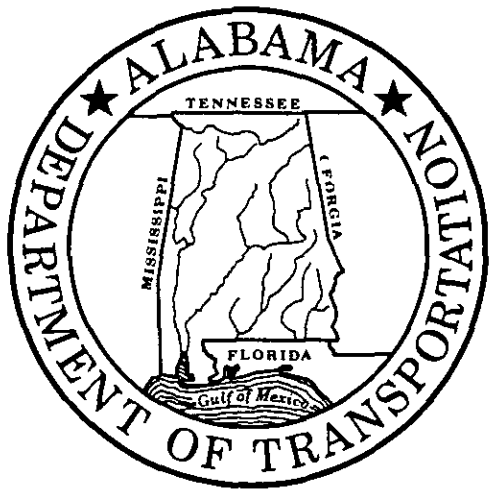
9/94



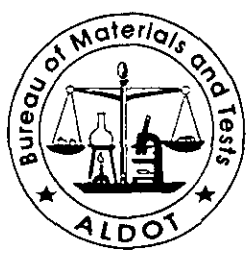
ALABAMA DEPARTMENT OF TRANSPORTATION

Foundation Report

Project No BRF-7501(8)
Bridge Replacement on U S 90
over Tensaw River

Mobile & Baldwin Counties

BUREAU OF MATERIALS AND TESTS



ALABAMA
DEPARTMENT OF TRANSPORTATION
MONTGOMERY ALABAMA 36130 3050

JIM FOLSOM
GOVERNOR

G M ROBERTS
DIRECTOR

September 1, 1994

Mr William F Conway
Chief, Bridge Engineer
OFFICE

Re BRF-7501(8)
Bridge Replacement on U S 90 over Tensaw River
Mobile & Baldwin Counties

Dear Sir

The foundation investigation for the proposed project was conducted during the dates of June 15 1994 to July 11, 1994

Procedure

Drill crews from the Materials and Tests Bureau conducted boring and sampling operations at the designated locations on the project site using truck-mounted machine-driven drills Borings were extended through the existing bridge deck to depths specified by the responsible geotechnical engineer

Standard penetration test (ASTM D-1586) and Thin-wall Tube (ASTM D-1587) samples were recovered by the driller and delivered to the Central Laboratory for evaluation and testing as directed by the soils engineer Field soil classifications and Atterberg limit tests were requested for the appropriate soils along with the D50 test required for scour analysis Test evaluation results as applicable are attached to this report in the Appendix

The location and depth of drilling and sampling operations, site stratigraphy, and the approximate relative density and moisture content of in-situ soils were prepared by the driller in the field Copies of the boring logs and are attached to this report The resulting soil profile appears as sketch 1

Groundwater levels shown on the boring logs and soil profile at the abutments are those estimated by the soils engineer

Geologic Setting

The project is in the Deltaic Plain district of the East Gulf Coastal Plain physiographic section (Sapp, C D , and Emplaincourt, J , 1975, Physiographic regions of Alabama Alabama Geological Survey Special Map 168) The Deltaic Plain district is alluvium of the Mobile River delta The terrain in the vicinity of the project is relatively flat The land surface in the vicinity of the corridor ranges from 0 to 5 feet above the National Geodetic Vertical Datum of 1929 (NGVD)

The project is underlain by alluvial deposits of Quaternary age (see fig 1) The alluvial deposits consist of white, gray, orange, and brown partly carbonaceous, locally fossiliferous, very fine- to coarse-grained sand that is gravelly in many exposures Gray and orange sandy carbonaceous clay is present in some areas The alluvial deposits in the Mobile River basin is as much as 150 feet thick (Reed, P C , 1971, Geology of Mobile County, Alabama Alabama Geological Survey Map 93)

Records of wells for Mobile and Baldwin Counties indicate the water table in the vicinity of the project is at or near sea level (Reed, P C , and McCain, J F , 1972, Water Availability in Mobile County, Alabama Alabama Geological survey May 121)

Settlement and Stability

The layout drawings show seven feet of additional fill at the abutments on top of an existing road bed, consisting of loose to medium sand and silt layers Settlement at the abutment locations should take place during construction and no problems with stability are anticipated if the road bed is constructed according to standard specifications

Corrosion

Water samples were tested at the central laboratory and did not pass the chemical analysis criteria If the drilled shaft alternate is chosen, type DS3 concrete should be used in the construction of the drilled shafts Results of the chemical analysis appear in the Appendix

Scour

A scour analysis report has been requested but was not available at this date, therefore, scour was estimated, assuming Q100 scour would erode into the existing river bottom until making contact with sands whose recorded SPT-N blow count equaled or exceeded 20 and/or clays whose SPT-N blow count equaled or exceeded 15 If the formal scour analysis indicates that these assumptions are erroneous, revised geotechnical recommendations concerning required pile and drilled shaft founding elevations will be prepared and distributed to adressees

Foundation Recommendations

Drilled shafts and pile footings were both considered at bent locations for this bridge project, with only pile abutments considered at both abutments Specific recommendations pertaining to both foundation alternatives are found in Tables 1 and 2

COM624P data has already been forwarded for use in drilled shaft lateral load design for bents 2 through 11 The permanent casing tip elevation was based on being forcably advanced into material capable of holding the casing up under its own weight prior to beginning required shaft excavations

At bents 2 through 11, 36-inch prestressed concrete pile footings were also considered Abutments 1 and 12 were designed for 16-inch prestressed concrete piles Both static and dynamic load tests are recommended for at least one pile at abutment 1 and , if pile footings are choosen for bents 2 through 11, at least one pile at bent 6 for verification of the pile capacity Hard driving should be expected for the last ten feet of pile driving at the bents The bottom of footing elevation for the pile footings is assumed to be at mean sea level

Seawall Recommendations

Under the existing eastbound bridge on U S 90 over the Tensaw River the west abutment (abutment 1) is surrounded by a retaining seawall This project includes the replacement of a missing section of this seawall The wall should be constructed using precast prestressed concrete panels whose thickness and width matches existing panels adjacent to the new wall segment New panels should be long enough to permit driving the panel tips to elevation -40 msl

If this Bureau can be of further assistance, please do not hesitate to contact us

Yours very truly,

Wm J Hartzog
Materials & Tests Engineer

By Stanley Armstrong HC
Stanley Armstrong
Asst Materials & Tests Engineer

SRA/PDC/pc
Attachments

cc Mr G M Harper
Mr Don T Arkle
Mr R F Poiroux (2 copies)
FHWA (Attn Mr Robert King)
Mr Wm B Holmes
Project File
File

BRF-7501(8)
Mobile/Baldwin County
Bridge Replacement on U S 90
Over Tensaw River

Table 1 Summary of Pile Foundation Recommendations (Part 1 of 2)

Location	Foundation Type	Allowable Load	Ground / Mud Line Elevation msl	Foundation Tip Elevations msl	Assumed Tip Elev (Length) of Permanent Casing	Notes
Abutment 1 Sta 257+76	16 " sq concrete piles	70 Tons per pile	14 0'	Est ≈ -37 0'		* Static and Dynamic load testing of one pile at bent 6 and at abutment 1 is recommended * Allowable loads include a minimum factor of safety for bearing capacity of 2 0 for piles * See the text of the report for an explanation of the alternatives listed in this table
Bent 2 Sta 259+01	36" sq concrete piles	100 Tons per pile	-13 0'	Est ≈ -58 0' Min ≈ -58 0'	(-73 0)	
Bent 3 Sta 260+18	36" sq concrete piles	100 Tons per pile	-23 0'	Est ≈ -88 0' Min ≈ - 77 0'	(-93 0)	
Bent 4 Sta 261+47	36" sq concrete piles	100 Tons per pile	- 28 0'	Est ≈ -100 0' Min ≈ -100 0'		
Bent 5 Sta 262+82	36" sq concrete piles	100 Tons per pile	-29 0'	Est ≈ -107 0' Min ≈ -107 0'		
Bent 6 Sta 264+37	36" sq concrete piles	100 Tons per pile	-37 0'	Est ≈ -126 0' Min ≈ -126 0'		
Bent 7 Sta 265+70	36" sq concrete piles	100 Tons per pile	-32 0'	Est ≈ -127 0' Min ≈ -127 0'		
Bent 8 Sta 267+04	36" sq concrete piles	100 Tons per pile	- 30 0'	Est ≈ -107 0' Min ≈ -107 0'		

* Revised 6/9/95

BRF-7501(8)
Mobile/Baldwin County
Bridge Replacement on U S 90
Over Tensaw River

Table 1 Summary of Pile Foundation Recommendations (Part 2 of 2)

Location	Foundation Type	Allowable Load	Ground Line / Mud Line Elevation	Foundation Tip Elevations msl	Assumed Tip Elev (Length) of Permanent Casing	Notes
Bent 9 Sta 268+38	36" sq concrete piles	100 Tons per pile	-28 0'	Est ≈ -100 0' Min ≈ -100 0'		
Bent 10 Sta 269+71	36" sq concrete piles	100 Tons per pile	-17 0'	Est ≈ -84 0' Min ≈ -84 0'	(-111 0)	
Bent 11 Sta 271+01	36" sq concrete piles	100 Tons per pile	-22 0'	Est ≈ -85 0' Min ≈ -85 0'	(-101 0)	
Abutment 12 Sta 272+26	16" sq concrete piles	70 Tons per pile	14 0'	Est ≈ -50 0'		

BRF-7501(8)
Mobile/Baldwin County
Bridge Replacement on U S 90
Over Tensaw River

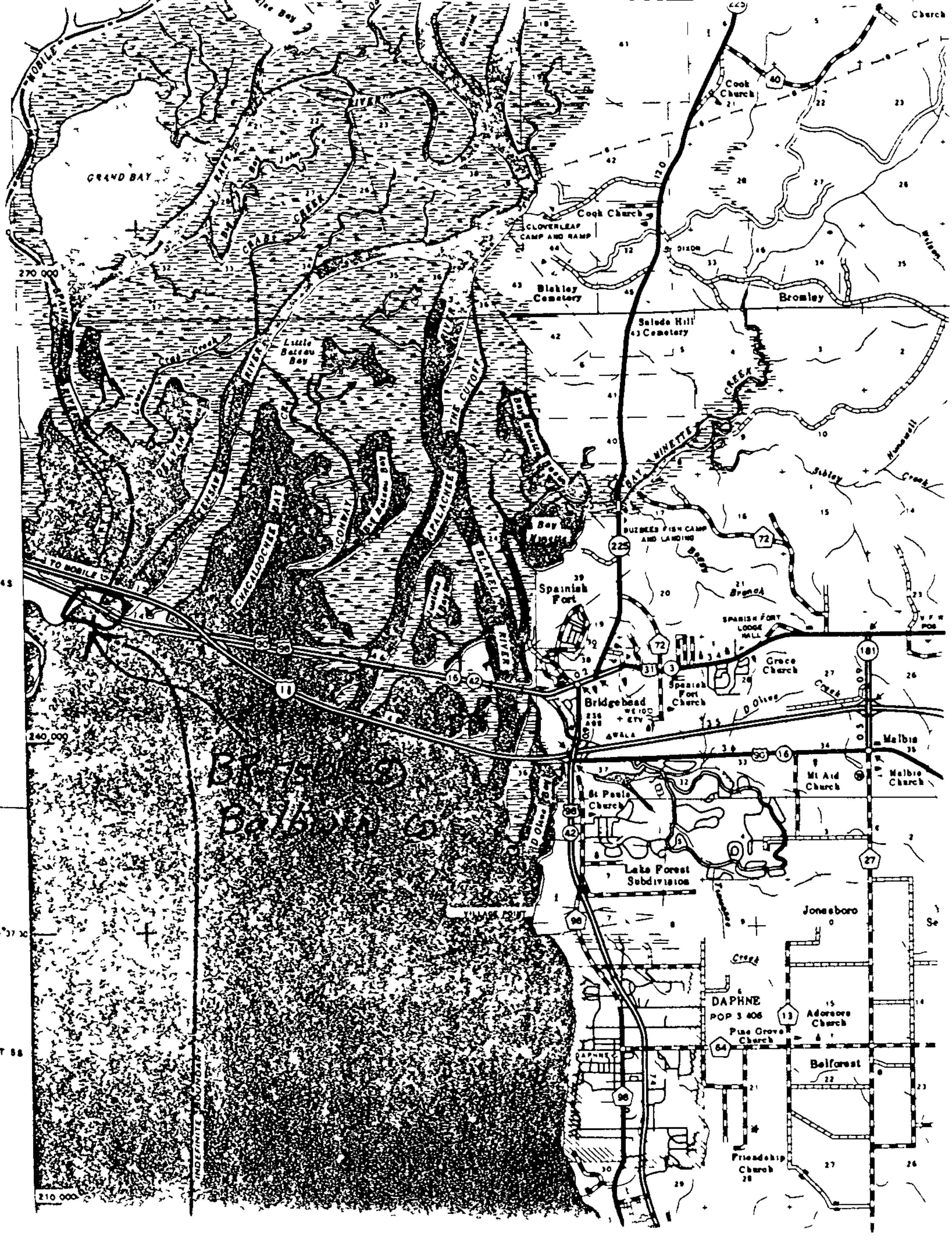
Table 2 Summary of Drilled Shaft Foundation Recommendations (Part 1 of 2)

Location	Foundation Type	Allowable Load	Ground / Mud Line Elevation msl	Foundation Tip Elevations msl	Assumed Tip Elev (Length) of Permanent Casing	Notes
Bent 2 Sta 259+01	108" diameter Drilled Shafts	650 Tons per shaft	-13 0'	-78 0'	-42 0' (44 0')	* Test all drilled shafts with cross-hole sonic logging unless dry hole construction method used * Allowable loads include a minimum factor of safety for bearing capacity of 3 0 for drilled shafts * Length of casing includes approximately 2 feet extending above the water surface * Type DS3 concrete should be used for the drilled shafts * See the text of the report for an explanation of the alternatives listed in this table
Bent 3 Sta 260+18	108" diameter Drilled Shafts	650 Tons per shaft	-23 0'	-116 0'	-68 0' (70 0')	
Bent 4 Sta 261+47	108" diameter Drilled Shafts	650 Tons per shaft	- 28 0'	-119 0'	-87 0' (89 0')	
Bent 5 Sta 262+82	108"diameter Drilled Shafts	650 Tons per shaft	-29 0'	-120 0'	-87 0' (89 0')	
Bent 6 Sta 264+37	108" diameter Drilled Shafts	650 Tons per shaft	-37 0'	-121 0'	-85 0' (87 0')	
Bent 7 Sta 265+70	108" diameter Drilled Shafts	650 Tons per shaft	-32 0'	-126 0'	-80 0' (82 0')	
Bent 8 Sta 267+04	108" diameter Drilled Shafts	650 Tons per shaft	- 30 0'	-122 0'	-82 0' (84 0')	

BRF-7501(8)
Mobile/Baldwin County
Bridge Replacement on U S 90
Over Tensaw River

Table 2 Summary of Drilled Shaft Foundation Recommendations (Part 2 of 2)

Location	Foundation Type	Allowable Load	Ground Line / Mud Line Elevation	Foundation Tip Elevations msl	Assumed Tip Elev (Length) of Permanent Casing	Notes
Bent 9 Sta 268+38	108" diameter Drilled Shafts	650 Tons per shaft-	-28 0'	-121 0'	-68 0' (70 0')	
Bent 10 Sta 269+71	108" diameter DrilledShafts	650 Tons per shaft	-17 0'	-115 0'	-57 0' (59 0')	
Bent 11 Sta 271+01	108" diameter Drilled Shafts	650 Tons per shaft	-22 0'	-121 0'	-59 0' (61 0')	



MOBILE
GRAND BAY
Little Bateau Bay
RIVER
CRAB CREEK
TENSAW
CHACALOOCHEE BAY
CONWAY
APALACHEE
BLAKELEY
RIVER
THE CUTOFF
TO MOBILE
Bay Minette
BAY MINETTE CREEK
Cook Church
CLOVERLEAF CAMP AND RAMP
DIXON
Blakley Cemetery
Bromley
Saluda Hill Cemetery
BUZBEES FISH CAMP AND LANDING
Spanish Fort
SPANISH FORT LODGE HALL
Grace Church
Spanish Fort Church
Bridgehead
Malbis
Malbis Church
Mt Aid Church
St Pauls Church
D Olive Creek
Lake Forest Subdivision
VILLAGE POINT
Jonesboro
DAPHNE
POP 3 406
Adoracore Church
Pine Grove Church
Belforest
Friendship Church
270 000
240 000
210 000
INDEFINITE

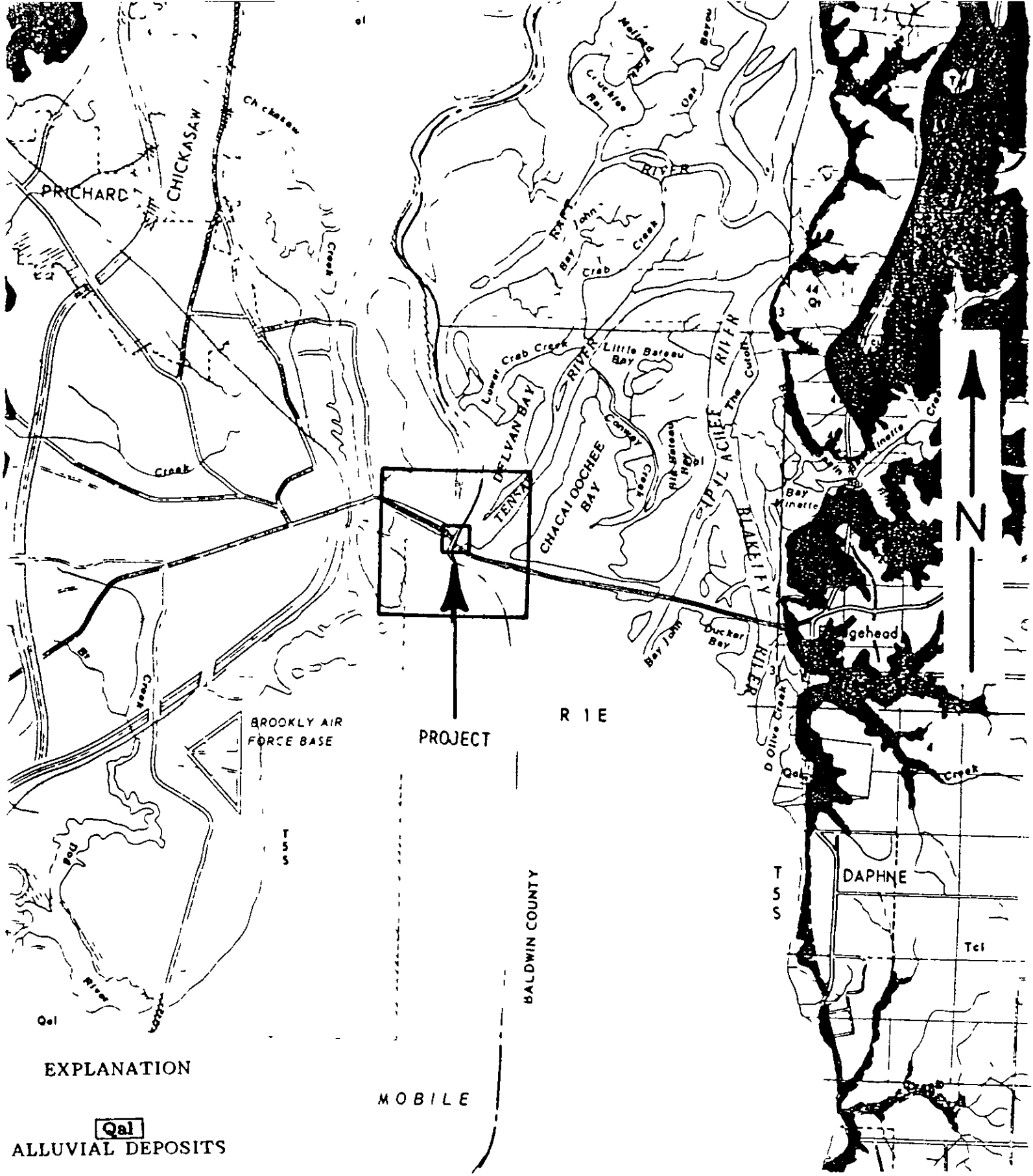
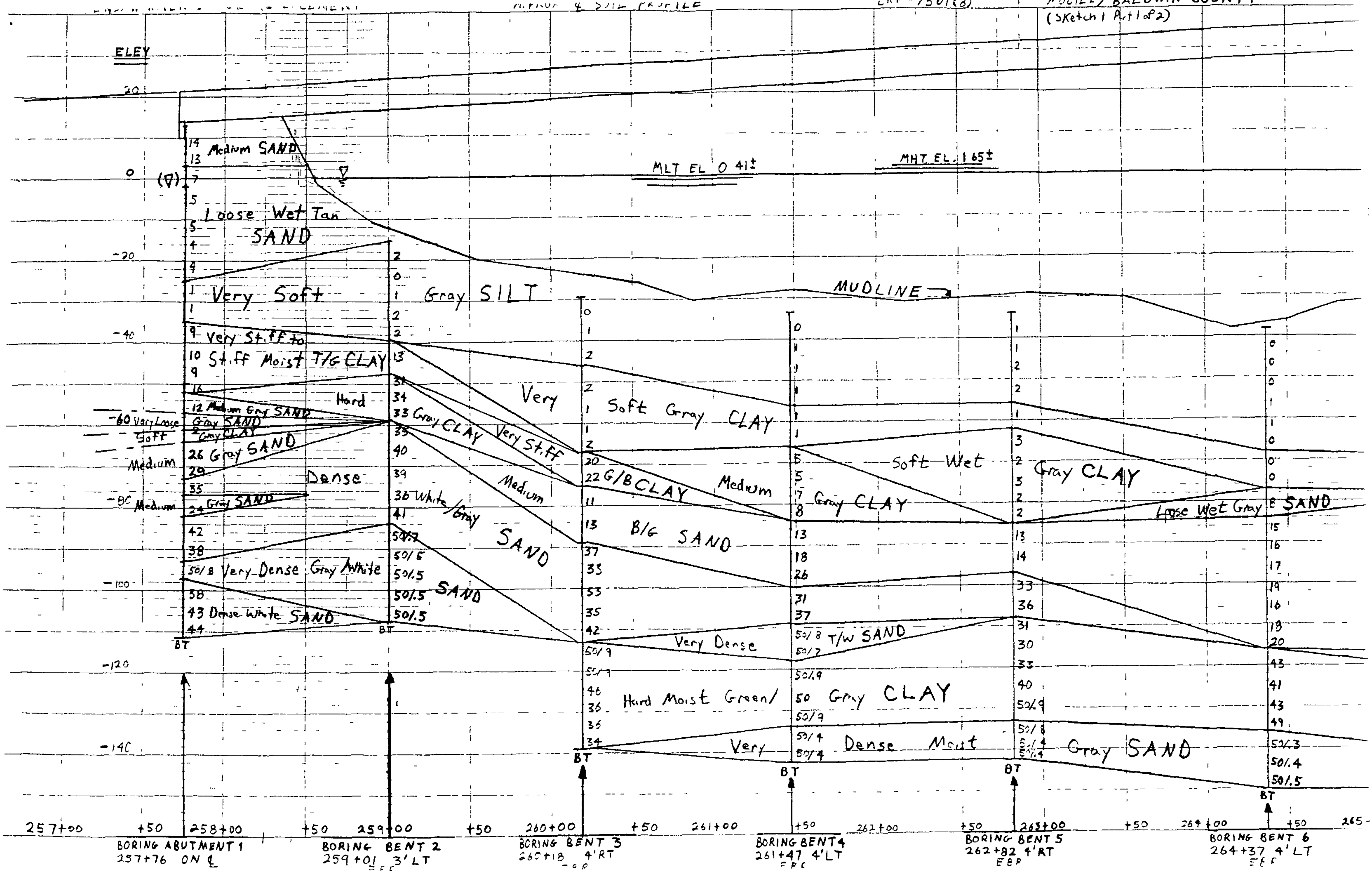


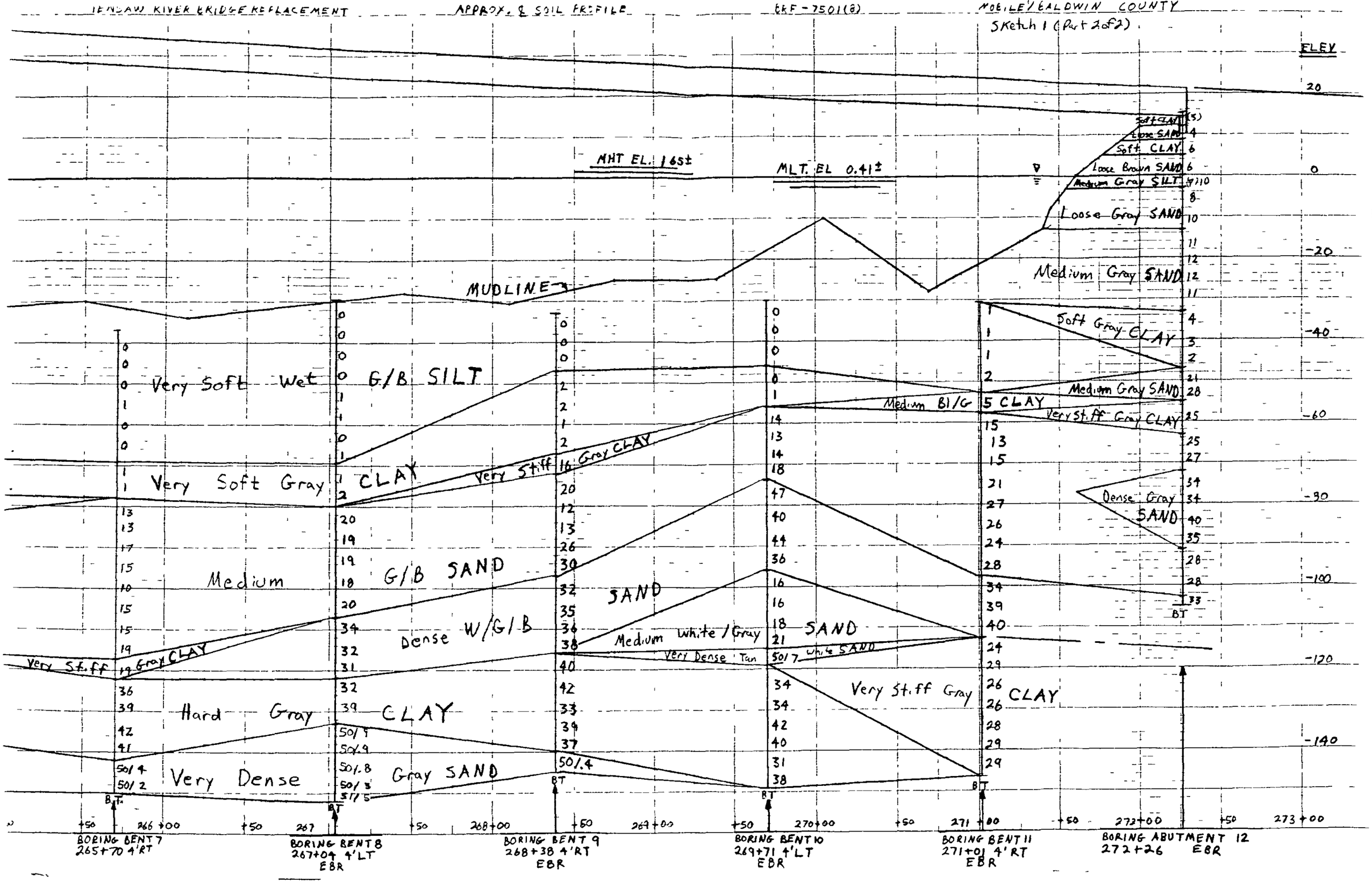
Figure 1 -- Geologic map of the Mobile area Mobile and Baldwin Counties, showing the location of Project BR-7501(8) (Reed, Philip C , 1971, Geology of Mobile County, Alabama Alabama Geological Survey Special Map 93) (Reed, Philip C , 1971, Geology of Baldwin County, Alabama Alabama Geological Survey Map 94)

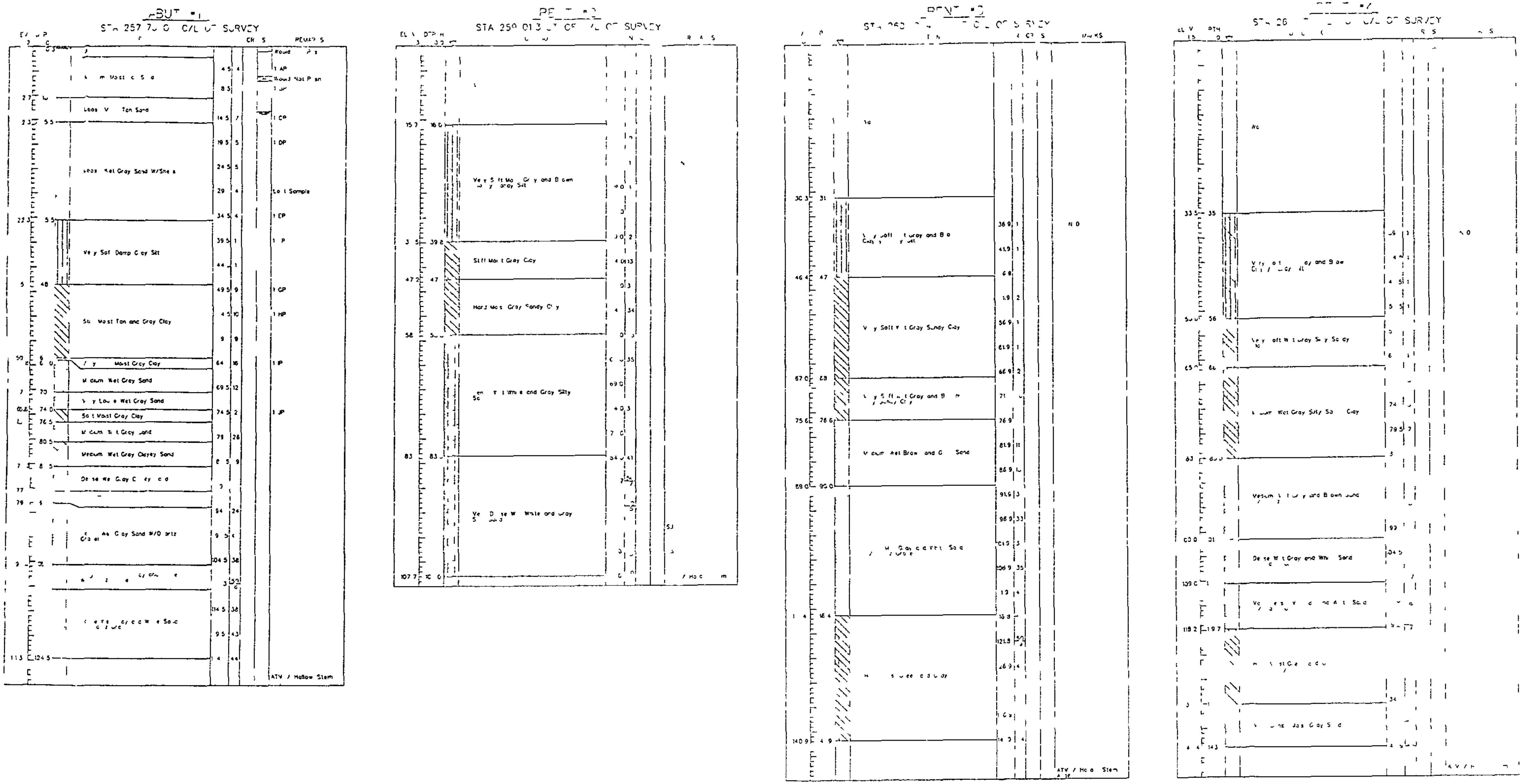


(Sketch 1 Part 1 of 2)
ELEV
20
0
-20
-40
-60
-80
-100
-120
-140
Medium SAND
Loose Wet Tan SAND
Very Soft Gray SILT
Very Stiff to Stiff Moist T/G CLAY
Hard
Medium Gray SAND
Very Loose Gray SAND
Soft Gray CLAY
Medium Gray SAND
Dense
Medium Gray SAND
Gray CLAY
Very Stiff
Medium
White/Gray SAND
Very Dense Gray White SAND
Dense White SAND
Very Soft Gray CLAY
G/B CLAY
Medium
B/G SAND
Soft Wet Gray CLAY
Gray CLAY
Loose Wet Gray SAND
Very Dense T/W SAND
Hard Moist Green/Gray CLAY
Very Dense Moist Gray SAND
MLT EL 0.41±
MHT EL 1.65±
MUDLINE
BT
257+00
+50
258+00
259+00
260+00
261+00
262+00
263+00
264+00
265
BORING ABUTMENT 1
257+76 ON ℄
BORING BENT 2
259+01 3' LT
BORING BENT 3
260+18 4' RT
BORING BENT 4
261+47 4' LT
BORING BENT 5
262+82 4' RT
BORING BENT 6
264+37 4' LT

TENSAW RIVER BRIDGE REPLACEMENT — APPROX. & SOIL PROFILE — BRF-7501(8) — MOBILE/BALDWIN COUNTY

Sketch 1 (Part 2 of 2)

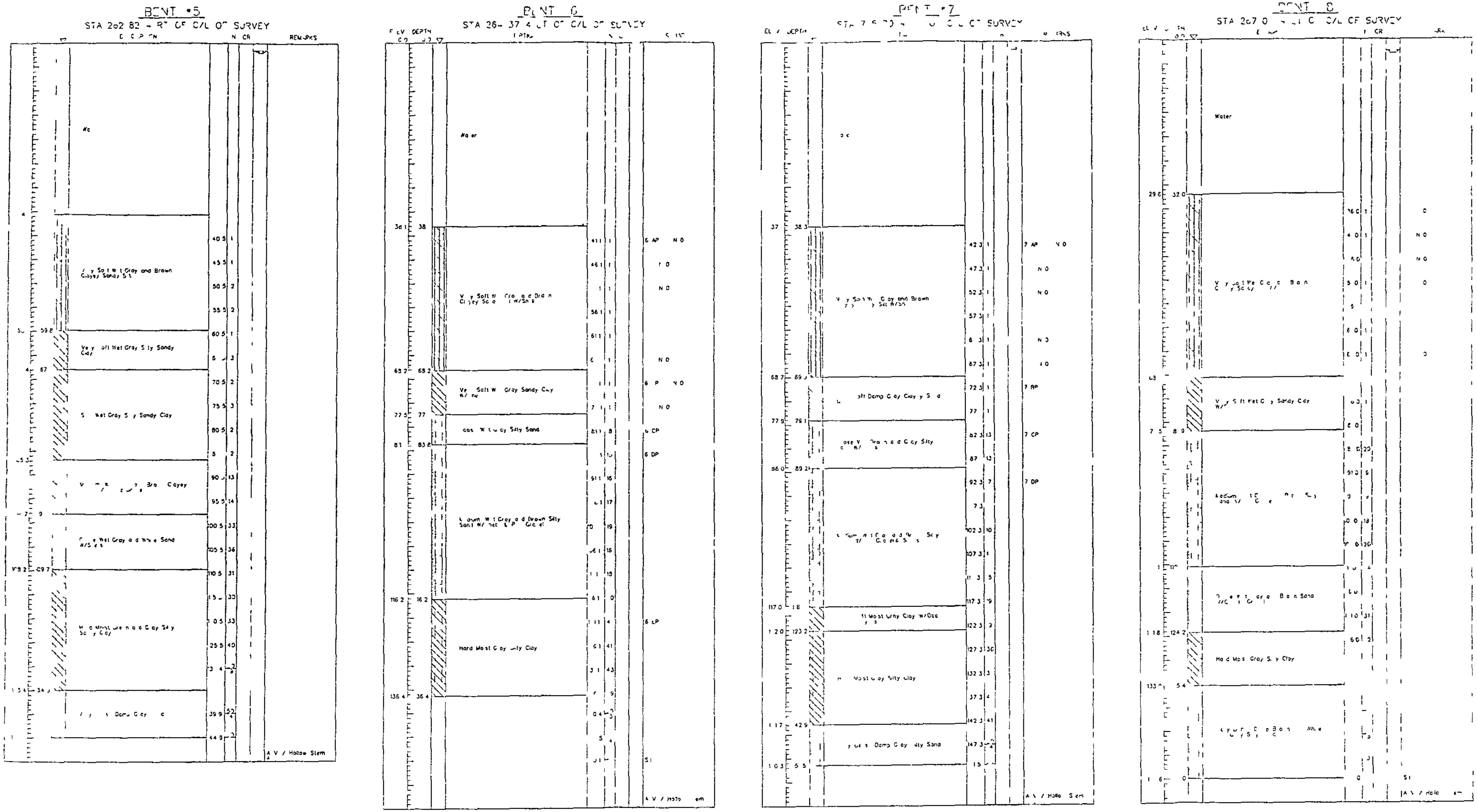




NOTE
The subsurface investigation for this Project was [illegible] by personnel from the Bureau
See Standard Drawing No. BUNI [illegible]

N STANDARD PENETRATION IN BLOWS PER FOOT (ASTM D 1586)
CR CORE RECOVERY NX OR AX [illegible] (ASTM D 2113)
S SYMBOLS DESCRIBED BELOW
UNDISTURBED SAMPLE (AS IN D 1587)
WATER TABLE TIME OF BORING
WATER TABLE 24 HOUR READING
LOSS OF DRILLING FLUID

BRIDGE SHEET NO OF	STATE OF ALABAMA HIGHWAY DEPARTMENT
BUREAU OF MATERIALS AND TESTS	BRF 7501(8) BRIDGE REPLACEMENT ON US 90 OVER TENSAW RIVER MOBILE & BALDWIN CO
APPROVED GEOTECHNICAL ENGINEER	
DATE	TEST BORING RECORD



N IS PENETRATION IN BLOWS PER FOOT (ASTM D 1586)

CR IS % CORE RECOVERY, X OR AX DESIGNATES TUBE (ASTM D 2113)

SYMBOLS DESCRIBED BELOW

UNDISTURBED SAMPLE (ASTM D 1587)

WATER TABLE TIME OF BORING

WATER TABLE 24 HOUR READING

LOSS OF DRILLING FLUID

NOTE

The subsurface investigation of this Project was conducted between ____ and ____ by personnel from the Bureau of Materials and Tests.

See Standard Drawing No. BENT note 23

BRIDGE SHEET NO. OF

STATE OF ALABAMA
HIGHWAY DEPARTMENT

BUREAU OF MATERIALS AND TESTS

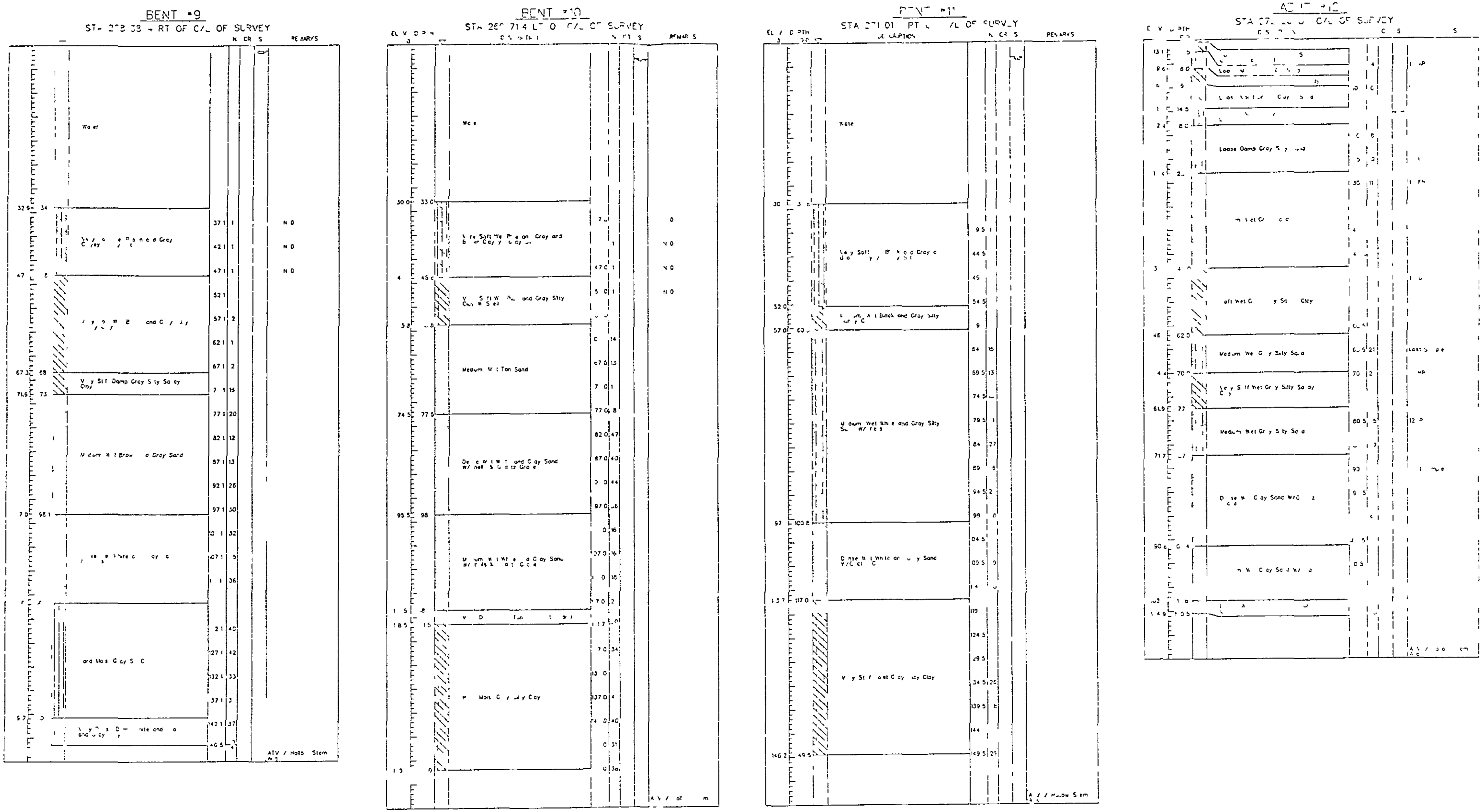
BRF 7501(8)
BRIDGE REPLACEMENT ON US 90
OVER TENSAW RIVER
MOBILE & BALDWIN CO

APPROVED

GEOTECHNICAL ENGINEER

DATE

TEST BORING RECORD



NOTE

[illegible]

See Standard Drawing No. BR [illegible] note 28

N IS PENETRATION IN BLOWS PER FOOT (ASTM D 1586)

CR IS % CORE RECOVERY [illegible]

SYMBOLS DESCRIBED BELOW

UNDISTURBED SAMPLE (ASTM D 1587)

WATER TABLE TIME OF BORING

WATER TABLE 24 HOUR READING

LOSS OF DRILLING FLUID

BRIDGE SHEET NO. [illegible]	STATE OF ALABAMA
BUREAU OF MATERIALS AND TESTS	BRF 750( ) BRIDGE REPLACEMENT ON US 90 OVER TENSAW RIVER MOBILE & BALDWIN CO
APPROVED [illegible] GEOTECHNICAL ENGINEER	
DATE -	TEST BORING RECORD

Appendix

Chemical Analysis Results

Soil Classification Results

B*

AB NO 311-3119 BMT-16 Rev 10/87

ALABAMA DEPARTMENT OF TRANSPORTATION

OPIES TO File
Chemical Lab
Stanley Armstrong

PROJECT NO(S) BRF-7501(8)

COUNTY Mobile/Baldwin

DIVISION 9th

DATE 08/03/94

)INSPECTION
'EPORT OF)ANALYSIS ON SAMPLE OF Water

)ATE RECEIVED 07/19/94
)ATE TESTED 08/02/94
'RODUCER
DENTIFICATION MARKS
OURCE OF MATERIAL Bridge Over Tensaw River On Battleship Parkway
)UANTITY (REPRESENTED)
SAMPLED BY / DATE 07/18/94
SUBMITTED BY / DATE
?EMARKS

TEST RESULTS

SOIL

>H	None
hloride, mg/L	Submitted
Sulfate, mg/L	
Resistivity, ohm-cm	

WATER

>H	7 48
Chloride, mg/L	45
Sulfate, mg/L	8
Resistivity, ohm-cm	5051

SAMPLE(S) N/A MEET THE REQUIREMENTS OF THE ALABAMA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR

kc ✓

E L McCutchin
TESTING ENGINEER

LAB NO 301-1003

BMT-149 Rev 10/87

ALABAMA DEPARTMENT OF TRANSPORTATION

COPIES TO File
Chemical Lab
Geotechnical Lab ✓

PROJECT NO(S) BRM-7501( )

COUNTY Mobile/Baldwin

DIVISION 9th

DATE 08/30/94

WATER ANALYSIS REPORT

SOURCE	Site 1 Of 1, Tensaw River
SAMPLED BY	McCartha
DATE/TIME SAMPLED	08/24/94 10 10 a m
WATER TEMPERATURE	29°C
SUBMITTED BY / DATE	McCartha
TESTED BY / DATE	Casey
WEATHER CONDITIONS	Air Temperature 28°C

REMARKS

PARAMETER	METHOD	RESULTS	UNIT
pH	EPA 150 1	6 56	
Turbidity	EPA 180 1	--	ntu
Dissolved Oxygen	EPA 360 1	7 7	mg/L
Chloride	EPA 325 3	949 62	mg/L
Sulfate	EPA 375 4	1312	mg/L
Specific Conductance at 25°C	EPA 120 1	--	u mhos/cm
Filtrable Residue	EPA 160 1	0 019	mg/L
Non-Filtrable Residue	EPA 160 2	1 717	mg/L
Total Residue	EPA 160 3	1 736	mg/L
Alkalinity as Calcium Carbonate	EPA 310 1	35 2	mg/L
Hardness as Calcium Carbonate (Calcium & Magnesium)	* 2340 (B)	129 7637	mg/L
Conductivity (milli-seimens)		341	
Oil & Grease		0 4060914	mg/L

* Standard Methods for the Examination of Water & Wastewater

METALS BY ATOMIC ABSORPTION METHODS

Total Iron	EPA 236 1	0 36	mg/L
Total Zinc	EPA 289 1	0 45	mg/L
Total Copper	EPA 220 1	0 04	mg/L
Total Chromium	EPA 218 1	0 11	mg/L
Total Nickel	EPA 249 1	0 04	mg/L
Total Manganese	EPA 243 1	0 09	mg/L
Total Magnesium	EPA 242 1	20 9	mg/L
Total Calcium	EPA 215 1	17 5	mg/L

E L McCutchin RC-S
TESTING ENGINEER

✓

LAB NO SEE BELOW

BMT-16 Rev 10/87

ALABAMA HIGHWAY DEPARTMENT

COPIES TO File
Soil Lab
Mr Stanley Armstrong - 1

PROJECT NO(S) BRF-7501(8)

COUNTY Mobile/Baldwin

DIVISION 9th

DATE 08/09/94

PARTICLE SIZE ANALYSIS FOR BRIDGE FOUNDATIONS

DATE TESTED	8/8/94
STATION	272+26
LOCATION	ON C/L
GROUND ELEVATION	15 59
REMARKS	FOUNDATION SAMPLE Abutment #12 Tensaw River

TEST RESULTS

LAB NUMBER	DEPTH (FT)	D50 (MM)	CLASSIFICATION
FGR-35-P-179	4 0 to 5 5	15	SM
FGR-35-P-180	9 0 to 10 5	15	SM
FGR-35-P-181	14 0 to 15 5	---*	SM
FGR-35-P-182	24 0 to 25 5	16	SM
FGR-35-P-183	29 0 to 30 5	16	SM
FGR-35-P-184	49 0 to 50 5	52 4%-200	CL
FGR-35-P-185	69 0 to 70 5	15	SM

*NOTE LOST SAMPLE DURING TESTING

dd

E L McCutchin
TESTING ENGINEER