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NATIONAL DAM INSPECTION PROGRAM. OLD DAM (NDI ID NUMBER PA-499)--ETC(U)
JAN 79 DACW31-79-C-0014
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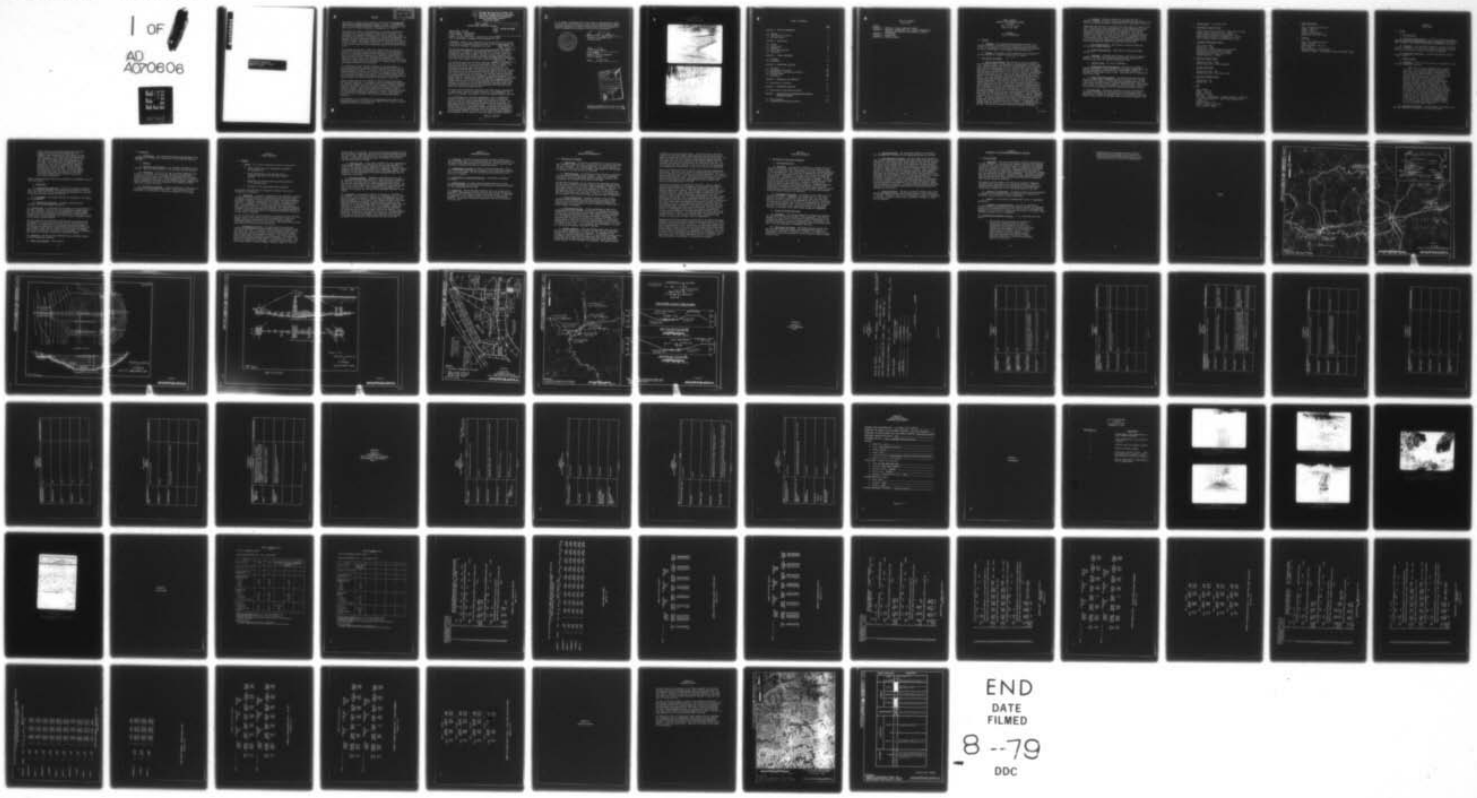

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigation and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

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

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

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

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

(6) National Dam Inspection Program. Old Dam (NDI ID Number PA-499), Ohio River Basin, St. Patricks Run, Washington County, Pennsylvania. Phase I Inspection Report.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-79-C-0014

NAME OF DAM: Old Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Washington
STREAM: St. Patrick's Run, a tributary of Raccoon Creek
DATE OF INSPECTION: November 29 and December 20, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of Old Dam is considered to be poor. (12) 77 P

The dam has been abandoned and is not being maintained. The owner reported that the valve on the downstream end of the outlet pipe was dynamited in an attempt to drain the lake. On the first inspection, the dam was found to be drained. During the review inspection, the pool was one foot below the spillway crest level and 17 feet above the pool level that existed on the first inspection. (11) Jan 79

The intake structure for the outlet works has apparently collapsed, and the water enters the outlet pipe through a mound of rubble. The downstream end of the outlet pipe could not be located since it apparently discharges under the surface of a pool of water at the downstream toe of the dam. The crest and the downstream end of the dam are irregular and are covered with brush and trees up to 20 feet high and four to eight inches in diameter. The spillway overflow structure has deteriorated and is in poor condition. The spillway capacity (10 percent PMF) is classified as seriously inadequate according to the recommended criteria. The spillway will not pass the recommended spillway design flood of half to full probable maximum flood (PMF) without overtopping, and failure of the dam resulting from overtopping would significantly increase the loss of life downstream over that which would exist just before overtopping failure.

In view of the deteriorated condition of the outlet works, inadequacies of the spillway, and the uncertain condition of the embankment, the facility is assessed to be unsafe, but not in imminent danger of failure.

It is recommended that the owner immediately retain a professional engineer to evaluate the dam and appurtenances and to prepare and execute a plan for orderly abandonment and breaching of the dam. The plan should include hydrologic and hydraulic studies evaluating the downstream effects of any planned action. If for any reason the owner should decide not to proceed with orderly abandonment and breaching of the dam, the dam and appurtenances should be immediately evaluated by a professional engineer for repairs to the outlet works and embankment and enlargement of the spillway to provide adequate spillway capacity.

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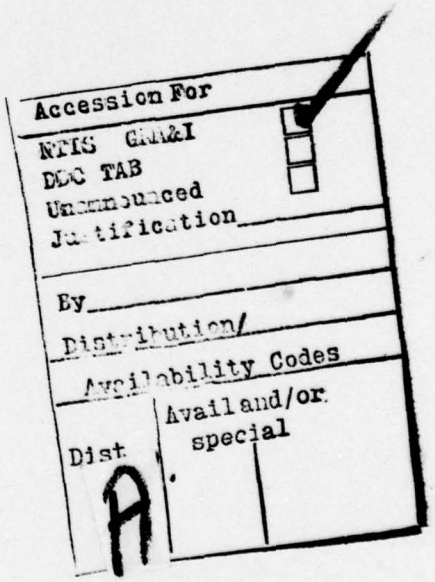
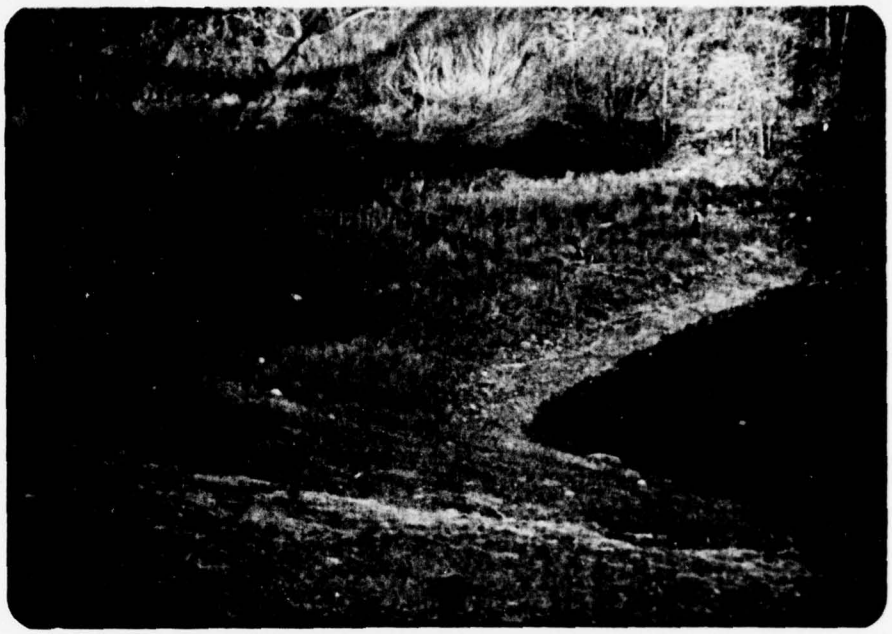
It is further recommended that in the event of unusually high runoff an around-the-clock surveillance plan should be implemented to detect possible problems and a formal warning system should be developed to alert the downstream residents in the event of an emergency.

Lawrence D. Andersen, P.E.
Vice President

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

DATE: 1 Mar 79





Upstream Face

Downstream Face

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
OLD DAM
NDI I.D. NO. PA-499
DER I.D. NO. 63-1

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

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

1.2 Description of Project

ABSTRACT

a. Dam and Appurtenances. The Old Dam is an earth embankment. As it presently exists, the embankment is approximately 130 feet long with a maximum height of 38 feet from the downstream toe and a minimum crest width of approximately 8 feet. Review of the design drawings indicates that the embankment as built was 235 feet long. It appears that during the reconstruction of U.S. Route 22, which is approximately 200 feet downstream from the crest of the dam, a significant fill was placed on the left abutment, reducing the embankment to its present length. The flood discharge facilities for the dam consist of a combined primary and emergency spillway located on the left abutment (looking downstream). The overflow structure of the spillway is a 49-foot-wide stone overflow section which discharges initially into an earth channel and then into a trapezoidal concrete discharge channel which terminates at a point approximately 200 feet downstream from the toe of the dam in line with the right abutment. The outlet works for the dam as designed consisted of a 24-inch cast-iron pipe through the embankment equipped with a masonry intake structure at the upstream end and a valve at the downstream toe of the embankment. However, presently it appears that the inlet structure has collapsed and now is a mound of rubble. The owner reported that the valve at the downstream end of the outlet pipe has been dynamited in an attempt to drain the lake. The downstream end of the pipe could not be located. It apparently discharges under the surface of the pool of water at the downstream toe of the dam. The dam has no operable emergency drawdown facilities.

ABSTRACT

b. Location. The dam is located on St. Patrick's Run, a secondary tributary of Raccoon Creek, approximately 200 feet north of U.S. Route 22 in Robinson Township, Washington County, Pennsylvania (Plate 1).

Downstream from the dam, St. Patrick's Run flows under U.S. Route 22 and joins Little Raccoon Creek approximately 1/2 mile downstream from the dam. A mobile home park consisting of 26 mobile homes is located immediately downstream from the Route 22 underpass. The Route 22 underpass is a parabolic culvert 26 feet wide at the base and approximately 15 feet high. The elevation of Route 22 is estimated to be at the same level as the crest of the dam. It is estimated that failure of the dam would cause large loss of life and property damage in the mobile home community immediately downstream from the dam.

c. Size Classification. Small (based on 38-foot height and 63 acre-feet storage capacity).

d. Hazard Classification. High (based on downstream damage potential).

e. Ownership. Allegheny Trails Council, Boy Scouts of America (address: Mr. Carl Lerz, Allegheny Trails Council, Boy Scouts of America, Flag Plaza, Pittsburgh, Pennsylvania 15219).

f. Purpose of Dam. The dam is abandoned.

g. Design and Construction History. The dam was designed by Douglas and McKnight, civil engineers of Pittsburgh, Pennsylvania. The dam was apparently constructed by the Citizens Water Company of MacDonald, Pennsylvania, prior to 1912. The exact date of construction could not be found.

h. Normal Operating Procedure. The dam has been abandoned with the outlet works open. Therefore, there is no normal pool. Average inflow into the reservoir is less than the discharge capacity of the outlet works, and the reservoir normally remains drained. However, with storm inflow in excess of the capacity of the outlet works, the reservoir can fill and discharge over the uncontrolled primary spillway.

1.3 Pertinent Data. Elevations referred to in this and subsequent sections of the report are calculated based on approximate field measurements, assuming the spillway crest to be at Elevation 996 (USGS Datum), which is the pool elevation shown on the USGS topographic map.

a. Drainage Area - 4.6 square miles

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - 1500, July 24, 1912
Outlet conduit at maximum pool - Unknown
Gated spillway capacity at maximum pool - N/A
Ungated spillway capacity at maximum pool - 1200
Total spillway capacity at maximum pool - 1200

c. Elevation (USGS Datum) (feet)

Top of dam - 1000
Maximum pool - 1000
Normal pool - 996 (spillway crest elevation)
Upstream invert outlet works - Unknown
Streambed at center line of dam - 962±
Maximum tailwater - Unknown

d. Reservoir Length (feet)

Normal pool level - 2000
Maximum pool level - 2200 (estimated)

e. Storage (acre-feet)

Normal pool level - 276
Maximum pool level - 390 (top of dam)

f. Reservoir Surface (acres)

Normal pool - 18
Maximum pool - 28

g. Dam

Type - Earth
Length - 130 feet
Height - 38 feet
Top width - 8 feet
Side slopes - Downstream: 1.5H:1V; Upstream: 1H:1V from crest to Elevation 995. 3H:1V below Elevation 995.
Zoning - No
Impervious core - No
Cutoff - Masonry cutoff wall
Grout curtain - Unknown

h. Regulating Outlet

Type - 24-inch cast-iron pipe
Length - 150± feet
Closure - None
Access - Not accessible
Regulating facilities - None

i. Spillway

Type - Stone overflow section
Length - 49 feet
Crest elevation - 996 feet
Gate - None
Upstream channel - Earth channel
Downstream channel - Trapezoidal concrete discharge channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics. A state report entitled, Report Upon the Dam of the Citizens Water Company of MacDonald, dated July 31, 1914, summarizes the available hydrologic and hydraulic information.

(2) Embankment. The available information consists of design drawings. However, in the 1914 state report, it was stated that the dam was not constructed according to the design drawings.

(3) Appurtenant Structures. Available information includes design drawings.

b. Design Features

(1) Embankment. In the 1914 state report, the features of the dam were described as follows:

> "This dam is an earth embankment with a masonry core wall. It is 239 feet long on top and 35 feet high, above the original surface of the ground; the top, 5 feet above the flow line, is 9 feet wide; the upstream slope is about 1 on 1-1/2, from the top to the flow line of the reservoir, below which it appeared to be about 1 on 2, which is the slope shown on the plans. This slope is protected below the flow line with riprap of small stones. The downstream slope appeared to be about 1 on 1-1/2, except near the base, where it appeared to be somewhat flatter. This slope is well protected with sod. The masonry core wall, on the center line of the dam, is 9 feet thick at the base and about 2 feet thick at the top, at the flow line of the reservoir. The foundation is said to extend well into bedrock, at a depth of about 13 feet below the natural surface of the ground. The plans show two puddle trenches, 5 feet wide, between the masonry core wall and the toe of the upstream slope" (Plate 2).

(2) Appurtenant Structures. The appurtenant structures of the dam were described as follows in the 1914 state report:

"A 24" cast iron outlet pipe extends from the valve chamber at the toe of the upstream slope to a chamber at the downstream toe, where there is a controlling valve. A 10" supply main extends from this pipe, immediately above the controlling valve, to the pumps in a building near the downstream toe of the slope. The outlet pipe is supported on piers, extending to rock, and is supported and encased in masonry for a distance of about 25 feet from the upstream side of the core wall. The valve chamber at the upstream toe of the slope is 12 feet square, and extends well above the flow line of the reservoir, with screened inlets, provided with valves, at different elevations."

Plate 3 presents details that are not completely in agreement with the 1914 state report.

c. Design Data

(1) Hydrology and Hydraulics. The 1914 state report indicates that, as originally designed, the spillway had a capacity of 1200 cfs. Later, the crest width of the spillway was enlarged from 43 to 50 feet to provide a spillway capacity of 1400 cfs.

(2) Embankment. No engineering data are available on the design of the embankment.

(3) Appurtenant Structures. No design calculations are available for the appurtenant structures.

2.2 Construction. No information was available on the construction of the dam. Apparently, the dam was constructed under a permit issued by the Water Supply Commission of the Commonwealth of Pennsylvania. One post-construction photograph indicates that an intake tower was constructed on the upstream end of the outlet works, although not shown in the original design drawings.

The only reported post-construction modification to the dam was the enlargement of the spillway from 43 feet wide to 50 feet wide in the early 1920s. It appears that the other post-construction change to the dam was the construction of the presently existing concrete spillway discharge channel and the addition of fill on the left abutment which covered almost half the length of the embankment. No information was found on the details of this post-construction change.

2.3 Operation. The dam has been abandoned, and as presently exists, it has no operational features.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. The available information was provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER).

b. Adequacy

(1) Hydrology and Hydraulics. The available information is very limited. Only the design capacity of the spillway has been reported.

(2) Embankment. In view of the age of the dam (completed prior to 1912), it is clear that the design approach and construction techniques are not likely to have been in conformance with currently accepted engineering practices. Design documents lack such considerations as embankment slope stability and seepage analyses. However, the design incorporated such basic components as an impervious cutoff trench and a masonry core wall.

(3) Appurtenant Structures. Limited information is available on the design of the appurtenant structures. This information is not considered to be sufficient to evaluate the adequacy of the design.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Old Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual examination of the spillway and its components and search for the outlet works of the dam.

3. Observation of factors affecting runoff potential of the drainage basin.

4. Evaluation of the downstream hazard potential.

The specific observations are illustrated in Plate 4 and in the photographs in Appendix C.

b. Embankment. In general, inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features. In general, the condition of the dam is considered to be poor. The downstream face of the dam and the crest were irregular and covered with trees 15 to 20 feet high and 4 to 8 inches in diameter. Although no wet areas and seeps were observed on the downstream face of the dam, ponded water along the toe of the dam precluded the inspection of this area for seepages.

The top of the dam was surveyed relative to the spillway crest elevation and was found to have several vertical irregularities. While the design freeboard of the dam was four feet, the survey indicated freeboards ranging from 3.9 feet to 6.3 feet. The lowest point occurred approximately 100 feet from the spillway wall.

c. Appurtenant Structures. The appurtenant structures were examined for deterioration or other signs of distress and obstructions that would limit flow. In general, the structures were found to be in poor condition. The stone spillway overflow structures have significantly deteriorated and collapsed at sections. The masonry spillway walls at the control section have also deteriorated. The condition of the concrete spillway discharge channel is considered to be fair. The dam has no visible outlet structures. The masonry intake tower of the outlet works appears to have collapsed, forming a mound of rubble at

the upstream toe of the dam. Flow from the lake was entering into the mound of rubble, suggesting that some flow was being maintained through the outlet works. The downstream end of the outlet works could not be located. It apparently discharges under the surface of the pool on the downstream side of the dam.

d. Reservoir Area. A map review indicates that the watershed is predominantly covered with woodlands and has not been developed. A review of the regional geology (Appendix E) indicates that the side slopes of the reservoir are susceptible to landslides. However, massive landslides which would significantly affect the storage volume of the reservoir or cause overtopping of the dam by displaced water are not considered to be likely.

e. Downstream Channel. Immediately downstream from the dam, St. Patrick's Run flows under Route 22. Below the Route 22 underpass, St. Patrick's Run flows through a narrow valley and joins Little Raccoon Creek approximately 1-1/2 miles downstream from the dam. The size of the culvert under Route 22 is considered to pose some restriction to flow from the dam. This condition was considered in the hydraulic calculations for the dam in the subsequent sections of this report.

3.2 Evaluation. The general condition of the dam is considered to be very poor. The size of the trees on the embankment, up to 20 feet high and 8 inches in diameter, suggests that the embankment has not been maintained in 15 to 20 years. The intake structure of the outlet works has apparently collapsed, forming a mound of rubble on the upstream toe of the dam through which water apparently enters into the outlet pipe. As reported by the owner, in an attempt to drain the reservoir, the downstream valve on the outlet pipe was dynamited. The downstream end of the outlet pipe could not be located. It is apparently located below the surface of the pool at the downstream toe of the dam. Although no seepages or wet areas were observed on the downstream face of the dam, ponded water along the toe of the dam precluded the observation of the toe area for such conditions.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. The dam has been abandoned, therefore, there are no applicable maintenance or operating procedures. The owner reported that the dam has been drawn down and the valve on the outlet pipe has been dynamited to maintain the lake at a drawn-down state.

4.2 Maintenance of the Dam. The dam is not being maintained. Trees up to 20 feet high and 8 inches in diameter on the crest and downstream face of the dam suggest that the dam has not been maintained in the past 10 to 15 years.

4.3 Maintenance of Operating Facilities. The dam has no operable facilities.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available via homes approximately 1/2 mile downstream from the dam.

4.5 Evaluation. The dam has been abandoned and is no longer being maintained. Operational facilities, such as outlet works, intake tower, blow-off valves, have either collapsed, have been removed, or reported as dynamited. As it presently exists, the dam has no operational features. The general operational condition of the dam is considered to be very poor.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Old Dam has a watershed of 4.6 square miles and would impound a reservoir with a surface area of 18 acres at the spillway crest elevation. The combined emergency and primary spillway of the dam is located on the left abutment. The capacity of the spillway is reported to be 1400 cfs with no freeboard.

b. Experience Data. As previously stated, Old Dam is classified as a small dam in the high hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass half to full PMF.

The PMF inflow hydrograph for the reservoir was determined utilizing the Dam Safety Version of the HEC-1 computer program, developed by the Hydrologic Center of the U.S. Army, Corps of Engineers. Data used for the computer input are presented in Appendix D. The PMF inflow hydrograph was found to have a peak flow of 7621 cfs, while the half PMF inflow hydrograph had a peak flow of 3810 cfs. The computer input and the summary of the computer output are also included in Appendix D.

c. Visual Observations. Although a portion of the spillway discharge channel immediately downstream from the spillway control structure is covered with brush which would require clearing, its present extent is not considered to pose a significant restriction to flows through the spillway.

d. Overtopping Potential. Various percentages of PMF inflow hydrograph were routed through the reservoir to determine the percent of PMF inflow that the dam can pass without significantly overtopping the embankment and breaching the dam. The computer analyses indicate that the spillway can pass 10 percent PMF without overtopping. At 20 percent PMF, the dam would overtop for a duration of 5 hours with a maximum depth of 0.85 foot; while at 50 percent PMF, the dam would be overtopped for a duration of 9.8 hours with a maximum depth of 2.53 feet if failure did not occur. It is estimated that overtopping of the dam by 6 inches would initiate breaching of the dam.

e. Spillway Adequacy. Since the spillway cannot pass the recommended spillway design flood of half to full PMF without overtopping, the spillway is classified to be inadequate. To determine if the spillway is seriously inadequate, that is, if dam failure resulting from overtopping would significantly increase the loss of life and damage downstream from the dam from that which would exist just before overtopping failure, a breach analysis was conducted. The breach analysis

consisted of two flood routing steps. In the first step, the flood stage in the potential damage area downstream from the dam was determined by routing the percent of PMF inflow just before overtopping. In the second step, the flood stages in the potential damage areas were determined by routing the same percent PMF inflow combined with the discharge that would be contributed by the breaching of the dam. The flood stages were then compared to see if the loss of life and damage are significantly increased due to failure of the dam by overtopping.

Plate 5 illustrates the cross sections at which the flood stages were determined. The first cross section is taken downstream from the U.S. Route 22 underpass in the vicinity of the mobile home park. The second cross section was taken in the vicinity of the confluence of St. Patrick's Run and Little Raccoon Creek. The computer outputs labeled as Step 1 show the flood stages at the above-referenced cross sections just before overtopping failure of the dam.

The dam breach analysis incorporated in the HEC-1 computer program requires the estimation of the geometry of the breach (the width and depth of breach), the time it would take the breach to reach the specified depth after starting, and the depth of overtopping that would initiate breaching. Since the size and shape of breach for an earth-fill dam cannot be readily determined, various breach sizes were assumed to observe the affect of varied assumptions on the flood stages downstream from the dam. Two trapezoidal breaches were assumed with base widths of 120 and 100 feet and depths of 5 and 14 feet, respectively. The first breach depth corresponds to the distance between the top of the masonry core wall in the embankment and the crest level, and the second breach depth corresponds to the distance between the first step taper in the masonry core wall and the crest level. For each breach, the time of development of the breach was taken as one-half hour. Further, it was assumed that the breaching would initiate when the dam is overtopped by 6 inches. The computer output for breach analysis is labeled as Step 2. The results corresponding to each breach size estimate are identified by Plans 1 and 2, respectively.

Comparison of the flood stages in the vicinity of the mobile home park downstream from the dam with and without overtopping failure of the dam indicates that with overtopping failure of the dam, flood stages would rise by approximately 3 feet. While prior to overtopping failure flood stages would be essentially within the stream banks, dam failure would cause flooding in the vicinity of the mobile home community. This rise in flood stage is considered to be significant in increasing the potential loss of life and damage downstream from the dam compared to that which would exist just before overtopping failure. Therefore, the spillway capacity is classified to be seriously inadequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, although the field observations did not reveal major signs of distress, such as cracks, bulges, or subsidence, some concern exists as to the continued integrity of the embankment due to the presence of ponded water at the downstream toe of the dam which saturates the toe of the dam and the steep downstream slopes. Furthermore, the ponded water at the toe of the dam precluded the inspection of this area for signs of seepage. It should be noted that the pool elevation on the date of inspection was 19 feet below the spillway crest elevation. Therefore, the dam was not inspected under a significant loading condition. Although during the review field inspection, conducted three weeks after the initial inspection, the reservoir was nearly full and no major signs of distress were observed, steady-state conditions would not have been developed during the rapid filling of the reservoir.

(2) Appurtenant Structures. No portions of the outlet works for the dam were visible. Apparently, the intake tower for the outlet works has collapsed. Presently, water enters into the outlet pipe through a mound of rubble at the upstream toe of the dam. Reportedly, the valve on the outlet pipe located at the downstream toe of the dam has also been dynamited. Due to the poor condition of the visible portions of the outlet works, concern exists as to the structural integrity of portions of the outlet works through the embankment.

b. Design and Construction Data

(1) Embankment. The dam was designed by professional engineers and apparently was constructed under their supervision. The dam was designed at a time (prior to 1912) when limited understanding of the geotechnical behavior of earth structures existed. Consequently, the available design and construction information includes no quantitative data to aid the assessment of embankment stability.

(2) Appurtenant Structures. The design drawings indicate that the cast-iron outlet pipe through the embankment was supported on masonry walls extending to firm ground. However, the design did not incorporate a concrete encasement or cutoff collars to control seepage along the pipe.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operating features of the dam.

d. Post-Construction Changes. The 1914 state report indicates that attempts were made to stop leakage which existed through the right abutment by constructing masonry walls along the faces of the exposed rock seams on the upstream side of the dam along the right abutment. The report further states that these attempts for controlling seepage through the right abutment were partially successful and the seepage on the date of inspection was estimated to be 250 gpm. State inspection reports as of 1946 also refer to seepage around the right abutment. The other post-construction change which affects the stability of the embankment was the placement of fill on the left abutment which reduced the length of the dam from 260 feet to approximately 130 feet. Although no reference was found to indicate when this fill was placed on the left abutment, it appears that this post-construction change was made during the reconstruction of U.S. Route 22, which is immediately downstream from the dam. It appears that the presently existing concrete spillway discharge channel was also constructed during the construction of Route 22.

e. Seismic Stability. The dam is located in Seismic Zone 1 and visual observations did not indicate major signs of static instability of the dam. Therefore, based on the recommended criteria for evaluation of stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that Old Dam is in poor condition. Although no major signs of distress were observed to indicate that there is imminent danger of instability, the overall condition is assessed to be unsafe. The poor condition of the outlet works, the presence of ponded water downstream which saturates the toe of the dam, and the unmaintained condition of the dam raise concern as to the continued integrity of the embankment. The dam was inspected when the lake was drawn down. Therefore, certain conditions may have been obscured which may have otherwise been detectable if inspected under normal operating conditions.

The capacity of the spillway was found to be seriously inadequate (10 percent PMF) according to the recommended criteria, since it is estimated that damage and loss of life potential downstream would significantly increase due to an overtopping failure of the dam.

b. Adequacy of Information. Although available design information is limited, it is considered that the condition of the dam can be reasonably assessed based on visual observations.

c. Urgency. The following recommendations should be implemented immediately.

d. Necessity for Additional Data. The dam and appurtenant structures should be evaluated by a professional engineer for implementation of the recommendations which are either orderly abandonment and breaching of the structure or repair and restoration of the outlet works, spillway structures, and the embankment.

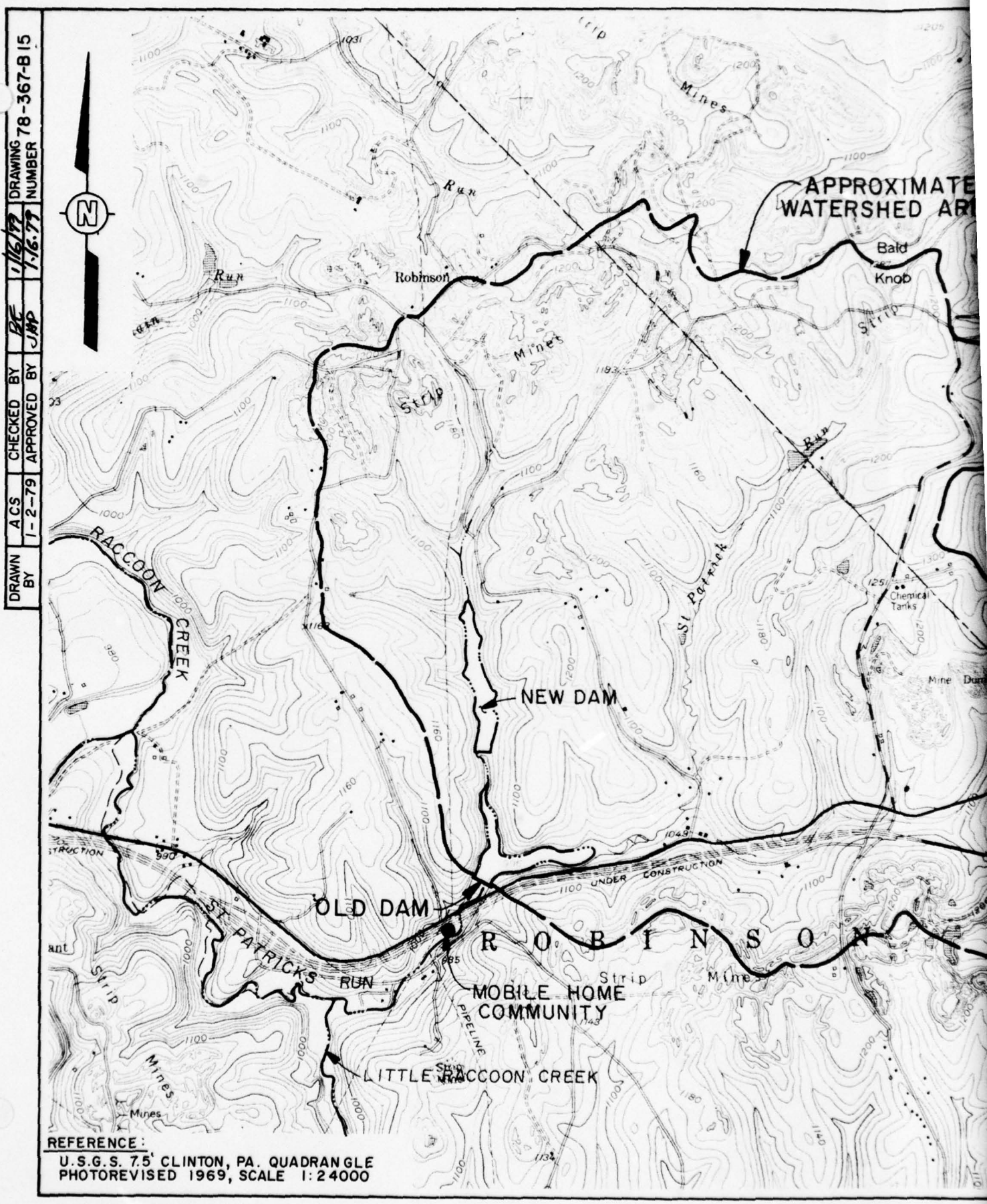
7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

1. Have the dam and appurtenances evaluated by a professional engineer either for orderly abandonment and breaching of the dam or for repairs and restoration of the outlet works and embankment and enlargement of the spillway to provide adequate spillway capacity. If the owner decides to breach or remove the dam, additional hydrologic and hydraulic studies should be performed to evaluate the downstream effects of this action.

2. Around-the-clock surveillance program should be implemented during unusually heavy runoff and a formal warning system should be developed to alert downstream residents in the event of emergencies.

PLATES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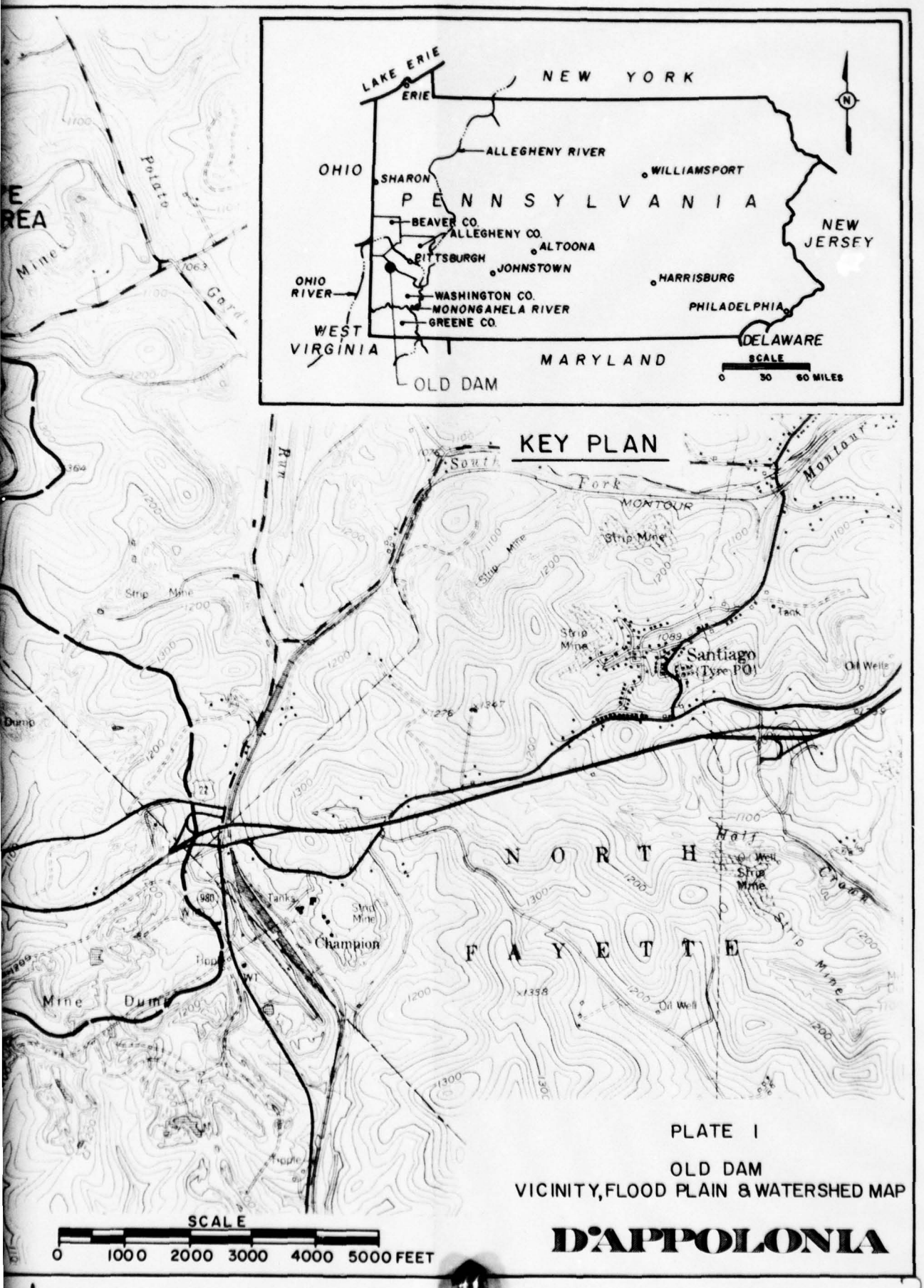
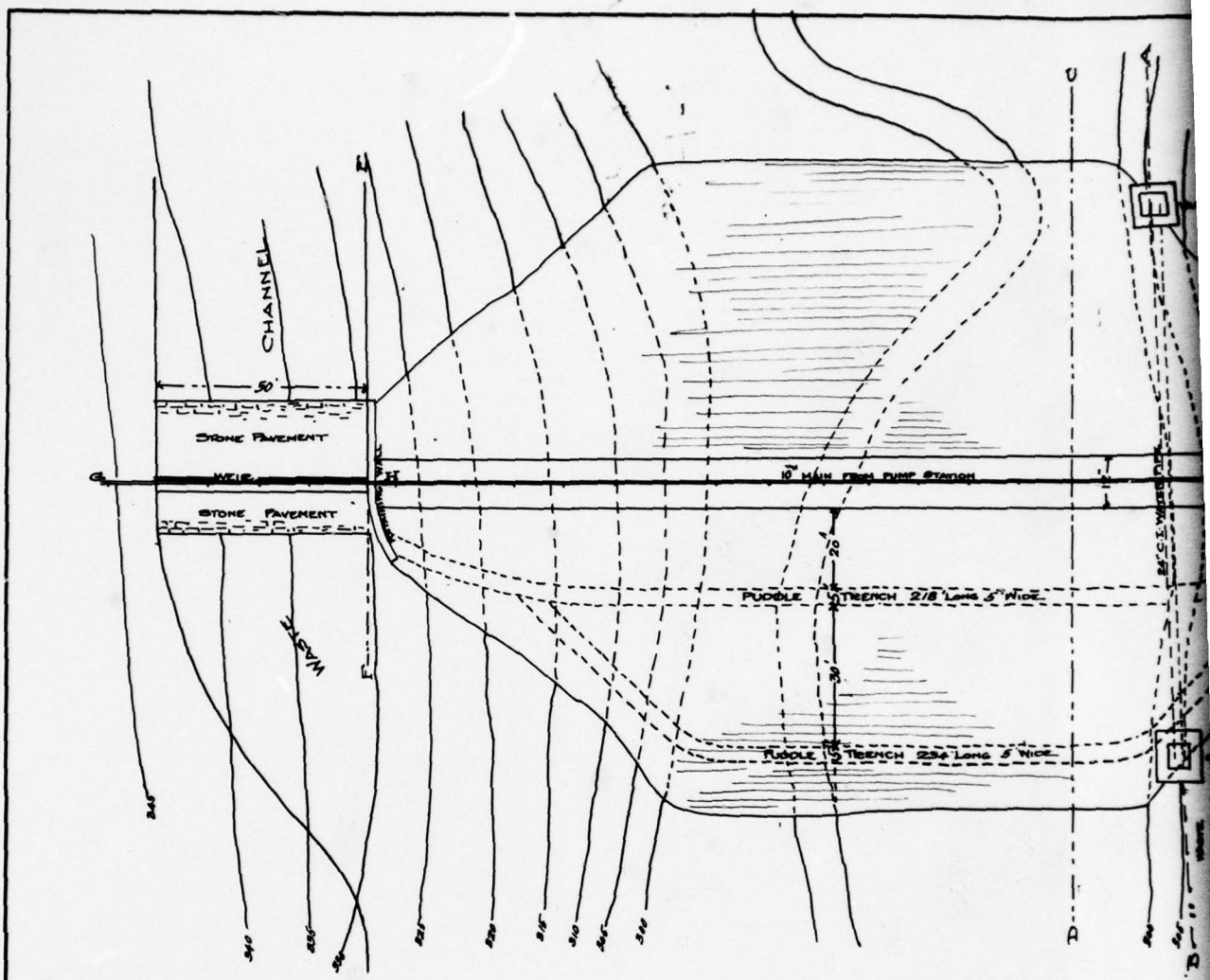


PLATE I

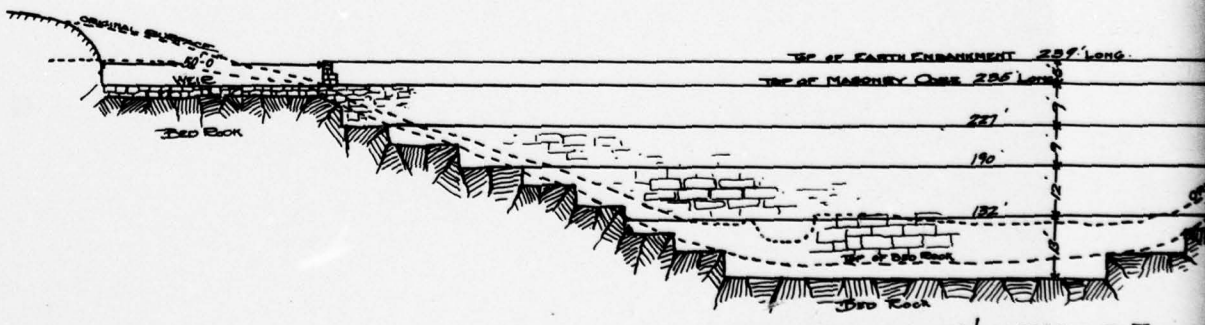
OLD DAM
VICINITY, FLOOD PLAIN & WATERSHED MAP

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	JE	1/16/79	DRAWING NUMBER 78-367-B16
	1-2-79	APPROVED BY	JMP	1.16.79	



GENERAL PLAN

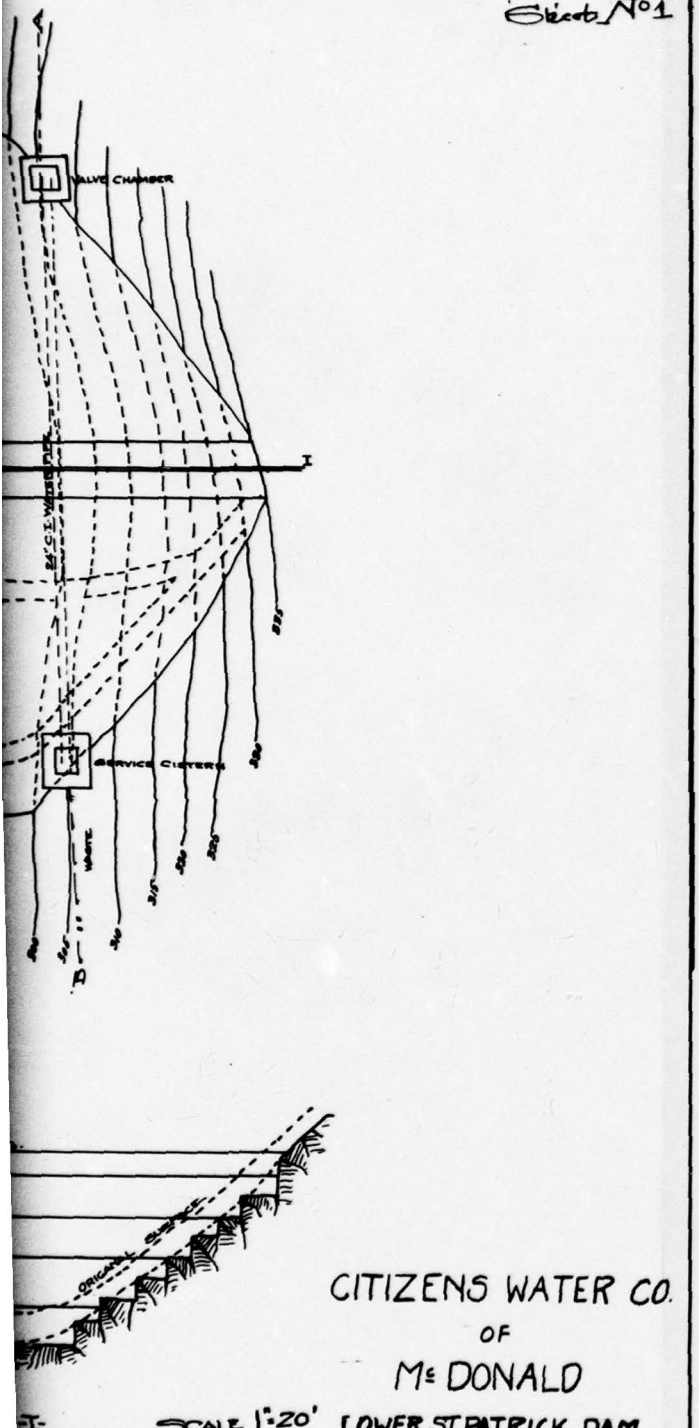


CROSS SECTION OF VALLEY AT G.I.

Copy. Traced 9-27-14

1

Sheet No 1



CITIZENS WATER CO.
OF
Mc DONALD

SCALE 1"=20' LOWER ST. PATRICK DAM.

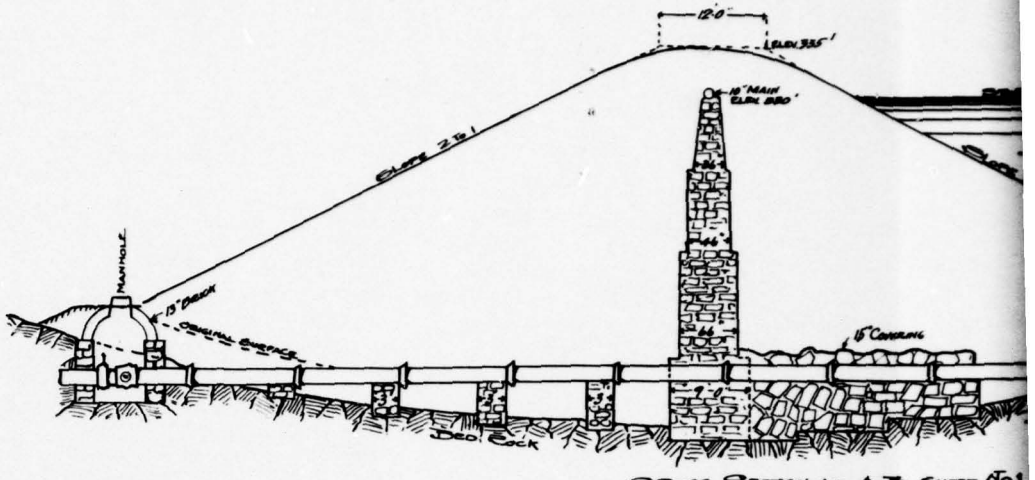
PLATE 2

D'APPOLONIA

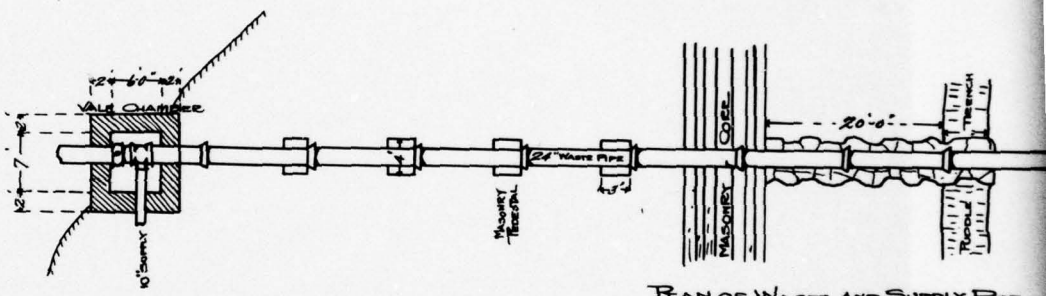
1

2

DRAWN BY	ACS	CHECKED BY		1/16/79	DRAWING NUMBER 78 57-B17
	1-2-79	APPROVED BY	JHP	1.16.79	



CROSS SECTION AT A-B. SHEET No 1

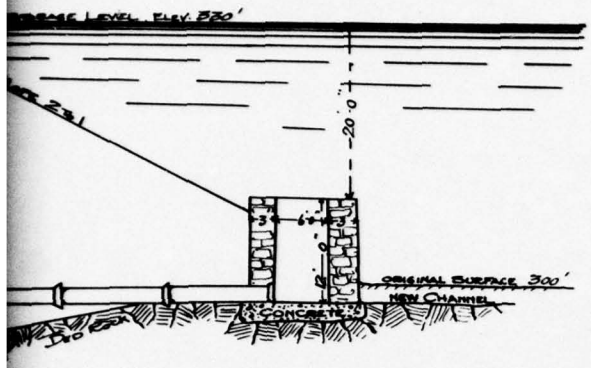


PLAN OF WASTE AND SUPPLY PIPE.

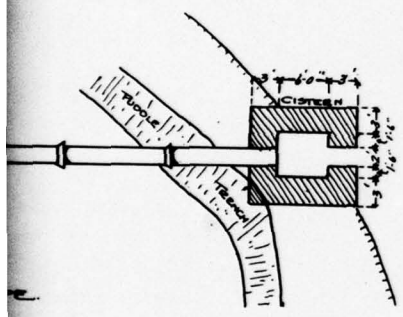
Copy. Issued. 8-27-14

NOTE: NOT AS BUILT

Sheet. No2



No1



SCALE 1"= 10'

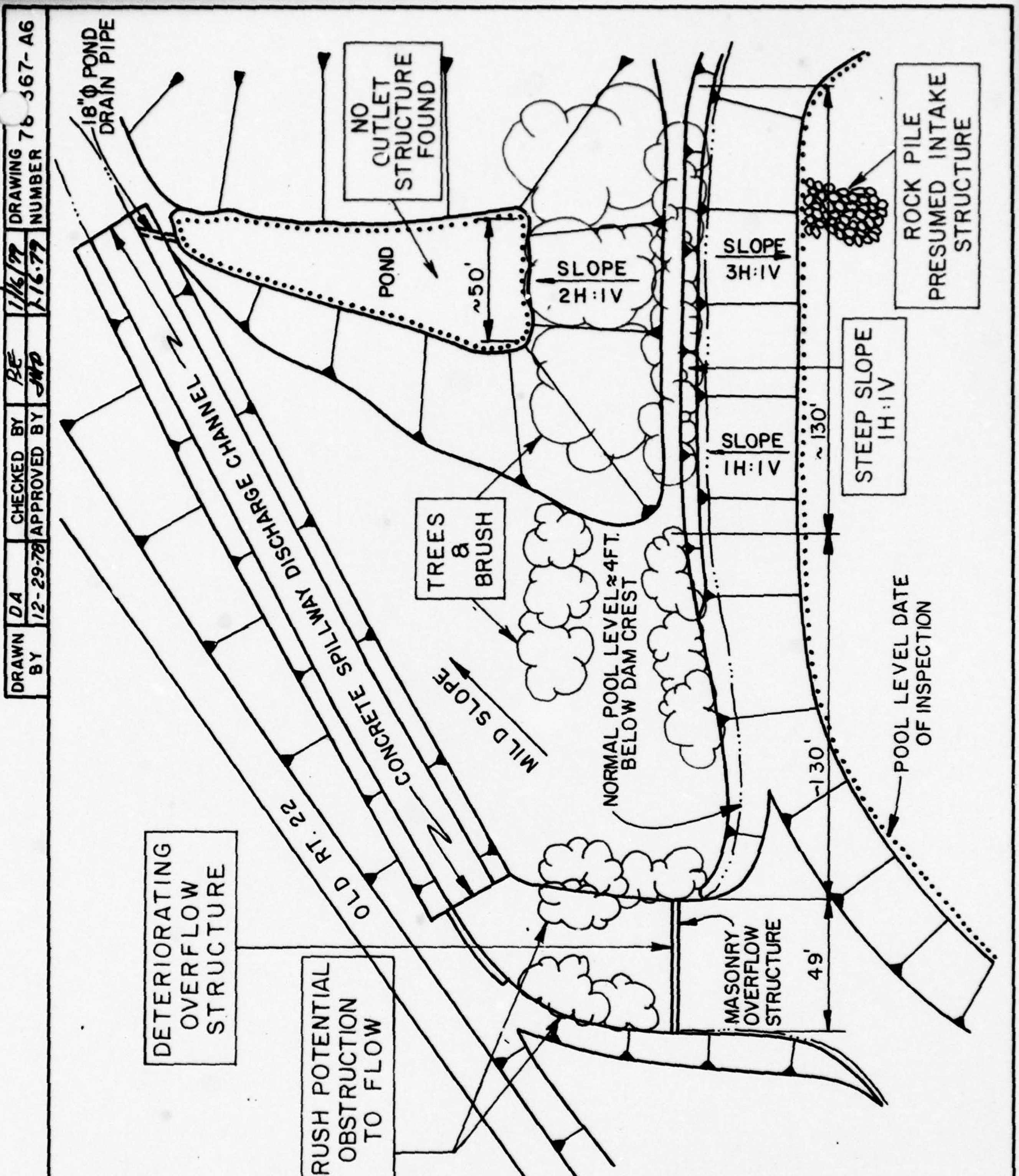
CITIZENS WATER CO.
OF
Mc DONALD
LOWER ST. PATRICK DAM.

30

PLATE 3

D'APPOLONIA

2



NOTES:

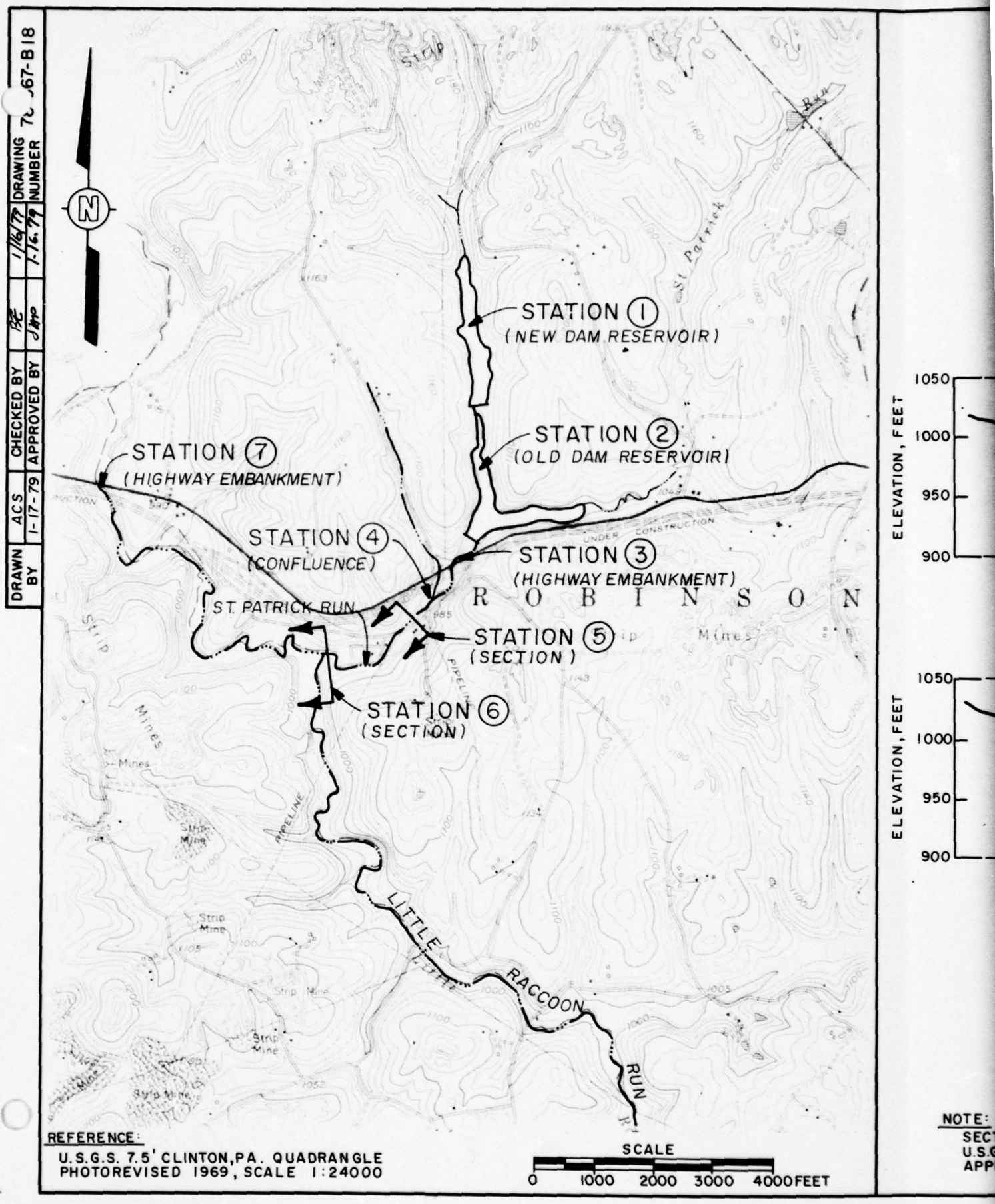
1. SPILLWAY FREEBOARD = 3.9 FEET.
2. POOL LEVEL DATE OF INSPECTION: 23 FEET BELOW DAM CREST.

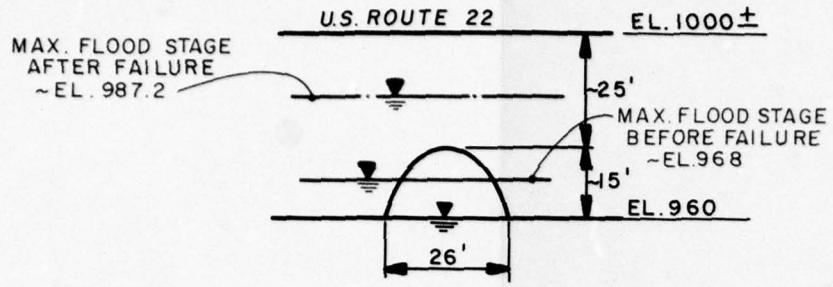
NOT TO SCALE

PLATE 4

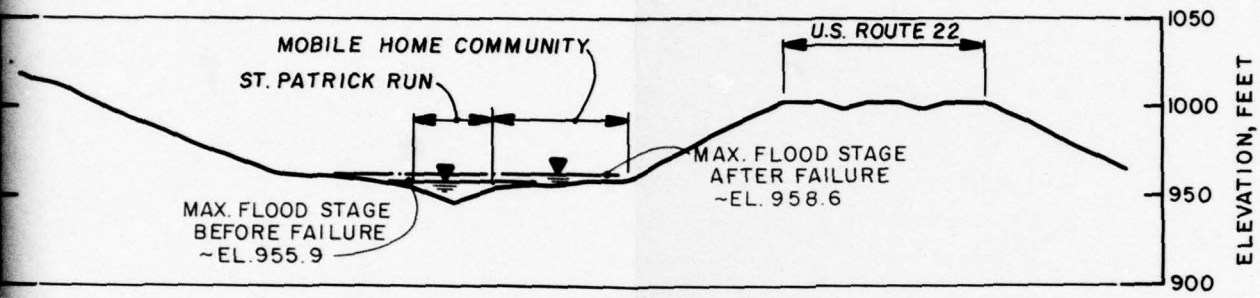
OLD DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: NOV. 29, 1978

D'APPOLONIA

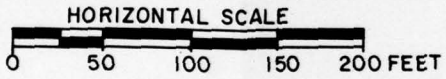

DRAWN BY
ACS
1-17-79
CHECKED BY
APPROVED BY
1/16/79
1.16.79
DRAWING NUMBER 7c .67-B18
N
STATION (1)
(NEW DAM RESERVOIR)
STATION (2)
(OLD DAM RESERVOIR)
STATION (7)
(HIGHWAY EMBANKMENT)
STATION (4)
(CONFLUENCE)
STATION (3)
(HIGHWAY EMBANKMENT)
ST. PATRICK RUN
STATION (5)
(SECTION)
STATION (6)
(SECTION)
ROBINSON
Strip Mines
Strip Mine
PIPELINE
LITTLE RACCOON RUN
East Patrick Run
UNDER CONSTRUCTION
ELEVATION, FEET
1050
1000
950
900
ELEVATION, FEET
1050
1000
950
900
REFERENCE:
U.S.G.S. 7.5' CLINTON, PA. QUADRANGLE
PHOTOREVISED 1969, SCALE 1:24000
SCALE
0 1000 2000 3000 4000 FEET
NOTE:
SECT
U.S.G
APPR

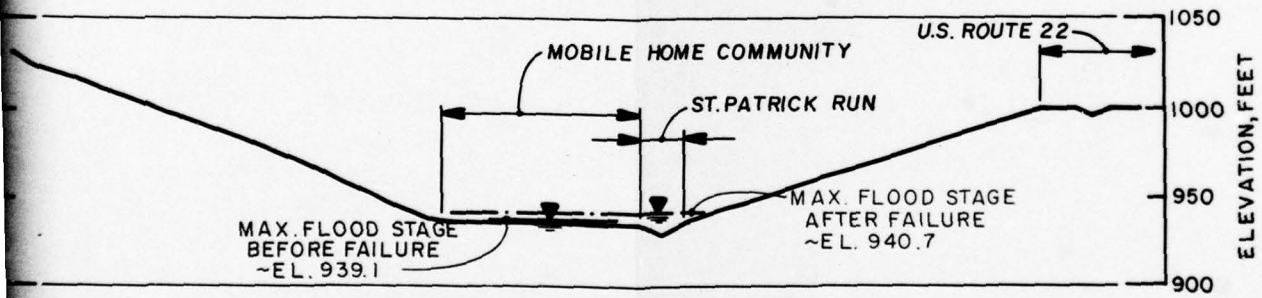


STATION ③-HIGHWAY EMBANKMENT

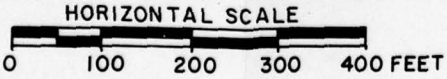


SECTION @ STATION ④





SECTION @ STATION ⑤



E:
ECTIONS WERE DEVELOPED FROM
S.G.S TOPOGRAPHY AND ARE ONLY
PPROXIMATE.

PLATE 5

D'APPOLONIA

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Old Dam COUNTY Washington STATE Pennsylvania ID# NDI I.D. No. PA-499 DER I.D. No. 63-1

TYPE OF DAM Earth HAZARD CATEGORY High

DATE(S) INSPECTION November 29, 1978 WEATHER Cloudy TEMPERATURE 30s

POOL ELEVATION AT TIME OF INSPECTION 977 M.S.L. TAILWATER AT TIME OF INSPECTION 962 M.S.L.

INSPECTION PERSONNEL:

Bilgin Erel

Wah-Tak Chan

REVIEW INSPECTION PERSONNEL:
(December 20, 1978)

E. D'Appolonia

L. D. Andersen

J. H. Poellot

B. Erel

Bilgin Erel RECORDER

VISUAL INSPECTION
PHASE 1
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The crest elevation varies between 0.1 foot below the design crest elevation to 2.3 feet above the design crest elevation. The low section is approximately 100 feet from the left abutment.	Crest of the dam should be regraded.
RIPRAP FAILURES	Riprap on the upstream face of the dam has deteriorated.	

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress.	
ANY NOTICEABLE SEEPAGE	No signs of seepage on the downstream face. Ponded water along the toe of the dam precludes inspection of this area for signs of seepage.	Ponded water should be drained.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No portions of the outlet conduit are visible.	
INTAKE STRUCTURE	The intake structures have apparently collapsed. Water enters through the outlet conduit to a mound of rubble.	Rubble should be cleared and necessary repair should be performed.
OUTLET STRUCTURE	Submerged. Not visible.	
OUTLET CHANNEL	No defined outlet channel. There is a pool approximately 50 feet wide and 200 feet long downstream from the dam. This pool overflows into the spillway discharge channel at an elevation higher than the ground surface at the toe of the dam. A drainpipe in the spillway discharge channel is apparently connected to this pool.	The pipe in the discharge channel is apparently not functioning since the pond is not drained.
EMERGENCY GATE	Not visible (as reported by the owner, the valve on the outlet pipe has been dynamited in an attempt to drain the lake).	Condition of the discharge and outlet pipe should be evaluated.

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	49-foot-wide stone overflow weir. In poor condition.	
APPROACH CHANNEL	Free of debris and major obstructions.	
DISCHARGE CHANNEL	Some overgrowth in this section immediately downstream from the overflow structure. The remaining portion of the discharge channel is free of obstructions and is in fair condition.	Requires clearing.
BRIDGE AND PIERS	None.	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

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

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep. No signs of landslides.	
SEDIMENTATION	Unknown.	
UPSTREAM RESERVOIRS	New Dam is located approximately one-half mile upstream from the reservoir.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Immediately downstream from the dam, the stream flows through an underpass under Route 22. The underpass is parabolic in cross section, 26 feet wide at the base, and approximately 15 feet high. Road level on Route 22 is approximately at the same elevation as at the crest of the dam.	
SLOPES	Significant erosion at the entrance of the Route 22 underpass is possible in the event of large flows.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Approximately 26 mobile homes are located about 500 feet downstream from the Route 22 underpass. Population: Approximately 100.	

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
AND HYDROLOGIC AND HYDRAULIC
PHASE I

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Old Dam

ID# NDI: PA-499; DER: 63-1

ITEM	REMARKS
AS-BUILT DRAWINGS	The design drawings are available in state files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by Douglas and MacKnight, civil engineers of Pittsburgh, Pennsylvania, prior to 1912.
TYPICAL SECTIONS OF DAM	See Plates 2 and 3. (Also see Section 2.1b of the report.)
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plate 3. (Also see Section 2.1b of the report).

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None available.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	Fill was placed on the left abutment reducing the crest length of the embankment from 260 feet to 130 feet. (See Plates 2 and 4).
HIGH POOL RECORDS	Reportedly, the dam was overtopped with a maximum depth of 8 inches during July 24, 1912. The damage was described as washing away of loose material on the downstream slope.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	The dam overtopped in 1912; however did not fail. The damage was washing away of loose materials on the downstream slope.
MAINTENANCE OPERATION RECORDS	Not available.
SPILLWAY PLAN SECTIONS DETAILS	See Plate 4.
OPERATING EQUIPMENT PLANS AND DETAILS	See Plate 3. (Also see Section 4.0 of the report.)

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 4.6 square miles (wooded)

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 996 (276 acre-feet)

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 1000 (390 acre-feet)

ELEVATION; MAXIMUM DESIGN POOL: 1000

ELEVATION; TOP DAM: 1000 as designed, 999.9 (low spot)

SPILLWAY:

a. Elevation 996

b. Type Stone overflow section

c. Width 49 feet

d. Length N/A

e. Location Spillover Approximately 100 feet from the spillway wall

f. Number and Type of Gates None

OUTLET WORKS: 24-inch cast-iron pipe

a. Type 24-inch cast-iron pipe

b. Location Near right abutment

c. Entrance Inverts Unknown

d. Exit Inverts Unknown

e. Emergency Draindown Facilities None

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

c. Records None

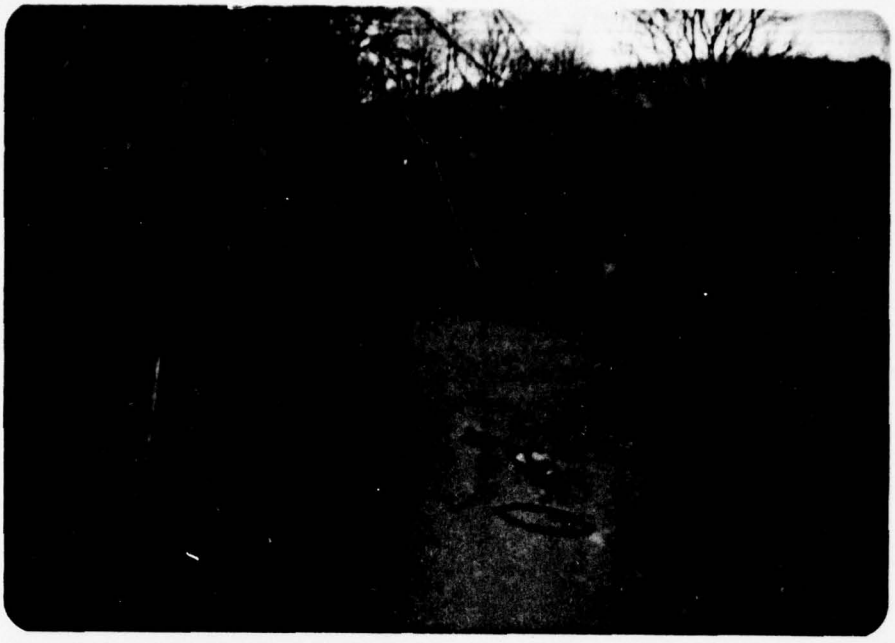
MAXIMUM NONDAMAGING DISCHARGE: Spillway capacity

APPENDIX C

PHOTOGRAPHS

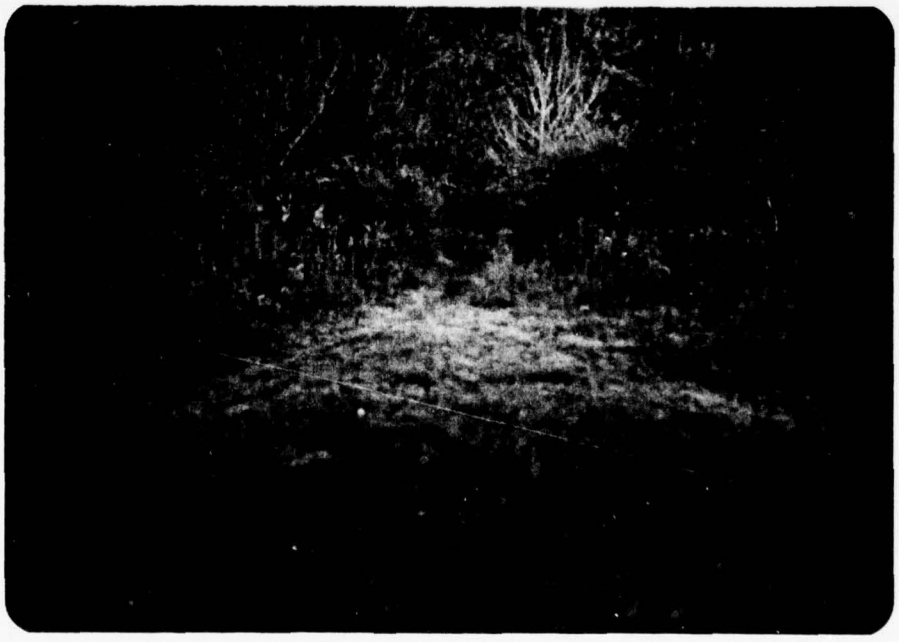
LIST OF PHOTOGRAPHS
OLD DAM
NDI I.D. NO. PA-499
NOVEMBER 29, 1978

PHOTOGRAPH NO.	DESCRIPTION
1	Ponded water in the downstream toe area (looking upstream).
2	Crest (looking west, view from left abutment).
3	Spillway crest and approach channel.
4	Spillway discharge channel.
5	Intake end of outlet conduit. (Water percolating into a mound of rocks. Downstream end could not be located.)
6	Culvert under Route 22 (approximately 300 feet downstream).



Photograph No. 1

Ponded water in the downstream toe area (looking upstream).

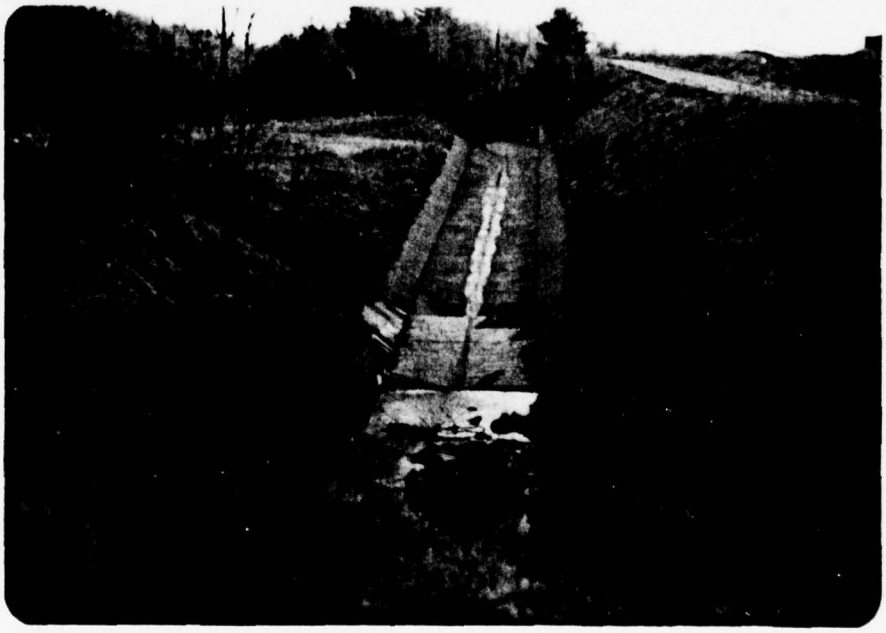


Photograph No. 2

Crest (looking west, view from left abutment).

Photograph No. 3

Spillway channel and approach channel.

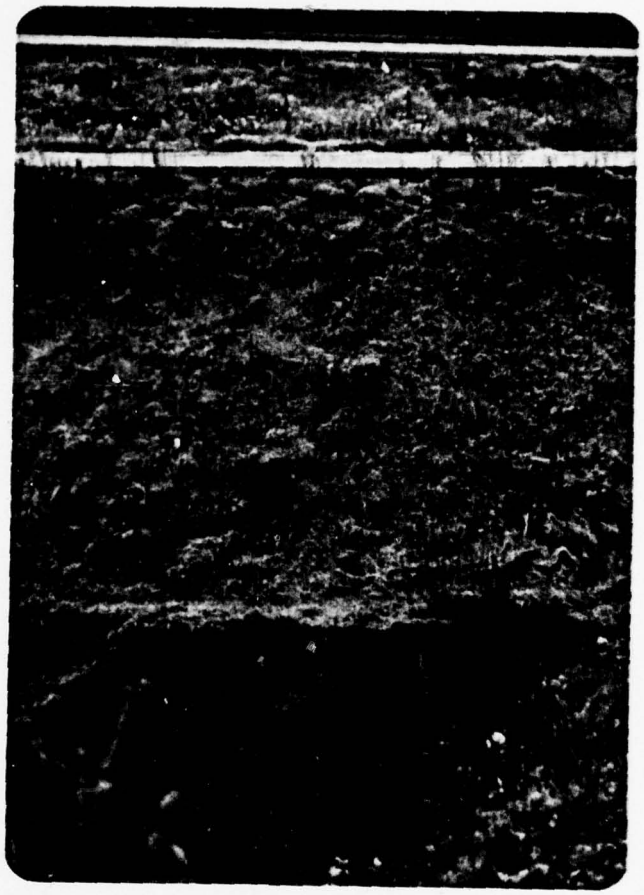


Photograph No. 4

Spillway discharge channel.

Photograph No. 5

Intake end of outlet conduit. (Water percolating into a mound of rocks. Downstream end could not be located.)



Photograph No. 6

Culvert under Route 22 (approximately 300 feet downstream).

APPENDIX D
CALCULATIONS

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Old Dam (NDI I.D. PA-499)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.1 INCHES/24 HOURS[1]

STATION	1	2	3	4	5 and 6
Station Description	New Dam	Old Dam	Rt. 22 Culvert of St. Patricks	Confluence of St. Patricks Run and No Name Creek	Potential Damage Area
Drainage Area (square miles)	1.3	3.3	-	0.5	-
Cumulative Drainage Area (square miles)	1.3	4.6	4.6	5.1	5.1
Adjustment of PMF for Drainage Area (%)[2]					
6 Hours	102	102	-	102	-
12 Hours	120	120	-	120	-
24 Hours	130	130	-	130	-
48 Hours	140	140	-	140	-
72 Hours	-	-	-	-	-
Snyder Hydrograph Parameters					
Zone[3]	28	28	-	28	-
C_p/C_t[4]	0.57/1.7	0.57/1.7	-	0.57/1.7	-
L (miles)[5]	1.9	2.5	-	0.11	-
L_{ca} (miles)[5]	0.9	0.9	-	0.06	-
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	1.96	2.123	-	0.374	-
Spillway Data					
Crest Length (ft)	20	49	15'x26' pipe	-	-
Freeboard (ft)	5.8	3.9	40±	-	-
Discharge Coefficient	2.65	2.65	0.6	-	-
Exponent	1.5	1.5	0.5	-	-

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Old Dam (NDI I.D. PA-499) (Continued)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.1 INCHES/24 HOURS[1]

STATION	7				
Station Description	Rt. 22 Culvert on Little Raccoon Creek				
Drainage Area (square miles)	10.4				
Cumulative Drainage Area (square miles)	15.5				
Adjustment of PMF for Drainage Area (%)[2]					
6 Hours	102				
12 Hours	120				
24 Hours	130				
48 Hours	140				
72 Hours	-				
Snyder Hydrograph Parameters					
Zone[3]	28				
C_p/C_t[4]	0.57/1.7				
L (miles)[5]	6.6				
L_{ca} (miles)[5]	3.4				
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	4.332				
Spillway Data					
Crest Length (ft)	15'x26' pipe				
Freeboard (ft)	100+				
Discharge Coefficient	0.6				
Exponent	0.5				

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  11 JAN 79
**********
    1                A1              SNYDER UNIT HYDROGRAPH,FLOOD ROUTING , DAM OVERTOPPING ANALYSES
    2                A2              OLD DAM,WASHINGTON COUNTY,NDI-ID.PA499      PROJECT NO.78-367-06
    3                A3              FOR 10%,20%,30%,40%,50%,60%,70%,80%, AND 100% PMF
    4                B    300       0       10        0        0        0        0        0       -4        0
    5                B1     5
    6                J      1       9        1
    7                J1  0.10    0.20    0.30    0.40    0.50    0.60    0.70    0.80    1.00
    8                K      0       1                                                1
    9                K1       CALCULATION OF INFLOW HYDROGRAPH TO NEW DAM,WASHINGTON COUNTY,PA503
   10                M      1       1     1.3               1.3                                1
   11                P             24.1     102      120     130      140
   12                T                                                      1.0    0.05            0.018
   13                W  1.960    0.57
   14                X   -1.0    -.05     2.0
   15                K      1       2                                                1
   16                K1       ROUTING FLOW THROUGH NEW DAM RESERVOIR STARTING AT SPILLWAY LEVEL
   17                Y                                        1       1
   18                Y1     1                                                240.0
   19                $S   0.1   240.0   353.0   600.0
   20                $E1000.0  1025.0  1031.0  1040.0
   21                $$1025.0    20.0    2.65     1.5
   22                $D1030.8    3.08     1.5   335.0
   23                K      0       2                                                1
   24                K1       CALCULATION OF INFLOW HYDROGRAPH TO OLD DAM,WASHINGTON COUNTY,PA499
   25                M      1       1     3.3               4.6                                1
   26                P             24.1     102      120     130      140
   27                T                                                      1.0    0.05            0.006
   28                W  2.123    0.57
   29                X   -1.0    -.05     2.0
   30                K      2       2                                                1
   31                K1       COMBINED INFLOW HYDROGRAPH AT OLD DAM (STATION 2)
   32                K      1       3                                                1
   33                K1       ROUTING FLOW THROUGH OLD DAM RESERVOIR STARTING AT SPILLWAY LEVEL
   34                Y                                        1       1
   35                Y1     1                                                276.0
   36                $S     0     276     390
   37                $E   966     996    1001
   38                $$   996      49    2.65     1.5
   39                $D999.89    3.08     1.5   260.0
   40                K     99
```

COMPUTER INPUT: OVERTOPPING ANALYSIS

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50	RATIO 6 .60	RATIO 7 .70	RATIO 8 .80	RATIO 9 1.00
HYDROGRAPH AT	1	1.30	1	313.	627.	940.	1254.	1567.	1881.	2194.	2507.	3134.
	(	3.37)	(	8.88)(	17.75)(	26.63)(	35.50)(	44.38)(	53.25)(	62.13)(	71.00)(	88.75)
ROUTED TO	2	1.30	1	238.	511.	836.	1216.	1545.	1860.	2175.	2489.	3116.
	(	3.37)	(	6.74)(	14.46)(	23.67)(	34.45)(	43.75)(	52.68)(	61.59)(	70.47)(	88.23)
HYDROGRAPH AT	2	3.30	1	762.	1524.	2286.	3048.	3810.	4572.	5335.	6097.	7621.
	(	8.55)	(	21.58)(	43.16)(	64.74)(	86.32)(	107.90)(	129.48)(	151.06)(	172.64)(	215.80)
2 COMBINED	2	4.60	1	962.	1976.	3007.	4253.	5353.	6433.	7510.	8585.	10737.
	(	11.91)	(	27.25)(	55.95)(	85.14)(	120.44)(	151.58)(	182.16)(	212.65)(	243.11)(	304.03)
ROUTED TO	3	4.60	1	897.	1962.	3003.	4233.	5340.	6418.	7493.	8567.	10713.
	(	11.91)	(	25.39)(	55.57)(	85.04)(	119.87)(	151.21)(	181.74)(	212.18)(	242.59)(	303.37)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1025.00	1025.00	1030.80
STORAGE	240.	240.	349.
OUTFLOW	0.	0.	740.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1027.72	0.00	291.	238.	0.00	43.17	0.00
.20	1029.53	0.00	325.	511.	0.00	42.83	0.00
.30	1030.96	.16	352.	836.	1.50	42.50	0.00
.40	1031.31	.51	362.	1216.	3.33	41.83	0.00
.50	1031.54	.74	368.	1545.	4.33	41.83	0.00
.60	1031.74	.94	373.	1860.	5.00	41.67	0.00
.70	1031.91	1.11	378.	2175.	6.00	41.67	0.00
.80	1032.08	1.28	383.	2489.	6.67	41.67	0.00
1.00	1032.38	1.58	391.	3116.	7.67	41.67	0.00

SUMMARY OF OVERTOPPING ANALYSIS (UPSTREAM DAM)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	996.00	996.00	999.89
STORAGE	276.	276.	365.
OUTFLOW	0.	0.	996.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	999.63	0.00	359.	897.	0.00	42.83	0.00
.20	1000.74	.85	384.	1962.	5.00	42.00	0.00
.30	1001.34	1.45	398.	3003.	7.17	42.17	0.00
.40	1001.94	2.05	411.	4233.	8.50	41.83	0.00
.50	1002.42	2.53	422.	5340.	9.83	41.83	0.00
.60	1002.85	2.96	432.	6418.	10.83	41.83	0.00
.70	1003.26	3.37	442.	7493.	11.83	41.83	0.00
.80	1003.64	3.75	450.	8567.	13.33	41.83	0.00
1.00	1004.36	4.47	467.	10713.	15.33	41.83	0.00

SUMMARY OF OVERTOPPING ANALYSIS

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  11 JAN 79
**********
    1                A1                SNYDER UNIT HYDROGRAPH,FLOOD  OUTING,DAM OVERTOPPING
    2                A2                OLD DAM,WASHINGTON COUNTY.    D.PA499      PROJECT NO.78-367-06
    3                A3                FOR 10%,15%, AND 20% PMF
    4                R    300       0      10       0       (       0       0       0      -4       0
    5                B1     5
    6                J      2       3       1
    7                J1  0.10    0.15    0.20
    8                K      0       1                                       1
    9                K1       CALCULATION OF INFLOW HYDROGRA       NEW DAM,WASHINGTON COUNTY,PA503
   10                M      1       1     1.3              1.                                      1
   11                P              24.1     102     120     130     140
   12                T                                                      1.0    0.05            0.018
   13                W  1.960    0.57
   14                X   -1.0    -.05     2.0
   15                K      1       2                                       1
   16                K1       ROUTING FLOW THROUGH NEW DAM RESERVOIR STARTING AT SPILLWAY LEVEL
   17                Y                                       1       1
   18                Y1     1                                                240.0
   19                $S   0.1   240.0   353.0   600.0
   20                $E1000.0  1025.0  1031.0  1040.0
   21                $$1025.0    20.0    2.65     1.5
   22                $D1030.8    3.08     1.5   335.0
   23                K      0       2                                       1
   24                K1       CALCULATION OF INFLOW HYDROGRAPH TO OLD DAM,WASHINGTON COUNTY,PA499
   25                M      1       1     3.3              4.6                                     1
   26                P              24.1     102     120     130     140
   27                T                                                      1.0    0.05            0.006
   28                W  2.123    0.57
   29                X   -1.0    -.05     2.0
   30                K      2       2                                       1
   31                K1       COMBINED INFLOW HYDROGRAPH AT OLD DAM (STATION 2)
   32                K      1       3                                       1
   33                K1       ROUTING FLOW THROUGH OLD DAM RESERVOIR STARTING AT SPILLWAY LEVEL
   34                Y                                       1       1
   35                Y1     1                                                276.0
   36                $S     0     276     390
   37                $E   966     996    1001
   38                $$   996      49    2.65     1.5
   39                $D999.89    3.08     1.5   260.0
   40                K      1       4                                       1
   41                K1       ROUTING FLOW THROUGH RT.22 CULVERT OF ST.PATRICK RUN
   42                Y                                       1       1
   43                Y1     1                                                0.0      -1
   44                Y4  960.    980.    990.   1000.
   45                Y5    0.   4850.   6260.   7399.
   46                $S   0.0    13.0    63.0   133.0
   47                $E 960.0   980.0  1000.0  1020.0
   48                $$ 960.0
   49                $D1000.0    3.08     1.5   600.0
   50                K      0       4                                       1
```

COMPUTER INPUT: BREACH ANALYSIS STEP 1

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51          K1      CALCULATION OF LOCAL INFLOW HYDROGRAPH AT STATION 4(POTENTIAL DAMAGE)
52          M       1       1       0.53            5.14                                    1
53          P               24.1    102     120     130     140
54          I                                                       1.0     0.05                    0
55          W   1.561   0.57
56          X    -1.0   -0.05    2.0
57          K       2       4                                               1
58          K1      COMBINED INFLOW HYDROGRAPH AT STATION 4(POTENTIAL DAMAGE AREA)
59          K       1       5                                               1
60          K1      CHANNEL ROUTING USING MODIFIED PULS--REACH 4 TO 5(POTENTIAL DAMAGE AREA)
61          Y                               1       1
62          Y1      1
63          Y6 0.045    0.035   0.045   950.0  1000.0  1500.0  0.0100
64          Y7   0.0  1000.0    75.0   960.0   150.0   955.0   170.0   950.0   180.0   950.0
65          Y7 200.0   955.0   275.0   960.0   375.0  1000.0
66          K       1       6                                               1
67          K1      CHANNEL ROUTING USING MODIFIED PULS -- REACH 5 TO 6
68          Y                               1       1
69          Y1      1
70          Y6 0.045    0.035   0.045   935.0  1000.0  1500.0  0.0100
71          Y7   0.0  1000.0   400.0   940.0   420.0   935.0   430.0   935.0   450.0   938.0
72          Y7 700.0   940.0   850.0   970.0  1000.0  1000.0
73          K       0       6                                               1
74          K1      CALCULATION OF INFLOW HYDROGRAPH TO LITTLE RACCOON RUN AT RT.22 CULVERT.
75          M       1       1       10.4            15.54                                   1
76          P               24.1    102     120     130     140
77          I                                                       1.0     0.05
78          W   4.332   0.57
79          X    -1.0   -0.05    2.0
80          K       2       6                                               1
81          K1      COMBINED INFLOW HYDROGRAPH AT RT.22 CULVERT OF LITTLE RACCOON RUN(ST.6)
82          K       1       7                                               1
83          K1      ROUTING FLOW THROUGH RT.22 CULVERT OF LITTLE RACCOON RUN (TO STATION 7)
84          Y                               1       1
85          Y1      1                                               0.0     -1
86          Y4  900.    920.    930.    940.
87          Y5    0.   4850.   6260.   7399.
88          $S   0.0   140.0   916.0  2673.0  5507.0 10037.0 17463.0
89          $E 900.0   920.0   940.0   960.0   980.0  1000.0  1020.0
90          $$ 900.0
91          $D1000.0    3.08     1.5   900.0
92          K      99
```

COMPUTER INPUT: BREACH ANALYSIS STEP 1
(CONTINUED)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	960.00	960.00	1000.00
STORAGE	0.	6.	63.
OUTFLOW	0.	0.	7399.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	963.70	0.00	2.	897.	0.00	42.83	0.00
.15	965.97	0.00	4.	1449.	0.00	42.17	0.00
.20	968.09	0.00	5.	1963.	0.00	42.17	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	960.00	960.00	1000.00
STORAGE	0.	0.	63.
OUTFLOW	0.	0.	7399.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	963.70	0.00	2.	897.	0.00	42.83	0.00
.15	965.97	0.00	4.	1449.	0.00	42.17	0.00
.20	968.09	0.00	5.	1963.	0.00	42.17	0.00

BREACH ANALYSIS STEP 1: ROUTING THROUGH HIGHWAY EMBANKMENT

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1000.	954.1	42.67
.15	1628.	955.4	42.17
.20	2206.	955.9	42.00

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1000.	954.1	42.67
.15	1628.	955.4	42.17
.20	2206.	955.9	42.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	999.	938.6	42.67
.15	1627.	938.9	42.17
.20	2206.	939.1	42.17

PLAN 2 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	999.	938.6	42.67
.15	1627.	938.9	42.17
.20	2206.	939.1	42.17

SUMMARY OF BREACH ANALYSIS STEP 1: FLOOD STAGES BEFORE DAM FAILURE

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
    ST MODIFICATION   11 JAN 79
**********************************
A1                    SNYDER UNIT HYDROGRAPH,FLOOD RO[illegible],DAM OVERTOPPING AND BREACH
A2                    OLD DAM,WASHINGTON COUNTY,NDI-I[illegible]99      PROJECT NO.78-367-06
A3                    FOR 10%,15%, AND 20% PMF (BREA[illegible]URE ANALYSES)
B      300       0      10       0       0               0       0      -4       0
B1       5
J        2       3       1
J1    0.10    0.15    0.20
K        0       1                                       1
K1         CALCULATION OF INFLOW HYDROGRAPH TO [illegible],WASHINGTON COUNTY,PA503
M        1       1     1.3             1.3                                       1
P             24.1     102     120     130     140
T                                                      1.0    0.05            0.018
W    1.960    0.57
X     -1.0    -.05     2.0
K        1       2                                       1
K1         ROUTING FLOW THROUGH NEW DAM RESERVOIR STARTING AT SPILLWAY LEVEL
Y                                1       1
Y1       1                                           240.0
$S     0.1   240.0   353.0   600.0
$E1000.0  1025.0  1031.0  1040.0
$$1025.0    20.0    2.65     1.5
$D1030.8    3.08     1.5   335.0
K        0       2                                       1
K1         CALCULATION OF INFLOW HYDROGRAPH TO OLD DAM,WASHINGTON COUNTY,PA499
M        1       1     3.3             4.6                                       1
P             24.1     102     120     130     140
T                                                      1.0    0.05            0.006
W    2.123    0.57
X     -1.0    -.05     2.0
K        2       2                                       1
K1         COMBINED INFLOW HYDROGRAPH AT OLD DAM (STATION 2)
K        1       3                                       1
K1         ROUTING FLOW THROUGH OLD DAM RESERVOIR STARTING AT SPILLWAY LEVEL
Y                                1       1
Y1       1                                           276.0
$S       0     276     390
$E     966     996    1001
$$     996      49    2.65     1.5
$D999.89    3.08     1.5   260.0
$H 120.0     1.0   995.0    0.50   996.0 1000.5
$B 100.0     1.0   986.0    0.50   996.0 1000.5
K        1       4                                       1
K1         ROUTING FLOW THROUGH RT.22 CULVERT OF ST.PATRICK RUN
Y                                1       1
Y1       1                                             0.0      -1
Y4    960.    980.    990.   1000.
Y5      0.   4850.   6260.   7399.
$S     0.0    13.0    63.0   133.0
$E   960.0   980.0  1000.0  1020.0
$$   960.0
```

COMPUTER INPUT: BREACH ANALYSIS STEP 2

```
$D1000.0    3.08     1.5   600.0
K       0       4                                                    1
K1       CALCULATION OF LOCAL INFLOW HYDROGRAPH AT STATION 4(POTENTIAL DAMAGE)
M       1       1    0.53            5.14                                        1
P              24.1     102      120      130      140
T                                                          1.0    0.05                  0
W   1.561    0.57
X    -1.0   -0.05     2.0
K       2       4                                                    1
K1       COMBINED INFLOW HYDROGRAPH AT STATION 4(POTENTIAL DAMAGE AREA)
K       1       5                                                    1
K1       CHANNEL ROUTING USING MODIFIED PULS--REACH 4 TO 5(POTENTIAL DAMAGE AREA)
Y                                  1       1
Y1      1
Y6 0.045   0.035   0.045   950.0  1000.0  1500.0  0.0100
Y7   0.0  1000.0    75.0   960.0   150.0   955.0   170.0   950.0   180.0   950.0
Y7 200.0   955.0   275.0   960.0   375.0  1000.0
K       1       6                                                    1
K1       CHANNEL ROUTING USING MODIFIED PULS -- REACH 5 TO 6
Y                                  1       1
Y1      1
Y6 0.045   0.035   0.045   935.0  1000.0  1500.0  0.0100
Y7   0.0  1000.0   400.0   940.0   420.0   935.0   430.0   935.0   450.0   938.0
Y7 700.0   940.0   850.0   970.0  1000.0  1000.0
K       0       6                                                    1
K1       CALCULATION OF INFLOW HYDROGRAPH TO LITTLE RACCOON RUN AT RT.22 CULVERT.
M       1       1   10.4            15.54                                       1
P              24.1     102      120      130      140
T                                                          1.0    0.05
W   4.332    0.57
X    -1.0   -0.05     2.0
K       2       6                                                    1
K1       COMBINED INFLOW HYDROGRAPH AT RT.22 CULVERT OF LITTLE RACCOON RUN(ST.6)
K       1       7                                                    1
K1       ROUTING FLOW THROUGH RT.22 CULVERT OF LITTLE RACCOON RUN (TO STATION 7)
Y                                  1       1
Y1      1                                                           0.0       -1
Y4  900.    920.    930.    940.
Y5    0.   4850.   6260.   7399.
$S    0.0   140.0   916.0  2673.0  5507.0 10037.0 17463.0
$E 900.0   920.0   940.0   960.0   980.0  1000.0  1020.0
$$ 900.0
$01000.0    3.08     1.5   900.0
K      99
```

COMPUTER INPUT: BREACH ANALYSIS STEP 2
(CONTINUED)

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .15	RATIO 3 .20
HYDROGRAPH AT	1	1.30	1	313.	470.	627.
	(	3.37)	(	8.88)(	13.31)(	17.75)(
			2	313.	470.	627.
			(	8.88)(	13.31)(	17.75)(
ROUTED TO	2	1.30	1	238.	373.	511.
	(	3.37)	(	6.74)(	10.56)(	14.46)(
			2	238.	373.	511.
			(	6.74)(	10.56)(	14.46)(
HYDROGRAPH AT	2	3.30	1	762.	1143.	1524.
	(	8.55)	(	21.58)(	32.37)(	43.16)(
			2	762.	1143.	1524.
			(	21.58)(	32.37)(	43.16)(
2 COMBINED	2	4.60	1	962.	1466.	1976.
	(	11.91)	(	27.25)(	41.52)(	55.95)(
			2	962.	1466.	1976.
			(	27.25)(	41.52)(	55.95)(
ROUTED TO	3	4.60	1	897.	1449.	3606.
	(	11.91)	(	25.39)(	41.03)(	102.10)(
			2	897.	1449.	6479.
			(	25.39)(	41.03)(	183.47)(
ROUTED TO	4	4.60	1	897.	1448.	3486.
	(	11.91)	(	25.39)(	41.01)(	98.71)(
			2	897.	1448.	5858.
			(	25.39)(	41.01)(	165.88)(
HYDROGRAPH AT	4	.53	1	143.	215.	287.
	(	1.37)	(	4.06)(	6.09)(	8.12)(
			2	143.	215.	287.
			(	4.06)(	6.09)(	8.12)(
2 COMBINED	4	5.13	1	1000.	1628.	3751.
	(	13.29)	(	28.30)(	46.09)(	106.22)(
			2	1000.	1628.	6124.
			(	28.30)(	46.09)(	173.40)(
ROUTED TO	5	5.13	1	1000.	1627.	3673.
	(	13.29)	(	28.30)(	46.08)(	104.02)(
			2	1000.	1627.	6128.
			(	28.30)(	46.08)(	173.51)(
ROUTED TO	6	5.13	1	999.	1626.	3556.
	(	13.29)	(	28.29)(	46.05)(	100.69)(

			2	999.	1626.	6020.
				(28.29)(	46.06)(	170.47)(
HYDROGRAPH AT	6	10.40	1	1617.	2426.	3235.
	(	26.94)		(45.80)(	68.70)(	91.60)(
			2	1617.	2426.	3235.
				(45.80)(	68.70)(	91.60)(
2 COMBINED	6	15.53	1	2569.	3874.	6088.
	(	40.22)		(72.74)(	109.69)(	172.39)(
			2	2569.	3874.	8463.
				(72.74)(	109.69)(	239.64)(
ROUTED TO	7	15.53	1	2548.	3842.	5030.
	(	40.22)		(72.15)(	108.80)(	142.42)(
			2	2548.	3842.	5239.
				(72.15)(	108.89)(	148.35)(

FLOOD ROUTING SUMMARY: BREACH ANALYSIS STEP 2

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	996.00	996.00	999.89
STORAGE	276.	276.	365.
OUTFLOW	0.	0.	996.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	999.63	0.00	359.	897.	0.00	42.83	0.00
.15	1000.37	.48	376.	1449.	3.33	42.17	0.00
.20	1000.53	.64	379.	3606.	1.14	41.67	41.17

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	996.00	996.00	999.89
STORAGE	276.	276.	365.
OUTFLOW	0.	0.	996.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	999.63	0.00	359.	897.	0.00	42.83	0.00
.15	1000.37	.48	376.	1449.	3.33	42.17	0.00
.20	1000.53	.64	379.	7387.	.99	41.60	41.17

SUMMARY OF BREACH ANALYSIS STEP 2: OLD DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	960.00	960.00	1000.00
STORAGE	0.	0.	63.
OUTFLOW	0.	0.	7399.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	963.70	0.00	2.	897.	0.00	42.83	0.00
.15	965.97	0.00	4.	1448.	0.00	42.17	0.00
.20	974.37	0.00	9.	3486.	0.00	41.67	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	960.00	960.00	1000.00
STORAGE	0.	0.	63.
OUTFLOW	0.	0.	7399.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	963.70	0.00	2.	897.	0.00	42.83	0.00
.15	965.97	0.00	4.	1448.	0.00	42.17	0.00
.20	987.15	0.00	31.	5858.	0.00	41.67	0.00

SUMMARY OF BREACH ANALYSIS STEP 2: HIGHWAY EMBANKMENT

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1000.	954.1	42.67
.15	1627.	955.4	42.17
.20	3673.	957.1	41.67

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1000.	954.1	42.67
.15	1627.	955.4	42.17
.20	6128.	958.6	41.67

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	999.	938.6	42.67
.15	1626.	938.9	42.17
.20	3556.	939.7	41.67

PLAN 2 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	999.	938.6	42.67
.15	1626.	938.9	42.17
.20	6020.	940.7	41.67

SUMMARY OF BREACH ANALYSIS STEP 2: FLOOD STAGES AFTER DAM FAILURE

APPENDIX E

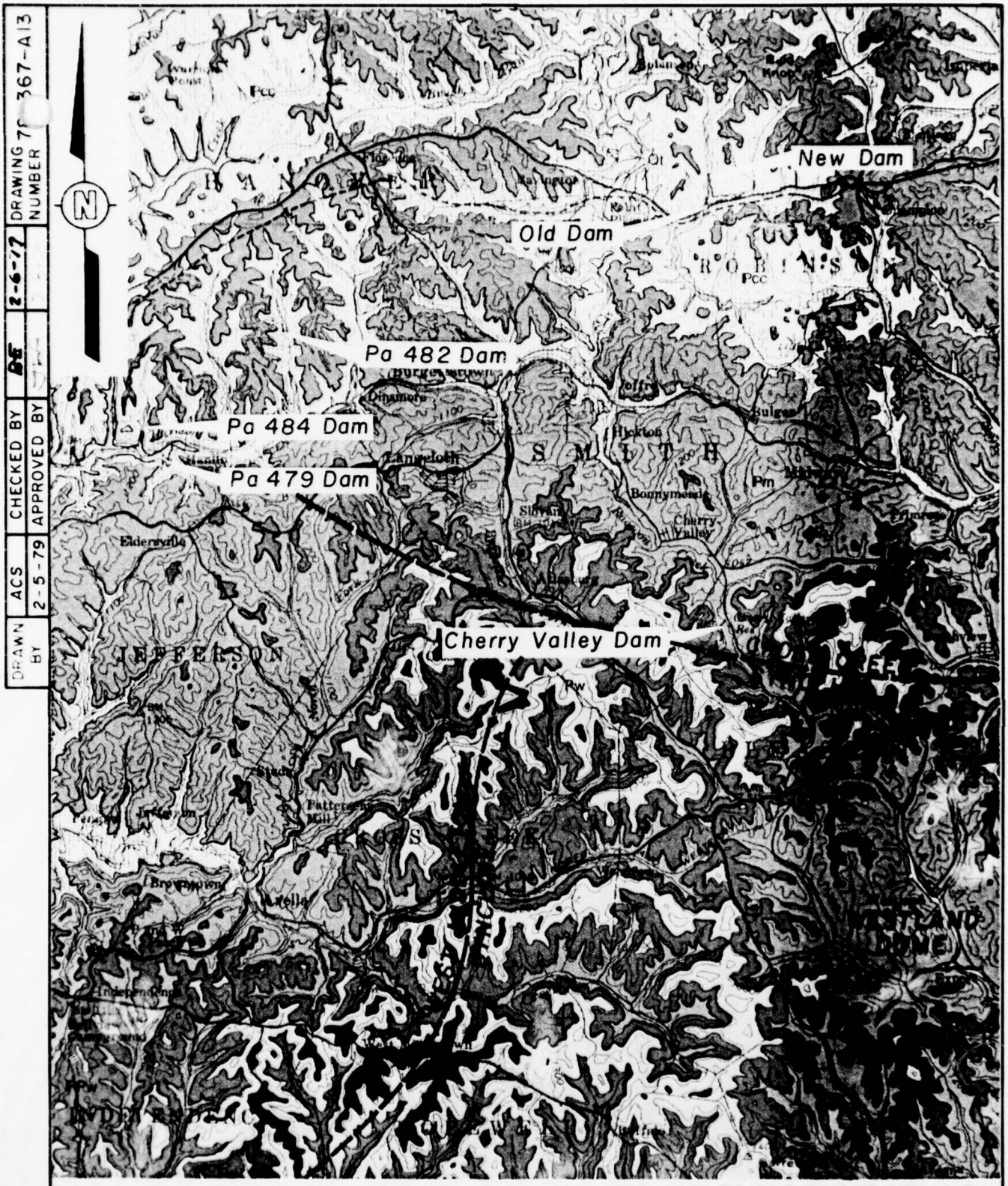
REGIONAL GEOLOGY

APPENDIX E
REGIONAL GEOLOGY

The rock strata in the vicinity of Old Dam are members of the Upper Conemaugh and Lower Monongahela groups (Upper Pennsylvanian Age) and are composed primarily of interbedded shale and sandstone, with a few coal seams. The dam is located on the northwest portion of the Candor Dome where the strata are nearly horizontal, dipping to the west from zero to 40 feet per mile.

The dam is probably founded on strata of the Morgantown Sandstone, a gray massive, coarse-grained sandstone. The strata in the slopes above the dam and reservoir are composed primarily of shale and claystone. The Pittsburgh coal seam occurs on the tops of the hills and defines the base of the Monongahela Group. The strata above the Pittsburgh coal seam consist of gray interbedded sandstone and shale. The dam is approximately 175 feet below the Pittsburgh coal seam.

As indicated on the U.S. Geological Survey Isopleth Map of Landslides for Washington County, Pennsylvania, dated 1978, the strata present in the valley slopes are susceptible to weathering and subsequent movement. Less than 10 percent of the area around the dam and reservoirs is covered by slide debris. There are two slides in the slopes of the reservoir.



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SCALE

0 1 2 3 4 5 miles

PA 479, PA 482, PA 484, NEW, OLD AND CHERRY VALLEY DAMS

GEOLOGY MAP

REFERENCE

GREATER PITTSBURGH REGION GEOLOGIC MAP COMPILED BY W.R. WAGNER, J.L. CRAFT, L. HEYMAN AND J.A. HARPER, DATED 1975, SCALE 1:125000

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	2-5-79	APPROVED BY	JHP	2-8-79	

GROUP	FORMATION		DESCRIPTION
	Alluvium	Qt	Sand, gravel, clay.
	Terrace deposits		Sand, clay, gravel on terraces above present rivers; includes Carmichaels Formation.
DUNKARD	Greene		Cyclic sequences of sandstone, shale, red beds, thin limestones and coals.
DUNKARD	Washington	Pw	Cyclic sequences of sandstone, shale, limestone, and coal; contains Washington coal bed at base.
DUNKARD	Waynesburg		Cyclic sequences of sandstone, shale, limestone and coal; contains Waynesburg coal bed at base.
MONONGAHELA		Pm	Cyclic sequences of shale, limestone, sandstone and coal; contains Pittsburgh coal bed at base.
P: CONEMAUGH	Casselman	Pcc	Cyclic sequence of sandstone, shale, red beds and thin limestone and coal.
P: CONEMAUGH	Ames		
P: CONEMAUGH	Glenshaw	Pcg	Cyclic sequences of sandstone, shale, red beds and thin limestone and coal; several fossiliferous limestone; Ames limestone bed at top.
ALLEGHENY	Vanport		Cyclic sequences of shale, sandstone, limestone, and coal; contains Brookville coal at base and Upper Freeport coal at top; within group are the commercial Vanport limestone and Kittanning and Clarion coals.
ALLEGHENY		Pa	

GEOLOG MAP LEGEND

REFERENCE:

GREATER PITTSBURGH REGION GEOLOGIC MAP
COMPILED BY W.R. WAGNER, J.L. CRAFT, L. HEYMAN
AND J.A. HARPER, DATED 1975, SCALE 1:125000