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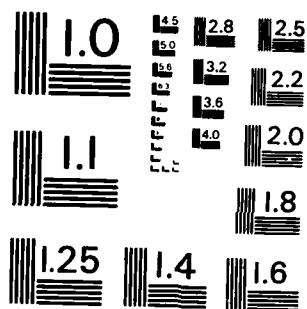
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EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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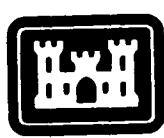
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SALT CREEK AND TRIBUTARIES, NEBRASKA

SITE 10

YANKEE HILL DAM AND LAKE

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**SALT CREEK AND TRIBUTARIES
YANKEE HILL DAM AND LAKE
SITE 10
DENTON, NEBRASKA**

EMBRACEMENT CRITERIA AND PERFORMANCE REPORT

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SALT CREEK AND TRIBUTARIES, NEBRASKA
SITE NO. 10
YANKEE HILL DAM AND LAKE
EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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**SALT CREEK AND TRIBUTARIES, NEBRASKA
SITE NO. 10
YANKEE HILL DAM AND LAKE**

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

Pertinent Data

1. Drainage Area 8.4 square miles

2. Reservoir Data

<u>Reservoir Level</u>	<u>Elevation (Ft., n.s.l.)</u>	<u>Gross Storage Capacity (Acre-Feet)</u>		<u>Surface Area (Acres)</u>
		<u>Initial</u>	<u>100-year</u>	
Maximum Pool	1267.8	10,300	8,866	600
Full Flood Control Pool	1262.0	7,500	6,066	525
Normal Operating Pool	1245.0	2,000	900	208
Sediment Storage Capacity	—	1,434	—	208

3. Embankment

Type	Homogeneous, Rolled Earth
Maximum Height above Streambed	60 Feet
Height above Valley Floor	45 Feet
Crest Elevation	1270.0 Feet n.s.l.
Crest Width	15 Feet
Crest Length	3100+ Feet
Slopes: Upstream and Downstream	1V on 3H, Above El. 1247.0 1V on 4H, Below El. 1247.0
Compacted Fill Quantities	502,000 C.Y.
Slope Protection	Grassed
Wave Erosion Protection	Riprap
Downstream Seepage Control	Pervious Chimney Drain w/Intermittent Outlets

4. Emergency Spillway

Type	Uncontrolled Grassed Earth Channel
Crest Elevation	1262.0 Feet n.s.l.
Width (Bottom)	400 Feet
Length	1100 Feet
Side Slopes	1V on 3H
Excavation Quantity	Approx. 224,000 C.Y.
Crest Length	200 Ft.

5. Outlet Works

Type Inlet	Concrete Drop
Low Level Gated Opening El.	1237.0 m.s.l.
Gate Size and Type	1 - 3' X 3' Slide w/Hand Operated Lift
Low Level Outlet (Perm. Pool)	1245.0 m.s.l.
No. Perm. Pool Openings and Size	2 - 1' X 2.5'
High Level Outlet (Norm. Flood Pool) El.	1250.0 m.s.l.
No. High Level Openings and Size	2 - 1.4' X 5.25'
Conduit Type, Size and Length	1 - 42" Ø CMP X 300' Long
Seepage Control	3 Seepage Diaphragms
Invert Elevation at Intake	1227.5 Feet m.s.l.
Invert Elevation at Outlet End	1218.0 Feet m.s.l.
Stilling Basin	None

6. Outlet Channel

Width (Bottom)	10 Feet
Length	800 Feet
Side Slopes	1V on 3H
Discharge Capacity	540 c.f.s.

7. Downstream Discharge. The maximum discharge downstream from the reservoir is 176 c.f.s. for the Reservoir Design Flood (maximum pool elevation 1262.0 feet m.s.l.) which is well within the bankfull capacity of 540 c.f.s. In the event of a probable maximum flood occurrence, the maximum outflow would be 12,200 c.f.s. for a maximum pool elevation of 1267.8 and would exceed the downstream capacity for a period of several days.

8. References. For additional information and description on the construction background and operational data and procedures regarding this dam and lake, reference is made to the "Yankae Hill Dam and Reservoir Site 10, Operation and Maintenance Manual," dated September 1969; "Design Memorandum No. MSC-18, Dam and Reservoir Site 10," dated May 1964; and the "Periodic Inspection Reports No. 1 and 2," dated April 1974, and October 1979, respectively.

APPENDIX A - DRAWINGS

<u>Plate No.</u>	<u>Title</u>
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A2	General Plan and Area Use
A3	Spillway - Profile, Sections and Details
A4	Embankment - Plan and Excavation
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A6	Embankment - Drain Profile and Sections
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A20	Piezometer Installation and Water Stage Recorder
A21	Reservoir Elevations and Piezometer Observations
A22	Water Stage Recorder Details

NOTE: Many of the Plates used are the original Construction Plates and contain notes referring to the construction of the dam.

APPENDIX B - PHOTOGRAPHS

<u>Photo No.</u>	<u>Description</u>
1.	Aerial Photographs 1a and *1b.
2.	View of downstream embankment slope from right abutment.
3.	View of upstream embankment slope from right abutment.
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5.	View of upstream end of emergency spillway channel.
6.	View across spillway channel from left cut slope side.
7.	View of embankment crest road, gagehouse, intake structure, and downstream slope from the southeastern end of the embankment.
8.	View of intake tower structure and surrounding riprap.
*9.	View of intake tower.
*10.	View from crest of dam of outlet end of discharge conduit and downstream channel.
*11.	View of outlet end of discharge conduit.
12.	View of outlet end of discharge conduit and plunge pool.
13.	View of upstream slope riprap protection and rock berm.

* NOTE: These photographs were taken 12 October 1973, (pool el. 1251.7), one day after the highest pool elevation in the history of Site 10 was recorded. Pool elevation on 11 October 1973 was 1252.66, approximately 7.7 feet above normal operating pool.

SALT CREEK AND TRIBUTARIES, NEBRASKA
SITE NO. 10
YANKEE HILL DAM AND LAKE

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

1. INTRODUCTION.

1.1. Purpose of Report. This report provides a summary record of significant design, construction, and operational data on Yankee Hill Dam for use by engineers to familiarize themselves with the project, re-evaluate the embankment when unsatisfactory performance occurs, and provide guidance for designing comparable future projects. It was prepared in accordance with MRD-R 1110-1-8, subject: "Construction Foundation Reports and Embankment Criteria and Performance Reports," dated 27 February 1978 and ER 1110-2-1901, subject: "Embankment Criteria and Performance Reports," dated 1 August 1972.

1.2. Authorization and Purpose of Project. Public Law 85-500, 85th Congress, commonly referred to as the "Flood Control Act of 1958" authorized construction of the Salt Creek projects. It authorized construction of a flood control project on Salt Creek and Tributaries, Nebraska, essentially in accordance with the report of the Chief of Engineers contained in House Document 396, 84th Congress, 2nd Session. Yankee Hill Dam is one of the features of the authorized project. It is a part of the flood control system for the city of Lincoln and vicinity, and also provides a permanent lake for development of public recreation and for fish and wildlife conservation by the Nebraska Game and Parks Commission.

1.3. Location and Description of Project. Yankee Hill Dam is located in Lancaster County in the southeastern part of the State of Nebraska. It dams the Cardwell Branch, a tributary of Salt Creek, approximately 3-1/2 miles east and 1/2 mile south of Denton, Nebraska. See Plate A1. The project consists primarily of an earth embankment, a grassed emergency spillway, and an outlet works. Plates A2, A3 and A4 show the general location and main features of the dam. An aerial view of the completed project is shown in Photo 1, Appendix B. Yankee Hill Dam is one of ten Salt Creek dams designed and constructed by the Corps of Engineers.

1.4. Project Maintenance. Major repairs of the embankment, spillway, outlet works and channel are the responsibility of the Corps of Engineers. The State Game and Parks Commission is responsible for routine maintenance, such as repair of minor slope erosion, control of burrowing animals, and maintenance of grass cover. The State is also responsible for maintaining and operating the permanent pool for fish and wildlife conservation and for recreational purposes. Since 1980, Ft. Crook Area Forces have been conducting monthly inspections of the dam. In-depth periodic inspections as well as periodic surveys and reading of instrumentation facilities are conducted by the Corps of Engineers.

1.5. History of Project Design.

1.5.1. Survey Report. The initial recommendations for construction of a system of dams on tributaries of the Salt Creek were made in the "Survey Report on Flood Control for Salt Creek and its Tributaries, Nebraska and its Supplements," dated January 1953. This report formed the basis for Congressional authorization.

1.5.2. General Design. In December 1960, the "General Design Memorandum," No. MSC 1, was submitted to higher authority. The report updated the survey report in terms of economic feasibility and provided an overall general design of the multi-dam Salt Creek Project.

1.5.3. Final Design. Final design of Yankee Hill Dam (Site 10) is covered in Design Memorandum MSC-18, "Dam and Reservoir Site 10," May 1964. This report covers the design of all features pertinent to the project, which included an earthfill embankment, an emergency spillway, outlet works, and the necessary bridge, road and utility alterations.

1.6. History of Project Construction. Yankee Hill Dam (Site No. 10) was constructed by contract, under the supervision of the Corps of Engineers, Omaha District. The job was advertised on 5 March 1965 and the bids were opened on 13 April 1965. Scott Construction Company of Hickman, Nebraska was awarded the contract and given notice to proceed on 30 April 1965 with 220 calendar days to complete the project. The contract (No. 65/319) cost was

\$182,000 which was \$68,000 below the engineer's estimate. The project was completed on 30 November 1965. No unusual construction problems were encountered.

2. **GEOLOGY.** The Salt Creek drainage basin is located primarily in Lancaster County in eastern Nebraska and lies entirely within the Dissected Till Plains Section of the Central Lowlands Physiographic Province. Pleistocene deposits of glacial, interglacial and eolian origin overlie bedrock, which is at a maximum depth of over 200 feet, although in some localized areas the bedrock occurs at relatively shallow depths. Bedrock under the greater portion of the basin is the Dakota Group sandstone and shales of Cretaceous age, with some Permian limestone and shales in the southeastern portion of the basin and Pennsylvanian limestone and shales in the northeastern portion of Lancaster County. In this general area a typical section of the Pleistocene deposits in descending order are as follows: Peorian Loess Formation, Loveland (loess-clay) Formation, Kansan Glacial Drift, Aftonian (interglacial) Formation, and the Nebraskan Glacial Drift. In general, the Salt Creek basin is an eroded and dissected till plain which was covered by two eolian deposits, the Loveland (loess-clay) Formation and the Peorian Loess Formation. Post-Loveland erosion removed most of the Loveland and the remaining Loveland was subsequently covered by younger Peorian Loess. In many places, especially in the western half of the basin, all the loess, both the Loveland and Peorian, was removed by erosion exposing the underlying glacial drift. In a few local areas, notably in the eastern part of Seward County, southcentral and northeastern part of Lancaster County, and southeastern part of Saunders County, all of the Pleistocene deposits have been removed by erosion exposing the underlying bedrock.

3. **FOUNDATION INVESTIGATION.**

3.1. **Subsurface Exploration.** A total of 16 borings and 9 hand-augered holes were drilled to determine soil characteristics for general and specific design studies of this site. These consisted of 8 borings made along the alignment of the dam axis, 4 borings within the proposed spillway area, and

4 borings and 9 hand-augered holes within the proposed borrow areas. The locations of the drill holes are shown on Plate A4. Representative disturbed jar and moisture samples were taken from each boring at every change of material and at intervals not greater than five feet in depth. Representative undisturbed Shelby samples of foundation materials underlying the flood plain were obtained from holes 5, 6, 7, and 8. Standard penetration tests were performed during drilling operations for holes 6 and 7, with penetration values of the cohesive material ranging from a low of 5 to a high of 18 blows per foot. Sack samples were obtained of representative material from the spillway and borrow area holes and undisturbed samples of loess were obtained from abutment holes 3 and 4. Boring logs showing pertinent field and laboratory classification data are presented in profile on Plates A7 and A8. All samples were shipped to the Corps of Engineers, Missouri River Division Laboratory in Omaha, Nebraska for testing.

3.2. Foundation Conditions. The embankment in the valley is founded on alluvial and glacial drift material deposited in the underlying Dakota Formation. In and near the abutments, the embankment bears variously upon soils of the Peorian and Loveland loess, Kansan Glacial Drift and weathered and unweathered Dakota. The valley alluvium has a maximum thickness of about 30 feet and consists predominantly of lean, silty and sand clays (CL). The clays above the water level were medium stiff to stiff with moisture contents ranging from 12 to 31 percent. The clays below the water level were soft to medium stiff and moisture contents were generally near the liquid limit. Some coarser grained alluvium existed below the water level. This material consisted of loose to dense clayey sands (SC), silty sands (SM), gravelly sands (SW-SM), and sand (SP-SM). Liquid limits of the alluvial clays generally varied from 30 to 43 and plastic limits varied from 8 to 21.

The Peorian and Loveland loess in the abutments generally was medium stiff to stiff, lean or sandy clays (CL) and fat clays (CH) and had depths of up to 25 feet within the embankment area. The glacial till consisted predominately of stiff clays (CL), (CH) and medium dense sands, (SP), (SM), (SC-SM), and (SC) with depths of up to 45 feet.

4. **FOUNDATION PREPARATION.** Foundation preparation consisted of clearing, grubbing, and stripping the area of the embankment, stripping the spillway area, and clearing selected areas of the reservoir. After stripping, the embankment foundation area was scarified, then compacted with a sheepsfoot roller.

5. **EMBANKMENT.** A discussion on the design and construction features of the embankment is presented. It includes a description of the embankment section, embankment materials, settlement, stability analyses, seepage control, and procedures followed in constructing the embankment.

5.1. **General.** The embankment is a rolled, homogeneous, impervious earthfill dam. It has a volume of approximately 502,000 cubic yards of compacted fill. The source of the fill for the embankment was spillway and borrow excavation. As-built drawings and photographs of the project are included in Appendices A and B respectively.

5.2. **Embankment Section.** Embankment sections and details are shown on Plates A5 and A6. The upstream and downstream embankment slopes are symmetrical being 1V on 3H above elevation 1247.0 and 1V on 4H below. The embankment is approximately 3100 feet long with a maximum height of 45 feet above the valley floor and 60 feet above the streambed. The crest is 15 feet wide with a top elevation of 1270.0 m.s.l. Slope protection of 18 inches of riprap over a 6 inch layer of filter blanket, extending 2 feet above and 4 feet below the permanent pool elevation was provided for the upstream embankment. Seeding was provided for other embankment and cut slopes. The completed embankment slopes are shown in Photos Nos. 2, 3, and 4.

5.3. **Embankment Materials.**

5.3.1. **Earthfill.** The embankment was constructed of material excavated from the spillway and borrow areas. Approximately one-half of the excavated material used in construction was loess, with the remainder being glacial drift and alluvium. These soils were generally lean to sandy clays (CL).

5.3.2. Riprap and Bedding. Wave action on the upstream face of the dam is dissipated on 18 inches of riprap placed on 6 inches of bedding. The riprap used was a quarried limestone, and specifications required it to be free from thin slabby pieces and to be reasonably well graded between the following limits:

<u>Weight per Stone</u>	<u>Percent of Total Weight Lighter Than or Passing</u>
320 lbs.	100
110 lbs.	35-60
3 inch screen	5-15

The six-inch bedding layers used beneath the riprap was required to be reasonably well graded within the following limits:

<u>Sieve Size</u>	<u>Percent by Weight Passing</u>
3/4"	100
No. 4	75-95
No. 16	45-70
No. 200	0-5

5.4. Slope Protection Placement.

5.4.1. Bedding. The specifications required that the 6-inch thick bedding material be placed in a manner that would prevent segregation of particle sizes. Compaction of the layer was not required, but it was to be finished to present a reasonably even surface. The average thickness was to be within a tolerance of plus or minus 1-inch from the thickness required and measured within areas not exceeding 100 square feet.

5.4.2. Riprap. Riprap stone was placed on the bedding layer so as to produce a reasonably well graded mass of rock with a minimum of voids. A tolerance of plus or minus 4-inches from the required slope lines and grades was allowed, except that either extremes of such tolerance was not continuous over an area greater than 200 square feet. The riprap was placed to its full thickness in one operation in such a manner as to avoid displacing bedding material. The desired distribution of stones throughout

the mass was obtained by selective loading at the quarry site and by controlled dumping. All stone was required to be placed by either a clam, orange peel or skip box. Dumping the stones at the top of the slopes and rolling or pushing the stones into place was not permitted. See Plates A4 and A9 for riprap sections and placement details.

5.5. Embankment Placement.

5.5.1. General. Specifications required that the gradation and distribution of materials throughout the earthfill section of the dam be such that the embankment be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material.

5.5.2. Compacted Embankment Fill. The more impervious materials were placed toward the upstream section of the embankment and the more pervious materials were placed toward the downstream section of the embankment to affect a transition in permeability from the upstream to the downstream faces of the embankment. Specifications required that fill material be placed in nearly horizontal layers not exceeding 6 inches in thickness after compaction, and having a moisture content ranging from 2 percent above optimum to 4 percent below optimum. The top of the fill was required to be crowned with a 5 percent grade to insure good drainage during the construction period. Before compaction, each layer of fill was required to be harrowed if needed, to break up and blend materials and to obtain uniform moisture content. If one pass of the harrow did not break up or blend the materials sufficiently, additional passes were necessary, but no more than three passes were required to be performed. There were no specific number of passes of roller equipment required, but each layer was to be compacted to at least 95 percent of the maximum density as determined by the Standard AASHTO method, T99, Method D. Portions of the fill which could not be compacted with rollers because of space restrictions were placed in four-inch loose lift layers and compacted with power tampers to the same degree of compaction as that obtained on other portions of the fill performed by rolling.

5.6. Embankment Settlement. The maximum computed foundation settlement at the embankment centerline was 1.4 feet. This was determined by considering a maximum embankment section of 45 feet in height to bear on 40 feet of compressible valley alluvium. Time studies indicated that approximately 45 percent of the consolidation would occur during construction and the remaining settlement would occur at a diminishing rate over an indefinite period. To allow for the continuing settlement the embankment was constructed with a 1-foot overbuild at the center of the valley section, tapering to zero at the ends of the embankment.

Foundation settlement gauges were not installed at this dam. Very minor settlement is assumed to have occurred since 1974, although surveys in 1976, and 1979 of surface movement markers show erratic vertical movements on some markers. These markers were assumed to be affected by frost action and therefore unstable. For more information about the movement markers, see Section 8.2 in this report.

5.7. Embankment Stability.

5.7.1. Shear Tests on Undisturbed Materials. Five unconfined compression tests were taken from the foundation lean clay material. The breaking strengths varied from 0.61 to 1.39 T/sq. ft., with an average breaking strength of 1.08 T/sq. ft., indicating an average shear strength value in terms of cohesion of 0.54 T/sq. ft. Two tests were also performed on samples of remolded embankment material. The breaking strengths varied from 1.41 to 1.58 T/sq. ft., average breaking strength of 1.5 T/sq. ft., and average cohesion of 0.75 T/sq. ft. The results of the tests are shown on Plates A11 and A14.

Ten series of triaxial compression tests were performed on undisturbed samples of foundation material and remolded samples of embankment material. These tests consisted of 5 series of unconsolidated-undrained (Q) tests, 2 series of consolidated-undrained (R) tests with pore pressures measured, and 3 series of consolidated-undrained (R) tests without pore pressures measured. The results of the tests are shown on Plates A11, A12, and A13.

5.7.2. Shear Tests on Remolded Material. Seven series of direct shear tests were performed on remolded embankment material and undisturbed foundation material. In the foundation the strengths varied from $\tan \phi = 0.52$ for stiff, moist, lean clay, to $\tan \phi = 0.76$ for soft, wet, sandy clay. For the embankment $\tan \phi$ was equal to 0.50 for both lean and sandy clay. Note that these strengths are the maximum shear strength values.

5.7.3. Adopted Shear Strengths. The adopted shear strength values used in stability computations were as follows:

<u>Material</u>	<u>Unconsolidated</u>		<u>Consolidated</u>		<u>Consolidated</u>	
	<u>Undrained</u>		<u>Undrained</u>		<u>Drained</u>	
	<u>(Q) Strength</u>		<u>(R) Strength</u>		<u>(S) Strength</u>	
	<u>Tan ϕ</u>	<u>Coh.</u>	<u>Tan ϕ</u>	<u>Coh.</u>	<u>Tan ϕ</u>	<u>Coh.</u>
Embankment	0.07	0.90	0.23	0.23	0.50	0
Fnd. Stratum "A"	0	1.68	0.26	0.80	0.58	0
Fnd. Stratum "B"	0	0.65	0.21	0.25	0.76	0
Fnd. Stratum "C"	0	2.00	0.15	1.34	0.60	0

5.7.4. Results of Stability Analysis.

5.7.4.1. Design Cases. Embankment stability analyses were performed for the end of construction, steady seepage, partial pool, and sudden drawdown cases. The method referred to was the circular arc analysis-finite slices, outlined in EM 1110-2-1902, Appendix III, dated 27 December 1960. The analyses were performed on the RCA 301 electronic computer using the 1116 series slope stability program. This program had been used on three previous jobs and was considered completely valid and in agreement with EM 1110-2-1902 procedures current at that time. Shear strength parameters used in the stability computations were determined from a composite of all available field and laboratory observations and tests. Typical sections and stability analyses are shown on Plate A10.

5.7.4.2. End of Construction. This case was analyzed on the assumption that the strength of the embankment and foundation was that available with instantaneous construction of the embankment ("Q" Strength Values). The water level was assumed at the ground surface.

5.7.4.3. Steady Seepage. The downstream slope was studied for the case of a sloping seepage line from conservation pool to tailwater. The "R" and "S" shear strength were used in separate studies to bracket the range of safety factors.

5.7.4.4. Sudden Drawdown. The sudden drawdown condition was performed assuming that instantaneous drawdown occurred from maximum pool to conservation pool. Since the factor of safety was much higher than required and as this is the more critical case, the case of drawdown from the spillway crest was not performed.

5.7.4.5. Partial Pool. The upstream embankment slope was designed for the condition of saturation at the most critical pool elevation. The saturation line at each pool level was assumed horizontal and the factor of safety was based on "R" shear strength values. A pool elevation of 1245.0 was determined to be the most critical.

5.7.4.6. Earthquake. Although this is a location with minor earthquake history, the factors of safety for this condition were computed and are listed on the stability plates. The static method of analysis was used with a 0.05 seismic coefficient.

5.7.4.7. Summary. All factors of safety for each case studied were greater than that required and are tabulated below:

<u>Case</u>	<u>Shear Strength</u>	<u>Safety Factor</u>		<u>Safety Factor with Earthquake</u>	
		<u>Computed</u>	<u>Required</u>	<u>Computed</u>	<u>Required</u>
End of Construction	Q	3.57	1.3	2.86	1.0
Steady Seepage	R	1.82	1.5	1.50	1.0
Steady Seepage	S	1.81	1.5	1.44	1.0
Sudden Drawdown	R	1.45	1.0	NA	NA
Partial Pool	R	1.70 (Min)	1.5	1.38	1.0

5.8. Seepage Control.

5.8.1. Embankment Seepage. Seepage through the embankment was considered a minor problem due to the relatively low permanent pool, the short durations of higher pools, and the relatively impervious nature of the

embankment fill. To control seepage which might occur, a vertical, pervious embankment seepage control drain with outlets was provided near the downstream toe of the embankment. See drawings on Plates A4, A5, and A6. To further control seepage through the embankment the more impervious materials encountered in the required excavations were placed in the upstream portion of the embankment.

5.8.2. Foundation Seepage. Underseepage through the foundation was not considered critical as the drillings did not disclose any continuous pervious layers, and as the few, thin pervious lenses were encountered they were covered with a thick impervious blanket.

5.9. Diversion and Closure. Plate A4 shows the location of the diversion channel, ditch, and plugs which were required to divert the flow through the embankment area. Typical diversion channel and ditch sections are shown on Plate A5.

Prior to the starting of closure operations for the embankment, the Contractor was required to complete all channel excavations, outlet works structure, and the embankment both right and left of the closure section to a minimum elevation of 1253.0. The closure operations were to begin no earlier than 1 August 1965 at a time when the weather and preparatory construction was right, and with the approval of the Contracting Officer. Details of the closure and date are not known.

6. EMERGENCY SPILLWAY. The emergency spillway is an uncontrolled, grassed, earth channel. It is located 300 feet left of the left abutment of the dam. The channel is 400 feet wide with 1V on 3H slopes. The channel crest at the upstream end is flat for 200 feet at elevation 1262.0. The bed slope downstream of the crest is 0.2 percent for 900 feet. The next 1450 feet downstream of the spillway is graded in such a manner as to direct flow from the spillway toward the existing channel downstream of the embankment. The bottom and side slopes of the channel are protected by a grass cover. An excavation quantity of approximately 224,000 cubic yards was required in the construction of the spillway channel. See drawing on Plate A3, and Photos Nos. 5 and 6.

7. **OUTLET WORKS.** The outlet works consist of a concrete drop inlet structure and a 300 foot long 42-inch CMP conduit. The drop inlet has openings at 3 levels; a low level gated opening at elevation 1237.0, two permanent pool openings at elevation 1245.0, and two 35-year flood openings at elevation 1250.0. The low level opening is 36" X 36" in size and controlled by a manually operated slide gate from the top of the cover plate. The cover plate extends 3.5 feet beyond the side of the shaft to serve as an anti-vortex device. The purpose of the gated outlet is to lower the level of the conservation pool in order to inspect the conduits, make shoreline repairs, and control the fish population. It may also be used to lower the flood pools more rapidly after the pool level has dropped to elevation 1250.0, thus minimizing interruptions to recreation facilities just above the conservation pool. The ungated openings are protected with metal pipe trash racks. See Plate 15 and Photos Nos. 8 and 9 for details and views of the outlet works structure.

Since its installation the 42-inch CMP has been lined with a 30-inch RCP as outlined in Phase IV-Outlet Works Rehabilitation, Salt Creek Dams and Lakes. See plates A15 and A16. The discharge end of the conduit is extended on a pile trestle far beyond the downstream toe of the embankment. An outlet channel extends downstream from the conduit end to the original creek channel. An excavation quantity of about 16,000 cubic yards was required in the construction of this channel. Photos Nos. 10, 11, and 12 show the main features of the discharge end of the conduit and outlet channel.

8. **INSTRUMENTATION.**

8.1. **General.** The instrumentation of the dam consist of 6 surface movement markers in the embankment (See Plate A17), 4 movement insert markers in the outlet works, and 3 piezometers. No settlement gauges or relief wells were ever installed at this dam site.

8.2. **Embankment.** Six surface movement markers were installed during the final construction of the dam in 1965 along the downstream edge of the crest. Since the 1974 Periodic Inspection, three horizontal and vertical movement surveys have been conducted. They were in 1976, 1977 and 1979. Plots of the surveys indicate a fairly small and uniform downstream

horizontal movement, whereas erratic vertical movements were recorded. Since no other indications of excessive vertical movement of the embankment was evident, the affect of frost action on the markers was blamed for the erratic readings. Movement of the embankment at this time is considered negligible; therefore, only markers which had been destroyed were replaced.

8.3. Outlet Works. Four movement inserts markers are located in the top of the concrete intake structure as shown on Plate A19. Vertical movement surveys of the intake structure have been conducted three times since the February 1974 surveys and the 1974 Periodic Inspection. They were in December 1974, December 1976 and October 1979. As seen on the movement vs. time plots on Plate A19, large amounts of rebound and settlement were recorded which do not seem very reasonable. It is suspicioned that the reference benchmarks may have been damaged by frost action, maintenance operations, or vandalism.

8.4. Piezometers. Three piezometers were installed in June of 1981. Their locations and descriptions are shown on Plate A20. No readings had been taken prior to the writing of this report.

9. OPERATIONAL HISTORY AND PERFORMANCE.

9.1. Operation and Maintenance Procedures. The Secretary of the Army granted to the State of Nebraska Game and Parks Commission, a license to use and occupy the land and water areas of the project for public recreation purposes. For consideration of the privileges granted, the State is required to maintain the project in a manner acceptable to the District Engineer. In general, this requires routine maintenance. Any major repairs to either the embankment, outlet works, or spillway is accomplished by the Corps of Engineers.

9.2. Inspections. Since 1980, Ft. Crook Area Forces have been conducting monthly inspections of all Salt Creek Dams. These reports include a complete visual inspection of all features of the dams. Also included are piezometer readings. In addition to the monthly inspections, in-depth periodic inspections are conducted at 5 year intervals in accordance with

ER 1110-2-100, "Periodic Inspections and Continuing Evaluation of Completed Civil Works Projects." These periodic inspections are made jointly by representatives of the Operations and Engineering Divisions of the Omaha District Corps of Engineers, and by representatives of the Missouri River Division Office. Periodic inspections for Yankee Hill Dam were made in April 1974, and in October 1979. They are reported in Periodic Inspection Reports No. 1 and No. 2 respectively. These reports include the results of the inspection, evaluation of the embankment, and structural performance based on the inspection and instrumentation observations.

9.3. Reservoir Levels. Reservoir elevations are determined by a reservoir stage recorder. See Plates A20 and A22. The instrument records the reservoir level in digital format on paper tape at 15 minute intervals. It is a bubbler-type installation whereby the stage is determined by the hydrostatic pressure required to force nitrogen gas out of a submerged orifice. Additional verification of these readings are determined periodically from a staff gauge located near the intake of the outlet structure. The highest reservoir level on record occurred on 11 October 1973 when it reached El. 1252.66 feet above mean sea level, about 7.7 feet above the normal operating pool of El. 1245.0. Photos Nos. 4, 9, 10, and 11 show the intake structure and outlet conduit during this period. Since then, the highest pool elevation was 1246.3 in March 1979. A plot of the reservoir elevations can be seen on Plate A21.

9.4. Significant Operational Events.

9.4.1. Riprap. In the Periodic Inspection Report No. 1, April 1974, it was recommended that a service or access berm be constructed on Salt Creek Dams just above the riprapped area. This would provide for more efficient and less costly maintenance, and for more efficient inspection of the riprap slope protection. In 1975-1977 a rock berm, surfaced with crushed rock was constructed at Yankee Hill Dam by Ft. Crook Area Forces along the upstream embankment slope at the top of the riprap. See Photos No. 8 and 13. Also, in 1978 a 250 ton stockpile of riprap was placed at the right abutment to provide for an on-site source of riprap for emergency repairs.

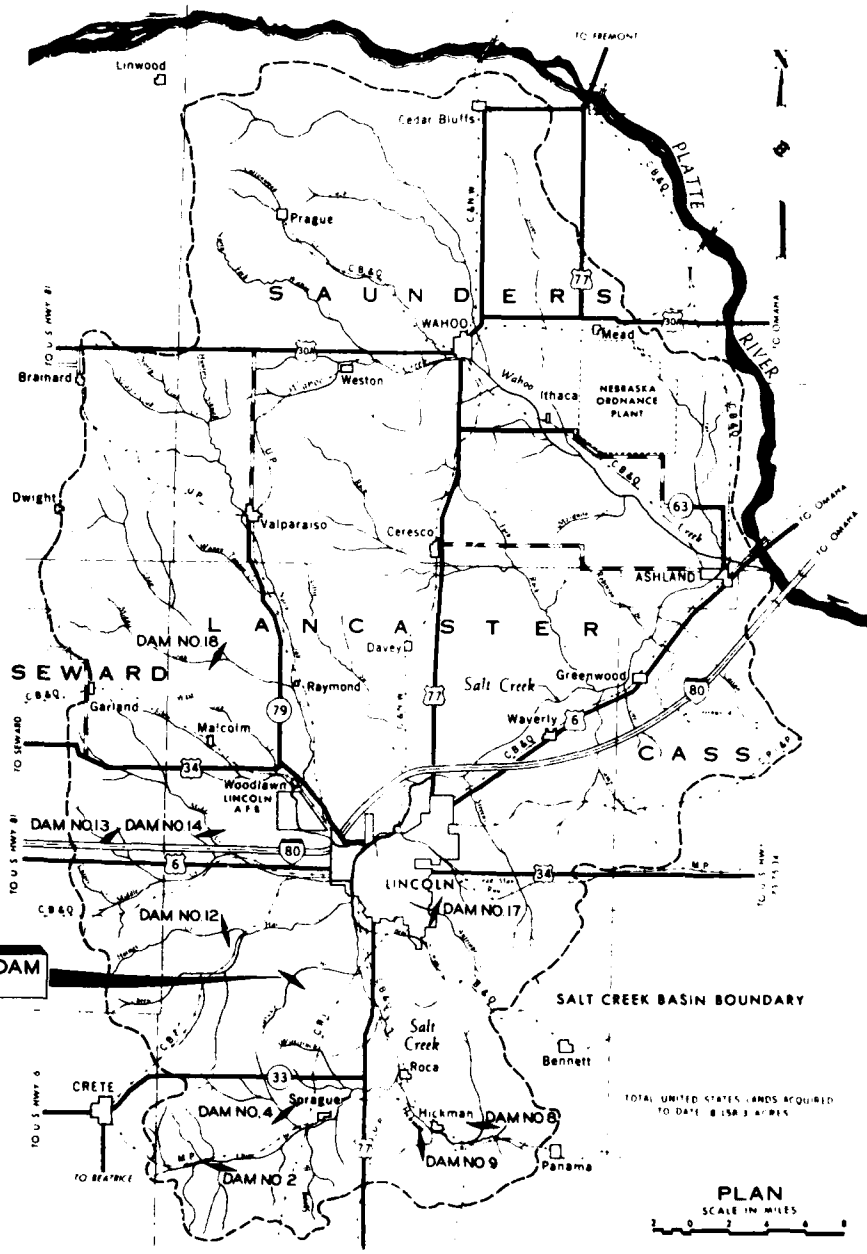
9.4.2. Repair of Outlet Works. During the first periodic inspection of the project in April 1974, small amounts of seepage were found in about 30 percent of the field joints of the conduit. The areas of leakage were located on one or both sides of the pipe and generally from about the area of springline down through the invert area. Subsequently, during the fall of 1977 to the spring of 1978, grouting of the CMP discharge conduit, reshaping the plunge pool, and downstream channel cleanout was performed under Phase I of a comprehensive "Outlet Works Rehabilitation" project scheduled for the Salt Creek Dams.

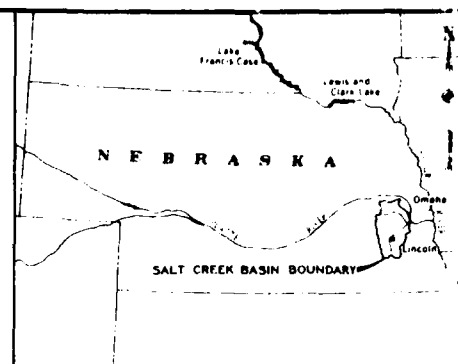
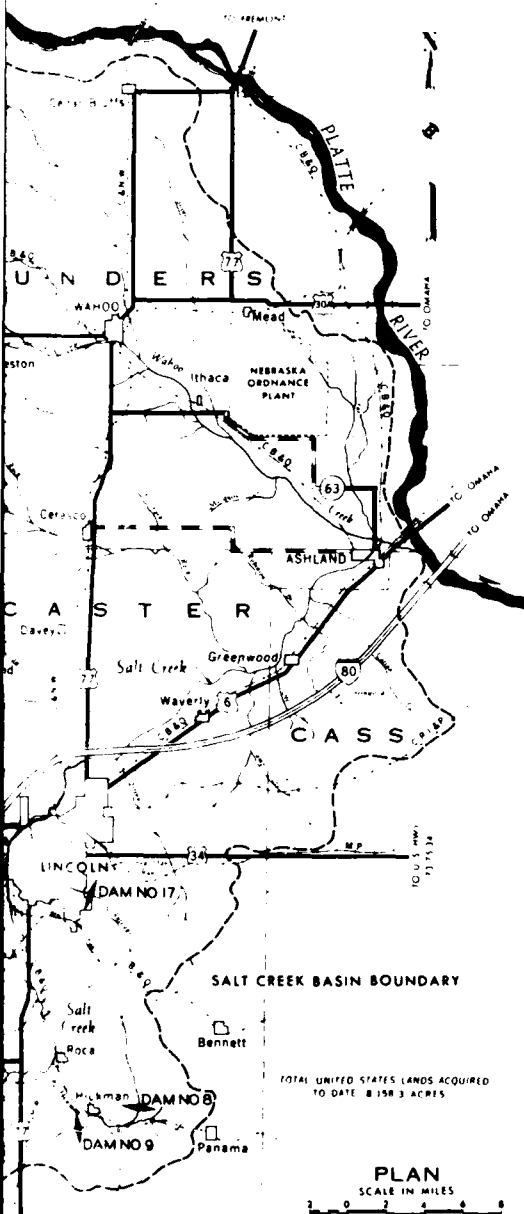
Additional rehabilitative measures were accomplished on the outlet conduit in 1980. Because of a general deterioration of the asphalt lining, leaking joints, and corrosion at this project and similar projects; a contract was let on 26 February 1980 to install a precast concrete pipe lining inside the existing corrugated metal pipes. This was completed under Phase IV - Outlet Works Rehabilitation, Salt Creek Dams and Lakes. The contract was awarded to Dobson Brothers Construction Company, Lincoln, Nebraska under contract No. 80-C-0151.

10. EVALUATION. The Yankee Hill Dam and appurtenant structures are in good condition. Since 1965, when the project was completed, inspections and evaluations of the instrumentation data has revealed no significant problems concerning the safety of the dam. The project is well maintained, and because of its relative close proximity to the Omaha District Offices, it can readily be inspected if potential problems develop. Maintenance problems which have developed, such as the deterioration of the conduit lining, generally are rectified before they turn into major problems which may subsequently affect the integrity of the dam.

APPENDIX A
DRAWINGS

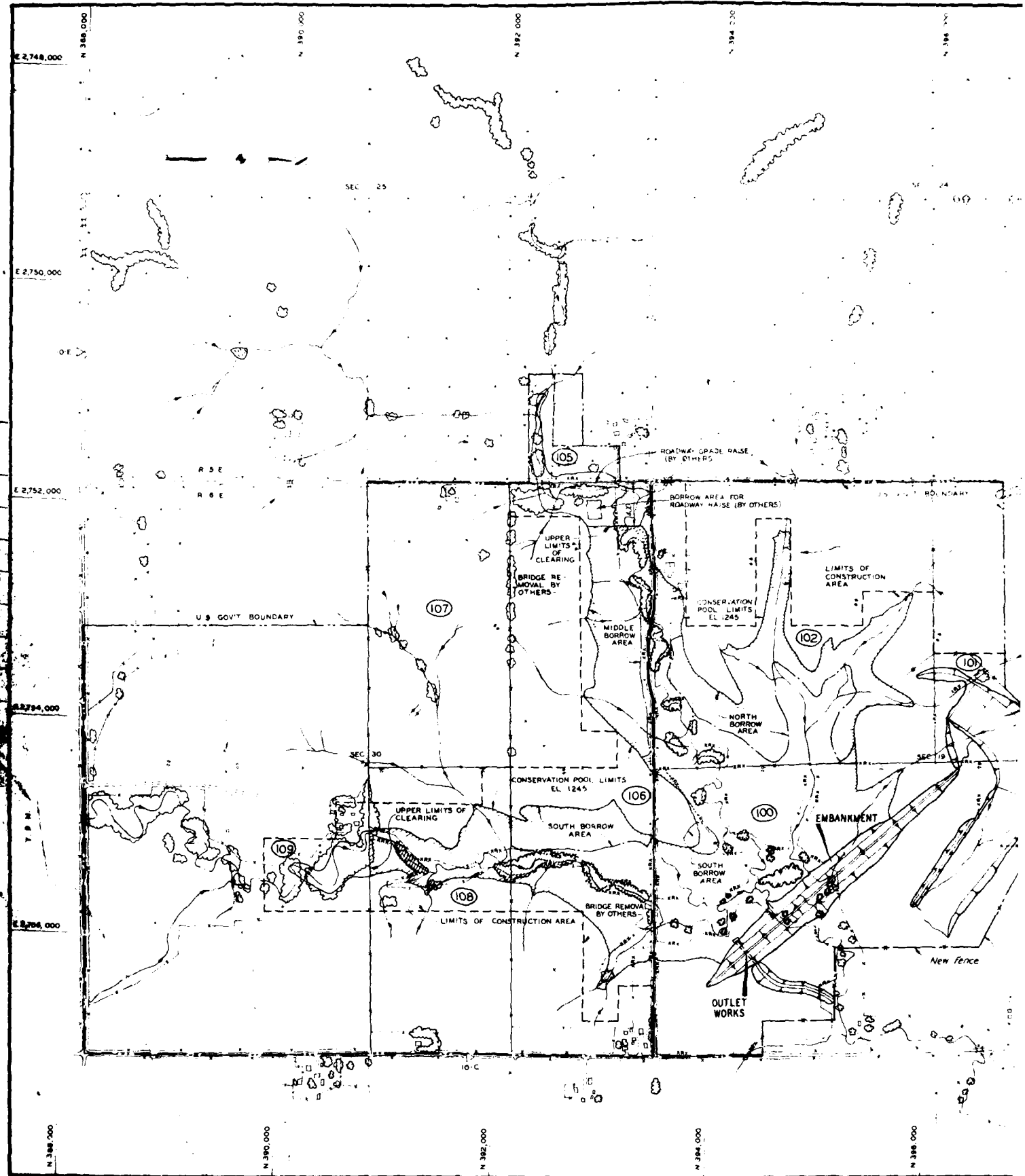
YANKEE HILL DAM
SITE NO. 10



[illegible]

THIS PLAN ACCOMPANIES CONTRACT NO
DACA#3 MODIFICATION NO

CORPS OF ENGINEERS



LEGEND

-  APPROX AREAS OF TREES AND BRUSH
-  APPROX AREA TO BE CLEARED
-  FENCE (APPROX LOCATION)
-  FENCE TO BE REMOVED
-  U.S. GOV'T BOUNDARY
-  LIMITS OF CONSTRUCTION AREA
-  BORROW AREA
-  EXISTING POWERLINE
-  BUILDING LOCATIONS
-  TRACT BOUNDARY LINE
-  POWERLINE RELOCATION (BY OTHERS)
-  CLEARING LIMITS

GENERAL NOTES:

1. All utility lines within the limits of the conservation pool will be removed by others.

THIS DRAWING HAS BEEN PREPARED FOR THE
ENGINEERING DISTRICT OF OHAMA, NEBRASKA

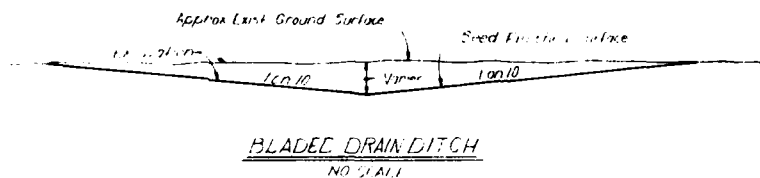
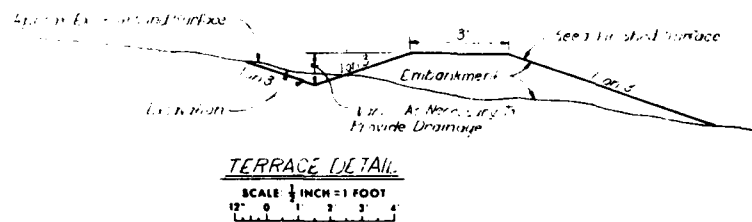
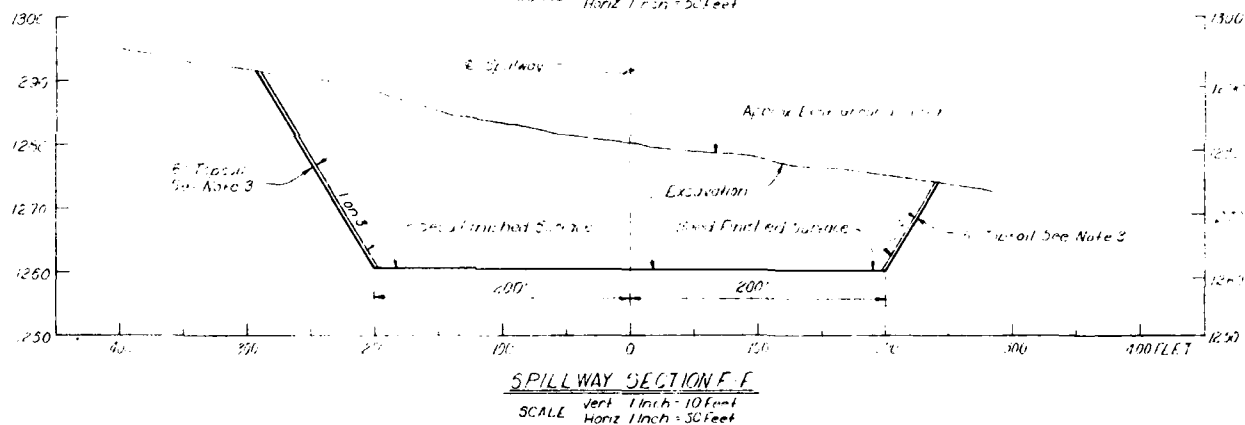
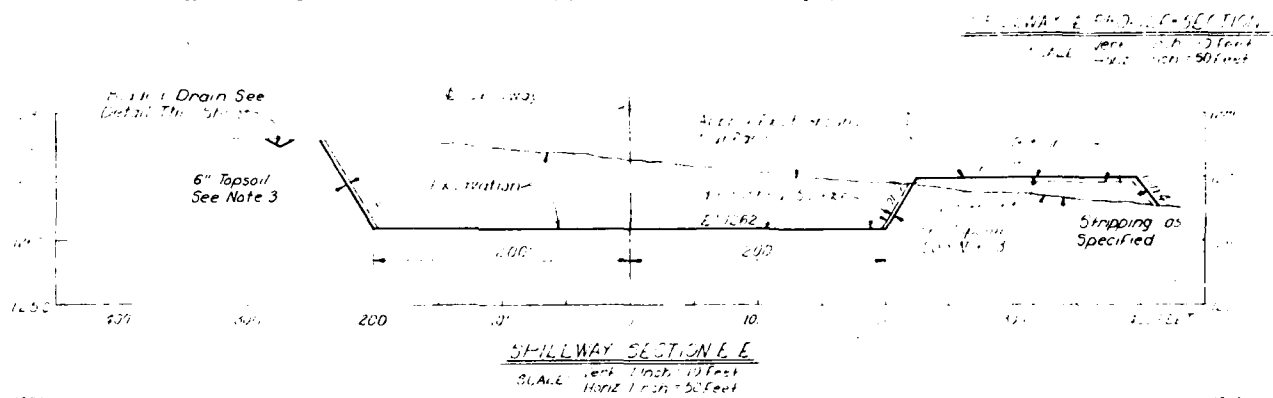
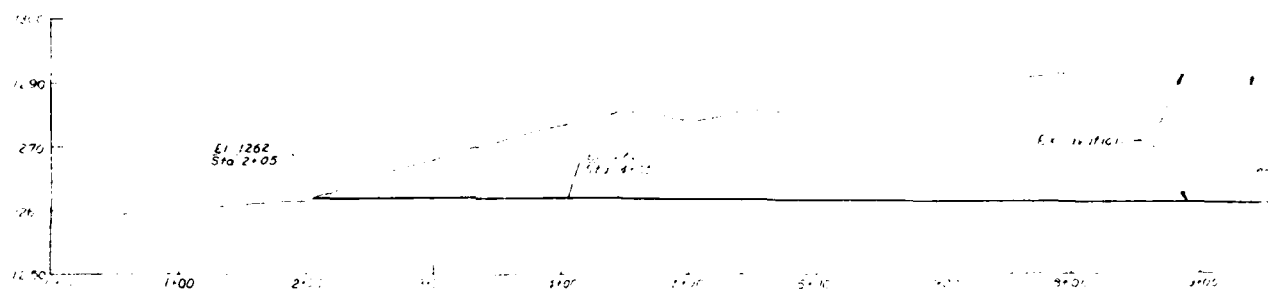
U. S. ARMY ENGINEER DISTRICT, OHAMA
CORPS OF ENGINEERS
OHAMA, NEBRASKA

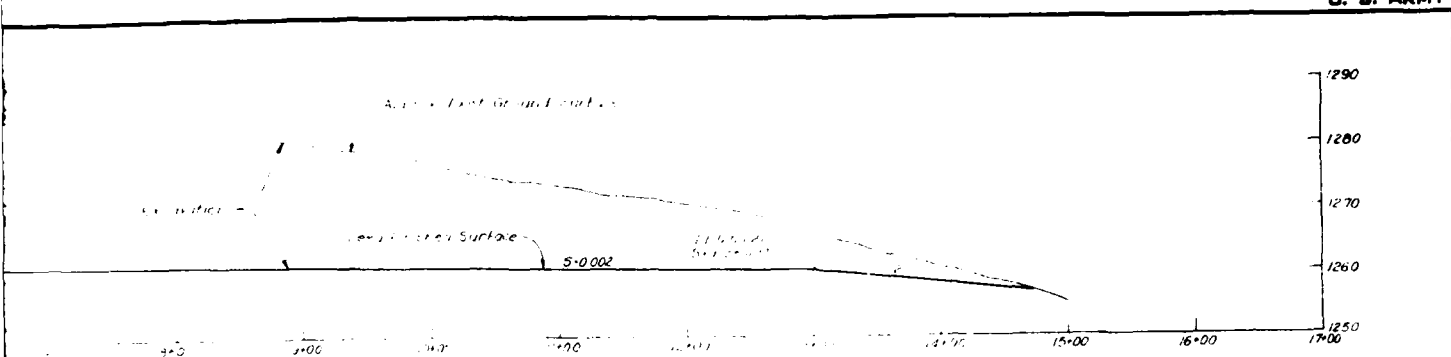
DESIGNED BY: M. J. S.
DRAWN BY: E. H. B.
CHECKED BY: E. H. B.
DIRECTED BY: E. H. B.
SUBMITTED BY: J. H. L. FOR APPROVAL

APPROVED: *Charles F. Hoot* DATE: MARCH 1954
APPROVED: *Donald J. Blair* DATE: AS SHOWN
PROJECT: SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
SITE NO. 10
GENERAL PLAN
AND AREA USE
SHEET: MSC II - 310E 2

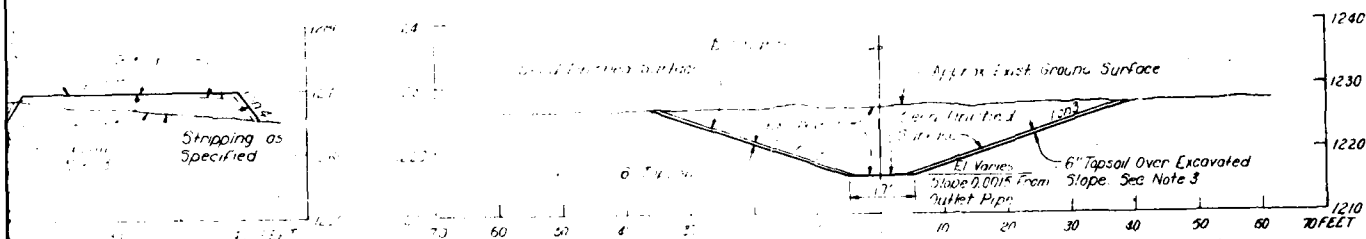


SCALE 1 INCH = 400 FEET

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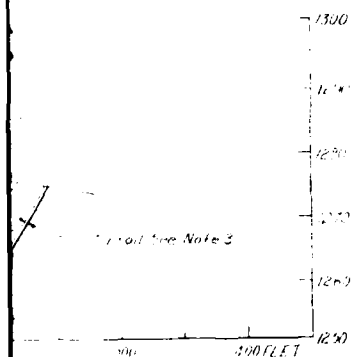


SPILLWAY SECTION E-E
 Scale: Vert. 1 inch = 5 feet
 Horiz. 1 inch = 50 feet



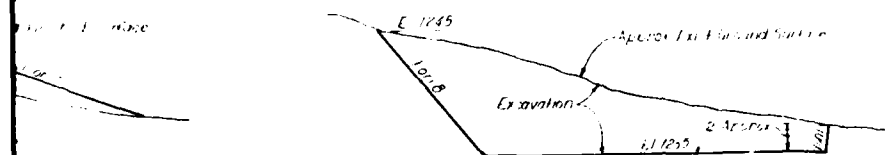
OUTLET WORKS CHANNEL SECTION C-C

SCALE 1 INCH = 10 FEET
 10 0 10



GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of profiles and sections see Plate A 4
3. Place 6" layer of topsoil on excavated 1 on 3 slopes of Spillway and Outlet Works Channel from the bottom of the Spillway or Channel to the top of the slope.



NORTH BORROW AREA SECTION J-J

SCALE: Vert. 1 inch = 5 feet
 Horiz. 1 inch = 50 feet

THIS DRAWING HAS BEEN REDUCED TO
 THREE-FOURTHS THE ORIGINAL SCALE.

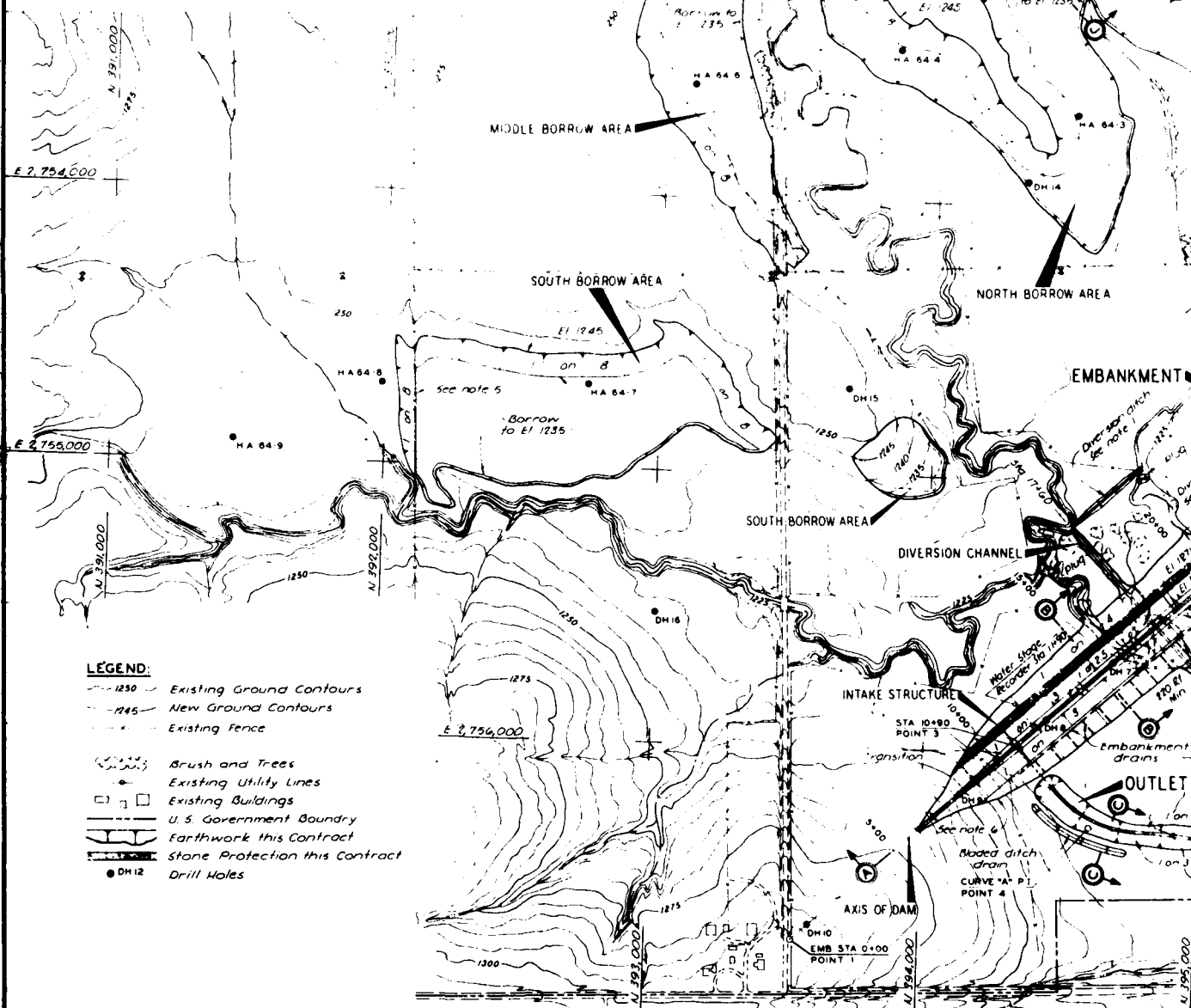


U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO. 10 SPILLWAY	
PROFILE, SECTIONS AND DETAILS	
DESIGNED BY: J.W.K.	DATE: MARCH 1963
DRAWN BY: W.L.H.	DATE: MARCH 1963
CHECKED BY: W.L.H.	DATE: MARCH 1963
APPROVED BY: L.V.S.	DATE: MARCH 1963
APPROVED BY: Charles P. Hoop	DATE: MARCH 1963
APPROVED BY: Harold L. Clair	DATE: MARCH 1963
MSC II-310E6	

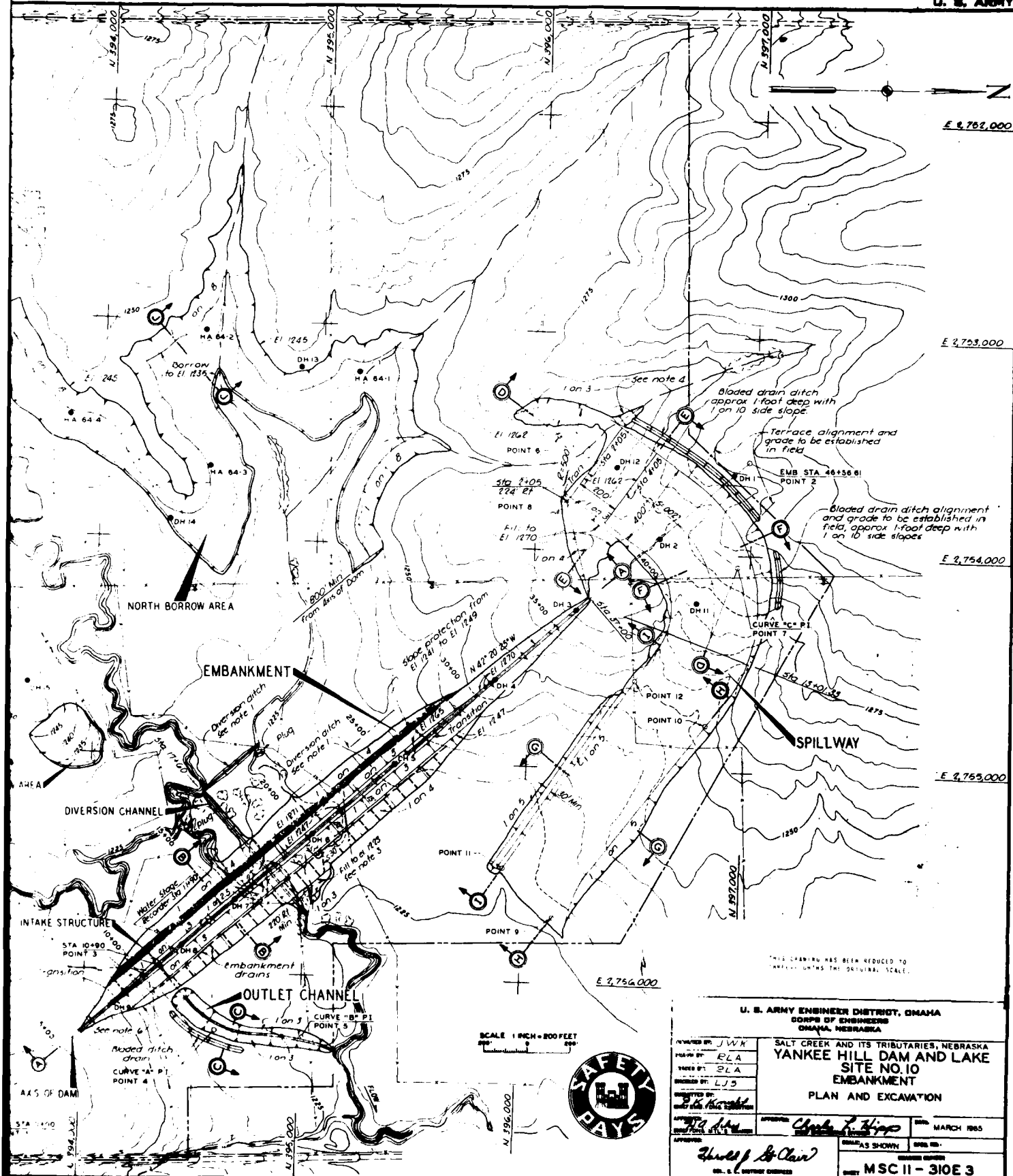
CORPS OF ENGINEERS

GENERAL NOTES:

1. The exact alignment, grade, width and side slopes of the diversion ditches and plugs will be selected by the Contractor, subject to approval. The ditches are optional if other means are used to provide drainage in and upstream of the embankment areas.
2. Grading downstream from Spillway shall be accomplished to the approximate new contours shown.
3. Waste material shall be placed in the channel fills at the downstream toe of the embankment and in the fills in the grading downstream from the Spillway. The waste material shall be placed in 2' lifts and traffic compacted as directed.
4. At spillway Sta. 2+000, grade bladed drain ditch at approx. 2% from El. 1262. Alignment and grade of all bladed drain ditches to be established in the field.
5. The south limit of the south borrow area shall be varied from that shown, in order to balance the earthwork between excavation, borrow and embankment.
6. Natural terraces shall be maintained against the embankment so as to prevent drainage along the embankment toe.
7. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
8. For Sections and Profiles, see



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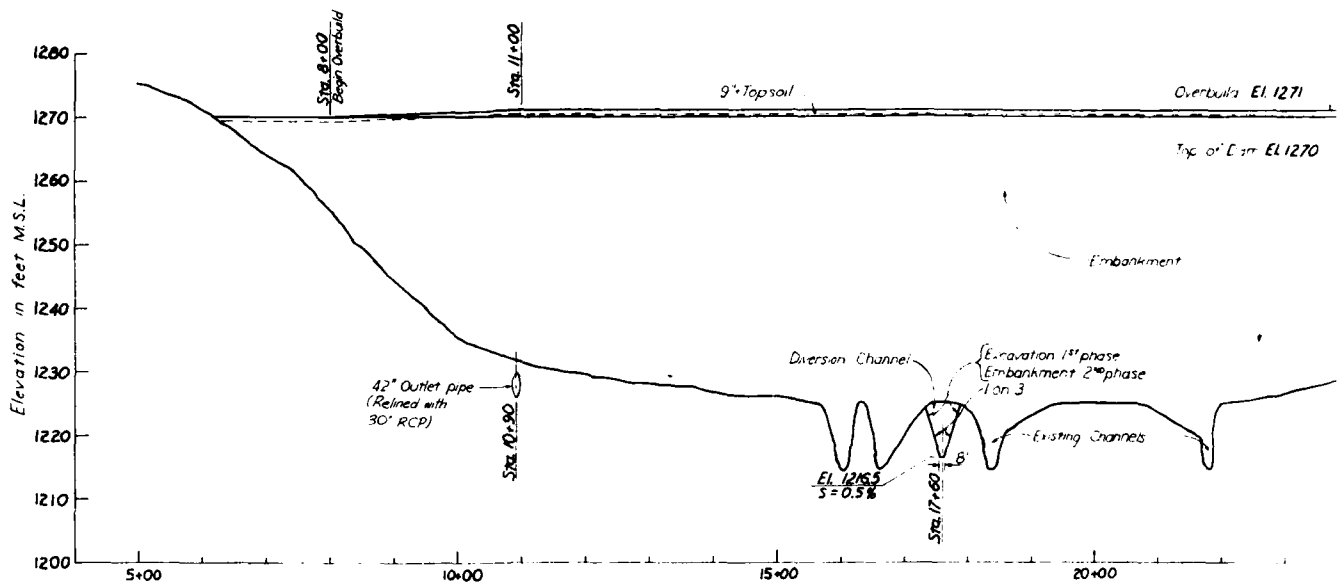
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10
EMBANKMENT
PLAN AND EXCAVATION

DESIGNED BY: JWH
CHECKED BY: BJA
DRAWN BY: BJA
REVIEWED BY: LJS
APPROVED BY: [Signature]
DATE: [Date]

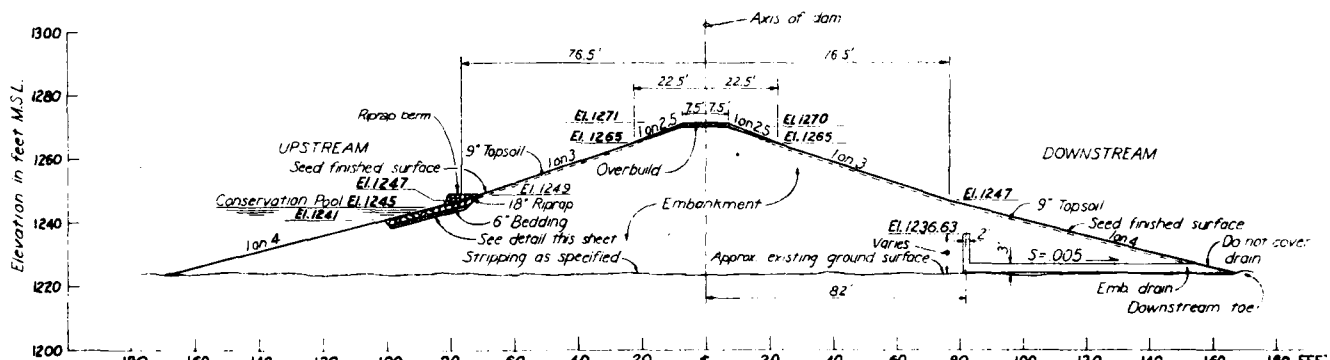
APPROVED: [Signature]
DATE: MARCH 1965

SCALE SHOWN: [Scale]
PROJECT: MSC 11 - 310E 3



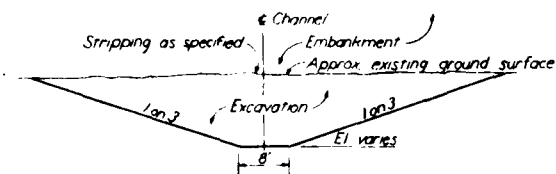
PROFILE ALONG AXIS OF DAM - SECTION A-A

SCALE: 1/2" = 10' HORIZ. 1" = 20' VERT.

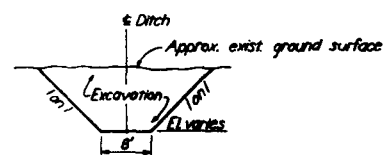


EMBANKMENT SECTION B-B

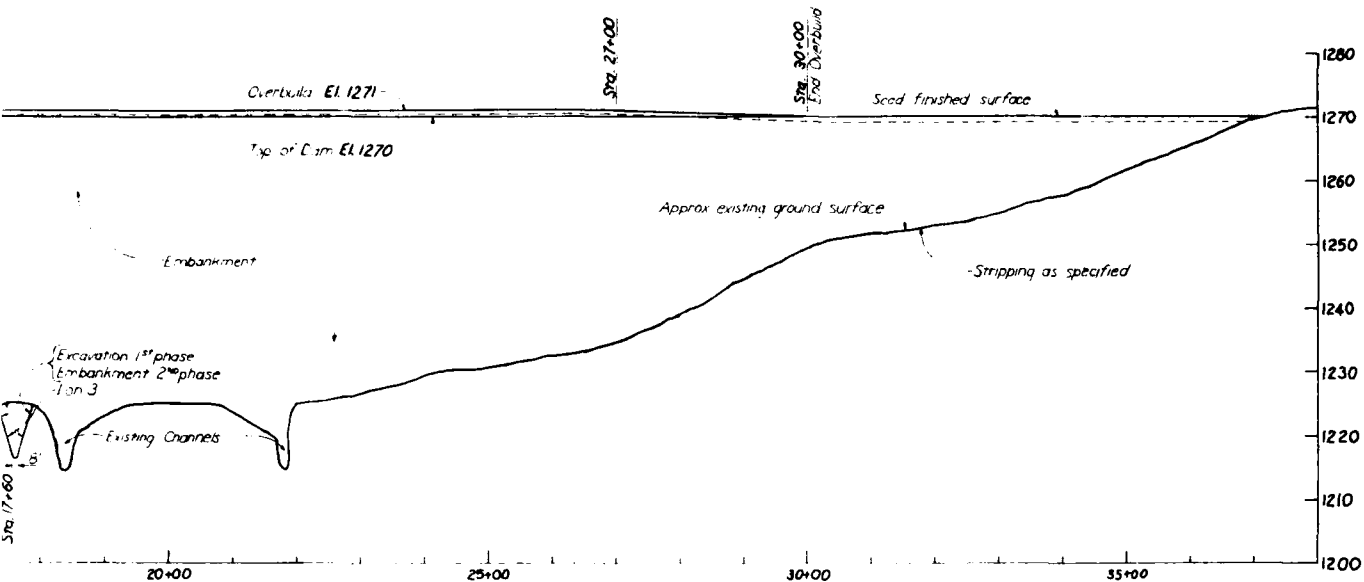
SCALE: 1" = 20 FEET
20' 0' 20'



TYPICAL DIVERSION CHANNEL SECTION
THRU EMBANKMENT
NO SCALE

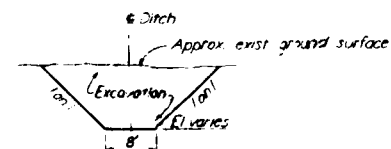
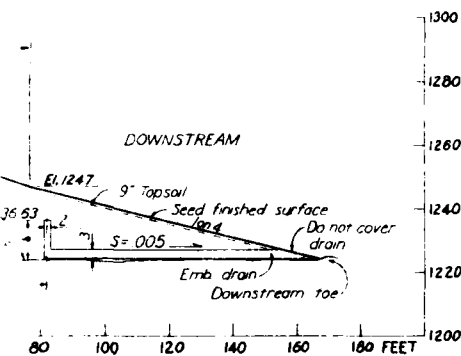


TYPICAL DIVERSION DITCH SECTION
NO SCALE



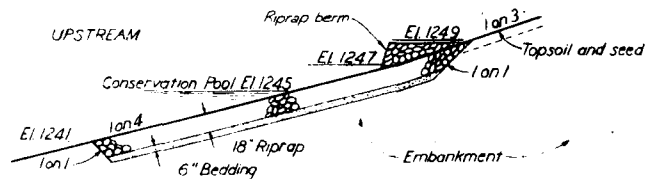
PROFILE ALONG AXIS OF DAM - SECTION A-A

VERT. 1" = 10 FEET
HORIZ. 1" = 100 FEET



DIVERSION DITCH SECTION

NO SCALE

RIPRAP DETAIL
NO SCALE

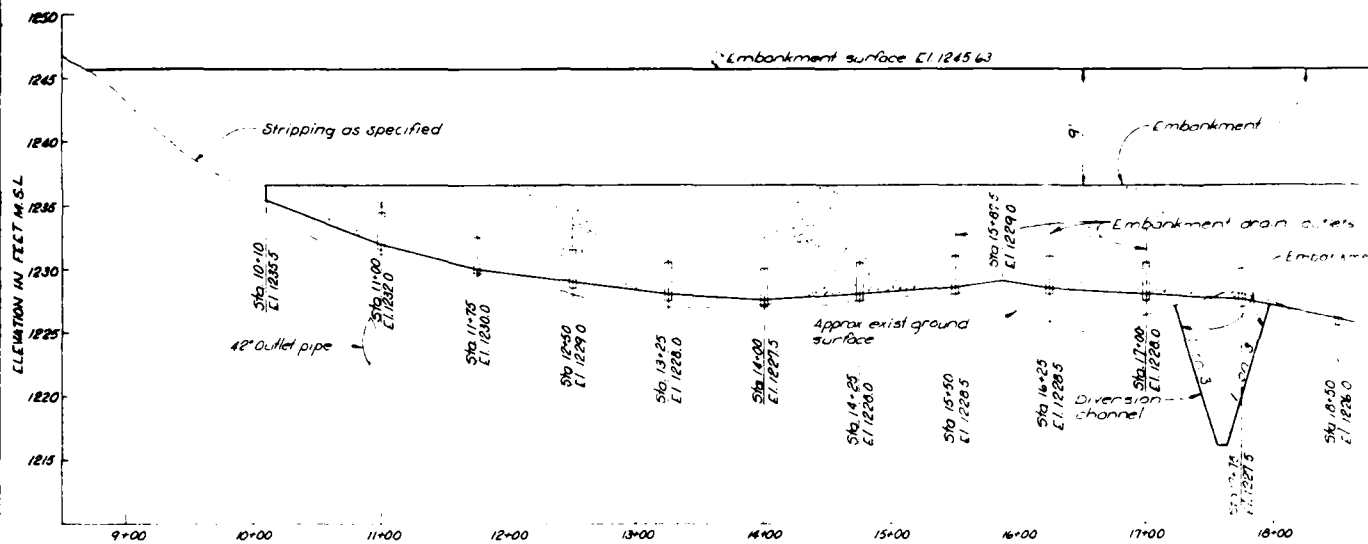
GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of profile and sections, see Plate A-4.

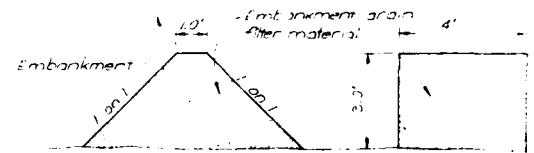
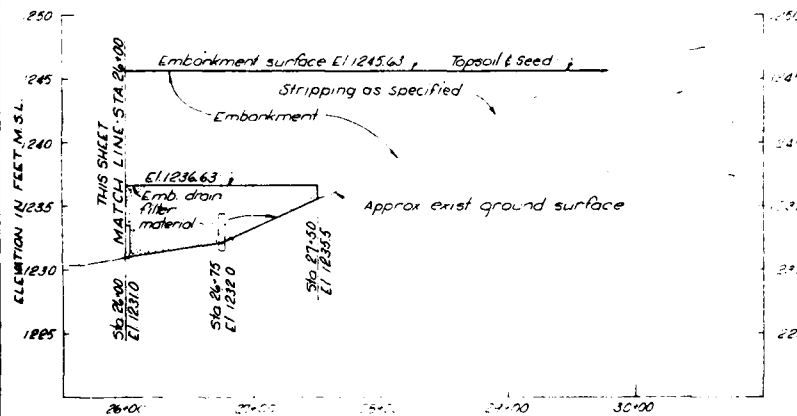
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THREE-FIFTHS THE ORIGINAL SCALE.



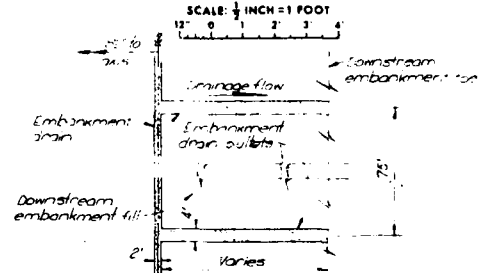
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO. 10 EMBANKMENT PROFILE, SECTIONS AND DETAILS	
DESIGNED BY: W.K.	DATE: MARCH 1965
DRAWN BY: T.A.J.	SCALE: AS SHOWN
CHECKED BY: T.A.J.	PROJECT NO.: 11-310E4
APPROVED BY: J.S.	ENGINEER: M.S.C. 11-310E4
APPROVED BY: [Signature]	ENGINEER: M.S.C. 11-310E4
APPROVED BY: [Signature]	ENGINEER: M.S.C. 11-310E4



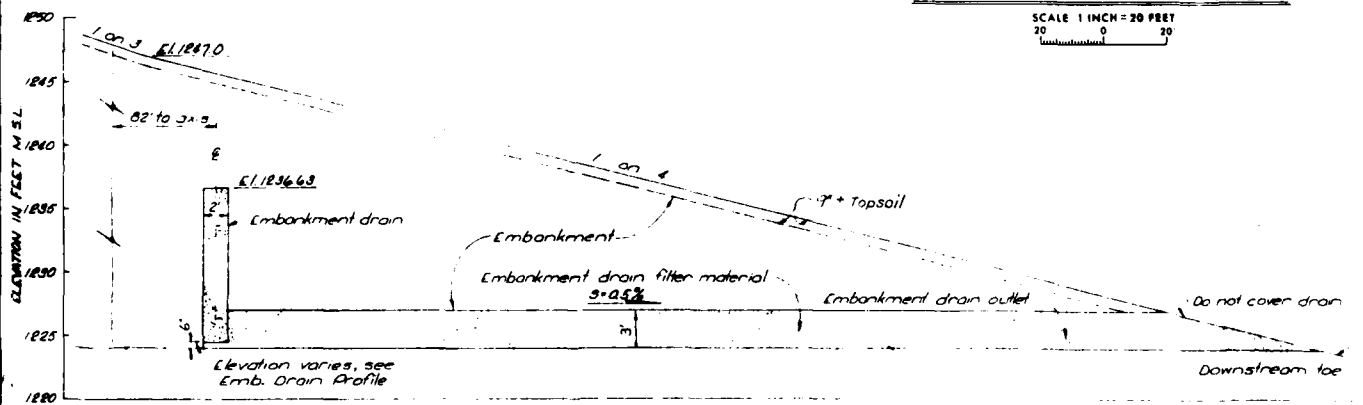
EMBANKMENT DRAIN PROFILE
SCALE: HORIZ. 1 INCH = 50 FEET
VERT. 1 INCH = 5 FEET



TYPICAL SECTION EMBANKMENT DRAIN OUTLET
ALTERNATE PLANS OF CONSTRUCTION
SCALE: 1/2 INCH = 1 FOOT



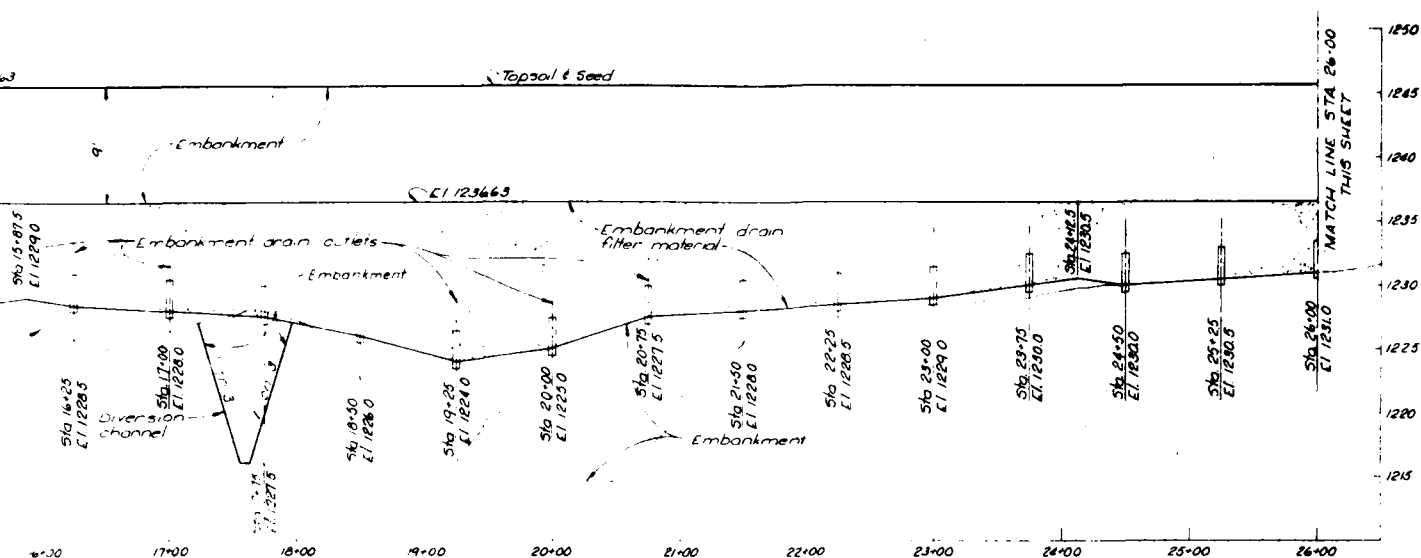
PLAN TYPICAL EMBANKMENT DRAIN OUTLET



TYPICAL SECTION EMBANKMENT DRAIN OUTLET

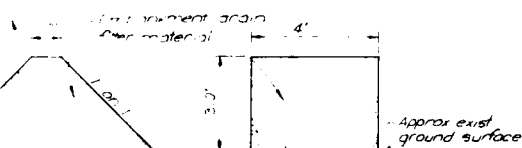
SCALE: 1 INCH = 5 FEET

A 100 Micrometer Plan or a Paper Reproduction Based
Copy must be Made Before Every Amendment and for Modification
DATE
AUTHOR
CHECKED
APPROVED



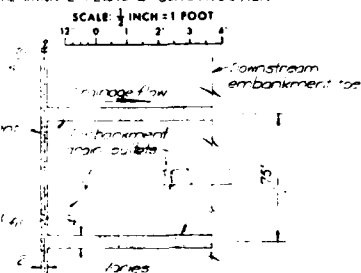
EMBANKMENT DRAIN PROFILE

HORIZ. 1 INCH = 50 FEET
VERT. 1 INCH = 5 FEET



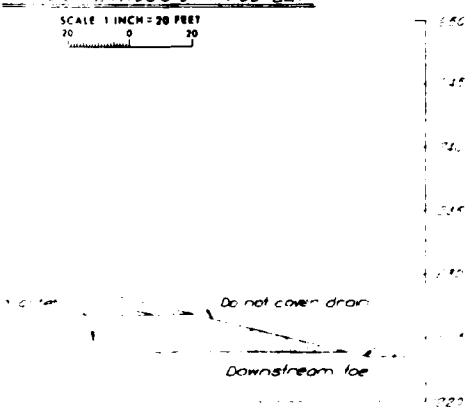
SECTION ON EMBANKMENT DRAIN OUTLET

ALTERNATE PLANS OF CONSTRUCTION



SECTION ON EMBANKMENT DRAIN OUTLET

SCALE 1 INCH = 20 FEET
20 0 20



GENERAL NOTES:

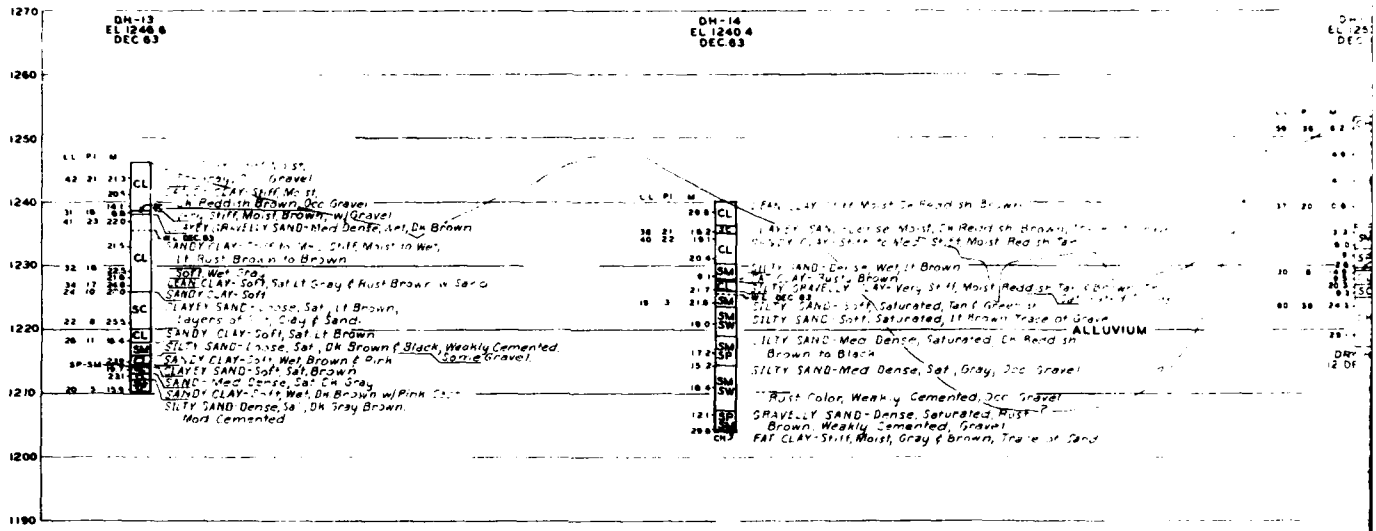
1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of Drainage Profiles, see Plate A4

THIS DRAWING HAS BEEN REDUCED TO
THREE-FOURTHS THE ORIGINAL SCALE.



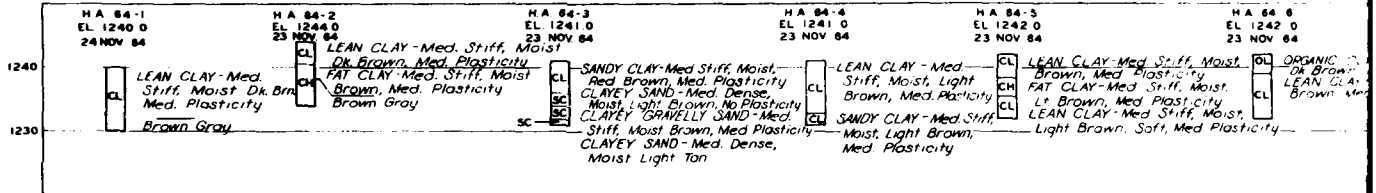
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY: A. E. R.		SALT CREEK AND ITS TRIBUTARIES, NEBRASKA	
DRAWN BY: R. A. R.		YANKEE HILL DAM AND LAKE	
CHECKED BY: R. A. R.		SITE NO. 10	
DESIGNED BY: L. J. B.		EMBANKMENT	
CHECKED BY: L. J. B.		DRAIN PROFILE AND SECTIONS	
APPROVED: <i>Charles L. Hays</i>		DATE: MARCH 1950	
APPROVED: <i>Harold H. Chir</i>		DRAWN AS SHOWN: YES	
U. S. ARMY ENGINEER DISTRICT, OMAHA		PROJECT NUMBER: MSC11-310 E 5	

CORPS OF ENGINEERS



BORROW AREA BORINGS

SCALE VERT 1 INCH = 10 FEET
HORIZ 1 INCH = 100 FEET



BORROW AREA BORINGS

(ELEVATIONS ESTIMATED)

CLASSIFICATION OF SOILS:

CH	FAT CLAY
CL	LEAN CLAY AND SANDY CLAY
ML	SILTS, SANDY SILTS AND CLAYEY SILT
SP	SAND OR GRAVELLY SAND, POORLY GRADED
SW	SAND OR GRAVELLY SAND, WELL GRADED
SM	SILTY SAND OR SILTY GRAVELLY SAND
SC	CLAYEY SAND OR CLAYEY GRAVELLY SAND
OL	ORGANIC CLAY

NOTES:

1. Soil description color etc field are log.
2. The data for each actual ge at the lo the borin condition for their variation materials if encountered in the purvi
3. Absence of any bo strued th ered in e
4. Informa in the Gr is shown at the Ow
5. Undiatu a rotary tube samp with a pe diameter

LEGEND:

DH - 4
HA 64-2
EL 1279.9
DEC 63



Drill Hole Number

Hand Auger Hole Number

Elevation at top of ground.

Date of boring

(M) Percent of moisture at time of drilling determined by laboratory test.

(P.I.) Plasticity Index

(L.L.) Liquid Limit

(S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches.

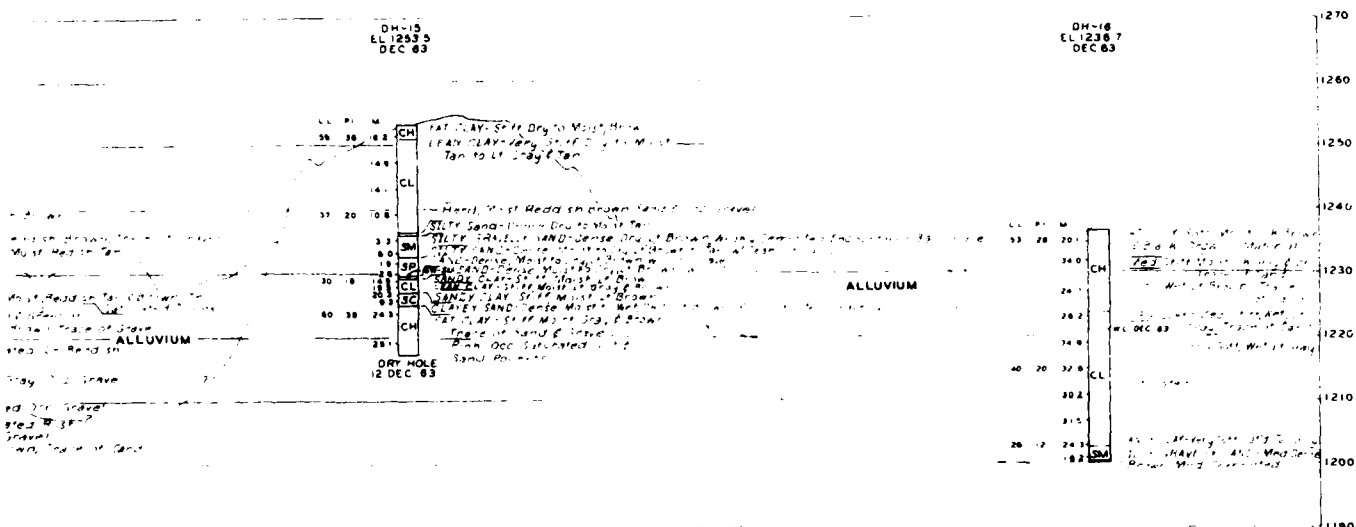
Soil Classification based on Atterberg Limits, Mechanical Analysis and Visual Inspection.

Static Water Level and date recorded.

Inspectors field description of soil encountered

Copy Must Be Made Before Every Addition and/or Modification

ADDITION NO.	DATE	MODIFICATION	DATE



HA 64-5 EL 1242.0 23 NOV 64	HA 64-6 EL 1242.0 23 NOV 64	HA 64-7 EL 1239.0 24 NOV 64	HA 64-8 EL 1242.0 24 NOV 64	HA 64-9 EL 1242.0 24 NOV 64
CL LEAN CLAY-Med Stiff, Moist Brown, Med Plasticity	OL ORGANIC CLAY-Med Stiff, Moist Dark Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity
CH FAT CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity
CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity
CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity	CL LEAN CLAY-Med Stiff, Moist Light Brown, Med Plasticity

BORROW AREA BORINGS

(ELEVATIONS ESTIMATED)

NOTES:

1. Soil descriptions (consistency, moisture, color etc.) based on visual inspection in the field are shown to the right of the graphic log.
2. The data shown graphically and by symbol for each respective boring represents the actual geologic features observed and logged at the location given on the drawing. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of this region are anticipated and if encountered, such variations will not be considered as differing "materially" within the purview of Article IV of the contract.
3. Absence of water readings in the Graphic Log of any boring is not necessarily to be construed that ground water will not be encountered in excavation at this location.
4. Information on material has been condensed in the Graphic Logs. Additional information is shown on field logs, which may be inspected at the Omaha District Office.
5. Undisturbed sampling was accomplished with a rotary drill using a 5 inch diameter Shelby tube sampler. Disturbed samples were obtained with a percussion type drill using a 6 inch diameter open end drive barrel.

GENERAL NOTES:

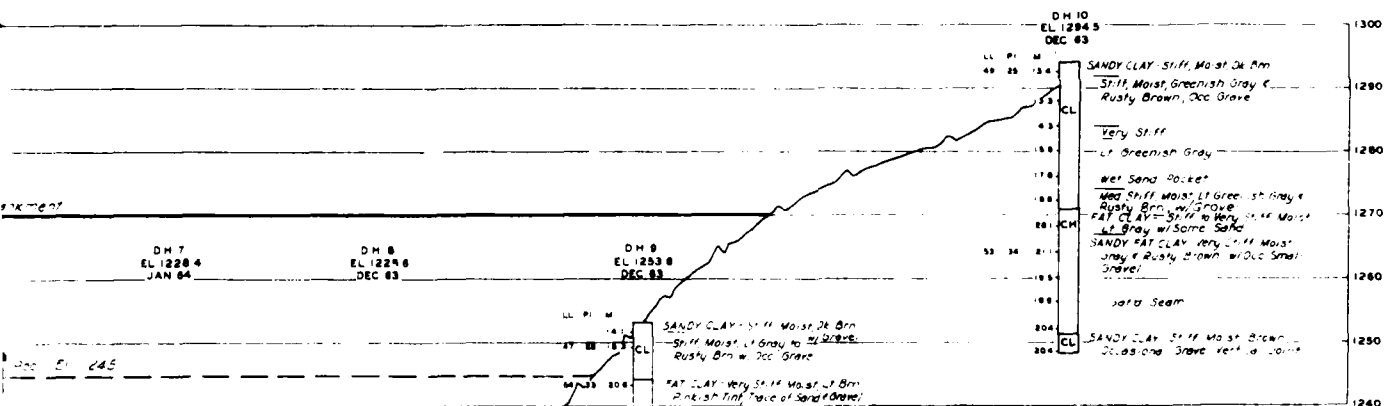
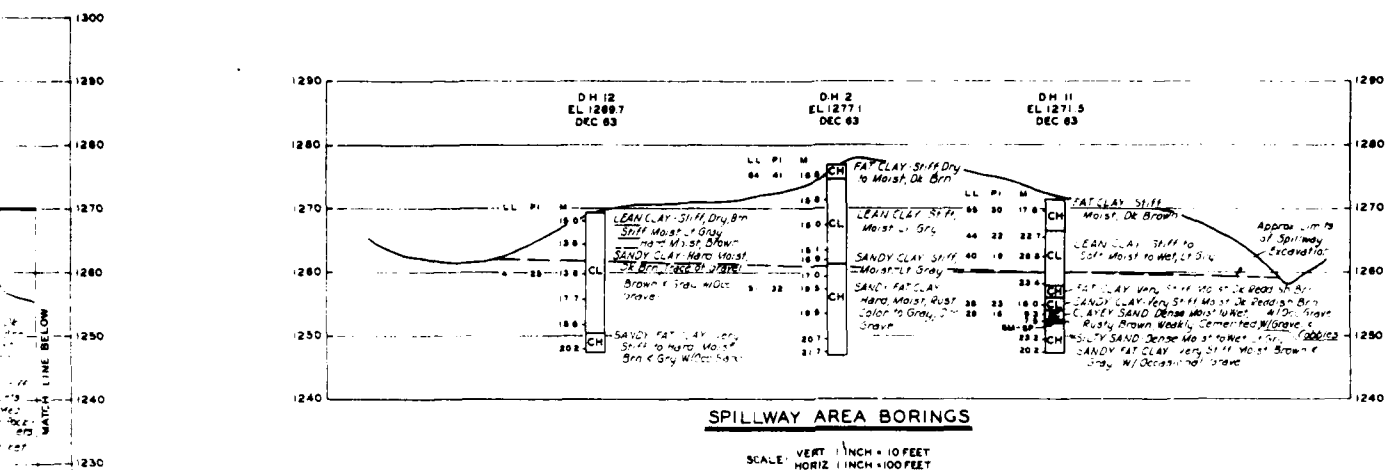
1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of borings, see Plate A-4

THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO. 10 BORING LEGEND AND RECORD OF BORINGS-BORROW AREA	
DESIGNED BY: J. W. H. M. G.	DATE: MAR 1965
CHECKED BY: E. V. L. M. G.	DATE: MAR 1965
APPROVED BY: [Signature]	DATE: MAR 1965
APPROVED BY: [Signature]	DATE: MAR 1965
MOSCII-310E10	



**GENERAL NOTES:**

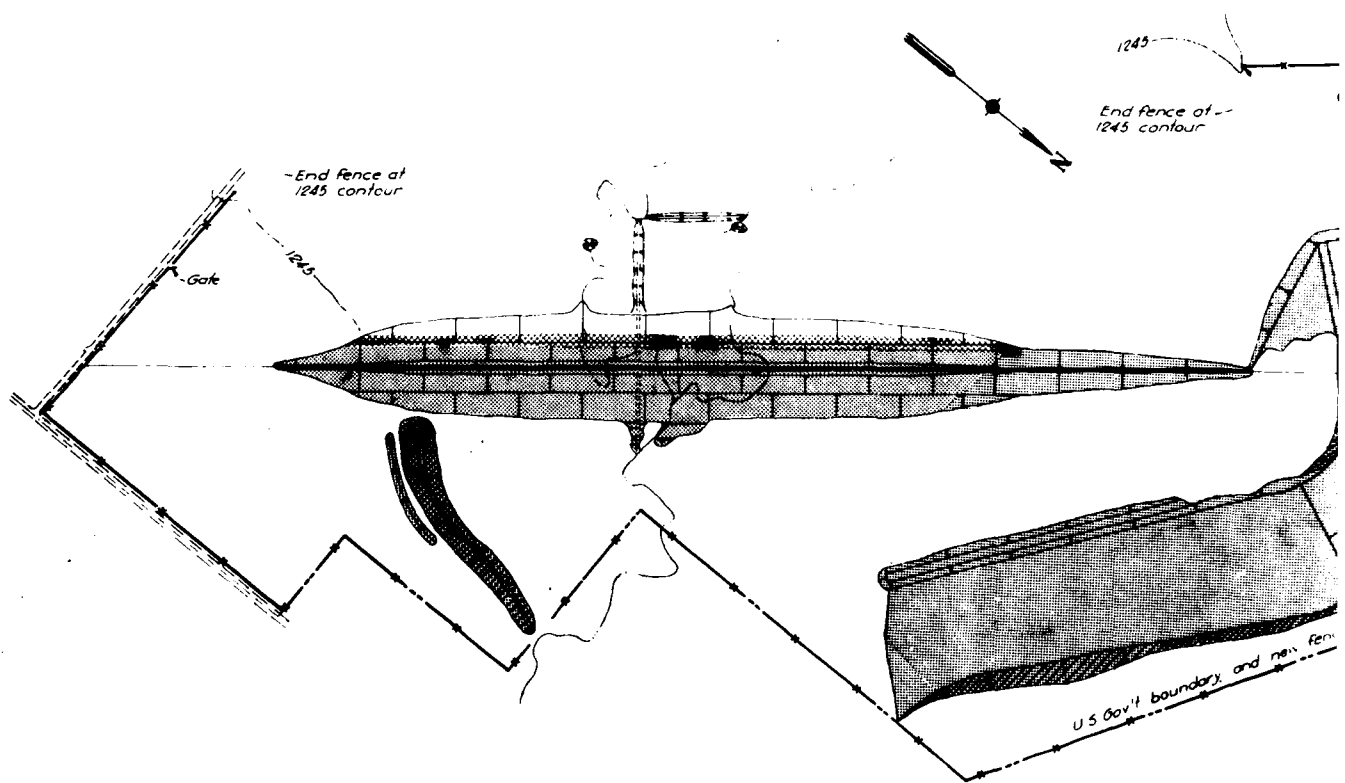
1. For Boring Legend, Classification of Soils and Notes, see Page A-1.
2. For location of Borings, see Page A-2.

THIS DRAWING HAS BEEN REDUCED TO
FIT THE SIZE OF THE ORIGINAL SCALE.



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO. 10 RECORD OF BORINGS EMBANKMENT AND SPILLWAY AREA	
DESIGNED BY: E. H. B.	DATE: MAR. 1965
CHECKED BY: E. H. B.	SCALE AS SHOWN
APPROVED BY: <i>Donald J. McClure</i>	PROJECT NO. 65-066 65-63
MSC11-310E II	

A 100 Microsecond film of a Paper, Appendix, Record
 Containing the Study, Design, Construction and the Modification



SLOPE PROTECTION AND FENCING PLAN

SCALE 1 INCH = 200 FEET
 0 100 200

All areas disturbed by grading under this contract shall be seeded. Disturbed areas up to 250 sq. ft. or less in size and riprap areas shall not be seeded. Areas disturbed by the contractor outside the above indicated areas for which approval has not been secured, shall be seeded by and at the expense of the contractor.

 Seeding, see note
 Topsoil of excavated slopes and seeding
 Embankment stone protection
 U.S. Gov't boundary
 Fence and gate this contract

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

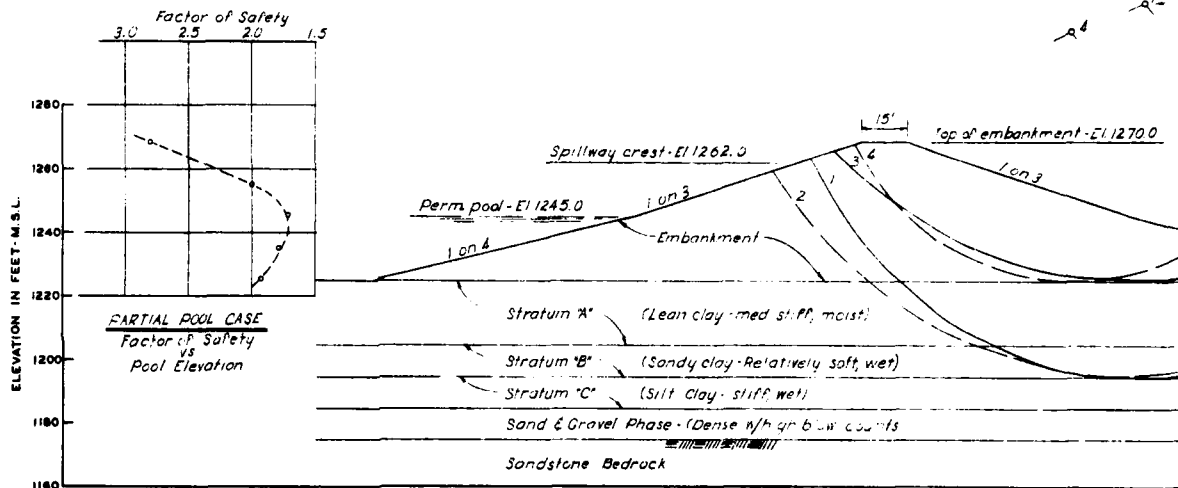
4 - 200 FEET
200



U. S. ARMY ENGINEER DISTRICT, OMAHA CHIEF OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY J.W.K.	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO.10 SLOPE PROTECTION AND FENCING DETAILS
DESIGNED BY D.E.H.	
DESIGNED BY D.E.H.	
DESIGNED BY L.J.S.	
BY <i>[Signature]</i>	
DATE <i>[Signature]</i>	DATE <i>Charles L. Bly</i> MARCH 1965
PROJECT <i>Thurlock St. Dam</i>	NO. <i>43 Short</i> DRAWING NUMBER MSC II - 310E

SUMMARY OF STABILITY STUDIES

CASE	SHEAR STRENGTH	CRITICAL ARC	ELEVATION OF WATER	SAFETY FACTORS		SAFETY FACTORS WITH EARTHQUAKE	
				COMPUTED	REQUIRED	COMPUTED	REQUIRED
END OF CONSTRUCTION	Q	1	1225	3.57	1.3	2.88	1.0
STEADY SEEPAGE	R	3 & 4	1245 TO 1225	1.82	1.5	1.50	1.0
STEADY SEEPAGE	S	1	1245 TO 1225	1.81	1.5	1.44	1.0
SUDDEN DRAWDOWN	R	4	1268 TO 1245	1.45	1.0	NOT APPLICABLE	
PARTIAL POOL	R	4	VARIES SEE GRAPH	1.70 (min)	1.5	1.38	1.0



STABILITY ANALYSIS - CIRCULAR ARC METHOD

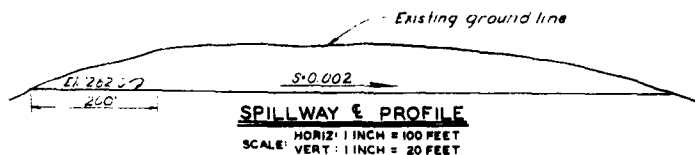
FINITE SLICES - ELECTRONIC COMPUTER PROGRAM

SCALE: 1 INCH = 20 FEET
20' 0'

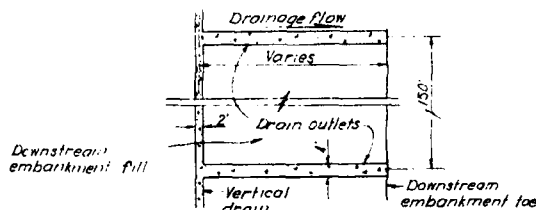
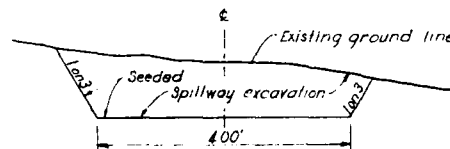
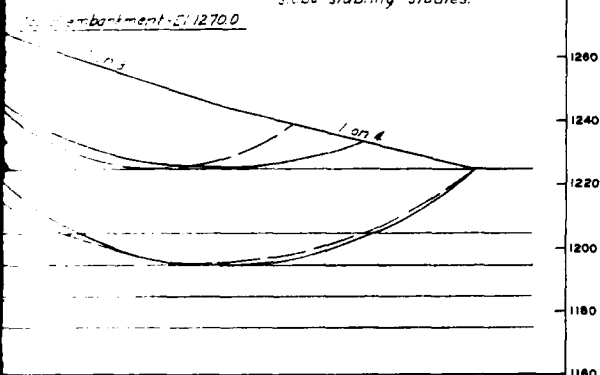
ADOPTED SHEAR STRENGTH VALUES

MATERIAL	UNCONSOLIDATED UNDRAINED (Q) STRENGTH		CONSOLIDATED UNDRAINED (R) STRENGTH		CONSOLIDATED DRAINED (S) STRENGTH	
	TAN ϕ	COH T/BF	TAN ϕ	COH T/BF	TAN ϕ	COH T/BF
EMBANKMENT	0.07	0.90	0.23	0.23	0.50	0
FDN. STRATUM "A"	0	1.88	0.26	0.80	0.58	0
FDN. STRATUM "B"	0	0.65	0.21	0.25	0.76	0
FDN. STRATUM "C"	0	2.00	0.15	1.34	0.60	0

FACTORS WITH EARTHQUAKE REQUIRED	
3	1.0
0	1.0
4	1.0
CABLE	
8	1.0



NOTE
Same arcs, symmetrical about
center of trial failure arc
were used for upstream
slope stability studies.



PLAN - TYPICAL PERVIOUS DRAIN

SCALE: 1 INCH = 20 FEET

THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

TEST	CONSOLIDATED DRAINED (S) STRENGTH
NO.	TAN ϕ COH T/SF
3	0.50 0
0	0.58 0
5	0.78 0
4	0.80 0



THIS PLAN ACCOMPANIES CONTRACT NO.
DA-38-066-100

U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA	
DAM AND RESERVOIR, SITE 10	
TYPICAL SECTIONS AND STABILITY ANALYSIS	
DATE: APRIL 1964	DESIGNED BY: Charles E. Hopp
CHECKED BY: Harold J. DeChow	APPROVED BY: [Signature]

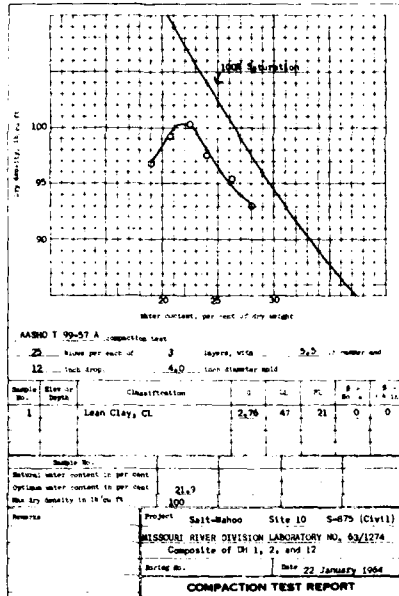


FIGURE 1

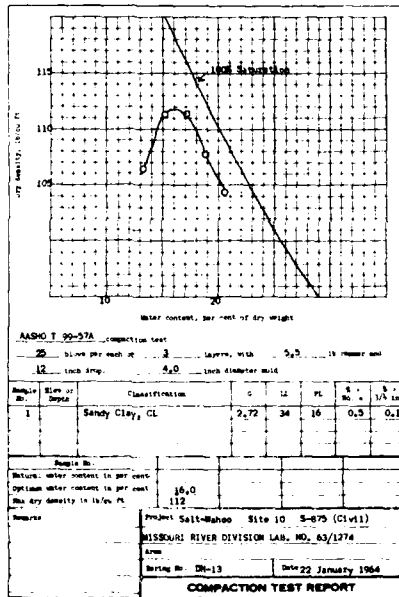


FIGURE 5

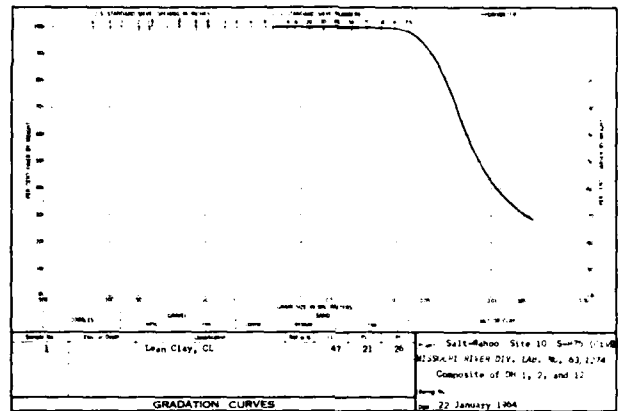


FIGURE 2

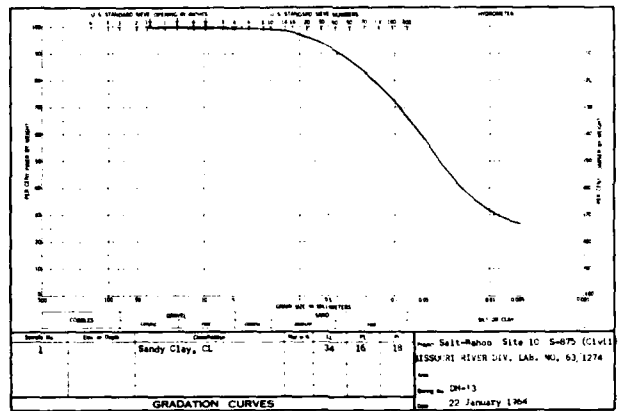


FIGURE 6

TABLE 1. - UNCONFINED COMPRESSION AND CLASSIFICATION TEST DATA

Salt-Mahoe Site No. 10									
TEST REQUEST NO. S-675 (CIVIL)									
MISSOURI RIVER DIVISION LABORATORY NO. 63/1274									
Sample No.	Sample No.	Dry Density (lb/cu ft.)	Moisture (percent)	L/D	Breaking Strength (lb/sq. ft.) (ton/sq. ft.)	Atterberg Limits	Failure Diagram	Classification (b)	Remarks
12	1	106.2	17.2	2.35	19.62	3.12	36	16	Steady clay, CL. Shear failure. Brown sandy clay. This specimen tested in triaxial apparatus. Specimen size: Dia. 1.18, Ht. 3.04
12	12	96.3	23.8	2.35	21.97	3.58	47	21	Lean clay, CL. Shear failure. Brown lean clay. This specimen tested in a triaxial apparatus. Specimen size: Dia. 3.18, Ht. 3.04

Notes: (a) L/D denotes ratio of length to diameter of the specimen.
 (b) Classification in accordance with Military Standard-419 (MS); Unified Soil Classification System for Roads, Airfields, Runways and Foundations, dated 30 June 1960.

SOIL CLASSIFICATION

Salt-Mahoe Site 10									
Pattern									
Sample No.	Sample No.	Moisture (percent)	Dry Density (lb/cu ft.)	Atterberg Limits	Failure Diagram	Classification (b)	Remarks	Sample No.	Sample No.
1	1	17.2	106.2	3.12	36	16	Steady clay, CL.	1	1
12	12	23.8	96.3	3.58	47	21	Lean clay, CL.	12	12

TABLE 1

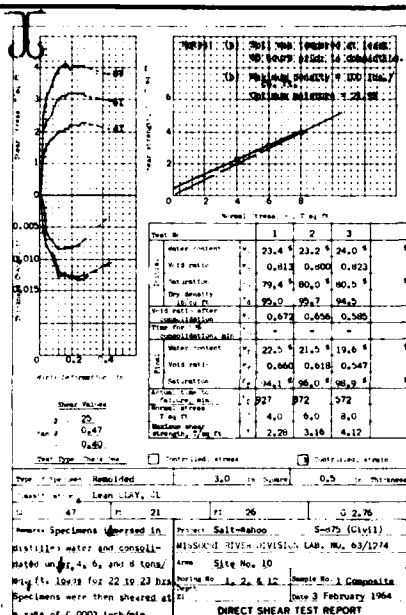
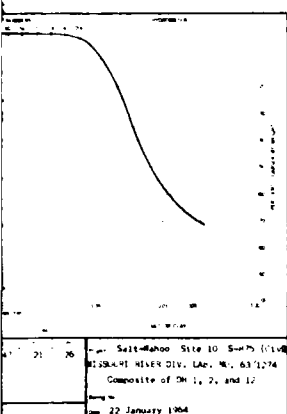


FIGURE 3

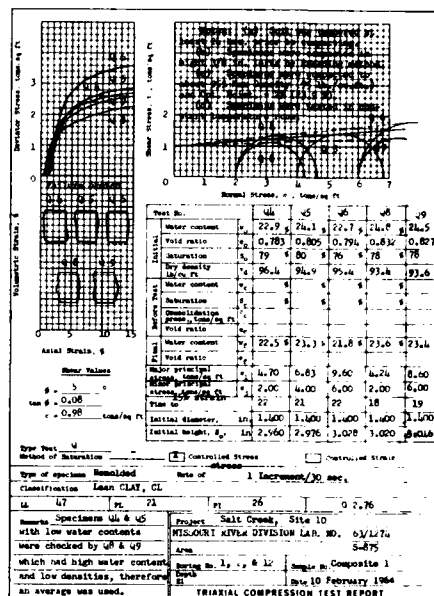


FIGURE 4

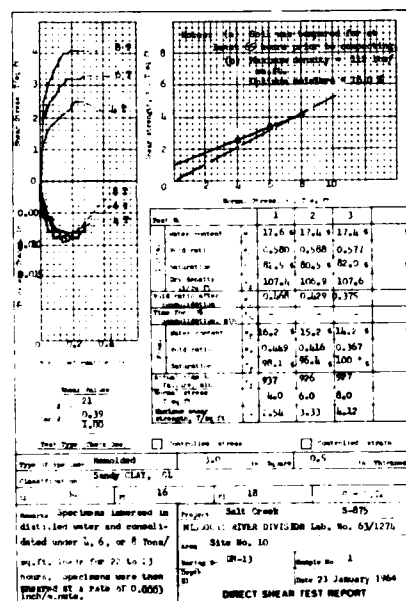


FIGURE 7

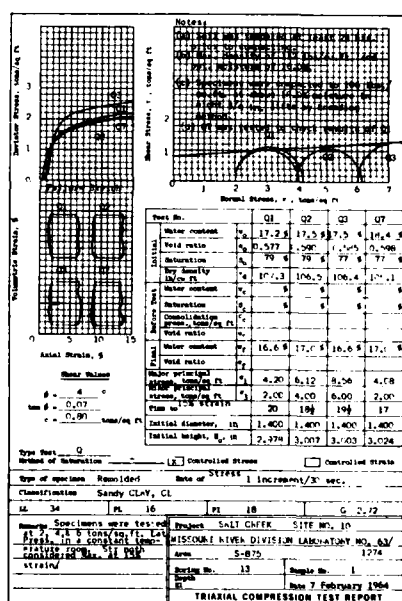


FIGURE 8

SOIL CLASSIFICATION RECORD SHEET									
Salt-Creek Site 10		MISSOURI RIVER DIV. LAB. NO. 63/1274		DATE: 22 JAN 64		BY: [Signature]		REVISION: 1	
TEST NO.	1	2	3	4	5	6	7	8	9
TEST TYPE	1	2	3	4	5	6	7	8	9
TEST RESULT	1	2	3	4	5	6	7	8	9
TEST COMMENT	1	2	3	4	5	6	7	8	9

TABLE 2

THIS PLAN ACCOMPANIES CONTRACT NO. 6A-28-056-001 MODIFICATION NO.



THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	REVISION	BY	APPROVED

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
DAM AND RESERVOIR, SITE 10
EMBANKMENT SOIL TEST DATA

DESIGNED BY: A.M.D.
CHECKED BY: E.C.V.
DRAWN BY: E.C.V.
APPROVED BY: C.W.H.

APPROVED BY: [Signature]
DATE: APRIL 1964

REVISIONS SHOWN: [Signature]
REVISIONS: [Signature]

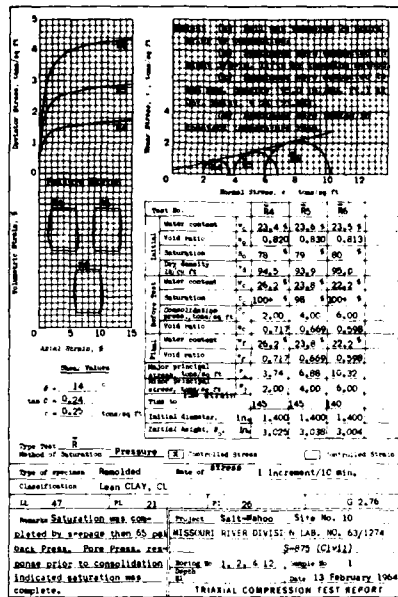


FIGURE 1

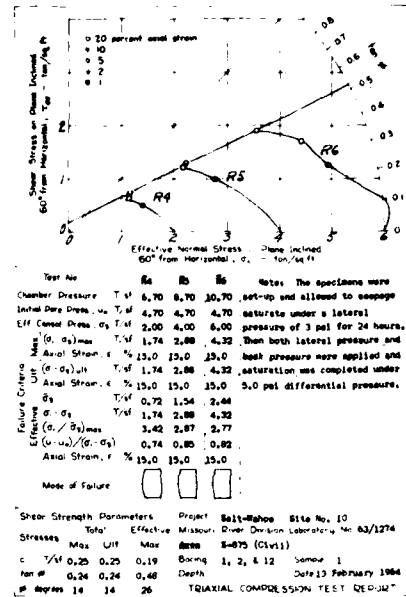


FIGURE 2

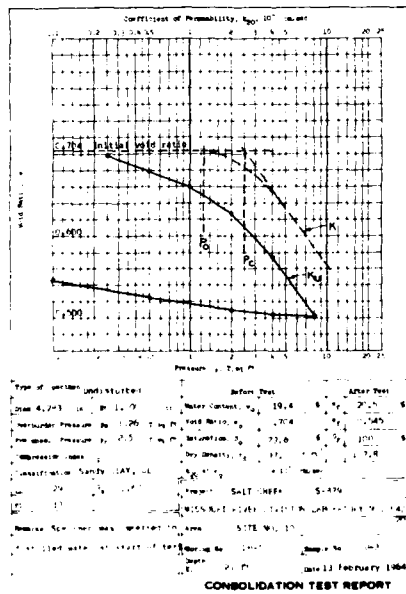


FIGURE 3

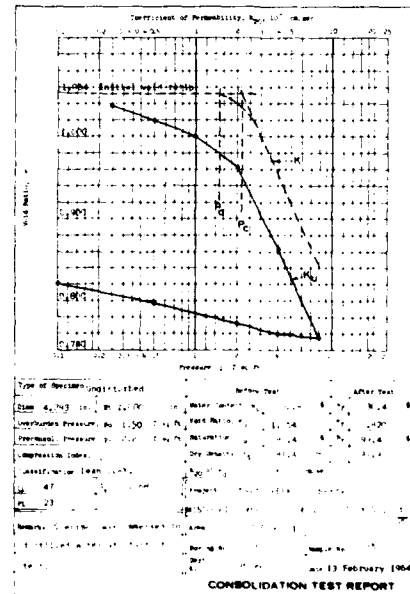


FIGURE 4

A US Government Work or A Paper Reproducible Under
Copy Must Be Made Before Every Addition and/or Modification

ADDITIONAL NO.
DATE
MODIFICATION
DATE

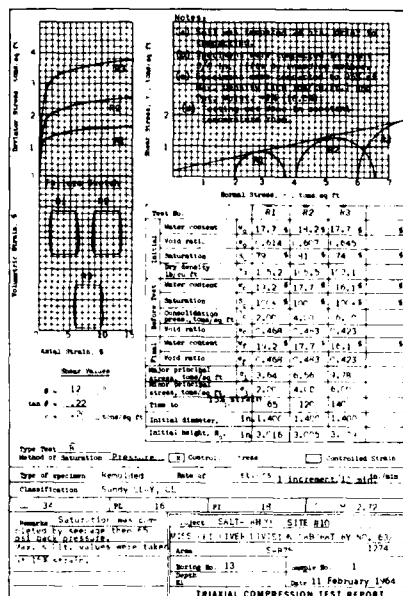


FIGURE 3

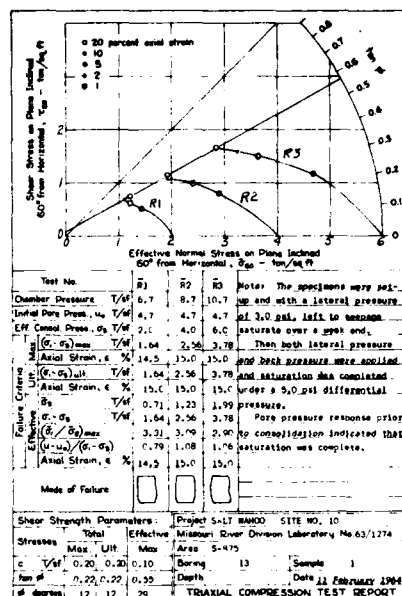


FIGURE 4

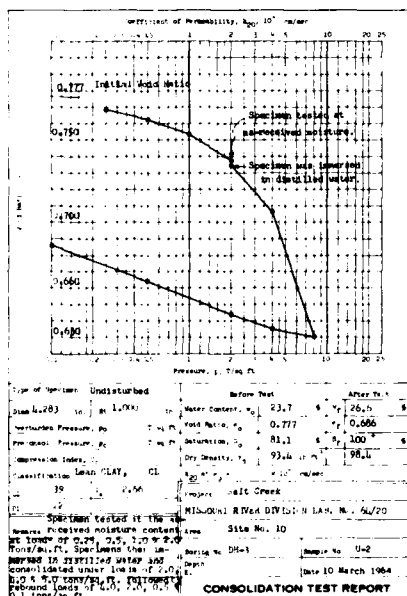


FIGURE 7

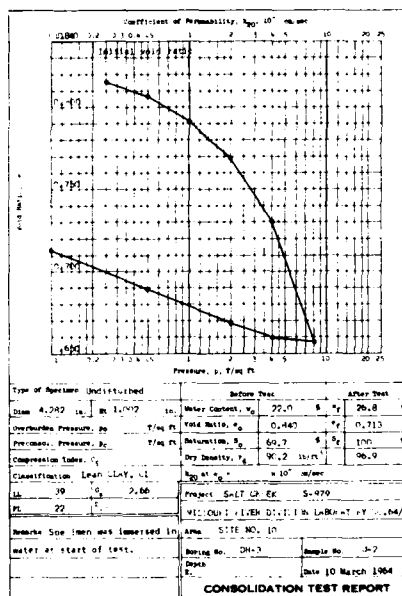


FIGURE 8

U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA			
DAM AND RESERVOIR, SITE 10			
EMBANKMENT SOIL TEST DATA AND FOUNDATION CONSOLIDATION TESTS			
DESIGNED BY: A M D	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA		
DRIVEN BY: E C V	DAM AND RESERVOIR, SITE 10		
TESTED BY: E C V	EMBANKMENT SOIL TEST DATA AND FOUNDATION CONSOLIDATION TESTS		
CHIEF BY: C W H	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA		
APPROVED BY: <i>Charles L. Hopp</i>	DATE: APRIL 1964		
APPROVED BY: <i>Harold J. DeChau</i>	DATE: APRIL 1964		
APPROVED BY: <i>Harold J. DeChau</i>	DATE: APRIL 1964		



THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

THIS PLAN ACCOMPANIES CONTRACT NO. DA-35-086-001. MODIFICATION NO.

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1961) PLATE A12

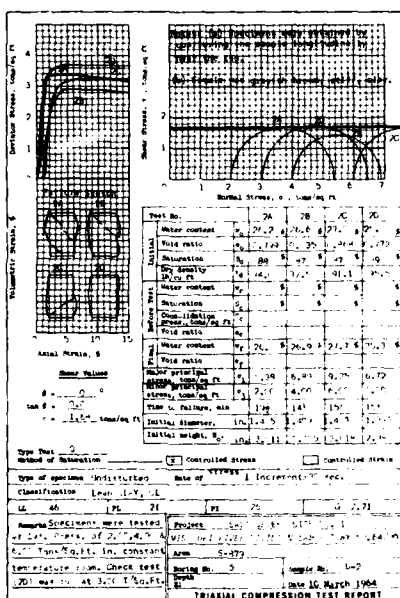
[illegible]

FIGURE 1

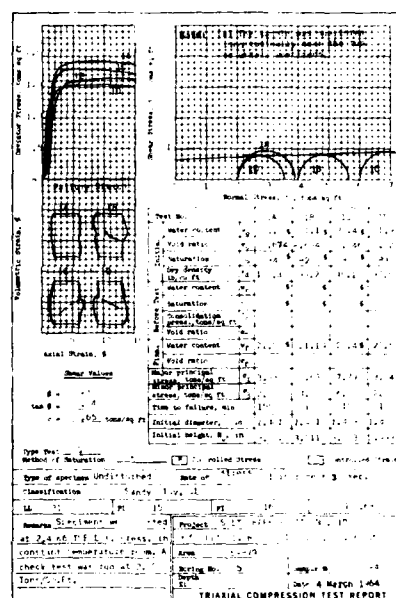


FIGURE 2

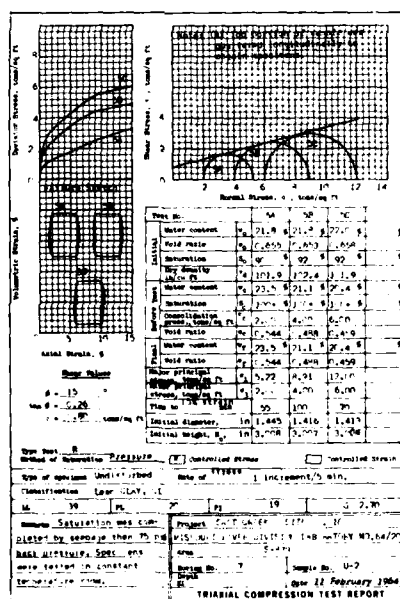


FIGURE 4

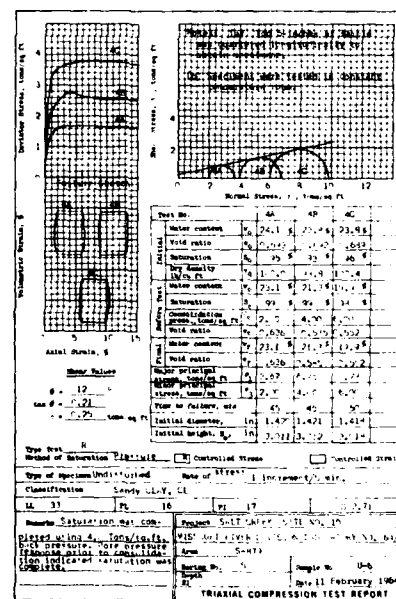


FIGURE 5

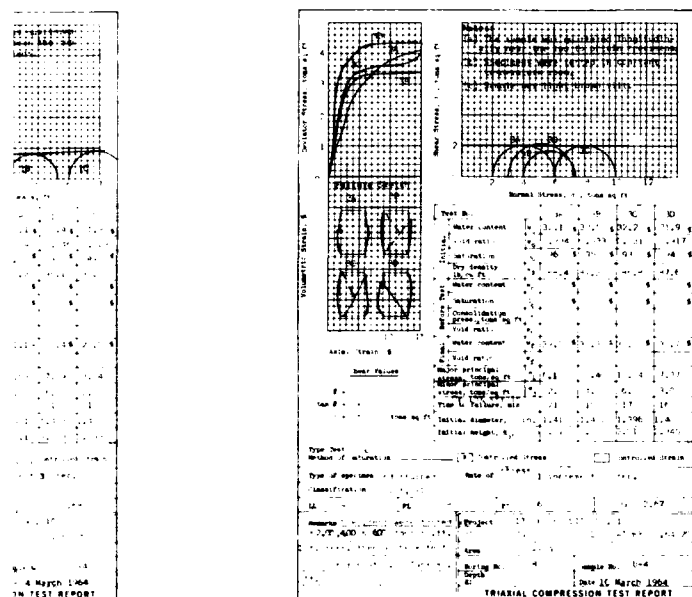


FIGURE 3

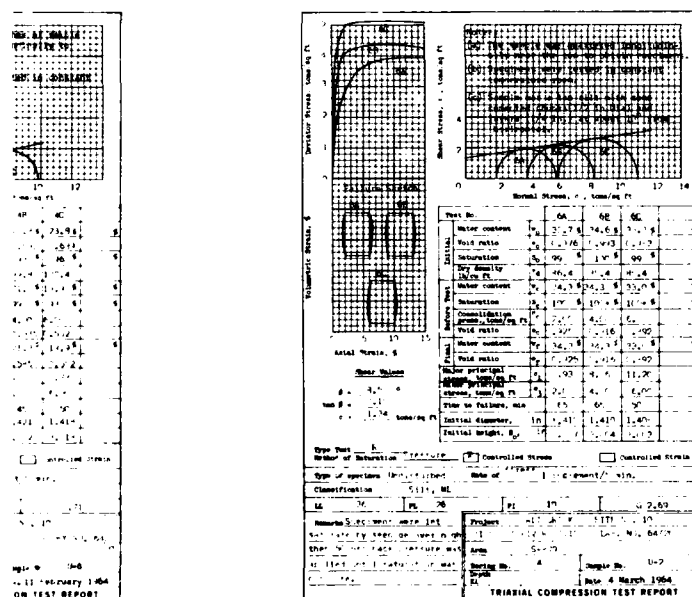


FIGURE 6

THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	HAZD	APPR
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA DAM AND RESERVOIR, SITE 10 FOUNDATION SOIL TEST DATA			
DESIGNED BY: A M D			
DRAWN BY: E C V			
TRACKED BY: E C V			
ENGINEERED BY: C W H			
CHECKED BY: <i>W. K. [Signature]</i> SPEC. FOR FOUNDATION	APPROVED: <i>Charles E. Hopp</i> DIST. ENGINEER		
APPROVED: <i>Harold J. [Signature]</i> DIST. ENGINEER	DATE: APRIL 1964	SCALE: AS SHOWN	
SPECIAL INSTRUCTIONS:		SPECIAL NO. AND ED-66a	
DRAWING NUMBER:		SHEET:	

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1981) PLATE A13

THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-066-^{eng.} , MODIFICATION NO.



2

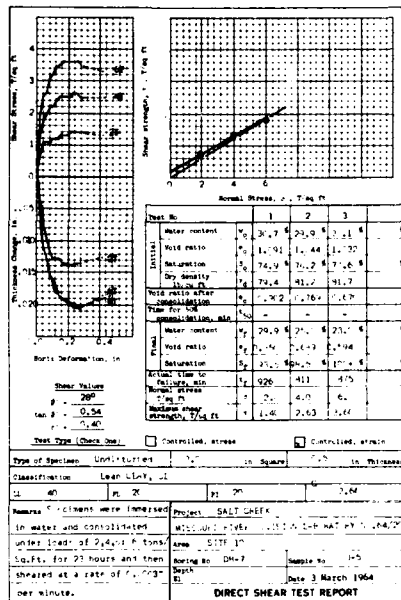


FIGURE 1

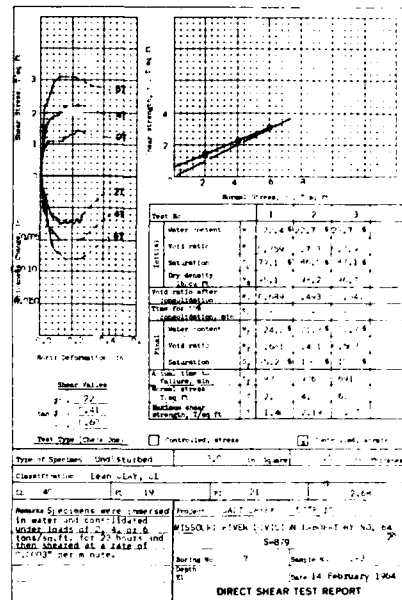


FIGURE 2

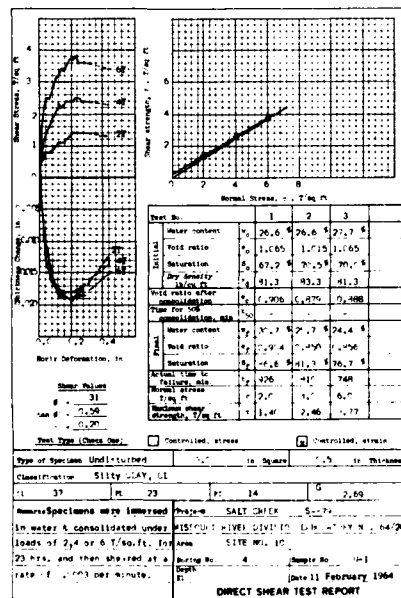


FIGURE 3

SALT CREEK, SITE 810

TEST REPORT NO. S-879

Hole No.	Sample No.	Depth	Dry Density (lb/cu. ft.)	Moisture (percent)	1/2 D	Breaking Strength (lb/sq. in. at 1/2 in. dia.)	Atterberg Limits	Liquid Limit (%)	Plastic Limit (%)
4	U-1	7.0-10.1	93.9	25.8	1.06	14.32	1.39	37	23
7	U-3	12.0-13.8	101.3	27.1	2.02	17.97	1.79	42	18
7	U-5	20.1-22.1	97.1	31.7	1.04	8.52	0.61	41	21
8	U-1	4.0-6.0	93.6	22.8	1.06	1.70	0.77	40	21
8	U-2	14.8-17.0	97.8	25.3	2.02	19.4	1.57	41	21

Note: 1/2 D density is 1.04 g/cm³ (63.9 lb/cu. ft.)

A 105 Micro-master Film or a Paper Reproducible Record Copy Must Be Made Before Every Addendum and/or Modification

ADDENDUM NO.
DATE
MODIFICATION
DATE

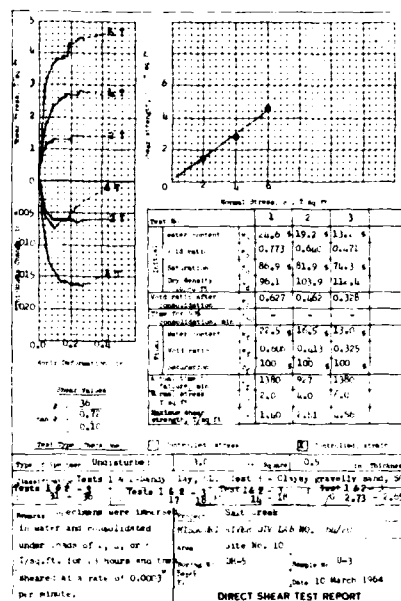
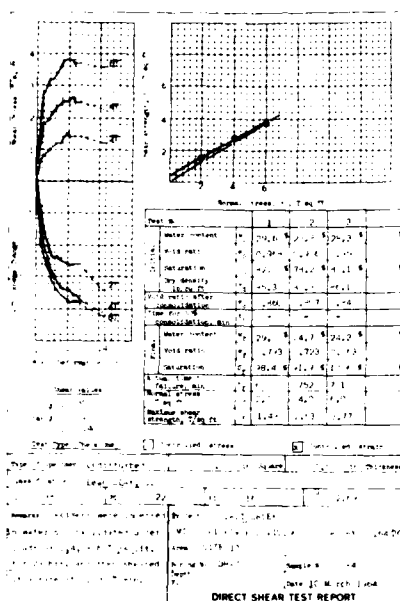


FIGURE 3

FIGURE 4

E 2

TABLE 1. - SUMMARY OF SOIL TEST DATA

TEST NO. 100, 101, 102

TEST NO. 100, 101, 102

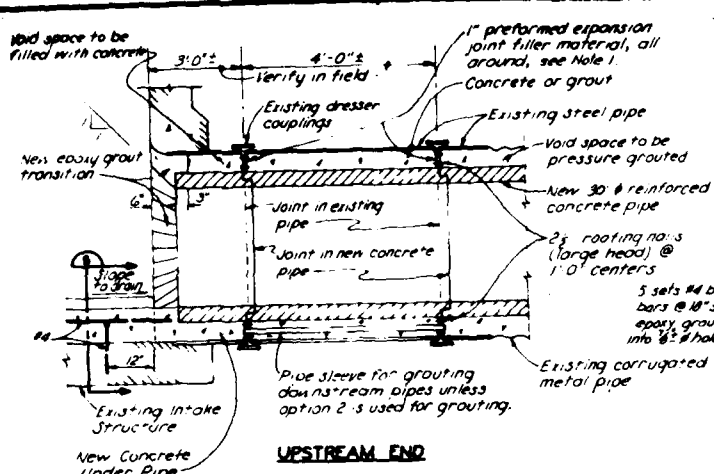
Density (lb/cu ft)	Moisture (percent)	U D	Bearing Strength		Atterberg Limits		Classification	Failure Diagram	Remarks
			lb/sq. ft.	lb/sq. ft.	LL	PL			
13.9	26.8	1.06	17.32	1.39	37	23	Silty CLAY, CL		General failure. Light brown silty clay. Sample contained small holes throughout and a vertical fault.
1.3	21.1	2.02	17.97	1.70	42	18	Lean CLAY, CL		Columnar failure. Dark brown lean clay. Sample contained some organic matter throughout.
1.1	3.27	1.04	5.52	0.61	41	21	Lean CLAY, CL		General failure. Dark brown lean clay. Sample contained some small holes throughout.
1.6	22.8	1.06	1.70	0.77	49	21	Lean CLAY, CL		Columnar failure. Dark brownish gray lean clay. Sample contained some small holes throughout.
0.7	25.3	2.00	19.7	1.57	5	27	Lean CLAY, CL		General failure. Reddish brown clay. Sample contained some small holes throughout.

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SIZE.

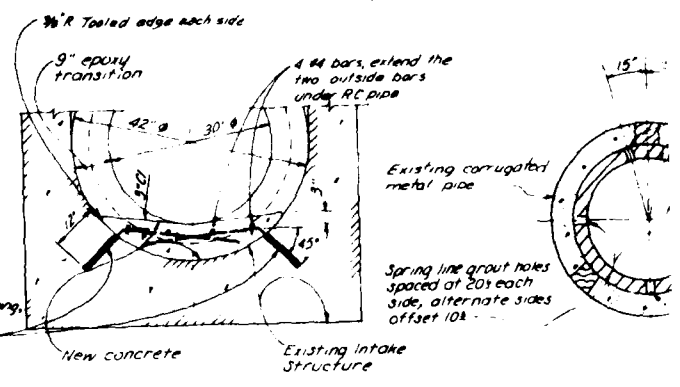


THIS PLAN ACCOMPANIES CONTRACT NO. DA-35-084-00. MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY: A.M.D. DRAWN BY: E.C.V. CHECKED BY: E.C.V. APPROVED BY: C.W.H.		SALT CREEK AND ITS TRIBUTARIES, NEBRASKA DAM AND RESERVOIR, SITE 10 FOUNDATION SOIL TEST DATA	
APPROVED BY: <i>Charles L. Blapp</i> DATE: APRIL 1966		APPROVED BY: <i>David J. de Clau</i> DATE: APRIL 1966	

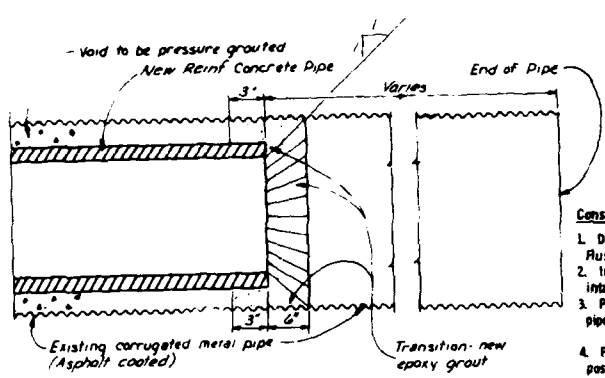


UPSTREAM END



SECTION A
NO SCALE

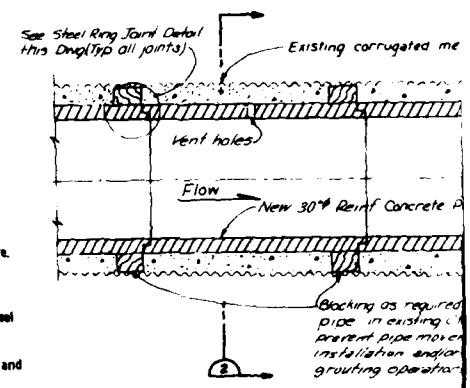
SECTION
NO SCALE



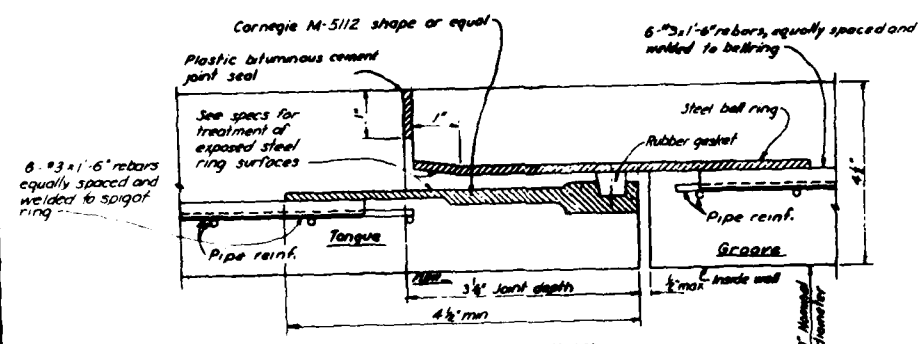
DOWNSTREAM END

Construction Procedure

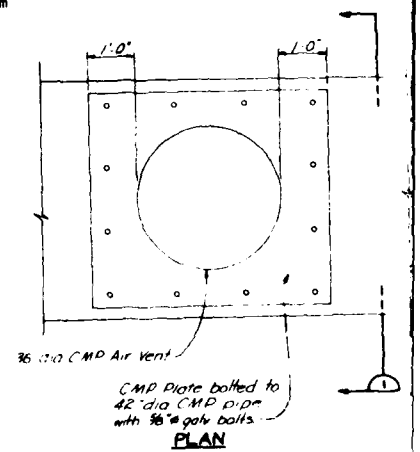
1. Drill holes and sandblast existing concrete in intake structure. Flush out debris.
2. Insert short upstream length of pipe in conduit and store in intake structure.
3. Place 4 foot length of pipe so that ends of pipe line up with steel pipe joints. Position pipe sleeve as shown on drawing.
4. Place concrete or grout around the 4 foot long concrete pipe and position preformed joint filler at both ends of pipe.
5. Position short upstream length of pipe and fill void space outside of pipe and place concrete in base of intake structure.
6. Install downstream concrete pipe sections and grout void space between new concrete pipe and old corrugated metal pipe.
7. Place new epoxy grout transition sections at upstream and downstream ends of new concrete pipe.



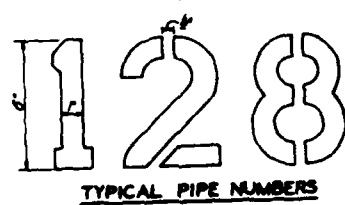
TYPICAL LONGITUDINAL SECTION
NO SCALE



STEEL RING JOINT DETAIL
NO SCALE



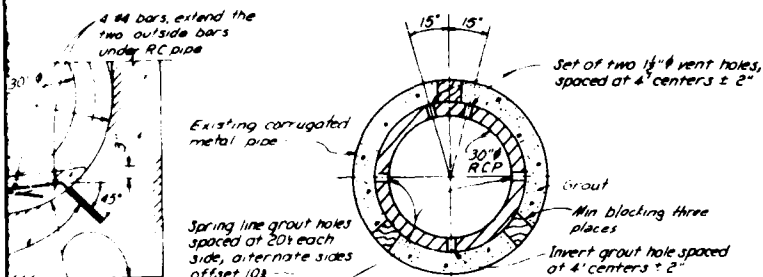
PLAN



TYPICAL PIPE NUMBERS

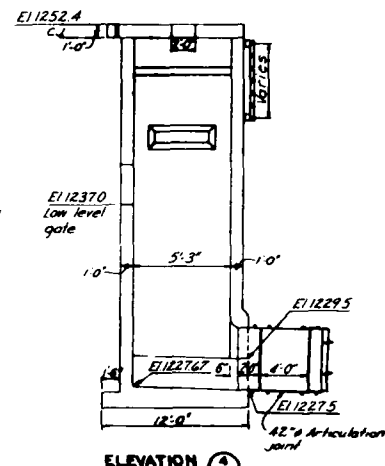
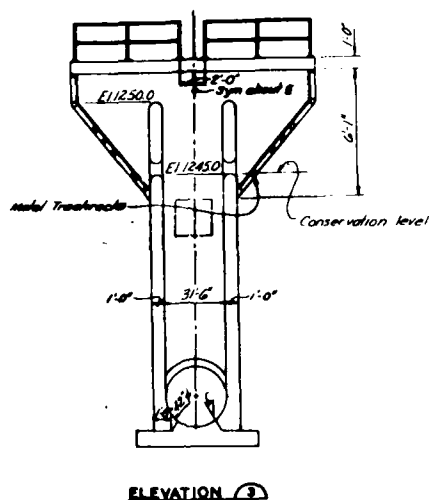
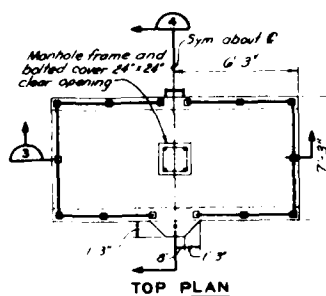
NOTE:
Permanent numbers to be painted on inside face of each concrete pipe section. Pipe sections are to be numbered consecutively starting at downstream end. Numbers are to be located at 2 o'clock position looking upstream.

side

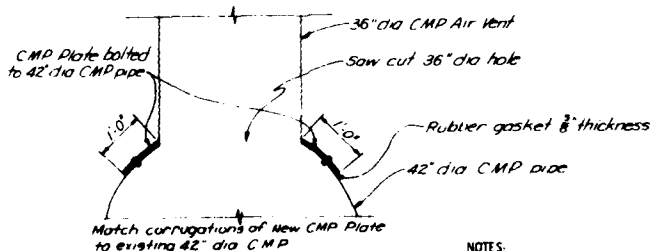
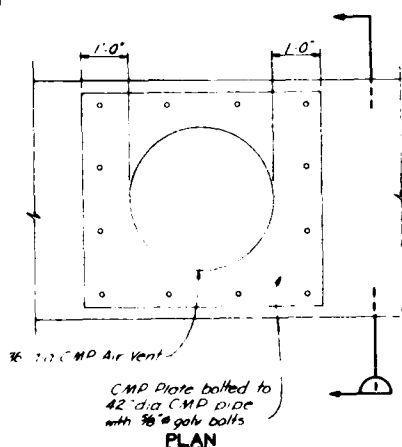
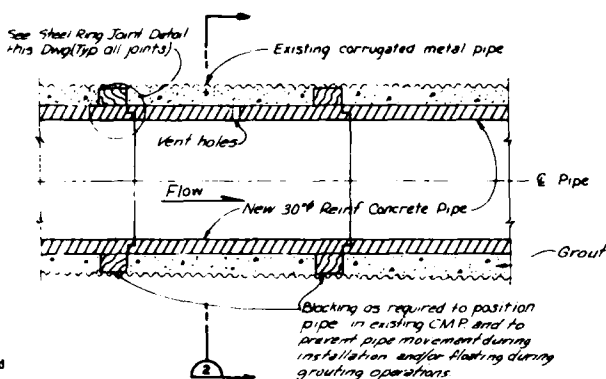


Existing intake structure

SECTION 2
NO SCALE



EXISTING INTAKE STRUCTURES
FOR INFORMATION ONLY
NO SCALE



NOTE:

The Contractor removed a section of the existing 42" dia. CMP and fabricated the 36" dia. air vent to a new section of 42" dia. CMP. The new 42" dia. CMP and new coupling bands were fabricated to the same details as the existing pipe with the exception that two 3/8" thick by 12" wide rubber gaskets were used under the coupling at each new joint in 42" CMP. Shaped and compacted gravel or crushed rock bedding was placed below the new section of CMP and coupling bands.

NOTES:

1. The joint filler shall be carefully cut with a power saber saw on a table and there shall not be over six (6) pieces in each joint. Small variations in fit 1/12-inch maximum shall be filled with plastic bituminous cement.

AIR VENT CONNECTION

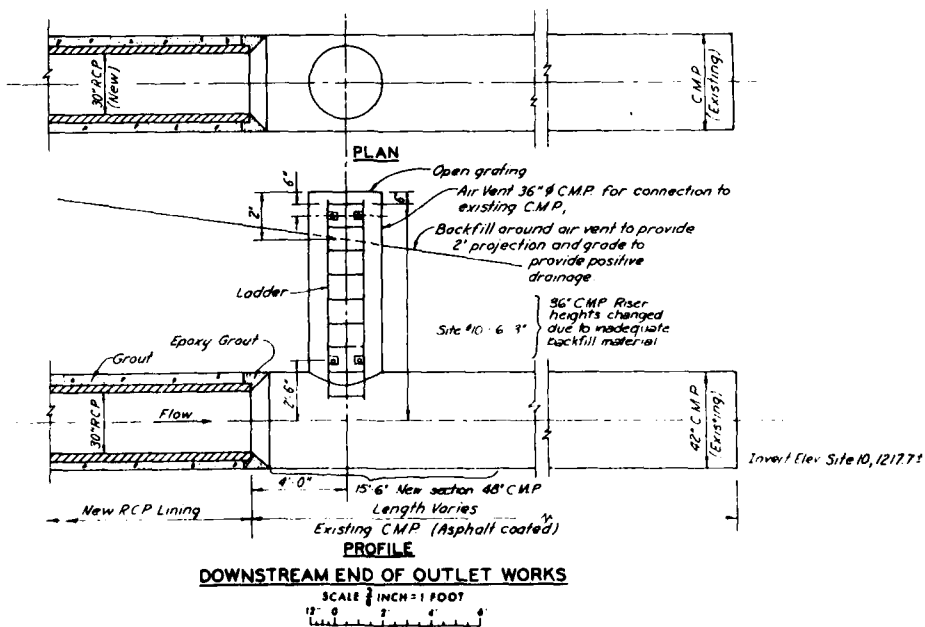
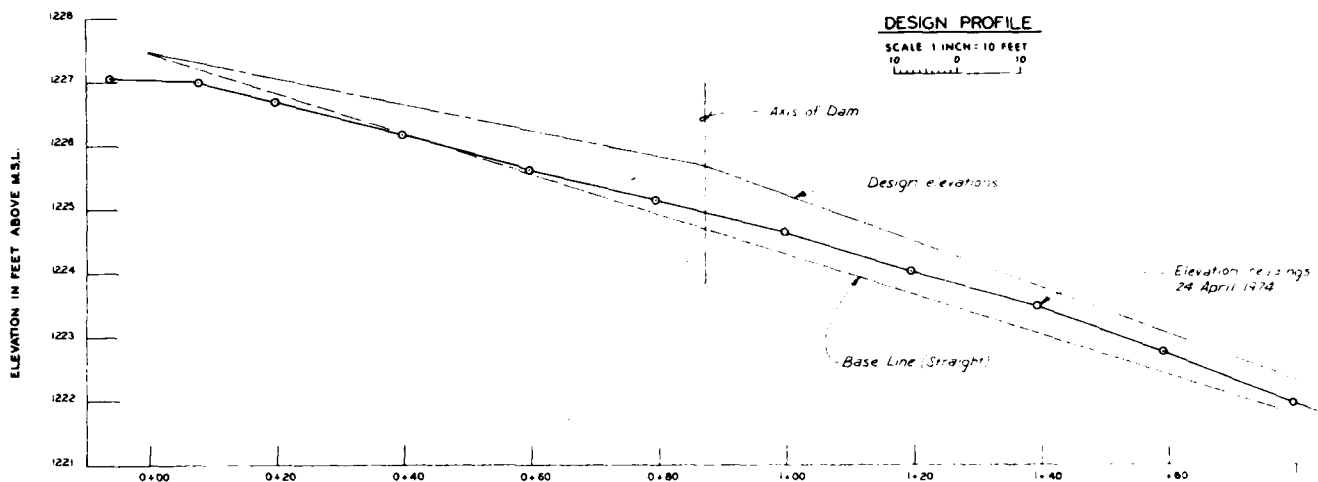
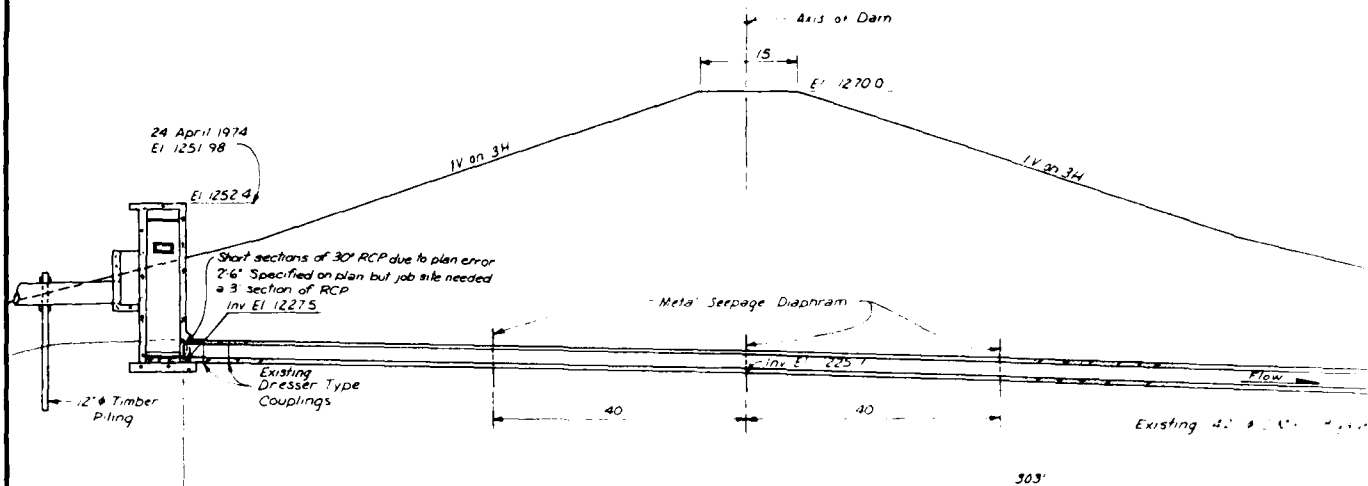
SCALE 3/4" = 1' 0"

THIS DRAWING HAS BEEN REDUCED TO THREE-FIFTHS THE ORIGINAL SCALE.

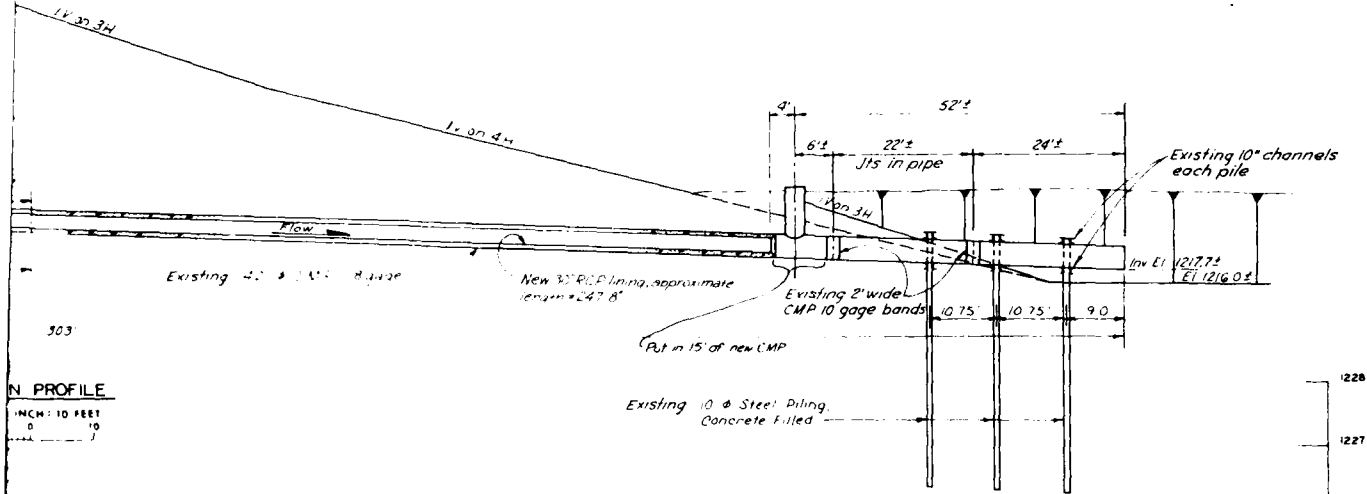
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO. 10 CONDUIT REHABILITATION			
DESIGNED BY: C. H. J.	CHECKED BY: M. H. G.	APPROVED BY: W. R. B.	DATE: 10/1/66
DRAWN BY: J. W. R.		SCALE: AS SHOWN	
APPROVED: J. W. R.		DRAWING NUMBER: MSC26-61E6	

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1961) PLATE A15

2



SETTLE
(INVERT EL)

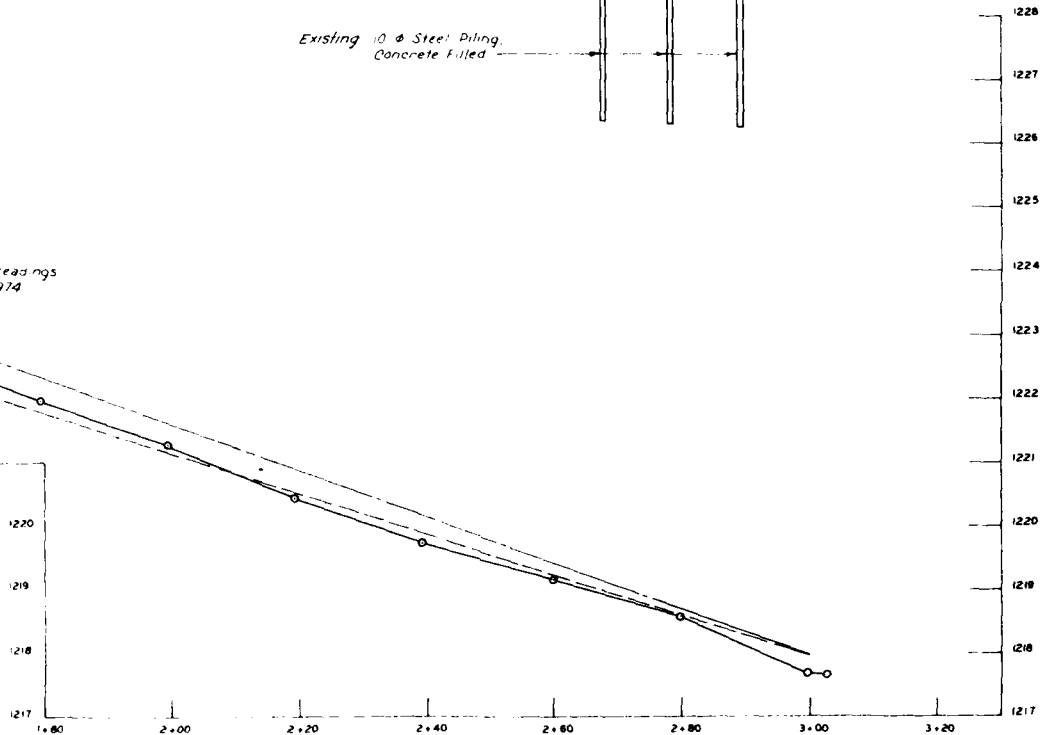


PLAN PROFILE

INCH = 10 FEET
0 10

Flow direction

Elevation readings
24 April 1974



SETTLEMENT PROFILE (INVERT ELEVATION READINGS)

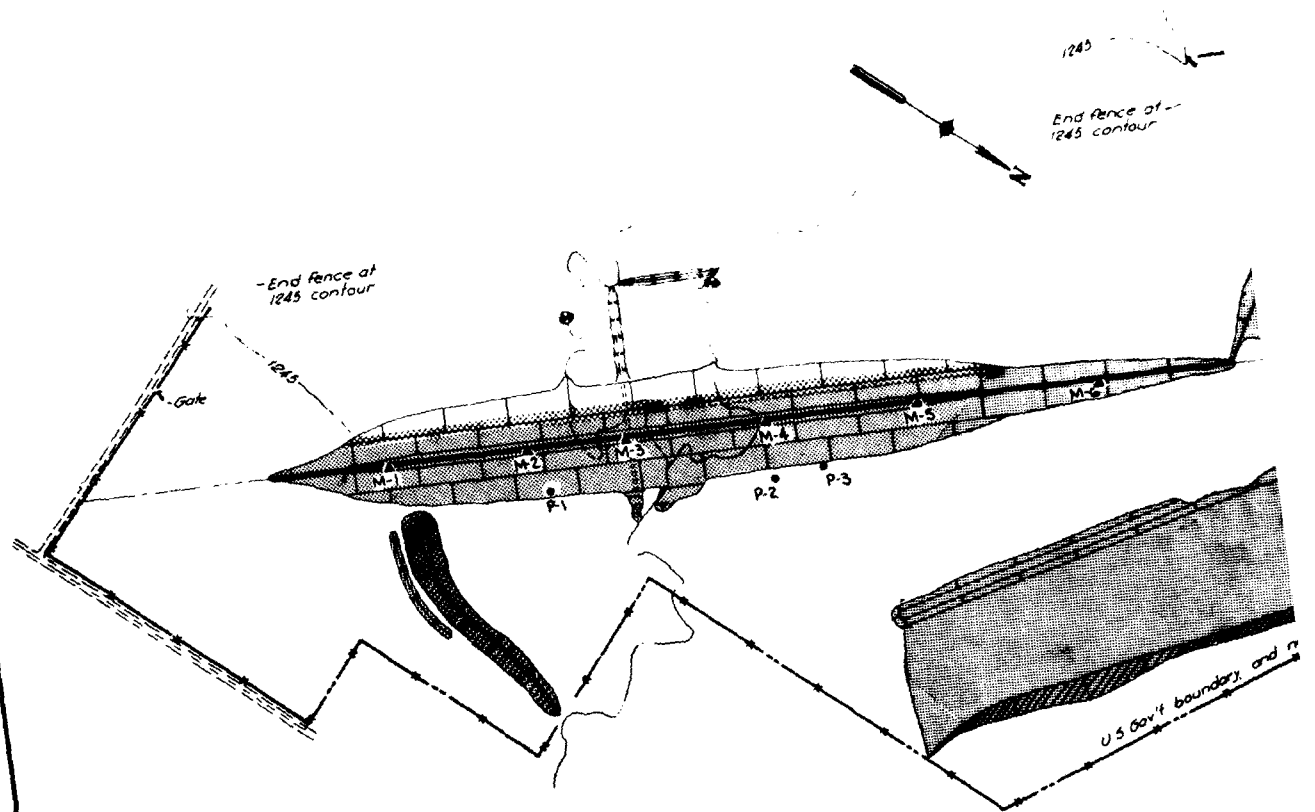
THIS DRAWING HAS BEEN REDUCED TO
THREE-FIFTHS THE ORIGINAL SCALE.

Flow Site 10, 1217.7±

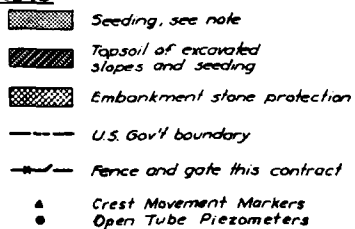


THIS PLAN ACCOMPANIES CONTRACT NO.
DACW45-80-C-051 MODIFICATION NO.

REVISIONS	DATE	DESCRIPTION	MADE	APPROVED
2220		REVISED TO SHOW AS BUILT CONDITIONS	SCS	JJG
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA				
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA OUTLET WORKS REHAB-PHASE IV SITE 10 YANKEE HILL DAM AND LAKE CONDUIT PROFILE AND SURVEY				
DESIGNED BY: C.E.J.	APPROVED: [Signature]			
DRAWN BY: [Signature]	DATE: FEB 1980			
CHECKED BY: M.L.P.	SCALE: AS SHOWN			
SUBMITTED BY: [Signature]	DRAWING NO. DACW45-80-B-0085			
APPROVED: [Signature]	PROJECT NO. MSC27-61E4			



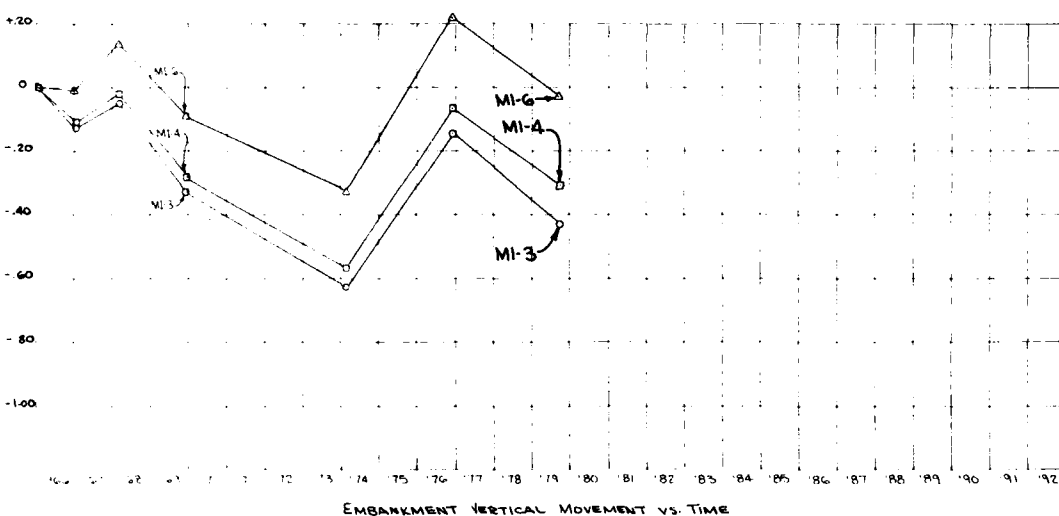
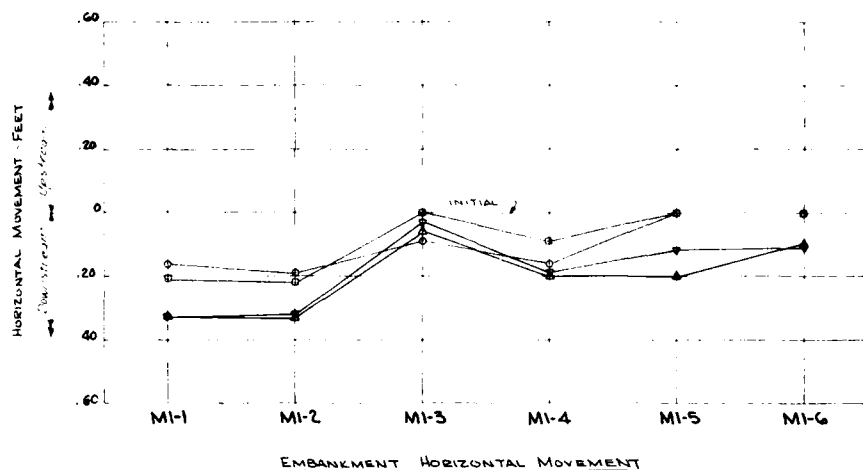
INSTRUMENTATION LOCATION PLAN
 SCALE: 1 INCH = 200 FEET
 200' 0' 200'



DATE	DESCRIPTION	MADE	APPROVED		
	REVISED				
U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA YANKEE HILL DAM AND LAKE SITE NO.10 INSTRUMENTATION LOCATION PLAN				
CHECKED BY					
REVIEWED BY					
APPROVED BY					
DATE					
REVISIONS	APPROVED	DATE			
DATE	DATE	DATE	FIELD AS SHOWN	SCALE	DATE
APPROVED				SCALE	



THIS PLAN ACCOMPANIES CONTRACT NO.
 DACA41 MODIFICATION NO.



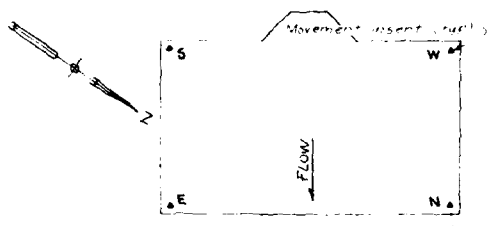
THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE.

NOTE: REFERENCE AT EACH END OF
THE DAM IN REPAIR PERIOD IN 1975.

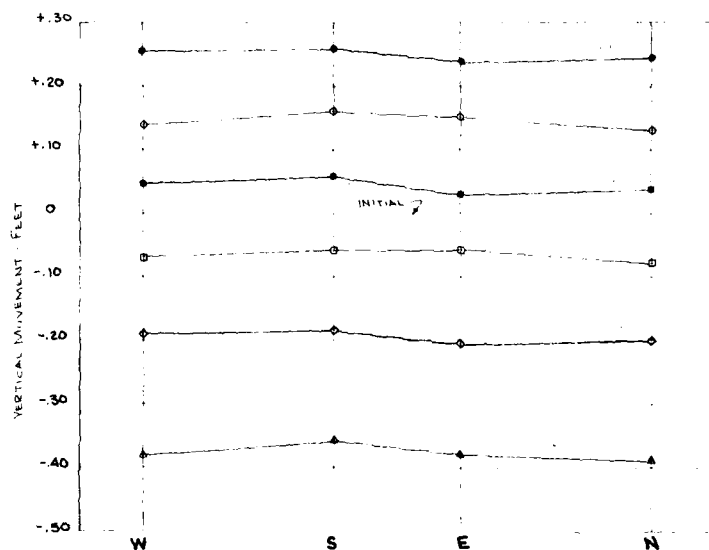


THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPROVED
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK, NEBRASKA SITE 10 YANKEE HILL DAM			
EMBANKMENT MOVEMENT INSERTS HORIZONTAL AND VERTICAL MOVEMENTS			
DESIGNED BY:	DATE:		
DRAWN BY:	DATE:		
CHECKED BY:	DATE:		
APPROVED BY:	DATE:		
SCALE AS SHOWN	SHEET NO.		
SHEET NO.			

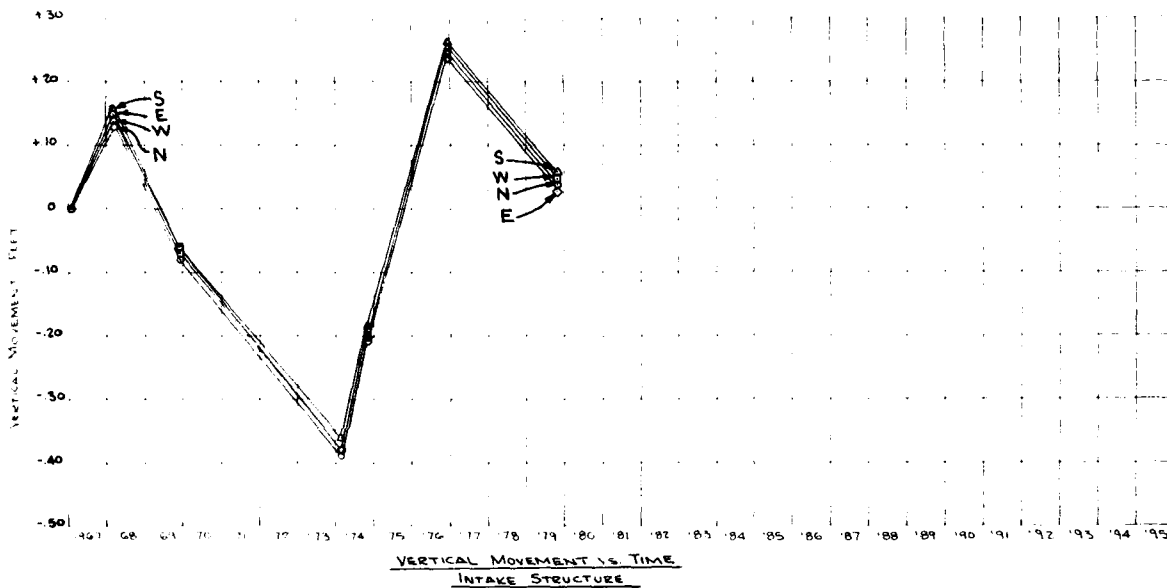


INTAKE STRUCTURE - PLAN



VERTICAL MOVEMENT -
INTAKE STRUCTURE

MOVEMENT	
INITIAL	DATE
○	MAR 1978
●	DEC 1979
○	FEB 1980
○	DEC 1984
●	DEC 1986
○	OCT 1987



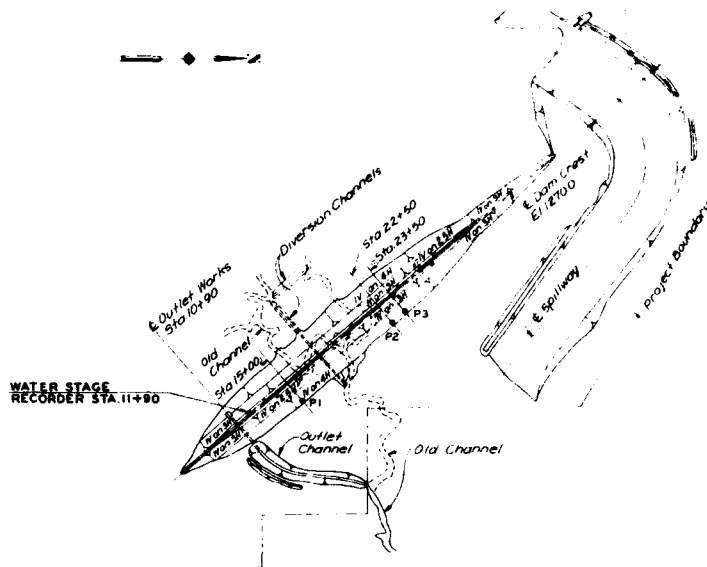
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THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

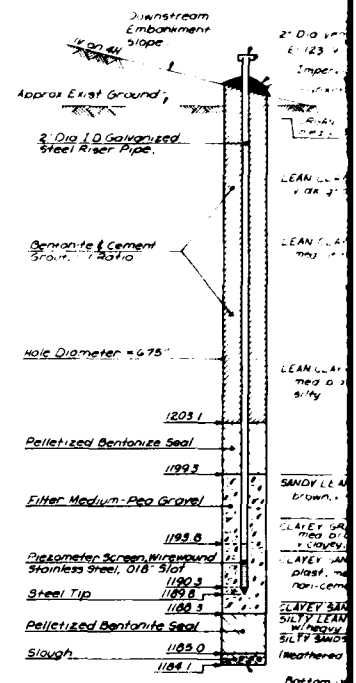
DATE		REVISIONS		NAME	APPROV.
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
SALT CREEK, NEBRASKA SITE 10 YANKEE HILL DAM INTAKE STRUCTURE - VERTICAL MOVEMENT					
DESIGNED BY:	CHECKED BY:	APPROVED:	DATE:		
DRAWN BY:	REVIEWED BY:	DATE:			
THIS PLAN ACCOMPANIES CONTRACT NO.		MODIFICATION NO.			

2



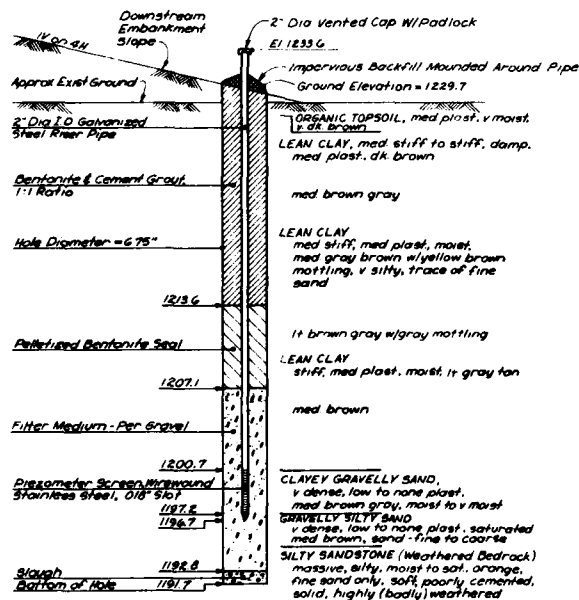
DAM SITE 10 PLAN

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400' 0' 400'



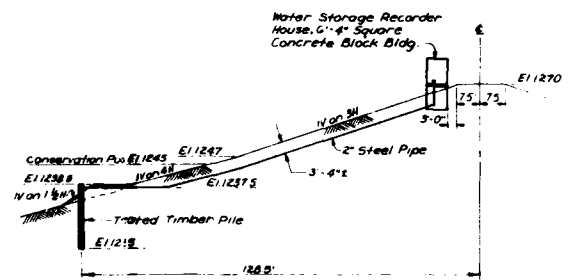
PIEZOMETER NO. 1
STA 15+00

SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



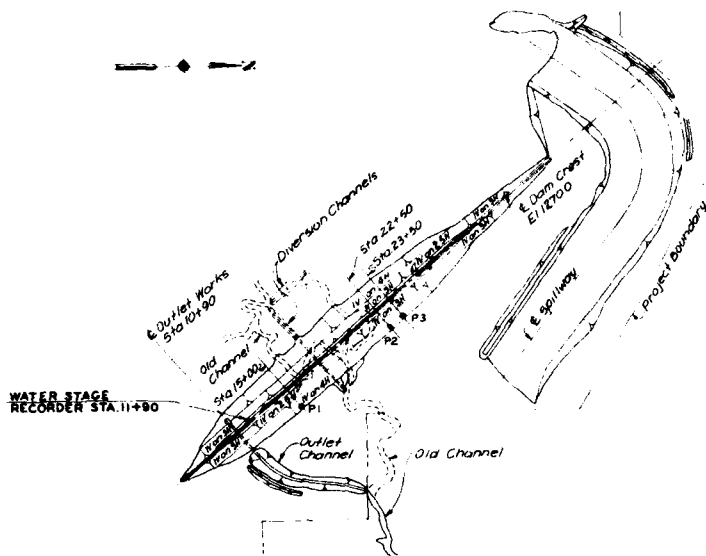
PIEZOMETER NO. 3
STA 23+50

SCALE VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



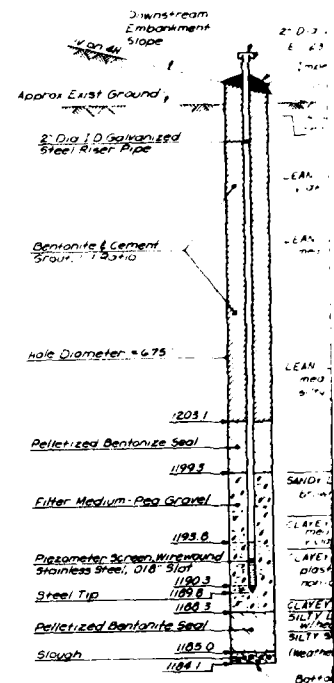
WATER STAGE RECORDER

SCALE 1 INCH = 2' FEET
20' 0' 2'



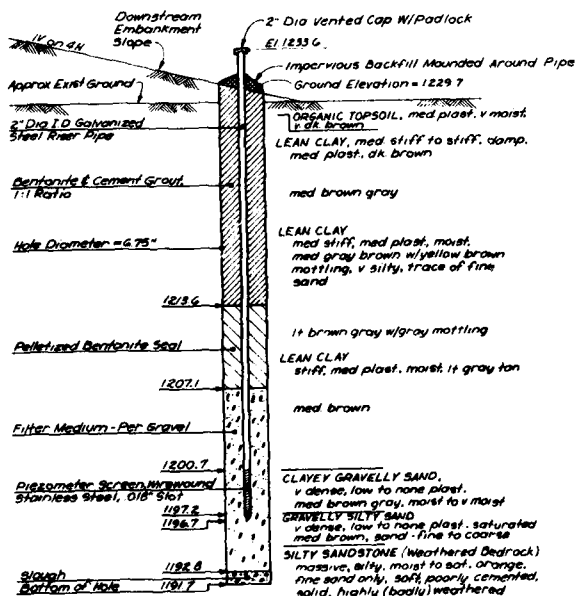
DAM SITE 10 PLAN

SCALE 1 INCH = 400 FEET
400' 0' 400'



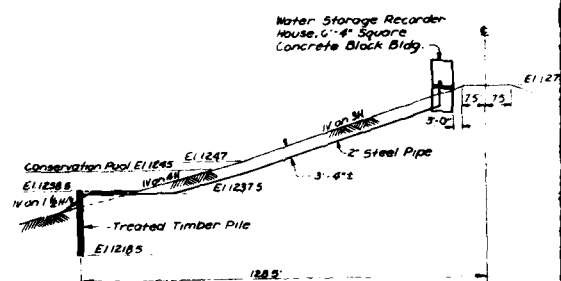
PIEZOMETER NO. 15

STA 15+00
VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE



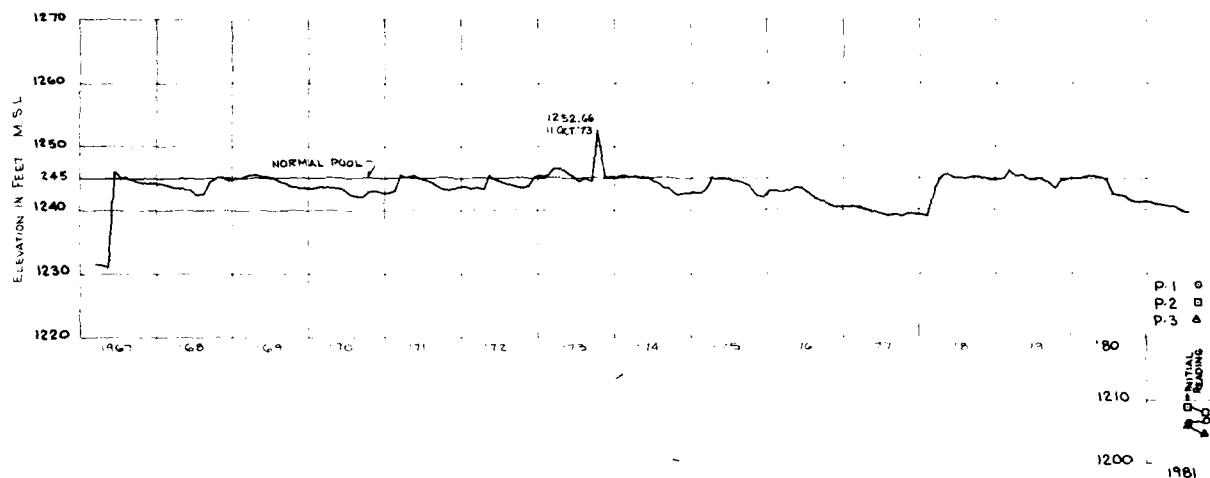
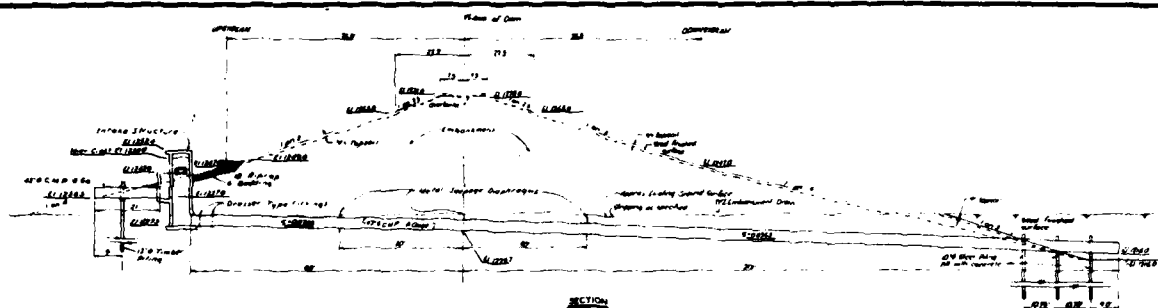
PIEZOMETER NO. 3

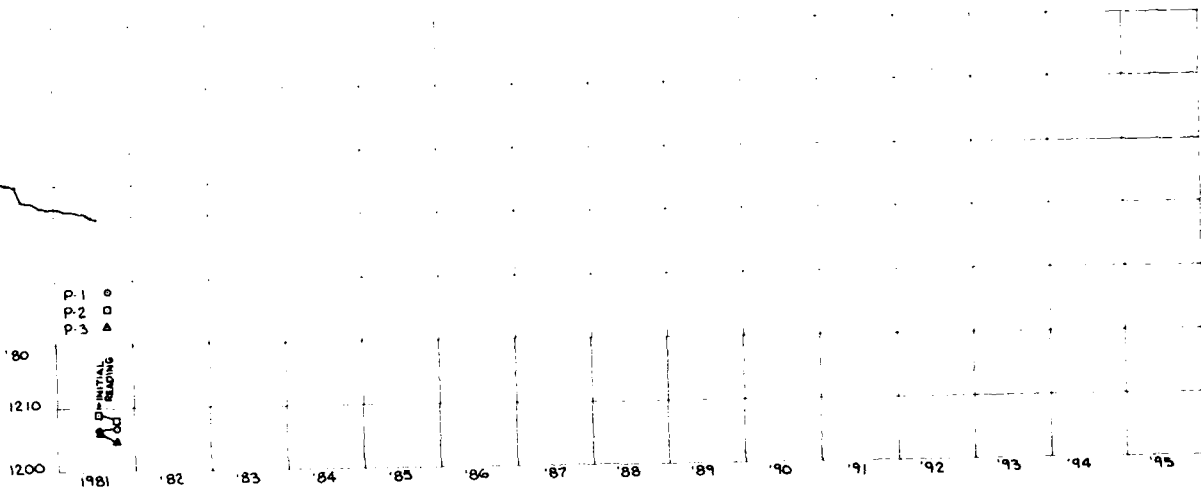
STA. 23+50
VERT 1 INCH = 5 FEET
HORIZ 1 INCH = NONE FEET



WATER STAGE RECORDER

SCALE 1 INCH = 20 FEET
20 0 20





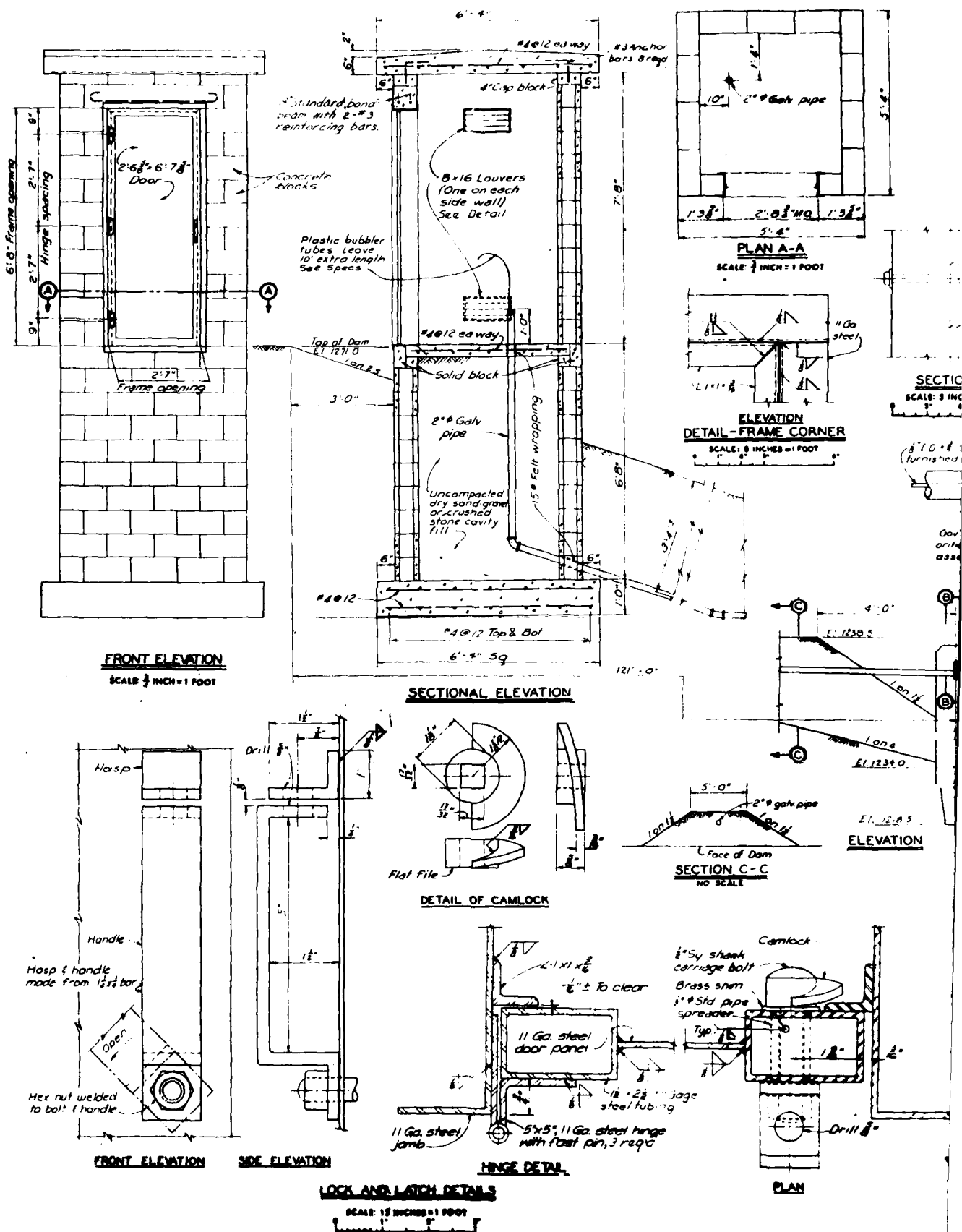
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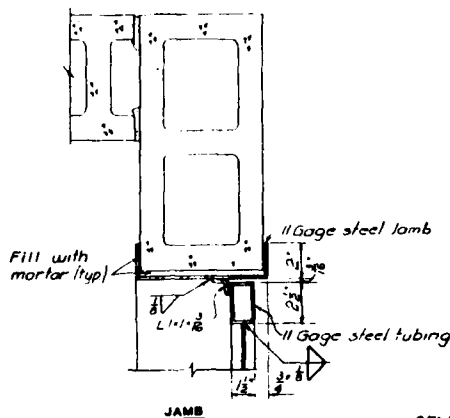
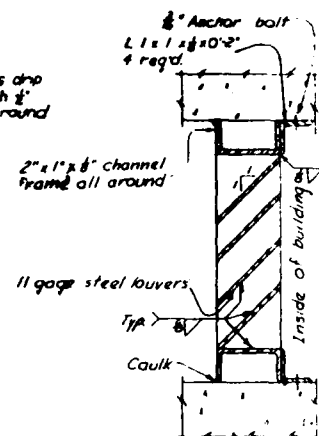
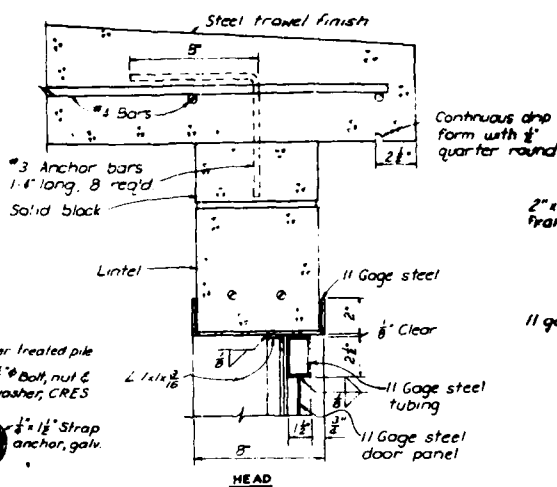
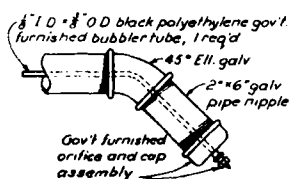
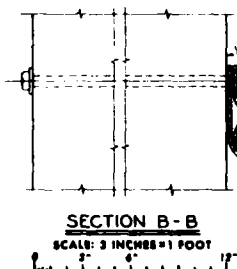
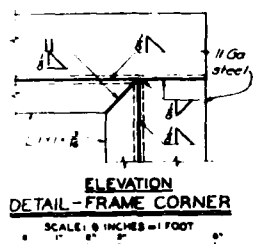
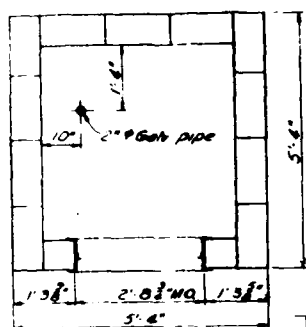


THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE		DESCRIPTION		MADE	APPROVED
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:		SALT CREEK, NEBRASKA			
DRAWN BY:		SITE 10			
CHECKED BY:		YANKEE HILL DAM			
APPROVED BY:		RESERVOIR ELEVATION & PIEZOMETER OBSERVATIONS			
ENGINEER	DESIGN	APPROVED	DATE		
DATE	SCALE	BY ENGINEERING DISTRICT	SCALE AS SHOWN	SPE. NO.	
APPROVED				DRAWING NUMBER	
U. S. E. DISTRICT ENGINEER		SHEET			

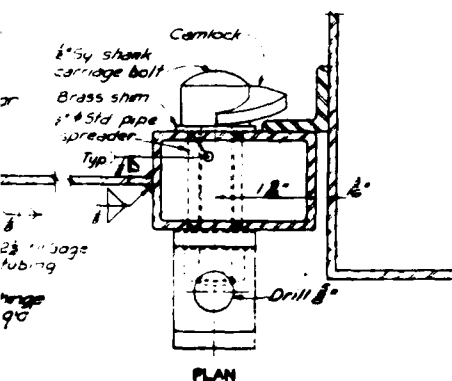
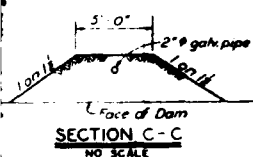
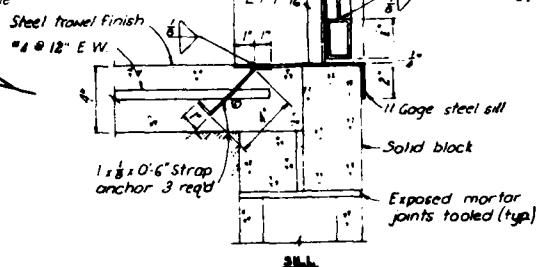
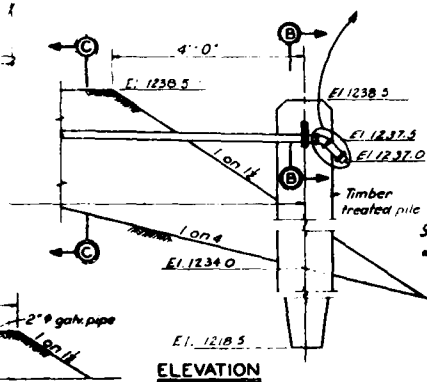
2





GENERAL NOTE:

1. All miscellaneous metals except Water Stage Recorder door and corrosion-resistant steel shall be galvanized after fabrication and before assembly

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKASALT CREEK AND ITS TRIBUTARIES, NEBRASKA
YANKEE HILL DAM AND LAKE
SITE NO. 10

WATER STAGE RECORDER DETAILS

DESIGNED BY: R. L. F.

CHECKED BY:

DRAWN BY: M. L. P.

APPROVED BY:

DATE: MAR 1965

DRAWN BY: J. W. H. H.

DATE: MAR 1965

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

SCALE: AS SHOWN

APPENDIX B
PHOTOGRAPHS



Photo No. 1a - August 1968, aerial view of project at normal operating pool level. Note the emergency spillway in the foreground of the picture.

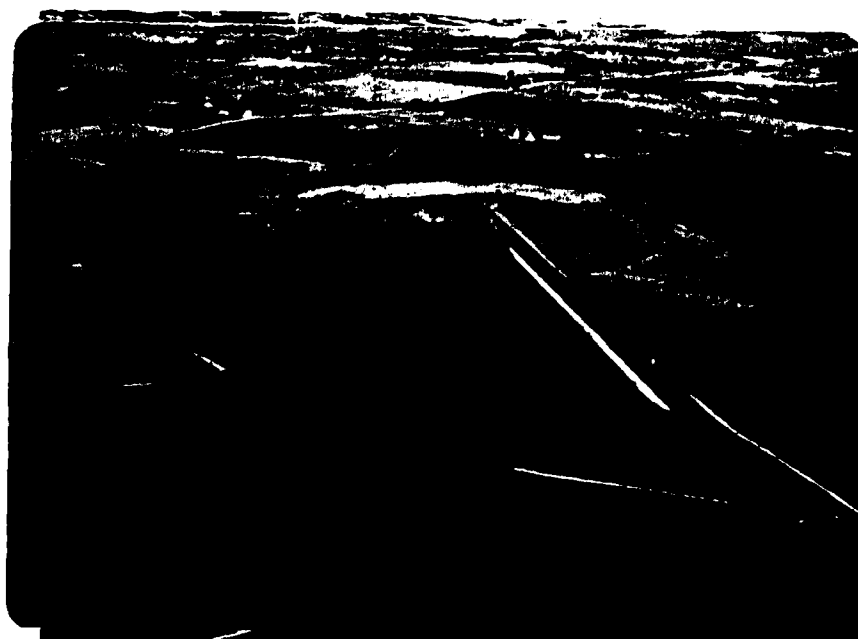


Photo No. 1b - October 1973, aerial view of project one day after record pool elevations were recorded. See note in Appendix B, PD-4.

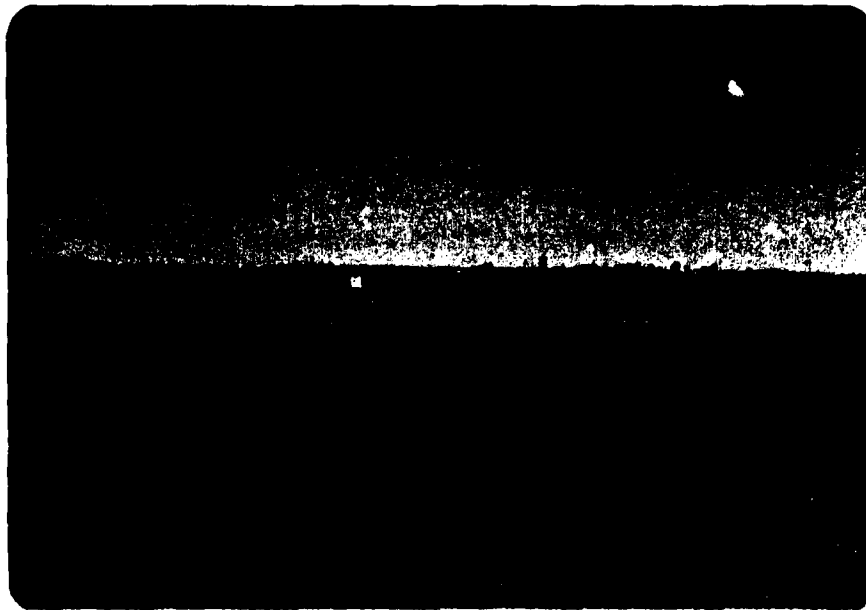


Photo No. 2 - View of downstream embankment slope
from right abutment. Normal Pool Conditions.

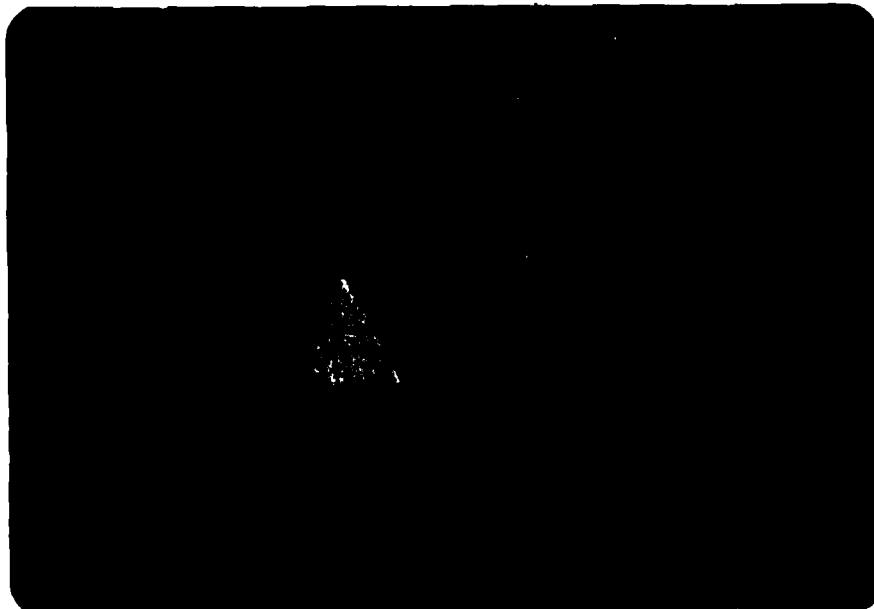


Photo No. 3 - View of upstream embankment slope
from right abutment. Normal Pool Conditions.

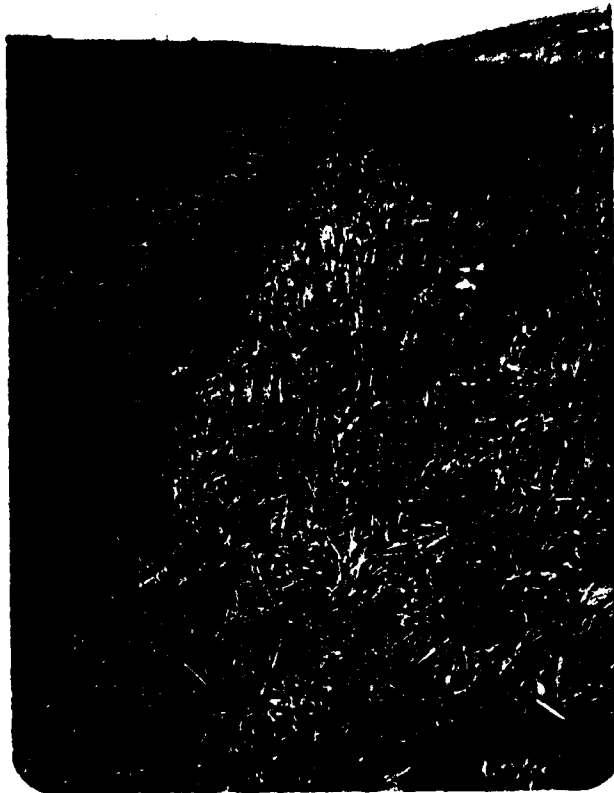


Photo No. 4 - View of upstream embankment slope from right abutment. Pool elevation is 1251.7, approximately 7.7 feet above normal operating pool.

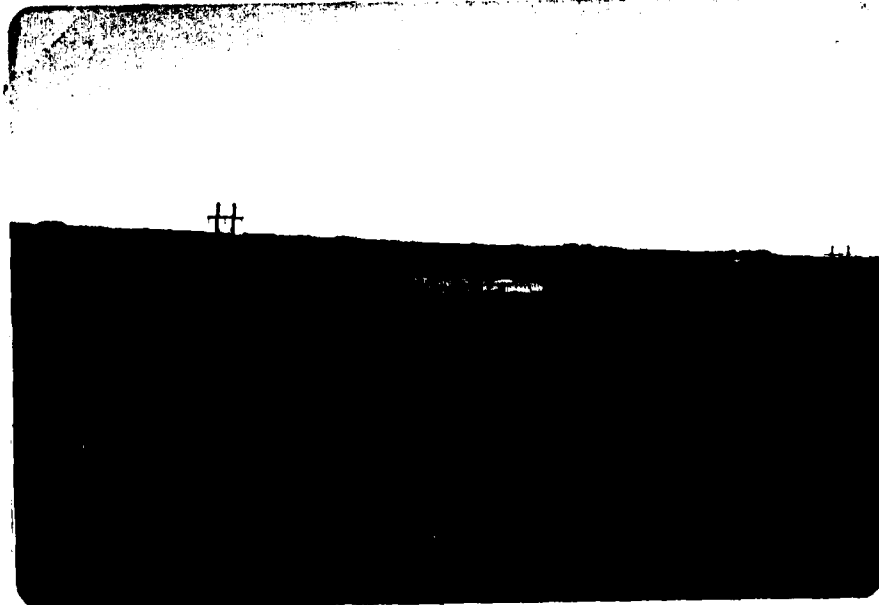


Photo No. 5 - View of upstream end of emergency spillway channel. Normal Pool Conditions.

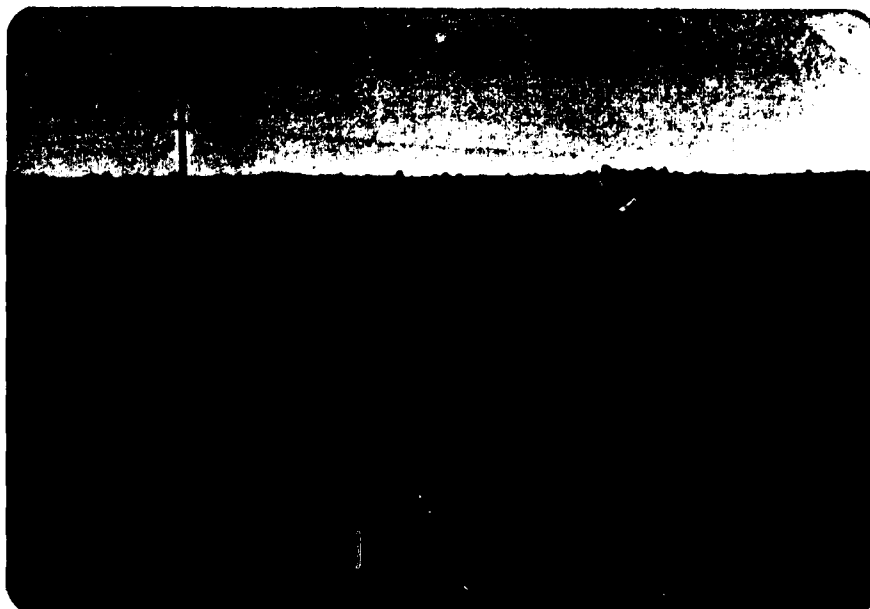


Photo No. 6 - View across spillway channel from left cut slope side. Normal Pool Conditions.



Photo No. 7 - View of embankment crest road, gage house, intake structure, and downstream slope from the southeastern end of the embankment. Normal Pool Conditions.

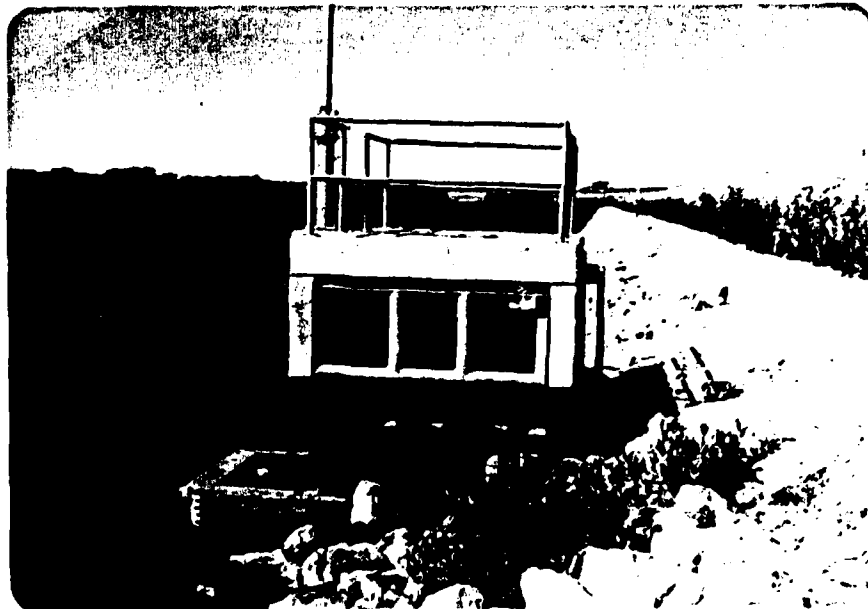


Photo No. 8 - View of intake tower structure and surrounding riprap during normal pool conditions. Note crushed rock service road along the top of the riprap.

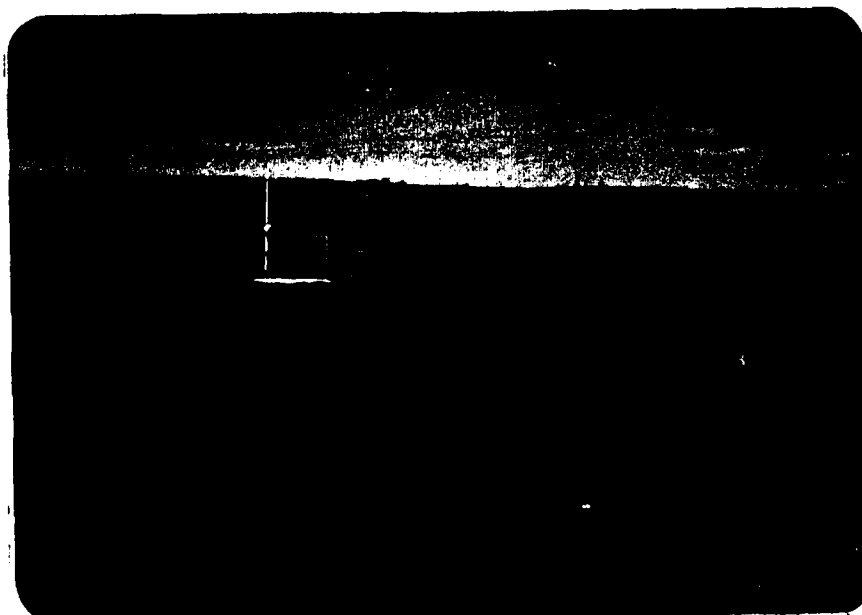


Photo No. 9 - View of intake tower in October of 1973. Pool level is approximately 7.7 feet above normal operating pool.

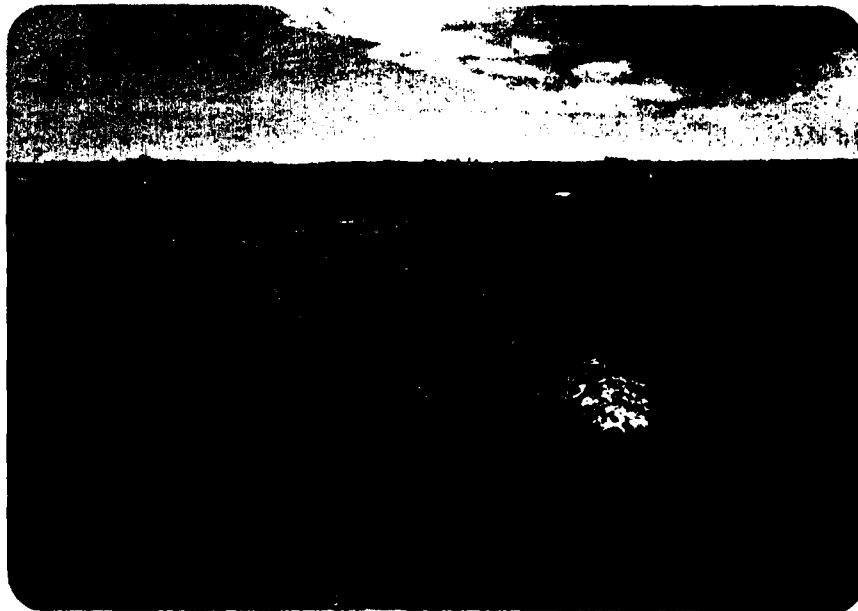


Photo No. 10 - View from crest of dam of outlet end of discharge conduit and downstream channel during high pool discharge. (October 1973)

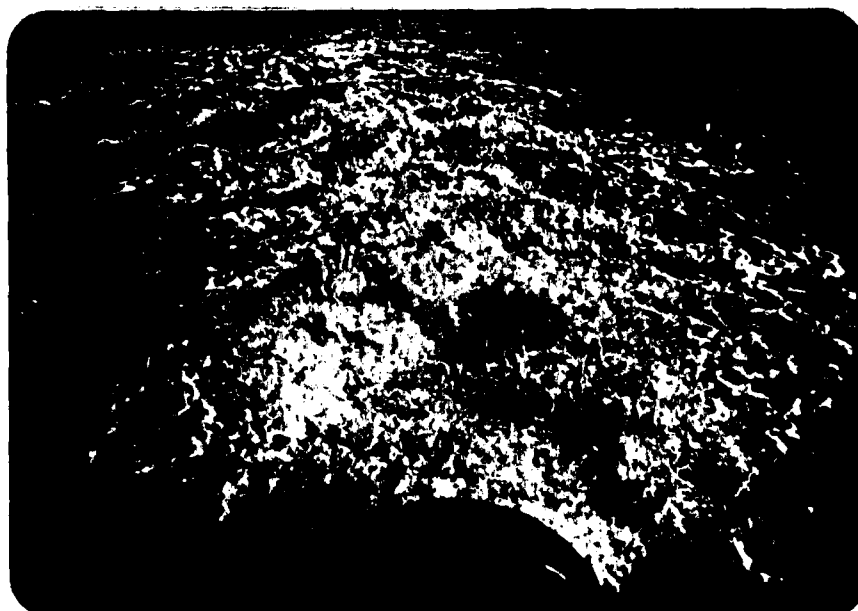


Photo No. 11 - View of outlet end of discharge conduit during high pool discharge. (October 1973)

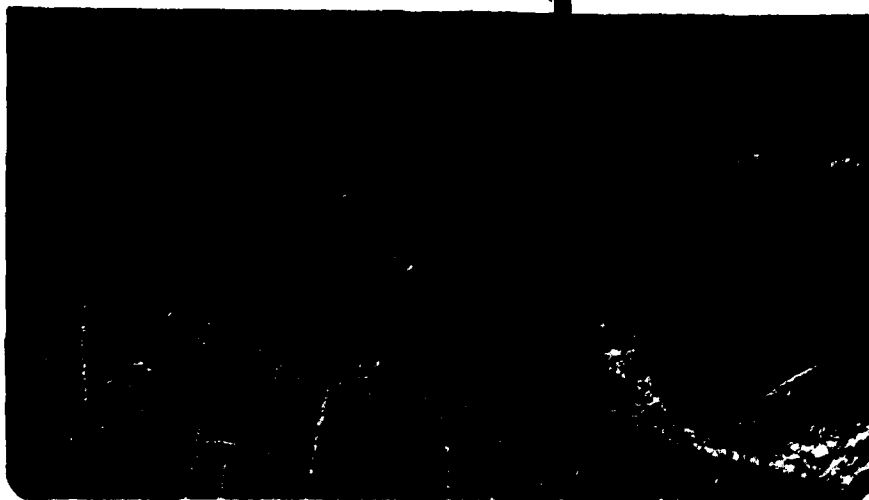


Photo No. 12 - View of outlet end of discharge conduit and plunge pool. Normal Pool Conditions.



Photo No. 13 - View of upstream slope riprap protection and rock berm surfaced with crushed rock to serve as service road. Normal Pool Conditions.

DATE
FILMED
- 83