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DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION. CORPS OF ENGINEERS 424 TRAPELO ROAD WALTHAM, MASSACHUSETTS 02254

REPLY TO ATTENTION OF: NEDED

SEP 1 1 1981

Honorable William A. O'Neill Governor of the State of Connecticut State Capitol Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Paper Mill Pond Dam (CT-00621) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is vitally important.

Copies of this report have been forwarded to the Department of Environmental Protection, and to the owner, Amerbelle Corporation, Rockville, CT. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,

Incl As stated C. E. EDGAR, III Colonel, Corps of Engineers Division Engineer CONNECTICUT RIVER BASIN

VERNON, CONNECTICUT

PAPER MILL POND DAM

CT 00621

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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NATIONAL DAM INSPECTION PROGRAM

Phase I Inspection Report

Identification No:	CT 00621
Name of Dam:	Paper Mill Pond Dam
Town:	Vernon
County & State:	Tolland, Connecticut
Stream:	Hockanum River
Date of Inspection:	March 10, 1981

BRIEF ASSESSMENT

Paper Mill Pond consists of a 17 foot long concrete spillway and a 15 foot long concrete dam, all completely surrounded by buildings of Amerbelle Corporation. At top of dam elevation, the dam impounds 90 acre-feet. Outlet works consist of a drawdown conduit of unknown size and twin 8-inch lines for process water. Under normal conditions, the entire flow of the Hockanum River discharges over the spillway. This dam has a maximum height of 16.7 feet with the top of dam 5.5 feet above the spillway crest. There are no available records to indicate when construction of the dam took place but indications are that it was in the early 1900's. The dam is presently used to supply process water. Originally, it was also used for the generation of electricity. Paper Mill Pond is classified as SMALL in size with a hazard classification of HIGH. The dam is in fair condition with some seepage from the face of dam and some deteriorated concrete. In addition to the operable outlet works, there is the 48-inch metal penstock tha: was originally used to supply water to the generator turbine. This outlet is plugged and the pipe partially filled and collapsed.

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The inlet channel from the impoundment starts at an arch under Route 31 and continues under a mill building, a local street and another building to the dam. Ledge forms the bottom of the outlet channel which passes under a building and plunges down a steep slope directly into the pool of the Hockanum River Dam, CT 00620. The relationship between the dam and buildings is shown on the Photo Index Plans in Appendix C.

Corps of Engineers Guidelines recommend a test flood of from half PMF to the PMF. Because the dam is at the low end of the range for the size classification, a test flood of half (½) PMF was used. A peak flow of 5,100 cfs was calculated for this test flood. Because of the relatively small size of the impoundment, surcharge storage only reduces the outflow to 5,000 cfs.

It is recommended that the owner engage the services of qualified registered engineer to accomplish the following: inspect the approach channel, spillway and discharge channel and perform a detailed hydrologic-hydraulic investigation to determine discharge capacities and assess the potential of overtopping the dam along with the need to increase project capacity; investigate seepage and deteriorated concrete on the downstream face of dam; investigate and determine adequacy of plugging the collapsed penstock; investigate the need to reconstruct the concrete portion of the south abutment.

In addition, the owner should institute a regular maintenance program; establish a program of annual technical inspections; and develop an Emergency Action Plan.

Recommendations and remedial measures listed above and detailed in Section 7 should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

FUSS & O'NEILL, INC.

By S. Fuss, P.E. Walter

President



This Phase I Inspection Report on Paper Mill Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the <u>Recommended Guidelines for Safety Inspection of</u> <u>Dams</u>, and with good engineering judgement and practice, and is hereby submitted for approval.

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ARAMAST MAHTESIAN, MEMBER Geotechnical Engineering Branch Engineering Division

amen M. T. Rizian

CARNEY M. TERZIAN, MEMBER Design Branch Engineering Division

JOSEPH W. FINEGAN JR, CHAIRMAN Water Control Branch Engineering Division

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APPROVAL RECOMMENDED:

In B. Fuyan

JOE B. FRYAR Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommerced 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

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of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

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

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

ii

TABLE OF CONTENTS

.....

1

1.

1.

Ľ

Section	Page			
Letter of Transmittal				
Brief Assessment				
Review Board Page				
Preface	ì			
Table of Contents	iii			
Overview Photo	∨i			
Location Map	vii			
REPORT				
1. PROJECT INFORMATION				
1.1 General	1			
a. Authority b. Purpose				
1.2 Description of Project	2			
 a. Location b. Description of Dam and Appurtenances c. Size Classification d. Hazard Classification e. Ownership f. Operator g. Purpose of Dam h. Design and Construction History i. Normal Operational Procedure 				
1.3 Pertinent Data	5			
2. ENGINEERING DATA				
2.1 Design Data	10			
2.2 Construction Data	10			

iii

Sectio	<u>n</u>		Page
	2.3	Operational Data	10
	2.4	Evaluation of Data	10
з.	VISU	AL INSPECTION	
	3.1	Findings	11
		 a. General b. Dam c. Appurtenant Structures d. Reservoir Area e. Downstream Channel 	
	3.2	Evaluation	15
4.	OPE	RATIONAL AND MAINTENANCE PROCEDURES	
	4.1	Operational Procedures	17
		a. General b. Description of any Warning System in Effect	
	4.2	Maintenance Procedures	17
		a. General b. Operating Facilities	
	4.3	Evaluation	
5.	EVA	LUATION OF HYDRAULIC/HYDROLOGIC FEATURE	S
	5.1	General	18
	5.2	Design Data	18
	5.3	Experience Data	19
	5.4	Test Flood Analysis	19
	5.5	Dam Failure Analysis	21

i٧

J,

Sectio	<u>n</u>		Page
6.	EVALUATION OF STRUCTURAL STABILITY		
	6.1	Visual Observation	24
	6.2	Design and Construction Data	24
	6.3	Post-Construction Changes	24
	6.4	Seismic Stability	24
7.		ESSMENT, RECOMMENDATIONS AND REMEDIAL	
	7.1	Dam Assessment	25
		a. Condition b. Adequacy of Information c. Urgency	
	7.2	Recommendations	25
	7.3	Remedial Measures	26
		a. Operation and Maintenance Procedures	
	7.4	Alternatives	26
		APPENDICES	

Appendix	Description	

- A INSPECTION CHECKLIST
- B ENGINEERING DATA
- C PHOTOGRAPHS
- D HYDROLOGIC AND HYDRAULIC COMPUTATIONS
- E INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS



OVERVIEW PHOTO

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NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT PAPER MILL POND DAM CT 00621

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

<u>Authority</u>. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England region. Fuss & O'Neill, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Fuss & O'Neill, Inc. under a letter of 25 November, 1980 from William E. Hodgson, Jr., Colonel of Engineers. Contract No. DACW33-81-C-0020 has been assigned by the Corps of Engineers for this work.

b. Purpose.

1. Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

- 2. Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.
- 3. To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT:

- a. Location. Paper Mill Pond Dam is located in the Rockville section of the Town of Vernon, County of Tolland. The dam is located at latitude 41°-52.0' and longitude 72°-26.5' and impounds the flow in the Hockanum River. Approximately 16 miles downstream, the Hockanum River joins the Connecticut River in the Town of East Hartford. Paper Mill Pond has a total watershed area of 16.5 square miles including 440 acre Shenipsit Lake (CT 00209). The dam is entirely surrounded by a building owned by Amerbelle Corporation south of East Main Street (Connecticut Route 74) just west of its intersection with Connecticut Route 31. The impoundment runs easterly along the south side of East Main Street. See Photo Index Plans in Appendix C for location of dam.
 - b. <u>Description of Dam and Appurtenances</u>. Paper Mill Pond dam is 32 feet long including a 17 foot long spillway. Both the dam and spillway are concrete with the upstream slopes unknown. On the downstream side, the dam is vertical and the spillway has a batter of about 1.6 horizontal to 1.0 vertical. The top of the dam is 3

- 5 -

feet thick. Stone and concrete building foundations form the abutments at each end of the dam.

A 48 inch diameter metal penstock leads from the dam to what was originally a turbine room for the generation of electricity. Although the controls are still in place and have been recently painted, they are inoperative. The penstock is partially filled and collapsed with the generating equipment removed. The method of plugging the penstock is unknown.

Controls on the crest of the dam operate a drawdown outlet, the size of which is unknown. This control is reported to be operated infrequently and can lower the water level in Paper Mill Pond only during periods of low flow in the Hockanum River. The control is the right hand wheel on the platform shown in Photo C-5.

There are also twin 8-inch pipes used to draw process water from the impoundment. The controls for these pipes are located within the mill complex.

Both the approach channel to the spillway and the downstream channel run through Amerbelle Corporation buildings. These channels appear to be of stone and concrete.

c. <u>Size Classification</u>. Paper Mill Pond Dam has a height of 16.7 feet from the crest of dam to bed of stream at the spillway. There

- 3 -

is a total storage volume of 90-acre-feet at top of dam level. The dam is therefore classified as a SMALL structure in accordance with the recommended guidelines of the Corps of Engineers which defines a small dam as one with a storage capacity of 50 to 1000 acre feet or a height of 25 or more but less than 40 feet.

- d. <u>Hazard Classification</u>: This dam is classified as having a HIGH hazard potential because a failure could cause more than a few losses of life. An apartment building located 2900 feet downstream with units partially below ground would have no flooding before failure and would have water depths 1.2 feet above ground at the building after failure. This would result in water depths of about 4.2 feet in several apartments. Upstream of this apartment building, the flow from the assumed breach discharge of 2,000 cfs would be contained within the channel.
- e. Ownership. Paper Mill Pond is owned by:

Amerbelle Corporation 104 East Main Street Rockville, CT 06066

f. <u>Operator</u>. The operator of the dam is Mr. Lawrence Passardi of Plant Maintenace under the direction of Mr. Irving Horowitz, Sr. Vice-President of Amerbelle Corporation, Telephone (203) 875-3325.

- 4 -

- g. <u>Purpose of Dam</u>. When the dam was originally constructed, it had the dual purpose of operating turbines to generate electricity and supplying process water for the mill complex. It is no longer used for generating electricity.
- Design and Construction History. No records are available regarding the history of the design and construction of Paper Mill Pond. Indications are that the dam was constructed in the early 1900's.
- i. <u>Normal Operating Procedures</u>. There are no written operating records available. The process water is drawn as required for the manufacturing process.

1.3 PERTINENT DATA:

- a. <u>Drainage Area</u>. The drainage area is 16.5 square miles of rolling uplands, mostly rural and generally wooded. Almost the entire watershed discharges through Shenipsit Lake located 3200 feet upstream from the dam.
- b. <u>Discharge to Dam Site</u>. There is no history of discharge data available for this dam. Listed below are calculated discharge data for the ungated spillway. Discharge records for the process

- 5 -

water are not available but are insignifican:. The size and type of drawdown conduit is unknown.

1. Outlet Works

1.

	a.	Process Water	Insig n ificant
	b.	Drawdown Outlet	Unknown
2.		mum known flood Sept. at Shenipsit Lake	1500 cfs.
з.	-	ed spillway capacity of dam elev. 479.5	700 cfs.
4.	-	ed spillway capacity flood elevation 489.8	5000 cfs.
5.		spillway capacity al poll elevation	N/A
6.		spillway capacity flood elevation	N/A
7.		spillway capacity Flood elevation 489.8	5000 cfs.
8.		project discharge of dam elevation 479.5	700 cfs.
9.		project discharge flood elevation 489,8	5000 cfs.

- 6 -

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It should be noted that it was assumed the entire Test Flood Discharge would reach the dam.

c. Elevation. (feet above NGVD)

1.	Streambed at toe of dam	462.8
2.	Bottom of cutoff	Unknown
з.	Maximum tailwater	Unknown
4.	Normal pool	474.0
5.	Full flood control pool	N/A
6.	Spillway crest	474.0
7.	Design surcharge	Unknown
8.	Top of dam	479.5
9.	Test flood surcharge	489.8
Res	ervoir. (Length in feet)	
1.	Normal pool	2500'
2.	Flood control pool	N/A
з.	Spillway crest pool	2500'
4.	Top of dam	2800'
5.	Test flood pool	3100'

- 7 -

d.

e.	Storage. (Acre-Feet)	
	1. Normal Pool	40
	2. Flood control pool	N/A
	3. Spillway crest pool	40
	4. Top of Dam	90
	5. Test flood pool	198
f.	Reservoir Surface. (acres)	
	1. Normal pool	8
	2. Flood control pool	N/A
	3. Spillway crest	8
	4. Test flood pool	12
	5. Top of dam	10
g.	Dam.	
	1. Type	Concrete
	2. Length	32'
	3. Height	16.7'
	4. Top width	3'
	5. Side slope	N/A
	6. Zoning	N/A
	7. Impervious Core	N/A
	8. Cutoff	Unknown
	9. Grout curtains	Unknown

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- 8 -

h.	Di∨e	ersion and Regulating Tunnel.	N/A
i.	Spil	lway.	
	1.	Туре	Concrete weir
	2.	Length	17'
	з.	Crest elevation	474.0
	4.	Gates	None
	5.	U/S Channel	Natural bed
	6.	D/S Channel	Natural bed (ledge)
j.	Regi	ulating Outlets.	
	Drawdown Outlet		
	1.	Invert	Unknown
	2.	Size	Unknown
	з.	Description	Unknown
	4.	Control mechanism	Hand wheel at top of dam
	5.	Other	Only effective during low flow
	Pro	cess Water	
	1.	Invert	Unknown
	2.	Size	2 @ 8"
	з.	Description	Metal pipe
	4.	Control mechanism	Valves at filter tank
	5.	Other	Flow insignificant

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SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No design data is available for this dam.

2.2 CONSTRUCTION:

No record of construction is available for this dam.

2.3 OPERATION:

No operating records are available for this dam.

2.4 EVALUATION:

- a. <u>Availability</u>. Because of the age of this dam, design and construction information are not available.
- b. <u>Adequacy</u>. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of the dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, the dam's past performance, and sound engineering judgment.
- c. Validity. The validity of the limited data must be verified.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

- <u>General</u>. Based on visual inspection, Paper Mill Pond Dam appears to be in fair condition. The dam is presently being used to impound process water for Amerbelle Corporation. In the past, it was also used to run turbines to generate electricity. Concrete was used for the construction of the dam and spillway. An area about 32 feet by 48 feet, completely surrounded by building, encloses the dam and controls with an approach channel and discharge channel. Both abutments are formed by the walls of the building which consist of stone and concrete.
- b. <u>Concrete</u>. The dam is of concrete and is three feet thick at the top with a vertical downstream face. Although the upstream face is not visible, it appears to also be vertical or nearly so. Based on nearby outcroppings, it is likely that the dam is founded on ledge.
 - Upstream Face The portion of the upstream face that is visible appears to be in good condition. Attached to the upstream face is the control mechanism for the drawdown outlet as shown in Photo C-8. This face should be inspected with the water level lowered.

- 11 -

- Crest Concrete on the crest is in fair condition with some minor scaling which does not appear to be a problem at this time.
- 3. Downstream Face The downstream face including the abutment for the spillway, as shown in Photo C-5 is in poor condition. There is some efflorescence and severe scaling along the lower two feet of wall as shown in Photos C-5 and C-6. Photo C-6 also shows seepage along the line between the good concrete and the scaled concrete. Because of the sharp line of demarcation between the good and poor concrete, it would appear two batches of concrete are involved. There does not seem to be any leakage around or through the abandoned penstock as shown in Photo C-7. The scaled area appears to be a surface defect, but this should be investigated further along with the cause of the seepage which appears to be along a cold joint. Fill downstream of the dam appears to be stable with some grass.
- c. Appurtenant Structures.
 - Spillway the spillway is 17 feet long and is made of concrete. Because of the flow, the condition could not be inspected, an inspection should be made when the impoundment is drawn down to expose both faces. Photo C-4 shows the downstream face

- 12 -

of the spillway and Photo C-9 shows the upstream side of the spillway. Except for some efflorescence on the north side, the north abutment of the spillway appears to be in good condition. The south abutment consists of the stone foundation of the building with a section of concrete wall cast on the face as shown in Photo C-10. The visual inspection indicates that the concrete is a facing and does not affect the stability of the dam. Exposed portions of the stone foundation are in fair condition while the concrete facing is in poor condition. There are cracks and badly scaled areas and the lower portion of the wall appears to have broken away. Although the deteriorated concrete does not appear to pose an immediate threat to the structural stability of the dam, it should be investigated further and any required repairs completed. From the visual inspection, the spillway appears to be founded on ledge. Methods of anchoring the spillway to the ledge are not apparent.

2. Drawdown Outlet - The owner does not know the size or type of drawdown outlet and it can not be seen with flow over the spillway. This outlet is rarely used and is not regularly tested for operation. All visible controls have been recently painted as shown in Photo C-8 and C-11. When last used, it was operable.

- 13 -

- 3. Process Water Outlet This outlet can not be seen and the only information available is that it consists of twin 8 inch pipes. Controls are within the mill complex near the filters used to cleanse the water. There are no reported problems with this system.
- 4. Penstock One of the original uses of the dam was generation of electricity with a 48 inch penstock running from the base of the dam to the turbine room downstream of the dam. All generating equipment has been removed and the penstock is partially collapsed and partially filled as shown in Photo C-7. The original controls are still in place and can be seen in Photo C-5 to the left of the dam crest. These controls no longer are connected to an operating gate. The method of plugging the upstream end of the penstock is unknown, but should be investigated to insure that the plug is functioning properly.

d. Reservoir Area.

The channel leading from the reservoir to the dam runs under two buildings and a narrow street between the building. This channel can not be inspected except with the impoundment lowered and under low flow conditions. At the upstream end of the building, the

- 14 -

channel passes under Route 31 in an arch culvert as shown in Photo C-3. This culvert appears to be in good condition. Photo C-2 shows the roadway over the channel. When storm flows exceed the capacity of the channel, excess flow runs northerly along Route 31 to Route 74 (East Main Street) and then westerly on Route 74 to rejoin the river downstream. No detrimental features in the reservoir area were observed during the visual inspection. Slopes are well covered with growth and appear to be stable. Photo C-1 shows the pond upstream of the dam.

e. <u>Downstream Channel</u>. The downstream channel from the dam to the pool at Hockanum River Dam (CT 00620) is on exposed ledge. Photo C-11 shows the channel from the spillway to where it enters the building through a stone arch. In Photo C-12, the channel is shown from where it leaves the building to the pool below. The portion of the channel walls that are visible are in fair condition with no apparent loose stone or deteriorated concrete.

3.2 EVALUATION:

Based on the visual inspection, the overall condition of Paper Mill Pond Dam is fair but with several areas that require attention.

During a period of low flow, the water level in the impoundment should be lowered and the spillway, upstream face of dam, approach channel and discharge channel should be inspected and a detailed hydrologic-

- 15 -

hydraulic investigation performed to determine capacities of channels and the spillway. Also, assess the potential of overtopping the dam and the need for and means to increase the project discharge capacity.

The seepage from the face of dam should be investigated and any required repairs made.

Deteriorated and cracked concrete at the south abutment should be repaired.

Adequacy of the plug in the penstock should be checked.

Determine the size and operability of the outlet mechanism.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES:

- a. <u>General</u>. The full flow of the Hockanum River passes over the spillway of Paper Mill Pond. Process water is drawn from above the dam through two 8 inch pipes by gravity. This flow is insignificant compared to the flow in the river and the size of the impoundment. The drawdown outlet is rarely used.
- b. <u>Description of Any Warning System in Effect</u>. There is no formal downstream warning system in case of emergency at the dam.

4.2 MAINTENANCE PROCEDURES:

- a. <u>General</u>. Minor maintenance is performed as required with no specific schedule. Major maintenance is lacking.
- b. <u>Operating Facilities</u>. Operational checks of the drawdown outlet are not routinely made. The process water outlet is used daily. Debris is removed as required.

4.3 EVALUATION:

A regular maintenance plan should be developed for operation of outlets, debris removal and minor repairs and an annual technical inspection instituted.

A downstream warning system should be developed and put into effect in case of emergency at this dam.

- 17 -

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL:

Paper Mill Pond is a 32 foot long concrete dam including a 17 foot spillway section. The maximum head at the spillway is 5.5 feet before the dam is overtopped.

The impoundment size at normal stage is approximately 8 acres with estimated storage volume of 40 acre-feet.

The watershed area is 16.5 square miles of rolling uplands, mostly rural and generally wooded except for the area immediately around the dam which is urban. About 98 percent of this watershed area discharges through the 440 acre Shenipsit Reservoir located 3200 feet upstream of Paper Mill Pond.

5.2 DESIGN DATA:

No specific data is available for this watershed or the structure at Paper Mill Pond. In lieu of existing design information, U.S.G.S. Topographic Maps were utilized to develop hydrologic parameters. Some of the pertinent hydraulic design data was obtained by actual field measurements at the time of the field inspection.

- 18 -

Also used was information developed for the Phase I Inspection Report for Hockanum River Dam (CT 00620) dated May 1980. This dam is located approximately 300 feet downstream of Paper Mill Pond.

5.3 EXPERIENCE DATA:

No records are available in regard to past operation of the impoundment or of surcharge encroachments and outflows through the spillway or outlet. The maximum past inflows are unknown at this dam. The U.S.G.S. reports a peak flow at Shenipsit Lake of 1500 cfs. in September 1938. It is reported by residents that part of the flow during this storm bypassed the dam and flowed along adjacent streets.

5.4 TEST FLOOD ANALYSIS:

Corps of Engineers guidelines were used as the basis for the Test Flood for determining the spillway adequacy. The size classification of the dam is SMALL based upon a height of 16.7 feet and a storage volume of 90 acre-feet. The hazard potential is HIGH because of the possibility of the loss of more than a few lives in the event of a dam failure. The test flood in the Corps of Engineers guidelines for this size dam and hazard potential ranges from the half ($\frac{1}{2}$) PMF to the PMF. The recommended spillway test flood is the half ($\frac{1}{2}$) PMF because the dam is at the low end of the range for the size classification.
Because of the very large percentage of the Hockanum River flow that passes through Shenipsit Lake, the test flood is strongly influenced by the lake. This influence was evaluated by routing the test flood through the Shenipsit Lake Dam structure to determine its outflow rate. The Phase I Report for Hockanum River Dam used stage-discharge and reservoir area data that was developed in the Phase I Report for Shenipsit Lake Dam dated September 1978.

The inflow used to evaluate the Paper Mill Pond Dam was set equal to 104 percent of the Shenipsit Lake Dam outflow. The added 4 percent is to approximate the runoff from the additional watershed area tributary to the river between the two dams. This resulted in a peak inflow rate of 5,100 cfs at Paper Mill Pond.

Because of the relatively small storage volume available in comparison to the flow, the effect of surcharge storage is small, resulting in a Test Flood peak flow of 5000 cfs. at the dam. The peak test flood stage at the dam would be elevation 489.8 which is 10.3 feet above the dam. Spillway capacity at top of dam elevation (479.5) is 700 cfs. which is 14 percent of the peak test flood outflow.

It is recognized that part of the flow would be blocked by the Route 31 culvert and the approach channel under the building as well as the downstream channel. Photo C-4 shows the downstream end of

- 20 -

the approach channel under the buildings. As shown in the photo, a large air duct partially blocks the channel under the building. Due to a curtain hanging in the channel, it is not possible to observe the size, configuration or condition of the channel under the two buildings and the street between them. This curtain is used to reduce wind currents under the building. In order to determine the capacity of the approach channel, it would be necessary to enter the channel with the pond lowered during a period of low flow.

When flows through Paper Mill Pond exceed the capacity of the channel, the excess water will flow north on Route 31 (Photo C-2) to East Main Street and then west to a shopping plaza about 1400 from Route 31. Just west of the shopping plaza, the flow can rejoin the Hockanum River.

5.5 DAM FAILURE ANALYSIS:

The downstream impact of dam failure was analyzed using the Corps of Engineers "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978 as used in the National Dam Inspection Program.

The peak outflow is calculated by combining the dam failure outflow and the pre-failure discharge. Water surface elevations are calculated for both the pre-failure and post-failure conditions at selected stations downstream of the dam. These calculations are included in Appendix D.

It was assumed that the entire 17 foot spillway would be breached. This resulted in a flood flow of 2000 cfs. The pre-failure flow is 700 cfs. It was assumed that the failure would take place with the pond at top of dam elevation (elevation 479.5).

Because of the steep slope of the channel, (See Photos C-11 and C-12) it is assumed that the flow will pass to and over the Hockanum River Dam (CT 00620) without causing any damage. Below this dam the river flows under an office building, two banks and a shopping plaza in a 14 foot wide by 10 foot high concrete box culvert. This culvert has an average slope of about 3.7 percent and the depth of flow would be 4 feet.

About 1800 feet downstream of Paper Mill Pond, the Hockanum River is in a natural channel with steep sides and an average slope of about 3 percent. The pre-failure stage would be elevation 343.0 or a depth of 3.0 feet. The post-failure stage would be 345.5 or a depth of 5.5 feet. Both flows would be contained within the banks of the river and would cause no damage. About 2900 feet downstream of the dam, the slope of the river bed flattens out to about 1.7%. At this point, the pre-failure stage would be elevation 291.3 or a depth of 4.3 feet and the post-failure stage would be 294.5 with a depth of 7.5 feet. The pre-failure flow would be contained within the banks of the river. The post-failure flow would result in approximately 1.2 feet of water at the base of a large apartment building about 25 feet from the banks of the river. This building, located 2900 feet downstream of the dam, was converted from an old mill building and several apartments on the lower level have floors about 3 feet below ground level. There are several windows and a doorway with a handicap ramp in the area that would be flooded by the assumed breach. Therefore, the 1.2 foot depth of water outside of the building would translate to 4.2 feet of water inside of the apartments.

Since the hazard classification is established as HIGH at this point, the dam failure hydrograph was not routed beyond this point.

- 23 -

SECTION 6 - STRUCTURAL STABILITY

6.1 VISUAL OBSERVATION:

The field inspection did not reveal any stability problems. However, the deteriorated portion of concrete at the south abutment should be investigated to insure that it does not affect stability.

6.2 DESIGN AND CONSTRUCTION DATA:

There is no design or construction data available to permit a formal evaluation of the stability of the dam. Thus, the evaluation of stability is based soley on the visual inspection.

6.3 POST CONSTRUCTION CHANGES:

There are no post construction changes apparent.

6.4 SEISMIC STABILITY:

Paper Mill Pond Dam is located in Seismic Zone 1 and in accordance with Corps of Engineers guidelines does not warrant further seismic analysis at this time.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

- a. <u>Condition</u>. Based on a visual inspection, the dam appears to be in fair condition. There are some features which could affect the long-term performance of the dam if they are not corrected as recommended in Sections 7.2 and 7.3.
- b. <u>Adequacy of Information</u>. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, past operational performance of the structure, and sound engineering judgment.
- c. <u>Urgency</u>. The recommendations and remedial measures presented in Sections 7.2 and 7.3 should be carried out within one year of receipt of this report by the Owner.

7.2 RECOMMENDATIONS:

It is recommended that the Owner employ a qualified registered engineer to:

a. With water levels lowered, inspect the outlet conduit, approach channel, spillway and discharge channel; perform a detailed

- 25 -

hydrologic-hydraulic investigation to determine the discharge capacity of the approach channel, spillway and downstream channel during major floods; assess the potential of overtopping the dam and need for and the means to increase the project discharge capacity.

- b. Investigate the seepage and deteriorated concrete on the downstream face of the dam and design remedial measures.
- c. Investigate and determine the adequacy of plugging of the unused and collapsed penstock to insure that there will not be leakage.
- d. Investigate the need for reconstruction of the concrete portion of the south abutment.

7.3 REMEDIAL MEASURES:

- a. Establish a regular schedule of maintenance including valve operation.
- b. Institute a program of annual technical inspections by a qualified registered engineer.
- c. Develop an "Emergency Action Plan" that will include an effective preplanned downstream warning system, location of emergency equipment, materials and manpower, authorities to contact and potential areas that require evacuation and will also include monitoring of the project during flood periods.

7.4 ALTERNATIVES:

There are no practical alternatives to the recommendations of Sections 7.2 and 7.3.

- 26 -

APPENDIX A

INSPECTION CHECK LIST

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VISUAL	INSF	PECTION	CHECK	LIST
PA	RTY	ORGANIZ	ATION	

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PROJECT Paper Mill Pond	DATE3/10/81
	TIME9:30
	WEATHER Cloudy 35°
·	W.S.Elev. 474.4 U.S. 463 DN.S.
PARTY:	
1. G. Mirtl, Hydroglogy & Hydrauli	cs 6
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	l 8
4. L. Passardi, Owner Chief of	
Maintenance 5	
PROJECT FEATURE 1. All features inspected by all mail 2.	
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A-1	

PERIODIC INSPECTION CHECK LIST

PROJECT Paper Mill Pond	DATE3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	No Embankment - Concrete Dam
Crest Elevation	479.5
Current Pool Elevation	. 474.0
Maximum Impoundment to Date	Unknown
Surface Cracks	N/A
Pavement Condition	None
Movement or Settlement of Crest	N/A
Lateral Movement	N/A
Vertical Alignment	N/A
Horizontal Alignment	N/A
Condition at Abutment and at Concrete Structures	Fair
Indications of Movement of Structural Items on Slopes	None
A-2	

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PERIODIC INSPEC	TION CHECK LIST
PROJECT Paper Mill Pond	DATE 3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
DIKE EMBANKMENT (cont)	
Trespassing on Slopes	N/A
Sloughing or Erosion of Slopes or Abutments	N/A
Rock Slope Protection – Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	N/A
Unusual Embankment or Downstream Seepage	Some seepage through concrete
Piping or Boils	N/A
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	None
Vegetation	N/A
A-3	

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PERIODIC INSPECT	ION CHECK LIST
PROJECT Paper Mill Pond	DATE3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Concrete walls
Bottom Conditions	Unknown
Rock Slides or Falls	None
Log Boom	None
Debris	Minor
Condition of Concrete Lining	Fair where visible
Drains or Weep Holes	None apparent
b. Intake Structure	
Condition of Concrete	Fair
Stop Logs and Slots	None
A-4	

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PERIODIC INSPEC	TION CHECK LIST
PROJECT Paper Mill Pond	DATE
PROJECT FEATURE	NAME
DISCIPLINE	NA ME
AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND	N/A
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	
A-5	
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PERIODIC INSPECTION CHECK LIST			
PROJECT Paper Mill Pond	DATE 3/10/81		
PROJECT FEATURE	NAME		
DISCIPLINE	NAME		
AREA EVALUATED	CONDITION		
OUTLET WORKS - CONTROL TOWER	Open Platform		
a. Concrete and Structural			
General Condition	Good		
Condition of Joints	Good		
Spatting	None		
Visible Reinforcing	None		
Rusting or Staining of Concrete	None		
Any Seepage or Efflorescence	None observed		
Joint Alignment	Good		
Unusual Seepage or Leaks in Gate Chamber	None observed		
Cracks	None observed		
Rusting or Corrosion of Steel	None		
A-6			

PERIODIC INSPECT	TION CHECK 1 IST
	TON CHECK LIST
PROJECT Paper Mill Pond	DATE3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (cont)	
b. Mechanical and Electrical	
Air Vents	None
Float Wells	None
Crane Hoist	None
Elevator	None
Hydraulic System	None
Service Gates	None
Emergency Gates	None
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System	None

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PERIODIC INSPEC	TION CHECK LIST
PROJECT Paper Mill Pond	DATE 3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET	N/A - Pipe direct from gates
CHANNEL General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	
A-8	}

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PERIODIC INSPECT	ION CHECK LIST
PROJECT Paper Mill Pond	DATE3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Not visible but indications that it i rock.
b. Weir and Training Walls	
General Condition of Concrete	Fair
Rust of Staining	None observed
Spalling	Some
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Some
A-9	

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PERIODIC INSPECT	ION CHECK LIST
PROJECT Paper Mill Pond	DATE 3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
b. Weir and Training Walls	
Drain Holes	None observed
c. Discharge Channel	
General Condition	Concrete - Poor Stone - Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Bedrock
Other Obstructions	None
A-10	

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PERIODIC INSPECT	ION CHECK LIST
PROJECT Paper Mill Pond	DATE 3/10/81
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	None
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
PaintA-11	

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PERIODIC INSPEC	TION CHECK LIST
PROJECT Paper Mill Pond	DATE <u>3/10/81</u>
PROJECT FEATURE	NAME
DISCIPLINE	NAME
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE (cont)	None
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

ENGINEERING DATA

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PAPER MILL POND DAM scale: 1"= 5'

NOTE: OUTLET WORKS DETAILS UNKNOWN

SECTION A-A



BUILDING

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Name	of Stream	
U.S.C	S.S. Quad.	
Owner	A merbille Corp	
Addre	ess Rockville, 06066	
	875-3325	
		<u>₽A17.1</u>
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APPENDIX C

PHOTOGRAPHS

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C-1 UPSTREAM POND

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C-2 STREET OVER APPROACH CHANNEL

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C-3 APPROACH CHANNEL UNDER STREET



C-4 APPROACH CHANNEL AT DAM



C-5 DOWNSTREAM FACE OF DAM



C-6 SEEPAGE FROM DAM



C-7 UNUSED PENSTOCK





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C-9 SPILLWAY LOOKING DOWNSTREAM



C-10 SOUTH SPILLWAY ABUTMENT



C-11 DISCHARGE CHANNEL AT SPILLWAY



C-12 DOWNSTREAM CHANNEL BELOW BUILDING

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APPENDIX D

HYDROLOGIC AND HYDRAULIC

COMPUTATIONS

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PREPARED DATE CHECKED DATE PROJECT NO. 7/8/81 nsulting engineers GZM 80-157 SUBJECT: Hydrologic & Hydraulic Computations - Paper Mill Poud SHEET NO.) of 7 Storage Volume Pond Area = 8.0 Ac. at spillway level = 10.0 Ac. at Top of Dam Elevetim Mayimum Depth = 16.7' Ave. Depth: 5.0 @ Spillway Level 5.0x BAC: 40 A. F. Above Spillway Level 5.5 × 9A1: 50 Total Storage = 90 Ac.F.M. Height of Dam = 16.7 Size Classification = Small Dam Failure Flow Wy - Assume entine spillway width fails W6=17 Yo= 16.7 QP1= 8/27 W6 Vg 6312 = 8/27 × 17 V32.2 × 16.73/2 = 2000 cfsBase Flow at Top of Dam Water Elevation Q= CLH312 C = 3.3L= 17' H: 5.5 Q= 700 cfs

FO	FUSS&ONEILL consulting engineers	PREPARED DAT BY G-J-M 7.5/	CHECKED BY	DATE	PROJECT
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	Stage / Discharge	in Boy C.	cluent		
	Depth Di	inange			
	2	700035			
	5	700 cfs			
	10	900 Cfs			
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APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

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