US Army Corps
of Engineers
Vicksburg District

JOE D. WAGGONNER, JR. LOCK AND DAM
RED RIVER WATERWAY, LOUISIANA

FOUNDATION REPORT

March 1996

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LOUISIANA, TEXAS, ARKANSAS, AND OKLAHOMA
MISSISSIPPI RIVER TO SHREVEPORT, LOUISIANA
JOE D. WAGGONNER, JR. LOCK AND DAM

FOUNDATION REPORT

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RED RIVER WATERWAY
LOUISIANA, TEXAS, ARKANSAS, AND OKLAHOMA
MISSISSIPPI RIVER TO SHREVEPORT, LOUISIANA
CONSTRUCTION FOUNDATION REPORT
JOE D. WAGGONNER, JR. LOCK AND DAM

SECTION I - INTRODUCTION

1-01. Authorization. Public Law 90-483, 90th Congress, approved 13 August 1968, authorized the construction of the "Red River Waterway, Louisiana, Texas, Arkansas, and Oklahoma" project in accordance with the recommendations of the Chief of Engineers as contained in House Document No. 304, 90th Congress, 2d Session.

1-02. Purpose and Scope. This document presents the "as built" foundation conditions for the Joe D. Waggonner, Jr. Lock and Dam of the Red River Waterway project. It was prepared to fulfill the requirements contained in ER 1110-1-1801, Construction Foundation Reports, 15 December 1981, and CELMK-CD SOP 415-216 Construction Supervision and Inspection, 24 February 1984 (Paragraph 2-31).

1-03. Authorized Project Description.

a. Overall Project Description. The overall project consists of four reaches: (1) Mississippi River to Shreveport, Louisiana; (2) Shreveport, Louisiana, to Daingerfield, Texas; (3) Shreveport, Louisiana, to Index, Arkansas; and (4) Index, Arkansas, to Denison Dam, Texas.

b. Mississippi River to Shreveport Reach. The Mississippi River to Shreveport reach of the project is located along the Red River in central and northwestern Louisiana. Within this reach, the project provides a navigable channel approximately 236 miles long, 9 feet deep, and 200 feet wide from the Mississippi River to Shreveport via the Old and Red Rivers. Five locks and dams furnish the required lift of 141 feet. The New Orleans District performed preliminary geotechnical investigations for all five locks and dams as well as detailed explorations and designs for L.C. Boggs Lock and Dam and Overton Lock and Dam. Vicksburg District performed detailed geotechnical explorations and geotechnical designs for Lock and Dam Nos. 3, 4, and Joe D. Waggonner, Jr. Lock and Dam. A review of the explorations and design of Joe D. Waggonner, Jr. Lock and Dam is covered in Sections 2 and 4 of this report.

1-04. Datum. All elevation datum used in this Memorandum are referenced to feet NGVD (National Geodetic Vertical Datum).

1-05. Joe D. Waggonner, Jr. Lock and Dam.

a. Location. The Joe D. Waggonner, Jr. Lock and Dam is located in a cutoff between 1967 river miles 247.0 and 250.0. The location of the lock and dam is shown on Plate 1. This is the fifth lock and dam complex of the five locks and dams that comprise the Mississippi River to Shreveport, Louisiana, reach of the Red River project. The project is located in Caddo and Bossier Parishes, Louisiana approximately 29 miles south of Shreveport, Louisiana.

b. Description. The completed plan for the lock and dam is shown on Plate 2 and Photographs 1 and 2. The dam consists of a gated spillway with five 60 foot wide tainter gates with a sill at elevation 110 (all elevations in feet, NGVD). Adjacent to the tainter gates is a 100 foot wide 7 foot high hinged crest gate dam with an ogee section at elevation 138 and a 154 foot concrete overflow weir at elevation 147.0. The single 84-foot wide by 685-foot long (nominal size) lock is located south of the gated spillway and connected to the spillway by a cutoff wall 58.0 feet in length with a top elevation of 153.0. The maximum lift and head for the lock and dam is from normal pool at elevation 145.0 to minimum tailwater (controlled condition) at elevation 120.0. Navigation will cease at the 10-year flood elevation of 138.6 downstream of the lock. The project design flood is predicted at elevation 150.2 upstream of the lock. The site plan for the lock and dam is shown on Plate 3. The major features of the Joe D. Waggonner, Jr. Lock and Dam complex were constructed in two phases. Phase I included the majority of the structural excavation, installation of the dewatering system which consisted of a slurry trench and deep wells, construction of a Resident Engineers Office, and construction of temporary access roads. Phase II involved construction of the lock and dam complex, approach channels, permanent access roads, supplementary pressure relief in the suballuvial Tertiary formation, and construction of the closure dam.

1-06. Disposition of Report. This report has been distributed in accordance with ER-1110-2-1801. Text, plates, and photographs are available in digitized form from the Vicksburg District Corps of Engineers, Engineering Division, Design Branch. Materials have been archived under file number R-14-207.

1-07. References. To facilitate implementation of the Inspection and Evaluation Program, and to avoid repetition of information presented previously, the following references are listed.

a. House Document No. 304, 90th Congress, 2d Session (the authorizing report).

b. Design Criteria Report, February 1972, and all endorsements thereto.

c. Existing Bridge Report, April 1972, and all endorsements thereto.

d. Preconstruction and Post-construction Groundwater Levels, Lock and Dam No 5, Red River Valley, Louisiana, by A.H. Ludwig, U.S. Geological Survey, Open File Report, 1979.

e. Agricultural Observation and Ground Water Study, Red River Waterway Project, Main Report and Appendix IV (L&D No. 5), by Soil Conservation Service in cooperation with U.S. Geological Survey, October 1975.

f. Design Memorandum No. 2, GDM-Phase I, Plan Formulation Site Selection, Mississippi River to Shreveport, Louisiana, May 1976, and all endorsements thereto.

g. Design Memorandum No. 3, Hydrology, Mississippi River to Shreveport, Louisiana, March 1974, and all endorsements thereto.

h. Design Memorandum No. 10, Hydrology and Hydraulic Design, Lock and Dam No. 1, January 1974, and all endorsements thereto.

i. Standardization Report, Locks and Dams Nos. 1 through 5, March 1977, and all endorsements thereto.

j. Design Memorandum No. 18, Hydrology and Hydraulic Design, John H. Overton Lock and Dam, June 1980, and all endorsements thereto.

k. Quality of Water in the Red River Alluvial Aquifer, Shreveport to the mouth of the Black River, Louisiana, by A.H. Ludwig, U.S. Geological Survey, Open File Report, 1974.

l. Final Environmental Statement, May 1973, Final Supplement No. 1 to Final Environmental Statement, February 1977, and Final Supplement No. 2 to Final Environmental Statement, November 1983, Mississippi River to Shreveport, Louisiana.

m. General Design Memorandum No. 26, General Design, Phase II - Project Design, Lock and Dam No. 5, June 1987, and all endorsements thereto.

n. General Design Memorandum No. 26, Supplement No. 1 - Project Design, Lock and Dam No. 5, August 1988, and all endorsements thereto.

o. Design Memorandum No. 27, Sources of Construction Materials, Lock and Dam Numbers 4 and 5, December 1989, and all endorsements thereto.

p. Design Memorandum No. 33, Detailed Design, Lock and Dan No. 5, August 1989, and all endorsements thereto.

q. Design Memorandum No. 34 (Revised) Hydrology and Hydraulic Design, Lock and Dam No. 5, March 1986, and all endorsements thereto.

r. Design Memorandum No. 38, Aesthetical Enhancement Report, Pool Nos. 1 through 5, November 1977, and all endorsements thereto.

In addition to the above general references, specific design references appear in the particular section to which they pertain.

SECTION II - INVESTIGATIONS

2-01. Pre-Construction Investigations.

a. General. The initial investigations for the Joe D. Waggonner, Jr. Lock and Dam (formerly known as Lock and Dam No. 5 (LD5)) were conducted by the U.S. Army Corps of Engineers, New Orleans District, during the period 1979 to 1980. In 1982, responsibility for the Lower Red River Valley was transferred to the Vicksburg District. Geotechnical evaluation of the New Orleans District data revealed no major differences in the three sites investigated. However, hydrologic and potamological considerations of sinuosity, potential siltation problems, as well as the presence of Howard Revetment dictated the selection of the right bank for the lock and dam site. Explorations for the Vicksburg District's General Design Memorandum were conducted from March 1985 to September 1986. The objective was to investigate the subsurface conditions at three proposed dam alignments and to select a dam centerline within that area. The Vicksburg District's Feature Design Memorandum investigations were conducted from October 1987 to August 1989. Explorations focused on the foundation conditions along the lock and dam centerlines, alluvial thickness along the proposed cofferdam alignment, conditions in the downstream channel area, and the closure dam. The results of most of the GDM and FDM investigations are contained in Volume IV, "Geotechnical Portfolio", of Feature Design Memorandum No. 33, (Detailed Design), which is composed of two parts. Part A contains plan maps, contour and isopach maps, geologic sections and profiles, boring and rock legends, piezometer and boring location maps, individual test data sheets, and test data summaries. Part B contains electric, gamma, graphic, and geologic logs.

b. New Orleans District Subsurface Investigation. The New Orleans District boring program was for the purpose of site selection. It consisted of 38 borings spaced on a 1000-foot grid to explore three locations; right bank, left bank, and the river channel. Two proposed borings (5-4D, 5-40) were not drilled. The borings varied from 54.0 to 164.5 feet deep. They were sampled continuously with a standard splitspoon through the Quaternary alluvium and by 6-inch diameter core barrel in the Tertiary. Detailed geologic field logs (Eng Form 1836) were made for each boring. Geophysical logs (natural gamma, spontaneous potential, and resistivity) were later made in adjacent fishtailed holes. Boring logs and some selected samples were examined by personnel from the Vicksburg District. However, the borings were too widely spaced except for generalized information. Geologic sections were constructed but correlation was uncertain. The logs of these borings are available in the Geotechnical Portfolio (Volume IV to DM No. 33) and in the construction contract drawings.

c. Vicksburg District Subsurface Investigation.

(1) General. Responsibility for field investigations at the Joe D. Waggonner, Jr. Lock and Dam were assumed by the Foundation and Materials Branch of the Vicksburg District in 1982. Maps with the boring locations are presented in the Geotechnical Portfolio (Volume IV to DM No. 33) and in the construction contract drawings.

(2) Explorations for the General Design Memorandum. One hundred-five borings were drilled for the general design investigation. (Note: The Vicksburg District system for numbering the borings begins with boring LD5-1-85, not to be confused with the New Orleans numbering system 5-1 through 5-39). Twenty borings (LD5-1-85 through LD5-20-85) were drilled from a barge in the Red River during March 1985. Samples were obtained with a 2-1/2 inch drive tube sampler at 5-foot intervals or strata change (whichever was lesser) through the Quaternary alluvium into the upper 2 to 10 feet of the Tertiary, Wilcox Group. Eighty-five borings were drilled with land based equipment during the period April to September 1986. The boring program incorporated different methods of sampling depending on the soil type and the location (relative to the lock and dam structure). Topstratum clays and silt were sampled at 5-foot intervals or stratum change by pushing a 5-inch Shelby tube. Undisturbed samples were taken in clays and silt. The alluvial sands were generally sampled at 5-foot intervals or stratum change using a 2-1/2 inch diameter drive tube sampler. However, in seven holes standard penetration tests were performed using a hydraulic operated automatic trip hammer with a 1 3/8 I.D. split spoon sampler. In the Tertiary Wilcox sediments the sampling frequency and method changed depending on the soil type. The upper claystone was sampled at 5-foot intervals using a core barrel. If lignite was indicated by the drilling action, it was immediately sampled using the core barrel. The Tertiary sand aquifer was sampled at 10-foot intervals using a 2-1/2 inch diameter drive tube sampler. Holes were terminated as directed by the field geologist based on the following criteria. The base of the Tertiary sand was designated as the drilling termination point within the structural excavation area. The top of the Tertiary sand was used as the drilling termination point in the upstream and downstream channel areas.

(3) Explorations for the Feature Design Memorandum. Seventy two borings were drilled during the period October 1987 to March 1989 as part of the investigations for the feature design. The drilling program included various methods of sampling. Sampling intervals depended on soil type and the purpose for which the boring was being made. Fifteen borings (LD5-113-87U through LD5-127-88U) were located in the structure area. These borings recovered undisturbed samples in the topstratum clays and silts. The substratum sand and Tertiary

sand were sampled with a standard diameter split spoon or a 2-1/2 inch diameter drive tube. The Tertiary claystone and lignite were sampled with a 4 inch core barrel or a 2-1/2 inch drive tube. Twelve borings were sampled on 5-foot intervals. The remaining three structure borings (LD5-117-87U, LD5-126-88U, and LD5-127-88U) were continuously sampled. Seventeen borings were drilled around the perimeter of the protected area (LD5-128-88U through LD5-144-88U) and thirteen borings (LD5-145-88U through LD5-157-89U) were drilled in the downstream channel. These borings were sampled on 5-foot intervals using a 5 inch Shelby tube and a 2-1/2 inch drive tube. The borings extended through the alluvial substratum and 10 feet into Tertiary. Five additional downstream borings (LD5-158-89 through LD5-162-89) were fishtailed through the alluvium and sampled the upper 10 feet of Tertiary material. Sixteen undisturbed borings (LD5-163-89U through LD5-178-89U) were drilled along the alignment for the east access road. These borings were drilled to a depth of 50 feet and five of them encountered Tertiary materials. Six general sample borings (LD5-179-89 through LD5-184-89) were drilled north of the access road in an area designated as the clay borrow area for the closure dam. These borings were drilled to a depth of 35 feet and revealed a paucity of adequate, suitable clay borrow materials.

(4) <u>Exploration subsequent to the Detailed Design</u>. Additional explorations were performed by the Corps during the period May through July 1989 and in August 1990. Six borings (LD5-185-89 through LD5-190-89) were drilled to a depth of 15 feet in the clay borrow area for the closure dam. Nine general sample borings (LD5-191-89 through LD5-199-89) were drilled to explore foundation conditions for the closure dam. These borings extended 50 feet and all nine encountered Tertiary materials at depths of 35 to 45 feet. Eight undisturbed borings (LD5-200-89U through LD5-207-89U) were drilled to a depth of 75 feet to examine the foundation conditions for the dredge containment levees. Twenty-two borrow borings (LD5-208-89 through LD5-229-89) were drilled to depths ranging from 10 to 30 feet within the areas designated for dredge disposal. Seven undisturbed borings (LD5-230-89U through LD5-236-89U) were drilled to a depth of 75 feet along the upstream channel alignment. In August 1990, the Vicksburg District undertook a drilling program to locate and sample a stratum of lignite known to exist in (or near) the Tertiary claystone stratum. Ten exploratory borings, numbered LD5-237, 237A, 237B, 237C, 237D, and LD5-238 through 242-90, were drilled at various locations along the proposed slurry trench alignment. Sampling was performed by fishtailing a hole to a depth 5 feet above the top of Tertiary elevation (as determined from adjacent borings) and continuously sampling through the claystone stratum.

2-02. Ground Water.

a. Field Pumping Test. A field pumping test was performed at the construction site during the period 13-17 July 1987. The purpose of the test was to determine the insitu, horizontal permeabilities within the Quaternary alluvial substratum and Tertiary sands. Results of the test were utilized in the design of a dewatering/pressure relief system and as a basis for the Government's construction dewatering cost estimate. The test well was located 5 feet south of the intersection of the centerline of the lock and the centerline of the dam with piezometer arrays radiating out from the test well (see DM No. 33, Volume III, Plate III-1). Subsurface conditions at the test well site consisted of clay which was encountered at the surface and extended to a depth of 5 feet underlain by silty sands and sands which extended to a depth of 75 feet. Below 75 feet a 5-foot thick layer of claystone was encountered which was underlain by lignite, silty sand, silt, and more claystone to a total depth of 151 feet. The test well was installed in a 30-inch diameter hole drilled to a point 1 foot into the claystone located beneath the Tertiary aquifer. Approximately 123 feet of 14 inch O.D., No. 30 slot, low carbon steel well screen with tapered welding rings and the required length of standard black riser pipe with tapered ends was installed in the hole. The well screen fully penetrated the pervious alluvial and Tertiary aquifers and had a plate welded on the bottom. The annulus between the screen and the hole wall was filled with filter gravel "E", which was placed by tremie pipe to minimize filter segregation. Piezometers were installed in both the well filter and inside the well screen to determine entrance head losses. Water samples were obtained periodically from the well for chemical analyses. Four radial arrays of piezometers were installed. A typical line had seven piezometer locations with at least two piezometers installed at each location to monitor the alluvial and Tertiary piezometric levels. However, at three locations on the east line, E3, E4, and E5, a third piezometer was installed to monitor the historic point bar topstratum. The double piezometers were used to determine head loss of each aquifer in response to drawdown of the pump test well. The double and triple piezometers were installed in separate bore holes approximately 5 feet apart. All piezometers had No. 10 slot plastic well points surrounded with concrete sand. The piezometers were sealed from an elevation 5 feet above the top of the well point to the ground surface. After development, the piezometers were monitored to determine the static water surface conditions prior to the initiation of the pump test. A two stage pumping test was performed with pumping rates of 300 and 600 GPM and corresponding drawdowns (at the well) of approximately 17.3 and 34.4 feet. Flow from the well was measured by a flow meter attached to the discharge pipe. During each stage of pumping, the well discharge, well drawdown, and piezometer readings were taken at intervals of 1 minute during the first 15 minutes and then at 20, 25, 30, 45, 60 minutes, 2, 3, 5 hours, etc., until the phreatic line within the aquifer stabilized. At that time well flows were measured inside the well screen with a velocity meter that measured water flows at 5 foot intervals beginning at the bottom of the well screen. Recovery or "rebound" water level data were measured after the pumping ceased. The test results show high permeabilities for the alluvial substratum sand aquifer. The average permeability of this aquifer was calculated to be 0.022 ft/min. The Tertiary sand exhibited an appreciable reduction of pore pressure while small quantities of flow were recorded which indicate that the Tertiary sand is a confined aquifer.

b. Water Chemistry. Thirteen piezometers were installed at the site during August and September of 1986. Data pertaining to tip elevation, aquifer monitored, and water elevations (September and December, 1986) are summarized on Table 2-1. Forty-nine piezometers were installed in June and July 1987 for the field pump test. Water quality data collected at the time of the pump test is shown in Table 2-2.

TABLE 2-1

PIEZOMETER NO.	MIDTIP	TOP OF RISER	WATER EL 9-4-86	WATER EL 12-21-86
LD5-57A-86	63.6	138.0	125.3	129.7
LD5-57B-86	25.0	138.0	123.0	130.2
LD5-63A-86	69.5	149.0	125.1	129.9
LD5-63B-86	26.0	149.0	124.6	129.1
LD5-68A-86	73.3	136.3	122.9	129.5
LD5-68B-86	33.3	136.3	124.6	129.2
LD5-72A-86	77.4	150.4	122.5	128.5
LD5-72B-86	37.4	150.4	124.4	128.4
LD5-73A-86	74.4	150.4	122.0	128.6
LD5-73B-86	34.9	149.9	123.9	128.6
LD5-82A-86	61.7	139.7	121.4	127.9
LD5-112A-86	46.6	140.1	121.3	128.5
LD5-112B-86	76.6	140.1	125.0	129.4
RED RIVER			116.3	131.0

NOTE: "A" = ALLUVIAL AQUIFER; "B" = TERTIARY AQUIFER

TABLE 2-2

RED RIVER LOCK AND DAM NO. 5
GROUND WATER CHEMISTRY FROM THE PUMP TEST WELL

pH	6.8 - 7.1
Temperature	20 - 24°C
Iron	2.8 - 7.2 mg/l
Chloride	70 - 350 mg/l
Hardness	300 - 500 $CaCO_3$ mg/l
Sulfate	124 - 280 mg/l
Nitrogen	0.8 - 4.8 NH_3 mg/l
Total Dissolved Sold	1260 mg/l
Turbidity	10 - 30 F.T.U.
Manganese	2.6 - 14.4 mg/l
Conductivity	2000 microhms/cm

2-03. Other Field Tests. Fifteen pressuremeter tests conducted in four boreholes designated as LD5-P1-89 through LD5-P4-89 at the Lock and Dam No. 5 site during the period 19-23 June 1989. The purpose of these tests was to obtain elastic moduli results for the insitu alluvial sand, Tertiary sand, claystone and lignite. The pressuremeter tests within the alluvial sand and Tertiary claystone, lignite, and sand indicated low strain elastic modulus values of 900 to in excess of 13000 tsf and high strain modulus of 100 to 3300 tsf. Geophysical logs (natural gamma, spontaneous potential, and resistivity) were obtained in most borings immediately after completion of the drilling. Geophysical signatures aided in determining stratum changes not found by sampling. A detailed geologic log (Eng Form 1836) was constructed for most borings based on samples, cuttings, drill action, and geophysical logs. The results of the pressure meter testing program are discussed in DM No. 33, Volume I and graphically presented in DM No. 33, Volume III. The geologic logs, geophysical logs, and graphic logs are presented in DM No. 33, Detailed Design, Volume IV, Part B.

2-04. Investigations During Construction. Both the Corps and the Contractor performed field investigations during the Construction period as described below.

a. Contractor Investigations. During May 1992 the Contractor encountered problems with the installation of sheet piling beneath the Upstream Return Wall. Seven borings were drilled using a hollow stem auger and the investigation revealed a 4 to 10 foot gravel (GP) stratum. The Contractor substituted PZ 37 sheet piling for the required PZ 22 sheet piling. The alignment was "straightened" to accommodate the thicker sheet piling as discussed in paragraphs 7-04 and 8-03.

b. COE Investigations. During the period 26 August to 6 September 1991 the Corps drilled 5 undisturbed borings (LD5-243-91U through LD5-247-91U) in the area just upstream of the lock and around the excavation perimeter. Borings extended 46 to 61 feet in depth. The samples were classified and a series of unconfined compression tests were performed on the cohesive soils. On 13 August 1993 two general sample borings were drilled in the downstream channel at lock stations 40+00 and 45+00. These borings were (mistakenly) numbered LD5-237-93 and LD5-238-93. (Note: numbers are repeats of those assigned to certain 1990 slurry trench borings). The borings penetrated 101 and 86 feet in depth (to the top of the Tertiary). Laboratory testing of the samples from these borings consisted of visual classification and grain size analysis. The majority of the information recovered by these borings was for soil intervals that were subsequently removed by excavation and therefore the boring profiles are not shown.

2-05. Laboratory Testing. Soil classification and water content determinations were made for all cohesive samples. Atterberg limits and unconfined compressive strengths were determined on selected cohesive samples. Granular samples were visually classified and grain size distributions were determined for selected samples. Triaxial shear and direct shear tests were performed on selected samples of clay (CH-CL), silty clay (CH-CL) and sandy clay (CH-CL). Triaxial shear tests consisted of Unconsolidated Undrained (Q) and Consolidated Undrained (R) tests. Pore Pressure readings were made on all R tests. Consolidation tests were performed on selected cohesive samples. Results of the laboratory testing program are presented in Design Memorandum 33; Detailed Design, Volume IV (Geotechnical Portfolio).

SECTION III - GEOLOGY

3-01. Regional Geology. For a complete presentation of the regional geological setting of the Joe D. Waggonner, Jr. Lock and Dam see Section 3 of Design Memorandum No. 26 "General Design", and Section 3 of Design Memorandum No. 33 "Detailed Design".

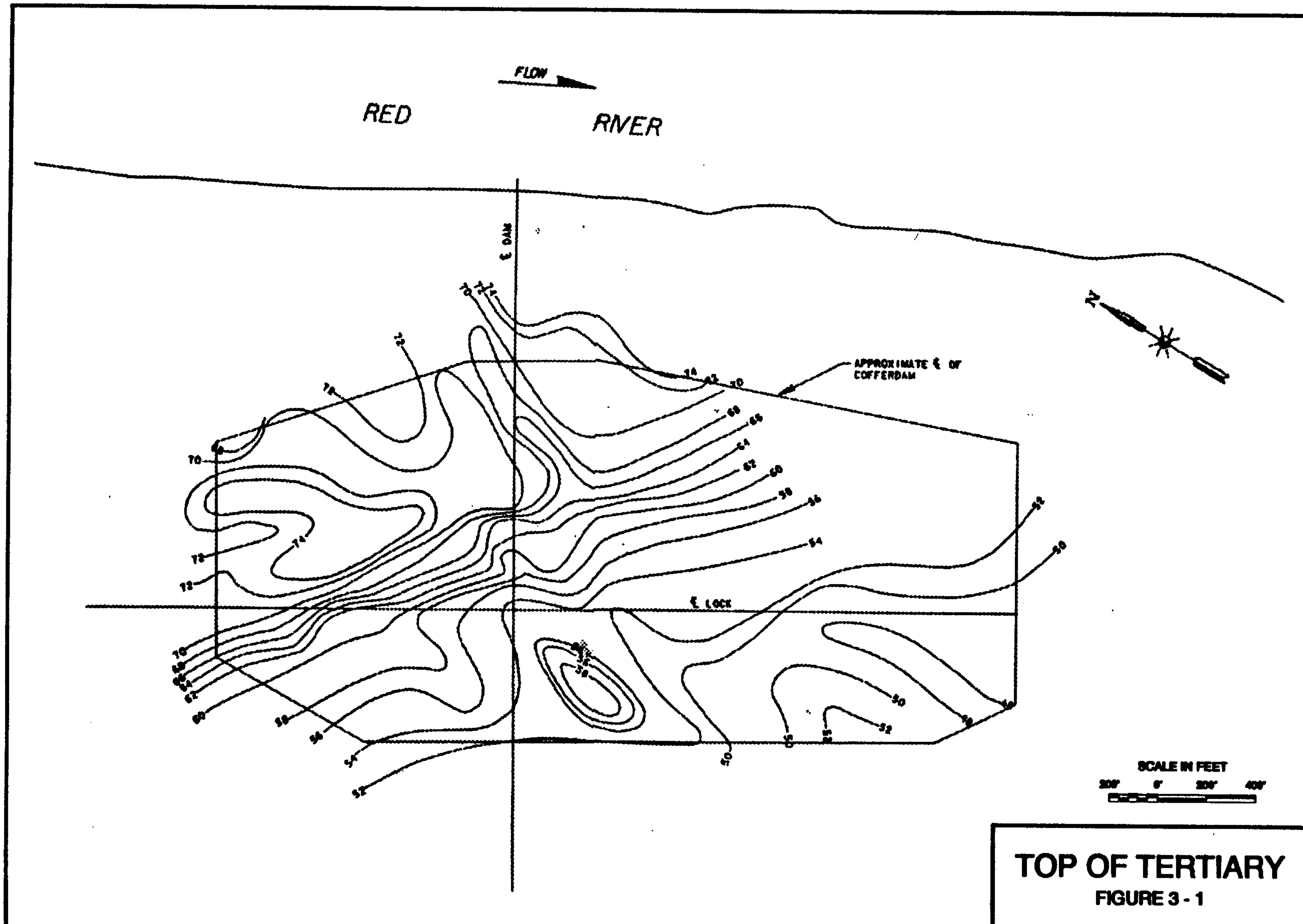
3-02. Site Geology.

a. General. Joe D. Waggonner, Jr. Lock and Dam is located on the right (descending) bank of the Red River between miles 247 and 250 (1967). The site is located in Caddo and Bossier Parishes approximately one mile north of the Red River Parish line (Plate 1). Following diversion of the river, access to the completed structure is from the left bank via U.S. Highway 71 and from the right bank via Louisiana State Highway 1. The site is located on the flood plain of the Red River. The area is an alluviated valley with low relief and numerous remnants of past river meanderings. The most prominent feature at the site is an escarpment which marks the boundary between an older, and topographically higher valley alluviation and the current Red River Meander belt. This escarpment has 10 to 15 feet of relief. A geological interpretation of the local area is published in WES Technical Report S-74-5 entitled "Geological Investigations of the Lower Red River-Atchaflaya Basin Area" by Smith and Russ (1974). The surface geology of the site is presented on portions of the Elm Grove, Bossier Point, East Point, and Clear Lake 7.5 minute topographic quadrangles. There are 5 geologic units present at the construction site. They are the Holocene topstratum and substratum (associated with the current Red River meander belt), the Holocene topstratum and substratum (associated with the alluvial terrace), and the Tertiary Wilcox Group (which underlies the Holocene alluvium). Sediments belonging to the contemporary floodplain deposit and those belonging to the somewhat older terrace deposit proved indistinguishable in the subsurface and no distinction in their engineering properties was discovered. Therefore, these units are treated as a single topstratum-substratum unit for the purposes of this report. It was possible to identify and map 3 distinct lithologies within the Tertiary deposits; claystone beds, lignite beds, and a sand aquifer.

b. Holocene Topstratum Geology. Alluvial topstratum deposits are classified according to their environment of deposition. Each topstratum type results from a specific environment in which constituent materials accumulate in a specific manner. As a consequence, each topstratum type has a suite of engineering properties that vary within known ranges. According to Technical Report S-74-5 the topstratum present at the Joe D. Waggonner, Jr. Lock and Dam site was deposited by point bar migrations (both on the elevated terrace and contemporary flood plain). Point bar topstratum is deposited by the meandering of streams within their alluvium. The parent stream erodes its outside or cut bank and creates a sedimentary deposit on its inside bank or point bar. Point bar topstratum typically displays a series of alternating ridges and swales when viewed in section. Ridge deposits are the remnants of elongated silty and sandy bars deposited during periods of high flow on the parent stream. Swales are accumulations of silts and clays deposited between ridges during falling river stages. The point bar topstratum deposits exposed in the open structural excavation were typically thin, ranging from 1 to 9 feet (Photograph 3). The topstratum is composed of clay (CH-CL), silt (ML), and fine silty sand (SM). The clay (CH-CL) ranges from reddish brown to gray in color, is medium to stiff in consistency, and contains wood, roots and occasional crumbly or slickensided zones. The silt portions of the topstratum are gray and sandy while the sand portions are fine grained and predominantly reddish brown to brown in color. It should be noted that investigative borings revealed that the point bar topstratum in the terrace deposit and along the terrace- contemporary flood plain contact ranges up to 50 feet in thickness. The geologic description contained on the boring logs generally coincides with that given above for the point bar topstratum exposed in the open excavation. This point bar topstratum unit was extensively used as a borrow source for clay backfill materials, especially in the upstream approach channel excavation (Photograph 3). This unit was not present in any of the foundations for the lock and dam.

c. Holocene Substratum Geology. Underlying the topstratum at the Joe D. Waggonner, Jr. Lock and Dam is the substratum. The substratum, which constitutes the alluvial aquifer at this site, is composed of a downward coarsening bed of sand which grades into gravelly sand. This unit ranges from approximately 40 feet to 70 feet thick with the thickest sections occurring at the downstream end of the site. The sands (SP-SM, SP) are brown and gray, medium and fine grained, and contain wood, lignite, clay balls, silty sand strata, silt strata, and occasional gravel below 50 feet (Photographs 4 and 5). This unit also contains isolated clay strata which ranged up to 12 feet in thickness. When a clay stratum occurred at final grade in a foundation area it was removed and the area was backfilled with compacted pervious fill.

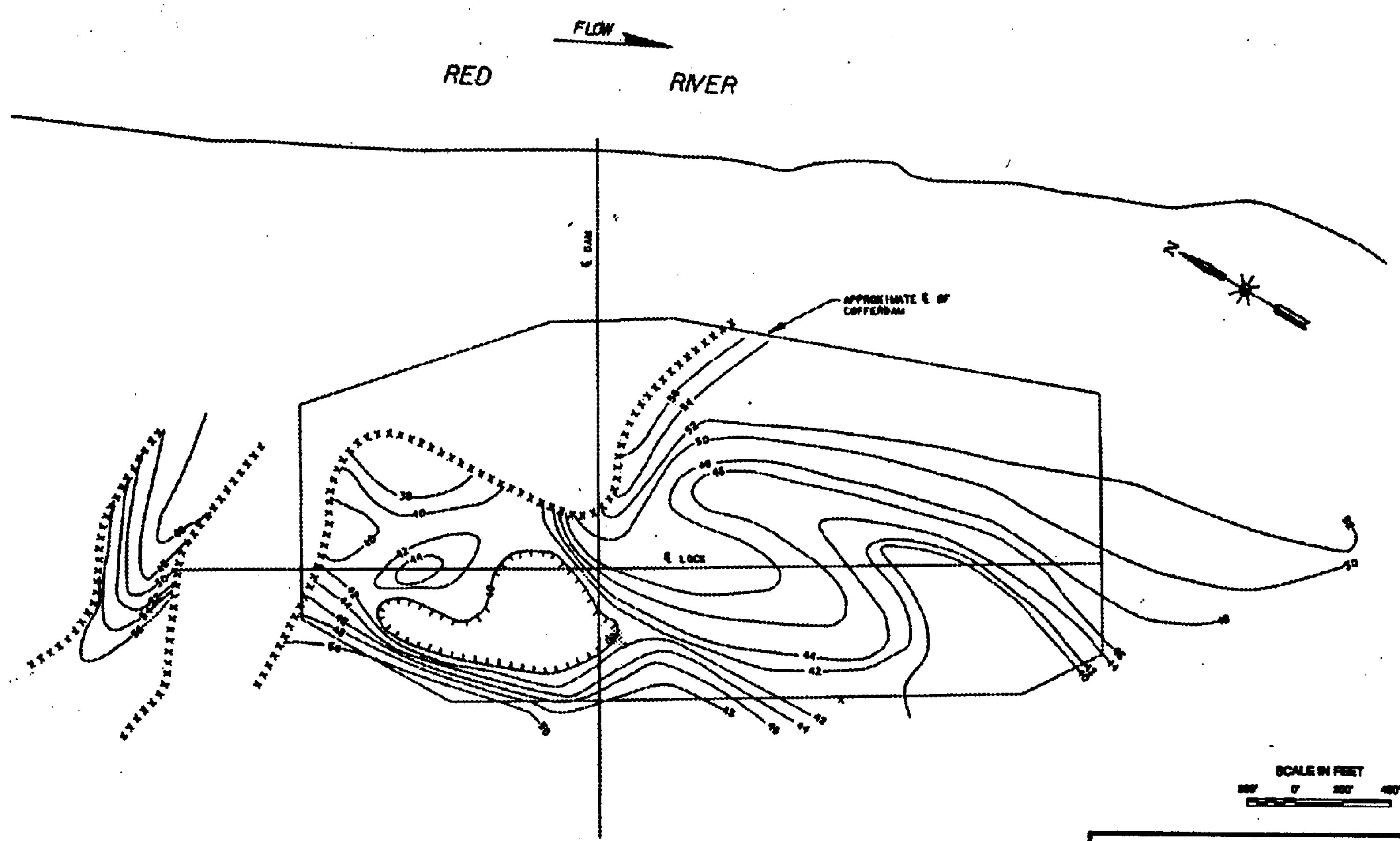
d. Tertiary Geology. Underlying the Holocene deposits at The Joe D. Waggonner, Jr. Lock and Dam site are formations of the undifferentiated Wilcox Group which is Eocene in age. The Tertiary deposits generally consist of a claystone stratum immediately beneath the alluvial aquifer. This claystone strata overlies a Tertiary sand aquifer. The top of the Wilcox is an erosional surface that varies from approximately elevation 48 to elevation 74 at the lock and dam site. Generally speaking, the interface is at a lower elevation beneath the terrace as compared to the contemporary alluvium (Figure 3-1). The Wilcox Formations were deposited by an accretionary shoreline and are



TOP OF TERTIARY

FIGURE 3 - 1

deltaic to near shore marine in origin. The Wilcox is composed of brown to black clay(stone) which contains a lignite bed over the downstream half of the site and light gray silty sand which contains occasional thin strata of gray, hard sandstone or siltstone. The clay(stone) is a highly overconsolidated marine clay. These hard Tertiary clays are referred to as "claystone" to emphasize their great difference with the Quaternary alluvial clays. The stress history of these Tertiary materials indicates that they were deeply buried in the geologic past and, as a result, they exhibited virtually no strain when subjected to the loads (stresses) associated with the lock and dam (i.e. settlement is not a problem on this foundation). These "claystones" are not competent rock like the minor sandstone and siltstone strata found on this job site. (Clay strata actually turned to rock would be designated as shale). They differ from the sandstones and siltstones in their high susceptibility to weathering, density, tensile strength and shear strength. A common feature within the claystone stratum was the presence of a lignite seam, especially over the downstream half of the site (Figure 3-2). The lignite was black, hard and ranged up to 6 feet in thickness. The lignite proved hard to satisfactorily sample and test and experience with similar materials made its engineering properties suspect. Therefore, the final alignment of the lock and dam was situated to avoid (as much as possible) areas of known lignite. The Tertiary sand aquifer is composed of gray, fine sand (SP) and silty fine sand (SP-SM). This unit underlies the entire site and the pump test revealed that it is a confined aquifer. The silty sand stratum is a local aquifer and some Tertiary dewatering and pressure relief was required on this site. Plate 4 shows the excavation plan and the location of samples recovered during the construction period. Plates 5 and 6 show the relationship of the structure to the underlying geology.



TOP OF LIGNITE

FIGURE 3 - 2

SECTION IV - DESIGN CONSIDERATIONS

4-01. Design Parameter. As a result of the laboratory testing program outlined in Paragraph 2-05 of this report the following strength parameters were utilized in the geotechnical design of Joe D. Waggonner, Jr. Lock and Dam. The design values are shown in tabular form on Table 4-1.

a. Lock and Dam, Guidewalls, Channels and Closure Dam. The following values were utilized in the design of the lock and dam, guidewalls, channels and closure dam.

(1) Quaternary Clays. All insitu topstratum clay (CH-CL) deposits were assigned an undrained (Q) shear strength $\phi = 0°$ with a cohesion based on the test results from representative borings in the vicinity. Topstratum clays were assigned a consolidated - undrained (R) shear strength of $\phi = 0°$ with a cohesion of 500 psf and a consolidated - drained (S) shear strength of $\phi = 22°$ with 0 cohesion. These clays were assigned a unit weight of 115 pcf.

(2) Quaternary Silty Sands. Quaternary sand and silty sand (SP, SM, SP-SM) were assigned a shear strength of $\phi = 30°$ and a unit weight of 120 pcf.

(3) Tertiary Claystone. These materials are highly over consolidated clays (CH-CL). They were assigned an undrained (Q) shear strength of $\phi = 6°$ with a cohesion of 2000 psf and a drained (S) shear strength of $\phi = 16°$ with 0 cohesion. A unit weight of 125 pcf was assigned to these materials.

(4) Tertiary Sand. Tertiary sand was assigned a shear strength of $\phi = 30°$ and no cohesion for both the short term (Q) and long term (S) cases. These materials were assigned a unit weight of 120 pcf.

(5) Pervious Backfill. Pervious backfills consisted of sand (SP) (known as select sand) and silty sand (SM) (known as pervious backfill). Both of these materials were assigned a shear strength of $\phi = 30°$ and a unit weight of 120 pcf.

(6) Sand Filters. All sand filters were assigned shear strength values of $\phi = 30°$ and unit weights of 120 pcf.

(7) Impervious Backfill. Clay used in the impervious upstream blanket and around the various backfill areas was assigned an undrained (Q) shear strength of $\phi = 0°$ and a cohesion of 1500 psf, a consolidated - undrained (R) shear strength of $\phi = 0°$ and a cohesion of 1000 psf and a drained (S) shear strength of $\phi = 24°$ with no cohesion. A unit weight of 115 pcf was used for this material.

b. Other Areas.

(1) Closure Dam Clay Fill. Clay used in the construction of the closure dam was assigned a Q and R strength of $\phi = 0$ and a cohesion of 750 psf. The closure dam clay fill was assigned an "S" strength of $\phi = 24°$ with no cohesion. These materials were assigned a unit weight of 115 pcf.

(2) Dredged and Dumped Silty Sand Fill. Dredged Sand and silty sand was used in constructing the closure dam. These materials were assigned an undrained (Q), shear strength, a consolidated - undrained (R) shear strength and a drained (S) shear strength of $\phi = 30°$ with no cohesion. A unit weight of 120 pcf was assigned.

(3) Silt Deposited In Channel. It was assumed in the design that a certain quality of silt (ML) would be deposited in the downstream channel area. These materials were assigned an undrained (Q) strength of $\phi = 0°$ and a cohesion of 500 psf, a consolidated - undrained (R) strength of $\phi = 20°$ and a cohesion of 300 psf and a drained (S) shear strength of $\phi = 28°$ and a unit weight of 115 pcf.

(4) Compacted Silty Sand Backfill. Compacted silty sand backfill was assigned a shear strength of $\phi = 30°$ with no cohesion and a unit weight of 120 pcf in all cases.

(5) Riprap and Rock Fill. Riprap and other protection stone was used extensively on this project. Riprap was assigned a strength (both Q and S) of $\phi = 35°$ and a unit weight of 135 pcf.

TABLE 4-1

Design Parameters

TYPE OF MATERIAL	TYPE OF TEST Q ϕ	Q c psf	R ϕ	R c psf	S ϕ	S c psf	Saturated Unit Weight pcf
Top Stratum Clay	0°	Varies	0°	500	22°	0	115
Top Stratum Silty Sands	30°	0	--	--	30°	0	120
Tertiary Claystone	6°	2000	--	--	16°	0	125
Tertiary Sands	30°	0	--	--	30°	0	120
Compacted Sand Backfill	30°	0	--	--	30°	0	120
Sand Filters	30°	0	--	--	30°	0	120
Compacted Clay Backfill	0°	1500	0°	1000	24°	0	115
Closure Dam Clay Fill	0°	750	0°	750	24°	0	115
Dredged & Dumped Silty Sand Fill	30°	0	30°	0	30°	0	120
Silt by Deposition	0°	500	20°	300	28°	0	115
Compacted Silty Sand Backfill	30°	0	30°	0	30°	0	120
Riprap & Rock Fill	35°	0	--	--	35°	0	135

NOTE: R value strengths apply only to the closure dam and dikes. The insitu strength of the clay materials varies and strengths used in individual analyses were selected from strength data for nearest boring. The values shown in Table 4-1 were selected as representative values for use in the analyses.

4-02. Design Procedures.

a. General. The lock and dam is founded on insitu substratum sands except in areas where over excavation was required. Over excavated areas were backfilled with select sand compacted to a minimum relative density of 80 percent. The insitu substratum sand extends from 4 feet to greater than 30 feet below the base of the structures. The substratum sands is underlain by Tertiary claystone, which is underlain by Tertiary sand. Thin layers of lignite occur within the claystone stratum.

b. Settlement. Settlement analyses were performed using CSETT, Waterways Experiment Station's program for determining induced stresses and resulting consolidation settlements. Loading cases were selected to yield the greatest foundation pressures. Design values of compression index, Cc, and recompression index, Cr, were selected based on experience with similar materials and typical values from NAVFAC DM-7.1 (for the substratum sand) and on consolidation tests (for the Tertiary claystone). Conservative values of Cc=.04 and Cr=.01 were selected for the substratum sand. It was assumed that the alluvial sands were normally consolidated. A design Cc=.06 was selected for the Tertiary claystone based on pressure void ratio curves from the consolidation tests. It was assumed that the Cr values of these soils would be about one half Cc, so a design value of Cr=.03 was used. The Tertiary sand and lignite layers were assumed to be incompressible. Original overburden pressures were computed based on soil conditions indicated by borings nearest each structure. Analyses were performed for lock monoliths L-2 (upstream gate) and L-10 (center of the lock chamber), the cutoff wall, dam monolith D-4, the overflow wall, and the upstream return wall. The results of the settlement computations are shown in Table 4-2. Sample calculations for predicting settlement are presented in DM 33, Volume II, Appendix A. In response to review comments, settlement along the lock centerline was also calculated and is presented in Supplement No. 1 to DM 33. Settlements between June 1994 and February 1995 of 0.04 foot at the lock and 0.05 foot at the dam have been recorded. The predicted settlements are considered conservative.

TABLE 4-2

Settlement Computation Results

Structure	Settlement (Inches)		
	r.s.	c.l.	l.s.
U.S. Gatebay Monolith L-2	3.86	4.32	5.36
Lock Monolith L-10	2.65	2.65	2.88
	u.s.	c.l.	d.s.
Cutoff Wall	4.48	3.89	3.86
Dam D-4	3.74	4.11	2.42
Overflow Wall	3.95	4.22	2.50
	toe	c.l.	heel
U.S. Return Wall	2.65	3.49	4.38

TABLE 4-3

Bearing Capacity Results

Monolith	Computed Allowable Bearing Capacity (KSF)	Maximum Bearing Pressure (KSF)	Safety Factor
Lock L-2	124.5	6.13	20.3
Lock L-4 through L-15	132.9	7.12	18.7
Lock to Dam Cutoff Wall	133.9	5.27	25.4
Dam D-1 through D-4 D-4	205.5 (ALT 1) 25.7 (ALT 2)	6.32	32.5 4.07
Crest Gated Dam D-5	99.9	7.01	14.3
Upstream Return Wall	40.5	3.88	10.4

c. Bearing Capacity. The structures analyzed were all founded on a medium dense to dense substratum sand which is underlain by Tertiary claystone and dense to very dense Tertiary sand. The claystone contains occasional lenses of lignite and lignitic claystone. Thickness of the substratum sand below the foundation of the structure is typically about 30 feet, except in the area of dam monoliths D-1 through D-4 where it ranges from 16 feet beneath D-1 to 4 feet beneath D-4. The thickness of the claystone layer ranges from 10 feet to 18 feet (see Plates 4, 5, and 6). The analyses were performed considering a one layer system consisting of sand, except monolith D-4 where two analyses were performed to model the sand and claystone. The sand was considered to control the bearing capacity of structures since they are founded directly upon it, and the thickness of claystone is relatively small in comparison to the base width of the structures. At monolith D-4, 19 feet of claystone were encountered 4 feet below the structure. The loading case analyzed for each structure was selected to yield the maximum base pressure coincident with the minimum embedment resulting from structural backfill. Allowable bearing capacities were computed using equations presented in the user's manual for the Computer Program CBEAR. The bearing capacity was computed considering the effects of embedment of foundation, submerged soil and surcharge. The most critical loading conditions were checked, including construction and normal operation for compliance with the minimum required bearing capacity factor of safety of 2.0. Structures analyzed were the upstream gatebay (monolith L-2), lock chamber monoliths L-4 through L-15, lock to dam cutoff wall, the dam, overflow section of the dam (crest gated dam) and the upstream return wall. The most critical case for each monolith analyzed was the construction case. The results are presented in Table 4-3, sample calculations are shown in DM 33, Volume II, Appendix A.

d. Uplift Stability. The tainter gated spillway and stilling basin, crest gated spillway and scour slab, and critical lock monoliths were checked for uplift stability in accordance with TL 1110-2-307, see Figure 3.5, EM 1110-2-2200, and EM 1110-2-2400. Water uplift profiles for the dam appear on Plates III-7 and III-8 in Volume III of DM 33; while head assumptions under the lock are presented on Figures 5-4, 5-5, and 5-6 of DM 33. Where drains are present, the stability was checked for zero percent drain effectiveness and a required factor of safety of 1.1. Scheduled and extreme maintenance are as defined in TL 1110-2-307. The results of the uplift stability analysis are summarized in Table 4-4.

TABLE 4-4

Uplift Stability Summary

Structure	Loading Condition	Effectiveness	Safety
Tainter Gated Spillway	Extreme Maintenance	0	1.53
Tainter Gate Stilling Basin	One Gate Half Open	0	1.13
Crest Gated Spillway	Normal Operation	50	3.04
Crest Gate Scour Slab	Normal Operation	50	1.90
Lock Monolith L-2	Scheduled Maintenance	NA	1.99
Lock Monolith L-4	Extreme Maintenance	NA	1.31
Lock Monolith L-17	Extreme Maintenance	NA	1.68

e. Sliding Stability Analyses. Sliding stability was evaluated for the dam, hinged crest gate, overflow wall, cutoff wall, upstream gate bay monolith, lower gate bay monolith, and lock chamber. The analyses were made using the computer program CSLIDE and the computer program SSW028 wedge method and calculations based on TL 1110-2-256 and EM 1110-2-1902. Sliding surfaces were checked along the base of the tainter gated monoliths and crest gated monolith. Uplifts for the spillway sections were computed using the creep path method beginning at the upper edge of the active wedge and exiting along a failure surface at the downstream edge of the structures. For the tainter gated and crest gated structures where drains will be provided, sliding stability analyses were performed assuming the drains were 0 percent and 50 percent effective. The results of these analyses are presented graphically in DM 33, Volume III, Plate III-7 and III-8, respectively. The upstream and downstream gatebay monoliths of the lock were checked for downstream sliding and the first chamber monolith (L-4) downstream of the upper gatebay monolith was checked for lateral sliding into the stilling basin. An exception to the creep path method was used to determine lock uplift. Based on experience from completed locks in the Lower Mississippi Valley Division, the seepage uplift has been found to be completely dissipated near the midpoint of the lock. Therefore, Station 3+92.5L was used as the point of zero residual seepage pressure. The results of these analyses are presented in DM 33, Volume III, Plates III-9, 10, and 11. Criteria for stability was classified on the basis of structural type: (1) concrete gravity structures which contain the pool and (2) concrete gravity structures not required to contain the pool. Structures that contain the pool include the tainter gated and crest gated spillways, the overflow wall, and the cutoff wall. These structures were designed to satisfy a higher factor of safety. Analyses for the overflow wall and cutoff wall are presented in DM 33, Volume III on Plates III-12 and III-13. Structures that do not contain the pool, (i.e. the lock and return walls) were designed for a lower factor of safety. The upstream return wall analysis is presented in DM 33, Volume III on Plate III-14. The required factor of safety is highest for operating conditions including normal operation (low flow) to extreme operation (10 year flood) and construction. When unusual loads are applied the allowable factor of safety is reduced, and when unusual loads are applied in combination, the allowable factor of safety is further reduced. The results of the structural sliding stability appear in Table 4-5. Only the most critical loading condition and factor of safety are reported in Table 4-5. The most critical condition is defined as the loading case for which the computed factor of safety has the smallest excess above the minimum required factor of safety.

TABLE 4-5

Structural Sliding Stability Summary

Structure	Loading Condition	Effectiveness	Safety
Tainter Gated Spillway	Normal Operation	50%	1.68
Crest Gated Spillway	Normal Operation	50%	2.08
Upstream Return Wall	Normal Operation	NA	1.83
Lock to Dam Cutoff Wall	One Gate Half Open	NA	2.95
Overflow Wall	Normal Operation	NA	3.31
Lock Monolith L-2	Normal Operation	NA	1.54
Lock Monolith L-4	Extreme Maintenance	NA	2.20
Lock Monolith L-17	Extreme Maintenance	NA	1.50

(f) Cofferdam Embankments and Structural Excavation Slopes. Stability of the structural excavation slopes was evaluated at the following locations using the design shear strengths presented in Paragraph 4-01. Section A-A is located on the west excavation slope at Station 14+40L. Sections B-B and C-C were located on the temporary upstream and downstream slopes in areas that were excavated for access channel construction.

Section D-D is located on the west slope adjacent to the upstream guide wall (approximately station -7+00L) and sections E-E and F-F were used to evaluate the east and west slopes along the dam centerline for sliding into the open gated dam foundation excavation. The computer program SSWO28 (wedge method) was used to perform the analyses. A construction case was investigated using both "Q" and "S" strengths for clay. Silt was assigned an "R" strength of ϕ = 20° with a cohesion of 300 psf and a drained (S) shear strength of ϕ = 28° and a unit weight of 115 pcf. The stability analyses with the location of cross-sections, an assumed ground water surfaces 5 feet below the natural ground, and the resultant factors of safety are shown on Plates III-16 through III-21 in DM 33, Volume III. Cases studied and minimum factors of safety are summarized in Table 4-6.

TABLE 4-6

Section	Case	Minimum Factor of Safety
A-A	Q	1.88
	S	1.62
B-B	Q	1.99
	S	1.95
C-C	Q	2.25
	S	1.53
D-D	Q	1.46
	S	1.69
E-E	Q	1.34
	S	1.56
F-F	Q	1.48
	S	1.41

g. Channel Excavation. Stability analyses were performed on upstream channel and downstream channel sections. The upstream channel was evaluated based on the stratigraphy shown by boring LD5-37-86U and the downstream channel was evaluated based on the stratigraphy shown by boring LD5-157-89U. Analyses of the channel sections were performed assuming the upstream and downstream disposal areas would be built to elevation 165.0. The dike along the channel sections were also analyzed assuming borrow material was excavated from the landside. This borrow area was assumed to extend to elevation 132.0. The construction case was run using both Q and S strengths. For the upstream channel section minimum factors of safety of 1.44 for Q case and 1.94 for S case were computed. For the downstream channel section minimum factors of safety of 1.41 for the Q case and 1.51 for the S case were computed. A sudden drawdown analysis was performed for the downstream channel and the minimum factor of safety was 1.82. This analysis is presented on Plates III-23 and III-24 in Volume III of DM 33.

4-03. Drainage Systems.

a. General. There were two main drainage systems used to relieve excess hydrostatic pressures at Joe D. Waggonner, Jr. Lock and Dam. These systems are described below and presented on Plates 7 through 13.

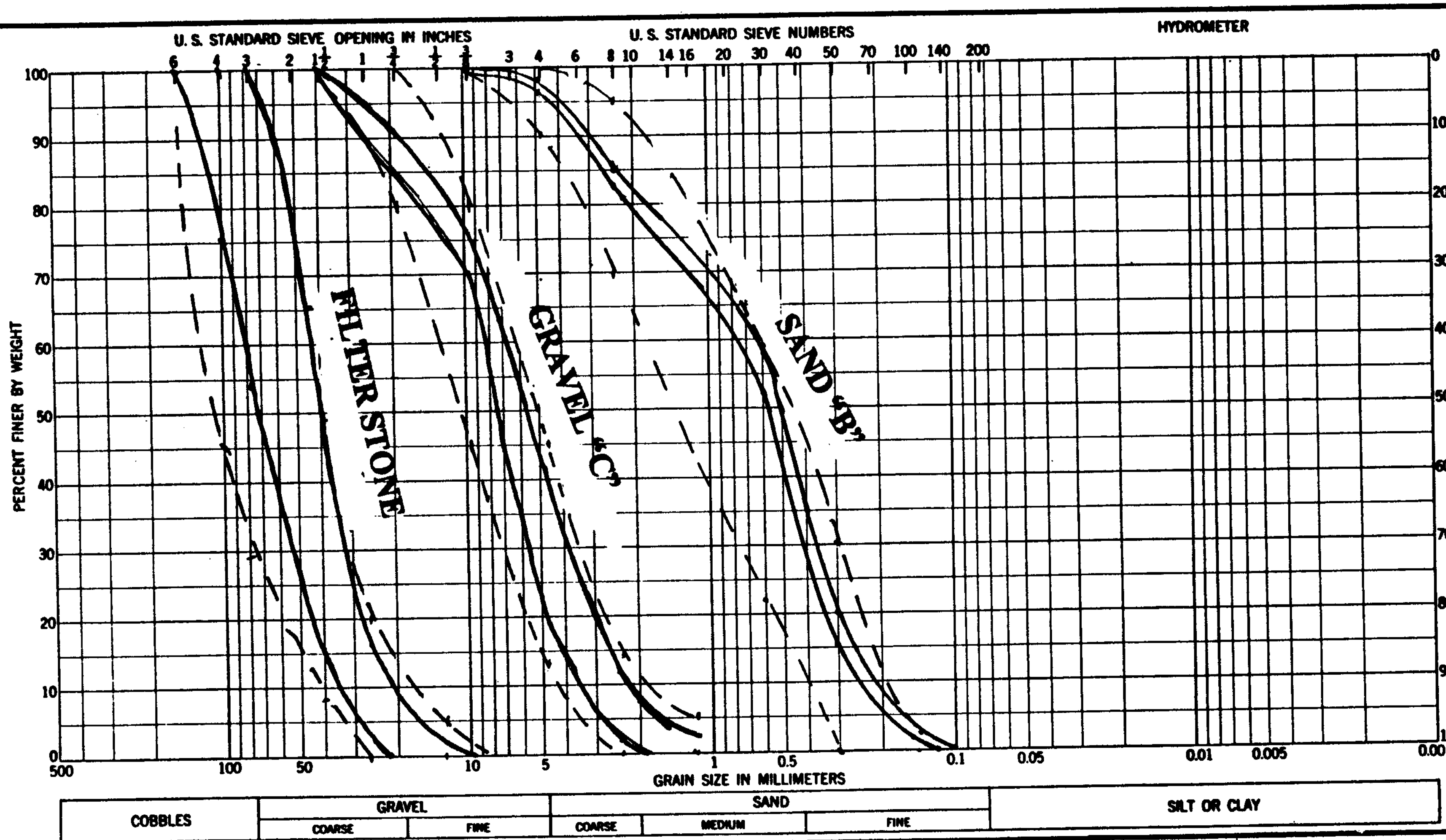
(1) Lock Wall Drainage System. The collector pipe and filter system behind the landside lock wall consists of an 8-inch PVC well screen, No. 10 slot, encapsulated by a layer of Filter Sand "B." The drainage system is used to lower hydrostatic pressures in the sand backfill (Photographs 8, 9, and 10). Pervious sand backfill was recovered and stockpiled during excavation. Select sand was processed from material dredged from the Red River (Photograph 11). Plate 7, 8, and 9 show the layout and the details of this system.

(2) Tainter Gate and Crested Gate Structures Underdrain System. The collector system beneath these structures consists of 6-inch stainless steel well screen, No. 20 Slot, within a 2-foot layer of Filter Gravel "C" underlain by a 6-inch layer of Filter Sand "B" (Photographs 12). The well screen is in a multiple loop configuration with outlets into the manholes found in each of the dam piers. These manholes have outlets to the lower pool below the elevation of the minimum lower pool. Plate 11, 12, and 13 show the layout and details of this system.

b. Filter Design. The gradation limits specified for the filter materials in this contract were as required in D.M. No. 27, Lock and Dam Nos. 4 and 5, "Availability of Construction Materials", dated December 1989. The gradation limits and Quality Assurance test data are presented in Tables 4-7, 4-8, and 4-9. The gradation bands of the filter materials provided for this project are presented on Figure 4-1. The filter sand and gravel were processed by Madden Contracting Co. Inc., from the Raley Gravel Pit. The filter stone was processed from the Herzog Stone Products Quarry, Hatton, Arkansas. The three filter materials do meet the filter criteria specified in EM 1110-2-1901, Engineering and Design - Seepage Analysis and Control for Dam, dated 30 September 1986, as follows:

Sand "B" vs Gravel "C"

$$\frac{D_{15}\ \text{Filter Gravel "C"}}{D_{85}\ \text{Filter Sand "B"}} = \frac{4}{2.3} = 1.7 \leq 5\text{; does meet piping ratio}$$



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI

GRADATION CURVES

Project LOCK AND DAM NO. 5
FILTER MATERIAL

Area

Boring No.

Date

ENG FORM 1 MAY 63 2087

FIGURE 4-1

$\frac{D_{15}\text{ Filter Gravel "C"}}{D_{15}\text{ Filter Sand "B"}} = \frac{2.6}{0.26} = 10 \geq 5$; does have sufficient permeability

$\frac{D_{50}\text{ Filter Gravel "C"}}{D_{50}\text{ Filter Sand "B"}} = \frac{7.5}{0.5} = 15 \leq 25$; does meet coefficient of uniformity

Gravel "C" vs Filter Stone

$\frac{D_{15}\text{ Filter Stone}}{D_{85}\text{ Gravel "C"}} = \frac{40}{12.7} = 3.1 \leq 5$; does meet piping ratio

$\frac{D_{15}\text{ Filter Stone}}{D_{15}\text{ Gravel "C"}} = \frac{25}{4.1} = 6.1 \geq 5$; does have sufficient permeability

$\frac{D_{50}\text{ Filter Stone}}{D_{50}\text{ Gravel "C"}} = \frac{72}{5.7} = 12.6 \leq 25$; does meet coefficient of uniformity

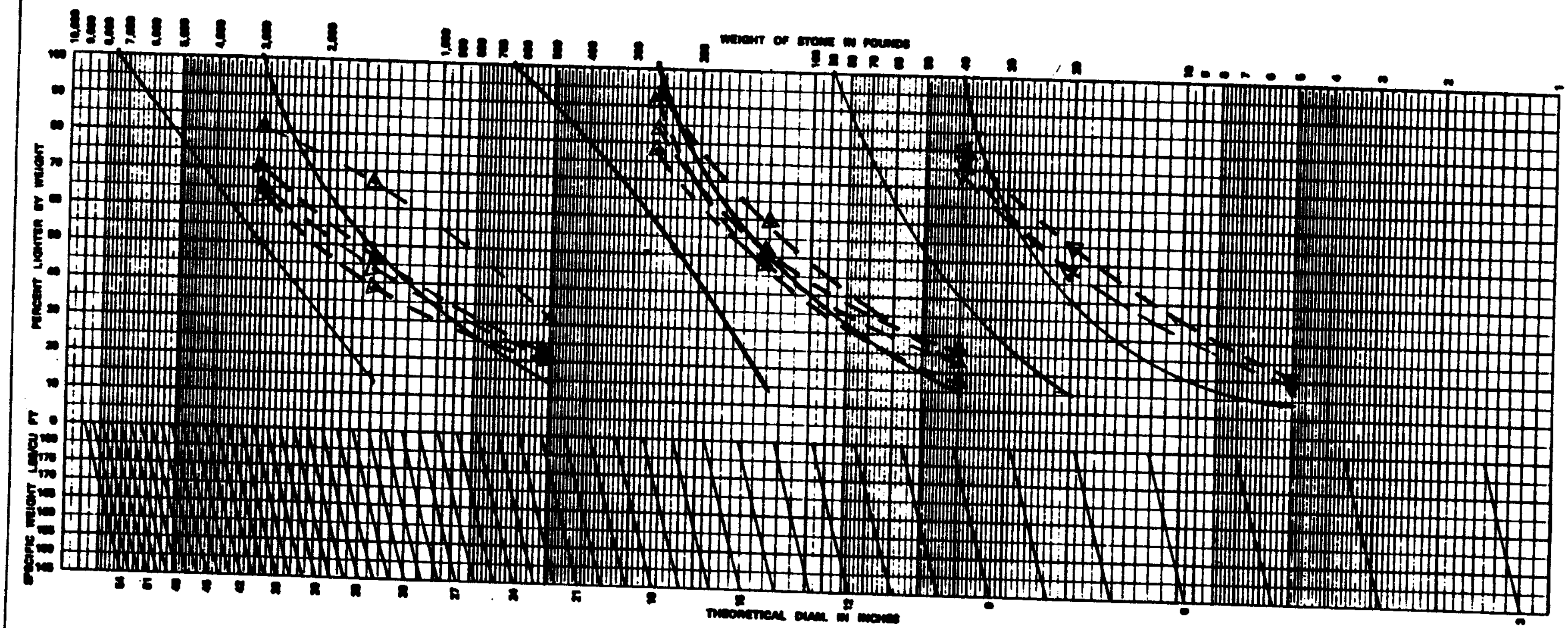
Filter Sand "B" vs Well Screen

$\frac{D_{50}\text{ Sand "B"}}{10\text{ Slot (010 in.)}} = \frac{0.5}{.25} = 2 \geq 1.2$; does meet piping ratio

4-04. Stone Protection and Channel Protection.

a. General. The stone protection and channel protection at Joe D. Waggonner, Jr. Lock and Dam were designed based on expected channel velocities at the structure, as presented in "Hydrology and Hydraulic Design, Lock and Dam No. 5," DM No. 34 (Revised Edition), dated 26 Jun 87. The stone protection consists of seven riprap gradations and the channel protection consists of two Graded Stone gradations. Plates 3, 14, and 15 show the locations and details of the various protection stone gradations used. Plates 16 and 17 show the locations and details of the various protection stone gradations used in the closure dam. A close up view of the stone protection used in the vicinity of the structure is presented on Plates 7 through 13 and Photographs 13, 14, 15, and 16). A bedding layer was placed on impervious foundations and covered with riprap. Filter layer systems were placed on pervious foundations and then covered with riprap. Engineering fabric (nonwoven geotextile) was also used beneath some riprap as a filter layer. The riprap and graded stone were produced at the Herzog Stone Products Quarry, Hatton, AR. from a volcanic formation locally called the Hatton Tuff (Rhyolite).

b. Gradation Limits. The gradation limits and Quality Assurance test data for the various riprap sizes and graded stone are presented in Tables 4-10 through 4-18 and Figure 4-2, 4-3, and 4-4. The gradation tests performed on the Graded Stone were performed following the LMVD Standard Test Method for Gradation of Riprap and Graded Stone. However, the tests performed on the riprap were performed incorrectly. The LMVD procedure is as follows:



R90, R650, R7400

SPECIFIC WEIGHT OF STONE 163 LBS/CU FT

PROJECT LOCK AND DAM NO. 5
AREA
DATE BY

RIPRAP GRADATION CURVES

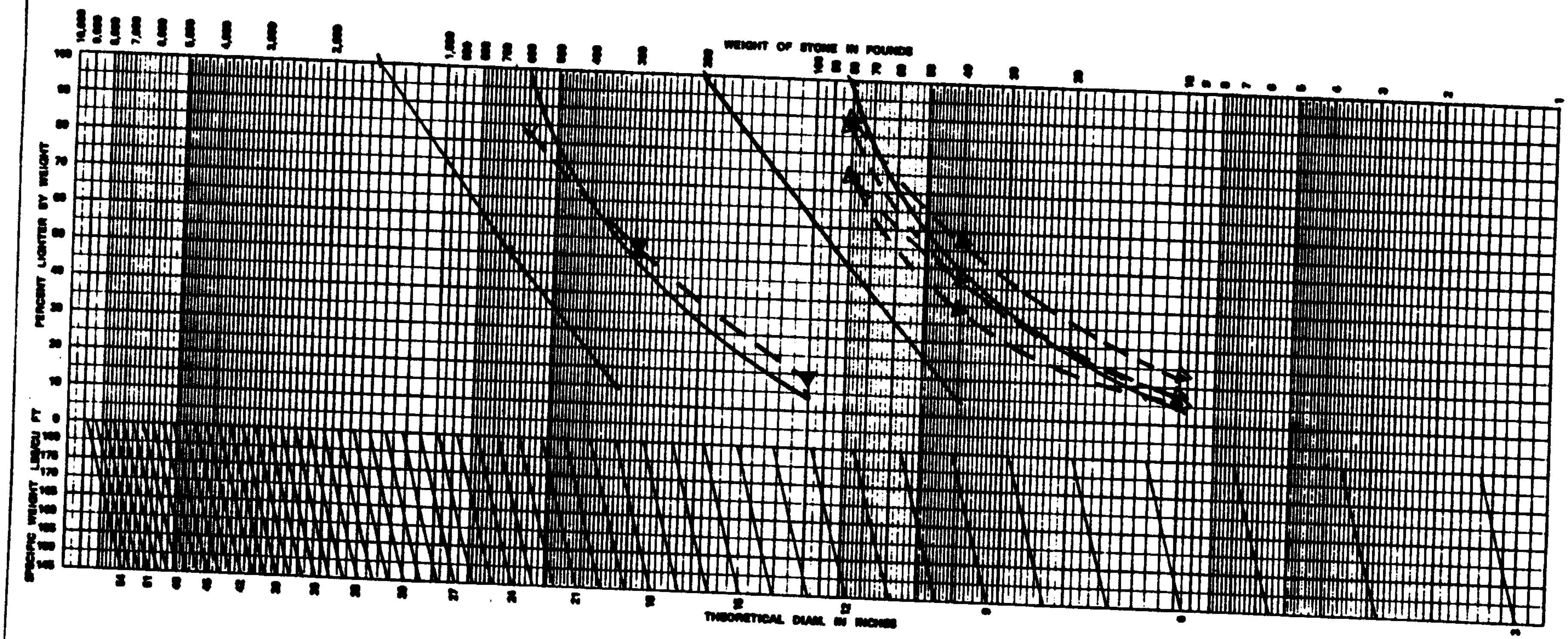
ENG FORM 4794-R, Sep 82

(EM 1110-2-1601)

(Proponent: DAEN-CWE-HD)

FIGURE 4-2

☆U.S. Government Printing Office : 1982 - 522-097/536



R200, R1500

SPECIFIC WEIGHT OF STONE 163 LBS/CU FT

PROJECT LOCK AND DAM NO. 5
AREA
DATE BY

RIPRAP GRADATION CURVES

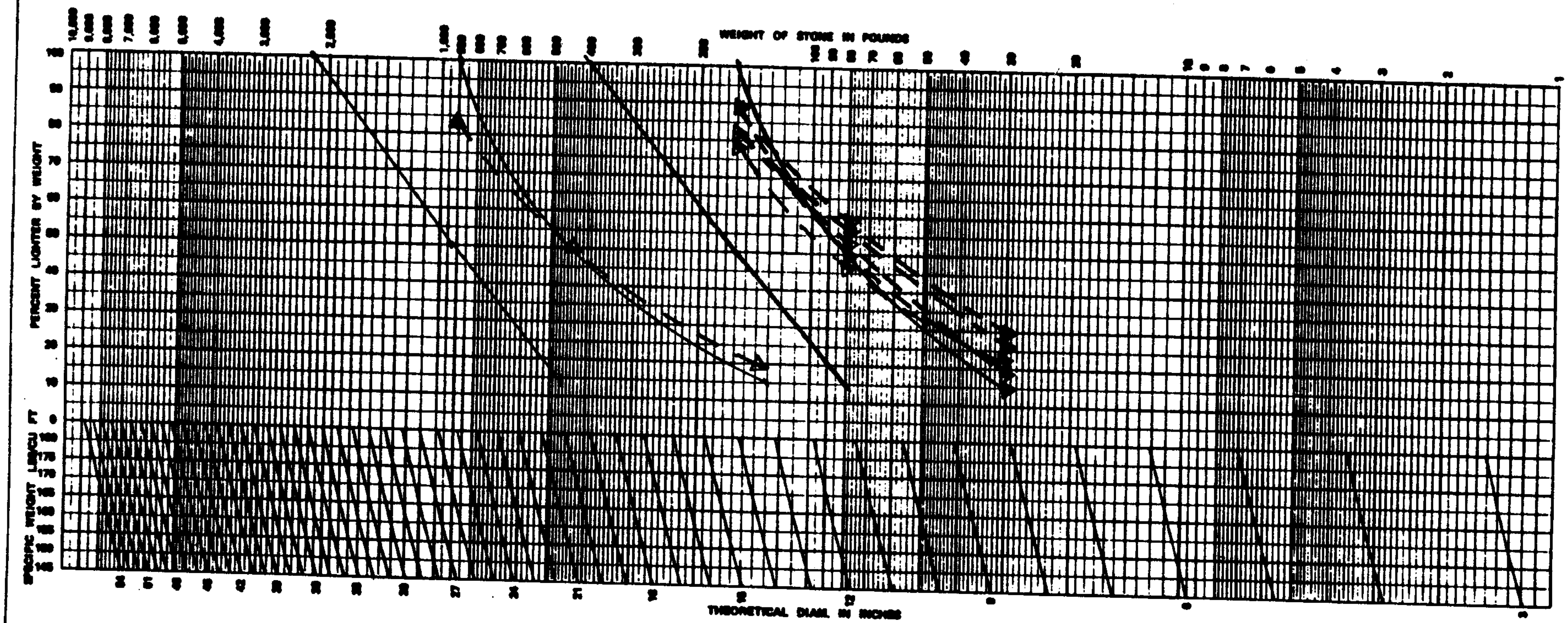
ENG FORM 4794-R, Sep 82

(EM 1110-2-1601)

(Proponent: DAEN-CWE-HD)

FIGURE 4-3

☆U.S. Government Printing Office : 1982 - 522-097/536



R400, R2200

SPECIFIC WEIGHT OF STONE 163 LBS/CU FT

PROJECT LOCK AND DAM NO. 5
AREA
DATE BY

RIPRAP GRADATION CURVES

ENG FORM 4794-R, Sep 82

(EM 1110-2-1601)

(Proponent: DAEN-CWE-HD)

FIGURE 4-4

☆U.S. Government Printing Office : 1982 - 522-097/536

Standard Test Method for Gradation of Riprap and Graded Stone

a. Select a representative sample (Note No. 1), weigh and dump on hard stand.

b. Select specific sizes (see example) on which to run "individual weight larger than" test. (See Note No. 2). Procedure is similar to the standard aggregate gradation test for "individual weight retained".

c. Determine the largest size stone in the sample. (100 percent size)

d. Separate by "size larger than" the selected weights, starting with the larger sizes. Use reference stones, with identified weights, for visual comparison in separating the obviously "larger than" stones. Stones that appear close to the specific weight must be individually weighed to determine size grouping. Weight each size group, either individually or cumulatively.

e. Paragraph d above will result in "individual weight retained" figures. Calculate individual percent retained (heavier than) and cumulative percent retained and cumulative percent passing (lighter than). Plot percent passing, along with the specification curve on ENG Form 4794-R.

NOTE NO. 1: Sample Selection: The most important part of the test and the least precise is the selection of a representative sample. No "standard" can be devised; larger quarry run stone is best sampled at the shot or stockpile by given direction to the loader; small graded riprap is best sampled by random selection from the transporting vehicles. If possible, all parties should take part in the sample selection, and agree before the sample is run, that the sample is representative.

NOTE NO. 2: Selection of Size for Separation: It is quite possible and accurate to run a gradation using any convenient sizes for the separation, without reference to the specifications. After the test is plotted on a curve, then the gradation limits may be plotted. Overlapping gradations with this method are no problem. It is usually more convenient, however, to select points from the gradation limits, such as the minimum 50 percent size, the minimum 15 percent size, and one or two others, as separation points.

FOR EXAMPLE ONLY

EXAMPLE GRADATION
SPECIFICATIONS

STONE WEIGHT IN LBS.	PERCENT FINER BY WEIGHT
400-160	100
160-80	50
80-30	15

EXAMPLE WORKSHEET

STONE SIZE LBS.	INDIVIDUAL WT. RETAINED	INDIVIDUAL PERCENT RETAINED	CUMULATIVE RETAINED	PERCENT PASSING
400	0	0	0	100
160	9,600	30	30	70
80	11,200	35	65	35
30	8,000	25	90	10

EXAMPLE WORKSHEET

STONE SIZE LBS.	INDIVIDUAL WT. RETAINED	INDIVIDUAL PERCENT RETAINED	CUMULATIVE RETAINED	PERCENT PASSING
-30	3,200	10	100	-

TOTAL 32,000 lbs.

NOTE: Largest stone 251 lbs.
Figure 4-5, LMVD Example Gradation Plot"

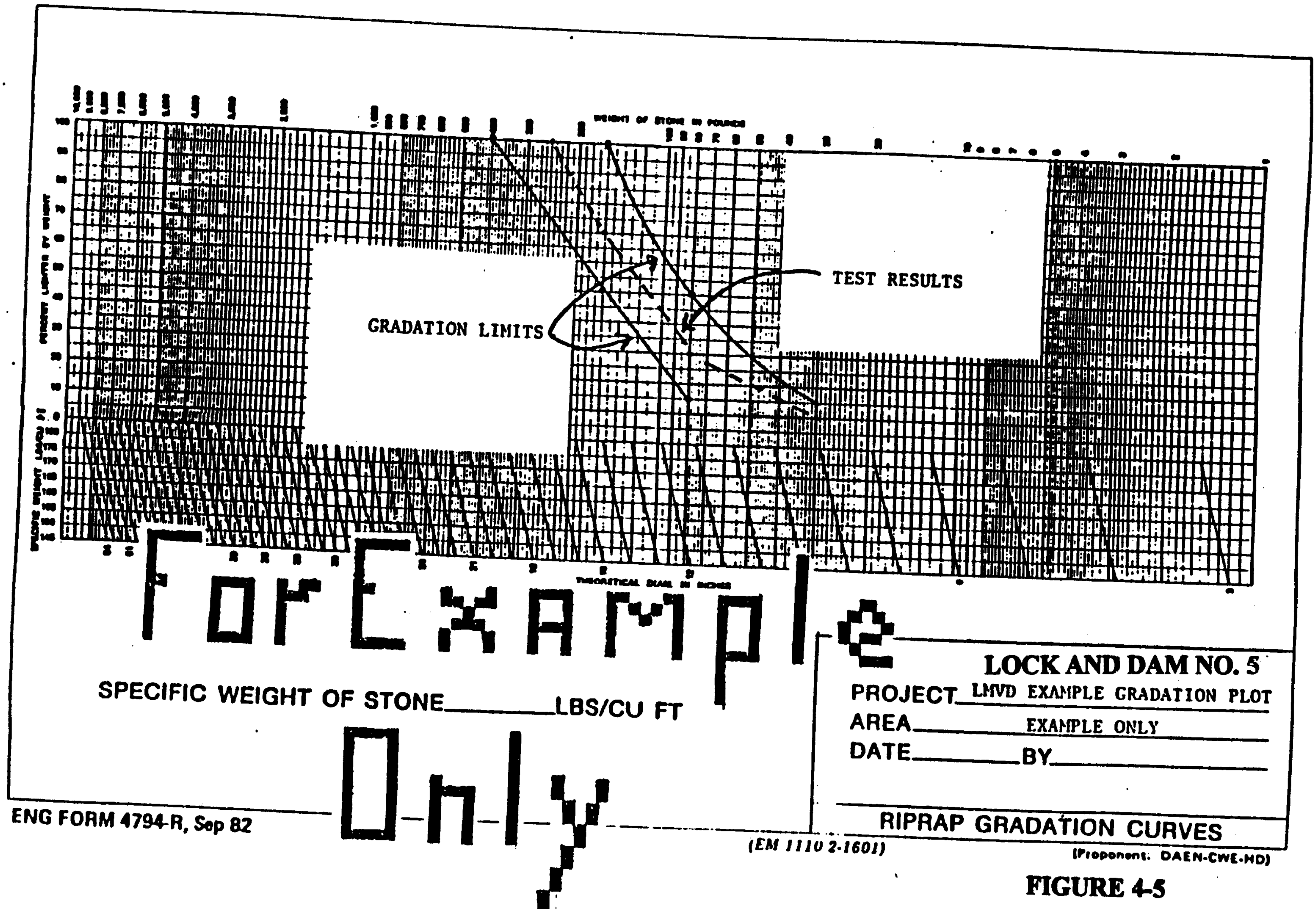


FIGURE 4-5

* U.S. Government Printing Office : 1982 - 523-097/

Most of the riprap used on this project was undersized because the gradation test was performed improperly. An example of a test performed on a sample of R400 riprap is on Table 4-19 and Figure 4-6. Instead of plotting the percent retained vs the "Size Selected for Separation" the percent retained was plotted against the average stone weight within that range. Also the maximum size stone was not weighed so the 100 percent passing could be plotted.

c. Engineering Fabric. The engineering fabric for this contract was purchased from Bradley Materials Co., Inc., Valparaiso, Florida, and manufactured by Nicolon Corp. There are no test data on the materials provided. The product names provided were Bradley 10NW for Grade 2 requirements and Bradley 12NW for Grade 1 requirements. These product names do not match with standard product line names for geotextiles manufactured by Bradley Materials or Nicolon. However, it can be surmised that these materials are Nicolon S1000 and Nicolon S1200, respectively. Based on data included in "Geotechnical Fabrics Report", Industrial Fabrics Association International, December 1992, these geotextiles should have met the requirements of this project.

d. Filter and Bedding Material Design. The gradation limits and Quality Assurance test data for Bedding Material are presented in Tables 4-20 and 4-21. The gradation bands of the bedding materials provided for this project are presented on Figure 4-7. The main criteria that needed to be met between the Filter Materials or Bedding Materials and the riprap is the piping ratio. Piping criteria were met for all materials except R650 riprap and Bedding Stone No. 2. However, this is not critical since the stone protection is placed on a clay foundation and the only material being lost would be some fines out of the bedding material.

Filter Stone vs R650 Riprap

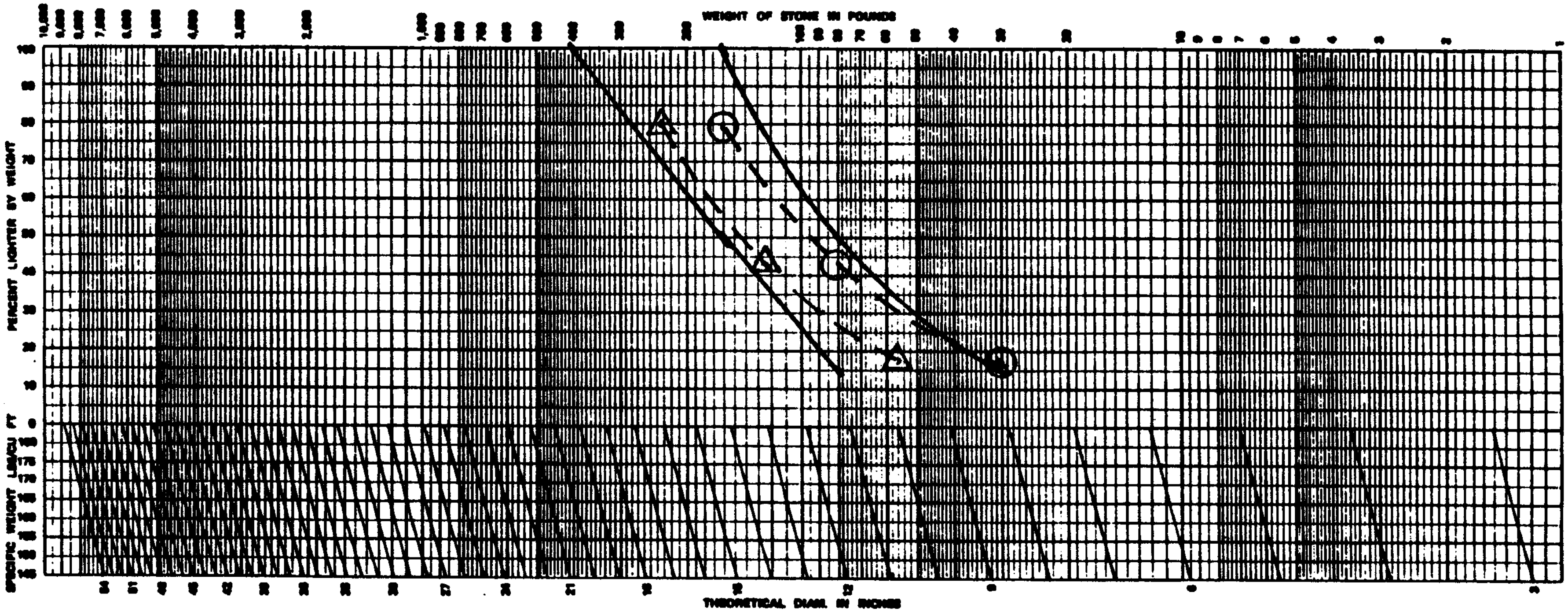
$$\frac{D_{15}\ \text{R650 Riprap}}{D_{85}\ \text{Filter Stone}} = \frac{215}{56} = 3.9 \le 5 \quad \text{does meet piping ratio}$$

Bedding Stone No. 1 vs R650 Riprap

$$\frac{D_{15}\ \text{R90 Riprap}}{D_{85}\ \text{Bedding Stone \#1}} = \frac{119}{21} = 5.7 \le 5 \quad \text{does not meet piping ratio}$$

Bedding Stone No. 2 vs R650 Riprap

$$\frac{D_{15}\ \text{R650 Riprap}}{D_{85}\ \text{Bedding Stone \#2}} = \frac{215}{27} = 8.0 \le 5 \quad \text{does not meet piping ratio}$$



R400 EXAMPLE

SPECIFIC WEIGHT OF STONE 163 LBS/CU FT

INCORRECT

CORRECT

PROJECT LOCK AND DAM NO. 5
AREA
DATE BY

RIPRAP GRADATION CURVES

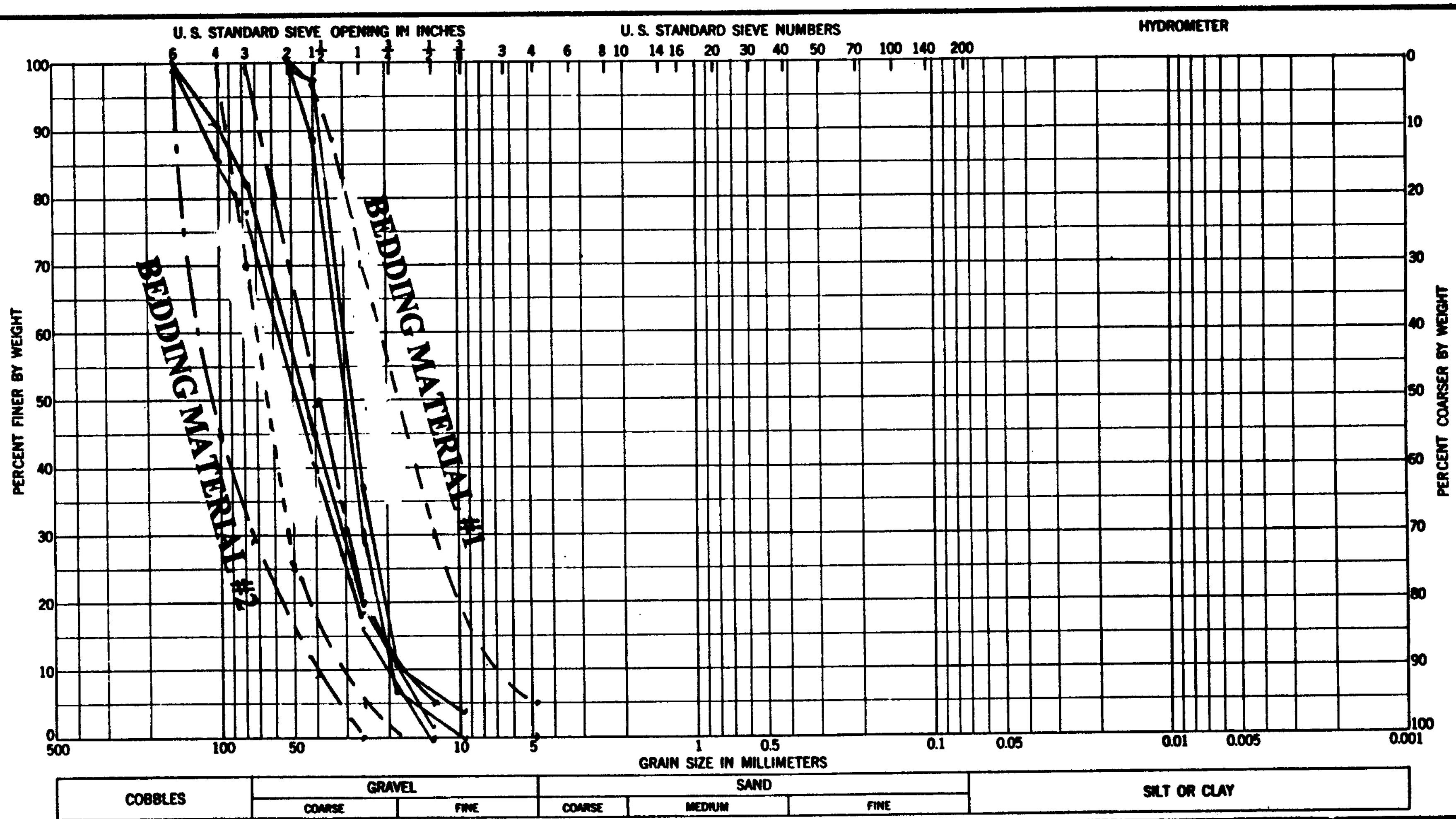
ENG FORM 4794-R, Sep 82

(EM 1110-2-1601)

(Proponent: DAEN-CWE-HD)

FIGURE 4-6

☆U.S. Government Printing Office : 1982 - 522-097/536



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI

GRADATION CURVES

Project **LOCK AND DAM NO. 5**

BEDDING MATERIAL

Area

Boring No.

Date

ENG FORM 1 MAY 63 2087

FIGURE 4-7

R90 Riprap vs R7400 Riprap

$$\frac{D_{15}\ \text{R7400 Riprap}}{D_{85}\ \text{R90 Riprap}} = \frac{558}{208} = 2.7 \le 5$$ does meet piping ratio

e. Possible Future Problems. The riprap downstream of the stilling basin was designed to withstand flow resulting from a gate mis-operation or an accident that results in a sudden concentrated very large increase in flow with a low tailwater. The riprap sample results shown on Figures 4-2, 4-3, and 4-4 indicate that the riprap in place does not meet specifications. Consequently, the channel protection downstream of the stilling basin will not provide the level of protection envisioned during the design phase. However, the riprap as shown on the previously mentioned figures will, most likely, provide adequate protection against flows resulting from normal operation, including the passage of flood flows. In the event of a gate misoperation or an accident that results in an extreme flow condition, serious consideration should be given to operating the remaining gates to reduce the pool level and raise the tailwater, which will reduce the attack on the riprap. Periodic surveys will need to be performed to check the condition of the stone protection downstream of the stilling basin. These surveys should be conducted on a regular basis and after significant flow events to verify the condition of the riprap below the stilling basin. Table 4-22 presents the specified riprap gradations, the associated design velocity, an estimate of the in-place gradation and its associated design velocity.

TABLE 4-7

Filter Sand "B"					
	Date	6/30/92	6/30/92	7/1/92	7/1/92
Specification		Percent Passing			
Sieve Size	Percent Passing				
3/8 inch	100	100	100	100	100
No. 4	90-100	97.6	97.2	97.5	96.8
No. 8	70-95	85.0	82.8	84.9	82.6
No. 30	22-57	57.8*	53.8	58.5*	53.6
No. 50	0-30	17.0	15.6	18.8	15.6
No. 100	0-5	2.5	2.3	3.0	2.2

TABLE 4-8

Filter Gravel "C"					
	Date	10/6/93	10/14/93	2/4/94	3/11/94
Specification		Percent Passing			
Sieve Size	Percent Passing				
1-1/2 in	100	100	100	100	100
3/4 inch	80-100	91	88	84	91
3/8 inch	45-80	76	70	73	76
No. 4	13-45	42	19	24	26
No. 8	0-14	12	3	4	2
No. 16	0-5	2	2	2	0

TABLE 4-9

Filter Stone					
	Date	3/12/93	2/1/94	6/8/94	10/19/94
Specification		Percent Passing			
Sieve Size	Percent Passing				
6 inch	100	100	100	100	100
4 inch	45-100	100	75.8	79.8	91.2
3 inch	29-100	100	54.0	63.6	87.4
1-1/2 in	8-48	17.4	14.6	25.5	46.3
1 inch	0-20	2.8	5.6	10.3	15.7
1/2 inch	0-5	0.9	0.1	1.1	1.4

TABLE 4-10

R 90 Riprap				
	Date	2/2/93	9/17/93	10/19/93
Specification		Percent Finer by weight		
Stone Size (lbs)	% Finer by wt.			
90-40	100	79.8	76.7	72.5
40-20	50	53.5	47.6	47.7
20-5	15	19.2	17.3	18.0
NOTE: Min W_{50} = 17 lbs, Sp.Gr.= 163 lbs/ft^3				

TABLE 4-11

R 200 Riprap				
	Date	11/3/92	11/11/92	9/22/93
Specification		Percent Finer by weight		
Stone Size (lbs)	% Finer by wt.			
200-80	100	89.5	74	87.2
80-40	50	57.3	39.8	48.8
40-10	15	23.5	16.6	17.2
NOTE: Min W_{50} = 32 lbs, Sp.Gr.= 163 lbs/ft^3				

TABLE 4-12

R 400 Riprap					
	Date	1/15/93	12/14/93	2/23/94	6/8/94
Specification		Percent Finer by weight			
Stone Size (lbs)	% Finer by wt.				
400-160	100	82.7	89.2	88.2	78.8
160-80	50	55.5	51.3	59.8	42.3
80-30	15	19.9	21.1	28.7	22.3
NOTE: Min W_{50} = 60 lbs, Sp.Gr.= 163 lbs/ft^3					

TABLE 4-13

R 650 Riprap					
	Date	11/11/92	9/22/93	2/7/94	10/18/94
Specification		Percent Finer by weight			
Stone Size (lbs)	% Finer by wt.				
650-260	100	89.4	84.9	92.3	78.7
280-130	50	59.1	51	46.2	48.4
130-40	15	22.6	26.7	17.8	22.4
NOTE: Min W_{50} = 105 lbs, Sp.Gr.= 163 lbs/ft^3					

TABLE 4-14

R 1500 Riprap				
	Date	5/17/93		
Specification		Percent Finer by weight		
Stone Size (lbs)	% Finer by wt.			
1500-600	100	82.2		
650-300	50	52.4		
330-100	15	18		
NOTE: Min W_{50} = 260 lbs, Sp.Gr.= 163 lbs/ft^3				

TABLE 4-15

R 2200 Riprap				
	Date	5/17/93		
Specification		Percent Finer by weight		
Stone Size	% Finer by wt.			
2200-900	100	83		
930-440	50	50.7		
460-130	15	18.6		
NOTE: Min W_{50} = 430 lbs, Sp.Gr.= 163 lbs/ft				

TABLE 4-16

R 7400 Riprap					
	Date	5/7/93	5/17/93	2/16/94	4/23/94
Specification		Percent Finer by weight			
Stone Size (lbs)	% Finer by wt.				
7400-3000	100	81.8	66.7	71.0	62
3100-1500	50	67.6	44.1	47.6	33.5
1500-500	15	31.7	23.4	23.1	20.21
NOTE: Min W_{50} = 850 lbs, Sp.Gr.= 163 lbs/ft^3					

TABLE 4-17

Graded Stone C					
	Date	5/13/92	10/20/92*	10/21/92*	11/30/92
Specification		Percent Finer by weight			
Stone Size (lbs)	% Finer by wt.				
400	100	100	98.4	98.7	100
250	70-100	96.7	97.2	95.5	82.8
100	50-80	78.6	79.8	76.0	67
30	32-58	46.5	52.9	51.9	42
5	15-34	21.1	26.7	26.5	15.2
1	2-30	7.34	6.1	8.6	5.8
Less than 1/2" sieve	0-10	--	--	--	--
NOTE: 5% of the material can weight more than 400 pounds. However no piece shall weigh more than 500 pounds. * Tests performed at the project site.					

TABLE 4-17 (cont.)

Graded Stone C (cont.)					
	Date	1/14/93	3/3/93	6/24/93	7/14/93
Specification		Percent Finer by weight			
Stone Size (lbs)	% Finer by wt.				
400	100	100	100	100	100
250	70-100	97.6	93.7	88.5	87.6
100	50-80	73.6	72.3	58.9	71.1
30	32-58	44.2	37.0	33.3	44.3
5	15-34	19.0	18.7	21.2	28.9
1	2-30	6.9	9.5	6.3	10.5
Less than 1/2" sieve	0-10	--	--	--	--

NOTE: 5% of the material can weight more than 400 pounds. However no piece shall weigh more than 500 pounds.
* Tests performed at the project site.

TABLE 4-18

Graded Stone B					
	Date	8/19/93	4/18/94	6/28/94	9/6/94
Specification		Percent Finer by weight			
Stone Size (lbs)	% Finer by wt.				
1200	100	100	100	100	100
750	72-100	80.1	92.6	78.2	88.1
200	40-65	53.0	58.7	40.0	54.0
50	20-38	22.2	33.4	21.7	32.1
10	5-22	13.0	11.5	9.3	19.6
5	0-15	7.5	3.5	7.5	7.7
1	0-5	1.8	0	0	1.1

TABLE 4-19

Presentation of Improper Gradation Procedure Used on This Project R400 Riprap					
Stone Size (lbs) 400-160		Stone Size (lbs) 160-80		Stone Size (lbs) 80-30	
# Pieces	Weight Retained	# Pieces	Weight Retained	# Pieces	Weight Retained
30	7020	76	9680	184	10280
Average Stone Weight (lbs)		Average Stone Weight (lbs)		Average Stone Weight (lbs)	
234		127.4		55.9	
Sample Weight (lbs)					
32,360					
% Retained		% Retained		% Retained	
21.7		29.9		31.8	
Cumulative Percent Passing		Cumulative Percent Passing		Cumulative Percent Passing	
78.3		43.4		16.6	
NOTE: The information presented in the shaded blocks should not be used for acceptance of a riprap gradation.					

TABLE 4-20

Bedding Material No. 1					
	Date	6/10/93	6/10/93	7/19/93	7/30/93
Specification		Percent Passing			
Sieve Size	Percent Passing				
4 inch	100				
3 inch	70-100				
2 inch	25-100	100	100	100	100
1-1/2 in	(90-100)*	92.7	92.6	97.8	89.9
1 inch	5-70	35.8	30.6	36.8	30.2
3/4 inch	(0-10)*	10.5	6.9	7.7	7.5
1/2 inch	0-30				
3/8 inch	(0-5)*	3.8	0.6	2.6	3.0
No. 4	0-5				
NOTE: * This material meet the gradation band for the 3/4 inch to 1-1/2 inch concrete aggregate					

TABLE 4-21

Bedding Material No. 2					
	Date	10/19/94	10/19/94	10/19/94	10/19/94
Specification		Percent Passing			
Sieve Size	Percent Passing				
6 inch	100	100	100	100	100
4 inch	45-100	90.4	87.3	89.5	90.6
3 inch	29-100	81.7	79.2	78.4	81.9
1-1/2 in	8-48	42.8	38.8	40.6	44.3
1 inch	0-20	16.6	17.1	16.2	16.7
1/2 inch	0-5	2.1	1.6	2.0	1.1

TABLE 4-22

Specified Riprap Size	Design Vel. ft/sec	Estimated Riprap Size (Gradation Test)	Design Vel. ft/sec
R7400	13.6	R5000	12.8
R2200	11.1	In-place riprap is acceptable	
R1500	10.4	R1000	9.8
R650	9.1	R400	8.4
R400	8.4	R200	7.5
R200	7.5	R140	7.1
R90	6.6	R50	5.9

SECTION V - EXCAVATION PROCEDURES FOR COMPONENT PARTS.

5-01. Excavation Grades. Excavation for the Joe D. Waggonner, Jr. Lock and Dam extended through the Holocene topstratum and into the Holocene substratum, which forms the foundation for the structure. Excavation for the gated dam approached within 4 feet of the underlying Tertiary sediments of the Wilcox Group (Plates 4, 5, and 6). Founding elevations range from 74.5 beneath the gated dam to 84.5 and 80.5 beneath the upper and lower lock gate bay monoliths, respectively. The stilling basin is founded at elevation 76.5 and the lock chamber is founded at elevation 87.5. Excavation and backfill sections are shown on Plates 7 through 13.

5-02. Dewatering Provisions. Dewatering provisions for Joe D. Waggonner, Jr. Lock and Dam included efforts in six main areas.

a. Unwatering the initial excavation.

b. Lower the water table 5 feet below excavation grade.

c. Relieve hydrostatic pressure in any pervious strata in the Tertiary formation to a point below the excavation grade.

d. Collect and dispose of all surface water within the protected area.

e. Install and monitor construction piezometers, and

f. Re-water the site at the completion of work.

The system employed consisted of a slurry cutoff to block seepage through the alluvial aquifer and a system of 12 alluvial deep wells. This portion of the dewatering system, along with seven double tipped piezometer, was installed by the Government under a Phase 1 contract and made available for use by the Phase II contractor. The contractor was responsible for supplementing this alluvial dewatering system as needed, installing a system to lower Tertiary pressures, and installing a piezometer system to monitor pressures in the Holocene and Tertiary aquifers. Surface water collection was accomplished using top bank ditches and sumps and a number of temporary sumps in the excavation.

5-03. Overburden Excavation. The excavation for the Joe D. Waggonner, Jr. Lock and Dam project was performed under two separate contracts. The initial excavation was performed under a "Phase 1" contract with Gus K. Newberg (contract number DACW-38-90-C-0097) and extended to elevation 105.5 beneath the structure. This excavation consisted of approximately 3.2 million cubic yards and was performed by Rogers under a subcontract. The final grade structural excavation and the channel excavations were performed under the Phase II contract using land-based equipment. Specific equipment involved included 2 Liebherr excavators (models 962 and 965), 12 Terex (TS 24) scrapers, and 4 Caterpillar (model 631) self loading scrapers. Excavated materials were transported using 16 yard Volvo trucks (models A25 and A35). Fine grading was performed under the main contract using small bulldozers and backhoes. The contractor installed a dewatering system in the access channels to allow the land based excavation to proceed (Photograph 17). The dewatering system for the channels is discussed below. The excavation plan for the structure is shown on Plate 4.

5-04. Dewatering System Kelley Dewatering installed the initial dewatering system and Case International installed a slurry trench under the Phase 1 contract. This system, which consisted of wells, piezometers, and a slurry trench, was turned over to the Phase II contractor. Griffin Dewatering Company was responsible for construction dewatering and surface water control at Joe D. Waggonner, Jr. Lock and Dam under the Phase II contract. Dewatering of the alluvial aquifer was accomplished using a combination of government furnished and contractor furnished deep wells in combination with the slurry trench installed by the government under a previous contract. The slurry trench is three feet wide and averages 90 feet in depth (Photograph 18). This initial dewatering system consisted of 12 deep wells (numbers W5-1 through W5-12) installed at the natural ground surface and extending to the top of the Tertiary formation. These wells contain a minimum 10 inch filter composed of gravel "E" and were constructed of fully penetrating 12 inch diameter, Number 40 slot continuous wire-wrapped screens through out the entire aquifer thickness. The contractor supplemented this system with 12 additional well (numbers W5-13 through W5-24). These wells were located in critical areas inside the excavation and extended into the Tertiary aquifer (Photograph 19). The phreatic surface in both the Tertiary and alluvial aquifers was monitored using the existing COE piezometers although the contractor supplemented this system by installing 10 Tertiary piezometers (numbers T-1 through T-10) around the perimeter of the excavation. Surface water was collected and controlled using a system of top bank sumps and pumps supplemented with temporary sumps which were relocated as the excavation progressed (Photograph 20). This surface water control system was modified on an ad hoc basis and on several occasions it failed to keep up with rainfall events and caused minor damage to the work area. The dewatering system was operated on an "as needed" basis, especially after the excavation was completed, and no attempt has been made to summarize the performance of the system. During the initial lowering of the water table the contractor alleged that the dewatering system was causing delays because the rate of drawdown slowed appreciably.

In fact, this was a result of diminished inflows into the wells as the driving head diminished (as the water surface approached the top of the Tertiary horizon). The instillation of the contractors' supplementary wells in critical areas allowed excavation to proceed without delays. The contractor also installed the following well systems to dewater the channels and allow land based excavation. Wells W-1A through W-6A were installed on the west bank of the downstream channel; Wells W-1B through W-6B were installed on the east bank of the downstream channel; Wells W-1C through W-15C were installed along the centerline of the upstream channel (Photograph 17), and Wells W-16C through W-24C were installed along the east top bank of the upstream channel. The wells consisted of 8 inch PVC risers and screens installed in the alluvial aquifer. The water table was monitored with a system of 8 piezometers in the upstream channel and 8 piezometers in the downstream channel. No significant problems occurred with the dewatering item of work. For a complete layout of the system within the protected area see Plate 18. The dewatering system for the channels was completely removed and therefore is not shown. The dewatering system within the protected area was abandoned and grouted in accordance with the laws of the state of Louisiana.

SECTION VI - CHARACTER OF THE FOUNDATION

6-01. Foundation Surfaces of Each Component. Joe D. Waggonner, Jr. Lock and Dam is founded on sand and silty sand of the Holocene substratum formation. Final grade excavation for the lock, dam, cutoff wall, and guidewalls extended into this unit and to a point 4 feet above the Tertiary deposits of the Wilcox Group. Foundations for the upstream return wall, downstream return wall and overflow wall sloped upward and are founded partially on this substratum unit and partially on the topstratum unit (although foundations for all three walls contain a variable thickness of fully compacted select sand beneath their bases). The crest gated spillway and the overflow wall are founded on variable thicknesses of fully compacted select sand (final grade excavation beneath these structures extended to within a few feet of the Tertiary materials as shown on Plates 5 and 6). The gated dam and associated stilling basin contains a two stage pressure relief/drainage system on top of the substratum foundation which is situated about four feet above the top of the Tertiary. Substratum foundations are fairly uniform in composition (Photograph 5). They consist predominantly of medium and fine, gray sand (SP) and silty fine sand (SM, SP-SM) with occasional lenses or strata of gray clay (CH-CL) (see Table 6-1). When one of these clay strata occurred at final grade in a foundation area, it was removed and back filled with fully compacted select sand. When clay strata occurred at final grade in areas scheduled for backfill or protection stone, it was removed and backfilled with fully compacted pervious backfill. Areas outside the foundation footprint were backfilled with fully compacted pervious backfill.

6-02. Condition of the Foundation.

a. Dam. The gated dam and stilling basin were constructed on an underdrain system which rests on a substratum sand foundation as shown on Plates 19 through 22. The cutoff wall, crest gated spillway (monolith D-5) and overflow wall were constructed on varying thicknesses of fully compacted select sand backfill which, in turn, rests on a substratum sand foundation (Plates 11 through 13 and Photographs 21, 22, 23, and 24). Backfill beneath the cutoff wall ranged from 1 to 3 feet. Backfill beneath the Crest Gated Spillway ranged from 3.5 feet to 25.5 feet. Backfill beneath the Overflow wall ranged from 1.5 feet (beneath Monolith OW-1) to approximately 5 feet (beneath Monolith OW-3). In foundation areas, contaminated or unsuitable material was removed and replaced with fully compacted select sand backfill.

b. Lock. The lock and guidewalls are founded on substratum sand and silty fine sand (SP, SP-SM) (Table 6-1). In all cases contaminated or unsuitable materials were removed and replaced with fully compacted select sand. A clay stratum was encountered near final grade in the upstream gate bay for the lock (monoliths L-1 and L-2) and in the upstream guidewall foundation (monoliths UG-1 and UG-2). In all cases the clay strata were removed (Plates 7 through 10). Clay backfill was placed beneath the riprap on the downstream channel slope adjacent to the downstream return wall and a clay blanket was constructed upstream of the gated dam as shown on Plate 3 and in Photographs 25 and 26. Earthen backfills were constructed on both sides of the lock chamber. A drainage system was installed in the backfill landside of the lock (Photographs 8, 9, and 10). Backfill riverside of the lock is constructed of free draining materials. For the details of the backfill drainage system see Plates 23 through 26.

6-03. <u>Water Problems</u>. Problems occurred with surface water control and dewatering within the slurry trench. During the 4 to 5 months between Phases, the Government maintained dewatering and surface water control. Several heavy rains during that period causes severe erosion on the excavation slopes which, on the left slope, threatened the integrity of the cofferdam. Most of this erosion occurred just downstream of the dam centerline. It was repaired by hired labor forces. Failure to control surface water during the Phase II contract resulted in minor erosion to the excavation side slopes which required repeated repair. In many locations the contractor opted to cover exposed Holocene sands with a veneer of visqueen or clay to prevent erosion. Excavation in the gated dam area was delayed when the dewatering wells failed to lower water table as fast as the excavation advanced. The contractor alleged changed conditions and installed 12 additional wells in critical locations around the deeper portions of the excavation. The Corps drilled 6 exploratory borings to investigate the subsurface conditions and to investigate the possibility of a slurry trench leak. The investigation failed to identify any problems and the necessary draw down was subsequently achieved using the 12 supplementary wells. The supplementary wells extended into the sub-alluvial Tertiary formation and successfully lowered Tertiary pressures to acceptable levels. The alluvial dewatering delays resulted because production from the existing wells diminished as the water table within the slurry trench was lowered. The additional wells successfully lowered the water table and, once lowered, only minor maintenance pumping was required. The dewatering system employed within the protected area is shown on Plate 18.

6-04. <u>Foundation Materials Mapped</u>. Five identifiable and mappable units were described in the exploration phase for Joe D. Waggonner, Jr. Lock and Dam. These units are (from oldest to youngest) the Tertiary Wilcox Group (undifferentiated), the alluvial terrace topstratum and substratum units, and the Holocene point bar topstratum and substratum units. Three of these geologic units have been mapped in the current report. They are the Wilcox (designated as TW), Holocene point bar topstratum (designated as Hpb) and undifferentiated substratum which constitutes the alluvial aquifer (designated as Hs). An attempt was made to identify individual clay(stone), lignite, and sand strata within the Wilcox based on preconstruction borings (Figure 3-2). It should be expected that lignite exists that was not identified in this process. The alluvial terrace units mentioned above were involved in the dewatering item of work (the west reach of the slurry trench is installed in this terrace). However, the groundwater investigations indicated that the properties of the substratum aquifer within the terrace deposit were similar to those of the aquifer within the current meander belt. The alluvial terrace was present in the disposal areas and did provide a significant source for backfill borrow. Terrace materials are not involved in any structural foundation areas and therefore are considered beyond the scope of this report.

Information on the extent and nature of the terrace alluvium is available in Design Memorandum 33 "Detailed Design" Volumes I and IV.

TABLE 6-1

JOE D. WAGGONNER, JR. LOCK AND DAM FOUNDATION SAMPLES
(Samples collected at final grade during the period February-March 1993)

NO.	STRATUM	ELEVATION	LOCATION	DESCRIPTION
1.	SUBSTRATUM	84.5	UPPER GATE BAY	SAND (SM), F, M, BR, GR
2.	SUBSTRATUM	74.5	GATED DAM	SAND (SP), M, F, BR
3.	SUBSTRATUM	74.5	GATED DAM	SAND (SP), M, F, BR
4.	SUBSTRATUM	78.5	GATED DAM	SAND (SP), M, F, BR
5.	TOPSTRATUM	130.0	OVERFLOW WALL	SILT (ML), BR, SANDY
6.	SUBSTRATUM	87.5	LOCK CHAMBER	SAND (SP), F, M, BR
7.	SUBSTRATUM	87.5	LOCK CHAMBER	SAND (SP), F, M, BR
8.	SUBSTRATUM	87.5	LOCK CHAMBER	SAND (SP-SM), F, BR
9.	SUBSTRATUM	80.5	LOWER GATE BAY	SAND (SP), F, M, BR

NOTE: FOR LOCATION OF FOUNDATION SAMPLES SEE PLATE 4.

SECTION VII - FOUNDATION TREATMENT

7-01. Drainage Provisions. Two drainage system have been incorporated into the Joe D. Waggonner, Jr. Lock and Dam as discussed below:

a. Underslab Drainage System. The foundation beneath the gated dam and stilling basin contains a two stage pressure relief/underseepage collector system as shown on Plates 19 through 22. The system consists of 6-inch thick layer of Filter Sand "B" placed on the foundation overlain by a second 18-inch filter composed of Gravel "C". Stainless steel collector pipes evacuate seepage and relieve excess hydrostatic pressures to tailwater (Photographs 10, 11, and 12). For a discussion of design and construction of the underslab drainage system, see Paragraph 4-03, Backfill Drainage and Underslab Relief Systems.

b. Backfill Drainage System. Backfills left and right of the lock chamber were designed with three zones; a select sand adjacent to the lock wall, a pervious fill zone and a random fill zone as shown on Plates 7 through 9 and 23 through 26. The backfill adjacent to the lock on the landside contains a collector pipe system which is encapsulated in Filter Sand "B" and discharges to tailwater. Minor design modifications and construction problems occurred to the backfills as discussed in Paragraph 8-02. For a complete discussion of the design of the backfill drainage system see Paragraph 4-03, Backfill Drainage and Underslab Relief Systems.

7-02. Sheet pile. Sheet piling was installed in numerous locations beneath the lock and dam. The foundations for the overflow wall, crest gated spillway, stilling basin for the crest gated spillway, gated dam, stilling basin, and cutoff wall are surrounded by sheet pile cutoffs on all four sides (with adjacent structures sharing a common sheet pile line) as shown on Photograph 7. The sheet pile cutoff driving line continues beneath the upstream gate bay of the lock, upstream approach monolith, upstream guard wall, and upstream return wall. A second sheet pile line was installed beginning on the riverside of the downstream approach monolith (L-18) and continuing beneath the downstream return wall. In addition, the pier footings for the upstream and downstream guidewalls are individually encapsulated within sheet pile "cells" (Photographs 27 and 28). The upstream sheet pile line beneath the lock and dam forms a positive seepage cutoff that ties into the slurry trench at either end of the dam. Sheet piling installed beneath the downstream approach monolith (L-18), downstream return wall, and the guidewalls is an erosion control measure intended to protect these foundations. Locations and depths of the sheetpiling are shown on Plates 27 and 28. Minor problems were experienced with sheet pile penetration along the right side of the lock beneath the upstream return wall. The PZ22 sheet pile could not be driven to design grade. The contractor employed a drill rig to explore the subsurface conditions and a 3 to 8 foot thick gravely sand layer was revealed. The problem was resolved by installing PZ35 sheetpiling beneath monoliths UR-2 and UR-3 as shown on Plates 27 and 28.

7-03. Instrumentation. The instrumentation package at Joe D. Waggonner, Jr. Lock and Dam consists of reference bolts, piezometers and settlement plates. The location and details of these instruments are shown on Plates 29 through 34.

SECTION VIII - CHANGES FROM DESIGN

8-01. Excavation Grades. Minor changes were made in the final grade excavation for the Joe D. Waggonner, Jr. Lock and Dam. Over excavation occurred in an effort to remove unsuitable silt (ML) and clays (CH-CL) from foundations. Areas over excavated included monoliths UG-1, UG-2, and UG-3 on the upstream guidewall; L-1 and L-2 in the lock, and DG-6 and DG-7 on the downstream guide wall. This over excavation was anticipated by the designers.

8-02. Lock Backfill. The contractor attempted to procure select sand for the backfills by dredging river sand (Photograph 9). Some of this material contained too high a percentage of fines. In order to accommodate the contractor the COE relaxed the gradation requirement for select sand from 5% passing #100 sieve to 9% passing #100 sieve and 5% passing #200 sieve in the areas outlined below:

a. Landside of the Lock. The select sand backfill zone landside of the lock was divided down the center into two zones. The zone closest to the lock wall was back filled with select sand meeting the original specifications. The remainder of the select sand area, except for a 2 foot block out around the collector system, was back filled using the more lenient gradations (see Plates 7, 8, 9, and 23).

b. Riverside of the Lock. The contractor proposed to use the modified select sand riverside of the lock. However, owing to the steepness of the backfill slope the contractor chose not to zone this backfill and actually used a material meeting the select sand specifications (5% passing #100) in place of a small amount of pervious.

8-03. Sheet pile Upstream Return Wall. The sheet pile driving operations beneath UR-2 and UR-3 could not penetrate to design grade. The contractor substituted PZ35 sheet pile (for the required PZ22) and straightened the driving line as shown on Plates 27 and 28. In spite of these changes the sheet piling could not be driven to design grade. Actual penetration is shown on Plate 28. For a discussion of the possible impacts of this change see paragraph 9-02.

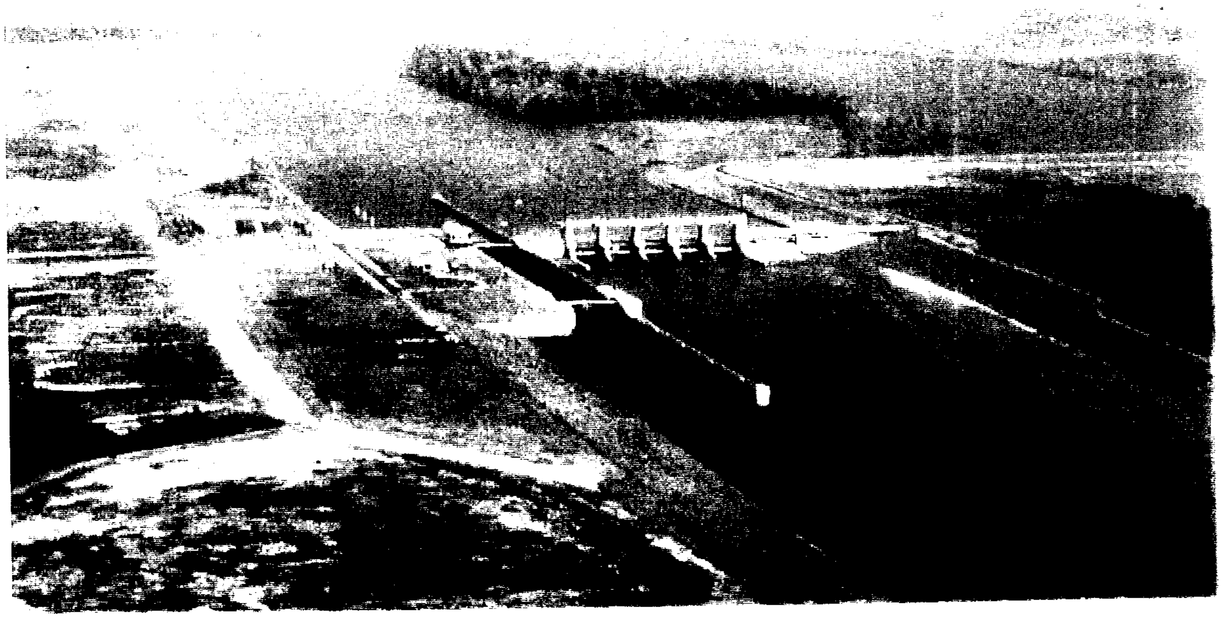
8-04. Closure Dam. The design of the closure dam was changed from a clay core to a 3 foot clay blanket on the upstream face (see Plates 15 and 16 and Photograph 29). This change was made because there was not an adequate amount of clay (CH-CL) borrow available from the designated borrow areas. This changed reduced the quantity of clay (CH-CL) required from 150,000 cubic yards to 42,000 cubic yards.

8-05. Dike Sand Fill. The diversion dike was constructed using a sand fill. Materials were end dumped as the dike advanced across the river. The designers had (apparently) presumed that the sand fill would be dredged in to diminish the amount of rock that would be required. A great deal of the end dumped material was lost to the ever increasing river velocity as the channel was constricted (Photograph 30).

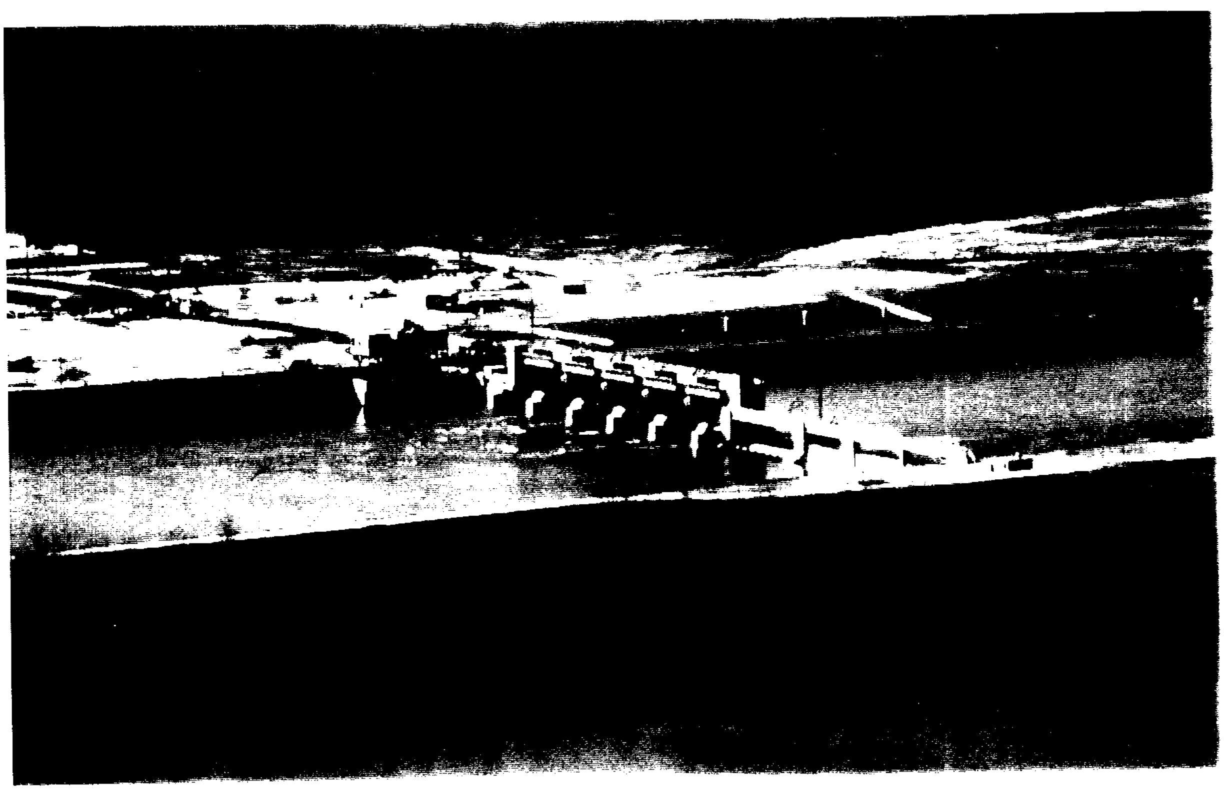
SECTION IX - POSSIBLE FUTURE PROBLEMS

9-01. Riprap at the End sill of the Stilling Basin. The Corp of Engineers has discovered some problems with the quality assurance testing procedures used by the contractor and approved by the Corps for the riprap on this job. Approved testing procedures resulted in the placement of riprap that is smaller than the designers intended. Possible erosion of the riprap should be monitored frequently, especially the R7400 riprap placed at the end seal of the stilling basin. Initial surveys of this area indicate that some riprap may be migrating downstream and scour holes developing. For a discussion of this problem see paragraph 4-04(e).

9-02. Sheet Piling beneath the Upstream Return Wall. The presence of a gravel layer at the base of the substratum prevented the contractor from installing the sheet pile cut-off beneath the Upstream Return Wall so that it was tied into the underlying Tertiary Formation. The designers had intended a positive seepage cut-off in both abutments tied into the slurry trench (to minimize abutment seepage). The presence of this "window" beneath the Upstream Return Wall may result in additional seepage exiting through the back fill collector system. For the location and dimensions of the "window" see Plates 6, 27, and 28.

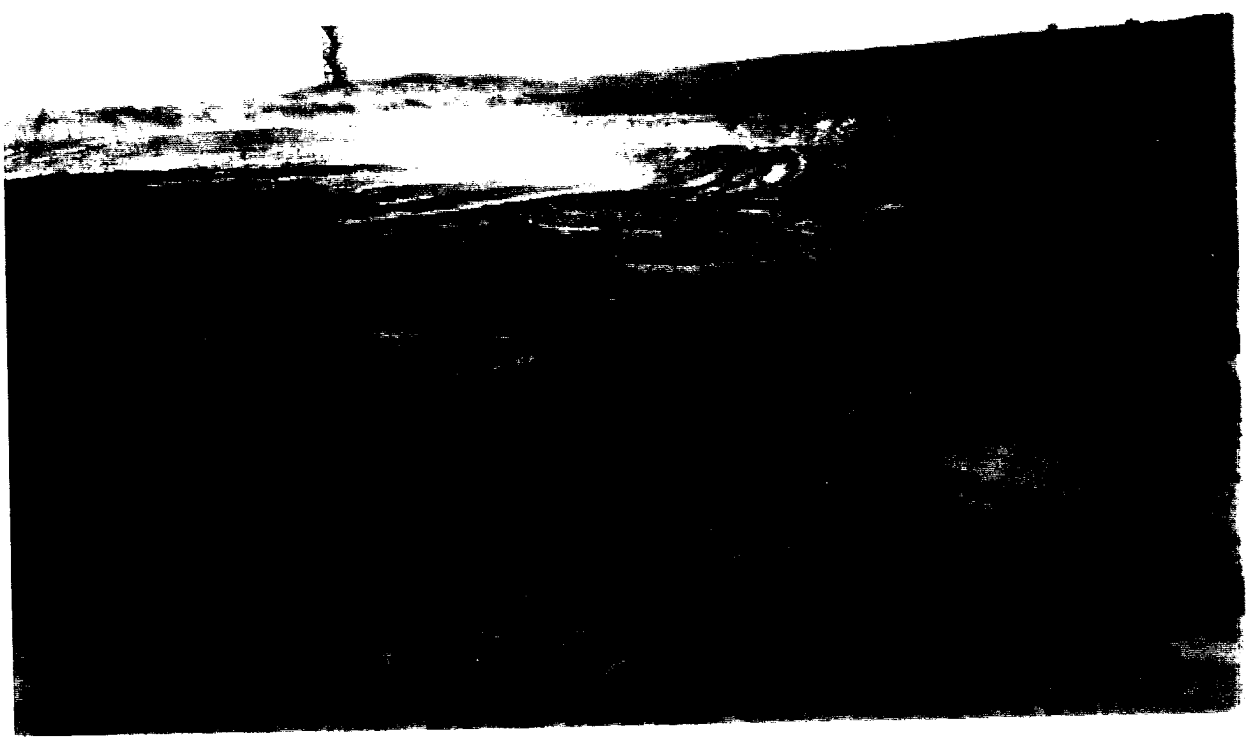


1. Looking upstream at completed structure.



2. Looking west at completed structure.

3. Excavation for upstream approach channel.
Note alluvial topstratum - substratum contact.



4. Tree buried in the Holocene substratum.

5. Foundation for the gated dam and stilling basin.

6. Foundation for the cutoff wall, gated dam, and stilling basin.

7. Foundation for the cutoff wall, gated dam and stilling basin looking west.

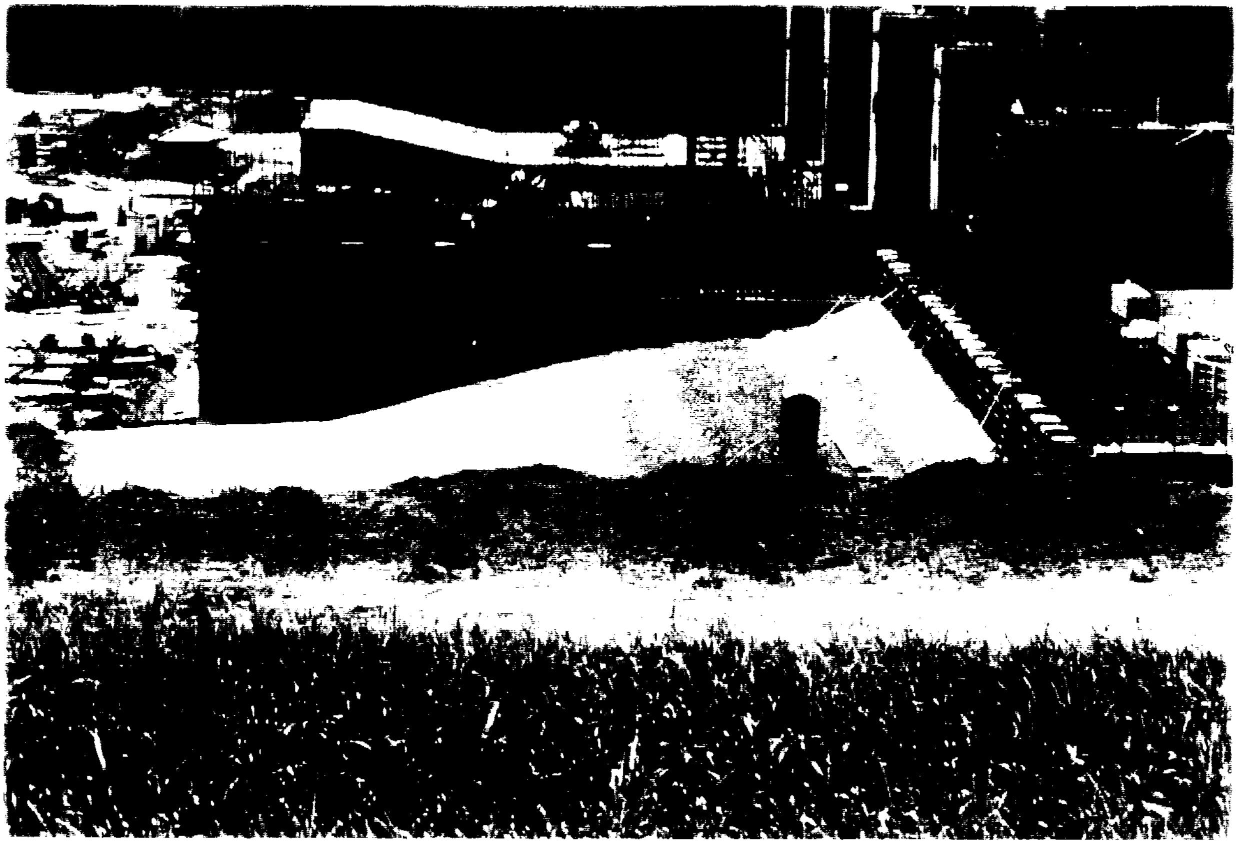
8. Installation of stainless steel collector pipe well screen in backfill landside of lock.

9. Cleanout pipe for backfill collector system landside of lock.

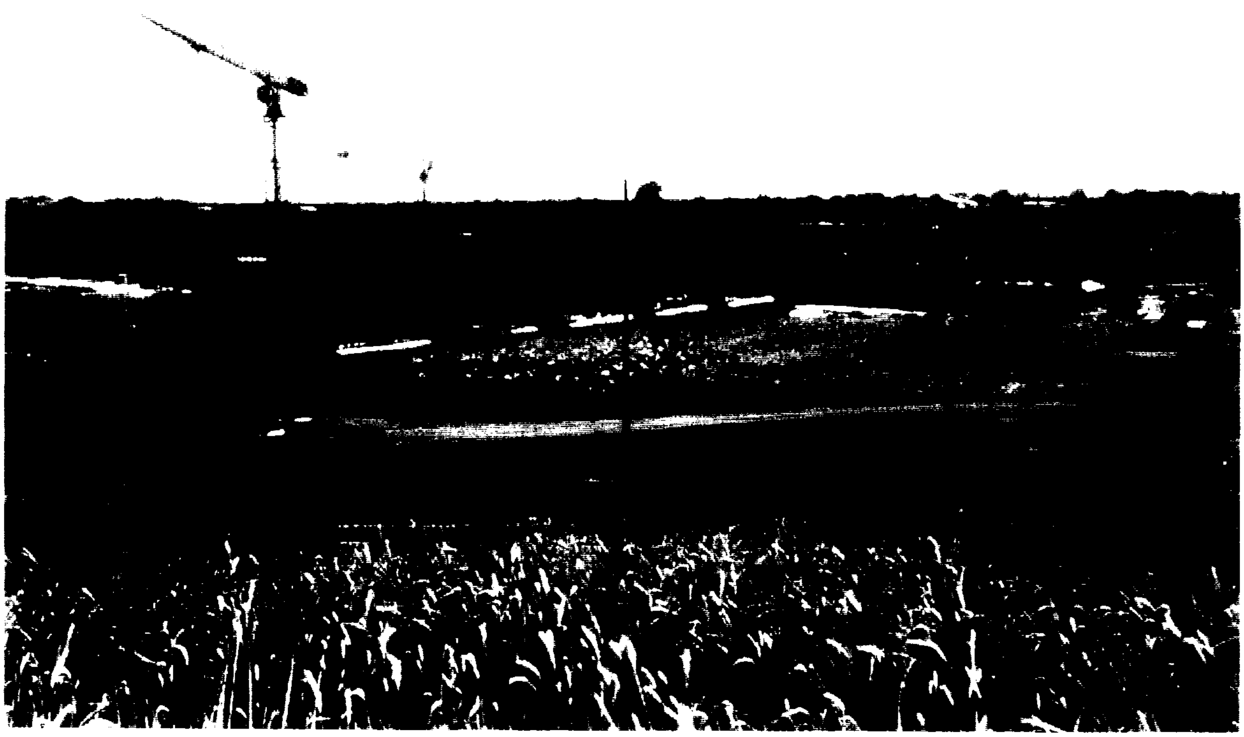
10. Backfilling operation adjacent to lock chamber.

11. Small dredge pumping material for use as select sand.

12. Stainless steel well screen used as collector pipes for pressure relief system.



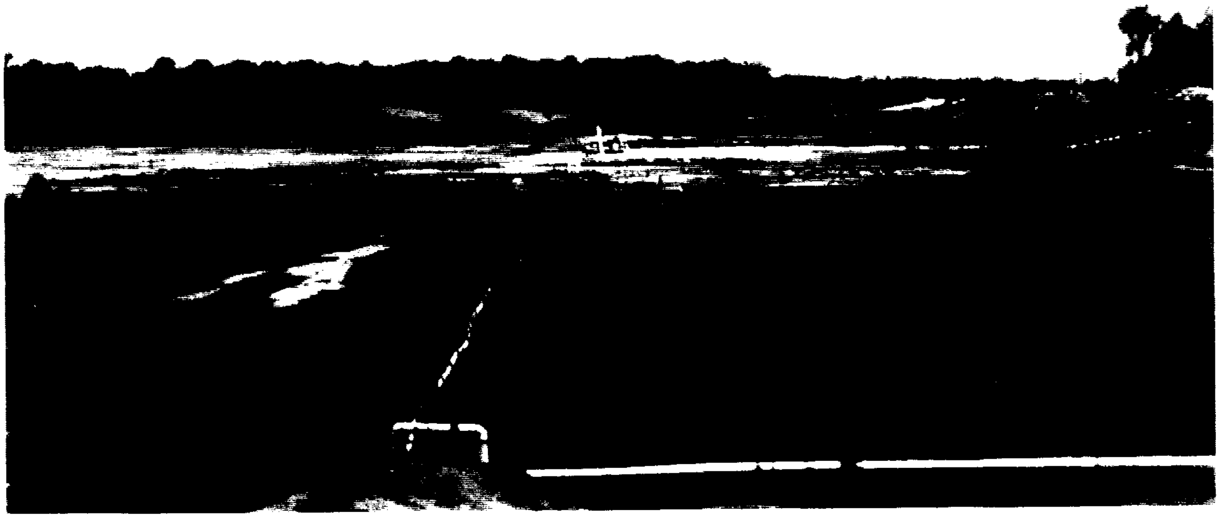
13. Preparation for placement of protection stone downstream of crest gated spillway.



14. Placing protection stone upstream of the gated dam.

15. Placing riprap in the downstream channel.

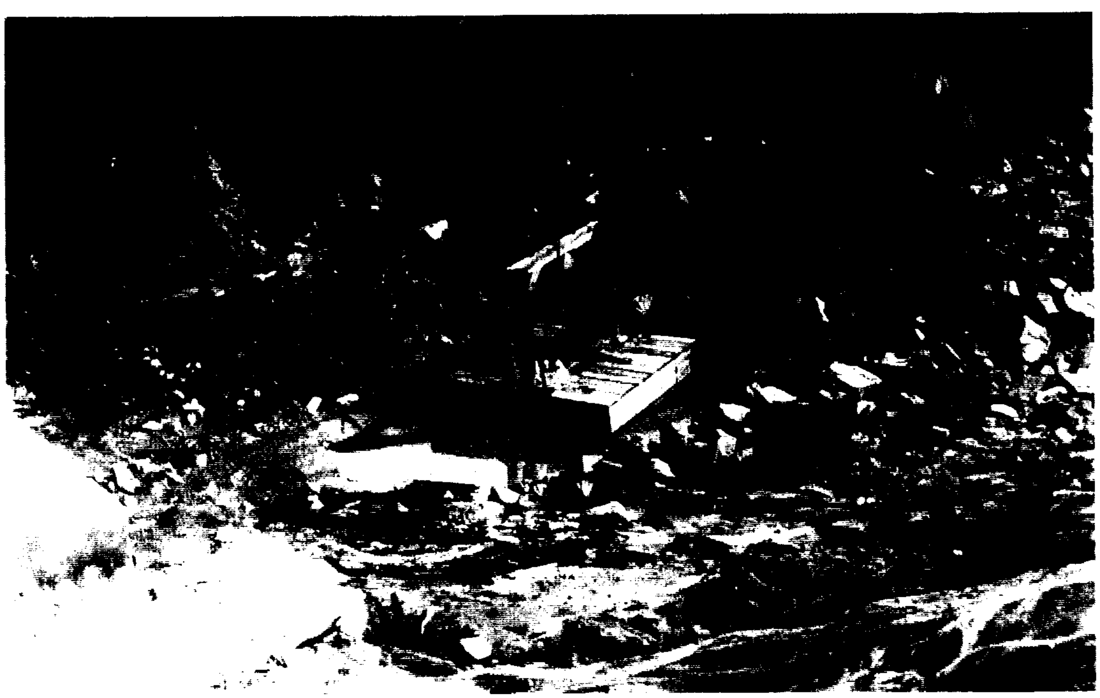
16. Eighty-one inch thickness R7400 on 12 inch thickness of riprap R90 on 24 inch thickness of filter material



17. Land based excavation for the upstream approach channel. Note the dewatering system.

18. Slurry trench excavation.

19. Typical dewatering well and sump pump.

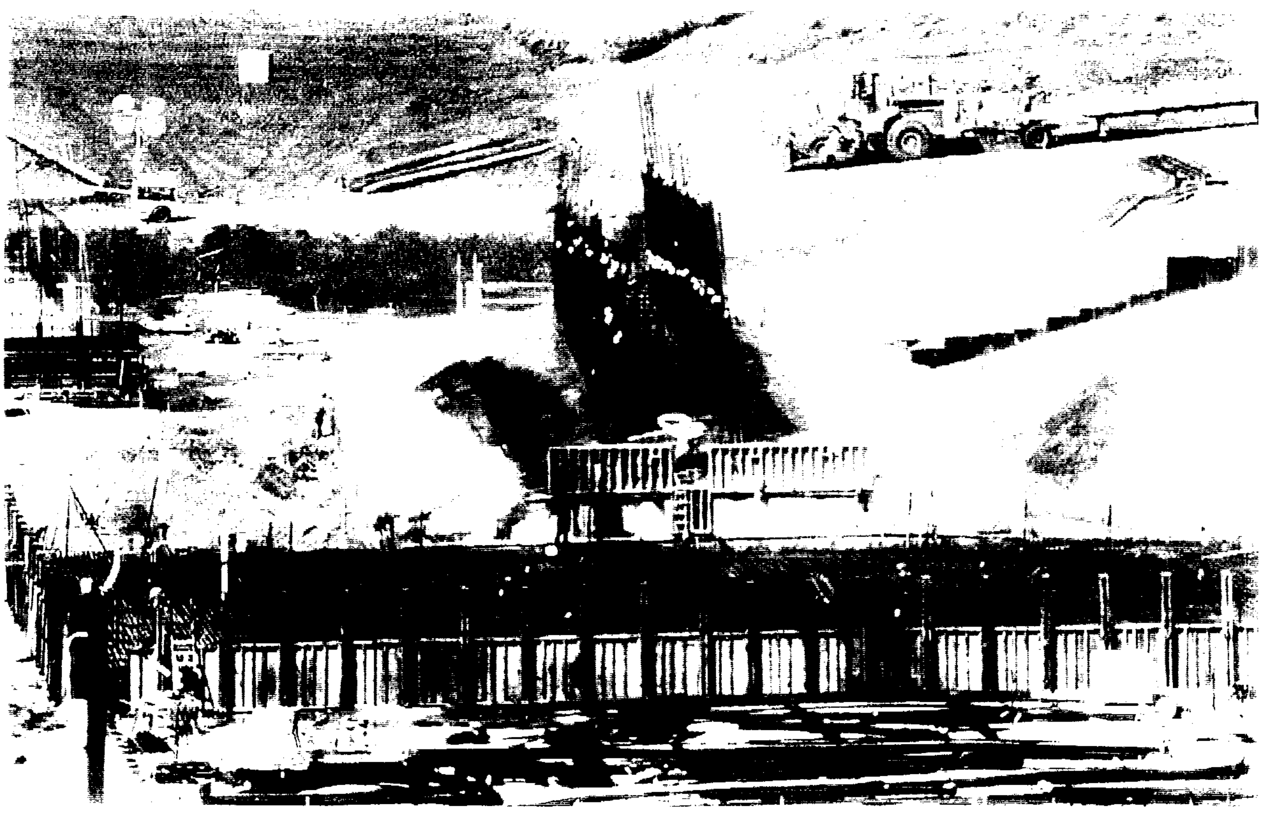


20. Temporary sump for surface water control.

21. Placing select sand on the foundation for the overflow wall.

22. Compacting select sand for the overflow wall foundation.

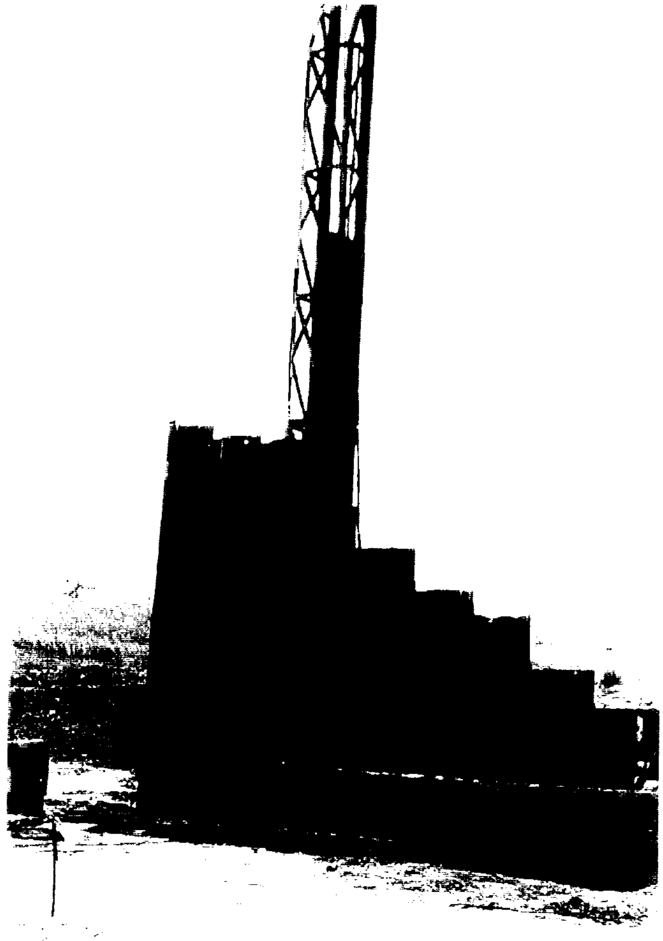
23. Placing pervious backfill downstream of the overflow wall.



24. Stabilization slab for the cut-off wall.

25. Compacting clay blanket - downstream of return wall.

26. Construction of impervious clay blanket
upstream of the gated dam.

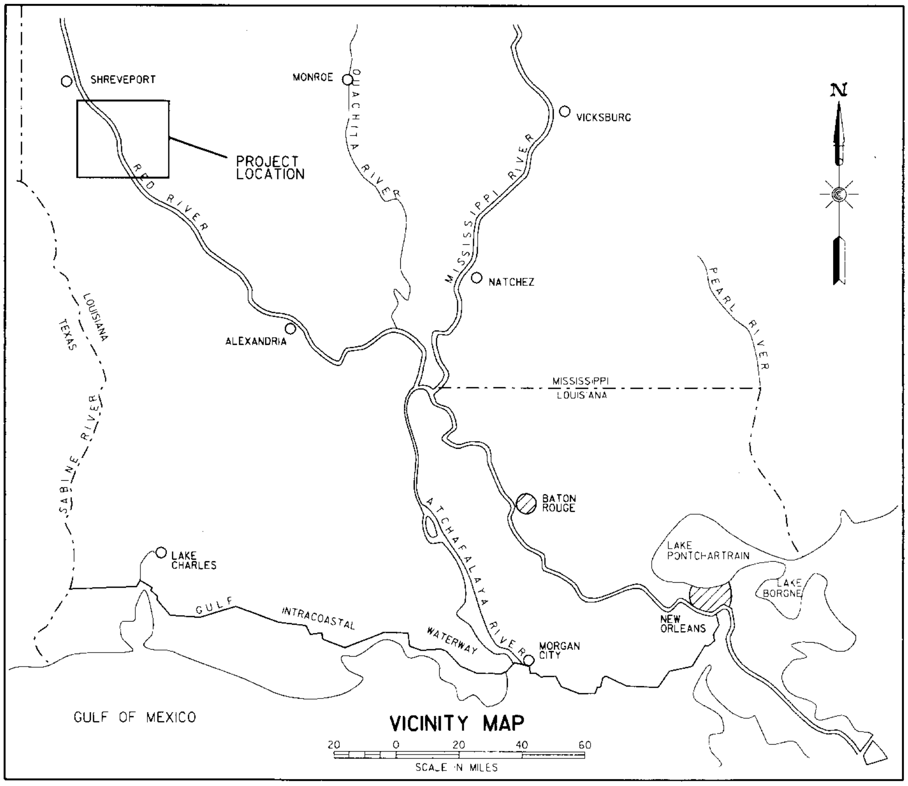


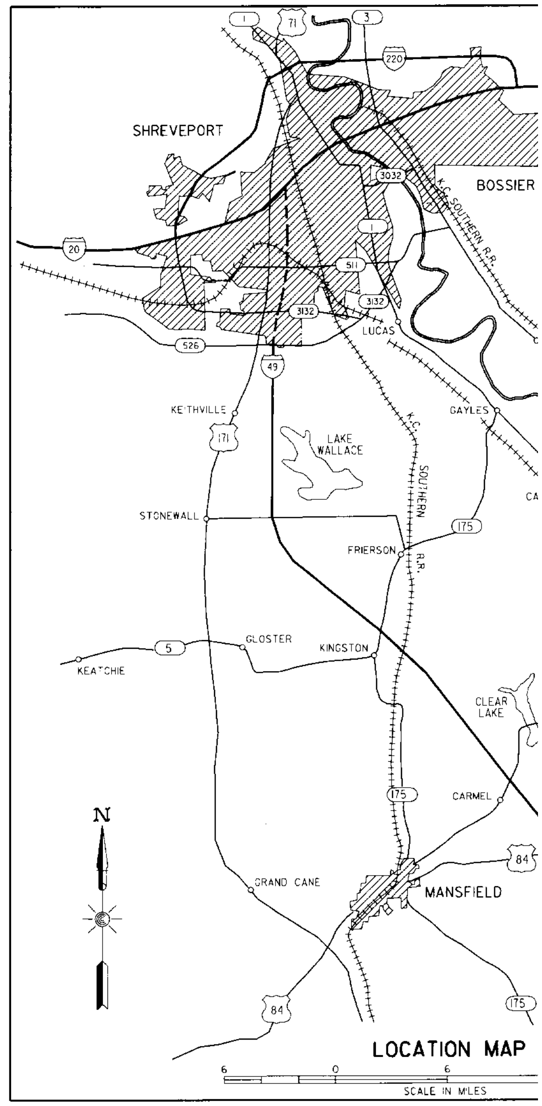
27. Templet for installing sheet pile.

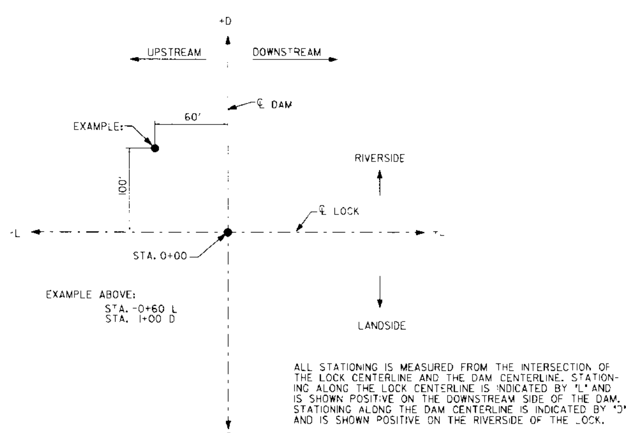
28. Sheet pile encapsulated footing for the downstream guidewall.

29. Construction of the closure dam.

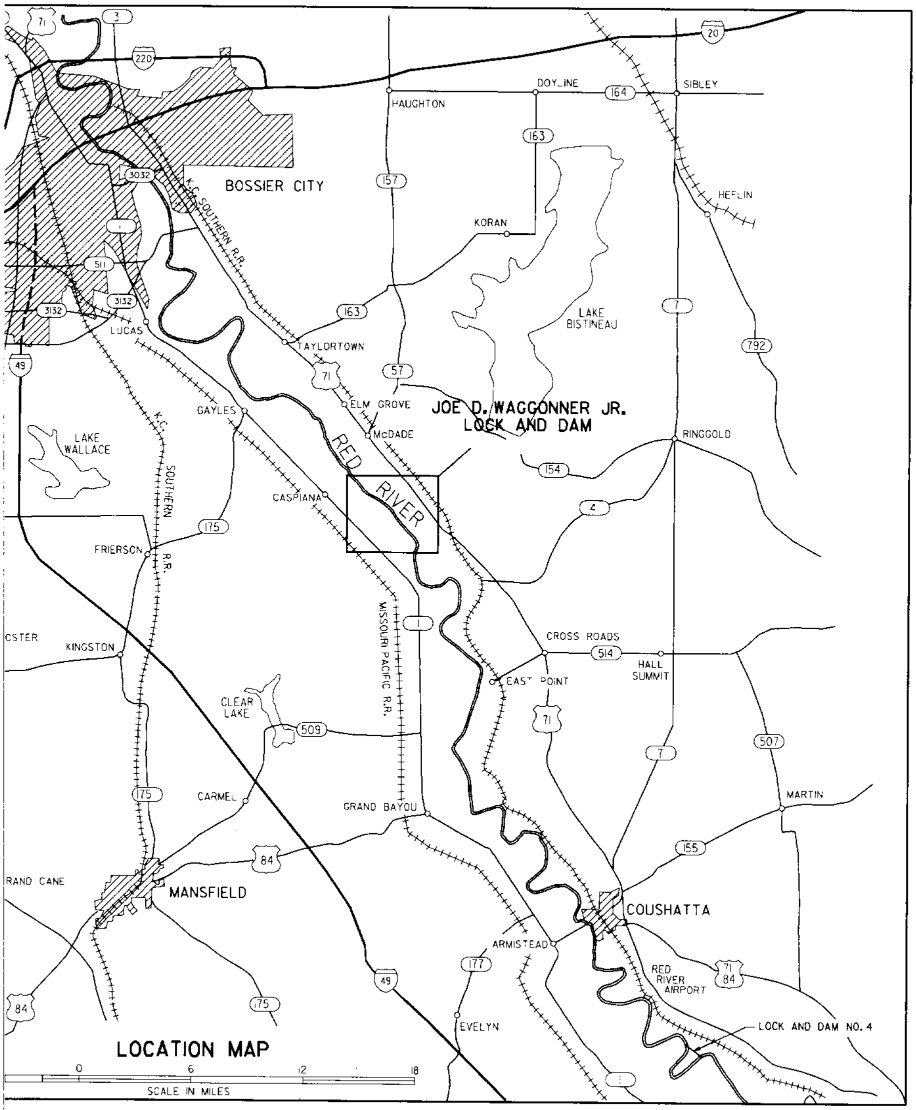
30. Construction of the diversion dike.







STATIONING KEY



RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

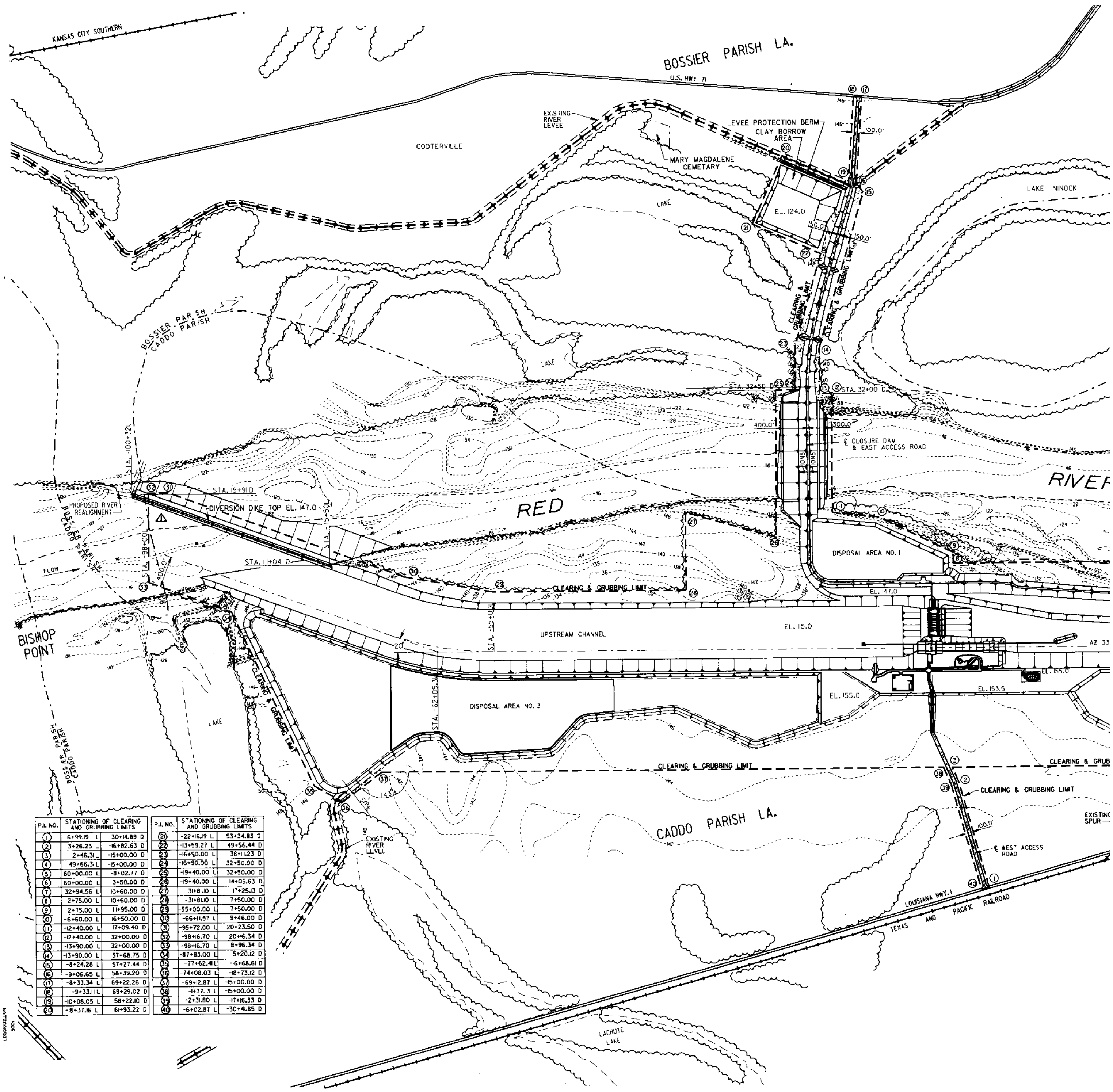
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

PROJECT LOCATION AND VICINITY MAP

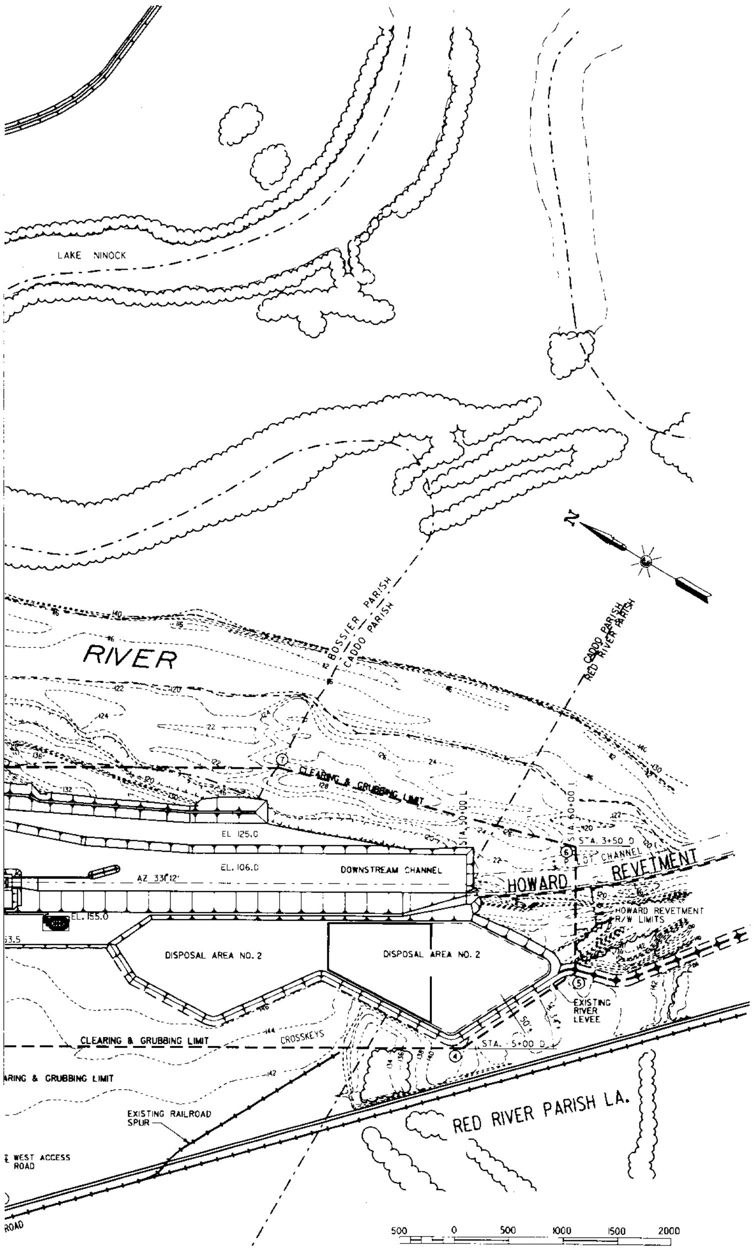
DATE: JANURARY 1996 | FILE NO. R-14-207 | PLATE 1

2



P.I. NO.	STATIONING OF CLEARING AND GRUBBING LIMITS		P.I. NO.	STATIONING OF CLEARING AND GRUBBING LIMITS	
1	6+99.19 L	-30+14.89 D	21	-22+16.19 L	53+34.83 D
2	3+26.23 L	-16+82.63 D	22	-13+59.27 L	49+56.44 D
3	2+46.31 L	-15+00.00 D	23	-16+90.00 L	38+11.23 D
4	49+66.31 L	-15+00.00 D	24	-16+90.00 L	32+50.00 D
5	60+00.00 L	-8+02.77 D	25	-19+40.00 L	32+50.00 D
6	60+00.00 L	3+50.00 D	26	-19+40.00 L	14+05.63 D
7	32+94.56 L	10+60.00 D	27	-31+81.10 L	17+25.13 D
8	2+75.00 L	10+60.00 D	28	-31+81.10 L	7+50.00 D
9	2+75.00 L	11+95.00 D	29	-55+00.00 L	7+50.00 D
10	-6+60.00 L	16+50.00 D	30	-66+11.57 L	9+46.00 D
11	-12+40.00 L	17+09.40 D	31	-95+72.00 L	20+23.50 D
12	-12+40.00 L	32+00.00 D	32	-98+16.70 L	20+16.34 D
13	-13+90.00 L	32+00.00 D	33	-98+16.70 L	8+96.34 D
14	-13+90.00 L	37+68.75 D	34	-87+83.00 L	5+20.12 D
15	-8+24.28 L	57+27.44 D	35	-77+62.41 L	-16+68.61 D
16	-9+06.65 L	58+39.20 D	36	-74+08.03 L	-18+73.12 D
17	-8+33.34 L	69+22.26 D	37	-69+12.87 L	-15+00.00 D
18	-9+33.11 L	69+29.02 D	38	-1+37.13 L	-15+00.00 D
19	-10+08.05 L	58+22.10 D	39	-2+31.80 L	-17+16.33 D
20	-18+37.16 L	61+93.22 D	40	-6+02.87 L	-30+41.85 D

L050002.20M
500H



RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT,LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

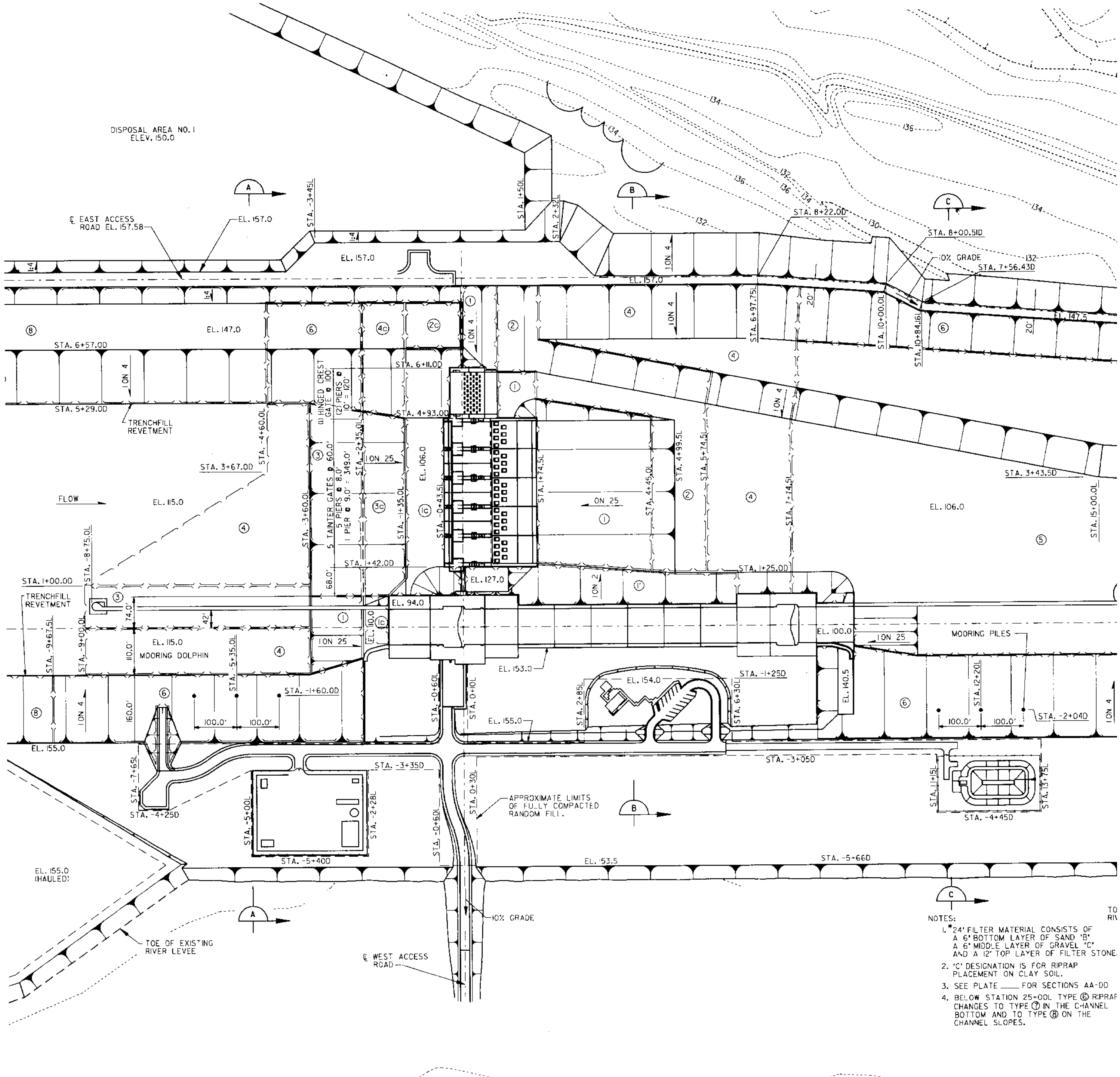
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

COMPLETED PROJECT PLAN

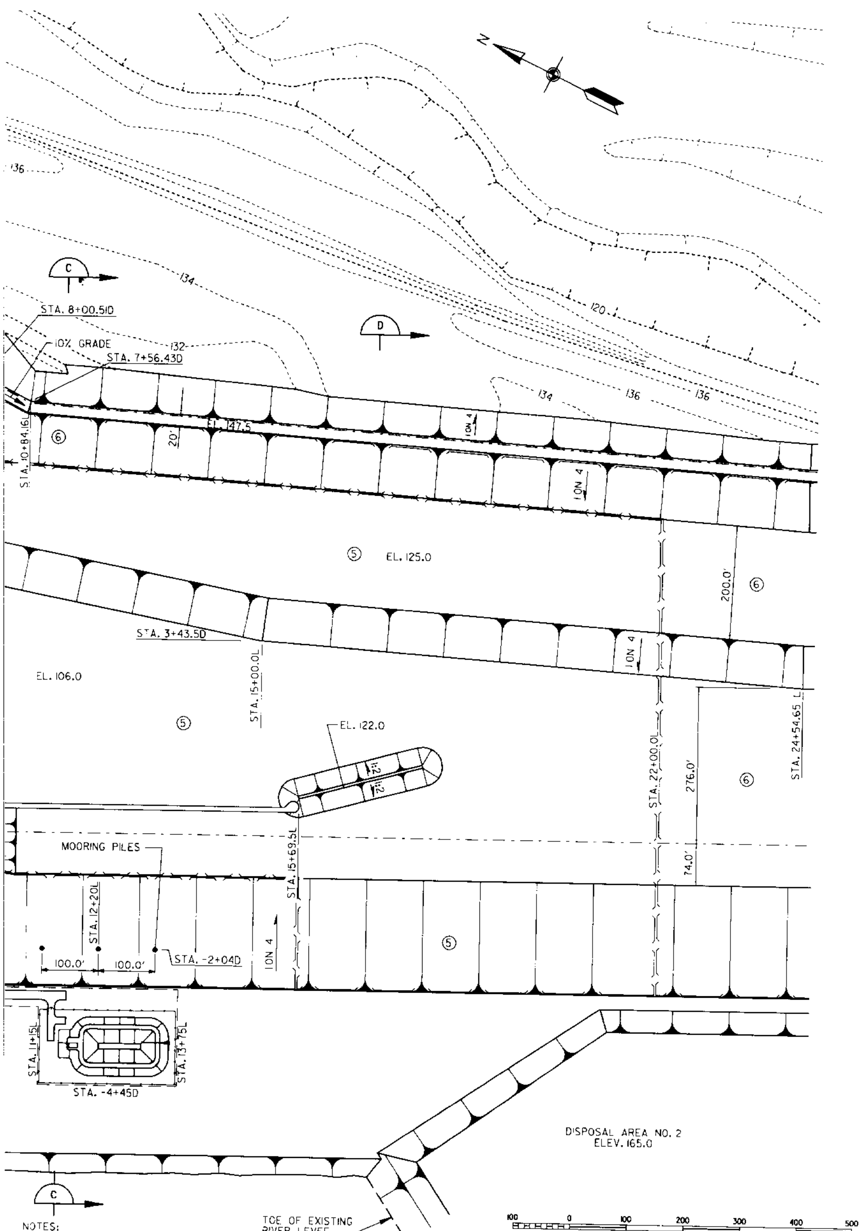
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 2

2



NOTES:

1. *24' FILTER MATERIAL CONSISTS OF A 6' BOTTOM LAYER OF SAND 'B' A 6' MIDDLE LAYER OF GRAVEL 'C' AND A 12' TOP LAYER OF FILTER STONE.
2. 'C' DESIGNATION IS FOR RIPRAP PLACEMENT ON CLAY SOIL.
3. SEE PLATE ____ FOR SECTIONS AA-DD
4. BELOW STATION 25+00L TYPE ⑥ RIPRAP CHANGES TO TYPE ⑦ IN THE CHANNEL BOTTOM AND TO TYPE ⑧ ON THE CHANNEL SLOPES.



NOTES:

1. *24" FILTER MATERIAL CONSISTS OF A 6' BOTTOM LAYER OF SAND "B" A 6' MIDDLE LAYER OF GRAVEL "C" AND A 12" TOP LAYER OF FILTER STONE.
2. "C" DESIGNATION IS FOR RIPRAP PLACEMENT ON CLAY SOIL.
3. SEE PLATE ____ FOR SECTIONS AA-DD
4. BELOW STATION 25+00L TYPE ⑥ RIPRAP CHANGES TO TYPE ⑦ IN THE CHANNEL BOTTOM AND TO TYPE ⑧ ON THE CHANNEL SLOPES.

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

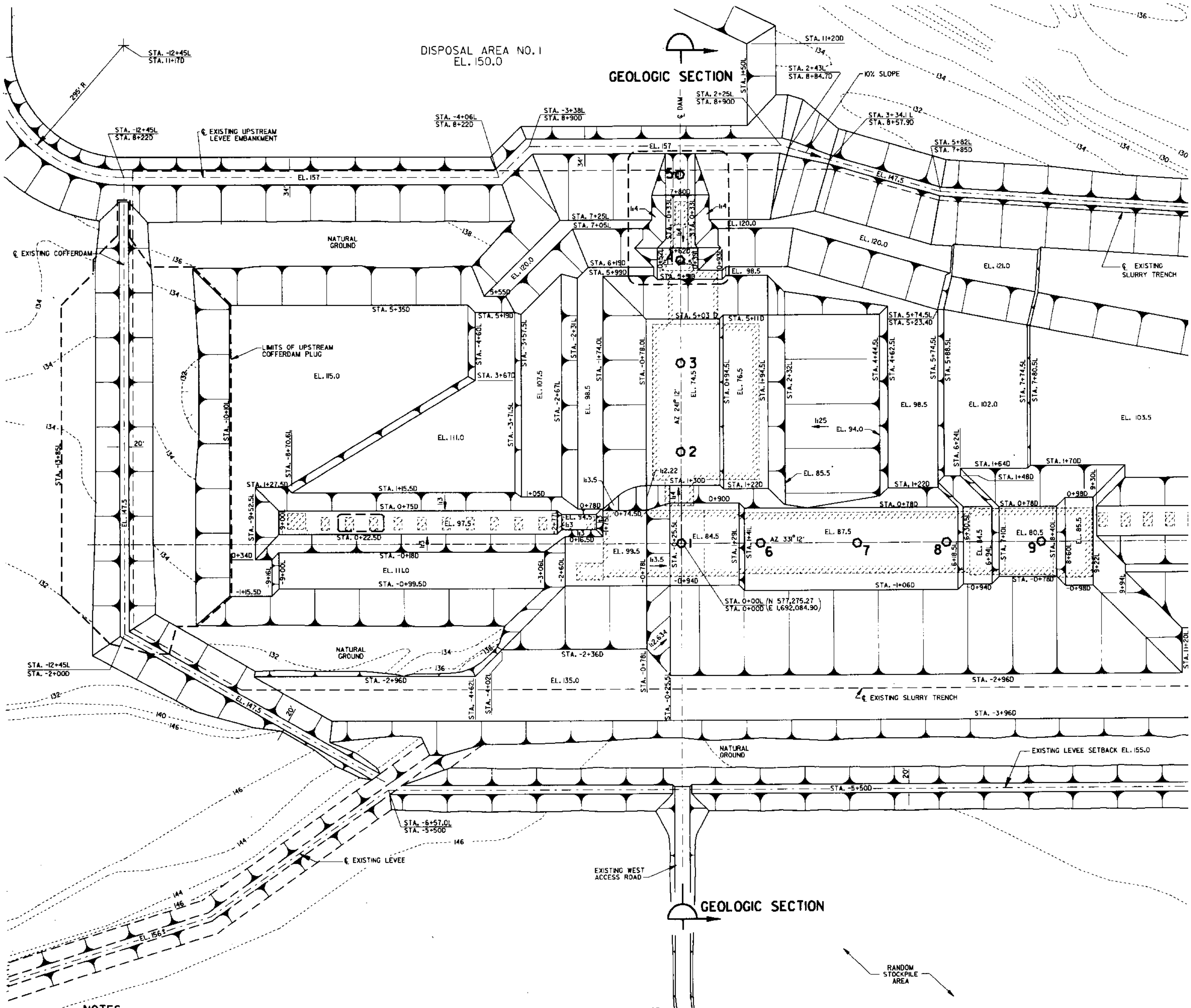
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

GENERAL STRUCTURE PLAN

DATE: JANURARY 1996 | FILE NO. R-14-207 | PLATE 3

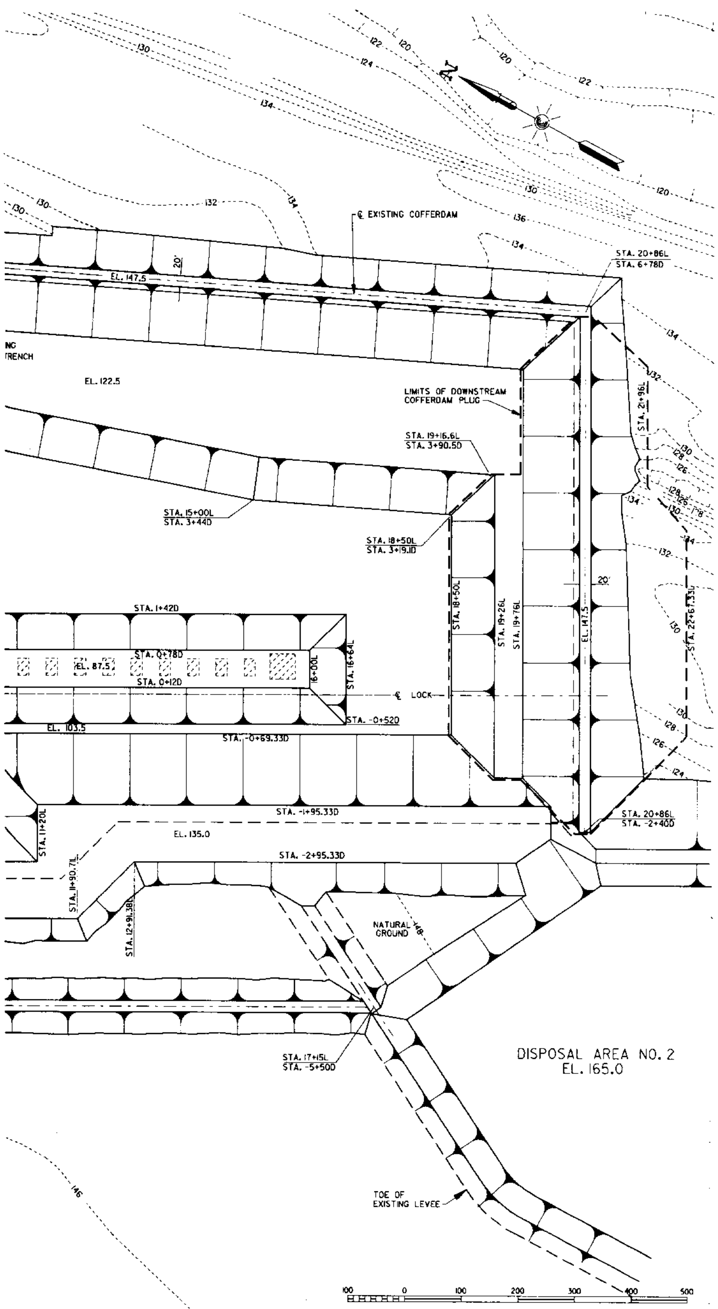
2



NOTES:

1. ALL STATIONING IS MEASURED FROM THE INTERSECTION OF THE LOCK CENTERLINE AND THE DAM CENTERLINE. STATIONING ALONG THE LOCK CENTERLINE IS INDICATED BT "L" AND IS SHOWN POSITIVE ON THE DOWNSTREAM SIDE OF THE DAM. STATIONUNG ALONG THE DAM CENTERLINE IS INDICATED BT "D" AND IS SHOWN POSITIVE ON THE RIVERSIDE OF THE LOCK.
2. FOR GEOLOGIC SECTIONS SEE PLATE 5 AND 6
3. FOR FOUNDATION SAMPLES SEE TABLE 6-1

⬡ = LOCATION OF FOUNDATION SAMPLE



RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

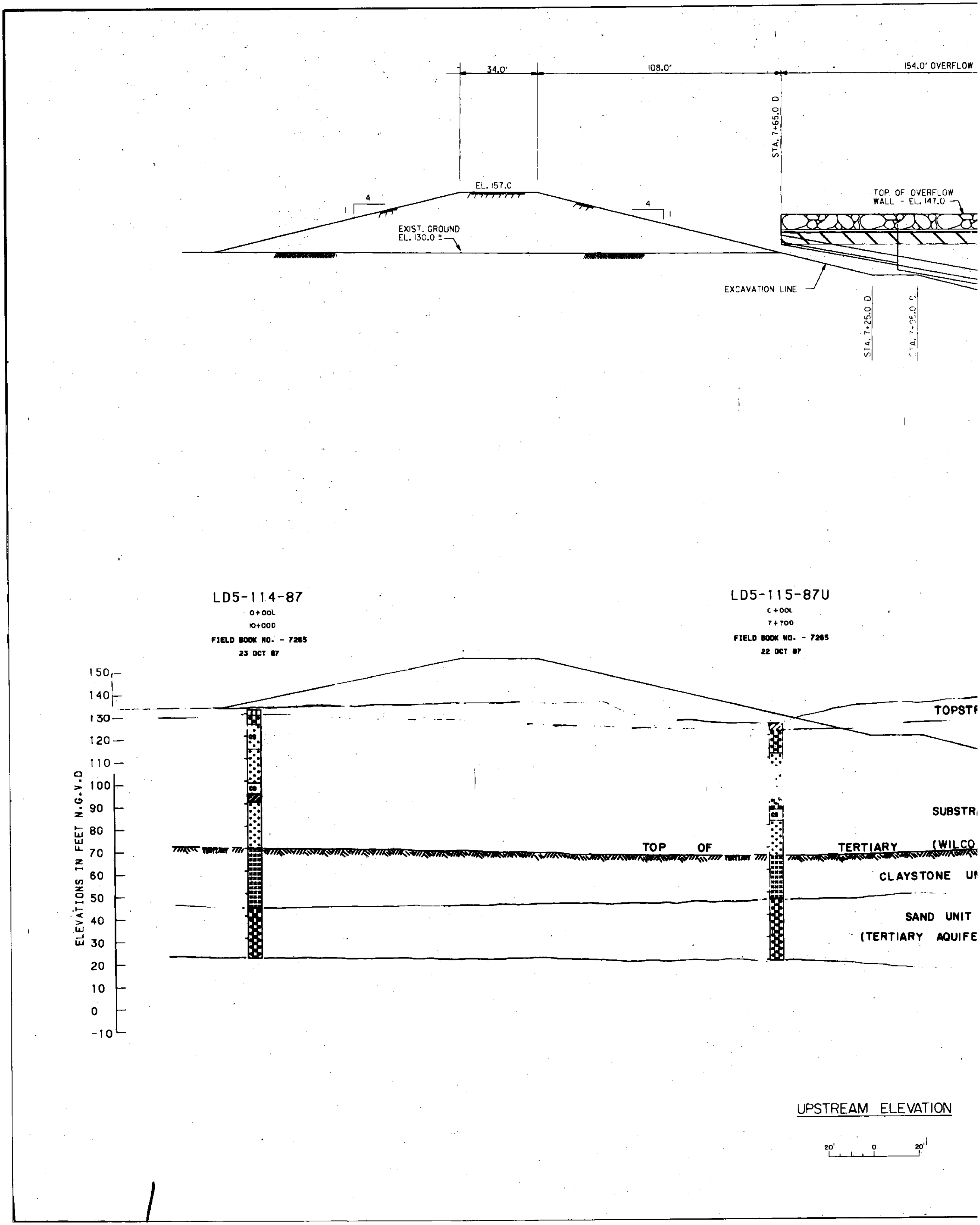
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

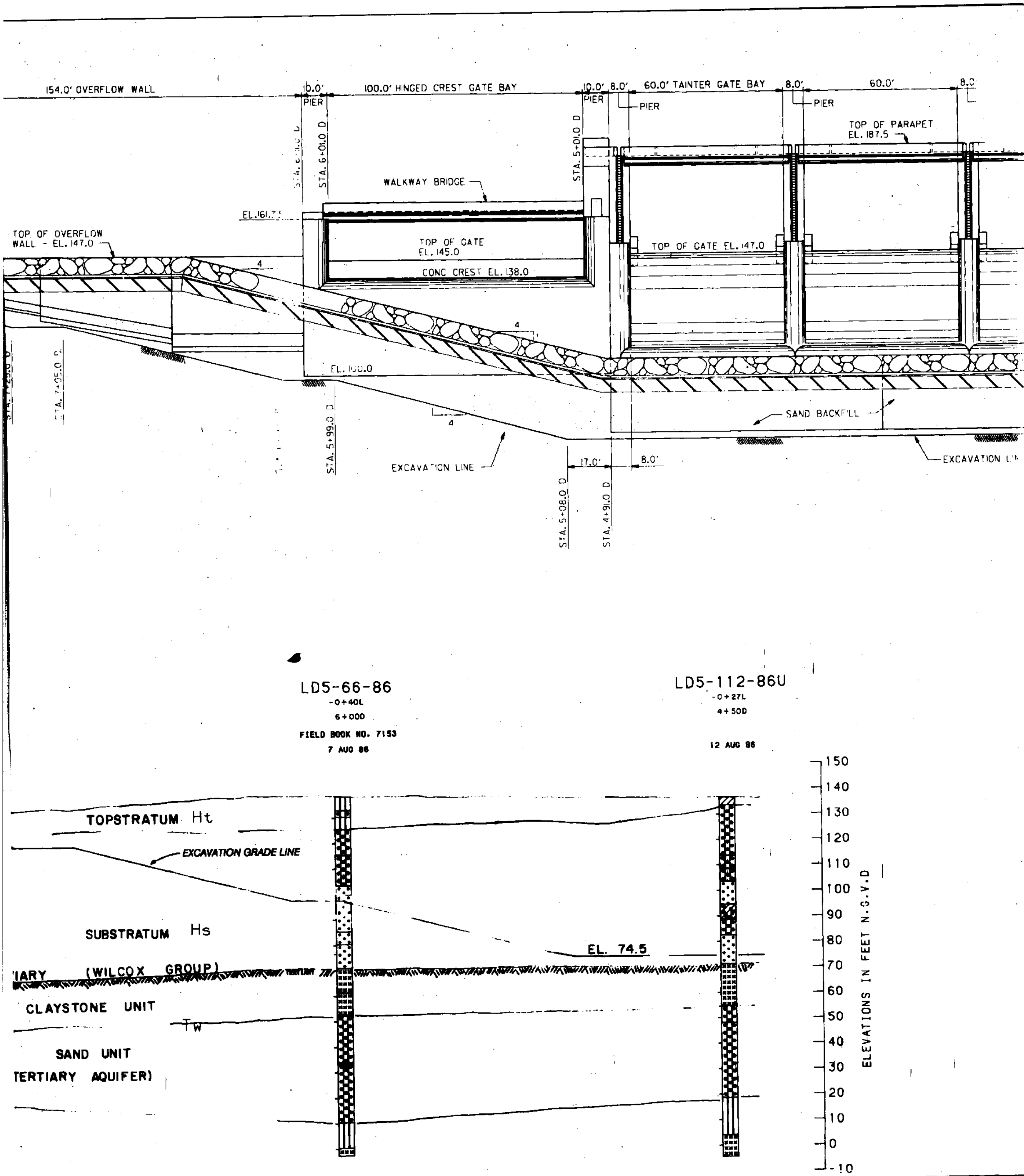
EXCAVATION FOR STRUCTURES WITH GEOLOGIC CROSS-SECTION AND GEOLOGIC SAMPLING

DATE: JANURARY 1996 FILE NO. FILE NO. R-14-207 PLATE 4

2



UPSTREAM ELEVATION



NOTES:

1. JOINS PLATE 6
2. FOR LOCATION OF SECTION SEE PLATE 4
3. Ht= HOLOCENE TOPSTRAUM
   Hs= HOLOCENE SUBSTRAUM
   Tw= TERTIARY WILCOX GROUP

ELEVATION

0 20'

RED RIVER WATERWAY
LA. TEX. ARK. & OKLA.
MISSISSIPPI RIVER TO SHREVEPORT, LA.

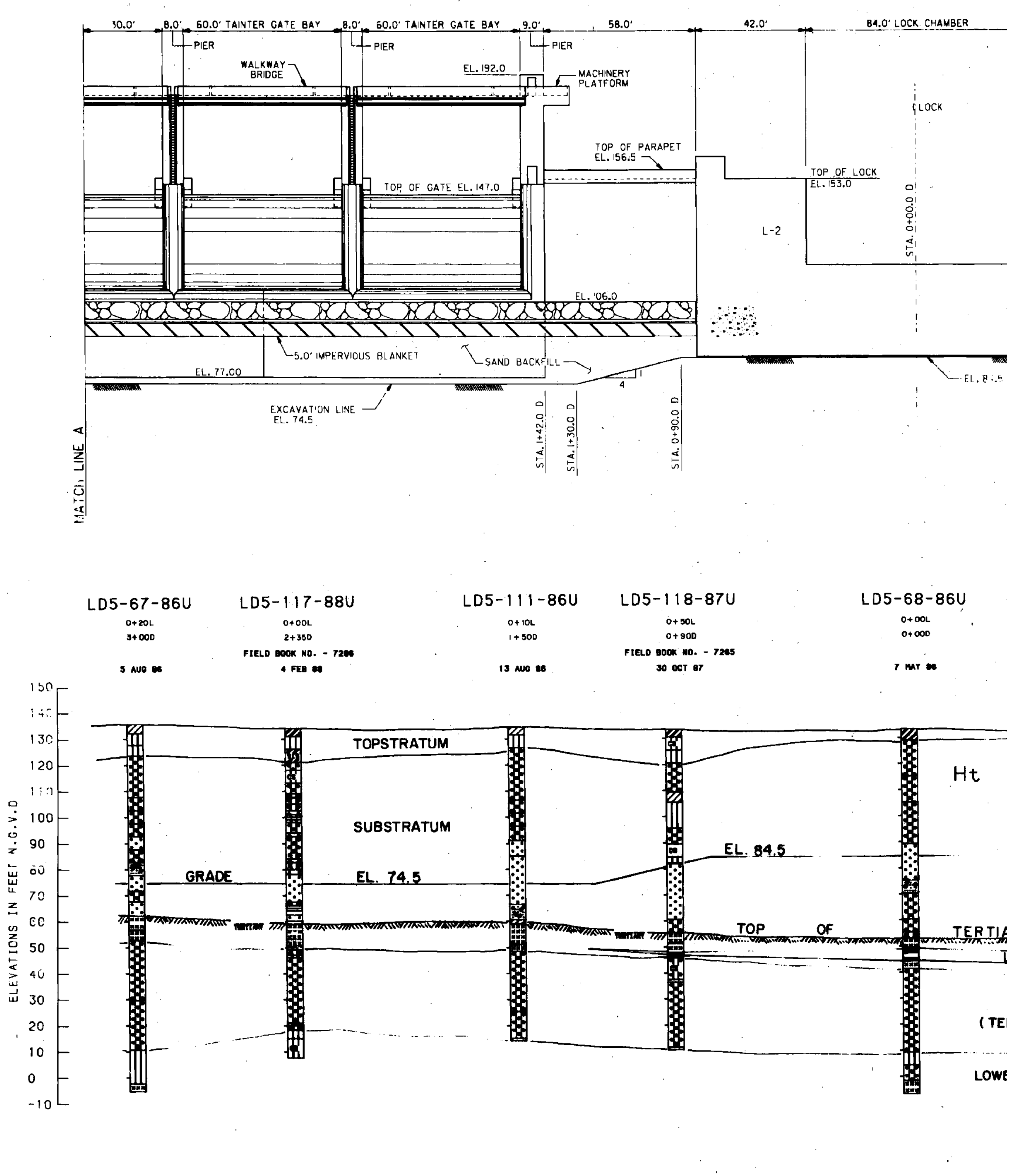
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

UPSTREAM ELEVATION WITH GEOLOGIC SECTION

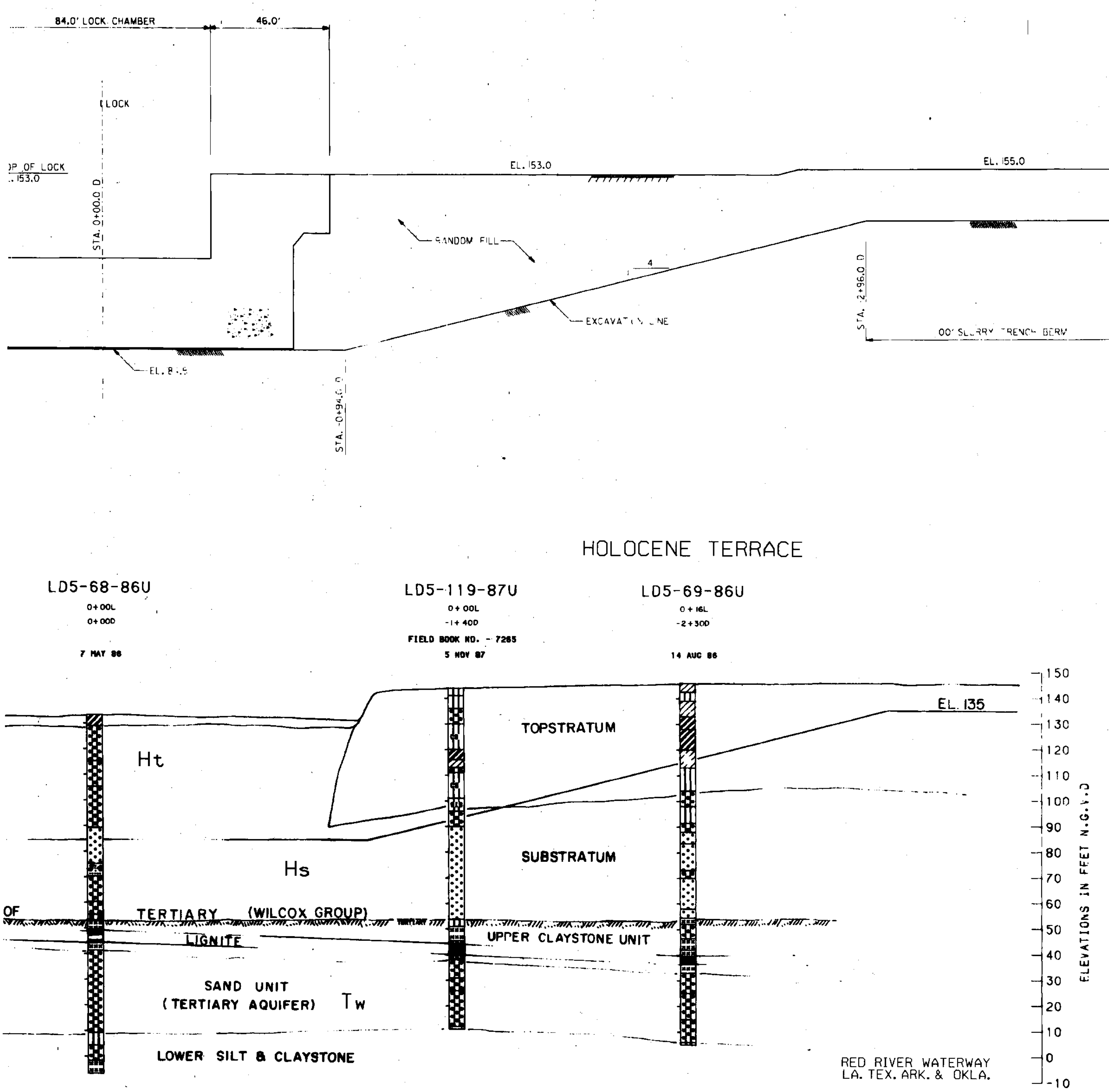
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS VICKSBURG, MISSISSIPPI

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE NO. 5



UPSTREAM ELEVATION

20' 0 20'



UPSTREAM ELEVATION

20' 0 20'

FOR NOTES SEE PLATE 5

RED RIVER WATERWAY
LA. TEX. ARK. & OKLA.
MISSISSIPPI RIVER TO SHREVEPORT LA.

JOE D. WAGGONNER JR. LOCK AND DAM

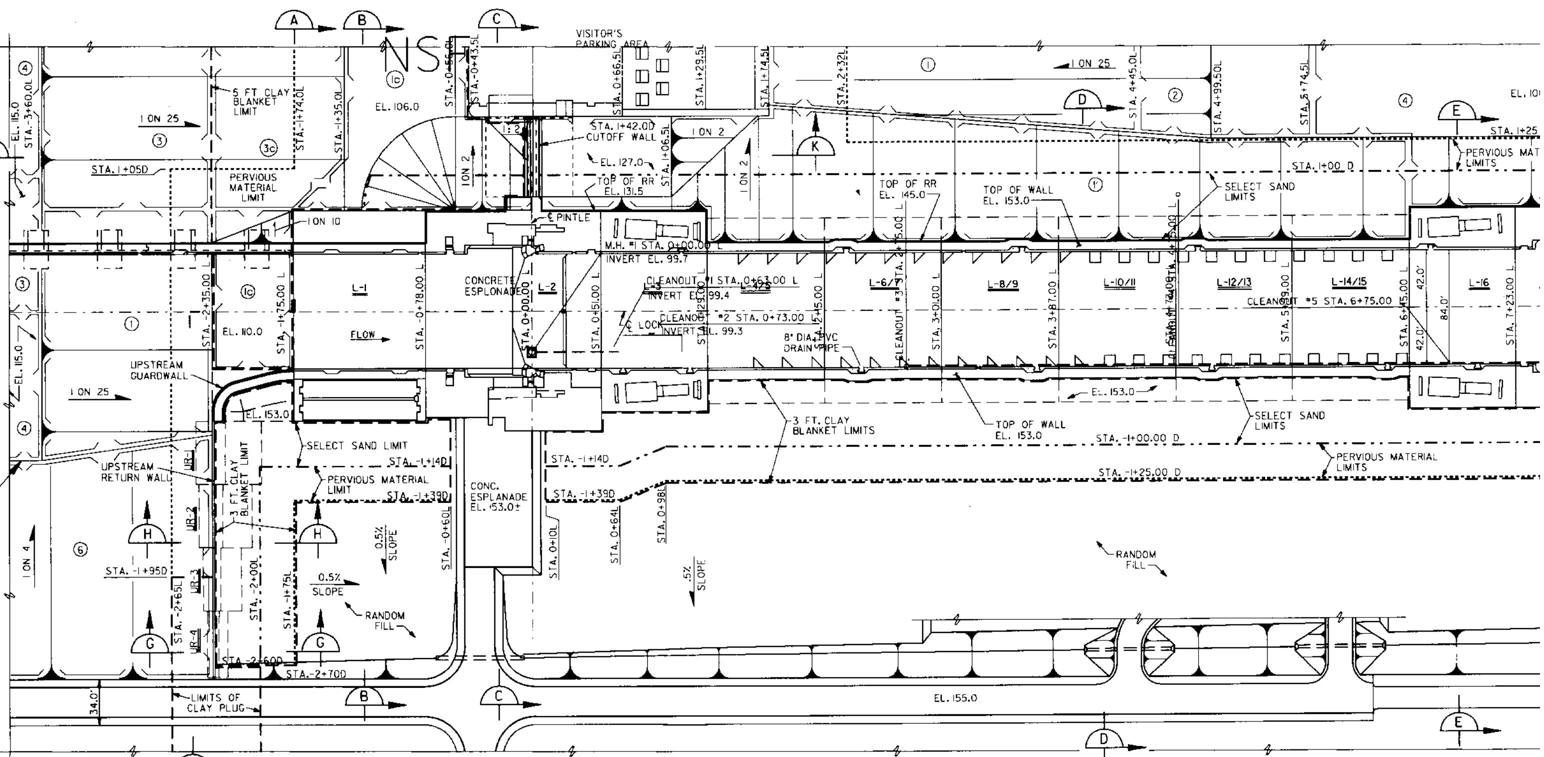
FOUNDATION REPORT

UPSTREAM ELEVATION WITH GEOLOGIC SECTION

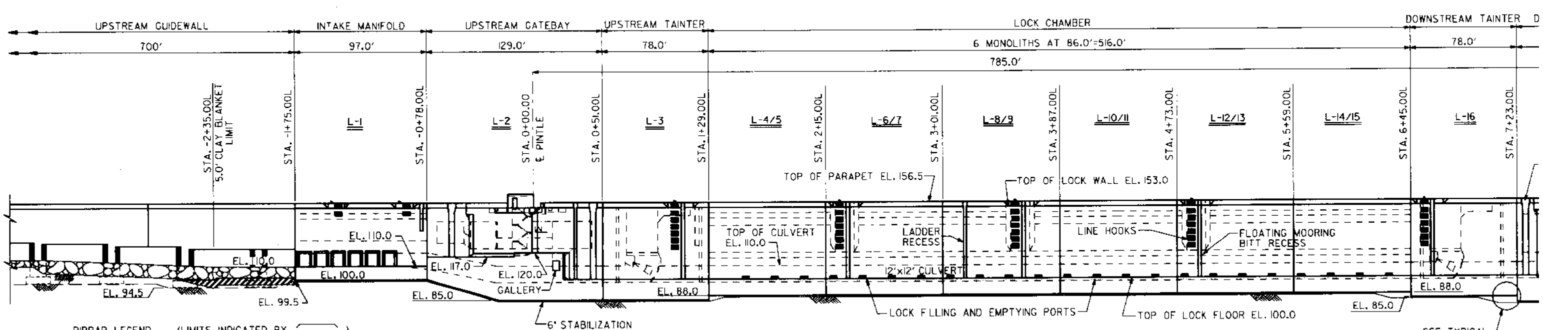
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE NO. 6

2



LOCK PLAN



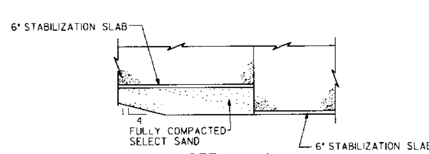
SECTION THRU ℄ LOCK

RIPRAP LEGEND (LIMITS INDICATED BY ⊂⊃)

- (1) 81" RIPRAP R7400 ON 12" RIPRAP R90 ON 24" FILTER MATERIAL*
- (1c) 81" RIPRAP R7400 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
- (2) 54" RIPRAP R2200 ON 12" RIPRAP R90 ON 24" FILTER MATERIAL*
- (2c) 54" RIPRAP R2200 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
- (3) 48" RIPRAP R1500 ON 12" RIPRAP R90 ON ENGINEERING FABRIC.
- (3c) 48" RIPRAP R1500 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
- (4) 36" RIPRAP R650 ON 12" FILTER STONE ON ENGINEERING FABRIC.
- (4c) 36" RIPRAP R650 ON 12" BEDDING MATERIAL NO. 2.
- (5) 30" RIPRAP R400 ON ENGINEERING FABRIC.
- (6) 16" RIPRAP R200 ON ENGINEERING FABRIC.
- (7) 12" RIPRAP R90 ON ENGINEERING FABRIC.
- (8) 18" GRADE STONE "C"
- (9c) 24" RIPRAP R650 ON 9" BEDDING MATERIAL NO. 2.
- (1') 81" RIPRAP R7400 ON 12" RIPRAP R90 ON ENGINEERING FABRIC ON 24" FILTER MATERIAL*

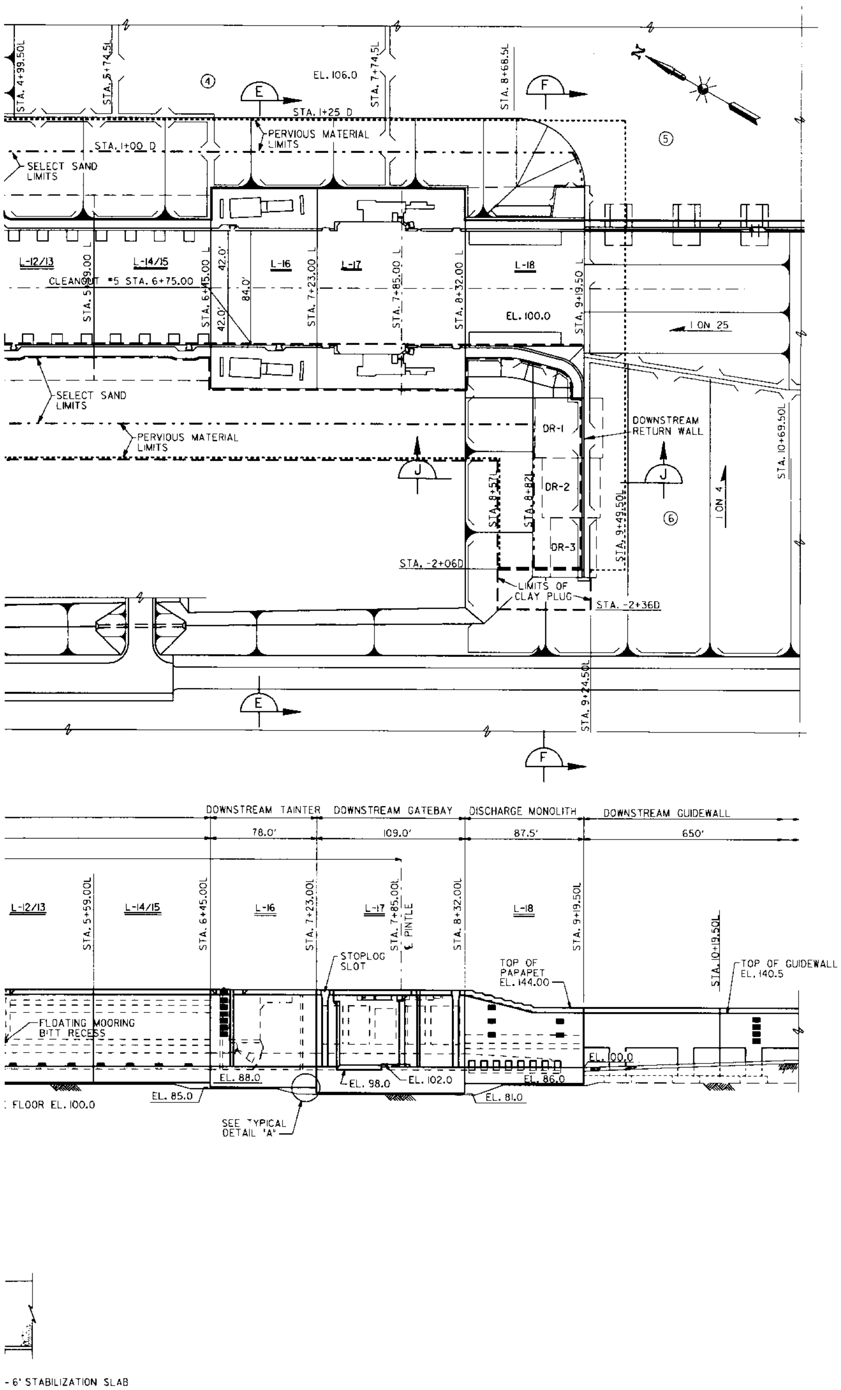
NOTES:

1. *24" FILTER MATERIAL CONSISTS OF A 6" BOTTOM LAYER OF SAND "B" A 6" MIDDLE LAYER OF GRAVEL "C" AND A 12" TOP LAYER OF FILTER STONE.
2. "C" DESIGNATION IS FOR RIPRAP PLACEMENT ON CLAY SOIL.
3. THICKNESS OF RIPRAP AND BEDDING PLACED SUBAQUEOUSLY SHALL BE CONTROLLED BY PLACEMENT REQUIREMENTS IN THE SPECIFICATIONS.
4. ALL CLAY BLANKETS SHALL BE FULLY COMPACTED.
5. NEOPRENE COATED FABRIC SHALL BE ATTACHED TO THE FACES OF CONCRETE STRUCTURES IN WHICH THE 5 FT. CLAY BLANKET ABUTS.



DETAIL "A"

SCALE: NONE



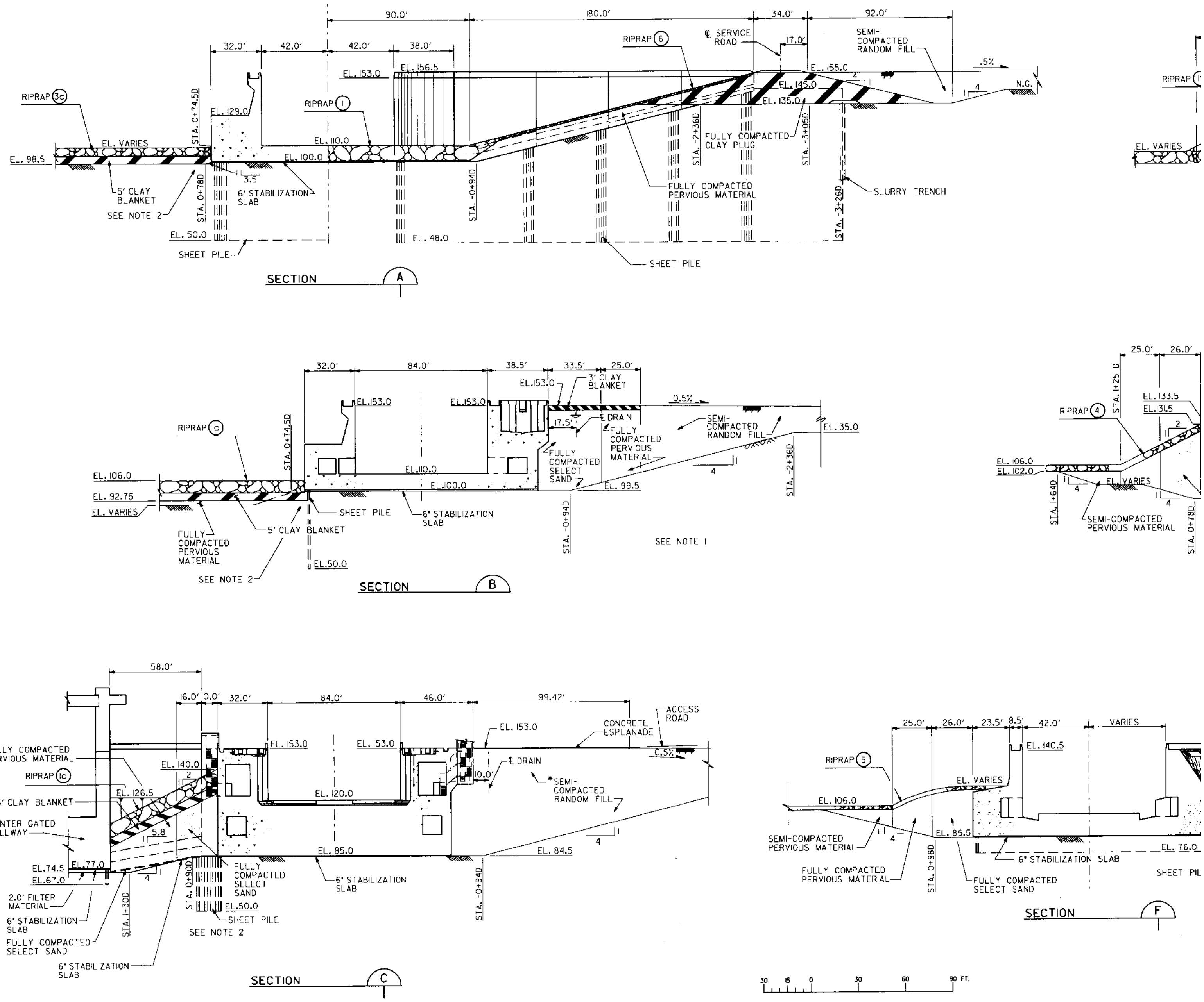
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

GENERAL LOCK PLAN

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 7



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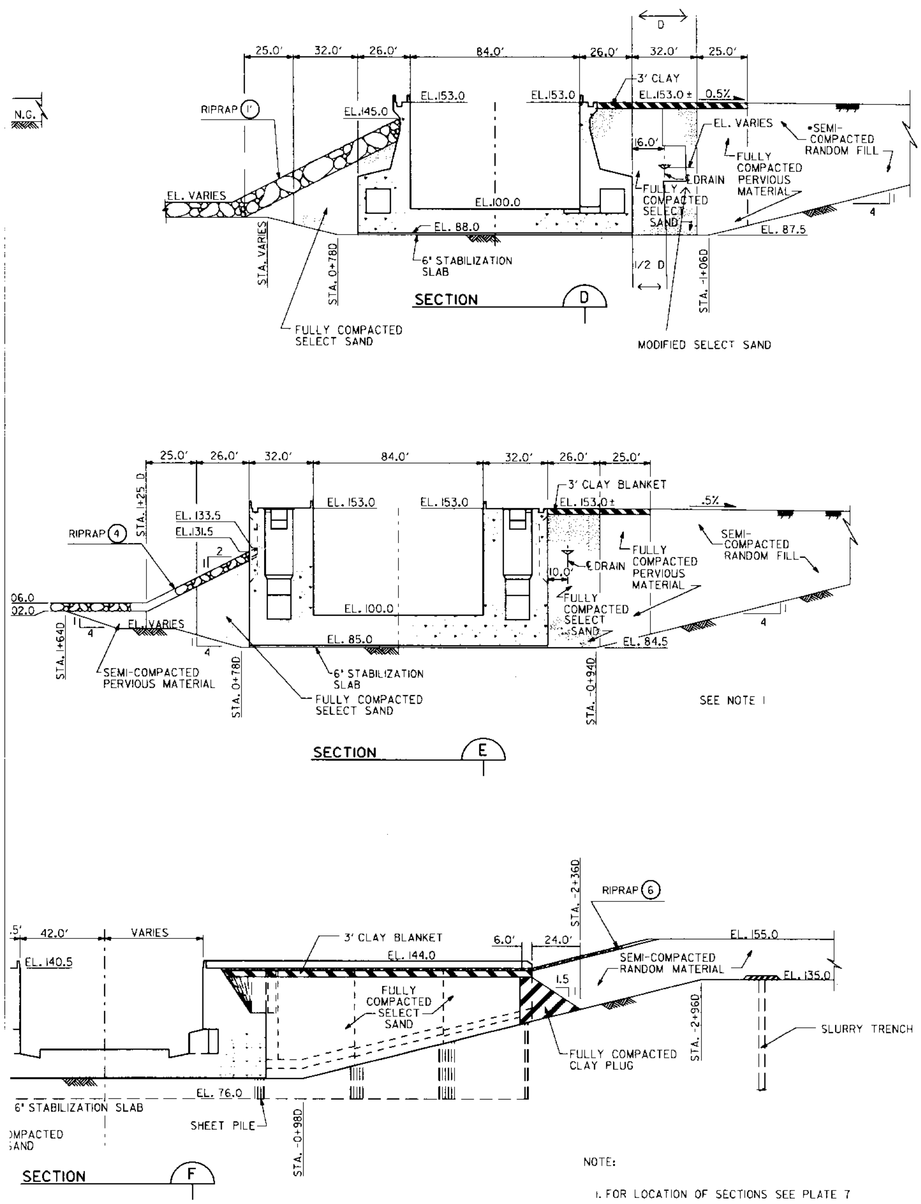
301



NOTE:

1. FOR LOCATION OF SECTIONS SEE PLATE 7

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

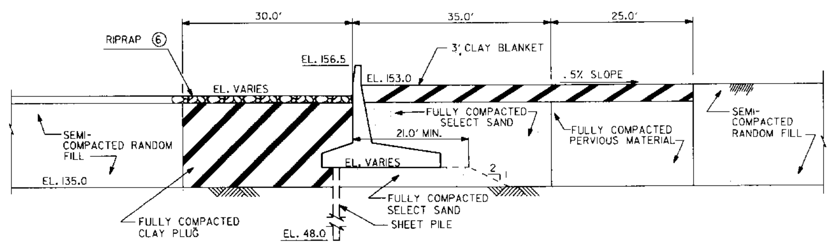
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

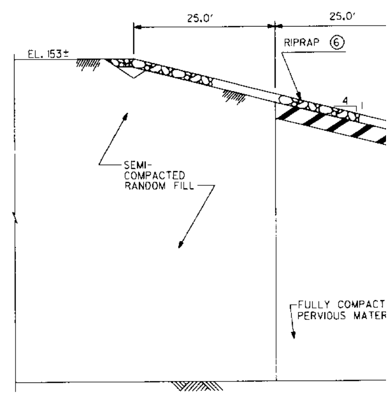
LOCK SECTIONS

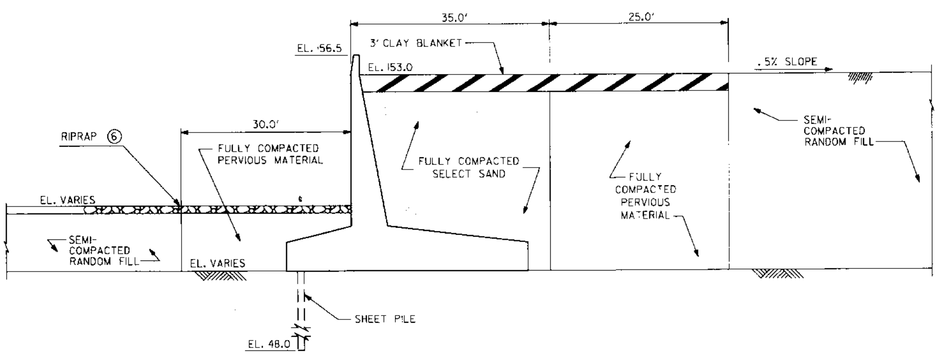
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 8

2

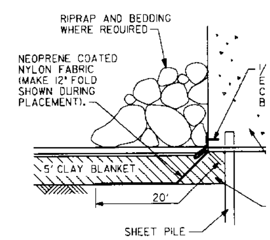


SECTION G

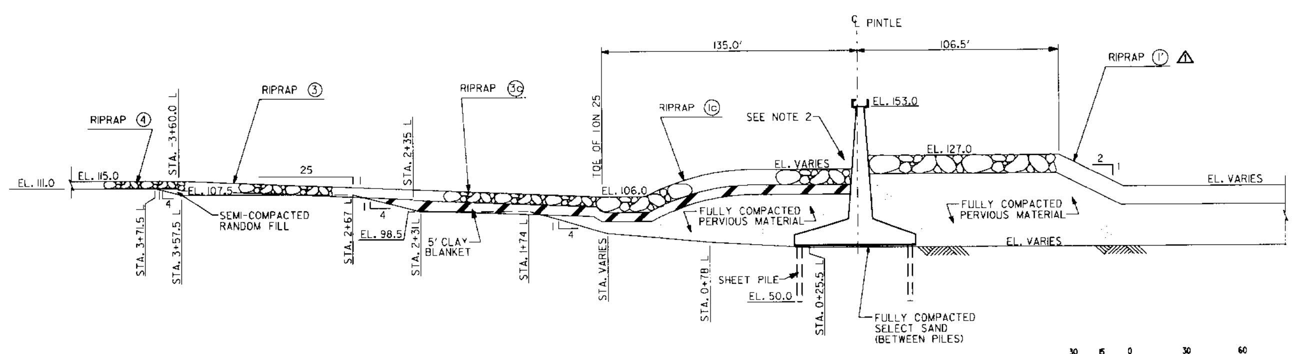




SECTION H

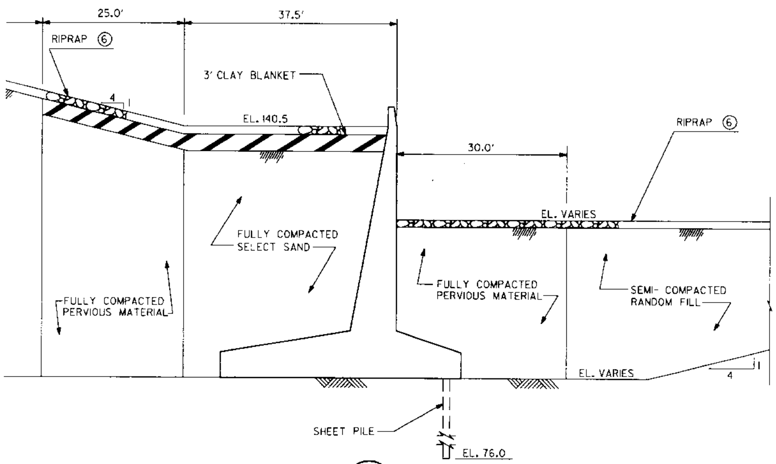


BOTTOM OF CLAY BLANKET BEL
EDGE OF STRUCTURE

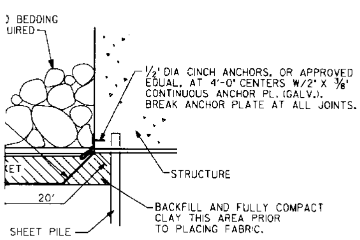


SECTION K

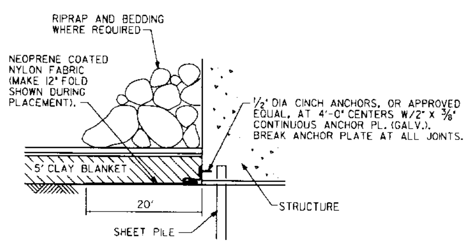
NOTES
1. S
2. N



SECTION J



OF CLAY BLANKET BELOW
IGE OF STRUCTURE



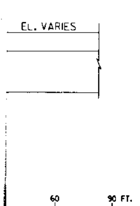
BOTTOM OF CLAY BLANKET AT OR ABOVE
BOTTOM EDGE OF STRUCTURE

TYPICAL INSTALLATION OF NEOPRENE COATED NYLON FABRIC

SCALE: 1 IN. = 10 FT.

NOTE:
NEOPRENE COATED NYLON FABRIC REQUIRED AT ALL LOCATIONS WHERE 5 FT. CLAY BLANKET ABUTS STRUCTURES.

NOTES:
1. SEE PLATE 7 FOR SECTION LOCATIONS AND RIPRAP DESIGNATIONS
2. NEOPRENE COATED NYLON FABRIC AT 5 FT. CLAY BLANKET NOT SHOWN FOR CLARITY. FOR INSTALLATION DETAILS, SEE THIS DWG.



RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

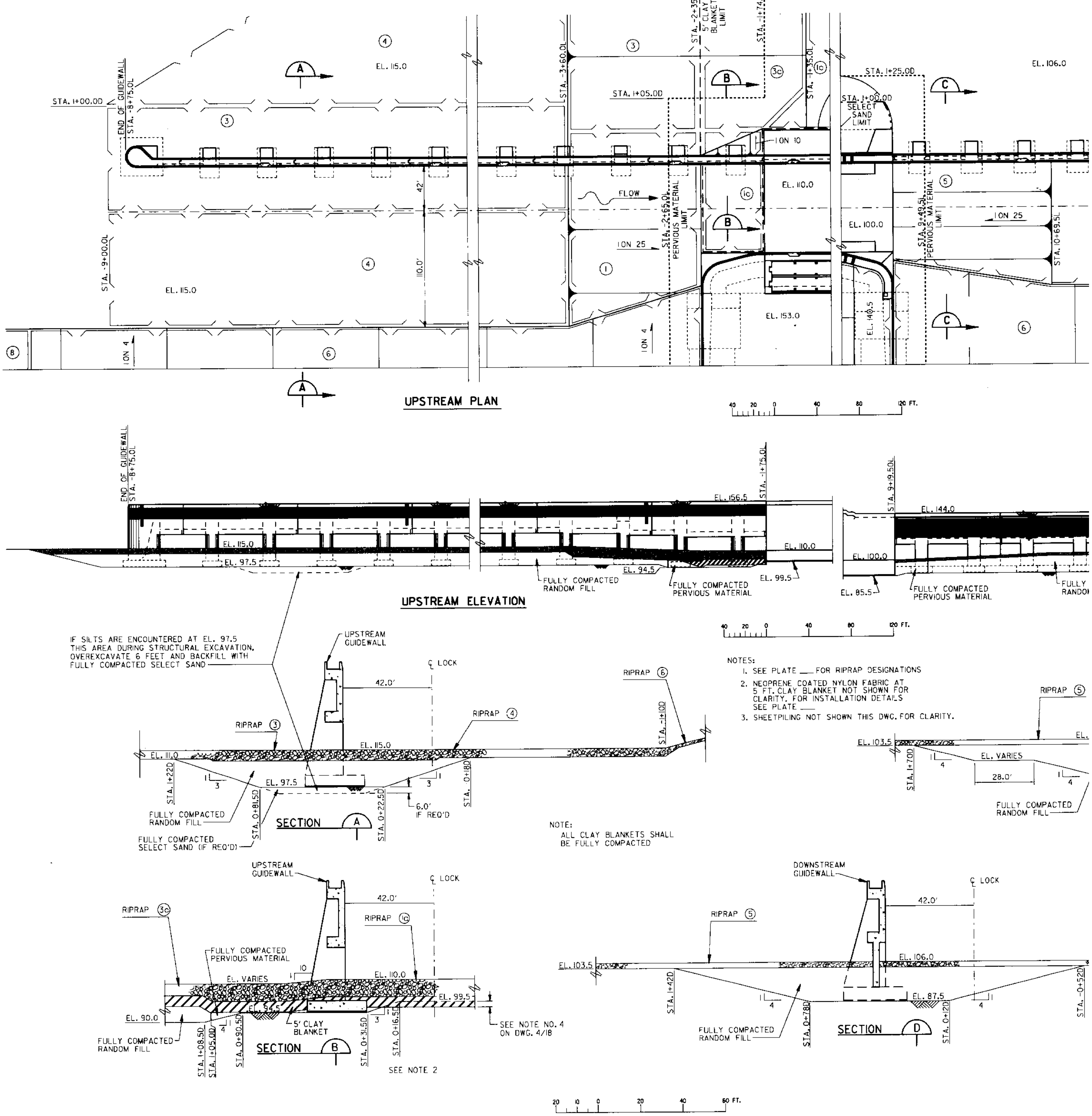
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

LOCK SECTIONS

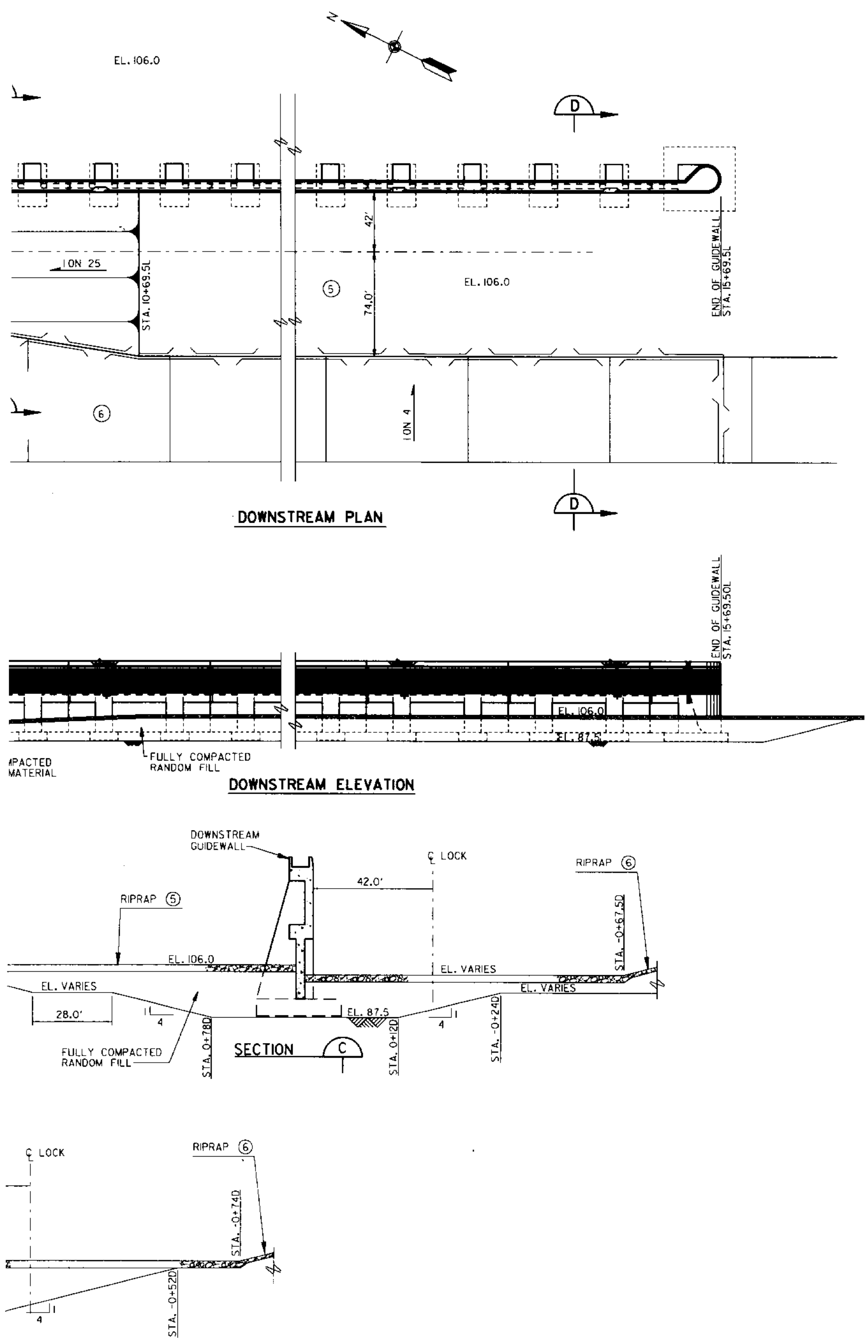
DATE: JANURARY 1996 | FILE NO. R-14-207 | PLATE 9

2



NOTES:
1. SEE PLATE ___ FOR RIPRAP DESIGNATIONS
2. NEOPRENE COATED NYLON FABRIC AT 5 FT. CLAY BLANKET NOT SHOWN FOR CLARITY. FOR INSTALLATION DETAILS SEE PLATE ___
3. SHEETPILING NOT SHOWN THIS DWG. FOR CLARITY.

NOTE:
ALL CLAY BLANKETS SHALL BE FULLY COMPACTED



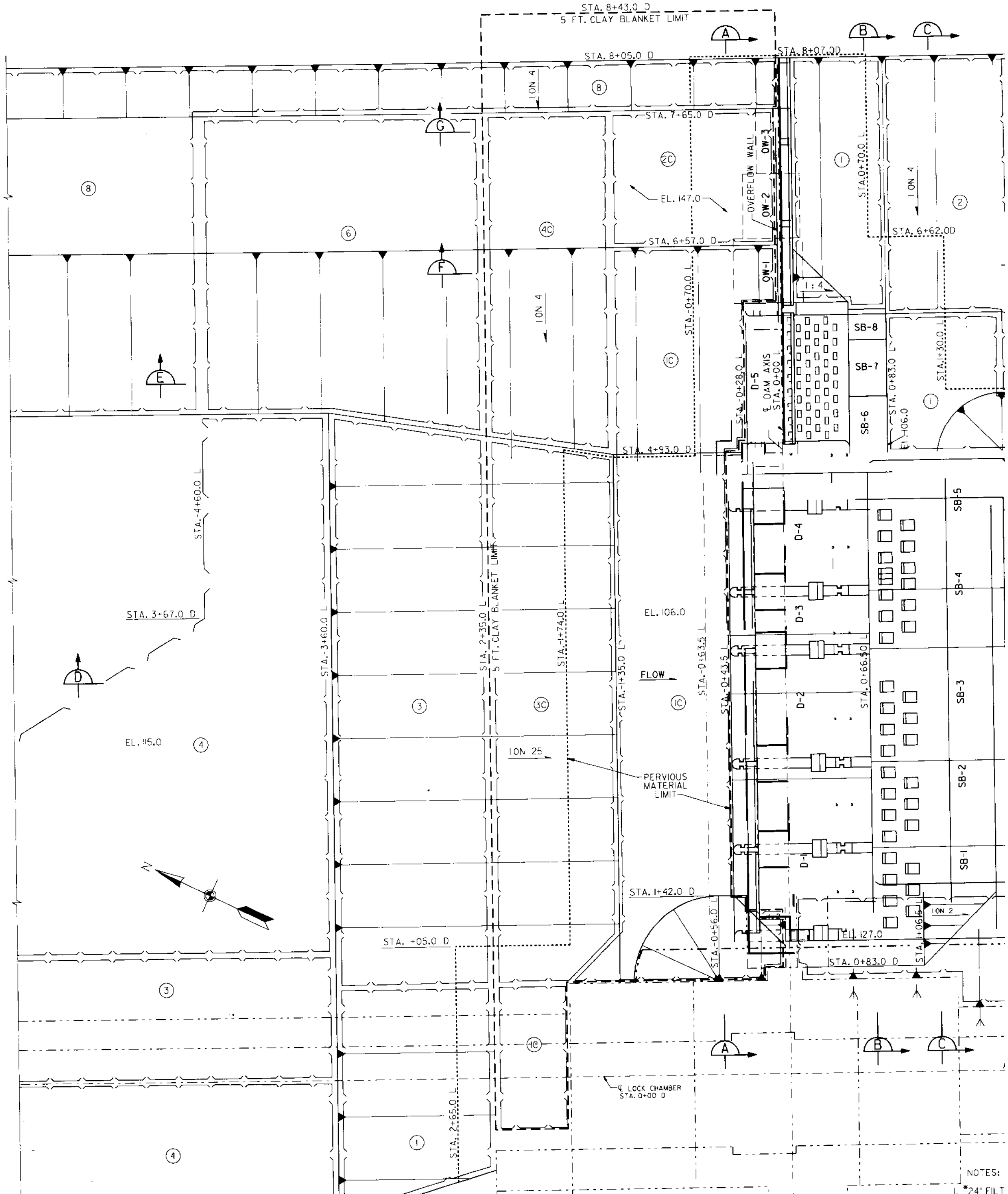
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT,LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

GENERAL GUIDEWALL PLAN ELEVATION AND SECTIONS

DATE: JANURARY 1996 | FILE NO. R-14-207 | PLATE 10

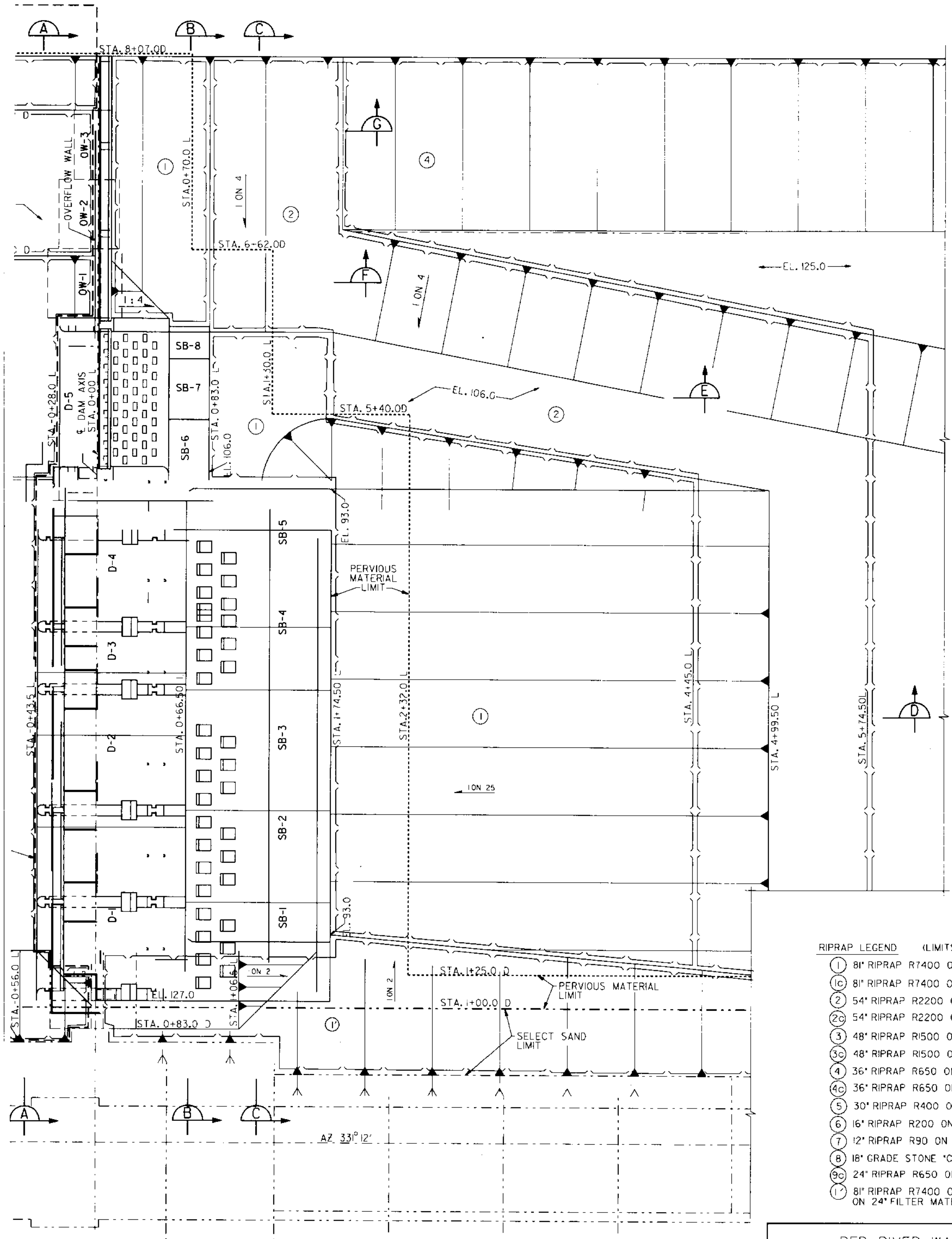


PLAN

40' 0 40'

NOTES:
1. "24" FILT
OF SAN
LAYER
2. "C" DESI
3. THICKNE
BE CON
4. ALL CL
5. NEOPRE
FACES
BLANKE
6. FOR SE

L0504OL3.DGN
k40



PLAN

40' 0 40'

RIPRAP LEGEND (LIMITS INDICATED BY ⊂⊃)

- (1) 81" RIPRAP R7400 ON 12" RIPRAP R90 ON 24" FILTER MATERIAL*
- (1c) 81" RIPRAP R7400 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
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- (7) 12" RIPRAP R90 ON ENGINEERING FABRIC.
- (8) 18" GRADE STONE "C"
- (9c) 24" RIPRAP R650 ON 9" BEDDING MATERIAL NO. 2.
- (1') 81" RIPRAP R7400 ON 12" RIPRAP R90 ON ENGINEERING FABRIC ON 24" FILTER MATERIAL*

NOTES:

1. *24" FILTER MATERIAL CONSISTS OF A 6" BOTTOM LAYER OF SAND "B", A 6" MIDDLE LAYER OF GRAVEL "C", AND A 12" TOP LAYER OF FILTERSTONE.
2. "C" DESIGNATION IS FOR RIPRAP PLACEMENT ON CLAY SOIL.
3. THICKNESS OF RIPRAP AND BEDDING PLACED SUBAQUEOUSLY SHALL BE CONTROLLED BY PLACEMENT REQUIREMENTS IN THE SPECIFICATIONS.
4. ALL CLAY BLANKETS SHALL BE FULLY COMPACTED.
5. NEOPRENE COATED NYLON FABRIC SHALL BE ATTACHED TO THE FACES OF CONCRETE STRUCTURES IN WHICH THE 5 FT. CLAY BLANKET ABUTS.
6. FOR SECTIONS SEE PLATE 12 AND 13

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
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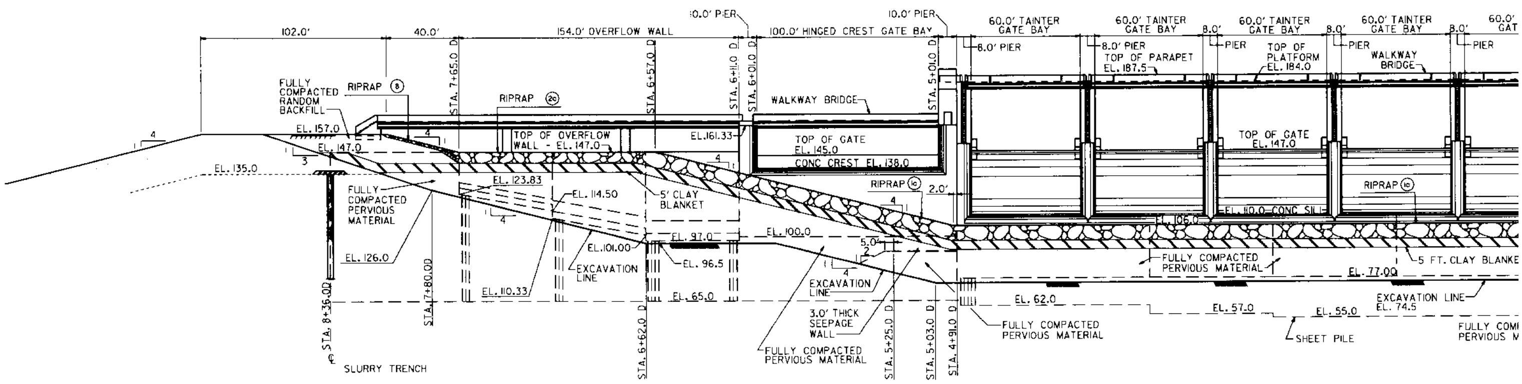
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

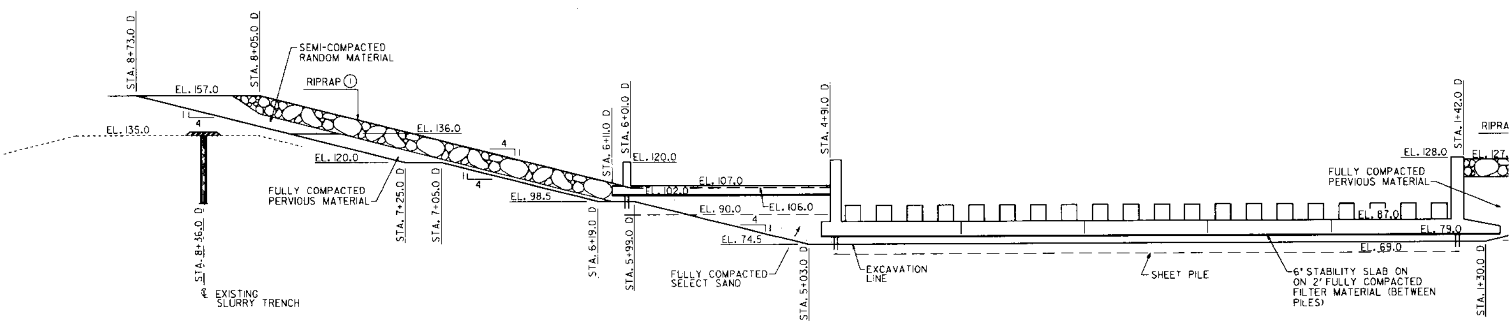
GENERAL DAM PLAN

2

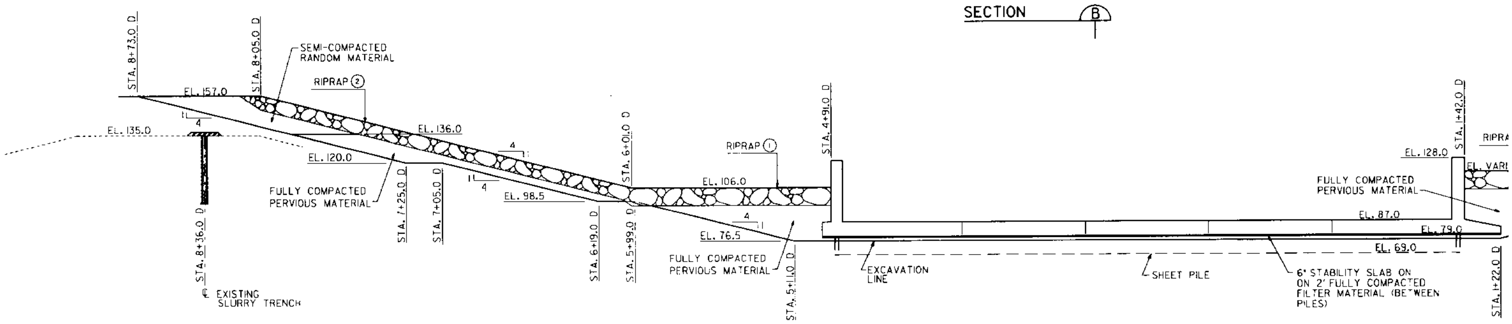
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 11



SECTION (A)



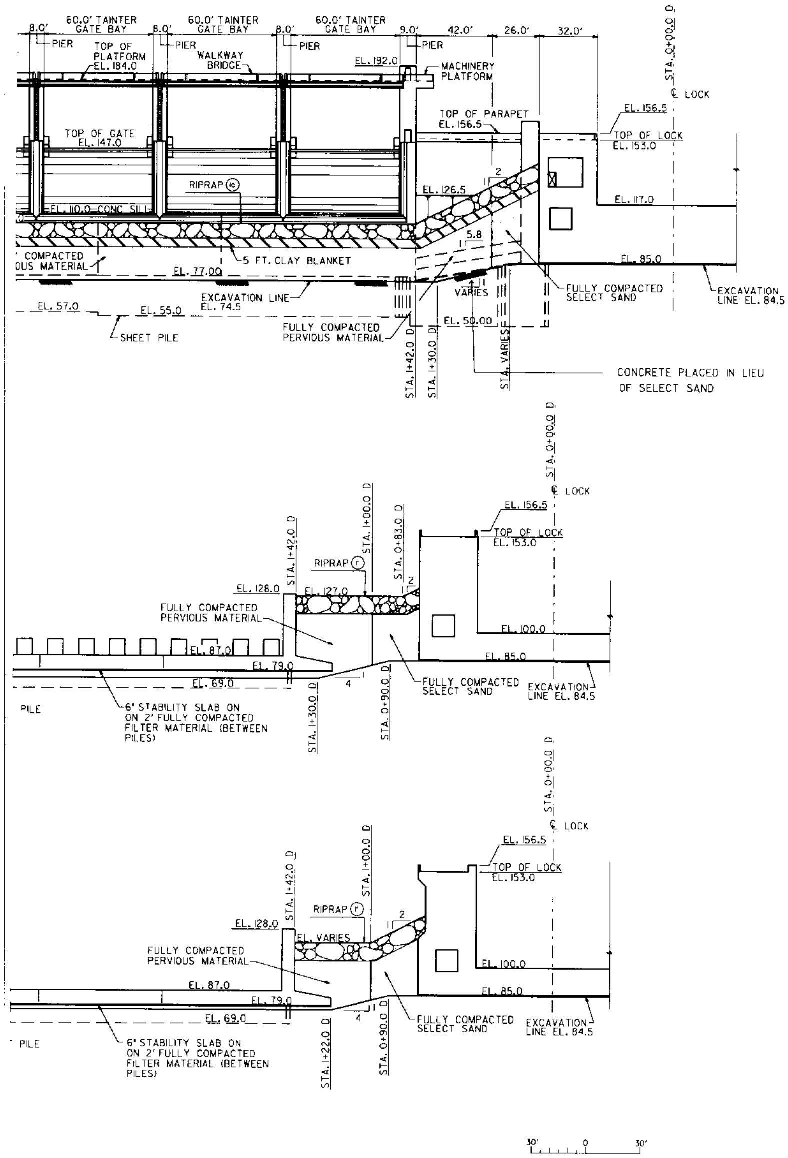
SECTION (B)



SECTION (C)

NOTES.

1. SEE PLATE __II__ FOR RIPRAP DESIGNATIONS.
2. NEOPRENE COATED NYLON FABRIC AT 5 FT. CLAY BLANKET NOT SHOWN FOR CLARITY. FOR INSTALLATION DETAILS SEE DWG. 4/11.
3. FOR LOCATION OF SECTION SEE PLATE __II__



RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

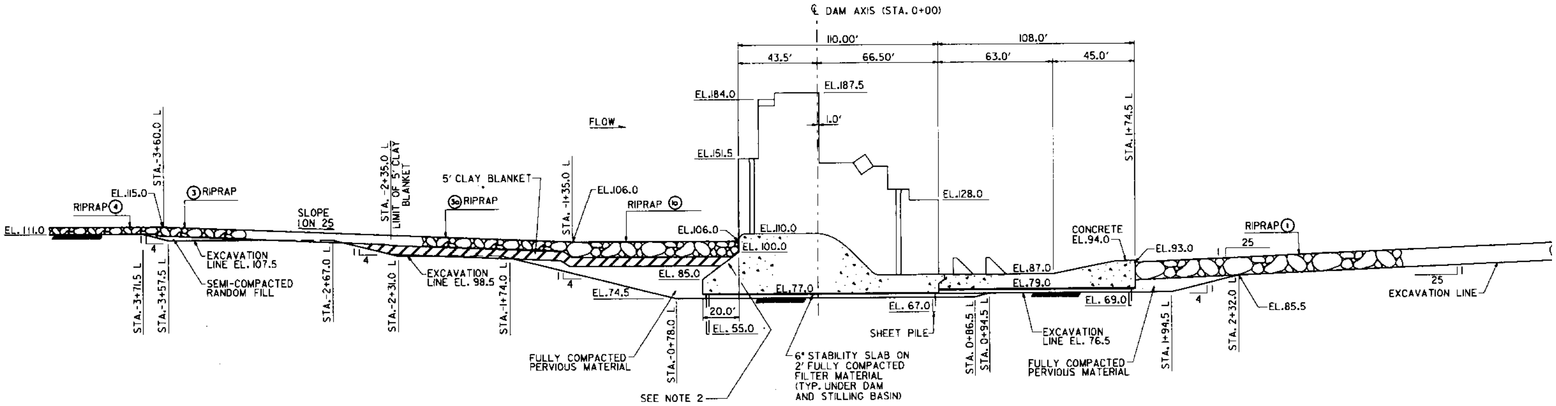
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

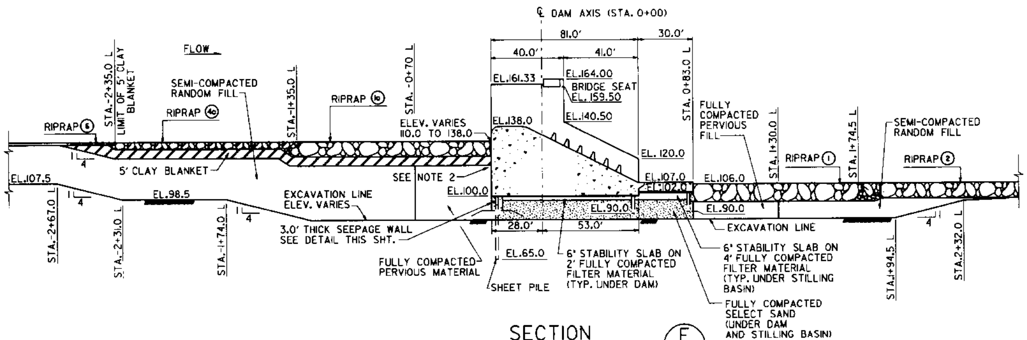
DAM SECTIONS

2

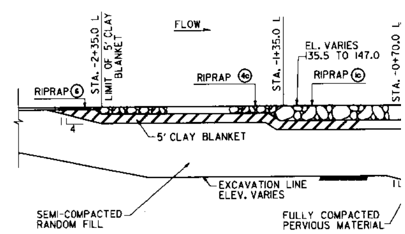
DATE: JANURARY 1996 | FILE NO. R-14-207 | PLATE 12

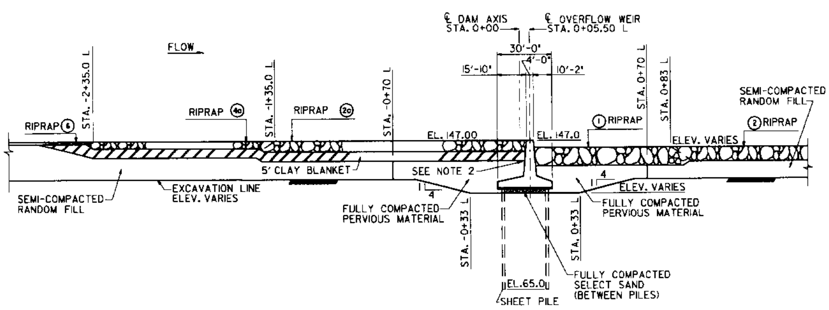


SECTION D

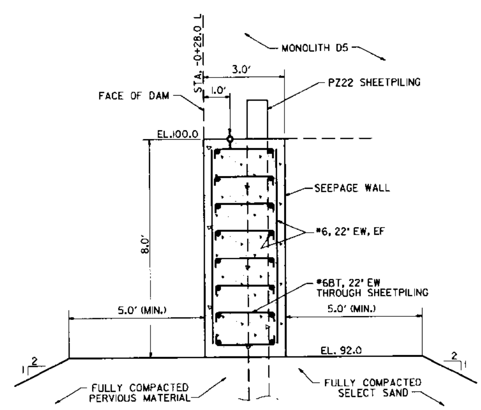


SECTION E

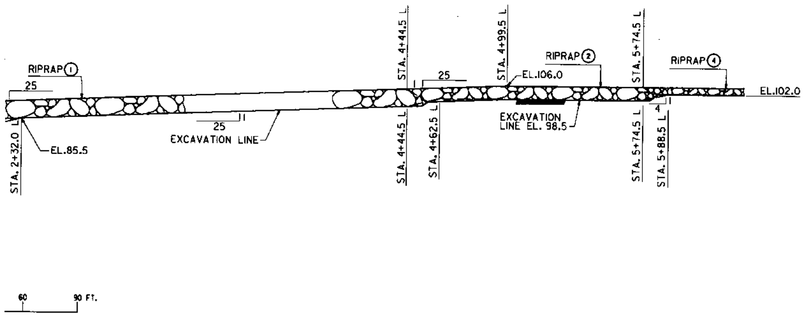


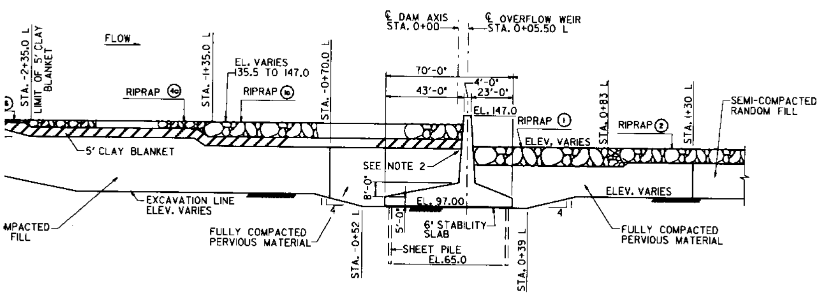


SECTION G



SEEPAGE WALL DETAIL

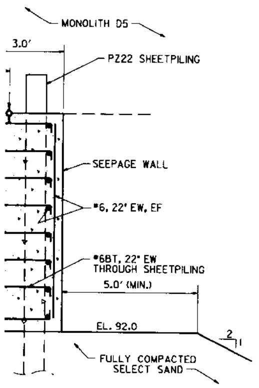




SECTION F

30 15 0 30 60 90 FT.

NOTES:
1. SEE PLATE __ _FOR RIPRAP DESIGNATIONS.
2. NEOPRENE COATED NYLON FABRIC AT 5 FT. CLAY BLANKET NOT SHOWN FOR CLARITY. FOR INSTALLATION SEE DWG. 4/11.
3. FOR LOCATION OF SECTION SEE PLATE __ _



E WALL DETAIL

1 2 3 4 5 FT.

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT,LA.
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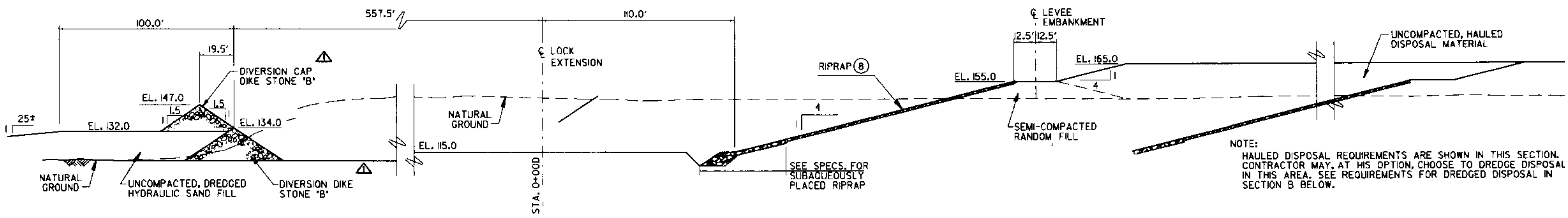
FOUNDATION REPORT

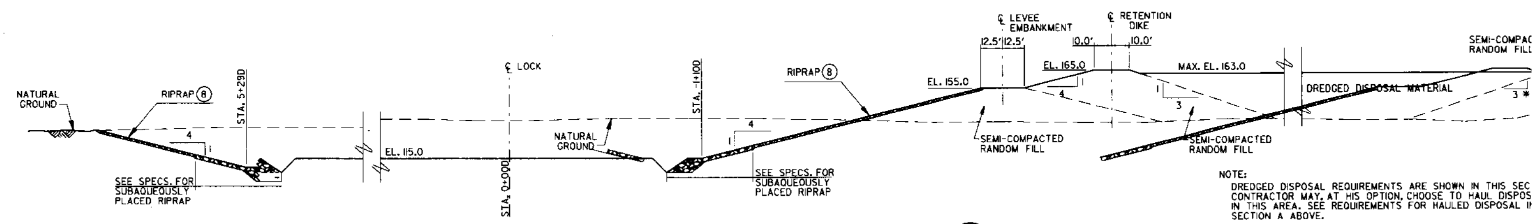
DAM SECTIONS

2

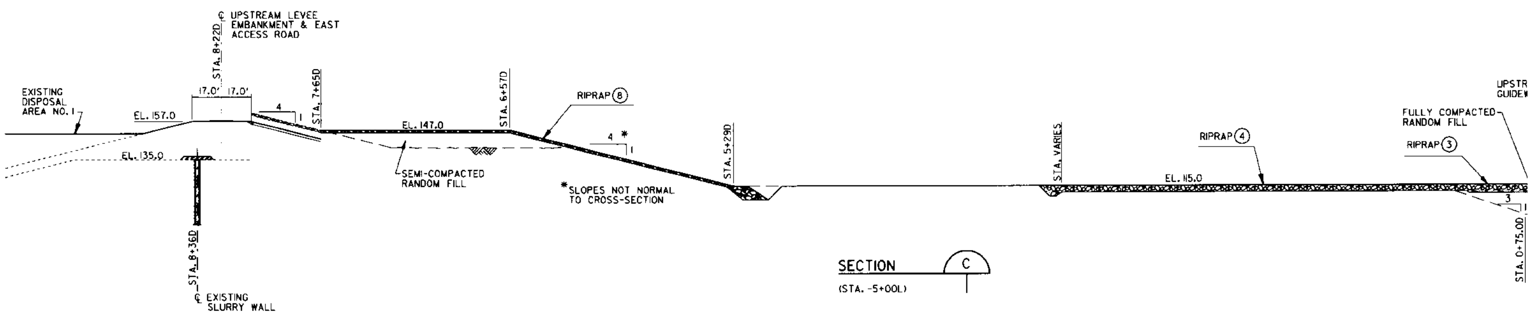
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 13



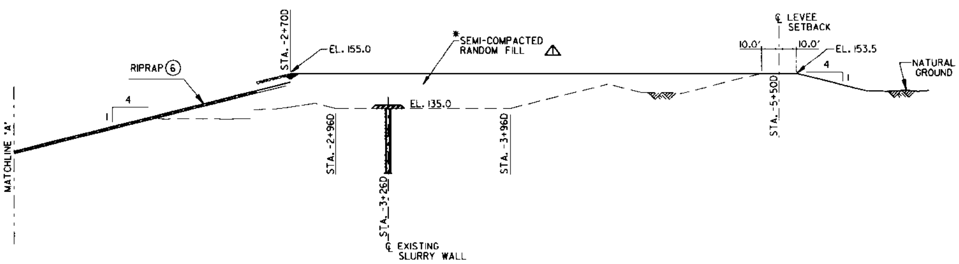
SECTION (A)
(STA. -80+00L)



SECTION (B)



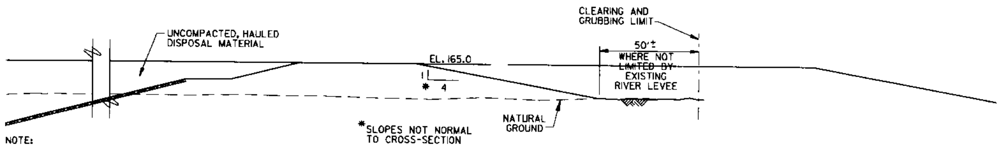
SECTION (C)
(STA. -5+00L)



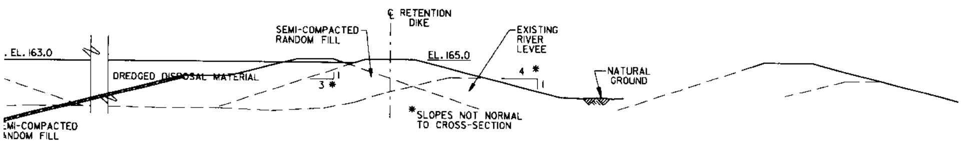
NOTE:

SEE PLATE II FOR RIPRAP DESIGNATIONS.

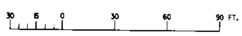
FOR LOCATION OF SECTION SEE PLATE 3

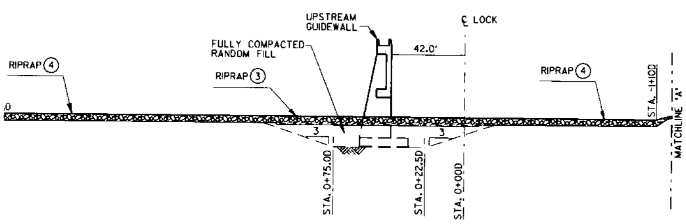


NOTE:
HAULED DISPOSAL REQUIREMENTS ARE SHOWN IN THIS SECTION. CONTRACTOR MAY, AT HIS OPTION, CHOOSE TO DREDGE DISPOSAL IN THIS AREA. SEE REQUIREMENTS FOR DREDGED DISPOSAL IN SECTION B BELOW.



NOTE:
DREDGED DISPOSAL REQUIREMENTS ARE SHOWN IN THIS SECTION. CONTRACTOR MAY, AT HIS OPTION, CHOOSE TO HAUL DISPOSAL IN THIS AREA. SEE REQUIREMENTS FOR HAULED DISPOSAL IN SECTION A ABOVE.





ITE:
SEE PLATE 11 FOR RIPRAP DESIGNATIONS.
FOR LOCATION OF SECTION SEE PLATE 3

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
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FOUNDATION REPORT

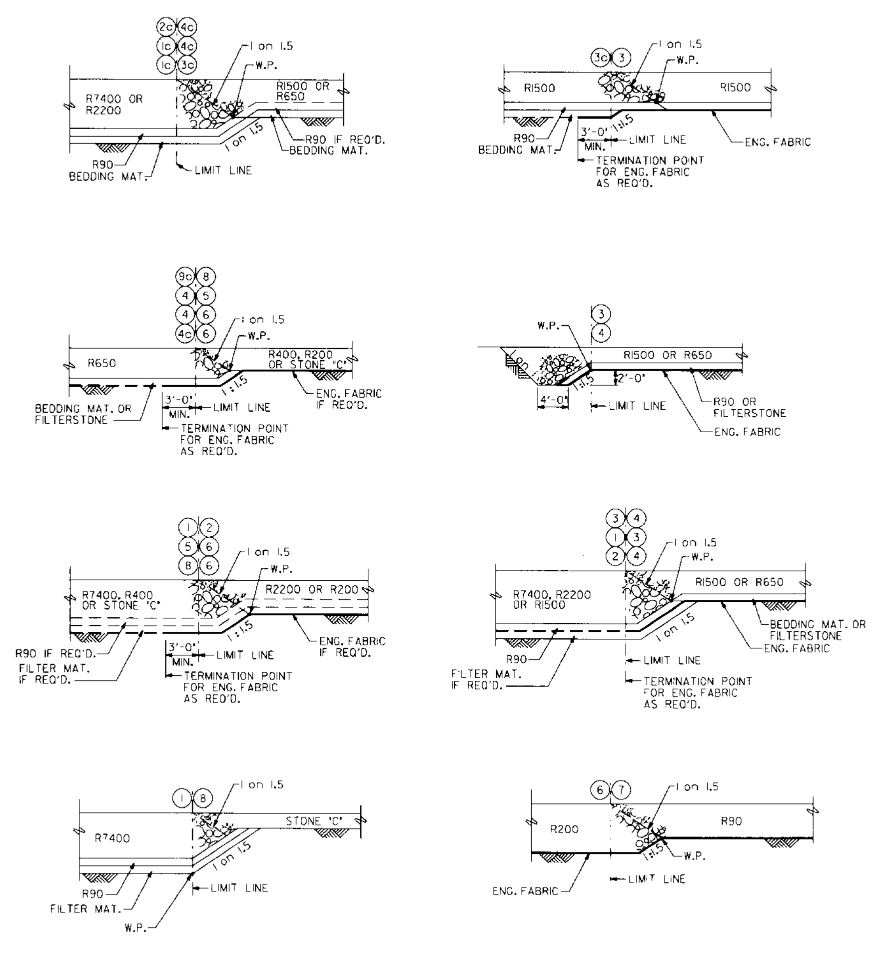
CHANNEL SECTIONS

2

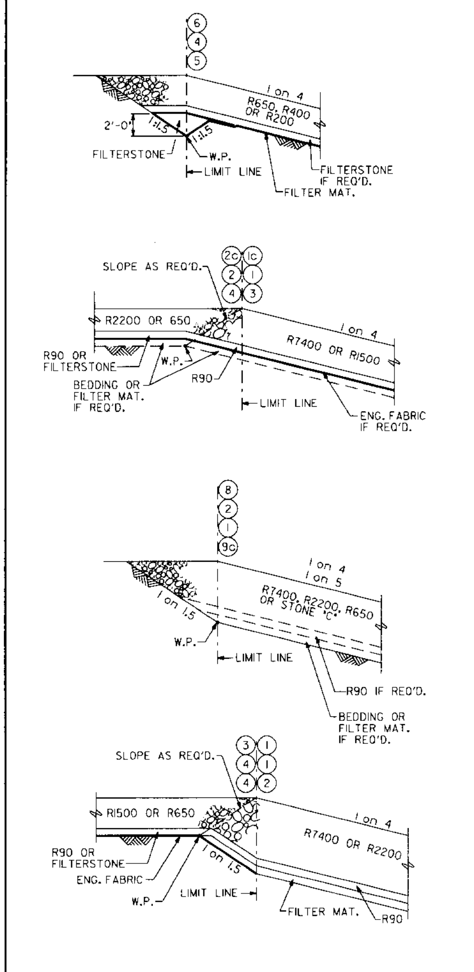
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 14

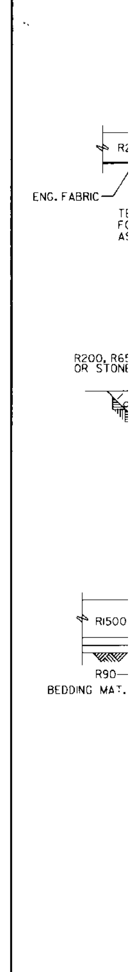
STONE PROTECTION DETAILS

HORIZONTAL TRANSITIONS



TOP OF SLOPE TRANSITIONS





RIPRAP LEGEND (LIMITS INDICATED BY ⬭)

- (1) 81" RIPRAP R7400 ON 12" RIPRAP R90 ON 24" FILTER MATERIAL*.
- (1c) 81" RIPRAP R7400 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
- (2) 54" RIPRAP R2200 ON 12" RIPRAP R90 ON 24" FILTER MATERIAL*.
- (2c) 54" RIPRAP R2200 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
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- (3c) 48" RIPRAP R1500 ON 12" RIPRAP R90 ON 6" BEDDING MATERIAL NO. 1.
- (4) 36" RIPRAP R650 ON 12" FILTER STONE ON ENGINEERING FABRIC.
- (4c) 36" RIPRAP R650 ON 12" BEDDING MATERIAL NO. 2.
- (5) 30" RIPRAP R400 ON ENGINEERING FABRIC.
- (6) 16" RIPRAP R200 ON ENGINEERING FABRIC.
- (7) 12" RIPRAP R90 ON ENGINEERING FABRIC.
- (8) 18" GRADE STONE 'C'
- (9c) 24" RIPRAP R650 ON 9" BEDDING MATERIAL NO. 2.
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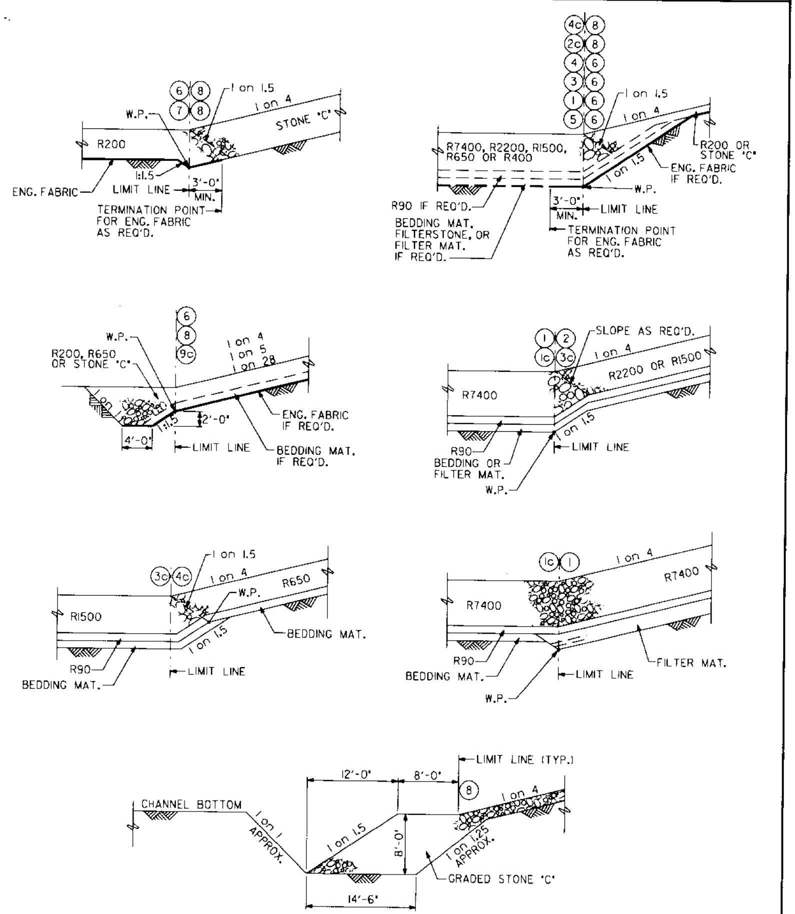
NOTES:

1. *24" FILTER MATERIAL CONSISTS OF A 6" BOTTOM LAYER OF SAND 'B' A 6" MIDDLE LAYER OF GRAVEL 'C' AND A 12" TOP LAYER OF FILTER STONE.
2. 'C' DESIGNATION IS FOR RIPRAP PLACEMENT ON CLAY SOIL.
3. TRANSITIONS OCCURING ALONG SLOPES FLATTER THAN 1 ON 10 SHOULD BE CONSIDERED HORIZONTAL UNLESS NOTED OTHERWISE.

L0504023.DGN

BOTTOM OF SLOPE TRANSITIONS



TRENCHFILL REVETMENT

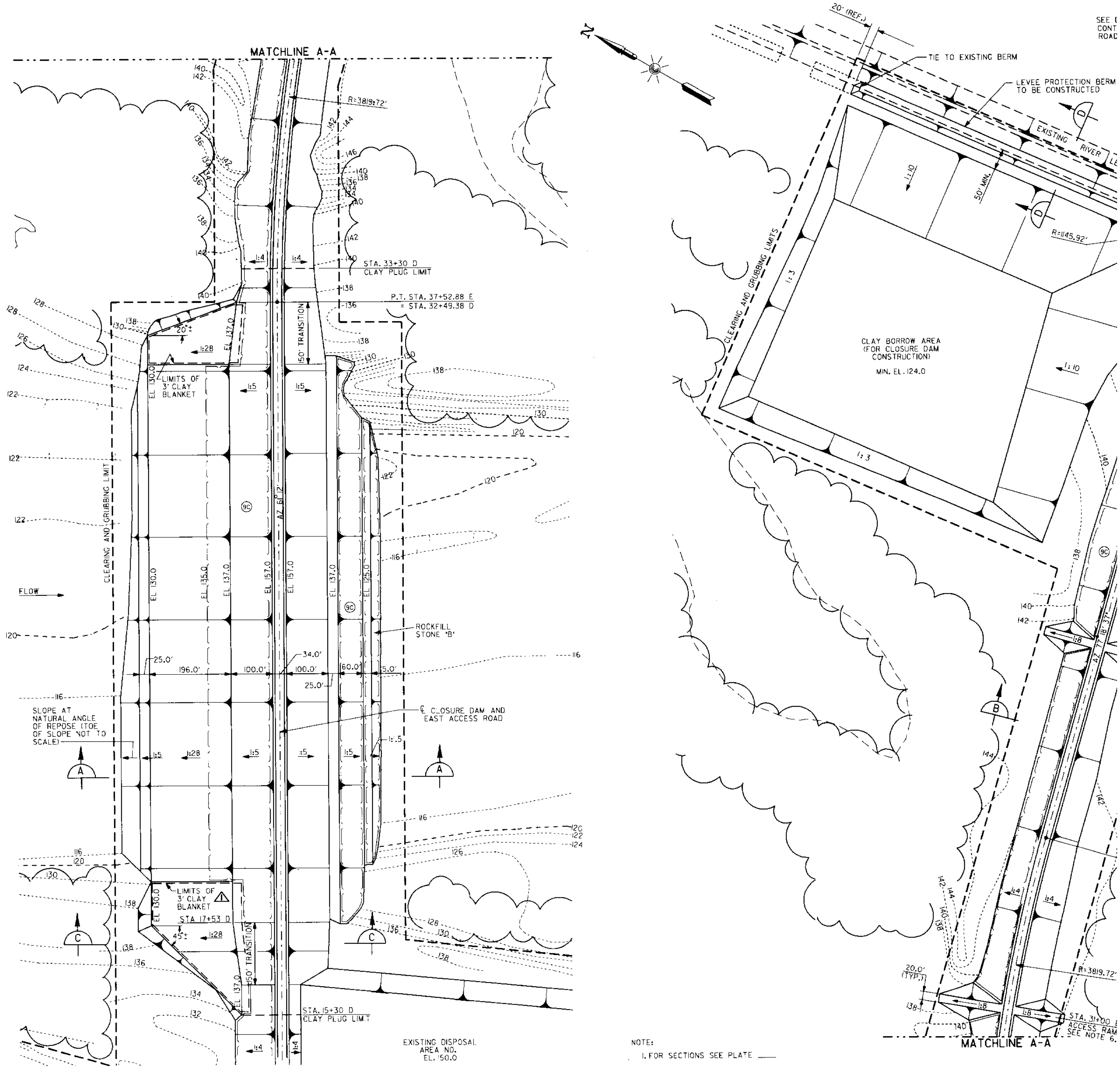
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

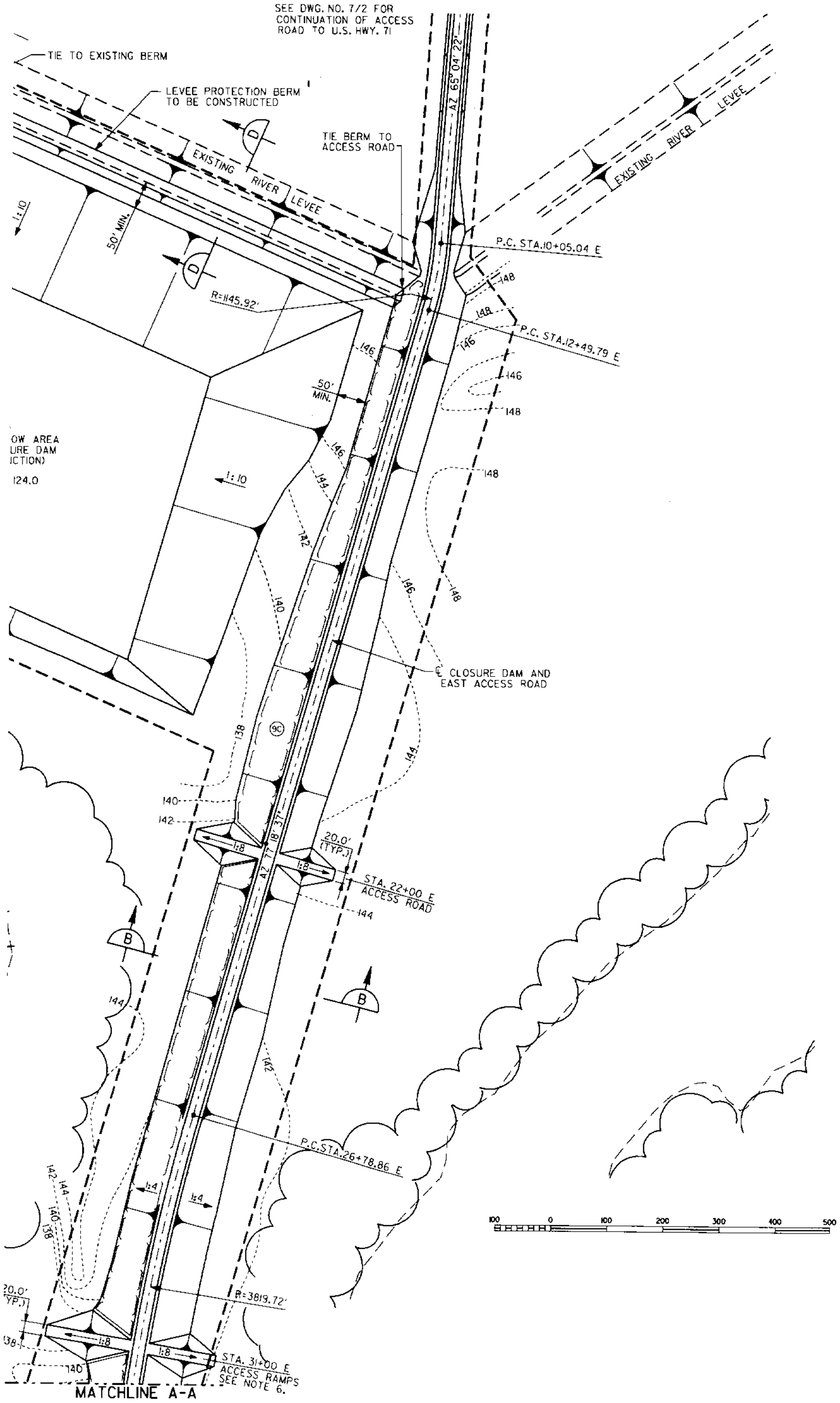
FOUNDATION REPORT

STONE PROTECTION DETAILS

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 15



MATCHLINE A-A
R=3819.72'
STA. 33+30 D
CLAY PLUG LIMIT
P.T. STA. 37+52.88 E
= STA. 32+49.38 D
150' TRANSITION
20'±
LIMITS OF
3' CLAY
BLANKET
CLEARING AND GRUBBING LIMIT
FLOW
EL 130.0
EL 135.0
EL 137.0
EL 157.0
EL 125.0
AZ 61°12'
ROCKFILL
STONE "B"
25.0'
196.0'
100.0'
34.0'
60.0'
5.0'
℄ CLOSURE DAM AND
EAST ACCESS ROAD
SLOPE AT
NATURAL ANGLE
OF REPOSE (TOE
OF SLOPE NOT TO
SCALE)
STA 17+53 D
45°±
STA. 15+30 D
CLAY PLUG LIMIT
EXISTING DISPOSAL
AREA NO.
EL. 150.0
20' (REF.)
TIE TO EXISTING BERM
LEVEE PROTECTION BERM
TO BE CONSTRUCTED
EXISTING RIVER
50' MIN.
R=1145.92'
CLEARING AND GRUBBING LIMITS
CLAY BORROW AREA
(FOR CLOSURE DAM
CONSTRUCTION)
MIN. EL. 124.0
20.0'
(TYP.)
R=3819.72'
STA. 31+00 E
ACCESS RAMP
SEE NOTE 6.
MATCHLINE A-A
NOTE:
1. FOR SECTIONS SEE PLATE ____



RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

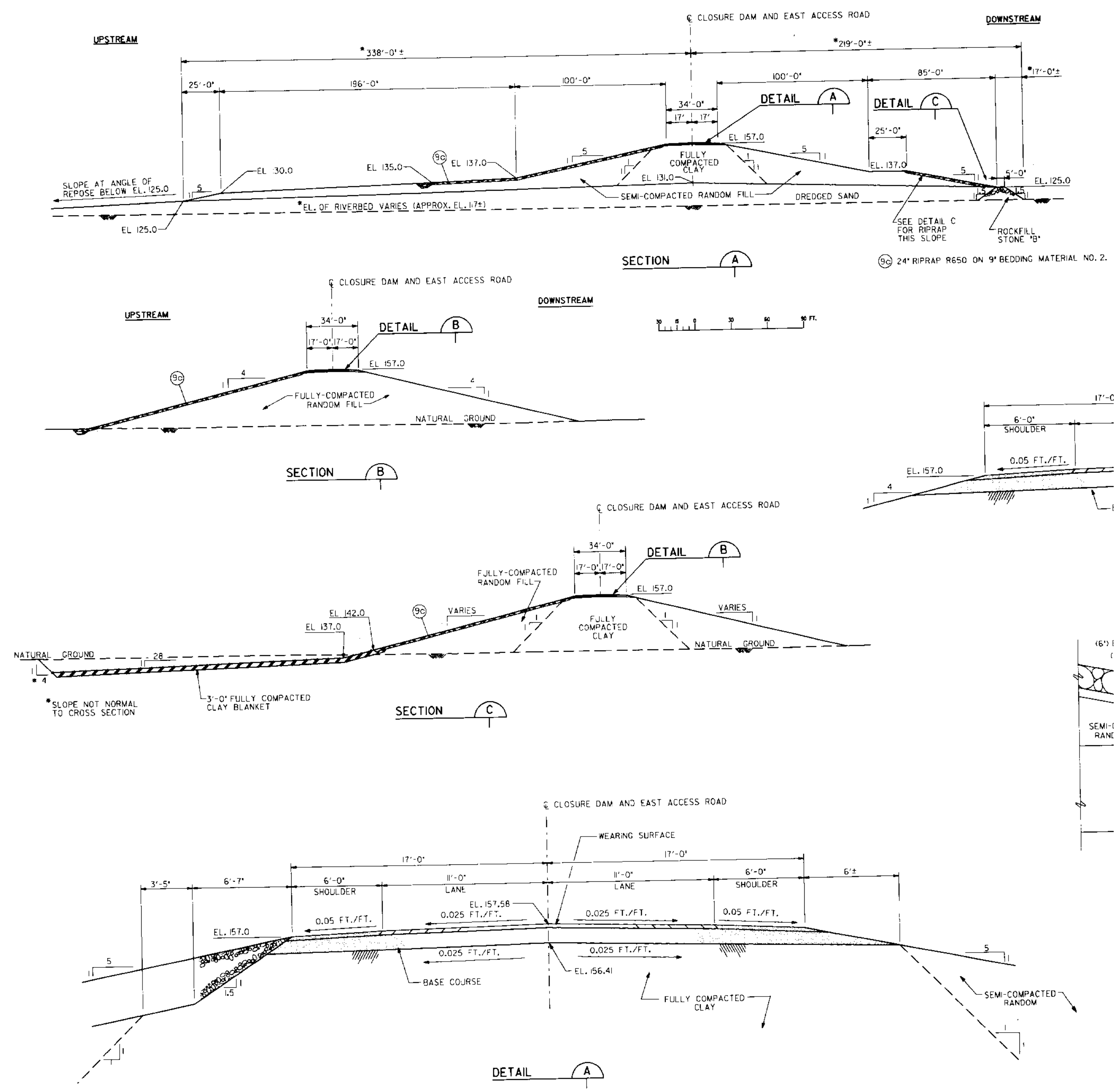
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

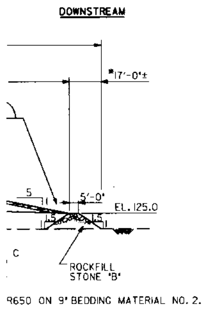
CLOSURE DAM PLAN

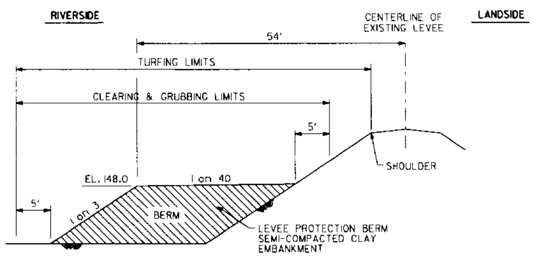
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 16

2

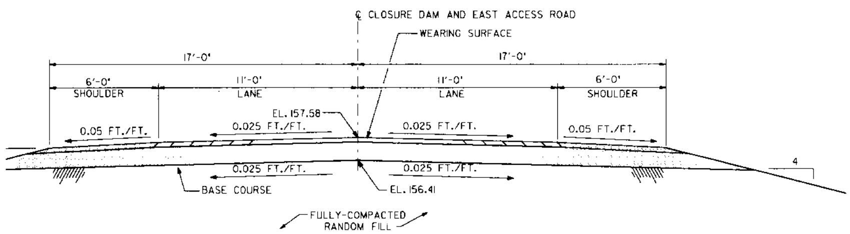


℄ CLOSURE DAM AND EAST ACCESS ROAD
UPSTREAM
DOWNSTREAM
*338'-0' ±
*219'-0'±
25'-0"
196'-0"
100'-0"
34'-0"
17' 17'
100'-0"
85'-0"
*17'-0"±
DETAIL A
DETAIL C
25'-0"
EL 157.0
FULLY COMPACTED CLAY
EL 131.0
EL 137.0
EL 135.0
EL 130.0
EL 125.0
SLOPE AT ANGLE OF REPOSE BELOW EL. 125.0
*EL. OF RIVERBED VARIES (APPROX. EL. 117±)
SEMI-COMPACTED RANDOM FILL
DREDGED SAND
SEE DETAIL C FOR RIPRAP THIS SLOPE
ROCKFILL STONE 'B'
5'-0"
SECTION A
9c 24" RIPRAP R650 ON 9" BEDDING MATERIAL NO. 2.
DETAIL B
17'-0" 17'-0"
FULLY-COMPACTED RANDOM FILL
NATURAL GROUND
SECTION B
EL. 157.0
6'-0" SHOULDER
0.05 FT./FT.
FULLY-COMPACTED RANDOM FILL
EL 142.0
VARIES
NATURAL GROUND
28
*SLOPE NOT NORMAL TO CROSS SECTION
3'-0" FULLY COMPACTED CLAY BLANKET
SECTION C
WEARING SURFACE
17'-0"
3'-5"
6'-7"
6'-0" SHOULDER
11'-0" LANE
6'±
EL. 157.58
0.025 FT./FT.
EL. 156.41
BASE COURSE
FULLY COMPACTED CLAY
SEMI-COMPACTED RANDOM
DETAIL A

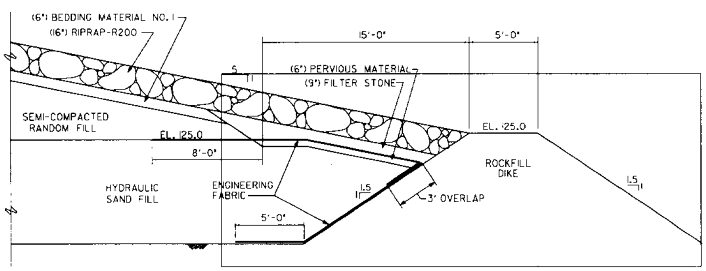




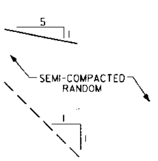
SECTION D



DETAIL B



DETAIL C



NOTES:

1. FULLY COMPACTED CLAY IN CLOSURE ACROSS THE RIVER CHANNEL EXTENDS FROM STATION 15+30 D TO STATION 33+30 D.
2. FOR LOCATION OF SECTIONS SEE PLATE 16

2

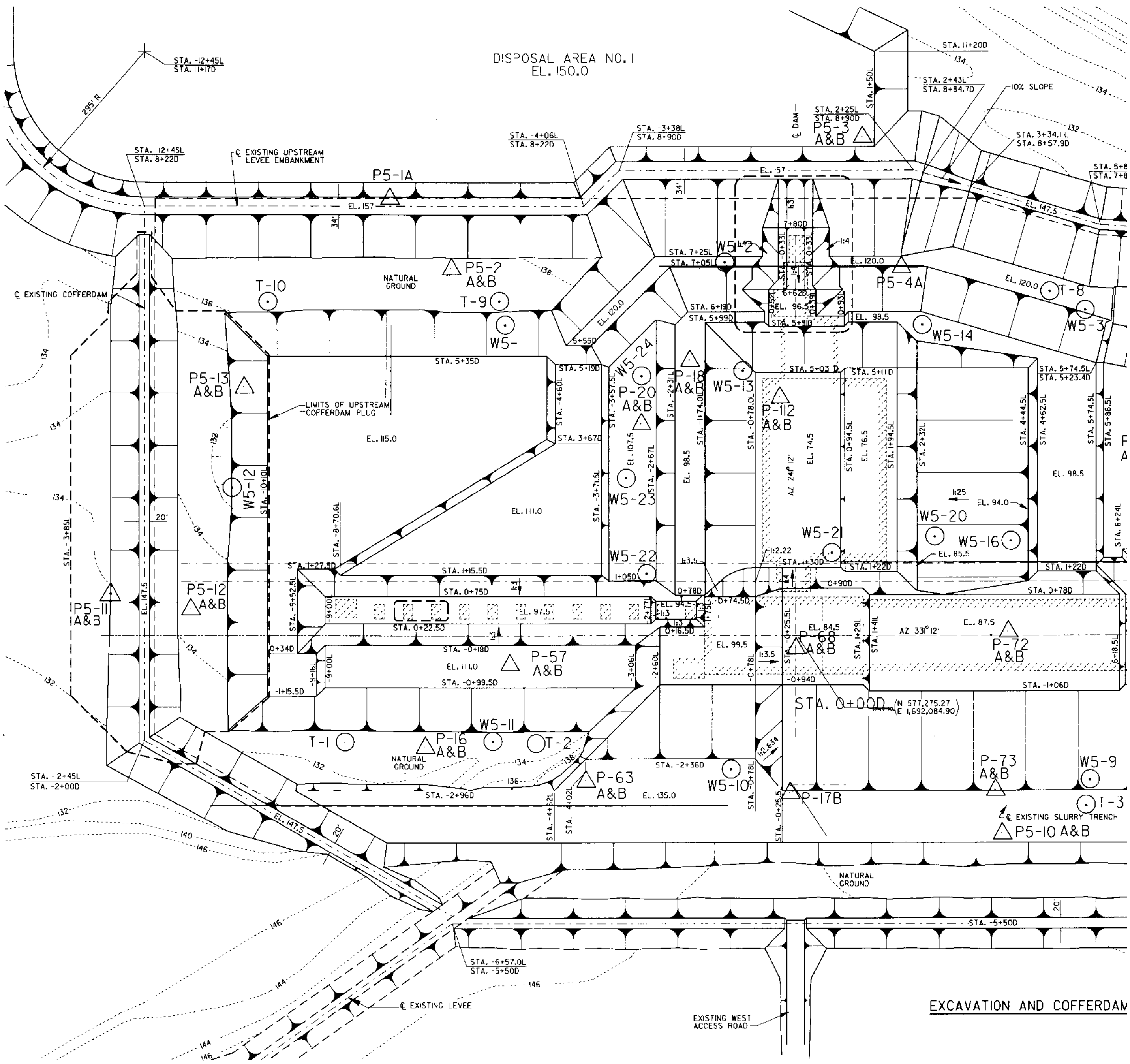
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

CLOSURE DAM DETAILS

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 17



NOTES:

1. WELLS

   WELLS W5-1 TO W5-10 INSTALLED BY GOVERMENT

   WELLS W5-11 TO W5-24 AND T-1 TO T-10 INSTALLED BY CONTRACTOR

2. PIEZOMETERS

   PIEZOMETERS PREFIXED WITH P5 INSTALLED BY CONTRACTOR

   PIEZOMETERS PREFIXED P INSTALLED BY GOVERMENT

   "A" TIP = ALLUVIAL; "B" TIP = TERTIARY

3. ABANDOMENT

   ALL WELLS AND PIEZOMETERS GROUTED OR REMOVED

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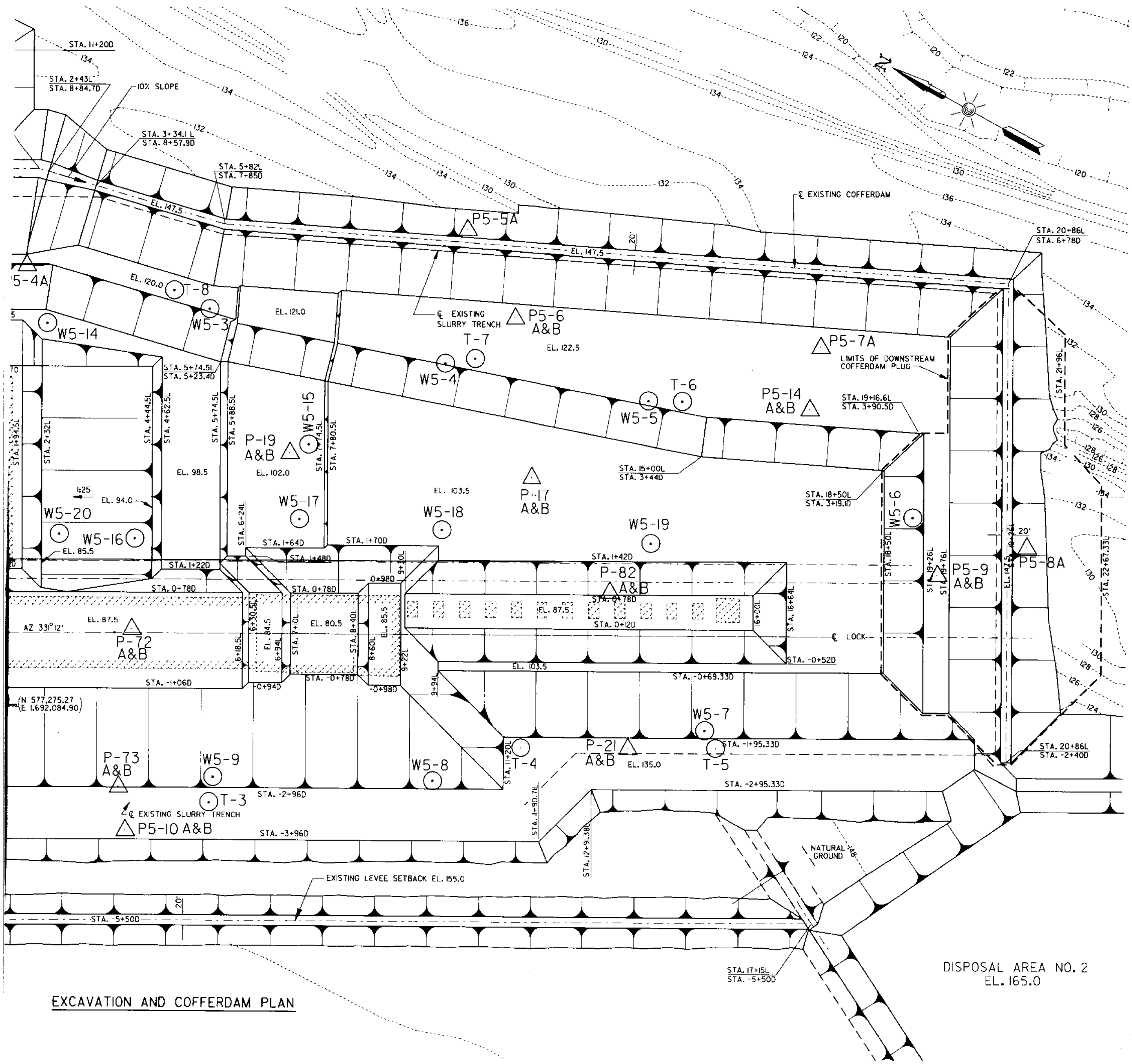
1006



EXCAVATION AND COFFERDAM PLAN

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

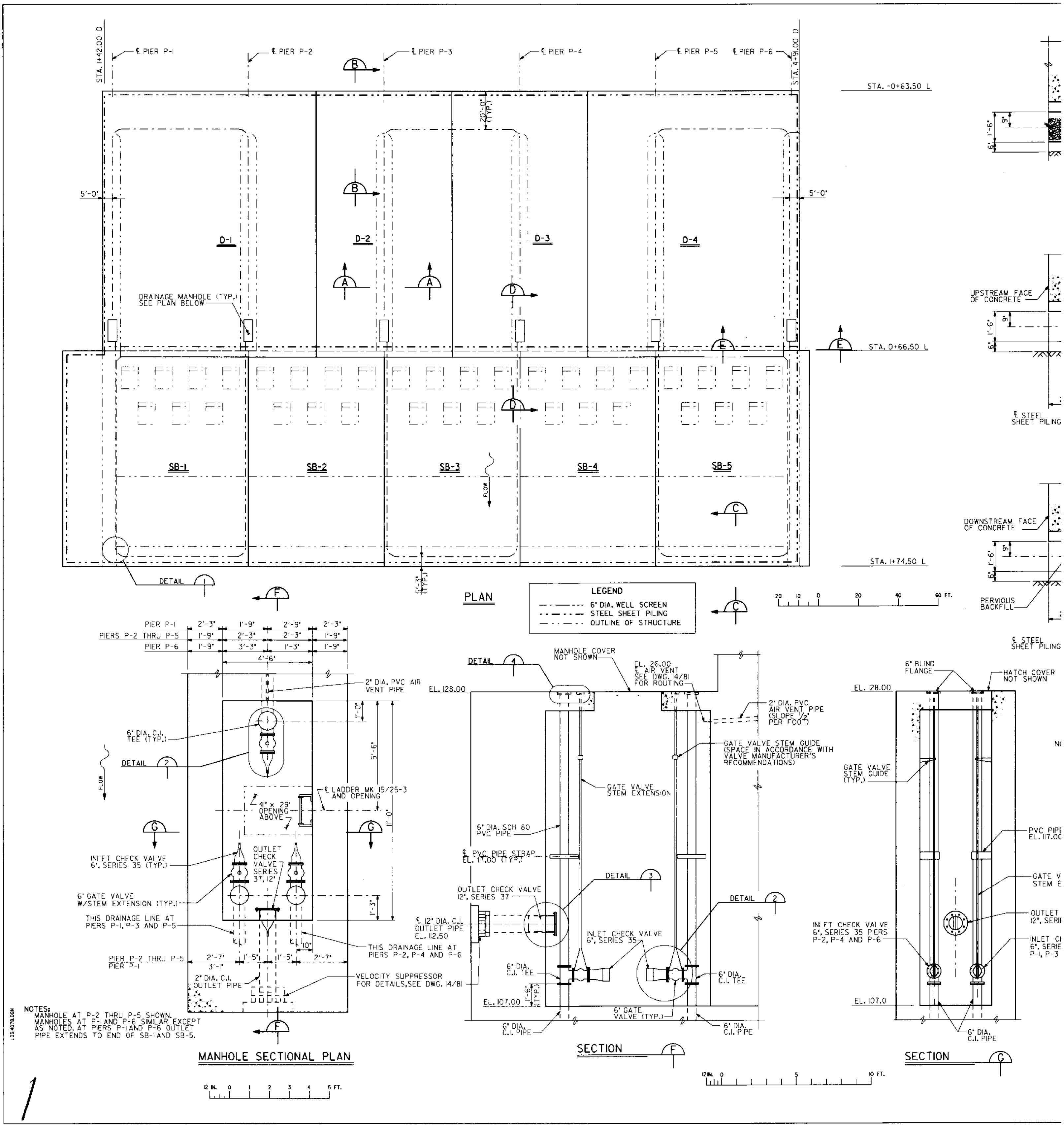
JOE D. WAGGONNER JR. LOCK AND DAM

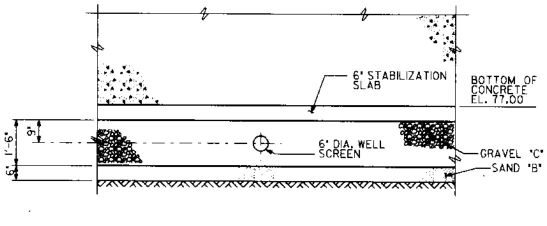
FOUNDATION REPORT

DEWATERING AND MONITORING PLAN

2

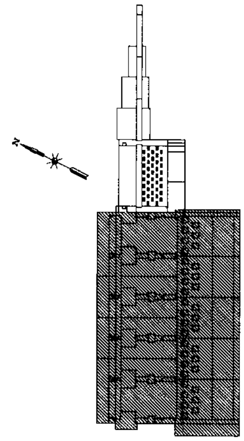
DATE: JANURARY 1996 FILE NO. FILE NO. R-14-207 PLATE 18

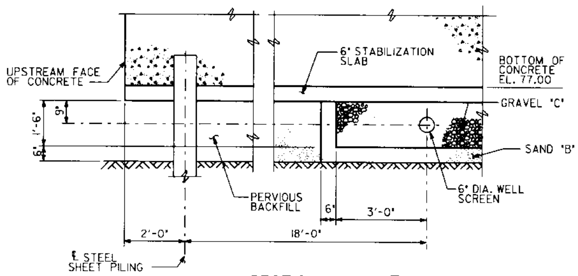

STA. 1+42.00 D
℄ PIER P-1
℄ PIER P-2
℄ PIER P-3
℄ PIER P-4
℄ PIER P-5
℄ PIER P-6
STA. 4+91.00 D
STA. -0+63.50 L
20'-0" (TYP.)
5'-0"
D-1
D-2
D-3
D-4
DRAINAGE MANHOLE (TYP.) SEE PLAN BELOW
STA. 0+66.50 L
SB-1
SB-2
SB-3
SB-4
SB-5
FLOW
STA. 1+74.50 L
DETAIL 1
5'-3" (TYP.)
PLAN
LEGEND
6" DIA. WELL SCREEN
STEEL SHEET PILING
OUTLINE OF STRUCTURE
20 10 0 20 40 60 FT.
UPSTREAM FACE OF CONCRETE
DOWNSTREAM FACE OF CONCRETE
℄ STEEL SHEET PILING
PERVIOUS BACKFILL
PIER P-1 2'-3" 1'-9" 2'-9" 2'-3"
PIERS P-2 THRU P-5 1'-9" 2'-3" 2'-3" 1'-9"
PIER P-6 1'-9" 3'-3" 1'-3" 1'-9"
4'-6"
2" DIA. PVC AIR VENT PIPE
6" DIA. C.I. TEE (TYP.)
DETAIL 2
1'-0"
5'-6"
11'-0"
1'-3"
℄ LADDER MK 15/25-3 AND OPENING
41" x 29" OPENING ABOVE
INLET CHECK VALVE 6", SERIES 35 (TYP.)
OUTLET CHECK VALVE SERIES 37, 12"
6" GATE VALVE W/STEM EXTENSION (TYP.)
THIS DRAINAGE LINE AT PIERS P-1, P-3 AND P-5
THIS DRAINAGE LINE AT PIERS P-2, P-4 AND P-6
10"
PIER P-2 THRU P-5 2'-7" 1'-5" 1'-5" 2'-7"
PIER P-1 3'-1"
12" DIA. C.I. OUTLET PIPE
VELOCITY SUPPRESSOR FOR DETAILS, SEE DWG. 14/81
NOTES:
MANHOLE AT P-2 THRU P-5 SHOWN. MANHOLES AT P-1 AND P-6 SIMILAR EXCEPT AS NOTED. AT PIERS P-1 AND P-6 OUTLET PIPE EXTENDS TO END OF SB-1 AND SB-5.
MANHOLE SECTIONAL PLAN
12 IN. 0 1 2 3 4 5 FT.
DETAIL 4
MANHOLE COVER NOT SHOWN
EL. 126.00 ℄ AIR VENT SEE DWG. 14/81 FOR ROUTING
EL. 128.00
2" DIA. PVC AIR VENT PIPE (SLOPE 1/2" PER FOOT)
GATE VALVE STEM GUIDE (SPACE IN ACCORDANCE WITH VALVE MANUFACTURER'S RECOMMENDATIONS)
GATE VALVE STEM EXTENSION
6" DIA. SCH 80 PVC PIPE
℄ PVC PIPE STRAP EL. 117.00 (TYP.)
DETAIL 3
OUTLET CHECK VALVE 12", SERIES 37
℄ 12" DIA. C.I. OUTLET PIPE EL. 112.50
DETAIL 2
INLET CHECK VALVE 6", SERIES 35
6" DIA. C.I. TEE
1'-6" (TYP.)
EL. 107.00
6" GATE VALVE (TYP.)
6" DIA. C.I. PIPE
SECTION F
12 IN. 0 5 10 FT.
6" BLIND FLANGE
HATCH COVER NOT SHOWN
EL. 128.00
GATE VALVE STEM GUIDE (TYP.)
PVC PIPE EL. 117.00
GATE VALVE STEM E
OUTLET 12", SERIE
INLET CHECK VALVE 6", SERIES 35 PIERS P-2, P-4 AND P-6
INLET C 6", SERIE P-1, P-3
EL. 107.0
6" DIA. C.I. PIPE
SECTION G
LOS4078.DGN
1



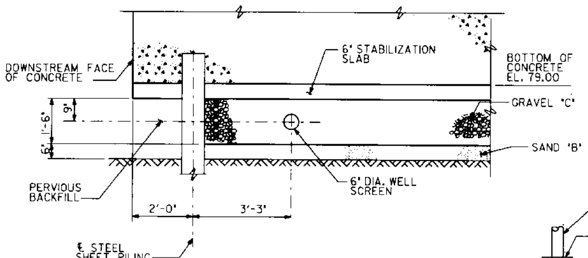
SECTION A

NOTE: TYPICAL AT PIERS P-2 THRU P-5

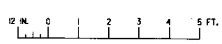


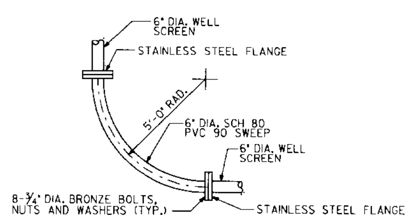


SECTION B



SECTION C

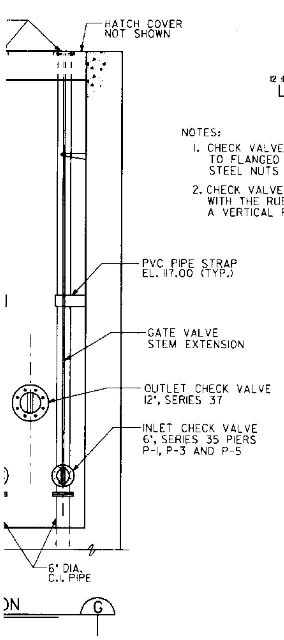




DETAIL

NOTE: TYPICAL AT ALL CORNERS

NOTES:
1. CHECK VALVES SHALL BE FASTENED TO FLANGED PIPE WITH STAINLESS STEEL NUTS AND BOLTS.
2. CHECK VALVES SHALL BE INSTALLED WITH THE RUBBER DUCKBILL IN A VERTICAL POSITION.



...ON G

NOTE.

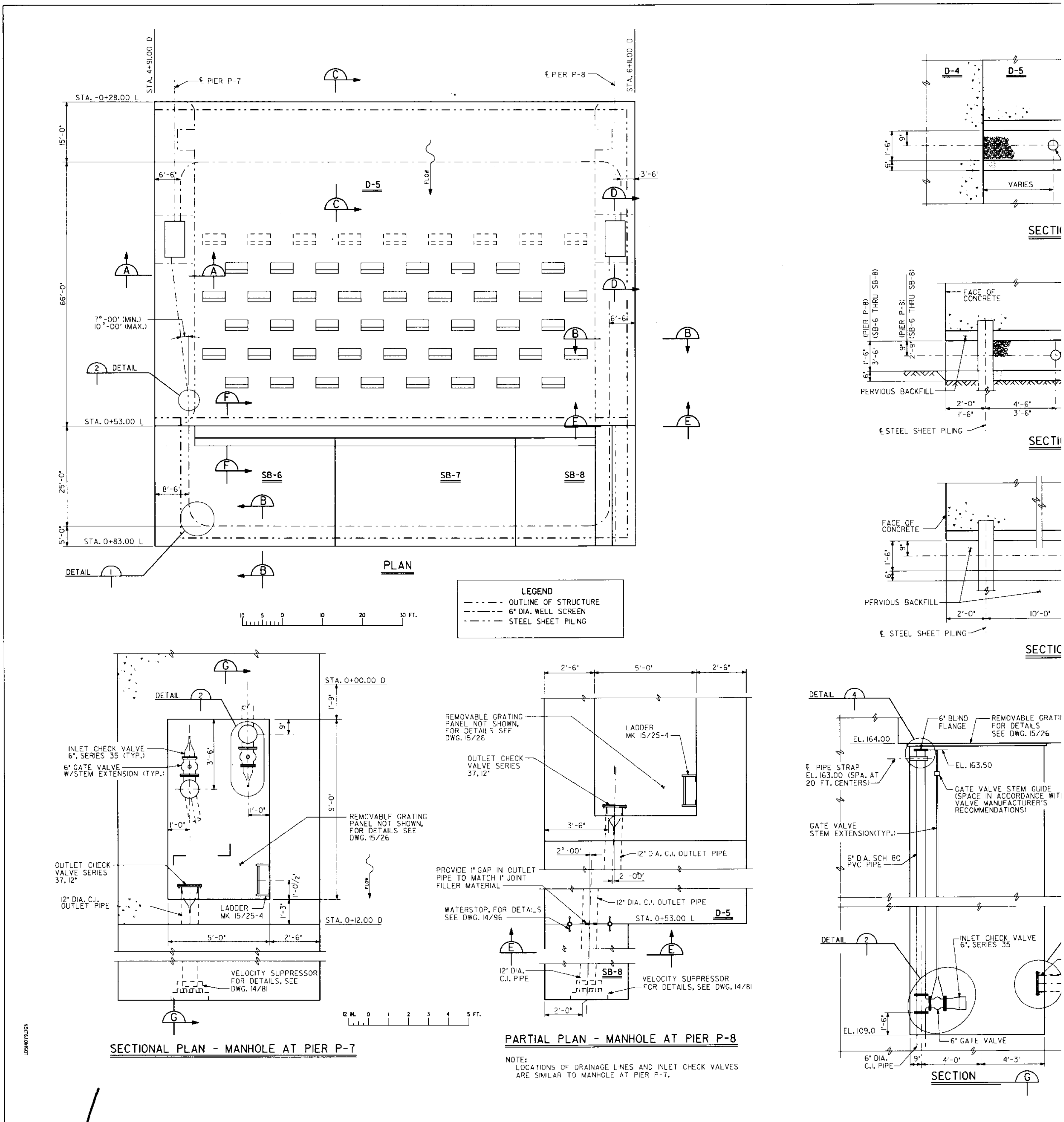
FOR SECTION D-D SEE PLATE 21
FOR SECTION E-E SEE PLATE 22

2

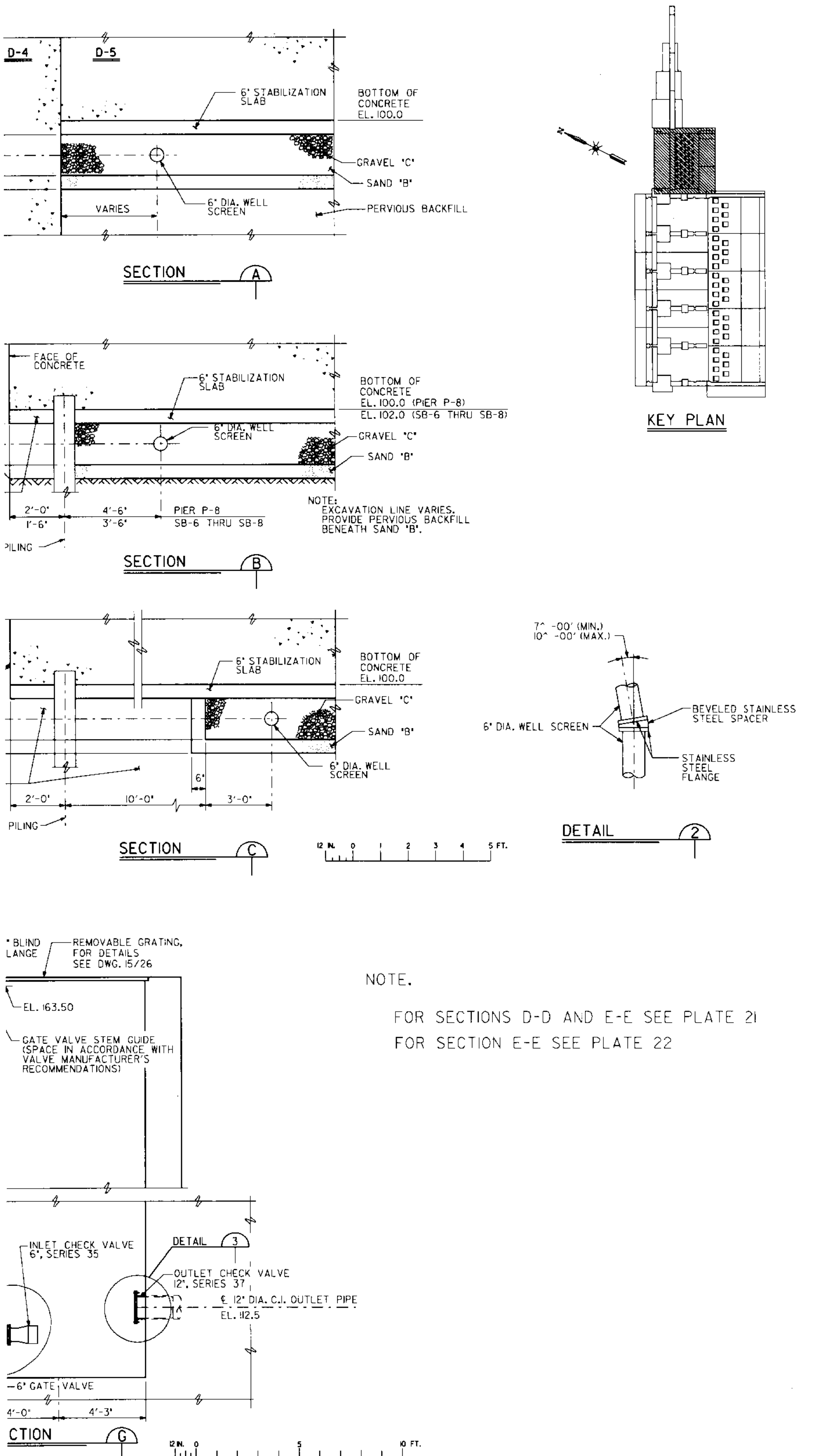
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM
FOUNDATION REPORT
MONOLITHS D-1 THRU D-4
UNDERDRAIN SYSYEM

DATE: JANUARY 1996 | FILE NO. R-14-207 | PLATE 19



PLAN
STA. 4+91.00 D
STA. 6+11.00 D
℄ PIER P-7
℄ PIER P-8
STA. -0+28.00 L
STA. 0+53.00 L
STA. 0+83.00 L
D-5
FLOW
SB-6
SB-7
SB-8
7°-00' (MIN.)
10°-00' (MAX.)
DETAIL 2
DETAIL 1
LEGEND
OUTLINE OF STRUCTURE
6" DIA. WELL SCREEN
STEEL SHEET PILING
SECTIONAL PLAN - MANHOLE AT PIER P-7
STA. 0+00.00 D
STA. 0+12.00 D
INLET CHECK VALVE 6", SERIES 35 (TYP.)
6" GATE VALVE W/STEM EXTENSION (TYP.)
REMOVABLE GRATING PANEL NOT SHOWN, FOR DETAILS SEE DWG. 15/26
OUTLET CHECK VALVE SERIES 37, 12"
12" DIA. C.I. OUTLET PIPE
LADDER MK 15/25-4
VELOCITY SUPPRESSOR FOR DETAILS, SEE DWG. 14/81
PARTIAL PLAN - MANHOLE AT PIER P-8
REMOVABLE GRATING PANEL NOT SHOWN, FOR DETAILS SEE DWG. 15/26
OUTLET CHECK VALVE SERIES 37, 12"
LADDER MK 15/25-4
12" DIA. C.I. OUTLET PIPE
PROVIDE 1" GAP IN OUTLET PIPE TO MATCH 1" JOINT FILLER MATERIAL
WATERSTOP, FOR DETAILS SEE DWG. 14/96
STA. 0+53.00 L
12" DIA. C.I. PIPE
VELOCITY SUPPRESSOR FOR DETAILS, SEE DWG. 14/81
NOTE:
LOCATIONS OF DRAINAGE LINES AND INLET CHECK VALVES ARE SIMILAR TO MANHOLE AT PIER P-7.
D-4
D-5
VARIES
SECTI
FACE OF CONCRETE
(PIER P-8) (SB-6 THRU SB-8)
PERVIOUS BACKFILL
℄ STEEL SHEET PILING
SECTI
SECTI
DETAIL 4
6" BLIND FLANGE
REMOVABLE GRATIN FOR DETAILS SEE DWG. 15/26
EL. 164.00
EL. 163.50
℄ PIPE STRAP EL. 163.00 (SPA. AT 20 FT. CENTERS)
GATE VALVE STEM GUIDE (SPACE IN ACCORDANCE WIT VALVE MANUFACTURER'S RECOMMENDATIONS)
GATE VALVE STEM EXTENSION(TYP.)
6" DIA. SCH 80 PVC PIPE
DETAIL 2
INLET CHECK VALVE 6", SERIES 35
EL. 109.0
6" GATE VALVE
6" DIA. C.I. PIPE
SECTION G
LD6H0792.DGN



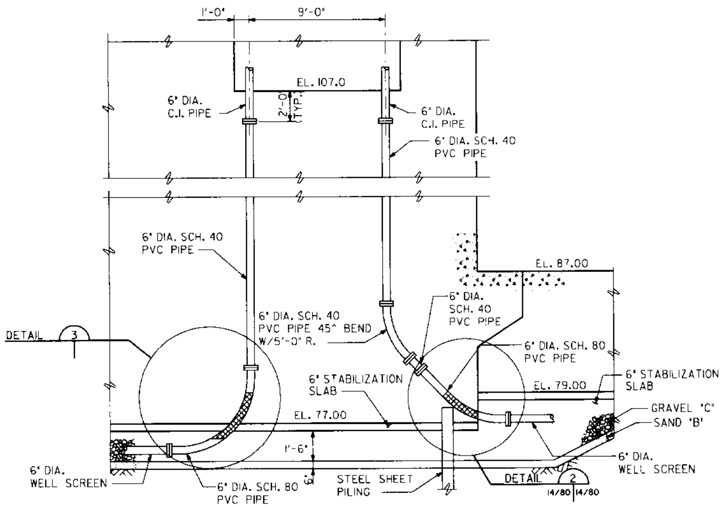
NOTE.

FOR SECTIONS D-D AND E-E SEE PLATE 21
FOR SECTION E-E SEE PLATE 22

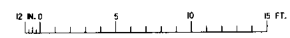
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

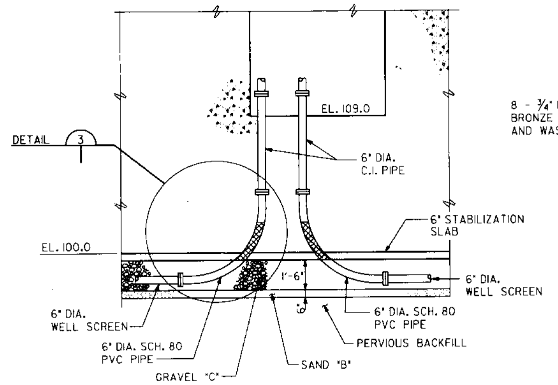
JOE D. WAGGONNER JR. LOCK AND DAM
FOUNDATION REPORT
MONOLITH D-5
UNDERDRAIN SYSTEM

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 20

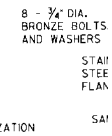


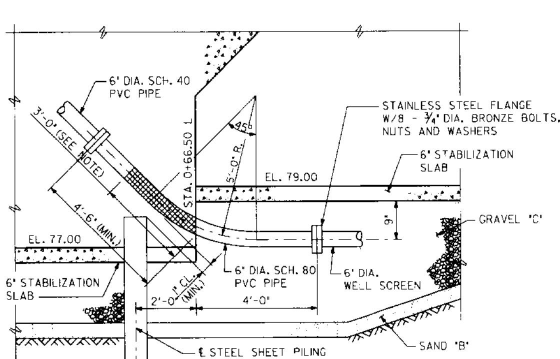
SECTION D





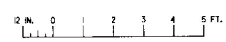
SECTION D

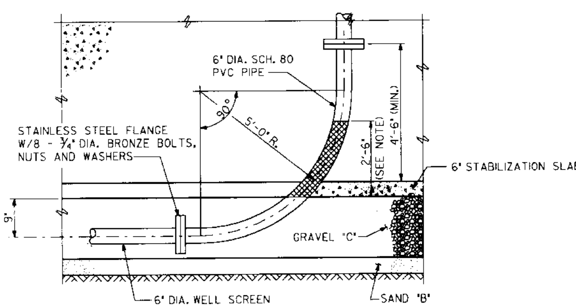




NOTE:
WRAP PVC PIPE WITH 1" PREMOLDED JOINT FILLER AND WITH TAPE.

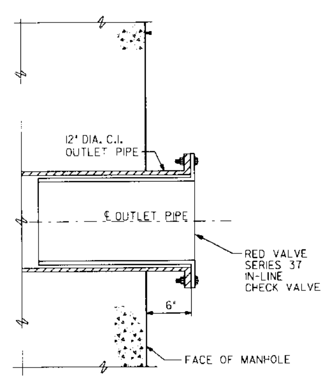
DETAIL 2



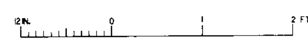


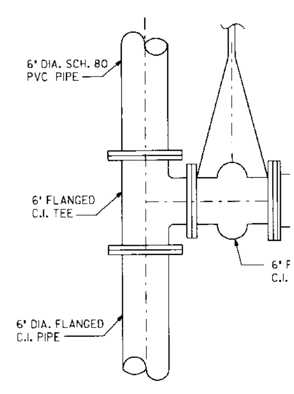
DETAIL 3

NOTE:
WRAP PVC PIPE WITH 1" PREMOLDED JOINT FILLER AND WRAP JOINT FILLER WITH TAPE.

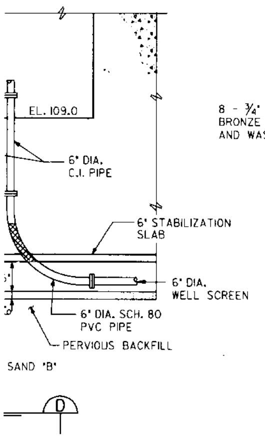


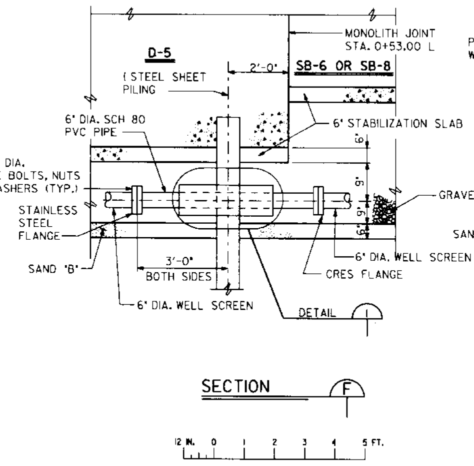
DETAIL 3

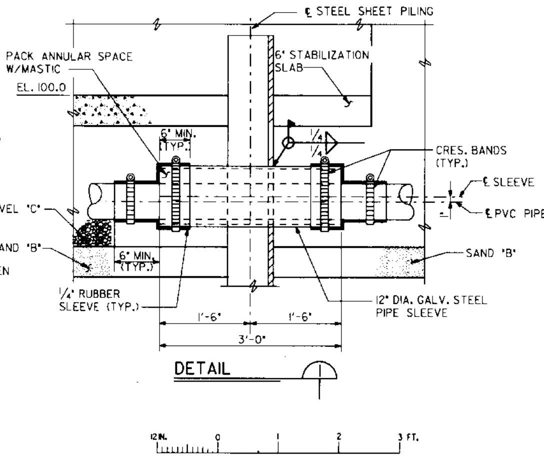


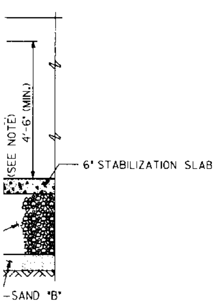


DETAIL







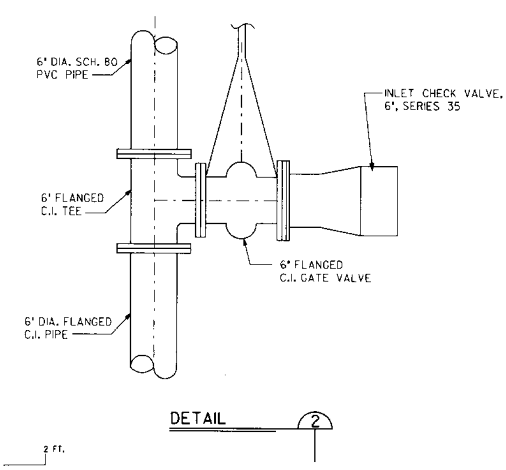


NOTES:

1. WHERE CRES. PLATES OR FLANGES BOLT TO CAST IRON, DRILL HOLES IN FLANGE OR PLATE AND DIELECTRIC GASKET FOR ⅞" CRES. BOLTS, NUTS AND WASHERS W/DIELECTRIC PLASTIC BOLT SLEEVES AND FLAT WASHERS.
2. THE MACHINED SURFACE OF STAINLESS STEEL PIPE SHALL BE SQUARE AND HORIZONTAL IN ALL DIRECTIONS PRIOR TO ACCEPTANCE BY THE CONTRACTING OFFICER.

NOTES.

1. FOR LOCATION OF SECTION D-D AND DETAILS 2 AND 3 SEE PLATE 19
2. FOR LOCATIONS OF D-D AND F-F AND DETAILS 2 AND 3 SEE PLATE 20



2

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

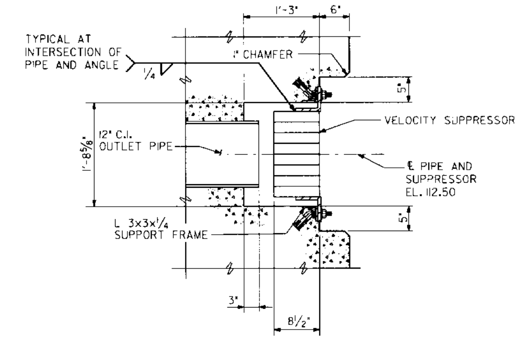
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

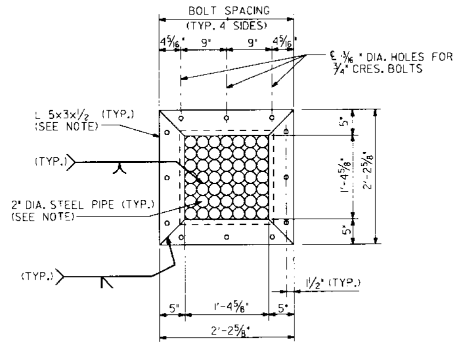
UNDERDRAIN SYSTEM

SECTIONS AND DETAILS

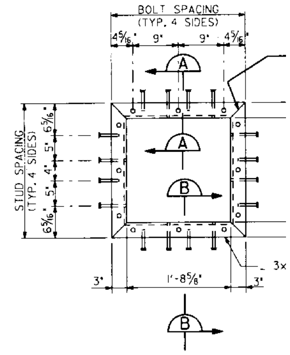
DATE: JANURARY 1996 | FILE NO. R-14-207 | PLATE 21



SECTIONAL ELEVATION



ELEVATION

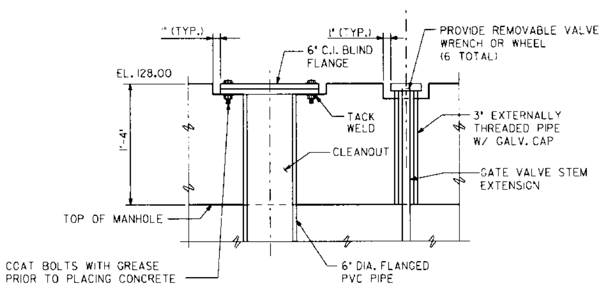


ELEVATION - SUPPORT FRAME

12 IN. 0 1 2 3 FT.

VELOCITY SUPPRESSOR

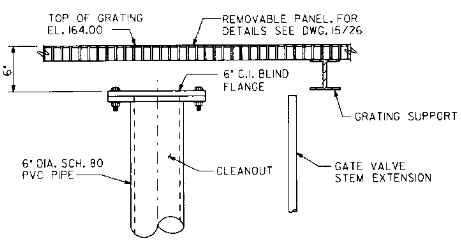
NOTE:
GALVANIZE VELOCITY SUPPRESSOR AND SUPPORT FRAME AFTER WELDING.



DETAIL 4

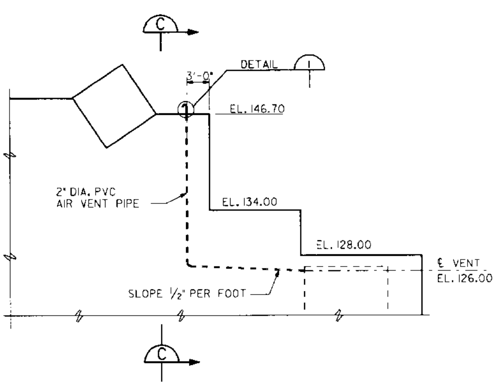
12 IN. 0 1 2 FT.

NOTE:
STAMP 6" C.I. BLIND FLANGE "DAM INFLOW" OR "BASIN INFLOW" AS APPLICABLE



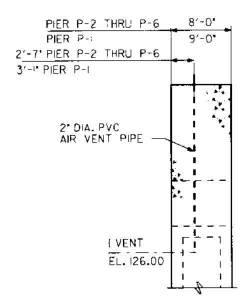
DETAIL 4

NOTE:
PROVIDE REMOVABLE VALVE WRENCH OR WHEEL (2 TOTAL)
STAMP 6" C.I. BLIND FLANGE "DAM INFLOW" OR "BASIN INFLOW" AS APPLICABLE. PROVIDE PERMANENT IDENTIFICATION TAGS ON GATE VALVE EXTENSIONS.



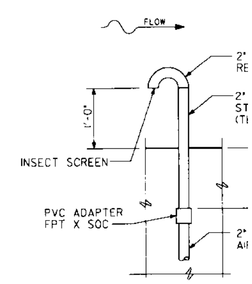
MANHOLE AIR VENT

10 FT. 0 10 20 FT.



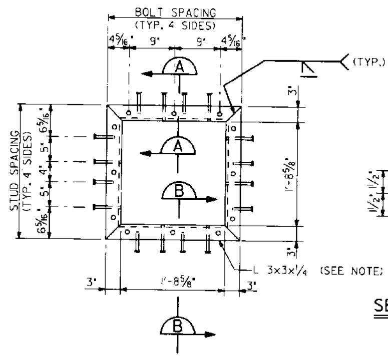
SECTION C

10 FT. 0 10 20 FT.

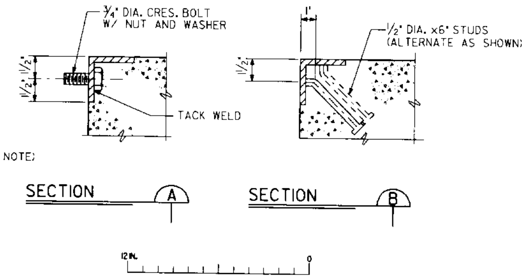


DETAIL

12 IN. 0 1



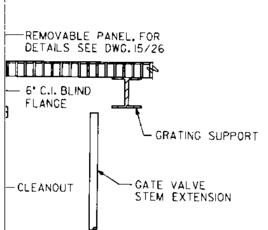
ELEVATION - SUPPORT FRAME

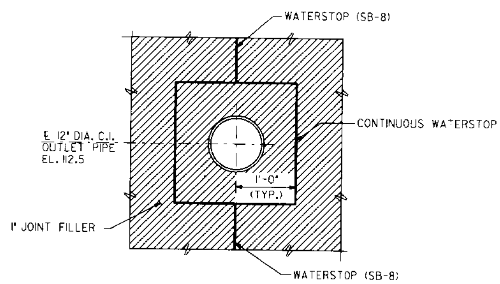


ES FOR
TS

CITY SUPPRESSOR

ZE VELOCITY SUPPRESSOR
PPORT FRAME AFTER WELDING.





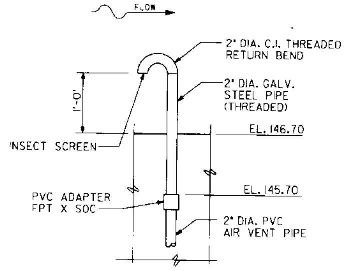
NOTE:
OUTLET PIPE SHALL BE DISCONTINUOUS AT MONOLITH JOINT.
PROVIDE 1" GAP TO MATCH 1" JOINT FILLER MATERIAL.
PROTECT END OF PIPE DURING CONCRETE PLACEMENT.

SECTION E

12 IN. 0 1 2 3 FT.

4

BLE VALVE WRENCH OR WHEEL (2 TOTAL)
ND FLANGE "DAM INFLOW" OR "BASIN INFLOW"
PROVIDE PERMANENT IDENTIFICATION TAGS ON
ENSIONS.



DETAIL I

12 IN. 0 1 2 3 FT.

20 FT.

NOTE.

FOR LOCATION OF SECTION E-E
AND DETAIL 4 SEE PLATE 19 AND 20

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
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JOE D. WAGGONNER JR. LOCK AND DAM

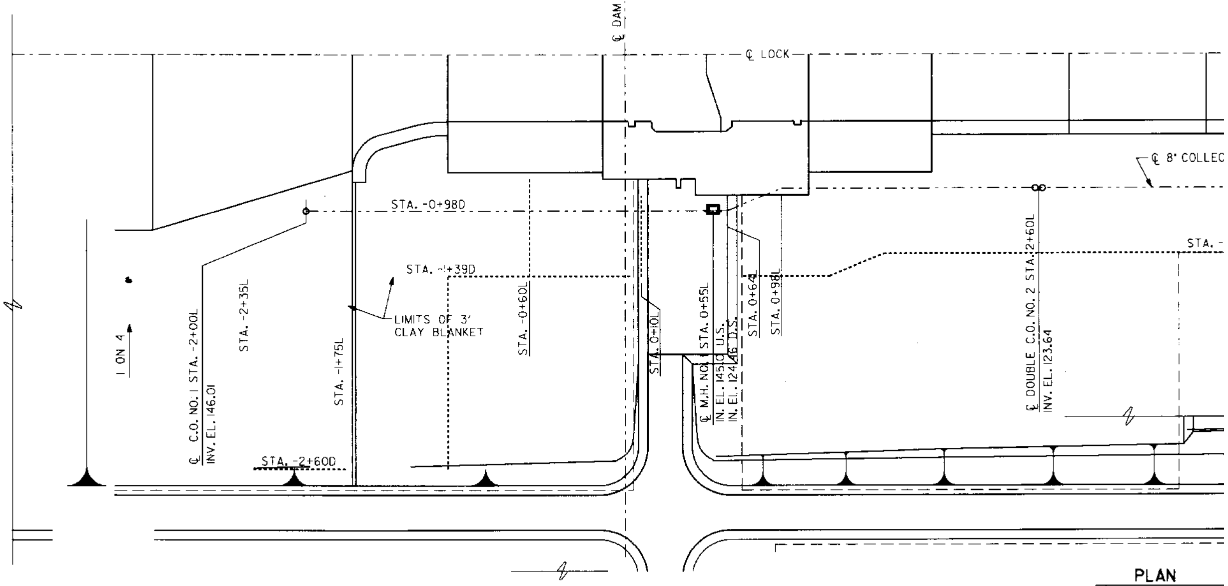
FOUNDATION REPORT

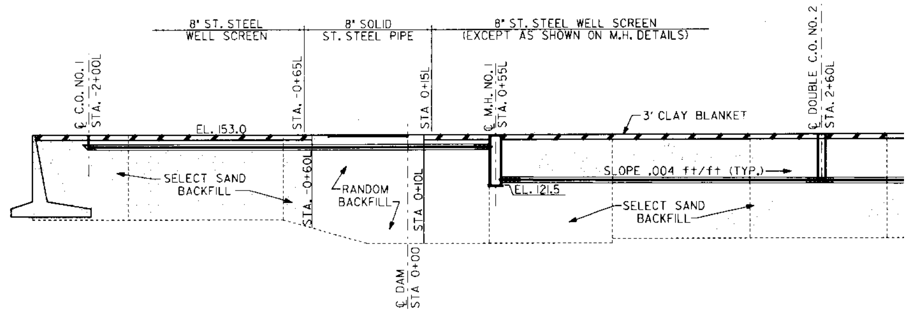
MONOLITHS D-1 THRU D-4

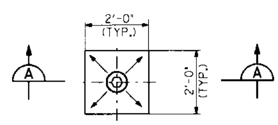
UNDERDRAIN SYSTEM DETAILS

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 22

2

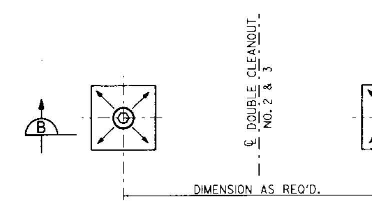




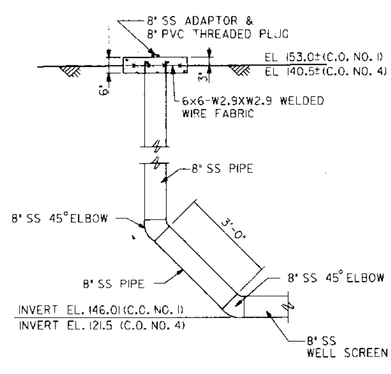


PLAN - CLEANOUT NO. 1 & 4

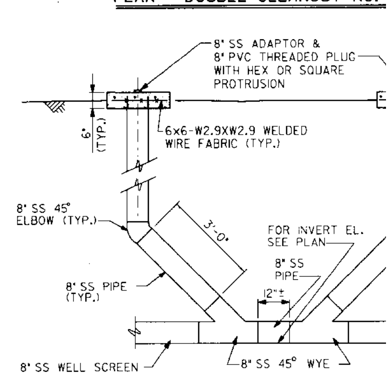
SCALE: 1/2 IN. = 1 FT.



PLAN - DOUBLE CLEANOUT NO.

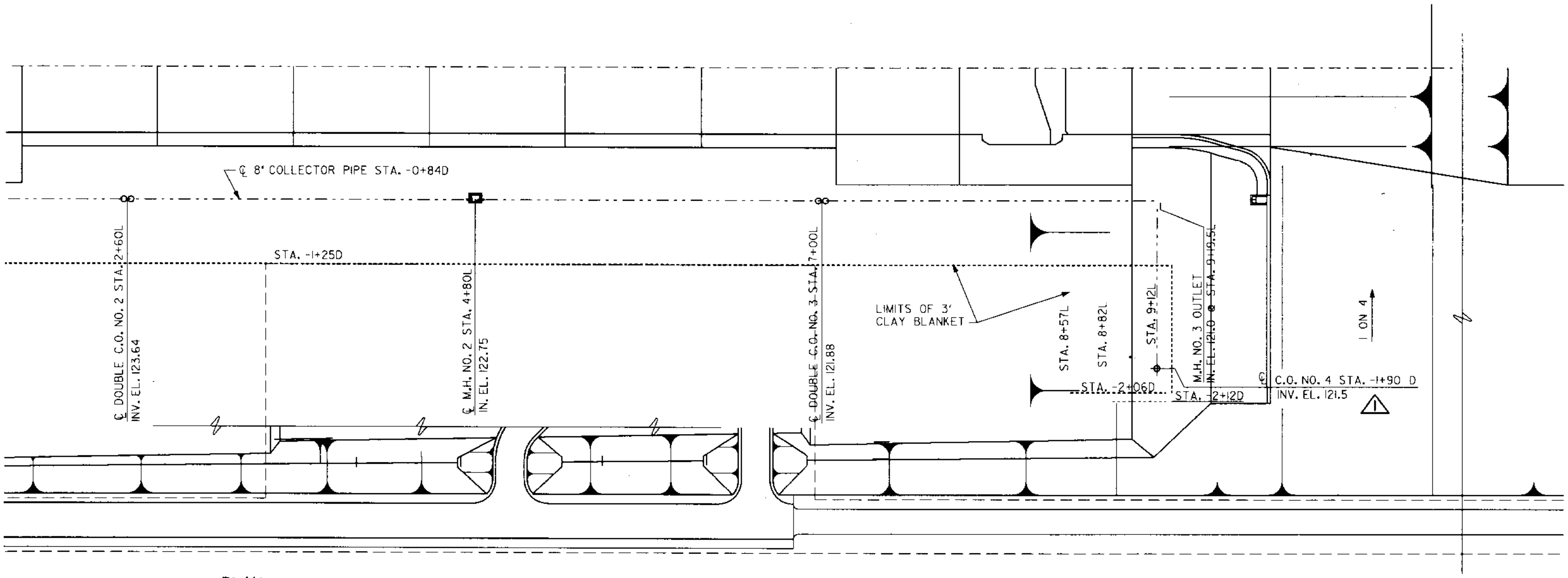


SECTION A

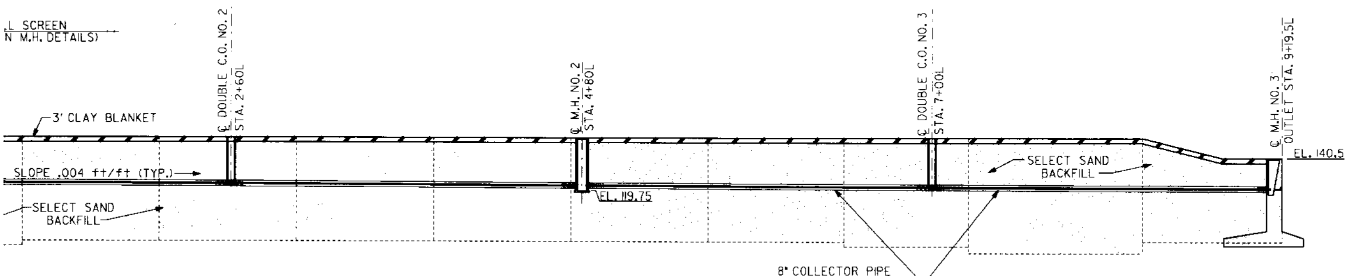


SECTION B

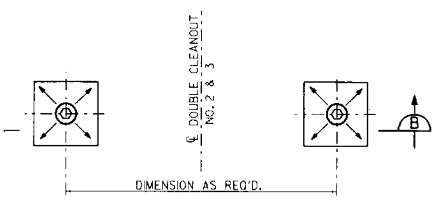
L0505015.DGN
40I



PLAN



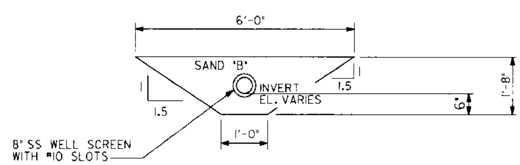
PROFILE



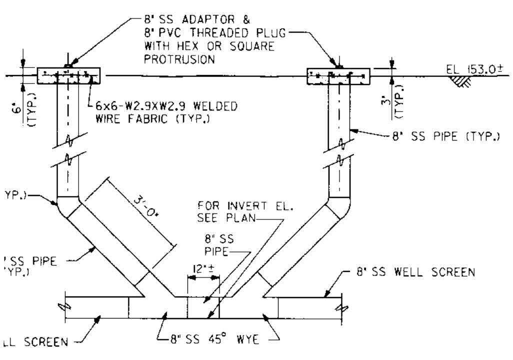
PLAN - DOUBLE CLEANOUT NO. 2 & 3

NOTE:

FOR DETAILS OF MANHOLE NO. 1 AND NO. 2 SEE PLATE 24 FOR DETAILS OF MANHOLE NO. 3 SEE PLATE 25 AND 26



DRAIN PIPE AND FILTER DETAIL



SECTION B

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

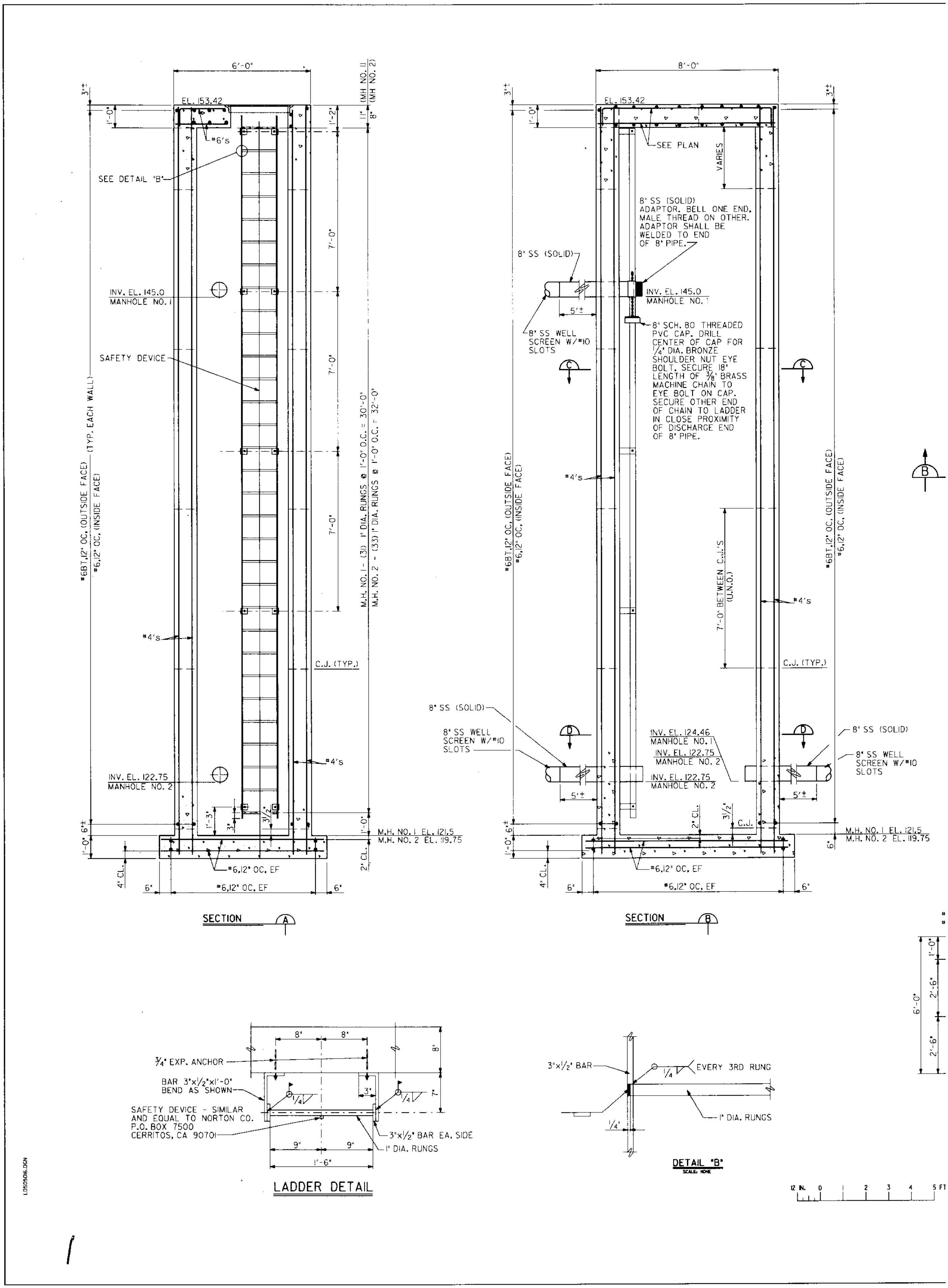
JOE D. WAGGONNER JR. LOCK AND DAM

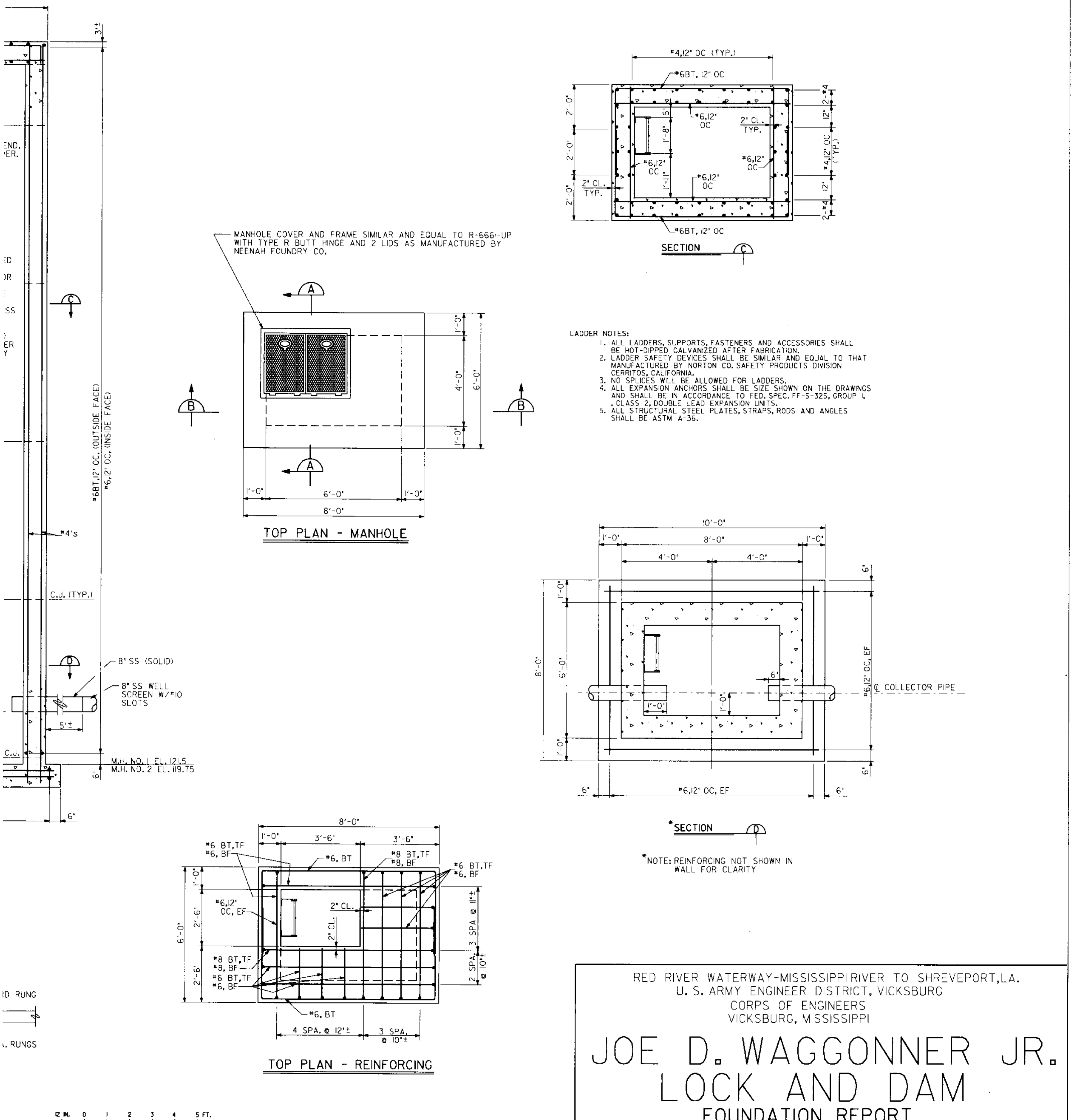
FOUNDATION REPORT

LOCK COLLECTOR DRAINAGE SYSTEM

2

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 23


6'-0"
EL. 153.42
#6's
SEE DETAIL "B"
INV. EL. 145.0
MANHOLE NO. 1
SAFETY DEVICE
#6BT,12" OC, (OUTSIDE FACE) (TYP. EACH WALL)
#6,12" OC, (INSIDE FACE)
M.H. NO. 1 - (31) 1" DIA. RUNGS @ 1'-0" O.C. = 30'-0"
M.H. NO. 2 - (33) 1" DIA. RUNGS @ 1'-0" O.C. = 32'-0"
#4's
C.J. (TYP.)
INV. EL. 122.75
MANHOLE NO. 2
M.H. NO. 1 EL. 121.5
M.H. NO. 2 EL. 119.75
#6,12" OC, EF
SECTION A
8'-0"
SEE PLAN
VARIES
8" SS (SOLID) ADAPTOR. BELL ONE END, MALE THREAD ON OTHER. ADAPTOR SHALL BE WELDED TO END OF 8" PIPE.
8" SS (SOLID)
8" SS WELL SCREEN W/#10 SLOTS
8" SCH. 80 THREADED PVC CAP. DRILL CENTER OF CAP FOR 1/4" DIA. BRONZE SHOULDER NUT EYE BOLT. SECURE 18" LENGTH OF 3/8" BRASS MACHINE CHAIN TO EYE BOLT ON CAP. SECURE OTHER END OF CHAIN TO LADDER IN CLOSE PROXIMITY OF DISCHARGE END OF 8" PIPE.
7'-0" BETWEEN C.J.'S (U.N.O.)
INV. EL. 124.46
MANHOLE NO. 1
INV. EL. 122.75
MANHOLE NO. 2
SECTION B
3/4" EXP. ANCHOR
BAR 3"x1/2"x1'-0" BEND AS SHOWN
SAFETY DEVICE - SIMILAR AND EQUAL TO NORTON CO. P.O. BOX 7500 CERRITOS, CA 90701
3"x1/2" BAR EA. SIDE
1" DIA. RUNGS
LADDER DETAIL
3"x1/2" BAR
EVERY 3RD RUNG
1" DIA. RUNGS
DETAIL "B"
SCALE: NONE
12 IN. 0 1 2 3 4 5 FT
L05056.DGN



LADDER NOTES:

1. ALL LADDERS, SUPPORTS, FASTENERS AND ACCESSORIES SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
2. LADDER SAFETY DEVICES SHALL BE SIMILAR AND EQUAL TO THAT MANUFACTURED BY NORTON CO. SAFETY PRODUCTS DIVISION CERRITOS, CALIFORNIA.
3. NO SPLICES WILL BE ALLOWED FOR LADDERS.
4. ALL EXPANSION ANCHORS SHALL BE SIZE SHOWN ON THE DRAWINGS AND SHALL BE IN ACCORDANCE TO FED. SPEC. FF-S-325, GROUP I, CLASS 2, DOUBLE LEAD EXPANSION UNITS.
5. ALL STRUCTURAL STEEL PLATES, STRAPS, RODS AND ANGLES SHALL BE ASTM A-36.

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
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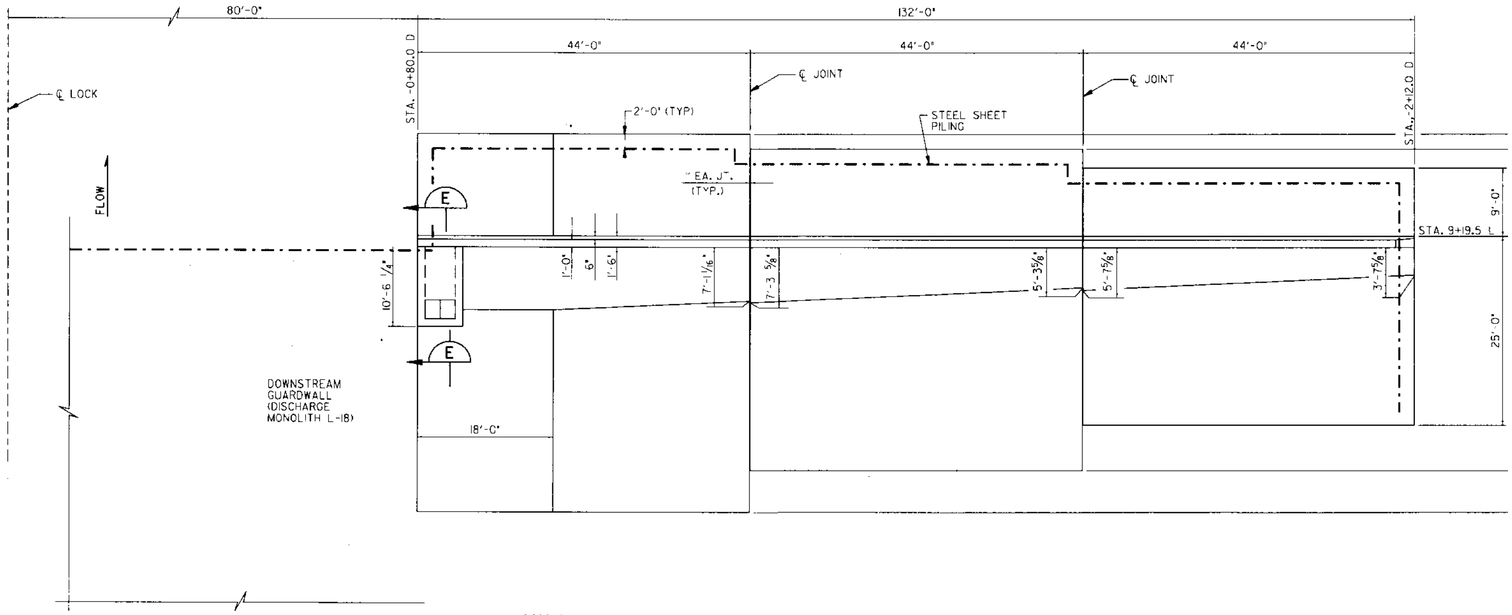
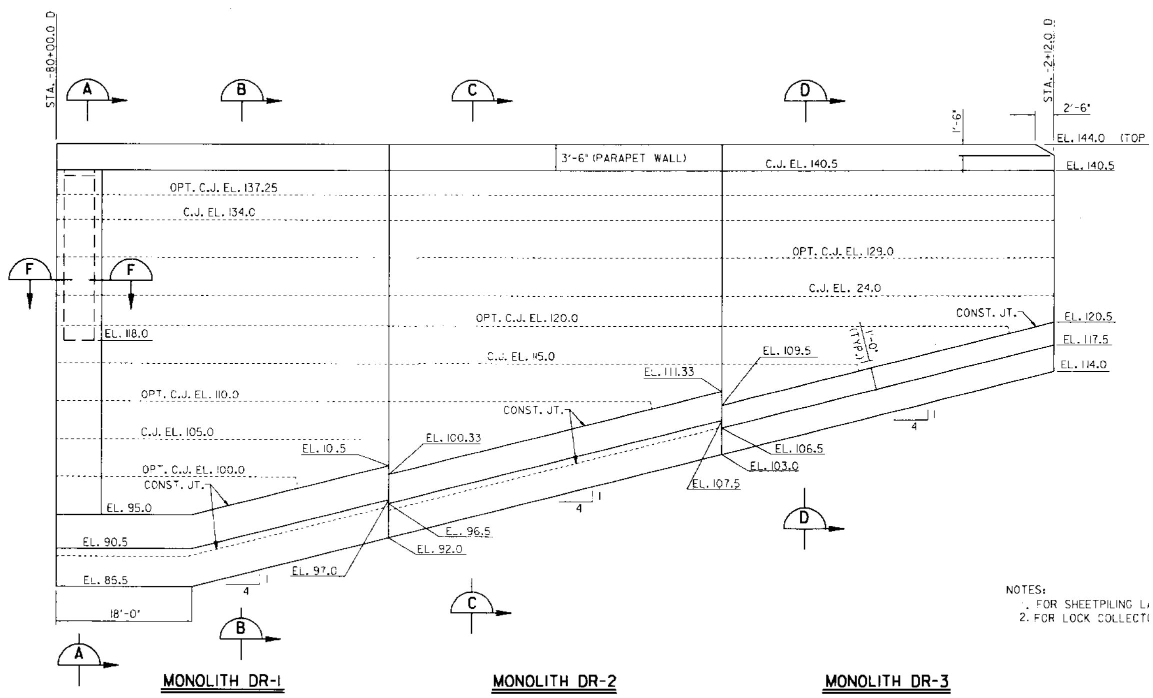
JOE D. WAGGONNER JR. LOCK AND DAM
FOUNDATION REPORT

MANHOLE DETAILS

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 24

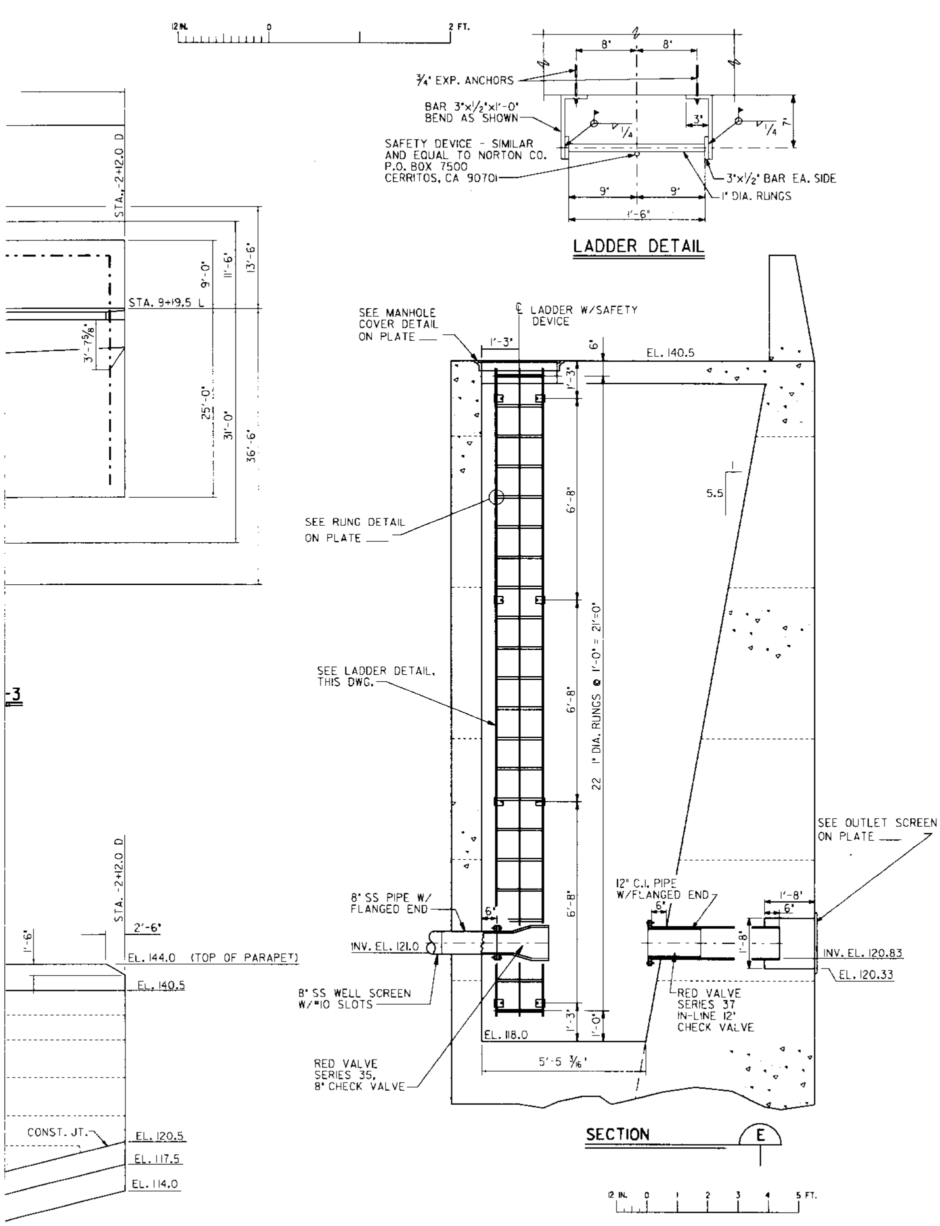


PLAN



NOTES:
1. FOR SHEETPILING L
2. FOR LOCK COLLECT

UPSTREAM ELEVATION



NOTES:
1. FOR SHEETPILING LAYOUT AND DETAILS SEE PLATE 27
2. FOR LOCK COLLECTOR DRAIN SYSTEM DETAILS SEE PLATE 23

2

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

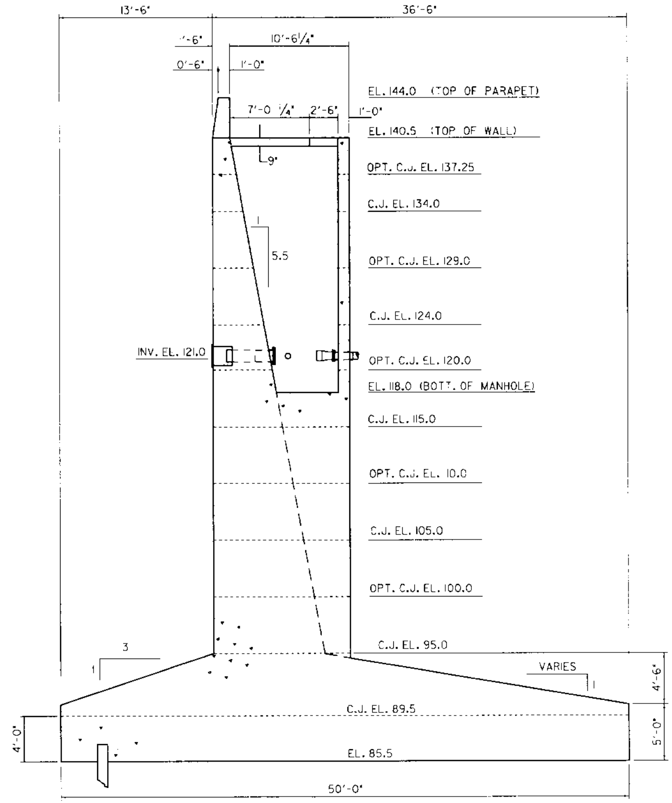
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

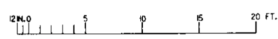
DOWNSTREAM RETURN WALL

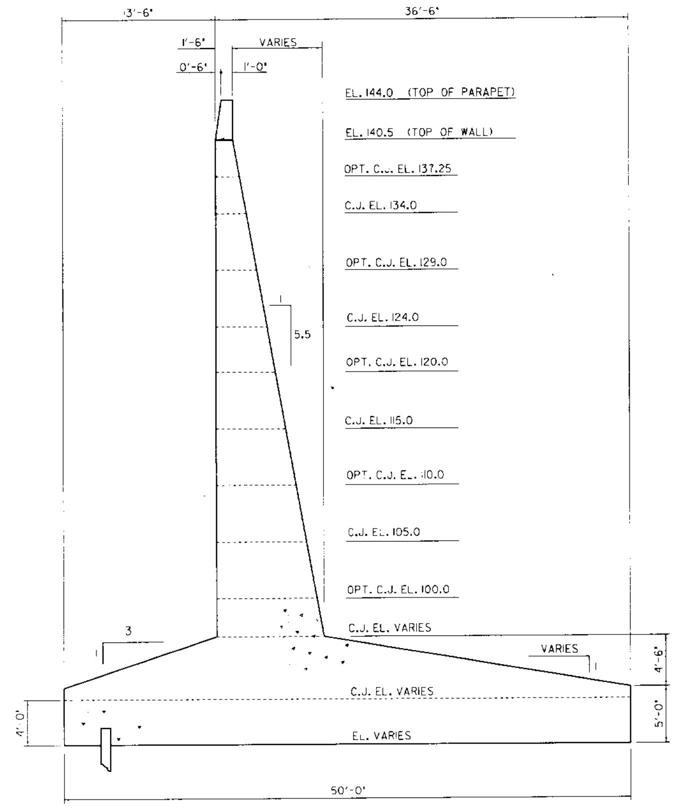
PLAN AND ELEVATION

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 25

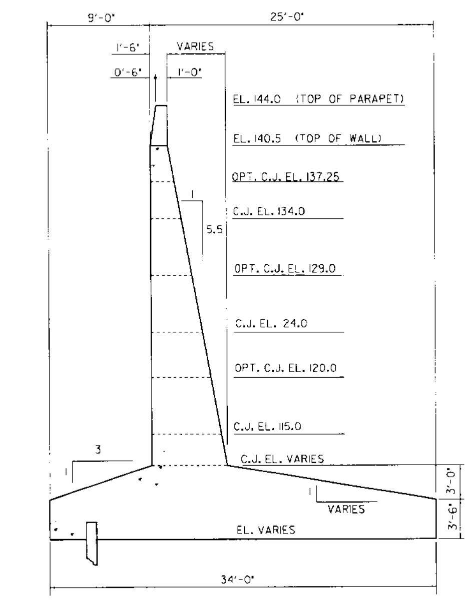


SECTION A

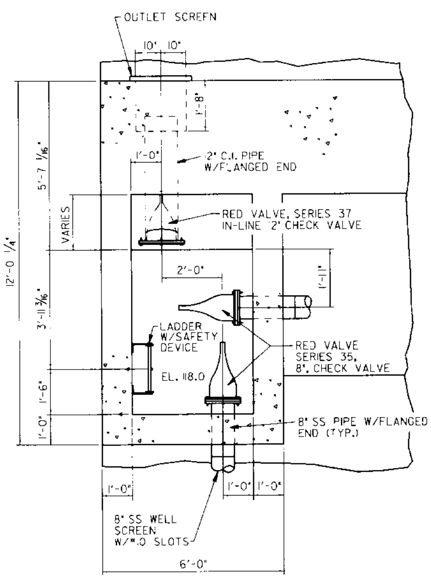




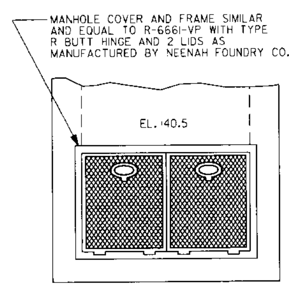
SECTION B



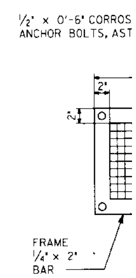
SECTION D



SECTION F



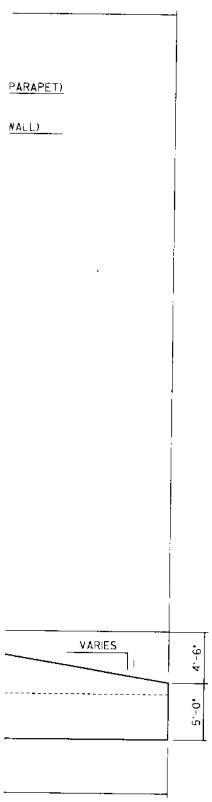
MANHOLE COVER DETAIL

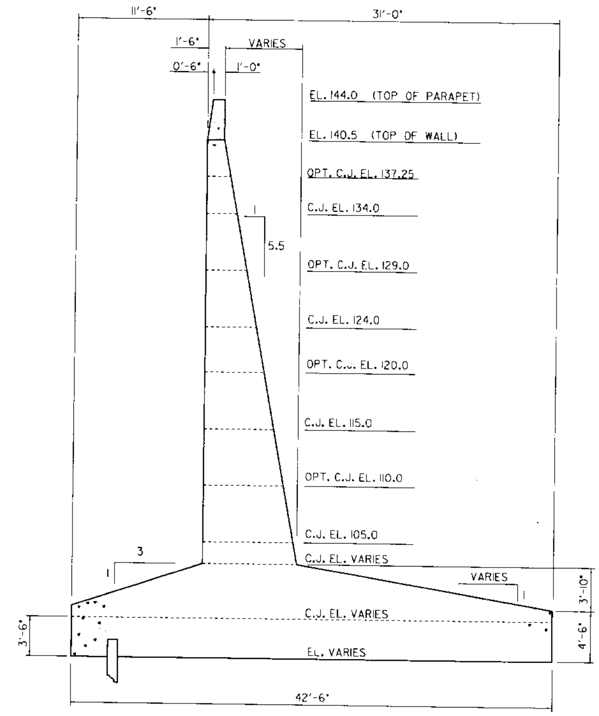


SCREE

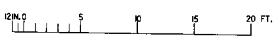
LADDER NOTES:

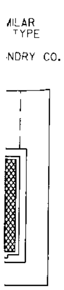
FOR LOCATION OF SECTIONS AND DETAILS SEE PLATE ____



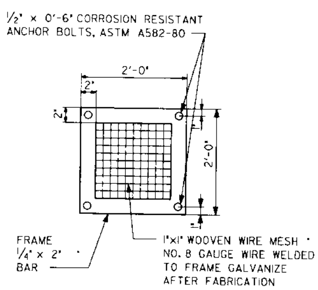


SECTION (C)

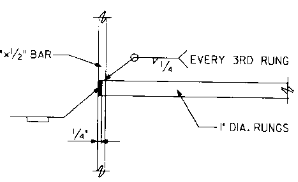




TAIL



SCREEN DETAIL



RUNG DETAIL

NS AND DETAILS SEE PLATE ____

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

DOWNSTREAM RETURN WALL SECTIONS

2

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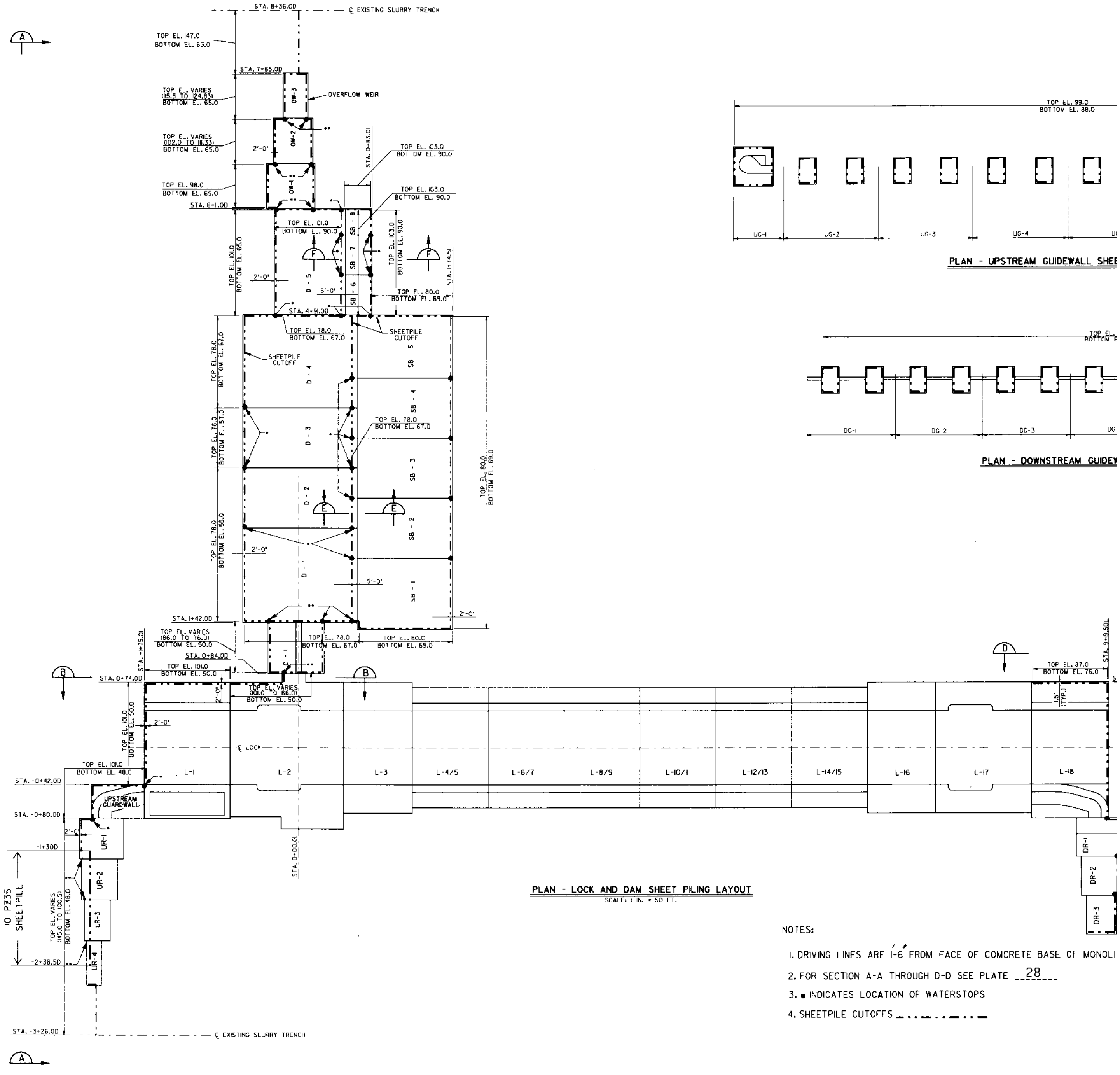


PLAN - UPSTREAM GUIDEWALL SHEE

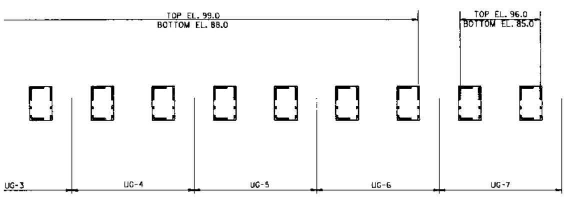
PLAN - DOWNSTREAM GUIDEW

PLAN - LOCK AND DAM SHEET PILING LAYOUT

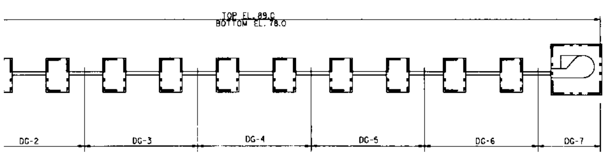
SCALE: 1 IN. = 50 FT.

NOTES:

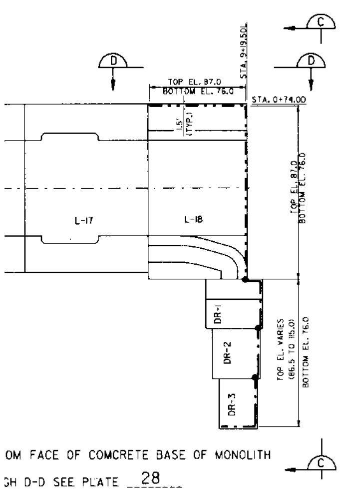
1. DRIVING LINES ARE 1'-6" FROM FACE OF COMCRETE BASE OF MONOLI
2. FOR SECTION A-A THROUGH D-D SEE PLATE 28
3. ● INDICATES LOCATION OF WATERSTOPS
4. SHEETPILE CUTOFFS — . . — . . — . . —

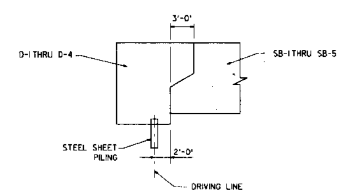


PLAN - UPSTREAM GUIDEWALL SHEET PILING LAYOUT



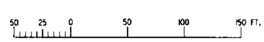
PLAN - DOWNSTREAM GUIDEWALL SHEET PILING LAYOUT





SECTION E
SCALE: NONE

SECTION F SIMILAR
SCALE: NONE



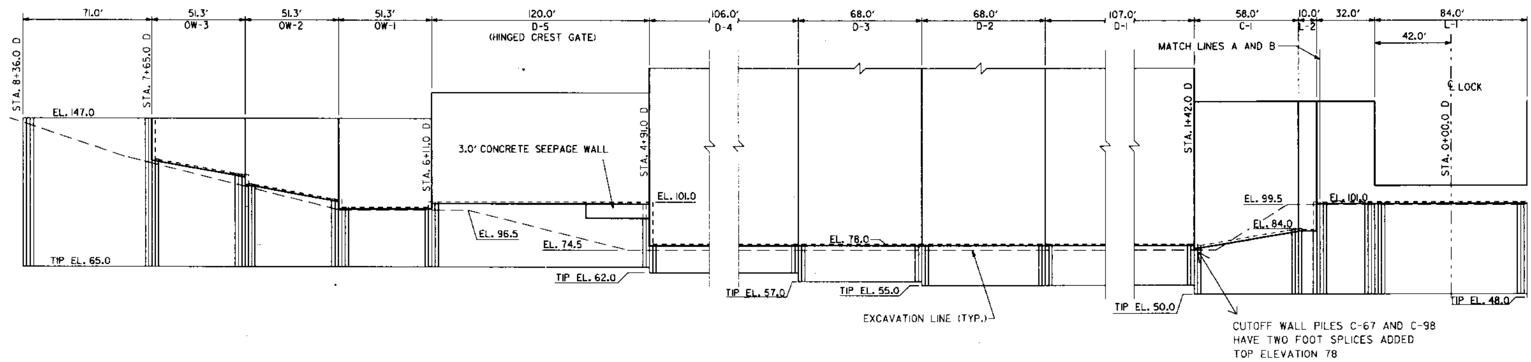
OM FACE OF COMCRETE BASE OF MONOLITH
GH D-D SEE PLATE 28
WATERSTOPS

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

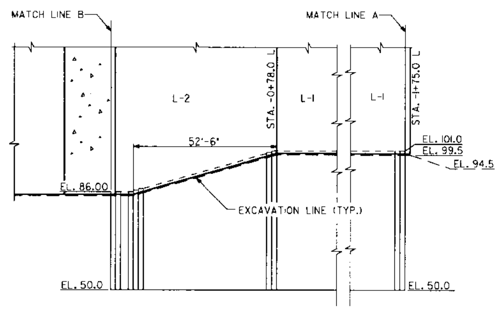
JOE D. WAGGONNER JR. LOCK AND DAM
FOUNDATION REPORT

LOCK AND DAM SHEET PILE LAYOUT

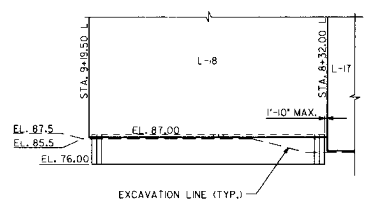
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 27



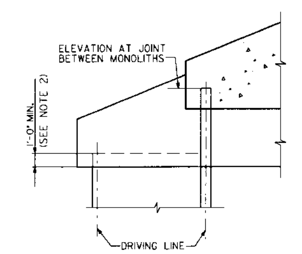
SECTION A



SECTION B

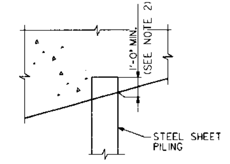


SECTION D

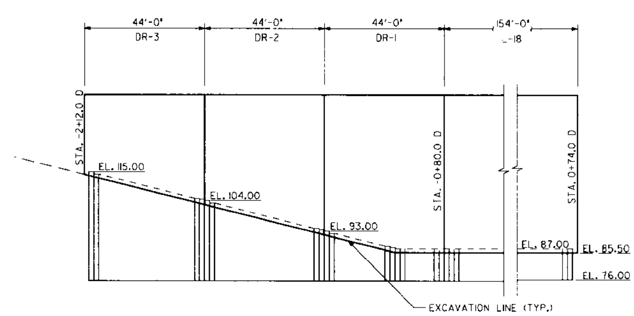


ELEVATION OF SHEET PILING AT ENDS OF MONOLITHS

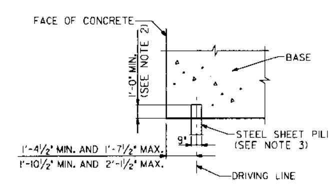
SCALE: NONE



ELEVATION OF SHEET PILE EMBEDME
IN SLOPING BASE

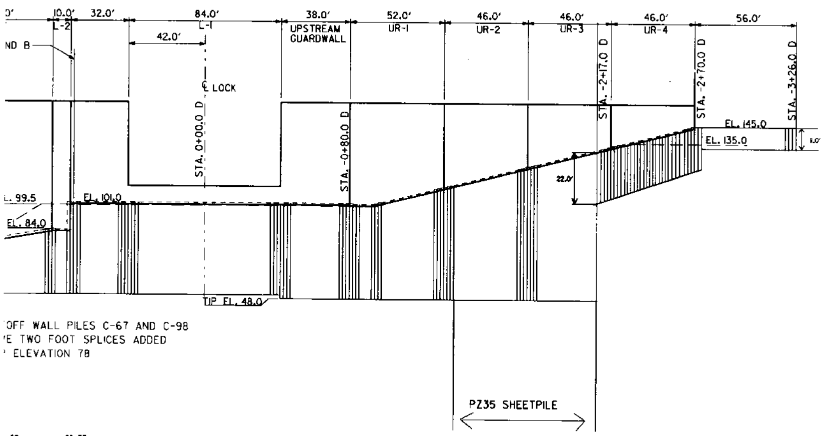


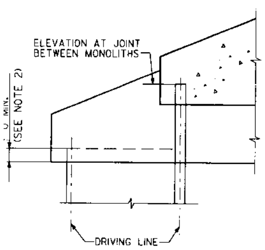
SECTION C



DETAIL OF TYPICAL SHEET PILING DRIVI

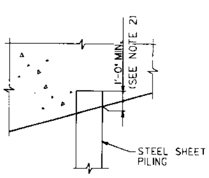
SCALE: NONE



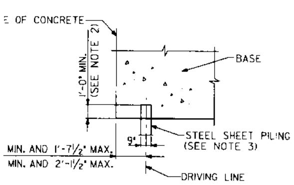


ELEVATION OF SHEET PILING AT ENDS OF MONOLITHS

SCALE: NONE



LEVATION OF SHEET PILE EMBEDMENT IN SLOPING BASE



AIL OF TYPICAL SHEET PILING DRIVING LINE

SCALE: NONE

SHEET PILING NOTES:

1. ALL SHEET PILING SHALL BE PZ22 EXCEPT AS NOTED.
2. THE TOP OF EACH SHEET PILE SHALL BE EMBEDDED A MIN. OF 1'-0" TO 1'-2" MAX. INTO THE CONCRETE BASE.
3. THE DRIVING LINE OF THE SHEET PILE SHALL BE 1'-6" (+1.5) OR 2'-0" (+1.5) FROM THE FACE OF THE CONCRETE BASE. SEE DETAIL.
4. FOR LOCATION OF SECTIONS SEE PLATE 27

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

LOCK AND DAM SHEET PILE SECTIONS

2

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 28

PIEZOMETERS						
Designation	Location	Station	Offset	Tip Elev.	Soil Type	Type
PL-1	LBD	0+00.00	-92.00 D	100.0	Sand	C
PL-2	LBD	2+72.00 L	-92.00 D	100.0	Sand	C
PL-3	LBD	5+44.00 L	-92.00 D	100.0	Sand	C
PL-4	LBD	8+16.00 L	-92.00 D	100.0	Sand	C
PL-5	L-2	0+35.00 L	44.50 D	82.0	Sand	A
PL-6	L-2	0+35.00 L	0	82.0	Sand	B
PL-7	L-2	0+35.00 L	44.50 D	82.0	Sand	A
PL-8	L-4/5	1+50.50 L	-44.00 D	85.0	Sand	A
PL-9	L-4/5	1+50.50 L	0	85.0	Sand	B
PL-10	L-4/5	1+50.50 L	44.00 D	85.0	Sand	A
PL-11	L-8/9	3+65.50 L	-44.00 D	85.0	Sand	A
PL-12	L-8/9	3+65.50 L	0	85.0	Sand	B
PL-13	L-8/9	3+65.50 L	44.00 D	85.0	Sand	A
PL-14	L-14/15	6+23.50 L	-44.00 D	85.0	Sand	A
PL-15	L-14/15	6+23.50 L	0	85.0	Sand	B
PL-16	L-14/15	6+23.50 L	44.00 D	85.0	Sand	A
PL-17	L-17	8+16.00 L	44.50 D	78.0	Sand	A
PL-18	L-17	8+16.00 L	0	78.0	Sand	B
PL-19	L-17	8+16.00 L	44.50 D	78.0	Sand	A
PD-20	D-1*	1+52.00 D	-103.50 L	70.0	Alluv. Sand	D
PD-21	D-1	1+52.00 D	-53.50 L	75.5	Gravel	B1
PD-22	D-1	1+52.00 D	53.50 L	70.0	Alluv. Sand	B
PD-23	D-1	1+52.00 D	56.50 L	75.5	Gravel	B1
PD-24	SB-1	1+52.00 D	164.50 L	77.5	Gravel	B1
PD-25	D-2*	3+12.00 D	-103.50 L	70.0	Alluv. Sand	D
PD-26	D-2	3+12.00 D	-53.50 L	75.5	Gravel	B1
PD-27	D-2	3+12.00 D	53.50 L	70.0	Alluv. Sand	B
PD-28	D-2	3+12.00 D	56.50 L	75.5	Gravel	B1
PD-29	SB-3	3+12.00 D	164.50 L	77.5	Gravel	B1
PD-29A	SB-3*	3+12.00 D	184.50 L	77.5	Sand	D1
PD-30	D-4	4+81.00 D	-53.50 L	75.5	Gravel	B1
PD-31	D-4	4+81.00 D	53.50 L	70.0	Alluv. Sand	B
PD-32	D-4	4+81.00 D	56.50 L	75.5	Gravel	B1
PD-33	SB-5	4+81.00 D	164.50 L	77.5	Gravel	B1
PD-34	D-5*	4+94.00 D	-60.00 L	100.0	Sand	D
PD-35	D-5	4+94.00 D	-18.50 L	98.5	Gravel	A1
PD-36	SB-6	4+94.00 D	73.00 L	98.5	Gravel	B1
PD-37	D-5*	6+08.00 D	-60.00 L	100.0	Sand	D
PD-38	D-5	6+08.00 D	-18.00 L	98.5	Gravel	A1
PD-39	SB-8	6+08.00 D	73.00 L	98.5	Gravel	B1
PC-40	CD	24+00.00 D	-0+19.00 L	120.0	Dredged Sand	C
PC-41	CD	24+00.00 D	0+19.00 L	120.0	Dredged Sand	C
PC-42	CD	24+00.00 D	1+19.00 L	120.0	Dredged Sand	C
PL-43	L-6/7*	2+60.00 L	0+80.00 L	90.0	Select Sand	D**
PL-44	L-10/11*	3+90.00 L	0+80.00 L	90.0	Select Sand	D**
PL-45	L-12/13*	5+20.00 L	0+80.00 L	90.0	Select Sand	D**

* ADJACENT TO

SURFACE MONUMENTS				
Designation	Location	Station	Offset	Elevation (ft NGVD)
SM-1	CD	15+00 D	20.00 US	156.41
SM-2	CD	17+00 D	20.00 US	156.41
SM-3	CD	19+00 D	20.00 US	156.41
SM-4	CD	21+00 D	20+00 US	156.41
SM-5	CD	23+00 D	20+00 US	156.41
SM-6	CD	24+00 D	20+00 US	156.41
SM-7	CD	25+00 D	20+00 US	156.41
SM-8	CD	27+00 D	20+00 US	156.41
SM-9	CD	29+00 D	20+00 US	156.41
SM-10	CD	31+00 D	20+00 US	156.41
SM-11	CD	33+00 D	20+00 US	156.41

REFERENCE BOLT GROUPS			
Designation	Monolith	No. of Bolts In Group	Offset
UPSTREAM RETURN WALL			
RB-1	UR-4	1	267.00 LS
RB-2	UR-4 and UR-3	3	224.00 LS
RB-3	UR-3 and UR-2	3	178.00 LS
RB-4	UR-2 and UR-1	3	132.00 LS
RB-5	UR-1 and US Guardwall	3	80.00 LS
LANDSIDE OF LOCK			
RB-6	US Guardwall and L-1	3	43.00 LS
RB-7	L-1 and L-2	3	43.00 LS
RB-8	L-2 and L-3	3	43.00 LS
RB-9	L-3 and L-4/5	3	43.00 LS
RB-10	L-4/5 and L-6/7	3	43.00 LS
RB-11	L-6/7 and L-8/9	3	43.00 LS
RB-12	L-8/9	1	49.00 LS
RB-13	L-8/9 and L-10/11	3	43.00 LS
RB-14	L-10/11 and L-12/13	3	43.00 LS
RB-15	L-12/13 and L-14/15	3	49.00 LS
RB-16	L-14 and L-16	3	43.00 LS
RB-17	L-16 and L-17	3	43.00 LS
RB-18	L-17 and L-18	3	43.00 LS
RB-19	L-18 and DR-1	3	80.00 LS
DOWNSTREAM RETURN WALL			
RB-20	DR-1 and DR-2	3	124.00 LS
RB-21	DR-2 and DR-3	3	168.00 LS
RB-22	DR-3	1	209.00 LS
UPSTREAM GUIDEWALL			
RB-23	UG-1	1	53.00 RS
RB-24	UG-1 and UG-2	3	43.00 RS
RB-25	UG-2 and UG-3	3	43.00 RS
RB-26	UG-3 and UG-4	3	43.00 RS
RB-27	UG-4 and UG-5	3	43.00 RS
RB-28	UG-5 and UG-6	3	43.00 RS
RB-29	UG-6 and UG-7	3	43.00 RS
RIVERSIDE OF LOCK			
RB-30	UG-7 and L-1	3	43.00 RS
RB-31	L-1 and L-2	3	43.00 RS
RB-32	L-2 and L-3	3	43.00 RS
RB-33	L-3 and L-4/5	3	43.00 RS
RB-34	L-4/5 and L-6/7	3	43.00 RS
RB-35	L-6/7 and L-8/9	3	43.00 RS
RB-36	L-8/9	1	49.00 RS
RB-37	L-8/9 and L-10/11	3	43.00 RS
RB-38	L-10/11 and L-12/13	3	43.00 RS
RB-39	L-12/13 and L-14/15	3	43.00 RS
RB-40	L-14/15 and L-16	3	43.00 RS
RB-41	L-16 and L-17	3	43.00 RS
RB-42	L-17 and L-18	3	43.00 RS
RB-43	L-18 and DG-1	3	43.00 RS
DOWNSTREAM GUIDEWALL			
RB-44	DG-1 and DG-2	3	43.00 RS
RB-45	DG-2 and DG-3	3	43.00 RS
RB-46	DG-3 and DG-4	3	43.00 RS
RB-47	DG-4 and DG-5	3	43.00 RS
RB-48	DG-5 and DG-6	3	43.00 RS
RB-49	DG-6 and DG-7	3	43.00 RS
RB-50	DG-7	1	53.00 RS
LOCK TO DAM CUTOFF WALL			
RB-51	L-2 and Cutoff Wall	3	1.50 DS
RB-52	Cutoff Wall and D-1	3	1.50 DS
TAINTER GATED SPILLWAY			
RB-53	D-1	1	31.00 US
RB-54	D-1	1	0.62US
RB-55	D-1	1	31.00 US
RB-56	D-1	1	0.62US
RB-57	D-2	1	31.00 US
RB-58	D-2	1	0.62US
RB-59	D-3	1	31.00 US
RB-60	D-3	1	0.62US
RB-61	D-4	1	31.00 US
RB-62	D-4	1	0.62US
RB-63	D-4	1	31.00 US
RB-64	D-4	1	0.62US
CREST GATED SPILLWAY			
RB-65	D-5	1	25.00 US
RB-66	D-5	1	10.62 DS
RB-67	D-5	1	25.00 US
RB-68	D-5	1	10.62 DS
OVERFLOW WALL			
RB-69	OW-1	1	5.50 DS
RB-70	OW-1 and OW-2	3	5.50 DS
RB-71	OW-2 and OW-3	3	5.50 DS
RB-72	OW-3	1	5.50 DS

S	
Designation	Monoli
TAI	
SP-1	D-1
SP-2	D-4
CR	
SP-3	D-5
SP-4	D-5

1. "L" BEHIND STA
2. "D" BEHIND STAT
3. OFFSET LEGEND:

4. LOCATION LEGEN

5. DESIGNATION LE

STA

-D

EXAM

SETTLEMENT PLATES				
Designation	Monolith	Station	Offset	Elevation
TAINTER GATED SPILLWAY				
SP-1	D-1	1+46.00 D	20.50 US	74.67
SP-2	D-4	4+86.50 D	20.50 US	74.67
CREST GATED SPILLWAY				
SP-3	D-5	4+95.50 D	19.75 US	97.67
SP-4	D-5	6+06.50 D	19.75 US	97.67

NOTES

1. "L" BEHIND STATION DENOTES LOCK C.L. STATIONING
2. "D" BEHIND STATION DENOTES LOCK DAM AXIS STATIONING
3. OFFSET LEGEND:

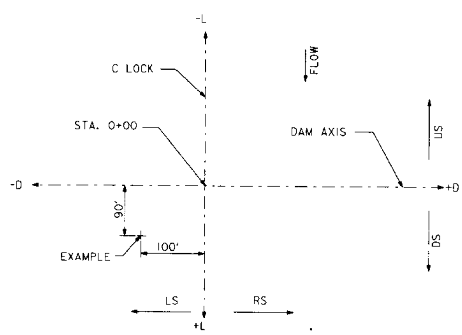
LS	LANDSIDE
RS	RIVERSIDE
DS	DOWNSTREAM
US	UPSTREAM

4. LOCATION LEGEND:

CD	CLOSURE DAM
D	DAM
P	DAM PIER
L	LOCK
UG	UPSTREAM GUIDEWALL
DG	DOWNSTREAM GUIDEWALL
C	CUTOFF WALL
OW	OVERFLOW WALL
LBD	LOCK BACKFILL DRAIN
SB	STILLING BASIN
UR	UPSTREAM RETURN WALL
DR	DOWNSTREAM RETURN WALL

5. DESIGNATION LEGEND:

PL	PIEZOMETER - LOCK
PD	PIEZOMETER - DAM
PC	PIEZOMETER - CLOSURE DAM
SM	SURFACE MONUMENT
RB	REFERENCE BOLT
SP	SETTLEMENT PLATE



EXAMPLE:
STA 0+90 L, -1+00 D

STATIONING KEY

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

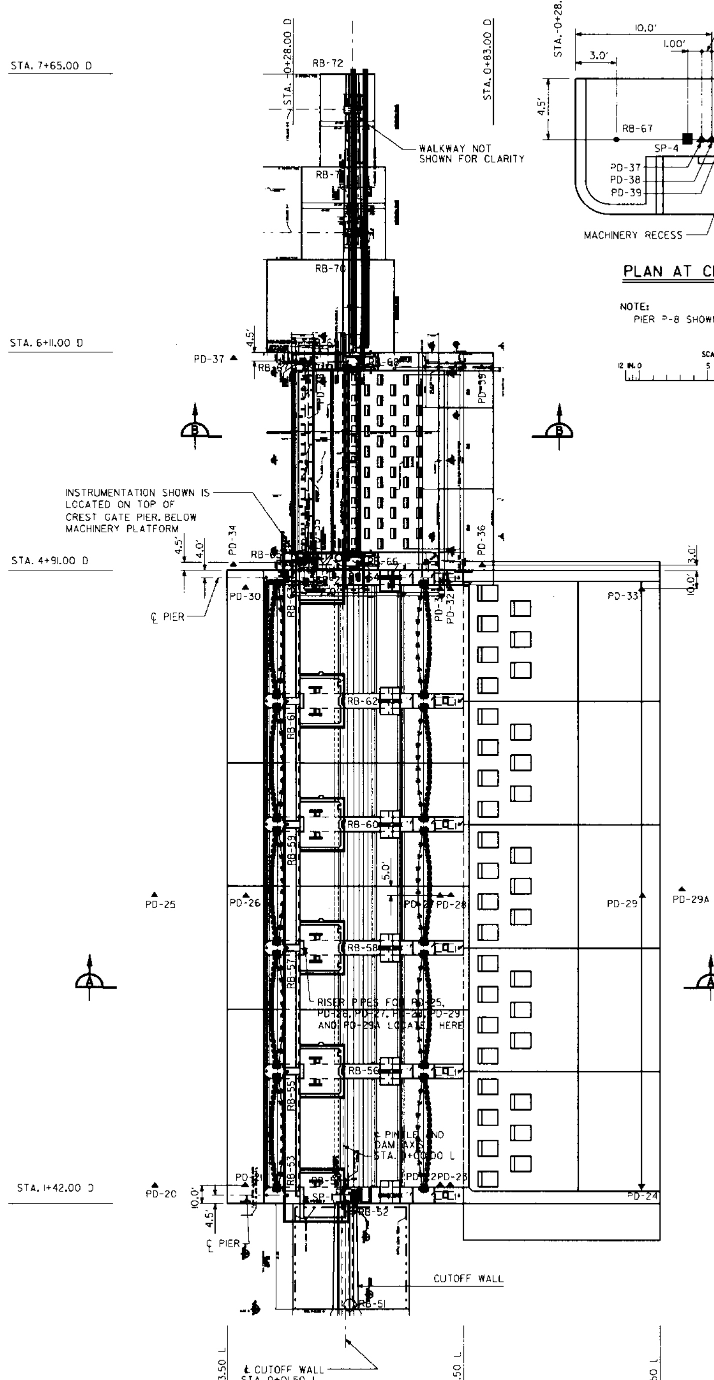
JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

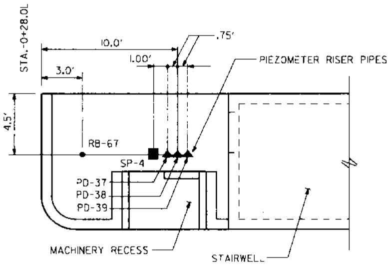
LOCK AND DAM INSTRUMENTATION TABULATION

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 29

2



PLAN

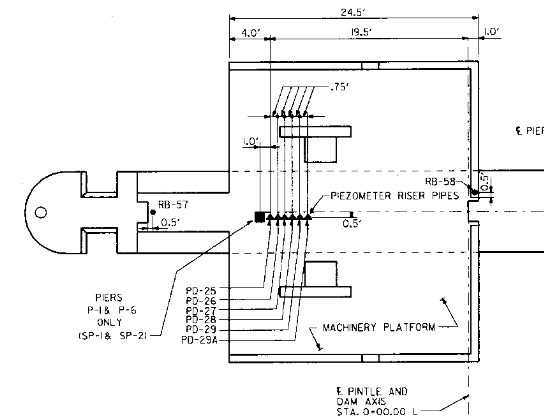


PLAN AT CREST GATE PIER

NOTE:
PIER P-8 SHOWN, PIER P-7 OPPOSITE HAND.

SCALE: 1/4 IN. = 1 FT.

12 IN. 0 5 10 15 FT.

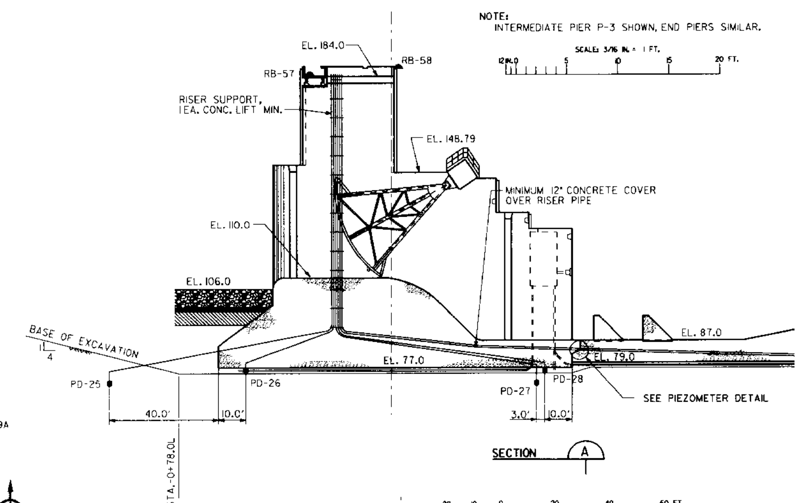


PLAN AT MACHINERY PLATFORM

NOTE:
INTERMEDIATE PIER P-3 SHOWN, END PIERS SIMILAR.

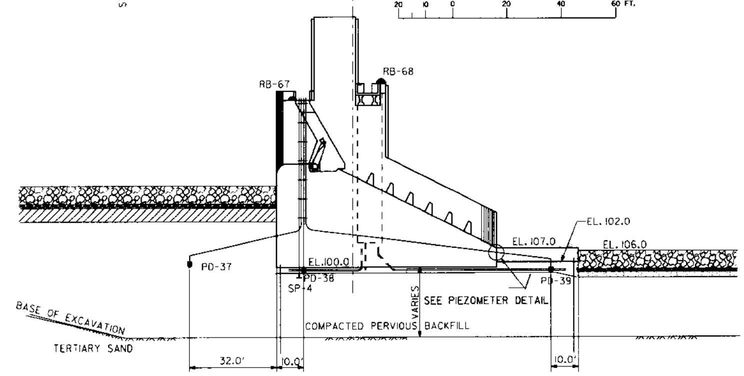
SCALE: 3/16 IN. = 1 FT.

12 IN. 0 5 10 15 20 FT.



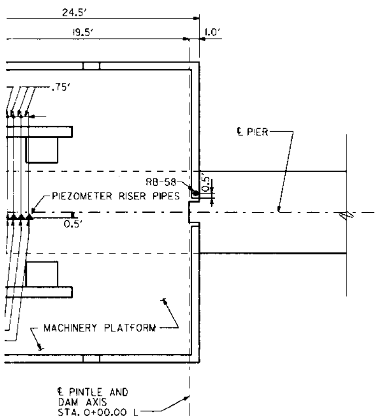
SECTION A

20 10 0 20 40 60 FT.



SECTION B

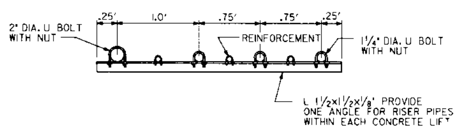
20 10 0 20 40 60 FT.



AT MACHINERY PLATFORM

:DIATE PIER P-3 SHOWN, END PIERS SIMILAR.

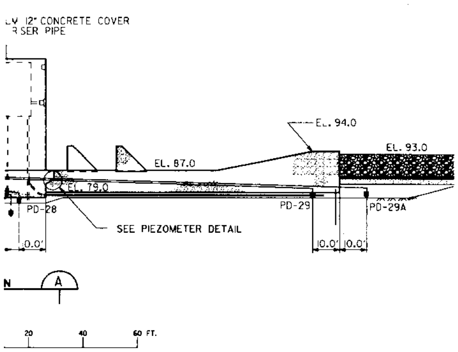
SCALE: 3/16 IN. = 1 FT.



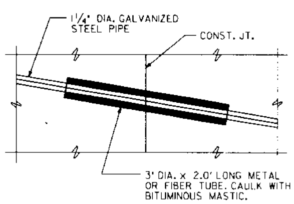
RISER PIPE SPACER DETAIL

SCALE: 1 1/2 IN. = 1 FT.

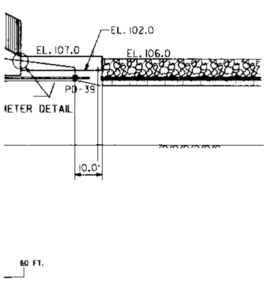
NOTE:
PIPE SPACER SHOWN FOR ILLUSTRATION. THE NUMBER OF RISER PIPES AND THE PRESENCE OF THE SETTLEMENT PLATE VARIES WITH LOCATION. PIPE SPACERS ARE REQUIRED FOR ALL RISERS IN LOCK AND DAM STRUCTURE.



LEGEND		
SYMBOL		INSTRUMENTS AND ABBREVIATIONS
SECTION	PLAN	
▼	▲	PIEZOMETERS (P)
▲	•	REFERENCE BOLT GROUPS (RB)
⊥	■	SETTLEMENT PLATE (SP)



PIEZOMETER DETAIL



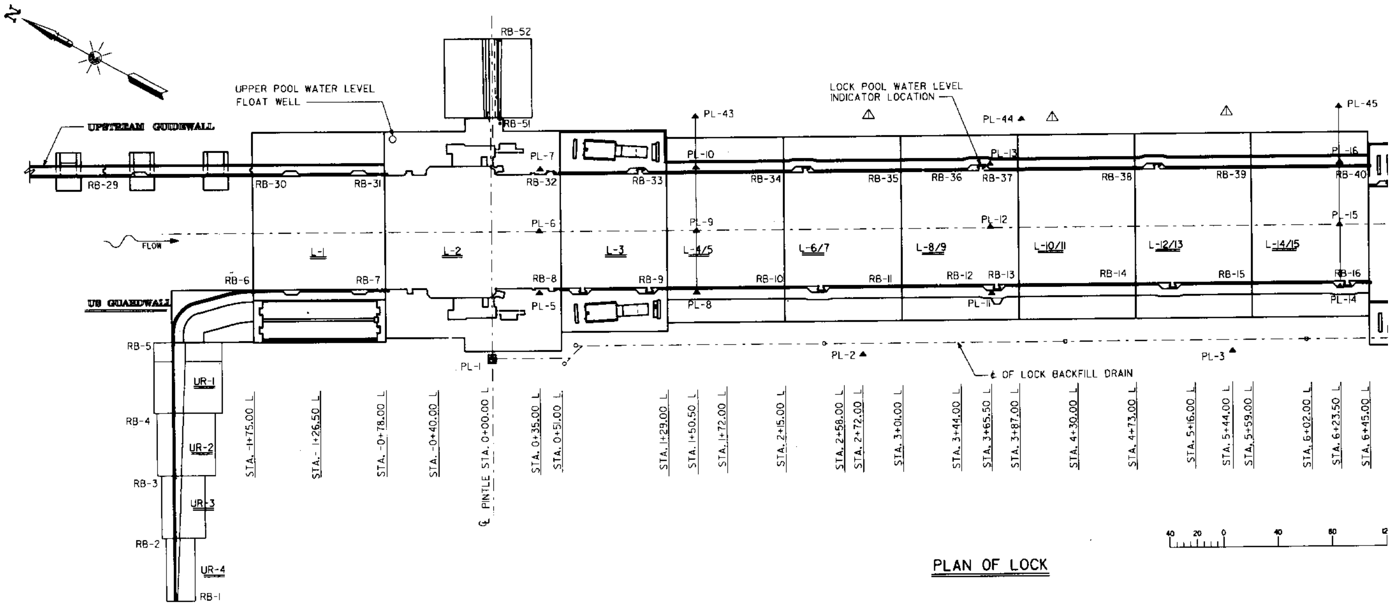
RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT, LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

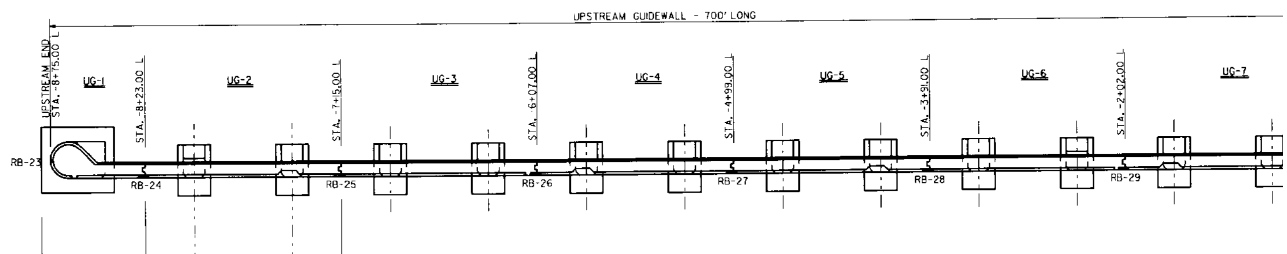
FOUNDATION REPORT

TAINTER GATE & CREST GATE SPILLWAY INSTRUMENTATION

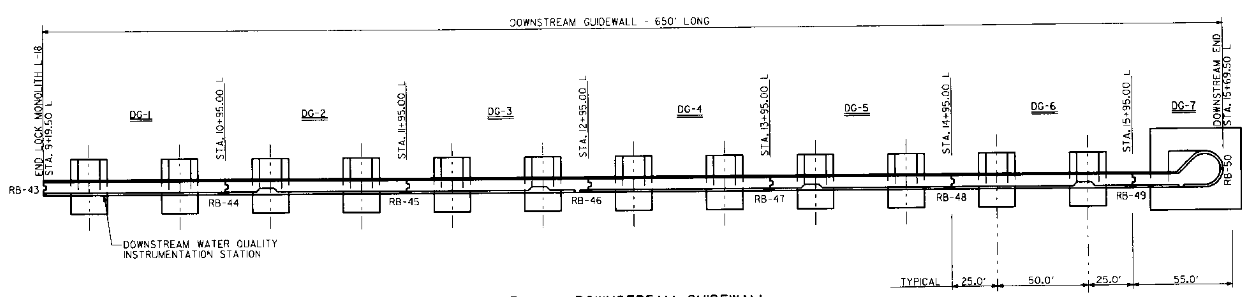
DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 30



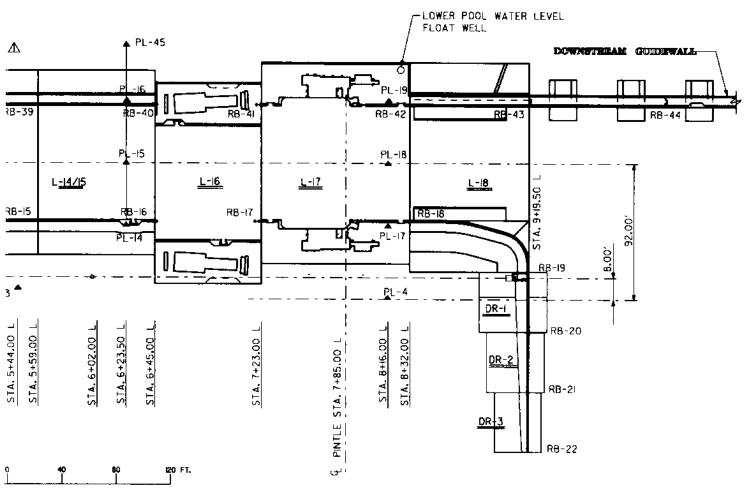
PLAN OF LOCK



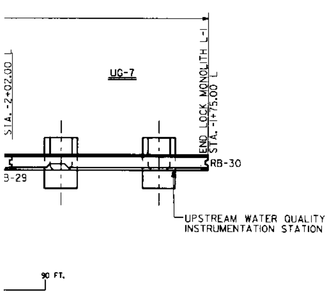
PLAN - UPSTREAM GUIDEWALL

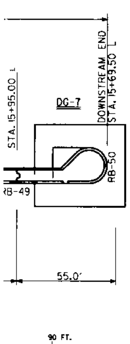


PLAN - DOWNSTREAM GUIDEWALL



LEGEND		
SYMBOL		INSTRUMENTS AND ABBREVIATIONS
SECTION	PLAN	
▼	▲	PIEZOMETERS (P)
▲	•	REFERENCE BOLT GROUPS (RB)



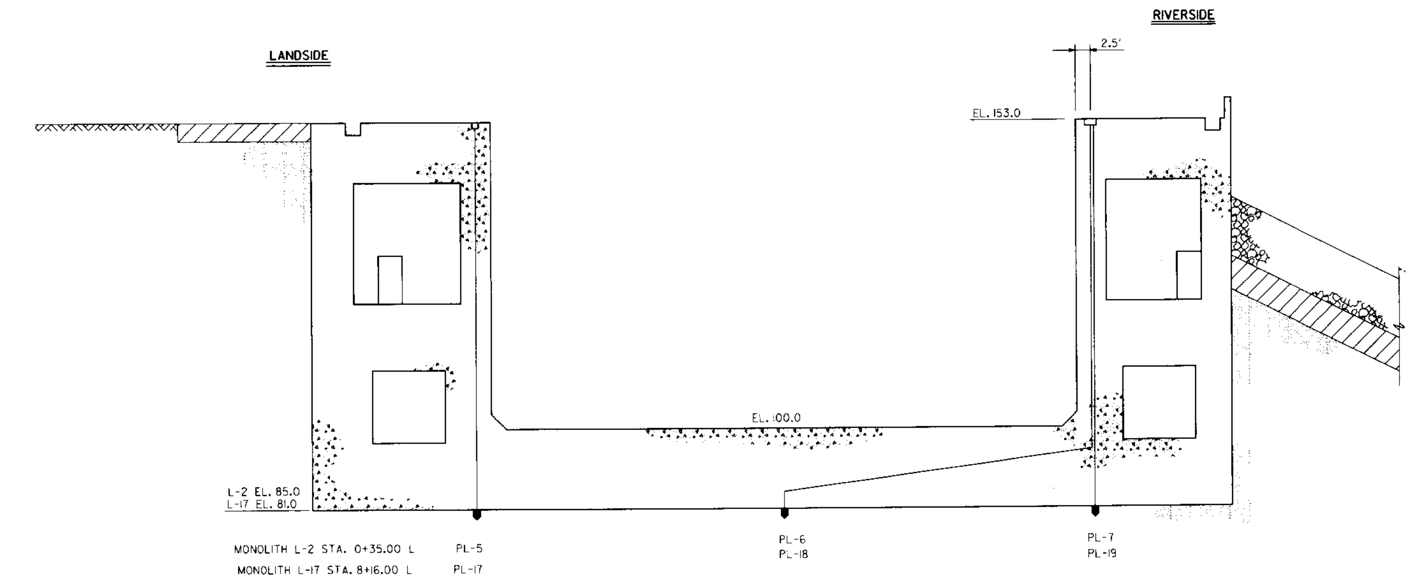


RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT,LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

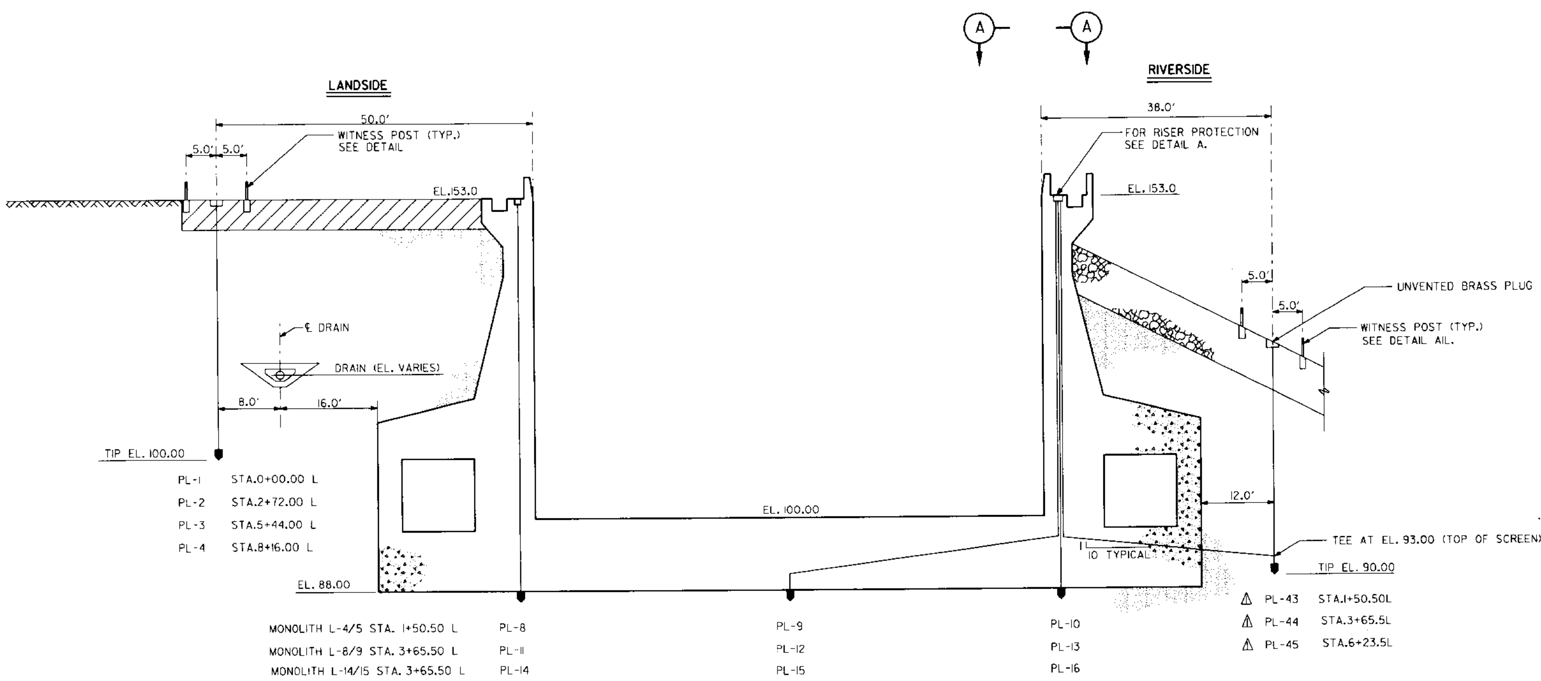
JOE D. WAGGONNER JR. LOCK AND DAM
FOUNDATION REPORT

LOCK INSTRUMENTATION PLAN

DATE: JANURARY 1996 FILE NO. R-14-207 PLATE 31

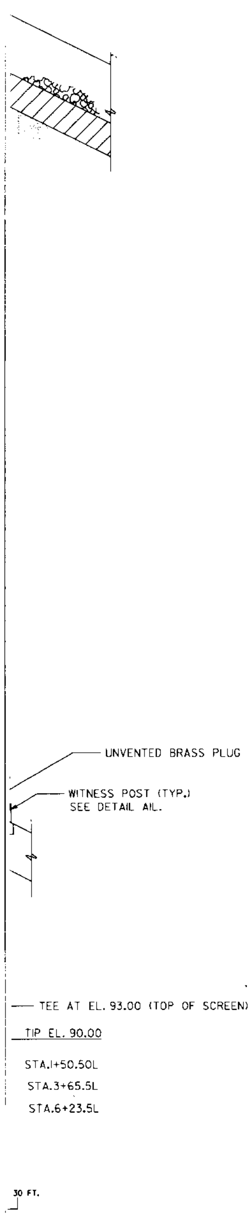


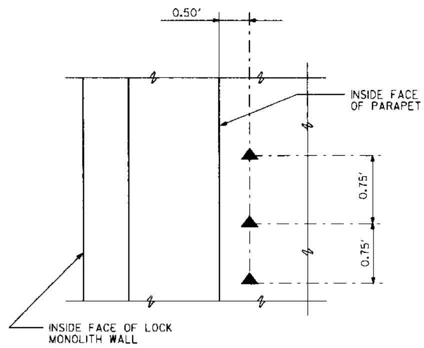
GATE MONOLITH PIEZOMETERS



CHAMBER MONOLITH AND LOCK BACKFILL PIEZOMETERS

LOCK MONOLITH PIEZOMETERS

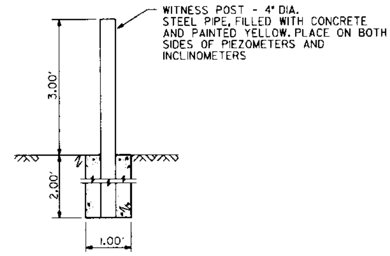




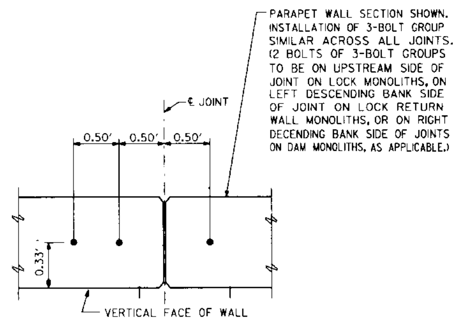
VIEW A - A

NOTE:
DETAIL SHOWN ON RIVERWALL SIDE OF LOCK MONOLITH. DETAILS ON LANDWALL LOCK MONOLITH, SIMILAR AND OPPOSITE HAND, WITH SINGLE RISER PIPE.

12 IN. 0 1 2 FT.



WITNESS POST



PLAN

RIVERSIDE SHOWN - LANDSIDE OPPOSITE HAND

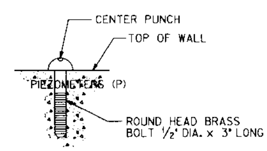
TYPICAL REFERENCE BOLT INSTALLATION

LEGEND

SYMBOL		INSTRUMENTS AND ABBREVIATIONS
SECTION	PLAN	
⬟	▲	PIEZOMETERS (P)

NOTE:

FOR PIEZOMETER DETAILS SEE PLATE ____



SECTION

REFERENCE BOLT DETAIL

RED RIVER WATERWAY-MISSISSIPPI RIVER TO SHREVEPORT,LA.
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

JOE D. WAGGONNER JR. LOCK AND DAM

FOUNDATION REPORT

LOCK INSTRUMENTATION SECTIONS

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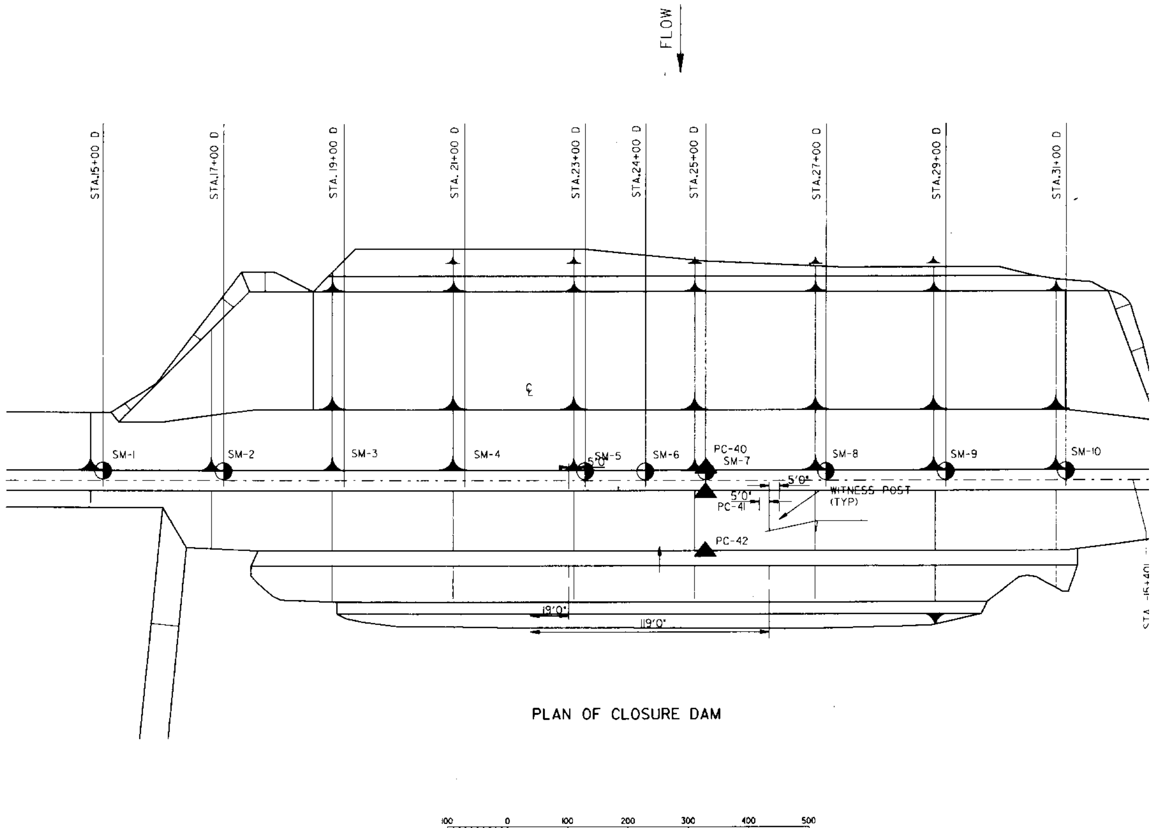
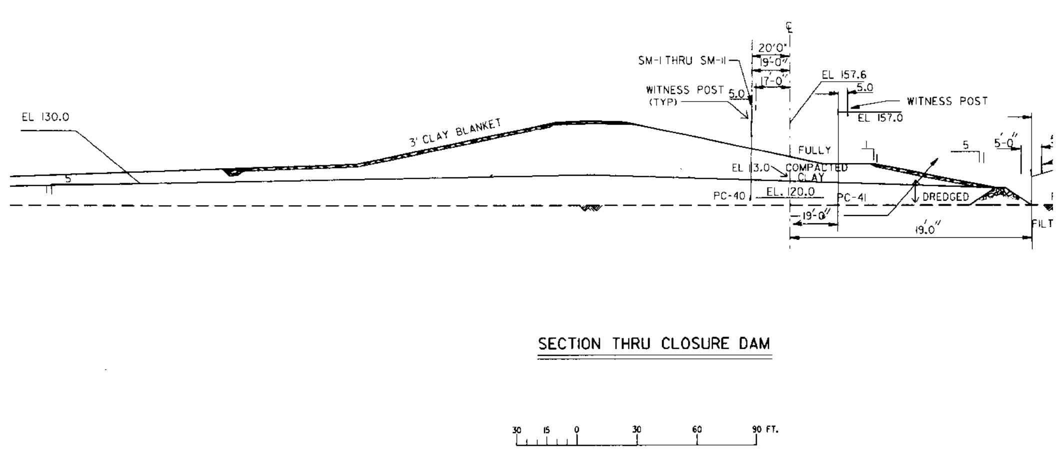
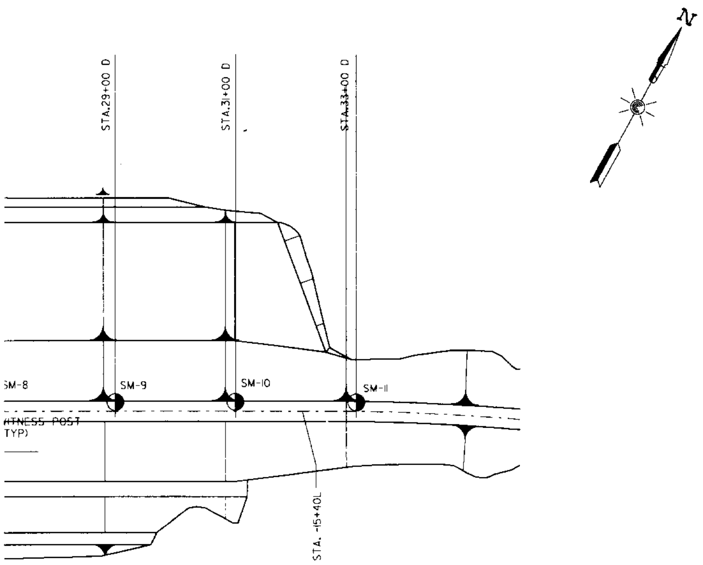


PLAN OF CLOSURE DAM

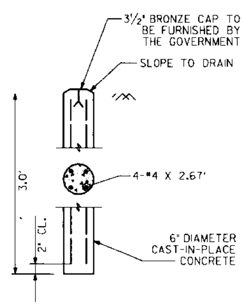
UPSTREAM



SECTION THRU CLOSURE DAM



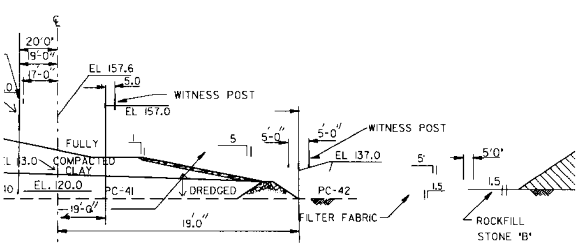
DOWNSTREAM



SURFACE MONUMENT

12 IN. 0 1 2 3 FT.

LEGEND		
SYMBOL		INSTRUMENTS AND ABBREVIATIONS
SECTION	PLAN	
▼	▲	PIEZOMETERS (P)
▮	◑	SURFACE MONUMENTS (SM)



DAM

90 FT.

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FOUNDATION REPORT

CLOSUE DAM INSTRUMENTATION

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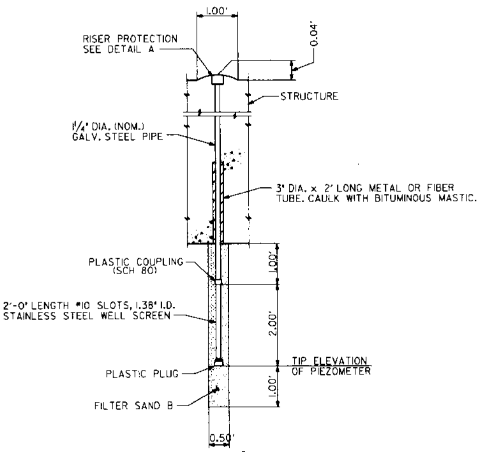
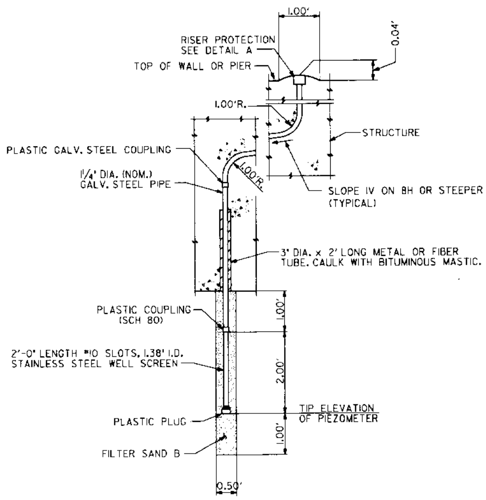
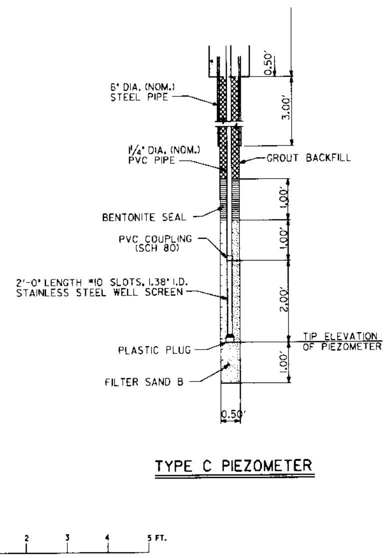


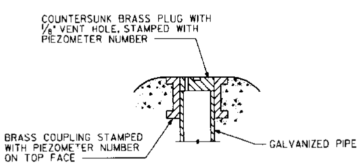
TYPE A PIEZOMETER



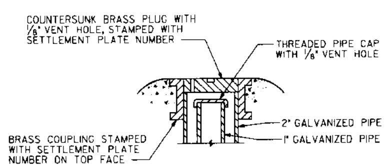
TYPE B PIEZOMETER



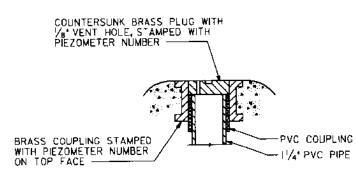
TYPE C PIEZOMETER



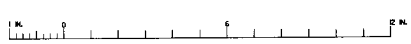
DETAIL A

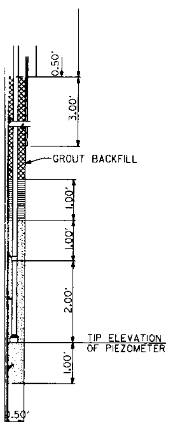


DETAIL B

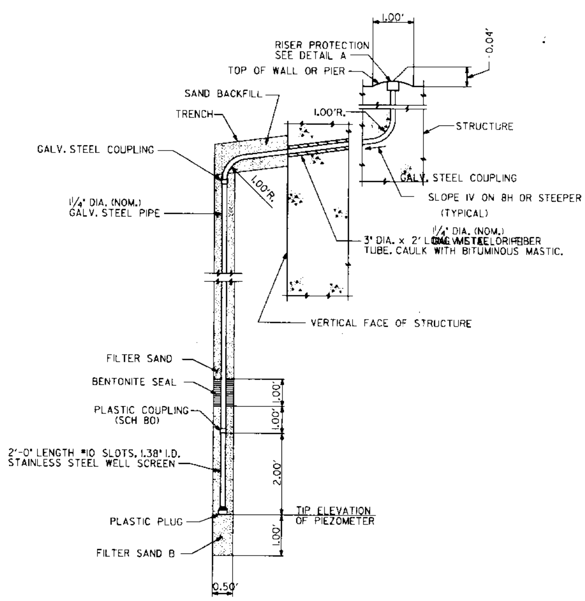


DETAIL C



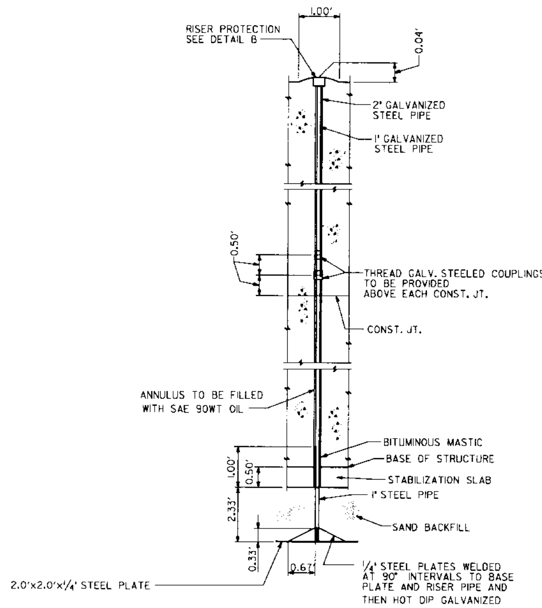


PIEZOMETER

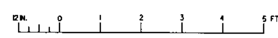


TYPE D PIEZOMETER

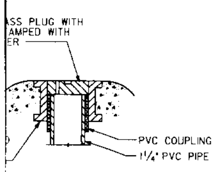
NOTE: TYPE DI SAME DETAILS EXCEPT TIP IS SLOPED AS IN TYPES AI, BI



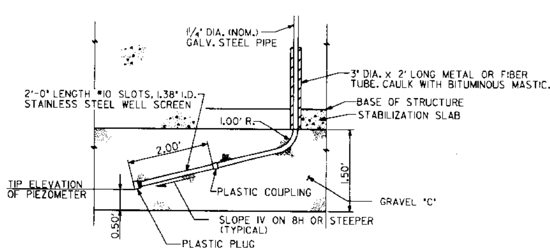
SETTLEMENT PLATE



NOTE : FOR LOCATION OF INSTRUMENTS SEE PLATE ______

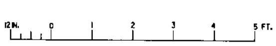


DETAIL C



NOTE: WILL APPEAR IN BOTH TYPE A AND TYPE B PIEZOMETERS INSTALLED BENEATH DAM AND STILLING BASIN. DENOTED AI AND BI ON DRAWING 9/3.

TYPE AI, BI PIEZOMETER TIP DETAIL
FOR TYPE A, B PIEZOMETER
INSTALLED IN GRAVEL "C"



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