and performed a 360-degree scanning sonar survey. The positioning report, prepared by Fugro Chance, is presented in Appendix C. The scanning sonar reports are available from Fugro Chance upon request.

Table 1: Final Boring Coordinates
(Texas South Central Zone Coordinates)

Boring Designation	Boring Designation by Fugro Chance*	Block Number (Galveston Area)	Proposed Boring Coordinates (ft)	Final Boring Coordinates (ft)	Boring Termination Depth (ft)
Boring 1	Core 1	363	X = 3,204,371.92 Y = 327,915.88	X = 3,204,379 Y = 327,917	26
Boring 2	Core 2	362	X = 3,206,611.55 Y =325,019.26	X = 3,206,625 Y = 325,015	26
Boring 3	Core 3	380	X = 3,208,819.93 Y =322,163.06	X = 3,208,821 Y = 322,164	26
Boring 4	Core 4	380	X = 3,210,977.64 Y =319,372.40	X = 3,210,977 Y = 319,369	26

* Refer to positioning report by Fugro Chance presented in Appendix C.

Samples were obtained through 5.0-in.-OD, 4.5-in.-IF drill pipe at 3-ft intervals to 26-ft penetration. A 2.50-in.-OD liner sampler was used to between 12- and 26-ft penetration at the boring locations. The remaining samples were taken using a 2.25-in.-OD thin-walled, Shelby tube sampler that was pushed into the soil with the weight of the drill pipe or driven into the soil. The drilling and sampling techniques used to complete this boring are explained in detail in Appendix A. The Summary of Field Operations is also presented in Appendix A.

The water depths at the boring locations were estimated using the wireline technique and are presented in Plate 1b. The water depth measurements are intended for the purpose of the geotechnical investigation only, and are not corrected for tidal or other variations. If utilized for other purposes, the water depth measurement should be adjusted to account for meteorological tide and datum corrections. The water depth measuring procedures are explained in detail in Appendix A.

Field and Laboratory Tests

The soil testing program was designed to evaluate pertinent index and engineering properties of the foundation soils. During the field operation, all samples were extruded from the sampler and classified by the soil technician or field engineer. Unit weight, Torvane, pocket penetrometer, and miniature vane were performed in the field on selected cohesive samples. All of the samples were shipped to Fugro's Houston laboratory where Atterberg limit tests, water content tests and grain-size analyses, as well as additional density tests, unconsolidated-undrained triaxial compression tests, and miniature vane tests, were performed.

A description of relevant laboratory procedures is provided in Appendix A. The strength and classification test results are presented graphically on the Log of Boring and Test Results (Plates 2 through 5) and are tabulated in Appendix A.

GENERAL SOIL CONDITIONS

The soil stratigraphy disclosed by the field and laboratory investigations is presented on the boring logs, Plates 2 through 5. The soil stratigraphy is based on the classification of soil samples recovered from the four borings and observations made during drilling operations. A generalized summary of the major soil strata is tabulated below:

Boring 1

Stratum	Penetration, ft From	To	Description
I	0	26	Very soft to soft clay

Boring 2

Strata	Penetration, ft From	To	Description
I	0	12	Very soft clay
II	12	21	Soft to stiff clay
III	21	26	Soft to firm clay to sandy lean clay

Boring 3

Strata	Penetration, ft From	To	Description
I	0	12	Very soft to soft clay
II	12	19	Firm to stiff clay
III	19	26	Firm lean clay interlayered with loose sandy silt to silty fine sand

Boring 4

Strata	Penetration, ft From	To	Description
I	0	9	Very soft to soft clay
II	9	19	Firm clay
III	19	26	Loose silt with sand to sandy silt

Detailed soil descriptions that include textural variations and inclusions are noted on the boring logs. A key to the terms and symbols used on the boring log is presented on Plate 6. The Roman numeral representing each stratum is also shown on the boring log.

CONCLUSIONS AND RECOMMENDATIONS

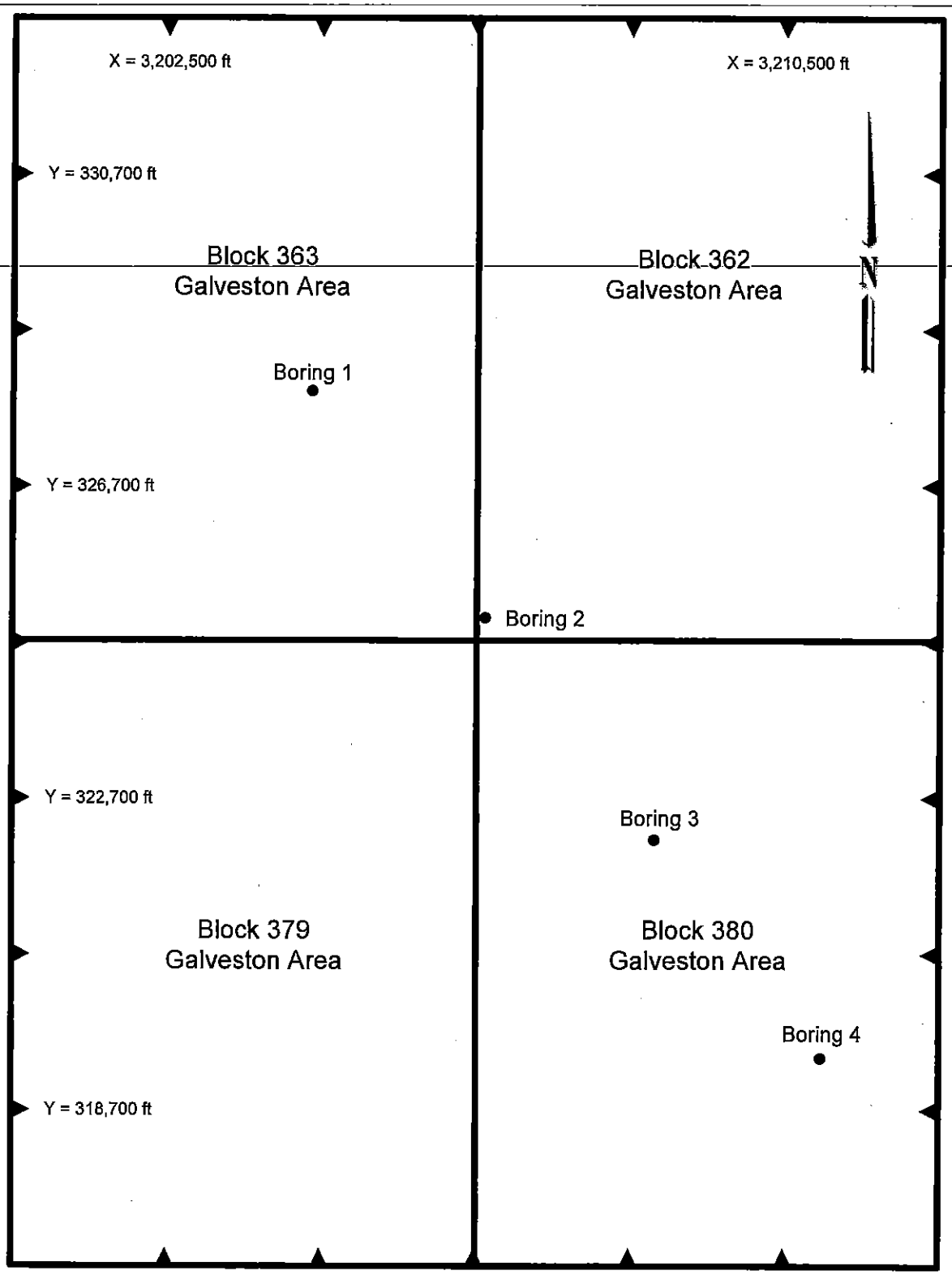
The geotechnical investigation along the proposed TOPS 42-in. Export Pipeline, Coastwise Safety Fairway Crossing in Blocks 362, 363, and 380 of the Galveston Area in the Gulf of Mexico consisted of four soil borings and field and laboratory testing. A summary of the pertinent conclusions and recommendations follows.

- Four borings were used to characterize the soil conditions along the proposed pipeline corridor.
- Scanning sonar surveys were performed at each boring location and is available upon request.
- Water depth measurements of 73-, 80-, 79-, and 82-ft were measured at Boring 1, Boring 2, Boring 3, and Boring 4 locations, respectively.
- No engineering analyses were requested for these locations.

SERVICE WARRANTY

Appendix B contains the "Service Warranty," which outlines the limitations and constraints of this report in terms of a range of considerations including, but not limited to, its purpose, its scope, the data on which it is based, its use by third parties, and possible changes in the conditions at the site with time. This section represents a clear description of the constraints, which apply to all reports issued by FMMG. It should be noted that the Service Warranty does not in any way supersede the terms and conditions of the contract between FMMG and the Client.

ILLUSTRATIONS



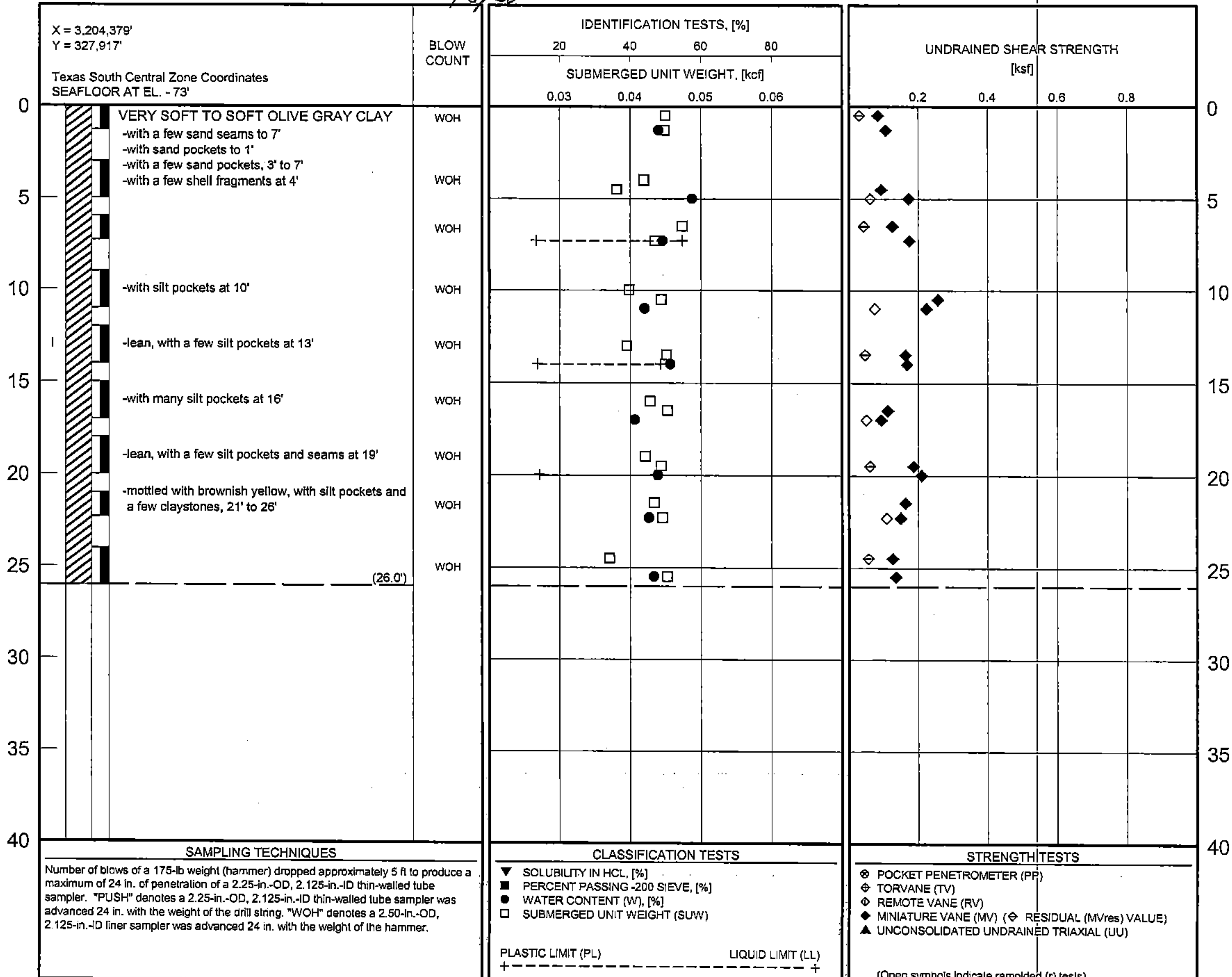
Projection: Texas South Central Zone Coordinates
Scale: 1 in = 2,000 ft

Date: 10/3/08
Drawn By:
Date: 10/3/08
Checked By: DMP
Date: 10/6/08
Approved By:

PLAN OF BORINGS

42-in. Export Pipeline, Coastwise Safety Fairway Crossing
Blocks 362, 363, and 380, Galveston Area

Report No. 0201-6508



FUGRO

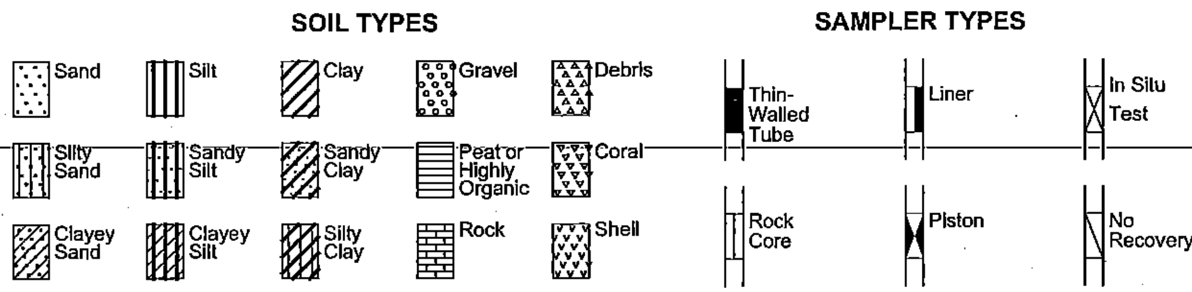
LOG OF BORING AND TEST RESULTS

42-in. Export Pipeline, Coastwise Safety Fairway Crossing, Boring 1

Block 363, Galveston Area

TERMS AND SYMBOLS USED ON BORING LOG

SOIL TYPES / SAMPLER TYPES



SOIL GRAIN SIZE

U.S. STANDARD SIEVE

	6"	3"	3/4"	4	10	40	200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY	
		COARSE	FINE	COARSE	MEDIUM	FINE			
	152	76.2	19.1	4.76	2.00	0.420	0.074	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS(1)

Consistency	Undrained Shear Strength, Kips Per Sq Ft
Very Soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

DENSITY OF GRANULAR SOILS(2,3)

Descriptive Term	*Relative Density, %
Very Loose	less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	greater than 85

*Estimated from sampler driving record

SOIL STRUCTURE(1)

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt, usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.

REFERENCES:

(1) ASTM D 2488

(2) ASCE Manual 56 (1976)

(3) ASTM D 2049

Information on each boring log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the log may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated in the text, and may vary with time, geologic condition or construction activity.

Drawn By: Date: 8/20/08
Checked By: Date: 8/20/08
Approved By: Date: 10/03/08

Checked By: AW Date: 10/2/08
Approved By: LS Date: 10/6/08

Drawn By: [illegible] Date: 10/2/08

Report No. 0201-6508

Summary of Test Results

Job No.: 0201-6508-1 02-Oct-2008 (Ver. #7)
Boring: 42-in. Export Pipeline, Coastwise Safety Fairway Crossing, Boring 1
Block: 363
Area: Galveston

Sample No.	Depth (ft)	Identification Tests: Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Submerged Unit Weight (pcf)	Passing No. 200 Sieve	Strength Estimate (ksf): Penetrometer	Strength Estimate (ksf): Torvane	Miniature Vane Tests (ksf): Undisturbed	Miniature Vane Tests (ksf): Remolded	Miniature Vane Tests (ksf): Residual	Compression Tests: Type Test	Moisture Content (%)	Confining Pressure (psi)	Undisturbed Strength (ksf)	Remolded Strength (ksf)	ε_{50} Strain (%)	Submerged Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.50					45				0.08		0.03									
2	1.30				48	45				0.11											
3	4.00					42															
4	4.50					38				0.09											
5	5.00				57						0.06										
5	5.00									0.17											
6	6.50					47				0.13		0.04									
7	7.30	.86	55	13	49	43				0.17											
8	10.00					40															
9	10.50					44				0.26											
10	11.00				44						0.07										
10	11.00									0.22											
11	13.00					40															
12	13.50					45				0.16		0.05									
13	14.00	1.08	49	14	51					0.17											
14	16.00					43															
15	16.50					45				0.11											
16	17.00				41						0.05										
16	17.00									0.09											
17	19.00					42															
18	19.50					44				0.19		0.06									
19	20.00	1.02	47	14	48					0.21											

NOTES:

TYPE OF TEST
U - Unconfined Compression
UU- Unconsolidated-Undrained Triaxial
CU- Consolidated-Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Plus Signs [+] denote tests which exceeded the capacity of the measuring device.

NP = Non Plastic Material

PLATE A-2a

FUGRO

Checked By: AW Date: 10/2/08
Approved By: LS Date: 10/6/08

Drawn By: mm Date: 10/2/08

Report No. 0201-6508

Summary of Test Results

Job No.: 0201-6508-1 02-Oct-2008 (Ver. #7)
Boring: 42-in. Export Pipeline, Coastwise Safety Fairway Crossing, Boring 1
Block: 363
Area: Galveston

		Identification Tests						Strength Estimate (ksf)		Miniature Vane Tests (ksf)			Compression Tests								
Sample No.	Depth (ft)	Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Submerged Unit Weight (pcf)	Passing No. 200 Sieve	Penetrometer	Torvane	Undisturbed	Remolded	Residual	Type Test	Moisture Content (%)	Confining Pressure (psi)	Undisturbed Strength (ksf)	Remolded Strength (ksf)	ε_{50} Strain (%)	Submerged Unit Weight (pcf)	Failure Strain (%)	Type of Failure
20	21.50					43				0.16											
21	22.30					45				0.15											
21	22.30				45						0.11										
22	24.50					37				0.13		0.06									
23	25.50				47	45				0.14											

NOTES:

TYPE OF TEST
U - Unconfined Compression
UU- Unconsolidated-Undrained Triaxial
CU- Consolidated-Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Plus Signs [+] denote tests which exceeded the capacity of the measuring device.

NP = Non Plastic Material

PLATE A-2b

TOPS
Texas Offshore Port System

SOIL BORINGS
CORES 1- 4
GALVESTON AREA BLOCKS 362, 363 & 380

1. INTRODUCTION:

Fugro Chance Inc. (CHANCE) was contracted by Fugro-McClelland Marine Geosciences, Inc. to position the L/B *"Petite"* for soil borings and to perform pre-well site investigations in Galveston Area, Blocks 362, 363 and 380, Offshore Texas.

2. REQUIREMENTS:

Positioning requirements were transmitted, via e-mail, to Mr. Tony Parker of ***CHANCE*** by Mr. Frank Ortiz of Fugro-McClelland Marine Geosciences, Inc. "Survey Request" forms dated July 10, 2008 e-mailed to Mr. Manuel Lopez of Enterprise Field Services, L.L.C., confirmed these requirements. Copies of these forms were also e-mailed to Mr. Frank Ortiz.

Requirements were as follows:

A) Proposed Locations

The Texas South Central Zone Coordinates are:

CORE 1- BLOCK 363	CORE 2 - BLOCK 362
Y = 327,915.88'	Y = 325,019.26'
X = 3,204,371.92'	X = 3,206,611.55'
CORE 3 - BLOCK 380	**CORE 4 - BLOCK 380**
Y = 322,163.06'	Y = 319,372.40'
X = 3,208,819.93'	X = 3,210,977.64'

B) Utilize scanning Sonar to perform site investigations.

3. CHANCE PERSONNEL:

Party Chief - P. Arceneaux
Surveyor - W. Straton

4. EQUIPMENT AND METHOD:

A) Primary Positioning System - **STARFIX® Satellite Positioning System**

Continuous dynamic positioning through the use of Navstar GPS with differential signals from multiple reference stations corrected for ionospheric and tropospheric effects transmitted via the **STARFIX®** equatorial geosynchronous satellite.

B) Secondary Positioning System - **Differential Global Positioning System (DGPS)**

DGPS utilizes the Navstar Satellite Constellation with data from selected reference sites transmitted via LF radio-link for enhanced accuracy through differential techniques.

C) **STARFIX.NAV®**

STARFIX.NAV® is an on board computer graphic system interfaced to the primary positioning system capable of displaying real time position of a vessel in relation to known hazards, fairways, proposed location, etc. **DRONE®** units when used on anchor handling vessels utilize Differential GPS transmitted to the master station via radio telemetry link to display in real time the position of that vessel.

D) Vessel orientation by Sperry SR 50 Mod 1 North Seeking Gyro or a S. G. Brown Meridian North Seeking Gyro

North seeking Gyro compass. Accuracy $\pm 2^{o}$ after 4 hours initial spin up.

E) Scanning Sonar

Simrad MS1000 High Resolution Sonar

5. RESULTS:

Geographic positions are based on Clarke 1866 Spheroid, North American Datum 1927. Grid coordinates are based on Texas South Central Zone Lambert, NAD 27.

Field operations were conducted from July 14, 2008 to July 18, 2008 with the following results:

A) **STARFIX®** positions derived by averaging readings over a one hour period at an update rate of 750 ms. per reading.

CORE 1- BLOCK 363

Y = 327,917.01'
X = 3,204,379.15'

Latitude: 28° 40' 55.185" N
Longitude: 95° 14' 35.344" W

This location being 3197.01' FSL and 2136.66' FEL of Block 363, Galveston Area

CORE 2 - BLOCK 362

Y = 325,015.26'
X = 3,206,625.03'

Latitude: 28° 40' 25.753" N
Longitude: 95° 14' 11.189" W

This location being 295.26' FSL and 109.22' FWL of Block 362, Galveston Area

CORE 3 - BLOCK 380

Y = 322,164.00'
X = 3,208,821.22'

Latitude: 28° 39' 56.835" N
Longitude: 95° 13' 47.578" W

This location being 2556.00' FNL and 2305.41' FWL of Block 380, Galveston Area

CORE 4 - BLOCK 380

Y = 319,368.63'
X = 3,210,976.70'

Latitude: 28° 39' 28.482" N
Longitude: 95° 13' 24.406" W

This location being 5351.37' FNL and 4460.89' FWL of Block 380, Galveston Area

6. CONFIRMATION:

DGPS was used for confirmation.

The results were as follows:

CORE 1 - BLOCK 363	CORE 2 - BLOCK 362
Y = 327,917'	Y = 325,015'
X = 3,204,379'	X = 3,206,625'
CORE 3 - BLOCK 380	**CORE 4 - BLOCK 380**
Y = 322,164'	Y = 319,369'
X = 3,208,821'	X = 3,210,977'

7. HSE INCIDENTS:

No incidents.

8. CHRONOLOGY:

July 14, 2008

0700 Arrived at Lafayette office to pick up job packet and equipment, departing for Pelican Island; start time for job
1300 Arrived at dock; mobing L/B "Petite"
1600 Mob complete; standing by to depart for proposed location
1830 En route to location GA. 363
2400 En route to location continues

July 15, 2008

0001 En route to location GA. 363
1230 Arrived at location; deploying Sonar 200' from proposed Core #1 site
1240 Conducting Sonar investigation on proposed core site
1300 Area appears clear; Sonar on deck; moving L/B into position
1330 L/B in position; deploying Sonar to continue site investigation
1350 Sonar data indicates area is clear; Sonar on deck; beginning pre-load
1530 Drill crew performing soil boring
1830 Starting final tie
1930 Final tie complete; no signal to Lafayette office available, will try again later for final tie confirmation from office
2210 Core #1 complete; jacking down to move to Core #2 site
2342 Moved vessel to GA. 362; deploying Sonar 150' away from proposed Core #2 site
2345 Conducting Sonar investigation on proposed core site
2400 Area appears clear; Sonar on deck; moving L/B into position

July 16, 2008

0001 Moving vessel into position continues
0017 Vessel in position; deploying Sonar to continue site investigation
0038 Sonar data indicates area is clear; Sonar on deck; beginning pre-load
0045 Drill crew performing soil boring
0830 Starting final tie
0900 Final tie complete
0913 Sent final tie for Core #1 and Core #2 to Lafayette office; awaiting confirmation
1030 Received confirmation for Core #1 and Core #2
1400 Core #2 complete
1420 Jacking down to move to proposed Core #3 site
1443 En route to proposed site
1510 Moved vessel to GA. 380; deploying Sonar 141' from proposed Core #3 site
1530 Conducting Sonar investigation on proposed core site
1548 Area appears clear; Sonar on deck; moving L/B into position
1605 L/B in position; deploying Sonar to continue site investigation
1630 Sonar data indicates area is clear; Sonar on deck; beginning pre-load
1740 Starting final tie; drill crew performing soil boring
1840 Final tie complete; emailing Lafayette office for final tie confirmation
2000 Received final tie confirmation from office
2400 Soil boring continues

July 17, 2008

0001 Standing by for completion of soil boring
0030 Core #3 complete; jacking down to move over to proposed Core #4 site
0130 At proposed core site; deployed Sonar; conducting site investigation
0155 Area appears clear; Sonar on deck; moving L/B into position
0212 Vessel in position; deploying Sonar to continue site investigation
0240 Sonar data indicates area is clear; Sonar on deck; beginning pre-load
0800 Pre-load complete; starting final tie
0900 Final tie complete; emailing Lafayette office for final tie confirmation
0930 Received final tie confirmation from office; drill crew preparing to start soil boring operations

0945 Drill crew performing soil boring
1230 Core #4 complete; demobing drill
1245 Demobing NAV
1330 L/B jacking down; preparing to depart location
1430 En route to dock in Pelican Island
2400 En route to dock continues

July 18, 2008

0001 En route to dock in Pelican Island
0230 Arrived at dock departing for Lafayette office
0700 Arrived at office; end time for job

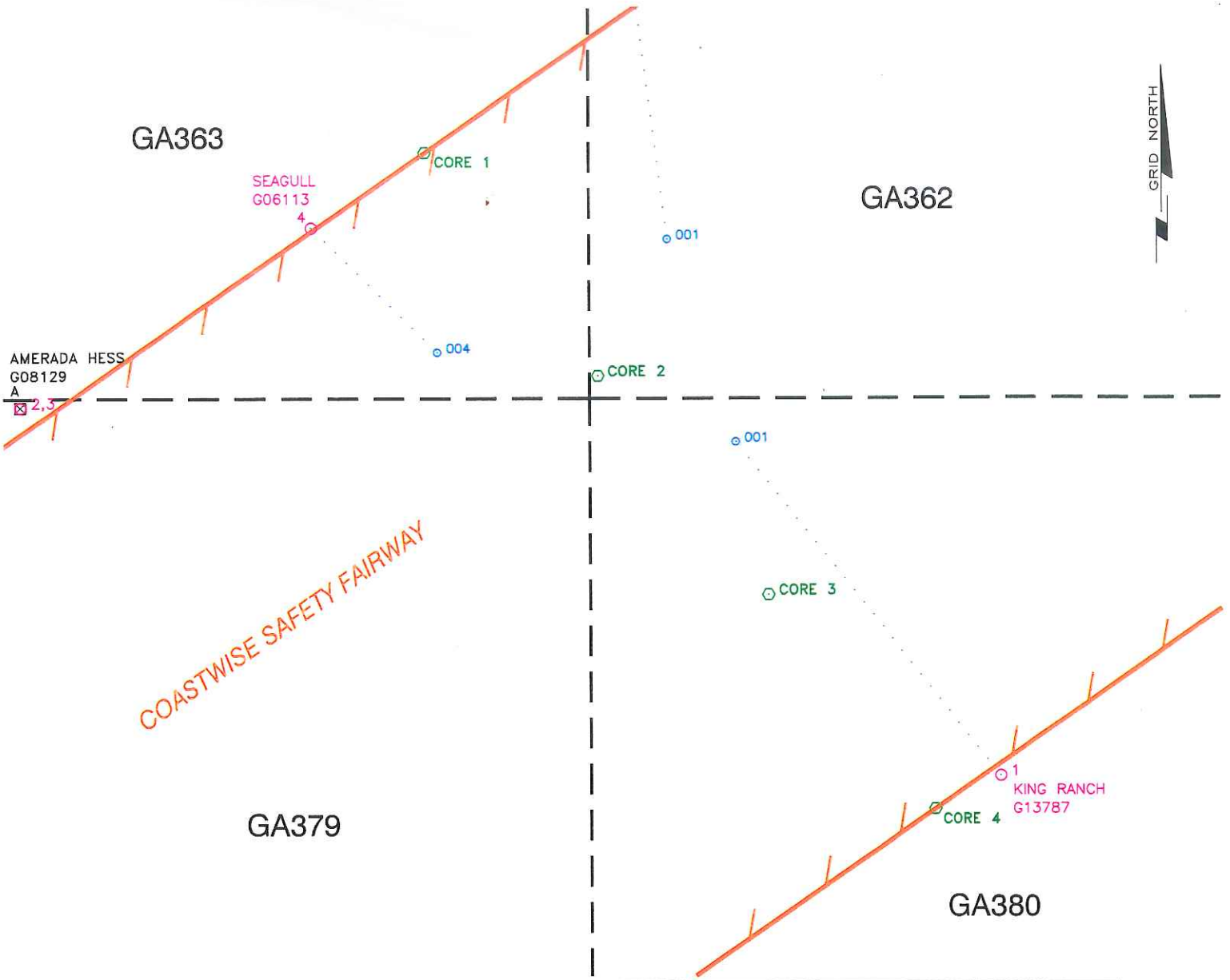
Sincerely,

FUGRO CHANCE INC.

James P. O'Neal, P.L.S.
Vice-President, Marine Operations

JPO: dme

Attachment



FINAL SOIL BORINGS

LOCATION	BLOCK	CALLNS	CALLEW	X COORDINATE	Y COORDINATE	LATITUDE	LONGITUDE
CORE 1	363	3,197.01' FSL	2,136.66' FEL	3,204,379.15'	327,917.01'	28° 40' 55.185"N	95° 14' 35.344"W
CORE 2	362	295.26' FSL	109.22' FWL	3,206,625.03'	325,015.26'	28° 40' 25.753"N	95° 14' 11.189"W
CORE 3	380	2,556.00' FNL	2,305.41' FWL	3,208,821.22'	322,164.00'	28° 39' 56.835"N	95° 13' 47.578"W
CORE 4	380	5,351.37' FNL	4,460.89' FWL	3,210,976.70'	319,368.63'	28° 39' 28.482"N	95° 13' 24.406"W

I HEREBY CERTIFY THAT THE ABOVE FINAL SOIL BORING POSITIONS ARE CORRECT.

STATE OF LOUISIANA
STEPHEN R. HENRY
REG. No. 4903
REGISTERED PROFESSIONAL LAND SURVEYOR

Stephen Henry

REG. PROFESSIONAL LAND SURVEYOR NO. 4903
STATE OF LOUISIANA 10-3-08

NOTES:

1) SURVEYED COORDINATES TRANSFORMED FROM NAD83 (GPS DATUM) TO NAD27 (CHART DATUM) USING NADCON VERSION 2.1.

Printed: 10/3/08

TOPS
Texas Offshore Port System

FINAL SOIL BORINGS
NO LEASE NUMBERS

BLOCKS 362, 363 & 380
GALVESTON AREA
GULF OF MEXICO

FUGRO CHANCE INC.
200 Dulles Dr. Lafayette, Louisiana 70506-3001 (337) 237-1300

GEODETIC DATUM: NAD27
PROJECTION: TEXAS SOUTH CENTRAL
GRID UNITS: US SURVEY FEET

SCALE IN FEET 0 2,000'

Job No.: 08-02132 | Date: 10/03/08 | Drwn: SJL | Chart: 1 Of: 1

Dwgfile: O:\WellPermit\TXsc\GA\Permit\380s363s362_Cores_0802132