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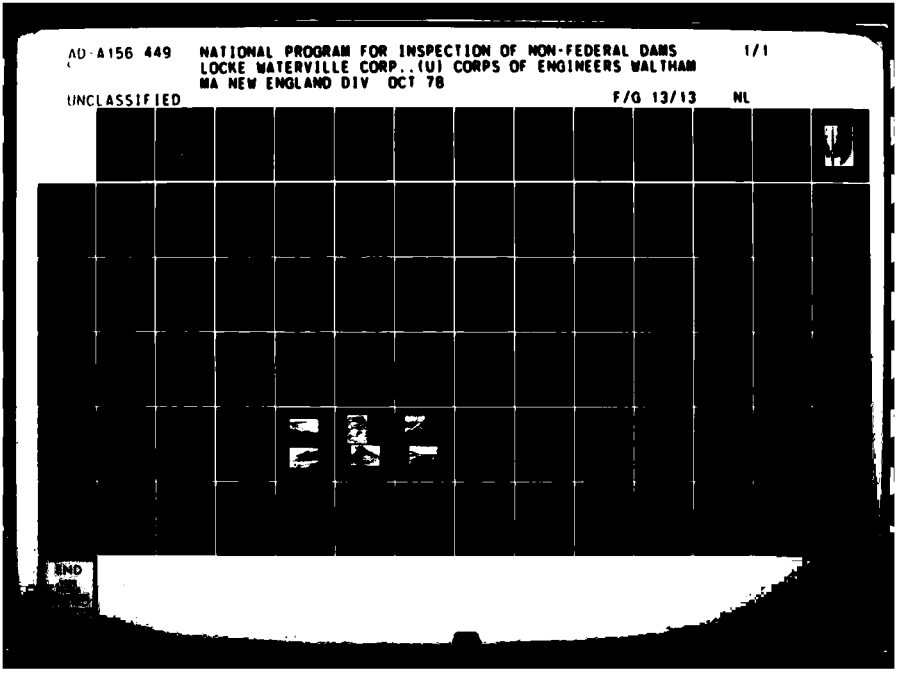

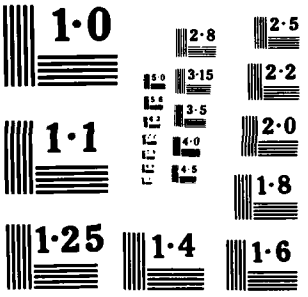
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MERRIMACK RIVER BASIN
CAMPTON, NEW HAMPSHIRE

LOCKE WATERVILLE CORPORATION DAM
NH 00416

AD-A156 449

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS, 02154

OCTOBER 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Tributary to Chickencoro Brook
Merrimack River Basin
Campton, New Hampshire

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

The dam is an earthfill embankment dam about 400 ft. long and 56 ft. high. The overall condition of the dam is considered fair because the embankment has exhibited settlement since its rebuilding in 1974, as well as erosion, seepage and leakage. The most inportant investigation is the assembly of documentation for the design of the dam,

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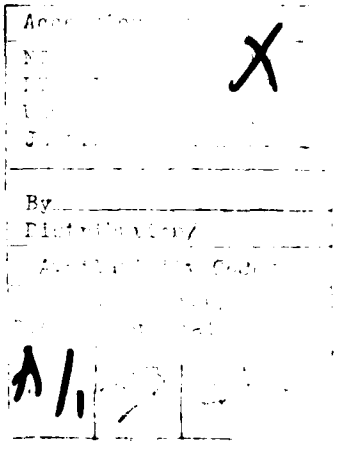
This Phase I Inspection Report on Locke Waterville Corp. Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment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

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division



Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

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LOCKE WATERVILLE CORPORATION DAM
NH 00416

MERRIMACK RIVER BASIN
GRAFTON, NEW HAMPSHIRE

Campton

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	LockeWaterville Corp. Dam, I.D. NH 00416
State Located:	New Hampshire
County Located:	Grafton
Stream:	Tributary to Chickenboro Brook
Date of Inspection:	June 5, 6 and 7, 1978

BRIEF ASSESSMENT

Locke Waterville Corporation Dam is an earthfill embankment dam, approx. 400-foot long and 56-foot high. The dam has a 36-inch diameter morning glory-type service spillway and a 40-foot wide auxiliary spillway located on its left abutment.

The overall condition of the dam is considered fair because the embankment has exhibited settlement since its rebuilding in 1974, as well as erosion, seepage and leakage.

The spillway capacity of the dam is sufficient to pass the SDF without overtopping of the dam. The spillway capacity was determined according to Corps of Engineers screening methods. The ability of the dam to pass high volume flood discharges can be improved by building up two sections of the embankment crest to its nominal height which is 6 feet above the service spillway inlet. The hydraulic capacity of the dam can be further assured by improving conditions at the auxiliary spillway.

It is recommended that the owner complete a program of investigations and remedial works within 12 months of the receipt of this Phase I Report. The scope of this program is listed in detail in Section 7. The most important of these investigations is the assembly of documentation for

the design of the dam, and the reassessment of the stability of the embankment, reflecting current as-built conditions. Other major actions include the regrading of the embankment to its nominal height and various steps to correct erosion seepage and deterioration of the downstream embankment slope.

Robert Gershowitz, P.E.

This Phase I Inspection Report on Locke Waterville Corp. 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.

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Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control 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 a Phase I investigation; however, the investigation is intended to identify any need for such studies.

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe condition 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 aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

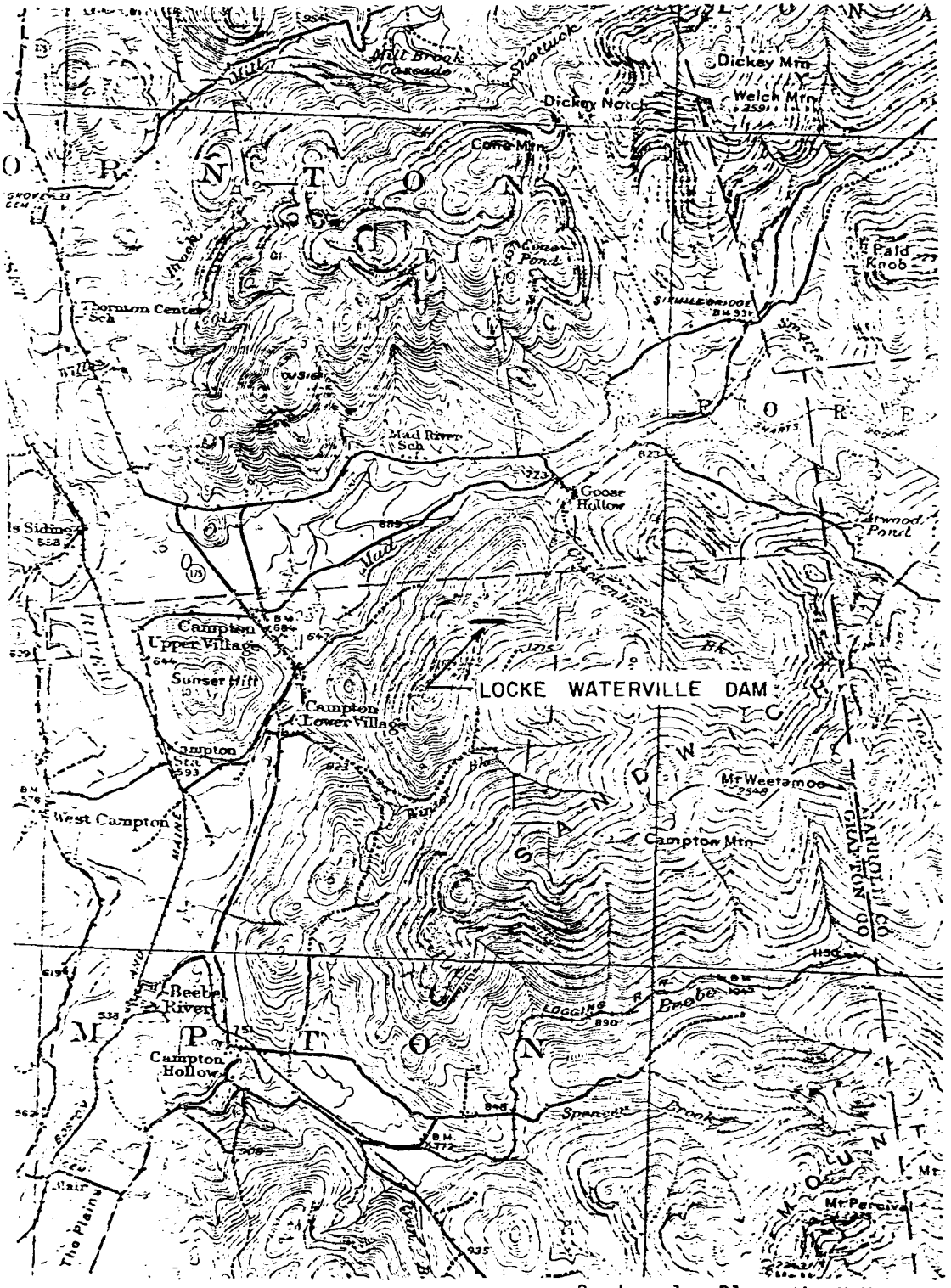
TABLE OF CONTENTS

(Continued)

APPENDICES

LOCKE WATERVILLE DAM

View of the dam from the upstream side. Note that the rebuilt section of the dam at the left abutment is lower than the remainder of the dam. The auxiliary spillway entrance is to the left of the dam.



VICINITY MAP

PHASE I INSPECTION REPORT

LOCKE WATERVILLE CORP. DAM NH 00416

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. HARRIS-ECI ASSOCIATES has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to HARRIS-ECI ASSOCIATES under a letter of June 7, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0305 has been assigned by the Corps of Engineers for this work.

b. Purpose

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

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Locke Waterville Corporation Dam is located on a tributary of Chickenboro Brook in the Town of Campton, Grafton County, New Hampshire, upstream of the locality known as Goose Hollow. Chickenboro Brook is a tributary of Mad River, and is part of the Merrimack River primary drainage basin.

b. Description of Dam and Appurtenances

Locke Waterville Corporation Dam is an earth fill dam constructed across the vee-shaped valley of a tributary of Chickenboro Brook. Complete plans do not exist for the dam and all dimensions following are approximate. The dam is approximately 400-foot long with a 15-foot wide unpaved crest. The upstream slope is estimated to be approximately 1 vertical on 2 horizontal and is covered by grass above the lake level. The downstream slope is also estimated to be 1 vertical on 2 horizontal at the top. A nearly flat berm has been added to the original downstream slope approximately one third of the way up from the downstream toe of the slope. The maximum height of dam is estimated at 50 feet as measured at its downstream toe.

The embankment was constructed in 1970, but part of it and the service spillway were rebuilt in 1974 to stop a serious leakage problem at the spillway and the left abutment contact area.

The spillway facilities consist of a 36-inch pipe glory hole service spillway and a 40-foot wide auxiliary spillway located to the left of the dam embankment.

The dam has a 20-inch diameter low level outlet whose inlet is submerged under the lake surface and is considered not operable in an emergency.

The reservoir is very small covering approximately 1.3 acres and is used for esthetic and recreation purposes. The rim slopes are wooded and moderately steep.

The downstream channel of the stream is extremely narrow and shallow, running in a steeply pitched vee-shaped valley. The nearest populated area is about 1 mile downstream and at an elevation 500 feet below the lake level.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "Small", since its storage is less than 1,000 acre-feet. The dam is also classified as "Intermediate" because its height is more than 40 feet but less than 100 feet. The overall size classification is the larger of the two classifications, and accordingly the dam is classified as "Intermediate" in size.

d. Hazard Classification

The dam has been classified Low Hazard Potential in the National Inventory of Dams maintained by the U.S. Army Corps of Engineers. The basis for thsi classification is that in the event of failure of the dam and its appurtenances, minimal damage could occur to downstream property together with no expected loss of lives. The current investigation does not concur with this classification, because of the downstream development along the main channel of Chickenboro Brook, which is located approximately 1 mile downstream of the dam axis and at an elevation some 550 ft. below the impoundment level. In case of a hypothetical dam failure, downstream property owners would have virtually no time at all to carry out emergency protective measures.

e. Ownership

Locke Waterville Corporation Dam is owned by the Waterville Estates Associates whose offices are adjacent to the dam site.

f. Operator

Locke Waterville Corporation Dam is operated by the Waterville Estates Associates, Box 36, Campton, New Hampshire 03223.

g. Purpose of Dam

The dam is operated as a recreation facility by the Waterville Estates Associates, and is used mainly for swimming.

h. Design and Construction History

The dam was designed before 1970 by Tri-State Surveying and Engineering Co., Inc. of Laconia, New Hampshire. Construction was completed in 1970. In 1974, it was rebuilt partially to correct a leakage problem at the service spillway and left abutment contact zone.

i. Normal Operating Procedures

The normal operating procedure is to allow the reservoir inflow water to enter the glory hole inlet of the service spillway without restrictions. The low level outlet is kept closed and is not conveniently operable since it is below the lake surface. The low level outlet was used in 1974 to draw down the lake in order to repair the leaking embankment.

1.3 Pertinent Data

a. Drainage Area — 110 acres (0.17 square miles).

b. Discharge at Dam Site

Maximum known flood at dam site:	Estimated at 50 cfs
Warm water outlet at pool elevation:	NA
Diversion tunnel low pool outlet at pool elevation:	NA
Diversion tunnel outlet at pool elevation:	NA
Gated spillway capacity at pool elevation:	NA
Gated spillway capacity at maximum pool elevation:	NA
Ungated spillway capacity at maximum pool elevation:	795 cfs (Elev. 1,339.5)
Total spillway capacity at maximum pool elevation:	795 cfs (Elev. 1,339.5)

c. Elevation (feet above MSL)

Top of dam:	1,339.5
Maximum pool design surcharge:	1,337
Full flood control pool:	NA
Recreation pool:	Elev. 1,334
Spillway crest:	Elev. 1,334
Upstream portal invert diversion tunnel:	NA
Downstream portal invert diversion tunnel:	NA
Streambed at centerline of dam:	Elev. 1,283
Maximum tailwater:	Not known

d. Reservoir

Length of maximum pool:	800 feet (est.)
Length of recreation pool:	750 feet (est.)
Length of flood control pool:	NA

e. Storage (acre-feet)

Recreation pool:	6.1 (Elev. 1,334)
Flood control pool:	NA
Design surcharge:	10.0 (Elev. 1,337)
Top of Dam:	13.7 (Elev. 1,339.5)

f. Reservoir Surface (acres)

Top of dam:	1.6 acres (Elev. 1,340)
Maximum pool:	1.4 acres (Elev. 1,339.5)
Flood-control pool:	NA
Recreation pool:	1.3 acres (Elev. 1,334)
Spillway crest:	1.3 acres (Elev. 1.334)

g. Dam

Type:	Earth fill
Length:	400 feet (est.)
Height:	56 feet at toe
Top width:	15 feet
Side slopes - Upstream:	1 V on 2 H
- Downstream:	1 V on 2 H
Zoning:	Central core pervious shell
Impervious core:	Glacial till
Cutoff:	Core connects to impervious stratum
Grout curtain:	None

h. Diversion and Regulating Tunnel

Type:	NA
Length:	NA
Closure:	NA
Access:	NA
Regulating facilities:	NA

i. Spillway

	Service	Auxiliary
Type:	36-in. pipe, glory hole entrance	Grassed saddle and chute
Length of weir:	NA	40 feet
Crest elevation:	1,334	1,336.8
Gates:	None	None
U.S. Channel:	None	Reservoir rim
D/S Channel:	Riprapped channel to natural brook	150-ft long grassed chute, then steeper wooded ravine channel

j. Regulating Outlets

Low level outlet:	20-inch diameter CMP
Controls:	Stop log closure at entrance submerged on upstream face of dam
Emergency gate:	None
Outlet:	Right downstream abutment contact area. No channel protection or stabilization provided

SECTION 2

2. ENGINEERING DATA

2.1 Design

The only engineering drawing uncovered for the dam is a cross section and appurtenant details for the original dam (see Drawing 1). This drawing has been redrawn for this report because the original was not of reproducible quality. The original was in the files of the N.H. Water Resources Board (NH-WRB). The dam cross section and details of the spillway have been significantly changed from the original. No drawings relating to the reconstruction have been uncovered.

No design computations have been uncovered. The basis for the spillway design capacity appears on the drawing and is apparently based on the use of the Rational Formula with a time of concentration of 42 minutes and a 100-year 1-hour rainfall intensity of 2.75 inches per hour. The resulting 100-year inflow was computed at 95 cubic feet per second. The design spillway size of 24 inches diameter was revised to 30 inches on the design drawings and has been rebuilt in 1974 to 36 inches. No hydraulic computations are available for the auxiliary spillway.

No stability computations have been uncovered for the dam.

2.2 Construction

No documentation of the construction of the dam is available from the files of the NH-WRB. According to the original design drawings "all top soil and undesirable material to be stripped and removed from construction site". From subsequent seepage problems, it is known that a layer of pervious materials underlying the embankment base at the left side was not detected during construction. Subsequently, in 1974, a substantial

part of of the left embankment was removed and rebuilt to correct the leakage. A berm was added to the downstream slope and a horizontal plastic drain was installed under the berm, feeding in the low level outlet pipe. The spillway was also reconstructed, increasing the pipe diameter to 36 inches and revising the intake to a glory hole design.

2.3 Operation

No records are kept of the operation of the dam. The maintenance worker at the site has said that the pool level has not risen more than 12 inches above the spillway inlet and that the auxiliary spillway has never overflowed.

2.4 Evaluation

a. Availability

The availability of engineering design information is extremely poor for a dam that is as recently constructed as 1970. The information contained on one original dam drawing has been largely superseded by the reconstruction in 1974. No data has been recovered that is considered pertinent to the safety evalustion of the dam.

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 history and sound engineering judgement.

c. Validity

The information acquired is of questionable validity. There is absolutely no corroboration that the original dam cross section shown on the one drawing recovered was built as shown. The top width of the embankment for example as shown on the plans (25 feet) does not reflect the actual construction (15 feet estimated).

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

LockeWaterville Corporation Dam has an embankment that has exhibited leakage in the past and currently shows seepage moist spots in its downstream face and at the right abutment contact. The embankment has been partially rebuilt.

b. Dam

- Embankment

  The original embankment leaked after being put in service between the left abutment contact and the original spillway which is about 40 feet away from the left abutment. According to the dam caretaker, the leakage was caused by a pervious stratum underlying the original embankment's foundation grade. A 100-ft section of the embankment at the left abutment was removed including the original service spillway and the foundation plane was lowered by removing the pervious layer. Impervious "hard pan" was placed over the foundation. The embankment and service spillway were rebuilt.

  The new embankment crest is approximately 6 to 18 inches lower than the adjacent original embankment crest and is eroded on the downstream side. A sloping berm was added to the downstream slope approximately 30 to 40 feet below the crest level. The width of the berm varies but is

typically 30-foot wide at the maximum section. The downstream slope below the berm level is extremely uneven and, apparently, no attempt was made to dress it to any consistent slope. Dumped stone materials remain ungraded at the top of the berm and along the lower downstream dam slope. According to the maintenance worker, a 4-inch diameter horizontal plastic drain was placed under the berm, running parallel to the dam axis and draining toward the right abutment. It was connected to the 20-inch diameter low level outlet pipe running through the dam at or near the bottom of the right abutment contact. The drain connection is at a manhole, but it was covered by the embankment materials and could not be inspected.

The 20-inch diameter low level outlet pipe emerges from the embankment toe a short distance further downstream running along the right abutment contact, or possibly the original brook channel. The pipe's discharge end is almost completely silted in and is corroded through the full thickness of metal in several places. The outlet ditch is silted and marshy. A seepage area exists at the toe of the embankment at the right abutment contact approximately at the point where the junction manhole was supposed to be located. The seepage was estimated at 3 gpm and the origin is thought to be the reservoir.

The entire right embankment to abutment contact serves as local surface drainage course between the the embankment and the equally steep valley slope. The contact is locally eroded and wet due to poor grading.

The original section of the upperpart of the downstream slope of the embankment is vegetated with grass and some wild growing bushes. The rebuilt part of the embankment does not support vegetation and is locally eroded by surface runoff. The berm and lower slope also do not support vegetation.

The left abutment contact is poorly trimmed and graded but is apparently dry and free of seepage points. Two local soft and moist spots on the surface of the upper part of the embankment slope were found during the inspection, but there is no measurable seepage emanating from either.

- Spillway

  The service spillway has been rebuilt in connection with the repairs to the embankment and consists of a vertical glory hole pipe entrance located on the upstream face of the dam with the lip nominally 6-ft. below the crest of the embankment. The glory hole entrance is protected from the adjacent embankment by a low head wall and wingwalls on two sides. The spillway entrance hole is protected by a conical wire mesh cage.

The spillway pipe is 36 inches in diameter and passes through the embankment exiting on the downstream slope in a culvert outlet type wingwall structure. The invert at the exit is approximately 36 feet below the entrance lip. The water exiting the spillway drops another 15 to 20 feet down the embankment slope which has been protected locally by large dumped stone and a rough finished concrete slab. The stone and concrete are very irregularly placed, and are undercut in places, possibly due to settlement or undermining.

- Low Level Outlet

  This outlet is apparently placed at the location of the original brook bed. The inlet end is in the reservoir at the toe of the upstream slope. According to the original design, the inlet is closed off with stop planks in a concrete headwall fitted out with stop plank grooves. The operation of the outlet requires the services of a scuba diver. It is not clear whether the stop planks are still in place or have been replaced by a gate valve. The outlet was used in 1974 to draw down the lake to permit rebuilding the left portion of the embankment.

- Foundation

  Foundation material under the dam appears to be a fine grained silty sand (recent stream deposits), as is exposed in the banks downstream of the dam. Numerous ground-water springs occur along these banks. One spring was noted approximately 50 feet beyond and above the right end of the embankment.

  The shape of the reservoir behind this dam suggests that the area may have been a marsh whose deposits now line the reservoir bottom. No construction data is available to know if this marsh material mantled the silty sand foundation and if it was removed prior to construction. The level survey made along the axis of the dam indicated a low spot near the right side. This low spot might indicate that soft material below the fill was not removed in its entirely and has consolidated after fill placement. A small marsh-type area occurs on the right bank adjacent to the stream channel approximately 50 feet downstream of the outlet.

c. Appurtenant Structures

- Auxiliary Spillway

  The auxiliary spillway is located on the far side of the ridge forming the left abutment. The auxiliary spillway is approximately 40-foot wide at the bottom and is bounded by moderate side slopes. The axis of the spillway is approximately in line with the main embankment crest, and the auxiliary spillway crest is approximately 2.5 to 3 feet above the service spillway

inlet. The first 100 feet of the auxiliary spillway are well graded, sloping downstream at less than 4 percent, and covered with a cut grass lawn. The spillway ends at a natural ravine which slopes steeply downhill and connects to the brook channel several hundred feet downstream. The ravine is fairly densely wooded, and the trees are considered a potential obstruction, being too close to the crest elevation of the auxiliary spillway.

d. Reservoir Area

The reservoir is small and is surrounded by moderately steep to steep rim slopes. The rim slopes are wooded in the natural state, but have been locally cleared for community buildings belonging to the owner. A small part of the reservoir rim adjacent to the dam's left abutment has been developed as a beach area for swimming. There are no apparent signs of reservoir rim instability. A smaller reservoir upstream of the main lake serves as a sediment trap.

e. Downstream Channel

The downstream channel of the tributary to Chickenboro Brook is extremely narrow and shallow. The channel runs steeply down a vee-shaped valley whose slopes are solidly covered with trees and brush. Parts of the channel are swampy due to its poor definition. There are no dwellings downstream of the dam within a mile of its axis. The nearest populated center is at Goose Hollow located adjacent to the main stem of Chickenboro Brook.

3.2 Evaluation

Significant deficiencies which could affect the dam's safety are:

1. The depressed dam crest at the left abutment where the embankment has been rebuilt. The crest is at this time lower because of incorrect grading or embankment settlement.

2. The depressed dam crest at the right abutment, possibly caused by settlement of marshy subsoil underlying the embankment or by poor original construction control.

3. The seepage emanating at the toe of the embankment near the right abutment contact.

4. The silted-in outlet area of low level outlet and the ill defined channel connecting the outlet to the brook.

5. The poorly trimmed and graded right and left abutment contacts. The right contact is wet in places and eroded in others due to surface runoff.

6. The eroded surface of downstream slope of the rebuilt embankment and berm.

7. The poorly graded and protected lower slope of the embankment.

8. Presence of local soft and wet spots on the upper part of the downstream slope and local presence of uncontrolled brush growth.

9. A wooded area downstream of the auxiliary spillway channel which may potentially reduce the capacity of the spillway.

10. Partially undercut and settled riprap embankment protection below the outlet of the service spillway.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

The operating procedures are simple in line with the simple facilities provided. The lake level is regulated by the inlet capacity of the glory hole service spillway and the grassed crest of the auxiliary spillway. There are no features to allow the convenient regulation of the lake surface except for the low level outlet whose inlet is submerged under the lake surface and requires scuba diving gear for operation.

4.2 Maintenance of the Dam

The maintenance of the dam itself is minimal, except that constant maintenance of the visible portion of the lake and the grassed auxiliary spillway area has been carried out in connection with its use as a recreation area. Debris is removed from the glory hole inlet screen. The grass on the embankment crest, the upstream face and the auxiliary spillway is cut. The downstream face of the embankment apparently has had little maintenance since it was rebuilt in 1974.

4.3 Maintenance of Operating Facilities

Since there are no operating facilities to speak of, there is no maintenance specifically directed to maintain them.

4.4 Description of any Warning System in Effect

There is no warning system is effect to warn downstream areas of impending high discharges over the dam's auxiliary spillway or impending overtopping.

4.5 Evaluation

The operational procedures should be improved in line with the current greater public interest in dam safety. The owner should institute an annual inspection of the dam, utilizing a visual check list similar to that used in this report. All maintenance work on the dam and auxiliary spillway should be scheduled, logged, and documented. The lake level should be recorded at daily intervals and a gage should be affixed to the service spillway wingwall for that purpose.

SECTION 5

5. HYDRAULIC / HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The evaluation of the hydraulic and hydrologic features of the Locke Waterville Corporation Dam was based on criteria set forth in the Corps Guidelines and additional guidance provided by the New England Division, Corps of Engineers. The Probable Maximum Flood (PMF) was first estimated from the guide curves for probable maximum flood for New England based on past Corps' studies. However, due to the small drainage area of Locke Waterville Corporation Dam, the SCS method for computing the peak discharge was also performed. The PMF value based on the original curve for rolling areas is 490 cfs and the PMF value calculated by the SCS method is 597 cfs. Therefore, the PMF value of 600 cfs was used in the evaluation of the spillway adequacy.

The maximum capacity of the service spillway is 295 cfs and the maximum capacity of the emergency spillway is 500 cfs resulting in a total spillway capacity of 795 cfs before overtopping the dam at its low point, at Elevation 1,339.5. The capacity for the nominal crest Elevation 1,340.0 would be 296 cfs for the service spillway and 640 cfs for the auxiliary spillway for a combined capacity of 936 cfs.

Since the dam has an adequate spillway capacity which will allow the passage of the SDF without overtopping of the embankment, dam break computations associated with dam overtopping were not carried out.

b. Experience Data

No records of reservoir stage or spillway discharge are available. According to a maintenance worker employed by the owner, the reservoir water surface elevation was never at a level higher than one foot above the service spillway crest.

c. Visual Observations

Both the watershed area and the reservoir surface area are small in size. The watershed area is covered with thick woods and forest, and the basin slope is steep. The river channel immediately downstream from the dam is narrow and steep. Grass growth is heavy along the crest portion of the emergency spillway. The discharge channel of the emergency spillway should be maintained under a low cut grass cover.

d. Overtopping Potential

As indicated in Section 5.1 - a., the combined spillway capacity is adequate to pass the Probable Maximum Flood peak without overtopping the dam. The potential of overtopping the dam due to extreme floods is minimal.

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual observations affecting the dam's stability center on the presence of leakage at the bottom right abutment contact and presence of wet spots on the upper part of the downstream slope. These conditions are signs of a high phreatic surface level and could mean that the core material is not as impervious as assumed.

Signs of embankment settlement at the right abutment and at the rebuilt left abutment also tend to cast some doubt on the dam's stability.

b. Design and Construction Data

The one drawing recovered differs in so many respects with the rebuilt structure that no use can be made of the information contained therein to assess stability. A program of acquiring additional data required to properly assess stability is given in Section 7.b. No construction data bearing on the determination of stability has been uncovered.

c. Operating Records

No operating records affecting the stability of the dam have been kept.

d. Post Construction Changes

As mentioned above, there have been extensive changes made to the downstream slope of the embankment by the addition of a berm and toe drain. A 100-foot section of the embankment adjacent to the left abutment has been removed and replaced to stop a leak from an underlying pervious

gravel seam in the foundation. No documentation of the rebuilding is available. The rebuilding has apparently stopped the leakage problem on the left abutment as far as could be determined visually.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the Recommended Phase I Guidelines, does not warrant seismic analyses.

SECTION 7

7. ASSESSMENT / REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The overall physical condition of Locke Waterville Corporation Dam is fair. The stability of the earth embankment is in question, since its crest is at an irregular elevation indicating that settlement may have taken place. In addition, the left and right downstream abutment contacts are poorly graded with the right abutment especially in need of correction because of erosion and wet spots caused by surface runoff. The downstream slope at the rebuilt section is eroded because of a lack of binding vegetative cover.

The upper part of the slope contains two wet spots where the phreatic surface has apparently penetrated to the face. The lower part of the rebuilt downstream slope is poorly trimmed to grade, and unprotected leading to erosion due to surface runoff. There is a source of leakage at the downstream toe of the embankment at or near the right abutment contact seeping at a rate of 3 gpm whose origin is believed to be the reservoir.

Locke Waterville Corporation Dam has adequate spillway capacity to pass the SDF flood determined according to the Corps of Engieers screening criteria. The only reservation that can be made in this respect is that the grassed area of the auxiliary spillway should be extended another 50 feet down the ravine to ensure that the currently calculated spillway capacity is not reduced by tree and debris blockage at the immediate end of the spillway. Extending the spillway clearing will ensure that back water effect of any conceivable blockage will not reduce the spillway capacity.

The dam's ability to pass SDF discharges would be enhanced if the crest of the embankment is brought up to its nominal elevation of 1,340, or 6 feet above the service spillway crest. Parts of the embankment are currently up to 6 inches below elevation 1,340.

The exit of the low level outlet is almost completely silted in and the connecting ditch to the brook channel is poorly graded and in swampy ground. The control of the inlet of the low level outlet is submerged and cannot be conveniently operated from a dry accessible location. The service spillway outlet discharges onto a part of the embankment protected by large riprap stones and a rough finished concrete slab. The outlet area is poorly and irregularly graded, resulting in the undercutting of the stone 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 history and sound engineering judgment.

c. Urgency

The urgency of performing the recommendation and remedial measures are detailed below.

d. Need for Additional Investigations

There is no need for further investigations in this phase of the program. Recommended investigations to be carried out by the owner are listed below.

7.2 Recommendations

It is recommended that the owner, within 12 months after receipt of this Phase I Report, assemble the following information:

a. Data Acquisition

(1) An updated as-built set of drawings of the dam showing all [illegible] and correcting inadequacies and omissions on the presently available drawings.

(2) Soils information defining the engineering parameters for the embankment core and shell materials, the embankment materials in the rebuilt embankment and berm section, and soils parameters under the right and left abutment contacts.

b. Investigations

(1) Determine phreatic levels in the downstream section of the dam at points of evident seepage or moist spots.

(2) Take additional borings, if required, to locate the extent of the core and shell materials and the embankment foundation interface.

(3) Reassess the stability of the as-built dam section and formulate a plan of corrective action if required.

7.3 Remedial Measures

a. Alternatives

No remedial measure alternatives can be suggested at this time until results of the reassessment of the stability are available. The seepage observed may be controlled by a sheet pile cutoff, impervious upstream slope blanketing, or left uncorrected while maintaining a monitoring program, all depending on the results of the stability reassessment.

All other corrective actions listed below are straigthforward and have no alternate course of action.

(1) Regrade the crest of the dam to at least 6 feet above the service spillway entrance lip.

(2) Dress and grade the downstream embankment slope, plant with vegetative cover as required, remove excessive brush growth.

(3) Regrade, fill in, and add protective stone materials to the area downstream of the service spillway outlet. Fill in all undercut portions and eliminate all sudden or abrupt drops exceeding 8 inches.

(4) Regrade the low level outlet channel connection to the brook, eliminating silt deposits and swampy and mucky bank areas. Stabilize with stone or concrete as needed.

(5) Regrade the downstream right and left abutment contacts to provide a stabilized water course for surface drainage.

b. O&M Maintenance and Procedures

The owner should initiate the following programs:

(1) An annual inspection of the dam utilizing visual check list similar to that used in this inspection report.

(2) Assemble and keep on hand a complete documentation of the dam as-built, including plans and back-up calculations.

(3) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

(4) Control grass growth in the present auxiliary spillway and extend the cleared spillway channel an additional 50 feet downstream.

(5) Provide a convenient operating control of the low level outlet from a point above the lake surface.

(6) Monitor the source of seepage observed.

(7) Install a lake gage at the intake, tied into the crest elevation of the dam. Log the lake level.

(8) The owner should establish a formal system with local officials for warning downstream residents in case of emergency. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

APPENDIX A

CHECK LISTS:
- VISUAL OBSERVATIONS
- ENGINEERING, CONSTRUCTION MAINTENANCE DATA
- HYDRAULIC AND HYDROLOGIC DATA ENGINEERING DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam LOCKE WATERVILLE CORP DAM County Grafton State New Hampshire Coordinators

Date(s) Inspection June 5, 1978
June 6, 1978
June 7, 1978 Weather Raining
Fair Sunny
Sunny Temperature 65°F
75°F
80°F

Pool Elevation at Time of Inspection 1334.2 M.S.L. Tailwater at Time of Inspection 1283 M.S.L.

Inspection Personnel:

Seymour Roth, June 5 and 7
David Kerkes, June 5 and 7
Yin Au-Yeung, June 5
Lynn Brown, June 6
William Flynn, June 6

Recorder: Seymour M. Roth

Present at site during inspection, on June 7: Mr. Earl Palmer, Maintenance Worker
Waterville Estates Association

Note: NA means not applicable

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE	NA	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	NA	
DRAINS	NA	
WATER PASSAGES	NA	
FOUNDATIONS	NA	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	NA	
STRUCTURAL CRACKING	NA	
VERTICAL & HORIZONTAL ALIGNMENT	NA	
MONOLITH JOINTS	NA	
CONSTRUCTION JOINTS	NA	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The downstream slope of the embankment is very sparsely vegetated in some areas and does not have any stone protection. It is generally eroded, along its upper reaches but most severely at the rebuilt section at the left side of the embankment. The lower part of the downstream slope is extremely irregular and eroded. The right downstream abutment contact is a drainage course and is eroded. The lower downstream slope is significantly different from shown on original design drawings. A terrace has apparently been added.	Regrade downstream face. Remove all brush growth. Protect with suitable vegetation or stone. Protect right downstream abutment contact to check erosion (stone, check dams or vegetation).
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	The horizontal alignment of the crest is acceptable. The vertical alignment of the crest varies over a foot in the original section of the embankment, with the low spot at the right abutment. The rebuilt section of the embankment is approximately 6 to 18 inches below the level of the adjacent original embankment section.	Build up embankment at right abutment and in the rebuilt section to nominal dam height of Elevation 1340 (6 ft. above service spillway slab).
RIPRAP FAILURES	There is some randomly placed riprap on the downstream slope, apparently left over from the rebuilding of the embankment. The protective stone downstream of the spillway outlet including rough formed concrete is partly undercut.	Rebuild stone protection downstream of spillway outlet to eliminate large drops and undercutting of protection.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The left abutment contact has been rebuilt and is apparently free of seepage. The right contact of the embankment forms a natural drainage course for the surface water coming down the sharply sloped right valley wall.	
ANY NOTICEABLE SEEPAGE	Moist spots were observed at two locations on the upper embankment. A major source of seepage was observed coming out of the embankment toe at the right abutment contact about 45 feet below the top of the embankment. The leakage was estimated at 3 gpm.	Collect, measure and monitor leakage at monthly intervals.
STAFF GAGE AND RECORDER	None installed.	
DRAINS	A 4-inch diameter plastic underdrain has been installed in connection with the rebuilding of the dam. This drain is installed under the downstream toe of the dam as rebuilt, and drains toward the right abutment. According to the owner's representative, the drain is connected to the 20-in. low level outlet by means of a manhole junction. The manhole junction could not be observed but the downstream end of the 20-inch outlet line can be seen. It is almost entirely covered with silt.	Regrade and stabilize the outlet area adjacent to the 20-in. CMP low level outlet. Check the 20-inch pipe between outlet and manhole for sediment deposits and flush out. Check the 4-in. toe drain for sediment deposits, and flush if necessary.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed. The dam's low level outlet is submerged and can only be operated by a scuba diver.	
INTAKE STRUCTURE	The intake for the low level outlet is submerged and could not be seen. According to plans, it consists of a concrete headwall with provisions for closure by means of stop logs.	
OUTLET STRUCTURE	The outlet end of the low level outlet is visible at the right abutment contact line. (see comments under "Embankment - Drains").	
OUTLET CHANNEL	No protection or stabilization provided (see recommendations under "Embankment - Drains").	
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	The service spillway consists of a glory hole intake 5 feet in diameter, narrowing down to a 36-inch diameter spillway discharge pipe. The inlet of the glory hole is at Elevation 1,334 and has been rebuilt. The concrete head and wingwall retaining the embankment around it is in good condition. The debris screen over the glory hole was also in good condition.	
APPROACH CHANNEL	Consists of a concrete floor slab, head and wingwalls set into the embankment slope to protect the dam from erosion.	
DISCHARGE CHANNEL	The outlet of the spillway pipe is a concrete wingwall structure set into the downstream embankment slope at the terrace level, one third of the way up the slope from the bottom. The head, wingwalls and floor of the outlet structure are all in good condition, no cracks or settlement was observed. The riprap protection downstream of the spillway outlet is poorly placed and has been undercut in places.	See recommendations for "Embankment - Riprap Failures".
BRIDGE AND PIERS	None	
AUXILIARY SPILLWAY CHANNEL	A 40-foot wide auxiliary spillway channel has been cut adjacent to the left abutment. The first 100 feet of this channel have been well maintained with a cut grass cover. The end of the auxiliary spillway feeds into a lateral gully. The condition of this facility was judged adequate.	No action required.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	RECOMMENDATIONS
CONCRETE SILL	NA	
APPROACH CHANNEL	NA	
DISCHARGE CHANNEL	NA	
BRIDGE AND PIERS	NA	
GATES & OPERATION EQUIPMENT	NA	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	Install a reservoir gage at the spillway intake headwall.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENTATIONS
SLOPES	The reservoir rim is moderately to steeply sloping and covered by timber growth. Some community buildings are on the left lake shore on higher ground. A small part of the lake rim adjacent to the dam has been improved as a sandy beach. The slope instability could be detected.	
SEDIMENTATION	Some sedimentation exists. An effort has been made to trap sediment in a small headwater impoundment immediately upstream of the main lake.	No action required at this time.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream permanent channel is very shallow and narrow. The overbank valley slopes are moderately to steeply sloping and covered with trees.	
SLOPES	The downstream channel slopes steeply down a natural valley.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	There are no homes in the immediate downstream vicinity of the brook. Further downstream, the brook joins the main branch of Chickenboro Brook and there is a development along the brook banks. Approximate number of homes estimated at 30-50.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not available
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Not available
TYPICAL SECTIONS OF DAM	The original cross section of dam is available, but no drawings exist for the downstream slope as rebuilt.
HYDROLOGIC/HYDRAULIC DATA	Some basic design data available on cross section drawing.
OUTLETS - PLAN	Available as originally built; no plans available for rebuilt facility.
- DETAILS	
- CONSTRAINTS	Not available
- DISCHARGE RATINGS	Not available
RAINFALL / RESERVOIR RECORDS	None

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None
GEOLOGY REPORTS	Geological section indicated on main cross section of dam, not considered adequate.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None uncovered
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None uncovered
POST-CONSTRUCTION SURVEYS OF DAM	None uncovered
BORROW SOURCES	Local materials were used according to holes on the one drawing available for review
SPILLWAY PLAN - SECTIONS - DETAILS	Available as originally built; no plans or details of rebuilt spillway available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available
MONITORING SYSTEMS	None
MODIFICATIONS	The dam has been significantly modified in an attempt to stop leakage at the spillway outlet pipe and along left contact. The entire spillway was rebuilt and the surrounding embankment reconstructed. A terrace was apparently added to the downstream dam slope.
HIGH POOL RECORDS	None available. The lake level has never reached the auxiliary spillway crest level which is about 2.5 feet above the service spillway entrance level.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None uncovered
PRIOR ACCIDENTS OR FAILURE OF DAM - DESCRIPTION - REPORTS	The dam leaked significantly at the spillway area and along the left abutment contact. It was partially rebuilt,approximately 4 years ago (1974?).
MAINTENANCE OPERATION RECORDS	None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: LOCKE WATERVILLE CORPORATION DAM

Drainage Area Characteristics: 0.17 square miles on tributary to Chickenboro Brook

Elevation Top Normal Pool (Storage Capacity): 1,334 (6.1 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): NA

Elevation Maximum Design Pool: 1,337

Elevation Top Dam: 1,340 nominal; low spots of crest are at Elev.1,339.5

SPILLWAY CREST:

a. Elevation 1,334 service spillway; 1,336.8 auxiliary spillway
b. Type Along hole conduit; service spillway, grassed crest auxiliary spillway
c. Width NA
d. Length Service spillway 5-ft. dia. along hole entrance to a 3-ft. dia. pipe; auxiliary 40 ft.
e. Location Spillover NA
f. No. and Type of Gates At or near left abutment

OUTLET WORK:

a. Type 20-inch diameter
b. Location Right abutment conduit
c. Entrance Inverts Unknown
d. Exit Inverts Unknown
e. Emergency Draindown Facilities Stop logged inlet accessible by scuba diver

HYDROMETEOROLOGICAL GAGES:

a. Type NA
b. Location NA
c. Records NA

MAXIMUM NON-DAMAGING DISCHARGE Approximately 750 cfs

APPENDIX B

PHOTOGRAPHS

ALL PHOTOGRAPHS TAKEN ON JUNE 5, 1978

Photo 1 - View of the service spillway on upstream face of dam.

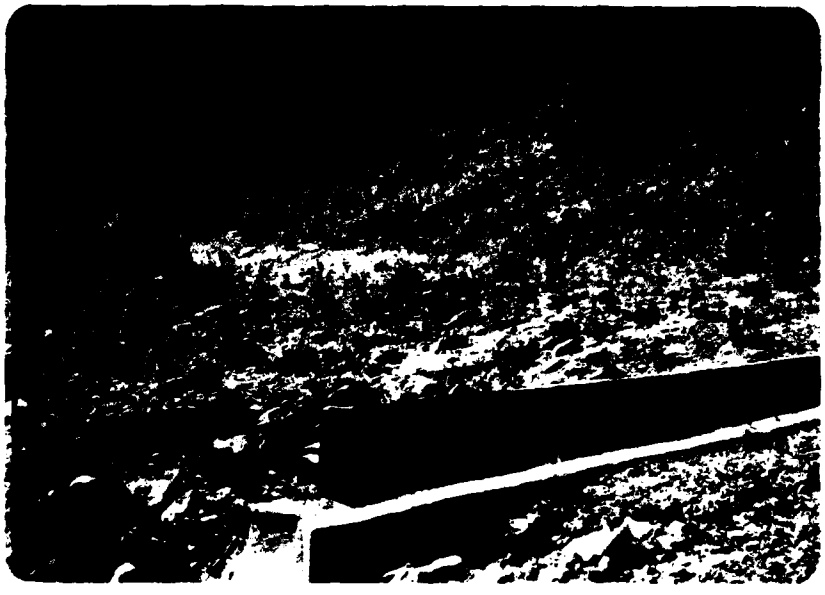


Photo 2 - View of the downstream face of dam looking toward the right abutment from the berm level. The service spillway outlet is in the foreground.

Photo 3 - View of the downstream face of the dam showing the service spillway outlet and the rebuilt section of the embankment. Note the absence of vegetation on embankment slope where rebuilding was done.

Photo 4 - View of the downstream embankment slope looking toward the left abutment. Note ungraded stone protection piles at berm level.

Photo 5 - View of downstream embankment slope showing local erosion.

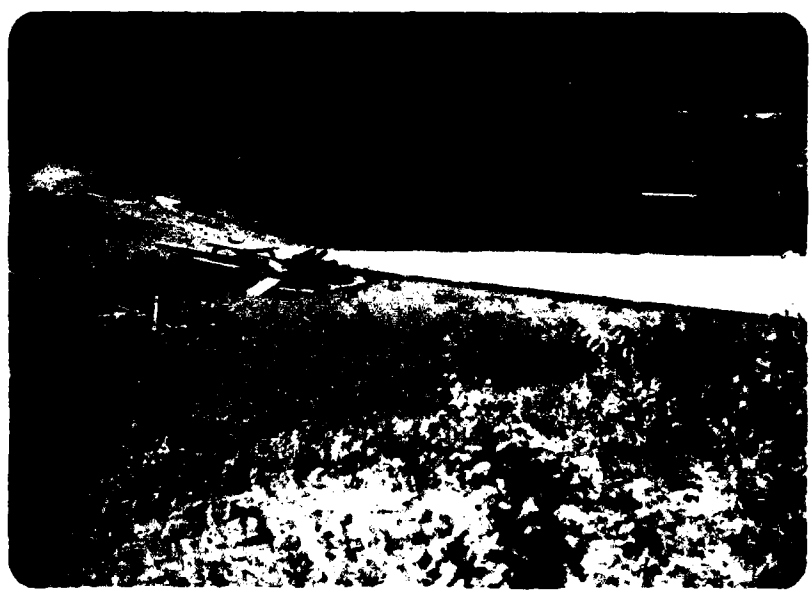
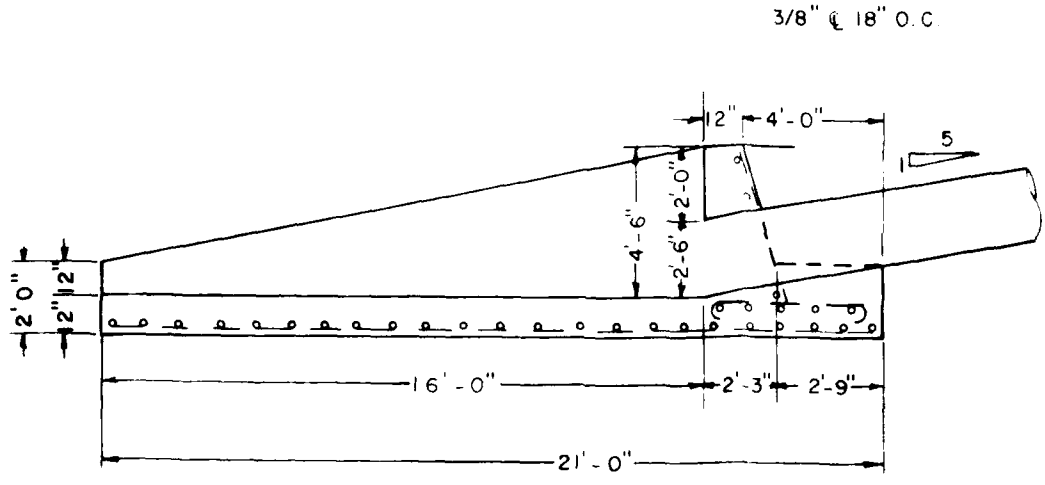


Photo 6 - View of dam and impoundment from the auxiliary spillway area on the left abutment.

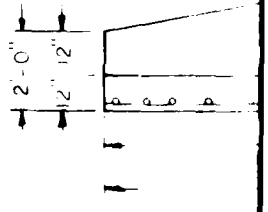
APPENDIX C

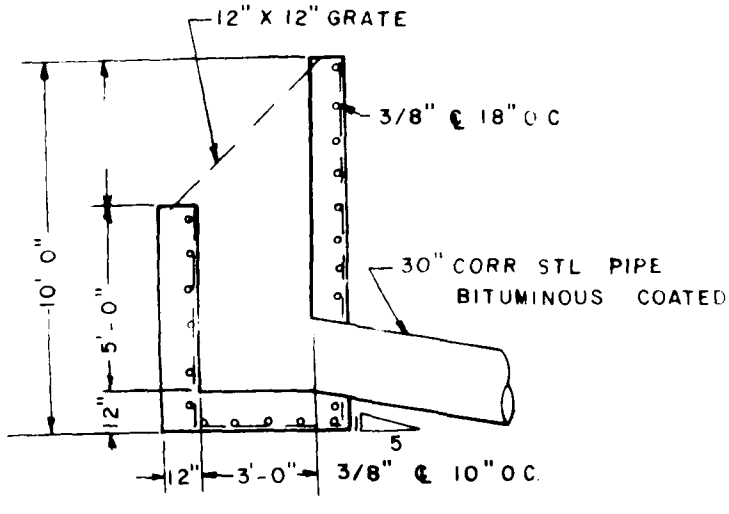
PLATES

PLANS & DETAILS OF DAM	Drawing 1
GEOLOGIC MAP	Drawing 2

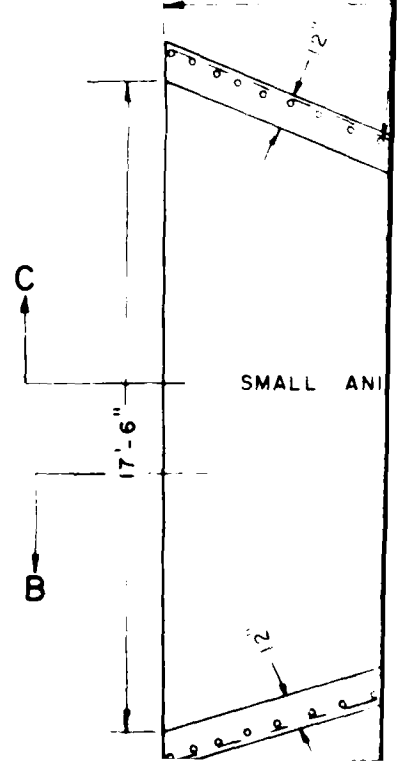


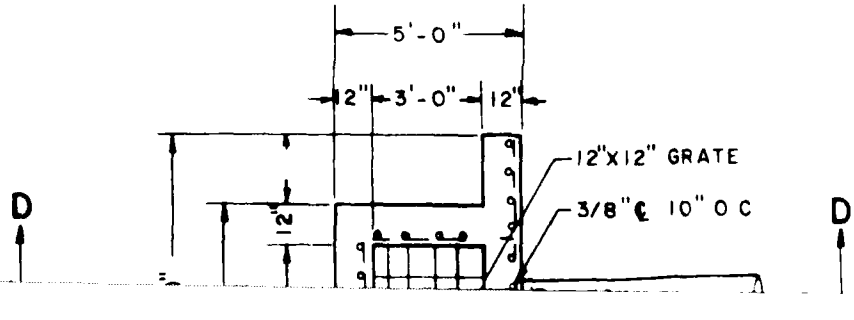
SECTION B-B

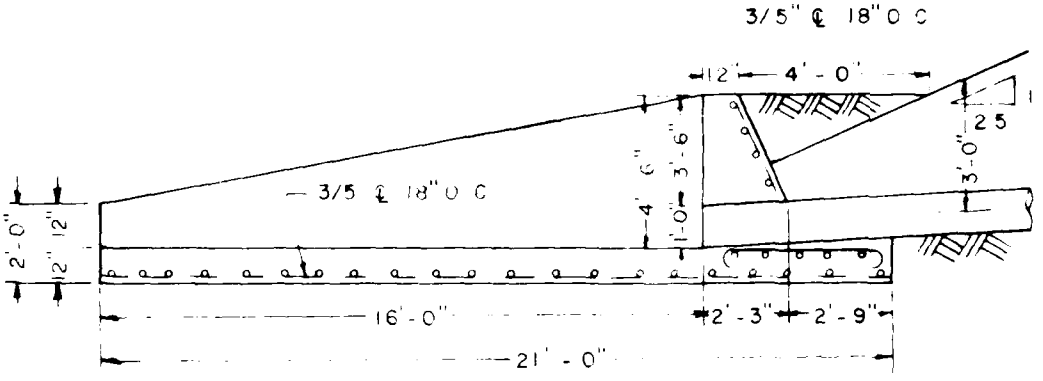




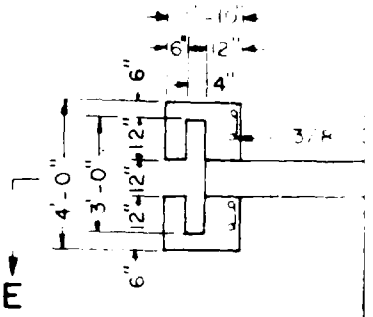
SECTION D-D





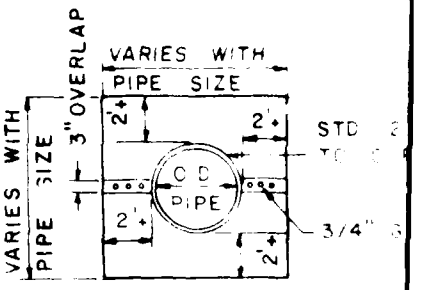


SECTION C-C

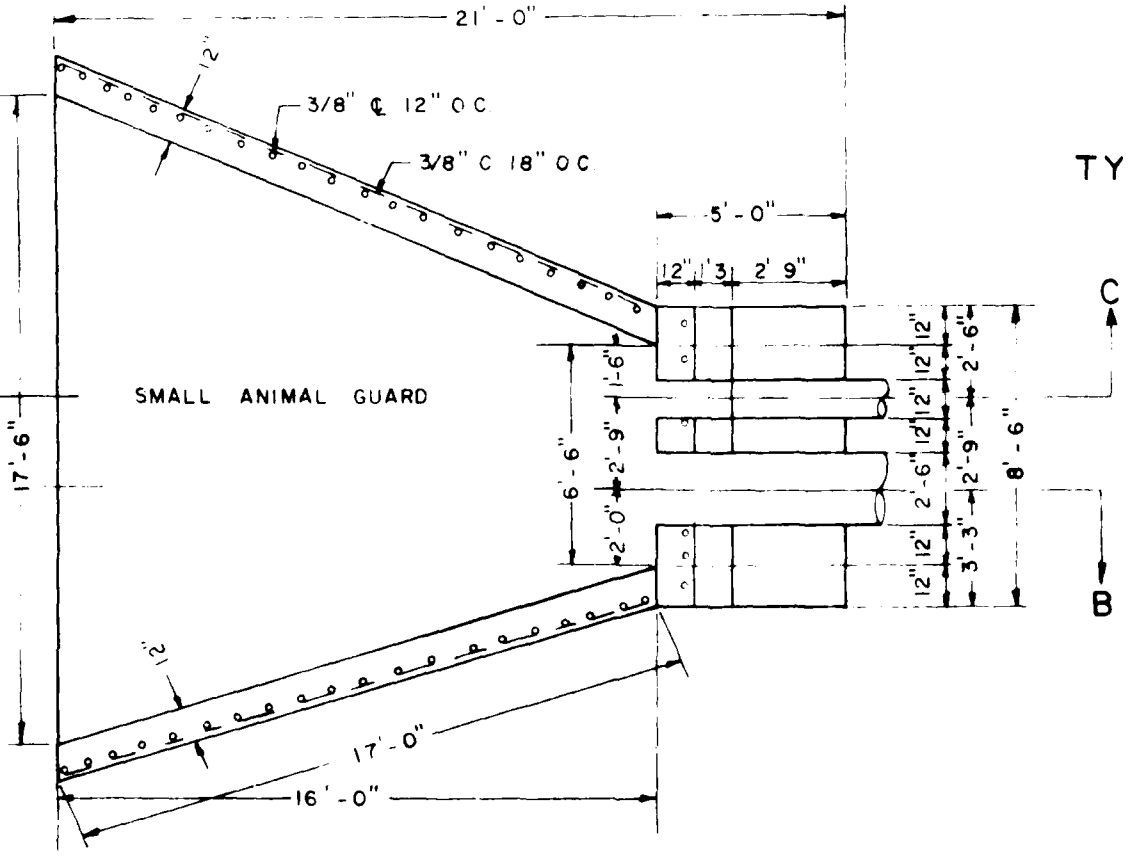


HEADWALL PLAN

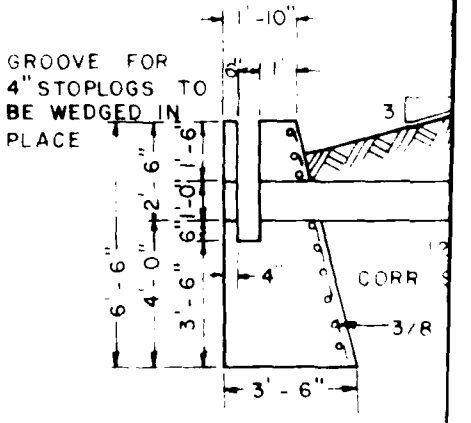
DETAIL C



TYPICAL ANTI-SEEP DIAP

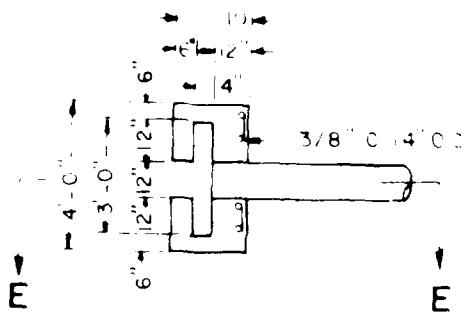


ENDWALL PLAN DETAIL A



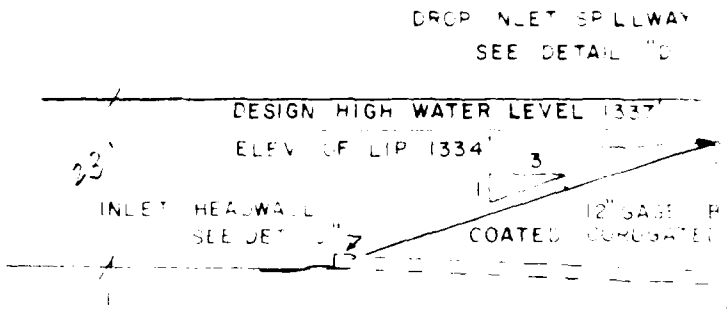
SECTION E-E

DRAWING REDRAWN FOR THIS REPORT FROM ORIGINAL PREPARED BY TRI-STATE SURVEYIN
SIGNED BY HERBERT F BUCHHOL



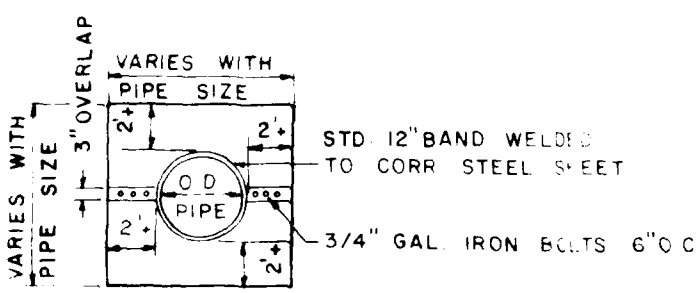
HEADWALL PLAN

DETAIL C

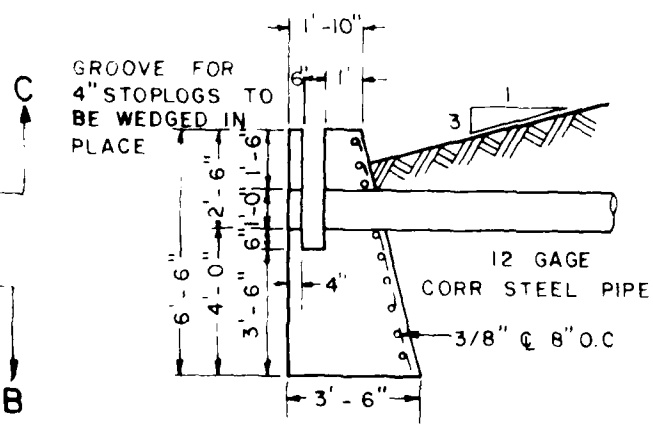


CORRUGATED STEEL DIAPHRAMS COATED 20' O.C
SEE DETAIL "E"

CUT OFF TRENCH TO IMPERV.
LAYERS FILL WITH GLACIAL



TYPICAL ANTI-SEEP DIAPHRAGM



SECTION E-E

TOP OF DAM ELEV 134

SE

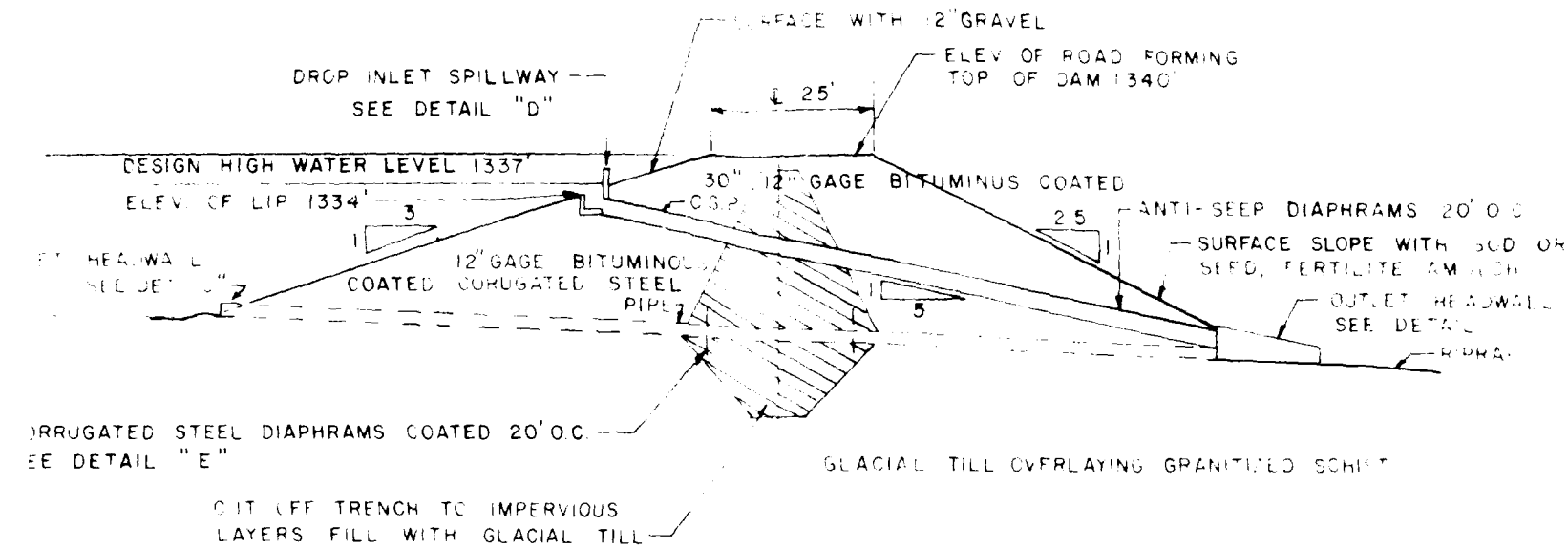
DESIGN DATA:

DRAINAGE AREA 110.5 ACRES

TIME OF CONCENTRATION 42 MIN

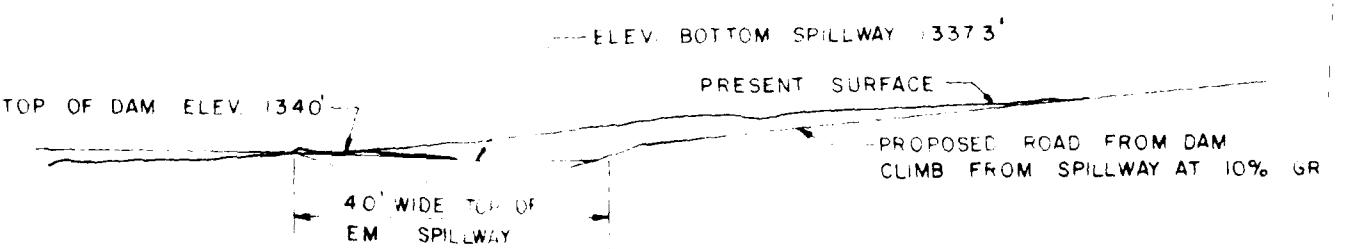
PREPARED BY TRI-STATE SURVEYING AND ENGINEERING CO. INC. LACONIA, NEW HAMPSHIRE
SIGNED BY HERBERT F. BUCHHOLTZ P.E.

1.4 x 56



SECTION M-M

SCALE 1" = 2'



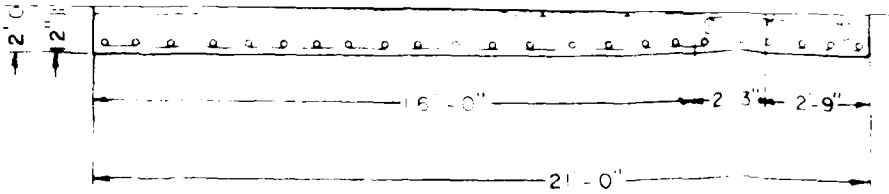
SECTION A-A

NOTE

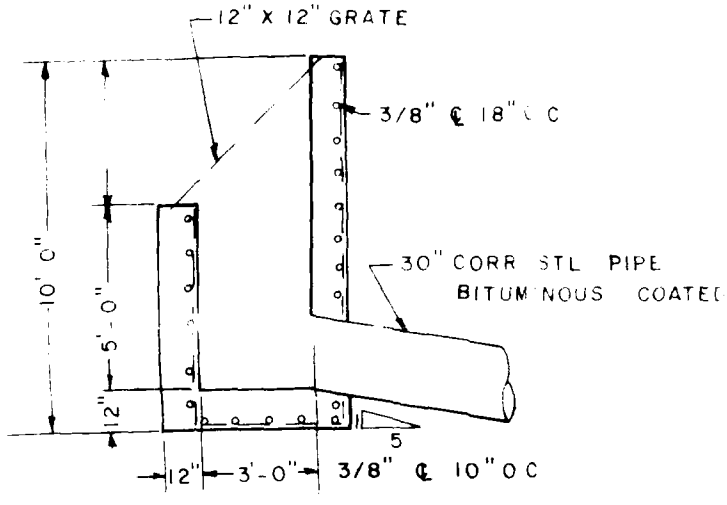
1. MATERIAL IN DAM TO BE GLACIAL TILL FOR HA SANDY LOAM EXCAVATED FROM RESERVOIR SIT
2. MATERIAL TO BE LAID DOWN IN 6" LAYERS AND COMPACTED BY SHEEPS FOOT ROLLERS TO 95 MAXIMUM DENSITY
3. ALL FILL AROUND PIPE TO BE HAND COMPAC 2' AROUND PIPE

DESIGN DATA:

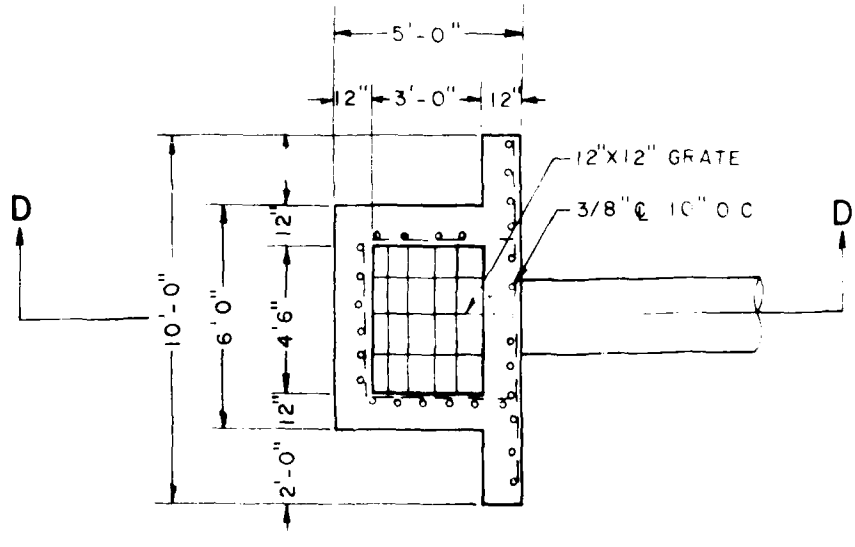
[illegible] 10.5 ACRES



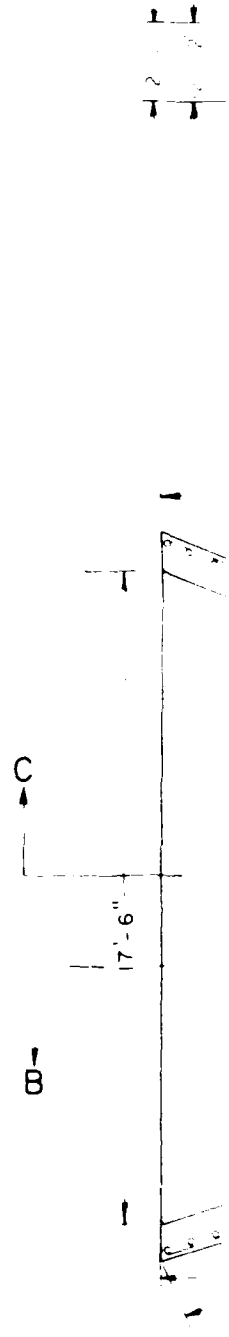
SECTION B-B



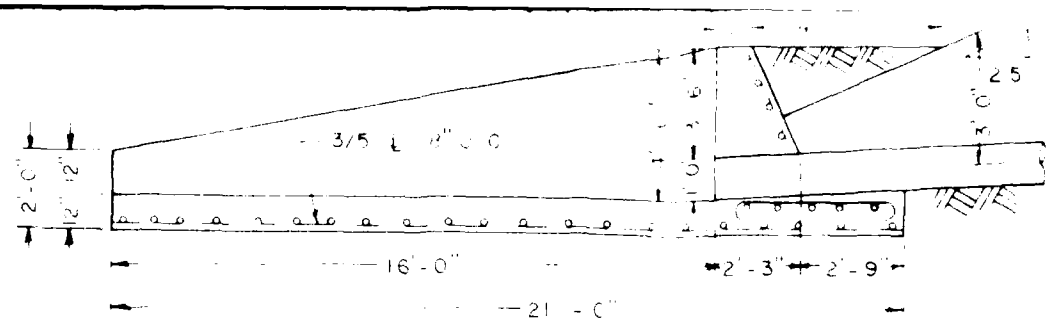
SECTION D-D



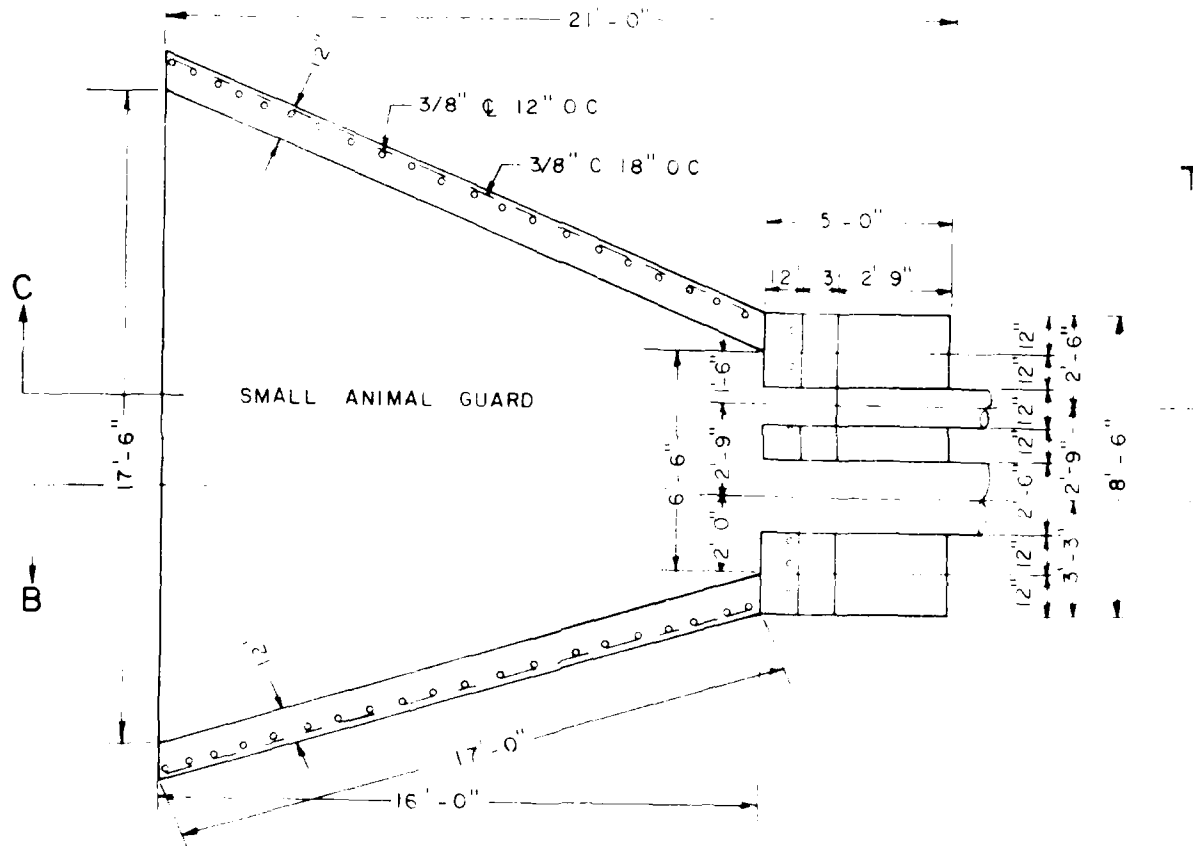
DROP INLET DETAIL D



END



SECTION C-C

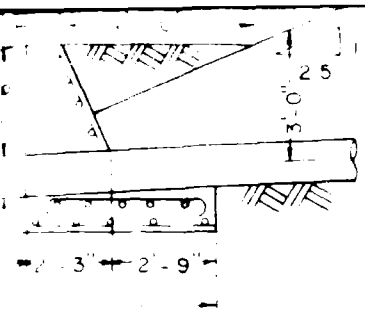


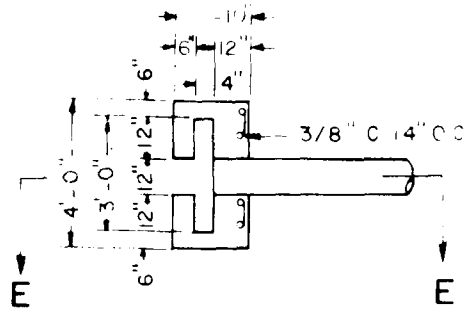
ENDWALL PLAN DETAIL A

TL PIPE
OUS COATED

VARIES WITH
PIPE SIZE

TYPICAL





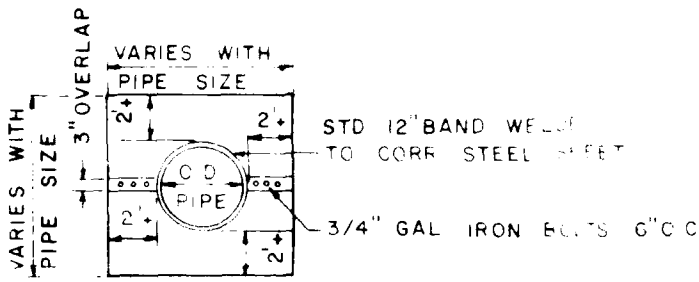
DESIGN H
E.L. F
23'
INLET HEADWA
SEE DE

HEADWALL PLAN

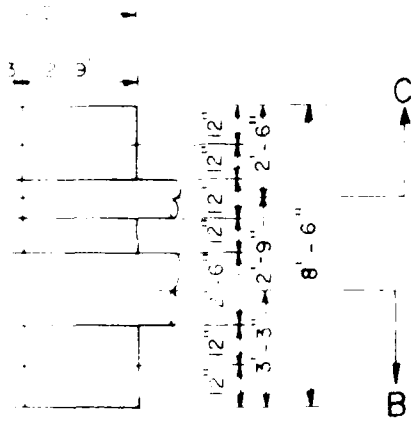
C

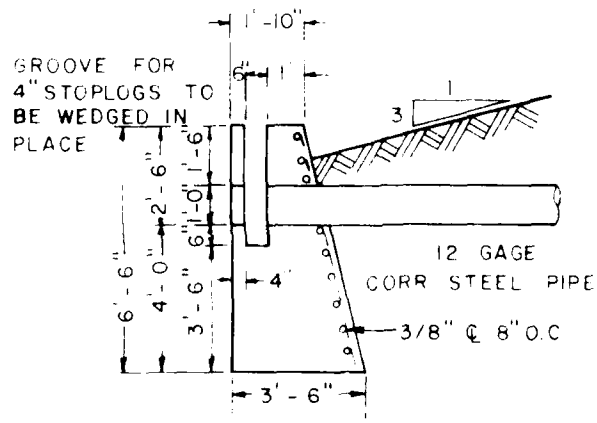
DETAIL C

CORRUGATED STEEL
SEE DETAIL "E"



TYPICAL ANTI-SEEP DIAPHRAGM

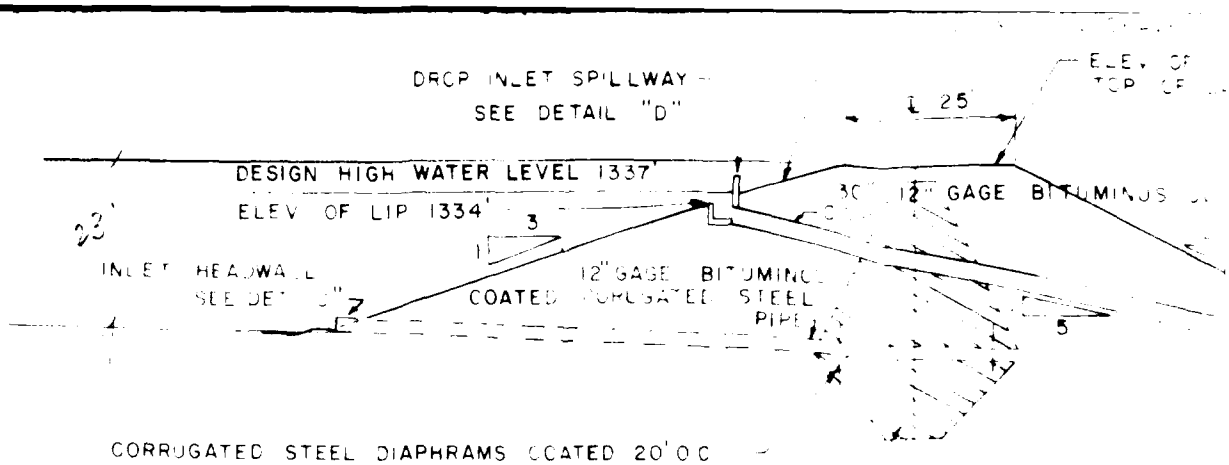




SECTION E-E

DESIGN DATA

DRAINAGE AREA
TIME OF CONCENTR
1HR RAINFALL 2
MAX FLOW 100YR
RESERVOIR CAPACITY
SURFACE AREA RES



CORRUGATED STEEL DIAPHRAMS COATED 20' O C
SEE DETAIL "E"

CUT OFF TRENCH TO IMPERVIOUS
LAYERS FILL WITH GLACIAL TILL

SECTION M-M

TOP OF DAM ELEV 1340'

40' WIDE TOP OF
EM SPILLWAY

PRESENT

SECTION A-A

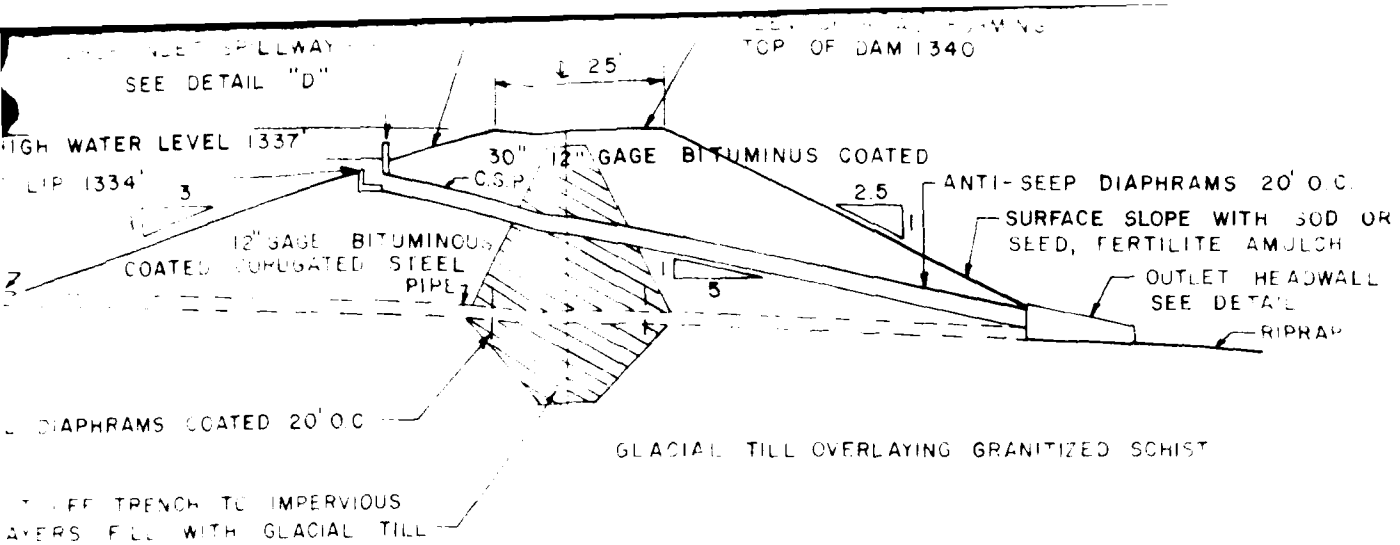
DESIGN DATA:

DRAINAGE AREA 110.5 ACRES
TIME OF CONCENTRATION 42 MIN
HR RAINFALL 2.75"
MAX FLOW 100YR STORM 95 C F S
RESERVOIR CAPACITY 2,000,000 GALS
SURFACE AREA RESERVOIR 56,000FT^2

NOTE:

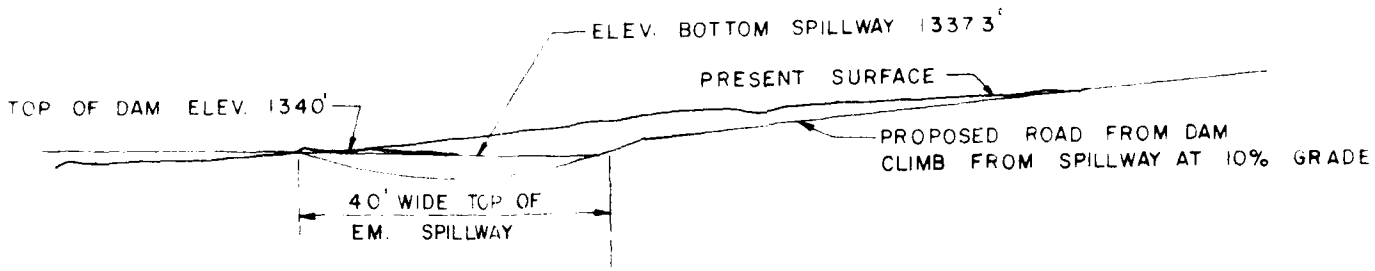
1 MATERIAL
SANDY LOA
2 MATERIAL
COMPACTED
MAXIMUM
3 ALL FILL
2' AROUND
4 ALL TOP
STRIPPED
5 ALL CONNE
PACKED WI

LOCKE WATE



SECTION M-M

SCALE 1" = 20'



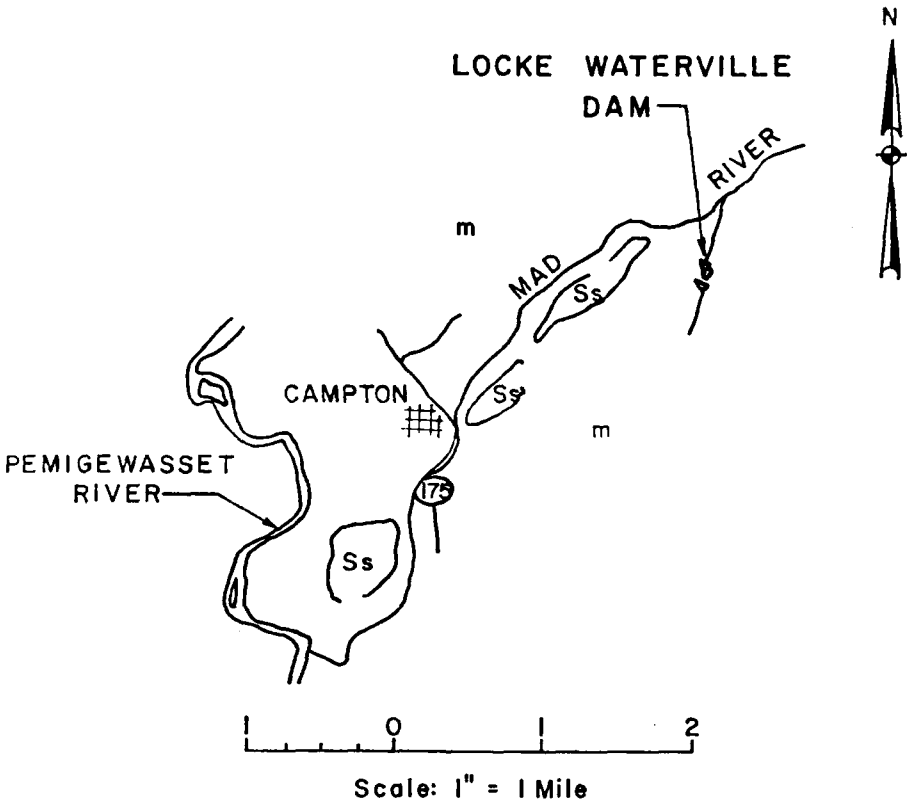
SECTION A-A

10.5 ACRES
TRATION 42 MIN.
75"
R. STORM 95 C.F.S.
TY 2,000,000 GALS.
ESERVOIR 56,000FT.^{2}

NOTE:

1. MATERIAL IN DAM TO BE GLACIAL TILL FOR HARMAN SANDY LOAM EXCAVATED FROM RESERVOIR SITE
2. MATERIAL TO BE LAID DOWN IN 6" LAYERS AND TO BE COMPACTED BY SHEEPS FOOT ROLLERS TO 95% MAXIMUM DENSITY
3. ALL FILL AROUND PIPE TO BE HAND COMPACTED TO 2' AROUND PIPE
4. ALL TOP SOIL AND UNDESIRABLE MATERIAL TO BE STRIPPED AND REMOVED FROM CONST. SITE.
5. ALL CONNECTIONS OF CORR. STEEL PIPE TO BE PACKED WITH WATER PROOF SEALANT.

LOCKE WATERVILLE CORP. DAM DWG. NO. 2



LEGEND:

Ss	Stratified Sandy Gravel Deposits in Kame Terraces or Valley Trains
m	Ground Moraine (Till)
——	Contact

NOTE: Bedrock, a Mica Schist, is not Exposed at Dam and Reservoir

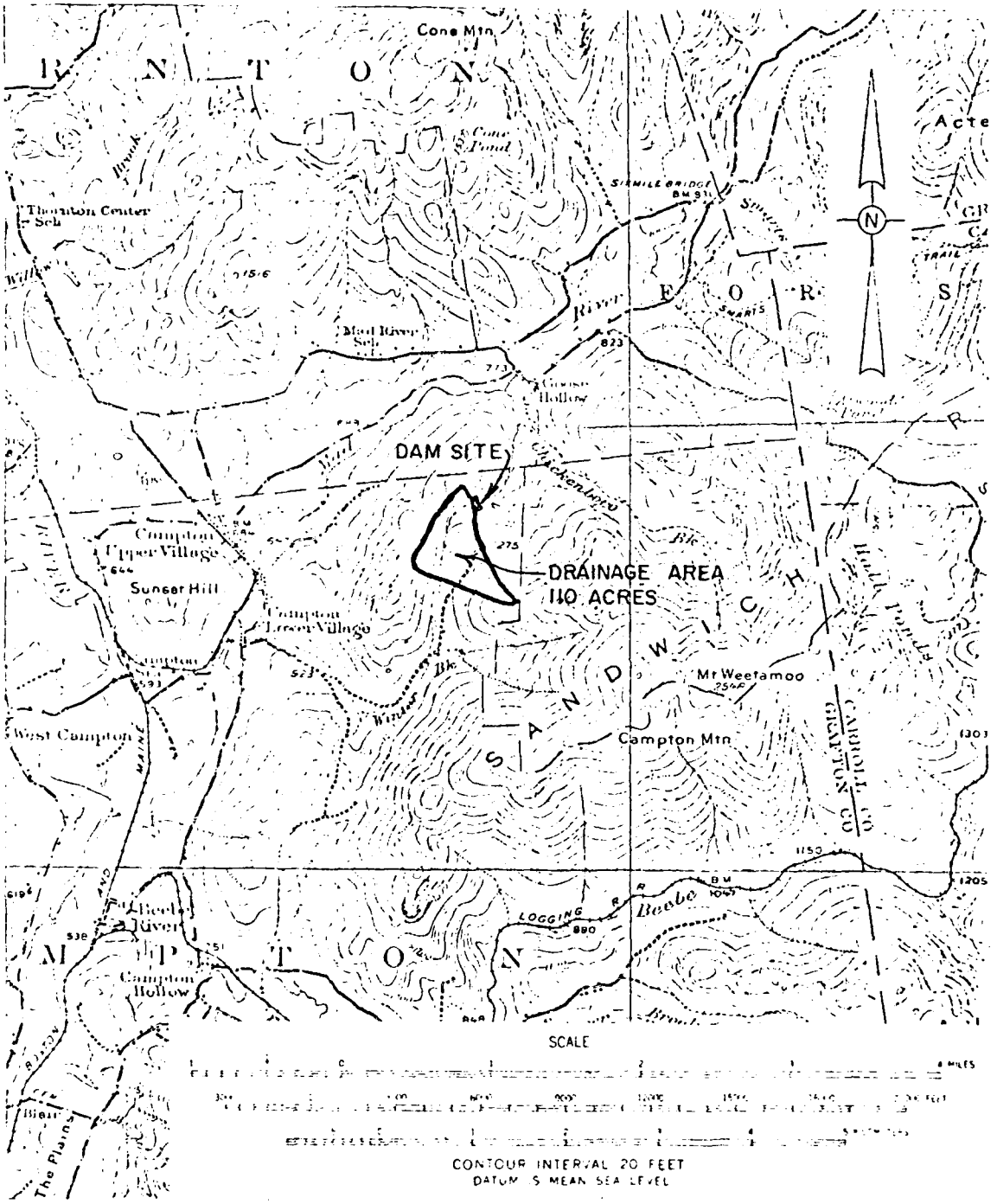
GEOLOGIC MAP
LOCKE WATERVILLE DAM

DWG. NO. 2

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE 1 - APPENDIX D



LOCKE WATERVILLE CO. DAM
DRAINAGE BASIN

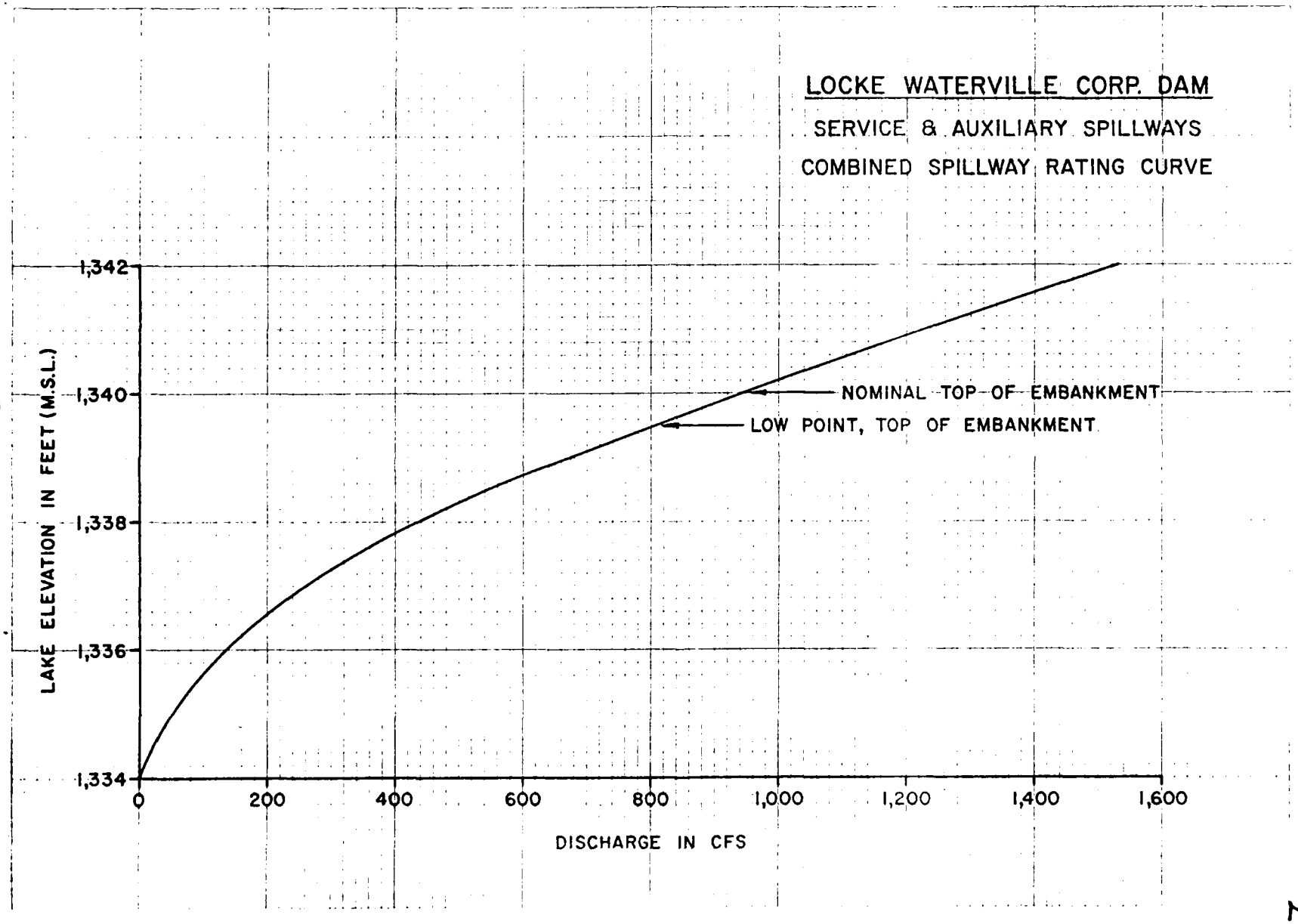


PLATE 2 APPENDIX D 2

HYDROLOGIC COMPUTATIONS

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT DAM SAFETY INSPECTION 11.14
LOCKE WATERVILLE DAM
COMPUTED BY ..... CHECKED BY SMK

SHEET NO 1 OF 3
JOB NO 10 057
DATE July 79

SPILLWAY RATING CURVE

(A) Control Spillway is 30' Gross Wide 5' diam x 3' diam

1) Treat as weir $L = TD = 15.7$ feet $C = 3.0$

Pool Elev	Head on Wo	$H^{3/2}$	$Q = CLH^{3/2}$ ($CL = 47$)
1334.0	0	0	0
34.5	0.5	.35	16
35.0	1.0	1.0	47
35.5	1.5	1.84	87
36.0	2	2.72	127
36.5	2.5	4.0	189
37.	3	5.2	245
38	4	8.0	376
39	5	11.5	
40	6	14.7	

2) Treat weir & Spillway below as a culvert

Entrance Elev 1334 ; $\mathcal{L}$ outlet = 1323

Losses
- Entrance $0.15\ V^2/2g$
- Exit $1.0\ V^2/2g$
- Friction $\frac{64.4}{\left(\frac{1.486}{.025}\right)^2} \frac{L}{R^{4/3}}$

$\frac{6.4}{60^2} \frac{60+60}{0.68} = 0.31$

$n = .025$
$S = 3.0$
$R = 0.75$
$R^{4/3} = .68$
$\frac{1.486}{n} \approx 60$
$L = 90'$
Span = 30'

Total losses ≈ use $1.5\ V^2/2g$

$Q = A\sqrt{\frac{2gh}{\Sigma k}} = 7.1\sqrt{\frac{64.4}{1.5}}\sqrt{h} = 46.5\sqrt{h}$

CALIBRATING CURVE

3) cont'd

Pool Elev.	h	$\sqrt{h}$	$Q = 465\sqrt{h}$
1334	34.7	5.99	2784
5	35.7	5.98	2781
6	36.7	6.06	2822
7	37.7	6.14	2861
8	38.7	6.22	2899
9	39.7	6.30	2936
1340	40.7	6.37	2972
1342	42.7	6.58	3060

4) Auxiliary Spillway Weir @ Elev 1336.3 L = 40
C = 2.9 C_L = 1.2

Pool Elev	h	$h^{3/2}$	$Q = CLh^{3/2}$	
1336.3	0	0	0	
1337.0	0.7	0.59	21	
37.5	1.2	1.31	47	
38	1.7	2.22	80	
39	2.7	4.44	160	
40	3.7	6.99	252	
41	4.7	9.65	348	< 500 cfs @ 1338.5
42	5.7	12.93	466	

5) Combined Pool Rating Curve

Pool Elev	Service Spillway	Auxiliary Spillway	Total Capacity
1334	0	-	0
35	47	-	47
36	127	-	127
37	245	21	266
38	400	80	480
39	568	160	728
40	736	252	988
41	904	348	1252
42	1072	466	1538

DAM SAFETY INSPECTION [illegible]
[illegible] HAMPDEN [illegible] [illegible] DAM
HYDRAULIC[illegible]

SHEET NO. [illegible] OF 5
JOB NO. [illegible]
BY [illegible] DATE [illegible]

[illegible] rating curves

A. Drop inlet spillway [illegible]

Inlet lip at el. 1334
Outlet basin [illegible] el 1320 [illegible]
[illegible] equation [illegible]

$Q = CA\sqrt{2g(H)}$
$= 2.95 \times 2.00\, h^{1/2}$
$= 236\, h^{1/2}$

W.S. El	h [illegible]	[illegible]
1334	0	[illegible]
1337	[illegible]	[illegible]
133[illegible]	[illegible]	[illegible]
13[illegible]	[illegible]	106
13[illegible]	[illegible]5	1[illegible]8

B. Emergency spillway, [illegible] = 40', El. 133[illegible] = [illegible]

El	H.	[illegible] H)$^{3/2}$	[illegible]
133[illegible]	0	0	[illegible]
1337.0	1.7	[illegible]	
13[illegible].0	2.7	[illegible]	[illegible]
1340.0	7.7	2213	

C. [illegible] Capacity at [illegible] dam = [illegible] 7 + 106 = 603 [illegible]

DAM SAFETY INSPECTION
MT. VERNON WATER WORKS DAM
HYD/HYDRAULICS

PMF ESTIMATES:

a/ Using NED regional curve for Eastern areas

$Q = 2323 - 616.99 \log A$, A = 110 acres = .171 sq. mi

$= 2323 - 616.99 \log \left(\frac{110}{640}\right)$

$= 2841$ cfs/sq. mi.

$Q_p = 2841 \times \frac{110}{640} = 488$ cfs or 490 cfs

b/ Since the regional curve does not give values smaller than 2 sq. mi. check with SCS method

PMP – 6 hr rainfall = 21"

1 hour PMP = 27% – 6 hr PMP = .38 x 21 = 7.9"

Curve Number for area = 95

PMP run off = 5.4"/hour D = 1 hour

$\Delta H = 10'$; $L = 1221' = .8$ miles

$T_c = \left(\frac{11.9 L^3}{10}\right)^{.385}$

$= 0.39$ hour

$T_p = \frac{1}{2} \times .6 \times .39 = 0.134$ hour

$Q_p = \frac{484 \times .171 \times 5.3}{0.134} = 597$ cfs

c/ Since b > a use 600 cfs for Max. Probable Flood Peak for reservoir.

SHEET NO. 7 OF

JOB NO.

BY DATE

low point Elev 1339.5 is 810 [illegible]

is "Significant according to our reassessment.

[illegible] by design flood [illegible] ½ PMF to [illegible] or 0.5(600 cfs) = [illegible] to 650 cfs

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

END

DATE
FILMED

8-85

DTIC