AD-A106 619 BLACK AND VEATCH KANSAS CITY MO F/G 13/13

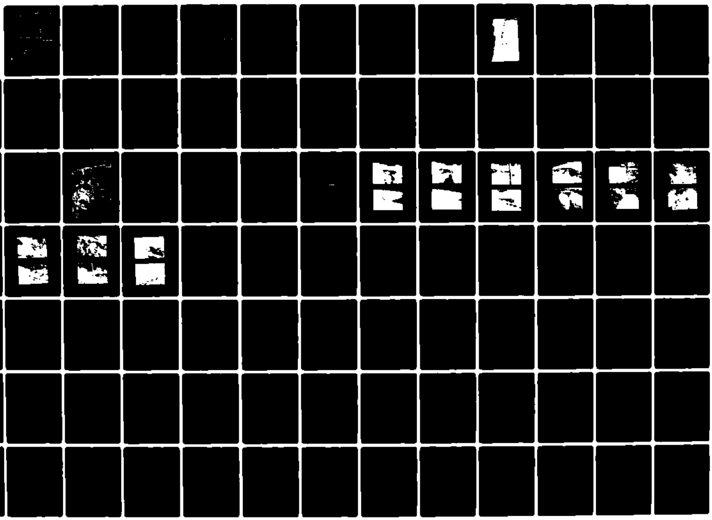
NATIONAL DAM SAFETY PROGRAM. KEHR'S MILL TRAIL LOWER DAM (MO 11--ETC(U)

NOV 80 E R BURTON, H L CALLAHAN DACW43-80-C-0074

UNCLASSIFIED NL

1 OF 2

AD A
106619



AD A106619

LEVEL II

# MISSOURI-KANSAS CITY BASIN

KEHR'S MILL TRAIL LOWER DAM
ST. LOUIS COUNTY, MISSOURI
MO 11277



# PHASE 1 INSPECTION REPORT
# NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District



PREPARED BY: U.S. ARMY ENGINEER DISTRICT. ST. LOUIS

FOR: STATE OF MISSOURI



NOVEMBER 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

# REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

| | |
|---|---|
| 1. REPORT NUMBER / 2. GOVT ACCESSION NO. AD-A106619 | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Kehr's Mill Trail Lower Lake Dam (MO 11277) St. Louis County, Missouri | 5. TYPE OF REPORT & PERIOD COVERED Final Report<br>6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) Black & Veatch, Consulting Engineers | 8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0074 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101 | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101 | 12. REPORT DATE November 1980<br>13. NUMBER OF PAGES Approximately 115 |
| 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) | 15. SECURITY CLASS. (of this report) UNCLASSIFIED<br>15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |

16. DISTRIBUTION STATEMENT (of this Report)

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

DD FORM 1473, 1 JAN 73 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

SECURITY CLASSIFICATION OF THIS PAGE(*When Data Entered*)

# MISSOURI-KANSAS CITY BASIN

| Accession For | |
|---|---|
| NTIS GRA&I | X |
| DTIC TAB | ☐ |
| Unannounced | ☐ |
| Justification | |
| By | |
| Distribution/ | |
| Availability Codes | |
| Dist | Avail and/or Special |
| A | |

**KEHR'S MILL TRAIL LOWER DAM**
**ST. LOUIS COUNTY, MISSOURI**
**MO 11277**

# PHASE 1 INSPECTION REPORT
# NATIONAL DAM SAFETY PROGRAM

Kehr's Mill Trail Lower Dam (MO 11277),
Missouri - Kansas City Basin, St. Louis
County, Missouri. Phase I Inspection Report.

**United States Army**
**Corps of Engineers**
*...Serving the Army*
*...Serving the Nation*

## St. Louis District

Final rept.,

15 DACW43-80-C-0074

10 Edwin R. /Burton Harry L. /Callahan

**PREPARED BY: U.S. ARMY ENGINEER DISTRICT. ST. LOUIS**

**FOR: STATE OF MISSOURI**

11 **NOV[redacted]80**

**DEPARTMENT OF THE ARMY**
ST. LOUIS DISTRICT. CORPS OF ENGINEERS
210 TUCKER BOULEVARD. NORTH
ST. LOUIS. MISSOURI 63101

REPLY TO
ATTENTION OF

SUBJECT: Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of of the Kehr's Mill Trail Lower Dam (MO 11277).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

| | | |
|---|---|---|
| SUBMITTED BY: | SIGNED<br>Chief, Engineering Division | 27 MAY 1981<br>Date |
| APPROVED BY: | SIGNED<br>Colonel, CE, District Engineer | 28 MAY 1981<br>Date |

KEHR'S MILL TRAIL LOWER DAM

ST. LOUIS, MISSOURI

MISSOURI INVENTORY NO. 11277

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

NOVEMBER 1980

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

| | |
|---|---|
| Name of Dam | Kehr's Mill Trail Lower Dam |
| State Located | Missouri |
| County Located | St. Louis County |
| Stream | Tributary of Caulks Creek |
| Date of Inspection | 19 November 1980 |

Kehr's Mill Trail Lower Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and were developed with the help of several Federal and state agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers, failure would threaten lives and property. The estimated damage zone extends approximately two miles downstream of the dam. Within the estimated damage zone are three dwellings and a road bridge. Contents of the estimated downstream damage zone were verified by the inspection team.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will not pass the probable maximum flood without overtopping but will pass 10 percent of the probable maximum flood. The spillway will not pass the flood which has a one percent chance of occurrence in any given year (100-year flood) but will pass the flood which has a ten percent chance of occurrence in any given year (10-year flood). The spillway design flood recommended by the guidelines is 50 to 100 percent of the probable maximum flood. Considering the damage zone, the spillway design flood should be 50 percent of the probable maximum flood. The probable maximum flood is defined as the flood discharge which may be expected from the most severe combination of critical meteorologic and hydrologic conditions which are reasonably possible in the region.

Based on visual observations, this dam appears to be in somewhat less than satisfactory condition. Deficiencies visually observed by the inspection team were the areas of seepage on the right and left abutments and at the right side of the spillway, erosion on the upstream and downstream slopes and at the right abutment, uncut weeds and trees on the downstream slope, an animal burrow on the upstream slope, and the possible slide area near the spillway. Seepage and stability analyses required by the guidelines were not available.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. In addition, detailed seepage and stability analyses of the existing dam, as required by the guidelines, should be performed. A detailed report discussing each of these deficiencies is attached.

Edwin R Burton

Edwin R. Burton, PE
Missouri E-10137

Harry L Callahan

Harry L. Callahan, Partner
Black & Veatch

OVERVIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
KEHR'S MILL TRAIL LOWER DAM

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF PLATES



LIST OF PHOTOGRAPHS

TABLE OF CONTENTS (Cont'd)

LIST OF PHOTOGRAPHS

## SECTION 1 - PROJECT INFORMATION

### 1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of the Kehr's Mill Trail Lower Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

### 1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in the valley of a tributary to Caulks Creek (Plate 1). The watershed is an area of low hills with fairly steep rugged terrain consisting of about 80 percent timber and 20 percent large lot residential development. The dam is approximately 475 feet long along the curved alignment of the crest and is 37 feet high. The dam crest is 59 feet wide and has a 21-foot wide asphalt road along its center. The upstream face of the dam slopes uniformly from the crest to the water surface of the lake. The downstream face of the dam has a nonuniform slope from the crest to the valley below.

(2) The spillway consists of twin 36-inch corrugated metal pipes with beveled ends installed through the embankment. The beveled inlet and outlet ends of the pipes are encased in unformed poured concrete (Photos 7, 8 & 9). Flow through the pipes will discharge onto a 19-foot wide concrete chute. The chute is placed on the downstream face of the dam and is constructed of unformed concrete poured over limestone riprap. The chute has a slightly concave cross section (Photo 10). There is no emergency spillway for this dam.

(3) One 12-inch polyvinyl chloride drain pipe and valve has been installed through the embankment. This pipe and valve was reported by Dick Manlin of the Charles Liebert Construction Company, but was not observed.

(4) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in western St. Louis County, Missouri, as indicated on Plate 1. The lake formed by the dam is in an area shown on the United States Geological Survey 7.5 minute series quadrangle map for Chesterfield, Missouri, 1,700 feet east and 1,300 feet north of the southwest corner of Survey #886 in Township 45N, Range 04E.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the small size category. A small size dam is classified as having a height less than 40 feet, but greater than or equal to 25 feet and/or a storage capacity less than 1,000 acre-feet, but greater than or equal to 50 acre-feet.

d. Hazard Classification. The hazard classification assigned by the Corps of Engineers for this dam is as follows: The Kehr's Mill Trail Lower Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, agricultural, industrial and commercial facilities, and to important public utilities, main highways, or railroads. For the Kehr's Mill Trail Lower Dam the estimated flood damage zone extends approximately two miles downstream of the dam. Within the estimated damage zone are three dwellings and a road bridge. Contents of the estimated downstream damage zone were verified by the inspection team.

e. Ownership. The dam is owned by the Kehr's Mill Trail Homes Association, c/o Mr. Warren Rusgis, 1607 Broken Reins Court, Chesterfield, Missouri 63017.

f. Purpose of Dam. The dam forms an 18-acre lake used for recreation within a residential subdivision.

g. Design and Construction History. The Charles Liebert Construction Company is the developer for the Kehr's Mill Trail subdevelopment according to Dick Manlin of that firm. The dam was constructed in 1976 by the J.H. Berra Construction Company. Brucker and Associates and the Mueller Engineering and Surveying Company were involved in the design of the dam.

h. Normal Operating Procedure. Under normal operation, rainfall, runoff, transpiration, evaporation, seepage losses, and overflow through the uncontrolled spillway all combine to maintain a relatively stable water surface elevation. Dick Manlin stated that there is also a valved drain pipe.

1.3 PERTINENT DATA

a. Drainage Area - 584 acres (including 510 acres upstream of the Kehr's Mill Trail Upper Dam).

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through a twin 36-inch corrugated metal pipe spillway that discharges to a concrete chute constructed on the downstream slope of the embankment. The chute discharges into a natural channel to the stream below.

(2) Estimated experienced maximum flood at damsite - Unknown. Mr. Dick Manlin of the Charles Liebert Construction Company stated that the maximum water surface has reached 3/4 pipe full. This is equivalent to elevation 507.2 m.s.l.

(3) Estimated ungated spillway capacity at maximum pool elevation - 140 cfs (50 Percent Probable Maximum Flood Pool El. 512.6).

c. Elevation (Feet above m.s.l.) Approximate elevations based on estimated tie to USGS Contour map.

(1) Top of dam - 509.6 (see Plate 3)

(2) Spillway pipe inlet invert - 504.9

(3) Spillway pipe outlet invert - 503.5

(4) Streambed at toe of dam - 473.0 ±

(5) Maximum tailwater - Unknown.

d. Reservoir.

(1) Length of maximum pool - 2,100 feet ± (50 Percent probable maximum flood pool level)

(2) Length of normal pool - 2,100 feet ± (Spillway pipe inlet invert)

e. Storage (Acre-feet).

(1) Top of dam - 342

(2) Spillway pipe inlet invert - 255

(3) Design surcharge - Not available.

f. Reservoir Surface (Acres).

(1) Top of dam - 19.6

(2) Spillway pipe inlet invert - 17.7

g. Dam.

(1) Type - Earth embankment.

(2) Length - 475 feet ±

(3) Height - 37 feet ±

(4) Top width - 59 feet

(5) Side slopes - upstream face 1.0 V on 4.4 H, downstream face varies between 1.0 V on 2.7 H and 1.0 V on 6.5 H (see Plate 4).

(6) Zoning - Unknown.

(7) Impervious core - Unknown.

(8) Cutoff - Unknown.

(9) Grout curtain - Unknown.

h. Diversion and Regulating Tunnel - None.

i. Spillway.

(1) Type - Uncontrolled, twin 36-inch corrugated metal pipes through the embankment with discharge to a 19-foot wide concrete chute on the downstream slope of the dam.

(2) Pipe inlet invert elevation - 504.9 feet m.s.l.

(3) Pipe outlet invert elevation - 503.5 m.s.l.

(4) Downstream end chute invert elevation - 484.8 m.s.l.

(5) Gates - None.

(6) Upstream channel - The Kehr's Mill Trail Upper Dam lies at the upstream end of the lake.

(7) Downstream channel - Eroded open channel below spillway chute to natural stream.

j. Emergency Spillway - None.

k. Valved Outlet - Dick Manlin of the Charles Liebert Construction Company stated that there is a 12-inch polyvinyl chloride drain pipe and valve. They were not observed by the inspection team.

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

A geologic investigation of the dam site was conducted by the Geology and Land Survey section of the Missouri Department of National Resources. Recommendations resulting from this investigation are presented in an engineering geologic report, Appendix B. A subsurface exploration and soils testing program was carried out by Brucker & Associates, Soils Engineers. Recommendations and boring logs are presented in a report of this exploration work, Appendix C. The dam design and hydrologic analyses were prepared by Mueller Engineering & Surveying Co. No design information was made available.

### 2.2 CONSTRUCTION

The dam was constructed by the J.H. Berra Construction Company in 1976. Construction records were unavailable.

### 2.3 OPERATION

Operational records and documentation of past floods were unavailable. Mr. Dick Manlin of the Charles Liebert Construction Company stated that the dam has never been overtopped. He said that he observed the maximum discharge to be about 3/4 pipe full, elevation 507.2 m.s.l., during the two largest storms since the dam was completed.

### 2.4 GEOLOGY

The site of the dam and reserovir is located in a steep-sided valley. The dam impounds a small, intermittent stream tributary to Caulks Creek.

Published information was not available on the soils in the area of the dam and reservoir. However, the engineering geology report mentioned above indicates that the soils consist of silty clay and clayey silt. The soils developed in residuum and colluvium according to the report.

The engineering geology report indicates that the bedrock consists of limestone of the Burlington formation of the Osage Series of the Mississipian system. The limestone is deeply weathered with extensive solutioning along vertical joints and bedding planes. Numerous outcrops of limestone are present in the valley walls. One spring was observed approximately 200 feet downstream of the dam on the left side of the valley. Left and right are used herein to provide directional reference while looking downstream.

The boring logs performed by Brucker & Associates indicate that the subsurface materials consist of alluvial silt of low plasticity (ML) overlying residual, highly-plastic clay with rock fragments (CH). Water was encountered in the borings approximately 8 to 12 feet below the surface in the vicinity of the dam. Limestone bedrock was encountered approximately 35 feet beneath the surface.

## 2.5 EVALUATION

a. Availability. No engineering design data were made available. A geologic report and a soils report were made available and are appended to this report.

b. Adequacy. No engineering design data were made available. Thus, an assessment of the design, construction, and operation could not be made. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. The validity of the design, construction, and operation could not be determined because engineering design data were not made available.

## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

a. General. A visual inspection of the Kehr's Mill Trail Lower Dam was made on 19 November 1980. The Black & Veatch inspection team consisted of Edwin Burton, team leader; Robert Pinker, geologist; Gary Van Riessen, geotechnical engineer; and John Ruhl, civil engineer. The dam appeard to be in somewhat less than satisfactory condition. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following conditions at the dam. The dam embankment appeared to be in satisfactory condition. The embankment has a wide crest and reasonable upstream and downstream slopes. The downstream slope of the embankment was nonuniform. The irregularities resulted from material (soil and broken asphalt) placed on the embankment in the area left of the spillway. Erosion on the downstream slope below the added material and erosion or repairs of the crest (Photos 15 & 19) suggest the possibility of the dam having been overtopped. A slope failure or slide on the downstream face near the center of the dam has possibly occurred as evidenced by a power pole and some older trees leaning up slope while the smaller trees were leaning down slope (Photo 18). No sinks or cracks in the embankment were observed. Areas of minor erosion on the upstream face due to local runoff and wave action were observed. Erosion on the right abutment was due to surface runoff. The material being eroded is a silty clay (CL). Evidence of nonflowing seepage was observed at the right abutment (Photo 16) and to the right of the spillway. Water was evident at the latter area. A spring was observed downstream of the dam near the left abutment. No toe drains or relief wells were observed. The upstream face of the dam has no riprap except near the left abutment but does have a fairly good grass cover for erosion protection. The downstream side of the crest and the downstream face have a poor grass and uncut weed cover. There were several small trees (1 to 4-inch) growing on the downstream embankment face. One small animal burrow was observed.

c. Appurtenant Structures. The only appurtenant structure observed was the twin pipe spillway and concrete chute. The pipes appeared to be in good condition. The inlet and outlet ends of the pipe were observed and the pipe interiors and alignment were observed from both ends (Photos 8 & 9). The observed pipe joints appeared to be tight without movement and without leakage into or out of the pipes. There was no visible distortion of the pipes or their alignment. Repairs to the concrete chute had been made recently by pouring additional concrete over part of the existing chute. There was some loose rock and debris in the pipes and on the chute but it should not obstruct flow through the spillway. The lake level at the time of the inspection was about 6 inches below the spillway inlet. There was no development in the spillway area which would suffer damage due to flow through the spillway.

d. Geology. The soils in the area of the dam and reservoir consist of silt and clay. The soils are developed in loess, colluvium and residuum. The soils are classified for engineering purposes as clayey silt (ML) and silty clay (CL) of low plasticity. Samples of the embankment were taken near the center of the downstream crest. The samples were visually classified as silty clay of low plasticity. Based on these samples, it is surmised that the embankment consists of silty clay material of low plasticity (CL).

Two outcrops were observed along the hill to the left of the left abutment. The outcrop consisted of three to four feet of medium to thin-bedded gray limestone (Photo 20). Both vertical and 75° joints were present in the limestone. Solutioning had also widened the bedding planes. The joints were open 2-6 inches and were oriented perpendicular to the dam. One area of seepage was observed along the toe of the embankment near the left abutment. It is believed that this seepage is from the spring described in the engineering geologic report.

e. Reservoir Area. No slumping or slides of the reservoir banks were observed. The area around the lake consisted of low, wooded hills with steep slopes to the lake. Runoff from the area enters the lake through poorly defined multiple channels. The lake was clear to a depth of approximately 18 inches with only a minor amount of siltation. The Upper Kehr's Mill Trail Dam (No. 11636) crosses the valley at the upper end of the lake.

f. Downstream Channel. The spillway discharges to an irregular natural channel lined by a thick growth of trees and brush.

3.2 EVALUATION

The various deficiencies observed at the time of the inspection are not believed to represent an immediate safety hazard. They do, however, warrant monitoring and control.

It is the belief of the inspection team that the additional material placed on the downstream slope was repair work from erosion due to overtopping. The potential for future overtopping is discussed in Section 5 of this report.

Speculation by the inspection team that a slide had occurred on the downstream slope is based only on the observation that the power pole and older trees appeared to be leaning. Additional evidence may have been hidden by the dense growth of weeds or by the repair work. This area should be monitored for new signs of instability.

The growth of trees and brush and the uncut grass on the downstream face of the dam, if allowed to go unchecked, could cause deterioration of the embankment. The roots of trees can loosen the embankment material and also can leave voids through which water can pass. Brush and weeds on the dam prevent inspection of the embankment and kill the smaller grasses whose roots are more effective in protecting the surface soil of the slope from erosion. The brush and tall uncut weeds provide habitat for burrowing animals which can damage the embankment.

The areas of seepage which were observed should be monitored regularly for quality and quantity. Seepage can cause internal erosion creating cavities and underground channels, thereby weakening the embankment and/or abutments.

The erosion on the upstream and downstream faces of the embankment and on the right abutment should be repaired and a suitable ground cover should be established for erosion protection. Riprap protection should be provided to reduce the potential for wave induced erosion.

Burrowing animals will continue to damage the embankment if a program is not undertaken to eliminate them. Piping failure of embankments has resulted from damage caused by burrowing animals.

# SECTION 4 - OPERATIONAL PROCEDURES

## 4.1 PROCEDURES

The pool is primarily controlled by rainfall, runoff, evaporation, transpiration, seepage losses, and capacity of the uncontrolled spillway. Dick Manlin stated that there is also a valved drain pipe.

## 4.2 MAINTENANCE OF DAM

Some maintenance was evident from the repairs to the downstream face, the spillway chute, and the pavement on the crest. Grass on the upstream face had been mowed.

## 4.3 MAINTENANCE OF OPERATING FACILITIES

The inspection team is not aware of any maintenance to the drain pipe and valve.

## 4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no existing warning system or preplanned scheme for alerting downstream residents for this dam.

## 4.5 EVALUATION

A maintenance program should be implemented to include cutting of weeds and grass on the downstream face of the dam, removal of trees and control of burrowing animals.

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

a. Design Data. No design data were made available.

b. Experience Data. The drainage area and lake surface area are developed from the USGS Chesterfield, Missouri quadrangle map. The dam layout is from a survey made during the inspection.

c. Visual Observations.

(1) The spillway appears to be in good condition. The lake level at the time of the inspection (El. 504.4) was below the spillway pipe inlet invert. There was an accumulation of debris at the pipe inlet (Photos 7 & 8) and trees were beginning to develop at the outlet (Photos 9 & 10) which could reduce the capacity of the spillway pipes. The channel downstream of the spillway was grown up with trees and brush but should not effect the capacity of the spillway.

(2) There is no emergency spillway for this dam.

(3) Spillway discharges do not endanger the integrity of the dam.

d. Overtopping Potential. Hydraulic routing of storms included routing through one upstream structure. The spillway will not pass the probable maximum flood without overtopping the dam. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway will pass 10 percent of the probable maximum flood without overtopping the dam. The spillway will not pass the one percent chance flood (100-year flood) estimated to have a peak outflow of 1,980 cfs developed by a 24-hour, one percent chance rainfall. The spillway will pass the ten percent chance flood (10-year flood) estimated to have a peak outflow of 40 cfs developed by a 24-hour, ten percent chance rainfall. According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of small size should pass 50 to 100 percent of the probable maximum flood. Considering the damage zone the appropriate spillway design flood should be 50 percent of the probable maximum flood. The portion of the estimated peak discharge of 50 percent of the probable maximum flood overtopping the dam would be 2,870 cfs of the total discharge from the reservoir of 3,010 cfs. The estimated duration of overtopping is 9.6 hours with a maximum height of 3.0 feet. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 3,620 cfs of the total discharge from the reservoir of 3,760 cfs. The estimated duration of overtopping is 12.2 hours with a maximum height of 3.3 feet. The embankment could be jeopardized should overtopping occur for these periods of time.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately two miles downstream of the dam. Three dwellings and a road bridge could be severely damaged and lives could be lost should failure of the dam occur. Contents of the estimated downstream damage zone were verified by the inspection team. Flood plain regulations under the National Flood Insurance Program restrict development in the flood plain of Caulks Creek which is immediately downstream of the dam. Caulks Creek has been designated as a flood insurance zone A6 in this area.

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. *Design and Construction Data*. No design data relating to the structural stability of the dam were found. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Operating Records. No operational records were available.

d. Postconstruction Changes. As noted in paragraph 3.1b, repairs to the dam may have been made subsequent to overtopping. Mr. Dick Manlin of the Charles Liebert Construction Company stated that additional fill material was placed on the downstream face to repair erosion caused by water from the spillway pipe overshooting the spillway chute. His company repaired the slope and extended the riprap and grouting below the pipes. He also stated that the repair work to the road across the crest of the dam was part of a pavement repair program throughout the residential subdivision.

e. Seismic Stability. The dam is located in Seismic Zone 2 which is a zone of moderate seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone. The seismic stability of an earth dam is dependent upon a number of factors: embankment and foundation material classifications and shear strengths; abutment materials, conditions, and strengths; embankment zoning; and embankment geometry. Adequate descriptions of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analysis required by the guidelines.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several conditions observed during the visual inspection by the inspection team should be monitored and/or controlled. These are the areas of seepage on the right and left abutments and at the right side of the spillway, erosion on the upstream and downstream slopes and at the right abutment, uncut weeds and trees on the downstream slope, an animal burrow on the upstream slope, and the possible slide area near the spillway. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

b. Adequacy of Information. Due to the unavailability of engineering design data, the conclusions in this report were based only on performance history, visual conditions, and the geologic and soils reports. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. It is the opinion of the inspection team that a program should be developed as soon as possible to implement remedial measures recommended in paragraph 7.2b. If the safety deficiencies listed in paragraph 7.1a are not corrected, they will continue to deteriorate and lead to a serious potential of failure. The item recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam nor does it identify any serious dangers which would require a Phase II investigation. However, the additional analyses noted in paragraph 2.5b are necessary for compliance with the guidelines.

e. Seismic Stability. This dam is located in Seismic Zone 2. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the recommended stability analysis.

7.2 REMEDIAL MEASURES

a. Alternatives. The spillway size and/or storage volume would need to be increased or the lake level would need to be permanently lowered to increase available flood storage in order to effectively pass the recommended spillway design flood. Spillway capacity could be increased by increasing the spillway pipe size and/or by providing an emergency spillway. The storage volume could be increased by raising the low areas of the dam crest.

b. Operation and Maintenance Procedures. The following operation and maintenance procedures are recommended and should be carried out under the direction of a professional engineer experienced in the design, construction, and maintenance of earth dams.

(1) The area of suspected sliding on the downstream slope of the dam should be monitored for signs of additional sliding.

(2) The seepage areas noted during the visual inspection should be closely monitored and documented as to quantity and quality of flow. Any significant changes should be evaluated.

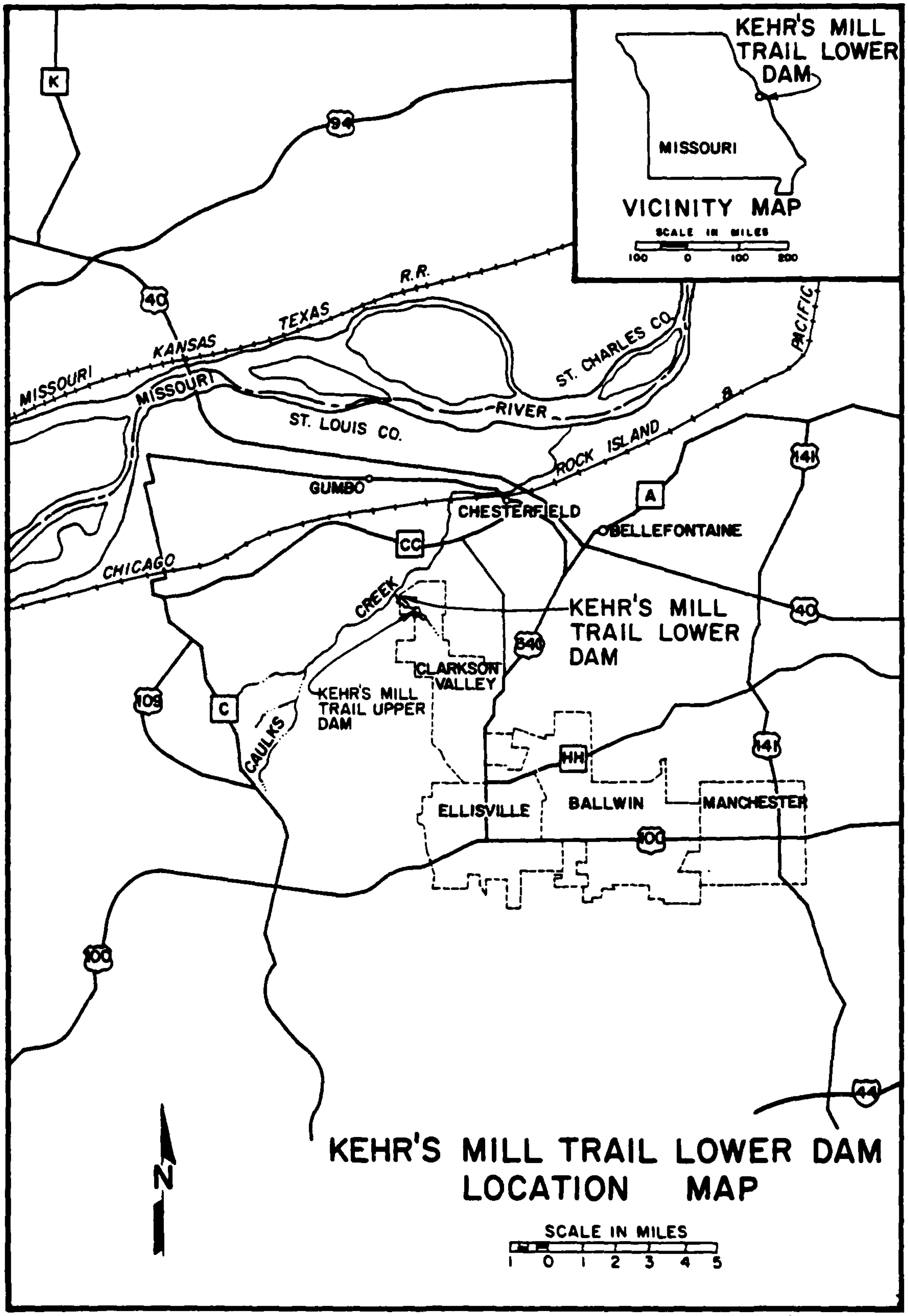
(3) An improved maintenance program to remove and control the growth of brush and trees on the embankment should be developed. Grass/weed cover on the embankment should be cut periodically.

(4) The areas of erosion discussed in paragraph 3.1b should be backfilled with suitable material and compacted. Suitable erosion protection should be developed. Riprap should be placed on the upstream face of the dam to an elevation above normal lake level.

(5) The animal burrow in the embankment should be repaired. Control measures should be implemented to discourage increased animal activity in the area.

(6) Seepage and stability analyses should be performed.

(7) A detailed inspection of the dam should be made periodically. This inspection should include measurement of seepage flows and analyzing water samples taken from the seeps and lake. More frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increase.




KEHR'S MILL TRAIL LOWER DAM
LOCATION MAP

PLATE I

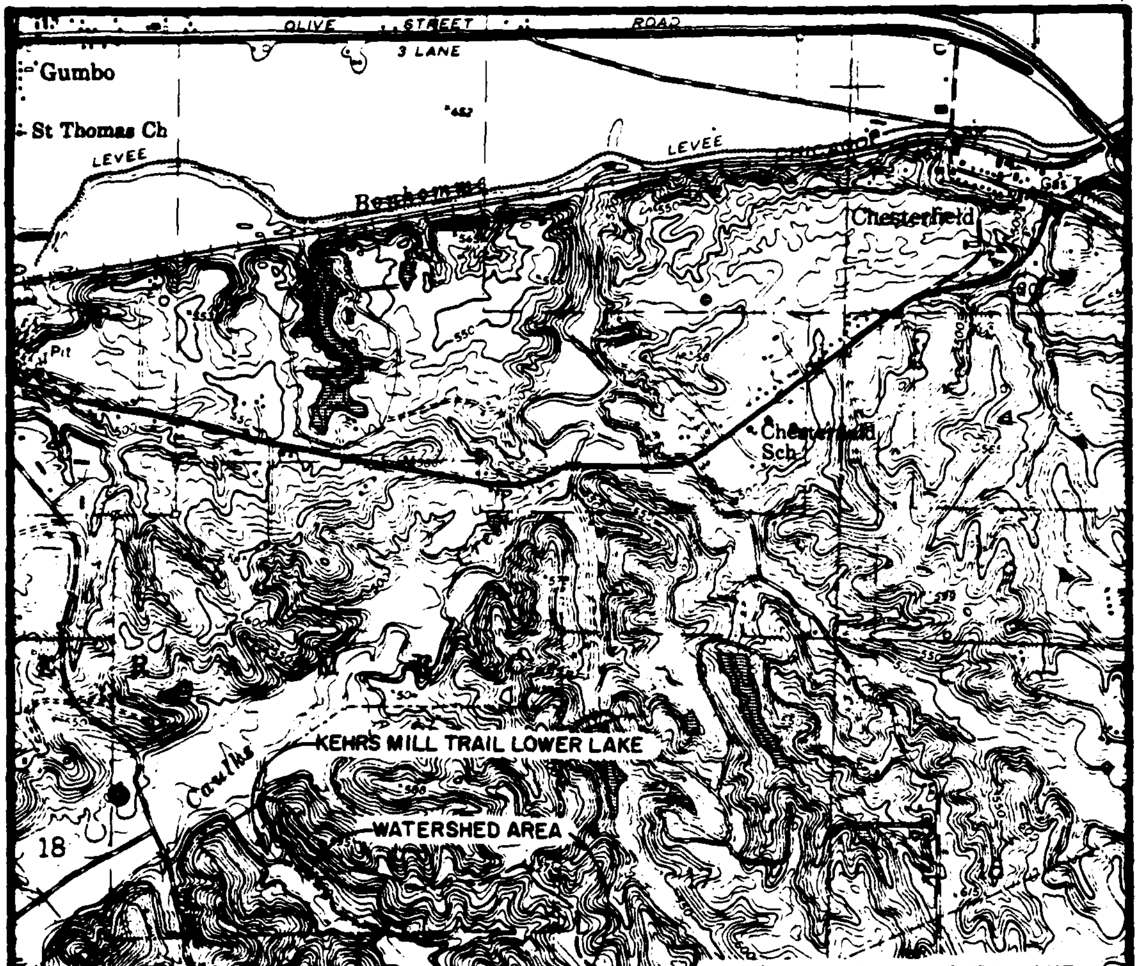
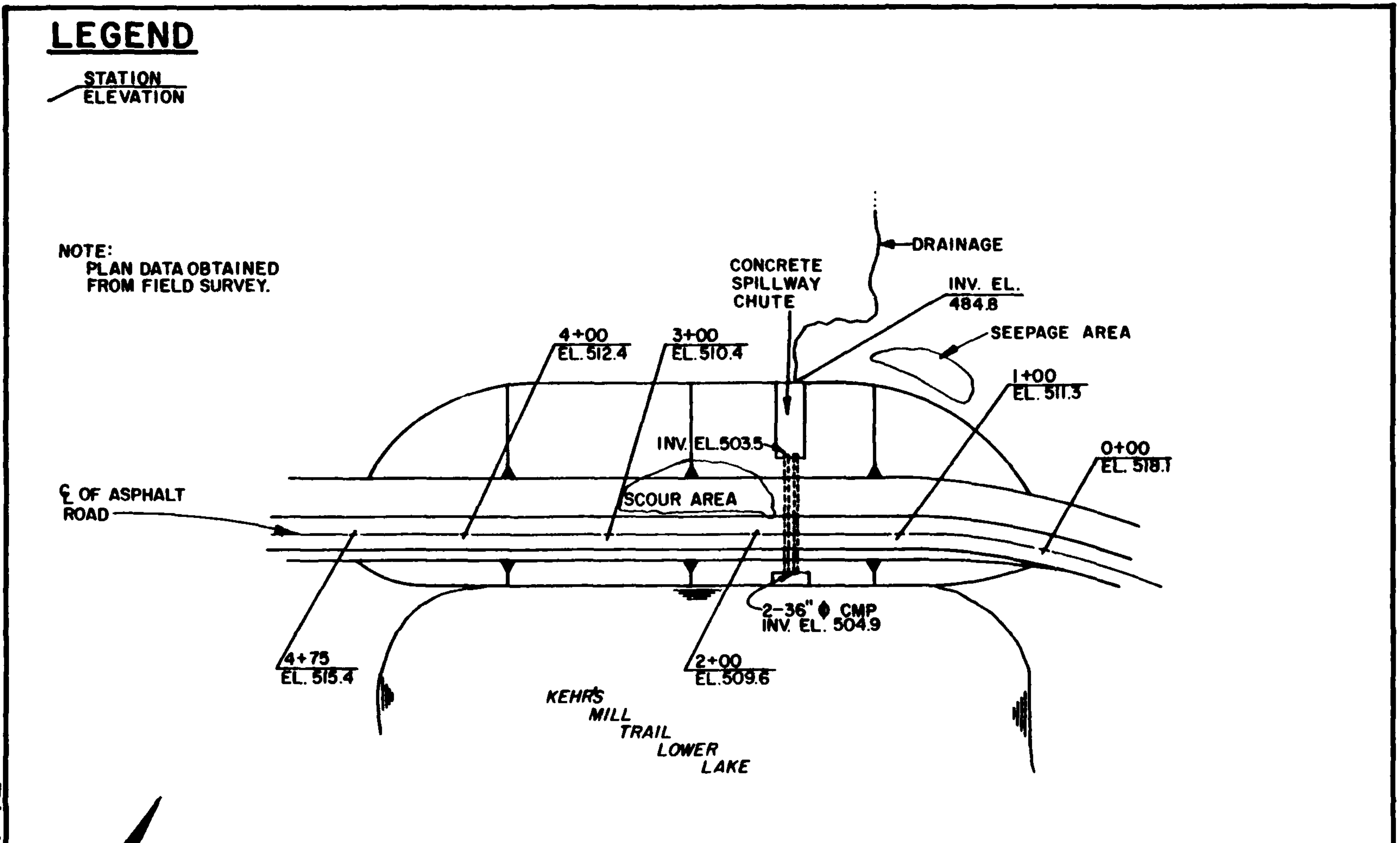
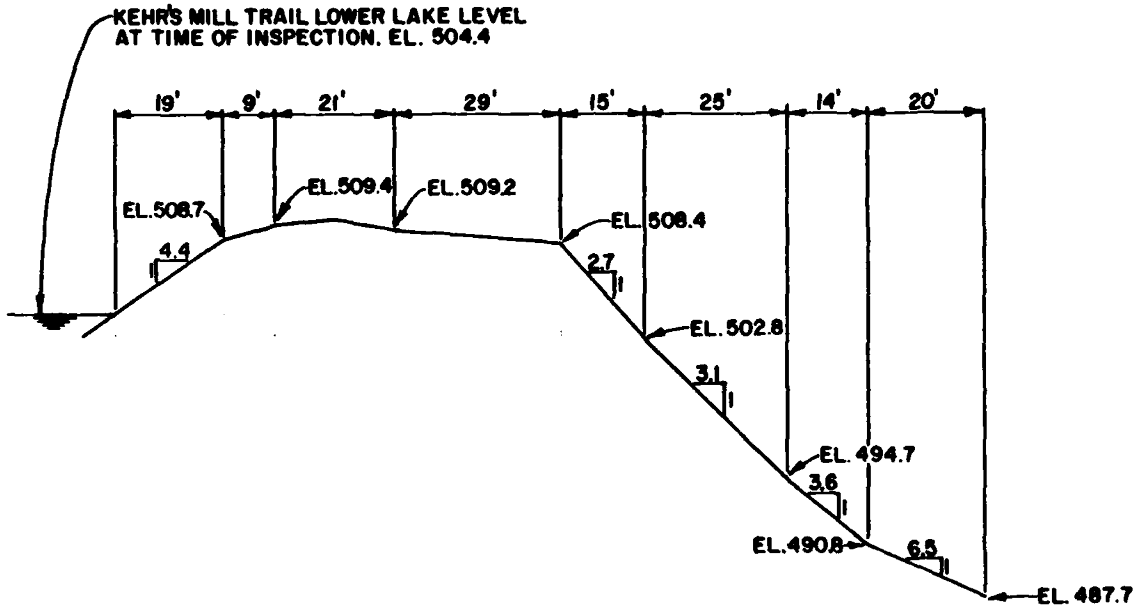

OLIVE STREET ROAD
3 LANE
Gumbo
St Thomas Ch
LEVEE
LEVEE
Chesterfield
KEHR'S MILL TRAIL LOWER LAKE
WATERSHED AREA
KEHR'S MILL TRAIL UPPER LAKE
(MO. 11636)
18
21
KEHR'S MILL TRAIL LOWER DAM
VICINITY TOPOGRAPHY
N
SCALE IN FEET
2000 1000 0 2000 4000

PLATE 2




KEHR'S MILL TRAIL LOWER DAM
DAM PLAN

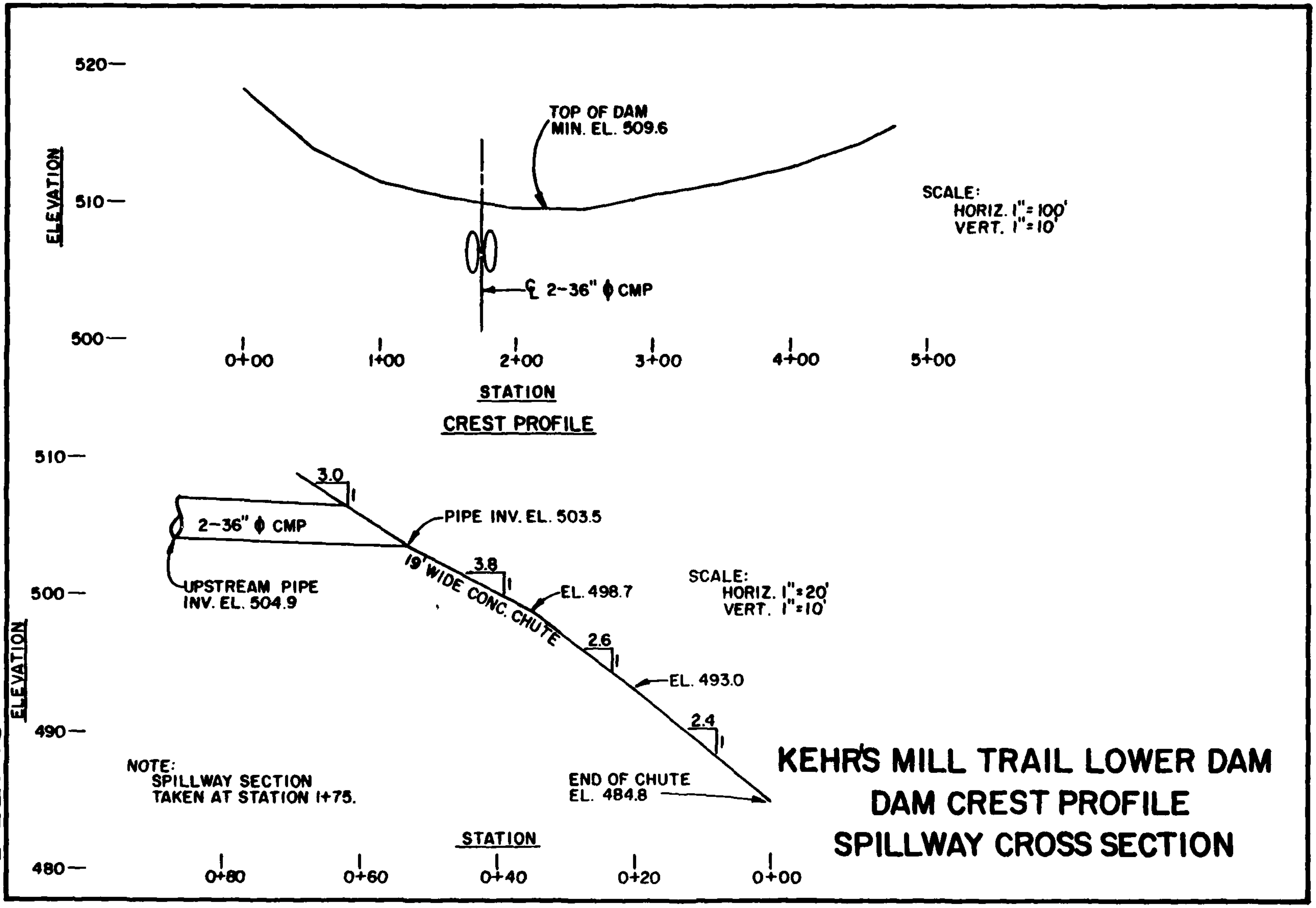
PLATE 3




NOTE:
CROSS SECTION TAKEN
AT STATION 2+50.

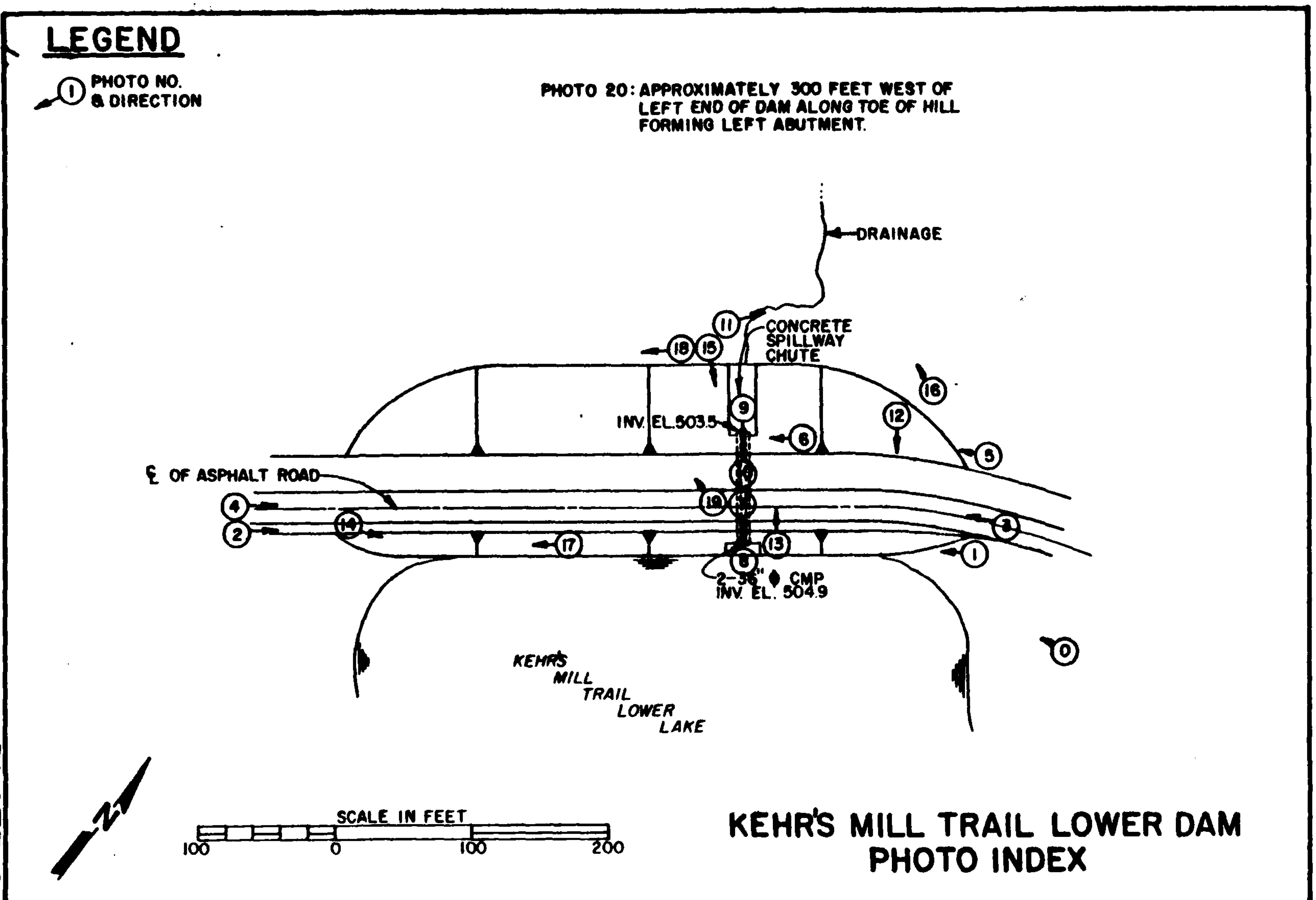
SCALE:
HORIZ. 1" = 30'
VERT. 1" = 10'

# KEHR'S MILL TRAIL LOWER DAM
## DAM CROSS SECTION



520
510
500
ELEVATION
TOP OF DAM
MIN. EL. 509.6
2-36" ϕ CMP
SCALE:
HORIZ. 1" = 100'
VERT. 1" = 10'
0+00
1+00
2+00
3+00
4+00
5+00
STATION
CREST PROFILE
510
500
490
480
ELEVATION
3.0
1
2-36" ϕ CMP
PIPE INV. EL. 503.5
3.8
1
UPSTREAM PIPE
INV. EL. 504.9
19' WIDE CONC. CHUTE
EL. 498.7
SCALE:
HORIZ. 1" = 20'
VERT. 1" = 10'
2.6
1
EL. 493.0
2.4
1
NOTE:
SPILLWAY SECTION
TAKEN AT STATION 1+75.
END OF CHUTE
EL. 484.8
STATION
0+80
0+60
0+40
0+20
0+00
KEHR'S MILL TRAIL LOWER DAM
DAM CREST PROFILE
SPILLWAY CROSS SECTION


PLATE 5




## KEHR'S MILL TRAIL LOWER DAM PHOTO INDEX

PHOTO 1: UPSTREAM FACE OF DAM LOOKING WEST

PHOTO 2: UPSTREAM FACE OF DAM LOOKING EAST

PHOTO 3: CREST OF DAM LOOKING WEST

PHOTO 4: CREST OF DAM LOOKING EAST

PHOTO 5: DOWNSTREAM FACE OF DAM LOOKING WEST

PHOTO 6: DOWNSTREAM FACE OF DAM LOOKING WEST
FROM NEAR SPILLWAY

PHOTO 7: SPILLWAY INLET LOOKING UPSTREAM

PHOTO 8: INLET TO SPILLWAY PIPES

PHOTO 9: OUTLET TO SPILLWAY PIPES

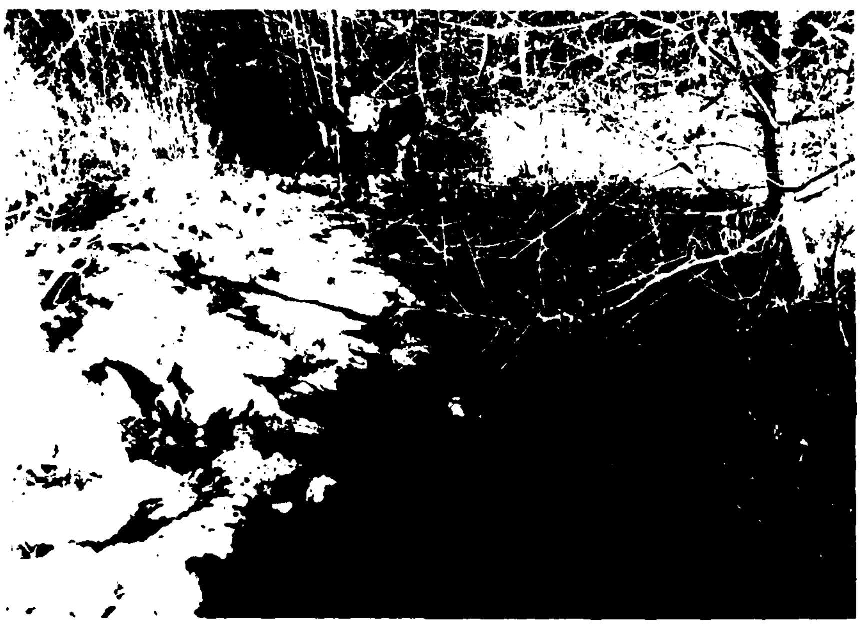


PHOTO 10: CONCRETE CHUTE DOWNSTREAM OF SPILLWAY PIPES

PHOTO 11: CHANNEL BELOW SPILLWAY CHUTE

PHOTO 12: EROSION ON RIGHT ABUTMENT

PHOTO 11: *CHANNEL BELOW SPILLWAY CHUTE*

PHOTO 12: EROSION ON RIGHT ABUTMENT

PHOTO 13: EROSION ON UPSTREAM FACE OF DAM

PHOTO 14: RIPRAP AT UPSTREAM EMBANKMENT-ABUTMENT INTERFACE

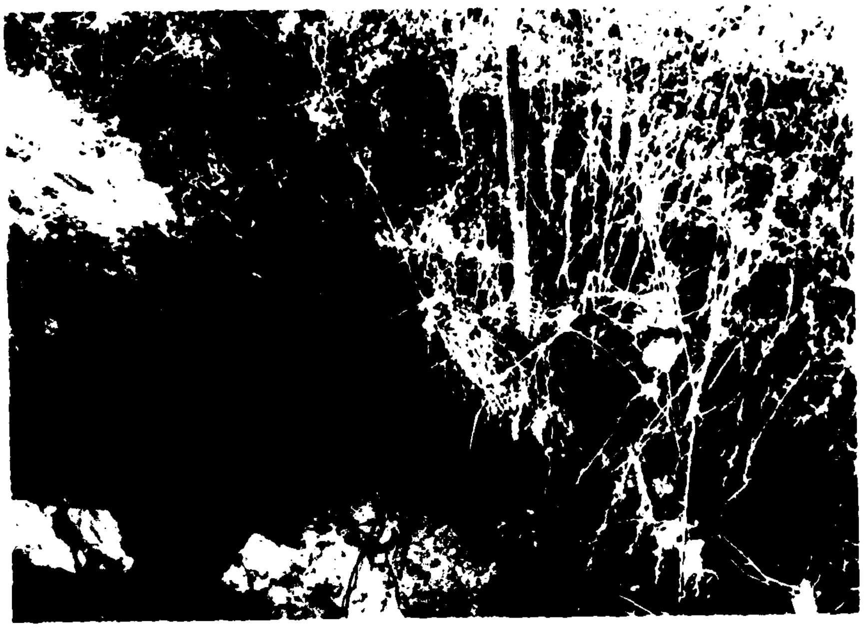


PHOTO 15: EROSION ON DOWNSTREAM FACE LEFT OF SPILLWAY CHUTE

PHOTO 16: POSSIBLE SEEPAGE AREA

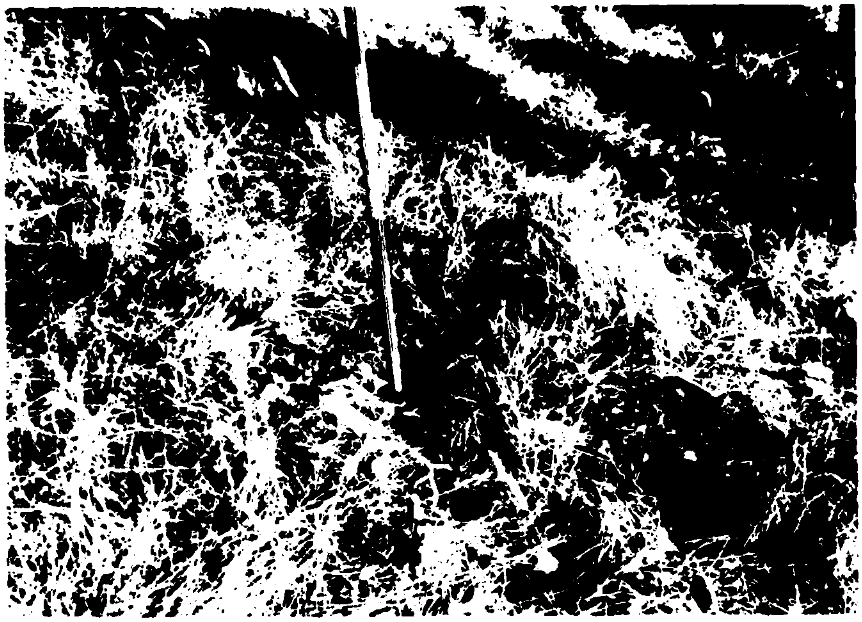


PHOTO 17: ANIMAL BURROW ON UPSTREAM FACE OF DAM

PHOTO 18: POSSIBLE SLIDE AREA ON DOWNSTREAM FACE OF DAM

PHOTO 19: CREST REPAIRS AT POSSIBLE OVERTOPPING AREA

PHOTO 20: ROCK OUTCROP AT LEFT ABUTMENT

# APPENDIX A

# HYDROLOGIC AND HYDRAULIC ANALYSES

## HYDROLOGIC AND HYDRAULIC ANALYSES

To determine the overtopping potential, flood routings were performed by applying the Probable Maximum Precipitation (PMP) to a synthetic unit hydrograph to develop the inflow hydrographs for the Kehr's Mill Trail Lower Dam and the upstream reservoir. The inflow hydrographs were then routed through the reservoirs and spillways. The overtopping analysis was determined using the computer program HEC-1 (Dam Safety Version) (1).

The PMP was determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33" (HMR-33) (2). Reduction factors were not applied. The rainfall distribution for the 24-hour PMP storm was determined according to the procedures outlined in HMR-33 and EM 1110-2-1411 (3). The St. Louis, Missouri rainfall distribution (5 min. interval - 24 hours duration), as provided by the St. Louis District, Corp of Engineers, was used when the one percent chance and ten percent chance probability floods were routed through both reservoirs and spillways.

The synthetic unit hydrograph for each watershed was developed by the computer program using the Soil Conservation Service (SCS) method (1 and 4). The parameters for the unit hydrograph are shown in Table 1. The time of concentration (Tc) was computed using the SCS method and verified by using the Kirpich method.

The SCS curve number (CN) method was used in computing the infiltration losses for the rainfall-runoff relationship. The CN values used, and the result from the computer output, are shown in Table 2.

The reservoir routing was performed using the modified Puls method. The initial reservoir pool elevations for the routing of each storm were determined to be equivalent to the inlet invert elevations of the spillways in accordance with antecedent storm conditions AMC II preceding the one percent and ten percent probability storms and AMC III conditions preceding the probable maximum storms as outlined by the U.S. Army Corps of Engineers, St. Louis District (5). The hydraulic capacity of the spillways and the storage capacities of the reservoirs were defined by the elevation, surface area, storage, and discharge relationships shown in Table 3.

The rating curve for the spillways are shown in Table 4. The flow over the crest of each dam was determined using the non-level dam crest option ($L and $V cards) of the HEC-1 program. The program assumes critical flow over a broad-crested weir. The flow through the spillways was determined from Hydraulic Charts for the Selection of Highway Culverts (6).

Where routing through the upstream reservoir resulted in overtopping of that structure, a breach analysis was performed using HEC-1. The breaching parameters are noted in Table 5. This structure will be referenced as "Upper Dam" through the remainder of this appendix.

The result of the routing analysis indicates that the spillway under study will pass a flood equivalent to 10 percent of the PMF without overtopping the dam.

A summary of the routing analysis for different ratios of the PMF is shown in Table 6.

The computer input data and a summary of the output data are presented at the back of this appendix.

## TABLE 1

## SYNTHETIC UNIT HYDROGRAPH

| Parameters: | Upper Dam | Lower Dam |
|---|---|---|
| Drainage Area (A) | 510 acres | 584 acres |
| Hydraulic Length of Watercourse ($\ell$) | 7,300 feet | 975 feet |
| Hydrologic Soil Cover Complex Number (CN') | 86 (AMC III)<br>72 (AMC II) | 86 (AMC III)<br>72 (AMC II) |
| Average Watershed Land Slope (Y) | 1.8 % | 13.4% |
| Lag Time ($L_g$) | 0.95 hours (AMC III)<br>1.47 hours (AMC II) | 0.07 hours (AMC III)<br>0.11 hours (AMC II) |
| Time of concentration ($T_c$) | 1.59 hours (AMC III)<br>2.45 hours (AMC II) | 0.9 hours (AMC III)<br>0.18 hours (AMC II) |
| Duration (D) | 12.7 min. (AMC III)<br>19.5 min. (AMC II) | 0.9 min. (AMC III)<br>1.5 min. (AMC II) |

(use 5 minutes in each case so that the durations used for the upper and lower lakes will be the same)

| | Discharge (cfs) | | | |
|---|---|---|---|---|
| | Upper Dam | | Lower Dam | |
| Time (Min.)* | AMC II | AMC III | AMC II | AMC III |
| 0 | 0 | 0 | 0 | 0 |
| 5 | 4 | 10 | 199 | 405 |
| 10 | 9 | 30 | 349 | 319 |
| 15 | 19 | 57 | 180 | 91 |
| 20 | 30 | 91 | 73 | 26 |
| 25 | 43 | 133 | 30 | 8 |
| 30 | 58 | 186 | 12 | 2 |
| 35 | 75 | 248 | 5 | 0 |
| 40 | 96 | 302 | 2 | |
| 45 | 119 | 344 | 0 | |
| 50 | 145 | 372 | | |
| 55 | 171 | 387 | | |
| 60 | 194 | 389 | | |

TABLE 1
(Continued)

| Time (Min.)* | Discharge (cfs) Upper Dam AMC II | AMC III |
|---|---|---|
| 65 | 214 | 386 |
| 70 | 230 | 368 |
| 75 | 242 | 346 |
| 80 | 250 | 321 |
| 85 | 254 | 293 |
| 90 | 255 | 259 |
| 95 | 254 | 220 |
| 100 | 253 | 187 |
| 105 | 244 | 162 |
| 110 | 235 | 141 |
| 115 | 225 | 122 |
| 120 | 215 | 107 |

*From HEC-1 computer output

FORMULAS USED:

$$L_g = \frac{\ell^{0.8} \times (S + 1)^{0.7}}{1,900 \times Y^{0.5}} \qquad (4)$$

$$S = \frac{1000}{CN'} - 10$$

$$T_c = L_g/0.6$$

$$D = 0.133\ T_c$$

TABLE 2

RAINFALL-RUNOFF VALUES

| Selected Storm Event | Storm Duration (Hours) | Rainfall (Inches) | Runoff (Inches) | Loss (Inches) |
|---|---|---|---|---|
| PMP | 24 | 32.74 | 30.86 | 1.88 |
| 50% PMP | 24 | 17.24 | 15.43 | 1.81 |
| 1% Probability | 24 | 6.97 | 3.80 | 3.17 |
| 10% Probability | 24 | 4.90 | 2.12 | 2.78 |

Additional Data:

1) No information on soil associations was available for this watershed.
   100 percent of drainage area assumed to be in hydrologic soil group C.
   20 percent of the land use was large residential lots.
   80 percent of the land use was timberland.
2) SCS Runoff Curve CN = 86 (AMC III) for the PMF.
3) SCS Runoff Curve CN = 72 (AMC II) for the one percent and ten percent probability floods (4 and 7).

TABLE 3

ELEVATION, SURFACE AREA, STORAGE, AND DISCHARGE RELATIONSHIPS

| Elevation (feet-msl) | Lake Surface Area (acres) | Lake Storage (acre-ft) | Spillway Discharge (cfs) |
|---|---|---|---|
| Upper Dam | | | |
| *524.8 | 16.4 | 160 | 0 |
| 527.3 | 18.4 | 203 | 51 |
| **529.8 | 20.4 | 252 | 110 |
| Lower Dam | | | |
| *504.9 | 17.7 | 255 | 0 |
| 507.2 | 18.6 | 297 | 46 |
| **509.6 | 19.6 | 342 | 97 |

*Spillway Pipe Inlet Invert Elevation
**Top of Dam Elevation

The relationships in Table 3 were developed from the Chesterfield, Missouri 7.5 minute quadrangle map and the field measurements.

## TABLE 4

## SPILLWAY RATING CURVE

| Reservoir Elevation (ft-msl) | Spillway Discharge (cfs) |
|---|---|
| Upper Dam | |
| *524.8 | 0 |
| 526.0 | 18 |
| 527.0 | 42 |
| 528.0 | 73 |
| 529.0 | 91 |
| **529.8 | 110 |
| Lower Dam | |
| *504.9 | 0 |
| 506.0 | 16 |
| 507.0 | 39 |
| 508.0 | 72 |
| 509.0 | 88 |
| **509.6 | 97 |

*Spillway Pipe Inlet Invert Elevation
**Top of Dam Elevation

METHOD USED:

Spillway release rates are based on nomographs for a pipe culvert with inlet and outlet control (6).

## TABLE 5

## BREACHING PARAMETERS

| | Upper Dam |
|---|---|
| Bottom Width of Breach (BRWID) | 10 feet |
| Side Slope of Breach (z) (In feet horizontal to 1.0 foot vertical) | 0.5 |
| Elevation of Breach Bottom at Maximum Size of Breach (ELBM) | 510.0 ft. m.s.l. |
| Time for Breach to Develop to Maximum Size (TFAIL) | 1.0 hour |
| Elevation of Water Surface Which Will Cause Dam to Fail (FAILEL) | 529.8 ft. m.s.l. |

## TABLE 6

## RESULTS OF FLOOD ROUTINGS

| Ratio of PMF | Peak Inflow (cfs) | Peak Lake Elevation (ft.-msl) | Total Storage (ac.-ft.) | Peak Outflow (cfs) | Depth of Dam Over Top (ft.) | Duration Overtop of Dam hrs. |
|---|---|---|---|---|---|---|
| - | 0 | *504.9 | 255 | 0 | - | - |
| 0.10 | 213 | 507.8 | 309 | 68 | 0 | 0 |
| 0.50 | 3,724 | 512.6 | 403 | 3,014 | 3.0 | 9.6 |
| 1.00 | 3,794 | 512.9 | 410 | 3,758 | 3.3 | 12.2 |

*Spillway Pipe Inlet Invert Elevation

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
     1          A1MISSOURI DAM INSPECTION PROGRAM
     2          A2ST LOUIS DISTRICT US ARMY CORPS OF ENGINEERS
     3          A3UPPER AND LOWER KEHR'S MILL TRAIL LAKE DAMS
     4          B    288       0       5       0       0       0       0       0       0       0
     5          B1     5
     6          J      1       6       1
     7          J1   .05     .10     .15     .20     .50     1.0
     8          K      0       1                               3       1
     9          K1   UPPER KEHR'S MILL TRAIL LAKE DAM (24 HR. PROBABLE MAXIMUM RUNOFF)
    10          M      1       2     .89                       1
    11          P          25.20     101     120     130
    12          T                                                     -1     -86
    13          W2          0.95
    14          X                      1
    15          K      1       2                                       1
    16          K1   ROUTING THROUGH UPPER KEHR'S MILL TRAIL LAKE DAM
    17          Y                              1       1
    18          Y1     1                                          -524.8      -1
    19          Y4 524.8   526.3   526.8   527.3   527.8   528.8   529.8   530.8   532.8   534.8
    20          Y4 536.8
    21          Y5    0.     22.     36.     52.     70.     86.    110.    126.    144.    164.
    22          Y5  184.
    23          SA    0.     4.2     6.9    12.6    20.6    32.4
    24          SE  499.    510.   514.9    520.    530.    540.
    25          SS 524.8
    26          SD 529.8
    27          SL    0.     73.     95.    207.    275.    328.    380.    417.    535.
    28          SV 529.8   529.9   530.0   530.1   530.3   531.0   531.9   532.5   535.2
    29          SB   10.      .5    510.      1.   524.8   529.8
    30          K      0       3                               3       1
    31          K1   LOWER KEHR'S MILL TRAIL LAKE DAM (24 HR. PROBABLE MAXIMUM RUNOFF)
    32          M      1       2     .11                       1
    33          P          25.20     101     120     130
    34          T                                                     -1     -86
    35          W2           .07
    36          X                      1
    37          K      2       4                                       1
    38          K1   COMBINE HYDROGRAPHS-TOTAL FLOW LOWER DAM (24 HR. PMF)
    39          K      1       5                                       1
    40          K1   ROUTING THROUGH LOWER KEHR'S MILL TRAIL LAKE DAM
    41          Y                              1       1
    42          Y1     1                                          -504.9      -1
    43          Y4 504.9   506.4   506.9   507.4   507.9   508.9   509.9   510.9   512.9   514.9
    44          Y4 516.9
    45          Y5    0.     22.     36.     52.     70.     86.    102.    120.   -140.    160.
    46          Y5  180.
    47          SA    0.     1.6     9.1    15.6    19.8    25.1
    48          SE  474.    480.    490.    500.    510.    520.
    49          SS 504.9
    50          SD 505.6
```

```
51          SL     0.    137.    158.    250.    320.    403.    443.    532.
52          SV  509.6   510.2   510.4   511.3   512.4   514.2   515.4   518.1
53          K      99
```

```
FLOOD HYDROGRAPH PACKAGE - HEC-1

******************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  01 APR 80
******************************
                      MISSOURI DAM INSPECTION PROGRAM
                      ST LOUIS DISTRICT US ARMY CORPS OF ENGINEERS
                      UPPER AND LOWER KEHR'S MILL TRAIL LAKE DAMS

                                      JOB SPECIFICATION
                      NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
                     268       0       5       0       0       0       0       0       0       0
                                           JOPER     NWT   LROPT   TRACE
                                               5       0       0       0

                              MULTI-PLAN ANALYSES TO BE PERFORMED
                                   NPLAN= 1 NRTIO= 6 LRTIO= 1
                        RTIOS=    .05    .10    .15    .20    .50   1.00

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

                                  SUB-AREA RUNOFF COMPUTATION

                     UPPER KEHR'S MILL TRAIL LAKE DAM (24 HR. PROBABLE MAXIMUM RUNOFF)

                              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                  1       0       0       0       0       3       1       0       0

                                          HYDROGRAPH DATA
                     IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                         1       2     .85     .00     .80    1.00    .000       0       0       0

                                            PRECIP DATA
                            SPFE     PMS      R6     R12     R24     R48     R72     R96
                             .00   25.20  101.00  120.00  130.00     .00     .00     .00

                                             LOSS DATA
                   LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                       0     .00     .00    1.00     .00     .00    1.00   -1.00  -86.00     .00     .00

                     CURVE NO =  -86.00  WETNESS =   -1.00  EFFECT CN =   86.00

                                        UNIT HYDROGRAPH DATA
                                     TC=     .00    LAG=    .95

                                           RECESSION DATA
                              STRTQ=     .00   QRCSN=     .00   RTIOR=  1.00

                     UNIT HYDROGRAPH 59 END OF PERIOD ORDINATES, TC=     .00 HOURS, LAG=    .95  VOL= 1.00
                  10.      30.      57.      91.     133.     186.     248.     302.     344.     372.
                 387.     389.     386.     368.     346.     321.     293.     259.     220.     187.
                 162.     141.     122.     107.      95.      83.      73.   [illegible]   [illegible]   [illegible]
                  [illegible]
```

B L A C K & V E A T C H        PROJECT 9166:        DATE 05 FEB 6        PAGE 6

FLOOD HYDROGRAPH PACKAGE - HEC-1        PROGRAM H21/C2-1V   TIME 17:58:42   CASE PMF

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11. | 9. | 8. | 7. | 6. | 5. | 5. | 4. | 4. | 3. | |
| 3. | 3. | 2. | 2. | 1. | 1. | 1. | 0. | 0. | | |

END-OF-PERIOD FLOW

| MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q | MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .01 | .00 | .01 | 0. | 1.01 | 12.05 | 145 | .21 | .20 | .01 | 384. |
| 1.01 | .10 | 2 | .01 | .00 | .01 | 0. | 1.01 | 12.10 | 146 | .21 | .20 | .01 | 389. |
| 1.01 | .15 | 3 | .01 | .00 | .01 | 0. | 1.01 | 12.15 | 147 | .21 | .20 | .01 | 397. |
| 1.01 | .20 | 4 | .01 | .00 | .01 | 0. | 1.01 | 12.20 | 148 | .21 | .20 | .01 | 416. |
| 1.01 | .25 | 5 | .01 | .00 | .01 | 0. | 1.01 | 12.25 | 149 | .21 | .20 | .01 | 429. |
| 1.01 | .30 | 6 | .01 | .00 | .01 | 0. | 1.01 | 12.30 | 150 | .21 | .20 | .01 | 456. |
| 1.01 | .35 | 7 | .01 | .00 | .01 | 0. | 1.01 | 12.35 | 151 | .21 | .20 | .01 | 491. |
| 1.01 | .40 | 8 | .01 | .00 | .01 | 0. | 1.01 | 12.40 | 152 | .21 | .20 | .01 | 534. |
| 1.01 | .45 | 9 | .01 | .00 | .01 | 0. | 1.01 | 12.45 | 153 | .21 | .21 | .01 | 582. |
| 1.01 | .50 | 10 | .01 | .00 | .01 | 0. | 1.01 | 12.50 | 154 | .21 | .21 | .01 | 635. |
| 1.01 | .55 | 11 | .01 | .00 | .01 | 0. | 1.01 | 12.55 | 155 | .21 | .21 | .01 | 689. |
| 1.01 | 1.00 | 12 | .01 | .00 | .01 | 0. | 1.01 | 13.00 | 156 | .21 | .21 | .01 | 745. |
| 1.01 | 1.05 | 13 | .01 | .00 | .01 | 0. | 1.01 | 13.05 | 157 | .25 | .25 | .01 | 800. |
| 1.01 | 1.10 | 14 | .01 | .00 | .01 | 0. | 1.01 | 13.10 | 158 | .25 | .25 | .01 | 854. |
| 1.01 | 1.15 | 15 | .01 | .00 | .01 | 0. | 1.01 | 13.15 | 159 | .25 | .25 | .01 | 906. |
| 1.01 | 1.20 | 16 | .01 | .00 | .01 | 0. | 1.01 | 13.20 | 160 | .25 | .25 | .01 | 955. |
| 1.01 | 1.25 | 17 | .01 | .00 | .01 | 0. | 1.01 | 13.25 | 161 | .25 | .25 | .01 | 1003. |
| 1.01 | 1.30 | 18 | .01 | .00 | .01 | 0. | 1.01 | 13.30 | 162 | .25 | .25 | .01 | 1049. |
| 1.01 | 1.35 | 19 | .01 | .00 | .01 | 0. | 1.01 | 13.35 | 163 | .25 | .25 | .01 | 1091. |
| 1.01 | 1.40 | 20 | .01 | .00 | .01 | 0. | 1.01 | 13.40 | 164 | .25 | .25 | .01 | 1131. |
| 1.01 | 1.45 | 21 | .01 | .00 | .01 | 0. | 1.01 | 13.45 | 165 | .25 | .25 | .00 | 1170. |
| 1.01 | 1.50 | 22 | .01 | .00 | .01 | 0. | 1.01 | 13.50 | 166 | .25 | .25 | .00 | 1207. |
| 1.01 | 1.55 | 23 | .01 | .00 | .01 | 0. | 1.01 | 13.55 | 167 | .25 | .25 | .00 | 1241. |
| 1.01 | 2.00 | 24 | .01 | .00 | .01 | 0. | 1.01 | 14.00 | 168 | .25 | .25 | .00 | 1274. |
| 1.01 | 2.05 | 25 | .01 | .00 | .01 | 0. | 1.01 | 14.05 | 169 | .32 | .31 | .01 | 1306. |
| 1.01 | 2.10 | 26 | .01 | .00 | .01 | 0. | 1.01 | 14.10 | 170 | .32 | .31 | .00 | 1336. |
| 1.01 | 2.15 | 27 | .01 | .00 | .01 | 0. | 1.01 | 14.15 | 171 | .32 | .31 | .00 | 1366. |
| 1.01 | 2.20 | 28 | .01 | .00 | .01 | 0. | 1.01 | 14.20 | 172 | .32 | .31 | .00 | 1395. |
| 1.01 | 2.25 | 29 | .01 | .00 | .01 | 0. | 1.01 | 14.25 | 173 | .32 | .31 | .00 | 1425. |
| 1.01 | 2.30 | 30 | .01 | .00 | .01 | 0. | 1.01 | 14.30 | 174 | .32 | .31 | .00 | 1455. |
| 1.01 | 2.35 | 31 | .01 | .00 | .01 | 1. | 1.01 | 14.35 | 175 | .32 | .31 | .00 | 1487. |
| 1.01 | 2.40 | 32 | .01 | .00 | .01 | 1. | 1.01 | 14.40 | 176 | .32 | .31 | .00 | 1520. |
| 1.01 | 2.45 | 33 | .01 | .00 | .01 | 1. | 1.01 | 14.45 | 177 | .32 | .31 | .00 | 1555. |
| 1.01 | 2.50 | 34 | .01 | .00 | .01 | 2. | 1.01 | 14.50 | 178 | .32 | .31 | .00 | 1589. |
| 1.01 | 2.55 | 35 | .01 | .00 | .01 | 2. | 1.01 | 14.55 | 179 | .32 | .31 | .00 | 1623. |
| 1.01 | 3.00 | 36 | .01 | .00 | .01 | 3. | 1.01 | 15.00 | 180 | .32 | .31 | .00 | 1656. |
| 1.01 | 3.05 | 37 | .01 | .00 | .01 | 3. | 1.01 | 15.05 | 181 | .19 | .19 | .00 | 1687. |
| 1.01 | 3.10 | 38 | .01 | .00 | .01 | 4. | 1.01 | 15.10 | 182 | .39 | .38 | .00 | 1715. |
| 1.01 | 3.15 | 39 | .01 | .00 | .01 | 5. | 1.01 | 15.15 | 183 | .39 | .38 | .00 | 1742. |
| 1.01 | 3.20 | 40 | .01 | .00 | .01 | 6. | 1.01 | 15.20 | 184 | .58 | .58 | .00 | 1769. |
| 1.01 | 3.25 | 41 | .01 | .00 | .01 | 6. | 1.01 | 15.25 | 185 | .68 | .67 | .01 | 1800. |
| 1.01 | 3.30 | 42 | .01 | .00 | .01 | 7. | 1.01 | 15.30 | 186 | 1.64 | 1.63 | .01 | 1846. |
| 1.01 | 3.35 | 43 | .01 | .00 | .01 | 8. | 1.01 | 15.35 | 187 | 2.71 | 2.69 | .02 | 1921. |
| 1.01 | 3.40 | 44 | .01 | .00 | .01 | 9. | 1.01 | 15.40 | 188 | 1.06 | 1.06 | .01 | 2062. |
| 1.01 | 3.45 | 45 | .01 | .00 | .01 | 10. | 1.01 | 15.45 | 189 | .68 | .67 | .00 | 2274. |
| 1.01 | 3.50 | 46 | .01 | .00 | .01 | 11. | 1.01 | 15.50 | 190 | .58 | .58 | .00 | 2450. |
| 1.01 | 3.55 | 47 | .01 | .00 | .01 | 12. | 1.01 | 15.55 | 191 | .39 | .39 | .00 | 2711. |
| 1.01 | 4.00 | 48 | .01 | .00 | .01 | 13. | 1.01 | 16.00 | 192 | .39 | .39 | .00 | 3012. |
| 1.01 | 4.05 | 49 | .01 | .00 | .01 | 14. | 1.01 | 16.05 | 193 | .30 | .30 | .00 | 3329. |
| 1.01 | 4.10 | 50 | .01 | .00 | .01 | 15. | 1.01 | 16.10 | 194 | .30 | .30 | .00 | 3615. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.01 | 4.15 | 51 | .01 | .00 | .01 | 16. |
| 1.01 | 4.20 | 52 | .01 | .00 | .01 | 17. |
| 1.01 | 4.25 | 53 | .01 | .01 | .01 | 18. |
| 1.01 | 4.30 | 54 | .01 | .01 | .01 | 19. |
| 1.01 | 4.35 | 55 | .01 | .01 | .01 | 20. |
| 1.01 | 4.40 | 56 | .01 | .01 | .01 | 21. |
| 1.01 | 4.45 | 57 | .01 | .01 | .01 | 22. |
| 1.01 | 4.50 | 58 | .01 | .01 | .01 | 23. |
| 1.01 | 4.55 | 59 | .01 | .01 | .01 | 24. |
| 1.01 | 5.00 | 60 | .01 | .01 | .01 | 25. |
| 1.01 | 5.05 | 61 | .01 | .01 | .01 | 26. |
| 1.01 | 5.10 | 62 | .01 | .01 | .01 | 27. |
| 1.01 | 5.15 | 63 | .01 | .01 | .01 | 27. |
| 1.01 | 5.20 | 64 | .01 | .01 | .01 | 28. |
| 1.01 | 5.25 | 65 | .01 | .01 | .01 | 29. |
| 1.01 | 5.30 | 66 | .01 | .01 | .01 | 30. |
| 1.01 | 5.35 | 67 | .01 | .01 | .01 | 31. |
| 1.01 | 5.40 | 68 | .01 | .01 | .01 | 31. |
| 1.01 | 5.45 | 69 | .01 | .01 | .01 | 32. |
| 1.01 | 5.50 | 70 | .01 | .01 | .01 | 33. |
| 1.01 | 5.55 | 71 | .01 | .01 | .01 | 34. |
| 1.01 | 6.00 | 72 | .01 | .01 | .01 | 34. |
| 1.01 | 6.05 | 73 | .07 | .03 | .03 | 35. |
| 1.01 | 6.10 | 74 | .07 | .04 | .03 | 37. |
| 1.01 | 6.15 | 75 | .07 | .04 | .03 | 39. |
| 1.01 | 6.20 | 76 | .07 | .04 | .03 | 42. |
| 1.01 | 6.25 | 77 | .07 | .04 | .03 | 47. |
| 1.01 | 6.30 | 78 | .07 | .04 | .02 | 53. |
| 1.01 | 6.35 | 79 | .07 | .04 | .02 | 61. |
| 1.01 | 6.40 | 80 | .07 | .04 | .02 | 71. |
| 1.01 | 6.45 | 81 | .07 | .05 | .02 | 83. |
| 1.01 | 6.50 | 82 | .07 | .05 | .02 | 95. |
| 1.01 | 6.55 | 83 | .07 | .05 | .02 | 109. |
| 1.01 | 7.00 | 84 | .07 | .05 | .02 | 123. |
| 1.01 | 7.05 | 85 | .07 | .05 | .02 | 136. |
| 1.01 | 7.10 | 86 | .07 | .05 | .02 | 152. |
| 1.01 | 7.15 | 87 | .07 | .05 | .02 | 166. |
| 1.01 | 7.20 | 88 | .07 | .05 | .02 | 179. |
| 1.01 | 7.25 | 89 | .07 | .05 | .02 | 192. |
| 1.01 | 7.30 | 90 | .07 | .05 | .01 | 205. |
| 1.01 | 7.35 | 91 | .07 | .05 | .01 | 216. |
| 1.01 | 7.40 | 92 | .07 | .05 | .01 | 226. |
| 1.01 | 7.45 | 93 | .07 | .05 | .01 | 236. |
| 1.01 | 7.50 | 94 | .07 | .05 | .01 | 245. |
| 1.01 | 7.55 | 95 | .07 | .05 | .01 | 253. |
| 1.01 | 8.00 | 96 | .07 | .05 | .01 | 261. |
| 1.01 | 8.05 | 97 | .07 | .06 | .01 | 268. |
| 1.01 | 8.10 | 98 | .07 | .06 | .01 | 275. |
| 1.01 | 8.15 | 99 | .07 | .06 | .01 | 282. |
| 1.01 | 8.20 | 100 | .07 | .06 | .01 | 288. |
| 1.01 | 8.25 | 101 | .07 | .06 | .01 | 293. |
| 1.01 | 8.30 | 102 | .07 | .06 | .01 | 298. |
| 1.01 | 8.35 | 103 | .07 | .06 | .01 | 303. |
| 1.01 | 8.40 | 104 | .07 | .06 | .01 | 308. |
| 1.01 | 8.45 | 105 | .07 | .06 | .01 | 312. |
| 1.01 | 8.50 | 106 | .07 | .06 | .01 | 316. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.01 | 16.15 | 195 | .30 | .30 | .00 | 3844. |
| 1.01 | 16.20 | 196 | .30 | .30 | .00 | 4007. |
| 1.01 | 16.25 | 197 | .30 | .30 | .00 | 4101. |
| 1.01 | 16.30 | 198 | .30 | .30 | .00 | 4132. |
| 1.01 | 16.35 | 199 | .30 | .30 | .00 | 4106. |
| 1.01 | 16.40 | 200 | .30 | .30 | .00 | 4021. |
| 1.01 | 16.45 | 201 | .30 | .30 | .00 | 3901. |
| 1.01 | 16.50 | 202 | .30 | .30 | .00 | 3754. |
| 1.01 | 16.55 | 203 | .30 | .30 | .00 | 3582. |
| 1.01 | 17.00 | 204 | .30 | .30 | .00 | 3387. |
| 1.01 | 17.05 | 205 | .23 | .23 | .00 | 3184. |
| 1.01 | 17.10 | 206 | .23 | .23 | .00 | 3000. |
| 1.01 | 17.15 | 207 | .23 | .23 | .00 | 2841. |
| 1.01 | 17.20 | 208 | .23 | .23 | .00 | 2702. |
| 1.01 | 17.25 | 209 | .23 | .23 | .00 | 2578. |
| 1.01 | 17.30 | 210 | .23 | .23 | .00 | 2470. |
| 1.01 | 17.35 | 211 | .23 | .23 | .00 | 2372. |
| 1.01 | 17.40 | 212 | .23 | .23 | .00 | 2283. |
| 1.01 | 17.45 | 213 | .23 | .23 | .00 | 2193. |
| 1.01 | 17.50 | 214 | .23 | .23 | .00 | 2111. |
| 1.01 | 17.55 | 215 | .23 | .23 | .00 | 2036. |
| 1.01 | 18.00 | 216 | .23 | .23 | .00 | 1969. |
| 1.01 | 18.05 | 217 | .02 | .02 | .00 | 1904. |
| 1.01 | 18.10 | 218 | .02 | .02 | .00 | 1842. |
| 1.01 | 18.15 | 219 | .02 | .02 | .00 | 1776. |
| 1.01 | 18.20 | 220 | .02 | .02 | .00 | 1713. |
| 1.01 | 18.25 | 221 | .02 | .02 | .00 | 1644. |
| 1.01 | 18.30 | 222 | .02 | .02 | .00 | 1569. |
| 1.01 | 18.35 | 223 | .02 | .02 | .00 | 1486. |
| 1.01 | 18.40 | 224 | .02 | .02 | .00 | 1396. |
| 1.01 | 18.45 | 225 | .02 | .02 | .00 | 1300. |
| 1.01 | 18.50 | 226 | .02 | .02 | .00 | 1202. |
| 1.01 | 18.55 | 227 | .02 | .02 | .00 | 1103. |
| 1.01 | 19.00 | 228 | .02 | .02 | .00 | 1005. |
| 1.01 | 19.05 | 229 | .02 | .02 | .00 | 910. |
| 1.01 | 19.10 | 230 | .02 | .02 | .00 | 820. |
| 1.01 | 19.15 | 231 | .02 | .02 | .00 | 737. |
| 1.01 | 19.20 | 232 | .02 | .02 | .00 | 660. |
| 1.01 | 19.25 | 233 | .02 | .02 | .00 | 591. |
| 1.01 | 19.30 | 234 | .02 | .02 | .00 | 529. |
| 1.01 | 19.35 | 235 | .02 | .02 | .00 | 477. |
| 1.01 | 19.40 | 236 | .02 | .02 | .00 | 433. |
| 1.01 | 19.45 | 237 | .02 | .02 | .00 | 394. |
| 1.01 | 19.50 | 238 | .02 | .02 | .00 | 360. |
| 1.01 | 19.55 | 239 | .02 | .02 | .00 | 331. |
| 1.01 | 20.00 | 240 | .02 | .02 | .00 | 305. |
| 1.01 | 20.05 | 241 | .02 | .02 | .00 | 281. |
| 1.01 | 20.10 | 242 | .02 | .02 | .00 | 261. |
| 1.01 | 20.15 | 243 | .02 | .02 | .00 | 242. |
| 1.01 | 20.20 | 244 | .02 | .02 | .00 | 227. |
| 1.01 | 20.25 | 245 | .02 | .02 | .00 | 213. |
| 1.01 | 20.30 | 246 | .02 | .02 | .00 | 201. |
| 1.01 | 20.35 | 247 | .02 | .02 | .00 | 192. |
| 1.01 | 20.40 | 248 | .02 | .02 | .00 | 183. |
| 1.01 | 20.45 | 249 | .02 | .02 | .00 | 176. |
| 1.01 | 20.50 | 250 | .02 | .02 | .00 | 170. |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 8.55 | 107 | .07 | .06 | .01 | 326. | 1.01 | 20.55 | 251 | .02 | .02 | .00 | 164. |
| 1.01 | 9.00 | 108 | .07 | .06 | .01 | 324. | 1.01 | 21.00 | 252 | .02 | .02 | .00 | 160. |
| 1.01 | 9.05 | 109 | .07 | .06 | .01 | 327. | 1.01 | 21.05 | 253 | .02 | .02 | .00 | 156. |
| 1.01 | 9.10 | 110 | .07 | .06 | .01 | 331. | 1.01 | 21.10 | 254 | .02 | .02 | .00 | 152. |
| 1.01 | 9.15 | 111 | .07 | .06 | .01 | 334. | 1.01 | 21.15 | 255 | .02 | .02 | .00 | 149. |
| 1.01 | 9.20 | 112 | .07 | .06 | .01 | 336. | 1.01 | 21.20 | 256 | .02 | .02 | .00 | 146. |
| 1.01 | 9.25 | 113 | .07 | .06 | .01 | 339. | 1.01 | 21.25 | 257 | .02 | .02 | .00 | 144. |
| 1.01 | 9.30 | 114 | .07 | .06 | .01 | 342. | 1.01 | 21.30 | 258 | .02 | .02 | .00 | 142. |
| 1.01 | 9.35 | 115 | .07 | .06 | .01 | 344. | 1.01 | 21.35 | 259 | .02 | .02 | .00 | 140. |
| 1.01 | 9.40 | 116 | .07 | .06 | .01 | 346. | 1.01 | 21.40 | 260 | .02 | .02 | .00 | 135. |
| 1.01 | 9.45 | 117 | .07 | .06 | .01 | 349. | 1.01 | 21.45 | 261 | .02 | .02 | .00 | 137. |
| 1.01 | 9.50 | 118 | .07 | .06 | .01 | 351. | 1.01 | 21.50 | 262 | .02 | .02 | .00 | 136. |
| 1.01 | 9.55 | 119 | .07 | .06 | .01 | 353. | 1.01 | 21.55 | 263 | .02 | .02 | .00 | 135. |
| 1.01 | 10.00 | 120 | .07 | .06 | .01 | 355. | 1.01 | 22.00 | 264 | .02 | .02 | .00 | 134. |
| 1.01 | 10.05 | 121 | .07 | .06 | .01 | 356. | 1.01 | 22.05 | 265 | .02 | .02 | .00 | 133. |
| 1.01 | 10.10 | 122 | .07 | .06 | .01 | 358. | 1.01 | 22.10 | 266 | .02 | .02 | .00 | 133. |
| 1.01 | 10.15 | 123 | .07 | .06 | .01 | 360. | 1.01 | 22.15 | 267 | .02 | .02 | .00 | 132. |
| 1.01 | 10.20 | 124 | .07 | .06 | .01 | 361. | 1.01 | 22.20 | 268 | .02 | .02 | .00 | 131. |
| 1.01 | 10.25 | 125 | .07 | .06 | .01 | 363. | 1.01 | 22.25 | 269 | .02 | .02 | .00 | 131. |
| 1.01 | 10.30 | 126 | .07 | .06 | .01 | 364. | 1.01 | 22.30 | 270 | .02 | .02 | .00 | 131. |
| 1.01 | 10.35 | 127 | .07 | .06 | .01 | 366. | 1.01 | 22.35 | 271 | .02 | .02 | .00 | 130. |
| 1.01 | 10.40 | 128 | .07 | .06 | .00 | 367. | 1.01 | 22.40 | 272 | .02 | .02 | .00 | 130. |
| 1.01 | 10.45 | 129 | .07 | .06 | .00 | 368. | 1.01 | 22.45 | 273 | .02 | .02 | .00 | 130. |
| 1.01 | 10.50 | 130 | .07 | .06 | .00 | 369. | 1.01 | 22.50 | 274 | .02 | .02 | .00 | 130. |
| 1.01 | 10.55 | 131 | .07 | .06 | .00 | 370. | 1.01 | 22.55 | 275 | .02 | .02 | .00 | 130. |
| 1.01 | 11.00 | 132 | .07 | .06 | .00 | 372. | 1.01 | 23.00 | 276 | .02 | .02 | .00 | 130. |
| 1.01 | 11.05 | 133 | .07 | .06 | .00 | 373. | 1.01 | 23.05 | 277 | .02 | .02 | .00 | 130. |
| 1.01 | 11.10 | 134 | .07 | .06 | .00 | 374. | 1.01 | 23.10 | 278 | .02 | .02 | .00 | 130. |
| 1.01 | 11.15 | 135 | .07 | .06 | .00 | 375. | 1.01 | 23.15 | 279 | .02 | .02 | .00 | 130. |
| 1.01 | 11.20 | 136 | .07 | .06 | .00 | 375. | 1.01 | 23.20 | 280 | .02 | .02 | .00 | 130. |
| 1.01 | 11.25 | 137 | .07 | .06 | .00 | 376. | 1.01 | 23.25 | 281 | .02 | .02 | .00 | 130. |
| 1.01 | 11.30 | 138 | .07 | .06 | .00 | 377. | 1.01 | 23.30 | 282 | .02 | .02 | .00 | 130. |
| 1.01 | 11.35 | 139 | .07 | .06 | .00 | 378. | 1.01 | 23.35 | 283 | .02 | .02 | .00 | 130. |
| 1.01 | 11.40 | 140 | .07 | .06 | .00 | 379. | 1.01 | 23.40 | 284 | .02 | .02 | .00 | 130. |
| 1.01 | 11.45 | 141 | .07 | .06 | .00 | 380. | 1.01 | 23.45 | 285 | .02 | .02 | .00 | 130. |
| 1.01 | 11.50 | 142 | .07 | .06 | .00 | 380. | 1.01 | 23.50 | 286 | .02 | .02 | .00 | 130. |
| 1.01 | 11.55 | 143 | .07 | .06 | .00 | 381. | 1.01 | 23.55 | 287 | .02 | .02 | .00 | 130. |
| 1.01 | 12.00 | 144 | .07 | .06 | .00 | 382. | 1.02 | .00 | 288 | .02 | .02 | .00 | 130. |

SUM 32.76 30.88 1.88 189370.
( 832.)( 784.)( 48.)( 5362.36)

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 4132. | 2668. | 657. | 657. | 189765. |
| CMS | 117. | 59. | 19. | 19. | 5361. |
| INCHES | | 24.05 | 30.57 | 30.57 | 30.57 |
| MM | | 610.81 | 776.54 | 776.54 | 776.54 |
| AC-FT | | 1026. | 1304. | 1304. | 1304. |
| THOUS CU M | | 1265. | 1608. | 1608. | 1608. |

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 207. | 103. | 33. | 33. | 9465. |

| | | | | | |
|---|---|---|---|---|---|
| CMS | 6. | 3. | 1. | 1. | 268. |
| INCHES | | 1.20 | 1.53 | 1.53 | 1.53 |
| MM | | 30.54 | 38.83 | 38.83 | 38.83 |
| AC-FT | | 51. | 65. | 65. | 65. |
| THOUS CU M | | 63. | 80. | 80. | 80. |

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 413. | 227. | 66. | 66. | 18931. |
| CMS | 12. | 6. | 2. | 2. | 536. |
| INCHES | | 2.40 | 3.06 | 3.06 | 3.06 |
| MM | | 61.08 | 77.65 | 77.65 | 77.65 |
| AC-FT | | 103. | 130. | 130. | 130. |
| THOUS CU M | | 126. | 161. | 161. | 161. |

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 620. | 310. | 99. | 99. | 28396. |
| CMS | 18. | 9. | 3. | 3. | 804. |
| INCHES | | 3.61 | 4.59 | 4.59 | 4.59 |
| MM | | 91.62 | 116.48 | 116.48 | 116.48 |
| AC-FT | | 154. | 196. | 196. | 196. |
| THOUS CU M | | 190. | 241. | 241. | 241. |

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 826. | 414. | 131. | 131. | 37861. |
| CMS | 23. | 12. | 4. | 4. | 1072. |
| INCHES | | 4.81 | 6.11 | 6.11 | 6.11 |
| MM | | 122.16 | 155.31 | 155.31 | 155.31 |
| AC-FT | | 205. | 261. | 261. | 261. |
| THOUS CU M | | 253. | 322. | 322. | 322. |

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 5

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 2066. | 1034. | 329. | 329. | 94653. |
| CMS | 58. | 29. | 9. | 9. | 2680. |
| INCHES | | 12.02 | 15.29 | 15.29 | 15.29 |
| MM | | 305.41 | 388.27 | 388.27 | 388.27 |
| AC-FT | | 513. | 652. | 652. | 652. |
| THOUS CU M | | 632. | 804. | 804. | 804. |

```
                         HYDROGRAPH AT STA      1 FOR PLAN 1, RTIO 6

                      PEAK     6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
              CFS    4132.      2068.       657.       657.        189305.
              CMS     117.        59.        19.        19.          5361.
           INCHES                24.05      30.57      30.57          30.57
               MM               610.81     776.54     776.54         776.54
            AC-FT                1026.      1304.      1304.          1304.
       THOUS CU M                1265.      1608.      1608.          1608.


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

                                  HYDROGRAPH ROUTING

               ROUTING THROUGH UPPER KEHR'S MILL TRAIL LAKE DAM

                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        2       1       0       0       0       0       1       0       0
                                         ROUTING DATA
            QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
               .0    .000     .00       1       1       0       0               0

                    NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                        1       0       0    .000    .000    .000   -525.      -1

    STAGE     524.80    526.30    526.80    527.30    527.80    528.80    529.80    530.80    532.80    534.80
              536.80

     FLOW        .00     22.00     36.00     52.00     70.00     86.00    110.00    120.00    144.00    164.00
              184.00

 SURFACE AREA=      0.       4.       7.      13.      21.      32.

     CAPACITY=      0.      15.      42.      91.     256.     518.

    ELEVATION=    499.     510.     515.     520.     530.     540.

                     CREL   SPWID   COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                    524.8      .0     .0      .0      .0      .0      .0      .0

                                              DAM DATA
                                     TOPEL    COQD    EXPD  DAMWID
                                     529.8      .0      .0      0.

    CREST LENGTH        0.       33.       95.      207.      275.      328.      380.      417.      535.
    AT OR BELOW
    ELEVATION        529.8     529.9     530.0     530.1     530.3     531.0     531.9     532.5     535.2

                                              DAM BREACH DATA
                                BRWID       Z    ELBM   TFAIL    WSEL  FAILEL
                                  10.     .50  510.00    1.00  524.80  529.80
```

```
**********          **********          **********          **********          **********

                         SUB-AREA RUNOFF COMPUTATION

          LOWER KEHR'S MILL TRAIL LAKE DAM (24 HR. PROBABLE MAXIMUM RUNOFF)

              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  3       0       0       0       0       3       1       0       0

                                  HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
              1       2     .11     .00     .11    1.00    .000       0       0       0

                                     PRECIP DATA
                  SPFE     PMS      R6     R12     R24     R48     R72     R96
                   .00   25.20  101.00  120.00  130.00     .00     .00     .00

                                      LOSS DATA
         LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
             0     .00     .00    1.00     .00     .00    1.00   -1.00  -86.00     .00     .00

         CURVE NO =  -86.00  WETNESS =   -1.00  EFFECT CN =   86.00

                                 UNIT HYDROGRAPH DATA
                                 TC=   .00   LAG=   .07

                                   RECESSION DATA
                        STRTQ=    .00    QRCSN=    .00    RTIOR= 1.00

         TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

         UNIT HYDROGRAPH  6 END OF PERIOD ORDINATES, TC=    .00 HOURS, LAG=    .07  VOL= 1.00
       405.      319.      91.      26.       8.       2.
```

0

END-OF-PERIOD FLOW

| MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q | MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .01 | .00 | .01 | 0. | 1.01 | 12.05 | 145 | .21 | .20 | .01 | 110. |
| 1.01 | .10 | 2 | .01 | .00 | .01 | 0. | 1.01 | 12.10 | 146 | .21 | .20 | .01 | 154. |
| 1.01 | .15 | 3 | .01 | .00 | .01 | 0. | 1.01 | 12.15 | 147 | .21 | .20 | .01 | 167. |
| 1.01 | .20 | 4 | .01 | .00 | .01 | 0. | 1.01 | 12.20 | 148 | .21 | .20 | .01 | 171. |
| 1.01 | .25 | 5 | .01 | .00 | .01 | 0. | 1.01 | 12.25 | 149 | .21 | .20 | .01 | 173. |
| 1.01 | .30 | 6 | .01 | .00 | .01 | 0. | 1.01 | 12.30 | 150 | .21 | .20 | .01 | 173. |
| 1.01 | .35 | 7 | .01 | .00 | .01 | 0. | 1.01 | 12.35 | 151 | .21 | .20 | .01 | 174. |
| 1.01 | .40 | 8 | .01 | .00 | .01 | 0. | 1.01 | 12.40 | 152 | .21 | .20 | .01 | 174. |
| 1.01 | .45 | 9 | .01 | .00 | .01 | 0. | 1.01 | 12.45 | 153 | .21 | .21 | .01 | 174. |
| 1.01 | .50 | 10 | .01 | .00 | .01 | 0. | 1.01 | 12.50 | 154 | .21 | .21 | .01 | 175. |
| 1.01 | .55 | 11 | .01 | .00 | .01 | 0. | 1.01 | 12.55 | 155 | .21 | .21 | .01 | 175. |
| 1.01 | 1.00 | 12 | .01 | .00 | .01 | 0. | 1.01 | 13.00 | 156 | .21 | .21 | .01 | 175. |
| 1.01 | 1.05 | 13 | .01 | .00 | .01 | 0. | 1.01 | 13.05 | 157 | .25 | .25 | .01 | 192. |
| 1.01 | 1.10 | 14 | .01 | .00 | .01 | 0. | 1.01 | 13.10 | 158 | .25 | .25 | .01 | 206. |
| 1.01 | 1.15 | 15 | .01 | .00 | .01 | 0. | 1.01 | 13.15 | 159 | .25 | .25 | .01 | 216. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 1.20 | 16 | .01 | .00 | .01 | 0. | 1.01 | 13.20 | 160 | .25 | .25 | .01 | 211. |
| 1.01 | 1.25 | 17 | .01 | .00 | .01 | 0. | 1.01 | 13.25 | 161 | .25 | .25 | .01 | 211. |
| 1.01 | 1.30 | 18 | .01 | .00 | .01 | 0. | 1.01 | 13.30 | 162 | .25 | .25 | .01 | 212. |
| 1.01 | 1.35 | 19 | .01 | .00 | .01 | 0. | 1.01 | 13.35 | 163 | .25 | .25 | .01 | 212. |
| 1.01 | 1.40 | 20 | .01 | .00 | .01 | 0. | 1.01 | 13.40 | 164 | .25 | .25 | .01 | 212. |
| 1.01 | 1.45 | 21 | .01 | .00 | .01 | 0. | 1.01 | 13.45 | 165 | .25 | .25 | .00 | 212. |
| 1.01 | 1.50 | 22 | .01 | .00 | .01 | 0. | 1.01 | 13.50 | 166 | .25 | .25 | .00 | 213. |
| 1.01 | 1.55 | 23 | .01 | .00 | .01 | 0. | 1.01 | 13.55 | 167 | .25 | .25 | .00 | 213. |
| 1.01 | 2.00 | 24 | .01 | .00 | .01 | 0. | 1.01 | 14.00 | 168 | .25 | .25 | .00 | 213. |
| 1.01 | 2.05 | 25 | .01 | .00 | .01 | 0. | 1.01 | 14.05 | 169 | .32 | .31 | .01 | 238. |
| 1.01 | 2.10 | 26 | .01 | .00 | .01 | 0. | 1.01 | 14.10 | 170 | .32 | .31 | .00 | 259. |
| 1.01 | 2.15 | 27 | .01 | .00 | .01 | 0. | 1.01 | 14.15 | 171 | .32 | .31 | .00 | 264. |
| 1.01 | 2.20 | 28 | .01 | .00 | .01 | 1. | 1.01 | 14.20 | 172 | .32 | .31 | .00 | 266. |
| 1.01 | 2.25 | 29 | .01 | .00 | .01 | 1. | 1.01 | 14.25 | 173 | .32 | .31 | .00 | 267. |
| 1.01 | 2.30 | 30 | .01 | .00 | .01 | 1. | 1.01 | 14.30 | 174 | .32 | .31 | .00 | 267. |
| 1.01 | 2.35 | 31 | .01 | .00 | .01 | 1. | 1.01 | 14.35 | 175 | .32 | .31 | .00 | 267. |
| 1.01 | 2.40 | 32 | .01 | .00 | .01 | 1. | 1.01 | 14.40 | 176 | .32 | .31 | .00 | 268. |
| 1.01 | 2.45 | 33 | .01 | .00 | .01 | 2. | 1.01 | 14.45 | 177 | .32 | .31 | .00 | 268. |
| 1.01 | 2.50 | 34 | .01 | .00 | .01 | 2. | 1.01 | 14.50 | 178 | .32 | .31 | .00 | 268. |
| 1.01 | 2.55 | 35 | .01 | .00 | .01 | 2. | 1.01 | 14.55 | 179 | .32 | .31 | .00 | 268. |
| 1.01 | 3.00 | 36 | .01 | .00 | .01 | 2. | 1.01 | 15.00 | 180 | .32 | .31 | .00 | 268. |
| 1.01 | 3.05 | 37 | .01 | .00 | .01 | 2. | 1.01 | 15.05 | 181 | .19 | .19 | .00 | 216. |
| 1.01 | 3.10 | 38 | .01 | .00 | .01 | 2. | 1.01 | 15.10 | 182 | .39 | .38 | .00 | 256. |
| 1.01 | 3.15 | 39 | .01 | .00 | .01 | 2. | 1.01 | 15.15 | 183 | .39 | .38 | .00 | 306. |
| 1.01 | 3.20 | 40 | .01 | .00 | .01 | 2. | 1.01 | 15.20 | 184 | .58 | .58 | .00 | 396. |
| 1.01 | 3.25 | 41 | .01 | .00 | .01 | 3. | 1.01 | 15.25 | 185 | .68 | .67 | .01 | 503. |
| 1.01 | 3.30 | 42 | .01 | .00 | .01 | 3. | 1.01 | 15.30 | 186 | 1.64 | 1.63 | .01 | 941. |
| 1.01 | 3.35 | 43 | .01 | .00 | .01 | 3. | 1.01 | 15.35 | 187 | 2.71 | 2.49 | .02 | 1691. |
| 1.01 | 3.40 | 44 | .01 | .00 | .01 | 3. | 1.01 | 15.40 | 188 | 1.06 | 1.06 | .01 | 1460. |
| 1.01 | 3.45 | 45 | .01 | .00 | .01 | 3. | 1.01 | 15.45 | 189 | .68 | .67 | .00 | 905. |
| 1.01 | 3.50 | 46 | .01 | .00 | .01 | 3. | 1.01 | 15.50 | 190 | .58 | .58 | .00 | 631. |
| 1.01 | 3.55 | 47 | .01 | .00 | .01 | 4. | 1.01 | 15.55 | 191 | .39 | .39 | .00 | 455. |
| 1.01 | 4.00 | 48 | .01 | .00 | .01 | 4. | 1.01 | 16.00 | 192 | .39 | .39 | .00 | 364. |
| 1.01 | 4.05 | 49 | .01 | .00 | .01 | 4. | 1.01 | 16.05 | 193 | .30 | .30 | .00 | 301. |
| 1.01 | 4.10 | 50 | .01 | .00 | .01 | 4. | 1.01 | 16.10 | 194 | .30 | .30 | .00 | 266. |
| 1.01 | 4.15 | 51 | .01 | .00 | .01 | 4. | 1.01 | 16.15 | 195 | .30 | .30 | .00 | 256. |
| 1.01 | 4.20 | 52 | .01 | .00 | .01 | 4. | 1.01 | 16.20 | 196 | .30 | .30 | .00 | 253. |
| 1.01 | 4.25 | 53 | .01 | .01 | .01 | 4. | 1.01 | 16.25 | 197 | .30 | .30 | .00 | 252. |
| 1.01 | 4.30 | 54 | .01 | .01 | .01 | 4. | 1.01 | 16.30 | 198 | .30 | .30 | .00 | 252. |
| 1.01 | 4.35 | 55 | .01 | .01 | .01 | 4. | 1.01 | 16.35 | 199 | .30 | .30 | .00 | 252. |
| 1.01 | 4.40 | 56 | .01 | .01 | .01 | 5. | 1.01 | 16.40 | 200 | .30 | .30 | .00 | 252. |
| 1.01 | 4.45 | 57 | .01 | .01 | .01 | 5. | 1.01 | 16.45 | 201 | .30 | .30 | .00 | 252. |
| 1.01 | 4.50 | 58 | .01 | .01 | .01 | 5. | 1.01 | 16.50 | 202 | .30 | .30 | .00 | 252. |
| 1.01 | 4.55 | 59 | .01 | .01 | .01 | 5. | 1.01 | 16.55 | 203 | .30 | .30 | .00 | 252. |
| 1.01 | 5.00 | 60 | .01 | .01 | .01 | 5. | 1.01 | 17.00 | 204 | .30 | .30 | .00 | 252. |
| 1.01 | 5.05 | 61 | .01 | .01 | .01 | 5. | 1.01 | 17.05 | 205 | .23 | .23 | .00 | 226. |
| 1.01 | 5.10 | 62 | .01 | .01 | .01 | 5. | 1.01 | 17.10 | 206 | .23 | .23 | .00 | 206. |
| 1.01 | 5.15 | 63 | .01 | .01 | .01 | 5. | 1.01 | 17.15 | 207 | .23 | .23 | .00 | 200. |
| 1.01 | 5.20 | 64 | .01 | .01 | .01 | 5. | 1.01 | 17.20 | 208 | .23 | .23 | .00 | 199. |
| 1.01 | 5.25 | 65 | .01 | .01 | .01 | 5. | 1.01 | 17.25 | 209 | .23 | .23 | .00 | 198. |
| 1.01 | 5.30 | 66 | .01 | .01 | .01 | 5. | 1.01 | 17.30 | 210 | .23 | .23 | .00 | 198. |
| 1.01 | 5.35 | 67 | .01 | .01 | .01 | 6. | 1.01 | 17.35 | 211 | .23 | .23 | .00 | 198. |
| 1.01 | 5.40 | 68 | .01 | .01 | .01 | 6. | 1.01 | 17.40 | 212 | .23 | .23 | .00 | 198. |
| 1.01 | 5.45 | 69 | .01 | .01 | .01 | 6. | 1.01 | 17.45 | 213 | .23 | .23 | .00 | 198. |
| 1.01 | 5.50 | 70 | .01 | .01 | .01 | 6. | 1.01 | 17.50 | 214 | .23 | .23 | .00 | 198. |
| 1.01 | 5.55 | 71 | .01 | .01 | .01 | 6. | 1.01 | 17.55 | 215 | .23 | .23 | .00 | 198. |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 6.00 | 72 | .01 | .01 | .01 | 6. | 1.01 | 18.00 | 216 | .23 | .23 | .00 | 198. |
| 1.01 | 6.05 | 73 | .07 | .03 | .03 | 17. | 1.01 | 18.05 | 217 | .02 | .02 | .00 | 112. |
| 1.01 | 6.10 | 74 | .07 | .04 | .03 | 27. | 1.01 | 18.10 | 218 | .02 | .02 | .00 | 45. |
| 1.01 | 6.15 | 75 | .07 | .04 | .03 | 30. | 1.01 | 18.15 | 219 | .02 | .02 | .00 | 26. |
| 1.01 | 6.20 | 76 | .07 | .04 | .03 | 32. | 1.01 | 18.20 | 220 | .02 | .02 | .00 | 20. |
| 1.01 | 6.25 | 77 | .07 | .04 | .03 | 34. | 1.01 | 18.25 | 221 | .02 | .02 | .00 | 18. |
| 1.01 | 6.30 | 78 | .07 | .04 | .02 | 35. | 1.01 | 18.30 | 222 | .02 | .02 | .00 | 18. |
| 1.01 | 6.35 | 79 | .07 | .04 | .02 | 36. | 1.01 | 18.35 | 223 | .02 | .02 | .00 | 18. |
| 1.01 | 6.40 | 80 | .07 | .04 | .02 | 37. | 1.01 | 18.40 | 224 | .02 | .02 | .00 | 18. |
| 1.01 | 6.45 | 81 | .07 | .05 | .02 | 38. | 1.01 | 18.45 | 225 | .02 | .02 | .00 | 18. |
| 1.01 | 6.50 | 82 | .07 | .05 | .02 | 39. | 1.01 | 18.50 | 226 | .02 | .02 | .00 | 18. |
| 1.01 | 6.55 | 83 | .07 | .05 | .02 | 39. | 1.01 | 18.55 | 227 | .02 | .02 | .00 | 18. |
| 1.01 | 7.00 | 84 | .07 | .05 | .02 | 40. | 1.01 | 19.00 | 228 | .02 | .02 | .00 | 18. |
| 1.01 | 7.05 | 85 | .07 | .05 | .02 | 41. | 1.01 | 19.05 | 229 | .02 | .02 | .00 | 18. |
| 1.01 | 7.10 | 86 | .07 | .05 | .02 | 42. | 1.01 | 19.10 | 230 | .02 | .02 | .00 | 18. |
| 1.01 | 7.15 | 87 | .07 | .05 | .02 | 42. | 1.01 | 19.15 | 231 | .02 | .02 | .00 | 18. |
| 1.01 | 7.20 | 88 | .07 | .05 | .02 | 43. | 1.01 | 19.20 | 232 | .02 | .02 | .00 | 18. |
| 1.01 | 7.25 | 89 | .07 | .05 | .02 | 43. | 1.01 | 19.25 | 233 | .02 | .02 | .00 | 18. |
| 1.01 | 7.30 | 90 | .07 | .05 | .01 | 44. | 1.01 | 19.30 | 234 | .02 | .02 | .00 | 18. |
| 1.01 | 7.35 | 91 | .07 | .05 | .01 | 44. | 1.01 | 19.35 | 235 | .02 | .02 | .00 | 18. |
| 1.01 | 7.40 | 92 | .07 | .05 | .01 | 45. | 1.01 | 19.40 | 236 | .02 | .02 | .00 | 18. |
| 1.01 | 7.45 | 93 | .07 | .05 | .01 | 45. | 1.01 | 19.45 | 237 | .02 | .02 | .00 | 18. |
| 1.01 | 7.50 | 94 | .07 | .05 | .01 | 46. | 1.01 | 19.50 | 238 | .02 | .02 | .00 | 18. |
| 1.01 | 7.55 | 95 | .07 | .05 | .01 | 46. | 1.01 | 19.55 | 239 | .02 | .02 | .00 | 18. |
| 1.01 | 8.00 | 96 | .07 | .05 | .01 | 46. | 1.01 | 20.00 | 240 | .02 | .02 | .00 | 18. |
| 1.01 | 8.05 | 97 | .07 | .06 | .01 | 47. | 1.01 | 20.05 | 241 | .02 | .02 | .00 | 18. |
| 1.01 | 8.10 | 98 | .07 | .06 | .01 | 47. | 1.01 | 20.10 | 242 | .02 | .02 | .00 | 18. |
| 1.01 | 8.15 | 99 | .07 | .06 | .01 | 47. | 1.01 | 20.15 | 243 | .02 | .02 | .00 | 18. |
| 1.01 | 8.20 | 100 | .07 | .06 | .01 | 48. | 1.01 | 20.20 | 244 | .02 | .02 | .00 | 18. |
| 1.01 | 8.25 | 101 | .07 | .06 | .01 | 48. | 1.01 | 20.25 | 245 | .02 | .02 | .00 | 18. |
| 1.01 | 8.30 | 102 | .07 | .06 | .01 | 48. | 1.01 | 20.30 | 246 | .02 | .02 | .00 | 18. |
| 1.01 | 8.35 | 103 | .07 | .06 | .01 | 48. | 1.01 | 20.35 | 247 | .02 | .02 | .00 | 18. |
| 1.01 | 8.40 | 104 | .07 | .06 | .01 | 49. | 1.01 | 20.40 | 248 | .02 | .02 | .00 | 18. |
| 1.01 | 8.45 | 105 | .07 | .06 | .01 | 49. | 1.01 | 20.45 | 249 | .02 | .02 | .00 | 18. |
| 1.01 | 8.50 | 106 | .07 | .06 | .01 | 49. | 1.01 | 20.50 | 250 | .02 | .02 | .00 | 18. |
| 1.01 | 8.55 | 107 | .07 | .06 | .01 | 49. | 1.01 | 20.55 | 251 | .02 | .02 | .00 | 18. |
| 1.01 | 9.00 | 108 | .07 | .06 | .01 | 50. | 1.01 | 21.00 | 252 | .02 | .02 | .00 | 18. |
| 1.01 | 9.05 | 109 | .07 | .06 | .01 | 50. | 1.01 | 21.05 | 253 | .02 | .02 | .00 | 18. |
| 1.01 | 9.10 | 110 | .07 | .06 | .01 | 50. | 1.01 | 21.10 | 254 | .02 | .02 | .00 | 18. |
| 1.01 | 9.15 | 111 | .07 | .06 | .01 | 50. | 1.01 | 21.15 | 255 | .02 | .02 | .00 | 18. |
| 1.01 | 9.20 | 112 | .07 | .06 | .01 | 50. | 1.01 | 21.20 | 256 | .02 | .02 | .00 | 18. |
| 1.01 | 9.25 | 113 | .07 | .06 | .01 | 51. | 1.01 | 21.25 | 257 | .02 | .02 | .00 | 18. |
| 1.01 | 9.30 | 114 | .07 | .06 | .01 | 51. | 1.01 | 21.30 | 258 | .02 | .02 | .00 | 18. |
| 1.01 | 9.35 | 115 | .07 | .06 | .01 | 51. | 1.01 | 21.35 | 259 | .02 | .02 | .00 | 18. |
| 1.01 | 9.40 | 116 | .07 | .06 | .01 | 51. | 1.01 | 21.40 | 260 | .02 | .02 | .00 | 18. |
| 1.01 | 9.45 | 117 | .07 | .06 | .01 | 51. | 1.01 | 21.45 | 261 | .02 | .02 | .00 | 18. |
| 1.01 | 9.50 | 118 | .07 | .06 | .01 | 51. | 1.01 | 21.50 | 262 | .02 | .02 | .00 | 18. |
| 1.01 | 9.55 | 119 | .07 | .06 | .01 | 51. | 1.01 | 21.55 | 263 | .02 | .02 | .00 | 18. |
| 1.01 | 10.00 | 120 | .07 | .06 | .01 | 52. | 1.01 | 22.00 | 264 | .02 | .02 | .00 | 18. |
| 1.01 | 10.05 | 121 | .07 | .06 | .01 | 52. | 1.01 | 22.05 | 265 | .02 | .02 | .00 | 18. |
| 1.01 | 10.10 | 122 | .07 | .06 | .01 | 52. | 1.01 | 22.10 | 266 | .02 | .02 | .00 | 18. |
| 1.01 | 10.15 | 123 | .07 | .06 | .01 | 52. | 1.01 | 22.15 | 267 | .02 | .02 | .00 | 18. |
| 1.01 | 10.20 | 124 | .07 | .06 | .01 | 52. | 1.01 | 22.20 | 268 | .02 | .02 | .00 | 18. |
| 1.01 | 10.25 | 125 | .07 | .06 | .01 | 52. | 1.01 | 22.25 | 269 | .02 | .02 | .00 | 18. |
| 1.01 | 10.30 | 126 | .07 | .06 | .01 | 52. | 1.01 | 22.30 | 270 | .02 | .02 | .00 | 18. |
| 1.01 | 10.35 | 127 | .07 | .06 | .01 | 52. | 1.01 | 22.35 | 271 | .02 | .02 | .00 | 18. |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 10.40 | 128 | .07 | .06 | .00 | 52. | 1.01 | 22.40 | 272 | .02 | .02 | .00 | 18. |
| 1.01 | 10.45 | 129 | .07 | .06 | .00 | 52. | 1.01 | 22.45 | 273 | .02 | .02 | .00 | 18. |
| 1.01 | 10.50 | 130 | .07 | .06 | .00 | 53. | 1.01 | 22.50 | 274 | .02 | .02 | .00 | 18. |
| 1.01 | 10.55 | 131 | .07 | .06 | .00 | 53. | 1.01 | 22.55 | 275 | .02 | .02 | .00 | 18. |
| 1.01 | 11.00 | 132 | .07 | .06 | .00 | 53. | 1.01 | 23.00 | 276 | .02 | .02 | .00 | 18. |
| 1.01 | 11.05 | 133 | .07 | .06 | .00 | 53. | 1.01 | 23.05 | 277 | .02 | .02 | .00 | 18. |
| 1.01 | 11.10 | 134 | .07 | .06 | .00 | 53. | 1.01 | 23.10 | 278 | .02 | .02 | .00 | 18. |
| 1.01 | 11.15 | 135 | .07 | .06 | .00 | 53. | 1.01 | 23.15 | 279 | .02 | .02 | .00 | 18. |
| 1.01 | 11.20 | 136 | .07 | .06 | .00 | 53. | 1.01 | 23.20 | 280 | .02 | .02 | .00 | 18. |
| 1.01 | 11.25 | 137 | .07 | .06 | .00 | 53. | 1.01 | 23.25 | 281 | .02 | .02 | .00 | 18. |
| 1.01 | 11.30 | 138 | .07 | .06 | .00 | 53. | 1.01 | 23.30 | 282 | .02 | .02 | .00 | 18. |
| 1.01 | 11.35 | 139 | .07 | .06 | .00 | 53. | 1.01 | 23.35 | 283 | .02 | .02 | .00 | 18. |
| 1.01 | 11.40 | 140 | .07 | .06 | .00 | 53. | 1.01 | 23.40 | 284 | .02 | .02 | .00 | 18. |
| 1.01 | 11.45 | 141 | .07 | .06 | .00 | 53. | 1.01 | 23.45 | 285 | .02 | .02 | .00 | 18. |
| 1.01 | 11.50 | 142 | .07 | .06 | .00 | 53. | 1.01 | 23.50 | 286 | .02 | .02 | .00 | 18. |
| 1.01 | 11.55 | 143 | .07 | .06 | .00 | 54. | 1.01 | 23.55 | 287 | .02 | .02 | .00 | 18. |
| 1.01 | 12.00 | 144 | .07 | .06 | .00 | 54. | 1.02 | .00 | 288 | .02 | .02 | .00 | 18. |
| | | | | | | | | | SUM | 72.76 | 30.88 | 1.88 | 26293. |
| | | | | | | | | | | ( 832.) | ( 784.) | ( 48.) | ( 744.53) |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 1691. | 296. | 91. | 91. | 26273. |
| CMS | 48. | 8. | 3. | 3. | 744. |
| INCHES | | 25.04 | 30.86 | 30.86 | 30.86 |
| MM | | 635.95 | 783.81 | 783.81 | 783.81 |
| AC-FT | | 147. | 181. | 181. | 181. |
| THOUS CU M | | 181. | 223. | 223. | 223. |

HYDROGRAPH AT STA    3 FOR PLAN 1, RTIO 1

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 85. | 15. | 5. | 5. | 1314. |
| CMS | 2. | 0. | 0. | 0. | 37. |
| INCHES | | 1.25 | 1.54 | 1.54 | 1.54 |
| MM | | 31.80 | 39.19 | 39.19 | 39.19 |
| AC-FT | | 7. | 9. | 9. | 9. |
| THOUS CU M | | 9. | 11. | 11. | 11. |

HYDROGRAPH AT STA    3 FOR PLAN 1, RTIO 2

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 169. | 30. | 9. | 9. | 2627. |
| CMS | 5. | 1. | 0. | 0. | 74. |
| INCHES | | 2.50 | 3.09 | 3.09 | 3.09 |
| MM | | 63.59 | 78.38 | 78.38 | 78.38 |
| AC-FT | | 15. | 18. | 18. | 18. |
| THOUS CU M | | 15. | 22. | 22. | 22. |

HYDROGRAPH AT STA    3 FOR PLAN 1, RTIO 3

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 254. | 44. | 14. | 14. | 3941. |
| CMS | 7. | 1. | 0. | 0. | 112. |
| INCHES | | 3.76 | 4.63 | 4.63 | 4.63 |
| MM | | 95.39 | 117.57 | 117.57 | 117.57 |
| AC-FT | | 22. | 27. | 27. | 27. |
| THOUS CU M | | 27. | 33. | 33. | 33. |

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 4

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 338. | 59. | 18. | 18. | 5255. |
| CMS | 10. | 2. | 1. | 1. | 149. |
| INCHES | | 5.01 | 6.17 | 6.17 | 6.17 |
| MM | | 127.19 | 156.76 | 156.76 | 156.76 |
| AC-FT | | 29. | 36. | 36. | 36. |
| THOUS CU M | | 36. | 45. | 45. | 45. |

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 5

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 846. | 146. | 46. | 46. | 13136. |
| CMS | 24. | 4. | 1. | 1. | 372. |
| INCHES | | 12.52 | 15.43 | 15.43 | 15.43 |
| MM | | 317.97 | 391.90 | 391.90 | 391.90 |
| AC-FT | | 73. | 90. | 90. | 90. |
| THOUS CU M | | 91. | 112. | 112. | 112. |

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 6

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 1691. | 296. | 91. | 91. | 26273. |
| CMS | 48. | 8. | 3. | 3. | 744. |
| INCHES | | 25.04 | 30.86 | 30.86 | 30.86 |
| MM | | 635.95 | 783.81 | 783.81 | 783.81 |
| AC-FT | | 147. | 181. | 181. | 181. |
| THOUS CU M | | 181. | 223. | 223. | 223. |

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

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS-TOTAL FLOW LOWER DAM (24 HR. PMF)

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO

4 2 0 0 0 0 1 0 0

SUM OF 2 HYDROGRAPHS AT 4 PLAN 1 RTIO 1

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 1. | 2. | 2. | 2. | 2. | 2. | 2. | 2. |
| 2. | 2. | 2. | 2. | 2. | 3. | 3. | 3. | 3. | 3. |
| 3. | 3. | 3. | 3. | 3. | 3. | 4. | 4. | 4. | 4. |
| 4. | 4. | 4. | 4. | 4. | 4. | 4. | 5. | 5. | 5. |
| 5. | 5. | 5. | 5. | 5. | 5. | 5. | 6. | 6. | 6. |
| 6. | 6. | 6. | 6. | 6. | 6. | 6. | 6. | 7. | 7. |
| 7. | 7. | 7. | 7. | 7. | 7. | 7. | 7. | 7. | 8. |
| 8. | 8. | 8. | 8. | 11. | 13. | 14. | 14. | 14. | 14. |
| 15. | 15. | 15. | 15. | 15. | 15. | 16. | 17. | 18. | 18. |
| 18. | 19. | 19. | 19. | 19. | 20. | 20. | 20. | 22. | 23. |
| 24. | 24. | 25. | 25. | 26. | 24. | 26. | 27. | 27. | 28. |
| 25. | 28. | 31. | 36. | 41. | 64. | 102. | 91. | 63. | 50. |
| 42. | 38. | 36. | 35. | 36. | 38. | 49. | 42. | 44. | 46. |
| 47. | 49. | 51. | 53. | 57. | 53. | 54. | 55. | 56. | 57. |
| 58. | 59. | 60. | 60. | 61. | 62. | 58. | 55. | 55. | 55. |
| 55. | 55. | 56. | 56. | 56. | 56. | 56. | 56. | 56. | 56. |
| 56. | 55. | 55. | 55. | 54. | 54. | 54. | 53. | 53. | 52. |
| 52. | 51. | 51. | 50. | 50. | 50. | 49. | 49. | 48. | 48. |
| 47. | 47. | 46. | 46. | 45. | 45. | 45. | 44. | 44. | 43. |
| 43. | 42. | 42. | 42. | 41. | 41. | 40. | 40. | 40. | 39. |
| 39. | 38. | 38. | 38. | 37. | 37. | 37. | 36. | 36. | 36. |
| 35. | 35. | 35. | 34. | 34. | 34. | 34. | 33. | | |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 102. | 53. | 21. | 21. | 6171. |
| CMS | 3. | 1. | 1. | 1. | 175. |
| INCHES | | .54 | .88 | .88 | .88 |
| MM | | 13.69 | 22.26 | 22.26 | 22.26 |
| AC-FT | | 26. | 43. | 43. | 43. |
| THOUS CU M | | 32. | 52. | 52. | 52. |

SUM OF 2 HYDROGRAPHS AT 4 PLAN 1 RTIO 2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 2. | 3. | 3. | 4. | 4. | 4. | 4. | 4. |
| 4. | 5. | 5. | 5. | 5. | 5. | 5. | 5. | 6. | 6. |
| 6. | 6. | 6. | 6. | 7. | 7. | 7. | 7. | 7. | 8. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8. | 8. | 8. | 8. | 9. | 9. | 9. | 9. | 9. | 9. |
| 10. | 10. | 10. | 10. | 10. | 11. | 11. | 11. | 11. | 11. |
| 12. | 12. | 12. | 12. | 12. | 12. | 13. | 13. | 13. | 13. |
| 13. | 14. | 14. | 14. | 14. | 14. | 14. | 15. | 15. | 15. |
| 15. | 15. | 16. | 16. | 21. | 26. | 28. | 28. | 28. | 29. |
| 29. | 29. | 30. | 30. | 30. | 31. | 33. | 34. | 35. | 36. |
| 36. | 37. | 38. | 38. | 39. | 39. | 40. | 41. | 44. | 46. |
| 48. | 49. | 50. | 51. | 53. | 54. | 55. | 57. | 58. | 60. |
| 56. | 61. | 63. | 79. | 91. | 137. | 213. | 192. | 139. | 114. |
| 99. | 93. | 93. | 93. | 93. | 96. | 98. | 100. | 102. | 104. |
| 105. | 107. | 109. | 113. | 110. | 109. | 111. | 112. | 113. | 115. |
| 116. | 117. | 115. | 119. | 120. | 121. | 113. | 107. | 106. | 106. |
| 106. | 106. | 107. | 107. | 107. | 107. | 109. | 108. | 107. | 107. |
| 107. | 107. | 106. | 106. | 106. | 105. | 105. | 104. | 104. | 103. |
| 102. | 102. | 101. | 101. | 100. | 99. | 99. | 98. | 97. | 97. |
| 96. | 95. | 95. | 94. | 93. | 93. | 92. | 92. | 91. | 90. |
| 90. | 89. | 89. | 89. | 87. | 87. | 87. | 86. | 86. | 85. |
| 85. | 85. | 84. | 84. | 83. | 83. | 83. | 82. | 82. | 81. |
| 81. | 81. | 80. | 80. | 80. | 79. | 79. | 78. | | |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 213. | 108. | 44. | 44. | 12608. |
| CMS | 6. | 3. | 1. | 1. | 363. |
| INCHES | | 1.10 | 1.82 | 1.82 | 1.82 |
| MM | | 28.05 | 46.19 | 46.19 | 46.19 |
| AC-FT | | 54. | 88. | 88. | 88. |
| THOUS CU M | | 66. | 109. | 109. | 109. |

SUM OF 2 HYDROGRAPHS AT 4 PLAN 1 RTIO 3

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 3. | 5. | 5. | 6. | 6. | 6. | 6. | 6. |
| 7. | 7. | 7. | 7. | 7. | 8. | 8. | 8. | 8. | 9. |
| 9. | 9. | 9. | 10. | 10. | 10. | 10. | 11. | 11. | 11. |
| 12. | 12. | 12. | 13. | 13. | 13. | 13. | 14. | 14. | 14. |
| 14. | 15. | 15. | 15. | 16. | 16. | 16. | 16. | 17. | 17. |
| 17. | 18. | 18. | 18. | 19. | 19. | 19. | 19. | 20. | 20. |
| 20. | 20. | 21. | 21. | 21. | 21. | 22. | 22. | 22. | 22. |
| 23. | 23. | 23. | 24. | 32. | 39. | 41. | 42. | 43. | 43. |
| 43. | 44. | 44. | 45. | 45. | 46. | 49. | 52. | 53. | 54. |
| 55. | 57. | 58. | 60. | 61. | 63. | 65. | 66. | 72. | 77. |
| 80. | 82. | 84. | 85. | 89. | 91. | 93. | 95. | 98. | 100. |
| 96. | 104. | 114. | 130. | 147. | 214. | 327. | 294. | 212. | 173. |
| 149. | 136. | 129. | 127. | 129. | 133. | 137. | 141. | 145. | 149. |
| 174. | 265. | 413. | 597. | 865. | 1058. | 1401. | 1792. | 2201. | 2615. |
| 2999. | 3341. | 2907. | 2553. | 2259. | 1993. | 1761. | 1563. | 1398. | 1256. |
| 1130. | 1019. | 919. | 830. | 751. | 679. | 615. | 557. | 505. | 457. |
| 414. | 374. | 341. | 310. | 262. | 258. | 235. | 215. | 198. | 181. |

B L A C K & V E A T C H    PROJECT 9166:    DATE 05 FEB 81    PAGE 43

FLOOD HYDROGRAPH PACKAGE - HEC-1    PROGRAM H21/G2-1V    TIME 17:58:42    CASE PMF

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 82. | 85. | 89. | 93. | 96. | 99. | 103. | 107. | 111. | 114. |
| 118. | 121. | 123. | 124. | 126. | 128. | 130. | 131. | 133. | 135. |
| 136. | 138. | 141. | 143. | 145. | 149. | 150. | 152. | 155. | 157. |
| 159. | 161. | 163. | 177. | 232. | 342. | 509. | 734. | 1024. | 1369. |
| 1751. | 2157. | 2570. | 2953. | 3361. | 2989. | 2602. | 2362. | 2145. | 1945. |
| 1778. | 1639. | 1526. | 1434. | 1359. | 1301. | 1273. | 1255. | 1237. | 1227. |
| 1223. | 1225. | 1232. | 1244. | 1259. | 1277. | 1297. | 1319. | 1368. | 1412. |
| 1443. | 1473. | 1496. | 1523. | 1550. | 1579. | 1606. | 1635. | 1665. | 1696. |
| 1476. | 1765. | 1824. | 1947. | 2082. | 2551. | 3337. | 3151. | 2655. | 2458. |
| 2381. | 2414. | 2501. | 2639. | 2813. | 3009. | 3167. | 3359. | 3507. | 3626. |
| 3716. | 3771. | 3794. | 3785. | 3722. | 3640. | 3556. | 3469. | 3376. | 3280. |
| 3184. | 3068. | 2993. | 2934. | 2816. | 2732. | 2564. | 2418. | 2322. | 2242. |
| 2162. | 2094. | 2021. | 1947. | 1871. | 1792. | 1712. | 1629. | 1546. | 1462. |
| 1379. | 1297. | 1215. | 1135. | 1055. | 984. | 914. | 848. | 786. | 729. |
| 675. | 626. | 581. | 539. | 500. | 465. | 433. | 405. | 379. | 356. |
| 335. | 316. | 299. | 284. | 271. | 259. | 248. | 238. | 229. | 221. |
| 214. | 207. | 201. | 195. | 191. | 187. | 183. | 179. | 176. | 173. |
| 171. | 168. | 166. | 164. | 163. | 161. | 160. | 159. | 157. | 156. |
| 156. | 155. | 154. | 153. | 153. | 152. | 152. | 151. | | |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 3794. | 2301. | 816. | 816. | 234893. |
| CMS | 107. | 65. | 23. | 23. | 6651. |
| INCHES | | 23.52 | 33.35 | 33.35 | 33.35 |
| MM | | 597.40 | 847.07 | 847.07 | 847.07 |
| AC-FT | | 1141. | 1618. | 1618. | 1618. |
| THOUS CU M | | 1407. | 1995. | 1995. | 1995. |

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

HYDROGRAPH ROUTING

ROUTING THROUGH LOWER KEHR'S MILL TRAIL LAKE DAM

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

ROUTING DATA

| QLOSS | CLOSS | AVG | IRES | ISAME | IOPT | IPMP | | LSTR |
|---|---|---|---|---|---|---|---|---|
| .0 | .000 | .00 | 1 | 1 | 0 | 0 | | 0 |

| NSTPS | NSTDL | LAG | AMSKK | X | TSK | STORA | ISPRAT |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | .000 | .000 | .000 | -505. | -1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | 504.90 | 505.40 | 506.90 | 507.40 | 507.90 | 508.90 | 509.90 | 510.90 | 512.90 | 514.90 |
| | 516.90 | | | | | | | | | |
| FLOW | .00 | 22.00 | 36.00 | 52.00 | 70.00 | 86.00 | 102.00 | 120.00 | 140.00 | 160.00 |
| | 180.00 | | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| SURFACE AREA= | 0. | 2. | 9. | 16. | 20. | 25. |
| CAPACITY= | 0. | 3. | 52. | 174. | 350. | 574. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ELEVATION= | 474. | 480. | 490. | 500. | 510. | 520. | | |

| CREL | SPWID | COQW | EXPW | ELEVL | COQL | CAREA | EXPL |
|---|---|---|---|---|---|---|---|
| 504.9 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |

DAM DATA

| TOPEL | COQD | EXPD | DAMWID |
|---|---|---|---|
| 509.6 | .0 | .0 | 0. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CREST LENGTH AT OR BELOW | 0. | 137. | 158. | 250. | 320. | 403. | 443. | 532. |
| ELEVATION | 509.6 | 510.2 | 510.4 | 511.3 | 512.4 | 514.2 | 515.4 | 518.1 |

STATION 5, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 1. | 2. |
| 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2. |
| 2. | 2. | 2. | 2. | 2. | 2. | 3. | 3. | 3. | 3. |
| 3. | 3. | 3. | 3. | 3. | 3. | 3. | 4. | 4. | 4. |
| 4. | 4. | 4. | 4. | 4. | 4. | 5. | 5. | 5. | 5. |
| 5. | 5. | 5. | 5. | 6. | 6. | 6. | 7. | 7. | 8. |
| 8. | 8. | 8. | 8. | 8. | 9. | 9. | 9. | 9. | 9. |
| 10. | 10. | 10. | 10. | 10. | 11. | 11. | 11. | 11. | 12. |
| 12. | 12. | 12. | 13. | 13. | 13. | 13. | 14. | 14. | 14. |
| 14. | 15. | 15. | 15. | 15. | 16. | 16. | 16. | 16. | 16. |
| 17. | 17. | 17. | 17. | 18. | 18. | 18. | 18. | 18. | 18. |
| 19. | 19. | 19. | 19. | 19. | 20. | 20. | 20. | 20. | 20. |
| 20. | 20. | 21. | 21. | 21. | 21. | 21. | 21. | 21. | 22. |
| 22. | 22. | 22. | 22. | 22. | 22. | 23. | 23. | 23. | 23. |
| 23. | 23. | 24. | 24. | 24. | 24. | 24. | 24. | 24. | 25. |
| 25. | 25. | 25. | 25. | 25. | 25. | 25. | 25. | | |

STORAGE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. |
| 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. |
| 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. |
| 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. |
| 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. |
| 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. | 255. |

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

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

| OPERATION | STATION | AREA | PLAN | RATIO 1 .05 | RATIO 2 .10 | RATIO 3 .15 | RATIO 4 .20 | RATIO 5 .50 | RATIO 6 1.00 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | RATIOS APPLIED TO FLOWS | | | | | |
| HYDROGRAPH AT | 1 | .80 | 1 | 207. | 413. | 620. | 826. | 2066. | 4132. |
| | ( | 2.07) | ( | 5.85)( | 11.70)( | 17.55)( | 23.40)( | 58.50)( | 116.99)( |
| ROUTED TO | 2 | .80 | 1 | 55. | 106. | 3311. | 3614. | 3590. | 3542. |
| | ( | 2.07) | ( | 1.57)( | 2.99)( | 93.76)( | 102.37)( | 101.65)( | 100.29)( |
| HYDROGRAPH AT | 3 | .11 | 1 | 85. | 169. | 254. | 338. | 846. | 1691. |
| | ( | .28) | ( | 2.39)( | 4.79)( | 7.18)( | 9.58)( | 23.94)( | 47.88)( |
| 2 COMBINED | 4 | .91 | 1 | 102. | 213. | 3341. | 3659. | 3724. | 3794. |
| | ( | 2.36) | ( | 2.88)( | 6.04)( | 94.60)( | 103.61)( | 105.44)( | 107.42)( |
| ROUTED TO | 5 | .91 | 1 | 25. | 68. | 2459. | 2902. | 3014. | 3758. |
| | ( | 2.36) | ( | .72)( | 1.93)( | 69.64)( | 82.18)( | 85.35)( | 106.43)( |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ...............

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 524.80 | 524.80 | 529.80 |
| STORAGE | 160. | 160. | 252. |
| OUTFLOW | 0. | 0. | 110. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| .05 | 527.39 | .00 | 235. | 55. | .00 | 18.92 | .00 |
| .10 | 529.62 | .00 | 248. | 106. | .00 | 18.92 | .00 |
| .15 | 530.27 | .47 | 261. | 3311. | .67 | 17.67 | 16.67 |
| .20 | 530.44 | .64 | 265. | 3614. | .75 | 17.08 | 16.08 |
| .50 | 530.36 | .56 | 263. | 3593. | .73 | 14.75 | 13.75 |
| 1.00 | 530.05 | .25 | 257. | 3542. | .58 | 16.92 | 11.08 |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ...............

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 504.90 | 504.90 | 509.60 |
| STORAGE | 255. | 255. | 342. |
| OUTFLOW | 0. | 0. | 97. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| .05 | 506.52 | .00 | 284. | 25. | .00 | 24.00 | .00 |
| .10 | 507.94 | .00 | 309. | 69. | .00 | 24.00 | .00 |
| .15 | 512.30 | 2.70 | 397. | 2459. | 5.33 | 17.63 | .00 |
| .20 | 512.53 | 2.93 | 402. | 2902. | 6.17 | 17.25 | .00 |
| .50 | 512.59 | 2.99 | 403. | 3014. | 9.58 | 14.92 | .00 |
| 1.00 | 512.93 | 3.33 | 416. | 3758. | 12.17 | 17.00 | .00 |

```
B L A C K     V E A T C H                                                        PROJECT 9166:      DATE 13 JAN 8'    'AGE   2
==================================================================================================================================
FLOOD HYDROGRAPH PACKAGE - HEC-1                                                 PROGRAM H21/02-1V -TIME -18:02:10 -- CASE 100

********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
********************************
    1             A1MISSOURI DAM INSPECTION PROGRAM
    2             A2ST LOUIS DISTRICT US ARMY CORPS OF ENGINEERS
    3             A3UPPER AND LOWER KEHR'S MILL TRAIL LAKE DAMS
    4             B     288      0      5      0      0      0      0      0      0      0
    5             B1      3
    6             K       0      1                           3      1
    7             K1   UPPER KEHR'S MILL TRAIL LAKE DAM (24 HR. 100-YEAR INFLOW)
    8             M       0      2    .80                    1
    9             O     288  6.974
   10             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   11             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   12             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   13             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   14             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   15             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   16             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   17             O1   .007   .007   .012   .012   .012   .012   .012   .012   .012   .012
   18             O1   .012   .012   .012   .012   .012   .012   .012   .012   .012   .012
   19             O1   .012   .012   .012   .012   .012   .012   .012   .012   .012   .012
   20             O1   .012   .012   .012   .012   .012   .012   .012   .012   .023   .023
   21             O1   .023   .023   .023   .023   .023   .023   .023   .023   .023   .023
   22             O1   .023   .023   .023   .023   .023   .023   .030   .030   .030   .030
   23             O1   .030   .030   .048   .048   .048   .049   .049   .049   .134   .134
   24             O1   .134   .255   .255   .546   .117   .180   .255   .134   .134   .134
   25             O1   .049   .049   .049   .048   .048   .048   .030   .030   .030   .030
   26             O1   .030   .030   .023   .023   .023   .023   .023   .023   .023   .023
   27             O1   .023   .023   .023   .023   .023   .023   .023   .023   .023   .023
   28             O1   .012   .012   .012   .012   .012   .012   .012   .012   .012   .012
   29             O1   .012   .012   .012   .012   .012   .012   .012   .012   .012   .012
   30             O1   .012   .012   .012   .012   .012   .012   .012   .012   .012   .012
   31             O1   .012   .012   .012   .012   .012   .012   .007   .007   .007   .007
   32             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   33             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   34             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   35             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   36             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   37             O1   .007   .007   .007   .007   .007   .007   .007   .007   .007   .007
   38             O1   .007   .007   .007   .007   .007   .007   .007   .007
   39             T                                                 -1    -72
   40             W2           1.47
   41             X                   1
   42             K       1      2                                  1
   43             K1   ROUTING THROUGH UPPER KEHR'S MILL TRAIL LAKE DAM
   44             Y                          1
   45             Y1      1                                     -524.8     -1
   46             Y4  524.8  526.3  526.8  527.3  527.8  528.8  529.8  530.8  532.8  534.8
   47             Y4  536.8
   48             Y5     0.    22.    36.    52.    70.    86.   110.   126.   144.   164.
   49             Y5   184.
   50             SA     0.    4.2    6.9   12.6   20.6   32.4
```

```
SE  495.    510.    514.9   520.    530.    540.
SS  524.8
SD  529.8
SL    0.     33.     95.    207.    275.    328.    380.    417.    535.
SV  529.8   529.9   530.0   530.1   530.3   531.0   531.9   532.5   535.2
SP   10.      .5    510.      1.    524.8   529.8
K      0       3                               3       1
K1   LOWER KEHR'S MILL TRAIL LAKE DAM (100-YEAR INFLOW)
M      C       2     .11
O    288   6.974
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .012    .012    .012    .012    .012    .012    .012    .012
O1  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
O1  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
O1  .012    .012    .012    .012    .012    .012    .012    .012    .023    .023
O1  .023    .023    .023    .023    .023    .023    .023    .023    .023    .023
O1  .023    .023    .023    .023    .023    .023    .030    .030    .030    .030
O1  .030    .030    .049    .048    .048    .049    .049    .049    .134    .134
O1  .134    .255    .255    .546    .817    .380    .255    .134    .134    .134
O1  .049    .049    .049    .048    .048    .048    .030    .030    .030    .030
O1  .030    .030    .023    .023    .023    .023    .023    .023    .023    .023
O1  .023    .023    .023    .023    .023    .023    .023    .023    .023    .023
O1  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
O1  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
O1  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
O1  .012    .012    .012    .012    .012    .012    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1  .007    .007    .007    .007    .007    .007    .007    .007
T                                                     -1     -72
W2          .11
X                      1
K      2       4                                       1
K1   COMBINE HYDROGRAPHS-TOTAL FLOW LOWER DAM (24 HR. 100-YEAR INFLOW)
K      1       5                                       1
K1   ROUTING THROUGH LOWER KEHR'S MILL TRAIL LAKE DAM
Y                              1
Y1     1                                          -504.9      -1
Y4  504.9   506.4   506.9   507.4   507.9   508.9   509.9   510.9   512.9   514.9
Y4  516.9
```

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | YS | 0. | 22. | 36. | 52. | 74. | 86. | 102. | 120. | 140. | 160. |
| 102 | YS | 180. | | | | | | | | | |
| 103 | SA | 0. | 1.6 | 9.1 | 15.6 | 19.8 | 25.1 | | | | |
| 104 | SE | 474. | 480. | 490. | 500. | 510. | 520. | | | | |
| 105 | SS | 504.9 | | | | | | | | | |
| 106 | SD | 509.6 | | | | | | | | | |
| 107 | SL | 0. | 137. | 158. | 250. | 326. | 403. | 443. | 572. | | |
| 108 | SV | 509.6 | 510.2 | 510.4 | 511.3 | 512.4 | 514.2 | 515.4 | 518.1 | | |
| 109 | K | 99 | | | | | | | | | |

B L A C K    C A T C H    PROJECT 9166:    DATE 13 JAN 81    SE 6

FLOOD HYDROGRAPH PACKAGE - HEC-1    PROGRAM H21/02-1V    TIME 18:02:10    CASE 100

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION    JULY 1978
LAST MODIFICATION    01 APR 80

MISSOURI DAM INSPECTION PROGRAM
ST LOUIS DISTRICT US ARMY CORPS OF ENGINEERS
UPPER AND LOWER KEHR'S MILL TRAIL LAKE DAMS

JOB SPECIFICATION

| NQ | NHR | NMIN | IDAY | IHR | IMIN | METRC | IPLT | IPRT | NSTAN |
|---|---|---|---|---|---|---|---|---|---|
| 288 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| JOPER | NWT | LROPT | TRACE |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

SUB-AREA RUNOFF COMPUTATION

UPPER KEHR'S MILL TRAIL LAKE DAM (24 HR. 100-YEAR INFLOW)

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 |

HYDROGRAPH DATA

| IHYDG | IUHG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | .80 | .00 | .80 | 1.00 | .000 | 0 | 0 | 0 |

PRECIP DATA

| NP | STORM | DAJ | DAK |
|---|---|---|---|
| 288 | 6.97 | .00 | .00 |

PRECIP PATTERN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 |
| .03 | .03 | .05 | .05 | .05 | .05 | .05 | .05 | .13 | .13 |
| .13 | .25 | .25 | .55 | .82 | .36 | .25 | .13 | .13 | .13 |
| .05 | .05 | .05 | .05 | .05 | .05 | .03 | .03 | .03 | .03 |
| .03 | .03 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |

```
 .01   .01   .01   .01   .01   .01   .01   .01   .01   .01
 .01   .01   .01   .01   .01   .01   .01   .01   .01   .01
 .01   .01   .01   .01   .01   .01   .01   .01   .01   .01
 .01   .01   .01   .01   .01   .01   .01   .01   .01   .01
 .01   .01   .01   .01   .01   .01   .01   .01   .01   .01
 .01   .01   .01   .01   .01   .01   .01   .01   .01   .01
 .01   .01   .01   .01   .01   .01   .01   .01

                              LOSS DATA
 LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
    0    .00    .00   1.00    .00    .00   1.00  -1.00 -72.00    .00    .00

       CURVE NO =  -72.00  WETNESS =   -1.00  EFFECT CN =   72.00

                         UNIT HYDROGRAPH DATA
                       TC=   .00   LAG=  1.47

                            RECESSION DATA
              STRTQ=     .00    QRCSN=     .00    RTIOR= 1.00

      UNIT HYDROGRAPH 90 END OF PERIOD ORDINATES, TC=     .00 HOURS, LAG=  1.47  VOL= 1.00
    4.     9.    19.    30.    42.    58.    75.    96.   119.   145.
  171.   194.   214.   230.   242.   250.   254.   255.   254.   253.
  244.   235.   225.   215.   204.   191.   177.   160.   144.   129.
  116.   106.    97.    88.    81.    74.    68.    63.    58.    53.
   48.    44.    40.    36.    33.    31.    28.    26.    23.    21.
   19.    18.    16.    15.    13.    12.    11.    10.     9.     9.
    8.     7.     7.     6.     6.     5.     5.     4.     4.     4.
    3.     3.     3.     3.     2.     2.     2.     2.     2.     2.
    1.     1.     1.     1.     1.     1.     1.     0.     0.     0.

     0                                END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD  RAIN  EXCS  LOSS  COMP Q     MO.DA  HR.MN  PERIOD  RAIN  EXCS  LOSS  COMP Q

  1.01    .05     1    .01   .00   .01     0.      1.01  12.05   145    .82   .55   .27     61.
  1.01    .10     2    .01   .00   .01     0.      1.01  12.10   146    .38   .28   .11     76.
  1.01    .15     3    .01   .00   .01     0.      1.01  12.15   147    .26   .19   .06     94.
  1.01    .20     4    .01   .00   .01     0.      1.01  12.20   148    .13   .10   .03    115.
  1.01    .25     5    .01   .00   .01     0.      1.01  12.25   149    .13   .10   .03    147.
  1.01    .30     6    .01   .00   .01     0.      1.01  12.30   150    .13   .10   .03    178.
  1.01    .35     7    .01   .00   .01     0.      1.01  12.35   151    .05   .04   .01    214.
  1.01    .40     8    .01   .00   .01     0.      1.01  12.40   152    .05   .04   .01    254.
  1.01    .45     9    .01   .00   .01     0.      1.01  12.45   153    .05   .04   .01    297.
  1.01    .50    10    .01   .00   .01     0.      1.01  12.50   154    .05   .04   .01    343.
  1.01    .55    11    .01   .00   .01     0.      1.01  12.55   155    .05   .04   .01    388.
  1.01   1.00    12    .01   .00   .01     0.      1.01  13.00   156    .05   .04   .01    430.
  1.01   1.05    13    .01   .00   .01     0.      1.01  13.05   157    .03   .02   .01    469.
  1.01   1.10    14    .01   .00   .01     0.      1.01  13.10   158    .03   .02   .01    502.
  1.01   1.15    15    .01   .00   .01     0.      1.01  13.15   159    .03   .02   .01    530.
  1.01   1.20    16    .01   .00   .01     0.      1.01  13.20   160    .03   .02   .01    551.
  1.01   1.25    17    .01   .00   .01     0.      1.01  13.25   161    .03   .02   .01    566.
  1.01   1.30    18    .01   .00   .01     0.      1.01  13.30   162    .03   .02   .01    575.
  1.01   1.35    19    .01   .00   .01     0.      1.01  13.35   163    .02   .02   .00    580.
  1.01   1.40    20    .01   .00   .01     0.      1.01  13.40   164    .02   .02   .00    580.
  1.01   1.45    21    .01   .00   .01     0.      1.01  13.45   165    .02   .02   .00    574.
```

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 1.55 | 23 | .01 | .00 | .01 | 0. | 1.01 | 13.55 | 167 | .02 | .02 | .00 | 550. |
| 1.01 | 2.00 | 24 | .01 | .00 | .01 | 0. | 1.01 | 14.00 | 168 | .02 | .02 | .00 | 534. |
| 1.01 | 2.05 | 25 | .01 | .00 | .01 | 0. | 1.01 | 14.05 | 169 | .02 | .02 | .00 | 516. |
| 1.01 | 2.10 | 26 | .01 | .00 | .01 | 0. | 1.01 | 14.10 | 170 | .02 | .02 | .00 | 494. |
| 1.01 | 2.15 | 27 | .01 | .00 | .01 | 0. | 1.01 | 14.15 | 171 | .02 | .02 | .00 | 471. |
| 1.01 | 2.20 | 28 | .01 | .00 | .01 | 0. | 1.01 | 14.20 | 172 | .02 | .02 | .00 | 445. |
| 1.01 | 2.25 | 29 | .01 | .00 | .01 | 0. | 1.01 | 14.25 | 173 | .02 | .02 | .00 | 419. |
| 1.01 | 2.30 | 30 | .01 | .00 | .01 | 0. | 1.01 | 14.30 | 174 | .02 | .02 | .00 | 394. |
| 1.01 | 2.35 | 31 | .01 | .00 | .01 | 0. | 1.01 | 14.35 | 175 | .02 | .02 | .00 | 371. |
| 1.01 | 2.40 | 32 | .01 | .00 | .01 | 0. | 1.01 | 14.40 | 176 | .02 | .02 | .00 | 350. |
| 1.01 | 2.45 | 33 | .01 | .00 | .01 | 0. | 1.01 | 14.45 | 177 | .02 | .02 | .00 | 330. |
| 1.01 | 2.50 | 34 | .01 | .00 | .01 | 0. | 1.01 | 14.50 | 178 | .02 | .02 | .00 | 312. |
| 1.01 | 2.55 | 35 | .01 | .00 | .01 | 0. | 1.01 | 14.55 | 179 | .02 | .02 | .00 | 296. |
| 1.01 | 3.00 | 36 | .01 | .00 | .01 | 0. | 1.01 | 15.00 | 180 | .02 | .02 | .00 | 281. |
| 1.01 | 3.05 | 37 | .01 | .00 | .01 | 0. | 1.01 | 15.05 | 181 | .01 | .01 | .00 | 268. |
| 1.01 | 3.10 | 38 | .01 | .00 | .01 | 0. | 1.01 | 15.10 | 182 | .01 | .01 | .00 | 255. |
| 1.01 | 3.15 | 39 | .01 | .00 | .01 | 0. | 1.01 | 15.15 | 183 | .01 | .01 | .00 | 244. |
| 1.01 | 3.20 | 40 | .01 | .00 | .01 | 0. | 1.01 | 15.20 | 184 | .01 | .01 | .00 | 233. |
| 1.01 | 3.25 | 41 | .01 | .00 | .01 | 0. | 1.01 | 15.25 | 185 | .01 | .01 | .00 | 222. |
| 1.01 | 3.30 | 42 | .01 | .00 | .01 | 0. | 1.01 | 15.30 | 186 | .01 | .01 | .00 | 213. |
| 1.01 | 3.35 | 43 | .01 | .00 | .01 | 0. | 1.01 | 15.35 | 187 | .01 | .01 | .00 | 203. |
| 1.01 | 3.40 | 44 | .01 | .00 | .01 | 0. | 1.01 | 15.40 | 188 | .01 | .01 | .00 | 195. |
| 1.01 | 3.45 | 45 | .01 | .00 | .01 | 0. | 1.01 | 15.45 | 189 | .01 | .01 | .00 | 187. |
| 1.01 | 3.50 | 46 | .01 | .00 | .01 | 0. | 1.01 | 15.50 | 190 | .01 | .01 | .00 | 179. |
| 1.01 | 3.55 | 47 | .01 | .00 | .01 | 0. | 1.01 | 15.55 | 191 | .01 | .01 | .00 | 172. |
| 1.01 | 4.00 | 48 | .01 | .00 | .01 | 0. | 1.01 | 16.00 | 192 | .01 | .01 | .00 | 165. |
| 1.01 | 4.05 | 49 | .01 | .00 | .01 | 0. | 1.01 | 16.05 | 193 | .01 | .01 | .00 | 158. |
| 1.01 | 4.10 | 50 | .01 | .00 | .01 | 0. | 1.01 | 16.10 | 194 | .01 | .01 | .00 | 151. |
| 1.01 | 4.15 | 51 | .01 | .00 | .01 | 0. | 1.01 | 16.15 | 195 | .01 | .01 | .00 | 145. |
| 1.01 | 4.20 | 52 | .01 | .00 | .01 | 0. | 1.01 | 16.20 | 196 | .01 | .01 | .00 | 139. |
| 1.01 | 4.25 | 53 | .01 | .00 | .01 | 0. | 1.01 | 16.25 | 197 | .01 | .01 | .00 | 133. |
| 1.01 | 4.30 | 54 | .01 | .00 | .01 | 0. | 1.01 | 16.30 | 198 | .01 | .01 | .00 | 126. |
| 1.01 | 4.35 | 55 | .01 | .00 | .01 | 0. | 1.01 | 16.35 | 199 | .01 | .01 | .00 | 123. |
| 1.01 | 4.40 | 56 | .01 | .00 | .01 | 0. | 1.01 | 16.40 | 200 | .01 | .01 | .00 | 118. |
| 1.01 | 4.45 | 57 | .01 | .00 | .01 | 0. | 1.01 | 16.45 | 201 | .01 | .01 | .00 | 114. |
| 1.01 | 4.50 | 58 | .01 | .00 | .01 | 0. | 1.01 | 16.50 | 202 | .01 | .01 | .00 | 109. |
| 1.01 | 4.55 | 59 | .01 | .00 | .01 | 0. | 1.01 | 16.55 | 203 | .01 | .01 | .00 | 105. |
| 1.01 | 5.00 | 60 | .01 | .00 | .01 | 0. | 1.01 | 17.00 | 204 | .01 | .01 | .00 | 102. |
| 1.01 | 5.05 | 61 | .01 | .00 | .01 | 0. | 1.01 | 17.05 | 205 | .01 | .01 | .00 | 98. |
| 1.01 | 5.10 | 62 | .01 | .00 | .01 | 0. | 1.01 | 17.10 | 206 | .01 | .01 | .00 | 95. |
| 1.01 | 5.15 | 63 | .01 | .00 | .01 | 0. | 1.01 | 17.15 | 207 | .01 | .01 | .00 | 92. |
| 1.01 | 5.20 | 64 | .01 | .00 | .01 | 0. | 1.01 | 17.20 | 208 | .01 | .01 | .00 | 89. |
| 1.01 | 5.25 | 65 | .01 | .00 | .01 | 0. | 1.01 | 17.25 | 209 | .01 | .01 | .00 | 87. |
| 1.01 | 5.30 | 66 | .01 | .00 | .01 | 0. | 1.01 | 17.30 | 210 | .01 | .01 | .00 | 85. |
| 1.01 | 5.35 | 67 | .01 | .00 | .01 | 0. | 1.01 | 17.35 | 211 | .01 | .01 | .00 | 83. |
| 1.01 | 5.40 | 68 | .01 | .00 | .01 | 0. | 1.01 | 17.40 | 212 | .01 | .01 | .00 | 81. |
| 1.01 | 5.45 | 69 | .01 | .00 | .01 | 0. | 1.01 | 17.45 | 213 | .01 | .01 | .00 | 79. |
| 1.01 | 5.50 | 70 | .01 | .00 | .01 | 0. | 1.01 | 17.50 | 214 | .01 | .01 | .00 | 78. |
| 1.01 | 5.55 | 71 | .01 | .00 | .01 | 0. | 1.01 | 17.55 | 215 | .01 | .01 | .00 | 77. |
| 1.01 | 6.00 | 72 | .01 | .00 | .01 | 0. | 1.01 | 18.00 | 216 | .01 | .01 | .00 | 75. |
| 1.01 | 6.05 | 73 | .01 | .00 | .01 | 0. | 1.01 | 18.05 | 217 | .01 | .01 | .00 | 74. |
| 1.01 | 6.10 | 74 | .01 | .00 | .01 | 0. | 1.01 | 18.10 | 218 | .01 | .01 | .00 | 73. |
| 1.01 | 6.15 | 75 | .01 | .00 | .01 | 0. | 1.01 | 18.15 | 219 | .01 | .01 | .00 | 72. |
| 1.01 | 6.20 | 76 | .01 | .00 | .01 | 0. | 1.01 | 18.20 | 220 | .01 | .01 | .00 | 71. |
| 1.01 | 6.25 | 77 | .01 | .00 | .01 | 0. | 1.01 | 18.25 | 221 | .01 | .01 | .00 | 70. |
| 1.01 | 6.30 | 78 | .01 | .00 | .01 | 0. | 1.01 | 18.30 | 222 | .01 | .01 | .00 | 69. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 6.35 | 79 | .01 | .00 | .01 | 0. | 1.01 | 18.35 | 223 | .01 | .01 | .00 | 68. |
| 1.01 | 6.40 | 80 | .01 | .00 | .01 | 0. | 1.01 | 18.40 | 224 | .01 | .01 | .00 | 67. |
| 1.01 | 6.45 | 81 | .01 | .00 | .01 | 0. | 1.01 | 18.45 | 225 | .01 | .01 | .00 | 66. |
| 1.01 | 6.50 | 82 | .01 | .00 | .01 | 0. | 1.01 | 18.50 | 226 | .01 | .01 | .00 | 65. |
| 1.01 | 6.55 | 83 | .01 | .00 | .01 | 0. | 1.01 | 18.55 | 227 | .01 | .01 | .00 | 64. |
| 1.01 | 7.00 | 84 | .01 | .00 | .01 | 0. | 1.01 | 19.00 | 228 | .01 | .01 | .00 | 62. |
| 1.01 | 7.05 | 85 | .01 | .00 | .01 | 0. | 1.01 | 19.05 | 229 | .01 | .01 | .00 | 61. |
| 1.01 | 7.10 | 86 | .01 | .00 | .01 | 0. | 1.01 | 19.10 | 230 | .01 | .01 | .00 | 60. |
| 1.01 | 7.15 | 87 | .01 | .00 | .01 | 0. | 1.01 | 19.15 | 231 | .01 | .01 | .00 | 58. |
| 1.01 | 7.20 | 88 | .01 | .00 | .01 | 0. | 1.01 | 19.20 | 232 | .01 | .01 | .00 | 57. |
| 1.01 | 7.25 | 89 | .01 | .00 | .01 | 0. | 1.01 | 19.25 | 233 | .01 | .01 | .00 | 55. |
| 1.01 | 7.30 | 90 | .01 | .00 | .01 | 0. | 1.01 | 19.30 | 234 | .01 | .01 | .00 | 54. |
| 1.01 | 7.35 | 91 | .01 | .00 | .01 | 0. | 1.01 | 19.35 | 235 | .01 | .01 | .00 | 53. |
| 1.01 | 7.40 | 92 | .01 | .00 | .01 | 0. | 1.01 | 19.40 | 236 | .01 | .01 | .00 | 51. |
| 1.01 | 7.45 | 93 | .01 | .00 | .01 | 0. | 1.01 | 19.45 | 237 | .01 | .01 | .00 | 50. |
| 1.01 | 7.50 | 94 | .01 | .00 | .01 | 0. | 1.01 | 19.50 | 238 | .01 | .01 | .00 | 49. |
| 1.01 | 7.55 | 95 | .01 | .00 | .01 | 0. | 1.01 | 19.55 | 239 | .01 | .01 | .00 | 48. |
| 1.01 | 8.00 | 96 | .01 | .00 | .01 | 0. | 1.01 | 20.00 | 240 | .01 | .01 | .00 | 47. |
| 1.01 | 8.05 | 97 | .01 | .00 | .01 | 0. | 1.01 | 20.05 | 241 | .01 | .01 | .00 | 46. |
| 1.01 | 8.10 | 98 | .01 | .00 | .01 | 0. | 1.01 | 20.10 | 242 | .01 | .01 | .00 | 45. |
| 1.01 | 8.15 | 99 | .01 | .00 | .01 | 0. | 1.01 | 20.15 | 243 | .01 | .01 | .00 | 44. |
| 1.01 | 8.20 | 100 | .01 | .00 | .01 | 0. | 1.01 | 20.20 | 244 | .01 | .01 | .00 | 44. |
| 1.01 | 8.25 | 101 | .01 | .00 | .01 | 0. | 1.01 | 20.25 | 245 | .01 | .01 | .00 | 43. |
| 1.01 | 8.30 | 102 | .01 | .00 | .01 | 0. | 1.01 | 20.30 | 246 | .01 | .01 | .00 | 42. |
| 1.01 | 8.35 | 103 | .01 | .00 | .01 | 0. | 1.01 | 20.35 | 247 | .01 | .01 | .00 | 42. |
| 1.01 | 8.40 | 104 | .01 | .00 | .01 | 0. | 1.01 | 20.40 | 248 | .01 | .01 | .00 | 41. |
| 1.01 | 8.45 | 105 | .01 | .00 | .01 | 0. | 1.01 | 20.45 | 249 | .01 | .01 | .00 | 41. |
| 1.01 | 8.50 | 106 | .01 | .00 | .01 | 0. | 1.01 | 20.50 | 250 | .01 | .01 | .00 | 41. |
| 1.01 | 8.55 | 107 | .01 | .00 | .01 | 0. | 1.01 | 20.55 | 251 | .01 | .01 | .00 | 40. |
| 1.01 | 9.00 | 108 | .01 | .00 | .01 | 0. | 1.01 | 21.00 | 252 | .01 | .01 | .00 | 40. |
| 1.01 | 9.05 | 109 | .02 | .00 | .02 | 0. | 1.01 | 21.05 | 253 | .01 | .01 | .00 | 40. |
| 1.01 | 9.10 | 110 | .02 | .00 | .02 | 1. | 1.01 | 21.10 | 254 | .01 | .01 | .00 | 39. |
| 1.01 | 9.15 | 111 | .02 | .00 | .02 | 1. | 1.01 | 21.15 | 255 | .01 | .01 | .00 | 39. |
| 1.01 | 9.20 | 112 | .02 | .00 | .02 | 1. | 1.01 | 21.20 | 256 | .01 | .01 | .00 | 39. |
| 1.01 | 9.25 | 113 | .02 | .00 | .02 | 1. | 1.01 | 21.25 | 257 | .01 | .01 | .00 | 39. |
| 1.01 | 9.30 | 114 | .02 | .00 | .02 | 1. | 1.01 | 21.30 | 258 | .01 | .01 | .00 | 38. |
| 1.01 | 9.35 | 115 | .02 | .00 | .02 | 2. | 1.01 | 21.35 | 259 | .01 | .01 | .00 | 38. |
| 1.01 | 9.40 | 116 | .02 | .00 | .02 | 2. | 1.01 | 21.40 | 260 | .01 | .01 | .00 | 38. |
| 1.01 | 9.45 | 117 | .02 | .00 | .02 | 2. | 1.01 | 21.45 | 261 | .01 | .01 | .00 | 38. |
| 1.01 | 9.50 | 118 | .02 | .00 | .02 | 3. | 1.01 | 21.50 | 262 | .01 | .01 | .00 | 38. |
| 1.01 | 9.55 | 119 | .02 | .00 | .02 | 3. | 1.01 | 21.55 | 263 | .01 | .01 | .00 | 38. |
| 1.01 | 10.00 | 120 | .02 | .00 | .02 | 4. | 1.01 | 22.00 | 264 | .01 | .01 | .00 | 38. |
| 1.01 | 10.05 | 121 | .02 | .00 | .02 | 5. | 1.01 | 22.05 | 265 | .01 | .01 | .00 | 38. |
| 1.01 | 10.10 | 122 | .02 | .00 | .02 | 5. | 1.01 | 22.10 | 266 | .01 | .01 | .00 | 38. |
| 1.01 | 10.15 | 123 | .02 | .00 | .02 | 6. | 1.01 | 22.15 | 267 | .01 | .01 | .00 | 37. |
| 1.01 | 10.20 | 124 | .02 | .01 | .02 | 7. | 1.01 | 22.20 | 268 | .01 | .01 | .00 | 37. |
| 1.01 | 10.25 | 125 | .02 | .01 | .02 | 8. | 1.01 | 22.25 | 269 | .01 | .01 | .00 | 37. |
| 1.01 | 10.30 | 126 | .02 | .01 | .02 | 9. | 1.01 | 22.30 | 270 | .01 | .01 | .00 | 37. |
| 1.01 | 10.35 | 127 | .03 | .01 | .02 | 10. | 1.01 | 22.35 | 271 | .01 | .01 | .00 | 37. |
| 1.01 | 10.40 | 128 | .03 | .01 | .02 | 11. | 1.01 | 22.40 | 272 | .01 | .01 | .00 | 37. |
| 1.01 | 10.45 | 129 | .03 | .01 | .02 | 12. | 1.01 | 22.45 | 273 | .01 | .01 | .00 | 37. |
| 1.01 | 10.50 | 130 | .03 | .01 | .02 | 13. | 1.01 | 22.50 | 274 | .01 | .01 | .00 | 37. |
| 1.01 | 10.55 | 131 | .03 | .01 | .02 | 14. | 1.01 | 22.55 | 275 | .01 | .01 | .00 | 37. |
| 1.01 | 11.00 | 132 | .03 | .01 | .02 | 15. | 1.01 | 23.00 | 276 | .01 | .01 | .00 | 37. |
| 1.01 | 11.05 | 133 | .05 | .01 | .03 | 17. | 1.01 | 23.05 | 277 | .01 | .01 | .00 | 37. |
| 1.01 | 11.10 | 134 | .05 | .02 | .03 | 18. | 1.01 | 23.10 | 278 | .01 | .01 | .00 | 37. |

```
B L A C K     V E A T C H                                                                PROJECT 9166:      DATE 13 JAN 81     AGE   10
*************************************************************************************************************************************
FLOOD HYDROGRAPH PACKAGE - HEC-1                                                         PROGRAM H21/02-1V  TIME  18:02:10   CASE 100

       1.01  11.15     135   .05    .02    .03      19.        1.01  23.15    279    .01    .01    .00       37.
       1.01  11.20     136   .05    .02    .03      21.        1.01  23.20    280    .01    .01    .00       37.
       1.01  11.25     137   .05    .02    .03      23.        1.01  23.25    281    .01    .01    .00       37.
       1.01  11.30     138   .05    .02    .03      25.        1.01  23.30    282    .01    .01    .00       37.
       1.01  11.35     139   .13    .05    .08      27.        1.01  23.35    283    .01    .01    .00       37.
       1.01  11.40     140   .13    .06    .08      30.        1.01  23.40    284    .01    .01    .00       37.
       1.01  11.45     141   .13    .06    .07      33.        1.01  23.45    285    .01    .01    .00       37.
       1.01  11.50     142   .26    .13    .13      37.        1.01  23.50    286    .01    .01    .00       37.
       1.01  11.55     143   .26    .14    .12      42.        1.01  23.55    287    .01    .01    .00       37.
       1.01  12.00     144   .55    .33    .22      50.        1.02    .00    288    .01    .01    .00       37.

                                                                                SUM   6.97   3.81   3.17    22740.
                                                                                   ( 177.)(  97.)(  80.)(  643.93)

                                    PEAK   6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                          CFS       580.     263.       79.       79.         22726.
                          CMS        16.       7.        2.        2.           644.
                       INCHES               3.06      3.67      3.67           3.67
                           MM              77.73     93.22     93.22          93.22
                        AC-FT               131.      157.      157.           157.
                    THOUS CU M              161.      193.      193.           193.


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

                                        HYDROGRAPH ROUTING

                         ROUTING THROUGH UPPER KEHR'S MILL TRAIL LAKE DAM

                                ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                    2       1       0       0       0       0       1       0       0
                                                       ROUTING DATA
                          QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                             .0    .000     .00       1       0       0       0               0

                                NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                                    1       0       0    .000    .000    .000   -525.      -1

  STAGE       524.80    526.30    526.80    527.30    527.80    528.80    529.80    530.80    532.80    534.80
              536.80

  FLOW           .00     22.00     36.00     52.00     70.00     86.00    110.00    120.00    144.00    164.00
              184.00

SURFACE AREA=       0.        4.        7.       13.       21.       32.

    CAPACITY=       0.       15.       42.       91.      256.      518.

   ELEVATION=     499.      510.      515.      520.      530.      540.

                              CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                             524.8      .0      .0      .0      .0      .0      .0      .0
```

DAM DATA

| TOPEL | COQD | EXPD | DAMWID |
|---|---|---|---|
| 529.8 | .0 | .0 | 0. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CREST LENGTH | 0. | 33. | 95. | 267. | 275. | 328. | 360. | 417. | 535. |
| AT OR BELOW ELEVATION | 529.6 | 529.9 | 530.0 | 530.1 | 530.3 | 531.0 | 531.9 | 532.5 | 535.2 |

DAM BREACH DATA

| BRWID | Z | ELBM | TFAIL | WSEL | FAILEL |
|---|---|---|---|---|---|
| 10. | .50 | 510.00 | 1.00 | 524.80 | 529.80 |

END-OF-PERIOD HYDROGRAPH ORDINATES

| HR.DA | HR.MN | PERIOD | HOURS | INFLOW | OUTFLOW | STORAGE | STAGE |
|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .08 | 0. | 0. | 160. | 524.8 |
| 1.01 | .10 | 2 | .17 | 0. | 0. | 160. | 524.8 |
| 1.01 | .15 | 3 | .25 | 0. | 0. | 160. | 524.8 |
| 1.01 | .20 | 4 | .33 | 0. | 0. | 160. | 524.8 |
| 1.01 | .25 | 5 | .42 | 0. | 0. | 160. | 524.8 |
| 1.01 | .30 | 6 | .50 | 0. | 0. | 160. | 524.8 |
| 1.01 | .35 | 7 | .58 | 0. | 0. | 160. | 524.8 |
| 1.01 | .40 | 8 | .67 | 0. | 0. | 160. | 524.8 |
| 1.01 | .45 | 9 | .75 | 0. | 0. | 160. | 524.8 |
| 1.01 | .50 | 10 | .83 | 0. | 0. | 160. | 524.8 |
| 1.01 | .55 | 11 | .92 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.00 | 12 | 1.00 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.05 | 13 | 1.08 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.10 | 14 | 1.17 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.15 | 15 | 1.25 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.20 | 16 | 1.33 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.25 | 17 | 1.42 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.30 | 18 | 1.50 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.35 | 19 | 1.58 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.40 | 20 | 1.67 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.45 | 21 | 1.75 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.50 | 22 | 1.83 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.55 | 23 | 1.92 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.00 | 24 | 2.00 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.05 | 25 | 2.08 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.10 | 26 | 2.17 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.15 | 27 | 2.25 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.20 | 28 | 2.33 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.25 | 29 | 2.42 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.30 | 30 | 2.50 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.35 | 31 | 2.58 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.40 | 32 | 2.67 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.45 | 33 | 2.75 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.50 | 34 | 2.83 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.55 | 35 | 2.92 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.00 | 36 | 3.00 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.05 | 37 | 3.08 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.10 | 38 | 3.17 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.15 | 39 | 3.25 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.20 | 40 | 3.33 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.25 | 41 | 3.42 | 0. | 0. | 160. | 524.8 |

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

SUB-AREA RUNOFF COMPUTATION

LOWER KEHR'S MILL TRAIL LAKE DAM (100-YEAR INFLOW)

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 |

HYDROGRAPH DATA

| IHYDG | IUHG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | .11 | .00 | .11 | .00 | .000 | 0 | 0 | 0 |

PRECIP DATA

| NP | STORM | DAJ | DAK |
|---|---|---|---|
| 288 | 6.97 | .00 | .00 |

PRECIP PATTERN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 |
| .03 | .03 | .05 | .05 | .05 | .05 | .05 | .05 | .13 | .13 |
| .13 | .25 | .25 | .55 | .82 | .38 | .25 | .13 | .13 | .13 |
| .05 | .05 | .05 | .05 | .05 | .05 | .03 | .03 | .03 | .03 |
| .03 | .03 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | | |

LOSS DATA

| LROPT | STRKR | DLTKR | RTIOL | ERAIN | STRKS | RTIOK | STRTL | CNSTL | ALSMX | RTIMP |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | .00 | .00 | 1.00 | .00 | .00 | 1.00 | -1.00 | -72.00 | .00 | .00 |

CURVE NO = -72.00 WETNESS = -1.00 EFFECT CN = 72.00

UNIT HYDROGRAPH DATA
TC= .00  LAG= .11

RECESSION DATA
STRTQ= .00  QRCSN= .00  RTIOR= 1.00

TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

UNIT HYDROGRAPH 9 END OF PERIOD ORDINATES, TC= .00 HOURS, LAG= .11 VOL= 1.00
199. 349. 180. 73. 30. 12. 5. 2. 0.

0

END-OF-PERIOD FLOW

| MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q | MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .01 | .00 | .01 | 0. | 1.01 | 12.05 | 145 | .62 | .55 | .27 | 261. |
| 1.01 | .10 | 2 | .01 | .00 | .01 | 0. | 1.01 | 12.10 | 146 | .38 | .28 | .11 | 321. |
| 1.01 | .15 | 3 | .01 | .00 | .01 | 0. | 1.01 | 12.15 | 147 | .26 | .19 | .06 | 264. |
| 1.01 | .20 | 4 | .01 | .00 | .01 | 0. | 1.01 | 12.20 | 148 | .13 | .10 | .03 | 189. |
| 1.01 | .25 | 5 | .01 | .00 | .01 | 0. | 1.01 | 12.25 | 149 | .13 | .10 | .03 | 132. |
| 1.01 | .30 | 6 | .01 | .00 | .01 | 0. | 1.01 | 12.30 | 150 | .13 | .10 | .03 | 106. |
| 1.01 | .35 | 7 | .01 | .00 | .01 | 0. | 1.01 | 12.35 | 151 | .05 | .04 | .01 | 83. |
| 1.01 | .40 | 8 | .01 | .00 | .01 | 0. | 1.01 | 12.40 | 152 | .05 | .04 | .01 | 55. |
| 1.01 | .45 | 9 | .01 | .00 | .01 | 0. | 1.01 | 12.45 | 153 | .05 | .04 | .01 | 42. |
| 1.01 | .50 | 10 | .01 | .00 | .01 | 0. | 1.01 | 12.50 | 154 | .05 | .04 | .01 | 36. |
| 1.01 | .55 | 11 | .01 | .00 | .01 | 0. | 1.01 | 12.55 | 155 | .05 | .04 | .01 | 34. |
| 1.01 | 1.00 | 12 | .01 | .00 | .01 | 0. | 1.01 | 13.00 | 156 | .05 | .04 | .01 | 33. |
| 1.01 | 1.05 | 13 | .01 | .00 | .01 | 0. | 1.01 | 13.05 | 157 | .03 | .02 | .01 | 30. |
| 1.01 | 1.10 | 14 | .01 | .00 | .01 | 0. | 1.01 | 13.10 | 158 | .03 | .02 | .01 | 25. |
| 1.01 | 1.15 | 15 | .01 | .00 | .01 | 0. | 1.01 | 13.15 | 159 | .03 | .02 | .01 | 22. |
| 1.01 | 1.20 | 16 | .01 | .00 | .01 | 0. | 1.01 | 13.20 | 160 | .03 | .02 | .01 | 21. |
| 1.01 | 1.25 | 17 | .01 | .00 | .01 | 0. | 1.01 | 13.25 | 161 | .03 | .02 | .01 | 21. |
| 1.01 | 1.30 | 18 | .01 | .00 | .01 | 0. | 1.01 | 13.30 | 162 | .03 | .02 | .01 | 21. |
| 1.01 | 1.35 | 19 | .01 | .00 | .01 | 0. | 1.01 | 13.35 | 163 | .02 | .02 | .00 | 19. |
| 1.01 | 1.40 | 20 | .01 | .00 | .01 | 0. | 1.01 | 13.40 | 164 | .02 | .02 | .00 | 17. |
| 1.01 | 1.45 | 21 | .01 | .00 | .01 | 0. | 1.01 | 13.45 | 165 | .02 | .02 | .00 | 16. |
| 1.01 | 1.50 | 22 | .01 | .00 | .01 | 0. | 1.01 | 13.50 | 166 | .02 | .02 | .00 | 16. |
| 1.01 | 1.55 | 23 | .01 | .00 | .01 | 0. | 1.01 | 13.55 | 167 | .02 | .02 | .00 | 16. |
| 1.01 | 2.00 | 24 | .01 | .00 | .01 | 0. | 1.01 | 14.00 | 168 | .02 | .02 | .00 | 16. |
| 1.01 | 2.05 | 25 | .01 | .00 | .01 | 0. | 1.01 | 14.05 | 169 | .02 | .02 | .00 | 16. |
| 1.01 | 2.10 | 26 | .01 | .00 | .01 | 0. | 1.01 | 14.10 | 170 | .02 | .02 | .00 | 16. |
| 1.01 | 2.15 | 27 | .01 | .00 | .01 | 0. | 1.01 | 14.15 | 171 | .02 | .02 | .00 | 16. |
| 1.01 | 2.20 | 28 | .01 | .00 | .01 | 0. | 1.01 | 14.20 | 172 | .02 | .02 | .00 | 16. |
| 1.01 | 2.25 | 29 | .01 | .00 | .01 | 0. | 1.01 | 14.25 | 173 | .02 | .02 | .00 | 16. |
| 1.01 | 2.30 | 30 | .01 | .00 | .01 | 0. | 1.01 | 14.30 | 174 | .02 | .02 | .00 | 16. |
| 1.01 | 2.35 | 31 | .01 | .00 | .01 | 0. | 1.01 | 14.35 | 175 | .02 | .02 | .00 | 16. |
| 1.01 | 2.40 | 32 | .01 | .00 | .01 | 0. | 1.01 | 14.40 | 176 | .02 | .02 | .00 | 16. |
| 1.01 | 2.45 | 33 | .01 | .00 | .01 | 0. | 1.01 | 14.45 | 177 | .02 | .02 | .00 | 16. |
| 1.01 | 2.50 | 34 | .01 | .00 | .01 | 0. | 1.01 | 14.50 | 178 | .02 | .02 | .00 | 16. |
| 1.01 | 2.55 | 35 | .01 | .00 | .01 | 0. | 1.01 | 14.55 | 179 | .02 | .02 | .00 | 16. |
| 1.01 | 3.00 | 36 | .01 | .00 | .01 | 0. | 1.01 | 15.00 | 180 | .02 | .02 | .00 | 16. |
| 1.01 | 3.05 | 37 | .01 | .00 | .01 | 0. | 1.01 | 15.05 | 181 | .01 | .01 | .00 | 14. |
| 1.01 | 3.10 | 38 | .01 | .00 | .01 | 0. | 1.01 | 15.10 | 182 | .01 | .01 | .00 | 11. |
| 1.01 | 3.15 | 39 | .01 | .00 | .01 | 0. | 1.01 | 15.15 | 183 | .01 | .01 | .00 | 10. |
| 1.01 | 3.20 | 40 | .01 | .00 | .01 | 0. | 1.01 | 15.20 | 184 | .01 | .01 | .00 | 9. |
| 1.01 | 3.25 | 41 | .01 | .00 | .01 | 0. | 1.01 | 15.25 | 185 | .01 | .01 | .00 | 9. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 3.30 | 42 | .01 | .00 | .01 | 0. | 1.01 | 15.30 | 186 | .01 | .01 | .00 | 8. |
| 1.01 | 3.35 | 43 | .01 | .00 | .01 | 0. | 1.01 | 15.35 | 187 | .01 | .01 | .00 | 8. |
| 1.01 | 3.40 | 44 | .01 | .00 | .01 | 0. | 1.01 | 15.40 | 188 | .01 | .01 | .00 | 8. |
| 1.01 | 3.45 | 45 | .01 | .00 | .01 | 0. | 1.01 | 15.45 | 189 | .01 | .01 | .00 | 8. |
| 1.01 | 3.50 | 46 | .01 | .00 | .01 | 0. | 1.01 | 15.50 | 190 | .01 | .01 | .00 | 8. |
| 1.01 | 3.55 | 47 | .01 | .00 | .01 | 0. | 1.01 | 15.55 | 191 | .01 | .01 | .00 | 8. |
| 1.01 | 4.00 | 48 | .01 | .00 | .01 | 0. | 1.01 | 16.00 | 192 | .01 | .01 | .00 | 8. |
| 1.01 | 4.05 | 49 | .01 | .00 | .01 | 0. | 1.01 | 16.05 | 193 | .01 | .01 | .00 | 8. |
| 1.01 | 4.10 | 50 | .01 | .00 | .01 | 0. | 1.01 | 16.10 | 194 | .01 | .01 | .00 | 8. |
| 1.01 | 4.15 | 51 | .01 | .00 | .01 | 0. | 1.01 | 16.15 | 195 | .01 | .01 | .00 | 8. |
| 1.01 | 4.20 | 52 | .01 | .00 | .01 | 0. | 1.01 | 16.20 | 196 | .01 | .01 | .00 | 8. |
| 1.01 | 4.25 | 53 | .01 | .00 | .01 | 0. | 1.01 | 16.25 | 197 | .01 | .01 | .00 | 8. |
| 1.01 | 4.30 | 54 | .01 | .00 | .01 | 0. | 1.01 | 16.30 | 198 | .01 | .01 | .00 | 8. |
| 1.01 | 4.35 | 55 | .01 | .00 | .01 | 0. | 1.01 | 16.35 | 199 | .01 | .01 | .00 | 8. |
| 1.01 | 4.40 | 56 | .01 | .00 | .01 | 0. | 1.01 | 16.40 | 200 | .01 | .01 | .00 | 8. |
| 1.01 | 4.45 | 57 | .01 | .00 | .01 | 0. | 1.01 | 16.45 | 201 | .01 | .01 | .00 | 8. |
| 1.01 | 4.50 | 58 | .01 | .00 | .01 | 0. | 1.01 | 16.50 | 202 | .01 | .01 | .00 | 8. |
| 1.01 | 4.55 | 59 | .01 | .00 | .01 | 0. | 1.01 | 16.55 | 203 | .01 | .01 | .00 | 8. |
| 1.01 | 5.00 | 60 | .01 | .00 | .01 | 0. | 1.01 | 17.00 | 204 | .01 | .01 | .00 | 8. |
| 1.01 | 5.05 | 61 | .01 | .00 | .01 | 0. | 1.01 | 17.05 | 205 | .01 | .01 | .00 | 9. |
| 1.01 | 5.10 | 62 | .01 | .00 | .01 | 0. | 1.01 | 17.10 | 206 | .01 | .01 | .00 | 9. |
| 1.01 | 5.15 | 63 | .01 | .00 | .01 | 0. | 1.01 | 17.15 | 207 | .01 | .01 | .00 | 9. |
| 1.01 | 5.20 | 64 | .01 | .00 | .01 | 0. | 1.01 | 17.20 | 208 | .01 | .01 | .00 | 9. |
| 1.01 | 5.25 | 65 | .01 | .00 | .01 | 0. | 1.01 | 17.25 | 209 | .01 | .01 | .00 | 9. |
| 1.01 | 5.30 | 66 | .01 | .00 | .01 | 0. | 1.01 | 17.30 | 210 | .01 | .01 | .00 | 9. |
| 1.01 | 5.35 | 67 | .01 | .00 | .01 | 0. | 1.01 | 17.35 | 211 | .01 | .01 | .00 | 9. |
| 1.01 | 5.40 | 68 | .01 | .00 | .01 | 0. | 1.01 | 17.40 | 212 | .01 | .01 | .00 | 9. |
| 1.01 | 5.45 | 69 | .01 | .00 | .01 | 0. | 1.01 | 17.45 | 213 | .01 | .01 | .00 | 9. |
| 1.01 | 5.50 | 70 | .01 | .00 | .01 | 0. | 1.01 | 17.50 | 214 | .01 | .01 | .00 | 9. |
| 1.01 | 5.55 | 71 | .01 | .00 | .01 | 0. | 1.01 | 17.55 | 215 | .01 | .01 | .00 | 9. |
| 1.01 | 6.00 | 72 | .01 | .00 | .01 | 0. | 1.01 | 18.00 | 216 | .01 | .01 | .00 | 9. |
| 1.01 | 6.05 | 73 | .01 | .00 | .01 | 0. | 1.01 | 18.05 | 217 | .01 | .01 | .00 | 8. |
| 1.01 | 6.10 | 74 | .01 | .00 | .01 | 0. | 1.01 | 18.10 | 218 | .01 | .01 | .00 | 6. |
| 1.01 | 6.15 | 75 | .01 | .00 | .01 | 0. | 1.01 | 18.15 | 219 | .01 | .01 | .00 | 6. |
| 1.01 | 6.20 | 76 | .01 | .00 | .01 | 0. | 1.01 | 18.20 | 220 | .01 | .01 | .00 | 5. |
| 1.01 | 6.25 | 77 | .01 | .00 | .01 | 0. | 1.01 | 18.25 | 221 | .01 | .01 | .00 | 5. |
| 1.01 | 6.30 | 78 | .01 | .00 | .01 | 0. | 1.01 | 18.30 | 222 | .01 | .01 | .00 | 5. |
| 1.01 | 6.35 | 79 | .01 | .00 | .01 | 0. | 1.01 | 18.35 | 223 | .01 | .01 | .00 | 5. |
| 1.01 | 6.40 | 80 | .01 | .00 | .01 | 0. | 1.01 | 18.40 | 224 | .01 | .01 | .00 | 5. |
| 1.01 | 6.45 | 81 | .01 | .00 | .01 | 0. | 1.01 | 18.45 | 225 | .01 | .01 | .00 | 5. |
| 1.01 | 6.50 | 82 | .01 | .00 | .01 | 0. | 1.01 | 18.50 | 226 | .01 | .01 | .00 | 5. |
| 1.01 | 6.55 | 83 | .01 | .00 | .01 | 0. | 1.01 | 18.55 | 227 | .01 | .01 | .00 | 5. |
| 1.01 | 7.00 | 84 | .01 | .00 | .01 | 0. | 1.01 | 19.00 | 228 | .01 | .01 | .00 | 5. |
| 1.01 | 7.05 | 85 | .01 | .00 | .01 | 0. | 1.01 | 19.05 | 229 | .01 | .01 | .00 | 5. |
| 1.01 | 7.10 | 86 | .01 | .00 | .01 | 0. | 1.01 | 19.10 | 230 | .01 | .01 | .00 | 5. |
| 1.01 | 7.15 | 87 | .01 | .00 | .01 | 0. | 1.01 | 19.15 | 231 | .01 | .01 | .00 | 5. |
| 1.01 | 7.20 | 88 | .01 | .00 | .01 | 0. | 1.01 | 19.20 | 232 | .01 | .01 | .00 | 5. |
| 1.01 | 7.25 | 89 | .01 | .00 | .01 | 0. | 1.01 | 19.25 | 233 | .01 | .01 | .00 | 5. |
| 1.01 | 7.30 | 90 | .01 | .00 | .01 | 0. | 1.01 | 19.30 | 234 | .01 | .01 | .00 | 5. |
| 1.01 | 7.35 | 91 | .01 | .00 | .01 | 0. | 1.01 | 19.35 | 235 | .01 | .01 | .00 | 5. |
| 1.01 | 7.40 | 92 | .01 | .00 | .01 | 0. | 1.01 | 19.40 | 236 | .01 | .01 | .00 | 5. |
| 1.01 | 7.45 | 93 | .01 | .00 | .01 | 0. | 1.01 | 19.45 | 237 | .01 | .01 | .00 | 5. |
| 1.01 | 7.50 | 94 | .01 | .00 | .01 | 0. | 1.01 | 19.50 | 238 | .01 | .01 | .00 | 5. |
| 1.01 | 7.55 | 95 | .01 | .00 | .01 | 0. | 1.01 | 19.55 | 239 | .01 | .01 | .00 | 5. |
| 1.01 | 8.00 | 96 | .01 | .00 | .01 | 0. | 1.01 | 20.00 | 240 | .01 | .01 | .00 | 5. |
| 1.01 | 8.05 | 97 | .01 | .00 | .01 | 0. | 1.01 | 20.05 | 241 | .01 | .01 | .00 | 5. |

B L A C K   V E A T C H        PROJECT 9166:    DATE 15 JAN 81    AGE 22

FLOOD HYDROGRAPH PACKAGE - HEC-1        PROGRAM H21/02-1V  TIME 18:02:10 — CASE 100

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 8.10 | 98 | .01 | .00 | .01 | 0. | 1.01 | 20.10 | 242 | .01 | .01 | .00 | 5. |
| 1.01 | 8.15 | 99 | .01 | .00 | .01 | 0. | 1.01 | 20.15 | 243 | .01 | .01 | .00 | 5. |
| 1.01 | 8.20 | 100 | .01 | .00 | .01 | 0. | 1.01 | 20.20 | 244 | .01 | .01 | .00 | 5. |
| 1.01 | 8.25 | 101 | .01 | .00 | .01 | 0. | 1.01 | 20.25 | 245 | .01 | .01 | .00 | 5. |
| 1.01 | 8.30 | 102 | .01 | .00 | .01 | 0. | 1.01 | 20.30 | 246 | .01 | .01 | .00 | 5. |
| 1.01 | 8.35 | 103 | .01 | .00 | .01 | 0. | 1.01 | 20.35 | 247 | .01 | .01 | .00 | 5. |
| 1.01 | 8.40 | 104 | .01 | .00 | .01 | 0. | 1.01 | 20.40 | 248 | .01 | .01 | .00 | 5. |
| 1.01 | 8.45 | 105 | .01 | .00 | .01 | 1. | 1.01 | 20.45 | 249 | .01 | .01 | .00 | 5. |
| 1.01 | 8.50 | 106 | .01 | .00 | .01 | 1. | 1.01 | 20.50 | 250 | .01 | .01 | .00 | 5. |
| 1.01 | 8.55 | 107 | .01 | .00 | .01 | 1. | 1.01 | 20.55 | 251 | .01 | .01 | .00 | 5. |
| 1.01 | 9.00 | 108 | .01 | .00 | .01 | 1. | 1.01 | 21.00 | 252 | .01 | .01 | .00 | 5. |
| 1.01 | 9.05 | 109 | .02 | .00 | .02 | 1. | 1.01 | 21.05 | 253 | .01 | .01 | .00 | 5. |
| 1.01 | 9.10 | 110 | .02 | .00 | .02 | 1. | 1.01 | 21.10 | 254 | .01 | .01 | .00 | 5. |
| 1.01 | 9.15 | 111 | .02 | .00 | .02 | 2. | 1.01 | 21.15 | 255 | .01 | .01 | .00 | 5. |
| 1.01 | 9.20 | 112 | .02 | .00 | .02 | 2. | 1.01 | 21.20 | 256 | .01 | .01 | .00 | 5. |
| 1.01 | 9.25 | 113 | .02 | .00 | .02 | 2. | 1.01 | 21.25 | 257 | .01 | .01 | .00 | 5. |
| 1.01 | 9.30 | 114 | .02 | .00 | .02 | 2. | 1.01 | 21.30 | 258 | .01 | .01 | .00 | 5. |
| 1.01 | 9.35 | 115 | .02 | .00 | .02 | 3. | 1.01 | 21.35 | 259 | .01 | .01 | .00 | 5. |
| 1.01 | 9.40 | 116 | .02 | .00 | .02 | 3. | 1.01 | 21.40 | 260 | .01 | .01 | .00 | 5. |
| 1.01 | 9.45 | 117 | .02 | .00 | .02 | 3. | 1.01 | 21.45 | 261 | .01 | .01 | .00 | 5. |
| 1.01 | 9.50 | 118 | .02 | .00 | .02 | 3. | 1.01 | 21.50 | 262 | .01 | .01 | .00 | 5. |
| 1.01 | 9.55 | 119 | .02 | .00 | .02 | 3. | 1.01 | 21.55 | 263 | .01 | .01 | .00 | 5. |
| 1.01 | 10.00 | 120 | .02 | .00 | .02 | 3. | 1.01 | 22.00 | 264 | .01 | .01 | .00 | 5. |
| 1.01 | 10.05 | 121 | .02 | .00 | .02 | 4. | 1.01 | 22.05 | 265 | .01 | .01 | .00 | 5. |
| 1.01 | 10.10 | 122 | .02 | .00 | .02 | 4. | 1.01 | 22.10 | 266 | .01 | .01 | .00 | 5. |
| 1.01 | 10.15 | 123 | .02 | .00 | .02 | 4. | 1.01 | 22.15 | 267 | .01 | .01 | .00 | 5. |
| 1.01 | 10.20 | 124 | .02 | .01 | .02 | 4. | 1.01 | 22.20 | 268 | .01 | .01 | .00 | 5. |
| 1.01 | 10.25 | 125 | .02 | .01 | .02 | 4. | 1.01 | 22.25 | 269 | .01 | .01 | .00 | 5. |
| 1.01 | 10.30 | 126 | .02 | .01 | .02 | 4. | 1.01 | 22.30 | 270 | .01 | .01 | .00 | 5. |
| 1.01 | 10.35 | 127 | .03 | .01 | .02 | 5. | 1.01 | 22.35 | 271 | .01 | .01 | .00 | 5. |
| 1.01 | 10.40 | 128 | .03 | .01 | .02 | 6. | 1.01 | 22.40 | 272 | .01 | .01 | .00 | 5. |
| 1.01 | 10.45 | 129 | .03 | .01 | .02 | 6. | 1.01 | 22.45 | 273 | .01 | .01 | .00 | 5. |
| 1.01 | 10.50 | 130 | .03 | .01 | .02 | 7. | 1.01 | 22.50 | 274 | .01 | .01 | .00 | 5. |
| 1.01 | 10.55 | 131 | .03 | .01 | .02 | 7. | 1.01 | 22.55 | 275 | .01 | .01 | .00 | 5. |
| 1.01 | 11.00 | 132 | .03 | .01 | .02 | 7. | 1.01 | 23.00 | 276 | .01 | .01 | .00 | 5. |
| 1.01 | 11.05 | 133 | .05 | .01 | .03 | 9. | 1.01 | 23.05 | 277 | .01 | .01 | .00 | 5. |
| 1.01 | 11.10 | 134 | .05 | .02 | .03 | 11. | 1.01 | 23.10 | 278 | .01 | .01 | .00 | 5. |
| 1.01 | 11.15 | 135 | .05 | .02 | .03 | 12. | 1.01 | 23.15 | 279 | .01 | .01 | .00 | 5. |
| 1.01 | 11.20 | 136 | .05 | .02 | .03 | 13. | 1.01 | 23.20 | 280 | .01 | .01 | .00 | 5. |
| 1.01 | 11.25 | 137 | .05 | .02 | .03 | 14. | 1.01 | 23.25 | 281 | .01 | .01 | .00 | 5. |
| 1.01 | 11.30 | 138 | .05 | .02 | .03 | 15. | 1.01 | 23.30 | 282 | .01 | .01 | .00 | 5. |
| 1.01 | 11.35 | 139 | .13 | .05 | .08 | 22. | 1.01 | 23.35 | 283 | .01 | .01 | .00 | 5. |
| 1.01 | 11.40 | 140 | .13 | .06 | .08 | 35. | 1.01 | 23.40 | 284 | .01 | .01 | .00 | 5. |
| 1.01 | 11.45 | 141 | .13 | .06 | .07 | 44. | 1.01 | 23.45 | 285 | .01 | .01 | .00 | 5. |
| 1.01 | 11.50 | 142 | .26 | .13 | .13 | 62. | 1.01 | 23.50 | 286 | .01 | .01 | .00 | 5. |
| 1.01 | 11.55 | 143 | .26 | .14 | .12 | 89. | 1.01 | 23.55 | 287 | .01 | .01 | .00 | 5. |
| 1.01 | 12.00 | 144 | .55 | .33 | .22 | 143. | 1.02 | .00 | 288 | .01 | .01 | .00 | 5. |

SUM 6.97 3.81 3.17 3229.
( 177.)( 97.)( 80.)( 91.44)

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 321. | 37. | 11. | 11. | 3232. |
| CMS | 9. | 1. | 0. | 0. | 92. |
| INCHES | | 3.14 | 3.80 | 3.80 | 3.80 |
| MM | | 79.64 | 96.41 | 96.41 | 96.41 |

| | | | | |
|---|---|---|---|---|
| AC-FT | 18. | 22. | 22. | 22. |
| THOUS CU M | 23. | 27. | 27. | 27. |

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

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS-TOTAL FLOW LOWER DAM (24 HR. 100-YEAR INFLOW)

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 4 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

SUM OF 2 HYDROGRAPHS AT 4

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 1. | 1. | 1. | 1. | 1. | 1. |
| 2. | 2. | 2. | 2. | 3. | 3. | 3. | 3. | 3. | 4. |
| 4. | 4. | 4. | 4. | 5. | 5. | 5. | 6. | 7. | 7. |
| 8. | 8. | 9. | 12. | 13. | 14. | 15. | 16. | 24. | 37. |
| 46. | 64. | 91. | 145. | 264. | 325. | 268. | 194. | 138. | 112. |
| 59. | 64. | 52. | 48. | 48. | 50. | 49. | 47. | 49. | 54. |
| 60. | 66. | 71. | 76. | 82. | 87. | 90. | 92. | 95. | 97. |
| 100. | 102. | 105. | 108. | 110. | 112. | 114. | 116. | 118. | 119. |
| 119. | 117. | 117. | 117. | 118. | 118. | 119. | 130. | 177. | 275. |
| 430. | 645. | 915. | 1233. | 1567. | 1965. | 2738. | 2685. | 3016. | 2609. |
| 2269. | 1981. | 1737. | 1529. | 1351. | 1195. | 1058. | 936. | 830. | 736. |
| 654. | 582. | 519. | 464. | 416. | 375. | 338. | 305. | 278. | 254. |
| 233. | 215. | 200. | 186. | 174. | 163. | 153. | 144. | 136. | 129. |
| 127. | 117. | 112. | 107. | 102. | 98. | 94. | 90. | 87. | 84. |
| 81. | 78. | 76. | 74. | 71. | 69. | 68. | 66. | 64. | 63. |
| 61. | 60. | 59. | 58. | 57. | 56. | 55. | 54. | 53. | 52. |
| 52. | 51. | 50. | 50. | 49. | 49. | 48. | 48. | 48. | 47. |
| 47. | 46. | 46. | 46. | 46. | 45. | 45. | 45. | 45. | 45. |
| 44. | 44. | 44. | 44. | 44. | 44. | 44. | 43. | | |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 3016. | 565. | 161. | 161. | 46296. |
| CMS | 85. | 16. | 5. | 5. | 1311. |
| INCHES | | 5.78 | 6.57 | 6.57 | 6.57 |
| MM | | 146.74 | 166.95 | 166.95 | 166.95 |
| AC-FT | | 280. | 319. | 319. | 319. |
| THOUS CU M | | 346. | 393. | 393. | 393. |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 1976. | 440. | 120. | 120. | 34668. |
| CMS | 56. | 12. | 3. | 3. | 982. |
| INCHES | | 4.50 | 4.92 | 4.92 | 4.92 |
| MM | | 114.34 | 125.02 | 125.02 | 125.02 |
| AC-FT | | 218. | 239. | 239. | 239. |
| THOUS CU M | | 269. | 295. | 295. | 295. |

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

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

| | | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | AREA |
|---|---|---|---|---|---|---|
| HYDROGRAPH AT | 1 | 580. | 263. | 79. | 79. | .80 |
| | ( | 16.43)( | 7.45)( | 2.23)( | 2.23)( | 2.07) |
| ROUTED TO | 2 | 3008. | 556. | 150. | 150. | .80 |
| | ( | 85.18)( | 15.75)( | 4.23)( | 4.23)( | 2.07) |
| HYDROGRAPH AT | 3 | 321. | 37. | 11. | 11. | .11 |
| | ( | 9.10)( | 1.05)( | .32)( | .32)( | .28) |
| 2-COMBINED | 4 | 3016. | 565. | 161. | 161. | .91 |
| | ( | 85.42)( | 16.00)( | 4.55)( | 4.55)( | 2.36) |
| ROUTED TO | 5 | 1978. | 440. | 120. | 120. | .91 |
| | ( | 56.03)( | 12.47)( | 3.41)( | 3.41)( | 2.36) |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..............

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 524.20 | 524.20 | 529.80 |
| STORAGE | 160. | 160. | 252. |
| OUTFLOW | 0. | 0. | 110. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| 1.00 | 529.88 | .08 | 253. | 3008. | .42 | 16.58 | 15.58 |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ...............

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 504.90 | 504.90 | 509.60 |
| STORAGE | 255. | 255. | 342. |
| OUTFLOW | 0. | 0. | 97. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| 1.00 | 512.02 | 2.42 | 391. | 1978. | 5.75 | 16.83 | .00 |

```
*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
*********************************

A1MISSOURI DAM INSPECTION PROGRAM
A2ST LOUIS DISTRICT US ARMY CORPS OF ENGINEERS
A3UPPER AND LOWER KEHR'S MILL TRAIL LAKE DAMS
B     288      0      5      0      0      0      0      0      0      0
B1      1
A       2      1                           3      1
K1    UPPER KEHR'S MILL TRAIL LAKE DAM (24 HR, 10-YEAR INFLOW)
B       0      2    .60                    1
C     288  4.906             IA 8    .50
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .009   .009   .009   .009   .009   .009   .009   .009
O1   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
O1   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
O1   .009   .009   .009   .009   .009   .009   .009   .009   .015   .015
O1   .015   .015   .015   .015   .015   .015   .015   .015   .015   .015
O1   .015   .015   .015   .015   .015   .015   .028   .028   .028   .028
O1   .028   .028   .041   .041   .041   .041   .041   .041   .066   .066
O1   .057   .165   .165   .374   .553   .260   .165   .057   .066   .066
O1   .041   .041   .041   .041   .041   .041   .028   .028   .028   .028
O1   .028   .028   .015   .015   .015   .015   .015   .015   .015   .015
O1   .015   .015   .015   .015   .015   .015   .015   .015   .015   .015
O1   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
O1   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
O1   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
O1   .009   .009   .009   .009   .009   .009   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
O1   .005   .005   .005   .005   .005   .005   .005   .005
T                                                 -1    -72
W2          1.47
X                         1
A       1      2                                  1
K1    ROUTING THROUGH UPPER KEHR'S MILL TRAIL LAKE DAM
Y                                1
Y1      1                                     -524.8     -1
Y4  524.8  526.3  526.8  527.7  527.9  528.8  529.6  530.8  532.8  534.8
Y4  534.9
Y5     0.    22.    36.    52.    76.    96.   110.   120.   144.   164.
Y5   164.
SA     0.    4.2    6.9   12.6   20.6   32.4
```

```
 51   SF  499.   510.   514.9   520.   530.   540.
 52   SS  524.8
 53   SD  524.5
 54   SL    0.    73.    95.   207.   275.   328.   380.   417.   535.
 55   SV  529.6  529.9  530.0  530.1  530.3  531.0  531.9  532.5  535.2
 56   SB   10.     .5   510.     1.   524.9  525.5
 57   K     2      3                          2      1
 58   K1  LOWER KEMP'S MILL TRAIL LAKE DAM (10-YEAR INFLOW)
 59   M     3      2    .11
 60   U   .265  4.906                DA =    .50
 61   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 62   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 63   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 64   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 65   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 66   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 67   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 68   O1  .005   .005   .009   .009   .009   .009   .009   .009   .009   .009
 69   O1  .005   .009   .009   .009   .009   .009   .009   .009   .009   .009
 70   O1  .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
 71   O1  .009   .009   .009   .009   .009   .009   .009   .009   .015   .015
 72   O1  .015   .015   .015   .015   .015   .015   .015   .015   .015   .015
 73   O1  .015   .015   .015   .015   .015   .015   .028   .028   .028   .028
 74   O1  .028   .028   .041   .041   .041   .041   .041   .041   .066   .066
 75   O1  .067   .165   .165   .274   .167   .260   .165   .067   .066   .066
 76   O1  .041   .041   .041   .041   .041   .041   .028   .028   .028   .028
 77   O1  .028   .028   .015   .015   .015   .015   .015   .015   .015   .015
 78   O1  .015   .015   .015   .015   .015   .015   .015   .015   .015   .015
 79   O1  .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
 80   O1  .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
 81   O1  .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
 82   O1  .009   .009   .009   .009   .009   .009   .005   .005   .005   .005
 83   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 84   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 85   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 86   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 87   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 88   O1  .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
 89   O1  .005   .005   .005   .005   .005   .005   .005   .005
 90   T                                             -1    -72
 91   W2         .11
 92   X                 1
 93   K     2      4                                 1
 94   K1  COMBINE HYDROGRAPHS-TOTAL FLOW LOWER DAM (24 HR. 10-YEAR INFLOW)
 95   K     1      5                                 1
 96   K1  ROUTING THROUGH LOWER KEMP'S MILL TRAIL LAKE DAM
 97   Y                           1
 98   Y1    1                                    -504.9     -1
 99   Y4  504.9  505.4  506.9  507.4  507.9  508.9  509.9  510.9  512.9  514.9
100   Y4  516.9
```

B L A C K   V E A T C H                                        PROJECT 9166:    DATE 15 JAN 81    IGE 4

FLOOD HYDROGRAPH PACKAGE - HEC-1                  PROGRAM H21/C2-1V  TIME 18:03:04  CASE 10

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Y5 | 0. | 22. | 36. | 52. | 70. | 86. | 102. | 120. | 140. | 160. |
| 102 | Y5 | 180. | | | | | | | | | |
| 103 | SA | 0. | 1.6 | 9.1 | 15.6 | 19.8 | 25.1 | | | | |
| 104 | SE | 474. | 480. | 490. | 500. | 510. | 520. | | | | |
| 105 | SS | 504.9 | | | | | | | | | |
| 106 | SD | 509.6 | | | | | | | | | |
| 107 | SL | 0. | 137. | 158. | 250. | 320. | 403. | 443. | 532. | | |
| 108 | SV | 509.5 | 510.2 | 510.4 | 511.3 | 512.4 | 514.2 | 515.4 | 518.1 | | |
| 109 | K | 99 | | | | | | | | | |

```
*************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
*************************************
```

MISSOURI DAM INSPECTION PROGRAM
ST LOUIS DISTRICT US ARMY CORPS OF ENGINEERS
UPPER AND LOWER KEHR'S MILL TRAIL LAKE DAMS

JOB SPECIFICATION

| NQ | NHR | NMIN | IDAY | IHR | IMIN | METRC | IPLT | IPRT | NSTAN |
|---|---|---|---|---|---|---|---|---|---|
| 288 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| JOPER | NWT | LROPT | TRACE |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

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

SUB-AREA RUNOFF COMPUTATION

UPPER KEHR'S MILL TRAIL LAKE DAM (24 HR. 10-YEAR INFLOW)

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 |

HYDROGRAPH DATA

| IHYDG | IUHG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | .62 | .00 | .62 | 1.00 | .000 | 0 | 0 | 0 |

PRECIP DATA

| NP | STORM | DAJ | DAK |
|---|---|---|---|
| 288 | 4.91 | .00 | .00 |

PRECIP PATTERN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 |
| .03 | .03 | .04 | .04 | .04 | .04 | .04 | .04 | .09 | .09 |
| .09 | .16 | .16 | .77 | .55 | .26 | .16 | .09 | .09 | .09 |
| .04 | .04 | .04 | .04 | .04 | .04 | .03 | .03 | .03 | .03 |
| .03 | .03 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | | |

LOSS DATA

| LROPT | STRKR | DLTKR | RTIOL | ERAIN | STRKS | RTIOK | STRTL | CNSTL | ALSMX | RTIPP |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | .00 | .00 | 1.00 | .00 | .00 | 1.00 | -1.00 | -72.00 | .00 | .00 |

CURVE NO = -72.00   WETNESS = -1.00   EFFECT CN = 72.00

UNIT HYDROGRAPH DATA
TC= .00   LAG= 1.47

RECESSION DATA
STRTQ= .00   QRCSN= .00   RTIOR= 1.00

UNIT HYDROGRAPH 90 END OF PERIOD ORDINATES, TC= .00 HOURS, LAG= 1.47 VOL= 1.00

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4. | 9. | 19. | 33. | 43. | 58. | 75. | 96. | 119. | 145. |
| 171. | 194. | 214. | 230. | 242. | 250. | 254. | 255. | 254. | 253. |
| 244. | 235. | 225. | 215. | 204. | 191. | 177. | 160. | 144. | 129. |
| 114. | 100. | 97. | 89. | 81. | 74. | 68. | 67. | 58. | 53. |
| 49. | 44. | 40. | 34. | 37. | 31. | 28. | 26. | 23. | 21. |
| 19. | 17. | 16. | 15. | 13. | 12. | 11. | 10. | 9. | 9. |
| 8. | 7. | 7. | 6. | 6. | 5. | 5. | 4. | 4. | 4. |
| 3. | 3. | 3. | 3. | 2. | 2. | 2. | 2. | 2. | 2. |
| 1. | 1. | 1. | 1. | 1. | 1. | 1. | 0. | 0. | 0. |

0
END-OF-PERIOD FLOW

| MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q | MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .00 | .00 | .00 | 0. | 1.01 | 12.05 | 145 | .58 | .31 | .27 | 23. |
| 1.01 | .10 | 2 | .00 | .00 | .00 | 0. | 1.01 | 12.10 | 146 | .26 | .15 | .10 | 31. |
| 1.01 | .15 | 3 | .00 | .00 | .00 | 0. | 1.01 | 12.15 | 147 | .16 | .10 | .06 | 41. |
| 1.01 | .20 | 4 | .00 | .00 | .00 | 0. | 1.01 | 12.20 | 148 | .09 | .05 | .03 | 53. |
| 1.01 | .25 | 5 | .00 | .00 | .00 | 0. | 1.01 | 12.25 | 149 | .08 | .05 | .03 | 67. |
| 1.01 | .30 | 6 | .00 | .00 | .00 | 0. | 1.01 | 12.30 | 150 | .08 | .06 | .03 | 84. |
| 1.01 | .35 | 7 | .00 | .00 | .00 | 0. | 1.01 | 12.35 | 151 | .04 | .03 | .01 | 102. |
| 1.01 | .40 | 8 | .00 | .00 | .00 | 0. | 1.01 | 12.40 | 152 | .04 | .03 | .01 | 123. |
| 1.01 | .45 | 9 | .00 | .00 | .00 | 0. | 1.01 | 12.45 | 153 | .04 | .03 | .01 | 146. |
| 1.01 | .50 | 10 | .00 | .00 | .00 | 0. | 1.01 | 12.50 | 154 | .04 | .03 | .01 | 170. |
| 1.01 | .55 | 11 | .00 | .00 | .00 | 0. | 1.01 | 12.55 | 155 | .04 | .03 | .01 | 194. |
| 1.01 | 1.00 | 12 | .00 | .00 | .00 | 0. | 1.01 | 13.00 | 156 | .04 | .03 | .01 | 216. |
| 1.01 | 1.05 | 13 | .00 | .00 | .00 | 0. | 1.01 | 13.05 | 157 | .03 | .02 | .01 | 239. |
| 1.01 | 1.10 | 14 | .00 | .00 | .00 | 0. | 1.01 | 13.10 | 158 | .03 | .02 | .01 | 256. |
| 1.01 | 1.15 | 15 | .00 | .00 | .00 | 0. | 1.01 | 13.15 | 159 | .03 | .02 | .01 | 274. |
| 1.01 | 1.20 | 16 | .00 | .00 | .00 | 0. | 1.01 | 13.20 | 160 | .03 | .02 | .01 | 287. |
| 1.01 | 1.25 | 17 | .00 | .00 | .00 | 0. | 1.01 | 13.25 | 161 | .03 | .02 | .01 | 296. |
| 1.01 | 1.30 | 18 | .00 | .00 | .00 | 0. | 1.01 | 13.30 | 162 | .03 | .02 | .01 | 303. |
| 1.01 | 1.35 | 19 | .00 | .00 | .00 | 0. | 1.01 | 13.35 | 163 | .01 | .01 | .00 | 308. |
| 1.01 | 1.40 | 20 | .00 | .00 | .00 | 0. | 1.01 | 13.40 | 164 | .01 | .01 | .00 | 310. |
| 1.01 | 1.45 | 21 | .00 | .00 | .00 | 0. | 1.01 | 13.45 | 165 | .01 | .01 | .00 | 309. |
| 1.01 | 1.50 | 22 | .00 | .00 | .00 | 0. | 1.01 | 13.50 | 166 | .01 | .01 | .00 | 306. |

B L A C K   V E A T C H                                                PROJECT 9166:     DATE 15 JAN 8?     AGE 8

FLOOD HYDROGRAPH PACKAGE - HEC-1                                       PROGRAM H21/02-JV  TIME 18:03:04  CASE 10

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 1.55 | 23 | .00 | .00 | .00 | 0. | 1.01 | 13.55 | 167 | .01 | .01 | .00 | 300. |
| 1.01 | 2.00 | 24 | .00 | .00 | .00 | 0. | 1.01 | 14.00 | 168 | .01 | .01 | .00 | 294. |
| 1.01 | 2.05 | 25 | .00 | .00 | .00 | 0. | 1.01 | 14.05 | 169 | .01 | .01 | .00 | 286. |
| 1.01 | 2.10 | 26 | .00 | .00 | .00 | 0. | 1.01 | 14.10 | 170 | .01 | .01 | .00 | 276. |
| 1.01 | 2.15 | 27 | .00 | .00 | .00 | 0. | 1.01 | 14.15 | 171 | .01 | .01 | .00 | 265. |
| 1.01 | 2.20 | 28 | .00 | .00 | .00 | 0. | 1.01 | 14.20 | 172 | .01 | .01 | .00 | 252. |
| 1.01 | 2.25 | 29 | .00 | .00 | .00 | 0. | 1.01 | 14.25 | 173 | .01 | .01 | .00 | 239. |
| 1.01 | 2.30 | 30 | .00 | .00 | .00 | 0. | 1.01 | 14.30 | 174 | .01 | .01 | .00 | 226. |
| 1.01 | 2.35 | 31 | .00 | .00 | .00 | 0. | 1.01 | 14.35 | 175 | .01 | .01 | .00 | 214. |
| 1.01 | 2.40 | 32 | .00 | .00 | .00 | 0. | 1.01 | 14.40 | 176 | .01 | .01 | .00 | 203. |
| 1.01 | 2.45 | 33 | .00 | .00 | .00 | 0. | 1.01 | 14.45 | 177 | .01 | .01 | .00 | 193. |
| 1.01 | 2.50 | 34 | .00 | .00 | .00 | 0. | 1.01 | 14.50 | 178 | .01 | .01 | .00 | 183. |
| 1.01 | 2.55 | 35 | .00 | .00 | .00 | 0. | 1.01 | 14.55 | 179 | .01 | .01 | .00 | 174. |
| 1.01 | 3.00 | 36 | .00 | .00 | .00 | 0. | 1.01 | 15.00 | 180 | .01 | .01 | .00 | 165. |
| 1.01 | 3.05 | 37 | .00 | .00 | .00 | 0. | 1.01 | 15.05 | 181 | .01 | .01 | .00 | 157. |
| 1.01 | 3.10 | 38 | .00 | .00 | .00 | 0. | 1.01 | 15.10 | 182 | .01 | .01 | .00 | 150. |
| 1.01 | 3.15 | 39 | .00 | .00 | .00 | 0. | 1.01 | 15.15 | 183 | .01 | .01 | .00 | 143. |
| 1.01 | 3.20 | 40 | .00 | .00 | .00 | 0. | 1.01 | 15.20 | 184 | .01 | .01 | .00 | 137. |
| 1.01 | 3.25 | 41 | .00 | .00 | .00 | 0. | 1.01 | 15.25 | 185 | .01 | .01 | .00 | 130. |
| 1.01 | 3.30 | 42 | .00 | .00 | .00 | 0. | 1.01 | 15.30 | 186 | .01 | .01 | .00 | 125. |
| 1.01 | 3.35 | 43 | .00 | .00 | .00 | 0. | 1.01 | 15.35 | 187 | .01 | .01 | .00 | 119. |
| 1.01 | 3.40 | 44 | .00 | .00 | .00 | 0. | 1.01 | 15.40 | 188 | .01 | .01 | .00 | 114. |
| 1.01 | 3.45 | 45 | .00 | .00 | .00 | 0. | 1.01 | 15.45 | 189 | .01 | .01 | .00 | 109. |
| 1.01 | 3.50 | 46 | .00 | .00 | .00 | 0. | 1.01 | 15.50 | 190 | .01 | .01 | .00 | 105. |
| 1.01 | 3.55 | 47 | .00 | .00 | .00 | 0. | 1.01 | 15.55 | 191 | .01 | .01 | .00 | 100. |
| 1.01 | 4.00 | 48 | .00 | .00 | .00 | 0. | 1.01 | 16.00 | 192 | .01 | .01 | .00 | 96. |
| 1.01 | 4.05 | 49 | .00 | .00 | .00 | 0. | 1.01 | 16.05 | 193 | .01 | .01 | .00 | 92. |
| 1.01 | 4.10 | 50 | .00 | .00 | .00 | 0. | 1.01 | 16.10 | 194 | .01 | .01 | .00 | 89. |
| 1.01 | 4.15 | 51 | .00 | .00 | .00 | 0. | 1.01 | 16.15 | 195 | .01 | .01 | .00 | 85. |
| 1.01 | 4.20 | 52 | .00 | .00 | .00 | 0. | 1.01 | 16.20 | 196 | .01 | .01 | .00 | 82. |
| 1.01 | 4.25 | 53 | .00 | .00 | .00 | 0. | 1.01 | 16.25 | 197 | .01 | .01 | .00 | 79. |
| 1.01 | 4.30 | 54 | .00 | .00 | .00 | 0. | 1.01 | 16.30 | 198 | .01 | .01 | .00 | 76. |
| 1.01 | 4.35 | 55 | .00 | .00 | .00 | 0. | 1.01 | 16.35 | 199 | .01 | .01 | .00 | 73. |
| 1.01 | 4.40 | 56 | .00 | .00 | .00 | 0. | 1.01 | 16.40 | 200 | .01 | .01 | .00 | 70. |
| 1.01 | 4.45 | 57 | .00 | .00 | .00 | 0. | 1.01 | 16.45 | 201 | .01 | .01 | .00 | 68. |
| 1.01 | 4.50 | 58 | .00 | .00 | .00 | 0. | 1.01 | 16.50 | 202 | .01 | .01 | .00 | 66. |
| 1.01 | 4.55 | 59 | .00 | .00 | .00 | 0. | 1.01 | 16.55 | 203 | .01 | .01 | .00 | 63. |
| 1.01 | 5.00 | 60 | .00 | .00 | .00 | 0. | 1.01 | 17.00 | 204 | .01 | .01 | .00 | 62. |
| 1.01 | 5.05 | 61 | .00 | .00 | .00 | 0. | 1.01 | 17.05 | 205 | .01 | .01 | .00 | 60. |
| 1.01 | 5.10 | 62 | .00 | .00 | .00 | 0. | 1.01 | 17.10 | 206 | .01 | .01 | .00 | 58. |
| 1.01 | 5.15 | 63 | .00 | .00 | .00 | 0. | 1.01 | 17.15 | 207 | .01 | .01 | .00 | 56. |
| 1.01 | 5.20 | 64 | .00 | .00 | .00 | 0. | 1.01 | 17.20 | 208 | .01 | .01 | .00 | 55. |
| 1.01 | 5.25 | 65 | .00 | .00 | .00 | 0. | 1.01 | 17.25 | 209 | .01 | .01 | .00 | 54. |
| 1.01 | 5.30 | 66 | .00 | .00 | .00 | 0. | 1.01 | 17.30 | 210 | .01 | .01 | .00 | 53. |
| 1.01 | 5.35 | 67 | .00 | .00 | .00 | 0. | 1.01 | 17.35 | 211 | .01 | .01 | .00 | 52. |
| 1.01 | 5.40 | 68 | .00 | .00 | .00 | 0. | 1.01 | 17.40 | 212 | .01 | .01 | .00 | 51. |
| 1.01 | 5.45 | 69 | .00 | .00 | .00 | 0. | 1.01 | 17.45 | 213 | .01 | .01 | .00 | 50. |
| 1.01 | 5.50 | 70 | .00 | .00 | .00 | 0. | 1.01 | 17.50 | 214 | .01 | .01 | .00 | 49. |
| 1.01 | 5.55 | 71 | .00 | .00 | .00 | 0. | 1.01 | 17.55 | 215 | .01 | .01 | .00 | 48. |
| 1.01 | 6.00 | 72 | .00 | .00 | .00 | 0. | 1.01 | 18.00 | 216 | .01 | .01 | .00 | 48. |
| 1.01 | 6.05 | 73 | .01 | .00 | .01 | 0. | 1.01 | 18.05 | 217 | .00 | .00 | .00 | 47. |
| 1.01 | 6.10 | 74 | .01 | .00 | .01 | 0. | 1.01 | 18.10 | 218 | .00 | .00 | .00 | 46. |
| 1.01 | 6.15 | 75 | .01 | .00 | .01 | 0. | 1.01 | 18.15 | 219 | .00 | .00 | .00 | 46. |
| 1.01 | 6.20 | 76 | .01 | .00 | .01 | 0. | 1.01 | 18.20 | 220 | .00 | .00 | .00 | 45. |
| 1.01 | 6.25 | 77 | .01 | .00 | .01 | 0. | 1.01 | 18.25 | 221 | .00 | .00 | .00 | 45. |
| 1.01 | 6.30 | 78 | .01 | .00 | .01 | 0. | 1.01 | 18.30 | 222 | .00 | .00 | .00 | 44. |

AD-A106 619 BLACK AND VEATCH KANSAS CITY MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. KEHR'S MILL TRAIL LOWER DAM (MO 11--ETC(U)
NOV 80 E R BURTON, H L CALLAHAN DACW43-80-C-0074

UNCLASSIFIED NL

2 OF 2
AD A
106619

END
DATE
FILMED
11-81
DTIC

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 6.35 | 79 | .01 | .00 | .01 | 0. | 1.01 | 18.35 | 223 | .00 | .00 | .00 | 44. |
| 1.01 | 6.40 | 80 | .01 | .00 | .01 | 0. | 1.01 | 18.40 | 224 | .00 | .00 | .00 | 43. |
| 1.01 | 6.45 | 81 | .01 | .00 | .01 | 0. | 1.01 | 18.45 | 225 | .00 | .00 | .00 | 42. |
| 1.01 | 6.50 | 82 | .01 | .00 | .01 | 0. | 1.01 | 18.50 | 226 | .00 | .00 | .00 | 42. |
| 1.01 | 6.55 | 83 | .01 | .00 | .01 | 0. | 1.01 | 18.55 | 227 | .00 | .00 | .00 | 41. |
| 1.01 | 7.00 | 84 | .01 | .00 | .01 | 0. | 1.01 | 19.00 | 228 | .00 | .00 | .00 | 40. |
| 1.01 | 7.05 | 85 | .01 | .00 | .01 | 0. | 1.01 | 19.05 | 229 | .00 | .00 | .00 | 39. |
| 1.01 | 7.10 | 86 | .01 | .00 | .01 | 0. | 1.01 | 19.10 | 230 | .00 | .00 | .00 | 38. |
| 1.01 | 7.15 | 87 | .01 | .00 | .01 | 0. | 1.01 | 19.15 | 231 | .00 | .00 | .00 | 37. |
| 1.01 | 7.20 | 88 | .01 | .00 | .01 | 0. | 1.01 | 19.20 | 232 | .00 | .00 | .00 | 37. |
| 1.01 | 7.25 | 89 | .01 | .00 | .01 | 0. | 1.01 | 19.25 | 233 | .00 | .00 | .00 | 36. |
| 1.01 | 7.30 | 90 | .01 | .00 | .01 | 0. | 1.01 | 19.30 | 234 | .00 | .00 | .00 | 35. |
| 1.01 | 7.35 | 91 | .01 | .00 | .01 | 0. | 1.01 | 19.35 | 235 | .00 | .00 | .00 | 34. |
| 1.01 | 7.40 | 92 | .01 | .00 | .01 | 0. | 1.01 | 19.40 | 236 | .00 | .00 | .00 | 33. |
| 1.01 | 7.45 | 93 | .01 | .00 | .01 | 0. | 1.01 | 19.45 | 237 | .00 | .00 | .00 | 32. |
| 1.01 | 7.50 | 94 | .01 | .00 | .01 | 0. | 1.01 | 19.50 | 238 | .00 | .00 | .00 | 31. |
| 1.01 | 7.55 | 95 | .01 | .00 | .01 | 0. | 1.01 | 19.55 | 239 | .00 | .00 | .00 | 31. |
| 1.01 | 8.00 | 96 | .01 | .00 | .01 | 0. | 1.01 | 20.00 | 240 | .00 | .00 | .00 | 30. |
| 1.01 | 8.05 | 97 | .01 | .00 | .01 | 0. | 1.01 | 20.05 | 241 | .00 | .00 | .00 | 29. |
| 1.01 | 8.10 | 98 | .01 | .00 | .01 | 0. | 1.01 | 20.10 | 242 | .00 | .00 | .00 | 29. |
| 1.01 | 8.15 | 99 | .01 | .00 | .01 | 0. | 1.01 | 20.15 | 243 | .00 | .00 | .00 | 28. |
| 1.01 | 8.20 | 100 | .01 | .00 | .01 | 0. | 1.01 | 20.20 | 244 | .00 | .00 | .00 | 28. |
| 1.01 | 8.25 | 101 | .01 | .00 | .01 | 0. | 1.01 | 20.25 | 245 | .00 | .00 | .00 | 27. |
| 1.01 | 8.30 | 102 | .01 | .00 | .01 | 0. | 1.01 | 20.30 | 246 | .00 | .00 | .00 | 27. |
| 1.01 | 8.35 | 103 | .01 | .00 | .01 | 0. | 1.01 | 20.35 | 247 | .00 | .00 | .00 | 27. |
| 1.01 | 8.40 | 104 | .01 | .00 | .01 | 0. | 1.01 | 20.40 | 248 | .00 | .00 | .00 | 26. |
| 1.01 | 8.45 | 105 | .01 | .00 | .01 | 0. | 1.01 | 20.45 | 249 | .00 | .00 | .00 | 26. |
| 1.01 | 8.50 | 106 | .01 | .00 | .01 | 0. | 1.01 | 20.50 | 250 | .00 | .00 | .00 | 26. |
| 1.01 | 8.55 | 107 | .01 | .00 | .01 | 0. | 1.01 | 20.55 | 251 | .00 | .00 | .00 | 25. |
| 1.01 | 9.00 | 108 | .01 | .00 | .01 | 0. | 1.01 | 21.00 | 252 | .00 | .00 | .00 | 25. |
| 1.01 | 9.05 | 109 | .01 | .00 | .01 | 0. | 1.01 | 21.05 | 253 | .00 | .00 | .00 | 25. |
| 1.01 | 9.10 | 110 | .01 | .00 | .01 | 0. | 1.01 | 21.10 | 254 | .00 | .00 | .00 | 25. |
| 1.01 | 9.15 | 111 | .01 | .00 | .01 | 0. | 1.01 | 21.15 | 255 | .00 | .00 | .00 | 25. |
| 1.01 | 9.20 | 112 | .01 | .00 | .01 | 0. | 1.01 | 21.20 | 256 | .00 | .00 | .00 | 25. |
| 1.01 | 9.25 | 113 | .01 | .00 | .01 | 0. | 1.01 | 21.25 | 257 | .00 | .00 | .00 | 24. |
| 1.01 | 9.30 | 114 | .01 | .00 | .01 | 0. | 1.01 | 21.30 | 258 | .00 | .00 | .00 | 24. |
| 1.01 | 9.35 | 115 | .01 | .00 | .01 | 0. | 1.01 | 21.35 | 259 | .00 | .00 | .00 | 24. |
| 1.01 | 9.40 | 116 | .01 | .00 | .01 | 0. | 1.01 | 21.40 | 260 | .00 | .00 | .00 | 24. |
| 1.01 | 9.45 | 117 | .01 | .00 | .01 | 0. | 1.01 | 21.45 | 261 | .00 | .00 | .00 | 24. |
| 1.01 | 9.50 | 118 | .01 | .00 | .01 | 0. | 1.01 | 21.50 | 262 | .00 | .00 | .00 | 24. |
| 1.01 | 9.55 | 119 | .01 | .00 | .01 | 0. | 1.01 | 21.55 | 263 | .00 | .00 | .00 | 24. |
| 1.01 | 10.00 | 120 | .01 | .00 | .01 | 0. | 1.01 | 22.00 | 264 | .00 | .00 | .00 | 24. |
| 1.01 | 10.05 | 121 | .01 | .00 | .01 | 0. | 1.01 | 22.05 | 265 | .00 | .00 | .00 | 24. |
| 1.01 | 10.10 | 122 | .01 | .00 | .01 | 0. | 1.01 | 22.10 | 266 | .00 | .00 | .00 | 24. |
| 1.01 | 10.15 | 123 | .01 | .00 | .01 | 0. | 1.01 | 22.15 | 267 | .00 | .00 | .00 | 24. |
| 1.01 | 10.20 | 124 | .01 | .00 | .01 | 0. | 1.01 | 22.20 | 268 | .00 | .00 | .00 | 24. |
| 1.01 | 10.25 | 125 | .01 | .00 | .01 | 0. | 1.01 | 22.25 | 269 | .00 | .00 | .00 | 23. |
| 1.01 | 10.30 | 126 | .01 | .00 | .01 | 0. | 1.01 | 22.30 | 270 | .00 | .00 | .00 | 23. |
| 1.01 | 10.35 | 127 | .03 | .00 | .03 | 0. | 1.01 | 22.35 | 271 | .00 | .00 | .00 | 23. |
| 1.01 | 10.40 | 128 | .03 | .00 | .02 | 1. | 1.01 | 22.40 | 272 | .00 | .00 | .00 | 23. |
| 1.01 | 10.45 | 129 | .03 | .00 | .02 | 1. | 1.01 | 22.45 | 273 | .00 | .00 | .00 | 23. |
| 1.01 | 10.50 | 130 | .03 | .00 | .02 | 1. | 1.01 | 22.50 | 274 | .00 | .00 | .00 | 23. |
| 1.01 | 10.55 | 131 | .03 | .00 | .02 | 1. | 1.01 | 22.55 | 275 | .00 | .00 | .00 | 23. |
| 1.01 | 11.00 | 132 | .03 | .00 | .02 | 1. | 1.01 | 23.00 | 276 | .00 | .00 | .00 | 23. |
| 1.01 | 11.05 | 133 | .04 | .01 | .03 | 2. | 1.01 | 23.05 | 277 | .00 | .00 | .00 | 23. |
| 1.01 | 11.10 | 134 | .04 | .01 | .03 | 2. | 1.01 | 23.10 | 278 | .00 | .00 | .00 | 23. |

```
   1.01  11.15   135   .04   .01   .03     3.      1.01  23.15   279   .00   .00   .00      23.
   1.01  11.20   136   .04   .01   .03     4.      1.01  23.20   280   .00   .00   .00      23.
   1.01  11.25   137   .04   .01   .03     4.      1.01  23.25   281   .00   .00   .00      23.
   1.01  11.30   138   .04   .01   .03     5.      1.01  23.30   282   .00   .00   .00      23.
   1.01  11.35   139   .05   .02   .03     6.      1.01  23.35   283   .00   .00   .00      23.
   1.01  11.40   140   .08   .02   .06     6.      1.01  23.40   284   .00   .00   .00      23.
   1.01  11.45   141   .09   .03   .06     9.      1.01  23.45   285   .00   .00   .00      23.
   1.01  11.50   142   .16   .06   .11    11.      1.01  23.50   286   .00   .00   .00      23.
   1.01  11.55   143   .16   .06   .10    14.      1.01  23.55   287   .00   .00   .00      23.
   1.01  12.00   144   .37   .16   .20    16.      1.02    .00   288   .00   .00   .00      23.

                                                               SUM  4.91  2.13  2.78   12636.
                                                                 ( 125.)( 54.)( 71.)( 357.81)

                              PEAK   6-HOUR  24-HOUR  72-HOUR  TOTAL VOLUME
                   CFS        313.    145.     44.      44.      12629.
                   CMS          9.      4.      1.       1.        358.
                INCHES                1.69    2.04     2.04       2.04
                    MM               42.97   51.80    51.80      51.80
                 AC-FT                 72.     87.      87.        87.
             THOUS CU M                89.    107.     107.       107.


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

                                   HYDROGRAPH ROUTING

               ROUTING THROUGH UPPER KEHR'S MILL TRAIL LAKE DAM

                      ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                        2       1       0       0        0       0      1       0       0
                                              ROUTING DATA
               QLOSS   CLOSS    AVG    IRES   ISAME    IOPT    IPMP           LSTR
                  .0    .000    .00      1       0       0       0              0

                      NSTPS   NSTDL    LAG   AMSKK       X     TSK    STORA  ISPRAT
                          1       0      0    .000    .000    .000    -525.     -1

    STAGE     524.80    526.30    526.80    527.30    527.80    528.80    529.80    530.80    532.80    534.80
              536.80

     FLOW        .00     22.00     34.00     52.00     70.00     86.00    110.00    120.00    144.00    164.00
              184.00

 SURFACE AREA=      0.       4.       7.      13.      21.      32.

    CAPACITY=       0.      15.      42.      91.     256.     518.

   ELEVATION=     499.     510.     515.     520.     530.     540.

                     CREL    SPWID    COQW    EXPW    ELEVL    COQL    CAREA    EXPL
                    524.8       .0      .0      .0       .0      .0       .0      .0
```

DAM DATA

| TOPEL | COQD | EXPD | DAMWID |
|---|---|---|---|
| 529.5 | .0 | .0 | 0. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CREST LENGTH | 0. | 33. | 95. | 207. | 275. | 328. | 380. | 417. | 535. |
| AT OR BELOW ELEVATION | 529.8 | 529.9 | 530.0 | 530.1 | 530.5 | 531.0 | 531.9 | 532.5 | 535.2 |

DAM BREACH DATA

| BRWID | Z | ELBM | TFAIL | WSEL | FAILEL |
|---|---|---|---|---|---|
| 10. | .50 | 510.00 | 1.20 | 524.80 | 529.80 |

END-OF-PERIOD HYDROGRAPH ORDINATES

| MO.DA | HR.MN | PERIOD | HOURS | INFLOW | OUTFLOW | STORAGE | STAGE |
|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .08 | 0. | 0. | 160. | 524.8 |
| 1.01 | .10 | 2 | .17 | 0. | 0. | 160. | 524.8 |
| 1.01 | .15 | 3 | .25 | 0. | 0. | 160. | 524.8 |
| 1.01 | .20 | 4 | .33 | 0. | 0. | 160. | 524.8 |
| 1.01 | .25 | 5 | .42 | 0. | 0. | 160. | 524.8 |
| 1.01 | .30 | 6 | .50 | 0. | 0. | 160. | 524.8 |
| 1.01 | .35 | 7 | .58 | 0. | 0. | 160. | 524.8 |
| 1.01 | .40 | 8 | .67 | 0. | 0. | 160. | 524.8 |
| 1.01 | .45 | 9 | .75 | 0. | 0. | 160. | 524.8 |
| 1.01 | .50 | 10 | .83 | 0. | 0. | 160. | 524.8 |
| 1.01 | .55 | 11 | .92 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.00 | 12 | 1.00 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.05 | 13 | 1.08 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.10 | 14 | 1.17 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.15 | 15 | 1.25 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.20 | 16 | 1.33 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.25 | 17 | 1.42 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.30 | 18 | 1.50 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.35 | 19 | 1.58 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.40 | 20 | 1.67 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.45 | 21 | 1.75 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.50 | 22 | 1.83 | 0. | 0. | 160. | 524.8 |
| 1.01 | 1.55 | 23 | 1.92 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.00 | 24 | 2.00 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.05 | 25 | 2.08 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.10 | 26 | 2.17 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.15 | 27 | 2.25 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.20 | 28 | 2.33 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.25 | 29 | 2.42 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.30 | 30 | 2.50 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.35 | 31 | 2.58 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.40 | 32 | 2.67 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.45 | 33 | 2.75 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.50 | 34 | 2.83 | 0. | 0. | 160. | 524.8 |
| 1.01 | 2.55 | 35 | 2.92 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.00 | 36 | 3.00 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.05 | 37 | 3.08 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.10 | 38 | 3.17 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.15 | 39 | 3.25 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.20 | 40 | 3.33 | 0. | 0. | 160. | 524.8 |
| 1.01 | 3.25 | 41 | 3.42 | 0. | 0. | 160. | 524.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.01 | 22.10 | 266 | 22.17 | 24. | 49. | 202. | 527.2 |
| 1.01 | 22.15 | 267 | 22.25 | 24. | 49. | 202. | 527.2 |
| 1.01 | 22.20 | 268 | 22.33 | 24. | 49. | 201. | 527.2 |
| 1.01 | 22.25 | 269 | 22.42 | 23. | 48. | 201. | 527.2 |
| 1.01 | 22.30 | 270 | 22.50 | 23. | 48. | 201. | 527.2 |
| 1.01 | 22.35 | 271 | 22.58 | 23. | 48. | 201. | 527.2 |
| 1.01 | 22.40 | 272 | 22.67 | 23. | 48. | 201. | 527.2 |
| 1.01 | 22.45 | 273 | 22.75 | 23. | 47. | 201. | 527.2 |
| 1.01 | 22.50 | 274 | 22.83 | 23. | 47. | 200. | 527.1 |
| 1.01 | 22.55 | 275 | 22.92 | 23. | 47. | 200. | 527.1 |
| 1.01 | 23.00 | 276 | 23.00 | 23. | 46. | 200. | 527.1 |
| 1.01 | 23.05 | 277 | 23.08 | 23. | 46. | 200. | 527.1 |
| 1.01 | 23.10 | 278 | 23.17 | 23. | 46. | 200. | 527.1 |
| 1.01 | 23.15 | 279 | 23.25 | 23. | 46. | 200. | 527.1 |
| 1.01 | 23.20 | 280 | 23.33 | 23. | 45. | 200. | 527.1 |
| 1.01 | 23.25 | 281 | 23.42 | 23. | 45. | 199. | 527.1 |
| 1.01 | 23.30 | 282 | 23.50 | 23. | 45. | 199. | 527.1 |
| 1.01 | 23.35 | 283 | 23.58 | 23. | 45. | 199. | 527.1 |
| 1.01 | 23.40 | 284 | 23.67 | 23. | 44. | 199. | 527.1 |
| 1.01 | 23.45 | 285 | 23.75 | 23. | 44. | 199. | 527.1 |
| 1.01 | 23.50 | 286 | 23.83 | 23. | 44. | 199. | 527.0 |
| 1.01 | 23.55 | 287 | 23.92 | 23. | 44. | 198. | 527.0 |
| 1.02 | .00 | 288 | 24.00 | 23. | 43. | 198. | 527.0 |

PEAK OUTFLOW IS 69. AT TIME 16.75 HOURS

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 69. | 64. | 25. | 25. | 7111. |
| CMS | 2. | 2. | 1. | 1. | 201. |
| INCHES | | .74 | 1.15 | 1.15 | 1.15 |
| MM | | 18.81 | 29.17 | 29.17 | 29.17 |
| AC-FT | | 32. | 49. | 49. | 49. |
| THOUS CU M | | 39. | 60. | 60. | 60. |

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

SUB-AREA RUNOFF COMPUTATION

LOWER KEHR'S MILL TRAIL LAKE DAM (10-YEAR INFLOW)

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 |

HYDROGRAPH DATA

| IHYDG | IUHG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | .11 | .00 | .11 | .00 | .000 | 0 | 0 | 0 |

PRECIP DATA

| NP | STORM | DAJ | DAK |
|---|---|---|---|
| 289 | 4.91 | .00 | .00 |

PRECIP PATTERN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .03 | .03 | .03 | .03 |
| .03 | .03 | .04 | .04 | .04 | .04 | .04 | .04 | .09 | .09 |
| .09 | .16 | .16 | .37 | .56 | .26 | .16 | .09 | .09 | .09 |
| .04 | .04 | .04 | .04 | .06 | .04 | .03 | .03 | .03 | .03 |
| .03 | .03 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | | |

LOSS DATA

| LROPT | STRKR | DLTKR | RTIOL | ERAIN | STRKS | RTIOK | STRTL | CNSTL | ALSMX | RTIMP |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | .00 | .00 | 1.00 | .00 | .00 | 1.00 | -1.00 | -72.00 | .00 | .00 |

CURVE NO = -72.00 WETNESS = -1.00 EFFECT CN = 72.00

UNIT HYDROGRAPH DATA
TC= .00 LAG= .11

RECESSION DATA
STRTQ= .00 QRCSN= .00 RTIOR= 1.00

TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

UNIT HYDROGRAPH 9 END OF PERIOD ORDINATES, TC= .00 HOURS, LAG= .11 VOL= 1.00
199. 749. 182. 73. 30. 12. 5. 2. 0.

0

END-OF-PERIOD FLOW

| MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q | MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .05 | 1 | .00 | .00 | .00 | 0. | 1.01 | 12.05 | 145 | .58 | .31 | .27 | 135. |
| 1.01 | .10 | 2 | .00 | .00 | .00 | 0. | 1.01 | 12.10 | 146 | .26 | .15 | .10 | 174. |
| 1.01 | .15 | 3 | .00 | .00 | .00 | 0. | 1.01 | 12.15 | 147 | .16 | .10 | .06 | 144. |
| 1.01 | .20 | 4 | .00 | .00 | .00 | 0. | 1.01 | 12.20 | 148 | .09 | .05 | .03 | 103. |
| 1.01 | .25 | 5 | .00 | .00 | .00 | 0. | 1.01 | 12.25 | 149 | .08 | .05 | .03 | 71. |
| 1.01 | .30 | 6 | .00 | .00 | .00 | 0. | 1.01 | 12.30 | 150 | .08 | .06 | .03 | 57. |

B L A C K   J E A T C H     PROJECT 9166:     DATE 15 JAN 81     .GE 18

FLOOD HYDROGRAPH PACKAGE - HEC-1     PROGRAM H21/02-1V     TIME 18:03:04     CASE 10

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | .35 | 7 | .00 | .00 | .00 | 0. | 1.01 | 12.35 | 151 | .04 | .03 | .01 | 46. |
| 1.01 | .40 | 8 | .00 | .00 | .00 | 0. | 1.01 | 12.40 | 152 | .04 | .03 | .01 | 33. |
| 1.01 | .45 | 9 | .00 | .00 | .00 | 0. | 1.01 | 12.45 | 153 | .04 | .03 | .01 | 27. |
| 1.01 | .50 | 10 | .00 | .00 | .00 | 0. | 1.01 | 12.50 | 154 | .04 | .03 | .01 | 25. |
| 1.01 | .55 | 11 | .00 | .00 | .00 | 0. | 1.01 | 12.55 | 155 | .04 | .03 | .01 | 24. |
| 1.01 | 1.00 | 12 | .00 | .00 | .00 | 0. | 1.01 | 13.00 | 156 | .04 | .03 | .01 | 24. |
| 1.01 | 1.05 | 13 | .00 | .00 | .00 | 0. | 1.01 | 13.05 | 157 | .03 | .02 | .01 | 22. |
| 1.01 | 1.10 | 14 | .00 | .00 | .00 | 0. | 1.01 | 13.10 | 158 | .03 | .02 | .01 | 19. |
| 1.01 | 1.15 | 15 | .00 | .00 | .00 | 0. | 1.01 | 13.15 | 159 | .03 | .02 | .01 | 17. |
| 1.01 | 1.20 | 16 | .00 | .00 | .00 | 0. | 1.01 | 13.20 | 160 | .03 | .02 | .01 | 17. |
| 1.01 | 1.25 | 17 | .00 | .00 | .00 | 0. | 1.01 | 13.25 | 161 | .03 | .02 | .01 | 16. |
| 1.01 | 1.30 | 18 | .00 | .00 | .00 | 0. | 1.01 | 13.30 | 162 | .03 | .02 | .01 | 16. |
| 1.01 | 1.35 | 19 | .00 | .00 | .00 | 0. | 1.01 | 13.35 | 163 | .01 | .01 | .00 | 15. |
| 1.01 | 1.40 | 20 | .00 | .00 | .00 | 0. | 1.01 | 13.40 | 164 | .01 | .01 | .00 | 12. |
| 1.01 | 1.45 | 21 | .00 | .00 | .00 | 0. | 1.01 | 13.45 | 165 | .01 | .01 | .00 | 10. |
| 1.01 | 1.50 | 22 | .00 | .00 | .00 | 0. | 1.01 | 13.50 | 166 | .01 | .01 | .00 | 9. |
| 1.01 | 1.55 | 23 | .00 | .00 | .00 | 0. | 1.01 | 13.55 | 167 | .01 | .01 | .00 | 9. |
| 1.01 | 2.00 | 24 | .00 | .00 | .00 | 0. | 1.01 | 14.00 | 168 | .01 | .01 | .00 | 9. |
| 1.01 | 2.05 | 25 | .00 | .00 | .00 | 0. | 1.01 | 14.05 | 169 | .01 | .01 | .00 | 9. |
| 1.01 | 2.10 | 26 | .00 | .00 | .00 | 0. | 1.01 | 14.10 | 170 | .01 | .01 | .00 | 9. |
| 1.01 | 2.15 | 27 | .00 | .00 | .00 | 0. | 1.01 | 14.15 | 171 | .01 | .01 | .00 | 9. |
| 1.01 | 2.20 | 28 | .00 | .00 | .00 | 0. | 1.01 | 14.20 | 172 | .01 | .01 | .00 | 9. |
| 1.01 | 2.25 | 29 | .00 | .00 | .00 | 0. | 1.01 | 14.25 | 173 | .01 | .01 | .00 | 9. |
| 1.01 | 2.30 | 30 | .00 | .00 | .00 | 0. | 1.01 | 14.30 | 174 | .01 | .01 | .00 | 9. |
| 1.01 | 2.35 | 31 | .00 | .00 | .00 | 0. | 1.01 | 14.35 | 175 | .01 | .01 | .00 | 9. |
| 1.01 | 2.40 | 32 | .00 | .00 | .00 | 0. | 1.01 | 14.40 | 176 | .01 | .01 | .00 | 9. |
| 1.01 | 2.45 | 33 | .00 | .00 | .00 | 0. | 1.01 | 14.45 | 177 | .01 | .01 | .00 | 9. |
| 1.01 | 2.50 | 34 | .00 | .00 | .00 | 0. | 1.01 | 14.50 | 178 | .01 | .01 | .00 | 9. |
| 1.01 | 2.55 | 35 | .00 | .00 | .00 | 0. | 1.01 | 14.55 | 179 | .01 | .01 | .00 | 9. |
| 1.01 | 3.00 | 36 | .00 | .00 | .00 | 0. | 1.01 | 15.00 | 180 | .01 | .01 | .00 | 9. |
| 1.01 | 3.05 | 37 | .00 | .00 | .00 | 0. | 1.01 | 15.05 | 181 | .01 | .01 | .00 | 8. |
| 1.01 | 3.10 | 38 | .00 | .00 | .00 | 0. | 1.01 | 15.10 | 182 | .01 | .01 | .00 | 7. |
| 1.01 | 3.15 | 39 | .00 | .00 | .00 | 0. | 1.01 | 15.15 | 183 | .01 | .01 | .00 | 6. |
| 1.01 | 3.20 | 40 | .00 | .00 | .00 | 0. | 1.01 | 15.20 | 184 | .01 | .01 | .00 | 6. |
| 1.01 | 3.25 | 41 | .00 | .00 | .00 | 0. | 1.01 | 15.25 | 185 | .01 | .01 | .00 | 6. |
| 1.01 | 3.30 | 42 | .00 | .00 | .00 | 0. | 1.01 | 15.30 | 186 | .01 | .01 | .00 | 5. |
| 1.01 | 3.35 | 43 | .00 | .00 | .00 | 0. | 1.01 | 15.35 | 187 | .01 | .01 | .00 | 5. |
| 1.01 | 3.40 | 44 | .00 | .00 | .00 | 0. | 1.01 | 15.40 | 188 | .01 | .01 | .00 | 5. |
| 1.01 | 3.45 | 45 | .00 | .00 | .00 | 0. | 1.01 | 15.45 | 189 | .01 | .01 | .00 | 5. |
| 1.01 | 3.50 | 46 | .00 | .00 | .00 | 0. | 1.01 | 15.50 | 190 | .01 | .01 | .00 | 5. |
| 1.01 | 3.55 | 47 | .00 | .00 | .00 | 0. | 1.01 | 15.55 | 191 | .01 | .01 | .00 | 5. |
| 1.01 | 4.00 | 48 | .00 | .00 | .00 | 0. | 1.01 | 16.00 | 192 | .01 | .01 | .00 | 5. |
| 1.01 | 4.05 | 49 | .00 | .00 | .00 | 0. | 1.01 | 16.05 | 193 | .01 | .01 | .00 | 6. |
| 1.01 | 4.10 | 50 | .00 | .00 | .00 | 0. | 1.01 | 16.10 | 194 | .01 | .01 | .00 | 6. |
| 1.01 | 4.15 | 51 | .00 | .00 | .00 | 0. | 1.01 | 16.15 | 195 | .01 | .01 | .00 | 6. |
| 1.01 | 4.20 | 52 | .00 | .00 | .00 | 0. | 1.01 | 16.20 | 196 | .01 | .01 | .00 | 6. |
| 1.01 | 4.25 | 53 | .00 | .00 | .00 | 0. | 1.01 | 16.25 | 197 | .01 | .01 | .00 | 6. |
| 1.01 | 4.30 | 54 | .00 | .00 | .00 | 0. | 1.01 | 16.30 | 198 | .01 | .01 | .00 | 6. |
| 1.01 | 4.35 | 55 | .00 | .00 | .00 | 0. | 1.01 | 16.35 | 199 | .01 | .01 | .00 | 6. |
| 1.01 | 4.40 | 56 | .00 | .00 | .00 | 0. | 1.01 | 16.40 | 200 | .01 | .01 | .00 | 6. |
| 1.01 | 4.45 | 57 | .00 | .00 | .00 | 0. | 1.01 | 16.45 | 201 | .01 | .01 | .00 | 6. |
| 1.01 | 4.50 | 58 | .00 | .00 | .00 | 0. | 1.01 | 16.50 | 202 | .01 | .01 | .00 | 6. |
| 1.01 | 4.55 | 59 | .00 | .00 | .00 | 0. | 1.01 | 16.55 | 203 | .01 | .01 | .00 | 6. |
| 1.01 | 5.00 | 60 | .00 | .00 | .00 | 0. | 1.01 | 17.00 | 204 | .01 | .01 | .00 | 6. |
| 1.01 | 5.05 | 61 | .00 | .00 | .00 | 0. | 1.01 | 17.05 | 205 | .01 | .01 | .00 | 6. |
| 1.01 | 5.10 | 62 | .00 | .00 | .00 | 0. | 1.01 | 17.10 | 206 | .01 | .01 | .00 | 6. |

B L A C K & V E A T C H                PROJECT 9166:        DATE 15 JAN 81     PAGE 19

FLOOD HYDR        PN PACKAGE - HEC-1                PROGRAM H21/02-1V   TIME 18:03:04     SE 10

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 5.15 | 63 | .00 | .00 | .00 | 0. | 1.01 | 17.15 | 207 | .01 | .01 | .00 | 6. |
| 1.01 | 5.20 | 64 | .00 | .00 | .00 | 0. | 1.01 | 17.20 | 208 | .01 | .01 | .00 | 6. |
| 1.01 | 5.25 | 65 | .00 | .00 | .00 | 0. | 1.01 | 17.25 | 209 | .01 | .01 | .00 | 6. |
| 1.01 | 5.30 | 66 | .00 | .00 | .00 | 0. | 1.01 | 17.30 | 210 | .01 | .01 | .00 | 6. |
| 1.01 | 5.35 | 67 | .00 | .00 | .00 | 0. | 1.01 | 17.35 | 211 | .01 | .01 | .00 | 6. |
| 1.01 | 5.40 | 68 | .00 | .00 | .00 | 0. | 1.01 | 17.40 | 212 | .01 | .01 | .00 | 6. |
| 1.01 | 5.45 | 69 | .00 | .00 | .00 | 0. | 1.01 | 17.45 | 213 | .01 | .01 | .00 | 6. |
| 1.01 | 5.50 | 70 | .00 | .00 | .00 | 0. | 1.01 | 17.50 | 214 | .01 | .01 | .00 | 6. |
| 1.01 | 5.55 | 71 | .00 | .00 | .00 | 0. | 1.01 | 17.55 | 215 | .01 | .01 | .00 | 6. |
| 1.01 | 6.00 | 72 | .00 | .00 | .00 | 0. | 1.01 | 18.00 | 216 | .01 | .01 | .00 | 6. |
| 1.01 | 6.05 | 73 | .01 | .00 | .01 | 0. | 1.01 | 18.05 | 217 | .00 | .00 | .00 | 5. |
| 1.01 | 6.10 | 74 | .01 | .00 | .01 | 0. | 1.01 | 18.10 | 218 | .00 | .00 | .00 | 4. |
| 1.01 | 6.15 | 75 | .01 | .00 | .01 | 0. | 1.01 | 18.15 | 219 | .00 | .00 | .00 | 3. |
| 1.01 | 6.20 | 76 | .01 | .00 | .01 | 0. | 1.01 | 18.20 | 220 | .00 | .00 | .00 | 3. |
| 1.01 | 6.25 | 77 | .01 | .00 | .01 | 0. | 1.01 | 18.25 | 221 | .00 | .00 | .00 | 3. |
| 1.01 | 6.30 | 78 | .01 | .00 | .01 | 0. | 1.01 | 18.30 | 222 | .00 | .00 | .00 | 3. |
| 1.01 | 6.35 | 79 | .01 | .00 | .01 | 0. | 1.01 | 18.35 | 223 | .00 | .00 | .00 | 3. |
| 1.01 | 6.40 | 80 | .01 | .00 | .01 | 0. | 1.01 | 18.40 | 224 | .00 | .00 | .00 | 3. |
| 1.01 | 6.45 | 81 | .01 | .00 | .01 | 0. | 1.01 | 18.45 | 225 | .00 | .00 | .00 | 3. |
| 1.01 | 6.50 | 82 | .01 | .00 | .01 | 0. | 1.01 | 18.50 | 226 | .00 | .00 | .00 | 3. |
| 1.01 | 6.55 | 83 | .01 | .00 | .01 | 0. | 1.01 | 18.55 | 227 | .00 | .00 | .00 | 3. |
| 1.01 | 7.00 | 84 | .01 | .00 | .01 | 0. | 1.01 | 19.00 | 228 | .00 | .00 | .00 | 3. |
| 1.01 | 7.05 | 85 | .01 | .00 | .01 | 0. | 1.01 | 19.05 | 229 | .00 | .00 | .00 | 3. |
| 1.01 | 7.10 | 86 | .01 | .00 | .01 | 0. | 1.01 | 19.10 | 230 | .00 | .00 | .00 | 3. |
| 1.01 | 7.15 | 87 | .01 | .00 | .01 | 0. | 1.01 | 19.15 | 231 | .00 | .00 | .00 | 3. |
| 1.01 | 7.20 | 88 | .01 | .00 | .01 | 0. | 1.01 | 19.20 | 232 | .00 | .00 | .00 | 3. |
| 1.01 | 7.25 | 89 | .01 | .00 | .01 | 0. | 1.01 | 19.25 | 233 | .00 | .00 | .00 | 3. |
| 1.01 | 7.30 | 90 | .01 | .00 | .01 | 0. | 1.01 | 19.30 | 234 | .00 | .00 | .00 | 3. |
| 1.01 | 7.35 | 91 | .01 | .00 | .01 | 0. | 1.01 | 19.35 | 235 | .00 | .00 | .00 | 3. |
| 1.01 | 7.40 | 92 | .01 | .00 | .01 | 0. | 1.01 | 19.40 | 236 | .00 | .00 | .00 | 3. |
| 1.01 | 7.45 | 93 | .01 | .00 | .01 | 0. | 1.01 | 19.45 | 237 | .00 | .00 | .00 | 3. |
| 1.01 | 7.50 | 94 | .01 | .00 | .01 | 0. | 1.01 | 19.50 | 238 | .00 | .00 | .00 | 3. |
| 1.01 | 7.55 | 95 | .01 | .00 | .01 | 0. | 1.01 | 19.55 | 239 | .00 | .00 | .00 | 3. |
| 1.01 | 8.00 | 96 | .01 | .00 | .01 | 0. | 1.01 | 20.00 | 240 | .00 | .00 | .00 | 3. |
| 1.01 | 8.05 | 97 | .01 | .00 | .01 | 0. | 1.01 | 20.05 | 241 | .00 | .00 | .00 | 3. |
| 1.01 | 8.10 | 98 | .01 | .00 | .01 | 0. | 1.01 | 20.10 | 242 | .00 | .00 | .00 | 3. |
| 1.01 | 8.15 | 99 | .01 | .00 | .01 | 0. | 1.01 | 20.15 | 243 | .00 | .00 | .00 | 3. |
| 1.01 | 8.20 | 100 | .01 | .00 | .01 | 0. | 1.01 | 20.20 | 244 | .00 | .00 | .00 | 3. |
| 1.01 | 8.25 | 101 | .01 | .00 | .01 | 0. | 1.01 | 20.25 | 245 | .00 | .00 | .00 | 3. |
| 1.01 | 8.30 | 102 | .01 | .00 | .01 | 0. | 1.01 | 20.30 | 246 | .00 | .00 | .00 | 3. |
| 1.01 | 8.35 | 103 | .01 | .00 | .01 | 0. | 1.01 | 20.35 | 247 | .00 | .00 | .00 | 3. |
| 1.01 | 8.40 | 104 | .01 | .00 | .01 | 0. | 1.01 | 20.40 | 248 | .00 | .00 | .00 | 3. |
| 1.01 | 8.45 | 105 | .01 | .00 | .01 | 0. | 1.01 | 20.45 | 249 | .00 | .00 | .00 | 3. |
| 1.01 | 8.50 | 106 | .01 | .00 | .01 | 0. | 1.01 | 20.50 | 250 | .00 | .00 | .00 | 3. |
| 1.01 | 8.55 | 107 | .01 | .00 | .01 | 0. | 1.01 | 20.55 | 251 | .00 | .00 | .00 | 3. |
| 1.01 | 9.00 | 108 | .01 | .00 | .01 | 0. | 1.01 | 21.00 | 252 | .00 | .00 | .00 | 3. |
| 1.01 | 9.05 | 109 | .01 | .00 | .01 | 0. | 1.01 | 21.05 | 253 | .00 | .00 | .00 | 3. |
| 1.01 | 9.10 | 110 | .01 | .00 | .01 | 0. | 1.01 | 21.10 | 254 | .00 | .00 | .00 | 3. |
| 1.01 | 9.15 | 111 | .01 | .00 | .01 | 0. | 1.01 | 21.15 | 255 | .00 | .00 | .00 | 3. |
| 1.01 | 9.20 | 112 | .01 | .00 | .01 | 0. | 1.01 | 21.20 | 256 | .00 | .00 | .00 | 3. |
| 1.01 | 9.25 | 113 | .01 | .00 | .01 | 0. | 1.01 | 21.25 | 257 | .00 | .00 | .00 | 3. |
| 1.01 | 9.30 | 114 | .01 | .00 | .01 | 0. | 1.01 | 21.30 | 258 | .00 | .00 | .00 | 3. |
| 1.01 | 9.35 | 115 | .01 | .00 | .01 | 0. | 1.01 | 21.35 | 259 | .00 | .00 | .00 | 3. |
| 1.01 | 9.40 | 116 | .01 | .00 | .01 | 0. | 1.01 | 21.40 | 260 | .00 | .00 | .00 | 3. |
| 1.01 | 9.45 | 117 | .01 | .00 | .01 | 0. | 1.01 | 21.45 | 261 | .00 | .00 | .00 | 3. |
| 1.01 | 9.50 | 118 | .01 | .00 | .01 | 0. | 1.01 | 21.50 | 262 | .00 | .00 | .00 | 3. |

FLOOD HYDROGRAPH PACKAGE - HEC-1 PROGRAM H21/02-1V TIME 18:03:04 CASE 10

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.01 | 9.55 | 119 | .01 | .00 | .01 | 0. | 1.01 | 21.55 | 263 | .00 | .00 | .00 | 3. |
| 1.01 | 10.00 | 120 | .01 | .00 | .01 | 0. | 1.01 | 22.00 | 264 | .00 | .00 | .00 | 3. |
| 1.01 | 10.05 | 121 | .01 | .00 | .01 | 0. | 1.01 | 22.05 | 265 | .00 | .00 | .00 | 3. |
| 1.01 | 10.10 | 122 | .01 | .00 | .01 | 0. | 1.01 | 22.10 | 266 | .00 | .00 | .00 | 3. |
| 1.01 | 10.15 | 123 | .01 | .00 | .01 | 1. | 1.01 | 22.15 | 267 | .00 | .00 | .00 | 3. |
| 1.01 | 10.20 | 124 | .01 | .00 | .01 | 1. | 1.01 | 22.20 | 268 | .00 | .00 | .00 | 3. |
| 1.01 | 10.25 | 125 | .01 | .00 | .01 | 1. | 1.01 | 22.25 | 269 | .00 | .00 | .00 | 3. |
| 1.01 | 10.30 | 126 | .01 | .00 | .01 | 1. | 1.01 | 22.30 | 270 | .00 | .00 | .00 | 3. |
| 1.01 | 10.35 | 127 | .03 | .00 | .03 | 1. | 1.01 | 22.35 | 271 | .00 | .00 | .00 | 3. |
| 1.01 | 10.40 | 128 | .03 | .00 | .02 | 2. | 1.01 | 22.40 | 272 | .00 | .00 | .00 | 3. |
| 1.01 | 10.45 | 129 | .03 | .00 | .02 | 2. | 1.01 | 22.45 | 273 | .00 | .00 | .00 | 3. |
| 1.01 | 10.50 | 130 | .03 | .00 | .02 | 2. | 1.01 | 22.50 | 274 | .00 | .00 | .00 | 3. |
| 1.01 | 10.55 | 131 | .03 | .00 | .02 | 3. | 1.01 | 22.55 | 275 | .00 | .00 | .00 | 3. |
| 1.01 | 11.00 | 132 | .03 | .00 | .02 | 3. | 1.01 | 23.00 | 276 | .00 | .00 | .00 | 3. |
| 1.01 | 11.05 | 133 | .04 | .01 | .03 | 4. | 1.01 | 23.05 | 277 | .00 | .00 | .00 | 3. |
| 1.01 | 11.10 | 134 | .04 | .01 | .03 | 5. | 1.01 | 23.10 | 278 | .00 | .00 | .00 | 3. |
| 1.01 | 11.15 | 135 | .04 | .01 | .03 | 6. | 1.01 | 23.15 | 279 | .00 | .00 | .00 | 3. |
| 1.01 | 11.20 | 136 | .04 | .01 | .03 | 6. | 1.01 | 23.20 | 280 | .00 | .00 | .00 | 3. |
| 1.01 | 11.25 | 137 | .04 | .01 | .03 | 7. | 1.01 | 23.25 | 281 | .00 | .00 | .00 | 3. |
| 1.01 | 11.30 | 138 | .04 | .01 | .03 | 7. | 1.01 | 23.30 | 282 | .00 | .00 | .00 | 3. |
| 1.01 | 11.35 | 139 | .05 | .02 | .05 | 10. | 1.01 | 23.35 | 283 | .00 | .00 | .00 | 3. |
| 1.01 | 11.40 | 140 | .08 | .02 | .06 | 15. | 1.01 | 23.40 | 284 | .00 | .00 | .00 | 3. |
| 1.01 | 11.45 | 141 | .09 | .03 | .05 | 19. | 1.01 | 23.45 | 285 | .00 | .00 | .00 | 3. |
| 1.01 | 11.50 | 142 | .16 | .06 | .11 | 27. | 1.01 | 23.50 | 286 | .00 | .00 | .00 | 3. |
| 1.01 | 11.55 | 143 | .16 | .06 | .10 | 39. | 1.01 | 23.55 | 287 | .00 | .00 | .00 | 3. |
| 1.01 | 12.00 | 144 | .37 | .16 | .20 | 68. | 1.02 | .00 | 288 | .00 | .00 | .00 | 3. |

| | | | | |
|---|---|---|---|---|
| SUM | 4.91 | 2.13 | 2.78 | 1603. |
| | ( 125.) | ( 54.) | ( 71.) | ( 51.06) |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 174. | 21. | 6. | 6. | 1804. |
| CMS | 5. | 1. | 0. | 0. | 51. |
| INCHES | | 1.75 | 2.12 | 2.12 | 2.12 |
| MM | | 44.51 | 53.82 | 53.82 | 53.82 |
| AC-FT | | 10. | 12. | 12. | 12. |
| THOUS CU M | | 13. | 15. | 15. | 15. |

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

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS-TOTAL FLOW LOWER DAM (24 HR. 10-YEAR INFLOW)

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 4 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

SUM OF 2 HYDROGRAPHS AT 4

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 0. | 0. | 1. | 1. | 1. | 1. | 1. | 2. | 2. | 2. |
| 3. | 3. | 4. | 5. | 6. | 6. | 7. | 8. | 10. | 15. |
| 19. | 27. | 40. | 68. | 134. | 175. | 145. | 104. | 77. | 59. |
| 48. | 36. | 31. | 33. | 33. | 31. | 30. | 29. | 29. | 30. |
| 31. | 33. | 33. | 32. | 32. | 34. | 37. | 39. | 42. | 45. |
| 48. | 51. | 53. | 55. | 57. | 59. | 61. | 63. | 65. | 66. |
| 67. | 67. | 67. | 69. | 69. | 69. | 70. | 71. | 71. | 72. |
| 72. | 73. | 73. | 74. | 74. | 74. | 74. | 74. | 74. | 74. |
| 74. | 74. | 74. | 74. | 74. | 74. | 74. | 74. | 74. | 73. |
| 73. | 73. | 73. | 72. | 72. | 72. | 71. | 70. | 69. | 69. |
| 69. | 68. | 68. | 67. | 67. | 67. | 67. | 66. | 66. | 66. |
| 65. | 65. | 65. | 64. | 64. | 64. | 63. | 63. | 62. | 62. |
| 62. | 61. | 61. | 61. | 60. | 60. | 59. | 59. | 59. | 58. |
| 59. | 57. | 57. | 57. | 55. | 56. | 55. | 55. | 55. | 54. |
| 54. | 54. | 53. | 53. | 53. | 53. | 52. | 52. | 52. | 51. |
| 51. | 51. | 50. | 50. | 50. | 50. | 49. | 49. | 49. | 49. |
| 49. | 48. | 48. | 48. | 47. | 47. | 47. | 47. | | |

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 175. | 66. | 31. | 31. | 6915. |
| CMS | 5. | 2. | 1. | 1. | 252. |
| INCHES | | .70 | 1.27 | 1.27 | 1.27 |
| MM | | 17.77 | 32.15 | 32.15 | 32.15 |
| AC-FT | | 34. | 61. | 61. | 61. |
| THOUS CU M | | 42. | 76. | 76. | 76. |

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

HYDROGRAPH ROUTING

ROUTING THROUGH LOWER KEHR'S MILL TRAIL LAKE DAM

| ISTAQ | ICOMP | IECON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

ROUTING DATA

| QLOSS | CLOSS | AVG | IRES | ISAME | IOPT | IPMP | LSTR |
|---|---|---|---|---|---|---|---|
| .0 | .000 | .00 | 1 | 0 | 0 | 0 | 0 |

| NSTPS | NSTDL | LAG | AMSKK | X | TSK | STORA | ISPRAT |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | .000 | .000 | .000 | -505. | -1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STAGE | 504.90 | 506.40 | 506.90 | 507.40 | 507.90 | 508.90 | 509.90 | 510.90 | 512.90 | 514.90 |
| | 516.90 | | | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.01 | 21.25 | 257 | 21.42 | 55. | 36. | 291. | 506.9 |
| 1.01 | 21.30 | 258 | 21.50 | 55. | 36. | 291. | 506.9 |
| 1.01 | 21.35 | 259 | 21.58 | 55. | 37. | 291. | 506.9 |
| 1.01 | 21.40 | 260 | 21.67 | 54. | 37. | 291. | 506.9 |
| 1.01 | 21.45 | 261 | 21.75 | 54. | 37. | 292. | 506.9 |
| 1.01 | 21.50 | 262 | 21.83 | 54. | 37. | 292. | 506.9 |
| 1.01 | 21.55 | 263 | 21.92 | 53. | 37. | 292. | 506.9 |
| 1.01 | 22.00 | 264 | 22.00 | 53. | 38. | 292. | 506.9 |
| 1.01 | 22.05 | 265 | 22.08 | 53. | 38. | 292. | 507.0 |
| 1.01 | 22.10 | 266 | 22.17 | 53. | 38. | 292. | 507.0 |
| 1.01 | 22.15 | 267 | 22.25 | 52. | 38. | 292. | 507.0 |
| 1.01 | 22.20 | 268 | 22.33 | 52. | 38. | 292. | 507.0 |
| 1.01 | 22.25 | 269 | 22.42 | 52. | 39. | 292. | 507.0 |
| 1.01 | 22.30 | 270 | 22.50 | 51. | 39. | 292. | 507.0 |
| 1.01 | 22.35 | 271 | 22.58 | 51. | 39. | 293. | 507.0 |
| 1.01 | 22.40 | 272 | 22.67 | 51. | 39. | 293. | 507.0 |
| 1.01 | 22.45 | 273 | 22.75 | 50. | 39. | 293. | 507.0 |
| 1.01 | 22.50 | 274 | 22.83 | 50. | 39. | 293. | 507.0 |
| 1.01 | 22.55 | 275 | 22.92 | 50. | 39. | 293. | 507.0 |
| 1.01 | 23.00 | 276 | 23.00 | 50. | 39. | 293. | 507.0 |
| 1.01 | 23.05 | 277 | 23.08 | 49. | 39. | 293. | 507.0 |
| 1.01 | 23.10 | 278 | 23.17 | 49. | 40. | 293. | 507.0 |
| 1.01 | 23.15 | 279 | 23.25 | 49. | 40. | 293. | 507.0 |
| 1.01 | 23.20 | 280 | 23.33 | 49. | 40. | 293. | 507.0 |
| 1.01 | 23.25 | 281 | 23.42 | 48. | 40. | 293. | 507.0 |
| 1.01 | 23.30 | 282 | 23.50 | 48. | 40. | 293. | 507.0 |
| 1.01 | 23.35 | 283 | 23.58 | 48. | 40. | 293. | 507.0 |
| 1.01 | 23.40 | 284 | 23.67 | 48. | 40. | 293. | 507.0 |
| 1.01 | 23.45 | 285 | 23.75 | 47. | 40. | 293. | 507.0 |
| 1.01 | 23.50 | 286 | 23.83 | 47. | 40. | 293. | 507.0 |
| 1.01 | 23.55 | 287 | 23.92 | 47. | 40. | 294. | 507.0 |
| 1.02 | .00 | 288 | 24.00 | 47. | 41. | 294. | 507.0 |

PEAK OUTFLOW IS 41. AT TIME 24.00 HOURS

| | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | TOTAL VOLUME |
|---|---|---|---|---|---|
| CFS | 41. | 34. | 11. | 11. | 3277. |
| CMS | 1. | 1. | 0. | 0. | 93. |
| INCHES | | .35 | .46 | .46 | .46 |
| MM | | 8.77 | 11.80 | 11.80 | 11.80 |
| AC-FT | | 17. | 23. | 23. | 23. |
| THOUS CU M | | 21. | 28. | 28. | 28. |

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

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

| | | PEAK | 6-HOUR | 24-HOUR | 72-HOUR | AREA |
|---|---|---|---|---|---|---|
| HYDROGRAPH AT | 1 | 310. | 145. | 44. | 44. | .80 |
| | ( | 8.76)( | 4.12)( | 1.24)( | 1.24)( | 2.07) |
| ROUTED TO | 2 | 69. | 64. | 25. | 25. | .80 |
| | ( | 1.95)( | 1.80)( | .70)( | .70)( | 2.07) |
| HYDROGRAPH AT | 3 | 174. | 21. | 6. | 6. | .11 |
| | ( | 4.94)( | .59)( | .18)( | .16)( | .28) |
| 2-COMBINED | 4 | 175. | 66. | 31. | 31. | .91 |
| | ( | 4.96)( | 1.94)( | .86)( | .88)( | 2.36) |
| ROUTED TO | 5 | 41. | 34. | 11. | 11. | .91 |
| | ( | 1.15)( | .96)( | .32)( | .32)( | 2.36) |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..............

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 524.80 | 524.80 | 529.80 |
| STORAGE | 160. | 160. | 252. |
| OUTFLOW | 0. | 0. | 110. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| 1.00 | 527.77 | .00 | 212. | 69. | .00 | 16.75 | .00 |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

| | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
|---|---|---|---|
| ELEVATION | 504.50 | 504.90 | 509.60 |
| STORAGE | 255. | 255. | 542. |
| OUTFLOW | 0. | 0. | 97. |

| RATIO OF PMF | MAXIMUM RESERVOIR W.S.ELEV | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC-FT | MAXIMUM OUTFLOW CFS | DURATION OVER TOP HOURS | TIME OF MAX OUTFLOW HOURS | TIME OF FAILURE HOURS |
|---|---|---|---|---|---|---|---|
| 1.00 | 507.04 | .00 | 294. | 41. | .00 | 24.00 | .00 |

# APPENDIX B

## ENGINEERING GEOLOGIC REPORT ON THE KEHR'S MILL TRAIL LAKE SITE

ENGINEERING GEOLOGIC REPORT ON THE KEHRS MILL TRAILS LAKE SITE

St. Louis County, Mo.

LOCATION: In a northwest trending tributary to Caulks Creek paralleling Kehrs Mill Road in Sec. 17 & 18, T. 45 N., R. 4 E., Chesterfield Quadrangle.

GEOLOGIC SETTING:

Two proposed lake sites are planned for the valley. One dam is proposed at the mouth of the tributary valley with the second dam proposed at the tail waters of the first, approximately at elevation 500 in the valley bottom.

Limestone of the Burlington Formation is the parent bedrock in the lake and watershed area. The Burlington in this area is very deeply weathered with much solution work along joints and bedding planes plus creating a very permeable bedrock. The bedrock, however, is masked for the most part by thick residual soil on the lower valley slopes which in turn is covered by an unknown but relatively thick sequence of silty and silty clay soil. Numerous outcrops of limestone are observable in the lower valley walls in the vicinity of the streambed upstream of the dams. At least one spring was observed on the lower valley wall at or just downstream of the right abutment. This spring is on the base of a narrow ridge which would have a relatively low water storage capacity and thus may represent water moving down the valley from the upstream (within the lake basin) area.

The thick soil cover represented as terraces in the valley bottoms and the residual, colluvial and silty soils on the ridges should prevent much of the water from the proposed lake from reaching the bedrock. Water that does reach the bedrock, however, can be expected to escape through the ridges or into bedrock in the valley bottom and under the proposed dam.

The drainage area encompasses approximately 550 surface areas $\pm$ and would be sufficient for the 15 acre and 13 acre proposed lakes, provided no adverse leakage conditions are encountered.

SUMMARY:

In summary, the bedrock is extremely permeable and will transmit water rapidly, particularly under pressure. The relatively thick soil cover masking the bedrock should provide enough protection to prevent water from reaching the bedrock in most areas of the lake.

RECOMMENDATIONS:

1) Because of the presence of the bedrock spring just downstream of the right abutment, it is recommended that the dam site of the lower dam be moved upstream at least to where the loop of the existing driveway road is present. The soil on the north or right abutment is thicker in this area and a relatively thick sequence of soil is present in the valley bottom that will help prevent water from getting to the bedrock. If the dam is placed at the location on the plans, the chances of lake water getting to the spring system will be very high.

2) It is recommended that the core under the dam be extended to bedrock across the valley bottom and up the valley wall to where clayey soils exceed 10 feet in thickness. No water was present in the stream system on the date of this investigation and it is thought that water moving down the valley is following old channels that are now covered or is moving at the soil bedrock contact somewhere on the valley bottom. The core should penetrate to rock if at all possible if the soil is less than 15 feet thick in the valley bottom.

3) It is recommended that the streambed be filled with borrow material to at least general floodplain elevation several hundred yards upstream of the dam. The weak point in the valley bottom is the existing streambed and filling of the streambed to general floodplain elevation will help prevent water from getting to gravels and/or bedrock in the deep water portion of the lake.

4) Borrow material should not be removed from the valley bottom or valley walls unless it can be shown to exceed at least 10 feet in thickness. The soil material not the bedrock is what will impound water in this basin. Adequate quantities of borrow material can probably be removed from the higher terraces on the floodplain and/or the shoreline of the proposed lake. Bedrock should not be exposed in the borrowing operation.

5) Small collapses of the lake bottom or lower valley walls is a distinct possibility in this geologic setting. Large voids can be present in the bedrock and in the residual soil. These openings are normally masked by soil material that can collapse when they become saturated. Some grouting at a later day may be necessary if these collapses should occur.

6) Drilling information and/or backhoe test pits would be very beneficial in determining soil quality and quantity in the valley bottom and valley walls, particularly on the centerline of the proposed dam.

7) This office would be happy to help evaluate drilling information if requested.

Thomas J. Dean, Geologist
Applied Engineering & Urban Geology
Geology & Land Survey
Nov. 28, 1975

orig: Allen Dolph
Jefferson County Engineering Co.
Hillsboro Bank Building
P. O. Box 578
Hillsboro, Mo. 63050

APPENDIX C

INVESTIGATION OF SUBSURFACE CONDITIONS
KEHR'S MILL TRAIL SUBDIVISION LAKES "A" & "B"

Investigation of Subsurface Conditions

KEHRS MILL TRAILS SUBDIVISION
LAKES "A" & "B"
ST. LOUIS COUNTY, MISSOURI

At the request of Manlin and Liebert Construction Company, we have investigated the subsurface conditions in the area of proposed lakes "A" and "B" of Kehrs Mill Trails Subdivision in St. Louis County, Missouri. The locations of the dams were selected by others.

The purpose of this investigation was to determine the feasibility of using the proposed reservoir areas as a borrow area and to outline specific problems which might develop with the proposed dams as a result of the existing subsurface conditions. It is not the purpose of this report to provide a detailed design for the proposed dams, since the dam design and hydrologic studies are being handled by Mueller Surveying & Engineering Company.

## Field Investigation

To investigate the subsurface conditions, six test holes were drilled at the locations shown on Figure 1. All test holes were advanced using a four-inch-diameter, truck-mounted auger. Samples in the borrow area were obtained at maximum vertical intervals of three feet or at every visible change in soil type. In Test Holes 1 and 2 split spoon samples were taken in accordance with ASTM recommended procedures. Undisturbed three-inch-diameter Shelby tube samples were obtained in Test Hole 1 at relatively shallow depths and were attempted at greater depths but due to the soft consistency of the materials it was not possible to recover samples. The type of sample was dictated by both the type of soil and location of the boring. The depth of each test hole varied depending upon the boring location and its purpose.

In the area of Lake "A", ground water was encountered in all of the test holes and it appears that a relatively stable ground water level is approximately eight feet beneath the ground surface. In the area of Lake "B", no significant quantity of water was encountered during the test drilling, although traces of water were noted at a depth of approximately 25 feet in Test Hole 5.

## General Conclusions and Recommendations

### Reservoir Areas

The results of these test holes indicate that for both Lakes "A" and "B" it will be feasible and economical to use the proposed reservoir areas as borrow areas. In Lake "A" the material from the ground surface to a depth of 10 to 15± feet is a low to medium plasticity silty clay and will be ideal for the construction of the embankment. At the time of our test drilling the moisture content was such that the material could be satisfactorily compacted with a minimum of effort. It is recommended that all material placed in the embankment be compacted to a minimum density of 90 percent of the Standard Density (ASTM D 698-70), and that the material be compacted with a moisture content as high as possible. This office has not made an investigation of quantities of material required to construct the dams; however, based on our subsurface investigation it appears that sufficient quantities of material in both réservoirs "A" and "B" is available. It will not be possible to excavate to a depth greater than six or seven feet in Lake "A" due to the relatively high ground water. The subsurface investigation indicates the potential problems associated with the design and construction of these dams are unique, and, consequently, each dam site is discussed individually.

Lake "A"

Four test holes were drilled for this site. Test Holes 1 and 2 are in the approximate location of the embankment while Test Holes 3 and 4 are in the reservoir area. Test Holes 3 and 4 indicate that the material in the reservoir is satisfactory for construction of the proposed embankment. We anticipate no problems associated with this material, either during or following the construction. The material will not be subject to volume change and associated changes in shear strength upon saturation. Assuming that the slopes of the embankment have been properly designed and the soil compacted, we would not anticipate any sloughing or failure of the slopes.

Test Holes 1 and 2 were drilled approximately along the centerline of the proposed embankment. In Test Hole 1 the material from the ground surface to a depth of 15' consists of a relatively low plasticity silty clay. A gravelly, rocky seam was detected at a depth of approximately 12 feet. At a depth of approximately 15 feet the material changed from a low plasticity clay to a reddish-brown, very high plasticity clay which contained abundant rock fragments. Auger refusal on rock or boulders was encountered in Test Hole 1 at a depth of 37 feet and the auger was advanced 12 inches into this material with the use of a claw tooth bit. The test hole was terminated at 38 feet. Ground water was encountered at approximately 12 feet below the existing ground surface which is consistent with the ground water level in the borrow areas.

Test Hole 2 which is located near the center of the valley was drilled to a depth of 45 feet at which depth it was arbitrarily terminated. Bedrock was not encountered throughout this depth although from 13 feet to 45 feet several thin layers of boulders or rock ledges exist which were underlain by extremely soft silts and clays. The boulders or ledges and the soft nature of the material precluded obtaining Shelby tube samples. During the drilling several zones were encountered which were so soft the augers settled under their own weight. It was not possible during the drilling to differentiate whether large gravel or boulders or ledges were present. As in Test Hole 1, a gravelly seam was detected at approximately 12 feet beneath the surface.

Based upon the information from these test holes we feel the problems associated with the design of this embankment are:

1. Unusually large total settlement in the vicinity of Test Hole 2.
2. Differential movement which may be extreme from the centerline of the existing valley to the abutments and which may cause damage to the discharge pipe.
3. Possible loss of water and subsequent lowering of the lake level due to leakage through the gravel seams.
4. Instability of the downstream embankment due to scouring and rapid drawdown associated with flood levels in Caulk's creek.

For design of the proposed embankment, and to determine satisfactory as well as economical slopes, we recommend a shear strength of 400 psf for fill material. This assumes that all material will be compacted to 90 percent of the Standard Proctor (ASTM D 698-70). To preclude the possible loss of water by leakage through what appears to be a permeable gravelly layer, we recommend the cutoff trench or key for this dam extend to a depth of 15 feet beneath the existing ground surface. This depth is based on the information obtained in the two test holes and it may be modified during the construction. There may be some seepage beneath the cutoff trench but we do not believe that it will be large enough to warrant a sheet pile cutoff wall.

The embankments should be designed for both a steady seepage condition and for possible rapid drawdown conditions at both the upstream and downstream faces of the embankment. Flood levels in the adjacent Caulk's Creek should be investigated and appropriate measures taken to protect the downstream toe against erosion. For stability analysis and design of the embankment the shear strength of the natural materials should not exceed 300 psf.

Lake "B"

It appears that most of the problems associated with the satisfactory performance of Lake "B" are hydrologic. Test Hole 5 was drilled near the centerline of the proposed embankment. Contrary to the conditions encountered in Lake "A" it does not appear that any major foundation problems are associated with the construction of this embankment. Ground water was not encountered in Test Hole 6 in the proposed borrow area and only a slight amount of seepage was encountered at a depth of 25± feet in Test Hole 5, therefore, it will not be a major consideration in the construction of this reservoir. The material beneath the proposed embankment is relatively high in shear strength, with moderate to high densities, and consequently we do not anticipate that either large total or differential settlement will occur beneath the proposed dam. The cutoff trench should be extended to a minimum depth of seven feet below existing (natural) grade to assure that leakage does not occur through the surficial soils. For design of the proposed embankment it is recommended that a shear strength of 500 psf be used for the virgin materials. The shear strength of the compacted soil within the embankment should be assumed as 400 psf.

In view of the relatively large watershed area and the steep slopes around this reservoir, it is anticipated that considerable erosion and subsequent silting will take place; therefore, it is recommended that consideration be given to siltation measures in the design of this reservoir. Based upon our field investigation it also appears that some slope stability problems may occur in the virgin materials particularly where the thin soils are overlying limestone which is generally the case throughout the reservoir area. These problems are best treated individually if and when they occur.

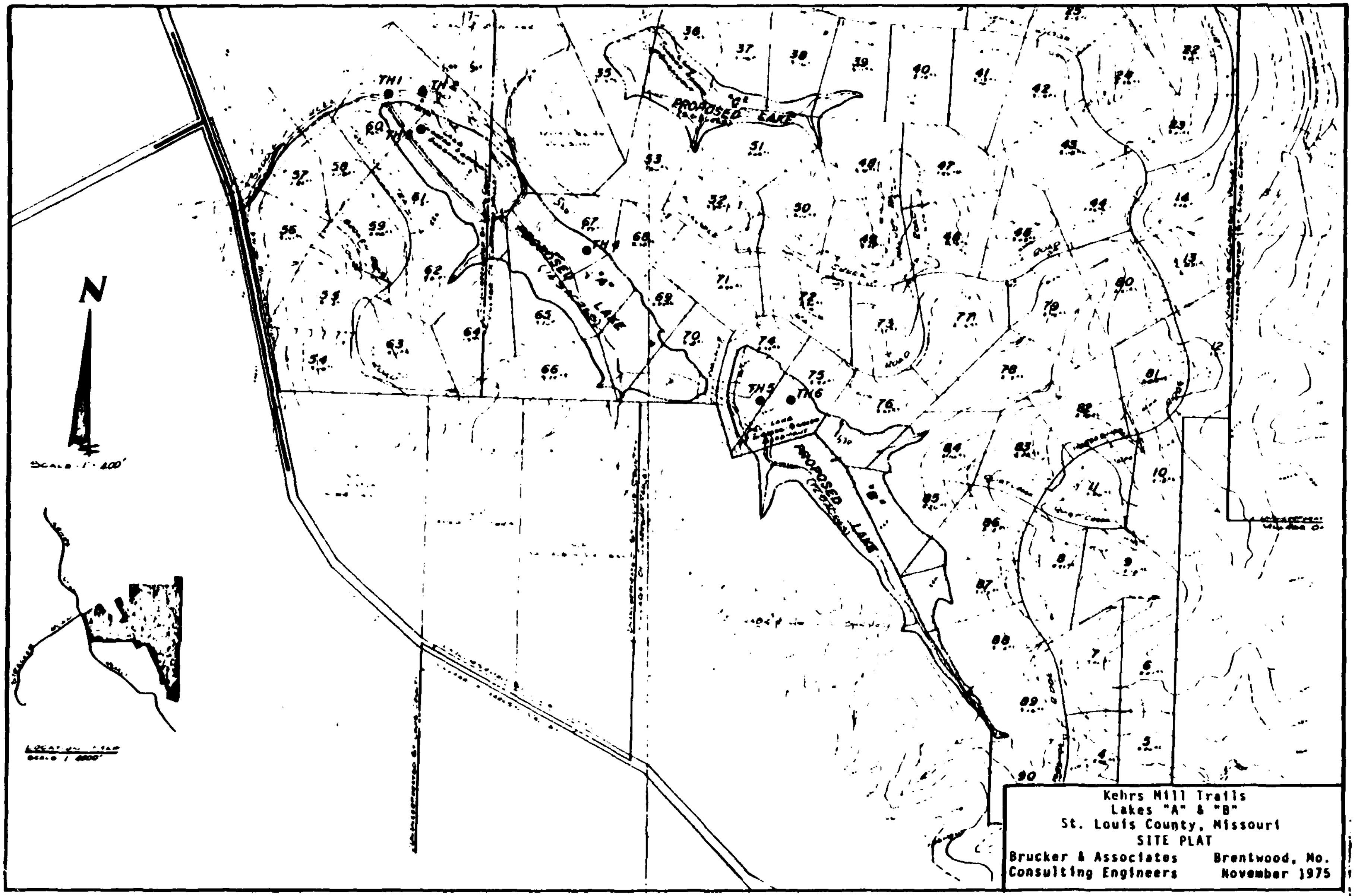

Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
SITE PLAT
Brucker & Associates Brentwood, Mo.
Consulting Engineers November 1975
PROPOSED LAKE
"A"
PROPOSED LAKE
"B"
PROPOSED "C" LAKE
TH1
TH2
TH3
TH4
TH5
TH6
N

Figure 1

# <u>LEGEND</u>

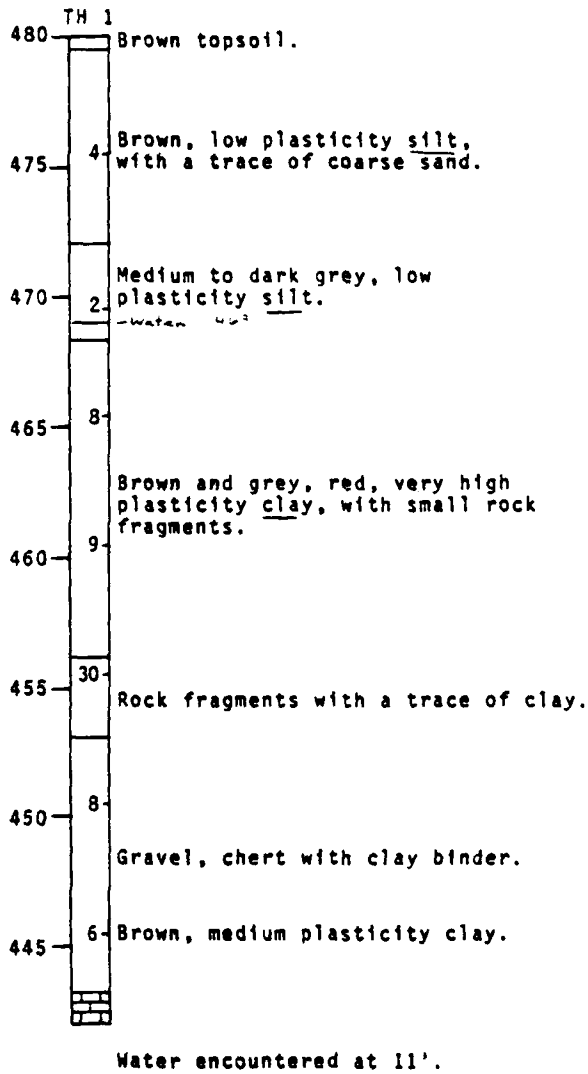
Figures within the graphical logs indicate the number of blows required to drive a 2-inch O.D. standard sampling spoon 12 inches, using a 140-pound weight falling 30 inches.

Shaded areas within graphical logs indicate topsoil.

Site drilled 11/14-17/75.

DRUCKER & ASSOCIATES

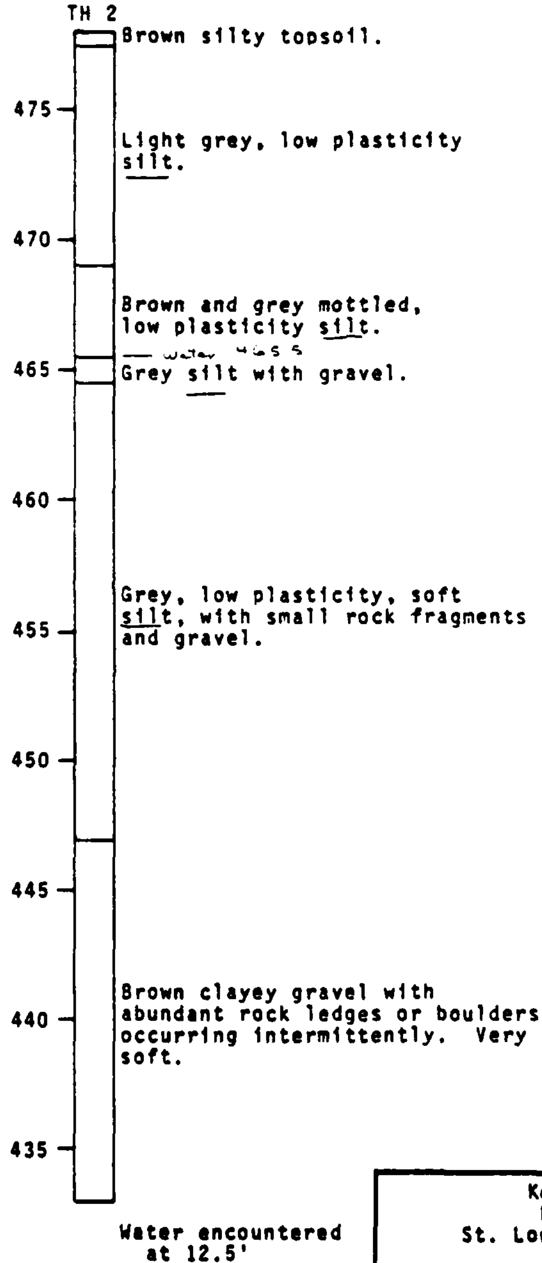
Figure 2




Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
BORING LOG

Brucker & Associates — Brentwood, Mo.
Consulting Engineers — November 1975

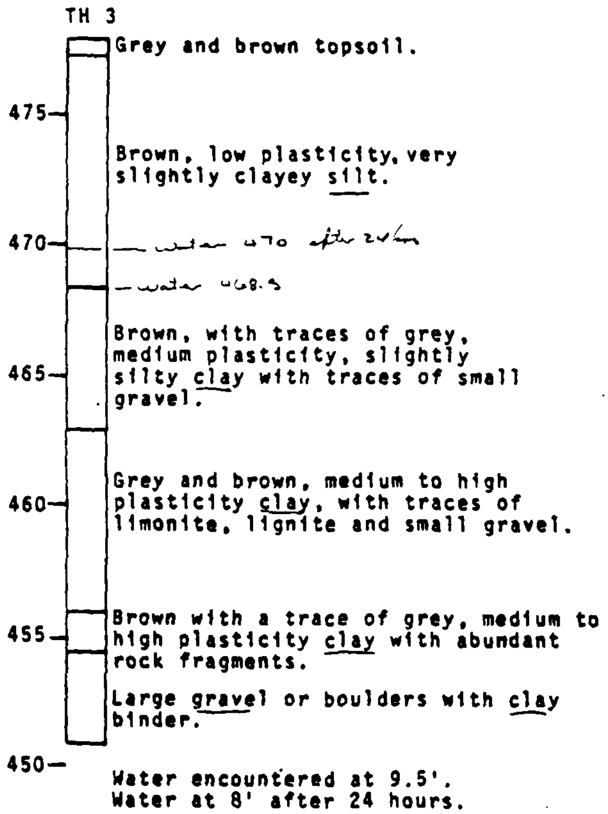
Figure 2-1




Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
BORING LOG

Brucker & Associates Consulting Engineers
Brentwood, Mo. November 1975

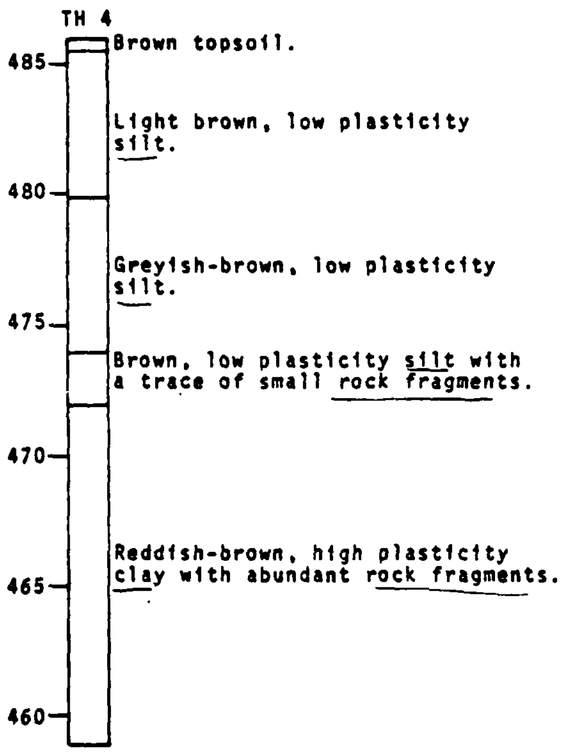
Figure 2-2




Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
BORING LOG

Brucker & Associates Brentwood, Mo.
Consulting Engineers November 1975

Figure 2-3

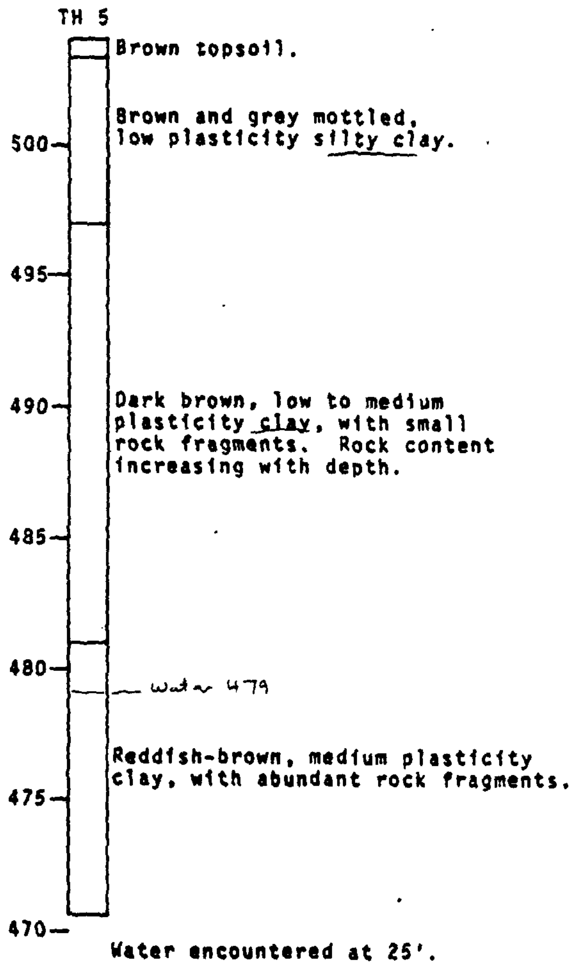



No ground water encountered.

Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
BORING LOG

Brucker & Associates — Brentwood, Mo.
Consulting Engineers — November 1975

Figure 2-4

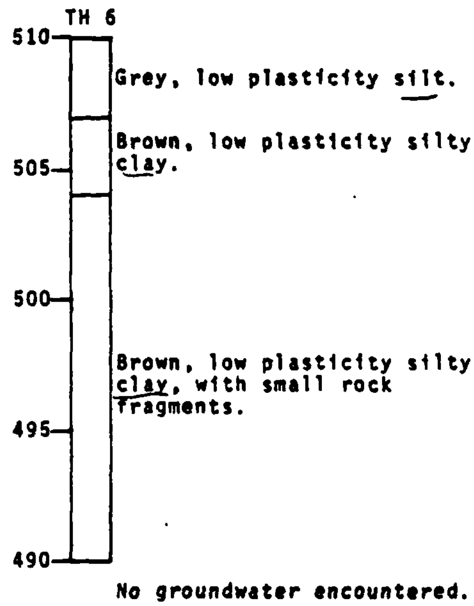



Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
BORING LOG

Brucker & Associates Consulting Engineers

Brentwood, Mo. November 1975

Figure 2-5




Kehrs Mill Trails
Lakes "A" & "B"
St. Louis County, Missouri
**BORING LOG**

Brucker & Associates Brentwood, Mo.
Consulting Engineers November 1975

Figure 2-6

## BIBLIOGRAPHY


(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July 1978, Davis, California.

(2) HMR-33, Seasonal Variations of Probable Maximum Preciptation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations from 6 to 48 Hours, U.S. Department of Commerce, NOAA, National Weather Service, 1956.

(3) EM-1110-2-1411, Standard Project Flood Determinations, U.S. Army Corps of Engineers, 26 March 1952.

(4) U.S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972.

(5) U.S. Army Corps of Engineers, St. Louis District, Hydrologic/Hydraulic Standards, Phase I Safety Inspection of Non-Federal Dams, 12 December 1979.

(6) U.S. Department of Commerce, Bureau of Public Roads, Hydraulic Engineering Circular, No. 5, Hydraulic Charts for the Selection of Highway Culverts, December 1965.

(7) U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, January, 1975.

(8) U.S. Department of Agriculture, Soil Conservation Service, Soil Survey Interpretations and Field Maps, 1980.

(9) Mary H. McCracken, Missouri Division of Geological Survey, Geologic Map of Missouri, 1961.

(10) Missouri Department of Natural Resources, Geological Survey, Engineering Geologic Report on the Kehr's Mill Trail Lake Site, November 1975.

(11) Brucker & Associates Consulting Engineers, Investigation of Subsurface Conditions - Kehr's Mill Trail Subdivision Lakes "A" & "B", November 1975, Brentwood, Missouri.

DAT

FILM