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NATIONAL DAM SAFETY PROGRAM. LAKE HERITAGE PROPERTY OWNER DAM (--ETC(U)
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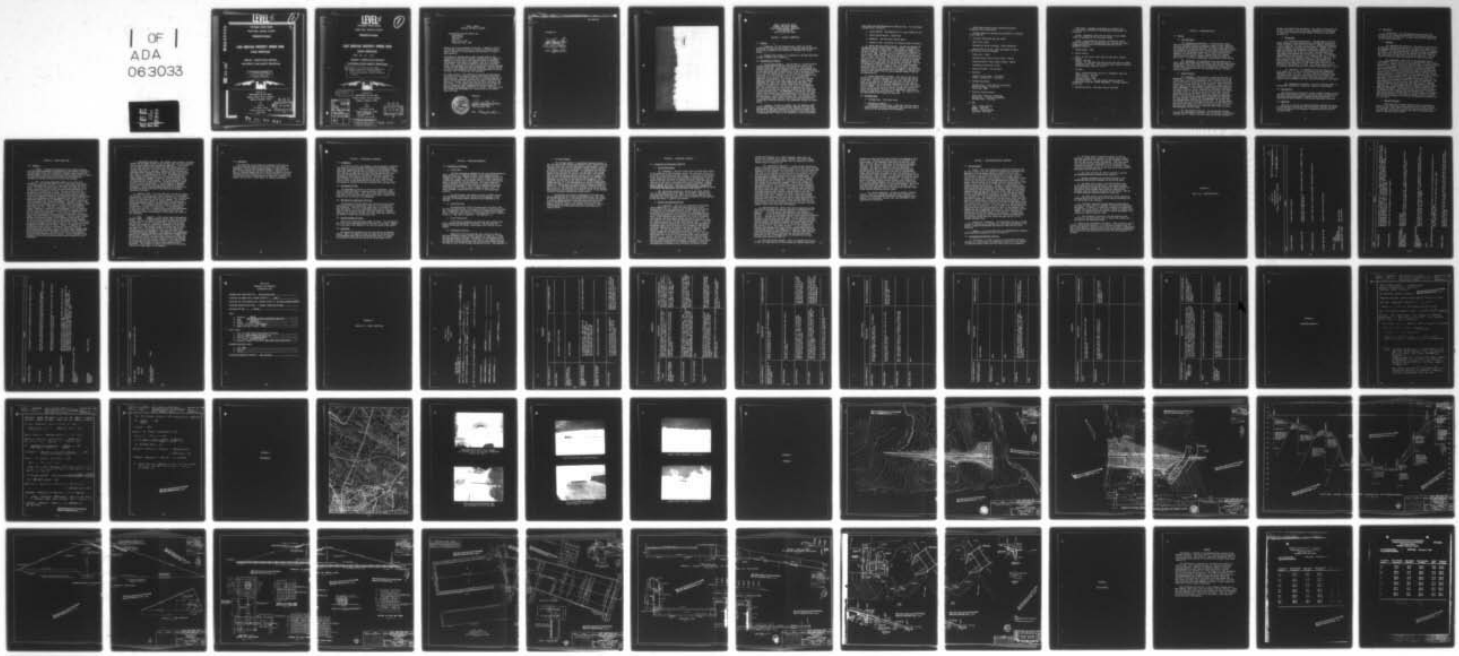

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POTOMAC RIVER BASIN

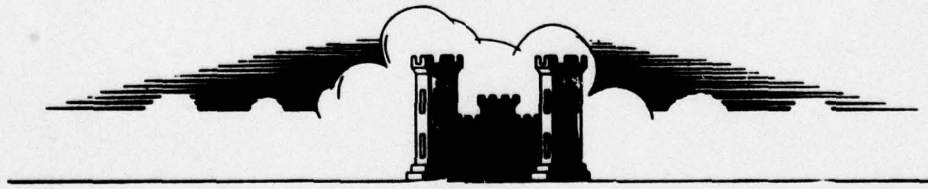
PLUM RUN, ADAMS COUNTY

PENNSYLVANIA

LAKE HERITAGE PROPERTY OWNER DAM

(LAKE HERITAGE)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



Prepared for

DEPARTMENT OF THE ARMY

Baltimore District, Corps of Engineers

Baltimore, Maryland 21203

By

EADS

1126 Eighth Avenue

Altoona, Pennsylvania 16602

JUNE 1978

LEVEL II

(1)

POTOMAC RIVER BASIN

PLUM RUN, ADAMS COUNTY

PENNSYLVANIA

LAKE HERITAGE PROPERTY OWNER DAM

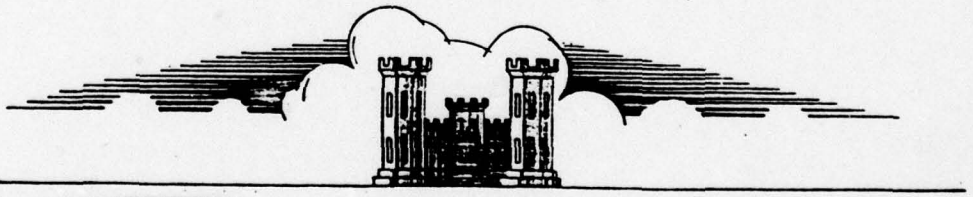
(LAKE HERITAGE)

NDI No. PA 334

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

(6) National Dam Safety Program. Lake Heritage Property Owner Dam (NDI-PA-334), Potomac River Basin, Plum Run, Adams County, Pennsylvania. Phase I Inspection Report.



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PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Lake Heritage Property Owners Dam
Pennsylvania
Adams County
Plum Run
April 5 & 6, 1978
Inspection Team - EADS

Based on the visual inspection of the dam, a complete review of the available engineering data and records and the past performance of the dam, it is our opinion that the dam is in fairly good condition.

The problem of seepage control and/or leakage seems to have stabilized for the present; however, monitoring of the amount of seepage is difficult due to the uncertain method of extending the discharge pipes and/or the complete cover-up of the western filter drain. This condition should be corrected in the near future, and additional tile drains installed for positive drainage of the wet areas downstream from the embankment. Readings should be made of the piezometers installed in the embankment to monitor the water level in the bedrock and embankment.

Of primary concern is the inability of the weir and spillway to pass one-half of the Probable Maximum Flood (PMF) without overtopping the dam. The Owner should retain a competent engineer to make a detailed hydrologic and hydraulic study to determine the capacity of the weir and spillway and the PMF for the dam in the near future. If the study should indicate that the spillway and weir is inadequate, then recommendations should be made for decreasing the overtopping potential of the dam. The study should also include the development of a rating curve for the outlet pipe of the dam.

Approved:

Robert C. Tomlinson

Robert C. Tomlinson, P.E.
Vice-President, EADS

Date: May 31, 1978

APPROVED BY:

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

DATE: 14 June 1978

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE HERITAGE PROPERTY OWNER DAM
LAKE HERITAGE DAM
ID NO. PA-334 (DER 1-80)

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority: The Dam Inspection Act, Public Law 92-367 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of dam inspections throughout the United States.

b. Purpose: The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances: Lake Heritage is a rolled earthfill structure approximately 1420 feet long and 53 feet high at the original stream bed. (See Drawings, Appendix E) The spillway is of the bathtub type, being rectangular in shape and permitting water to flow over three sides (a modification of the side channel spillway), with a concrete channel and walls 16 feet deep at the centerline of the dam. The stilling basin consists of a hole excavated at the downstream end of the spillway that has been extended after completion of the project. Rock riprap or derrick rock has been added for protection of the side slopes as well as the roadway embankment and single span bridge immediately downstream. The outlet pipe or conduit is a spiral welded steel 24 inch pipe, encased in concrete, with a 24 inch gate valve at the downstream end. Due to the degree of difficulty in operating the value, a 16 inch plug valve has been added approximately 20 feet downstream from the original valve. The embankment is drained by a sand and gravel filter blanket under the downstream half of the fill, which outlets into an 8 inch corrugated metal pipe. The spillway walls were drained by a gravel drain with open joint tile; however, there is correspondence that indicates these drains have been partially grouted due to possible erosion of the embankment through the gravel drains.

b. Location: The dam is located in Mt. Joy Township, Adams County, Pennsylvania, (see Location Map, Appendix D) on Plum Run, approximately 1400 feet upstream from its junction with White Run. The dam is approximately 2.93 miles southeast of the center square in Gettysburg, and is shown on the Gettysburg 7½ minute quadrangle

sheet dated 1951 and photorevised in 1968 and 1973. The coordinates are N39°37'01", E77°11'33".

c. Classification: Intermediate (53 ft. high & 2520 acre ft.)

d. Hazard Classification: Significant

e. Ownership: Lake Heritage Property Owners

f. Purpose of Dam: Recreation for property owners and guests.

g. Design and Construction History: The dam was designed for the American Realty Service Corporation by Ralph L. Woolpert Co., Consulting Engineers, Dayton, Ohio. Construction was begun in the spring of 1965 and, as closely as can be determined, completed in the spring of 1966. However, prior to completion, the parts of the gravel drains behind the spillway walls were grouted and replaced with a vertical sand filter. Relief holes were also drilled in the spillway slab in anticipation of relieving the buildup of seepage beneath the slab. There was also evidence of seepage through the embankment and leakage under the dam through the bedrock. Part of the seepage from the bedrock was visible in the exposed bedrock of the spillway "bucket." Remedial steps were taken, including additional studies, the installation of piezometers, the extension of the spillway slab downstream and the placement of adequate size riprap in the "bucket" area to insure adequate safety of the dam and appurtenances.

h. Normal Operational Procedure: The level of the lake is maintained at spillway elevation 480 for the recreational period of the year. Usually in November of each year, the level of the water in the reservoir is drawn down about six to eight feet to provide protection of all man-made improvements in the lake area from ice damage. Then in the early spring, the valve in the outlet pipe is closed so the lake will return to normal pool elevation. As per the piezometers installed in the embankment, there are no records of them being read after April, 1969. As a matter of fact, the dam attendent didn't know what they were.

1.3 Pertinent Data

a. Drainage Area: 3.94 square miles

b. Discharge at Damsite -
Maximum known flood at dam - 4,200 cubic feet per second (cfs) estimated June 1972 (determined from high water mark as pointed out by dam attendent and estimated).

Outlet works conduit at pool operating elevation - discharge curve not available.

Spillway capacity at maximum pool elevation is estimated to be 4,200 cfs.

c. Elevation (feet above mean sea level)

Top of dam - 483.0

Maximum pool design surcharge - 483.0 (uncertain)

Maximum pool of record - 483.0 (estimated for Agnes flood of June, 1972 by caretaker)

Normal pool - 480.0

Upstream portal invert outlet conduit - 430.75

Downstream portal invert outlet conduit - 428.62

Streambed at centerline of dam -

Maximum tailwater - not available

d. Reservoir

Length of maximum pool - 1.50 miles
Length of normal pool - 1.45 miles

e. Storage (acre-feet)

Spillway crest - 2520 (821 million gallons)
Design surcharge - unavailable
Top of dam - 2966

f. Reservoir Surface (acres)

Top of dam - 155 acres (estimated)
Maximum pool - 155 acres (estimated)
Spillway crest - 146 acres

g. Dam

Type - rolled earthfill
Length - 1420 feet
Height - 53 feet maximum
Top Width - 20.0 feet

Side slopes - upstream 3 horizontal to 1 vertical and a 5 foot berm at elevation 477.00 downstream 2½ horizontal to 1 vertical.

Zoning - homogenous earth with no zoning, 18 inch dumped riprap on upstream with 12 inch gravel filter.

Cutoff - Design drawings indicate a 20 foot-wide cutoff trench was excavated into unweathered rock, fissures and cracks slushed with neat grout and then backfilled with rolled embankment material.

Grout curtain - none

h. Outlet Conduit

Type - 24 inch spiral steel pipe 1/4 inch thick, encased in concrete
Length - 360 feet
Closure - 24 inch gate valve and 16 inch plug valve at outlet
Regulating facilities - gate and plug valve, manually operated.
Estimated outlet capacity - 63 cfs

i. Spillway

Type - uncontrolled bath tub-type or rectangular ogee weir
Length of weir - 205 feet
Crest elevation - 480.0
Upstream channel - none
Downstream channel - no good defined channel; severely restricted by bridge and roadway embankment. Spillway capacity is 4200 cfs.

j. Regulating Outlet - none other than 24 inch pipe.

SECTION 2 - ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics: The Pennsylvania Department of Environmental Resources prepared a report in May, 1965 upon receiving the application by the American Realty Service Corporation for construction of Lake Heritage Dam. The report summarizes the soils and foundation investigation, and a limited amount of hydrology and hydraulics for the project, noting the "C" curve criteria for the design of the spillway facilities. Remarks were also included concerning the 3.0 foot of freeboard and the action of waves and wave run-up. No hydraulic computations were included in the records.

(2) Embankment: The embankment design was based on the report "Soils And Foundation Investigation, Lake Heritage Adams County, Pennsylvania" dated April 1965; and includes the results of geologic reconnaissance, soils and subsurface investigation, laboratory test results and recommendations for the embankment design, including stability analysis.

b. Design Features

(1) Embankment: The construction drawings show that the embankment is an homogeneous earthfill structure with 3H to 1V upstream slope, a 2½ H to 1V downstream slope, a 20-foot crest width and a 5-foot berm at elevation 477.00 or 3.0 feet below normal pool elevation, or 6 feet below top of dam elevation. Topsoil and all organic material was to be removed to subsoil elevation beneath the entire embankment. A 20-foot wide cutoff trench was to have been excavated to bedrock, and all weathered and fractured rock removed. The cutoff trench is located at the centerline of dam. From the downstream limits of the cutoff trench, a 4-foot thick sand and gravel filter blanket was to be constructed within the embankment, and an 8 inch helical corrugated metal perforated pipe installed for free drainage. Material for the embankment was to come from the upstream borrow area outside with the lake. An 18 inch dumped rock riprap layer on 12 inch stone filter was to be provided on the upstream slope between the 5-foot bench and top of dam. A 2-foot high stone wave suppressor was to be hand-placed along the top of the dam adjacent to the riprap.

(2) Appurtenant Structures: The construction drawings indicate that the abutment structures for the spillway are reinforced concrete, with all slabs of the weir chute and spillway founded on

bedrock and anchored into the bedrock. The intake structure for the 24 inch drain pipe as well as the pipe encasement is of reinforced concrete, with the pipe extending beneath the dam on a skew angle at about 61°.

c. Design Data

(1) Hydrology and Hydraulics: The Department of Environmental Resources' report states that the spillway was designed for a flow of 4150 cfs, and that the spillway is capable of discharging a flow of 4200 cfs. No other data was given or included in the dam files to document the hydrology and hydraulics. However, DER's report did discuss the difference in elevation between the normal pool level and the top of dam of 3.0 feet, with the head of 3.0 feet passing the required flow through the spillway. Preliminary computations were made using K = 3.7, length of weir (L) = 218 feet and H = 3 feet, and a maximum discharge of 4200 cfs computed. This would place the pool elevation at the top of dam elevation 483. But it further stated that "the significant wave height to be expected on this lake during a storm having wind velocities of 50 mph would be approximately 3.0 feet. On a riprap surface such as is provided, the wave run-up on the upstream slope would be 2.7 feet."

(2) Embankment: The embankment design was based on the soils report of G. K. Jewell and Associates and the recommended embankment section was used. All data collected including boring and test pit logs, results of laboratory soil classification tests, gradation curve, compaction curves, unconfined and triaxial compression test and graphic stability test were presented in the report.

(3) Appurtenant Structures: There was no design values or calculations available for review with respect to the spillway.

2.2 Construction

Construction data available for review included original contract drawings, specifications, periodic inspection reports of PennDER and the various reports by Gannett Fleming Corddry and Carpenter, Inc. concerning the modifications to the dam and appurtenant structures.

2.3 Operation

There are no records concerning operational problems for review. The dam operator reported that the only problem concerned the amount of work and degree of difficultness in opening and closing the 24 inch gate valve.

2.4 Evaluation

a. Availability: All the engineering data available was provided by the Pennsylvania Department of Environmental Resources. To date, we have not been able to obtain the hydraulic report from the dam design consultant.

b. Adequacy

(1) Hydrology and Hydraulics: There were no data that was to have been computed and supplied by the dam design consultant on the hydrology and hydraulic analysis, included in the files supplied by PennDER. The only hydraulic data available was that information that could be collected from the two reports of PennDER concerning the "Report Upon the Application of Lake Heritage, Inc.," and the "Report on Review of Plans and Inspection of Lake Heritage Dam."

(2) Embankment: The design of the embankment appears to be adequate and in accordance with accepted engineering principles and practice. However, the use of weathered shale in place of sand and gravel for the filter blanket could have an effect on the phreatic line in the embankment. At the present, the seepage problems that were present during and after construction seem to have stabilized, but it is very difficult to determine the amount of seepage that is occurring due to the location of the filter drains and lack of their positive drainage. It also appears that the bedrock has more fissures and joints than anticipated, or as reported by G. K. Jewell and Associates in their soils and foundation investigation report; and this could lead to possible flow of water under the embankment. The area between the toe and the access road appears to have some wet spots and seepage, and the berm area has some seepage or discharge flowing in it. It would appear that this seepage is probably coming under the dam through the bedrock which is the red shales of the Gettysburg Formation. A more positive way should be made available for monitoring these seepage flows and recording them. Although a grout curtain was not provided into the formation bedrock, it appears that the perviousness of the bedrock at present could be effecting and lowering the phreatic line through the embankment and helping to act as a drain.

c. Operating Records

While there are no formal operating records available for review, it was reported by the dam operator that no major problems have occurred in the 7 years that he has been operating the dam. It is noted that the facility withstood the floods of tropical storm Agnes in 1972 and Eloise in 1975.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General: The general appearance of this project indicates that the earthen embankment and appurtenances were formally engineered and the project fairly well maintained. However, once one notes the maximum height of the top of the dam above the spillway crest (3.0 feet), one would then question the maximum flood flow the project was designed for and the efficiency of the weir and spillway.

b. Dam: The earthen embankment appears to be fairly well maintained. There are some small (2-4 ft. high) cedar trees growing on the downstream face as well as a few small pine trees and other brush. At several locations where trail bikes have been run up the slope, destroying the sod, boards have been placed perpendicular to on the paths to prevent use of them. The sod or grass cover was beginning to include briars and weeds, and the sod cover was sparce in some locations, apparently due to the granular subsoils exposed. There were no apparent seepage or wet areas observed on the downstream slope of the embankment; but what appeared to be a waste fill area downstream between the toe of embankment and the road has several wet areas and spongy spots, indicating seepage. The grass in this latter area was thick and appeared not to have been mowed for sometime. There were tracks left by a power mower or tractor, said tracks probably being made last fall. There was no evidence of surface cracks or recent sloughing or settlement on the embankment or at the abutments. However, the right or west spillway wall backfill appeared to be low due to probable past settlement. A small hole was found close to the top of the embankment just west of the spillway wall, and several gopher holes were notices in the embankment. The drain from the major portion of the sand and gravel filter appeared to be working, with the flow of water discharging from a wood trough that was attached to the sand and gravel drain pipe now covered with riprap. No evidence of positive drainage from the western drain in the vicinity of the new maintenance building could be found. However, it appeared that the building and access road is constructed in the drain area; all excavation was wet and muddy. Within the bucket area, seepage seemed to be coming from the exposed bedrock, as well as both spillway wall drains and spillway slab. The water at the time of the inspection was 13-14 inches below the top of the weir. We were informed by the caretaker that the outlet pipe was closed about a week prior to our inspection.

c. Appurtenant Structures: The "bathtub" type spillway, discharge channel and the upper portion of the spillway slab, and walls appeared to be in good condition and functioning adequately. It was noted that the west spillway wall abutting the weir section was only 3'-2½"± above the weir. Only very minor leakage was noted at this location; none other in the area. However, on the following day additional minor leakage was noted through the upper west spillway wall joint at its junction with the slab. The bottom portion of the original spillway slab which has already been replaced was badly cracked on a diagonal of about 30 with the surface, said cracking being due to frost heave. The 10 foot extension of the spillway slab was in good condition, including the paved sloped portion of the "stilling basin." The spillway walls appeared to be in good condition, with very minor evidence of downshill settlement. The 1/2 inch premoulded expansion joint material in the walls was being forced out of the joint due to probable expansion of the wall.

d. Reservoir Area: It is not known for sure what the extent of siltation is in the reservoir area. However, it is our understanding that, each winter when the level of the lake is drawn down, the silt of the upper end of the lake is removed. All siltation within the lake area probably is transported from outside the housing development since all overbank areas are well sodded and maintained. It is estimated that the overbank slope areas are flatter than 1 vertical to 4 horizontal. If any appreciable siltation has occurred, it probably took place during development of the shore areas. It is noted that backfilling around the spillway walls within the dam area is from within 2 to 3 feet of weir elevation.

e. Downstream Channel: A local access road to the eastern portion of the development parallels the axis about 125 feet downstream. The original outlet from the basin to the south side of the road were 3 - 36 inch corrugated metal pipes with concrete headwalls and wingwalls. Being very inadequate at flood stage, a steel truss bridge (probably bought from some other location) was added later. This bridge has about a 42 foot design span and appears to be constructed on piles, with very heavy rock riprap protecting the embankment. (See Appendix D for photograph) The combined waterway openings of the bridge and corrugated pipes appear to be inadequate for the maximum flood flow of 4200 cfs; and combined with their locations, skew of pipes and bridge with the axis of the spillway and the alignment of the outlet channel to the spillway axis and drainage structures would indicate that the roadway would probably flood out under maximum flooding conditions. The original old channel downstream from the outlet channel and bridge appears to be adequate.

3.2 Evaluation

The conditions of the project as reviewed in the field and a review of the dam records as furnished by the Pennsylvania Department of Environmental Resources appear to have stabilized and, for the present, are considered adequate. However, the 3 feet of freeboard between the top of the dam and the weir, and the efficiency of the spillway due to its close proximity of 30± feet from the east shore is questionable and leaves one in doubt as to whether the dam crest is high enough for adequate protection.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

An interview with Mr. Don Steimior, the dam operator, indicated that there is no set procedure established for operating the dam, other than maintaining the pool at spillway crest elevation of 480.0. Any excess inflow into the lake is passed over the spillway. In the Fall, the dam is drawn down 6-8 feet, with the permission of the Pennsylvania Department of Environmental Resources, to prevent ice damage to piers, wharfs, walls, etc., and silt removal. The level of water is controlled through the 24 inch outlet pipe by the two valves at the downstream end of the pipe. This is the only method of controlling the pool elevation below spillway level.

4.2 Maintenance of Dam

The embankment of the dam is fairly well maintained. But it doesn't appear that there is regular mowing of the grass, maybe only once or twice a year. Also, small cedar trees, an occasional pine tree, briars and some brush have been allowed to grow on the slope as well as the top of the embankment.

4.3 Maintenance of Operating Facilities

The operator of the dam stated that the valve on the 24 inch outlet pipe had been closed about a week prior to when we made our inspection. Since the 24 inch gate valve is so difficult to open and operate, it is our understanding that the 16 inch plug valve is used to control the pool level when required. However, there were no records in the DER files that showed when permission was given to install the 16-inch plug valve.

4.4 Warning Systems in Effect

There are no formal warning systems in effect. The dam operator who lives in the area keeps watch on the level of the lake. However, it is not known if the operator is on the site during flood events.

4.5 Evaluation

The operational procedures for this dam seem to be adequate. However, there is no means to lower the level of the lake in case of an emergency other than by the outlet pipe, which is further restricted by the 16-inch plug valve and 15-inch pipe orifice.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features

a. Design Data

The data furnished by PennDER for the Lake Heritage Reservoir makes reference to a complete hydraulic report prepared by the designers of the dam. However, review of the PennDER files did not produce such a report. The files did contain a report prepared by a hydraulic engineer from the PennDER Division of Dams and Encroachments, concerning the Lake Heritage Dam. The report states the spillway capacity of the dam was capable of passing 4,200 cfs, as required by the PennDER "C" curve criterion explained in PennDER Publication No. 41, "Construction or Repair of Dams," 1975. In short, PennDER's reports were very critical of the outlet works capacity.

No rating curves, area-capacity curves, frequency curves, unit hydrographs, design storm, design flood hydrography, flood routings, or discharge channel capacities were submitted by the designer.

b. Experience Data

No hydrologically similar drainage basins for which a PMF has been calculated exists in the nearby vicinity of the Lake Heritage Dam. Consequently, the PMF peak inflow was estimated from drainage area vs. PMF peak inflow charts for the Potomac River Basin, supplied by the U.S. Army Corps of Engineers. (See Appendix C.)

c. Visual Observations

On the date of inspection no conditions were observed that would indicate the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped.

d. Overtopping Potential

Comparison of the estimated PMF peak inflow of 15,200 cfs with the estimated ultimate spillway capacity of 4,200 cfs, as taken from the dam records indicates the potential for overtopping of Lake Heritage Dam definitely exists. An estimate of the storage effect of the reservoir shows Lake Heritage does not have the necessary storage available to pass the PMF without overtopping the dam. (See Appendix C.)

e. Spillway Adequacy

The spillway capacity is considered inadequate because it will not pass the PMF without overtopping the dam. One-half of the PMF peak inflow into Lake Heritage would be approximately 7,600 cfs. Comparing this flow with the estimated ultimate spillway capacity of 4,200 cfs indicates the potential for overtopping Lake Heritage Dam exists at even one-half the PMF. An estimate of the storage effect of the reservoir for one-half the PMF shows Lake Heritage does not have the storage capacity available that is necessary to pass one-half the PMF without being overtopped. (See Appendix C.) Therefore, the spillway is considered to be inadequate. Even though the spillway cannot pass one-half of the PMF without overtopping the dam, it is not considered to be seriously inadequately because its failure would not significantly increase the hazard to human life. The maximum estimated trailwater elevation below the Dam is 437.0+. This elevation is 46 feet below the top of the Dam. Overtopping Lake Heritage Dam would probably result in the ultimate failure of the dam by progressive erosion action.

Considering the elevation differential of 46 feet, and the storage capacity of at least 821,000,000 gallons, the failure of Lake Heritage Dam due to overtopping would increase the hazard to property damage downstream from that which would exist just before overtopping failure. Overtopping failure of the Dam, however, would not significantly increase the hazard to loss of life downstream from that which would exist just before overtopping failure.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

(1) Embankment: The only visual item of concern with respect to the stability of the embankment concerns the efficiency of the sand and gravel filter blanket and the 8" drain. In the area of the stilling basin, the original drain has been extended in the basin by the use of a wood trough and the amount of seepage cannot be determined. Also the other filter drain could not be positively located, other than the wet condition of the soils in the approximate area of the drain. Another item of concern could be an increase of leakage through the ungrouted bedrock beneath the drain. Since the natural bedrock is acting as a drain under the dam to lower the phreatic surface, the possibility exists of piping of the embankment into the rock in the future.

(2) Appurtenant Structures: Based on the visual inspection, all appurtenant structures appear to be stable. However, the crack that has developed in the lower area of the spillway slab will eventually have to be repaired, but is not detrimental to the stability of the slab which is anchored into bedrock.

b. Design and Construction Data

(1) Embankment: The soils and foundation investigation report prepared by G. K. Jewell and Associates prior to the construction of the dam included slope recommedations and factors of safety for the recommended typical section. Based on the classification of the soils to be used for the embankment and the falling-head permeability test performed upon the remolded borrow soils, it was determined the permeability is so low as to have no significance; and that seepage through the dam will be minor. It was stated in the report that the foundation rock which is red shale and sandstone would have a safety factor greater than 2. A series of graphic stability analyses were performed for both upstream and downstream slopes and were based on soil strenghts as measured by unconfined compression and triaxial compression tests on remolded specimens. All data was included in the report appendix. The stability analyses indicated that the factor of safety for a sudden drawdown for an upstream 3H to 1V slopes is 1.33. For the downstream slope of 2H to 1V, the minimum safety factor had been computed as 1.5. However, the 2½H to 1V slope on the downstream face was recommended and used due to maintenance purpose. These factors should be considered as adequate. Subsequent safety factor, determined and documented in "An Engineering Report on Drilling, Instrumentation and Observation of the Dam," by Gannett Fleming

Corddry and Carpenter, Inc., dated September, 1968, after the dam was full of water for one year, indicates the minimum safety factor of 1.42 for a steady seepage case, as compared to a normal design factor of safety of 1.5.

(2) Appurtenant Structures: A review of the construction drawings indicate that the abutment structures for the entire spillway appear to be well designed and constructed. All of the structures are founded on or into bedrock. The anchoring of all the slabs into bedrock aids in the stability of the structure from sliding as well as uplifting due to buoyancy and freezing of the seepage water. The minimum amount of seepage (almost nil) attest to the quality of construction of the concrete weir, chute and spillway. However, the majority of this spillway is not exposed to the freeze and thaw cycles due to the annual drawdown. Where the spillway slab has cracked, repairs will be required and an alternate method of drainage arrived at. The spillway walls appear to be of adequate design to retain the earth fill, even though the upper portion of the gravel drain has been grouted. The extension of the spillway slab downstream ten feet from the original terminus with the 9 foot deep cutoff wall has helped to further anchor the spillway structure to the hill. However, the small 3 foot high spillway walls have been overtopped and thus the cut slopes behind the walls protected with riprap. A new valve house has been added for the protection of the plug valve about 18 feet from the old valve box. It would appear that some protection should be provided to prevent damage of this house from frost and freezing.

c. Operating Records: While there were no operating records available for the dam, the operator reported no problems with the dam in the seven years he has been employed as the operator. However, there are indications that the wrong type of gate valve was used resulting in considerable amount of work and effort required by at least two men when the gate valve has to be opened or closed. Therefore, the 16" plug valve was added. It was reported that the spillway successfully passed the Agnes flood of 1972 and subsequent floods; however, the operator reported the maximum height of the pool to be "within a few inches" of the top of the spillway wall; the west wall is 3' - 2½"± above the weir. It was reported by an engineer from PennDER that a gage station located downstream from Lake Heritage and with a drainage area of about 12 square miles had a maximum discharge in 1972 of 4300 cfs. Therefore, Lake Heritage should have a much smaller flood flow for the June 1972 flood. Using the 0.8 rule to transpose date, the maximum flow for Lake Heritage should be about 1,800 cfs.

d. Post Construction Changes: Prior to completion of the dam in 1966, the upper portion of the spillway wall gravel drains were

grouted to prevent possible future piping of the embankment soils in this area. Vertical sand filters were also installed in the upper portion of the embankment within the spillway wall area. Later, in early 1968, six holes were drilled and 12 piezometers installed. The results, conclusions and recommendations are included in the report by GFC&C as previously mentioned. A horizontal drain was also installed at elevation 460 between station 10+65 to 11+95 to dry up a wet area on the downstream slope, with additional pipe added to carry the discharge to the stilling basin. Again in 1970, a 10 foot section was added to the downstream end of the spillway, and additional concrete was placed on the upstream slope of the stilling basin. All slopes of the basin or discharge channel received further riprap protection. Prior to the riprap placement, the truss bridge was constructed to provide additional flow area to the outlet channel. Due to the required efforts and manpower to open the 24 inch gate valve, a plug valve was added and a masonry building with open wall downstream from the discharge pipe was added.

(e) Seismic Stability: The dam is located in Seismic Zone No. 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations, studies, etc. were performed to substantiate this conclusion.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety: The visual inspection, operational history of the dam and a review of all the records as provided by the Pennsylvania Department of Environmental Resources indicates that the Lake Heritage Dam is now functioning satisfactory, but that there are some potential weaknesses in the design of the seepage control features of the dam that could eventually lead to unfavorable effects on the long term stability of the embankment and foundations. It appears that the design of the project and the interim remedial steps taken to insure the stability of the dam are in accordance with accepted engineering procedures. However, it further appears that there could have been some shortcuts taken or money-saving materials used during the dam construction. Of primary concern is the almost complete absence of the sand and gravel filter under the downstream portion of the embankment, as noted in the core borings and report for the installation of the piezometers by Gannett Fleming Corddry and Carpenter Inc. How widespread this could be is unknown; it was reported by Gannett and Fleming that the horizontal filter consisted mostly of crushed shale of varying sizes which disintegrated. There were traces of sand found on the sand drain wood trough flowing into the stilling basin, but due to the rock riprap, no accumulated amount could be seen or determined. It also appears that the maintenance of downstream slope has been neglected, as well as the immediate area between the toe of embankment and the road. More and better positive drainage of the seepage areas and drains should be installed for better monitoring of the seepage in the dam area. The hydrologic and hydraulic procedures used during this inspection indicate that the spillway and dam could not retain and pass one-half of the Probable Maximum Flood.

b. Adequacy of Information: The information that was available during the inspection was adequate for a reasonable assessment of the project, except the hydrologic and hdyraulic data that was quite deficient.

c. Urgency: It is considered that the recommendations suggested below should be implemented as soon as practical.

7.2 Recommendations/Remedial Measures

a. Facilities: In order to assure the continued satisfactory operation of Lake Heritage and become more familiar with its ability to withstand future floods, the following actions are recommended:

1. The Owner retain a competent engineer to make an hydrologic and hydraulic analysis of Lake Heritage to determine the capacity of the spillway and the frequency of flood that the dam can pass without overtopping. The study should also consider and make recommendations for decreasing the overtopping potential of the dam, as well as develop a rating curve for the outlet pipe due to the plug valve being installed downstream from the gate valve.

2. All trees and brush be removed completely from the dam embankment and the disturbed area repaired.

3. Regular maintennace be performed (mowing) on the downstream slope and area between the toe and the road.

4. The Owner should uncover the filter blanket drain in the western end of the dam area or maintenance building area and positive drainage be provided for future monitoring. The eastern filter blanket drain should be replaced with permanent pipe for positive discharge and monitoring. Records of these discharges should be kept for future use.

5. The Owner should install additional drains downstream from the dam to drain the wet areas for easier maintenance and for monitoring of any drainage.

6. A periodic inspection program should be developed by the Owner to assure that all features of the dam are continually maintained. If there is a significant increase in the measured seepage flow in any drains, the reservoir should be lowered immediately, an inspection made for possible sinkhole development and appropriate remedial measures taken.

7. The piezometers installed in the dam should be read periodically and observations made to insure that seepage does not exist on the downstream slope.

b. Operation and Maintenance Procedures: While the dam is maintained in fairly good condition, it is considered important that the owner should develop a formal warning system in the event of emergencies, and at such times an around the clock surveillence should be maintained during periods of high precipitation to allow for early detection of problems.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Lake Heritage Dam

ID # 334 (DER 1-80)

ITEM	REMARKS
AS-BUILT DRAWINGS	Design drawings available.
REGIONAL VICINITY MAP	Project shown on Gettysburg, PA. Quadrangle Sheet N 3945 - W 7707.5/7.5, 1951, and photorevised in 1968 and 1973.
CONSTRUCTION HISTORY	Periodic construction reports by PennDER representative available.
TYPICAL SECTIONS OF DAM	General section of dam available.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	Not available.
RAINFALL/RESERVOIR RECORDS	None available.

ITEM	REMARKS
DESIGN REPORTS	Soil And Foundation Investigation by G. K. Jewell & Associates, April, 1965 Report Upon The Application of Lake Heritage, Inc., PennDER, May 6, 1965. Report On Observations of Leakage and Seepage Downstream Of The Dam by Geo-Technical Services, December, 1966. An Engineering Report on Drilling, Instrumentation and Observation Of The Dam, by Gannett Fleming Corddry & Carpenter, Inc., September, 1968.
GEOLOGY REPORTS	Included in Soil and Foundation Investigation Report.
DESIGN COMPUTATIONS	None available.
HYDROLOGY & HYDRAULICS	None available.
DAM STABILITY	Stability analysis made but not available. Stability checked by GFC&C and available.
SEEPAGE STUDIES	Foundation report includes groundwater measurements and included in report.
MATERIALS INVESTIGATIONS	
BORING RECORDS	Boring logs available on design drawings and in foundation investigation report.
LABORATORY	Investigation included all soil parameters, compaction test, unconfined and triaxial comp.
FIELD	tests and all results included in report.
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	- An Engineering Report on Drilling, Instrumentation and Observation of the Dam, September, 1968. Final Inspection Report on Spillway Additions, February, 1970.
BORROW SOURCES	The specifications called for all soil material to be obtained from the borrow area immediately upstream from the embankment, but borrow area to be located above proposed water level of lake.

ITEM	REMARKS
MONITORING SYSTEMS	12 piezometers installed in embankment two years after completion of dam.
MODIFICATIONS	Spillway slab extended downstream and stilling basin modifications. Gravel drains behind spillway walls grouted and vertical sandfilters installed.
HIGH POOL RECORDS	Dam attendant reported an unofficial high pool elevation at the approximate top of spillway walls or elevation 483±.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Report On Observations of Leakage and Seepage Downstream Of The Dam by Geo-Technical Services, December, 1966. An Engineering Report on Drilling, Instrumentation and Observation Of The Dam by Gannett Fleming Corddry & Carpenter, Inc., September, 1968. Final Inspection Report on Spillway Additions, Lake Heritage Dam, by Gannett Fleming Corddry & Carpenter, February, 1970.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None available.

ITEM	REMARKS
SPILLWAY PLAN	Included with construction plans.
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	None.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Rolling farm land

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 480.0

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): No flood storage provided.

ELEVATION MAXIMUM DESIGN POOL: 483.00 (from plan of dam)

ELEVATION TOP DAM: 483.00

CREST:

a. Elevation 480.00
b. Type Reinforced concrete rectangular ogee weir
c. Width 2.60 feet
d. Length 205.04 feet
e. Location Spillover East abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 24" steel drain pipe encased in concrete
b. Location Under eastern portion of dam
c. Entrance inverts Elevation 430.75
d. Exit inverts Elevation 428.62
e. Emergency drawdown facilities None other than outlet pipe

HYDROMETEOROLOGICAL GAGES:

a. Type None
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: Not available

APPENDIX B

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase I

Name Dam Lake Heritage Property Owners Dam (Lake Heritage) County Adams State Pennsylvania ID # 334 (DER 1-80)

Type of Dam Earth Fill Hazard Category 2

Date(s) Inspection 4/5 & 6/78 Weather Fair & Cold to Cloudy Temperature 45 - 50°

Pool Elevation at Time of Inspection 478.9+ M.S.L. Tailwater at Time of Inspection 426.0+ M.S.L.

Inspection Personnel:

Robert C. Tomlinson, P.E.
Lynn Young
John B. Smilnak, P.E.
Eric Critchfield, P.E.
Dennis M. Stidinger

Robert C. Tomlinson Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No evidence of surface cracks.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noticeable.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No sloughing apparent. Some erosion due to trail bikes on downstream slope perpendicular to axis. One small area of depression approximately 100 ft. west of spillway, half way up slope could be construction irregulation.	Trail bike paths should be resodded.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical and horizontal alignment uniform.	
RIPRAP FAILURES	No sign of riprap failure. Wave suppressor on top of dam constructed 2 ft. high of large pieces of riprap and could be considered an extension of riprap.	Bottom of riprap and the 5' bench as detailed on dam plans never seen wher water is drawn down for wintertime protection of wharfs, etc.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
Slopes	Both upstream & downstream slopes are uniform and in general good condition. Downstream sod cover good with some bare areas and gopher holes. *	All brush, pine and cedar trees should be removed totally and scars repaired. Reseed or sod. *
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Embankment at spillway walls seems to have settled slightly, although East or left spillway was never fully backfilled.	Due to bend in spillway, East wall height same as West wall, and total backfill not needed.
ANY NOTICEABLE SEEPAGE	No noticeable seepage through embankment. Some seepage approx. 300 ft. ± West of spillway 10' from toe and 400 ft. ± West of spillway approx. 20' from toe. No apparent sediment. Some flow along berm of road, which local residents say is from original springs. ~~Also seepage from bedrock below east wall area.~~	Area east of old road to spillway, between toe of fill and road, appears to have been backfilled 4-8ft. thick with random material. Probably not compacted.
STAFF GAGE AND RECORDER	None	
DRAINS	West toe drain in vicinity of maintenance building covered over by new construction of maintenance building, parking area & driveway. East toe drain discharges by new valve building by way of wood trough. *Unknown small hole within 3' ± top of dam & 6' ± from West spillway wall.	West toe drain should be uncovered and reconstructed for free drainage to roadway drainage ditch. *If possible, rid area of gophers. Fill all holes with compacted material.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet inaccessible due to water and earth embankment. Outlet pipe encased in concrete.	
INTAKE STRUCTURE	24" outlet pipe submerged and has never been seen by present caretaker.	
OUTLET STRUCTURE	Valve housing of original 24" pipe is reinforced concrete box with access lid. New valve provided downstream with concrete block walls and poured R.C. roof; open end to stream.	24" gate valve to hard to open and couldn't get it to reseal. New valve house should be protected from freezing.
OUTLET CHANNEL	Considerable cracking of last bottom slab at discharge end of walled spillway, and the most recently placed slab. Slab cracking on diagonal through slab at 20 + 30° due to frost heave of slab.	Last section of slab should be provided with more positive drainage below frost level or winter freeze of water discharging from weepholes.
EMERGENCY GATE	24" gate valve followed by a 16" quick-opening plug valve. Discharge orifice of plug valve reduced to 15".	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete weir appears in good condition. No evidence of leakage into upper spillway below weir.	
APPROACH CHANNEL	No approach channel. Rectangular basin with weir on three sides projects out into lake.	Question efficiency of weir due to restricted flow area to East weir side.
DISCHARGE CHANNEL	Walls show minimal evidence of expansion, extruding some exp. joint material from joints. Conditions of wall good.	
BRIDGE AND PIERS	None	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None evident.	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	Two piezometers installed on crest of dam and four part way up the downstream embankment. All appear to be straddling the outlet pipe, about 12-13' off centerline.	Piezometers installed after dam was constructed.
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	All slopes very flat and inhabited, with lawns covering shoreline.	
SEDIMENTATION	No appreciable amount noted, although silt is removed when level of lake is drawn down for winter.	Silt removal is an annual maintenance job, as per dam operator.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No stilling basin. Small 42' ± steel truss bridge with 2:1 underslopes that severely block outlet channel. Also 3-36" CM pipes. Bridge opening 1/3 of normal opening due to riprap placed for bridge protection. Outlet channel appears to be very inadequate due to roadway fill.	A larger waterway opening should be provided to reduce build-up of tailwater.
SLOPES	Stable and partially riprapped downstream from bridge.	
APPROXIMATE NO. OF HOMES AND POPULATION	No homes immediately downstream for at least 2,000'. One home south of Route 140 which could be within highwater elevation. No other homes within a mile could be found on a general reconnaissance trip.	Informed there is a possibility of an area sewage treatment plant

APPENDIX C

HYDROLOGY/HYDRAULICS

BY PEC DATE 4/79 | DAM SAFETY INSPECTION | SHEET NO. 1 OF 1
CHKD. BY DATE | DETERMINATION OF PMF PEAK INFLOW | JOB NO.
LAKE HERITAGE DAM | CONTRACT NO.

SIZE CLASSIFICATION : INTERMEDIATE
HAZARD CLASSIFICATION : SIGNIFICANT
DRAINAGE AREA : 3.94 MI^2

NO UPSTREAM IMPOUNDMENTS

MAXIMUM SPILLWAY DESIGN FLOOD (SDF) = ½ PMF ± 0 PMF

EST. MAX. SPILLWAY CAPACITY = $C_w L h^{3/2}$

Assume $C_w = 3.4$, $L = 205'$ (Inside Length), $h = 3'$

EST. MAX. SPILLWAY CAPACITY = $Q_{MAX} = 3.4 \times 205 \times (3)^{3/2} = 3622$ CFS

ESTIMATE PMF PEAK INFLOW FROM GRAPH OF DRAINAGE AREA (D.A.) VS PMF PEAK FLOW / MI^2 FOR POTOMAC RIVER BASIN. D.A. = 3.94 MI^2.

PMF PEAK FLOW = 3850 CFS / MI^2 x 3.94 MI^2 = 15,169 CFS

SAY PMF PEAK FLOW = 15,200 CFS

15,200 CFS > 3622 CFS

∴ SPILLWAY CANNOT PASS THE PMF PEAK FLOW. DETERMINE STORAGE EFFECT OF RESERVOIR.

Note: Spillway length used is inside dimension of spillway length. Coefficient, C_w assumed to be 3.4 and taken from King's Handbook of Hydraulics.
Spillway capacity as taken from dam records of PEPCO DER used $C_w = 3.7$ and spillway length of 218 to determine spillway capacity of 4200 cfs.

Use above computed flow of 3622 cfs since H cannot exceed 3.0 without overtopping, and C_w would average closer to 3.4.

SP 1093TA

BY REC DATE 4/78 | DAM SAFETY INSPECTION | SHEET NO. 1 OF 2
CHKD. BY DATE | STORAGE EFFECT OF RESERVOIR | JOB NO.
LAKE HERITAGE DAM | CONTRACT NO.

SURFACE AREA @ NORMAL POOL EL. OF 480.0 = 146 AC.
SURFACE AREA @ MAX. POOL EL. OF 483.0 = 151 AC.

STORAGE AVAILABLE ABOVE NORMAL POOL EL. =

$$\frac{(146+151)}{2} \times 3' = 445.5 \text{ ACRE-FT.}$$

USING SHORTCUT METHOD SUGGESTED BY NAD

MAXIMUM SPILLWAY DISCHARGE = 3,622 CFS
PMF PEAK INFLOW ($Q_{I\,MAX}$) = 15,200 CFS

$$P = \frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{3,622}{15,200} = .24$$

$$\therefore (1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{VOLUME OF INFLOW HYDROGRAPH}} = .76$$

VOLUME OF INFLOW HYDROGRAPH (V)

Assuming a Triangular Shape

Total Time (T) = 51 HRS. (From Plot of Total Time vs Drainage Area (D.A.) for D.A. = 3.94 MI^2 and using Potomac River Basin)

$$V = \tfrac{1}{2}(Q_{I\,MAX})(T) = \tfrac{1}{2}(15,200\,CFS)(51\,HR)\left(\frac{acre}{43,560\,ft^2}\right)\left(\frac{3600\,s}{HR.}\right)$$

$$V = 32,000 \text{ ACRE-FT}$$

REQUIRED RESERVOIR STORAGE = .76 (32,000)

= 24,320 ACRE-FT

STORAGE AVAILABLE = 446 ACRE-FT < 24,320

∴ LAKE HERITAGE RESERVOIR WILL NOT BE ABLE TO CONTAIN THE PMF WITHOUT BEING OVERTOPPED.

CHECK STORAGE EFFECT OF RESERVOIR AT ½ PMF.

1/2 PMF PEAK INFLOW = 1/2 x 15,200 cfs = 7,600 cfs

$P = \frac{3622}{7600} = .48$

$\therefore (1-P) = .52$

VOLUME OF INFLOW HYDROGRAPH (V)

Assuming a Triangular Shape

$V = \frac{1}{2}(7600 \text{ cfs})(5 \text{ HR})\left(\frac{\text{acre}}{43{,}560 \text{ ft}^2}\right)\left(\frac{3600 \text{ sec}}{\text{Hr.}}\right)$

V = 16,000 ACRE - Ft

REQUIRED RESERVOIR STORAGE = .52(16,000)

= 8320 ACRE-Ft

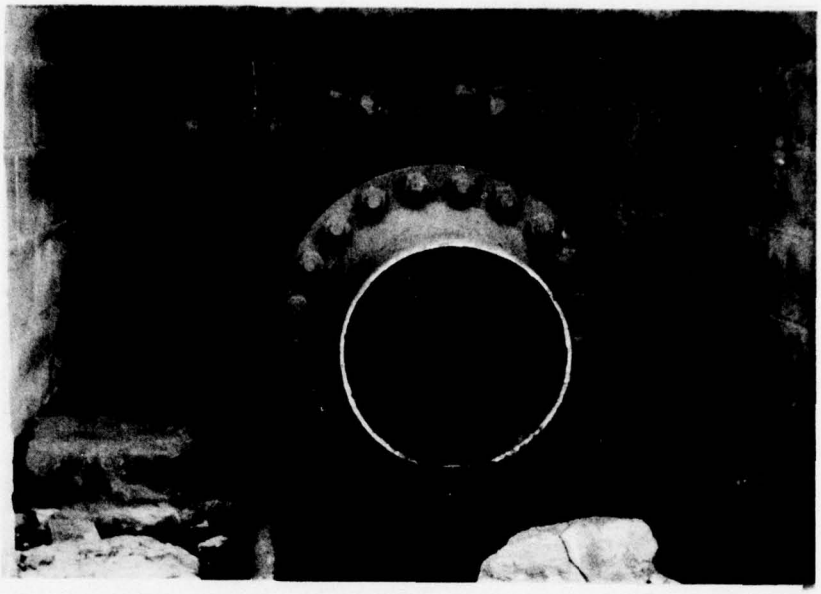
STORAGE AVAILABLE = 446 ACRE-Ft < 8320

$\therefore$ LAKE HERITAGE RESERVOIR WILL NOT BE ABLE TO CONTAIN 1/2 THE PMF WITHOUT BEING OVERTOPPED.

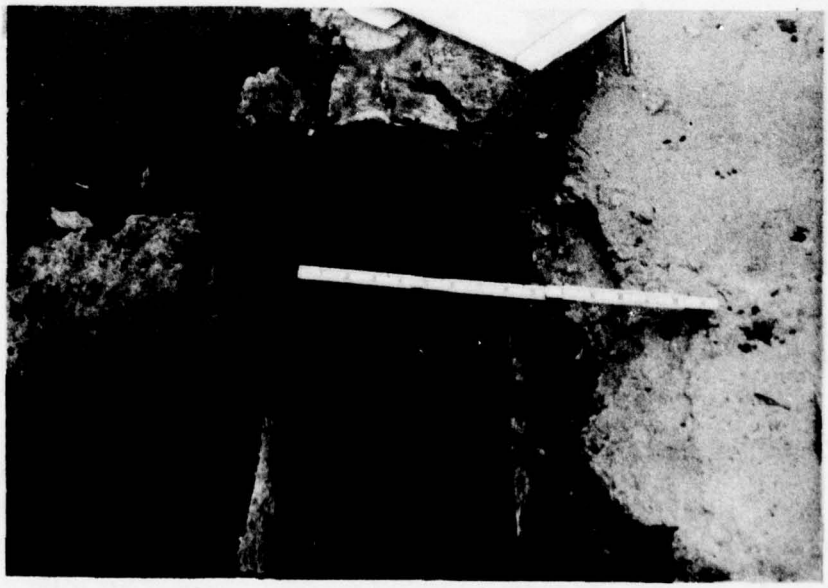
APPENDIX D

PHOTOGRAPHS

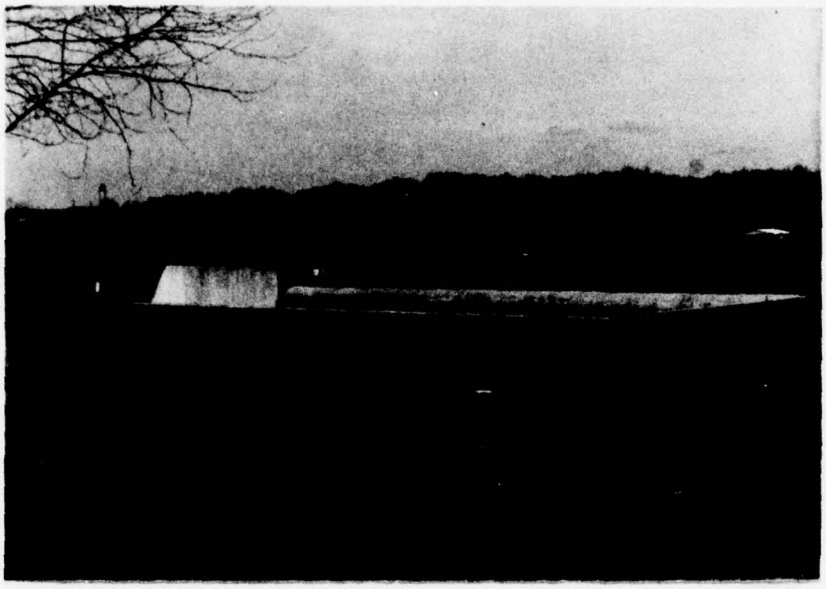

LAKE HERITAGE DAM
GETTYSBURG
CAVALRY
Run
Plum
Wolf Hill
Sheep Heaven
Benner Hill
CONFEDERATE
PARK
Swimming Pool
Powers Hill
Creek



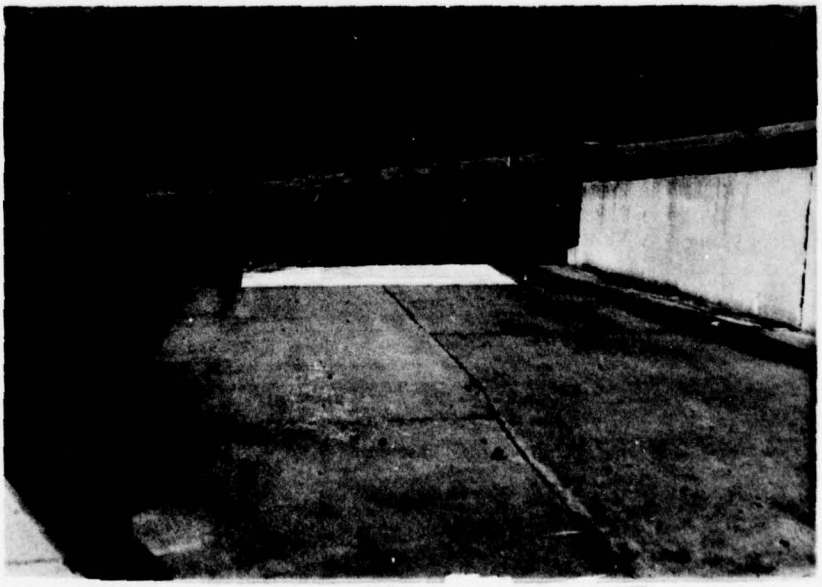
DOWNSTREAM END OF OUTLET PIPE, SHOWING
15" DISCHARGE PIPE & 16" PLUG VALVE DOWNSTREAM
FROM 24" GATE VALVE



WOOD TROUGH CARRYING DRAINAGE FROM
SAND AND GRAVEL FILTER 8" TOE DRAIN

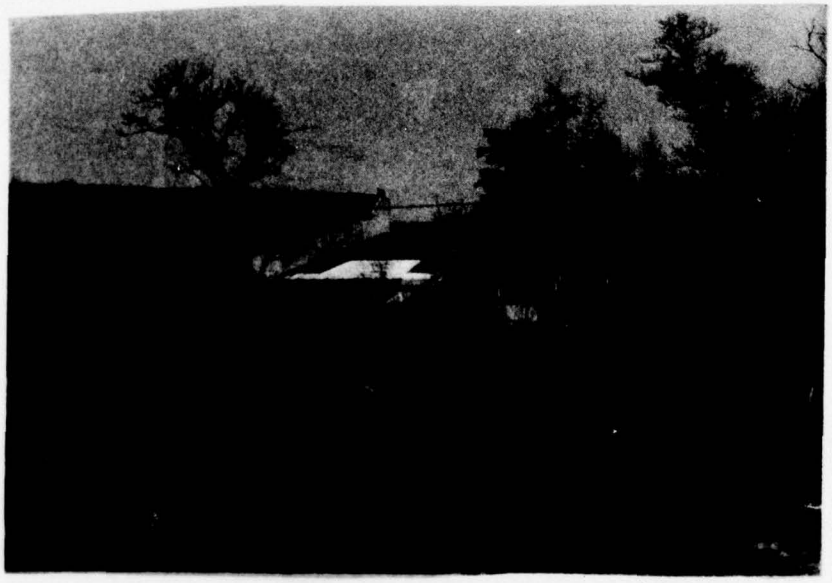


VIEW OF DAM SPILLWAY, LOOKING SOUTHWEST



VIEW LOOKING DOWN SPILLWAY, WITH
OUTLET CHANNEL TO LEFT-CENTER

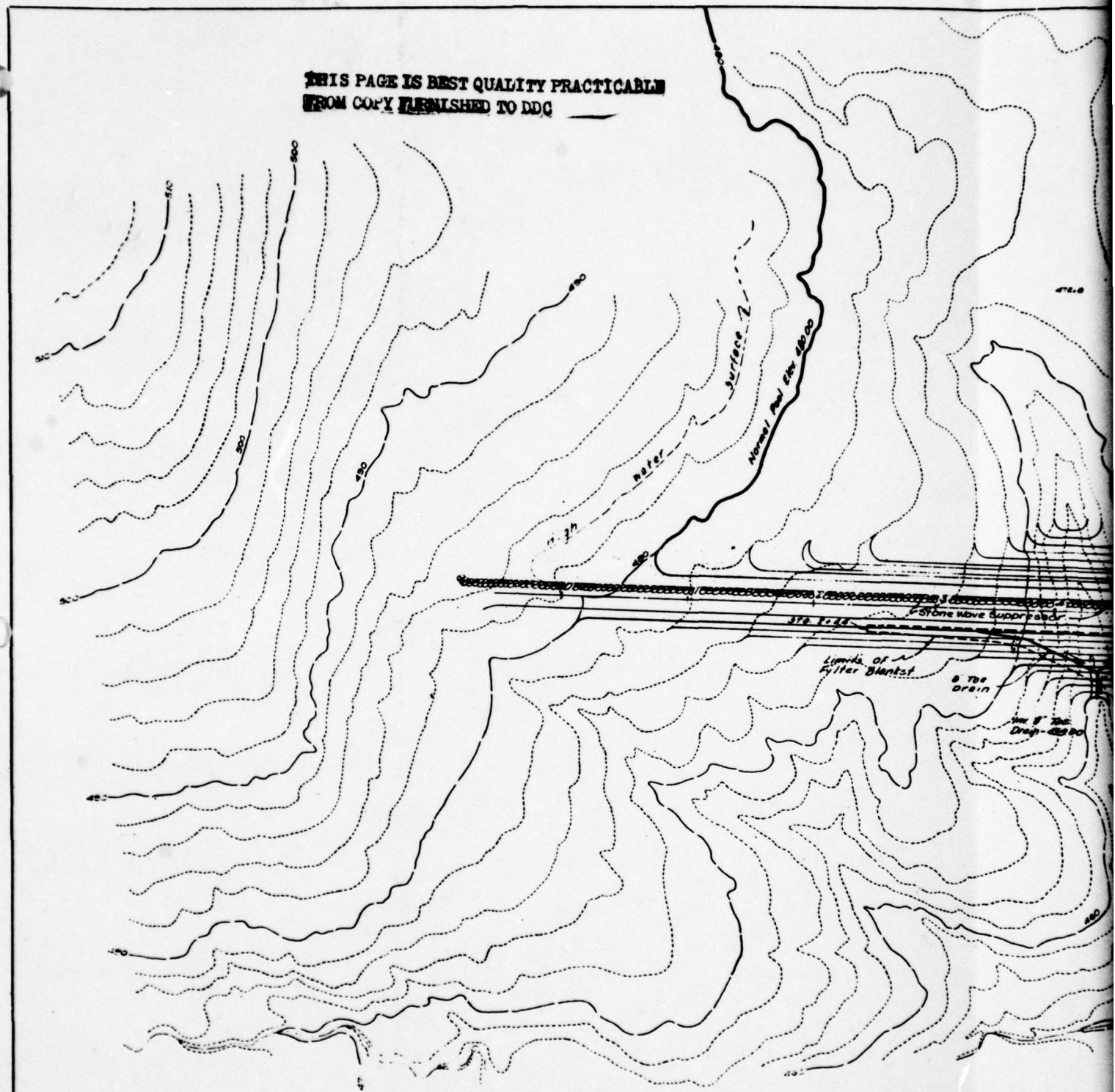
GENERAL VIEW OF EMBANKMENT, LOOKING WEST

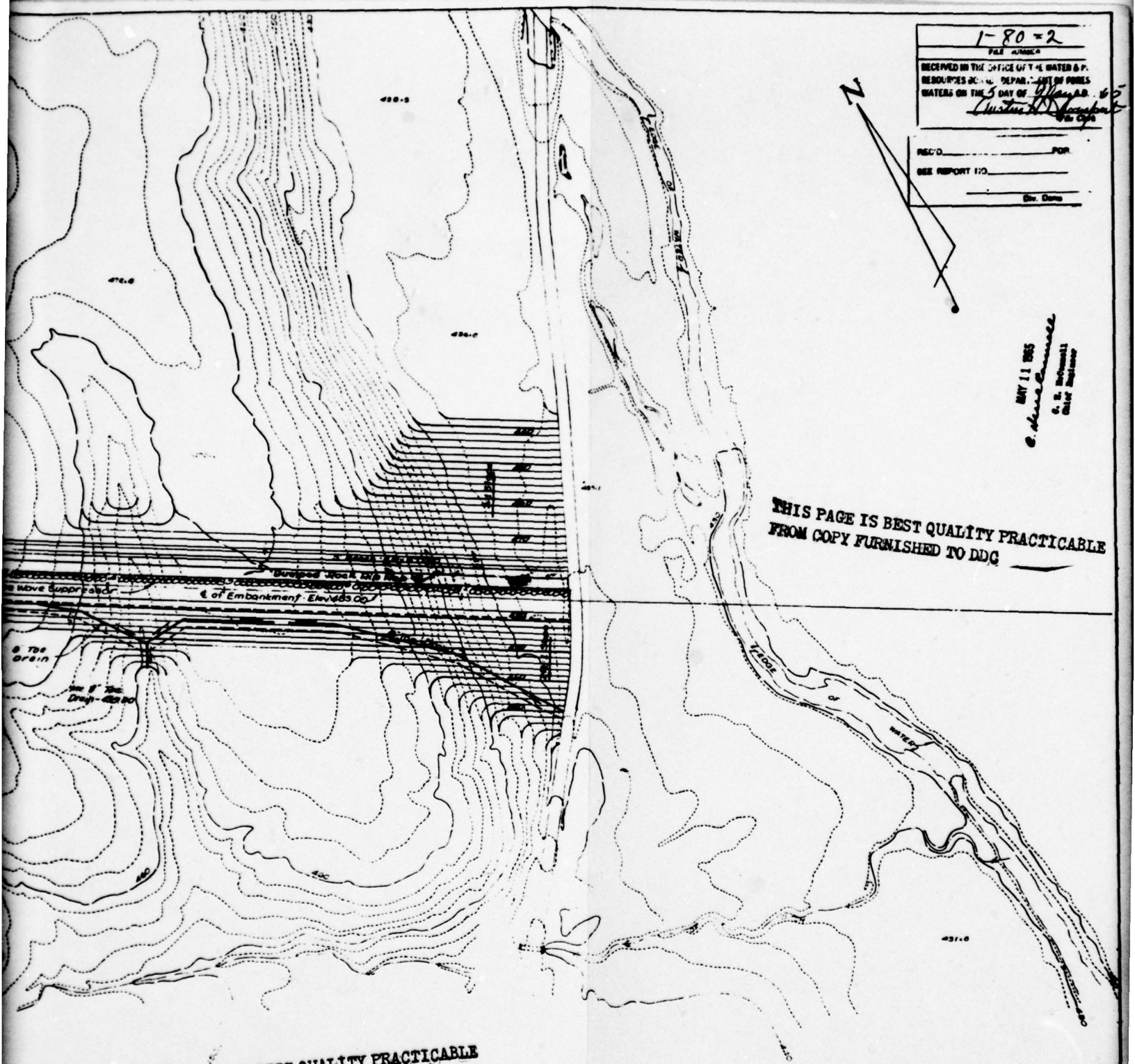


GENERAL VIEW OF SPILLWAY, LOOKING NORTH

APPENDIX E

DRAWINGS





1-80-2

FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & P. RESOURCES BOARD DEPARTMENT OF FORES WATERS ON THE 5 DAY OF May A.D. 65

Chairman

REC'D _____ FOR

SEE REPORT NO. _____

Div. Dams

MAY 11 1965

C. E. McDonnell
Chief Engineer

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FROM COPY FURNISHED TO DDC

No.	Date	Revision
1	9-69	Revised & Toe Drains & Limits of Filter Blanket

LAKE HERITAGE, INC.

STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

LAKE HERITAGE
PLAN
EMBANKMENT & SPILLWAY

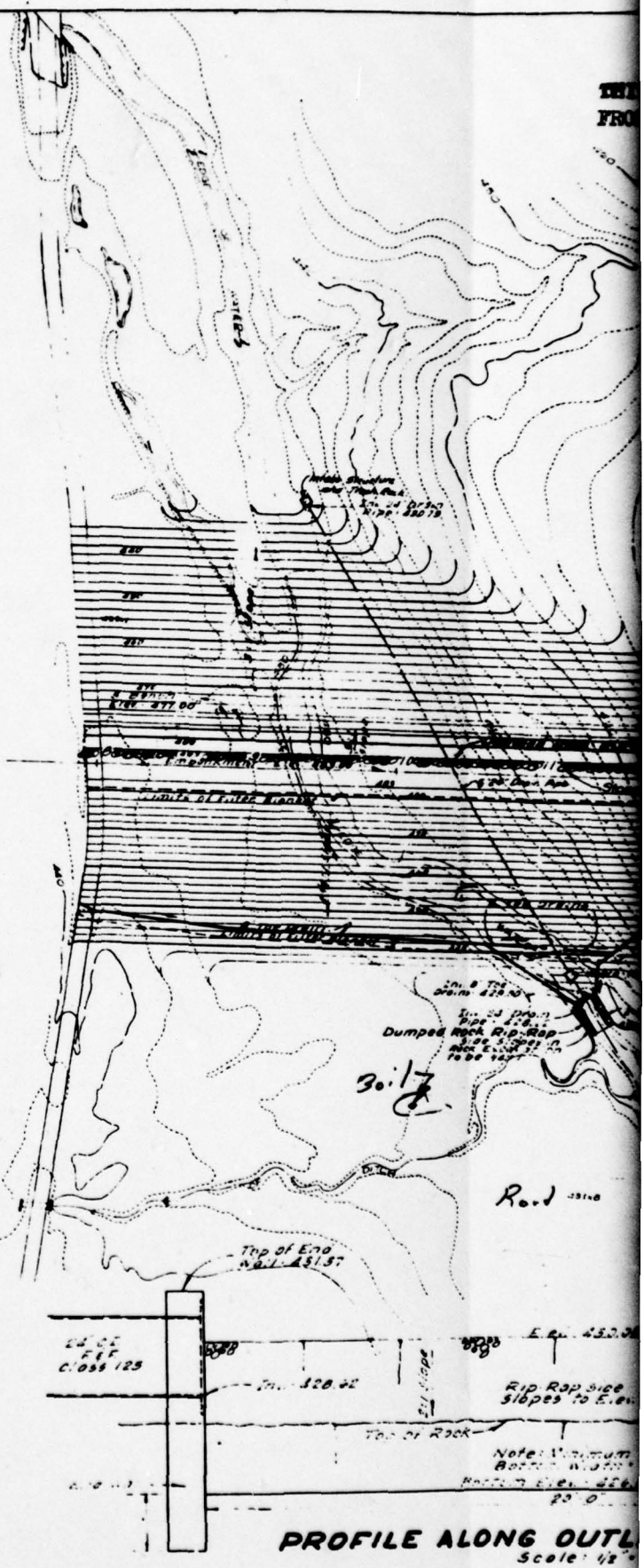
Scale: 1" = 50' Date: April, 1965

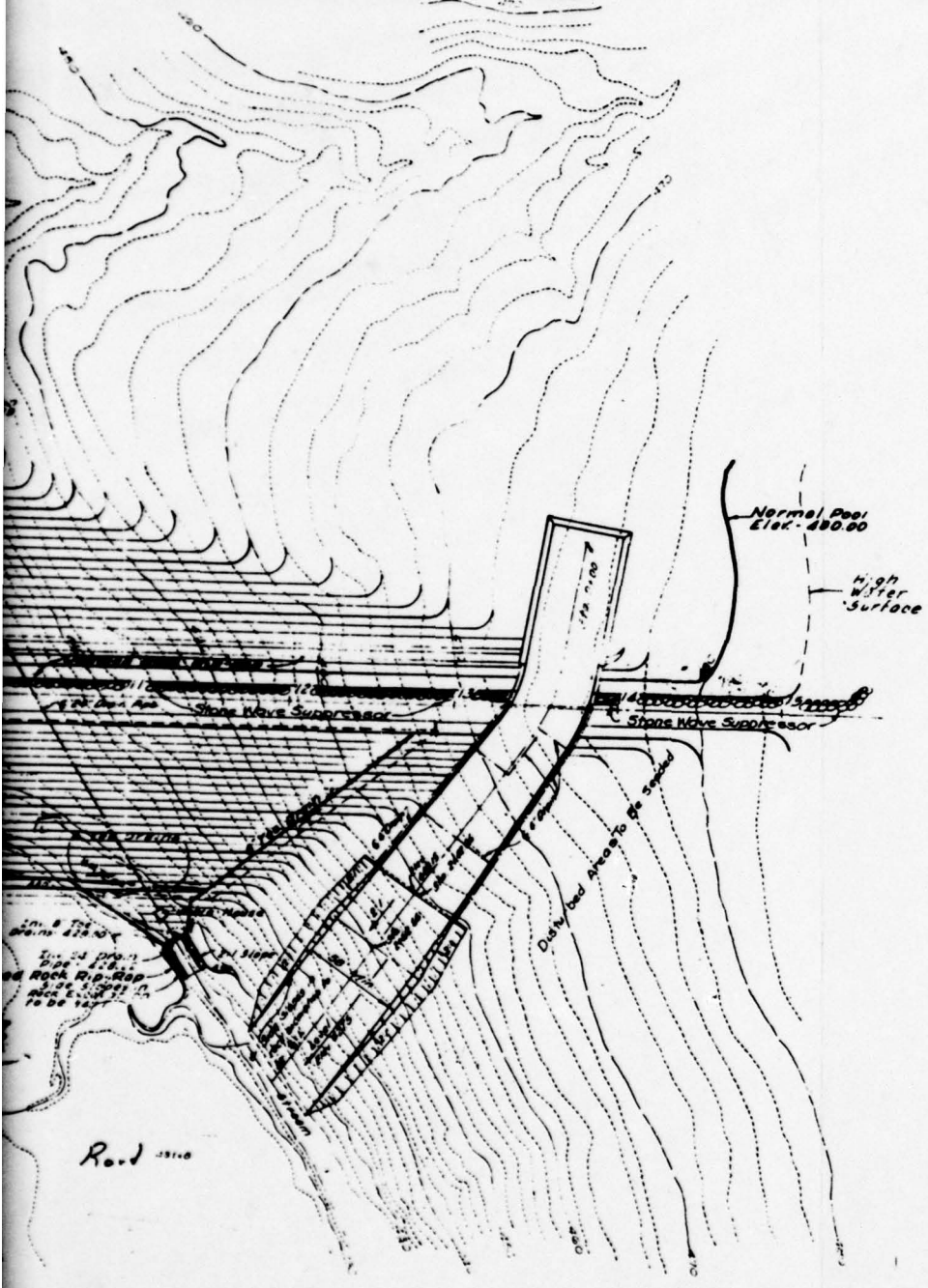
Des: RALPH L. WOOLPERT CO. Contract No. 5813

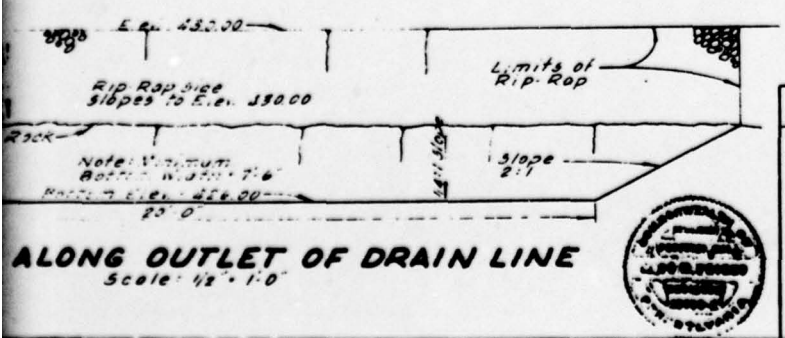
Dr: CONSULTING ENGINEERS Sheet No. 2 of 10

Chd: 368 West First St., Dayton 2, Ohio

Approved: R.W. Freund Engineer







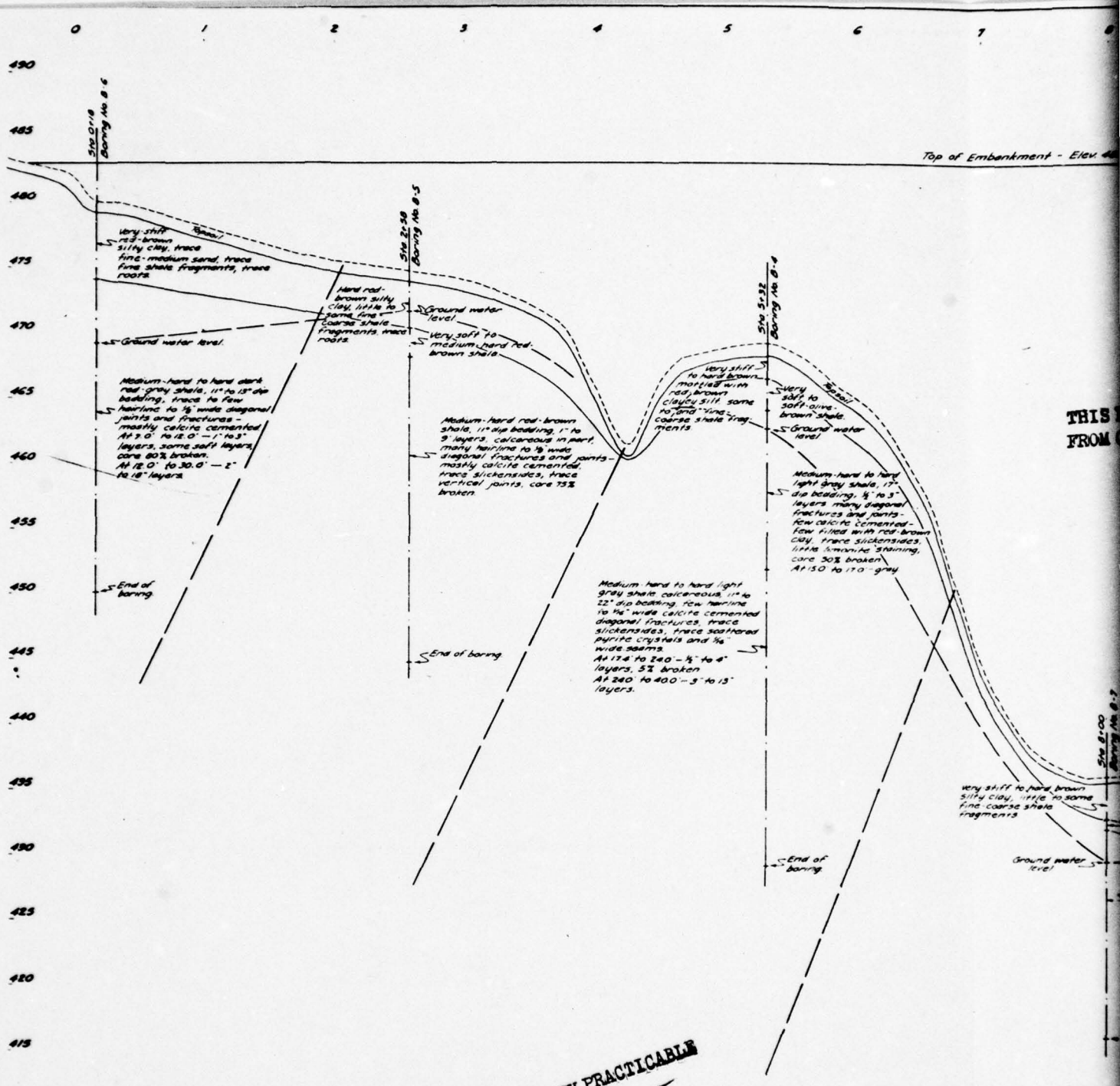
ALONG OUTLET OF DRAIN LINE
Scale: 1/2" = 1'-0"

No.	Date	Revision
1	9-65	Add 8" Toe Drains in Vicinity of 24 Drain Pipe

LAKE HERITAGE, INC.
STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

LAKE HERITAGE
PLAN
EMBANKMENT & SPILLWAY

Scale: 1"=50' Date: April, 1965
Des: RALPH L. WOOLPERT CO. Contract No. 5813
Dr: CONSULTING ENGINEERS Sheet No. 3 of 10
Chd: 860 West First St., Dayton, Ohio
Approved: A.M. Freiman Engineer



SECTION ALONG CENTER

Scale:

No.	Date	Revision

LAKE HERITAGE, INC.
STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

LAKE HERITAGE
LONGITUDINAL SECTION
EMBANKMENT

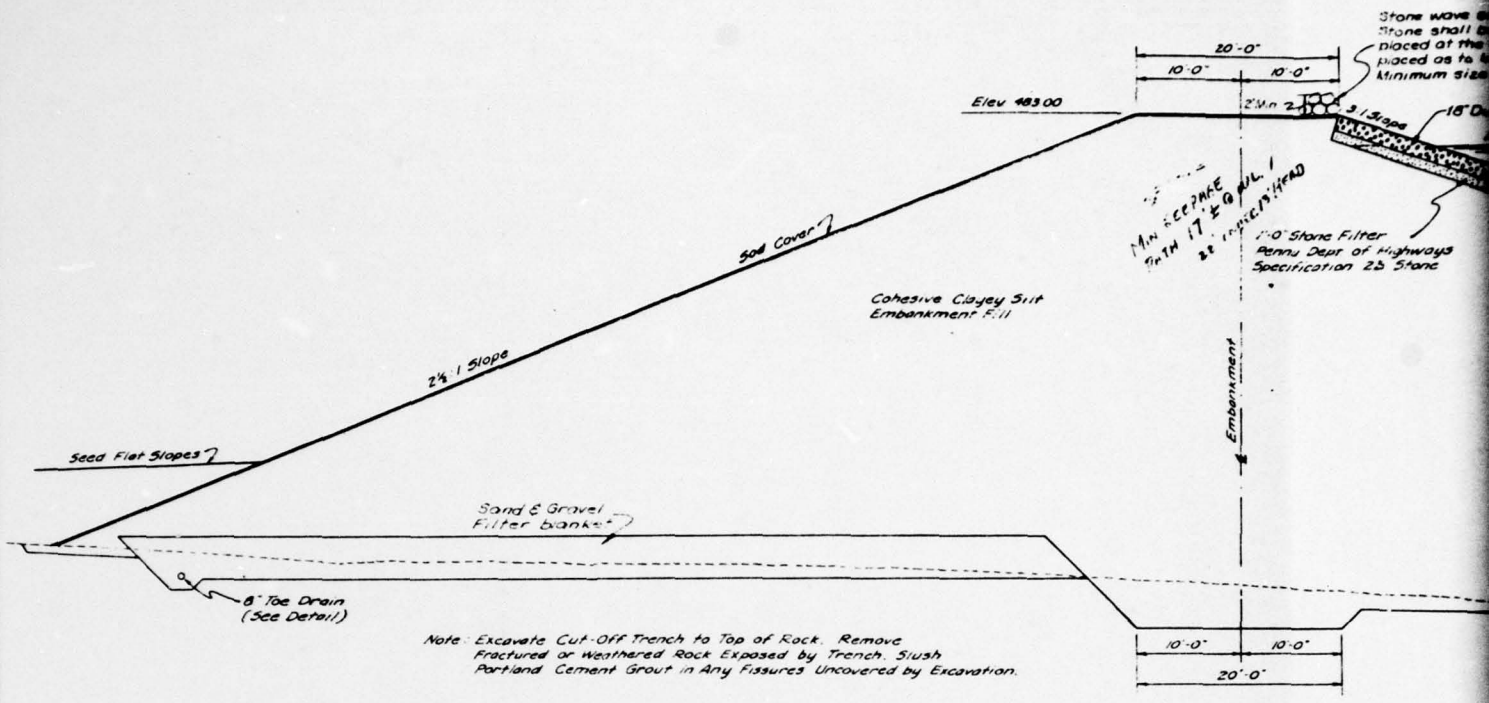
Scale: As Noted | Date: April, 1965

Des:
Dr.: D.A.W.
Ckd:

RALPH L. WOOLPERT CO.
CONSULTING ENGINEERS
260 West First St., Dayton 2, Ohio

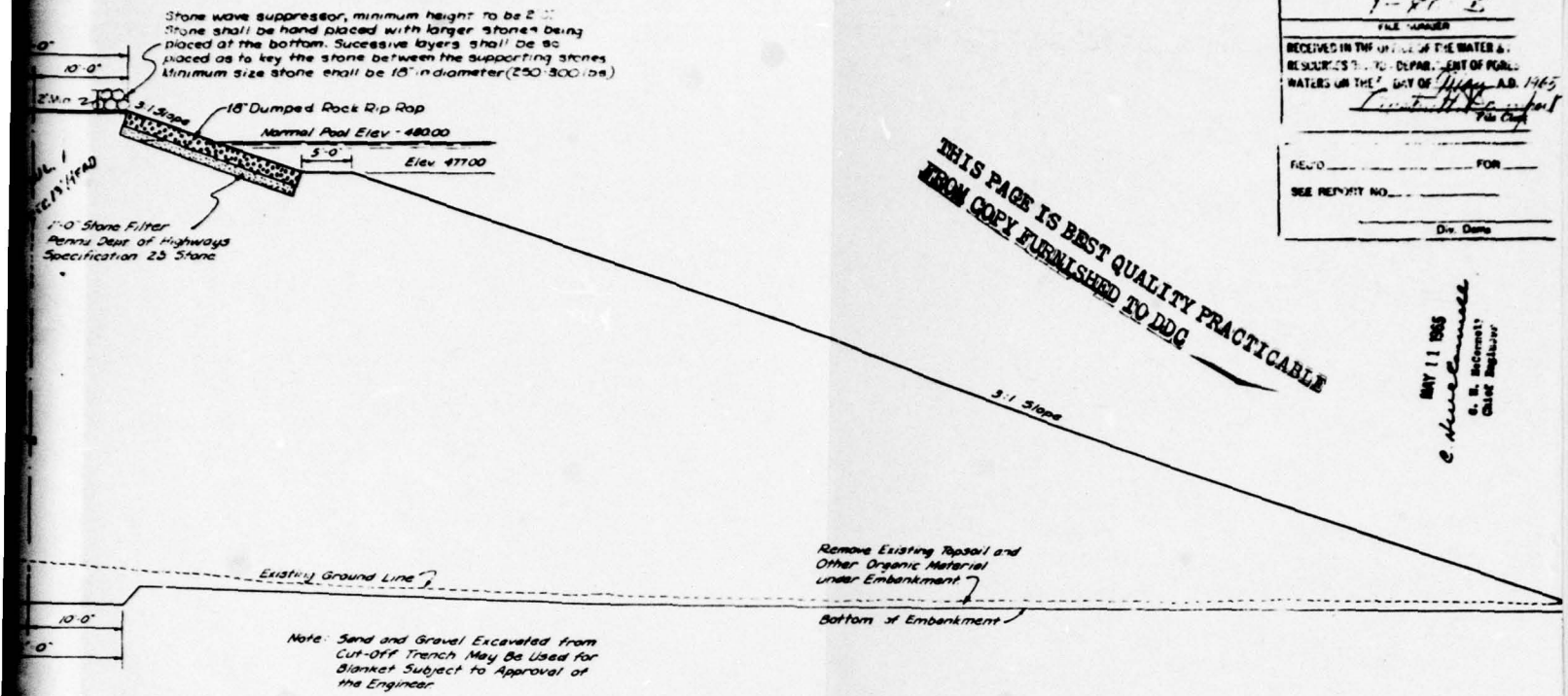
Approved: A.M. Friend, Engineer

Contract No. 9018
Sheet No. 4 of 10



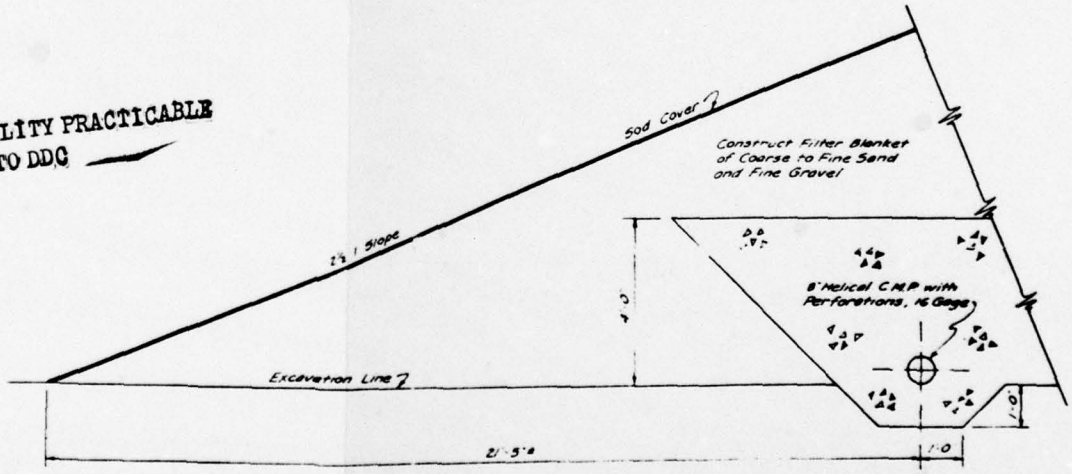
EMBANKMENT - TYPICAL

Scale: ⅛"=1'-0"



T - TYPICAL SECTION

Scale: 1/8"=1'-0"



DETAIL - TOE DRAIN

Scale: 1/2"=1'-0"

No.	Date	Revision

LAKE HERITAGE, INC.
STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

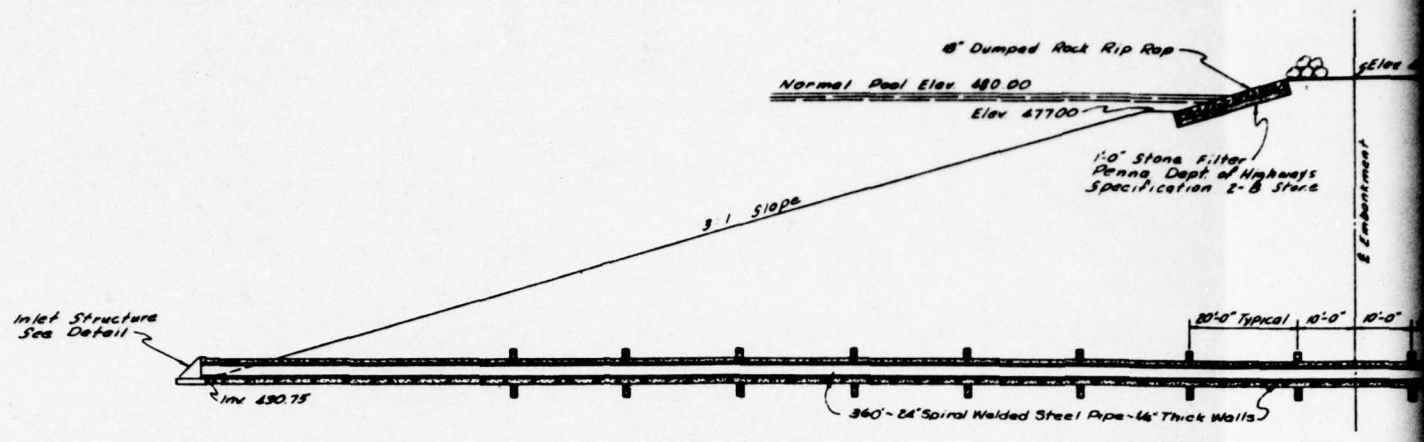
LAKE HERITAGE
DETAILS
EMBANKMENT

Scale: As Noted Date: April, 1965

Des.
Drn. D.A.W.
Chkd.
Approved G.M. Brand

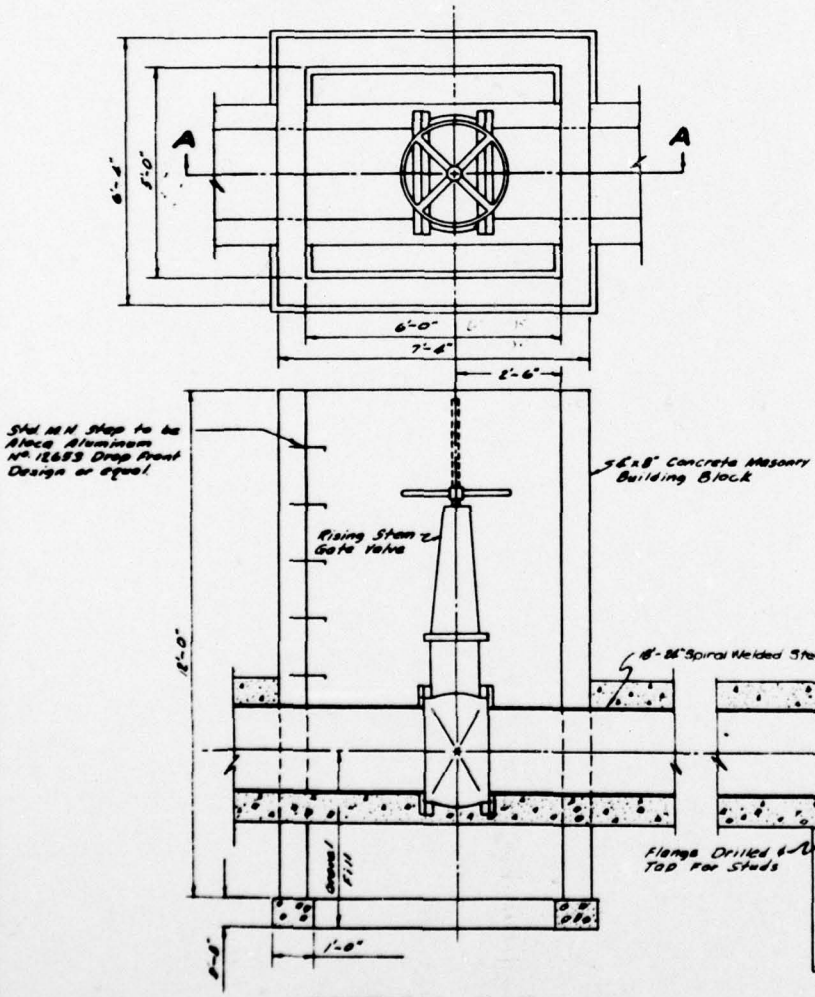
RALPH L. WOOLPERT CO.
CONSULTING ENGINEERS
Dayton 2, Ohio
Engineer

Contract No. 9813
Sheet No. 5 of 10



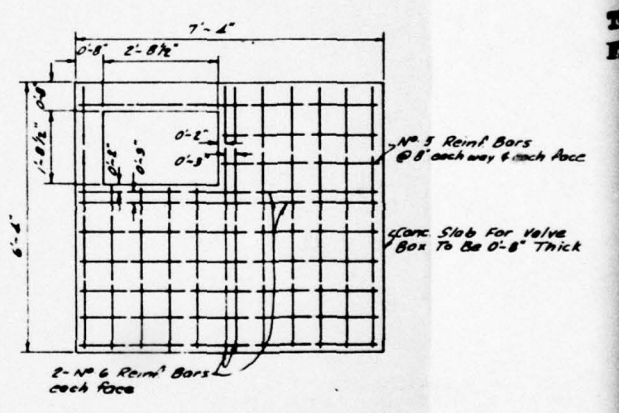
PROFILE OF DRAI

Scale: 1" = 1



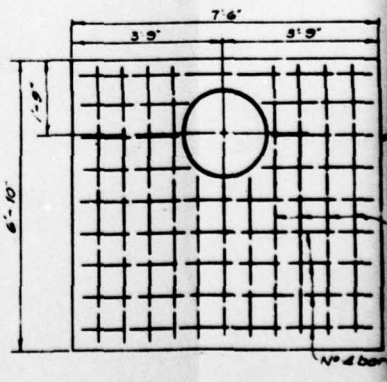
SECTION A-A
DETAIL OF VALVE BOX

Scale: 1/2" = 1'-0"



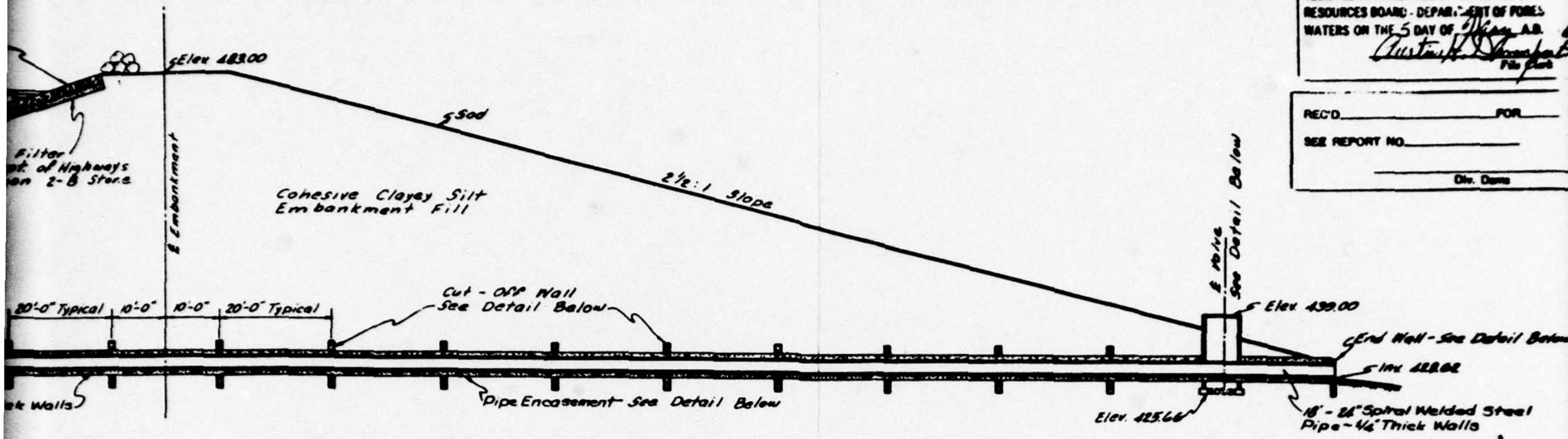
DETAIL OF CONC. SLAB
FOR TOP OF VALVE BOX

Scale: 1/2" = 1'-0"



DETAIL OF END WALL

Scale: 1/2" = 1'-0"



...ILE OF DRAIN LINE

Scale: 1" = 15'-0"

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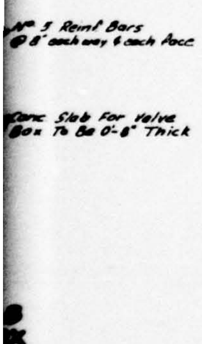
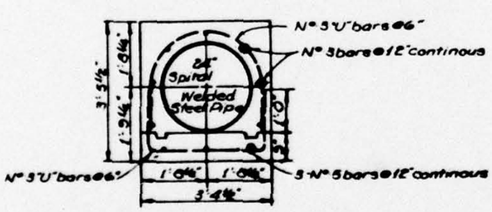
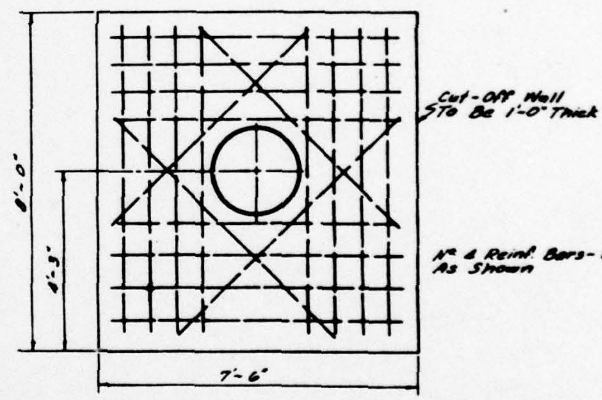


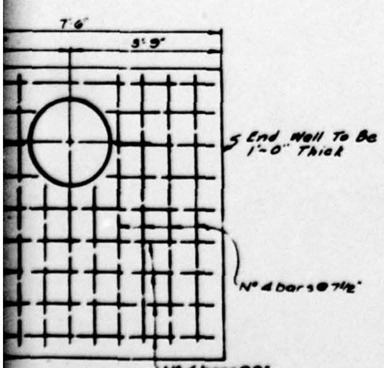


DETAIL OF PIPE ENCASEMENT
NO SCALE



DETAIL OF CUT-OFF WALL

Scale: ½" = 1'-0"



...OF END WALL

Scale: ½" = 1'-0"

No.	Date	Revision
1	5 65	Revised pipe encasement

LAKE HERITAGE, INC.
STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

LAKE HERITAGE
DETAILS
DRAIN LINE

Scale: As Noted — Date: April, 1965

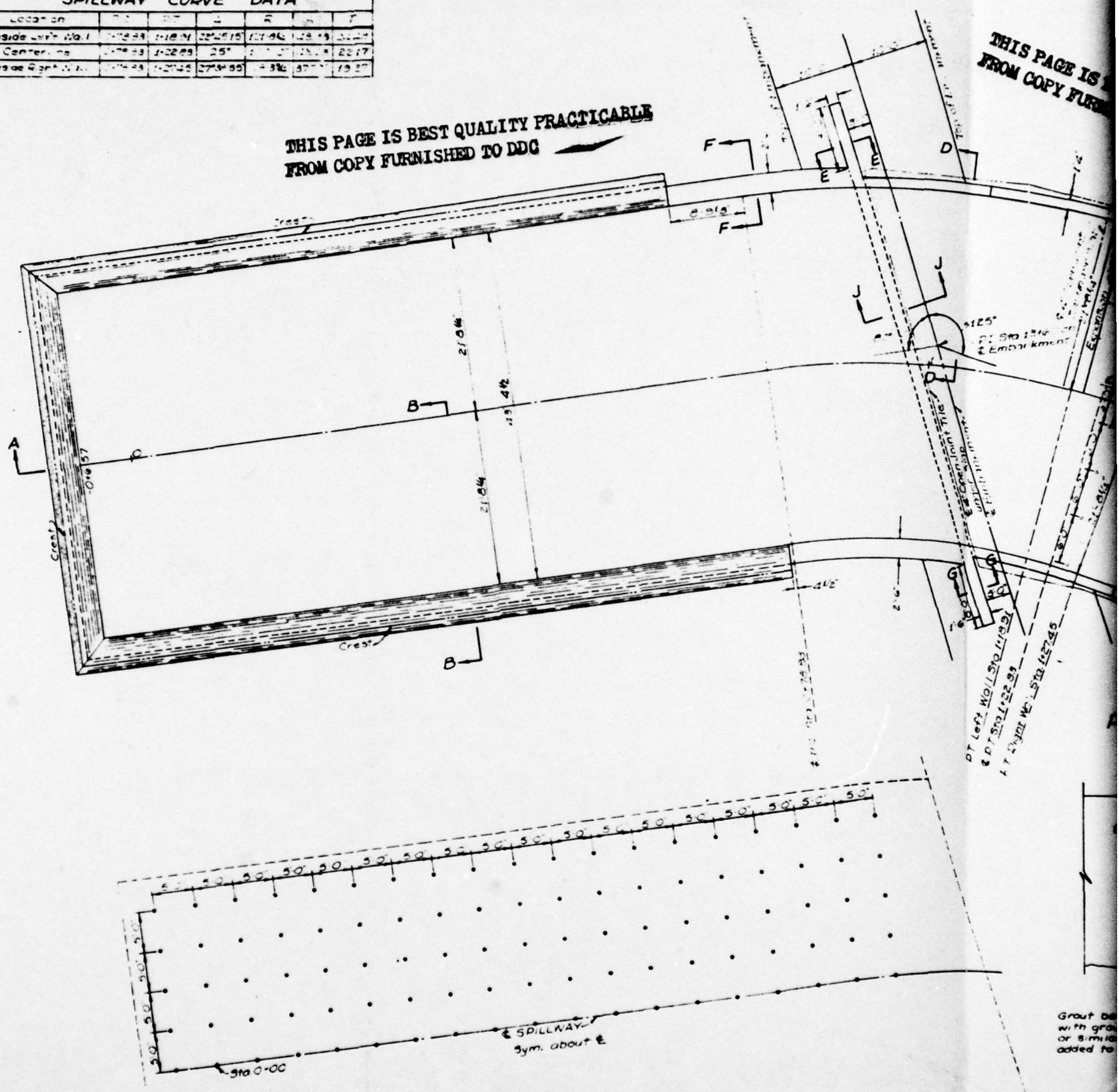
RALPH L. WOOLPERT CO.
CONSULTING ENGINEERS
310 West First St., Dayton 2, Ohio

Contract No. 6815 — Sheet No. 6 of 10

Approved: A.M. Friend — Engineer

SPILLWAY CURVE DATA						
Location	[illegible]	[illegible]	Δ	R	[illegible]	T
Inside Left Wall	[illegible]	1+18.[illegible]	22°25'15"	[illegible]	[illegible]	[illegible]
Centerline	[illegible]	1+22.89	25°	[illegible]	[illegible]	22.17
Inside Right Wall	[illegible]	1+27.45	27°3[illegible]'55"	[illegible]	37.[illegible]	19.27

THIS PAGE IS [illegible]
FROM COPY FURN[illegible]



HALF PLAN
STA -(0+05) TO STA. 0+85
SHOWING LOCATION OF 2"
DRILL HOLES FOR ANCHOR BARS
SCALE 1/8"=1'-0"

1

No.	Date	Revision
1	5-69	Add drain line at expansion joint, change length of cut-off wall
2	5-69	Add 3 rows of Anchor Bars

LAKE HERITAGE, INC.
STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

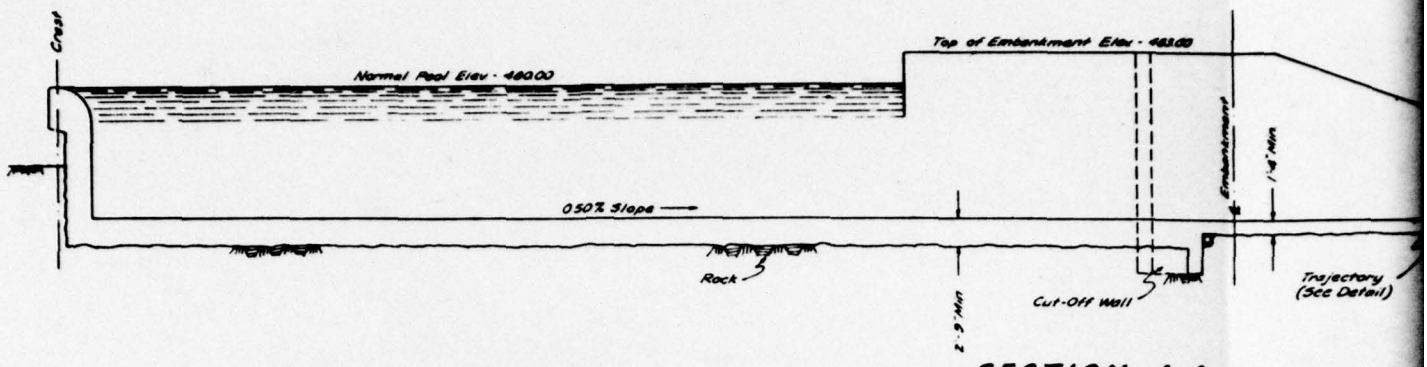
LAKE HERITAGE
DETAILS
EMBANKMENT & SPILLWAY

Scale: As Noted | Date: April, 1969

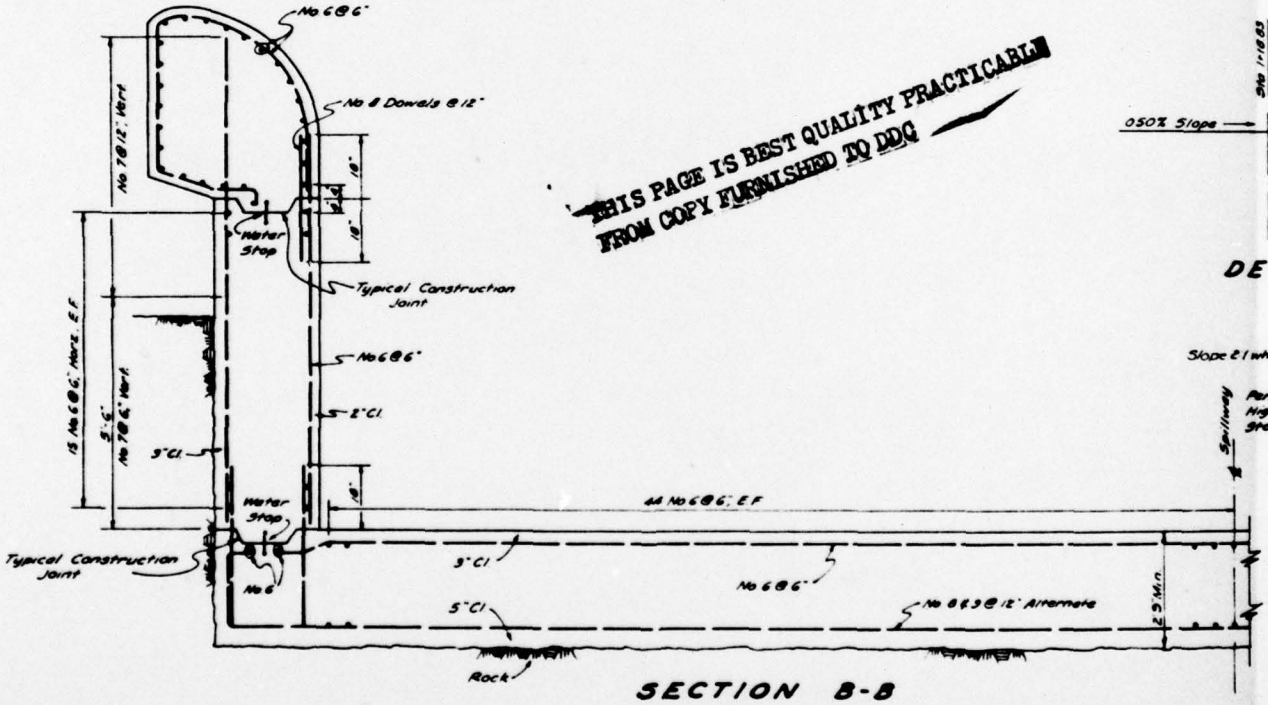
Des:
Dr.:
Chkd:
Approved:

RALPH L. WOOLPERT CO.
CONSULTING ENGINEERS
Dayton 2, Ohio

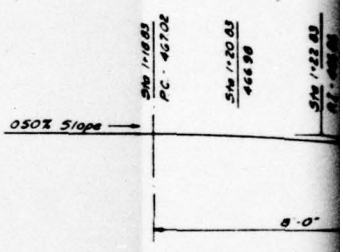
Contract No. 5813
Sheet No. 8 of 10
Engineer



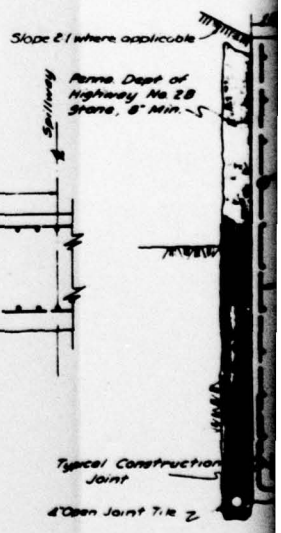
SECTION A-A
PROFILE ALONG CENTERLINE OF SP
Scale: 1/8" = 1'-0"

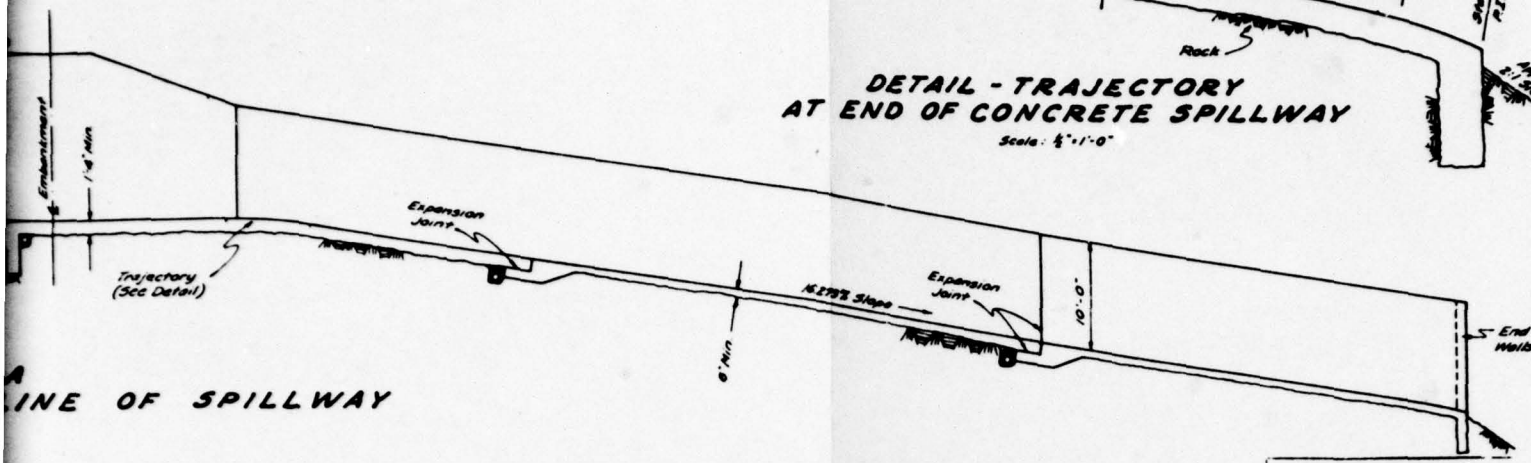


SECTION B-B
Scale: 1/2" = 1'-0"



DETAIL - TR
Scale: 1/2"

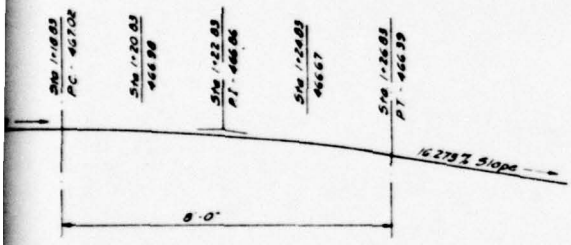




DETAIL - TRAJECTORY AT END OF CONCRETE SPILLWAY

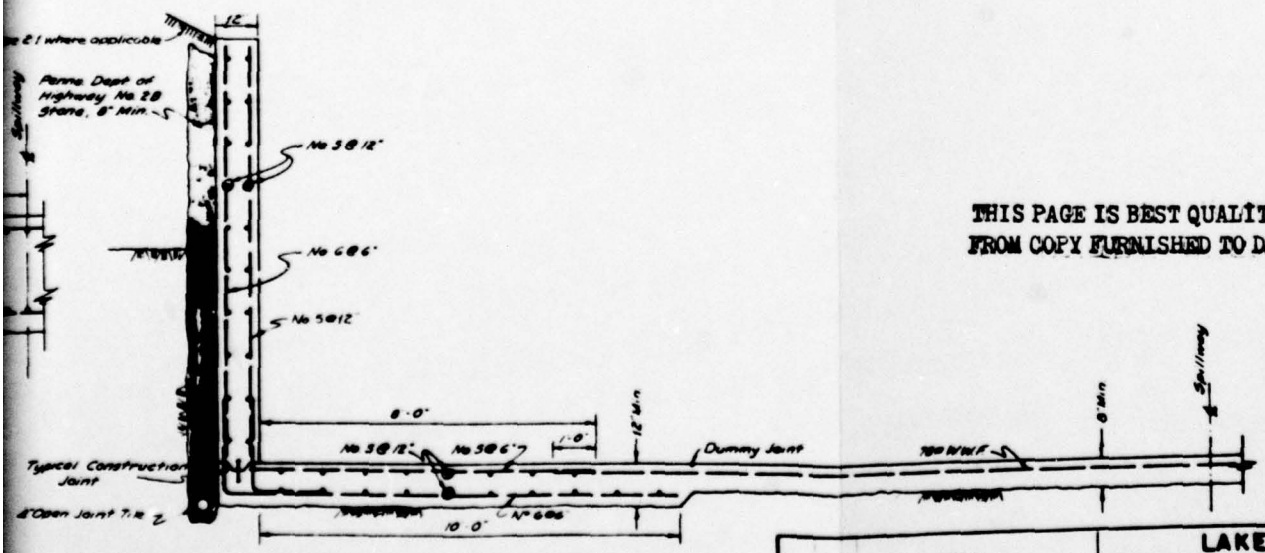
Scale: ½"=1'-0"

LINE OF SPILLWAY



DETAIL - TRAJECTORY

Scale: ½"=1'-0"



SECTION C-C

Scale: ½"=1'-0"

No.	Date	Revision
1	3-65	Add drain line in Section A-A & C-C
		Revise drain line in Section C-C

LAKE HERITAGE, INC.
STRABAN, MOUNT PLEASANT, & MOUNT JOY TOWNSHIPS
ADAMS COUNTY, PENNSYLVANIA

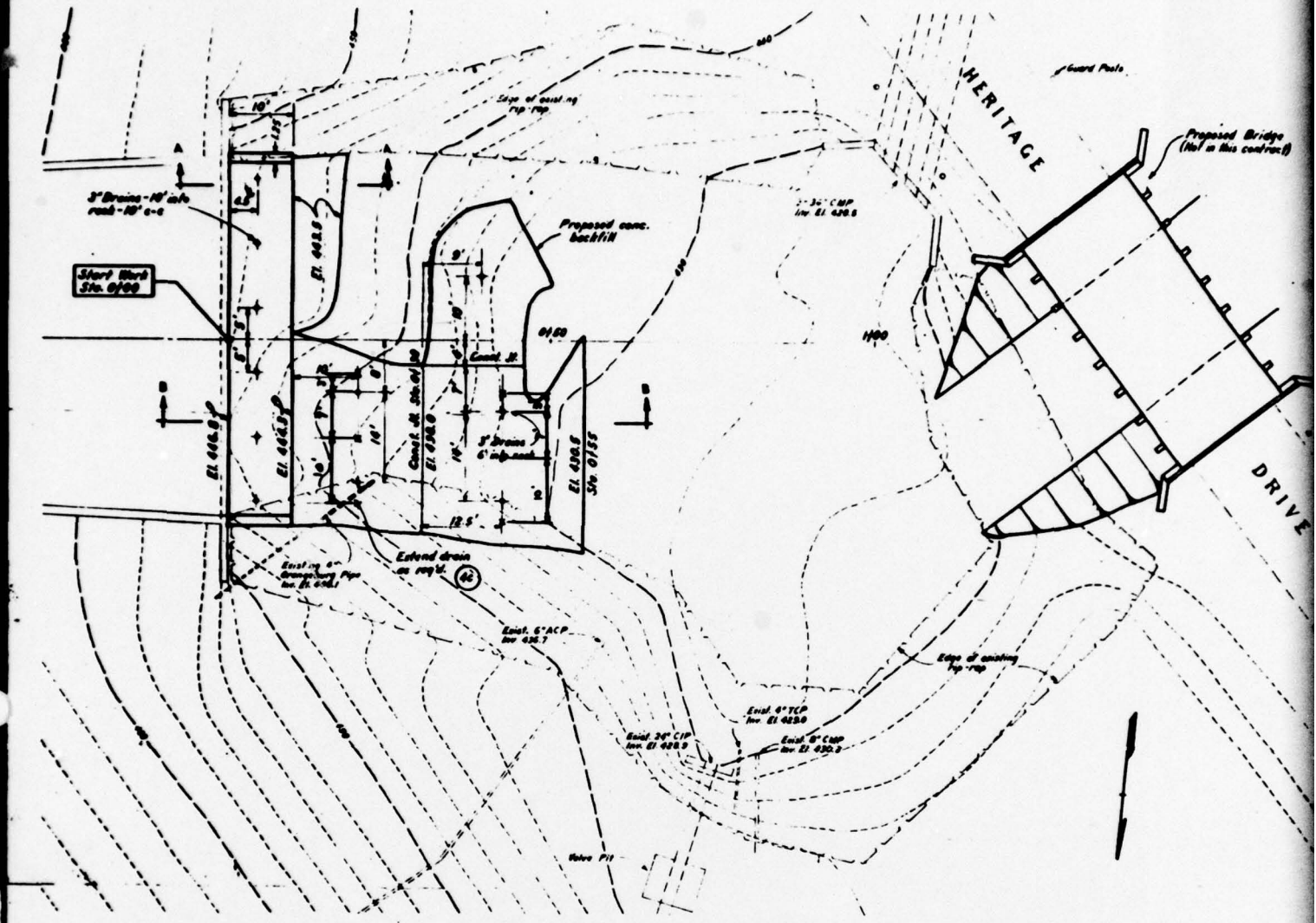
LAKE HERITAGE
DETAILS
EMBANKMENT & SPILLWAY

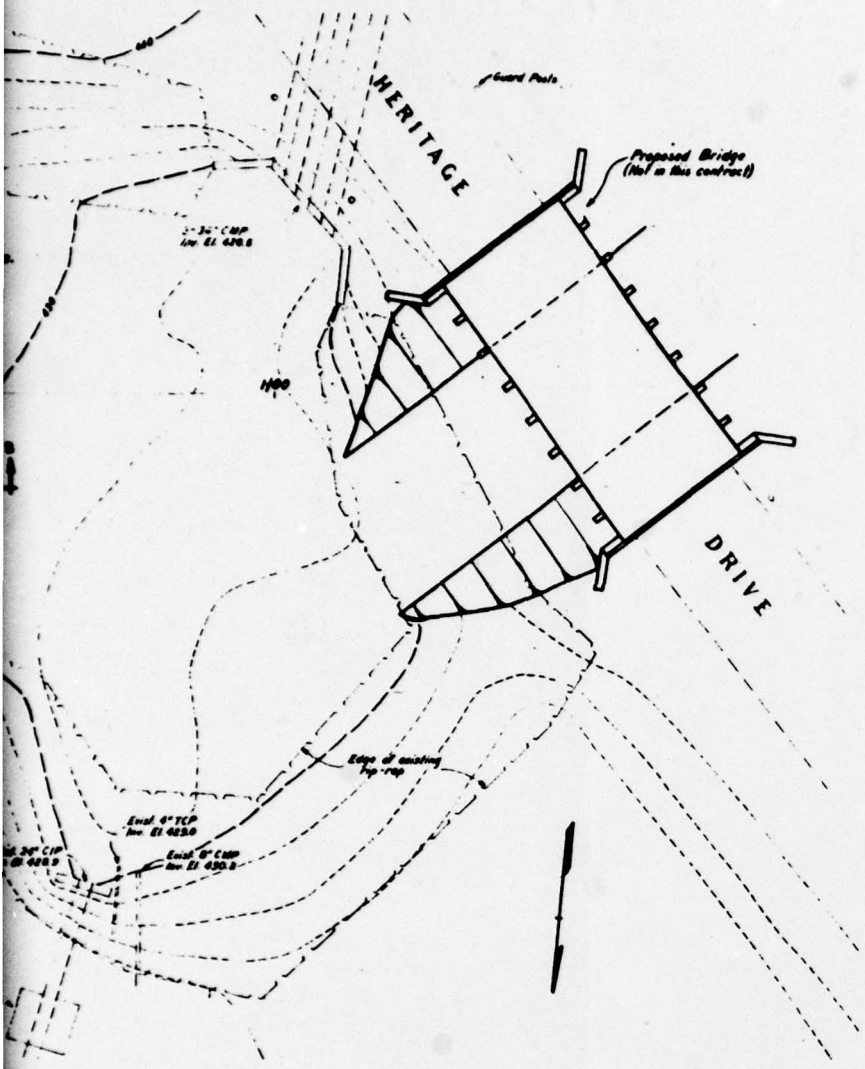
Scale: As Noted | Date: April, 1965

Des: | Dr.: D.R.M. | Ck'd: | Approved: A.M. Freed

RALPH L. WOOLPERT CO.
CONSULTING ENGINEERS
30 West First St., Dayton 2, Ohio

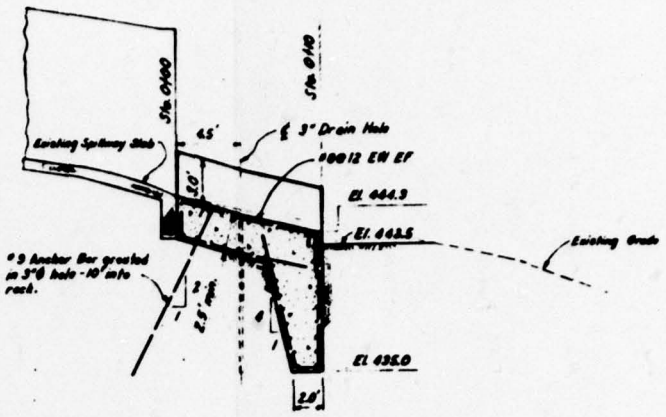
Contract No. 9813
Sheet No. 9 of 10





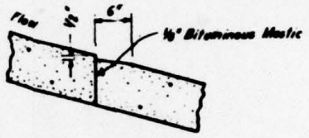
PLAN

Scale: 1" = 10'



SECTION A-A

Scale: 1" = 5'



DETAIL "A"

No Scale

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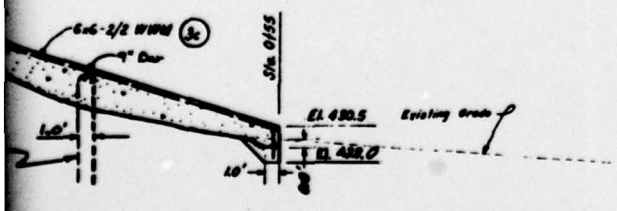

NOTES:

(2) Indicates Payment Item, see Specifications for description

Clear dimension for reinforcing steel to be 3"

A.C.H	AMERICAN REALITY SERVICE, INC. LAKE HERITAGE DAM	SHEET NO. 1 of 3
M.L.S.	SPILLWAY ADDITIONS PLANS - SECTIONS	JOB NO. 4766
M.L.S.		DATE Aug. 1969
A.C.H.		

REVISIONS			
NO.	DESCRIPTION	DATE	BY

GARRETT FLEMING GODDEY & CARPENTER, INC.
ENGINEERS
P. O. BOX 1963 HARRISBURG, PENNA.

APPENDIX F

MISCELLANEOUS

GEOLOGY

The project is located in the Gettysburg Plain portion of the Piedmont Province. This area is part of a narrow lowland approximately 20 miles wide. The surface is lower than the general level of surrounding uplands because of the soft easily erodable rocks which underlie it.

The project area is underlain by the Gettysburg Formation of Triassic age. This formation consists of a thick red shale and soft red sandstone. Much of the formation, however, has been metamorphosed to a dark purple or black argillite or a white porcelamite by the intrusion of a thick diabase sill (the Gettysburg Sill) a short distance to the west. The bright red shale of the unaltered formation is changed to dull red on the outer borders of the metamorphosed zone, becoming harder and darker toward the interior of the zone, and at the contact with the diabase mass is dark purple to black, hard, generally fragile argillite. At places where the parent shale was somewhat calcareous, it was altered to a light buff or white, porous porcelamite.

Dips are generally about 20% to the northwest although may be much steeper, nearly 50%, along the contact with the intrusive. There has been some major faulting to the northwest and east of the project area with general fault trends nearly east-west. There was, however, no surficial evidence of faulting in the reservoir area observed during the field investigation.

AMERICAN REALTY SERVICE CORPORATION
Engineering & Construction Department
1204 Linden Avenue
Memphis, Tennessee 38104

LAKE HERITAGE DAM
PIEZOMETER READINGS

DATE READ December 5, 1968

Piezometer Number	Top of Casing Elevation	Base Depth of Water	Base Elevation of Water	Depth Base	Elevation Base
1-1	472.0	29.0	443.0		
1-2	472.0	22.0	450.0		
2-1	450.0	11.0	439.0		
2-2	450.0	11.5	438.5		
3-1	460.0	17.0	443.0		
3-2	460.0	21.0	439.0		
4-1	460.0	19.0	441.0		
4-2	460.0	22.0	438.0		
5-1	485.0	41.0	444.0		
5-2	485.0	41.0	444.0		
6-1	485.0	33.0	452.0		
6-2	485.0	33.0	452.0		

AMERICAN REALTY SERVICE CORPORATION
Engineering & Construction Department
1204 Linden Avenue
Memphis, Tennessee 38104

472343

LAKE HERITAGE DAM
PIEZOMETER READINGS

DATE READ February 6, 1969

Piezometer Number	Top of Casing Elevation	Base Depth of Water	Base Elevation of Water	Depth Read	Elevation of Water
1-1	472.0	29.0	443.0	29.0	443.0
1-2	472.0	22.0	450.0	23.0	450.0
2-1	450.0	11.0	439.0	11.0	439.0
2-2	450.0	11.5	438.5	11.5	438.5
3-1	460.0	17.0	443.0	17.0	443.0
3-2	460.0	21.0	439.0	21.0	439.0
4-1	460.0	19.0	441.0	19.0	441.0
4-2	460.0	22.0	438.0	22.0	438.0
5-1	485.0	41.0	444.0	41.0	444.0
5-2	485.0	41.0	444.0	41.0	444.0
6-1	485.0	33.0	452.0	35.0	450.5
6-2	485.0	33.0	452.0	35.0	450.5

AMERICAN REALTY SERVICE CORPORATION
Engineering & Construction Dept.
1204 Linden Avenue
Memphis, Tennessee - 38104

479346

LAKE HERITAGE DAM
PIEZOMETER READINGS

DATE READ: April 7, 1969

Piezometer Number	Top of Casing Elevation	Base Depth of water	Base Elevation of Water	Depth Read	Elevation of water
1-1	472.0	29.0	443.0	29.0	443.0
1-2	472.0	22.0	450.0	24.0	448.0
2-1	450.0	11.0	439.0	11.0	439.0
2-2	450.0	11.5	438.5	11.5	438.5
3-1	460.0	17.0	443.0	17.0	443.0
3-2	460.0	21.0	439.0	22.0	438.0
4-1	460.0	19.0	441.0	19.0	441.0
4-2	460.0	22.0	438.0	22.0	438.0
5-1	485.0	41.0	444.0	41.0	444.0
5-2	485.0	41.0	444.0	41.0	444.0
6-1	485.0	33.0	452.0	35.0	450.5
6-2	485.0	33.0	452.0	35.0	450.5