REPORT OF GEOTECHNICAL EXPLORATION SHIPYARD - PHASE I BULKHEAD JACKSONVILLE, FLORIDA E&A PROJECT NO. 01-1346



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TRI-LEGACY DEVELOPMENT

for

by

Ellis & Associates, Inc. 7064 Davis Creek Road Jacksonville, Florida 32256

November 9, 2001

7064 DAVIS CREEK ROAD JACKSONVILLE, FLORIDA 32256 PHONE: 904/880-0960 FAX: 904/880-0970



November 9, 2001

Tri-Legacy Development P.O. Box 41064 Jacksonville, Florida 32202

Attention: Mr. W. Hamilton Taylor

Subject:

Report of Geotechnical Explorations Shipyard-Phase I Bulkhead Jacksonville, Florida E&A Project No. 01-1346

Dear Mr. Taylor:

Ellis & Associates, Inc. (E&A) has completed a geotechnical exploration for the subject project as authorized by Eng. Andy Zarka, P.E. with BHR, Inc., on September 6, 2001, and was performed in accordance with our proposal dated June 29, 2001. The exploration was performed to determine the subsurface conditions along the proposed bulkhead alignment and to provided design recommendations for the proposed construction.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project and look forward to providing the materials testing and observation that will be required during the construction phase. If you have any questions or if we may be of any further service, please contact us.

Very truly yours, ELLIS & ASSOCIATES, INC.

Antoinette (Tina) D. Meskel, P.E. Sr. Project Engineer Registered, Florida No. 56999 N.Owin

Nemer (Nick) Y. Abdulla Oweis, P.E. Sr. Geotechnical Engineer Registered, Florida No. 44755

cc: Eng. Andy Zarka, P.E.- BHR, Inc. Eng. Lake Ray, III - Harbor Engineering

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1.0 **PROJECT INFORMATION**

1.1 Site Location and Description

The project site is located just south of the Hart Expressway and west of Metropolitan Park along the northern bank of the St. Johns River at the shipyard area (750 East Bay Street), in Jacksonville, Florida. The subject project area is located between Hogan Creek to the west and Pier No. 7 to the east, thus incorporating existing Piers 5, 6 and 7. Historical information indicates that the area has been used for industrial activities from the late 1800's to 1992. The areas of the project originally consisted of salt marshes and tidal flats, which have been filled to construct the existing river front facilities.

The topography of the ground surface adjacent to the existing bulkhead is generally relatively level. The ground surface is generally covered with grass and concrete pavement. Voids have occurred adjacent to the existing bulkhead deadman anchors and/or concrete crib. The bulkheads consist of steel sheet and concrete piles and appeared to be in poor condition at the time of our field exploration. Pier No. 6 is located between the proposed bulkhead areas within the Phase I portion of the project. The adjacent land to the north is currently relatively level and is developed with one-story structures and pavement and parking areas.

1.2 **Project Description**

Project information has been provided to us in discussions with Eng. Andy Zarka, P.E. with BHR, Inc., and Eng. Lake Ray, III, Eng. Kumran Marashi, P.E., and Eng. John Hutchins, P.E. with Harbor Engineering, Inc. We have been provided with a set of drawings titled Map Showing Boundary and Topographic Survey Of Shipyard (Sheet Nos. 1-8) for the subject site prepared by BHR, dated May 4, 2001 and other relevant information. These plans show the boundary limits of the site, layout of the existing construction, the existing roadways adjacent to the site, and site topographic information.

Based on the provided information, it is our understanding the project will consist of installing steel sheet pile walls adjacent the existing steel sheet and concrete bulkhead walls. It is understood the proposed sheet pile walls will be installed approximately one foot in front of the existing walls (waterside). We understand that flowable fill may be placed between the existing and proposed wall. It is our understanding the sheet piles could have section lengths of 50 to 60 feet and that pre-cast/pre-stressed concrete displacement piles may be used to provide anchor support to the walls. It is assumed that the river at the bulkhead would be dredged to El. -10.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. Any changes in these conditions should be provided so the need for reevaluation of our recommendations can be assessed.



2.0 FIELD EXPLORATION

A field exploration was performed during the period of September 17 to 28, 2001. A digitized copy of the plan provided to us, which shows the approximate boring locations, is included as the Field Exploration Plan, Figure 2. The approximate boring locations were determined in the field by our personnel using taped measurements from existing controls, and should be considered accurate only to the degree implied by the method of measurement used.

To explore the subsurface conditions along the existing/proposed bulkhead alignment, we located and performed 10 Standard Penetration Test (SPT) borings. Five SPT borings were drilled adjacent to the bulkhead on the landside to depths of approximately 50 to 75 feet below the existing ground surface, and five SPT borings were drilled waterside to depths varying between 50 and 60 feet below the mudline. The borings were performed in general accordance with the methodology outlined in ASTM D 1586. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation.

3.0 <u>LABORATORY TESTING</u>

3.1 Index Testing

Representative soil samples obtained from the SPT borings were visually classified in general accordance with the Unified Soil Classification System (USC). Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength characteristics. The laboratory testing determined the Atterberg limits, organic material, percent fines and natural moisture contents of the selected soil samples. The results of the laboratory testing are shown on the Summary of Laboratory Test Data included in Appendix B. Also, these results are shown on the Log of Boring records included in Appendix A and on the Generalized Subsurface Profiles (Figures 3 to 5) at the respective depths from which the tested samples were recovered.

3.2 Corrosion Testing

In addition, a selected soil sample was tested for corrosion properties. The tests performed included pH, electrical resistivity, and chloride and sulfate content. The results of the corrosion property tests are discussed in Section 5, and shown on Table 2.

4.0 <u>GENERAL SUBSURFACE CONDITIONS</u>

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on Figures 3 to 5. Detailed boring records are included in Appendix A. When reviewing these records it should be

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understood that the soil conditions will vary between the boring locations. The following discussion summarizes the general soil conditions encountered.

The results of the borings indicated relatively variable subsurface soil conditions. The waterside borings were performed in 6 to 14 feet of water (approximately El. -5 to -12) at the time of drilling depending on tide fluctuation. Below the mudline, approximately 11- to 29-foot thick layer of very soft organic silt (OL) and very loose silty fine sand with many organic materials (PT) were encountered to approximately El. -23 to -36. Below this soil zone, very loose to very dense fine sand (SP), fine sand with silt (SP-SM), fine sand with clay (SP-SC), silty fine sand (SM), clayey fine sand (SC), and very soft to firm sandy clay and clay (CH) were encountered to approximately El. -50 to -56. Loose to dense fine sand with clay (SP-SC) and clayey fine sand (SC) containing limestone fragments and phosphate nodules, locally referred to as Marl, then were encountered to the boring termination depths of 50 and 60 feet below mudline (El. -54 to -65).

The landside borings were performed through 6 to 27 feet of fill soils above the organic stratum. Concrete and asphalt pavement and topsoil were encountered to depths of approximately 0.5 feet. These materials were underlain by intermittent layers of very loose to dense fine sand (SP), fine sand with silt (SP-SM), silty fine sand (SM), clayey fine sand (SC) to approximately El. –6 to –26. This zone also contained layers of wood, roots and construction rubble. Soft to stiff organic silt and other soils with organic materials were encountered to approximately El. –11 to –32. Below this soil zone, inter-layered loose to dense fine sand, fine sand with silt, fine sand with clay, clayey to very clayey fine sand and soft to firm clay and sandy clay were encountered to approximately El. –45 and –45, respectively. Clayey fine sand containing limestone fragments and phosphate nodules (Marl) were then encountered to approximately El. –45 to –68 (boring termination depths).

4.2 Groundwater Level

The groundwater level was encountered at each of the landside borings and recorded, at the time of drilling, at depths varying from 2.5 to 6.0 feet below the existing ground surface. As previously mentioned, the water depth varied between 6 and 14 feet at the waterside boring locations at the time of our exploration. However, it should be anticipated the groundwater level will fluctuate due to seasonal climatic variations, tidal fluctuations, surface water runoff patterns, construction operations, and other interrelated factors. The depth to the groundwater level at each boring location is noted on the Generalized Subsurface Profiles and on the Log of Boring records.

5.0 DESIGN RECOMMENDATIONS

5.1 General

Our geotechnical engineering evaluation of the site and subsurface conditions at the property with respect to the planned construction and our recommendations for construction of the bulkhead walls are based on (1) our site observations, (2) the field and laboratory test data obtained, and (3) our understanding of the project information and structural conditions as presented in this report. 01-1346.doc Page 3

If the structural conditions are incorrect, please contact us so that we can review our recommendations. Also, the discovery of any site or subsurface conditions during construction, which deviate from the data obtained during this geotechnical exploration should also be reported to us for our evaluation.

The recommendations presented in the subsequent sections of this report present design and construction techniques, which are appropriate for the planned construction. We recommend that we be provided the opportunity to review final design specifications to verify that our recommendations have been properly interpreted and implemented.

5.2 Bulkhead Design Parameters

5.2.1 Selection of Engineering Properties

following genera	il soil profile:
Elevation, feet (MLW)	Description
Landside Only, -5 to -10	Very loose to medium dense fine sand (SP), fine sand with silt (SP-SM), silty fine sand (SM), clayey fine sand (SC) (Fill Soils)
-10 to -30	Soft to stiff organic silt (OL) and other soils with organic materials (PT)
-30 to -55	Very loose to very dense fine sand (SP), fine sand with silt (SP-SM), fine sand with clay (SP-SC), silty fine sand (SM), clayey fine sand (SC), and very soft to firm sandy clay and clay (CH)
-55 to -65	Loose to dense fine sand with clay (SP-SC) and clayey fine sand (SC) (Marl)

Our review of the results of the SPT borings conducted at the proposed bulkhead indicated the following general soil profile:

The above soil profile is outlined in general terms only. However, based on the relatively variable subsurface soil conditions encountered at the boring locations, soil parameters required for design of the proposed bulkhead walls were prepared in sections of relatively similar soil characteristics along the proposed wall alignment as shown on Plate 1. The parameters are based on empirical correlations between N-values and various soil properties. In each case, N-values were averaged over the zone of interest. Included are typical soil unit weight, angle of internal friction, cohesion, and the angle of wall friction.

5.2.2 Construction Considerations

It should be anticipated that debris may be encountered at the site which may impede the sheet pile driving operations. The contractor should be made aware that difficult driving conditions may be encountered during the proposed sheet pile installation. Also, if the existing bulkhead and it's associated anchors/cribs are not removed prior to driving the sheet piles, the voids behind the existing

bulkhead should be filled with compacted structural fill. Raveled soils should be over-excavated and re-compacted. Fine sand or FDOT 57 stone can be used to fill the space between the existing and proposed bulkhead. As an alternative, flowable fill may be used to fill the voids behind the existing bulkhead and the space between the existing and proposed bulkhead walls.

5.3 Bulkhead Pile Anchor Design Recommendations

5.4.1 Uplift Capacity

As previously mentioned, we understand 18-inch square displacement piles may be used as anchors to tie back the proposed bulkhead. Based on the results of our analysis, 18-inch diameter square precast/prestressed concrete piles, properly placed to bear in the medium dense to dense clayey fine sands (Marl) encountered at the boring locations between elevations of approximately El. -50 to El. -60 would provide allowable tensile capacities on the order of 30 to 70 tons with a safety factor of 2. Figures 1 through 6 included in Appendix D present allowable uplift pile capacities as a function of pile embedment depth for each section of proposed wall shown on Plate 1. It should be noted that the presented capacities were determined for vertical piles. Once a final design batter angle has been determined for the piles, we would be pleased to review the provided information.

5.4.2 Lateral Load Analysis

Lateral loads acting on the foundation may be resisted by the lateral resistance of the piles. The main criteria of assessing the allowable load per pile are to satisfy both the allowable bending moment in the pile and the allowable deflection of the pile group, depending on the soil conditions within a depth equal to approximately 20 times the pile diameter. The following soil parameters should be used for lateral analysis:

Elevation	Saturated Unit Weight, ^Y s (pcf)	Internal Friction Angle, φ (degrees)	Soil Modules, k (pci)	Cohesion, C (psf)	Soil Strain . Parameter, E ₅₀
Landside, 6 to -10	115	35	125		
-10 to -30	85	0	5	100	
-30 to -55	120	32	25		0.02
-55 to -65	120	58	50		

5.4 Environmental Classification

Corrosion series tests were performed on soil samples obtained at the boring locations. The samples were tested to evaluate the environmental classification for the proposed wall. Based on the test results and classification procedures, the soils encountered are considered moderately aggressive for

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concrete and steel. The environmental classification was based on the procedures presented in the FDOT Structures Design Manual, Chapter 7. Test results are included in Appendix B.

6.0 Pile Anchor Construction Considerations

6.1 Installation Criteria

The actual in-place length of the driven piles should be determined in the field by the use of wave equation analysis. The wave equation analysis considers the energy of the driving system and the weight and stiffness of the pile element, which is considered essential in achieving the proper penetration of the bearing strata by the pile and thus a satisfactory pile foundation system.

Care should be exercised to avoid damaging any nearby structures during pile driving operations. We recommend monitoring the vibrations generated by the pile driving operations. Pile driving should cease if deemed detrimental to adjacent structures and Ellis & Associates, Inc. should be contacted immediately. Predrilling through the existing bulkhead and concrete deadman/crib would be required to install the piles.

6.2 Hammer Selection

To help reduce over-driving, we recommend that the final driving criteria be carefully specified with respect to the pile type, pile size, and hammer size. The pile driving hammer should therefore be properly selected with relation to the size, weight, and type of pile specified. The ratio of an air or steam hammer ram to the weight of the pile should not be less than one-half and should preferably be on the order of 0.67 to 1.0. We recommend that the pile driving equipment be approved by the geotechnical engineer.

6.3 Quality Control

An engineering technician (1) familiar with the installation of driven piles into subsurface soil conditions similar to those at this site and (2) acting under the direction and supervision of the geotechnical engineer should witness the installation of the production piles. His duties should include, but not be limited to, the following:

- 1. Keep an accurate record of pile installation and driving procedures.
- 2. Verify that all piles are installed to the proper driving resistance and to a depth indicative of the piles bearing in the desired bearing formation.
- 3. Confirm that the pile driving equipment is operating properly.
- 4. Inspect the piles prior to installation for defects and confirm that the piles are not damaged during installation.

If the installation of the piles cannot be witnessed by a qualified engineering technician, we recommend as a minimum construction control measure that all pile driving records be reviewed by the geotechnical engineer prior to the superstructure construction. 01-1346.doc Page 6



6.4 Pile Load Test Considerations

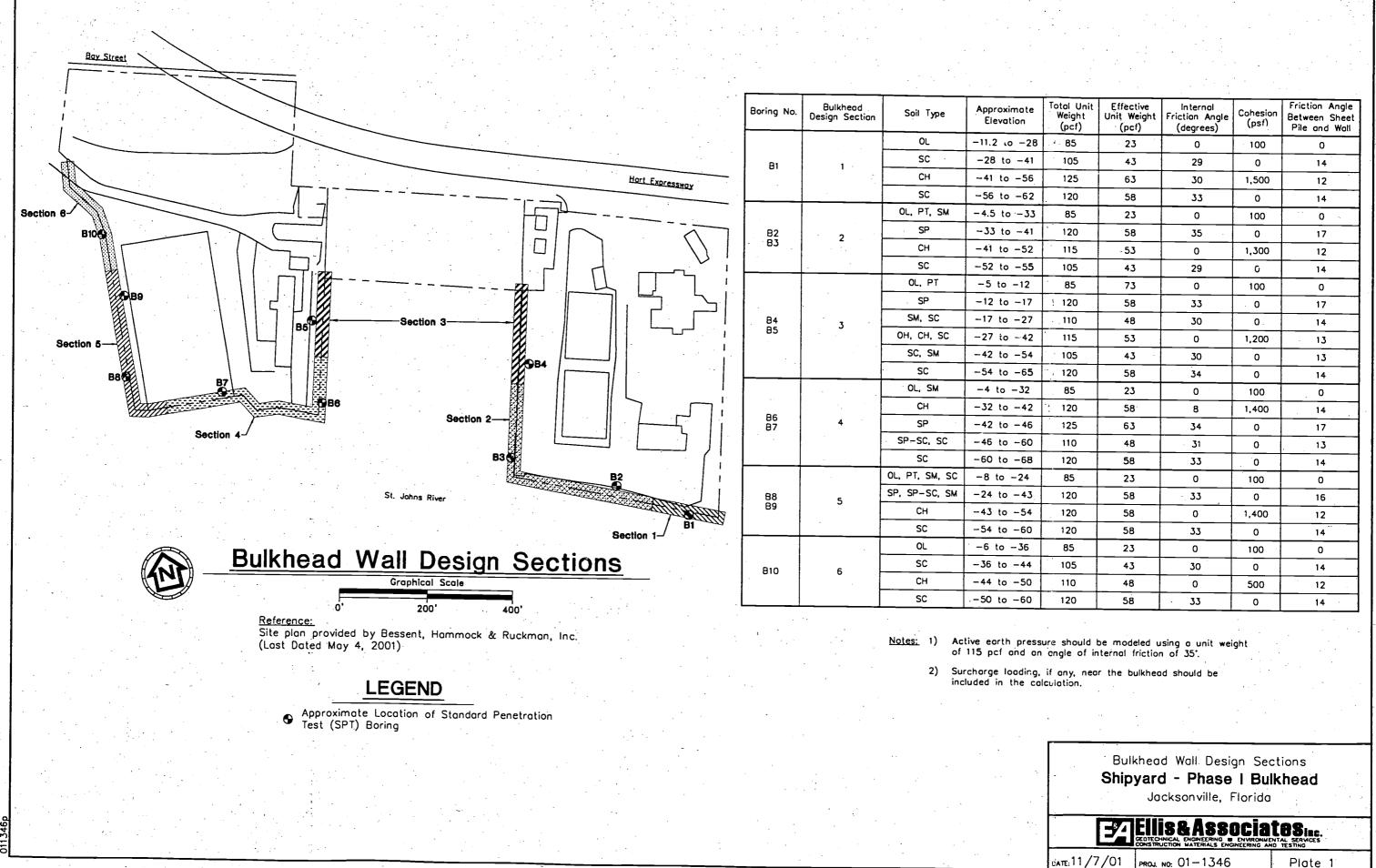
We recommend that at least six dynamic pile load tests (one at each section) be performed using the Pile Driving analyzer (PDA). The PDA data will be used to evaluate: hammer-driving system performance, pile stresses during driving, pile structural integrity and calculation of pile static compression bearing capacity. The dynamic results will then be used in wave equation analysis to establish an optimum driving criteria to be employed in driving the production piles. Prior to test pile driving, hammer specifications should be made available to us to assess pile driving system suitability.

7.0 <u>REPORT LIMITATIONS</u>

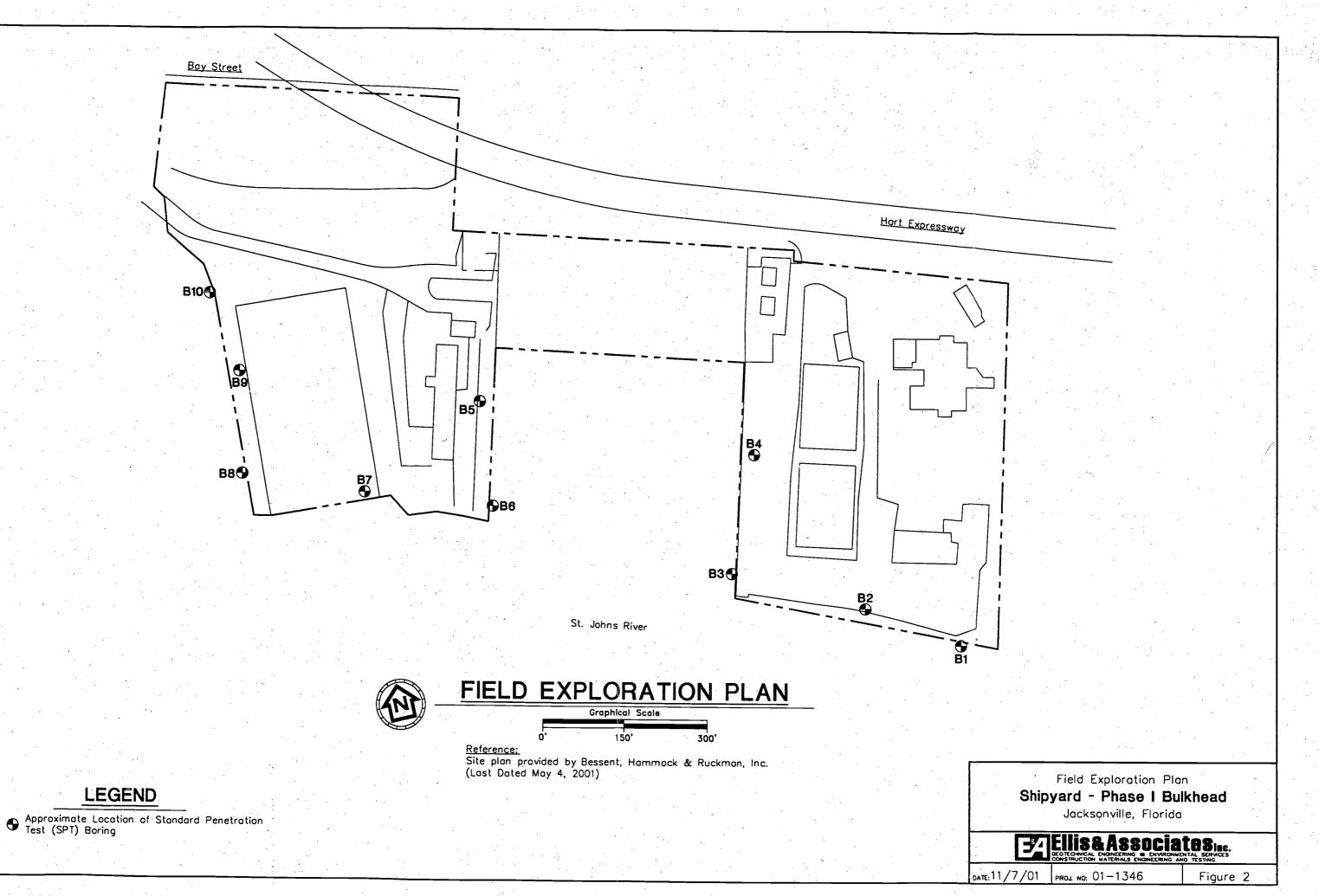
Our geotechnical exploration has been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Ellis & Associates is not responsible for any independent conclusions, interpretation, opinions or recommendations made by others based on the data contained in this report.

Petroleum odor was noted during visual classification of soil samples as indicated on the soil profiles (Figures 3 through 5) and the individual boring logs. These statements are strictly for the information of our client. We recommend that the procedures used for construction activities at this site be in compliance with the Consent Order agreement already in place for the facility.

This report does not reflect any variations which may occur adjacent to or between soil borings. The discovery of any site or subsurface condition during construction which deviate from the data obtained during this geotechnical exploration should be reported to us for our evaluation. Also, in the event of any change to the structural conditions or the location of the bulkhead walls, please contact us so that we can review our recommendations. We recommend that we be provided the opportunity to review the final design specifications to verify that our recommendations have been properly interpreted and implemented.

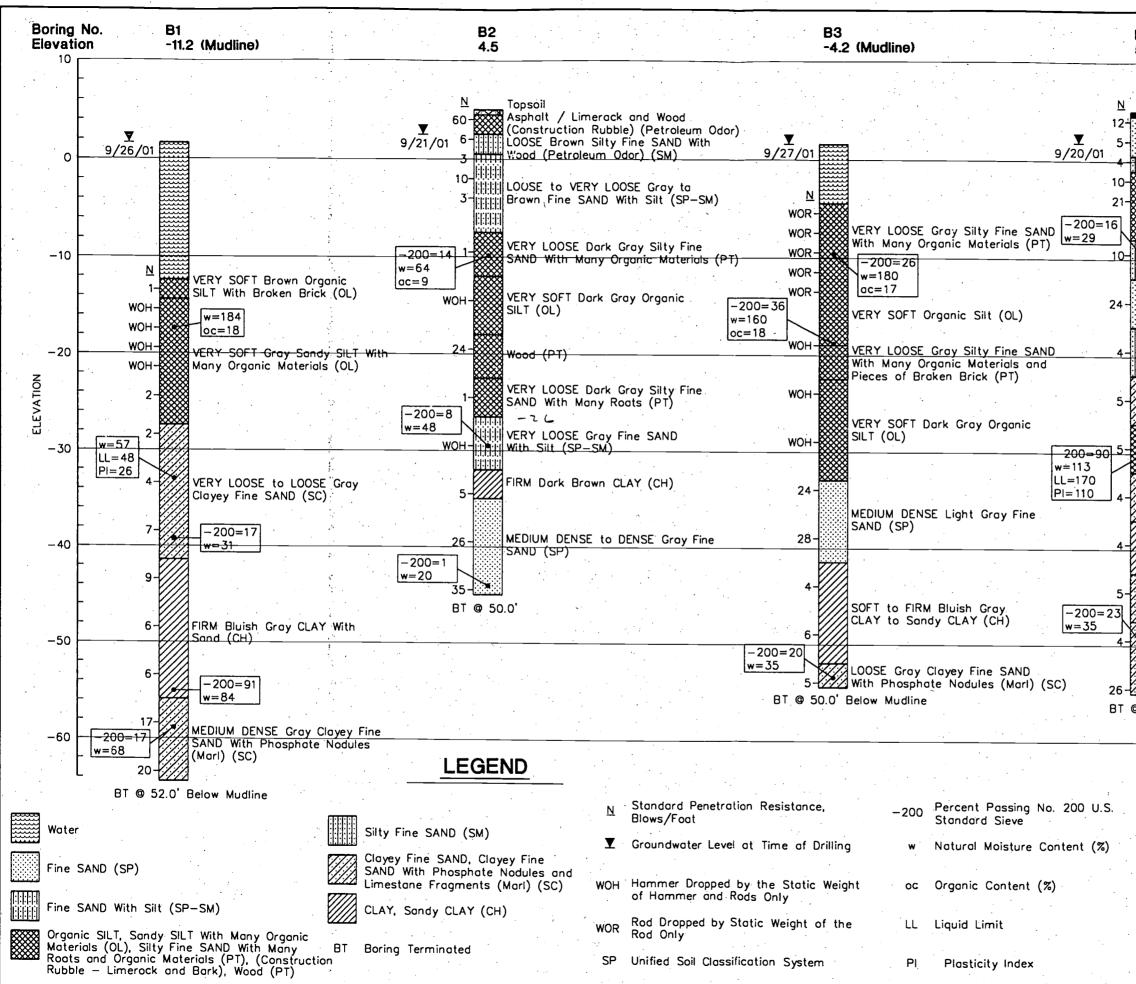


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e	Total Unit Weight (pcf)	Effective Unit Weight (pcf)	Internal Friction Angle (degrees)	Cohesion (psf)	Friction Angle Between Sheet Pile and Wall		
28	85	23	0	100	0		
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6	125	63	30	1,500	12		
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3	85	23	0	100	··· 0 ···		
.1	120	58	35	0	17		
2	115	- 53	0	1,300	12		
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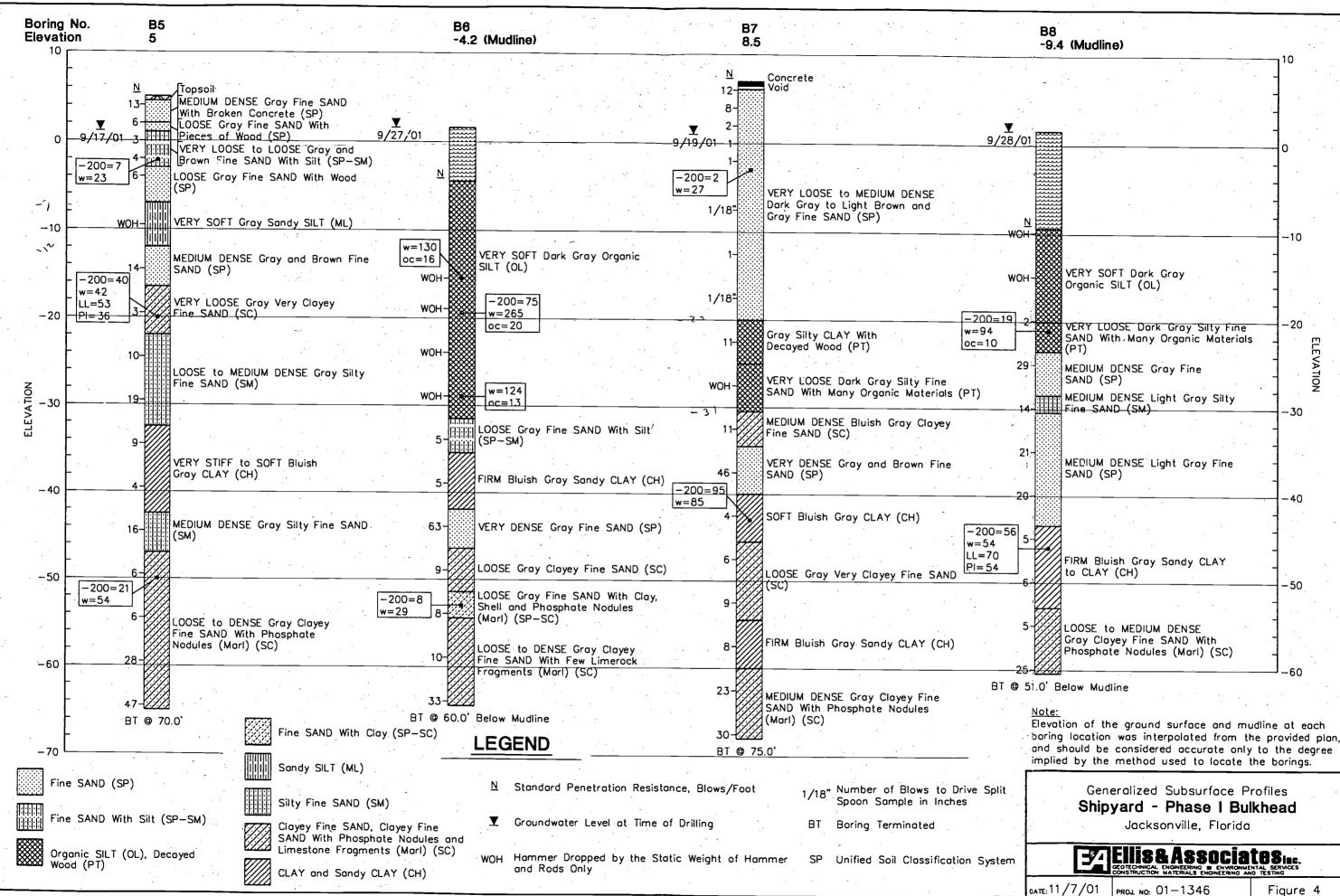
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LOOSE Gray Clayey Fine SAND (SC) -	ELEVATION
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With Limestone Fragments (Marl) (SC)	· ·
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Phosphate Nodules (Marl) (SC)	
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Elevation of the ground surface and mudline	at each
boring location was interpolated from the pr	ovided plan.
and should be considered accurate only to	the degree
implied by the method used to locate the t	
Generalized Subsurface Profile	es
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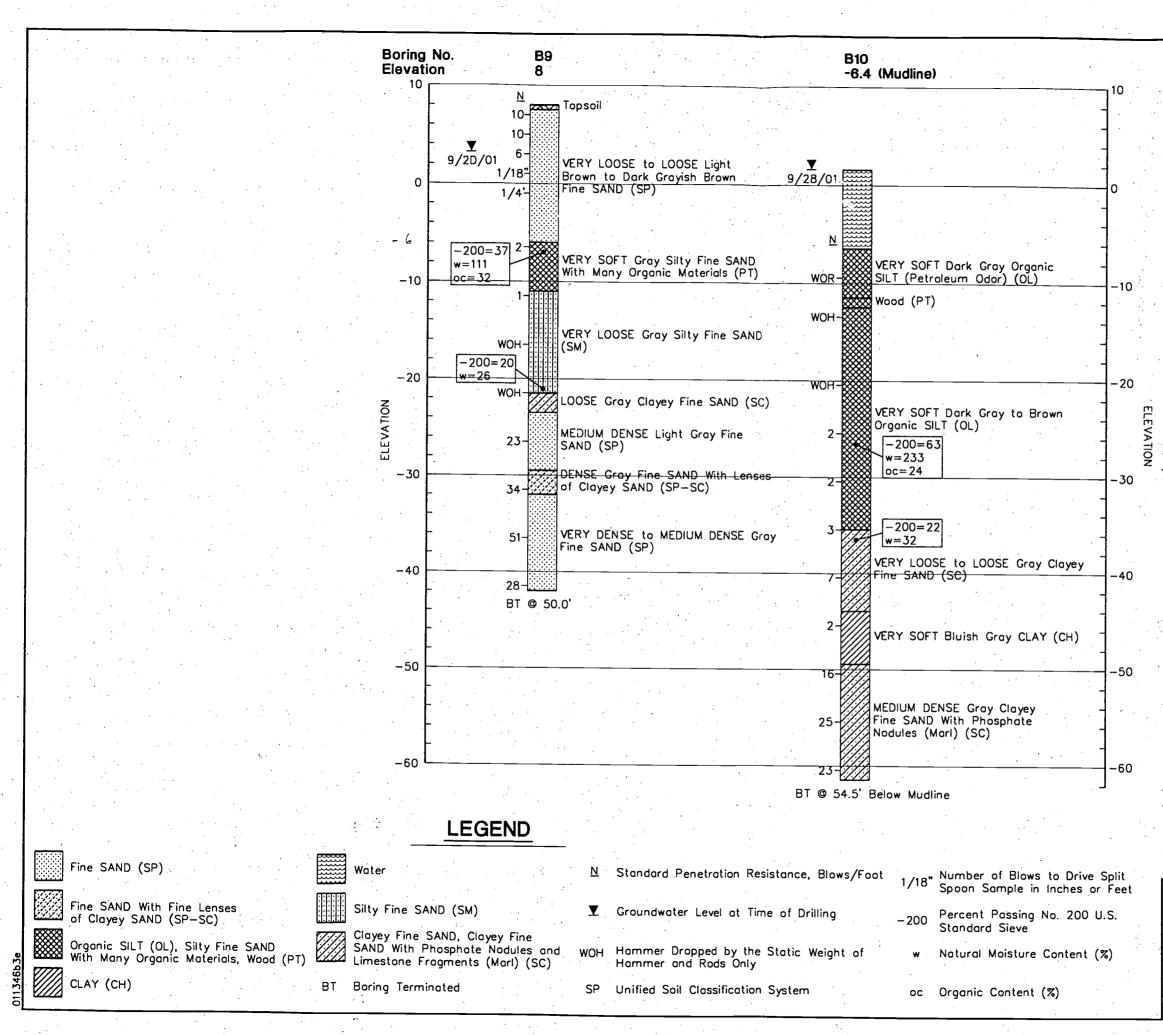
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Figure 3



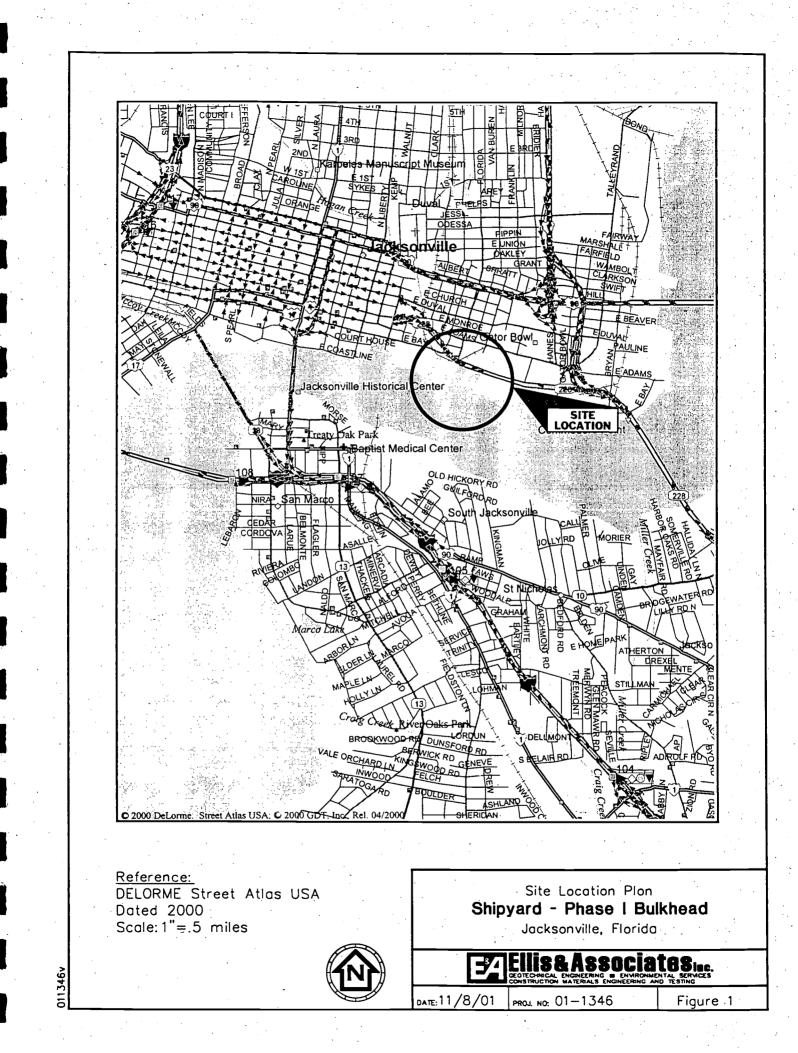
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E/A	EIIIS&ASSOCIA Economical Engineering II Environme Economitation Materials Engineering A	NTAL SERVICES
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FIGURES

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SOIL BORING LOGS

APPENDIX A

LOG OF BORING

 Project No.:
 01-1346

 Boring No.:
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				rd - Phase I H			Client: Drill Rig: Drill Rod	<u>BK 51</u>	acy		Driller	D.	<u>Coll</u> : Super	ier Gel-X
							Casing Siz	ze: <u>BW</u>			Length	of Cas	ing: .	
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Project	: <u>Shi</u> j	pya	rd - Phase I Bulkhead			riLeg					
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	ĘĨΞ		FIRM Bluish Gray CLAY With Sand						Ē		
12	55		(CH)		6		90.5				
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13	60		MEDIUM DENSE Gray Clayey Fine SAND With Black Phosphate Nodules (Marl) (SC)	2	17		16.5				
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TOJECI:	Shipy	ard - Phase I Bulkhead			<u>riLeg</u> BK 51			Driller:	s.	Hall	
Boring	Location	See Field Exploration Plan	Drill	Rod:	AW		-	Drill Mu	ud: <u>S</u>	uper C	el-X
Ground	water De	pth: 2.5' Time: DrillingDate: 9/21/01	Borin	g Size g Beg	:: <u>BW</u> un:	<u>9/21/</u>		Length of Boring (0/21/01
SAMPLE NO.	⊃ DEPTH, FEET C campie tvde	DESCRIPTION Surface Elevation: 4.5'		BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	° ° PLASTIC LIMIT	→ MOISTURE → CONTENT	- © ♦ LIQUID LIMIT	 Pocket Undist Pocket Distur Torvane Unconfi Compression 	
		Topsoil		60							
1		Asphalt / Limerock and Wood (Construction Rubble) (Petroleum Odor)			•				 	Tulli	
2		LOOSE Brown Silty Fine SAND With Wood (Petroleum Odor) (SM)		6					ىلىنىك بىلىن		
3		VERY LOOSE Gray Fine SAND With Silt (SP-SM)		3	· _		-	-			
4		LOOSE to VERY LOOSE Brown Fine SAND With Silt (SP-SM)		10							
5	10			3					ببابب		
				•						م بىزايى	
6	15	VERY LOOSE Dark Gray Silty Fine SAND With Many Organic Materials (PT)		1	8.8	14.1				لسبلسبلست	
			•		· · · ·						
7		VERY SOFT Dark Gray Organic SILT (OL)		мон					استانيان		
				•							
х 7 — х		Wood (PT)									
8	E 25			24			:				

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LOG OF BORING

 Project No.:
 01-1346

 Boring No.:
 B2

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				rd - Phase I F			Dril	nt: <u>Ti</u> l Rig:] l Rod:	<u>BK 51</u>			iller: <u>S</u> ill Mud:	. Hall Super C	
				h: <u>2.5'</u> Time:			Casi	ing Size	BW	9/21/	Ĭe	ngth of C		
				<u> </u>			DOI				-		TSHFAR	STRENGTH
SAMPIF NO.		55 DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation:	<u>4.5'</u>		-	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	оРГ	T = 5	Pocket Undist Pocket Postur Torvane Torvane Triaxia Compre 0 0	STRENGTH. (SF Penetrometer urbed Sample Penetrometer bed Sample ined ission 1 2
				Wood (PT)					• •					
9				VERY LOOSE Da SAND With Man		y Fine	•	1	~ · · .					
		30												
				VERY LOOSE Gr Silt (SP-SM)	ay Fine SAND	With				-				
10	0	35		·				WOH		1				
				FIRM Dark Bro	WN CLAY (CH)		¢ .							
1:	1	40		MEDIUM DENSE	to DENSE Gray	y Fine		5						
				SAND (SP)		· · · ·	•							
1:	2	45					•	26						
1	3							35		1	+			
		50		Boring Termin	ated At 50'				<u> </u>				<u>F</u> =	
				· ·	· · · ·			·	5 .					

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Ellis & Asso	Clates inc.		Project N
	LOG OF BORING		Boring N
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 oject No.:
 01-1346

 oring No.:
 B3

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	vater De		oration Pla		Drill Roc Casing S Boring B	ze: BW	9/27/0	L	rill Mud: ength of C oring Con	asing:	<u>Gei-X</u> 9/27/01
SAMPLE NO.	DEPTH, FEET				BLOWS PER FOOT	PERCENT ORGANIC	SING VE	o PLASTIC LIMIT	() + CONTENT () + CONTENT		R STRENG KSF et Pepetromet isturbed Sample and and Sample and and and and and and and and and and
	5	Water									
1		VERY LOOSE Gra With Many Organ									
3	10	VERY SOFT Gray	Organic SII	LT (OL)	wo wo		26		+		· · · · · · · · · · · · · · · · · · ·
5	15				WO	R					
6	20				wc	н					
7		VERY LOOSE Gra With Many Orga Pieces of Brok VERY SOFT Dark	nic Materia en Brick (P	ls and T)							

Boring No.: <u>B3</u> LOG OF BORING Sheet _ 2 of Project: Shipyard - Phase I Bulkhead Client: TriLegacy Driller: D. Collier Drill Rig: BK 81 Boring Location: See Field Exploration Plan Drill Rod: AW Drill Mud: Super Gel-X Casing Size: <u>BW</u> Length of Casing: Time: DrillingDate: 9/27/01 Boring Begun: 9/27/01 Groundwater Depth: Boring Completed: <u>9/27/01</u> SHEAR STRENGTH KSF ○ Pocket Penetrometer Ordisturbed Sample ○ Pocket Penetrometer Disturbed Sample ♥ Torvane ♥ Unconfined Compression STriaxial Compression PERCENT PASSING NO. 200 SIEVE PERCENT ORGANIC **OPLASTIC LIMI** MOISTURE BLOWS PER FOOT NUMBER OF CONTRACT OF CONTRACT. SAMPLE TYPE S. DEPTH, FEET MATERIAL DESCRIPTION SAMPLE +(*) 100 200 0 Surface Elevation: 0.8' 25 WOF VERY SOFT Dark Gray Organic SILT 7 (OL) 36 WOH 18 30 8 MEDIUM DENSE Light Gray Fine SAND 35 24 9 (SP) 40 28 10 SOFT Bluish Gray CLAY (CH) 45 4 11 FIRM Bluish Gray Sandy CLAY (CH) F 12 50 🚽

Project No.: 01-1346

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 B3

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 of
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Proje	ct: <u>Shi</u> j	pya	rd - Phase I Bulkhead		nt: <u>T</u>				Deiller		Collie	<u> </u>
Borin	g Locatio	on:	See Field Exploration Plan	Dril	l Rig:] l Rod:	AW			_Drill Mu	id: <u>S</u>	Super Ge	<u>1-X</u>
Grou	ndwater	Dep	th:Time: DrillingDate: 9/27/01	Casi Bori	ng Size ng Beg	: <u>BW</u> un:	9/27/	01	Length o Boring C	of Cas	ing: leted: <u>9</u> /	27/01
SAMPLE MO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation: <u>0.8'</u>			PERCENT ORGANIC	VE	1	+ MOISTURE		SHEAR S Pocket P Dindistu Pocket P Pocket P Poch Pocket P Pocket P P	TRENGTH SF enetroneter roed Sample enetroneter ed Sample ed sion
12			FIRM Bluish Gray Sandy CLAY (CH)			· .				Ē	1	
	55		LOOSE Gray Clayey Fine SAND With Phosphate Nodules (Marl) (SC)	-			20			<u>متداديداريد انديرا</u>		
13					5		20			Ē		
	60		Boring Terminated At 56'									
	7 5	1							· · ·			
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LOG OF BORING

 Project No.:
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 Boring No.:
 B4

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Pro	ject:	<u>Shi</u>	pya	rd - Phase I Bulkhead			riLeq			D-111-				·
Bor	ring	Locatio	on:	See Field Exploration Plan	Drill	Rod:				Driller: Drill M	ud: <u>3</u>	Super		
Gro		water	Deni	th: <u>3.2'</u> Time: <u>DrillingDate</u> : <u>9/20/01</u>	Casi	ng Size	e: <u>BW</u>	9/20/	01	_Length _Boring	of Ca	sing:	0/5	20/01
		mater 1	-	. <u>5.5</u> Thit. <u>511111119</u> Date. <u>5720701</u>						bormg	Comp			
	SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation: <u>5.0'</u>		BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	° o PLASTIC LIMIT	(1) + MOISTURE (1) + CONTENT	So LIQUID LIMIT	© ● ● ■ 871855558728	ket Pen disturb	RENGTH etrometer ed Sample etrometer sample on on on
				Asphalt							└── <u></u> É	╹╉╌╩	<u> </u>	
	1			MEDIUM DENSE Gray and Dark Gray Fine SAND (SP)		12						بليبايب		
	2			LOOSE Brown Fine SAND (SP)		5					È			
	3	5		LOOSE Brown Silty Fine SAND With		4								
	_			Some Decayed Wood (SM)							Ē	<u> </u>		
	4			Wood and Bark (PT)		10								
	5					21						IIII		
				LOOSE Gray Silty Fine SAND With		•								
	6	15		Clay (SM)		10		16		· · ·				
	•			MEDIUM DENSE Gray and Brown Fine SAND (SP)	•	•								
	7	20		SAND (SF)		24								
													а А.	
	.			LOOSE Gray Silty Fine SAND (SM)										
	8				•	4								
		25				,	<u> </u> .	<u> </u>	<u> </u>			·		ł
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Project: Shipyard - Phase I Bulkhead

SAMPLE NO.

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Project N	lo.:		1346
Boring N			B4
Sheet	2	of	3

1

Driller: S. Hall Drill Rig: BK 51 Boring Location: See Field Exploration Plan Drill Mud: Super Gel-X Drill Rod: AW Casing Size: BW Length of Casing: Groundwater Depth: <u>3.2'</u> Time: <u>DrillingDate</u>: <u>9/20/01</u> Boring Begun: 9/20/01 Boring Completed: 9/20/01 SHEAR STRENGTH KSF TYPE PERCENT PASSING NO. 200 SIEVE PERCENT ORGANIC MATERIAL OPLASTIC LIMI MOISTURE BLOWS PER FOOT LIMI NJF ○ Pocket Penetrometer Undisturbed Sample ○ Pocket Penetrometer Disturbed Sample ▼ Torvane ♥ Unconfined Compression Triaxial ⊠ Compression DEPTH, FEET DESCRIPTION SAMPLE LIQUID + (%) 0 0 100 200 Surface Elevation: _5.0' 0 25 LOOSE Gray Silty Fine SAND (SM) LOOSE Gray Clayey Fine SAND (SC) 5 30 FIRM Dark Gray Organic CLAY With Sand (OH) 10 5 35 89.9 LOOSE Dark Gray Very Clayey Fine SAND (SC) 11 4 40 SOFT Brownish Gray CLAY With Sand (CH) 12 4 45 LOOSE Dark Gray Clayey Fine SAND With Limestone Fragments (Marl) (SC) 13 5 50

LOG OF BORING

Client: TriLegacy

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 Project No.:
 01-1346

 Boring No.:
 B4

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•]	Project:	: <u>Ship</u>	yard - Phase I Bulkhead		nt: <u>Tr</u>				·	
]	Boring	Locatio	n: See Field Exploration Plan	Dril Dril	1 Rig: <u>1</u> 1 Rod:	<u>3K 51</u> AW	.	Driller: Drill M	<u>S. Ha</u> 1d: Sup	<u>11</u> er Gel-X
				Casi	ing Size	. RW		Length of	of Casing:	
(Fround	water L	Pepth: <u>3.2'</u> Time: <u>DrillingDate: 9/20/01</u>	Bori	ing Begu	1 n:	9/20/01	Boring (1: <u>9/20/01</u>
	SAMPLE NO.	DEPTH, F	DESCRIPTION Surface Elevation: <u>5.0'</u>		BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE ° • PLASTIC LIMIT	(*) + MOISTURE		LAR STRENGTH KSF ocket Penetrometer Undisturbed Sample ocket Penetrometer Disturbed Sample orvane mconfined Compression riaxial compression
			LOOSE Dark Gray Clayey Fine SAND With Limestone Fragments (Marl) (SC)			.				
	14		LOOSE to MEDIUM DENSE Gray Clayey Fine SAND With Phosphate Nodules (Marl) (SC)		4		23.4			
	15	60	Boring Terminated At 60'		26					
		65		•						
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						•				
•		₽ 75⊅			ł		· · · ·		<u> </u>	· · · · · · · · · · · · · · · · · · ·

Ellis & Associat	es inc.

 Project No.:
 01-1346

 Boring No.:
 B5

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LOG OF BORING

ring	Location	See Field Exploration Plan	Drill Rig: Drill Rod:	AW			Drill l	Mud:	<u>Hall</u> Super		X
ound	lwater De	pth: <u>3.9'</u> Time: <u>DrillingDate</u> : <u>9/17/01</u>	Casing Siz Boring Ber	e: <u>BW</u> 71101:	9/17/	01	Lengtl Boring	n of Ca	sing: leted:	9/17	/01
SAMPLE NO.	DEPTH, FEET SAMDIE TVDE	DESCRIPTION	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL			3 + MOISTURE	<pre>> LIQUID LIMIT</pre>	SHEA Pock Pock Pock Pock Torv Uncc Con Uncc Con Con Con Con Con Con Con Con	R STRI KSF et Penet isturbed turbed S ane nfined pression xial pression	Eival Samp romet Sample
	0	/ Surface Elevation: <u>5.0'</u> _ Topsoil			ā .	0 :	20 4	0 60 L			
1		MEDIUM DENSE Gray Fine SAND With Broken Concrete (SP)	-13	-							• :
2		LOOSE Gray Fine SAND With Pieces of Wood (SP)									
3		VERY LOOSE to LOOSE Gray and Brown Fine SAND With Silt (SP-SM)	1 3							·	
4			4	• •	7.4		.+				•
5		LOOSE Gray Fine SAND With Wood (SP)	6								
											· · .
		VERY SOFT Gray Sandy SILT (ML)									
6	15		WOH								·. ·
·		MEDIUM DENSE Gray and Brown Fine SAND (SP)									
7	20		14			· · ·		,		· · . · .	· ·
		VERY LOOSE Gray Very Clayey Fine SAND (SC)	•		,						•
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 01-1346

 Boring No.:
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 Sheet
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Casing Size: BM Length of Casing: Groundwater Depth: 3.9'_Time: DrillingDate: 9/17/01 Boring Begun: 9/17/01 Boring Complete: 9/17/01 or Lag Lag			ard - Phase I Bulkhead	Drill Drill	Rig: Rod:	riLeg <u>BK 51</u> <u>AW</u>			_Drill		Super	Gel-X
OR U	Grour	dwater Der	oth: 3.9' Time: DrillingDate: 9/17/01	Casi	ng Size	: <u>BW</u>	9/17/	01	_Leng Borin	h of Ca	sing: _ leted·	9/17/01
VERY LOOSE Gray Very Clayey Fine SAND (SC) LOOSE to MEDIUM DENSE Gray Silty Fine SAND (SM) 10 10 35 STIFF to SOFT Bluish Gray CLAY (CH) 12 40 MEDIUM DENSE Gray Silty Fine SAND (SM)		DEPTH, FEET Sample type	DESCRIPTION	BUL			г – т	L _	() + MOISTURE		SHEAR ○ Pocket ○ Pocket ○ Pocket ○ Pocket ○ Dist.t ▼ Torvan ○ Compl ■ Tciax	STRENGTH KSF t. Pepetrometer sturbed Sample t. Penetrometer urbed Sample fined ression
10 35 STIFF to SOFT Bluish Gray CLAY (CH) 11 40 4 MEDIUM DENSE Gray Silty Fine SAND (SM)	9		VERY LOOSE Gray Very Clayey Fine SAND (SC) LOOSE to MEDIUM DENSE Gray Silty				39.6		-0 			
11 40 11 40 12 45 45 4 MEDIUM DENSE Gray Silty Fine SAND (SM)	10				19							
12 40 4 4 4 MEDIUM DENSE Gray Silty Fine SAND (SM)				-								
MEDIUM DENSE Gray Silty Fine SAND (SM)	11			•	9							
MEDIUM DENSE Gray Silty Fine SAND (SM)				, ,						•		
					4					.		
	13)	16							

		1119 0	1 Mgg	ocia	LGJ	5 inc. G OF BC	RING				Bo	oject N oring No ieet	o.:	01-134
oject:	<u>Shipya</u>	ard - Pha	<u>ase I Bul</u>	lkhead			ient: <u>T</u>	riLeq	acy	· ·		۴	•	
-	•			oration 1	Plan	Dr	ill Rig: ill Rod:	<u>WA</u>			Drill N		Super	Gel-X
round	water Dep	th: <u>3.9'</u>	_Time: D	DrillingDa	ate: <u>9/</u>	Ca <u>17/01</u> Bc	sing Size	:: <u>BW</u> jun:	<u>9/17/</u>	01	Lengtr Boring	of Cas Compl	leted:	9/17/0
SAMPLE NO.) DEPTH, FEET SAMPLE TYPE	DESCR	IPTION Elevation: <u>5</u>	5.01			BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	- ° O PLASTIC LIMIT	6 5 + MOISTURE ★ CONTENT	٩LI	O Pocke Undi O Pocke Disti ▼ Torvai ● Uncon	STREN KSF t. Penetron sturbed Sat t. Penetron urbed Sam fined ression ial ression 1
	50 4 (ray Silty	- Fine	: SAND	1 · · ·				-			
				Gray Cla phate Noo								· · · · · · · · · · · · · · · · · · ·	- - - - - - - - - - - - - - - - - - -	
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15	60						6							
			, · ·			•								
16	65					-	28				× .			
				• • • • • •	.`	: : : : :								
-17	70	·		· 			47							
		Boring	Termina	ted At 7	0'									
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Ellis & Associates inc. Project No.: ___01-1346 Boring No.: B6 LOG OF BORING Sheet _ 1 of Project: Shipyard - Phase I Bulkhead Client: TriLegacy <u>S. Hall</u> Driller: Drill Rig: BK 51 Boring Location: See Field Exploration Plan Drill Mud: Super Gel-X Drill Rod: AW Length of Casing: Casing Size: BW Groundwater Depth: Time: DrillingDate: 9/277/01 Boring Begun: 9/27/01 Boring Completed: 9/27/01 TH ter ble ter

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SAMPLE NO.	o DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation: 0.8'	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	NO. 200 SIEVE	- CONTENT - CONTENT	- go LIQUID LIMIT	SH ⊙F ♥T ♥T	EAR STRENGT KSF Decket Penetronet Undisturbed Samp ocket Penetronet Disturbed Sample forvare mconfined Compression Itiaxial Compression
			Water						-	
1	10		VERY SOFT Dark Gray Organic SILT (OL)	WOR	15.6		+		سلسلسلسلس	
2	15					•			mmunni	
3	20			WOH	19.77	/4.5				

		Ellis & Associates inc. Log of	BO	RING			•	B	roject N oring N neet	o.: _	B6
Project:	<u>Ship</u>	yard - Phase I Bulkhead		nt: \underline{T}	riLeq BK 51	acy		Drille	r: <u>S.</u>	нал	
Boring	Location	n: See Field Exploration Plan	Dril	l Rod:	AW			_Drill I	Mud: <u>s</u>	Super	Gel-X
Ground	water D	epth:Time: DrillingDate: 9/277/01	_ Casi	ng Size ng Beg	e: <u>BW</u> un:	9/27/	01	_Lengtl _Soring	h of Cas g Comp	ing: ieted:	9/27/
SAMPLE NO.	DEPTH, FEET	DESCRIPTION Surface Elevation: 0.8'		BLOWS PER FOOT	ERCENT ORGANIC MATERIAL	VE	IC LIMIT		♦ LIQUID LIMIT	SHEAR Pocket Pocket Pocket Pocket Pocket Shear Pocket	KSF t Penetri isturbed t Penetri urbed Sa ane ine pression
4	25	VERY SOFT Dark Gray Organic SILT		WOH					╵╶╸┾	╹┫┸┸	
		(OL)								ىلىبىلىبىلىبىل	
5	E 30 -			woн	13.3			-+		<u>ال</u>	
,		LOOSE Gray Fine SAND With Silt (SP-SM)								ىلىمامىلىما	
	Ē 35 🚽			5					·		
0		FIRM Bluish Gray Sandy CLAY (CH)									
	40			5							
7											
· · ·		VERY DENSE Gray Fine SAND (SP)	. •					· .		:	
. 8 .	45			63				_			
			· · .								
		LOOSE Gray Clayey Fine SAND (SC)									

Project No.: Boring No.:		01-1346				
		B6				
Sheet	3	_ of _	_ 3			

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oring Loo roundwat		See Field Exploration Plan h:Time: DrillingDate: 9/277/	_ Drill _ Casin	Rod: g Size	: <u>BW</u>		Leng	Mud: <u>Su</u> th of Casin g Comple	ng:	
	S UEPTH, FEET	DESCRIPTION Surface Elevation: _0.8'		ER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	MOISTURE		SHEAR ST KS Pocket Pe Undisturpe Disturpe Torvane Unconfrine Compress Triaxial Triaxial	petromet bed Samp netromet d Sample d ion
9	,	LOOSE Gray Clayey Fine SAND (SC								
		LOOSE Gray Fine SAND With Clay, Shell and Phosphate Nodules (Ma	-1)							
		(SP-SC) LOOSE to MEDIUM DENSE Gray Clay Fine SAND With Few Limestone Fragments (Marl) (SC)	èy	8		7.7	t			- -
11	50			10						
12	55			33						
		Boring Terminated At 66'								
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F	roject:	Shipya	rd - Phase I Bulkhead	Clie	nt: <u>T</u> 1	riLeq	acy				<u>.</u>
Ē	oring	Location:	See Field Exploration Plan	Dril	l Rig: 1 l Rod:	AW		Driller: Drill M		<u>Hall</u> Super Ge	<u>1-x</u>
_				Casi	ng Size	BW	0/10/01	Length	of Cas	sing:	
) I	round	water Dep	th: <u>6.0'</u> Time: <u>DrillingDate: 9/19/01</u>	Bori	ng Beg	un:			Comp	leted: <u>9/</u>	
	SAMPLE NO.	O DEPTH, FEET	Surface Elevation: _8.5'		BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	os (a) + CONTENT	t Hidnid Limit	SHEAR ST KS Pocket Pee Disturion Pocket Pee Unconfine Compress Triaial Compress 0 1	F Detrometer Detrometer Sample Janple
	1		Concrete	•	12						
	2		MEDIUM DENSE Dark Gray Fine SAND (SP) LOOSE to VERY LOOSE Light Brown		8						
	3	5	Fine SAND (SP)	7	2			· · · · · · · · · · · · · · · · · · ·			
	4				1						
	5		VERY LOOSE Light Brown Fine SAND (SP)		1		1.9				
				· ·							
			VERY LOOSE Gray Fine SAND (SP)	· . ·							
•	6				1/18"						
-				• •			•				
	7	20			1						
	 :		VERY LOOSE Dark Gray and Gray Fin	 1e							
·	8		SAND (SP)		1/18"						
	- -	£ 25 ₽			· .		<u> </u>				<u> </u>

Project No.:	01-1	.346
Boring No.:	В	7
Sheet2	of	3

LOG OF BORING

oring l	Locatio	n:	See Field Exploration Plan	Drill	Rod:				_Dril	ler: <u>S</u> 1 Mud:	Supe	er Gé	1-X
roundy	water D	Dept	h: <u>6.0'</u> Time: <u>DrillingDate: 9/19/01</u>]	Casiı Boriı	ng Size ng Beg	:: <u>BW</u> un:	9/19/	01	_Len _Bori	gth of (ing Con	lasing:	: 9/	19/01
SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation: 8.5'			PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	- ° o PLASTIC LIMIT		- •		ocket Pe Undistur	ion
9	25		VERY LOOSE Dark Gray and Gray Fine SAND (SP) Gray Silty CLAY With Decayed Wood (PT)		11								
			VERY LOOSE Dark Gray Silty Fine SAND With Many Organic Materials (PT)							· · · · · · · · · · · · · · · · · · ·			
10	35				WOH				•				
11	40		MEDIUM DENSE Bluish Gray Clayey Fine SAND (SC)	-	11					· .		,	
12			VERY DENSE Gray and Brown Fine SAND (SP)	•	46				. * . *				
	45		SOFT Bluish Gray CLAY (CH)	· · · · · · · · · · · · · · · · · · ·									· .
13	50				4		94.6		•				

noject: Shinyard - Phase I Eulkhead Oring Location: See Field Exploration Plan roundwater Depth: 6.0' Time: DzillingDate: 9/19/01 Boring Begun: 9/19/02 Boring Completed: 9/19/01 Boring Control to See Field Exploration Plan roundwater Depth: 6.0' Time: DzillingDate: 9/19/01 Boring Begun: 9/19/02 Boring Completed: 9/19/01 Boring Control to See Field Exploration Plan boring Control to			Ellis & Associates inc. LOG OF yard - Phase I Bulkhead	BORING		1907		B	Boring N	No.:	_ <u> </u>	
index	oring l	Locatio	n: <u>See Field Exploration Plan</u>	Drill Rig: Drill Rod: Casing Siz	<u>BK 51</u> <u>AW</u> ze: BW			Drill Lengt	Mud: th of Ca	Super sing:	Gel-	
SOFT Bluish Gray CLAY (CH) LOOSE Gray Very Clayey Fine SAND (SC) 6 15 6 15 6 16 16 6 16 16 16 16 16 16	NO.	DEPTH, FEET	DESCRIPTION Surface Elevation: <u>8.5'</u>	PER FOOT	1		L	3 + MOISTURE	◆ LIQUID LIMIT	SHEAL ○ Pock ○ Pock ○ Pock ○ Pock ○ Pock ○ Pock ○ Torv ○ Com □ Toria □ Toria	R STRE KSF et Penetr Isturbed et Penetr furbed Si ane nfined pression	NGT Sampl romete ample
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60 FIRM Bluish Gray Sandy CLAY (CH) 16 65 65 MEDIUM DENSE Gray Clayey Fine SAND With Phosphate Nodules (Marl) (SC) 17	14	55		6				· · · · · · · · · · · · · · · · · · ·				
16 65 MEDIUM DENSE Gray Clayey Fine SAND With Phosphate Nodules (Marl) (SC) 17	15			9								
65 MEDIUM DENSE Gray Clayey Fine SAND With Phosphate Nodules (Marl) (SC)			FIRM Bluish Gray Sandy CLAY (CH)									
With Phosphate Nodules (Marl) (SC) 17	16	65		8								
			MEDIUM DENSE Gray Clayey Fine SAN With Phosphate Nodules (Marl) (SC									•
	17	70		23								* * * *

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Project No.:	01-3	1346
Boring No.:	E	8
Sheet 1	of	3
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LOG OF BORING.

oring	Locatio	m:	See Field Ex	ploration Pla	in	Drill Rig Drill Ro	<u>g: <u>BK 8</u> d: <u>AW</u></u>	1		_Drill _Drill	Mud:	Supe	<u>llier</u> er Ge	1-X
						Casing S	ize: BV	1		_Leng	th of C	asing:		
round	lwater I	Dept	h:Time:	Drilling Date:	<u>9/26/01</u>	Boring E	Begun:	<u>9/28/</u>	-	Bor	ng Con		1: <u>9/</u>	28/01
SAMPLE NO.	o DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation:	0.8.		BI OWS PER FOOT	PERCENT ORGANIC	PERCENT PASSING NO. 200 SIEVE	C ° O PLASTIC LIMIT)	-1 🖾 '	Corperson cocket Per Disturber orvane nconfine Compress riaxial Compress	TRENG petromel Sed Sample ad Sample sion sion
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	5													
	10												· · ·	
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2														
3	15					W	ОН						• • •	
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6			Many Organic	Materials (E	Ϋ́Τ)		2) 19		•		 + +		
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LOG OF BORING

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 01-1346

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Project:	<u>Shipya</u>	ard - Phase I B	ulkhead		Client: Drill Ri				Dr	iller:	D. Co	ollier			
Boring	Location:	See Field Exp	loration Pl	an	Drill Re	od: <u>A</u>	W		Drill Mud: <u>Super Gel-X</u> Length of Casing:						
Ground	water Dep	th:Time:	Drilling Date:	9/28/01	Casing Boring	Begun	: <u>9</u>	9/28/	01Bo	Boring Completed: 9/28/01					
SAMPLE NO.	52 DEPTH, FEET	Surface Elevation:			DI AUS DED EDAT	PERCENT ORGANIC	MATERIAL	PERCENT PASSING NO. 200 SIEVE	o PL	CONTENT	UID LIMIT	KS Pocket Per Undistur	RENGTH F hetrometer bed Sample of Sample f ion ion		
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9				· · · · ·	2	1									
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10				· · · ·	2	0									
	45 5														
11		FIRM Bluish G	ray Sandy CI	LAY (CH)		5		56	0	+ 0					
	Ē 50 ₹												· · · · · · · · · · · · · · · · · · ·		

Project No.:	01-1	<u>3</u> 46
Boring No.:		3
Sheet <u>3</u>	of	3

LOG OF BORING

roundwater Depth:Time: DrillingDate: 9/28/C1 Boring Begur: 2/28/O1 Boring Complexed: 2/28			 See Field Exploration Plan	Drill Casi	Rod:	- BW]	Drill M Length	ud: <u>Su</u> of Casi		<u>el-X</u>
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DENSE Gray Clayey Fine SAND With Phosphate Nodules (Marl) (SC) 5 60 60 14 Boring Terminated At 62'	12				6	· · ·					
14 25 Boring Terminated At 62'	13	55	DENSE Gray Clayey Fine SAND With		5						
	14	60	Boring Terminated At 62'		25						
							· · · · · · · · · · · · · · · · · · ·				

Project No.:	01-1	L346
Boring No.:	B	9
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LOG OF BORING

Proje	ect: <u>S</u>	hip	ya:			nt: <u>T:</u> Rig:	riLeq ATV	acy	· .		ler: D.			
Borii	ng Lo	catio	n:	See Field Exploration Plan	Drill	Rod:					l Mud: gth of Ca		r Gel	L-X
Grou	ndwa	ter D	ept	h: <u>4.8'</u> Time: <u>DrillingDate</u> : <u>9/20/01</u>	Bori	ng Beg	un:	9/20/	01		ing Com	pleted:		
SAMPLE NO.			SAMPLE TYPE	DESCRIPTION Surface Elevation: 8.0'		BLOWS PER FOUT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	T ° OPLASTIC LIMIT	to state and sture			KS	RENGTH F etroneter sed Sample petroneter i Sample ion ion 2
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2	lui lui	11111		LOOSE Dark Grayish Brown Fine SAND (SP))	10								
3		5		LOOSE to VERY LOOSE Light Brown Fine SAND (SP)		6								
.4	hulu	111 1				1/18"					•			
5		11111	.*			1/4'								
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			-								•			
6		15		VERY LOOSE Gray Silty Fine SAND With Many Organic Materials (PT)		2	32.3	37.1			t -			
7		20	_	VERY LOOSE Gray Silty Fine SAND (SM)		1					· ·			
	- Luulu													
8	يليديان				90 - 12 - 14	WOH				· · · ·				
		25 🚽	, .					1	<u> </u> ;			<u>E </u>]		<u> </u>

LOG OF BORING

 Project No.:
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Р	oject:	Ship	oya	rd - Phase I Bulkhead	Clien	nt: <u>Tr</u> Rig: 4	riLeq	acy		Drille	r: <u>D.</u>	Smi	th	
B	oring 1	Locatio	on:	See Field Exploration Plan	Drill	Rod:	WA			Drill]	Mud:	Supe	r Gel	-X
G	round	water I	Dept	h: 4.8' Time: DrillingDate: 9/20/01	Casi: Bori:	ng Size ng Beg	: <u>BW</u> un:	9/20/	01	Lengt	h of Ca g Comp	sing: leted:	9/2	0/01
	SAMPLE NO.	55 DEPTH, FEET	SAMPLE TYPE	DESCRIPTION Surface Elevation: <u>8.0'</u>		BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	- ° O PLASTIC LIMIT		Contraction of the second seco		AR STI KSF Ket Pen Wisturb	RENGTH etrometer ed Sample etrometer Sample on
	9	30		VERY LOOSE Gray Silty Fine SAND (SM) LOOSE Gray Clayey Fine SAND (SC)		WOH		19.6		+				
	10	35		MEDIUM DENSE Light Gray Fine SAND (SP))	23						سطيسا يسالين		
	11			DENSE Gray Fine SAND With Lenses of Clayey SAND (SP-SC)	•	34								
	12	40		VERY DENSE to MEDIUM DENSE Gray Fine SAND (SP)		51								
	13	- 50		Boring Terminated At 50'	•	28		•			- - -			
	•	- 50								. ,				

Ellis & Associates inc. LOG OF BORING Proj

	<u>Shir</u> Locatio		Client:] Drill Rig:	<u>BK 51</u>		Drill		Hall	
	LOCALIO		Drill Rod: Casing Siz	e: BW			th of Ca	<u>Super Ge</u> sing:	<u>1-X</u>
Ground	water I	Pepth:Time: DrillingDate: 9/28/01	Boring Be	gun:	9/28/01	Bori	ng Com	pleted: <u>9/</u>	28/01
SAMPLE NO.	o depth, feet	DESCRIPTION Surface Elevation: _0.8'	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	MOISTURE		SHEAR S Pocket Pe Undistur Pocket Pe Disturbe Torvane Unconfine Compress Triaxial Compress	TRENGTH F netroneter bed Sample netroneter d Sample d ion ion 2
		Water		1.					
÷				•					
		VERY SOFT Dark Gray Organic SILT (Petroleum Odor) (OL)							
1			WOR						
2		Wood (PT) VERY SOFT Dark Gray Organic SILT							· •
		(OL)	won						
3									- -
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Project No.:	01-1	.346
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Sheet 2	of	3

LOG OF BORING

	Locatio									_ Dril Casi	1 Rod:	e: BW			_Dri _Ler	igth of	d: <u>S</u> f Casi	uper C ng:	
round	water D	Depth		T	ime:	Drill	ingDa	te: <u>9</u> /	28/0	<u>1</u> Bori	ing Beg	gun:	<u>9/28/</u>		Bor	ing C		eted: 9	
SAMPLE NO.	DEPTH, FI	SAMPLE TYPE	•	CRIPT		0.81		•		• •	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	° o PLASTIC LIMIT	. (1		► LIQUID LIMIT	SHEAR Pocket Undist Pocket S Pocket Torvane Unconfi Compre Compre Compre 0	SIRENC SF Penetrom Penetrom bed Samp ned ssion ission
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5		\	OL) ERY	SOFT	Brow	n Oro	ganic	SIL	r (ol	/)	2	33.7	62.6			: +			· · ·
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8		•		t	-	•	· •.	•		· .	7								
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9		v	ERY	SOFT	Blui	sh Gi	ray Cl	LAY	(CH)	•	2					•			
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	50 ⊐	· .	•				_			· · ·	<u> </u>	L	<u> </u>		• .		<u>F</u>	7	

Ellis & Associates inc. Project No.: ___01-1346 Boring No.: ____ B10 LOG OF BORING Sheet _ 3 of · Project: Shipyard - Phase I Bulkhead Client: TriLegacy Driller: S. Hall Drill Rig: BK 51 See Field Exploration Plan Boring Location: Drill Rod: AW Drill Mud: Super Gel-X Casing Size: BW Length of Casing: Time: DrillingDate: 9/28/01 Boring Begun: Groundwater Depth: 9/28/01 Boring Completed: <u>9/28/01</u> SHEAR STRENGTH KSF Pocket Penetrometer Undisturbed Sample Pocket Penetrometer Torvane Unconfined Compression Triaxial Compression PERCENT PASSING NO. 200 SIEVE **OPLASTIC LIMI** SAMPLE TYPE **BLOWS PER FOOT** PERCENT ORGANI(MOISTURE LIMIT DEPTH, FEET ŝ MATERIAL DESCRIPTION SAMPLE LIQUID + (*) 100 200 300 0 Surface Elevation: 0.8' 50 -VERY SOFT Bluish Gray CLAY (CH) MEDIUM DENSE Gray Clayey Fine SAND 16 With Phosphate Nodules (Marl) (SC) 10 55 25 11 60 23 12 Boring Terminated At 63' 65 70 -75



FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPf) borings were made in general accordance with the latest revision of ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils". The borings were advanced by rotary (or "wash-n-chop") drilling techniques. At 2 1/2 to 5 foot intervals, a split-barrel sampler inserted to the borehole bottom and driven 18 inches into the soil using a 140 pound hammer falling on the average 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less if in hard rock-like material), the sampler was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to our laboratory where they were examined by our engineer in order to verify the driller's field classification. The retrieved samples will be kept in our facility for a period of six (6) months unless directed otherwise.

APPENDIX B

LABORATORY DATA

Ellis & Associatos

SUMMARY OF LABORATORY TEST RESULTS

Project: Shipyard - Phase I Client: TriLegacy Group, LLC Project No.: 01-1346

	· •			Natural	Att	erberg Li	mits	
· · · · ·	Sample	Organic	Fines	Moisture	Liquid	Plastic	Plasticity	Pocket
Boring/	Depth	Content	Content	Content	Limit	Limit	Index	Pen.
Sample No.	(ft.)	%	%	. %	%	%		(tsf)
B1/3	19	18		184	·			
B1/8	35			57	48	22	26	
B1/9	40		17	31			· ·	
B1/12	55		90	84				
B1/13	60		16	68				
B2/6	15	9	14	64				-
B2/10	35		8	48				
B2/13	50	-	1	20				· ·
B3/3	12	17	26	180				、
B3/8	30	18	36	160				
B3/13	55		20	35				
B4/6	15		16	29				
B4/10	35		90	_ 113	170	60	110	
B4/14	55		23	35		, , ,	· ·	
B4/15	60		15	39				·
B5/4	7		7 ·	23				
B5/8	25		40	42	53	17	36	
B5/14	55		21	54				
B6/1	8	16		130	· · · · ·			· · · · · · · · · · · · · · · · · · ·
B6/3	20	20	75	.265		-		
B6/5	30	13		124				
B6/10	55		8	29				
B7/5	9		2	. 27	· . •			
B7/13	50		95	85				
B8/6	_ 21	10	19	94				
B 8/11	46		56	53	70	16	54	
B9/6	15	32	37	111				•
B9/9	29		20	26				
B10/5	27	34	. 63	233 ·	•.			
B10/7	37		22	32				

CORROSION SERIES TEST RESULTS

Shipyard – Phase I Jacksonville, Florida E&A Project No. 01-1346

Boring/ Sample	Approximate test depth below existing grade (feet)	Soil Stratum	Chlorides (mg/Kg)	Resistivity (ohm-cm)	Sulfates (mg/Kg)	pH
B2/4	7.0	SP-SM	30U	6,000	54	7.3
B5/9	30.0	SM	321	2,000	81	7.2
B6/4	25.0*	SP-SM	1,400	160	180	7.4
B7/10	35.0*	РТ	82	830	9.0U	7.8
B8/14	61.0*	SC	321	2,100	120	7.6

Depth Below Mudline

 (1) (U) = Compound was analyzed for but not detected; value is between the Method Detection Level (MDL) and the Practical Quantitation Level (PQL).

(2) (I) = Analyte detected; value is between the Method Detection Level (MDL) and the Practical Quantitation Level (PQL).



LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 445 ± 10 degrees Celcius.

Atterberg Limits

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D 4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.



KEY TO SOIL CLASSIFICATION

Description of Compactness or Consistency in Relation

To Standard Penetration Resistance

	GRAINED SOILS and Graveis)
N-Value	Compactness
0 - 3 4 - 10 11 - 30 31 - 50 51 and Greater	Very Loose Loose Medium Dense Dense Very Dense

	AINED SOILS and Clays)
N-Value	Compactness
0 - 1 2 - 4 5 - 8 9 - 15 16 - 30 31 and Greater	Very Soft Soft Firm Stiff Very Stiff Hard

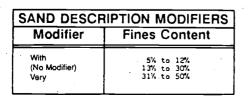
DESCRIPTION OF SOIL COMPOSITION**

(Unified Soil Classification System)

	•	-	LABORATO	RY CLASSIFICATION CRITERIA	
MAJOR DI		Group Symbol	FINER THAN 200 SIEVE %	SUPPLEMENTARY REQUIREMENTS	SOIL DESCRIPTION
Coarse grained (over 50% by weight coarser than No. 200 sieve)	Gravelly soils (over half of coarse fraction	Gw	0 - 5*	D_{60}/D_{10} greater than 4,	Well graded gravels, sandy gravels
(nan 140, 200 steve)	larger than No. 4)	GP	0 - 5*	$D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3 Not meeting above gradation for GW	Gap graded or uniform gravels, sandy gravels
		GM	12 or more"	PI less than 4 or below A-line	Silty gravels, silty sandy gravels
· · · · ·		GC	12 or more*	PI over 7 above A-line	Clayey gravels, clayey sandy gravels
	Sandy soils (over half of coarse fraction	's₩	· 0 - ·5*	D_{60}/D_{10} greater than 6, $D_{30}^{2}/(D_{60} \times D_{10})$ between 1 & 3	Well graded sands, gravelly sands
	finer than No. 4)	SP	0 - 5*	Not meeting above gradation requirements	Gap graded or uniform sands, gravelly sands
		SM	12 or more*	PI less than 4 or below A-line	Silty sands, silty gravelly sands
		sc	12 or more*	PI over 7 and above A-line	Clayey sands, clayey gravelly sands
Fine grained (over 50% by weight finer than No. 200 sieve)	Low compres- sibility (liquid limit	ML	Plasticity cha	rt	Silts, very fine sands, silty or Clayey fine sands, micaceous silts
	less than 50)	CL	Plasticity cha	rt	Low plasticity clays, sandy or silty clays
		OL	Plasticity cha	rt, organic odor or color	Organic silts and clays of low plasticity
	High compres- sibility (liquid limit	мн	Plasticity cha	rt	Micaceous silts, diatomaceous silts, volcanic ash
	more than 50)	сн	Plasticity cha	rt	Highly plastic clays and sandy clays
		он	Plasticity cha	rt, organic odor or color	Organic silts and clays of high plasticity
Soils with fibrous org	anic matter	Pt	Fibrous organi	c matter; will char, burn or glow	Peat, sandy peats, and clayey peat

• For soils having 5 to 12 percent passing the No. 200 sieve, use a dual symbol such as GW-GC.

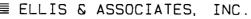
** Standard Classification of Soils for Engineering Purposes (ASTM D 2487)

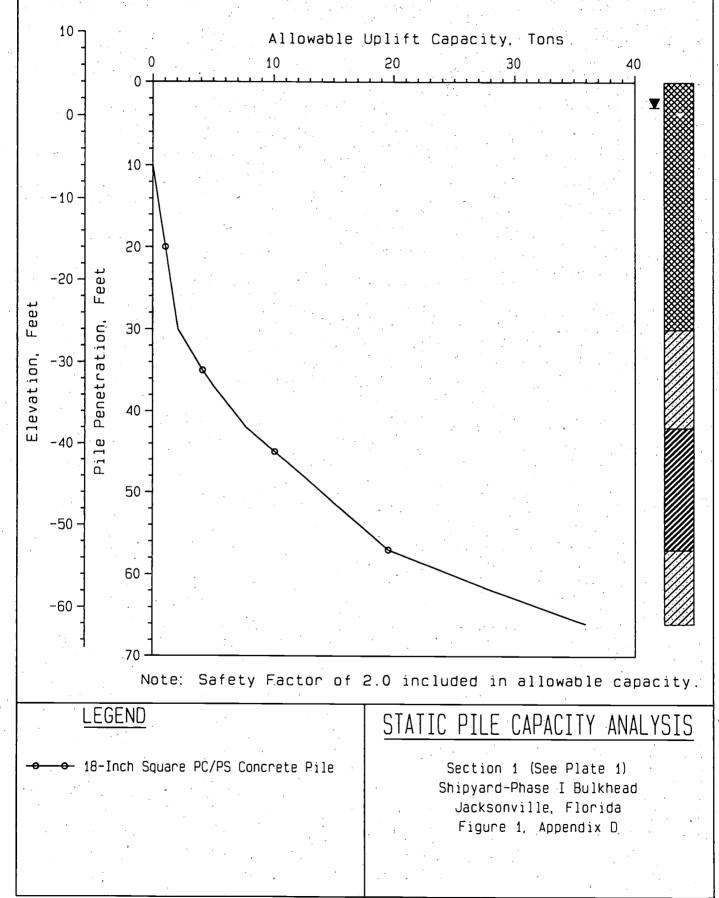


ORGANIC MATERIAL MODIFIERS								
Modifier	Organic Content							
Trace Few Some Many	1% to 2% 2% to 4% 4% to 8% >8%							

<u>APPENDIX C</u>

BULKHEAD ANCHOR PILE UPLIFT CAPACITY CURVES

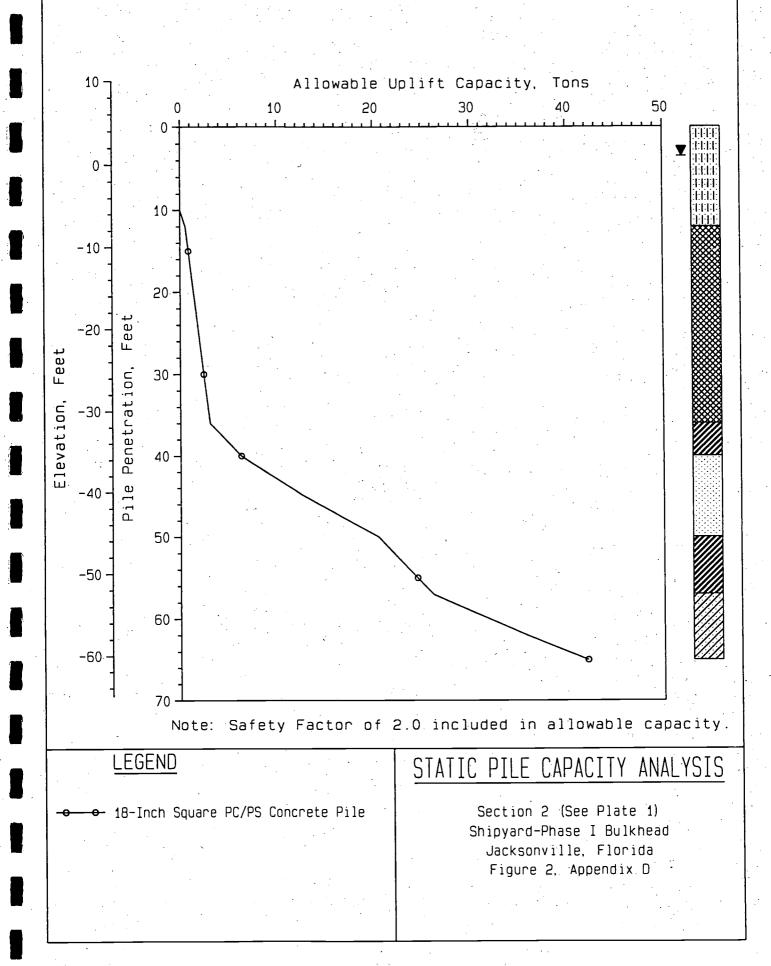




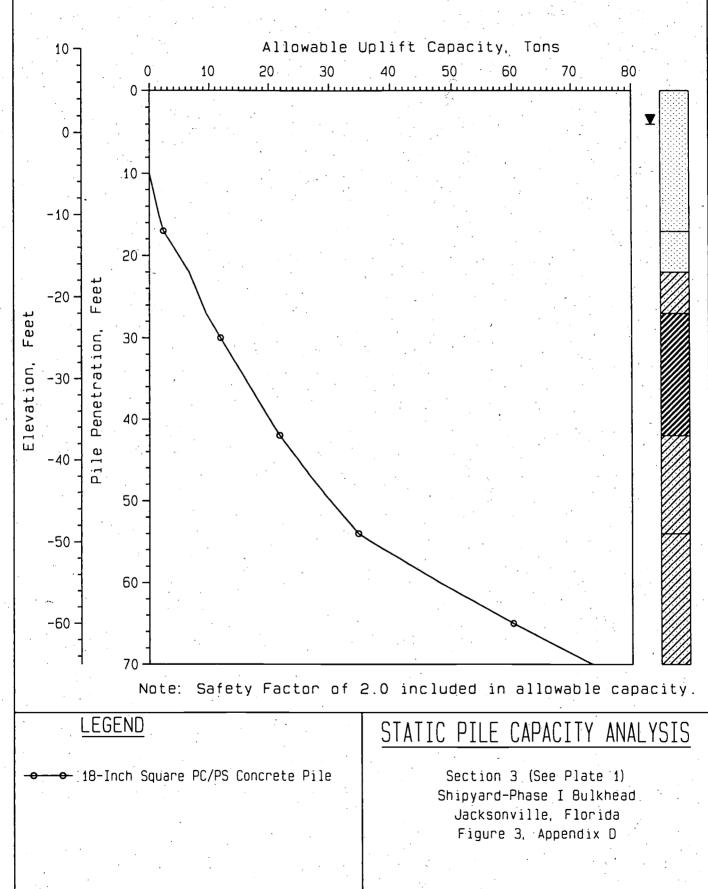
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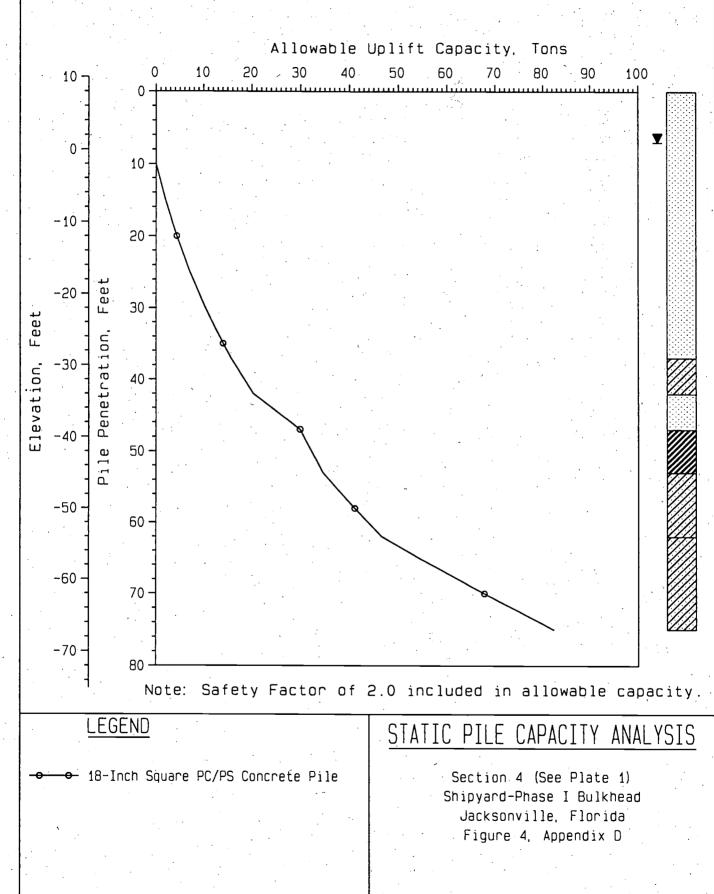


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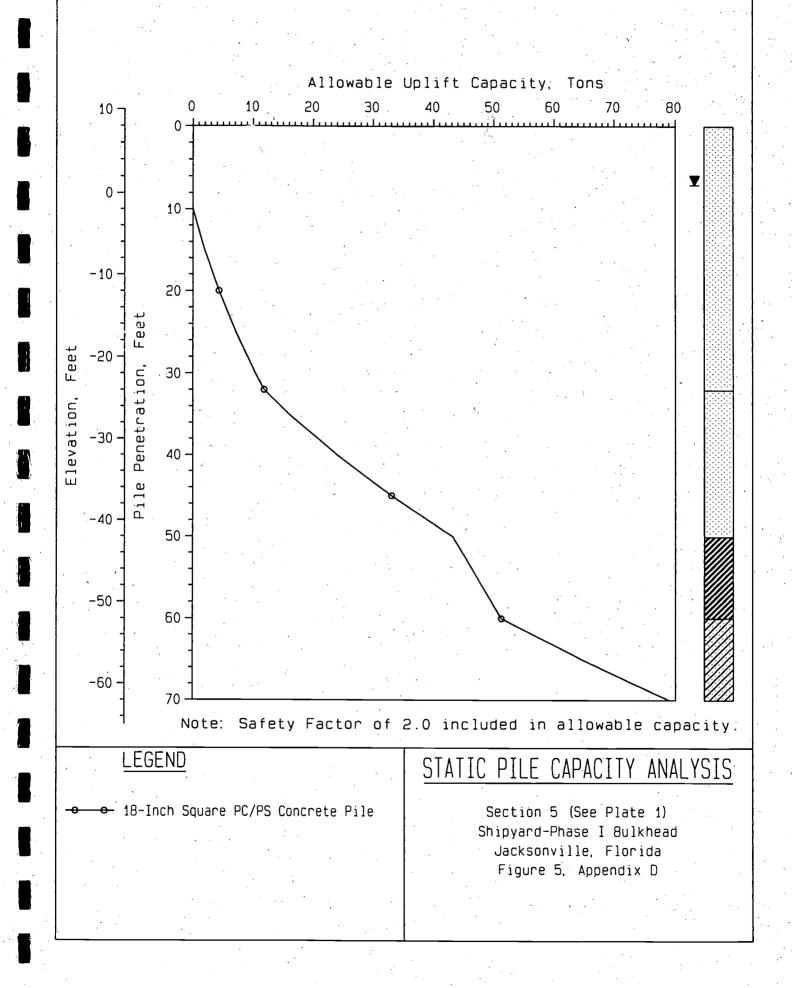


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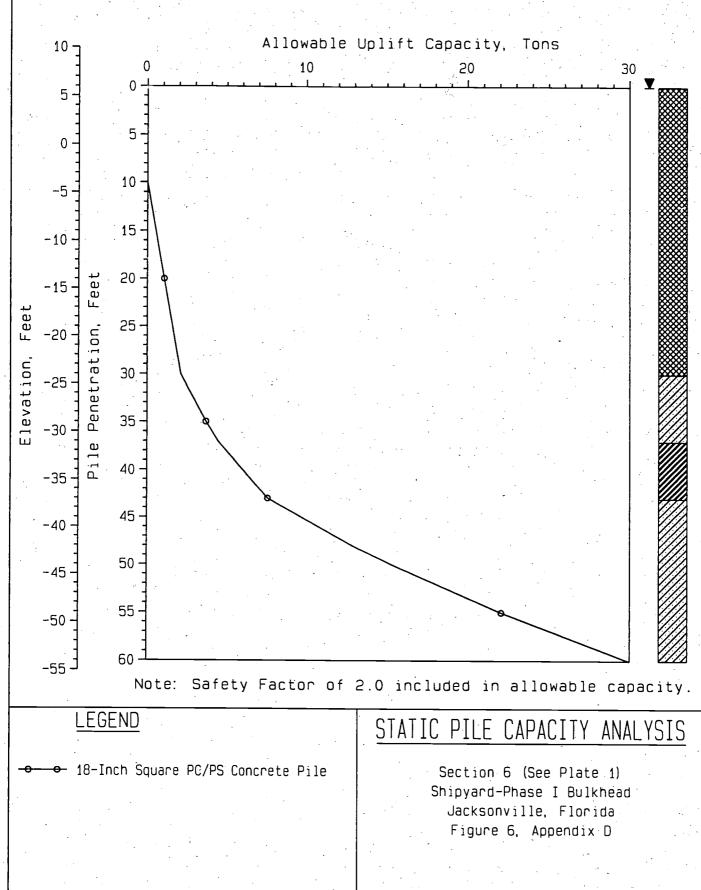
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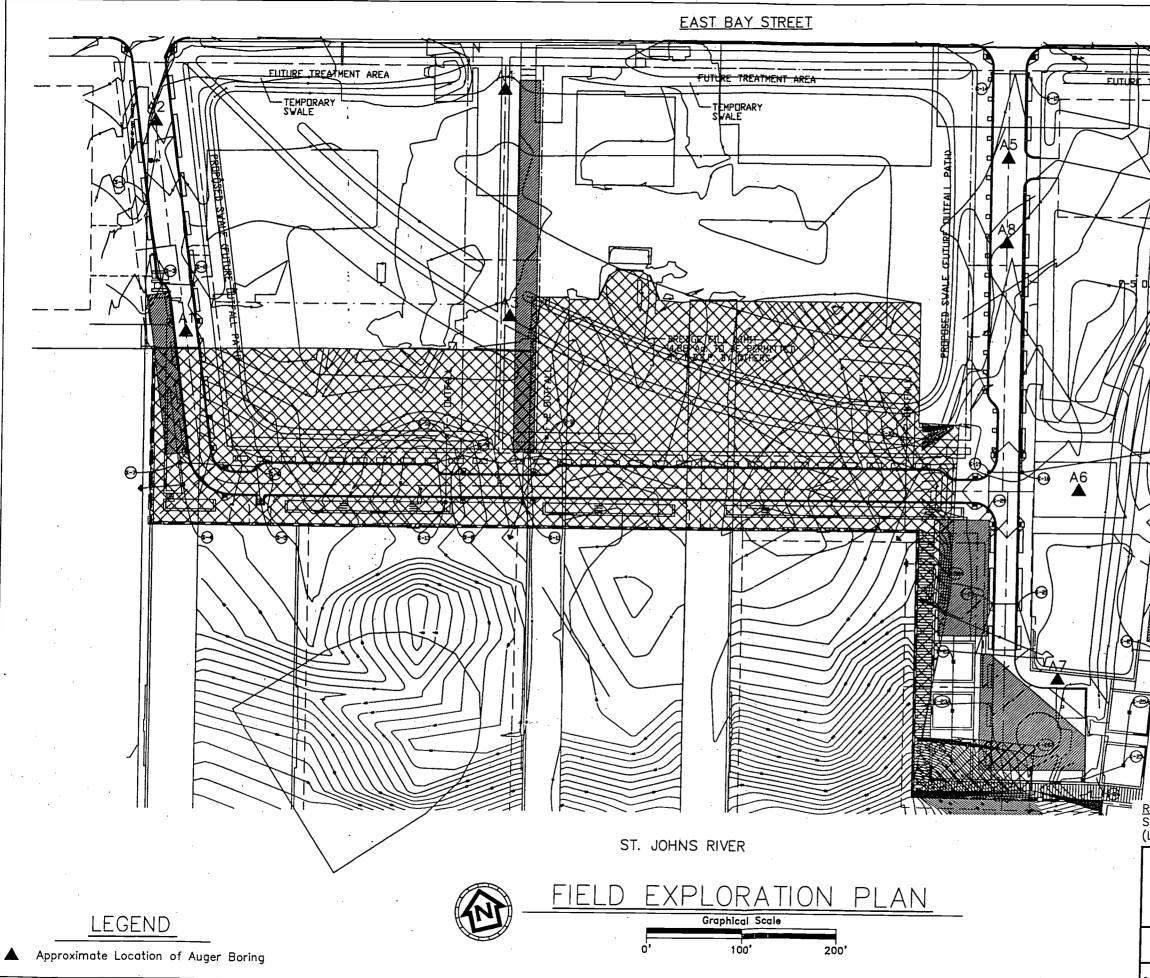
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ADDITIONAL GEOTECHNICAL BORINGS FOR WEST SIDE OF SHIPYARDS



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The YAN
TREATMENT AREA
E 6 DUTFALL
Reference:
Site plan provided by Bessent, Hammock & Ruckman, Inc. (Last Dated 2/11/02)
Field Exploration Plan
Shipyard Bulkhead — Phase II Jacksonville, Florida
EILIS & ASSOCIA to SINC. GEOTECHNICAL ENGINEERING ENVIRIMENTAL SERVICES CONSTRUCTION MATERIALS ENGINEERING INDITESTING
DATE 4/4/02 PROJ NO: 01-1346a Figure 3

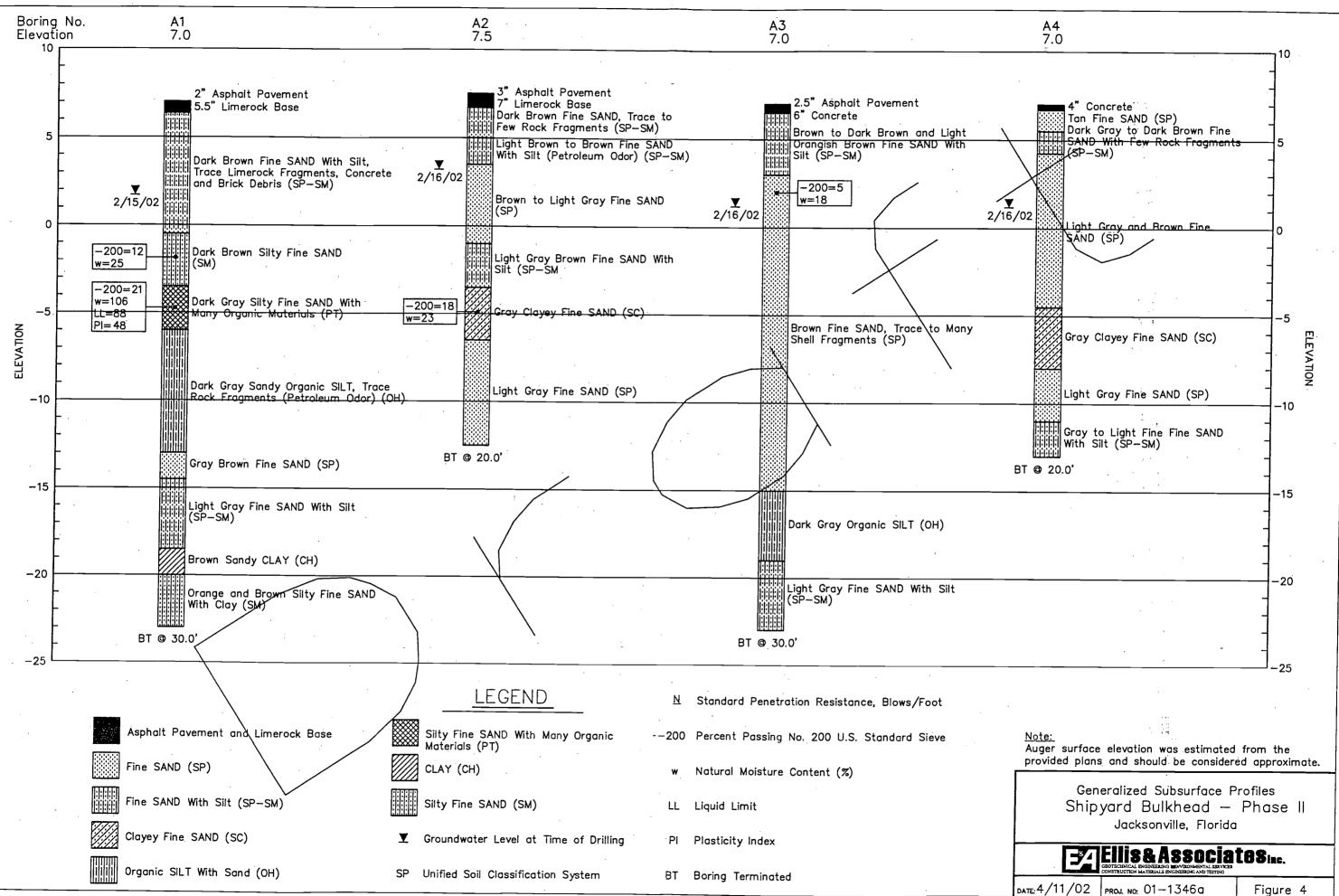
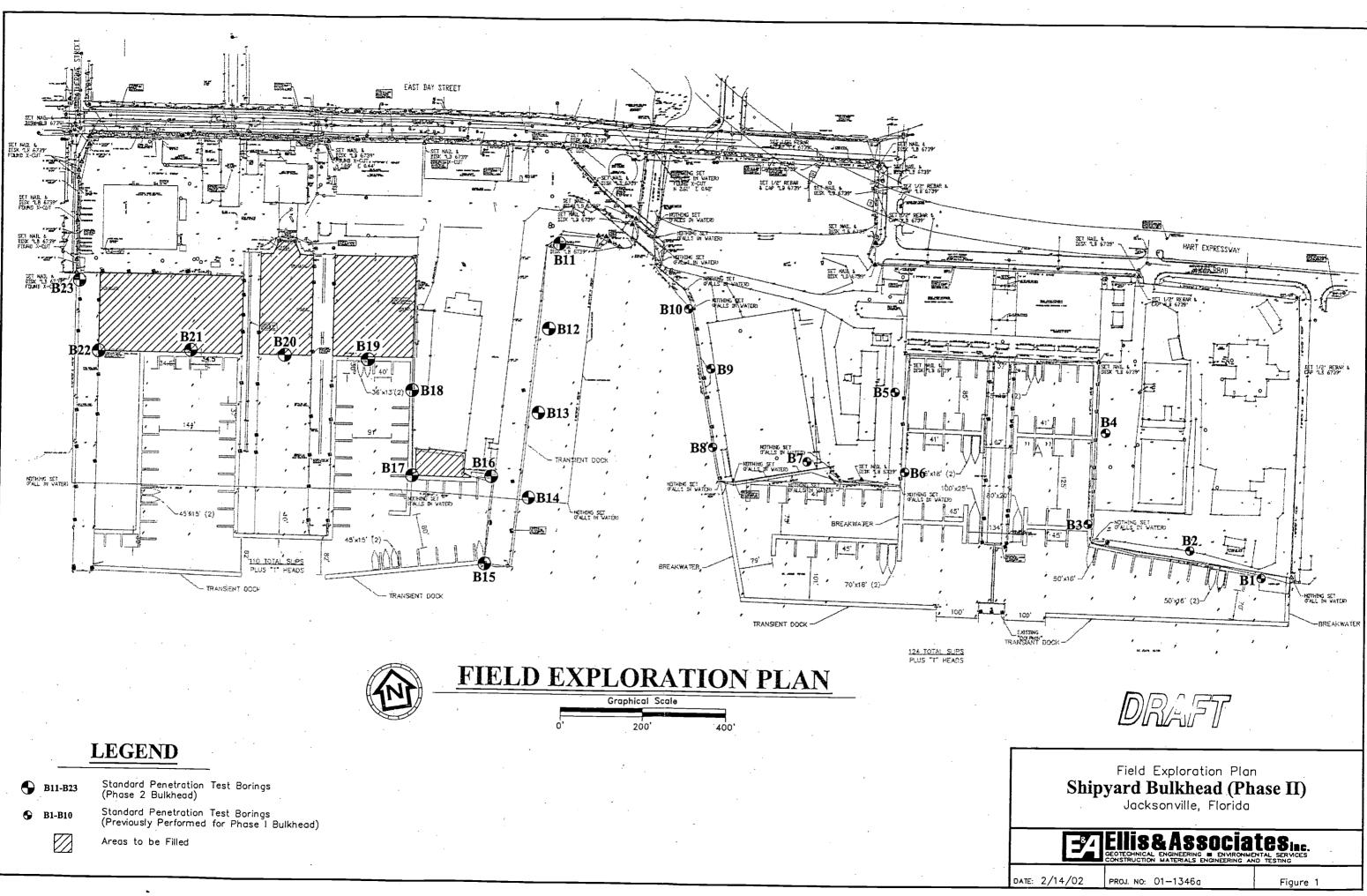
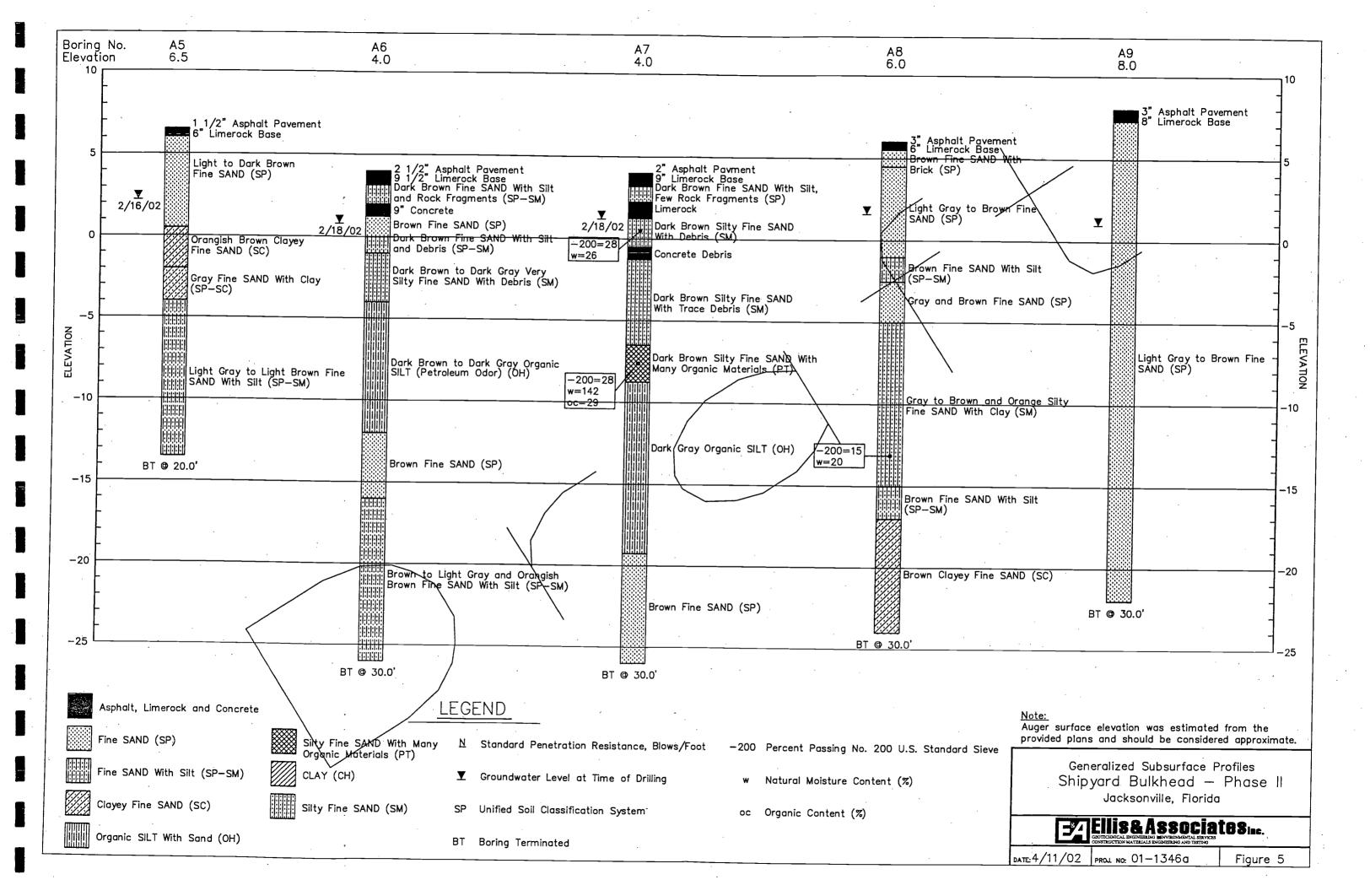


Figure 4



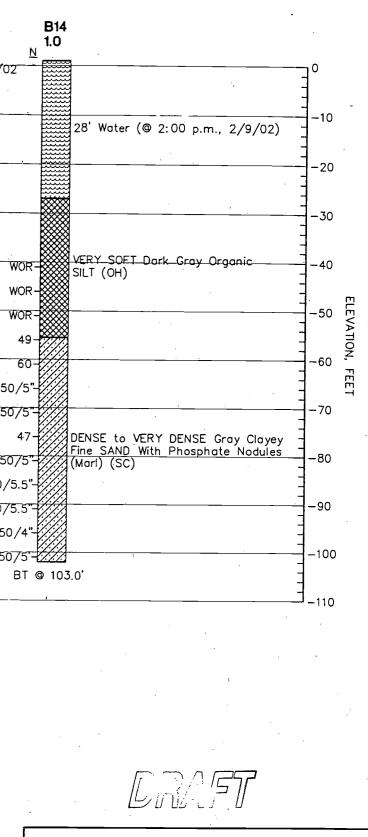


oring No. evation	B1 1.0		B12 1.0		B13 1.0	•	
° F	<u>▼ [№]</u> /26/02	6' of water (@ 8:00 a.m., 1/26/02)	⊻ <u>N</u>		<u>▼ №</u> 1/29/02	· · ·	
			10'	Water (@ 9:00 a.m., 1/28/02)		10' Water (@ 12:00, 1/29/02)	2
-10	WOR-	B11-UD1	WOR -	· · ·	WOR-		
-20	wor-						
	WOR-	VERY SOFT Dark Brownish Organic	WOH-	Y SOFT Dark Gray Organic	WOR-	. · · ·	
-30		SILT (Muck) (OH)		-(Muck) (OH)		VERY SOFT Brownish Gray	
-40		8	WOH-	-UD1	WOR-	Organic SILT (Muck) (OH)	
	WOR-		WOH-	•	WOH-		
-50		×			<u>wон</u> -	·	
-60	50/5.5"-		47-	SE Gray Clayey Fine SAND With phate Nodules (Marl) (SC)	WOH		
-70	40-	VERY DENSE to DENSE Greenish Gray Clayey Fine SAND (Marl) (SC)	40-	SE Grav Clavev Fine SAND	× · · · · ·	DENSE Gray Clayey Fine SAND (Marl) (SC)	_
	46-2/2 52/2"-	VERY DENSE Gray Clayey Fine SAND With Black Phosphate	42-00 VER	DENSE Grav Silty Fine SAND	42 39	· · · · · · · · · · · · · · · · · · ·	
-80 -	<u>50/3</u> " ΒΤ @ ξ	Nodules (Mari) (SC)	50/2"-###### With	Limestone Fragments (Marl) (SM) HARD Gray LIMESTONE	50/4"-		
90		<u>.</u>	150/3"		50/4"- 39-	VERY DENSE Light Brown Fine SAND With Clay (Marl) (SP-SC)	
			64	E to VERY DENSE Gray Clayey	40-		
100 			<u>50/5 - /// (Marl</u>	SAND With Phosphate Nodules) (SC)	50/5.5"-	DENSE to VERY DENSE Light Gray Clayey Fine SAND With Trace	
110 E	• .		67- 37-	· .	81- 30-	Phosphate (Marl) (SC)	

GENERALIZED SUBSURFACE PROFILES

		LEGE	ND		· .	
		Silty Fine SAND (SM)	<u>N</u>	 Standard Penetration Resistance, Blows/Foot	SP	Unified Soil Classification System
 Organic SILT (Muck) (OH)		Clayey Fine SAND (SC)	. 50/5'	Number of Blows to Drive Split Spoon Sample in Inches	¥	Groundwater Level at Time of Drilling
 Fine SAND (SP)		Limestone	WOH	Hammer Dropped by the Static Weight of Hammer and Rods Only	BT	Boring Terminated
Fine SAND With Cloy (SP-SC)	I	Relatively Undisturbed Sample "Shelby Tube"		Rod Dropped by Static Weight of Rods Only		

.



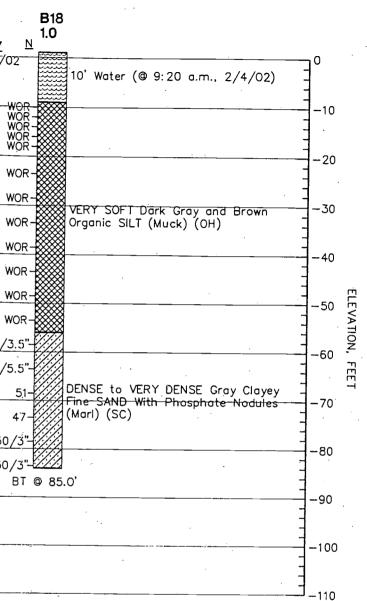
Ellis & Associates Ellis & Associates Ellis & Contract Diversion & Diversion Construction Waterass Draketing and Testing Date: 2/14/02 PROJ. NO: 01-1346a Figure 2

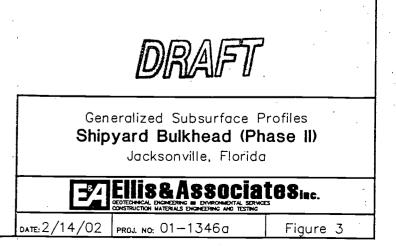
. -

Boring No	B16	6					
Elevation	1.0		B17		B19		
0	<u>▼ №</u> 1730702		`⊻ ⊵		<u>▼ ^N</u>		J
F		6.5' Water (@ 12:45 p.m., 1/30/0	^{(1/31/02}) 1/31/02		2/5/02	9' Water (@ 10:00 a.m., 2/5/02)	2/4
-10		8				(@ 10.00 u.m., 2/5/02)	
	WOR- WOR- WOR-	VERY SOFT Dark Brownish Gray Organic SILT (Muck) (OH)		······································	WOR-	X · · · · · · · · · · · · · · · · · · ·	
	6222	Metal Debris			WOR-	8	
-20	50/3"-	VERY LOOSE Light Grav to Brown		40' Water (@ 4:00 p.m., 1/31/02)		· · · · · · · · · · · · · · · · · · ·	
F	2-4///	Clayey to Silty Fine SAND With Limestone Fragments (SC)			WOR-		
-30					WOR-		
	100-	MEDIUM DENSE Light Gray Clayey Fine SAND (SC)		- -	WOR-	VERY SOFT Dark Gray and Brown	
-40	50/5"				WOR-	Organic SILT (OH)	
F	80-		WOR - WOR - WOR -		WOR-		
-50	40-			VERY SOFT Dark Gray Organic SILT (Muck) (OH)	WOR-		
	50/4"-		WOR-		wor-		
È a	67-	DENSE to VERY DENSE Gray to			WOR-		
-60		Light Gray Clayey Fine SAND, Trace to Few Limestone Fragments and					50
	50/5"-	Phosphate Nodules (Marl) (SC)	58-	DENSE TO VERY DENSE Gray Clayey	50/4"-		50
-70	50/5.5"_////	· · · · · · · · · · · · · · · · · · ·	56-777	ine SAND With Phosphate Nodules	42-///	DENSE to VERY DENSE Gray Clayey	
F	54-		49-		52-	Fine SAND With Phosphate Nodules (Marl) (SC)	
-80 [<u>50/5.5"_2/2/</u> BT @ 80	<u>a</u>	73-		50/4.5"-		·
· È	81 @ 80	J.5	50/5.5"-	ÆRY DENSE Gray Cemented Fine SAND With Clay (Marl) (SP-SC)	50/3"-		
-90				IARD Gray Sandy CLAY (CH)	BT @ 84	.0'	
Ē		•	75-				
-100			50/4"-	ÆRY DENSE Gray Clayey Fine SAND Vith Phosphate Nodules (Marl) (SC)		•	
			50/5"-		· · · ·	· · · · · · · · · · · · · · · · · · ·	
			, BT @ 105.	0'			
-110					· · · · ·		

GENERALIZED SUBSURFACE PROFILES

• • • •				
· · ·				
		LEGEND	т., ст.	
Water	<u>N</u>	Standard Penetration Resistance, Blows/Foot	SP	Unified Soil Classification System
Organic SILT (Muck) (OH)	¥	Groundwater Level at Time of Drilling	50/5"	Number of Blows to Drive Split Spoon Sample in Inches
Clayey Fine SAND (SC)	WOH	Hammer Dropped by the Static Weight of Hammer and Rods Only	BT	Boring Terminated
Sandy CLAY (CH)	WOR	Rod Dropped by Static Weight of the Rod Only		





evation	<u>Y</u> <u>N</u>	9	B21 1.0 ▼ <u>N</u>		B22 1.0 ▼ <u>N</u>		-
Ĕ		5 Water (@ 11:00 a.m., 2/6/02)	2/7/02	8' Water (@ 9:00 a.m., 2/7/02)	<u>₹</u> <u>1</u> 2/8/02	10' Water (@ 8:00 a.m., 2/8/02)	⊻ 2/8/
-10 F	WOR- WOR- WOR- WOR-			· · ·		10 water (@ 0.00 d.m., 2/8/02)	
	WOR- WOR-		WOR-		WOR- WOR- WOR- WOR-		
-20	WOR-		WOR-		WOR-	VERY SOFT Dark Gray and Brown Organic SILT (Muck) (OH)	
È	WOR-	VERY SOFT Dark Grayish Brown	WOR-	· <u> </u>			
-30 -	WOR-	Organic-SILT (Muck) (OH)		VERY SOFT Dark Gray and Brown Organic SILT (Muck) (OH)	50/3"	VERY_HARD_Light_Gray_Limestone	5
-40	WOR-		WOR-		50/4"-	*	:
-40 F	WOR-		WOR-		<u>51-</u> /// 80-////		
-50	WOR-		WOR-		47-		
	woн-		WOH-	· · · · ·	56-		50,
-60	34-///		51-		46-	DENSE to VERY DENSE Gray Clayey Fine SAND With Phosphate Nodules	
Ē	50/5"-	DENSE to VERY DENSE Gray Clayey Fine SAND With Phosphate Nodules		DENSE to VERY DENSE Gray to Light Gray Clayey Fine SAND With	51-	(Marl) (SC)	
-70	<u>46</u> _/// 84-///	(Mari) (SC)	52-52-	Phosphate_Nodules (Marl) (SC)	63-	·	5
-80	36-		48-		54-		5
Ē	BT @ 80	0.0'	77-2/2/2 BT @ 83.0	0'	62- 50/5.5"-	· · · · · · · · · · · · · · · · · · ·	5
-90	·		61 @ 63.0		BT @ 85	0'	
			· .				

GENERALIZED SUBSURFACE PROFILES

- LEGEND
- N Standard Penetration Resistance, Blows/Foot
- ▼ . Groundwater Level at Time of Drilling
- Hammer Dropped by the Static Weight of Hammer and Rods Only WOH
- WOR Rod Dropped by Static Weight of the Rod Only
- SP Unified Soil Classification System
- 50/5" Number of Blows to Drive Split Spoon Sample in Inches
- BT Boring Terminated

-110

Water

Organic SILT (Muck) (OH)

Clayey Fine SAND (SC)

Sandy CLAY (CH)

Limestone

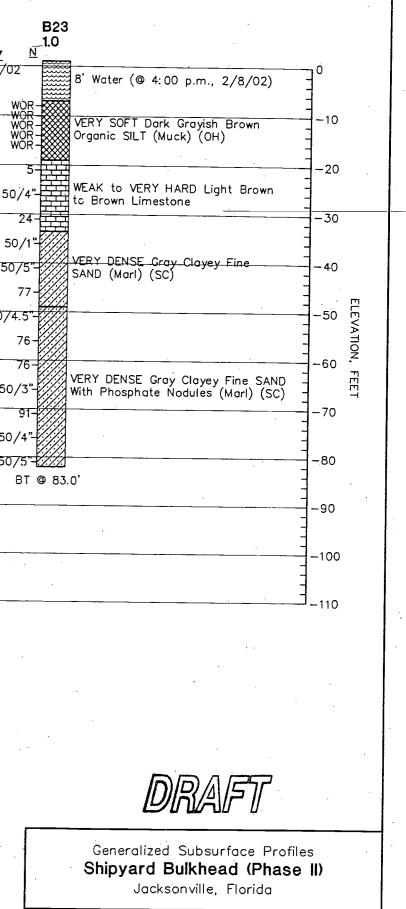




Figure 4