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NATIONAL DAM INSPECTION PROGRAM. DAM NUMBER 3, NDI NUMBER PA - --ETC(U)
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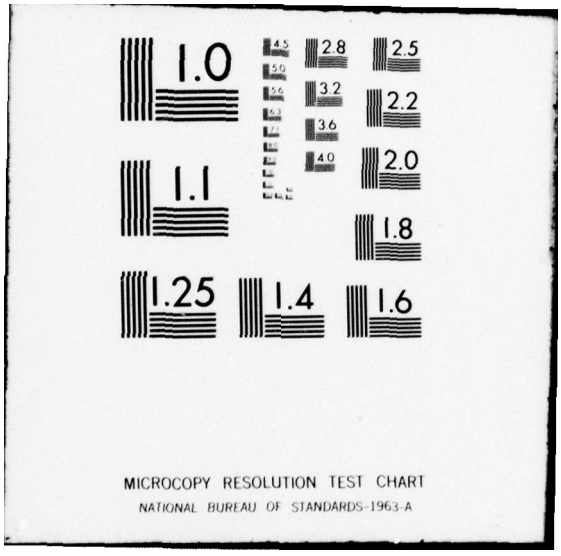
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LEVEL II

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OHIO RIVER BASIN
WASHINGTON COUNTY

PENNSYLVANIA

number

DAM No. 3,
NDI No. Pa-510.

number

Ohio River Basin, Washington County, Pennsylvania.

PHASE I INSPECTION REPORT,
(6) NATIONAL DAM INSPECTION PROGRAM.

(10) Bernard M. Mihalcin

PREPARED FOR

(15) DACW31-78-C-0052

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

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

(12) 64p. (11) JUL 78

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

LEVEL III

Dam No. 3

Pennsylvania

Washington County

First Order Tributary of Chartiers Creek

2 June 1978 (visual inspection)

Inspection Team - GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, past performance, and available engineering data, the dam and its appurtenances are considered to be in poor to fair condition.

The spillway is capable of passing 60 percent of the flow resulting from a storm of PMF magnitude without overtopping. Thus, the spillway is considered inadequate but not seriously inadequate.

It is recommended that: 1) remedial measures be implemented on the spillway and outlet conduit controls to restore and assure continued operability; 2) the downstream slope be cleared of all heavy vegetation, brush, and debris and an assessment made of the seepage and drainage facilities; 3) the owner's proposed plan for the emergency supply of safe potable water be revised to include the possible warning and/or evacuation of downstream residences in the event hazardous embankment conditions develop; 4) the 12-inch line, shown on Figure 1 near the left abutment, be located and that its operability be restored or that it be plugged at the inlet; and 5) the owner regrade the embankment to provide for maximum storage and spillway capacity.

Finally, the dam should be inspected on a periodic basis to check for hazardous conditions which might develop.

Contract DACW31-78-C-0052

GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

Date July 21, 1978

Approved:

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

Date 30 Jul 78

Overview photograph of Dams nos. 3 and 4

TABLE OF CONTENTS

		Page
SYNOPSIS		i
OVERVIEW PHOTOGRAPH		iii
TABLE OF CONTENTS		iv
SECTION 1 - GENERAL INFORMATION		1
1.0	Authority	1
1.1	Purpose	1
1.2	Description of Project	1
1.3	Pertinent Data	2
SECTION 2 - ENGINEERING DATA		6
2.1	Design	6
2.2	Construction Records	7
2.3	Operational Records	7
2.4	Other Investigations	7
2.5	Evaluation	8
SECTION 3 - VISUAL INSPECTION		9
3.1	Observations	9
3.2	Evaluation	10
SECTION 4 - OPERATIONAL PROCEDURES		11
4.1	Normal Operating Procedure	11
4.2	Maintenance of Dam	11
4.3	Maintenance of Operating Facilities	11
4.4	Warning Systems in Effect	11
4.5	Evaluation	11
SECTION 5 - HYDROLOGIC/HYDRAULIC EVALUATION		12
5.1	Design Data	12
5.2	Experience Data	12
5.3	Visual Observations	12
5.4	Overtopping Potential	12
5.5	Spillway Adequacy	13
SECTION 6 - EVALUATION OF STRUCTURAL INTEGRITY		14
6.1	Visual Observations	14
6.2	Design and Construction Techniques	14
6.3	Past Performance	14
6.4	Seismic Stability	14
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES		15
7.1	Dam Assessment	15
7.2	Recommendations/Remedial Measures	15

TABLE OF CONTENTS

APPENDIX A - CHECK LIST - ENGINEERING DATA
APPENDIX B - CHECK LIST - VISUAL INSPECTION
APPENDIX C - HYDRAULICS AND HYDROLOGY CALCULATIONS
APPENDIX D - PHOTOGRAPHS
APPENDIX E - GEOLOGY
APPENDIX F - FIGURES
APPENDIX G - REGIONAL VICINITY MAP

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
DAM NO. 3
NDI# PA-510, PENNDER# 63-4

SECTION 1
GENERAL INFORMATION

1.0 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.

~~1.1 Purpose~~.

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

1.2 Description of Project.

a. Dam and Appurtenances. Dam No. 3, locally known as Washington Dam No. 3, is an earthen embankment approximately 1,020 feet in length with a maximum height of 48 feet. The facility is served by a concrete chute spillway with a broad-crested weir located adjacent the right abutment as shown by Figure 1. The outlet works consists of a 16-inch diameter cast iron supply pipe with the inlet located to the right of dam center. The condition of a 12-inch diameter line and control house shown on Figure 1 are unknown. They may have been removed or plugged when the dam was raised in 1923. The supply line originates at a small concrete intake structure that rises about one foot above normal pool level.

b. Location. Dam No. 3 is located along a first order tributary of Chartiers Creek in North Franklin Township, Washington County, Pennsylvania. The city of Washington, Pennsylvania, is situated approximately 3.5 miles due north of the dam. The dam, reservoir, and watershed are contained within the Washington East and Washington West U.S.G.S. 7.5 minute quadrangles (see Appendix G). The coordinates of the dam are N40° 8.7' and W80° 15.9'.

c. Size Classification. Intermediate (48 feet high, 318 acre-feet storage at spillway crest).

d. Hazard Classification. High (at least six homes downstream).

e. Ownership. Western Pennsylvania Water Company
62 East Wheeling Street
Washington, Pennsylvania 15301

f. Purpose of Dam. Dam No. 3 reservoir serves as a water supply storage facility for the surrounding communities served by the Western Pennsylvania Water Company. Limited recreational use is permitted.

g. Historical Data. Dam No. 3 is an earthen embankment originally constructed in 1895. Original plans and specifications are not available, however, reports from PennDER files indicate the structure was 640 feet in length and 36 feet high. It impounded a reservoir with 106 million gallons capacity and had a surface area of 34 acres. This facility was served by a 55-foot wide wasteway located at the right abutment (looking downstream) along with a single 16-inch diameter cast iron pipe and sluice gate.

The only defect concerning the dam which was consistently reported in the first 30 years of service was seepage near the left abutment. The problem was eventually studied by an independent consultant who determined that it could be attributed to natural springs emanating from the hillside.

In 1923, the dam was raised 12 feet to increase storage. Included in this project was the construction of a new concrete spillway located to the right of the existing wasteway and an extension and addition to the existing outlet works. Specifications are available in PennDER files which describe the required work in addition to several photographs taken during construction.

Seepage near the left abutment remained a problem for the new facility. In 1936, seepage at the toe was estimated in a state inspection report to be on the order of 60 to 75 thousand gallons per day. As no further correspondence is available on this report and later reports indicate small seepage, the estimate appears questionable. More recent state inspections reiterate seepage observations, dense overgrowth, and general deterioration of the spillway structure.

1.3 Pertinent Data.

a. Drainage Area. 1.5 square miles.

b. Discharge at Dam Site. According to water company

personnel present during inspection, discharge records are not available for this facility. The maximum flood at this site and its resulting discharge over the spillway is not known.

Outlet Works Conduit at Operating Pool Elevation - Discharge curve not available.

Spillway Capacity at Maximum Pool Elevation - 1856 cfs (top of dam).

c. Elevation (feet above mean sea level).

Top of Dam - 1082.4.

Maximum Pool Design Surcharge - Not known.

Maximum Pool of Record - Not known.

Normal Pool (spillway crest) - 1077.4.

Upstream Portal Invert Outlet Conduit - 1062.

Downstream Portal Invert Outlet Conduit - Not known.

Streambed at Centerline of Dam ≈ 1035.

Maximum Tailwater - Not known.

d. Reservoir (miles).

Length of Maximum Pool ≈ 0.9 (elevation 1082.4 top of dam).

Length of Normal Pool ≈ 0.7 (elevation 1077.4 spillway crest).

e. Storage (acre-feet).

Spillway Crest - 318.

Top of Dam ≈ 482.

Design Surcharge - Not known.

f. Reservoir Surface (acres).

Top of Dam ≈ 60.

Maximum Pool - Design not known.

Spillway Crest ≈ 41.

g. Dam.

Type - Rolled earthfill.

Length - 1020 feet.

Height - 48 feet.

Top Width - 12 feet.

Side Slopes - Upstream 2H:1V
Downstream 2.5H:1V

Zoning - Homogeneous earth; 15-inch riprap on upstream face as indicated by drawings.

Impervious Core - Homogeneous earthfill section.

Cutoff - Design drawings dated July 1923 indicate two clay puddle core trenches 4 feet wide installed along that portion of the embankment that extends beyond the old embankment. Specifically, a puddle core trench is indicated beneath the center of the dam and another at the upstream toe. Both of the trenches apparently were carried down to impervious material.

Grout Curtain - None.

Drains - Six-inch vitrified clay (pipes) with crushed stone indicated on drawings and in specifications for downstream toe.

h. Outlet Conduit.

Type - 16-inch diameter cast iron supply pipe encased in concrete.

Length - Supply line extends to a pumping station located several miles downstream (see Figure 1).

Closure - Gate valves at intake are inoperable. Supply line is regulated at downstream pumping station.

Access - Intake inaccessible by foot.

Regulating Facilities - Flow is regulated at the pumping station located downstream.

i. Spillway.

Type - Concrete chute with broad-crested weir.

Length - 280 feet.

Crest Elevation - 1077.4.

Upstream Channel - Short natural channel exhibiting heavy grass-like vegetation.

Downstream Channel - The discharge channel beyond the concrete spillway is narrow with steep heavily wooded slopes. At a point less than one mile downstream flow discharges into Chartiers Creek located in a broad grassy valley.

j. Regulating Outlets. 16-inch diameter cast iron supply line with inlet at the intake structure and flow controlled at the downstream pumping station.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. No design reports are available.

2. Embankment. A copy of the specifications used during the 1923 reconstruction of the facility and the design drawings are available from PennDER files.

3. Appurtenant Structures. Same as 2 (above).

b. Design Features.

1. Embankment. Available contract documents and historical data indicate that the present Dam No. 3 embankment was constructed of rolled earthfill. The original embankment which was constructed around 1895 was incorporated into the present structure and currently functions as a part of the upstream portion of the dam (see Figure 2). Specifications and drawings indicate two clay puddle cutoff trenches were constructed under the upstream toe and crest of the new section of embankment. The cutoffs extend approximately 200 feet beyond the right abutment of the original embankment, are 4 feet wide, and were presumably carried down to impermeable material.

Available drawings and construction photographs indicate the upstream face of the dam to be sloped at 2H to 1V and covered with riprap consisting of 15 inches of stone paving set in crushed stone. The downstream face is sloped at 2.5H to 1V and is provided with a thick grass cover as is the crest. No rock toe or toe drain is indicated by the drawings (an apparent rock toe was, however, observed in the field).

The specifications and related correspondence state that seepage encountered during construction of the new embankment in the valley bottom was to be directed into drains consisting of 6-inch vitrified pipe surrounded and covered by stone at points directed by the engineer. These drains are indicated also on Figure 1, Appendix F.

2. Appurtenant Structures.

a) Spillway. The primary discharge is a reinforced concrete spillway and broad-crested weir located

adjacent to the right abutment (see Figures 1 and 3, Photographs 3 and 4). The spillway slab is reportedly keyed at the spillway entrance as shown on Figure 3.

b) Supply Line. A 16-inch diameter cast iron supply pipe, encased in concrete within the structure, has its inlet at the intake structure (not indicated on plan Figure 1) located approximately 220 feet to the left of the spillway. The drawings indicate the line is valved and controlled manually from atop the intake structure. Downstream of the dam the pipe is reportedly valved again and equipped with a blow-off line which allows flow to be discharged into the stream below (see Figure 1). The supply line reportedly continues onto a pumping station further downstream.

c) Intake Structure. The intake structure is constructed of reinforced concrete with plan dimensions of 6 feet by 6 feet (see Figure 2). The structure rises about 1 foot above normal pool level, however, access to it is not provided. Two valve wheels are situated on the roof of the structure. The drawings indicate these wheels regulate flow through a sluice gate and the 16-inch supply line (see Figure 2 and Photograph 2).

2.2 Construction Records.

The only records of construction available are in the form of a progress report dated 12-21-23 by the Pennsylvania Water Supply Commission and a few photographs taken during the raising of the embankment.

2.3 Operation Records.

Conversations with those water company personnel present during the visual inspection indicate operational records are kept at the pumping station. Monthly reservoir storage records dating back to 1960 are also available.

2.4 Other Investigations.

Several state inspection reports are available from PennDER files the majority of which were compiled between 1923 and 1946. The latest inspection report is dated September 25, 1961, at which time the general appearance of the dam was considered poor because of heavy vegetation on the slopes and silting and vegetation in the spillway approach.

2.5 Evaluation.

Sufficient data are available to indicate that the structure (particularly as raised in 1923) was adequately engineered, however, there is some question as to whether there is sufficient drainage and zoning within the embankment for controlling seepage. As-built reports and verification of specification compliance are lacking. Historical records presented in state inspection reports appear incomplete and sometimes ambiguous.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of this structure and its related appurtenances suggests the dam is performing adequately, however, the structure is insufficiently maintained, and in poor to fair condition.

b. Embankment. The embankment was in fair condition with dimensions in general conformance with the contract drawings (see Figures 1 and 2). No signs of embankment distress were noted, however, the crest and downstream slope were heavily vegetated with high grass. Shrubs and brush covered the toe, making a detailed inspection difficult. The lower five feet of the downstream toe appears to be a rockfill. This feature is not indicated on the available drawings nor is it contained in the specifications. Noticeable seepage was occurring along the left abutment where an erosion gulley (see Photograph 6) has developed along most of the toe. The area is heavily vegetated and difficult to assess, however, some of the seepage appears to originate through the abutment. The embankment was not ostensibly saturated above the toe. Seepage was also noted along the right abutment-embankment contact emanating slightly above the apparent rock toe. Remnants of a weir and collector sump were found adjacent to the rock toe.

A level survey indicated that the embankment adjacent to the spillway is about one foot lower than the top of the wingwall, thus decreasing the effective spillway head and reservoir storage capacity.

c. Appurtenant Structures.

1. Spillway. The spillway structure (a concrete chute with broad-crested weir) is functional, however, in need of significant surficial repair. The weir is particularly deteriorated exhibiting areas of spalling and seepage through the concrete and may need extensive structural repair (see Photographs 3 and 4).

The approach channel is silted and heavily overgrown (see Photograph 4).

2. Intake Structure. Only the top foot of the intake structure was visible and access is not provided from the embankment. As indicated in Photograph 2, slight deterioration of the concrete is evident. Two valve stems are also visible.

3. Outlet Facilities. No outlet works (blow-off lines, valves, etc.) could be located at the downstream toe.

4. Reservoir Area. The slopes adjoining the reservoir area are heavily wooded moderate slopes. No signs of slope distress were observed, however, some silting was noted at several inlets upstream of the left abutment.

5. Downstream Channel. The channel immediately downstream of Dam #3 is characterized as a narrow wooded valley containing the overflow from the dam spillway. After passing beneath a paved road approximately 500 feet downstream, flow from Dam #3 discharges into the broad (approximately 700 feet wide), sparsely wooded floodplain of Chartiers Creek.

3.2 Evaluation.

At least six homes are located sufficiently close to the floodplain to conceivably be within the effects of the flow resulting from a breach of the embankment. Consequently, the hazard rating assigned to Dam #3 is high.

Visual inspection was limited to the embankment spillway facilities since no access is provided to the intake structure. Locations of the outlet facilities are unknown. Vegetation on the downstream slope was heavy precluding a thorough evaluation of seepage.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedure.

According to water company personnel, there are no formal operational procedures at the facility. Outflow passes over the spillway and discharges into the natural channel below. The only other outlet serving the structure is a 16-inch supply line connected to the water company's distribution system. This outlet cannot be regulated from the dam. Valves, the controls of which are visible on top of the intake structure, are reported to be non-operational. In addition, a 16-inch blow-off line supposedly located downstream could not be located by the inspection team nor was its location known by water company personnel. Consequently, it is assumed that the blow-off line is non-functional.

4.2 Maintenance of Dam.

The dam is reportedly maintained on an as-needed basis. Part of the regular maintenance includes mowing the crest and slopes as well as clearing debris from the spillway. Maintenance records are not kept.

4.3 Maintenance of Operating Facilities.

Water company representatives present during inspection reported that the valves at the intake structure are inoperable and have been for years, consequently, no maintenance other than general clean-up are performed on the operating facilities on a regular basis.

4.4 Warning Systems.

There are no formal warning systems in effect, however, Western Pennsylvania Water Company has, in proposed form, an emergency plan for maintaining a potable water supply that can be readily adapted for this use.

4.5 Evaluation.

Lack of formal procedures of operations and maintenance have apparently resulted in inoperative appurtenances, uncertainty of appurtenances locations, and inadequate maintenance.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No hydrologic or hydraulic design data are available.

5.2 Experience Data.

No data relative to the past performance of the dam and its outlet works are available. All observed structures are intact indicating probable adequate past performance.

5.3 Visual Observations.

The dam and its appurtenances appeared to be in adequate condition, to consider the results of the hydrologic/hydraulic analysis reasonable. An apparent embankment crest settlement of one foot (maximum) near the spillway channel was observed. The analysis assumes this condition will be corrected and proceeds on that basis.

5.4 Overtopping Potential.

The "PMF Peak Flow" for this watershed was determined based on data supplied by the Corps of Engineers, Baltimore District. Specifically, the data pertains to a stream gaging station located on Chartiers Creek at Washington, Pennsylvania. Based on a drainage area of 28.6 square miles, the PMF at this location is 27,200 cfs.

Utilizing this data and applying it, the following equation yields a value of PMF for the watershed in this analysis. That is:

$$Q_1 = \left[\frac{D_1}{D_2}\right]^n Q_2$$

where

Q_1 = PMF at Dam #3
Q_2 = 27,200 cfs
D_1 = drainage area of Dam #3
D_2 = 28.6 square miles
n = empirical constant = 0.7.

The value of n chosen for this analysis is 0.7. This value falls between those values recommended by the Corps of Engineers, Pittsburgh District, for comparison of watersheds within the Ohio River Basin. Based on this information, PMF Q = 3,454 cfs.

Calculations were performed to evaluate the overtopping potential of the dam for existing and design conditions during the PMF.

Based on the above values, the inflow volume for this storm is 4,567 acre-feet. This appears to be excessive and, as a consequence, an inflow volume based on 26 inches of runoff, that is, 2,080 acre-feet, was used in subsequent calculations.

The spillway has a maximum discharge capacity equivalent to 1856 cfs. A comparison of peak inflow with maximum discharge shows the discharge capacity to be less than the peak inflow resulting from the PMF. Consequently, some storage volume is required.

Calculating the volume of storage available and comparing it to the volume of storage required reveals the dam is incapable of handling a storm of PMF magnitude. In fact, the analysis indicates the dam will pass and/or contain only 60 percent of the PMF. As a result, the embankment will overtop if subjected to the PMF.

5.5 Spillway Adequacy.

The facility will pass and/or contain approximately 60 percent of the PMF. As a result, the spillway is deemed inadequate but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appeared to be in fair structural condition. Areas of noticeable seepage were found at the toe along both abutments. An erosion ditch found along the left abutment is clear evidence of the structure's history of reported seepage in this area (see Photograph 6). Neither of these conditions are considered critical at this time. In addition, the seepage may be due to drainage laterals purportedly placed during construction.

b. Appurtenant Structures. The visual inspection indicated the spillway to be in poor to fair condition and in definite need of remedial repair. Spalling and scaling, as well as random cracking, were evident throughout the entire structure including wingwalls, channel floor, and weir face. Areas of deterioration that are considered most severe include the weir, upper channel floor, and plunge pool walls (see Photographs 3 and 4). Seepage through the weir face near its center section and severe spalling indicate major structural repairs may be necessary.

6.2 Design and Construction Techniques.

Actual design data, design computations, or reports were not available for any aspect of this facility.

6.3 Past Performance.

No records of past performance are available.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and is thus subject to minor earthquake induced forces. Since the embankment is broad-based and constructed of residual soils, it is believed that the static stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations or investigations, etc., were performed to confirm this belief.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, operational history, and available engineering data suggest that the dam and its appurtenances are in poor to fair condition.

Hydraulic and hydrologic calculations used during our investigation indicated that the spillway is capable of passing and/or storing 60 percent of the flow resulting from a storm of PMF magnitude. Consequently, this spillway is considered inadequate but not seriously inadequate.

b. Adequacy of Information. The available data was thought to be sufficient to make an accurate Phase I assessment of the facility.

c. Urgency. It is suggested that the recommendations and studies listed below be implemented as soon as possible.

d. Necessity for Additional Investigations. Additional investigations are deemed necessary to evaluate the severity of concrete deterioration and the sources of seepage noted along the downstream toe.

7.2 Recommendations/Remedial Measures.

It is recommended that:

a. evaluation and remedial work be immediately implemented on the spillway structure to prevent further deterioration.

b. necessary repairs to restore operability be made on the sluice gate and valve that control conduit flow at the intake.

c. the 12-inch diameter line near the left abutment be located and its operability restored. Otherwise, the line should be plugged at the inlet end.

d. the downstream slope be cleared of all brush and heavy vegetation to permit an evaluation of seepage sources. The embankment toe should be examined to locate purported drains which should then be opened to provide free, unobstructed drainage. Based on the results of the above evaluation and probings, a series of observation wells may be

required to assess the position of the phreatic surface within the embankment, and additional measures may be necessary to control seepage if it is not controlled by exposing the existing drains.

e. the owner's proposed emergency plan to maintain a safe potable water delivery be revised to include warning and evacuation plans in case of emergency embankment conditions develop including round-the-clock surveillance during periods of high water levels.

f. the owner regrade the embankment to provide for maximum storage and spillway capacity.

g. the site be inspected periodically to check for hazardous conditions which might develop.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Dam #3

ID # NDl #PA-510
PennDER 63-4

ITEM	REMARKS	SHEET 1

AS-BUILT DRAWINGS

Drawings available are not marked "As Built"
Set of 4 drawings by D.C. Morrow, Engr. Dated July 1923 (not numbered)
Set of 1 drawing by American Water Works Service Company, Inc., Dated 11-21-57

REGIONAL VICINITY MAP

Aerial photograph available

CONSTRUCTION HISTORY

Written by G.A.I. based on PennDER files and newspaper report supplied by owner.

TYPICAL SECTIONS OF DAM

Included in drawing set by D.C. Morrow, Engr.

OUTLETS - PLAN Included in drawing set by D.C. Morrow, Engr.

- DETAILS Included in drawing set by D.C. Morrow, Engr.

- DISCHARGE RATINGS None available.

RAINFALL/RESERVOIR RECORDS Rainfall records compiled at the Washington Pumping Station which served as a local gaging station until 1977. Monthly reservoir storage capacity records from 1960 to the present are available from the owner.

ITEM	REMARKS	ID # PA-510	SHEET 2

DESIGN REPORTS

None available.

GEOLOGY REPORTS

None available.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

None available.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Logs of test pits are available on drawing set by D.C. Morrow, Engr.

POST-CONSTRUCTION SURVEYS OF DAM

None

BORROW SOURCES

Indicated on drawing set by D.C. Morrow, Engr.

ITEM	REMARKS	ID # PA-510	SHEET 3

MONITORING SYSTEMS

None

MODIFICATIONS

Repairs to spillway apron in 1957. Indicated on drawing by American Water Works Service Company, Inc.

HIGH POOL RECORDS

None available.

POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS

Report by Wm. Wylie (Consulting Civil Engineer) dated 2-26-15, that is, after the construction of original embankment. Report concerns seepage at left abutment.

PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS

Not applicable

MAINTENANCE OPERATION RECORDS

Maintenance performed on an as needed basis. Formal records are not available.

ITEM	REMARKS	ID # PA-510	SHEET 4

SPILLWAY PLAN

SECTIONS

DETAILS

Drawings by American Water Works Service Company, Inc.

OPERATING EQUIPMENT
PLANS & DETAILS

Details of intake structure available on drawing set by D.C. Morrow, Inc.

NDI# PA-510

CHECK LIST ID # PennDER 63-4
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.5 square miles.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1077.5 (318 acre-feet).

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not known.

ELEVATION MAXIMUM DESIGN POOL: Not known.

ELEVATION TOP DAM: 1082.9

SPILLWAY DATA:

a. Crest Elevation 1077.4
b. Type Concrete chute with broad-crested weir.
c. Weir Length 50 feet.
d. Channel Length 280 feet.
e. Location Spillover right abutment.
f. Number and Type of Gates none.

OUTLET WORKS:

a. Type One 16" diameter supply line with 16" downstream blow-off.
b. Location Left of dam center approximately 350' from left abutment.
c. Entrance Inverts ele. 1042 (estimate)
d. Exit Inverts Not known.
e. Emergency Draindown Facilities blow-off reportedly downstream, could not be located by dam inspection team.

HYDROMETEOROLOGICAL GAGES:

a. Type rain gage.
b. Location Washington Pumping Station.
c. Records Washington Pumping Station.

MAXIMUM NON-DAMAGING DISCHARGE: Not known.

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NDI# PA-510

DAM NAME Water Company No. 3 COUNTY Washington STATE Pennsylvania ID # PennDER 63-4

TYPE OF DAM Earth HAZARD CATEGORY High

DATE(S) INSPECTION June 2, 1978 WEATHER sunny & hot TEMPERATURE 65°-85°

POOL ELEVATION AT TIME OF INSPECTION _____ M.S.L. TAILWATER AT TIME OF INSPECTION _____ M.S.L.

INSPECTION PERSONNEL:	Water Co. Personnel	Others
B. M. Mihalcin	B. McAdams - Engr.	L. Busack (PennDER)
J. P. Nairn	J. Orlando - Risk & Matl's Mgr.	
K. H. Khilji	R. Newman - Production Supt.	
D. L. Bonk		
	B. M. Mihalcin RECORDER	

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	Slight erosion from runoff and seepage flow at left abutment.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Satisfactory - Low point in embankment adjacent to the spillway.	
RIPRAP FAILURES	None observed - Riprap appears to be a sandy limestone - Durable rock facing is patchy on downstream slope.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM

Good condition - Erosion gully at junction of embankment and left abutment about midway between crest and toe.

ANY NOTICEABLE SEEPAGE

Seepage noted at left abutment - embankment contact, also seepage near toe of dam approximately 150 feet from highest embankment section (toward right abutment).

STAFF GAGE AND RECORDER

None observed. Reportedly measured with a rule at spillway.

DRAINS

A 6-inch pipe exists through the spillway near the bottom of the apron.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet conduit not observed.	
INTAKE STRUCTURE	Two valves reportedly open at the intake dam controlling a 16-inch diameter pipe - Flow now controlled at pumping station. Intake valves reportedly full open and have not been operated in years.	
OUTLET STRUCTURE	None at site.	
OUTLET CHANNEL	N/A	
EMERGENCY GATE	Valve controls at plant.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

CONCRETE WEIR

Asphalt coated - Poor surface condition (severly spalled). Water seeping through the weir near center of spillway.

APPROACH CHANNEL

Not directly observed because of high water, stumps visible in channel.

DISCHARGE CHANNEL

Appears to have been resurfaced with a layer of grout. Cracks and joints were patched with bitumen. Two 24 to 50 feet^2 areas of severe scaling. Left apron sidewall rotated due to lateral earth pressures. Plunge pool at the end of the spillway has wall at exit which serves as an energy dissipator. The wall was in fair to poor condition.

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

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHERS	Gaging station on Chartiers Creek.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle to moderate.	
SEDIMENTATION	Some siltation noted at inlets - No surveys performed to gage actual amount.	

DOWNSTREAM CHANNEL ID # PA-510 SHEET 8

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural channel downstream of spillway cut through shales and siltstones. Approximately five feet of soil cover on wooded slopes adjoining channel. Overflow passes beneath bridge on secondary road ≈500 feet downstream of dam and then enters broad valley containing Chartiers Creek.	
SLOPES	See above.	
APPROXIMATE NO. OF HOMES AND POPULATION	At least 6 homes are located sufficiently close to the floodplain to conceivably be within the effects of the flow resulting from a breach of the embankment. Population 12 - 24 persons.	

APPENDIX C

HYDRAULICS/HYDROLOGY

SUBJECT DAM SAFETY INSPECTION
CITIZEN'S WATER CO. DAM #3

BY DLB DATE 6-5-78 PROJ. NO. 78-501-510

CHKD. BY JTS DATE 6-8-78 SHEET NO. 1 OF 8

gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

LOCATION (DAM, RESERVOIR, AND WATERSHED)

WASHINGTON EAST QUADRANGLE
WASHINGTON WEST QUADRANGLE
} 7.5 MINUTE MAP U.S.G.S.

DAM STATISTICS

REF: REPORT 9-25-61 by PA. DIV. OF DAMS & ENCROACHMENTS

MAXIMUM HEIGHT OF DAM = 48Ft

DRAINAGE AREA = 1.5 sq. Mi

STORAGE CAPACITY = 318 AC-FT (REF: INFORMATION IN BASIC CONTRACT)

SIZE CLASSIFICATION

DAM SIZE = INTERMEDIATE (REF 1, TABLE 1)

HAZARD RATING = HIGH (REF 1, TABLE 2)

REQUIRED SDF = PMF (TABLE 3, REF 1)

REF 1: "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS"
DEPT OF ARMY - OFFICE OF CHIEF ENGINEER — APPENDIX D

SUBJECT DAM SAFETY INSPECTION
DAM #3

BY DJP DATE 2-18-78 PROJ. NO. 78-501-510

CHKD. BY JPN DATE 2-19-78 SHEET NO. 2 OF 8

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$$Q_1 = \left[\frac{D_1}{D_2}\right]^n Q_2$$

Q_1 = PMF @ DAM #3

Q_2 = PMF FROM STATION AT CHARTIER'S CREEK (WASHINGTON, PA.)
= 27,200 CFS (SUPPLIED BY CORPS)

D_1 = DRAINAGE AREA AT DAM #3 = 1.5 SQ. MI

D_2 = DRAINAGE AREA AT CHARTIERS CREEK (WASHINGTON, PA.)
= 28.6 SQ. MI. (SUPPLIED BY CORPS)

n = 0.6 TO 0.8

FOR $n = 0.6$

$$Q_1 = \left[\frac{1.5}{28.6}\right]^n (27,200 \text{ CFS}) = 4639 \text{ CFS}$$

FOR $n = 0.8$

Q_2 = = 2572 CFS

ACTUAL Q FROM C OF E CURVE = 2880 CFS

4639 CFS > 2880 CFS > 2572 CFS

SUBJECT DAM SAFETY INSPECTION
CITIZENS WATER CO. DAM #3

BY DLB DATE 6-5-78 PROJ. NO. 78-501-507

CHKD. BY JPN DATE 7-19-78 SHEET NO. 3 OF 8

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Environmental Specialists

USE $n = 0.7$ (MEAN OF VALUES SUGGESTED BY COE SUPPORTED BY HYDROLOGIC UNIT CONCERNING STORMS IN THE OHIO RIVER BASIN)

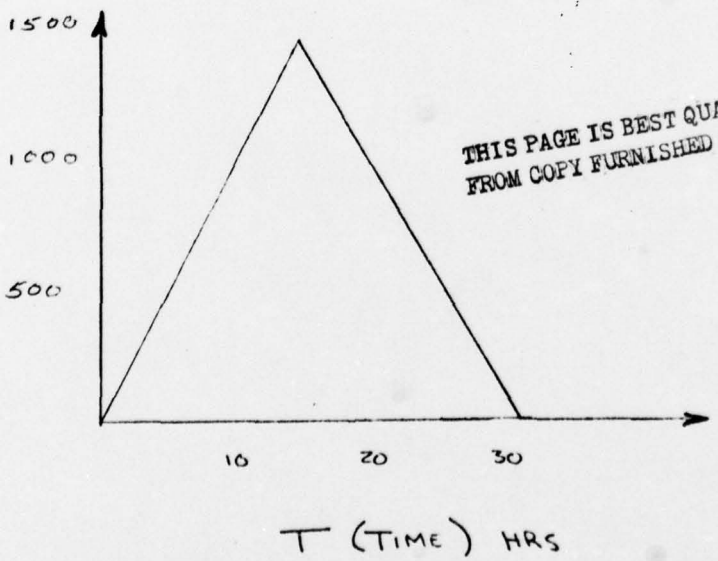
$$Q = \left[\frac{1.5}{28.6}\right]^{0.7} (27,200 \text{ CFS}) = 3454 \text{ CFS}$$

PMF = 3454 CFS

DEVELOP INFLOW HYDROGRAPH

MAXIMUM INFLOW = 3454 CFS

TOTAL TIME OF FLOW = 32 HRS



REF 2 : "STANDARD HANDBOOK FOR CIVIL ENGINEERS" by F.S. MERRITT

SUBJECT Dam Safety Inspection
Citizen's Water Co. Dam #3

BY DLB DATE 6-20-78 PROJ. NO. 78-501-510

CHKD. BY JPN DATE 7-19-78 SHEET NO. 4 OF 8

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VOLUME OF INFLOW HYDROGRAPH

$V = \frac{1}{2}(Q_{INFLOW})(TIME)$

$= \frac{1}{2}(3454\ CFS)(32\ HRS)(3600\ SEC/HR)(1\ ACRE/43{,}560\ SQ.\ FT.)$

$= 4567$ ACRE-FEET

DETERMINE THE AVERAGE RAINFALL IN INCHES REQUIRED TO PRODUCE THE INFLOW VOLUME ABOVE

$$\frac{(4567\ AC\text{-}FT.)(1\ SQ\ MI/640\ ACRES)(12\ IN/FT)}{(1.5\ SQ.\ MI)} = 57.1\ INCHES$$

VOLUMES PRODUCED BY RAINFALLS IN EXCESS OF 26 INCHES MUST BE RECALCULATED USING 26 INCHES AS AN UPPER BOUND

$$\frac{(26\ INCHES)(1.5\ SQ.\ MI)}{(12\ IN/FT)}(640\ ACRES/1\ SQ.\ MI) = 2080\ AC\text{-}FT$$

VOLUME OF INFLOW (RECALCULATED) = 2080 AC-FT

SUBJECT DAM SAFETY INSPECTION
CITIZEN'S WATER CO DAM #3

BY DLB DATE 6-5-78 PROJ. NO. 78-501-510

CHKD. BY JTS DATE 6-8-78 SHEET NO. 5 OF 8

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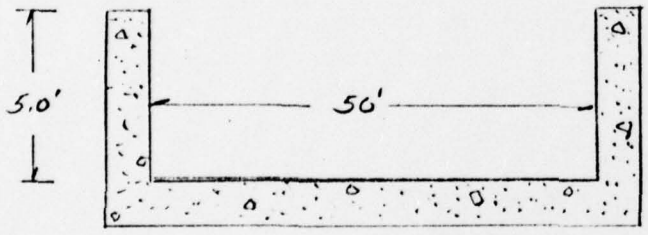
NOTE: Q_{IMAX} REMAINS CONSTANT.
STORM DURATION DECREASES IN ACCORDANCE WITH THE DECREASE OF INFLOW VOLUME

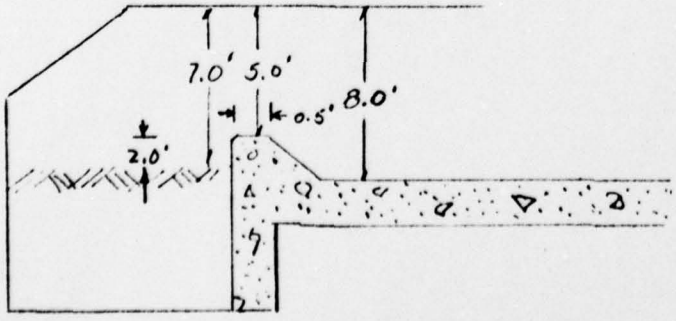
EQUIVALENT STORM DURATION = $(2080_{AC-FT})(2)(43{,}560\ FT^2/AC)/(3454\ AC-FT)(3600\ SEC/HR)$

= 14.6 HRS

SPILLWAY CAPACITY



NOTE: ALL DIMENSIONS WERE TAKEN IN FIELD DURING INSPECTION AND DO NOT NECESSARILY COINCIDE WITH THOSE SHOWN ON THE CONTRACT DRWGS.



SUBJECT DAM SAFETY INSPECTION
CITIZEN'S WATER CO. DAM #3

BY DLB DATE 6-5-78 PROJ. NO. 78-501-507

CHKD. BY JTS DATE 6-8-78 SHEET NO. 6 OF 8

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SPILLWAY CREST ELEVATION = 1077.5

HEAD ABOVE SPILLWAY CREST = 5.0 Ft

$Q = C L H^{3/2}$ (REF 2, EQ 21-121)

L = 50 FT
H = 5.0 Ft
BREADTH OF WEIR = 0.5 FEET

(FROM TABLE 21-15, REF 2)

$\therefore C = 3.32$

$Q = (3.32)(50)(5.0)^{3/2}$

$Q = 1856$ CFS

MAXIMUM SPILLWAY DISCHARGE > PMF (PEAK INFLOW)
1856 CFS > 3454 CFS

SUBJECT DAM SAFETY INSPECTION
DAM #3

BY DLB DATE 7-8-78 PROJ. NO. 78-501-507

CHKD. BY JJW DATE 7-19-78 SHEET NO. 7 OF 8

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CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING SHORT CUT METHOD AS RECOMMENDED BY NAD.

$$P = \frac{\text{MAXIMUM SPILLWAY DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{1856 \text{ CFS}}{3454 \text{ CFS}} = 0.54$$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{VOLUME OF HYDROGRAPH}} = (1-0.54) = 0.46$$

(SHEET 3)

REQUIRED STORAGE = (0.46)(2080AC-FT) = 957 AC-FT

CALCULATE AVAILABLE STORAGE

FREEBOARD AVAILABLE = 3.0FT (FIELD MEASURED)

RESERVOIR SURFACE AREA ≅ 41 ACRES (PLANIMETERED OFF U.S.G.S.)

STORAGE AVAILABLE = (3.0 FT)(41 ACRES) ≅ 123 AC-FT

STORAGE REQUIRED (957 AC-FT) > STORAGE AVAILABLE (123AC-FT)

SUBJECT DAM SAFETY INSPECTION
DAM #3

BY DLB DATE 7-18-78 PROJ. NO. 78-501-507

CHKD. BY JPN DATE 7-19-78 SHEET NO. 8 OF 8

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ESTABLISH WHAT PERCENT PMF THE DAM WILL PASS AND/OR CONTAIN THE SDF.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{Q_{I\,MAX}} = \frac{1856\ \text{CFS}}{Q_{I\,MAX}}$$ (SHEET 6)

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{VOLUME OF INFLOW}}$$ (SHEET 7) (SHEET 4)

$$1 - \frac{1856\ \text{CFS}}{Q_{I\,MAX}} = \frac{123\ \text{AC-FT}}{\frac{1}{2}(Q_{I\,MAX})(14.6\ \text{HRS})(3600\ \text{SEC/HR})(1\ \text{ACRE}/43{,}560\ \text{FT}^2)}$$

$$1 - \frac{1856\ \text{CFS}}{Q_{I\,MAX}} = \frac{123\ \text{AC-FT}}{0.6\,Q_{I\,MAX}}$$

$$0.6\,Q_{I\,MAX} - 1114 = 123$$

$$0.6\,Q_{I\,MAX} = 1237$$

$$Q_{I\,MAX} = 2062\ \text{CFS}$$

PMF (PEAK INFLOW) = 3454 CFS (SHEET 3)

$Q_{I\,MAX}$ = 60% PMF

APPENDIX D

PHOTOGRAPHS

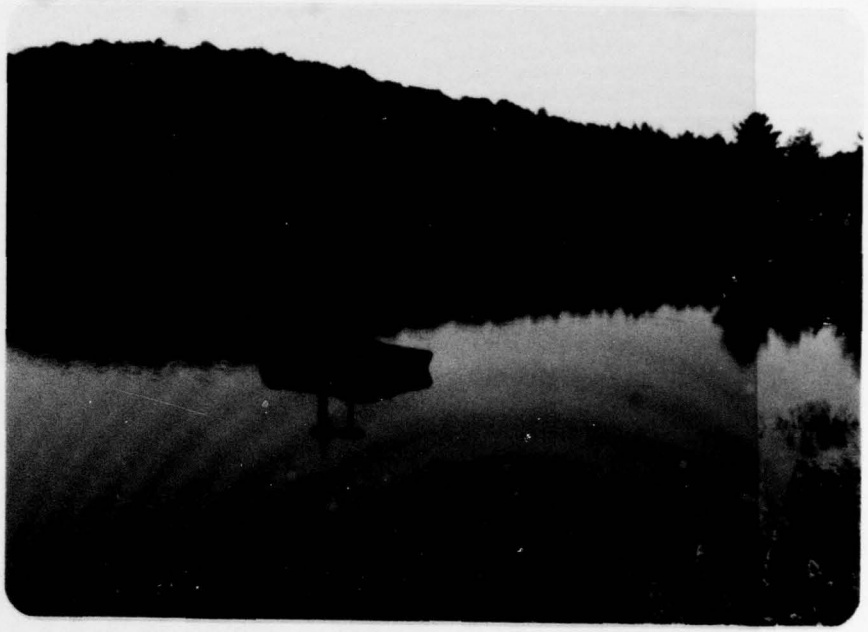
PHOTOGRAPH 1 View looking across the crest of the Dam #3 embankment. The spillway is located adjacent to the right abutment in the background of the photograph.

PHOTOGRAPH 2 View of the controls for the outlet system of Dam #3. Also note the riprap on the upstream face of the dam.

PHOTOGRAPH 3 View of the spillway and discharge channel serving Dam #3. Note the deteriorated condition of the concrete in the left foreground of the photograph.

PHOTOGRAPH 4 Close-up view of some spalling on downstream face of the weir. Water was leaching through the weir at the time of inspection.

1



2

3

4

PHOTOGRAPH 5 View of a portion of the rock toe near the center of the Dam #3 embankment. Some seepage was noted in the area.

PHOTOGRAPH 6 View of an erosion channel which was excavated by runoff and seepage that issues from the area just downstream of the left abutment.

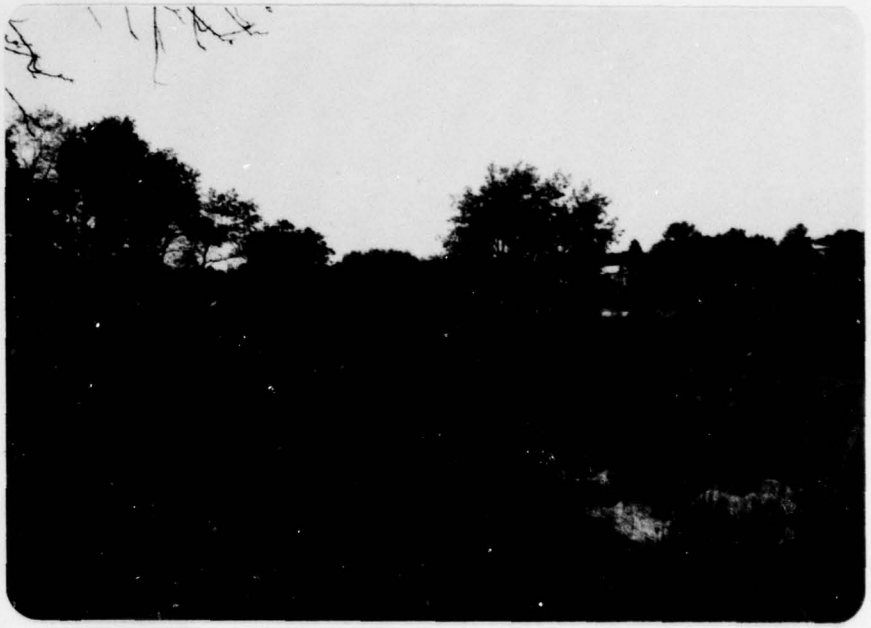
PHOTOGRAPH 7 View of a concrete 2-lane bridge located just downstream of the Dam #3 spillway. The bridge and road represents the first downstream restriction from the dam.

PHOTOGRAPH 8 After passing beneath the bridge, the natural drainage enters this broad valley. Note the homes on the floodplain in the background of the photograph.

5

6

7



8

APPENDIX E

GEOLOGY

Dam No. 3 is located within an area of flat lying sedimentary rocks of the Pennsylvanian age Washington Formation. These strata are predominantly alternating beds of shale and sandstone with some coal beds and discontinuous limestone units.

The rocks of the Washington Formation are commonly poorly jointed and water wells in the area are often poor producers because of the scarcity of fractures.

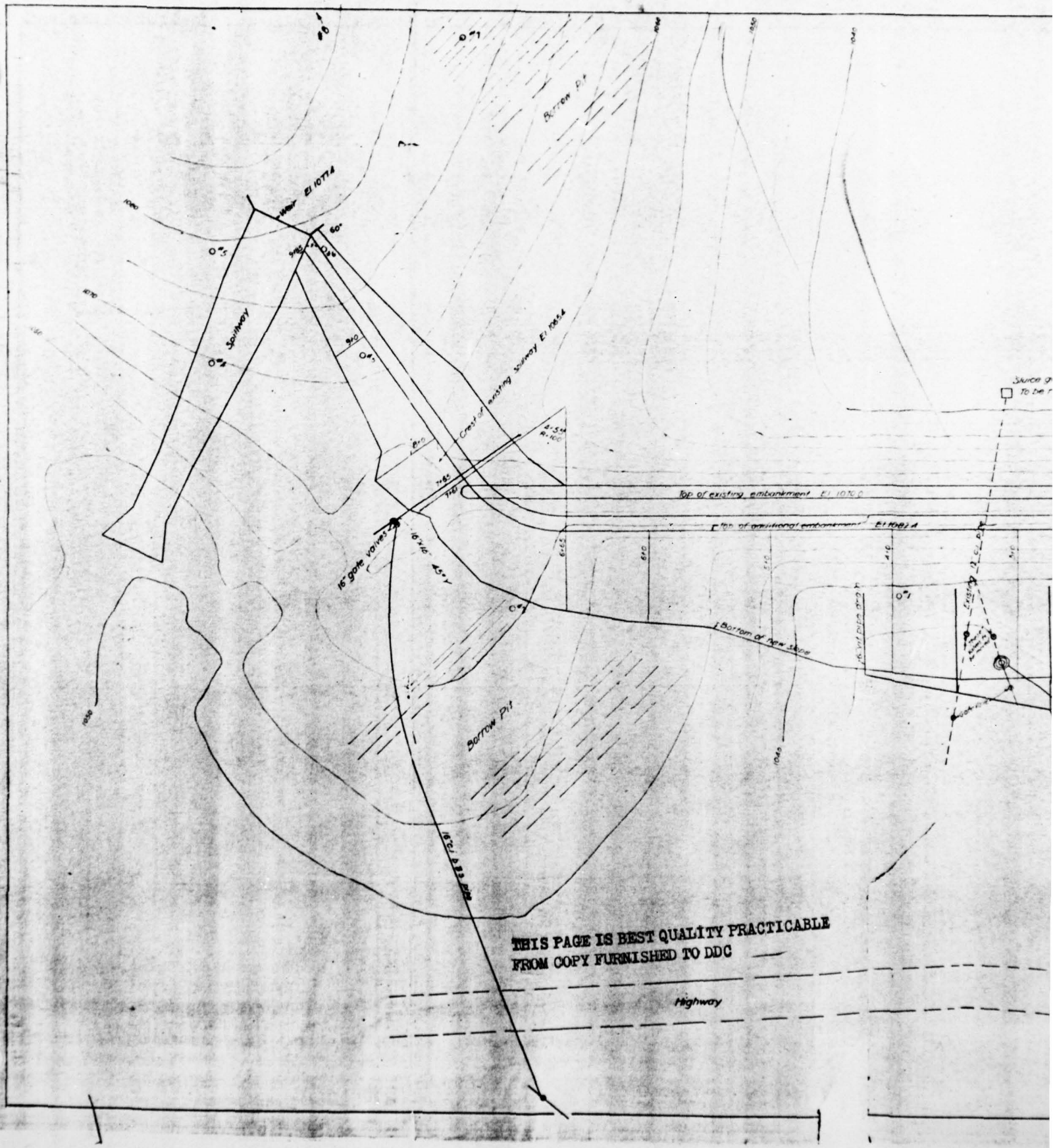
Figure 1 (Appendix F) provides a log of test pits detailing subsurface conditions at the site.

APPENDIX F

FIGURES

LIST OF FIGURES

Figure	Description
1	General Plan - Storage Reservoir No. 3 (With Test Pit Logs)
2	Sections and Intake - Storage Reservoir No. 3
3	Repairs to Spillway Apron Plan, Sections and Details Reservoir No. 3



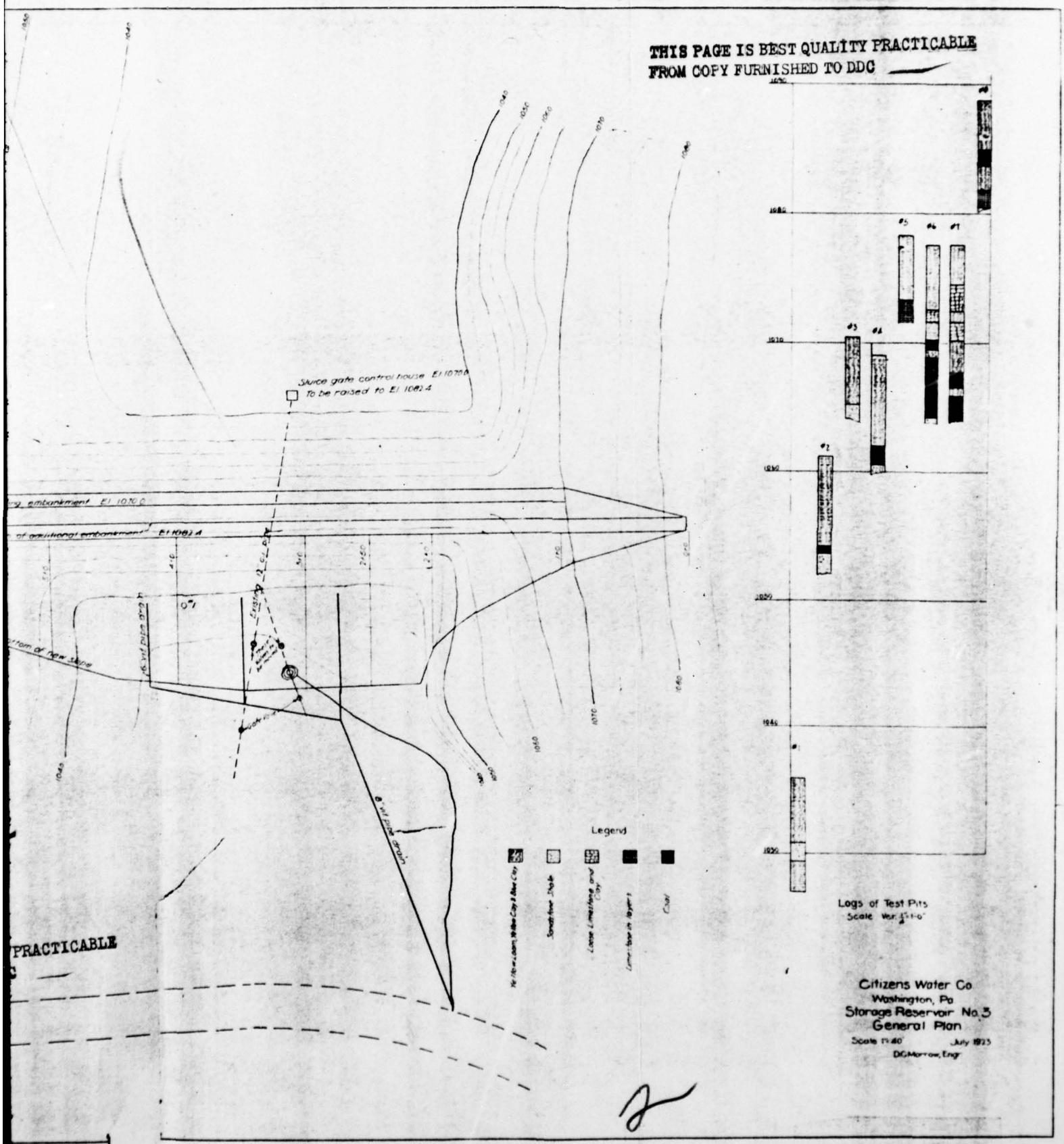
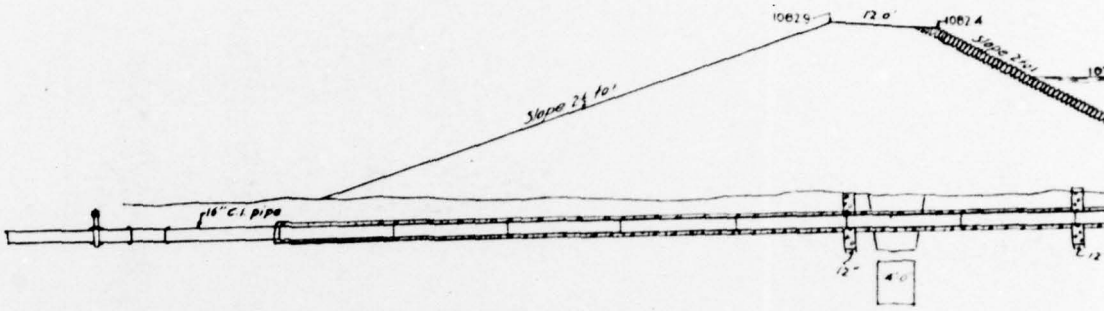
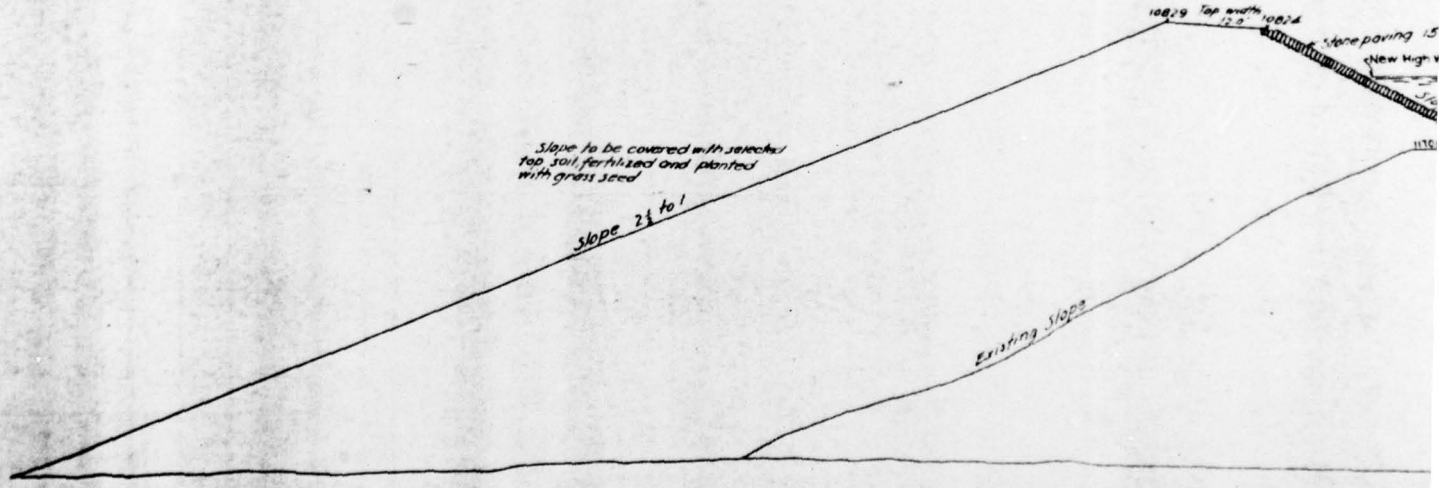


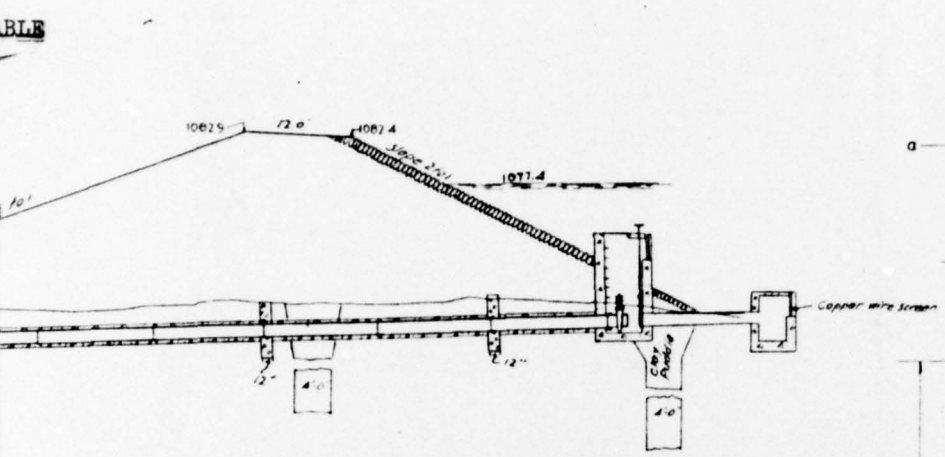
FIGURE 1



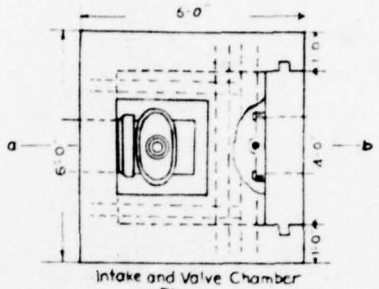
Section at Sta 7+65
Scale ⅛"=1'-0"



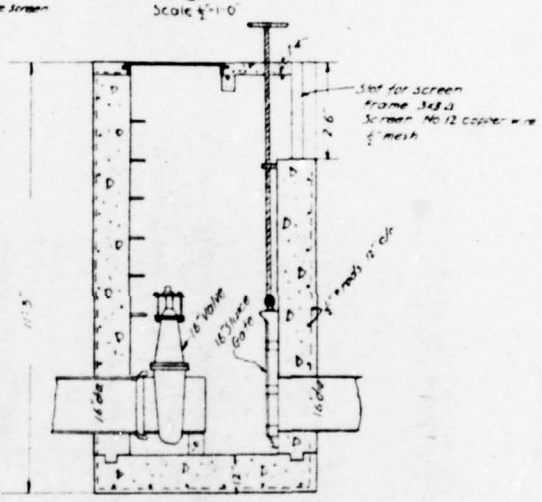
Section at Sta 24+50
Scale ⅛"=1'-0"



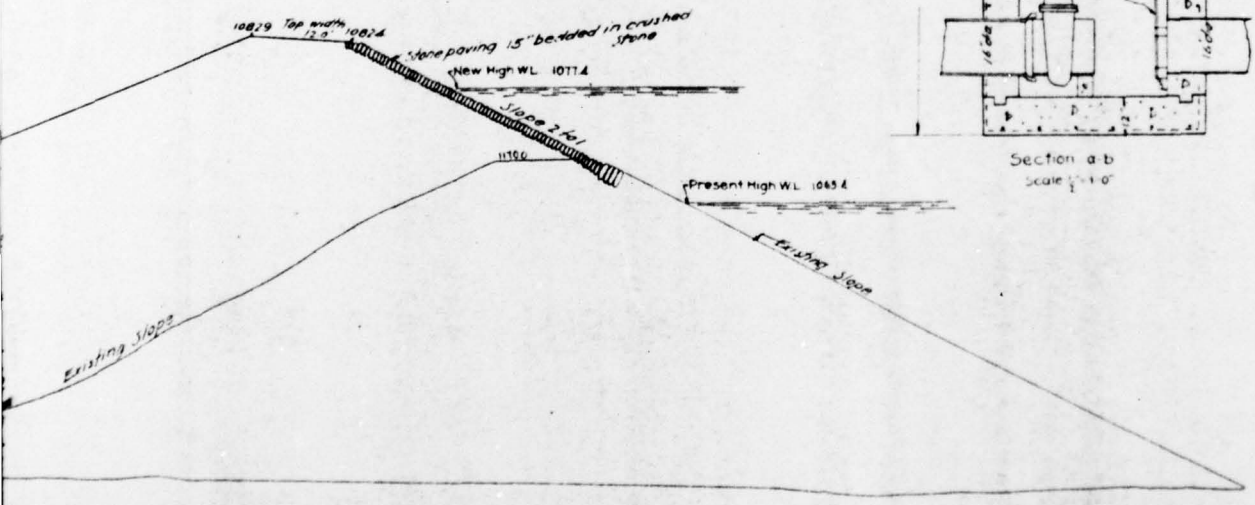
Section at Sta 7+65
Scale 1/8"=1'-0"



Intake and Valve Chamber
Plan
Scale 1/2"=1'-0"



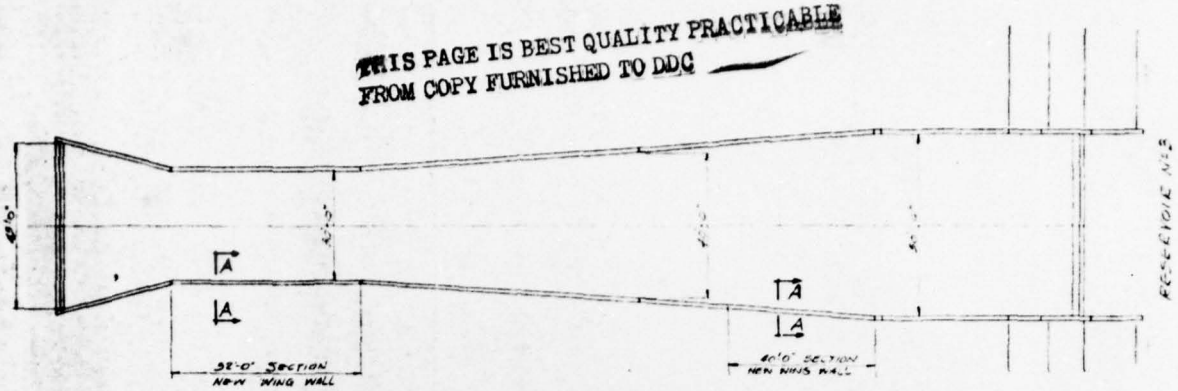
Section a-b
Scale 1/2"=1'-0"



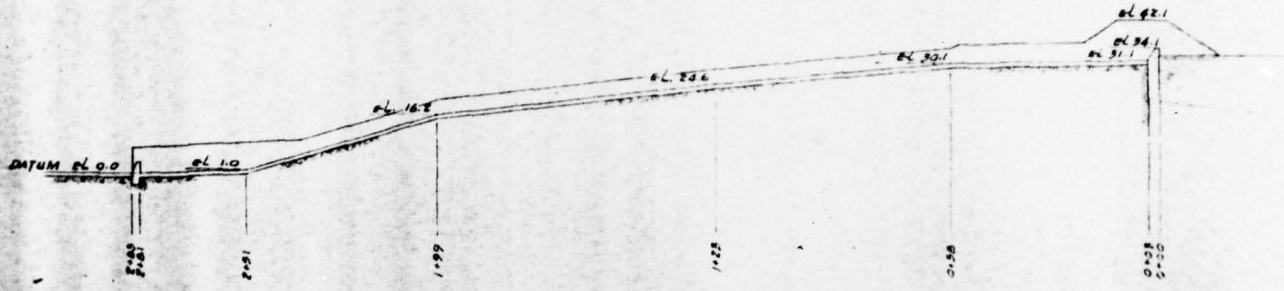
Section at Sta 2+50
Scale 1/8"=1'-0"

Citizens Water Co
Washington, Pa
Storage Reservoir No 3
Sections and Intake
Scales as indicated July 1923
D.C. Morrow Engr

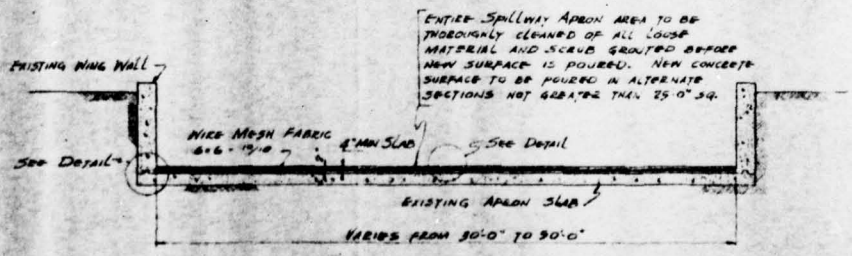
FIGURE 2



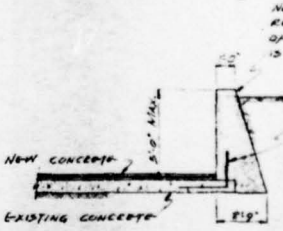
PLAN – SPILLWAY APRON
SCALE 1"=20'-0"



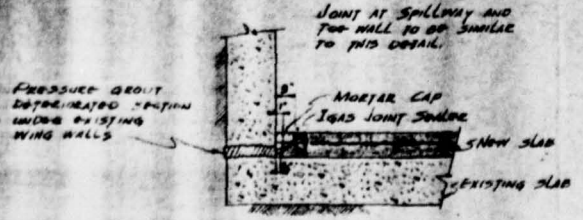
ELEVATION
SCALE 1"=20'-0"



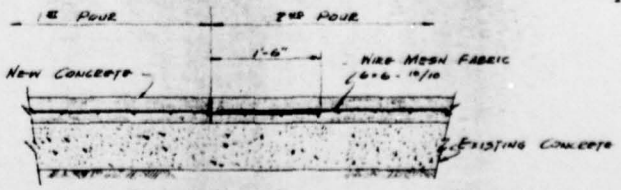
TYPICAL SPILLWAY APRON SECTION
SCALE 4"=1'-0"



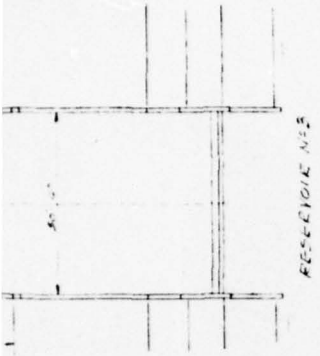
SECTION AA
SCALE 4"=1'-0"

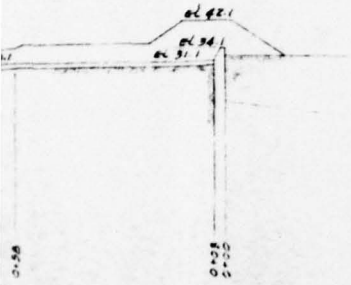


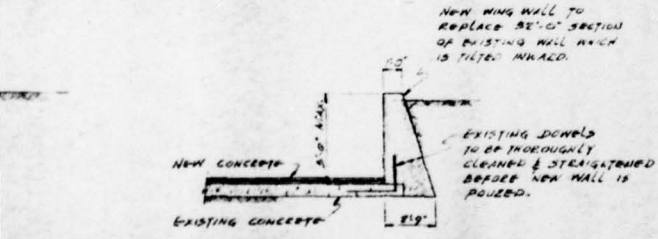
WING WALL JOINT DETAIL
Scale 1"=1'-0"



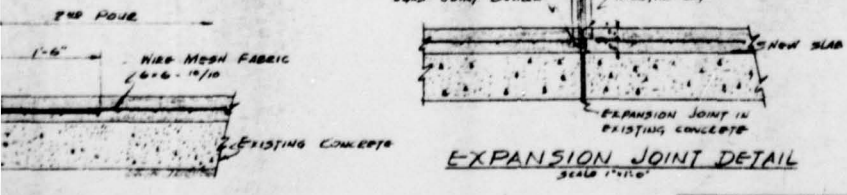
SLAB JOINT DETAIL
Scale 1"=1'-0"







SECTION AA
SCALE 1"=1'-0"



EXPANSION JOINT DETAIL
SCALE 1"=1'-0"

JOINT DETAIL
SCALE 1"=1'-0"

PLANS PREPARED BY
HOWARD J. CROOK P.E.
PENNA. LICENSE No. 809-E

REVISIONS

WASHINGTON DIVISION RESERVOIR No. 3
REPAIRS TO SPILLWAY APRON
PLAN, SECTIONS & DETAILS

THE CITIZENS' WATER COMPANY OF WASHINGTON
WASHINGTON, PA.

AMERICAN WATER WORKS SERVICE COMPANY
THREE JOHN CENTER PLAZA

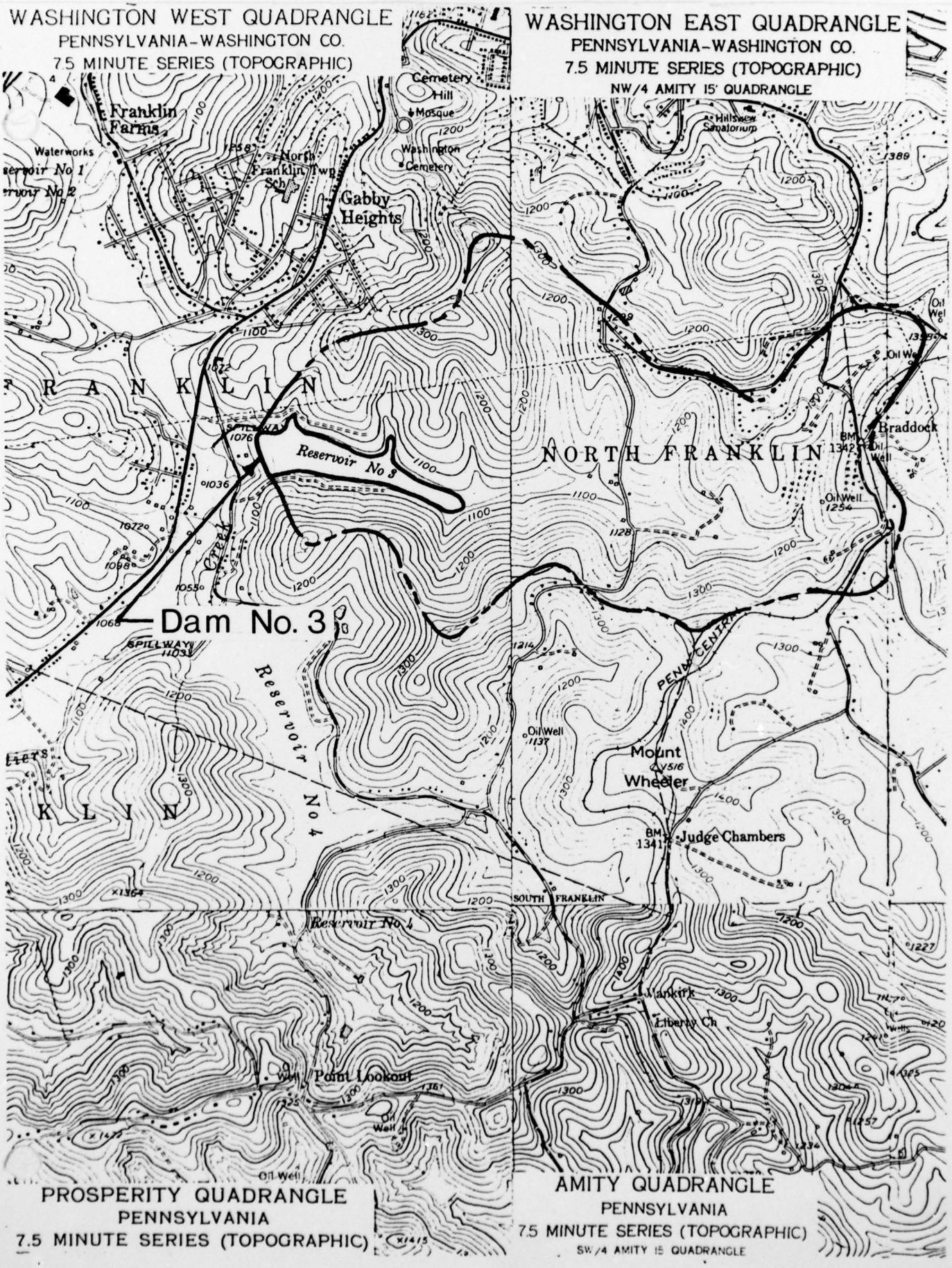
SCALE: AS NOTED
DRAWN BY S. SMITH
APPROVED A.J.C.

USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES

FIGURE 3

APPENDIX G

REGIONAL VICINITY MAP


WASHINGTON WEST QUADRANGLE
PENNSYLVANIA-WASHINGTON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
WASHINGTON EAST QUADRANGLE
PENNSYLVANIA-WASHINGTON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 AMITY 15' QUADRANGLE
Franklin Farms
Waterworks
Reservoir No 1
Reservoir No 2
North Franklin Twp Sch
Cemetery Hill
Mosque
Washington Cemetery
Gabby Heights
Hillsview Sanatorium
Braddock
Oil Well
Oil Well 1254
Oil Well 1137
Reservoir No 3
Dam No. 3
SPILLWAY
Creek
Reservoir No 4
PENN CENTRAL
Mount Wheeler
Judge Chambers
SOUTH FRANKLIN
Point Lookout
Liberty Ch
R A N K L I N
NORTH FRANKLIN
K L I N
PROSPERITY QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
AMITY QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 AMITY 15' QUADRANGLE