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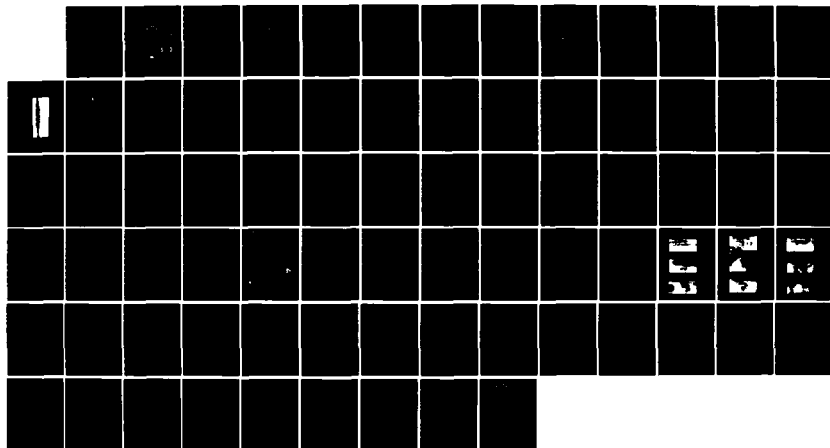
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WEBSTER BROOK DAM (ME.) (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV SEP 81

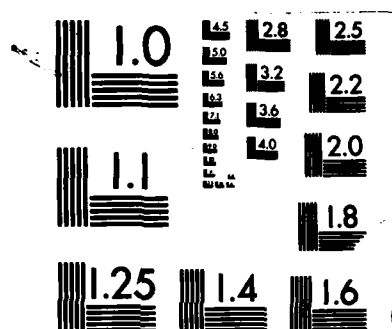
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SAINT JOHN RIVER BASIN
Limestone, Maine

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WEBSTER BROOK DAM ME 00229

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Saint John River Basin Limestone Maine LimestoneStream		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The earthfill embankment is 1050 ft. long and 66 ft. high. The embankment dam principal spillway drop inlet, principal spillway impact basin and emergency spillway were found in good condition. The dam is classified as intermediate in size with a high hazard potential. No urgent or emergency actions are required for the dam based on this inspection.		

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

REPLY TO
ATTENTION OF:

SEP 23 1981

NEDED

Honorable Joseph E. Brennan
Governor of the State of Maine
State Capitol
Augusta, Maine 04330

Dear Governor Brennan:

Inclosed is a copy of the Webster Brook Dam (ME-00229) 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 Agriculture and to the owner, Town of Limestone. Copies will be available to the public in thirty days.

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

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

Incl
As stated



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WEBSTER BROOK DAM

ME 00229

ST. JOHN RIVER BASIN
LIMESTONE, MAINE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No. : ME 00229
Name of Dam : Webster Brook Dam
(Trafton Lake)
Town : Limestone
County & State : Aroostook, Maine
Stream : Limestone Stream
Date of Inspection : November 6, 1979

BRIEF ASSESSMENT

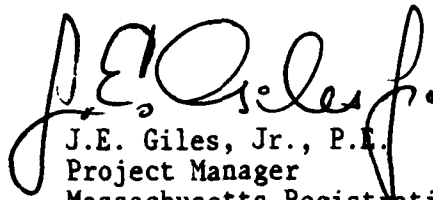
Webster Brook Dam is an eleven year old recreational and flood water retarding structure designed by the USDA Soil Conservation Service. The earth fill embankment is 1050 feet long and 66 feet high. The downstream slope, the crest, and the upstream slope above the recreation pool are grass covered. A reinforced concrete drop inlet principal spillway leads to a 30 inch diameter reinforced concrete conduit under the dam that ends in a reinforced concrete impact basin. A grass lined earth cut emergency spillway is provided at the left abutment. A normal pool of small to intermediate size (approximately 51' deep and 1,700 ac.-ft.) is maintained behind the dam.

The embankment dam, principal spillway drop inlet, principal spillway impact basin and emergency spillway were found in good condition. In the embankment itself, there were no dips, sags or other evidence of distress. The reinforced concrete structures were sound with no evidence of deterioration. The grass cover on the downstream embankment, crest and emergency spillway were well developed. The grass cover on the upstream face was very sparse. Stagnant water was observed at the toe of the downstream slope to the right of the downstream outlet structure.

Based on a maximum storage of 6080 acre-feet and a height of 66 feet, Webster Brook Dam falls within the intermediate size classification. The dam's hazard classification has been established as high based on the potential for loss of more than a few lives in the event of a dam failure. The test flood was estimated for the 4.06 square mile drainage area of rolling terrain using the "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Safety Investigations", New England Division Corps of Engineers, March 1978. The test flood was the PMF. This yielded a peak inflow of 5140 cfs (1270 csm) and a routed peak outflow of 2680 cfs. The computed maximum reservoir level El. 590.4 NGVD was below the embankment crest El. 595 NGVD and no overtopping of the

embankment would occur. The capacity of the dam is greater than 100% of the test flood.

No urgent or emergency actions are required for Webster Brook Dam based on this inspection. Remedial measures include monitoring the project during periods of intense rainfall, developing a downstream warning system, establishing a monthly visual inspection program and conducting bi-annual technical inspections of the dam.

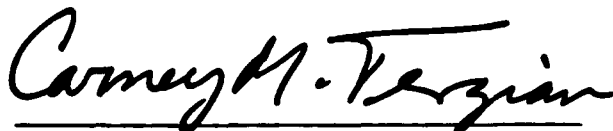
A handwritten signature in cursive script, appearing to read "J.E. Giles, Jr.", is positioned above the printed name and title.

J.E. Giles, Jr., P.E.
Project Manager
Massachusetts Registration No. 1643

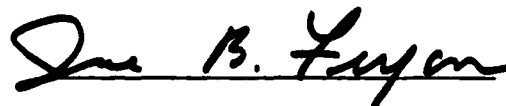
This Phase I Inspection Report on Webster Brook Dam (ME-00229) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.


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


ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division


CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:


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, 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 Phase I investigation: however, the investigation is intended to identify any need for such studies.

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through 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 reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an 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 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 compliance with OSHA rules and regulations is also excluded.

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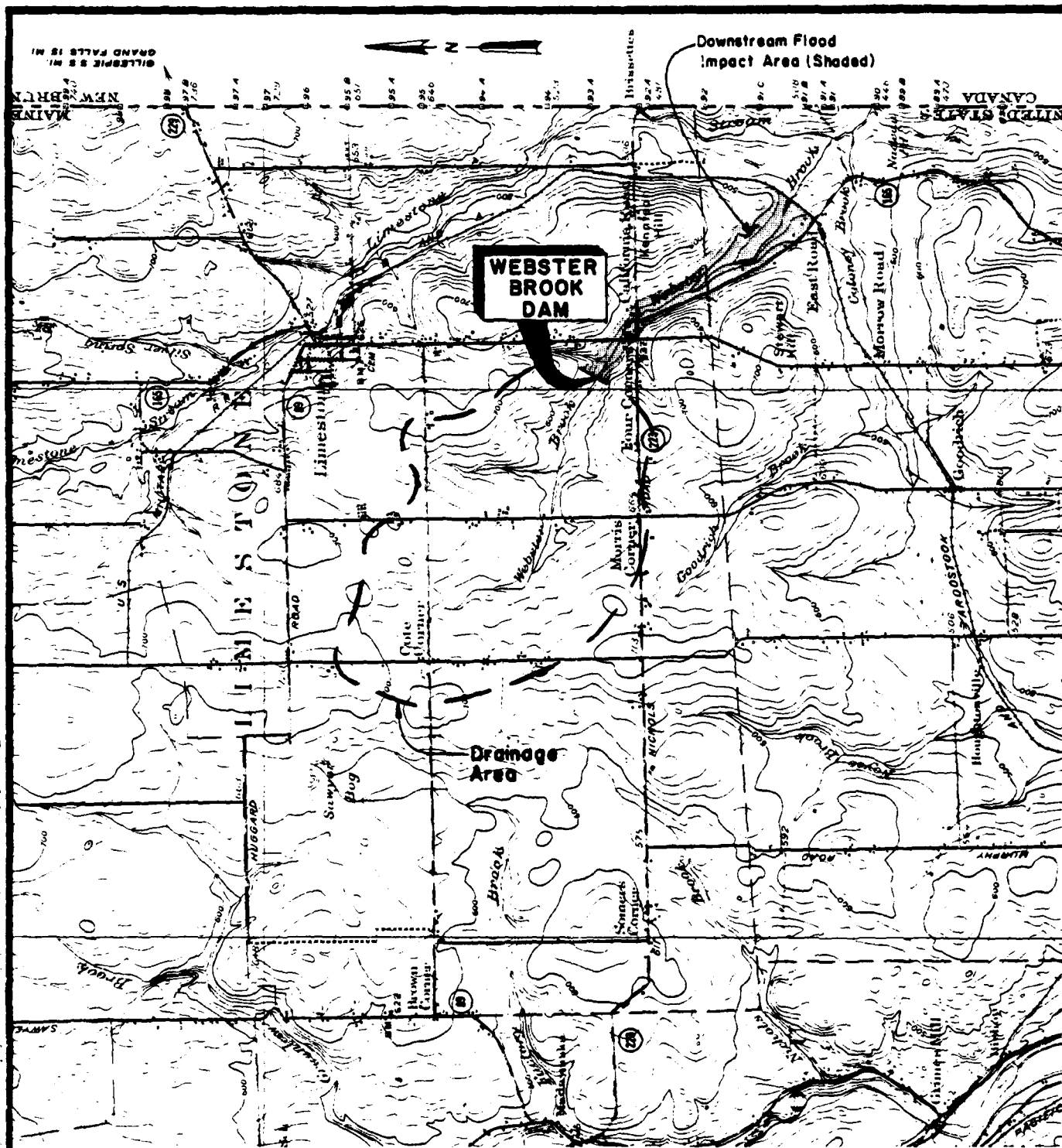
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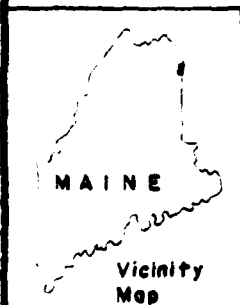
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WEBSTER BROOK DAM
VIEW FROM RIGHT BANK OF RESERVOIR



FROM: USGS FORT FAIRFIELD, ME.
QUADRANGLE MAP



SCALE
1/2 Miles
1 : 62,500

WEBSTER BROOK DAM LOCATION MAP

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

MAIN

DATE November, 1980

CLIENT JOB PLATE
1345 72 01

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

WEBSTER BROOK DAM, LIMESTONE MAINE
TRAFTON LAKE

SECTION I

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. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Maine. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of November 6, 1979 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0011 has been assigned by the Corps of Engineers for this work.
- b. Purpose - The purposes of the inspection program are:
 - (1) To 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) To encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.
 - (3) To update, verify and complete the National Inventory of Dams.
- c. Scope of Inspection Program - The scope of this Phase I inspection report includes:
 - (1) Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgment on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 Description of Project

- a. Location - The Webster Brook Dam is located on Webster Brook, approximately 2.5 miles above its confluence with Limestone Stream. The dam is approximately 2 miles south of the Town of Limestone, Maine. The small community of Four Corners lies approximately 1/2 mile directly downstream from the dam. The impounded water is known as Trafton Lake. The site is included on the U.S.G.S. 7.5 minute series Quadrangle, "Limestone, Maine", with approximate coordinates of N46°52'44", W67°49'53". (Also found on the U.S.G.S. 15 minutes series Quadrangle, "Ft. Fairfield, Maine.")
- b. Description of Dam and Appurtenances - The project is a dual purpose recreation and floodwater retarding structure. It consists of three principal features: an earthfill dam, a principal spillway, and an emergency spillway. The dam is 1050 feet long, 66 feet high, and 20 feet wide at its crest. Material excavated from the reservoir area was used for the fill in the dam. The upstream slope is 3:1 and the downstream slope is 2.5:1. The fill materials are of glacial till origin with zoning limited to placing the more impervious material in the core and the more pervious material in the outside shells. The structure has a toe drain system with collector pipes and a central cutoff trench.

The principal spillway is an ungated drop intake to a 30 inch diameter reinforced concrete pipe under the dam. The 30-inch pipe is provided with anti-seep collars and discharges into a reinforced concrete impact basin (energy dissipator). The emergency spillway is an excavated, grass lined, earth channel adjacent to the left abutment. The contour of the property on the downstream side of the emergency spillway allows for flows through this spillway to be carried away from the dam. The emergency spillway is 100 feet wide at the crest with an elevation of 588.6 feet NGVD and approximately 2 horizontal to 1 vertical side slopes. The dam is equipped with a 18" gated reservoir drain. The normal recreation pool is maintained at a constant elevation by a 1'-10" x 1'-10" ungated overflow opening in

the principal spillway riser. This orifice (Invert Elev. 580.0 NGVD) is a double opening, each being 7.5 feet wide by 1.25 feet high with a 6" radius weir. The maximum depth of the reservoir is normally 51 ft.

Plans, profiles, and sections of the dam and its appurtenant structures are included in Appendix B. Photographs are shown in Appendix C.

- c. Size Classification - The maximum embankment height is 66 feet above the stream channel and the maximum storage is 6080 acre feet at El. 595.0 NGVD. This gives the dam an intermediate size classification based on both the storage and the height (greater than 10,000 ac-ft or higher than 40 ft and less than 50,000 ac-ft and 100 ft). This is in accordance with the Recommended Guidelines for Safety Inspection of Dams.
- d. Hazard Classification - This facility is classified as a high hazard potential dam based on the potential for loss of more than a few lives in the event of a dam failure. The dam breach analysis shows that in the small community of Four Corners (approximately 3000' immediately downstream) at least six houses would be impacted with a flood wave having an initial depth of approximately 25'-30'.
- e. Ownership - The dam and associated works are owned by the Town of Limestone, Maine.
- f. Operators - The project is designed for unsupervised operation. No manual operations are required to pass a flood flow. The project is operated and maintained by the Town of Limestone, Maine. The responsible person is Mr. Thomas Stevens, Town Manager, Limestone, Maine 04750, Telephone (207) 325-3131. (At the time of the field inspection the Town Manager was Mr. Peerless J. Snow).
- g. Purpose of Dam - The project is a dual purpose recreation and floodwater retarding structure of standard USDA SCS design. The reservoir is maintained at El. 580 (1700 ac. ft.) for fish and recreation purposes.
- h. Design and Construction History - The project was designed by the USDA Soil Conservation Service, Orono, Maine; constructed by H. E. Sargent, Inc., Stillwater, Maine; and completed in 1969. No post-construction changes are reported or observed.
- i. Normal Operating Procedures - The reservoir is normally maintained at El. 580 NGVD for recreation purposes. All flood flows are passed through the principal and emergency spillways which are designed for uncontrolled discharge. If the reservoir level drops below El. 580 the 18" drain can be opened to allow downstream flow to continue. No other operating procedures are in evidence.

1.3 Pertinent Data

a. Drainage Area - Webster Brook Dam controls a drainage area of 4.06 square miles. The watershed is approximately 35 percent wooded and 65 percent agricultural. The slopes are gentle with one small marshy pond area upstream. The elevation range of the watershed is from 720' to 530' NGVD.

b. Discharge at Damsite

(1) Outlet Works - The high-stage principal spillway orifice is a double opening (each is 7.5 feet wide x 1.25 feet high) with a sill at Elev. 585.0 NGVD. This ungated orifice opens into a vertical concrete riser that discharges through a 30" diameter concrete conduit, invert Elev. 530.0 NGVD. A 1'-10" x 1'-10" low-stage ungated opening in the riser shaft controls the recreation pool elevation, holding it to Elev 580 NGVD during normal conditions. The emergency spillway is an excavated, grass lined, earth channel with a crest at El. 588.6 NGVD. A screw operated sluice gate and 18"Ø CMP provide the capability to drain the reservoir to El. 531.0 NGVD. This 18" drain discharges into the 30" conduit.

(2) Maximum known flood - Unknown.

(3) Principal spillway capacity at top of dam - N/A.*

(4) Principal spillway capacity at emergency spillway crest elevation - 190 cfs.

(5) Gated spillway capacity at normal pool elevation - N/A.

(6) Principal spillway capacity at test flood elevation - 193 cfs.

(7) Emergency spillway capacity at test flood elev. - 2680 cfs @ El. 590.4 NGVD.

(8) Total project discharge at top of dam - N/A.*

(9) Total project discharge at test flood elevation - 2680 cfs @ 590.4 NGVD.

* Note: This has not been determined since the PMF never reaches the top of the dam.

c. Elevations (feet above NGVD)

(1) Streambed at toe of dam	529.0
(2) Bottom of cutoff	524.0
(3) Maximum tailwater	Not available

(4) Normal pool (Max. Depth = 51')	580.0
(5) Full flood control pool	588.6
(6) Principle spillway crest	
(a) low stage	580.0
(b) high stage	585.0
(7) Emergency spillway crest	588.6
(8) Design surcharge (Original Design)	589.5
(9) Top of dam	595.0
(10) Test flood surcharge	590.4
d. <u>Reservoir</u> (Length in feet)	
(1) Normal pool	4600
(2) Flood control pool	5850
(3) Spillway crest pool @ Elev. 585.0	4870
(4) Top of dam	7500
(5) Test flood pool	6800
e. <u>Storage</u> (acre-feet)	
(1) Normal pool	1700
(2) Flood control pool	3500
(3) Spillway crest pool @ Elev. 585.0	2600
(4) Top of dam	6080
(5) Test flood pool	4110

f. Reservoir Surface (acres)

(1) Normal pool	104
(2) Flood-control pool	144
(3) Spillway crest	124
(4) Test flood pool	153
(5) Top of dam	193

g. Dam

(1) Type	Earthfill
(2) Length	1050 feet
(3) Height	66 feet
(4) Top Width	20 feet
(5) Side Slopes	Upstream 3 Hor. to 1 Vert. Downstream 2.5 Hor. to 1 Vert.
(6) Zoning	2 zones
(7) Impervious Core	Most impervious toward the core
(8) Cutoff	5' trench
(9) Grout curtain	None
(10) Other	N/A

h. Diversion and Regulating Tunnel - None

i. Spillway

- (1) Type - Reinforced concrete riser to 30" ϕ conduit
- (2) Length of weir - 7.5 feet x 2
- (3) Crest elevation - El. 585.0
- (4) Gates - ungated
- (5) U/S Channel - N/A

(6) D/S Channel - Natural

(7) General - Reinforced Concrete Impact Basin at Outfall

Items Numbered 8 through 10 refer to the Emergency Spillway

(8) Crest - El. 588.6

(9) Length of crest - 100 feet

(10) U/S Channel - Grass lined earth channel

(11) D/S Channel - Grass lined earth channel

(12) General - 2 Hor. to 1 Vert. side slopes

j. Regulating Outlets

(1) Invert - El. 531.0

(2) Size - 18" ϕ CMP

(3) Description - Sluice gate to drain reservoir

(4) Control Mechanism - 18" ϕ Sluice gate w/screw operator

(5) Other - 1' 10" x 1' 10" ungated low stage overflow opening in principle spillway riser; invert elevation 580.0'.

SECTION 2

ENGINEERING DATA

2.1 Design

As built drawings of Webster Brook Dam are on file at the GSA Federal Archives and Records Center, 380 Trapelo Road, Waltham, MA 02154 (617-223-2657). Design calculations and specifications were not available. The December 1964 Limestone Stream Watershed Work Plan indicates that:

"...hydrology and hydraulics analyses followed procedures given in the National Engineering Handbook of the Soil Conservation Service, Section 4, Supplement A, Hydrology (NEH 4A) and Section 5, Hydraulics (NEH 5)."

and for civil works:

"All designs are in accord with the latest Soil Conservation Service design criteria as set forth in Engineering Memoranda SCS-27, 31, 4D and 42; Technical Release No. 10; Section 3.21, Hydrology, Supplement A of the National Engineering Handbook; U.S. Weather Bureau Technical Paper No. 40; and other sources of recognized engineering material."

2.2 Construction

The Webster Brook Dam and appurtenances were constructed in 1969 by H. E. Sargent, Inc. of Stillwater, Maine. No construction records or photographs were available to the inspection team. A set of "as built" construction prints pertinent to this report are included in Appendix B.

2.3 Operation

No formal operational procedures were available for review. The principal and emergency spillways are uncontrolled structures requiring no manual operations.

2.4 Evaluation

a. Availability: The following information was made available by the SCS, Orono, Maine, office:

(1) As-built drawings (Appendix B).

(2) Limestone Steam Watershed Work plan, by Central Aroostook Soil Conservation District, December 1964.

(3) Information storage and retrieval data (Appendix E.)

Other pertinent engineering data such as the original design calculations are stored at the Federal Records Center in Waltham, Massachusetts and were not readily available.

- b. Adequacy: The lack of design calculations did not allow for a definitive review. Evaluation is based on visual inspection, past performance history and engineering judgment and experience.
- c. Validity: The limited data available restrict evaluation of the Webster Brook Dam and appurtenances to the visual inspection and engineering judgment. The field inspection indicated that the external features of Webster Brook Dam substantially agree with those shown on the available plans.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General - The field inspection was conducted by L. Seward and J. Jonas of Chas. T. Main, Inc. on 6 November 1979, and J.E. Giles, Jr. on August 12, 1981. On the date of inspection, the Webster dam and appurtenances were in good condition. No urgent or emergency actions are required at this time.

b. Dam

(1) Crest - The embankment crest was true to line with no apparent dips, sags, cracks or other evidence of distress (Photo 1). The top of the settled dam is given as Elev. 595.0 NGVD (see drawing 7 of 21, page B-8). The top of the "constructed dam" is given at Elev. 597.0' NGVD (see drawing 4 of 21, page B-5). This 2 foot variance at the center of the dam was designed so as to allow for the natural settlement of the structure over the lifetime of the project. The visual inspection shows the crest to have a slight crown which is in agreement with the as-built drawing (Photo 1). The crest is grass covered with no pavement.

(2) Upstream slope - The upstream slope riprap appeared in good condition. The slope above the normal pool El. 580 has a sparse grass cover. There was no evidence of sloughing or erosion on the slope.

(3) Downstream slope - The downstream slope has a well developed, tight grass cover (Photo 4). No significant gully action was observed on the slope. No slides or sags were observed.

(4) Downstream toe - The downstream toe is generally dry with no boils or seeps observed. Stagnant water was evident to the right of the outlet structure.

(5) Underdrain system - Two 6-inch diameter toe drain collector pipes issue from the dam adjacent to the principal spillway outlet. These outlets had no observed flows.

(6) Instrumentation - No instrumentation was observed.

c. Appurtenant Structures

(1) Principal Spillway - The principal spillway intake (Photo 2 and 3) was observed from shore. The exposed concrete and steel trashrack appeared in good condition.

(2) Outlet works - The outlet impact basin (Photo 5) was found in good condition. All construction joints were tight. No spalling was observed. The reservoir drain inlet was submerged and could not be inspected. The outlet conduit could not be inspected. The control mechanism for the drain was reported to have been recently operated without problems by the Limestone Town Manager.

(3) Emergency spillway - The emergency spillway was clear of debris and in good condition with a well developed grass cover (Photo 7).

- d. Reservoir Area - No areas of potential or actual shoreline movement were observed. There is a small pond located in the reservoir headwaters with a small dike separating the two. The top of this dike is at approximate Elev. 585. A 30" Ø corrugated steel conduit connects the two bodies of water. At the end of the conduit is a timber outlet structure (Photo 8).
- e. Downstream Channel - The downstream channel (Photo 6) was clear with no evidence of erosion. Further downstream, Webster Brook flows under Center Road and Route 165. It passes under Center Road through two corrugated steel culverts (Photo 9), one at 80" Ø and one at 27" Ø. It passes under Rte 165 through a bridge structure having an opening of 4' x 20' wide.

3.2 Evaluation - In general, the dam and appurtenances are in good condition. The slopes are stable and the crest is in good shape. The concrete structures are sound. No urgent or emergency repairs are required.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

- a. General: The principal and emergency spillways are uncontrolled overflow structures. No manual operations are required to insure safe passage of a flood flow.
- b. Description of Downstream Warning System: No warning system or emergency evacuation plans are in effect for this project.

4.2 Maintenance Procedures

- a. General: The Town of Limestone has an operation and maintenance agreement with the Soil Conservation Service. Each dam is inspected at least once annually and after every major storm. An inspection report is prepared and any required maintenance is then performed by the town.
- b. Operating Facilities: There are no manual operating facilities at this structure except for the reservoir drain gate on the principal spillway riser. Recent operation of the drain was reported. No regular maintenance procedures for the project operating facilities are specified.

4.3 Evaluation

The operating and maintenance procedures are limited for this project. The owner should establish procedures to inspect the structures regularly, continue to keep the embankment free of brush and trees, and to monitor the project during periods of intense rainfall.

The owner should arrange to have a technical inspection made on a bi-annual basis. The owner should establish a warning system to follow in the event of emergency conditions.

SECTION 5

EVALUATION OF HYDROLOGIC AND HYDRAULIC FEATURES

- 5.1 General - The watershed is 4.06 square miles of undeveloped rolling terrain. The dam is located on the Webster Brook, about 2.7 miles upstream from the confluence with Limestone Stream. The dam develops sufficient storage to reduce the Test Flood peak from 5140 cfs (1270 csm) to 2680 cfs (about 48% reduction).
- 5.2 Design Data - The dam was designed by the Soil Conservation Service, U.S. Department of Agriculture. The original hydrologic/hydraulic design called for the principal spillway to pass the 100 year flood and the emergency spillway to pass the Probable Maximum Precipitation (PMP) storm. The maximum height of the dam is 66 feet (capacity 6080 ac. ft.) and is classified as an intermediate size dam. The principal spillway consists of a reinforced concrete riser, a gated reservoir drain, a 30" diameter conduit with anti-seep collars and an energy dissipating structure at the outlet with a rip-rapped channel. The dam has an emergency spillway located adjacent to the left abutment. The drawings show that the bottom width is 100 feet with a crest at Elev. 588.6 feet. The drawings give the channel depth at the crest as 6.4 feet with channel side slopes of 2:1 (see sketch on page D-10).
- 5.3 Experience Data - There are no records of past floods or overtopping of the dam.
- 5.4 Test Flood Analysis - Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March 1978, the watershed classification (rolling), and hydraulic computations, the test flood for this high hazard, intermediate size dam is estimated to be equivalent to the PMF of 5140 cfs. The flood routing starting elevation was selected to be the principal spillway crest elevation (585 ft), and the inflow hydrograph peak was reduced by the volume between emergency spillway crest and principal spillway intake elevations. For this portion of Maine, the Maximum Probable Runoff is assumed to be 13 inches. The routed test flood outflow was determined in accordance with Corps of Engineers "Guidance for Estimating Effect of Surge Storage on Maximum Probable Discharges", and the hydraulic characteristics of the dam. Spillway discharge was computed as open channel flow. The routed test flood outflow was determined to be 2680 cfs, and the corresponding water surface elevation 590.4 ft. The top of the dam is 595.0 ft. and thus the dam will not be overtopped. The emergency spillway capacity is more than 100 percent of the test flood. As a check, a second test flood routing was performed assuming weir control in the emergency spillway and the dam was not overtopped.
- 5.5 Dam Failure Analysis - The volume in the reservoir corresponding to the water surface Elev. 590.4 NGVD is 4110 ac.-ft. which is the value used in this dam failure analysis. The impact of failure of the dam was assessed

using the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" prepared by the Corps of Engineers. The breach discharge was estimated with the maximum water surface elevation during a Test Flood event. The breach width was selected to be 35 percent of the length of the dam at mid-height. The downstream discharge is a sum of the breach discharge and the discharge from the spillway. The total peak discharge was estimated to be 158,396 cfs.

The result of the calculations are included in Appendix D. The conclusion of this dam failure analysis is that at least six houses located approximately 3000' downstream in the small community of Four Corners will be impacted by a flood wave with an initial depth of approximately 25'-30'. (See the Location Map, page vi, for the Downstream Flood Impact Area.) From the USGS map it is estimated that these subject houses are about 10 feet above the streambed. The prefailure channel level in this area was calculated to be approximately 7 feet. Thus, an unexpected dam failure at Webster Brook Dam will result in a potential loss of more than a few lives and serious property damage.

SECTION 6
EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation

The visual inspection on November 8, 1979 revealed no dips, sags, depressions or other evidence of instability.

6.2 Design and Construction Data

Original design calculations and construction records were not available for review in preparing this report. The construction drawings for the dam were reviewed. A typical construction specification for Durepo Brook Dam was reviewed as it was reported to be similar to the Webster Brook specification.

6.3 Post Construction Changes

No evidence of modification to the dam since construction was observed or reported.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 2 and, in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition - The visual inspection indicates that Webster Brook Dam is in good condition. The inspection revealed that there is a small area of stagnant water to the right of the spillway outlet at the toe with limited seepage observed in this area.
- b. Adequacy of Information - 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 history and engineering judgment.
- c. Urgency - The recommendations and remedial measures presented below should be implemented by the owner within two years of receipt of this Phase I Inspection Report.

7.2 Recommendations - None

7.3 Remedial Measures The owner should:

- a. Establish a system to monitor the project during periods of intense rainfall.
- b. Develop a downstream warning system to be used in case of an emergency at the dam.
- c. Implement a monthly visual inspection program of the dam and its appurtenances. Observations should be noted in a maintenance log.
- d. Continue to keep the embankment free of brush and trees and continue to keep the grass mowed.
- e. Conduct a technical inspection of the project every two years.
- f. Obtain and maintain a set of as-built drawings and inspection reports.

7.4 Alternatives

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

APPENDIX A

FIELD INSPECTION CHECK LIST

INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Webster Brook Dam
(Trafton Lake)

DATE Nov. 6, 1979

TIME 9:00

WEATHER Fair Cold

U.S. ELEV. _____ U.S. _____ DN.S.

PARTY:

- | | |
|---|-----------|
| 1. <u>Lewis B. Seward - Hydrologist</u> | 6. _____ |
| 2. <u>Jan N. Jonas - Civil Engineer</u> | 7. _____ |
| 3. <u>Peerless J. Snow - Limestone Town</u>
<u>Manager</u> | 8. _____ |
| 4. <u>J.E. Giles, Jr. - Project Manager</u> | 9. _____ |
| 5. _____
on August 12, 1981 | 10. _____ |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. All of the project features were inspected by each of the party members.		
2. _____		
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

INSPECTION CHECKLIST

PROJECT Webster Brook Dam DATE Nov. 6, 1979
 PROJECT FEATURE Earthfill dam NAME Lewis B. Seward
 DISCIPLINE Hydro NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	597
Current Pool Elevation	not known
Maximum Impoundment to Date	736 ac.ft
Surface Cracks	none visible
Pavement Condition	grassed slopes with riprap on u/s
Movement or Settlement of Crest	none noticeable
Lateral Movement	none noticeable
Vertical Alignment	good
Horizontal Alignment	no change
Condition at Abutment and at Concrete Structures	no damage to embankment-riprap
Indications of Movement of Structural Items on Slopes	none
Trespassing on Slopes	none
Vegetation on Slopes	thick grass
Sloughing or Erosion of Slopes or Abutments	none -
Rock Slope Protection - Riprap Failures	u/s with riprap, d/s grassed - no failure
Unusual Movement or Cracking at or near Toes	none
Unusual Embankment or Downstream Seepage	limited seepage d/s right from outlet - stagnant water at toe
Piping or Boils	none
Foundation Drainage Features	drain holes in both wing walls d/s no water was flowing
Toe Drains	none visible
Instrumentation System	none noticed

INSPECTION CHECKLIST

PROJECT Webster Brook Dam

DATE Nov. 6, 1979

PROJECT FEATURE Earthfill Dam

NAME Lewis B. Seward

DISCIPLINE Hydro

NAME Jan N. Jonas

AREA EVALUATED

CONDITIONS

OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE

a. Approach Channel

Slope Conditions

Bottom Conditions

Rock Slides or Falls

Log Boom

Debris

Condition of Concrete Lining

Drains or Weep Holes

b. Intake Structure

Condition of Concrete

Stop Logs and Slots

Not applicable

New concrete - very good
none, uncontrolled spillway
with trashracks

INSPECTION CHECKLIST

PROJECT Webster Brook Dam

DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam

NAME Lewis B. Seward

DISCIPLINE Hydro

NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. <u>Concrete and Structural</u>	same as intake tower
General Condition	very good
Condition of Joints	tight
Spalling	none
Visible Reinforcing	none
Rusting or Staining of Concrete	none
Any Seepage or Efflorescence	not applicable
Joint Alignment	good
Unusual Seepage or Leaks in Gate Chamber	not applicable
Cracks	none
Rusting or Corrosion of Steel	none
b. <u>Mechanical and Electrical</u>	
Air Vents	none
Float Wells	none
Crane Hoist	none
Elevator	none
Hydraulic System	none
Service Gates	none
Emergency Gates	hand operated gate valve from top of intake structure
Lightning Protection System	none
Emergency Power System	none
Wiring and Lighting System in Gate Chamber	none

INSPECTION CHECKLIST

PROJECT Webster Brook Dam

DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam

NAME Lewis B. Seward

DISCIPLINE Hydro

NAME Jan N. Jonas

AREA EVALUATED

CONDITIONS

OUTLET WORKS - TRANSITION AND CON-
DUIT

Concrete pipe embedded in dam
not exposed for inspection

General Condition of Concrete
Rust or Staining on Concrete
Spalling
Erosion or Cavitation
Cracking
Alignment of Monoliths
Alignment of Joints
Numbering of Monoliths

INSPECTION CHECKLIST

PROJECT Webster Brook Dam

DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam

NAME Lewis B. Seward

DISCIPLINE Hydro

NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	very good
Rust or Staining	none
Spalling	none
Erosion or Cavitation	none
Visible Reinforcing	none
Any Seepage or Efflorescence	none
Condition at Joints	tights
Drain Holes	at wing walls
Channel	grassed cut slopes
Loose Rock or Trees Overhanging Channel	none
Condition of Discharge Channel	very good - no obstacles, grassed banks

INSPECTION CHECKLIST

PROJECT Webster Brook Dam

DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam

NAME Lewis B. Seward

DISCIPLINE Hydro

NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. <u>Approach Channel</u>	
General Condition	satisfactory - grassed slopes
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	none
Floor of Approach Channel	weathered rock covered with grass
b. <u>Weir and Training Walls</u>	
General Condition of Concrete	no concrete used - earth and rock
Rust or Staining	cut slopes, unpaved floor
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. <u>Discharge Channel</u>	
General Condition	nothing downstream
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

APPENDIX B
ENGINEERING DATA

- Note:
1. All design records are in storage at the:
National Archives and Records Service
GSA Federal Archives and Records Center
380 Trapelo Road, Waltham, Massachusetts 02154
617-223-2657
 2. No past inspection reports were available for review or are known to exist.

LIST OF ENCLOSED DRAWINGS

	<u>Sheet Number</u>
<u>1.</u> Plan of Storage and Borrow Area	2 of 21
<u>2.</u> Plan of Dam Site	3 of 21
<u>3.</u> Cutoff Trench Details	4 of 21
<u>4.</u> Fill Placement and Spillway Excavation	5 of 21
<u>5.</u> Drainage Details	6 of 21
<u>6.</u> Principle Spillway	7 of 21
<u>7.</u> Test Pits Logs	19 of 21
<u>8.</u> Test Pits Logs	20 of 21

References

Material from the following references was extracted and incorporated herein:

- a. "Limestone Stream Watershed Work Plan" Central Aroostook Soil Conservation District December, 1964.
- b. U.S. Dept. of Agriculture, Soil Conservation Service, "Webster Brook Site Drawings", Project No. ME-504-P, (21 sheets) 1967 series.
- c. "Durepo Brook - Invitation to Bid" March 1971 SCS construction specification (Typ.)
- d. SCS Technical Information Storage and Retrieval System Printout.

APPROX. ELEV. 400-600
 100' 200' 300' 400' 500' 600' 700' 800' 900' 1000'

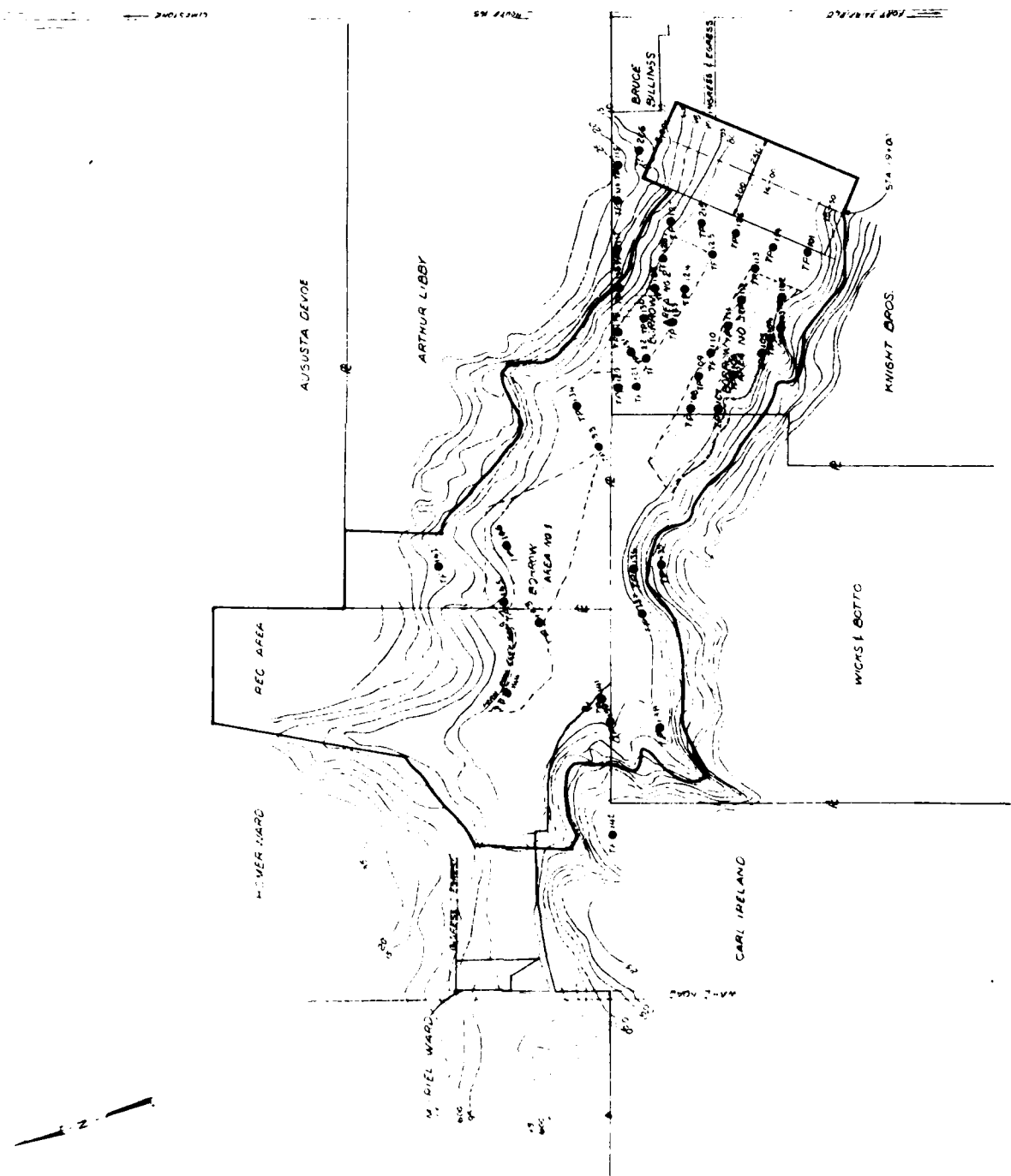
LEGEND
 Barlow Areas
 Water Limits

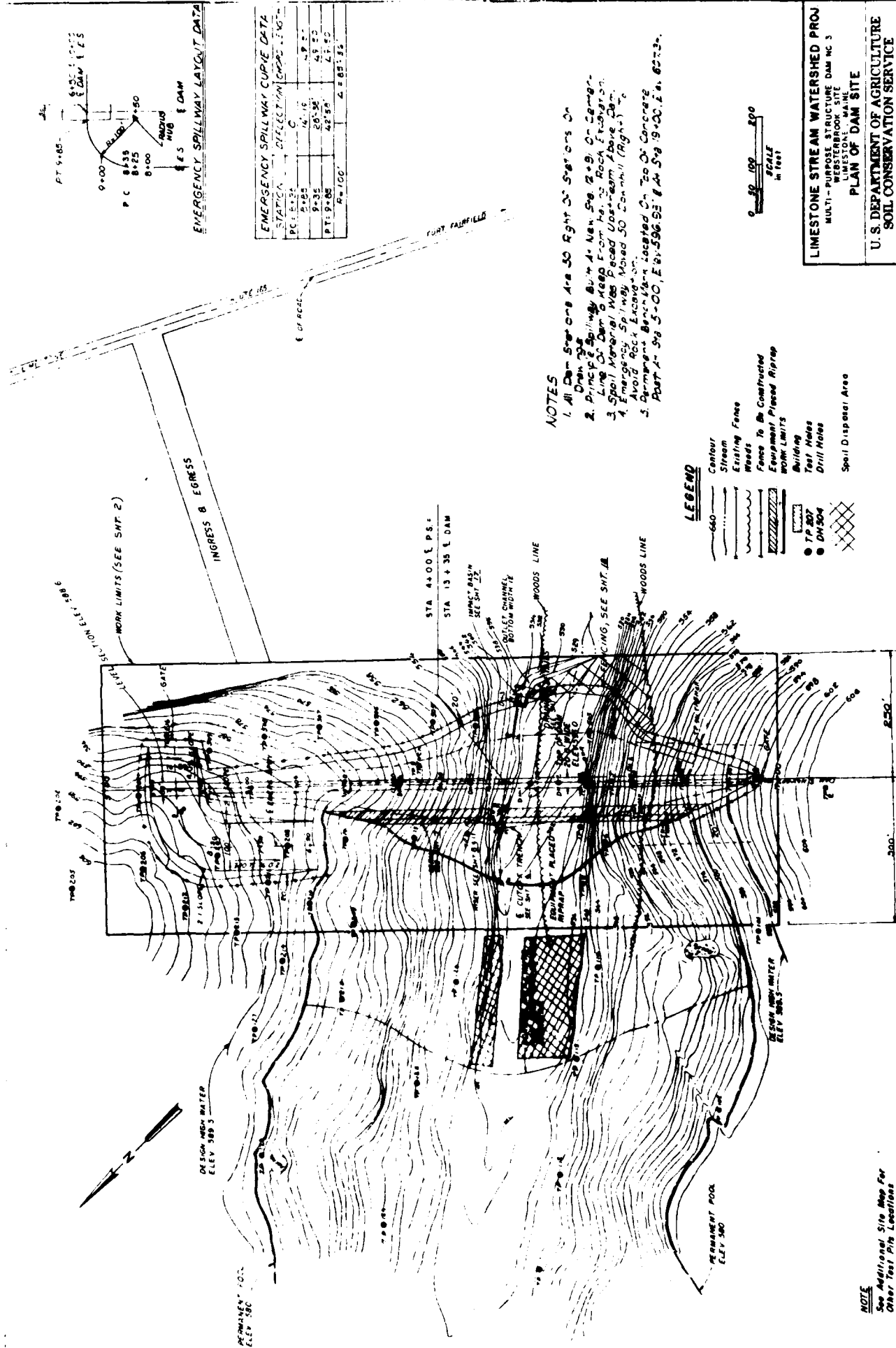
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LIMESTONE STREAM WATERSHED PROJ.
 MULTI-PURPOSE STRUCTURE DAM NO. 3
 LIMESTONE, NAME
 WEBSTER BROOK SITE
 PLAN OF STORAGE & BORROW AREA
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

0 P. BOWIE 3.67
 M. ATLAS 3.67

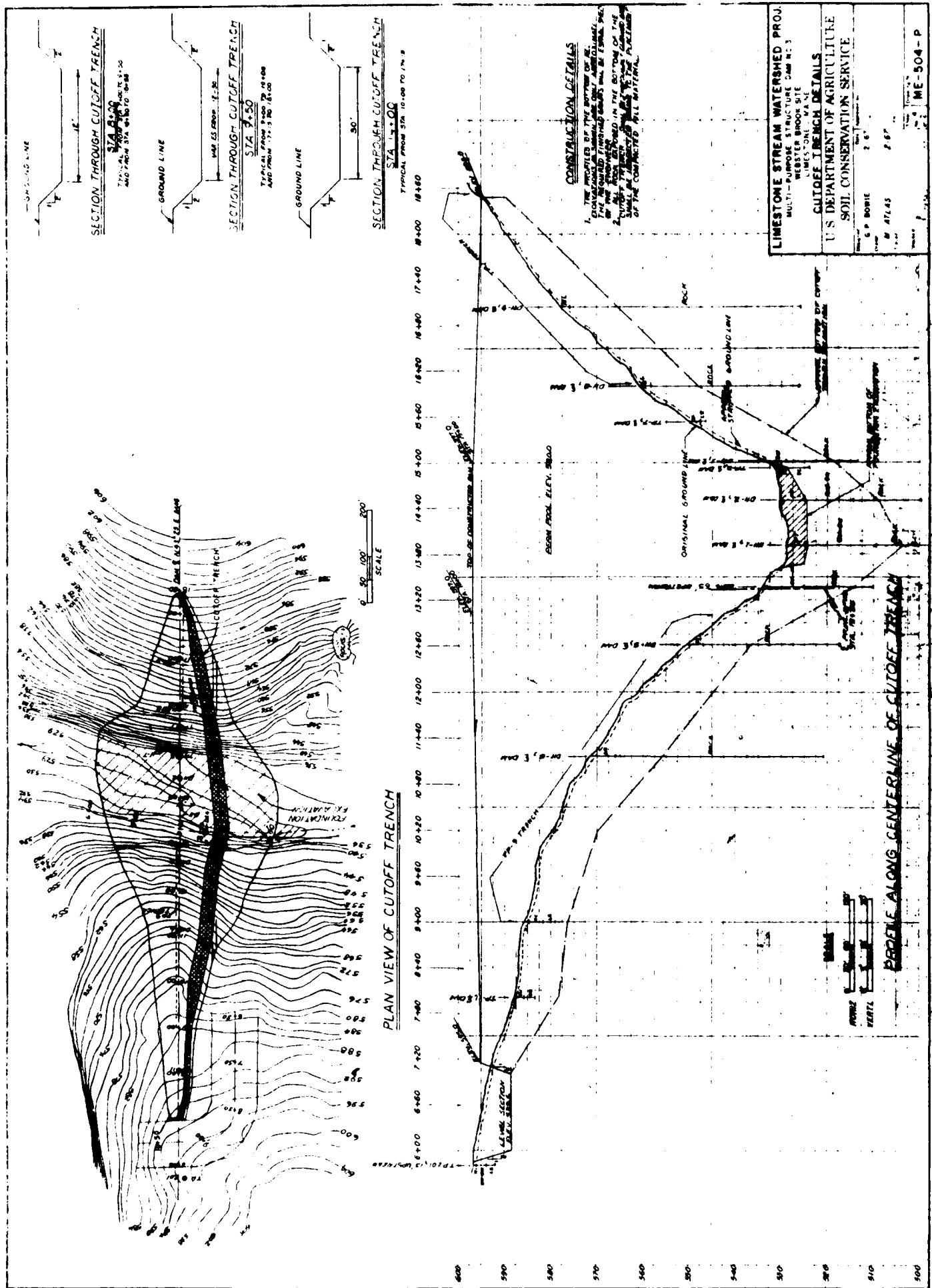
WE-SCA-P



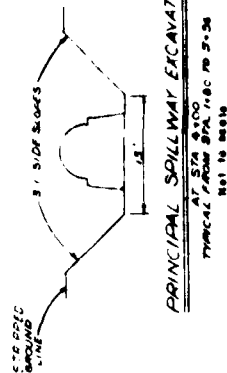
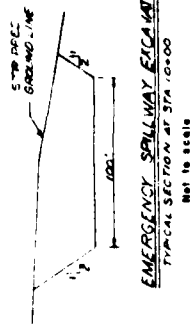
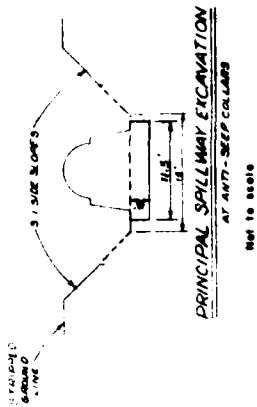


NOTE
***See Additional Site Map For
Other Test Pit Locations***

Rev: 22 7/10/67 C

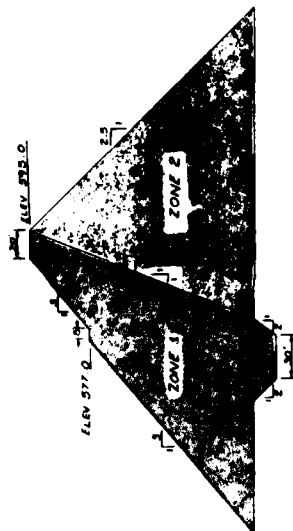


ME-504-P

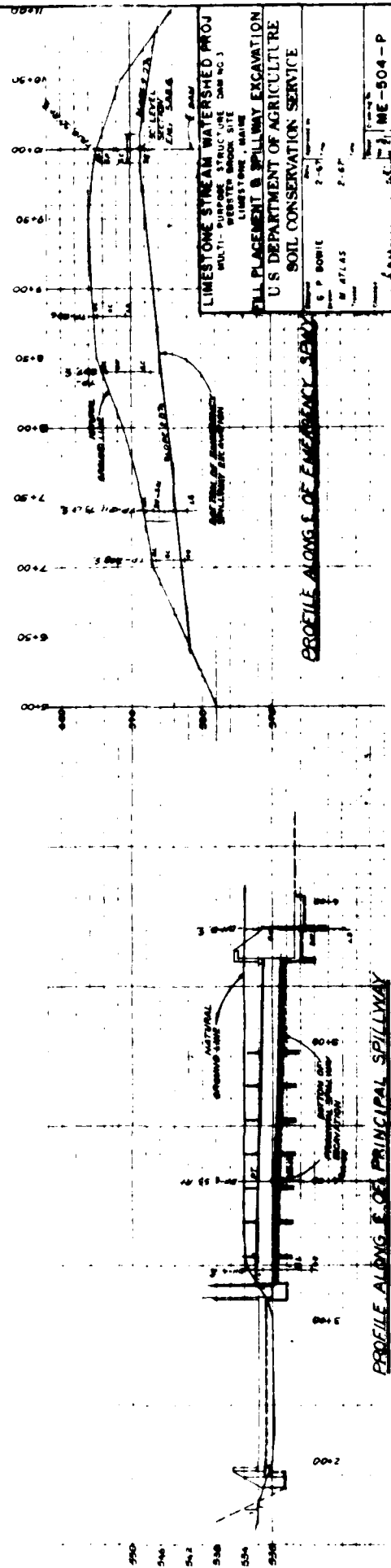


ZONE	MATERIAL	MAX ROCK SIZE	MAX LIFT	REQD	CONSTRUCTION
1	CLAYEY GRAVEL (G.C.) FROM DOWNHILL AREA REPRESENTED BY MATERIAL IN TR-148 1-1-3	6"	8"	1.5% TO 1.8% OF FILL TO 15% OF FILL	CLASS A
2	SILT GRAVEL (G.C.) FROM DOWNHILL AREA REPRESENTED BY MTS. 120, 135, 140	6"	8"	1.5% TO 1.8% OF FILL TO 15% OF FILL	CLASS A

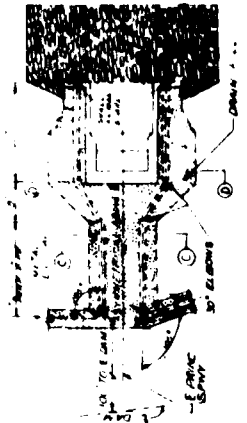
CONSTR. DETAIL
THE FOUNDATION SURFACE THROUGHOUT THE BASE OF THE DAM, SHALL BE SCARIFIED TO A DEPTH OF 6" AND COMPACTED PRIOR TO PLACEMENT OF EARTH FILL.
THE PROJECTIONS OF THE FILL MATERIAL SHALL BE APPROXIMATELY THE PROJECTIONS OF THE FILL WHICH INCLUDES UP TO 3 FEET OF WEATHERED ROCK.



TYPICAL SECTION OF EMBANKMENT AT STA 14+00
TYPICAL FROM STA 10+00 TO 14+00



LIMESTONE STREAM WATERSHED PROJ
MULTI-PURPOSE STRUC. PROJ. LAM. NO. 3
LIMESTONE, MAINE
DRAINAGE DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. P. BOWIE 2-37
M. ATLAS 2-67
ME-504-P



CONSTRUCTION NOTES

1. DRAIN IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AS APPLICABLE.

2. THE DRAIN IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AS APPLICABLE.

3. THE DRAIN IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AS APPLICABLE.

4. THE DRAIN IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AS APPLICABLE.

5. THE DRAIN IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AS APPLICABLE.

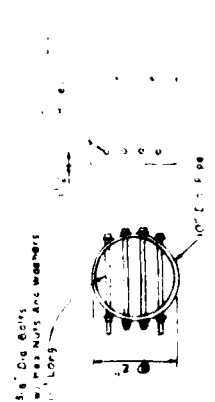
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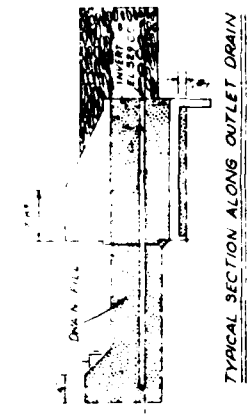
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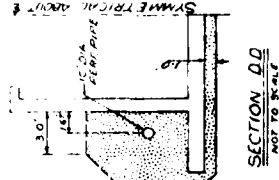
10. THE DRAIN IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, LATEST EDITION, AS APPLICABLE.



SMALL ANIMAL GUARD DETAILS
NOT TO SCALE
12 DEC. 1967

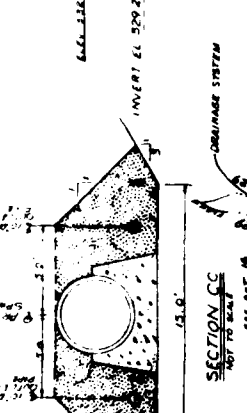


TYPICAL SECTION ALONG OUTLET DRAIN
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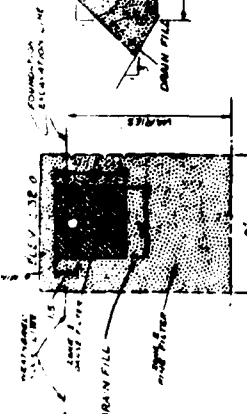


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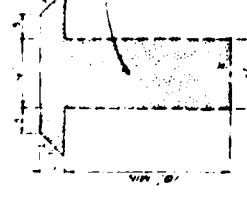
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5	100	0
10	100	0
20	100	0
40	100	0
60	100	0
80	100	0
100	100	0
120	100	0
140	100	0
160	100	0
180	100	0
200	100	0



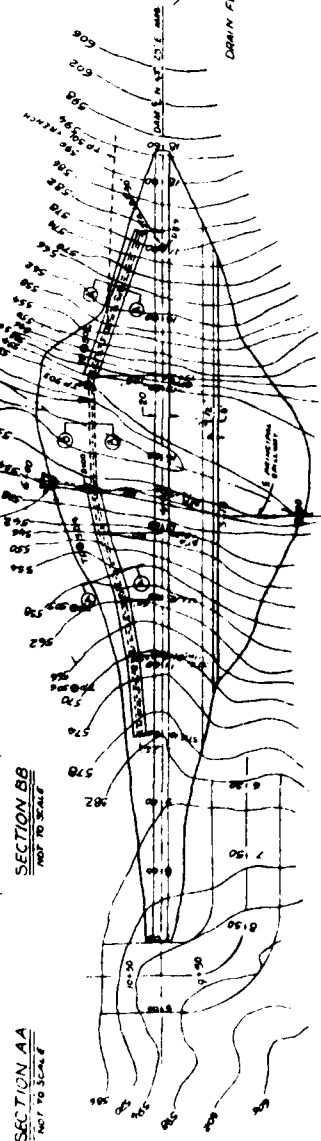
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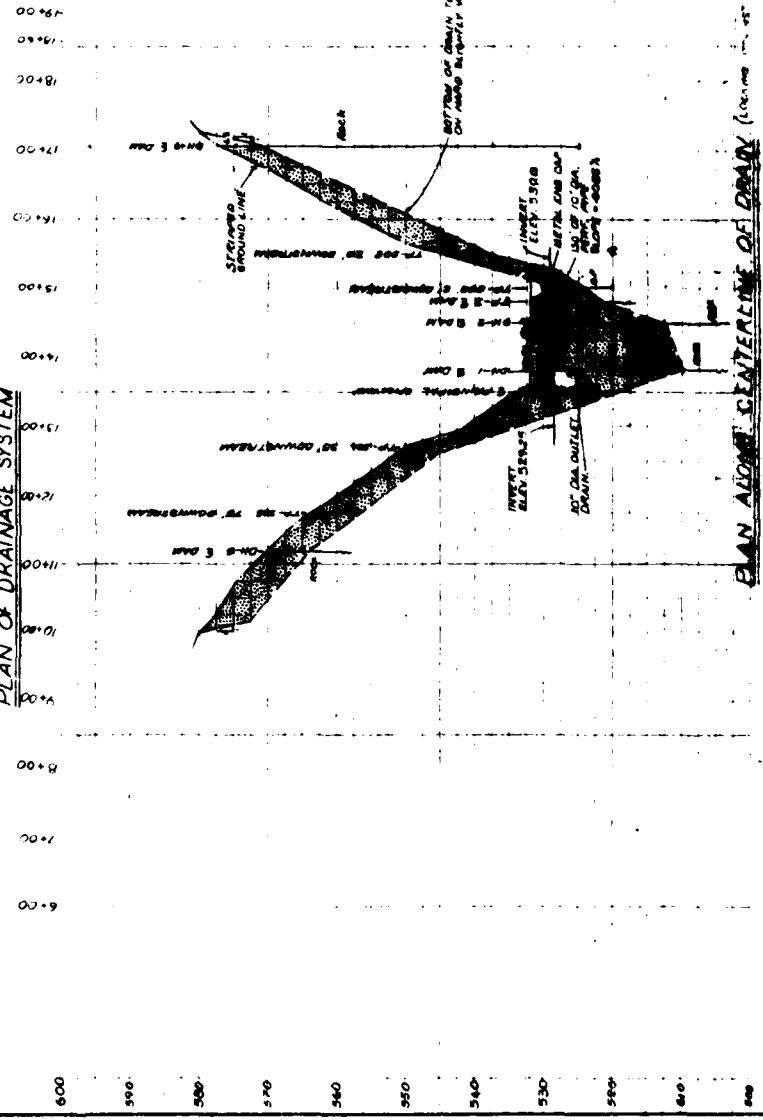
SECTION BB
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SECTION AA
NOT TO SCALE



PLAN OF DRAINAGE SYSTEM



PLAN ALONG CENTERLINE OF DRAIN (SEE ME-504-P)

MULTI-PURPOSE STRUCTURE CAM NC :

WESTERN BROOK SITE

PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

6 P BOWE 2-67
W ATLAS 2-67

ME-504-2

[illegible]

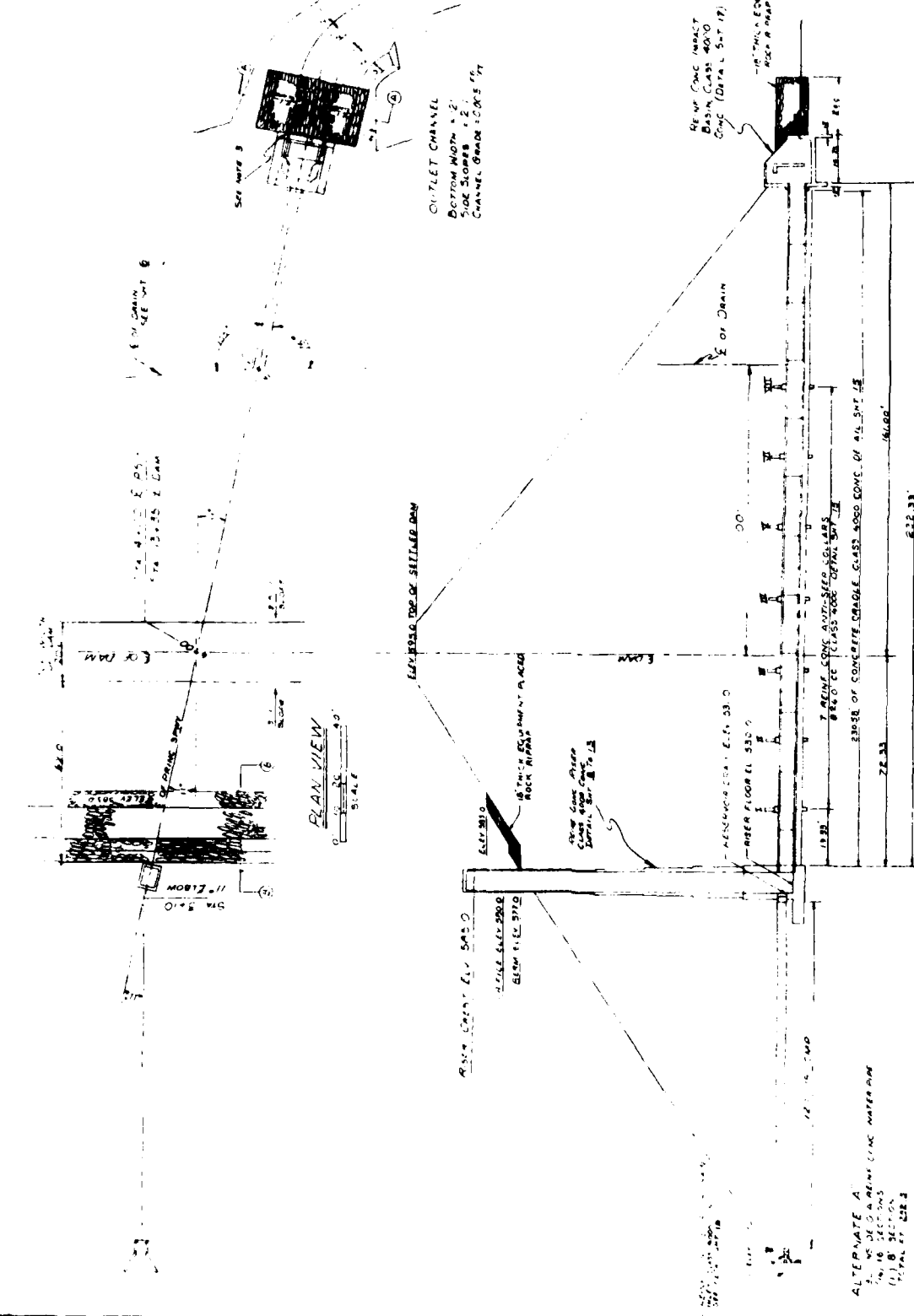
DATE	DESCRIPTION	AMOUNT	BALANCE
10/1	TO BALANCE	100.00	100.00
10/2	BY CHECK	25.00	75.00
10/3	TO DEPOSIT	50.00	125.00
10/4	BY CHECK	15.00	110.00
10/5	TO DEPOSIT	30.00	140.00
10/6	BY CHECK	20.00	120.00
10/7	TO DEPOSIT	40.00	160.00
10/8	BY CHECK	10.00	150.00
10/9	TO DEPOSIT	25.00	175.00
10/10	BY CHECK	35.00	140.00
10/11	TO DEPOSIT	15.00	155.00
10/12	BY CHECK	45.00	110.00
10/13	TO DEPOSIT	20.00	130.00
10/14	BY CHECK	30.00	100.00
10/15	TO DEPOSIT	10.00	110.00
10/16	BY CHECK	25.00	85.00
10/17	TO DEPOSIT	40.00	125.00
10/18	BY CHECK	15.00	110.00
10/19	TO DEPOSIT	30.00	140.00
10/20	BY CHECK	20.00	120.00
10/21	TO DEPOSIT	45.00	165.00
10/22	BY CHECK	10.00	155.00
10/23	TO DEPOSIT	25.00	180.00
10/24	BY CHECK	35.00	145.00
10/25	TO DEPOSIT	15.00	160.00
10/26	BY CHECK	40.00	120.00
10/27	TO DEPOSIT	20.00	140.00
10/28	BY CHECK	30.00	110.00
10/29	TO DEPOSIT	10.00	120.00
10/30	BY CHECK	25.00	95.00
10/31	TO DEPOSIT	40.00	135.00
11/1	BY CHECK	15.00	120.00
11/2	TO DEPOSIT	30.00	150.00
11/3	BY CHECK	20.00	130.00
11/4	TO DEPOSIT	45.00	175.00
11/5	BY CHECK	10.00	165.00
11/6	TO DEPOSIT	25.00	190.00
11/7	BY CHECK	35.00	155.00
11/8	TO DEPOSIT	15.00	170.00
11/9	BY CHECK	40.00	130.00
11/10	TO DEPOSIT	20.00	150.00
11/11	BY CHECK	30.00	120.00
11/12	TO DEPOSIT	10.00	130.00
11/13	BY CHECK	25.00	105.00
11/14	TO DEPOSIT	40.00	145.00
11/15	BY CHECK	15.00	130.00
11/16	TO DEPOSIT	30.00	160.00
11/17	BY CHECK	20.00	140.00
11/18	TO DEPOSIT	45.00	185.00
11/19	BY CHECK	10.00	175.00
11/20	TO DEPOSIT	25.00	200.00
11/21	BY CHECK	35.00	165.00
11/22	TO DEPOSIT	15.00	180.00
11/23	BY CHECK	40.00	140.00
11/24	TO DEPOSIT	20.00	160.00
11/25	BY CHECK	30.00	130.00
11/26	TO DEPOSIT	10.00	140.00
11/27	BY CHECK	25.00	115.00
11/28	TO DEPOSIT	40.00	155.00
11/29	BY CHECK	15.00	140.00
11/30	TO DEPOSIT	30.00	170.00
11/31	BY CHECK	20.00	150.00
12/1	TO DEPOSIT	45.00	195.00
12/2	BY CHECK	10.00	185.00
12/3	TO DEPOSIT	25.00	210.00
12/4	BY CHECK	35.00	175.00
12/5	TO DEPOSIT	15.00	190.00
12/6	BY CHECK	40.00	150.00
12/7	TO DEPOSIT	20.00	170.00
12/8	BY CHECK	30.00	140.00
12/9	TO DEPOSIT	10.00	150.00
12/10	BY CHECK	25.00	125.00
12/11	TO DEPOSIT	40.00	165.00
12/12	BY CHECK	15.00	150.00
12/13	TO DEPOSIT	30.00	180.00
12/14	BY CHECK	20.00	160.00
12/15	TO DEPOSIT	45.00	205.00
12/16	BY CHECK	10.00	195.00
12/17	TO DEPOSIT	25.00	220.00
12/18	BY CHECK	35.00	185.00
12/19	TO DEPOSIT	15.00	200.00
12/20	BY CHECK	40.00	160.00
12/21	TO DEPOSIT	20.00	180.00
12/22	BY CHECK	30.00	150.00
12/23	TO DEPOSIT	10.00	160.00
12/24	BY CHECK	25.00	135.00
12/25	TO DEPOSIT	40.00	175.00
12/26	BY CHECK	15.00	160.00
12/27	TO DEPOSIT	30.00	190.00
12/28	BY CHECK	20.00	170.00
12/29	TO DEPOSIT	45.00	215.00
12/30	BY CHECK	10.00	205.00
12/31	TO DEPOSIT	25.00	230.00

NOTE:
DIMENSIONS FOR PIPE LEGS ARE BASED
ON NOMINAL LENGTHS AND DO NOT INCLUDE
CAPS

Distance from Base camp	Number of M.C. at Camp	Number of M.C. at Camp
I	183	529.3
II	183	529.3
III	183	529.3
IV	183	529.3
V	183	529.3
VI	183	529.3
VII	183	529.3

NOTE:

1. REPAIR AND DRAIN SHALL CONFORM TO SPEC. 2 AND SHALL BE 18" T.C. 16 GUARD, STAFFE 1 CLASS 1, TYPE D NON-DEGRADABLE
2. ALL CONCRETE CONDUIT SHALL CONFORM TO MATERIAL SPEC 109
3. DEPRESS RIMPIPE AROUND OUTLET SHALL BE 18"



PROFILE ALONG E OF PRINCIPAL SPILLWAY

FULL

NCAR/3.5C41E

Rev. 540 7/10/82 2

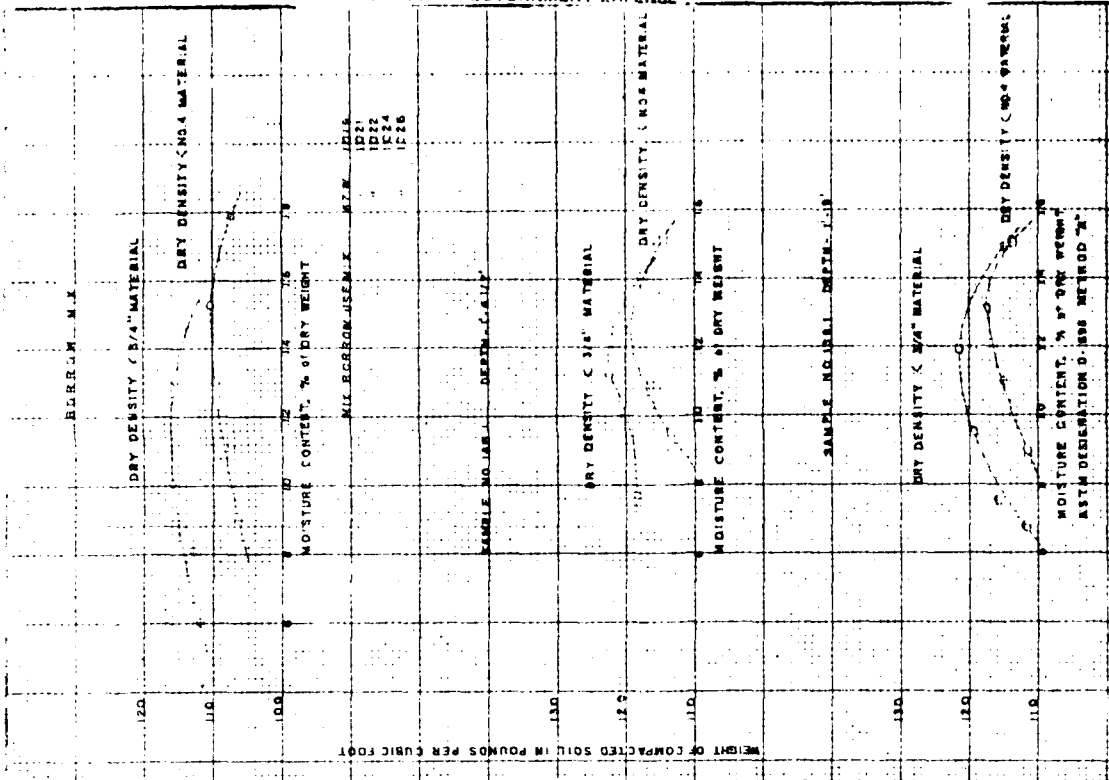
ALTERNATE A
2- WOODS DRILLING CONC WATER ADS
10, 16 SECTIONS
(1) 8' SECTION
TOTAL 24.83

ALTERNATE B"
20 INS. L.O.A. MEANS CONC. WATER PIPE
111.47 SECT. 242
111.16 SECT. 244
TOTAL FT. 232.2

MIN 100% BEARING STRNGTH FOR COLL-CRACK
PRESERVE DEDUCTIBLE: 11 LOS PER LIN FT

MIN 100% BEARING STRNGTH FOR COLL-CRACK
PRESERVE DEDUCTIBLE: 11 LOS PER LIN FT

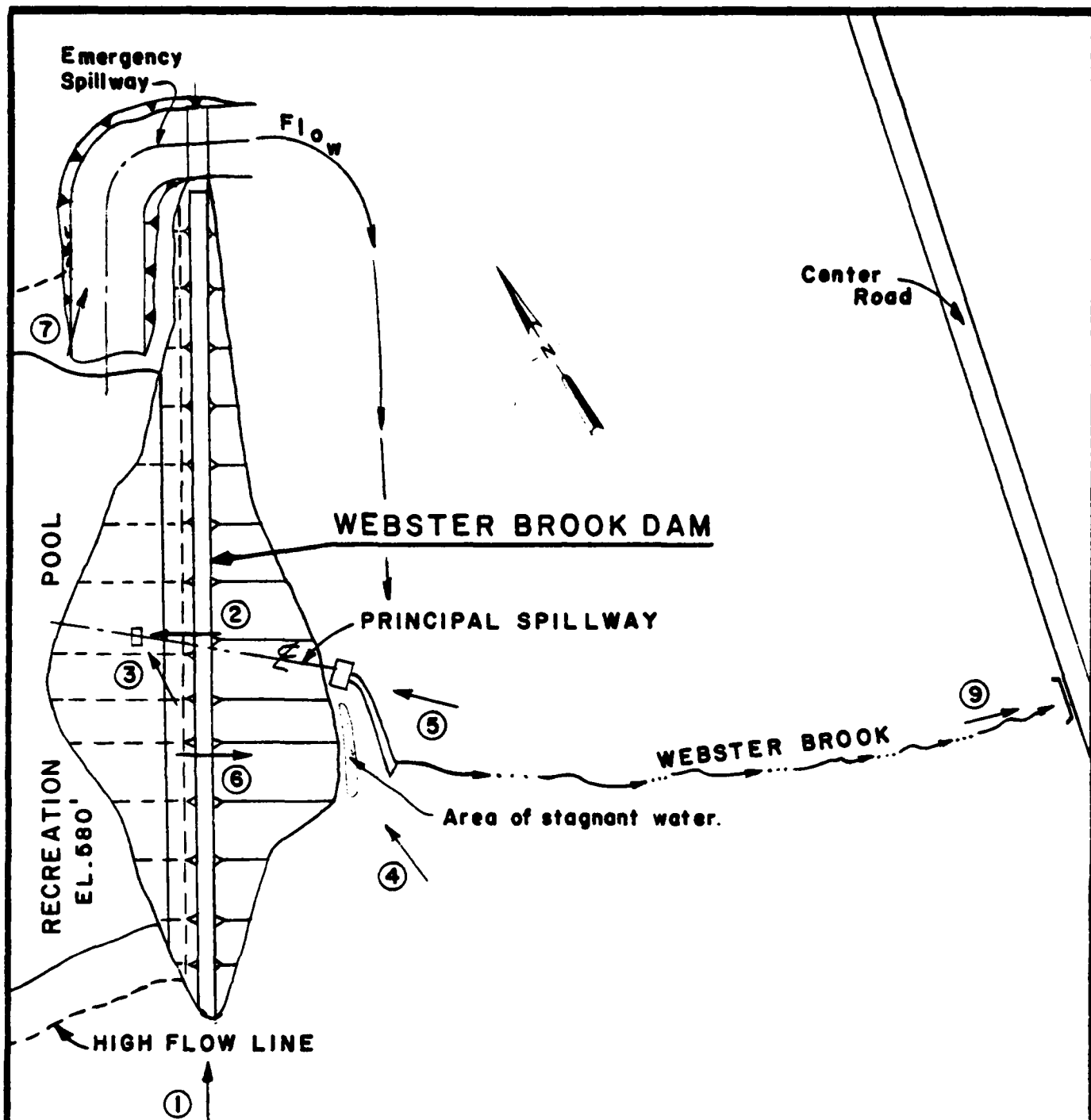
[illegible]



LIMESTONE STREAM WATERSHED PROJ
 MULT - P. ABOVE 1500' - RE JAN 12
 WEBSTER BROOK SITE
 JIMMIE, MAINE
 LOSS OF DRILL HOLES
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 WASHINGTON, D.C. 20250
 REGIONAL OFFICE
 1000 BR. A. JENNER BLDG.
 WASHINGTON, D.C. 20004
 MF-504-P

APPENDIX C

PHOTOGRAPHS



LEGEND

① PHOTO LOCATION

NOTE: Photo No. 8 is not shown on this map.

WEBSTER BROOK DAM PHOTO LOCATION

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

DATE November, 1980

MAIN

CLIENT 100 PLATE

1345 72 4



Photo #1
General view of
Dam from right
Abutment



Photo #2
View of Principal
Spillway Intake
from Crest of
Dam.

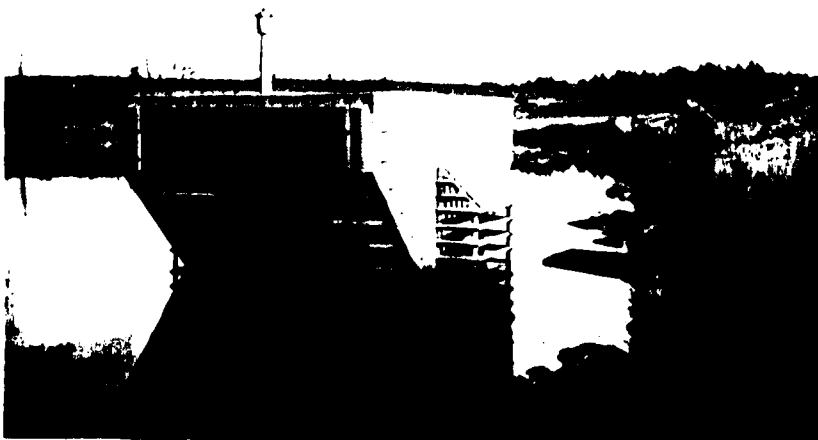


Photo #3
Close-up view of
Principal Spillway
Intake Structure



Photo #4

View of Downstream
Slope with Outlet
Structure



Photo #5

Concrete Outlet
Structure



Photo #6

View of Outlet
Channel from
Crest of Dam



Photo # 7

Emergency Spillway



Photo # 8

Upstream Reservoir

Outlet Structure



Photo # 9

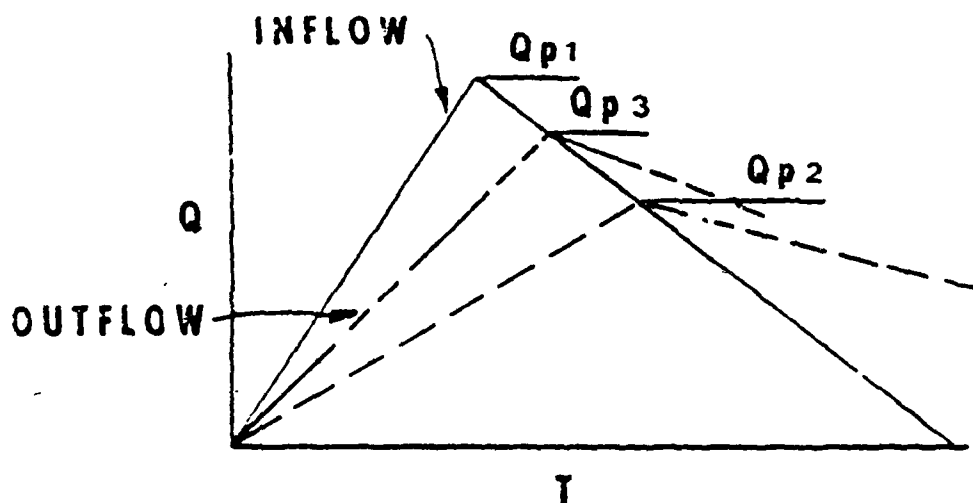
Center Road

Culverts

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Q_{p1}) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass " Q_{p1} ".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

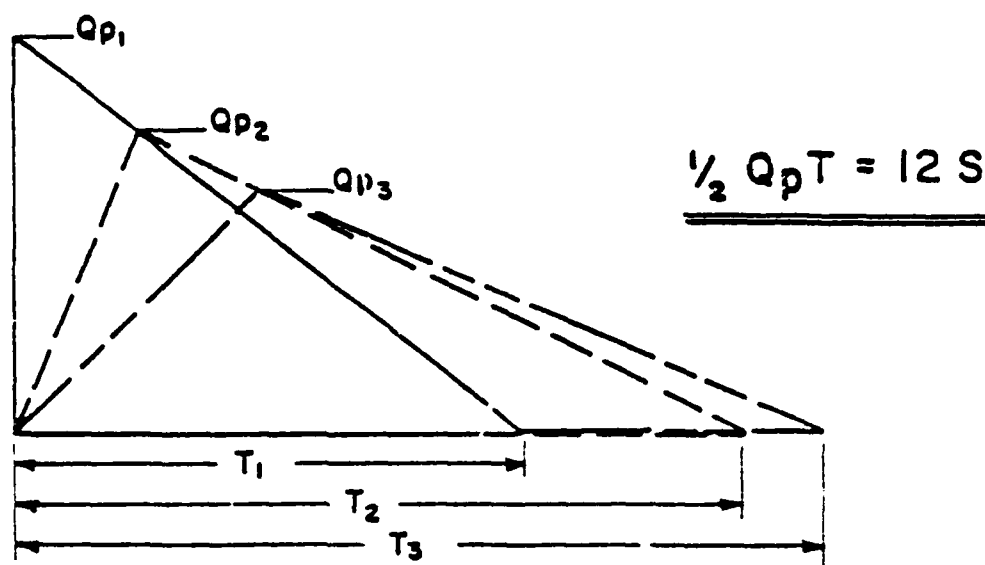
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and " $STOR_2$ " To Pass " Q_{p2} "

b. Average " $STOR_1$ " and " $STOR_2$ " and Determine Average Surcharge and Resulting Peak Outflow " Q_{p3} ".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g} Y_0^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_0 = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS $1/2$ OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2} .

$$Q_{p2}(\text{TRIAL}) = Q_{p1} \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING $Q_{p2}(\text{TRIAL})$.

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2} .

$$Q_{p2} = Q_{p1} \left(1 - \frac{V_{\text{avg}}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surchage Height and
"STOR₂" To Pass "Q_{p2}"

b. Avg "STOR₁" and "STOR₂" and
Compute "Q_{p3}".

c. If Surchage Height for Q_{p3} and
"STOR_{avg}" agree O.K. If Not:

STEP 4: a. Determine Surchage Height and
"STOR₃" To Pass "Q_{p3}"

b. Avg. "Old STOR_{avg}" and "STOR₃"
and Compute "Q_{p4}"

c. Surchage Height for Q_{p4} and
"New STOR_{avg}" should Agree
closely

MAIN

Client CORPS OF ENGINEERS

Job No. 134T-072 Sheet 1 of 14

Subject WEBSTER BROOK RES. FLOOD ROUTING By T. OTTUM

Date 1-27-81

CURVE FITTING

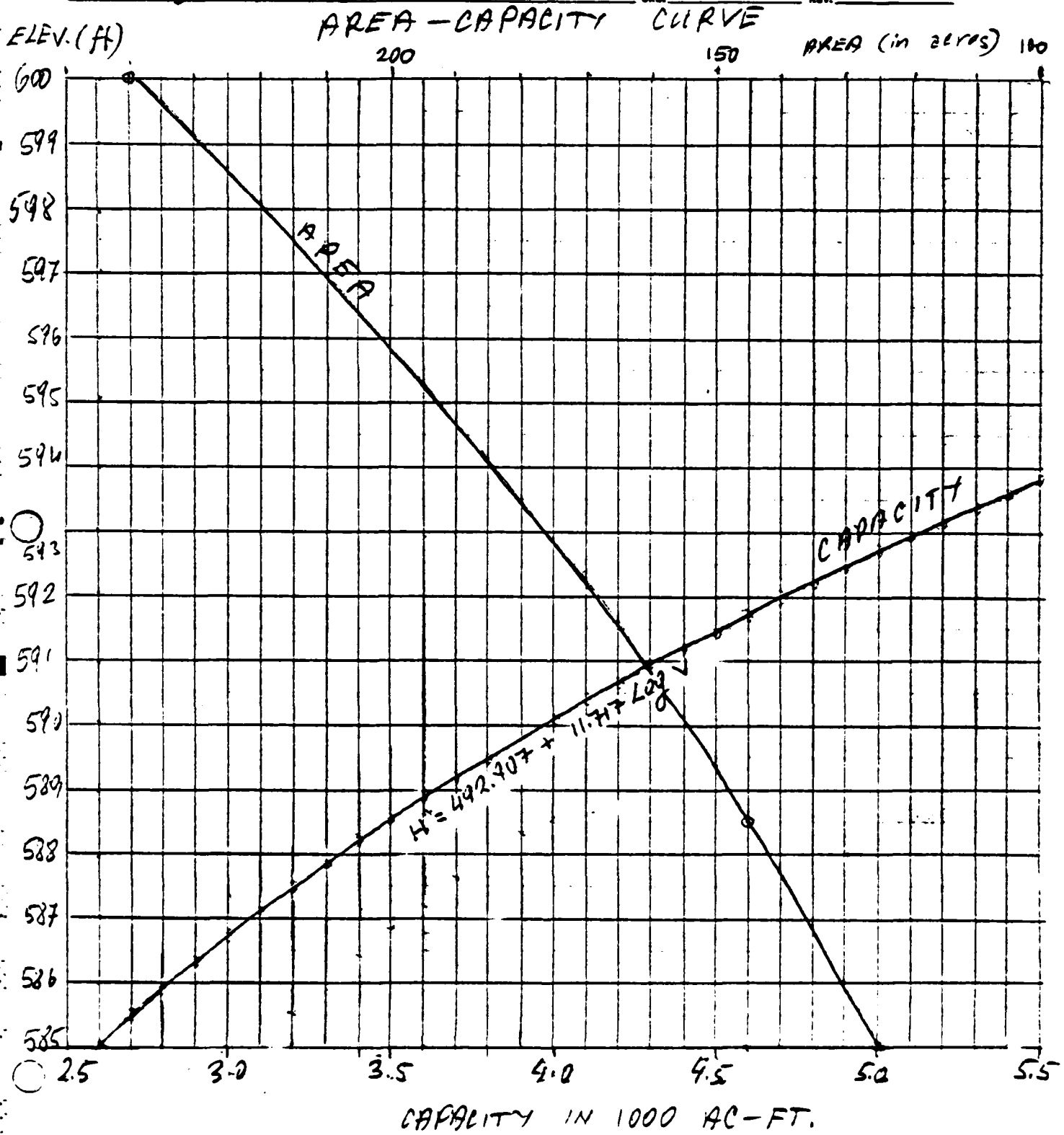
Chd.

Rev.

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2700 00	585 00	585 00	X(I)	YHAT
2900 00	585 00	585 00		
3100 00	585 00	585 00	4100 00	590 38
3300 00	585 00	585 00	X(I)	YHAT
3500 00	585 00	585 00		
3700 00	585 00	585 00	4200 00	590 56
3900 00	585 00	585 00	X(I)	YHAT
4100 00	585 00	585 00		
4300 00	585 00	585 00	4300 00	590 94
4500 00	585 00	585 00	X(I)	YHAT
4700 00	585 00	585 00		
4900 00	585 00	585 00	4400 00	591 21
5100 00	585 00	585 00	X(I)	YHAT
5300 00	585 00	585 00		
5500 00	585 00	585 00	4500 00	591 47
5700 00	585 00	585 00	X(I)	YHAT
5900 00	585 00	585 00		
6100 00	585 00	585 00	4600 00	591 73
6300 00	585 00	585 00	X(I)	YHAT
6500 00	585 00	585 00		
6700 00	585 00	585 00	4700 00	591 98
6900 00	585 00	585 00	X(I)	YHAT
7100 00	585 00	585 00		
7300 00	585 00	585 00	4800 00	592 23
7500 00	585 00	585 00	X(I)	YHAT
7700 00	585 00	585 00		
7900 00	585 00	585 00	4900 00	592 47
8100 00	585 00	585 00	X(I)	YHAT
8300 00	585 00	585 00		
8500 00	585 00	585 00	5000 00	592 71
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8900 00	585 00	585 00		
9100 00	585 00	585 00	5100 00	592 94
9300 00	585 00	585 00	X(I)	YHAT
9500 00	585 00	585 00		
9700 00	585 00	585 00	5200 00	593 17
9900 00	585 00	585 00	X(I)	YHAT
10000 00	585 00	585 00		
			5300 00	593 39
			X(I)	YHAT
			5400 00	593 61
			X(I)	YHAT
			5500 00	593 82
			X(I)	YHAT
			5600 00	594 03
			X(I)	YHAT

MAIN

Client COAPS OF ENGINEERS Job No. BUS-272 Sheet 2 of 14
 Subject WEBSTER BROOK RESERVOIR By T. OTOVA Date 1-27-81
FLOOD ROUTING Ckd. _____ Rev. _____



MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 3 of 14
Subject WEBSTER BROOK RESERVOIR By T. OTOVA Date 1-28-81
FLOOD ROUTING Ckd. _____ Rev. _____

Drainage Area = 4.06 sq. mi.

For rolling terrain $q_{PMF} = 1850$ cfs

These results are based on 19" runoff.

The Depth-Area-Duration curves yield 13" of runoff for the area considered and this is used in the calculations insted of 19" as is shown in Corps of Engineers Guidelines.

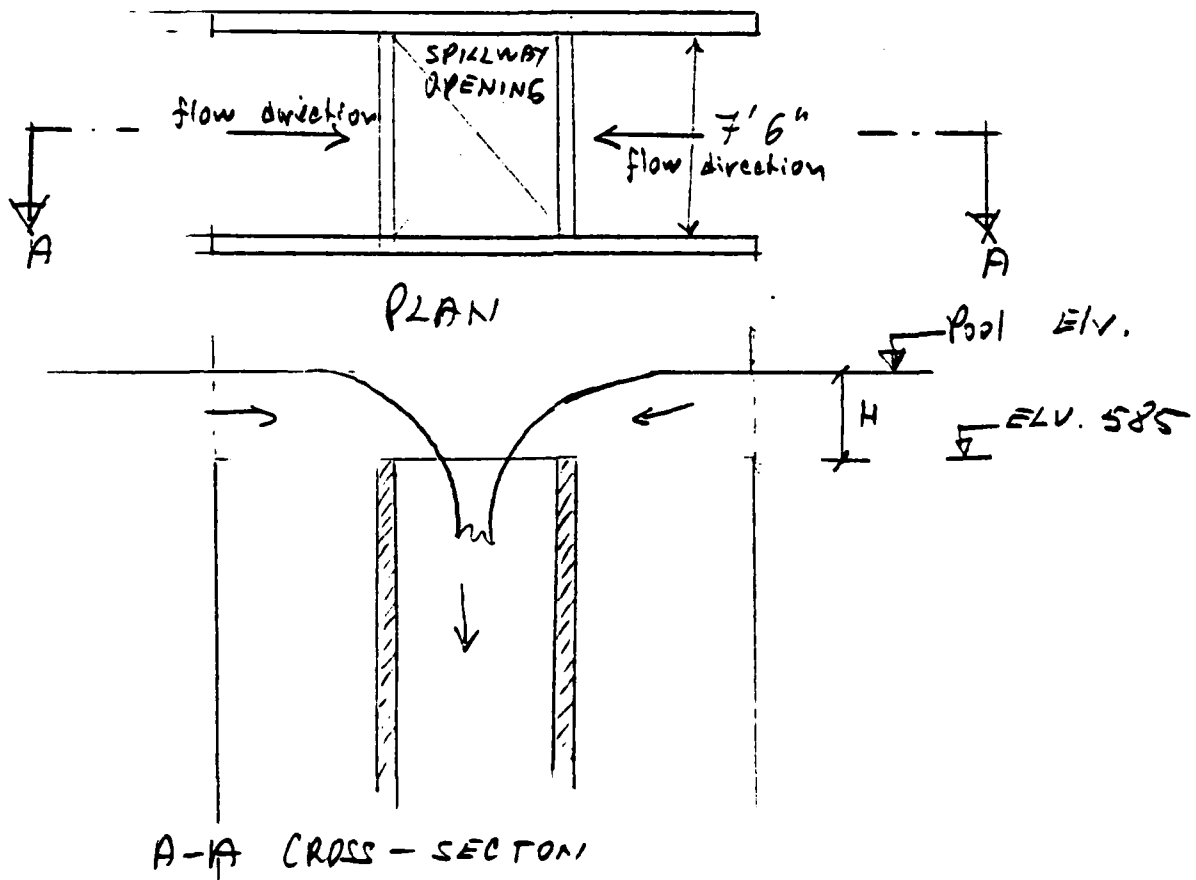
$$\text{New } q_{PMF} = 1850 \times \frac{13}{19} = 1265.8 \text{ cfs}$$

$$Q_{\text{Test flood}} = 1265.8 \times 4.06 = 5139 \text{ cfs.}$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-DY2 Sheet 3^A of 14
 Subject WEBSTER BROOK By T. OTAVA Date 6-25-80
FLOOD LEVEL CALCULATIONS Ckd. _____ Rev. _____

CALCULATION OF THE POOL ELEVATION FOR 208 cfs
DISCHARGE FROM THE PRINCIPAL SPILLWAY:



$$L = 7.5 \text{ ft} \times 2 = 15.0 \text{ ft.}$$

$$C = 3.3 \text{ (Spillway coef)}$$

$$H = \left(\frac{Q}{C \times L} \right)^{2/3}$$

$$H = \left(\frac{208}{3.3 \times 15} \right)^{2/3} = 2.6 \text{ ft.}$$

$$\text{Pool Elevation} = 585 + 2.6 = 587.6 \text{ ft. D-8}$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-032 Sheet 3 of 14
 Subject WEBSTER BROOK By T. OTOVA Date 4-25-80
FLOOD LEVEL CALCULATIONS Ckd. _____ Rev. _____

PIPE SPILLWAYS

PRINCIPAL SPILLWAY

The formula used in these calculations is presented in the Bureau of Reclamation's DESIGN OF SMALL DAMS (1977) Page 567, Figure B-10

$$Q = \left[\frac{2.5264 * (1 + K_e) * D^{5/2} * H^{3/2}}{466.18 * n^2 * L * D^{1/3} + 1 * (Q/10)^{1/2}} \right]^2$$

Where,

- H = Head in feet
- K_e = Entrance loss coefficient
- D = Diameter of pipe in feet
- n = Mannings roughness coefficient
- L = Length of culvert in feet
- Q = Design discharge rate in cfs

The results prove that the controlling structure is 30" ϕ pipe.

$$K_e = .2$$

$$D = 2.5 \text{ (ft)}$$

$$n = .01$$

$$L = 233 \text{ (ft)}$$

$$\text{ENTRANCE ELV} = 595 \text{ (ft)}$$

$$\text{OUTLET ELV} = 531 \text{ (ft)}$$

ELEVATION (ft) DISCHARGE (cfs)

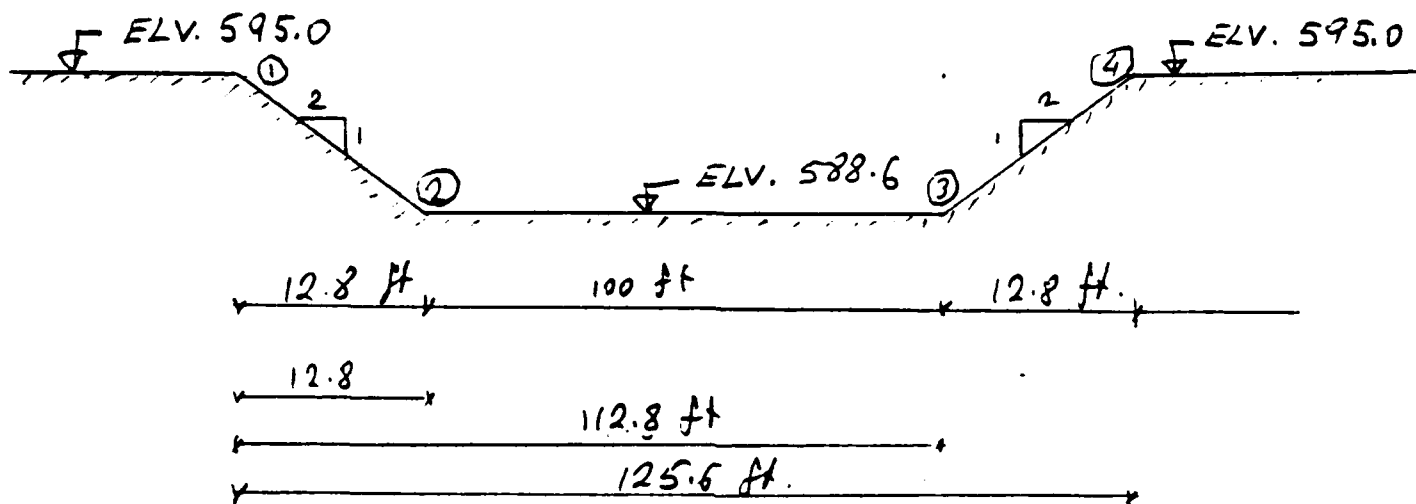
595
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555
550
545
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535
531

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910
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930
940
950
960
970
980
990
1000

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 4 of 14
 Subject WEBSTER BROOK RESERVOIR By T. OTOVA Date 1-2-81
FLOOD ROUTING Ckd. _____ Rev. _____

EMERGENCY SPILLWAY:



$$Q = \frac{1.49 \times A \times R^{2/3} \times S^{1/2}}{m}$$

Slope $S = 0.04$

Assumed $m = 0.03$

An open channel flow was assumed as being more conservative.

By using Slope - Area Computer program the rating curve of the emergency spillway was derived, which is shown on the next page.

A curve fitting analysis was performed and the exponential formula of the curve was found to be

$$H_{ELV} = 0.0183287 \times V_{(20-ft)}^{0.5816837} + 588.6$$

MAIN

Client COECS OF ENGINEERS Job No. 1345-032 Sheet 5 of 14
 Subject WEBSTER BROOK RESERVOIR By T. O'DONNELL Date 1-2-81
FLOOD ROUTING Ctd. _____ Rev. _____

SLOPE-AREA METHOD

No OF CROSS-SEC POINTS = 4

SLOPE = 0.4

1.1 = 0.0
 1.1 = 0.0
 1.1 = 0.0
 1.1 = 0.0

1.1 = 0.0
 1.1 = 0.0
 1.1 = 0.0
 1.1 = 0.0

1.1 = 0.0
 1.1 = 0.0
 1.1 = 0.0

W.S. ELEV.

590

591

592

593

594

595

DISCHARGE

1768.8

4393.4

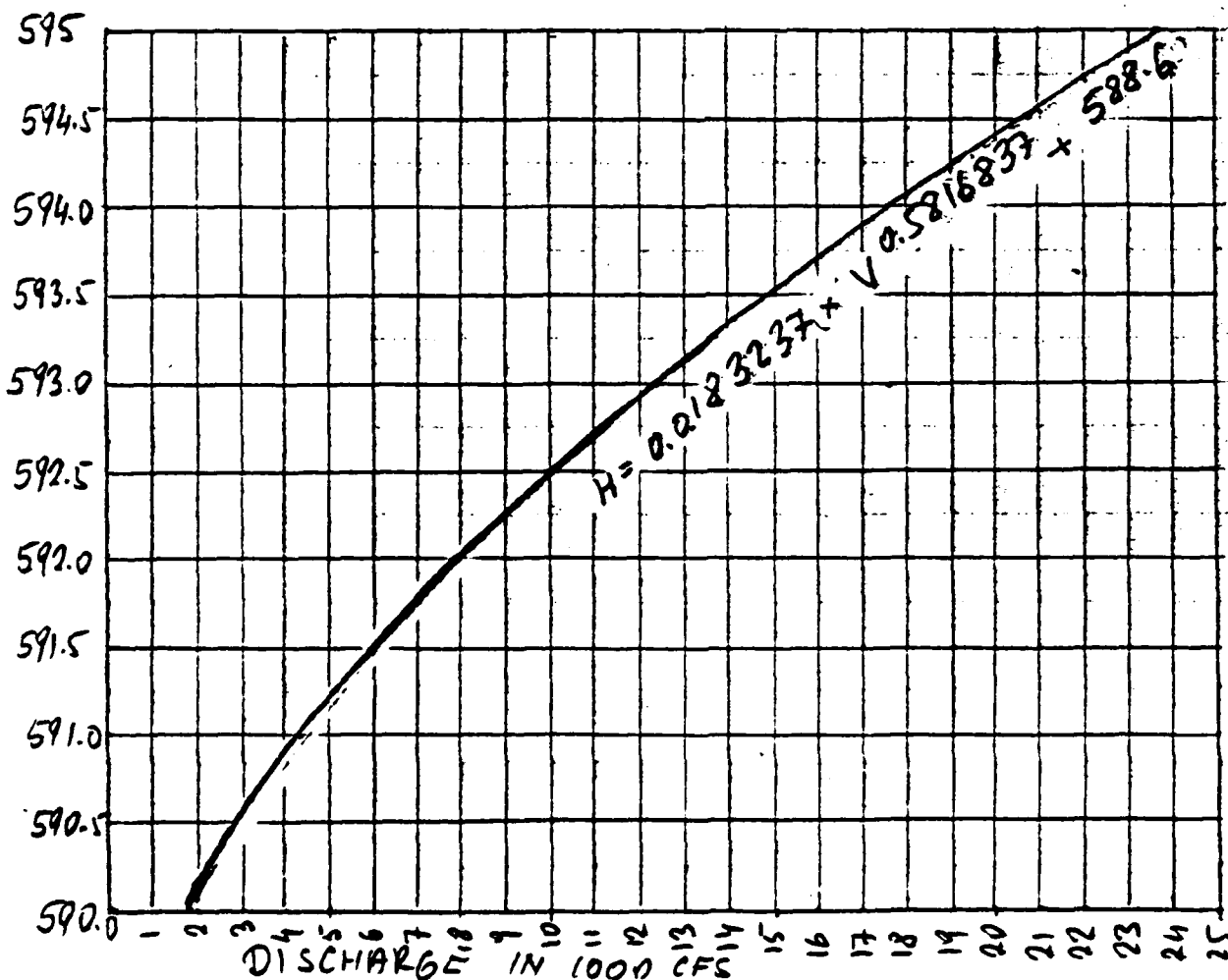
7940.1

12339.6

17552.9

23554.7

EMERGENCY SPILLWAY RATING CURVE



MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 6 of 14
 Subject WEBSTER BROOK RESERVOIR By T.OTOVA Date 1-28-81
FLOOD ROUTING Ckd. _____ Rev. _____

ESTIMATING

EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES

These calculations are performed according to the Corps of Engineers Guidelines

WEBSTER BROOK DAM

D A T A

DRAINAGE AREA,
A = 4.06 (sq. mi.)

PEAK INFLOW,
Q_{p1} = 5139 (cfs)

PRINCIPAL SPILLWAY CREST ELEV.,
EL₁ = 585 (ft.)

EMERGENCY SPILLWAY CREST ELEV.,
EL₂ = 588.6 (ft.)

Emergency Spillway Rating Curve is defined as,

$$H = a * Q^b$$

$$a = .0187287$$

$$b = .5816837$$

The Capacity - Elev. curve is defined as,

$$Elev = m + n * Log(Volume)$$

$$m = 492.907$$

$$n = 11.717$$

TOTAL PMF RUNOFF,
R = 17 (in.)

CALCULATIONS

S T E P 1

Reduction of the Q_{p1} due to starting elevation at Principal Spillway crest elev.

Volume at 585 (ft.)

$$Volume_1 = Exp((ELW_1 - m)/n)$$

$$Volume_1 = 2590.94 \text{ (ac-ft)}$$

Volume at 588.6 (ft.)

$$Volume_2 = Exp((ELV_2 - m)/n)$$

$$Volume_2 = 3522.838 \text{ (ac-ft)}$$

Diff. of Volumes,

$$Diff. Volume = 931.897 \text{ (ac-ft)}$$

or,

$$Diff. Volume, D = 4.3 \text{ (in.)}$$

$$NEW Q_{p1} = Q_{p1} * (1 - D/R)$$

$$NEW Q_{p1} = 3437 \text{ (cfs)}$$

S T E P 2

Surcharge Height,

$$H = a * Q_{p1}^b$$

$$H = 2.08 \text{ (ft.)}$$

Surcharge Volume,

$$ELV = ELV_2 + H$$

$$ELV = 590.68 \text{ (ft.)}$$

$$Volume = 4210.705 \text{ (ac-ft)}$$

$$STOR_1 = Volume - Volume_2$$

$$STOR_1 = 687.667 \text{ (ac-ft)}$$

$$STOR_1 = 3.17 \text{ (in.)}$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 7 of 14
 Subject WEBSTER BROOK RESERVOIR By T. OTTO Date 1-22-81
FLOOD ROUTING Ckd. _____ Rev. _____

Corresponding Discharge:

$$Q_{P2} = Q_{P1} * (1 - \text{STOR1} / R)$$

$$Q_{P2} = 2597 \text{ (cfs)}$$

STEP 3

Surcharge Height:

$$H = a * Q_{P2} ^ b$$

$$H = 1.77 \text{ (ft.)}$$

Surcharge Volume, STOR2:

$$ELV = ELV2 + H$$

$$ELV = 590.37 \text{ (ft.)}$$

$$\text{Volume} = 4099.254 \text{ (ac-ft)}$$

$$\text{Diff Volume} = \text{Volume} - \text{Volume2}$$

$$\text{Diff Volume} = 576.416 \text{ (ac-ft)}$$

$$\text{STOR2} = 2.66 \text{ (in.)}$$

$$\text{OLD STOR. AVE.} = (\text{STOR1} + \text{STOR2}) / 2$$

$$\text{OLD STOR. AVE.} = 2.91 \text{ (in.)}$$

$$Q_{P3} = Q_{P1} * (1 - \text{OLD STOR. AVE.} / R)$$

$$Q_{P3} = 2665 \text{ (cfs)}$$

STEP 4

Surcharge Height

$$H3 = a * Q_{P3} ^ b$$

$$H3 = 1.8 \text{ (ft.)}$$

Diff Volume, STOR3:

$$E1 = H3 + H2$$

$$E1 = 590.4 \text{ (ft.)}$$

$$\text{Volume} = E_{\text{ave}} * (E1 - m) * n$$

$$\text{Volume} = 4106.58 \text{ (ac-ft)}$$

$$\text{STOR3} = \text{Volume} - \text{Volume2}$$

$$\text{STOR3} = 385.342 \text{ (ac-ft)}$$

$$\text{STOR3} = 2.7 \text{ (in.)}$$

$$\text{NEW STOR. AVE.} = (\text{OLD STOR. AVE.} + \text{STOR3}) / 2$$

$$\text{NEW STOR. AVE.} = 2.81 \text{ (in.)}$$

$$Q_{P4} = Q_{P1} * (1 - \text{NEW STOR. AVE.} / R)$$

$$Q_{P4} = 2693 \text{ (cfs)}$$

Surcharge Height

$$H4 = a * Q_{P4} ^ b$$

$$H4 = 1.81 \text{ (ft.)}$$

$$E2 = H4 + H2$$

$$E2 = 590.41 \text{ (ft.)}$$

C H E C K I N G :

$$E3 - E2 = .01 \text{ (ft.)}$$

R E S U L T S :

$$\text{AVERAGED DISCHARGE} = 2579 \text{ (cfs)}$$

$$\text{WATER SURFACE ELEV.} = 590.4 \text{ (ft.)}$$

$$\text{SURCHARGE HEIGHT} = 1.8 \text{ (ft.)}$$

$$\text{CREST ELEV. OF THE DAM:}$$

$$E_c = 595 \text{ (ft.)}$$

$$\text{VOLUME AT DAM CREST ELEV.}$$

$$V_c = 6082.902 \text{ (ac-ft)}$$

$$\text{VOLUME AT MAX. WATER SURFACE ELEV.}$$

$$V_w = 4110.626 \text{ (ac-ft)}$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-037 Sheet 2 of 14
 Subject WEBSTER BROOK DAM By T. O'DONNELL Date 1-28-81
FAILURE ANALYSES Ckd. _____ Rev. _____

WEBSTER BROOK DAM FAILURE ANALYSES

These calculations are performed according to the RULE OF THUMB procedures of the Corps of Engineers

The breach discharge:
 $Q_{b1} = 3.27 * W_b * a^{0.5} * Y_o^{3/2}$

Where,

Y_o is the height of the breach (from river bed to the max. pool level)

W_b is 35% of the length of the dam, or $W_b = .35 * W_d$

a is the acceleration of the area $11.7 * 10^{-3} \text{ sec}^{-2}$

$$Y_o = 61.4 \text{ (ft)}$$

$$W_b = 550 \text{ (ft)}$$

$$W_d = 191 \text{ (ft)}$$

From above equation:
 $Q_{b1} = 155717 \text{ (cfs)}$

The natural channel cross sections are simplified as triangular cross sections

The stage-discharge relationship becomes as,

$$Q = [1.068 * n * \tan(\alpha) * 0.4 * C_{os}(\alpha)^{2/3} * S^{1/5}]^{3/8} \dots (I)$$

Where,

Q = Discharge (cfs)
 n = Side slope angle (deg)
 S = Channel slope

The cross section Area

$$A = W^2 * \tan(\alpha) \dots (II)$$

The Volume of the Reservoir

$$V = 4119 \text{ (ac-ft)}$$

$$V = 179071500 \text{ (cu-ft)}$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-177 Sheet 9 of 14
 Subject WEBSTER BROOK DAM By T. OTAVA Date 1-28-81
FAILURE ANALYSIS Ckd. _____ Rev. _____

REACH (1) CALCULATIONS

Test flood discharge
 $Q_t = 2679$ (cfs)

$a = 3.91$ (deg)
 $\theta = .985$
 $\lambda = .97$
 $L = 500$ (ft)

From Formula (I),

Prefailure height,

$h_1 = 7.1$ (ft)

From Formula (II),

$A_1 = 755$ (sq-ft)

$Q = Q_{p1} + Q_t$

From Formula (I),

Total Height,
 $h = 32.9$ (ft)

From Formula (II),

Total Area,
 $A = 16314$ (sq-ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 15549$ (sq-ft)

Residual Volume,

$V_1 = L \times A_2$

$V_1 = 7774557$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_1 / V)$

$Q_{p2} = 148955$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$Q = 151634$ (cfs)

$h = 32$ (ft)

From Formula (II),

$A = 15789$ (ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 15023$ (ft)

$V_2 = A_2 \times L$

$V_2 = 7511960$ (cub-ft)

$V_{ave} = (V_1 + V_2) / 2$

$V_{ave} = 7643259$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_{ave} / V)$

$Q_{p2} = 149069$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$h_2 = 32.4$ (ft)

RESULTS

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 32.4 (ft)

3) Breach Discharge = 149069 (cfs)

4) Reach Length = 500 (ft)

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 10 of 14
 Subject WEBSTER BROOK DAM By T. OTOVA Date 1-28-81
FAILURE ANALYSES Chd. _____ Rev. _____

REACH (2) CALCULATIONS

Test flood discharge:
 $Q_t = 2679$ (cfs)

$s = 3.81$ (deg.)
 $g = .005$
 $u = .07$
 $L = 500$ (ft)

From Formula (I),

Prefailure height,

$h_1 = 7.1$ (ft)

From Formula (II),

$A_1 = 765$ (sq-ft)

$Q = Q_{p1} + Q_t$

From Formula (I),

Total height,
 $h = 32.4$ (ft)

From Formula (II),

Total Area,
 $A = 15797$ (sq-ft)

Residual Area,

$A_2 = A - A_1$
 $A_2 = 15032$ (sq-ft)

Residual Volume,

$V_1 = L \times A_2$

$V_1 = 7516419$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - W_1 \times W_2)$

$Q_{p2} = 142811$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$Q = 145490$ (cfs)

$h = 31$ (ft)

From Formula (III),

$A = 15306$ (sq-ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 14541$ (sq-ft)

$V_2 = A_2 \times L$

$V_2 = 7270606$ (cub-ft)

$V_{ave} = (V_1 + V_2) \div 2$

$V_{ave} = 7393613$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_{ave} \div W_3)$

$Q_{p2} = 142913$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$h_2 = 31.9$ (ft)

RESULTS

1. Prefailure Height = 7.1 (ft)

2. Postfailure Height = 31.9 (ft)

3. Breach Discharge = 142913 (cfs)

4. Reach Length = 500 (ft)

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 11 of 14
 Subject WEBSTER BROOK DAM By T. OTOVA Date 1-28-8
FAILURE ANALYSES Ckd. _____ Rev. _____

P E A C H (3) CALCULATIONS

Test flood discharge
 $Q_t = 1579$ (cfs)

$s = 3.31$ (deg.)
 $z = 1.005$
 $n = .07$
 $L = 500$ (ft)

From Formula (I),

Prefailure height,

$h_1 = 7.1$ (ft)

From Formula (II),

$A_1 = 765$ (sq. ft.)

$Q = Q_{p1} + Q_t$

From Formula (I),

Total Height,
 $h = 31.9$ (ft)

From Formula (II),

Total Area,
 $A = 15314$ (sq-ft)

Residual Area,

$A_2 = A - A_1$
 $A_2 = 14549$ (sq-ft)

Residual Volume,

$V_1 = L \times A_2$

$V_1 = 7274840$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_1 / V)$

$Q_{p2} = 137106$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$Q = 139785$ (cfs)

$h = 31$ (ft)

From Formula (II),

$A = 14854$ (ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 14089$ (ft)

$V_2 = A_2 \times L$

$V_2 = 7044607$ (cub-ft)

$V_{ave} = (V_1 + V_2) / 2$

$V_{ave} = 7159724$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_{ave} / V)$

$Q_{p2} = 137198$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$h_2 = 31.4$ (ft)

RESULTS

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 31.4 (ft)

3) Breach Discharge = 137198 (cfs)

4) Reach Length = 500 (ft)

MAIN

Client CORPS OF ENGINEERS
 Subject WEBSTER BRIDE DAM
FAILURE ANALYSES

Job No. 1345-072 Sheet 12 of 14
 By T. OTOVA Date 1-28-81
 Ckd. _____ Rev. _____

PEACH (4) CALCULATIONS

Test flood discharge
 $Q_t = 2679$ (cfs)

$z = 7.81$ (dee.)
 $s = .005$
 $x = .07$
 $L = 500$ (ft)

From Formula (I),
 Prefailure height,

$h_1 = 7.1$ (ft)

From Formula (II),
 $A_1 = 765$ (sq. ft.)

$Q = Q_{p1} + Q_t$

From Formula (I),
 Total Height,
 $h = 31.4$ (ft)

From Formula (II),
 Total Area,
 $A = 14861$ (sq-ft)

Residual Area,
 $A_2 = A - A_1$
 $A_2 = 14096$ (sq-ft)

Residual Volume,

$V_1 = L \times A_1$

$V_1 = 7048269$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - W_1 / W)$

$Q_{p2} = 131796$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$Q = 134475$ (cfs)

$h = 30$ (ft)

From Formula (II),

$A = 14429$ (sq-ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 13664$ (sq-ft)

$V_2 = A_2 \times L$

$V_2 = 6832008$ (cub-ft)

$Wave = (V_1 + V_2) / 2$

$Wave = 6940138$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - Wave / W)$

$Q_{p2} = 131879$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$h_2 = 31$ (ft)

RESULTS

1.) Prefailure Height = 7.1 (ft)

2.) Postfailure Height = 31 (ft)

3.) Breach Discharge = 131879 (cfs)

4.) Reach Length = 500 (ft)

Client CORPS OF ENGINEERS
 Subject WEBSTER BROOK DAM
FAILURE ANALYSES

Job No. 1345-072 Sheet 13 of 14
 By T. J. J. 994 Date 1-28-81
 Ck. _____ Rev. _____

REACH (5) CALCULATIONS

Test flood discharge
 $Q_t = 2579$ (cfs)

$a = 7.91$ (deg.)
 $b = 995$
 $c = 87$
 $L = 500$ (ft)

From Formula (I),

Prefailure height,

$h_1 = 7.1$ (ft)

From Formula (II),

$a_1 = 765$ (sq-ft)

$Q = Q_{p1} + Q_t$

From Formula (I),

Total Height,
 $h = 31$ (ft)

From Formula (II),

Total Area,
 $A = 14435$ (sq-ft)

Residual Area,

$A_2 = A - A_1$
 $A_2 = 13670$ (sq-ft)

Residual Volume,

$V_1 = L \times A_2$

$V_1 = 6835341$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_1 / V)$

$Q_{p2} = 125844$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$Q = 129523$ (cfs)

$h = 30$ (ft)

From Formula (II),

$A = 14028$ (sq-ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 13263$ (sq-ft)

$V_2 = A_2 \times L$

$V_2 = 6631812$ (cub-ft)

$V_{ave} = (V_1 + V_2) / 2$

$V_{ave} = 6733577$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_{ave} / V)$

$Q_{p2} = 126919$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$h_2 = 30.5$ (ft)

RESULTS

1. Prefailure Height = 7.1 (ft)

2. Postfailure Height = 30.5 (ft)

3. Breach Discharge = 126919 (cfs)

4. Reach Length = 500 (ft)

MAIN

Client CORPS OF ENGINEERS
 Subject WEBSTER BROOK DBM
FAILURE ANALYSIS

Job No. 1345-032 Sheet 14 of 14
 By T. OTTUM Date 1-28-81
 Ctd. _____ Rev. _____

REACH (6) CALCULATIONS

Test flood discharge:
 $Q_t = 1879$ (cfs)

$\theta = 3.81$ (deg.)
 $\gamma = 885$
 $\eta = 97$
 $L = 500$ (ft)

From Formula (I),

Pretailure height,

$h_1 = 7.1$ (ft)

From Formula (II),

$A_1 = 765$ (sq. ft.)

$Q = Q_{p1} + Q_t$

From Formula (I),

Total Height,
 $h = 30.5$ (ft)

From Formula (II),

Total Area,
 $A = 14034$ (sq-ft)

Residual Area,

$A_2 = A - A_1$
 $A_2 = 13269$ (sq-ft)

Residual Volume,

$V_1 = L \times A_1$

$V_1 = 6634855$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_1 / V)$

$Q_{p2} = 122215$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$Q = 124894$ (cfs)

$h = 30$ (ft)

From Formula (II),

$A = 13651$ (ft)

Residual Area,

$A_2 = A - A_1$

$A_2 = 12885$ (ft)

$V_2 = A_2 \times L$

$V_2 = 6442960$ (cub-ft)

$V_{ave} = (V_1 + V_2) / 2$

$V_{ave} = 6538908$ (cub-ft)

$Q_{p2} = Q_{p1} \times (1 - V_{ave} / V)$

$Q_{p2} = 122283$ (cfs)

From Formula (I),

$Q = Q_{p2} + Q_t$

$h_2 = 30.1$ (ft)

RESULTS

1. Pretailure Height = 7.1 (ft)

2. Posttailure Height = 30.1 (ft)

3. Breach Discharge = 122283 (cfs)

4. Reach Length = 500 (ft)

APPENDIX E

INFORMATION AS CONTAINED IN THE
"NATIONAL INVENTORY OF DAMS IN THE UNITED STATES"

NOT AVAILABLE AT THIS TIME

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