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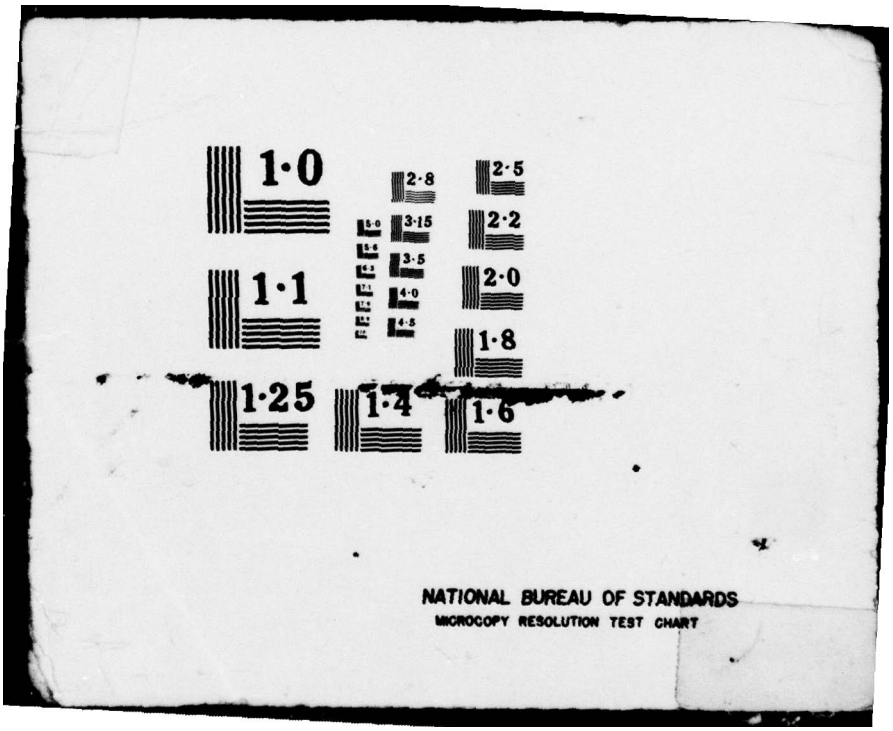
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OHIO RIVER BASIN

MILL RUN, CRAWFORD COUNTY

PENNSYLVANIA

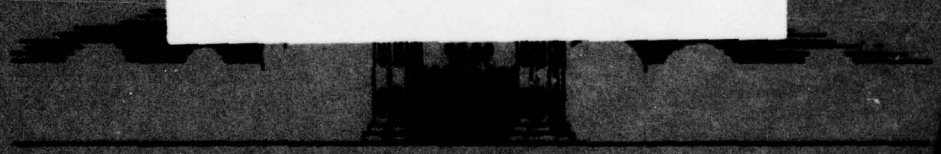
LEVEL II

TAMARACK LAKE DAM "A"

NDI No. PA 00181
PennDER No. 20-47A
SCS No. PA 461A

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



prepared for

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

prepared by

MICHAEL BAKER, JR., INC.
Consulting Engineers
Rt. 60 at Dutch Ridge Road
Beaver, Pennsylvania 15009

May 1979

OHIO RIVER BASIN

TAMARACK LAKE DAM "A"
CRAWFORD COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 00181
PennDER No. 20-47A
SCS No. PA 461A

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(6) National Dam Inspection Program. Tamarack Lake Dam 'A' (NDI-PA-00181, PennDER No. 20-47A, SCS No. PA-461A), Ohio River Basin, Crawford County, Commonwealth of Pennsylvania. Phase I Inspection Report.

Mill Run

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by: MICHAEL BAKER, JR., INC.
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4301 Dutch Ridge Road
Beaver, Pennsylvania 15009

Date: (11) May 1979

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JOB

(10) C. Y. Chen

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PREFACE

This report was 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 frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Tamarack Lake Dam "A", Crawford County, Pennsylvania
NDI No. PA 00181, PennDER No. 20-47A, SCS No. PA 461A
Mill Run
Inspected 29 November 1978

ASSESSMENT OF GENERAL CONDITIONS

Tamarack Lake is impounded by two separate dams at opposite ends of the reservoir. Tamarack Lake Dam "A" is located at the northern end of the reservoir and Tamarack Lake Dam "B" is located at the southern end of the reservoir. Tamarack Lake Dam "A" is a zoned earth dam designed by the Soil Conservation Service (SCS), U.S. Department of Agriculture. This multi-purpose reservoir and dam is presently owned and operated by the Pennsylvania Fish Commission. The dam has a crest length of 1000 feet and a maximum height of 22 feet. A 16-foot-high diversion dam was constructed to the left of the emergency spillway channel. Tamarack Lake Dam "A" is classified as a "High" hazard-"Intermediate" size dam.

The dam was found to be in good overall condition at the time of inspection. The owner should perform several minor items of remedial work without delay. These are:

1) Install a weir to monitor the seepage.

2) Provide proper inspection access to the vertical drain on the left side of the outlet conduit.

3) After access has been provided, a qualified professional engineer should inspect the vertical drain and provide recommendations as necessary.

4) Periodically inspect and maintain the vertical drains in the future as necessary.

5) Repair minor erosion areas on the dams. Efforts to prevent use of motorcycles and other vehicles on the dams and in the spillway should be increased.

6) Install properly designed riprap or other measures to prevent erosion around the plunge pool.

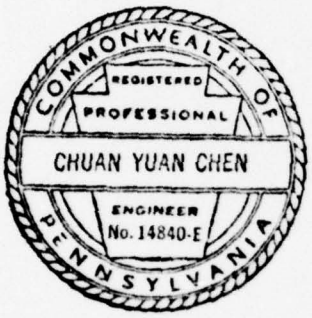
In addition, the following operational measures are recommended to be undertaken by the owner:

1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, for Phase I Inspection Reports, revealed that the spillway will pass the Probable Maximum Flood (PMF) without overtopping the dam. The spillway is therefore considered "adequate."



Submitted by:

MICHAEL BAKER, JR., INC.

C. Y. Chen

C. Y. Chen, Ph.D., P.E.
Engineering Manager-Geotechnical

Date: 25 May 1979

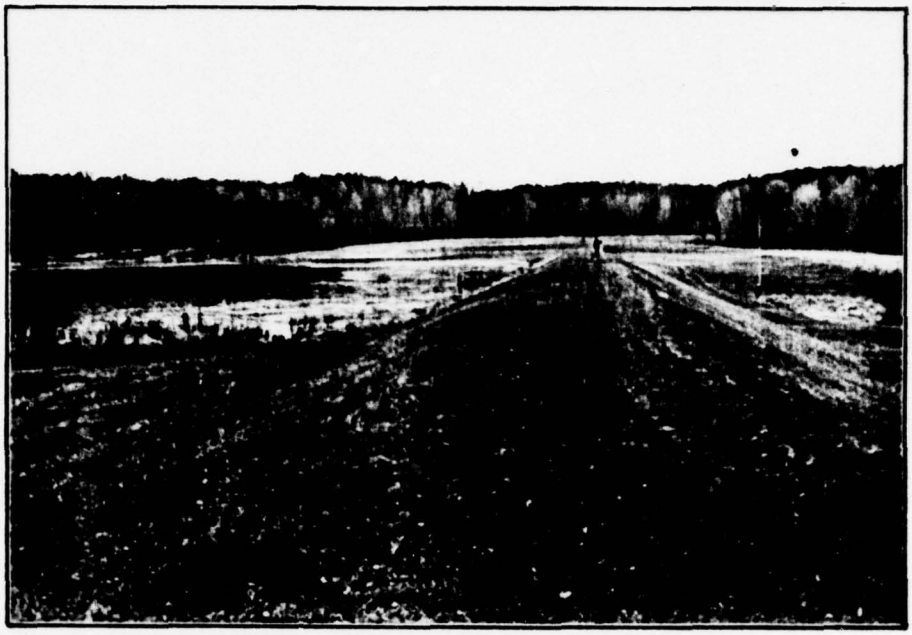
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

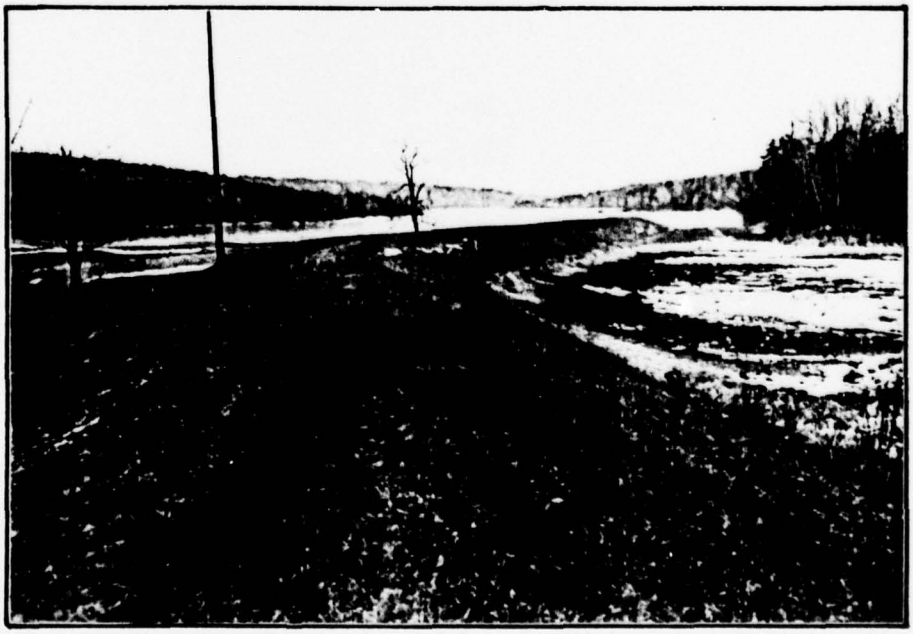
J. K. Withers

C. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date: 17 Jun 79



Overall View of Dam from Right Abutment toward Emergency Spillway and Diversion Dam.



Overall View of Diversion Dam Looking towards Reservoir

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TAMARACK LAKE DAM "A"
NDI No. PA 00181, PennDER No. 20-47A, SCS No. PA 461A

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 inspection of dams throughout the United States.

b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances - Tamarack Lake is impounded by two separate dams at opposite ends of the reservoir. Tamarack Lake Dam "A" is located at the northern end of the reservoir and consists of a main embankment, emergency spillway channel, riser intake and outlet conduit, and a diversion dam located to the left of the emergency spillway channel. Tamarack Lake Dam "B" is located at the southern end of the reservoir and consists of a main embankment, emergency spillway channel, riser intake and outlet conduit, and a saddle dike located to the left of the emergency spillway channel.

Tamarack Lake Dam "A" is 22 feet high and approximately 1000 feet long. A clay core and cutoff trench extend throughout the length of the dam. The minimum width of the core and cutoff trench is 10 feet. The cutoff trench varies in depth below the original ground surface from 4 to 13 feet with the lowest elevation (1195.0 feet) near the location of the outlet conduit. A 3-foot-wide by 5-foot-deep filter trench was installed below the existing ground line in the downstream embankment to drain toward the center of the dam near the outlet conduit. A connecting filter blanket was designed to collect this seepage and drain toward two vertical drains at the downstream toe of the embankment, approximately 35 feet to each side of the outlet conduit.

Both Dam "A" and "B" are constructed with a two-stage inlet riser unit and 30-inch reinforced concrete outlet pipe. The first stage orifice for Dam "A" is 1 foot by 1.5 feet with a crest elevation of 1216.0 feet (normal pool). The second stage orifice is 2 feet by 2.5 feet with a crest elevation of 1218.0 feet. The riser unit for Dam "B" consists of a first stage inlet, 1.75 feet by 2.5 feet, and a crest elevation of 1216.0 feet. The second stage opening for riser unit of Dam "B" is an overflow weir on the side walls of the unit. The crest elevation is 1218.0 feet and is 15 feet long.

Both dams have a vegetated earth spillway channel with crests elevations of 1220.0 feet. The spillway channel for Dam "A" is 188 feet wide at the base and approximately 600 feet long. The spillway channel for Dam "B" is 150 feet wide at the base and approximately 500 feet long.

A diversion dam was constructed just to the left of the emergency spillway channel of Dam "A". This dam diverts runoff from a drainage area of 0.68 square mile into Tamarack Lake. This homogeneous embankment is approximately 16 feet high, 680 feet long, and has a crest elevation of 1236.0 feet. A 30-foot-wide channel diverts the overflow into the reservoir. The control section for this channel is El. 1230.0 feet. A concrete pilot channel is located in the center of the channel. A pond drain consisting of a 24-inch slide gate and bituminous coated corrugated metal pipe serves as the drawdown for this structure. At the time of inspection this drain was open and no water was impounded behind the diversion dam.

b. Location - Tamarack Lake Dam "A" is located in West Meade Township, Crawford County, Pennsylvania approximately 2 miles southeast of the city of Meadville, Pennsylvania. The dam is located approximately 1.5 miles south of PA Route 27 and 3.5 miles east of the junction of Interstate 79 and U.S. Route 6.

c. Size Classification - The maximum height of the dam is 22 feet. The lake volume to the top of the dam at El. 1223.0 feet is 8150 acre-feet. Therefore, the dam is in the "Intermediate" size category.

d. Hazard Classification - Many lives could be lost in the event of a failure of Tamarack Lake Dam "A" because of several homes located along Mill Run downstream of the dam. Therefore, this dam is considered in the "High" hazard category.

e. Ownership - The dam and lake are owned by the Commonwealth of Pennsylvania, Pennsylvania Fish Commission. Mr. E. Jon Grindall, Senior Project Engineer, Pennsylvania Fish Commission, Robison Lane, Bellefonte, Pennsylvania 16823 is responsible for engineering aspects of the dam. Mr. Melvin Dinger, Maintenance Foreman, Pennsylvania Fish Commission, Box 408, Tionesta, Pennsylvania 16353 is responsible for maintenance and operation of the dam.

f. Purpose of Dam - The dam is used for flood detention. The reservoir is used for fish and wildlife development, and recreation.

g. Design and Construction History - The dam was constructed in 1961 and 1962 by Bell and Bell Contractors of Eldred, Pennsylvania. The dam was designed by the U.S. Soil Conservation Service (SCS).

h. Normal Operational Procedures - Normal pool is controlled by two low-stage riser orifices at El. 1216.0 feet. (One riser orifice each at Tamarack Lake Dams "A" and "B".) The second stage at El. 1218.0 feet is controlled by an orifice 2 feet by 2.5 feet at Tamarack Lake Dam "A" and by a 15-foot-wide overflow weir at Tamarack Lake Dam "B". Excess flows are diverted through side channel emergency spillways at both of the dams. The drawdown facilities are operated biannually to insure proper operation.

1.3 PERTINENT DATA

a. Drainage Area (square miles) -	4.99
b. Discharge at Dam Site (c.f.s.) -	
Maximum Flood -	Unknown
Tamarack Lake Dam "A"	
Principal Spillway Capacity (At Pool El. 1223.3 ft.*) -	79.6
Emergency Spillway Capacity (At Pool El. 1223.3 ft.) -	3047
Total Spillway Capacity (At Pool El. 1223.3 ft.) -	3126.6

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* Feet above Mean Sea Level (M.S.L.)

Tamarack Lake Dam "B"	
Principal Spillway Capacity (At Pool El. 1223.3 ft.) -	97.1
Emergency Spillway Capacity (At Pool El. 1223.3 ft.) -	2368
Total Spillway Capacity (At Pool El. 1223.3 ft.) -	2465.1
Tamarack Lake	
Total Spillway Capacity (At Pool El. 1223.3 ft.) -	5592

c. Elevation (feet above M.S.L.) -

Design Top of Dam -	1223.0
Minimum Top of Dam -	1223.2
Normal Pool -	1216.0
Maximum Pool (Phase I Analysis*) -	1222.9
Emergency Spillway Crest -	1220.0
Second Stage Orifice on Intake Riser -	1218.0
Streambed at Centerline of Dam -	1201.2
Maximum Tailwater -	Unknown

d. Reservoir (feet) -

Length of Maximum Pool -	18,000
Length of Normal Pool -	18,000
Length of Flood Control Pool -	18,000

e. Storage (acre-feet) -

At Low Stage Orifice Crest (Normal Pool) (El. 1216.0 ft.) -	3850
At Second Stage Orifice Crest (El. 1218.0 ft.) -	5000
At Emergency Spillway Crest (El. 1220.0 ft.) -	6200
At Design Top of Dam (El. 1223.0 ft.) -	8150
At Minimum Top of Dam (El. 1223.2 ft.) -	8270

f. Reservoir Surface (acres) -

At Low Stage Orifice Crest (Normal Pool) (El. 1216.0 ft.) -	556
At Second Stage Orifice Crest (El. 1218.0 ft.) -	591
At Emergency Spillway Crest (El. 1220.0 ft.) -	620
At Design Top of Dam (El. 1223.0 ft.) -	670

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* See Appendix D.

g. Dam

Type -	Earthfill
Length (feet) -	1000
Height (feet) -	22
Top Width (feet) -	12
Side Slopes - Upstream - (with two 10-foot wide berms at El. 1215 and 1210 ft.)	3H:1V*
Downstream - (with 10-foot-wide berm at El. 1210 ft.)	2.5H:1V

Zoning - A central clay core and cutoff trench with a top width of 10 feet at El. 1216.0 ft. was constructed in this dam. The cutoff trench varied from 4 feet to 13 feet below the original ground line. The bottom (minimum) width of the trench was 10 feet. The lowest point of the cutoff trench at the original streambed was El. 1195.0 ft. (see Plates 4 and 5).

Drains - A filter trench was installed from 16 to 27 feet downstream from the centerline of the dam running from original Station 6+80 to Station 13+25. The 3-foot-wide filter trench was installed to a depth of 5 feet below the original ground line. A connecting filter blanket, minimum thickness of 2 feet, outletting at the downstream toe of the embankment was installed from approximate original Station 9+90 to Station 11+40. Two vertical drains were designed to collect the seepage from the filter blanket and discharge it into the outlet channel (see Plates 7 and 8).

h. Diversion and Regulating Tunnel - None

i. Spillway (Emergency Spillway in SCS Terminology) -

Type - Vegetated earth channel located at left end of main dam	
Length (feet) -	600
Base Width (feet) - Upstream of control section -	188
Downstream of control section -	200
Side Slopes -	3H:1V
Crest Elevation (feet M.S.L.) -	1220.0

---

* Horizontal to Vertical.

Gates - None

Downstream Channel - Located approximately 250 feet downstream from the outlet conduit is a roadway embankment and culvert. Low flows pass through the culvert; however, during flood flows, the approximately 5-foot-high embankment would retard flows until overtopped. From that point, Mill Run flows to Meadville Dam.

j. Regulating Outlets (Principal Spillway in SCS Terminology) -

Type - Two-stage inlet riser and 30-inch reinforced concrete outlet pipe

First Stage Orifice -

Crest Elevation (feet M.S.L.) -	1216.0
Width (feet) -	1.5
Height (feet) -	1.0

Second Stage Orifice -

Crest Elevation (feet M.S.L.) -	1218.0
Width (feet) -	2.5
Height (feet) -	2.0

Outlet Pipe - Consists of a 30-inch reinforced concrete pipe supported on a concrete cradle. Three reinforced concrete anti-seep collars were provided on 20-foot centers from the downstream edge of the intake riser. The remaining 52-foot length of outlet pipe is not provided with anti-seep collars. The pipe was installed in 16-foot-long sections for a total length of 113.3 feet (including the wall section at the intake riser). The bottom of the construction trench for the outlet pipe was established at El. 1195.0 feet and was 12 feet wide. The trench was then back filled with clayey (CL) material to envelop the concrete cradle and outlet pipe (see Plate 6).

Riser Floor Invert Elevation (feet M.S.L.) -	1200.0
Outlet Conduit Exit Invert Elevation (feet M.S.L.) -	1198.87

k. Drawdown Facilities - Drawdown of the reservoir can be accomplished by a 24-inch bituminous coated corrugated metal pipe entering the upstream face of

the intake riser unit. The inlet for this drain is located approximately 65 feet upstream from the riser and consists of a 6-foot-high vertical standing half-section of 38-inch diameter corrugated metal pipe. A galvanized grating is provided over the upstream half of the intake. Flow from the drainpipe to the riser unit is manually controlled by a 24-inch slide gate and valve on the upstream face of the riser unit.

l. Diversion Dam -

Type - Homogeneous earthfill embankment		
Length (feet) -		680
Height (feet) -		16
Top Width (feet) -		10
Side Slopes -	Upstream -	3H:1V
	Downstream -	3H:1V

Drains - A 3-foot-wide by 5-foot-high filter trench was provided for the downstream side of the embankment from original Station 1+45 to Station 5+12 draining toward the outlet pipe at Station 3+35. Two 8-inch bituminous coated corrugated metal drainpipes (perforated for part of their length) were installed on either side of the outlet pipe of the diversion dam. These drains carry the seepage from the filter trench to the downstream outlet (see Plate 12 and Photo 10).

m. Diversion Dam Regulating Outlet - A 108-foot-long, 24-inch bituminous coated corrugated metal pipe serves as a drain for the diversion dam pond. This outlet conduit is controlled by a 24-inch slide gate (see Plate 13) with entrance invert of El. 1222.0 ft. Any flow entering the pipe would drop to invert El. 1219.9 feet at the upstream end of the pipe. The exit invert is El. 1218.8 feet. Three 14 gage bituminous coated corrugated metal anti-seep collars were installed on 20-foot centers near the center of the dam along the outlet pipe. The outlet pipe was installed in a clay backfilled trench throughout its length (see Plates 11 and 13).

n. Diversion Ditch - A 30-foot-wide channel will divert the runoff from the pond into Tamarack Lake. A low flow 1-foot-deep, "V"-shaped, concrete pilot channel is located in the center of this diversion channel. The entrance elevation of the diversion channel is El. 1230.0 ft. The diversion dam impounds runoff from a 0.68 square mile drainage area. The maximum depth of impoundment is approximately 10 feet.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Tamarack Lake Dam "A" was designed by the SCS according to its standard practice for structures of this type, circa 1960. Design data included in this report were obtained from:

1) SCS Drawings No. PA-461-A&B-P, "Mill Run Watershed Project, Multiple Purpose Dam PA-461-A&B, Crawford County, Pennsylvania." Design drawings dated May and June 1961. "As built" plans with major modifications incorporated into the drawings are dated April 1962. Copies of "as built" sheets numbers 3-8, 17-20, and 20A are included in this report as Plates 3-13. Prints of the "as built" drawings are available in the files of the Harrisburg SCS office.

2) SCS Drawings No. PA-461-A&B, "Mill Run Watershed Protection Project, Crawford County, Pennsylvania," dated May 1961, Design Hydrograph and Freeboard Hydrograph sheets. Prints are available in Pennsylvania Department of Environmental Resource's (PennDER) files.

3) "Mill Run Watershed Work Plan," report prepared by Crawford County Board of Commissioners, et al., March 1960. A copy of the report was made available to the inspection team by the Pennsylvania Fish Commission.

4) Dam Permit Application Report prepared by the Pennsylvania Department of Forests and Waters (predecessor of PennDER) on 2 August 1961.

5) "Design Report for Mill Run Watershed, Site PA-461 (A and B), Crawford County, Pennsylvania, Drawing No. PA-461-R, 4 sheets, dated 15 June 1961. Available in the files of the Harrisburg SCS office.

6) Design information and calculations available in the files of the Harrisburg SCS office, including:

    a) Hydrologic and hydraulic design calculations (24 pp.).

b) Structural design calculations, i.e., riser design, anti-seep collar design, etc. (18 pp.).

c) Laboratory soil testing results from the SCS Soil Mechanics Laboratory in Lincoln, Nebraska. Three-page report plus 5 pages of summary test data sheets.

d) Geology Report PA-461-G. Summary report of site reconnaissance, test pits, and soil borings.

7) Various post-construction inspection reports by the SCS, the Pennsylvania Fish Commission, and PennDER (available in PennDER's files).

2.2 CONSTRUCTION

Readily available information on the construction of this dam was reviewed in connection with this Phase I Investigation. This information consisted of PennDER File 20-47A for this dam. Many design and construction modifications recorded were incorporated into the "as built" drawings. Most of these drawings have been included in this report; however, all additional drawings are available in the files of the SCS Harrisburg office.

2.3 OPERATION

The "Mill Run Watershed Work Plan" and a subsequent agreement between the Pennsylvania Fish Commission and the SCS, dated 21 August 1961, details the provisions for operation and maintenance of this structure. A copy of this agreement was provided to the inspection team by the Pennsylvania Fish Commission and is readily available.

2.4 EVALUATION

The information reviewed for this dam did not indicate any cause for concern for the safety of this structure.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The dam and its appurtenant structures were found to be in good overall condition at the time of the inspection, with the exception of the seepage area noted at the downstream toe of the embankment left of the outlet conduit. Noteworthy deficiencies observed are described briefly in the following paragraphs. The complete visual inspection check list and field sketches are given in Appendix A.

b. Dam - Clear seepage was exiting near the downstream toe of the embankment from the edge of the plunge pool to approximately 50 feet left of the outlet pipe. This area has been present for an undetermined amount of time as evidenced by the uncut, overgrown grass and because the area has not been recorded in any of the inspection reports reviewed. The volume of flow exiting this area was estimated at 1 g.p.m. (see Photo 5). Two vertical drains reportedly installed 35 feet on either side of the outlet conduit near the downstream toe of the embankment were not inspected by the inspection team. However, Mr. Melvin Dinger, Regional Maintenance Foreman for the Pennsylvania Fish Commission, made a follow-up inspection of the vertical drains on 7 May 1979. He noted that the vertical drain on the right side of the outlet was readily located and consisted of an Alternate "S" type vertical drain as shown on Plate 8 of this report. He opened the manhole cover and inspected the drain and noted a thin sheet of water overlying the gravel but no movement of water was apparent. The manhole for the vertical drain to the left of the outlet pipe was not located. However, the drain outlet was observed in the plunge pool, approximately 1 foot below tailwater level.

c. Diversion Dam - Some minor erosion was observed on the crest of the dam. No other significant deficiencies were noted. The pond drain was open at the time of inspection and no water was impounded behind the dam.

d. Appurtenant Structures - The concrete in the intake and outlet structures of the principal spillway system is in good condition. According to the owner's personnel, the plunge pool is enlarging.

e. Reservoir Area - The side slopes of the reservoir are steep but with good vegetative cover. No unusual sedimentation has occurred in the reservoir.

f. Downstream Channel - The original stream channel of Mill Run forms the downstream outlet channel. Approximately 250 feet downstream from the dam is a 5-foot-high roadway embankment. A corrugated metal pipe culvert carries the flow under the roadway. This embankment would be overtopped should the emergency spillway channel ever carry any flood flows; however, this is not considered to present any problems. Approximately ten homes are located downstream along Mill Run before it enters Meadville Dam Pond approximately 2 miles downstream. After flowing through Meadville Dam (NDI No. PA 00177, PennDER No. 20-48, SCS No. PA 460) and the city of Meadville, Mill Run joins French Creek an additional 1.5 miles downstream from Meadville Dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The following is a brief summary of the emergency plan now in effect for the dam:

The Crawford County waterways patrolman or a deputy patrolman shall observe the structure during periods of heavy precipitation. Should they observe any of the following conditions during these observations, they are instructed to notify the PennDER Regional Office at Meadville [telephone (814) 724-8550, a 24-hour number].

1) Sliding of upstream or downstream slopes or abutments contiguous to the dam;

2) sudden subsidence of the crest of the dam;

3) longitudinal or transverse cracking of the crest of the dam;

4) unusual release of water from the face or toe of the dam;

5) any other unusual conditions at the downstream slope of the dam;

6) significant landslides in the reservoir area and;

7) unusual discharges through the spillway system.

It is recommended that additional emergency procedures be prepared, prominently displayed, and furnished to all personnel. The owner should coordinate with the Pennsylvania Emergency Management Agency (formerly Civil Defense), and other appropriate agencies and civil officials in developing an emergency evacuation plan for areas which will be affected in the event of a dam failure.

4.2 MAINTENANCE OF DAM

Routine maintenance is performed periodically by Pennsylvania Fish Commission personnel. Inspections of the dam are routinely performed weekly by the area maintenance manager. Annual inspections are performed by the SCS in conjunction with the Pennsylvania Fish Commission.

4.3 MAINTENANCE OF OPERATING FACILITIES

The pond drain slide gate is reportedly operated twice a year to verify operational adequacy. Trash and debris are removed during personnel visits to the dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There are no warning procedures in the event of a dam failure. An emergency warning procedure should be developed.

4.5 EVALUATION OF OPERATING ADEQUACY

Both operational and maintenance procedures are considered adequate for the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - Hydrologic and hydraulic design calculations for Tamarack Lake were obtained from the SCS "Design Report." According to SCS criteria, the emergency spillway and freeboard hydrographs were developed and routed through the reservoir to establish the elevations of the design high water and crest of dam. The emergency spillway hydrograph was developed using a 6-hour rainfall of 8.8 inches with a peak discharge of 8366 c.f.s. The freeboard hydrograph was developed using a 6-hour rainfall of 17.7 inches with a peak discharge of 16,394 c.f.s.

b. Experience Data - No detailed reservoir stage/rainfall records are available. The owners of the dam, however, reported that the reservoir level has never reached the emergency spillway crest.

c. Visual Observations - No condition was observed at the time of the inspection to indicate that the spillway and outlet works could not operate satisfactorily in the event of a flood.

d. Overtopping Potential - The Tamarack Lake Dam "A" is classified as a "High" hazard-"Intermediate" size dam requiring evaluation for a spillway design flood equal to the Probable Maximum Flood (PMF). The spillways consist of a typical SCS concrete riser and vegetated earth channel. The hydrologic and hydraulic capabilities of the reservoir and spillways were evaluated by routing the PMF through the reservoir with the aid of the U.S. Army Corps of Engineer's Flood Hydrograph Package, HEC-1. The PMF hydrograph developed as part of this analysis had a peak discharge of 9980 c.f.s. based on a 6-hour rainfall of 21.9 inches. Discharges from the outlet works located at both Dam "A" and Dam "B" were considered in the flood routing. The results of this routing indicate that the reservoir is capable of passing the PMF with a corresponding maximum reservoir level of El. 1222.9 feet, which is 0.3 foot below the minimum crest of dam of El. 1223.2 feet. The maximum discharge from the reservoir is 4610 c.f.s. of which approximately 2580 c.f.s. discharges from dam site "A" into Mill Run.

e. Spillway Adequacy - The dam, as outlined in the above analysis, is capable of passing the PMF without overtopping. Therefore, the spillway is "adequate" according to the recommended criteria.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - The marshy area and seepage observed during the visual inspection is not considered detrimental to the stability of the dam according to the conditions present at the time of inspection.

b. Design and Construction Data - Calculations of embankment slope and foundation stability were not available for review. However, a summary report from the SCS Soil Mechanics Laboratory at Lincoln, Nebraska dated 14 April 1961 contained the following information:

> "Shear Strength - Two remolded compacted samples were tested in triaxial shear. The materials were compacted to 95% of Standard Proctor density. The specimens were then soaked to saturation before testing. Values obtained were, Φ = 21.5°, c = 100 p.s.f. for mix curve 4 and Φ = 26.5°, c = 125 p.s.f. for mix curve 5. A stability analysis was made on the embankment material alone for a 23-foot fill. The weaker shear value was used to be conservative. An additional 10-foot berm was needed at El. 1210 upstream to give a safety factor of 1.51. The downstream slope required a 10-foot berm at El. 1210 also to make a safety factor of 1.78."

It should be pointed out that two berms were placed on the upstream slope at El. 1215 feet and El. 1210 feet, thus increasing the factor of safety reported above. The above information coupled with the visual inspection indicate no further stability assessments are deemed necessary unless the condition of the dam changes in the future.

c. Operating Records - No operating records were available. The operation procedures do not indicate cause for concern relative to the structural stability of the dam.

d. Post-Construction Changes - The post-construction changes (see Appendix B, Check List - Engineering Data) made to the dam do not appear to adversely affect the structural stability.

e. Seismic Stability - The dam is located near the boundary between Zones 1 and 2 of the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspections of Dams." Both of these zones are considered to present no hazard from earthquakes provided static stability conditions are satisfied and conventional safety margins exist. Tamarack Lake Dam "A" has been shown to meet the stability requirements and, therefore, further consideration of the seismic stability is not warranted at this time.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - The dam was in good overall condition at the time of inspection. The marshy area and seepage observed during the visual inspection does not constitute a hazard to the safety of the structure according to the conditions present at the time of the inspection. Tamarack Lake Dam "A" is a "High" hazard-"Intermediate" size dam requiring a spillway capacity equal to the PMF. As presented in Section 5, the spillways and reservoir were determined adequate to pass the PMF without overtopping the dam.

b. Adequacy of Information - The information available and the observations made during the field inspection are considered sufficient for this Phase I Inspection Report.

c. Urgency - The owner should initiate the action discussed in paragraph 7.2 without delay.

d. Necessity for Additional Data/Evaluation - The owner should have a qualified professional engineer inspect the vertical drain on the left side of the outlet conduit (principal spillway) after proper access to the vertical drain has been provided. The engineer should examine for blockage in the outlet pipe, the need for maintenance of the vertical drain, or the necessity of an additional seepage control measure.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed a few items of remedial work which should be performed without delay by the owner. These include:

1) Install a weir to monitor the seepage.

2) Provide proper inspection access to the vertical drain on the left side of the outlet conduit. This could be accomplished by extending the drain housing and manhole cover to an elevation above the existing ground surface.

3) The owner should have a qualified professional engineer inspect the vertical drain on the left side of the outlet conduit. The engineer should examine for blockage of the 6-inch

outlet pipe for the vertical drain, the necessity of any maintenance of the vertical drain or the necessity for an alternate seepage control measure, and develop additional recommendations as necessary.

4) Periodically inspect and maintain the vertical drains as necessary.

5) Repair the minor erosion areas on the main embankment and diversion dam. Efforts to prevent the use of motorcycles and other vehicles on these areas and in the spillway should be increased.

6) Install properly designed riprap or other measures to prevent erosion around the plunge pool.

In addition, the following operational measures are recommended to be undertaken by the owner:

1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

PLATES

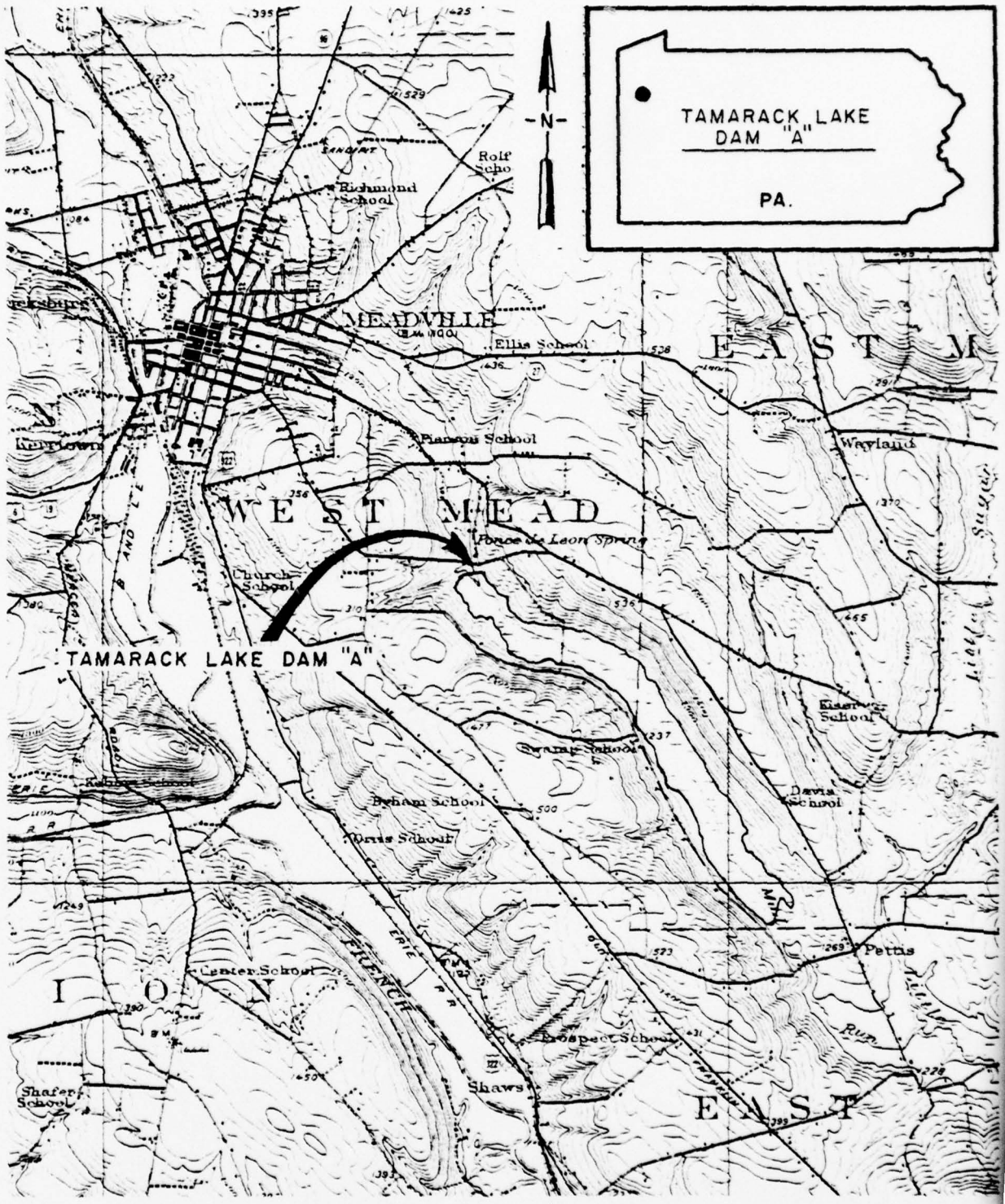
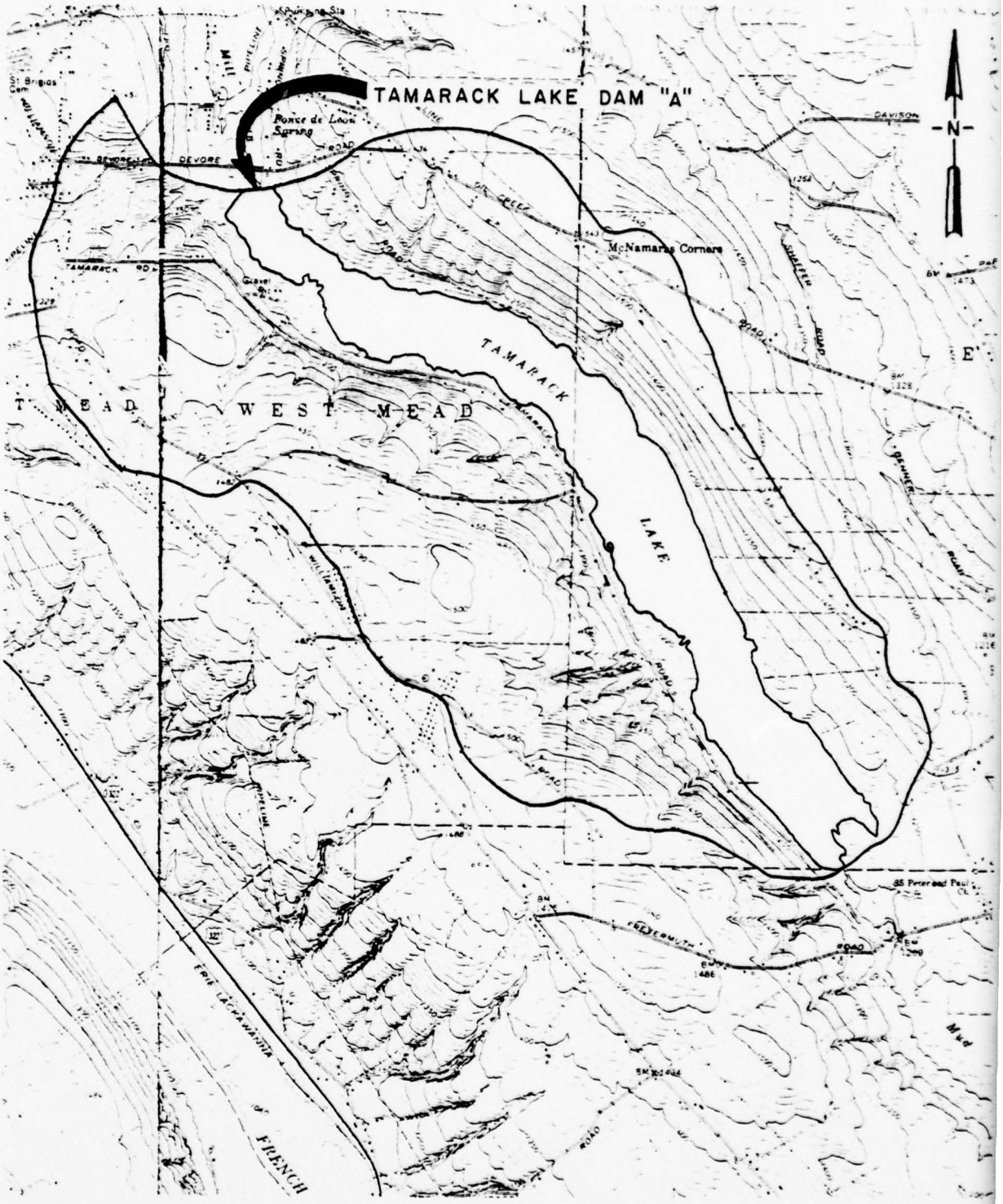


PLATE 1 LOCATION PLAN

TAMARACK LAKE DAM "A"



SCALE 1:24000

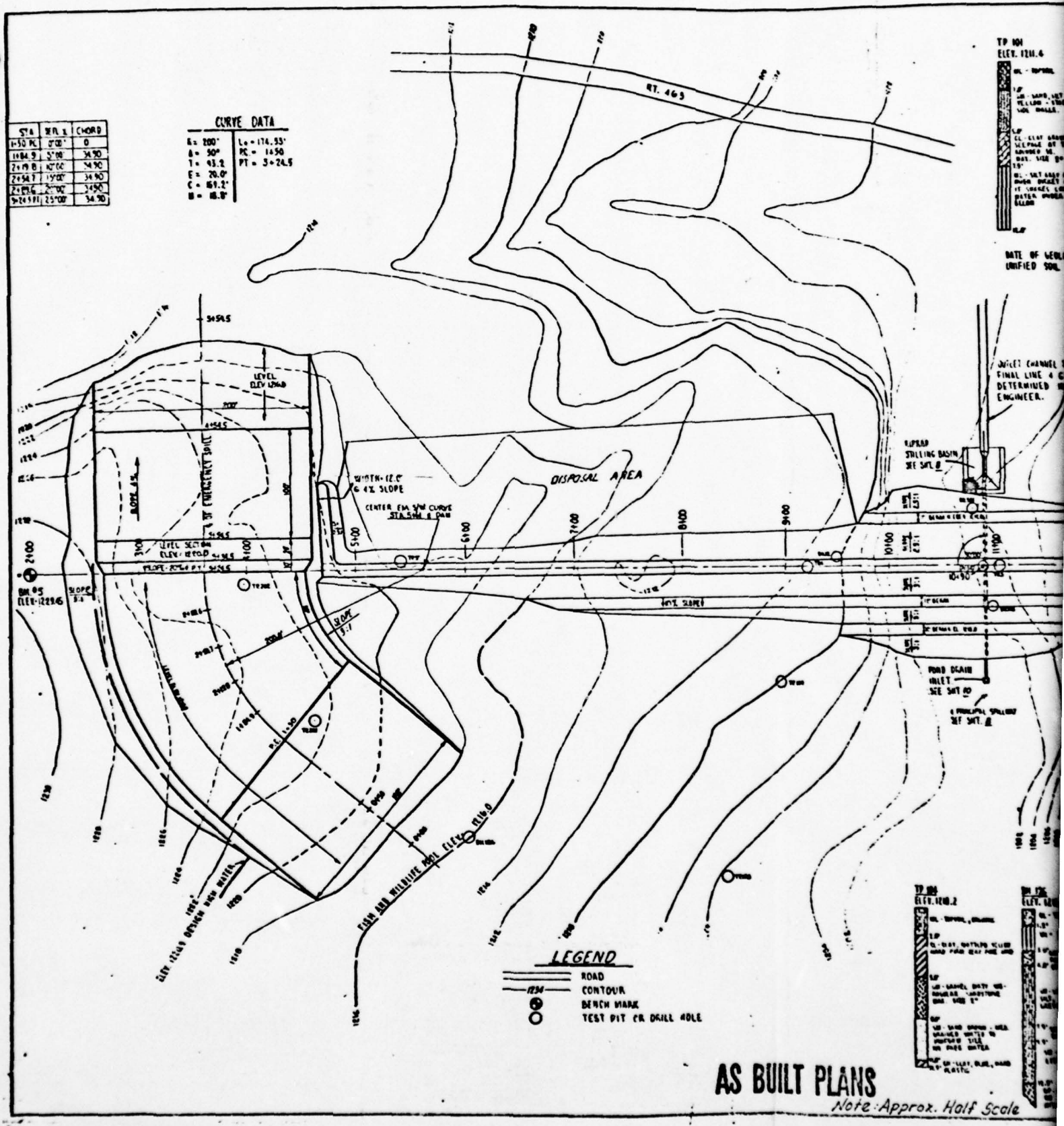
1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

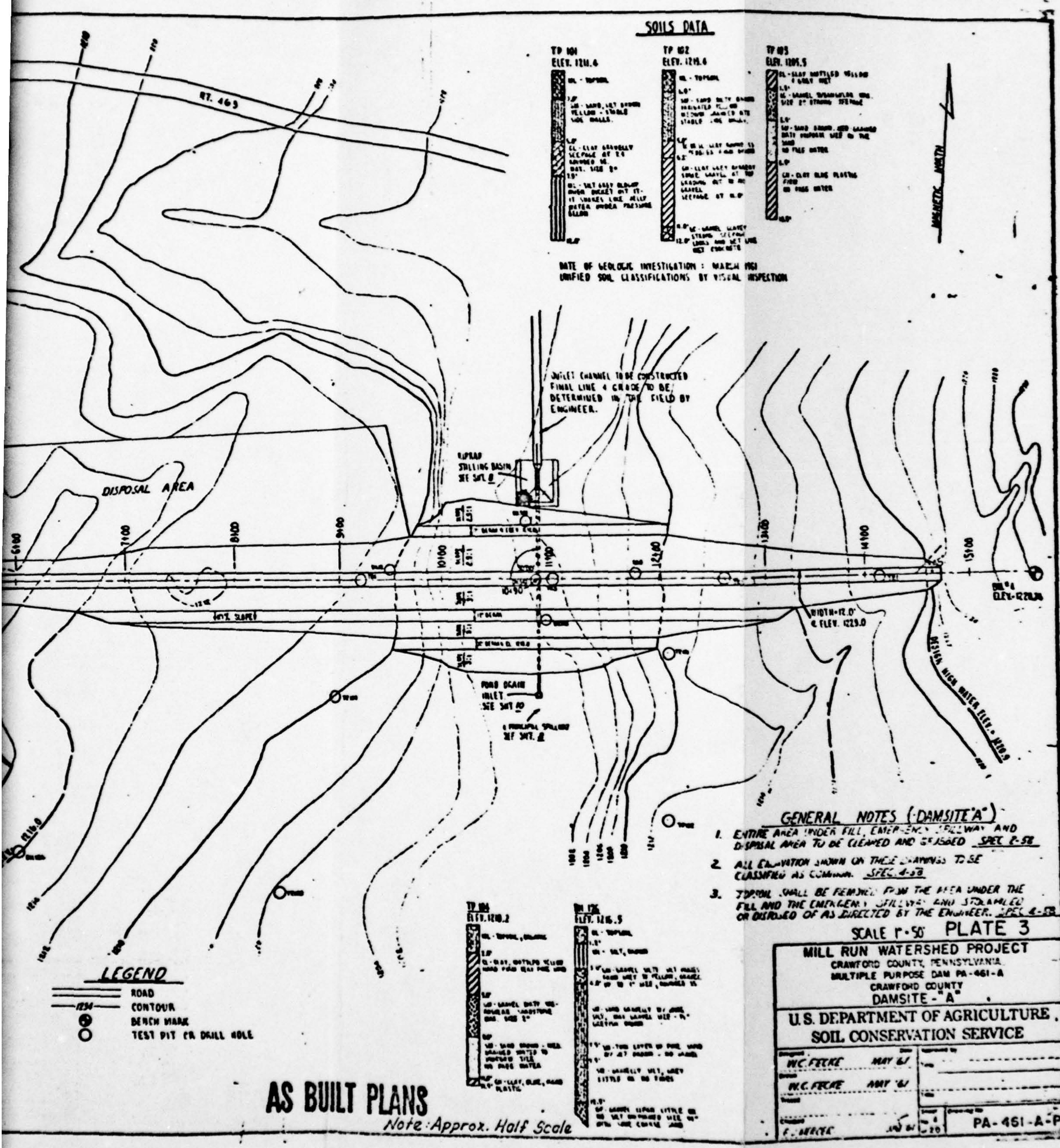
PLATE 2 WATERSHED MAP

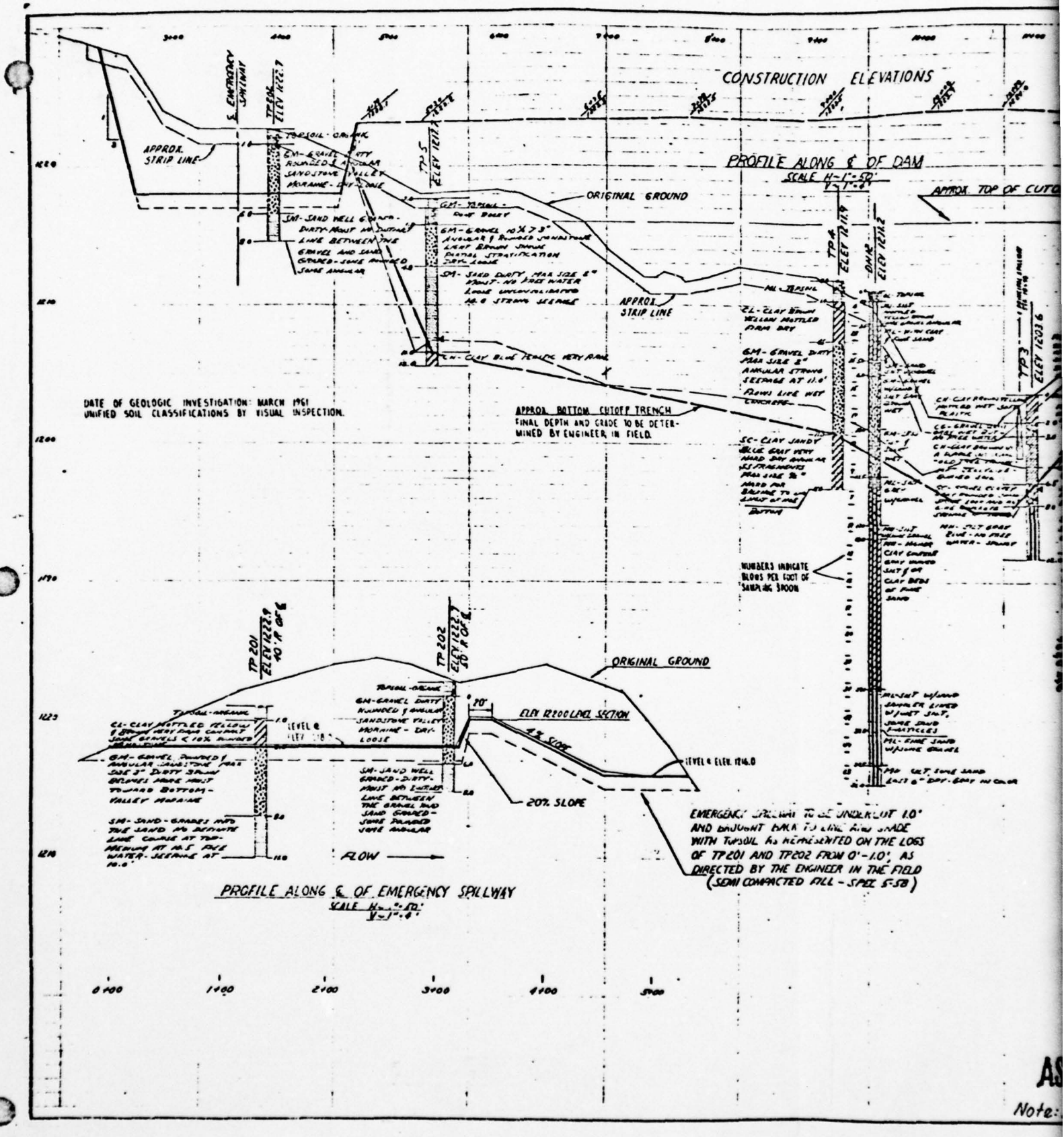
TAMARACK LAKE DAM "A"



AS BUILT PLANS

Note: Approx. Half Scale


SOILS DATA
TP 101 ELEV. 1211.6
TP 102 ELEV. 1219.6
TP 103 ELEV. 1205.5
DATE OF GEOLOGIC INVESTIGATION : MARCH 1961
UNIFIED SOIL CLASSIFICATIONS BY VISUAL INSPECTION
MAGNETIC NORTH
RT. 469
OUTLET CHANNEL TO BE CONSTRUCTED FINAL LINE & GRADE TO BE DETERMINED IN THE FIELD BY ENGINEER.
RIPRAP STILLING BASIN SEE SHT. 8
DISPOSAL AREA
WIDTH = 12.0' ℄ ELEV. 1229.0
HIGH WATER ELEV. = 1219.0
GENERAL NOTES (DAMSITE "A")
1. ENTIRE AREA UNDER FILL, EMERGENCY SPILLWAY AND DISPOSAL AREA TO BE CLEARED AND GRUBBED SPEC. 2-58
2. ALL EXCAVATION SHOWN ON THESE DRAWINGS TO BE CLASSIFIED AS COMMON. SPEC. 4-58
3. TOPSOIL SHALL BE REMOVED FROM THE AREA UNDER THE FILL AND THE EMERGENCY SPILLWAY AND STOCKPILED OR DISPOSED OF AS DIRECTED BY THE ENGINEER. SPEC 4-58
TP 106 ELEV. 1210.2
DH 136 ELEV. 1216.5
LEGEND
ROAD
CONTOUR
BENCH MARK
TEST PIT OR DRILL HOLE
SCALE 1" = 50'
PLATE 3
MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
DAMSITE - "A"
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
W.C. FECKE MAY '61
W.C. FECKE MAY '61
PA-461-A-P
AS BUILT PLANS
Note: Approx. Half Scale


CONSTRUCTION ELEVATIONS
PROFILE ALONG ℄ OF DAM
SCALE H-1"=50'
V-1"=8'
APPROX TOP OF CUTO
ORIGINAL GROUND
APPROX STRIP LINE
APPROX BOTTOM CUTOFF TRENCH
FINAL DEPTH AND GRADE TO BE DETERMINED BY ENGINEER IN FIELD.
DATE OF GEOLOGIC INVESTIGATION: MARCH 1961
UNIFIED SOIL CLASSIFICATIONS BY VISUAL INSPECTION.
NUMBERS INDICATE BLOWS PER FOOT OF SAMPLING SPOON
TP 201 ELEV 1221.9
TP 202 ELEV 1222.7
ORIGINAL GROUND
ELEV 1200 LEVEL SECTION
4:1 SLOPE
20% SLOPE
LEVEL @ ELEV 1216.0
FLOW
EMERGENCY SPILLWAY TO BE UNDERCUT 1.0' AND BACKFILLED WITH TOPSOIL AS REPRESENTED ON THE LOGS OF TP 201 AND TP 202 FROM 0'-1.0' AS DIRECTED BY THE ENGINEER IN THE FIELD (SEMI COMPACTED FILL - SPEC 5-58)
PROFILE ALONG ℄ OF EMERGENCY SPILLWAY
SCALE H-1"=50'
V-1"=8'
0+00
1+00
2+00
3+00
4+00
5+00

Note:

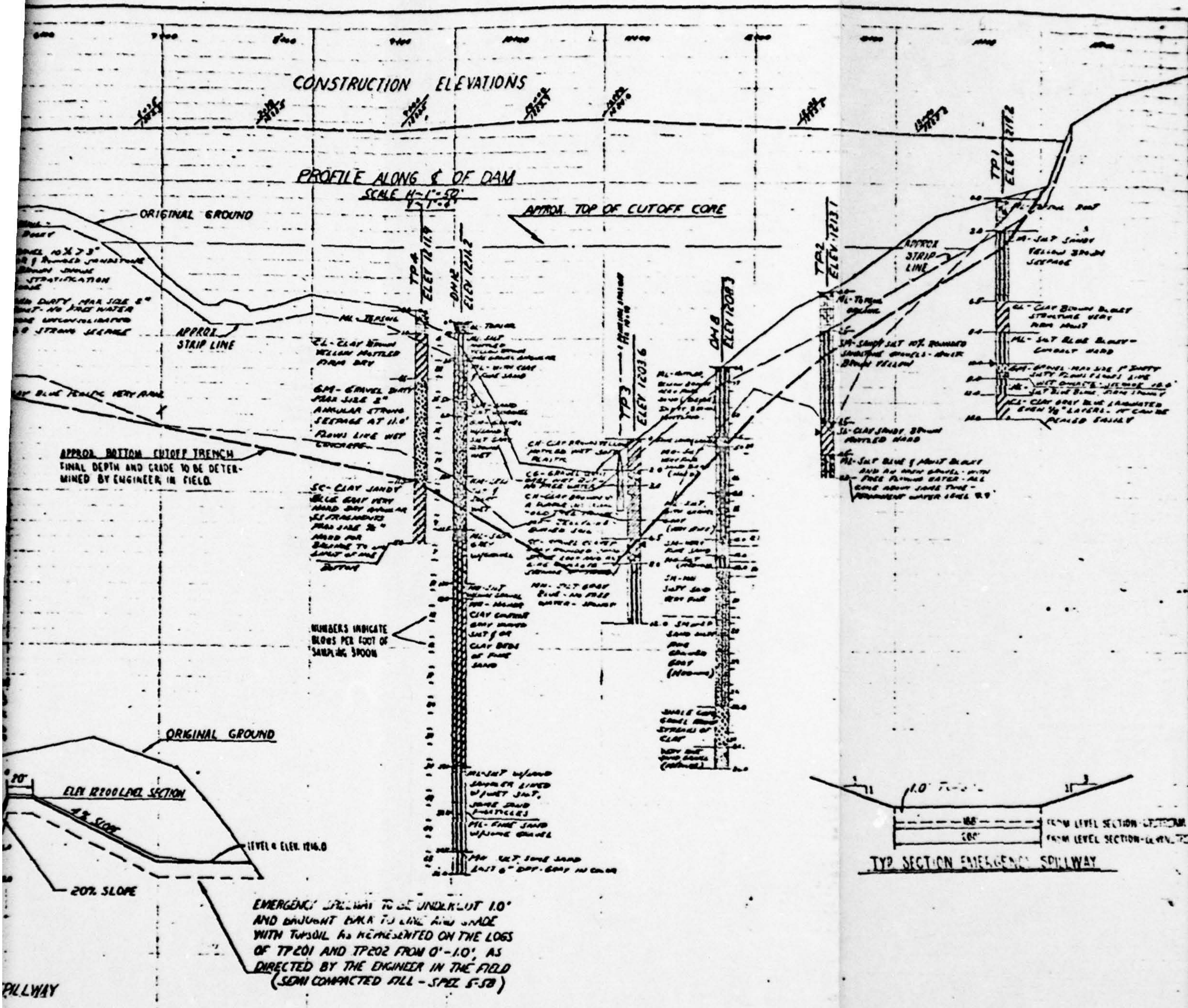


PLATE 4

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
PROFILES-"A"

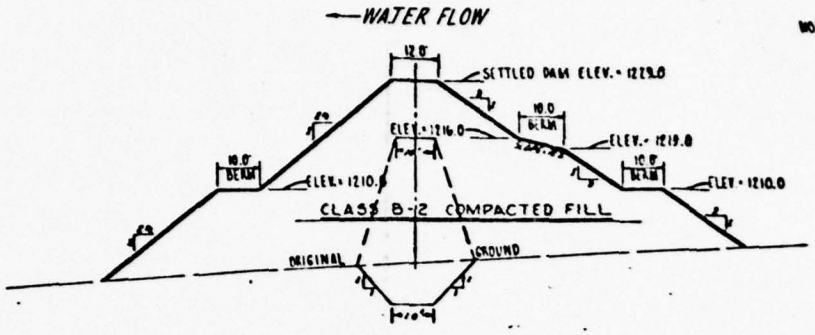
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

G.E. VAN BUSKIRK
S.C. ROSSIER

PA-461-A-P

AS BUILT PLANS

Note: Approx. Half Scale



TYPICAL SECTION, DAM "A"

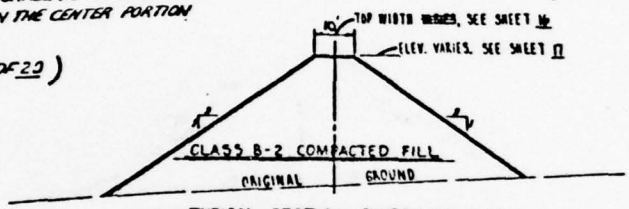
NOTE:

EMBANKMENT OF ALL "A" & "B" WILL BE CONSTRUCTED SIMULTANEOUSLY, WITH THE CONSTRUCTION SURFACES BEING MAINTAINED AT APPROXIMATELY THE SAME ELEVATION AT ALL TIMES, NOT TO EXCEED PLUS OR MINUS 18 INCHES

NOTE:

FILL MATERIAL AS REPRESENTED ON THE LOG OF TEST PIT 412 SHALL BE SELECTIVELY PLACED WITH CLAY IN THE CENTER PORTION OF THE FILL.

(SEE SHEET 17 OF 29)

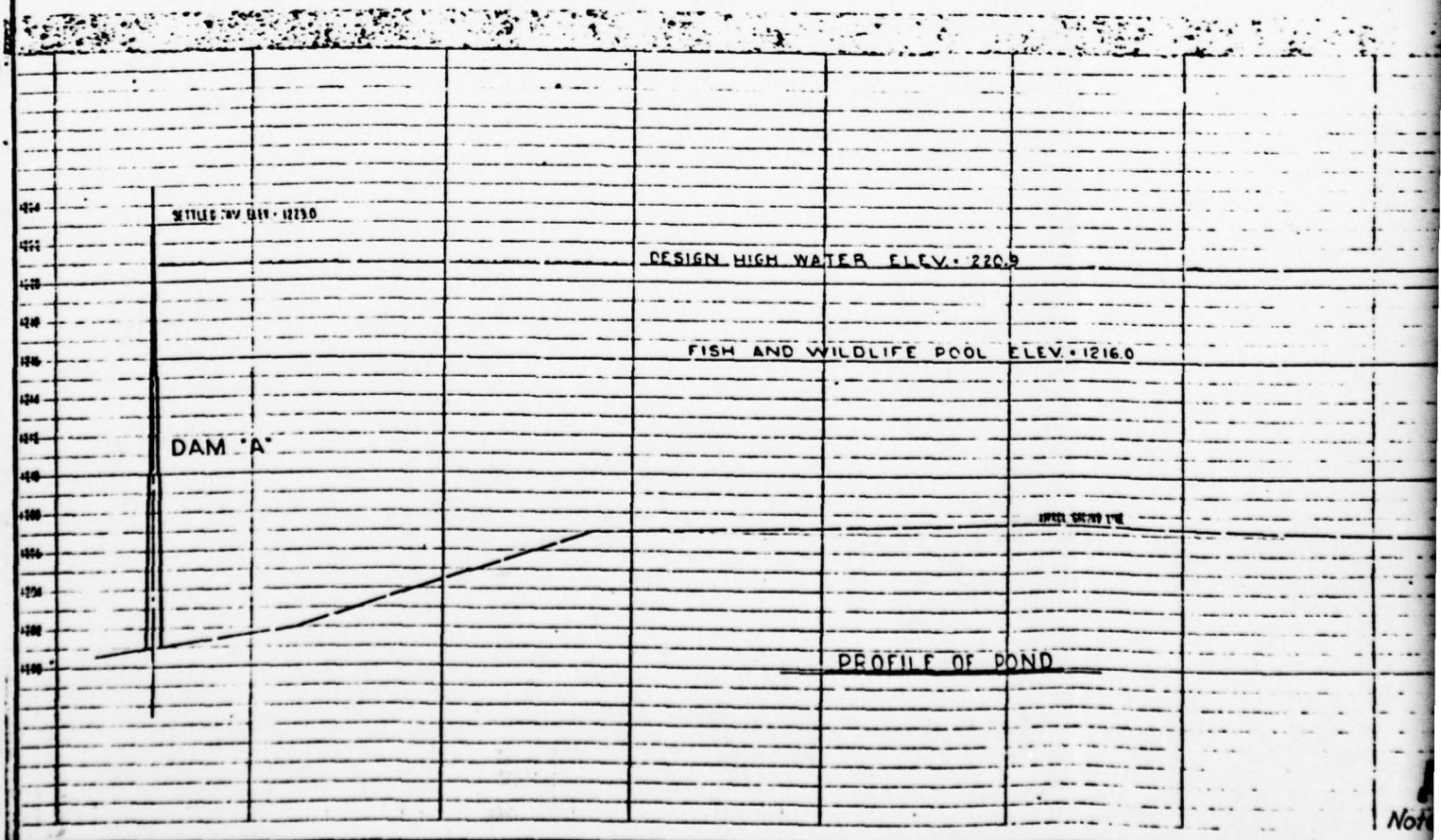


TYPICAL SECTION, DIVERSION DAM

NOTE:

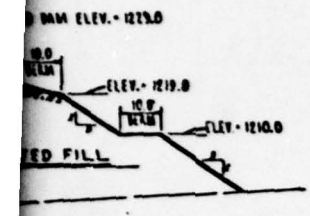
FILL MATERIAL SHALL BE SELECTIVELY WITH CLAYEY SILT AS REPRESENTED ON TEST PIT 109 FROM 1' TO 9.0' IN THE PORTION OF THE FILL.

SILTY GRAVEL AS REPRESENTED ON TEST PIT 107 (FROM 2' TO 4') AND AS REPRESENTED ON THE LOG SHALL BE PLACED IN THE PORTION OF THE FILL



PROFILE OF POND

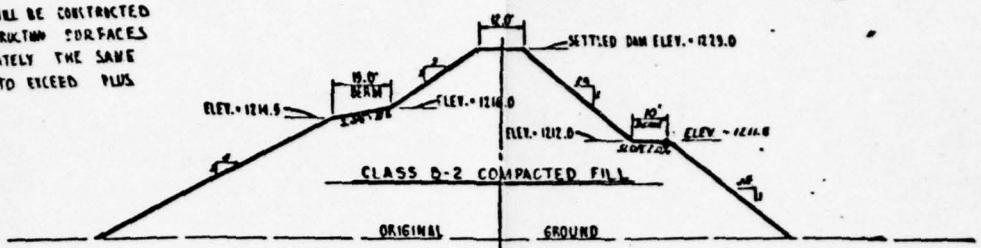
NOTE:
EMBANKMENT OF ALL "A" & 461 "B" WILL BE CONSTRUCTED SIMULTANEOUSLY, WITH THE CONSTRUCTION SURFACES BEING MAINTAINED AT APPROXIMATELY THE SAME ELEVATION AT ALL TIMES, NOT TO EXCEED PLUS OR MINUS 18 INCHES



AM "A"

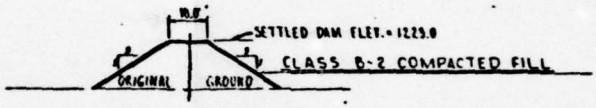
ON DAM

WATER FLOW



TYPICAL SECTION, DAM "B"

NOTE:
FILL MATERIAL SHALL BE SELECTIVELY PLACED WITH CLAYEY SILT AS REPRESENTED ON THE LOG OF TEST PIT 109 FROM 1' TO 9.0' IN THE CENTER PORTION OF THE FILL.
SILTY GRAVEL AS REPRESENTED ON THE LOG OF TEST PIT 107 (FROM 2' TO 4') AND SANDY GRAVEL AS REPRESENTED ON THE LOG OF TEST PIT 108 SHALL BE PLACED IN THE DOWNSTREAM PORTION OF THE FILL



TYPICAL SECTION "DIKE"

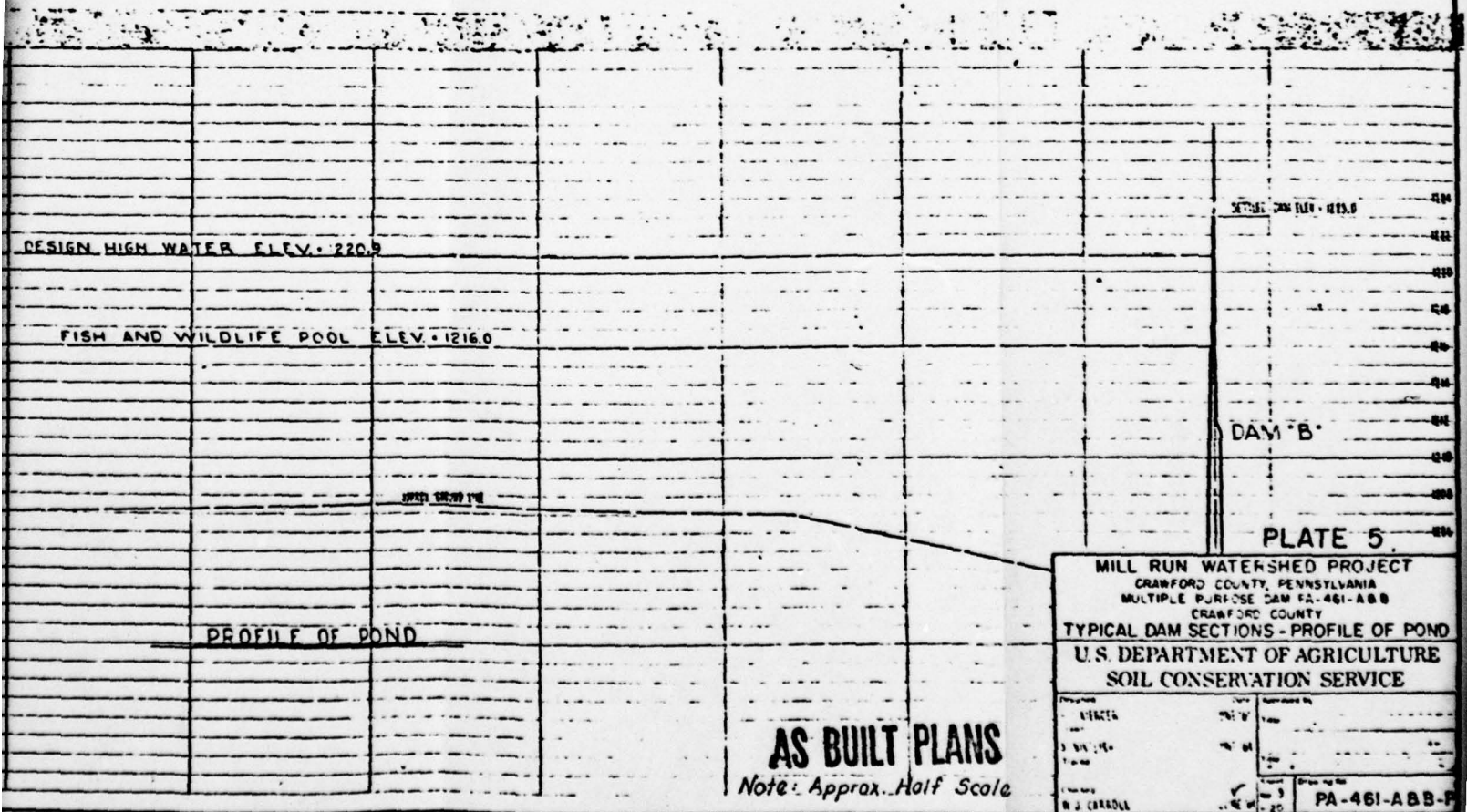
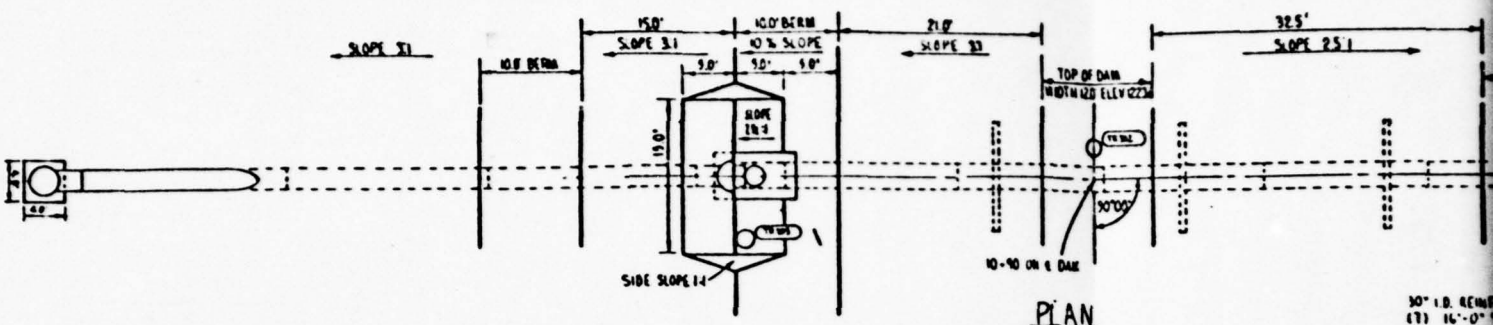


PLATE 5

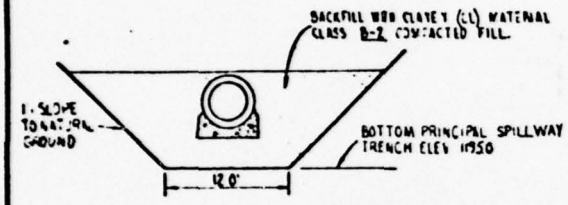
MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-ABB
CRAWFORD COUNTY
TYPICAL DAM SECTIONS - PROFILE OF POND
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AS BUILT PLANS
Note: Approx. Half Scale

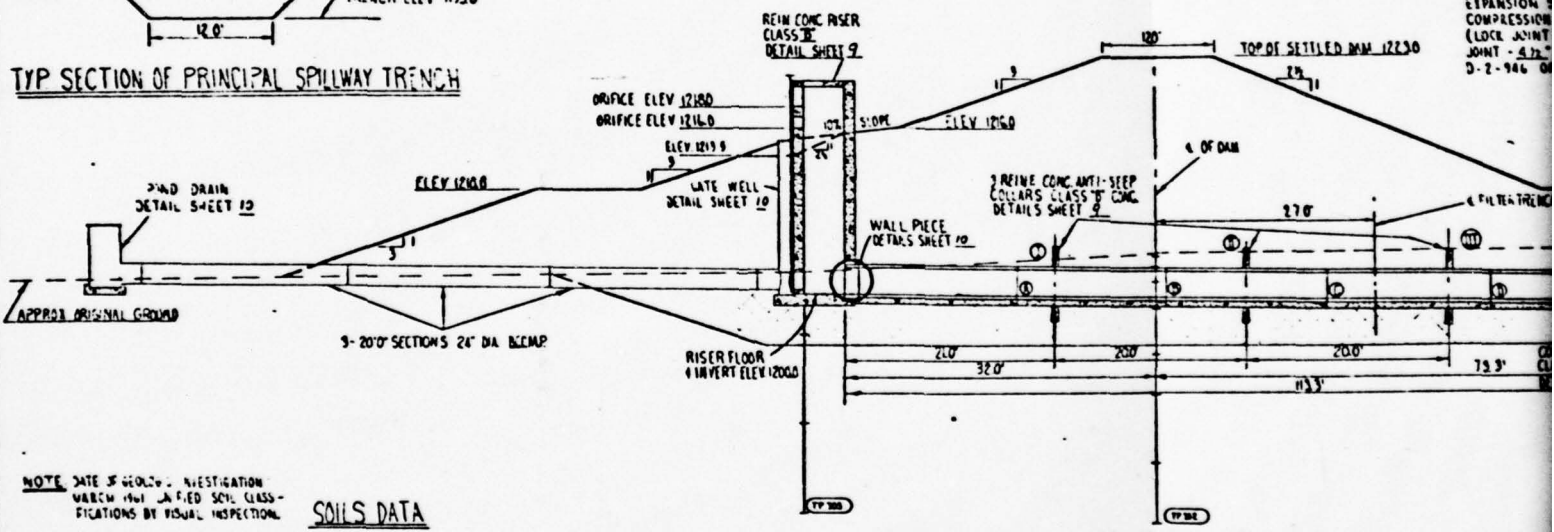
PA-461-ABB-P



PLAN
SCALE 1"=8'



TYP SECTION OF PRINCIPAL SPILLWAY TRENCH

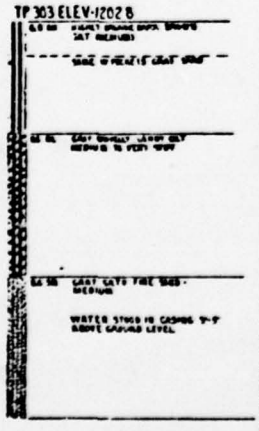


PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY
SCALE 1"=8'

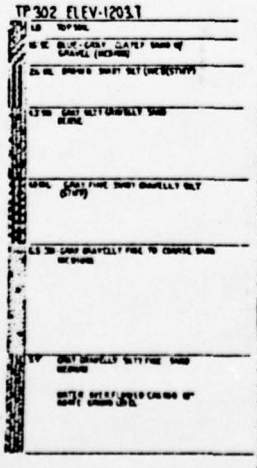
NOTE DATE OF GEOLOGIC INVESTIGATION MARCH 1961 UNIFIED SOIL CLASSIFICATIONS BY VISUAL INSPECTION

SOILS DATA

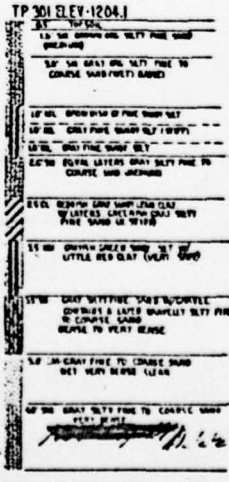
TP 303 ELEV-1202.8



TP 302 ELEV-1203.7

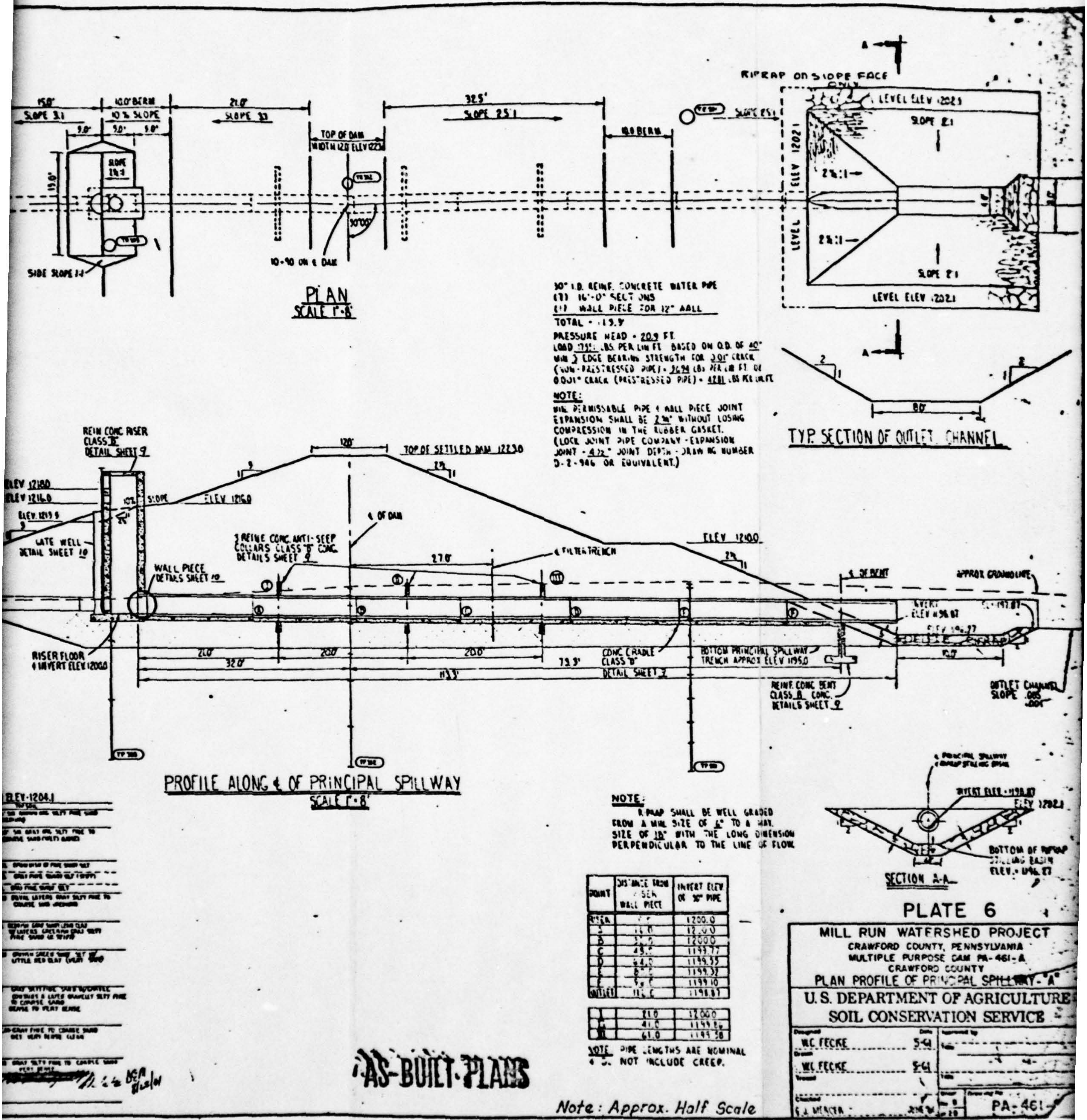


TP 301 ELEV-1204.1



AS-BUILT PLANS

Note:



POINT	DISTANCE FROM RISER WALL PIECE	INVERT ELEV OF 30" PIPE
RISER	[illegible]	1200.0
A	16.0	1200.0
B	[illegible]	1200.0
C	48.[illegible]	1199.77
D	64.0	1199.55
E	[illegible]	1199.32
F	[illegible]	1199.10
OUTLET	113.[illegible]	1198.87
I	21.0	1200.0
II	41.0	1199.86
III	61.0	1199.58

NOTE: PIPE LENGTHS ARE NOMINAL & DO NOT INCLUDE CREEP.

Note: Approx. Half Scale

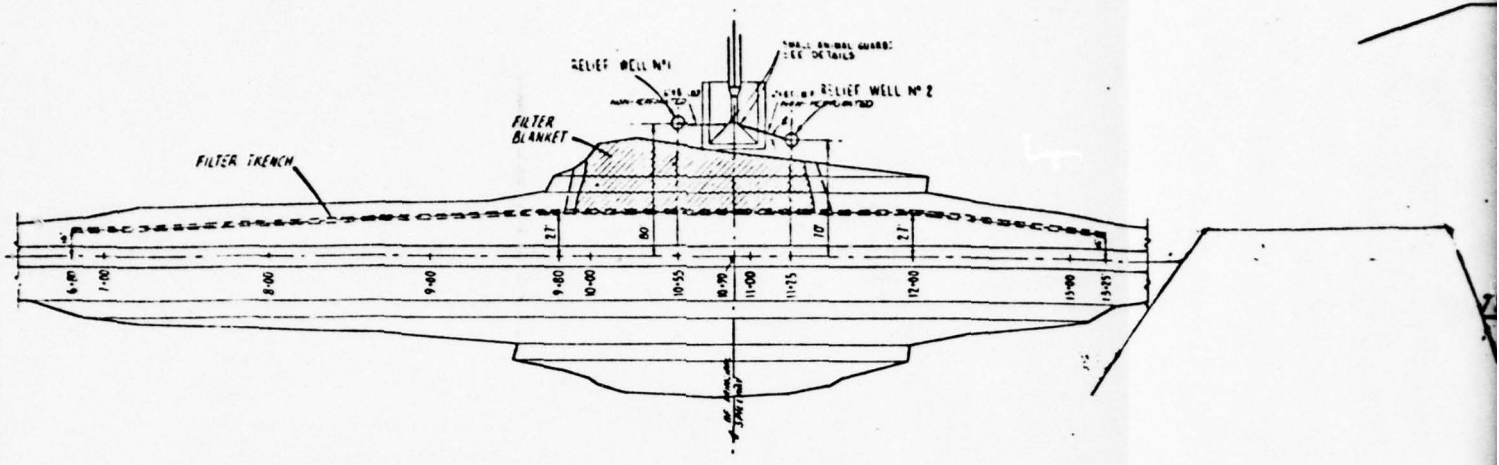
PLATE 6

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
PLAN PROFILE OF PRINCIPAL SPILLWAY - "A"

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

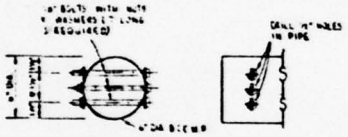
Designed W.C. FECKE 5-61
Drawn W.C. FECKE 5-61

PA-461



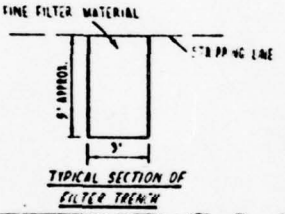
PLAN VIEW OF FILTER TRENCH & FILTER BLANKET

SCALE: 1" = 500'



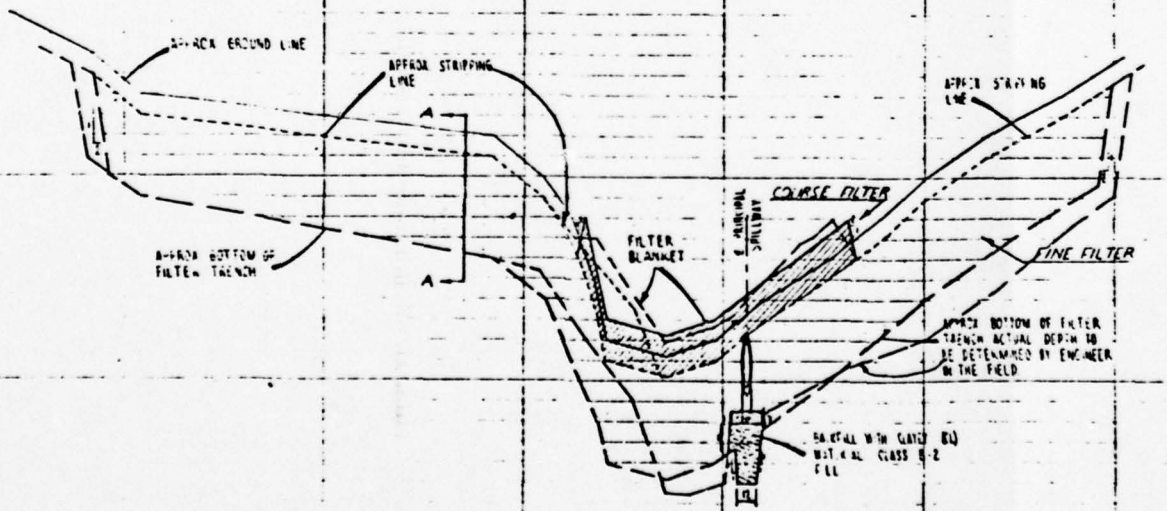
DETAILS OF SMALL ANIMAL GUARD

2 REQUIRED NOT TO SCALE



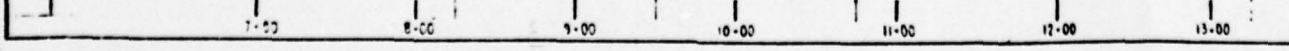
TYPICAL SECTION OF FILTER TRENCH

SECTION A-A

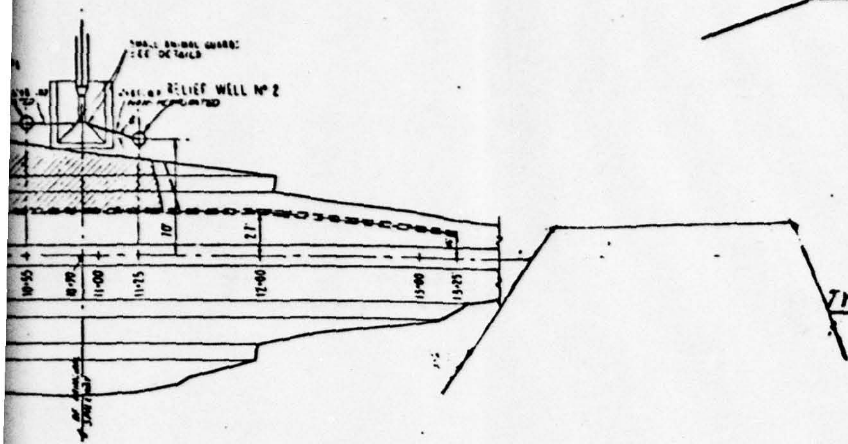


PROFILE ON CENTERLINE OF FILTER TRENCH

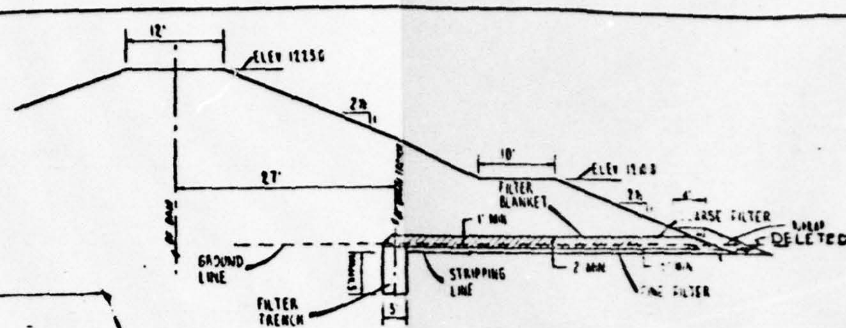
SCALE: HORIZ. 1" = 50'
VERT. 1" = 6'



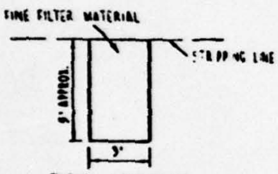
Not



FILTER BLANKET

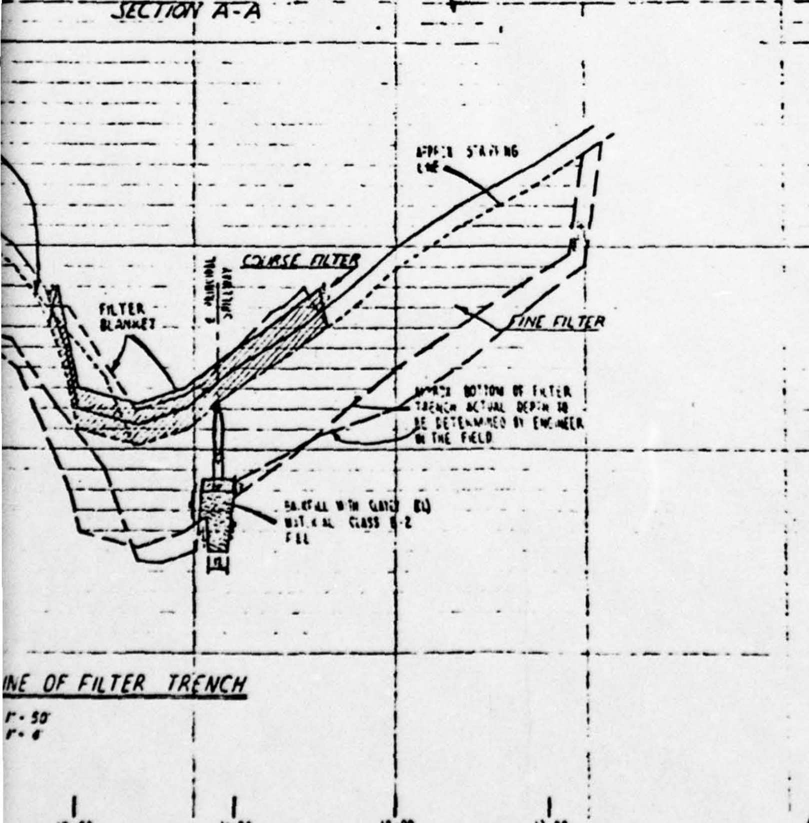


TYPICAL SECTION OF FILTER TRENCH & FILTER BLANKET
SCALE: 1"=100'



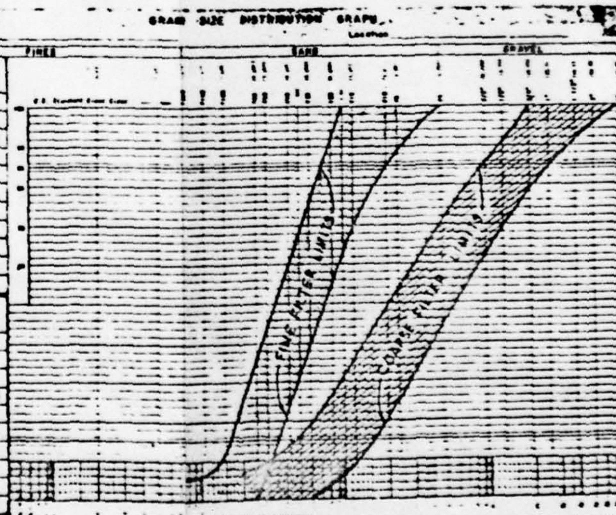
TYPICAL SECTION OF FILTER TRENCH

SECTION A-A



LINE OF FILTER TRENCH

GRAIN SIZE DISTRIBUTION GRAPH



DESIGN DATA FOR FINE FILTER

Sieve No.	% Passing
Nº 4	100
Nº 10	85 - 100
Nº 20	55 - 92
Nº 40	22 - 60
Nº 60	0 - 36
Nº 100	0 - 12
Nº 200	0 - 5

DESIGN DATA FOR COARSE FILTER

Sieve No.	% Passing
3"	100
1½"	95 - 100
¾"	80 - 100
½"	70 - 92
⅜"	62 - 83
Nº 4	45 - 70
Nº 10	20 - 50
Nº 30	0 - 20
Nº 50	0 - 10
Nº 200	0 - 5

AS BUILT PLANS

Note: Approx. Half Scale

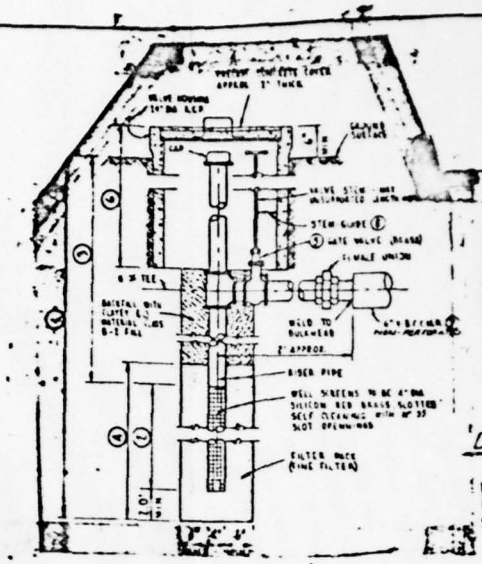
PLATE 7

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
SEEPAGE DRAIN DETAILS "A"

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

C B FORD — JUNE '61
S. C. ROSSIER — 6/61

PA-461-A-P



ITEMS
(1) RELIEF WELL - DRILL TO DEPTH
(2) WELL SCREEN (BOTTOM PLUG)
(3) RISER PIPE 'T' CAP + FITTINGS
(4) FILTER PACK FINE FILTER
(5) VALVE - 4" DIA, BRASS
(6) VALVE HOUSINGS - 24" R.C.P.
(7) OUTLET PIPE - 6" BCCMP
(8) STEM GUIDE

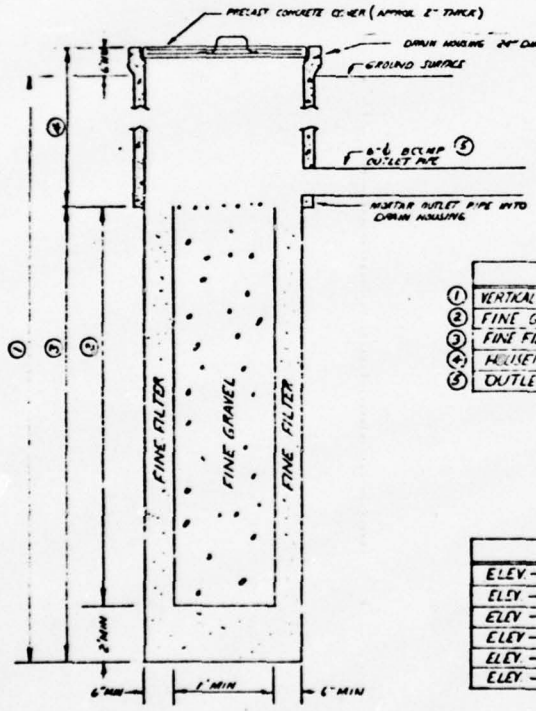
NOTE ALL PIPE & FITTINGS ... OTHERWISE NOTED.

DETAIL & INFORMA...

NOTE ALL PIPE FITTINGS & ... INCLUDING DRILLING OF WEL... SPEC. 19-58.

CROSS SECTION OF RELIEF WELL (ALTERNATE "A")

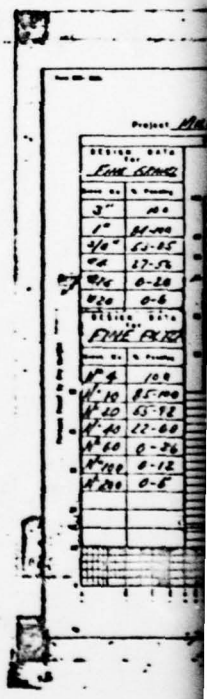
VERTICAL DRAIN (ALTERNATE "B")



ITEMS	#1	#2	#1 As Built	#2 As Built
(1) VERTICAL DRAIN DRILLING DEPTH	27'	25'	26.9	26.1
(2) FINE GRAVEL	17.5'	17.5'	17.5	18.5
(3) FINE FILTER	19.5'	19.5'	19.5	20.5
(4) HOUSEINGS - 24" RCP W COVER	20'	6.0'	2.0	6.0
(5) OUTLET PIPE - 6" BCCMP	310	330	322	322

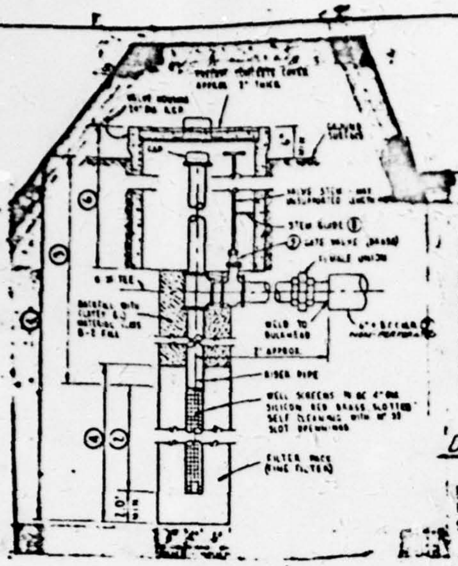
POSITION	#1	#2	#1 As Built	#2 As Built
ELEV — GROUND	1202.0	1202.5	1199.4	1200.4
ELEV — TOP OF GRAVEL	1200.5	1200.5	1197.0	1200.0
ELEV — BOTTOM OF GRAVEL	1183.0	1183.0	1180.0	1182.0
ELEV — BOTTOM OF HOLE	1181.0	1181.0	1179.5	1179.5
ELEV — OUTLET 6" ϕ BCCMP	1199.0	1199.5	1194	1199.0
ELEV — INLET 6" ϕ BCCMP	1200.7	1201.7	1198.4	1200.1

NOTE: ALL ELEVATIONS ARE APPROXIMATE. FINAL ELEVATIONS ARE TO BE DETERMINED BY THE ENGINEER IN THE FIELD.



AS B...

Note: App...



CROSS SECTION OF RELIEF WELL (ALTERNATE "A")

	ITEMS	#1	#2
1	RELIEF WELL - DRILLING DEPTH	21.0'	25.0
2	WELL SCREEN W/BOTTOM PLUG #35 4"	6.0'	6.0
3	RISER PIPE W/CAP + FITTINGS	11.0'	15.0
4	FILTER PACK FINE FILTER (#1)	12.0'	12.0
5	VALVE - 4" DIA, BRASS	1	1
6	VALVE HOUSINGS - 24" RCP W/COVER	2'	6
7	OUTLET PIPE - 6" BCCMP	300	320
8	STEM GUIDE	NONE	2

NOTE: ALL PIPE & FITTINGS GALVANIZED UNLESS OTHERWISE NOTED.

POSITION	#1	#2
ELEV - GROUND	1202.0	1206.0
ELEV - ⊄ VALVE	1200.0	1200.0
ELEV - TOP SCREEN	1191.0	1191.0
ELEV - BOTTOM SCREEN	1183.0	1183.0
ELEV - BOTTOM OF HOLE	1181.0	1181.0
ELEV - OUTLET	1199.0	1199.0

NOTE: ALL ELEV ARE APPROX. FINAL ELEV TO BE DETERMINED BY ENGINEER IN FIELD.

DETAIL & INFORMATION PERTAINING TO RELIEF WELLS #1 & #2

NOT TO SCALE

NOTE: ALL PIPE FITTINGS & OTHER MATERIALS REQUIRED FOR INSTALLATION OF RELIEF WELLS INCLUDING DRILLING OF WELLS TO BE FURNISHED BY THE CONTRACTOR. SEE STD CONST. SPEC. 19-50.

24" DIA RCP

...E INTO

ITEMS	#1	#2	As Built #1	As Built #2
...ERTICAL DRAIN DRILLING DEPTH	21'	25'	21.9	26.1
...FINE GRAVEL	12.5'	12.5'	17.9	18.5
...FINE FILTER	19.5'	19.5'	19.5	20.5
...HOUSEINGS - 24" RCP W COVER	2.0'	6.0'	2.0	6.0
...OUTLET PIPE - 6" BCCMP	310	330	32.2	32.2

POSITION	#1	#2	As Built #1	As Built #2
ELEV. — GROUND	1202.0	1206.0	1199.4	1205.4
ELEV. — TOP OF GRAVEL	1200.5	1200.5	1197.0	1200.0
ELEV — BOTTOM OF GRAVEL	1183.0	1183.0	1180.0	1182.0
ELEV — BOTTOM OF HOLE	1181.0	1181.0	1177.5	1179.5
ELEV. — OUTLET 6" ϕ BCCMP	1199.0	1199.0	1197.4	1199.0
ELEV. — INLET 6" ϕ BCCMP	1200.7	1200.7	1198.4	1200.1

...TE: ALL ELEVATIONS ARE APPROXIMATE. FINAL ELEVATIONS ARE TO BE DETERMINED BY THE ENGINEER IN THE FIELD.

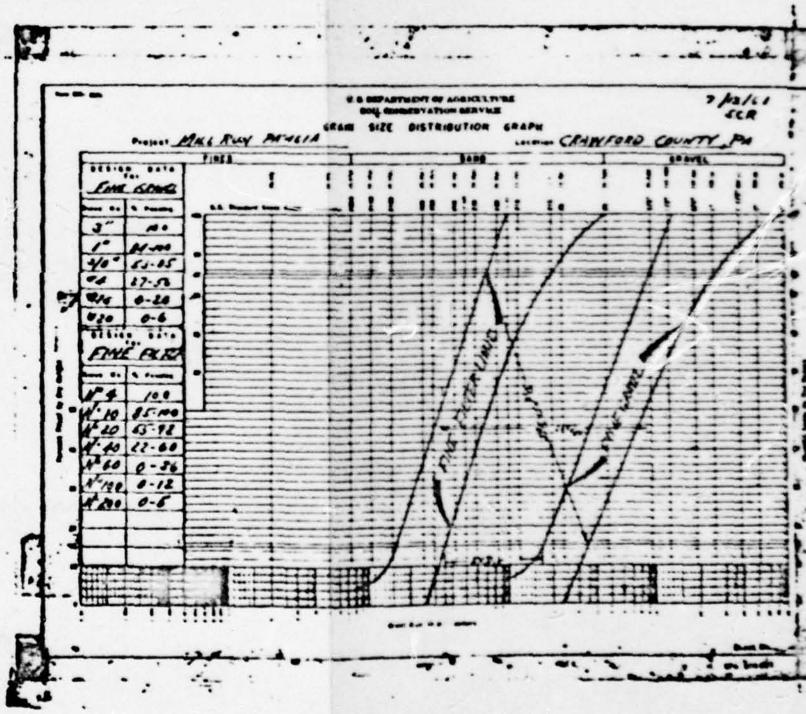


PLATE 8

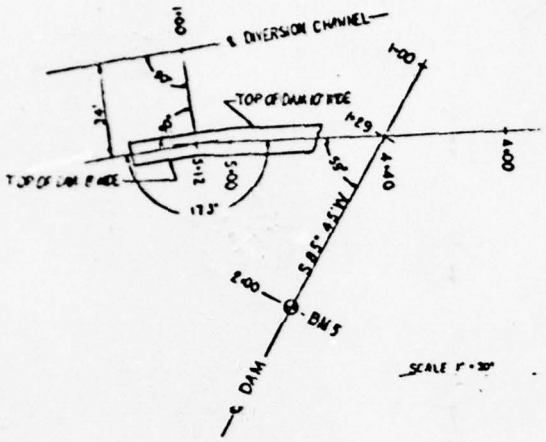
MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
SEEPAGE DRAIN DETAILS "A"

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FRED D. THEURER		
B.J. GERMANA	JUNE 61	
H.T. BROWNING, JR		
C.B. FORD	JUNE 61	
GERMAN B.KERMAK	AUG 61	
S.C. ROSSIER	JUNE 61	PA-461-A-P

AS BUILT PLANS

Note: Approx. Half Scale

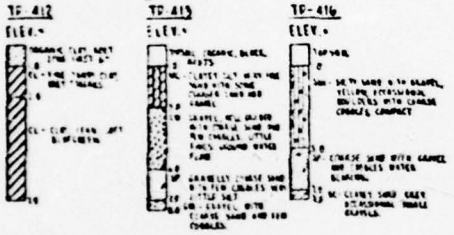


CENTERLINE LAYOUT OF DIVERSION DAM

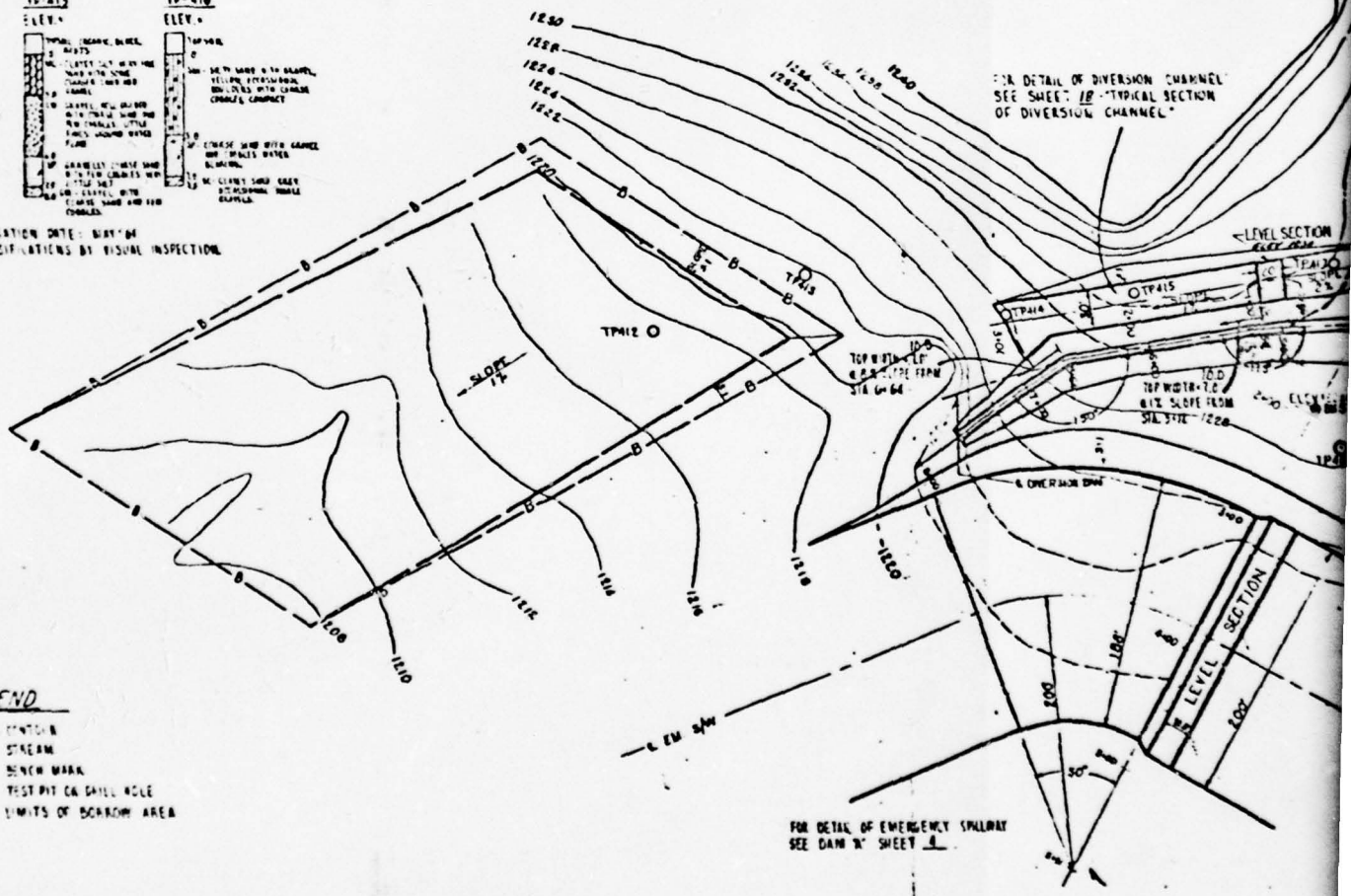
NORTH MAGNETIC

GENERAL NOTES ("DIVERSION DAM")

1. ENTIRE AREA UNDER FILL, DIVERSION CHANNEL, AND BORROW AREA TO BE CLEARED AND GRUBBED. SPEC 2-58
2. NORMAL POOL AREA TO BE CLEARED. SPEC 1-58
3. TOPSOIL SHALL BE REMOVED FROM THE AREA UNDER FILL AND DIVERSION CHANNEL AND STOCKPILED OR DISPOSED OF AS DIRECTED BY THE ENGINEER. SPEC 4-58
4. ALL EXCAVATION SHOWN ON THESE DRAWINGS TO BE CLASSIFIED AS COMMON. SPEC 4-58



EXPLORATORY INVESTIGATION DATE: MAY '58
VERIFIED FOR CLASSIFICATIONS BY VISUAL INSPECTION



LEGEND

- 1234 — CONTOUR
- STREAM
- BENCH MARK
- TEST PIT OR DRILL HOLE
- B—B LIMITS OF BORROW AREA

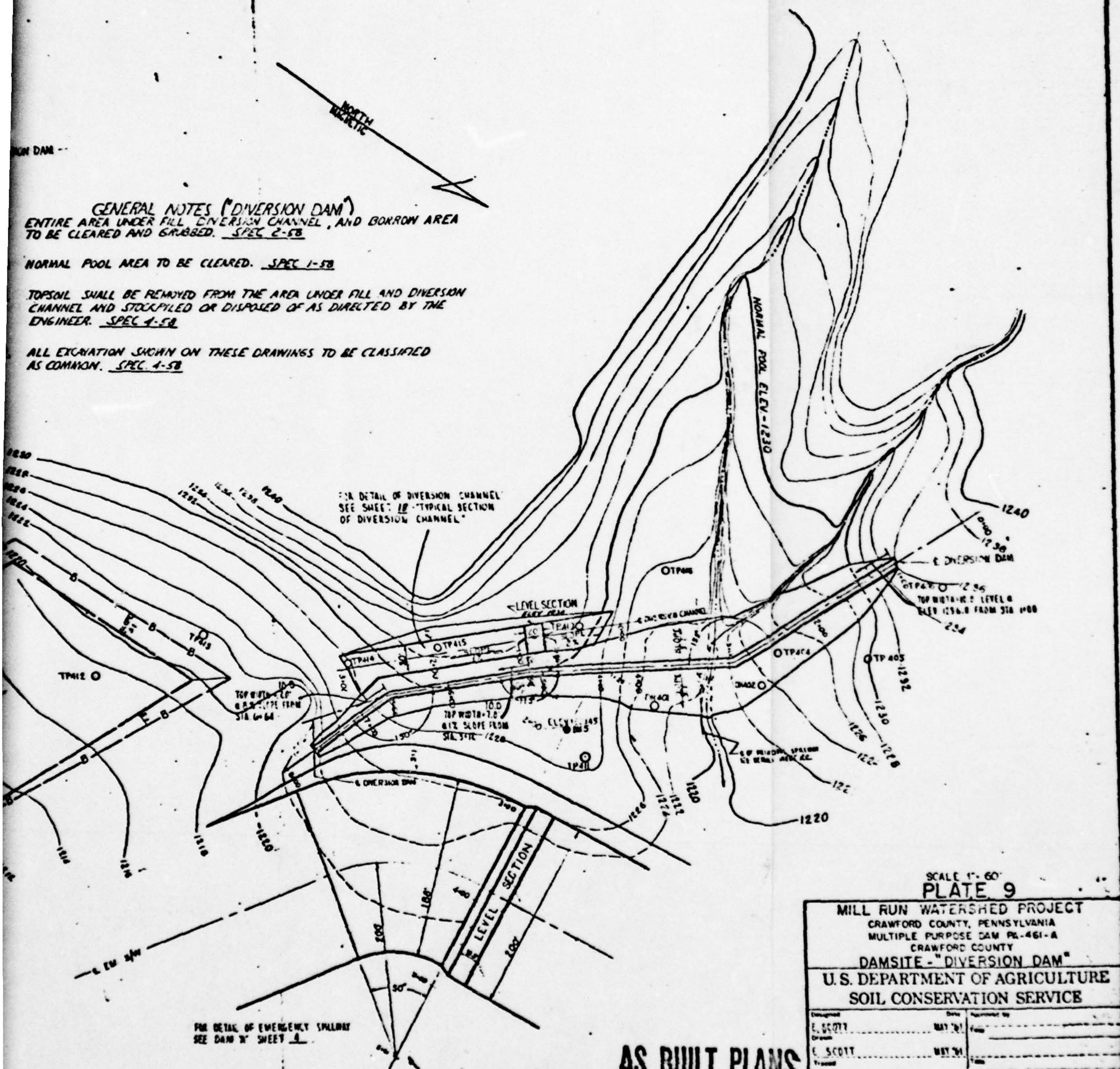
GENERAL NOTES ("DIVERSION DAM")

ENTIRE AREA UNDER FILL, DIVERSION CHANNEL, AND BORROW AREA TO BE CLEARED AND GRUBBED. SPEC 2-58

NORMAL POOL AREA TO BE CLEARED. SPEC 1-58

TOPSOIL SHALL BE REMOVED FROM THE AREA UNDER FILL AND DIVERSION CHANNEL AND STOCKPILED OR DISPOSED OF AS DIRECTED BY THE ENGINEER. SPEC 4-58

ALL EXCAVATION SHOWN ON THESE DRAWINGS TO BE CLASSIFIED AS COMMON. SPEC. 4-58



SCALE 1" = 60'

PLATE 9

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
DAMSITE - "DIVERSION DAM"

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed E. SCOTT	MAY '61	Approved by
Drawn E. SCOTT	MAY '61	
Checked G. J. MERCER	MAY '61	Drawing No. PA-461-A-P

AS BUILT PLANS

Note: Approx. Half Scale

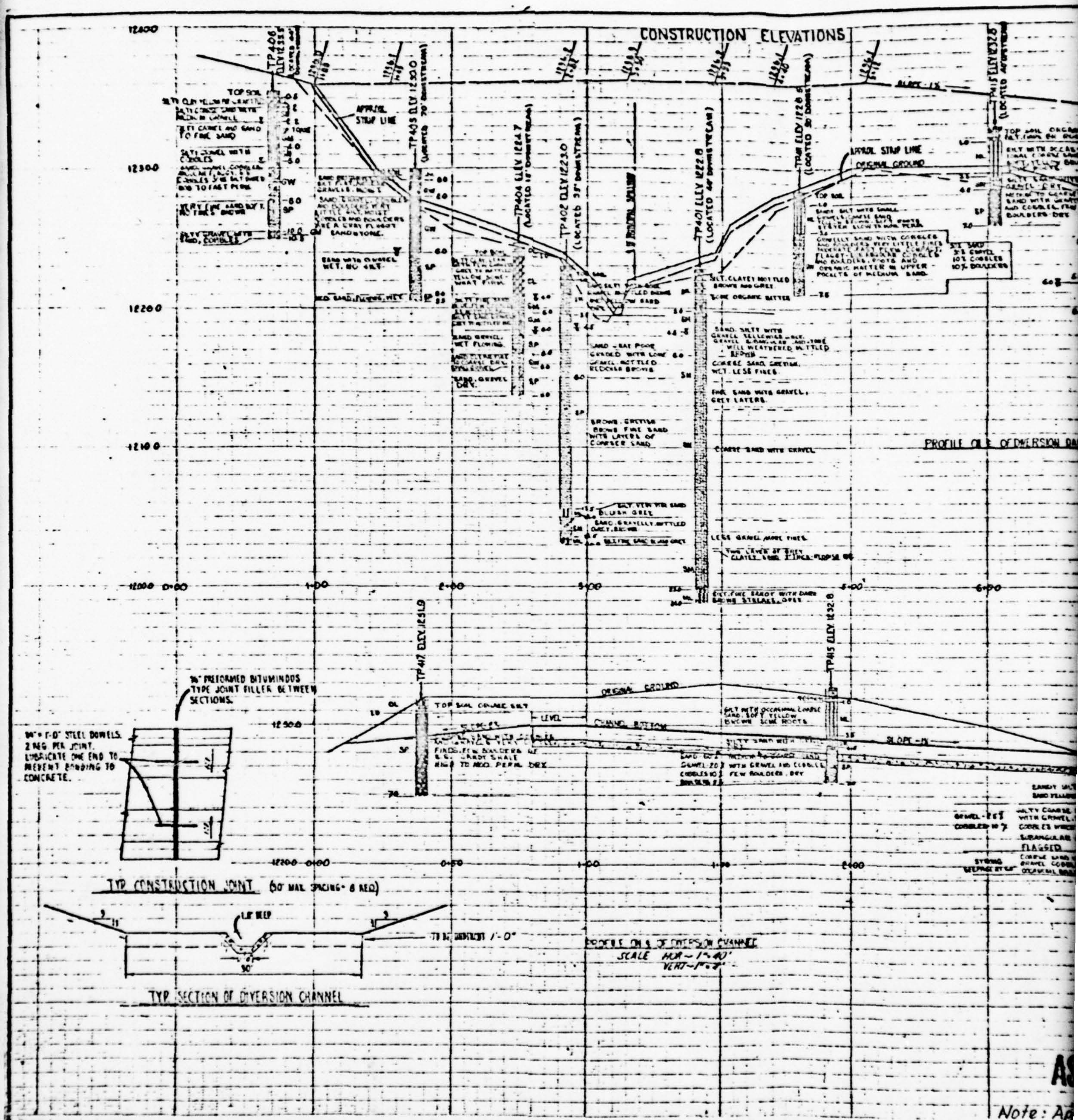
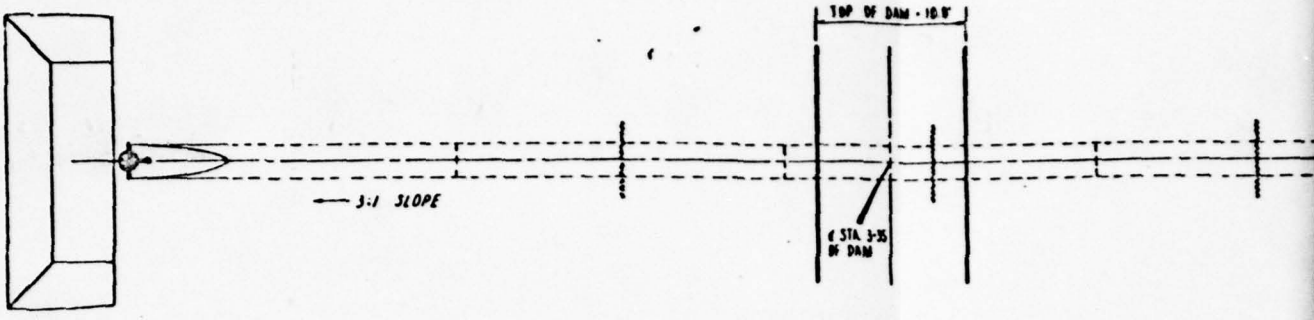

CONSTRUCTION ELEVATIONS
TP406
TP403
TP404
TP402
TP401
TP411
TP417
TP415
APPROX. STRIP LINE
ORIGINAL GROUND
CHANNEL BOTTOM
LEVEL
SLOPE - 1%
PROFILE ON ⊈ OF DIVERSION DA
1/2" PREFORMED BITUMINOUS TYPE JOINT FILLER BETWEEN SECTIONS.
TYP CONSTRUCTION JOINT (50' MAX SPACING - 8 REQ)
TYP SECTION OF DIVERSION CHANNEL
PROFILE ON ⊈ OF DIVERSION CHANNEL
SCALE HOR - 1"=40'
VERT - 1"=8'
Note: A

PLATE 10

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
PROFILES - "DIVERSION DAM"

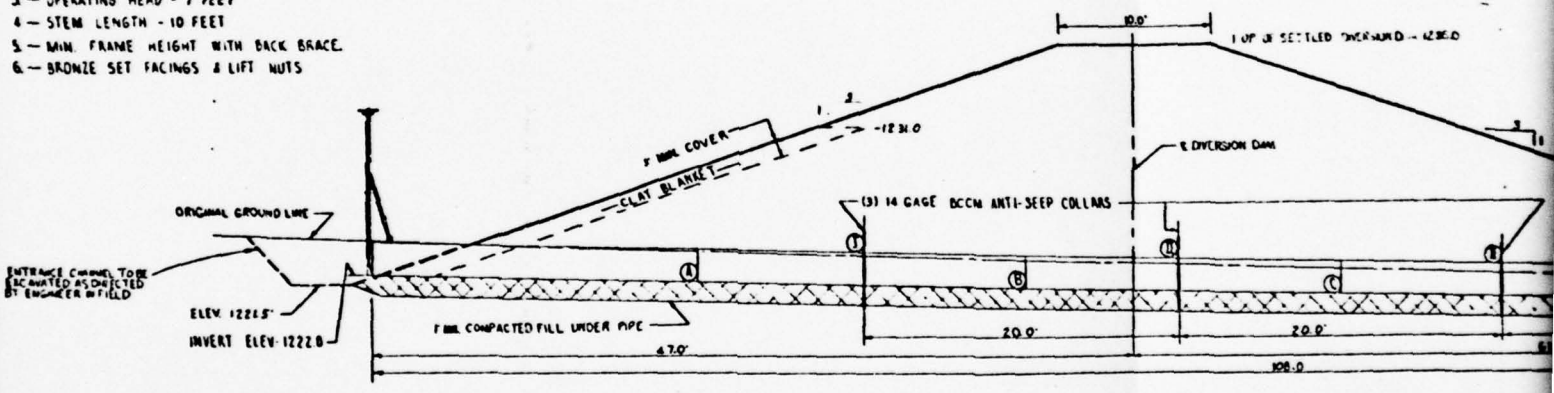
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	J. SCOTT	Approved by	
Drawn	J. SCOTT 5/1961	Title	
Traced		Title	
Checked	F.D. THEURER	Sheet No. 10 of 20 Sheets	Drawing No. PA-461-A-P



SLIDE GATE NOTES — CHANGED (see Revised Drawings)

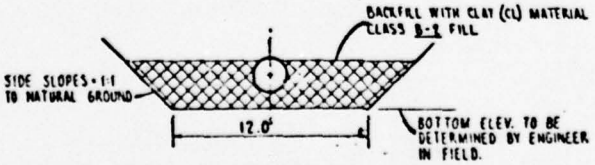
1 — 24" SLIDE GATE - ARMCO MODEL 101C OR APPROVED EQUAL.
2 — LIFT - H-14 REMOVABLE
3 — OPERATING HEAD - 7 FEET
4 — STEM LENGTH - 10 FEET
5 — MIN. FRAME HEIGHT WITH BACK BRACE.
6 — BRONZE SET FACINGS & LIFT NUTS



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

SCALE 1" = 50'

NOTE:
THE PIPE SHALL BE DOUBLE RIVETED, ASBESTOS BONDED, ASPHALT COATED, PAVED INVERT, AND HAVE WATERTIGHT CONNECTING BANDS. THE MINIMUM GAUGE OF PIPE SHALL BE 14 GAUGE.

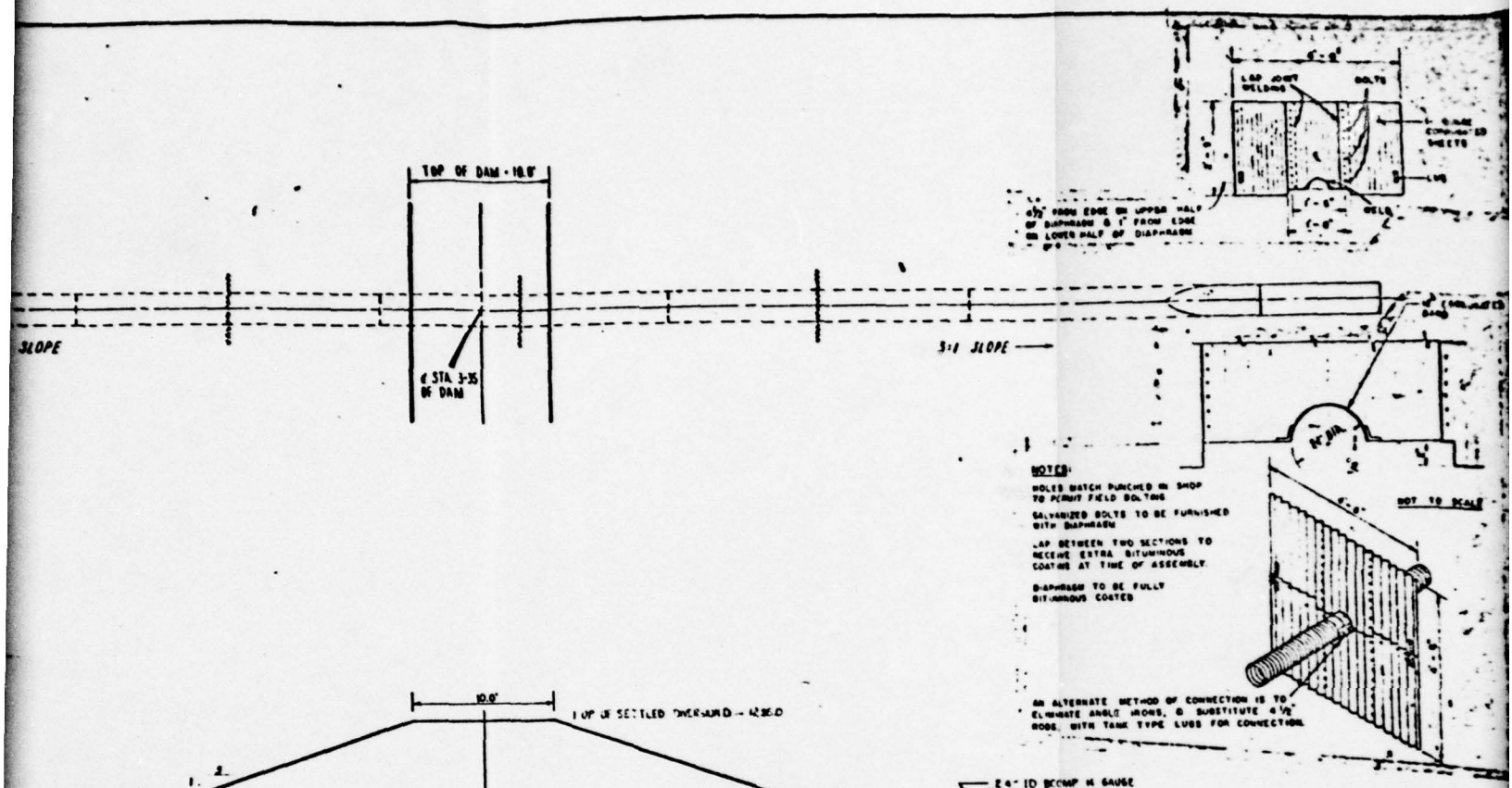


TYPICAL SECTION OF PRINCIPAL SPILLWAY TRENCH

POINT	DISTA...
INLET	
A	
B	
C	
D	
E	
OUTLET	
I	
II	
III	

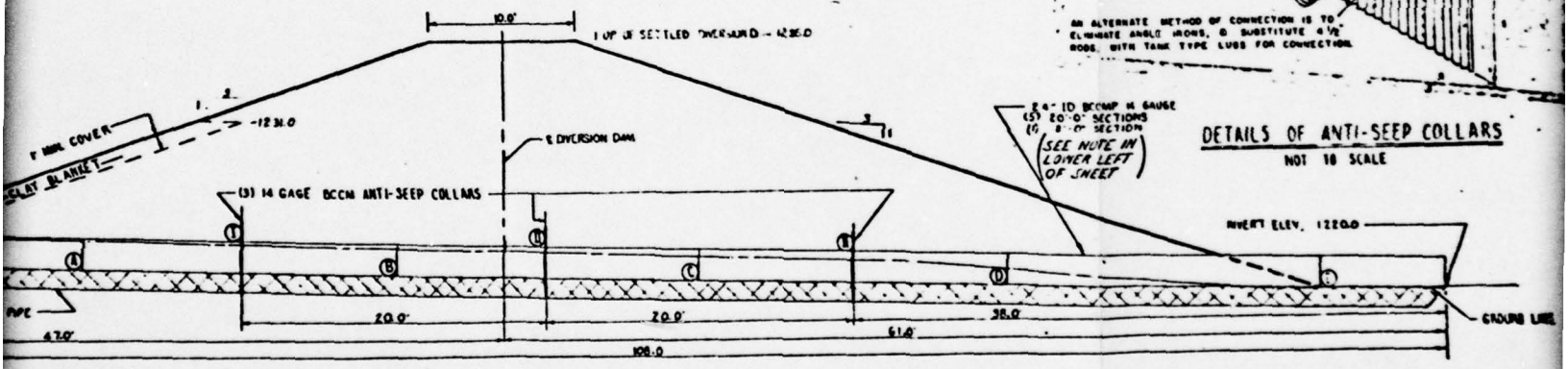
NOTE: PI...

Note: A...



DETAILS OF ANTI-SEEP COLLARS

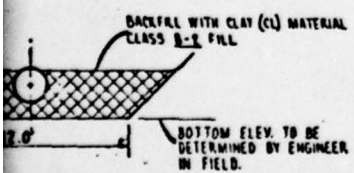
NOT TO SCALE



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

SCALE 1"=50'

NOTE: LINE AND GRADE OF EXIT CHANNEL TO BE TIED IN WITH EXISTING CHANNEL BY ENGINEER IN FIELD



RINCIPAL SPILLWAY TRENCH

POINT	DISTANCE FROM INLET END	INVERT ELEV OF 24" PIPE
INLET	0	1222.00
A	20	1221.60
B	40	1221.20
C	60	1220.80
D	80	1220.40
E	100	1220.00
OUTLET	108	1220.00
I	30	1221.40
II	90	1221.00
III	70	1220.60

NOTE: PIPE LENGTHS ARE NOMINAL AND DO NOT INCLUDE CREEP.

AS BUILT PLANS

Note: Approx. Half Scale

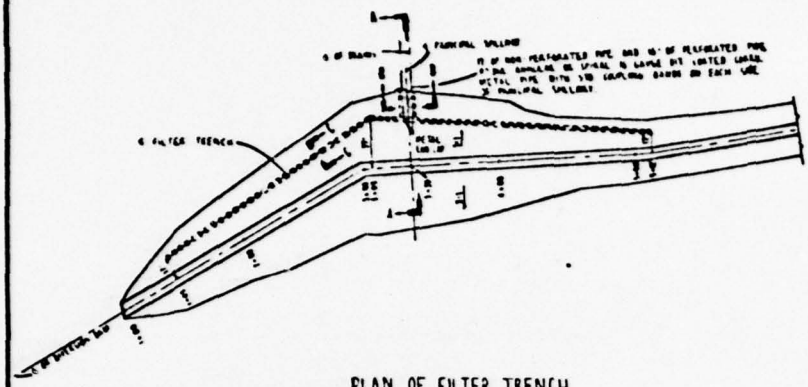
PLATE II

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
PLAN- PROFILE OF PRINCIPAL SPILLWAY, "DIVERSION"

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

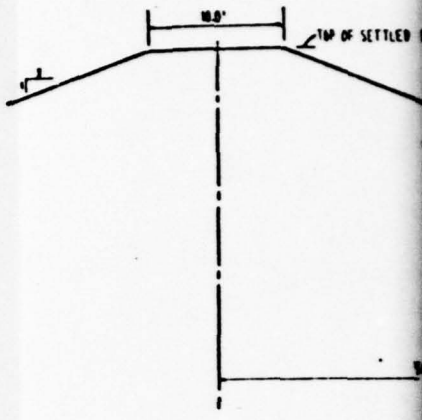
Designed E. SCOTT	Date MAY '61	Approved by	
Drawn E. SCOTT	MAY '61	Title	
Traced		Title	
Checked E.J. MEAGER	✓ JUNE '61	Scale No. 20 of 20	Drawing No. PA-461-

2.

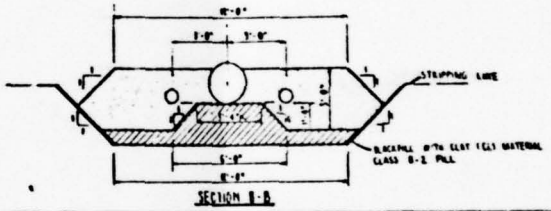


PLAN OF FILTER TRENCH

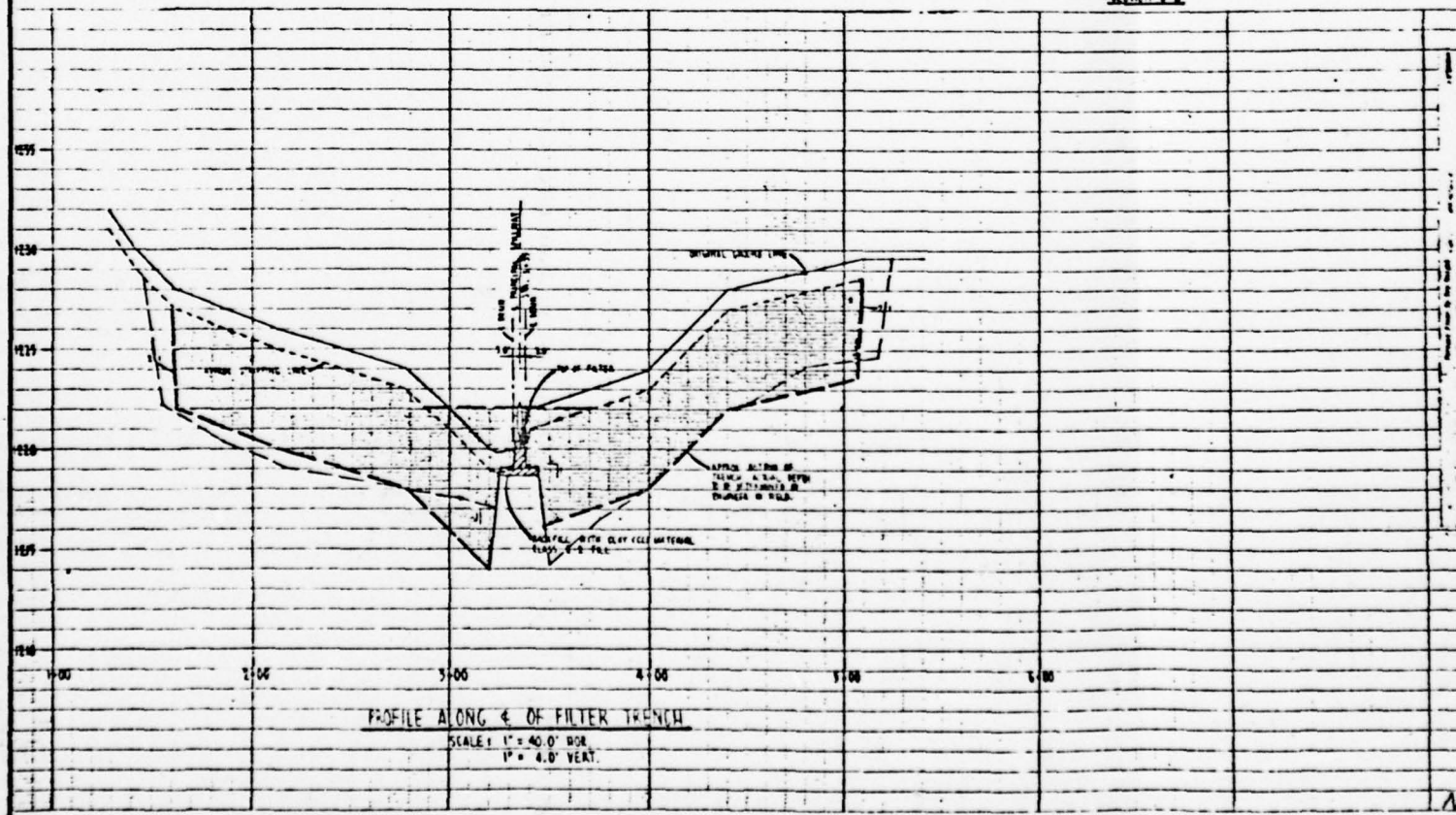
SCALE: 1" = 60.0'



SECTION A-A



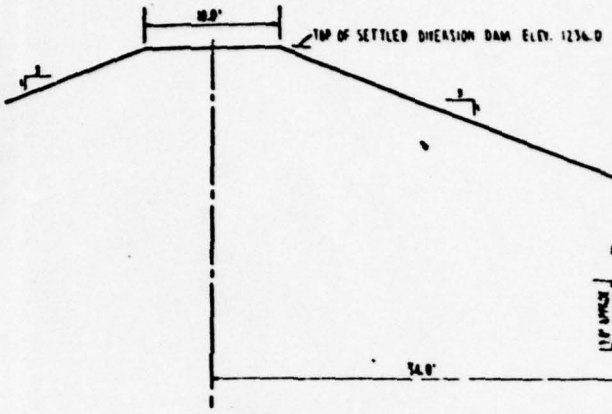
SECTION B-B



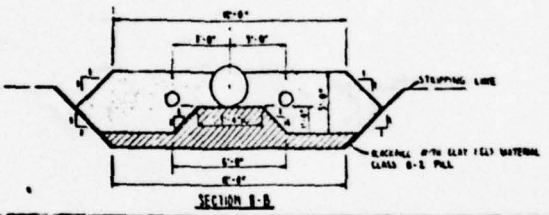
PROFILE ALONG ℄ OF FILTER TRENCH

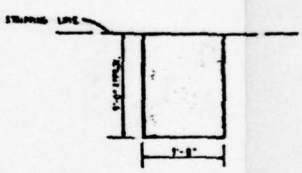
SCALE: 1" = 40.0' HOR.
1" = 4.0' VERT.

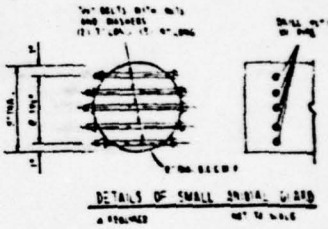
Note:

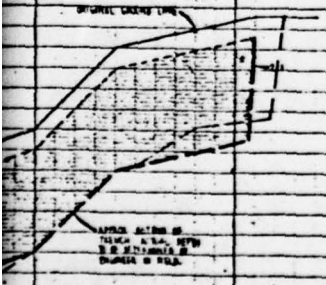


SECTION A-A









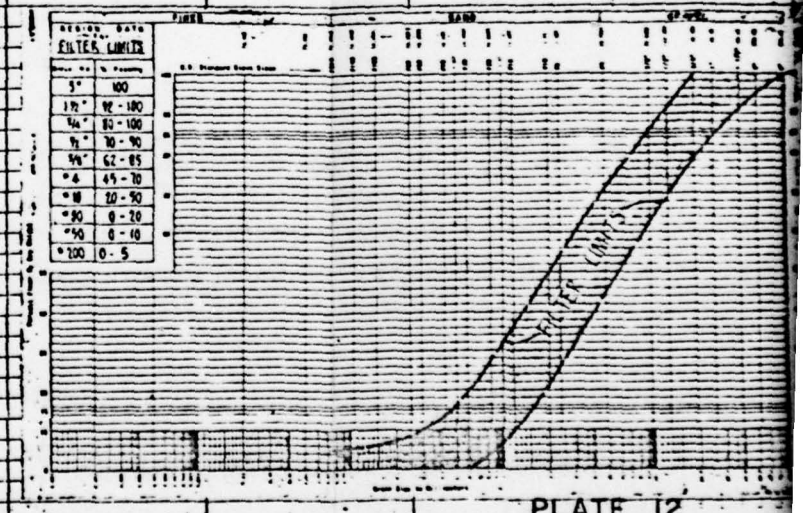


PLATE 12

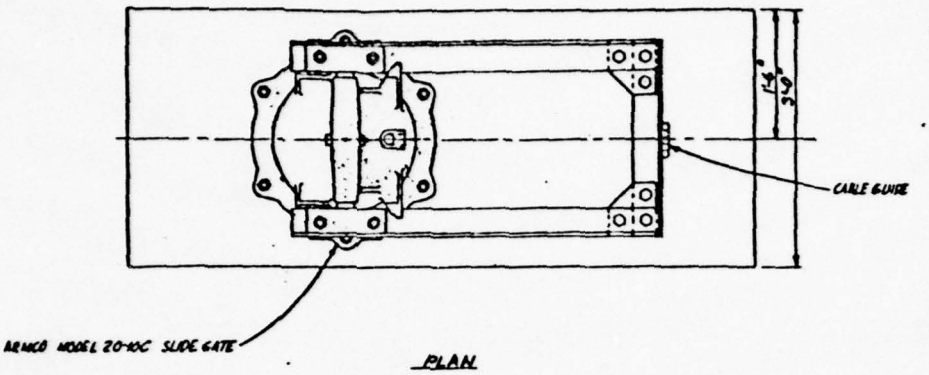
MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
CRAWFORD COUNTY
SEEPAGE DRAIN DETAILS - DIVERSION D

U.S. DEPARTMENT OF AGRICULTUR
SOIL CONSERVATION SERVICE

Designed Fred D. Theurer 6/61
Drawn W. H. MORGAN APR 61
Traced
Checked S. C. ROSSIER 6/61
Approved by
Title
Date
Sheet No. 12
Drawing No. PA-461-

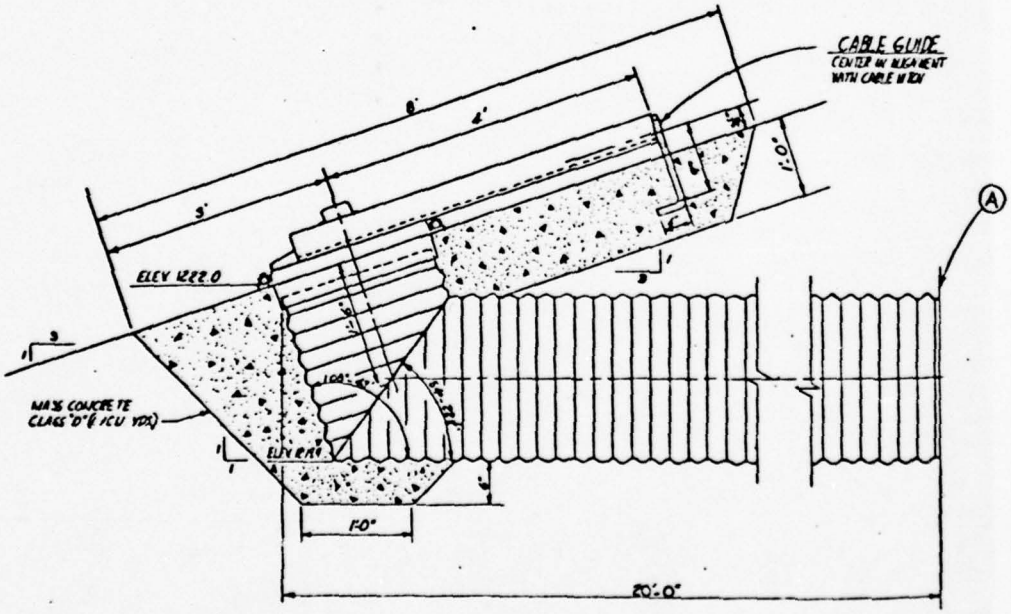
AS BUILT PLANS

Note: Approx. Half Scale



PLAN

SLIDE GATE INSTALLATION
(SCALE 1"=1'-0")



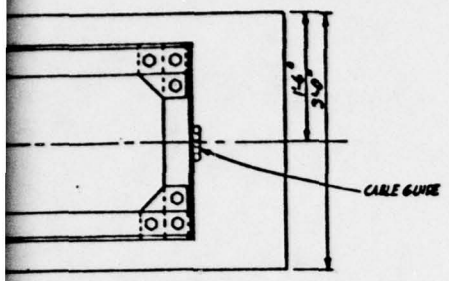
SIDE ELEVATION

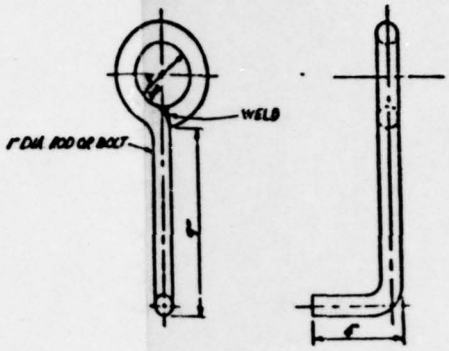
POINT	
INLET	
A	
B	
C	
D	
E	
OUTLET	
I	
II	
III	

NOTE:

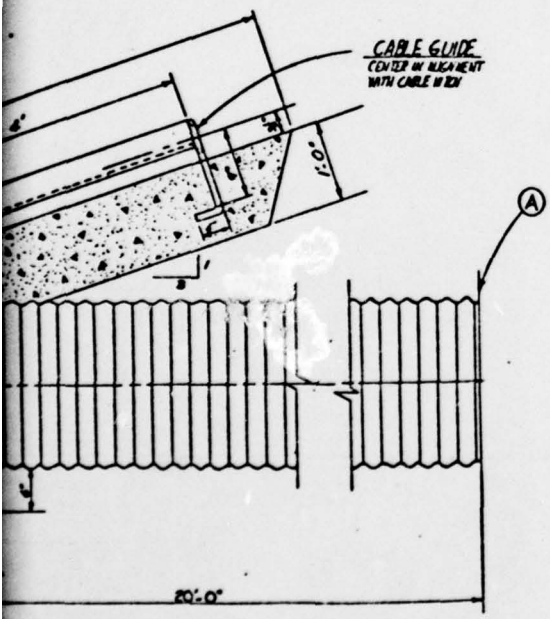
Note: Ap

CABLE GUIDE DETAIL
(NOT TO SCALE)





INSTALLATION
(1"=1'-0")



SIDE ELEVATION

GENERAL NOTES

1. 24" SLIDE GATE - ARMCO MODEL 20-40C OR APPROVED EQUAL (MODIFIED TO OPEN WITH CABLE) MODIFICATION TO BE APPROVED BY ENGINEER
2. OPERATING HEAD - 7'
3. MIN FRAME HEIGHT - 46"
4. "SPIGOT BACK
5. BRONZE SEAT FACINGS
6. ANCHOR BOLTS WILL BE LOCATED ACCORDING TO MANUFACTURES RECOMMENDATIONS

POINT	DISTANCE FROM INLET END	INVERT ELEV OF 24" PIPE
INLET	0	1219.90
A	20	1219.80
B	40	1219.70
C	60	1219.50
D	80	1219.20
E	100	1218.90
OUTLET	108	1218.80
I	30	1219.75
II	50	1219.60
III	70	1219.35

NOTE PIPE LENGTHS ARE NOMINAL AND DO NOT INCLUDE C BELL

PLATE 13

MILL RUN WATERSHED PROJECT
CRAWFORD COUNTY, PENNSYLVANIA
MULTIPLE PURPOSE DAM PA-461-A
"MODIFICATION"
PLAN-PROFILE OF PRINCIPAL SPILLWAY "DIVERSION D

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	W D CARPENTER	Date 9 APR 62	Submitted by
Drawn	PA STALTER	9 APR 62	Title
Traced			
Checked	LEWIS WALL	11 APR 62	Drawing No. PA-461-A-P

AS BUILT PLANS

Note: Approx. Half Scale

APPENDIX A

CHECK LIST - VISUAL INSPECTION AND FIELD SKETCHES

Check List
Visual Inspection
Phase 1

Name of Dam Tamarack Lake Dam "A" **County** Crawford **State** PA **Coordinates** **Lat.** 41° 36.9'
NDI # PA 00181
PennDER # 20-47A
SCS # PA 461A
Long. 80° 07.0'

Date of Inspection 29 Nov. 1978 Weather Overcast, windy Temperature 30°F.

Pool Elevation at Time of Inspection 1216.7 ft.* M.S.L. Tailwater at Time of Inspection 1198.6 ft.* M.S.L.

*All elevations are referenced to the elevation of the principal spillway crest (El. 1216.0 ft.).

Inspection Personnel:

Michael Baker, Jr., Inc.:

David F. Johns
Rodney E. Holderbaum
James G. Ulinski

Owner's Representatives
Pennsylvania Fish Commission:

E. Jon Grindall
Senior Project Engineer
Bureau of Fisheries and Engineering

Melvin W. Dinger
Maintenance Foreman
Region I

James G. Ulinski **Recorder**

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

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

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Vehicles tracks were observed on the dam, diversion dam, and emergency spillway. No other problems were observed.	Areas should be reseeded.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No problems were observed.	
RIPRAP FAILURES	No riprap failures were observed.	The riprap would not protect the upstream face of the dam during high pools.

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DIVERSION DAM	No significant problems were observed at the diversion dam. The pond drain was open at the time of inspection and no water was impounded. A minor amount of flow was observed exiting the seepage drain outlets on both sides of the outlet conduit.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems were observed.	
ANY NOTICEABLE SEEPAGE	Seepage was observed at the toe of the embankment to the left of the outlet conduit. No migration of fine material was observed. The volume of flow from the area was estimated at 1 g.p.m.	The potential for migration of fines and resulting problems for this seepage can be reduced or eliminated by the proper operation (or installation) of relief wells. In addition, this area should be observed frequently in the future.
STAFF GAGE AND RECORDER	None	
DRAINS	Two relief wells shown on the "as built" drawings (see Plates 7 and 8) were not inspected in the field by the inspection team. However, a corrugated metal drainpipe was observed exiting into the plunge pool from the right side and a concrete manhole cover was observed (but not opened) on the right side. The volume of flow of this pipe could not be determined because the outlet was below tailwater level. No relief well cover or exit pipe was observed on the left side.	It is recommended that the relief wells be made operational (or installed) and properly maintained.

OUTLET WORKS

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet conduit, at its exit, is in very good condition.	At the time of the inspection, the conduit was flowing partially full.
INTAKE STRUCTURE	No deterioration of the structure's concrete surfaces was observed. The structure is in excellent condition.	
OUTLET STRUCTURE	The outlet conduit exits directly into a natural stilling pool. Both the outlet pipe and stilling pool are in very good condition.	
OUTLET CHANNEL	The outlet channel is free of debris and obstructions. A small road crossing is located several hundred ft. downstream from the outlet.	The road crossing does not appear to cause a serious obstruction to reservoir discharges.
EMERGENCY GATE	A visual inspection of the emergency gate was not possible. The owner, however, reported that the gate is operable.	The owner indicated that the gate is operated biannually to ensure proper operation.

UNGATED SPILLWAY

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTION	No problems were observed in the horizontal and vertical alignment of the control section. The section is well vegetated and free of erosion.	
APPROACH CHANNEL	The approach channel is well vegetated and free of debris and erosion.	
DISCHARGE CHANNEL	The discharge channel appeared to be in very good condition. It is well vegetated and free of erosion.	
BRIDGE AND PIERS	Not Applicable	

GATED SPILLWAY - Not Applicable

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

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

INSTRUMENTATION - None

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER		

RESERVOIR

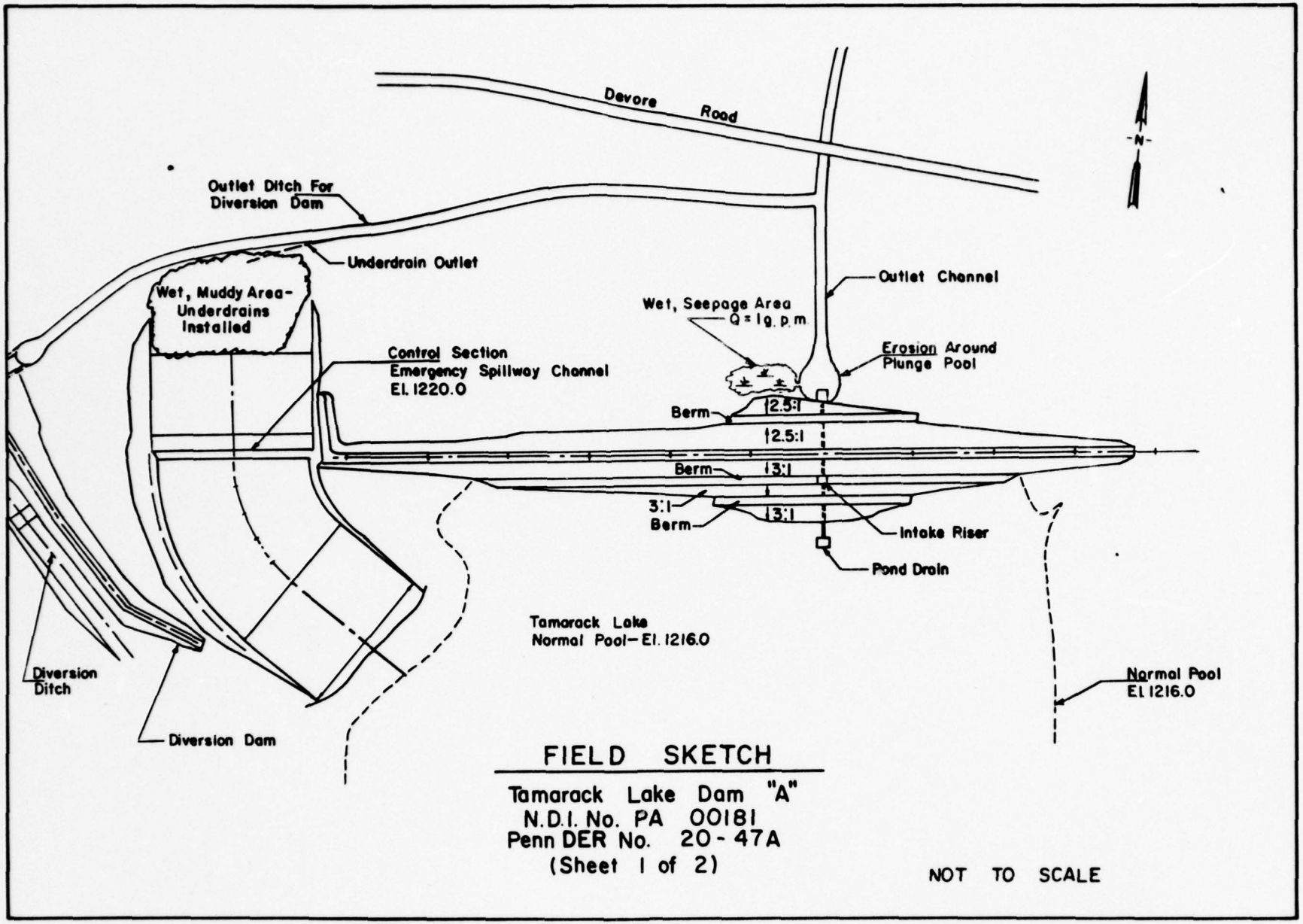
Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are relatively steep. Although some of the watershed is developed, the slopes are primarily wooded or grass covered.	
SEDIMENTATION	Because of the age of the structure and the watershed cover, sedimentation should not present a problem at this time.	

DOWNSTREAM CHANNEL

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

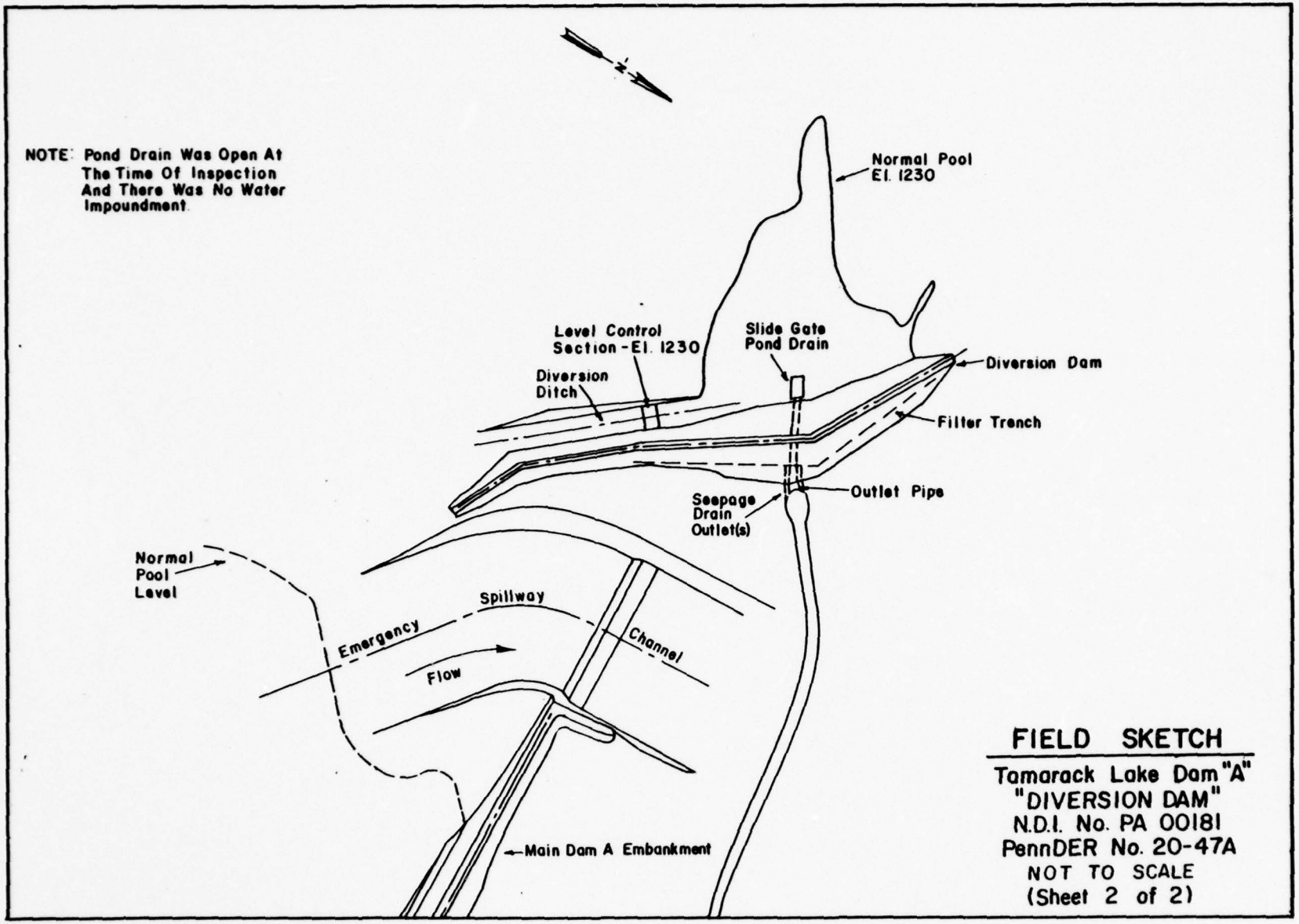
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is free of debris and other obstructions. A small road bridge is located a few hundred ft. downstream from the dam.	
SLOPES	The slope of the downstream channel is mild, averaging less than 1%.	
APPROXIMATE NO. OF HOMES AND POPULATION	Several homes are located downstream between Tamarack Dam "A" and Meadville Dam. The city of Meadville is situated immediately downstream from the Meadville Dam.	



FIELD SKETCH

Tamarack Lake Dam "A"
N.D.I. No. PA 00181
Penn DER No. 20-47A
(Sheet 1 of 2)

NOT TO SCALE



FIELD SKETCH

Tamarack Lake Dam "A"
"DIVERSION DAM"
N.D.I. No. PA 00181
PennDER No. 20-47A
NOT TO SCALE
(Sheet 2 of 2)

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

ITEM	REMARKS
PLAN OF DAM	See Plate 3, Plan of Tamarack Lake Dam "A".
REGIONAL VICINITY MAP	A USGS 7.5 minute topographic quadrangle, Cockranton, Pennsylvania, was used to prepare the vicinity map which is enclosed in this report as the Location Plan (Plate 1).
CONSTRUCTION HISTORY	The dam was designed by the Soil Conservation Service (SCS). The dam was constructed by Bell and Bell Contractors of Eldred, Pennsylvania in 1961 and 1962.
TYPICAL SECTIONS OF DAM	See Plate 5, Typical Dam Sections.
HYDROLOGIC/HYDRAULIC DATA	Some hydrologic/hydraulic data are included in the "Mill Run Watershed Work Plan" report prepared by the Mercer County Commissioners, et. al., March 1960. Other information is included in the Dam Permit Application Report prepared by the Pennsylvania Department of Forests and Waters on 2 August 1961 (in the PennDER files). Prints of the SCS drawings "Freeboard Hydrograph" and "Spillway Hydrograph," dated May 1961, are also in the PennDER files. A summary design report (PA-461-R) contains additional hydrologic and hydraulic information. Design calculations and the design report are available in the SCS Harrisburg office files.
OUTLETS - PLAN AND DETAILS	See Plate 6-Plan and Section of Principal Spillway.
- CONSTRAINTS	None
- DISCHARGE RATINGS	are available in the SCS design files and included as part of Appendix D.
RAINFALL/RESERVOIR RECORDS	No rainfall or reservoir level records are available.

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

ITEM	REMARKS
DESIGN REPORTS	Available in the files of the SCS Harrisburg office.
GEOLOGY REPORTS	Geology information is included in the "Mill Run Watershed Work Plan," PennDER's permit application report, the files of the SCS Harrisburg office, and various Pennsylvania Geological Survey publications.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS	Design computations on these subjects are available in the files of the SCS Harrisburg office.
DAM STABILITY SEEPAGE STUDIES	Summary recommendations from the SCS Soil Mechanics Laboratory in Lincoln, Nebraska are available in a report (3 pp.) available in the SCS Harrisburg office files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See Plates 4, 6, 9, and 10. Additional information is available in the SCS Harrisburg office files.
POST-CONSTRUCTION SURVEYS OF DAM	Presented on "as built" drawings by the SCS. Most are presented as plates of this report; however, all additional plates are available in the SCS Harrisburg office files.
BORROW SOURCES	Excavation for the emergency spillway channel produced some of the material incorporated into the embankment. However, if additional fill material was necessary, the information reviewed did not indicate the source of this material.

Name of Dam: TAMARACK LAKE DAM "A"
NDI # PA 00181

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Most of the modifications (design changes) from the construction period are incorporated into the "as built" drawings. Additional post-construction modifications include installing drainage tiles in the emergency spillway channel to remove the artesian groundwater seepage (1978).
HIGH POOL RECORDS	No reservoir level or high pool records are kept for Tamarack Lake.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	The dam is inspected yearly by personnel from the SCS and the Pennsylvania Fish Commission.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	Yearly inspections are made by the SCS along with the Pennsylvania Fish Commission. Maintenance and operation are reviewed as a part of the inspections and recommendations for corrective action given, if necessary. Yearly summaries of the maintenance performed and schedules for future maintenance are forwarded to the district conservationist of SCS at Clarion, Pennsylvania.

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS, and DETAILS	See Plates 3, 4, and 9.
OPERATING EQUIPMENT PLANS & DETAILS (PRINCIPAL SPILLWAY - SCS)	See Plate 6. Additional structural details are shown on the "as built" drawings available in the SCS Harrisburg office files.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 4.99 sq.mi. (mostly farmland and forest)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1216.0 ft. (3850 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1223.2 ft. (8270 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: 1223.0 ft.

ELEVATION TOP DAM: 1223.2 ft. (Minimum), 1223.0 ft. (Design)

CREST: (SCS Terminology - Emergency Spillway)

a. **Elevation** 1220.0 ft. (control section)
b. **Type** Vegetated earth channel
c. **Width** 188 ft.
d. **Length** Approximately 600 ft.
e. **Location Spillover** At left end of dam
f. **Number and Type of Gates** None

OUTLET WORKS: (SCS Terminology - Principal Spillway)

a. **Type** Concrete riser and 30-in. outlet pipe
b. **Location** Approximately 400 ft. from right abutment of dam
c. **Entrance inverts** El. 1216.0 ft. (low stage), El. 1218.0 ft. (high stage)
d. **Exit inverts** El. 1198.9 ft.
e. **Emergency draindown facilities** 24-in. gated C.M.P.

HYDROMETEOROLOGICAL GAGES: None

a. **Type**
b. **Location**
c. **Records**

MAXIMUM NON-DAMAGING DISCHARGE Unknown

APPENDIX C

PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam

Top Photo - Overall View from Right Abutment Toward Emergency Spillway and Diversion Dam

Bottom Photo - Overall View of Diversion Dam Looking Towards Reservoir

Photo 1 - View of Dam from Junction of Embankment and Emergency Spillway

Photo 2 - View of Principal Spillway Intake, Upstream Slope and Riprap Protection

Photo 3 - View of Principal Spillway Outlet Conduit and Plunge Pool [Drain Outlet at Left (in photo) of Conduit and Seepage Area to Right of the Conduit]

Photo 4 - View of Outlet Channel and Downstream Roadway Culvert

Photo 5 - View of Seepage Area Located to Left of Outlet Conduit

Photo 6 - View Looking Upstream at Emergency Spillway Channel (Diversion Dam Forms Left Abutment of Emergency Spillway Channel Located in Right Portion of Photo)

Photo 7 - View Looking Downstream from Reservoir at Diversion Dam (Emergency Spillway Channel in Right Portion of Photo, Diversion Ditch in Left Portion of Photo, Drained Diversion Pond in Upper Left Center Portion of Photo)

Photo 8 - View of Drained Diversion Pond from Crest of Diversion Dam

Photo 9 - View of Slide Gate Pond Drain Inlet for Diversion Dam Pond

Photo 10 - View of Pond Drain Outlet Conduit and Drain Outlets

Note: Photographs taken on 29 November 1978.

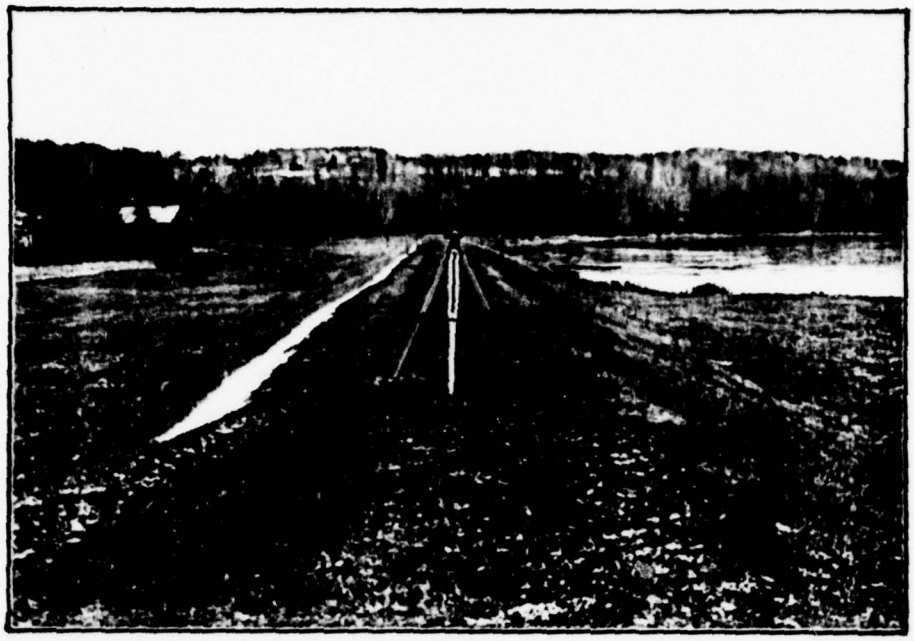


PHOTO 1. View of Dam from Junction of Embankment and Emergency Spillway

PHOTO 2. View of Principal Spillway Intake, Upstream Slope, and Riprap Protection

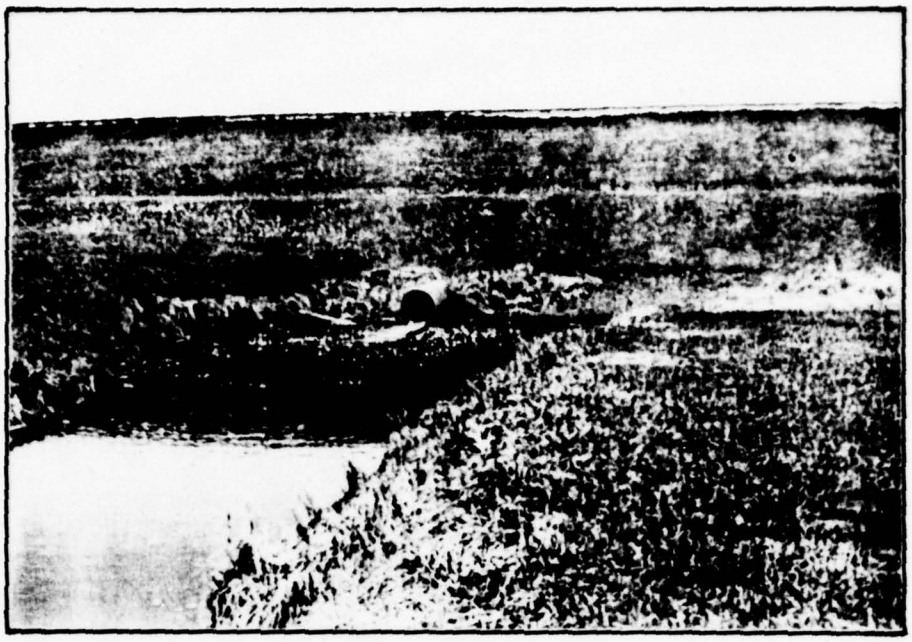


PHOTO 3. View of Principal Spillway Outlet Conduit and Plunge Pool
[Drain Outlet at Left (in Photo) of Conduit and Seepage Area to Right of Conduit]

PHOTO 4. View of Outlet Channel and Downstream Roadway Culvert

PHOTO 5. View of Seepage Area Located to Left of Outlet Conduit

PHOTO 6. View Looking Upstream at Emergency Spillway Channel (*Diversion Dam Forms* Left Abutment of Emergency Spillway Channel Located in Right Portion of Photo)

PHOTO 7. View Looking Downstream from Reservoir at Diversion Dam (Emergency Spillway Channel in Right Portion of Photo, Diversion Ditch in Left Portion of Photo, Drained Diversion Pond in Upper-Left Center Portion of Photo)

PHOTO 8. View of Drained Diversion Pond from Crest of Diversion Dam

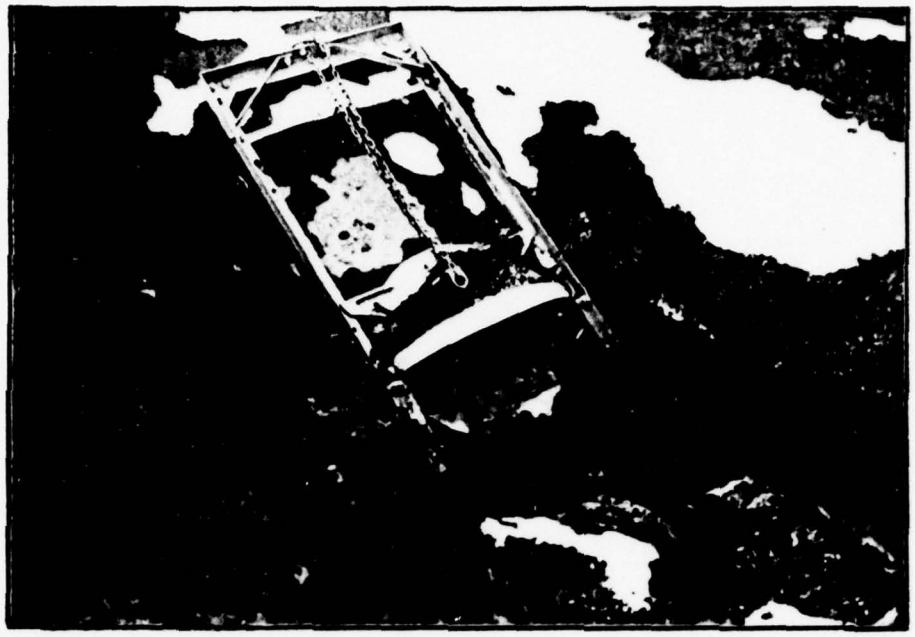


PHOTO 9. View of Slide Gate Pond Drain Inlet for Diversion Dam Pond

PHOTO 10. View of Pond Drain Outlet Conduit and Drain Outlets

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Tamarack Lake - Dam "A" S.O. No. _____

_____ Sheet No. _____ of _____

_____ Drawing No. _____

Computed by _____ Checked by _____ Date _____

Table of Contents

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variation of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

In addition, the conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Tamarack Lake Dam "A" S.O. No.
Rainfall and Hydrograph Data Sheet No. 1 of 11
Drawing No.
Computed by GAS Checked by REH Date 3-5-79

Rainfall: (from HMR-33, all season)

PMP (24 hr. - 200 mi.^{2}) = 23.4 inches

Drainage area = 4.99 mi.^{2} (Zone 2)

P (6 hr.) = 1.11 PMP
P (12 hr.) = 1.27 PMP
P (24 hr.) = 1.41 PMP
P (48 hr.) = 1.51 PMP

Hydrograph Coefficients:

Drainage basin is located in zone 23 (Ohio River Basin)

$T_p = C_T (L^{0.6})$* $C_T = 3.3$

$L = 4800 ft = 0.91$ mile

note: L (length of watercourse) was determined by measuring the lengths of 14 watercourses tributary to the reservoir and using the average of these lengths.

$T_p = 3.3 (0.91)^{0.6} = 3.12$

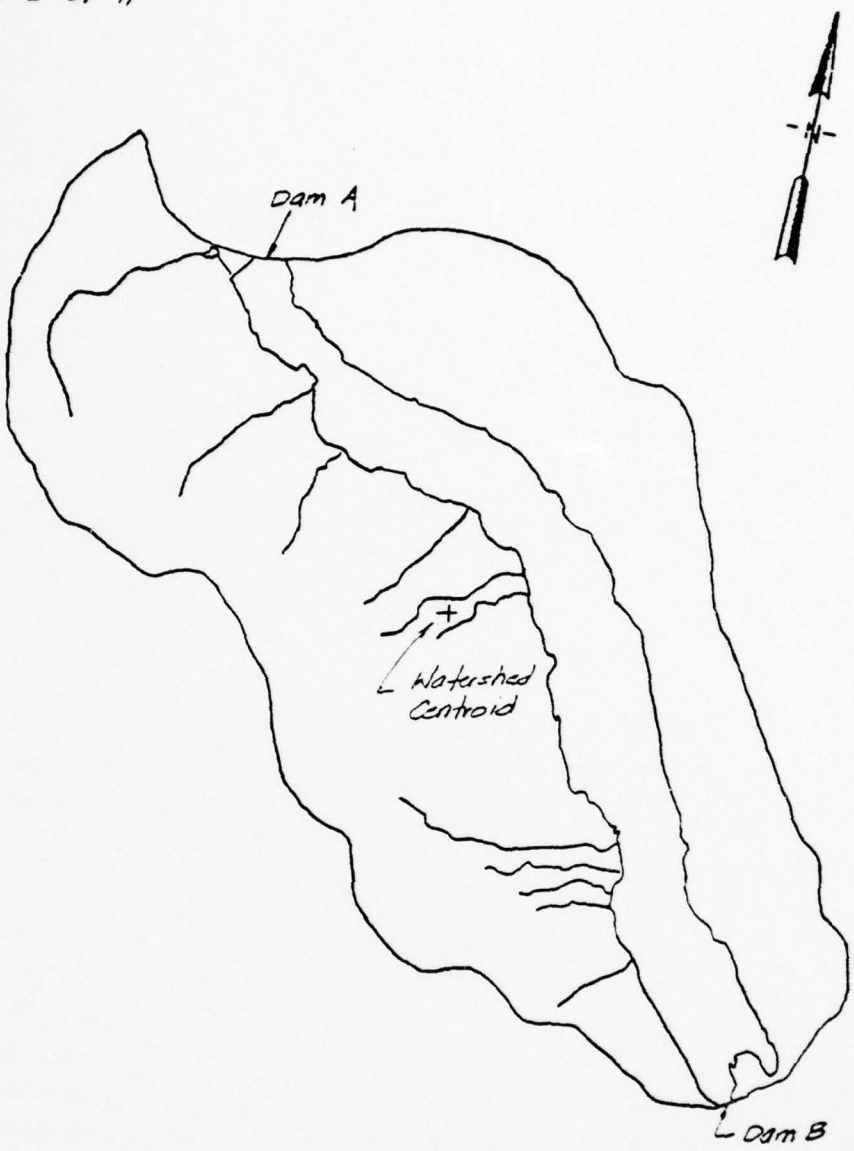
for duration = $3.12/5.5 = 0.57$ hour

For duration = 20 min $T_p = 3.12 + 0.25 (0.33 - 0.57)$

$T_p = 3.06$ hours

$C_p = 0.55$

* This method of analysis was used since the reservoir is longer than the longest watercourse.



0 4000 8000

SCALE IN FEET

U.S.G.S. Quads:
Cochranton
Geneva

D.A. = 4.99 sq. mi.

DATE: 2-22-19

Tamarack Lake Watershed

MICHAEL BAKER JR. INC.
Consulting Engineers & Surveyors

SCALE 1:62500

1 0 1 2 3 4 MILES

30000 0 30000 60000 90000 120000 150000 180000 210000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Tamarack Lake Dams "A" & "B" S.O. No.
Stage vs. Discharge Sheet No. 4 of 11
Drawing No.
Computed by gas Checked by REH Date 3-5-79

The following information was taken from the SCS Design Report for Tamarack Lake.

Stage (elev.)	Discharge Principal Spwy "A"	Discharge Principal Spwy "B"	Discharge Emergency Spwy "A & B"	Discharge "A" Emg. Spwy	Discharge "B" Emg. Spwy
1216	0	0			
1217	6.2	8			
1218	11.0	24			
1219	20.8	84			
1220	48.1	90	0	0	0
1220.9	55.5	91.9	620	330	290
1221.11	63.9	93.1	1775	999	776
1222.51	72.6	95.1	3590	2020	1570
1223.30	79.6	97.1	5413	3047	2368
1223.91	83.4	98.5	7280	4096	3184

Stage (elev.)	Total Discharge Spillway "A"	Total Discharge Spillway "B"	Total Discharge from Reservoir
1216	0	0	0
1217	6.2	8	14
1218	11.0	24	35
1219	20.8	84	105
1220	48.1	90	139
1220.9	385.5	381.9	767
1221.11	1062.9	869.1	1933
1222.51	2092.6	1665.1	3758
1223.30	3126.6	2465.1	5592
1223.91	4179.4	3282.5	7461

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

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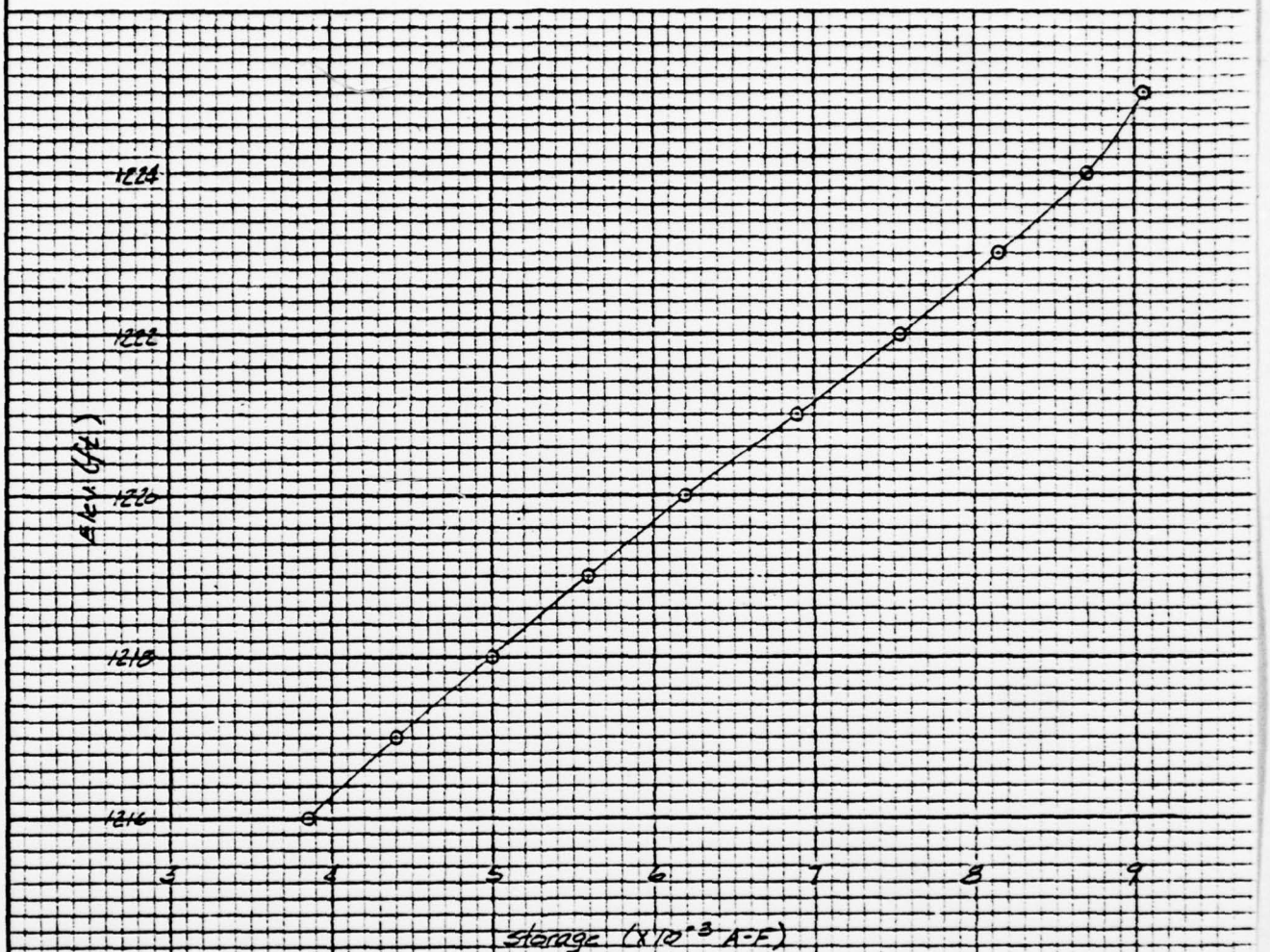
Beaver, Pa. 15009

Subject Tamarack Dams "A" & "B" S.O. No.
Stage vs. Storage Sheet No. 5 of 11
Drawing No.
Computed by REH Checked by g.a.s. Date 3-2-79



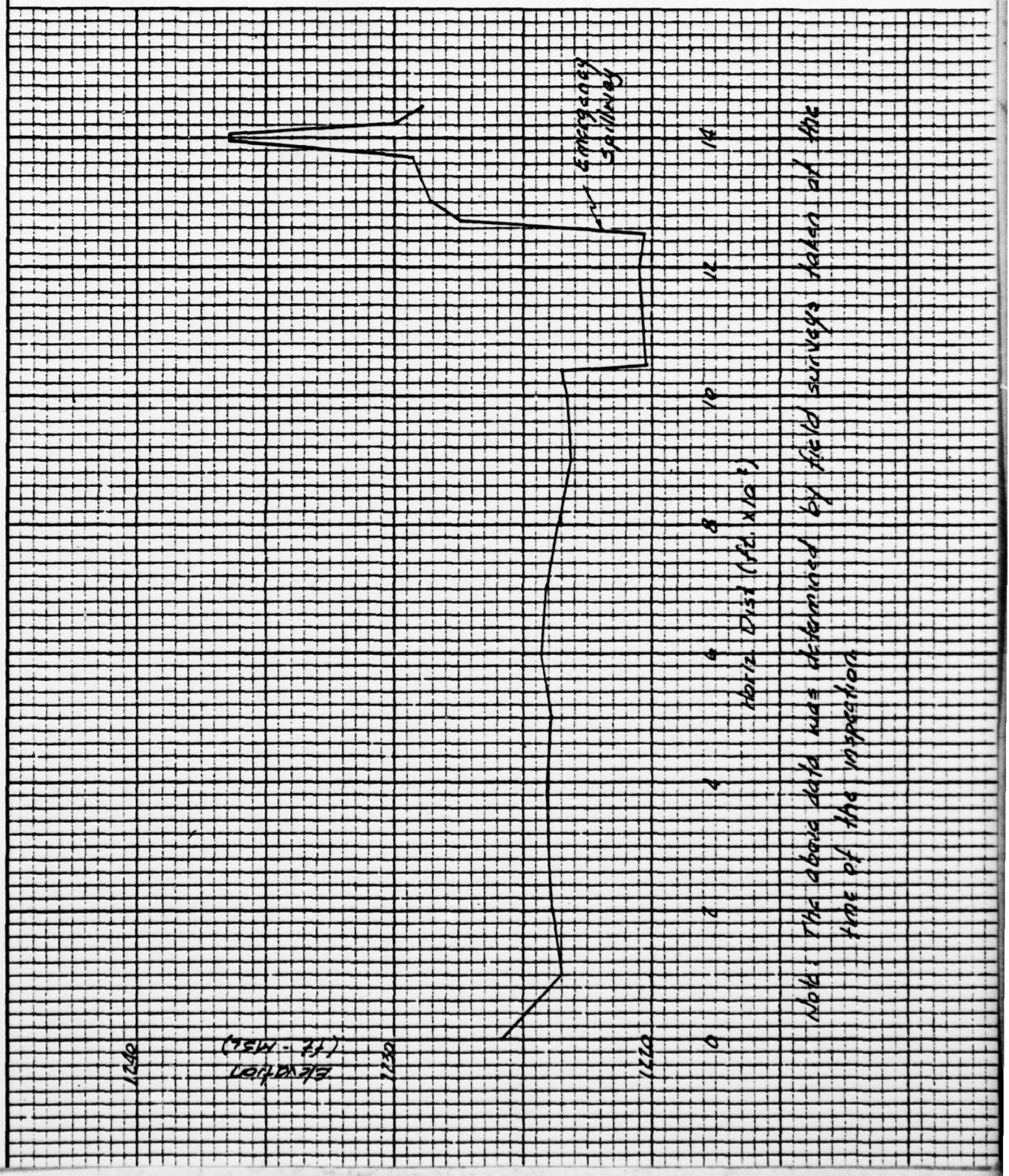
The following values were taken from the design data: (Acs Design Report)

Elev (ft)	Storage (A-F)
1216	3850
1217	4400
1218	5000
1219	5600
1220	6100
1222	8150
1225	9650

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Tamarack Lake (Dam "A") S.O. No.
Top of dam profile Sheet No. 6 of 11
Drawing No.
Computed by G.A.S. Checked by REH Date 3-1-79



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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
**********
     1              A1       NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
     2              A2       HYDROLOGIC AND HYDRAULIC ANALYSIS OF TAMARACK LAKE  A  &  B
     3              A3       PROBABLE MAXIMUM FLOOD PMF/UNIT GRAPH BY SNYDERS METHOD
     4              B    300      0      20       0       0       0       0       0      -4       0
     5              B1     5
     6              J      1      1       1
     7              J1   1.0
     8              K      0      1                                               1
     9              K1           HYDROGRAPH FOR OVERLAND FLOW
    10              M      1      1    4.99               4.99
    11              P            23.4    117     127     141     151
    12              T                                                   1.0    0.05
    13              W    3.06   0.55
    14              X    -1.5  -0.05     2.0
    15              K      1    DAM                                             1
    16              K1           THIS IS A ROUTING FOR TAMARACK LAKE
    17              Y                                    1       1
    18              Y1                                                  -1216     -1
    19              Y4   1216    1217    1218    1219    1220  1220.90 1221.71 1222.57 1223.30 1223.91
    20              Y5      0      14      35     105     139     767    1933    3758    5592    7462
    21              $S   3850    4400    5000    5600    6200    6880    7530    8150    8700    9050
    22              $E   1216    1217    1218    1219    1220    1221    1222    1223    1224    1225
    23              $$   1216
    24              $D   1223    2.65     1.5    1800
    25              K      99
```

Sheet 7 of 11

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  25 SEP 78
**********************************

RUN  DATE 04/24/79
     TIME    11.56

                 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
                 HYDROLOGIC AND HYDRAULIC ANALYSIS OF TAMARACK LAKE  A  &  B
                 PROBABLE MAXIMUM FLOOD PMF/UNIT GRAPH BY SNYDERS METHOD

                                JOB SPECIFICATION
       NQ      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
      300        0       20        0        0        0        0        0       -4        0
                                 JOPER      NWT    LROPT    TRACE
                                     5        0        0        0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1 NRTIO= 1 LRTIO= 1
          RTIOS=    1.00

  *********      *********      *********      *********      *********

                                SUB-AREA RUNOFF COMPUTATION

                 HYDROGRAPH FOR OVERLAND FLOW

                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                          1       0       0       0       0       0       1       0       0

                                   HYDROGRAPH DATA
       IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
           1       1    4.99     0.0    4.99     0.0     0.0       0       0       0

                                     PRECIP DATA
                SPFE     PMS      R6     R12     R24     R48     R72     R96
                 0.0   23.40  117.00  127.00  141.00  151.00     0.0     0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                      LOSS DATA
          LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
              0     0.0     0.0    1.00     0.0     0.0    1.00    1.00    0.05     0.0     0.0

                                  UNIT HYDROGRAPH DATA
                           TP=  3.06     CP=0.55     NTA=  0

                                    RECESSION DATA
                        STRTQ=    -1.50    QRCSN=    -0.05    RTIOR= 2.00

          UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG=   3.08 HOURS, CP= 0.55  VOL= 1.00
        19.       72.      145.      231.      325.      418.      496.      551.      584.      588.
       556.      506.      461.      420.      382.      348.      317.      289.      263.      240.
       218.      199.      181.      165.      150.      137.      124.      113.      103.       94.
        86.       78.       71.       65.       59.       54.       49.       44.       41.       37.
        34.       31.       28.       25.       23.       21.       19.       17.       16.       14.
```

13. 12. 11. 10. 9. 8. 8. 7. 6. 6.
5. 5.

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	28.27	25.83	2.44	251211.
										(718.)(	656.)(	62.)(	7113.51)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

THIS IS A ROUTING FOR TAMARACK LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
0	0	0	0.0	0.0	0.0	-1216.	-10

STAGE	1216.00	1217.00	1218.00	1219.00	1220.00	1220.90	1221.71	1222.57	1223.30	1223.91
FLOW	0.0	14.00	35.00	105.00	139.00	767.00	1933.00	3758.00	5592.00	7462.00
CAPACITY=	3850.	4400.	5000.	5600.	6200.	6880.	7530.	8150.	8700.	9050.
ELEVATION=	1216.	1217.	1218.	1219.	1220.	1221.	1222.	1223.	1224.	1225.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1216.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1223.0	2.6	1.5	1800.

PEAK OUTFLOW IS 4609. AT TIME 46.67 HOURS

********** ********** ********** ********** **********

Sheet 9 of 11

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00
HYDROGRAPH AT	1	4.99 (12.92)	1	9978. (282.55)(
ROUTED TO	DAM	4.99 (12.92)	1	4609. (130.52)(

Sheet 10 of 11

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	DESIGN TOP OF DAM
ELEVATION	1216.00	1216.00	1223.00
STORAGE	3850.	3850.	8150.
OUTFLOW	0.	0.	4839.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1222.91	0.0	8093.	4609.	0.0	46.67	0.0

Maximum discharge from reservoir is 4609 c.f.s of which approximately 56% or 2580 cfs discharges from dam site A. This was determined from the discharge ratings taken from the SCS design report.

Sheet 11 of 11

APPENDIX E

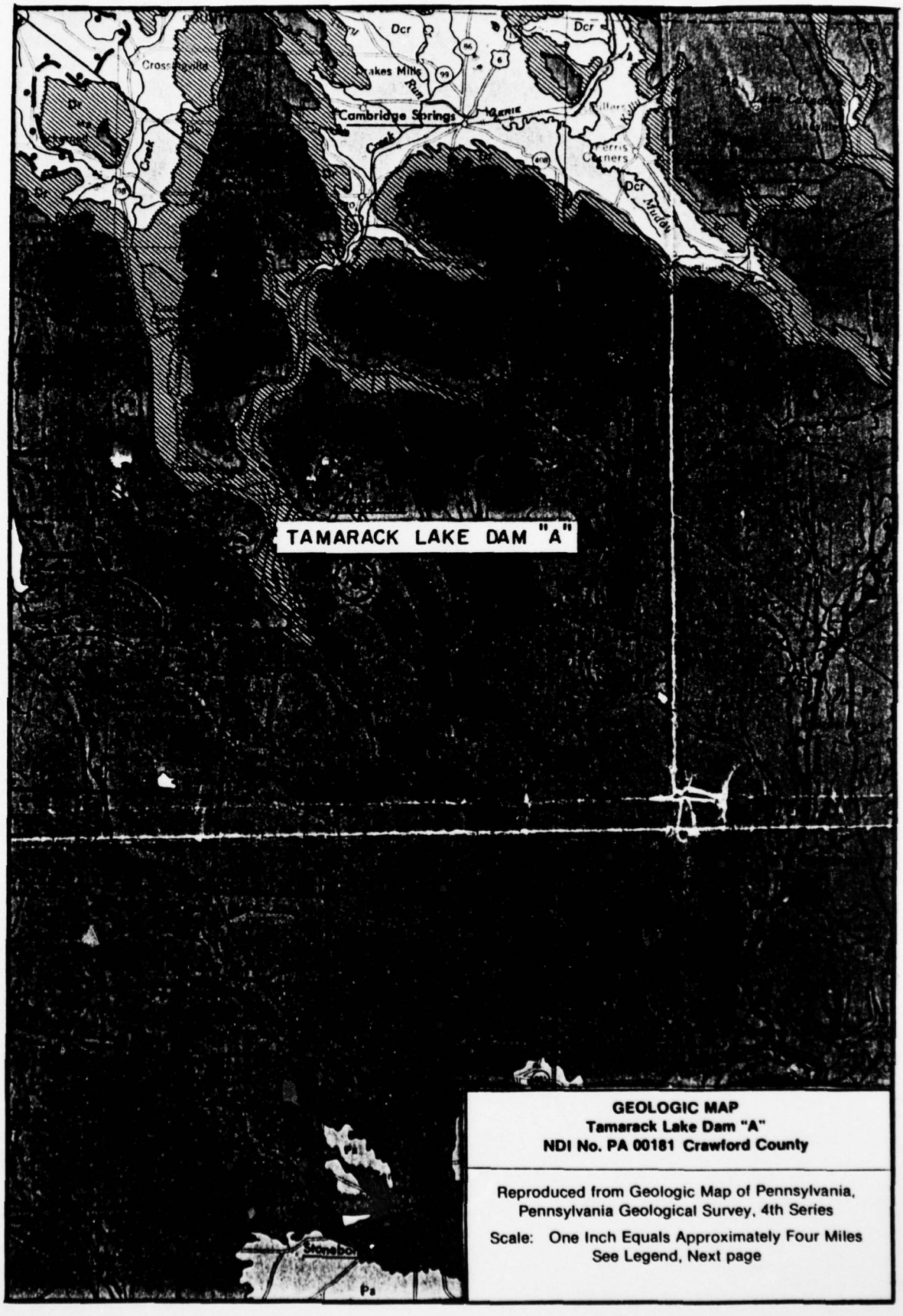
REGIONAL GEOLOGY

TAMARACK LAKE DAM "A"
NDI No. PA 00181, PennDER No. 20-47A, SCS No. 461A

REGIONAL GEOLOGY

Tamarack Lake Dam "A" is located on Mill Run in the glaciated section of the Appalachian Plateaus physiographic province. Bedrock units beneath the glacial till are members of the Pocono group, Mississippian system which regionally are gently dipping gray, hard and massive sandstones and conglomerates with some shale seams.

The reservoir between Tamarack Lake Dam "A" and Tamarack Lake Dam "B" was formerly a swampy area on Wisconsin stage Kent ground moraine at the drainage divide between Mill Run and Mud Run. Geologic maps show the dam itself has been constructed on glacial outwash deposits. The test pits and borings made for design of the dam penetrated glacial deposits of interbedded sand, sand and gravel, silt and clay up to 36 feet thick. No bedrock was encountered. One test boring showed a groundwater table within 4 feet of the surface and several test pits showed considerable seepage. Some of the varved clay and silt deposits at the site are possibly earlier glacial lake deposits.



GEOLOGIC MAP
Tamarack Lake Dam "A"
NDI No. PA 00181 Crawford County

Reproduced from Geologic Map of Pennsylvania, Pennsylvania Geological Survey, 4th Series

Scale: One Inch Equals Approximately Four Miles
See Legend, Next page

LEGEND

PERMIAN

Pg

Greene Formation

Cyclic sequences of sandstone, shale, red beds, limestone and coal; base at the top of the Upper Washington Limestone.

PERMIAN AND PENNSYLVANIAN

PPw

Washington Formation

Cyclic sequences of sandstone, shale, limestone and coal; some red shale, some mineable coal; base at the top of the Waynesburg Coal.

PENNSYLVANIAN

APPALACHIAN PLATEAU

Pm

Monongahela Formation

Cyclic sequences of sandstone, shale, limestone and coal; limestone prominent in northern outcrop areas; shale and sandstone increase southward; commercial coals present; base at the bottom of the Pittsburgh Coal.

Pc

Conemaugh Formation

Cyclic sequences of red and gray shales and siltstones with thin limestones and coals; massive Mahoning Sandstone commonly present at base; Ames Limestone present in middle of sections; Brush Creek Limestone in lower part of section.

Pa

Allegheny Group

Cyclic sequences of sandstone, shale, limestone and coal; numerous commercial coals; limestones thicken westward; Vanport Limestone in lower part of section; includes Kittanning, Freeport, and Clarion Formations.

Pp

Pottsville Group

Predominantly sandstones and conglomerates with thin shales and coals; some coals mineable locally.

ANTHRACITE REGION

Ppp

Post-Pottsville Formations

Brown or gray sandstones and shales with some conglomerate and numerous mineable coals.

Pp

Pottsville Group

Light gray to white, coarse grained sandstones and conglomerates with some mineable coal; includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

MISSISSIPPIAN

Mmc

Mauch Chunk Formation

Red shales with brown to greenish gray flaggy sandstones; includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties; Loyalhanna Limestone at the base in southwestern Pennsylvania.

Mp

Pocono Group

Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale; includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations; includes part of "Oswayo" of M. L. Fuller in Potter and Tioga counties.

DEVONIAN

UPPER

WESTERN PENNSYLVANIA

Doo Dr

Oswayo Formation

Greenish gray to gray shales, siltstones and sandstones becoming increasingly shaly westward; considered equivalent to type Oswayo. Riceville Formation Dr in Erie and Crawford Counties, probably not distinguishable north of Corry.

Dcr

Cattaraugus Formation

Red, gray and brown shale and sandstone with the proportion of red decreasing westward; includes Venango sands of drillers and Salamanca sandstone and conglomerate; some limestone in Crawford and Erie counties.

Dct

Conneaut Group

Alternating gray, brown, greenish and purplish shales and siltstones; includes "pink rock" of drillers and "Chemung" and "Girard" Formations of northwestern Pennsylvania.

Dcp

Canadaway Formation

Alternating brown shales and sandstones; includes "Portage" Formation of northwestern Pennsylvania.