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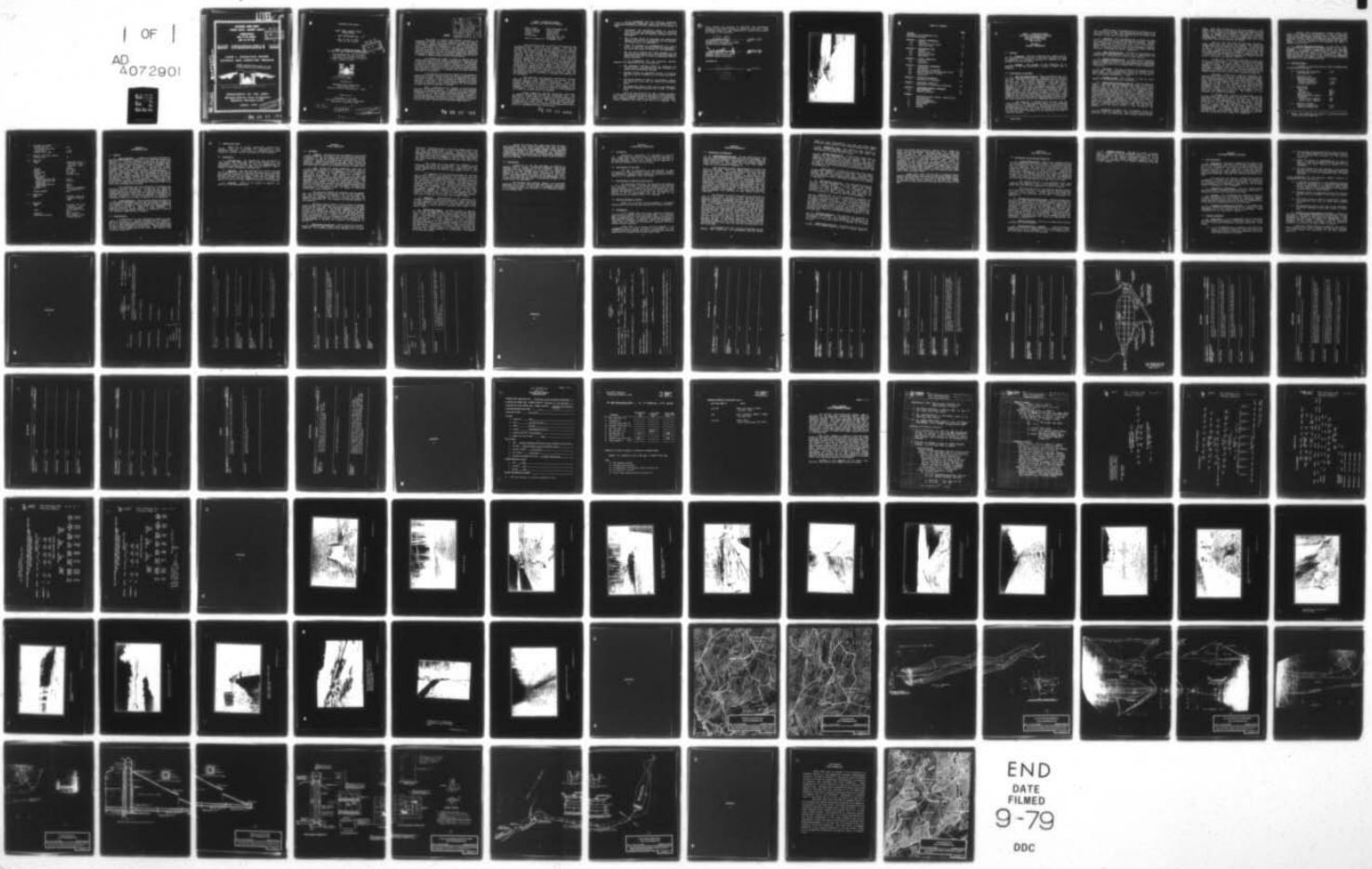

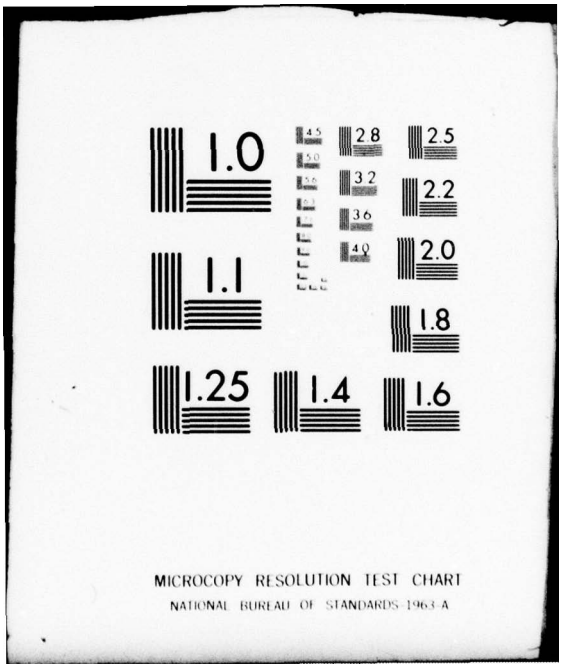
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LEVEL II

DELAWARE RIVER BASIN
SAMBO CREEK, MONROE COUNTY

PENNSYLVANIA
NDS ID PA. 00837
DER ID 45-155

EAST STROUDSBURG DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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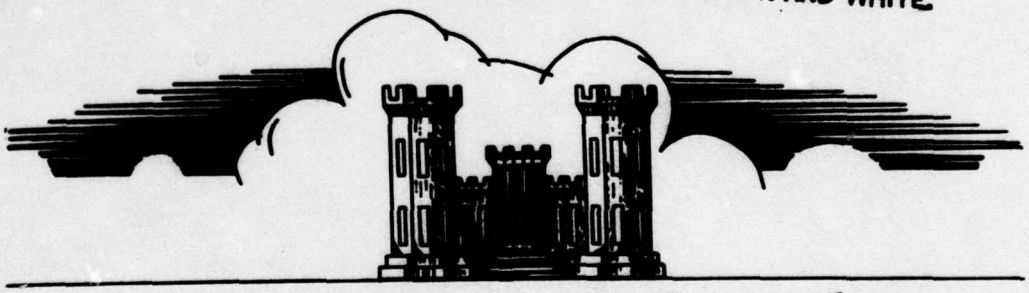


Contract #DACW31-79-C-0017

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

APRIL 1979

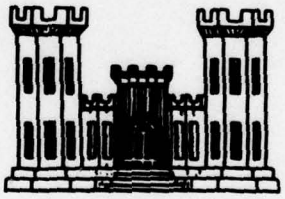
DELAWARE RIVER BASIN

SAMBO CREEK, MONROE COUNTY,
PENNSYLVANIA

EAST STROUDSBURG DAM

NDS I.D. NO. PA 00637
DER I.D. NO. 45-155

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



(15) DACW31-79-C-0017

Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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(11) APRIL 1979

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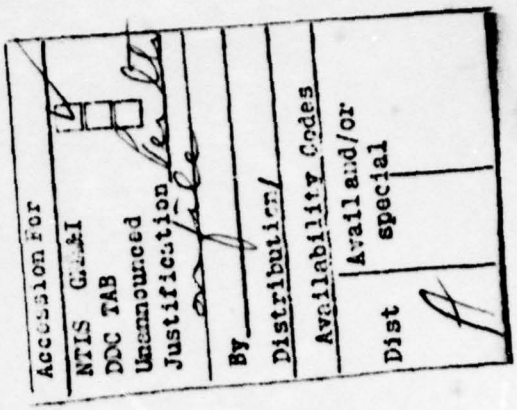


PREFACE

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 the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is to expeditiously identify 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 investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed 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 design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	East Stroudsburg Dam
County Located:	Monroe County
State Located:	Pennsylvania
Stream:	Sambo Creek
Coordinates:	Latitude 41° 3.8'
	Longitude 75° 10.1'
Date of Inspection:	6 November 1978

East Stroudsburg Dam is owned by the Borough of East Stroudsburg and is used for water supply. The dam was completed in 1936. The spillway was reconstructed in 1949 and in 1976, when sections of the intake tower were reconstructed. The dam and intake system are considered to be in fair condition and the spillway is considered to be in poor condition. The dam is classified as a "High" hazard potential structure consistent with the potential to cause extensive property damage and possible loss of life in the event of failure. The dam is also classified as an "Intermediate" size structure by virtue of its 47.5 foot height and greater than 1,000 acre-foot total storage capacity. The limited design documentation, specifications, visual inspection and reports of significant changes during construction are only sufficient to evaluate the external features of the dam and the hydrologic and hydraulic aspects of the spillway. There was not sufficient data in the files to evaluate the stability of the embankment.

The hydrologic and hydraulic calculations indicate that the dam will pass approximately 48 percent of the Probable Maximum Flood without overtopping. Since the duration and depth of overtopping is short and only two inches through the low point, failure of the riprap slope is not expected. Therefore, the spillway system is considered to be "Inadequate". If the low point is filled in, the embankment will retain 0.65 PMF without overtopping.

Visual inspection revealed significant quantities of seepage discharging through the downstream toe. The spillway is in poor condition. Based on findings presented in this report, the following recommendations are presented and divided into two categories. The first category includes recommendations which should be implemented immediately, whereas the second category consists of recommendations which should be implemented as soon as practical.

It is recommended that the following recommendations be implemented immediately under the supervision of a registered professional engineer experienced in the design of dams.

1. Piezometers and wellpoints should be installed along the crest and downstream slopes to determine pore pressures and the phreatic surface within the embankment.

2. Test borings should be performed and undisturbed samples retrieved for an evaluation of the engineering properties of the embankment.

3. Using the findings of recommendations of 1 and 2 above, a stability analysis should be performed to determine the factor of safety of this embankment.

4. The low point between the right abutment of the spillway and the dam should be filled with compacted impervious materials to bring the embankment back to design elevation.

It is recommended that the following remedial measures be implemented as soon as practical.

1. The emergency spillway should be evaluated and rehabilitated in accordance with the findings of a registered professional engineer.

2. Seepage through the embankment should be collected and monitored for changes in flow rates and turbidity.

3. Provisions should be made to periodically inspect the gatehouse tower and the intake and discharge pipes.

4. The depression noted on the crest of the embankment should be inspected annually and filled, if necessary.

Since the facilities do not have a formal procedure of observation and warning during periods of high precipitation, such a procedure should be developed and implemented. This procedure should include a procedure for warning downstream residents that high flows are to be expected. The

Owner should also develop an operation and maintenance procedure which would include an inspection checklist. These procedures should be used regularly to inspect and maintain all items of the structure.

25 April 1979
Date

John Boschuk, Jr., P.E.
Pennsylvania Registration 27450E
Woodward-Clyde Consultants

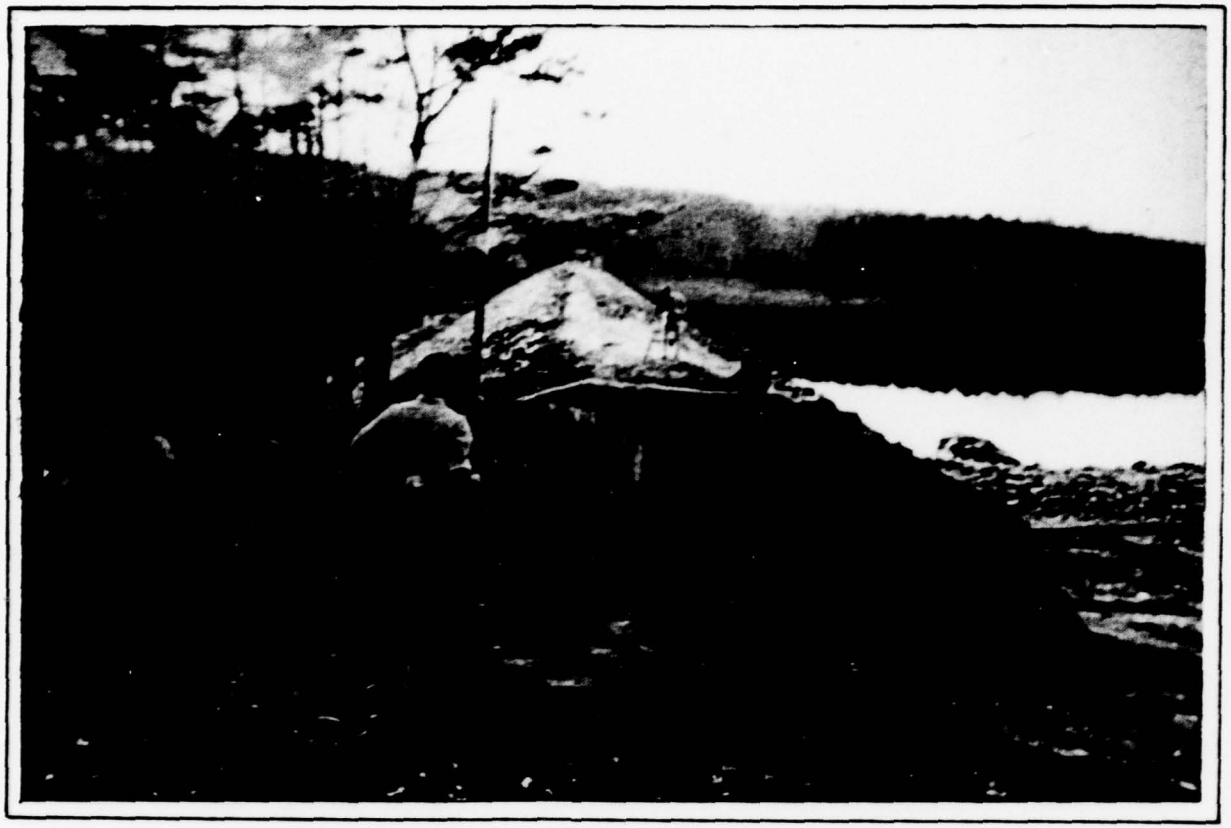
April 25, 1979
Date

John E. Frederick, Jr., P.E.
Maryland Registration 7301
Woodward-Clyde Consultants

APPROVED BY:

19 May 79
Date

G. K. Withers
Colonel, USA
District Engineer



OVERVIEW
EAST STROUDSBURG DAM, MONROE COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
EAST STROUDSBURG DAM
NATIONAL ID #PA 00637
DER #45-155

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. East Stroudsburg Dam is a 47.5 foot high earth and rock fill embankment with a concrete core wall. The dam is located across Sambo Creek and is about 740 feet long. The structure impounds a 57-acre lake with a 914 acre-foot normal storage capacity. Available records indicate that the core wall is founded in clay or hardpan. Upstream of the core wall, embankment materials consist of compacted soils. The upstream slope is protected with hand placed riprap. The slope is 2H:1V above elevation 867* and below elevation 867 the slope increases to 2.5H:1V. The compacted fill section downstream of the core wall has a 1H:1V slope and the overlying hand placed rock section has a slope of 2H:1V with a six foot berm at approximately elevation 873. The crest elevation is 893 with a measured width of 12 feet.

The gatehouse is located about 320 feet from the right abutment. The best available section of this gatehouse is shown on Plate 5, Appendix E. The sluice gates are inside the gatehouse, one for the 24-inch intake pipe and one for the 24-inch discharge pipe. The intake is located at the upstream toe and the outlet discharges at the downstream toe into a rocklined channel.

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* USGS Datum

Excess water is discharged over the spillway at the left abutment of the dam. The spillway has a weir length of 40 feet and a depth of five feet, measured from the design crest elevation to the crest of the weir.

b. Location. East Stroudsburg Dam is located on Sambo Creek in Monroe County, Middle Smithfield Township. The dam and reservoir are located on the "East Stroudsburg, Pennsylvania" Quadrangle at coordinates N 41° 3.8' W 75° 10.1', approximately 3.6 miles north of East Stroudsburg, Pennsylvania. A regional location plan of East Stroudsburg Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" size dam by virtue of its 47.5 foot height and greater than 1,000 acre-foot total storage capacity.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive property damage and loss of life downstream along Sambo Creek and at the confluence with Brodhead Creek in East Stroudsburg, Pennsylvania.

e. Ownership. The dam is owned by the Borough of East Stroudsburg. All correspondence should be issued to Mr. Donald Gage, Borough Manager, Post Office Box 303, Borough of East Stroudsburg, Pennsylvania 18301.

f. Purpose of Dam. The reservoir is used for water supply for the Borough of East Stroudsburg.

g. Design and Construction History. Plans and applications to construct East Stroudsburg Dam began in the early 1930's, when the Borough decided that additional water supplies would be required for the increasing population of East Stroudsburg and surrounding areas. Mr. Edward C. Hess, Borough Engineer, designed this structure. Between 1931 and 1934, several modifications were made to the plans as a result of meetings between the Owner and the State. Pursuant to the approval of these modifications, the application was issued in 1934, and work began in November of 1934, under the direction of Mr. A. L. Rake, superintendent of construction. An 8 August 1935 Progress Report noted that, "the job has been shut down for resubmitting the project under the new set-up; however, work was being carried on with delinquent tax payers..."

Dewatering problems were encountered during the core wall foundation excavation. Water entered the excavation primarily from the downstream side through several gravel

zones. Additional excavations in the area revealed a large gravel layer, shown on the typical section enclosed herein as Plate 3. This gravelly and boulder ridden zone was a constant source of seepage and foundation construction problems. Seepage was controlled by a series of sumps and terra cotta drainage pipes. As the fill work proceeded, these terra cotta pipes were filled with concrete and sealed.

Early in 1935, Mr. Hess and the State representatives noted that the valley was riddled with stone and boulders which were suitable for construction. It was decided to use the rock as fill on the downstream section of the structure. In February 1935, the spillway was shifted from the right abutment to the left abutment. In July 1936, the State requested the spillway size to be increased from 25 feet x 4 feet to 40 feet x 5 feet in response to a request from the Corps of Engineers, Philadelphia District.

In May 1935, significant quantities of water were found in the excavations. Mr. Hess attributed this seepage to springs within the gravel layer, with which the State engineer concurred. By July 1935, most of the core wall was completed. In October 1935, the left end of the core wall was shortened to expedite construction. The State representatives permitted this reduction in the length of the core wall as the seepage around this wall would not be considered dangerous.

Throughout construction, several incidences were reported where the fill was wet, spongy and unsatisfactory. This problem persisted throughout the construction and apparently corrective measures, if any, were very limited. In many cases, the fill was riddled with large stones and often these stones were nested and not removed or at least dispersed throughout the lift. Along the downstream section of the embankment between the core wall and the rock fill toe, alternating layers of rock and clay were placed in what is known as the impervious section. The quality of this placement was considered marginal.

In December 1936, reservoir filling began and the spillway began discharging water in May 1937. Immediately thereafter, leakage was noted at the right side of the dam along the toe and subsequently at the left side of the dam along the toe. Shortly thereafter, five pipes were installed to collect this water and discharge it in the wasteway channel. Seepage continued and, by 1938, appeared to have stabilized based on inspection reports and other letters of correspondence. The seepage rates described in reports prepared in the late 1930's and 1940's is apparently the same that was noted during this latest 1978 inspection.

Shortly after construction, several cracks were noted at the junction of the spillway weir with the retaining walls, which subsequently worsened and, in 1949, these were cited for repairs. Repair work began and was finished in that same year, in which the entire spillway system was rehabilitated. A plan and profile of the spillway are shown in Appendix E as Plate 4.

h. Normal Operating Procedures. At full pool, reservoir outflow is controlled by the spillway at the left abutment. On occasion, supplemental water for municipal purposes is discharged from the reservoir through the high level intake pipe (a siphon) over the spillway weir. The gatehouse can be used to drain the reservoir or supplement flows downstream, as needed. There are no minimum discharge requirements for East Stroudsburg Dam.

1.3 Pertinent Data.

A summary of pertinent data for East Stroudsburg Dam is presented as follows.

a.	Drainage Area (sq miles) (See Section 5.1)	1.68
b.	Discharge (cfs)	
	Maximum Known Flood	Unknown
	Maximum Discharge	
	Existing Conditions	1,429
	Design Conditions	2,146
c.	Elevations*	
	Top of Dam	
	Design	893.0
	Low Point	892.4
	Spillway Crest	888
	Downstream Berm (approx)	873
	Gatehouse	
	Intake Invert (approx)	846
	Outlet Invert (approx)	845
d.	Reservoir (miles)	
	Length at Normal Pool	0.76
	Fetch at Normal Pool	0.72

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* Note: All elevations are based on a spillway elevation of 888 taken from USGS map.

e.	Storage (acre-feet)	
	At Normal Pool	914
	Top of Dam (existing conditions)	1,338
	Design Top of Dam	1,472
f.	Reservoir Surface (acres)	
	Normal Pool	57
g.	Dam Data	
	Type	Compacted earth & rock fill with a concrete core wall.
	Length	738 feet
	Height	47.5 feet
	Crest Width	12 feet
	Volume	641,000 cu yd
	Side Slopes	
	Upstream	
	above elevation 867	2H:1V
	below elevation 867	2.5H:1V
	Downstream	
	Impervious Section	1H:1V
	Rock Shell	2H:1V
	Cutoff	Core wall embedded in foundation.
	Grout Curtain	None
h.	Gatehouse	
	Type	Concrete tower embedded in embankment.
i.	Spillway	
	Type	Concrete weir and concrete discharge channel.
	Size	40 ft wide x 5 ft deep.
	Location	Left abutment
	Downstream Channel	Hand placed stone lined channel.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data for East Stroudsburg Dam is presented in the checklist attached as Appendix A. Principal documents containing pertinent data used for this report include the "Report Upon the Application of the Borough of East Stroudsburg", dated 25 November 1932, and the "Report Upon the Request of the Borough of East Stroudsburg", dated 5 December 1934, together with several progress reports prepared by the State of Pennsylvania. In addition, there were several drawings prepared by Edward C. Hess, Borough Engineer. Many were superceded as the design was modified. Those drawings showing pertinent features of the dam are enclosed in Appendix E. Where possible, corrected information is noted on the drawings. There were also miscellaneous letters, correspondence, memos, inspection reports and 35 black-and-white construction photos in DER files which were available and reviewed.

The available data were sufficient to evaluate the principal external features of the dam and the hydraulic characteristics of the spillway. Considering the number of changes made during construction and reported deficiencies in embankment placement, there was not sufficient information on internal features of the dam and gatehouse to evaluate the embankment stability or interior features of the gatehouse.

b. Design Features. The principal design features are illustrated on the plan, profile and cross-section plates of the embankment and appurtenant structures enclosed in Appendix E as Plates 2 through 6. These plates are reproduced from drawings prepared by Mr. Edward C. Hess, Engineer. A description of the design features is presented in Section 1.2, entitled "Description of Project".

2.2 Construction.

A description of the construction history is presented in Section 1.2. Records indicate that Mr. Edward C. Hess was the Resident Engineer and designer of the structure. Mr. A. L. Rake represented the Borough of East Stroudsburg and served as superintendent of construction. Construction began in 1934, and was completed by late 1936. The reservoir was filled by 1 May 1937.

2.3 Operational Data.

There are no current operational records maintained. There are no minimum flow requirements for the downstream channel. There were no available water level records or rainfall records available for this structure.

2.4 Evaluation.

a. Availability. All engineering data reproduced in this report and described herein and studied for this investigation were provided by DER and supplemented by information obtained from the Owner and the Edward C. Hess & Company of East Stroudsburg, Pennsylvania.

b. Adequacy. The data available for review from DER files, the Owner and their engineer was sufficient to evaluate the external features of the dam and the hydrologic and hydraulic features of the design. There was not enough data to evaluate the internal components of the structure, the quality of the fill or the interior portions of the gatehouse.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated as follows. In general, the dam and its appurtenant facilities are in fair condition. Specific portions of the dam, which include the spillway, wasteway channel and downstream toe area, are poorly maintained and in need of an extensive amount of repair work.

b. Dam. During the visual inspection, there were no indications of distortion in alignment or grade that would be indicative of movement of the embankment or the foundation. There were no signs of riprap distortion, movement or significant deterioration. The quality of the rock was assessed to be good. No surface cracks could be noted along the crest or the downstream slope as these portions of the embankment are totally covered with hand placed rock. The upstream slope showed no signs of significant sloughing or erosion, but there were several isolated depressed areas along the crest indicating that the rock has moved. Although this displacement is considered minor, it should be monitored during each annual inspection.

The junctions between the abutments and the embankment were inspected and evaluated to be in good condition. The junction between the abutment and the spillway was inspected and settlement of 12 to 14 inches was noted, as shown on Photograph 16. This reduces the storage capacity of the reservoir.

The major item of concern is the quantity of seepage noted through the downstream toe, as well as other areas just above and below the toe. This extensive seepage area is shown on Sheet 5A, Appendix B. The visual inspection also noted several pipes discharging seepage into the wasteway channel. A review of the construction files confirms that seepage noted during construction was collected and transported through pipes that discharge into the wasteway channel. An evaluation of this seepage is discussed in Section 6 and Appendix F, and recommendations to monitor the situation are presented in Section 7.

c. Appurtenant Structures. Only a portion of the gatehouse, housing the gate hoists, above the dam crest could be inspected. All visible portions were assessed to be in good

condition. Representatives of the water company stated that the tower was rehabilitated in 1976, when the floor, roof, gate stems and hoists were replaced. Inspection inside the gatehouse below the floor was prevented because the Owner did not have proper safety equipment to satisfy OSHA requirements and would not allow the inspection team to enter the tower. The sluice gates were exercised by the Owner and found to be operable.

The intake and outlet pipes are embedded in the embankment and could not be inspected. The outlet structure at the downstream toe was judged to be in good condition. The outlet channel below the dam was also judged to be in good condition.

An inspection of the spillway revealed the concrete was in fair condition with spalling. The concrete floor and masonry walls of the wasteway channel are considered to be in fair condition in the upper portion and in very poor condition for the bottom 100 feet of the channel. The portion of the channel considered to be in poor condition has many undermined areas beneath the channel floor, causing the concrete floor to collapse. See Photograph 11. One portion of the left wall has rotated inward and several zones were noted where groundwater seepage is discharging through the wall and beneath the channel floor. A cast iron pipe supported on rock piles is located across the weir of the discharge channel. This pipe is used as a high level water supply intake.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability or other features that would significantly affect the flood storage capacity of the reservoir. The reservoir side slopes are moderate to steep and well vegetated with timber to the water's edge.

e. Downstream Channel. As shown on Plate 1, Appendix E, there are two dams between East Stroudsburg Dam and the town of East Stroudsburg where Sambo Creek enters Brodhead Creek. The middle dam is an earthen embankment which supplies water to the treatment plant which is located a few hundred feet downstream. A brief inspection of this structure revealed that it is in good condition and well maintained. The earth embankment is not assessed capable of withstanding overtopping for a significant period of time without failure. The dam further downstream is a small concrete gravity dam built in 1921, which was used as an intake dam. This dam was inspected and judged capable of withstanding overtopping during extreme events.

Beyond the concrete dam, Sambo Creek flows through a semi-residential area before entering the town of East Stroudsburg, where the creek passes through highly populated areas and discharges into the Brodhead Creek. In the event of catastrophic failure of East Stroudsburg Dam, significant property damage and possible loss of life would be expected in East Stroudsburg, thus justifying the "High" hazard classification of the dam.

3.2 Evaluation.

Inspection of the dam disclosed no evidence of apparent past or present significant movements that would indicate existing instability of the structure. Significant quantities of clear seepage were noted at, just above and beyond the toe of the dam which, according to historical records, existed immediately after the filling of the reservoir. This condition is considered to be undesirable, as it is not monitored and may have a significant effect on the stability of the embankment.

The spillway and wasteway channel, as previously mentioned, was in fair condition near the top and in very poor condition at the base. In the event of extremely high flows, it is expected that large portions of the discharge channel will be washed away.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Operational procedures are discussed in Section 1.2. A dam tender is required only to regulate discharge for water supply when water is not flowing over the spillway at the left abutment. There are no formal written operation or maintenance procedures for this structure.

4.2 Maintenance of the Dam.

The dam is maintained by the Borough of East Stroudsburg, whose maintenance staff periodically inspects the embankment, removes woody vegetation, and performs minor repairs to the embankment crest and slopes.

4.3 Maintenance of Operating Facilities.

As previously mentioned, the gatehouse was repaired in 1976, when the floor, roof and gate stems of the building were replaced. It is reported that representatives of the Borough periodically exercise the gates to assure that they operate satisfactorily. It is obvious from the discussion in Section 3 and the photographs that the spillway is not maintained and the channel needs to be repaired.

4.4 Warning Systems In Effect.

There are no formal warning systems or procedures established to be followed during periods of heavy rainfall.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a full-time dam tender, is a realistic means of operating the relatively simple control facilities at East Stroudsburg Dam. An operation maintenance procedure, including an inspection checklist, should be developed to insure that all items are periodically inspected and maintained in good condition.

Since there is no formal warning procedure, it is recommended that a formal procedure be developed so that residents below the dam can be warned of potentially hazardous conditions or extreme flows through Sambo Creek.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design/Evaluation Data. During construction of the dam, the State requested the spillway size be increased. The existing spillway capacity was evaluated in a State inspection report dated 23 May 1944. Hydrologic and hydraulic evaluations performed in conjunction with this 1979 Phase I inspection are contained in Appendix C.

The watershed is small, approximately 2.1 miles long and 0.7 miles wide. About 1.24 square miles drain into the reservoir naturally. A channel diverts flow from Michael Creek into East Stroudsburg Reservoir. As shown on the hydrologic map, the diversion channel intercepts runoff from an 0.44 square miles area and discharges it in the reservoir. The diverted flow from Michael Creek is considered insignificant during a large storm; however, the intercepted runoff is considered significant, making the total drainage area 1.68 square miles. Elevations range from approximately 1,100 feet to a normal pool elevation of 888 at the spillway crest. The watershed is more than 95 percent wooded with less than five percent residential development. It is likely that residential development will continue to some degree within the watershed.

The spillway originally approved by the State was 25 feet by 4 feet deep. On June 16, 1936, personnel from the Corps of Engineers, Philadelphia District, met with the State Engineers regarding recommended spillway capacity of earthen dams. A memorandum from the Chief of Engineers suggested that there be a freeboard of five feet above the maximum spillway requirements. An alternate definition was that the spillway be built large enough to provide an excess of 50 percent above the maximum known requirements as determined from the local rainfall records. The storm of record had occurred in 1913, when about 7.5 inches of rain fell in three hours and 50 minutes. As a result, the State requested that the spillway size be increased to 40 feet by 5 feet, with a capacity of 850 cfs with two feet of freeboard, and Mr. Hess, the Borough Engineer, agreed. A 1944 State inspection report evaluated the spillway capacity to be 2,195 cfs (using a coefficient of discharge equal to 3.88) when the reservoir surface was at the top of the dam.

In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design

flood for this "Intermediate" size dam and "High" hazard potential classification is the Probable Maximum Flood (PMF).

b. Experience Data. No reservoir level records or rainfall records are maintained for this dam other than observations of extreme low pool levels.

c. Visual Observations. A high level intake pipe is placed over the spillway crest and extends back to the reservoir and also down the spillway channel. The pipe is supported in places by piles of stone. During extreme events, it is likely that debris would dislodge the pipe, allowing it to wedge in the spillway and debris to build up, increasing the reservoir level and decreasing the spillway capacity. See Photograph No. 3.

Photograph No. 16 shows the relatively large amount of settlement adjacent to the spillway wall. This settlement reduces the maximum reservoir level and, therefore, the spillway capacity. Other observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix B.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the "HEC-1, Dam Safety Version", computer program. A brief description of the program is included in Appendix C. It is assumed that the diverted flow from Michael Creek will have no effect on evaluation of this dam. The drainage area added by the diversion channel is included as part of the watershed.

Calculations for this investigation estimate the spillway discharge to be about 1,744 cfs with the reservoir at the top of the spillway wall. Under existing conditions, settlement adjacent to spillway wall, the spillway discharge is reduced to about 1,160 cfs. The HEC-1 program computed the peak PMF inflow to be about 4,000 cfs. As shown in Appendix C, the spillway can pass about 0.48 PMF under existing conditions and about 0.62 PMF with an embankment elevation of 893.6, the minimum crest elevation excluding settlement adjacent to the spillway wall.

e. Spillway Adequacy. The spillway will not pass 0.5 PMF without overtopping. The spillway is considered to be "Inadequate" but not "Seriously Inadequate" as overtopping by two inches for this short duration is assessed not to cause failure.

f. Downstream Conditions. Discharge from the dam flows through a wide wooded valley for about 1.5 miles, where it

enters the Middle Dam Reservoir, DER No. 45-3. About 0.6 miles farther downstream, discharge enters the Intake Dam Reservoir, DER No. 45-93. The Middle Dam has an estimated total capacity of 250 acre-feet and estimated spillway capacity of 1,200 cfs. The earth embankment is judged to fail if overtopped for a significant period of time. Since the reservoir of the Intake Dam is very small, failure is estimated to have little effect downstream. About 1.1 miles downstream of the Intake Dam are seven homes built on the flood plain and are subject to damage, including loss of life, if East Stroudsburg Dam failed. About 1.9 miles further downstream, or five miles below East Stroudsburg Dam, Sambo Creek enters Brodhead Creek.

Sambo Creek flows through East Stroudsburg before entering the Brodhead, where there are potential damage areas. Damage, including loss of life, would be significantly greater if the dam failed during passing of the PMF than damage resulting from high flows occurring just before failure of the dam.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. There was no evidence found of existing embankment stability problems. The embankment slopes are reasonably uniform, with no signs of significant displacement or sloughing. The condition of the riprap on both the upstream slope above the water level and the entire downstream slope was judged to be in good condition. Significant quantities of seepage were noted above, at and beyond the toe of the dam. The seepage was clear and, based on inspection reports, construction documentation and other correspondence in DER files, began shortly after the reservoir was filled and has continued at approximately the same rate ever since.

The exposed portions of the gatehouse tower were inspected and observed to be in good condition. The sluice gates were exercised and appeared to function properly.

The lower 100 feet of the spillway wasteway channel is in very poor condition. The upper part of the channel and weir are in fair condition. Overall deterioration and poor condition of the structure can be seen in Photograph 11, Appendix D.

b. Design and Construction Data. Design documentation was limited. There were no structural calculations, stability analysis, seepage analysis or design drawings in DER files or in the files of the Owner and the Engineer. A complete set of construction specifications was available in DER files and reviewed. Progress reports, letters and memos indicate that significant deviations from the specifications were made. Therefore, an assessment of the embankment stability based on this information could not be performed. Considering these facts and the quantity and locations of seepage through the embankment, recommendations for stability evaluations are presented in Section 7.2.

c. Operating Records. There are no operational records available for this structure.

d. Post-Construction Changes. Post-construction changes are limited to rehabilitation of the spillway in 1949, rehabilitation of the gatehouse in 1976, and installation of the high level intake over the spillway.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. Since the results of the static stability analysis were not available, an assessment of the seismic stability of the dam is also unknown.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. The visual inspection and review of the limited documentation indicates that the dam, foundation and portions of the appurtenant structures of East Stroudsburg Dam are in fair condition. The lower portion of the spillway discharge channel is in poor condition. Significant quantities of uncontrolled clear seepage were noted through the downstream embankment, spillway and wasteway discharge channels.

The hydrologic and hydraulic computations presented in Appendix C indicate that the dam will pass 48 percent of the Probable Maximum Flood without overtopping. As two inches of overtopping is not assessed to cause failure, the spillway system is considered to be "Inadequate".

b. Adequacy of Information. The very limited design and construction information available was not sufficient to adequately evaluate the stability of the dam.

c. Urgency. The recommendations presented in Section 7.2 have been divided into two categories. The first category includes recommendations which should be implemented immediately, whereas the second category consists of recommendations which should be implemented as soon as practical.

d. Necessity of Additional Studies. It is judged that additional investigations pertaining to the stability of the embankment and of the spillway should be performed. These recommendations are described in Section 7.2.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following recommendations be implemented immediately under the direction of a registered professional engineer experienced in dam design.

(1) It is recommended that piezometers and observation wells be installed along the crest and along the downstream slope to determine embankment pore pressures and the phreatic surface.

(2) Test borings should be performed to obtain relatively undisturbed samples of the embankment material for an engineering evaluation of the material properties.

(3) Using the results of recommendations (1) and (2) above, a stability analysis should be performed to determine the static factors of safety for this embankment.

(4) The zone between the right abutment of the spillway and dam should be filled with compacted impervious materials to bring the embankment back to design elevation.

It is recommended that the following remedial measures be implemented as soon as practical.

(1) A thorough investigation of the emergency spillway should be performed by a registered professional engineer experienced in the design of dams. Based on the results of this investigation, the emergency spillway should be rehabilitated.

(2) Seepage through the embankment should be collected and monitored for changes in flow rates and turbidity.

(3) Provisions should be made to periodically inspect the gatehouse tower and the intake and discharge pipes.

(4) The depression noted on the crest of the embankment should be inspected annually and filled, if necessary.

b. Operation and Maintenance Procedures. Because of the location and hazard classification of this dam, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents of high flows along Sambo Creek or evacuating residents in the event that dam failure is pending.

The Owner should develop an operation and maintenance procedure to be used to insure that the dam is operated in a safe manner and maintained in the best possible condition.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *East Stoudsburg Dam*

ID # *PA 00637*

ITEM	REMARKS
AS-BUILT DRAWINGS	*A complete set is not available. Portions of relatively pertinent and, at least, partially accurate drawings have been enclosed in Appendix E.*
REGIONAL VICINITY MAP	*See Plate 1, Appendix E.*
CONSTRUCTION HISTORY	*See text of report.*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN DETAILS CONSTRAINTS	*See Appendix E.*
DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	*Available data is presented in Section 5 and Appendix C.*

ITEM	REMARKS
DESIGN REPORTS	*None available from DER, Owner or Designer.*
GEOLOGY REPORTS	*None available except data presented in Appendix F.*
DESIGN COMPUTATIONS	*- See Appendix C.*
HYDROLOGY & HYDRAULICS	
DAM STABILITY	*- Data not available from DER, Owner or Designer.*
SEEPAGE STUDIES	
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*None available.*
POST-CONSTRUCTION SURVEYS OF DAM	*None.*
BORROW SOURCES	*Specific sources are unknown but records infer that material came from within the reservoir area.*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*It is understood that the interior of the intake tower was rehabilitated a few years ago. The spillway was rebuilt in 1949 to it's present configuration.*
HIGH POOL RECORDS	*No firm records are available.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None known.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None*
MAINTENANCE OPERATION RECORDS	*None available.*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*Available plans and details of these items are presented in Appendix E.*
MISCELLANEOUS	1. *35 black and white construction photographs taken during construction.* 2. *A 12 page set of specifications prepared by Edward Hess, Engineer* 3. *Progress Reports.* 4. *State Inspection Reports.* 5. *"Report Upon the Application of the Borough of East Stroudsberg".*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *East Stroudsburg Dam* County *Monroe* State *Pennsylvania* National ID # *PA 00637*

Type of Dam *Earth* Hazard Category *I (High)*

Date(s) Inspection *6 Nov. 1978 & 7 Nov. 1978* Weather *Clear & Cool* Temperature *40-50°F*

Pool Elevation at Time of Inspection *881.1 ±* M.S.L. Tailwater at Time of Inspection *NA* M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist)
Raymond Lambert (Geologist)
John H. Frederick, Jr. (Geotechnical)
Vincent McKeever (Hydrologist)
John Boschuk, Jr. (Geotechnical/Civil)

John Boschuk, Jr. Recorder

Remarks:

Mr. John H. Dennis, E.C. Hess, and Mr. Carl L. Michaels, Borough of East Stroudsburg were on site (6 Nov. 1978) and provided assistance to the inspection team.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

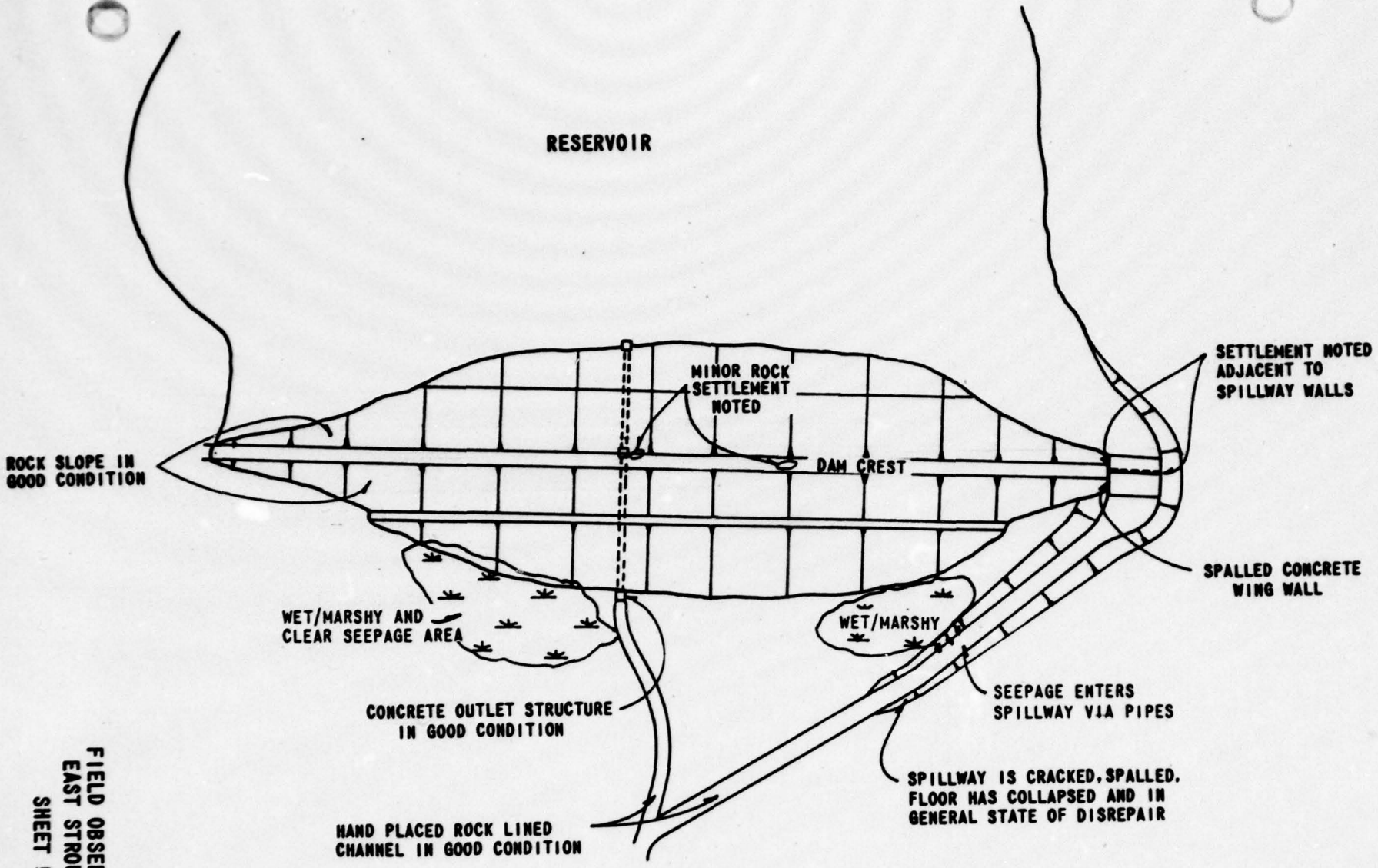
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed. Entire dam is covered with rock.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*None observed but two rock depressions were noted on the upstream side of the crest at the top of the slope.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*No unusual movements observed except for two slight depressions on the crest. The first is on the upstream side of the intake tower and the second is a circular depression (6± feet diameter) approximately 1/3 of the crest length from the left abutment. See Sheet 5a.*	
RIPRAP FAILURES	*None observed but there are distortions on the upstream side which are believed to be associated with adjustments of the rock slope.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*All junctions are in good condition.*	
ANY NOTICEABLE SEEPAGE	*Yes. See Sheet 5a. Most of the area along the toe and 50 feet or more downstream is wet and marshy.*	
STAFF GAGE AND RECORDER	*None.*	
DRAINS	*Internal drains could not be observed or located.*	



FIELD OBSERVATION PLAN
EAST STROUDSBURG DAM
SHEET 5a OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*None observed. The tower was rehabilitated two years ago when the floor, roof and valve stems were replaced. See Plate 6 of Appendix E.*	
INTAKE STRUCTURE	*The tower appears to be in good condition. The inside of the tower below the reservoir level could not be inspected because safety equipment was not available.*	
OUTLET STRUCTURE	*The outlet pipe is embedded in the embankment and could not be inspected. However, the end of the pipe was exposed and is in good condition.*	
OUTLET CHANNEL	*Good condition.*	
EMERGENCY GATE	*The valve was exercised and found to be operable.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*Fair condition, some spalling of concrete was noted.*	
APPROACH CHANNEL	*Cast iron pipe (high level water supply intake) is in the approach channel supported on rock piles. It is possible during large storms that large debris would dislocate the pipe or lodge under the pipe and cause a significant reduction in discharge.*	
DISCHARGE CHANNEL	*The discharge channel has a concrete floor and masonry walls and is in fair to good condition except the bottom 100 feet is in very poor condition. The floor of the channel has been undermined by seepage and has fallen in, the left wall has rotated in, see Sheet 5a for seepage.*	
BRIDGE AND PIERS	*A foot bridge across the discharge channel is located about 80 feet below the weir. The bridge has no effect on spillway discharge.*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*None*	
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*None*	
BRIDGE AND PIERS	*None*	
GATES AND OPERATION EQUIPMENT	*None*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Reservoir slopes are moderate to steep, well vegetated with timber to the waters edge.*	
SEDIMENTATION	*Some sediment at upper end of reservoir within the normal pool. No effect on flood water storage.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The downstream channel is eight feet wide with dry stone walls 27 inches high. The flood plain is wide, flat with 10-20 inch diameter trees and light underbrush. The channel is in good condition with little or no debris.*	
SLOPES	*The valley gradient is approximately 0.011.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*About 1.5 miles downstream of the dam is Middle Dam, an earthen embankment, judged tc fail if overtopped. About 0.6 miles further downstream, discharge enters the Intake Dam Reservoir, a concrete gravity dam. About 1.1 miles further downstream are 7 houses built on the flood plain. About 5 miles below East Stroudsburg dam, Sambo Creek enters the Brodhead Creek, in the Boro of East Stroudsberg, where there are many homes and businesses.*	

APPENDIX

C

EAST STROUDSBURG DAM

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *95% wooded, little residential development.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *888 feet (1) (914 Acre-Feet)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *893 feet (133 Acre-Feet existing).*

ELEVATION MAXIMUM DESIGN POOL: ----

ELEVATION TOP DAM: *893.0 feet.*

SPILLWAY

a. Elevation *888.0*

b. Type *Low weir and chute.*

c. Width *40 feet.*

d. Length *Approximately 300 feet.*

e. Location Spillover *Left abutment.*

f. Number and Type of Gates *None.*

OUTLET WORKS:

a. Type *Concrete gatehouse with concrete pipes extending to toe of dam.*

b. Location *Near centerline at about the middle of dam.*

c. Entrance inverts *845.5 feet±.*

d. Exit inverts *844.5 feet.*

e. Emergency draindown facilities *24 inches concrete pipe.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None.*

b. Location *N/A*

c. Records *N/A*

MAXIMUM NON-DAMAGING DISCHARGE:

(1) taken from USGS Map, all elevations referenced to this.

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 3/26/79
By: MFB
Sheet: 2 of 11

DAM East Stroudsburg Dam Nat. ID No. PA00637 DER No. 45-155

ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1. Min. Crest Elev., ft.			
2. Freeboard, ft.			
3. Spillway(1) Crest Elev, ft.			
3a. Secondary(2) Crest Elev, ft.			
4. Max. Pool Elev., ft.			
5. Max. Outflow(3), cfs		2195	
6. Drainage Area, mi²	1.3		1.68
7. Max. Inflow(4), cfs			
8. Reservoir Surf. Area, Acre	59		54
9. Flood Storage(5), Ac-Ft			

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

(3) At maximum pool, with freeboard, ungated spillways only.

(4) For columns B, C, use PMF.

(5) Between lowest ungated spillway and maximum pool.

Date: 3/26/79
By: MFB
Sheet: 3 of 11

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from sheet 2)	Source
6A, BA	Application Report dated 25 Nov. 1932
5B	State Inspection Report dated 23 May 1944
6C, BC	USGS Map "East Stroudsburg, Pa" (1973)

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

Classification (Ref. - Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as "High" as loss of life would result from failure.

2. The size classification is "Intermediate" based on its height and total capacity.

3. The spillway design flood based on size and hazard classification, is the Probable Maximum Flood (PMF).

Hydrology and Hydraulic Analysis

1. During construction, July 1936, the State requested the spillway be increased to 40ft. x 5ft. (from 25ft x 4ft) so that Q = 850 cfs w/ 2ft. of freeboard. A May 23, 1978 inspection report computed the max. discharge to be 2195 cfs.

2. Evaluation of structure was by use of the computer program. Computer input data as follows:

Inflow hydrograph
rainfall ref. Hydrometerological Report No. 33 (see sheet 8)
drainage area - determined from current USGS maps.
1.24 sq. miles drain directly into reservoir - flow is diverted from Michael Creek to East Stroudsburg reservoir, it is judged the diverted flow is insignificant as far as evaluation of the dam is concerned. However, the diversion channel intercepts runoff from an additional 0.44 sq. miles, which is considered significant.
the total drainage area is 1.68 sq. miles
Snyder's hydrograph parameters, t_p & C_p
$t_p = C_t (L \cdot L_{ca})^{0.3}$
$C_t = 1.23$ Information received from Corps of
$C_p = 0.45$ Engineers, Baltimore, for Zone 1.

$L = 2.00$ miles from USGS map for
$L_{ca} = 1.09$ miles D.A. = 1.68

$t_p = 1.23 (2.00 \cdot 1.09)^{0.3} = 1.572$

BY MFG DATE 3/26/25 Rev 11/21/79 SUBJECT East Stroudsburg Dam Hydrology / Hydraulics SHEET 6 OF 11

CHKD. BY DATE JOB No.

Reservoir routing

elevation - storage, shown on sheet 9
volumes were computed from a July 1992 topographic map.

elevation - discharge, shown on sheet 9
assumes no blockage by high intake pipe and/or debris
as the concrete weir is small and at the level of the approach channel, assume critical flow at the weir for a rectangular section:

$d_c = \frac{2}{3} H_e$ (H_e = reservoir level - 888)

$\frac{V_c^2}{2g} = \frac{1}{3} H_e$

L = 40.25 ft. field checked
H = 5.83 ft. field measured distance between weir & top of spillway wall
H = 4.38 ft. field measured distance between weir & settled point adjacent to spillway wall.

Overtopping potential

existing conditions - low point adjacent to spillway wall shown in Photo 16. As shown on sheet 10, the spillway discharges about 0.48 PMF w/o overtopping the dam. The reservoir level at 0.5 PMF is computed to be 892.58 w/ a maximum discharge of 1224 cfs. Straight line interpolation of computer input for elevation - discharge indicates 1223.48 cfs through the spillway, therefore, very little is actually going over the embankment. It is assessed that the dam will not fail by overtopping during 0.5 PMF. Therefore, all conditions for a "Seriously Inadequate" spillway are not met (ref - ETL No. 1110-2-234)

design conditions - assuming minimum embankment elevation of 893.6 (existing minimum crest elevation excluding settlement adjacent to spillway wall). As shown on sheet 11, the spillway could discharge about 0.63 PMF with min. crest elev of 893.6.

MFB 3/27/79

East Stroudsburg Dam
Hydrology / Hydraulics

SH. 7 OF 11

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

 RUN  DATE= 79/04/24.
      TIME= 13.04.34.
```

EAST STROUDSBURG DAM
NAT ID NO. PA 00637 DER NO. 45-155
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	-4	0
			JOPER	NUT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1

RTIOS= .40 .50 .70 1.00

MFB 3/27/79

East Stroudsburg Dam
Hydrology / Hydraulics

SH. 8 OF 11

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
IN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.68	0.00	1.68	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	111.00	124.00	134.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.57 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 57 END-OF-PERIOD ORDINATES, LAG= 1.58 HOURS, CP= .45 VOL= 1.00

17.	62.	127.	198.	261.	302.	312.	293.	265.	240.
217.	196.	177.	160.	145.	131.	118.	107.	97.	87.
79.	71.	65.	58.	53.	48.	43.	39.	35.	32.
29.	26.	24.	21.	19.	17.	16.	14.	13.	12.
10.	9.	9.	8.	7.	6.	6.	5.	5.	4.
4.	3.	3.	3.	3.	2.	2.			

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 26.13 23.75 2.38 97258.
(664.)(603.)(60.)(2754.04)

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUT	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-888.	-1

STAGE	888.00	888.50	889.00	890.00	892.00	893.00	894.00	896.00	898.00
FLOW	0.00	44.00	124.00	352.00	994.00	1390.00	1827.00	2813.00	3931.00

CAPACITY=	0.	13.	103.	303.	658.	914.	1588.	1800.
ELEVATION=	843.	853.	863.	873.	883.	888.	895.	897.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
888.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
892.4	0.0	0.0	0.

CREST LENGTH AT OR BELOW	0.	3.	200.	740.
ELEVATION	892.4	893.6	893.9	894.0

PEAK OUTFLOW IS 936. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 1224. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 1873. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 3594. AT TIME 42.25 HOURS

Existing Conditions
(low point adjacent to spillway wall)

MFB 3/27/79 Revised 5/15

East Stroudsburg Dam
Hydrology/ Hydraulics
SH. 10 OF 11

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	RATIOS APPLIED TO FLOWS RATIO 1 .40	RATIO 2 .50	RATIO 3 .70	RATIO 4 1.00
HYDROGRAPH AT	IN	1.68	1	1599.	1999.	2798.	3998.
	(	4.35)	(	45.28)(	56.60)(	79.24)(	113.20)(
ROUTED TO	OUT	1.68	1	936.	1224.	1873.	3594.
	(	4.35)	(	26.51)(	34.67)(	53.04)(	101.78)(

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	888.00	888.00	892.40
STORAGE	914.	914.	1338.
OUTFLOW	0.	0.	1152.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	891.82	0.00	1282.	936.	0.00	43.75	0.00
.50	892.58	.18	1355.	1224.	2.00	43.75	0.00
.70	893.95	1.55	1487.	1873.	5.75	43.50	0.00
1.00	894.63	2.23	1552.	3594.	7.75	42.25	0.00

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	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .70	RATIO 3 1.00
HYDROGRAPH AT	IN	1.68	1	1999.	2798.	3998.
	(	4.35)	(	56.60)(	79.24)(	113.20)(
ROUTED TO	OUT	1.68	1	1232.	1907.	3621.
	(	4.35)	(	34.90)(	54.01)(	102.53)(

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	888.00	888.00	893.80
STORAGE	914.	914.	1472.
OUTFLOW	0.	0.	1744.

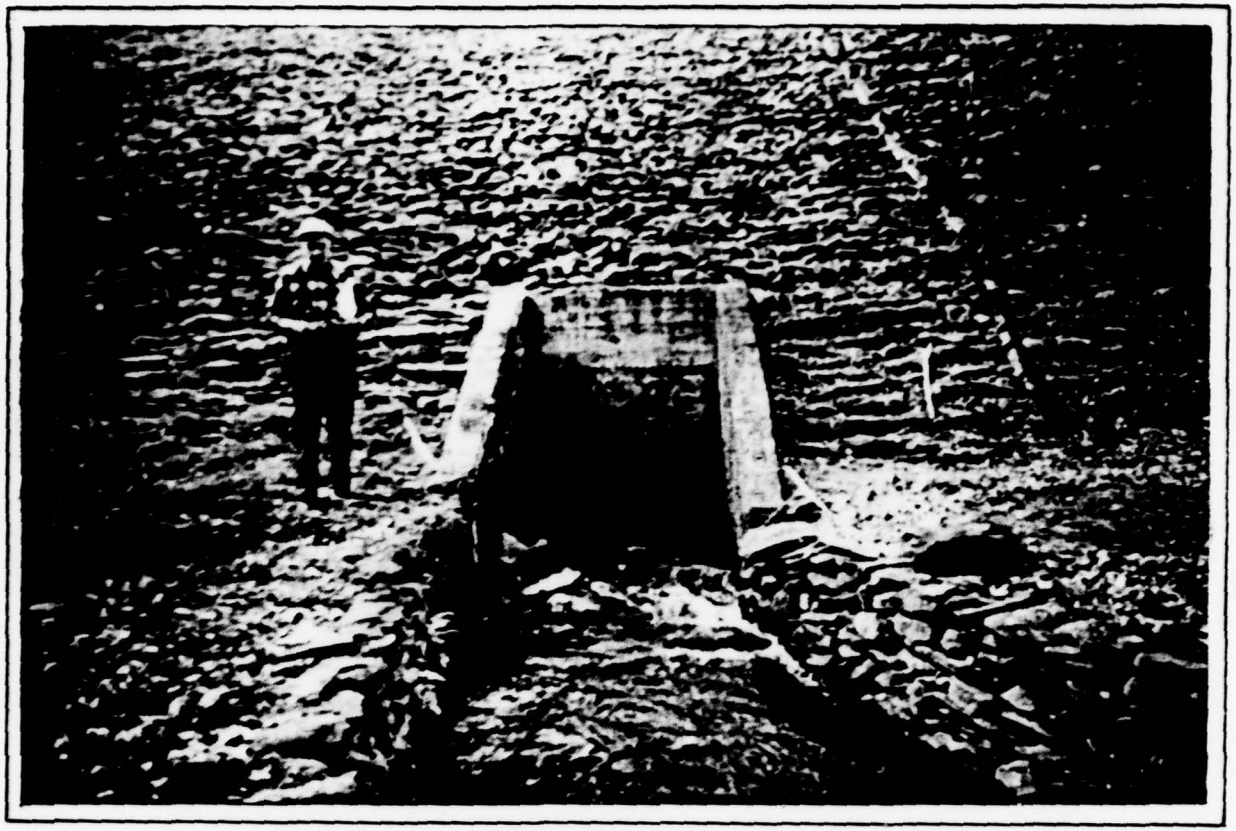
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	892.57	0.00	1354.	1232.	0.00	43.75	0.00
.70	893.93	.13	1485.	1907.	1.25	43.50	0.00
1.00	894.56	.76	1545.	3621.	4.25	42.25	0.00

Minimum Crest Elevation — Percentage of PMF Passed
At top of spillway wall - 893.8 — 68
Min. Crest elev. excluding settlement 893.6 — 65
Design elevation - 893.0 — 56

MFB 3/23/79 Rev 4/24/79
East Stroudsburg Dam
Hydrology / Hydraulics
SH. 11 OF 11

APPENDIX

D



OUTLET OF DISCHARGE PIPE.

PHOTOGRAPH NO. 1

DISCHARGE CHANNEL.

PHOTOGRAPH NO. 2

SPILLWAY APPROACH CHANNEL.

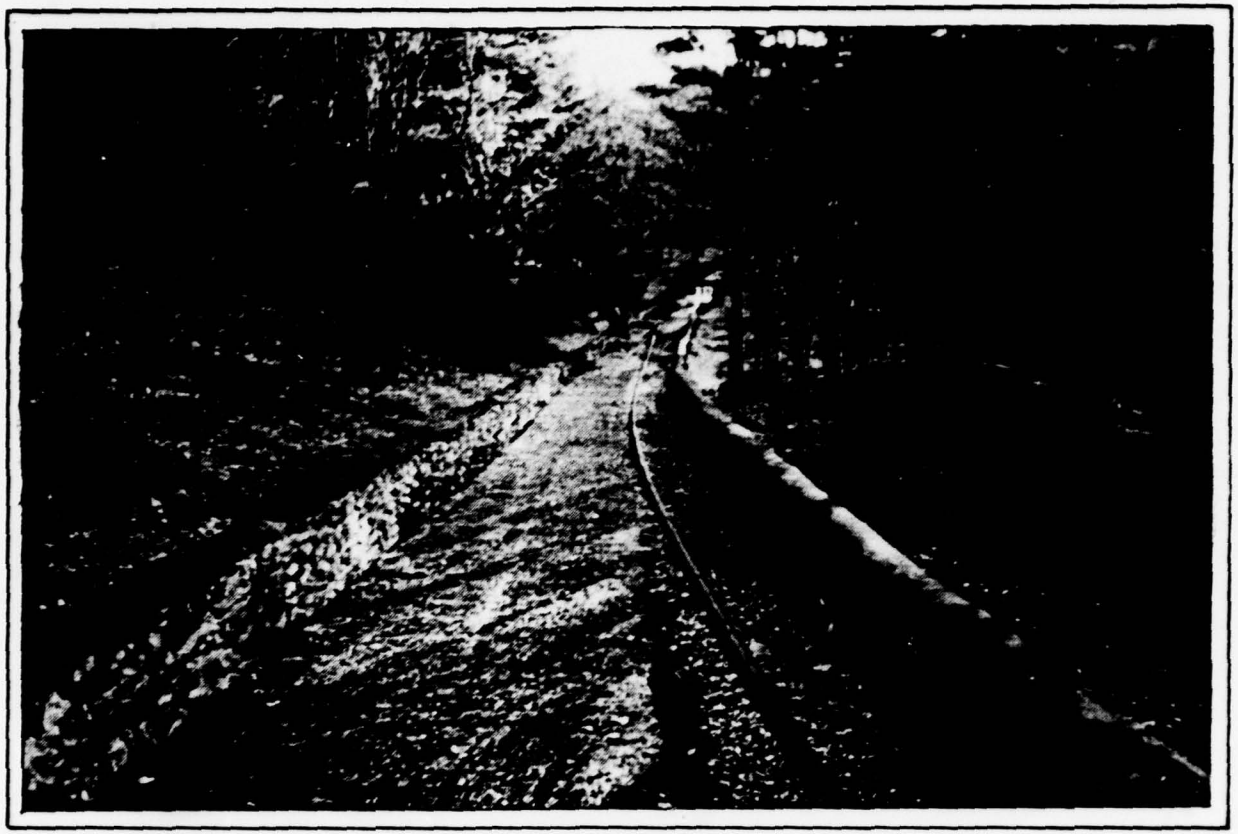
PHOTOGRAPH NO. 3

SPILLWAY CREST LOOKING TOWARDS
THE LEFT ABUTMENT.

PHOTOGRAPH NO. 4

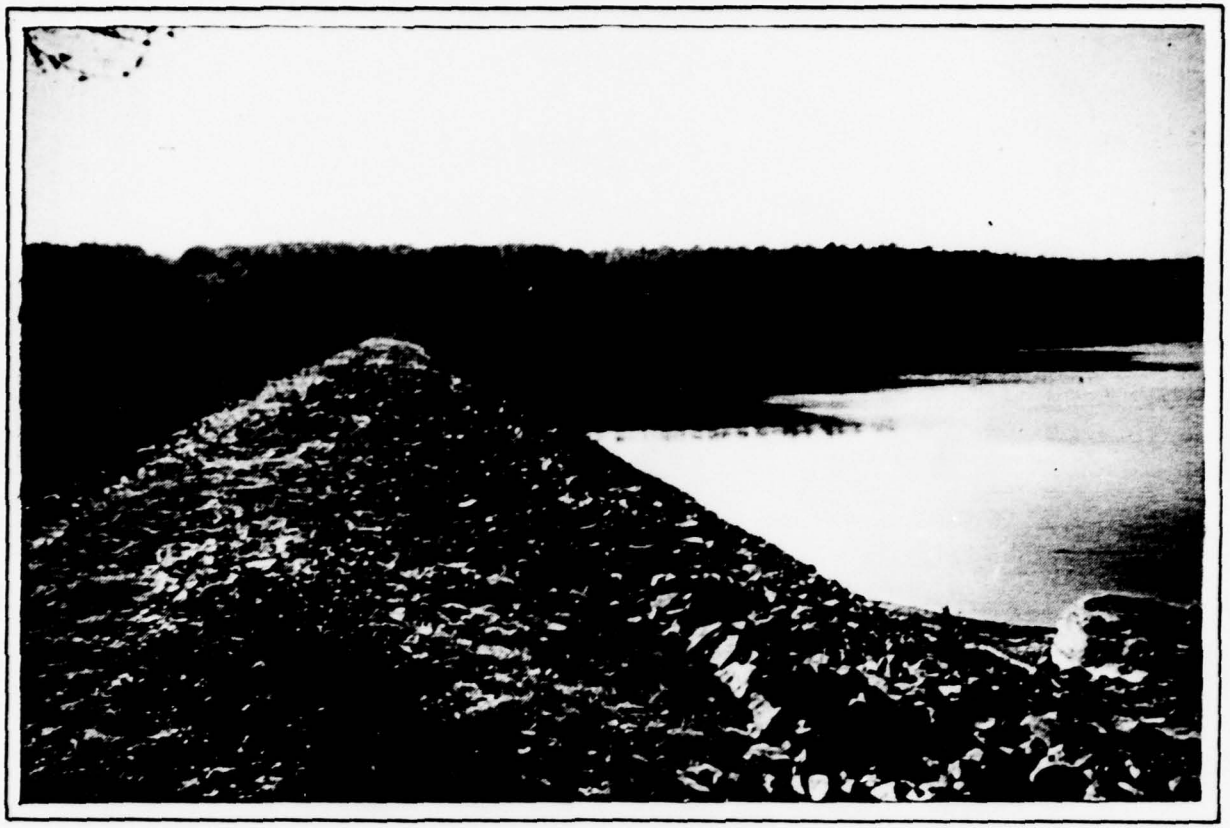
VIEW OF SPILLWAY CHANNEL IMMEDIATELY
DOWNSTREAM OF WEIR

PHOTOGRAPH NO. 5



OVERVIEW OF SPILLWAY DISCHARGE
CHANNEL.

PHOTOGRAPH NO. 6

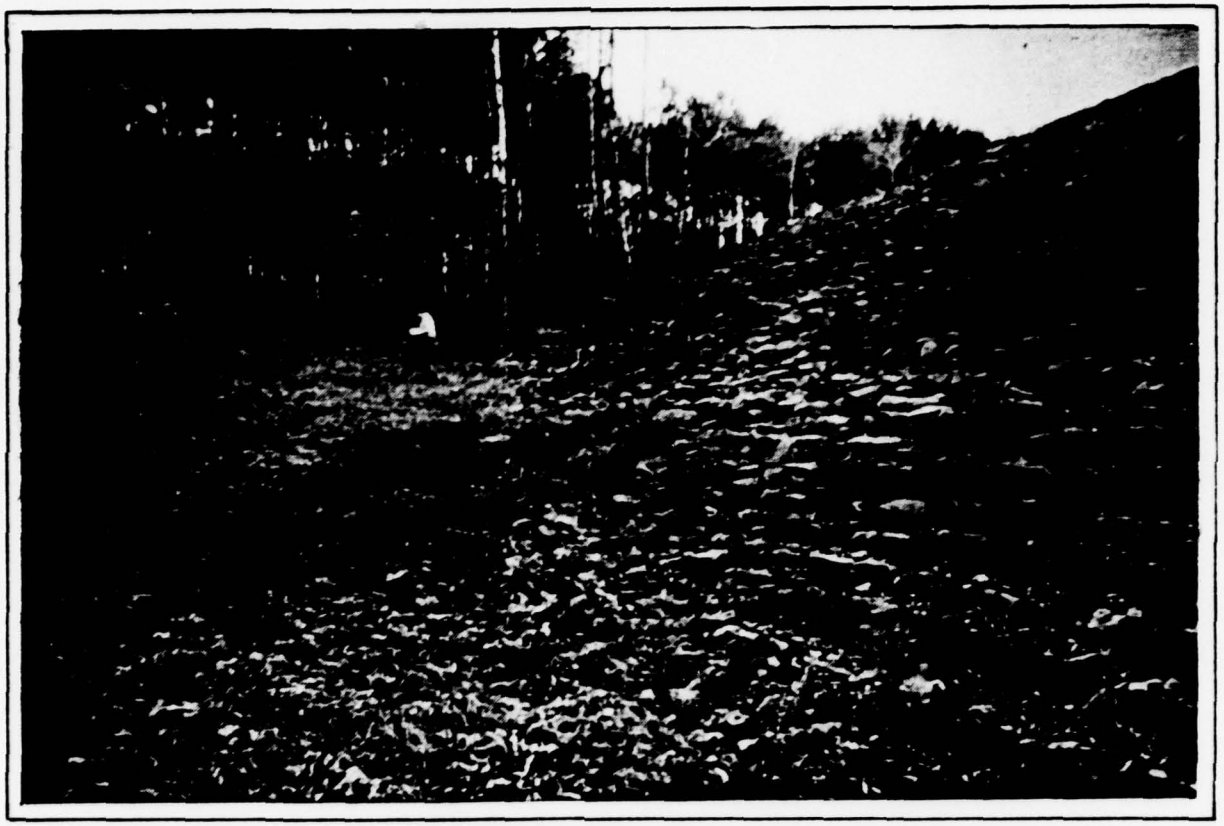


OVERVIEW OF CREST AND UPSTREAM SLOPE
LOOKING TOWARDS THE RIGHT ABUTMENT.

PHOTOGRAPH NO. 7

OVERVIEW OF DOWNSTREAM SLOPE.

PHOTOGRAPH NO. 8



MARSHY AREA AT DOWNSTREAM TOE JUST
TO THE RIGHT OF THE DISCHARGE PIPE.

PHOTOGRAPH NO. 9

SPRING OUTLET PIPE THROUGH SPILLWAY WALL.

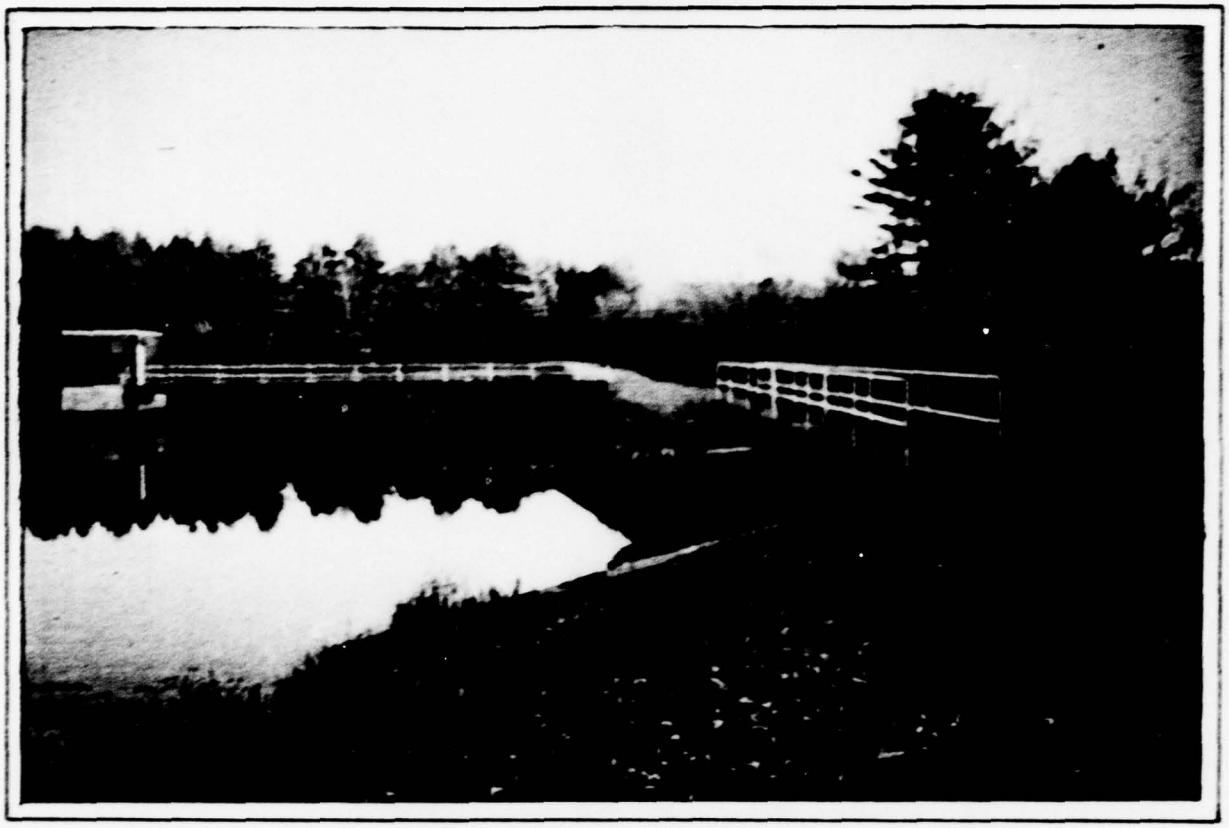
PHOTOGRAPH NO. 10

DETERIORATED SECTIONS OF
THE SPILLWAY.

PHOTOGRAPH NO. 11

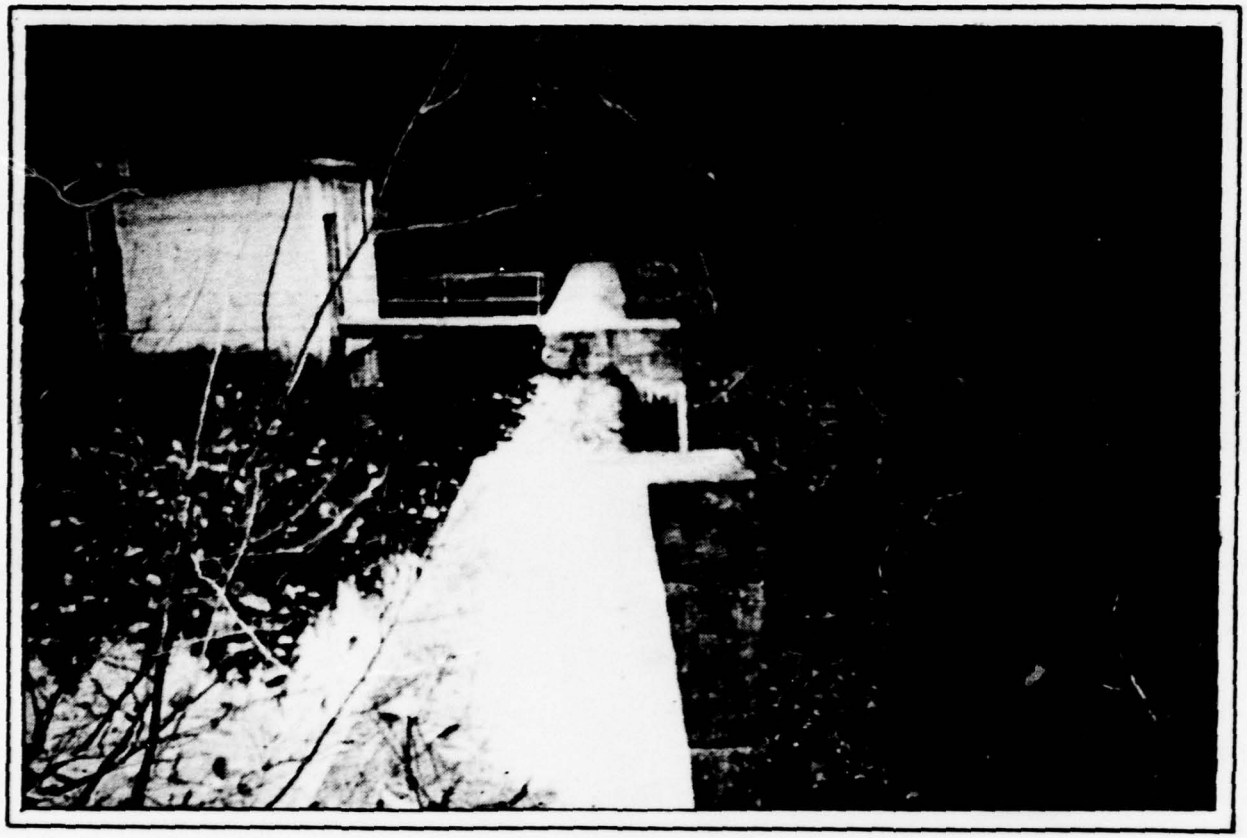
SPALLED CONCRETE ON SPILLWAY
WINGWALL.

PHOTOGRAPH NO. 12



VIEW OF MIDDLE DAM ON SAMBO CREEK
BELOW EAST STROUDSBURG DAM.

PHOTOGRAPH NO. 13



VIEW OF LOWER DAM ON SAMBO CREEK
BELOW MIDDLE DAM.

PHOTOGRAPH NO. 14

VIEW LOOKING DOWNSTREAM AT CORE WALL CONSTRUCTION. NOTE THE EXTENT OF THE ROCKFILL ZONE AT THE DOWNSTREAM TOE.

PHOTOGRAPH NO. 15

DEPRESSION IN EMBANKMENT
ADJACENT TO LEFT SPILLWAY
WALL.

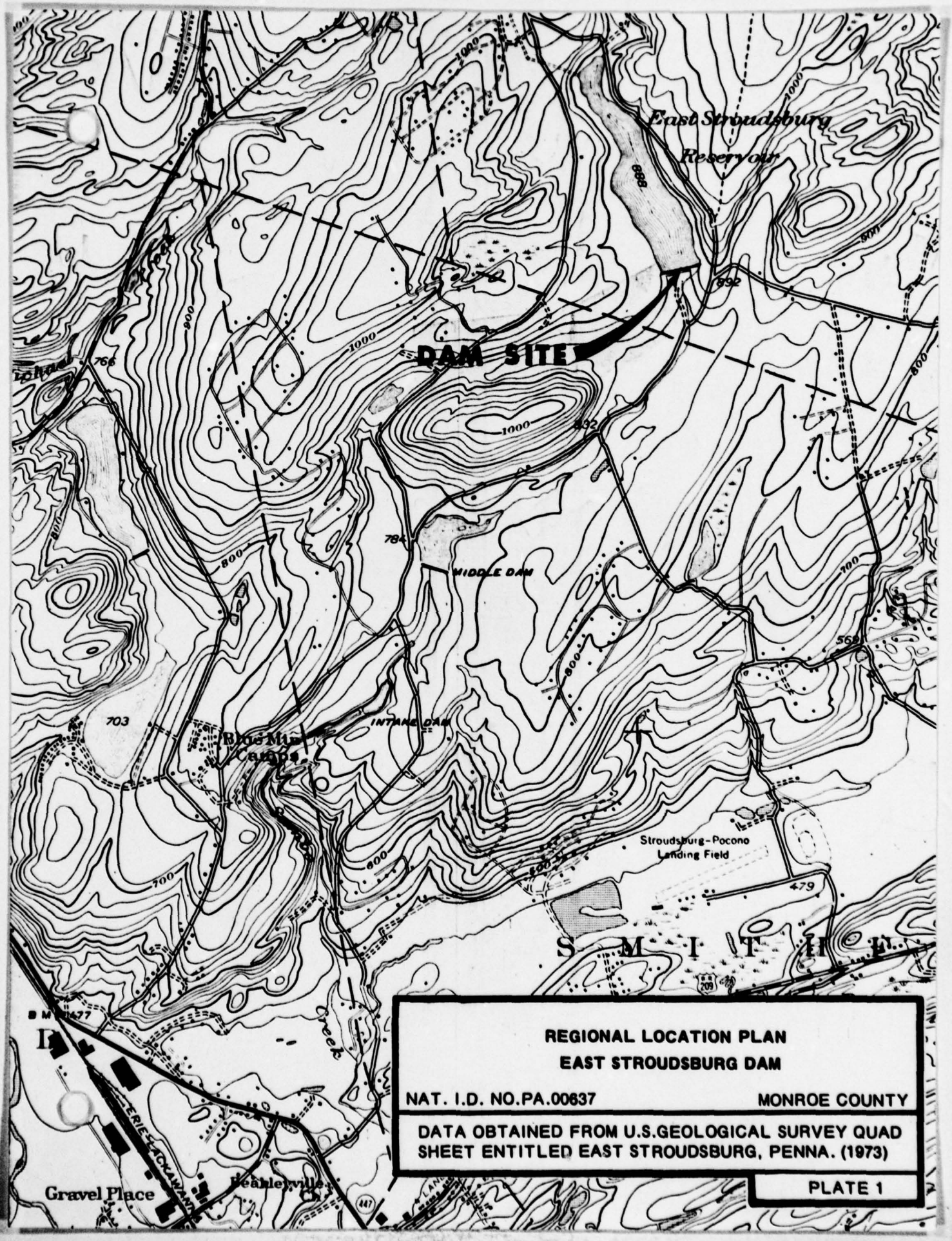
PHOTOGRAPH NO. 16

DITCH DIVERTING FLOW FROM MICHAEL CREEK.

PHOTOGRAPH NO. 17

APPENDIX

E



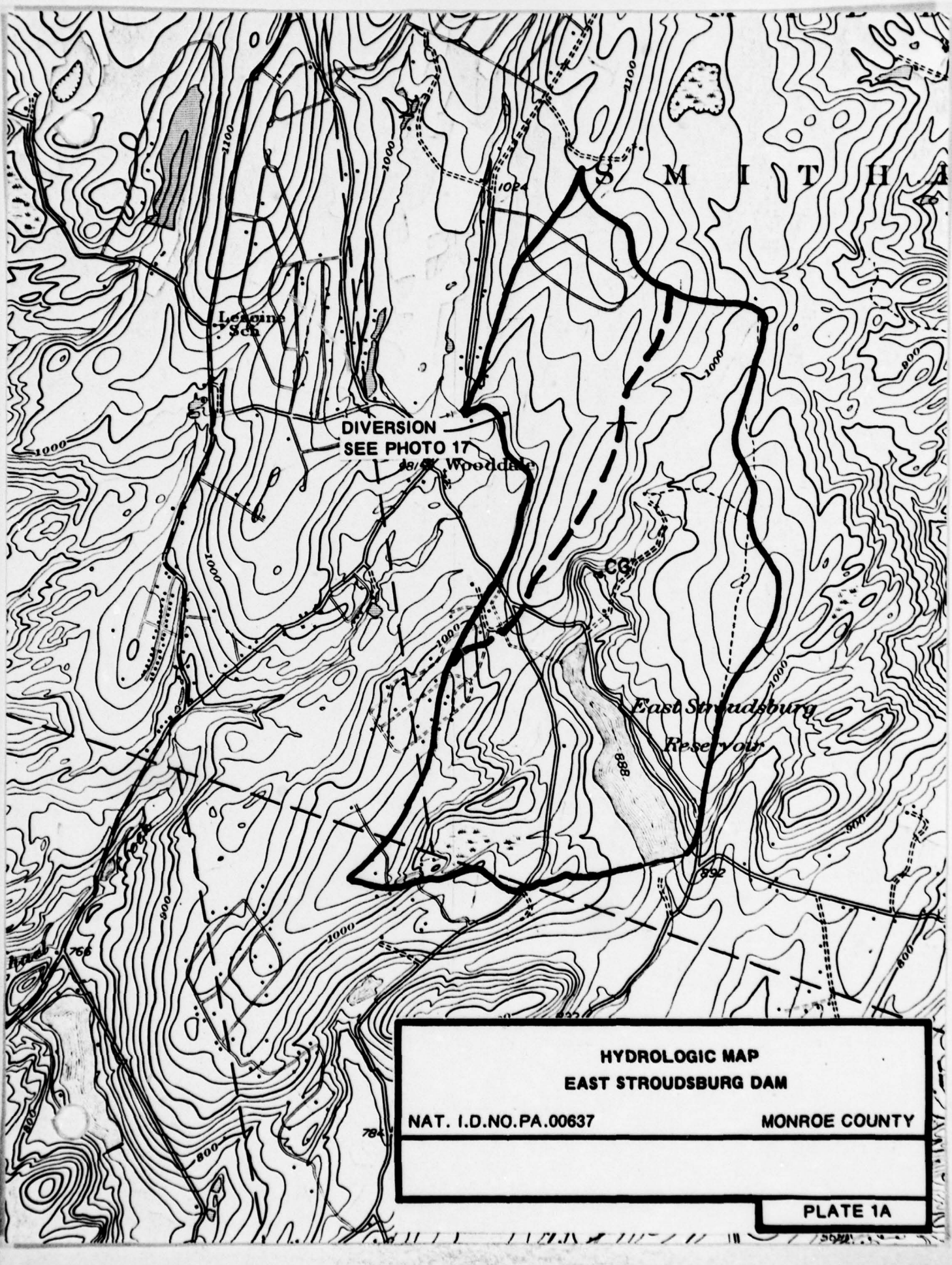
REGIONAL LOCATION PLAN

EAST STROUDSBURG DAM

NAT. I.D. NO.PA.00637 **MONROE COUNTY**

DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEET ENTITLED EAST STROUDSBURG, PENNA. (1973)

PLATE 1

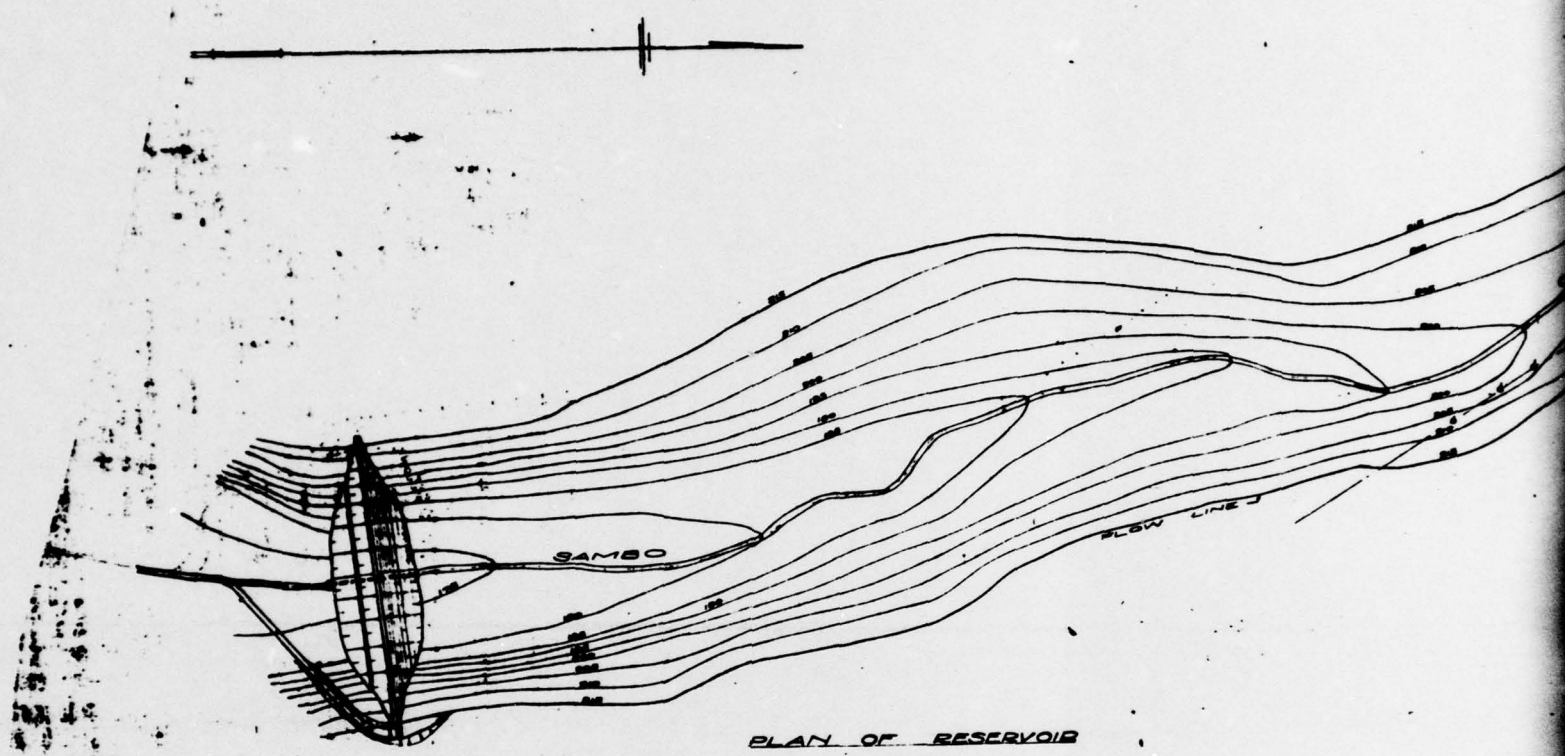


HYDROLOGIC MAP

EAST STROUDSBURG DAM

NAT. I.D.NO.PA.00637 MONROE COUNTY

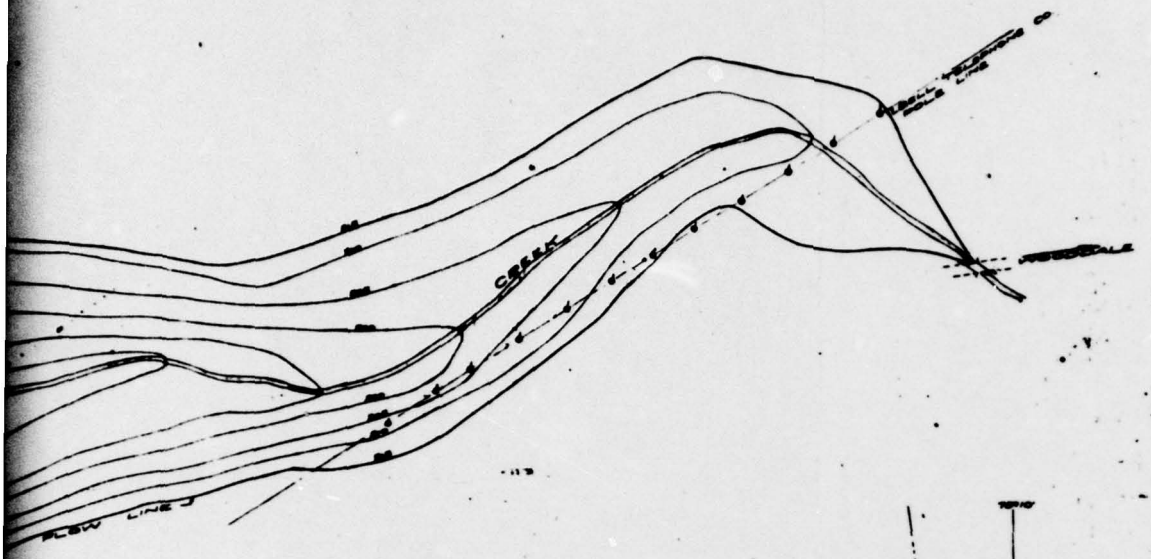
PLATE 1A

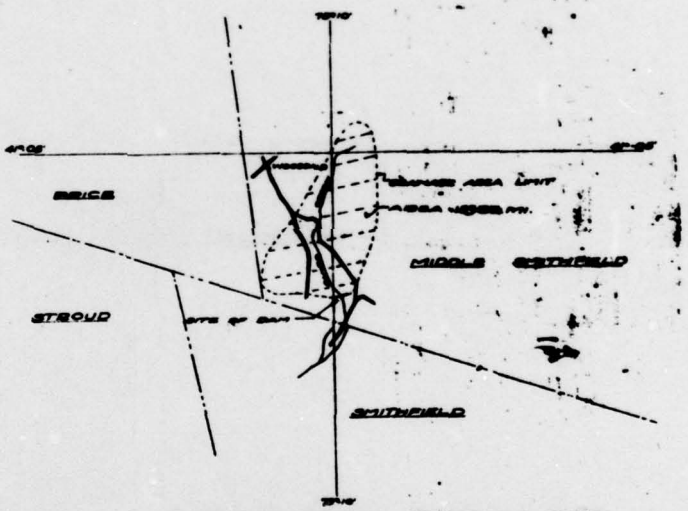


PLAN OF RESERVOIR

SCALE 1"=800'

NOTE: AREA OF RESERVOIR AT
ELEV. 88 = 13.8 ACRES.
CAPACITY = 36,590,000 GALS.
ELEV 918 ASSUMED = 686 ACTUAL





PORTION OF BUSHKILL QUADRANGLE SHEET
SHOWING LOCATION OF DAM, SITE AND DRAINAGE AREA

2

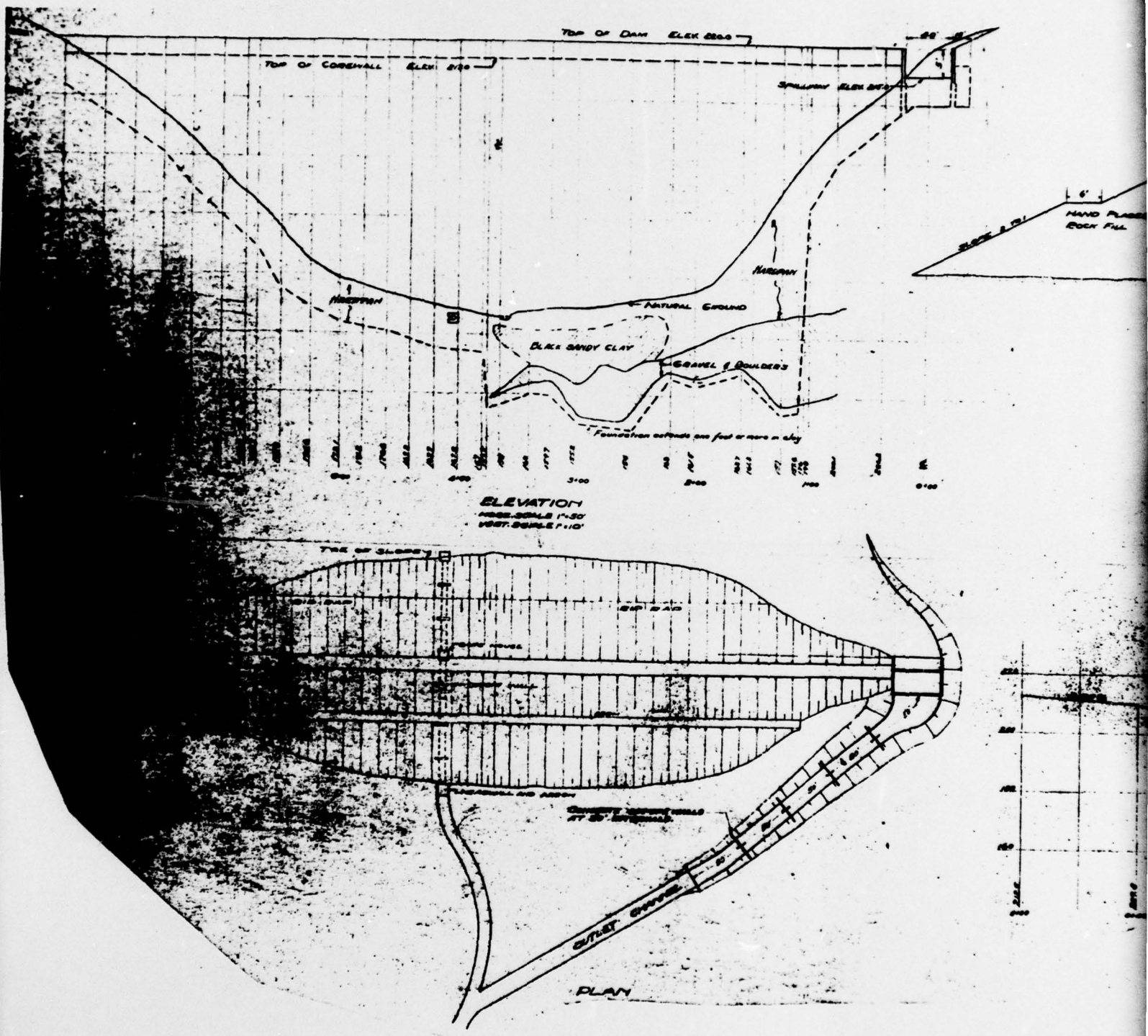
PLAN OF DAM AND RESERVOIR

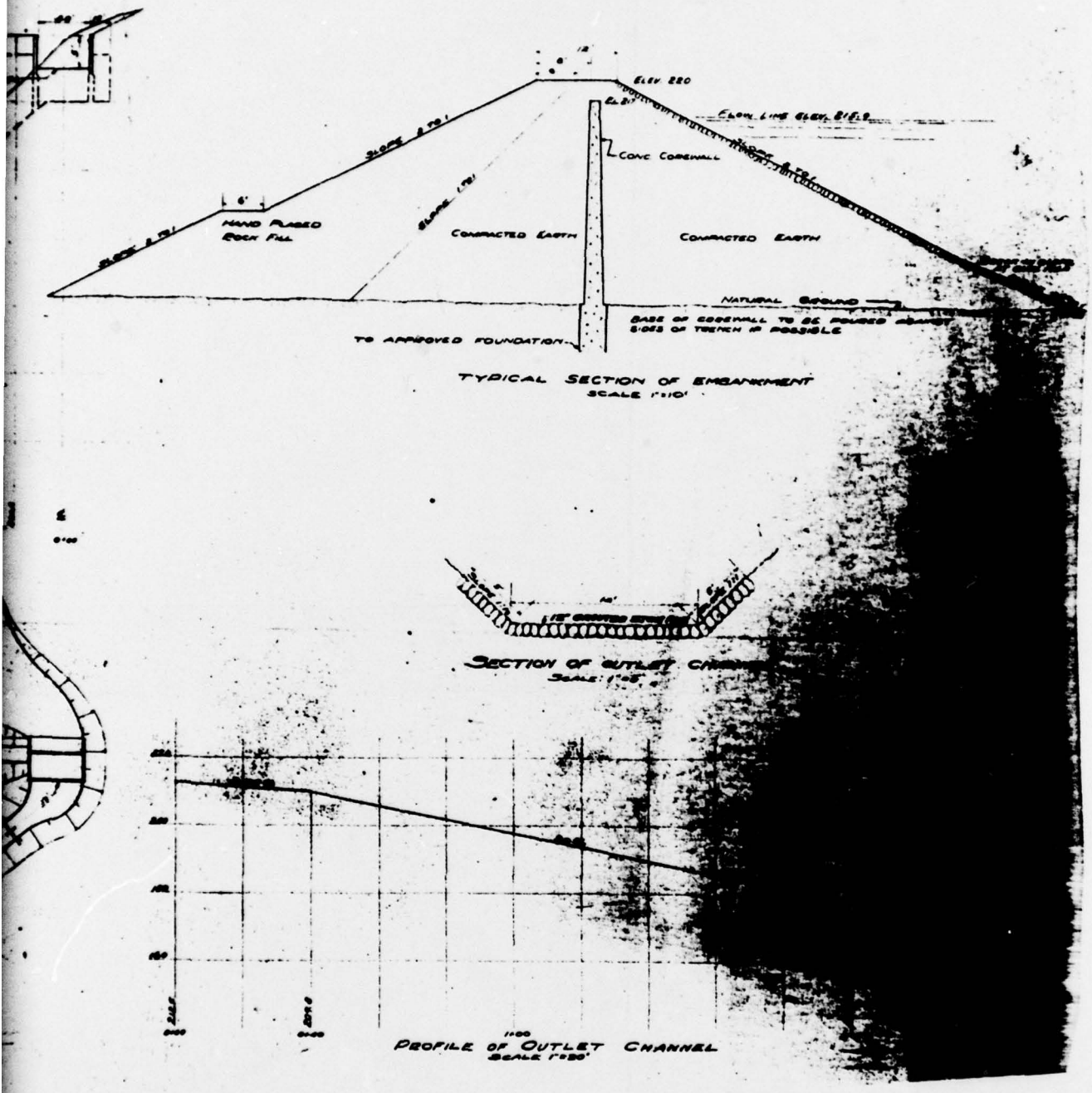
EAST STROUDSBURG DAM

NAT. I.D. NO.PA.00637 **MONROE COUNTY**

DATA OBTAINED FROM E.C.HESS BORO ENGINEER, MIDDLE SMITHFIELD TWP.,MONROE COUNTY,PA.DATED JULY1932

PLATE 2


TOP OF DAM ELEV. 2806
TOP OF CORE WALL ELEV. 2780
SPILLWAY ELEV. 2772
6'
HAND PLACED ROCK FILL
NATURAL GROUND
BLACK SANDY CLAY
GRAVEL & BOULDERS
Foundation extends one foot or more in clay
ELEVATION
HORIZ. SCALE 1"=50'
VERT. SCALE 1"=10'
TOE OF SLOPE
OUTLET CHANNEL
PLAN



2

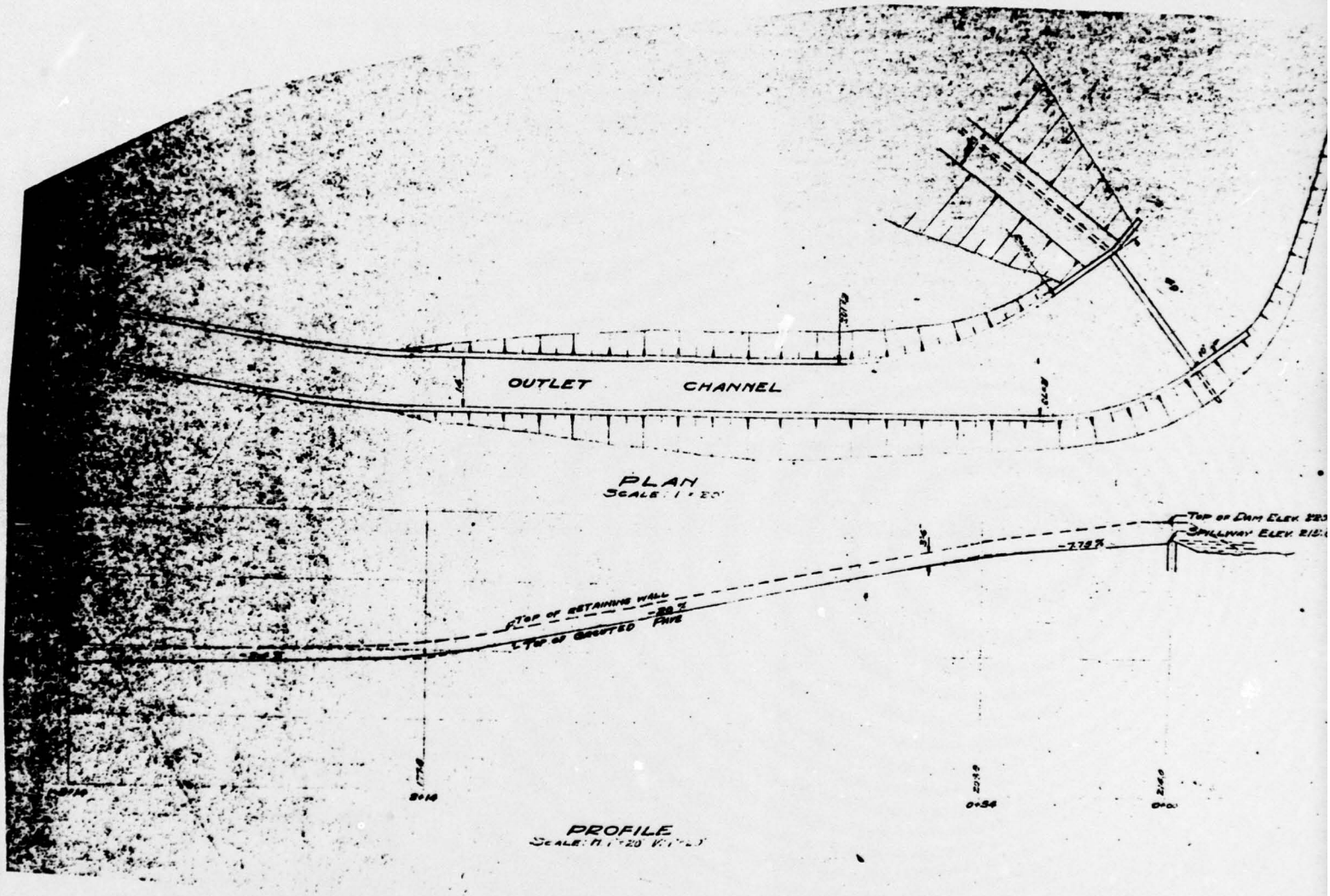
PLAN AND PROFILE OF EMBANKMENT

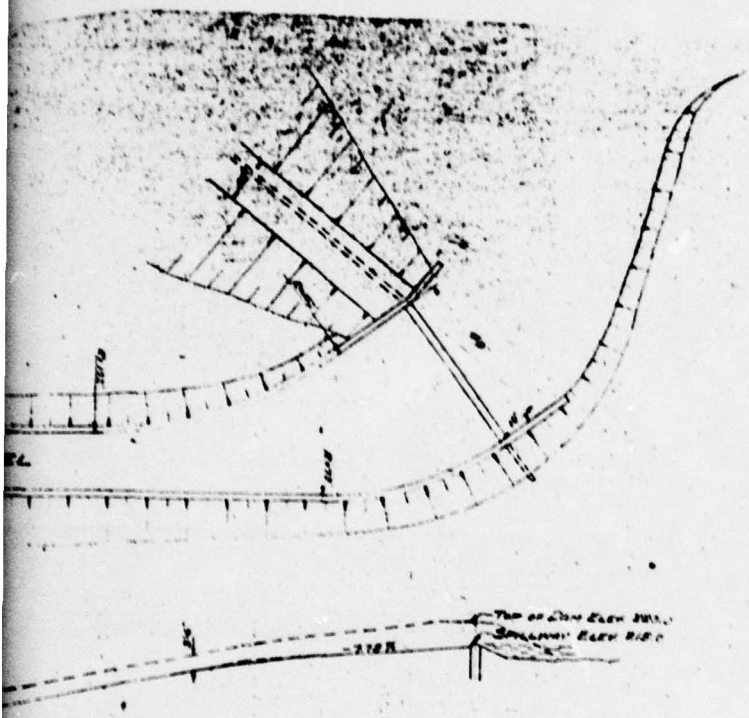
EAST STROUDSBURG DAM

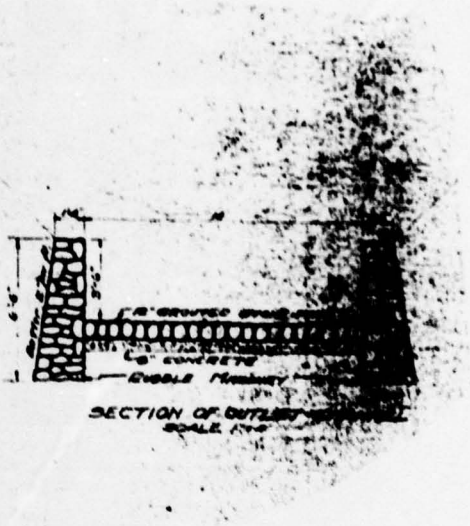
NAT. I.D. NO.PA.00637 MONROE COUNTY

DATA OBTAINED FROM E.C.HESS, BORO ENGINEER, MIDDLE SMITHFIELD TWP., MONROE CO.PA. DATED JULY 1932

PLATE 3


OUTLET CHANNEL
PLAN
SCALE: 1" = 20'
Top of Dam Elev. 323
Spillway Elev. 312
-27.8%
-20%
Top of Retaining Wall
Top of Grouted Fill
PROFILE





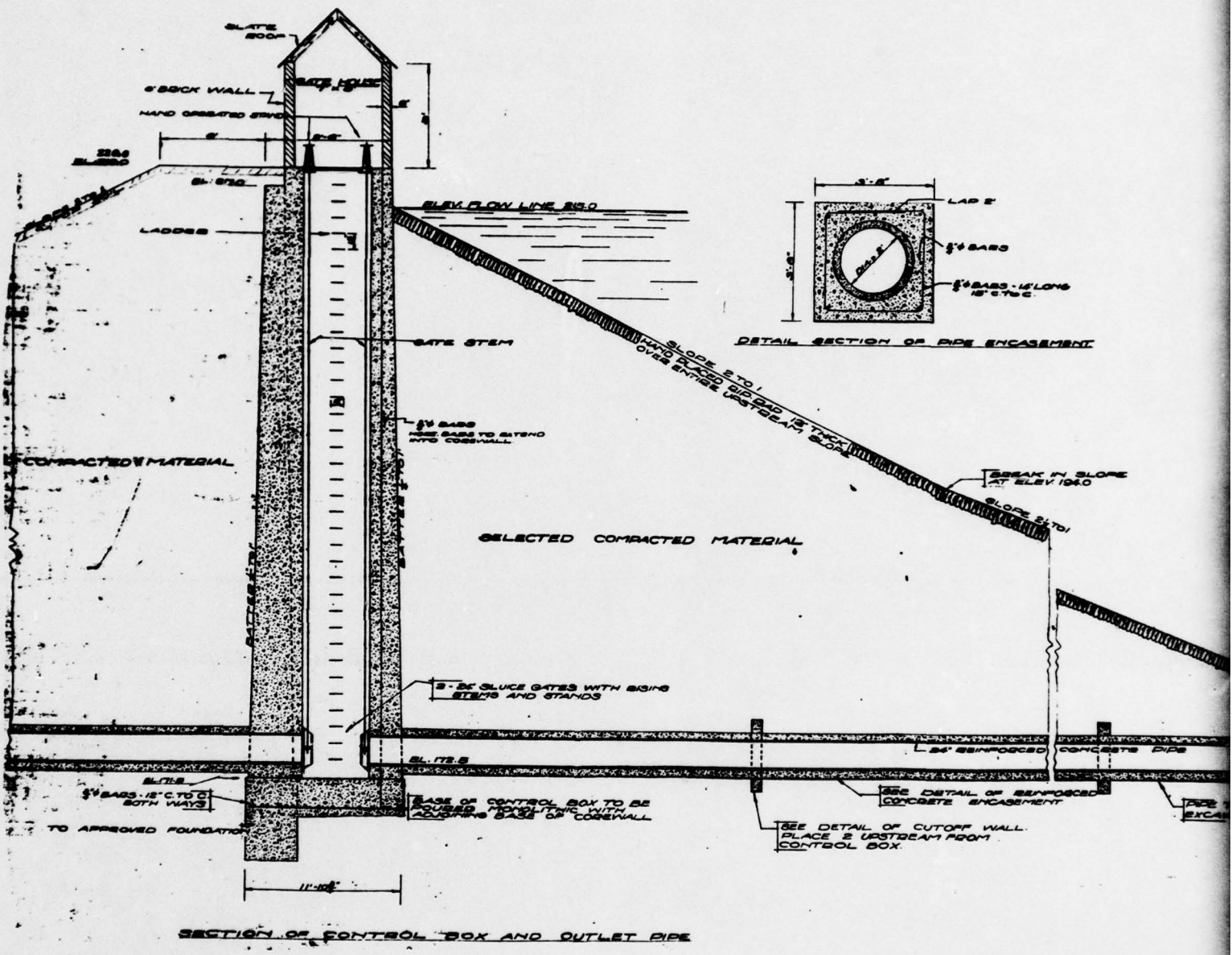
2

PLAN OF SPILLWAY
EAST STROUDSBURG DAM

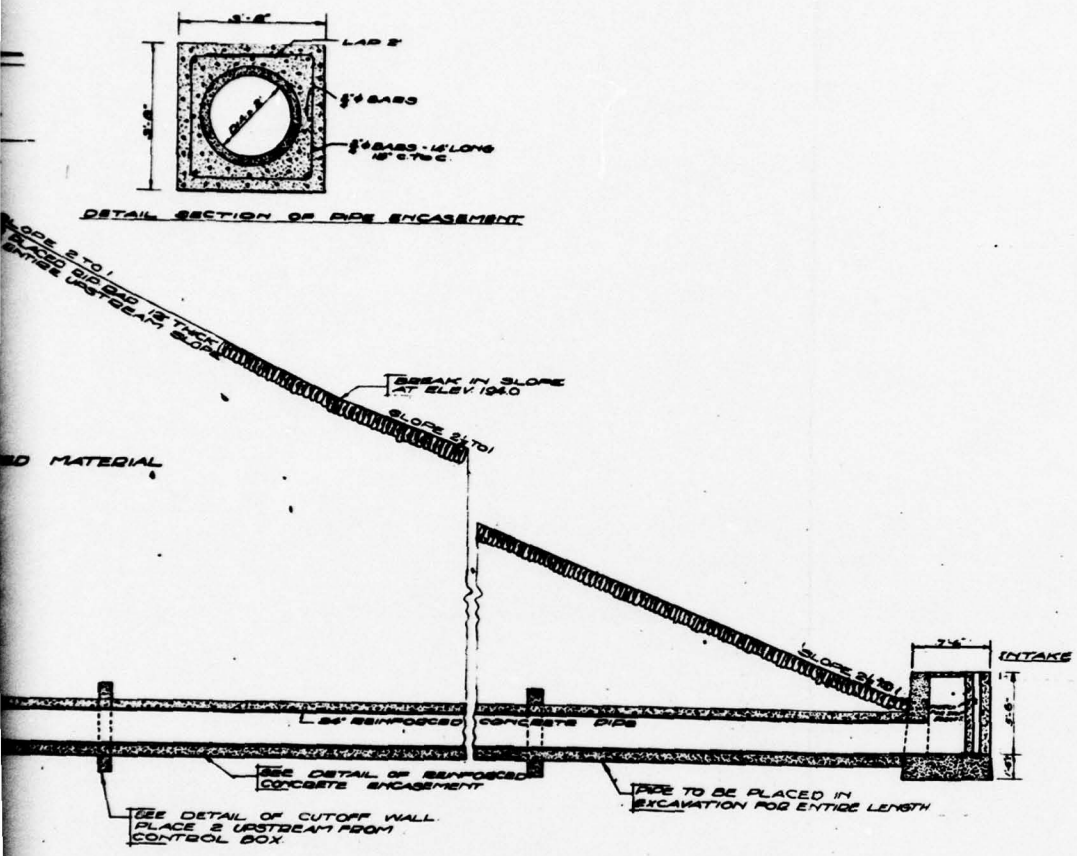
NAT. I.D. NO.PA.00637 MONROE COUNTY

DATA OBTAINED FROM E.C.HESS, BORO ENGINEER, MIDDLE SMITHFIELD TWP.,MONROE CO.PA. DATED JULY 1932

PLATE 4



SECTION OF CONTROL BOX AND OUTLET PIPE



2

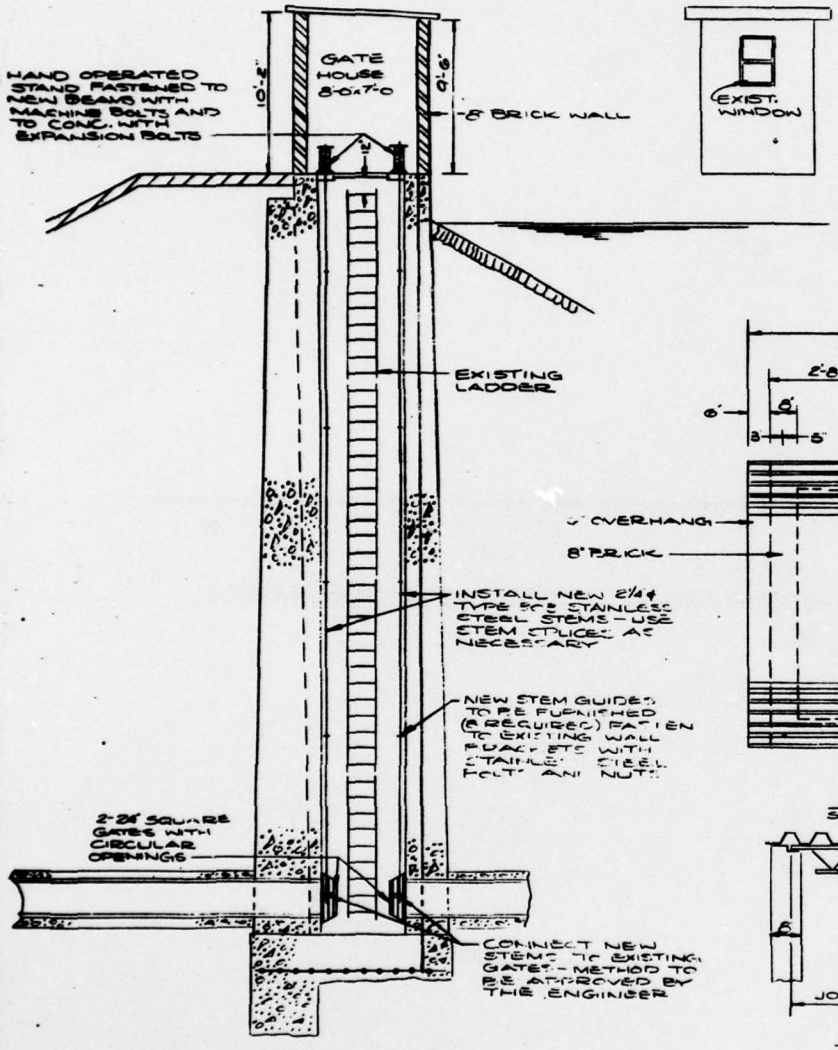
PROFILE OF GATE HOUSE
EAST STROUDSBURG DAM

NAT. I.D. NO.PA.00637 **MONROE COUNTY**

DATA OBTAINED FROM E.C.HESS BORO ENGINEER, MIDDLE SMITHFIELD TWP., MONROE COUNTY,PA. DATED JULY 1932

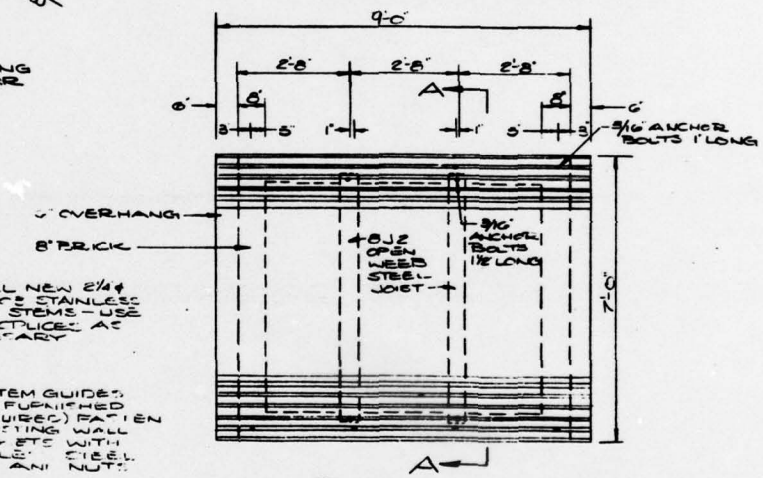
PLATE 5

NOTE:
REMOVE EXISTING REIN. CONC. ROOF LAYER & COURSES OF BRICK TO BE REPOINTED. USE ADDITIONAL BRICK AS NECESSARY FOR NEW ROOF

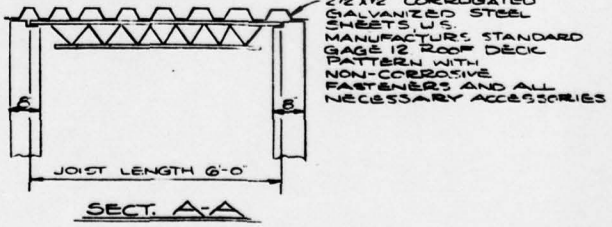


SECT. OF CONTROL BOX
SCALE 1"=1'-0"

NOTE:
REPLACE EXIST. GLASS WINDOW PANES WITH ⅛" THICK LEXAN OR EQUAL & REGLAZE
CONTRACTOR SHALL VERIFY DIMENSIONS OF WINDOW PANES BEFORE ORDERING MATERIAL (EACH PANE APPROX. 14½" x 18½" & THERE ARE 4 PANES)

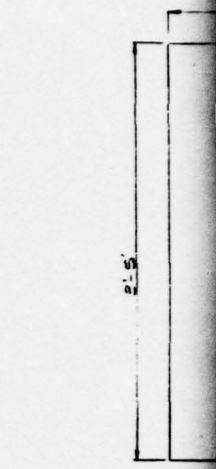


PLAN
SCALE 1/2"=1'-0"

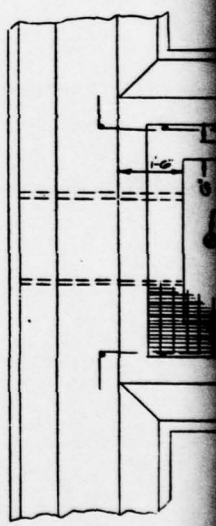


SECT. A-A

GATE HOUSE ROOF



BRONZ

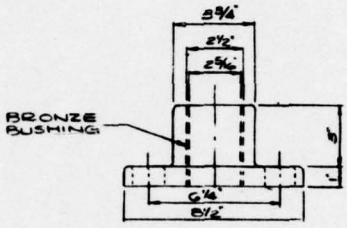


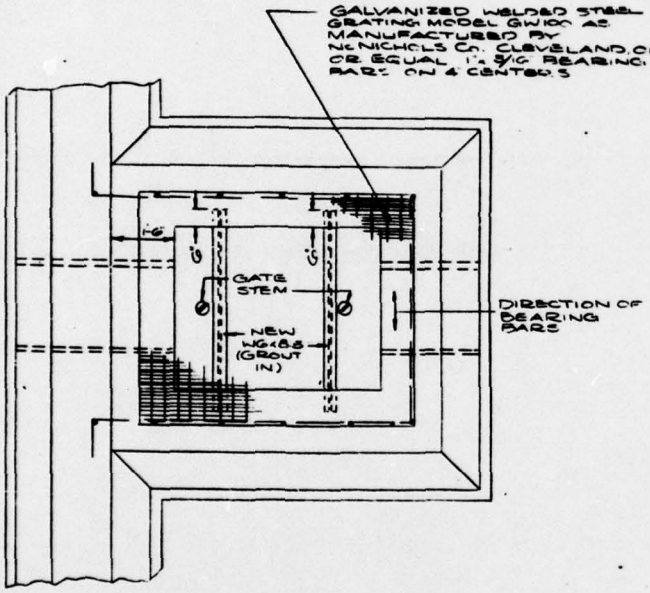
PLAN O

NOTE:
ALL EXPOSED STEEL IN
SHAPES, LADDERS, FLOOR
JOIST SHALL BE HOT-D
CONTRACTOR SHALL V
DIMENSIONS PRIOR TO OR

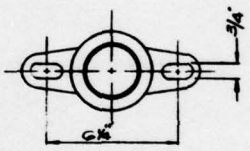
NOTE:
CONTRACTOR SHALL CAREFULLY REMOVE EXISTING STONE PLAQUE AND DELIVER IT TO THE OFFICE OF THE DAM MANAGER INTACT.
NEW BRONZE PLAQUE SHALL BE ATTACHED TO THE GATE HOUSE IN IT PLACE AND MASONRY PATCHED AS NECESSARY.

BRONZE PLAQUE DETAIL
NOT TO SCALE





PLAN OF GATE CONTROL BOX



STEM GUIDE
SCALE: 3"=1'-0"

WORK INCLUDED IN THIS CONTACT:
1-REPLACE STEMS AND STEM GUIDES
2-CONNECT NEW STEMS TO EXISTING GATES AND STANDS
3-REPLACE GRATING AND BEAMS IN GATE HOUSE FLOOR.
4-REPLACE EXISTING GLASS WINDOW PANES WITH LEXAN AND REGLAZE.
5-REPLACE EXISTING REINFORCED CONCRETE ROOF WITH CORRUGATED GALVANIZED STEEL ROOF WITH JOISTS
6-REPOINT AND/OR REBUILD UPPER 3 COURSES OF BRICK IN GATE HOUSE
7-FURNISH AND INSTALL BRONZE PLAQUE

E:
L EXPOSED STEEL INCLUDING STRUCTURAL ES, LADDERS, FLOOR GATING AND T SHALL BE HOT-DIP GALVANIZED.
NTRACTOR SHALL VERIFY ALL NSIONS PRIOR TO ORDERING MATERIAL.

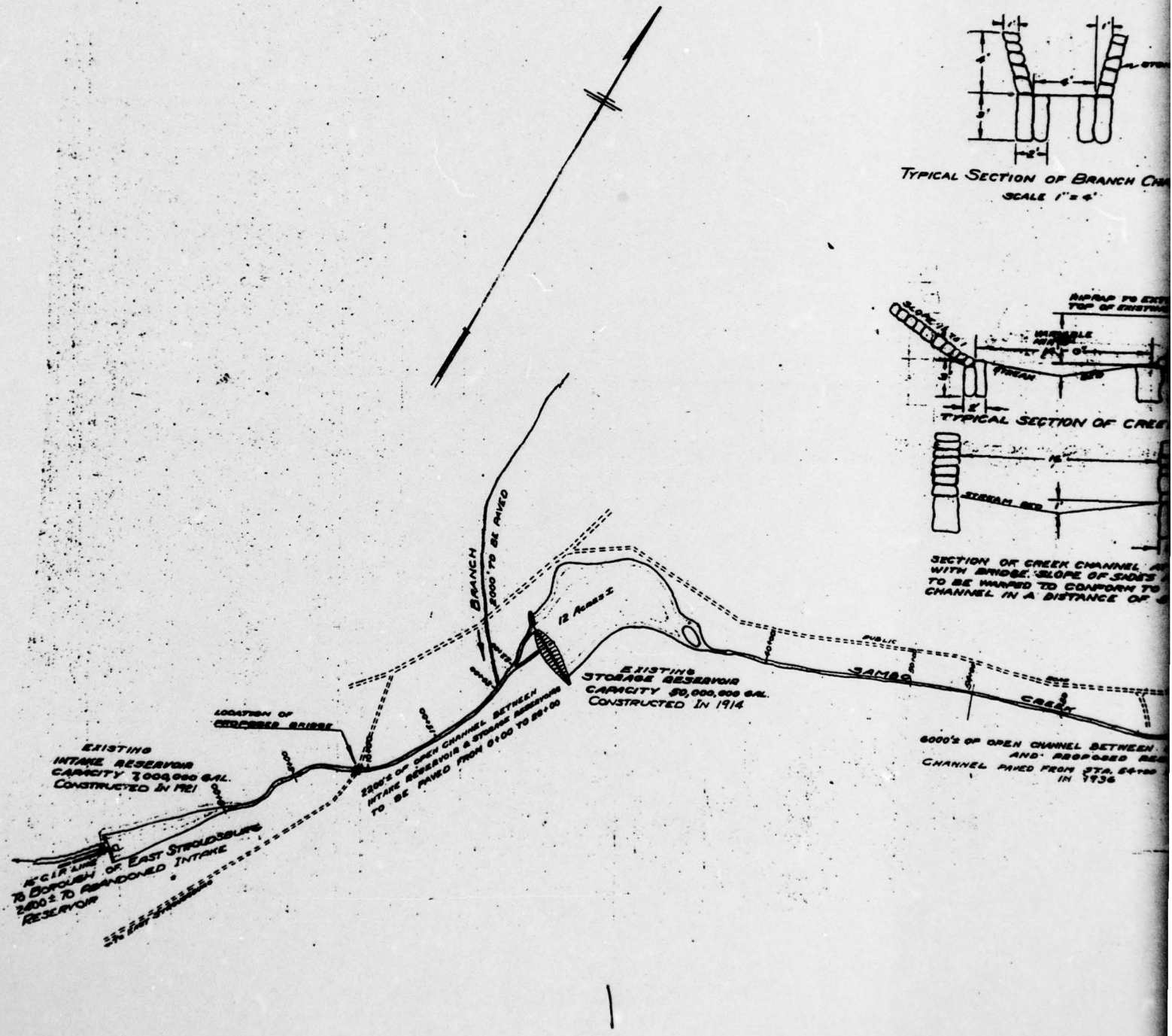
2

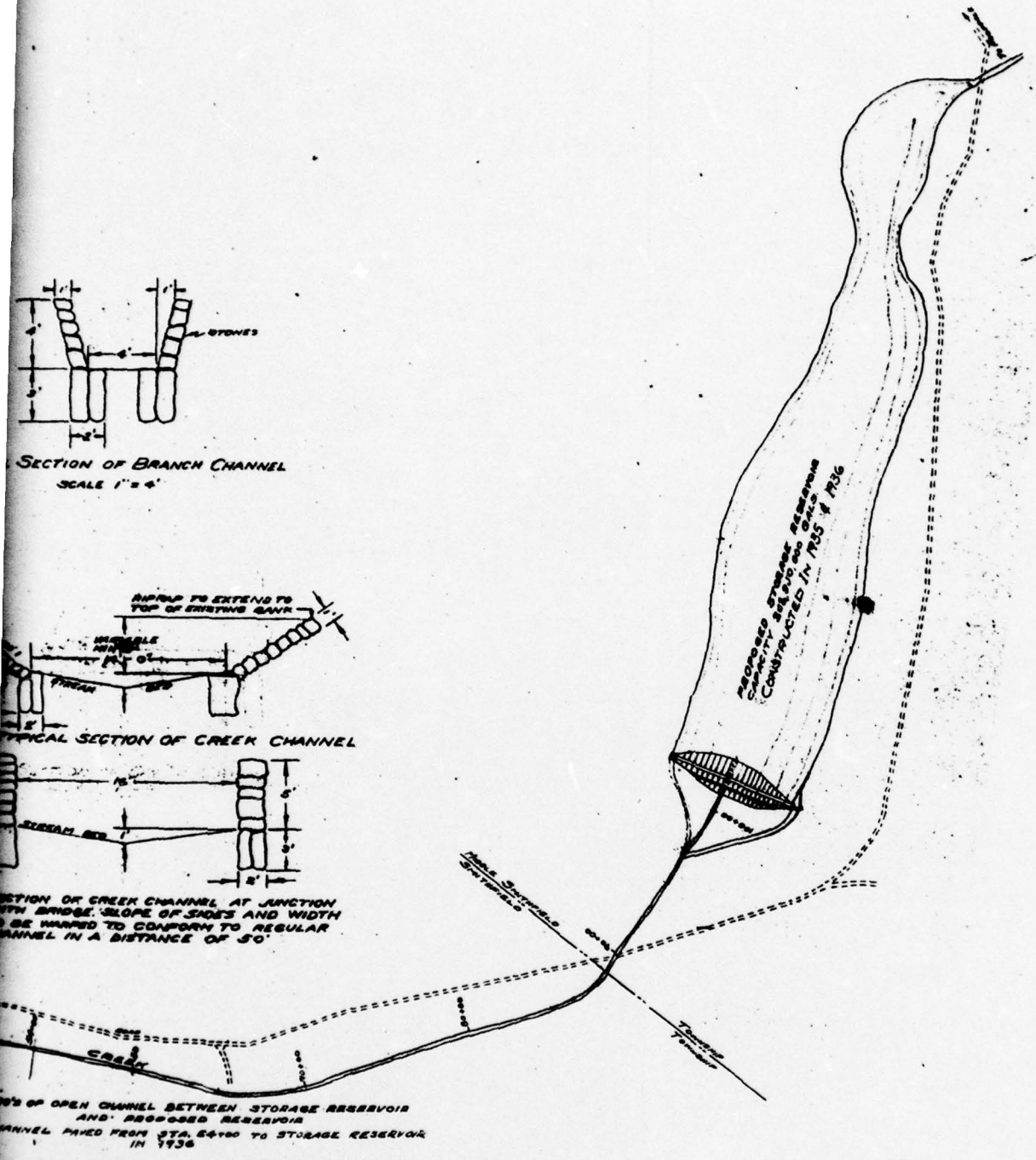
DETAILS OF REHABILITATED GATE HOUSE
EAST STROUDSBURG DAM

NAT. I.D.NO.PA.00637 **MONROE COUNTY**

DATA OBTAINED FROM EDWARD C. HESS, CONSULTING ENGINEER STROUDSBURG, PA. DWG. NO. 1-17-44, DATED 3/11/75

PLATE 6


TYPICAL SECTION OF BRANCH CH
SCALE 1" = 4'
RIPRAP TO EXT
TOP OF EXISTING
SLOPE 1½ TO 1
TYPICAL SECTION OF CREE
STREAM BED
SECTION OF CREEK CHANNEL
WITH BRIDGE. SLOPE OF SIDES
TO BE WARPED TO CONFORM TO
CHANNEL IN A DISTANCE OF
BRANCH
2000' TO BE PAVED
12 ACRES
EXISTING
STORAGE RESERVOIR
CAPACITY 80,000,000 GAL.
CONSTRUCTED IN 1914
PUBLIC
ROAD
SAMBO
CREEK
LOCATION OF
CROSSING BRIDGE
EXISTING
INTAKE RESERVOIR
CAPACITY 3,000,000 GAL.
CONSTRUCTED IN 1911
2200'± OF OPEN CHANNEL BETWEEN
INTAKE RESERVOIR & STORAGE RESERVOIR
TO BE PAVED FROM 0+00 TO 22+00
6000'± OF OPEN CHANNEL BETWEEN
AND PROPOSED
CHANNEL PAVED FROM STA. 64+00
IN 1936
E.C.I.P. LINE
TO BOROUGH OF EAST STROUDSBURG
2600'± TO ABANDONED INTAKE
RESERVOIR



SECTION OF CREEK CHANNEL AT JUNCTION ...TH BRIDGE. SLOPE OF SIDES AND WIDTH ...BE WARPED TO CONFORM TO REGULAR ...ANNEL IN A DISTANCE OF 50'

...'S OF OPEN CHANNEL BETWEEN STORAGE RESERVOIR AND PROPOSED RESERVOIR

...ANNEL PAVED FROM STA. 64+00 TO STORAGE RESERVOIR IN 1936

2

DAMS ACROSS SAMBO CREEK
EAST STROUDSBURG DAM

NAT. I.D.NO. PA.00637 — MONROE COUNTY

DATA OBTAINED FROM EDWARD C. HESS BORO ENGINEER, MIDDLE SMITHFIELD TWP., MONROE COUNTY, DATED AUGUST 23,1933 REVISED 1936

PLATE 7

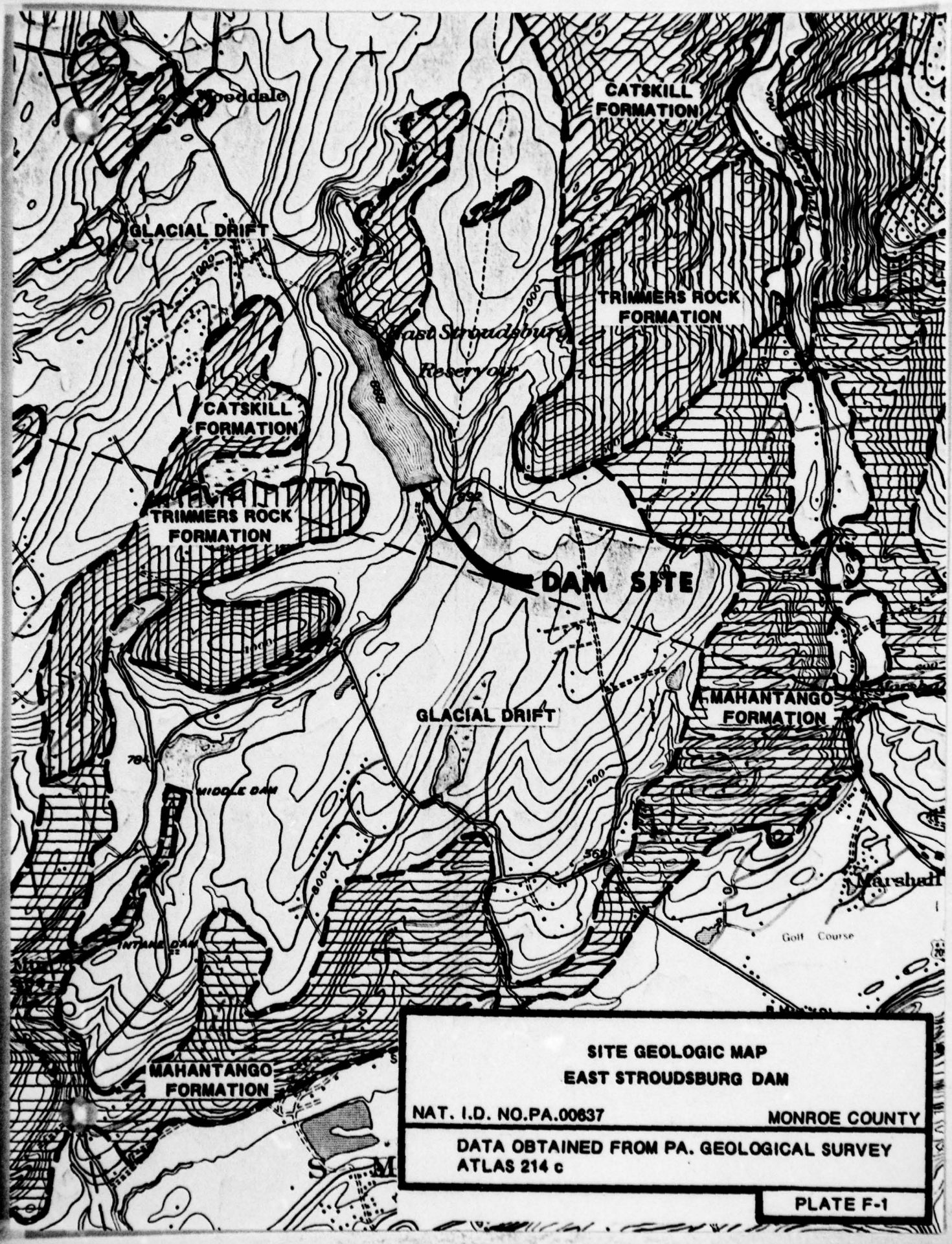
APPENDIX

F

SITE GEOLOGY
WHITE HERON DAM

White Heron Dam is located in the Glaciated Low Plateaus Section of the Appalachian Plateaus Physiographic Province. As shown on Plate F-1, the dam site and surrounding region, as is much of northeastern Pennsylvania, is underlain by Devonian age siltstone and shale formations. These formations are in part covered by a mantle of Wisconsin age glacial drift. The particular siltstone and shale units which underlie this dam site are referred to as the Mahantango Formation, which has a regional northeast strike with a slight to moderate dip to the northwest. Exposures of limestone occur to the south, but not in the vicinity of the dam site.

The soils upon which the dam is founded consist of the variable soil types encountered in glacial drift deposits. As reported in the State files, materials encountered during foundation excavation included clay, sand and gravel. In the right abutment area, bedrock was located from 6 to 10 feet below ground surface. The combination of relatively shallow bedrock and a glacial drift cover is a likely explanation for the spring encountered in the right abutment area during construction, which continues to contribute to the marshy area downstream adjacent to the dam toe, as observed during the course of the field inspection. The other areas of seepage observed, if not related internally to the dam itself, would not be unexpected considering the general nature of glacial soils.



SITE GEOLOGIC MAP
EAST STROUDSBURG DAM

NAT. I.D. NO.PA.00637 MONROE COUNTY

DATA OBTAINED FROM PA. GEOLOGICAL SURVEY
ATLAS 214 c

PLATE F-1