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NATIONAL DAM INSPECTION PROGRAM, HALLOWOOD LAKE DAM, DELAWARE R--ETC(U)
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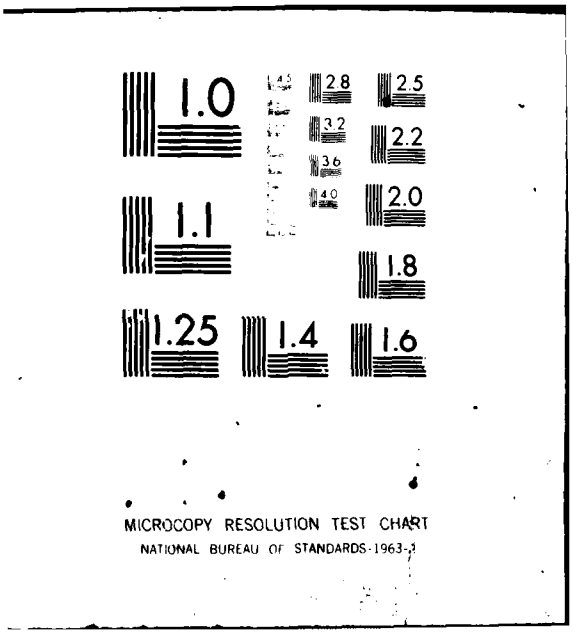
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(6) National Dam Inspection Program. Hallowood Lake Dam.

DELAWARE RIVER BASIN,

LONG RUN, MONROE COUNTY,

PENNSYLVANIA

~~HALLOWOOD LAKE DAM~~

NDI ID ~~No.~~ Number PA-00730

DER ID ~~No.~~ Number 45-194

HALLOWOOD HOMES ASSOCIATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

(11) DACW 31-80-C-0017

(12) Frederick Fitchko

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
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For

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

FEBRUARY 1980

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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 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.

DELAWARE RIVER BASIN

LONG RUN, MONROE COUNTY

PENNSYLVANIA

HALLOWOOD LAKE DAM

NDI ID No. PA-00730
DER ID No. 45-194

HALLOWOOD HOMES ASSOCIATION INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

FEBRUARY 1980

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Hallowood Lake Dam NDI ID No. PA-00730 DER ID No. 45-194
Size:	Small (31 feet high; 395 acre-ft)
Hazard Classification:	Significant
Owner:	Hallowood Homes Association, Inc. Ms. Evelyn Haldeman R.D. 4, Box 520H53 East Stroudsburg, Pa 18301
State Located:	Pennsylvania
County Located:	Monroe
Stream:	Long Run
Date of Inspection:	12 November 1979

Based on visual inspection, available records, calculations, past operational performance, and according to criteria established for these studies, Hallowood Lake Dam is judged to be in good condition. The spillway will pass about 82 percent of the Probable Maximum Flood (PMF) without overtopping of the dam. Since the spillway will pass the 1/2 PMF, which is the Spillway Design Flood (SDF) for Hallowood Lake Dam, the spillway capacity is rated as adequate. The SDF is based on the criteria and the downstream conditions.

No stability problems were evident for the embankment or the appurtenant structures at the time of the visual inspection.

The ability of the outlet works to function is unknown because it has not been recently operated.

Maintenance of the dam and appurtenant structures is considered inadequate.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, without delay:

(1) Ensure the operational adequacy of the outlet works, and operate the gate at regular intervals.

(2) Monitor the wet area located downstream from the dam. Records of its character, area, and discharge should be maintained. If any changes, such as turbidity or a significant increase in flow occur, have the condition assessed by a professional engineer experienced in the design and construction of dams.

(3) Remove trees, brush, and high weeds from the embankment and appurtenant structures.

(4) Fill the burrowing animal hole on the downstream slope of the embankment.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Hallowood Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Hallowood Lake Dam.

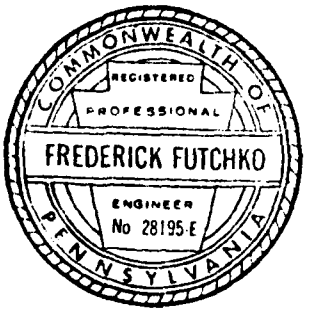
(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a program of regular maintenance so that all features of the dam are properly maintained.

HALLOWOOD LAKE DAM

Submitted by:



GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 21 March 1980

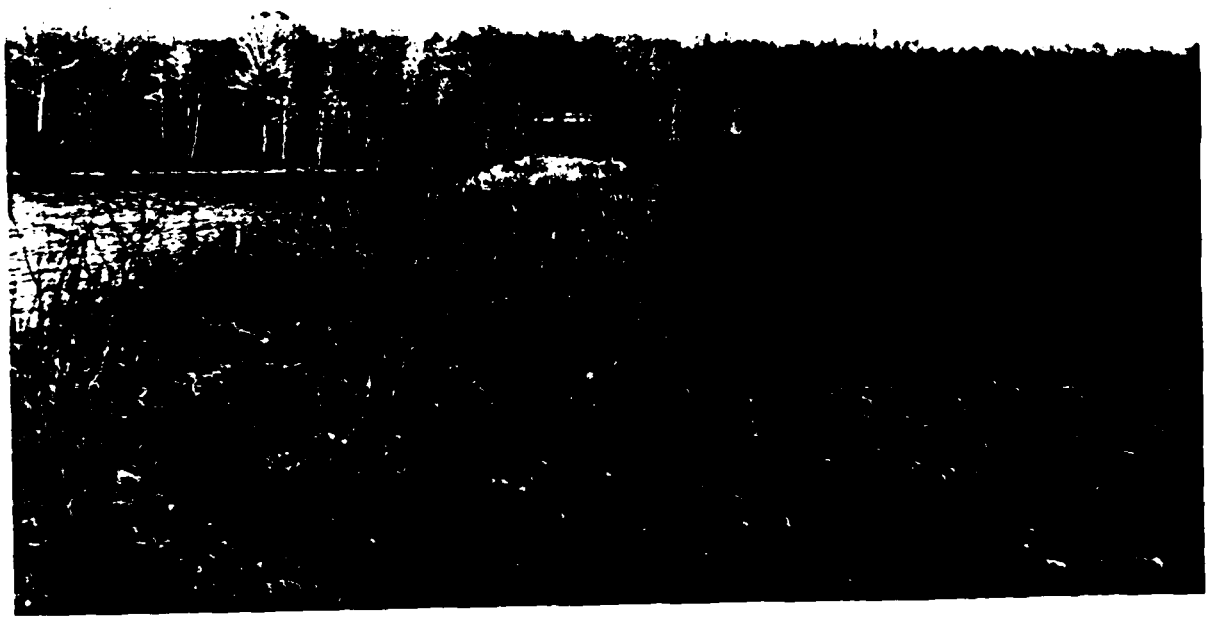
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 10 APR 1980

HALLOWOOD LAKE DAM



Overview

DELAWARE RIVER BASIN

LONG RUN, MONROE COUNTY

PENNSYLVANIA

HALLOWOOD LAKE DAM

NDI ID No. PA-00730
DER ID No. 45-194

HALLOWOOD HOMES ASSOCIATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

FEBRUARY 1980

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. Hallowood Lake Dam is a homogeneous, earthfill embankment. It is 31 feet high at its maximum section and 595 feet long. An earth-filled cutoff trench to bedrock is located along the axis of the dam.

The spillway is located at the right abutment. The spillway consists of an approach channel, a concrete weir, an outlet channel, and a stilling basin. The crest length of the spillway is 55.0 feet.

The outlet works is located at the maximum embankment section. It consists of a submerged intake structure at the upstream toe of the dam, a 24-inch diameter, concrete-encased, steel conduit through the embankment, and an outlet structure at the downstream toe of the dam. A sluice gate is located on the intake structure. The gate operating mechanism is located atop the dam.

The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is included in Appendix F.

b. Location. Hallowood Lake Dam is located on Long Run in Price Township, Monroe County, Pennsylvania, approximately 6 miles north of East Stroudsburg. Hallowood Lake Dam is shown on USGS Quadrangle, East Stroudsburg, Pennsylvania, at latitude N 41° 05' 30" and longitude W 75° 11' 40". A location map is shown on Plate E-1.

c. Size Classification. Small (31 feet high, 395 acre-feet).

d. Hazard Classification. Significant hazard. Downstream conditions indicate that a significant hazard classification is warranted for Hallowood Lake Dam (Paragraphs 3.1e and 5.1c (4)).

e. Ownership. Hallowood Homes Association, Inc., Ms. Evelyn Haldeman, R.D. 4 Box 520H53, East Stroudsburg, Pennsylvania 18301.

f. Purpose of Dam. Recreation.

g. Design and Construction History. The dam was designed by Guyton Kempter Associates, Inc., Consulting Engineers, of Delaware Water Gap, Pa. in 1969. Fisher, Fang and Associates of Bethlehem, Pa. were consultants for geotechnical services. The dam was constructed in 1970 by Papillon Construction Company of Stroudsburg. Supervision of construction was performed by the design engineer and his geotechnical consultant.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. The outlet works is not normally used. Spillway discharge flows downstream to the confluence with Broadhead Creek.

1.3 Pertinent Data.

a.	Drainage Area. (square miles)	1.1
b.	Discharge at Damsite. (cfs.)	
	Maximum known flood at damsite	Unknown.
	Outlet works at maximum pool elevation	83
	Spillway capacity at maximum pool elevation	1,710
c.	Elevation. (feet above msl.)	
	Top of dam	1042.0
	Maximum pool	1042.0
	Normal pool (spillway crest)	1038.0
	Upstream invert outlet works	1013.0
	Downstream invert outlet works	1011.2
	Streambed at toe of dam	1011.0
d.	Reservoir Length. (miles)	
	Normal pool	0.46
	Maximum pool	0.52
e.	Storage. (acre-feet)	
	Normal pool	288
	Maximum pool	395
f.	Reservoir Surface. (acres)	
	Normal pool	24
	Maximum pool	30
g.	Dam.	
	Type	Homogeneous earthfill.
	Length (feet)	595

g.	Dam. (cont'd)	
	Height (feet)	31
	Topwidth (feet)	16.5
	Side Slopes	
	Upstream	1V on 2.5H
	Downstream	1V on 2H
	Zoning	None.
	Cutoff	Earth-filled trench to bedrock.
	Grout Curtain	None.
h.	Diversion and Regulating Tunnel.	None.
i.	Spillway.	
	Type	Concrete weir.
	Length of Weir (feet)	55.0
	Crest Elevation	1038.0
	Upstream Channel	Reservoir, vertical concrete walls.
	Downstream Channel	Concrete chute and exposed bedrock.
j.	Regulating Outlets.	
	Type	One 24-inch dia. steel pipe encased in concrete.

j. Regulating Outlets. (cont'd)

Length (feet)	135
Closure	Sluice gate at intake structure at upstream end.
Access	Top of dam.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Design data available for review consisted of the approved design drawings, a geotechnical report, the construction specifications, and the permit application report.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Photographs in Appendix C and on Plates E-2 through E-6 in Appendix E. The embankment is shown on Photographs A through D. The spillway is shown on Photographs E through G. The outlet works is shown on Photographs B and H.

c. Design Considerations. Design considerations for the dam and spillway are covered in Sections 5 and 6.

2.2 Construction.

a. Data Available. Construction data available for review included the following: a dam completion report prepared by the design engineer; a letter report from the design engineer that summarizes the embankment construction procedures that were used; a letter report from the geotechnical consultant concerning embankment construction; as-built slope data; and fourteen construction inspection reports that were prepared by the Commonwealth.

b. Construction Considerations. The construction data indicate that the construction work was performed in a satisfactory manner. Both the design engineer and his geotechnical consultant certified compliance with the approved plans and specifications. Inspection reports prepared by the Commonwealth noted some minor deficiencies, such as some cracking of the spillway concrete.

2.3 Operation. There are no formal records of operation. Available data indicate that no problems have developed since the project was completed.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER). The Owner was available for information during the visual inspection. The Owner also researched his files for information at the request of the inspection team.

b. Adequacy. The available engineering data are detailed, and the assessment is based on a combination of the available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

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

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is good. Deficiencies were observed as noted below. A sketch of the dam with the locations of deficiencies is presented on Exhibit B-1 in Appendix B. Survey information acquired for this Report is summarized in Appendix B. On the day of the inspection, the pool was at the spillway crest.

b. Embankment. The top of the dam has a width of 16.5 feet and is covered with grass (Photograph A). The survey data show that the entire top of the dam is at or above the design elevation. The riprap on the upstream slope is intact, but it is overgrown with high weeds and light brush (Photograph B).

The downstream slope of the dam is in good condition (Photograph C). It is covered with grass and high weeds. Each of the two toe drain outlets had a clear flow on the day of the inspection. The discharge from the right outlet was about 4 gpm (Photograph D), and the discharge from the left outlet was about 1 gpm. One wet area was located about 50 feet downstream from the dam and about 15 feet left of the outlet channel for the conduit. A slight, clear flow from the wet area was present.

c. Appurtenant Structures. The spillway is in fair condition (Photographs E, F and G). Some cracks are present in the spillway walls, but no differential movements have occurred. A few small trees are growing behind the right wall of the spillway. A substantial amount of vegetation is growing in the joints between the concrete slabs (Photographs E and F). The grouted stone protection in the outlet channel is slightly deteriorated, and it has some vegetation growing in it (Photograph G). The stilling basin, located about 120 feet downstream from the dam, is in satisfactory condition.

The outlet works is located at the maximum section of the dam. The intake structure was submerged and could not be inspected. The outlet conduit, a 24-inch diameter steel pipe encased in concrete, had a slight flow of water through it. No deficiencies exist for the small concrete outlet structure (Photograph H). The gate operating mechanism, located atop the dam, was slightly rusted. The Owner stated that the gate had not been operated in three or four years and declined to operate it without having a repairman available at the site.

d. Reservoir Area. The watershed is nearly all wooded and has only a minor amount of development.

e. Downstream Channel. An unpaved roadway crosses Long Run about 0.1 mile downstream from the dam. It was judged that the roadway embankment, which is about 6 feet high, would be overtopped and washed away if the dam were to fail. Two dwellings, each about 20 feet above the streambed, are also located in that area. It was judged that damage would occur near the dwellings if the dam failed, but loss of life would be unlikely. State Route 447, a major transportation artery in the area, crosses Long Run near its confluence with Broadhead Creek, about 1.2 miles downstream from the dam. Failure of the dam would cause significant damage to Route 447. A map of the downstream area is presented on Exhibit D-1 in Appendix D.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the spillway crest level with excess inflow discharging over the spillway and into the downstream channel. The outlet works is not normally used.

4.2 Maintenance of Dam. Maintenance of the dam is performed on an as-needed basis, as determined by the Hallowood Homes Association. There are no established procedures for regular maintenance. The Owner stated that some trees were removed two years ago. The Owner stated that informal inspections of the dam are made about four times per year by Association members.

4.3 Maintenance of Operating Facilities. There are no established procedures for regular maintenance of the outlet works. The Owner stated that the gate was last operated three or four years ago.

4.4 Warning Systems in Effect. The Owner has no emergency operation and warning system.

4.5 Evaluation of Operational Adequacy. The embankment, spillway, and outlet works are in need of maintenance work. Inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The available data indicate that the design discharge for the spillway is 1,707 cfs. The data obtained for this Report indicate that existing conditions match design assumptions. Therefore, the design discharge was used for this Report. The drainage area used for design purposes was 1.2 square miles. The drainage area computed and used for this Report is determined from recent USGS mapping and is 1.05 square miles.

b. Experience Data. No records of maximum pool levels were available.

c. Visual Observations.

(1) General. The visual inspection of Hallowood Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. There are no low areas on the top of the dam. The spillway design head of 4 feet is available under existing conditions.

(3) Appurtenant Structures. The spillway outlet channel has vegetation growing in the joints between the concrete slabs and also in the grouted stone protection. While it does not affect the hydraulic capacity, such growth will eventually cause significant damage to the features.

The ability of the outlet works to function is uncertain.

(4) Downstream Conditions. Failure of Hallowood Lake Dam would cause significant damage to two roadways and would cause damage near two dwellings. The downstream conditions indicate that a significant hazard classification is warranted for Hallowood Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small) and hazard potential (Significant) of Hallowood Lake Dam is between the 100-year Flood and one-half of the Probable Maximum Flood (PMF). Because of the downstream conditions and the height of the dam, the 1/2 PMF is selected as the SDF for Hallowood Lake Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of the dam is based on existing conditions, and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Hallowood Lake Dam can pass about 82 percent of the PMF before overtopping of the dam occurs.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Since Hallowood Lake Dam can pass the 1/2 PMF, which is the recommended SDF, the spillway capacity is rated as adequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Hallowood Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. The growth of brush on the embankment is undesirable. Root systems can displace slope protection, eventually cause loosening of embankment material, and create paths along which seepage and piping (internal erosion) might occur. Growth of high weeds is undesirable because it hinders inspection of the dam.

The clear flow from the toe drain outlets is normal and indicates proper functioning of the drainage system. The wet area located downstream from the dam might or might not be the result of seepage under the dam. Examination of the area indicated that it might be seepage from the hillside. No evidence of any slope stability problems was apparent for the embankment.

(3) Appurtenant Structures. The cracks in the spillway walls are reported to have appeared shortly after the walls were constructed. Since there has been no differential movement at the cracks and since the cracks are small, they are not considered to be a hazard. The vegetation growing at the joints between the concrete slabs and in the grouted stone protection is undesirable. Continued growth will eventually cause significant deterioration of the features.

b. Design and Construction Data. Stability analyses for the embankment were performed by Fisher, Fang and Associates, the geotechnical consultants. The computed minimum factors of safety were 2.0 for conditions at the end of construction and 1.6 for a rapid drawdown condition. The steady seepage condition was judged not to

be a critical condition for this dam because of the toe drain, and no analysis was performed. Although no factor of safety was computed for the steady seepage condition, it is assumed to be adequate based on the computed factors of safety for the other conditions, the angle of the downstream slope, and the absence of evidence of any stability problems.

No stability analyses were available for the spillway weir. Based on the depth of embedment into rock, the structure is judged to be stable for the expected loading conditions.

c. Operating Records. There are no formal records of operation. According to available data, no stability problems have occurred over the operational history of the dam.

d. Post-construction Changes. There have been no post-construction changes to the dam.

e. Seismic Stability. Hallowood Lake Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. Since it is assumed that the factors of safety under static loading conditions are adequate for Hallowood Lake Dam, it is assumed that the seismic stability is adequate.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Hallowood Lake Dam is judged to be in good condition. The spillway will pass about 82 percent of the PMF before overtopping of the dam occurs. Since the spillway will pass the 1/2 PMF, which is the SDF for Hallowood Lake Dam, the spillway capacity is rated as adequate. The SDF is based on the criteria and the downstream conditions.

(2) No stability problems were evident for the embankment or appurtenant structures at the time of the visual inspection.

(3) The ability of the outlet works to function is unknown because it has not been recently operated.

(4) Maintenance of the dam and appurtenant structures is inadequate.

(5) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiency
Embankment:	Brush and high weeds: wet area downstream from toe.
Spillway:	Small cracks in spillway walls; vegetation in slab joints and in grouted stone protection; small trees behind right wall.
Outlet Works:	Not maintained.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented without delay.

d. Necessity for Further Investigations. Accomplishment of the remedial measures outlined in Paragraph 7.2 will not require further investigations by the Owner.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, without delay:

(1) Ensure the operational adequacy of the outlet works, and operate the gate at regular intervals.

(2) Monitor the wet area located downstream from the dam. Records of its character, area, and discharge should be maintained. If any changes such as turbidity or a significant increase in flow occur, have the condition assessed by a professional engineer experienced in the design and construction of dams.

(3) Remove trees, brush, and high weeds from the embankment and appurtenant structures.

(4) Fill the burrowing animal hole on the downstream slope of the embankment.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Hallowood Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Hallowood Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a program of regular maintenance so that all features of the dam are properly maintained.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Hallowood Lake Dam

NDI ID NO.: PA-00730 DER ID NO.: 45-194

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	Design drawings and as-built slope data.
REGIONAL VICINITY MAP	See Plate E-1 in Appendix E.
CONSTRUCTION HISTORY	Constructed 1970. No modifications.
TYPICAL SECTIONS OF DAM	See Plates E-3 and E-4 in Appendix E.
OUTLETS: Plan Details Constraints Discharge Ratings	No discharge ratings. Details shown on Plates E-5 and E-6 in Appendix E.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None.
DESIGN REPORTS	"Soil and Foundation Report" by Fisher, Fang and Associates, Bethlehem, Pa. Permit application report by Commonwealth.
GEOLOGY REPORTS	Contained in design reports.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	Hydrology and hydraulic computations on Plate E-2 in Appendix E. Results of stability analyses contained in "Soil and Foundation Report".
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	Results of investigations and testing are in "Soil and Foundation Report" by Fisher, Fang and Associates.
POSTCONSTRUCTION SURVEYS OF DAM	As-built slopes surveyed upon completion.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Borrow area located 300 feet from left abutment.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	None.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None.
SPILLWAY: Plan Sections Details	See Plates E-3 and E-4 in Appendix E.
OPERATING EQUIPMENT: Plans Details	See Plate E-5 in Appendix E.
PREVIOUS INSPECTIONS Dates Deficiencies	None.
CONSTRUCTION INSPECTIONS	Inspected 14 times by Commonwealth during construction.

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Hallowood Lake Dam County: Monroe State: Pennsylvania

NDI ID No.: PA-00730 DER ID No.: 45-194

Type of Dam: Homogeneous earthfill Hazard Category: Significant

Date(s) Inspection: 12 November 1979 Weather: Clear Temperature: 50° F

Pool Elevation at Time of Inspection: 1038.0 msl/Tailwater at Time of Inspection: 1011.1 msl

Inspection Personnel:

A. H. Whitman (GFCC) E. Haldeman (Owner)

D. R. Ebersole (GFCC) R. Amey (Owner)

D. B. Wilson (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	None.	One burrowing animal hole on downstream slope.
CREST ALIGNMENT: Vertical Horizontal	See survey data at end of Appendix B.	No low areas.
RIPRAP FAILURES	Riprap generally satisfactory but overgrown with weeds and light brush.	

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No deficiencies.	
ANY NOTICEABLE SEEPAGE	One wet area about 50' downstream from toe about 15' left of outlet channel. Could be surface drainage problem or seepage.	Recommend checking condition during summer months.
STAFF GAGE AND RECORDER	None.	
DRAINS	Approx. 4 gpm clear flow from right toe drain outlet and 1 gpm clear flow from left toe drain outlet.	
TREES / BRUSH	Light brush on upstream slope. High weeds and vines on downstream slope.	

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	No deficiencies.	
APPROACH CHANNEL	Reservoir area - no obstructions.	Rock outcrops at upstream end of right approach wall: red and gray siltstone.
DISCHARGE CHANNEL	Concrete walls: occasional fine cracks (no displacements); none to minimal flow from weepholes. Concrete slabs: generally good but vegetation in slab joints. Grouted stone protection: minor deterioration and some vegetal growth.	Some small trees and shrubs growing behind right wall. Stilling pool located significant distance from dam.
BRIDGES AND PIERS	None.	

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
[redacted] OUTLET CONDUIT	24-inch diameter steel outlet conduit. Slight flow through conduit.	
INTAKE STRUCTURE	Submerged - could not inspect.	Operating mechanism at top of dam slightly rusted.
OUTLET STRUCTURE	No deficiencies.	
OUTLET CHANNEL	No deficiencies.	
EMERGENCY GATE	Located at intake structure at upstream toe of dam.	

INSTRUMENTATION

Sheet 1 of 1

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

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	No indications of stability problems.	
SEDIMENTATION	None reported.	
WATERSHED DESCRIPTION	Long, narrow watershed; approx. 95 percent wooded; very minor development.	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: **Obstructions** **Debris** **Other**	Unpaved roadway crosses valley 0.1 mile downstream.	Roadway has 5-foot dia. culvert. Could easily be blocked by debris.
SLOPES	Vary from mild to steep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Two dwellings about 0.15 mile downstream and about 20 feet above streambed.	No other structures along Long Run. Rt. 447 located 1.1 mile downstream. Confluence with Broadhead Cr. 1.2 miles downstream.

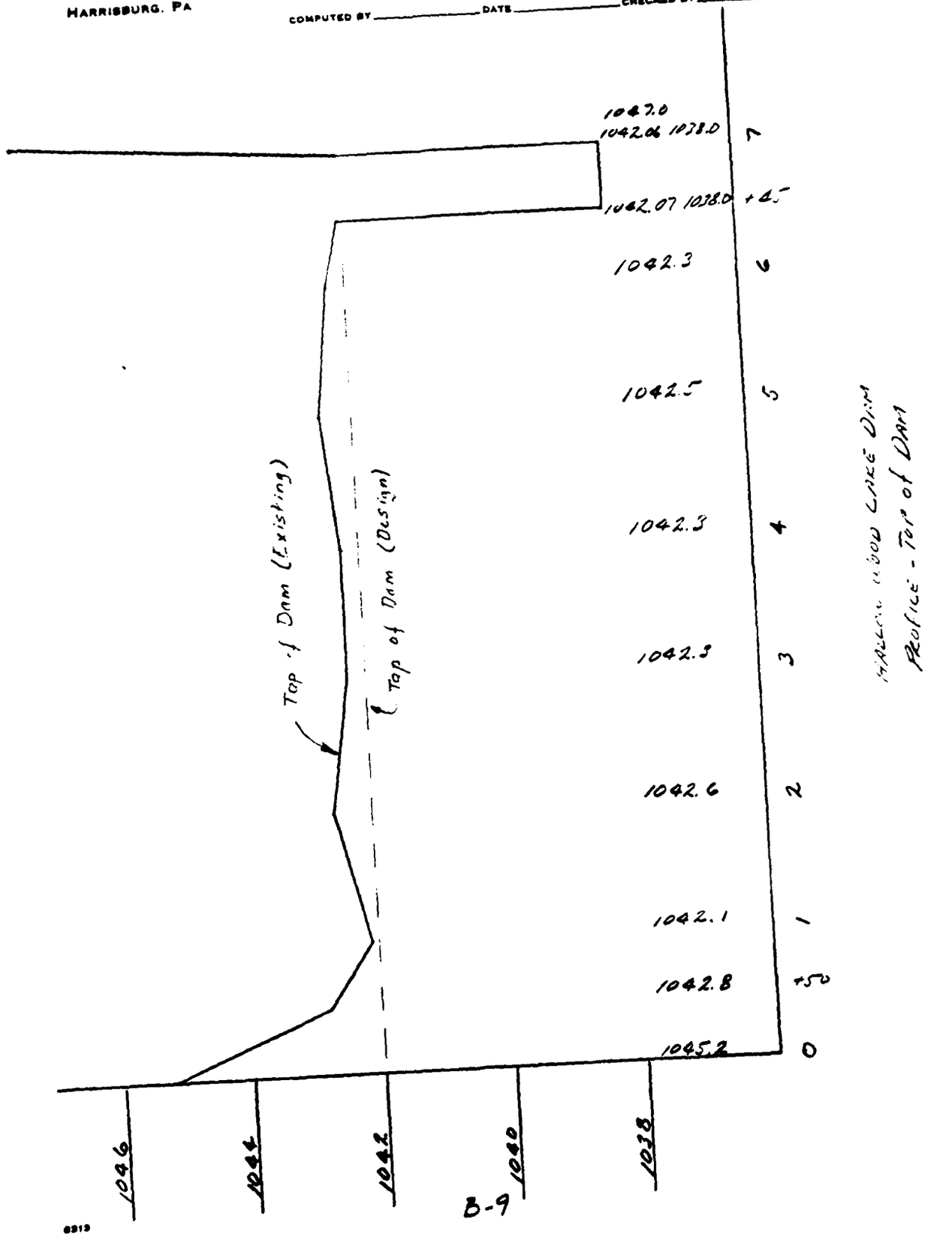
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA

SUBJECT _____ FILE NO. _____

SHEET NO. _____ OF _____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



8319

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HARRISBURG, PA.

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FOR _____ SHEET NO. ____ OF ____ SHEETS
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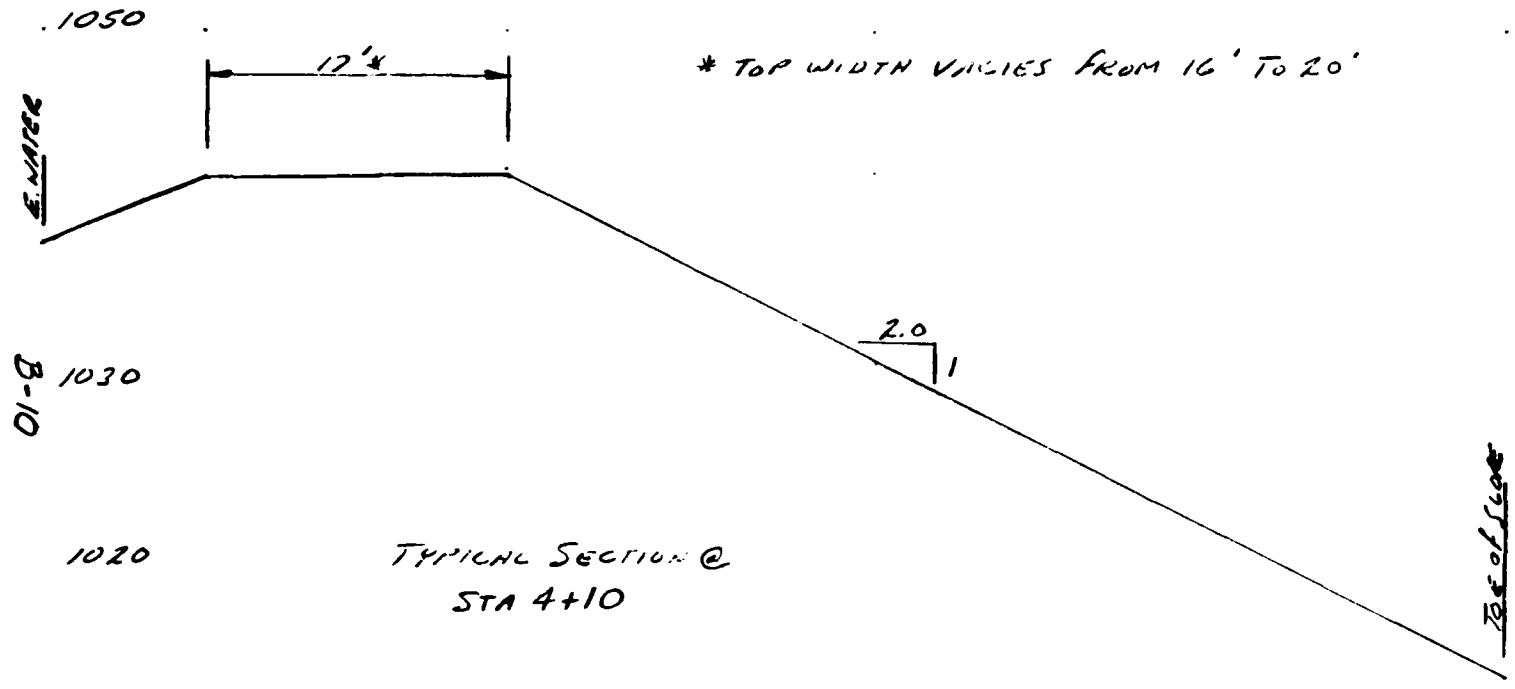
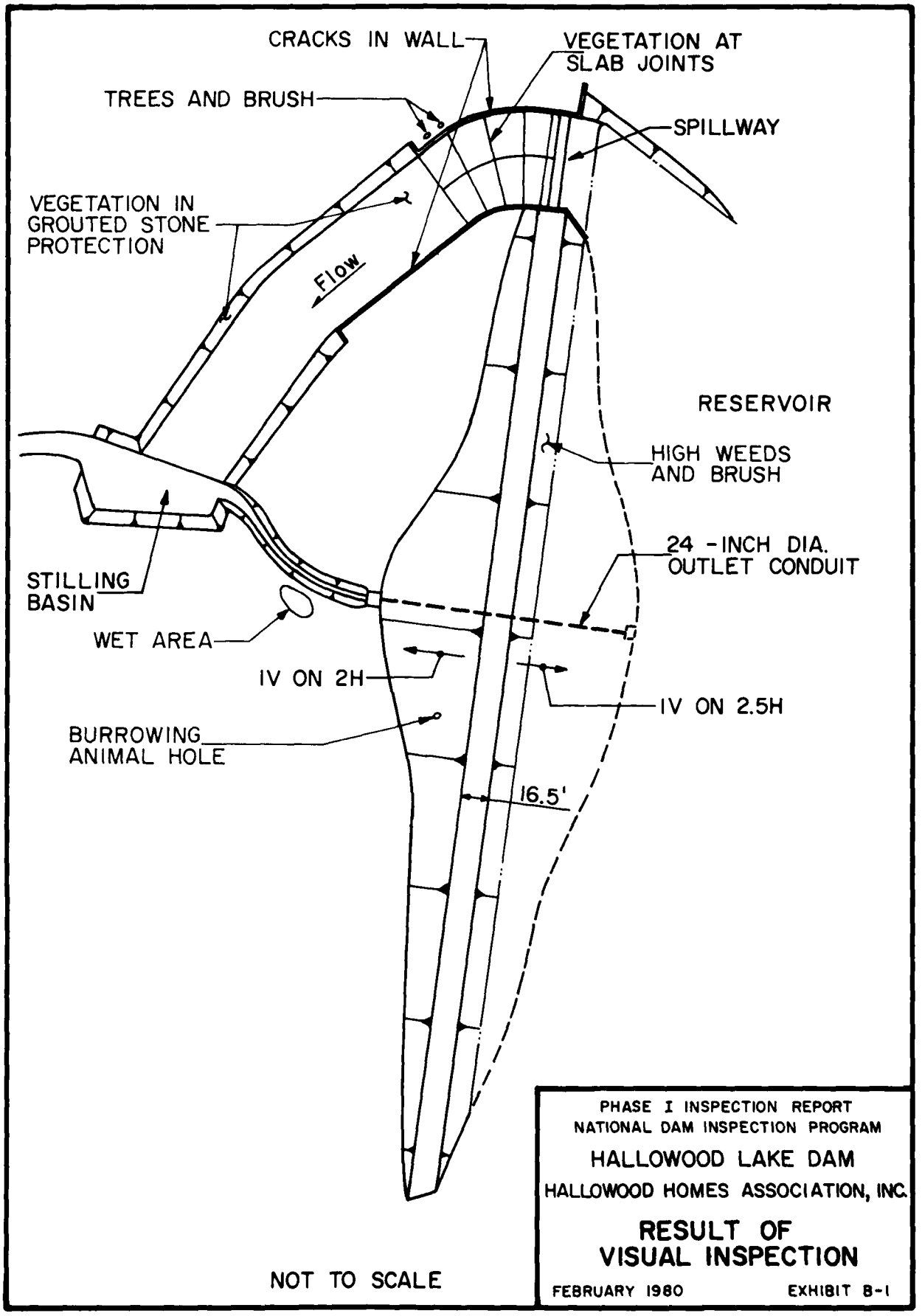


TYPICAL SECTION @
STA 4+10

SCALE: 1" = 10'

HILLCREST LAKE DAM

B-10



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

HALLOWOOD LAKE DAM

HALLOWOOD HOMES ASSOCIATION, INC.

RESULT OF VISUAL INSPECTION

FEBRUARY 1980 EXHIBIT B-1

APPENDIX C

PHOTOGRAPHS

HALLOWOOD LAKE DAM

A. Top of Dam.

B. Upstream Slope and Gate Operating Mechanism.

C. Downstream Slope.

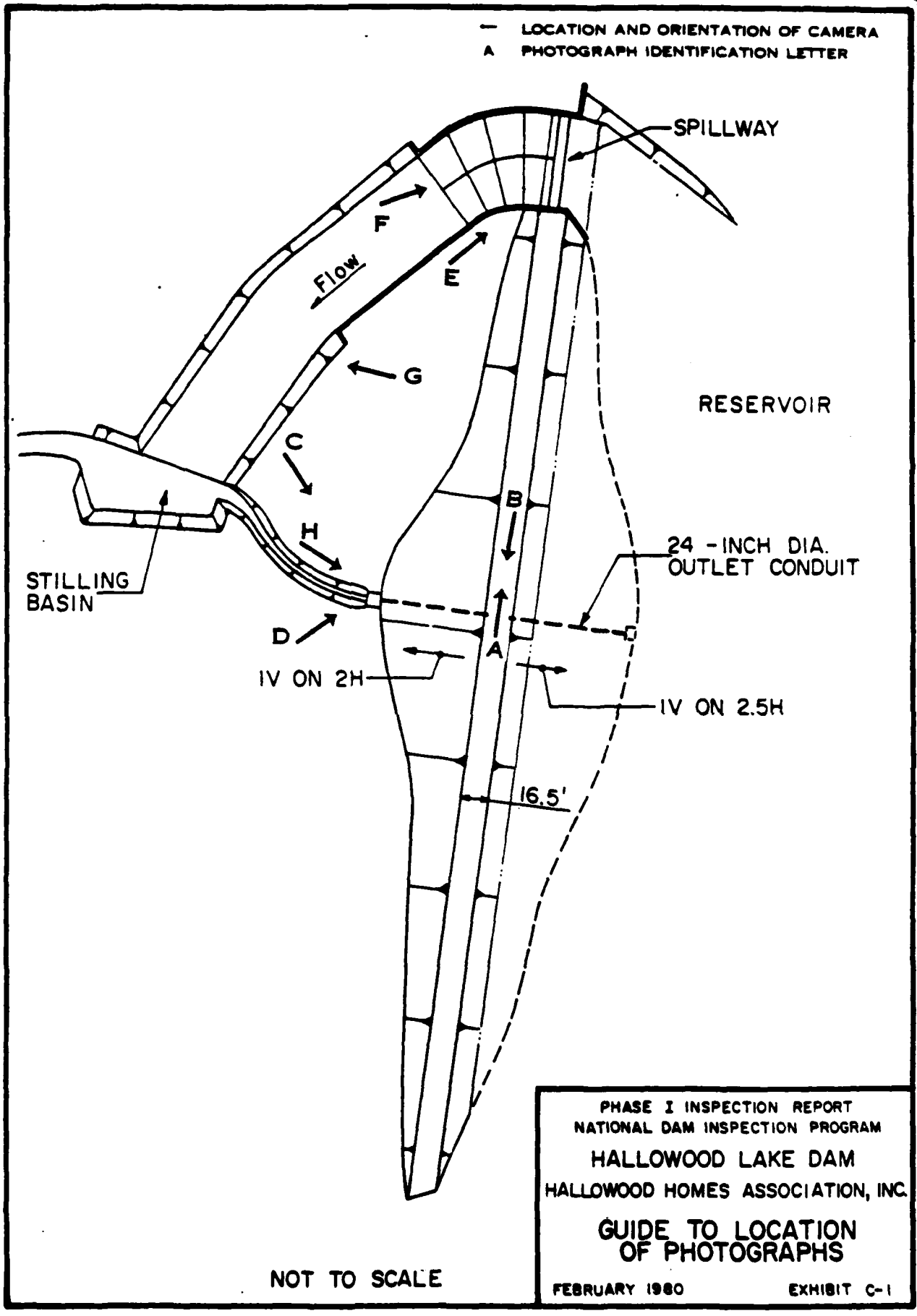
D. Toe Drain Outlet.

E. Spillway.

F. Spillway.

G. Spillway Outlet Channel.

H. Outlet Conduit.


— LOCATION AND ORIENTATION OF CAMERA
A PHOTOGRAPH IDENTIFICATION LETTER
SPILLWAY
F
Flow
E
G
RESERVOIR
C
B
H
24 - INCH DIA.
OUTLET CONDUIT
STILLING
BASIN
D
A
1V ON 2H
1V ON 2.5H
16.5'
NOT TO SCALE
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
HALLOWOOD LAKE DAM
HALLOWOOD HOMES ASSOCIATION, INC.
GUIDE TO LOCATION
OF PHOTOGRAPHS
FEBRUARY 1980
EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

Delaware River Basin
Name of Stream: Long Run
Name of Dam: Hallewood Lake Dam
NDI ID No.: PA - 00730
DER ID No.: 45 - 194
Latitude: N 41° 05' 30" Longitude: W 75° 11' 40"
Top of Dam Elevation: 1042.0
Streambed Elevation: 1011.0 Height of Dam: 31 ft
Reservoir Storage at Top of Dam Elevation: 395 acre-ft
Size Category: Small
Hazard Category: Significant (see Section 5)
Spillway Design Flood: Varies from 100-year to ½ PMF
Select ½ PMF based on downstream conditions

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
	NONE			

DOWNSTREAM DAMS

	NONE			

Delaware River Basin

Name of Stream: Long Run

Name of Dam: Hollowood Lake Dam

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A-1	1.05	0.45	1.23	3.0	1.3	—	1.85	1	A
Total	1.05								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)
RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.2 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.2

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	—
96 hours	—

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HARRISBURG, PA.

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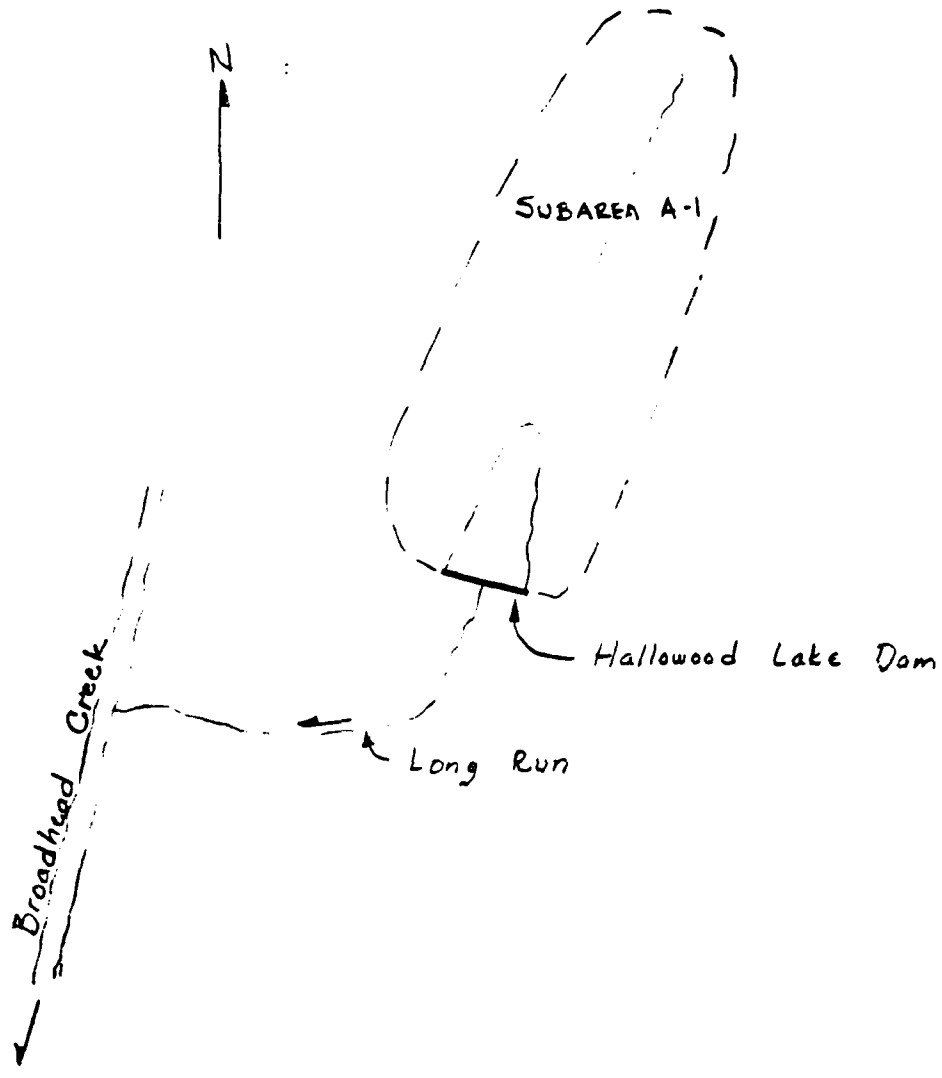
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



Hallowood Lake Dam
Sketch of System

NOT TO SCALE

8313

Data for Dam at Outlet of Subarea A-1

Name of Dam: Hollowood Lake Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	1042.0	1042.0
Spillway Crest Elevation	1038.0	1038.0
Spillway Head Available (ft)	4.0	4.0
Type Spillway	Concrete ogee	
"C" Value - Spillway	3.88	3.88
Crest Length - Spillway (ft)	55.0	55.0
Spillway Peak Discharge (cfs)	1,707	1,707
Auxiliary Spillway Crest Elev.		
Auxiliary Spill. Head Avail. (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spill. (ft)		
Crest Length - Auxil. Spill. (ft)	N/A	N/A
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)		

Spillway Rating Curve: $Q = (3.88)(55.0)(H)^{3/2}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	1011.2		
Invert of Inlet	1013.0		
Type	Steel		
Diameter (ft) = D	2		
Length (ft) = L	135		
Area (sq. ft) = A	3.1		
N	0.012		
K Entrance	0.5		
K Exit	1.0		
K Friction=$29.1_N{}^2L/R^{4/3}$	1.4		
Sum of K	2.9		
$(1/K)^{0.5} = C$	0.6		
Maximum Head (ft) = HM	30.8		
$Q = CA\sqrt{2g(HM)}$ (cfs)	83		
Q Combined (cfs)			

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet D-4)

Name of Dam: Hallowood Lake Dam

STORAGE DATA:

Elevation		Area (acres)		Storage million gals	acre-ft		Remarks
1002.0	=ELEVO*	0		0	0		
1038.0	=ELEV1	24	=A1	94	288	=S1	Storage & Elev. from DEL record Data
1042.0		30		129	395		
1060.0	**	63		395	1,211		

* ELEVO = ELEV1 - $(3S_1/A_1)$
** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 4 percent of subarea watershed.

BREACH DATA: Breach analysis not required for significant hazard dams.

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: _____

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) _____ fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = _____ ft., C = ____ Top of Dam El.= ____

HMAX + Top of Dam El. = _____ = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = _____ ft (width of bottom of breach)
Z = _____ (side slopes of breach)
ELBM = _____ (bottom of breach elevation, minimum of zero storage elevation)
WSEL = _____ (normal pool elevation)
T FAIL= _____ mins = _____ hrs (time for breach to develop)

Selected Computer Output

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  17 JAN 80
**********
    1                 A1                                NATIONAL DAM INSPECTION PROGRAM
    2                 A2                                        LONG RUN
    3                 A3                                      HALLOWOOD
    4                 P     300         0        15         0         0         0         0         0        -4         0
    5                 P1      5
    6                 J       1         6         1
    7                 J1      1       .9        .8        .7        .6        .5
    8                 K       0         1                                                1
    9                 K1        RUNOFF FROM WATERSHED
   10                 M       1         1     1.05                1.05                                       1
   11                 P                22.7       111       123       133       142
   12                 T                                                                  1       .05                 .04
   13                 W    1.95       .45
   14                 X    -1.5     -0.05       2.0
   15                 K       1         1                                                1
   16                 K1        ROUTE THROUGH HALLOWOOD DAM
   17                 Y                                   1
   18                 Y1      1                                                    -1038
   19                 SA      0        24        63
   20                 SE   1092      1038      1060
   21                 SS   1038        55      3.88       1.5
   22                 SD   1062       3.1       1.5       595
   23                 K      99
```

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 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50
HYDROGRAPH AT	1	1.05	1	2196.	1976.	1757.	1537.	1317.	1098.
	(	2.72)	(	62.19)(	55.96)(	49.76)(	43.52)(	37.31)(	31.09)(
ROUTED TO	1	1.05	1	2173.	1933.	1670.	1457.	1244.	1032.
	(	2.72)	(	61.56)(	54.74)(	47.28)(	41.26)(	35.24)(	29.23)(

SUMMARY OF DAM SAFETY ANALYSIS

HALLOWOOD LAKE DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1038.00	1038.00	1042.00
STORAGE	288.	288.	395.
OUTFLOW	0.	0.	1707.

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
1.00	1042.28	.28	404.	2173.	2.50	41.75	0.00
.90	1042.16	.16	400.	1933.	1.75	42.00	0.00
.80	1041.96	0.00	393.	1670.	0.00	42.25	0.00
.70	1041.60	0.00	383.	1457.	0.00	42.25	0.00
.60	1041.24	0.00	373.	1244.	0.00	42.25	0.00
.50	1040.86	0.00	362.	1032.	0.00	42.50	0.00

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Hallowood Lake Dam
Summary of Pertinent Results

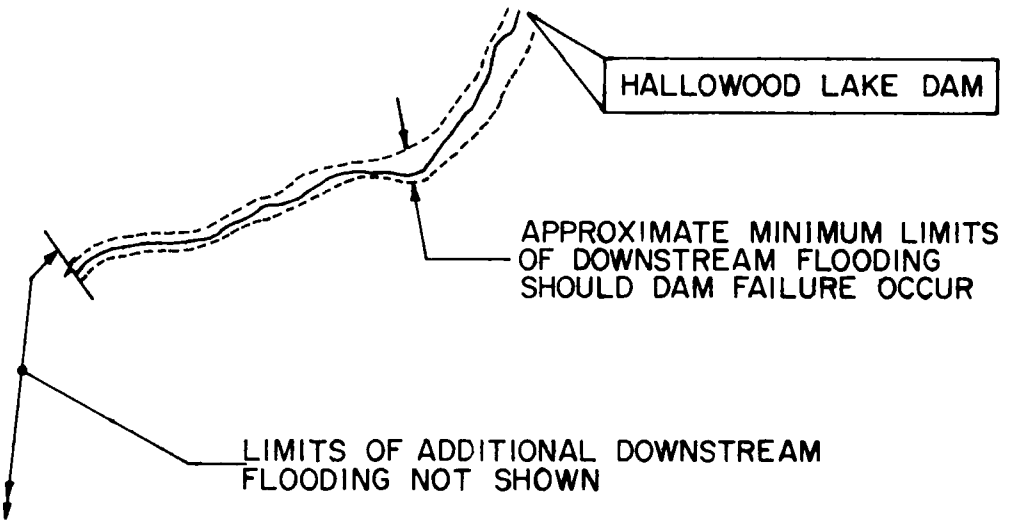
PMF Rainfall = 25.22 inches

Multi-ratio Analysis	PMF	½ PMF
Hallowood Lake Dam:		
Runoff (inches)	22.92	11.46
Inflow (cfs)	2196	1098
Outflow (cfs)	2173	1032
Depth of Overtopping (ft)	0.28	0.00
Duration of Overtopping (hr)	2.50	0.00

NOTE: SDF for Hallowood Lake Dam is ½ PMF.

NOTES:

1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.
2. CIRCLED NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.



2000 0 2000

SCALE: 1 IN. = 2000 FT.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

HALLOWOOD LAKE DAM

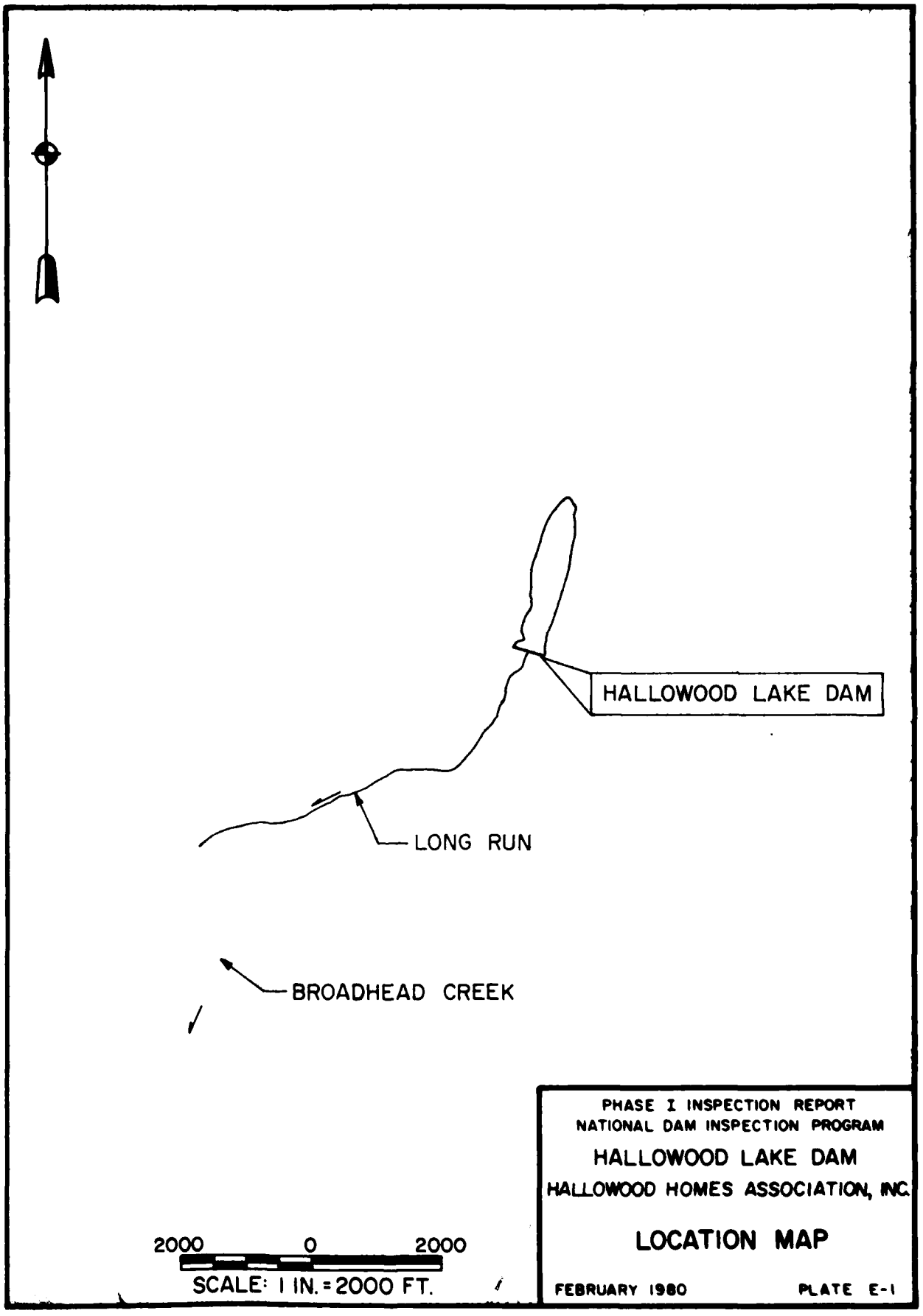
HALLOWOOD HOMES ASSOCIATION, INC.

DOWNSTREAM DEVELOPMENT PLAN

FEBRUARY 1980 EXHIBIT D-1

APPENDIX E

PLATES



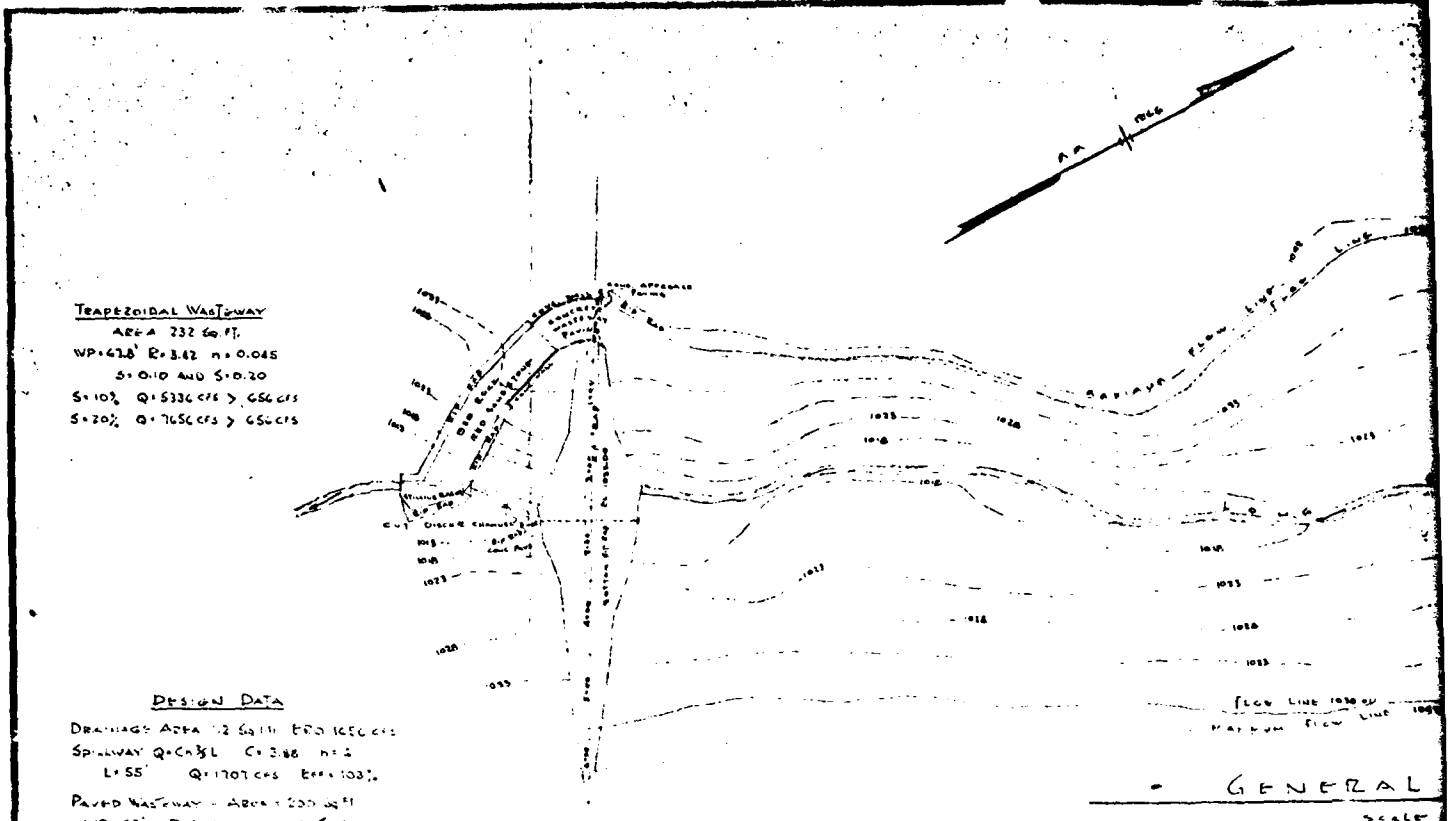
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

HALLOWOOD LAKE DAM

HALLOWOOD HOMES ASSOCIATION, INC.

LOCATION MAP

FEBRUARY 1980 PLATE E-1



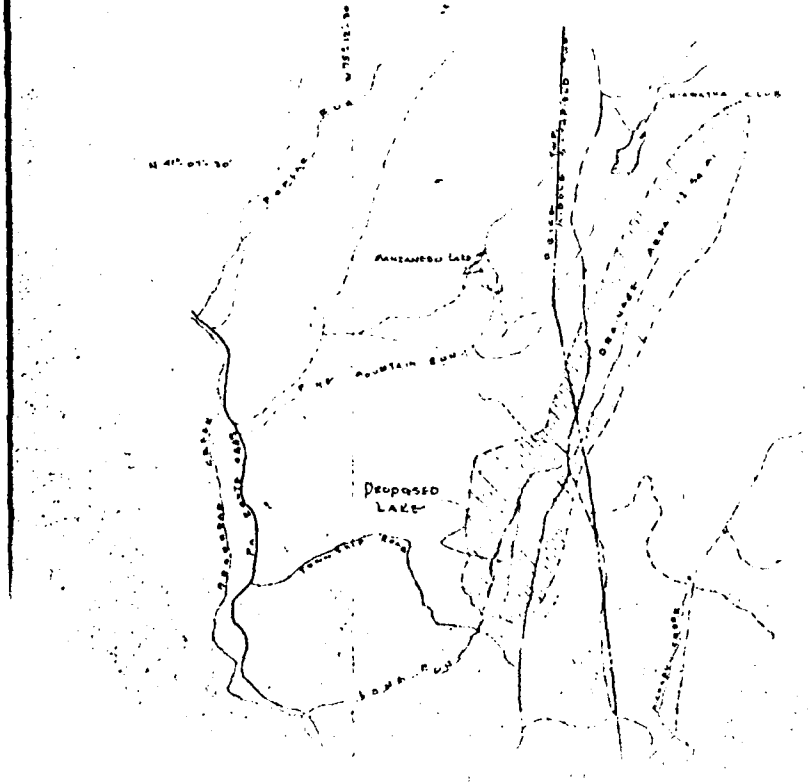
TRAPEZOIDAL WASTEWAY
AREA 232 Sq Ft.
WP = 42.8' R = 3.82 n = 0.045
S = 0.10 AND S = 0.20
S = 10% Q = 5336 cfs > 656 cfs
S = 20% Q = 7656 cfs > 656 cfs

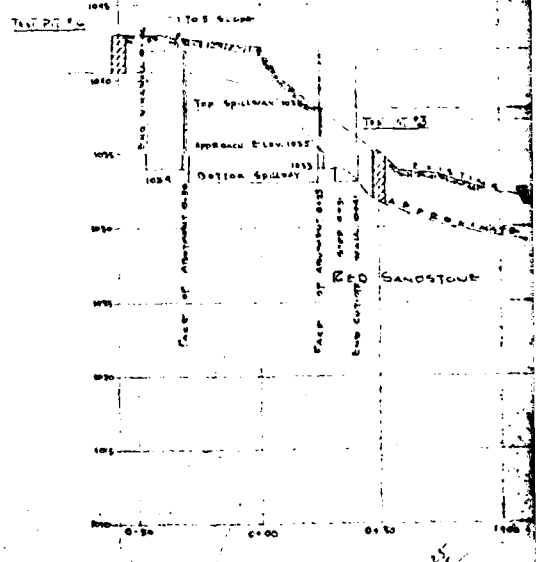
DESIGN DATA

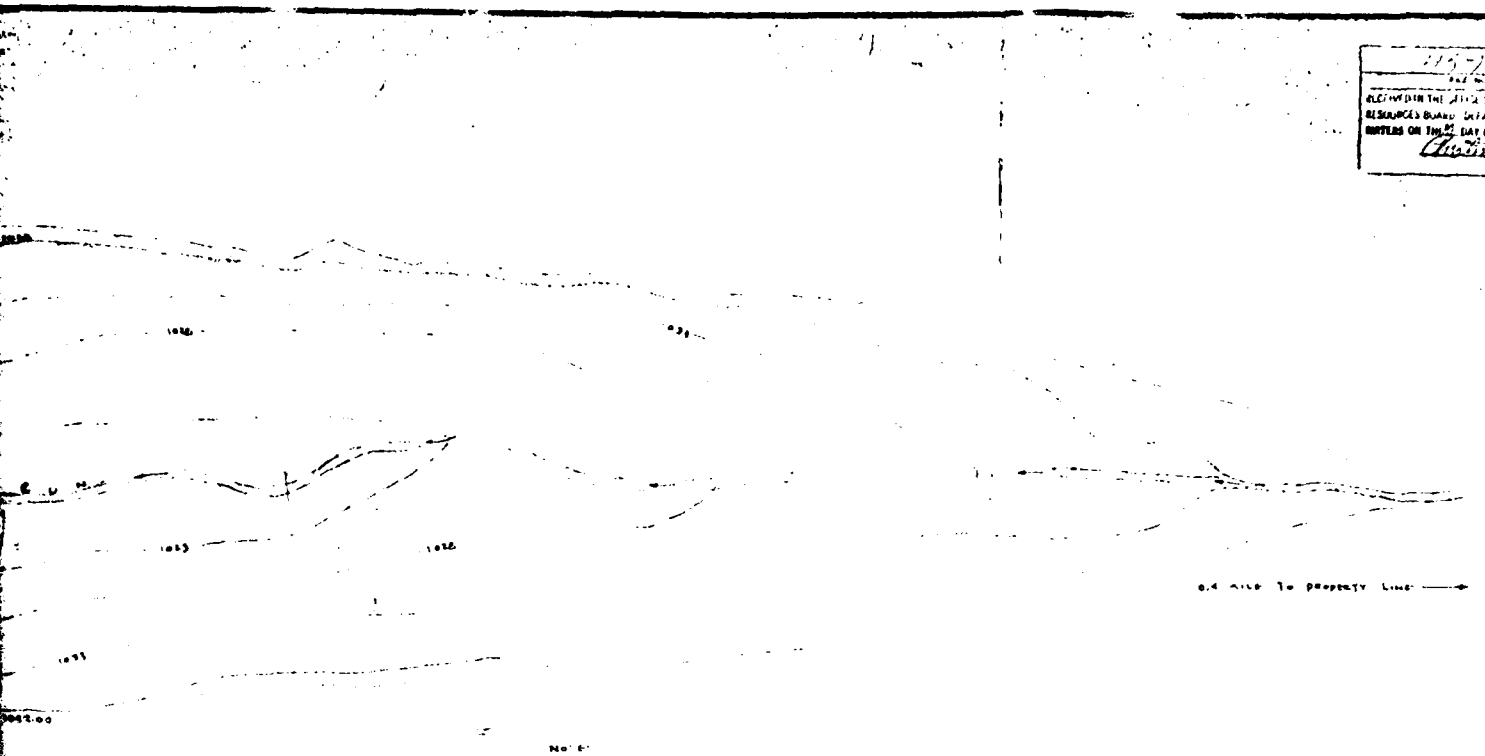
DRAINAGE AREA 1.2 Sq Mi ERO 1650 cfs
SPILLWAY Q = CnL$^{3/2}$ C = 3.86 n = 2
L = 55' Q = 11707 cfs Eff = 103%
PAVED WASTEWAY - AREA = 200 Sq Ft
WP = 63' R = 3.17 n = 0.015 S = 0.01
Q = 4780 cfs > 1650 cfs

- GENERAL

Scale



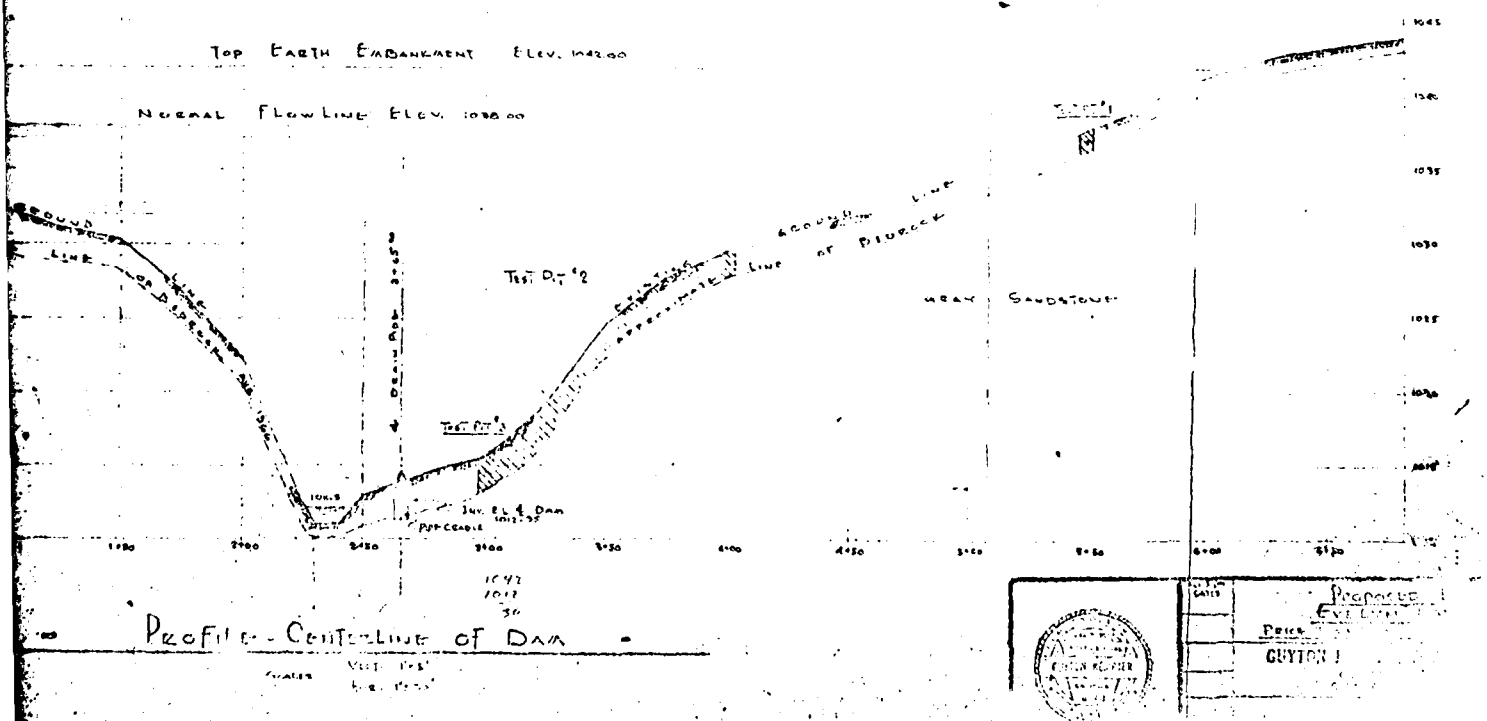




NOTE:
PERMANENT STRUCTURES OR IMPROVEMENTS
PROHIBITED BELOW ELEV 1042

PLAN

1" = 100'



PROFILE - CENTERLINE OF DAM

Proposed Evelyn

Price

GUYTON

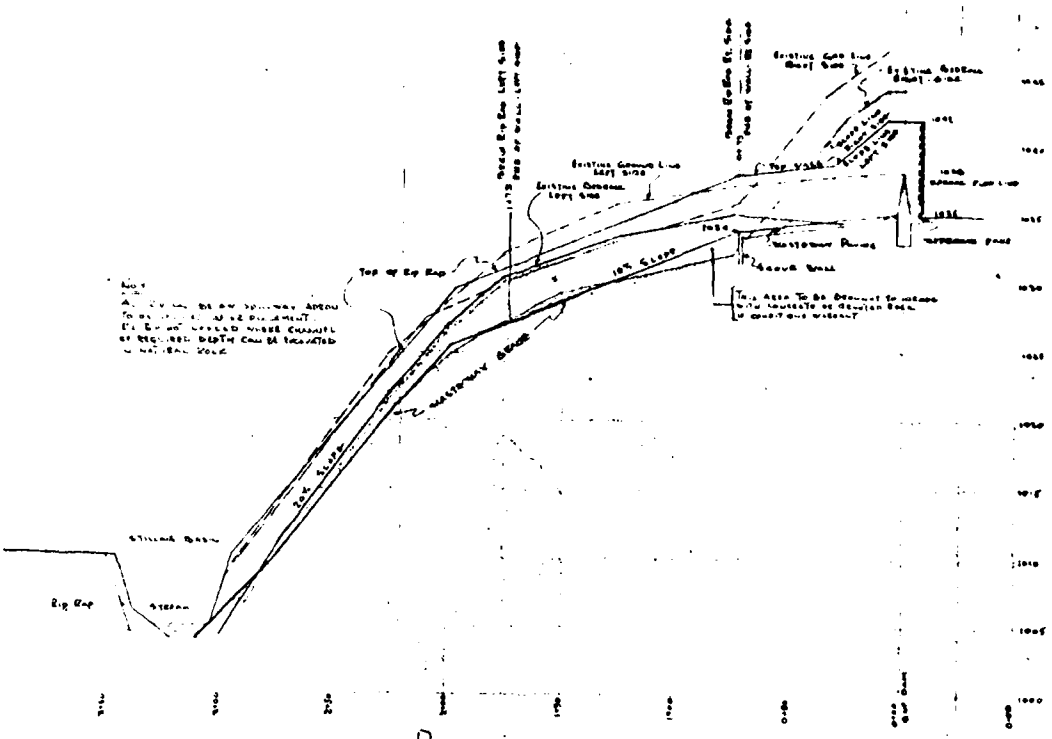
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

HALLOWOOD LAKE DAM

HALLOWOOD HOMES ASSOCIATION, INC.

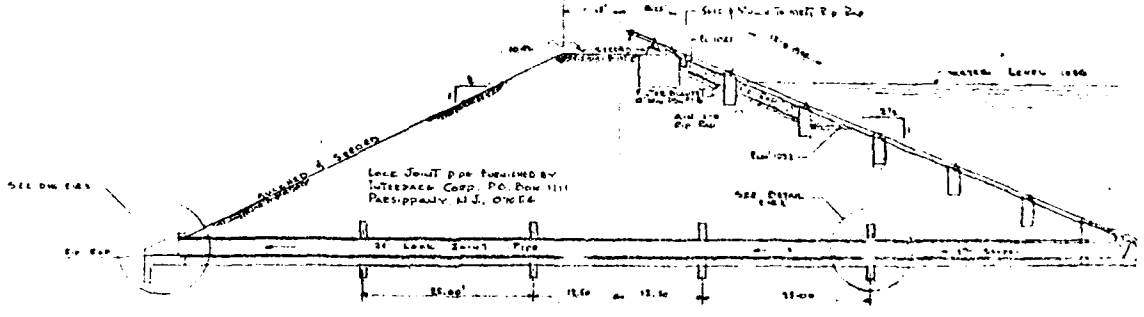
GENERAL PLAN AND PROFILE

FEBRUARY 1980 PLATE E-2



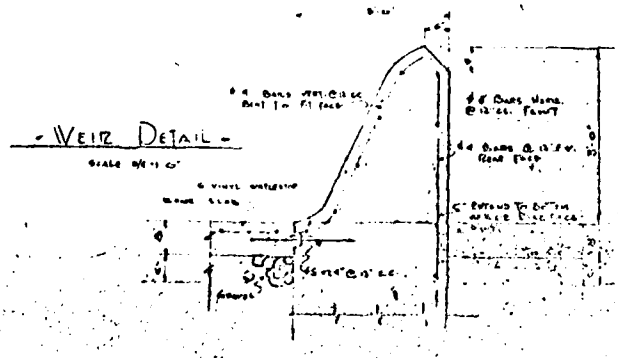
- Profile Wasteway Channel -

Scale Vert. 1"=5'
Hor. 1"=50'



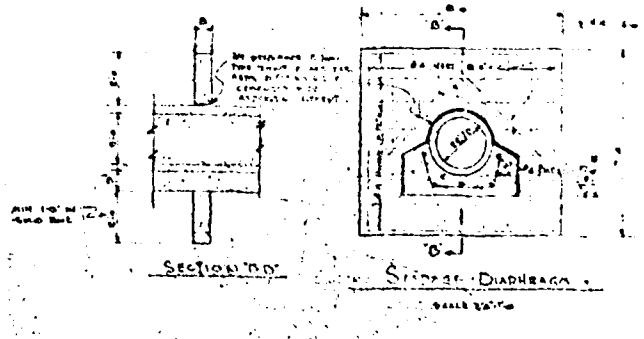
- Cross Section @ Outlet Gate -

Scale 1"=10'

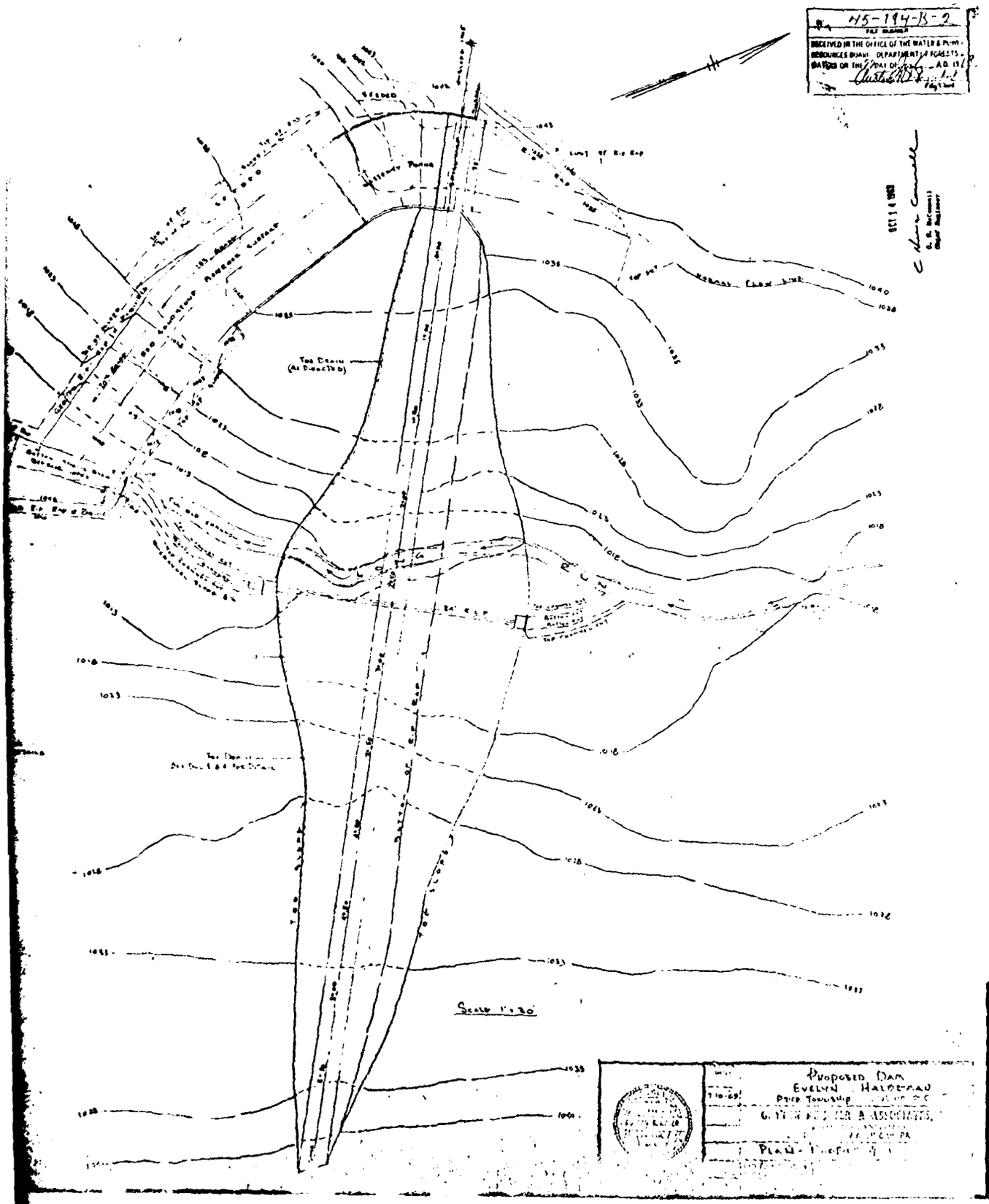


- Weir Detail -

Scale 1"=1'-0"



Scale 1/4"=1'-0"



PA-194-B-2

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD, DEPARTMENT OF FORESTS & WATERS ON THE 2nd DAY OF ... A.D. 19..

Proposed Dam
Evelyn Haldeman
Penn Township
G. [illegible] & Associates

THIS PAGE IS BEST QU
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PHASE I INSPE
NATIONAL DAM INS

HALLOWOOD

HALLOWOOD HOMES

PLAN, S
AND DE

FEBRUARY 1980

TY PRACTICABLE
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ON REPORT
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KE DAM
SOCIATION, INC.
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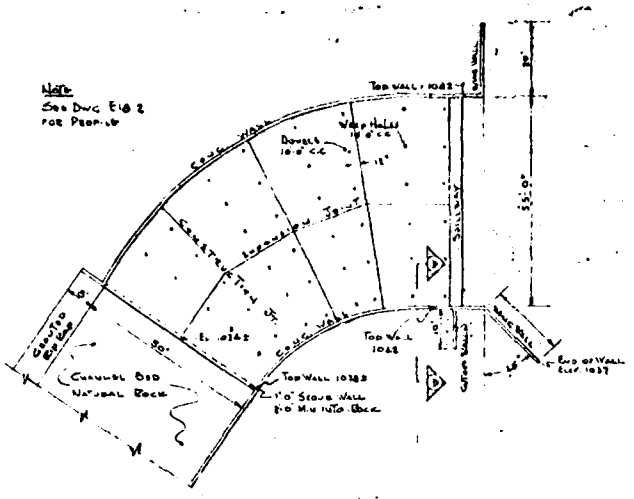
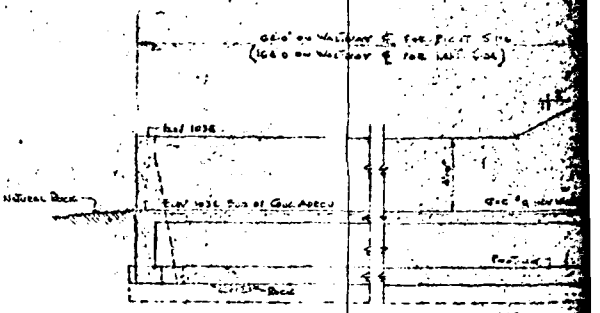
PLATE E-3

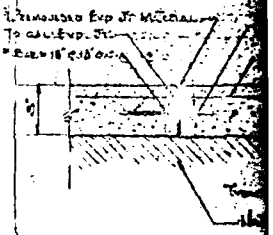
3



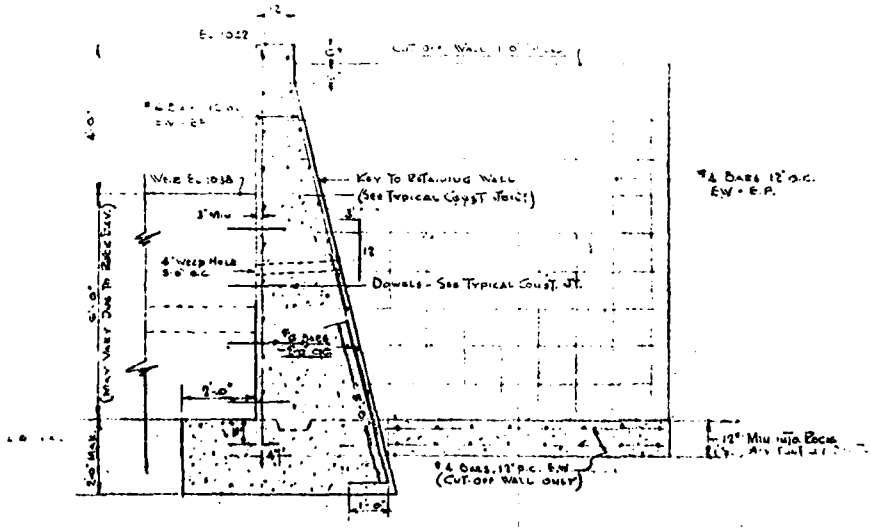
WASTEWAY PAVING PLAN

Scale 1" = 20'





TYPICAL JOINT



SECTION 'A-A' (TYPICAL)

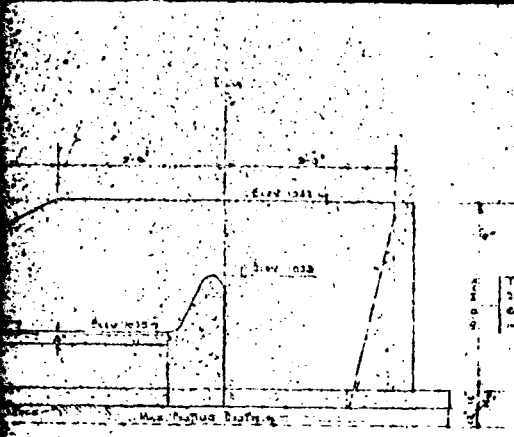
Scale ¼" = 1'-0"

45-194-B=4
P.S.A. NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD, DEPARTMENT OF FORESTS AND WATERS ON THE 2 DAY OF [illegible] A.D. 19[illegible]

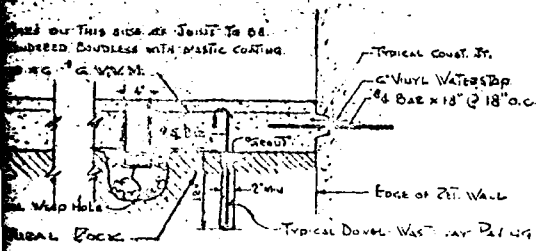
OCT 1 4 1963

C. H. McConnell
Chief Engineer



WASTEWAY ELEVATION

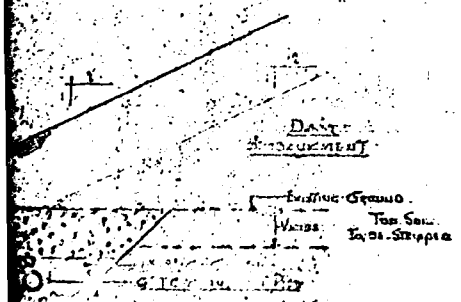
Scale 1/4"=1'-0"



Note
Weep Holes in Wasteway Slab To Be Installed in Compliance with Section 19.3 of Standard Specifications and General Conditions of Penna Department of Forests and Waters

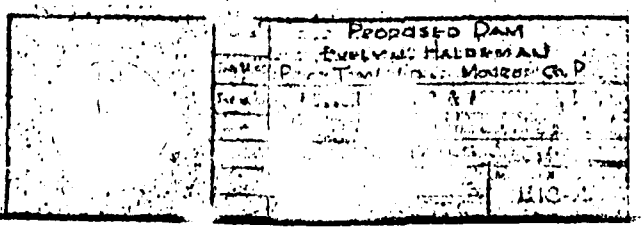
SLAB @ APRON SLAB & SECTION A-A

Scale 1"=1'-0"



Note
Concrete for footings, outlet gate supports and headwalls may be PDH Class "B" concrete, all others to be Class "A".

Penna. Dept of Highways Form 408 (1961) and Dept of Forests and Waters "Standard Specifications and General Conditions" will apply where applicable and copies of same will be furnished to bidders if requested



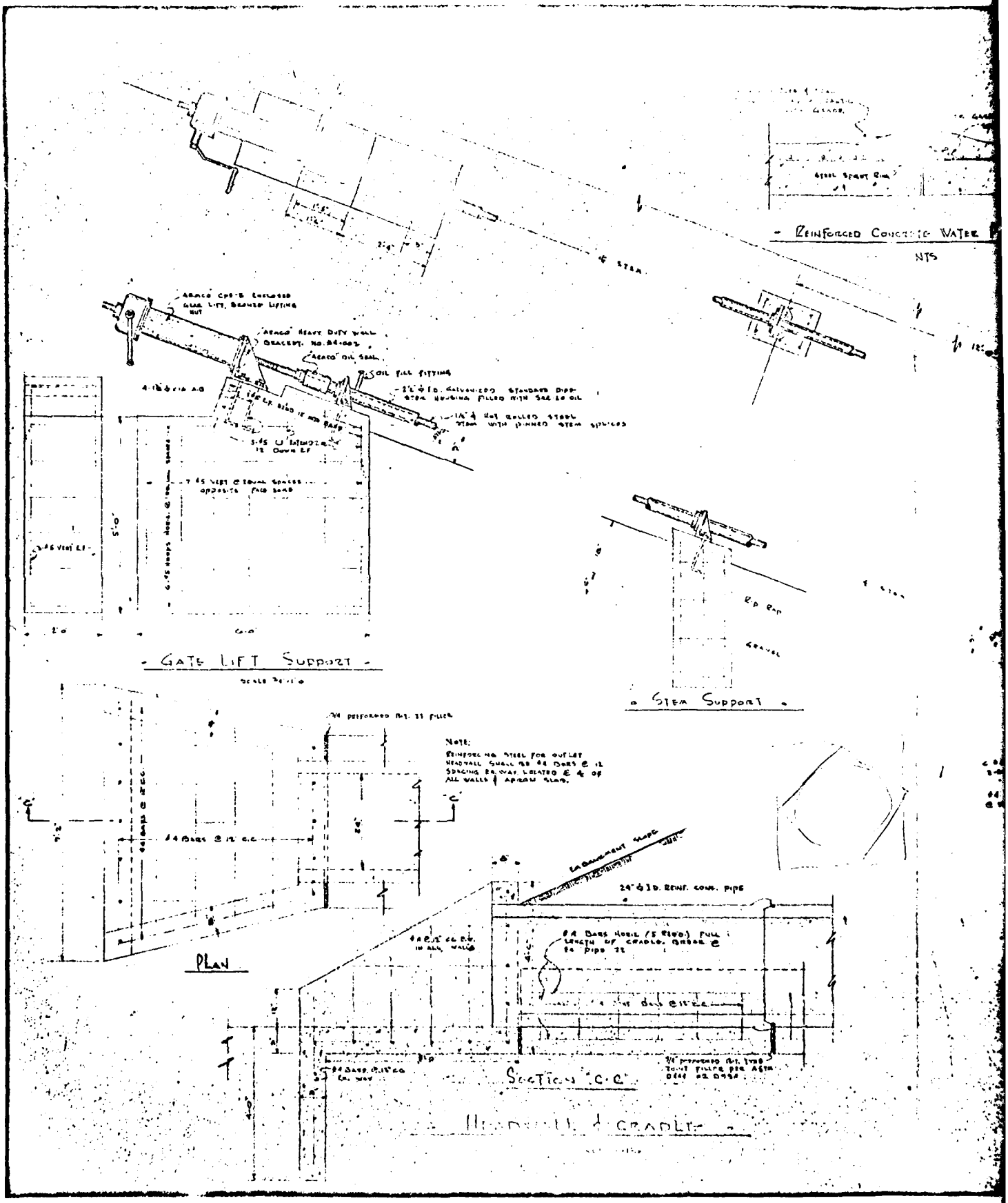
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

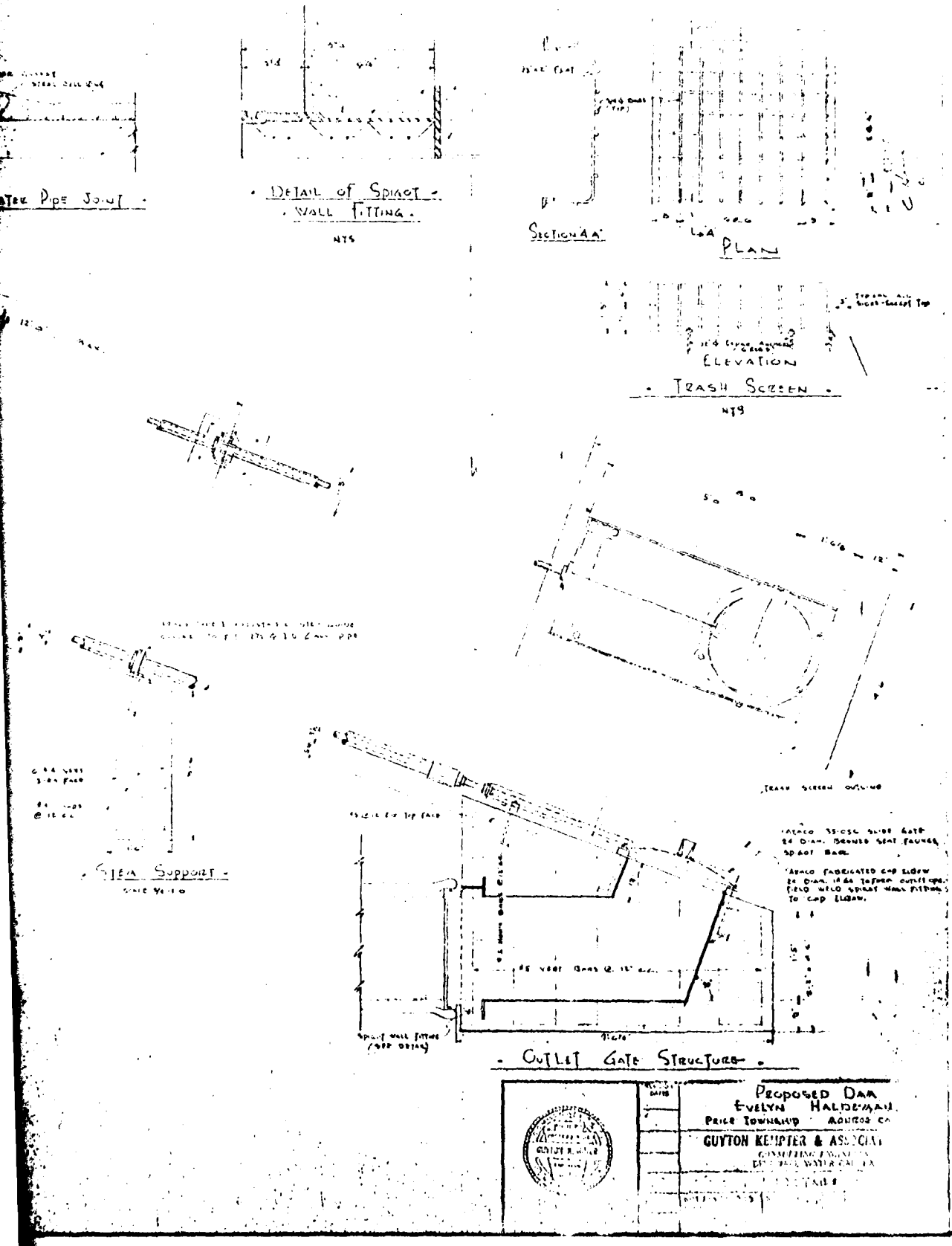
HALLOWOOD LAKE DAM

HALLOWOOD HOMES ASSOCIATION, INC.

DETAILS

FEBRUARY 1980 PLATE E-4


- Reinforced Concrete Water
NTS
- Gate Lift Support -
- Stem Support -
PLAN
Section "C-C"
Note:
Reinforcing steel for outlet headwall shall be #4 bars @ 12 spacing ea. way located @ ¢ of all walls & apron slab.
24" ϕ 310. Reinf. conc. pipe
#4 Bars Horiz. (5 req'd) full length of cradle, under @ to pipe
- Headwall & Cradle -



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FEBRUARY 1980

PRACTICABLE

REPORT
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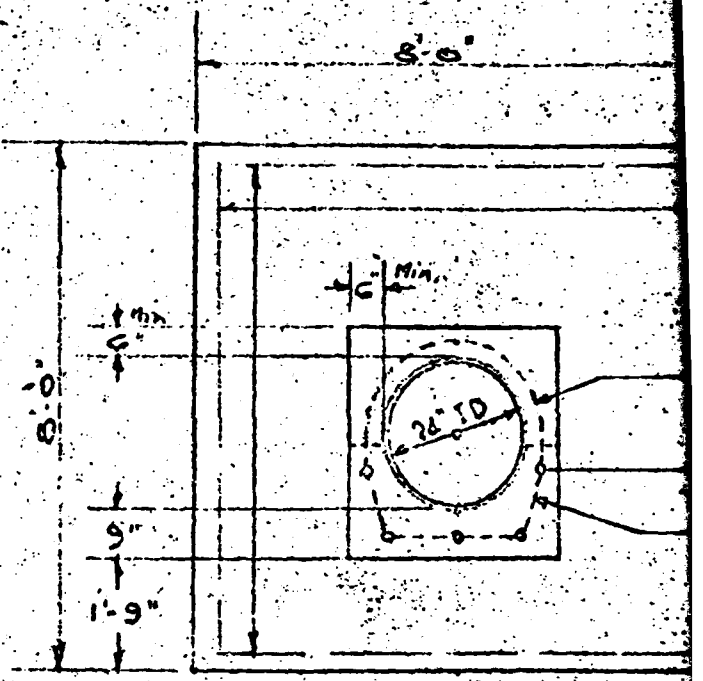
E DAM
OCIATION, INC.

RKS

PLATE E-5

PIPE TO BE 3/8" SCHED. 40 STEEL. 2000 PSI BURSTING STRENGTH



PIPE CASING & ANTI-SEEP

SCALE 3/8" = 1'-0"

8" THICK CONC ANTI-SEEP RING
(⅜" STEEL PLATE MAY BE USED INSTEAD.)

6x6-#4 W.W.M.
TIE TO #4 BARS

#4 BARS CONTINUOUS
(5 REQ'D.)

#3 BARS 18" c.c.

RING

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
CLAYTON KEMPTER
No. 6117

Rec'd 3/9/71 45-194B

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

HALLOWOOD LAKE DAM

HALLOWOOD HOMES ASSOCIATION, INC.

OUTLET CONDUIT
ENCASEMENT DETAIL

FEBRUARY 1980 PLATE E-6

APPENDIX F

GEOLOGY

HALLOWOOD LAKE DAM

APPENDIX F

GEOLOGY

Hallowood Lake Dam is located in Monroe County within the Appalachian Plateau Province. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Plateau Escarpment. The escarpment is well-defined southwestward from Camelback Mountain, but is more irregular between Camelback Mountain and Mt. Pocono, which lies to the north. Streams east of the escarpment drain directly to the Delaware River, while those to the west drain to the Lehigh River.

The Pocono Plateau Section lies west of the escarpment. This area is relatively flat, with local relief seldom exceeding 100 feet. The topography has been greatly influenced by continental glaciation. Many features were created by deposition of glacial materials. The entire plateau lacks well-developed drainage.

East of the escarpment is the Glaciated Low Plateaus Section of the province. The area is characterized by pre-glacial erosional topography with locally-thick glacial deposits. Local relief is generally 100 to 300 feet.

Bedrock units of the sections described above are the lithified sediments of offshore marine, marginal marine, deltaic and fluvial environments associated with the Devonian Period. These units include siltstones of the Mahantango Formation, siltstones and shales of the Trimmers Rock and seven mapped members of the Catskill Formation. These members include sandstones, siltstones, and shales of the Towamensing Member; sandstone, siltstone and shale of the Walcksville Member; sandstones, siltstones and shale of the Beaverdam Run Member; sandstone and shale in the Long Run Member; sandstones and conglomerates in the Packerton Member; sandstone and some conglomerates in the Poplar Gap Member; and sandstones and conglomerates in the Duncannon Member.

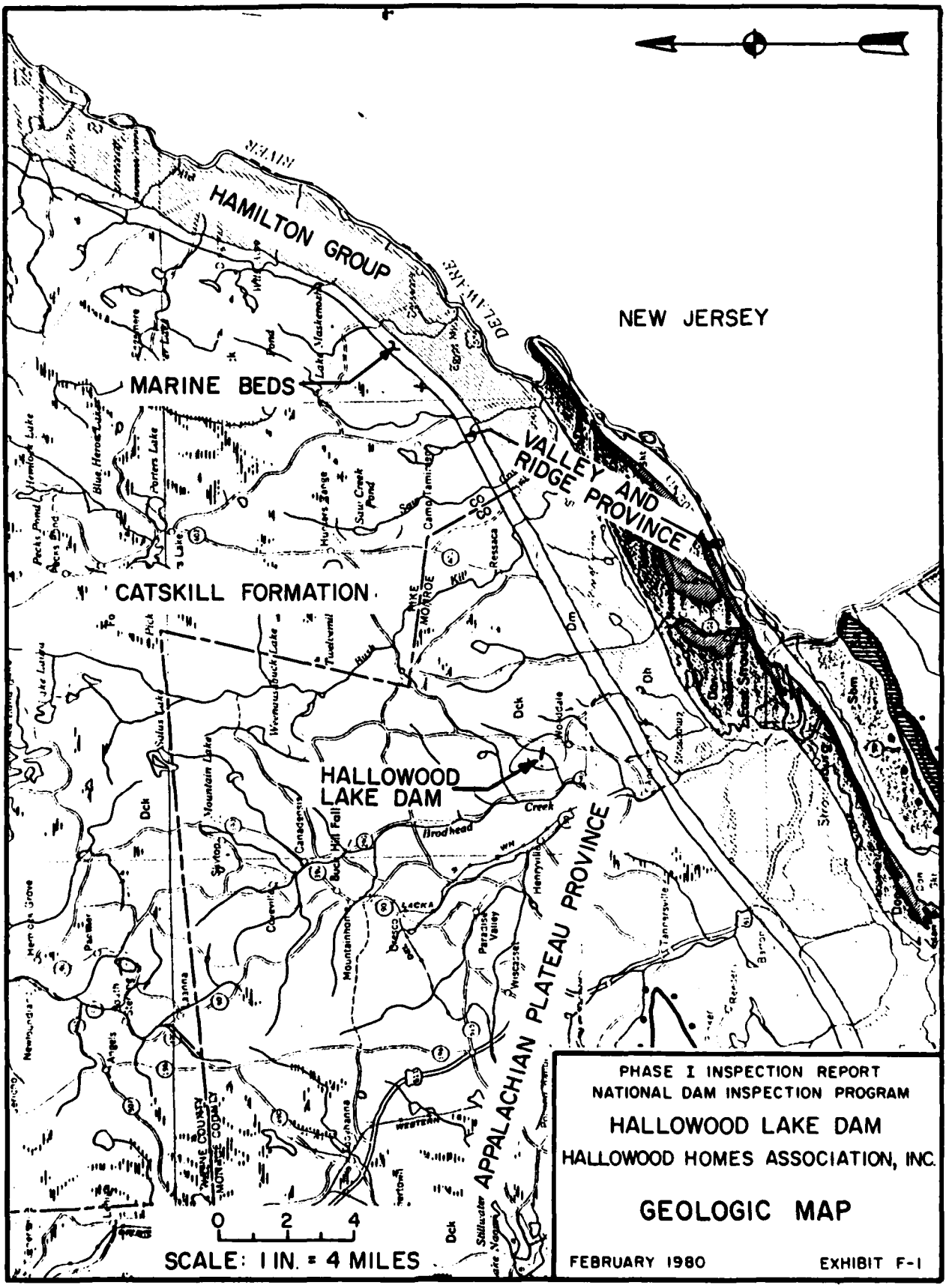
Hallowood Lake Dam is underlain by the Walcksville member of the Catskill Formation. The Walcksville Member is a cyclic sequence of sandstones and shales with some interbedded siltstones. Sandstones in this member are

predominantly medium-to thick-bedded, well-sorted quartz grains in a clay matrix with a silica cement. Within the sandstone there are a few interbedded shale-chip conglomerates. Shales occur primarily as non-fissile to sub-fissile thin beds, with some grading into siltstone. All lithologies in this member exhibit low porosity except where fractured by cleavage and jointing.

Sandstones and siltstones associated with the Walcksville Member are reported to maintain steep cut slopes. However, the shales weather rapidly when exposed. Slopes cut parallel to bedding strike may result in block slides on interbedded shales. The sandstones are good foundations for heavy structures.

Bedrock in the area is almost entirely overlain by glacial till of Late Wisconsin Age. This till is an unsorted mixture of clay, silt, sand, and gravel. It is moderately cohesive, and is generally derived locally from the sandstones of the Catskill Formation.

The soil and foundation report for Hallowood Lake Dam indicates that the bedrock at the site is overlain by about 5 feet of sandy silt. Bedrock at the site is a fine-grained siltstone. A well-defined boundary exists between the weathered rock and unweathered rock. Below the zone of weathering, the siltsone is sound, hard, and shows no evidence of extensive fissuring. A cutoff trench was excavated along the axis of the dam to the unweathered surface of the siltstone.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

HALLOWOOD LAKE DAM

HALLOWOOD HOMES ASSOCIATION, INC.

GEOLOGIC MAP

FEBRUARY 1980 EXHIBIT F-1