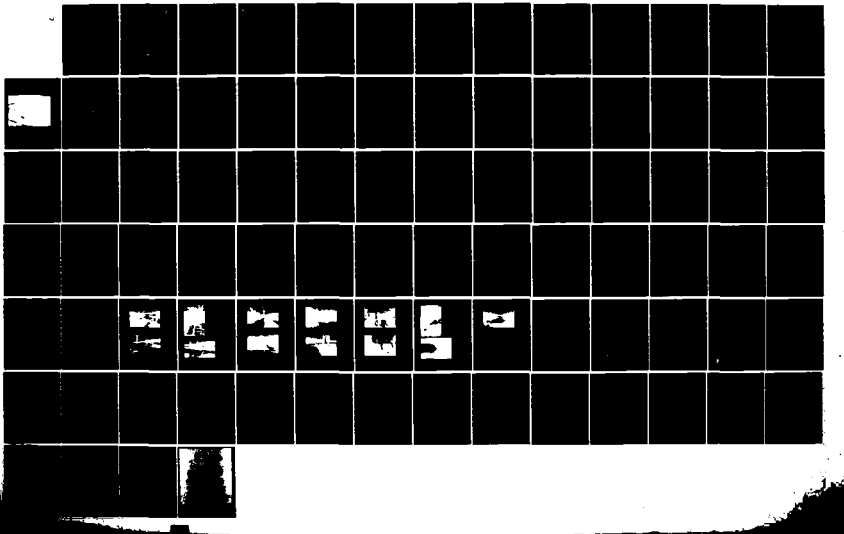
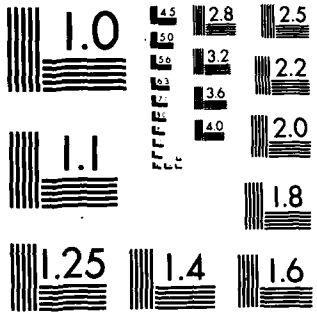
AD-A143 517 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS OLD 1/1
DANIELS DAM (CT 0.. (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV AUG 80

UNCLASSIFIED F/G 13/13 NL





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

1

THAMES RIVER BASIN
KILLINGLY, CONNECTICUT

OLD DANIELS DAM
CT. 00168

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

AUGUST, 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00168	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Old Daniels Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE August, 1980 13. NUMBER OF PAGES 70
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Thames River Basin
Killingly, Conn.
Old Daniels Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Old Daniels dam is an earth embankment strucure with a stone masonry concrete spillway. The dam is 18 ft. in height and apprc.. 346 in length (including the spillway). The dam is considered to be in FAIR condition. The dam is classified as SMALL in size and a SIGNIFICANT hazard structure in accordance with recommended guidelines established by the Corps of Engineers. The test flood adopted for OLD DANIELS DAM is equal to one-half the PMF.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED

7 OCT 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Old Daniels Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved 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 a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Sactchidananda Ashram-Yogaville, Inc., Pomfret Center, Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

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

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

OLD DANIELS DAM

CT 00168

THAMES RIVER BASIN

KILLINGLY, CONNECTICUT

PHASE I - INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	Old Daniels Dam
ID NUMBER:	CT 00168
COUNTY & STATE:	Windham County Connecticut
STREAM:	Five Mile River
DATE OF INSPECTION	2 April, 1980

BRIEF ASSESSMENT

Old Daniels dam is an earth embankment structure with a stone masonry concrete spillway. The impoundment was formerly used for industrial power and process water, but is now used for recreation only. The dam was constructed around 1880. The dam is 18 feet in height and approximately 346 feet in length (including the spillway). The stone masonry concrete cap spillway has a crest length of about 112 feet. The outlet works is located approximately 30 feet from the right spillway abutment and consists of a stone masonry lined approach channel, a concrete intake structure which houses three manually operated wooden gates, and a concrete lined stone masonry arched outlet conduit. The sluice gates were ~~rehabilitated~~ rehabilitated in 1964.

The dam is considered to be in FAIR condition. Deficiencies include lack of riprap on the upstream slopes, large trees on the embankment slopes near the retaining walls of the spillway discharge channel, and the partly collapsed stone wall on the left bank of the spillway discharge channel.

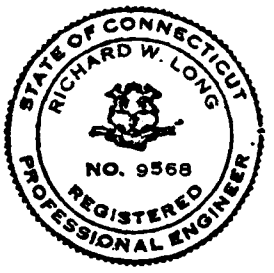
The dam is classified as SMALL in size and a SIGNIFICANT hazard structure in accordance with recommended guidelines established by the Corps of Engineers. The test flood adopted for OLD DANIELS DAM is equal to one-half the Probable Maximum Flood (PMF) which is estimated to be 10,240 CFS from the 51.2 square mile drainage basin. Calculations indicate that the routed test flood outflow of 10,150 CFS (200 CSM) would overtop the dam by about 3.53 feet, therefore the spillway capacity is considered inadequate. Assuming the pool elevation at the top of the dam, the spillway can pass a flow of 1920 CFS which represents only 19 percent of the routed test flood outflow.

It is recommended that the owner engage the services of a registered Engineer experienced in the design of dams to accomplish the following:

Perform detailed hydraulic and hydrologic studies to further assess the need for and means to increase the project discharge capacity, place riprap on the upstream slope of the embankment to prevent further sloughing and erosion remove trees growing on the embankments, repair the spillway discharge training walls. The above reccommendations and other remedial measures as described in Section 7 should be implemented within one year after receipt of this Phase I Inspection Report.

CE MAGUIRE, INC.

By: Richard W. Long
Richard W. Long
Vice President



This Phase I Inspection Report on Old Daniels Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

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, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or to 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 condition which might otherwise be detectable if inspected under the normal operating environment of the structure.

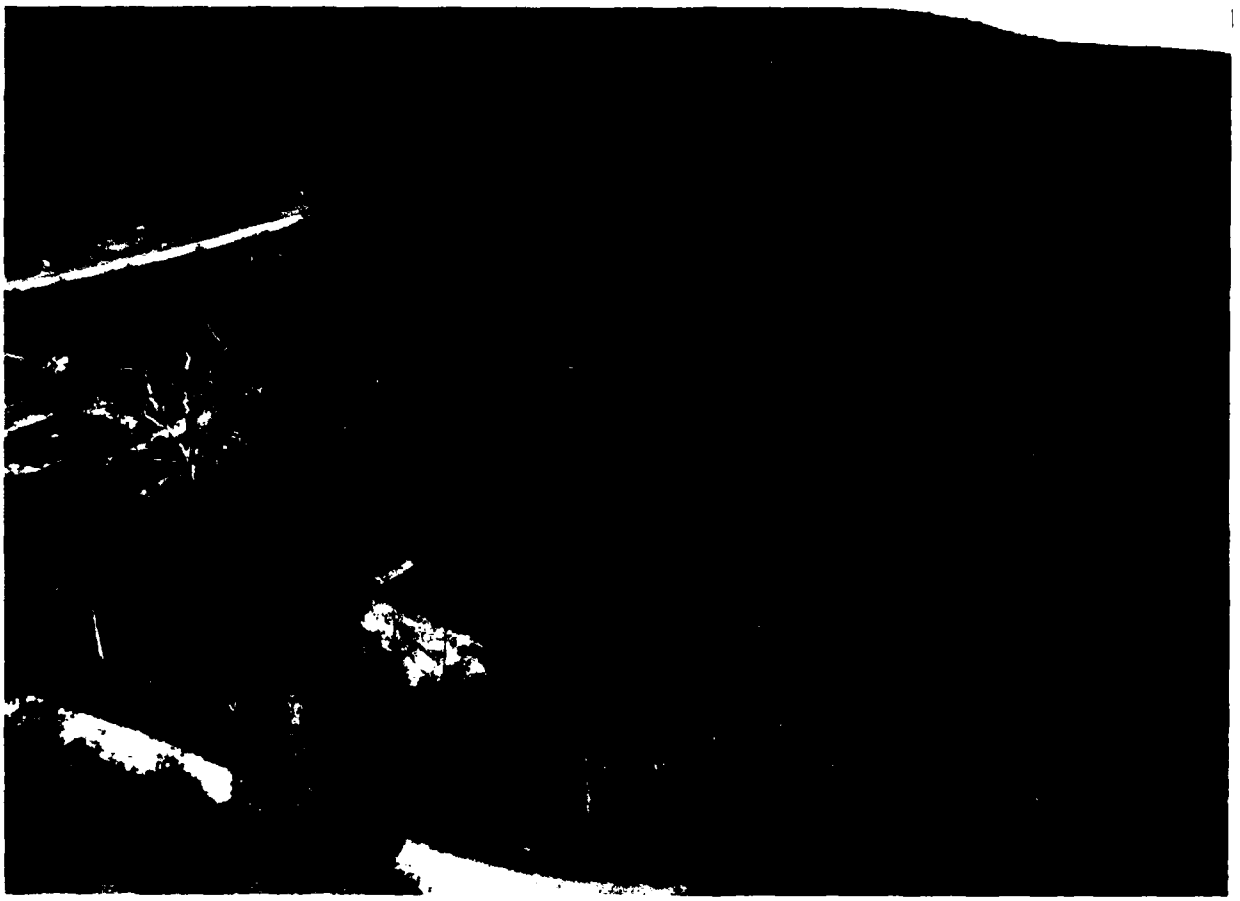
It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through 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 Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable 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 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.

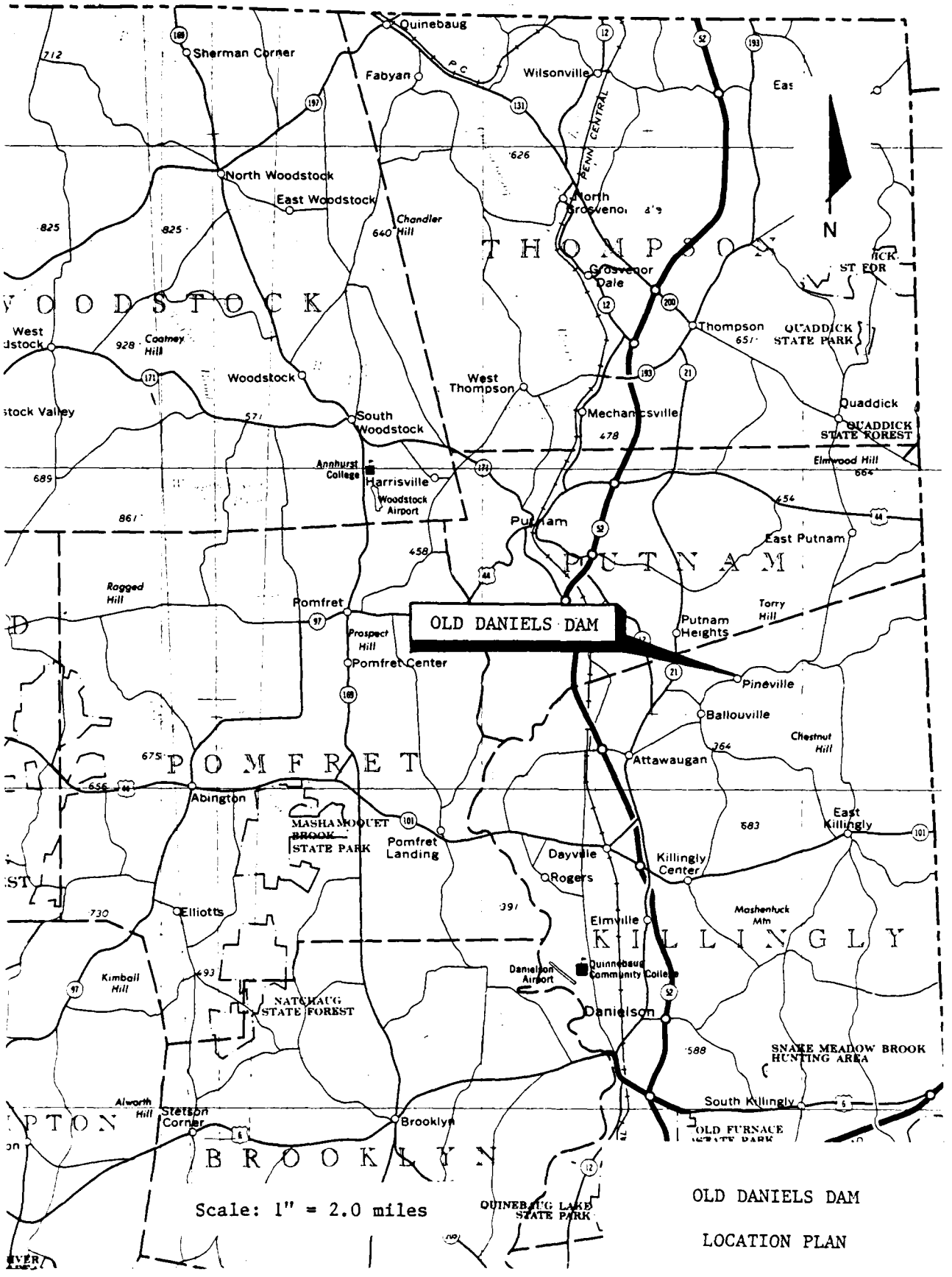
The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of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

TABLE OF CONTENTS

APPENDICES



OVERVIEW PHOTO - Old Daniels Dam



Scale: 1" = 2.0 miles

OLD DANIELS DAM

LOCATION PLAN

PLATE NO. 1

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

OLD DANIELS DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. 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. CE Maguire, 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 CE Maguire, Inc., under a letter from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-80-C-0013 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection.

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. Old Daniels Dam is located in the Town of Killingly, Windham County, Connecticut, at the intersection of River Road and Putnam Road. Coordinates of the dam are approximately 41°51.9'N Latitude and 71°51.1'W Longitude. The dam impounds water from Five Mile River which drains a 51.2 square mile watershed of rolling terrain. The axis of the dam is oriented in a northwest-southeast alignment with the impoundment to the north-east.

b. Description of the Dam and Appurtenances. The dam is approximately 346 feet in length (including the overflow spillway), about 18 feet high, and is an earth embankment structure. The spillway is constructed of field stone masonry with a concrete capped weir section and is approximately 112 feet long. The spillway is located approximately 78 feet from the left dam abutment. The outlet works consists of a manually operated triple gated intake structure and concrete lined arch culvert headrace which presently discharges into Five Mile River approximately 155 feet downstream from the dam. The outlet works gate structure is located approximately 30 feet from the right spillway abutment.

c. Size Classification.

Old Daniels dam has an impoundment capacity at the top of the dam (elev. 361.0 feet N.G.V.D.) equal to 272 Ac-Ft. and a height of 18 feet. Guidelines established by the Corps of Engineers, indicate that both the height and storage for this dam classify it as a SMALL size structure.

d. Hazard Classification.

This dam is classified as a SIGNIFICANT hazard potential structure because its failure could result in loss of a few lives, inundation to 1-2 dwellings, 2 roads, one industrial structure, and may cause disruption to public utilities. Water depths at the inundated dwellings and industrial structure may range from 1 to 2 feet from the dam failure flow. It is estimated that the failure discharge of 6748 CFS will travel downstream through Five Mile River streambed with high velocities. Total water depths may range from 10-11 feet at a distance of 5,000 feet. See Appendix D for additional data.

e. Ownership. Old Daniels Dam is owned by Sactchidananda Ashram - Yogaville, Inc., P. O. Box 108, Pomfret Center, Connecticut 06259.

f. Operator. There are no operating personnel at the site. Any request for information should be through Brother Screta at the above address or telephone 203/974-1045.

g. Purpose of Dam. The impoundment at Old Daniels Dam is used for recreation.

h. Design and Construction History. There are no records of construction for Old Daniels Dam. The dam was reportedly constructed about 1880. Repairs to the outlet works gates were completed in 1964. There are no other records of repairs available for the dam.

i. Normal Operating Procedures. The water level is normally uncontrolled and allowed to discharge over the spillway crest. There are no operating procedures, therefore, for this dam.

1.3 Pertinent Data

a. Drainage Area.

The Old Daniels Dam drainage basin encompasses the northern reaches of the Five Mile River and extends into the following communities; Putnam, Killingly and Thompson, Connecticut; Glocester and Burrillville, Rhode Island; and Douglas, Massachusetts. The basin is generally rectangular in shape with a length of 8 miles, a width of 7 miles, and a total drainage area of 51.2 sq. miles) (See Appendix D for Basin Map). Approximately 10% of the watershed (5.12 sq. miles) is swampy or occupied by water storage reservoirs. The topography is generally flat with elevations ranging from a high of 610.0 feet NGVD to 358.0 feet at the spillway crest. Basin slopes being 0.01 to 0.015 feet per feet are generally flat. The time of concentration of the entire watershed is more than 3 hours and is relatively large, thus reducing the probability that all surface runoff will peak simultaneously at the reservoir site during a high intensity rainfall event. In addition, the large amount of storage areas within the watershed tend to moderately dampen and attenuate the peak flow.

b. Discharges at Damsite. Limited discharge data is available for this dam. The estimated extreme freshet recorded in the files of Connecticut Department of Environmental Protection for this dam is equal to 1,460 CFS. Listed below are other discharge data for spillway and outlet works.

1. Outlet Works

Control Gates Size	Three 3.5' W x 4.0'H Invert elev.350.4 feet (NGVD)
Outlet Conduit	7.3'W x 7.6'H concrete lined stone masonry arch.
i). Discharge capacity	490 CFS at spillway crest elev. 358.0
ii). Discharge capacity	600 CFS @ top of dam elev. 361.0
iii). Discharge capacity	700 CFS @ test flood elev. 364.53

2.	Maximum known flood at damsite	1460 CFS (March 1968)
3.	Ungated spillway capacity at top of dam	1920 cfs
4.	Ungated dam overflow capacity at test flood elevation	10,150 CFS
5.	Gated spillway capacity at normal pool elevation	N/A
6.	Gated spillway capacity at test flood elevation	N/A
7.	Total spillway capacity at test flood elevation	N/A (Dam overtopped)
8.	Total project discharge at top of dam	2,520 CFS
9.	Total project discharge at test flood elevation	10,850

c. Elevations (ft. above NGVD)

1.	Streambed at toe of dam	Upstream not observable. Downstream 343.0
2.	Bottom of cutoff	Unknown
3.	Maximum tailwater	Unknown
4.	Recreation pool	358.0
5.	Full flood control pool	Not applicable
6.	Spillway crest	358.00
7.	Design surcharge (Original Design)	Unknown
8.	Top of dam	361.0
9.	Test flood surcharge	364.53

d. Reservoir (Length in feet)

1.	Normal pool	4,000
2.	Flood control pool	N/A
3.	Spillway crest pool	4,000
4.	Top of dam	4,000
5.	Test flood pool	4,000
e.	Storage (acre-feet)	
1.	Normal pool	176
2.	Flood control pool	N/A
3.	Spillway crest pool	176
4.	Top of dam	272
5.	Test flood pool	390
f.	Reservoir Surface (acres)	
1.	Normal pool	32
2.	Flood-control pool	N/A
3.	Spillway crest	32
4.	Test flood pool	32
5.	Top of dam	32
g.	Dam	
1.	Type	Earth embankment
2.	Length (including spillway)	346.0 feet
3.	Height	18 feet
4.	Top Width	Variable
5.	Side Slopes	Variable
6.	Zoning	Unknown

7.	Impervious Core	Unknown
8.	Cutoff	Unknown
9.	Grout Curtain	Unknown
10.	Other	Unknown
h.	Diversion and Regulating Tunnel	N/A
i.	Spillway	
1.	Type	Concrete & stone masonry uncontrolled vertical overflow
2.	Length of weir	112 feet
3.	Crest elevation	358.0 feet
4.	Gates	None
5.	U/S Channel	Straight approach natural stream bed
6.	D/S Channel	Natural stream bed
7.	General	Immediately downstream stone masonry bridge abutments (Putnam Road Bridge) 32 feet wide x 17 feet high are quite restrictive to river flows.

j. Regulating Outlets

Refer to paragraph 1.2b "Description of Dam and Appurtenances, Pg. 1-2 for description of outlet works

1.	Invert	349.6 D.S. 350.4 U.S.
2.	Size	7.3 feet wide x 7.6 feet high concrete lined arch culvert with three -3.5'W x 4.0'H gates

3.	Description	Gated stone masonry concrete lined arch culvert
4.	Control Mechanism	Three manually operated 3.5 W x 4 H feet wooden gates
5.	Other	---

SECTION 2

ENGINEERING DATA

2.1 Design Data

No design data is available for this dam.

2.2 Construction Data

No record of original construction is available for this dam. Some correspondence pertaining to minor repair work for the gates and appurtenances since July 1963, 1964, and 1966 is available and has been included in Appendix B.

2.3 Operation Data

No records are maintained of gate operation.

2.4 Evaluation of Data

a. Availability. There are no plans, specifications, or computations available from the Owner regarding the design of this dam. Limited correspondence pertaining to repair work and field inspections were available from the State of Connecticut, Department of Environmental Protection.

b. Adequacy. 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 visual inspection, past performance, and sound engineering judgment.

c. Validity. The validity of the limited data must be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase 1 Inspection of Old Daniels Dam was performed 2 April 1980 by representatives of CE Maguire, Inc. and Geotechnical Engineering, Inc.

Based on the visual inspection, history, and general appearance, the Old Daniels Dam and its appurtenances are judged to be in FAIR condition.

b. Dam. The dam is an earth embankment structure with an overflow spillway located toward the left dam abutment. The total length of the dam including the 112-foot spillway is 346 feet.

The dam is divided into three sections by the spillway and gated headrace (see Plate B-1).

The upstream slope to the left of the spillway is covered with brush and trees of up to 14 inches in diameter. It appears that, at one point in time, the upstream face of the embankment slope was protected by a vertical stone masonry wall. A portion of this wall can be seen in Photo C-3 and, as shown in the photo, the wall is leaning slightly toward the Reservoir. Other remains of the wall can be seen along the upstream waters edge. The upstream slope is very irregular and in some locations sloughing has produced a nearly vertical face.

The upstream slope which is located between the right spillway abutment and the right headrace abutment is grass covered and faced with a vertical stone masonry wall. There are many dislodged stones, but generally this section is in fair condition.

The section of the upstream slope to the right of the headrace is grass covered and very irregular. Several trees and some light brush cover a small area of the embankment. Portions of the slope are faced with the remains of a stone masonry wall. The face of the wall appeared to be very irregular beneath the water surface and is partially collapsed at several locations where wave action has eroded the exposed slope.

The embankment crest to the left of the spillway is grass covered with a typical crest width of 14 feet. Trespassing has removed the grass cover in some areas (see Photo C-1). Runoff from the crest has caused some soil to wash out from behind the stone masonry wall on the upstream slope (see Photo C-3).

The crest of the dam embankment to the right of the spillway structure is grass covered and very wide. Several large diameter trees are growing on the crest. Elevations on this side of the crest vary approximately 1.5 feet lower than the crest elevations to the left of the spillway.

The downstream slope at the left of the spillway is very irregular and is covered with heavy brush and trees up to 20 inches in diameter (see Photo C-1).

The downstream slope at the right of the spillway is down to the watershed uneven and grass covered with some growth of thick brush and trees down to the waterline. Seepage was not noticed on the embankment slope. Water overflowing the spillway made it impossible to examine the right training wall for seepage.

c. Appurtenant Structures.

1. Spillway and Training Walls. The natural stream channel forming the approach channel to the spillway was submerged and could not be inspected during the field investigation of the dam.

   The left downstream training wall of the spillway exhibited local bulging and tipping near the toe of the spillway. Several stones have been dislodged and soil from behind the wall has eroded to produce local depressions. (See Photo C-12).

2. Outlet Works. The outlet works consists of a headrace with a manually operated triple gated 7.5-foot diameter concrete lined stone masonry arch culvert located approximately 30 feet from the right spillway abutment. The timber control gates are approximately 3.5 W x 4 H feet each and were reportedly rehabilitated in 1964. Some leakage of the gates was noted during the field inspection of the dam (see Photo C-10 taken from within the arch culvert). The arch culvert is approximately 155 feet in length. Discharges through the culvert flow some over foundation ruins and finally into Five Mile River approximately 250 feet from the toe of the spillway.

   The concrete lined arch conduit once served as a source of power for a mill located some distance downstream. The original length of the conduit was apparently about 372 feet. The outlet conduit, now however, has been shortened by the construction of a masonry bulkhead. Flows now discharge at a point approximately 155 feet below the dam, through the sidewall of the culvert tunnel.

The overall appearance of the conduit (see Photo C-9) is fair. Several areas along the joint between the sidewalks and floor slab of the conduit have been eroded from scour and water was observed to flow or seep out before reaching the outlet. Spalling and cracking of the concrete in the conduit and exposed reinforcement were observed. The left and right sidewalls of the intake structure also showed general deterioration (see Photo C-8). The exposed concrete on the gate structure appeared to be in good condition.

d. Reservoir Area. No specific detrimental features in the reservoir area were observed during the visual inspection. The slopes of the shoreline are well covered with trees and brush to preclude sloughing of shoreline materials.

e. Downstream Channel. The spillway discharge channel consists of the natural stream bed of the Five Mile River. The left and right banks of the channel immediately downstream from the toe of the spillway are stone walls which extend downstream to the Putnam Road Bridge, approximately 76 feet from the spillway crest (see Photo C-7). The approximate dimensions of the bridge opening are 32 feet wide (bridge abutment to bridge abutment) by 17 feet high (stream bed to the low cord of the bridge). There is a small island of large trees and brush located at the toe of the spillway. Numerous trees overhang the discharge channel downstream of the Putnam Road Bridge. The superstructure of the bridge was eroded and in disrepair.

3.2 Evaluation

Based on visual observation, the dam is judged to be in fair condition with several areas which require attention:

a. Lack of slope protection on the upstream slopes left and right of the spillway could lead to erosion of the upstream slopes and crest of the embankment.

b. Trees on the upstream and downstream slopes could be uprooted during storms, leaving depressions that may encourage further erosion of the slopes. Continued growth of tree roots could provide paths of seepage through the embankment.

c. Trees growing adjacent to the top of the downstream spillway channel walls could dislodge or displace stones in that wall as the root development increases.

d. Continued collapse of the left downstream channel wall could reduce the stability of the downstream slope of the embankment left of the spillway and encourage sloughing into the downstream channel.

e. A detailed examination of the spillway should be made during a low flood period.

SECTION 4

OPERATIONAL & MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. The water level at Old Daniels Dam is generally uncontrolled. All discharges pass over the uncontrolled spillway with the outlet works gates closed. As a rule, the outlet gates are opened only for repair work.

b. Description of Any Warning System in Fffect. No warning system is in effect for this dam.

4.2 Maintenance Procedures

a. General. There is no specific maintenance program for this dam.

b. Operating Facilities. The operating gates of the outlet works were reportedly rehabilitated in 1964. There is no scheduled maintenance program for Old Daniels Dam, but rather maintenance is generally undertaken on an as-needed basis.

4.3 Evaluation

There is no regularly scheduled maintenance program. A systematic and complete inspection and maintenance program should be developed and instituted at the dam. An Emergency Action Plan also needs to be developed and implemented that will provide the Owner with adequate time to respond to critical situations.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General.

The Old Daniels Dam is located on Five Mile River at the intersection of Putnam Road and River Road, in the Town of Killingly, Connecticut. The watershed for the reservoir is equal to 51.2 square miles with approximately 10 percent of this basin natural storages and swamp. There is a gaging station located downstream from the dam approximately 3 miles.

The dam has a spillway length of 112 feet and a surcharge height of 3.0 feet. The total length of the dam is 346 feet. The reservoir has a storage capacity at the spillway crest level of 176 Ac-Ft. and can accommodate 0.64 inches of runoff from the watershed. Each foot of depth in the reservoir above the spillway level can accommodate 32 Ac-Ft. of volume of water equivalent to 0.12 inches of runoff.

Because the dam has only 96 Ac-Ft. of surcharge storage available, it is considered a small storage facility. With a maximum spillway capacity equal to 1,920 CFS, which is 19 percent of the "test flood" outflow, the dam is a low spillage facility. Since the embankments are earth, it is considered less stable against overtopping and erosion.

5.2 Design Data.

No specific design data is available for this watershed or structure at Old Daniels Dam. In lieu of existing design information, U.S.G.S. Topographic Maps (Scale 1" = 2,000') were utilized to develop hydrologic parameters such as drainage areas, reservoir surface areas, basin slopes, time of concentration, and other runoff characteristics. Elevation/storage relationships for the reservoir were approximated. Surcharge storage was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic data was obtained and/or confirmed by actual field measurements at the time of visual field inspection.

Test flood inflow/outflow values and dam failure profiles were determined in accordance with the Corps of Engineers guidelines. Final values in this report are approximate and are no substitute for actual detailed analysis.

5.3 Experience Data.

No historical data for recorded discharges or water surface elevations are available for this dam or the watershed. Gage data for the U.S.G.S. gaging station located approximately 3.0 miles downstream of the dam can be obtained from U.S.G.S. Connecticut, telephone 203/244/2528. The U.S. Geologic Survey list for gauge # 01126000 Five Mile River at Killingly, Connecticut, the maximum discharge for the period of record 1938-1979 is 2480 CFS occurring July 24, 1938.

5.4 Test Flood Analysis.

Recommended guidelines for Safety Inspection of Dams by the Corps of Engineers were used for selection of the "Test Flood". This dam is classified under those guidelines as a SIGNIFICANT hazard and SMALL in size. Guidelines indicate that a 100-year to half PMF storm event be used as a range of test floods for such classification. The watershed has a total drainage area equal to 51.2 square miles of which 5.12 (10 percent) is swampy or covered by natural storages. This drainage area is sparsely populated, mostly wooded, and generally flat with rolling terrain. Basin slopes average 0.02 feet/feet and are considered flat. The watershed was classified as coastal flat. A test flood equal to one-half the PMF was calculated to be 200 CSM, equal to 10,240 CFS for a drainage area of 51.2 square miles. The outflow discharge for the test flood inflow was 10,150 CFS. The spillway and outlet rating curves are illustrated in Appendix D. Flood routings were performed with the assumed initial condition of full reservoir (at spillway crest elevation).

The analysis indicates that the spillway capacity is hydraulically inadequate to pass the test flood. The routed test flood would overtop the dam by approximately 3.53 feet assuming the overflow length of dam was 234 feet. The inflow and outflow discharge values for this test flood are 10,240 CFS and 10,150 CFS, respectively. The maximum outflow capacity of the spillway without overtopping the dam is 1,920 CFS which is only 19 percent of the test flood outflow.

At the spillway crest elevation of 358.0 feet, the capacity of the outlet structure is 490 CFS. It will require one hour to lower the reservoir level the first foot assuming a pool surface area of 32 acres. For the total 196 Ac-Ft. of available storage below the spillway crest, it will require one half day to drain this reservoir.

5.5 Dam Failure Analysis

For this analysis, a full depth - partial width (41.0 feet) breach was assumed to have occurred in this dam. This will result in an unsteady flow condition that produces a flood wave that travels

downstream through the valley as well as a reflective wave that rebounds in the reservoir and reinforces the downstream surge.

The calculated dam failure discharge of 6,798 CFS assumes the reservoir is full at the top of dam just prior to failure, and will produce an approximate water surface level of elevation 351.5 immediately downstream from the dam. This will raise the water surface approximately 6.0 feet over the depth just prior to failure when the discharge is 1,920 CFS. The estimated damage reach extends downstream 5,000 feet where normal uniform flow would occur. The failure could result in the loss of a few lives, inundation of 1-2 dwellings and one industrial building, potential damage to 2 roads (Putnam Road and River Road), and disruption of public utilities within the rights of way of the roadways. Water depths from the dam failure flow at the inundated structures will range from 1 to 2 feet.

It is estimated that total water depths would average 10.8 feet and that velocities of flow could cause erosion, stripping of vegetation, and additional damage from debris impact. The prime impact area has been estimated, if the dam were to fail, and has been delineated on a U.S.G.S. quadrangle map in Appendix D. As a result of the failure analysis, the dam has been classified as a SIGNIFICANT hazard structure.

OLD DANIELS DAM

Inflow, Outflow and Surcharge Data

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR* EFFECTIVE RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE HEIGHT IN FEET	SURCHARGE STORAGE ELEVATION
100	7.0	4.6	3584	3400	3.90	361.90
½ PMF = Test Flood	11.9	9.5	10240	10150	6.53	364.53

*Infiltration assumed as 0.1"/hour
**Lake assumed initially full at spillway crest elevation 358.0
(top of dam = 361.0)

NOTES:

1. Q_{100}; inflow discharges were computed by the approximate methodology of the Soil Conservation Service.
2. ½ PMF and "test flood" computation based on COE instructions and guidelines.
3. Maximum capacity of spillway without overtopping the top of the dam elevation (361.0) is equal to 1,920 C.F.S.
4. All discharges indicated are dependent upon the continued integrity of upstream storage reservoirs.
5. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.
6. Test flood = Half PMF = 200 CSM = 10,240 CFS (D.A. = 51.2 square miles).

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The visual observations did not disclose any evidence of present structural instability except for the local collapse of a portion of the stone wall that forms the downstream left training wall of the spillway. Conditions observed that may lead to future structural instability include:

1. Continued erosion of the upstream slopes of the earth embankments due to lack of slope protection.

2. Presence of trees on the slopes of the earth embankments and spillway training walls that by uprooting during storms or by continued root development cause the failure of the structure.

6.2 Design and Construction Data

No design or construction drawings or records for the embankment or spillway are available.

6.3 Post-Construction Changes

Repair to the wooden low-level gates are indicated to have been completed in an inspection report dated September 4, 1964.

6.4 Seismic Stability

The dam is located in Seismic Zone 1, and in accordance with the Recommended Phase 1 Guidelines does not warrant seismic stability analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Assessment

a. Condition. Based on the visual inspection, the dam appears to be in FAIR condition. There are several features that could adversely affect the condition of the dam in the future:

1. Lack of riprap protection on the upstream slopes.

2. Trees on the embankment slopes and adjacent to the stone training walls of the spillway discharge channel could dislodge stones or cause the collapse of the walls from further root development or uprooting during storm activity.

3. The partly collapsed stone wall on the left bank of the spillway discharge channel which could increase sloughing and further collapse of the wall, especially during high water.

b. Adequacy of Information. The available information is such that the assessment of the condition of the dam must be based on visual observation only.

c. Urgency. The recommendations and remedial measures described below should be implemented by the Owner within one year after receipt of the Phase 1 report.

7.2 Recommendations

The following items should be undertaken under the direction of a qualified registered engineer and recommendations resulting from any analyses should be implemented by the Owner.

a. Design and place riprap on upstream slopes of the embankment.

b. Remove trees growing on the embankment slopes and backfill root depressions with appropriate compacted soils.

c. Cut all trees growing within 20 feet of the stone walls forming the sidewalls of the spillway discharge channel from the spillway to the Putnam Road Bridge.

d. Repair all sections of the stone sidewalls forming the banks of the spillway discharge channel where large voids or irregularities exist and where the walls are partly collapsed.

e. Inspect the spillway when there is minimum or no flow.

f. Perform detailed hydrologic and hydraulic investigations to further assess the need for and means to increase the project discharge capacity.

7.3 Remedial Measures

a. Operation and Maintenance Procedures.

1. Clear brush, vines and trees on the downstream and upstream slopes.

2. Institute a program of annual technical inspection by a qualified registered engineer.

3. Develop a system for the recording of data with regard to items such as water levels, discharges, time and drawdown to assist those responsible for the monitoring of the structure.

7.4 Alternates

There are no recommended alternates to the recommendations discussed above.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Old Daniels Dam

DATE April 2, 1980

TIME 9:00 A.M.

WEATHER Cloudy 40°F

W.S.ELEV. 358.85 U.S. 343.5 D.S.

PARTY:

1. A. Reed, CEM
2. L. Topp, CEM
3. R. Brown, CEM
4. E. Dessert, CEM
5. G. Castro, GEI
6. R. Stetkar, GEI
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT Old Daniels Dam DATE April 2, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	358.0
Current Pool Elevation	358.85
Maximum Impoundment to Date	Unknown. March 18 & 19, 1968 - 2½ feet of water over spillway (5 inches freeboard).
Surface Cracks	None observed.
Movement or Settlement of Crest	Too irregular to judge.
Lateral Movement	Too irregular to judge.
Vertical Alignment	Too irregular to judge.
Horizontal Alignment	Too irregular to judge.
Condition at Abutment and at Concrete Structures	Some erosion behind left training wall of spillway.
Trespassing on Slopes	Some on crest of left embankment - more observed on right embankment.
Sloughing or Erosion of Slopes or Abutments	Erosion at water level on upstream slope of left embankment. No significant erosion on right embankment.
Rock Slope Protection - Riprap Failures	No slope protection.
Unusual Movement or Cracking at or Near Toe.	None observed.
Unusual Embankment or Downstream Seepage	None observed.
Piping or Boils	None observed.

PERIODIC INSPECTION CHECKLIST

PROJECT Old Daniels Dam DATE April 2, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT (Cont.)	
Foundation Drainage Features	None observed
Toe Drains	None observed.
Instrumentation System	None observed.

PERIODIC INSPECTION CHECKLIST

PROJECT Old Daniels Dam DATE April 2,1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Flat, natural bed of Five Mile River.
Bottom Conditions	Earth
Rock Slides or Falls	None observed.
Log Boom	None
Debris	None
Condition of Concrete Lining	None
Drains or Weep Holes	None
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	Gates rehabilitated in 1964 appear in good condition ; some leakage at seats.

PERIODIC INSPECTION CHECKLIST

PROJECT Old Daniels Dam DATE April 2, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONDUIT	Conduit 7.5'H x 7.25'W concrete arch, flat invert. Concrete stone masonry faced with concrete.
General Condition of Concrete	Fair
Rust or Staining on Concrete	None observed.
Spalling	Yes, near invert at sidewalls.
Erosion or Cavitation	None observed.
Cracking	None observed.
Alignment of Monoliths	Good alignment.
Alignment of Joints	Good alignment.

PERIODIC INSPECTION CHECKLIST

PROJECT Old Daniels Dam DATE April 2, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Poor
Rust or Staining	None observed
Spalling	Base slab - right training wall eroded.
Erosion or Cavitation	None
Visible Reinforcing	Yes, through crown where holes were opened.
Any Seepage or Efflorescence	Flow in arch from gates not observable.
Condition at Joints	Good
Drain Holes	None
Channel	Natural streambed of Five Mile River.
Loose Rock or Trees Overhanging Channel	Numerous
Condition of Discharge Channel	Overgrown with vegetation and loose stone.

PERIODIC INSPECTION CHECKLIST

PROJECT Old Daniels Dam DATE April 2, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	Spillway crest length 112 ft.
a. Approach Channel	Natural bed of Five Mile River, Straight.
General Condition	Good
Loose Rock Overhanging Channel	None observed,
Trees Overhanging Channel	Many along streambank of river.
Floor of Approach Channel	Earth
b. Weir and Training Walls	Right abutment 3.5'H Left abutment 2.4'H
General Condition of Masonry	Dislodged, portion tilted into river.
Rust or Staining	None
Spalling	Facing of ogee partially spalled,
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None observed. Flow over weir.
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Many
Floor of Channel	Natural streambed.
Other Obstructions	Putnam Road Bridge opening 77 ft. downstream. Opening 32'W x 17'H. Large trees growing at downstream toe of spillway.

APPENDIX B

ENGINEERING DATA

APPENDIX B-1

Correspondence pertaining to the history, maintenance, and modifications to the Old Daniels Dam as well as copies of past inspection reports are located at:

State of Connecticut
Department of Environmental Protection
State Office Building
165 Capitol Avenue
Hartford, Connecticut
Attention: Mr. Victor J. Galgowski,
Dam Safety Engineer

APPENDIX B-2

SELECTED COPIES OF PAST INSPECTION REPORTS

★ THINK CASH! Send in a suggestion. You could win an award! ★
Send your suggestion to: *Employees' Suggestion Awards Program, 165 Capitol Ave., Hartford, 06115.*

Interdepartment Message

STO-201 REV. 3/77 STATE OF CONNECTICUT
Stock No. 6938-051-01)

SAVE TIME: *Handwritten messages are acceptable.*
Use carbon if you really need a copy. If typewritten, ignore faint lines.

	NAME	TITLE	DATE
To	Victor F. Galgowski	Supt. of Dam Maintenance	23 May 1978
	AGENCY	ADDRESS	
	Water Resources Unit		
	NAME	TITLE	TELEPHONE
From	Charles J. Pelletier	Consultant	
	AGENCY	ADDRESS	
	Environmental Protection		

SUBJECT

Old Daniels Dam, Killingly 5

This dam was inspected on May 19, 1978. The estimated flow at the time of inspection was about 200 c.f.s. The spillway is masonry with a concrete cap and is about 120' long. The training walls at the ends of the spillway are about 3.7 feet above the spillway crest. This spillway has an estimated capacity of about 2250 c.f.s. with no freeboard or about 1255 c.f.s. with one foot of freeboard. Referring to Part 1 of the Water Resources Inventory of Connecticut, the 100 year or 5 x mean annual flood, on this stream (Five Mile River) is about 3000 c.f.s. at the gage where the drainage area is 58.2 square miles. Drainage area at this dam is 51.2 square miles. The spillway capacity (no freeboard) is less than Q 100.

There is a short earth embankment at the south end of the spillway and a larger section north from the spillway. There are two low areas in the northerly embankment - both about 3.1 feet above the spillway. The estimated Q 100 = 2700 c.f.s. would overtop the dam in these areas by about 0.5 feet. One of these overflows is to the north and then west along the adjacent town road. The other is west across the dam where the dam section has a broad flat top. It is unlikely that overflows would cause a substantial failure of this dam.

There is a forebay and gate structure in the northerly earth section which discharges through a concrete conduit. The conduit extends about 100 yards to the northwest. Water passing through the gate is being discharged through an opening in the side of the conduit on the west side of Putnam Road. A small building is located on the end of the conduit and some part of the conduit appears to have been converted for human occupancy.

The spillway is about 17 feet above the downstream channel. The masonry in the spillway could not be observed because of the flow. The masonry training walls at the ends of the spillway appear to be in satisfactory condition except for the section at the south end of the spillway opposite the toe of the spillway. Masonry at this point is partially collapsed.

The gate structure appears to be in good condition, however, the concrete sides of the forebay are in poor condition.

SAVE TIME: *If convenient, handwrite reply to sender on this same sheet.*

The risk of failure of this dam with sudden release of a large volume of water is low. However, it would be desirable to do some work and make some changes to improve the structure.

1. The most important work to be done is the restoration of the training wall at the south end of the dam.

2. Trees on and adjacent to the southerly earth embankment should be removed to ground level.

3. The earth embankment should be raised to eliminate the low points and provide a one foot freeboard above the 100 year flood. The embankment south from the spillway should be widened at the same time.

4. Concrete in the area of the forebay should be repaired.

The spillway masonry should be inspected at low flow conditions.

Water Resources Unit

CJP:ljk

FORM PUR STO 201

INTERDEPARTMENT MAIL

DATE: April 1, 1968

TO: File

DEPARTMENT:

FROM: William H. O'Brien

DEPARTMENT: Water Resources Commission

SUBJECT: Old Daniels Dam, Killingly (or Warsaw Dam)

On March 27, 1968, at the request of Owen Bell, Town Manager, the undersigned visited the subject dam with Mr. Bell and Irving Owen, Road Foreman.

There were some small trees growing on the east earth abutment and one 18 inch elm on the West side which should be cut down. The downstream face of the spillway has an excellent cover of concrete over what appears to be irregularly laid stones to create a splashing effect.

The storm of March 18th and 19th, 1968, created more run-off at this location than either the 1938 or 1955 storms according to Mr. Owen. In this March storm there was approximately 2½ feet of water going over the spillway with 5 inches of freeboard. Some stones in the retaining wall on the downstream east side had been displaced. They should be replaced and strengthened.

Mr. Bell is to send me the owner's name and address. We will then write to the owner, with our [redacted] comments.

W. H. O'Brien

William H. O'Brien
Civil Engineer

September 13, 1966

Re: Dam on Five Mile River

Mr. Thomas Young
Aspinock Road
Killingly, Connecticut

Dear Sir:-

At your request I made an inspection today of your dam on Five Mile River in Killingly, Connecticut.

This is located 41° 52' 59" North and 71° 51' 3" West on the Thompson Quadrangle of the U. S. Geological Survey.

On July 22, 1963 I made a report on the dam suggesting certain changes and improvements on the gates leading to the sluiceway. These changes were made and are satisfactory.

At the present time the concrete on the walls leading to the gates is in poor condition. This concrete should be removed and replaced with new good concrete with a mix of 1 part cement 2 parts sand and 3 parts gravel.

The stone work on the West abutment wall above the dam needs relaying and repointing. A small section of the top of the dam should have concrete placed on it to hold the stones in place. This is on the West end of dam.

There is one leak on the East side of dam which shows up downstream. I suggest pulling the pond down 2 or 3 feet in depth and trying to seal off the East abutment wall with concrete. At that time an effort should be made to locate the leak and perhaps stop it with several loads of clay or light material.

I do not consider the dam to be in any danger and the above items should be considered as routine maintenance.

The spillway is 120 feet long and abutment on West side is 3 feet high and 4 feet high on West side. This dam is at least 70 years old and has withstood all floods and is in fairly good condition now.

The repair items suggested above are not critical but I think should be done as soon as convenient.

Very truly yours,

B H Flynn

BHP/ew
c.c.: Mr. William P. Sander
State Water Resources Commission

FORM PUR STO 200

INTERDEPARTMENT MAIL

DATE: September 4, 1964

TO: John J. Curry, Chief Engineer	DEPARTMENT: Water Resources
FROM: William P. Sander, Engineer - Geologist	DEPARTMENT: Water Resources

SUBJECT: Old Daniels Dam - Killingly

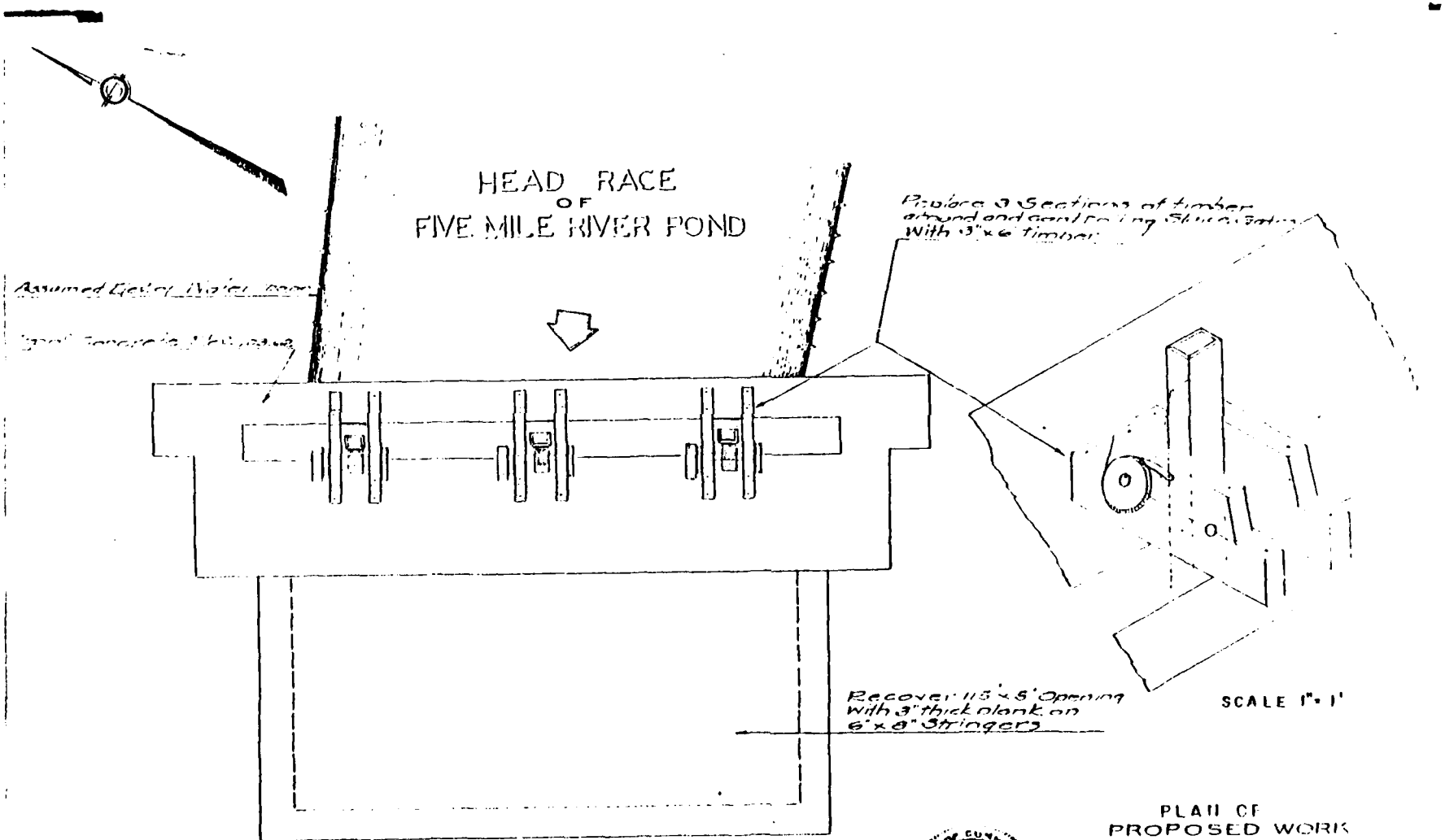
On September 1, 1964, an inspection was made of the recently completed repairs to the above mentioned dam. These repairs were ordered on March 2, 1964 with completion to be by September 2, 1964.

The repairs to the wood gates were found to be according to the approved plan and the entire job was well done.

It is my recommendation that a certificate of approval now be issued for these repairs.

WPS Sander
Engineer - Geologist

WPS:js



PLAN OF
PROPOSED WORK
ON
SLUICE GATES
OWNED BY
THOMAS [illegible]
DANIELSON, CONNECTICUT

BENJAMIN H. PALMER
SHEPARD B. PALMER

CHANDLER & PALMER
CIVIL ENGINEERS
114-116 THAYER BUILDING
TELEPHONE TURNER 7-5640

MEMBERS AMERICAN AND CONNECTICUT SOCIETIES
OF CIVIL ENGINEERS

DAMS
WATER SUPPLIES
SEWERAGE
APPRAISALS
REPORTS
SURVEYS

NORWICH, CONN.

July 22, 1963

State of Connecticut
Water Resources Commission
State Office Building
Hartford 15, Connecticut

ATTENTION: Mr. William P. Sander

Dear Sir:

Referring to your letter of July 18, 1963, I have, today, inspected the dam which is located near Pineville. This is located at 41 degrees 52 minutes 59 seconds North and 71 degrees 51 minutes 03 seconds West on the Thompson Quadrangle.

This dam is known locally as the Old Daniels Dam. It consists of an earth dam with stone step facing on the downstream side. The dam itself is in reasonably good condition although no maintenance work has been done on it for a long time.

On the Westerly side of the dam there are three wooden gates which lead to a concrete sluiceway. These wooden gates are badly rotted and are leaking water quite badly, although the gates are closed. The wooden timbers over the structure are rotted and broken and present a hazard for any persons who might fall into this area. A large six foot diameter concrete sluiceway takes the water under the road and discharges it into the brook downstream.

I consider that the wooden gates and cover over the entrance to the sluiceway present a definite hazard and should be repaired. If the gates fail, they will permit a large amount of water to go downstream very rapidly which might cause trouble downstream. I recommend that the Owner be required to either replace the gates and timber work or else open the gates gradually and release the water in the pond. The concrete work at the sluiceway entrance also needs some corrective work done to it.

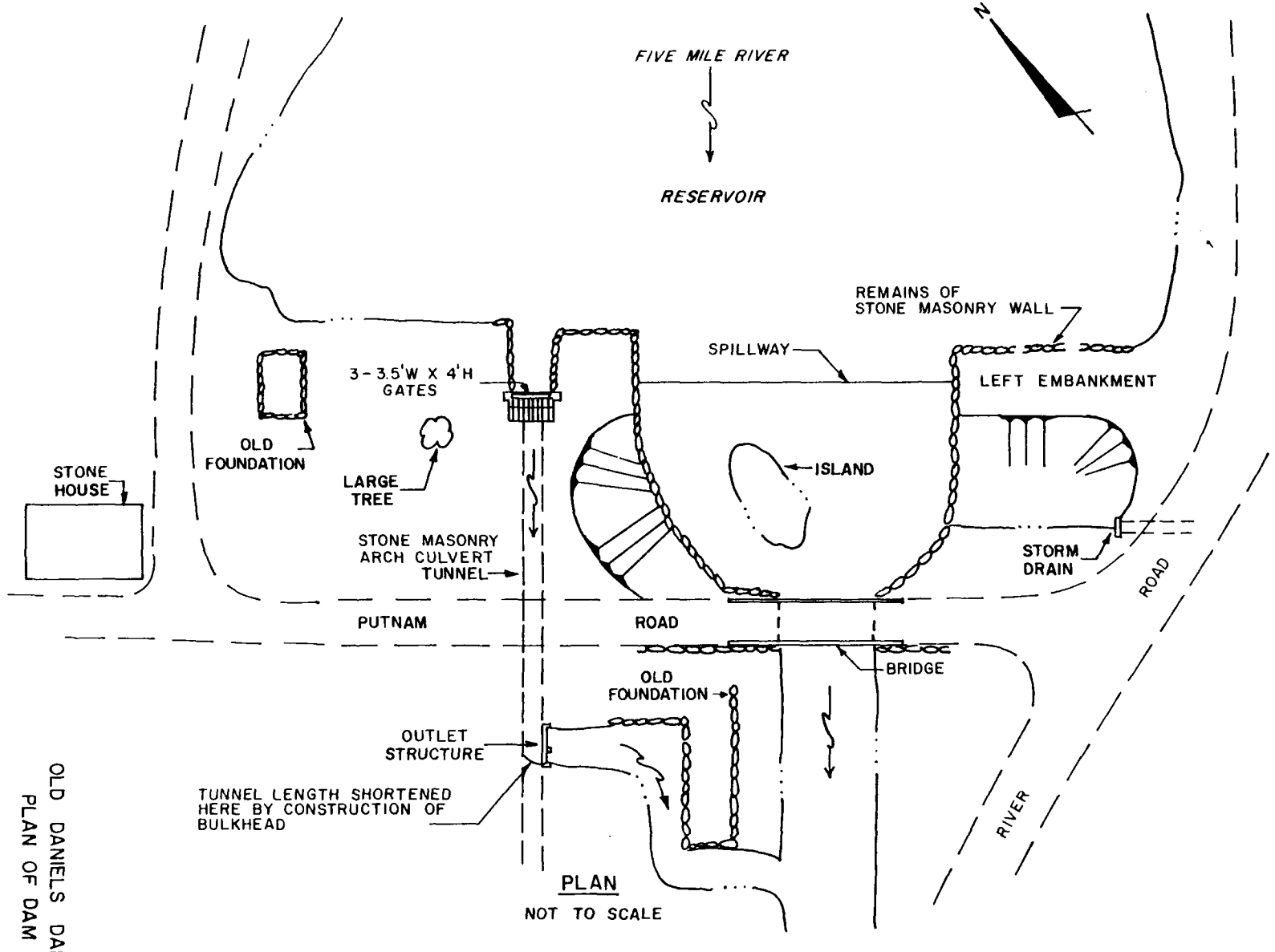
I think that these items should be taken care of at once.

Very truly yours,
CHANDLER & PALMER

B. H. Palmer

APPENDIX B-3

PLANS, SECTIONS AND DETAILS

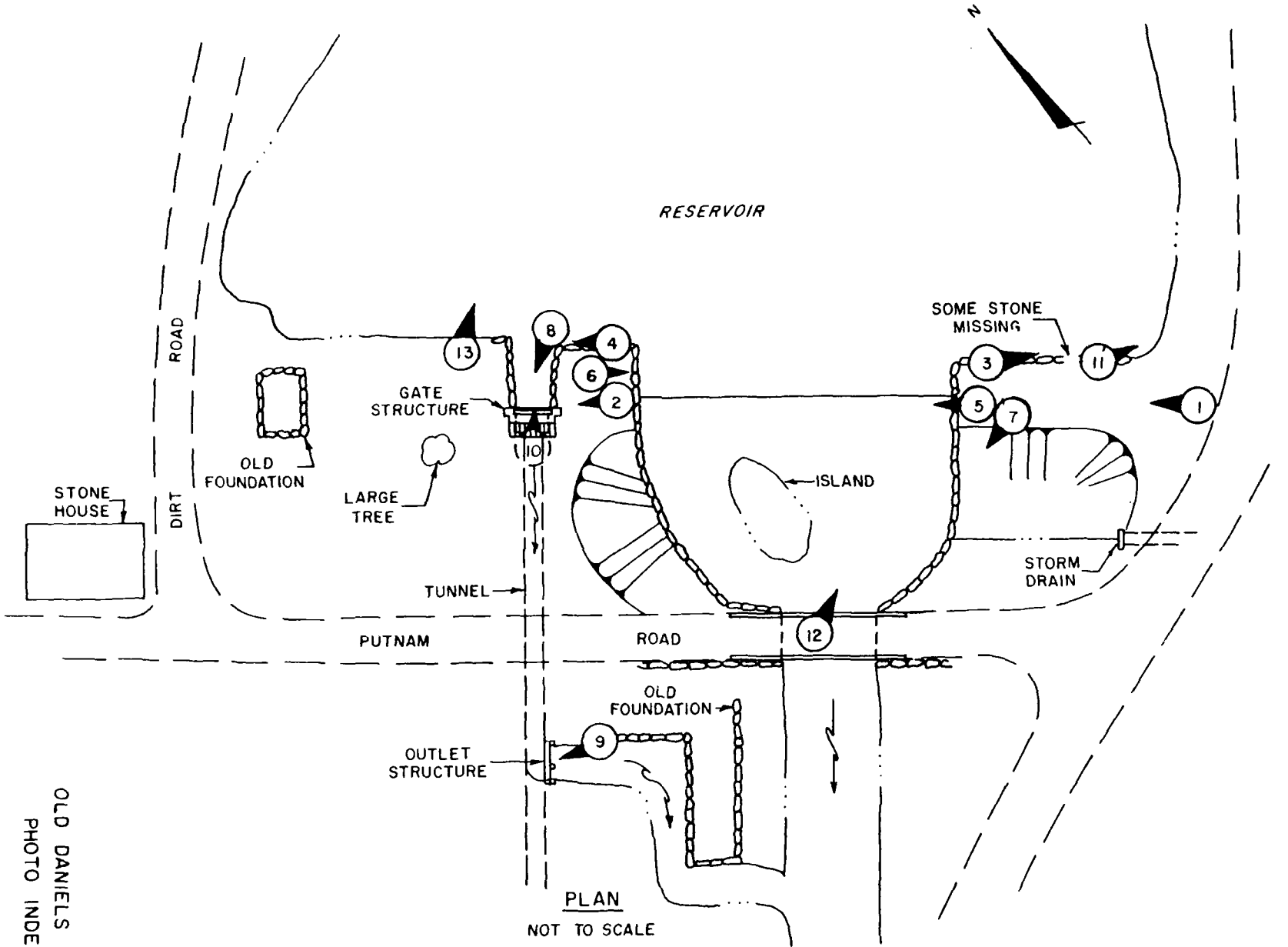


OLD DANIELS DAM
PLAN OF DAM

PLATE B-1

APPENDIX C

PHOTOGRAPHS



PLAN

NOT TO SCALE

OLD DANIELS DAM
PHOTO INDEX

PHOTO C-1 Crest of dam and downstream slope looking from the left dam abutment. Note large trees growing on the slope.

PHOTO C-2 Crest of dam looking from the right spillway abutment.

PHOTO C-3 Upstream slope looking from the left spillway abutment toward the left dam abutment. Note large trees and brush growing on slope and stone masonry wall tilting toward the reservoir.

PHOTO C-4 Upstream slope of dam and headrace looking toward the right dam abutment from the right spillway abutment.

PHOTO C-5 Spillway crest looking from the left spillway abutment.

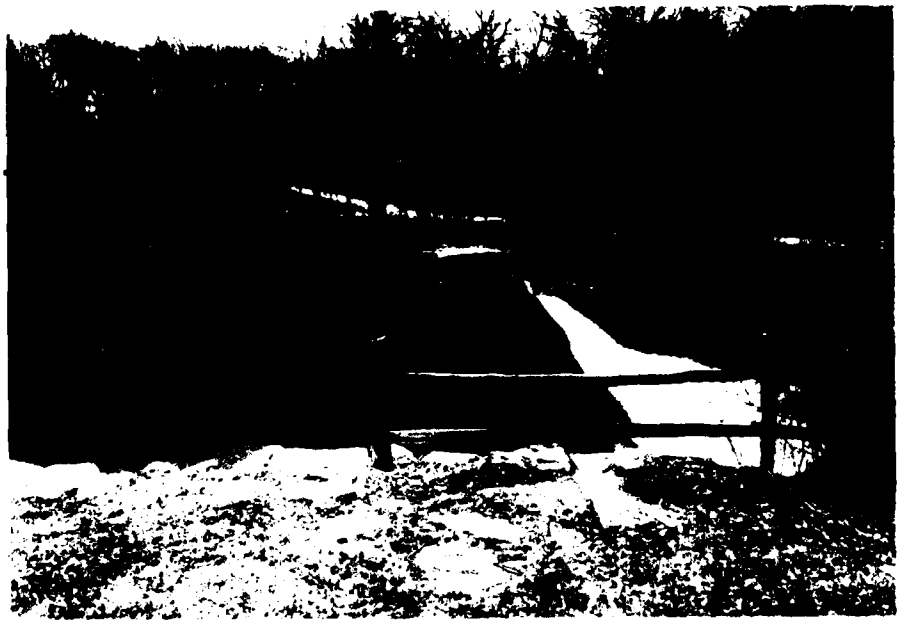


PHOTO C-6 Spillway crest looking from the right spillway abutment.

PHOTO C-7 Spillway discharge channel looking from the left spillway abutment. Note small island with brush and trees right center and narrow bridge opening in background.

PHOTO C-8 Triple gated headrace.

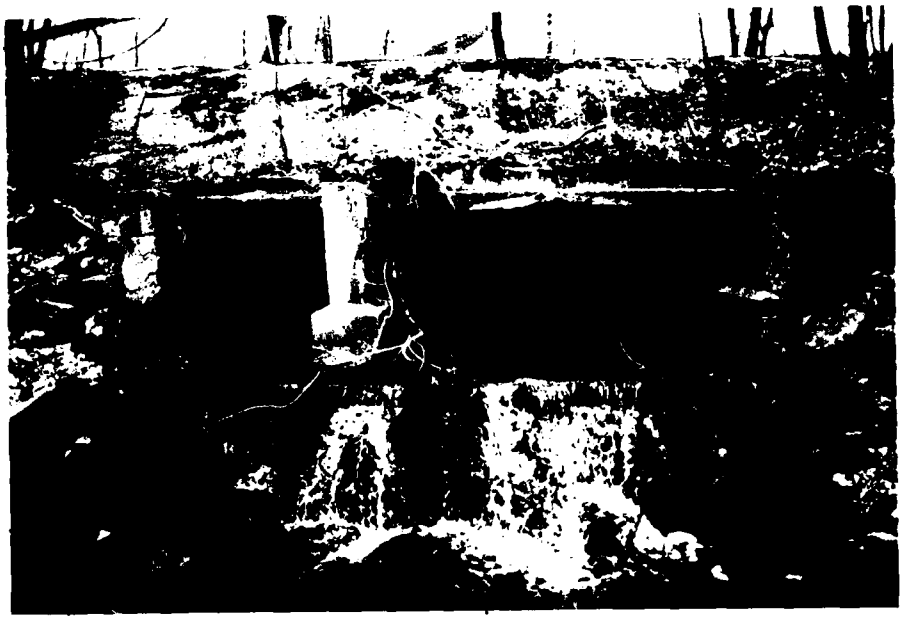


PHOTO C-9 Tailrace outlet chamber.

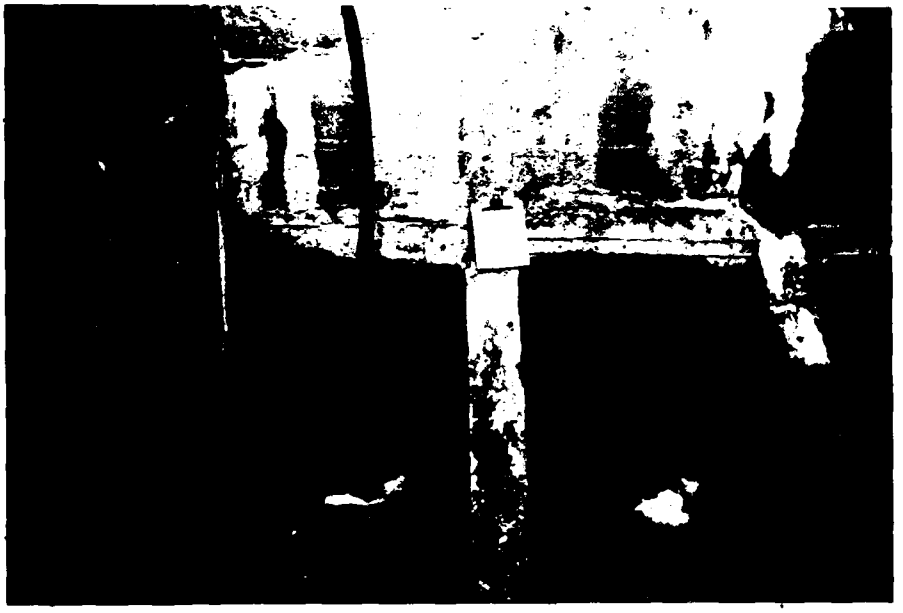


PHOTO C-10 Downstream side of the triple gated headrace intake chamber taken from inside the outlet conduit looking at gates. Note water leaking between wooden gates and concrete seats.

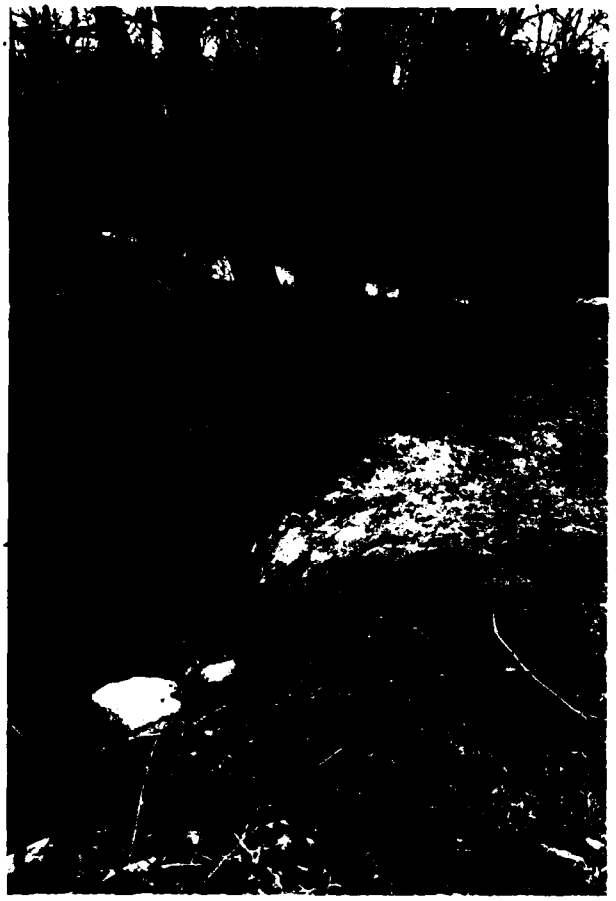


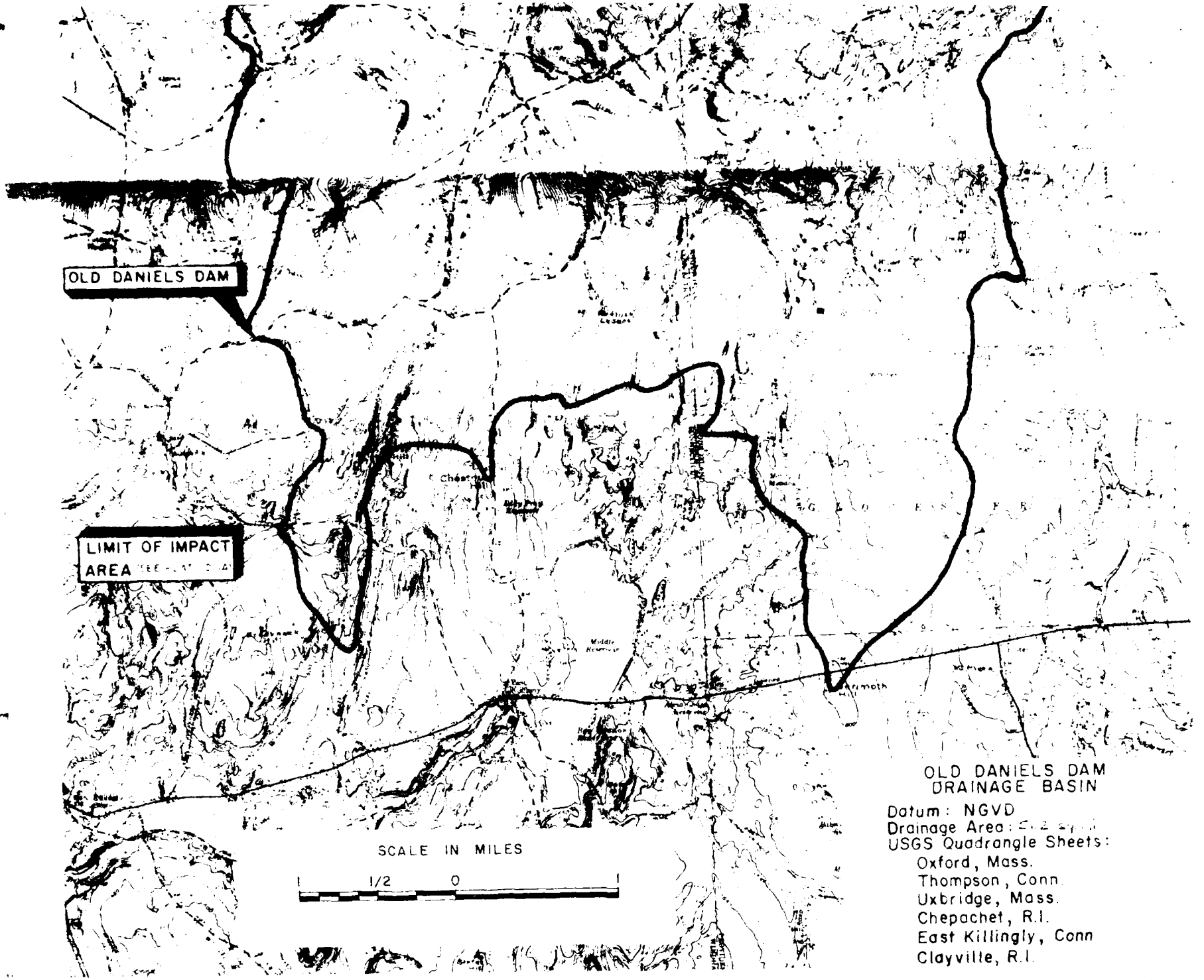
PHOTO C-11 Large diameter trees growing on upstream embankment and erosion of embankment taken near left spillway abutment looking in the direction of the left dam abutment.

PHOTO C-12 Left spillway discharge channel wall. Note dislodged stones at center of photo.

PHOTO C-13 Overview photo of pond.

APPENDIX D

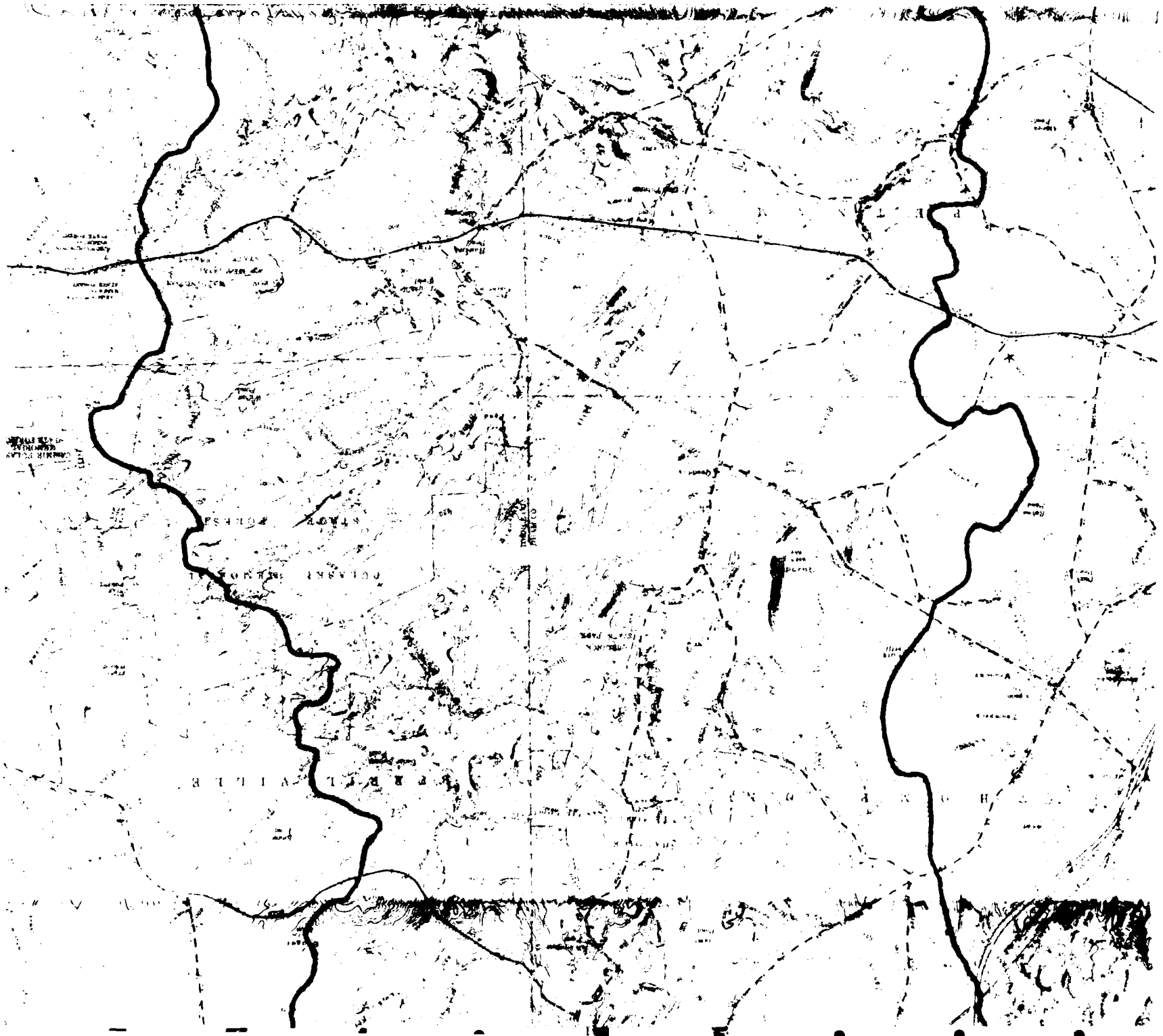
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

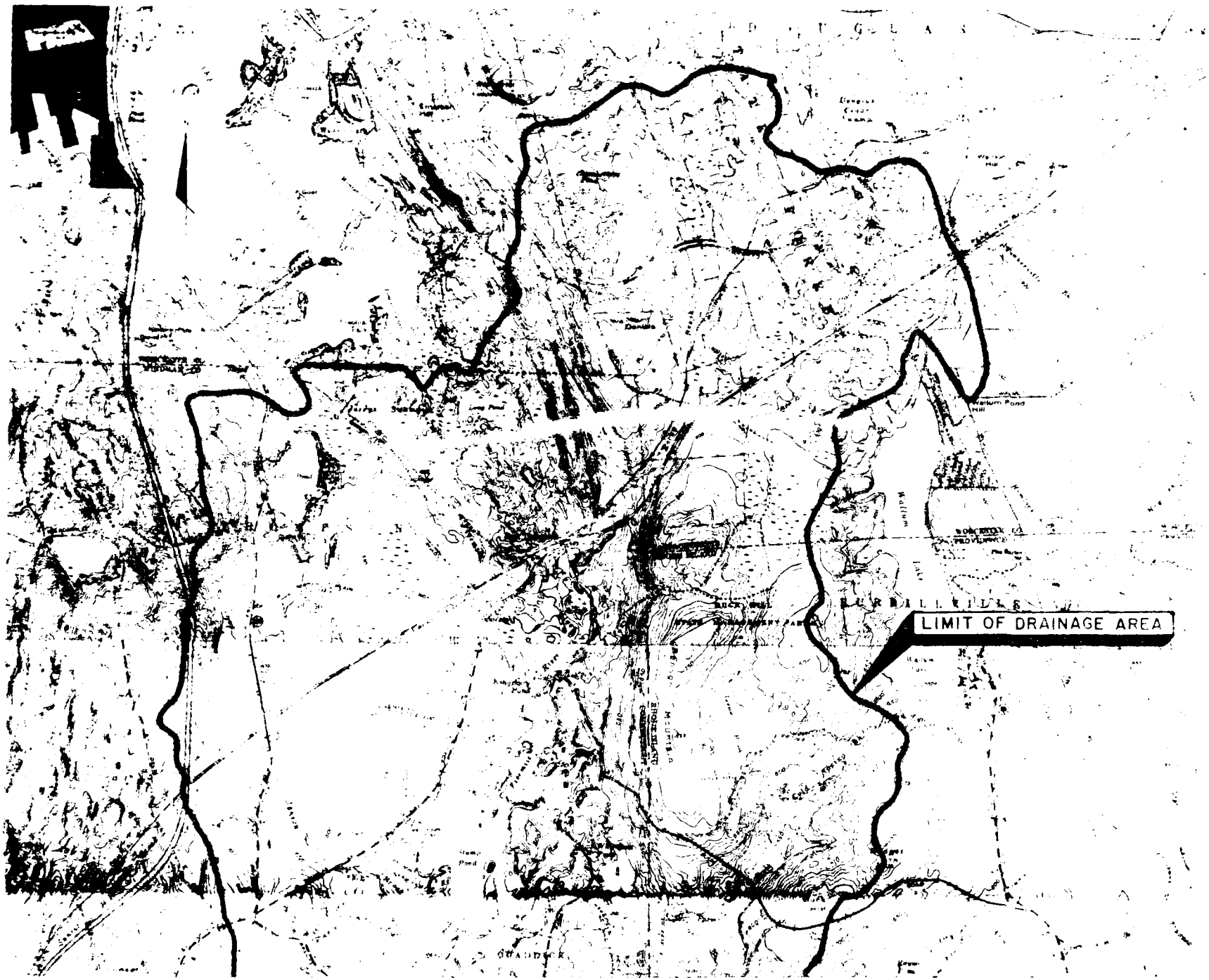


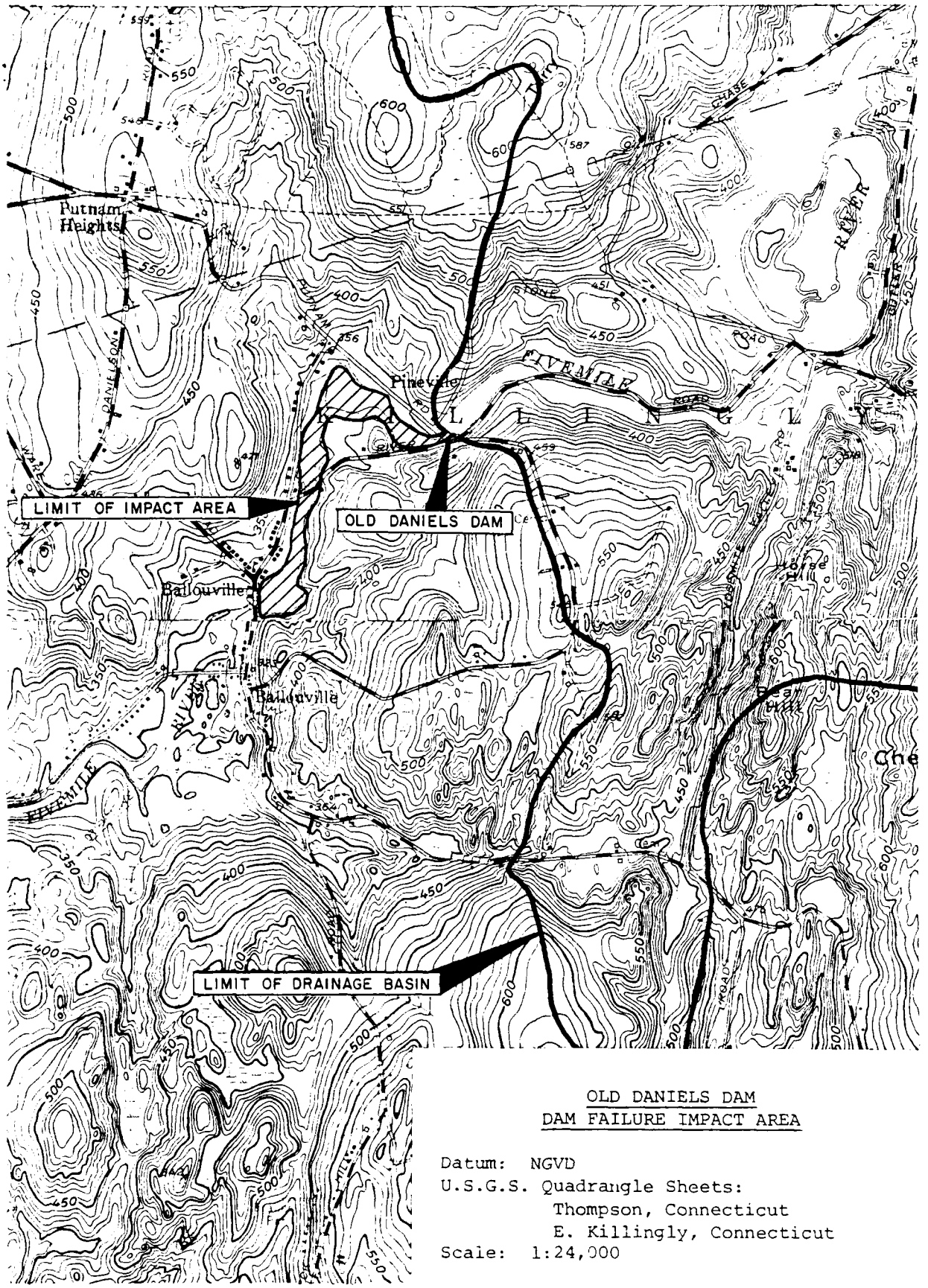
OLD DANIELS DAM
DRAINAGE BASIN

Datum: NGVD
Drainage Area:
USGS Quadrangle Sheets:
Oxford, Mass.
Thompson, Conn.
Uxbridge, Mass.
Chepachet, R.I.
East Killingly, Conn.
Clayville, R.I.

PLATE D-1




LIMIT OF DRAINAGE AREA



OLD DANIELS DAM
DAM FAILURE IMPACT AREA

Datum: NGVD
U.S.G.S. Quadrangle Sheets:
Thompson, Connecticut
E. Killingly, Connecticut
Scale: 1:24,000

Plate D-1A

OLD DANIELS DAM

A. Size Classification

Height of dam = 18 ft.; hence SMALL

Storage capacity at top of dam (elev. 361.0) = 272 AC-FT.; hence SMALL

Adopted size classification SMALL

B. Hazard Potential

The dam is classified as a SIGNIFICANT hazard potential structure because it's failure could result in loss of a few lives; inundation of 5-7 dwellings; one industrial establishment and 2 roads; and may cause disruption to public utilities. It is estimated that the failure discharge of 6748 CFS will travel downstream through the Five Mile River streambed with velocities up to 31 feet per second. Water depths may range from 10-11 feet at a distance of 5,000 feet.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	SMALL	100 year to Half PMF

Adopted Test Flood = Half PMF = 200 CSM

= 10240 CFS

D. Overtopping Potential

Drainage Area = 51.2 sq. miles

Spillway crest elevation = 358.0 NGVD

Top of Dam Elevation = 361.0 NGVD

Maximum spillway discharge Capacity without overtopping of dam = 1920 CFS

"test flood" inflow discharge = 10240 CFS

"test flood" outflow discharge = 10150 CFS

% of "test flood" overflow carried by spillway without overtopping = 18.9

"test flood" outflow discharge portion which overflows over the dam = 8080 CFS

% of test flood which overflows over the dam = 81.1

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: April 2, 1980

Name of Dam Old Daniels Dam ; Location of Dam Five Mile River ; Town Killingly, Ct.

Watershed Characterization swampy; natural storages; flat slopes ; 5.12 sq. miles of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = Half PMF = 200 CSM = 10240 CFS; Re = Effective Rainfall = 9.5 inches

D.A. = Drainage Area (Gross) = 51.20 Square Miles; Basin Slope = 0.02 hence; Flat

S.A. = Surface Area of Reservoir = 0.05 Square Miles; Time of Concentration more than 3 hours minutes

Shape and Type of Spillway = Free vertical overflow; masonry with concrete capping

B = Width of Spillway = 112.0 feet; C = Coefficient of Discharge = (3.33-Friction) = 3.3

D-3

Maximum Capacity of Spillway Without Overtopping = 1920 CFS = 18.9 % of test flood outflow

Top of Dam Elevation = 361.0 ; Spillway Crest Elevation = 358.0

Overflow portion of Length of Dam = 200 ft. ; C = Coefficient of discharge for Dam = 3.0

Name of Dam	Test Flood Q_p CSM	Test Flood Q_p CFS	Inflow Characteristics h_0 in feet	Inflow Characteristics S_0 in in.	Outflow Characteristics First Approximation Q_{p1} CFS	h_1 in ft.	S_1 in in.	Outflow Characteristics Second Approximation S_2 in in.	h_2 in ft.	Q_{p2} CFS	Outflow Characteristics Third Approximation (Adopted) S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Old Daniels Dam	100yr = 70	3584	4.97	0.058	—	—	—	—	—	—	0.046	3.90	3400
	½PMF = 200	10240	8.76	0.102	—	SEE	PLATE	D-11	—	—	0.0764	6.53	10150

Q_p = Discharge; h= Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

NAME OF DAM: OLD DANIELS DAM

ESTIMATING EFFECT OF SURCHARGE STORAGE ON "TEST FLOOD"

A. This routing of floods through the reservoir was carried out according to the guidelines established by the Corps of Engineers in Phase 1 Inspection for Dam Safety Investigations issued in March, 1978.

B. Formulas used are as follows:

i. For no overtopping: $Q = C_1 B_1 h_1^{3/2}$
For overtopping: $Q = C_1 B_1 [h_2 + F.B.]^{3/2} + C_2 B_2 h_2^{3/2}$
For open channel flow: N/A
For orifice flow: N/A

where C_1 = coefficient of discharge for spillway; B_1 = length of spillway
C_2 = coefficient of discharge for dam; B_2 = length of dam
h_1 = head over spillway crest (feet); h_2 = head over dam (feet)
F.B. = distance between spillway crest and top of dam

ii. Surcharge storage in inches = $S = 12 (h_1 + h_2) \frac{S.A.}{D.A.} = 0.0117$
where S.A. = surface area
D.A. = drainage area in sq. miles

iii. $Q_{outflow} = Q_{inflow} (1 - \frac{S}{Re})$; where Re = effective rainfall = 9.5"

iv. Length of dam = 200 ft. ; Top of Dam elev. = 361.0 ; c for dam = 3.0
Length of spillway = 112 ft. ; Spillway crest el. 358.0 ; c for spillway = 3.0

$Q = 3.3 \times 112 (3 + h_2)^{1.5} + 3 \times 200 h_2^{1.5}$ where h_2 is head over top of dam

S = storage in inches = $12h \frac{S.A.}{D.A.} = 0.0117h$ where h is head over spillway crest

v. Q_{inflow} = 1/2 PMF = 10240 C.F.S.

Q in CFS	Elevation	Total Head over crest $h_1 + h_2 = h$	Storage in inches = S	Remarks
10202	361	3.0	0.0351	
10189	362	4.0	0.0468	
10177	363	5.0	0.0585	
10164	364	6.0	0.0702	
10152	365	7.0	0.0819	
10139	366	8.0	0.0936	
10150	364.53	6.53	0.0764	

"Rule of Thumb Guidance for Estimating Downstream Dam Failure Discharge"

BASIC DATA

Name of dam OLD DANIELS DAM Name of town KILLINGLY, CT.

Drainage area = 51.20 sq. mi., Top of dam 361.0 NGVD

Spillway type = overflow free vertical fall; sharp crest Crest of spillway 358.0 NGVD

Surface area at crest elevation = 0.05 sq. mi. = 32 Acres

Reservoir bottom near dam = 344.0 NGVD

Assumed side slopes of embankments 2:1

Depth of reservoir at dam site 17.0 = y_o = 17.0 ft.

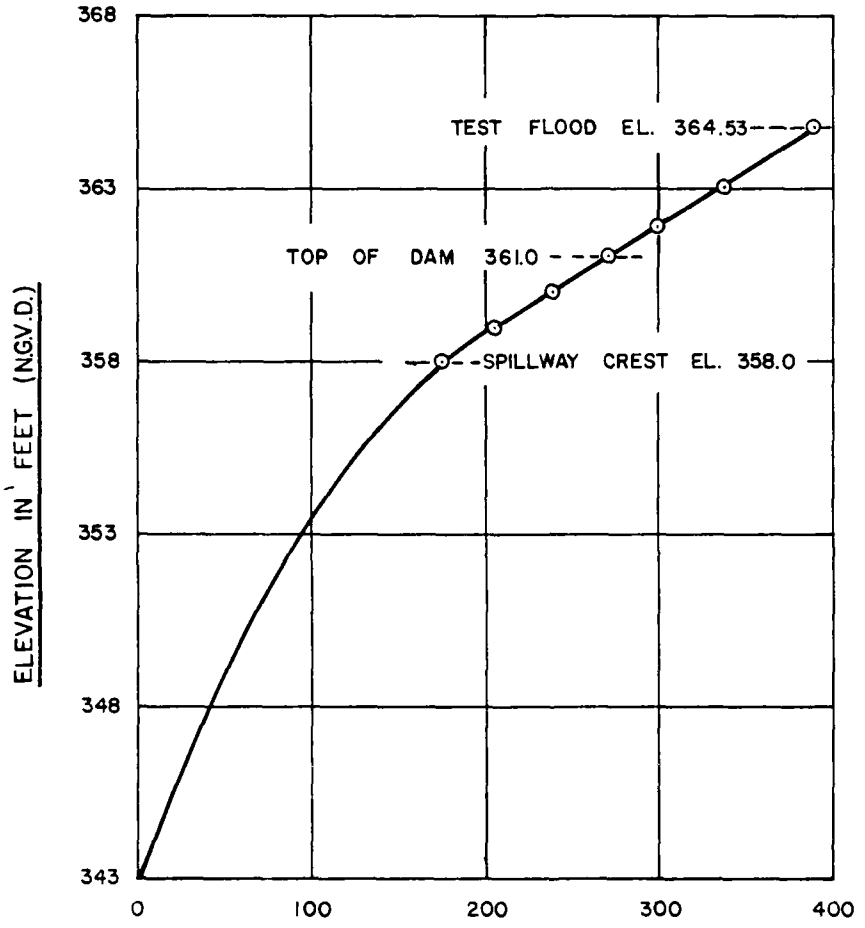
Mid-height elevation of dam = 352.5 NGVD

Length of dam at crest = overflow length 200 ft.

Length of dam at mid-height = 166 ft.

25% of dam length at mid-height = W_b = 41

Elevation (NGVD)	Estimated Storage in AC-FT	
358.0	176	Spillway Crest Elevation
359.0	208	
360.0	240	
361.0	272	Top of Dam Elevation
361.90	330	100-year Flood Elevation
363.0	336	
364.53	390	Test Flood Elevation



STORAGE-ELEVATION CURVE

OLD DANIELS DAM

PLATE D-6

OLD DANIELS DAM

i. DAM FAILURE ANALYSIS

A. Failure Analysis
Discharge = $\frac{8}{27} W_B \sqrt{g}\ y_o^{1.5}$ C.F.S.
$= 1.68 W_B y_o^{1.5}$
$= 4828$ C.F.S.

B. Maximum Spillway

Discharge with W.S.E.

At top of Dam @ 361.0 1920 C.F.S.

C. Total Dam Failure Discharge 6748 C.F.S.

D. Reservoir - Storage Data:

Volume of storage at spillway crest = 176 AC-ft. @ Elev. 358.0

Surcharge storage at top of dam = 96 AC-ft. @ Elev. 361.0

Storage Total = 272 AC-ft. @ Elev. 361.0

E. Flood Discharge Channel

i. Maximum depth of flow just D/S of Dam = $\frac{4}{9} y_o$ = 7.5 feet

Notes:

1. Failure of dam is assumed to be instantaneous. When pool reaches top of dam, and is a full-depth partial width rectangular shape failure with a width of failure = W = 41.0 feet and depth of failure y_o = _____ 17.0 feet.
2. Steady, uniform flow phenomenon is assumed for determination of failure profile and is based on Manning's formulae.
3. Failure profile for impacted area determination is determined at three typical cross sections in the downstream channel. Reduction in discharge due to available storage has been taken into account.

ii. Reach 1

Length = 2000 feet; Station 0 to Station 20+00; n = 0.05

Bed slope = $S_o \simeq S_f$ = 0.0085; Bed width = b = 46.6 feet

Bed width is scaled from U.S.G.S. map; scale 1" = 2,000 feet

As bed width is large and 1" = 2,000 feet and 10-foot contour interval scale maps are being used for various channel parameters, it is appropriate to assume that d = R = Hyd Radius = depth, hense Manning's formulae is transformed:

$$Q = A \frac{1.49}{n} R^{2/3} \sqrt{S} = bd \frac{1.49}{n} d^{2/3} \sqrt{S}$$

$$Q = b \frac{1.49}{n} \sqrt{S}\, d^{5/3} = Kd^{5/3} = 128 d^{5/3}$$

State Discharge Relationship for Reach 1

Depth = d in Feet	Stage of Elevation	Discharge in CFS = Q	Velocity in ft./sec.	Storage Volume in AC-ft. = V
0	330	0	0	0
2	333	406	4.72	4.0
4	334	1288	7.48	8.0
6	336	2532	9.81	12.0
8	338	4090	11.88	16.0
10	340	5932	13.80	20.0
12	342	8037	15.57	24.0

F. Water surface profiles resulting from maximum spillway discharge and also from dam failure discharge are shown on Plate D-12 for comparison purposes. This figure also shows the rise in water depth due to failure of dam.

Also, Discharge -- Depth and Storage-depth curves are shown on Plate D-13 for downstream channel.

Notes: 1. Storage volume in AC-ft = $\frac{\text{(Length of Reach) (Bed Width) (Depth)}}{43{,}560}$

2. Failure discharge being large will mostly be overbank flow on existing channel.

G. For Q_1 = 6748 CFS; depth = 10.8 ft. V_1 = 22 AC-ft.

Trial $Q_2 = Q_1 \left(1 - \frac{V_1}{\text{Storage}}\right) = Q_1 \left(1 - \frac{22}{272}\right)$ = 6202 CFS;

V_2 = AC-ft.

Avg $V = \frac{V_1 + V_2}{2}$ = 21.5 AC-ft.

$Q_2 = Q_2 \left(1 - \frac{V \text{ Avg.}}{\text{Storage}}\right)$ = 6215 CFS; y_2 = 10.2 ft.

Depth at center of flood as adopted = = 10.2 ft.

iii. Reach 2

Length = 3000 feet; Station 20+00 to Station 50+00; n = 0.05

Bed slope = $S_o \simeq S_f$ = 0.0045; Bed width = b = 71.6 feet

Bed width is scaled from map of scale 1" = 2,000 feet

As bed width is large and 1" = 2,000 feet and 10-foot contour interval scale maps are being used for various channel parameters, it is appropriate to assume that d = R = Hyd Radius = depth, hense Manning's formulae is transformed in this case to with channel parameters adopted as before.

$$Q = A \frac{1.49}{n} = R^{2/3} \sqrt{S} = bd \frac{1.49}{n} d^{2/3} \sqrt{S}$$

$$Q = b \frac{1.49}{n} \sqrt{S} \; d^{5/3} = Kd^{5/3} = 143 \, d^{5/3}$$

Stage Discharge Relationship for Reach 2

Depth = d in Feet	Stage of Elevation	Discharge in CFS = Q	Velocity in ft/sec	Storage Volume in AC-ft = V
0	324	0	0	0
2	326	453	3.77	8.25
4	328	1440	6.00	16.50
6	330	2829	7.86	24.75
8	332	4570	9.82	33.00
10	334	6627	11.05	41.25
12	N/A			

G. For Q_1 = 6215 CFS; depth = 10.20ft. V_1 = 20.5 AC-ft.

Trial $Q_2 = Q_1 \left(1 - \frac{V_3}{\text{Storage}}\right) = Q_1 \left(1 - \frac{20.5}{272}\right) = 5704$ CFS

$\therefore V_2$ = 38 AC-ft.

Avg $V = \frac{V_1 + V_2}{2} = 29.25$ AC-ft.

$Q_2 = Q_1 \left(1 - \frac{V \text{ Avg.}}{\text{Storage}}\right)$ = 5546 CFS; y_2 = 9.50ft.

Depth at center of flood as adopted = 9.85 ft.

Additional dam failure analysis beyond Reach 1 has not been undertaken because the depth of flow of 9.85 feet at the end of Reach 1 will not cause any hazardous conditions further downstream. The failure discharge and depth will continually decrease beyond Reach 2,

SUMMARIZED AND ADOPTED VALUES

FOR

DAM FAILURE ANALYSIS

i. Name of Dam OLD DANIELS DAM

ii. Dam Failure Discharge _____ = 4828 cfs.

iii. Maximum Spillway Discharge _____ = 1920 cfs.

iv. Total Dam Failure Discharge _____ = 6748 cfs.

v. Normal (Manning Depth) for 6748 CFS = 10.2 feet for first 2000 feet

vi. Normal (Manning Depth) for 5340 CFS = 8.0 feet for next 3000 feet
* see below

vii. Increase in depth due to failure of dam = 6.0 feet

viii. W.S.E. prior to failure = Ground Elevation + spillway discharge depth.

ix. W.S.E. after failure = Ground Elevation + Dam failure depth.

Note: The adopted depth of flow values are assumed to be accurate representations of damages in the impacted areas. Professional judgement is used in these final adopted values.

* Normal (Manning Depth) for 1920 CFS = 4.8 feet for first 2000 feet.

Normal (Manning Depth) for 450 CFS = 2.0 feet for next 3000 feet.

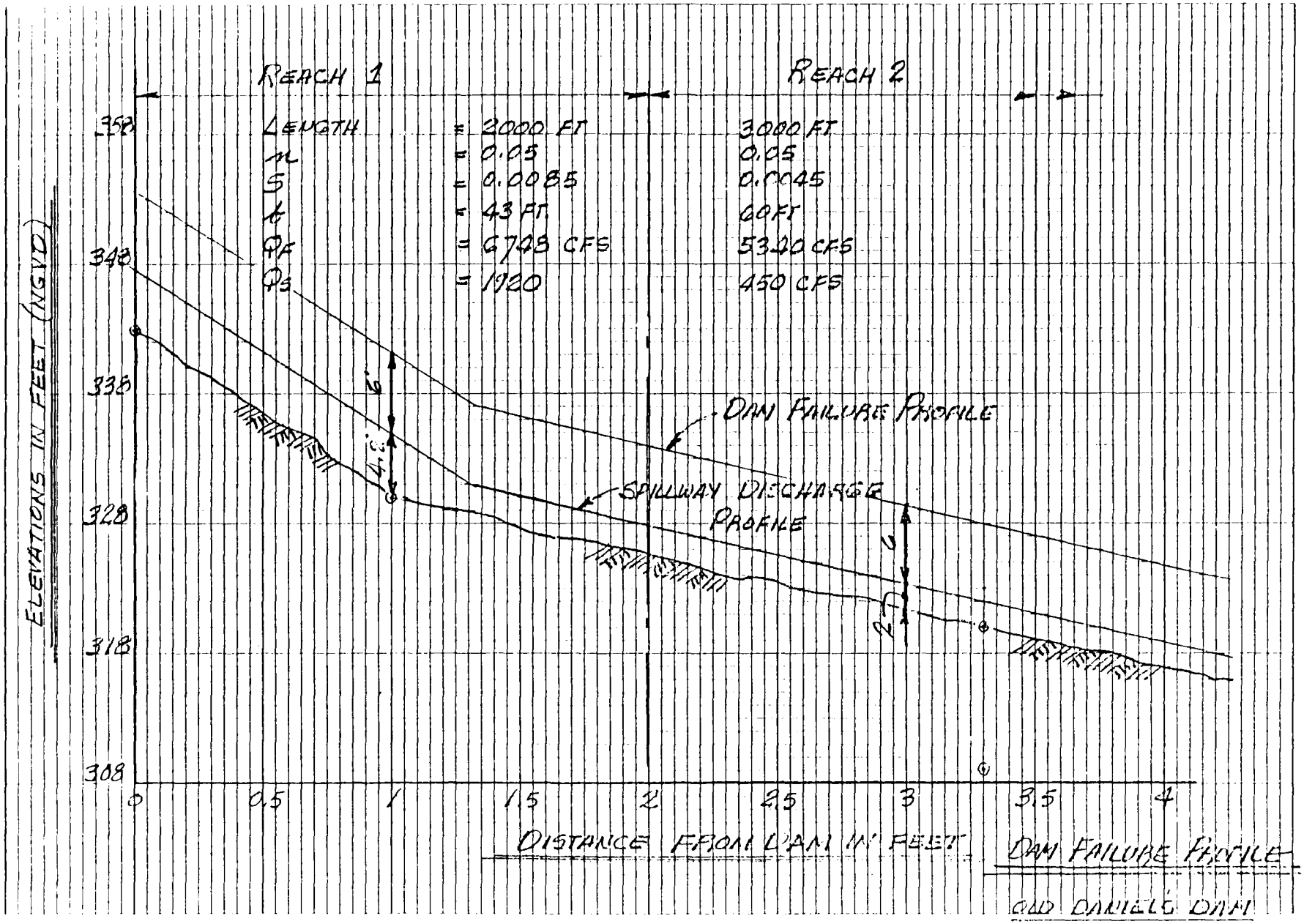

REACH 1
REACH 2
LENGTH = 2000 FT
n = 0.05
S = 0.0085
y = 43 FT
QF = 6708 CFS
QS = 1920
3000 FT
0.05
0.0045
40 FT
5320 CFS
450 CFS
358
348
338
328
318
308
ELEVATIONS IN FEET (NGVD)
DAM FAILURE PROFILE
SPILLWAY DISCHARGE PROFILE
y
0.5
1
1.5
2
2.5
3
3.5
4
DISTANCE FROM DAM IN FEET
DAM FAILURE PROFILE
OLD DANIELS DAM

PLATE D-13

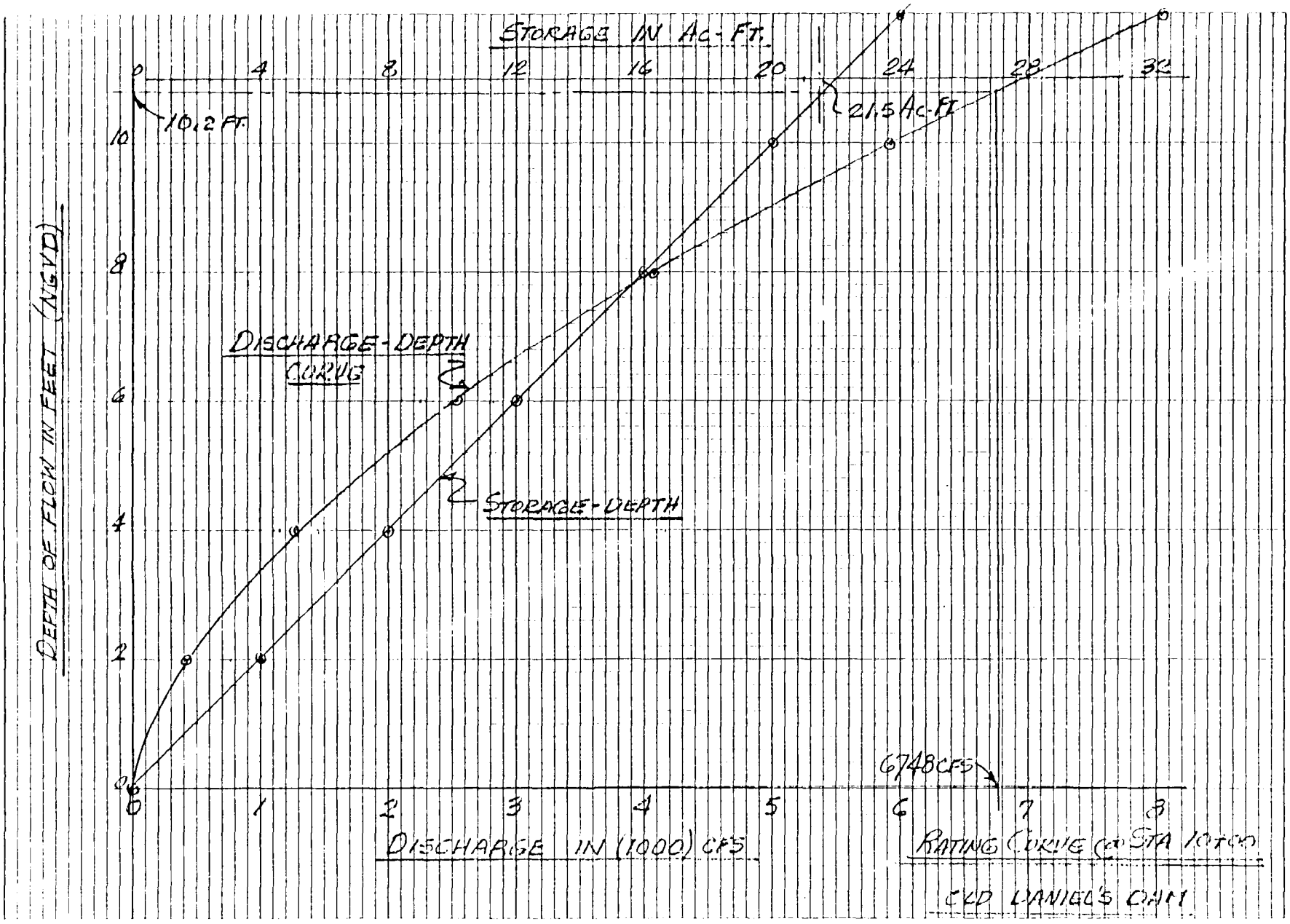

STORAGE IN Ac-Ft.
0
4
8
12
16
20
24
28
32
10.2 FT.
21.5 Ac-Ft
DEPTH OF FLOW IN FEET (ABOVE INVERT)
10
8
6
4
2
0
DISCHARGE-DEPTH CURVE
STORAGE-DEPTH
6748 CFS
1
2
3
4
5
6
7
8
DISCHARGE IN (1000) CFS
RATING CURVE @ STA 10+00
OLD DANIEL'S DAM

PLATE D-13

OLD DANIELS DAM

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Spillway width = 112 feet; Spillway crest elevation = 358.0 NGVD

Overflow Length of dam = 200 feet; Top of dam elevation = 361.0 NGVD

C = 3.3 for spillway and 3.0 for dam

i) SPILLWAY RATING CURVE COMPUTATIONS

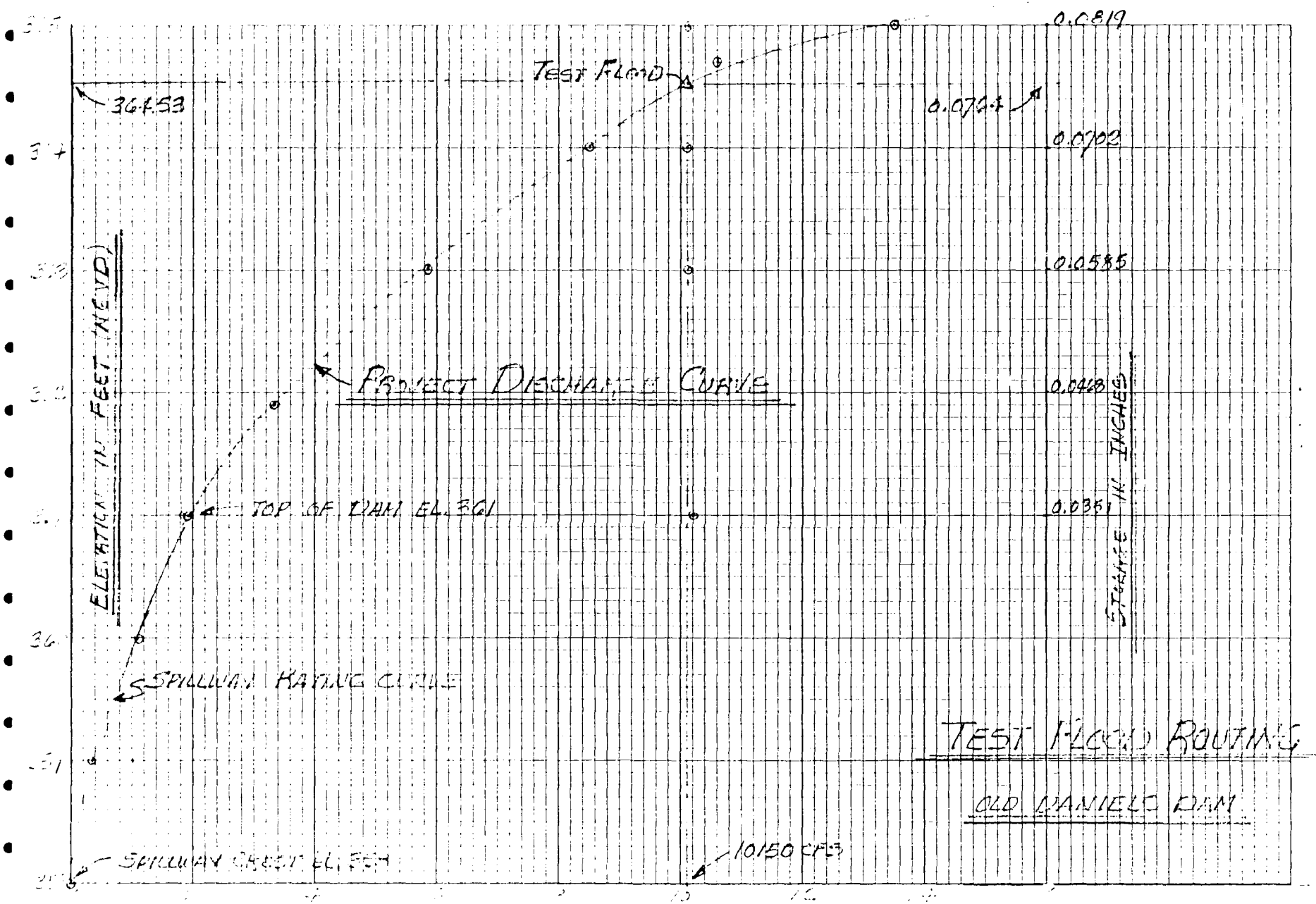
Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
358.0	0	Spillway Crest Elevation
359.0	370	
360.0	1045	
361.0	1920	Top of Dam Elevation
361.9	3360	100-year Flood Elevation
363.0	5829	
364.0	8549	
364.7	10680	
365.0	13553	

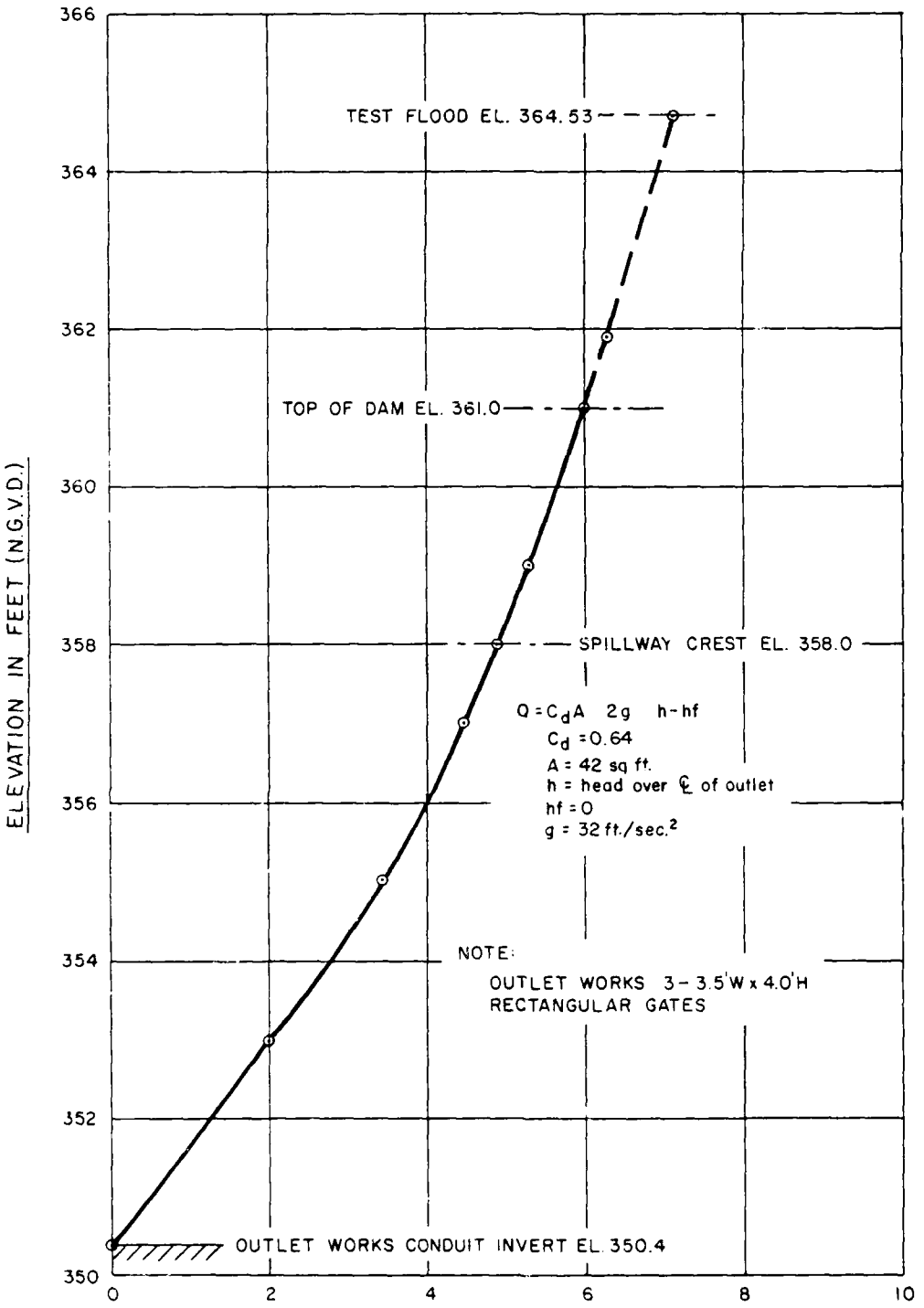
ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
350.4		Invert of Outlet Elevation
353.3	200	
355.0	346	
357.0	447	
358.0	490	Spillway Crest Elevation
359.0	529	
361.0	600	Top of Dam Elevation
361.9	629	100-year Flood Elevation
364.53	713	Test Flood Elevation

Size of outlet = 3-3.5'W x 4.0'H; Area of outlet = 42.0 sq. ft.

Invert of outlet = 350.40; Center line of outlet = 352.40


0.0819
Test Flood
36.53
0.0747
0.0702
0.0585
ELEVATION IN FEET (NGVD)
PROJECT DISCHARGE CURVE
0.0468
STORAGE IN INCHES
TOP OF DAM EL. 361
0.0351
SPILLWAY RATING CURVE
TEST FLOOD ROUTING
OLD HAMMELS DAM
10150 CFS
SPILLWAY CREST EL. FEET

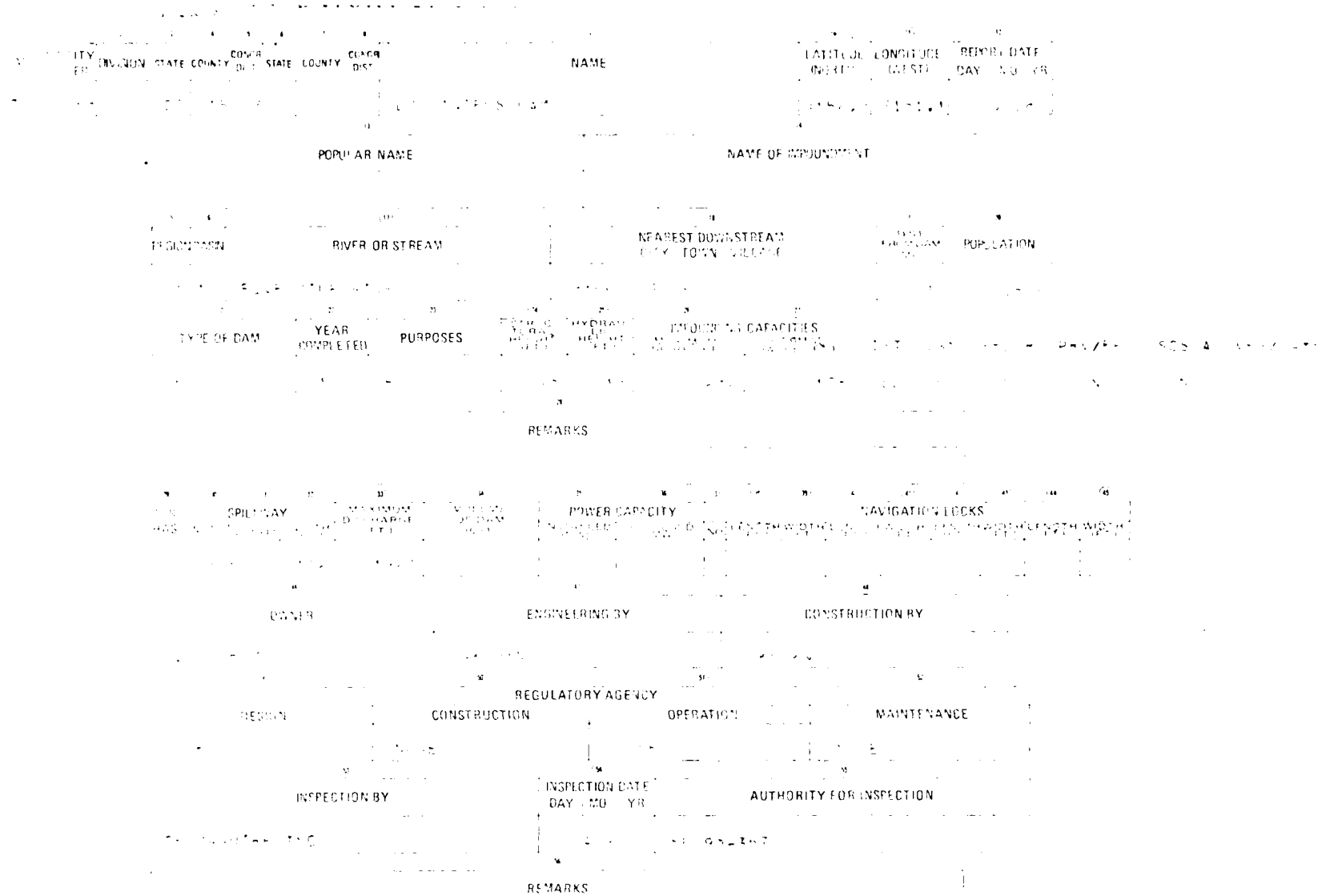


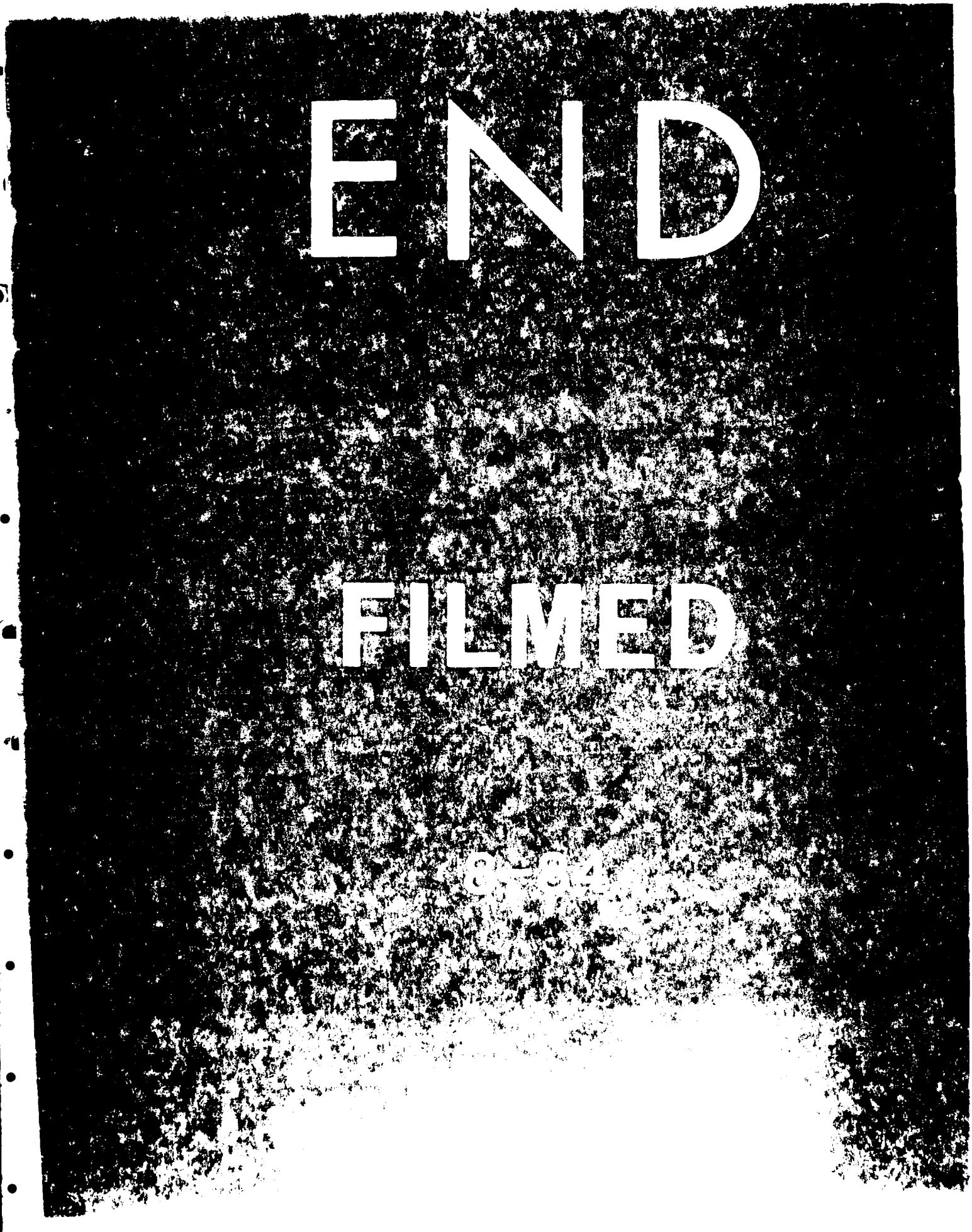
OUTLET RATING CURVE
OLD DANIELS DAM

PLATE D-16

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS


NAME
POPULAR NAME
NAME OF IMPOUNDMENT
RIVER OR STREAM
POPULATION
TYPE OF DAM
YEAR COMPLETED
PURPOSES
REMARKS
SPILLWAY
POWER CAPACITY
OWNER
ENGINEERING BY
CONSTRUCTION BY
REGULATORY AGENCY
CONSTRUCTION
OPERATION
MAINTENANCE
INSPECTION BY
AUTHORITY FOR INSPECTION
REMARKS


END
FILMED