet) and $y=H_2$ (Selected at 1' above ϕ of 20" outlet)

$$t = \frac{2A}{C \cdot a} \left(\sqrt{H_1} - \sqrt{H_2} \right) \sqrt{2g}$$

$$A = \text{Average Lake Area between Spillway Crest (16') and Lake @ El. 810 (2 Ac) or 9 Ac (392,040 Sq. Ft.)}$$

$$C = \text{Orifice Constant} = \text{Say } 0.6$$

$$a = \text{Area of 20" } \phi \text{ outlet pipe} = 2.18 \text{ Sq. Ft.}$$

$$H_1 = 17 \quad H_2 = 1$$

$$t = \frac{2(392,040)}{0.6(2.18)} \left(\sqrt{17} - \sqrt{1} \right) \sqrt{2(32.2)} = 2.71 \text{ Days} \quad \text{NO PROBLEM}$$

Upon cascading down the spillway the flood will pass through an opening to be cut into the old dam. Said opening will be 15 feet wide conforming to the width between buttresses below the present spillway. Considering the opening as a culvert with inlet control, the total depth of flow using procedures in BPR (HEC # 5) would be 11.0 feet. With an invert proposed of 815.0 this depth converts to 826.0. The opening proposed still allows for lake control at the spillway.

Upon passing through the opening in the old dam the water drops about 10-1/2 feet into a plunge pool which is aided by a three foot high check dam located immediately below the drop. This installation will aid in the dissipation of energy created by the flood. The entire channel below the dam will be rip-rapped a distance of some 125 feet.

STRUCTURAL CONSIDERATIONS

Earl Reservoir was constructed circa 1912 as an earth dam with a masonry core wall. In recent years, there have developed various forms of leaks through the dam masonry with the water level dropping several feet below the spillway, particularly in the summer season. Also, the stone masonry has been damaged by wave and ice action on its upper portions. These concerns combined with aesthetic considerations and a need to improve the hydraulic capacity of the spillway led to the development of the proposed structure.

Soil Borings were taken for the proposed project. The underlying soils for the structure were found to be dense and sandy soils containing varying proportions of silty clay. These materials were deemed to be of a suitable bearing and permeability capacity to meet the needs of the project. A copy of the Boring Logs are included elsewhere in this Report.

An underwater inspection of the existing structure made by certified divers and several sink holes were discovered along and near the upstream face of the core wall. One sink hole in particular was approximately two (2') feet in diameter and appeared to be causing a migration of fine materials, through the dam, to an outflow area discovered 75'+ downstream. Concern for the progressive nature of this type of failure led to the lowering of the reservoir.

In light of the accumulated data, the proposed structure was selected to incorporate a steel sheeting cut-off wall capped by a reinforced concrete curtain wall along the existing core wall. This is tied into a reinforced concrete spillway with a designed crest length of 110'.

Various other architectural and aesthetic treatments were included in the proposed projects to compliment the recreational nature of the site.

Re: Our File # 77-1170
Earl Reservoir

ESTIMATE OF QUANTITIES

<u>Item Number</u>	<u>Item</u>	<u>Unit</u>	<u>Quan.</u>	<u>Unit Price</u>	<u>Total</u>
1.	Clearing & Grubbing	L.S.	L.S.	\$5,000.	\$ 5,000.00
2.	Removal of Bridge & Core- wall Section	L.S.	S.S.	10,000.	\$ 10,000.00
3.	Unclassified Excavation and Disposal	C.Y.	1900	\$ 3	\$ 5,700.00
4.	Select Fill	C.Y.	1250	\$ 6	\$ 7,500.00
5.	Class B Concrete For Structures	C.Y.	900	\$ 160.	\$144,000.00
6.	Bar Eninforcement for Structures	LBS.	24,500	\$.65	\$ 15,925.00
7.	Corrugated Steel Pipe 24 inch diameter	L.F.	375	\$ 20.	\$ 7,500.00
8.	Mudgate Structure	L.S.	L.S.	\$ 5,000.	\$ 5,000.00
9.	Water Supply Structure Modification	L.S.	L.S.	\$ 3,000.	\$ 3,000.00
10.	Inlets, Type A	Unit	3	\$ 1,000.	\$ 3,000.00
11.	Manholes	Unit	1	\$ 1,500.	\$ 1,500.00
12.	Beam Guide Rail (Timber Faced)	L.F.	125	\$ 10.	\$ 1,250.00
13.	Pipe Railing	L.F.	510	\$ 20.	\$ 10,200.00
14.	Topsoil (4" TH.) and Seeding	S.Y.	1100	\$ 3.	\$ 3,300.00
15.	Dry, Rip-Rap	C.Y.	170	\$ 30.	\$ 5,100.00
16.	Permanent Steel Sheet Piling	S.F.	8700	\$ 12.	\$104,400.00
		Total			\$332,375.00

HYDROLOGIC EVALUATION

Earl Reservoir - Town of Woodbury

Total Drainage Area - 464 acres (0.725 Sq. Mi.) Exhibit A
Storm Precipitation - 7.20" (100 year rainfall) Exhibit B
Use SCS Type II Rainfall Distribution

- A) Divide basin into 6 drainage areas.
- B) Use procedures SCS TR#55.

Drainage Area #1

- a) D.A.=110 acres (0.172 SQ. Mi.)
- b) $T_t \sim 1$) Overland Flow 40' in 600' (fig. 3-1) also Exhibit D
 - 2) Channel Flow 650' in 3700 (see exhibit attached)
Exhibit D
$$T_t(1) = 600/0.66(60) = 15 \text{ minutes}$$
$$T_t(2) = 9 \text{ minutes}$$
$$T_c \sim 24 \text{ minutes, Use } 0.4 \text{ hour}$$
- c) Hydrologic Soil Group - Use C (soil types, bath, swartz-wood & Lacka wanna, Scribia-Sun, Arnot-Oqaqua Rocky and Arnot Rock Outcrop)
- d) Land Use - Good Woods - Exhibit E
- e) Curve Number - 70 - Exhibit E
- *f) Run-off (precipitation) - 3.79" = d, Note: From SCS TP 149.
- g) Travel Time to Lake - T_t 14' in 700' = 5+minutes (say 0.10 hour)

*May obtain directly from SCS National Engineering Handbook.

Drainage Area #2

- a) D.A. = 107 acres (0.167 Sq. Mi.)
- b) $T_t \sim 1$) O.F. 20' in 400' $T_t = 13 \text{ minutes}$
 - 2) C.F. 670' in 4500' $T_t = 12 \text{ minutes}$
$$T_c \sim 25 \text{ minutes Use } 0.4 \text{ hour}$$
- c) Hydrologic Soil Group - C
- d) Land Use - Good Woods
- e) Curve Number - 70
- f) R.O. = 3.79"
- g) T_t to Lake - 0.10 hour

Drainage Area #3

- a) D.A. = 144 acres (0.225 Sq. Mi.)
- b) $T_t \sim 1$) O.F. 80' in 800' $T_t = 19$ minutes
2) C.F. 400' in 1200' - (swamp) - 180' in 2200'
 $T_t = 11$ minutes $T_c = 30$ minute or 0.50 hour
Note: A swampy area consisting of 10+ acres exists mid-way up basin. Based upon methods in TR-55 peak flow could be reduced by some 25%. The new peak (using table 5-3) coincides with a T_c in excess of 0.8 hour (see Exhibit F). Use $T_c \sim 0.75$ hour.
- c) Hydrologic Soil Group - C
- d) Land Use - Good Woods
- e) Curve Number - 70
- f) Run-off - 3.79"

Drainage Area #4

- a) D.A. = 20 acres (0.031 Sq. Mi.)
- b) $T_t = T_c =$ O.F. = 100' in 1000' ~ 21 minutes, use 0.3 hour
- c) Hydrologic Soil Group - 5 acres D and 15 acres C
- d) Land Use - Good Woods
- e) Curve Number - $5(77) + 15(70)/20 = 71.8$
- f) Run-off - 3.97"

Drainage Area #5

- a) D.A. = 25 acres (0.039 Sq. Mi.)
- b) $T_t = T_c =$ O.F. = 140' in 1100' ~ 20 minutes, use 0.3 hour
- c) Hydrologic Soil Group - C
- d) Land Use - Good Woods
- e) Curve Number - 70
- f) Run-off ~ 3.79 "

Drainage Area #6

- a) D.A. = 58 acres (0.091 Sq. Mi.)
- b) $T_t = T_c =$ O.F. = 110' in 1250' ~ 28 minutes, use 0.5 hour

- c) Hydrologic Soil Group - 43 acres C and 15 acres pond
- d) Land Use - Good Woods
- e) Curve Number - $43(70) + 15(100)/58 = 77.8$
- f) Run-off ~ 4.64"

See Exhibit G-3

FLOOD ROUTING (STEP METHOD)

A) Stage vs. Discharge

- 1) Select spillway length to keep lake depth to within 3.0 of normal during flood flow.
- 2) Provide additional freeboard - Require at least 1.0' above flood level.
- 3) Use trapezoidal weir section - inclined upstream face vertical downstream face - Exhibit H
- 4) Select weir length 110 feet - use $C=3.3$ (conservative)

<u>Stage (ft)</u>	<u>Discharge (cfs)</u>	<u>Stage (ft)</u>	<u>Discharge(cfs)</u>
0	-	2.3	1342
0.3	63	2.8	1804
0.8	275	3.3	2176
1.3	570	3.8	2689
1.8	930		

Datum Elevation 828.2

B) Stage vs. Storage

<u>Stage (ft)</u>	<u>Elevation</u>	<u>Lake Area (ac)</u>	<u>Storage (Ac-ft)</u>
0	828.2	16.00	
0.3	828.5	16.82	4.92
0.8	829.0	17.65	13.54
1.3	829.5	18.47	22.57
1.8	830.0	19.30	32.01
2.3	830.5	19.85	41.80
2.8	831.0	20.40	51.86
3.3	831.5	20.95	62.20
3.8	832.0	21.50	72.81

FLOOD ROUTING CHART A

* Δt = 0.10 hour - 360 seconds

Stage (ft)	A(Acres)	Q(cfs-out)	Q/2	Storage (Ac-ft)	S/ Δt *	S/ Δt -Q2	S/ Δt +Q,
0	16.00	-	-	0	0	--	-
0.3	16.82	63	32	4.92	595	563	627
0.8	17.65	275	138	13.54	1638	1500	1776
1.3	18.47	570	285	22.57	2731	2446	3016
1.8	19.30	930	465	32.01	3873	3408	4338
2.3	19.85	1342	671	41.80	5058	4387	5729
2.8	20.40	1804	902	51.86	6275	5373	7177

FLOOD ROUTING CHART B - See Exhibit J

Hour	Inflow(cfs)	Iav	150% Iav	S/ Δt -Q/2	S/ Δt +Q/2	H(ft)	Qout-cfs
11.0	47	-	-	-	-	.15	20(est)
11.1	55	51	77	285	362	.17	25
11.2	64	60	90	325	415	.20	32
11.3	74	69	104	385	489	.24	43
11.4	84	79	119	465	584	.29	56
11.5	95	90	135	550	685	.33	69
11.6	145	120	180	630	810	.39	88
11.7	217	181	272	740	1012	.48	121
11.8	442	330	495	905	1400	.65	190
11.9	799	621	932	1225	2157	.98	352
12.0	1107	953	1430	1850	3280	1.41	608
12.1	1258	1183	1774	2670	4444	1.85	913
12.2	1211	1235	1853	3540	5393	2.19	1176
12.3	1084	1148	1722	4200	5922	2.38	1333
12.4	922	1003	1509	4600	6109	2.45	1392
12.5	759	841	1262	4725	5987	2.41	1358

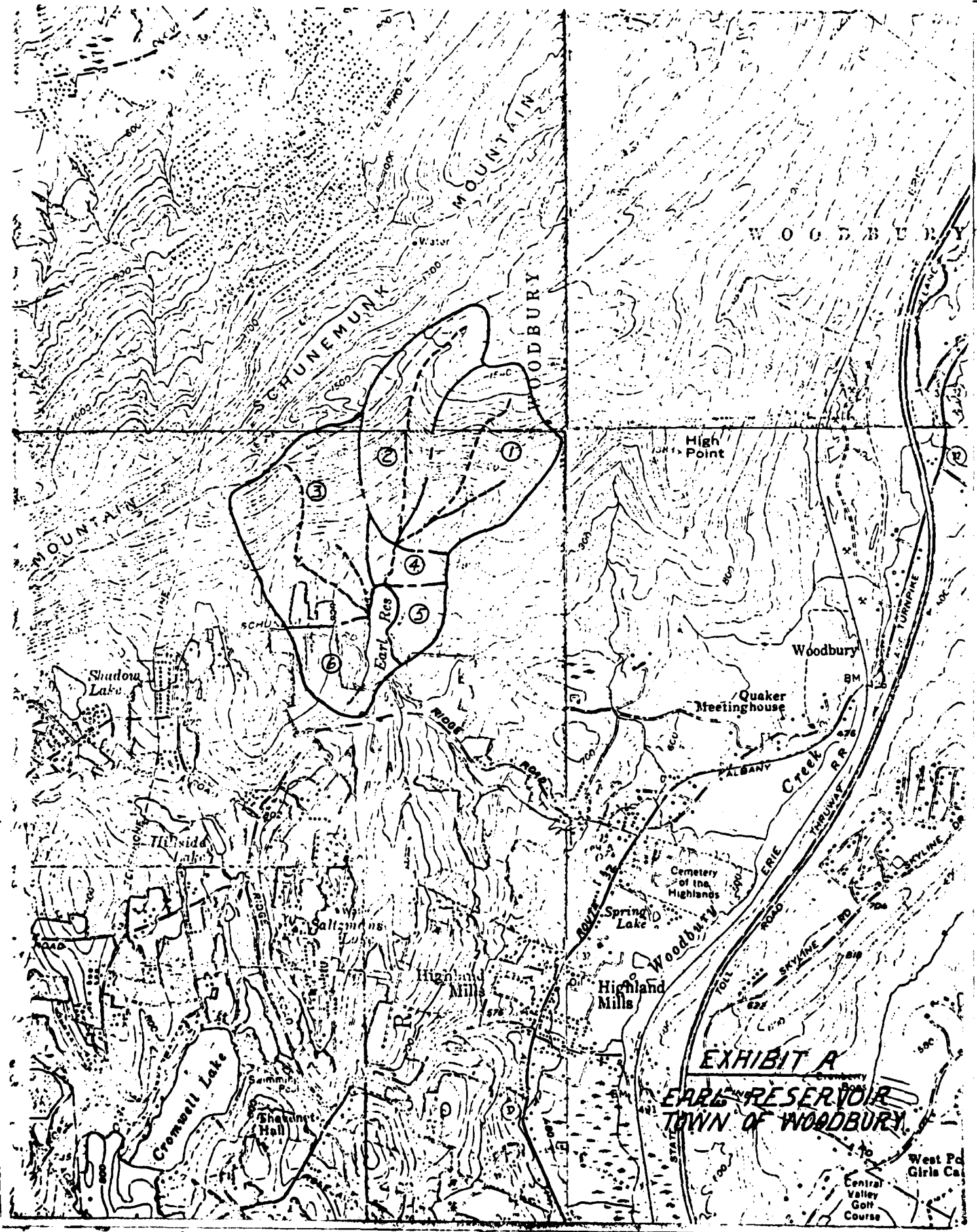


EXHIBIT A
EARL RESERVOIR
TOWN OF WOODBURY

West Pk
Girls Cn
Central
Valley
Golf
Course

CONTINUOUS UNITED STATES

100-YEAR 24-HOUR RAINFALL (INCHES)



Prepared by U. S. Weather Bureau

EXHIBIT B

EARL RESERVOIR
TOWN OF WOODBURY

then by dividing the total overland flow length by the average velocity.

EXHIBIT C

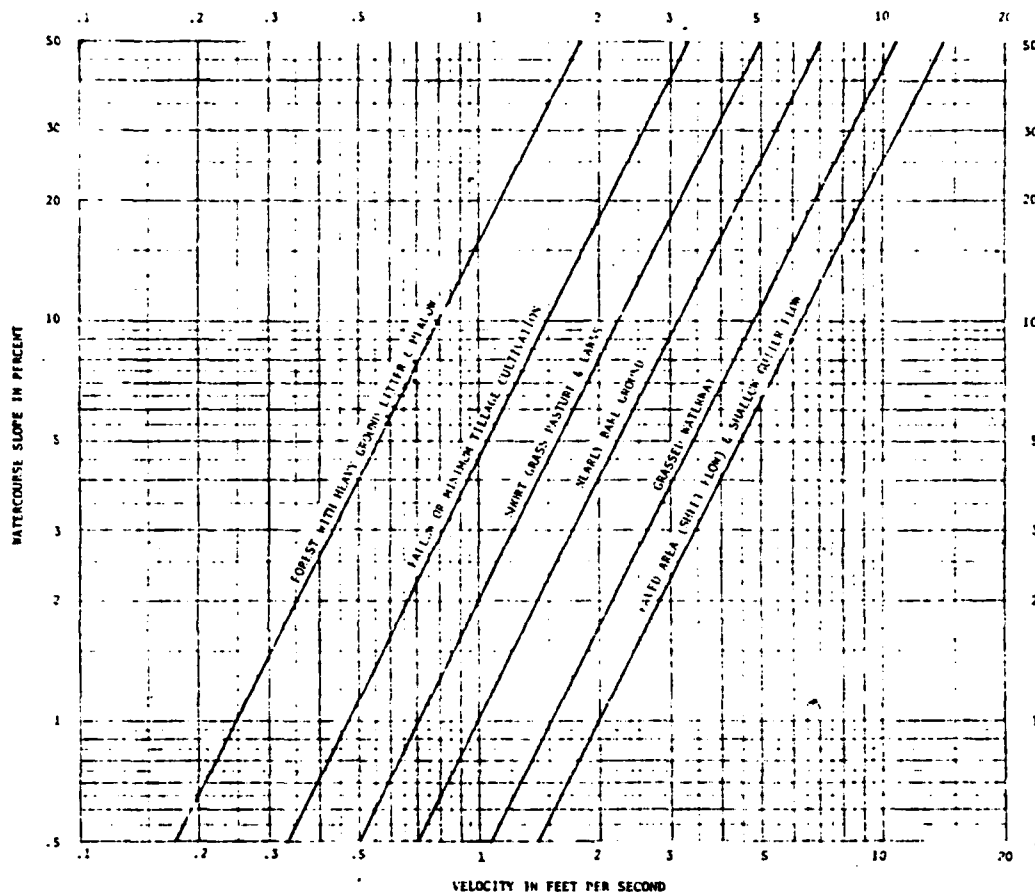


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases, average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

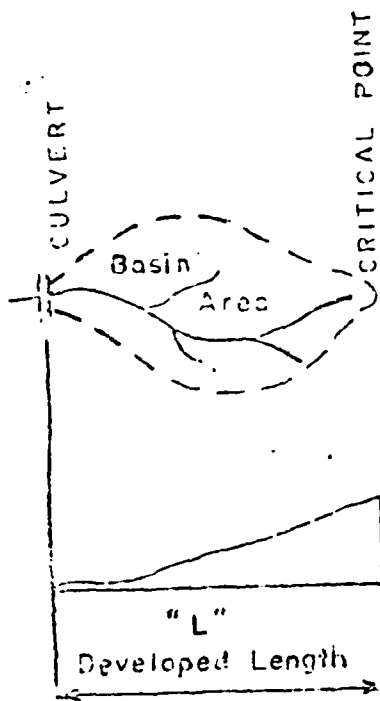
Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

**EARL RESERVOIR
TOWN OF WOODBURY**

Nomograph For The Calculation Of "T"

EXHIBIT D

For use with
Rational Formula
to find "Q"



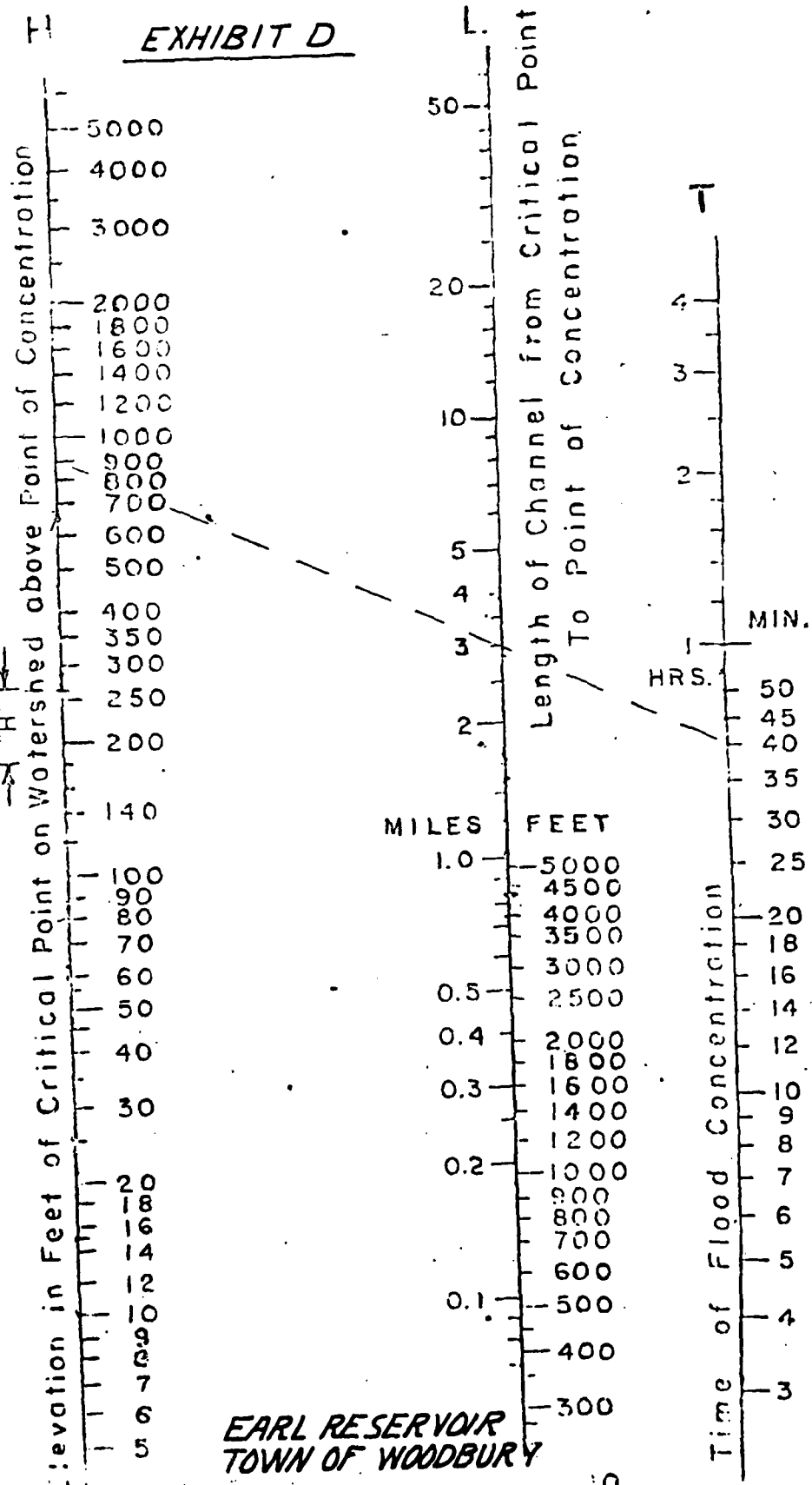
Example

Given $H = 900'$

$L = 3$ Miles

By Calc. $T = 40$ Min.

$$Q = CIA$$



EARL RESERVOIR
TOWN OF WOODBURY

EXHIBIT E

Table E-2: Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land ^{1/} : without conservation treatment	72	81	88	91
: with conservation treatment	62	71	78	81
Pasture or range land: poor condition	68	79	86	89
good condition	39	61	74	80
Meadow: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch	45	66	77	83
good cover ^{2/}	25	55	70	77
Open spaces, lawns, parks, golf courses, cemeteries, etc.				
good condition: grass cover on 75% or more of the area	39	61	74	80
fair condition: grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious).	81	88	91	93
Residential: ^{3/}				
Average lot size Average % Impervious ^{3/}				
1/8 acre or less 65	77	85	90	92
1/4 acre 38	61	75	83	87
1/3 acre 30	57	72	81	86
1/2 acre 25	54	70	80	85
1 acre 20	51	68	79	84
Paved parking lots, roofs, driveways, etc. ^{1/}	98	98	98	98
Streets and roads:				
paved with curbs and storm sewers ^{1/}	98	98	98	98
gravel	76	85	89	91
dirt	72	82	87	89

^{1/} For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.

^{2/} Good cover is protected from grazing and litter and brush cover soil.

^{2/} Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

^{3/} The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

^{3/} In some warmer climates of the country a curve number of 95 may be used.

**EARL RESERVOIR
TOWN OF WOODBURY**

EXHIBIT F

Table E-3.---Adjustment factors where ponding and swampy areas are spread throughout the watershed or occur in central parts of the watershed

Ratio of drainage area to ponding and swampy area	Percentage of ponding and swampy area	Storm frequency (years)					
		2	5	10	25	50	100
500	0.2	0.94	0.95	0.96	0.97	0.98	0.99
200	.5	.88	.89	.90	.91	.92	.94
100	1.0	.83	.84	.86	.87	.88	.90
50	2.0	.78	.79	.81	.83	.85	.87
40	2.5	.73	.74	.76	.78	.81	.84
30	3.3	.69	.70	.71	.74	.77	.81
20	5.0	.65	.66	.68	.72	.75	.78
15	6.7	.62	.63	.65	.69	.72	.75
10	10.0	.58	.59	.61	.65	.68	.71
5	20.0	.53	.54	.56	.60	.63	.68
4	25.0	.50	.51	.53	.57	.61	.66

Table E-4.---Adjustment factors where ponding and swampy areas are located only in upper reaches of the watershed

Ratio of drainage area to ponding and swampy area	Percentage of ponding and swampy area	Storm frequency (years)					
		2	5	10	25	50	100
500	0.2	0.96	0.97	0.98	0.98	0.99	0.99
200	.5	.93	.94	.94	.95	.96	.97
100	1.0	.90	.91	.92	.93	.94	.95
50	2.0	.87	.88	.88	.90	.91	.93
40	2.5	.85	.85	.86	.88	.89	.91
30	3.3	.82	.83	.84	.86	.88	.89
20	5.0	.80	.81	.82	.84	.86	.88
15	6.7	.78	.79	.80	.82	.84	.86
10	10.0	.77	.77	.78	.80	.82	.84
5	20.0	.74	.75	.76	.78	.80	.82

These conditions may occur in a proposed or existing urban or suburban area and the adjustment factors from tables E-2, E-3, or E-4 should be applied after the peaks have been adjusted for the effects of urbanization as described in chapter 4.

Example E-3

A 5-acre pond is located at the downstream end of a 100-acre watershed in which a housing development is proposed. The average watershed slope is 4 percent and the present-condition curve number is 75. After the installation of the housing development, 30 percent of the watershed will be impervious and 50 percent of the hydraulic length will be modified. The future-condition curve number is estimated to be 80. For a rainfall

**EARL RESERVOIR
TOWN OF WOODBURY**

EXHIBIT G-1

Table 5-3.--Tabular discharges for type-II storm distribution (csm/in)--Continued Sheet 2 of 5

T _h	TIME OF CONCENTRATION = 0.3 hours Hydrograph Time in Hours																			
	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5
0	21	43	141	324	586	658	535	372	251	184	148	124	102	86	77	71	61	51	41	34
0.25	17	31	43	67	134	279	461	559	530	428	318	234	179	143	116	97	76	59	45	37
0.50	13	22	29	34	42	65	124	238	78	479	499	447	363	281	216	168	110	74	51	41
0.75	10	17	21	24	27	32	41	63	114	203	316	413	457	443	389	319	198	105	60	45
1.00	8	13	16	18	20	23	26	31	40	60	103	176	269	358	415	426	344	182	77	51
1.50	5	8	10	11	12	13	15	16	18	21	24	28	36	52	82	132	272	382	192	81
2.00	3	5	6	7	8	9	10	11	12	14	15	17	19	21	25	44	151	351	198	85
2.50	1	3	4	4	5	5	6	6	7	8	9	10	11	12	14	17	28	162	328	200
3.00	0	1	2	2	3	3	3	4	4	5	5	6	6	7	8	9	10	14	33	169
3.50	0	0	1	1	1	1	2	2	2	3	3	3	4	4	5	5	6	9	14	38
4.00	0	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	4	5	9	15

T _h	TIME OF CONCENTRATION = 0.4 hours Hydrograph Time in Hours																			
	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5
0	20	39	103	224	419	558	575	451	331	247	190	155	127	105	90	80	66	53	42	35
0.25	15	28	38	54	98	196	343	467	508	464	380	295	228	180	145	119	87	64	47	38
0.50	12	20	26	30	37	53	92	172	286	395	462	453	402	332	266	211	137	84	54	42
0.75	10	16	19	22	25	29	36	51	85	150	242	338	407	429	406	356	241	128	65	47
1.00	8	12	15	17	19	21	24	28	34	49	78	132	208	292	362	403	368	220	88	55
1.50	5	8	9	10	11	12	14	15	17	19	22	25	31	43	65	102	220	365	224	93
2.00	3	5	6	6	7	8	9	9	10	11	13	14	16	17	20	23	37	119	338	225
2.50	1	3	3	4	4	5	5	6	6	7	8	9	10	11	12	13	16	25	132	317
3.00	0	1	2	2	2	3	3	3	4	4	5	5	6	6	7	8	10	13	28	140
3.50	0	0	1	1	1	1	1	2	2	2	3	3	3	4	4	5	6	8	13	32
4.00	0	0	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	5	8	14

EARL RESERVOIR
TOWN OF WOODBURY

EXHIBIT G-2

Table 5-3.--Tabular discharges for type-II storm distribution (csm/in)--Continued Sheet 3 of 5

T _p	TIME OF CONCENTRATION = 0.5 hours by method used in hours																							
	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	10	26	50	66	72	433	496	474	395	309	242	194	158	120	109	94	75	57	43	36	31	25	18	15
0.25	15	35	37	52	54	172	277	372	425	424	353	226	270	221	102	150	107	73	49	39	33	26	19	15
0.50	12	20	25	30	29	58	101	169	252	327	374	385	366	329	285	241	169	103	59	44	36	27	19	15
0.75	9	15	19	22	25	30	41	63	103	162	229	272	335	354	348	325	255	157	77	50	39	29	20	16
1.00	7	12	15	17	19	21	25	31	43	66	103	153	210	264	304	327	217	231	109	61	44	31	21	16
1.50	5	8	9	10	11	12	14	15	17	20	24	31	43	63	92	129	214	295	224	115	65	36	23	17
2.00	3	5	6	6	7	8	9	10	11	12	13	14	16	19	23	30	50	143	271	216	120	46	25	18
2.50	1	3	3	4	4	5	5	6	7	7	8	9	10	11	12	14	18	39	150	253	209	71	28	19
3.00	0	1	2	2	2	3	3	4	4	4	5	5	6	7	7	8	10	15	48	154	239	126	32	21
3.50	0	0	1	1	1	1	2	2	2	2	3	3	4	4	5	5	6	8	16	56	155	227	38	23
4.00	0	0	0	0	0	1	1	1	1	1	1	2	2	2	3	3	4	5	9	19	63	217	52	25

T _p	TIME OF CONCENTRATION = 0.75 hours by method used in hours																							
	11.0	11.5	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.2	13.5	14.0	14.5	15.0	16.0	18.0	20.0
0	15	29	57	58	163	248	329	375	358	359	325	276	232	195	165	142	107	76	51	39	33	26	19	15
0.25	12	21	29	29	61	100	158	227	291	336	355	348	321	285	247	212	156	103	62	44	36	27	19	15
0.50	10	16	21	24	29	41	63	100	150	208	253	295	327	329	314	268	226	147	79	52	40	29	20	16
0.75	8	13	15	18	20	24	29	43	65	58	112	152	259	270	203	311	286	208	107	63	45	31	21	16
1.00	6	10	13	14	15	17	20	24	31	44	65	95	134	177	220	256	294	264	149	81	53	33	21	16
1.50	4	6	9	9	10	11	12	13	14	16	19	23	31	42	60	83	147	269	248	152	85	40	23	17
2.00	2	4	5	5	6	7	7	8	9	10	11	12	14	16	18	23	39	97	251	235	153	56	26	19
2.50	1	2	3	3	4	4	4	5	5	6	7	7	8	9	10	11	15	28	107	218	236	91	29	20
3.00	0	1	1	2	2	2	2	3	3	4	4	5	5	6	6	7	8	12	33	113	225	153	34	22
3.50	0	0	1	1	1	1	1	1	2	2	2	3	3	3	4	4	5	7	13	29	217	215	44	24
4.00	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	3	4	7	15	45	207	63	26

EARL RESERVOIR
TOWN OF WOODBURY

CALCULATED

(ESTIMATED)

PEAK DISCHARGE CALCULATIONS (BY TABULAR METHOD - EXHIBIT C)

S.D.

Area TC T₁ DA RAIN CN R.O. 110 115 117 118 119 120 121 122 123 124 125 126 127 128 129 130

Hour

1 0.4 0.1 0.172 7.20 70 3.79 12 23 30 102 189 269 314 298 262 205 173 158 109 88 73 62

2 0.4 0.1 0.167 " 70 3.79 11 22 48 99 183 261 305 289 254 211 167 133 105 85 70 60

3 0.75 - 0.225 " 70 3.79 12 24 48 83 138 211 281 320 331 314 277 235 197 166 140 121

4 0.3 - 0.031 " 71.8 3.97 2 5 17 39 72 81 66 46 31 22 18 15 12 10 9 8

5 0.3 - 0.039 " 70 3.79 3 6 21 49 90 102 83 58 39 27 22 18 15 12 11 10

6 0.5 - 0.091 " 77.8 4.64 7 15 33 70 127 183 209 200 167 130 102 81 66 54 46 39

47 95 217 442 799 1107 1258 1211 1084 922 757 610 504 415 349 300 55 64 74 84 145

↑

EARL RESERVOIR
TOWN OF WOODBURY

$Q_{100} (PEAK) = 1258 \text{ C.F.S.}$

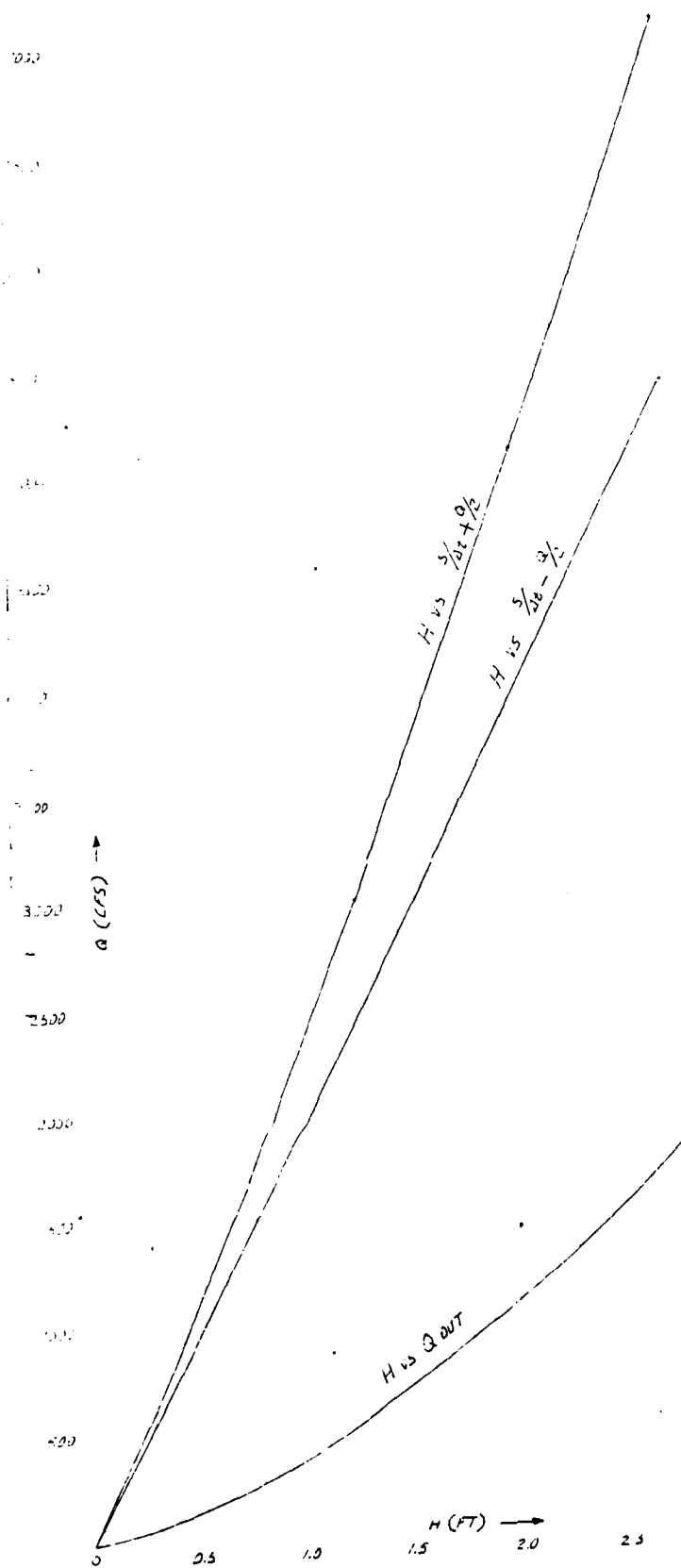


EXHIBIT J
EARL RESERVOIR
TOWN OF WOODBURY

EXHIBIT H

5-26 HANDBOOK OF HYDRAULICS

weirs of this type, each 4.9 ft high, were performed by the U.S. Deep Waterways Board.

Coefficients covering the range of Bazin's experiments are given in Table 5-9. Table 5-10 gives coefficients resulting from the experiments by the U.S. Deep Waterways Board.

For weirs of trapezoidal cross section with sloping upstream face and vertical downstream face

(Fig. 5-10) there are five series of experiments by the U.S. Deep Waterways Board. All the models for these experiments were approximately 4.9 ft high, and the breadth of crest AB was either 0.33 or 0.66 ft. The length of all weirs was 6.53 ft. Table 5-11 gives coefficients derived from these experiments.

TYPICAL
→

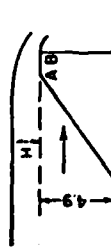


FIG. 5-10. Trapezoidal weir.

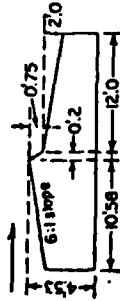


FIG. 5-11

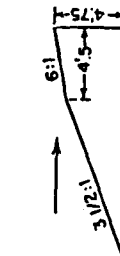


FIG. 5-12

Weirs of Irregular Section. Figures 5-11 to 5-15 represent models of weirs experimented on by the U.S. Deep Waterways Board, under the direction of G. W. Rafter, at the hydraulic laboratory of Cornell University. From four to seven experiments were run on each model, the range of head varying approximately from 1 to 5.5 ft. Values of C tabulated from these experiments are given in Table 5-12.

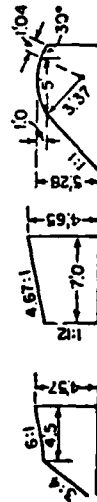


FIG. 5-13



FIG. 5-14



FIG. 5-15

Experiments for the U.S. Geological Survey, under the direction of Robert E. Horton, were performed in 1903 at the hydraulic laboratory of Cornell University to determine the coefficients of discharge of weirs modeled after various types

WEIRS

5-27

of dams. Figures 5-16 to 5-23 show forms of crests of models experimented on. The weirs were all 11.25 ft high and either 8 or 15 ft long. The purpose of the experiments was to enable the Geological Survey to determine more accurately discharges

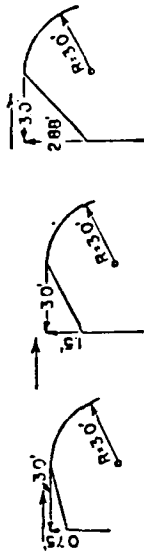


FIG. 5-16

FIG. 5-17

FIG. 5-18

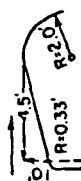


FIG. 5-19



FIG. 5-20

FIG. 5-21

FIG. 5-22



FIG. 5-23



FIG. 5-24

FIG. 5-25

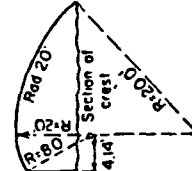


FIG. 5-26

FIG. 5-27

over weirs at gaging stations. Coefficients obtained from these experiments are given in Table 5-13.

Figure 5-21 is a cross section of the old dam at Austin, Tex. Five series of gaging of flow over this dam were made with a current meter by Taylor¹ in 1900. The range of head was from 0.42 to 1.44 ft.

¹T. G. Taylor, The Austin Dam, U.S. Geol. Survey Water Supply and Irrigation Paper 40, 1900.

EARL RESERVOIR
TOWN OF WOODBURY

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

September 28, 1977

RE: Earles' Reservoir, Town of Woodbury

Our Area Engineering Support Staff in Newburgh, New York, has checked your computations, of the Earles' Reservoir dam and spillway capacities, for a 100 year storm event. They saw no problem with your computations.


Malcolm Henning
District Conservationist

11.20

RECEIVED
SEP 29 1977

RAIMONDI ASSOCIATES, P. C.



TEST BORING DATA

Length of Casing Driven

EXHIBIT T-1
EARL RESERVOIR
TOWN OF WOODBURY

125. MAPPING DATA

Location

Completed 9/22/77

Length of Casing Driven 30'

Inside Dia. of Casing 24"
" " " Spoon 13 1/2"
Weight of Hammer on Casing 300 lbs.
" " " " Spoon 140 lbs.
Drop of Hammer on Casing 24"
" " " " Spoon 30"

DRY SAMPLE DATA			
Sample No.	Elevation bottom of Spoon	Total Penetration	Length of Sample
1 *	21' 6"	18"	
2 *	26' 6"	"	
3 *	31' 6"	"	
* Used 300# Hammer to drive Spoon			

CORE DATA				
Sample No.	Elevation		Core Recovered	Boring Feet Per Hour
	Top	Bot.		

Core Diameter

EXHIBIT T-2

EARL RESERVOIR
TOWN OF WOODBURY

DO NOT WRITE ON BACK OF SHEET

TEST BORING DATA

Length of Casing Driven

EXHIBIT T-3

EARL RESERVOIR
TOWN OF WOODBURY

TEST HOLE NO. W-4

Location Woodbury, N.Y.

Completed 9/22/77

Length of Casing Driven

Inside Dia. of Casing 2½"
" " " Spoon 1¾"
Weight of Hammer on Casing 300 lbs.
" " " " Spoon 140 lbs.
Drop of Hammer on Casing 24"
" " " " Spoon 30"

DRY SAMPLE DATA			
Sample No.	Elevation bottom of Spoon	Total Penetration	Length of Sample
1	11'6"	18"	
2	16'6"	"	
3	23'6"	"	
4 *	31'6"	"	
* Used	300# Hammer on Spoon		

CORE DATA				
Sample No.	Elevation		Core Recovered	Boring Fee Per Hour
	Top	Bot.		

Core Diameter

EXHIBIT T-4

EARL RESERVOIR
TOWN OF WOODBURY

DO NOT WRITE ON BACK OF SHEET

TEST BORING DATA

Location Woodbury, NY.

Completed 9/1/77

Length of Casing Driven

Inside Dia. of Casing	2 1/2"
" " " Spoon	1 3/4"
Weight of Hammer on Casing	300 lbs.
" " " " Spoon	140 lbs.
Drop of Hammer on Casing	24"
" " " " Spoon	30"

DRY SAMPLE DATA			
Sample No.	Elevation bottom of Spoon	Total Penetration	Length of Sample
1	6'6"	18"	
2	11'6	"	
3 *	16'6	"	
4 *	21'6	"	
5 *	26'6	"	
* Used 300# Hammer			

CORE DATA				
Sample No.	Elevation		Core Recovered	Boring Feet Per Hour
	Top	Bot.		

Core Diameter

EXHIBIT T-5

EARL RESERVOIR
TOWN OF WOODBURY

BEST BOOKING DATA

Length of Casing Driven

EXHIBIT T-6
EARL RESERVOIR
TOWN OF WOODBURY

TEST BORING DATA

Length of Casing Driven 25' 0

EARL RESERVOIR
TOWN OF WOODBURY

TEST BORING DATA

Length of Casing Driven

EARL RESERVOIR
TOWN OF WOODBURY

W. M. WALSH COMPANY, INC.
Crosskill, New Jersey

TEST BORING DATA

TEST HOLE NO. L-9

Project Earl's Lake

Location Woodbury, NY

Drings made by: A. Ecke

Arch. Eng. A. G. Lichtenstein

Date Started 9/1

Completed 9/2/77

L. of Ground Water

Raimondi Assoc.

Length of Casing Driven

Ground Line Elevation		Blows on Spoon			
		0-6	6-12	12-18	18+
5	25	Brn. Clayey Silt some fine Sand, Gravel, Boulders			
	70				
	52				
	73				
	69				
10	38	1	47	38	29
	42				
	97				
	90				
	76				
15	68	2	29	48	33
	57				
	79				
	55				
	48				
20	73	3	31	62	110
	85				
	141				
	189				
	276				
25	75	4	84	100+	
	71				
	73				
	300				
	300				
30		5	150+		
35		6	60	100+	
40					
45					

Inside Dia. of Casing 2 1/2"
" " " Spoon 1 3/8"
Weight of Hammer on Casing 300 lbs.
" " " " Spoon 140 lbs.
Drop of Hammer on Casing 24"
" " " " Spoon 30"

DRY SAMPLE DATA			
Sample No.	Elevation bottom of Spoon	Total Penetration	Length of Sample
1	6'6"	18"	
2	11'6"	"	
3	16'6"	"	
4 *	21'0"	12"	
5 *	25'6"	6"	
6 *	31'0"	12"	
* Used 300# Hammer			

CORE DATA			
Sample No.	Elevation		Boring Feet Per Hour
	Top	Bot.	

Type of Core Drill

Core Diameter

EXHIBIT T-9

EARL RESERVOIR
TOWN OF WOODBURY

APPENDIX F
BACKGROUND DOCUMENTS

W. M. IMBRIE, PRESIDENT
MARVYN SCUDDER, TREASURER

COMMONWEALTH WATER COMPANY OF NEW YORK
48 BROADWAY, NEW YORK

44
10/17/12
17

October 17, 1912.

Mr. Alexander Rice MacKin, S. E.,
New York Conservation Committee,
Albany, N. Y.

Dear Sir:

Your telegram of Tuesday unfortunately reached me too late to allow my being able to meet you at 8:45 yesterday morning at Highland Mills. I instructed my assistant engineer, however, to show you every courtesy and expedite as far as possible any investigation or inspection which you might wish to make, and I trust that this was done.

A rather meagre telephone message this morning informed me that you visited the site and inspected the trench which is being put in for the foundation.

I was also informed that you deemed it necessary to carry the footings of the extreme easterly wing of the dam down about five feet and that you further thought it would be necessary to go fifteen or twenty feet in depth at the center, that is, under the heaviest portion of the dam, unless rock should be encountered at a higher level.

These views coincide entirely with my own and I feel that the footings should be carried to the levels suggested by you, unless indeed rock is encountered. Personally I feel that rock will be encountered at a higher level under

Mr. Alexander Rice McKim -2-

the deeper portion of the dam.

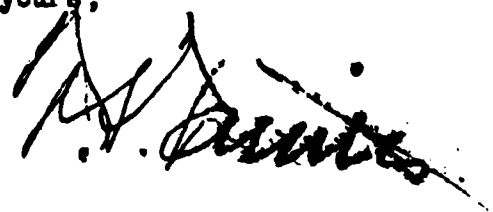
The soundings taken by us across the Valley showed rock at about the level shown on the plans, or rather on sections, but the formation is so treacherous and the ground is larded with broken boulder formation that it is more than possible that some of our soundings reached boulder rather than ledge rock; in fact the trench as open to date seems to indicate this.

My feeling is that if we go to the depths suggested by you and concurred in by me and find at those levels a very heavy dense clay which would seem impervious to water action we would be abundantly safe in establishing such levels for our lower footings.

I would be extremely obliged to you, when writing me on the subject, if you will be as full as possible as you have time. Of course, I realize that you are a very busy man, and have many demands upon your time, but I want you to feel that it is the desire of the Company, as well as its engineer, to embody and carry out your views as far as it is possible.

With kind personal regards, I am

Very truly yours,



FST/T

Engineer

Woodbury Field + Stream
Inc.

DAM INSPECTION REPORT
(By Visual Inspection)

<u>Dam Number</u>	<u>River Basin</u>	<u>Town</u>	<u>County</u>	<u>Hazard Class*</u>	<u>Date & Inspector</u>
453	L. Hudson	Woodbury	Orange	A	6-14-74 GHE-KDH

<u>Type of Construction</u>	<u>Use</u>
☐ Earth w/concrete spillway	☒ Water Supply
☐ Earth w/drop inlet pipe	☐ Power
☐ Earth w/stone or riprap spillway	☒ Recreation
☐ Concrete	☐ Fish and Wildlife
☒ Stone	☐ Farm Pond
☐ Timber	☐ No Apparent Use-Abandoned

<u>Estimated Impoundment Size</u>	<u>Estimated Height of Dam above Streambed</u>
☐ 1-5 acres	☐ Under 10 feet
☐ 5-10 acres	☐ 10-25 feet
☒ Over 10 acres	☒ Over 25 feet

<u>Condition of Spillway</u>	
☐ Service satisfactory	☐ Auxiliary satisfactory
☒ In need of repair or maintenance	☐ In need of repair or maintenance

Explain: Leakage thru stone

<u>Condition of Non-Overflow Section</u>	
☐ Satisfactory	Explain: _____
☒ In need of repair or maintenance	
<u>Leakage thru stone</u>	

<u>Condition of Mechanical Equipment</u>	
☐ Satisfactory	Explain: _____
☐ In need of repair or maintenance	

Evaluation (From Visual Inspection)

☒ No defects observed beyond normal maintenance

☐ Repairs required beyond normal maintenance

*Explain Hazard Class, if Necessary _____

Supplement D-1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233

EARTH DESIGN

SH-10113

APPLICATION FOR PERMIT

FOR THE CONSTRUCTION, RECONSTRUCTION OR REPAIR OF A DAM OR OTHER IMPOUNDMENT STRUCTURE

Read instructions on reverse side of last sheet before completing this application. PLEASE TYPE OR PRINT CLEARLY IN INK

PROJECT DESCRIPTION

1. LOCATION ON U.S. GEOLOGICAL SURVEY MAP Name of Map Monroe		Latitude 41°-21'-48"	Longitude 74°-08'-10"	2. PROPOSED USE FOR IMPOUNDED WATER Recreation & Aux. Water Supply	3. STATE THE HEIGHT ABOVE SPILLCREST OF THE LOWEST PART OF THE IMMEDIATE UPSTREAM ADJOINING PROPERTY OR PROPERTIES * All surrounding prop feet
4. IS THIS PROPOSED POND OR LAKE PART OF A PUBLIC WATER SUPPLY? ☒ Yes ☐ No If not, where is nearest downstream public water supply intake?				5. SIZE OF AREA DRAINING INTO POND OR LAKE (Acres or Square Miles) 464 Acres	HEIGHT OF DAM ABOVE STREAM BED? 28 (proposed) feet

6. THE DRAINAGE AREA IS COMPOSED OF: (Total = 100%)
 95 % Forest _____ % Cropland _____ % Pasture _____ % Other **4** % Swamp **1** % Suburban Lands _____ % Urban Lands _____

7. TYPE OF SPILLWAY ☐ Service Spillway - Auxiliary ☐ Spillway Combination ☒ Single Spillway ☐ Pipe Riser ONLY ☐ Other w/ mud gate	8. DESIGNER'S ESTIMATE OF CLASS OF HAZARD (As described in "Guidelines for Small Earth Dam Designs") ☐ Class "A" ☒ Class "B" ☐ Class "C" NOTE: Provide descriptive information on character of downstream area.
--	--

9a. SPILLWAY INFLOW DESIGN FLOOD 1500 X 100 yr.* Frequency * Flood Peak 1087 cfs Runoff Volume 5.86 in.	9b. SERVICE SPILLWAY INFLOW DESIGN FLOOD Frequency _____ Flood Peak _____ cfs Runoff Volume _____ in.
--	--

10. THE SINGLE SPILLWAY OR AUXILIARY SPILLWAY IS COMPOSED OF:
☐ Vegetated Earth ☒ Concrete ☐ Timber ☐ Rock-filled Crib ☐ Masonry ☐ Other _____

11. MAXIMUM VELOCITY WITHIN THE SINGLE OR AUXILIARY SPILLWAY 8.5 fps	12. SINGLE OR AUXILIARY SPILLWAY DISCHARGE AT DESIGN HIGH WATER 1392 cfs	13. TYPE OF ENERGY DISSIPATER PROVIDED ON SINGLE SPILLWAY ☐ Hydraulic Jump Basin ☒ Drop Structure ☐ Other _____
---	---	--

14. POND OR LAKE WILL BE DRAINED BY MEANS OF 20" mudgate	WATER WILL BE SUPPLIED TO RIPARIAN OWNERS DOWNSTREAM BY MEANS OF normal overflow
--	--

15. AREA-CAPACITY DATA Answer 1, 2 and 3, OR 1, 2, 4, 5		ELEVATION, Referred to Assumed Benchmark	SURFACE AREA	VOLUME STORED	16. TYPE OF ENERGY DISSIPATER AT OUTLET OF CONDUIT: ☐ Impact Basin ☐ Hydraulic Jump Basin ☒ Plunge Pool ☐ Other _____
1. Top of Dam	832 Feet	21.50 Acres	72.81 Acre-Feet		IS PIPE RISER PROVIDED WITH AN ANTI-VORTEX DEVICE? ☐ Yes ☒ No
2. Design High Water	830.65 Feet	20.02 Acres	44.82 Acre-Feet		
3. Single Spillway Crest	828.40 Feet	160 Acres	*150.4 Acre-Feet		
4. Auxiliary Spillway Crest	_____ Feet	_____ Acres	_____ Acre-Feet		
5. Service Spillway Crest	_____ Feet	_____ Acres	_____ Acre-Feet		

17. DRAWDOWN TIMES: Answer 1 and 2, OR 1, 3 and 4* See attached Engineer's report.		3. Can the Service Spillway evacuate 75% of the storage between the auxiliary spillway and the Service Spillway crest within seven days? ☐ Yes ☒ No
1. Has provision been made to evacuate 90% of the storage below the lowest spillway crest within fourteen days? ☒ Yes ☐ No	2. Can the single spillway evacuate 75% of the storage between the maximum design high water and the spillway crest within 48 hours? ☐ Yes ☒ No	4. Can the Service Spillway and the Auxiliary Spillway in combination evacuate the storage between the design high water and the auxiliary spillway crest within 12 hours? ☐ Yes ☒ No

18. SOIL DATA - State the character of the bed and banks in respect to natural types of soil materials, hardness, perviousness, water bearing, effect of exposure to air and water, uniformity, etc.

See Boring logs

If an earth dam, describe the material to be used in the embankment.

See Specifications

What is the source of embankment fill material(s)?

Contractors option

*erties owned by APPLICANT

Are there porous seams or fissures beneath the foundation of the proposed dam? ☐ Yes ☒ No		Method used to obtain the above soil data ☒ Soil Borings ☐ Test Pits	
19. DESIGN ENGINEER Name of Agency or Individual A.G. Lichtenstein & Ass. Address 1258 Teaneck Road, Teaneck, N.Y. 07666 Title resident		20. CONSTRUCTION ENGINEER Name of Agency or Individual Raimondi Assoc. P.C. Address 110 Stage Road, Monroe, N.Y. 10950 Title President	
P.E. License No. of Individual 28337 Telephone No. 201-837-4300		P.E. License No. of Individual 40,212 Telephone No. 914-782-8681	

- ☐ Article 15 (STREAM PROTECTION) Environmental Conservation Law
- ☒ For the construction, reconstruction or repair of a DAM or other impoundment structure.
- ☐ For the construction, reconstruction or repair of any permanent DOCK, pier or wharf; and any dock, pier or wharf, built on open work supports, which has a top surface area of more than 200 square feet.
- ☒ For the disturbance of a STREAM BED or excavation in or fill of navigable waters.
- ☐ Article 24 (FRESHWATER WETLANDS) Environmental Conservation Law
- ☐ Article 25 (TIDAL WETLANDS) Environmental Conservation Law

Read instructions on reverse side of last sheet before completing this application. PLEASE TYPE OR PRINT CLEARLY IN INK.

1. NAME AND ADDRESS OF APPLICANT		TELEPHONE NO.
First	M.I. Last	
Town of Woodbury		914-928-6829
Street Address		
Albany Turnpike (Route 32) Highland Mills, N.Y.		
Post Office	State	Zip Code
10930		
2. NAME AND ADDRESS OF OWNER (If different from Applicant)		
First	M.I. Last	
Street Address		
Post Office		
State		
Zip Code		
3. AGENCY SUBMITTING APPLICATION		
Park Commission		
PROJECT DATA		
4. LOCATION OF WETLAND OR ADJACENT AREA, STREAM, OR BODY OF WATER		
Body of Water	Town	County
Earl Reservoir	Woodbury	Monroe
Locate by giving distance and direction from a commonly accepted and identifiable landmark or body of water or U.S.G.S. coordinates.		
5. SIZE OF WORK SECTION	6. SPECIFIC LOCATION	7. WILL PROJECT UTILIZE STATE OWNED LANDS?
500' +	D.E.C. Designation H-89-7-6-P229a	☐ Yes ☒ No
8. TYPE AND EXTENT OF WORK (Feet of new channel; yards of material to be removed, draining, dredging, filling, etc.)		
Reconstruction of Dam		
9. DOES PROJECT COMPLY WITH A. Use Guidelines (If any)		B. Development Restrictions (If any)
N.A.		
10. PURPOSE (Hardship)		
Emergency dam repair & municipal recreation		
11. IF A DAM OR OBSTRUCTION, INDICATE Height <u>28</u> Size of Pond <u>16 + Acres</u>		12. PROPOSED STARTING DATE June 1, 1978
		13. APPROXIMATE COMPLETION DATE Nov. 1, 1978
14. NAME AND ADDRESS OF TWO OFFICIAL NEWSPAPERS IN LOCALITY WHERE PROPOSED ACTIVITY IS LOCATED		
Times Herald Record 1 Stage Road Monroe, New York 10950		Photo News Warwick, N.Y.
15. CERTIFICATION		
I hereby affirm under penalty of perjury that information provided on this form and all attachments submitted herewith is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law. As a condition to the issuance of a permit, the applicant accepts full legal responsibility for all damage, direct or indirect, of whatever nature, and by whomever suffered, arising out of the project described herein and agrees to indemnify and save harmless the State from suits, actions, damages and costs of every name and description resulting from the said project.		
DATE		SIGNATURE

END

DATE
FILMED

11-81

DTIC