

PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

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

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

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

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PHASE I REPORT NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS AND RECOMMENDATIONS

UPPER MT. HOLLY DAM

Name of Dam:

State & State No.: PENNSYLVANIA, 21-001

County: CUMBERLAND

Stream: MOUNTAIN CREEK

Date of Inspection: OCTOBER 16, 1980

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in poor condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is high. These classifications indicate that the Spillway Design Flood (SDF) should be in the range of one-half the Probable Maximum Flood (PMF) to the full PMF. The recommended SDF for this structure is one-half the PMF. The spillway capacity is adequate for passing only 4 percent of the PMF peak inflow without overtopping the dam. The spillway is considered to be seriously inadequate, and the facility is classified as unsafe, non-emergency.

The following recommendations are presented for immediate action by the owner:

- 1. That a detailed hydrologic and hydraulic engineering analysis be made by a professional engineer with experience in the design and construction of dams to determine means for providing adequate spillway capacity.
- 2. That the upstream and downstream slopes and the crest be cleared of all trees, brush and weeds under the supervision of a professional engineer, experienced in the design and construction of dams. The embankment shall be maintained on a regular basis.
- That after clearing, the right embankment be inspected for signs of seepage, sloughs and other indications of instability.

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UPPER MT. HOLLY DAM NOI NO. PA-00583 DER NO. 21-001

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- 4. That the left embankment he widened and be provided with a protective vegetative cover.
- 5. That trees in the spillway riprap be removed and that the voids in the riprap be filled.
- 6. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.
- 7. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.
- 8. That, in lieu of improving the facilities, the embankment be breached after obtaining a permit from the Bureau of Dam Safety, Obstruction and Storm Water Management, Pennsylvania Department of Environmental Resources.

15 DACW31-81-C-0013

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SUBMITTED BY:

DATE: June 5, 1981

APPROVED BY:

BERGER ASSOCIATES, INC. HAFRISBURG, PENNSYLVANIA

JAMES W. PECK Volument, Corps of Engineers Commander and District Englacer

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DATE: 17 June 1981

National Dam Inspection Program. Upper Mt. Holly Dam (NDI Number PA-ØØ583, DER Number 21-ØØ1), Susquehanna River Basin, Cumberland County, Pennsylvania. Phase I Inspection Report,

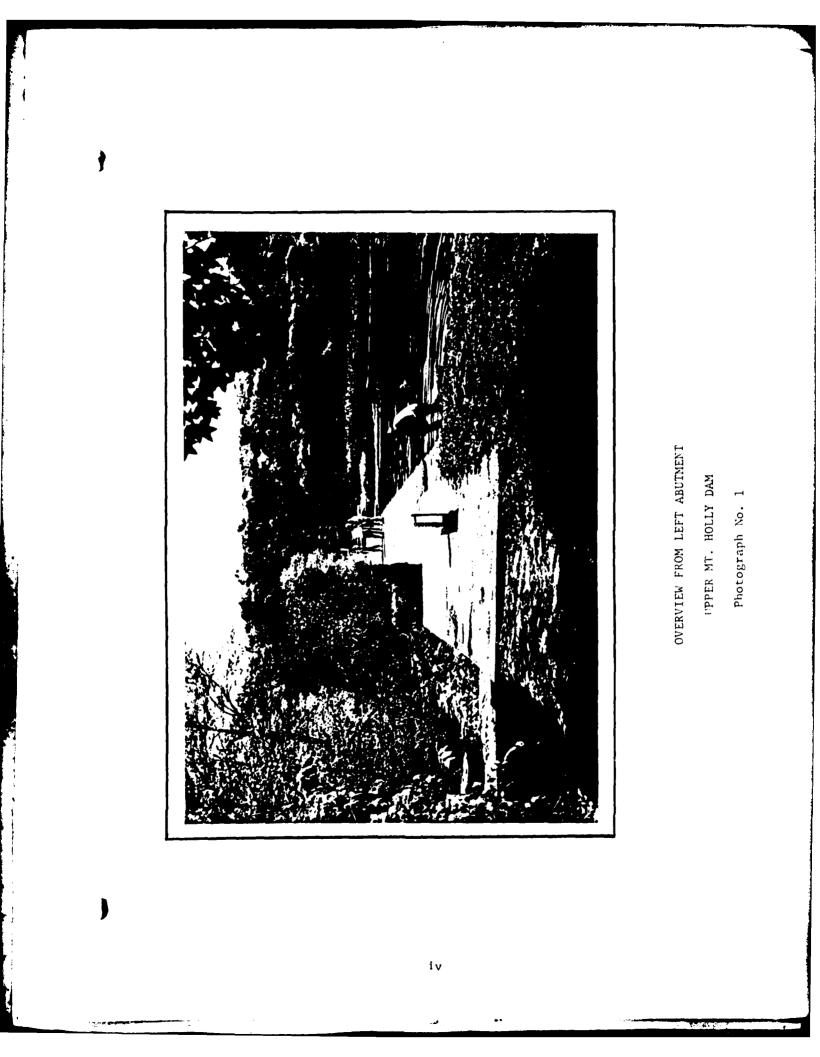


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PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

UPPER MT. HOLLY DAM

NDI NO. PA-00583 DER NO. 21-001

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of 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 and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Note: Pool elevation is shown on the U.S.G.S. quadrangle sheet at elevation 594. This elevation is used in this report as the spillway crest elevation. This compares to an elevation of 96.7 shown on Plate III, Appendix E, including the 3 inches of concrete topping.

Upper Mt. Holly Dam is an earthfill structure with a maximum embankment height of 13 feet. The dam was constructed in 1855 to provide power for water wheels at a mill located about 700 feet downstream of the dam. A 206 foot wide spillway is located near the left abutment. The embankment to the right of the spillway is about 420 feet long. The right abutment ties into a rairroad bridge over the headrace. Three wooden slide gates control the flow to the downstream mill where the water is used for industrial purposes.

A non-operable wooden sluice gate is located at the left end of the spillway. The gate is blocked by debris.

B. Location

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Borough of Mt. Holly Springs, Cumberland County U.S.G.S. Quadrangle - Mt. Holly Springs, Pa. Latitude 40°-06.0', Longitude 77°-11.0' Appendix E, Plates I & II

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D.	Size Classification:	Small:	Height		13 feet
			Storage	-	140 acre-feet

- D. <u>Hazard Classification</u>: High (Refer to Section 3.1.E.)
- E. <u>Ownership</u>: Eaton Dikeman Division of Knowlton Brothers Mr. Philip H. Avery, President Mt. Holly Springs, PA 17065
- F. Purpose: Water Supply

G. Design and Construction History

The dam was constructed in 1855 by four gentlemen living in Mt. Holly Springs. The original spillway consisted of a planked weir. The structure was first inspected by a state representative in June 1914, and a report was prepared. Records indicate that the dam was breached by floods at least five times. Many repairs and improvements have been made over the years. Reference is made to Section II of this report for recorded modifications.

H. Normal Operating Procedures

Drainage Area (square miles)

Water for industrial use is regulated by the sluice gates in the headrace and by valves on the pipe intake at the mill. All inflow above the spillway crest is discharged over the spillway. The sluice gate in the left spillway abutment is not operable.

1.3 PERTINENT DATA

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	From files: Computed for this report:	44.1 44.43
	Use:	44.43
в.	Discharge at Dam Site (cubic feet per second) See Appendix D for hydraulic calculations.	
	Maximum known flood (estimated from records of U.S.G.S. gage on nearby Yellow Breeches Creek)	5447
	Outlet works low pool outlet at pool Elev. 590	194
	Outlet works at pool level Elev. 594 (spillway crest)	309

	Spillway capac (low point of		Elev. 596.7		2018
с.	Elevation (fee	t above mean	sea level)		
	Top of dam (de	sign)			597.3
	Top of dam (lo	w point as su	urveyed)		596.7
	Spillway crest	(low flow no	otch)		594
	Upstream porta	l invert			584 .9
	Downstream por	tal invert			584.2
	Streambed at d	ownstream to	e of dam (estimate)	584
D.	Reservoir (mil	es)			
	Length of norm	al pool			0.4
	Length of maxi	mum pool			0.5
Ε.	<u>Storage</u> (acre-	feet)			
	Spillway crest	(Elev. 594 i	including siltatio	n)	61
	Top of dam (El	ev. 596.7)			140
F.	Reservoir Surf	<u>ace</u> (acres)			
	Top of dam (El	ev. 596.7)			43
	Spillway crest	(Elev. 594)			20
G.	Dam				
	Refer to Plate	III in Apper	ndix E for plan an	d section	
	Туре:	Homogeneous	earthfill.		
	Length:	700 feet.			
	Height:	13 feet.			
	Top Width:	Design - 12	feet; Survey - Va	ries.	
	Side Slopes:	Upstream Downstream	Design 2.5H to 1V 2H to 1V	Surveyed Irregula Irregula	.r

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Zoning:	None.
Cutoff:	Unknown

Grouting: None.

H. Outlet Facilities

	Drawdown:	6' x 16' concrete arch.
	Туре:	Outlet tunnel.
	Location:	Near left abutment.
	Closure:	5' x 5' timber gate on downstream end.
	Upstream Invert:	584.9
	Downstream Invert:	584.2
	Headrace	
	Туре:	Concrete slide gate structure.
	Location:	Near right abutment.
	Closure:	Three 5' x 5' timber gates.
	Invert:	589.6
ı.	Spillway	
	Туре:	Uncontrolled, broad crested, concrete weir with low flow notch.
	Length:	206 feet, including 16 foot long low flow notch.
	Crest Elevation:	Low flow notch: 594.0 Spillway: 594.2
	Location:	Near left end of dam.
J.	Regulating Out	tlet

See Section 1.3.H.

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SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Engineering design data for the original Upper Mt. Holly Dam, which was constructed in 1855, do not exist. A report in the files of the Pennsylvania Department of Environmental Resources, dated June 1914, indicates that the dam was constructed by four persons by the names of Kempton, Given, McArgis and Mullen. The report states that the original dam had a planked spillway at the location of the existing spillway. This spillway failed in 1863 and was replaced with a masonry gravity section. An auxiliary 40 to 50 foot wide timber spillway was located near the railroad. This auxiliary spillway failed in 1889 and 1909. At the time of first PennDER inspection in 1914, the embankment had a top width of 12 feet and 2H to IV side slopes. The report indicates that the dam site had been stripped of debris, boulders and muck prior to construction and that the spillway was founded on hardpan. This hardpan was at a varying depth of 2 to 10 feet below the creek bed.

The drawdown facility consisted of three 5' x 5' cast iron gates in the left spillway abutment. The report indicates that the dam was in poor condition. The timber auxiliary spillway was rotting, the gravity spillway was disintegrating and the embankment was overgrown and had an uneven crest. The total spillway capacity was approximately 3260 cfs. The required capacity was 175 cfs per sq. mile, or 7720 cfs. The owner was requested to repair the structure or to breach it.

Plans were prepared in October 1914 by Mr. C.A. Bryan, Carlisle, Pennsylvania, for repairs. These plans included the raising of the embankment profile from the existing 2.3 feet to 6.0 feet above the spillway crest. These plans were approved on May 15, 1915. Before any changes were made, the dam was breached by overtopping on August 21, 1915, over a length of 26 feet.

A report states that the breach had caused only minor damage in Mt. Holly Springs, although it was difficult to establish what additional damage had been caused by the failure of the dam. The breach showed that the embankment had been constructed mostly of a sandy material with only a slight mix of clay at the upstream side. A large amount of fistsized stone was in the fill material.

The breach was filled in the fall of 1915 with "good material." However, the owners refused to implement other improvements. The new fill settled about ten inches over the next year. In June 1919, the dam breached again at the location of the auxiliary spillway. The breach was 43 feet wide and 9 feet deep. Considerable damage was reported in the Borough. The owners, who had acquired the dam just before the breach occurred, constructed a concrete gravity section in the breach. This wall, described as 4'-7'' wide on top and about 13 feet high, was constructed without a permit. The top seven feet of the wall were exposed and had sloping surfaces with a width of about seven feet at the ground elevation.

PennDER requested plans, which were submitted in 1922 (Plate III, Appendix E). After approval, all repairs were made. The repairs included the removal of brush and trees, the raising of the embankment to elevation 100.0, and the leveling of the spillway crest with three inches of concrete to elevation 96.7. The embankment was not raised to elevation 102.0, as shown on Plate III, Appendix E.

Inspection reports between 1924 and 1940 indicate that seepage occurred along the toe, that the crest was uneven and brush and trees were growing on the embankment. The abutment walls of the auxiliary spillway cracked and settled.

The dam was obtained by the present owners in 1940. In 1942, the area of the auxiliary spillway was backfilled to an elevation matching the top of the dam. It is unknown whether or not the gravity section was removed.

The overall condition of the facility deteriorated and PennDER suggested in 1952 to rebuild the facilities. The owners engaged the Gunite Construction Corporation, New York, New York, to gunite the spillway, as shown on Plate IV, Appendix E. All work was completed in December 1952, and the facilities were reported to be in good condition.

The last State inspection occurred in December 1959, and indicated that the dam was in fair condition. Brush on the embankment and seepage along the toe were reported.

2.2 CONSTRUCTION

Records of construction do not exist.

2.3 OPERATION

Records of operation are not maintained by the owner. The available inspection reports indicate that the dam was breached five times. Statements indicate that most failures occurred in the auxiliary spillway prior to actual overtopping of the embankment.

2.4 EVALUATION

A. Availability

The described history and design data of this dam are located in the files of PennDER, Harrisburg, Pennsylvania.

B. Adequacy

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Because of the lack of engineering data, the assessment of the dam is based on the results of the visual inspection.

C. Operating Records

Operating records have not been maintained.

D. Post Construction Changes

Numerous alterations have been made to the original structure constructed in 1855. Reference is made to Section 2.1 of this report for a detailed description.

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SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. <u>General</u>

The general appearance of Upper Mt. Holly Dam is poor. The earth embankment is overgrown with brush and trees and the slopes are uneven. The riprap at the downstream side of the spillway has several voids and several trees are growing in this area. The reservoir is silted for most of its storage area at normal pool elevation. The drawdown sluice gate leaks and is inoperable.

The visual inspection check list and sketches of the general plan and profile of the dam, as surveyed during the inspection, are presented in Appendix A of this report. Photographs of the facilities taken during the inspection are reproduced in Appendix C.

Messrs. Guise and Wardwell represented the owner and accompanied the inspectors on the day of inspection.

B. Embankment

Earthfill embankments are located to the left and right of the spillway. The left embankment is in poor condition. It has a very narrow crest (2 to 5 feet) without any protective cover. Many trees are located on this embankment (Photograph No. 2). The right embankment is also in a poor condition. The vertical profile is irregular, and a heavy growth of weeds, brush and trees cover the embankment (Photograph No. 9). Close inspection for seepage, sloughs and other signs of instability was not possible. It appeared that the downstream and upstream slopes were irregular.

It was not possible to survey a typical cross section. The embankment crest appears to be about nine feet above the downstream toe. The right embankment ties into a railroad embankment. The wingwall of a railroad bridge over the headrace has been extended with a concrete wall at the upstream side of the embankment (Photograph No. 10).

C. Appurtenant Structures

The spillway is located near the left abutment and consists of an 8.5 foot wide, broad crested weir. The original masonry weir has been gunited on the top and on part of the downstream side. Some seepage through the wall was detected about one to two feet below the crest. The gunited surface was in fair condition. Several cracks have developed. A low flow notch is located in the left half of the spillway (Photograph No. 6). The spillway abutments are in good condition. The right abutment has been gunited (Photograph No. 5). The downstream side of the spillway is protected with hand laid riprap (Photograph No. 4). Several voids have developed in this surface and several trees are growing on this surface. Both conditions could cause further erosion of this protection.

A large $(16' \times 6')$ arch opening is located in the left spillway abutment on the upstream side. A part of the opening has been blocked off with concrete and the only drawdown opening is a 5 foot by 5 foot opening closed with a timber gate. The mechanism to open the gate has disappeared (Photograph No. 1), and the gate is inoperable. The timber gate leaks considerably (Photograph No. 7). The concrete abutment walls are in good condition.

Siltation of reservoir has reached a point one to two feet below the weir crest. The flow to the headrace is along the right abutment and passes under the railroad bridge. The race makes a 90 degree bend and after this bend the flow is controlled in a structure with three 5 foot by 5 foot timber gates. These gates appear to be in good condition. Flow release through these gates are limited to prevent flooding of the mill.

D. Reservoir Area

The reservoir has been silted for a large part. Fishermen report that there are still areas about six feet deep, but the larger area is only one to two feet deep. Large portions of the reservoir are overgrown with weeds.

The left side of the reservoir has a steep, wooded slope; the right side is flat.

Laurel Lake Dam is located about seven miles upstream from the dam. This dam (PA DER No. 21-25) is a concrete gravity dam having a 200 foot long ogee section spillway with 11.5 feet of freeboard. A Phase I inspection was completed on Laurel Lake Dam in 1979. This upstream reservoir was included in the computations in Appendix D.

E. Downstream Channel

A paper mill is located about 700 feet downstream from the dam. The stream runs through a wooded area and then through a narrow valley parallelling Route 34 and a railroad. The valley widens about 4,000 feet below the dam and the stream runs through the Borough of Mt. Holly Springs. A potential hazard to loss of life of more than a few exists downstream if the dam would fail. The hazard category for the Upper Mt. Holly Dam is considered to be "High."

3.2 EVALUATION

The overall evaluation of these facilities indicates that Upper Mt. Holly Dam is in poor condition. The growth of brush and trees on the embankment and in the downstream area of the spillway should be removed.

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After this clearing, the embankment should be inspected for seepage and signs of instability. The embankment should be made level and should be protected against erosion with a good grass mat. The riprap at the downstream side of the spillway should be repaired. $_{\checkmark}$

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SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Upper Mt. Holly Dam was constructed for and is still used for industrial purposes. Maintenance procedures appear to be non-existent. The gates on the headrace appear to be operated only occasionally.

4.2 MAINTENANCE OF DAM

The inspection indicates that there is no maintenance performed on the embankment. Trees, brush and weed growth are not controlled.

4.3 MAINTENANCE OF OPERATING FACILITIES

The drawdown facility in the left spillway abutment has not been used in at least 10 years and is inoperable at the present time.

4.4 WARNING SYSTEM

There is no formally organized surveillance and downstream warning system in existence at the present time.

4.5 EVALUATION

Operational procedures for these facilities are non-existent. It is recommended that a regular maintenance procedure be developed for the dam, which should include the control of weed and brush growth on the embankment and the maintenance of the spillway.

A formal surveillance plan and downstream warning system should be developed for implementation during periods of heavy or prolonged precipitation.

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SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from PennDER for Upper Mt. Holly Dam was not very extensive. No unit hydrograph, design storm, design flood hydrograph, or flood routings were available. The PennDER files did contain discharge rating tables for the spillways and discharge outlets as they existed in 1914.

B. Experience Data

It was reported that the dam was overtopped several times and was breached on five occassions. However, there are no records of flood levels at Upper Mt. Holly Dam. Based on records of the U.S.G.S. stream gage on Yellow Breeches Creek at nearby Camp Hill, Pennsylvania, the maximum inflow to Upper Mt. Holly Dam occurred in September 1975. The estimated maximum inflow was 5447 cfs.

C. Visual Observations

It was noted that the 5 foot by 5 foot gate on the outlet conduit was inoperable. This gate was leaking badly (see Photograph No. 7). No other conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily until the dam is overtopped. Upstream of Upper Mt. Holly Dam is Laurel Lake Dam, a recreational facility. This upstream impoundment was included in the computations contained in Appendix D.

D. Overtopping Potential

Upper Mt. Holly Dam has a total storage capacity of 140 acrefeet and an overall height of 13 feet above streambed. These dimensions indicate a size classification of "small." The hazard classification is "high" (see Section 3.1.E.).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is in the range of one-half the Probable Maximum Flood (PMF) to the full PMF. Because of the small size of this dam, the recommended SDF is one-half the PMF. The SDF peak inflow is 32,938 cfs (see Appendix D for HEC-1 inflow computations).

Comparison of the estimated SDF peak inflow of 32,938 cfs with the estimated spillway discharge capacity of 2,018 cfs indicates that a potential for overtopping of the Upper Mt. Holly Dam exists.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam does not have the necessary storage available to pass the SDF without overtopping. The spillway-reservoir system can pass a flood event equal to 4% of a PMF without overtopping based on the existing low point of the dam profile.

E. Dam Break Evaluation

A restaurant is located about 4,300 feet downstream from the dam. Just downstream of the restaurant is the residential area of Mt. Holly Springs. On the basis of the results of the dam break analysis. using the U.S. Army Corps of Engineers HEC-1 program, the water surface elevations in the vicinity of the restaurant have been compared for several conditions prior to and after a dam break (refer to Table 1, Appendix D). For an earth dam, it is estimated that 0.5 foot of overtopping would result in a breach. Calculations indicate that 6 percent of the PMF inflow would cause an overtopping of 0.5 foot. The increase in water levels downstream due to overtopping of 0.5 foot with no failure as compared to no overtopping would be 2.5 feet. While more property would be exposed to flooding, the increase in the hazard to loss of life is not considered significant. With failure, the breaching analysis indicates a rise of 2.6 feet above the flow level just prior to breach when considering a .25 hour time to complete the breach and 1.2 foot rise above flow level just prior to breach when considering a two hour time to complete the breach. The increase in hazard to loss of life and property damage is reflected not only in the increase in depth of water of 2.6 feet in the 15 minute breach and 1.2 feet in the two hour breach, but more significantly in the shorter time to reach the peak. Less time would be available to respond to the flooding under the breach conditions.

Being an earth embankment, it is judged that the breach would be completed between the 15 minute and the two hour period. The numerical difference of water levels is 1.4 feet. The property damage would be similar with either time of failure. The time factor, however, is most significant regarding loss of life. Calculations indicate that the water depth will increase at a rate of 2.6 feet in 30 minutes under the .25 hour breach condition.

One large manmade dam is located upstream of Upper Mt. Holly Dam. For this evaluation, this impoundment was not considered to have breached (see Appendix D).

On the basis of these calculations, it is concluded that the hazard to loss of life and property damage is significantly increased when the dam is overtopped and failed as compared to the condition just prior to failure.

Refer to Table 1, Appendix D, for comparison of flood water levels.

F. Spillway Adequacy

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Calculations show that the spillway discharge capacity and reservoir storage capacity combine to handle 4% of the PMF (refer to Appendix D).

Since the spillway discharge and reservoir storage capacity cannot pass one-half of the PMF, the downstream hazard to loss of life is high, and this hazard is significantly increased when the dam fails as compared to just prior to failure; the spillway is therefore judged to be seriously inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of Upper Mt. Holly Dam did not detect any signs of seepage through the embankment. A heavy growth of brush and trees prevented close observation of the embankment. It appeared, however, that the upstream and downstream slopes are uneven. The left end of the embankment has a barren, narrow crest.

2. Appurtenant Structures

The spillway weir appears to be stable. The gunite surface has cracked and some seepage through the gravity section is occurring. To prevent future erosion, the trees in the downstream slope should be removed and the voids should be filled.

B. Design and Construction Data

Design and construction data for this dam are too limited to make an engineering evaluation. Reports indicate that the dam was breached at least five times. The first breach occurred at the main spillway, which consisted of a timber construction. This was replaced by the present masonry structure, which has since been capped with concrete. All other breaches occurred at the auxiliary spillway near the railroad. These breaches occurred by failure of the timber structure or by seepage along the smooth backface of the abutment of this spillway.

C. Operating Records

Operating records for this dam have not been maintained by the owner.

D. Post Construction Changes

Many construction changes have occurred since the completion of the dam in 1855. Reference is made to Section 2.1 of this report for the recorded history of these changes.

E. Seismic Stability

This dam is located in Seismic Zone 1, and it is considered that the static stability is sufficient to withstand minor earthquakeinduced dynamic forces. No studies or calculations have been made to confirm this assumption.

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SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection indicates that Upper Mt. Holly Dam is in poor condition. Engineering and construction data are limited or nonexistent. Reports indicate that five breaches have occurred. However, since the auxiliary spillway was replaced by an embankment, no other failures have been reported. Maintenance procedures are non-existent. Removal of trees and brush is recommended.

The hydrologic and hydraulic computations indicate that the combination of the storage capacity and the discharge capacity of the spillway are sufficient to pass only four percent of the PMF without overtopping the embankment. The recommended SDF is fifty percent of the PMF. Failure of the dam could occur with six percent of the PMF. The hazard to loss of life is significantly increased when the dam fails. The spillway is considered to be seriously inadequate and the facility is classified as unsafe, non-emergency.

B. Adequacy of Information

The visual inspection is considered to be sufficiently adequate for making a reasonable assessment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Additional Studies

A detailed hydrologic and hydraulic study is recommended to determine methods of improving the spillway capacity.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for immediate implementation by the owner:

1. That a detailed hydrologic and hydraulic engineering analysis be made by a professional engineer with experience in the design and construction of dams to determine means for providing adequate spillway capacity.

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- 2. That the upstream and downstream slopes and the crest be cleared of all trees, brush and weeds under the supervision of a professional engineer experienced in the design and construction of dams. The embankment shall be maintained on a regular basis.
- 3. That after clearing, the right embankment be inspected for signs of seepage, sloughs and other indications of instability.
- 4. That the left embankment be widened and be provided with a protective vegetative cover.
- 5. That trees in the spillway riprap be removed and that the voids in the riprap be filled.
- 6. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.
- 7. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.
- 8. That, in lieu of improving the facilities, the embankment be breached after obtaining a permit from the Bureau of Dam Safety, Obstruction and Storm Water Management, Pennsylvania Department of Environmental Resources.

APPENDIX A

CHECK LIST OF VISUAL INSPECTION REPORT

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APPENDIX A

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PHASE I - VISUAL INSPECTION REPORT

PA DER # 21-001	NDI NO. PA-00583
NAME OF DAMUpper_Mt. Holly_Dam	HAZARD CATEGORYHigh
TYPE OF DAM Earthfill with concrete	overflow.
LOCATION South Middleton TOWNSHIP (Cumberland COUNTY, PENNSYLVANIA
INSPECTION DATE 10/16/80 WEATHER	Sunny TEMPERATURE 70's
INSPECTORS: H. Jongsma (Recorder)	OWNER'S REPRESENTATIVE(s):
R. Shireman	George E. Guise
A. Bartlett	Bob Wardwell
J. Watson	
BREAST ELEVATION: <u>596.7 (low point)</u> SPILLWAY ELEVATION: <u>594.0</u>	
MAXIMUM RECORDED POOL ELEVATION:	
GENERAL COMMENTS:	
Earthfill dam on right side overgrown the appearance of no maintenance.	with weeds, brush and trees and ha
Concrete overflow section in fair conc	lition.
Left end of embankment in poor condit:	ion.

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VISUAL INSPECTION EMBANKMENT

ſ	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None detectable in heavy brush.
B. UNUSUAL MOVEMENT BEYOND TOE	None detected.
C. SLOUGHING OR EROSION	
OF EMBANKMENT OR	None detected. Heavy brush prevents close inspection. Upstream and downstream
ABUTMENT SLOPES	slopes are uneven.
D. ALIGNMENT OF CREST:	Horizontal alignment appears to be good.
HORIZONTAL: VERTICAL:	The left end curves to mountainside.
	For vertical profile see Plate A-II.
E. RIPRAP FAILURES	No riprap.
F. JUNCTION EMBANKMENT & ABUTMENT OR	Left embankment has only a narrow crest
SPILLWAY	(2 to 5 feet). Right embankment ties in to railroad embankment.
G. SEEPAGE	None detected.
H. DRAINS	
	None.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Left embankment bare and some trees.
	Right embankment overgrown with brush, weeds and trees.

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VISUAL INSPECTION OUTLET WORKS

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	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Concrete arch opening (16' x 6') at upstream side. Closed with timber gate.
B. OUTLET STRUCTURE	5' x 5' timber gate opening in concrete wall and is inoperable. Gate leaks badly. Some leakage adjacent to gate on right.
C. OUTLET CHANNEL	Channel with heavy, gunited walls, then natural stream.
D. GATES	Timber gate 5' x 5' (inoperable).
E. EMERGENCY GATE	Timber gate (inoperable).
F. OPERATION & CONTROL	Have not been operated in at least 10 years.
G. BRIDGE (ACCESS)	None. Close to left abutment which is accessable by car.

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VISUAL INSPECTION SPILLWAY

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	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Direct from reservoir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	A low flow notch in the left half of concrete overflow section. Broad crested weir in fair condition. Weir is gunited on stone wall. Some seepage about one to two feet below crest. Some cracks in weir. Overflow section has hand laid riprap at downstream side. Seepage not detrimental to safety of structure.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Riprapped steep section. Small stream and woods. Some trees on riprap.
D. BRIDGE & PIERS	None, except railroad bridge over mill race.
E. GATES & OPERATION EQUIPMENT	None, except three 5' x 5' gates on mill race.
F. CONTROL & HISTORY	Unknown. Left abutment was overtopped with Agnes.

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VISUAL INSPECTION

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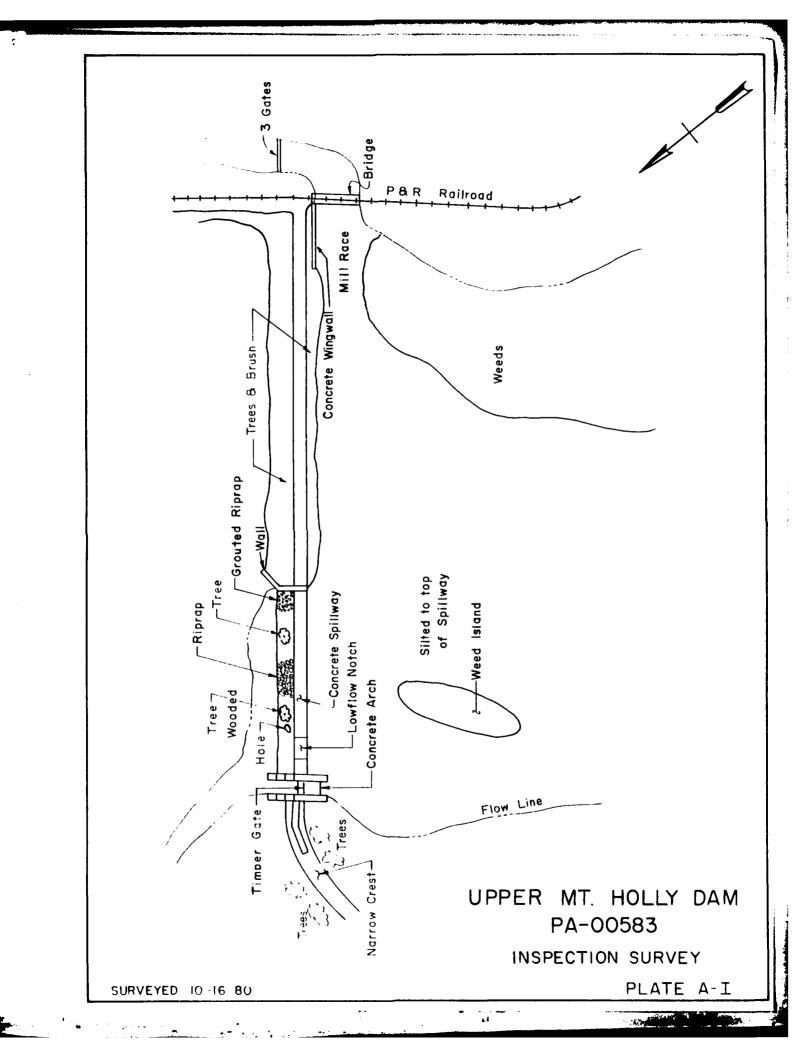
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OBSERVATIONS AND REMARKS
None.
Left side steep, wooded. Right side flat.
Reservoir silted up. Maximum depth about 6 feet. Large areas with only 1 or 2 feet of water at normal pool.
Mostly wooded.
Wooded natural stream, narrow valley parallelling Route 34 and railroad.
Stable.
Over hundred.
Paper mill, Route 34, deer lodge, and Mt. Holly Springs.

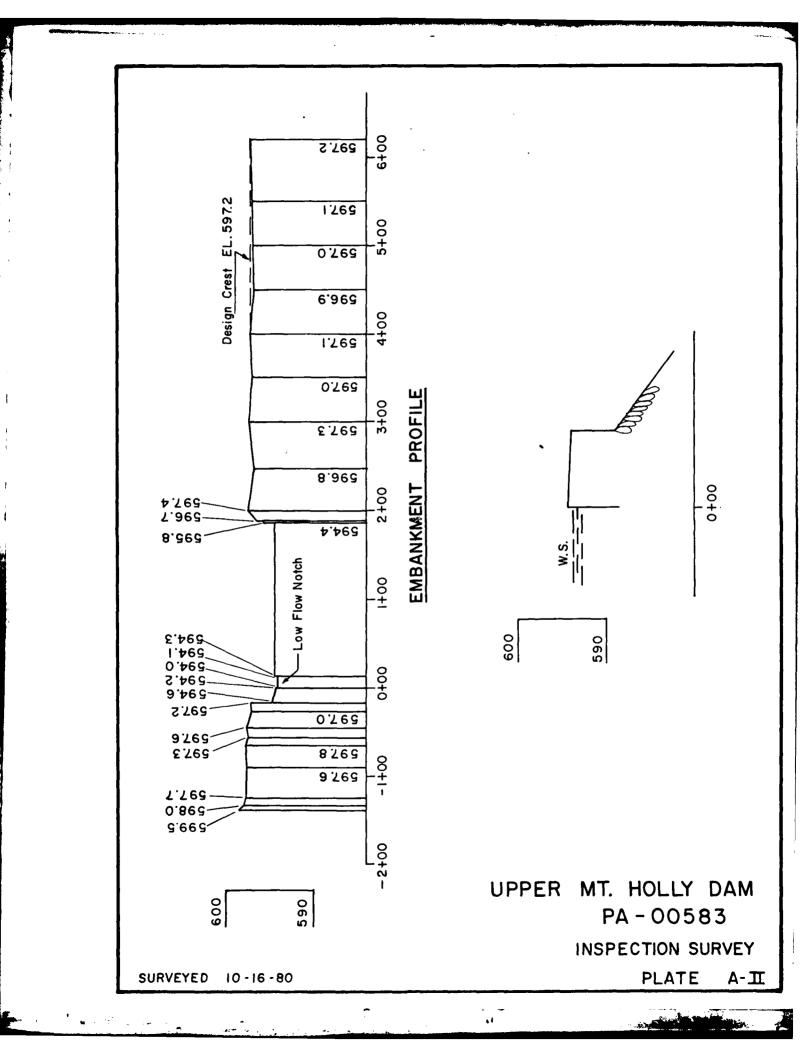
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APPENDIX B

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APPENDIX B

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PA DER # 21-001

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NDI NO. PA-00 583

NAME OF DAM Upper Mt. Holly Dam

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Mt. Hoily Springs, Pa. See Plate II, Appendix E
CONSTRUCTION HISTORY	Constructed in 1855. Breached 5 times. Rebuilt and repaired several times. Auxiliary spillway built in 1919 and back- filled in 1942. Spillway gunited in 1952.
GENERAL PLAN OF DAM	See Plate III, Appendix E.
TYPICAL SECTIONS OF DAM	Plate III, Appendix E. Drawings of 1922. Never repaired in accordance with plans. No later plans available.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	No plans.

ENGINEERING DATA

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ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	No records.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	Plans prepared in 1914 and 1922. Plans not used for reconstruction. Many inspection reports by PennDER.
BORROW SOURCES	Unknown.
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ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Gunited spillway in 1952, raising crest 3". Embankment near railroad rebuilt after 5 breaches.
HIGH POOL RECORDS	No records.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	No reports.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	Dam had a low overflow section with planks near railroad. Breaches occurred in 1863, 1889, 1909, 1915 and 1919 in this area.
MAINTENANCE & OPERATION RECORDS	No-records.
SPILLWAY PLAN, SECTIONS AND DETAILS	None.

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ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	No operable operating equipment.
CONSTRUCTION RECORDS	No records.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Inspection reports by PennDER. Refer to Section 2 of this report for discussion.
MISCELLANEOUS	
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NDI NO. PA-00 583

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DRAINAGE AREA CHARACTERISTICS: Woodland
ELEVATION:
TOP NORMAL POOL & STORAGE CAPACITY: <u>Elev. 594.0</u> Acre-Feet 61
TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev.596.7 Acre-Feet 140
MAXIMUM DESIGN POOL:597.3
TOP DAM:596.7
SPILLWAY:
a. Elevation 594
b. Type <u>Concrete</u> , broad crested weir with sloping face and low flow notch.
c. Width 206'
d. Length
e. Location Spillover Near left abutment
f. Number and Type of Gates <u>None</u> .
OUTLET WORKS:
a. Type <u>6' x 16' concrete arch tunnel with 5' x 5' timber gate</u> .
b. Location <u>Near left abutment</u> .
c. Entrance inverts584.9
d. Exit inverts584_2
e. Emergency drawdown facilities _ 5' square timber gate.
HYDROMETEOROLOGICAL GAGES:
a. Type None.
b. Location
c. Records
MAXIMUM NON-DAMAGING DISCHARGE: 2018 cfs.

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APPENDIX C

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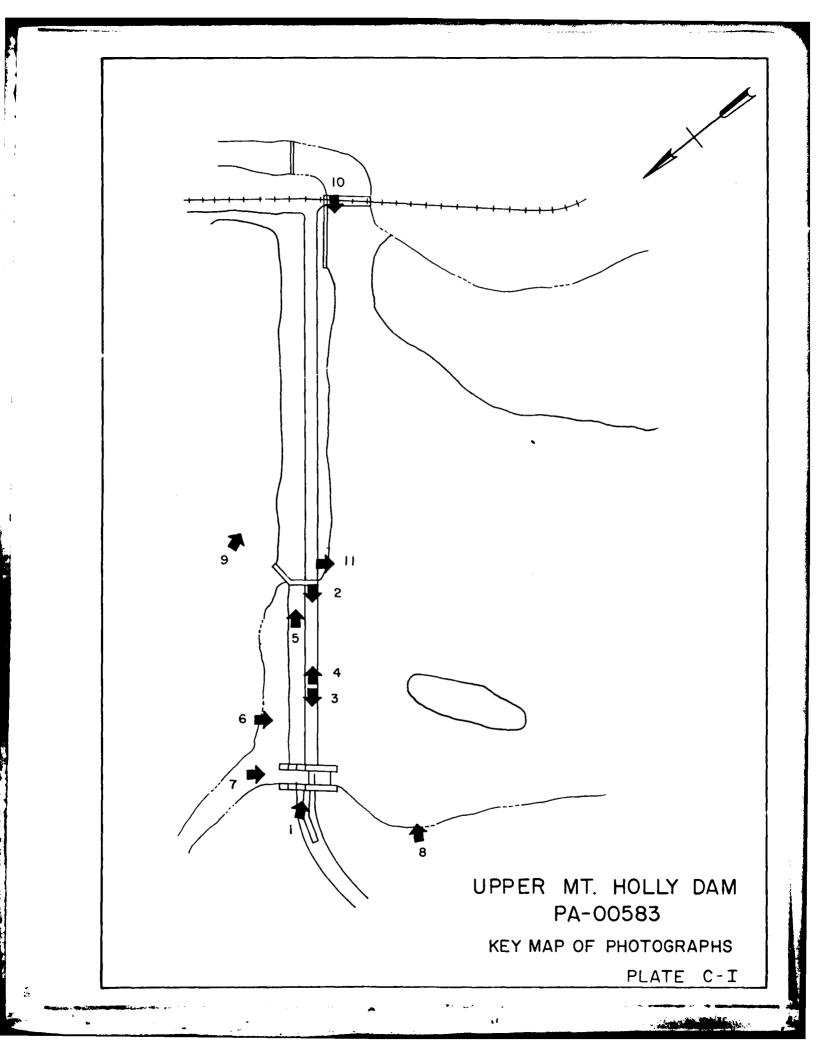
PHOTOGRAPHS

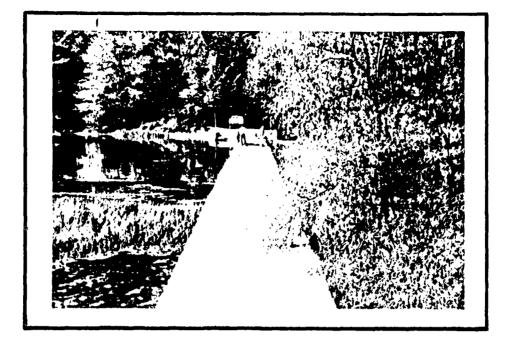
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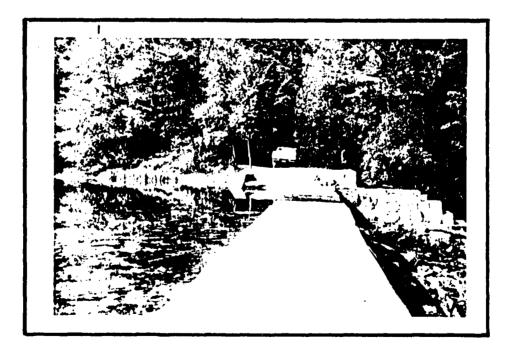
APPENDIX C

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OVERVIEW OF SPILLWAY FROM RIGHT ABUTMENT - NO. 2



LEFT SPILLWAY ABUTMENT - NO. 3

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PA-00583 Plate C-II

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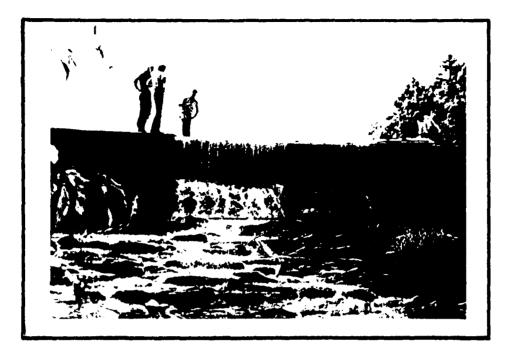


DOWNSTREAM ROCK PROTECTION OF SPILLWAY - NO. 4



RIGHT SPILLWAY ABUTMENT - NO. 5

PA-00583 Plate (-11)



LOW FLOW SECTION OF SPILLWAY - NO. 6



DOWNSTREAM SIDE OUTLET STRUCTURE - NO. 7

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PA-00583 Plate C-iv



OVERVIEW SPILLWAY FROM LEFT RESERVOIR BANK - NO. 8

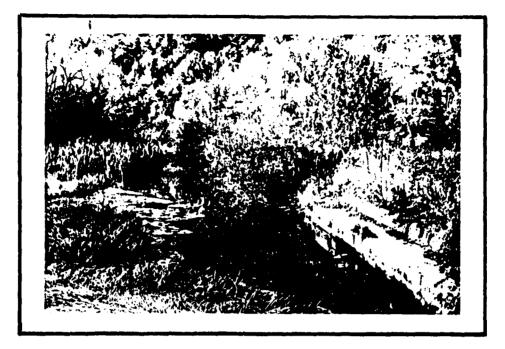


DOWNSTREAM SLOPE OF EMBANKMENT - NO. 9

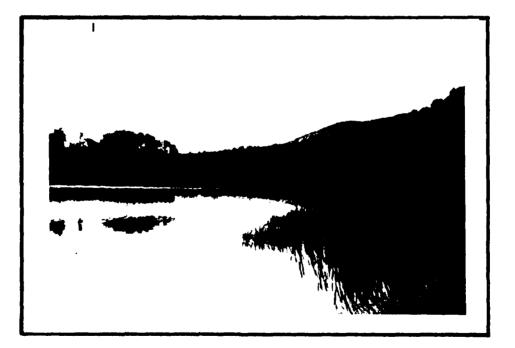
PA-00583 Plate C-V

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CHANNEL TO HEADRACE LOOKING UPSTREAM - NO. 10 NOTE: OVERGROWN EMBANKMENT



RESERVOIR OVERVIEW - NO. 11 NOTE: WEED GROWTH IN RESERVOIR

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PA-00583 Plate C-VI APPENDIX D

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HYDROLOGY AND HYDRAULIC CALCULATIONS

APPENDIX D

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SUMMARY DESCRIPTION OF FLOOD HYDROGRAPH PACKAGE (HEC-1) DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

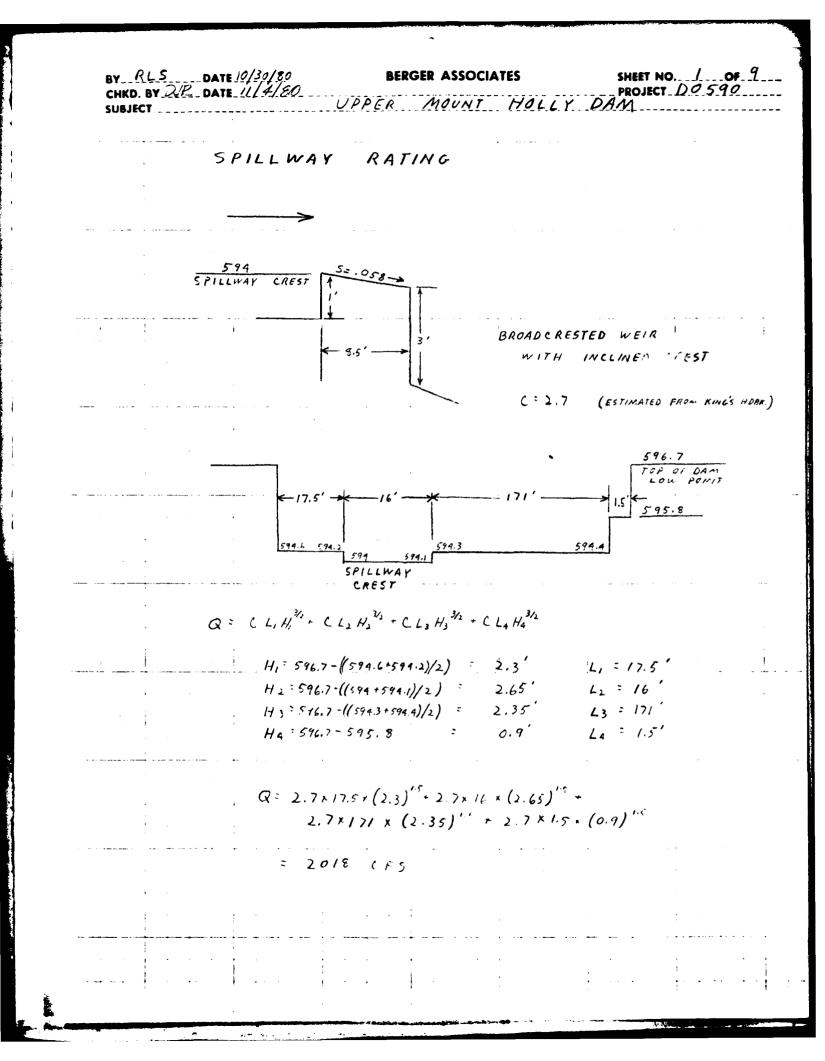
The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

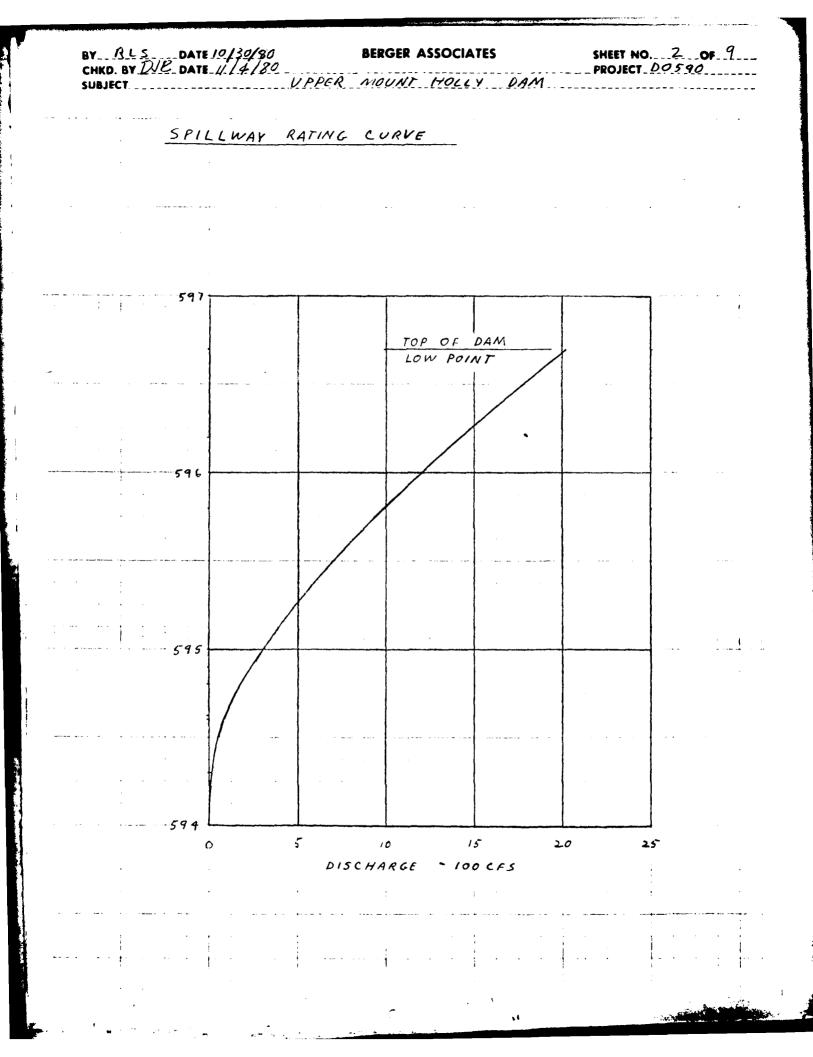
- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.





BY RLS DATE 10/34/80 BERGER ASSOCIATES CHKD. BY DATE UPPER MOUNT HOLLY DAM SHEET NO. <u>3</u> OF 9 PROJECT <u>D0590</u> DISCHARGE THRU OUTLET WORKS CONCRETE ARCH TUNNEL 6'x 16' WITH 5'x5' NOUDEN GATE UESTREAM INVERT = 584.9 Q= CAV29H C=0.6 (KING'S HOBK.) AT POOL ELEV. 594 H: 594-587.4: 6.6' $Q = 0.6 \times 5 \times 5 \times (2 \times 32.2 \times 6.6)^{\circ \cdot 5^{-1}}$ = 309 CFS AT LOW POOL ELEV 590 H= 590 - 587.4 = 2.6 $Q = 0.6 \times 5 \times 5 \times (2 \times 32.2 \times 2.6)^{0.5}$ = 194 CFS · · · · · ·

	DATE 2/25/81	BERGER ASSOCIA		r no. <u>A</u> ect <i>D_257Q</i>
CHKD. BY	DATEVPPt	R MOUNT H	OLLY DAM	
	EMBANKMEN	IT RATING		
.=	·	Q= CLH 312	C= 2.7 (k	INC'S HOBK.)
	AT ELEV 597			
		x (.15)" = 1		
	2.7 37	x (.1) " = 3		
		x (.05) 45 = 2		
	2.7 × 19	x (,2)"5 = 4		
	2.7 ×14	× (.1)"5= 1	٤ = 11 0	rs
	AT ELEV 597.5	F		, <u>.</u>
• • 1	2.7 × 1	$0 \times (.4)^{1.5} = 7$		
	2,7 x /	7 × (.25)".5= 6		
		x (.45) ".5 = 9		
<u></u>	2.7 × 5	$0 \times (.4)^{1.5} \cdot 34$	•	
		0 x (.45)".5: 82		
		0 × (.35) ^{1.5} : 28		
		50 x (.5) "= 143		
	2.7 X	70 x (.35) ^{1.5} - 39	<u></u>	· - · · · · ·
	2.7 ×	$4 \times (.1)^{1.5} = -$		
	2.7 × 6	$6 \times (.1)^{1.5} = 1$		
	2,7 ×/	9 x (.7)"= 30		
-	2.7 × 2	L6 x (.35) - 15		
		$24 \times (.35)^{5} = 13$	2:407	CFS
	AT ELEV 598	o x (.9) ^{1.5} = 23		
	2.7 × 7	$0 \times (.7)^{1.5} = 32$	· 1	· · ·
· · · · · · · · · · · · · · · · · · ·		$0 \times (.55)^{1.5} = 11$	•*	
		0 × (.45) ^{1.5} = 8		
•		3 × (.3)" ⁵ = 10		
		3 x (.25) " 11		
		1 × (.15)"5=2		
		1 × (.95)"5:28		
		50 x (.9)"5: 115		
		0 x (.95)".5:250		
	2.7 ×5	0 x (.85)"= 106		,
	2.7 × 1	50 x (1)1.5 : 405		
	2.7 K	70 K (.85)"5 = 148		
·	2.7 × 1	9 K (1.2)" 5 : 67	. <u>.</u>	
	2.7 * 3	0 x (.8)"5. 58	. .	
	2.7 × 4	12 × (.6) ^{1.5} = 53	5= 1327	CFS
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BY RLS DA	ate <u>2/25/</u> 81 ate	BERGER ASSOCIATES	SHEET	NO. 5 OF	<u> </u>
SUBJECT	VPF	PER MOUNT HOLL	Y DAM		• • •
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	EMBANKMENI	RATING (CONT.)		
	AT ELEV 59	8.5			
	-	$(1.4)^{1.5} = 45$			
· · · · · · ·		(1.2) ".5 = 71			
		(1.05)".5 29			
	2.7 × 10 ×	(.95)"= 25			
· · ·	2.7 × 23 ×	(.8) ^{1.5} = 44	· · ·		
t	2.7 × 33 ×	(.75) ^{1.5} = 58	;	i	•
		(.65) ^{1.5} = 16			
· ·		(1.45)"5 = 52			
		$(1.4)^{1.5} = 22.4$			
		(1.45) ^{1.5} : 471			
	2,7 × 50 ×	$(1.35)^{1.5} = 2/2$			
	2.7 × 150 ×	$(1.5)^{1.5} > 744$			
	2.7 × 70 ×	(1.35) 297	<u> </u>		
	2.7 × 19 ×	$(1.7)^{1.5} = 1.3$			
· .	2,7 x 30 x	(1.3) = 120 $(105)''^{5} = 131$	1		
	2,) × 45 ×	(12) 131	2 = 2652	_	
· · · · · · · · · · · · · · · · · · ·	AT ELEV 59	• • • • • • • • • • • • • • • • • • •	E: 4269		·
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	AT ELEV 59	9.5	2:6130		
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	AT ELEV 60	0	5:8208		
· ·	AT ELEV 60	1	٤ = 12 931		
	· · · ·	<u>.</u>			
	AT ELEV 60	5	5=24310		
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· .	AT ELEV 60	S ⁻	5 = 37861		
	AT ELEV 60	· · · · · · · · · · · · · · · · · · ·	2:6/622	•	
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BERGER ASSOCIATES

BY RLS __DATE 10/3//80 CHKD. BY P.J.E. DATE U. 1/80

PROJECT DOSGO UPPER MOUNT HOLLY DAM SUBJECT

MAXIMUM KNOWN FLOOD AT DAMSITE

THERE ARE NO RECORDS OF POOL LEVELS FOR THIS DAM. BASED ON THE RECORDS OF THE GAGING STATION FOR YELLOW BREECHES CREEK AT NEARBY CAMP HILL, PA. (D.A. = 216 SQ.MI.) THE MAYIMUM DISCHARGE AT THE GAGE OCCURRED IN SEPTEMBER, 1975 WHEN A DISCHARGE OF 19300 CFS WAS OBSERVED. THE MAXIMUM INFLOW TO UPPER MOUNT HOLLY DAM 15 ESTIMATED TO BE :

SHEET NO. 6. OF 9

 $Q = \left(\frac{44.43}{2/6}\right)^{0.8} \times 19300$

= 5447 CFS

DESIGN FLOOD

SIZE CLASSIFICATION MAXIMUM STORAGE = 146 ACRE-FEET MAXIMUM HEIGHT = 13 FEET " SMALL SIZE CLASSIFICATION 15

HAZARD CLASSIFICATION BORCUGH OF MOUNT HOLLY SPRINGS IS LOCATED ALONG THE DOWNSTREAM CHANNEL. USE "HIGH"

RECOMMENDED SPILLMAY DESIGN FLOOD THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SOF IN THE RANGE OF ONE HALF PMF TO THE PROBABLE MAXIMUM FLOOD.

SUBJECT	DATE 2/26/81		BERGER ASSOC		PROJEC	NO. 7 0 T Der 10	"
• · · · · · · · · ·	VASTREA	M RESE	NVOIR	·			
	LAU	REC LA	KE DAM				
··· ·	· · · · · · ·	D.A.= 2	3.57 58.M			. .	
	(DATA	FROM. PH.	ASE I INSPECT	ION REPORT)		
····	2	50'LONG,	25' HIGH CO	NCRETE C	NAVITY DA	m	
	5	PILLWAY	= 200' LONG	C. OGEE	SECTION	c = 3, 8	
••• ••• ••• •••		,	CEV. = 774				
	To	POF DAM	ELEV. = 786	\$.0			
. 			TORAGE = 1 STORAGE = 8				
	· · · · · · · · · · · · · · · · · · ·	AXIMUM	SPILLUNY	CAPACITY	= 32720	CF S	
	. <i>N</i>) A ¥ I Ra U RA	SPILLU AY	CAPACITY	- 32720	C A S	
	~	, , ,	SPILLUNY	CAPACITY	- 32720	C & S	
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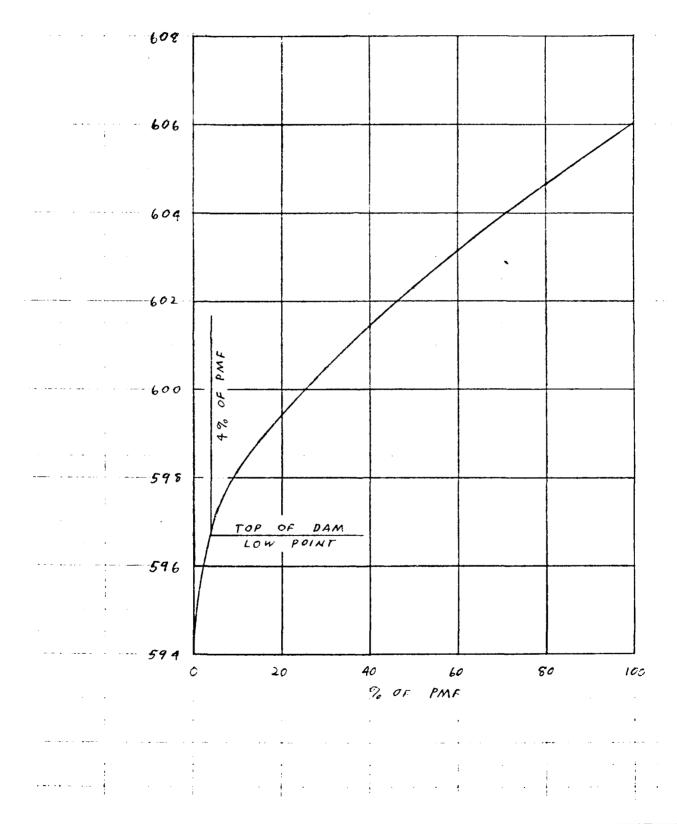
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SHEET NO. 8 OF 9 PROJECT DO 5 90

BY RLS DATE 2/27/51 BERGER ASSOCIATES CHKD. BY DATE UPPER MOUNT HOLLY DAM

SPILLWAY CAPACITY CURVE



	EACH ASSU BREACH WI SIDE SLOPE FAILURE TI POOL LEVEL A UPSTREAM R LAUREL	<u>ΜΡΤΙΟΛΙ 5</u> ID TH = 50 5 (ΕΛΑΤΗ Ε MAE (ΕΑΛΤΗ BETWEEN VSE: .25 HA., 57 FAILURE : SAY 0.5 ES ER VOIR : CAME DAM =	TMBANKIAEN EMBANKMEN ISMIN A SHR., IHR., EANIA EA FT. OVER	NT) = AND 2 HR. 2 HR. MBAHKMEIIT TOD OF DAM TOD OF DAM	1/
	BREACH WI SIDE SLOPE FAILURE TI POOL LEVEL A UPSTREAM R LAVREL	ID TH = 50 5 (ЕЛАТН Е IME (ЕДАТН ВЕТШЕЕН USE: .25 НА., 67 ГДІЦИЛЕ : 5АЧ 0.5 ES ER VOIR : СЛНЕ DAM =	MBANKIAEN EMBANKMEN ISMIN. A SHR., IHR., EANIN EN FT. OVER	NT) = AND 2 HR. 2 HR. MBAHKMEIIT TOD OF DAM TOD OF DAM	1/
	SIDE SLOPE FAILURE TI POOL LEVEL A UPSTREAM R LAUREL	5 (ЕЛЛТИ Е МЕ (ЕЛЛТИ ВЕТШЕЕМ USE: .25 НА., 57 ГЛІСИЛЕ SAY 0.5 ES (ЛИОГЛ : СЛНЕ DAM =	MBANKIAEN EMBANKMEN ISMIN. A SHR., IHR., EANIN EN FT. OVER	NT) = AND 2 HR. 2 HR. MBAHKMEIIT TOD OF DAM TOD OF DAM	1/
	SIDE SLOPE FAILURE TI POOL LEVEL A UPSTREAM R LAUREL	5 (ЕЛЛТИ Е МЕ (ЕЛЛТИ ВЕТШЕЕМ USE: .25 НА., 57 ГЛІСИЛЕ SAY 0.5 ES (ЛИОГЛ : СЛНЕ DAM =	MBANKIAEN EMBANKMEN ISMIN. A SHR., IHR., EANIN EN FT. OVER	NT) = AND 2 HR. 2 HR. MBAHKMEIIT Тор ог DAM FED_BY 69= PM	1/
	FAILURE TI POOL LEVEL A UPSTREAM R LAUREL	IME (ЕЛЛТН ВЕТШЕЕН USE: .25 НА., GT FAILURE : SAY O.S ESERVOIR: CAKE DAM.=	EMBANKME 15 MIN . A SHR., IHR., EANIH EN FT. OVER NOT OVERTOPP	NT) = AND 2 HR. 2 HR. MBAHKMEIIT Тор ог DAM FED_BY 69= PM	1/
· · · · · · · · · · · · · · · · · · ·	POOL LEVEL A UPSTREAM R LAVREL TION AT DAMAGE	ΒΕΤΨΕΕΝ VSC: .25 HA., GT FAILURE : SAY 0.5 ESERVOIR : LAKE DAM =	IS MIN. A SHR., IHR., EANII EN FT. OVER NOT OVERTOPP	9ND <u>)</u> HR. 2HR. МВАНКМЕПТ ТОР ОГ ДАМ 260_ВУ 690 РМ	1/
· · · · · · · · · · · · · · · · · · ·	UPSTREAM R LAUREL 1011 AT DAMAGE	USE: .25 HA., 57 FAILURE : 5A4 0.5 ESERVOIR: CAKE DAM =	SHR., IHR., EARTH EL FT. OVER NOT OVERTORP	2 на. МВАНКМЕПТ ТОР ОГ ДАМ 260_ВУ 690 РМ	1/
· · · · · · · · · · · · · · · · · · ·	UPSTREAM R LAUREL 1011 AT DAMAGE	ESERVOIR:	EARTH EN FT. OVER NOT OVERTOPP	М.В.А.Н.К.М.Е.П.Г ТОР ОГ ОЛИЛ 260 ВУ 690 РМ	1/
· • · · · · · · · · · · · · · · · · · ·	UPSTREAM R LAUREL 1011 AT DAMAGE	5AY 0.5	FT OVER	ТОР ОГ ДЛИЛ 260_ВУ 692 РМ	1/
· · · · · · · · · · · · · · · · · · ·	LAUREL 11011 AT DAMAGE	СЛНЕ DAM =			1/
· · · · · · · · · · · · · · · · · · ·	TION AT DAMAGE	· · · · · · · · · · · · · · · · · · ·			1/
· • • • • • •	TION AT DAMAGE	• • • •	NILL NOT BR	REACH	
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HYDROLOGY AND HYDRAULIC ANALYSIS DATA BASE

NAN PRO	IE OF DAM: <u>Upper Mt.</u> BABLE MAXIMUM PRECIPI	TATION (PMP) =_		INCHES/24 HOURS			
(FOR	FOOTNOTES SEE NEXT PAGE)	·		· · · · · · · · · · · · · · · · · · ·			
	STATION	I	2	3	4		
STATI	ON DESCRIPTION	LAUREL LAKE	LAUREL LAKE DAM	UPPER MOUNT HOLLY RESERVOIR	UPPER MOUNT HOLLY DAM		
DRAIN	AGE AREA (SQUARE MILES)	23.57		20.86			
CUMULATIVE DRAINAGE AREA (SQUARE MILE)		23.57	23.57	44.43	44.43		
ADJUSTMENT OF PMP FOR	R 6 HOURS HOURS 12 HOURS HOURS 24 HOURS HOURS 48 HOURS HOURS 72 HOURS HOURS 72 HOURS HOURS 72 HOURS	98 107.5 117 130		98 107.5 117 130			
SNTUER HTURUGRAPH PARAMETERS	ZONE ⁽³⁾ $C_p / C_1^{(4)}$ L (MILES) ⁽⁵⁾ L_{co} (MILES) ⁽⁵⁾ $T_p = C_t (L \cdot L_{co})^{0.3}$ (Hours)	15A .54/1.15 10.33 4.92 3.74		15A .54/1.15 7.88 3.90 3.21			

SNYD	$T_p = C_t (L \cdot L_{co})^{C.C} (Hours)$	3.74		3.21	
TA	CREST LENGTH (FT.)		200		206
DA	FREEBOARD (FT.)		11.5		2.7
A	DISCHARGE COEFFICIENT		3.8		2.7
וררא	EXPONENT		1.5		1.5
SP	ELEVATION		774.5		594
(6)	NORMAL POOL	774.5 = 25(7)		594 = 20	
REA CRES	ELEV	780 = 40		600 = 72	
A A	FREEBOARD (FT.) DISCHARGE COEFFICIENT EXPONENT ELEVATION NOR MAL POOL ELEV. ELEV. NOR MAL POOL ⁽⁷⁾	790 = 73		610 = 104	
	NORMAL POOL ⁽⁷⁾	774.5 = 160		594 = 61	
STORAGE ACRE - FEET)	(8)	755.3 = 0		584.8 = 0	

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- (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.

(6) Planimetered area encompased by contour upstream of dam.

(7)_{PennDER} files.

(8) Computed by conic method.

TABLE NO. 1

COMPARISON OF WATER SURFACE ELEVATIONS

UPPER MT. HOLLY DAM

SDF = 32,938 cfs

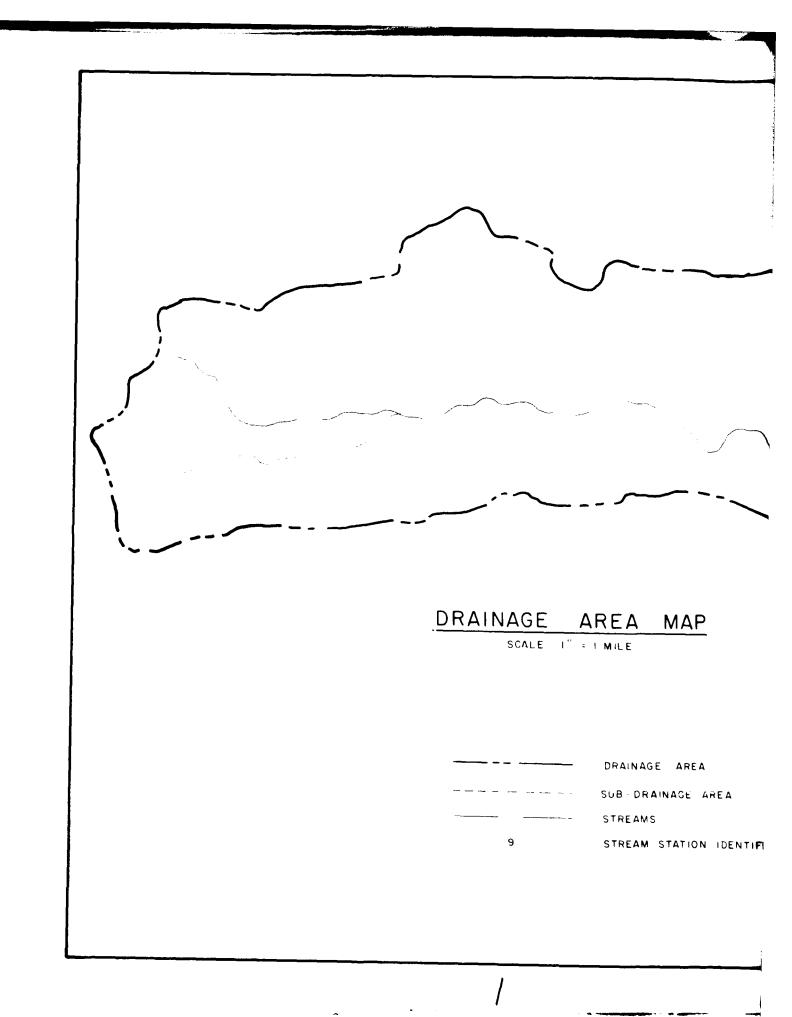
PMF = 68,135 cfs

Crest Elevation (Low Point) - 596.7 Spillway Elevation - 594

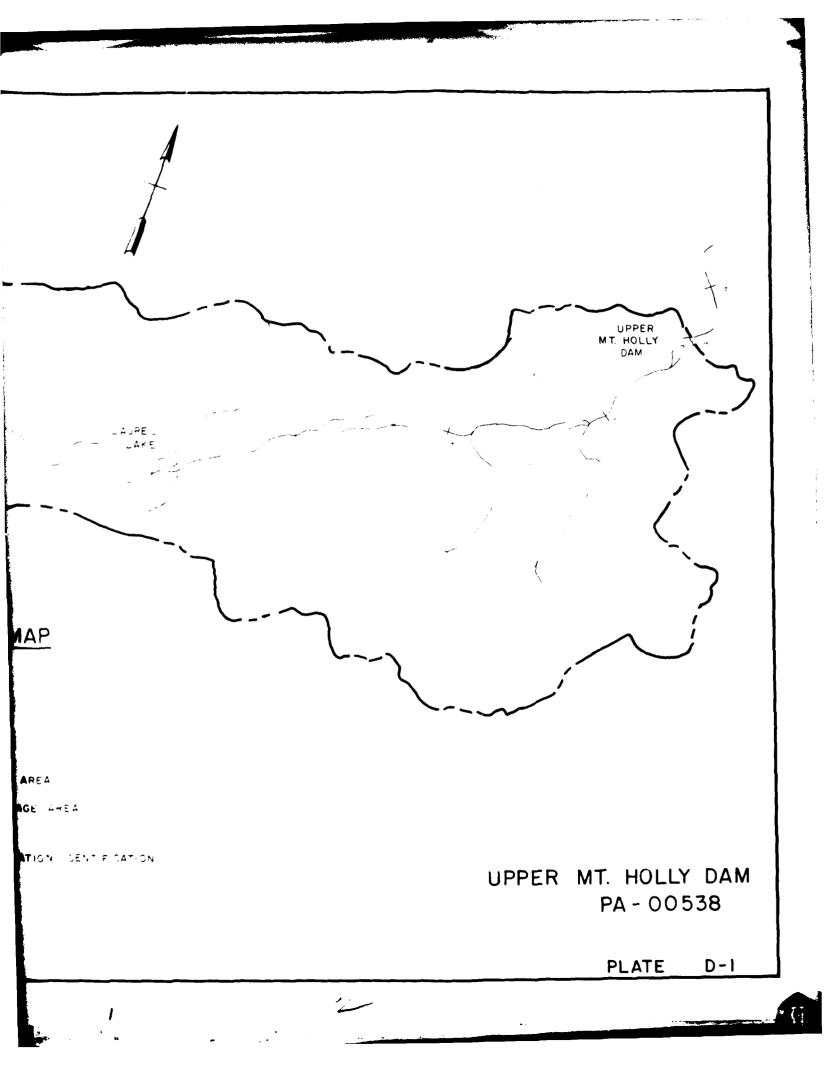
	STAGE	CREST OF ELEVATION	DAM DEPTH	4300' D/S OF DAM* ELEVATION
Α.	At Low Point in Embankment Crest	596 .7	0	568.3
В.	6% PMF Overtopping No Breach	597.43	.73	570.8
с.	6% PMF Overtopping (.25 Hour Breach)	597.27	.57	573.4
D.	6% PMF Overtopping (2 Hour Breach)	597.31	.61	572.0

*Restaurant located about 4,300 feet downstream of Upper M2. Holly Dam. Considered to be damage center. (This area is just upstream of the residential portion of Mt. Holly Springs.)

Condition C: (Time refers to elapsed time after st , i storm). Time to reach breach elevation 598.2 at dam = 43.0 Hours. Water level 4300' downstream prior to breach = 570.8. Duration of breach = .25 Hours. Time for breach to peak 4300' downstream = .5 Hours. Peak elevation 4300' downstream due to breach = 573.4. Rate of increase in water level = 2.6' in 30 Minutes.



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	DAM SAFETY V LAST HODIF: **********	ICATION 01)								
)	1	A1	*****	124	UPPER NO	แม่กายกาย	Y DAM	****	илинтат	IN CREEK		•
	2	A2						SFRINGS,			Y. FA.	
	3	A3			NDI + PA			LER # 21-				· · ·
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	6	J	1	9	1							
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	22		755.3	774.5	776.5	778.5	780	782	784	786	788	79(
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	. 24	\$D	786	3.05	1.5	150						
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	31 32	Ү7 К	1100 1	710 4	1300	720	1600	730	4			
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	40	K1			ROUTING	THRU RE	ACH 4 -	5				
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1	42	Y1	1		,							
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	44 45	Y7 Y7	0 740	640 620	100 770	630	200 800	620 640	700	610	710	61
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	325.	308.	291.	. 275.	261.	247.	233.	221.	207.	197.	
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					HYDROGI	RAPH ROUI	TING						4
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		QLOSS 0.0	CLOSS 0.000	AVG 0.00	IRES 1	ISAME 0	IOPT 0	IPHP 0		LSTR 0			
			NSTPS 1	NSTDL 0	LAG Q	AKSKK 0.000	X 0.000	TSK 0.000	STORA 160.	ISPRAT -1			
STAGE	774.50	775 .50	7.	76.50	777.50	77	8,50	780.00) 7	82.00	784.00	786.00	788.00
FLOW	0.00	760.00	21	50.00	3950.00	608	0.00	10078.00) 165	90.00	24189.00	32720.00	42090.00
SURFACE AREA=	0.	25	i .	30.	36.	40.		46.	52,	59.	67.	73.	
CAPACITY=	0.	160	•	215.	280.	337.	4	22.	520.	631.	756.	876.	
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		CREI 774.5			Q₩ EXF .0 0.			DQL CARI).0 0		(PL).0			
					TOPEL 786.0	DAK D COQD 3.1		DANWID 150.					
PEAK OUTFLOW IS	36575. A	T TIME	43.50	IOURS								·	
PEAK OUTFLOW IS	27426. A	T TIME	43.50 H	iours									
PEAK OUTFLOW IS	18285, A	T TIKE	43.50 H	IOURS									
PEAK OUTFLOW IS	9137 . A	T TIME	43.50 H	OURS									
PEAK OUTFLOW IS	5479. A	T TIME 4	43. 50 H	OURS									
PEAK OUTFLOW IS	3650. A1	TIME 4	13.50 HI	OURS									
PEAK OUTFLOW IS	1822. AT	TINE 4	13.50 H	JURS									
K OUTFLOW IS	1094. AT	TIME 4	3.50 Hi	JURS									
PEAK OUTFLOW IS	361. AT	TINE 4	3.75 HC	IURS									

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					HYDROGI	RAPH ROUT	ING						5
			ROUTIN	g thru	REACH 2 ·	- 3							
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NORMAL DEPTH	CHANNEL RO	JTING											
ūn(.10				ELMAX 730.0	RLNTH 7800.	SEL •00640							
	SS SECTION (0.00 730.) 00.00 710.)	00 100.00	720.00	200.0	00 710.00	850.00	700	00 850.00	700 . 0	0			
STORAGE	0.00 1837.78	22.69 2148.04		5.12 1.69	187.27 2808.99		7 .1 6 3.15	510.78 3535.16		32+13 25+03	987.35 4332.76	1257.44 4758.35	1540.91 5201.79
CUTFLOW	0.00 82631.96	192.38 104428.53		2.34 0.21	3212.37 154873.49		4.52 4.83	12242.90 214433.76		86.34 39.40	31236 . 85 263704 . 36	46026.29 322063.25	63155.61 362751.98
STAGE	700.00 715.79	701.58 717.37		3.16 8.95	704.74 720.53			707.89 723.68			711.05 726.34	712.63 728.42	714.21 730.00
FLOW	0.00 82631.96	192.38 104428.53			3212.37 154873.49			12242.90 214433.76				46026.29 322063.25	63155.61 362751.98
MAXIMUM STAG	E IS 71	1.6											
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ORMAL DEPTH	CHANNEL RO	UTING									•••••	مرد مرد مرد م
QN (1) QN(2)	QN(3)	ELNVT ELMAX	RLNTH	SEL							بر ۲۵ میر ۹
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9	0.00 690.0 50.00 670.0	00 100.00 00 1120.00	SSTA,ELEV,ST 680.00 150 680.00 1200 100.61	.00 670.00 .00 690.00	300.CC					1150 45	1473.46	1800.24
STORAGE	0.00 2139.99	27.02 2492.71	100.61 2858.39			17.50 16.58	4025.85		7.73	4859.23	5291.33	5734.04
OUTFLOW	0.00 57241.17	136.05 72234.86	786.24 88769.81				8521.67 147660.89		1.91 3.39	21746.29 194437.22	31962.67 220041.47	43807.78 247117,38
STAGE			663.16 678.95	664.74 680.53			667.39 683.69		9.47 5.26		672.63 686.42	674.21 690.00
FLOW	0.00 57241.17		786+24 88769+81	2242.54 106854.19	4 474 7 12650	8.53)4.35	8521.67 147660.89	2 1370 17030	1.91 8.39	21746.29 194437.22	31962.67 220041.47	43807.78 247117.88
AXINUH STAC	GE IS 67	3.2										
AXIMUM STAU	GE IS 67	1.9										
AXIMUM STAL	GEIS 67	0.3										
IAXIMUN STA	GE IS 66	8.0										
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			hydrogi	RAPH RQU	ING				
	ROUTI	NG THRU I	REACH 4	- 5					
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	NSTFS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT	
	1	0	0	0.000	0.000	0.000	0.	0	

NORMAL DEPTH CHANNEL ROUTING

QN(1) QN(2) QN(3) ELNVT ELMAX RLNTH SEL .1000 .0700 .1000 610.0 640.0 10500. .00470

CRDSS SECTION COORDINATES--STAFELEV,STAFELEV--ETC 0.00 640.00 100.00 630.00 200.00 520.00 700.00 610.00 710.00 610.00 740.00 620.00 770.00 630.00 600.00 640.00

STORAGE	0.00	19.92	71.99	156.22	272.50	421+13	601.32	809.27	1025.95	1250.52
	1482.97	1723.32	1971.55	2227. <i>66</i>	2491.67	2763+56	3043,33	3331.00	3626.54	3929.98
OUTFLOW	0.00	108.96	605+95	1703.21	3578.82	6392.01	10289 .3 5	16216.81	23785.14	32549.92
	42467.75	53516.96	65679+78	78943.47	93299.06	108740.48	125263.94	142867.47	161550.54	181313.87
STAGE	610.00	611.58	613.16	614.74	616.32	617.89	619+47	621.05	622.63	624.21
	625.79	627.37	628.95	630.53	632.11	633.63	635 -26	636.84	638.42	640.00
FLOW	0.00	108.96	605.95	1703.21	3578.82	6392.01	10289 .35	16216.81	23788.14	32549,92
	42467.75	53516.96	65679.78	78943.47	93299.06	108740.48	125263 .9 4	142867.47	161550.5‡	181313,69

MAXIMUM STAGE IS 624.7

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- MAXIMUM STAGE IS 623.2
- MAXIMUM STAGE IS 621.3
- MAXIMUM STAGE IS 618.8
- MAXIMUM STAGE IS 617.1
- MAXIMUM STAGE IS 616.1
- MAXIMUM STAGE IS 614.6
- MAXIMUM STAGE IS 613.6
- MAXIMUM STAGE IS 612.1

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-			SU3-A	REA RUNDEF COMPUTATIO	N	0
9			INFLOW HYDROGRA	PH - UPPER MOUNT HOLL	Y SUBAREA	
3			ISTAQ ICOMP 6 0	IECON ITAFE JPLT 0 0 0		TAGE IAUTO 0 0
Ø					TIO ISNOW ISAME 000 0 0	
1		SFF1 0.00			48 R72 K96	
0	0.00 TRSPC COMPUTED BY THE PROGRAM IS		.846	107.50 117.00 130.	00 0.00 0.00	
•		LROPT STRKR D O 0.00		LOSS DATA AIN STRKS RTICK 9.00 0.00 1.00		
G				INIT HYDROGRAFH DATA 5.21 CP= .54 NTA	= 0	
		-	- •	RECESSION DATA ORCSN=05	•	
Ø		UNIT HYDROGRAP 47. 178.		D ORDINATES: LAG= 3	.20 HOURS, CP= .54	VOL= 1.00 1876. 2045.
6		2207. 2300. 1477. 1384.	2339. 2299. 1297. 1215. 676. 633.	2183. 2045. 1138. 1066.	1916. 1796. 999. 935. 521. 463.	1632, 1576, 377, 822, 457, 423,
8		401. 376. 207. 176. 107. 102.	352. 330. 184. 172.		272. 254.	238, 223, 124, 116,
9		57. 53. 30. 28.	50. 47. 26. 24.	44. 41. 23. 21.	38, 36, 20, 19,	65. 61. 34. 32. 18.
0	0 HD.DA	HR.MN PERIOD RAI	N EXCS LOSS	END-OF-FERIOD FLOW COMP Q MO.DA	HR.MN FERIOD RAI	N EXCS LOSS COMP D
a						7 23.48 2.49 1261989. .)(596.)(63.)(35735.55)
.		*****	*****	*******	******	******
``` <b>`</b>			C	COMBINE HYDROGRAPHS		
				APHS AT UPPER MOUNT H	OLLY DAN	
•			ISTAO ICOMP 7 2	IECON ITAPE JPL1 0 0 0		TAGE IAUTO O O
	•	****	*****	******	********	*******

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ويتحدونا فتناقر ومرود بالألام وألافان كالمراجع والمناجع ومناقرين والمتوجو والأنباط والمراجع فأعلال فليقاف والمتكر والمت

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# HYDROGRAPH ROUTING

RESERVOIR	ROUTING -	-	THRU	UPPER	HOUNT	HOLLY	DAN

		QLOSS 0.0	CLOSS AV 0.000 0.0	1 0 ROU G IRES 0 1	ITAPE O TING DATA ISAME O	JPLT 0 IOPT 0	JPRT 0 IPMP 0	1	ISTAGE 0 LSTR 0	IAUTO O		
			NSTPS NSTD 1	L LAG 0 0	AMSKK 0.000	X 0.000	TSK 0.000	STORA 61.	ISPRAT -1			
STAGE	594.00 599.00	594.50 599.50	595.00 600.00	575.50 601.0		6.00 3.00	596.70 605.00		97.00 08.00	597.50	598.00	578.50
FLOW	0.00 9864.00	42.00 12649.00	304.00 15697.00	699.00 22490.00		3.00 3.00	2018.00 57217.00		25.00 03.00	3532.00	5222.00	7371.00
SURFACE ARE	A= 0.	20	), 72.	104.								
CAPACIT	Y= 0.	, 61	. 321.	1196.								
ELEVATIO	N= 585.	594	. 600.	610.								
		CRE 594.			XPW ELE D.O O		COQL CARE		XPL 0.0			
•				TOPEL 596.7	DAM Cood 0.0	DATA Expd 0.0	DAMUID 0.					
PEAK OUTFLOW	IS 68138.	AT TIME	43.75 HOURS	·	-							
PEAK OUTFLOW	IS 50567.	AT TIME	43.75 HOURS									
PEAK OUTFLOW	IS 32892.	AT TIKE	44.00 HOURS									
PEAK OUTFLOW	IS 15705.	AT TIME	44.25 HOURS									
PEAK DUTFLOW	IS 9138.	AT TIME	44.50 HOURS									
PEAK OUTFLOW	IS 5922.	AT TIME	44.50 HOURS									
PEAK OUTFLOW	IS 2789.	AT TIME	44.75 HOURS									
PEAK OUTFLOW	IS 1566.	AT TIME	45.25 HOURS									
PEAK OUTFLOW	IS 465.	AT TIME	46.00 HOURS									

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#### 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)

						RATIOS AP	PLIED TO FI	LOWS				
OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4		RATIO 6		RATIO 8	RATIO 9
· .				1.00	•75	.50	•25	•15	.10	. •05	•03	.01
HYDROGRAFH AT	1	23.57	1	36654.	27491.	18327.	9164.	5498.	3665.	1833.	1109.	367.
	(	61.05)	(	1037.94)(	778,45)(	518,97)(	259,48)(	155.69)(	103.79)(	51.90)(	31.14)(	10.38)
ROUTED TO	2	23.57	1	36575.	27426.	18285.	9137.	5479.	3650.	1822.	1094.	361.
	(	61.05)	(	1035.69)(	776.61)(	517,79)(	258,74)(	155.15)(	103.36)(	51.59)(	30.97)(	10.22)
ROUTED TO	3	23.57	1	36393.	27253.	18089.	9002.	5376.	3573.	1769.	1040.	343.
	(	61,05)	(	1030.52)(	771.71)(	512,22)(	254.89)(	152,22)(	101.19)(	50,09)(	29.46)(	9.71)
ROUTED TO	4	23.57	1	36059.	26915.	17774.	8712.	5166.	3398.	1656.	966.	307.
	(	61,05)	(	1021.08)(	762.15)(			146.28)(	96.22)(		27.34)(	8.68)
ROUTED TO	5	23.57	1	35797.	26695,	17570.	8506.	5015.	3277.	1577,	915.	283.
	(	61,05)		1013.67)(	755.93)(		240.86)(	142.00)(	92.79)(		25,92)(	8.02)
HYDROGRAPH AT	6 7	20,86	1	35967,	26976,	17984.	8992.	5395.	3597.	1798.	1079.	360.
	(	54.03)	(	1018,48)(	763.86)(			152,77)(			30.55)(	10.18)
2 COMBINED	7	44.43	1	68135.	50632.	32938.	15714.	9150.	5924.	2795.	1574.	466.
	(		(	1929.37)(							44.58)(	13.21)
ROUTED TO	8	44,43	1	68138.	50567.	32892.	15705.	9138.	5922.	2789.	1566.	465.
	ັ(	115.07)		1929.47)(				258.75)(		78,97)(	44.35)(	13.15)

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# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW		VALUE .50 60. 0.	SPILLWAY CRI 774.50 160. 0.		OF DAM 786.00 631. 32720.	
RATIO	HAXIHUN	MAXIHUH	MAXIMUM	MAXIMUM	DURATION	TINE OF	TIME OF
OF	RESERVOIR	DEPTH	STORAGE	OUTFLOW	OVER TOP	MAX GUTFLOW	FAILURE
PHF	W.S.ELEV	OVER DAM	AC-FT	CFS	HOURS	HOURS	HOURS
1.00	786,76	•76	677.	36575.	2.25	43.50	0.00
•75	784.76	0.00	560.	27426.	0.00	43.50	0.00
•50	782.45	0.00	443.	18285.	0.00	43.50	0.00
•25	779.65	0.00	323.	9137.	0.00	43.50	0.00
.15	778,22	0.00	270.	5479.	0.00	43.50	0.00
.10	777.33	0.00	241.	3650.	0.00	43.50	0.00
•05	776.26	0.00	208.	1822.	0.00	43.50	0.00
.03	775.74	0.00	193.	1094.	0.00	43.50	0.00
.01	774.97	0.00	172.	351.	0.00	43.75	0.00

PLAN 1 S

STATION

3

.1

TIME HOURS

MAXIMUN MAXIMUM RATIO FLOW,CFS STAGE,FT

-	•03 •01	<b>596.32</b> 595.20	0.00 0.00	126. 0.	1566. 465.	0.00 0.00	<b>45.25</b> 45.00	0.00 0.00	
	.10 .05	598.16 597.16	1.46 .46	207. 159.	5922. 2789.	11.50 6.00	44.50 44.75	0.00 0.00	
<b>.</b>	.15	598.85	2.15	246.	9138.	14.25	44.50	0.00	
	•25	600.00	3.30	321.	15705.	17.75	44.00	0.00	
-	.75 .50	604.29 602.30	7.59 5.60	658. 495.	50567. 32892.	33.25 23.25	43.75 44.00	0.00	
	1.00	606.01	9.31	808.	68138.	38.75	43.75	0.00	
₽	PMF	H.S.ELEV	DVER DAM	AC-FT	CFS	HOURS	HOURS	HOURS	
-	RATIO DF	MAXIHUN RESERVOIR	MAXIMUN Depth	MAXIMUM Storage	MAXIMUM OUTFLOW	DURATION OVER TOP	TIME OF MAX OUTFLOW	TIME OF FAILURE	
		OUTFLOW		0.	0.		2018.		
•		ELEVATION STORAGE	593	5.95 60.	594.00 61.		596.70 140.		
PLAN	1		INITIAL	VALUE	SPILLWAY CRE	ST TOP	OF DAN		
1					H SAFETY ANA				
•			.01	283,	612.1	47.50			
			.05 .03	1577. 915.					
•			.10	3277.					
<b>A</b>			15،	5015.	617.1	45.50			
•			•50 •25	17570+ 8506+	621.3 618.8				
8			.75	26695.	623.2	44.50			
•			1.00	35797.	624.7	44.25			
0			RATIO	MAXIMUM FLOW,CFS					
6			,						
			F	LAN 1	STATION	5			
Ø			•01	307.	662.0	46.00			
			.03	966.	663.4	45.50			
0			•10 •05	3398. 1656.	665.5 664.1				
			.15	5166.	666.5				
0			•25	8712.	668.0	44.50			
•			∙75 •50	26915. 17774.					
Ð			1.00	36059.	673.2				
8			RATIO	FLOW,CFS	STAGE / FT	HOURS			
0				MAXIMUM					
-			F	PLAN 1	STATION	4			
-			.03 .01	1040. 343.					
0			•05	1769.	703.6	44,25			
•			.15 .10	5376. 3573.					
•			•25	9002.	707.0	43.75			
•			•75 •50	27253. 18089.	710.5 709.1				
		•	1.00	36393.					
~			RATIO	FLOW,CTS	STAGE FT	Hours			
A 5,5 -				~					
							Concession and succession of the		·

######################################	ICATION 01 ********										
1	A1	. የግጥ ቁጥቁጥ		UPPER M	DUNT HOLI	Y DAM	****	KOUNTAD	IN CREEK		
2	A2						SPRINGE			TY+ FA.	
3	A3			NDI + PA			DER # 21		-		
4	В	300	0	15	0		0	0	:	- 4	
5	B1	5									
6	J	5	1	1							
7	J1	•06									
8	K		1					1			
9	K1			INFLOW !	HYDROGRAM	°H - LAI	JREL LAKE	SUBAREA			
10	M	1		23.57		44.43				1	
11	۴		23.6	98	107.5	117	130				
12	T							1	.05		
13	W	3.74	•54								
14	X	-1.5	05	2							
15	K	1	2					1			
16	N1			KESERVO			JREL LAKE				
17	Ŷ				1	1					
18	Y1		77C C					160	-1		
19		774.5	775.5		777.5	778.5	780	782	784	785	73
20	Y5		760	2150	3950 75 5	6080	10078	16590	24189	32720	4207
21 22	\$A #E		25	30	35.5	40		52	57	66.5	73.
22		755.3 774.5	774,5	776.5	778.5	780	782	784	786	783	79
23			7 05	1 5	150			<b>`</b> .			
25	\$D K	786 1	3.05 3		150			4			
26	K1	-	J		THRU RE	46H 2 -	7	1			
27	KI Y			1001110		нон 2 - 1	J				
28	Y1	1			ĩ	1					
29	Y6		.07	.1	700	730	7800	.0064			
30	Y7	-	730	100	720	200	7800	+0054 850	700	017	74
31		1100	710	1300	720	1600	730	VLa	700	86C	70
32	K	1	4			1000	737	1			
33		-	•	ROUTING	THRU RE	ACH 3 -	4	•			
34	ř				1	1	•				
35	¥1	1			-	-					
36	Y6	•1	•07	•1	660	690	10300	.0037			
37	¥7		690	100	680	150		300	660	310	66
38	Y7	950	670	1120	680	1200	690				
39	K	1	5					1			
40	K1			ROUTING	THRU RE		5				
41	Y				1	1					
42	Y1										
43	Y6		.07	+1	610	640		•0047			
44	¥7		640	100	630	200	620	700	610	710	61
45 46	Y7 K	740	620 6	770	630	800	640	4			
40 47	n K1		ò	TNELOU	UVBOODA	DU . HD-		1 - มกเร			
48	H H	1	1		нырилакч		PER MOUNT	NULLI 31	UPHACH	1	
49	n P	I	23.6	20.86 98	107.5	44.43 117				1	
50	Ţ		2010	10	1V/+J	117	130	1	.05		
1 51	ម	3.21	.54					1	•••		
52	x	-1.5	05	2							
53	ĸ	2	7					1			
54	K1				HYDROGR	AFHS AT	UFPER MO	UNT HOLI	Y DAK		
55	ĸ	1	8					1			
56	K1			RESERVO	IR ROUTI	NG - TH	RU UPPER	-	LLY DAM		
57	Ŷ				1	1					
58	¥1	1			-	•		61	-1		
59	¥4	594	594.5	595	595.5	596	596.7	597	597.5	578	598.
60	¥4	599	599.5	600	601	603		608			
41	17 V.C.		0.1.0	000	4001	000	0.0	0.00			

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37         98         59         1         588         25         594         772           48         49         50         1         588         25         594         597.2           71         59         50         1         588         2         594         597.2           71         59         50         1         588         2         594         597.2           73         K1         Routine Take RACH 8 - 9         1         1         1         1           73         K1         Routine Take RACH 8 - 9         1         1         1         1           74         Y         1         1         1         1         1         1           74         Y         1         1         1         1         1         1           75         76         77         10         579         100         580         10         500         100         500         100         500         100         500         100         500         100         500         100         500         100         500         100         100         100         100         100 <th100< th=""></th100<>		62 63 64 65 66	\$\$	0 · 584.8 594	12649 20 594	15677 72 600	22490 104 610	38483	57217	89705			, <b></b> .	1	3
72 K 1 9 1 73 K1 ROUTING THEW EACH 8 - 9 74 Y 1 1 75 Y1 1 76 Y1 1 77 Y7 0 590 100 580 140 570 160 560 170 560 77 Y7 210 570 250 580 275 570 100 560 170 560 77 K 99 1 PREVIEW OF SEQUENCE OF STREAM HETWORK CALCULATIONS 1 RUNOFF HYDROGRAPH TO 2 RUNOFF HYDROGRAPH TO 3 RUNOFF HYDROGRAPH TO 3 RUNOFF HYDROGRAPH TO 4 RUNOFF HYDROGRAPH TO 5 RUNOFF HYDROGRAPH TO 5 RUNOFF HYDROGRAPH TO 5 RUNOFF HYDROGRAPH TO 8 RUNOFF HYDROGRAPH TO 9 RUNOFF HYDROGRAPH	)	67 68 69 70	\$B \$B \$B \$B \$B	50 50 50 50	1 1 1 1	588 588 588	,25 ,5 1	594 594 594	597.2 597.2 597.2	:		en Territ			
<pre>76</pre>	)	73 74	К1 У	-	•	ROUTING 1				1					
1 PREVIEW OF SEQUENCE OF STREAM HETWORK CALCULATIONS NUMOF MYDROGRAPH AT 1 ROUTE HYDROGRAPH TO 2 ROUTE HYDROGRAPH TO 3 ROUTE HYDROGRAPH TO 4 ROUTE HYDROGRAPH TO 5 ROUTE HYDROGRAPH TO 5 ROUTE HYDROGRAPH TO 5 ROUTE HYDROGRAPH TO 9 END OF RETWORKSTREAM HETWORK SALES ISTETISTIC JULY 1978 LAST HODIFICATION 01 APR 80 STATISTICTION 101 APR 80 HUPFER KOUNT HOLLY DAM SAMS MOUNTAIN CREEK SOCOUCH GF MOUNT HOLLY DAM SAMS MOUNTAIN CREEK SOCOUCH SAMS SAMS SAMS AND SAMS MOUNTAIN CREEK SOCOUCH SAMS SAMS SAMS SAMS SAMS SAMS SAMS SAM	)	76 77 78	Y6 Y7 Y7	•1 0 210	590	100	580	140	570		560	170	560		
ROUTE HYBROGRAPH TO 2 ROUTE HYBROGRAPH TO 3 ROUTE HYBROGRAPH TO 3 ROUTE HYBROGRAPH TO 5 ROUTE HYBROGRAPH TO 5 ROUTE HYBROGRAPH AT 6 COMBINE 2 HYBROGRAPH AT 6 COMBINE 2 HYBROGRAPH AT 7 ROUTE HYBROGRAPH TO 8 ROUTE HYBROGRAPH TO 9 END OF METUORK ILAST HOLFICATION JULY 1978 LAST HOLFICATION JULY 1978 LAST HOLFICATION 01 APR 80 LAST HOLFICATION 01	• 1		ĸ	99	PREVIEW	OF SEQUE	ENCE OF S	TREAM NO	ETWORK C	ALCULATI	DHS				
RUNDEF HYDROGRAPH AT 6 COMPINE 2 HYDROGRAPH AT 7 ROUTE HYDROGRAPH TO 9 END OF NETWORK 11***********************************	)					ROUTE HY Route hy Route hy	Y DROGRAFH Y DROGRAPH Y DROGRAPH	TO TO TO		1 2 3 4				•	
END OF NETWORK	· )					RUNDFF H COMBINE ROUTE HY	HYDROGRAPI 2 HYDROI YDROGRAPH	H AT Graphs A To	ΑT	6 7 8					
<pre>FLOOD HYDROGRAPH PACKAGE (HEC-1) DAM SAFETY VERSION JULY 1978 LAST MODIFICATION 01 APR 80 ####################################</pre>						ROUTE HY	YDROGRAPH.	10		9					
<pre>     TIME# 13.31.50.     UPPER MOUNT HOLLY DAM **** MOUNTAIN CREEK     BOROUGH OF HOUNT HOLLY SATURES, CUMBERLAND COUNTY, PA.     NDI # PA-00533 PA LER # 21-1     JOB SPECIFICATION     NO NHR NMIN IDAY IHR IMIN HETRC IPLI IPRT NSTAN     JOO 0 15 0 1 0 0 0 -4 0     JOPER NNI LROPT TRACE     5 0 0 0     MULTI-PLAN ANALYSES TO BE PERFORMED     NPLAN= 5 NRIIO= 1 LRTIO= 1     RTIOS= .06 </pre>	٠													·	
BOROUGH OF HOUNT HOLLY SFRINGS, CUMBERLAND COUNTY, PA. NDI # PA-00533 PA DER # 21-1 JOB SPECIFICATION NO NHR NMIN IDAY IHR IMIN METRC IPLT IPRT NSTAN JOD 0 15 0 9 0 0 0 -4 0 JOPER NWT LROPT TRACE 5 0 0 0 0 MULTI-PLAN ANALYSES TO BE PERFORMED NPLAN= 5 NRTIO= 1 LRTIO= 1 RTIOS= .06	ן ו ו	FLOOD HYDRG DAM SAFETY LAST MODI	GRAPH PACKA VERSION FICATION O	GE (HEC- JJLY 19 1 APR 80	1) 78							·		~~	
NDI # PA-00533       PA LER # 21-1         JOB SPECIFICATION         NO       NHR         NO       NHR         JOD SOULTION         JOD SOULTION         NO       NHR         NO       NHR         JOD SOULTION         JOD SOULTION         NO       NHR         NO       NHR         NO       NHR         NO       0         JOD SOULTION       0         JOD O       15         JOPER       NNT LROPT TRACE         JOPER       NNT LROPT TRACE         JOPER       NNT LROPT TRACE         JOPER       NNT LROPT TRACE         NULTI-PLAN ANALYSES TO BE PERFORMED         NPLAN= 5 NRTID= 1 LRTID= 1         NTIDS=       .06	)	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION 0 ************** 81/02/26.	GE (HEC- JJLY 19 1 APR 80	1) 78									·~	
NO NHR NMIN IDAY IHR IMIN METRC IPLT IPRT NSTAN 300 0 15 0 9 0 0 -4 0 JOPER NWT LEOPT TRACE 5 0 0 0 MULTI-PLAN ANALYSES TO BE PERFORMED NPLAN= 5 NRTIO= 1 LRTIO= 1 RTIOS= +06	)	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION 0 ************** 81/02/26.	GE (HEC- JJLY 19 1 APR 80	1) 78 **	END OF N	NETWORK	Dam 1	****					~~	
5 0 0 0 MULTI-PLAN ANALYSES TO BE PERFORMED NPLAN= 5 NRTIO= 1 LRTIO= 1 RTIOS= .06	)	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION 0 ************** 81/02/26.	GE (HEC- JJLY 19 1 APR 80	1) 78 **	END OF N PFER MOU: DROUGH OF	NETWORK NETHOLLY F HOUNT HI DO533	dam 1 Dlly Sff Pa def	**** RINGS, C 1 # 21-1	UNBERLAN		ΡΑ.			·
MULTI-PLAN ANALYSES TO BE PERFORMED NPLAN= 5 NRTIO= 1 LRTIO= 1 RTIOS= .06	) ) )	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION O *********** 81/02/26. 13.31.50.	GE (HEC- JJLY 19 1 APR 80 *******	1) 78 ** U B N N	END OF N PPER MOU! OROUGH OF DI # PA-C IN IDA 15	NT HOLLY F Hount Hi Do533 Job Si Ay IHi O 4	DAM 1 DLLY SFF PA DEF PECIFICA R IMI D	NINGS, C NINGS, C NTION N MET O	UMBERLAN RC IPI 0	D COUNTY,	T NST			•
	) ) )	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION O *********** 81/02/26. 13.31.50.	GE (HEC- JJLY 19 1 APR 80 *******	1) 78 ** U B N N	END OF N PFER MOUN OROUGH OF DI # PA-C IN IDA 15 JOPE	NETWORK NETWORK F Hount Hi Do533 Job Si Job Si Ay Ihi O <u>S</u> Er Nu	DAM 1 OLLY SFF PA DEF PECIFICA R IMI O T LROF	X <b>***</b> RINGS, C TION N HET O T TRA	UMBERLAN RC IPI 0 CE	D COUNTY,	T NST		·~~	
)	• • • • •	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION O *********** 81/02/26. 13.31.50.	GE (HEC- JJLY 19 1 APR 80 ********	1) 78 ** B N HR NH	END OF N PFER MOUN OROUGH OF DI # PA-C IN IDA 15 JOPE MULTI-	NT HOLLY F HOUNT HI Do533 Job Si Ay Ihi O 4 ER NW 5 0 -Plan Anai	DAM 1 OLLY SFF PA DEF PECIFICA R IMI O T LROF O	K### RINGS, C R # 21-1 NTION N MET O T TRA O O BE PER	UMBERLAN RC IPI O CE O FORMED	D COUNTY,	T NST			•
	• • • • •	FLOOD HYDRG DAM SAFETY LAST MODI ********** RUN DATE*	GRAPH PACKA VERSION FICATION O *********** 81/02/26. 13.31.50.	GE (HEC- JJLY 19 1 APR 80 ********	1) 78 ** B N HR NH	END OF N PFER MOUN OROUGH OF DI # PA-C IN IDA 15 JOPE MULTI-	NT HOLLY F HOUNT HI Do533 Job Si Ay Ihi O 4 ER NW 5 0 -Plan Anai	DAM 1 OLLY SFF PA DEF PECIFICA R IMI O T LROF O	K### RINGS, C R # 21-1 NTION N MET O T TRA O O BE PER	UMBERLAN RC IPI O CE O FORMED	D COUNTY,	T NST			·

	******	*******	******	*******	1111111111	
e Ander en Artige Nergen		SUB	-AREA RUNDEF COMPUTA	ION		14
		INFLOW HYDROG	RAPH - LAUREL LAKE SI	JEAREA		
3						
		ISTAG ICOMP 1 0	IECON ITAPE JI 0 0	PLT JPRT INAKE I 0 0 1	STAGE IAUTO	
			HYDROGRAPH DATA			1
	IHYDG		IAP TRSDA TRSPC	RATIO ISNOW ISAHE	LOCAL	
	1.	1 23.57 0.	00 44.43 0.00	0,000 0 1	0	
	<i>n</i>		PRECIP DATA	· · ·		
			R6 R12 R24 00 107.50 117.00 1	R48 R72 R96 30.00 0.00 0.00		
TRSPC COHPU	TED BY THE PROGRAM					
9	•	**	LOSS DATA			
	LROPT STRKR	-	ERAIN STRKS RTIG		SHX RTIHP	
	0 0.00	0.00 1.00	0.00 0.00 1.0	0 1.00 .05 (	0.00	
			UNIT HYDROGRAPH DAT			
<b>3</b>		TP=	3.74 CP= .54	NTA= 0		
	_		RECESSION DATA			
		STRTQ= -1	.50 ORCSN=05	RTION= 2.00		
				3.73 HOURS, CF= .54		•
	37. 139. 1927. 2065.	285. 450 2170. 223		. 1089. 1321. . 2145. 2029.		
	1718. 1625.	1538. 145	5. 1376. 1302	. 1232. 1155.	1102. 1043	
9 ²²	987. 933.	883. 83 507. 48				
1. T.	567. 536. 325. 308.	507. 48 291. 27				4 ⁻
	187. 177.	167. 15				
	107. 101.		1. 86. 81			
	62. 58.	55. 5		44, 42,		••••
	35, 33,	32. 3	0. 28. 27	25. 24.	23. 21	l.
•	0		END-OF-PERIOD FLO	1		•
<b>60.</b> D	A HR.NN PERIOD	RAIN EXCS LOS	s comp a ho.	DA HR.HN PERIOD R	AIN EXCS LOSS	COMP Q
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<b>A</b>					.97 23.49 2.49	
					60.)( 576.)( 63.)	
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			HYDROGRAPH ROUTING			_
		RESERVOIR ROL	UTING - LAUREL LAKE			15
	•	ISTAQ ICOMP 2 1	IECON ITAPE JI 0. 0	PLT JPRT INAME IS 0 0 1	TAGE IAUTO O O	
			ALL PLANS HAVE SAME ROUTING DATA	•		
	QLOSS 0.0	CLOSS AVG 0.000 0.00	IRES ISAME I( 1 1	IPT IPHP I 0 0	LSTR 0	
		NSTPS NSTDL 1 0	LAG AMSKK 0 0.000 0.0	X TSK STORA ISH 000 0.000 160.	PRAT -1	
STAGE	774.50 775.50	0 776.50	777.50 778.50	780.00 782.0	00 784.00	786.00 788.00
S, FLOW	0.00 760.00	0 2150.00	3950.00 6080.00	10078.00 16590.0	00 24187.00 32	720.00 42090.00
SURFACE ARE	A= 0, 2	25. 30.	36, 40,	46. 52.	59. 67.	73.
SURFACE ARE CAPACIT ELEVATIO	Y= 0, 10	60. 215.	280. 337.	422. 520. 8	531. 756.	896.
ELEVATIO	N= 755, 77	75. 777.	779. 780.	782. 784. 7	786. 788.	790.
	CF 774		ΟΩU EXPU ELEVL 0.0 0.0 0.0	COQL CAREA EXFL 0.0 0.0 0.0		· · ·
		•	DAN DATA Topel Cood ex 786.0 3.1 1	PD DANWID .5 150.		•
PEAK DUTFLOW	IS 2189. AT TIME	E 43.50 HOURS		• • • • • • • • • • • • • • • • • • •		••• • • • • • •
PEAK OUTFLOW	IS 2189, AT TIME	E 43.50 HOURS				•
PEAK OUTFLOW	IS 2189. AT TIME	E 43.50 HOURS				· · ·
PEAK DUTFLOW	IS 2189. AT TIME	43,50 HOURS				
PEAK OUTFLOW	IS 2189, AT TIME	43.50 HOURS				L
1977 - 19 19 19						
1. 19 	******	********	*******	*******	******	

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•					HYDROGR	APH ROUT	ING						16 -
			ROUTI	NG THRU	REACH 2 -	3							
	•		ISTAQ	ICOMP	IECON	ITAFE	JPLT	JFRT	INAHE	ISTAGE	IAUTO		
			3	1	0	0	0	0	1	0	0		
4. *** **					ALL PLAN ROUT	IS HAVE S ING DATA							
•		QLDSS 0.0	CLDSS 0.000	AVG 0.00	IRES 1	ISAME 1	IOFT 0			LSTR 0			•
			NSTPS	NSTOL	LAG	AHSKK		-	CTOPA		•.		
			1	0	0	0.000	X 0.000		0.	ISPRAT 0			
•							د						•
NORMAL	. DEPTH CHANNEL RO	DUTING				-							· ·
		*****											
	QN(1) QN(2)	QN(3)	ELNVT	ELKAX	RLNTH	SEL							
-	.1000 .0700		700.0	730.0	7800.								· .
•		•							•				•
•		.00 100.00	720.0	0 200.	00 710.0	0 650.0	0 700.	00 860.0	) 700.(	00			
STOR	0.00 730 1100.00 710	.00 100.00 .00 1300.00 22.69	720.0 720.0	0 200.0 0 1600.0 85.12	00 710.00 00 730.00 187.2	0 830.0 0 7 3	29,16	510.7	3 3	32,13	987.35 4332.76	1257.44	1540.9 5201.7
	0.00 730 1100.00 710 RAGE 0.00 1837.78	.00 100.00 .00 1300.00 22.69 2148.04	720.0 720.0 24	0 200.0 0 1600.0 85.12 171.69	00 710.00 00 730.00 187.2 2808.9	0 850.0 0 7 3 7 31	29,16 63,15	510.77 3535.17	3 <del>)</del> 5 39	<b>732.13</b> 725.03	4332.76	4758.35	5201.7
	0.00 730 1100.00 710 RAGE 0.00 1837.78	.00 100.00 .00 1300.00 22.69	720.0 720.0 24 11	0 200.0 0 1600.0 85.12	00 710.00 00 730.00 187.2	0 650.0 0 7 3 7 31 7 68	29,16	510.7	3 5 5 35 0 197	32,13			1540.9 5201.7 63155.8 362951.9
OUTF	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00	.00 100.00 .00 1300.00 22.69 2148.04 192.38	720.0 720.0 24 11 1285 7	0 200.0 0 1600.0 85.12 071.69	00 710.00 00 730.00 187.2 2808.9 3212.3	0 850.0 7 3 7 31 7 68 9 1834 4 7	29.16 63.15 14.52	510.77 3535.17 12242.99	3 35 5 35 0 197 5 2478	732,13 725,03 786,34	4332.76 31285.85	4758.35 48026.29	5201.7 63155.6
OUTF St	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38	720.0 720.0 24 11 1285 7 7 7	00 200.0 00 1600.0 85.12 071.69 122.34 530.21 703.16	00 710.00 00 730.00 187.2 2808.9 3212.3 154873.4 704.7	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.89	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732,13 725,03 786,34 339,40 709,47	4332.76 31286.85 283704.36 711.05	4758.35 46026.29 322063.25 712.63	5201.7 63155.6 362951.9 714.2 730.0
DUTF St F Maximu	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34	00 710.00 00 730.00 187.2 2808.9' 3212.3 154873.4 704.7 720.5 3212.3	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732.13 725.03 786.34 939.40 709.47 725.26 786.34	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6
DUTF St F Maximu	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96 UM STAGE IS 76	.00 100.00 .00 1300.00 22.67 2148.04 192.38 104428.53 701.58 717.37 192.38 104428.53	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34	00 710.00 00 730.00 187.2 2808.9' 3212.3 154873.4 704.7 720.5 3212.3	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732.13 725.03 786.34 939.40 709.47 725.26 786.34	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6
OUTF St Haxihu Haxihu	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96 UM STAGE IS 7 UM STAGE IS 7	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38 104428.53	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34	00 710.00 00 730.00 187.2 2808.9' 3212.3 154873.4 704.7 720.5 3212.3	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732.13 725.03 786.34 939.40 709.47 725.26 786.34	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6
DUTF - St Haximu Maximu Maximu	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96 UM STAGE IS 7 UM STAGE IS 7 UM STAGE IS 7	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38 104428.53 03.9	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34	00 710.00 00 730.00 187.2 2808.9' 3212.3 154873.4 704.7 720.5 3212.3	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732.13 725.03 786.34 939.40 709.47 725.26 786.34	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6
DUTF - St Haximu Maximu Maximu	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96 UM STAGE IS 7 UM STAGE IS 7 UM STAGE IS 7	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38 104428.53 03.9 03.9	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34	00 710.00 00 730.00 187.2 2808.9' 3212.3 154873.4 704.7 720.5 3212.3	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732.13 725.03 786.34 939.40 709.47 725.26 786.34	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6
DUTF - St Haximu Maximu Maximu	0.00 730 1100.00 710 RAGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96 UM STAGE IS 7 UM STAGE IS 7 UM STAGE IS 7	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38 104428.53 03.9 03.9 03.9	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34	00 710.00 00 730.00 187.2 2808.9' 3212.3 154873.4 704.7 720.5 3212.3	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 0 197 5 2478 9 1 9 1 9 1 9 1 9 1	732.13 725.03 786.34 939.40 709.47 725.26 786.34	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6
DUTF - St Haximu Maximu Maximu	0.00 730 1100.00 710 AGE 0.00 1837.78 FLOW 0.00 82631.96 TAGE 700.00 715.79 FLOW 0.00 82631.96 UM STAGE IS 7 UM STAGE IS 7	.00 100.00 .00 1300.00 22.69 2148.04 192.38 104428.53 701.58 717.37 192.38 104428.53 03.9 03.9 03.9	720.0 720.0 24 11 1285 7 7 7	00 200. 00 1600. 85.12 171.69 122.34 130.21 703.16 718.95 122.34 530.21	00 710.0 00 730.0 187.2 2808.9 3212.3 154873.4 704.7 720.5 3212.3 154873.4	0 650.0 7 3 7 31 7 68 9 1834 4 7 3 7 68	29.16 63.15 14.52 54.83 06.32 22.11 14.52 54.83	510.77 3535.17 12242.99 214433.77 707.8° 723.67 12242.99	3 33 5 33 5 2478 9 3 5 2478 9 3 5 2478	732.13 786.34 839.40 709.47 725.26 786.34 839.40	4332.76 31286.85 283704.36 711.05 726.84 31286.85	4758.35 46026.29 322063.25 712.63 728.42 46026.29	5201.7 63155.6 362951.9 714.2 730.0 63155.6

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				HYDROGRA	PH ROUTING					17
			ROUTING THRU	REACH 3 -	4					
	•	I	ISTAQ ICOMP 4 1		ITAFE JFLT 0 0	JFRT (	INAKE ISTAGE 1 0		·	
	• •		CLOSS AVG	ROUTI IRES	HAVE SAME NG DATA ISAME IOPT 1 0	IPHP 0	LSTR			
1 1 1 1 1		N	ISTPS NSTDL 1 0		AHSKK X 0.000 0.000		STORA ISPRAT 0. 0		· · · · · · · · · · · · · · · · · · ·	
NORMAL DEPTH	CHANNEL ROUT	TING								
DN ( ) . DN ( )			LNVT ELMAX 50.0 690.0	RLNTH 103000	SEL 0390					
	750.00 670.0	0 100.00 0 1120.00	680.00 150. 680.00 1200.	00 670.00 00 670.00	300.00 660.	00 310.00				
2	0.00 690.0	0 100.00	660.00 150.	00 670.00		00 310.00 600.80 4026.85	660.00 860.67 4437.73	1157.65 4859.23	1473.46 5291.33	
	0.00 690.0 950.00 670.0 0.00	0 100.00 0 1120.00 27.02	680.00 150. 680.00 1200. 100.61	00 670.00 00 670.00 220.77	300.00 660. 387.50	600.80	860.67			5734.0 43807.7 247117.8
STORAGE Dutflow Stage	0.00 690.0 750.00 670.0 2139.99 0.00	0 100.00 0 1120.00 27.02 2492.71 136.05	660.00 150. 660.00 1200. 100.61 2658.39 786.24	00 670.00 00 670.00 220.77 3236.92 2242.54	300.00 660. 387.50 3626.58 4748.53	600.80 4026.85 8521.67	860.67 4437.73 13761.91	4859.23 21746.29	5291.33 31962.67	5734.04 43807.79 247117.88 674.2
STORAGE Dutflow Stage	0.00 690.0 950.00 670.0 2139.99 0.00 57241.17 660.00	0 100.00 0 1120.00 27.02 2492.71 136.05 72234.86 661.58	660.00 150. 680.00 1200. 100.61 2858.39 786.24 88769.81 663.16	00 670.00 00 690.00 220.77 3236.92 2242.54 106854.19 664.74	300.00 660. 387.50 3626.53 4748.53 126504.35 666.32 682.11 4748.53	600.80 4026.85 8521.67 147660.89 667.89	860.67 4437.73 13761.91 170308.39 669.47	4859.23 21746.29 194437.22 671.05	5291.33 31962.67 220041.47 672.63	5734.0 43807.7 247117.8 674.2 690.0 43807.7
STORAGE Dutflow Stage	0.00 690.0 950.00 670.0 2139.99 0.00 57241.17 660.00 675.79 0.00 57241.17	0 100.00 0 1120.00 27.02 2492.71 136.05 72234.86 661.58 677.37 136.05 72234.86	660.00 150. 660.00 1200. 100.61 2858.39 786.24 88769.81 663.16 678.95 786.24	00 670.00 00 690.00 220.77 3236.92 2242.54 106854.19 664.74 680.53 2242.54	300.00 660. 387.50 3626.53 4748.53 126504.35 666.32 682.11 4748.53	600.80 4026.85 8521.67 147660.89 667.89 683.68 8521.67	860.67 4437.73 13761.91 170308.39 667.47 685.26 13761.91	4859.23 21746.29 194437.22 671.05 686.84 21746.29	5291.33 31962.67 220041.47 672.63 688.42 31962.67	5734.0 43807.7 247117.8 674.2 690.0 43807.7
STORAGE DUTFLOW Stage FLOW	0.00 690.0 950.00 670.0 2139.99 0.00 57241.17 660.00 675.79 0.00 57241.17 GE IS 664	0 100.00 0 1120.00 27.02 2492.71 136.05 72234.86 661.58 677.37 136.05 72234.86	660.00 150. 660.00 1200. 100.61 2858.39 786.24 88769.81 663.16 678.95 786.24	00 670.00 00 690.00 220.77 3236.92 2242.54 106854.19 664.74 680.53 2242.54	300.00 660. 387.50 3626.53 4748.53 126504.35 666.32 682.11 4748.53	600.80 4026.85 8521.67 147660.89 667.89 683.68 8521.67	860.67 4437.73 13761.91 170308.39 667.47 685.26 13761.91	4859.23 21746.29 194437.22 671.05 686.84 21746.29	5291.33 31962.67 220041.47 672.63 688.42 31962.67	5734.0 43807.7 247117.8 674.2 690.0 43807.7
STORAGE DUTFLOW Stage Flow Maximum Stag	0.00 690.0 950.00 670.0 2139.99 0.00 57241.17 660.00 675.79 0.00 57241.17 GE IS 664 GE IS 664	0 100.00 0 1120.00 27.02 2492.71 136.05 72234.86 661.58 677.37 136.05 72234.86	660.00 150. 660.00 1200. 100.61 2858.39 786.24 88769.81 663.16 678.95 786.24	00 670.00 00 690.00 220.77 3236.92 2242.54 106854.19 664.74 680.53 2242.54	300.00 660. 387.50 3626.53 4748.53 126504.35 666.32 682.11 4748.53	600.80 4026.85 8521.67 147660.89 667.89 683.68 8521.67	860.67 4437.73 13761.91 170308.39 667.47 685.26 13761.91	4859.23 21746.29 194437.22 671.05 686.84 21746.29	5291.33 31962.67 220041.47 672.63 688.42 31962.67	5734.0 43807.74 247117.88 674.2 690.00 43807.77
STORAGE DUTFLOW STAGE FLOW MAXIMUM STAG MAXIMUM STAG MAXIMUM STAG	0.00 690.0 950.00 670.0 2139.99 0.00 57241.17 660.00 675.79 0.00 57241.17 GE IS 664 GE IS 664 GE IS 664	0 100.00 0 1120.00 27.02 2492.71 136.05 72234.86 661.58 677.37 136.05 72234.86 6.5 5.5 5.5	660.00 150. 660.00 1200. 100.61 2858.39 786.24 88769.81 663.16 678.95 786.24	00 670.00 00 690.00 220.77 3236.92 2242.54 106854.19 664.74 680.53 2242.54	300.00 660. 387.50 3626.53 4748.53 126504.35 666.32 682.11 4748.53	600.80 4026.85 8521.67 147660.89 667.89 683.68 8521.67	860.67 4437.73 13761.91 170308.39 667.47 685.26 13761.91	4859.23 21746.29 194437.22 671.05 686.84 21746.29	5291.33 31962.67 220041.47 672.63 688.42 31962.67	5734.0 43807.7 247117.8 674.2 690.0 43807.7
STORAGE DUTFLOW STAGE FLOW MAXIMUM STAG MAXIMUM STAG	0.00 690.0 950.00 670.0 2139.99 0.00 57241.17 660.00 675.79 0.00 57241.17 GE IS 664 GE IS 664 GE IS 664	0 100.00 0 1120.00 27.02 2492.71 136.05 72234.86 661.58 677.37 136.05 72234.86 6.5 5.5 5.5 5.5 5.5	660.00 150. 660.00 1200. 100.61 2858.39 786.24 88769.81 663.16 678.95 786.24	00 670.00 00 690.00 220.77 3236.92 2242.54 106854.19 664.74 680.53 2242.54	300.00 660. 387.50 3626.53 4748.53 126504.35 666.32 682.11 4748.53	600.80 4026.85 8521.67 147660.89 667.89 683.68 8521.67	860.67 4437.73 13761.91 170308.39 667.47 685.26 13761.91	4859.23 21746.29 194437.22 671.05 686.84 21746.29	5291.33 31962.67 220041.47 672.63 688.42 31962.67	1800.24 5734.04 43907.75 247117.85 674.21 670.00 43807.75 247117.55

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					HYDRCGR	карн кәл	TING						18
· ···			ROUTIN	NG . THRU	REACH 4 -	- 5							
	•		ISTAD 5	ICOHP 1	IECON O	ITAPE 0	JPLT 0	JPRT 0	INAKE 1	ISTAGE O			
•		QLDSS 0.0	CL055 0.000	AVG 0.00		NS HAVE TING DAT ISAME 1		IFMP 0		LSTR O		•	
•			NSTPS 1	NSTDL O	LAG	AMSKK 0.000	X 0.000		STORA 0.	ISPRAT 0			
					۰.	-	÷				,	•	
NORMAL DEPTH	I CHANNEL ROU	UTING 											
QN( .1(	(1) QN(2) 000 .0700		ELNVT 610.0	ELNAX 640.0	RLNTH 10600.	SEL .00470					·		•
CRI	OSS SECTION												•
	0.00 640. 740.00 620. 0.00	00 100.00 00 770.00 19.92	) 630.0 ) 630.0 ?-	0 200.0 0 800.0 71.99	00 620.0 00 640.0 156.2	0 700.0 0 2 2	72.60	421.13	5 4	601.82	809.27		
STORAGE	0.00 640. 740.00 620. 0.00 1482.97	00 100.00 00 770.00 19.92 1723.32	> 630.0 > 630.0 2 2 19	00 200.0 00 800.0 71.99 71.55	00 620.0 00 640.0 156.2 2227.6	0 700.0 0 2 2 6 24	72.60 191.67	421.13 2763.56	i 3	601.82 043.33	3331.00	3626.54	3929.9
	0.00 640. 740.00 620. 0.00	00 100.00 00 770.00 19.92	) 630.0 ) 630.0 2 2 19 5 6	0 200.0 0 800.0 71.99	00 620.0 00 640.0 156.2	0 700.0 0 2 2 6 24 1 35	72.60	421.13	5 30 5 30	601.82		3626.54 23788.14	3929.9 32549.9
STORAGE Outflow Stage	0.00 640. 740.00 620. 0.00 1482.97 0.00	00 100.00 00 770.00 19.92 1723.32	) 630.0 ) 630.0 2 19 5 6 5 656 3 6	00 200.0 00 800.0 71.99 771.55 505.95	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7	0 700.0 0 2 2 6 24 1 35 7 932	72.60 91.67 78.82 99.06 16.32	421.13 2763.56 6392.01	3 30 102 3 1252	601.82 043.33 289.35	3331.00 16216.81 142867.47 621.05	3626.54 23738.14 161550.54 622.63	3929.9 32549.9 181313.8 624.2
STORAGE Outflow Stage	0.00 640. 740.00 620. 0.00 1482.97 0.00 42467.75 610.00	00 100.00 00 770.00 19.92 1723.33 108.96 53516.96 611.58	) 630.0 ) 630.0 2 19 5 6 5 656 3 6 7 6	00 200.4 00 800.7 71.99 771.55 505.95 579.78	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7	0 700.0 0 2 2 6 24 1 35 7 932 4 6 3 6	72.60 91.67 78.82 99.06 16.32	421.13 2763.56 6392.01 108740.48 617.89	5 3( 5 3( 3 1252 9 ( 3 ( 1 10)	601.82 043.33 289.35 263.94 619.47	3331.00 16216.81 142867.47 621.05	3626.54 23768.14 161550.54 622.63 638.42 23788.14	3929.9 32549.9 181313.8 624.2 640.0 32549.9
STORAGE OUTFLOW STAGE	0.00 640. 740.00 620. 0.00 1482.97 0.00 42467.75 610.00 625.79 0.00 42467.75	00 100.00 00 770.00 19.92 1723.32 108.94 53516.94 611.55 627.37 108.94	) 630.0 ) 630.0 2 19 5 6 5 656 3 6 7 6	00 200 00 800. 71.99 771.55 505.95 579.78 513.16 528.95 505.95	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7 630.5 1703.2	0 700.0 0 2 2 6 24 1 35 7 932 4 6 3 6	72.60 91.67 78.82 99.06 916.32 932.11	421.13 2763.56 6392.01 108740.48 617.89 633.68 6392.01	5 3( 5 3( 3 1252 9 ( 3 ( 1 10)	601.62 043.33 289.35 263.94 619.47 635.26 289.35	3331.00 15216.91 142867.47 621.05 636.84 16216.81	3626.54 23768.14 161550.54 622.63 638.42 23788.14	3929.9 32549.9 181313.8 624.2 640.0 32549.9
STORAGE Outflow Stage Flow	0.00 640. 740.00 620. 0.00 1482.97 0.00 42467.75 610.00 625.79 0.00 42467.75 GE IS 61	00 100.00 19.92 1723.32 108.92 53516.92 611.52 627.37 108.92 53516.92	) 630.0 ) 630.0 2 19 5 6 5 656 3 6 7 6	00 200 00 800. 71.99 771.55 505.95 579.78 513.16 528.95 505.95	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7 630.5 1703.2	0 700.0 0 2 2 6 24 1 35 7 932 4 6 3 6	72.60 91.67 78.82 99.06 916.32 932.11	421.13 2763.56 6392.01 108740.48 617.89 633.68 6392.01	5 3( 5 3( 3 1252 9 ( 3 ( 1 10)	601.62 043.33 289.35 263.94 619.47 635.26 289.35	3331.00 15216.91 142867.47 621.05 636.84 16216.81	3626.54 23768.14 161550.54 622.63 638.42 23788.14	3929.9 32549.9 181313.8 624.2 640.0 32549.9
STORAGE OUTFLOW Stage Flow Maximum Stag	0.00 640. 740.00 620. 0.00 1482.97 0.00 42467.75 610.00 625.79 0.00 42467.75 GE IS 61 GE IS 61	00 100.00 19.92 1723.32 108.92 53516.92 611.52 627.37 108.92 53516.92 44.9	) 630.0 ) 630.0 2 19 5 6 5 656 3 6 7 6	00 200 00 800. 71.99 771.55 505.95 579.78 513.16 528.95 505.95	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7 630.5 1703.2	0 700.0 0 2 2 6 24 1 35 7 932 4 6 3 6	72.60 91.67 78.82 99.06 916.32 932.11	421.13 2763.56 6392.01 108740.48 617.89 633.68 6392.01	5 3( 5 3( 3 1252 9 ( 3 ( 1 10)	601.62 043.33 289.35 263.94 619.47 635.26 289.35	3331.00 15216.91 142867.47 621.05 636.84 16216.81	3626.54 23768.14 161550.54 622.63 638.42 23788.14	3929.9 32549.9 181313.8 624.2 640.0 32549.9
STORAGE DUTFLOW STAGE FLOW MAXIMUM STAU MAXIMUM STAU MAXIMUM STAU	0.00 640. 740.00 620. 0.00 1482.97 0.00 42467.75 610.00 625.79 0.00 42467.75 GE IS 61 GE IS 61 GE IS 61 GE IS 61	00 100.00 19.92 1723.33 108.94 53516.96 611.56 627.37 108.94 53516.96 41.9 14.9 14.9	) 630.0 ) 630.0 2 19 5 6 5 656 3 6 7 6	00 200 00 800. 71.99 771.55 505.95 579.78 513.16 528.95 505.95	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7 630.5 1703.2	0 700.0 0 2 2 6 24 1 35 7 932 4 6 3 6	72.60 91.67 78.82 99.06 916.32 932.11	421.13 2763.56 6392.01 108740.48 617.89 633.68 6392.01	5 3( 5 3( 3 1252 9 ( 3 ( 1 10)	601.62 043.33 289.35 263.94 619.47 635.26 289.35	3331.00 15216.91 142867.47 621.05 636.84 16216.81	3626.54 23768.14 161550.54 622.63 638.42 23788.14	1250.5 3929.9 32549.9 181313.8 624.2 640.0 32549.9 181313.8
STORAGE DUTFLOW Stage FLOW Maximum Stat Maximum Stat	0.00 640. 740.00 620. 0.00 1482.97 0.00 42467.75 610.00 625.79 0.00 42467.75 GE IS 61 GE IS 61 GE IS 61 GE IS 61	00 100.00 19.92 1723.33 108.94 53516.96 611.56 627.37 108.94 53516.96 44.9 14.9	) 630.0 ) 630.0 2 19 5 6 5 656 3 6 7 6	00 200 00 800. 71.99 771.55 505.95 579.78 513.16 528.95 505.95	00 620.0 00 640.0 156.2 2227.6 1703.2 78943.4 614.7 630.5 1703.2	0 700.0 0 2 2 6 24 1 35 7 932 4 6 3 6	72.60 91.67 78.82 99.06 916.32 932.11	421.13 2763.56 6392.01 108740.48 617.89 633.68 6392.01	5 3( 5 3( 3 1252 9 ( 3 ( 1 10)	601.62 043.33 289.35 263.94 619.47 635.26 289.35	3331.00 15216.91 142867.47 621.05 636.84 16216.81	3626.54 23768.14 161550.54 622.63 638.42 23788.14	3929.9 32549.9 181313.8 624.2 640.0 32549.9

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•		SUB-A	REA RUNOFF COMPUTATIO	н		19
•		INFLOW HYDROGRA	APH - UPPER MOUNT HOLI	LY SUBAREA		
	•	ISTAQ ICOMP	IECON ITAFE JPL		TAGE IAUTO	•
		6 0	•	0 0 1	0 0	
	IHYDG IUH 1	G TAREA SNAF 1 20.86 0.00		ATIO ISNOW ISAME 000 0 1	LOCAL 0	• •
			FRECIP DATA			
	SPFE 0.00	23.60 98.00	R12 R24 107.50 117.00 130	R48 R72 R96 .00 0.00 0.00		
TRSPC COMPU	ITED BY THE PROGRAM IS	•846	••		· . ·	• .• #
	LROPT STRKR I	LTKR RTIOL E	LOSS DAŢA RAIN STRKS RTIOK	STRTL CNSTL ALS	HX RTIMP	
			0.00 0.00 1.00	1.00 .05 0.		
			UNIT HYDROGRAPH DATA	A- 0		•
		TP=		A= 0		·
*** ***	•	STRTO= -1.5	RECESSION DATA 0 DRCSN=05	RTIOR= 2.00		
• 2•				3.20 HOURS, CP= .54		
41 - 1 	<b>47.</b> 178.	364, 585, 2339, - 2299,	831. 1094. - 2183 2045.	1371. 1641. 1916 1776.	1876, 2065, 1682, 1576,	
•	1477. 1384. 770. 721.	1297, 1215, 676, 633,	1138. 1066.	999. 936. 521. 488.	877. 822. 457. 428.	
•	401. 376.	352. 330.	309, 290,	272. 254.	238. 223.	
	209. 196. 109. 102.	184. 172. 96. 90.	84. 79.	142. 133. 74. 69.	124. 116. 65. 61.	:
	57, 53, 30, 28,	50. 47. 26. 24.		38. 36. 20. 19.	34. 32. 18.	
	0		END-OF-PERIOD FLOW			
NO.1	DA HR.MN PERIOD RA	IN EXCS LOSS	COMP Q MO.DA	HR.MN PERIOD RAD	IN EXCS LOSS COMP O	
				SUM 25.0	97 23.48 2.49 1261989.	•
					0.)( 596.)( 63.)(35735.55)	•
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	*******	*****	*******	*******	******	
14			COMBINE HYDROGRAPHS			
		CONBINE HYDROG	RAPHS AT UFFER HOUNT	HOLLY DAM		
		ISTAQ ICOMP			STAGE IAUTO	
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· • • • • • • • • • • • • • • • • • • •				RESE	NOIR RO	JTING - 1	(HRU UPPE	r mount	HOLLY DA	ĸ			÷	
				ISTAQ 8	icokp 1	IECON O	ITAPE O	JPLT 0		INAME 1	ISTAGE 0	IAUTO O		
			0LOSS 0.0	CLOSS 0.000	AVG 0.00	r Rou	ns have ( Iting dat) Isahe 1		IPKP 0	. ·	LSTR 0			
				NSTPS 1	NSTDL 0	LAG O	AMSKK 0.000	X 0.000	TSK 0.000	STORA 61.	ISFRAT –1			
•	STAGE	594.00 599.00	594.5( 599.5(	-	95.00 )0.00	595.50 601.00	•	6.00 3.00	<b>596.70</b> 605.00	5	- 77.00 28.00	597.50	598.00	59
(	FLOX	0.00 9864.00	42.00 12649.00		)4.00 7.00	699.00 22490.00		3.00 3.00	2018.00 57217.00	24:	25.00	3532.00	5222.00	737
. S	URFACE ARE	A=	0. 2	·•••	72,	104.				•	i.	•		
	CAPACITY	(=	0,- 6	1	321.	1196.				•			:	
	ELEVATION	l= 58	35 <b>.</b> 59	4.	600.	610.							•	•
<u></u>			CRI 594			-	PW ELEV .0 0.		0L CARE 0.0 0.				• •	
4. - 6. - 6.						TOPEL 596.7	DAK D Cood O.O		DAHWID O.			·	•	
			·		BRWID 50.	Z		TFAIL	WSEL F. 594.00 74	AILEL 00.00				
PEAK	OUTFLOW IS	338:	. AT TIME	44.75 H	DURS									
			• •	;	BRWID 50.	DA Z 1.00 58	M BREACH Elbm T 38.00	FAIL	WSEL F4 194.00 59	ILEL 7.20			-	
BEGIN	I DAH FAILU	RE AT 43.	00 HOURS						<b>*</b> .	• • •				
PEAK	OUTFLOW IS	6635	, AT TIKE	43.25 HE	NRS								·	
- 95614	Day ====	,		P	RWID 50.	DAM Z 1.00 58	BREACH I Elbh Tf 3.00	FAIL	NSEL FA. 14.00 597	ILEL 7.20				•
	DAM FAILUR	E AT 43.(	0 HOURS									۰.		
PEAK	OUTFLOW IS	5943.	AT TIKE	13.50 HAI	JRS					,		Ť	• •	•

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••; ••					•			DAM BREAD			F . T				•
					-	BRWID	Z	ELBN	TFAIL	WSEL 594.00	FAILEL				
						50+	1.00	588.00	1.00	374+VV	377120				
	BEGIN DAK FAI	LURE AT	43.00	HOURS								:			· .
													••••		
•	PEAK OUTFLOW	IS	5113.	AT TIME	44.00	HOURS									- :
1 : :	•					-		-							1
	•							DAM BREAD		licci					· ·
• •						BRWID 50+	Z 1.00	ELBM 588.00	TFAIL 2.00	WSEL 594.00	FAILEL 597.20				
	•					501	1,00	500100	2	0,					
	BEGIN DAM FAI	LURE AT	43.00	) HOURS											۰.
3.4	FEAK OUTFLOW	15	4379.	AT TIHE	45.00	HOURS								•	•
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)				,			HYDRO	GRAPH ROU	TING						
	· · ·				ROUTI	NG THRU	REACH 8	- 9							•
												105105		÷.	•
					ISTAQ <b>9</b>	ICOMP 1	IECON O		JFLT O	JPRT 0	INARE 1	ISTAGE O	IAUTO O		
			•		'	•		v	v	v	•	•	•		
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				OLOSS	CLOSS	AVG	IRES	UTING DAT ISAME	A IOPT	IPHP		LSTR		••	
				0.0	0.000	0.00	1		0			0			
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					NSTFS 1	NSTDL O			X 0.000			ISFRAT 0			
					1	. <b>v</b>	v	0.000	V+VVV	01000		v			
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		CHADIC	0.001	TNO											
	NORMAL DEPTH	UNHINE													-
9													*		
	<u></u>	 4.1					 Bi 1/7//	051					• ·	1	• •
	QH(			ON(3) .1000	ELNVT 560.0	ELMAX 570.0	RLNTH	SEL .00560							
3		VY, VV	,	*1000	30010	37710	JUV∳.	100300							
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NAXIMUH STA	GE IS :	572.0					•			-
NAXINUN STA	GE IS S	572.6								
HAXIMUM STA	GE IS S	572.9								
MAXIMUH STA	GE IS S	573+4			~					
MAXIMUM STA	GE IS S	570.8		••	-					
	7903.93	9782.42	11897.63	14240.12	16932.79	19742.93	22985.20	26577.83	30539.33	34888.18
FLOW	0.00	104.99	345.33	706.46	1190.17	1801.85	2548.20	3559.53	4806.53	6249.7
Unite	575.79	577.37	578.95	580.53	582.11	583.68	565.26	586.84	588.42	590.00
STAGE	560,00	561.58	563,16	564,74	566.32	567.89	569.47	571.05	572.63	574.21
OUTFLOW	0.00 7903.93	104.99 9782.42	345.33 11897.63	706,46 14240,12	1190.17 16832.79	1801.85 19742.83	2548.20 22985.20	3559.53 26577.83	4306.53 30537.33	6249.71 34888.18
	102.60	121.71	142.79	165.91	191.85	220.87	252,97	263.14	326.37	367.71
STORAGE	0.00	5.17	11.32	18.46	26.58	35.68	45.78	57.07	70.28	85.45

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() ()	•	FEAK FLOW AND STO	FLOWS IN CUBIC FE		PLE PLAN-RATIO ECONOM IC METERS FER SECOND KILOMETERS)		
•	OFERATION	STATION ARE	A PLAN RATIO 1 .06	RATIOS	AFFLIED TO FLOWS		
	HYDROGRAFH A1	T 1 23.5 ( 61.05		ية م			
	ROUTED TO	2 23.5 ( 61.05	7 1 2189.		:		
	ROUTED TO	3 23.5 ( 61.05					
•	ROUTED TO	4 23.5 ( 61.05				-	

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9	ROUTED TO	5	23.57	i	1919.	
		- (	61.05)	Ĵ.	54.35)(	
	•			2	1919.	
<b>G</b>				(	54.35)(	
•				3	1919.	
	•			(	54.35)(	
				4	1919.	
				(	54,35)(	
<b>8</b>				5	1919.	
• .				(	54.35)(	
<b>G</b>	HYDROGRAPH AT	6	20.86	1	2158.	
<b>.</b>		(	54.03)	(	61.11)(	
•				2	2158.	
<b>(</b> )				(	61.11)(	
				3	- 2158.	:
				(	61.11)(	•
0				4	2158.	-
				(	61,11)(	
•				5	2158.	
<b>8</b> .				(	61.11)(	
	2 COMBINED	7	44.43	1	3388.	
<b>(</b> )		(	115.07)	(	95.94)(	
<b>Y</b>		•		2	3388.	
				(	95.94)(	
<b>B</b>				3	3388.	
U .				(	95.94)(	
				4	3383.	
•				(	95,94)(	
•				5	3388.	
•			•	(	95.94)(	
8	ROUTED TO	8	44.43	1	3381.	
• -		(	115.07)	(	95.73)(	
6			•	2	6635.	
<b>Y</b>				(	187.89)(	
				3	5943.	
				્	168.27)(	
•				4	5113.	
		•		(	144.77)(	
<b>1</b>				5	4379,	
• .				(	124.00)(	
	ROUTED TO	9	44.43	1	3379.	
•		(	115.07)	(	95.68)(	
	*			2	5477.	
				(	155.09)(	
<u> </u>				3	5041.	
				(	142.74)(	
•				4	4750.	
- ,				_(	134.51)(	
		•		5	4330.	
0				(	122.61)(	
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Ø	1			9	SUMARY OF	DAM SAFETY A				25
	PLAN	l 1	ELEVATION STORAGE	INITIA 77	L VALUE 4.50 160.	SFILLWAY C 774.5 160	REST TO	0F DAM 786.00		
6			OUTFLOW		0.	0		631. 32720.		
0		. RATIO Of PMF	HAXIHUH RESERVOIR N.S.ELEV	HAXIHUN Depth Over Dan	KAXIMUN Storage AC-Ft		DURATION OVER TOP HOURS		TIKE OF FAILURE HOURS	
Ø		•06	776.52	0.00	216.	2187.	0.00	43.50	0.00	•
0	PLAN	2	ELEVATION STORAGE	77	L VALUE 4.50 160.	SPILLWAY CR 774.50 160.	)	P DF DAM 786.00 631.		
0			OUTFLOW		0.	0.	,	32720.		
0		RATIO OF _ PMF	MAXIMUM RESERVOIR ₩.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP • HOUKS	TINE OF MAX OUTFLOW HOURS	TIME OF FAILURE	
Ø		•06	776,52	0.00	216,	2189.	0.00	43.50	HOURS 0.00	:
8) (5)	PLAN	3	ELEVATION STORAGE OUTFLOW		VALUE 1.50 60. 0.	SPILLWAY CR 774.50 160. 0.		° DF DAH 786.00 631. 32720.		•
		RATIO OF PMF	MAXIKUM RESERVOIR W.S.ELEV	MAXIMUM Depth Over Dam	MAXINUN STORAGE AC-FT	MAXINUM Dutflow CFS	DURATION OVER TOP HOURS	TIME OF MAX CUTFLOW HOURS	TIME OF FAILURE HOURS	- - 
		.06	776.52	0.00	216.	2187.	0.00	43.50	0.00	
0	PLAN	4	ELEVATION Storage Outflow	INITIAL 774 1		SPILLWAY CRE 774.50 160. 0.		OF DAM 785.00 631. 32720.		
<del>9</del> 3.		RATIO Of Phf	MAXIMUM Reservoir N.S.Eley	MAXIHUH Depth Over Dam	MAXIMUM STORAGE AC-FT	MAXIMUM DUIFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX DUTFLOW HOURS	TIME OF FAILURE HOURS	
<b>A</b>		06	776.52	0.00	216.	2189.	0.00	43.50	0.00	

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(*) (*)	FLAN	5	ELEVATION STORAGE OUTFLOW	INITIAL V 774.3 160 0	) •	5PILLWAY CRES 774.50 160. 0.	IT TO	P OF DAM 786.00 631. 32720.	
<b>@</b>	۰.	RATIO OF PMF	HAXIMUM RESERVDIR W.S.ELEV		MAXIMUM STORAGE AC~FT		DURATION OVER TOP HOURS	TINE OF Max outflow Hours	TIME OF FAILURE HOURS
•		.06	776.52	0.00	216.	2189.	0.00	43.50	0.00
<b>(</b> )				FLA	N 1	STATION	3		
0					HAXINUN FLOU/CFS		TIME HOURS		
۵۶				.06	2124.	703.9	44.00		
Ø				FLA	N 2	STATION	3		
		-		RATIO	HAXIHUH FLOU/CFS				
9				.06	2124.	703.9	44.00		
				FLA	N 3	STATION	3		
8				RATIO	Haxinun Floy,CFS				
8				.06	2124.	703.9	44.00		
8				FLA	N 4	STATION	3		
<b>5</b> 7				RATIO	MAXIMUM FLOW,CFS	NAXINUN Stage/Ft			
0				.06	2124.	703.9	44.00		
9				FLA	N 5	STATION	3		
<b>3</b>				RATIO	MAXINUM FLOW/CFS				
3				.06	2124.	703.9	44.00		
					N 1	STATION	4		
•				RATIO	HAXIKUM FLOW,CFS				
<b>•</b>				.06	1974.	664.5	45.25	i	

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٩	LAN 2	STATION	4
RATIO	HAXIMU FLOW,CFS		
.06	1994.	664.5	45.25
PI	LAN 3	STATION	4
RATIO	HAXIHUH FLOW,CFS	NAXIKUN STAGE,FT	TINE HOURS
•06	1994.	664.5	45.25
FI	LAN 4	STATION	4
RATIO	HAXIMUH FLOW≠CFS	HAXIMUN Stage+Ft	TIHE Hours
•06	1994.	664.5	45.25
FL	.AN 5	STATION	4
RATIO		MAXIMUH STAGE+FT	TIME HOURS
.06	1974.	664.5	45+25
FL	.AN 1	STATICN	5
RATIO	HAXIKUN FLOW+CFS	MAXIMUH Stage+Ft	time Hours
•06	1919.	614.9	45.00
PL	AN 2	STATION	5
RATIO	HAXIHUH FLO₩≠CFS		TIME HCURS
•06	1919.	614.9	46.00
PL	AN 3	STATION	5
RATIO	MAXIHUH FLOW/CFS		TINE Hours
•06	1719.	614.9	46.00
FL <i>i</i>	AN 4	STATION	5
RATIO	MAXIMUM FLOW+CFS		TIME Hours
.06	1919.	614.9	46.00

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•			F	LAN 5	STATION	5		
	<b>.</b>		RATIO	HAXIHUI FLO¥+CFS				• · ·
				1919 MMARY OF Di Print A	AH SAFETY ANA	LYSIS	•	
PLAN	1	ELEVATION STORAGE OUTFLOW	• 594	.00 ;	SPILLWAY CRE 594.00 61. 0.			
	RATIO DF PHF	HAXIMUM RESERVOIR W.S.ELEV	Kaxihuk Depth Dver Dah	MAXIMUM Storage AC-FT	HAXIHUH OUTFLO₩ CFS	DURATION OVER TOP HOURS	TIME OF Max Cutflow Nours	TIME OF FAILURE HOURS
	• • 06	597.43	.73	171.	3381.	7.75	44.75	0.00
PLAN	2	ELEVATION STORAGE OUTFLOW	594	.00	SFILLWAY CRE 594.00 61. 0.			
	RATIO DF PMF	HAXIMUH RESERVOIR W.S.ELEV	MAXIHUH Depth Over Dam	MAXIMUM Storage AC-FT	MAXIMUM DUTFLOW CFS	DURATION OVER TOP HOURS	TINE OF HAX CUTFLOW HOURS	TIME OF FAILURE HOURS
	.06	597.27	•57	164.	6635.	1.76	43.25	43.00
PLAN	3	ELEVATION STORAGE OUTFLOW	594		594.00 61.		P OF DAM 596.70 140. 2016.	
	RATIO Of PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEFTH OVER DAM	HAXIHUH STORAGE AC-FT	MAXIHUH Outflow CFS	PURATION OVER TOP HOUKS	TIBE OF MAK CUTFLOW HOURS	TIME OF FAILUSE HOURS
	.06	597.27	.57	164.	5943.	1.94	43.50	43.00
FLAN	4	ELEVATION STORAGE RHTFLOW		1.00 61.	594.00 61.		576.70 140.	
	PLAN	OF PHF .06 PLAN 2 RATIO OF PMF .06 PLAN 3 RATIO OF PMF	ELEVATION STORAGE OUTFLOWRATIO OF PMFMAXIMUM RESERVOIR W.S.ELEV.06597.43PLAN 2RATIO OF PMFMAXIMUM RESERVOIR OUTFLOWRATIO OF PMFMAXIMUM RESERVOIR W.S.ELEV.06597.27PLAN 3RATIO OF PMFMAXIMUM RESERVOIR W.S.ELEV.06597.27PLAN 3RATIO OF PMFMAXIMUM RESERVOIR W.S.ELEV.06597.27PLAN 4ELEVATION STORAGE OUTFLOWRATIO PMF.06597.27FLAN 4 ELEVATION	ELEVATION594STORAGE OUTFLOWSTORAGE OUTFLOWMAXIMUM DEPTH DVER DAM.06S97.43.73PLAN 2INITIAL ELEVATION STORAGE OUTFLOWINITIAL S94RATIO OF PMFMAXIMUM RESERVOIR OUTFLOWMAXIMUM DEPTH DVER DAMRATIO OF PMFMAXIMUM NS.ELEVMAXIMUM DEPTH OUFE DAMRATIO OF PMFMAXIMUM NS.ELEVMAXIMUM DEPTH OVER DAM.06S97.27.57PLAN 3INITIAL ELEVATION STORAGE OUTFLOWINITIAL S94RATIO PMFMAXIMUM NS.ELEVMAXIMUM DEPTH OVER DAM.06S97.27.57FLAN 4INITIAL ELEVATION S10KAGEINITIAL S94	ELEVATION STORAGE OUTFLOW         594.00 61. 0UTFLOW           RATIO OF PMF         MAXIMUM RESERVOIR W.S.ELEV         MAXIMUM DEPTH DVER DAM         MAXIMUM AC-FT           .06         597.43         .73         171.           PLAN 2         INITIAL VALUE STORAGE OUFLOW         INITIAL VALUE S94.00         61. 0.           RATIO PLAN 2         MAXIMUM MAXIMUM OF PMF         MAXIMUM RESERVOIR W.S.ELEV         NAXIMUM DEPTH OVER DAM         NAXIMUM AC-FT           .06         597.27         .57         164.           PLAN 3          INITIAL VALUE S10RAGE OUFLOW         S10RAGE OVER DAM         61. 0.           RATIO OF PMF         MAXIMUM W.S.ELEV         INITIAL VALUE S94.00         61. 0.           RATIO PHA         MAXIMUM W.S.ELEV         INITIAL VALUE S94.00         61. 0.	PLAN1INITIALVALUE STORAGE OUTFLOWSPILLWAY CRE S74.00 61. 0.RATIO OF PHFHAXIMUM RESERVOIR W.S.ELEVINITIAL VALUE DUER DAH OUER DAHSPILLWAY CRE 574.00 OUTFLOW OUTFLOW DUER DAH AC-FTHAXIMUH HAXIMUH OUTFLOW OUTFLOW OUTFLOW OUTFLOW OUTFLOWPLAN2 ELEVATION STORAGE OUFLOW OUFLOWINITIAL VALUE SFILLWAY CRE SFILLWAY CRE SF	PLAN       1       INITIAL VALUE STRAGE DUTFLOW       SPILLWAY CREST 594.00       TOF SP4.00         RATIO OF PNF       MAXIMUN RESERVOIR PNF       MAXIMUN NS.ELEV       MAXIMUN DUFL DW       MAXIMUN DEPTH DUFR DAH       MAXIMUH AC-FT       MAXIMUH OUTFLOW       DURATION OUTFLOW         .06       597.43       .73       171.       3381.       7.75         PLAN       2       .06       597.27       .75       164.       61.       00         .06       597.27       .57       164.       6635.       1.76         PLAN       3        INITIAL VALUE       SPILLWAY CREST HOURS       10         .06       597.27       .57       164.       6635.       1.76         PLAN       3        INITIAL VALUE       SPILLWAY CREST S94.00       0.       0.         .06       597.27       .57       164.       574.3.       1.94	PLAN         1         INITIAL VALUE 594.00         SPILLWAY CREST         TOP OF DAH 594.00           STORAGE DUTFLOW         594.00         594.00         594.00         594.00         594.00           RATIO OF         MAXIMUN RESERVOIR         MAXIMUH DEFTH         MAXIMUH AC-FT         MAXIMUH DUFATION         MAXIMUH HAXIMUH HAXIMUH         MAXIMUH HAXIMUH HAXIMUH STORAGE         MAXIMUH AC-FT         MAXIMUH HAXIMUH HAXIMUH STORAGE         SPILLWAY CREST         TOP OF DAH HOURS           PLAN         2          INITIAL VALUE STORAGE         SPILLWAY CREST         TOP OF DAH HOURS           PLAN         2          INITIAL VALUE STORAGE         SPILLWAY CREST         TOP OF DAH HOURS           PLAN         2          INITIAL VALUE STORAGE         SPILLWAY CREST         TOP OF DAH HOURS           PLAN         2          INITIAL VALUE STORAGE         SPILLWAY CREST         TOP OF DAH HAX.CUTCU           PLAN         4

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Pl	LAN 5	.06 RATIO OF PMF .06	597.29 ELEVATION STORAGE OUTFLOW MAXIMUM RESERVOIR W.S.ELEV 597.31	.59 INITIAL 594 KAXIMUM DEPTH OVER DAM		5113. SPILLWAY CRES 594.00 61. 0.		44.00 DF DAM 596.70 140. 2018.	43.00
Ρl	LAN 5	RATIO OF PMF	STORAGE OUTFLOW MAXIMUM RESERVOIR N.S.ELEV	594. Kaximuk Depth	.00 51. 0.	594.00 61.		596.70 140.	
		OF PMF	RESERVOIR N.S.ELEV	DEPTH	MAXIMUM				
		.06	597.31		STORAGE AC-FT		DURATION OVER TOP HOURS	TIME OF MAX CUTFLOW HCURS	TIME OF FAILURI HOURS
				•61	166.	4379.	2.96	45.00	43.00
				PI	LAN 1	STATION	9		
				RATIO	HAXIHUM FLOW,CFS	HAXIMUN STAGE+FT	TIME HOURS		
				•06	3379.	570.8	45.00		
				P	LAN 2	STATION	9		
				RATIO	MAXIMUM FLOW,CFS		TIME KOURS		
				•06	5477.	573.4	43.50		
				F	LAN 3	STATION	9		
				RATIO	MAXIMUN FLOW,CFS		TIME HOUPS		
				•06	5041.	572.9	43.75		
				F	LAN 4	STATION	9		
				RATIO	MAXIMUM FLOW,CFS				
				•06	4750.	572.6	44.00		
				F	'LAN 5	STATION	9		
				RATIO	HAXIHUH FLOW+CFS				
501 ET	NCOUNTERE	Π.		•06	4330.	572.0	45.00		

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### APPENDIX E

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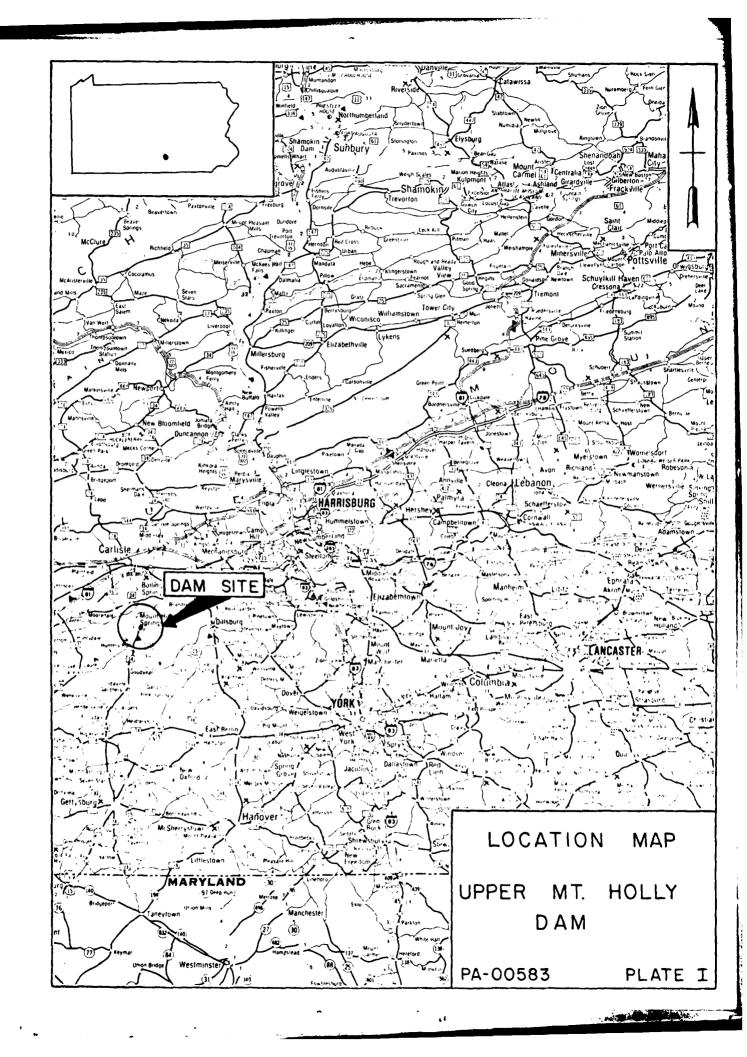
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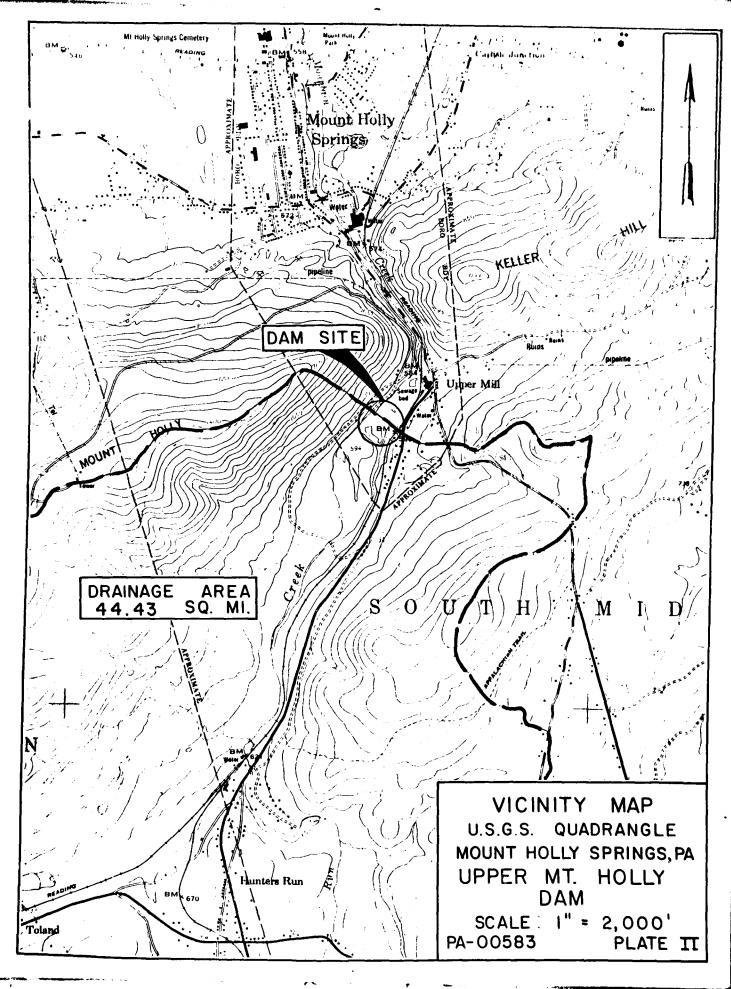
PLATES

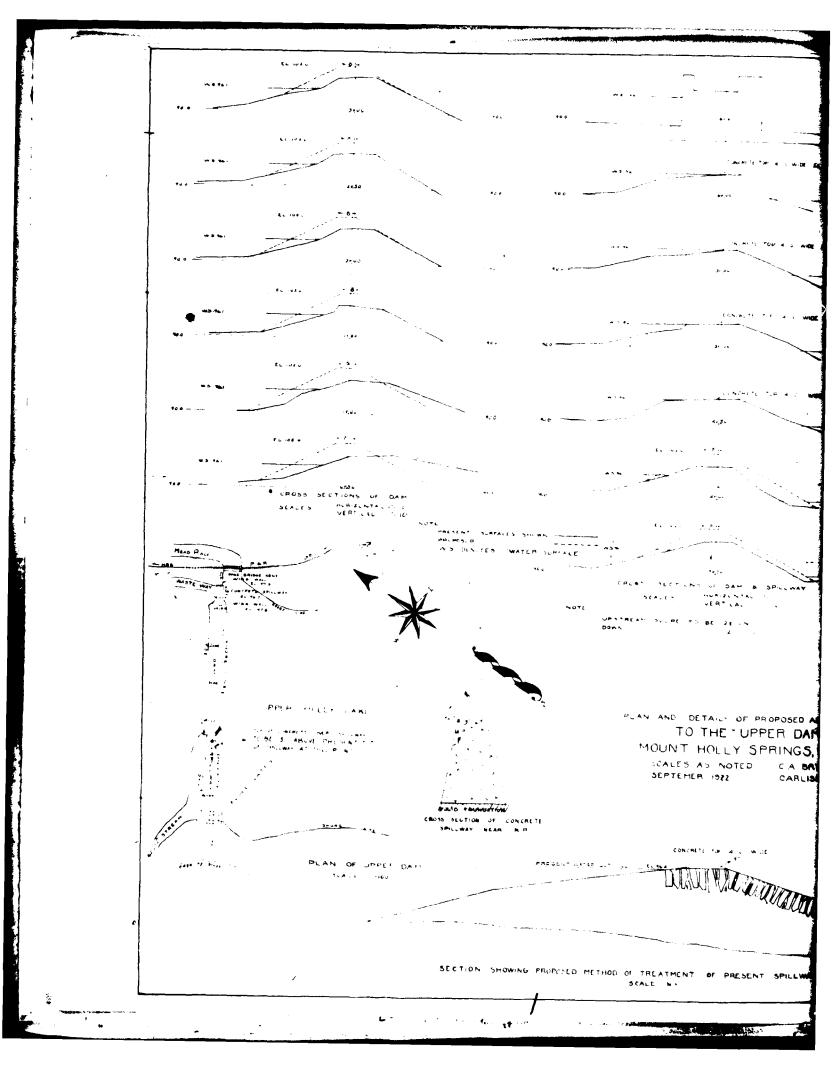
APPENDIX E

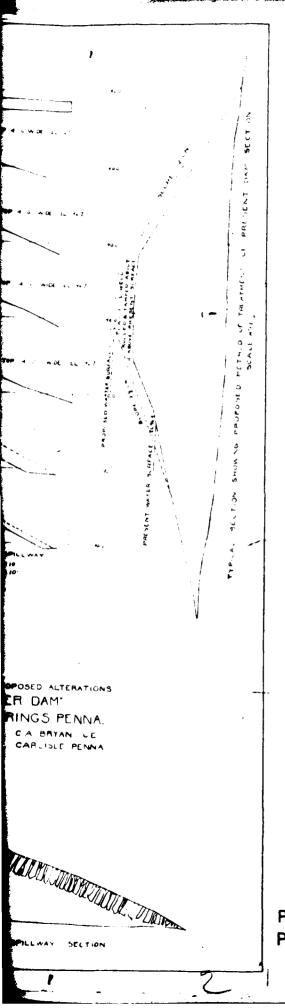
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## PA-00583 PLATE III

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139541 S' Emerge Gunite -1 , Existing Concrete Laps. Weldel Wirs Fabric Rein torcing 3" Gunita Erster. Eristing State Dani Cove at Base 12 111 PA-00583 PLATE IV A Dec Fendrein CROSE SECTION OF DAM PROFILE KERNE TO LAW THE EATON-DIKENDAN G. GUMTE CLUSTRICTION GRA 20 LEADING AND HEVE YES INY Mount Hilly Segures, P.C. JULY 5, 1932

APPENDIX F

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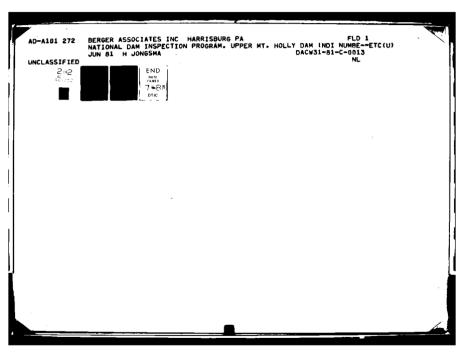
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GEOLOGIC REPORT

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APPENDIX F



#### GEOLOGIC REPORT

#### BEDROCK - DAM AND RESERVOIR

This area overlies the Tomstown Dolomite which consists of a medium to dark gray, dense, finely crystalline domolite and weathers to a buff and olive-gray color.

#### STRUCTURE

There exists a NE striking fault on the NW border of the reservoir, with the upthrown side to the north and the downthrown side to the south. Joints, which are moderately abundant and well developed, have a blocky pattern and dip between 45-85°. The Mountain Creek Syncline occurs along the SE border of the reservoir.

#### **OVERBURDEN**

The overburden is most probably a clayey residual soil resulting from the carbonate leaching of the parent bedrock.

#### AQUIFER CHARACTERISTICS

The Tomstown Dolomite has a low magnitude secondary porosity and little subsurface drainage, therefore seepage should be minimal.

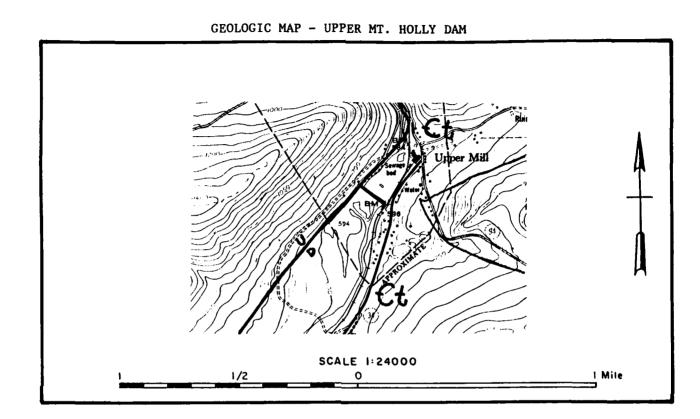
#### DISCUSSION

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According to available construction plans, the dam rests on bedrock. If such is the case, the Tomstown Dolomite provides a good quality foundation for heavy structures. However, as with any carbonate rock, sinkholes and bedrock pinnacles should be thoroughly investigated.

#### SOURCES OF INFORMATION

- Freedman, J., 1967. Geology or a Portion of the Mt. Holly Springs Quadrangle, Adams and Cumberland Counties, Pennsylvania: Pennsylvania Geological Survey PR 169.
- McGlade, W.G., et. al., 1972. Engineering Characteristics of the Rocks of Pennsylvania: Pennsylvania Geological Survey EG 1.



# LEGEND

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Tomstown Dolomite

Fault

The Logic Method and the Line

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