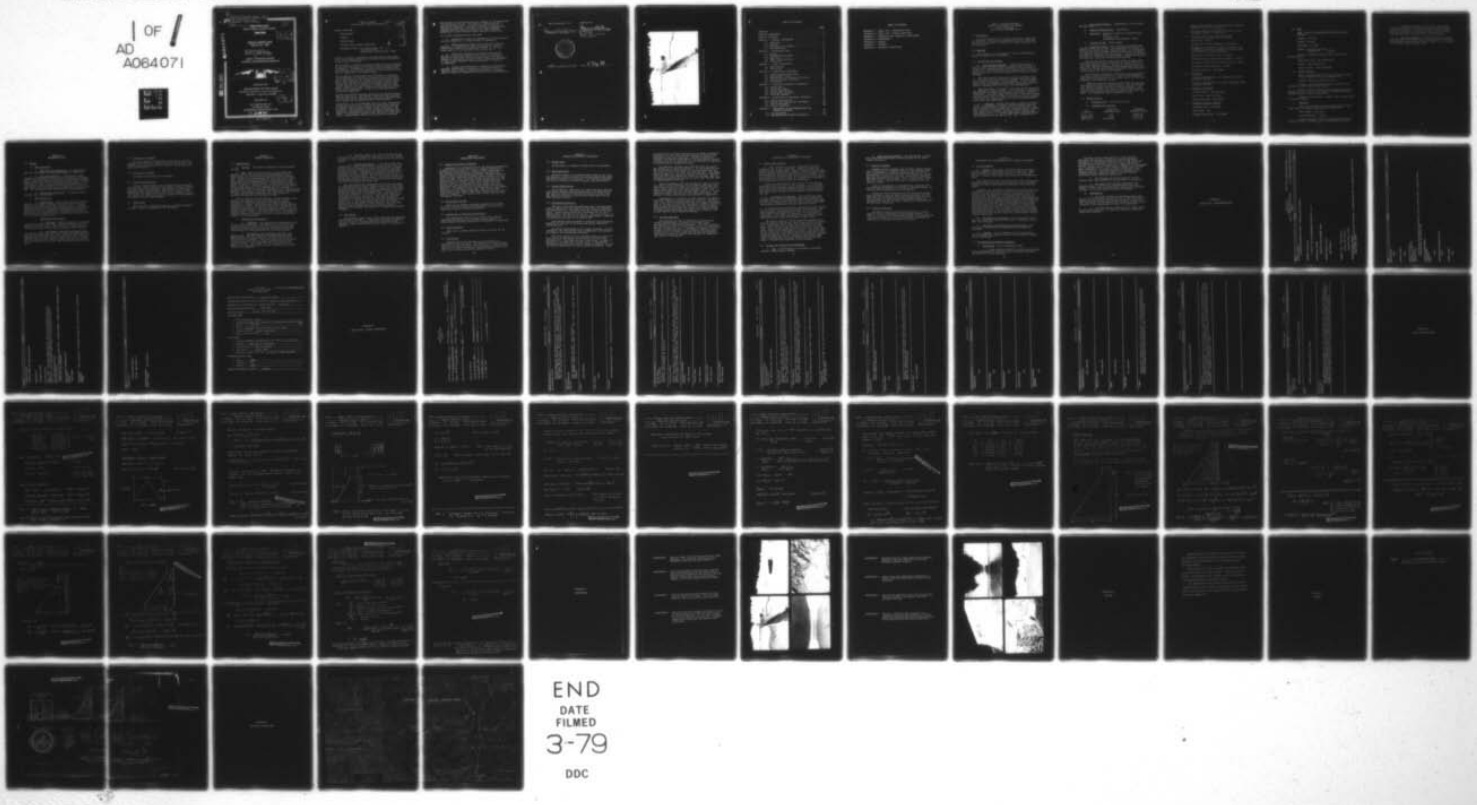
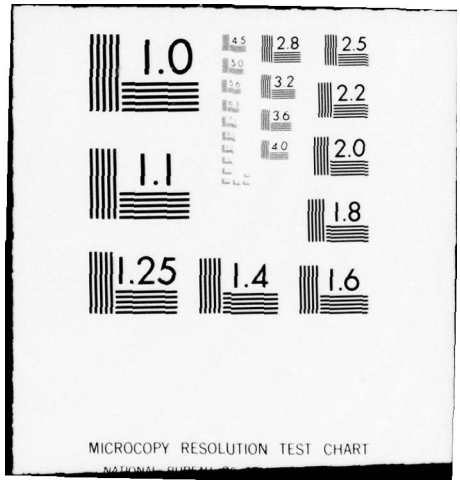
AD-A064 071 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. INDIAN CREEK DAM (NDI-PA-199),--ETC(U)
AUG 78 DACW31-78-C-0052
UNCLASSIFIED NL

1 OF 1
AD
A064071



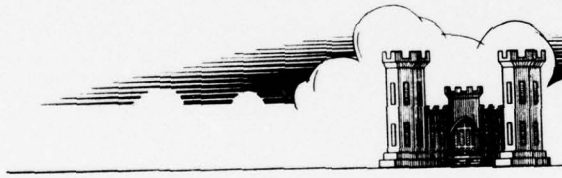
END
DATE
FILMED
3-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART

OHIO RIVER BASIN
INDIAN CREEK, FAYETTE COUNTY
PENNSYLVANIA

INDIAN CREEK DAM
NDI No. Pa. - 199

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



PREPARED FOR

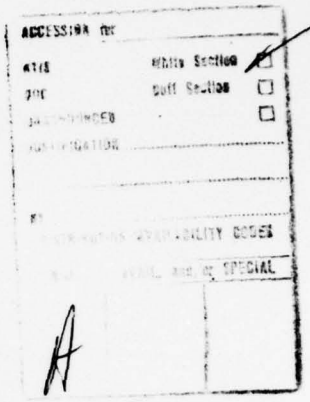
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

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

AUGUST 1978

PHASE I REPORT
National Dam Inspection Report



Indian Creek Dam

Pennsylvania

Fayette

Indian Creek

22 June 1978 (visual inspection)

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

Based on a visual inspection, available engineering data, and a brief stability analysis, the facility is considered to be in fair condition.

The spillway is capable of passing and/or storing 18 percent of the flow resulting from a storm of PMF magnitude without overtopping. Furthermore, the calculations indicate that the structure would be overtopped to a depth exceeding five feet if subjected to the above inflow.

Brief stability calculations were performed to conservatively estimate the factors of safety against overturning and sliding based on the limited design information available. The calculations indicate that under extreme flood conditions, the dam is marginally designed against overturning and that the resistance to sliding appears inadequate; however, the latter cannot be thoroughly evaluated based on available data. In any event, the spillway is considered inadequate.

Seepage was observed passing through the downstream masonry face in many areas. The ground in the area approximately 130 feet left of the spillway was saturated indicating that some seepage may be passing beneath the structure.

Consequently, it is recommended that the owner immediately engage the services of a registered professional engineer to conduct a more detailed study of the stability of the structure. This analysis should include a hydraulic and hydrologic investigation to more accurately ascertain the amount of overtopping expected under PMF and 1/2 PMF conditions. Consideration should also be given the cracking

and seepage on the downstream face, seepage at the downstream toe and seismic forces. The reservoir should also be drawn down temporarily, to permit a visual inspection of the spillway section. The owner should then implement any remedial measures deemed necessary to assure adequate performance of the structure under operating conditions.

It is also recommended that the owner:

a. Immediately assess the operability of the blow-off line and restore it to working order if necessary.

b. Make periodic surveys of the reservoir area to determine if sedimentation above the reservoir level is effectively reducing the available storage and take appropriate measures to preclude adverse effects on the dam.

c. Develop an operations and maintenance manual for use of the outlet works at the facility as well as develop a formal plan for surveillance during periods of intense or prolonged rainfall and for warning the residents of Camp Carmel (located 5 miles downstream) in case of an emergency.

d. Enlist the services of a registered professional engineer experienced in the design and construction of concrete gravity dams to inspect the facility on annual basis to check for hazardous conditions which could develop.

GAI Consultants, Inc.

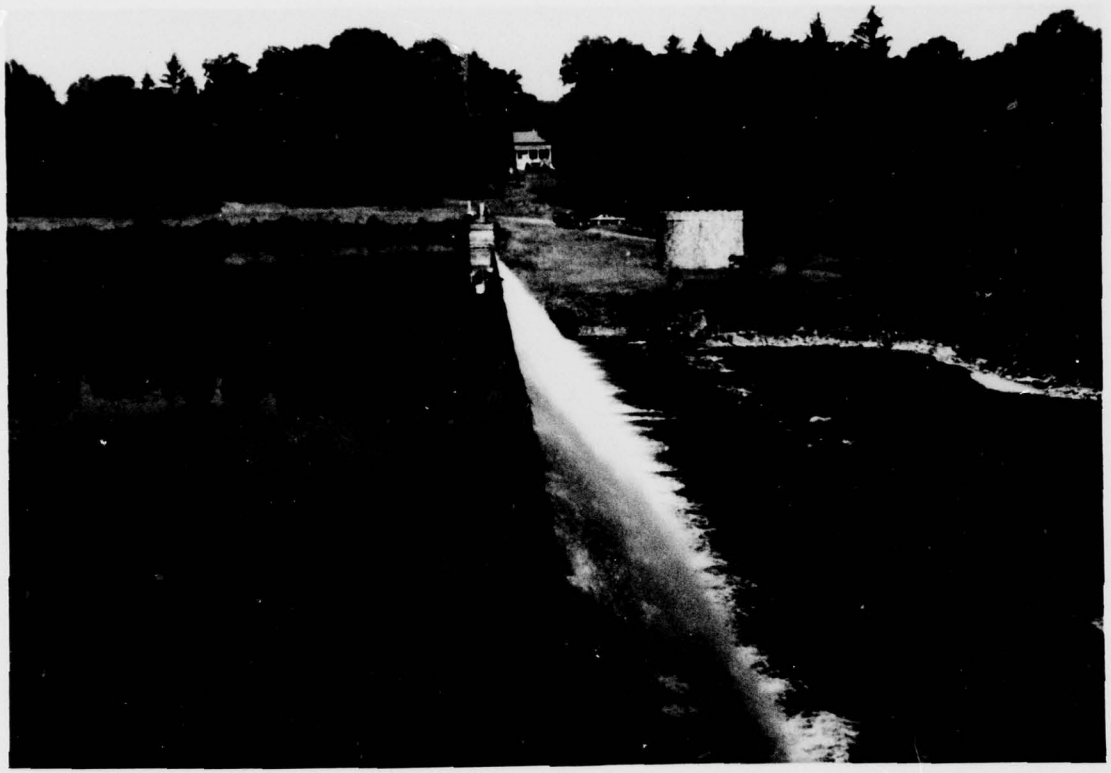
Bernard M. Mihalcin, P.E.

Date August 28, 1978

Approved by:

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

Date 11 Sep 78



Overview Photograph of Indian Creek Dam

TABLE OF CONTENTS

TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
INDIAN CREEK DAM
NDI# PA-199, PENNDER# 26-11

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. Indian Creek Dam is a gravity type, masonry structure approximately 515 feet in length with a maximum height of 40 feet. The facility is served by a broad-crested overflow spillway with a rough cut masonry face and a cut stone coping located near the right abutment.

The outlet works consists of a 48-inch diameter cast iron blow-off pipe and a 36-inch diameter cast iron supply pipe located to the left of the spillway. At the intake, these lines are equipped with sliding sluice gates that are manually operated from the crest (see Photograph 2).

The gate house is located at the left end of the spillway immediately below the dam. It is circular in design and constructed of random sized masonry resting on a concrete foundation. Both the supply and blow-off lines pass through the gate house with the former continuing on toward Connellsville while the latter discharges into the stream approximately 300 feet downstream.

b. Location. Indian Creek Dam is located on Indian Creek, in Springfield Township, Fayette County, Pennsylvania, approximately 10 miles east of Connellsville. The dam, reservoir, and watershed are contained within the Mill Run, Bakersville, Donegal, Kingwood, Seven Springs, and Stahlstown U.S.G.S. 7.5 minute quadrangles (see Appendix G). The coordinates of the dam are N39° 58.9' and W79° 27.3'.

c. Size Classification. Intermediate (40 feet high, 706 acre-feet).

d. Hazard Classification. Significant.

e. Ownership. Municipal Authority of Westmoreland County
P. O. Box 730
Greensburg, Pennsylvania 15601

f. Purpose of Dam. Water supply.

g. Historical Data. The facility was designed and constructed by the American Pipe Manufacturing Company in 1905 for the Mountain Water Supply Company. It is reportedly constructed of cyclopean concrete, faced with 24 inches of rough cut stone and cut stone coping. Since no provision was made for expansion and contraction, cracks have appeared periodically, requiring corrective maintenance.

The dam experienced record pool levels in March 1936, (3.62 feet above spillway crest) and in August 1943 (4.5 feet above spillway crest). Records are not available for June 1972, however, discussions with maintenance personnel at the site during this inspection indicate that during the "Agnes" storm, the dam was overtopped.

Silting and a consequent reduction in storage capacity has been a problem at this site. The dam was dredged in 1966 under the direction of its present owner the Municipal Authority of Westmoreland County.

Inspection reports indicate the facility to have been well maintained over its entire history. The only consistent reported defects have been cracking adjacent to the left spillway sidewall and areas of slight seepage along cracks in the masonry and along the wall at the right abutment. The seepage was never considered serious.

1.3 Pertinent Data.

a. Drainage Area. 109.6 square miles.

b. Discharge at Dam Site.

Date	Head Over Spillway (ft)	Estimated Discharge (cfs)
March 1936	3.62	5,680 cfs
August 1943	4.50	7,875 cfs
June 1972	Overtopped	Not known

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

Spillway Capacity at Maximum Pool (top of dam elevation 1253.8) - 12,125 cfs.

c. Elevation (feet above mean sea level).

Top of Dam - 1253.8.

Maximum Pool Design Surcharge - Not known.

Maximum Pool of Record - 1252.3 in August 1943 (recorded); however, reportedly >1253.8 in 1972 (not recorded - visual estimate).

Normal Pool (spillway crest) - 1247.8.

Upstream Portal Invert Outlet Conduit - 1224.3.

Downstream Portal Invert Outlet Conduit ≈ 1220.

Streambed at Dam Centerline ≈ 1219.

Maximum Tailwater - Not known.

d. Reservoir.

Length of Maximum Pool ≈ 0.6 miles (top of dam elevation 1253.8).

Length of Normal Pool ≈ 1.3 miles (spillway crest elevation 1247.8).

e. Storage (acre-feet).

Spillway Crest - 706 acre-feet.

Top of Dam ≈ 826 acre-feet.

Design Surcharge - Not known.

f. Reservoir Surface (acres).

Spillway Crest ≈ 65 acres.

Top of Dam ≈ 137.

Maximum Design Pool - Not known.

g. Dam.

Type - Gravity (cyclopean concrete and masonry facing).

Length - 515 feet.

Height - 40 feet.

Top Width - 6 feet.

Slopes - Vertical upstream
Downstream 7H:10V

Zoning - Cyclopean concrete core with 24-inch masonry facing.

Impervious Core - Not applicable.

Cutoff - None indicated.

Grout Curtain - None indicated.

h. Outlet Conduit.

Type - 42-inch diameter cast iron blow-off line. 36-inch diameter cast iron supply line.

Length ≈ 400 feet (blow-off line).

Closure - Sliding sluice gates at intake on upstream face and valved at gate house.

Access - Sluice controls are accessible by foot located atop the crest. Gate house is situated immediately downstream and is readily accessible.

Regulating Facilities - Conduit flow is controlled at the gate house.

i. Spillway.

Type - Uncontrolled broad-crested overflow type with rough cut masonry face and a cut stone cap.

Weir Length - 300 feet.

Crest Elevation - 1247.8.

Upstream Channel - Natural bed with evidence of heavy siltation. Forebay depth is approximately 20 feet.

Downstream Channel - The channel immediately beyond the spillway is a rough concrete and rock apron (boulder concrete). Beyond this, about 20 feet from the base of the spillway is a natural rock channel free of obstructions with steep and heavily wooded slopes.

j. Regulating Outlets. 42-inch diameter cast iron blow-off line with intake along the upstream face of the left abutment and valved at the gate house. Also equipped with 36-inch diameter supply line.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available.

1. Hydrology and Hydraulics. No engineering data were available concerning hydraulics or hydrology.

2. Dam and Foundation. Calculations which consider sliding and overturning were contained in PENNDER files. The calculations are placed on regular tablet paper and are post-construction calculations dated 1940. A brief stability analysis is also contained within Appendix C of this report. Also contained within the files is a set of calculations for the addition of flashboards to Indian Creek Dam. The flashboards were apparently never constructed.

3. Appurtenant Structures. Structural design analyses were not available.

b. Design Features.

1. Gravity Dam. Indian Creek Dam is a gravity dam with a cyclopean concrete core faced with rough cut masonry (see Figure 1 and Photographs 2 and 5). Records contained within PENNDER files indicated that the structure is founded on rock, predominantly sandstone with lesser amounts of shale and limestone. The upstream face of the dam is vertical, whereas the downstream face is sloped 7H to 10V below the spillway crest.

2. Appurtenant Structures.

a) Spillway. Indian Creek Dam is served by a broad crested weir overflow spillway measuring 300 feet (long) by 6 feet (high). The spillway is capped with cut stone coping held in place with steel bars (see Figure 1).

b) Gate House, Blow-Off and Supply Pipes. A circular masonry gate house is located just downstream of the dam (see Photograph 2). This structure houses the gate controls for a 36-inch diameter supply pipe and a 48-inch diameter blow-off pipe, both of which also can be regulated via sluice gates on the inlet ends (controlled from crest of dam).

2.2 Construction Records.

The only records of construction consist of a single drawing titled "Plan of Indian Creek Dam," dated 1905. The drawing shows plan and sectional views of the dam and gate house (see Figure 1).

2.3 Operational Records.

No operational records are available.

2.4 Other Investigations.

Several PennDER reports are available from the period 1914 to 1961. The facility is described as being in good to excellent condition throughout this period. A 1940 report mentions slight seepage and a rusty scale forming on the downstream face about 130 feet left of the spillway as well as a small leak along the plane of contact of the foundation and masonry at the right abutment.

2.5 Evaluation.

The available engineering data are considered adequate to make a general assessment of the structure.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general condition of the structure is fair.

b. Dam. There are many cracks on the downstream masonry face of the structure (see Photographs 4 and 5). Some seepage can be seen issuing from the cracks particularly in the area approximately 130 feet left of the spillway. Deposits of calcium carbonate (efflorescence) cover large areas on the downstream face indicating that dissolution of cement is taking place. A rusty scale can also be seen in this area. The exact nature or source of the scale is not known although it is possible that it is simply staining from iron rich minerals contained within the sandstone masonry. The ground in the area 130 feet left of the spillway is saturated possibly indicating that some seepage is issuing from beneath the structure as well.

Just to the left of the spillway a large section of the masonry face contains vertical and horizontal cracks. Reference to cracks at this point are made on numerous occasions in PennDER files dating from the earliest inspections prior to 1920. The mortar joints have reportedly been cleaned and repointed on several occasions, however, as can be seen in Photograph 5, the effectiveness of the repointing seems minimal. Figure 1 indicates that 1-1/2 inch dowels of unknown length were installed in the cut stone coping thus binding it to the masonry.

c. Appurtenant Structures.

1. Spillway. The spillway was discharging water at the time of inspection, consequently, it could not be directly observed (according to Mr. Ken Baker of the Westmoreland County Municipal Authority, water has discharged continuously over the structure for the last 8 years).

2. Gate House, Gate Controls, Blow-off, and Supply Line. The gate controls located within the gate house appeared in good condition, although they were not operated in our presence. The sluice gate on the inlet end of the supply line was reportedly operated recently and functioned well. The sluice gate on the blow-off line, however, has not been closed in recent years and its operability is in question.

3. Reservoir Area. The slopes surrounding the reservoir vary from gentle to steep and are heavily wooded. No signs of slope distress were observed during the investigation.

4. Downstream Channel. A few years after the completion of Indian Creek Dam, it became obvious that the erosive action of the water discharging over the spillway was having a deleterious effect on the channel just downstream of the dam. Consequently, a boulder concrete apron measuring 35 feet in length was constructed in 1914 as protection for the bedrock. The concrete apron is said to be six feet deep at several places. The riprap paving (see Photograph 1) protecting the left bank near the gate house was also placed about the same time.

The area immediately downstream of the concrete apron is characterized as a steep sided wooded valley containing the rock-lined Indian Creek channel. Approximately 5 miles downstream, flow from Indian Creek passes under a railroad bridge and enters the Youghiogeny River. Camp Carmel, a religious encampment, is located on the south bank of the Youghiogeny River at this point. The camp is inhabited throughout the summer months and could potentially be affected by a failure of Indian Creek Dam, depending on the water level in the Youghiogeny River prior to failure. Because of the proximity of Camp Carmel to the river and the resultant possible loss of life and/or damage to property, the facility was placed in a "significant" hazard category.

3.2 Evaluation.

Measurements taken in the field generally correspond to those shown on Figure 1. Significant cracking was noted in the stone facing. Seepage along the left section may indicate a poor cutoff condition and should be evaluated in detail.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedure.

According to a representative of the Municipal Authority of Westmoreland County, there are no formal operational procedures at the facility. Excess inflow discharges over the ungated broad-crested weir spillway and enters the natural Indian Creek channel downstream. Normally water is drawn from the reservoir through a 36-inch supply line at a rate of 1 MGD. This situation changes if the water in the Youghiogeny River becomes turbid (the Youghiogeny River is the main source of water to the water system) when the Indian Creek facility becomes the main source of water. Reportedly this situation occurs about three times yearly. Recently, a treatment facility was constructed a few hundred feet north of the Indian Creek Dam. The facility was constructed by the Indian Creek Water Authority and is currently on standby. The facility will be put into use when the demand increases.

4.2 Maintenance of Dam.

There are no formal maintenance programs at the dam. The only available history of maintenance is contained in inspection reports by PennDER personnel.

4.3 Maintenance of Operating Facilities.

The operational facilities at Indian Creek Dam are reportedly maintained on a periodic basis; however, no formal manual outlining objections or procedures is available.

4.4 Warning System.

There are no formal warning systems in effect at the facility.

4.5 Evaluation.

Maintenance of the facility is not provided on a scheduled or routine basis. The blow-off line has not been operated in years and hence its operability is questionable. There are no formal operations or maintenance manuals available; nor is there any warning system in effect.

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 design storm used in the original analysis or data pertinent to spillway evaluation based on past performance are available. All observed structures are intact indicating probable adequate past performance.

5.3 Visual Observations.

On the date of inspection, no conditions were observed that would indicate that the appurtenant structures of the dam would not operate satisfactorily during a flood event. One possible exception is the blow-off pipe which has not been operated in years.

5.4 Overtopping Potential.

The ratio "PMF Peak Flow/Drainage Area" was determined from an empirical curve supplied by the Corps of Engineers, Baltimore District. The curve used was the Ohio River Basin curve. Based on this curve and a drainage area of 109.6 square miles, Peak PMF Q = 70,144 cfs. The size category is "intermediate" and the hazard rating "significant", therefore the SDF should be equal to 1/2 PMF to PMF.

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

An inflow volume based on 26 inches of runoff, (151,979 acre-feet,) for the PMF was used in subsequent calculations to evaluate the overtopping potential.

The total capacity of the spillway based on a head of 6 feet, which is equivalent to the interval at which the spillway crest lies below the top of dam crest, is equal to 12,125 cfs. A comparison of peak inflow to the maximum discharge shows that some storage volume is required to hold the excess inflow until it can be safely discharged. Based

on normal pool elevation 1247.8 and an available freeboard capacity of 6 feet, the available storage is found to approximately equal 801 acre-feet. Further calculations indicate that Indian Creek Dam will not pass and/or contain a storm in excess of 18 percent of the PMF when the spillway is functioning at maximum efficiency.

An additional analysis was performed with the entire dam studied as a broad-crested weir. It was found that the PMF is discharged while reaching a maximum head above the dam crest of five to slightly less than 10 feet. The higher figure assumes flow only over the dam and does not consider flow over the slope beyond the limits of the dam. The corresponding discharge for 10 feet of water over the dam crest is approximately 70,000 cfs.

Since overtopping will not necessarily lead to failure of a gravity type structure such as Indian Creek Dam, consideration was given to both overturning and sliding potential. Three separate cases were analyzed. Case I considered the water level at the dam crest; Case II at 5 feet above the crest; Case III at 9 feet above the crest. The results of these calculations are presented in Appendix C.

Overtopping of a concrete gravity type dam is usually a tolerable condition when its duration is short. Nevertheless, flow across the downstream face will cause the foundation at the toe to erode and some design allowance should be made in consideration of this condition. Since no design calculations are available for review, the overall effects of Indian Creek Dam being overtopped for an extended time period require a more extensive analysis.

5.5 Spillway Adequacy.

The spillway and dam as designed will pass and/or contain approximately 18 percent of the PMF, thus the spillway is considered inadequate. The hazard rating for Indian Creek Dam is "significant" and it is questionable whether the dam will fail if overtopped; however, since it is such a great distance to any permanent dwellings downstream failure of Indian Creek Dam may not significantly increase the hazard to downstream residents as compared to just prior to overtopping.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Dam. Based on a visual examination, the dam appeared to be in fair condition. Numerous cracks are evident on the masonry face. Water is seeping through the dam and despositing calcium carbonate on the downstream face (efflorescence) suggesting dissolution of the cement. The total extent of cracking could not be gauged at the time of inspection and it is not known if cracking has progressed to the cyclopean concrete core of the structure.

A wet area was observed near the toe of the dam approximately 130 feet left of the spillway. It is thought that some of the seepage could be issuing from beneath the structure since the total amount of water noted exceeded that which could readily be attributed to seepage through the dam.

b. Appurtenant Structures. The spillway was discharging at the time of inspection and thus could not be directly observed. Direct observation of the spillway may be difficult considering that the structure has reportedly continuously passed water for the last eight years.

A spillway apron of boulder concrete was constructed in 1914 to protect the downstream channel from erosion. The apron measures approximately 310 feet by 35 feet and is reportedly 6 feet thick in some areas. At the time of inspection, a few holes were noted in the concrete apron indicating that is has worn through in some areas.

The outlet system at Indian Creek Dam consists of a 36-inch diameter supply pipe and 48-inch diameter blow-off pipe. Both pipes are of cast iron construction and are fitted with trash screens and sluice gates at the inlet ends. Both are also gated within the circular stone gate house located just downstream of the dam. The sluice gate on the inlet end of the supply pipe was reportedly closed recently; however, the sluice gate on the blow-off line has remained opened for years. Normally flow through these lines is controlled via valves located within the gate house. No gates were operated in our presence.

6.2 Design and Construction Techniques.

a. Dam. No information is available concerning design or construction reports.

b. Appurtenant Structures. No information is available concerning the design or construction of the appurtenant structures.

6.3 Past Performance.

PennDER records indicate that the Water Supply Commission (predecessor of PennDER) asked for and received rainfall and discharge records for Indian Creek Dam for the period March 17, 18, and 19, 1936. The water level in the spillway was reported as 3.62 feet on the 17th. Rainfall data were supplied as follows: 17th - 2.00"; 18th - 2.08"; and 19th -0.44". During this time, the blow-off was reportedly closed.

Later correspondence in PennDER files indicates that the spillway was flowing at 4.5 feet in August of 1943. No rainfall data accompanied this information.

During our field inspection of the structure, maintenance personnel from the water company indicated that the structure was overtopped during the "Agnes" storm of 1972. This information could not be substantiated during our conversation with Mr. Ken Baker (engineering representative for the water authority).

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and is subject to minor earthquake induced dynamic forces. In light of the observed cracking and leakage at the downstream toe, these forces may not be insignificant and should be included in a detailed structural evaluation.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection and operational history suggest that the dam is in fair condition. There was no evidence of mass deterioration of the structure; however, cracking and seepage were noted on the downstream face.

The ground in an area 130 feet left of the spillway was saturated indicating that some seepage may also be passing beneath the dam. This condition requires a more detailed study.

Hydraulic and hydrologic calculations indicate that the spillway can pass 18 percent of the flow resulting from a storm of the PMF magnitude without overtopping, thus, it is considered inadequate. In addition, the calculations indicate that the dam would be overtopped by approximately 5 to 10 feet of water if subjected to a storm of PMF magnitude. (The range is given since the calculations do not include provisions for flow over the slopes beyond the dam limits.) Assuming conservative parameters, stability calculations were performed to assess the factor of safety against overturning and sliding. They indicate that the dam is marginally designed relative to overturning under extreme loading conditions and that sliding could be a problem under normal loading conditions.

b. Adequacy of Information. The information available was considered sufficient to make a reasonable assessment of the project.

c. Necessity for Additional Investigations. The additional investigations listed below are considered necessary.

d. Urgency. It is suggested that the additional investigations and remedial measures listed below be implemented immediately.

7.2 Recommendations/Remedial Measures.

a. Facilities. It is recommended that:

1. A more detailed study be carried out utilizing field and laboratory testing to more accurately ascertain the stability of the structure.

Included in this study should be a more detailed hydrologic and hydraulic analysis to better determine the amount of overtopping under PMF and 1/2 PMF conditions. Consideration should also be given to the cracking and seepage through the downstream face, seepage at the downstream toe and seismic forces. The reservoir should also be drawn down, temporarily, to enable a visual evaluation of the spillway section. The owner should then implement those remedial measures deemed necessary to assure adequate performance under operating conditions.

2. The operability of the blow-off line be assessed and it be restored to working order if necessary.

3. The owner make periodic surveys of the reservoir area to determine if sedimentation above the normal reservoir pool is effectively reducing the available storage. If so, the reservoir should be dredged.

b. Maintenance.

1. The owner develop an operations manual for use of the outlet works at the facility as well as develop a formal plan for surveillance during periods of heavy rainfall and runoff and for warning the residents of Camp Carmel (located 5 miles downstream) in case of an emergency.

2. The facility be inspected on an annual basis, by qualified personnel, 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 Indian Creek Dam

ID # NDI# PA-199; PennDER 26-11

ITEM	REMARKS	SHEET 1

AS-BUILT DRAWINGS

Drawings provided by owner - mostly piping details.

REGIONAL VICINITY MAP

U.S.G.S. and one topographic map from owner.

CONSTRUCTION HISTORY

Obtained from PennDER files.

TYPICAL SECTIONS OF DAM

See Figure 1.

OUTLETS - PLAN See Figure 1.

- DETAILS See Figure 1.

- DISCHARGE RATINGS None.

RAINFALL/RESERVOIR RECORDS

No rainfall data available from owner - Reservoir has been in constant overflow for at least eight years.

DESIGN REPORTS

None.

GEOLOGY REPORTS

None.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Overturning and sliding calculations found on tablet paper in PennDER files. Calculations were dated 1940.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

None.

POST-CONSTRUCTION SURVEYS OF DAM

None.

BORROW SOURCES

N/A.

ITEM	REMARKS	ID # PA-199	SHEET 3

MONITORING SYSTEMS

Venturi meter in house below dam.

MODIFICATIONS

Dredged in 1966.

HIGH POOL RECORDS

March 1936 - 3.62 feet above spillway crest (pool elevation 1251.42).
August 1943 - 4.50 feet above spillway crest (pool elevation 1252.30).
June 1972 - Dam overtopped (verbal data); (pool elevation > 1253.8).

POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS

Study prior to purchase around 1966 - needed dredged - recent Bankson Engineers study - report not yet available.

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS

None known.

MAINTENANCE - None available - No formal program but visited about 3 times/week.
OPERATION -
RECORDS

ITEM	REMARKS	ID # PA-199	SHEET 4

SPILLWAY PLAN

SECTIONS See Figure 1.

DETAILS See Figure 1.

OPERATING EQUIPMENT
PLANS & DETAILS See Figure 1.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

ID # Pa.-199; PennDER# 26-11

DRAINAGE AREA CHARACTERISTICS: 109.6 sq. miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1247.8 , 706 acre-feet

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): not known

ELEVATION MAXIMUM DESIGN POOL: not known

ELEVATION TOP DAM: 1253.8 , 826 acre-feet

SPILLWAY DATA

a. Elevation (crest) 1247.8
b. Type Broad-crested weir overflow w/ masonry face and cut stone cap.
c. Width 300 feet
d. Length cyclopean concrete apron 35 feet long.
e. Location Spillover right of dam center
f. Number and Type of Gates none

OUTLET WORKS:

a. Type 42 inch dia. blowoff pipe; 36 inch dia. supply pipe
b. Location Both left of dam center
c. Entrance Inverts 1224.3 ; 1224.3
d. Exit Inverts 1220 ; 1220
e. Emergency Draindown Facilities 42 inch dia. blow-off pipe

HYDROMETEOROLOGICAL GAGES:

a. Type None
b. Location N/A
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NDI PA-199

DAM NAME Indian Creek COUNTY Fayette STATE PA ID # PennDER 26-11

TYPE OF DAM Concrete/Masonry Grav. HAZARD CATEGORY Significant

DATE(S) INSPECTION 22 June 1978 WEATHER Clear TEMPERATURE 70° at 8:00 a.m.

POOL ELEVATION AT TIME OF INSPECTION 1248 M.S.L. TAILWATER AT TIME OF INSPECTION ≈6 inches M.S.L. above spillway apron.

INSPECTION PERSONNEL:

B. M. Milhalcin (GAI)	Westmoreland Co. Mun. Authority	
J. P. Nairn (GAI)	Ken Baker	
P. Tolcser (GAI)		
D. L. Bonk (GAI)		

D. L. Bonk RECORDER

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Through downstream face between vertical wall section and sloped section. Seeps apparently emanate through mortar joints. Seepage also at toe as is evidenced by small pools and wet soil. Most prominent area of seepage is approximately 130 feet from left spillway abutment (all seepage noted is on left abutment).	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Right abutment keyed into rock. Good condition. Left abutment placed on gentle natural slope. Good condition, except for noticeable seepage.	
DRAINS	None observed.	
WATER PASSAGES	None.	
FOUNDATION	See seepage discussion above. Ground saturated and soft along portions of the toe.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
SURFACE CRACKS CONCRETE SURFACES	Failure of mortar joints is evident underneath coping. Mortar is in generally satisfactory condition over remainder of structure.	
STRUCTURAL CRACKING	Cracks are visible in the block on left spillway abutment approximately 15 feet from spillway crest. Large crack also visible on downstream face of left abutment that extends from spillway crest to 15 feet to the left. Cracks are 1/4 inch to 1/2 inch wide.	
VERTICAL AND HORIZONTAL ALIGNMENT	Good condition.	
MONOLITH JOINTS	None observed.	
CONSTRUCTION JOINTS	None observed.	
STAFF GAGE OF RECORDER:	None observed.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable (cast iron pipe).	
INTAKE STRUCTURE	Thirty-six-inch supply line and 48-inch blow-off have inlets on upstream side of left abutment. Both have sluice gates that are manually controlled directly above on top of the crest. Screws look to be in good condition and are protected with a polyethylene cover. Threads in good condition.	
OUTLET STRUCTURE	Forty-eight-inch diameter blow-off discharges into Indian Creek approximately 80 yards from spillway. Round stone masonry gage house located immediately downstream of left abutment houses the valve system. Valves appear in good condition.	
OUTLET CHANNEL	Outlet discharges into natural stream (Indian Creek) below the dam.	
EMERGENCY GATE	Sluice gates located 50 feet to the left of the spillway are controlled directly above from the dam crest.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Three hundred-foot long broad-crested spillway constructed of cut stone (smooth) coping with a rubble masonry face.	
APPROACH CHANNEL	N/A.	
DISCHARGE CHANNEL	Thirty-five feet of unformed boulder concrete apron extends downstream from toe of spillway. Beyond this lies a natural rock lined channel which gradually narrows to about 100 feet downstream.	
BRIDGE AND PIERS	None observed.	

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 observed.	
WEIRS	None observed.	
PIEZOMETERS	Non observed.	
OTHERS	Venturi meter measures flow in conduits and is located approximately 200 yds downstream in wooden chlorination building. Not observed directly but could be seen through window of the structure in which it was housed.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

SLOPES

Steep on all sides and heavily wooded.

SEDIMENTATION

Measurements indicate water depth upstream to be at approximately 20 feet near spillway crest, indicating siltation. Note: Measurements across the left abutment were not uniform. In particular, no siltation was evident at the outlets. General appearance of the reservoir proper seems to indicate substantial siltation as evidenced by driftwood protruding through the surface. Reservoir was dredged in 1966.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural rock-lined channel with no obstructions observed.	
SLOPES	Steep on both sides and heavily wooded.	
APPROXIMATE NO. OF HOMES AND POPULATION	None observed and none shown on U.S.G.S. 7.5 minute map until Indian Creek passes under railroad bridge and converges with the Youghiogeny River, approximately 5 miles downstream. At the confluence is located Camp Carmel, a religious retreat composed of several wooden structures, the lowest of which was 17 feet above water level during inspection.	

APPENDIX C

HYDROLOGY/HYDRAULICS

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 1 OF 12

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

LOCATION (DAM, RESERVOIR, AND WATERSHED)

MILL RUN	QUADRANGLE	U.S.G.S. 7.5 MINUTE MAP
BAKERSVILLE	QUADRANGLE	
DONEGAL	QUADRANGLE	
KINGWOOD	QUADRANGLE	
SEVEN SPRINGS	QUADRANGLE	
STAHLSTOWN	QUADRANGLE	

DAM STATISTICS (REF. 1)

MAXIMUM HEIGHT OF DAM = 40 FT.

DRAINAGE AREA = 109.6 SQ. MI.

STORAGE CAPACITY = 231 MIL. GAL.
= 706 ACRE-FEET

SIZE CLASSIFICATION

DAM SIZE = INTERMEDIATE (REF. 2, TABLE 1)

HAZARD RATING = SIGNIFICANT (REF. 2, TABLE 2)

REQUIRED SDF = ½ PMF TO PMF (REF 2, TABLE 3)

REF. 1: WATER SUPPLY COMMISSION REPORT ON "INDIAN CREEK DAM" OCT 29, 1914

REF 2: "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS" DEPT. OF ARMY – APPENDIX D.

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 2 OF 19

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

DRAINAGE AREA = 109.6 SQ. MI. (SHEET 1)

PMF (PEAK FLOW)/AREA = 640 CFS/SQ. MI (REF: C OF E CURVE)

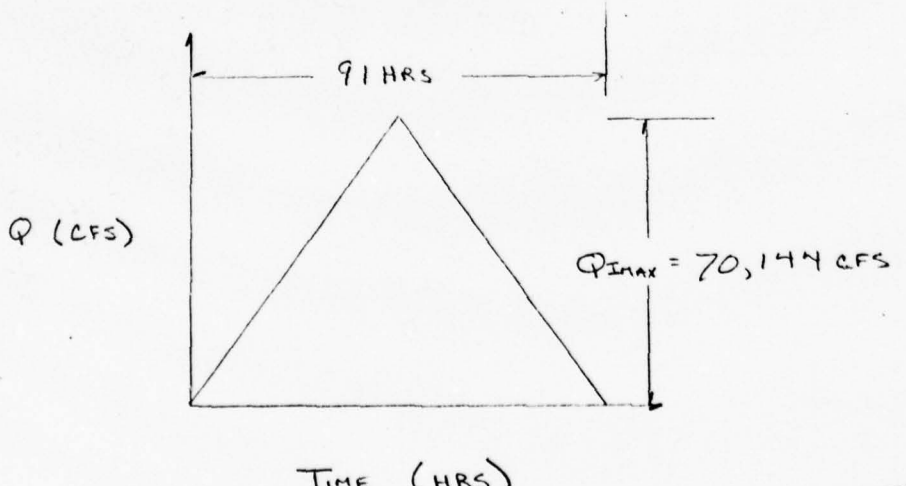
PMF = (640 CFS/SQ. MI.)(109.6 SQ. MI) = 70,144 CFS

SDF = PMF

DEVELOP INFLOW HYDROGRAPH

MAXIMUM INFLOW = 70,144 CFS

TOTAL TIME OF FLOW = 91 HRS (REF: C OF E CURVE)



SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 3 OF 19

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

VOLUME OF INFLOW FROM HYDROGRAPH

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

$= \frac{1}{2}(70,144\ CFS)(91\ HRS)(3600\ SEC/HR)(1\ ACRE/43,560\ SQ.FT)$

$= 263,765$ ACRE-FEET

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

$\frac{(263,765\ ACRE\text{-}FEET)}{(109.6\ SQ.\ MI.)}(1\ SQ.\ MI./640\ ACRES)(12\ IN/FT) = 45.1$ INCHES

VOLUMES PRODUCED BY PMF RAINFALLS IN EXCESS OF 26 INCHES ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER LIMIT.

$(26\ INCHES)(640\ ACRES/SQ.MI.)\frac{(109.6\ SQ.MI)}{(12\ IN/FT)} = 151,979$ AC-FT

VOLUME OF INFLOW (RECALCULATED) $= 151,979$ AC-FT

NOTE: $Q_{I_{MAX}}$ REMAINS CONSTANT.
STORM DURATION DECREASES IN ACCORDANCE WITH THE DECREASE IN INFLOW VOLUME.

STORM DURATION $= [(151,979\ AC\text{-}FT)(2)(43,560\ FT^3/AC)]/(70,144\ CFS)(3600\ SEC/HR)$
$= 52.4$ HRS

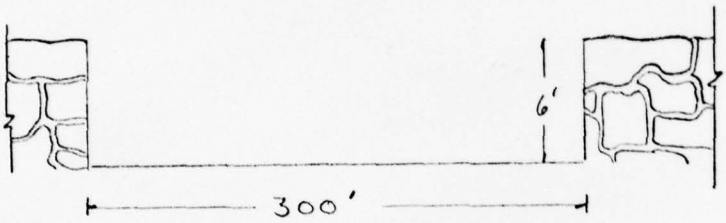
SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

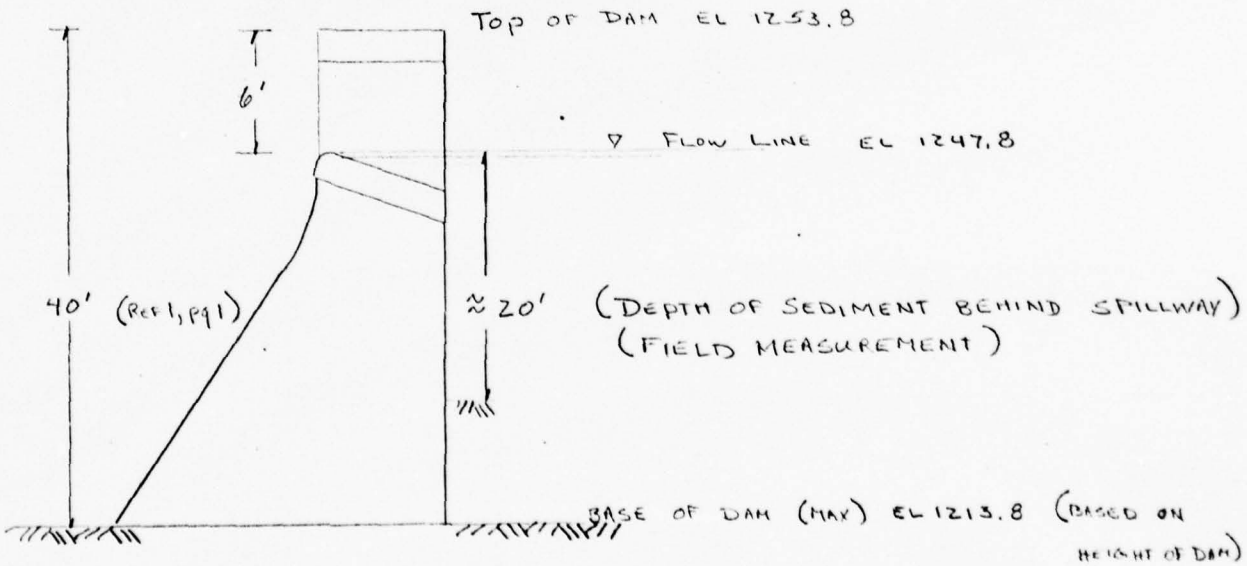
BY DLB DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 4 OF 19

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

SPILLWAY CAPACITY





NOTE: ABOVE DIMENSIONS TAKEN FROM DRWG DATED 2-13-05 BY THE AMERICAN PIPE MANF'G CO. AND HAVE BEEN VERIFIED IN THE FIELD

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLP DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 5 OF 19

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

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

$L = 300$ FT
$H = 6.0$ FT

BREADTH OF CREST = 6.0 FT (REF : DRWG DATED 2-13-05 BY AMER PIPE MANF'G CO.)

$C \cong 2.75$ (APPROXIMATED FROM TABLE 21-15, REF 3)

$Q = (2.75)(300\text{ FT})(6.0)^{3/2}$

$Q = 12,125$ CFS

PMF (PEAK INFLOW) > MAXIMUM SPILLWAY DISCHARGE
70,144 CFS > 12,125 CFS.

REF 3: "STANDARD HANDBOOK FOR CIVIL ENGINEERS", 2ND EDITION 1976 McGRAW HILL by F. S. MERRITT

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-2-79 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-79 SHEET NO. 6 OF 19

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

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

$$P = \frac{\text{MAXIMUM SPILLWAY DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{12,125}{70,144} \quad \text{(SHEET 5)} \quad \text{(SHEET 2)}$$

$P = 0.17$

$$(1-P) = \frac{\text{REQ'D RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = (1 - 0.17) = 0.83$$

VOLUME OF INFLOW $\doteq$ 151,979 AC-FT (SHEET 3)

REQUIRED STORAGE = $(0.83)(151,979 \text{ AC-FT}) = 126,143 \text{ AC-FT}$

AVAILABLE STORAGE = (FREEBOARD)(RESERVOIR AREA)

FREEBOARD = 6FT (SHEET 4)

RESERVOIR AREA (@ NORMAL POOL) $\doteq$ 65 ACRES (PLANIMETERED OFF U.S.G.S. 7.5 MINUTE QUADRANGLE MILL RUN

RESERVOIR AREA (@ TOP OF DAM) = 137 ACRES (PLANIMETER ESTIMATE OFF U.S.G.S.)

$$\text{AVAILABLE STORAGE} = 6\text{FT}\left[\frac{(65 + 137)\text{ACRES}}{2}\right] \doteq 801 \text{ ACRE-FEET}$$

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 7 OF 19

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

STORAGE REQUIRED >> STORAGE AVAILABLE
126,143 AC-FT >> 801 AC-FT

CONCLUSION : INDIAN CREEK DAM CANNOT PASS AND/OR CONTAIN THE PMF WITHOUT OVERTOPPING

PROJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-26-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 8 OF 19

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

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

$$P = \frac{\text{MAXIMUM DISCHARGE RATE}}{Q_{I\,MAX}} = \frac{12{,}125\ CFS}{Q_{I\,MAX}} \qquad \text{(SHEET 5)}$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE VOLUME}}{\text{VOLUME OF INFLOW HYDROGRAPH}} \qquad \text{(SHEET 6) / (SHEET 3)}$$

$$1 - \frac{12{,}125\ CFS}{Q_{I\,MAX}} = \frac{801\ AC\text{-}FT}{\frac{1}{2}(Q_{I\,MAX})(52.4\ HRS)(3600\ SEC/HR)(1\ ACRE/43{,}560\ FT^2)}$$

$$1 - \frac{12{,}125\ CFS}{Q_{I\,MAX}} = \frac{801\ AC\text{-}FT}{2.17\ Q_{I\,MAX}}$$

$$2.17\ Q_{I\,MAX} - 26{,}311 = 801$$

$$2.17\ Q_{I\,MAX} = 27{,}112$$

$$Q_{I\,MAX} = 12{,}494\ CFS$$

PMF (PEAK FLOW) = 70,144 CFS (SHEET 2)

$$Q_{I\,MAX} = 17.8\%\ PMF$$

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-2-78 PROJ. NO. 78-301-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 9 OF 19

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

CALCULATE THE HEAD AT WHICH THE INDIAN CREEK DAM WILL PASS THE PMF WITH WATER FLOWING OVER THE ENTIRE LENGTH.

AVAILABLE STORAGE $\cong$ 801 AC-FT

$\therefore$ TO PASS PMF, REQUIRED STORAGE MUST EQUAL AVAILABLE STORAGE = 801 AC-FT

$$(1-P) = \frac{\text{AVAIL. RESERVOIR STORAGE}}{\text{VOLUME OF INFLOW}}$$

$$(1-P) = \frac{801 \text{ AC-FT}}{151,979 \text{ AC-FT}} = 0.005$$

$$P = 0.995 = \frac{\text{MAXIMUM TOTAL DISCHARGE}}{\text{PMF (PEAK INFLOW)}}$$

MAXIMUM TOTAL DISCHARGE = (0.995)(70,144 CFS)

$\cong$ 69,800 CFS

TOTAL DISCHARGE IS OBTAINED USING THE FOLLOWING TWO EQUATIONS:

SPILLWAY SECTION

$Q_1 = CL(H+6')^{3/2}$

LEFT AND RIGHT ABUTMENTS

$Q_2 = CLH^{3/2}$

L = 300 FEET ← (FIELD MEASURED) → L = 182 FT + 25 FT = 207 FT

$C \cong 2.75$ ← (SHEET 5) → $C \cong 2.75$

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB DATE 7-7-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 10 OF 19

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

THRU TRIAL AND ERROR CALCULATE THE FOLLOWING TABLE:

H	Q_1	Q_2	Q_{TOTAL}
1.0	15,279	569	15,848
5.0	30,098	6,364	36,462
7.0	38,670	10,543	49,213
10.0	52,800	18,001	70,801
9.0	47,928	15,370	63,298

CONCLUSION: INDIAN CREEK DAM WILL PASS THE PMF WITH LESS THAN 10 FEET OF HEAD PASSING OVER THE ENTIRE CREST.

SUBJECT DAM SAFETY INSPECTION
INDIAN CREEK DAM

BY DLB/JTS DATE 7-2-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 11 OF 19

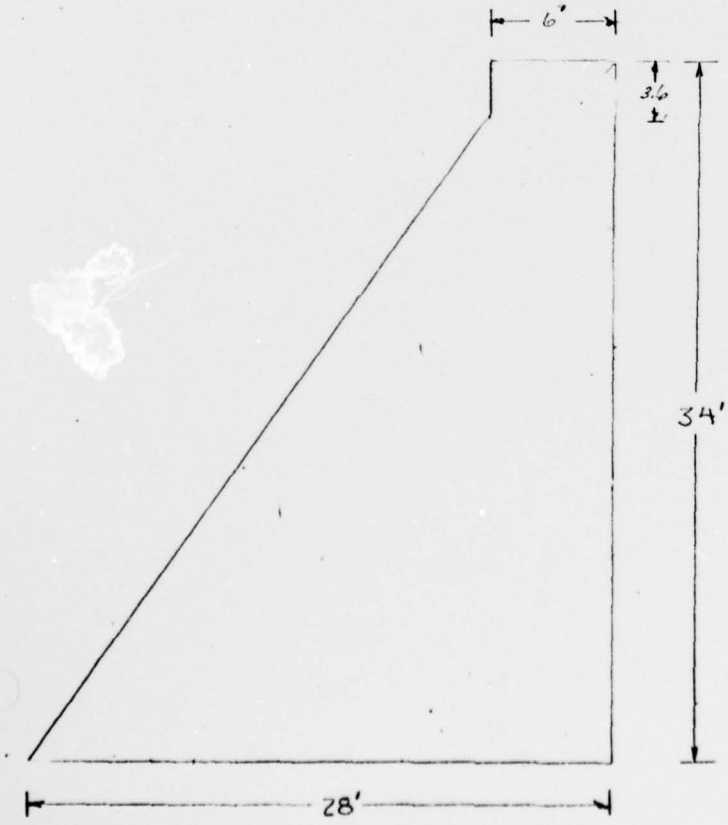
gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

DAM STABILITY

THE DAM WILL BE ANALYZED FOR OVERTURNING AND SLIDING BY CONSIDERING A CROSS SECTION TAKEN AT THE SPILLWAY UNDER RESERVOIR FULL CONDITIONS, 5 FT. OF WATER OVER THE CREST AND 9 FT. OF WATER OVER THE CREST. IN EACH CASE 100% OF UPLIFT AND NO TAILWATER ARE ASSUMED.

OVERTURNING (MAXIMUM HEAD CONDITIONS)

THE CRITICAL SECTION TO BE ANALYZED IS A CROSS SECTION TAKEN AT THE SPILLWAY WITH DIMENSIONS APPROXIMATED AS SHOWN BELOW



NOTE - REFER TO SHEET 3 FOR ELEVATIONS AND ADDITIONAL REFERENCES
DIMENSIONS TAKEN FROM FIGURE 1

SCALE : 1.25" = 10'

SUBJECT DAM INSPECTION
INDIAN CREEK DAM

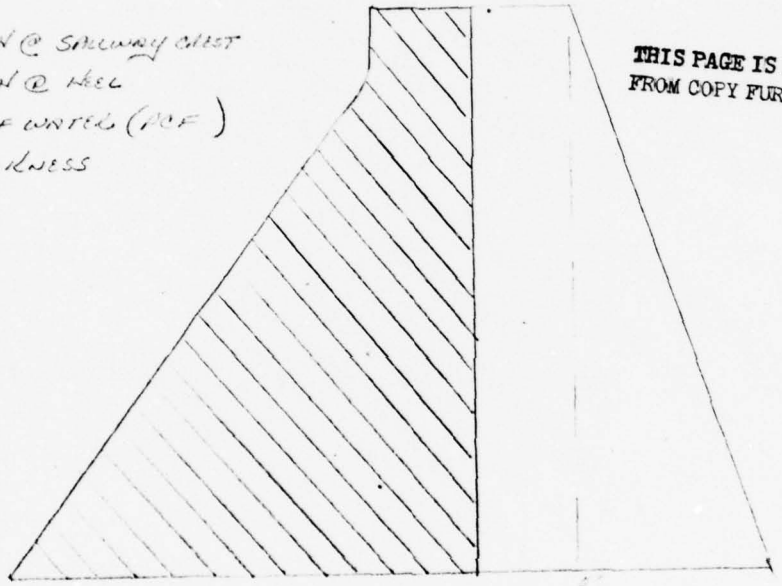
BY JPN DATE 7-25-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-27-78 SHEET NO. 12 OF 19

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

THE FOLLOWING DIAGRAM ILLUSTRATES HYDROSTATIC PRESSURES. NO TAILWATER IS ASSUMED. A 1.0' SECTION OF THE DAM IS TO BE ANALYZED.

h_1 = WATER DEPTH @ SPILLWAY CREST
h_2 = WATER DEPTH @ HEEL
γ = WEIGHT OF WATER (PCF)
t = BASE THICKNESS



HYDROSTATIC FORCE ON U/S FACE OF DAM

CASE I (FULL RESERVOIR) $H_{h_1} = \gamma \frac{h_1+h_2}{2} t = 62.4\left(\frac{6+40}{2}\right)34'(1') = 48,797^{\#}$

CASE II (5' WATER OVER DAM) $H_{h_2} = \gamma \frac{h_1+h_2}{2} t = 62.4\left(\frac{11+45}{2}\right)(34')(1') = 59,405^{\#}$

CASE III (9' WATER OVER DAM) $H_{h_3} = \gamma \frac{h_1+h_2}{2} t = 62.4\left(\frac{15+49}{2}\right)(34')(1) = 67,891^{\#}$

POINT OF ACTION OF HYDROSTATIC FORCE

$$X = \frac{\Sigma M}{\Sigma D}$$

CASE I $$\frac{6\times34\times17 + \frac{34'\times34'}{2}(11.3')}{6\times34 + \frac{(34')(34')}{2}} = \frac{9999.4}{782} = 12.8 \text{ (from base)}$$

SUBJECT Dry Inspection
Indian Creek Dam

BY JPN DATE 7-25-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 13 OF 19

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

POINT OF ACTION OF HYDROSTATIC FORCE (cont.)

$$X = \frac{\Sigma M}{\Sigma A}$$

CASE II
5' WATER OVER DRY CREST

$$\frac{11 \times 34 \times 17 + \frac{34^2}{2}(11.3)}{11 \times 34 + \frac{34^2}{2}} = \frac{12889}{952} =$$

13.5 (From base)

CASE III
9' WATER OVER DRY CREST

$$\frac{15 \times 34 \times 17 + \frac{34^2}{2}(11.3)}{15 \times 34 + \frac{34^2}{2}} = \frac{15201}{1088} =$$

14.0 (from base)

UPLIFT PRESSURE (CASE 1)

$$U = \gamma \frac{h_1 + h_2}{2} t$$

WHERE: t = BASE THICKNESS = 28'
h_1 = WATER DEPTH (HEEL) = 40'
h_2 = WATER DEPTH (TOE) = 0'
γ = UNIT WT. OF WATER

$$U = (62.4) \frac{40 + 0}{2} (28')(1.0) = 34,944\ \#$$

SUBJECT Dam Inspection
Indian Creek Dam

BY JPN DATE 4-25-78 PROJ. NO. 12-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 14 OF 19

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

UPLIFT PRESSURE (CASE II)

$U = 62.4 \left(\frac{45+0}{2}\right) 28.0(1.0)$

$U = 39,312^{\#}$

$t = 28.0'$
$h_1 = 45.0'$
$h_2 = 0$
$\gamma = 62.4$ pcf

UPLIFT PRESSURE (CASE III)

$U = 62.4 \left(\frac{49+0}{2}\right) 28.0(1.0)$

$U = 42806^{\#}$

$t = 28.0'$
$h_1 = 49.0'$
$h_2 = 0.0$
$\gamma = 62.4$

POINT OF ACTION OF UPLIFT FORCE FOR ALL THREE CASES.

ASSUME UPLIFT ACTS $1/3\,t$ FROM THE HEEL OF THE DAM

$1/3\,t = 1/3(28) = 9.3'$

OBJECT DRY INSPECTION
INDIAN CREEK DAM

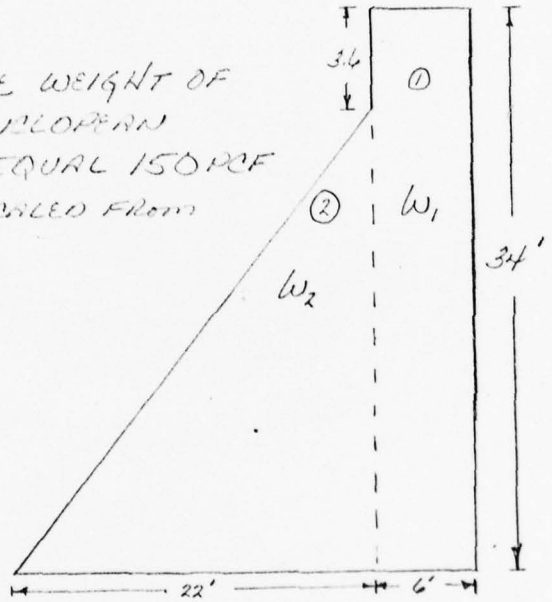
BY JTN DATE 7-24-79 PROJ. NO. 79-501-109

CHKD. BY JTS DATE 7-30-79 SHEET NO. 15 OF 19

CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

WEIGHT OF DAM
TAKEN AT CRITICAL SECTION (OVERFLOW SECTION)

NOTE: ASSUME WEIGHT OF MASONRY & CYCLOPEAN CONCRETE TO EQUAL 150 PCF
DIMENSIONS SCALED FROM FIGURE 1



SECTION ①

$$W_1 = \gamma_{DRY}\, hbt = 150\,PCF\,(34')(6')(1.0') = 30{,}600^{\#}$$

$$W_2 = \gamma_{DRY}\,\frac{hbt}{2} = 150\,PCF\,\frac{30.4'(22')}{2}(1.0') = 50{,}160^{\#}$$

SUBJECT DAM INSPECTION
IRONWOOD CREEK DAM

BY JJN DATE 7-25-78 PROJ. NO. 78-501-199

CHKD. BY LTS DATE 7-30-78 SHEET NO. 16 OF 19

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

RESULTANT FORCES ON DAM

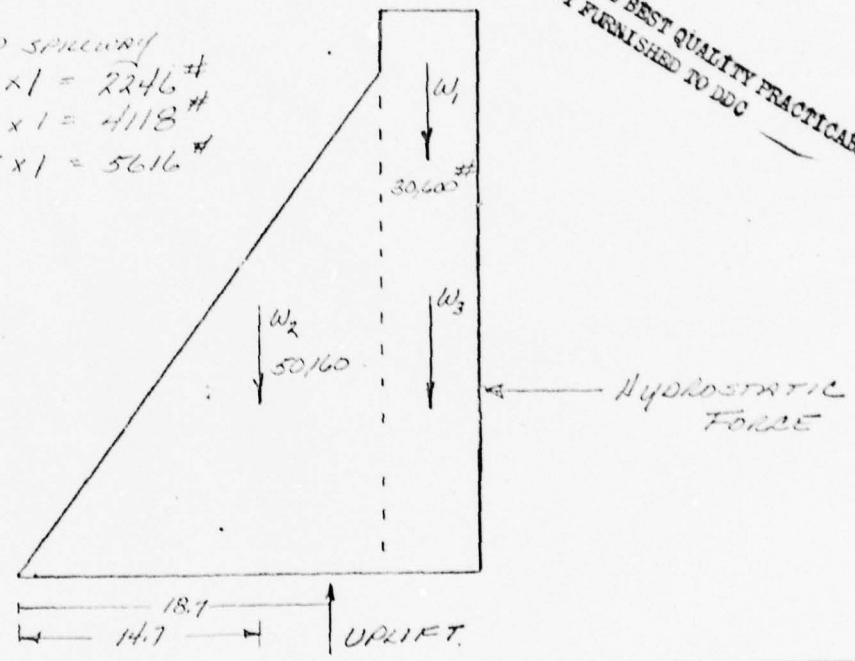
NOTE:

W_3 = WT OF WATER ATOP SPILLWAY

CASE 1 – $62.4 \times 6 \times 6 \times 1 = 2246^{\#}$

CASE 2 – $62.4 \times 6 \times 11 \times 1 = 4118^{\#}$

CASE 3 – $62.4 \times 6 \times 15 \times 1 = 5616^{\#}$



CASE 1 (WATER LEVEL @ CREST OF DAM)

OVERTURNING MOMENTS ΣM @ TOE

$M_1 = 34,944(18.7) + 48,797(12.8) = 1,278,054$ FT-LB

RESISTING MOMENTS ΣM @ TOE

$M_2 = 50,160(14.7) + 30,600(25) + 2246(25) = 1558,502$ FT-LB

$$F.S. = \frac{\text{RESISTING MOMENTS}}{\text{OVERTURNING MOMENTS}} = 1.22$$

JECT Dam Inspection
Indian Creek Dam

BY JPI DATE 7-25-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 17 OF 19

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

RESULTANT FORCES ON DAM (cont.)

CASE II (WATER LEVEL 5' ABOVE DAM CREST)

OVERTURNING MOMENTS ΣM@TOE

M_1 $39,312^{\#}(13.7') + 59,405^{\#}(13.5') = 1,537,102$ FT-lbs

RESISTING MOMENTS ΣM@TOE

M_2 $50,160^{\#}(14.7') + 30,600^{\#}(25') + 4118^{\#}(25') = 1,605,302$ FT lbs

$$F.S. = \frac{\text{RESISTING MOMENTS}}{\text{OVERTURNING MOMENTS}} = 1.04$$

CASE III (WATER LEVEL 9' ABOVE DAM CREST)

OVERTURNING MOMENTS ΣM@TOE

M_1 $42,806^{\#}(18.7') + 67,891^{\#}(14.0') = 1,750,946$ FT-lbs

RESISTING MOMENTS

M_2 $50,160^{\#}(14.7') + 30,600^{\#}(25') + 5616^{\#}(25') = 1,642,752$ FT-lbs

$$F.S. = \frac{\text{RESISTING MOMENTS}}{\text{OVERTURNING MOMENTS}} = 0.94$$

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

PROJECT Dam Inspection
Indian Creek Dam

BY JHI DATE 7-25-78 PROJ. NO. 78-501-199

CHKD. BY JTS DATE 7-30-78 SHEET NO. 18 OF 19

SLIDING

THE DAM WILL BE ANALYZED FOR SLIDING BY ASSUMING THE SAME CONDITIONS AND TYPICAL SECTION AS USED IN THE OVERTURNING CALCULATIONS.

FORCES INDUCING SLIDING

HYDROSTATIC FORCE = CASE I = 48,797#
CASE II = 59,405#
CASE III = 67,891#

FORCES RESISTING SLIDING

$$Q = \frac{CA + (\Sigma W - U)\tan\phi}{\Sigma V}$$ (SEE REF. 4 P. 338)

WHERE
- ΣV = SUM OF HORIZONTAL FORCES
- Q = SHEAR FRICTION FACTOR
- C = COHESION VALUE OF CONCRETE OR ROCK
- A = AREA OF BASE CONSIDERED
- $\tan\phi$ = COEFFICIENT OF INTERNAL FRICTION
- ΣW = WEIGHT OF DAM
- U = UPLIFT

CASE I

$$Q = \frac{(83{,}006^{\#} - 34{,}944^{\#}) .70}{48{,}797^{\#}}$$ (SEE REF 5 PAGE 7-10-7 TAN Φ IS WEIGHTED FOR C)

$\therefore Q = \underline{0.69}$

REFERENCE 4" DESIGN OF SMALL DAMS" BUREAU OF RECLAMATION, U.S. GOVERNMENT PRINTING OFFICE, REVISED REPRINT, 1974.

SUBJECT Dry Impoundment
Indian Creek Dam

BY JRN DATE 7-25-78 PROJ. NO.

CHKD. BY JTS DATE 7-30-78 SHEET NO. 19 OF 19

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

CASE II

$$Q = \frac{(54{,}678^{\#} - 39{,}312^{\#})(.70)}{59{,}405^{\#}} = \frac{31{,}896}{59{,}405} =$$

$$Q = 0.54$$

CASE III

$$Q = \frac{(86{,}376^{\#} - 42806^{\#})(0.70)}{61{,}691^{\#}} = \frac{30{,}479^{\#}}{67{,}891^{\#}} =$$

$$Q = 0.45$$

REFERENCE 5 "DESIGN MANUAL" SOIL MECHANICS, FOUNDATIONS, AND EARTH STRUCTURES, NAVFAC DM-7, MARCH 1971, DEPARTMENT OF THE NAVY, NAVAL FACILITIES ENGINEERING COMMAND, WASHINGTON, D.C. 20390

APPENDIX D

PHOTOGRAPHS

PHOTOGRAPH 1 View of Indian Creek Dam taken from the right abutment. The circular structure in the background contains the gate controls.

PHOTOGRAPH 2 View of the Indian Creek Dam taken from the area just downstream of the left abutment. The two gate controls on the crest of the dam operate sluice gates on 36-inch diameter supply and 48-inch diameter blow-off pipes.

PHOTOGRAPH 3 View of the Indian Creek Reservoir as seen from the crest of the dam. Note the character of the slopes bounding the reservoir.

PHOTOGRAPH 4 View of an area of seepage located at the toe of Indian Creek Dam. The rust colored area on the dam represents an area where seepage was passing through the structure. Standing water can be seen near the center of the photograph.

1

2

3

4

PHOTOGRAPH 5 Close-up view of a large crack in the masonry portion of the dam just left of the left spillway abutment wingwall.

PHOTOGRAPH 6 View of the area immediately downstream of Indian Creek Dam taken from the crest of the structure.

PHOTOGRAPH 7 View of the discharge end of the 48-inch blow-off pipe located a few hundred feet downstream of the dam.

PHOTOGRAPH 8 View of a religious camp located on the floodplain opposite the confluence of Indian Creek and the Youghigheny River approximately 5 miles downstream of the Indian Creek Dam.

5

6

8

APPENDIX E

GEOLOGY

Indian Creek Dam is located near the axis of the Ohiopyle Syncline in the predominantly massive, coarse grained sandstones and conglomerates of the Pennsylvanian age Pottsville Group.

Massive sandstone strata (possibly the Homewood Formation) crop out on the right abutment. These strata are durable, cross-bedded, well jointed, and contain numerous carbonaceous remains of fossilized plants.

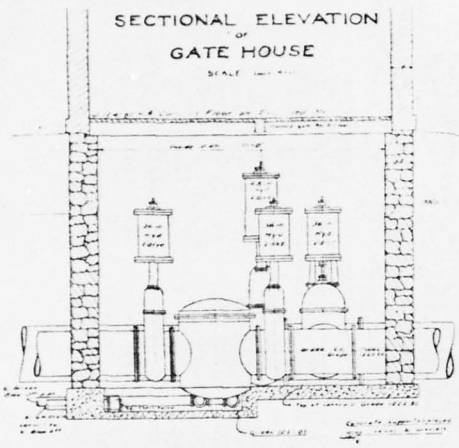
Just downstream of the dam the Indian Creek valley is characterized as a steep sided, V-shaped and heavily wooded valley which extends to the Youghiogeny River approximately five miles downstream.

APPENDIX F

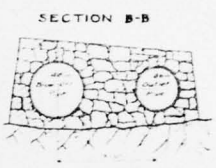
FIGURES

LIST OF FIGURES

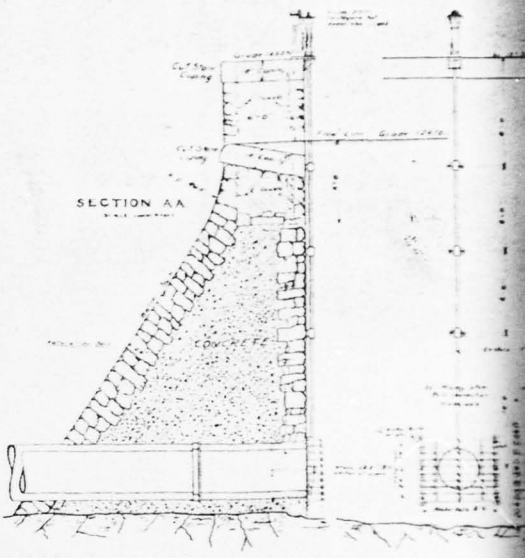
SECTIONAL ELEVATION
OF
GATE HOUSE



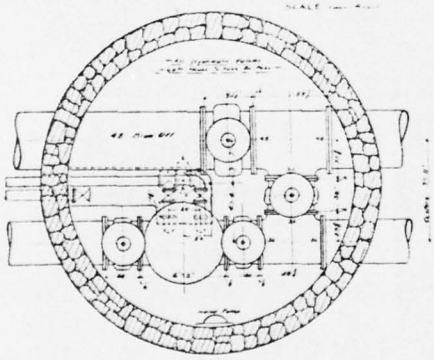
SECTION B-B

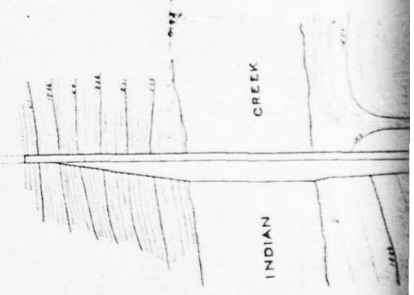


SECTION AA



PLAN OF GATE HOUSE.



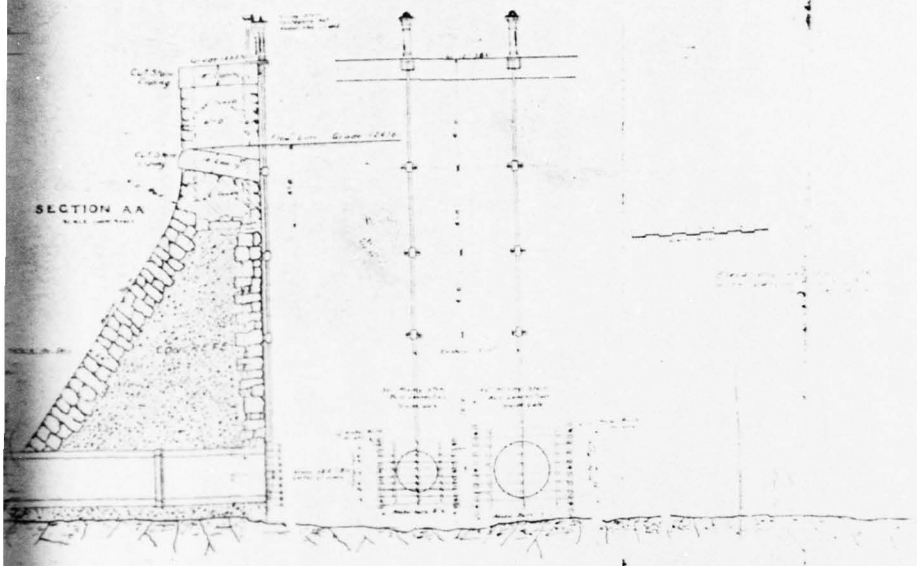


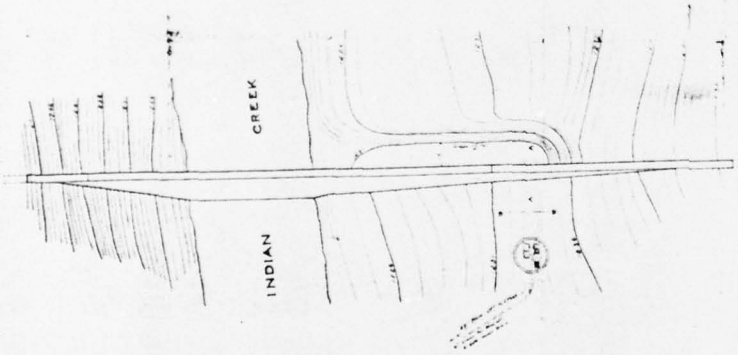
ELEVATION AND PLAN

DATUM: MEAN TIDE, SANDY HOOK

INDIAN CREEK DAM

CTICABLE





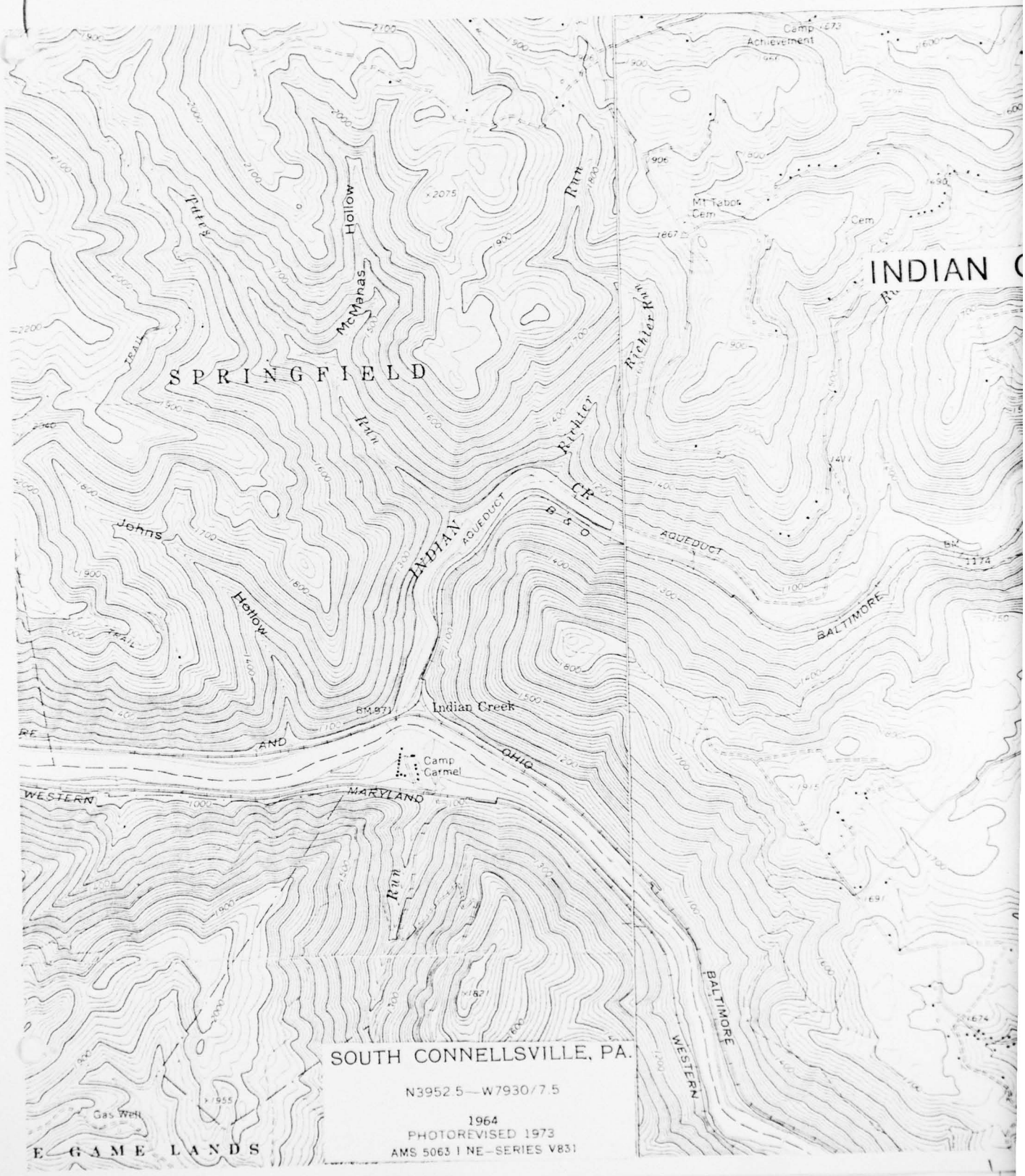
ELEVATION AND PLAN OF DAM

10 5-2

FIGURE 1

APPENDIX G

REGIONAL VICINITY MAP



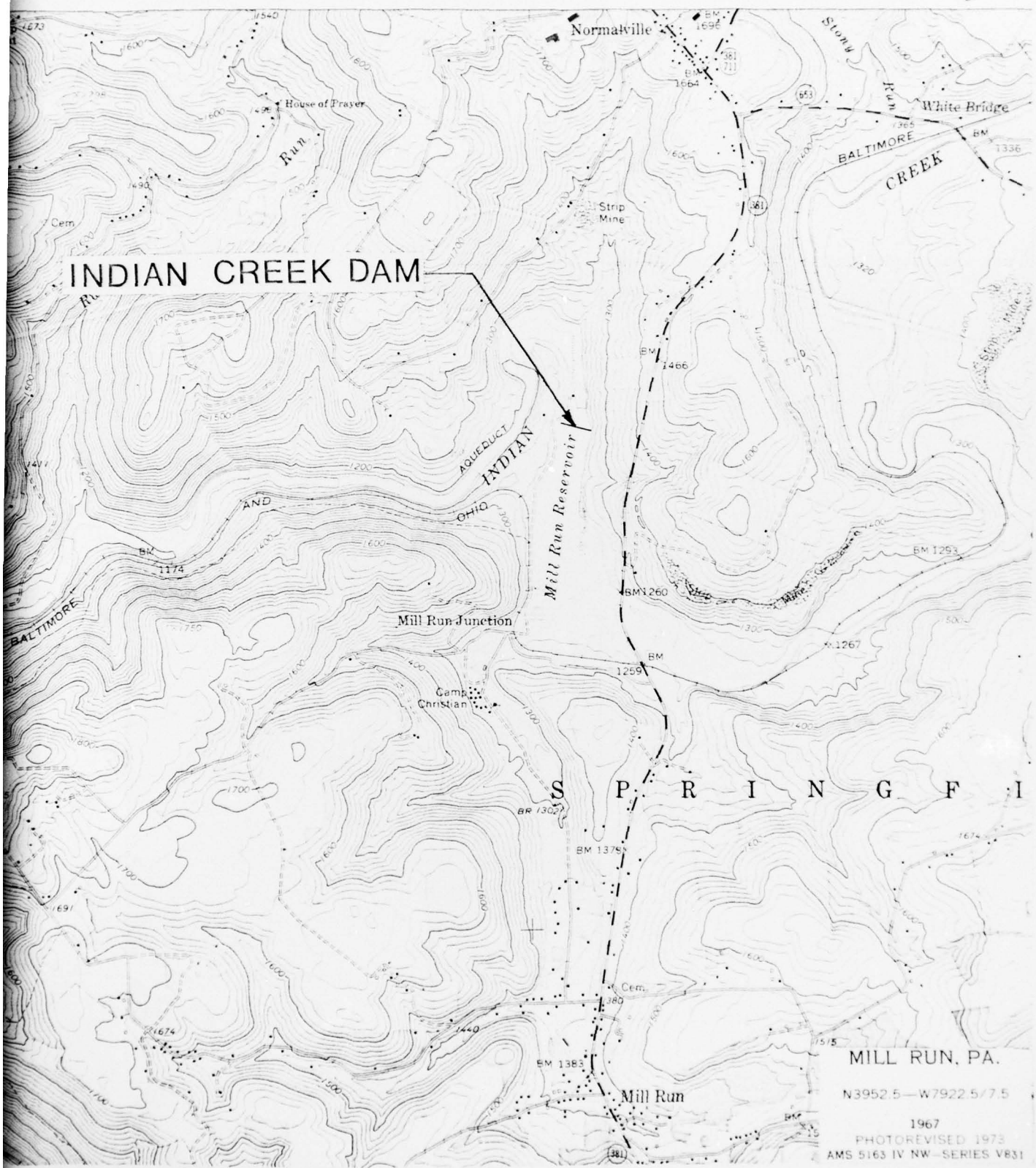
SOUTH CONNELLSVILLE, PA.

N3952.5—W7930/7.5

1964

PHOTOREVISED 1973

AMS 5063 I NE—SERIES V831


INDIAN CREEK DAM
Normalville
House of Prayer
Run
Cem.
Strip Mine
Stony Run
White Bridge
BALTIMORE
CREEK
Mill Run Reservoir
INDIAN
AQUEDUCT
AND
OHIO
BR 1174
BALTIMORE
Mill Run Junction
Camp Christian
BM 1466
BM 1293
BM 1260
1267
BM 1259
BR 1302
BM 1378
Cem.
BM 1383
Mill Run
S P R I N G F I
MILL RUN, PA.
N3952.5—W7922.5/7.5
1967
PHOTOREVISED 1973
AMS 5163 IV NW—SERIES V831