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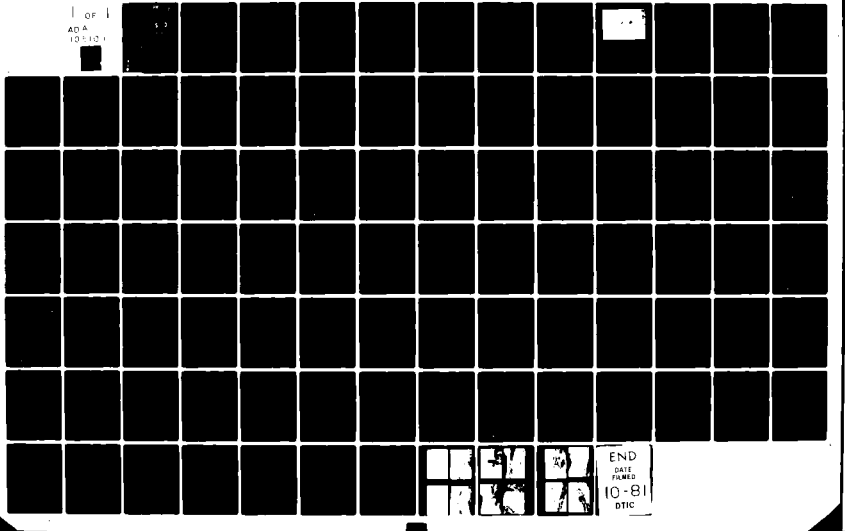

LEVEL II

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BS

VERDIGRIS-NEOSHO RIVER BASIN

STRUCTURE F-3

NEWTON COUNTY, MISSOURI

MO 20514

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
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St. Louis District

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

FOR: STATE OF MISSOURI

AUGUST, 1980

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

REPLY TO ATTENTION OF

SUBJECT: Structure F-3
Newton County, Missouri
Missouri Inventory No. 20514

This report presents the results of field inspection and evaluation of the Structure F-3. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division — 09 OCT 1980 Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 10 OCT 1980 Date

VERDIGRIS-NEOSHO RIVER BASIN

STRUCTURE F-3
NEWTON COUNTY, MISSOURI
MISSOURI INVENTORY NO. 20514

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared By

Anderson Engineering, Inc., Springfield, Missouri
Hanson Engineers, Inc., Springfield, Illinois

Under Direction Of

St. Louis District, Corps of Engineers

For

Governor of Missouri

AUGUST, 1980

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
SUMMARY

Name of Dam: Structure F-3
State Located. Missouri
County Located: Newton
Stream: Tributary of Lost Creek
Date of Inspection. May 29, 1980

Structure F-3 was inspected by an interdisciplinary team of engineers from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The purpose of this 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 they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, the St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur if the dam fails. The estimated damage zone extends approximately two miles downstream of the dam. Located within this zone are approximately 24 dwellings and Highway 43, all in the town of Seneca.

The dam is in the small size classification, since it is greater than 25 ft high but less than 40 ft high, and the maximum storage capacity is greater than 50 ac-ft but less than 1,000 ac-ft.

Our inspection and evaluation indicates that the combined spillways do meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The combined spillways will pass 100 percent of the Probable Maximum Flood without overtopping. 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 guidelines require that a dam of small size with a high downstream hazard potential pass 50 to 100 percent of the PMF. Considering the height of dam (35 feet), the maximum storage capacity (67 acre-feet), and the low volume of permanent water storage, 50 percent of the

PMF has been determined to be the appropriate spillway design flood. The 100-year flood (1 percent probability flood) will not overtop the dam. The 1 percent probability flood is one that has a 1 percent chance of being exceeded in any given year.

Deficiencies visually observed by the inspection team were: (1) some small brush growth on the embankment faces; and (2) erosion channels in the emergency spillway.

Another deficiency was the lack of seepage and stability analysis comparable to the requirements of the recommended guidelines.

It is recommended that the owners take the necessary action without undue delay to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.

Jack Healy

Jack Healy, P.E.
Hanson Engineers, Inc.

Steve Brady

Steve Brady, P.E.
Anderson Engineering, Inc.

Nelson Morales

Nelson Morales, P.E.
Hanson Engineers, Inc.

Tom Beckley

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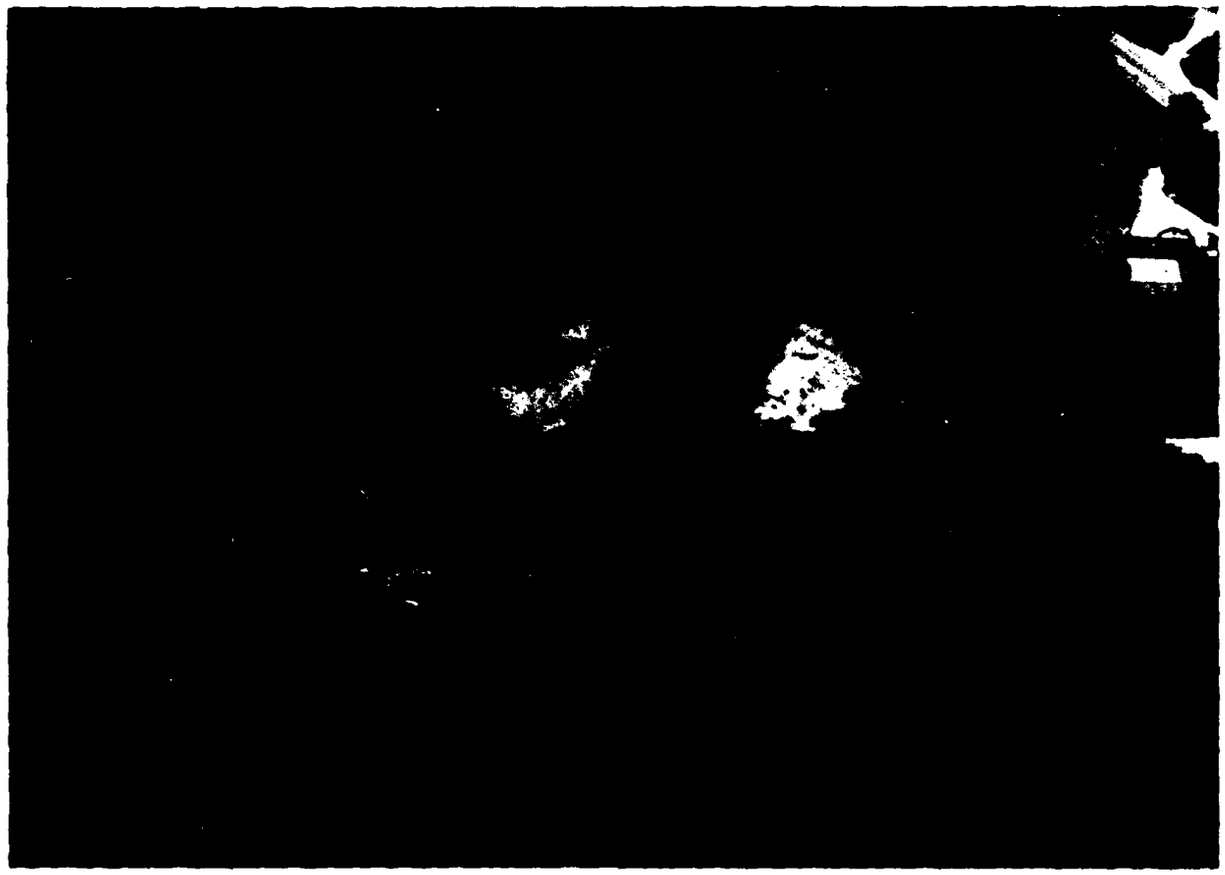


AERIAL VIEW OF LAKE AND DAM

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
STRUCTURE F-3 ID NO. 20514

TABLE OF CONTENTS

Paragraph No.	Title	Page No.
	SECTION 1 - PROJECT INFORMATION	
1.1	General	1
1.2	Description of the Project	1
1.3	Pertinent Data	3
	SECTION 2 - ENGINEERING DATA	
2.1	Design	7
2.2	Construction	8
2.3	Operation	8
2.4	Evaluation	9
	SECTION 3 - VISUAL INSPECTION	
3.1	Findings	10
3.2	Evaluation	11
	SECTION 4 - OPERATIONAL PROCEDURES	
4.1	Procedures	13
4.2	Maintenance of Dam	13
4.3	Maintenance of Operating Facilities	13
4.4	Description of Any Warning System in Effect	13
4.5	Evaluation	13
	SECTION 5 - HYDRAULIC/HYDROLOGIC	
5.1	Evaluation of Features	14
	SECTION 6 - STRUCTURAL STABILITY	
6.1	Evaluation of Structural Stability	16
	SECTION 7 - ASSESSMENT/REMEDIAL MEASURES	
7.1	Dam Assessment	17
7.2	Remedial Measures	18

APPENDICES

	Sheet
APPENDIX A	
Location Map	1
Vicinity Map	2
Plan, Profile and Section of Dam	3
Profile and Section of Spillway	3A
Plan Sketch of Dam	4
Project Map - Lost Creek Watershed	5
SCS As Built Plan Sheets	6 - 10
Inspection Report	11
APPENDIX B	
Geologic Regions of Missouri	1
Thickness of Loessial Deposits	2
Geologic Investigation Plan Sheet	3
Detailed Geologic Investigation of Dam Site	4 - 21
APPENDIX C	
Overtopping Analysis - PMF	1 - 9
APPENDIX D	
List of Photographs	1
Photograph Index	2
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 St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Structure F-3 in Newton County, Missouri.

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 a 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, "Recommended Guidelines for Safety Inspection of Dams, Appendix D." 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:

Structure F-3 is an earth fill structure approximately 35 ft high and 280 ft long at the crest. The appurtenant work consists of a 30 inch diameter reinforced concrete principal spillway pipe with a reinforced concrete flow riser and an earth cut swale located at the west abutment.

Sheet 3 of Appendix A shows a plan, profile, and typical section of the embankment as obtained from field inspection data. Sheets 6 through 10 of Appendix A are selected As Built drawings obtained from the U. S. Department of Agriculture, Soil Conservation Service, Columbia, Missouri.

B. Location:

The dam is located in the southwestern part of Newton County, Missouri on a tributary of Lost Creek. The dam and lake are within the Seneca, Missouri 7.5 minute quadrangle sheet (Section 26, T25N, R34W - latitude 36°51.2'; longitude 94°36.7'). Sheet 2 of Appendix A shows the general vicinity. Sheet 5 of Appendix A is the Project Map developed as part of the Work Plan for Watershed Protection and Flood Prevention for the Lost Creek Watershed prepared by the Soil and Water Conservation District of Newton County.

C. Size Classification:

With an embankment height of 35 ft and a maximum storage capacity of approximately 67 acre-ft, the dam is in the small size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has classified this dam as a high hazard dam. The estimated damage zone extends approximately two miles downstream of the dam. Located within this zone are approximately 24 dwellings and Highway 43, all in the town of Seneca. The effected features within the estimated damage zone were field verified by the inspection team. A portion of the dwellings are shown in Photograph No. 12.

E. Ownership:

The dam is owned by the Lost Creek Watershed Subdistrict, Jim Stone, Chairman, P. O. Box 149, Neosho, Missouri 64850 and is on property owned by the Eagle-Pitcher Company (Attn: Mr. Fred Sieliner), Seneca, Missouri 64865.

F. Purpose of Dam:

The dam was constructed under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Statute 666) as amended primarily for the purpose of a Debris Basin Structure for the Lost Creek Watershed, Newton County, Missouri.

G. Design and Construction History:

The dam was designed by the U. S. Department of Agriculture, Soil Conservation Service, Columbia, Missouri, under the Authority of the Watershed Protection and Flood Prevention Act. Prior to the design of the dams, a watershed work plan for the Lost Creek Watershed was prepared in January 1971, by the Soil and Water Conservation District of Newton County with assistance by SCS. A partial set of As Built Plans is included as Sheets 6 through 10 of Appendix A. A complete set of plans are available through the Columbia, Missouri office of SCS.

Geologic Investigations and analyses completed by SCS are included as Sheets 3 through 21 of Appendix B.

The contract for construction was let on July 22, 1976, for Newton County Structure F-3. Newton County Structures F-1 and F-2 were included in the contract with Structure F-3.

The contractor for this project was Higginbotham Construction Company, Route 1, Brookline, Missouri. Construction commenced in October 1976, and the dam was completed in July 1977.

Inspection of the project was conducted under the control of Mr. Joe Green, Project Engineer, Soil Conservation Service, Mount Vernon, Missouri. Results of the inspection and testing including inspector's field notes, compaction and concrete reports, are currently on file in the Columbia, Missouri SCS office.

Mr. Higginbotham indicated that the dam was built in general conformance with the plans. During excavation for the principal spillway support pier, a cavernous opening that appeared to run parallel to the valley was exposed. Under direction of the Soil Conservation Service, the debris was removed from the area and filled with compacted creek gravel. The support pier was then placed on the compacted creek gravel. The core trench was excavated to the elevations shown on the plans and filled in with select material from the borrow area located within the lake bed. Compaction of the embankment was by the use of a double sheepsfoot roller. He stated that the emergency spillway section was excavated to the plan elevation and topsoil was placed over the exposed rock and compacted earth to the final spillway elevation.

Mr. Green likewise indicated that no modifications to the plans other than the principal spillway outlet, were required during the construction phase. He or one of his staff performed daily inspections during the course of construction.

H. Normal Operating Procedures:

All flows will normally be passed by the restricted flow riser to the 30 inch spillway pipe and the uncontrolled earth cut emergency spillway. Information obtained from Mr. Green indicates that the maximum pool level for this dam has never to his knowledge been more than a foot or two above the slide gate.

1.3 PERTINENT DATA:

Pertinent data about the dam, appurtenant works, and reservoir are presented in the following paragraphs. Sheet 3 of Appendix A presents a plan, profile, and typical section of the embankment from field data obtained by the inspection team. Sheets 6 through 10 of Appendix A are selected sheets from the complete set of As Built plans prepared by the Soil Conservation Service.

A. Drainage Area:

The drainage area for this dam, as obtained from the Watershed Work Plan and As Built Plans (Sheet 10 of Appendix A) is approximately 88 acres.

B. Discharge at Dam Site:

(1) All discharge at the dam site is through the restricted flow riser for the 30 inch diameter principal spillway pipe and an uncontrolled earth cut emergency spillway.

(2) Estimated Total Spillway Capacity at Maximum Pool (Top of Dam - El. 961.3): 1,502 cfs

(3) Estimated Capacity of Principal Spillway: 23 cfs

(4) Estimated Experienced Maximum Flood at Dam Site: No Flow Through Spillways Reported

(5) Diversion Tunnel Low Pool Outlet at Pool Elevation: Not Applicable

(6) Diversion Tunnel Outlet at Pool Elevation: Not Applicable

(7) Gated Spillway Capacity at Pool Elevation: Not Applicable

(8) Gated Spillway Capacity at Maximum Pool Elevation: Not Applicable

C. Elevations:

All elevations are consistent with an assumed mean sea level elevation of 966.73 for Benchmark #1 described in As Built Plans as top of concrete monument Sta. 0 + 00.21 centerline dam (See Sheet 6 of Appendix A).

(1) Top of Dam: 961.3 feet MSL

(2) Principal Spillway Crest: 943.8 feet MSL

(3) Emergency Spillway Crest: 956.4 feet MSL

(4) Principal Spillway Pipe Invert Elevation at Outlet: 926.1 feet MSL

(5) Streambed at Centerline of Dam: 926.0 feet MSL

(6) Pool on Date of Inspection: 933.4 feet MSL

(7) Apparent High Water Mark: 935.0 feet MSL

(8) Maximum Tailwater: None

(9) Upstream Portal Invert Diversion Tunnel: Not Applicable

(10) Downstream Portal Invert Diversion Tunnel: Not Applicable

D. Reservoir Lengths:

(1) At Principal Spillway Crest: 350 Feet

(2) At Emergency Spillway Crest: 850 Feet

(3) At Top of Dam: 1,100 Feet

E. Storage Capacities:

(1) At Principal Spillway Crest: 8.4 Acre-Feet

(2) At Emergency Spillway Crest: 41.5 Acre-Feet

(3) At Top of Dam: 67 Acre-Feet

F. Reservoir Surface Areas:

(1) At Principal Spillway Crest: 1.3 Acres

(2) At Emergency Spillway Crest: 4.3 Acres

(3) At Top of Dam: 6.5 Acres

G. Dam:

(1) Type: Earth

(2) Length at Crest: 280 Feet

(3) Height: 35 Feet

(4) Top Width: 14 Feet

(5) Side Slopes: Upstream varies from 1V:2.47H to 1V:4.50H; Downstream varies from 1V:2.74H to 1V:3.61H

(6) Zoning: Gravelly Silt and Clay

(7) Impervious Core: 12 Feet Wide

(8) Cutoff: 8 Feet Below Base of Dam

(9) Grout Curtain. None

H. Diversion and Regulating Tunnel:

(1) Type: Not Applicable

(2) Length: Not Applicable

(3) Closure: Not Applicable

(4) Access: Not Applicable

(5) Regulating Facilities: Not Applicable

I. Spillway:

I.1 Principal Spillway:

(1) Location: Centerline Dam Station 1 + 82

(2) Type: 30 Inch Diameter Reinforced Concrete Pipe with Restricted Flow Riser

I.2 Emergency Spillway:

(1) Location: West Abutment

(2) Type: Earth Cut Swale

(3) Upstream Channel: Grass covered earth channel

(4) Downstream Channel: Grass covered, moderate earth slopes changing to asphalt roadway with shallow ditches

J. Regulating Outlets:

The 8 inch diameter slide gate associated with the restricted flow riser is the only regulating outlet feature of the dam.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

Design calculations and construction plans were prepared by and are currently on file with the U. S. Department of Agriculture Soil Conservation Service in Columbia, Missouri. A partial set of these plans is included as Sheets 6 through 10 of Appendix A. A Watershed Work Plan was prepared for the Lost Creek Watershed prior to the design phase. A copy of the Project Map is included as Sheet 5 of Appendix A. This plan, prepared under the Authority of Public Law 566, is also on file in the Columbia SCS office.

A. Surveys:

A topographic survey was conducted by the Soil Conservation Service for the Lost Creek watershed. The survey was tied to the sea level datum. Temporary benchmarks were located at each dam site. Concrete monuments were set at each end of the embankment by SCS. A description of these benchmarks is shown on Sheet 6 of Appendix A. From the topographic survey data a 4 foot contour interval map was drawn for design purposes.

B. Geology and Subsurface Materials:

The site is located in the border zone between the Ozarks and Western Plains geologic regions of Missouri. This area is characterized topographically by rolling to hilly with oak and hickory forest areas. The sedimentary rock layers exposed in the Ozarks region dip downward away from the Ozarks region, and the higher and younger sedimentary deposits become the surface ledges in southwest Missouri. The soils in this region are residual from cherty and dolomitic limestones of the Mississippian age. The site is located upon an outcrop of the Warsaw formation of the Meramecian series. The limestone bedrock occurs at an average depth of 10 feet below initial ground level along the entire dam centerline, as described in the Geologic Report on the site. The Geologic Report prepared by the Soil Conservation Service is contained in Appendix B.

Soils in the area of the dam are one of this area's most common soils. The embankment soils are reddish-brown silty clays (CL) with chert rock fragments. The chert is from the parent material and is found in each of the soil layers of this soil series. These soils generally make good fill material when properly compacted.

The "Geologic Map of Missouri" indicates that two known faults run in a northeast-southwesterly direction through or very near the dam site. The Missouri Geological Survey has indicated that these faults are known as the Seneca faults and there is no known activity or movement. These faults in this area are generally considered to be inactive. The publication "Caves of Missouri" indicates there are four caves in Newton County and these are several miles from the dam site.

C. Foundation and Embankment Design:

Included as Sheet 3 of Appendix B is the "Geologic Investigation of Dam Site" for this structure. The profile at the centerline of the dam shows the location of the borings as obtained by SCS. Sheets 4 through 13 of Appendix B are the detailed soil investigation with conclusions from the study. Sheets 12 and 13 of Appendix B are a discussion of the results from the Soil Mechanics Laboratory of SCS. One of the tests performed was slope stability analysis.

Based upon the available information, the basic foundation soil appears to be silty clays (CL). There is apparently no particular zoning of the embankment, and no internal drainage features are known to exist.

D. Hydrology and Hydraulics:

The hydrologic and hydraulic design parameters of this dam are as shown on Sheet 10 of Appendix A. The Soil Conservation Service surveyed 17 valley cross-sections in the watershed and routed 8 evaluation storms through the channel using the T. R. 20 computer program. Assistance was obtained from the Tulsa District, Corps of Engineers for the study and evaluation. Based on the As Built Plans and a field check of spillway dimensions and embankment elevations and a check of the drainage area on U.S.G.S. quad sheets, hydrologic analysis using U. S. Army Corps of Engineers guidelines were performed and appear in Appendix C as Sheets 1 through 9.

E. Structure:

The only structure associated with this dam is the restricted flow riser. Details of this riser appear as Sheet 9 of Appendix A.

2.2 CONSTRUCTION:

Inspection during the construction of the dam was performed by the Soil Conservation Service Office, Mount Vernon, Missouri, under the direction of Mr. Joe Green, Project Engineer. Mr. Green stated that daily inspection was performed during construction. The inspector's log and inspection tests, to include compaction and concrete testing, are currently on file at the Soil Conservation Service Office, Columbia, Missouri. The construction inspection data were not obtained.

2.3 OPERATION:

Normal flows would be passed by the restricted flow riser to the 30 inch diameter spillway pipe and the uncontrolled earth-cut spillway. Mr. Green stated that normally the 8 inch diameter slide gate on the flow riser is closed.

2.4 EVALUATION:

A. Availability:

The engineering data available are as listed in Section 2.1.

B. Adequacy:

The engineering data available were inadequate to make a detailed assessment of the design, construction, and operation of this structure. 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. The seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

C. Validity:

The As Built Plans and Soil Investigation data and test results prepared by the Soil Conservation Service included in Appendices A and B are valid engineering data on the design and construction of the dam.

SECTION 3 - VISUAL INSPECTON

3.1 FINDINGS:

A. General:

The field inspection was made on May 29, 1980. The inspection team consisted of personnel from Anderson Engineering, Inc. of Springfield, Missouri, and Hanson Engineers, Inc. of Springfield, Illinois. The team members were:

Steve Brady - Anderson Engineering, Inc., (Civil Engineer)
Tom Beckley - Anderson Engineering, Inc., (Civil Engineer)
Jack Healy - Hanson Engineers, Inc., (Geotechnical Engineer)
Nelson Morales - Hanson Engineers, Inc., (Hydraulic Engineer)

Photographs of the dam, appurtenant structures, reservoir, and downstream features are presented in Appendix D.

B. Dam:

The dam appears to be in good condition. No sloughing or sliding of the embankment was noted. The horizontal and vertical alignments of the crest were good, and no surfacing cracking or unusual movement was obvious. The crest of the embankment was 14 feet wide and the lowest crest elevation was 961.3. The field survey data obtained by the inspection team compared favorably to the As Built Plans for this dam.

On the date of inspection, the pool level was about 0.1 ft above the slide gate invert. No apparent high water mark was observed. According to Mr. Green, the maximum pool has been a foot or two higher. He stated that the dam has never held water. To his knowledge, there has not been any attempt to locate the apparent leakage. The Lost Creek Watershed Work Plan noted that the geologic site conditions make permanent water storage unpredictable. As the structure was intended to function as a Debris Basin Structure, permanent water storage is not a major factor.

Shallow auger probes into the embankment indicated the fill material to be a reddish-brown silty clay (CL). The embankment is grass-covered and appears to be in good condition. Due to the heavy grass cover, thorough inspection of the embankment was difficult. No sloughing of the embankment or seepage through the embankment was evident. No animal burrows were noted. No serious erosion was observed.

No riprap was noted on the upstream face at normal pool elevation. Due to the lack of permanent water capability and the heavy grass cover, erosion does not appear to be a problem. A scattering of light brush growth on the embankment was noted.

No instrumentation (monuments, piezometers, etc.) other than B.M. #1 was observed.

C. Appurtenant Structures:

C.1 Principal Spillway:

The principal spillway consisting of the 30 inch reinforced concrete spillway pipe and associated flow restrictor riser is in good condition. The 8 inch diameter slide gate was in good working condition. Opening of the slide gate and permitting a small quantity of water to exit the spillway pipe was performed by the inspection team.

The approach to the inlet structure was clear. Considerable riprap was placed around the inlet structure. The primary orifice (12.0 feet above the structure invert) did not appear to have been used. Past flow through the spillway pipe occurred when the slide gate was opened.

Riprap was observed at the outlet of the spillway pipe. Flow through the pipe would not be expected to result in serious erosion.

C.2 Emergency Spillway:

The emergency spillway was located at the west abutment. The spillway channel appeared to be an earth cut channel. The grass cover in the channel was fair with some erosion that appeared to be due to vehicular traffic within the spillway channel. The spillway has not carried flows since the dam was constructed. According to Mr. Higginbotham portions of the spillway were excavated to rock and then covered with topsoil. Continued use of the spillway would probably result in appreciable erosion.

The outlet channel is directed well away from the embankment. The outlet and inlet channel were clear.

D. Reservoir:

The immediate periphery of the lake was wooded and grass covered with moderate slopes. The reservoir banks appeared to be in good condition with heavy grass cover. No appreciable sedimentation was noted.

E. Downstream Channel:

Immediately downstream of the embankment, the channel is grass covered. At the approximate point of covergence of the principal and emergency spillway, the channel is defined by the asphalt roadway and shallow ditch. The slopes are moderate.

3.2 EVALUATION:

Due to the apparent geologic conditions, the dam does not impound any appreciable permanent water storage. With use as

a Debris Basin Structure with limited flows, the absence of riprap on the upstream face of the embankment and the unlined emergency spillway section do not appear to be significant.

Some light brush growth was noted on the embankment. The grass cover on the dam was good. The presence of any seepage areas could not be observed due to the lack of water impounded by the dam.

Photographs of the dam, appurtenant structures, and the reservoir are presented in Appendix D.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

The operation and maintenance of the dam are the responsibility of the Lost Creek Watershed District Board in conjunction with the Soil and Water Conservation District, Neosho, Missouri. For the first three years after construction of the dam, a joint inspection is being conducted by members of the District Board and the Soil Conservation Service. After three years the District Board is responsible for providing yearly inspections. In addition to the annual inspection, the dam is to be inspected after each severe flood and after the occurrence of any other unusual conditions which might adversely affect the dam. The inspection is to include the condition of principal spillway and its appurtenances, the emergency spillway, the earthfill and any other items installed as a part of the structure. Copies of the inspection report are forwarded to the Soil Conservation Service office in Springfield, Missouri. The last annual inspection was conducted on May 14, 1980, and the results are included as Sheet 11 of Appendix A.

4.2 MAINTENANCE OF DAM:

After the yearly inspection of the dam, the Lost Creek Watershed District Board determines the maintenance to be done. Monies for the required maintenance are derived from a tax levy imposed upon the residents of the Watershed District.

4.3 MAINTENANCE OF OPERATING FACILITIES:

The maintenance required for the restricted flow riser is accomplished after the yearly inspection by the Watershed District Board. The slide gate appeared to be in good condition.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

The inspection team is unaware of any existing warning system for this dam.

4.5 EVALUATION:

The general maintenance of the dam and associated items appeared to be in good condition. The brush growth should be removed from the dam on a yearly basis. Should the dam ever provide permanent water storage, riprap may be required on the upstream face. Periodic maintenance of the emergency spillway may be required if vehicles are allowed to continue to use the channel.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. Design Data:

The hydrologic and hydraulic design data for this dam are as shown on Sheet 10 of Appendix A.

B. Experience Data:

No recorded rainfall, runoff, discharge, or reservoir stage data were obtained for this lake and watershed. During the design phase, flood frequency used in evaluation of damages was obtained from six representative stream gauges in the surrounding area.

C. Visual Observations:

The approach channels to the spillway are clear. The emergency spillway is well separated from the embankment, and spillway releases would not be expected to endanger the dam. The downstream channel has a dense growth of brush and trees.

D. Overtopping Potential:

The hydraulic and hydrologic analyses (using the U. S. Army Corps of Engineers guidelines and the HEC-1 computer program) were based on (1) a field survey of spillway dimensions and embankment elevations; (2) an estimate of the reservoir storage and the pool and drainage areas from the Seneca, Missouri, 7.5 Minute U.S.G.S. quad sheet; and (3) data obtained from the As Built Plans for this project (See Appendix A, Sheets 6 through 10).

Based on the hydrologic and hydraulic analysis presented in Appendix C, the combined spillways will pass 100 percent of the Probable Maximum Flood. 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 recommended guidelines from the Department of the Army, Office of the Chief of Engineers, require that this structure (small size with high downstream hazard potential) pass 50 percent to 100 percent of the PMF, without overtopping. Considering the height of dam (35 feet), the maximum storage capacity (67 acre-feet) and the low volume of permanent water storage 50 percent of the PMF has been determined to be the appropriate spillway design flood. The structure will pass a 1 percent probability flood without overtopping.

Application of the probable maximum precipitation (PMP), minus losses, resulted in a flood hydrograph peak inflow of 1,763 cfs. For 50 percent of the PMP, the peak inflow was 882 cfs.

The routing of the PMF through the spillways and dam indicates that the dam will not be overtopped. The maximum discharge capacity of the spillways is 1,502 cfs. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. Visual Observations:

Observed features which could adversely affect the structural stability of this dam are discussed in Sections 3.1B and 3.2.

B. Design and Construction Data:

Design data obtained are included in Appendix A. Analysis of the soil structure is included in Appendix B. Additional design data and construction notes and test results are located at the Soil Conservation Service in Columbia, Missouri.

Seepage and stability analysis comparable to the requirements of the guidelines were not available, which constitutes a deficiency which should be rectified.

C. Operating Records:

No operating records have been obtained.

D. Post-Construction Changes:

There have been no reported post-construction changes to this dam.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in stability analyses performed for this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

This Phase I inspection and evaluation should not be considered as being comprehensive since the scope of work contracted for is far less detailed than would be required for an in-depth evaluation of dams. Latent deficiencies, which might be detected by a totally comprehensive investigation, could exist.

A. Safety:

The embankment is in good condition. Some items were noted during the visual inspection which should be investigated further, corrected, or controlled. These items are: (1) light brush on the embankment faces; and (2) the erosion channels in the emergency spillway channel.

Another deficiency was the lack of seepage and stability analyses comparable to the recommended guidelines.

The dam will not be overtopped by flows of the Probable Maximum Flood. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

B. Adequacy of Information:

The conclusions in this report were based on review of the information listed in Section 2.1, the performance history as related by others, and visual observation of external conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

C. Urgency:

The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the deficiencies listed in paragraph B are not corrected, and if good maintenance is not provided, the embankment condition will deteriorate and possibly could become serious in the future.

D. Necessity for Additional Inspection:

Based on the result of the Phase I inspection, no additional inspection is recommended.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES:

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

A. Alternatives:

Not Applicable

B. O & M Procedures:

(1) Seepage and stability analyses comparable to the requirements of the recommended guidelines should be performed by an engineer experienced in the construction of dams.

(2) The light brush growth should be removed, and vegetative growth on the dam should be cut annually.

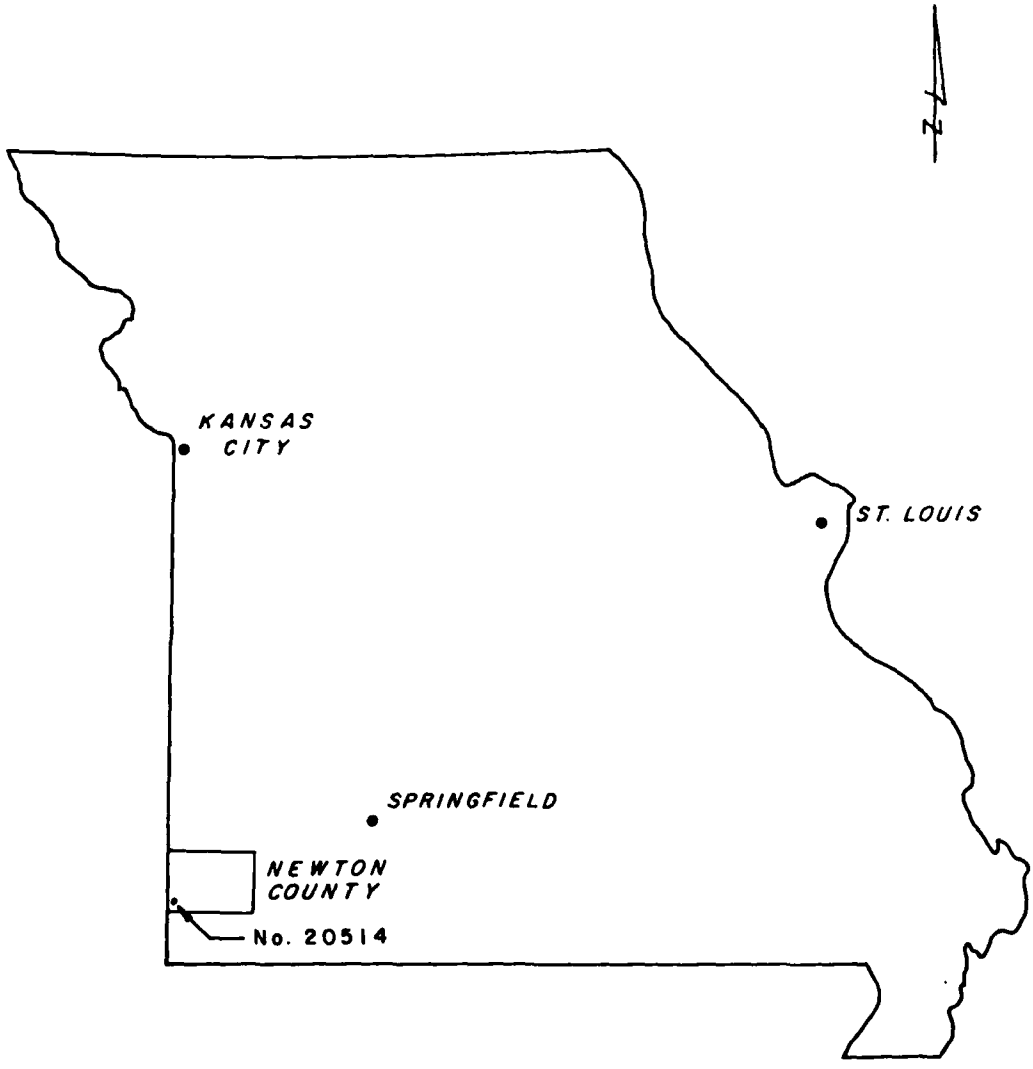
(3) Wave protection should be provided for the upstream face of the embankment if permanent water storage is accomplished.

(4) Vehicular traffic should be prohibited from driving in the emergency spillway channel, and existing erosion of the channel should be repaired and maintained.

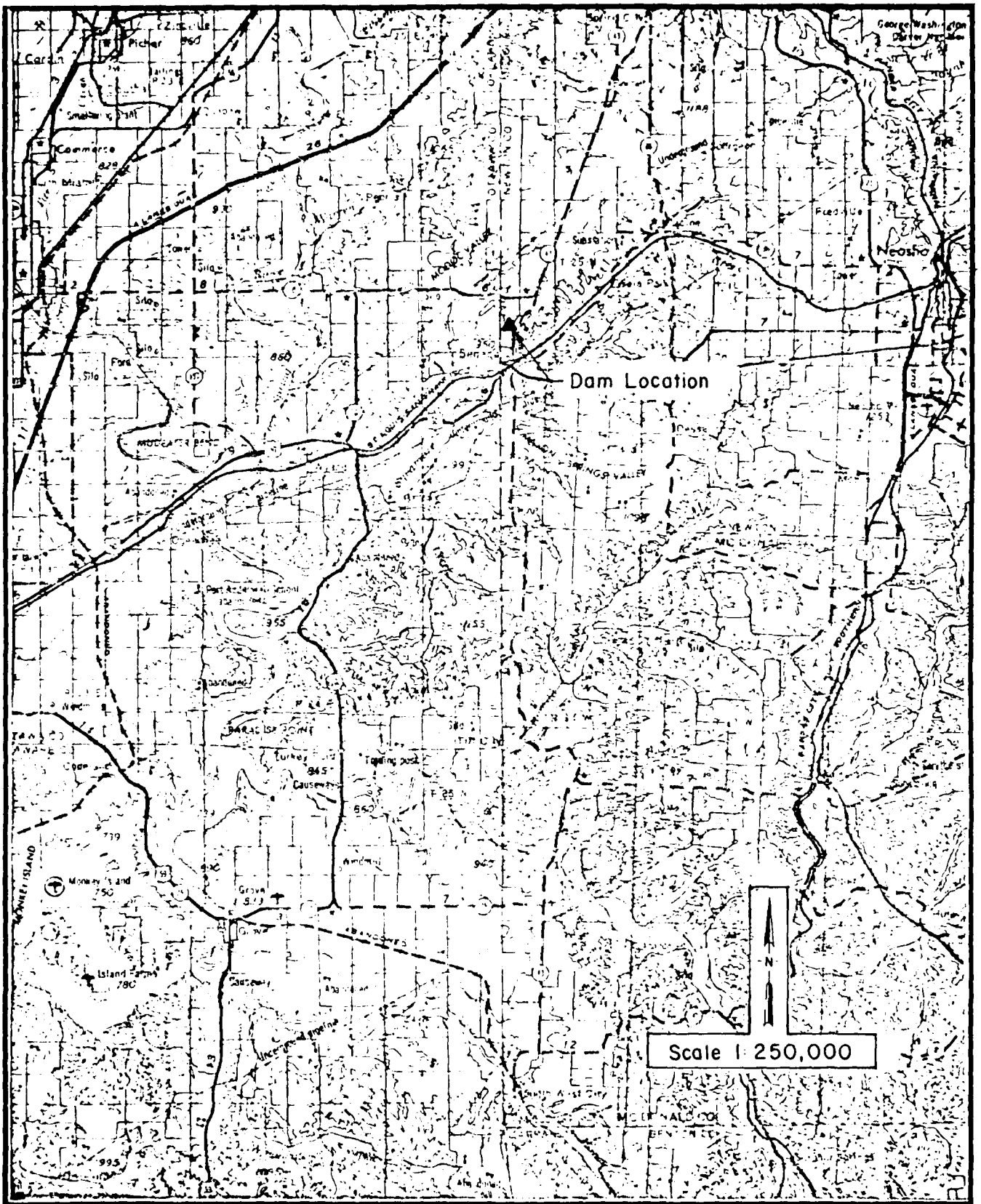
(5) A detailed inspection of the dam should be made periodically by an engineer experienced in the design and construction of dams.

APPENDIX A

Dam Location and Plans



LOCATION MAP



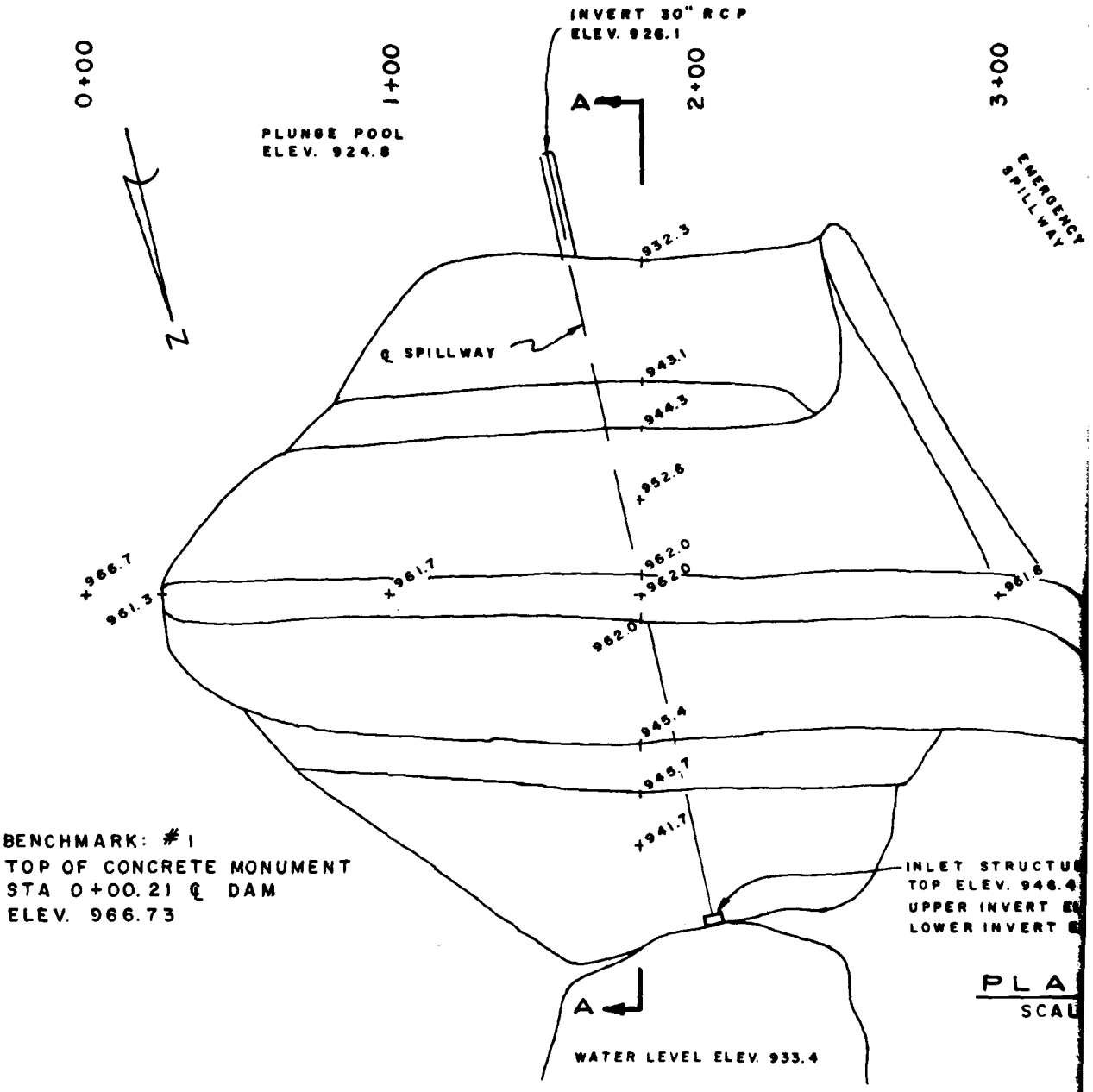
VICINITY MAP

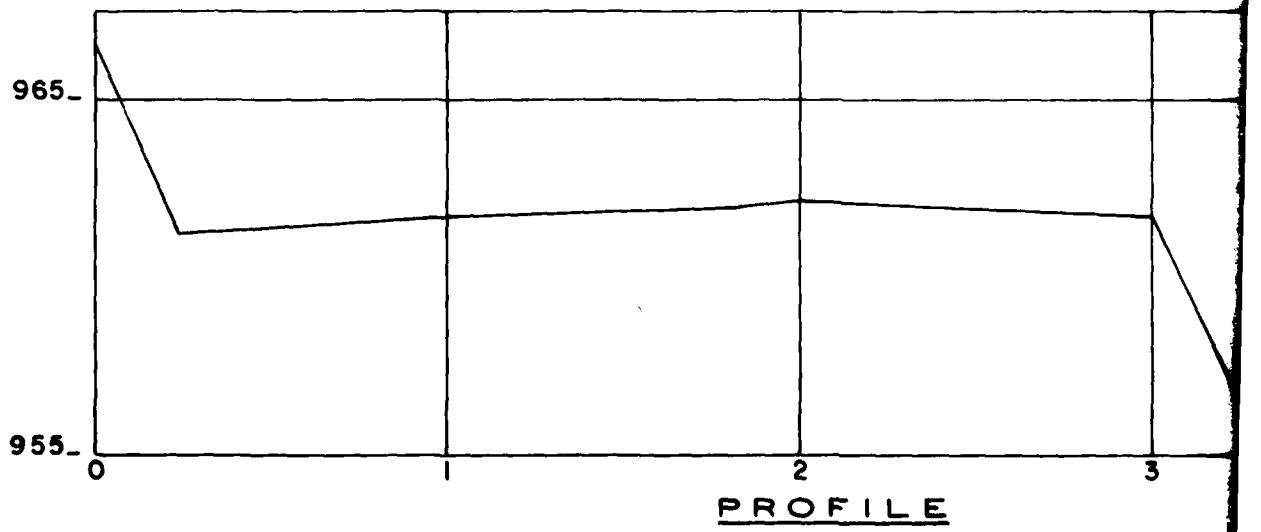
HANSON ENGINEERS

SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

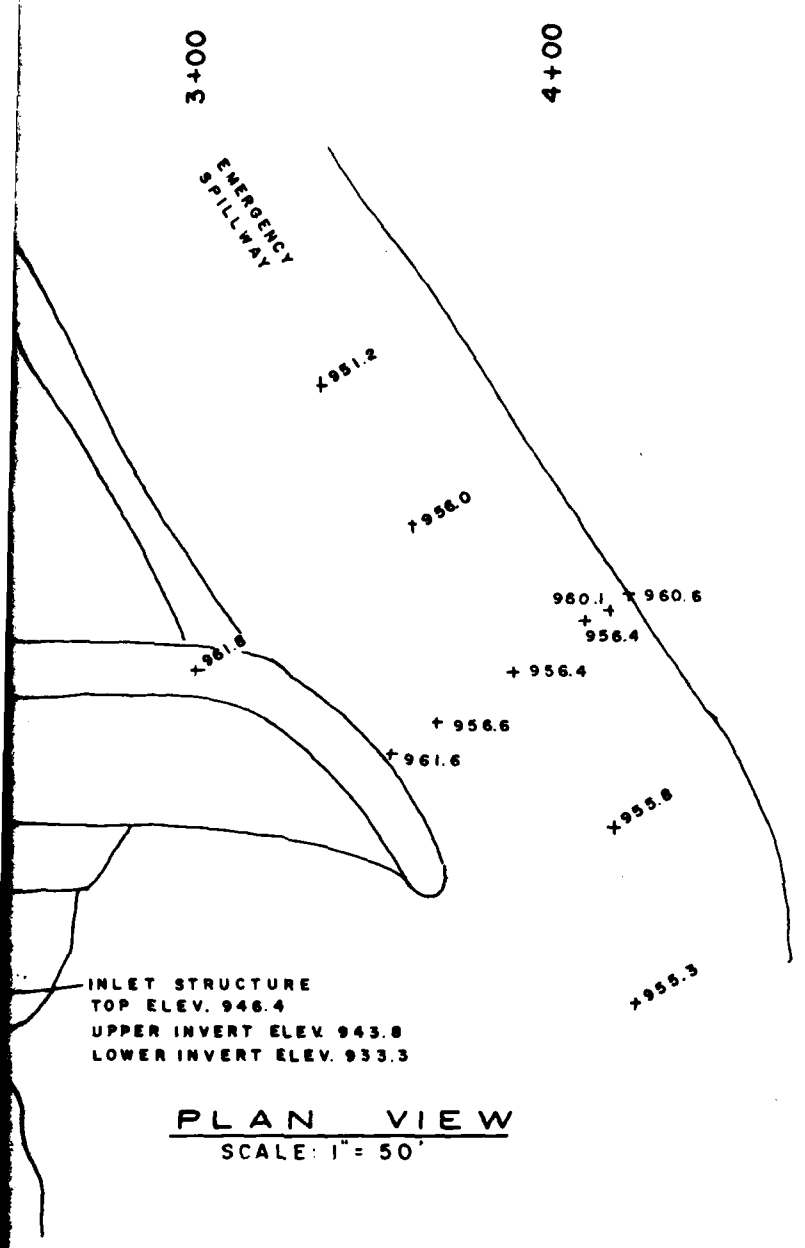
Newton County Structure F-3 Dam
Newton County, Missouri
Mo. I.D. No. 20514

Sheet 2, Appendix A

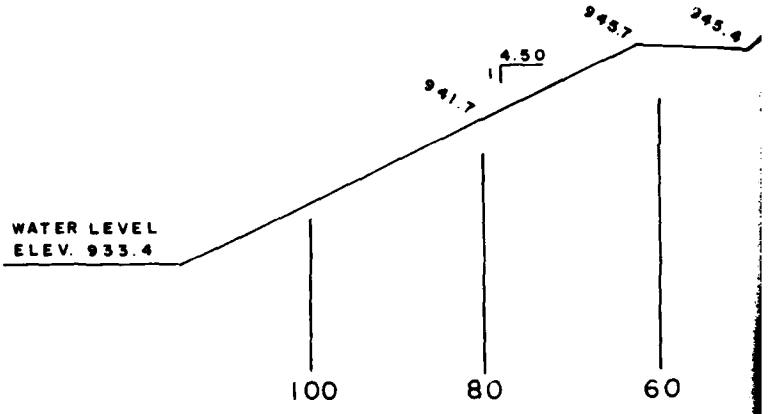

INVERT 30" RCP
ELEV. 926.1
0+00
1+00
2+00
3+00
A
PLUNGE POOL
ELEV. 924.8
EMERGENCY SPILLWAY
N
℄ SPILLWAY
932.3
943.1
944.3
952.6
962.0
962.0
966.7
961.3
961.7
962.0
961.8
945.4
945.7
941.7
INLET STRUCTU
TOP ELEV. 946.4
UPPER INVERT
LOWER INVERT
A
WATER LEVEL ELEV. 933.4
BENCHMARK: #1
TOP OF CONCRETE MONUMENT
STA 0+00.21 ℄ DAM
ELEV. 966.73
PLA
SCAL

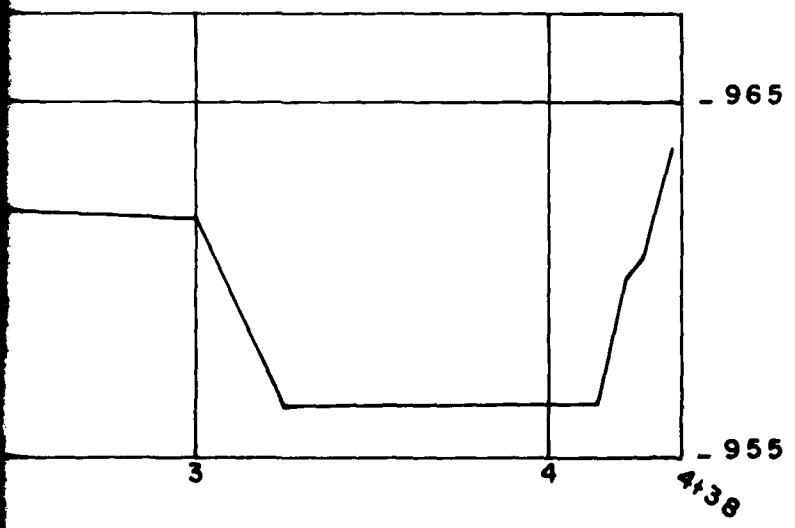

965
955
0
1
2
3

PROFILE

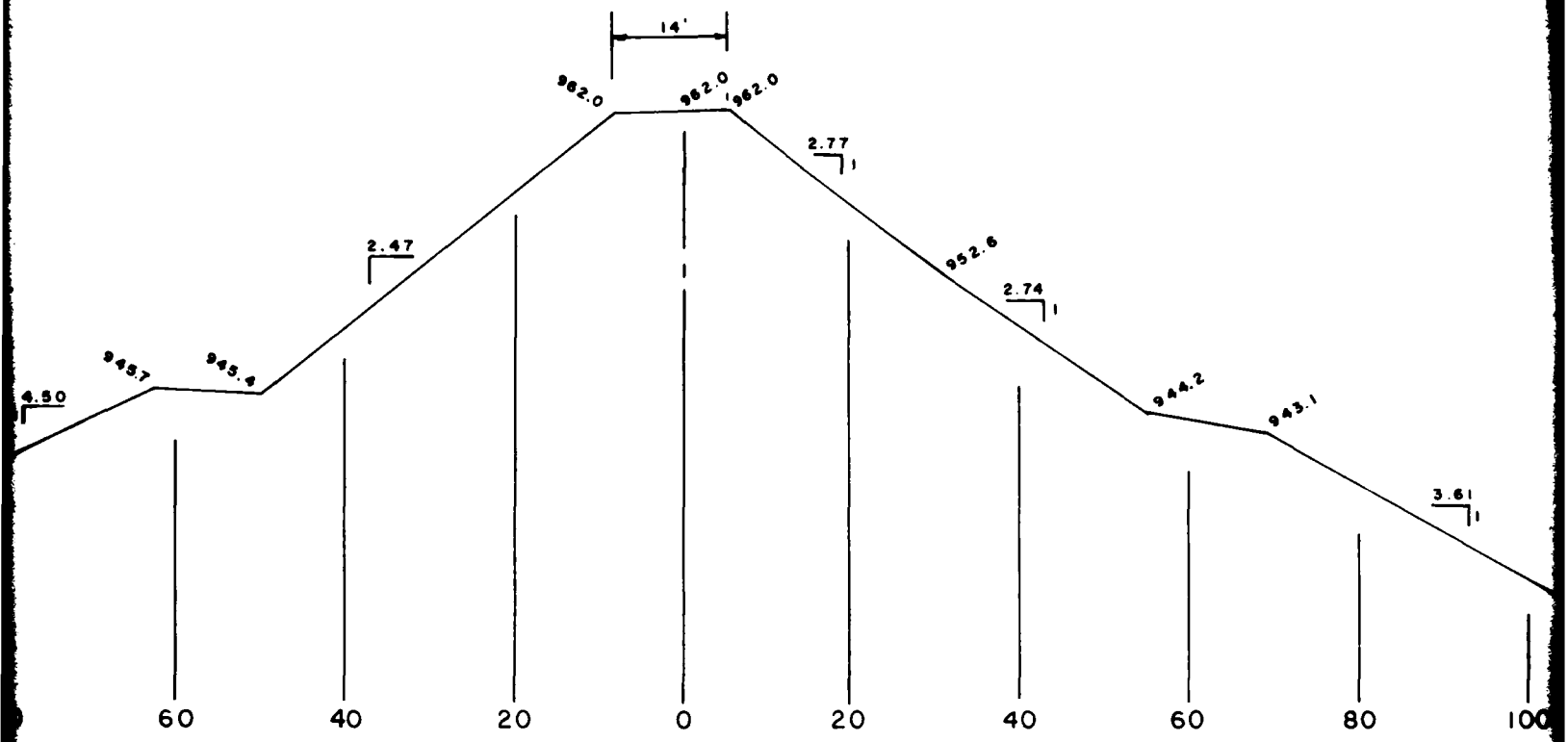


PLAN VIEW
SCALE: 1" = 50'





12



SECTION A-A STA 1+82

SHEET 3 APPE

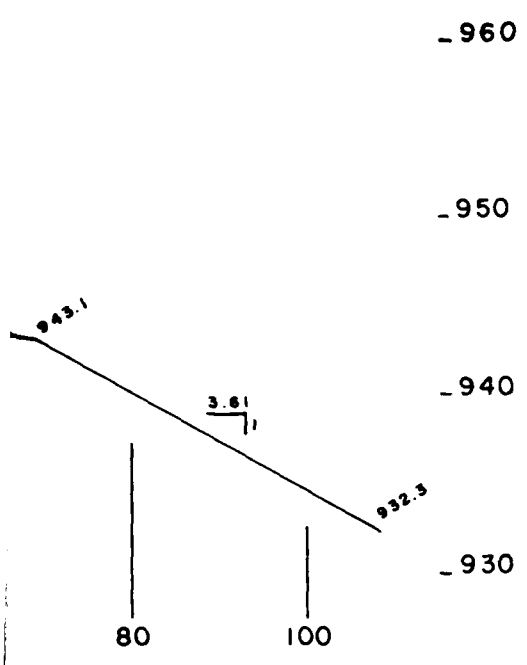
ANDERSON ENGINE
730 NORTH BENTO
SPRINGFIELD, MI

NEWTON COUNTY S

MO. No. 2

PLAN &

NEWTON CO



SHEET 3 APPENDIX A

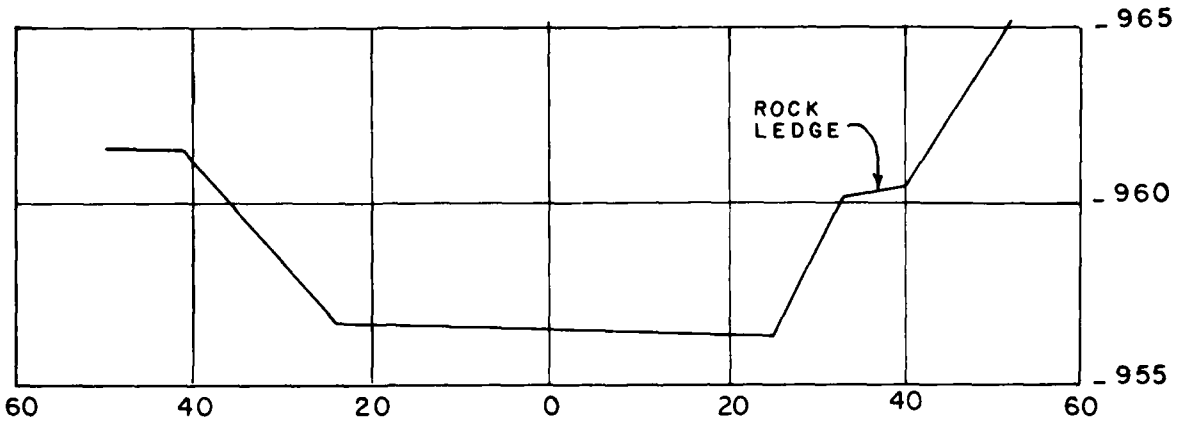
ANDERSON ENGINEERING, INC.
730 NORTH BENTON AVENUE
SPRINGFIELD, MISSOURI 65802

NEWTON COUNTY STRUCTURE F-3

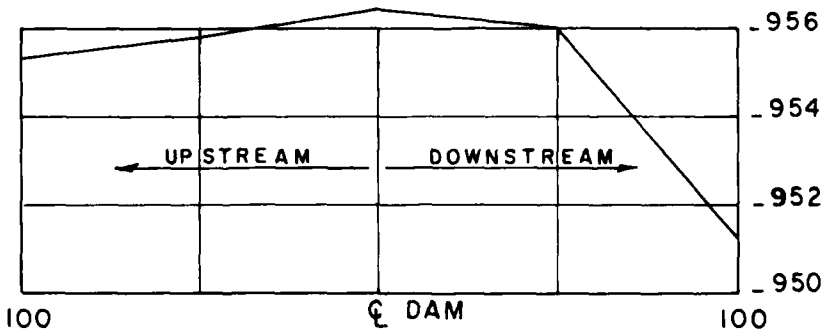
MO. No. 20514

PLAN & PROFILE

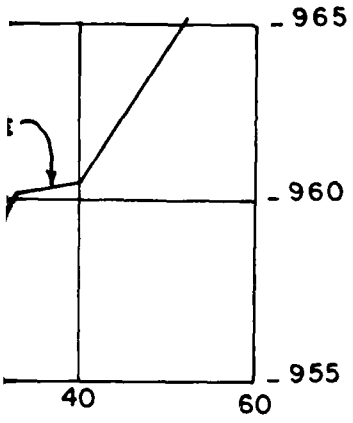
NEWTON COUNTY, MO.

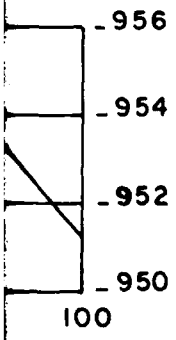


SPILLWAY SECTION



SPILLWAY PROFILE





SHEET 3A APPENDIX A

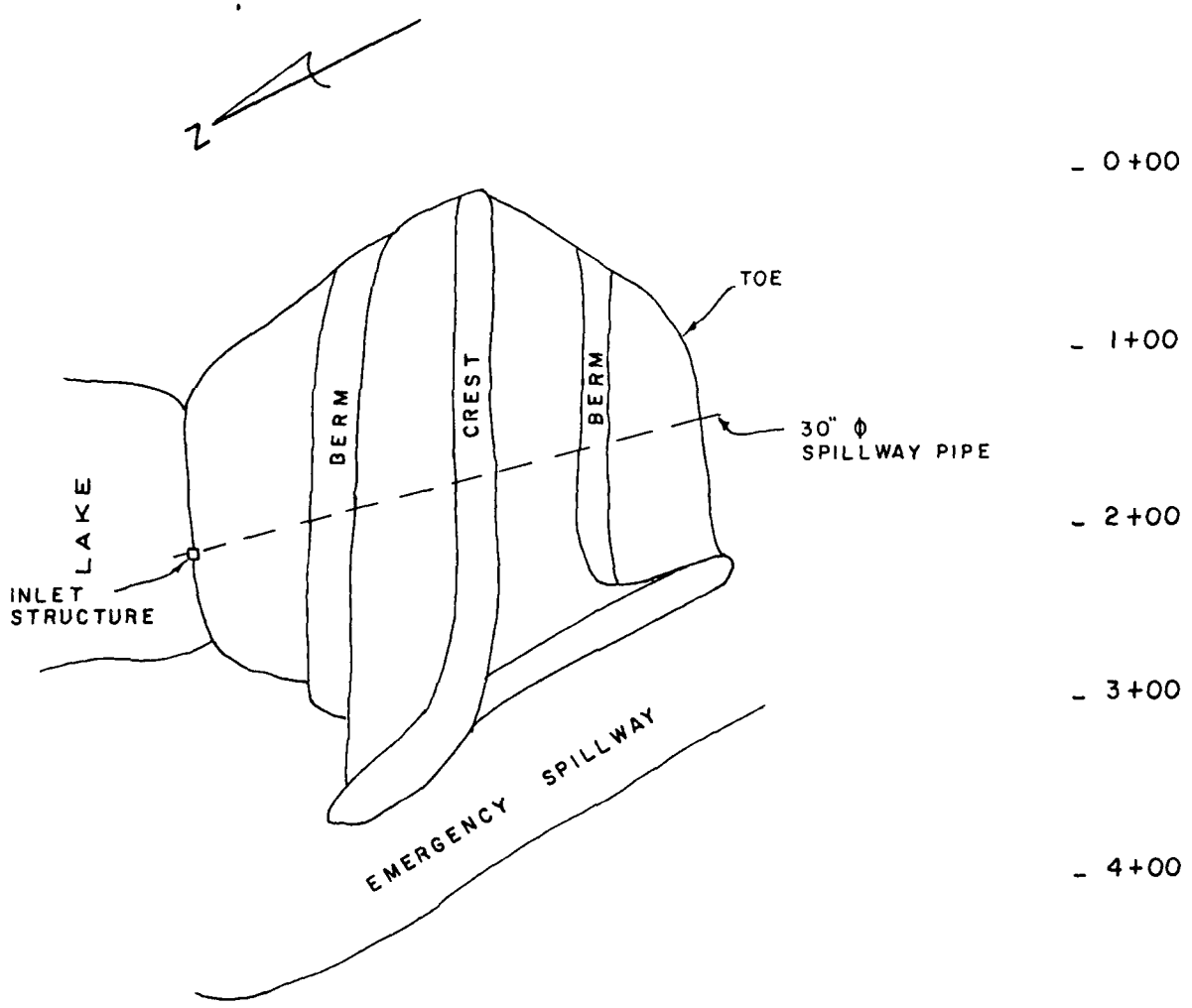
ANDERSON ENGINEERING, INC.
730 NORTH BENTON AVENUE
SPRINGFIELD, MISSOURI 65802

NEWTON COUNTY STRUCTURE F-3

MO. No. 20514

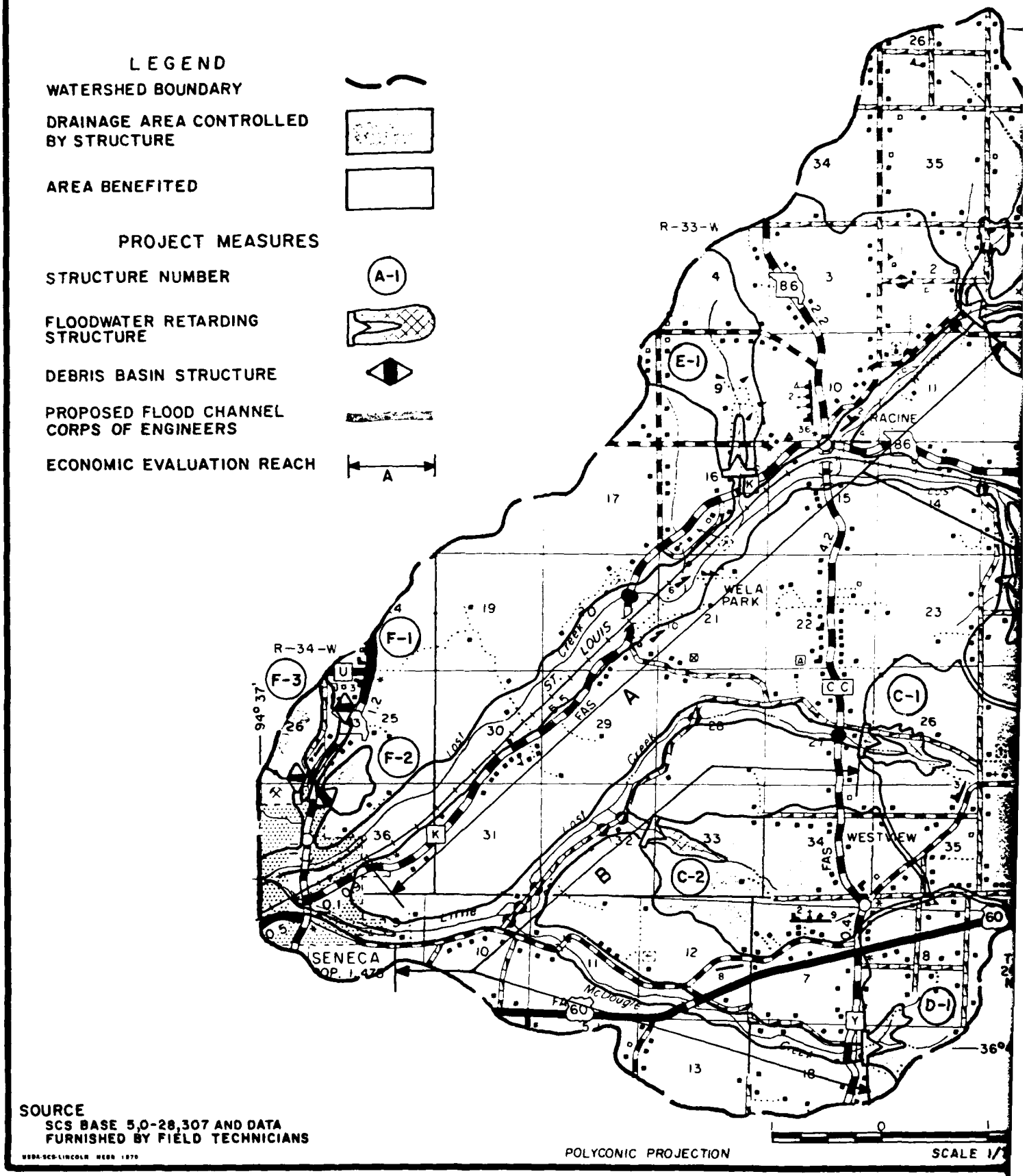
SPILLWAY
SECTION & PROFILE

NEWTON COUNTY, MO.



PLAN SKETCH OF DAM
STRUCTURE F-3
MO. No. 20514

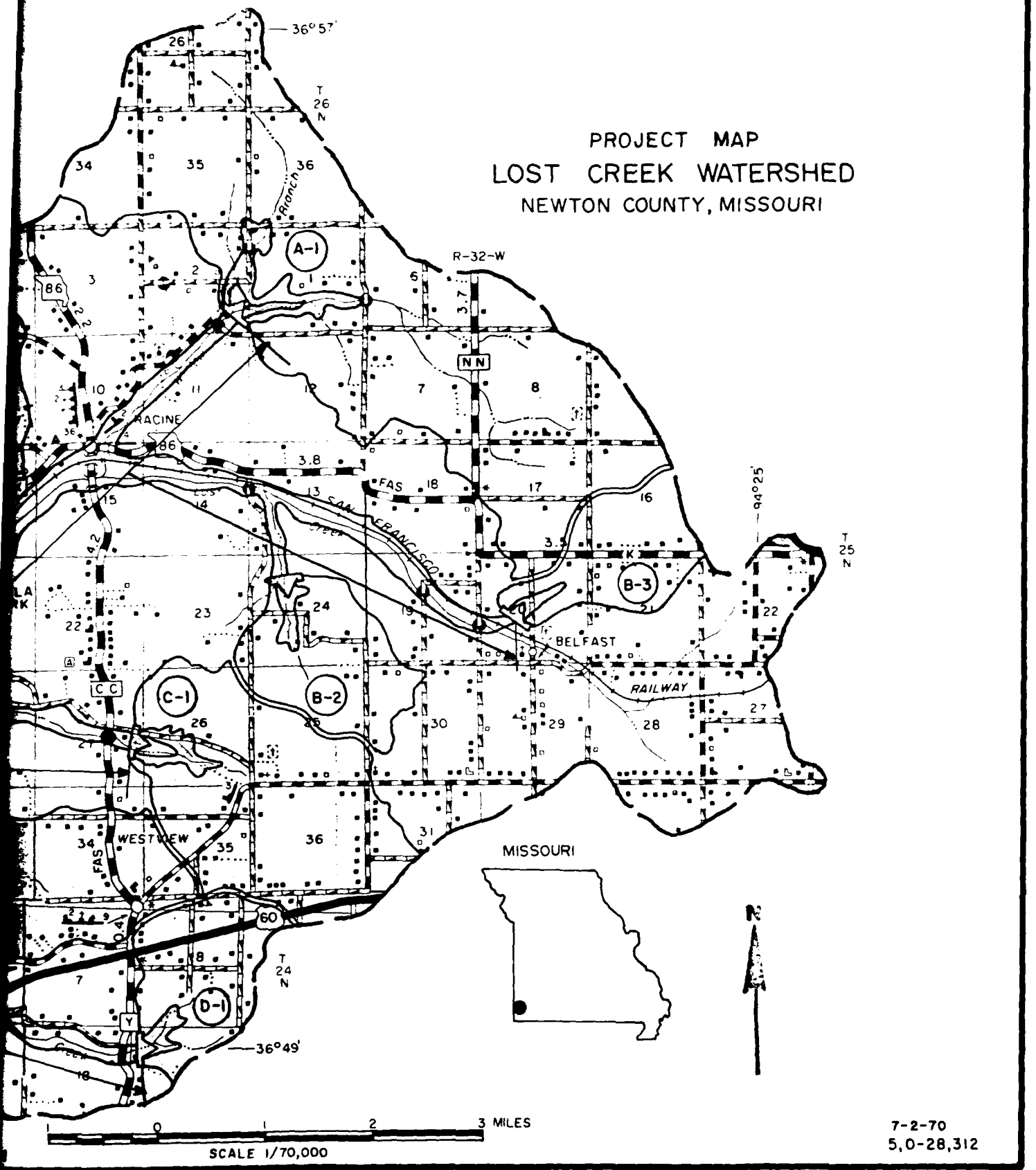
U. S. DEPARTMENT OF AGRICULTURE



SOURCE
SCS BASE 5,0-28,307 AND DATA FURNISHED BY FIELD TECHNICIANS

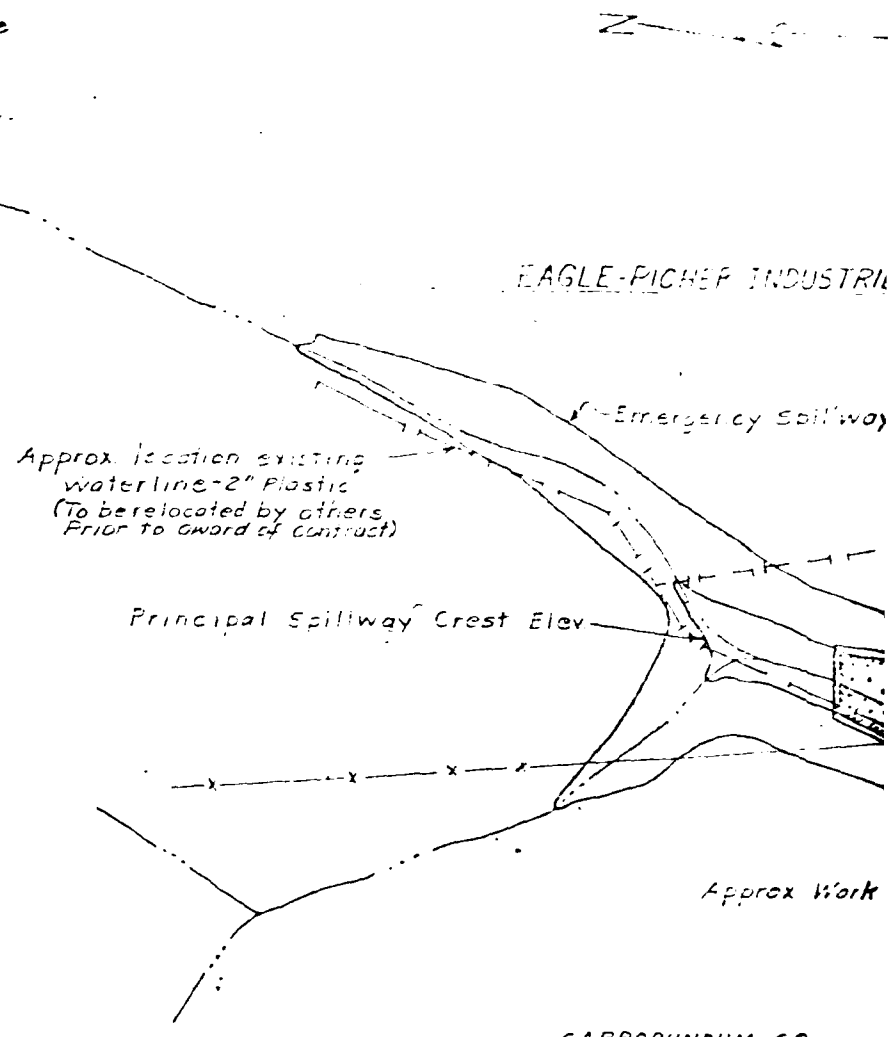
POLYCONIC PROJECTION

SCALE 1/


PROJECT MAP
LOST CREEK WATERSHED
NEWTON COUNTY, MISSOURI
36°57'
94°25'
36°49'
T 26 N
T 25 N
T 24 N
R-32-W
A-1
B-1
B-2
B-3
C-1
D-1
NN
CC
FAS
86
60
RACINE
BELFAST
WESTVIEW
SAN FRANCISCO CREEK
RAILWAY
MISSOURI
0 1 2 3 MILES
SCALE 1/70,000
7-2-70
5,0-28,312

B.M. #1 Elev. 966.73 ± Top of Concrete monument Sta. 0+00.21 & Dam.

B.M. #2 Elev. 993.08 Top of concrete monument Sta. 5+22.28 & Dam.



DATA TABLE

Drainage Area, Acres	88
Sediment Storage, Acre Feet	24
Retaining Storage, Acre Feet	33.1
Sediment Pool, Acres	1.5
Retaining Pool, Acres	4.3

Structure F-3 is located approx. ¼ mile north of Seneca, Missouri, near the center of the SE ¼ of Section 26, T. 25 N., R. 34 W.

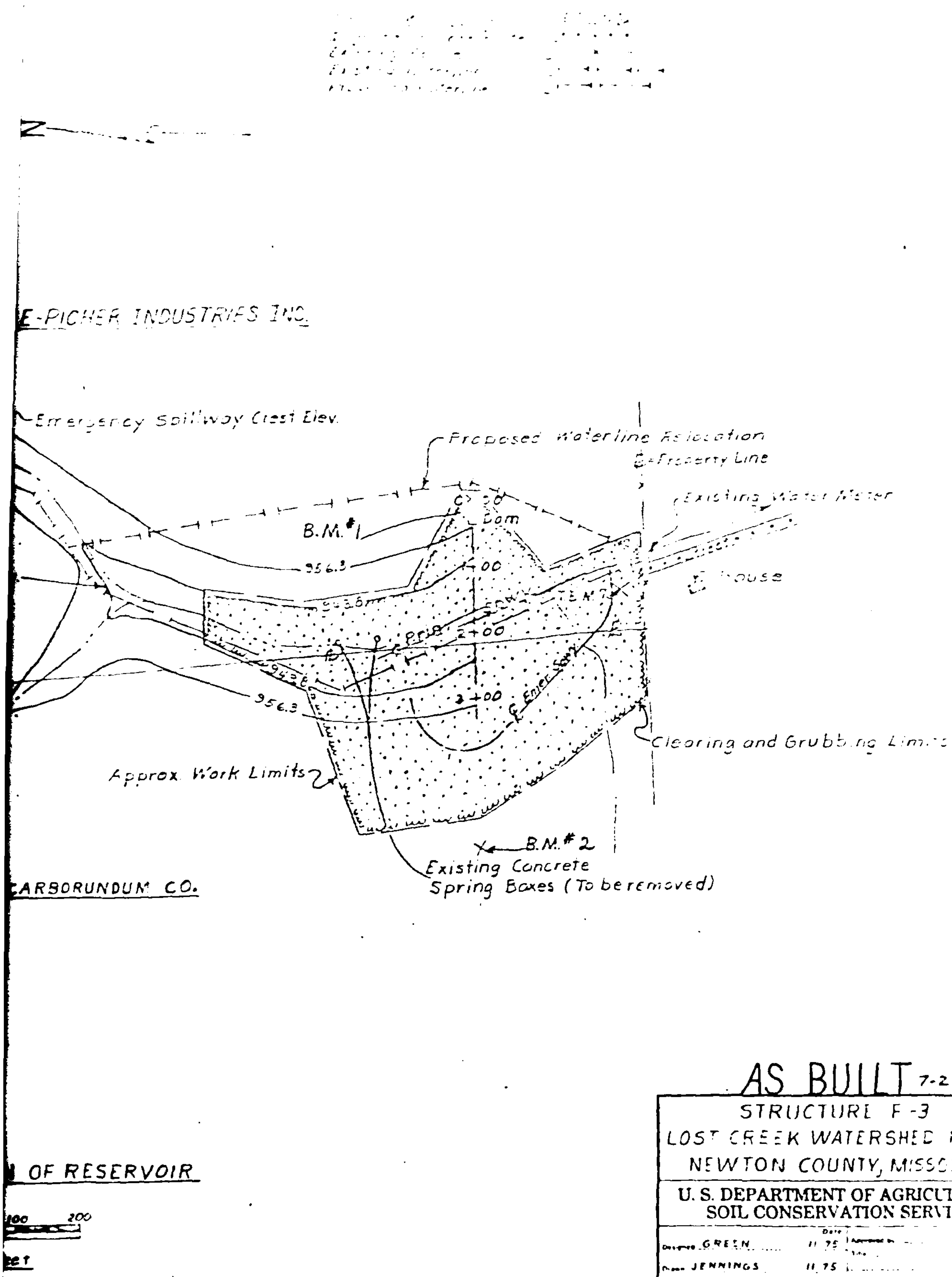
QUANTITIES

Clearing and Grubbing (Approx 4.4 Acres) ——— Lump Sum

GENERAL PLAN OF RESERVOIR

100 50 0 100 200

Scale in Feet



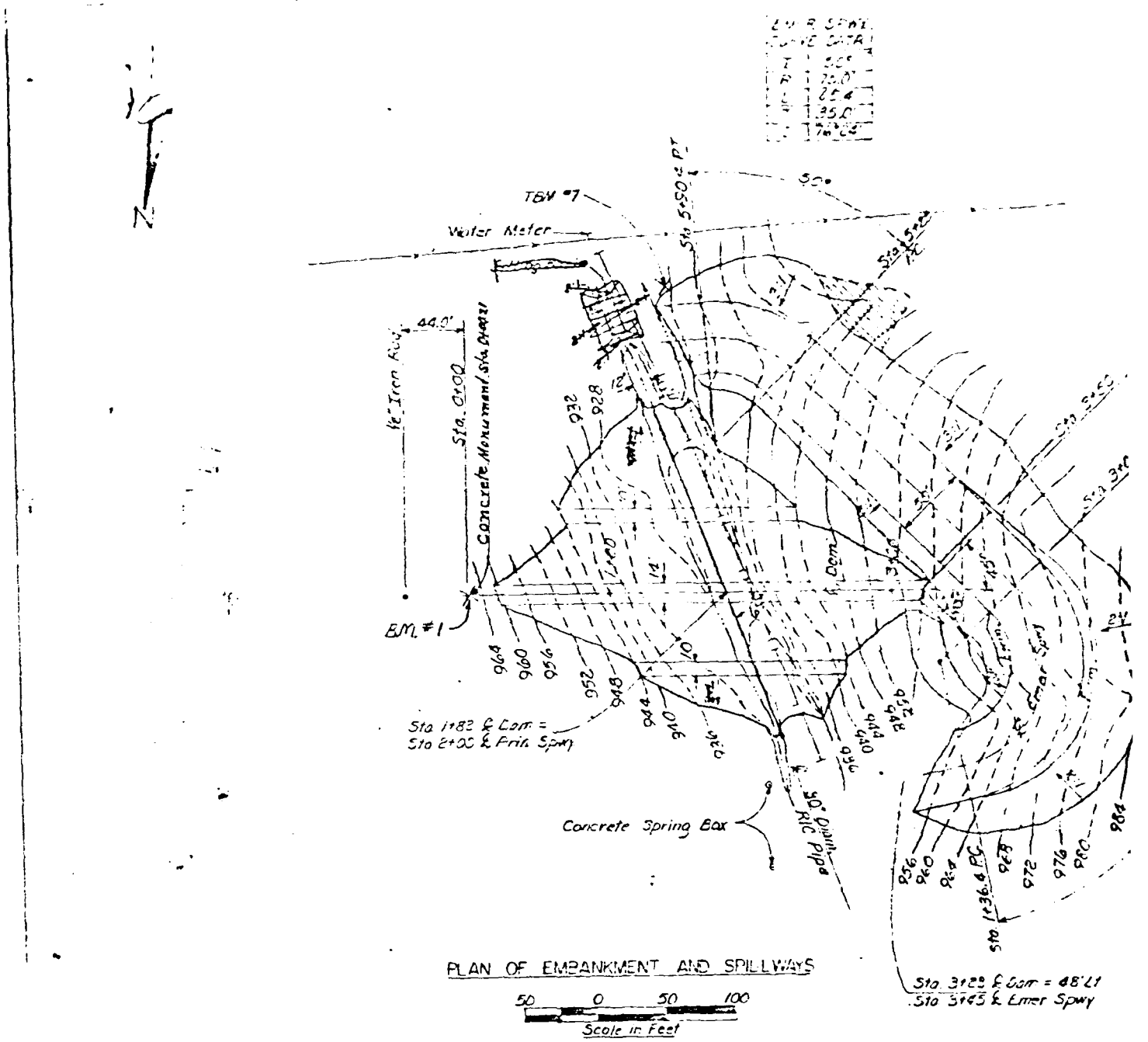
AS BUILT 7-28-77

STRUCTURE F-3
LOST CREEK WATERSHED P.L.-566
NEWTON COUNTY, MISSOURI

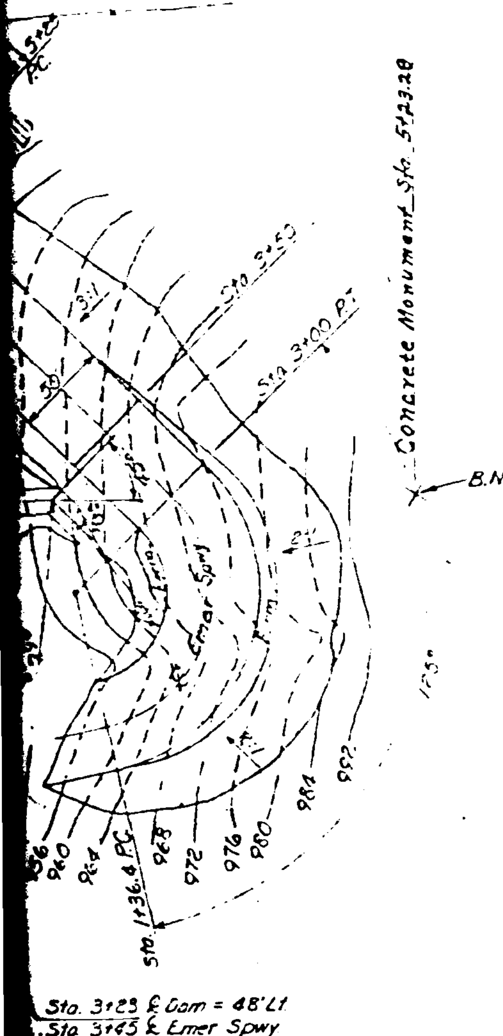
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed GREEN 11-75
Drawn JENNINGS 11-75
Traced ELAINE E. SMITH 3-76

COMPLETED 7-26-77


N
TBM #7
Water Meter
Sta 5+50 ± PT
90°
44.0'
Sta. 0+00
Concrete Monument
BM #1
Sta 1+82 & Com =
Sta 2+00 & Frin. Spwy
Concrete Spring Box
50° Rip Rap
Sta 3+29 & Com = 48.71
Sta 3+65 & Emer Spwy
PLAN OF EMBANKMENT AND SPILLWAYS
50 0 50 100
Scale in Feet
10.5'
44.3'
42.0'
11.0'
14.0'
0.2'
944.3
Rock Fill
Ground Line
Core Trench
18.0'
TYPICAL SECTION OF EMBANKMENT

Waste Area [illegible]



EMER SPWY CURVE DATA

I	125°
P	75.0'
L	163.6'
T	144.1'
D	76°24'

NOTES:

Topsoil

A minimum of 6 inches of topsoil to be placed on all compacted earth fill and the earth portion of the emer spwy.

Waste Areas

Waste areas will be as shown or as designated by the Engineer

Silting Basin

The dimensions shall be [illegible] bottom width, approx. depth of 2', 2:1 side slopes and 30' length. Excavation into rock will not be required. [illegible] may be necessary to obtain the required depth. The basin shall be [illegible] to grade and [illegible] to the surrounding area after all construction is complete and prior to seeding operations.

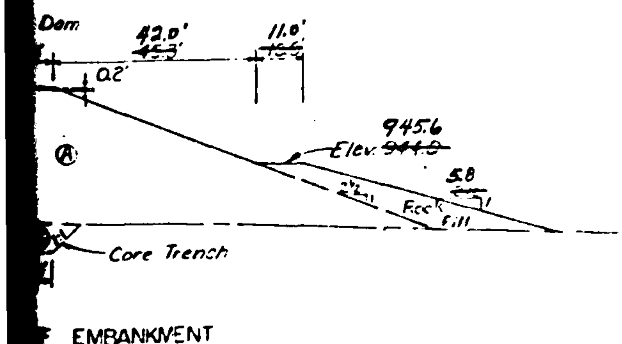
Emergency Spillway Berms

The berms shown in the emergency spillway cut are at the top of the bedrock surface. The width of these berms is variable.

QUANTITIES

Item	Quantity	Unit
Excavation Common EC		
Core Trench	1264	Cu Yds
Structure & Silting Basin	620	Cu Yds
Total	1884	Cu Yds
Excavation Rock EF		
Emer. Spwy	1991	Cu Yds
Earth Fill, Class (A)	18309	Cu Yds
Rock Fill	1798	Cu Yds
*Topsoil	4,600	Sq Yds
Seeding	3.9	Acres
Mulching	7.8	Tons
Temporary Seeding	0	Acres

~~*4,650 Sq Yds Topsoil at a depth of 6 inches = 775 Cu Yds~~



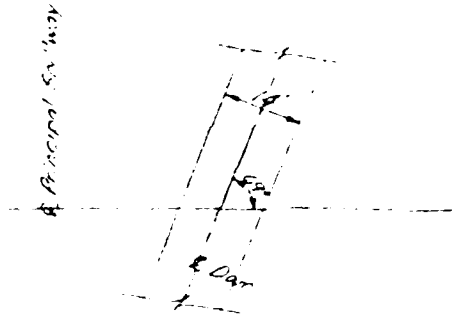
AS BUILT 7-28-77

STRUCTURE F-3
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

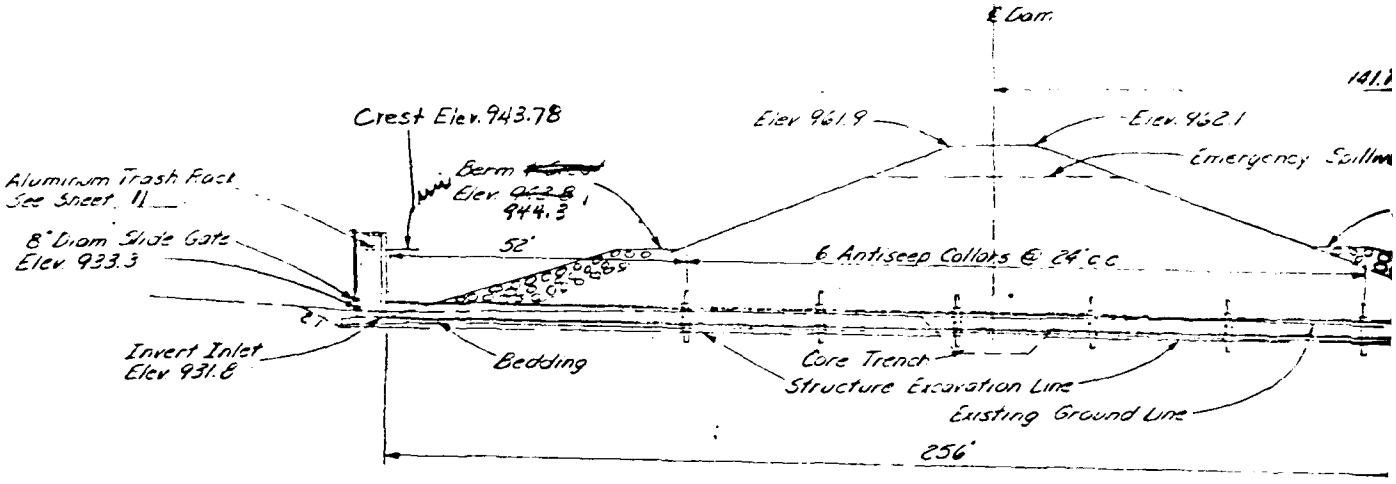
Designed M.N.F.	Date 1976	Approved by [illegible]
Drawn J.A.S.	3-76	[illegible]
Traced		
Checked E.E.S. & M.N.F. 3-76	Sheet 5 of 13	Drawing No. 5-E-35,713

Distance From Outlet	Elevation
0	926.00
16	926.36
24	926.54
40	926.99
56	927.41
72	927.82
88	928.23
104	928.63
120	929.01
136	929.38
152	929.73
168	930.09
184	930.42
200	930.75
216	931.07
232	931.38
248	931.69
256	931.80



PARTIAL PLAN

Existing



SECTION ON CENTERLINE

16 8 0 16 32

Scale in feet

MATERIALS

Concrete, Class 4000

Steel Bar Reinforcement

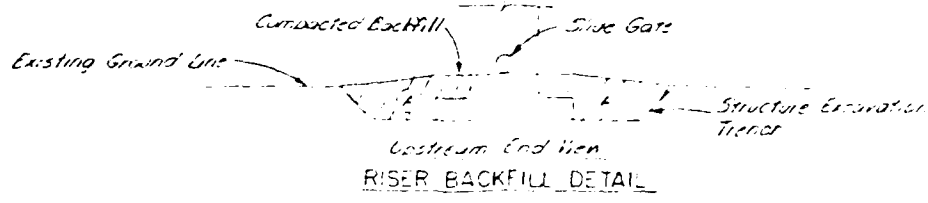
Prestressed Concrete Pressure Pipe, 30" Diam., Steel Cylinder Type

Aluminum Trash Rack

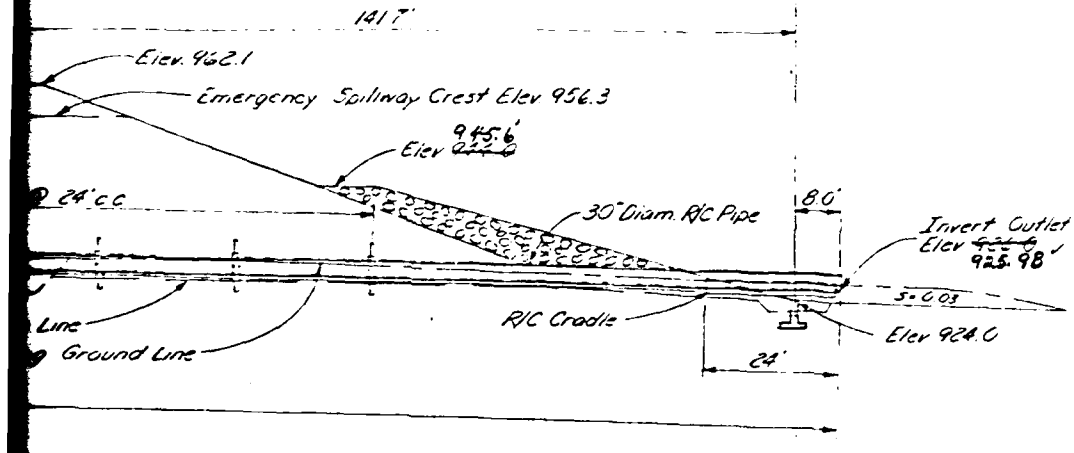
Slide Gate, 8" Diam.

NOTES

1. Pipe elevations other than those shown in the table will be furnished by the Engineer, when required
2. Antiseep collars shall not be placed closer than two (2) feet to a pipe joint.
3. Compacted backfill shall be placed over the riser footing up to the slide gate invert elevation. The backfill will be beveled to the existing ground line as shown in the Riser Backfill Detail.



RISER BACKFILL DETAIL



& Concrete Fier

NTERLINE

32

et

AS BUILT 7-28-77

MATERIALS

	50.3 Cu. Yds.
	3398' ~~3376~~ Pounds
el Cylinder Type	256 Lin. Ft.
	Lump Sum
	1 Each

STRUCTURE F-3

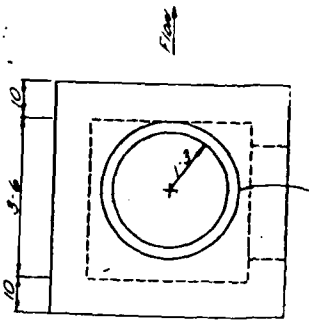
RESTRICTED FLOW INLET FOR 30" DIAM PIPE
GENERAL LAYOUT
LOST CREEK WATERSHED P.L.566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

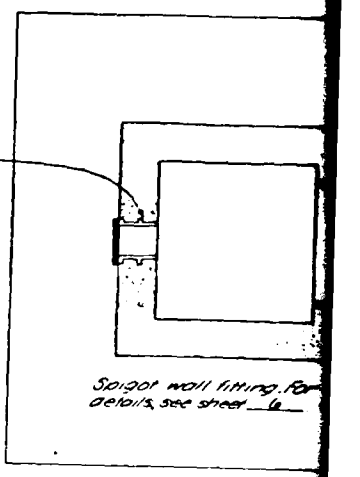
Designed	BES & MMB	Date 3-76	Approved by
Drawn	BAE	3-76	Title
Traced			Date
Checked	MMB & BES	3-76	Sheet No. 4 of 13 — Drawing No. 5-E-35 713

COMPLETED 7-28-77

12

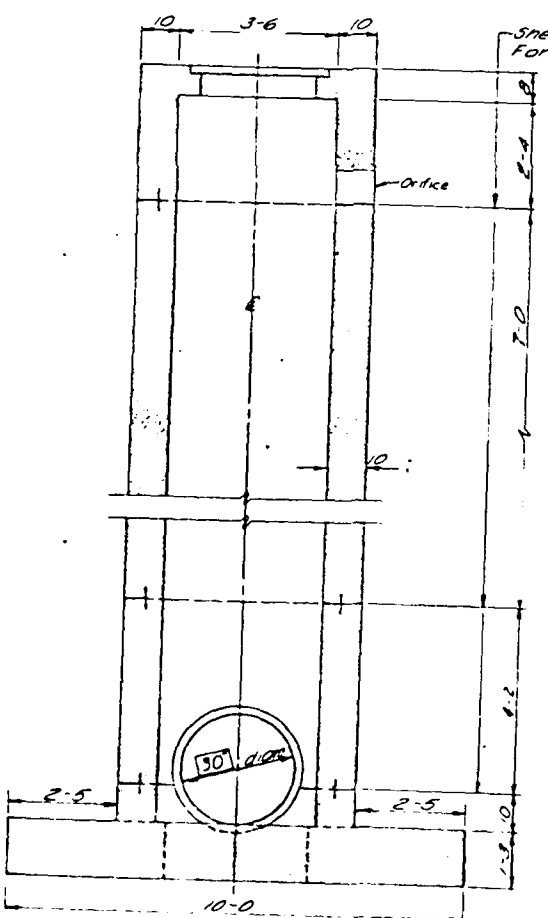


TOP PLAN

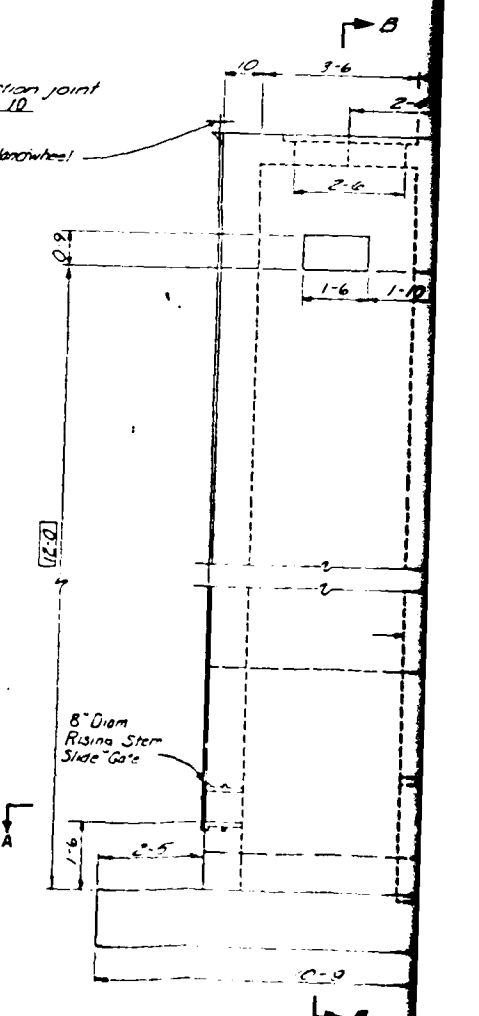


SECTION A-A

NOTE: FOR DETAIL OF TRASH RACK AND ANCHORAGE SEE SHEET 11.



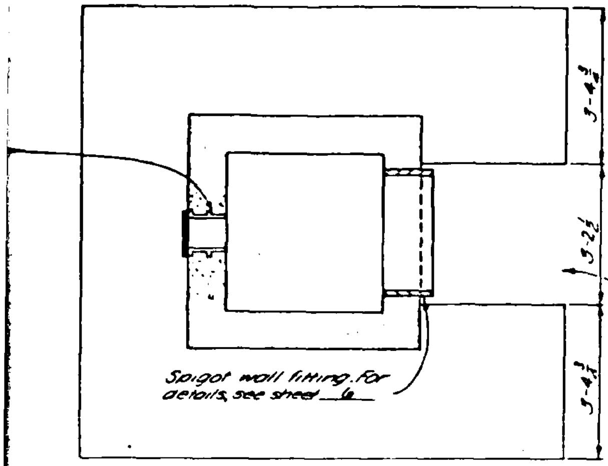
SECTION B-B



SIDEWALL ELEVATION

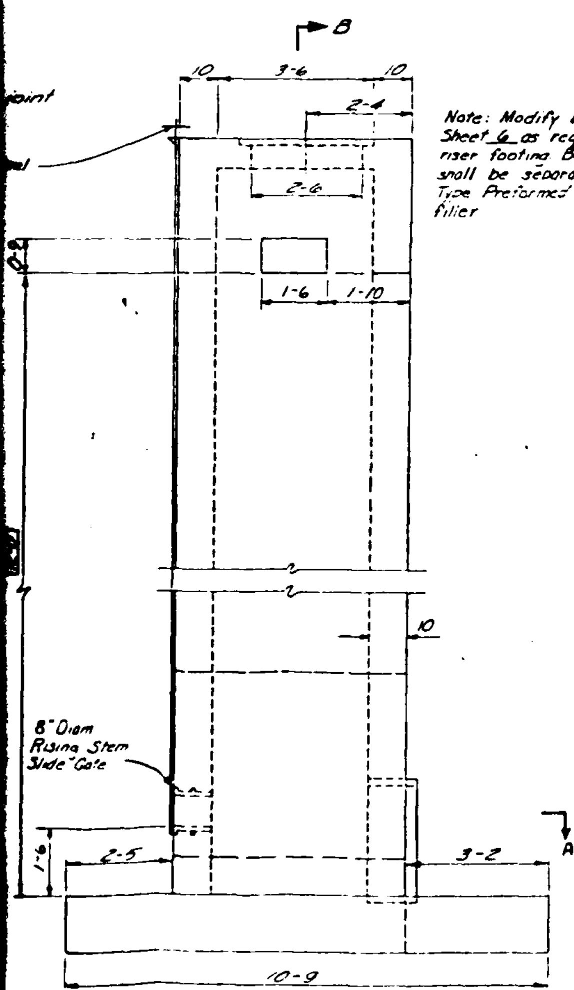
DETAILS OF 3'-6" x 3'-6" RESTRICTED FLOW RISER
(1' ≤ Height ≤ 15' X Sidewall Orifice)

E B [illegible] - DESIGN SECTION LINCOLN, NEBRASKA
DATE COMP. NO. SE-13 850 22*
DATE APPROVED MAY 10, 197 REV. [illegible]
SHEET 1 OF 6



SECTION A-A

ANCHORAGE SEE SHEET 11.



SIDEWALL ELEVATION

Note: Modify bedding shown on Sheet 6 as required to fit between riser footing. Bedding and footing shall be separated by 3/4" Bituminous Type Preformed expansion joint filler

BAR BENDS

STEEL SCHEDULE

MARK	SIZE	QUANTITY	LENGTH	TOTAL LENGTH	TYPE	B	C
B1	5	9	9-6	85-6	1		
B2	5	8	3-0	24-0	1		
B3	5	8	10-3	82-0	1		
B4	5	5	7-0	35-0	1		
B5	5	9	9-6	85-6	1		
B6	5	8	3-0	24-0	1		
B7	5	8	10-3	82-0	1		
B8	5	11	7-0	77-0	1		
B9	6	12	10-3	123-0	21	3-3	7-0
B10	6	6	7-9	46-6	21	0-9	7-0
B11	4	3	4-0	12-0	1		
B12	4	10	7-6	75-0	21	0-9	6-9
B13	4	6	7-6	45-0	21	0-9	6-9
B14	4	3	4-0	12-0	1		
B15	5	2	4-0	8-0	21	0-9	3-3
B16	5	18	6-6	117-0	21	3-3	3-3
B17	4	21	4-3	89-3	1		
B18	5	4	4-6	18-0	21	1-3	3-3
B19	6	2	3-9	7-6	1		
B20	6	2	2-9	5-6	21	0-9	2-0
M1	4	17	8-3	140-3	1		
M2	4	36	4-3	153-0	1		
M3	4	17	8-3	140-3	1		
M4	4	36	6-6	234-0	21	3-3	3-3
M5	4	6	6-9	40-6	1		
T3	4	14	6-6	91-0	21	3-3	3-3
T4	4	20	4-3	85-0	1		
T5	5	10	6-0	60-0	21	2-9	3-3
T6	5	2	3-6	7-0	21	0-9	2-9
T7	5	3	4-0	12-0	21	1-3	2-9
T8	5	1	2-9	2-9	21	1-0	1-9
T9	5	3	3-3	9-9	21	0-6	2-9
T10	5	2	4-3	8-6	21	1-6	2-9
T11	5	1	2-6	2-6	21	0-9	1-9
T12	4	4	1-3	5-0	1		
T13	4	4	2-3	9-0	1		
T14	4	15	2-9	41-3	1		
T15	4	4	1-9	7-0	1		
T16	4	4	4-9	19-0	21	1-6	3-3
T17	4	4	0-9	3-0	1		
T18	4	5	1-3	6-3	1		
T19	4	3	0-6	1-6	1		

NOTE: T1 and T2 Bars deleted from steel schedule

0 1 2 3 4
Scale in feet

AS BUILT 7-28-77

STRUCTURE F-3

QUANTITIES

STEEL
#4 BARS - 12092.5 FT. - 8078 LB
#5 BARS 740.50 FT. - 772.3 LB
#6 BARS 182.5 FT. - 274.1 LB
TOTAL [illegible] LB
CONCRETE, CLASS 4,000 # 12.9 CU YD

R/C RESTRICTED FLOW RISER
FOR 30" DIAM. R/C PIPE
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	B E S	3-76	Approved by
Drawn	J A G	4-76	Title
Traced			
Checked	M M B	4-76	Sheet 7 of [illegible] — Drawing No. 5 E-3[illegible]

STRUCTURE DATA

Class of Structure "C" Debris Basin

Drainage Area (total) 88 Ac. 0.14 Sq.Mi.

(uncontrolled) 88 Ac. 0.14 Sq.Mi.

Time of Concentration 0.29 Hours

Soil Cover Complex Number 71 For A.M.C. II

Sediment Capacity Available 8.4 Ac.Ft. below Elev. 943.8

Total Sediment Capacity Available 8.4 Ac.Ft.

Capacity Equivalents (Vol.) 1.14 In.

Retarding Capacity Provided 33.1 Ac.Ft.

Capacity Equivalents (Vol.) 4.51 In.

Water Supply Provided None Ac.Ft.-Identify Uses

Principal Spillway:

Maximum Capacity ~~(low stage)~~ 19 c.f.s.

Maximum Capacity (high stage) — c.f.s.

10 Day Drawdown Elev. 943.8

Emergency Spillway:

Percent Chance Use 1 Storm Duration 6 Hour

Type Vegetated Earth "n" Value Used 0.04

Emergency Spillway Hydrograph for Class "C" Structures

Rainfall 12.00 in.

Runoff 8.19 in.

Peak Inflow 549 c.f.s.

Maximum Discharge - Emergency Spillway 92 c.f.s.

Maximum Water Surface Elev. 957.6

Velocity of Flow (Ve) 5.9 f.p.s.

Supplementary Data and Special Design Features:

Principal Spillway Crest Elev. = 943.8

Emergency Spillway Crest Elev. = 956.3

Emergency Spillway Bottom Width = 50'

Settled Top of Dam Elev. = 961.3

Height x Storage = 28.2 x 41.5 = 1170

Freeboard Hyd

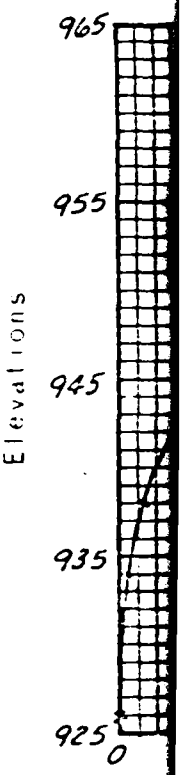
Rainfall

Runoff

Peak Infl

Maximum D

Maximum W



Supplementar
Special Desi

TRUCTURE DATA

Freeboard Hydrograph for Class "C" Structures

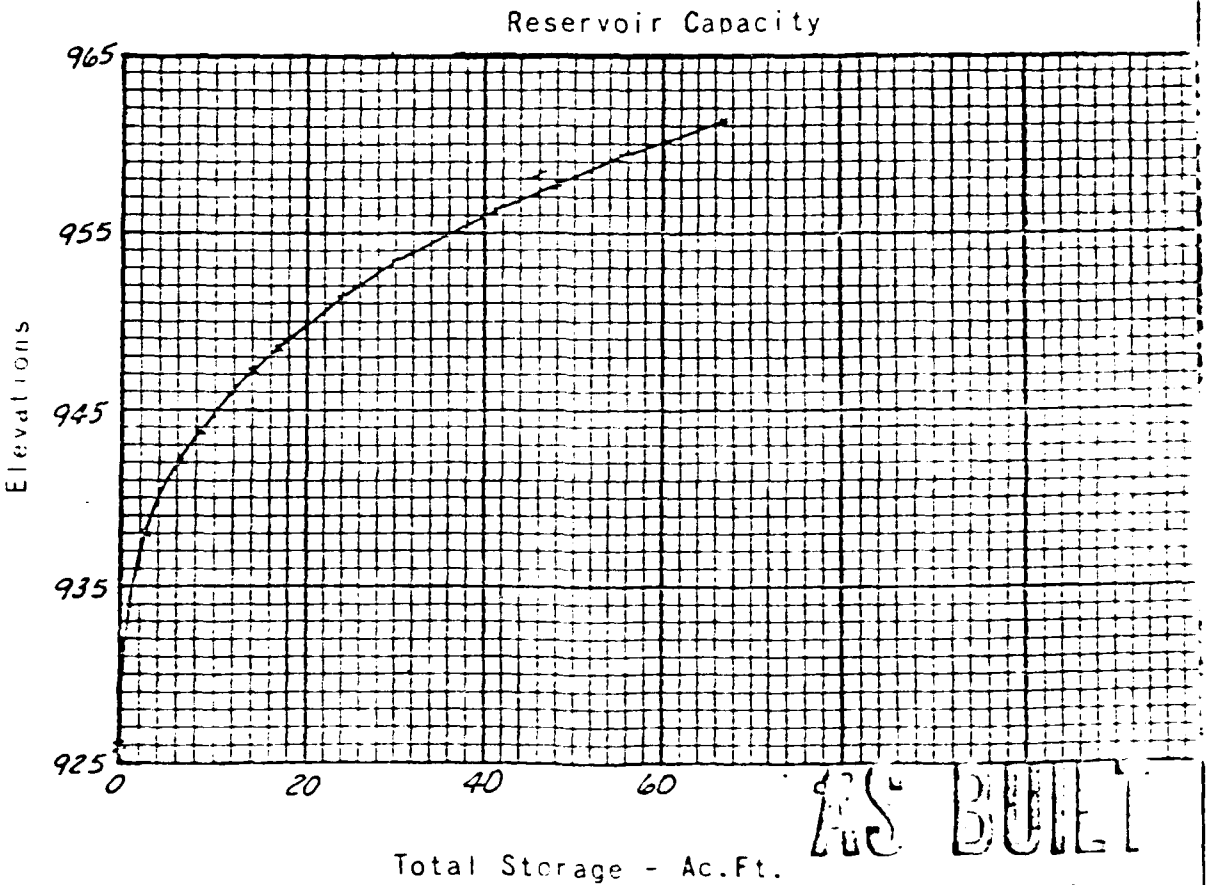
Rainfall 28.80 in.

Runoff 24.41 in.

Peak Inflow 1,617 c.f.s.

Maximum Discharge - Emergency Spillway 1,255 c.f.s.

Maximum Water Surface Elev. 961.3



AS BUILT

7-28-77

Supplementary Data and
Special Design Features:

STRUCTURE F-3
LOST CREEK WATERSHED PL-566
NEWTON COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JAG & MMB 3-76

BES 3-76

1-AS-38a (11/70) UNITED STATES DEPARTMENT OF AGRICULTURE
Refer to: AS-210-5 SOIL CONSERVATION SERVICE
File Code: AS-12-13 Columbia, Missouri 65201

OPERATION AND MAINTENANCE INSPECTION REPORT FOR STRUCTURES

May 14, 1980

Special [ ]

Watershed Lost Creek Structure No. F-3 Inspection:

Annual [x]

Newton County

Item	Condition: Satisfactory	Condition: Unsatisfactory	Describe Maintenance and Needed Repairs	Estimated Costs	Agreed Date Repairs To Be Compl'd	Date Repairs Compl'd
Vegetation	✓					
Fences	N.A.					
Principal Spillway	✓					
Emergency Spillway		✓	Topsoil, seed Gate & posts	$200	October 1, 1980	
Embankment	✓					
Reservoir Area	✓					
Scour Hole & Outlet Chnl	✓					
Foundation Drains & Relief Wells	N.A. N.A					
Other Periodic inspection of the dam			Weed beat and/or sprayed	$25	October 1, 1980	

Remarks: Vehicular Traffic Has caused minor damage to the emergency spillway. Watershed subdistrict will repair and install gate. Ed Landowner (Eagle Picher Co) will erect a gate to exclude traffic.

Warren H Boone
District Conservationist

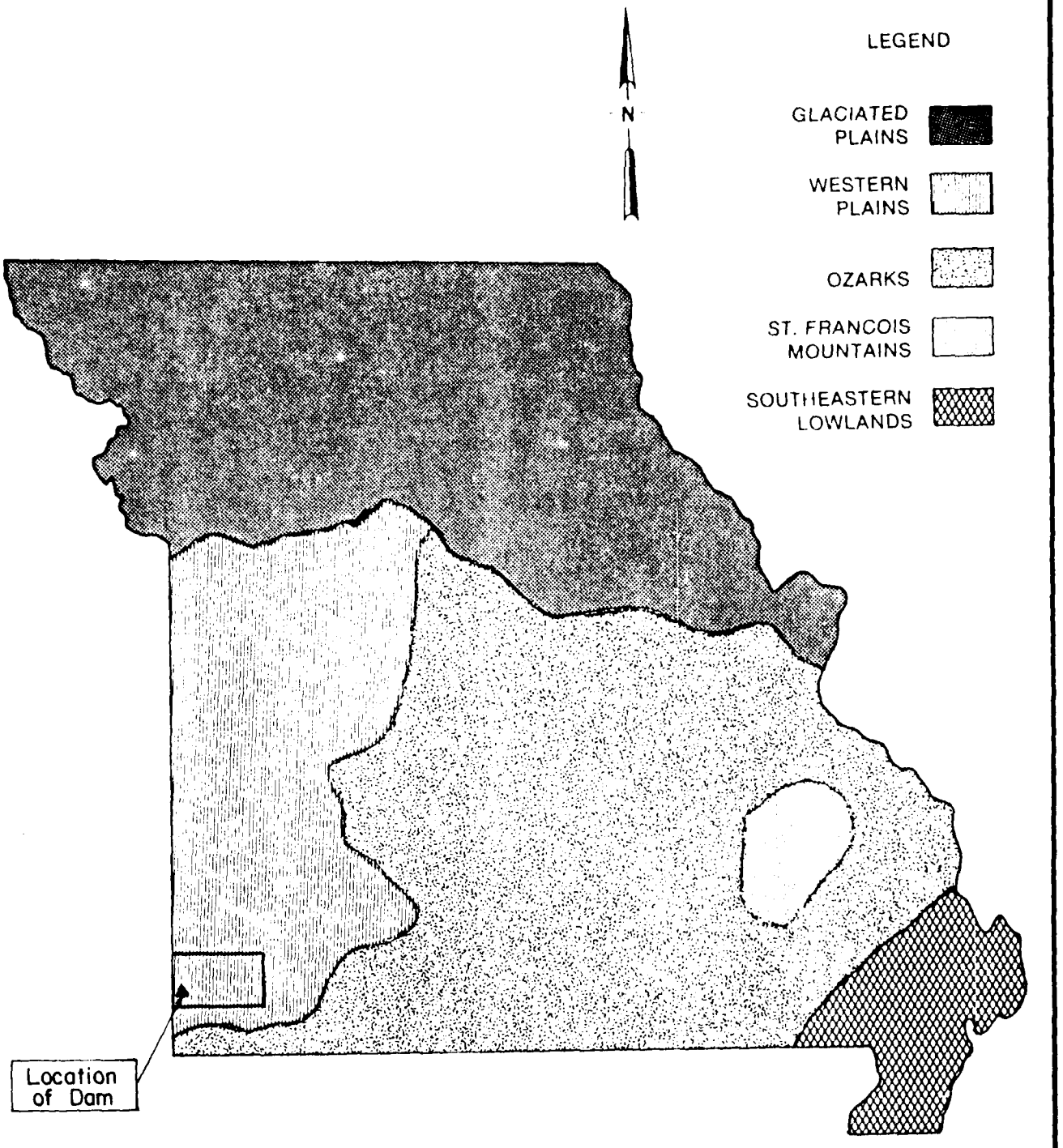
Gloria Wilson
Sponsoring Local Organization Rep.

Newton Soil and Water Conservation District
Sponsoring Local Organization

(Check list on reverse side)

APPENDIX B

Geology and Soils



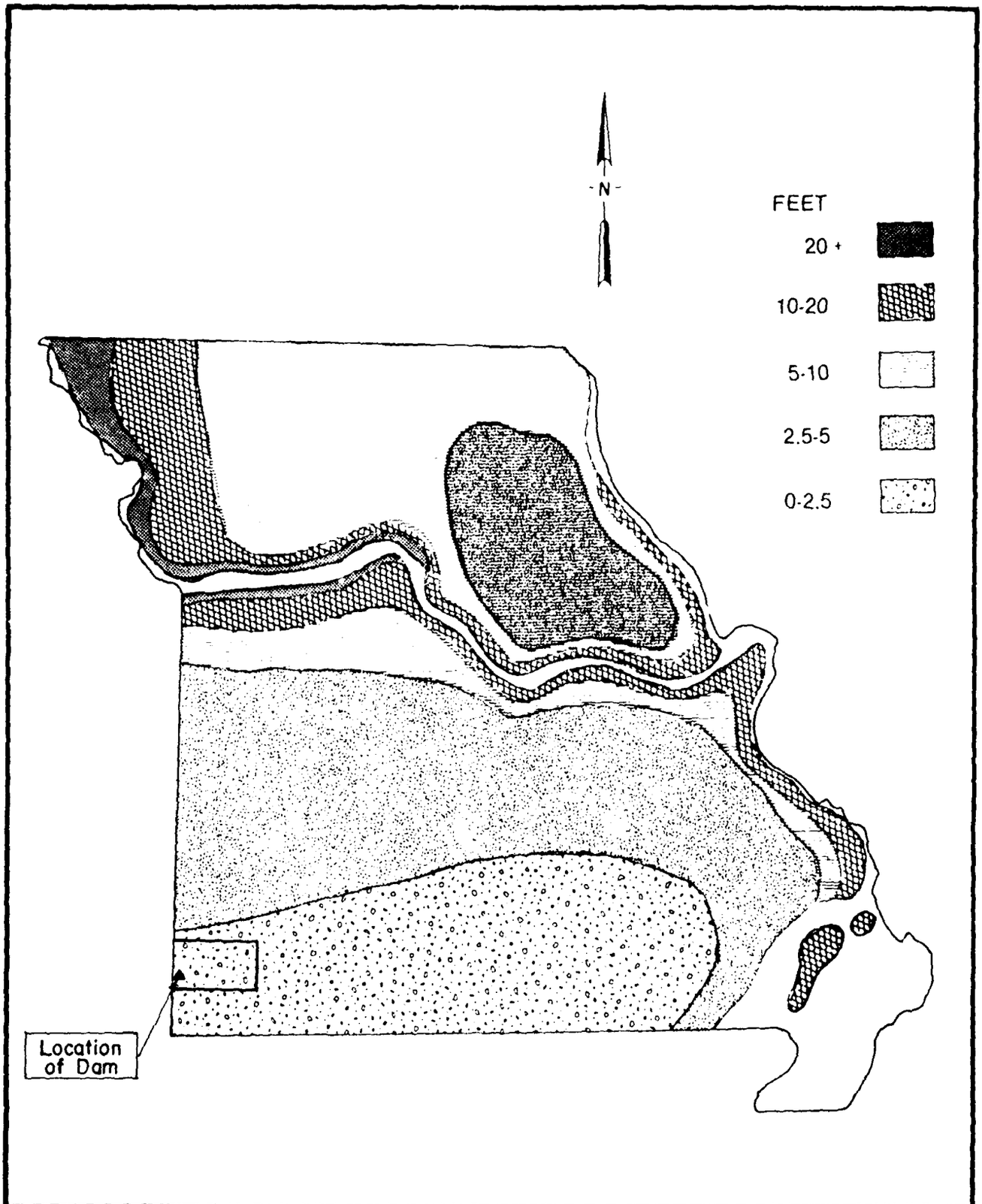
MAJOR GEOLOGIC REGIONS OF MISSOURI

HANSON ENGINEERS

SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

Newton County Structure F-3
Newton County, Missouri
Mo. I.D. No. 20514

SHEET 1, APPENDIX B



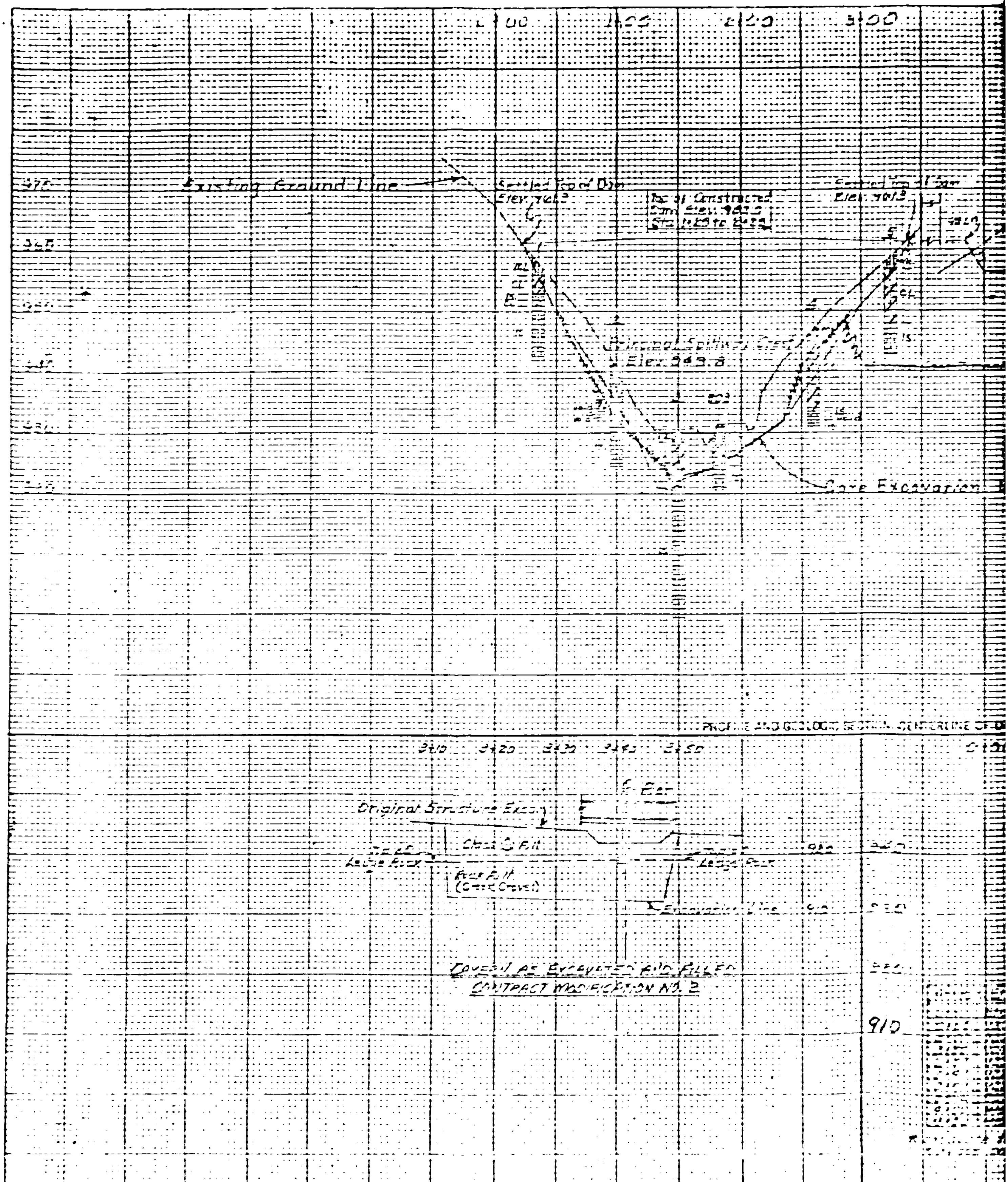
THICKNESS OF LOESSIAL DEPOSITS

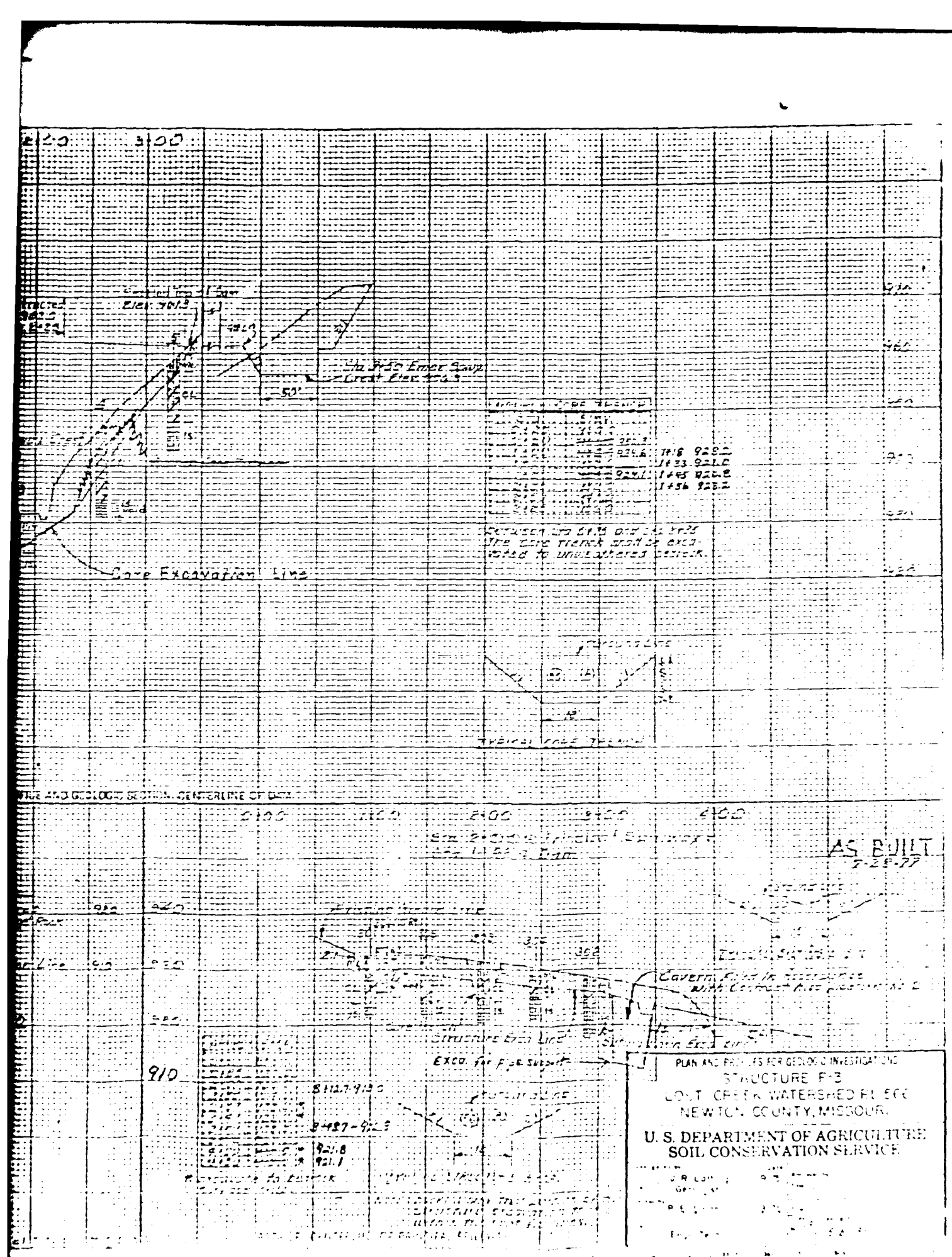
HANSON ENGINEERS

SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

Newton County Structure F-3
Newton County, Missouri
Mo. I.D. No. 20514

SHEET 2, APPENDIX B


Existing Ground Line
Core Excavation
Original Structure Excav.
Ledge Rock
CONDUIT AS EXCAVATED AND FILLED
CONTRACT MODIFICATION NO. 2
910


Core Excavation Line
AS BUILT
2-25-77
PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS
STRUCTURE F-3
COLT CREEK WATERSHED FLOOD
NEWTON COUNTY, MISSOURI
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Form SCS 376A
Sheet 1 of 6

10-59

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Missouri County Newton ; ¼, SE ¼, Sec. 26, T 25N R 34W ; Watershed Lost Creek

Subwatershed ____ Fund class WF-08 2018 (PL-2, WF-1, etc.) Site number F-3 Site group II Structure class C

Investigated by [signature] (signature and title) Equipment used D6C Dozer-Failing 1500RD, Backhoe, Ford 753 (Type, size, make, model, etc.) Date 11-11-75

SITE DATA

Drainage area size 0.14 sq. mi., 88 acres. Type of structure Compacted Earth Purpose Debris Basin

Direction of valley trend (downstream) South Maximum height of fill 32.6 feet. Length of fill 310 feet.

Estimated volume of compacted fill required 15,183 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	8.4 Total	1.3	15.8
Floodwater	33.1	4.3	28.3

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Ozark Highland Topography Rolling Attitude of beds: Dip S Strike E-W

Steepness of abutments: Left 26 percent; Right 19 percent. Width of floodplain at centerline of dam 85 feet

General geology of site. This site is located upon an outcrop of the Warsaw formation of the Meramician series and is Mississippian in age. Bedrock is hardness 4-5 limestone with seams of chert which occurs at an average depth of 8 to 9 feet along the ℄ dam alignment. The bedrock surface is uneven and pinnacled.

Soils materials developed above bedrock are of medium to very stiff consistency and are clayey gravelly silts (ML), cobbles, gravel and boulders with a clay matrix, and stiff red waxy clay (CL).

Circulation was lost while drilling borings in the clay-limestone contact zone. See logs of test holes.

No water was in the channel at the time of the site investigation; however, perched water tables were encountered in some flood plain borings and the spring and downstream spring box located in the channel had water in them. The landowner reported that the spring had considerable volume, but high flow was not substantiated by observation.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV 2 64
SHEET 2 OF 6

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE ℄ Dam

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Failing 1500 RD	5	1	--	1	
Boring #3 was redrilled with backhoe					
TOTAL	5	1	--	1	

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Hardness 4-5 limestone bedrock was encountered at an average depth of 8 to 9 feet along the ℄ dam alignment.

Soil materials developed above bedrock on the left abutment are cherty gravelly clays with cobbles. On the right abutment cobbly cherty gravelly clays with some boulders were found. Colluvial gravelly clays with cobbles are present above limestone through the narrow floodplain section.

Perched erratic water levels were present through the flood plain, but in boring #3 located at station 1+50 ℄ dam a reliable water level was encountered at a depth of 9.5 feet after 72 hour check (elevation 921').

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM S. C. S. 376B
REV 2-64
SHEET 3 OF 6

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Principal Spillway

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Failing 1500 RD	5	--	--	--	--
Backhoe Ford 753	1	--	---	--	--
TOTAL	6	--	--	--	--

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Hardness 4-5 limestone with chert lenses was encountered at an average depth of 7 feet along the principal spillway alignment. The limestone surface is uneven, weathered and pinnacled.

Soil horizons developed above bedrock are a medium consistency brown gravelly silt (ML) surface horizon which extends to a depth of 2 to 3 feet below the surface horizon and extending to the limestone surface clay and cobbles with a few boulders are encountered.

Circulation was lost while drilling in 1 of the 5 principal spillway borings. Since gravel and cobbles plugged the holes, the only reliable water level elevation occurs in Backhoe hole #306 where water stabilized after one week at 6.2 ft. depth (927^6).

F-3

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV 2 54
SHEET 4 OF 6

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Borrow

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
Backhoe Ford 753	5	2	--	4	--
TOTAL	5	2	--	4	--

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

Hardness 4-5 cherty limestone was encountered in all of the borrow borings at an average depth of 6.5 feet.

Colluvial gravelly clays with cobbles are present above limestone through the narrow floodplain area. Soil materials developed above bedrock on the left flank are cherty gravelly clays with cobbles and materials on the right flank are cobbly cherty gravelly clays with some boulders.

Borings #101 and #105 had water in them at an average elevation of 933 feet. The other three borrow holes were dry.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS 378B
REV. 2 64
SHEET 5 OF 6

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Emergency Spillway

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY - EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
			UNDISTURBED	DISTURBED	
	EXPLORATION	SAMPLING	(STATE TYPE)	LARGE	SMALL
D6C Dozer	1	1	--	3	--
Failing 1500 RD	6	--	--	--	--
Backhoe Ford 753	6	--	--	--	--
TOTAL	13	1	--	3	--

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

A thin mantle of brown-tan silt (ML) overlies cobbles and boulders with a red clay matrix in the second horizon. This horizon is mostly thin to medium bedded limestone that is fractured, stratified and discontinuously bedded. Below this second horizon and overlying solid limestone is a red waxy stiff clay. Average depth to solid limestone is 8.5 to 9.0 feet. The limestone surface is rough pinnacled and uneven.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FORM SCS-376B
REV. 2-64
SHEET 6 OF 6

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Stream Channel

(CENTERLINE OF DAM, PRINCIPAL SPILLWAY, EMERGENCY SPILLWAY, THE STREAM CHANNEL, INVESTIGATIONS FOR DRAINAGE OF STRUCTURE, BORROW AREA, RESERVOIR BASIN, ETC.)

DRILLING PROGRAM

EQUIPMENT USED	NUMBER OF HOLES		NUMBER OF SAMPLES TAKEN		
	EXPLORATION	SAMPLING	UNDISTURBED (STATE TYPE)	DISTURBED LARGE	DISTURBED SMALL
No borings					
TOTAL					

SUMMARY OF FINDINGS
(INCLUDE ONLY FACTUAL DATA)

The realigned principal spillway is adjacent on the right flank of the channel and the borings on this alignment have similar material as would be expected in the channel.

The high concentration of cobbly material on the surface of the channel did not allow any penetration of the hand auger after numerous attempts.

No water was present in the channel at the time of the site investigation, however, the spring box and the downstream reserve box, both located in the channel had water in them. Cobbles, trash and organic debris litter the channel area.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCS-376C
REV. 2 64
SHEET 1 OF 1

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

WATERSHED	SUBWATERSHED	COUNTY	STATE
Lost Creek		Newton	Missouri

SITE NO.	SITE GROUP	STRUCTURE CLASS	INVESTIGATED BY: (SIGNATURE OF GEOLOGIST)	DATE
F-3	II	C		11-11-75

INTERPRETATIONS AND CONCLUSIONS

℄ Dam The recommended minimum cutoff trench depths should provide an adequate cutoff. The trench will bottom on cobbly, gravelly clay on the left abutment, gravelly clay through the floodplain and residual type 40% boulders and cobbly material with a clay matrix on the right abutment. The high concentration of boulder size limestone material present on the right abutment are encountered at depths of 2 to 4 feet from the surface and it would appear desirable to seat the cutoff below the boulder horizon, at least below permanent pool elevation.

Principal Spillway Location, alignment and foundation are satisfactory and the skewed location at station 1+82 ℄ dam is adequate. It is suggested that the ML surface material found along this alignment be removed during construction.

Drainage Not recommended

Stream Channel 1 to 2 feet removal of silt, gravel, trash and organic debris along with standard embankment preparation at all sections is suggested.

Emergency Spillway An estimated 11,000 cubic yards of required excavation may be expected from this area of which an estimated 500 cubic yards of this amount may be expected to be hardness 4-5 fairly solid limestone rock. Rippable boulders and cobbles along with gravelly clay material should be encountered above the solid rock. All rock should be suitable for front berm protective cover.

Borrow Ample materials are available along with required excavation from the emergency spillway to construct the embankment. More plastic materials are encountered on the left than on the right flank where higher percentages of boulders and cobbles are present. It is suggested that borrowing be limited in the floodplain area to depths of 4-6 feet or less because of the high perched water levels and the shallow limestone bedrock surface.

ENGINEER'S REPORT

SITE F-3 LOST CREEK

1. STREAM CHANNEL - Stripping and foundation preparation and core trench excavation should eliminate all the stream channel cleanout needed.

2. DEPTH OF CORE - Recommend that the core trench be as shallow as possible to insure a safe dam. Suggest 12.0 foot bottomwidth with 1:1 side slopes.

3. UNDESIRABLE MATERIAL - The only undesirable material is the rock excavation in the emergency spillway and oversize rock from other borrow sources. Suggest this material be placed on the front slope of the dam below the upstream berm or buried in the borrow area.

4. MATERIALS - Excavation from core and emergency spillway except for rock excavation may be used for fill. Emergency spillway excavation with 3:1 side slopes will amount to approximately 12,000 cubic yards of material, some of which is rock. Ample fill material is available from emergency spillway and core trench excavations and by excavating below the emergency spillway elevation in the borrow area. Consideration should be given to steeper side slopes for the emergency spillway due to rock encountered above grade.

5. CONDUIT - Due to class of structure the conduit will be reinforced 30 inch concrete pipe with capped riser.

6. DRAINAGE - It is very doubtful that any type of drainage will be needed.

7. Recommend that fill placement control be class C compaction or class A compaction with controls on the minus 3/4" fraction.

Joe A. Green, Project Engineer
October 9, 1975

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE - Soil Mechanics Laboratory

800 "J" Street, Lincoln, Nebraska 68508

SUBJECT: ENG 13-18, Missouri WF-08, Lost Creek, Site F-3 DATE: January 21, 1976
(Newton County)

TO: Monroe Dale
State Conservation Engineer
Soil Conservation Service
Columbia, Missouri

ATTACHMENTS

1. Form SCS-ENG-356, Soil Mechanics Laboratory Data, 1 sheet
2. Form SCS-ENG-355A & 355B, Triaxial Shear Test, 1 test, 2 sheets
3. Form SCS-ENG-352, Compaction and Penetration Resistance, 4 sheets
4. Form SCS-357, Summary - Slope Stability Analysis, 2 sheets

DISCUSSION

FOUNDATION

A. Bedrock. Limestone bedrock occurs at a depth of about 5 feet on the left abutment and at a depth of about 8 feet in the floodplain section. The bedrock occurs at a depth of about 13 feet on the right abutment.

B. Soil Classification. The soil sampling the bedrock is logged as ML overlying CL with some GC in the floodplain. The ML zone logged is about 2 feet thick.

The only sample submitted from the foundation was a bag sample from the floodplain and it is a GC that contains 33 percent fines.

EMBANKMENT

A. Soil Classification. Six samples were submitted from the emergency spillway and the borrow area. Three of the samples are fine-grained soils that class as CH. The other three are gravelly soils that class as GM and GC.

B. Compacted Density. Compaction tests were made on four samples as requested. The test on Sample 203-2 was made on the total sample, which was all finer than the No. 10 size. The tests on Samples 201-3, 103-2, and 102-1 were made on the minus 3/4" fraction.

The moisture density relationship is shown on the attached Form SCS-ENG-352.

C. Shear Strength. A $\overline{CU}$ triaxial shear test was made on the minus 3 4-inch material from Sample 201-3. The test specimens were compacted to 95 percent of standard Proctor density. The test was made on saturated material, and the shear strength parameters obtained are $\phi = 13°$, $c = 300$ psf and $\bar{\phi} = 33°$, $\bar{c} = 75$ psf.

SLOPE STABILITY

A stability analysis was made for the proposed 2½:1 embankment slopes. The analysis considered the sudden-drawdown condition from emergency spillway elevation and the steady-seepage condition with a phreatic line from emergency spillway elevation and no embankment drain.

The analysis was made for the maximum embankment section. Since no foundation samples were submitted for shear strength tests, the assumption was made that the foundation soil was stronger than the embankment soil.

The analysis shows that the slope below the proposed 10-foot upstream berm should be flattened to 3:1 and that a 10-foot berm at elevation 44 should be added to the downstream slope with a 3:1 slope below the berm.

A summary of the analysis is attached.

CONCLUSIONS AND RECOMMENDATIONS

The proposed design outlined in the engineer's report appears to be adequate providing the slopes are modified as shown by the slope stability analysis. Compaction to 95 percent of ASTM D698 on the minus 3 4-inch fraction is required.

Tests indicate that the soil here does not contain dispersed clay, so the proposal to build the dam without an embankment drain appears to be all right. It is likely that some seepage will occur through the bedrock in the foundation.

Jorn P. Dunnigan
Head

Attachments

cc: Joe A. Green, Project Engr., Mt. Vernon (2)
Buell M. Ferguson, Lincoln, Nebr.

SCS-ENG-354
Rev. 3-70
FILE CODE ENG-13-18

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

11/28/75 MISSOURI

Lost Creek Site: F-3

MECHANICAL ANALYSIS — GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT

Laboratory Sample Number	Field Number	Location and Description	Depth	Field Classification	Fines					Sand						Gravel						Atterberg Limits LL	PI	Unified Classification	Soluble Salts %	Dispersion %				
76W																														
773	3-1	℄ Dam, 1+50 ℄ Dam L. Bag	2-8.5'	CL-GC	13	19	26	32	35	33	34	36	38	42	48	56	60	68	75	91	100	25	23	GC		7				
774	201-1	Emer. Spwy., 1+50 ℄ Dam L. Bag	2-3.5'	--	9	15	23	32	35	36	37	37	41	43	50	52	56	60	64	[illegible]	[illegible]	28	5	GM		10				
775	201-2	" " L. Bag	3.5-5.5'	CL	41	45	56	71	73	75	81	86	94	100								58	32	CH		TR	(1)	[illegible]	[illegible]	
776	201-3	" " L. Bag	5.5-7.5'	CL	27	32	37	[illegible]	[illegible]	[illegible]	[illegible]	47	52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	94	100	56	30	GC		16				
															76	85	90	100				DRY DENSITY < [illegible]					[illegible]	[illegible]	[illegible]	
777	101-2	Borrow, 35' US, B 2+20 L. Bag	3.5-5.5'	CL-GC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	77	[illegible]	[illegible]	91	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	CH						
															94	96	97	100				DRY DENSITY < [illegible]					[illegible]	[illegible]	[illegible]	
778	101-3	" " L. Bag	5.5-6.5'	CL	[illegible]	57	77	92	93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51	[illegible]	CH						
779	102-1	Borrow, 10' US, B 1+50 L. Bag	L-6.5'	CL-GC	7	12	19	28	31	32	33	34	37	37	45	53	55	63	73	91	100	33	12	GC		TR				
															66	78	88	100				DRY DENSITY < [illegible]					[illegible]	[illegible]	[illegible]	

Sheet 14 of Appendix B

SCS-ENG-355A (Rev. 3-70)
FILE CODE ENG-22

LABORATORY NO. [illegible]

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	TRIAXIAL SHEAR TEST

PROJECT and STATE: [illegible] SITE F-3, [illegible]
SAMPLE LOCATION: [illegible]

FIELD SAMPLE NO: 201-3
DEPTH: 1.5 - 2.5'
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: [illegible]
TESTED AT: [illegible]
APPROVED BY:
DATE:

INDEX TEST DATA

USCS GC ; LL 56 ; PI 30
% FINER (mm): 0.002 27 ; 0.005 32 ;
0.074 (#200) 41
G_s (-#4) 2.65 ; G_s (+#4) 2.13
STANDARD: γ_d MAX. 93.0 pcf; w_o _____ %
MODIFIED: γ_d MAX. _____ pcf; w_o _____ %

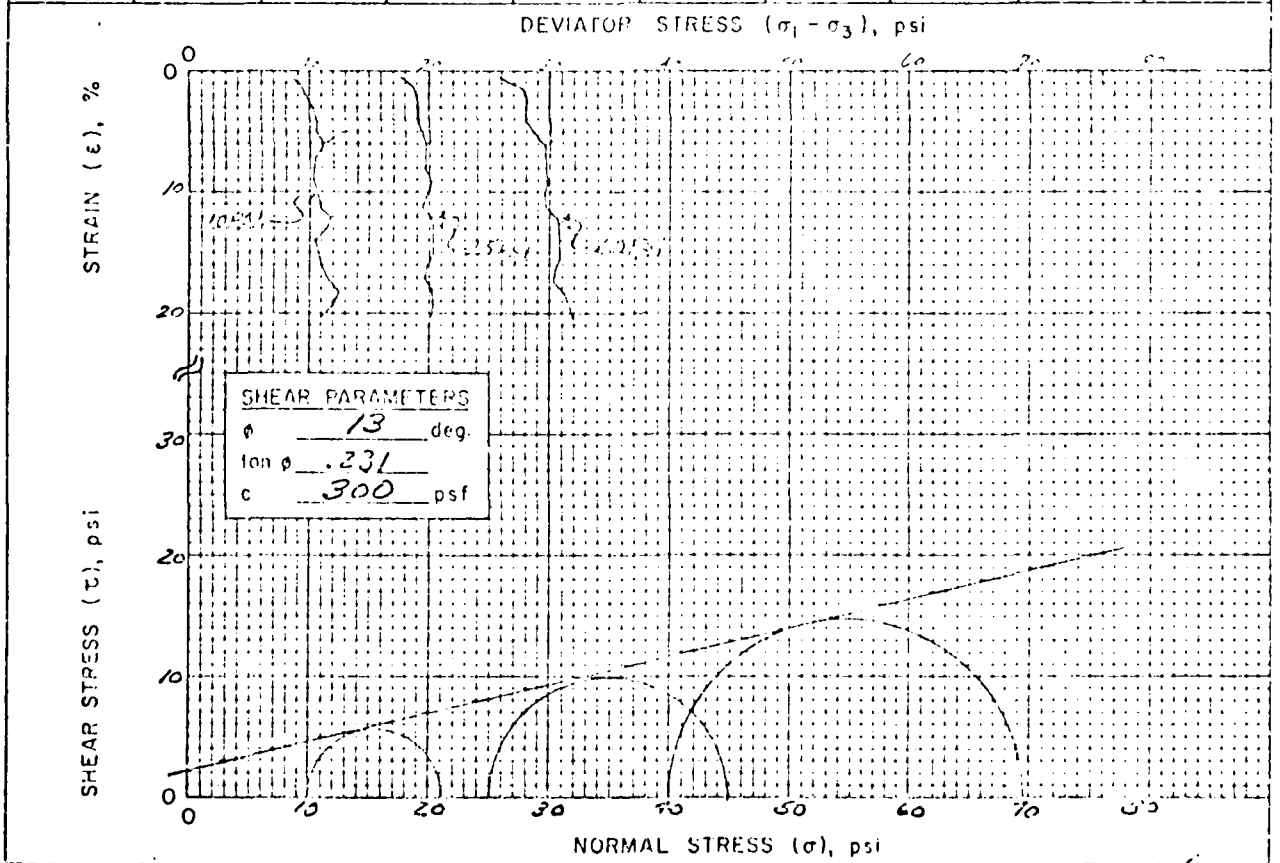
SPECIMEN DATA

HEIGHT 5.0 "; DIAMETER 2.8 "
MATERIALS TESTED PASSED [illegible] SIEVE
METHOD OF PREPARATION [illegible]
COMPACTION AT 1152.5
MOLDING MOISTURE 26.9 %
MOLDED AT 96.5% OF γ_d MAXIMUM

TYPE OF TEST

UU ☐
CU ☐
$\overline{CU}$ ☒
CD ☐

DRY DENSITY INITIAL pcf ☐ g/cc ☐	DRY DENSITY CONSOLIDATED pcf ☐ g/cc ☐	B PARAMETER	MOISTURE CONTENT, % START OF TEST	MOISTURE CONTENT, % DEG OF SAT AT START OF TEST	MOISTURE CONTENT, % END OF TEST	TIME OF CONSOLIDATION (hrs)	MINOR PRINCIPAL STRESS σ_3 (psi)	DEVIATOR STRESS $\sigma_1 - \sigma_3$ (psi)	AXIAL STRAIN AT FAILURE, ε (%)
82.3		0.92	27.3		32.2	16.08	10	11.1	6.0
89.7		0.95	26.0		28.8	15.92	25	19.8	6.0
88.5		0.95	27.4		27.2	15.67	40	29.6	6.3



REMARKS BACK-PRESSURED

SCS-PIG-YY816-711
FILE COPY PIG-27

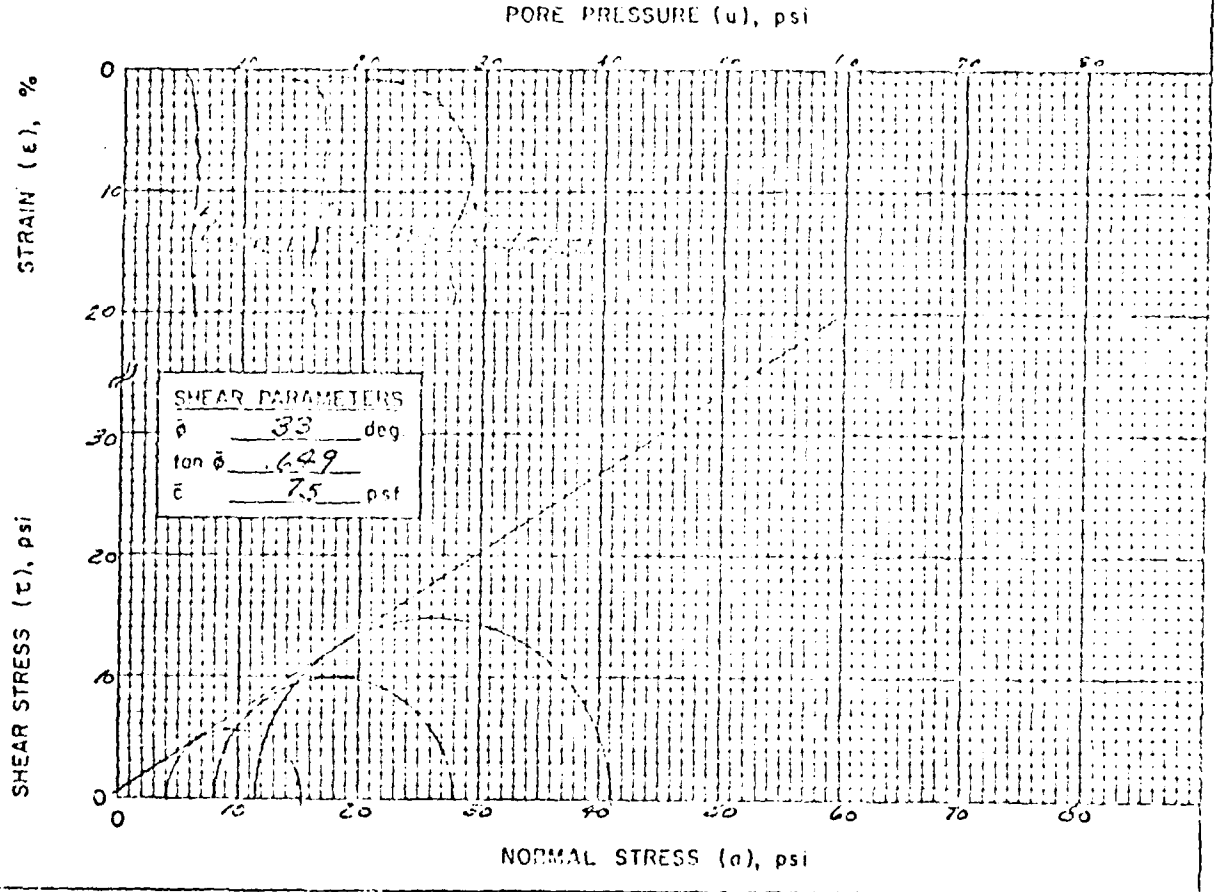
LABORATORY NO. 216-YY-006

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	TRIAXIAL SHEAR TEST with pore pressure measured

PROJECT and STATE: Lacy Creek, Site 3, Missouri — SAMPLE LOCATION: Auger Boring

TYPE OF SAMPLE: Undisturbed — TESTED BY: Sue Lissack — APPROVED BY: — DATE:

MINOR PRINCIPAL STRESS, σ_3 (psi)	PORE PRESSURE, u (psi)	EFFECTIVE MINOR PRINCIPAL STRESS, $\bar{\sigma}_3$ (psi)	DEVIATOR STRESS, $\sigma_1 - \sigma_3$ (psi)	FAILURE CRITERIA	AXIAL STRAIN AT FAILURE, ϵ (%)
10	5.9	4.1	11.1		6.0
26	16.9	8.1	19.8		6.0
40	28.5	11.5	29.6		6.3



REMARKS BACK-PRESSURED

SCS-ENG-332 (REV. 3-70)
FILE CODE: ENG-22

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Locust Creek #F-3, Missouri

FIELD SAMPLE NO.	LOCATION	DEPTH
201-2	Emer. Spwy. 1450' ℄ Dam	5.5'-5.5'

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
	SNAL-LINCOLN		

CLASSIFICATION CH LL 58 PI 32

MAX. PARTICLE SIZE INCLUDED IN TEST #4 "

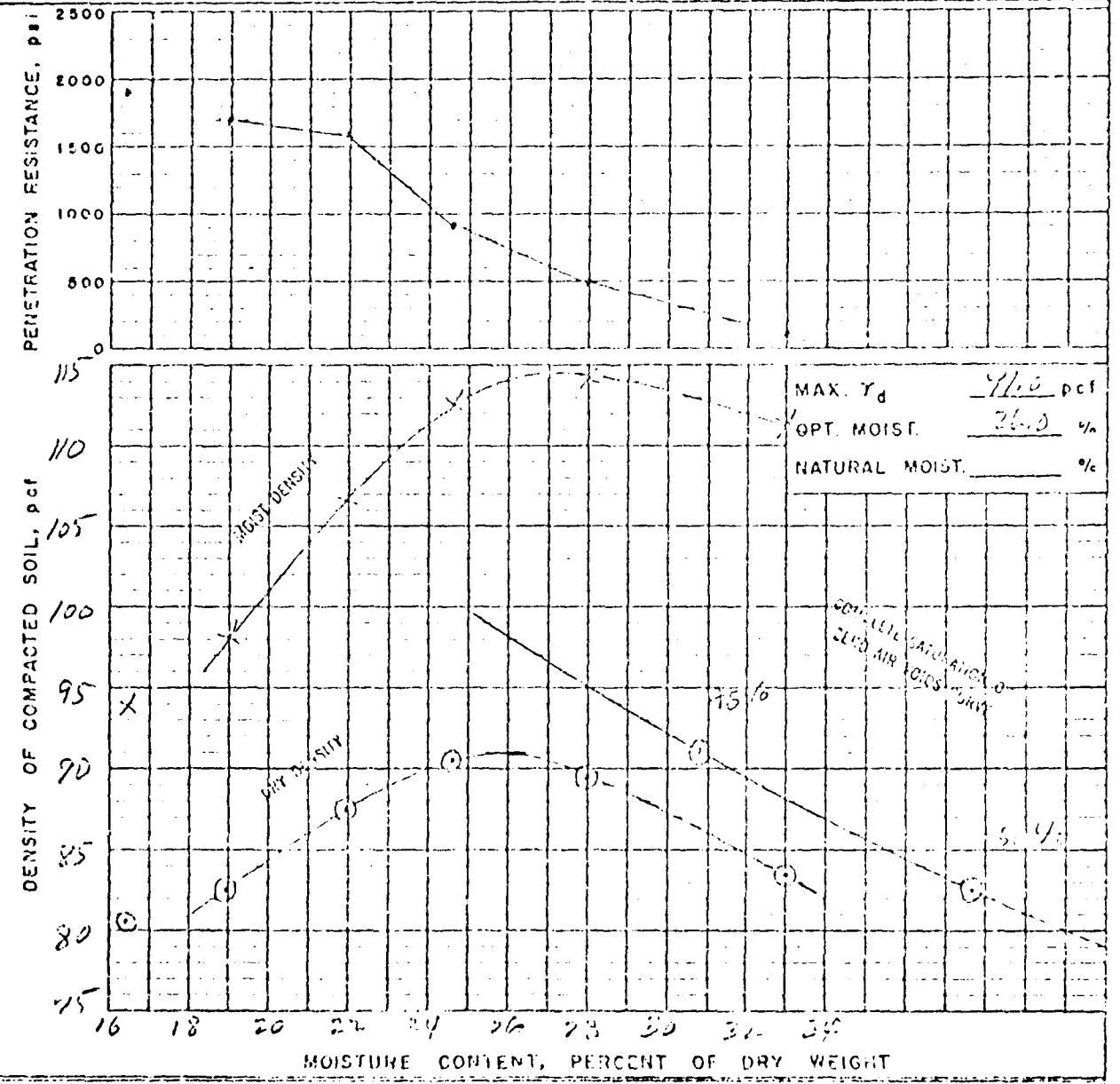
SPECIFIC GRAVITY (G_s) { MINUS NO 4 2.65 / PLUS NO. 4 }

CURVE NO. 1 OF 4

STD (ASTM D-698) [-]; METHOD A

MOD (ASTM D-1557) [ ]; METHOD

OTHER TEST [ ] (SEE REMARKS)



REMARKS

SCS-ENG-352 (REV. 3-70)
FILE CODE ENG-22

LABORATORY NO. 74W776

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Lost Creek #F-3 Missouri

FIELD SAMPLE NO	LOCATION	DEPTH
201-3	Emer. spwy. 1+50 ℄ Dam	5.5'-7.5'

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
	SOIL-LINCOLN		

CLASSIFICATION GC LL 56 PI 30

MAX. PARTICLE SIZE INCLUDED IN TEST 2 3/4"

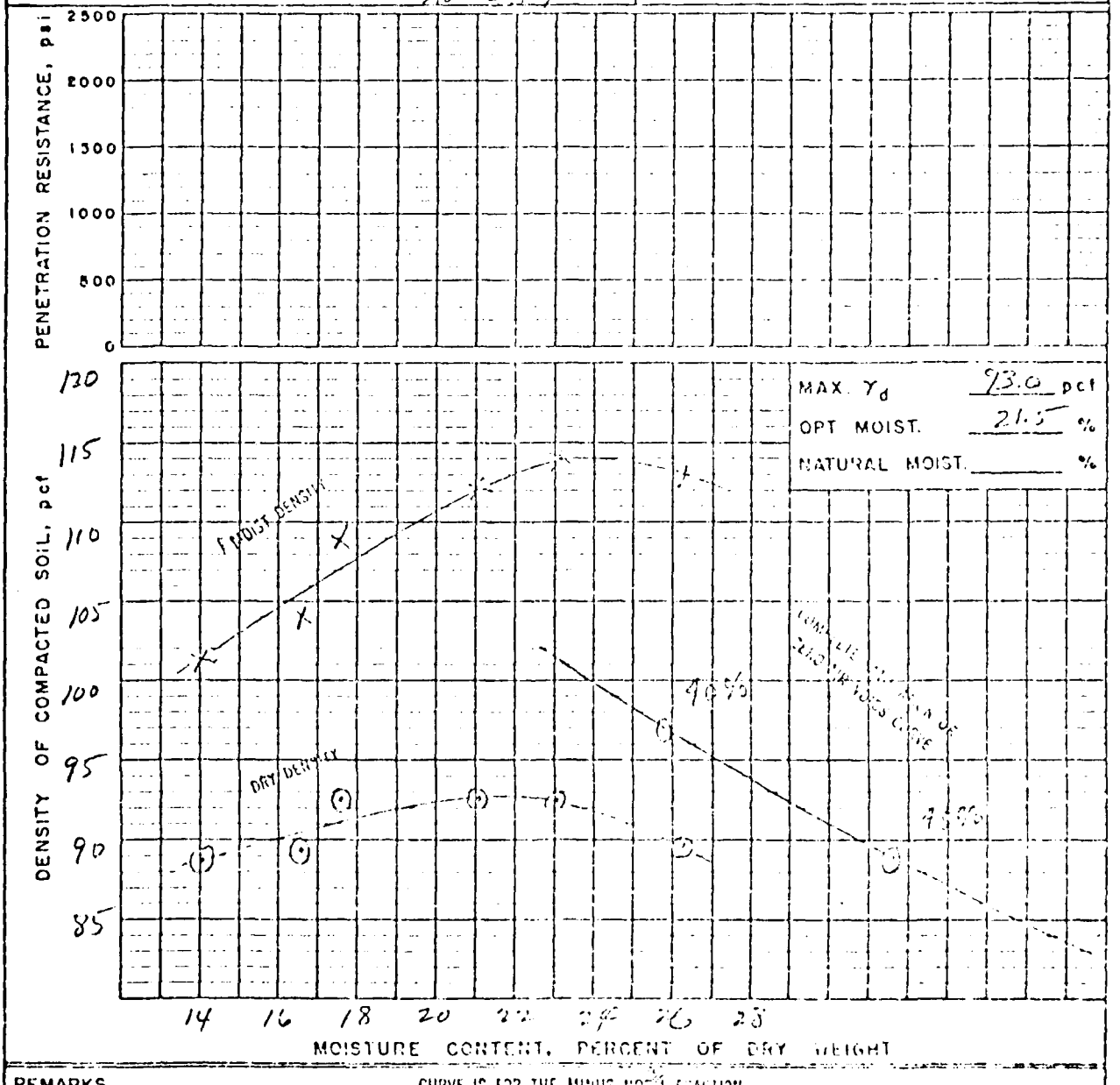
SPECIFIC GRAVITY (G_s) { MINUS NO 4 2.65 / PLUS NO. 4 2.63 / AV. 2.64

CURVE NO. 2X OF 4

STD (ASTM D-698) [X]; METHOD C

MOD (ASTM D-1557) [ ]; METHOD

OTHER TEST [ ] (SEE REMARKS)



REMARKS

CURVE IS FOR THE MINUS NO. 4 FRACTION

GRADATION OF TOTAL SAMPLE

< NO. 200 44 %; < NO. 4 61 %; < 3 IN. 100 %

SCS-ENG-352 (REV. 3-70)
FILE CODE ENG-22

LABORATORY NO. 70W777

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Lost Creek WF-3, Missouri

FIELD SAMPLE NO	LOCATION	DEPTH
101-2	Borrow, 35' U.S. B 2+20	3.5'-5.5'

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
	SML-LINCOLN		

CLASSIFICATION CH LL 54 PI 32 CURVE NO. 3X OF 4

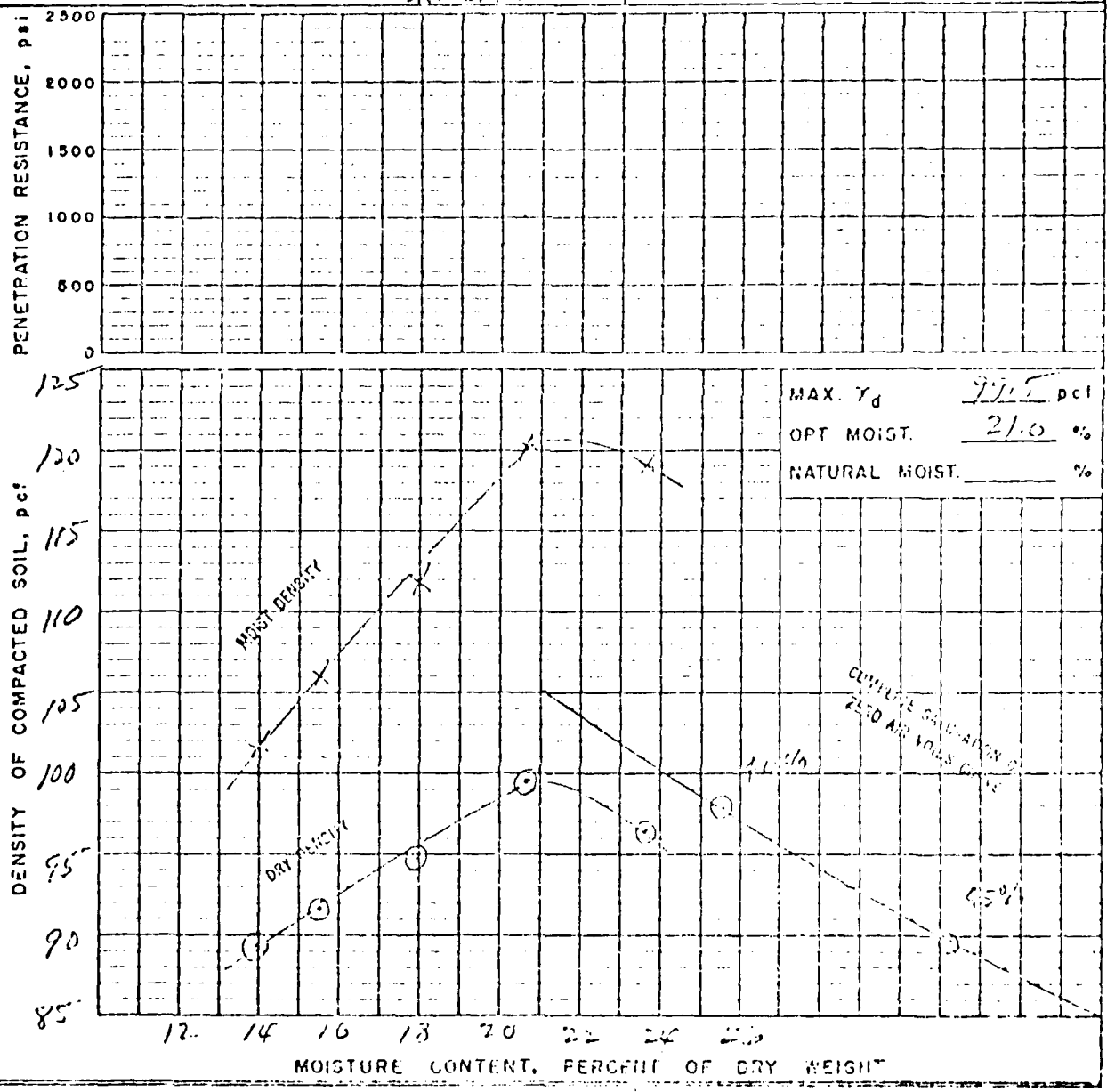
MAX. PARTICLE SIZE INCLUDED IN TEST < 3 "

SPECIFIC GRAVITY (G_s) { MINUS NO 4 2.63 ; PLUS NO. 4 2.36 ; AV. 2.61 }

STD (ASTM D-698) [X]; METHOD C

MOD (ASTM D-1557) [ ]; METHOD ____

OTHER TEST [ ] (SEE REMARKS)



REMARKS

CURVE IS FOR THE MINUS NO. 4 FRACTION

GRADATION OF TOTAL SAMPLE

< NO. 200 71 %; < NO. 4 83 %; > 3" 10 %

SCS-ENG-35 (REV. 3-70)
FILE COPY ENG-22

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Lost Creek #F-3, Missouri

FIELD SAMPLE NO	LOCATION	DEPTH
LC-2-1	Borrow, 10' US, B 1+50	1'-6.5'

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
	SIAL-LINCOLN		

CLASSIFICATION GC LL 33 PI 12 CURVE NO. 11 OF 11

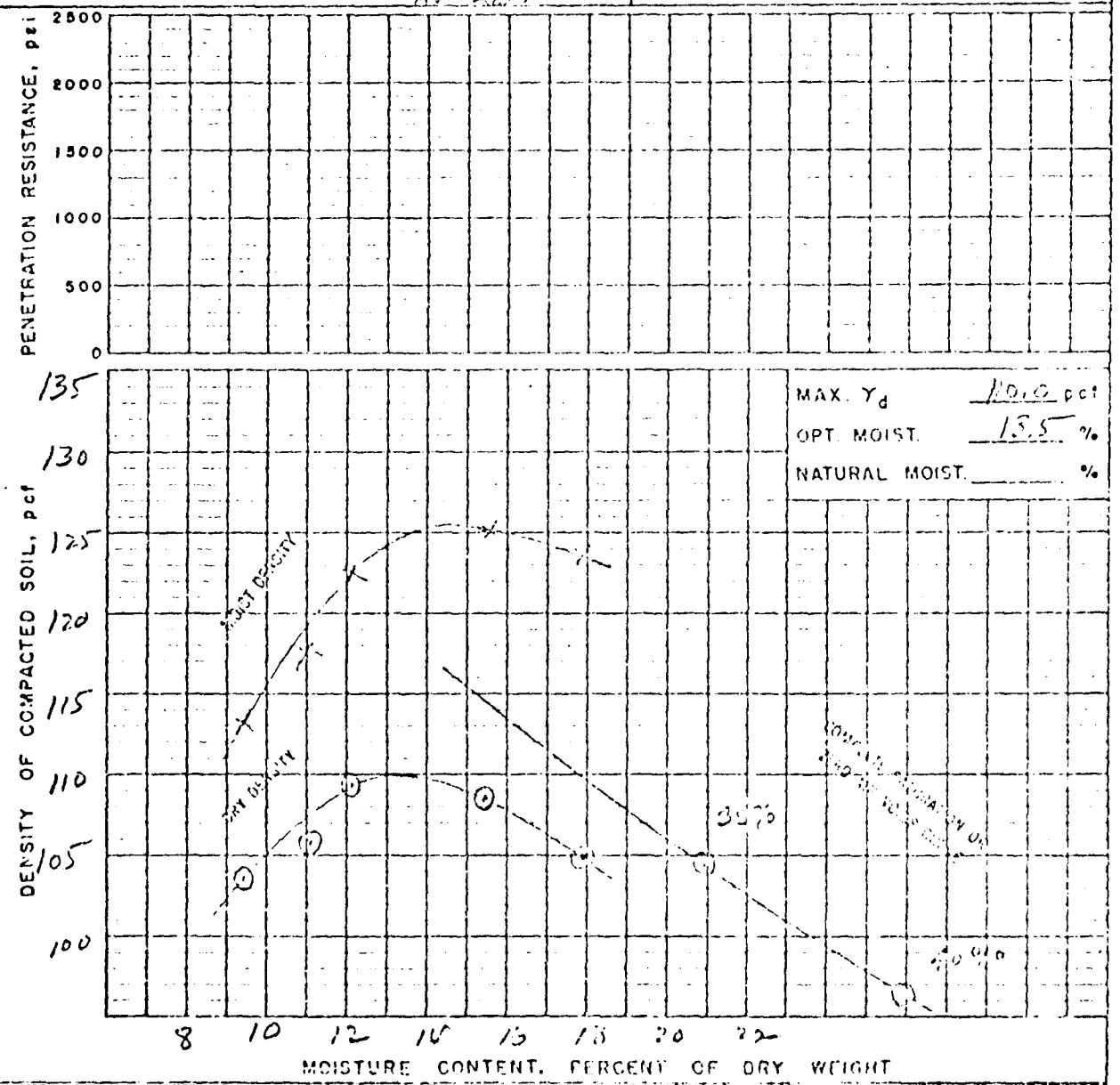
MAX. PARTICLE SIZE INCLUDED IN TEST 2 3/4 "

SPECIFIC GRAVITY (G_s) { MINUS NO 4 2.65* / PLUS NO. 4 2.40 / AV. 2.57

STD (ASTM D-698) [X]; METHOD C

MOD (ASTM D-1557) [ ]; METHOD

OTHER TEST [ ] (SEE REMARKS)



REMARKS

CURVE IS FOR THE MINUS 1 1/2" FRACTION

GRADATION OF TOTAL SAMPLE

< NO. 200 31 % < NO. 4 45 % < 3" IS 100 %

Form SCS 357
Rev. 6-65

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SUMMARY - SLOPE STABILITY ANALYSIS

PROJECT and STATE	DATE
LOST CREEK #F-3 MISSOURI	1-9-76

METHOD OF ANALYSIS	ANALYZED AT	APPROVED BY
ICES	S.M.L. LINCOLN, NE.	

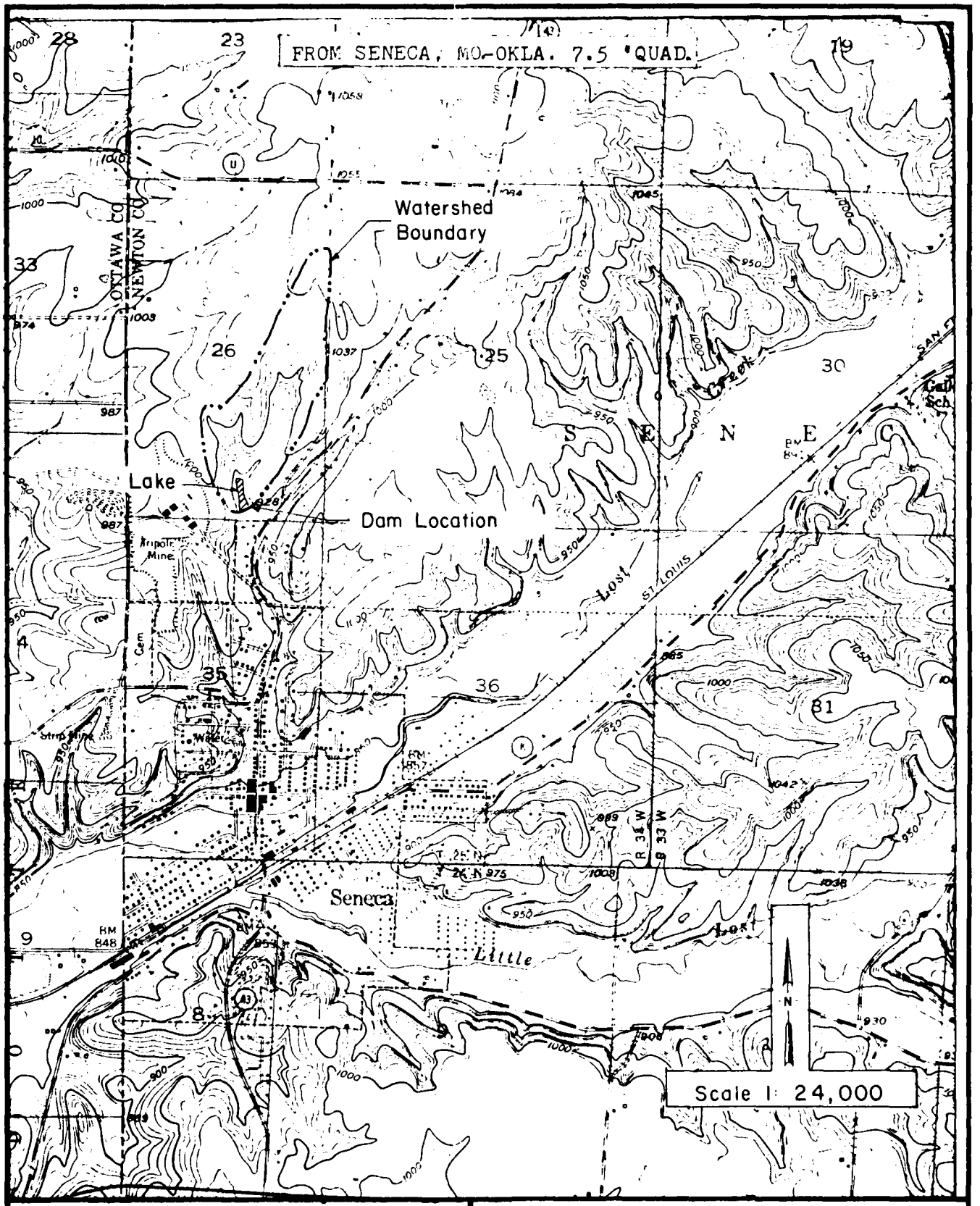
	SOURCE AND USE OF MATERIALS	CLASSIFICATION	γ_d (pcf)	γ_m (pcf)	γ_{sat} (pcf)	γ_{sub} (pcf)	ϕ (deg)	$\tan \phi$	c (psf)	REMARKS
			ADOPTED DESIGN DATA							
①	Embankment	GC	93.8	112.0	119.5	57.0	13	.231	300	
②							33	.649	75	
③										
④										
⑤										
⑥										
⑦										
⑨										

TRIAL NO.	SLOPE	CONDITIONS: Upstream - Fulldrawdown; Downstream - Steady Seepage	F_s	F_s
		Maximum Section @ Station 1+75	Bishop	Simple Circle
1Up	2½:1	Embank. (13°-300) only, 10' berm @ elev. 43.9.	1.23	1.26
2Up	2½:1	Embank. (13°-300) only, 10' berm @ elev. 43.3.	1.35	1.31
3Up	2½:1	Embank. (33°-75) only, 10' berm @ elev. 43.9.	1.37	1.39
4Dn	2½:1	Embank. (13°-300) only.	1.29	1.13
5Dn	2½:1	Embank. (13°-300) only, 10' berm @ elev. 44.0.	1.43	1.42
6Dn	2½:1	Embank. (33°-75) only, 10' berm @ elev. 44.0.	1.70T	1.63

Sheet 1 of 2

APPENDIX C

Overtopping Analysis



LAKE AND WATERSHED MAP

HANSON ENGINEERS

SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

Newton County Structure F-3 Dam
Newton County, Missouri
Mo. I.D. No. 20514

Sheet 1, Appendix C

APPENDIX C

HYDROLOGIC AND HYDRAULIC ANALYSIS

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 hydrograph. The inflow hydrograph was then routed through the reservoir and spillway. The overtopping analysis was accomplished using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

The PMP was determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33". Reduction factors were not applied. The rainfall distribution for the 24 hour PMP storm duration was assumed according to the procedures outlined in EM 1110-2-1411 (SPD Determination).

The synthetic unit hydrograph for the watershed was developed by the computer program using the SCS method. The parameters for the unit hydrograph are shown in Table 1 (Sheet 4, Appendix C).

The SCS curve number (CN) method was used in computing the infiltration losses for rainfall-runoff relationship. The CN values used, and the result from the computer output, are shown in Table 2 (Sheet 5, Appendix C).

The reservoir routing was accomplished by using the Modified Puls Method. The hydraulic capacity of the spillway was used as an outlet control in the routing. The hydraulic capacity of the spillway and the storage capacity of the reservoir were defined by the elevation-surface area--storage-discharge relationships shown in Table 3 (Sheet 6, Appendix C). This dam has been designed for flood control purposes, and the water surface elevation is maintained below the principal spillway invert elevation. To consider the effect of the reservoir storage, an antecedent storm of 25 percent and 50 percent of the PMF was considered (assuming the reservoir at the sedimentation pool elevation 943.8) to determine the starting reservoir elevation for the routing of 50 percent and 100 percent of the PMF respectively. The antecedent storms were assumed to occur four days prior to their corresponding storm. Both antecedent storms will fill the reservoir beyond the emergency spillway level, but at the end of the four days, the reservoir will reduce to the sedimentation pool level since the principal spillway is unregulated. Thus, the final routing analysis was accomplished considering the starting reservoir level at the principal spillway invert elevation 943.8 (sedimentation pool).

The result of the routings of the PMF ratios indicate that the dam will pass the 1 percent probability flood without overtopping the dam.

The rating curve for the spillways (see Table 4, Sheet 6, Appendix C) was determined assuming orifice flow for the principal spillway and channel flow for the emergency spillway.

The flow over the crest of the dam during overtopping was determined using the non-level dam option ($L and $V cards) of the HEC-1 program. The program assumed critical flow over a broad-crested weir.

A summary of the routing analysis for different ratios of the PMF is shown in Table 5 (Sheet 7, Appendix C).

The computer input data, a summary of the output data, and a plot of the inflow-outflow hydrograph for the PMF are presented on Sheets 8, 9 and 10 of Appendix C.

TABLE 1

SYNTHETIC UNIT HYDROGRAPH

Parameters:

Drainage Area (A)	0.14 sq. miles
Length of Watercourse (L)	0.70 miles
Difference in elevation (H)	121 feet
Time of concentration (Tc)	0.29 hours
Lag Time (Lg)	0.17 hours
Time to peak (Tp)	0.21 hours
Peak Discharge (Qp)	323 cfs
Duration (D)	5 min.

Time (Min.)(*)	Discharge (cfs)(*)
0	0
5	97
10	294
15	302
20	189
25	95
30	51
35	27
40	14
45	7
50	4
55	2
60	1

(*) From the computer output

FORMULA USED:

$$Tc = \left(\frac{11.9\ L^3}{H}\right)^{0.385}$$

$$Lg = 0.6\ Tc$$

$$Tp = \frac{D}{2} + Lg$$

$$Qp = \frac{484\ A.Q}{Tp} \qquad Q = \text{Excess Runoff} = 1 \text{ inch}$$

TABLE 2

RAINFALL-RUNOFF VALUES

Selected Storm Event	Storm Duration (Hours)	Rainfall (Inches)	Runoff (Inches)	Loss (Inches)
PMP	24	35.49	33.50	1.99

Additional Data:

1) Soil Conservation Service Soil Group B
2) Soil Conservation Service Runoff Curve CN = 85 (AMC III) for the PMF
3) Soil Conservation Service Runoff Curve CN = 71 (AMC II) for the 1 percent chance flood
4) Percentage of Drainage Basin Impervious 2 percent

TABLE 3

ELEVATION, SURFACE AREA, STORAGE AND DISCHARGE RELATIONSHIPS

Elevation (feet-MSL)	Lake Surface Area (acres)	Lake Storage (acre-ft)	Spillway Discharge (cfs)
926.0	0	0	-
*943.8	1.3	8.4	0
950.0	2.4	20	14
956.3	4.3	41.5	19
960.0	6.4	60	872
**961.3	6.5	67	1502
965.0	7.0	92	-
970.0	15.6	165	-

*Principal spillway crest elevation
**Top of dam elevation

The above relationships were developed using data from the SCS plans and the U.S.G.S., Seneca, MO.-OKLA. 7.5 minute quadrangle map.

TABLE 4

SPILLWAYS RATING CURVE

Reservoir Elevation	Primary Spillway	Emergency Spillway	Total Discharge
Ft(MSL)	cfs	cfs	cfs
943.8	0	-	0
946.0	8	-	8
956.4	19	0	19
956.9	19	29	48
957.9	20	185	205
958.4	20	300	320
958.9	21	444	465
959.9	22	805	827
960.9	23	1238	1261
961.0	23	1288	1311
*961.3	23	1479	1502
962.9	24	2350	2374
963.9	25	3000	3025

*Top of dam elevation

METHOD USED:

1) Principal Spillway: assuming orifice flow

$Q = C.A.(2g.h)^{1/2}$

Q = Discharge in c.f.s.

C = Discharge coefficient = 0.60

A = Opening area in ft^2 (9" x 18")

g = Acceleration of gravity = 32.2 ft/sec^2

h = Head from reservoir elevation to the center of the opening (in ft)

2) Emergency Spillway: Assuming open channel flow.
Using charts from "UD Method of Reservoir Flood Routing", S.C.S. Technical Release No. 35, February 1967.

TABLE 5

RESULTS OF FLOOD ROUTINGS

Ratio of PMF	Peak Inflow (CFS)	Peak Lake Elevation (ft.-MSL)	Total Storage (AC.-FT.)	Peak Outflow (CFS)	Depth (ft.) Over Top of Dam
-	-	*943.8	8	0	-
0.10	176	951.7	26	14	-
0.20	353	956.9	44	45	-
0.25	441	957.2	46	98	-
0.30	529	957.9	50	214	-
0.35	617	958.6	53	364	-
0.40	705	959.0	55	489	-
0.50	882	959.5	57	679	-
0.75	1322	960.5	63	1075	-
1.00	1763	**961.3	67	1494	0

* Principal spillway crest elevation
**Top of dam elevation

The dam and spillway will be capable of holding and passing 100 percent of the PMF without overtopping the dam.

```
A       OVERTOPPING ANALYSIS FOR NEWTON COUNTY STRUCTURE F-3 DAM ( # 2 )
A       STATE ID NO. 20514  COUNTY NAME : NEWTON
A       HANSON ENGINEERS INC. DAM SAFETY INSPECTION JOB # 8083001
B    300                5
B1     5
J      1        9        1
J1   .10      .20      .25      .30      .35      .40      .50      .75      1.0
K      0        1                                  3        1
K1       INFLOW HYDROGRAPH COMPUTATION **
M      1        2     0.14               0.14        1                            1
P      0     27.3      102      120      130
T                                                                -1      -85              0.02
U2  0.29     0.17
X      0       -.1        2
K      1        2                                 0        4        1
K1       RESERVOIR ROUTING BY MODIFIED PULS AT DAM SITE **
Y                                         1        1
Y1     1                                                        8.4       -1
Y4 943.8    946.0    956.4    956.9    957.9    958.4    958.9    959.9    960.9    961.0
Y4 961.3    962.9    963.9
Y5     0        8       19       48      205      320      465      827     1261     1311
Y5  1502     2374     3025
$S   8.4       20     41.5       60       67       92
$E 943.8    950.0    956.3    960.0    961.3    965.0
$$ 943.8
$D 961.3
$L     0       80      110      235      280      280      280      280
$V 961.3    961.7    961.8    962.0    962.2    963.0    964.0    965.0
K     99
```

PMF Ratios
Input Data

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

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

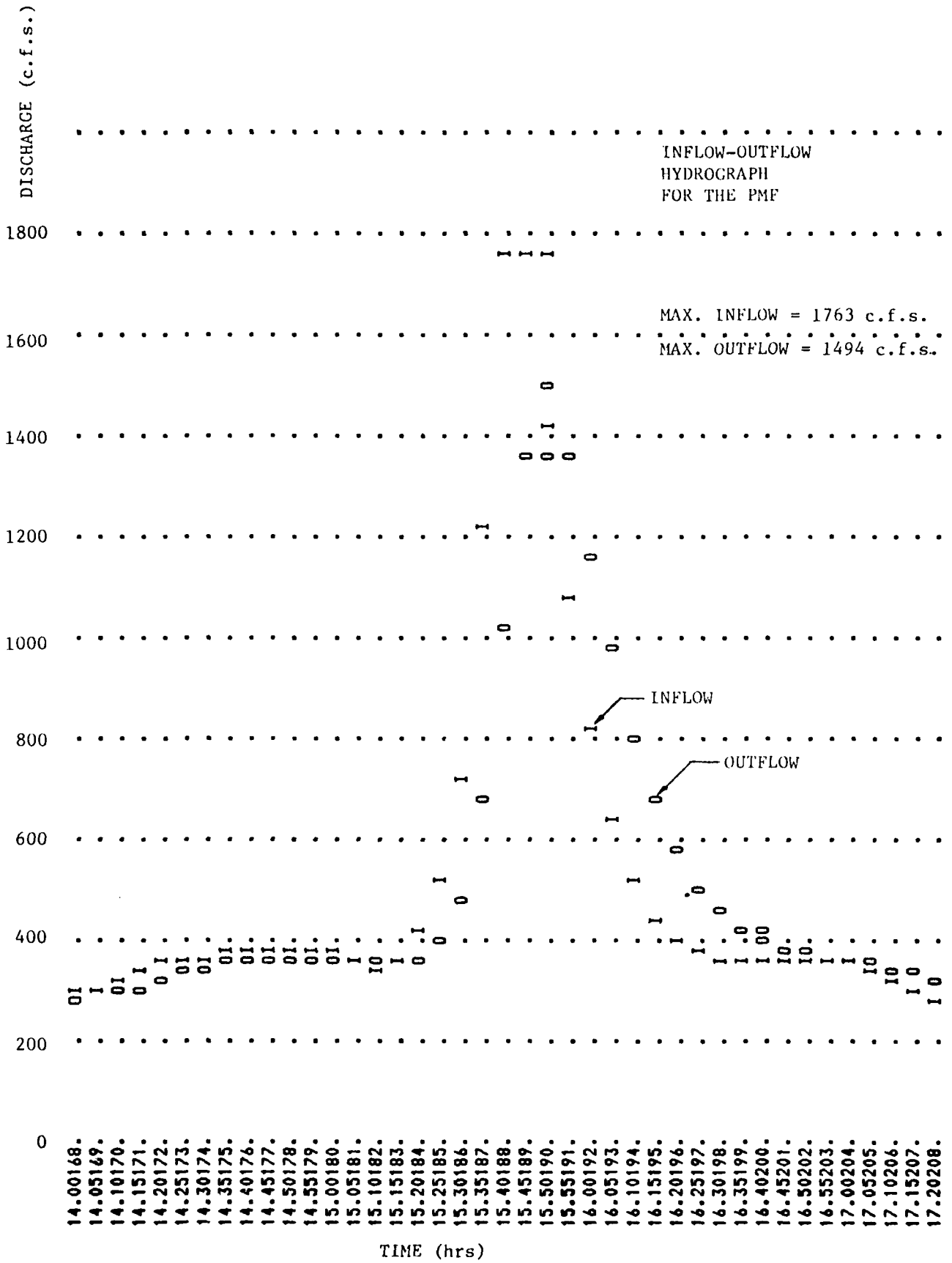
OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				0.10	0.20	0.25	0.30	0.35	0.40	0.50	0.75	1.00
HYDROGRAPH AT	1	0.14	1	176.	353.	441.	529.	617.	705.	882.	1322.	1763.
	(	0.36)	(	4.99)(	9.99)(	12.48)(	14.98)(	17.48)(	19.97)(	24.97)(	37.45)(	49.93)
ROUTED TO	2	0.14	1	14.	45.	98.	214.	364.	489.	679.	1075.	1494.
	(	0.36)	(	0.40)(	1.29)(	2.77)(	6.06)(	10.32)(	13.84)(	19.23)(	30.44)(	42.31)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	943.80	943.80	961.30
STORAGE	8.	8.	67.
OUTFLOW	0.	0.	1502.

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
0.10	951.70	0.00	26.	14.	0.00	18.42	0.00
0.20	956.86	0.00	44.	45.	0.00	18.08	0.00
0.25	957.22	0.00	46.	98.	0.00	16.33	0.00
0.30	957.94	0.00	50.	214.	0.00	16.08	0.00
0.35	958.55	0.00	53.	364.	0.00	15.92	0.00
0.40	958.97	0.00	55.	489.	0.00	15.92	0.00
0.50	959.49	0.00	57.	679.	0.00	15.83	0.00
0.75	960.47	0.00	63.	1075.	0.00	15.83	0.00
1.00	961.29	0.00	67.	1494.	0.00	15.83	0.00


DISCHARGE (c.f.s.)
INFLOW-OUTFLOW
HYDROGRAPH
FOR THE PMF
MAX. INFLOW = 1763 c.f.s.
MAX. OUTFLOW = 1494 c.f.s.
INFLOW
OUTFLOW
1800
1600
1400
1200
1000
800
600
400
200
0
14.00168.
14.05169.
14.10170.
14.15171.
14.20172.
14.25173.
14.30174.
14.35175.
14.40176.
14.45177.
14.50178.
14.55179.
15.00180.
15.05181.
15.10182.
15.15183.
15.20184.
15.25185.
15.30186.
15.35187.
15.40188.
15.45189.
15.50190.
15.55191.
16.00192.
16.05193.
16.10194.
16.15195.
16.20196.
16.25197.
16.30198.
16.35199.
16.40200.
16.45201.
16.50202.
16.55203.
17.00204.
17.05205.
17.10206.
17.15207.
17.20208.
TIME (hrs)

APPENDIX D

Photographs

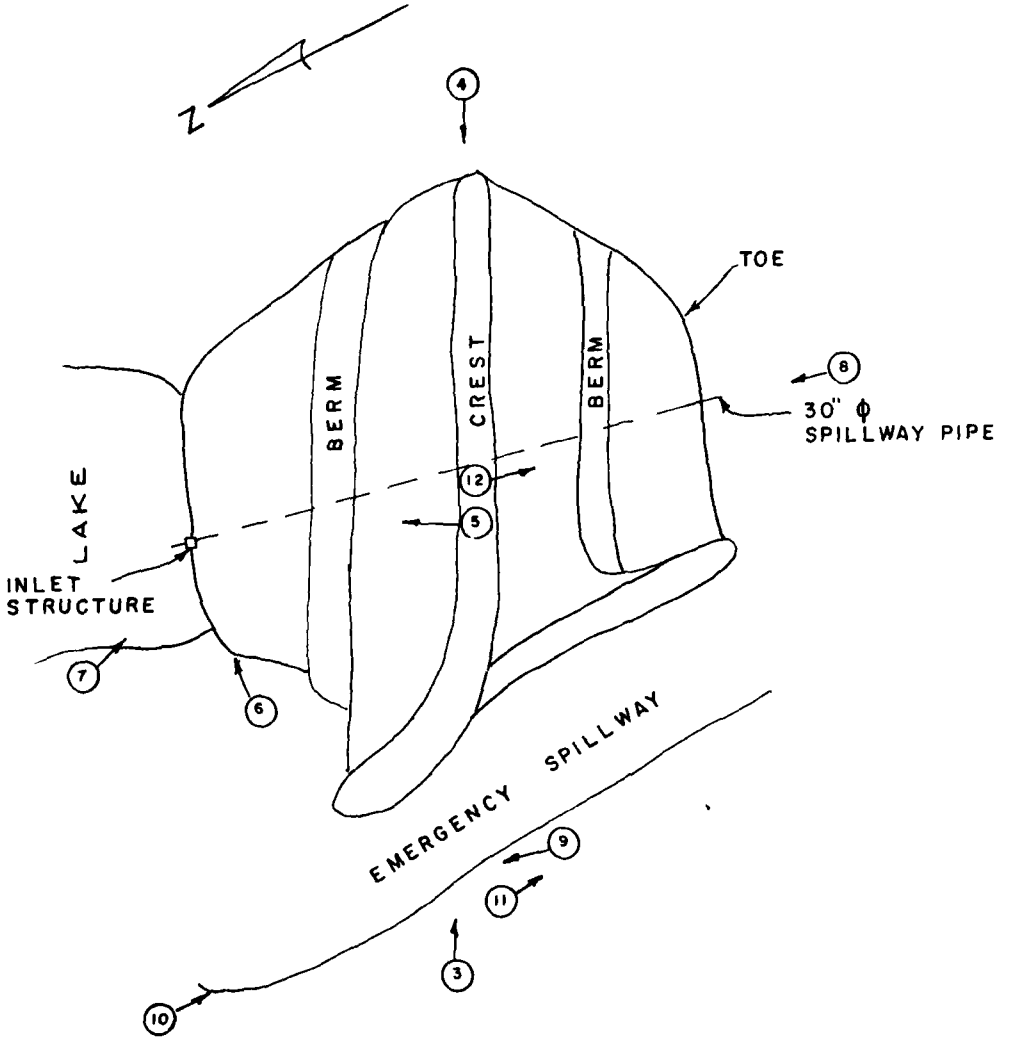
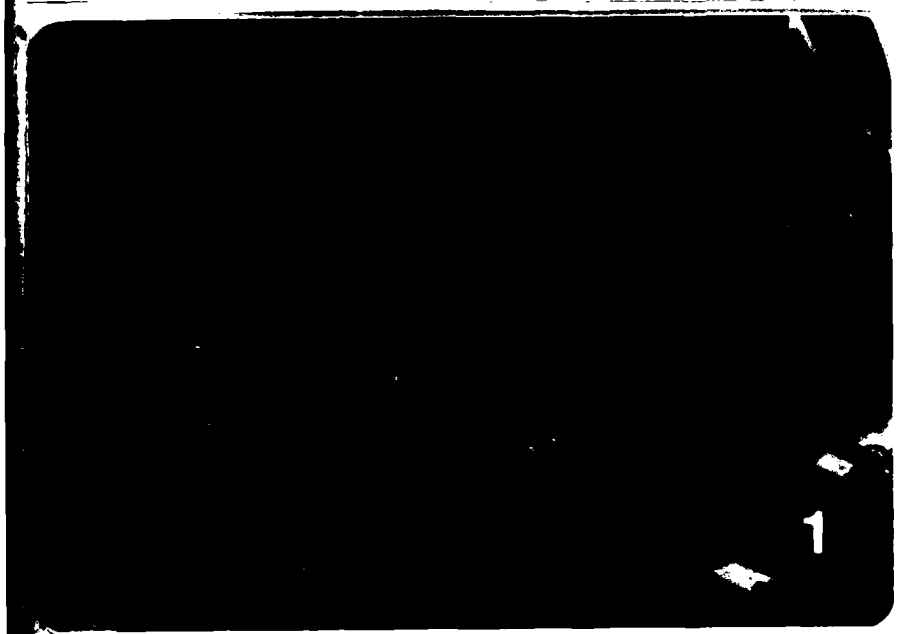


PHOTO INDEX

STRUCTURE F-3
MO. No. 20514

LIST OF PHOTOGRAPHS

Photo No.	Description
1	Aerial View of Dam
2	Aerial View of Dam and Downstream Hazard
3	Crest of Embankment (Looking East)
4	Crest of Embankment (Looking West)
5	Upstream View from Crest (Looking North)
6	View of Inlet Structure (Looking Northeast)
7	Closeup of Inlet Structure (Looking Southeast)
8	View of Spillway Pipe Oulet (Looking North)
9	Upstream View of Emergency Spillway (Looking Northeast)
10	Downstream View of Emergency Spillway (Looking South)
11	Downstream View of Emergency Spillway (Looking Southeast)
12	Downstream View from Crest (Looking South)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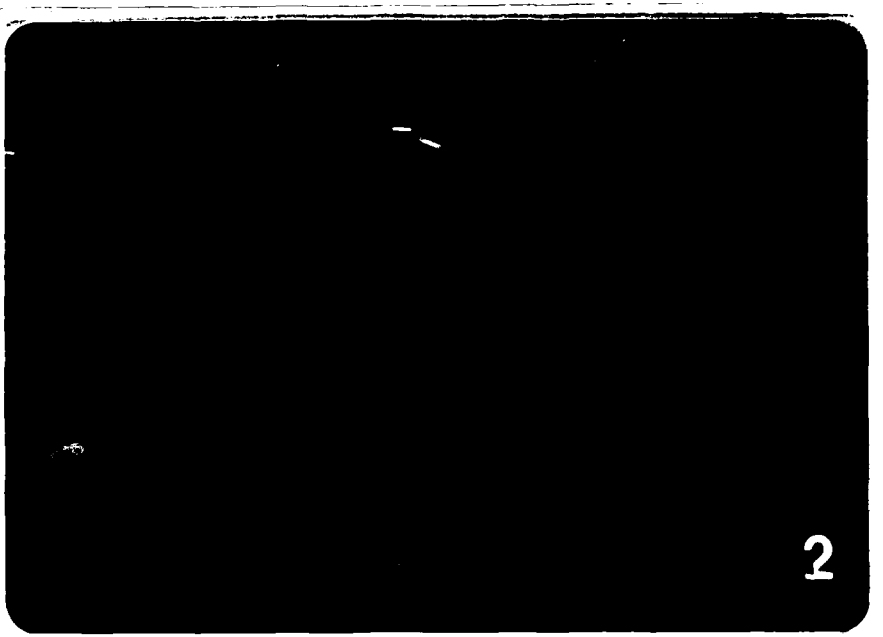
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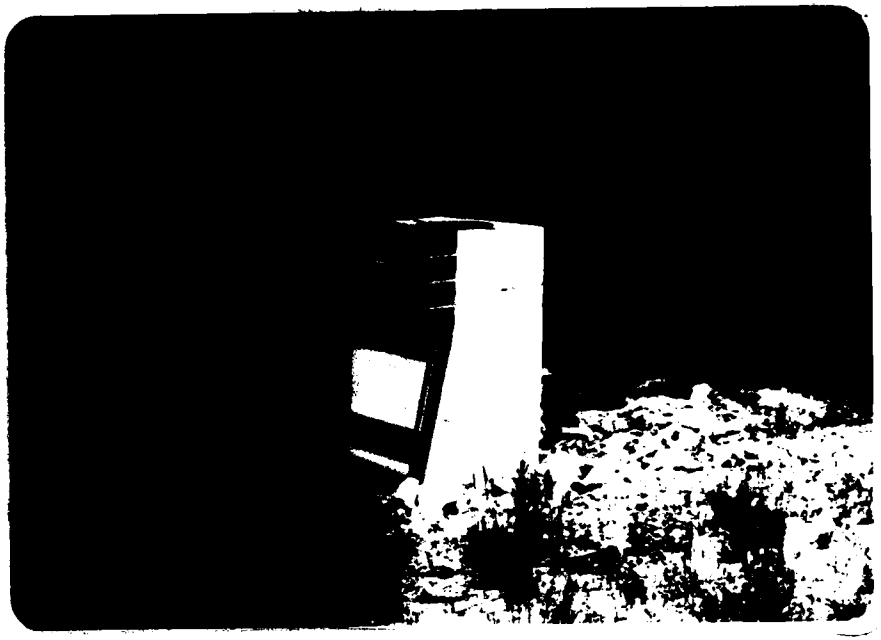
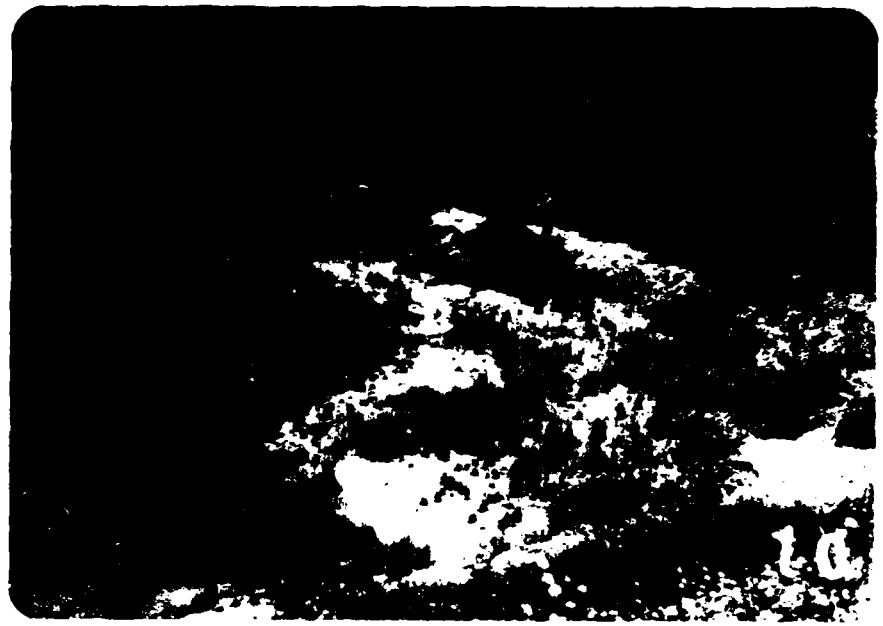
3


4

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11


12