Class 3 Modification Application
Permit and Compliance Plan No. 50099



Shell USA, Inc.
5900 Highway 255
Deer Park, Harris County, Texas

SWR No. 30007
EPA ID No. TXD067285973

Volume II
(Appendix V.D)

Revision 15
June 2024

Appendix V.D

Surface Impoundment Engineering Reports

This permit modification is to request that SCLP be allowed to build over the West South Effluent Treater (West SET or west basin) Basin (TCEQ Permit Unit No. 5; NOR 152) for the purposes of upgrading and expanding existing SET front end. This unit was Certified Closed in December 2017 and accepted as closed as a landfill by the TCEQ on February 13, 2018.

This modification will not alter the East SET and Middle SET, thus, those engineering reports are not include.

Although information pertaining to a "surface impoundment closed as a landfill" would be provided in Appendix V.G – Landfills, the information pertaining to the inactive and closed SET Basins is provided in Appendix V.D to be consistent with the 2022/2023 Renewal Application.

Engineering Plan-*2025 West Set Front End Upgrade Conceptual Cap Modification Plan, May 2024*
INCLUDED AND THE FOCUS OF THIS PERMIT MODIFICATION

Engineering Report – East SET Basin (From the 2022 Class 3 Application for the Shell Oil Company, Deer Park Complex) NOT INCLUDED

Closure Certifications – Middle NOT INCLUDED

Closure Certifications - West SET Basins INCLUDED AS PART OF CAP MODIFICATION PLAN NOTED ABOVE

Table V.D.1 – Surface Impoundments INCLUDED

Table V.D.6 – Surface Impoundment Liner System INCLUDED

Engineering Plan-*2025 West Set Front End Upgrade Conceptual Cap Modification Plan, June 2024*

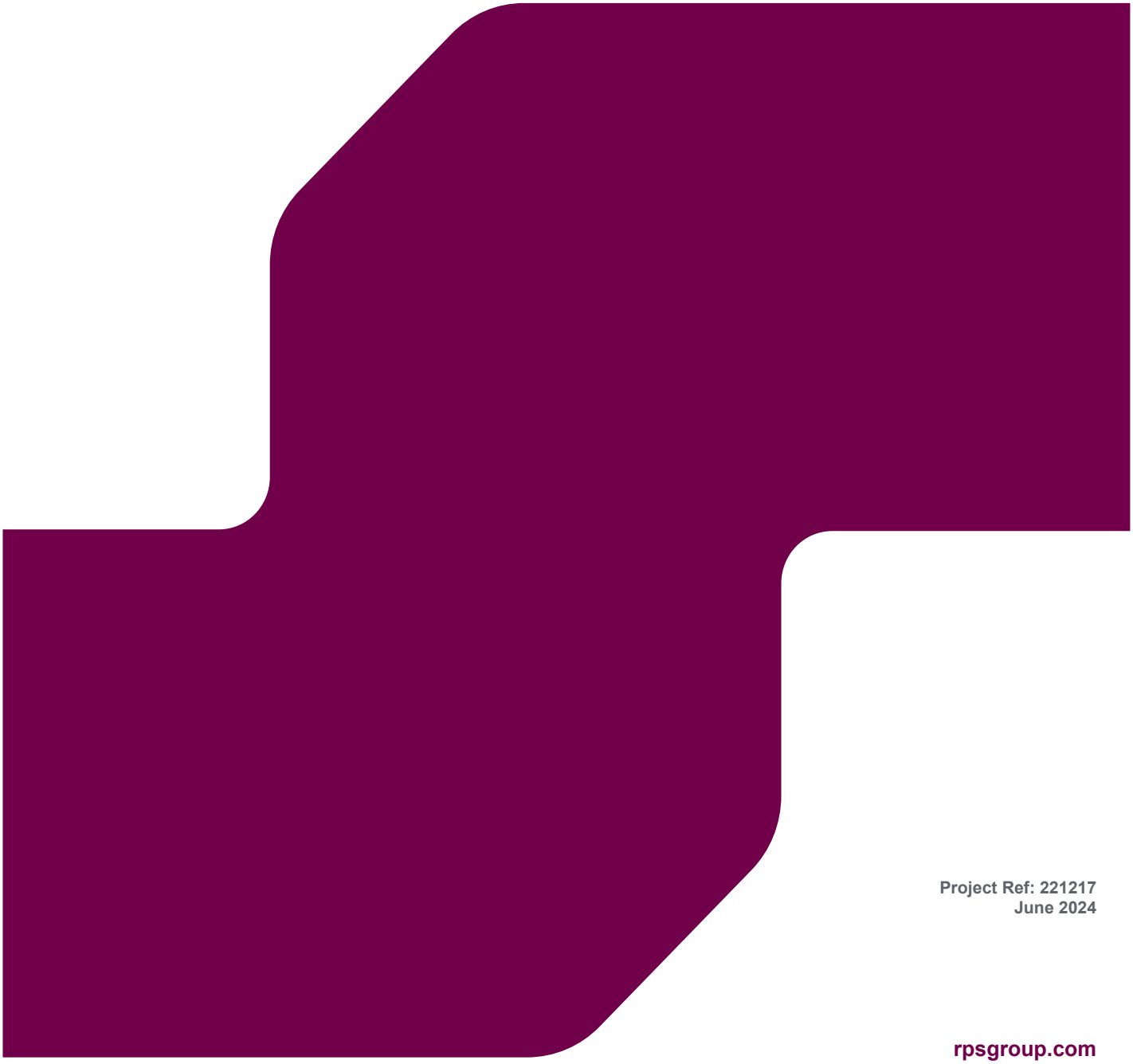
Shell USA, Inc.
SWR No. 30007
Rev. 15 – June 2024

MAKING COMPLEX EASY

A TETRA TECH COMPANY

2025 WEST SET FRONT END UPGRADE CONCEPTUAL CAP MODIFICATION PLAN
WEST SOUTH EFFLUENT TREATER BASIN

Prepared for Shell USA, Inc.



Project Ref: 221217
June 2024

rpsgroup.com

Contents

1 PREFACE 1

2 INTRODUCTION 2
2.1 Description of West SET Basin 3
2.2 Waste Managed at the SET Basins 3
2.3 Closure Performance Standards 3
2.4 Organization of Report 4

3 GROUNDWATER CONDITIONS 6
3.1 Description of Upper Water-Bearing Zone 6
3.2 Description of Constituents of Concern in Groundwater 6

4 WASTE CHARACTERIZATION 7
4.1 Wastes Managed in SET Basins 7
4.2 Waste Characterization Sampling 7
4.3 Characterization of Sludge 8
4.4 Characterization of Concrete Liner 8

5 CLOSURE PROCEDURES 9
5.1 Operations to Maintain Wastewater Treatment during Closure 9
5.2 Closure Schedule 9

6 POST CLOSURE PLAN AND COST ESTIMATE 10
6.1 General 10
6.2 Preservation of Benchmarks 10
6.3 Post-Closure Notices 10
6.4 Post-Closure Cost Estimate 11

Tables

Table 1:	Waste Managed in SET Basins
Table 2:	October 2023 Analytical Results SET Compliance Wells (from AECOM)
Table 3:	Summary of Organics and RCRA Metals Detected from Middle SET Sludge and Clay Samples
Table 4:	Dioxins/Furans (SW846 8290) Analytical Summary

Figures

Figure 1:	Location of Basins within Refinery
Figures 2 thru 4	Conceptual Drawings Plain View
Figures 5 thru 7	Conceptual Drawings Cross-Section View
Figure 8	Foundation and Pile Detail
Figures 9	April and October, 2023 Groundwater Concentration Map for WMA B (PMZ-1) (from AECOM Figure 2.7.a)

Appendices

Appendix A:	TCEQ Closure Acceptance Letter, February 2018
Appendix B:	Closure Certification Report, December 2017
Appendix C:	Certifications/Engineering Opinions – Worley, Fugro, TorcSill
Appendix D:	2016 Clay Cap Construction Quality Control Plan
Appendix E:	Preliminary Construction Schedule

1 PREFACE

Elements of this *2025 West SET Front End Upgrade Conceptual Cap Modification Plan for the South Effluent Treater (SET) Basins* ("conceptual cap modification plan") are taken from the following documents:

- 2024 Groundwater Annual Report, Shell Chemical LP, Deer Park, Harris County, Texas, TCEQ SWR No. 30007, TCEQ Hazardous Waste Permit/Compliance Plan No. CP-50099, EPA Identification No. TXD067285973; CN601542012; RN100211879, January 19, 2024
- Closure and Post-Closure Plans, South Effluent Treater Basins, October 2020
- TCEQ Correspondence, Closure of Closure Certification Report, Shell Oil Company – Deer Park, Harris County, Hazardous Waste Permit No. 50099, February 13 2018
- Closure Certification Report, West South Effluent Treater Basin, December 2017
- Revised Closure Plan, East and West South Effluent Treater Basins, January 2016
- Revised Closure Plan, South Effluent Treater Basins, Revision 2, August 2013
- Revised Closure Plan, South Effluent Treater Basins, July 2011

The conceptual cap modification plan is not re-closing the West SET basin, but rather minimally changing the cap configuration so that another operating unit can be constructed above the closed basin. This cap modification plan is conceptual and full design plans are in the process of being finalized. Much of the information is repeated from previous plans and reports for historical context and clarity (see Section 1).

2 INTRODUCTION

Shell USA, Inc. was issued renewed Hazardous Waste Permit and Compliance Plan No. 50099 for the Deer Park complex at 5900 Highway 255 in Deer Park, Harris County, Texas on August 24, 2023. The recently issued permit includes the closed West SET basin (accepted as certified closed as a landfill by the Texas Commission on Environmental Quality (TCEQ) on February 13, 2018). This conceptual cap modification plan is not re-closing the West SET basin, but rather minimally changing the cap configuration so that another operating unit can be constructed above the closed basin. Full design plans are in the process of being finalized. Much of the information is repeated from previous plans and reports for historical context and clarity (see Section 1).

As per 30 TAC 305.69(d) and 30 TAC 305.69(k), this conceptual cap modification plan has been prepared as part of a permit modification to request that Shell be allowed to build over the West South Effluent Treater (West SET or west basin) Basin (TCEQ Permit Unit No. 5; NOR 152) for the purposes of upgrading and expanding existing plant operations. This unit was Certified Closed in December 2017 and accepted as closed as a landfill by the TCEQ on February 13, 2018.

Conceptual design drawings of the cap revisions can be seen in Figures 2 through 8. The conceptual cap modification over the West SET will incorporate the following:

- Remove the existing concrete cap and grade in the area in proximity of proposed new equipment and foundations to promote positive drainage away from equipment and foundations. A stormwater drainage collection system will be designed to intercept storm waters which run-off from the cap in the area of the foundations and new equipment.
- Construct and install new equipment on top of the basin which will consist of tanks, piping, pipe supports, and related components.
- Tanks, piping, and equipment will utilize structural foundations consisting of reinforced concrete mats, concrete footings, helical piles with concrete caps, and small concrete piers for pipe supports. The concrete mat foundations or footings will be installed within the existing clay cap. Helical piles and smaller concrete piers will extend through the clay cap and into the stabilized waste, however the piles or concrete piers will not penetrate or come into contact with the existing bottom concrete liner.
- Repair the portions of the existing concrete cap which were removed for the installation of the equipment.
- Seal at the extent of the new concrete foundations and helical piles which are within or penetrate the existing clay cap using an expanding bentonite clay to minimize potential for vertical pathways at the foundations and prevent rainwater from direct migration through the cap at the foundations and into the landfill.
- In addition to the bentonite clay seal, the replaced concrete and compacted clay cap will be reconstructed adjacent to the bentonite discussed above.

It is important to note that the bottom of the closed landfill will not be penetrated by the equipment or the foundations and that the newly replaced clay and concrete foundations will meet or exceed the vertical permeability requirements of the existing cap (10-7 cm/sec or less for a four foot thick clay soil cap) in order to minimize water infiltration into the closed landfill cell. Ongoing cap inspections and groundwater monitoring required under Hazardous Waste Permit/Compliance Plan No. 50099 will continue on schedule as required

Letters providing technical review and analysis, including discussion of the conceptual design, can be found in *Appendix C, Certifications/Engineering Opinions from Worley, Fugro, and TorcSill.*

2.1 Description of West SET Basin

The West SET was a permitted hazardous waste surface impoundment with top dimensions of 340 feet (length) by 218 feet (width), 2:1 (horz:vert) side slopes, and a depth of 17 feet (depth). The basin was equipped with aerators, associated supports, and walkways, and functioned as an aeration basin for treatment of process wastewater. The west basin was operated in parallel configuration and received the same wastewater influent from the process units as the middle and east basins. The bottom liner of the unit is approximately 6-inches thick of reinforced concrete.

At closing of the basin, the waste was stabilized with a resulting thickness of 2 to 3 feet. Over the stabilized waste was added approximately 10-feet of low permeability structural fill, 3-feet of low permeability clay, and a 6-inch reinforced concrete surface liner.

The West SET was Certified Closed in December 2017 and accepted as closed as a landfill by the TCEQ on February 13, 2018 (see Attachments A and B).

2.2 Waste Managed at the SET Basins

Prior to closure in 2017, the basin was operated as an aggressive biological treatment unit and managed hazardous and non-hazardous wastewaters that are bio-treated by activated sludge and high-rate aeration. Table 1 provides a summary of the wastes currently and historically managed in the basins.

2.3 Closure Performance Standards

The cap modification closure performance standards are expected to be equal to, or more protective, than those achieved and documented in the December 2017 Certified Closure Report (Appendix B). In summary, the closure standards are as follows:

- Clay Cap-Replaced and Existing
    - Minimum thickness of 4 feet +-;
    - Minimum compaction of 98% Standard proctor density at -1% to +3% optimum moisture content;
    - Maximum permeability of 1 x 10-7 cm/sec, and
    - Minimum shear strength of 1,000 psf.
    - Where shallow foundations for the tanks or equipment will be installed and over-excavation is required for the installation of the foundations, a reinforced concrete layer will be constructed, such that the minimum thickness of the clay cap plus the concrete foundation is 4-feet.
- Concrete Pavement-Replaced
    - Minimum thickness of 6 inches and consists of fiber reinforced concrete with a minimum compressive strength of 4,000 psi
    - Sloped to promote positive drainage away from foundations and to the stormwater collection system (i.e., drains and sumps) as can be seen in Figures 2 thru 8.
- Helical Pile Installations-New
    - Helical piles will be designed for certain foundations to support equipment and minimize vertical and lateral movement and disturbance of the cap.
    - Concrete caps will be installed as part of the pile and the annular space between the pile cap and clay soil landfill cap will be sealed using granular bentonite and compacted clay. The seal will prevent migration of stormwaters through the pile penetrations and into the landfill beneath the clay cap.

Additional information can be found in Appendix B through D and in Figures 2 through 8.

Much of the following description is extracted from the 2016 original closure plan and other documents (see Section 1) which addressed the SET basins together and is provided for historical context and clarity. The 2025 West SET Front End Upgrade project is not re-closing the SET basin, but rather minimally changing the cap configuration so that another operating unit can be constructed above the closed basin.

In accordance with 40 CFR §264.111, conceptual cap modification plan is designed to minimize or eliminate the need for further maintenance; and to minimize or eliminate the post-closure release of hazardous wastes, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

Shell achieved this performance standard by closing the basins under the “in-place” alternative of risk-reduction standard Remedy Standard B (RSB) (30 TAC 350.33). A RSB closure was appropriate for the SET basins due to the presence of historical contamination in the vicinity as evidence by several PMZs that encompass and surround the area around the SET basins. The PMZs continue to be authorized through Shell’s Compliance Plan (CP-50099) and address three water-bearing zones (WBZs) at the Shell facility that are separated vertically from one another. The depths of the basins extend into the upper water-bearing zone (WBZ-1), and some of the hazardous constituents associated with the listed wastes managed in the basins are the same as those found in the WBZ-1 protective concentration level exceedance (PCLE) zone. CP Table I of the Compliance Plan lists the SET basins as potential release sources of the groundwater contamination and includes them under Waste Management Area B (WMA-B). However, due to the up-gradient and side-gradient locations of the highest levels of contaminant concentrations in WBZ-1 and its more extensive footprint at the site, the groundwater contamination is believed to be associated with historical releases not associated with the SET basins. This observation is further supported by the lack of detection (or very low-level detections) of chemicals of concern (COCs) identified from recent sludge samples collected from the middle basin (see Section 3.2).

Since a PMZ is a response action that is only allowed under RSB, closure of the SET basins will also be conducted under RSB because a definitive assignment of all groundwater contamination to historical sources may be impractical. As described in Section 4, the RSB closure performance standard was met by stabilizing the sludge remaining after removal of liquids and pumpable solids from each basin. Following stabilization, a final cover was constructed over each basin. The covers were designed and constructed of materials and at slopes that will minimize erosion and infiltration and promote drainage throughout the post-closure care period, considering the concentrations of COCs remaining in the wastes/affected soils. The cover for the west basin was constructed of materials that will allow the surfaces to be utilized for lay-down, vehicle parking or other use that will not interfere with the integrity of the cover systems. The 2016 plan anticipated the following submittal of closure certification for the middle basin to the TCEQ, the aeration tank would be constructed on top of the cover system to replace the SET basins.

2.4 Organization of Report

The following sections of the conceptual cap modification plan are organized as follows:

Section 3: Groundwater Conditions. This section describes the groundwater conditions around the SET basins.

Section 4: Waste Characterization. This section describes the wastes managed in the SET basins and summarizes the results of a waste characterization sampling program conducted for the middle basin.

Section 5: Remedy Standard B Closure Procedures. This section describes the procedures that will be followed to accomplish the closures of the East and West SET basins under TRRP Remedy Standard B. The section includes verification sampling procedures and analytical parameters, as well as a description of closure verification reporting.

Section 6: Post-Closure Care. Post-closure care procedures for the East and West SET Basins are summarized in this section.

3 GROUNDWATER CONDITIONS

Much of the following description characterizing groundwater in the vicinity of the SET basins is extracted from the 2016 original Closure Plan, the AECOM January 2024 Annual Groundwater Monitoring Report (AECOM Report), and other documents (see Section 1 for a complete list). The data from these reports is provided for historical context and clarity. It is noted that the most recent groundwater data can be found in the AECOM Report and represents the most current nature and extent description of impacts to groundwater beneath the project site. It is also noted, that Table 2 and Figure 9 in this conceptual cap modification plan have been borrowed from the AECOM Report and the entire AECOM Report is available upon request.

3.1 Description of Upper Water-Bearing Zone

Currently, TCEQ RCRA Permit 50099/CP-50099 places the SET basins within the footprint of Waste Management Area B (WMA-B). The water-bearing zone of interest and related to the closure of the West SET basin is the most shallow, upper groundwater unit and is referred to as Water Bearing Zone 1 (WBZ-1) (see AECOM Report). WBZ-1 consists of discontinuous beds of silty sand, sand, and silt, which occur from 10 feet above to -15 feet below Mean Sea Level (MSL) and range in thickness from 1 to 14 feet. WBZ-1 is most prevalent along the western and southern portions of the facility property and tends to thin or pinch out along the eastern and northern portions of the facility.

As per the AECOM Report, groundwater remediation and controls in WMA-B consist of institutional controls, active recovery and hydraulic control of impacted groundwater (using dedicated pumps in monitoring wells), batch recovery of impacted groundwater (through weekly monitoring well evacuations using vacuuming trucks), and hydraulic control through the installation of an approximately 340-foot-long, 40-foot-deep slurry wall installed in August 2006 between the east aeration basin and Patrick Bayou and between MW-28R and MW-26R.

3.2 Description of Constituents of Concern in Groundwater

A review of recent groundwater monitoring analytical results from area monitoring wells (see Table 2 and Figure 9) indicate there are only minor exceedances of Groundwater Protection Standards (GWPS) in a few monitoring wells upgradient of the SET basins (primarily 1,2,3-Trichloropropane) and no exceedances of GWPS in monitoring wells downgradient of the SET basins and adjacent to Patrick Bayou.

Earlier investigations (see Appendix B – Certified Closure Report) determined that the distribution of groundwater impacts compared to sludge sample analytical results collected from the middle basin indicate that the constituents identified in the groundwater did not result from waste handling at the SET basins, but rather from historical sources associated with petrochemical operations at the Deer Park facility.

4 WASTE CHARACTERIZATION

This section describes wastes managed in the SET basins and results of waste characterization sampling conducted during 2010.

4.1 Wastes Managed in SET Basins

Wastewaters and sludges managed in the basins include the hazardous and non-hazardous wastes listed in Table 1. Wastes that are classified as listed hazardous wastes are further described as follows:

- K174 - Wastewater treatment sludges from the production of ethylene dichloride or vinyl chloride monomer. Wastewaters are processed in the SET basins from the production of both ethylene dichloride and vinyl chloride monomer. It is noted that K174 is a "contingent management" listing whereby the listing does not apply if the waste is disposed of in a Subtitle C landfill or a permitted non-hazardous landfill and the waste is not otherwise placed on land prior to final disposal. The K174 listing applies to the sludges at the SET basins because the basins are surface impoundments, which are considered land-disposal units [see 40 CFR§268.2(c)].

- K017, K019, K020 – Heavy ends from the production of epichlorohydrin, ethylene dichloride, and vinyl chloride, respectively. These hazardous waste codes apply to the wastewater received from a vinyl chloride monomer plant operated by OxyVinyls, LP (OxyVinyls), which is co-located at the Shell facility. It is noted that the stream was delisted by the EPA on April 22, 2004 and is described in the delisting as "incinerator scrubber water generated from treating and neutralizing gasses generated in the firebox during the incineration process".

In addition to the listed hazardous wastes, SET basins have historically managed characteristically hazardous wastewater (D002, D007, D018, D022, D026, D028, D035, and/or D038) and non-hazardous wastewater.

4.2 Waste Characterization Sampling

On November 30 and December 1, 2010, samples were collected of sludge and underlying clays from two locations within the middle basin. At each location, the first sample was sludge, with an estimated thickness of one to two feet, and the second sample was collected from the upper one foot of clay soils underlying the sludge. The samples were collected using PVC casing that was pushed into the sludge. Water inside the casing was then removed to the extent practicable prior to collecting the sludge sample. Next, a split-spoon sampler was advanced through the casing and into 1-foot of the underlying clay for the second sample at each location. The samples were packaged in laboratory-provided glass containers and shipped under chain-of-custody to the analytical laboratory. Following collection of the samples, boreholes were filled with bentonite. Sampling equipment was cleaned and rinsed between each sample location.

Sludge and clay samples were analyzed for volatile organics, semi-volatile organics, RCRA metals, and dioxins and furans. The analytical list for samples included all 40 CFR Part 261 Appendix VII constituents associated with the listed hazardous wastes (K017, K019, K020 and K174) managed in the SET basins. In addition, samples were analyzed for hazardous characteristics. Analytical reports for the analyses are provided as Appendix B. A summary of volatile organics, semi-volatile organics and metals detected in the samples is provided in Table 3. The table also includes the industrial soil-to-groundwater, cross-media ($^{GW}Soil_{ing}$) Tier 1 PCLs for a greater than 0.5-acre source area or Texas-specific background levels [30 TAC §350.51(m)] for some metals. A summary of dioxin and furan results is provided in Table 4. PCLs for dioxin and furan congeners were derived using the

procedures detailed in 30 TAC §350.76(d)(2)(B). For comparison, the table also includes concentration limits for RCRA Land Disposal Restrictions (LDRs) treatment standards under 40 CFR §268.40 for K174 dioxins and furans.

4.3 Characterization of Sludge

As shown in Table 3, the sludge samples did not contain concentrations of volatile or semi-volatile organics above applicable Tier 1 PCLs. These results indicate that the aeration biological system in the SET basins has effectively reduced levels of organic hazardous constituents associated with influent wastewater. However, concentrations of several metals (i.e., arsenic, lead, selenium, and mercury) were above PCLs and/or Texas-specific background levels for both sludge samples. It is noted that these metals are not hazardous constituents associated with the listed hazardous wastes managed in the basins. As shown on Table 4, concentrations of dioxins and furans detected in the sludge samples were well below applicable PCLs and LDR treatment standards.

4.4 Characterization of Concrete Liner

The bottom liner of the West Set 6-inch reinforced concrete as can be seen in Figures 5 thru 7.

5 CLOSURE PROCEDURES

This conceptual cap modification plan is not re-closing the West SET basin, but rather minimally changing the cap configuration so that another operating unit can be constructed above the closed basin. Full design plans are in the process of being finalized.

5.1 Operations to Maintain Wastewater Treatment during Closure

Not Required. Because the West SET basin was closed as a landfill in 2016, there are no operations to maintain during the cap modification process. Regularly scheduled cap inspections and groundwater monitoring required by the HW-50009/CP-50009 plan will continue.

5.2 Closure Schedule

Construction of the 2025 West SET Front End Upgrade project is expected to begin early 2025. A preliminary construction schedule can be found in Exhibit E.

6 POST CLOSURE PLAN AND COST ESTIMATE

6.1 General

Post-closure care of the SET basin closure area was provided for a minimum of 30 years after completion of the closure of the last basin. The former basins will remain secure behind the chain-link fence that surrounds the Shell facility. Controlled access will continue throughout the post-closure period. Ongoing inspections required under Table III.D. – Inspection Schedule of the permit and groundwater monitoring required under Section XI Compliance Plan will not change.

The current post-closure care program will be continued to provide for the inspection and maintenance activities for the final cover system as they are today. Each final cover system is maintained, inspected for damage, and repaired when necessary. The inspections are conducted on a semiannual basis (at a minimum). The following provides a list of inspection/maintenance items that are conducted at the SET basin closure area:

- Inspect for areas of ponded water and backfill/repair as necessary;
- Inspect for evidence of damage to the overlying concrete cover and any erosion or damage to the underlying clay soil cap and subgrade;
- Repairs to the concrete cover and clay soil cap as necessary; and
- Maintain the run-off and run-on control systems to prevent erosion or other damage to the final cover system.

An inspection form is utilized to document the post-closure inspections and any maintenance/repair activities conducted on the cover system. The inspection forms are maintained at the Shell facility. During the post-closure care period the name, address, and phone number of the representative to contact regarding the closed landfill is:

Nicole Roper
Environmental Team Lead
Shell USA, Inc.
5900 Highway 225
Deer Park, Texas 77536
(713) 246-7278

A printed, updated post-closure plan will be kept at the facility throughout the post-closure period.

6.2 Preservation of Benchmarks

As required, survey benchmarks are protected and maintained throughout the post-closure care period. The benchmarks are inspected annually to confirm their presence. Once every five years, and any time an inspection reveals damage to or loss of a benchmark, the validity of the benchmark(s) will be verified by a registered public surveyor.

6.3 Post-Closure Notices

In accordance with 40 CFR §264.119(c), no later than 60 days after completion of the established post-closure care period for the SET basins, Shell will submit to the Executive

Director, by registered mail, a certification that the post-closure activities for the SET basins have been completed in accordance with the specifications approved in the post-closure plan. The certification will be signed by an authorized representative of Shell and an independent, registered professional engineer.

6.4 Post-Closure Cost Estimate

The total cost of post-closure care for the East, West, and Middle SET Basins is estimated as $456,006.00 (2023 Dollars-Table VII.E.2.). This cost includes inflation adjustments based on TCEQ's web page https://www.tceq.texas.gov/agency/financial/financial-assurance/annual_inflation_factors.html.

In a letter date March 28, 2024, Shell USA, Inc. submitted its required 2023 financial assurance documents for 2023, listing financial assurance for Closure ($2,704,051.63), Post Closure ($456,005.22), and Corrective Action ($7,424,866.96), totaling $10,584,924.00.

Tables

Table 1
Hazardous and Non-Hazardous Wastes Managed in SET Basins

NOR No.	Waste	EPA Waste Codes	TCEQ Waste Classification	TCEQ Waste Codes
Waste Currently Managed in Unit				
24	BioSolids, Chemical Hazardous	K174	H	0316607H
27	Primary and BioSolids from NET		2	03196072
28	Primary and BioSolids from SET[1]	K017, K019, K020	H	0320607H
70	Wastewater, Non-Hazardous		1	80041021
77	Amines in Water, Non-Hazardous		1	80111021
88	Wastewater from OxyVinyls, LP[1]	K017, K019, K020	H	8022102H
Waste Previously Managed in Unit				
85	Wastewater, Hazardous	D002, D007, D018, D022, D026, D028, D035, D038	H	8019102H
90	Amine/Water Mixture from Fuel Gas Treating Units	D018	H	8025102H

[1] Waste delisted by EPA on April 22, 2004

Table 2
Solids Equalization Lagoons (SEL) Summary of Chemical Analyses
Point of Compliance - October 2023
Shell Chemical LP, Deer Park, TX

Monitoring Well		Patrick Bayou GWPS *	MW-12R	MW-38R	MW-280R
Date Sampled			10/12/2023	10/12/2023	10/12/2023
Parameter	Units		Result	Result	Result
Volatile Organic Compounds by 8260					
1,1,2-Trichloroethane	mg/L	5.24	< 0.000411	NS	< 0.000411
1,1-Dichloroethane	mg/L	420	< 0.000635	NS	0.00415
1,1-Dichloroethylene	mg/L	209	< 0.000738	NS	< 0.000738
1,2,3-Trichloropropane	mg/L	0.27	< 0.00047	NS	< 0.00047
1,2-Dichloroethane	mg/L	217	< 0.000372	NS	< 0.000372
1,2-Dichloropropane	mg/L	12	< 0.000556	NS	< 0.000556
1,3-Dichloropropane*	mg/L	0.02	< 0.000514	NS	< 0.000514
2-Butanone (MEK)	mg/L	1950	< 0.00828	NS	< 0.00828
4-Methyl-2-pentanone (MIBK)	mg/L	2640	< 0.00749	NS	< 0.00749
Acetone	mg/L	10000	0.00754 J	NS	< 0.00307
Acetonitrile	mg/L	400	< 0.0146	NS	< 0.0146
Allyl chloride (3-Chloropropene)	mg/L	73	< 0.000597	NS	< 0.000597
Benzene	mg/L	54.7	< 0.00046	NS	0.00410
Chlorobenzene	mg/L	11.8	< 0.000455	NS	0.00168
Chloroethane*	mg/L	29	< 0.00198	NS	< 0.00198
Chloroform	mg/L	80.4	< 0.000464	NS	< 0.000464
cis-1,2-Dichloroethene	mg/L	6.70	< 0.000457	NS	< 0.000457
Cumene (Isopropylbenzene)	mg/L	4.70	< 0.000592	NS	0.00374
Dichloromethane (Methylene Chloride)	mg/L	284	< 0.00173	NS	< 0.00173
Ethylbenzene	mg/L	2.81	< 0.000385	NS	< 0.000385
Styrene	mg/L	4.29	< 0.000619	NS	< 0.000619
tert-Butyl Alcohol (TBA)	mg/L	1280	< 0.005	NS	< 0.005
Tetrachloroethylene	mg/L	17.5	< 0.000655	NS	< 0.000655
Toluene	mg/L	5.89	< 0.000475	NS	< 0.000475
trans-1,2-dichloroethylene	mg/L	6.7	< 0.000368	NS	< 0.000368
Trichloroethylene	mg/L	13.8	< 0.000791	NS	< 0.000791
Vinyl chloride	mg/L	15.1	< 0.000428	NS	< 0.000428
xylenes (m & p-xylene)	mg/L	6.38	< 0.00124	NS	0.00390 J

Notes:

Bold values exceed GWPS.

GWPS - Groundwater Protection Standard

* - GWPS in blue are conservatively based on the TRRP C/I $^{GW}GW_{Ing}$ PCL.

J - Concentration estimated between the SDL and the MQL.

NS - Well not sampled due to lack of water.

Table 2 (Continued)

South Effluent Treater (SET) Area Summary of Chemical Analyses - Point of Compliance - October 2023
Shell Chemical LP, Deer Park, TX

Monitoring Well		Patrick Bayou GWPS*	MW-26R	MW-27R	MW-37R	MW-269	MW-271	MW-276R	MW-277	MW-277-DUP
Date Sampled			10/11/2023	10/11/2023	10/12/2023	10/12/2023	10/11/2023	10/12/2023	10/11/2023	10/11/2023
Parameter	Units		Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organic Compounds by 8260										
1,1,1,2-Tetrachloroethane*	mg/L	0.079	< 0.000644	< 0.000644	< 0.00644	< 0.00644	< 0.000644	< 0.000644	< 0.000644	< 0.000644
1,1,1-Trichloroethane (Methyl chloroform)*	mg/L	0.2	< 0.000585	< 0.000585	< 0.00585	< 0.00585	< 0.000585	< 0.000585	< 0.000585	< 0.000585
1,1,2,2-Tetrachloroethane*	mg/L	0.01	< 0.00047	< 0.00047	< 0.0047	< 0.0047	< 0.00047	< 0.00047	< 0.00047	< 0.00047
1,1,2-Trichloroethane	mg/L	5.24	< 0.000411	< 0.000411	< 0.00411	< 0.00411	< 0.000411	< 0.000411	< 0.000411	< 0.000411
1,1-Dichloroethane	mg/L	420	< 0.000635	0.00379	< 0.00635	< 0.00635	< 0.000635	< 0.000635	< 0.000635	< 0.000635
1,1-Dichloroethylene	mg/L	209	< 0.000738	< 0.000738	< 0.00738	< 0.00738	< 0.000738	< 0.000738	< 0.000738	< 0.000738
1,2,3-Trichloropropane	mg/L	0.27	< 0.00047	< 0.00047	0.785	< 0.0047	< 0.00047	0.00353	< 0.00047	< 0.00047
1,2-Dichloroethane	mg/L	217	< 0.000372	< 0.000372	0.00377 J	< 0.00372	< 0.000372	< 0.000372	< 0.000372	< 0.000372
1,2-Dichloropropane	mg/L	12	< 0.000556	< 0.000556	< 0.00556	< 0.00556	< 0.000556	< 0.000556	< 0.000556	< 0.000556
1,3-Dichloropropane*	mg/L	0.02	< 0.000514	< 0.000514	< 0.00514	0.018 J	< 0.000514	< 0.000514	< 0.000514	< 0.000514
1,4-Dichlorobenzene*	mg/L	0.075	< 0.000449	< 0.000449	< 0.00449	< 0.00449	< 0.000449	< 0.000449	< 0.000449	< 0.000449
1-Chloro-2,3-Epoxypropane*	mg/L	0.21	< 0.00752	< 0.00752	< 0.0752	< 0.0752	< 0.00752	< 0.00752	< 0.00752	< 0.00752
2-Butanone (MEK)	mg/L	1950	< 0.00828	< 0.00828	< 0.0828	< 0.0828	< 0.00828	< 0.00828	< 0.00828	< 0.00828
4-Methyl-2-pentanone (MIBK)	mg/L	2640	< 0.00749	< 0.00749	< 0.0749	< 0.0749	< 0.00749	< 0.00749	< 0.00749	< 0.00749
Acetone	mg/L	10000	0.00811 J	< 0.00307	< 0.0307	< 0.0307	< 0.00307	< 0.00307	0.0141 J	0.0314 J
Allyl chloride (3-Chloropropene)	mg/L	73	< 0.000597	< 0.000597	0.0347 J	< 0.00597	< 0.000597	< 0.000597	< 0.000597	< 0.000597
Benzene	mg/L	54.7	< 0.00046	0.0648	0.0147	1.87	< 0.00046	< 0.00046	0.000636 J	0.00086 J
Carbon Tetrachloride	mg/L	19.2	< 0.000896	< 0.000896	< 0.00896	< 0.00896	< 0.000896	< 0.000896	< 0.000896	< 0.000896
Chlorobenzene	mg/L	11.8	< 0.000455	0.00114	< 0.00455	0.0251	< 0.000455	0.000787 J	0.00756	0.00676
Chloroform	mg/L	80.4	< 0.000464	< 0.000464	< 0.00464	< 0.00464	< 0.000464	< 0.000464	< 0.000464	< 0.000464
Chloromethane	mg/L	1270	< 0.00204	< 0.00204	< 0.0204	< 0.0204	< 0.00204	< 0.00204	< 0.00204	< 0.00204
cis-1,2-Dichloroethene	mg/L	6.70	< 0.000457	< 0.000457	< 0.00457	< 0.00457	< 0.000457	< 0.000457	< 0.000457	< 0.000457
Cumene (Isopropylbenzene)	mg/L	4.70	0.00157	0.00315	< 0.00592	< 0.00592	< 0.000592	< 0.000592	0.00788	0.00988
Dichloromethane (Methylene Chloride)	mg/L	284	< 0.00173	< 0.00173	< 0.0173	< 0.0173	< 0.00173	< 0.00173	< 0.00173	< 0.00173
Ethylbenzene	mg/L	2.81	< 0.000385	0.00729	< 0.00385	0.0308	< 0.000385	< 0.000385	< 0.000385	< 0.000385
Styrene	mg/L	4.29	< 0.000619	0.00288	< 0.00619	0.0371	< 0.000619	< 0.000619	< 0.000619	< 0.000619
tert-Butyl Alcohol (TBA)	mg/L	1280	< 0.005	< 0.005	< 0.05	< 0.05	< 0.005	0.276	0.0132 J	0.0425 J
Tetrachloroethylene	mg/L	17.5	< 0.000655	< 0.000655	< 0.00655	< 0.00655	< 0.000655	< 0.000655	< 0.000655	< 0.000655
Toluene	mg/L	5.89	< 0.000475	0.0243	< 0.00475	0.847	< 0.000475	< 0.000475	< 0.000475	< 0.000475
trans-1,2-dichloroethylene	mg/L	6.7	< 0.000368	< 0.000368	< 0.00368	< 0.00368	< 0.000368	< 0.000368	< 0.000368	< 0.000368
Trichloroethylene	mg/L	13.8	< 0.000791	0.00392 J	< 0.00791	< 0.00791	< 0.000791	< 0.000791	< 0.000791	< 0.000791
Vinyl chloride	mg/L	15.1	< 0.000428	< 0.000428	< 0.00428	0.0337	< 0.000428	< 0.000428	< 0.000428	< 0.000428
xylenes (m & p-xylene)	mg/L	6.38	< 0.00124	0.00881 J	< 0.0124	0.0496 J	< 0.00124	< 0.00124	< 0.00124	< 0.00124

Table 2 (Continued)

South Effluent Treater (SET) Area Summary of Chemical Analyses - Point of Compliance - October 2023
Shell Chemical LP, Deer Park, TX

Monitoring Well		Patrick Bayou GWPS*	MW-26R	MW-27R	MW-37R	MW-269	MW-271	MW-276R	MW-277	MW-277-DUP
Date Sampled			10/11/2023	10/11/2023	10/12/2023	10/12/2023	10/11/2023	10/12/2023	10/11/2023	10/11/2023
Parameter	Units		Result	Result	Result	Result	Result	Result	Result	Result
Semivolatile Organic Compounds by 8270										
1,2,4,5-Tetrachlorobenzene*	mg/L	0.022	< 0.00336	< 0.000672	< 0.000672 UJL	< 0.000672	< 0.000672	< 0.000672	< 0.00336	< 0.00336
1,2,4-Trichlorobenzene*	mg/L	0.07	< 0.0034	< 0.00068	< 0.00068 UJL	< 0.00068 UJL	< 0.00068	< 0.00068 UJL	< 0.0034	< 0.0034
2-Methylnaphthalene	mg/L	214	< 0.0024	< 0.00048	< 0.00048 UJL	0.00292 JL	< 0.00048	< 0.00048 UJL	< 0.0024	< 0.0024
2-Methylphenol (o-Cresol)*	mg/L	3.7	< 0.000797 UJL	< 0.000159 UJL	< 0.000159 UJL	< 0.000159 UJL	< 0.000159 UJL	< 0.000159 UJL	< 0.000797 UJL	< 0.000797 UJL
3 & 4 Methylphenol	mg/L	314	< 0.000814 UJL	< 0.000163 UJL	< 0.000163 UJL	< 0.000163 UJL	< 0.000163 UJL	< 0.000163 UJL	< 0.000814 UJL	< 0.000814 UJL
4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)*	mg/L	0.0073	< 0.00368	< 0.000736	< 0.000736	< 0.000736 UJL	< 0.000736 UJL	< 0.000736 UJL	< 0.00368	< 0.00368
4-Chloro-3-methylphenol (p-Chloro-m-cresol)*	mg/L	0.37	< 0.000784	< 0.000157	< 0.000157 UJL	< 0.000157 UJL	< 0.000157 UJL	< 0.000157 UJL	< 0.000784	< 0.000784
Acenaphthene*	mg/L	4.4	< 0.00104	0.00138 J	< 0.000208	< 0.000208 UJL	< 0.000208	< 0.000208	< 0.00104	< 0.00104
Acenaphthylene	mg/L	0.0124	< 0.00107	0.00365	< 0.000215 UJL	< 0.000215	< 0.000215	< 0.000215 UJL	< 0.00107	< 0.00107
Anthracene*	mg/L	22	< 0.000769	0.000341 J	< 0.000154	< 0.000154	< 0.000154	< 0.000154	< 0.000769	< 0.000769
Bis(2-chloroethyl)ether*	mg/L	0.0019	< 0.00139	< 0.000278	< 0.000278 UJL	< 0.000278 UJL	< 0.000278	< 0.000278 UJL	< 0.00139	< 0.00139
Bis(2-ethylhexyl)phthalate	mg/L	0.000519	< 0.00112	< 0.000225	< 0.000225 UJL	< 0.000225 UJL	< 0.000225	< 0.000225 UJL	< 0.00112	< 0.00112
Fluoranthene*	mg/L	2.9	< 0.000738	0.000184 J	< 0.000148	< 0.000148	< 0.000148	< 0.000148	< 0.000738	< 0.000738
Fluorene*	mg/L	2.9	< 0.00103	< 0.000205	< 0.000205 UJL	0.000803 JL	< 0.000205	< 0.000205 UJL	< 0.00103	< 0.00103
Hexachloroethane*	mg/L	0.051	< 0.0007	< 0.00014	< 0.00014 UJL	< 0.00014 UJL	< 0.00014	< 0.00014 UJL	< 0.0007	< 0.0007
Naphthalene	mg/L	0.182	< 0.00211	0.0034	< 0.000423 UJL	0.0502 JL	< 0.000423	< 0.000423 UJL	< 0.00211	< 0.00211
Nitrobenzene	mg/L	33.5	< 0.00467	< 0.000934	< 0.000934 UJL	< 0.000934 UJL	< 0.000934	< 0.000934 UJL	< 0.00467	< 0.00467
Phenanthrene	mg/L	0.0154	< 0.000882	0.000945 J	< 0.000176	0.000789 J	< 0.000176	< 0.000176	< 0.000882	< 0.000882
Phenol	mg/L	48.1	0.00219 JL	0.00264 JL	< 0.000202 UJL	< 0.000202 UJL	< 0.000202 UJL	0.000718 J	< 0.00101 UJL	0.00275 JL
Pyridine*	mg/L	0.073	< 0.00362 UJL	< 0.000725 UJL	< 0.000725 UJL	< 0.000725 UJL	< 0.000725 UJL	< 0.000725 UJL	< 0.00362 UJL	< 0.00362 UJL
Metals by 6020B										
Arsenic*	mg/L	0.01	0.00225 J	0.0171	0.027	0.0412	0.00229 J	0.00404	0.00269 J	0.00263 J
Barium*	mg/L	2	0.0672	0.814	0.0914	2.42	0.0381	0.16	0.462	0.485
Cadmium	mg/L	0.00227	< 0.00024	< 0.00024	< 0.00024	< 0.00024	< 0.00024	< 0.00024	< 0.00024	< 0.00024
Chromium	mg/L	0.000451	0.000661 J	0.05	0.00171 J	0.00122 J	0.00146 J	0.00104 J	0.000626 J	< 0.00056
Lead	mg/L	2.42	< 0.000367	0.0113	< 0.000367	< 0.000367	< 0.000367	0.00328	< 0.000367	< 0.000367
Manganese	mg/L	60.2	0.85	11.5	0.96	3.07	0.215	9.84	0.269	0.281
Selenium*	mg/L	0.05	< 0.000266	0.000274 J	< 0.000266	0.000313 J	0.0313	< 0.000266	< 0.000266	< 0.000266
Mercury by 7470A										
Mercury	mg/L	0.0077	< 0.0000706	< 0.0000706	< 0.0000706	< 0.0000706	< 0.0000706	< 0.0000706	< 0.0000706	< 0.0000706
Amines										
Diethanolamine (DEA)*	mg/L	0.037	< 0.05	< 0.05	< 1	< 0.05	< 0.05	< 0.05	< 1	< 0.05

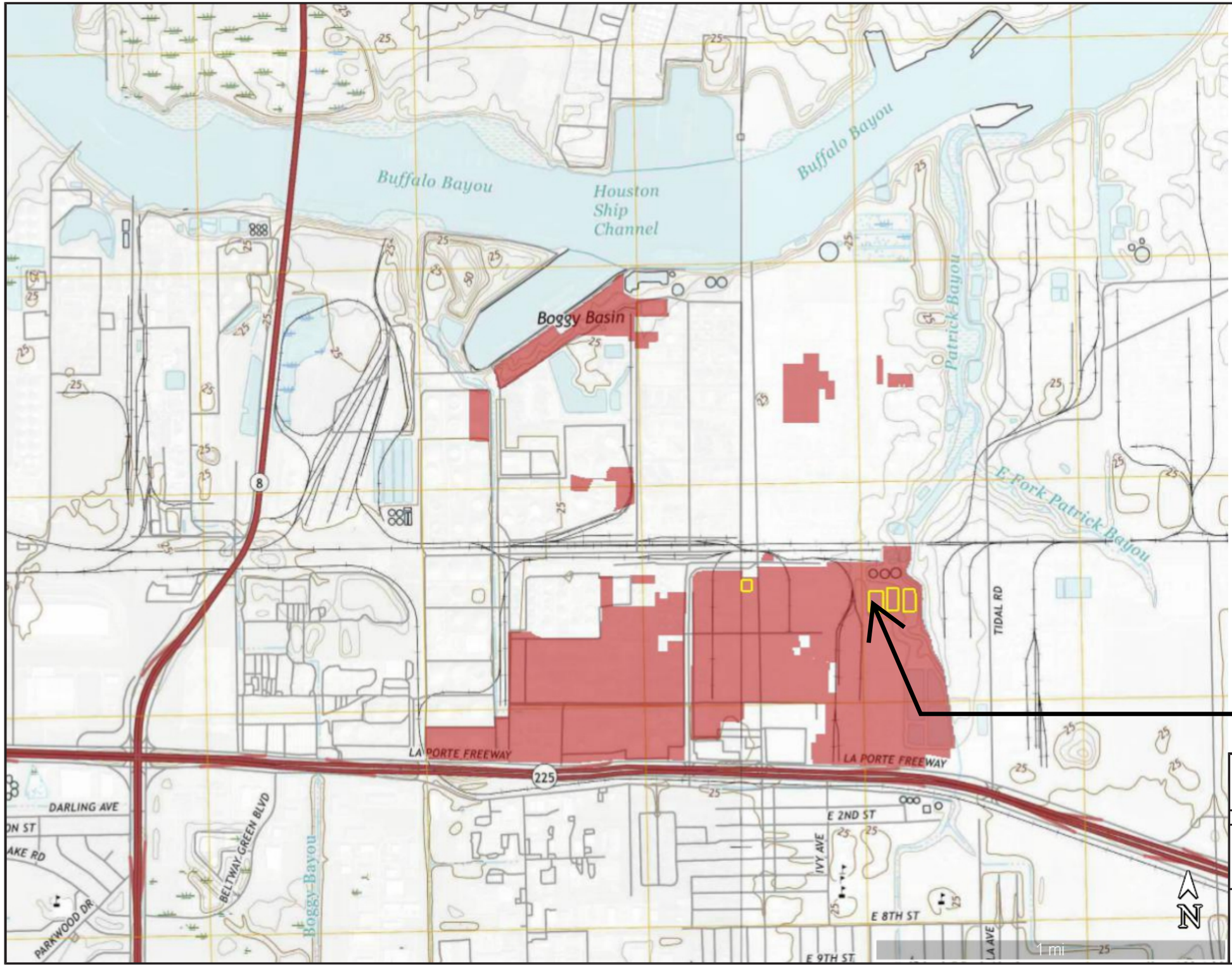
Table 2 (Continued)

South Effluent Treater (SET) Area Summary of Chemical Analyses - Point of Compliance - October 2023
Shell Chemical LP, Deer Park, TX

Monitoring Well		Patrick Bayou GWPS*	MW-26R	MW-27R	MW-37R	MW-269	MW-271	MW-276R	MW-277	MW-277-DUP
Date Sampled			10/11/2023	10/11/2023	10/12/2023	10/12/2023	10/11/2023	10/12/2023	10/11/2023	10/11/2023
Parameter	Units		Result	Result	Result	Result	Result	Result	Result	Result
Dioxins and Furan by 8290A										
1,2,3,4,6,7,8-HpCDD	pg/L	NA	< 4.63	994	< 4.44	< 4.4	< 4.51	< 4.49	< 4.49	< 4.48
1,2,3,4,6,7,8-HpCDF	pg/L	NA	< 2.56	788	< 2.45	< 2.43 UJL	< 2.49	3.02 J	< 2.48	< 2.47
1,2,3,4,7,8,9-HpCDF	pg/L	NA	< 2.56	74.2	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,4,7,8-HxCDD	pg/L	NA	< 2.56	26.1	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,4,7,8-HxCDF	pg/L	NA	< 2.56	161	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,6,7,8-HxCDD	pg/L	NA	< 2.56	82.8	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,6,7,8-HxCDF	pg/L	NA	< 2.56	140	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,7,8,9-HxCDD	pg/L	NA	< 2.56	40.5	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,7,8,9-HxCDF	pg/L	NA	< 2.56	41.6	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
1,2,3,7,8-PeCDF	pg/L	NA	< 2.82	67.5	< 2.71	< 2.68	< 2.75	< 2.74	< 2.73	< 2.73
1,2,3,7,8-PeCDD	pg/L	NA	< 3.23	34.7	< 3.1	< 3.07	< 3.14	< 3.13	< 3.13	< 3.13
2,3,4,6,7,8-HxCDF	pg/L	NA	< 2.56	180	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47 UJL
2,3,4,7,8-PeCDF	pg/L	NA	< 2.56	112	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47 UJL
2,3,7,8-TCDD	pg/L	NA	< 0.893	3.45 J	< 0.856	< 0.849 UJL	< 0.869	< 0.865	< 0.865	< 0.864
2,3,7,8-TCDF	pg/L	NA	< 0.83	38.9	< 0.796 UJL	< 0.789	< 0.808	< 0.805	< 0.804	< 0.803 UJL
Total HpCDF	pg/L	NA	< 2.56	1600	< 2.45	< 2.43	< 2.49	6.05 J	< 2.48	< 2.47
Total HpCDD	pg/L	NA	< 4.63	2050	< 4.44	< 4.4	< 4.51	< 4.49	< 4.49	< 4.48
Total HxCDF	pg/L	NA	< 2.56	1470	< 2.45	< 2.43	2.59 U	< 2.48	< 2.48	< 2.47
Total HxCDD	pg/L	NA	< 2.56	629	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
OCDD	pg/L	NA	< 37	4030	< 35.5	< 35.2	< 36	< 35.9	< 35.9	< 35.8
OCDF	pg/L	NA	< 6.29	1030	< 6.03	< 5.98	< 6.12	6.86 J	< 6.09	< 6.09
Total PeCDF	pg/L	NA	< 2.56	1280	< 2.45	< 2.43	< 2.49	< 2.48	< 2.48	< 2.47
Total PeCDD	pg/L	NA	< 3.23	346	< 3.1	< 3.07	< 3.14	< 3.13	< 3.13	< 3.13
Total TCDD	pg/L	NA	< 0.893	34.5	< 0.856	< 0.849	< 0.869	< 0.865	< 0.865	< 0.864
Total TCDF	pg/L	NA	< 0.83	793	< 0.796	< 0.789 UJL	< 0.808	< 0.805	< 0.804	2.86 J
TCDD TEQ	pg/L	30	7.52	187.68	7.21	7.14	7.31	7.29	7.29	7.27

Notes:
Bold values exceed GWPS.
GWPS - Groundwater Protection Standard
* - GWPS in blue are conservatively based on the TRRP C/I $^{GW}GW_{Ing}$ PCL.
J - Concentration estimated between the SDL and the MQL.
L - Bias in sample result is likely to be low.
NA - Not applicable
NS - Well not sampled due to lack of water or data not collected.
TCDD - 2,3,7,8 -Tetrachlorodibenzo-p-dioxin
TEQ - Toxicity equivalency
U - Not detected based on analyte detected in blank.

Figures



LEGEND

SHELL DEER PARK CHEMICALS PERMITTED FACILITY

PERMITTED UNIT BOUNDARY

West SET Project Area

SHELL USA, INC.
DEER PARK, TEXAS

PROJ. NO.: 216077 | DATE: 03/30/22 | FILE:

PERMITTED FACILITY MAP
Figure 1

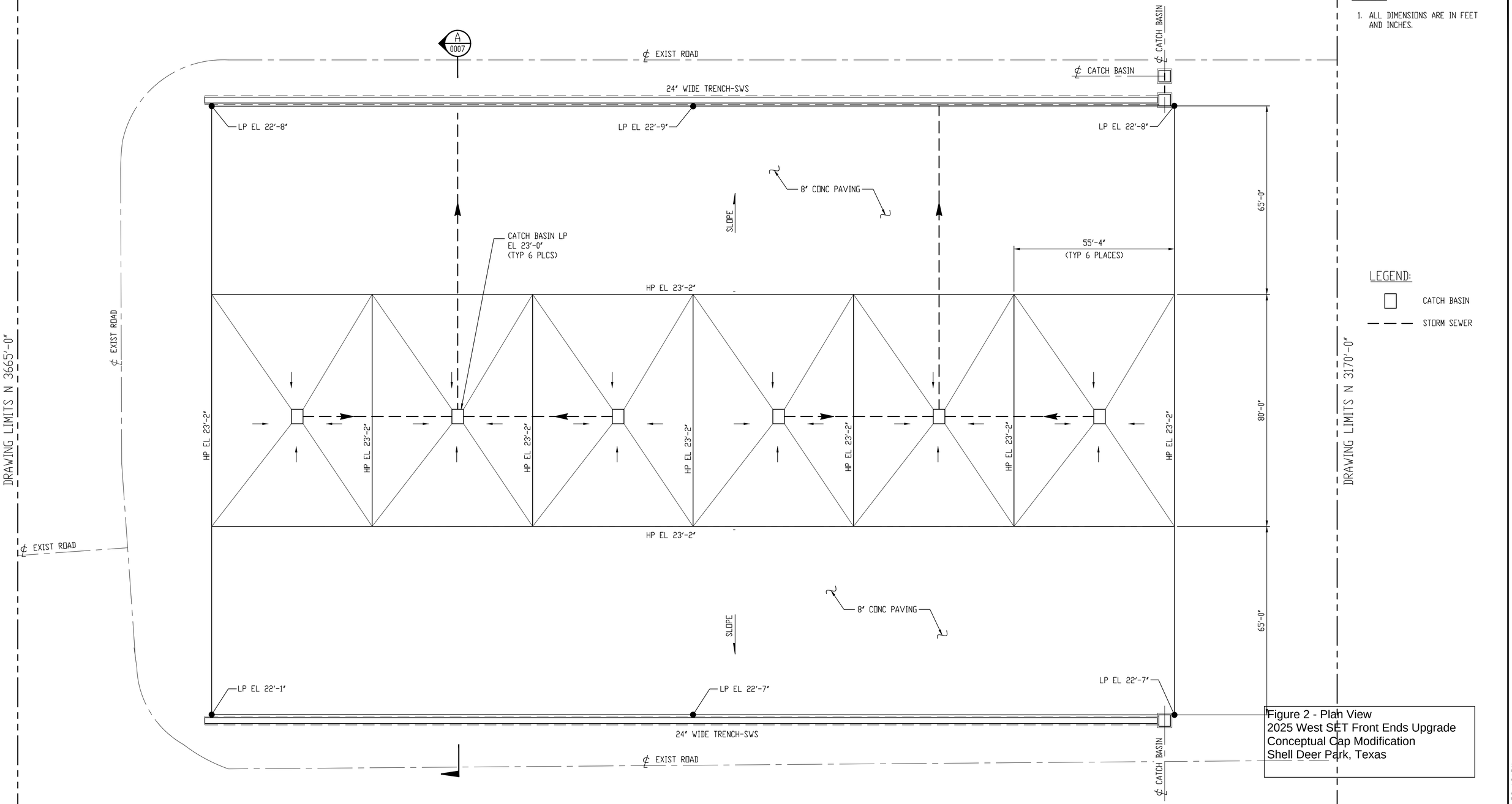
4801 Southwest Parkway
Parkway II, Suite 150
Austin, Texas 78735
TBPE No. 1298

DRAWING LIMITS E 905'-0"

DRAWING LIMITS N 3665'-0"

DRAWING LIMITS N 3170'-0"

DRAWING LIMITS E 620'-0"



NOTES:

1. ALL DIMENSIONS ARE IN FEET AND INCHES.

LEGEND:

- CATCH BASIN
- STORM SEWER

Figure 2 - Plan View
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG PLOT PLAN
PAVING PLAN – BASINS
ETSS NORTH AND SOUTH BASINS

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
.	.	.	.	RC	TR	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

	DATE		DATE	SCALE:	ISSUE DATE:	LOC:
DRAWN: RC	09/26/23	APPROVED: .	.	1/16" = 1'-0"	.	C
CHECKED: TR	09/26/23	APPROVED: .	.	DWG. No.	E-	.
APPROVED: PL	.	APPROVED: .	.			

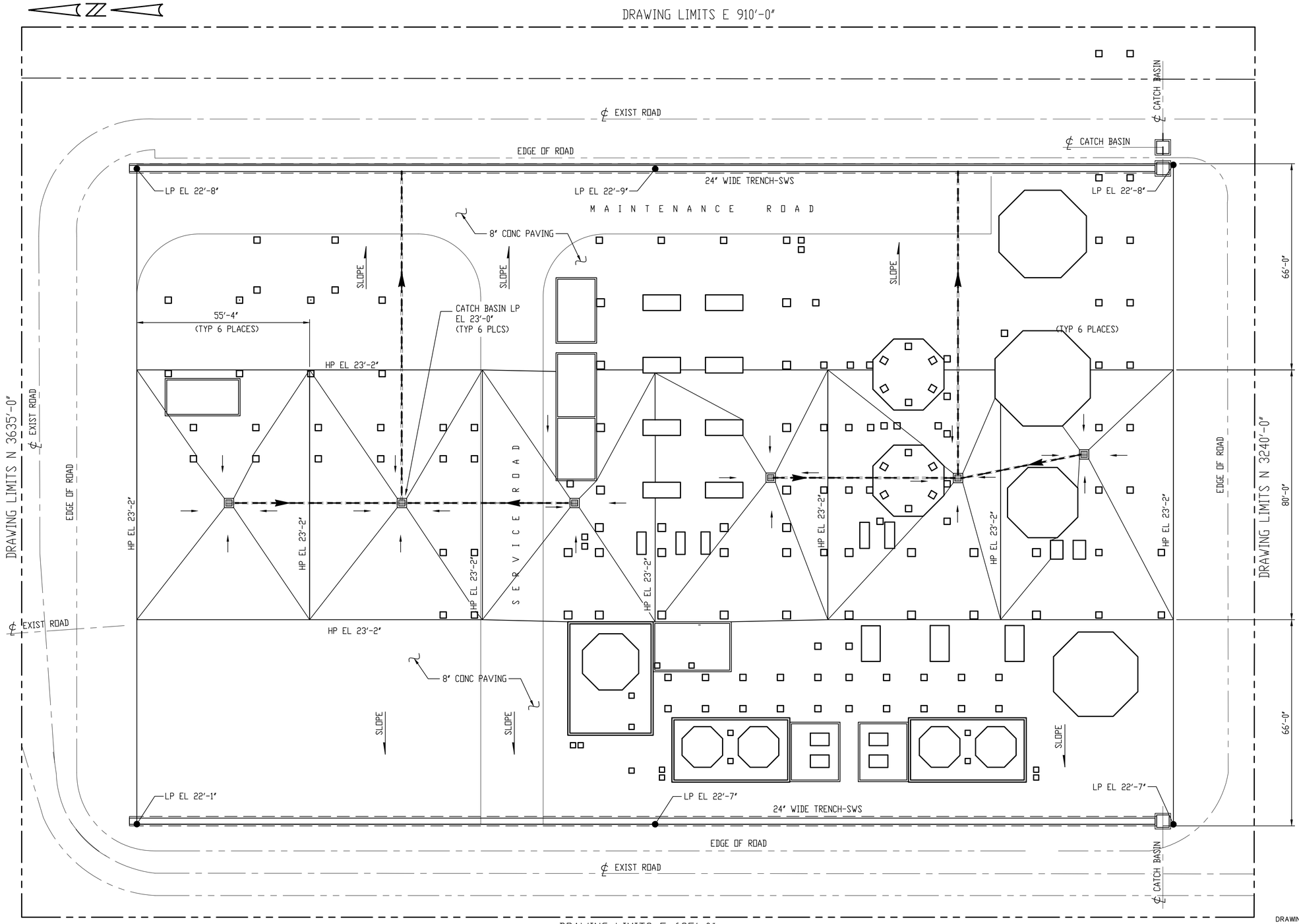
JOB NO.: 153358

WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

Worley
energy | chemicals | resources

\\I-RACK PRINT (11 x 17) *** PC-ACAD"

SDPMCP-00185-CS-DSK-0006



NOTES:

1. FOR NOTES AND REFERENCE DRAWINGS SEE DRAWING SDPMCP-00185-CS-DSK-0001.

REFERENCE DRAWING:

SDPMCP-00185-CS-DSK-0002 FOUNDATION AND PILE LOCATION PLAN

LEGEND:

- CATCH BASIN
- STORM SEWER

Figure 3 - Plan View
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG PLOT PLAN
WEST BASIN PAVING PLAN-BASINS
ETSS NORTH AND SOUTH BASINS

	DATE		DATE	SCALE:	ISSUE DATE:	LOC:
DRAWN: RC	03/26/24	APPROVED: . .		1/16" = 1'-0"		C
CHECKED: TR	04/05/24	APPROVED: . .		DWG. No. E-		
APPROVED: PL	.	APPROVED: . .				

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
A	04/24	00185	ISSUE FOR TECQ - PERMITTING	RC	TR	PL	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

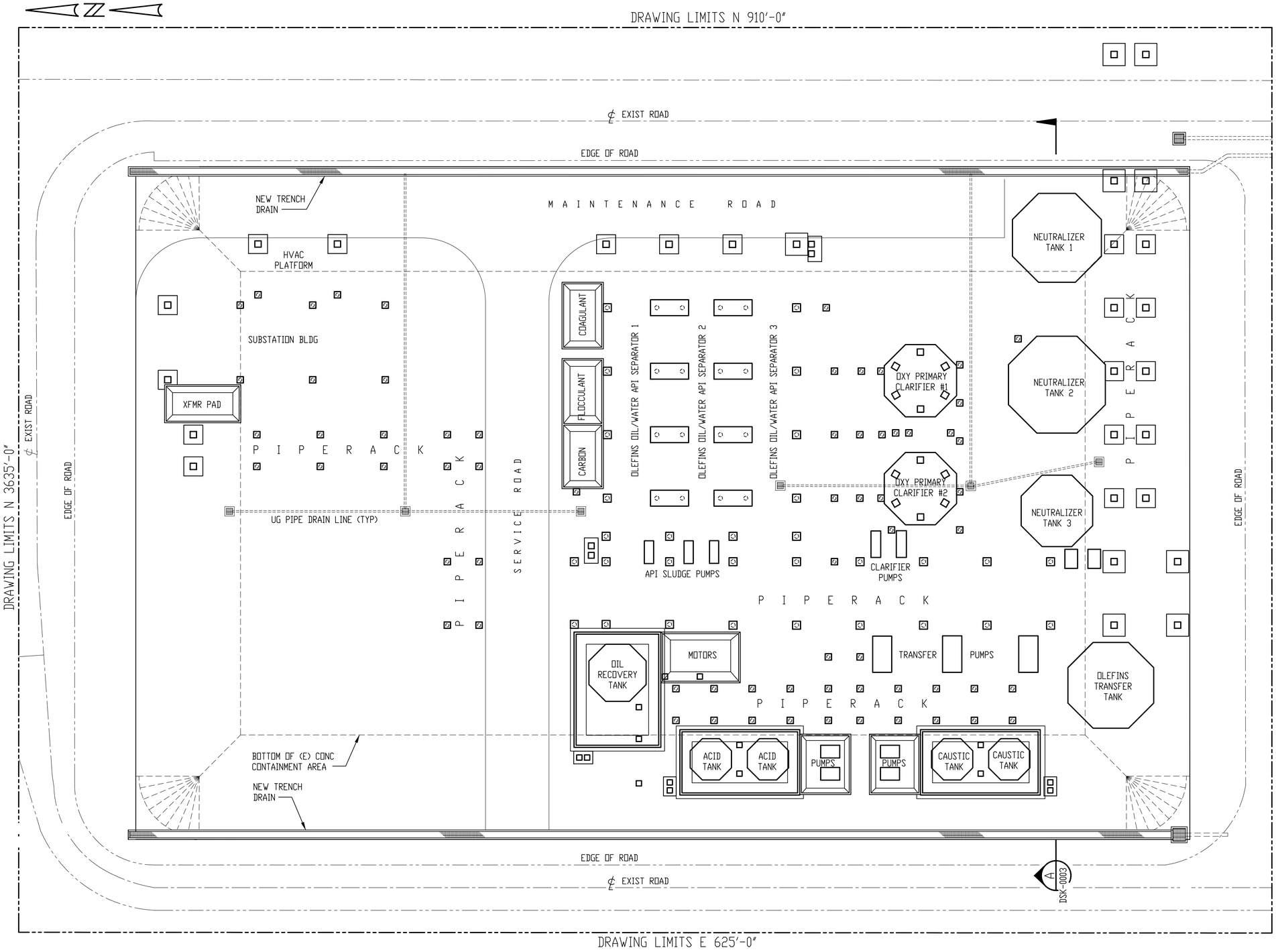
JOB NO.: 153358

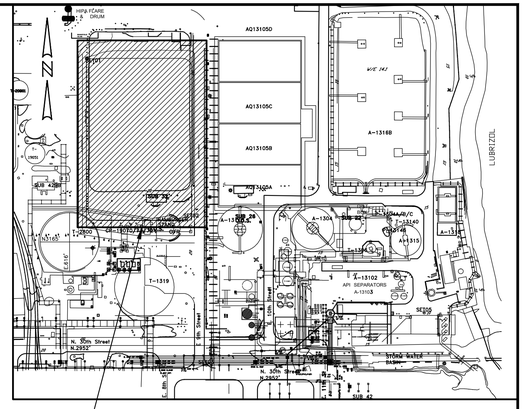
WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

Worley
energy | chemicals | resources

"11-RACK PRINT (11 x 17) *** PC-ACAD"

SDPMCP-00185-CS-DSK-0002





KEY PLAN

NOTES:

1. (E) DENOTES EXISTING.

REFERENCE DRAWINGS:

SDPMCP-00185-CS-DSK-0002	PAVING PLAN
SDPMCP-00185-CS-DSK-0003	SECTION
SDPMCP-00185-CS-DSK-0004	DETAILS

LEGEND:

PILE

Figure 4 - Plan View
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG PLOT PLAN
WEST BASIN FOUNDATION AND PILE LOCATION PLAN - BASINS
ETSS NORTH AND SOUTH BASINS

JOB NO.: 153358

WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

Worley
energy | chemicals | resources

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
A	04/24	00185	ISSUE FOR TECQ - PERMITTING	RC	TR	PL	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

		DATE			DATE	SCALE:	ISSUE DATE:	LOC:
DRAWN:	RC	03/27/24	APPROVED:	.	.	1/16" = 1'-0"	.	C
CHECKED:	TR	04/05/24	APPROVED:	.	.	DWG. No.	E-	.
APPROVED:	PL	.	APPROVED:	.	.			

"1-RACK PRINT (11 x 17) *** PC-ACAD"

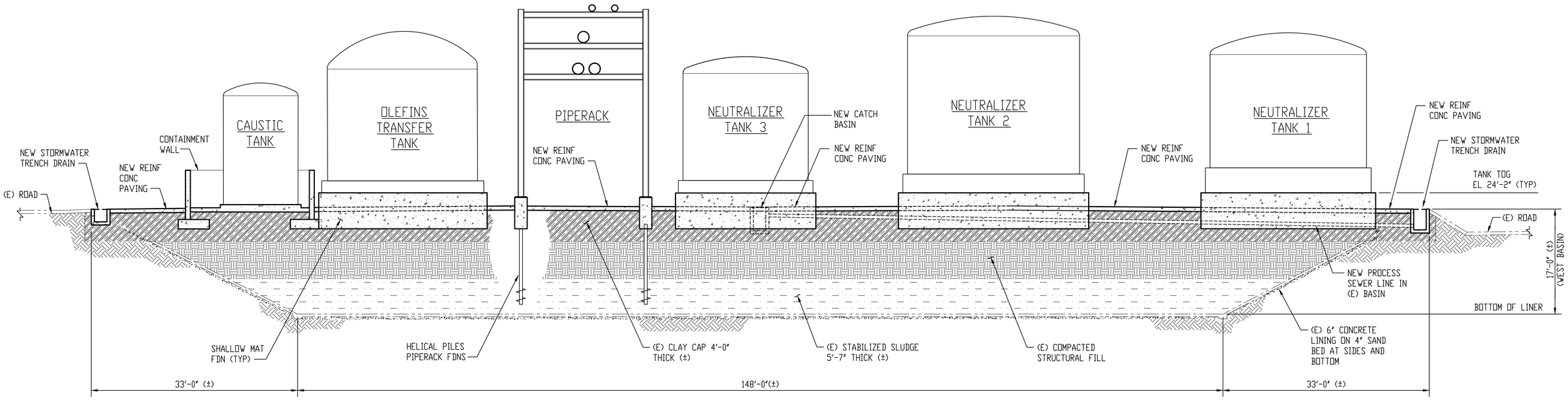
SDPMCP-00185-CS-DSK-0001

NOTES:

1. FOR NOTES AND REFERENCE DRAWINGS SEE DRAWING SDPMCP-00185-CS-DSK-0001.
2. (E) DENOTES EXISTING.
3. ALL EQUIPMENT SHOWN IS NEW.

REFERENCE DRAWING:

SDPMCP-00185-CS-DSK-0002	FOUNDATION AND PILE LOCATION PLAN



CROSS SECTION OF WEST BASIN (A DSK-0001)
(LOOKING NORTH)

Figure 5 - Cross-Section View
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG DETAIL DRAWING
WEST BASIN CROSS SECTION – BASINS
ETSS NORTH AND SOUTH BASINS

	DATE		DATE	SCALE:	ISSUE	LOC:
DRAWN: RC	03/28/24	APPROVED: .	.	1/8" = 1'-0"	DATE: .	C
CHECKED: TR	04/04/24	APPROVED: .	.	DWG. No. E-		
APPROVED: PL	.	APPROVED: .	.			

REVISIONS

NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
A	04/24	00185	ISSUE FOR TECQ – PERMITTING	RC	TR	PL	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

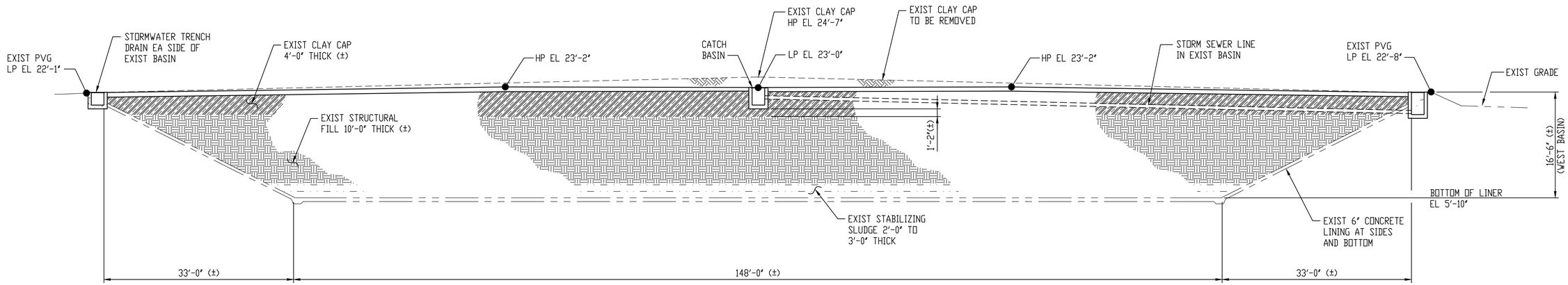
JOB NO.: 153358

WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

Worley
energy | chemicals | resources

"1-RACK PRINT (11 x 17) *** PC-ACAD"

SDPMCP-00185-CS-DSK-0003-A



SECTION A
0006

Figure 6 - Cross-Section View
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG DETAIL DRAWING
PAVING SECTION – BASINS
ETSS NORTH AND SOUTH BASINS

	DATE		DATE
DRAWN: RC	09/27/23	APPROVED: .	.
CHECKED: TR	10/xx/23	APPROVED: .	.
APPROVED: PL	.	APPROVED: .	.

SCALE: 1/8" = 1'-0" | ISSUE DATE: 08/21/23 | LOC: C

DWG. No. E-

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

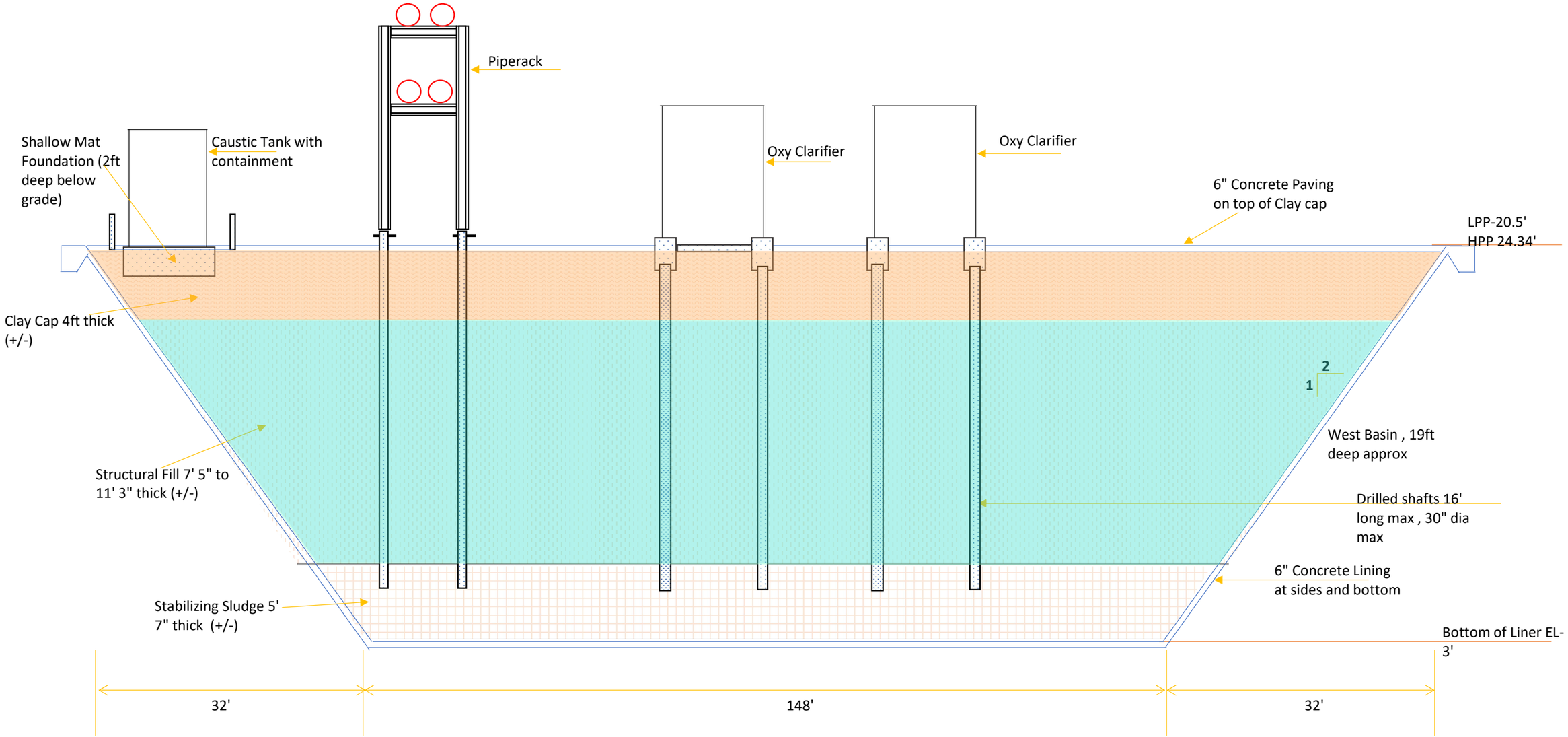
JOB NO.: 153358

WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

Worley
energy | chemicals | resources

"11-RACK PRINT (11 x 17) *** PC-ACAD"

SDPMCP-00185-CS-DSK-0007



Crosssection of Basin Looking North

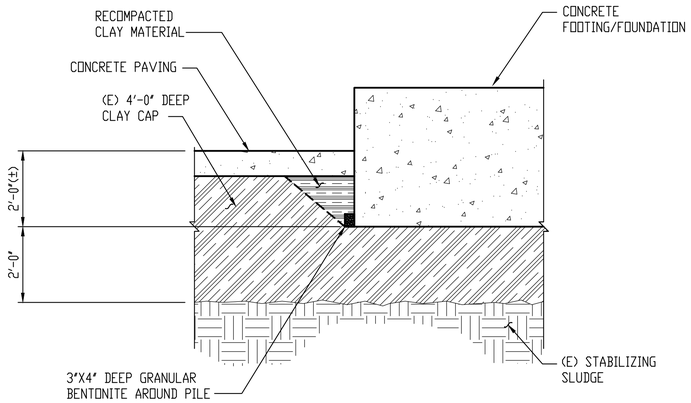
Figure 7 - Cross-Section View
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

NOTES:

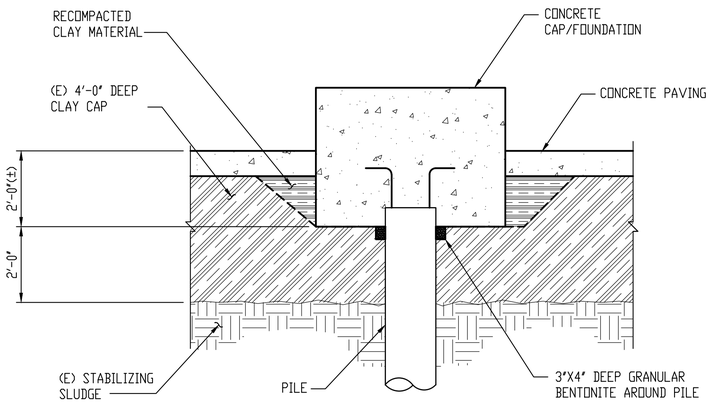
1. FOR NOTES AND REFERENCE DRAWINGS SEE DRAWING SDPMCP-00185-CS-DSK-0001.
2. (E) DENOTES EXISTING.

REFERENCE DRAWING:

SDPMCP-00185-CS-DSK-0001	FOUNDATION AND PILE LOCATION PLAN



TYPICAL FOUNDATION FILL DETAIL



TYPICAL PILE CAP FILL DETAIL

Figure 8 - Foundation and Pile Detail
2025 West SET Front Ends Upgrade
Conceptual Cap Modification
Shell Deer Park, Texas

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG DETAIL DRAWING
WEST BASIN PILE CAP FILL DETAIL – BASINS
ETSS NORTH AND SOUTH BASINS

		DATE		DATE	SCALE: 1/2"=1'-0"	ISSUE DATE: .	LOC: C
DRAWN:	RC	04/01/24	APPROVED: .	.			
CHECKED:	TR	04/05/24	APPROVED: .	.	DWG. No. E-		.
APPROVED:	PL	.	APPROVED: .	.			

REVISIONS

NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
A	04/24	05700S	ISSUE FOR TECQ – PERMITTING	RC	TR	PL	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

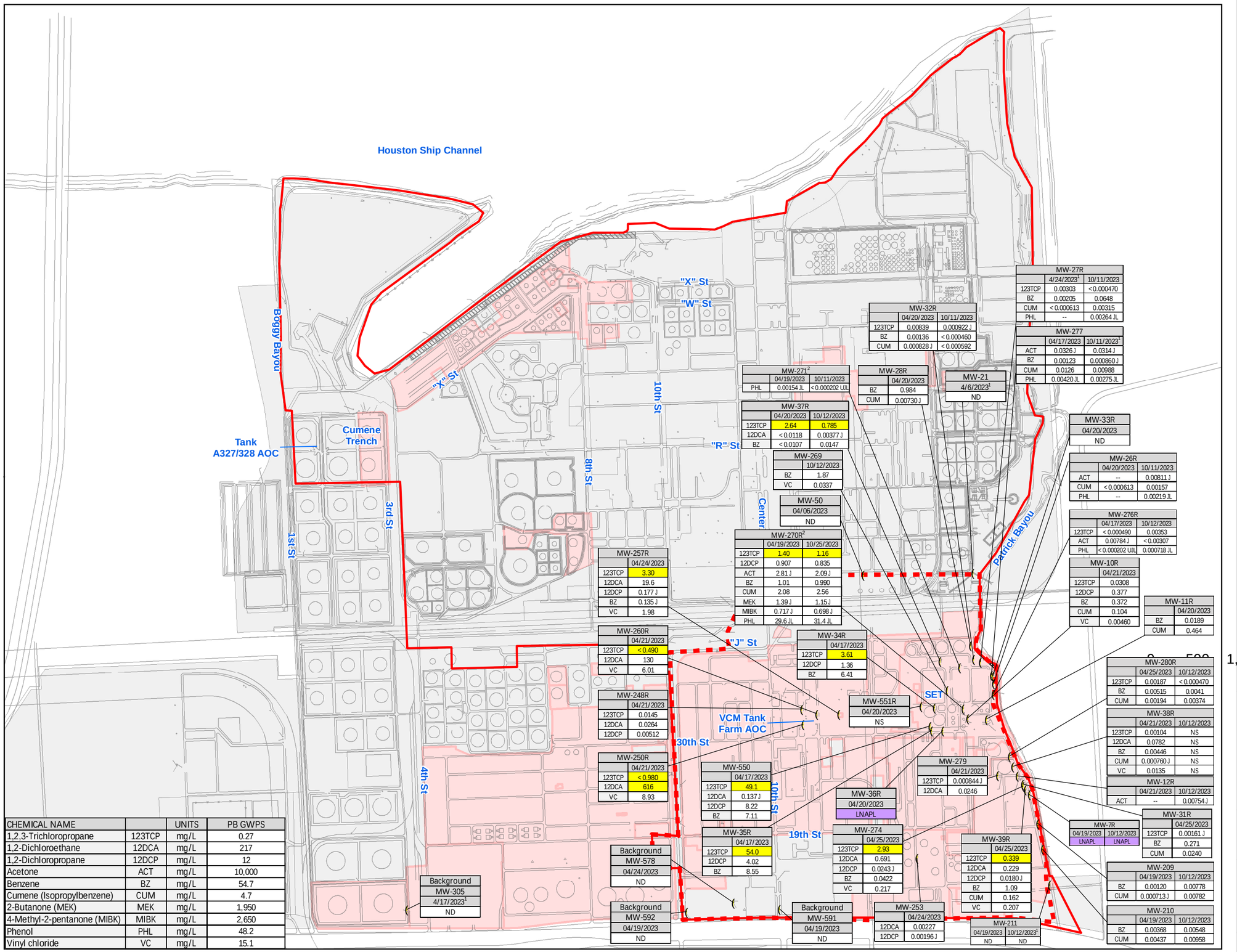
JOB NO.: 153358

WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

Worley
energy | chemicals | resources

SDPMCP-00185-CS-DSK-0004

Path: C:\Users\lillianageorgeta.croi\AECOM Directory\GDS GIS Services - GIS CAD PROJECTS\DCS AMERICAS\REMWEST\F343\SCLP_DPRLP_DeerPark, TX\Shell Chemical LP, Deer Park\20240103\Work\SCLP_2-7.a Groundwater Concentration Map WMA B (PMZ-1).mxd



CHEMICAL NAME		UNITS	PB GWPS
1,2,3-Trichloropropane	123TCP	mg/L	0.27
1,2-Dichloroethane	12DCA	mg/L	217
1,2-Dichloropropane	12DCP	mg/L	12
Acetone	ACT	mg/L	10,000
Benzene	BZ	mg/L	54.7
Cumene (Isopropylbenzene)	CUM	mg/L	4.7
2-Butanone (MEK)	MEK	mg/L	1,950
4-Methyl-2-pentanone (MIBK)	MIBK	mg/L	2,650
Phenol	PHL	mg/L	48.2
Vinyl chloride	VC	mg/L	15.1

Legend

- Compliance Plan Well
- 2023 PMZ-1 Boundary
- 2017 PMZ-1 Boundary
- Sheet Piling
- Slurry Wall

Property Owner / Operator

- Deer Park Refining LP
- Shell Chemicals LP
- Exceeds Patrick Bayou (PB) Groundwater Protection Standards (GWPS)

Notes:
All concentrations are in mg/L.

J indicates result is less than the MQL but greater than or equal to the SDL and the concentration is an estimated value.

L indicates bias in sample result is likely to be low.

LNAPL indicates Light Non-Aqueous Phase Liquid.

U indicates not detected based on analyte detected in blank.

ND indicates results are not detected for all constituents.

NS indicates location not sampled due to lack of water.

GWPS = Groundwater Protection Standard

[1] Sample and duplicate sample combined using the highest values.

[2] Results for MW-270R and MW-271 are only compared to the Variance Highest Values.

All wells were sampled and analyzed in accordance with Compliance Plan requirements. Concentrations are only shown for chemicals detected in each well. However, acetone and phenol are shown on all wells analyzed for those chemicals.

0 500 1,000 2,000 Feet

AECOM
19219 Katy Freeway, Suite 100
Houston, TX 77094
Tel: 281-646-2400
Fax: 281-646-2401

Groundwater Concentration Map for WMA B (PMZ-1)

Shell Chemical LP
Deer Park, TX
Figure 9 (AECOM Figure 2.7.a)

Date:	Proj. No.:	Figure:
1/19/2024	60717994	2.7.a

Appendicies

Appendix A
TCEQ Closure Acceptance Letter, February 2018

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

February 13, 2018

Ms. Diana Henk
Environmental Specialist
Shell Chemical L.P.
P.O. Box 100
Deer Park, Texas 77536

Re: Acceptance of Closure Certification Report
Shell Oil Company – Deer Park, Harris County
Hazardous Waste Permit No. 50099
Industrial Solid Waste Registration No. 30007
EPA Identification No. TXD067285973
Tracking No. 22310802; RN100211879/CN601542012

Dear Ms. Henk:

The Industrial & Hazardous Waste (I&HW) Permits Section of the Texas Commission on Environmental Quality (TCEQ) reviewed your Closure Certification Report dated December 19, 2017, addressing the closure of Activated Sludge Biotreater (SET), West Basin (Permit Unit No. 4). Based on the information provided in the report, the I&HW accepts that the closure of SET West Basin was completed in accordance with 40 Code of Federal Regulations Section (§)264.110 through §264.116, the Texas Risk Reduction Program 30 Texas Administrative Code (TAC), Chapter 350, and RCRA Permit No. 50099, Provision VII.D.

In accordance with 30 TAC §305.69 and the instructions in the Part A and Part B permit application forms, within 60 days of the date of this letter, please submit a Class 1 permit modification request to reflect the status of the above-referenced unit(s). In addition, please include in your request, along with a copy of the TCEQ closure acceptance letter, any other closed permit unit(s) for which the status of the unit(s) has not been reflected in the permit. Please note your request should include revisions necessary to applicable sections, tables, and attachments of your Part A and Part B permit application.

Please be aware that it is the continuing obligation of persons associated with a site to ensure that municipal hazardous waste and industrial solid waste are managed in a manner which does not cause the discharge or imminent threat of discharge of waste into or adjacent to waters in the state, a nuisance, or the endangerment of the public health and welfare as required by 30 TAC §335.4. If the closure fails to comply with these requirements, the burden remains upon Shell Oil Deer Park to take any necessary and authorized action to correct such conditions.

Should you have any questions, please contact Mr. Chris Shaw, P.E., of the I&HW Permits Section at (512) 239-2349. If you respond in writing, please include mail code MC 130 in the mailing address.

Sincerely,



Mr. Will Wyman, Team Leader
Industrial & Hazardous Waste Permits Section
Waste Permits Division
Texas Commission on Environmental Quality

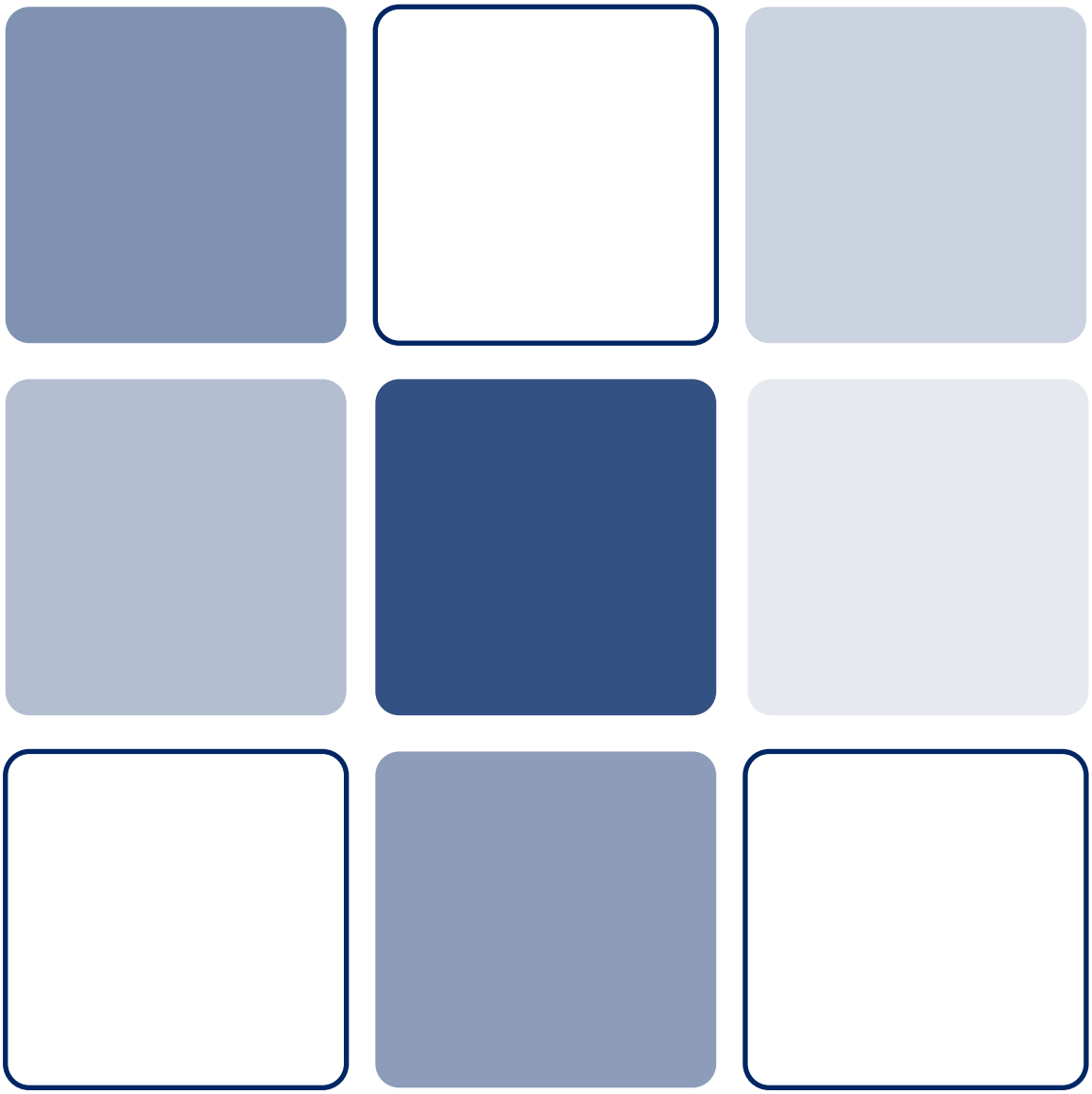
WW/CS/sm

Appendix B
Closure Certification Report, December 2017

Closure Certification Report

West South Effluent Treater Basin

Date Submitted: December 2017
Client: Shell Chemical LP Deer Park Facility



West South Effluent Treater Basin
Closure Certification Report

Prepared for:
Shell Chemical LP Deer Park Facility
P.O. Box 100
Deer Park, Texas 77536

By:
RPS
4801 Southwest Parkway
Parkway 2, Suite 150
Austin, Texas 78735

T (512) 326-5659
F (512) 326-5723

www.rpsgroup.com

December 2017

Table of Contents

1 Introduction 1
1.1 Description of West SET Basin 1
1.2 Summary of Closure Activities 4
1.3 Organization of Report 4
2 Closure Implementation 5
2.1 Pre-Construction Activities 5
2.2 West Basin Shutdown 8
2.3 Demolition and Sludge Stabilization 9
2.4 Structural Backfill 11
2.5 Stabilized Clay Cap 13
2.6 Protective Concrete Pavement 13
3 Certification 15

List of Figures

Figure 1 - Location of Basins within Refinery 3
Figure 2 - Basin Plan and Cross-Section 7

Appendices

Appendix A – Geotechnical Report
Appendix B – Middle Basin Construction Quality Control Plan
Appendix C – Construction Drawings
Appendix D – Initial Basin Treatability Study
Appendix E – Initial Sludge Stabilization CQC Documentation
Appendix F – Partially Stabilized Sludge Treatability Study
Appendix G – Partially Stabilized Sludge Rework CQCP
Appendix H – Stabilized Sludge Rework CQC Documentation
Appendix I – Structural Fill Construction CQC Documentation
Appendix J – Clay Cap CQC Documentation
Appendix K – Concrete CQC Documentation
Appendix L – Top of Structural Backfill, Clay Cap, and Concrete Pavement Spot Elevation Drawings

1 Introduction

The closure has been completed for the West South Effluent Treater (SET) Basin located at the Shell Oil's Deer Park, Texas facility. The closure was conducted in accordance with:

- Remedy Standard B (RSB) of the Texas Risk Reduction Program (TRRP) through the closure Shell's hazardous waste permit (HW-50099), which includes the document *Revised Closure Plan, East and West South Effluent Treater Basins*, March 2016 (Closure Plan).

The Closure Plan provides for the closure of the East and West SET Basins following closure of the Middle SET Basin, which was closed in 2014.

Prior to initiating closure of the middle basin, additional aeration capacity was installed in the east and west basins and wastewater flows were diverted from the middle basin to the other basins. Following closure of the Middle SET Basin, an above-grade concrete tank was constructed on top of the closed basin and new treatment equipment installed inside the tank. The new SET system became fully operational in December 2016, and wastewater flows to the west basin ceased in February 2017. Figure 1 shows the location of the basins within the Refinery.

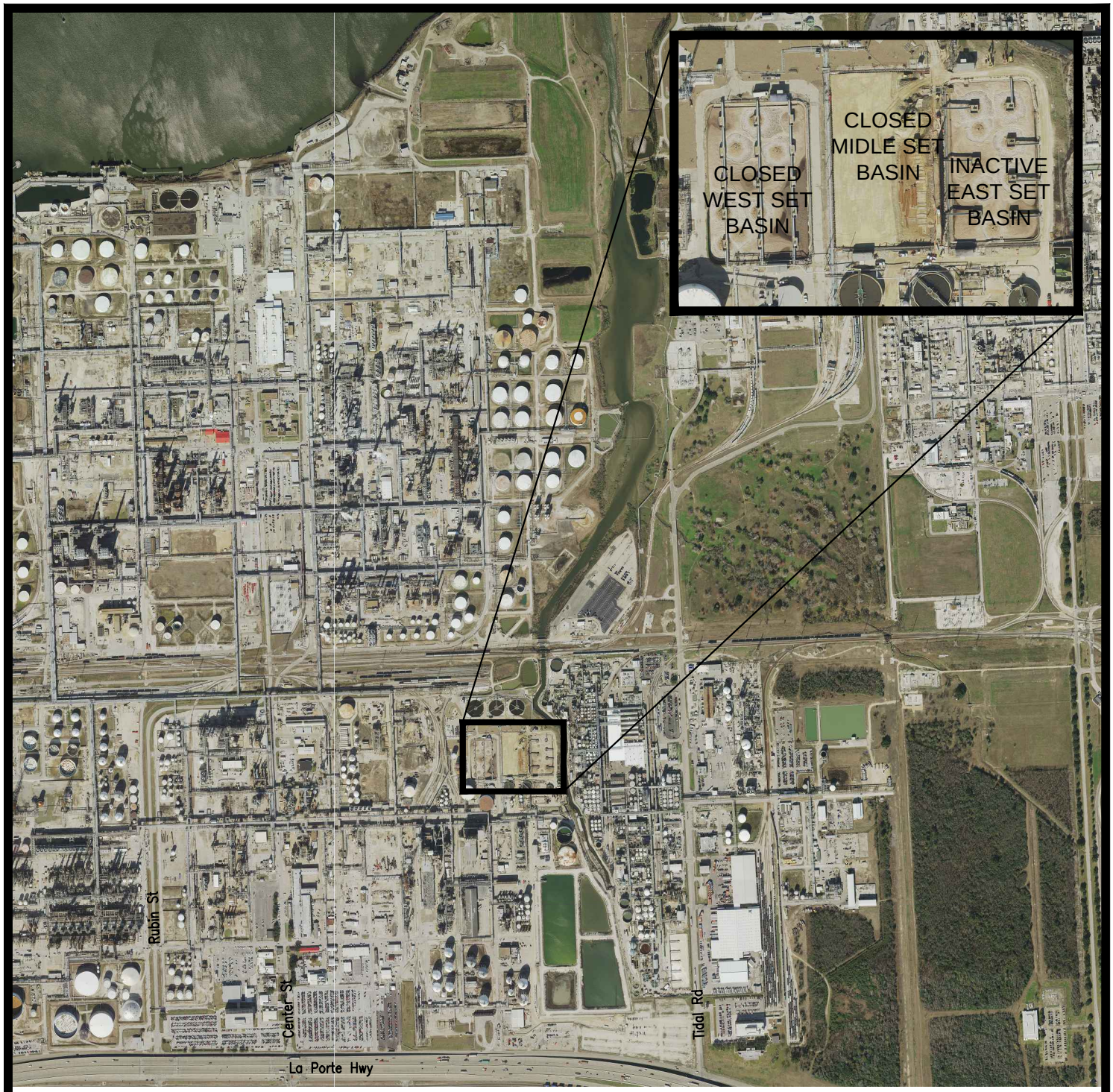
The west basin was closed prior to the east basin to allow construction of equipment and tanks referred to as the SET Front-End, which consist of an oil water separator, primary clarifier, neutralization tanks, transfer tanks, oil tank and new oil mist generator. Similar to construction of the new SET system on top of the close middle basin, and per the East and West SET Basins Closure Plan, the SET Front-End will be constructed on top of the southern portion the closed west basin. The remainder of the closed west basin unit will be used as a laydown yard. Closure of the east basin is planned to begin in the first quarter of 2018.

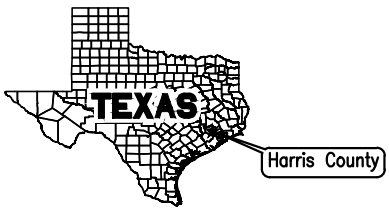
Following closure of the east and west basins, Shell will place a record of the closure of all three basins in the deed records of Harris County in accordance with 30 TAC § 350.111 and 40 CFR §264.119.

1.1 Description of West SET Basin

The West SET Basin (west basin) was a permitted hazardous waste surface impoundment with top dimensions of 340 feet (length) by 218 feet (width), 2:1 (horz:vert) side slopes, and a depth of 16 feet (depth). The basin was equipped with aerators and associated supports and

walkways and functioned as an aeration basin for treatment of process wastewater. The west basin was operated in parallel configuration and received the same wastewater influent from the process units as the middle and east basins.





N

0 1200 2400 Feet

RPS

TSPE No. 1298

SHELL OIL
DEER PARK, TEXAS

FIGURE 1
LOCATION OF SET BASINS WITHIN SHELL FACILITY

WEST SET BASIN CLOSURE CERTIFICATION REPORT

DRAWN BY:	A QUINONES
APPROVED BY:	J ISENSEE
PROJECT NO:	UEC02043
FILE NO:	
DATE:	JAN, 2017

O:\Shell Deer Park Refining Serv\UEC02043 - East & West SET Basins Closure\West SET Basin Closure Certification 1/25/2017 3:06 PM

1.2 Summary of Closure Activities

This closure certification report describes the procedures that were conducted to take the west basin out of service, stabilize basin sludge in-place, backfill the basin, and install the final cover system. As described in this report, the closure of the west basin has been successfully completed so that construction of the SET Front-End equipment can be constructed on top of the southern portion of the closed unit, and the remainder of the closed unit can be used as a laydown yard.

1.3 Organization of Report

The remaining sections of the report are described as follows:

- Section 2: Closure Implementation – This section summarized the closure activities conducted at the west basin.

- Section 3: Certification – This section provides a certification for the closure by an independent Texas-licensed professional engineer.

2 Closure Implementation

The closure of west basin was conducted between April 2016 and July 2017 in accordance with procedures provided in the approved closure plan and as described in this report. A summary of the steps conducted to close the west basin is provided herein. The general contractor for the project was Bo-Mac Contractors, LTD (Bo-Mac). Bo-Mac mobilized to the site April 2, 2016 (following pre-construction activities) and completed the closure in July 2017. Figure 2 provides a plan view and cross section through the closed basin.

2.1 Pre-Construction Activities

A summary of activities were undertaken prior to initiating closure construction activities is provided below.

Geotechnical Investigation and Study

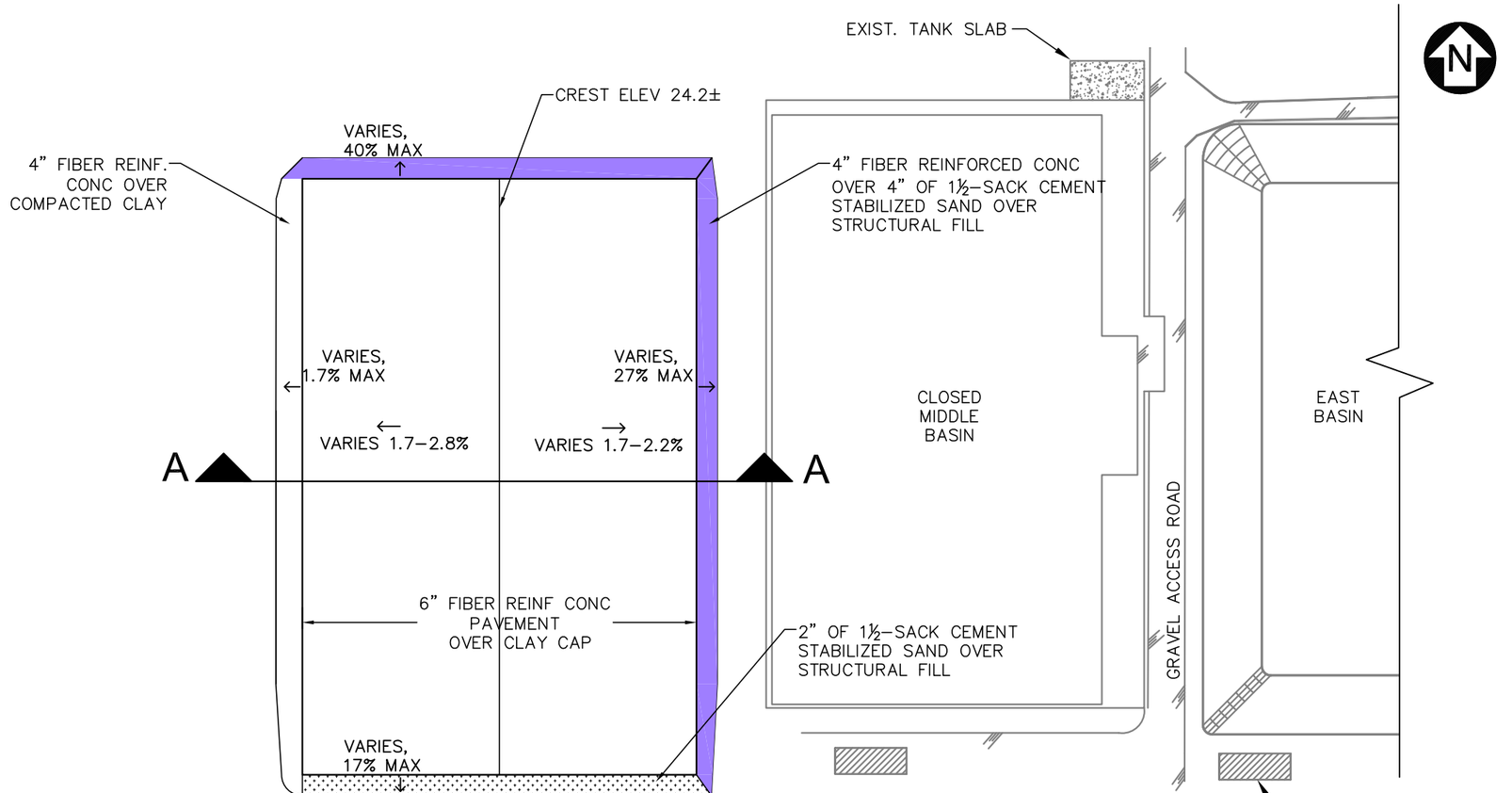
As mentioned above, the middle basin was the first basin to be closed, and a new SET system consisting of an above-grade concrete tank and new treatment equipment was constructed on top of the closed basin. For closure of the middle basin, on behalf of Shell, Fugro Consultants, Inc. (Fugro) performed a geotechnical investigation as detailed in the report entitled "Revised Geotechnical Study, SET Aeration Basin Upgrade Project, Shell Deer Park Refinery, Deer Park, Texas" (January 25, 2013) and an addendum entitled "Additional Geotechnical Recommendations" (June 10, 2013). The geotechnical report and addendum were developed with input from Shell, RPS, and the contractor and engineers for the basin, Remedial Construction Services, LP (RECON) and S&B Engineers and Constructors, Ltd (S&B), respectively. The text portion from the January 2013 report is provided as Appendix A.

Critical construction parameters established by the study included:

- Verification of the adequacy of the required minimum unconfined compression of 25 psi for the stabilized sludge specified in the revised closure plan; Determination of the required minimum shear strength of 1,000 psf for the backfill materials (e.g. structural fill, stabilized clay cap, and protective cover) installed above the stabilized sludge;
- Material and construction specifications and recommendations for sludge stabilization and backfill materials;
- Estimate of aeration tank settlement;
- Stability analysis of the adjacent side slopes in the east and west basins, which resulted in the installation of sheet piling on the east and west sides of the middle basin; and

- Construction monitoring recommendations.

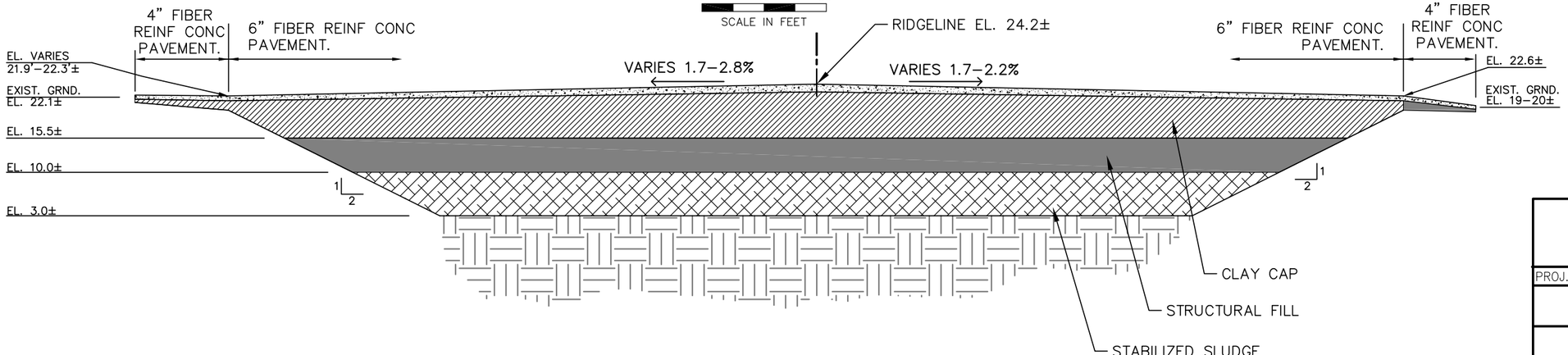
A separate geotechnical investigation was not performed for closure of the West Basin since the 2013 investigation geographically encompassed all three basins, and the loads of the SET Front End foundation and equipment to be constructed on top of the closed West Basin will be less than those for the SET tank and equipment constructed on top of the closed middle basin. Additionally, monitoring of settlement of the closed Middle Basin cover system and overlying new SET treatment system showed virtually no settlement even though pre-construction settlement modeling predicted modest settlement.



PLAN VIEW

0 40' 80'

SCALE IN FEET



SECTION A-A

0 10' 20'

SCALE IN FEET

SHELL OIL
DEER PARK, TEXAS

PROJ. NO.: 021149	DATE: SEP 2017	FILE: 021149_FIGURE 2

FIGURE 2
BASIN PLAN AND CROSS SECTION

WEST SET BASIN CLOSURE
CERTIFICATION REPORT

RPS
4801 Southwest Parkway,
Parkway 2, Suite 150
Austin, Texas 78735
(512) 326-5659
TBPE F-18972

SHEET
1 of 1

O:\Shell Deer Park Refining Serv\UEC02043 - East & West SET Basins Closure\West SET Basin Closure Certification\working files 9/18/2017 10:36 AM

Construction Quality Control Plan

RPS prepared a construction quality control plan (CQCP) for the middle basin that addressed all materials used to backfill and cap the basin. The CQCP was developed based on "Appendix D – Low-Permeability Soil Cap Construction Quality Control Plan" of the revised closure plan, requirements and recommendations contained in the geotechnical report, and input from the middle basin's project team (Shell, Bo-Mac, Fugro, and S&B). A copy of the CQCP is provided in Appendix B.

Similar to the geotechnical work performed for the middle basin closure, the middle basin's CQCP was also used for as the CQCP for the west basin.

Sludge and Clay Cap Treatability Study

As required in the CQCP, Fugro, on behalf of Bo-Mac performed a treatability study to test various reagents and mixing ratios (recipes) and select an optimal recipe for stabilizing the basin sludge. The mix recipe and methods used to stabilize the sludge are summarized in Section 2.3.

The CQCP also specifies a treatability study for the clay cap since it was believed an un-amended low-permeability clay cap would not have the required minimum shear strength of 1,000 psf that was required to support the new tank. However, Bo-Mac found a borrow source of clay that, without amendment, met both the permeability and shear strength requirements. Accordingly, a treatability study was not performed on the clay cap material.

Construction Drawings

CDI Corporation (CDI) prepared construction drawings for closure of the west basin. Input from the project team (Shell, Bo-Mac, Fugro and RPS) was used in development of the construction drawings. Copies of the construction drawings are provided in Appendix C.

2.2 West Basin Shutdown

As described in the closure plan, closure construction activities commenced with the east and west basins being outfitted with additional aeration capacity for treatment in accordance with the facility's TPDES water quality permit. Installation of the additional aeration capacity was performed by Instrument Technology International (ITI) and Turner Industries (Turner). The work was conducted in May 2013.

The west basin was taken out of service on February 2016. Turner personnel subsequently demolished walkway platforms, side and handrails, and aerator motors and mixer blades. Removed items were decontaminated via high-pressure washing in accordance with land-disposal restrictions treatment standards for debris (40 CFR §268.45) over a concrete area so that washwater drained into the middle basin. The decontaminated platforms, side and handrails (constructed of fiberglass) were disposed as non-hazardous waste at a commercial (Republic Services) landfill. Most of the decontaminated aerator motors and mixer blades were warehoused onsite for spare parts. Any decontaminated metal equipment or other items were loaded into scrap-iron boxes and sent to a scrap metal processing company (Midwest Steel Company).

Concurrent with demolition activities the remaining wastewater from the west basin was pumped to adjacent "distribution boxes" which drain to the facility's wastewater treatment system. Dewatering the west basin was completed in April 2016. Bo-Mac also mobilized to the site on April 2016.

2.3 Demolition and Sludge Stabilization

Following dewatering of the west basin, the upper approximately 6 feet of the basin's perimeter concrete sidewall apron was decontaminated. Decontamination water pumped to the adjacent "distribution boxes" that drain to the facility's wastewater treatment system. Decontaminated concrete was demolished and transported to Houston Products Processing (HPP), a commercial recycling facility.

As required by the CQCP, a treatability study was performed by Fugro on behalf of Bo-Mac to identify a reagent and sludge recipe that would yield a stabilized sludge with a minimum unconfined compressive 25 psi. A copy of the treatability study is provided in Appendix D.

Based on the results of the study, the selected stabilization recipe was 2 parts (by volume) clay mixed with 1 part in-situ sludge. Once thoroughly mixed, CFB ash (petroleum coke circulating fluidized bed or fly ash) supplied by Headwaters Resources was mixed with the clay-sludge mixture at a 15% dosage rate by weight assuming a clay-sludge mixture unit weight of 105 lbs/ft^3.

For sludge stabilization and other construction quality control testing purposes, the west basin's surface area (approximately 70,500 ft^2) was divided into 12 approximately equal-sized (5,900 ft^2) blocks. At the bottom of the basin, the area encompassed by each of these blocks is approximately 3,300 ft^2. For sludge stabilization, each block was subdivided into six

approximately 70' by 70' grids to meet the strength testing frequency requirement of 1 test per 5,000 ft^2,

Fugro provided construction quality assurance and control (CQC) monitoring and testing for the stabilized sludge, structural backfill, and clay cap. Soil materials were transported to and discharged into the basin via dump trucks. For sludge stabilization, CFB ash was transported to the basin via tanker truck and discharged pneumatically via hose from the tanker truck to the active grid undergoing stabilization. Monitoring of sludge stabilization included visual observation of the clay and sludge mixing, discharge of CFB ash, and mixing of CFB ash with clay-sludge mixture. Mixing of the stabilization materials was done using a combination of a long-reach excavator and 300 trackhoe with standard buckets. The final thickness of the stabilized sludge above the bottom of the basin varied between approximately four and eight feet.

Towards the end of the sludge solidification process, the steel platforms that supported the aeration equipment and their concrete foundations (and some remaining items not previously removed) were decontaminated, demolished and removed from the basin. The decontaminated platforms and any other remaining metal (excluding equipment kept by Shell for spare parts) were loaded into scrap-iron boxes and sent to Midwest Steel Co. for recycling. The demolished concrete foundations were transported to HPP for recycling.

The CQCP calls for determining the shear strength of the stabilized sludge via testing of undisturbed core samples of the stabilized sludge. However, it was not possible to obtain undisturbed core samples of the stabilized sludge as the samples would break apart either during coring or when the core was removed (via cutting off the casing) from the core casing in the lab. As an alternative, cone penetrometer tests (CPT) were performed by Fugro to estimate the unconfined compressive strength of the stabilized sludge. Initially, 20 CPT were performed with some of the locations selected by Fugro and others by Bo-Mac. The locations of the CPT and the CPT results are provided in Appendix E.

As indicated on the CPT graphs in Appendix E, at five of the 20 CPT locations (2, 4, 5, 6 & 8), the stabilized sludge met the 25 psi requirement throughout its depth profile. At 14 of the remaining 15 CPT locations, sludge strengths were significantly less than 25 psi, typically in the lower portions of the sludge profile. Subsequent to obtaining the results of CPTs, core samples of the lower strength portions of the sludge profile were obtained adjacent to CPT locations 12 and 17. Pocket penetrometer readings of the unconfined strength of stabilized sludge varied between 0 and 0.25 tsf (3.5 psi). Bo-Mac subsequently excavated an approximate 10' x 10' pit

at CPT locations 12 and 17, and it was noted there was a high degree of variability in the texture and visual appearance of the materials in the sludge stockpiles. Observed and sampled materials included what appeared to be clay clogs, relatively undisturbed sludge, and stabilized sludge.

As an additional test, several samples of the stabilized sludge were placed in water to evaluate the potential affect on the strength of the samples. It was observed that the apparently well-stabilized samples were unaffected and looked like wet concrete, while the apparently not-as-well-stabilized samples started to break apart and cloud the water.

Based on the above results, it was concluded that the clay, sludge, and ash were not thoroughly enough mixed in several basin blocks, and the entirety of volume of "partially stabilized sludge" within each of these blocks would have to be excavated and reworked to meet the 25 psi requirement. Accordingly, samples of the lower (bottom) materials and upper (top) materials were collected by Fugro from new test pits on October 18 to perform for another treatability study using Portland cement as the reagent. A copy of the treatability study for the rework of the blocks with partially stabilized sludge is provided in Appendix F. The recipe used to rework partially stabilized sludge was partically stabilized sludge (PSS) broken into 4" (maximum) particle size then mixed with low stability material (LSM) (PSS to LSM ration 2:1). A cement slurry (0.85 water to Portland Cement radio) added to the PSS/LSM mixture (cement to PSS/LSM ration 4% min).

In addition to performing a treatability study for rework of partially stabilized sludge, a supplementary construction quality control plan (Rework CQCP) was also developed for the rework project. The Rework CQCP was prepared by RPS with the input and assistance of Fugro, Bo-Mac, and, Shell. A copy of the Rework CQCP is provided in Appendix G. A copy of the construction quality control (QCQ) documentation is provided in Appendix H.

Rework of partially stabilized sludge commenced on November 11, 2016 and was completed in early December. CPT tests were performed intermittently to assure that strength of the reworked stabilized sludge meets the 25 psi requirement. Eighteen CPT tests were performed, and all the tests showed reworked stabilized sludge met the 25 psi requirement throughout its depth profile.

2.4 Structural Backfill

Per the closure plan, on top of the stabilized sludge, the middle basin was backfilled with structural fill (also referred to as "fill" and "backfill") up to the subgrade elevation of the clay cap.

The closure plan shows the surface of the structural fill sloped at a one percent slope up from the perimeter of the basin towards its center, creating a north-south ridge with gabled ends, upon which a four-foot thick clay cap would be constructed. However, in order to address varying elevations and facilities which needed to remain in place around the perimeter of the basin, the following modification to the above design were made:

- Surface of the structural fill was constructed essentially flat at a nominal elevation of 15.5 ft msl;
- Thickness of the clay cap was varied to create a constant-elevation north-south ridge line for the entire length of the basin (thereby eliminating the gabled ends) and east and west sides with slopes greater than one percent.
- To make up the elevation difference between the top of concrete pavement and the existing grade on the west side of the basin, the clay cap was extended outside the basin approximately 17 ft (max) to the edge of an existing paved access road such that the top of the basin's concrete pavement matched the top of the existing road's pavement (21.77 to 22.19 ft msl).
- To make up the elevation difference between the top of concrete pavement and existing grade along the north and east sides of the basin, the following materials, from bottom to top, were constructed approximately 13 ft (max) outside the basin (18.16 to 20.39 ft msl):
  - Compacted structural fill of varying thickness;
  - Four inches of 1½-sack cement stabilized sand; and
  - Four inches of fiber reinforced concrete.
- To make up the elevation difference between the top of concrete pavement and existing grade along the south side of the basin, the following materials, from bottom to top, were constructed approximately 11 ft (max) outside the basin (22.18 to 22.81 ft msl):
  - Compacted structural fill of varying thickness; and
  - Two inches of 1½-sack cement stabilized sand.

The structural fill was comprised of off-site sandy soil meeting the following requirements:

- Uniform Soil Classification of CL,
- Liquid limit less than 40,
- Plasticity index between 10 and 20,
- Maximum effective clod size of 3-inches;
- Minimum compaction of 98% Standard proctor density at -1% to +3% optimum moisture content; and
- Minimum in-place shear strength of 1,000 psf.

The surface of the structural fill was graded to provide a smooth surface for placement of the clay cap.

The results of preconstruction materials testing for the soils used for structural fill are provided in Appendix I. The results of construction moisture-density and unconfined compression/shear stress testing for the structural backfill are also provided in Appendix I.

2.5 Clay Cap

Per the Closure Plan, a low permeability clay cap was installed on top of the structural fill. Minimum in-place requirements for the clay cap were:

- Minimum thickness of 4 feet;
- Minimum compaction of 98% Standard proctor density at -1% to +3% optimum moisture content;
- Maximum permeability of 1 x 10^{-7} cm/sec, and
- Minimum shear strength of 1,000 psf.

It was anticipated that a treatability study would have to be performed to identify an appropriate mixture of reagents that would yield a clay cap with a minimum shear strength of 1,000 psf and maximum permeability of 10^{-7} cm/sec. However, a source of clay was found that met both the maximum permeability and minimum shear strength requirement without amendment of the clay.

The results of preconstruction materials testing for the soils used for the clay cap are provided in Appendix J. The results of tests for in-place moisture-density, unconfined compression/shear stress, and permeability for the clay cap are also provided in Appendix J.

2.6 Concrete Pavement

CDI Drawing E-146761-2 (Appendix C) includes the material and construction requirements for the protective concrete pavement installed over the clay cap. The specifications for the protective concrete pavement are that it have a minimum thickness of 6 inches and consist of fiber reinforced concrete with a minimum compressive strength of 4,000 psi. Appendix K contains results of the concrete compressive strength tests.

Appendix L contains three versions of Construction Drawing E-146763-2 with as-built spot elevations of the top of structural fill, top of clay cap, and top of concrete pavement. Per the top of structural fill spot elevation drawing, the surface of the structural fill was constructed relatively flat with elevations varying between 15.35 and 15.58 ft msl.

Per the top of clay cap spot elevation drawing, the north-south ridge line was constructed at an elevation of approximately 23.54 ft. Based on the as-built spot elevations, the east and west slopes towards the sides of the basin are at grades varying between approximately 1.1 to 2.0 percent. Based on the top of structural fill and clay cap spot elevations, the minimum thickness of the constructed clay cap within the limits of the basin is over 6 ft (21.80 ft - 15.52 ft).

Per the top of concrete paving spot elevation drawing, the north-south ridge line of the pavement is slightly above elevation 24.1 ft msl. Based on the top of structural fill and clay cap spot elevations, the east and west slopes towards the sides of the basin are at grades varying between approximately 1.6 to 2.8 percent. Based on the top of clay cap and concrete pavement elevations, the thickness of the concrete paving varies between approximately 0.4 ft (5 inches) and 1.2 feet. While 5 inches does not meet the 6 inches minimum thickness pavement requirement, there is only one location where the as-built concrete thickness is appreciably less than 6”, and the average thickness of the concrete pavement over the entire basin is approximately 8 inches. Additionally, the 28-day concrete compressive strengths for the two sample locations nearest the 5” location average 5,800 psi (see Test Report 0187 in Appendix K). Based solely on a strength-to-thickness ratio analysis, a 5” thick, 5,800 psi concrete pavement is equivalent to a 7¼” thick, 4,000 psi concrete pavement. Based on the above, the installed reinforced concrete pavement meets the intent and goal of Shell’s hazardous waste permit and Closure Plan; to provide high-load bearing, durable, and low maintenance protective cover over the low-permeability clay cap.

3 Certification

I certify that the closure of the West SET Basin at Shell's Deer Park Refinery between April 2016 and July 2017 was performed in accordance with procedures provided in the approved closure plan and as described in this report.

James Isensee, P.E.
Licensed Professional Engineer
State of Texas
License No. 63740

Date

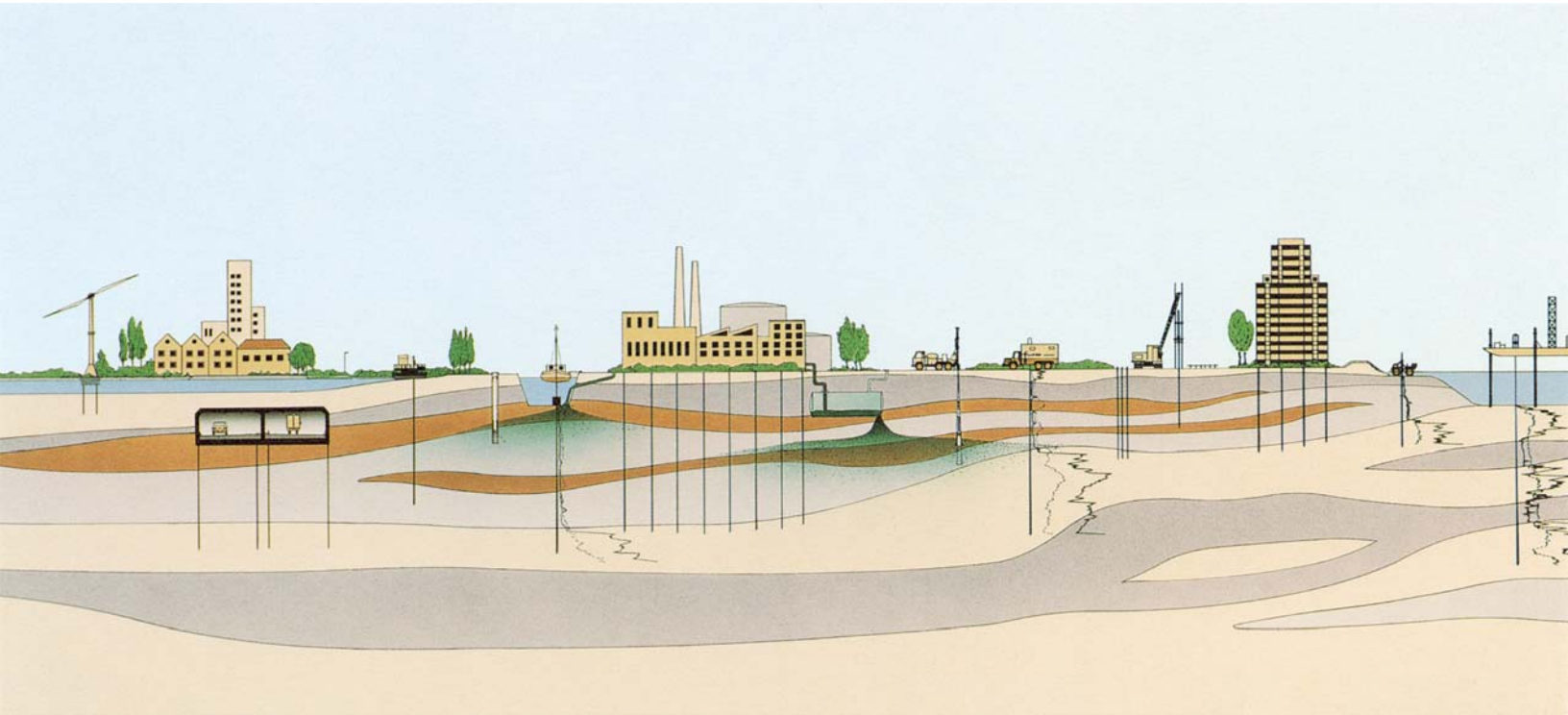
Authorized Shell Oil Representative (Print): _____
Title: _____
Signature: _____ Date: _____

Appendix A – Geotechnical Report

FUGRO CONSULTANTS, INC.

REVISED GEOTECHNICAL STUDY
SET AERATION BASIN UPGRADE PROJECT
SHELL DEER PARK REFINERY
DEER PARK, TEXAS

S&B ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS



FUGRO CONSULTANTS, INC.

6100 Hillcroft (77081)
P.O. Box 740010
Houston, Texas 77274
Tel: (713) 369-5400
Fax: (713) 369-5518

Report No. 04.10120070r_Revision 2
January 25, 2013

SHELL DEER PARK REFINING COMPANY
5900 State Highway 225
Deer Park, Texas 77536

Attention: Mr. Travis Twardowski, P.E.
Project Manager

Revised Geotechnical Study
SET Aeration Basin Upgrade Project
Shell Deer Park Refinery
Deer Park, Texas

Introduction

Fugro Consultants Inc. (Fugro) is pleased to present this revised report of our geotechnical study for the above referenced project. Mr. Travis Twardowski, P.E. with Shell Deer Park Refining Company (Shell) requested our services via an email to Ms. Julia Clarke, E.I.T. with Fugro on March 1, 2012. Our services were authorized through Shell Purchase Order No. 4550299033, dated May 16, 2012. We performed our services in general accordance with Fugro Proposal No. 04.10120070pR1 dated May 7, 2012. Mr. Todd Houston with Shell requested this revised report via an email to Mr. William Martin of Fugro on December 19, 2012. This revised report supersedes all previously provided geotechnical information for the project and contains a summary of our field exploration, laboratory testing, and our geotechnical recommendations for the construction of the proposed SET Aeration Basin foundation.

We are submitting this report at the request of Shell. However, as discussed during the teleconference on January 23, 2013, with members of Shell and S&B Engineers & Constructors (S&B), additional engineering analysis will be required to finalize the geotechnical recommendations for the SET Aeration Basin. The results of our analysis will be presented in an addendum report to be issued at a later date and will incorporate soil information, to be obtained from additional soil borings to be drilled at the project site. Current plans are to drill the soil borings within the next few weeks. As such, the information contained herein is subject to change.

Project Description. We understand that Shell plans to close three existing process wastewater aeration basins in the South Effluent Treatment Area, within their existing Facility in Deer Park, Texas. We understand the Middle SET Basin will be closed first to accommodate the construction of a concrete tank system that will replace the basins. S&B is currently assisting Shell with the design and construction of the new aeration basin. The project site is located in the southeast portion of the Shell Deer Park Refinery. A *Vicinity Map* of the project site is presented on Plate 1. Based on information provided by S&B, we understand the location of the new aeration basin will

be within the footprint of the existing middle aeration basin. The new basin will consist of an open concrete tank structure. The proposed tank will be about 350 feet long by 200 feet wide by 25 feet tall. We understand the maximum contact pressure between the tank and the newly placed fill will be no greater than 2,500 pounds per square foot and the maximum depth of effluent (maximum specific gravity of 1.0) in the tank is 25 feet. Currently the site of the proposed new effluent basin is developed with the existing middle south effluent treatment (SET) aeration basin.

In addition to the SET Aeration Basin, Shell indicated that an anoxic tank with approximate dimensions of about 45 feet by 45 feet is planned immediately adjacent to the SET Basin. Based on our discussions with Shell during our meeting on December 3, 2012, we further understand that the maximum contact pressure underneath the anoxic tank foundation will be 2,500 pounds per square foot. We also understand that the anoxic tank will share a common wall with the aeration basin tank.

Furthermore, we understand that, in order to prepare the site for the planned construction of the concrete tank, the scope of the project includes stabilizing the existing sludge within the basin, placing approximately 12 feet of select structural backfill to bring the basin to the elevation of the bottom of the proposed clay cap, placing a clay cap and a protective cover layer. We understand that the top of the clay cap would be at the existing grade. A cross-section showing the basin backfill profile is provided in Appendix A.

Fugro was requested to provide geotechnical recommendations for the design and construction of the proposed new SET Aeration Basin. We understand that no below-grade structures are planned as part of the proposed construction.

Previous Geotechnical Studies. Fugro previously performed several geotechnical studies in the vicinity of the proposed project site. We reviewed the following reports as part of this study:

- *"*Geotechnical *Study; Proposed Sites for an Ethylene Plant; Shell Deer Park Refinery, Houston, Texas (Report No. 0301-8100)",* dated July 21, 1998 performed by Fugro.
- *"*Geotechnical *Study, Main Aeration Basin – South Effluent Treatment Area, Shell Deer Park Refinery, Deer Park, Texas (Report No. 04.12100071)",* dated September 1, 2010 performed by Fugro Consultants, Inc.

Our recommendations for the proposed structures are based only on the subsurface information obtained from the borings drilled for this study and the previous CPT soundings preformed at this site. The locations of the previous nearby soil borings are indicated on the *Plan of Borings* presented on Plate 2. Copies of the pertinent CPT sounding logs from these previous geotechnical studies are provided in Appendix B.

Purposes and Scope. The purposes of this study were: 1) to explore and evaluate the subsurface conditions at the site of the proposed new aeration basin tank, 2) review existing subsurface data presented in previous Fugro reports, and 3) provide geotechnical

recommendations to guide others in the design and construction of the foundation for the proposed new aeration basin tank. We accomplished these purposes by:

- Drilling one (1) geotechnical soil boring to a depth of 150 feet below existing grade, and two (2) geotechnical soil borings each to a depth of 100 feet below existing grade, at locations around the vicinity of the existing aeration basins, to explore subsurface soil and depth-to-water conditions;
- Performing field and laboratory tests on selected soil samples to evaluate the geotechnical engineering properties of the subsurface soils;
- Reviewing and Analyzing the field and laboratory data to develop geotechnical engineering recommendations for the foundation for the proposed new aeration basin tank; and
- Preparing this engineering report summarizing our findings and recommendations.

Environmental assessment, compliance with State and Federal Regulatory requirements, assessment of potential migration, and/or environmental analyses, including those associated with biological agents, were beyond the scope of this study. A fault study was also beyond the scope of our study. We were neither asked nor authorized to evaluate the presence of faults or environmental conditions at the site.

Applicability of Report. The explorations and analyses for this study, as well as the conclusions and recommendations contained in this report, were selected or developed based on our understanding of the project as described previously and in later sections of this report. If there are differences in location or design features as we understand them, or if the locations or design features change, we should be authorized to review the changes and, if necessary, to modify our conclusions and recommendations. The observations, conclusions, and recommendations presented in this report may not apply to locations outside the project boundaries.

We have prepared this report exclusively for Shell Deer Park Refinery to guide others in the design and construction of the foundation as described in this report. We have conducted this study using the standard level of care and diligence normally practiced by recognized engineering firms now performing similar services under similar circumstances. We intend for this report, including all illustrations, to be used in its entirety. This report should be made available to prospective contractors for information only and ***not*** as a warranty of subsurface conditions. It should not be used, whether in whole or part, as a stand-alone construction specifications document.

Field Exploration

This section provides information relating to our field exploration activities for this project. We have included discussions relating to drilling methods, sampling methods, depth-to-water observations, and borehole completion.

General. We explored the subsurface conditions at the site by drilling three (3) geotechnical soil borings, designated Borings B-1 through B-3. Boring B-1 was drilled to a depth of about 150 feet below existing site grade, and Borings B-2 and B-3 were each drilled to a depth of about 100 feet below existing site grade. Fugro selected the number of borings, their locations and their depths based on the information provided by Shell. It should be noted that the soil borings were drilled in the general vicinity of the project site (about 350 to 600 feet). The soil borings were located away from the proposed aeration basin to avoid potential cross-contamination of groundwater from drilling operations. The boring locations were selected by Fugro and Shell Engineering and Environmental groups after reviewing available information on potential access of environmental impact. Shell personnel staked the boring locations in the field. The approximate boring locations are shown on the *Plan of Borings* on Plate 2.

Drilling Methods. Drilling was performed with a truck-mounted drill rig using a combination of dry-auger and wet-rotary techniques. Detailed descriptions of the soils encountered in the borings drilled for this project are presented in the boring logs on Plates 3 through 5. A key identifying the terms and symbols used on the boring logs is presented on Plates 6a and 6b.

Sampling Methods. Soil samples were generally taken at 2-foot intervals to a depth of 16 feet below existing grade, at about 5-foot intervals between 16 feet and 100 feet, and at 10-foot intervals thereafter to the completion depth of the borings. Samples of cohesive soil were generally obtained by hydraulically pushing a 3-inch-diameter, thin-walled tube a distance of about 24 inches. Our field procedure for cohesive soil sampling was conducted in general accordance with the *Standard Practice for Thin-Walled Tube Sampling of Soils* (ASTM D1587). All samples were extruded in the field and visually classified by our field technician. We obtained field estimates of the undrained shear strength of the recovered samples using a calibrated hand-held penetrometer. Where applicable, the field estimates were modified for stiff to very stiff, over-consolidated natural cohesive soils, as described on Plate 6b. Portions of each recovered soil sample were placed into rigid plastic tubes or plastic bags for transportation to our laboratory.

The field procedure for granular soil sampling was conducted in general accordance with the *Standard Method for Penetration Test and Split-Barrel Sampling of Soils* (ASTM D1586). Granular soil samples were generally obtained using the Standard Penetration Test (SPT) as described on Plate 6b. Our field technician recorded the hammer blows for each sampling interval. The SPT N-value is recorded on the boring logs. The soil samples obtained from the split-barrel sampler were visually classified and packaged for transportation to our laboratory.

Depth-to-Water Observations. All borings performed for this study were initially drilled using dry-auger drilling techniques in an effort to identify the depth-to-water in the open boreholes. Once

water was encountered, drilling was temporarily halted and the water levels in the open boreholes were monitored at 5-minute intervals for a period of 30 minutes. The interpreted depth-to-water conditions are presented in the *General Site Conditions* section of this report.

Borehole Completion. Upon completion of drilling and sampling operations, the soil borings were backfilled with cement-bentonite grout. We grouted the borehole from the bottom up using a tremie pipe. When grout returned to the surface, we removed the tremie pipe and topped-off the boreholes by pouring grout from the surface.

Laboratory Testing

We directed our laboratory-testing program towards classifying the subsurface soils and evaluating the classification properties, undrained shear strength, and compressibility characteristics of the subsurface soils. All laboratory tests were performed in general accordance with applicable American Society for Testing and Materials (ASTM) testing standards, as tabulated at the end of this section.

Classification Tests. The classification tests included tests for natural moisture content, liquid and plastic limits (collectively termed Atterberg Limits), dry unit weight, and material finer than the No. 200 sieve (percent fines). These tests aid in classifying the soils and are used to correlate the results of other tests performed on samples taken from different borings and/or different depths. The results of the classification tests performed on soil samples taken from the borings performed for this study are presented on the boring logs on Plates 3 through 5.

Undrained Shear Strength Tests. The undrained shear strength of select undisturbed samples of cohesive soils was measured by performing unconfined compression tests and unconsolidated undrained triaxial compression tests. Natural moisture contents and dry unit weights were determined as routine portions of the compression tests. The results of the undrained shear strength tests are presented on the boring logs on Plates 3 through 5.

Compressibility Characteristics. The compressibility characteristics of the cohesive foundation soils were determined by performing an incrementally-loaded one-dimensional consolidation test. Three undisturbed samples were selected for consolidation testing. The natural moisture content and dry weight was determined as routine portions of the consolidation test. The consolidation test results are presented as a plot of axial strain versus effective vertical stress in Appendix C.

Summary of Laboratory Testing. The following table lists the types and number of geotechnical laboratory tests as well as the test method standards performed for this study.

Table: Laboratory Test Summary

Laboratory Test	Quantity	Testing Standard
Moisture Content	27	ASTM D 2216
Atterberg Limits	14	ASTM D 4318
Percent Finer than a No. 200 Sieve	6	ASTM D 1140
Unit dry Weight	22	ASTM D2166
Unconfined Compression Test	7	ASTM D 2166
Unconsolidated-Undrained Triaxial Compression	15	ASTM D 2850
One-Dimensional Consolidation	3	ASTM D 2435

General Site Conditions

The interpreted site and subsurface conditions based on our experience, field exploration, and laboratory testing are discussed in this section. This section also includes a discussion on the depth-to-water conditions.

Site Location and Description. The project site is located in the south effluent treatment area of the existing Shell Refinery located in Deer Park, Texas. The existing site consists of 3 operational aeration basins that are bounded by Patrick Bayou to the East. The approximate location of the site is presented on Plate 1.

Based on information provided by Shell, the site is currently developed with a fully operational aeration basin, designated as the Middle Aeration Bain. We understand the existing basin includes a concrete apron, block footing foundations to support equipment pads for aerators and the existing catwalks along with ancillary piping and equipment. We understand that the existing basin will be dewatered and the apron and the majority of the existing foundations will be removed prior to stabilization of the sludge and placement of new fill.

At the time of our field investigation, the ground surface at the site was relatively flat and consisted of crushed stone and debris associated with the existing effluent treatment facilities. Please note that we encountered fill material extending from the existing ground surface to a maximum depth of 10 feet below existing grade in the borings drilled for this study.

Subsurface Conditions. The subsurface conditions presented in this report are based on the soil information obtained from Borings B-1 through B-3 drilled for this study and our experience in this area. As stated previously, soil borings were drilled in the general vicinity of the proposed aeration basin. The (near surface) soil conditions in the immediate vicinity of the aeration basin may be different from those encountered in the soil borings drilled for this study. In general, subsurface conditions encountered at the proposed site consist primarily of fill material underlain by natural

granular and cohesive soils. The subsurface stratigraphy is generalized in the following paragraphs.

Fill material, consisting of clay, sand and sandy silt, was encountered from the ground surface and extended to depths ranging from about 2 to 10 feet below existing site grade. Measured moisture contents in these soils ranged from 15 to 40 percent. Measured liquid limits in these soils ranged from 65 to 72 percent with calculated plasticity indices ranging from 47 to 48 percent. Based on the field and laboratory measurements, undrained shear strengths in these soils generally ranged from about 0.40 ksf (soft) to 2.0 ksf (very stiff).

Natural cohesive soils consisting of clay, sandy clays, silty clay were encountered from below the fill material to a depth of about 133 feet below existing grade. Please note Borings B-2 and B-3 were teminated at a depth of 100 feet below existing site grade. Measured moisture contents in these soils ranged from 15 to 40 percent. Measured liquid limits in these soils ranged from 32 to 82 percent with calculated plasticity indices ranging from 21 to 63 percent. Based on the field and laboratory measurements, undrained shear strengths in these soils generally ranged from about 0.75 ksf (firm) to greater than 4.0 ksf (hard).

In Boring B-1, below the natural cohesive soils, natural granular soils consisting of sands were encountered to a depth of about 145 feet below existing grade. The measured N-value from the Standard Penetration Test (SPT) was greater than 50 blows/foot, indicating a very dense condition.

The granular soils, in Boring B-1, were underlain by natural cohesive soils consisting of clay to a depth of about 150 feet below existing grade, the maximum depth explored at this site. A moisture content of 28 percent was measured in these soils. Measured undrained shear strengths in these soils generally ranged from about 2.7 ksf (very stiff) to greater than 4.0 ksf (hard).

Additional subsurface details and laboratory testing results for this study are included on the boring log on Plates 3 through 5. A key to the terms and symbols used on the boring log is presented on Plates 6a and 6b.

Depth-to-Water Conditions. As mentioned earlier, all the soil borings were initially drilled using dry-auger techniques to facilitate depth-to-water observations in the open boreholes. Groundwater observations were not performed in Borings B-1 and B-2 due to caving of the borehole sidewalls during dry-auger drilling. Groundwater was initially noticed in Borings B-3 at a depth of about 14 feet below existing site grade in Boring B-3. Once groundwater was encountered in Boring B-3, drilling was halted temporarily and groundwater levels were monitored at 5-minute intervals for a period of 25 minutes. The water level in the open boreholes, after a period of 25 minutes, was observed to be at about 9 feet below existing site grade in Boring B-3.

Please note that short-term depth-to-water observations recorded in open boreholes should not be considered to represent a long-term condition. The time associated with short-term observations may not be sufficient for the conditions in the open borehole to reach equilibrium. More accurate determinations of groundwater levels are usually made using long-term standpipe piezometer readings. Groundwater levels will fluctuate with seasonal variations in rainfall and surface runoff,

especially during extended periods of heavy rainfall or dry weather. The groundwater level at the proposed project site may be influenced by the water levels in the adjacent Patrick Bayou. For design purposes, the groundwater level should be assumed to approach the ground surface.

Variations. Our interpretations of soil and depth-to-water conditions, as described in this report, are based on data obtained from our visual observations, sample borings, laboratory tests, and our experience in this area. Although we have allowed for minor variations in the subsurface conditions, our recommendations may not be appropriate for subsurface conditions other than those reported herein. It is possible that undisclosed variations in soil or depth-to-water conditions may occur outside the boring locations **(especially with regard to the depth, consistency, and lateral extent of fill material)**. We recommend careful observations during construction to verify our interpretations. Should variations from our interpretations be found, we recommend that we be notified and authorized to evaluate what, if any, revisions should be made to our recommendations.

Key Design Components

This project entails the conversion of an existing below-grade wastewater treatment pond basin to an above-grade open tank system known as the SET Aeration Basin Upgrade Project. As noted previously, current plans are to stabilize the existing sludge within the basin, place approximately 12 feet of select structural backfill to bring the basin to the elevation of the bottom of the proposed clay cap, place a 4-foot thick clay cap, and a protective cover layer with a minimum thickness of about 6-inches. We also understand that final grade within the footprint of the proposed new aeration basin will be no greater than 1-foot above surrounding site grade.

We understand the main components of the construction process will be performed in the following order: 1) removal of a portion of (at least the top 4 feet) the existing concrete apron structure, as necessary for construction of the low permeability clay layer and to evaluate the presence of voids prior to backfilling, 2) the construction of a ramp to access the basin pit, 3) stabilization of the existing sludge sediments, 4) placement of structural fill, 5) placement of low permeable clay cap to extend from the elevation of the existing water level up to existing site grade for a minimum of 4 feet, whichever is greater, 6) placement of 6-inch protective cover, and 7) construction of the proposed concrete tank and associated equipment/structures. A cross-section showing the basin backfill profile is provided in Appendix A. The following table presents each of the proposed materials and their proposed thicknesses for each layer starting from the bottom of the tank foundation:

Proposed Layer Material and Thickness

Layer Designation	Proposed Material Type	Bottom Depth of Layer	Layer Thickness
Protective Layer	Crushed Stone/ Granular Fill	0.5 ft	0.5 ft
Clay Cap	Clay	4.5 ft	4 ft(2)
Structural Fill	Sandy Clay	16.5 ft	12 ft
Sludge	Soil/Sediments	18.5 ft	Up to 24 inches(1)

Notes:

1) Based on probing performed by others within the basin slopes and bottom, we understand the thickness of the existing sludge layer varies, with an average sludge thickness of about 12-inches.
2) We understand from Shell that the thickness of the clay cap and protective layer are minimal requirements specified in the TCEQ approved closure plan.

We understand visual inspections will be performed behind the concrete apron during the abandonment of a portion of the existing concrete apron structure to evaluate the presence of voids prior to backfill operations. If voids are observed during visual inspection behind the concrete apron, we recommend that we be contacted to evaluate the presence of voids and provide remediation recommendations on a case-by-case basis. Additionally, a geophysical report would present possible voids, geophysical anomalies, existing foundations and/or underground structures, including those potentially located along the side slopes of the existing basins. Furthermore, we recommend careful review of any documentation concerning the design and construction of the concrete apron. Documentation on the placement and compaction of fill material, placement of concrete, or any other construction records may be reviewed to minimize the unknowns associated with the concrete apron.

The following sections provide our recommendations and discussion pertaining to each of the proposed layers. Recommendations presented in the following sections require that ponded water be drained and that sufficient drainage is maintained during construction. We also recommend evaluating OSHA requirements for working in the pit during the construction process as temporary shoring and/or sheetpiling may be required during construction.

Stabilization of Existing Sludge

As stated previously, we understand that sludge material (average of about 12-inches) associated with the existing aeration basin is present at the project site. Current plans are to treat the sludge with in-situ sludge improvement techniques to form a uniform bearing stratum. Proper treatment of

sludge is critical in avoiding large differential settlements within the proposed SET aeration basin foundation.

The objective of mixing the existing onsite sludge/soil-sediments with the reagent is to provide a material that meets the requirements for compressive strength and allowable bearing capacity as described in this report. We believe that the allowable bearing capacities will be achieved, and that the mat foundation recommendations, provided in this geotechnical report, will be applicable, provided non-structural materials are stabilized to meet the requirements as described in this report. In addition, the stabilization plan should be designed to achieve a material with a uniform strength after the completion of treatment.

Based on the information provided, we understand the applied pressure will be no greater than 2,500 psf at the bottom of the basin tank and no greater than 2,500 psf at the bottom of the anoxic tank. Therefore, we anticipate the applied pressure on the sludge material will be imposed from the basin tank load plus the overburden of the newly placed fill. Based on the 2V:1H method of stress distribution of the new aeration basin load through the fill material plus the overburden pressure of the fill, we recommend the sludge be treated to achieve an unconfined compressive strength of 25 psi. For properly placed and compacted structural clay fill we recommend an allowable bearing capacity of 2,500 psf be assumed at the bottom tank foundation. The allowable bearing capacity includes a factor of safety of 2.0. It should be noted that the allowable bearing capacity as estimated in this report assumes adequate distance between the edge of the foundation and the side slopes of the existing adjacent aeration basins. We recommend that Fugro be contacted to verify the allowable bearing capacity provided in this report after the completion of final design.

We recommend the sludge be stabilized in accordance with the following procedures:

- Sludge/Soil-sediments to be stabilized should be similar to those found in the samples collected for the treatment/stabilization study. Should variations be found in the subsurface conditions at this site, we recommend that we be notified and authorized to evaluate what, if any, revisions should be made to our recommendations.
- Reagents used to treat/stabilize the in-situ soil-sediment materials at this site should be consistent with the reagent used in the laboratory program.
- Stabilization should extend through the entire depth and to the lateral bounds of the existing sludge material.
- Soil-Sediments should be thoroughly mixed with reagents to produce a uniform stabilized homogeneous layer with an unconfined compressive strength of at least 25 psi after 3 days of cure time. However the cure time may be revised during the

stabilization study. We calculate resulting shear strength of 1,800 psf for the stabilized sludge layer.

- We understand the excavation/existing basin will be evaluated using OSHA requirements for working in the pit or retained using temporary shoring or sheetpiling. Therefore, mixing may be performed using an approved single-pass or multiple-pass rotary speed mixer, or approved auger mixer. Please note that bucket mixing may not achieve the desired homogeneous product. In addition, care should be taken to achieve uniform treatment of the sludge along the walls of the excavation.
- Loads should not be transferred to the stabilized sludge until after the uniformity of the stabilized area is verified with a proofroll using a fully loaded dump truck or a heavy rubber-tired vehicle or heavy smooth drum roller (20-ton) and the consistency is confirmed with compressive strength testing. Proofrolling the stabilized sludge should comprise of at least five passes. Consecutive passes should be made perpendicular to each other. Areas of the stabilized sludge that are observed to be soft, wet, weak areas or in which pumping or significant deflections are observed should be re-treated to the depth, and in accordance with the stabilization recommendations provided herein.

In addition, conducting a test strip on site may yield information about actual construction and field-testing that is not available through only laboratory testing. We would be pleased to work with you to develop such a testing program.

Backfill Existing Basin

We understand the existing basin will be backfilled following the stabilization of sludge material, encountered at the bottom of the existing aeration basin. We recommend verification of the uniformity of stabilization and strength within the stabilized sludge material prior to backfill operations. Recommendations for backfilling the existing aeration basin are provided in the following sections.

We understand that the existing basin will be backfilled to bring the grade within the basin to the elevation of the existing surrounding grade at the project site. Based on our discussions with Shell, we understand that the backfill operations will consist of the following:

- Current plans include placement of about 12 feet of structural fill above the treated sludge material. Structural fill should be placed as per the recommendations provided in the construction considerations section of this report.
- We understand that a clay cap, with a minimum thickness of 4 feet will be placed above the structural fill layer. The properties of the clay cap were not available at the time of this report. However, the clay cap layer must meet the structural

requirements described herein and additionally have a permeability less than 10^{-7} cm/sec as required by the TCEQ-approved closure plan. Therefore, we understand current plans are to chemically stabilize the clay cap material.

- We understand that a protective cover layer with a minimum thickness of about 6-inches will be placed on top of the clay cap.

Structural Fill. We understand select fill options under consideration for site grade raise backfill include structural clay and course grained soil. In addition we understand that recycled soil may be used as backfill material. Once the source of recycled soil is identified, we recommend that the geotechnical properties of the recycled soil be verified by the geotechnical engineer of record through laboratory testing prior to use as backfill. Regardless of the soil selected as backfill, we recommend that we be retained to evaluate the backfill material selected for the project. However, recommendations for structural clay fill material and placement are provided in the *Construction Considerations* section of this report.

Clay Cap. We understand the clay cap will consist of a low permeable clay material. We understand that Portland Cement (PC) or a mixture of PC and lime fly-ash reagents are being considered to stabilize the cap material. Our recommendations for stabilizing clay using PC or a mixture of PC and lime fly-ash reagents are inclusive with the lime-stabilization recommendations provided in the Construction Considerations section of this report. Once the final clay cap material is selected, we recommend that the shrink-swell potential, strength, strain and permeability properties of the material be verified with adequate laboratory testing prior to its use.

Protective Cover. We understand that a 6-inch thick protective cover layer will be placed over the clay cap. We anticipate that the protective cover materials will consist of flowable fill, granular fill, or structural clay fill. Recommendations for each of these materials are presented in the *Fill Material and Placement* section of this report.

Backfill Placement Recommendations. Backfill of the existing basin can be achieved by using structural fill. As discussed, structural clay fill may be used to backfill the existing basin. We recommend that structural clay fill be placed in 6- to 8-inch thick loose lifts to backfill the entire basin. We recommend that the structural clay fill be compacted to at least 98 percent of maximum dry density measured in accordance with standard effort described in ASTM D698 (Standard Proctor). Each lift should be tested for compaction and proofrolled as described herein prior to placing subsequent lifts. For additional recommendations regarding placement and compaction, refer to *Fill Material and Placement Section* of this report.

Hand compaction or reduced lift thickness may be required near the existing basin slopes. We recommend using hand-operated compaction equipment and 4-inch thick loose lifts in confined areas. Reduced lift thickness may also be required if the recommended dry density cannot be achieved for the recommended entire depth for each lift.

A fully loaded dump truck or any other heavy rubber-tired vehicle or heavy smooth drum roller (20-ton) should be used to proofroll the backfill after each lift. At least three passes should be made during proofrolling. Consecutive passes should be made perpendicular to each other, and the perimeter should be proofrolled to the furthest extent possible. We recommend that a Geotechnical Engineer or a qualified representative be present on site to observe the exposed subgrade prior to placement of each lift.

As noted above, we recommend the Geotechnical Engineer-of-Record or their qualified representative be onsite during the construction process, in particular during stabilization activities and during placement and compaction of fill to confirm that the soil conditions are consistent with those recommended. We recommend density checks are performed through the entire lift thickness for each lift. We also recommend that the Geotechnical Engineer-of-Record evaluate laboratory testing to confirm the suitability of proposed fill materials prior to their use. The Geotechnical Engineer-of-Record or their qualified representative should also be onsite to document fill placement and compaction activities.

Moisture Conditioning. It is important to note that maintaining a constant moisture content within the fill soils both pre- and post-construction is important to the successful performance of the proposed mat foundation.

We recommend moisture conditioning the newly placed backfill. Moisture conditioning should be performed to bring the in-situ moisture content of the backfill to within 2 to 3 percentage points higher than the plastic limit of the subgrade soils. Moisture conditioning can be accomplished by controlled sprinkling of water on the exposed cohesive soils and compacting to at least 98 percent of the maximum dry density, as determined by ASTM D698 (Standard Proctor) prior to placement of additional fill for basin backfill. It should be noted that moisture conditioning might help reduce, but not eliminate, soil movements.

Strength Verification. We recommend that, prior to applying loads, the strength of the stabilized sludge and the backfill material be evaluated using soil borings or CPT's. The stabilized sludge material should achieve a minimum unconfined compressive strength of at least 25 psi and the backfill materials should achieve a minimum shear strength of at least 1,000 psf. Soil borings or CPT's should be performed at a frequency of at least 1 every 10,000 square feet. Samples or data should be obtained continuously through the backfill material and the stabilized sludge. Upon completion of drilling and sampling or CPT sounding the holes should be backfilled with cement bentonite grout.

Impact on Future Construction. We recommend the boundaries of the stabilized zones, including the depth of stabilization, should be surveyed. These areas should be superimposed on the proposed development plans to evaluate the potential for encountering stabilized materials during construction. Stabilized soils pose challenges during future excavation, drilling, sampling, and foundations installation activities. We recommend special consideration should be given to excavation methods required to penetrate stabilized zones at this site.

SET Aeration Basin Foundation Recommendations

A foundation system should satisfy two basic and independent design criteria. First, the bearing pressure transmitted to the foundation soils should not exceed the net allowable soil bearing capacity, which includes an appropriate safety factor. The allowable net bearing pressure for shallow foundations is a function of, among other items, the bearing surface, the strength of the foundation soils, the location of the foundation, the shape of the foundation, and the recommended factor of safety. Second, settlements during the operating life should not be of a magnitude that will cause structural damage to the structures or their utility connections. Settlements are a function of, among other things, the underlying soil conditions, the foundation size and shape, and the sustained applied foundation pressures of the foundation elements.

We understand that the current plans are to support the new aeration basin tank on a shallow mat foundation, placed directly above the basin backfill material. However, we understand that the anoxic tank will be placed on existing natural cohesive soils. Based on the information obtained during our field exploration, we consider that the proposed structure can be supported on a shallow mat foundation. Therefore, geotechnical recommendations for shallow mat foundations are provided in the *Shallow Foundations* Section of this report.

Shallow Foundations

The following subsections provide our recommendations for the shallow mat foundation, including foundation depth, allowable bearing pressure, resistance to uplift loads, resistance to overturning loads, coefficient of subgrade reaction, resistance to lateral loads, estimated settlement and additional considerations.

Foundation Depth. Based on the information provided, we understand current plans are to place the mat foundation for the proposed new aeration basin tank should directly on the newly placed protective cover layer and the anoxic tank on natural stiff clay soils. Information relating to site preparation, backfill operations and strength verification is presented in the *Backfill Existing Basin* Section of this report.

Allowable Net Bearing Pressure. The shallow mat foundation should be proportioned so the maximum contact pressure under dead, live, and transient loads, including wind loads, does not exceed the allowable net bearing pressure of the foundation soils. The allowable net bearing pressures, presented herein, include a factor of safety of at least 2 for total loading conditions, and at least 1.5 for transient loading conditions. Total loading conditions as described in this report refer to the combination of total dead and live loads. It should be noted that some regulations recommend higher factor of safety be used for tanks. If a higher factor of safety is required we recommend the allowable net bearing pressures be calculated using an ultimate bearing capacity of 5,000 psf. Transient loading conditions refer to the combination of dead, live, and infrequent transient, *i.e.* wind, loads.

Allowable Net Bearing Pressure for Shallow Foundations

Foundation Type	Foundation Depth	Loading Conditions [1]	
		Total (F.S. = 2)[2]	Transient (F.S. = 1.5)
Mat Foundation	Final Grade	2,500 psf	3,300 psf

Notes:
(1) Refer to report text for additional information relating to loading conditions.
(2) F.S. refers to factor of safety.

Foundations should be proportioned so that the maximum contact pressure under various load combinations does not exceed the allowable net bearing pressures given above. Bearing pressure, as used in this report, is defined on Plate 7. To calculate values of W_e, W_s, and W_f from Plate 7, use unit weights of 60 pcf for soil and 90 pcf for concrete.

Based on the subsurface information obtained from the soil borings drilled outside the project boundaries, fill material was encountered to depths ranging from about 2 to 10 feet below existing grade. We do not recommend placing the anoxic tank on existing fill material. Therefore, we recommend the depth of fill material is confirmed at the location of the anoxic tank, and that we are contacted to review and revise our recommendations if fill material greater than 2 feet deep is observed within the footprint of the anoxic tank foundation.

Resistance to Uplift Loads. The uplift resistance of shallow foundations will be limited by the weight of the foundation and any soil directly above the foundations. For design purposes, the ultimate uplift resistance should be based on effective unit weights of 60 pcf for soil and 90 pcf, and total unit weights of 120 pcf for soil and 150 pcf for concrete. We recommend that the ultimate weight of concrete and soil be reduced by a factor of 1.2 to compute the allowable uplift resistance.

Resistance to Overturning Loads. For shallow foundations subjected to overturning moments, the design should consider a trapezoidal distribution of contact pressure between the base of the foundation and the foundation soil such that full soil contact and positive pressure is maintained under the foundation. The maximum contact pressure should not exceed the appropriate allowable net bearing pressure for the foundation soils as discussed earlier in this section.

Coefficient of Subgrade Reaction. Often, the design of mat foundation involves the concentration of various magnitudes of point loads across the mat foundation. Typical analyses require a coefficient of subgrade reaction, which is defined as the ratio between the pressure at any given point on the surface of contact and the deformation produced by the load application at that point. Input dimensions of the value of the coefficient of subgrade reaction for specific computer programs should be reviewed. Some programs require a subgrade value for a 1-foot by 1-foot plate while others require the subgrade value for the actual foundation size.

Based on site specific soil data and published correlations for similar materials, the coefficient of subgrade reaction for a 1-foot by 1-foot plate can be taken as 60 pci for the newly placed fill as described herein. These values can be used for both vertical and horizontal coefficients. Terzaghi[1] also provides equations for adjusting the coefficient of subgrade reaction for a 1-foot plate to actual foundation dimensions.

Resistance to Lateral Loads. Resistance of the shallow mat foundation to lateral loads can be provided by adhesion acting on the base of the foundation. For design purposes, the resistance due to adhesion and passive soil pressure can be assumed to be developed simultaneously.

For concrete foundations poured in good contact with stiff, cohesive fill soils as described herein, the allowable base adhesion may be taken as 200 psf. Passive resistance should be neglected unless area paving or some other impervious barrier is provided. An allowable net passive pressure of 700 psf should be used for firm to stiff, cohesive fill soils as described herein. For the proposed soil conditions, we believe these allowable values will provide a factor of safety of at least 2 with respect to the ultimate values.

Estimated SET Aeration Basin Tank Settlement

The new aeration basin tank will experience settlements due to the newly applied load, the self-weight of the fill material and the consolidation of the underlying clay layers.

As mentioned earlier, additional fill will be used to backfill the existing basin. Settlements are expected to occur within the fill used to backfill the basin and also in the underlying foundation soils. Fill material is expected to settle about 1 to 2 percent of its total height. The settlement of final site grade will vary depending on the type of fill, the thickness of the fill, and the compaction used to place the material. However, we do not anticipate that the settlements within the underlying clay soils due to the net increase in load from the backfill to be significant. Any settlement due to the net increase in load from the backfill material is expected to occur during construction, prior to placing the SET Aeration Basin Tank in service.

Based on the soil index properties and consolidation testing results, and our previous experience in this area, we estimate the total settlement for the SET Aeration Basin to be on the order of 8 to 12 inches. The total settlements include about 6 to 8 inches in the underlying clay layers below the aeration basin, and about 2 to 4 inches within the newly placed fill. Given the extent of loading, edge settlements may be very close to center settlements. We anticipate the edge settlements to be on the order of 4 to 6 inches. It should be noted that the edge settlements along the north-south and east-west direction may be different, particularly between the areas where the thickness of fill material under the foundation footprint varies significantly. In addition, the settlement along the SET Aeration Basin walls may not be uniform and will depend on the variation in the fill thickness. We also expect that approximately 30 to 40 percent of the anticipated consolidation

[1] Terzaghi, Karl (1955), "Evaluation of Coefficients of Subgrade Reaction", *Geotechnique*, London, Vol 5, No. 4, pp. 297-326.

settlement may occur during the hydrotest. For this reason, it is recommended that final piping connections be made after the hydrotest. The remaining consolidation settlement is expected to occur during the design life of the Aeration Basin Tank depending on the loading frequency and duration of loads. For the anoxic tank we estimate the total settlements to be on the order of about 4 to 6 inches, however, these estimates will be revised based on the information obtained from the soil borings scheduled at a later date.

Furthermore, based on the configuration of the existing basin and the new SET Aeration Basin Tank footprint, the new basin would be placed on previously placed fill and on new fill. We anticipate higher settlements within the Basin in the areas supported on new fill as compared to those supported on previously placed fill or native soil. Our settlement analysis assumes the fill thickness is uniform, however, we understand the actual fill thickness will vary, and therefore, additional subsurface data will be required to estimate the settlement for the new SET Aeration Basin. For this reason, the settlement values presented herein may be revised once new subsurface data is made available.

Additionally, the amount of actual settlement will depend on the uniformity and the final strength and properties of the stabilized sludge material, the placement and compaction of the backfill material, and the clay cap, etc. If the calculated settlements are in excess of the tolerable settlements for the proposed SET Aeration Basin, we recommend that a detailed settlement analyses be performed to evaluate ground improvement options to reduce the settlements. Ground improvement techniques may include placement of surcharge, prior to construction to accelerate the settlement of the proposed tank. Oftentimes, surcharge loading is used in combination with wick drains to accelerate the consolidation settlements. Settlement plates may be installed to monitor the short-term and long-term settlements due to backfill, grade raise and tank loading. We will be pleased to evaluate the potential use of ground improvement techniques to reduce the calculated settlements discussed in this report.

The consolidation settlement discussed above assumes the foundation acts as an isolated foundation with clear spacing from adjacent foundations equal to or greater than the width of the largest foundation. The settlement is also based on static loading conditions.

Additional Considerations. The locations, and loads of the proposed new basin need to consider the impact they will have on the existing adjacent basin slopes and foundations and underground structures, *i.e.* existing underground pipelines. Specific data regarding the existing adjacent basins, potential existing foundations and/or underground structures was not available at the time of this report. Additionally, a geophysical report would present possible geophysical anomalies, existing foundations and/or underground structures, including those potentially located along the side slopes of the existing basins. We recommend that the proposed loaded areas do not impose additional stresses to the adjacent basin side slopes/walls, potential existing underground foundations and do not exceed the structural loading capacities of potential underground structures.

Loaded areas should be located at a distance such that the existing foundations and underground structures are outside the loaded areas' influence. This influence zone is typically defined by a line extending downward at 45 degrees from the outside edges of the loaded areas and out a horizontal distance equal to the width of the loaded areas. Care should be taken that the proposed loaded areas do not impose additional stresses to the adjacent basin slopes, existing foundations, and do not exceed the structural loading capacities of underground structures.

We understand the existing east and west pond basins will be taken out of service, backfilled and capped at some point in the future. However, the new basin will be constructed prior to backfill of the adjacent basins. As such, the additional surcharge loads applied by the new above-grade basin may impose stress on the existing nearby below-grade basin side-slopes/walls and thus influence the performance of the proposed new above-grade basin. Information regarding the slope of the existing adjacent basin sides and their proximity to the proposed new basin was not provided at the time of this report, however, we recommend the stability of the existing slopes be evaluated due to the proposed new loading from the new aeration basin. Additionally, existing foundations that will remain in service within the vicinity of the proposed new SET Aeration Basin should be evaluated for additional settlements and potential downdrag loads if supported on deep foundations consisting of piles or drilled shafts.

Tank Hydrotesting Recommendations

The proposed aeration basin tank should be tested before being placed in service according to current API Specifications[2]. We recommend a leak detection system is installed in the new above ground SET aeration basin. Hydrotesting generally consists of filling the tank with water after construction, under controlled conditions to:

1. Check the competency of the tank walls,
2. Verify the ability of the foundation materials to carry the loads imposed by the tank and contents, and
3. Reduce the amount of immediate settlement that the tank will experience after it is placed in service.

We recommend implementation of a controlled, stage-loaded hydrotest program accompanied by a movement-monitoring program. The following paragraphs discuss our recommendations for hydrotesting the aeration basin storage tank.

Survey Control. We recommend that a series of reference points be established around the tank walls in order to monitor the movements of the tank during hydrotesting. API recommends at least 8 reference points be established around the perimeter of the tank but with spacing no more than

[2] *API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction*, American Petroleum Institute, December 2001.

30 feet apart. Based on this API recommendation, we suggest 37 reference points along the perimeter of the tank.

Elevations of these points should be obtained prior to, during, and after hydrotesting. Elevation readings should be taken to the nearest one-hundredth (0.01) of a foot. Readings should be referenced to a benchmark well away from the zone of influence of each tank (*i.e.* at least one tank diameter from the tank hydrotested). In addition, a control should be established on each tank bottom within the tank to measure movement before and after hydrotesting.

Loading. We suggest that, initially, water for the hydrotest be added to the tank to reach one-half of the full tank height. This water level should be maintained until settlement observations indicate the rate of settlement has decreased significantly (at least one day). After any settlement observations have stabilized, the tank should then be filled to the full mark. Each level should be maintained until settlement readings are smaller than a predetermined range. If excessive settlement rates are observed, smaller loading increments may be required.

Data Evaluation. Settlement observations should be reviewed as the hydrotesting proceeds to assess total settlement, differential settlement, local slope, tank tilt, and out-of-plane distortion for the tank. The project engineer and/or the tank design engineer should establish criteria for acceptable settlement prior to hydrotesting. If settlements start approaching unacceptable limits, tank filling should be halted and not resumed until the situation is reviewed and evaluated by the project engineer and/or tank design engineer. Settlement observations should be obtained frequently to develop the data necessary to assess tank performance, preferably once daily. The Geotechnical Engineer-of-Record should be given the opportunity to review and evaluate the settlement data during hydrotesting of the completed tank for foundation performance assessment.

Construction Considerations

The following subsections provide our construction considerations for abandonment of existing foundations and concrete apron, shallow open-cut excavations, groundwater considerations, structural clay fill, lime stabilization, flowable fill, and construction monitoring.

Abandonment of Existing Foundations and a Portion of the Concrete Apron. Buried and surficial foundation elements and non-reinforced concrete features of unknown depth and size, typical of an existing aeration basin may be encountered at present site. We recommend the existing foundations and concrete apron be excavated before stabilizing the sludge or placing new fill for the proposed new aeration tank basin. Failure to properly remove the referenced elements of the existing structures, or failure to properly evaluate the underlying materials, may have considerable detrimental effect on the performance of the foundation soils at this site. Existing features should be properly removed, on a case-by-case basis, prior to the stabilization of sludge or placement of fill.

Shallow footings should be completely removed and the excavation should be backfilled with properly placed and compacted structural clay fill. If drilled footings, timber piles or other deep

foundations are observed, we recommend that the pile/shaft should be cut off at least 2 feet below final grade or below the proposed shallow foundation. The remainder of the foundation elements should be left in place. Portions of the foundation elements left in place should be surveyed. The existing foundations should be superimposed on the proposed development plans to evaluate the potential for obstructions to new construction.

All utilities and associated bedding material that are planned to be abandoned should be completely removed from within the proposed foundations area. As an alternative, the existing utilities may be abandoned in place but should be properly pressure grouted to completely fill the utility. The excavations resulting from foundations and utility removal should be backfilled with properly placed and compacted structural clay fill or flowable fill.

Although not observed during our field activities, the potential exists that other types of buried structures could exist on these sites. These buried structures will need to be addressed on an individual basis if encountered during construction.

Disturbance from demolition activities could reduce the load carrying capabilities of the onsite foundation soils and increase settlement. The Geotechnical Engineer-of-Record, or their qualified representative, should observe the final exposed subgrade, and should also be onsite during abandonment and demolition. Foundations within the proposed embedment depths should be completely removed, and their excavations backfilled with flowable fill or lean concrete

Shallow Open-Cut Excavations. Excavation safety systems should be in accordance with current federal Occupational Safety and Health Administration (OSHA) standards for excavations. The OSHA requirements do not generally require shallow excavations to depths of 4 feet or less to be sloped back or braced. However, if sloughing and caving is experienced, we recommend that the slopes be cut back to a stable slope. Excavations deeper than 4 feet are required to be sloped back or braced, according to OSHA regulations.

We classify the surficial natural soils at the site as Type C soils. Excavations deeper than about 4 feet should be either braced or sloped back no steeper than 1.5-horiozontal to 1-vertical in Type C soils. Flatter slopes or bracing should be used if sloughing or raveling is observed. We also recommend that positive surface drainage away from all excavations should be established to prevent surface runoff from either flooding excavations or ponding around completed foundations.

Any seepage into excavations is expected to be minor. However, the seepage will be weather dependent, thus seepage levels may significantly increase after rain events. Pumps and sumps should be available onsite to handle the expected seepage.

Groundwater Considerations. A depth-to-water of about 11 feet below existing site grade was encountered in our soil Boring B-3 drilled for this project. Although, short-term depth-to-water observations were not made in our Borings B-1 or B-2, groundwater levels will vary seasonally and could be as high as the ground surface during extended periods of wet weather. Additionally, Patrick Bayou, adjacent to the project site could flood and raise the water level above existing site grade. However, we understand the existing basin is elevated above surrounding grade, earthen

lined, and the primary water related concerns will be associated with rain and potential runoff water collected within the basin. The basin should be free of ponded water during construction.

Potential contractors should be prepared to dewater within the basin during construction. We recommend that the design of both temporary and permanent dewatering systems consider potential water infiltrating the existing open basin during construction. We anticipate that seepage may be handed using a proper dewatering system most of the water should be able to be handled using sumps and pumps. Additionally, we recommend that the groundwater levels be monitored before and during construction and the contractor be informed of the groundwater and potential for water to collect within the basin so that he is prepared to control water. If the degree of water collected within the basin is excessive, submersible centrifugal pumps or similar may be required. The Geotechnical Engineer-of-Record should be consulted if excessive seepage is noted within the basin.

Fill Material and Placement. The following sub-sections discuss our recommendations for fill materials, including placement and compaction, to be used for this project.

Structural Clay Fill. We recommend using low plasticity cohesive soils for structural clay fill. Structural clay fill can be used as backfill against the foundation. Structural clay fill should have a liquid limit of less than 40, and a plasticity index between 10 and 20. We do not recommend mixing high plasticity clay with sand to achieve the index properties of structural clay fill. Structural clay fill should be free of deleterious matter and should have an effective clod diameter less than 3 inches. Structural clay fill should be placed in 6- to 8-inch-thick loose lifts and uniformly compacted to 98 percent of the maximum dry density at a moisture content of 1 percent “dry” to 3 percent “wet” of optimum as determined by ASTM D698. Structural clay fill should be compacted by a sheepsfoot or padfoot type roller, or by alternative methods that provide a “kneading” compaction equivalent to the sheepsfoot or padfoot roller. We recommend using hand-operated compaction equipment and 4-inch-thick loose lifts adjacent to foundations and in confined areas.

If wet weather or extended dry periods deteriorate the exposed surface whereby a good bond cannot be formed between successive lifts, the earthwork Contractor should prepare the surface as necessary. This preparation may include removing or scarifying the top couple of inches of the underlying material before placing the next lift.

Granular Fill. Granular Fill can consist of crushed stone or sand with a maximum particle size of 4 inches and no more than 12 percent passing the No. 200 sieve. The material shall consist of sound particles, which are angular and not rounded. Numerous gradations will be applicable, however the material should be well graded and have sufficient fines to fill voids between larger particles. The gradation of the selected granular fill should be approved by the Geotechnical Engineer. Granular fill should be placed in lifts no greater than 10-inchs, and at a moisture content within 2 percent of optimum moisture content, as determined by ASTM D698. Granular fill should be compacted to at least 98 percent of the maximum dry density, as determined by ASTM D698 using a vibratory roller.

Lime or (Portland Cement) Stabilization. Lime (or PC) -stabilization may be used to modify potential clay cap materials to achieve strength requirements of low-permeable clays. Laboratory tests should be conducted at the time of construction to determine the optimum lime (or PC) content. The optimum lime (or PC) content is the amount of lime (or PC) necessary to achieve a pH of 12.4 (which represents lime fixation), while trying to achieve a plasticity (PI) of less than 20. Organics, chemical fertilizers, and some clay minerals can modify the amount of lime necessary for lime fixation. We recommend that a *'Treatability Study'* include a lime series test sequence using the specific soil samples and proposed lime (or PC) additive. In either case, the treatment study should consider the effects potential water seepage might have on the stabilized clay cap material.

Lime-stabilization should be done in accordance with the Lime Association recommendations. Key items for lime-stabilizing the clay soils include placing the proper percentage of lime, thoroughly mixing the lime into the clay soils, bringing the stabilized soil to the proper moisture content, allowing the stabilized soil to cure for at least 48 hours, adjusting the moisture content from 1 percent "dry" to 3 percent "wet" of optimum moisture content, pulverizing the soils again until the lime is thoroughly blended, then placing the stabilized soil in accordance with the recommendations discussed herein. Accelerators, such as Basic ST-Alkali Free may be considered to reduce reaction time between the clay and the reagent.

The moisture-density relationship should be established based on a material sample obtained after stabilization with lime. Lime stabilized clay should be placed in 6- to 8-inch-thick loose lifts and uniformly compacted to 98 percent of the maximum dry density at a moisture content of 1 percent "dry" to 3 percent "wet" of optimum as determined by ASTM D698. A combination of sheepsfoot or padfoot rollers and pneumatic rollers is recommended to compact the lime-stabilized clay fill. We recommend using hand-operated compaction equipment and 4-inch-thick loose lifts adjacent to foundations and in confined areas.

Flowable Fill. In general, sandy soils containing less than about 30 percent fines are suitable for use as soil-cement slurry. Soil-cement slurry should meet the following recommendations.

- Sandy soils used for soil-cement slurry contain no more than 30 percent fines.
- The soils should be free of deleterious materials and have a plasticity of less than six.
- The soil and cement should be thoroughly mixed.
- Proportioning of the sandy soil and cement is sufficient to produce a minimum unconfined compressive strength of 60 psi at 48 hours while remaining workable for placement. The 7-day unconfined compressive strength should be at least 100 psi.
- The soil-cement slurry is not placed when ambient air temperature is below 40 degrees Fahrenheit.
- An "elephant trunk" vibrator should be used to consolidate and remove air voids from the mixture after initial placement.

- The consistency of the flowable fill mix should be confirmed prior to placement. The mix consistency should be such that when the mix is placed in a 3-inch diameter, 6-inch tall cylinder and the cylinder is immediately pulled up, the mix should produce at least an 8-inch diameter circular spread with no segregation.
- Construction activities over the soil-cement slurry should not be allowed until after initial set (4 to 6 hours) has been achieved for the soil-cement slurry.

Construction Monitoring. We strongly recommend that a Geotechnical Engineer, or their qualified representative, be present onsite during construction to observe and monitor construction activities. Construction monitoring performed by qualified personnel independent of the Contractor is recommended because the performance of foundations constructed during this project will be directly related to the Contractor's adherence to the recommendations presented in this report and to the specifications prepared by the Designer. Additionally, unanticipated subsurface conditions may be encountered during construction. Qualified geotechnical personnel observing construction onsite can monitor construction activities and may aid in recognizing unanticipated subsurface conditions and reconciling these conditions with design recommendations.

Construction monitoring should be performed during site preparation, and the installation of foundations to verify the suitability of the foundation soils, and the placement of foundation concrete. Due to our familiarity with the project in general and the geotechnical recommendations in particular, we recommend that we be retained during site preparation, foundation installation, and construction phases to provide material testing and construction surveillance to: (1) observe compliance with the design concepts, specifications, and recommendations; (2) observe subsurface conditions during construction; and (3) perform quality control tests.

* * *

Appendix B – Construction Quality Control Plan

RPS

Cielo Center, 1250 South Capital of Texas Highway, Building Three, Suite 200, Austin, Texas 78746, USA
T +1 512 347 7588 F +1 512 347 8243 W www.rpsgroup.com

Construction Quality Control Plan
Middle South Effluent Treater Basin
Final Closure



Shell Chemical LP
Deer Park Facility

June 2013

Table of Contents

List of Sections

Section 1 Introduction....1
1.1 General....1
1.2 Cover System Construction Process....2

Section 2 Specified Testing Procedures....4

Section 3 In-Situ Sludge and Clay Stabilization....5
3.1 Treatability Study....5
3.2 Stabilization Procedures....6

Section 4 Materials Requirements....8
4.1 Stabilized Recycle Sludge....8
4.2 Structural Fill....8
4.3 Clay Cap....8
4.4 Protective Layer....9

Section 5 Materials Pre-Construction Testing....10
5.1 Stabilized Recycle Sludge....10
5.2 Structural Fill....10
5.3 Clay Cap....11
5.4 Protective Layer....11

Section 6 Construction....12
6.1 General....12
6.2 Stabilized Recycle Sludge....12
6.3 Structural Fill....13
6.4 Clay Cap....14
6.5 Protective Layer....15

Section 7 Construction QA/QC Testing and Observation....16
7.1 Quality Control/Quality Assurance Responsibilities....16
7.2 Construction Testing....16
7.2.1 Stabilized Recycle Sludge....17
7.2.2 Structural Fill....17
7.2.3 Clay Cap....18
7.2.4 Protective Layer....18
7.3 Construction Monitoring....19

Section 8 Surveying....20

Section 9 Documentation Presentation....21

List of Appendices

Appendix A Re-Use Criteria

Section 1
Introduction

1.1 General

The Shell Chemical LP (Shell) Deer Park facility has three process wastewater aeration basins designated as the East, West and Middle South Effluent Treater (SET) Basins. The basins are hazardous waste surface impoundments that treat wastewater by using a conventional activated sludge technology. Shell plans to close the surface impoundments and replace them with a tank-based treatment system that will be exempt from RCRA permitting under the "wastewater treatment unit" exclusion of 40 CFR §264.1(g)(6). The Middle SET Basin (Basin) will be closed first to accommodate the construction of a concrete tank system (Aeration Tank) that will replace the basins. The concrete tank will be constructed within the footprint of the Basin following completion of closure activities for the Basin. The closure of the East and West SET Basins will be completed following start-up of full-scale wastewater treatment operations at the tank system.

This Construction Quality Control (CQC) Plan has been prepared for construction and Quality Assurance/Quality Control (QA/QC) personnel for use in installation of the Basin's closure/cover system (cover system). The CQC Plan identifies general construction procedures, and Quality Assurance/Quality Control (QA/QC) testing and documentation.

The soil components of the cover system, from bottom to top, are:

- Stabilized Recycle Sludge, stabilized in-place to have an unconfined compressive strength of at least 25 psi;
- Structural Fill to the approximate existing wastewater elevation in the Basin;
- Clay Cap, 48-inch (minimum) thick with a permeability of no more than 1 x 10^{-7} cm/sec;
- Protective layer, 6- inch (minimum) thick; and
- After construction of the Aeration Tank, a low-silt, erosion-resistant soil or other approved material will be placed around the Aeration Tank and over any exposed portions of the Protective Layer. This material will be supplied and placed by the contractor responsible for construction of the Aeration Tank.

QA/QC testing will be the responsibility of the Quality Control Professional (QCP). The QCP will be an engineer or engineering geologist experienced in QA/QC testing. The QCP will directly

supervise the QA/QC program. The QCP will be a representative of the owner. Actual QA/QC testing and documentation may be performed by a qualified technician designated by the QCP.

Material requirements for installation of the soil components of the cover system are also specified in this CQC Plan. Material requirements, specific test requirements and testing frequencies presented in this CQC Plan were developed based on accepted industry practice and TCEQ and EPA guidance for hazardous waste landfill cover systems.

1.2 Cover System Construction Process

The following steps will be conducted to complete the closure of the Basin:

- Wastewater inflows to the Basin will cease by diverting the wastewater influent flow to both of the adjacent East and West SET Basins, which will first be outfitted with additional aeration capacity to handle the additional organic loading in accordance with the facility's TPDES permit.

- The wastewater and suspended pumpable solids in the Basin will be pumped to one or both of the adjacent other basins.

- Basin aerators and associated equipment will be de-energized. Following removal of the overlying wastewater, the aerators and associated equipment, structural steel and concrete sidewalls will be decontaminated with a high-pressure wash in accordance with the land-disposal restrictions (LDR) treatment standards for debris (40 CFR §268.45).

- The decontaminated aerators and associated equipment, structural steel, concrete etc. will be demolished and removed as the stabilization proceeds throughout the Basin. This material will be either re-used at the facility or managed as non-hazardous waste that will be properly classified and disposed.

  On a case by case basis, the equipment foundations may remain in place with the approval of the project's geotechnical engineer to assure that sludge stabilization (see below) can be effectively accomplished adjacent to the foundations,

- The recycle sludge remaining in the bottom of the Basin will be stabilized with fly ash or a similar dewatering agent/chemical reagent and bulking agent (i.e., clay) as needed to provide a minimum unconfined compressive strength of 25 pounds per square inch (psi), which will be sufficient to provide the necessary structural support remaining components of the cover system and Aeration Tank.

- The Basin will be backfilled with structural fill to the base of the overlying clay cap. The structural fill will have a minimum shear strength of 1,000 psf and may be comprised of recycled soils that meet the re-use criteria provided in Appendix A. The structural fill will be graded to provide a uniform, level surface for construction of a clay cap.

- A 4-foot thick compacted clay cap will be placed over the structural fill. The cap will be constructed of imported clay soils stabilized with cement, fly ash, and/or other stabilizing

reagents. The in-place compacted clay cap will have a minimum shear strength of 1,000 psf and have a permeability of less than 1 x 10^{-7} cm/sec.

- The clay cap will be covered with a minimum of 6 inches of protective cover soil to protect the cap prior to and during construction of the Aeration Tank.

- After construction of the Aeration Tank foundation, exposed portions of protective layer outside the footprint of the replacement tank will be covered with a low-silt, erosion-resistant soil or other material sloped at a 3% to 5% grade away from the Aeration Tank. This material will be supplied and placed by the contractor responsible for construction of the Aeration Tank.

Section 2
Specified Testing Procedures

The following tests will be performed in accordance with the designated testing standard when specified for the materials used in closure of the Basin. Testing will also be performed in accordance with other applicable standards not necessarily specific to a specified test (e.g. ASTM D1452, D1586, D1587, etc.) and that, accordingly, are not listed below.

Specified Test	Test Standard
Coefficient of Permeability	ASTM D5084 flexible wall parameter method; or Corps of Engineers EM 1110-2-1906, App VII falling head method
Sieve Analysis (percent passing the on-inch, No. 40 and No. 200 sieves)	ASTM D422 (percent passing the on-inch and No. 40 sieves); and ASTM D1140 (percent passing the No. 200 sieve)
Atterberg Limits (PI and LL)	ASTM D4318
Standard Proctor Moisture-Density Relationship	ASTM D698
Moisture Content (Laboratory)	ASTM D2216
In-Place Density	ASTM D6938 (nuclear gauge); or ASTM D2937 (drive cylinder); or ASTM D1556 (sand cone)
In-Place Moisture Content	ASTM D6938 (nuclear gauge); or ASTM D2216 (oven); ASTM D4643 (microwave); or ASTM D4959 (direct heating)
Unconfined Compressive Strength Shear Strength	ASTM D2166
Compressive Strength of Concrete Cylinders	ASTM C39
Soil Classification	ASTM D2487

Section 3
In-Situ Sludge and Clay Stabilization

3.1 Treatability Study

A treatability study will be performed by the Basin closure contractor prior to diverting wastewater inflows to an adjacent basin(s) to determine acceptable reagents for stabilizing the Basin recycle sludge and clay used for clay cap construction. Flyash from coal-fired power plants, kiln dust from cement kilns, lime, Portland cement and/or other reagents may be evaluated for sludge stabilization. Lime or Portland cement alone with or without lime fly-ash, or a combination of lime and Portland cement with or without lime fly-ash may be evaluated for clay stabilization. The nearest available sources of those materials will be identified and costs estimated for purchase and delivery of the materials. Samples of reagents deemed to be potentially cost-effective will be obtained from the suppliers along with representative samples of the Basin sludge and clay from any potential borrow source(s) for the clay cap.

Sludge and clay samples will be mixed with varying proportions of each reagent or reagent mixture (and for the clay, varying proportions of water) in order to evaluate the most effective reagent(s) that would, in a timely and efficient manner, react with and stabilize the sludge or soil matrices. The samples will be mixed and placed in 2"x4" or 3"x6" plastic cylinders, or similar containers, and allowed to cure (i.e., hydrate and harden) for up to 56 days. It is currently anticipated that testing of a minimum of three reagents or reagent mixtures at three admixture percentages each will be sufficient to determine the best stabilization recipe for sludge stabilization. More recipes may be needed for determining the best stabilization recipe for clay stabilization. The best recipes will be the ones that require the least cost/cubic yard of reagent needed to achieve an unconfined compressive strength of at least 25 psi for the stabilized recycle sludge and a shear strength of at least 1,000 psf and a permeability of no more than 1×10^{-7} cm/sec for the stabilized clay cap. Unconfined compression tests will be done on selected solidified recipe sample of the stabilized recycle sludge to determine if they meet the 25 psi requirement. Unconfined compression tests and permeability tests will be done on selected solidified recipe samples of the stabilized clay to determine if they meet the 1,000 psf and 1×10^{-7} cm/sec requirements. Pre-construction tests shall be done on the recipe samples of the stabilized clay as specified in Section 5.3.

3.2 Stabilization Procedures

Periods of high winds can occur in the project area and reagents could easily become airborne and create nuisance issues for downwind receptors if they are not handled correctly. Following are two options for effectively introducing reagent to the recycle sludge or clay cap materials in high-wind environments.

If a granular reagent such as pebble quicklime or a granular bedash is used, these materials can be introduced and mixed into the Basin sludge utilizing a standard bucket on a long-reach (e.g., 60-ft boom, etc.) excavator with minimal nuisance dust generation during moderately windy conditions. To initiate recycle sludge stabilization in the Basin, the excavator would likely start off working from the perimeter of the Basin to start the stabilization process, and then move down to work on top of the stabilized (solidified) sludge. The long-reach excavator may be complemented with a low ground-pressure bulldozer working in the Basin to facilitate movement of unstabilized and stabilized recycle sludge toward and away from the excavator.

If a more powder-like reagent such as flyash or Portland cement is used, this material will be delivered in pneumatic tanker trucks, which would be parked adjacent to the Basin. For sludge stabilization, flyash or cement could be pneumatically pumped (pumping using pressurized air) via high-pressure hoses from the tanker trucks through an ashing filter or to an excavator injector attachment designed especially for the purpose of mixing reagents with high-moisture solids. Injectors or filters of the type being proposed would introduce the reagent directly into the sludge without exposing the reagent to the wind. The injectors accomplish this via delivery ports at the end of multiple heavy-duty steel “fingers” that have the same pivoting motion as a bucket attachment at the end of an excavator boom. The ashing units accomplish this by seating the skirt of the unit into the sludge. With an injector or filter sludge-stabilization equipment setup, similar to above, the excavator might initially work from the perimeter of the Basin, stabilizing material out to its maximum reach in a strip. Once a strip along the perimeter is stabilized, the excavator would move out onto the solidified sludge and work in successive strips into and across the Basin.

For biosolids stabilization, it may be also necessary to introduce a “body feed” to thicken the sludge. Acceptable materials include clay or select “structural” fill. For clay stabilization, and as an alternate method for sludge stabilization, emissions control of a powder-like reagent delivered pneumatically could be accomplished through the use of a sprinkler/misting system that would wet discharged reagent and its emissions at the point of discharge and when being

mixing with the clay. For clay stabilization, the contractor also has the option of stabilizing the clay at the borrow site and then transporting the uncured mixture to the Basin for placement and compaction.

Reagent admixture control in either of the above mixing scenarios would be implemented by estimating the volume of sludge or clay in a given mixing area (i.e. a square equal to the reach of the excavator) and introducing the appropriate tonnage of reagent to that mixing area based on the treatability study. Although the initial treatability study would provide a base recipe for the stabilization process, the amount of reagent used would be adjusted as needed based on real-time observations and evaluations of the mixing process in the field.

As required, high ground-pressure bulldozer and/or compaction equipment will be used after integration of the reagents(s) into the sludge or clay to compact and grade the material matrix to achieve the required in-place material properties and provide a smooth surface for placement of the overlying component layer of the cover system.

Section 4
Materials Requirements

4.1 Stabilized Recycle Sludge

The stabilized recycle sludge component of the cover system shall have a minimum in-place unconfined compressive strength of 25 psi (1.8 tsf) after 3 days cure time.

4.2 Structural Fill

Soil used for the structural fill component of the cover system shall:

- Have a Unified Soils Classification System designation of SACL with a liquid limit less than 40, plasticity index between 10 and 20, and maximum effective clod size of 3 inches; or
- Course Grained Soil, consisting of well-graded, angular particles with a maximum size of 4 inches, no more than 12 percent passing the No. 200 sieve, no significant silt content, and with sufficient fines to fill voids between larger particles (e.g. GW, GC, SW or SC);
- Be virgin clean soil or, if from an impacted-soils recycling facility, the facility must be a TCEQ-registered facility and the soil must meet the soil re-use criteria provided in Appendix A;
- Meet the additional material requirements in the following table.

Test Parameters	Value
In-Place Density	98% of Standard Proctor Density, Minimum
In-Place Moisture Content	CL Soil: -1% to +3% of Standard Proctor Optimum Moisture Content Course Grained Soil: -2% to +2% of Standard Proctor Optimum Moisture Content
In-Place Shear Strength	1,000 psf, minimum

4.3 Clay Cap

Soil used for the clay cap component of the cover system shall:

- Have a Unified Soils Classification System designation of CH;
- Must be virgin clean soil or, if from an impacted-soils recycling facility, the facility must be a TCEQ-registered facility and the soil must meet re-use criteria provided in Appendix A;
- Be free of clods with a maximum effective clod size of 3 inches or more, rocks larger than 2 inches, and debris; and

- Meet the additional material requirements in following table.

Test Parameters	Value
Plasticity Index	15, Minimum
Liquid Limit	30, Minimum
Percent Passing the No. 200 Sieve	30% Minimum
Percent Passing the one-inch sieve	100% Minimum
In-Place Hydraulic Conductivity	1×10^{-7} cm/s, Maximum
In-Place Density	98% of Standard Proctor Density, Minimum
In-Place Moisture Content	-1% to +3% over the Standard Proctor Optimum Moisture Content
In-Place Shear Strength	1,000 psf, minimum

4.4 Protective Layer

Prior to construction of the Aeration Tank, the protective layer component of the cover system located under the foundation shall be one of the following:

- Structural fill as specified above; or
- Flowable fill consisting of a thoroughly mixed combination of clear, neutral-range pH water, Portland cement, and sandy soils containing no more than 30 percents fines, free of deleterious materials, and having plasticity index less than 6 (e.g. SW, SP and SC), and meeting the following requirements:
    - Mixture consistency such that when placed in 3-inch diameter by 6-inch tall cylinder and the cylinder is quickly pulled up, the mix produces at least an 8-inch diameter circular spread with no segregation,
    - An unconfined compressive strength of at least 60 psi at 48 hours while remaining workable for placement; and
    - 7-day unconfined compressive strength of at least 100 psi;

After construction of the Aeration Tank, a low-silt, erosion-resistant soil or other approved material will be placed around the Aeration Tank and over any exposed portions of the protective layer with a 3% to 5% grade away from the tank . This material will be supplied and placed by the contractor responsible for construction of the Aeration Tank.

Section 5
Materials Pre-Construction Testing

Preconstruction testing as detailed below will be performed to check that soil and stabilization materials planned for use in the layers of the cover system meet the materials properties requirements specified in Section 4.

5.1 Stabilized Recycle Sludge

A treatability study shall be performed as described in Section 3.1 for the stabilized recycle sludge.

5.2 Structural Fill

The following table presents the minimum preconstruction testing frequencies for soils used as structural fill.

Required Tests	Testing Frequency
Atterberg Limits (not required for Course Grained Soils); Sieve Analysis (percent passing 1 ½-inch, No. 40 and No. 200 Sieve); Moisture Content (laboratory); Standard Proctor; Unconfined compressive strength	1 per each soil type or significant change in soil; or 1 per change in borrow source.

5.3 Clay Cap

The following table presents the minimum preconstruction frequencies for soil used to construct the clay cap.

Required Tests	Testing Frequency
Atterberg Limits; Sieve Analysis (percent passing 1 ½-inch, No. 40 and No. 200 Sieve); Moisture Content (laboratory); Standard Proctor.	1 per each soil type or significant change in soil; or 1 per change in borrow source.
Atterberg Limits; Hydraulic conductivity.	Selected soil-reagent mixture remolded to 98% of its Standard Proctor Density at -1% to +3% above its optimum moisture content.

A treatability study shall be performed as described in Section 3.1 for soil used for the clay cap component of the cover system.

5.4 Protective Layer

If structural fill is used for the protective layer, the minimum preconstruction frequencies listed in the Section 5.2 table for structural fill shall apply to soils used for the protective layer. If flowable fill is used for the protective layer, the following table presents the minimum preconstruction testing frequencies.

Required Tests	Testing Frequency
Atterberg Limits (not required for SW or SP soils); Sieve Analysis (percent passing No. 4 and No. 200 Sieve); Compressive strength of concrete cylinder	1 per each soil type or significant change in soil; or 1 per change in borrow source; or 1 per change in soil/cement/water mixture ratio.

Section 6
Construction

6.1 General

Prior to beginning construction of component layers of the cover system, preconstruction testing as specified in Section 5 will be performed to identify materials which meet all project requirements.

The subgrade layer for each subsequent layer (structural fill, clay cap and protective layer) shall be graded and smoothed prior to placement of the overlying layer. Areas of any subgrade layer containing soft or otherwise unstable soils will be repaired by undercutting and backfilling to grade with material meeting the pre-construction material and in-place requirements for the subgrade layer.

Prior to placement, soils may require processing to breakup any large clods and to adjust the moisture content. The soil may be processed in a staging area or it may be placed as a loose 6 to 8-inch thick lift and processed in place prior to compaction. For moisture adjustments, water should be spread evenly on the surface of the soil and then be thoroughly mixed and evenly distributed throughout the lift by disking, tilling or other satisfactory means. If water adjustments are not needed, disking or tilling may still be required to breakup large clods. If amended soils are being used, the soil amendment(s) should be incorporated into the soil matrix using similar methods as described above for adding water and as detailed in Section 3.2.

For the clay cap, the top of the underlying structural fill and the top of the clay cap shall be surveyed so the thickness of the clay cap can be confirmed and documented prior to placement of the protective layer. Similarly, the top of the protective layer shall be surveyed so the thickness of the protective layer can be confirmed and documented prior to construction of the Aeration Tank foundation.

All materials shall be unfrozen when used and unamended soils shall be unsaturated. Materials shall not be compacted over porous, wet, frozen, or spongy subgrade surfaces.

6.2 Stabilized Recycle Sludge

Construction of the stabilized recycle sludge layer of the cover system shall be in accordance with the stabilization procedures described in Section 3.2. Additionally, the following

recommendations from the report “Revised Geotechnical Study, Set Aeration Basin Upgrade Project, Shell Deer Park Refinery Deer Park, Texas, January 24, 201(3)” by Fugro Consultant, Inc. will be followed:

“Loads should not be transferred to the stabilized sludge until after the uniformity of the stabilized area is verified with a proofroll and the consistency is confirmed with compressive strength testing. Proofrolling the stabilized sludge should comprise of at least five passes. Consecutive passes should be made perpendicular to each other. Areas of the stabilized sludge that are observed to be soft, wet, weak areas or in which pumping or significant deflections are observed should be re-treated (throughout the entire thickness of the stabilized sludge), and in accordance with the stabilization recommendations provided herein.”

6.3 Structural Fill

If SACLsoils are used for structural fill, after any processing required as described in Section 6.1, the soil shall be spread out in approximate 6 to 8-inch thick loose lifts and compacted with a minimum 20-ton smooth drum roller,or sheepsfoot or padfoot roller, or alternate method that provides an equivalent compaction. Hand-operated compaction equipment and 4-inch loose lifts will be used adjacent to foundations and in confined spaces. The compaction equipment will make a sufficient number of passes, and a minimum of 3 passes, to produce the desired compaction throughout the lift. Roller weights may be varied provided that the soil fill is sufficiently compacted.

If the exposed surface of a lift has been deteriorated by wet weather or an extended dry period, the top 2 inches of the lift shall be removed or scarified to facilitate bonding of the lift to the subsequent lift.

If Course Grained Soil is used for structural fill, the soil shall be spread out in loose lifts no more than 10 inches thick and compacted with a vibratory roller. Hand-operated compaction equipment and 4-inch loose lifts will be used adjacent to foundations and in confined spaces.

If a sheepsfoot, padfoot or similar type roller is used for compaction of the structural fill, the surface of the final lift of structural fill shall be rolled with a smooth, steel-wheeled roller to provide a hard, uniform and smooth surface for placement of the overlying layer.

Each structural fill lift will be compacted to the requirements specified in Section 4 and tested per the requirements of Section 7 to check that proper moisture, compaction, etc. has been

achieved prior to placement of the overlying lift. Any areas which fail to meet the compaction criteria will be reworked and retested prior to placing subsequent lifts. The top of the final lift of the structural fill will be surveyed. The topographic data obtained from the survey will be used to confirm the final lift was graded flat (e.g. same elevation across its surface) and to the correct elevation, and to confirm the thickness of the overlying clay cap after its placement.

6.4 Clay Cap

Construction of the clay cap shall be in accordance with the stabilization procedures described in Section 3.2 and as described below.

After any processing required as described in Section 6.1, soil to be used for the clay cap shall be spread out in approximate 6 to 8-inch thick loose lifts and compacted with a minimum 20-ton smooth drum roller, or sheepsfoot or padfoot roller, or alternate method that provides an equivalent compaction. If a sheepsfoot or padfoot roller is used, a smooth drum roller will be used after compaction to seal the surface of the lift. Hand-operated compaction equipment and 4-inch loose lifts shall be used adjacent to foundations and in confined spaces.

Compaction equipment will make a sufficient number of passes (a minimum of three) to produce the desired compaction throughout the lift.. Roller weights may be varied provided that the soil fill is satisfactorily blended during compaction.

Each lift of the clay cap will be compacted to the requirements in Section 4 and tested per the requirements of Section 7 prior to placement of the overlying lift. Any areas which fail to meet in-place clay cap requirements will be reworked and retested prior to placement of another lift. Permeability testing will be performed on samples collected via Shelby tubes inserted through one or more in-place lifts, or via an approved alternate sampling method. Also, with the exception of the final lift, the surface of each lift will be scarified one to two inches deep so that it bonds to each subsequent lift. The surface of the final lift of clay cap shall be rolled with a smooth, steel-wheeled roller to provide a hard, uniform and smooth surface for placement of the overlying layer.

Prior to placing the overlying protective layer, the top of the final lift of the clay cap will be surveyed. The topographic data obtained from the survey will be used to confirm the final lift was graded flat, to confirm the clay cap is at least 48 inches thick, and to confirm the thickness of the overlying protective layer after its placement.

The surface of the clay cap will be covered as soon as possible after completion to prevent desiccation. Areas where the clay cap has been exposed for extended periods will be inspected for desiccation cracks. If significant cracks are present, the surface of the clay cap will be wetted and reworked to close the cracks before overlying components are placed.

6.5 Protective Layer

If structural fill is used for the protective layer, the construction procedures described herein for structural fill shall be followed.

If flowable fill is used for the protective layer, the placement shall be done in such a manner as to eliminate voids/unfilled spaces. An elephant-trunk type vibrator shall be used to consolidate the fill and eliminate any voids.

The finished surface of the protective layer will be surveyed to determine if it meets the minimum thickness requirement of 6 inches.

Section 7
Construction QA/QC Testing and Observation

7.1 Quality Control/Quality Assurance Responsibilities

Construction quality control of the component layers of the cover system will be the responsibility of the Contractor. The Contractor's quality control efforts to meet project specifications shall include:

- Checks that the subgrade layer for each subsequent layer has been properly prepared;
- Checks that only soil from approved borrow sources are used;
- Checks of loose lift thickness;
- Checks that a consistent application of solidification reagent(s) and water are used to provide uniform reagent dispersion and moisture content throughout the material matrix be stabilized; and
- Checks for consistent operation of compaction equipment to achieve uniform density throughout lifts.

The QCP will be responsible for quality assurance testing, and construction monitoring and documentation of the clay soil cap quality assurance procedures and results. Further, the QCP will record the lift and location of all in-place density tests and be responsible for developing plan layouts of the soil components layers showing the test locations for each lift. After installation of the cover system is completed, the QCP shall submit the test results to the Owner for inclusion in a final closure certification report.

7.2 Construction Testing

During construction of the cover system component layers, the QCP will test the in-place density and moisture content of all the layers and the unconfined compressive strength of the in-place stabilized recycle sludge as detailed herein. Density will be measured using the nuclear density gauge, drive cylinder, or sand cone methods. In-situ soil moisture content may be determined using the nuclear gauge, oven, direct-heating or microwave methods. If using the nuclear gauge method, per ASTM D6938 requirements, a confirmatory laboratory soil moisture determination will be performed to check for any systematic errors in the nuclear gauge moisture content determination.

Unconfined compressive strength of the stabilized recycle sludge will be measured using an undisturbed core sample of the in-place stabilized recycle sludge (obtained using a thin-wall tube sampler).

Any testing area which does not meet the project specifications will require reworking and retesting until a passing condition is achieved prior to placement of subsequent lifts. The QCP will document all test locations, elevations or lift numbers, test dates, and test results.

Voids resulting from density testing or undisturbed sampling will be backfilled with cement bentonite grout under the direction of the QCP.

7.2.1 Stabilized Recycle Sludge

The minimum testing frequencies for the stabilized recycle sludge component of the cover system are listed below.

Test	Frequency
Unconfined compressive strength	ASTM D2166: Minimum 1 per 5,000 ft^2 of stabilized recycle sludge

7.2.2 Structural Fill

The minimum testing frequencies for structural fill are listed below.

Test	Frequency
In-place density	Minimum of 1 test per 5,000 ft^2 per lift.
In-place moisture content	1 per density test.
Percent passing No. 200 sieve	Minimum 1 per each 20 field densities, or major fraction thereof.
Atterberg Limits (not required for Course Grained Soils)	Minimum 1 per each 20 field densities, or major fraction thereof.
Laboratory moisture content	Minimum 1 per each 5 field densities, or major fraction thereof.
Shear strength	ASTM D2166: Minimum 1 per 10,000 ft^2 of each l lift

Voids resulting from density testing or undisturbed sampling will be filled with cement bentonite grout under the direction of the QCP.

7.2.3 Clay Cap

The minimum testing frequencies for the clay cap are listed below.

Test	Frequency
In-place density	Minimum of 1 test per 5,000 ft^2 per lift (but no less than 5 tests per lift).
In-place moisture content	1 per density test.
Undisturbed coefficient of permeability	Minimum 1 per 20 field density tests (but at least 1 test per each lift).
Percent passing No. 200 sieve	Minimum 1 per each 20 field densities, or major fraction thereof.
Atterberg Limits	Minimum 1 per each 20 field densities, or major fraction thereof.
Laboratory moisture content	Minimum 1 per each 5 field densities, or major fraction thereof.
Shear strength	ASTM D2166: Minimum 1 per 10,000 ft^2 of each lift

Voids resulting from density testing or undisturbed sampling will be backfilled with cement bentonite grout under the direction of the QCP.

7.2.4 Protective Layer

If structural fill is used for the protective layer, the above minimum testing frequencies for structural fill shall apply.

If flowable fill is used for the protective layer, prior to thestart of each work shift, its mixture consistency shall be tested by placing a sample in a 3-inch diameter by 6-inch tall cylinder. When the cylinder is quickly pulled up, the mix shall produce at least an 8-inch diameter circular spread with no segregation. If the diameter of the spread is less than 8-inch or segregation occurs, the batch, truckload, etc. will be rejected or amended until it meets these requirements.

Additional minimum testing frequencies for the protective layer are listed below.

Test	Frequency
Compressive strength of concrete cylinder	ASTM D39: Minimum 1 per 100 cy of flowable fill

7.3 Construction Monitoring

The QCP will periodically monitor component layer construction to check that proper materials and techniques are utilized. At a minimum, each construction day the QCP is on-site the QCP will observe and document, as applicable, the following:

- Work area and elevation of lift;
- Source and type of reagent(s) being used;
- Soil material source;
- Loose lift thickness;
- Visual description of material being placed;
- Lift placement technique;
- Moisture adjustment technique;
- Compaction equipment type; and
- Verification that nuclear gauge test probe, drive cylinder, sand cone, and thin wall tube sampler voids are backfilled with bentonite or a bentonite and soil mixture.

Any observations by the QCP that indicate component construction is not meeting the project specifications shall immediately be brought to the attention of the Contractor Superintendent. Any discrepancy which is not corrected shall be brought to the attention of Shell Oil.

Section 8
Surveying

It is the responsibility of the Contractor to verify that components of the final cover system are constructed to the specified thicknesses and grades. The subgrade of the clay cap (top of the structural fill layer), top of the clay cap, and top of the protective layer shall be surveyed at the minimum frequency of one point per 5,000 square feet (e.g., 70 feet by 70 feet grid). Based on the survey data, the QCP will verify the top of the clay cap is flat (i.e. same elevation across its surface), and the clay cap has a uniform minimum thickness of 48 inches. Additionally, the QCP will confirm the protective layer has a minimum thickness of 6 inches.

Section 9
Documentation Presentation

After the project is completed, summaries of the QA/QC test results will be provided to the Owner for inclusion in a formal closure certification report for submittal to the TCEQ. The report will contain preconstruction test data, construction test data, survey data, the results of tests performed for or by the QCP, and other data considered pertinent to the construction quality assurance effort.

Appendix A

Re-Use Criteria

Appendix A

Soil Reuse Criteria - SET Basin Closure

Shell proposes to reuse onsite affected soils and sediments as select fill for the closures of the SET basins at its Deer Park facility in accordance with 30 TAC §§ 335.6 and 350.36. The affected soils and sediments may be utilized for backfill and capping materials for the in-place closure of the basins and will replace backfilled soils that would otherwise have to be purchased. The soils and sediments will be obtained from portions of the on-site affected property (as defined by the plume management zones) and will be tested to confirm that they meet critical protective concentration levels (PCLs) for the SET basin area.

Background

Shell plans to close the three SET basins in place by (1) removing wastewater, (2) stabilizing sludge, (3) backfilling with select fill, and (4) capping with clay or select fill. Shell proposes to reuse on-site soils and/or sediments as backfill and/or capping material for the basin closures in lieu of commercially available soils. The soils/sediments result from construction projects, on-site spill clean-up activities and a planned maintenance project that will involve the excavation of sediments from the Stormwater Impoundment Basin (SWIB). The soil and sediments may contain low concentrations of hydrocarbon and/or petrochemical contamination. Prior to use, the soils and/or sediments may be stabilized with fly ash or other suitable stabilization agent to meet the engineering specifications for backfill and/or capping material, as described in the Construction Quality Assurance Plan (CQAP) for the closure (Appendix D of the Closure Plan). It is noted that approximately 8" of commercially available crushed rock will be placed over the caps of the SET basins as part of closure, except for most of the middle basin, which will be covered with a new concrete aeration tank.

Site Hydrogeology

The groundwater in the area of the SET basins has been impacted by various historical releases and leaks associated with petrochemical product manufacture, transfer and storage. The groundwater PCLE zone is comprised of overlapping plumes that encompasses approximately 1,400 acres of the 1,600-acre Shell Deer Park facility. The PCLE zone extends vertically through the top three water-bearing zones (WBZs) beneath the facility, which are named (from top to bottom) WBZ-1, WBZ-2 and WBZ-3. Plume Management Zones (PMZs) have been established in each of these WBZs through a Compliance Plan Modification issued by the TCEQ on January 28, 2011. The PMZs encompass waste units and areas of concern that have been grouped together into five waste management areas (WMAs). The SET basins are included within WMA-B.

A review of recent semi-annual groundwater reports submitted under Shell's Compliance Plan indicates that groundwater samples from WBZ-1 monitor wells in the area of the

SET basins routinely contain concentrations of 1,2,3-trichloropropane (1,2,3-TCP), 1,2-dichloropropane (1,2-DCP), 1,1-dichloroethane (1,1-DCA), trichloroethylene (TCE) and benzene above Groundwater Protection Standards (GWPS) established in the Compliance Plan. The distribution of groundwater impacts and the results from recent sludge samples collected from the middle basin indicate that the constituents identified in the groundwater did not result from the SET basins, but rather from historical sources associated with petrochemical operations at the Deer Park facility.

Critical Protective Concentration Level Development

Protective concentration levels (PCLs) have been developed for the soils/sediments to be reused as select fill to ensure that chemicals of concern (COCs) do not exceed critical PCLs for the SET basin area. The following COCs and associated PLCs are proposed for the soil/sediment reuse program:

Soil Reuse Analytical Criteria

Constituent	PCL (mg/kg)	Tier Level
Benzene	0.54	2
Ethylbenzene	3.8	1
Toluene	4.1	1
Xylenes	61	1
1,2-Dichloropropane	0.027	2
1,2,3-Trichloropropane	3.8	2
1,1-Dichloroethane	28	1
1,2-Dichloroethane	0.0069	1
2.3-Dichlorobutane	3.8	1
Trichloroethylene	0.017	1
2-Butanone (MEK)	44	1
4-Methyl-2-pentanone (MIBK)	7.4	1
Acetone	64	1
Isopropylbenene (Cumene)	520	1
Tert-butyl alcohol (TBA)	6.9	1
Vinyl chloride	0.011	1
Phenol	29	1
Chromium	1,200	1
Lead	90	2
TPH (C6-C12)[1]	30	1
TPH (C>12 –C35)[1]	300	1

(1) Tier 1 PCLs may be calculated for TPH for soils/sediments based on the aromatic and aliphatic hydrocarbon fractions derived using Texas 1006 analytical method and the "TPH PCL Calculator" spreadsheet obtained from the TCEQ.

The critical PCLs are based on commercial/industrial land use and a 30-acre release source. The list of the COCs is based on (1) the constituents detected in sludge and/or soil samples collected from the middle basin (see Table 3-1 of SET Basin Closure Plan) and (2) constituents that are monitored semiannually under Shell's Compliance Plan (see Table IIIA of Compliance Plan No. 50099). Total petroleum hydrocarbons (TPH) are included as general indicator parameter of hydrocarbon contamination.

As shown in the above table, several Tier 2 PCLs have been developed as critical PCLs for the soil reuse program. The following provides a summary of how the Tier 2 PCLs were derived.

- 1,2,3-TCP and 1,2-DCP . Tier 2 soil PCLs for have been calculated for 1,2,3-TCP and 1,2-DCP based on existing concentrations in groundwater in accordance with RSB criteria of 30 TAC §350.33(a)(2). The average groundwater concentrations of these COCs identified in downgradient wells 26R, 27R, 276R and 277 from the semi-annual monitoring events conducted between 2008 and 2010 were utilized to develop "existing concentrations" of the COCs in groundwater. A summary of the identified concentrations of 1,2,3-TCP and 1,2-DCP in groundwater samples collected from the wells during this time period is included in Attachment A-1. As shown in the attachment, "average" 1,2,3-TCP and 1,2-DCP groundwater concentrations of 0.438 mg/l and 0.0012 mg/l, respectively, were calculated for the downgradient boundary of the SET basins. Based on these groundwater concentrations, Tier 2 $^{GW}Soil_{Ing}$ PCLs of 3.8 mg/kg and 0.027 mg/kg were calculated for 1,2,3-TCP and 1,2-DCP, respectively. The spreadsheets used for the calculations are included in Attachment A-1.

- Benzene. A Tier 2 $^{GW}Soil_{Ing}$ value of 0.54 mg/kg was calculated for benzene based on the GWPS of 0.208 mg/l established in Shell's Compliance Plan. A factor of 41.6 was calculated by dividing the benzene GWPS by the Tier 1 groundwater PCL (0.005 mg/l) and multiplying the Tier 1 $^{GW}Soil_{Ing}$ PCL (0.013 mg/kg) by the factor .

- Lead. A Tier 2 $^{GW}Soil_{Ing}$ value of 90 mg/kg was calculated for lead using a site-specific pH of 7.9 standard units and soils (loamy) found in the area of the SET basins. The pH value is the average of the measured pH values (7.77 and 8.04 standard units) from two clay samples collected from the middle basin. The Tier 2 value of 90 mg/kg for lead was calculated using the procedure referenced in 30 TAC §350.75(b)(1) and the spreadsheet for its calculation is provided as Appendix A-1.

Reuse Methodology

Soils and sediments that are to be reused for select fill for the SET basin closure will be sampled and analyzed as described below. Only those soils/sediments that meet the criteria specified below will be reused.

Soil will be sampled at a minimum rate of one sample per 300 cubic yards. In addition, at least one sample will be collected from each source material that is designated for the

reuse program. Soil reuse will be documented by recording the reuse location, date of placement, and associated analyses. The documentation will be retained on-site.

Attachment A-1
Calculation of Average Concentrations of 1,2,3-Trichloropropane and 1,2-Dichloropropane in Groundwater at SET Basins

Detected Concentrations, 1,2,3-TCP (mg/l)

MW-26R

0.017
0.035
0.0378 average: 0.03

MW-27R

0.49
1.2
0.72
1.59
0.591
0.363 average: 0.826

MW-276R

0.0013
0.01
2.45 average: 0.820

MW-277

0.0081
0.0209
0.331
0.00431 average: 0.078

Overall average: 0.438

Detected Concentrations, 1,2-DCP (mg/l)

MW-26R – all non-detect

MW-27R

0.002
0.0032
0.0021
0.00777
0.00195
average: 0.003

MW-276R

0.0203

average: 0.0203

MW-277 – all non-detect

0.028

Overall average: 0.012

Tier 2 ^{GW}Soil PCL - Lead

$$Tier2^{GW}Soil-PCL=\frac{(^{GW}GW-PCL)*LDF}{K_{SW}}*\frac{L_2}{L_1}$$

$$LDF=10$$

$$K_{SW}=\frac{P_b}{O_{ws}+K_dP_b+H'O_{as}}$$

VARIABLES	DEFINITION (UNITS)	Lead	Lead
L_2	depth from top of affected soil to groundwater (ft), default.	1.0	1.0
L_1	thickness of affected soil based where maximum concentrations occurred (ft), default.	1.0	1.0
θ_{ws}	volumetric water content of soil (cm^3-water/cm^3-soil), default value used	0.16	0.16
θ_{as}	volumetric air content of soils (cm^3-air/cm^3-soil) = θ_T - θas, default value used	0.21	0.21
ρ_b	soil bulk density (g/cm^3), default value used	1.67	1.67
LDF	Lateral Dilution Factor for 30-acre source area (unitless)	10	10
Kd	Soil-water distribution coefficient from TRRP	10	597
	Soil pH (soil type) =	4 (sand)	7.9 (loam)
H'	Dimensionless Henry's Law Constant from Figure 30 TAC 350.73(e).	0	0
$^{GW}GW_{Ing}$	Residential groundwater PCL for Class 2 Groundwater (mg/L)	1.5E-02	1.5E-02
K_{sw}	Soil Leachate Partition Factor (mg/L-water)/(mg/kg-soil), chemical specific	0.099051	0.001675
		Tier 1	**Tier 2**
$^{GW}Soil_{Ing}$ PCL	Soil PCL, soil-to-groundwater protection (mg/kg). The Tier 2 ^{GW}Soil PCL was used for closure	**1.5**	**90**

Tier 2 ^{GW}Soil Calculations for 1,2,3-trichloropropane and 1,2-dichloropropane

A Tier 2 $^{GW}Soil_{Class2}$ PCL was calculated for 1,2,3-trichloropropane and 1,2-dichloropropane in soil at the Deer Park SET Basins. The site-specific data for existing groundwater concentrations within the groundwater Plume Management Zone is used in the TRRP ^{GW}Soil Equation for this PCL.

$$^{GW}Soil = \frac{(GroundwaterPCL) \times LDF}{K_{sw}} x \frac{L_2}{L_1}$$

$$K_{sw} = \frac{\rho_b}{\Theta_{ws} + K_d \rho_b + H' \Theta_{as}}$$

Variable	Description (units)	1,2,3-trichloropropane		1,2-dichloropropane	
		Default Value	Tier 2 $^{GW}Soil_{Class2}$ PCL	Default Value	Tier 2 $^{GW}Soil_{Class2}$ PCL
Groundwater PCL	The applicable groundwater protective concentration level is the existing concentration based on an average of the concentrations measured at the four point of compliance wells (27R, 28R, 276R, and 277) as measured during the semi-annual monitoring events in 2008 through 2010.	0.00003	0.438	0.005	0.012
LDF	Lateral dilution factor for a "0.5 to 30 acre" source area (unitless)	10	10	10	10
K_{sw}	COC-specific soil leachate partition factor for chemical of concern (mg/L-mg/kg)	1.1418194	1.141819445	4.379799	4.379799421
rb	Soil bulk density (g/cm^3)	1.67	1.67	1.67	1.67
Q_{ws}	Volumetric water content of vadose zone soils (cm^3-water/cm^3-soil)	0.16	0.16	0.16	0.16
Q_{as}	Volumetric air content of vadose zone soils (cm^3-water/cm^3-soil)	0.21	0.21	0.21	0.21
K_d	Soil-water partition coefficient (cm^3-water/cm^3-soil). Kd = Koc x foc; 289 x 0.002 for 1,2,3-TCP & 58.9 x 0.002 for 1,2-DCP (TRRP Tier 1 default values)	0.778	0.778	0.1178	0.1178
H'	Dimensionless Henry's Law Constant (unitless)	0.0158	0.0158	0.117	0.117
L1	Depth of soil contamination (ft)		1		1
L2	Depth to ground water (ft)		1		1
^{GW}Soil	**Tier 2 Soil-to-Groundwater PCL, $^{GW}Soil_{Class2}$ (mg/kg)**		**3.8**		**0.027**

Appendix C – Construction Drawings

CIVIL/STRUCTURAL DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE	REVISION	ISSUED HEREWITH
E-146761	DRAWING INDEX & GENERAL NOTES	1	✓
E-146762	BACKFILL PLAN, SECTIONS & ELEVATIONS	1	✓
E-146763	PAVING PLAN, SECTIONS & DETAILS	1	✓

"SET" BASIN BACKFILL GENERAL NOTES

A. ALL BACKFILL WORK AND TESTING SHALL BE IN COMPLIANCE WITH "REVISED CLOSURE PLAN, EAST AND WEST SOUTH EFFLUENT TREATER BASINS, (MARCH 2016)" ("SET" BASIN CLOSURE PLAN), "CONSTRUCTION QUALITY CONTROL PLAN, MIDDLE SOUTH EFFLUENT TREATER BASIN, FINAL CLOSURE (JUNE 2013)" (CQCP), AS APPLICABLE, AND THESE NOTES

B. WEST "SET" BASIN SHALL BE CLOSED BY SYSTEMATIC SLUDGE STABILIZATION AND BACKFILL, WITH LAYERS THAT, FROM TOP DOWN, ARE COMPRISED OF A 6 INCH (MIN) REINFORCED CONCRETE PAVING, 4 FEET THICK (MIN) STABILIZED CLAY CAP, COMPACTED STRUCTURAL/SELECT FILL, AND STABILIZED SLUDGE.

C. STABILIZED SLUDGE SCOPE (1)

1. A TREATABILITY STUDY WILL BE PERFORMED BY THE BASIN CLOSURE CONTRACTOR TO DETERMINE ACCEPTABLE REAGENTS FOR STABILIZING THE BASIN RECYCLE SLUDGE. DETAILS REGARDING THIS STUDY AND SUBSEQUENT STABILIZATION PROCEDURES SHALL COMPLY WITH THE GUIDANCE PROVIDED IN THE CQCP.
2. SLUDGE SHALL BE STABILIZED IN-PLACE WITH FLY ASH (OR SIMILAR DEWATERING AGENT/CHEMICAL REAGENT AND BULKING AGENT), AND SHALL HAVE AN UNCONFINED COMPRESSIVE STRENGTH OF AT LEAST 25 PSI AFTER 3 DAYS CURE TIME.
3. LOADS SHOULD NOT BE TRANSFERRED TO THE STABILIZED SLUDGE UNTIL AFTER THE UNIFORMITY OF THE STABILIZED AREA IS VERIFIED WITH A PROOF ROLL AND THE CONSISTENCY IS CONFIRMED WITH COMPRESSIVE STRENGTH TESTING. PROOF ROLLING THE STABILIZED SLUDGE SHOULD COMPRISE OF AT LEAST FIVE PASSES WITH A HEAVY LOADED PNEUMATIC-TIRED VEHICLE, SUCH AS A 20 TON LOADED DUMP TRUCK. CONSECUTIVE PASSES SHOULD BE MADE PERPENDICULAR TO EACH OTHER. AREAS OF THE STABILIZED SLUDGE THAT ARE OBSERVED TO BE SOFT, WET, WEAK AREAS OR IN WHICH PUMPING OR SIGNIFICANT DEFLECTIONS ARE OBSERVED SHOULD BE RE-TREATED (THROUGHOUT THE ENTIRE THICKNESS OF THE STABILIZED SLUDGE), AND IN ACCORDANCE WITH THE STABILIZATION RECOMMENDATIONS PROVIDED IN THE CQCP.
4. CONTRACTOR SHALL REFER TO THE CQCP FOR REQUIREMENTS REGARDING STABILIZED SLUDGE TESTING METHODS AND FREQUENCY.

D. COMPACTED STRUCTURAL FILL (2)

1. THE BASIN SHALL BE BACKFILLED WITH STRUCTURAL FILL TO THE ELEVATION NOTED ON THE DESIGN DRAWINGS. STRUCTURAL FILL MAY BE COMPRISED OF RECYCLED SOILS THAT MEET THE RE-USE CRITERIA PROVIDED IN THE CQCP. THE SURFACE OF THE COMPACTED STRUCTURAL FILL SHALL BE SLOPED 1% FROM THE CENTER TOWARDS THE EDGES OF THE EXISTING BASIN. THE STRUCTURAL FILL WILL BE GRADED TO PROVIDE A UNIFORM SURFACE FOR CONSTRUCTION OF SUCCESSIVE CLOSURE MAKE-UP LAYER(S).
2. STRUCTURAL FILL COMPOSITION, MATERIAL TESTING REQUIREMENTS, AND PRE-CONSTRUCTION TESTING OF PROPOSED STRUCTURAL FILL, SHALL COMPLY WITH THE CQCP AND AS NOTED BELOW.
3. STRUCTURAL FILL SHALL BE SANDY CLAY SOILS MATERIAL THAT COMPLIES WITH THE SHELL SPECIFICATION DEP 34.11.00.12, FREE OF ORGANIC OR OTHER DELETERIOUS MATERIALS. SUCH MATERIAL SHOULD NOT CONTAIN ANY CINDER, BRICK, ASPHALT, ASH OTHER UNSUITABLE MATERIALS. STRUCTURAL FILL SHALL HAVE A MAXIMUM CLAY LUMP SIZE LESS THAN THREE INCHES ACROSS. MATERIAL SHALL HAVE A LIQUID LIMIT NOT GREATER THAN 40 AND A PLASTICITY INDEX BETWEEN 10 AND 20. A GEOTECHNICAL ENGINEER FAMILIAR WITH THE SUBSURFACE CONDITIONS AND COMPACTION CRITERIA SHALL PROVIDE INSPECTION SERVICES OF STRUCTURAL FILL MATERIAL, PLACEMENT AND COMPACTION. PRELIMINARY SAMPLE AND TESTING OF BORROW SITE MATERIAL SHALL BE FURNISHED UPON REQUEST.
4. ALL STRUCTURAL FILL MATERIAL SHALL BE COMPACTED TO AT LEAST 98% OF THE SOIL MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 ("STANDARD PROCTOR"). THE MATERIAL SHALL BE COMPACTED WITHIN THE ONE TO THREE PERCENTAGE (1% TO +3%) POINTS ABOVE THE OPTIMUM MOISTURE CONTENT VALUE. DURING COMPACTION, ANY ADDED WATER SHALL BE UNIFORMLY APPLIED AND THOROUGHLY MIXED INTO THE SOIL BY DISKING OR SCARIFYING.
5. STRUCTURAL FILL SHALL BE PLACED IN MAXIMUM LIFTS OF EIGHT (8) INCHES OF LOOSE MATERIAL. EACH LIFT OF STRUCTURAL FILL SHOULD BE TESTED FOR COMPACTION BY A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEERING COMPANY PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS. IN-PLACE COMPACTION TESTING (DENSITY AND MOISTURE CONTENT) SHALL BE PERFORMED AT A MINIMUM FREQUENCY OF ONE TEST PER 2500 SQUARE FEET (E.G. 50 FEET BY 50 FEET GRID).
6. THE SUBGRADE LAYER FOR EACH SUBSEQUENT LAYER OF FILL SHALL BE GRADED, SMOOTHED, AND TESTED PRIOR TO PLACEMENT OF THE OVERLYING LAYER. AREAS OF ANY SUBGRADE LAYER CONTAINING SOFT OR OTHERWISE UNSTABLE SOILS WILL BE REPAIRED BY UNDERCUTTING AND BACKFILLING TO GRADE WITH MATERIAL MEETING THE PRE-CONSTRUCTION MATERIAL AND IN-PLACE REQUIREMENTS FOR THE SUBGRADE LAYER.
7. PRIOR TO PLACEMENT, SOILS MAY REQUIRE PROCESSING TO BREAKUP ANY LARGE CLODS AND TO ADJUST THE MOISTURE CONTENT. FOR MOISTURE ADJUSTMENTS, WATER SHOULD BE SPREAD EVENLY ON THE SURFACE OF THE SOIL AND THEN BE THOROUGHLY MIXED AND EVENLY DISTRIBUTED THROUGHOUT THE LIFT BY DISKING, TILLING OR OTHER SATISFACTORY MEANS. IF WATER ADJUSTMENTS ARE NOT NEEDED, DISKING OR TILLING MAY STILL BE REQUIRED TO BREAKUP LARGE CLODS. IF AMENDED SOILS ARE BEING USED, THE SOIL AMENDMENT(S) SHOULD BE INCORPORATED INTO THE SOIL MATRIX USING SIMILAR METHODS AS DESCRIBED ABOVE FOR ADDING WATER AND AS DETAILED IN THE CQCP. ALL MATERIALS SHALL BE UNFROZEN WHEN USED AND UNAMENDED SOILS SHALL BE UNSATURATED. MATERIALS SHALL NOT BE COMPACTED OVER POROUS, WET, FROZEN, OR SPONGY SUBGRADE SURFACES.
8. COMPACTED STRUCTURAL FILL SHALL HAVE AN ALLOWABLE BEARING PRESSURE OF AT LEAST 2,500 PSF WITH A FACTOR OF SAFETY EQUAL TO TWO (F.S. = 2.0).
9. QUALITY CONTROL AND CONSTRUCTION TESTING OF STRUCTURAL BACKFILL SHALL COMPLY WITH THE REQUIREMENTS OF THE CQCP. ANY TESTING AREA WHICH DOES NOT MEET THE PROJECT REQUIREMENTS WILL REQUIRE REWORKING AND RETESTING UNTIL A PASSING CONDITION IS ACHIEVED PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS. THE PROJECT QUALITY CONTROL PROFESSIONAL (QCP, SEE CQCP) SHALL DOCUMENT ALL TEST LOCATIONS, ELEVATIONS OR LIFT NUMBERS, TEST DATES, AND TEST RESULTS. VOIDS RESULTING FROM DENSITY TESTING OR UNDISTURBED SAMPLING WILL BE BACKFILLED WITH CEMENT BENTONITE GROUT UNDER THE DIRECTION OF THE QCP.
10. CONSTRUCTION MONITORING AND SURVEYING DURING PLACEMENT OF STRUCTURAL FILL SHALL BE PER THE REQUIREMENTS LISTED IN THE CQCP.

E. STABILIZED CLAY CAP (3) △2

1. A 4 FEET THICK CLAY CAP WILL BE PLACED OVER THE STRUCTURAL FILL. THE CLAY CAP SHALL BE CONSTRUCTED OF IMPORTED CLAY SOILS. THE IN-PLACE CLAY CAP WILL HAVE A MINIMUM SHEAR STRENGTH OF 1,000 PSF, AND HAVE A PERMEABILITY OF NO MORE THAN $1X10^{-7}$ CM/SEC.
2. IF CLAY MATERIAL CAN NOT BE FOUND TO MEET THE CRITERIA IN NOTE ONE ABOVE, A TREATABILITY STUDY WILL BE PERFORMED BY THE BASIN CLOSURE CONTRACTOR TO DETERMINE ACCEPTABLE REAGENTS FOR STABILIZING THE STABILIZED CLAY CAP. DETAILS REGARDING THIS STUDY AND SUBSEQUENT STABILIZATION PROCEDURES SHALL COMPLY WITH THE GUIDANCE PROVIDED IN THE CQCP.
3. IF STABILIZATION IS REQUIRED, STABILIZED CLAY CAP COMPOSITION, MATERIAL TESTING REQUIREMENTS, AND PRE-CONSTRUCTION TESTING OF PROPOSED CLAY CAP MATERIALS, SHALL COMPLY WITH THE CQCP.
4. ALL MATERIALS SHALL BE UNFROZEN WHEN USED AND UNAMENDED SOILS SHALL BE UNSATURATED. MATERIALS SHALL NOT BE COMPACTED OVER POROUS, WET, FROZEN, OR SPONGY SUBGRADE SURFACES.
5. THE CLAY CAP SOILS SHALL BE PLACED IN 6" TO 8" LOOSE LIFTS AND UNIFORMLY COMPACTED TO 98% OF THE MAXIMUM DRY DENSITY AT A MOISTURE CONTENT, 1% "DRY" TO 3% "WET" OF OPTIMUM AS DETERMINED BY ASTM D698. IN-PLACE COMPACTION TESTING (DENSITY AND MOISTURE CONTENT) SHALL BE PERFORMED AT A MINIMUM FREQUENCY OF ONE TEST PER 5000 SQUARE FEET (E.G. 70 FEET BY 70 FEET GRID).
6. COMPACTED CLAY CAP SHALL HAVE AN ALLOWABLE BEARING PRESSURE OF AT LEAST 2,500 PSF WITH A FACTOR OF SAFETY EQUAL TO TWO (F.S. = 2.0).
7. QUALITY CONTROL AND CONSTRUCTION TESTING OF THE CLAY CAP SHALL COMPLY WITH THE REQUIREMENTS OF THE CQCP. ANY TESTING AREA WHICH DOES NOT MEET THE PROJECT REQUIREMENTS WILL REQUIRE REWORKING AND RETESTING UNTIL A PASSING CONDITION IS ACHIEVED PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS. THE QUALITY CONTROL PROFESSIONAL (QCP, SEE CQCP) SHALL DOCUMENT ALL TEST LOCATIONS, ELEVATIONS OR LIFT NUMBERS, TEST DATES, AND TEST RESULTS. VOIDS RESULTING FROM DENSITY TESTING OR UNDISTURBED SAMPLING WILL BE BACKFILLED WITH CEMENT BENTONITE GROUT UNDER THE DIRECTION OF THE QCP.
8. CONSTRUCTION MONITORING AND SURVEYING DURING PLACEMENT OF THE COMPACTED CLAY CAP SHALL BE PER THE REQUIREMENTS LISTED IN APPENDIX D OF THE "SET" BASIN CLOSURE PLAN AND IN THE CQCP.
9. 6" REINFORCED CONCRETE PAVING SHALL BE PLACED DIRECTLY ON TOP OF THE STABILIZED CLAY CAP. METHODS USED FOR THE CONSTRUCTION OF THE CONCRETE PAVING SHALL MINIMIZE ANY TYPE OF DISTURBANCE, EXCAVATION, OR PENETRATION OF THE CLAY CAP. IF ANY DISTURBANCE OF THE CLAY CAP DOES OCCUR, ANY LOOSE MATERIAL SHALL BE REMOVED AND THE DISTURBED AREA BACKFILLED WITH CEMENT BENTONITE GROUT.

F. 6" (MIN) REINFORCED CONCRETE PAVEMENT (4)

1. THE STABILIZED CLAY CAP SHALL BE COVERED WITH REINFORCED CONCRETE PAVING (6" THICK MINIMUM) TO PROTECT IT FROM FUTURE CONSTRUCTION ACTIVITIES.
2. REINFORCED CONCRETE MATERIAL AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH ACI 301, "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" AND ACI 318, "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE".
3. CONCRETE FOR PAVING SHALL ATTAIN A 28 DAY MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 4,000 PSI.
4. TYPE II PORTLAND CEMENT SHALL BE USED AND SHALL CONFORM TO ASTM C150. ONLY ONE BRAND OF CEMENT SHALL BE USED FOR ALL CONCRETE EXPOSED SURFACES.
5. CONCRETE MIX DESIGN SHALL BE SUBMITTED TO THE ENGINEER OF RECORD AND TO THE SHELL REPRESENTATIVE FOR REVIEW AND COMMENT. CONCRETE MIX DESIGN AND PROPORTIONING OF MATERIALS (WATER, CEMENT, COARSE AND FINE AGGREGATE, ADMIXTURES, ETC.) SHALL BE IN ACCORDANCE WITH ACI 301. MAXIMUM WATER CEMENT RATIO SHALL BE 0.40. AIR CONTENT AT POINT OF DELIVERY SHALL BE 5% (±1%). WEIGHT OF POZZOLAN MATERIALS SHALL NOT EXCEED 20% OF THE TOTAL CEMENTITIOUS MATERIAL WEIGHT. MAXIMUM AGGREGATE SIZE SHALL BE 1.5 INCHES. SLUMP AT POINT OF DELIVERY SHALL BE 2 TO 4 INCHES.
6. CONCRETE INSPECTION AND TESTING SHALL BE IN ACCORDANCE WITH ACI 301.
7. CONCRETE SLAB REINFORCEMENT SHALL BE "TUF-STRAND SF" MACRO SYNTHETIC STRUCTURAL FIBERS, BY EUCLID CHEMICAL COMPANY, AT A DOSAGE RATE OF 5.8 POUNDS PER CUBIC YARD. FIBERS SHALL CONFORM TO ASTM C1116, "STANDARD SPECIFICATION FOR FIBER REINFORCED CONCRETE".
8. THE FINISHED SURFACE OF THE PAVING SHALL BE SURVEYED TO VERIFY THAT IT MEETS THE MINIMUM THICKNESS REQUIREMENT OF 6 INCHES.

G. SURVEYING

1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT EACH COMPONENT OF THE TOTAL COVER SYSTEM IS CONSTRUCTED TO THE SPECIFIED THICKNESS AND GRADE. THE SUBGRADE OF THE STABILIZED CLAY COVER (TOP OF THE STRUCTURAL FILL LAYER), TOP OF THE STABILIZED CLAY CAP, AND TOP OF PAVING, SHALL ALL BE SURVEYED AT THE MINIMUM FREQUENCY OF ONE POINT PER 5000 SQUARE FEET (E.G. 70 FEET BY 70 FEET GRID).
2. BASED ON THE SURVEY DATA OF THE WEST BASIN, THE QCP WILL VERIFY THAT THE TOP OF STRUCTURAL FILL, TOP OF THE STABILIZED CLAY CAP, AND TOP OF PAVING ARE SLOPED AT 1% FROM THE CENTER OF BASIN TO THE PERIMETER OR EDGES OF THE RESPECTIVE LAYER.

ISSUED FOR CONSTRUCTION 01/31/17

REFERENCE DRAWINGS:

E-146762	BACKFILL PLAN, SECTIONS & ELEVATIONS
E-146763	PAVING PLAN, SECTIONS & DETAILS

CDI® Corporation
11200 RICHMOND AVE, SUITE 500
HOUSTON, TEXAS 77082
P: 713-280-2600, F: 713-280-2206
TEXAS ENGINEERING FIRM F-3045

CONSTRUCTION

STATE OF TEXAS · JOSHUA KERCH · -109487- · LICENSED PROFESSIONAL ENGINEER

DRAWING CODE: Y705-SET-EFLO

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
0	05/16	00212	ISSUED FOR CONSTRUCTION	JDB	DLH	.	.	.
1	09/16	00212	MODIFY NOTES, REMOVE GEOSYNTHETIC CLAY LINER, MODIFY PAVING REINFORCEMENT	JDB	DLH	.	.	.
2	01/17	00212	MODIFIED CLAY CAP NOTES	JR	JK	RF	.	.

ACCOUNT NUMBER: 00212
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

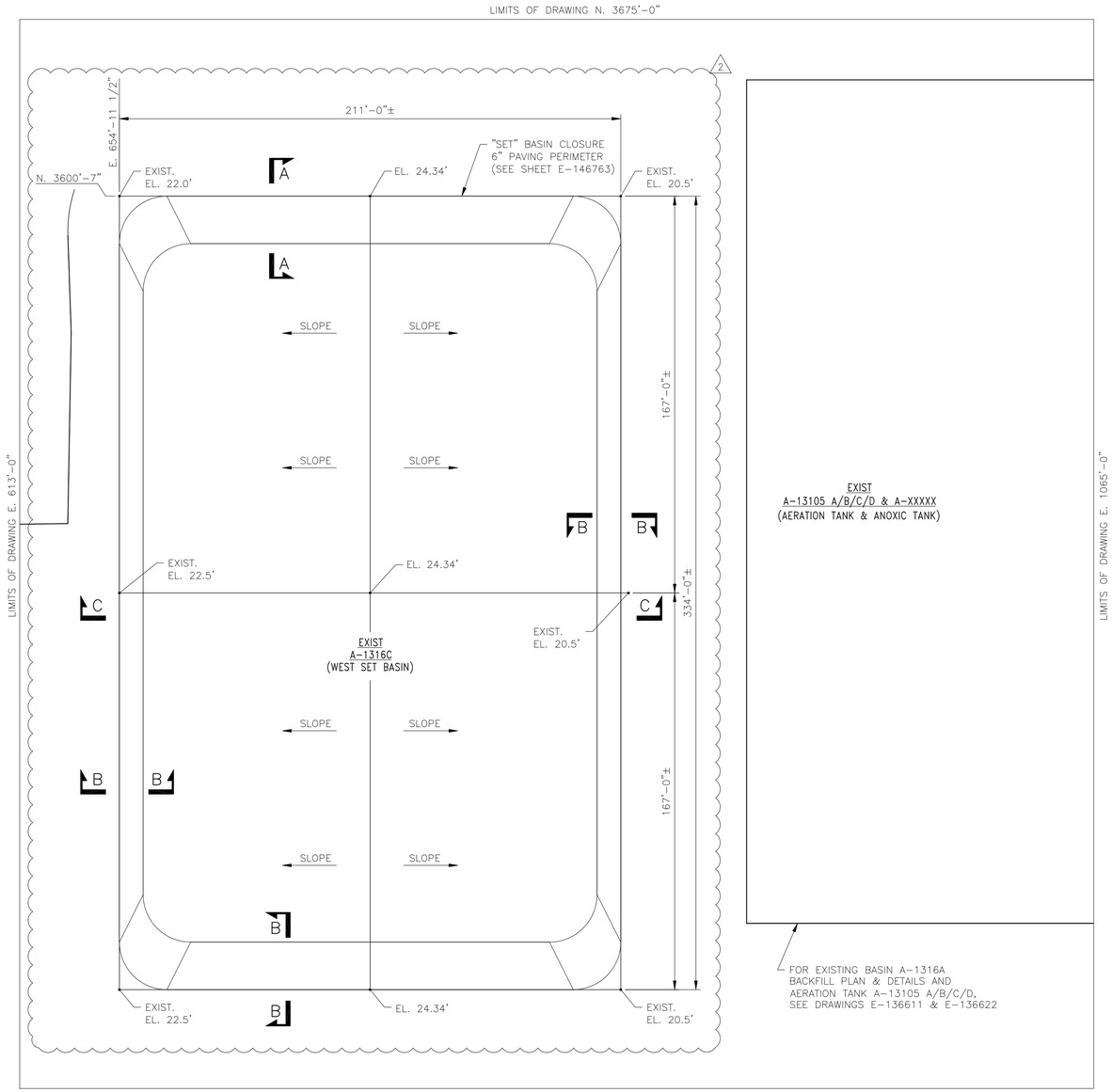
SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL – PLAN & ELEVATION
DRAWING INDEX & GENERAL NOTES
WEST (A-1316C) SET BASIN CLOSURE

		DATE			DATE
DRAWN:	JDB	04/16	APPROVED:	.	.
CHECKED:	DLH	04/16	APPROVED:	.	.
APPROVED:	.	.	APPROVED:	.	.

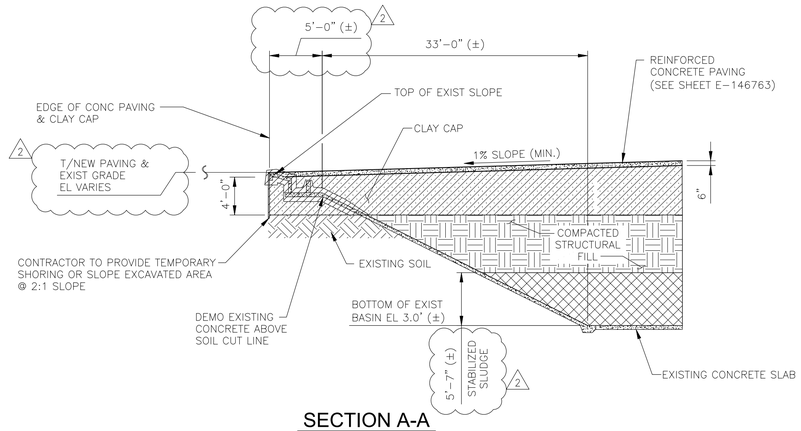
SCALE: AS NOTED | ISSUE DATE: 01/31/17 | LOC: C

DWG. No. E-146761-2



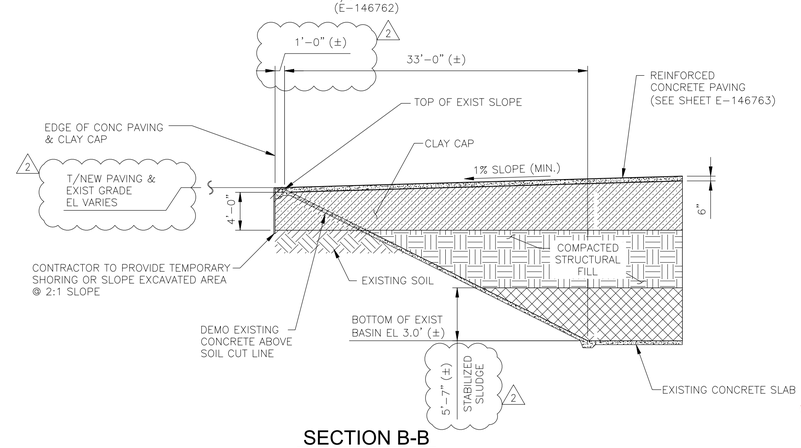
WEST BASIN BACKFILL PLAN

1"=30'-0"



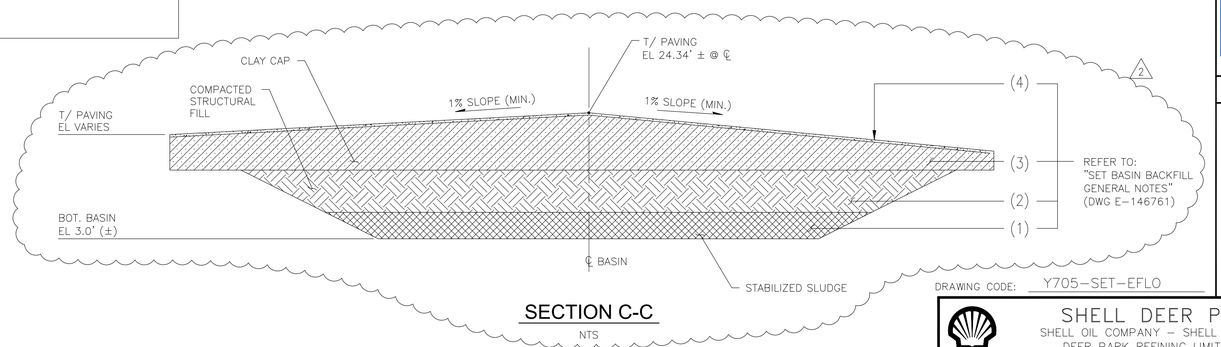
SECTION A-A

1/8"=1'-0"
(E-146762)



SECTION B-B

1/8"=1'-0"
(E-146762)



SECTION C-C

NTS

DRAWING CODE: Y705-SET-EFLO

NOTES:

1. FOR FOR GENERAL NOTES & DRAWING INDEX, SEE DRAWING E-146761.

ISSUED FOR CONSTRUCTION 01/31/17

CDI® Corporation
11200 RICHMOND AVE, SUITE 500
HOUSTON, TEXAS 77082
P: 713-280-2600, F: 713-280-2206
TEXAS ENGINEERING FIRM F-3045

CONSTRUCTION

STATE OF TEXAS -JOSHUA KERCH- -109487- LICENSED PROFESSIONAL ENGINEER

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
0	05/16	00212	ISSUED FOR CONSTRUCTION	JDB	DLH	.	.	.
1	09/16	00212	MODIFY SECTIONS & REMOVED GEOSYNTHETIC CLAY LINER	JDB	DLH	.	.	.
2	01/17	00212	UPDATED PAVING ELEVATIONS AND ADDED SECTIONS	JR	JK	RF	.	.

ACCOUNT NUMBER: 00212
FILM DATES:

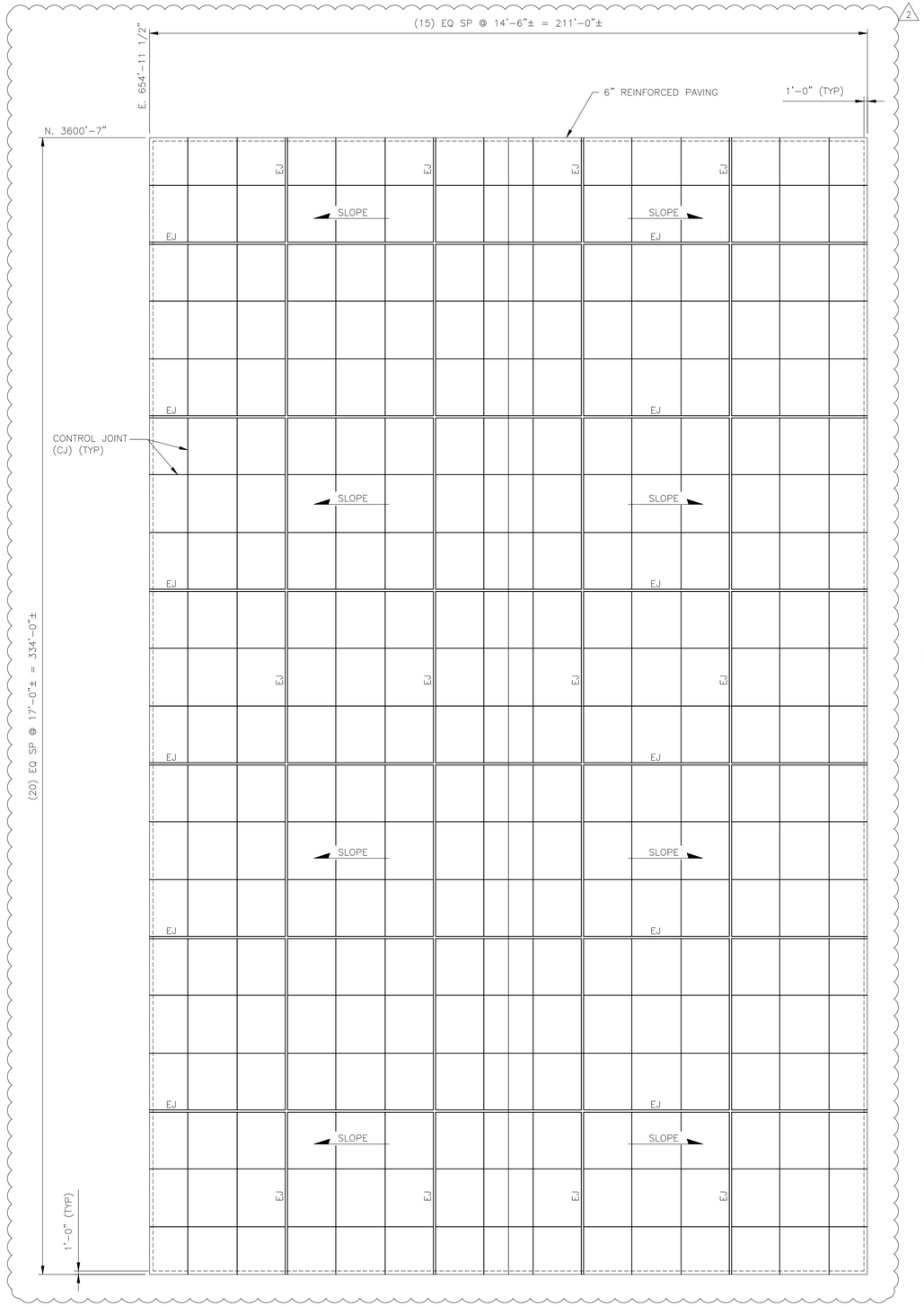
NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

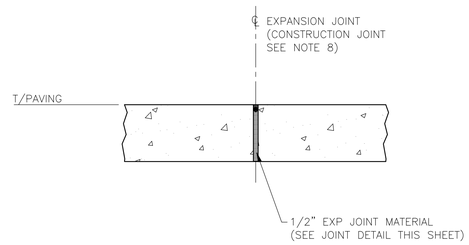
CIVIL – PLAN & ELEVATION
BACKFILL PLAN
WEST (A-1316C) SET BASIN CLOSURE

		DATE			DATE
DRAWN:	JDB	04/16	APPROVED:	.	.
CHECKED:	DLH	04/16	APPROVED:	.	.
APPROVED:	.	.	APPROVED:	.	.

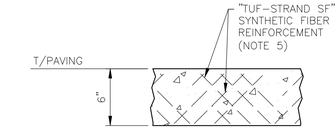
SCALE: AS NOTED
ISSUE DATE: 01/31/17
LOC: C
DWG. No. E-146762-2



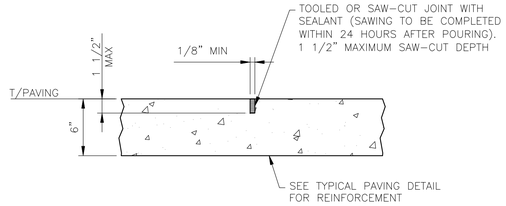
PAVING JOINT PLAN
1"=20'-0"



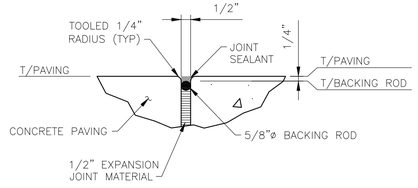
EXPANSION JOINT DETAIL
1 1/2"=1'-0"



TYPICAL PAVING DETAIL
1 1/2"=1'-0"



CONTROL JOINT DETAIL
1 1/2"=1'-0"



JOINT DETAIL @ EJ
3"=1'-0"

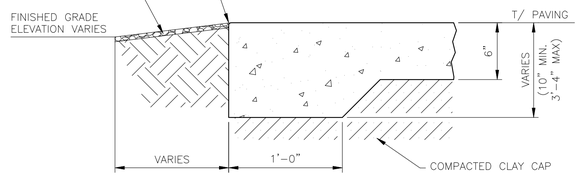
NOTES:

1. FOR FOR GENERAL NOTES & DRAWING INDEX, SEE DRAWING E-146761.
2. FOR CONCRETE NOTES, SEE SECTION "F" ON DRAWING E-146761.
3. LIMITS OF PAVING SHOWN ARE APPROXIMATE, AND SHOULD COINCIDE WITH THE REQUIREMENTS OF SECTION A-A OF DRAWING E-146762. MINIMUM PROJECTION OF PAVING AND COMPACTED CLAY CAP BEYOND THE PERIMETER OF THE EXISTING BASIN SHOULDER SHALL BE 3'-0".
4. NEW CONCRETE PAVING SHALL BE 6" MINIMUM THICKNESS. SEE ELEVATIONS AND SLOPES AS SHOWN ON PLAN AND SECTIONS OF THIS DRAWING AND E-146762.
5. PAVING REINFORCEMENT SHALL BE "TUF-STRAND SF" MACRO SYNTHETIC STRUCTURAL FIBERS, BY EUCLID CHEMICAL COMPANY, AT A DOSAGE RATE OF 5.8 POUNDS PER CUBIC YARD. FIBERS SHALL CONFORM TO ASTM C1116, "STANDARD SPECIFICATION FOR FIBER REINFORCED CONCRETE".
6. CONCRETE PAVING WILL BE PLACED OVER A MIN. 4 FEET THICK CLAY CAP. PENETRATIONS INTO THE CLAY CAP SHALL BE MINIMIZED. TEMPORARY PENETRATIONS FOR SURVEY MARKERS, FORM STAKES, ETC., INTO THE PROTECTIVE CLAY CAP, SHALL BE BACKFILLED WITH CEMENT BENTONITE GROUT.
7. CONTROL JOINT SPACING SHALL BE A MAXIMUM OF 17'-0" AND EQUALLY SPACED BETWEEN EXPANSION JOINTS, UNLESS NOTED OTHERWISE. CONTROL JOINTS IN CONCRETE PAVING SHALL BE SAW-CUT OR TOOLED, WITH SEALANT APPLIED AT JOINT SURFACE. FOR SAW-CUT JOINT, SAWING SHALL TAKE PLACE WITHIN 24 HOURS AFTER PLACING CONCRETE.
8. EXPANSION JOINT DETAIL SHALL BE USED AS CONSTRUCTION JOINTS, WHERE THE STARTING AND STOPPING OF CONCRETE PLACEMENT ACTIVITIES IS REQUIRED.
9. JOINT SEALANT FOR GENERAL PURPOSE USE SHALL BE THIOKOL 2235M TWO-PART POLYSULFIDE JOINT SEALANT AS MANUFACTURED BY THIOKOL, OR APPROVED EQUIVALENT.

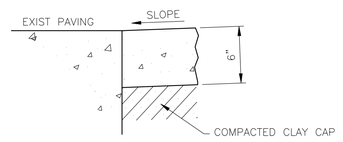
LEGEND:

CJ — DENOTES CONTROL JOINT

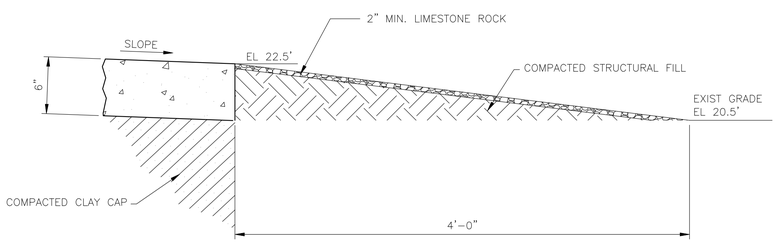
EJ — EXPANSION JOINT



NORTH AND SOUTH EDGE OF PAVING DETAIL
1 1/2"=1'-0"



WEST EDGE OF PAVING DETAIL
1 1/2"=1'-0"



EAST EDGE OF PAVING DETAIL
1 1/2"=1'-0"

ISSUED FOR CONSTRUCTION
01/31/17

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
0	05/16	00212	ISSUED FOR CONSTRUCTION	JDB	DLH	.	.	.
1	09/16	00212	MODIFY EXPANSION JOINT DETAIL, CHANGE REINFORCEMENT TO SYNTHETIC FIBERS	JDB	DLH	.	.	.
2	01/17	00212	UPDATED PAVING SLOPE ARRANGEMENT AND ADDED DETAILS	JR	JK	RF	.	.

ACCOUNT NUMBER: 00212
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

CDI® Corporation
11200 RICHMOND AVE, SUITE 500
HOUSTON, TEXAS 77082
P: 713-280-2600, F: 713-280-2206
TEXAS ENGINEERING FIRM F-3045

CONSTRUCTION

STATE OF TEXAS — JOSHUA KERCH — -109487- LICENSED PROFESSIONAL ENGINEER

DRAWING CODE: Y705-SET-EFLO

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL – PLAN & ELEVATION
BACKFILL PLAN
WEST (A-1316C) SET BASIN CLOSURE

		DATE			DATE
DRAWN:	JDB	04/16	APPROVED:	.	.
CHECKED:	DLH	04/16	APPROVED:	.	.
APPROVED:	.	.	APPROVED:	.	.

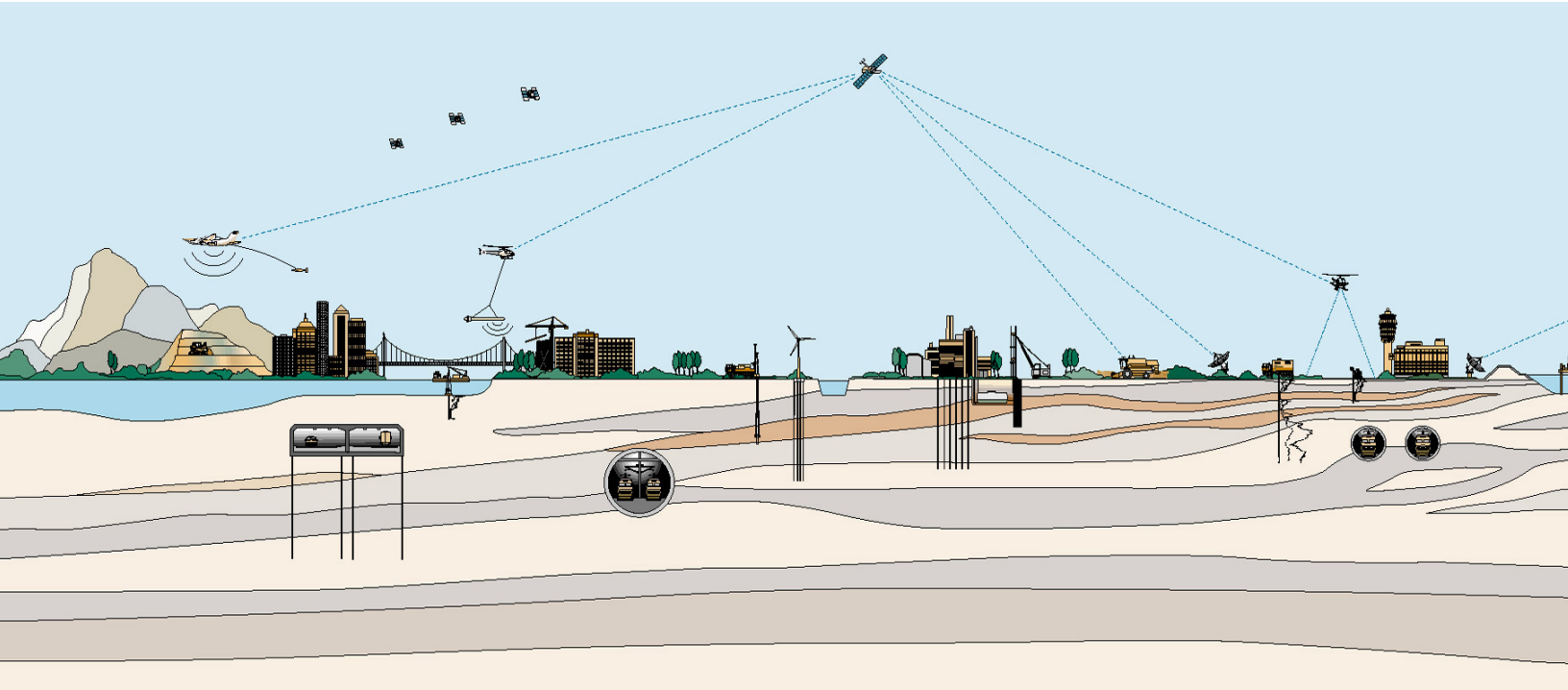
SCALE: AS NOTED
ISSUE DATE: 01/31/17
LOC: C
DWG. No. E-146763-2

Appendix D – Initial Sludge Treatability Study

FUGRO CONSULTANTS, INC.

SET BASIN TREATABILITY STUDY
SHELL DEER PARK REFINING
DEER PARK, TEXAS

SHELL OIL PRODUCTS COMPANY
DEER PARK, TEXAS



FUGRO CONSULTANTS, INC.

6100 Hillcroft (77081)
P.O. Box 740010
Houston, Texas 77274
Tel: (713) 369-5400
Fax: (713) 369-5518

Report No. 04.10160022-1
July 13, 2016

Shell Deer Park Refining
5900 State Highway 225
Deer Park, Texas 77536

Attention: Mr. Rick Frantz, P.E.
Civil/Structural Engineer - Projects

SET Basin Treatability Study
Shell Deer Park Refining
Deer Park, Texas

Introduction

Fugro Consultants, Inc. (Fugro) is pleased to present the results of our treatability for the East and West SET Aeration Basin Closure Project in Deer Park, Texas. Mr. Rick Frantz, P.E. with Shell Oil Products Company (Shell) requested this study during a meeting with Mr. William Martin, P.E. of Fugro on January 21, 2016. Our services were authorized through Shell Deep Park Refining Purchase Order No. 4518118534 dated February 9, 2016. We performed our services in general accordance with Fugro Proposal No. 04.10160022p1 dated February 4, 2016.

Project Description. Shell is planning to close their existing east and west aeration basins located in the South Effluent Treatment Area, at their existing facility in Deer Park, Texas. The existing east and west basins cover an area of approximately 200 by 350 feet and 220 by 340 feet, respectively. Each basin is about 16 feet deep below adjacent grade with side slopes at 2-horizontal to 1-vertical. Upon completion of closure activities, the current plans are to utilize the east basin as a parking area and the west basin as a laydown area for storage of construction materials, supplies, and equipment.

The current planned closure procedure for the east and west basins includes: 1) draining the basins, 2) stabilizing the existing sludge (about 2 to 4 feet of sludge at the bottom of each basin) with fly ash and borrow soil, 3) placing structural fill to bring grade to within 4 feet of the surrounding grade, 4) placing a cap (4-foot thick clay cap or geosynthetics clay liner (GCL)) to achieve final site grade, and 5) placing a protective surface cover over the cap.

Shell has recently completed the closure of the middle SET basin. RECON performed the treatability study and the closure for the Middle Basin Closure Project.

Scope of Treatability Study. The scope of this treatability study was to: 1) review the previous treatability study performed by RECON for the middle basin, 2) mix the sludge collected from the west basin with different proportions of borrow soil and fly ash and evaluate the strength gain with

time, 3) evaluate the classification properties and the strength of laboratory compacted structural fill, 4) evaluate the classification, hydraulic conductivity, and the strength of the borrow clay cap material, and 5) present the results of the study in a data report.

Environmental assessments, compliance with State and Federal Regulatory requirements, and environmental analyses were beyond the scope of our services.

Applicability of Report. Our scope of services was limited to laboratory testing. If borrow sources and materials differ from those used during the treatability study, the results may differ. If different materials or sources are used, additional laboratory testing should be performed to confirm the required results. In addition, test results of specimens preparation in the laboratory, under laboratory conditions, could differ from what is achieved in the field under field mixing and compacting conditions. As such, a field monitoring and testing program should be developed to confirm that required strengths and permeability are achieved.

We have prepared this data report exclusively for Shell to assist in the closure of the east and west basins. We have conducted this study using the standard level of care and diligence normally practiced by recognized engineering firms now performing similar services under similar circumstances. This is a data report only; no design recommendations or specifications are presented herein. Fugro makes no claim or representation concerning any activity or condition falling outside the specified purpose to which this data report is directed.

Material for Laboratory Testing

The closure of the East and West Basins will be performed by Bo-Mac. For our treatability study, Bo-Mac identified the potential offsite borrow source for 1) the soil to be mixed with the sludge, 2) the structural fill, and 3) the clay cap. Bo-Mac also identified the provider of the fly ash to be mixed with the sludge. Various mixture ratios of the sludge/soil/fly ash were proposed by Bo-Mac based on their experience.

Eight 5-gallons buckets of sludge from the West Basin were provided by Shell to Fugro on April 12, 2016. The fly ash was provided and delivered to our Houston office by a Headwaters Resources representative. Fourteen 5-gallon buckets of two potential borrow materials were obtained by Fugro from Megasand Enterprises, Inc. on April 13, 2016 (eight 5-gallon buckets of clayey sand) and on May 13, 2016 (six 5-gallon buckets of clay). It should be noted, based on preliminary strength test results of the treated sludge using “clayey sand”, the mix ratios and materials were adjusted.

Laboratory Testing

The laboratory-testing program was directed toward evaluating the:

- Classification properties of the two proposed offsite borrow materials (clayey sand and clay).
- Standard Proctor compaction curves of two proposed offsite borrow materials (clayey sand and clay)
- Compressive strength of the various sludge/soil/fly ash mixes and the strength gain with time.
- Compressive strength of the proposed structural fill.
- Compressive strength and the hydraulic conductivity of the proposed clay cap.

The laboratory tests were performed in general accordance with the appropriate standards as tabulated in this section.

Classification Tests. The classification tests included tests for water content, liquid and plastic limits (collectively termed Atterberg limits), and percent passing the No. 200 sieve (percent fines). These tests aid in classifying the soils. The results of the classification tests are presented in Tables 1 and 2 for the clayey sand and clay respectively.

Table 1. Summary of Classification Tests – Clayey Sand

Soil Sample No. (Clayey Sand)	Water Content, (%)	Percent Passing No. 200 Sieve	Atterberg Limits		
			LL	PL	PI
1	13	43	26	11	15
2	14	-	-	-	-
3	13	42	25	11	14
4	13	-	-	-	-
5	13	40	24	11	13
6	13	-	-	-	-
7	12	41	28	11	17
8	12	-	-	-	-
9	13	43	28	11	17
10	12	-	-	-	-
11	-	46	25	14	11
12 (Proctor Test)	-	44	32	14	18

Table 2. Summary of Classification Tests – Clay

Soil Sample No. (Clay)	Water Content, (%)	Percent Passing No. 200 Sieve	Atterberg Limits		
			LL	PL	PI
1	19	85	53	13	40
2	21	-	-	-	-
3	19	87	52	12	40
4	20	-	-	-	-
5	19	85	51	13	38
6	20	-	-	-	-
7 (Permeability Test)	17	84	56	13	43
8 (Proctor Test)	-	81	52	17	35

Standard Proctor Compaction. The Standard Proctor tests were performed on the borrow clayey sand and the borrow clay. These tests were performed on untreated bulk samples (i.e. the sample was not treated with fly ash). Using standard effort, the Standard Proctor Compaction test determines the optimum moisture content at which the soil will have its maximum density. The results of the laboratory compaction tests are presented in Appendix A. The Standard Proctor Test on the borrow clayey sand resulted in an optimum water content of about 11 percent and a corresponding dry unit weight of about 119 pcf. The Standard Proctor Test on the borrow clay resulted in an optimum water content of about 18 percent and a corresponding dry unit weight of about 107 pcf.

Strength Tests. The strength of compacted clayey sand and clay (samples compacted at 98 percent Standard Proctor), and treated sludge/borrow soil/ fly ash mixes were measured by performing unconfined triaxial compression tests. The natural water content and dry unit weights were determined as routine parts of the strength tests. The results of the laboratory compressive tests are presented in Tables 3 through 5. The unconfined compressive strength as a function of time for the two mixes being considered by Shell, the 1 to 1.5 ratio of sludge to clay with 15 percent fly ash and the 1 to 1.5 ratio of sludge to clay with 18 percent fly ash, are presented graphically on Plate 1. Note that the sludge/borrow soil/ fly ash mixed samples were compacted by tamping to simulate anticipated field procedures for stabilizing/mixing the sludge material in the east and west basins.

Table 3. Undrained Shear Strength of Soils Compacted at 98 Percent of Standard Proctor

Borrow Material	Sample No.	Water Content, (%)	Dry Unit Weight, (pcf)	Undrained Strength, (psf)
Clayey Sand	1	13	119	1,190
	2	13	118	1,550
Clay	1	17	102	2,450
	2	17	103	2,370

Table 4. Compressive Strength of Sludge/Clayey Sand/Fly Ash Mix

Ratio of Sludge to Clayey Sand by Volume	Percent Fly Ash by Dry Weight	Curing Period (Days)	Water Content, (%)	Dry Unit Weight, (pcf)	Compressive Strength, (psi)
1 to 1	9	3	53	66	9
			55	66	7
		7	51	66	14
		14	56	62	13
1 to 1	12	3	53	47	7
			52	65	7
		7	50	65	13
		14	53	65	19
1 to 1	15	3	52	67	9
			48	65	9
		7	49	69	16
		14	49	68	25
1 to 1	18	3	49	67	8
			48	69	11
		7	51	67	15
		14	48	67	25
2 to 1	15	3	63	60	5
			64	59	5
		7	63	60	7
		14	66	58	12

Table 5. Compressive Strength of Sludge/Clay/Fly Ash Mix

Ratio of Sludge to Clay by Volume	Percent Fly Ash by Dry Weight	Curing Period (Days)	Water Content, (%)	Dry Unit Weight, (pcf)	Compressive Strength, (psi)
1 to 1	12	1	61	60	6
		2	61	59	6
		3	58	62	10
		7	61	59	4
		14	57	60	31
		21	60	61	38
1 to 1	15	1	68	58	5
		2	65	57	7
		3	65	58	9
		7	68	56	10
		14	64	59	32
		21	57	62	43
1 to 1	18	1	65	58	4
		2	63	59	6
		3	59	60	6
		7	60	60	14
		14	66	58	24
		21	69	58	14
1 to 1½	12	1	53	65	4
		2	63	61	3
		3	55	63	9
		7	62	60	5
		21	53	68	4
1 to 1½	15	1	51	66	9
		2	52	64	13
		3	50	68	16
		7	51	66	27
		21	50	67	49
1 to 1½	18	1	47	72	13
		2	49	68	20
		3	46	70	22
		7	44	70	34
		21	43	73	63

Permeability Test. The permeability of the borrow clay soil, which is being considered for the clay cap, was determined by performing one hydraulic conductivity test on a soil sample compacted at 98 percent of Standard Proctor. The permeability of the soil is expressed using the coefficient of permeability (k), also referred to as hydraulic conductivity, which has units of velocity (distance/time). The coefficient of permeability represents the ability of a soil to transmit water and is influenced by factors such as the soil grain size distribution, soil mineralogy, degree of saturation, permeating fluid, and void ratio.

The coefficient of permeability was determined by using a flexible-wall permeameter. During the hydraulic conductivity test, the compacted sample was saturated with tap water and then incrementally and isotropically consolidated to an effective consolidation stress. Permeation of tap water was then accomplished using a falling-head constant volume system. The constant-volume system maintains continuity of inflow and outflow of the permeating fluid during the permeability determination. The worksheets for the hydraulic conductivity test is presented in Appendix B. The compacted borrow clay sample resulted in a hydraulic conductivity value of about 5.8×10^{-9} cm/sec.

Summary of Laboratory Tests. Table 6 provides a summary of the types and number of laboratory tests performed for this study as well as the applicable test standards.

Table 6. Summary of Laboratory Testing

Type of Test	Quantity	Testing Standard
Water Content	74	ASTM D2216
Dry Unit Weight	68	ASTM D7263
Atterberg Limits	12	ASTM D4318
Percent Passing the No. 200 Sieve	12	ASTM D1140
Unconfined Compression	57	ASTM D2166
Standard Proctor Compaction	2	ASTM D698
Hydraulic Conductivity	1	ASTM D5084

Material Specifications and Test Results

Based on our communication with Shell, it is our understanding that the material specifications for the east and west basins will be similar to the material specifications that were established for the middle basin. Material specifications along with test results for the stabilized sludge, structural fill, and clay cap are summarized in Table 7.

Table 7. Material Specifications and Test Results Summary

Material	Parameter	Requirement	Borrow Clayey Sand [2]	Borrow Clay [2]
Treated Sludge	Unconfined Compressive Strength	25 psi [1]	See Table 4	See Table 5
Structural Fill (Option 1)	Unified Soil Classification System Designation	SC (SACL)	SC	CH
	Liquid Limit	LL ≤ 40	24 - 32	51 - 56
	Plasticity Index	10 ≤ PI ≤ 20	11 - 18	35 - 43
	Clod Size	≤ 3 inches	Process as Necessary	Process as Necessary
	Undrained Shear Strength	≥ 1 ksf	1.19 – 1.55 ksf [3]	2.45 – 2.37 ksf [3]
Structural Fill (Option 2)	Unified Soil Classification System Designation	GW, GC, SW, or SC	SC	CH
	Angular Particles	≤ 4 Inches	All Material less than 4 Inches	All Material less than 4 Inches
	Percent Passing Sieve No. 200	≤ 12 %	40 – 46 %	81 – 87 %
	Undrained Shear Strength	≥ 1 ksf	1.19 – 1.55 ksf [3]	2.45 – 2.37 ksf [3]
Clay Cap	Unified Soil Classification System Designation	CH	Not considered suitable for a clay cap because of high sand content.	CH
	Clod Size	< 3 inches		Process as Necessary
	Rock size	< 3 inches		No Rock Present
	Plasticity Index	PI ≥ 15		35 - 43
	Liquid Limit	LL ≥ 30		51 - 56
	Percent Passing 1 Inch Sieve	100 %		100 %
	Percent Passing No. 200 Sieve	≥30 %		81 – 87 %
	Hydraulic Conductivity	≤ 1 x 10^{-7} cm/sec		5.8 x 10^{-9} cm/sec

Notes: (1) After 3-day cure period.

(2) Items shaded in ▭ meet requirements.

(3) Compacted at 98 Percent of Standard Proctor at a moisture content of 1 percent dry to 3 percent wet of optimum moisture content.

* * *

The following illustration and appendices are attached and complete this report:

	Plate
Unconfined Compressive Strength – Sludge, Clay, and Fly Ash Mix	1
Appendix A – Standard Proctor Compaction Test Results	A-1 and A-2
Appendix B – Hydraulic Conductivity Test Worksheets	B-1 thru B-3

Closing

We appreciate the opportunity to be of continued service to Shell and look forward to working with you again in the near future. Please call us if you have any questions or comments concerning this data report or when we may be of further assistance.

Sincerely,
FUGRO CONSULTANTS, INC.
TBPE Firm Registration No. F-299

Rani Jaafar, Ph.D.
Senior Project Professional

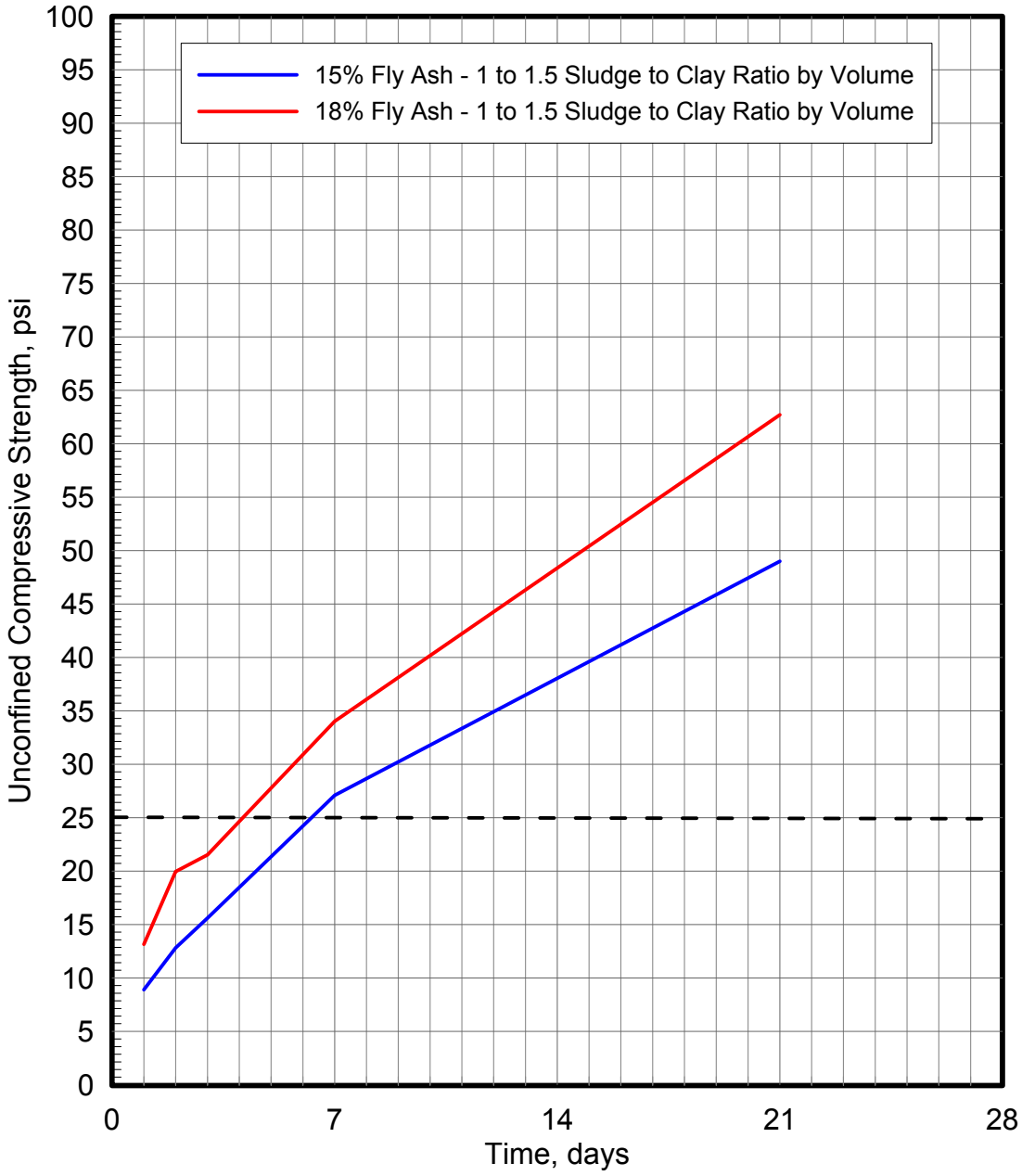
Robert P. Ringholz, P.E.
Chief Engineer

STATE OF TEXAS
ROBERT P. RINGHOLZ
54454
REGISTERED
PROFESSIONAL ENGINEER
13 July 2016

Copies Submitted:
Addressee – Electronic File (3): [redacted]

RJ/RPR
R:\04100\2016 Projects\0001-0099\04.10160022 - Shell SET Basins\010 Reporting\Data Report No. 04.10160022-1.doc

ILLUSTRATION



UNCONFINED COMPRESSIVE STRENGTH
SLUDGE, CLAY, AND FLY-ASH MIX
SET BASIN TREATABILITY STUDY
SHELL DEER PARK REFINING
DEER PARK, TEXAS

PLATE 1

APPENDIX A

STANDARD PROCTOR COMPACTION TEST RESULTS

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

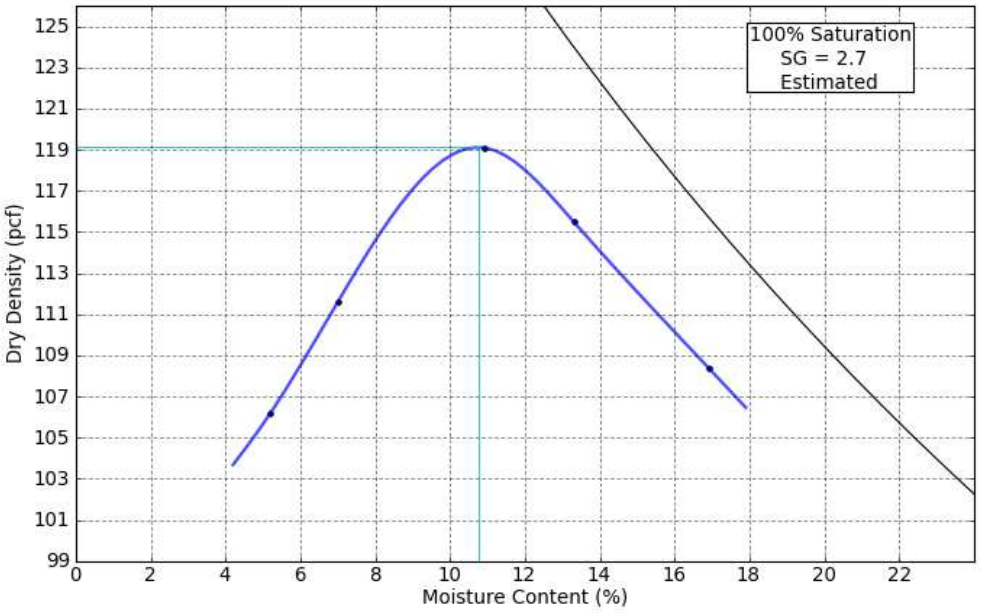
Project: East and West SET Aeration Basin Closures

Client: Shell Deer Park Refining Company
5900 State Highway 225
Deer Park, Texas 77536

Report Date: 07/05/2016
Project No.: 04.10160022

Visual Classification: Tan Clayey Sand

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 119.1 pcf
Optimum Water Content: 10.8 %

Properties:	ASTM D4318
Liquid Limit	32
Plastic Limit	14
Plasticity Index	18
	ASTM D1140
% Passing 200:	44.4

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Sampled By Others

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

P.T.Kolitha Karunaratne, P.E.
CMET Operations Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

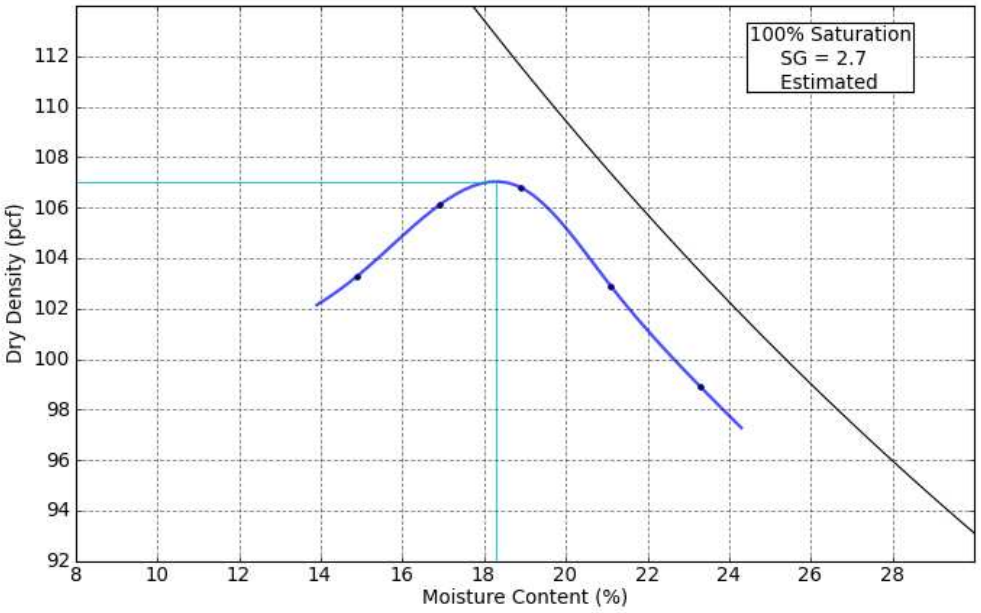
Project: East and West SET Aeration Basin Closures

Client: Shell Deer Park Refining Company
5900 State Highway 225
Deer Park, Texas 77536

Report Date: 07/05/2016
Project No.: 04.10160022

Visual Classification: Brown and Gray Fat Clay with Sand

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 107.0 pcf
Optimum Water Content: 18.3 %

Properties:	ASTM D4318
Liquid Limit	52
Plastic Limit	17
Plasticity Index	35
	ASTM D1140
% Passing 200:	81.4

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Sampled By Others

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

P.T.Kolitha Karunaratne, P.E.
CMET Operations Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

APPENDIX B

HYDRAULIC CONDUCTIVITY TEST WORKSHEETS

HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Setup / Take Down
ASTM D 5084

Project Number: 04.10160022 | Test Type: Permeability Vert. | Cell No.: Perm-4 | File Name: - - _CS-1-6bV

Project Name: | Test Stress(es), σ'_c or $\sigma'_{v,c}$ = 5 , NA , NA & NA psi (1)

Task No.: | Perm. Orientation: [X] Vert.; [ ] Horiz. G_s = 2.750 | [ ] Meas.; [X] Assumed

Test No.: NA | Test Series No.: NA | Hydraulic System Used: [X] Hg (CV-FH) [ ] FH (Open System)

Part of Hyd. Conductivity Series [ ] No.; [X] Yes; if yes with [X] Vert.; [ ] Horiz.; [ ] Remolded

Assig. Remarks:

[ ] Tube [X] Field Extruded [ ] Liner [ ] Remolded	[X] Tamping	[ ] Constant Effort:	Blows/Tamps per Layer =
Boring No.: - - [X] Reconstituted	[ ] Impact/Rammer	Rammer Wgt.(lbf)=	No. Layers = 6.00
Sample No.: CS-1-6 Compostite No.:	[ ] Pluviated:	Tamper Force (lbf)=	Drop (in.) =
Depth (ft): Specimen No.: b	[ ] Kneading	[ ] Undercompaction: U_{ni} (%) =	Dia. (in.) =
[ ] Spec. Selection by X-ray; [ ] Geomarine Sample	[X] Notation?	Ref. Effort= UK % Comp. = UK	± Opt. = UK

Type	[X] Isotropic	[ ] K_o stress path	[ ] Rings	Piston:	[X] Yes ;	[ ] No	[ ] Attached to top cap	
Consolidation:	[ ] Anisotropic	[ ] 45° stress path		Piston diameter:	[ ] 1/2";	[ ] 1/4";	[X] 1/8";	[ ]

Water Content (WC);	Initial - Trimming Location			Final (W_{at})	**SOIL MASSES:**	Initial	Final
	Top ($W_{o,1}$)	Bottom ($W_{o,2}$)	Sides ($W_{o,3}$)	(see below)	Moist + Tare (etc.)(g):	342.16	362.92
Container No	6477			5092	Tare (etc.) (g):	0.00	0.00
Mass Moist Soil + Cont. (g)	138.63			99.80	Spec. Moist Mass (g):	342.16	362.92
Mass Dry Soil + Cont. (g)	123.43			86.42	EXCESS DRY SOIL (soil stuck to stones, filter paper, membrane, etc)		
Mass Container (g)	30.80			30.79	Container No:		
Water Content, $W_{o,n}$ (%)	16.41			24.05	Mass Dry Soil + Container (g)		
Avg. Initial WC, $W_{o,avg}$ (%)	16.41	Final (W_{at}); [X] Slice; [ ]		Whole Spec.	Mass Container (g):		
[ ] See attached data sheet(s) for additional water contents					Mass Excess Dry Soil (g):		0.00

Specimen Dimensions

	Height (mm) Initial (H_o)	Height (mm) Final (H_{at})		Diameter (mm) Initial (D_o)	Diameter (mm) Final (D_{at})
GB	100.010	100.010	T	51.00	51.00
1	-12.42	-10.75	M	51.00	51.25
2	-12.48	-10.74	B	51.00	51.15
3	-12.45	-10.75	T'		
4	-12.46	-10.77	M'		
5	-12.46	-10.75	B'		
Avg.	87.56	89.26	Avg.	51.00	51.13

Measuring Devices:

Pi Tape: [X] Dia.

Calipers: [ ] Ht.; [ ] Dia.

Dial Comparator: [X] Ht.; [ ] Dia.

A_o (cm^2) = 20.43

V_o (cm^3) = 178.86

A_{at} (cm^2) = 20.54

V_{at} (cm^3) = 183.29

NA - Not Applicable; UK - Unknown; GB - Gage Block

Estimated Initial Unit Weight:

Total, $\gamma_{t,o}$ (lb/ft^3) = 119.42 | Dry, $\gamma_{d,o}$ (lb/ft^3) = 102.59

Membrane / Filter Paper / Platens

Membrane (mm)			Top	Bottom
Thickness:	[ ]	Single	0.62	0.67
	[X]	Double	0.64	0.66
Circumference (C_{rm})			138.00	138.00
Summary:			Thickness	Diameter
[ ] Nominal Value		Average:	0.32	43.93

Filter Paper : Top + Bottom : [X] Yes ; [ ] No

Whatman No. 54: [X] Yes ; [ ] Other:

Mass top cap, M_{tc} (g) = ; ÷ 454 = lbf

Mass (cap, dial, piston, etc.) (g) = NA ; NA lbf

Note: (1) Each Test Stress is identified as a Test Stage on other data sheets.

Final Specimen Description (USCS group name & symbol, color, layering, max. part. size, slickensided, fissured, blocky, honeycombed, etc.)

Fat Clay, gray with few calcareous nodoles

[ ] Photo taken (internal sliced surface & outside surface)

Other Remarks

Trimmed / Reconstituted By: AA Date: 6/7/2016

Setup By: RC,jr Date: 6/13/2016

Take Down By: RC,jr Date: 6/21/2016

Prelim. Calc. By: RC,jr Calculated By: RC,jr

Reviewed By: JL

PLATE B-1

HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Calculations & Summary

Project Number: 04.10160022 Cell No.: Perm-4 File Name: - - _CS-1-6bV

Task Number: Specific Gravity: 2.750 [ ] Measured; [X] Assumed

Boring No.: - - Sample No.: CS-1-6 Specimen No.: b Depth (ft):

Type Test: Permeability Vert. Specimen: [X] "Intact"; [X] Reconstituted; [ ] Remolded

Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = ppm

	Inital Water Contents (WC), (W_o) over Saturation, (S_o), in (%):						Calculated Mass of Dry Soil (g)	
	Top, $W_{o,1}$	Botttom, $W_{o,2}$	Sides, $W_{o,3}$	Avg., $W_{o,avg}$	Selct., $W_{o,s}$	Back Cal., $W_{o,bc}$	Initial Selected WC, w_o (%)	16.41
W_o	16.41			16.41	16.41	16.96	Initial , $M_{d,o}$	293.93
S_o	67.3			67.3	67.3	68.7	Final, $M_{d,at}$	292.56
	Measured final mass of moist soil, $M_{t,at}$ (g)					362.92	Selected, M_d	293.24
	Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g)					362.92		

Consolidation Data	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	
Changes in Height (mm) and Volume (cm^3) Within Given Consolidation Stages/Columns	At Initial Seating Stress	During Back-Pressuring	1st Consol. Increment (1)	Column 2 or 3 to **1st Test** Stage (1)	Column 4 to **2nd Test** Stage	Column 5 to **3rd Test** Stage	Column 6 to **4th Test** Stage	
Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec.								
Change in Height, $\Delta H_{c,n}$	0.00	-1.60		0.16	NA	NA	NA	
Sum of changes in burette readings $\Delta b_{r,n}$ (+ out)				-1.05	NA	NA	NA	
burette readings $\Delta b_{r,n}$ (- in)	-0.18	-19.52	NA	NA	NA	NA	NA	2
Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$	0.00	-9.81		0.98	NA	NA	NA	
Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$				-1.07	NA	NA	NA	
Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$			NA	NA	NA	NA	NA	3
Selected $\Delta V_{c,n}$	0.00	-9.81		-1.05	NA	NA	NA	

Summary For Test Stages					Vol. Factor used to cal. $\Delta V_{HC,n}$
Test Stage:	1st = 1	2nd = 2	3rd = 3	4th = 4	in perm. stage(2)= NA
Cell Pressure, $\sigma_{c,n}$ (psi)	85.00	NA	NA	NA	Number of
Back Pressure, $U_{b,n}$ (psi)	80.00	NA	NA	NA	Test Stages = 1
Axial Force Reading, $P_{r,n}$ (lbf)	NA	NA	NA	NA	Ht. change during permation
Eff. Consol. Stress (σ'_c or $\sigma'_{v,c}$) (4), (ksf)	0.72	NA	NA	NA	& removal of cell pressure, (5)
t_c, ON or in [X] days [ ] hrs	3.00	NA	NA	NA	ΔH_{td} (mm) = -0.02

At Final Test Stress/Stage - Summary of Calculation of ΔV_c (cm^3) by Different Procedures

By Selected Volumes	By Saturation = 100 %	By Change in Mass (6)	For Diff. in Meas. Vol. (V_o-V_{at}),	For Selected ΔV_c, requirec
ΔV_c = -10.86	ΔV_c = 2.23	ΔV_c = -1.10	& corr. for ΔH_{td} ΔV_c = -4.51	G_s for S_c = 100 %: 2.450

At Final Test Stress/Stage - Consolidation Conclusions

$\Delta H_{c,f}$ (mm) = -1.44	$\Delta V_{c,f}$ (cm^3) = 2.23	Back Cal. G_s for S=100% = 2.750	Normalized	Ht. Ch. (%) =	0.28
$\varepsilon_{ac,c}$ (%) = -1.64	$\varepsilon_{vc,f}$ (%) = 1.25		Diff. in:	Vol. Ch. (%) =	3.72

Summary of Specimen Physical Properties

Specific Gravity: G_s = 2.750		Height	Volume	Area	Water Content	Unit Weight Total	Unit Weight Dry	Saturation	Void Ratio	Volumetric Water	Porosity	Skempton B para-
Condition:		(mm)	(cm^3)	(cm^2)	(%)	(pcf)	(pcf)	(%)	e	Content	n	meter %(7)
Initial:		87.56	178.86	20.43	16.68	119.42	102.35	68.0	0.674	0.2740	0.403	100.0
After	to 1st σ'_c	89.00	176.63	19.85	23.76	128.27	103.64	100.0	0.654	0.3952	0.395	
Consol.:	to 2nd σ'_c											NA
	to 3rd σ'_c											"
	to 4th σ'_c											"

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.

(2) The ht. changes occuring within each permeation stage (1 - 4) are recorded in these rows (after Column 3).

(3) The volume changes occuring within each permeation stage (1 - 4) are calculated/recorded in these rows (after Column 3).

(4) Stresses are not corr. for membrane.

(5) Log as a **negative** number if change in height is upward.

(6) ~ $M_{t,o}$-($M_{tat,c}$+$\Delta V_{in,column1\&2}$)

(7) Initial value is after back pressuring

NA - Not Applicable; ON - Over Night; WC - Water Content Remarks:

Calculated By: RC,jr Reviewed By: JL

PLATE B-2

HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: ASTM D 5084, METHOD F:

Using Flexible Wall Permeameter and Mercury Constant Volume - Falling Head Hydraulic System

Project Number: 04.10160022	Test Type: Permeability Vert.	Cell No.: Perm-4		Boring/Exploration No.: - -
Task Number:	Test Stage: 1 of 1	Test Station No.: 21		Sample No.: CS-1-6
Project Name:	Test No.: NA	Hyd. App. No. (Permometer): 1		Penetration/Depth (ft):
	Test Series No.: NA	File Name: - - _CS-1-6bV		Composite Sample No.:
Axial Load Cell No.: NA	Factor, (lbf/V/V): NA	Excit. Volt, V: NA	Ch. No.: NA	Ht. Reading before Perm. (mm): 7.680
Vert. Dial/DT No.: DG-061	Factor, (mm/V/V):	Excit. Volt, V:	Ch. No.:	Ht. Reading at σ_c = 0 (mm): 7.700

Permeation & Specimen Information

Permeant:	X	Tap Water;			
Direction of Flow:	X	Up;		Down	
Perm. Orientation:	X	Vertical;		Horizontal	
Specimen:	X	"Intact;"	X	Reconstituted;	

Back Pressure, U_b (psi)	Stage	Height, $L_{t,n}$ (mm)	Area, $A_{t,n}$ (cm^2)
= 80.0	Preliminary:	88.666	20.63
	Final:	88.996	19.85

Prelim. change in height during consol., $\Delta H_{c,p}$ (mm) = -1.11

Hydraulic System Constants

Mercury U-Tube Manometer

Area headwater tube, a_{in} (cm^2):	0.7671
Area tailwater tube, a_{out} (cm^2):	0.03142
ΔHg_{eq} at equilibrium (cm):	0.4
Fluid Density Const. (15-25°C):	12.57

Remarks:

Mercury Head Settings (D 5084)

Estimated k_t (cm/sec)	Max. Gradient ($i_o = h/L_{t,p}$)	Permometer ΔHg Setting (cm)	Min. Cell Pressure (psi)
1.0E-4 to 1.0E-5	≤5	3.2	81.3
1.0E-5 to 1.0E-6	≤10	6.7	82.5
1.0E-6 to 1.0E-7	≤20	13.7	85.0
<1.0E-7 or <3.0E-2 (m/yr)	≤30	20.8	87.6
For Special Gradient, i_o			

Trial No.	Read-ings By	Date y= 2016 (m/d)	Time (1) hr:min	Temp. °C	Δt (min)	Axial Force (volt)	Pressure Cell, σ_c (psi)	Pressure Back, u_b (psi)	X Dial DT Reading (mm)	Mercury Head Readings (2) Tail, tw_r (cm) (3&4)	Mercury Head Readings (2) Head, hw_r (cm)	Total Head Loss (cm of water)	Initial Hyd. Gradient, i_o Preliminary Final	Hydraulic Conductivity, k Preliminary, k_t (m/yr) (cm/s)	Hydraulic Conductivity, k Final, $k_{20°C}$ (m/yr) (cm/s)	Minimum Allowable tw_r (cm)
	rc,jr	6/20	9:01:04	19.2	102.4	NA	85.0	80.0	7.680	19.00	1.45	225.3	25.4	3.17E-03	3.36E-03	14.70
1	rc,jr	6/20	10:43:28	19.6		NA	85.0	80.0	7.680	18.00	XXXXX	212.2	25.3	1.01E-08	1.06E-08	
	rc,jr	6/20	10:44:50	19.6	138.8	NA	85.0	80.0	7.680	21.00	1.35	251.7	28.4	2.09E-03	2.19E-03	16.19
* 2	rc,jr	6/20	13:03:41	19.9		NA	85.0	80.0	7.680	20.00	XXXXX	238.6	28.3	6.61E-09	6.95E-09	
	rc,jr	6/20	13:04:23	19.9	247.1	NA	85.0	80.0	7.680	21.00	1.35	251.7	28.4	1.41E-03	1.48E-03	16.19
* 3	rc,jr	6/20	17:11:30	20.0		NA	85.0	80.0	7.680	19.80	XXXXX	235.9	28.3	4.48E-09	4.69E-09	
	rc,jr	6/21	4:39:57	19.0	227.7	NA	85.0	80.0	7.680	21.00	1.35	251.7	28.4	1.80E-03	1.92E-03	16.19
* 4	rc,jr	6/21	8:27:36	19.4		NA	85.0	80.0	7.680	19.60	XXXXX	233.3	28.3	5.71E-09	6.08E-09	
	rc,jr	6/21	8:28:07	19.4	276.0	NA	85.0	80.0	7.680	21.00	1.35	251.7	28.4	1.71E-03	1.79E-03	16.19
* 5	rc,jr	6/21	13:04:10	20.3		NA	85.0	80.0	7.680	19.40	XXXXX	230.7	28.3	5.41E-09	5.67E-09	

(*) Indicates trials used for calculations of: Average $k_{20°C}$, Max. Dev. from mean, and Average (i_o).

(1) If a stopwatch is used to obtain Δt, only record the initial time reading.

(2) Read both mercury levels at top of meniscus.

(3) The tailwater column is the column of mercury which is higher than the other (headwater) column.

Average $k_{20°C}$:	5.84E-09	cm/s
Max. Dev. from Mean:	19.8%	
Avg. Initial Gradient (i_o) :	28.3	
Intrinsic (Absolute) Permeability, *K*:	5.98E-14	cm^2

(4) To meet the reading accuracy requirement of 5%, the drop in the tail water reading has to be > 1 cm. For CMT testing with k < about 5×10^{-8} cm/sec, that requirement can be reduced by about ½.

Prelim. Calc. By: RC,jr Final Calc. By: RC,jr Reviewed By: JL

PLATE B-3

Appendix E – Initial Sludge Stabilization CQC Documentation

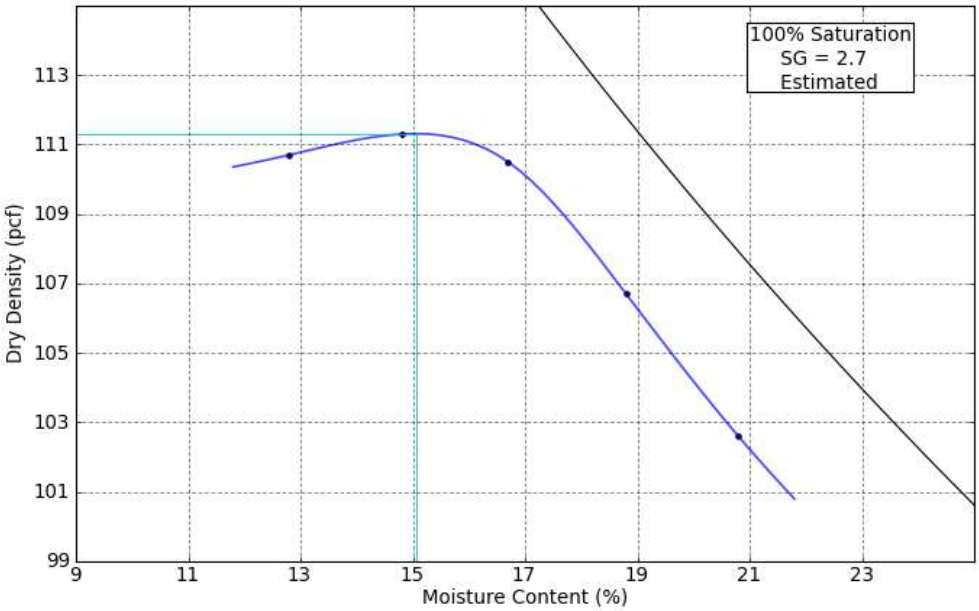
Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project:	Shell SET East/ West Basin Closure	**Sample Date:**	08/01/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Report Date:**	08/05/2016
		Project No.:	04.12164967
		Report No.:	0009
Contractor:	Bomac Construction		

Visual Classification: Tan and Brown Lean Clay
Sample Source: Offsite, Baytown Sand and Clay, Pit 5
Supplier: Baytown Sand and Clay, Pit 5, FM 3180 South
Material Application: Fill

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 111.3 pcf
Optimum Water Content: 15.1 %

Properties:	ASTM D4318
Liquid Limit	31
Plastic Limit	17
Plasticity Index	14
	ASTM D1140
% Passing 200:	86.0

Remarks: CMT Form S-003ELM (Revised 08/11). As received (in-situ) moisture: 26.8%

Fugro Representative: Mazhar Hassan

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

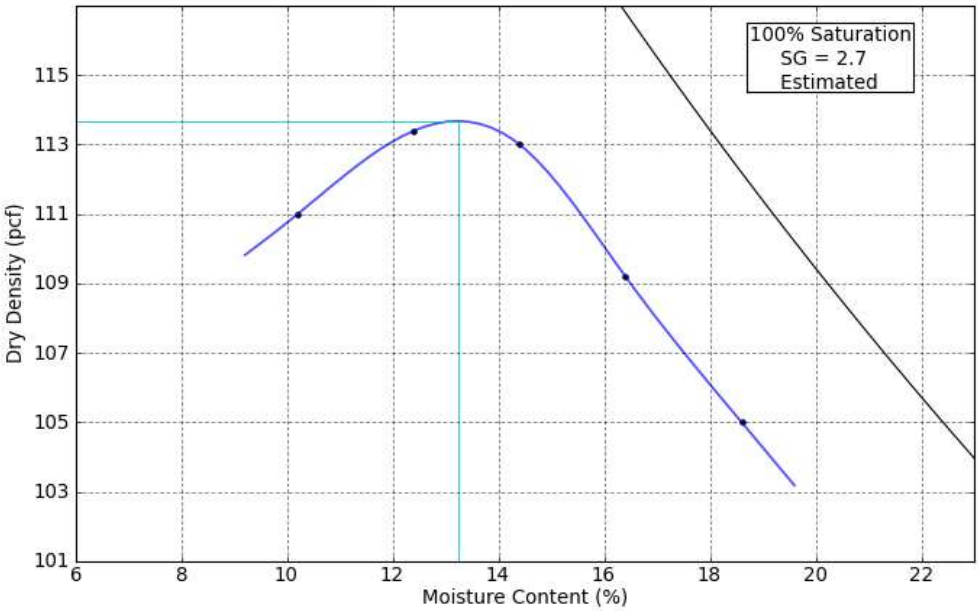
Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project:	Shell SET East/ West Basin Closure	**Sample Date:**	08/01/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Report Date:**	08/05/2016
		Project No.:	04.12164967
		Report No.:	0010
Contractor:	Bomac Construction		

Visual Classification: Tan and Brown Lean Clay with Sand
Sample Source: Offsite, Baytown Sand and Clay, Pit 4
Supplier: Baytown Sand and Clay, Pit 4, FM 3180 South
Material Application: Fill

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 113.7 pcf
Optimum Water Content: 13.2 %

Properties:	ASTM D4318
Liquid Limit	27
Plastic Limit	18
Plasticity Index	9
	ASTM D1140
% Passing 200:	72.7

Remarks: CMT Form S-003ELM (Revised 08/11). As received (in-situ) moisture: 17.1%

Fugro Representative: Mazhar Hassan

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	08/08/2016
		Report Date:	08/18/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0011
Contractor:	Bo-Mac Construction		

Remarks: Please find attached the report of Unconfined Compressive Strength tests for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Construction

Sample Date: 08/08/2016
Report Date: 08/18/2016
Project No.: 04.12164967
Report No.: 0011

Visual Classification: Stabilized Sludge
Material Application: Stabilization, Existing Material
Specification: (ASTM D2166) Test Frequency = minimum 1 test per 5,000 square feet with Unconfined Compressive Strength = 25 psi at 28 days.

Supplier: Bo-Mac Construction
Sample Source: West Basin

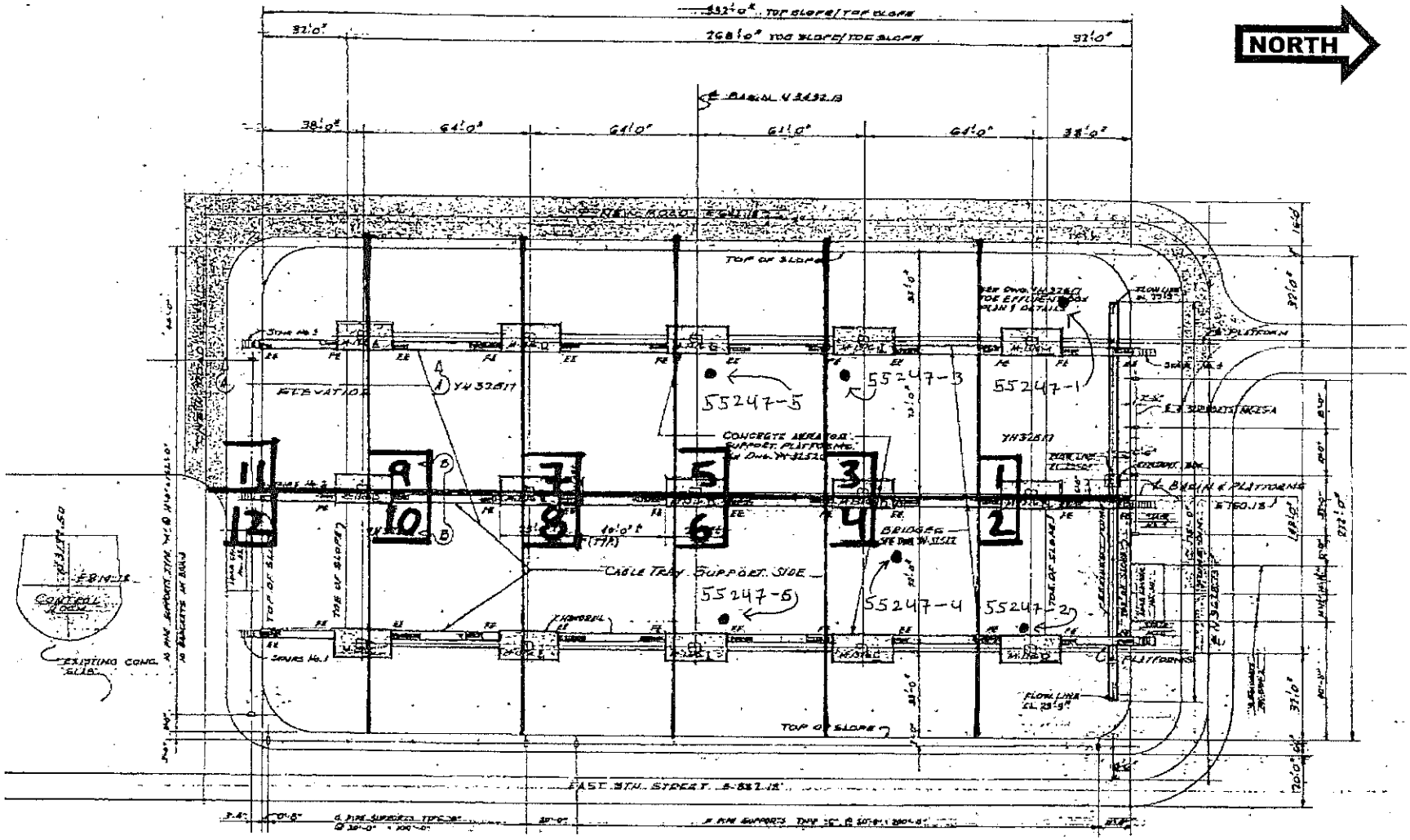
Sample No.	Mix Date	Test Date	Age	Unconfined Compressive Strength (psi)	Moisture Content (%)	Dry Unit Weight (pcf)	Pocket Penetrometer Readings (tsf)	Notes
55247-1	N/A	-	N/A	-	-	-	4.5	1, 2
55247-2	N/A	08/10/2016	N/A	15.1	46.1	69.2	4.5	1
55247-3	N/A	08/10/2016	N/A	20.4	40.4	73.7	3.8	1
55247-4T	N/A	08/10/2016	N/A	102	34.0	76.1	4.5	1
55247-4B	N/A	08/10/2016	N/A	97.3	29.7	83.4	4.5	1
55247-5	N/A	08/10/2016	N/A	50.3	26.6	86.2	4.3	1
55247-6	N/A	-	N/A	-	-	-	4.5	1, 2

Remarks: If sample age is available, the test results shown above comply with the project specification requirements except those marked by an asterisk (*). T – Top, B – Bottom, N/A – Not Available.

Note 1: See Attached Sample Location Map and Unconfined Compressive Strength Graphs.
Note 2: Sample was damaged during sample processing and could not be tested.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc



WEST BASIN

(Approximate Locations)

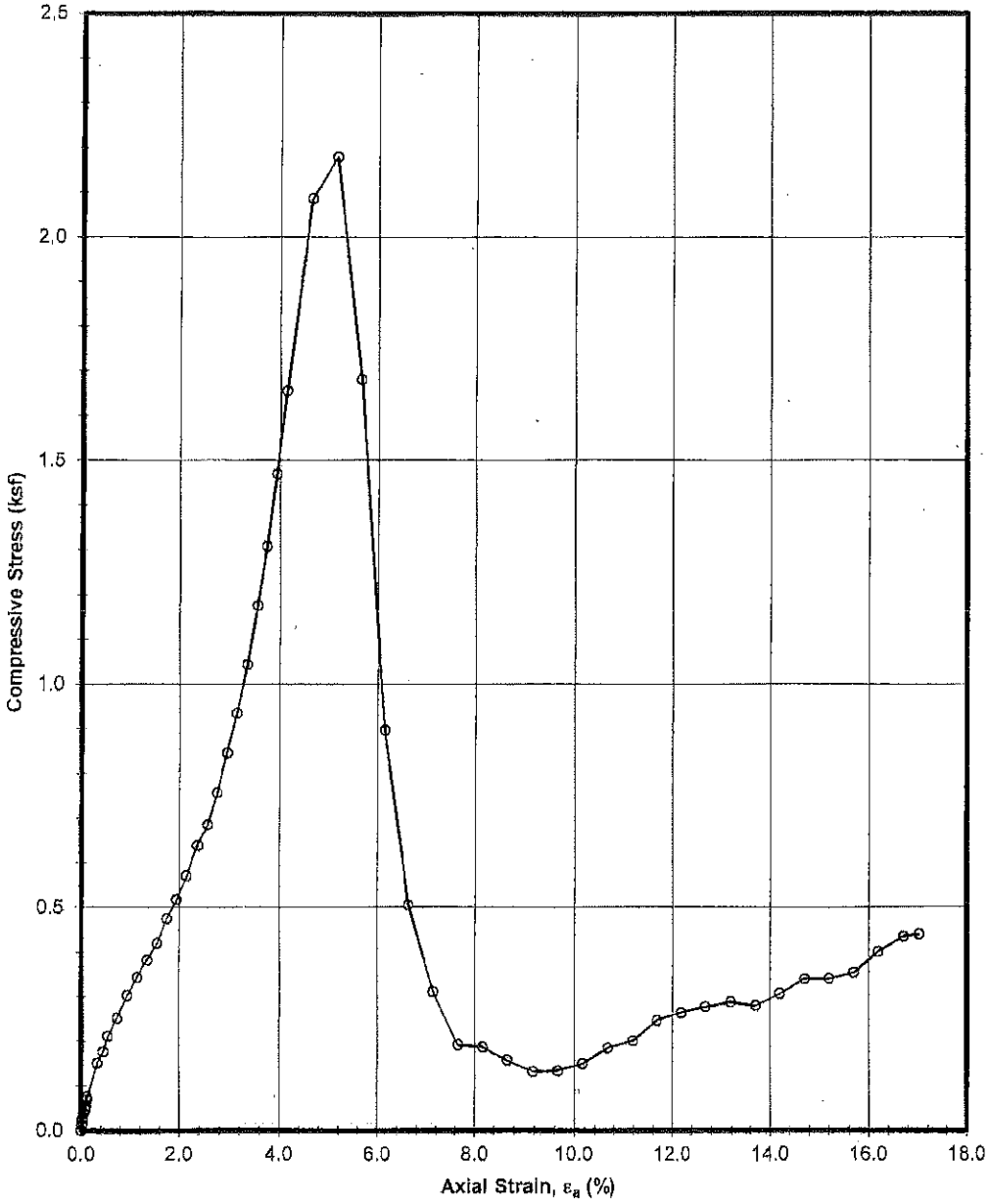
Source: Shell Chemical Company (YH-32516-4)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: Sludge Sampling

Work Order: 55247 Date: 8/8/16

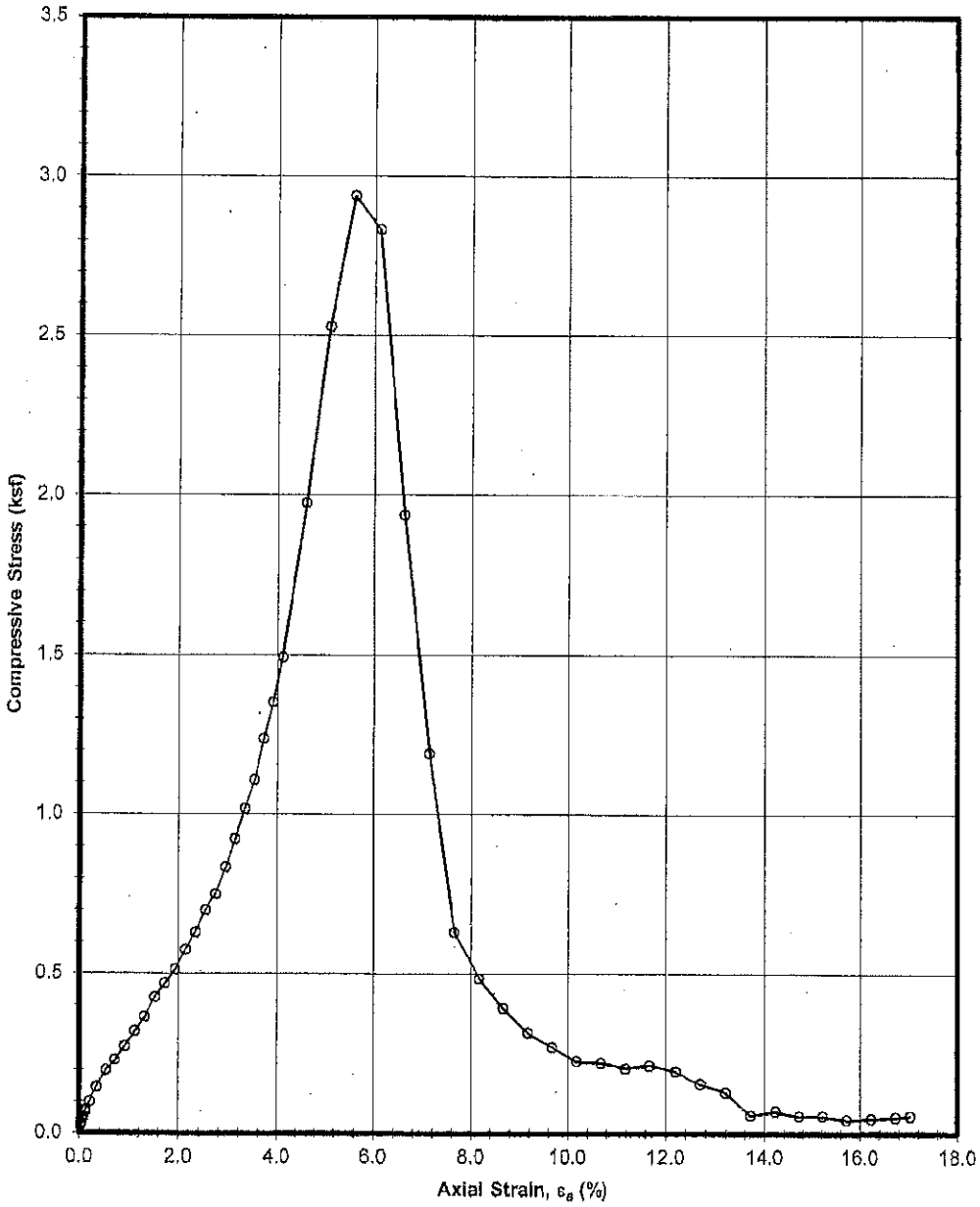


Unconfined Triaxial Compression Test

Intact Specimen

~~Boring 1, Sample 2A, Depth 0 ft~~

55247-2

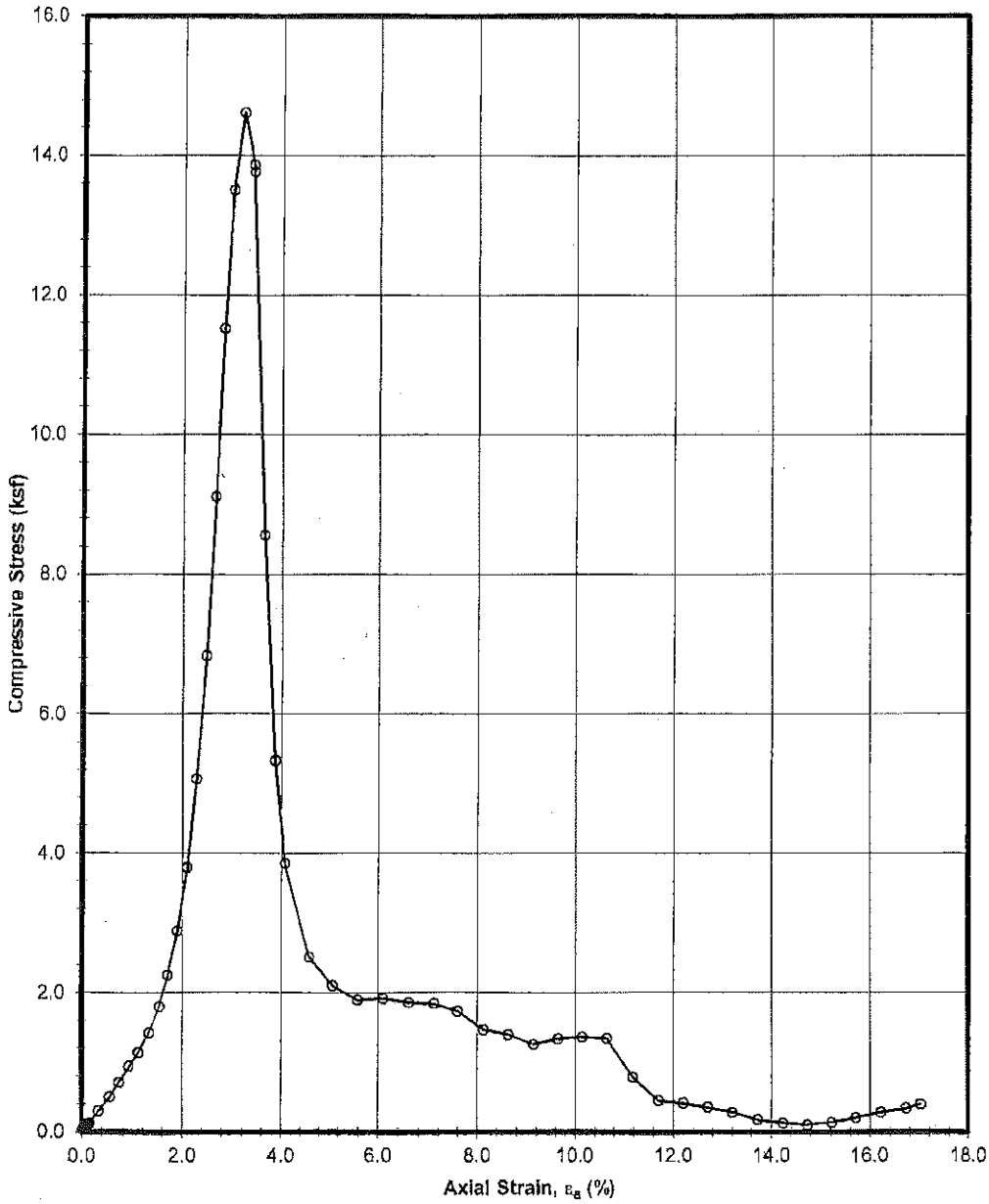


Unconfined Triaxial Compression Test

Intact Specimen

~~Boring 1, Sample 3A, Depth 0 ft~~

55247-3

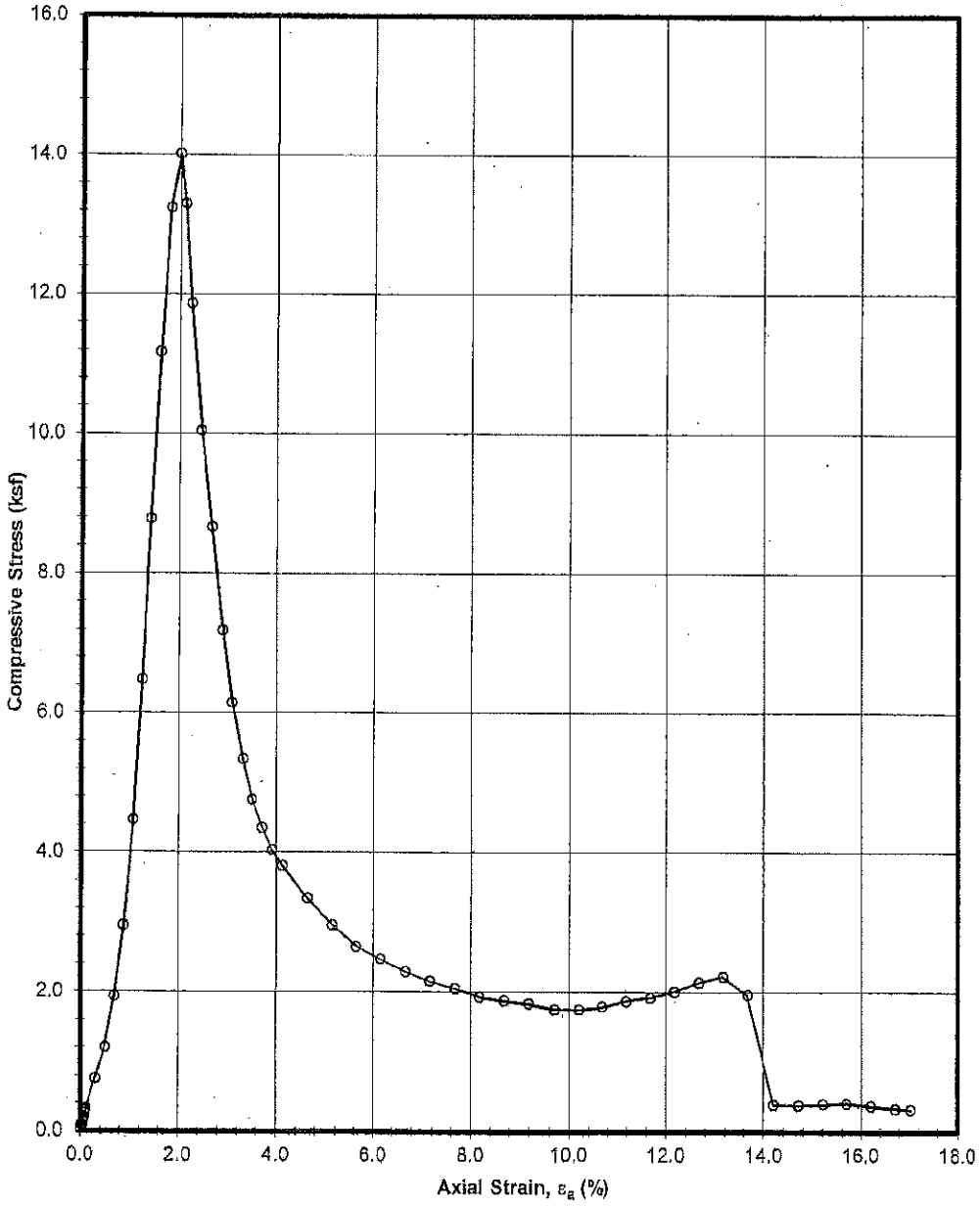


Unconfined Triaxial Compression Test

Intact Specimen

~~Boring 1, Sample 4AA, Depth 0 ft~~

55247-4T

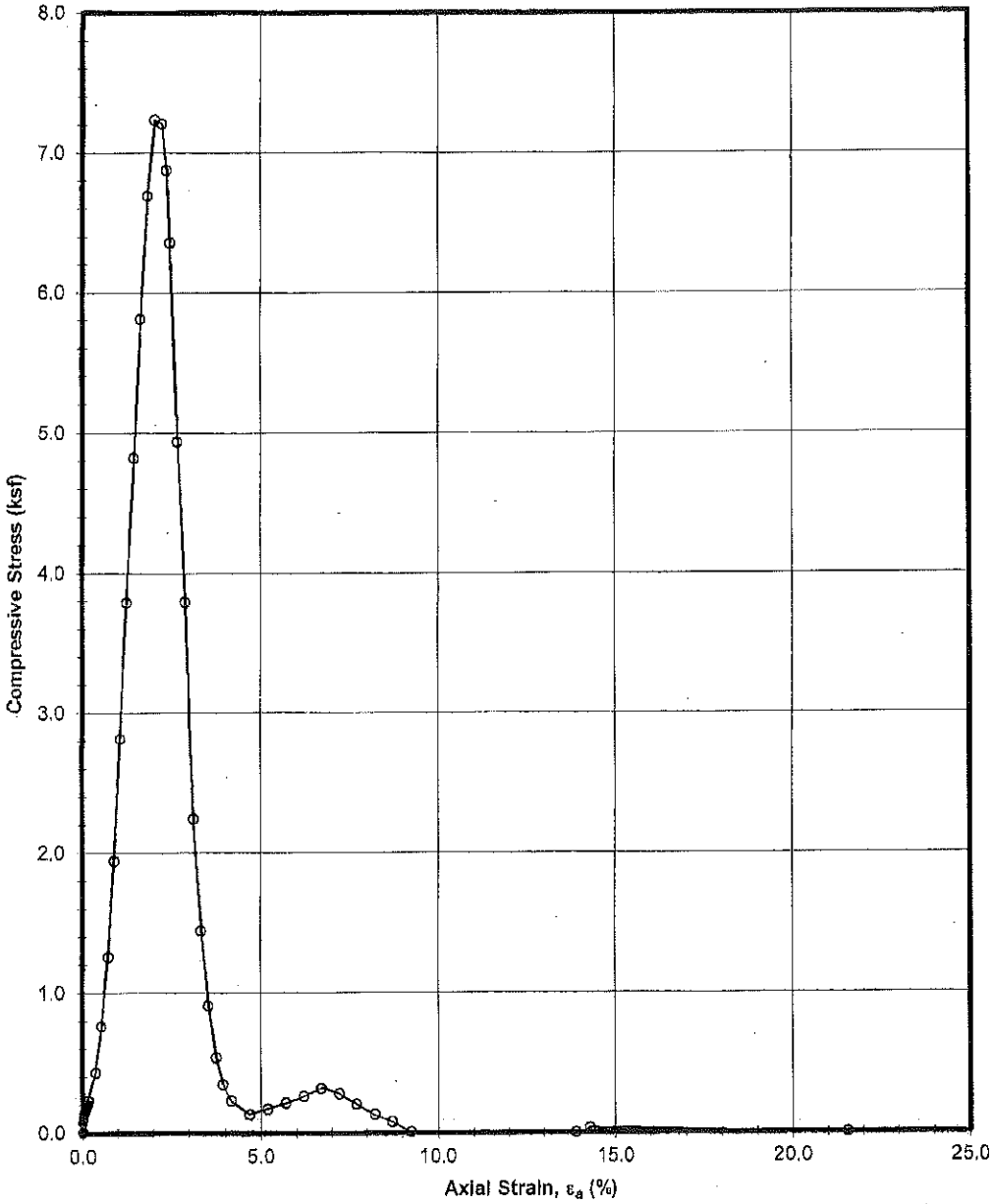


Unconfined Triaxial Compression Test

Intact Specimen

~~Boring 1, Sample 4BA, Depth 0 ft~~

55247-4B



Unconfined Triaxial Compression Test

Intact Specimen

~~Boring 1, Sample 5A, Depth 0 ft~~

55247-5

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase-1- West Basin	**Sample Date:**	08/15/2016
		Report Date:	08/18/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0012
Contractor:	Bo-Mac Contractors		

On 08/15/2016, a representative of Fugro Consultants, Inc. visited the above referenced project site to perform the scheduled Soil Sample Pick up. After arrival to the job site, the testing was cancelled by the contractor due to weather conditions.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	08/22/2016
		Report Date:	08/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0013
Contractor:	Bo-Mac Contractors		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Construction

Sample Date: 08/22/2016
Report Date: 08/30/2016
Project No.: 04.12164967
Report No.: 0013

Visual Classification: Stabilized Sludge
Material Application: Stabilization, Existing Material
Specification: (ASTM D2166) Test Frequency = minimum 1 test per 5,000 square feet with Unconfined Compressive Strength = 25 psi at 28 days.

Supplier: Bo-Mac Construction
Sample Source: West Basin

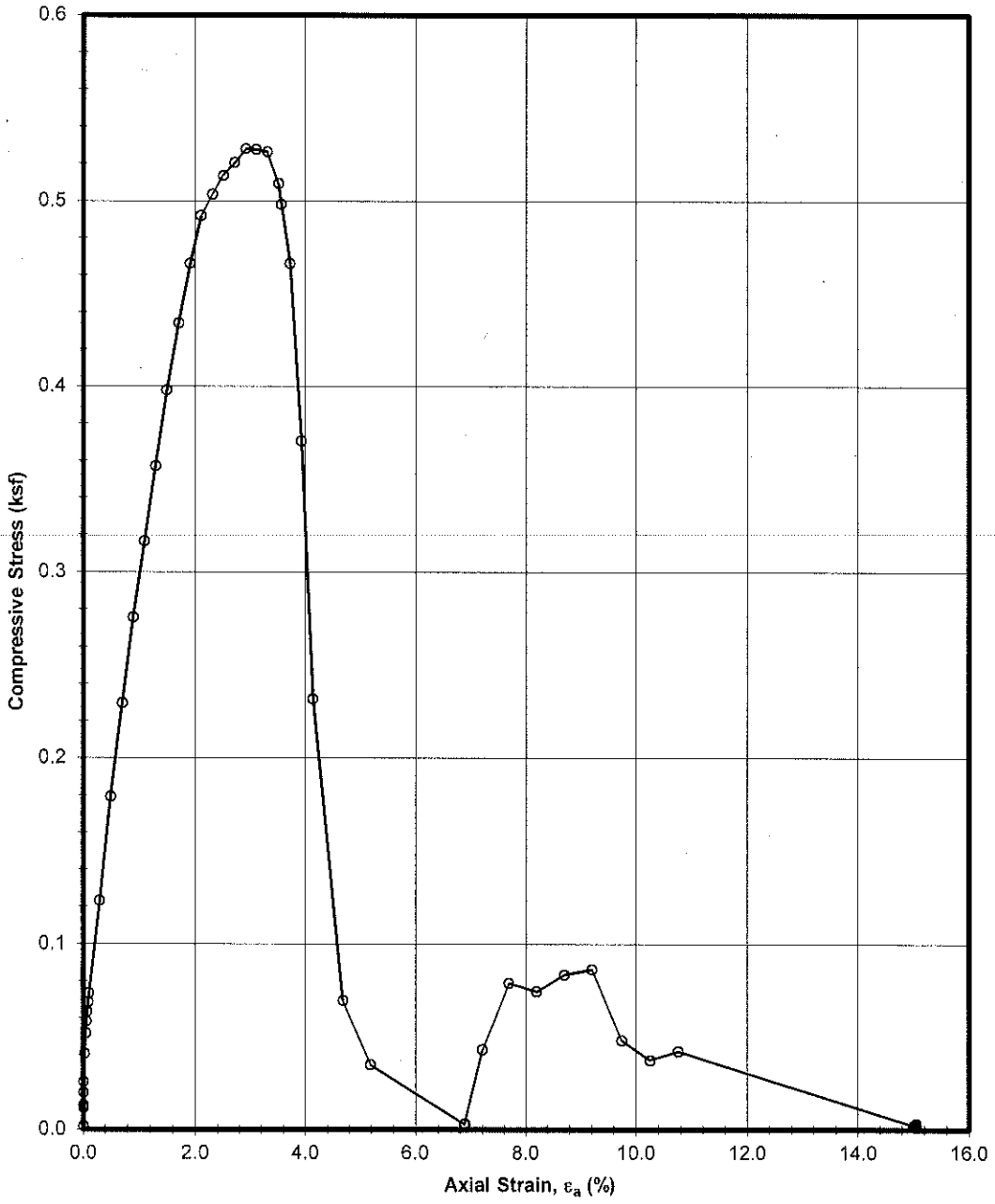
Sample No.	Mix Date	Test Date	Age	Unconfined Compressive Strength (psi)	Moisture Content (%)	Dry Unit Weight (pcf)	Pocket Penetrometer Readings (tsf)	Notes
55498-1T	N/A	08/22/2016	N/A	3.67	35.1	101.3	-	1
55498-1B	N/A	08/22/2016	N/A	23.4	38.6	102.9	-	1
55498-2T Sample A	N/A	08/22/2016	N/A	12.0	42.4	101.4	4.5	1
55498-2T Sample B	N/A	08/22/2016	N/A	22.6	39.3	105.0	-	1
55498-3	N/A	-	N/A	-	-	-	1.5	1,2
55498-6	N/A	-	N/A	-	-	-	4.5	1,2
55498-7	N/A	-	N/A	-	-	-	-	1, 2
55498-8	N/A	-	N/A	-	-	-	4.5	1,2
55498-9T	N/A	08/22/2016	N/A	9.4	33.8	108.7	-	1
55498-10T	N/A	08/22/2016	N/A	8.6	26.4	106.9	-	1

Remarks: If sample age is available, the test results shown above comply with the project specification requirements except those marked by an asterisk (*). T – Top, B – Bottom, N/A – Not Available.

Note 1: See Attached Sample Location Map and Unconfined Compressive Strength Graphs.
Note 2: Sample was damaged during sample processing and could not be tested.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

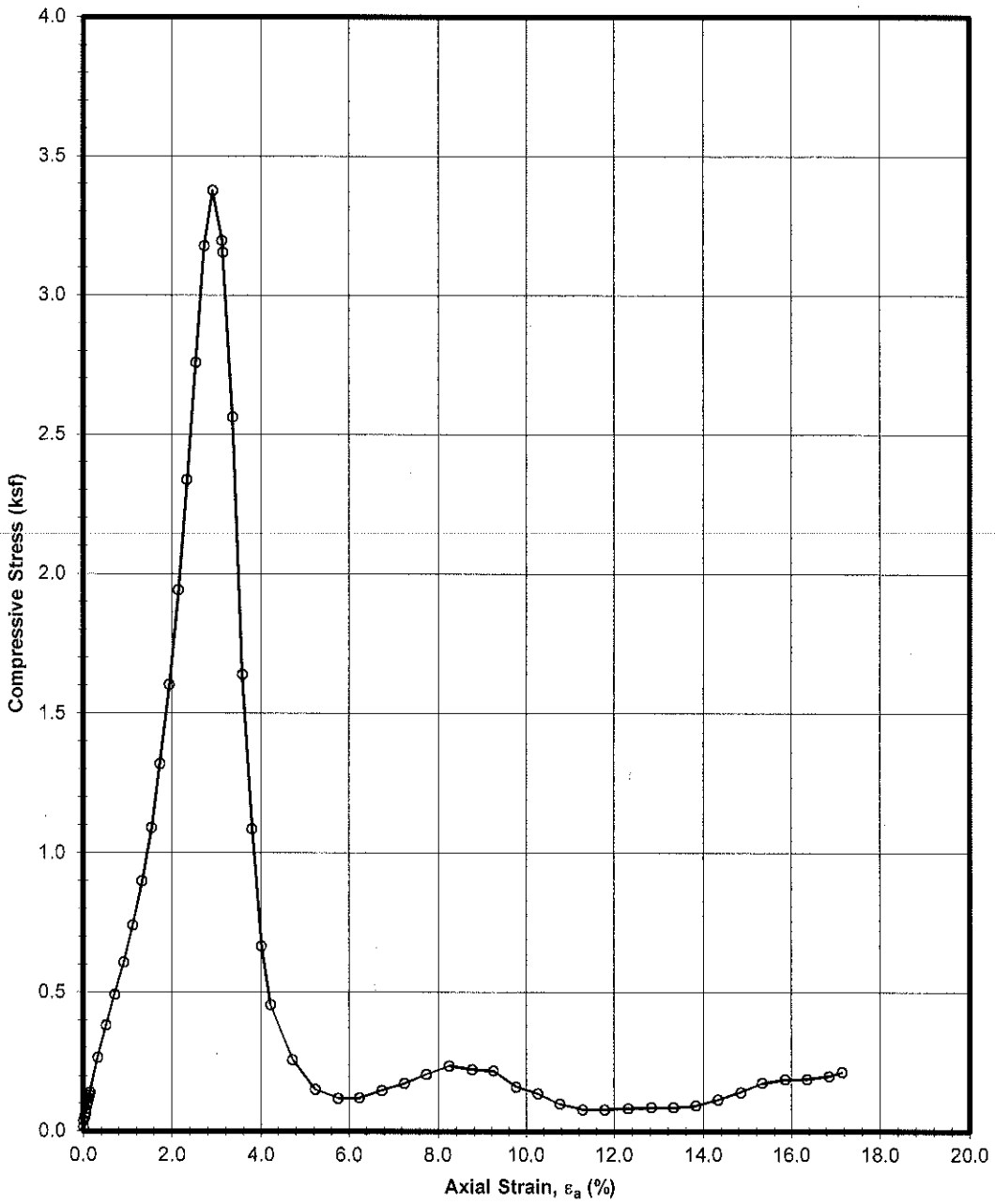
The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc



Unconfined Triaxial Compression Test

Intact Specimen

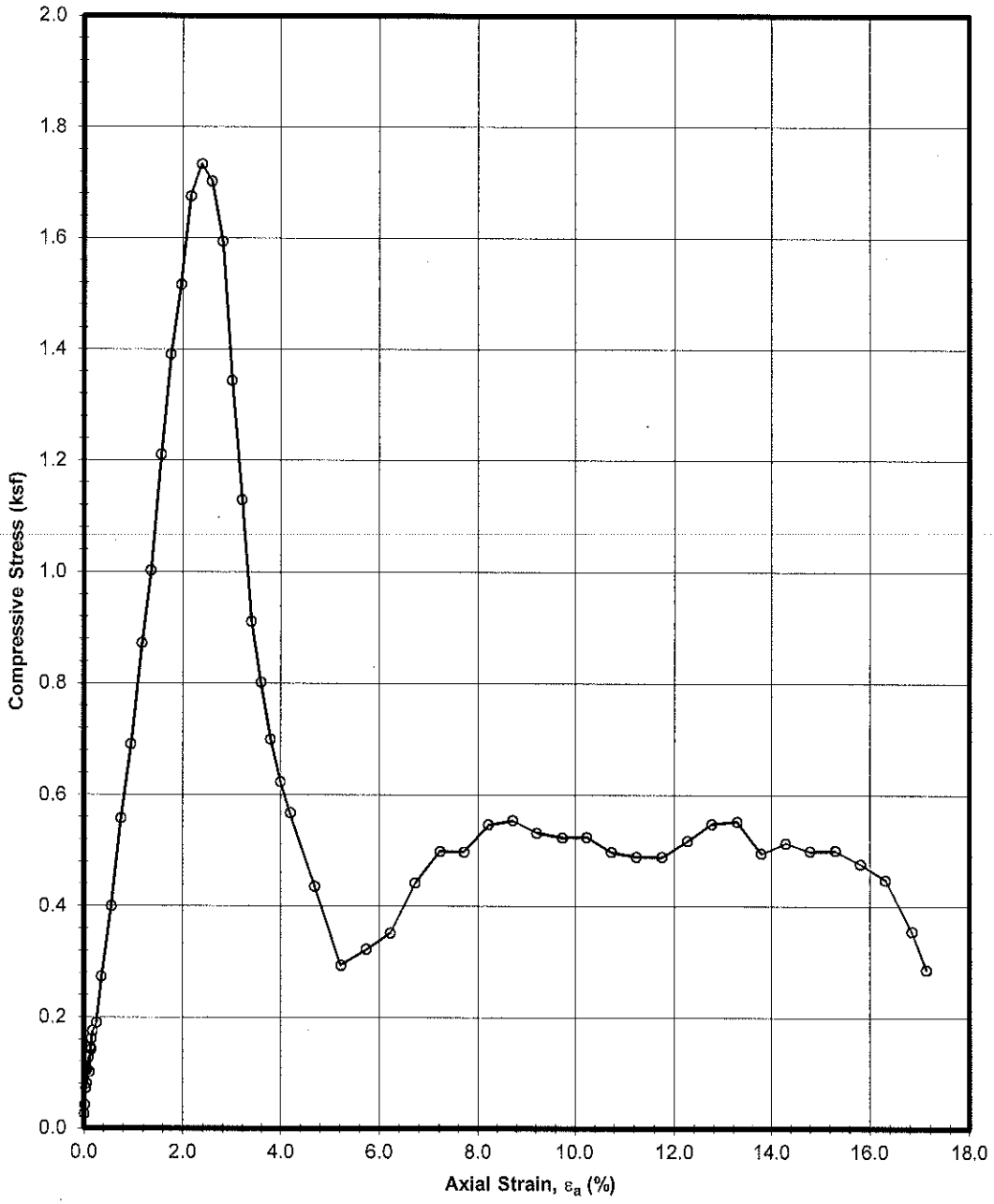
Boring 1, Sample 55498-1(TOP)A, Depth 1 ft



Unconfined Triaxial Compression Test

Intact Specimen

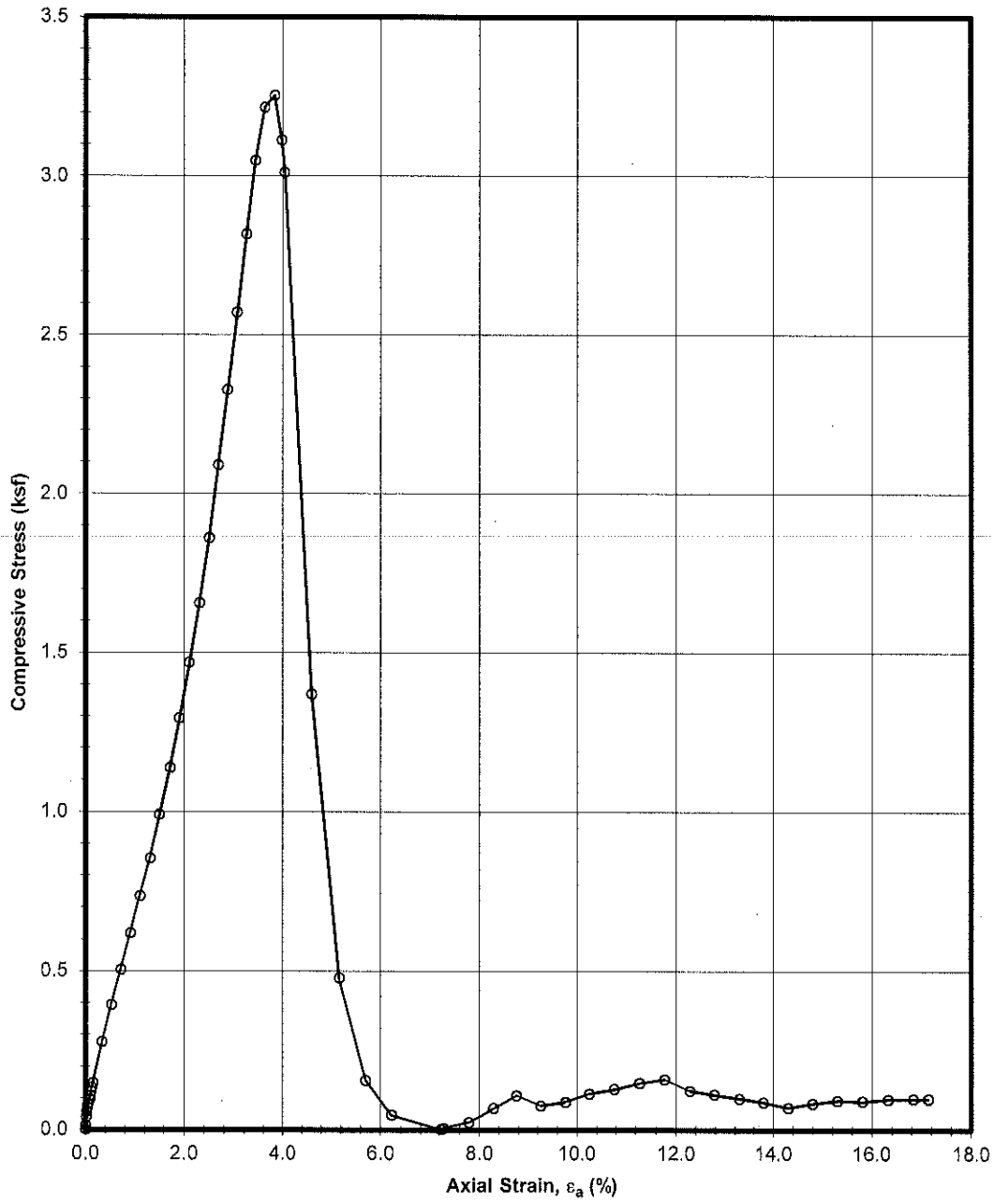
Boring 1, Sample 55498-1(BOT)A, Depth 1 ft



Unconfined Triaxial Compression Test

Intact Specimen

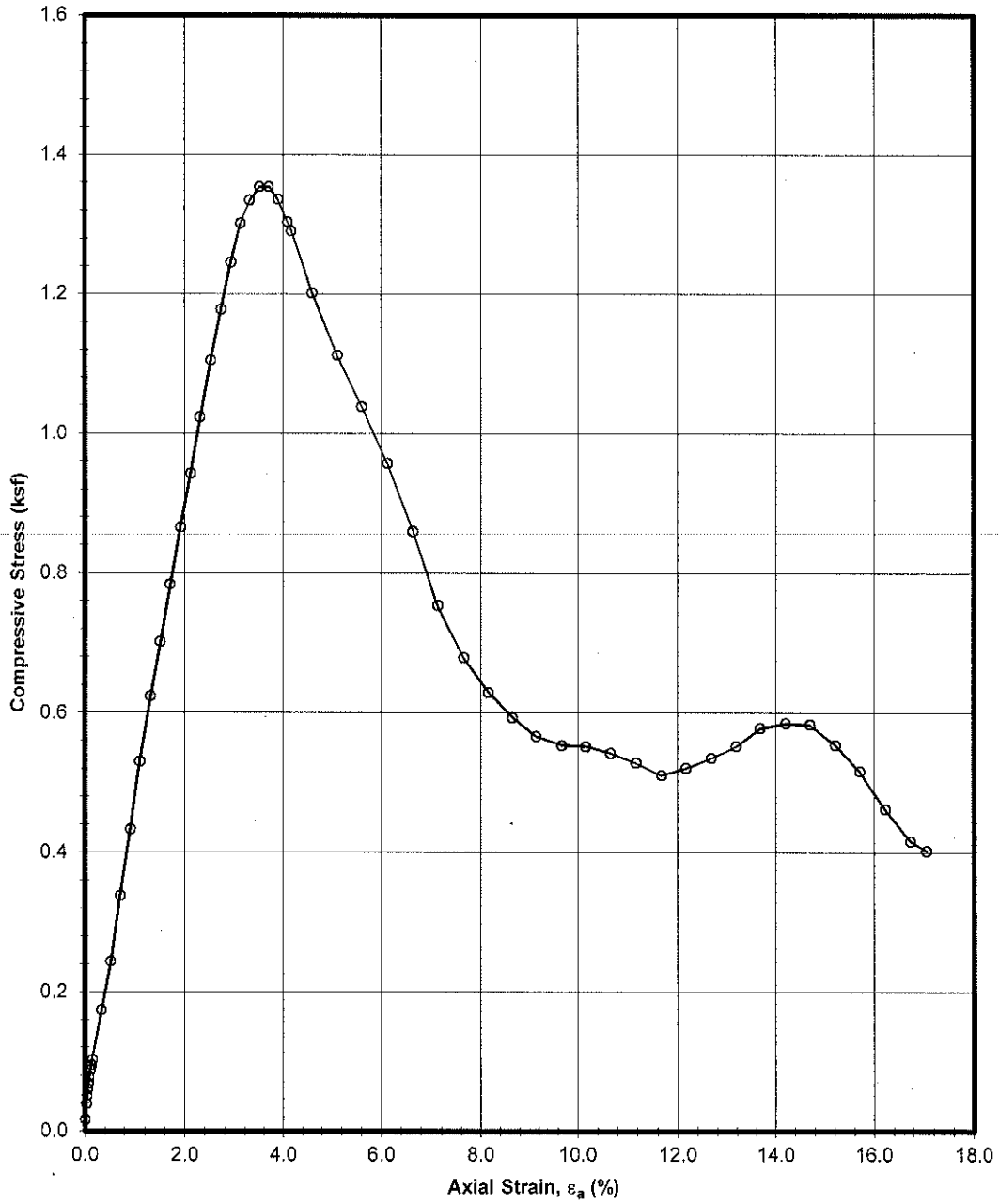
Boring 1, Sample 55498-2A(TOP)A, Depth 1 ft



Unconfined Triaxial Compression Test

Intact Specimen

Boring 1, Sample 55498-2B(TOP)A, Depth 1 ft



Unconfined Triaxial Compression Test

Intact Specimen

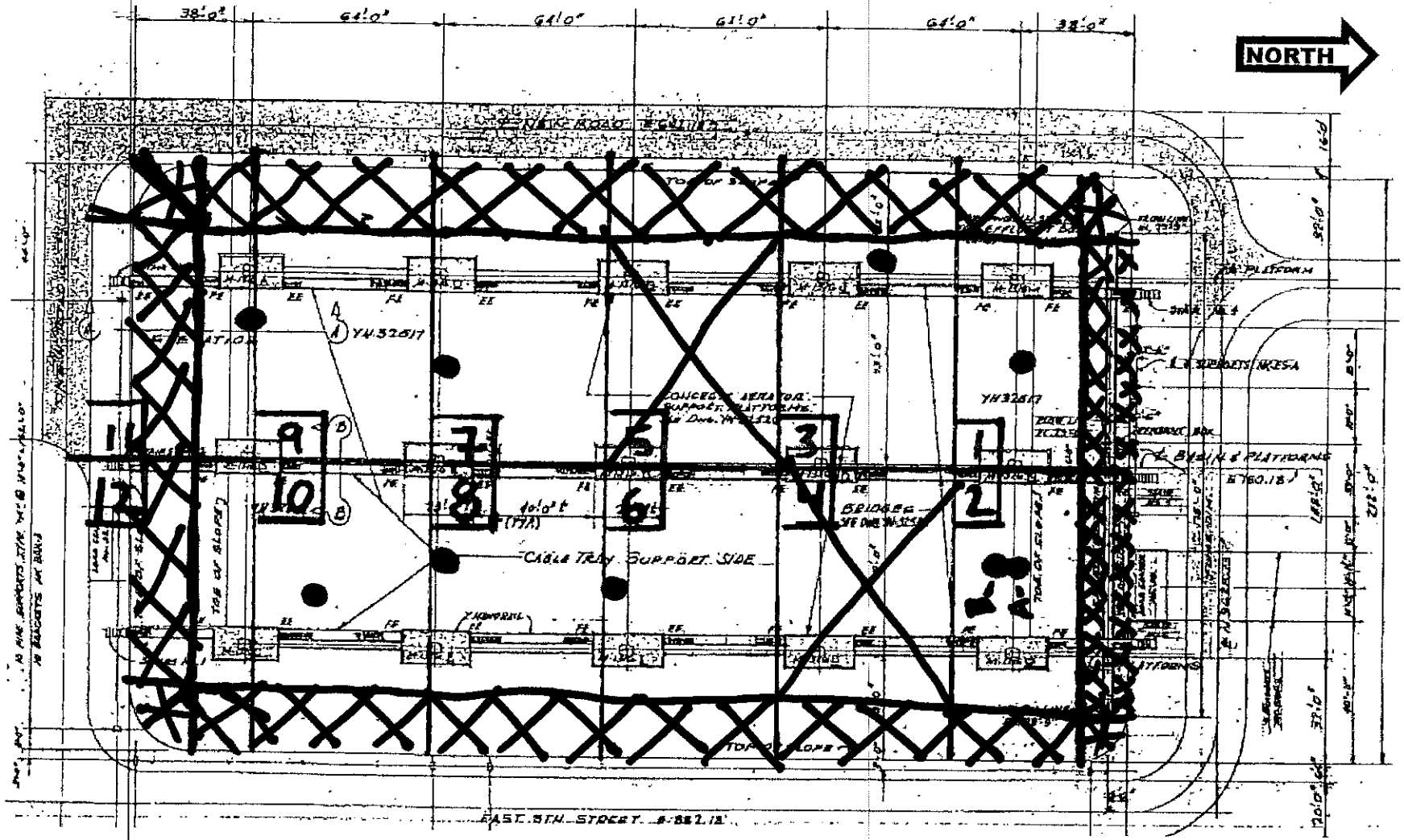
Boring 1, Sample 55498-9(TOP)A, Depth 1 ft



Unconfined Triaxial Compression Test

Intact Specimen

Boring 1, Sample 55498-10(TOP)A, Depth 1 ft



WEST BASIN

(Approximate Locations)

Source: Shell Chemical Company (YH-32516-4)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: Soil Sample - Shelby tubes

Work Order: 88498 Date: 8-22-16

Concrete Slope

● = Sample Location

AREAS Sampled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	08/23/2016
		Report Date:	08/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0014
Contractor:	Bo-Mac Construction		

As requested, a representative of Fugro Consultants, Inc. went to the project site to visually observe the contractor mixing sludge, soil, and fly-ash areas of the west basin (See Attached Sketch).

- Sludge/Soil/fly-ash was mixed using a truck hoe excavator.
- Water was added to the mixing process as needed.
- Soil mixture was spread and compacted using the bucket of the truck hoe excavator.
- The contractor began removing temporary ramp to gain access to the final area of mixing fly-ash in the west basin.
- The contractor was pumping rain water out of the low areas of the west basin.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

WEST BASIN

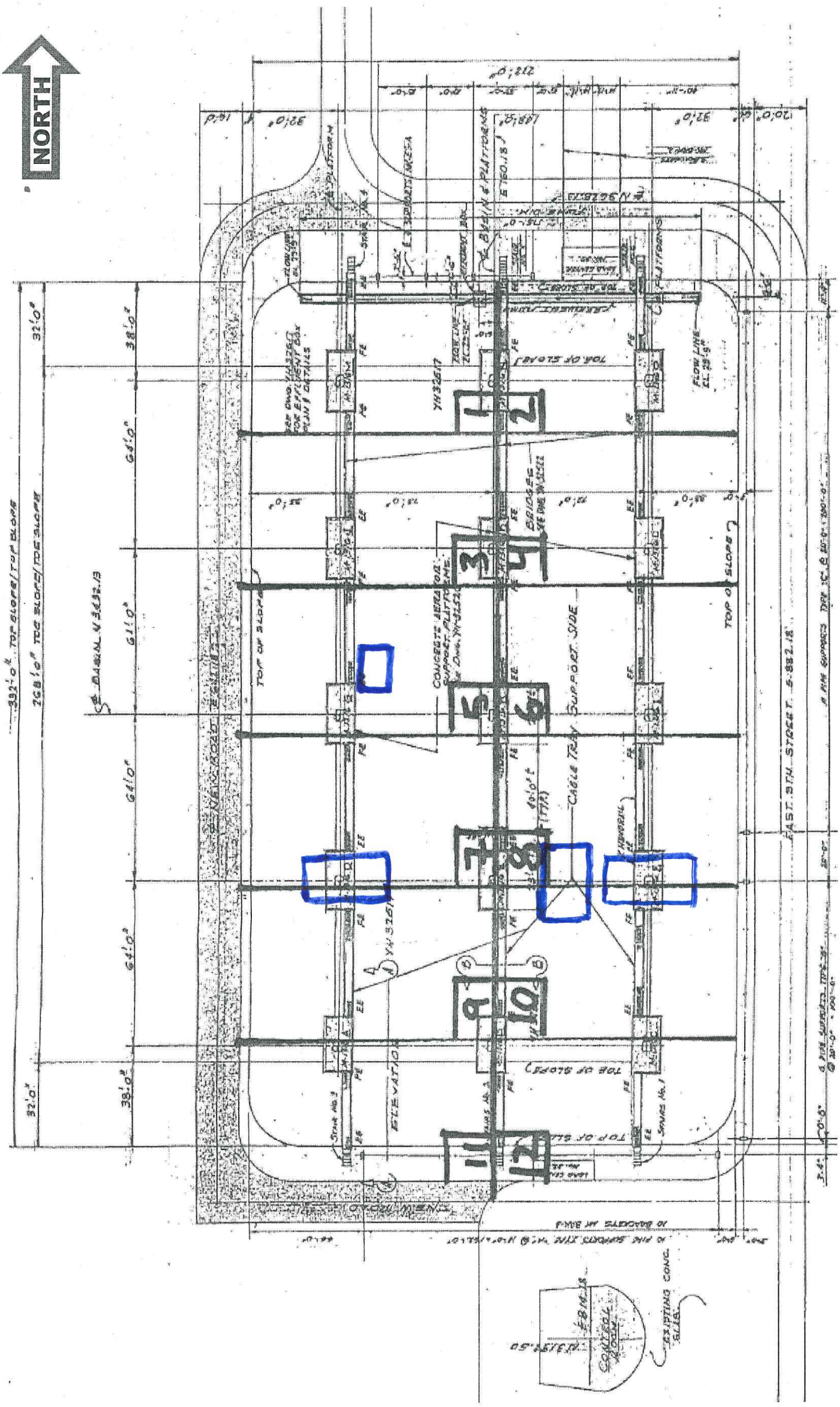
(Approximate Locations)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: Flyash mixing operations

Work Order: 55499 Date: 8-23-16



Source: Shell Chemical Company (YH-32516-4)

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	08/24/2016
		Report Date:	08/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0016
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to perform the following (See Attached Sketch):

•Soil sample pick-up, resampled West Basin Area # 6 for the 3rd time. The previous samples did not produce a testable sample.
•Site observation - Observed contractor mixing areas of the west basin, sludge, soil and fly-ash into a uniform gray fine soil mixture using track hoe excavators.
•Soil mixture was spread and compacted using the excavator bucket.
•Contractor used a bulldozer to dress up soil mixture in the West Basin Areas # 2, # 3, # 4, # 5, # 6, # 8, # 10 and # 12.

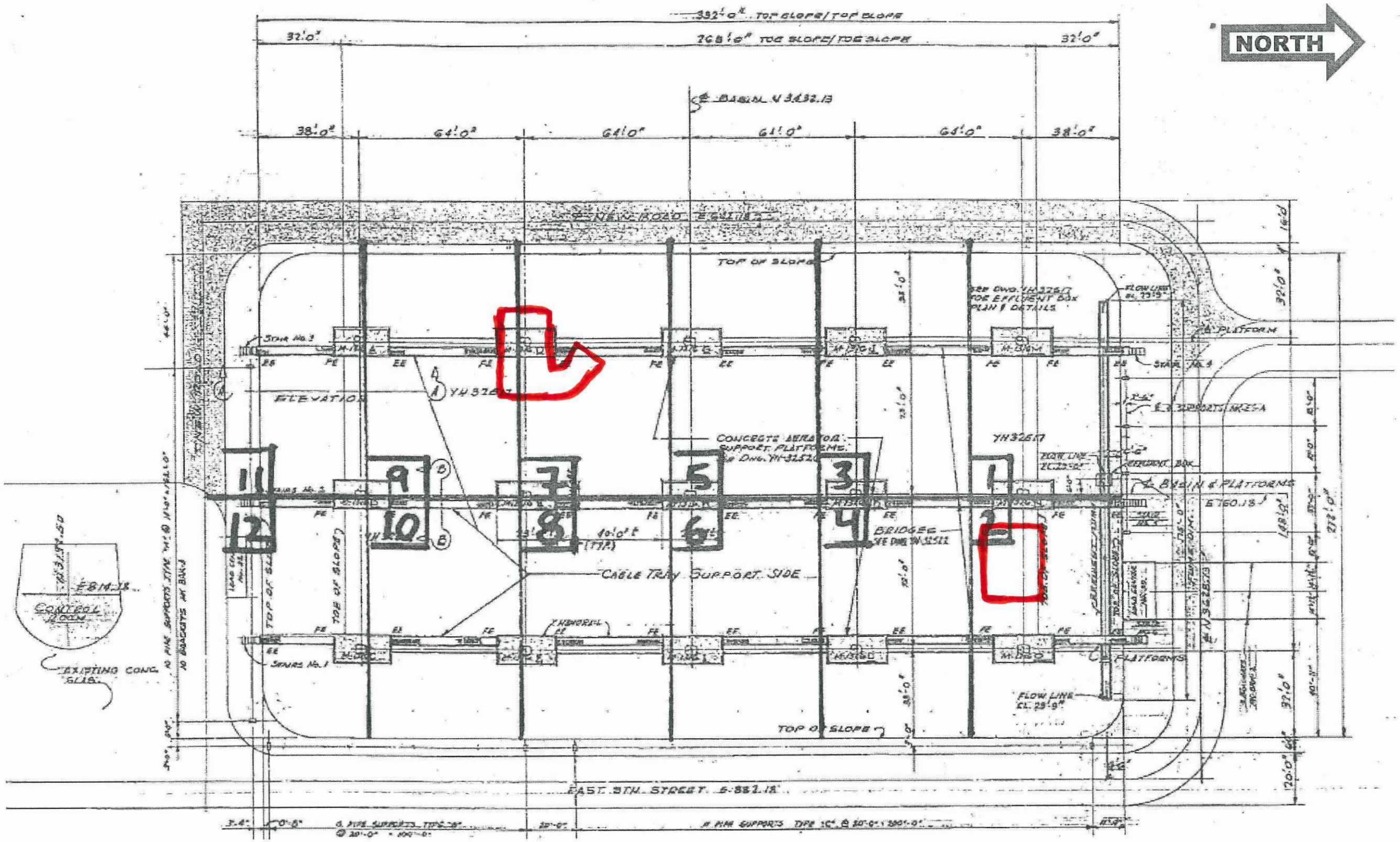
•Contractor dug 2 pits at West Basin ramp area for placement of fly-ash. One load of fly-ash was placed in the southern pit.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.



WEST BASIN

(Approximate Locations)

Source: Shell Chemical Company (YH-32516-4)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: Flyash mixing @ Elections

Work Order: 55500 Date: 8-24-16

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	08/25/2016
		Report Date:	08/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0017
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to visually observe the following (See Attached Sketch):

•Site observation, Contractor dug 3 pits at west basin ramp area and placed 3 drums loads of fly-ash into pits.
•Contractor began demolition of aerators and platforms.
•Contractor began mixing of sludge, fly-ash and soil at west basin ramp area.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

WEST BASIN

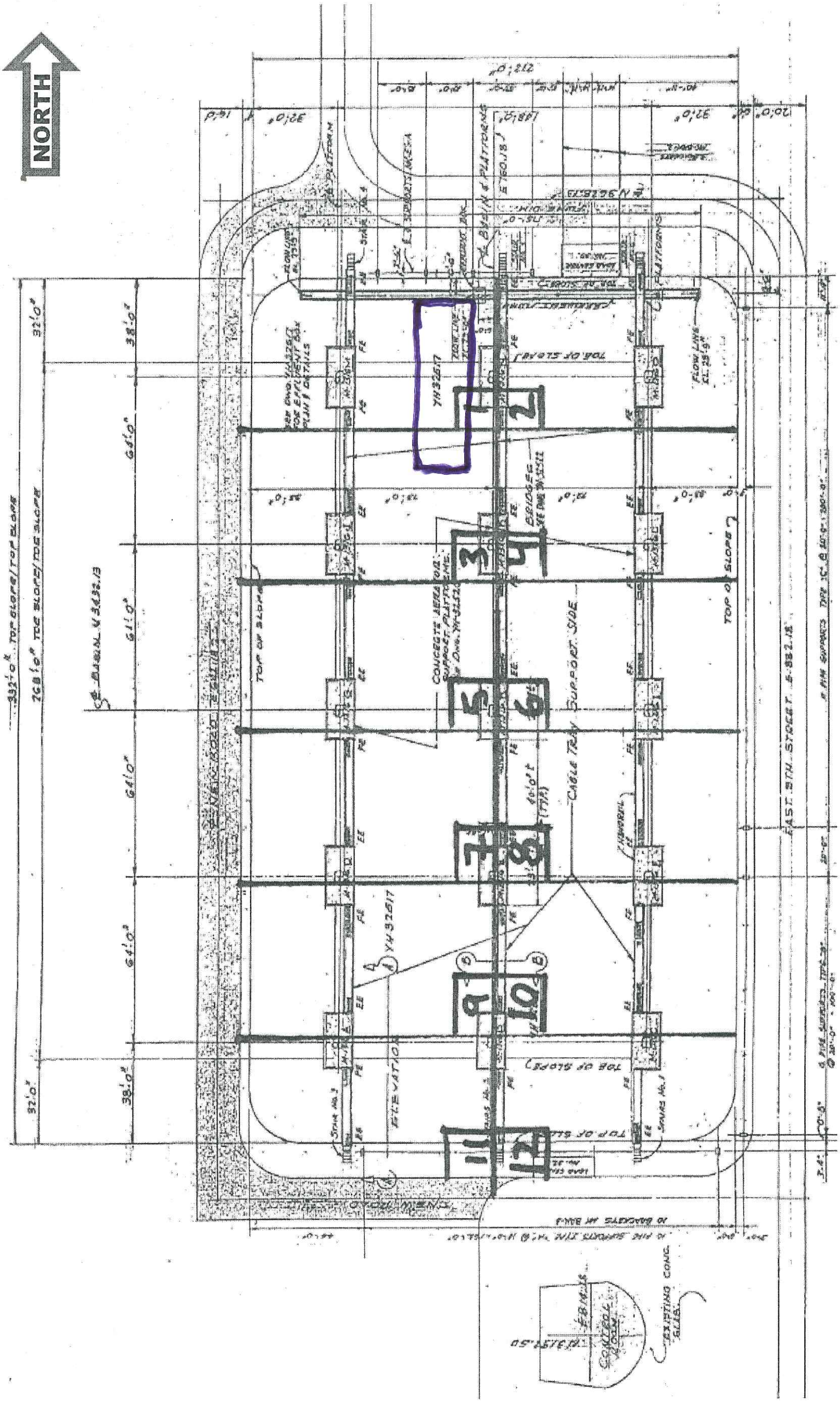
(Approximate Locations)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: flyash moving operations

Work Order: 55501 Date: 8-25-16



Source: Shell Chemical Company (YH-32516-4)

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	08/26/2016
		Report Date:	08/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0018
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to perform the following (See Attached Sketch):

•Site observation: Visually observed the contractor mixing sludge, soil and fly-ash into a gray soil mixture using a track hoe excavator.
•After mixing, the mixture was compacted using the excavator bucket.
•Contractor continued demolition of aerator platforms.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

WEST BASIN

(Approximate Locations)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: Flyash Mixing Operations

Work Order: 555502 Date: 8-26-16

Source: Shell Chemical Company (YH-32516-4)

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

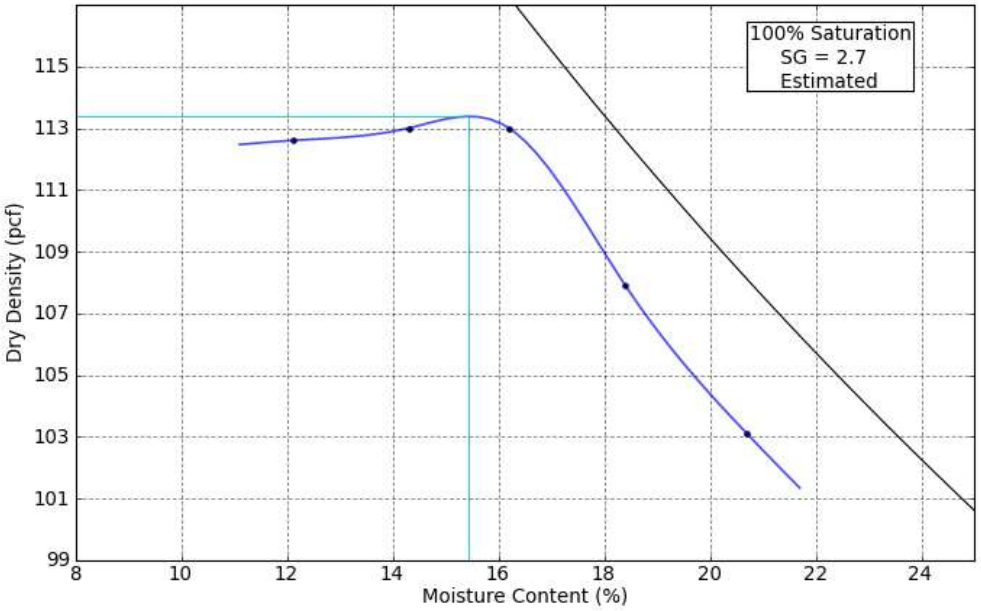
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Construction

Sample Date: 09/22/2016
Report Date: 09/28/2016
Project No.: 04.12164967
Report No.: 0019

Visual Classification: Tan and Gray Sandy Lean Clay
Sample Source: Offsite, Baytown Sand and Clay, Angel Pit #1
Supplier: Baytown Sand and Clay, Angel Pit #1
Material Application: Backfill, Structural

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 113.4 pcf
Optimum Water Content: 15.4 %

Properties:	ASTM D4318
Liquid Limit	30
Plastic Limit	18
Plasticity Index	12
	ASTM D1140
% Passing 200:	57.1

Remarks: CMT Form S-003ELM (Revised 08/11). As received (in-situ) moisture content: 17.6%

Fugro Representative: Robert Nowlin

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

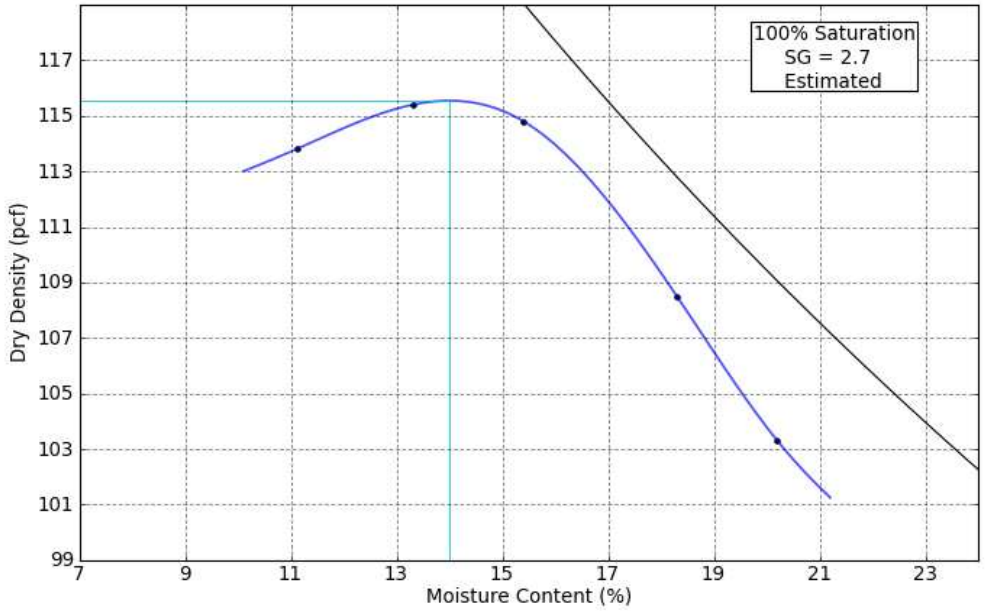
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Construction

Sample Date: 09/22/2016
Report Date: 09/28/2016
Project No.: 04.12164967
Report No.: 0020

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: Offsite, Mega Sand
Supplier: Mega Sand
Material Application: Backfill, Structural

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 115.6 pcf
Optimum Water Content: 14.0 %

Properties:	ASTM D4318
Liquid Limit	33
Plastic Limit	13
Plasticity Index	20
	ASTM D1140
% Passing 200:	55.7

Remarks: CMT Form S-003ELM (Revised 08/11). As received (in-situ) moisture content: 16.4%

Fugro Representative: Robert Nowlin

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	09/23/2016
		Report Date:	09/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0021
Contractor:	Bo-Mac Contractors		

On 09/23/2016, a representative of Fugro Consultants, Inc. visited the above referenced project site to perform the scheduled Proofrolling observation. After arrival to the job site, the technician was placed on "stand-by". Testing was later cancelled by the contractor due to weather conditions.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF PROOF ROLL OBSERVATIONS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	09/26/2016
		Report Date:	09/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0022
Contractor:	Bo-Mac Contractors		

A representative of Fugro Consultants, Inc. observed proofrolling of the subgrade (Tan and gray sandy clay) in the area of west basin (See Attached Sketch), to delineate soft, wet, and/or weak areas, if present. Proofrolling was performed utilizing a fully loaded dump truck. At the time of the proofroll, the subgrade appeared to be stable with ruts not greater than 1".

If the subgrade conditions vary significantly from those at the time of our proofroll before additional construction proceeds within the above-referenced area, we request the opportunity to reevaluate the subgrade.

The technician informed Edmond Hall with Bo-Mac Contractors of the field test results prior to leaving the jobsite.

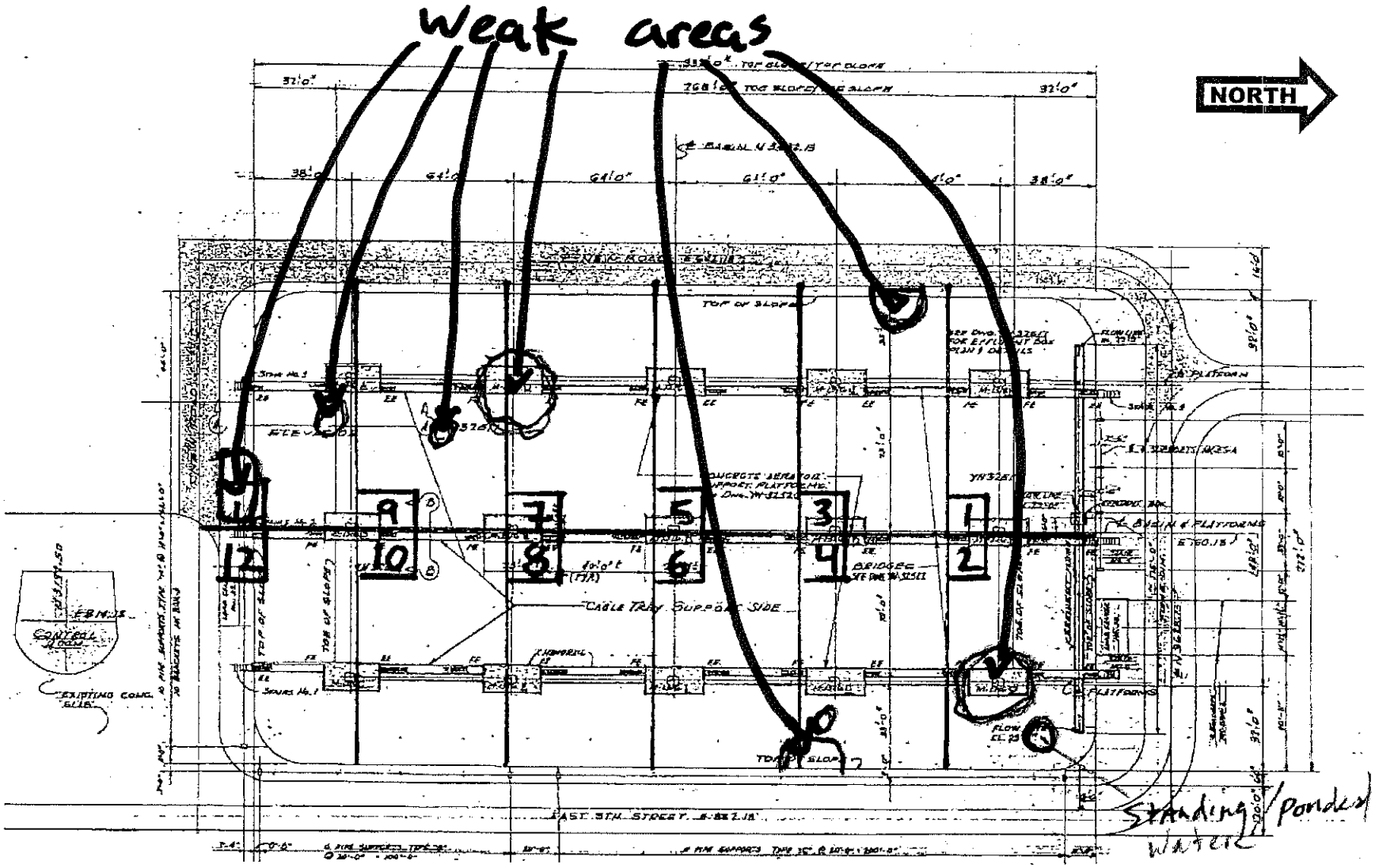
Remarks: CMT Form G-015ELM (Revised 12-09)

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.



RP 9/29

WEST BASIN

(Approximate Locations)

Source: Shell Chemical Company (YH-32516-4)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

Activity: Proof Roll

Work Order: GL120 Date: 9/26/16

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	09/27/2016
		Report Date:	09/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0023
Contractor:	Bo-Mac Contractors		

On 09/27/2016, a representative of Fugro Consultants, Inc. visited the above referenced project site to perform the scheduled CPT Testing. After arrival to the job site, the technician was on "stand-by". Site access was not granted at the gate. Fugro will not invoice for this workday.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	09/27/2016
		Report Date:	09/30/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0024
Contractor:	Bo-Mac Contractors		

On 09/27/2016, a representative of Fugro Consultants, Inc. visited the above referenced project site to perform the scheduled CPT Testing. After arrival to the job site, the technician was on "stand-by". Site access was not granted at the gate. Fugro will not invoice for this workday.

Fugro Representative: Ilanga Priyanke

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	09/29/2016
		Report Date:	10/03/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0025
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to assist with Cone Penetrometer Testing.

Fugro Representative: Ilanga Priyanke

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	09/29/2016
		Report Date:	10/17/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0026
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for Cone Penetrometer Testing on 20 locations inside of the west basin. (See Attached Sketch)

Fugro Representative: Richard Osborne

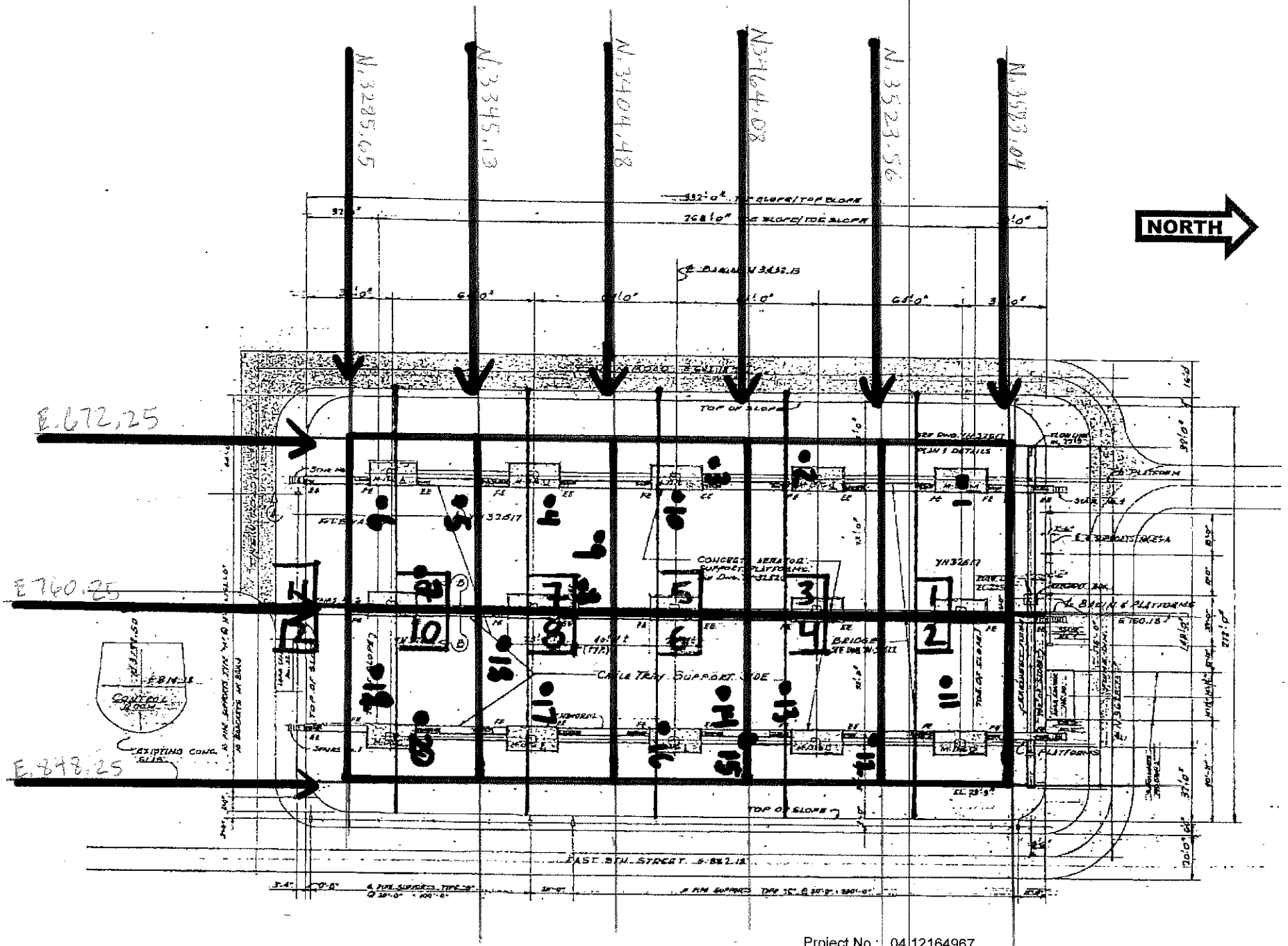
Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Rafael Pérez, E.I.T.
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

#	Northern	Eastern
1	3561.37	691.77
2	3489.30	681.81
3	3447.37	685.10
4	3370.65	703.28
~~5~~	3331.33	703.95
6	3297.93	704.35
~~7~~	~~3313.86~~	~~744.13~~
8	3386.22	750.47
9	3401.07	723.74
10	3431.37	700.24
11	3551.21	791.27
12	3519.82	827.10
13	3479.99	797.37
14	3451.10	798.77
15	3463.76	828.64
16	3414.59	824.60
17	3376.78	804.48
18	3358.74	782.03
19	3297.19	790.95
20	3314.59	817.37

COORDINATES OF CPT LOCATIONS



WEST BASIN

(Approximate Locations)

Source: Shell Chemical Company (YH-32516-4)

Project No.: 04.12164967

Project: Shell SET East/West Basin Closure (**Phase 1 – West Basin**)

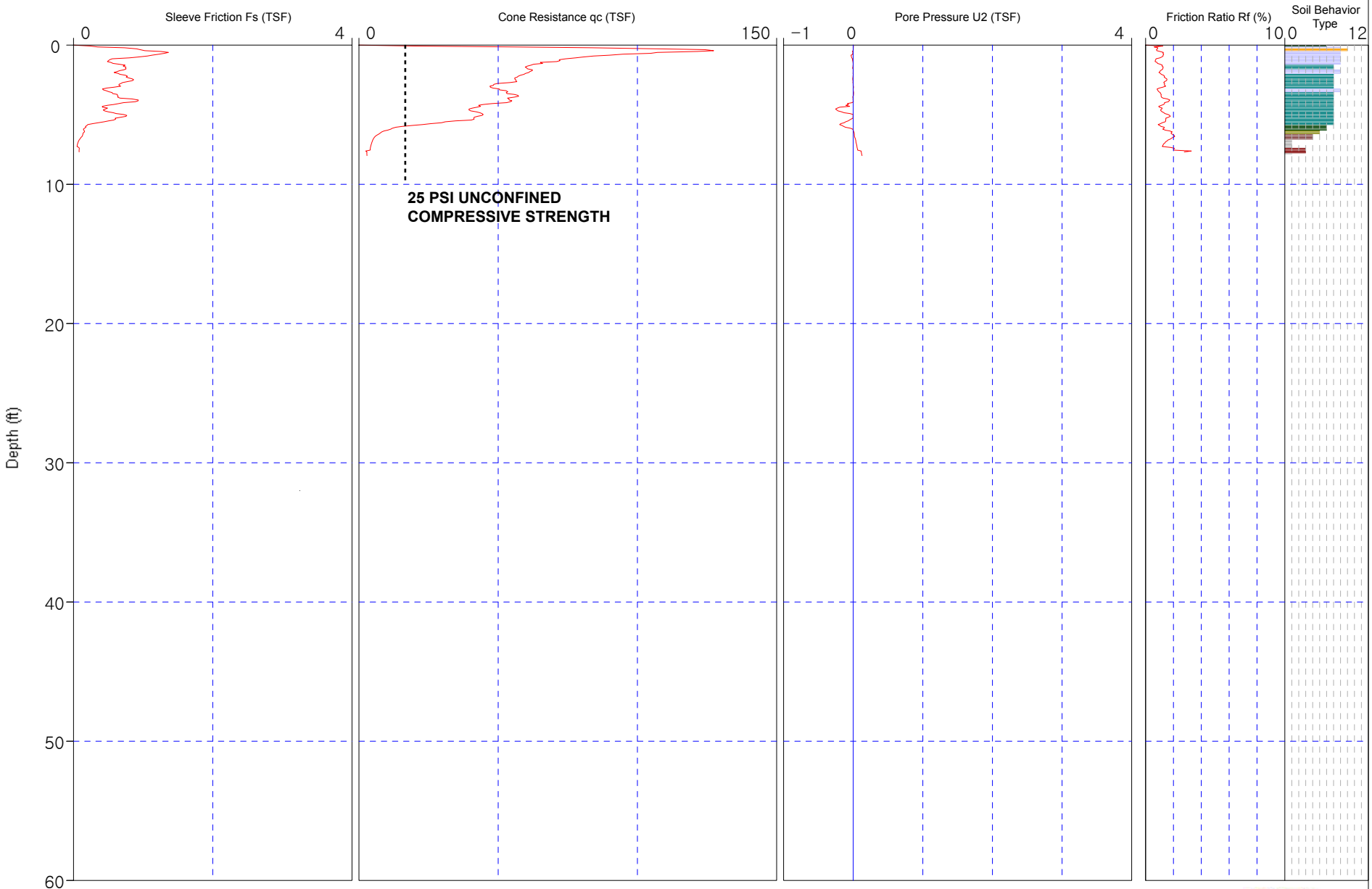
Activity: CPT testing

Work Order: 56180 Date: 9/29/16

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-01
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

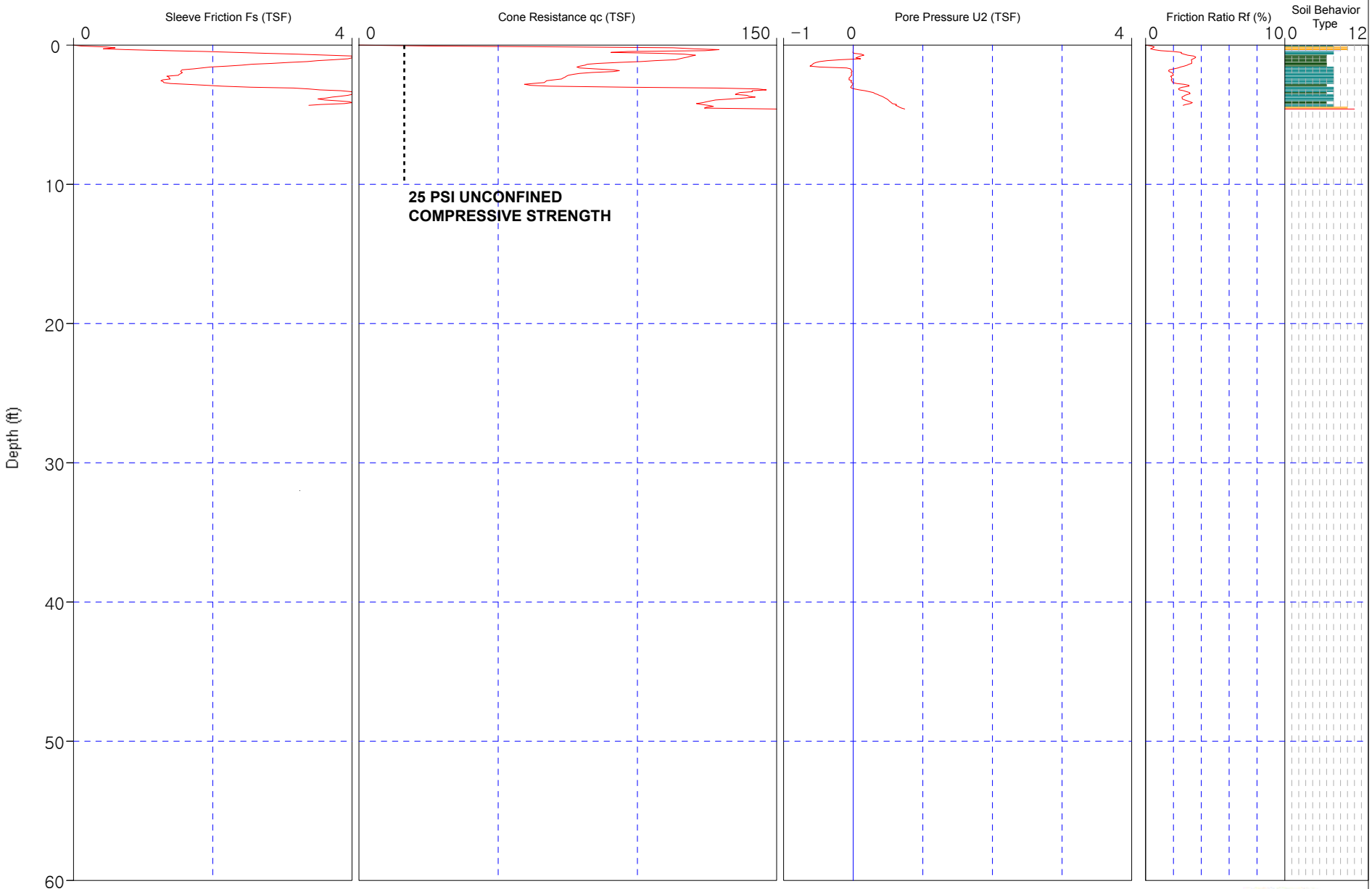


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-02
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



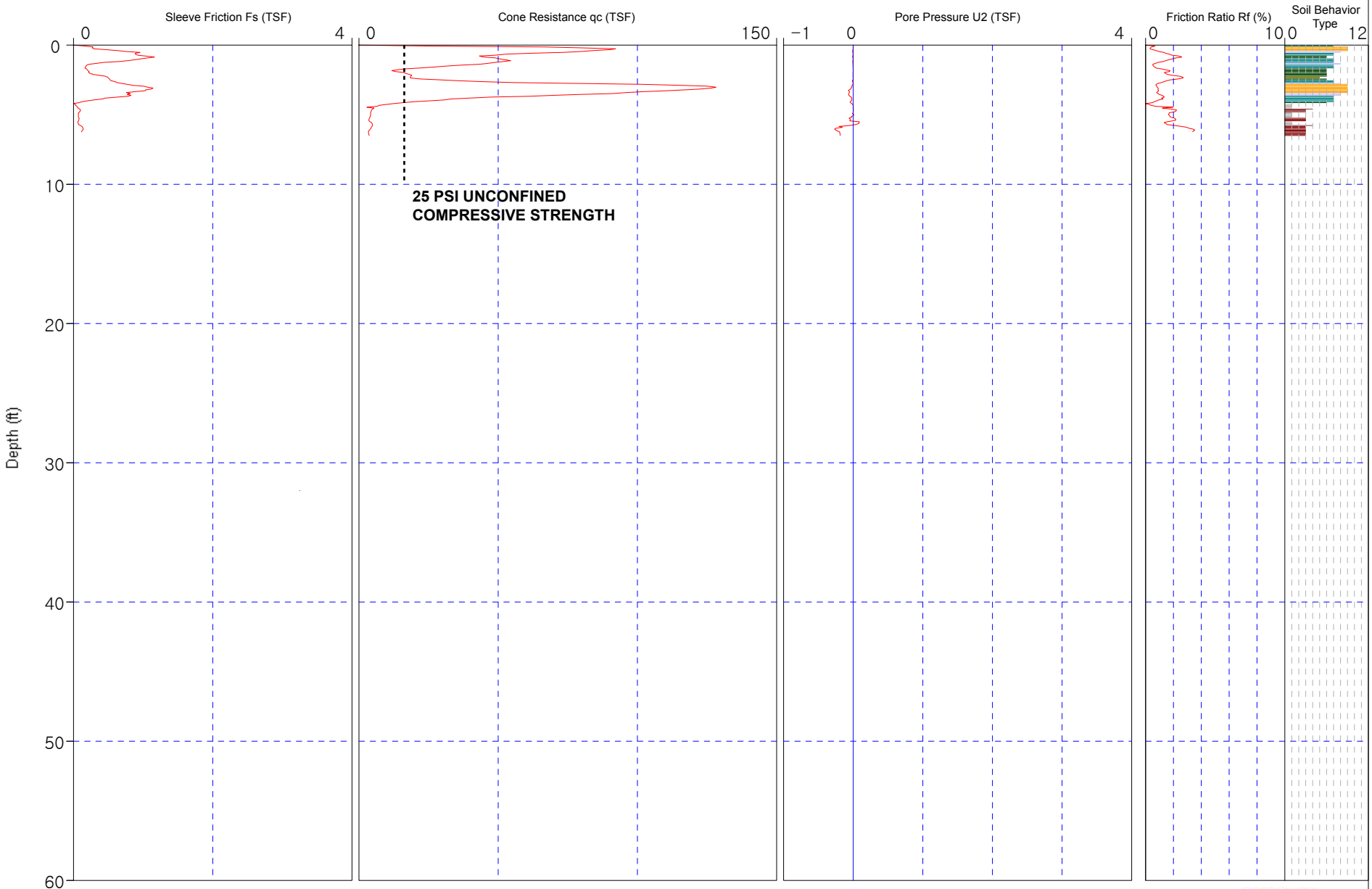
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-03
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

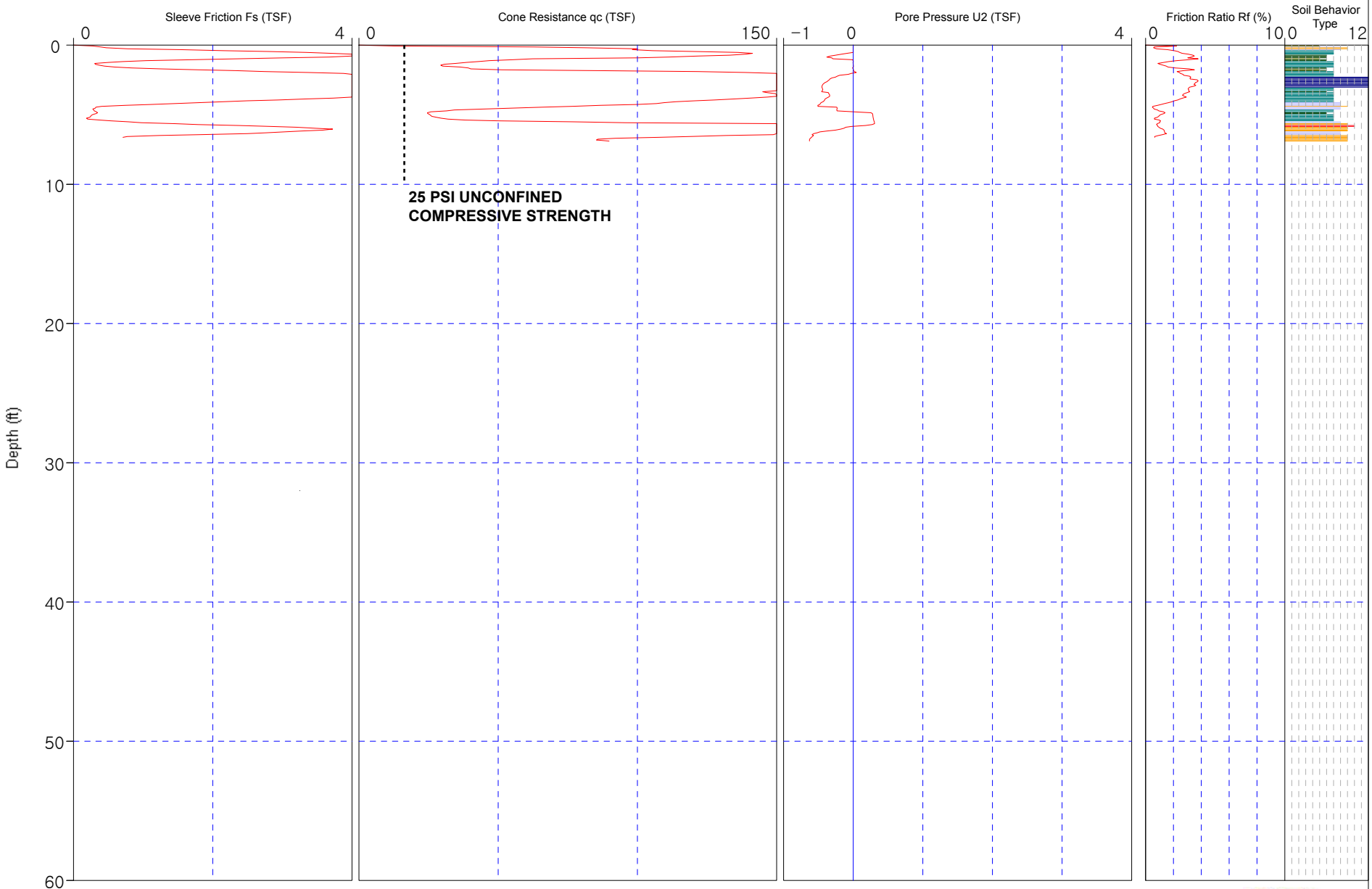


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-04
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

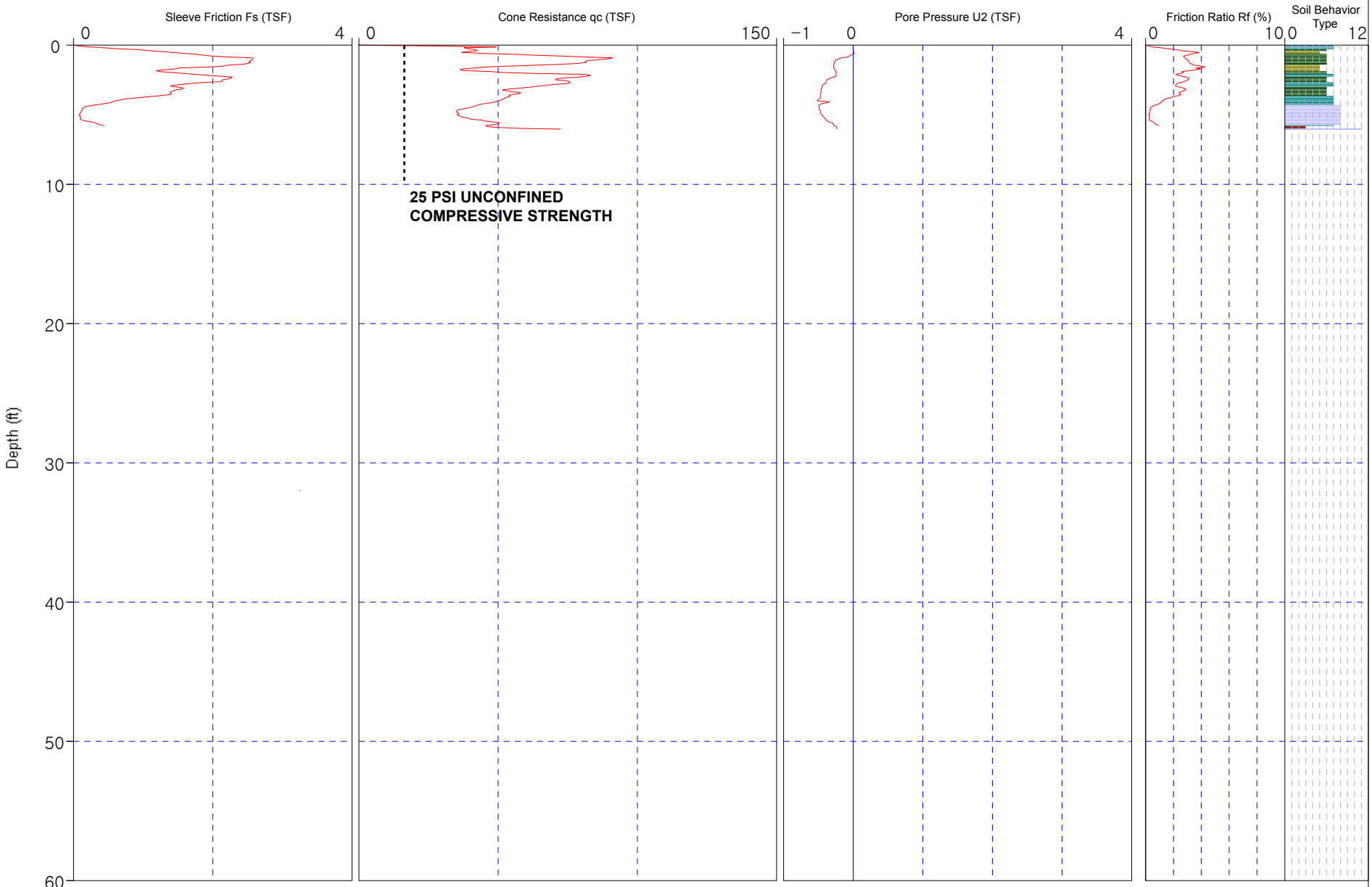


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-05
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

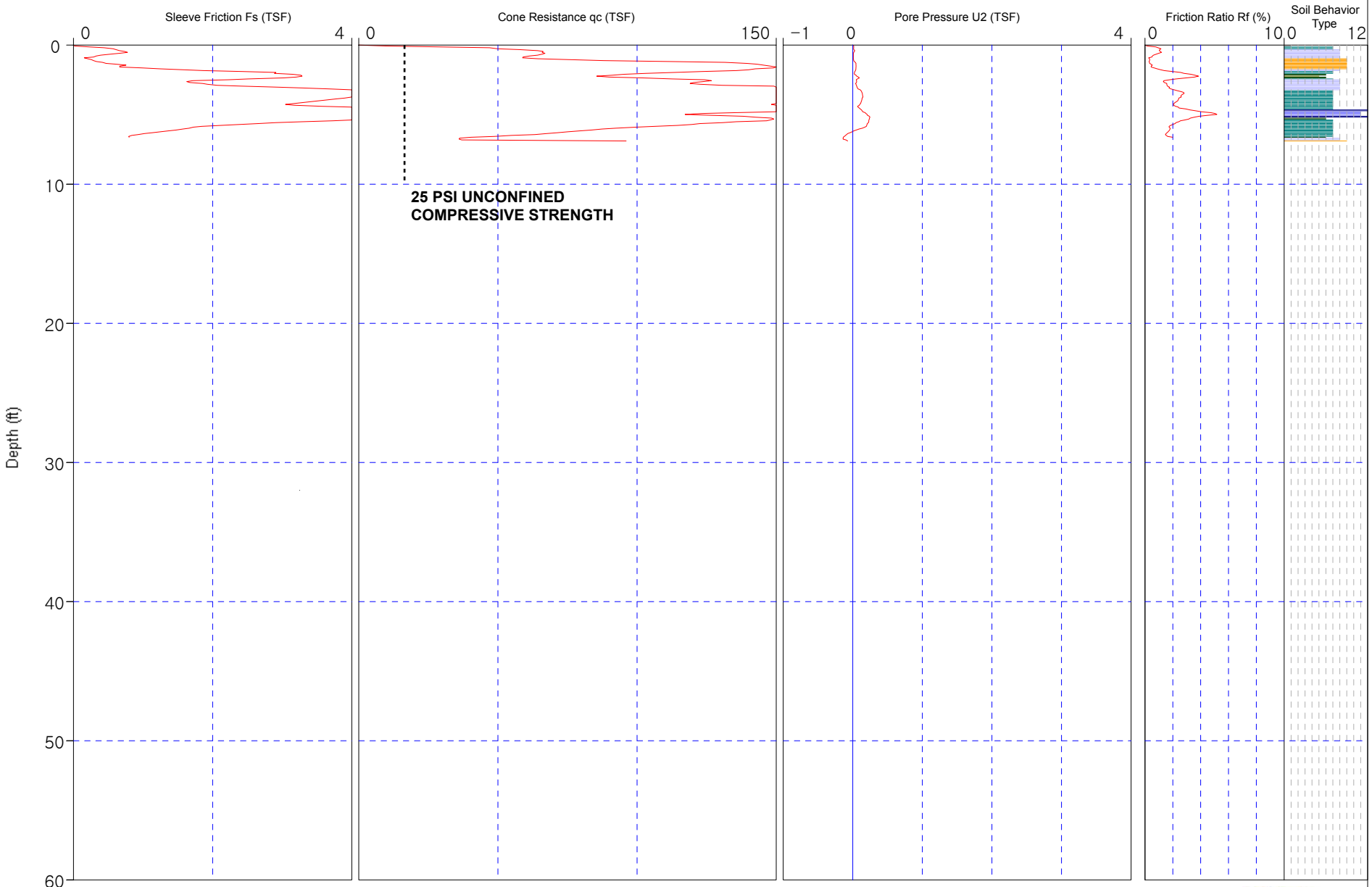


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-06
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



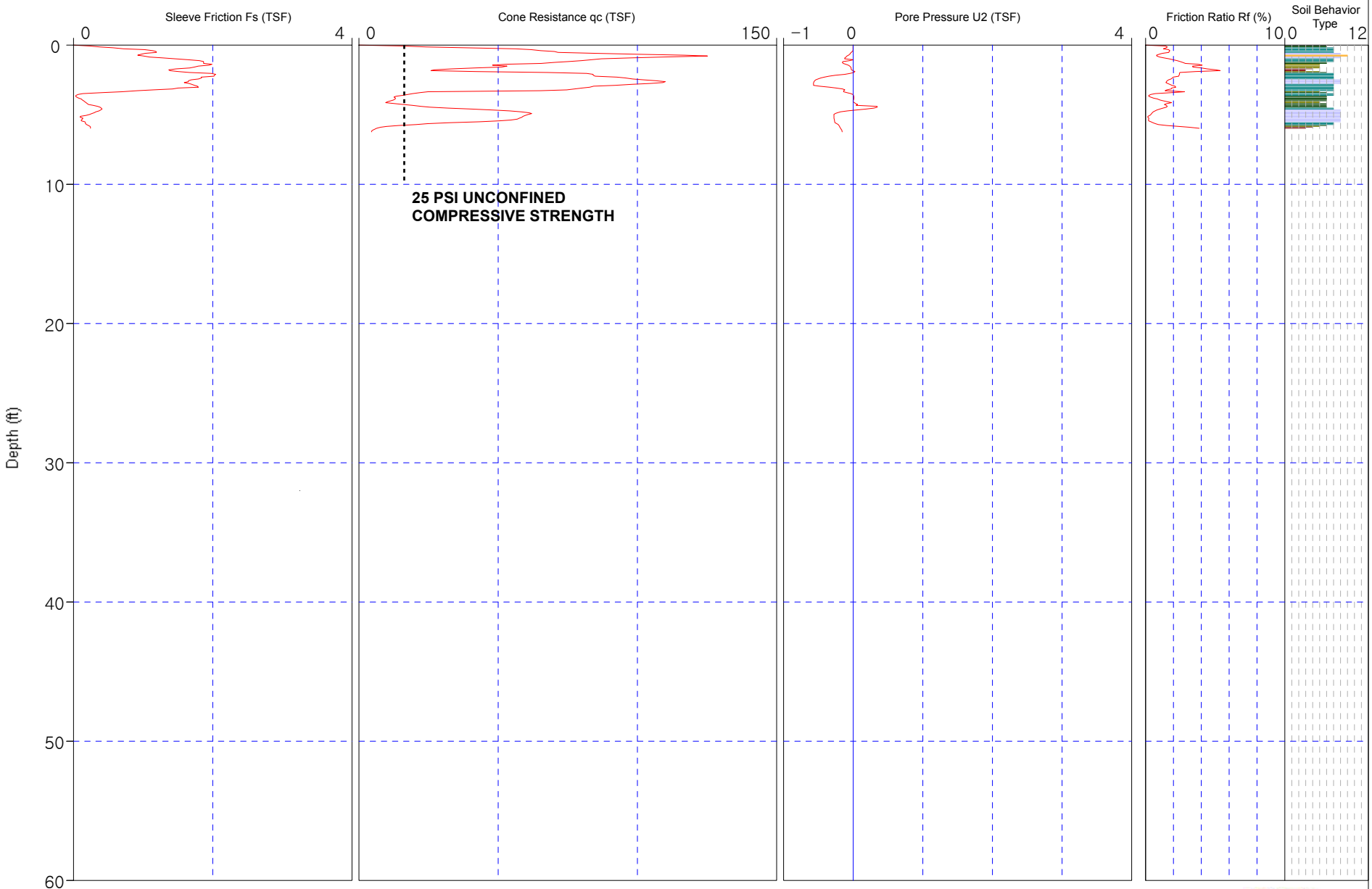
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-07
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



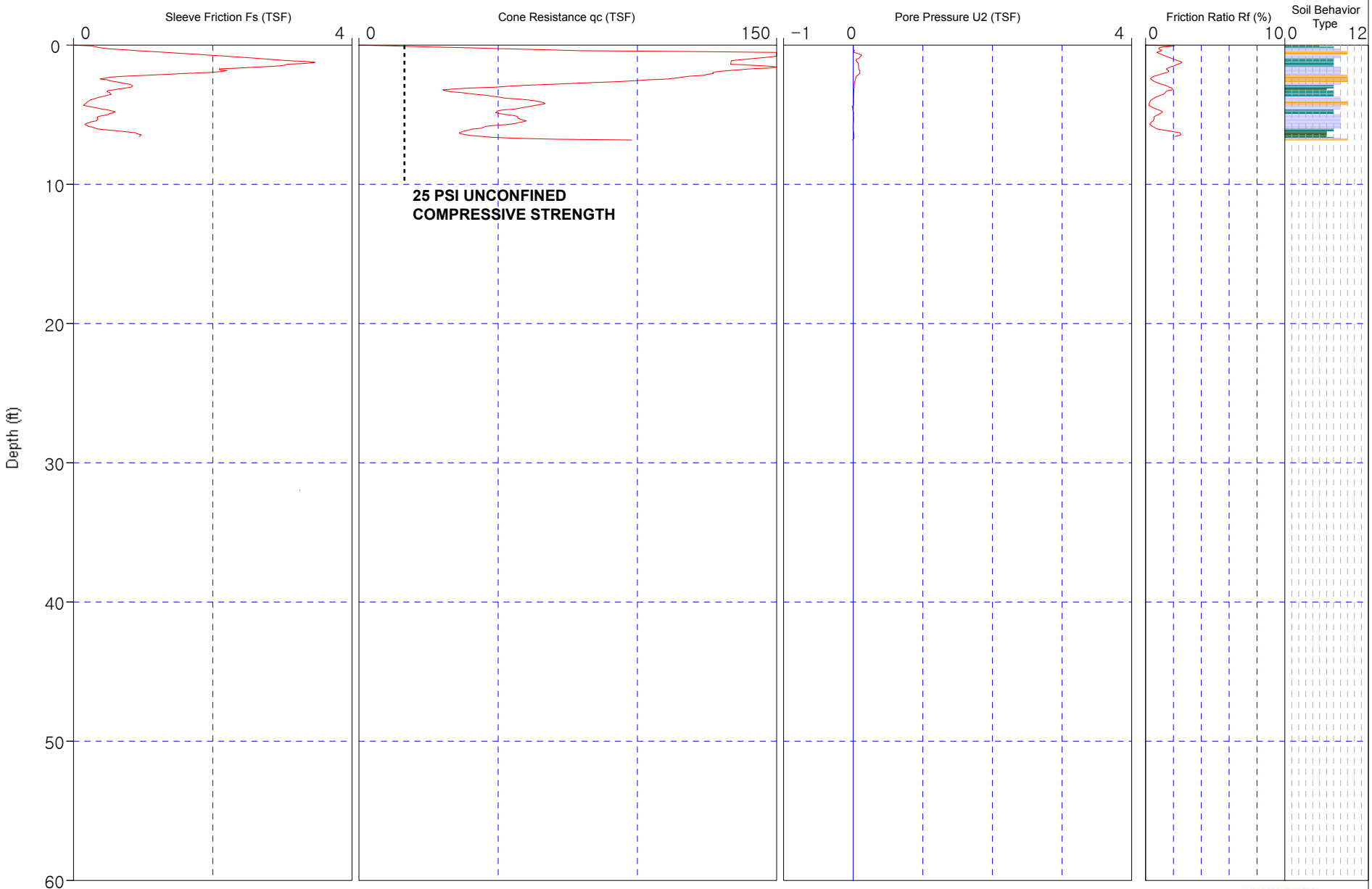
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-08
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



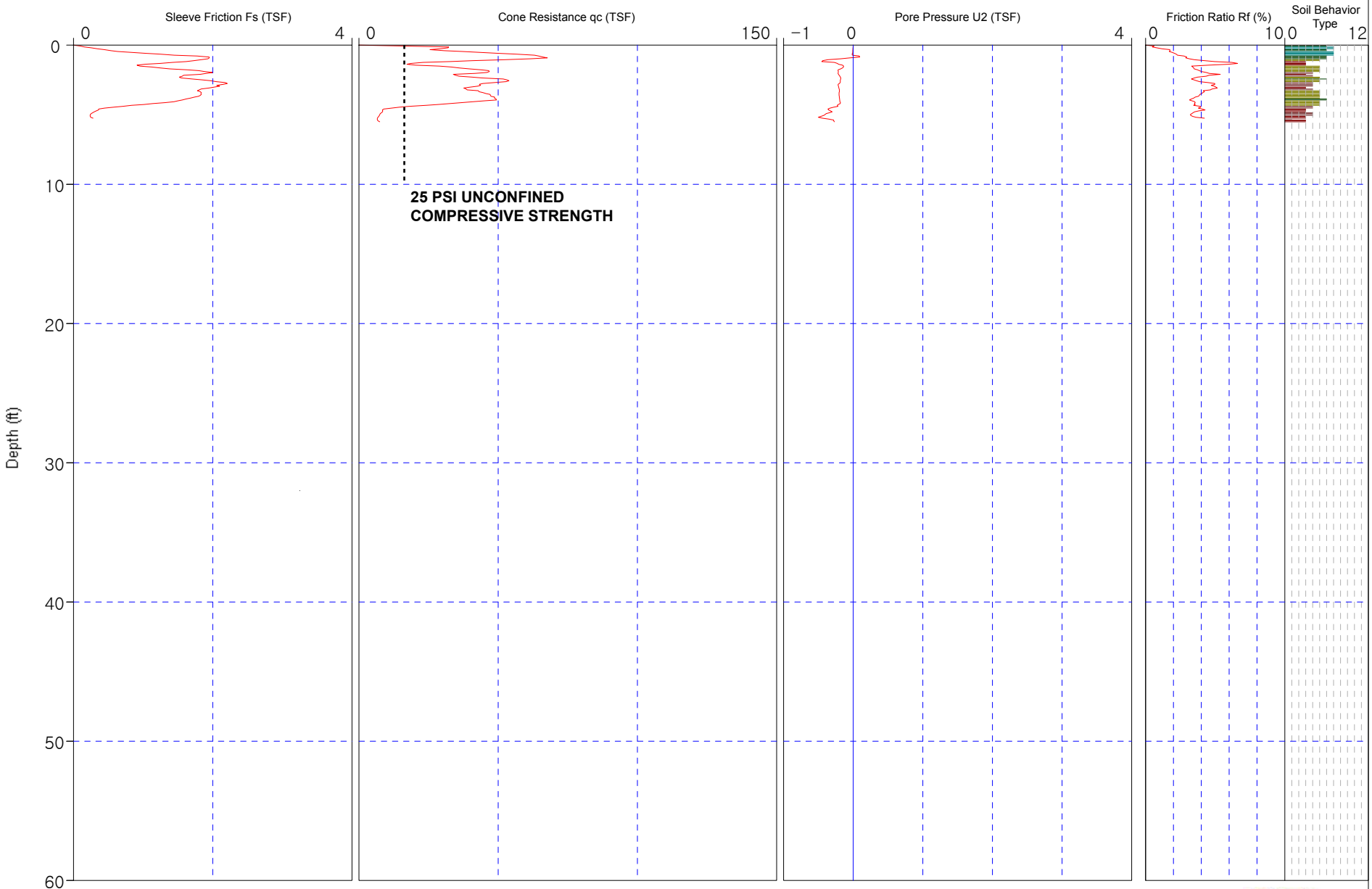
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-09
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



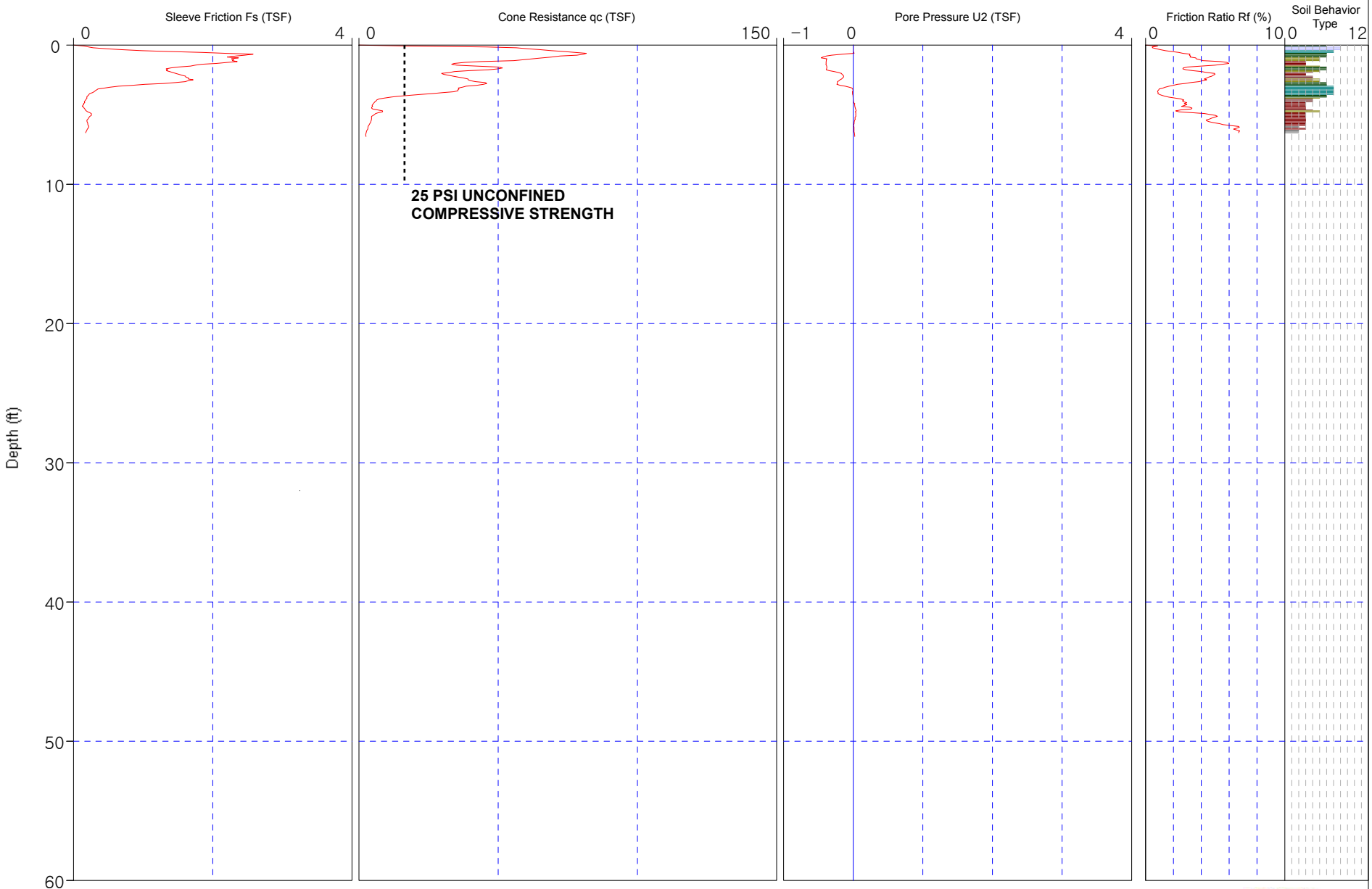
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-10
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

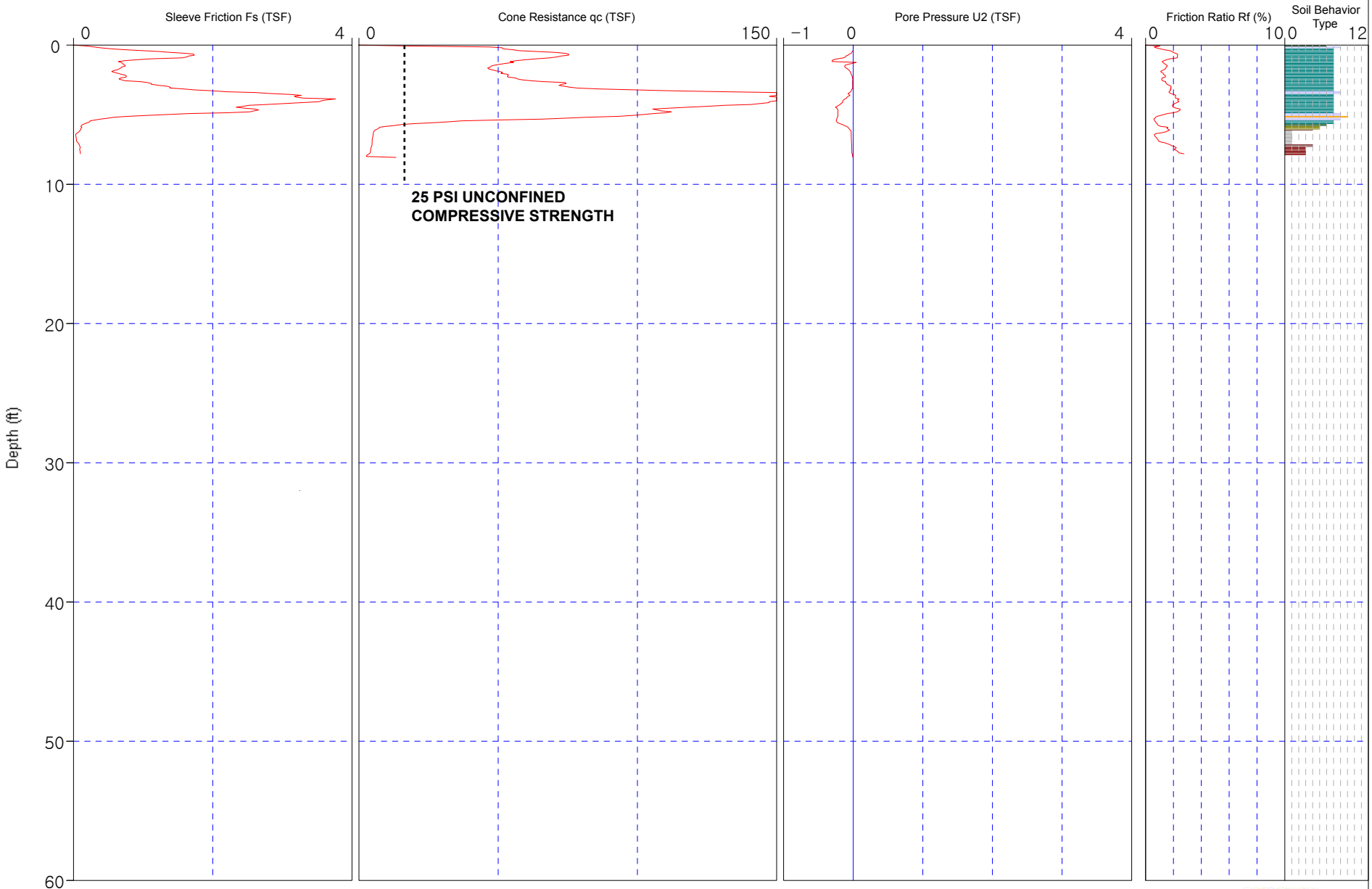


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-11
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

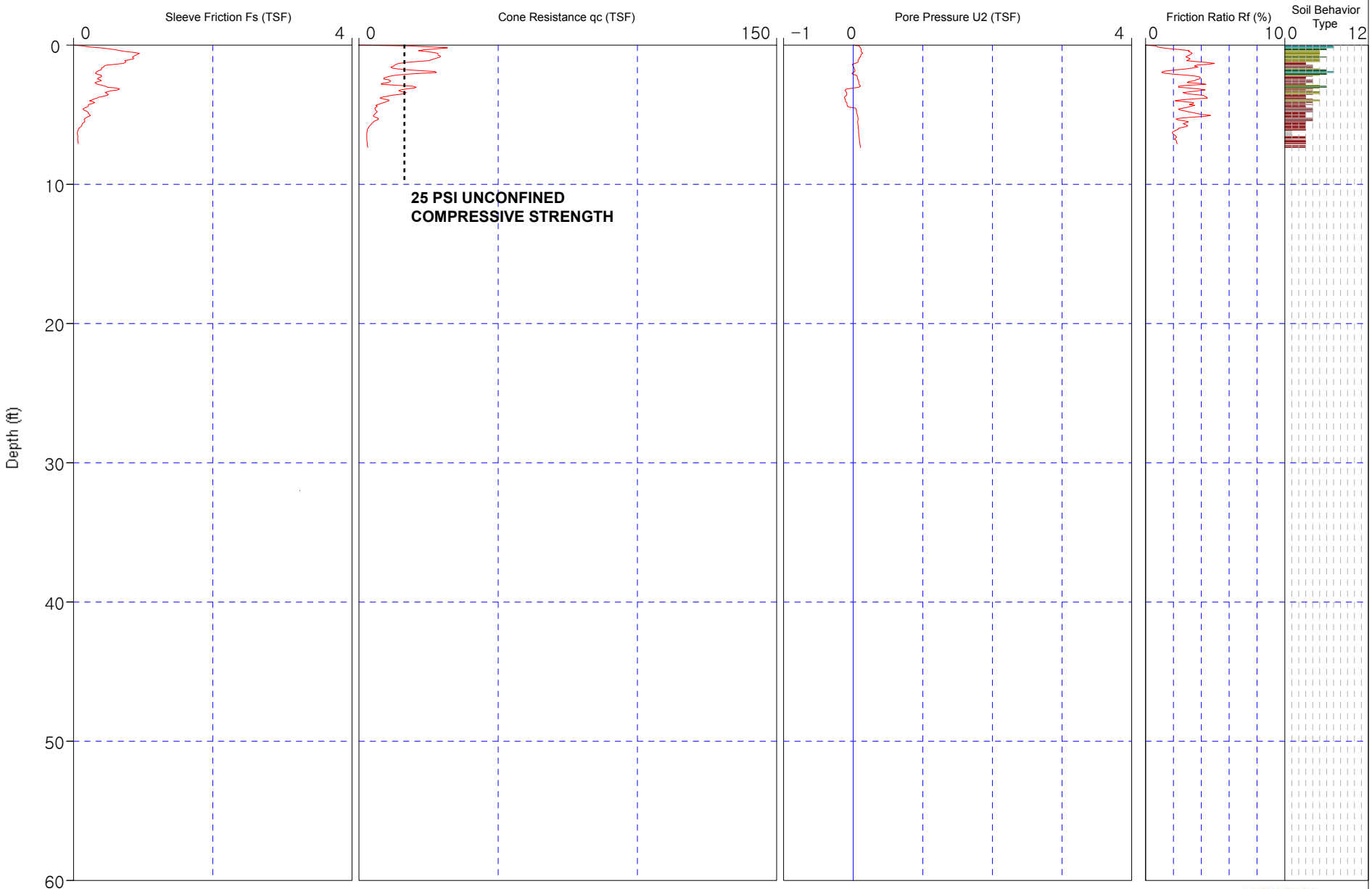


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-12
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

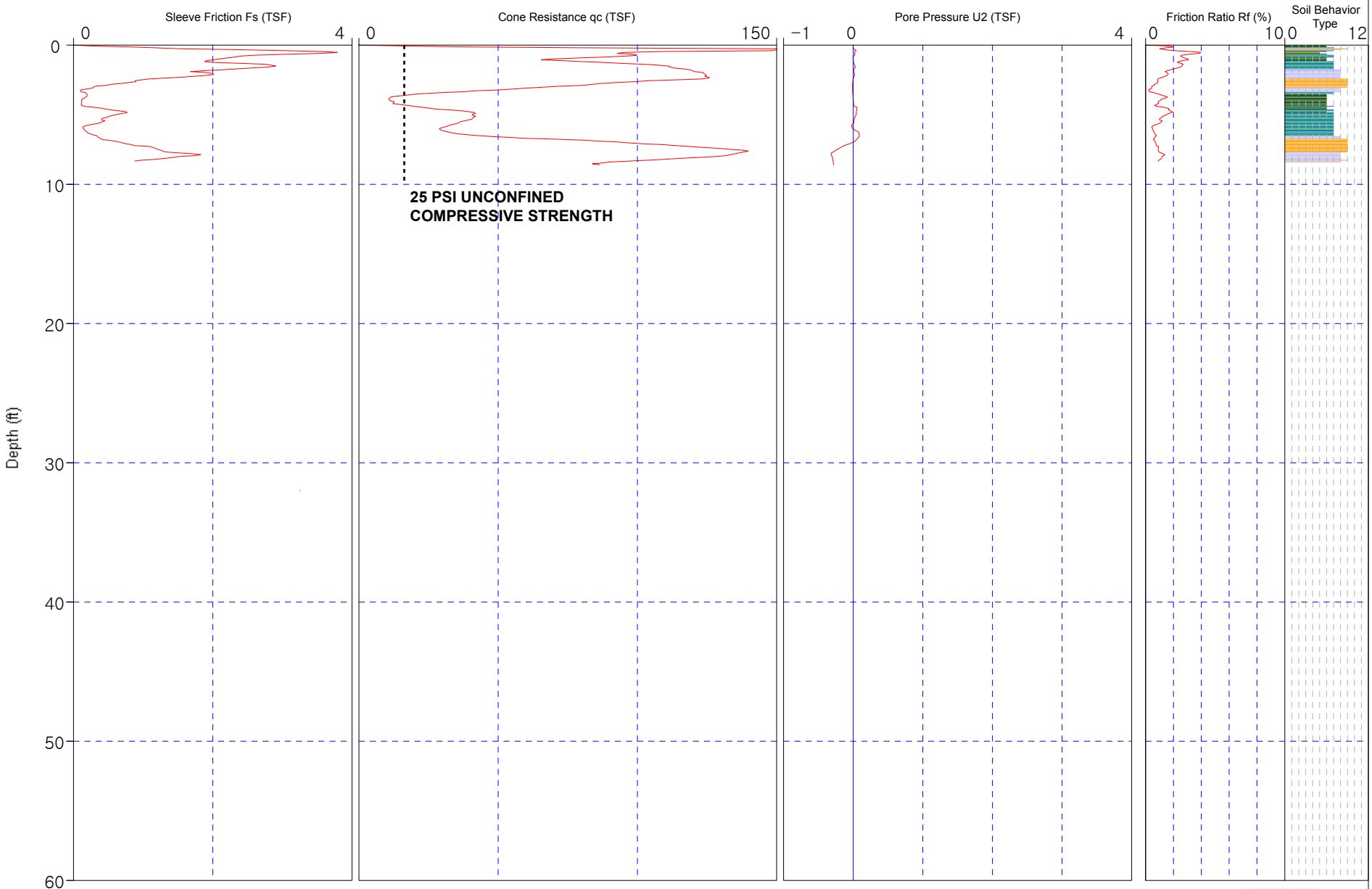


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-13
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



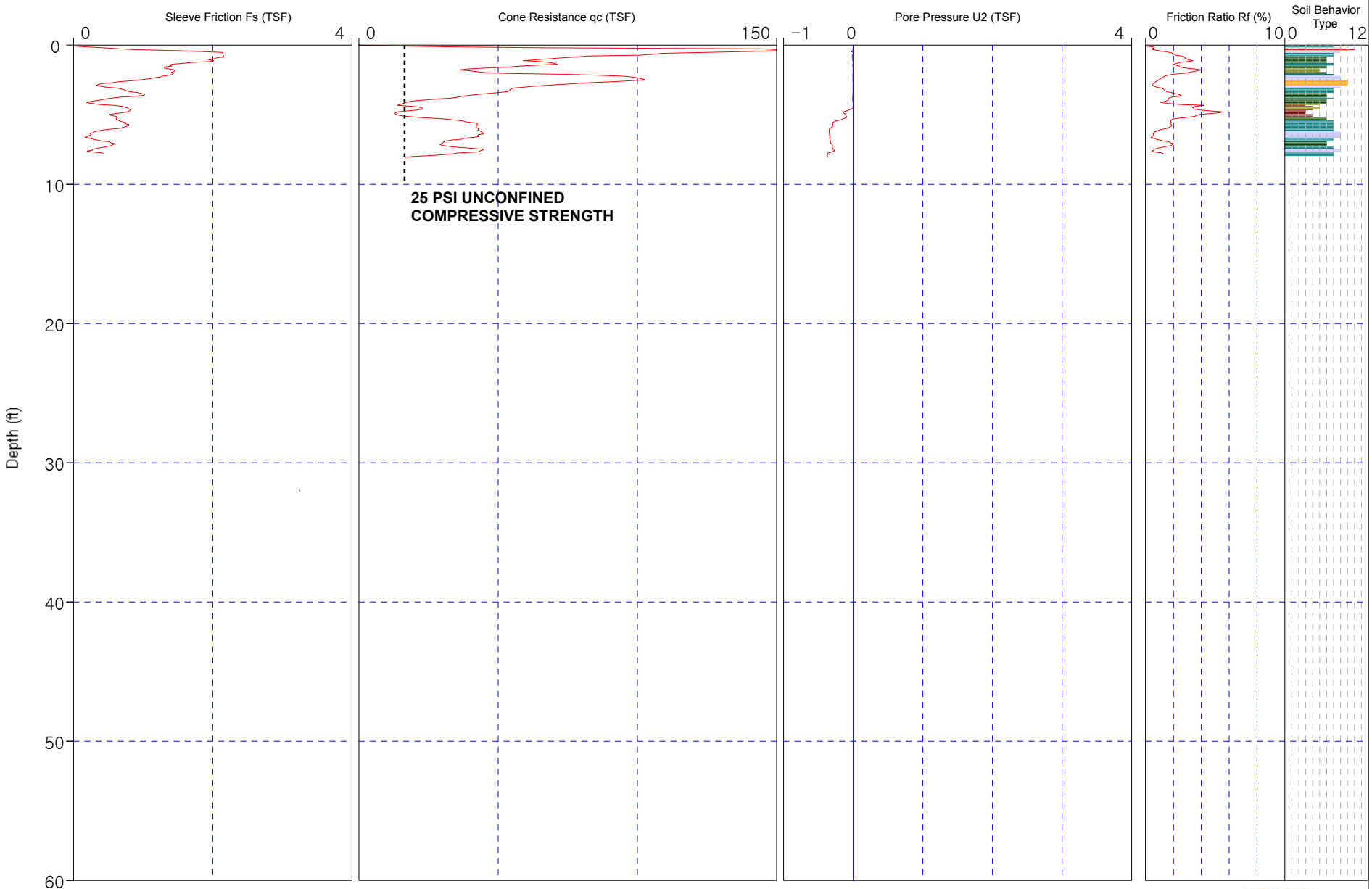
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-14
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



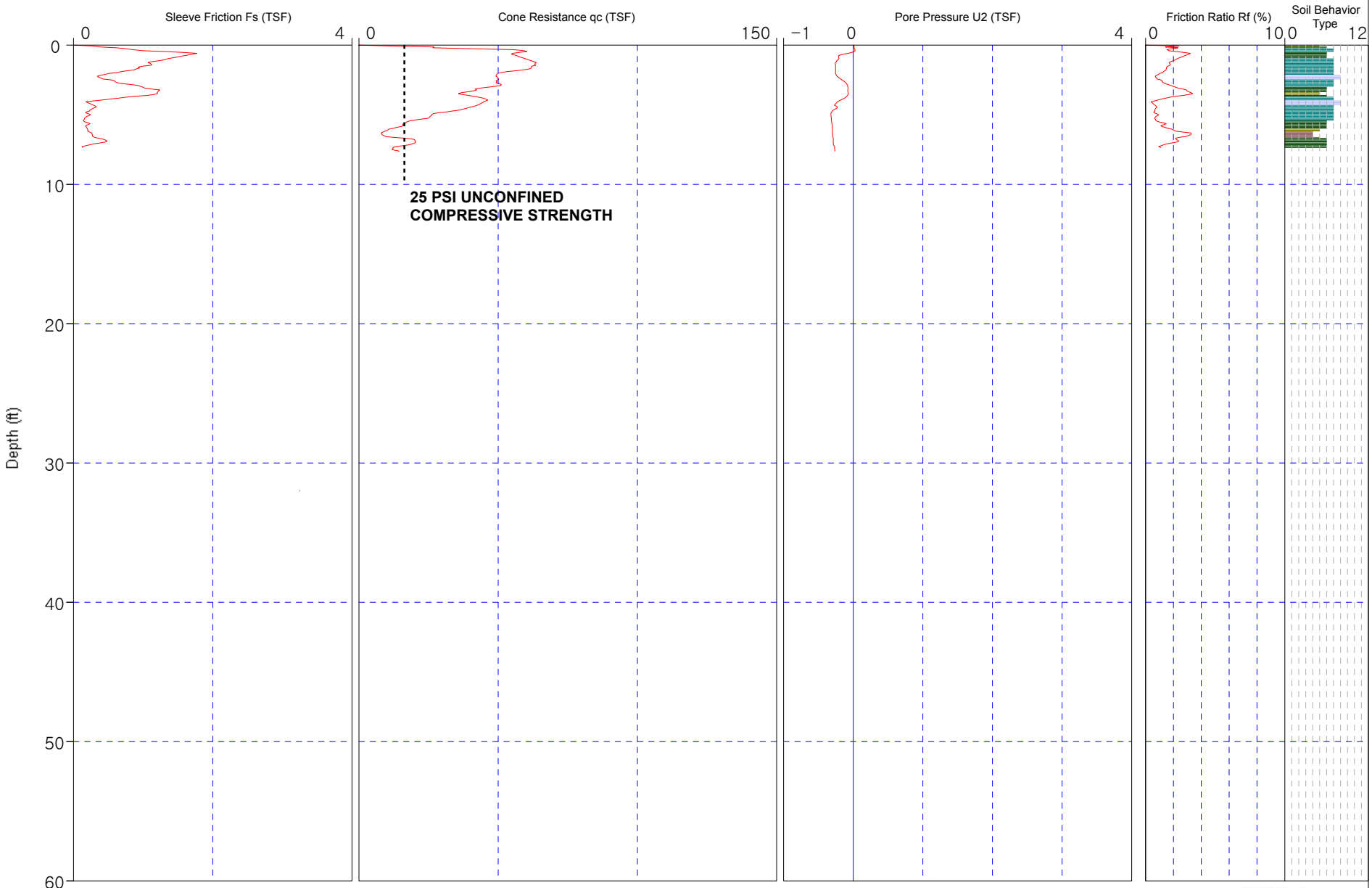
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-15
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

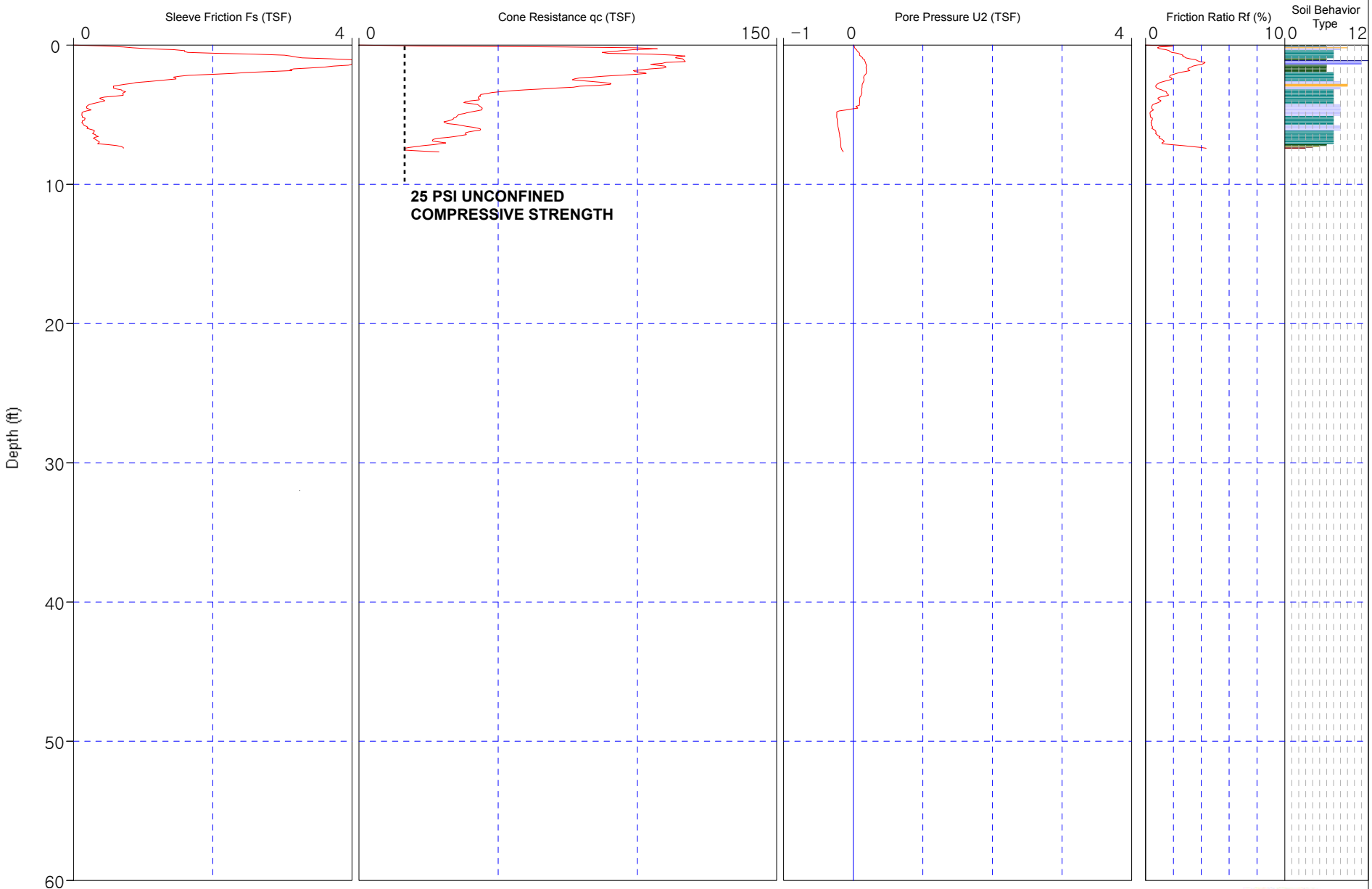


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-16
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



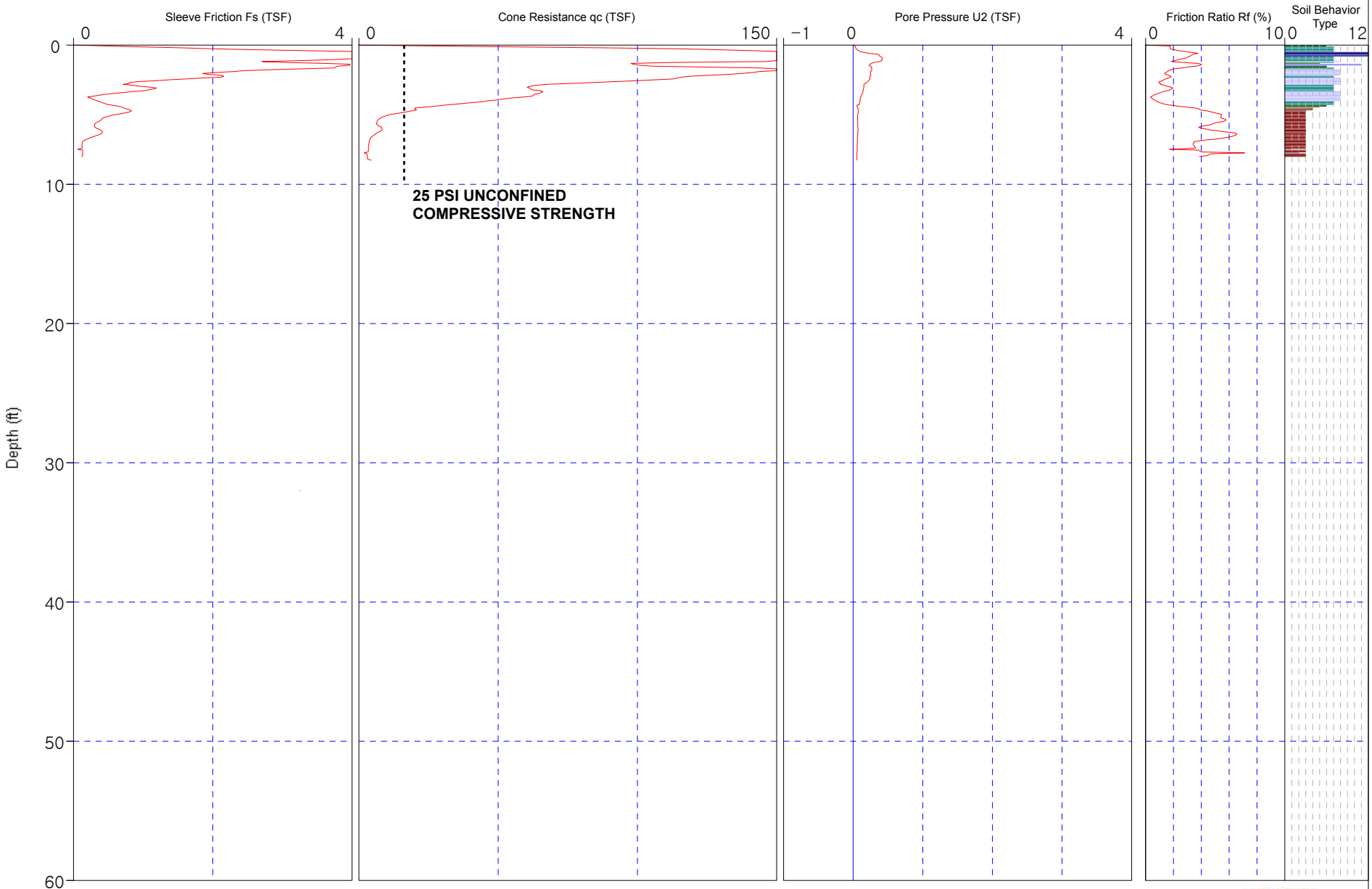
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-17
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

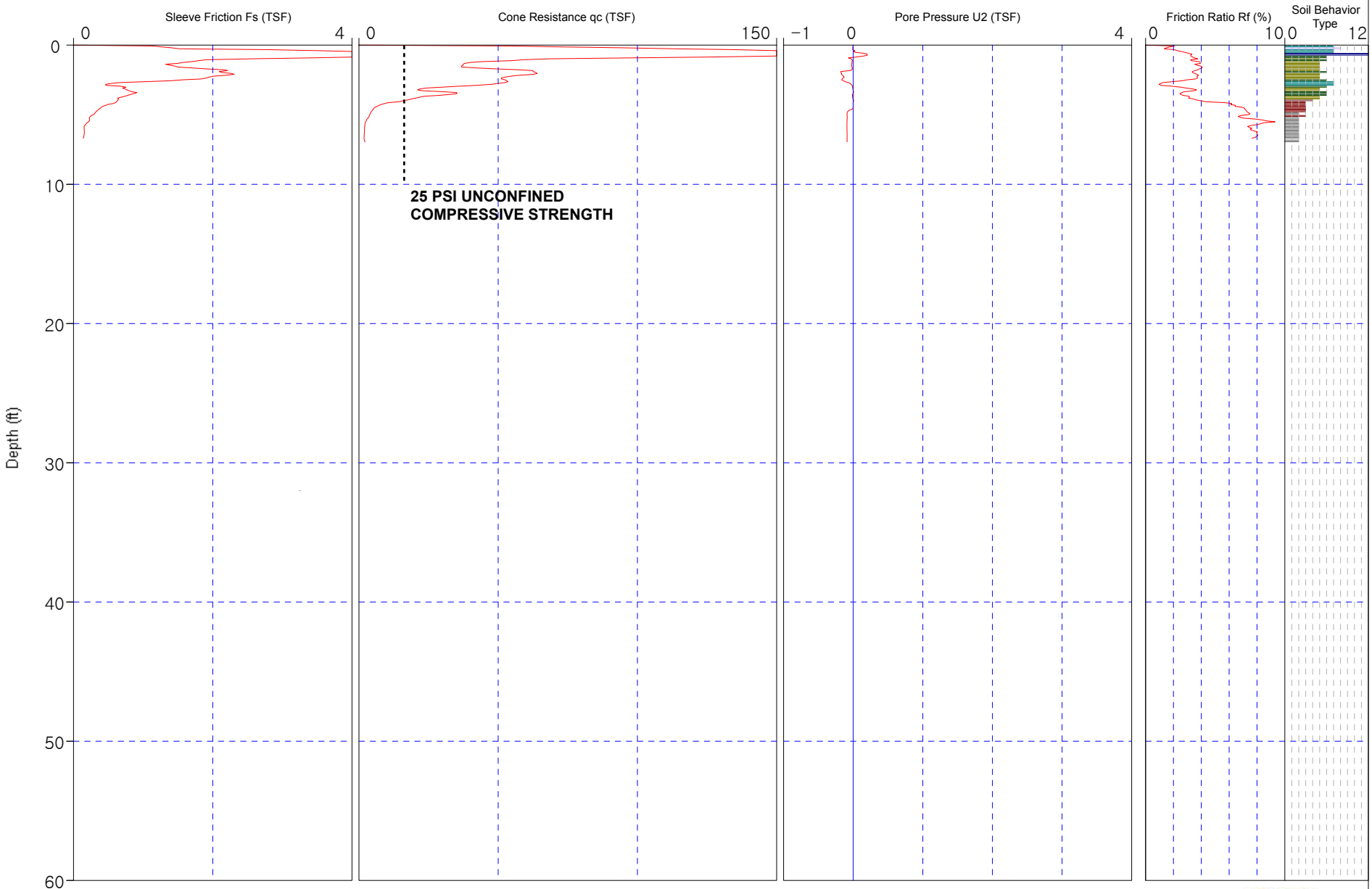


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-18
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



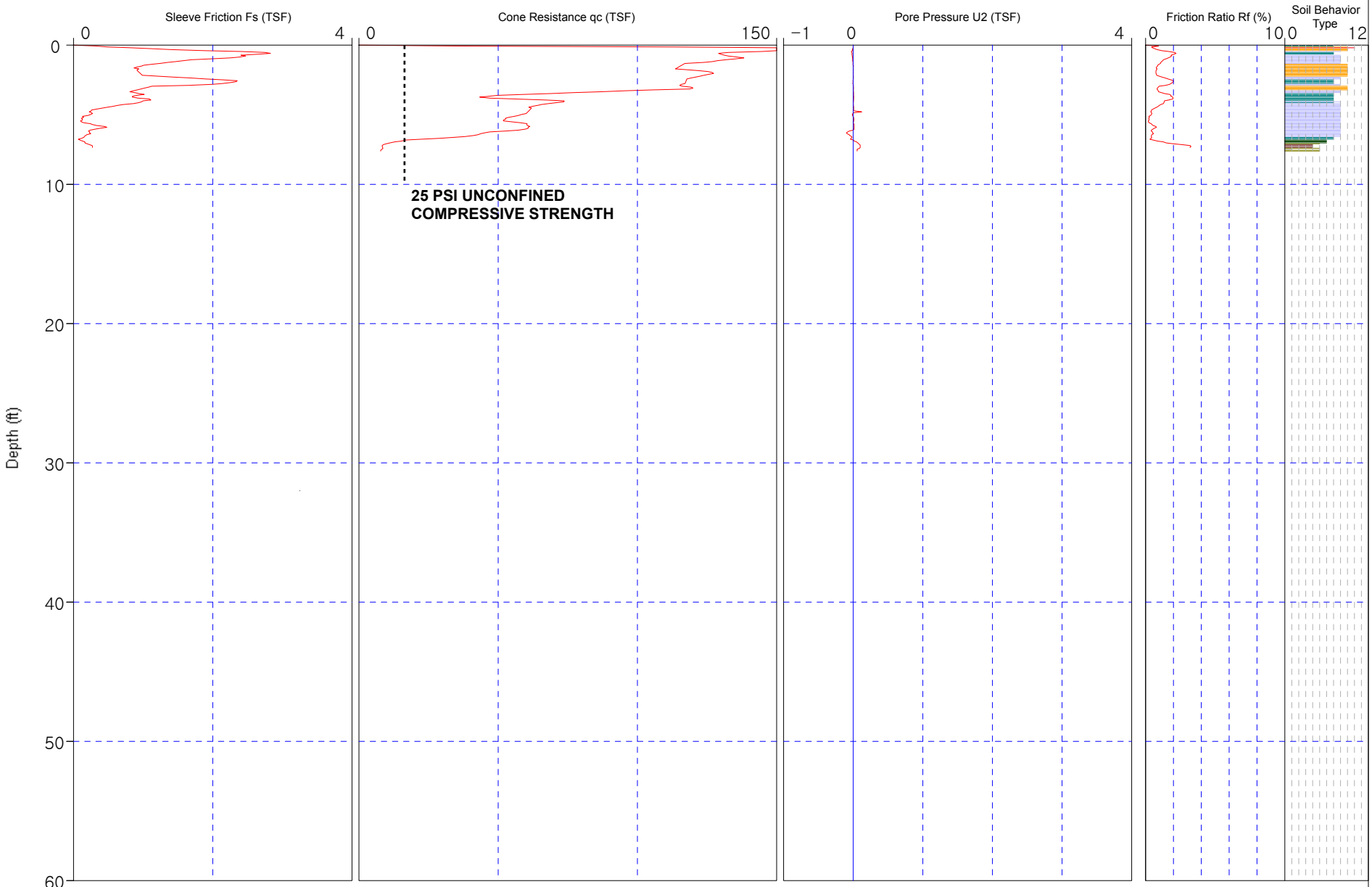
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-19
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

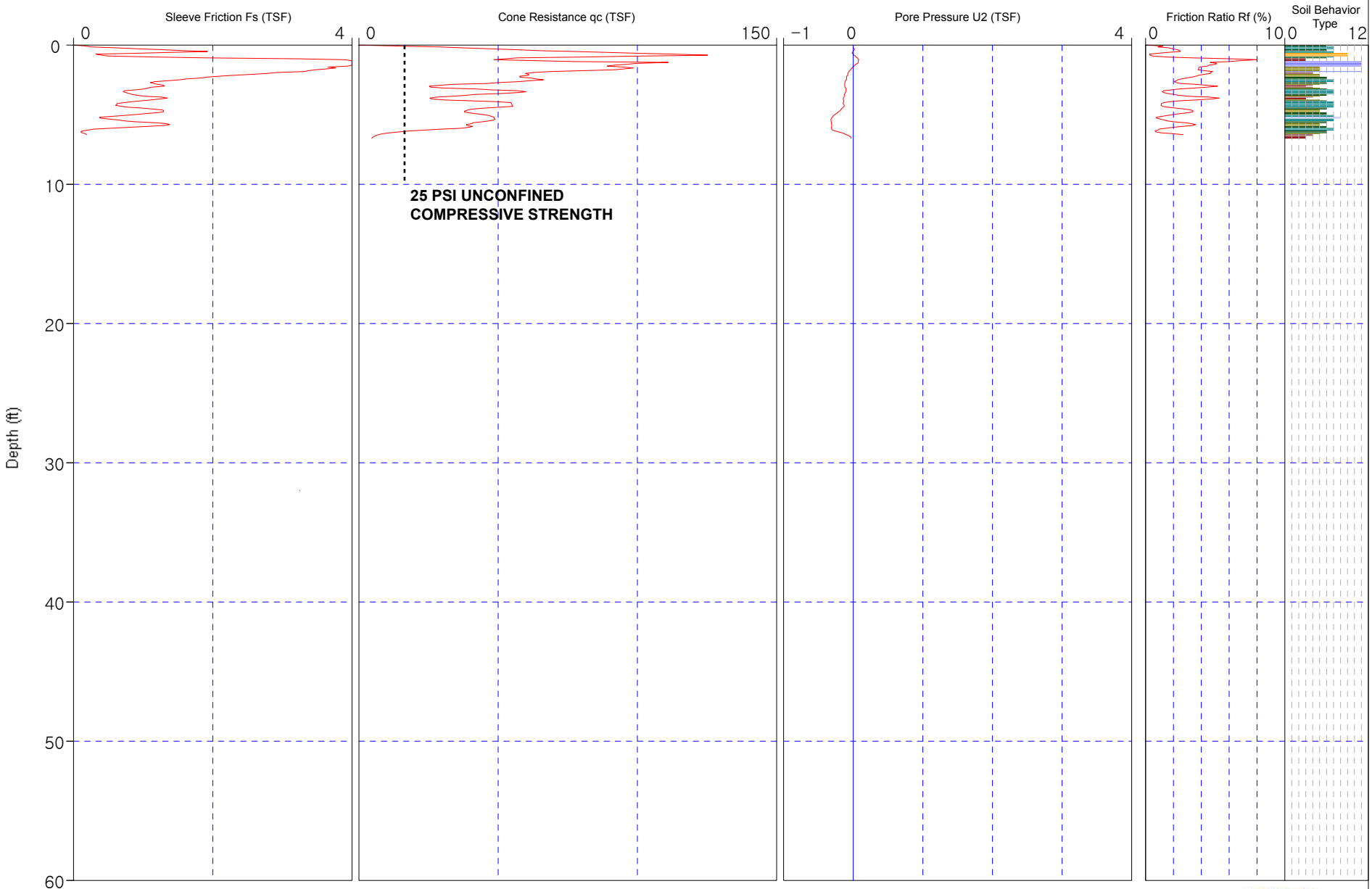


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: East and West Aeration Basin

CPT Number: CPT-20
Date: 29-Sep-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	10/10/2016
		Report Date:	10/20/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0027
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to pick up samples of stabilized sludge. Prior to arrival on-site, the contractor dug two pits. One at Area # 12 and one at Area # 17. Each pit had two piles of excavated materials, 0 to -2' and below 2' (per contractor). Samples from each pile were picked up: a bulk sample (chunks) and a sample obtained with a shovel (loose). I visually observed the moisture content of the below 2' piles to be higher than the 0 to -2' piles and the pit at Area # 12 had water in the bottom of the excavation.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Edison Stevens

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	10/17/2016
		Report Date:	10/20/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0028
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to pick up samples of recycled stabilized sludge. Bo-Mac Contractors was not on-site. Soil samples were taken from soil piles at Areas # 12 and # 17 test pits, 0 to -2' and below 2' at each pit. A total of eight samples were taken for a treatability study.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Edison Stevens

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	10/18/2016
		Report Date:	10/20/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0029
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to pick up soil samples of recycled stabilized sludge. A new pit was excavated in Area # 17. Three bags of material from 0 to -3' and 3 bags of material from -4' to -6' were obtained for treatability study.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Edison Stevens

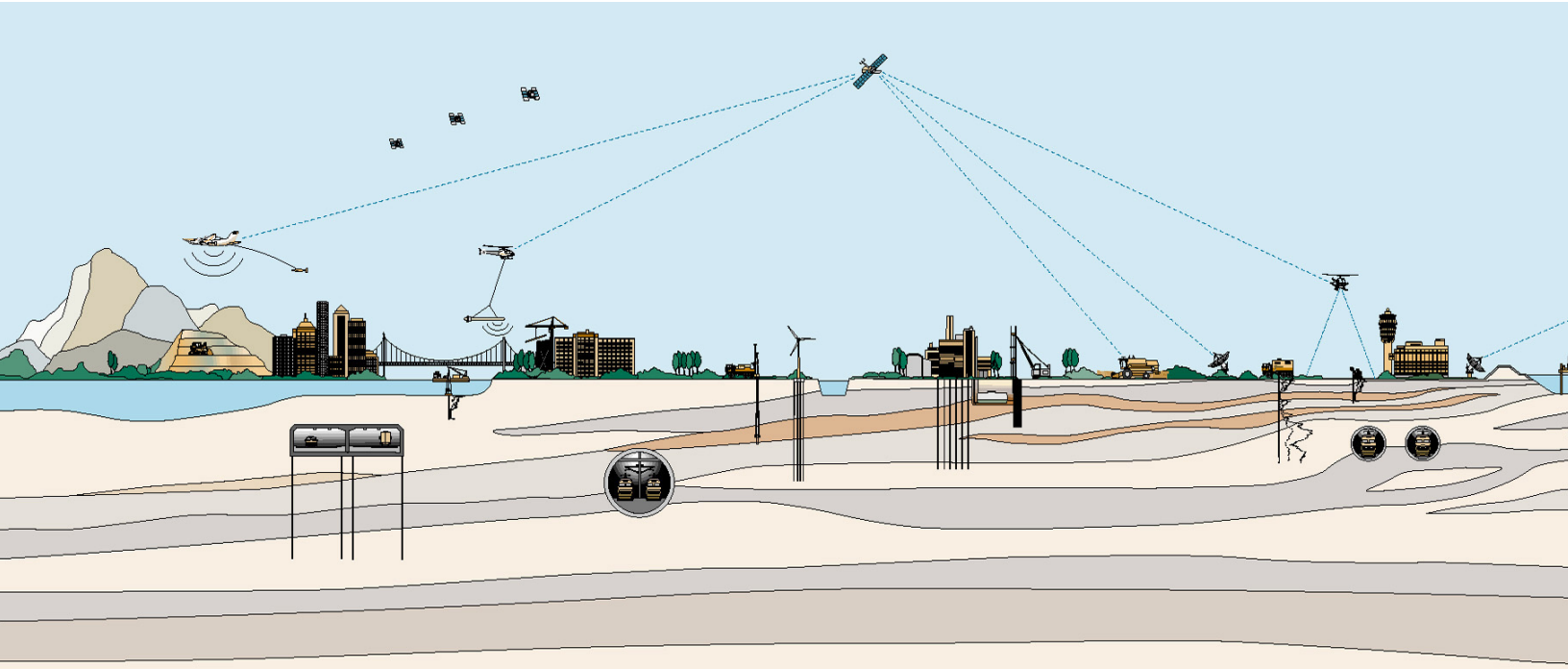
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Appendix F – Partially Stabilized Sludge Treatability Study

FUGRO CONSULTANTS, INC.

SET BASIN SECOND TREATABILITY STUDY
SHELL DEER PARK REFINING
DEER PARK, TEXAS

SHELL OIL PRODUCTS COMPANY
DEER PARK, TEXAS



FUGRO CONSULTANTS, INC.

6100 Hillcroft (77081)
P.O. Box 740010
Houston, Texas 77274
Tel: (713) 369-5400
Fax: (713) 369-5518

Report No. 04.12164967-1
November 14, 2016

Shell Deer Park Refining
5900 State Highway 225
Deer Park, Texas 77536

Attention: Ms. Dottie Williams
Project Engineer

SET Basin Second Treatability Study
Shell Deer Park Refining
Deer Park, Texas

Introduction

Fugro Consultants, Inc. (Fugro) is pleased to present the results of our second treatability study for the East and West SET Aeration Basin Closure Project in Deer Park, Texas. Mr. Mark Maxwell with Bo-Mac Contractors, LTD (Bo-Mac) proposed this study in an email to Mr. Robert Ringholz on October 13, 2016. Our services were authorized through Shell Deep Park Refining Purchase Order No. 4518118534 dated February 9, 2016.

Project Description. Shell is planning to close their existing east and west aeration basins located in the South Effluent Treatment Area, at their existing facility in Deer Park, Texas. The existing east and west basins cover an area of approximately 200 by 350 feet and 220 by 340 feet, respectively. Upon completion of closure activities, we understand that 1) the west basin will be occupied with operating equipment, and 2) the east basin will be utilized as a parking area and/or a laydown area for storage of construction materials, supplies, and equipment.

An initial study was prepared by Fugro (Fugro Report No. 04.10160022-1 dated July 13, 2016) to stabilize the sludge at the bottom of each basin with fly ash and borrow cohesive soil. The initial stabilization effort, conducted July through September on the sludge material at the bottom of the west basin, was only partially successful in achieving the minimum unconfined compressive strength of 25 psi throughout the west basin. The upper zone of the stabilized sludge was found to predominantly meet unconfined compressive strength requirement while the lower zone of the stabilized sludge did not meet required compressive strength. As such, a second stabilization study using Portland cement as the reagent was proposed by Bo-Mac.

The current planned closure procedure for the west basin includes: 1) re-stabilizing the existing mix of sludge, cohesive soil, and fly ash with Portland cement slurry, 2) placing structural fill to bring grade to within 4 feet of the surrounding grade, 3) placing a cap (4-foot thick clay cap or

geosynthetics clay liner (GCL)) to achieve final site grade, and 4) placing a protective surface cover over the cap.

Scope of Treatability Study. The scope of this treatability study was to: 1) mix upper zone material with lower zone material and stabilize it with Portland cement slurry at different water to cement ratios and evaluate the strength gain with time, and 2) present the results of the study in a data report.

Environmental assessments, compliance with State and Federal Regulatory requirements, and environmental analyses were beyond the scope of our services.

Applicability of Report. Our scope of services was limited to laboratory testing. If mixing materials differ from those provided to Fugro by Bo-Mac and used during the second treatability study, the results may differ. If different materials are used, additional laboratory testing should be performed to confirm the required unconfined compressive strength. In addition, test results of specimens prepared in the laboratory, under laboratory conditions, could differ from what is achieved in the field under field mixing and compaction conditions. As such, a field monitoring and testing program has been developed to confirm that required strengths are achieved.

We have prepared this data report exclusively for Shell and Bo-Mac to assist in the closure of the west basins. We have conducted this study using the standard level of care and diligence normally practiced by recognized engineering firms now performing similar services under similar circumstances. This is a data report only; no design recommendations or specifications are presented herein. Fugro makes no claim or representation concerning any activity or condition falling outside the specified purpose to which this data report is directed.

Material for Laboratory Testing

The closure of the West Basin will be performed by Bo-Mac. For our second treatability study, the upper zone and lower zone samples were collected by Bo-Mac and transported by a Fugro representative to our laboratory. In total, three bags of each of the upper zone material (0 to 3 feet) and lower zone material (4 to 6 feet) were collected on October 18, 2016. Bo-Mac also identified the type of Portland cement to be used to prepare the cement slurry. The Portland cement was bought from Home Depot. Various water to cement ratios were proposed by Bo-Mac based on their experience. Initial mixing requirements, provided to Fugro on October 17, 2016, specified: 1) first mixing one-part upper zone material with two-part lower zone material by dry weight, and 2) then adding 4 percent Portland cement by dry weight of mix (1 part upper and 2 part lower) in a slurry form prepared with a water to cement ratio of 0.48. After the initial batch of samples were molded/reconstituted, Fugro informed Shell and Bo-Mac that the prepared samples appeared to be dry. As such, Bo-Mac requested on October 28, 2016 to prepare two new batch of samples with a water to cement ratios of 0.65 and 0.85, respectively.

Laboratory Testing

The laboratory-testing program was directed toward evaluating the unconfined compressive strength of three various upper zone material/lower zone material/cement slurry mixes and the strength gain with time, as listed below:

- Mix 1: 1 part upper, 2 part lower, and 4 percent cement. The cement was added in a slurry form at a water to cement ratio of 0.48.
- Mix 2: 1 part upper, 2 part lower, and 4 percent cement. The cement was added in a slurry form at a water to cement ratio of 0.65.
- Mix 3: 1 part upper, 2 part lower, and 4 percent cement. The cement was added in a slurry form at a water to cement ratio of 0.85.

Note that the above specified amount of upper zone material, lower zone material, and cement is mixed by dry weight. The unconfined compression tests were performed in general accordance with ASTM D2166.

Strength Tests. The strength of treated upper zone material /lower zone material /cement slurry mixes were measured by performing unconfined triaxial compression tests. The natural water content and dry unit weights were determined as routine parts of the strength tests. The results of the laboratory compressive tests are presented in Table 1. Note that the upper zone material/lower zone material/cement slurry mixed samples were compacted by tamping to simulate anticipated field procedures for stabilizing/mixing the sludge material in the west basin. Based on the CQCP dated October 26, 2016 and prepared specifically for the second stabilization study, the upper zone material/lower zone material/cement slurry mix is required to have an insitu 7-day compressive strength of at least 25 psi.

Table 1. Unconfined Compressive Strength of Upper Zone Material/lower Zone Material /Cement Slurry Mix

Ratio of Upper Material to Lower Material by Dry weight	Percent of Portland Cement by Dry Weight	Water to Cement ratio for Cement Slurry	Curing Period (Days)	Water Content, (%)	Dry Unit Weight, (pcf)	Compressive Strength, (psi)
1 Upper to 2 Lower	4	0.48	3	30.7	66.3	8.7
				30.4	64.6	13.7
			7	30.3	64.7	22.3
				30.7	70.2	28.5
			14	30.3	66.1	28.2
				29.3	67.6	19.5
1 Upper to 2 Lower	4	0.65	3	31.4	66.7	17.7
				31.4	70.8	22.3
			7	31.3	67.5	37.2
				31.8	69.4	25.7
1 Upper to 2 Lower	4	0.85	3	32.5	70.1	20.0
				33.3	72.2	26.5
			7	33.0	72.8	55.8
				32.0	72.4	37.4

Summary of Laboratory Tests. Table 2 provides a summary of the types and number of laboratory tests performed for this study as well as the applicable test standards.

Table 2. Summary of Laboratory Testing

Type of Test	Quantity[1]	Testing Standard
Water Content	14	ASTM D2216
Dry Unit Weight	14	ASTM D7263
Unconfined Compression	14	ASTM D2166

Note:
(1) Not all samples that were prepared were tested.

* * *

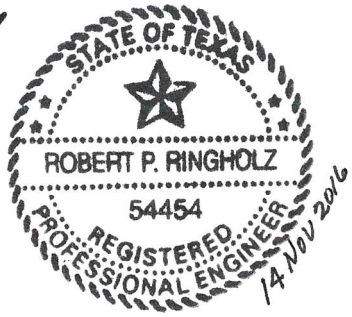
Closing

We appreciate the opportunity to be of continued service to Shell and Bo-Mac, and we look forward to working with you again in the near future. Please call us if you have any questions or comments concerning this data report or when we may be of further assistance.

Sincerely,
FUGRO CONSULTANTS, INC.
TBPE Firm Registration No. F-299

Rani Jaafar, Ph.D.
Senior Project Professional

Robert P. Ringholz, P.E.
Chief Engineer



Copies Submitted:
Addressee – Electronic File (6): [redacted]

RJ/RPR
L:\000 CMET JOBS\0412's\4900-4999\04.12164967 - RP- SET East West Basin Closure - Treatability Study\Reports\Stabilization Study\ Data Report No. 04.12164967-1.doc

Appendix G – Partially Stabilized Sludge Rework CQCP

Construction Quality Control Plan
Rework of Partially Stabilized Sludge
West SET Basin Closure
Shell Deer Park Refinery
November 16, 2016

Introduction

The initial effort conducted July through September to solidify and stabilize the sludge at the bottom of the West SET Basin and achieve a minimum unconfined compressive strength of 25 psi was only partially successful. After Bo-Mac Contractors, LTD (Bo-Mac) completed its stabilization effort, Fugro Consultants, Inc. (Fugro) performed Cone Penetrometer Tests (CPT) to evaluate the strength of the stabilized material. The CPT results indicated that multiple locations within the basin failed to achieve the minimum required compressive strength of 25 psi. More specifically within the lower portions of the stabilized material, the CPT results yielded compressive strength readings less to significantly less than 25 psi. Additionally, Fugro drilled two borings to a depth of 8 feet below grade to visually evaluate the stabilized material. Pocket penetrometer readings performed on samples retrieved from depths of 6 to 8 feet yielded unconfined compressive strengths from 0 to 0.25 tsf (0 to 3.5 psi). Bo-Mac subsequently excavated two test pits that revealed areas where the sludge, soil, and CFB fly ash had not been adequately mixed.

Samples of the lower (bottom) materials and upper (top) materials were collected by Fugro from new test pits on October 18 2016 for another treatability study using Portland cement as the reagent.

This construction quality control plan (CQCP) was prepared by RPS with the input and assistance of Fugro, Bo-Mac, and, the project owner, Shell Oil Company – Deer Park Refinery (Shell). The below definitions have been established for this CQCP and to assist in communications between parties relative the subject project.

- Stabilized sludge (SS) – West Basin sludge mixed with cohesive soil (clay), circulating fluidized-bed boiler fly and bed ash (CFB ash) and solidified into a firm solid as a result of the initial effort by Bo-Mac to stabilize the sludge in the bottom of the dewatered basin (initial stabilization effort). The existing surface of the West Basin consists of stabilized sludge.
- Low strength material (LSM) – Material consisting of West Basin sludge, clay, and/or CFB ash that was not thoroughly mixed and stabilized into a firm solid in the initial stabilization effort.
- Pulverized stabilized sludge (PSS) – Stabilized sludge to be broken into pieces no greater than 4 inches by Bo-Mac and to be thoroughly mixed with LSM and a Portland cement slurry to create a reworked stabilized sludge.
- Reworked stabilized sludge (RSS) – Thoroughly mixed LSM, PSS, and a slurry consisting of Portland cement and water. After curing, RSS will be required to have a 7–day unconfined compressive strength of at least 25 psi.

Rework Plan

Bo-Mac proposes to use track-hoes with buckets to break up the stabilized sludge (SS) into pulverized stabilized sludge (PSS) and mix it with low strength material (LSM) and a Portland cement slurry to produce a reworked stabilized sludge (RSS) throughout the entirety of the basin with an unconfined compressive strength of at least 25 psi. The goal is to add and incorporate into the PSS and LSM mixture 4 percent cement by weight (of the combined PSS and LSM).

Bo-Mac proposes to excavate and break up the SS into PSS and then mix the PSS with the LSM piecemeal using discreet "grids". Page 1 of the Appendix A provides a plan view of Bo-Mac's plan to divide the bottom of the basin into 10 approximately 5,000 ft^2 rectangular "blocks". Page 2 of Appendix A similarly shows Bo-Mac's plan to divide each block (as necessary based on the limits of excavation) into 12 approximately 15' x 28' grids to better control (i.e. manage material ratios) of the mixing process. Bo-Mac will lay out each grid with pin flags on the four corners and a flag in the middle. The flag in the middle will be picked up by the operator before starting excavation of the SS. The operator will turn this flag over to Bo-Mac's QA/QC field representative at the end of the day that each grid rework is completed along with a record that includes the date, operator's name, estimated material volumes mixed, and any other comments as deemed appropriate by the operator.

Based on the mentioned CPT results, Bo-Mac proposes that Blocks 1, 2, 5, 8 and 10 will be completely excavated and reworked, but only portions of Blocks 4, 6, 7 and 9 will be reworked with the limits of the excavation determined in the field by Fugro's onsite representative and Bo-Mac's QA/QC field representative. Shell may require additional CPT or other tests be performed to confirm that no LSM exists in the unexcavated portions of the partially excavated blocks. Based on the variability of SS and LSM encountered during rework of the blocks and mutually agreeable evaluation of test results and or field observation, Shell may also require that additional blocks be completely excavated and reworked to assure that no LSM is present and the entirety of bottom of the West Basin consists of SS and RSS.

Work within each grid will start with the removal of approximately the top 3' of SS within the grid with the excavated material (e.g. PSS) temporarily stockpiled on top of an adjacent grid(s). The remaining material in the grid (e.g. SS and/or LSM) will then be excavated to the bottom of the basin and thoroughly mixed in place before any cement slurry is added. Any of the remaining material consisting of SS will be broken up to meet the PSS 4" (maximum) particle size requirement (see below). The cement slurry will then be added and the materials thoroughly mixed. After performing any additional work on the stockpiled PSS as necessary to meet the 4" particle size requirement, the temporarily stockpiled PSS will be moved back into the grid and thoroughly mixed with the previously mixed LSM and cement slurry.

The cement slurry will be prepared offsite and tailgated via concrete ready mix trucks to the edge of the active grid. To achieve the 4 percent cement target, approximately 6 cubic yards (CY) of slurry will be used in each grid.

Material Requirements

1. PSS maximum particle size: 4 in.
2. Maximum volume ratio of LSM to PSS: 2:1 (same ratio of LSM to PSS used in the October 2016 Fugro treatability study).
3. Cement slurry: 0.85 (approximate) water to Portland cement weight ratio
4. Cement to PSS and LSM mixture dry weight ratio: 4 percent minimum.
5. Wet RSS mix: Consistency of well mixed materials with minimal free liquids and not dry.
6. Cured RSS mix: 25 psi minimum 28-day unconfined compressive strength.

Quality Control Monitoring

1. For every delivered load of cement slurry to the project, Bo-Mac will provide Fugro documentation of when mixing of the slurry was completed, and the weights of water and cement used to make the slurry. Cement slurry will be delivered to the site in ready-mix concrete trucks.
2. A Fugro representative will visually monitor the excavation, pulverizing, and nearby stockpiling of the well solidified sludge and periodically take particle size measurements. The Fugro representative will notify Bo-Mac if the LSM and PSS includes particle sizes exceeding 4 in. Bo-Mac will further process any LSM and PSS with particles exceeding the maximum 4 in. requirement.
3. A Fugro representative will record the time period and visually monitor the mixing of the in-place LSM and cement slurry in the active excavation grid and advise Bo-Mac if the representative believes additional mixing is required prior to introduction of the stockpiled PSS into the active excavation grid.
4. The Fugro representative will advise Bo-Mac if the representative believes additional conditioning, mixing, or other adjustments are necessary to meet the wet RSS mix consistency requirement.
5. Fugro will perform CPT soundings to evaluate the targeted strength of RSS throughout its entire profile. Two sounding events are planned with the first being performed on approximately half of the reworked grids. The second sounding event will occur after all remaining grids have been reworked. Each sounding will be performed no less than 7 days after the grid where the sounding is located is considered to be stabilized by Bo-Mac. Production progress will impact the schedule for the CPT soundings. Fugro will coordinate scheduling of the CPT soundings with Bo-Mac. The number and locations of soundings will be determined by Fugro and Bo-Mac, though at least 20 CPT soundings (approximately 1/2,500 ft^2), will be performed. Failed areas, if any, will be identified by Fugro for re-work by Bo-Mac.

Appendix H – Stabilized Sludge Rework CQC Documentation

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/09/2016
		Report Date:	11/11/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0031
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cubic yards of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Technician collected cement delivery tickets, recorded times of cement batching at the plant, start and finish of cement slurry discharge from the truck, mixing , addition of pulverized stabilized sludge and time cell completed. (See Attached Sketch).

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

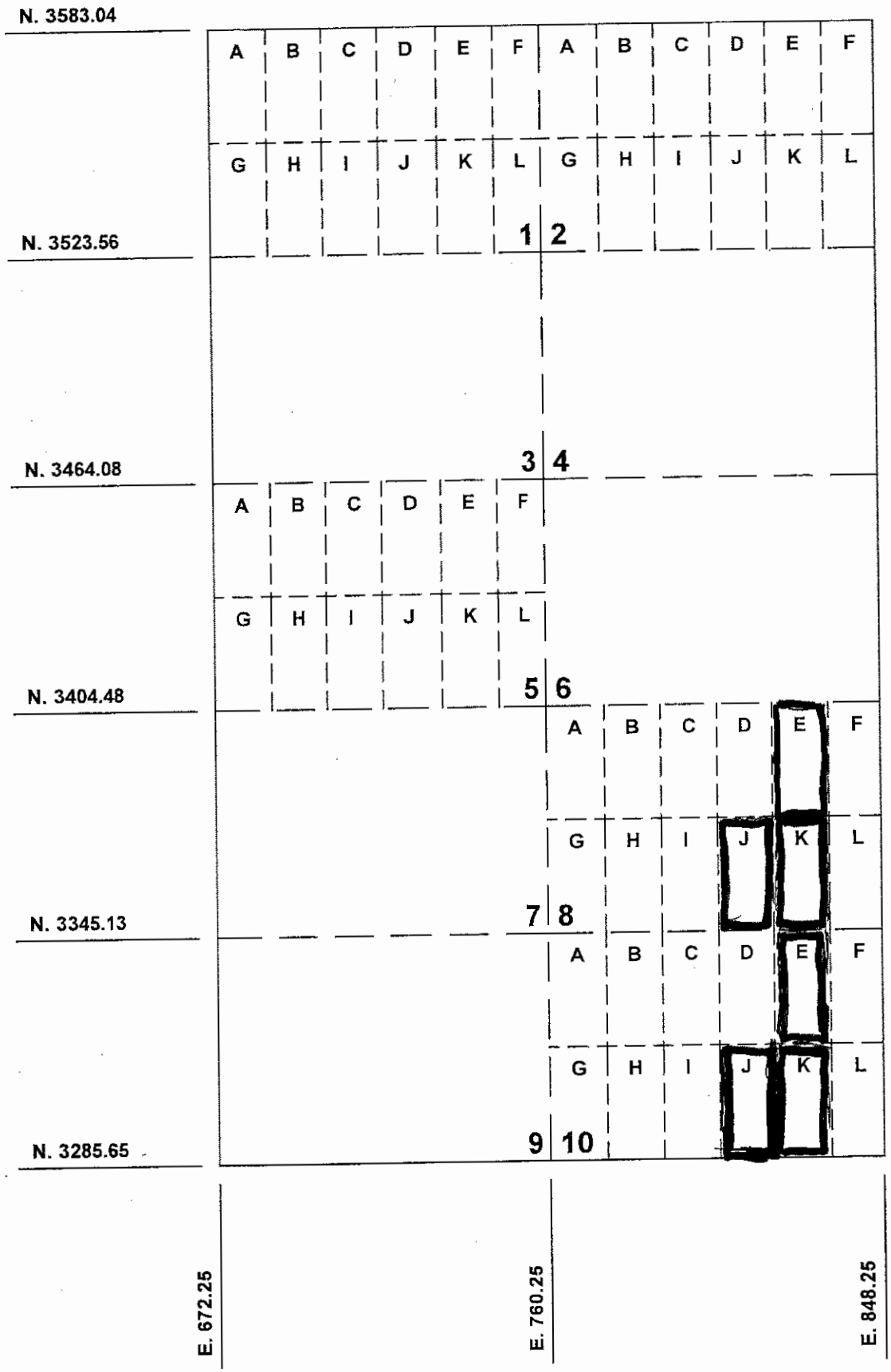
Shell SET East/West Basin Closure

0412.16.4967

11/10/16

West Basin

W/O 56914



Project No: 0412-16-4967
Project Name: Shell set East/West Basin Closure

Date: 11-10-16

W/O 56914

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
10 / K	10067233	43897857	8:00am	~~50~~ 100	8:47am	8:50am	8:54am	9:07am	11:15am
8 / K	10067237	43897872	8:15am	568	8:47am	8:50am	8:56am	9:06am	10:39am
8 / E	10065991	43898493	10:31am	572	11:13am	11:17am	11:30am	11:48am	1:08pm
10/E	10037798	~~8~~ 43898499	10:40am	570	12:05pm	12:09pm	12:10pm	12:38pm	2:23pm
8 / J	10064682	43899100	1:24pm	561	2:28pm	2:31pm	2:36pm	2:46pm	4:02pm
10 / J	10037798	43899099	1:40pm	337	2:49pm	2:52pm	3:00pm	3:15pm	4:27pm

* Grid 10 cell K water entering through slope paving weep holes and construction joint. Adjacent Grid 10 cell L from 11/9/16 was also very wet in the bottom.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/10/2016
		Report Date:	11/11/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0032
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). The technician observed the excavation and pulverization of stabilized sludge, the adding of slurry and mixing of slurry with pulverized stabilized sludge. The technician collected cement delivery tickets, recorded time of cement slurry discharge, mixing and addition of pulverized stabilized sludge and time completed, (See Attached Sketch).

Fugro Representative: Richard Osborne

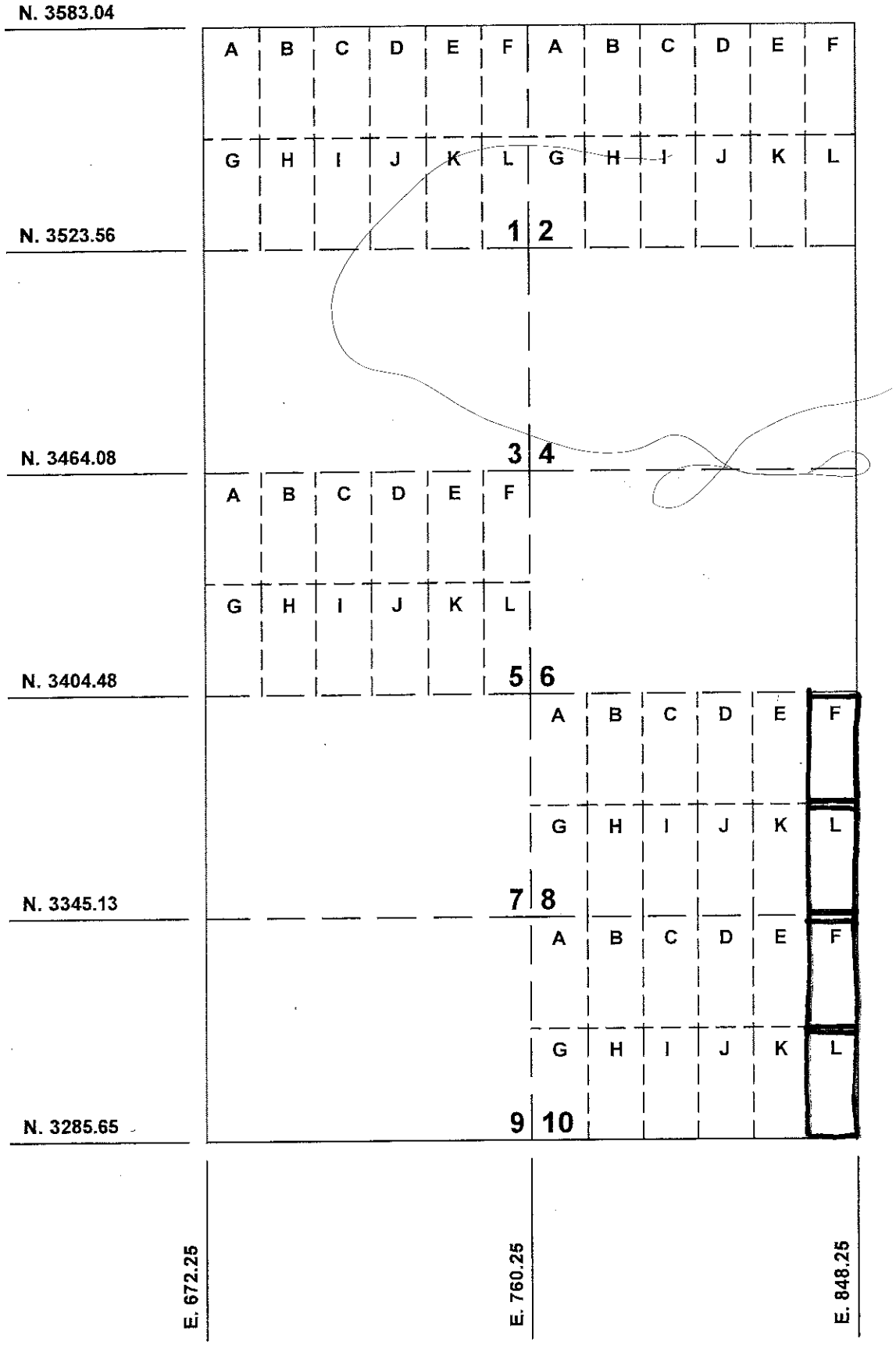
Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Shell SET E/W Basin Closure
0412-16-4967
11/9/16
W/O 56893

West Basin



Project No: 0412-16-4967
Project Name: Shell SET East/West Basin Closure

Date: 11-9-16

w/o 56893

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
10 / L	10022363	43895939	9:06Am	275gal.	10:01am	10:08Am	10:02A	10:23A	11:50Am
8 / L	10037691	43896045	9:15Am	565gal.	10:10Am	10:16Am	10:13Am	10:40Am	12:00pm
10 / F	10022363	43896851	1:59pm	550gal.	2:37pm	2:40pm	2:37pm	3:09pm	4:57pm
8 / F	10037506	43896936	2:20pm	572gal	3:09pm	3:14pm	3:23pm	3:41pm	4:28pm

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/11/2016
		Report Date:	11/15/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0033
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, the addition of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded times of cement batching at the plant, start and finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed. (See Attached Sketch).Please see note for Grid 8, Cell D at bottom of page 2 of the report.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Project No: 0412-16-4967
Project Name: Shell SET East/West Basin Closure

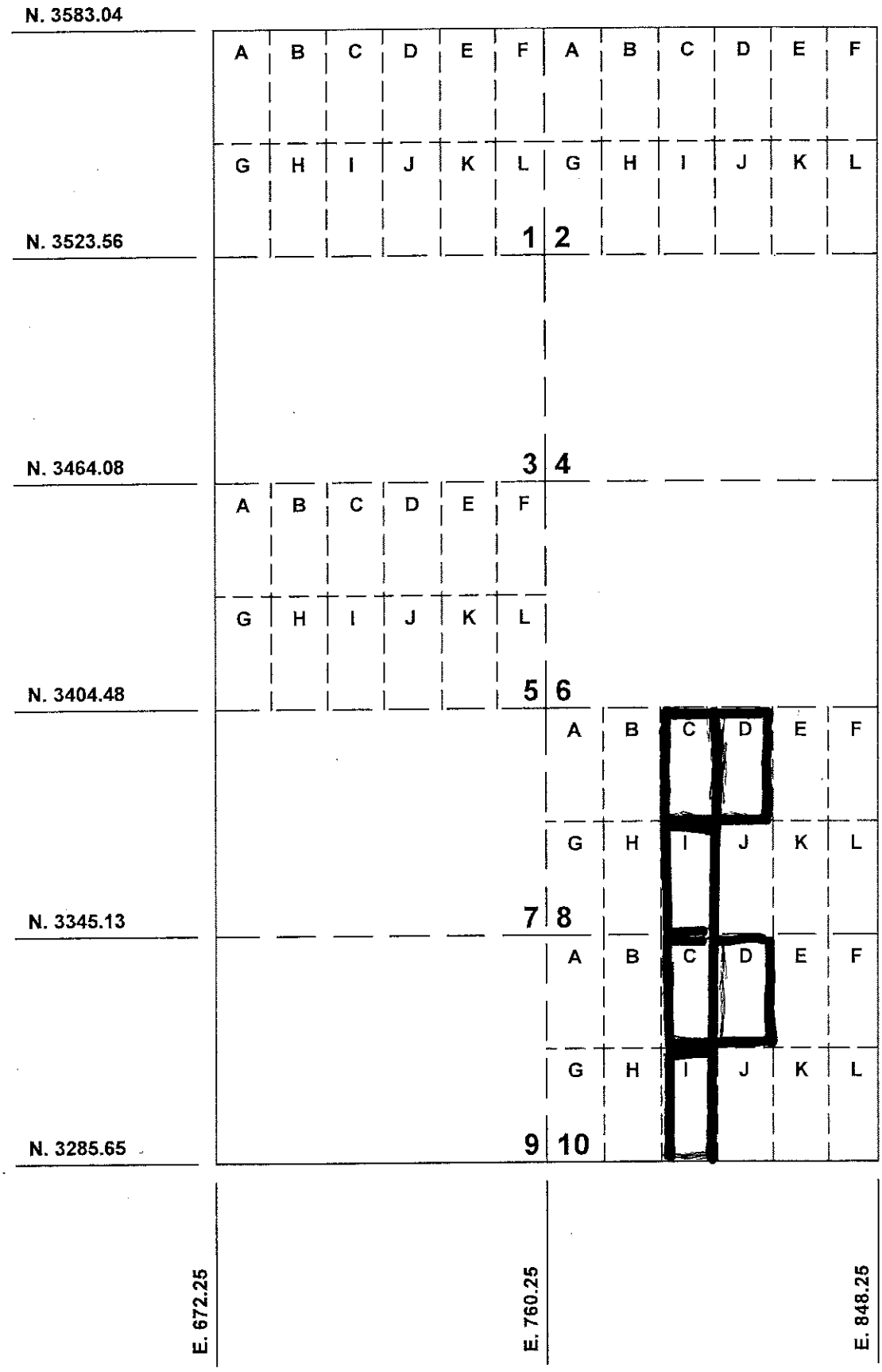
Date: 11-11-16

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.	finish Mixing
8 / D	10064696	43900243	7:42 Am	704 gal	8:32 Am	8:34 Am	8:40 Am	8:57 Am	10:35 Am
10 / D	10063757	43900244	7:50 Am	570	8:40 Am	8:44 Am	8:46 Am	9:18 Am	10:29 Am
8 / I	~~10036867~~ 10066001	~~43900846~~ 43900849	10:31 Am	778	11:25 Am	11:27 Am	11:29 Am	11:42 Am	1:24 pm
10 / I	10036867	43900846	10:26 Am	672	11:26 Am	11:27 Am	11:28 Am	11:43 Am	1:32 pm
8 / C	10064424	43901391	1:34 pm	732	2:04 pm	2:07 pm	2:10 pm	2:20 pm	3:51 pm
10 / C	10065982	43901401	1:16 pm	800	2:06 pm	2:09 pm	2:13 pm	2:21 pm	3:58 pm

* Grid 8 cell D very dry w/ pockets of Gray/white powder (Flyash) - Bomac added 704 gal. of water - area still appears to be on dry side.
Grid 8 cell C - large pocket/layer of Flyash
Bomac's office ok'd Adding of up to 800 gal. As needed if cell material was Dry

Shell SET East/West Basin Closure
0412-16-4967
11/11/16

West Basin



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/14/2016
		Report Date:	11/15/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0034
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds of cement slurry to cell, mixing of slurry and pulverizing stabilized sludge. Fugro collected cement delivery tickets, recorded time of cement batching at the plant, start to finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed, (See Attached Sketch). Please see note for Grid 10, cell G located at the bottom of page 2.

Fugro Representative: Richard Osborne

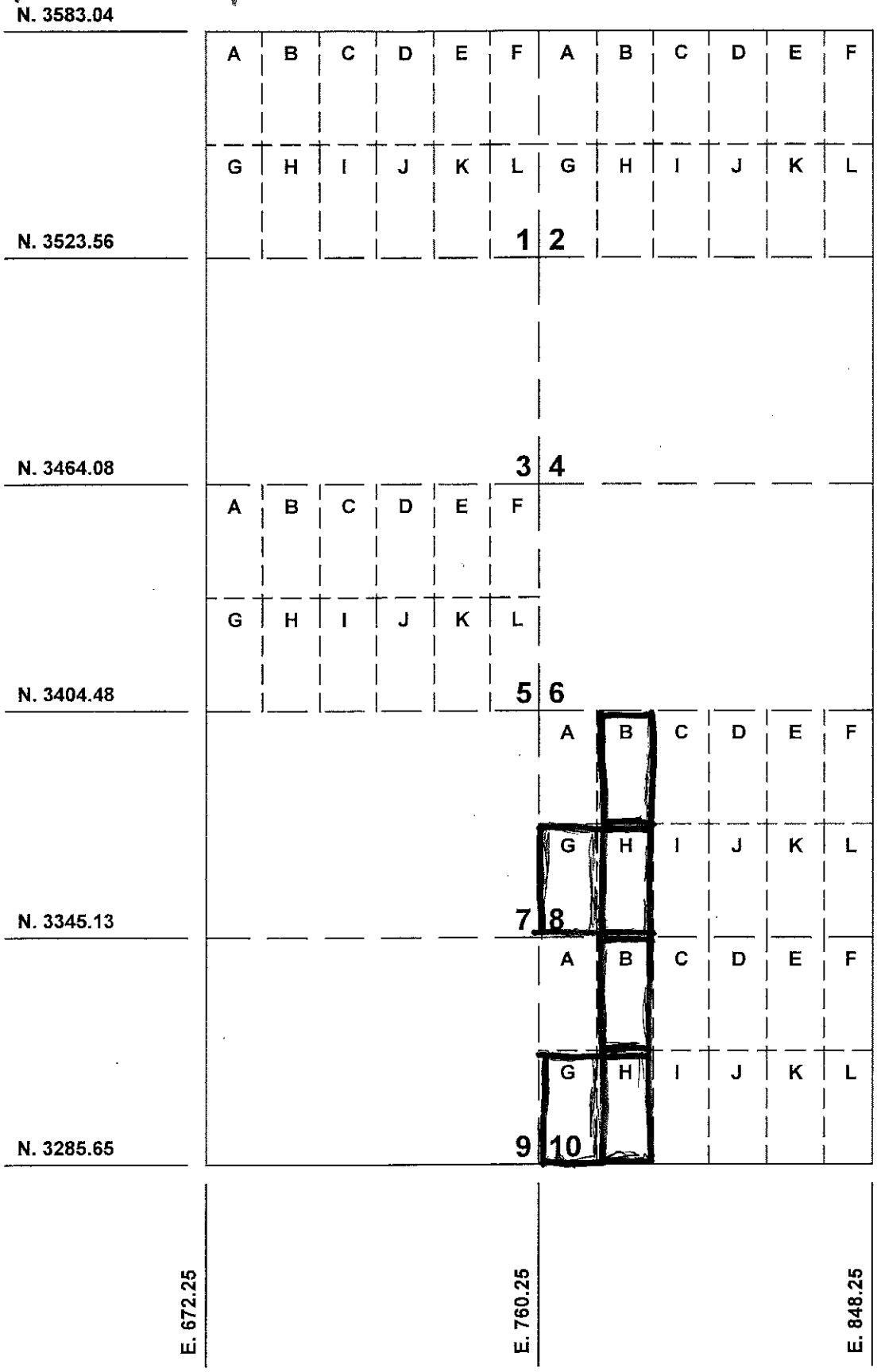
Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Shell SET East/West Basin Closure
04/2-16-4967
11/14/16
W/O 57004

West Basin



Project No: 0412.16-4967
Project Name: Shell SET East/West Basin Closure

Date: 11-14-16

w/o 57004

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
8 / H	10064167	43902618	6:54 Am	700	7:46 Am	7:50 Am	7:54 Am	8:09 Am	9:50 Am
10 / H	10037547	43902783	7:48 Am	502	8:33 Am	8:35 Am	8:42 Am	8:52 Am	9:47 Am
8 / B	10064399	43903442	10:55 Am	800	11:27 Am	11:30 Am	11:39 Am	11:48 Am	2:00 pm
10 / B	10065992	43903410	10:50 Am	745	11:27 Am	11:29 Am	11:38 Am	11:47 Am	1:45 pm
8 / G	10065992	43903807	1:30 pm	700	2:20 pm	2:24 pm	2:30 pm	2:38 pm	3:59 pm
10 / G	10064399	43903795	1:19 pm	151	2:21 pm	2:26 pm	2:30 pm	2:37 pm	3:38 pm

* Grid 10 cell G water entering through weep holes in slope paving

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/15/2016
		Revised Report Date:	11/28/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0035
Contractor:	Bo-Mac Contractors	**Previous Report Date:**	11/16/2016

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation, (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded times of cement slurry batching at plant, start and finish of cement slurry discharge from trucks, mixing addition of pulverized stabilized sludge and time cell completed, (See Attached Sketch). Grid 7 cell A & Grid 9 cell, (cell size 28'15') were excavated based on visual observation of the edge faces of these cells. No visual clues as to the strength of the materials were apparent but mixing in the adjacent area appeared to be somewhat uniform in color, tan & gray with no large pockets of sludge, clay or fly ash in the cell face but moisture content of lower level material was noticeably higher than the material in the upper half.

Adjacent areas may need CPT tests performed to verify strength requirement of 25psi has been reached. Please see grid notes located at the bottom of page 3.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

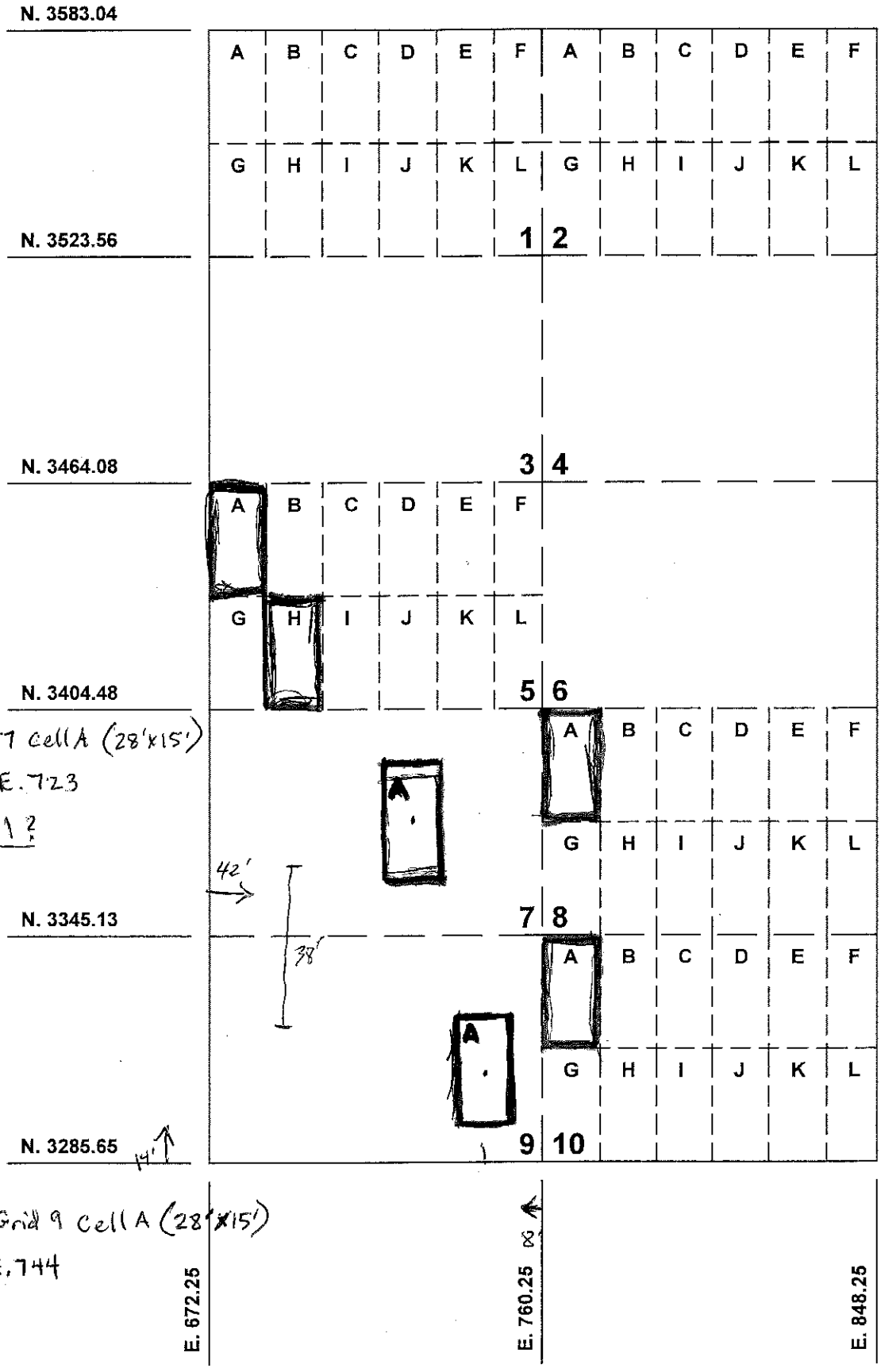
Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Shell SET East/West Basin Closure
0412-16-4967
11/15/16

West Basin

W/O 57036



Center of Grid 7 Cell A (28'x15')
is (N. 3401) E. 723
maybe N. 3381 ?

Center of Grid 9 Cell A (28'x15')
is N. 3313 E. 744

Project No: 0412.16-4967
Project Name: Shell SET East/West Basin Closure

Date: 11-15-16

W/057036

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
8 / A	10064399	43904752	7:50 Am	800	8:30 Am	8:35 Am	8:43 Am	8:58 Am	11:18 pm
10 / A	10064475	43904900	8:38 Am	600	9:22 Am	9:25 Am	9:39 Am	9:48 Am	11:04 Am
9 / A	10065986	43905442	10:50 Am	60	11:45 Am	11:48 Am	12:00 pm	12:10 pm	1:45 pm
7 / A	10064399	43905513	10:52 Am	70	11:49 Am	11:51 Am	12:02 pm	12:12 pm	1:36 pm
5 / H	10064475	43905981	1:23 pm	200	2:18 pm	2:23 pm	2:28 pm	2:36 pm	3:42 pm
5 / A	10066007	43906015	1:50 pm	400	2:34 pm	2:37 pm	2:46 pm	2:57 pm	4:19 pm

* Grid 7 cell A and Grid 9 cell A - 70 gallons & 60 gallons of water added from Cement slurry Truck - Water source at Shell deer park was off from 11:15 Am till 2:00 pm - Cement Soil mixture was dryer but had enough moisture to be cohesive and able to compact with bucket.

* Grid 5 Cell A water in cell entering through concrete bottoms.
Grid 5 Cell H material in bottom was very moist - No free running water observed.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/16/2016
		Report Date:	11/18/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0036
Contractor:	Bo-mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding 6 cubic yards of cement slurry to cell, mixing slurry and pulverized stabilized sludge. Technician collected cement delivery tickets, recorded times of cement slurry batching at the plant, start and finish of cement slurry discharge from the truck, mixing, addition of pulverized stabilized sludge and time cell completed. (See Attached Sketch)

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

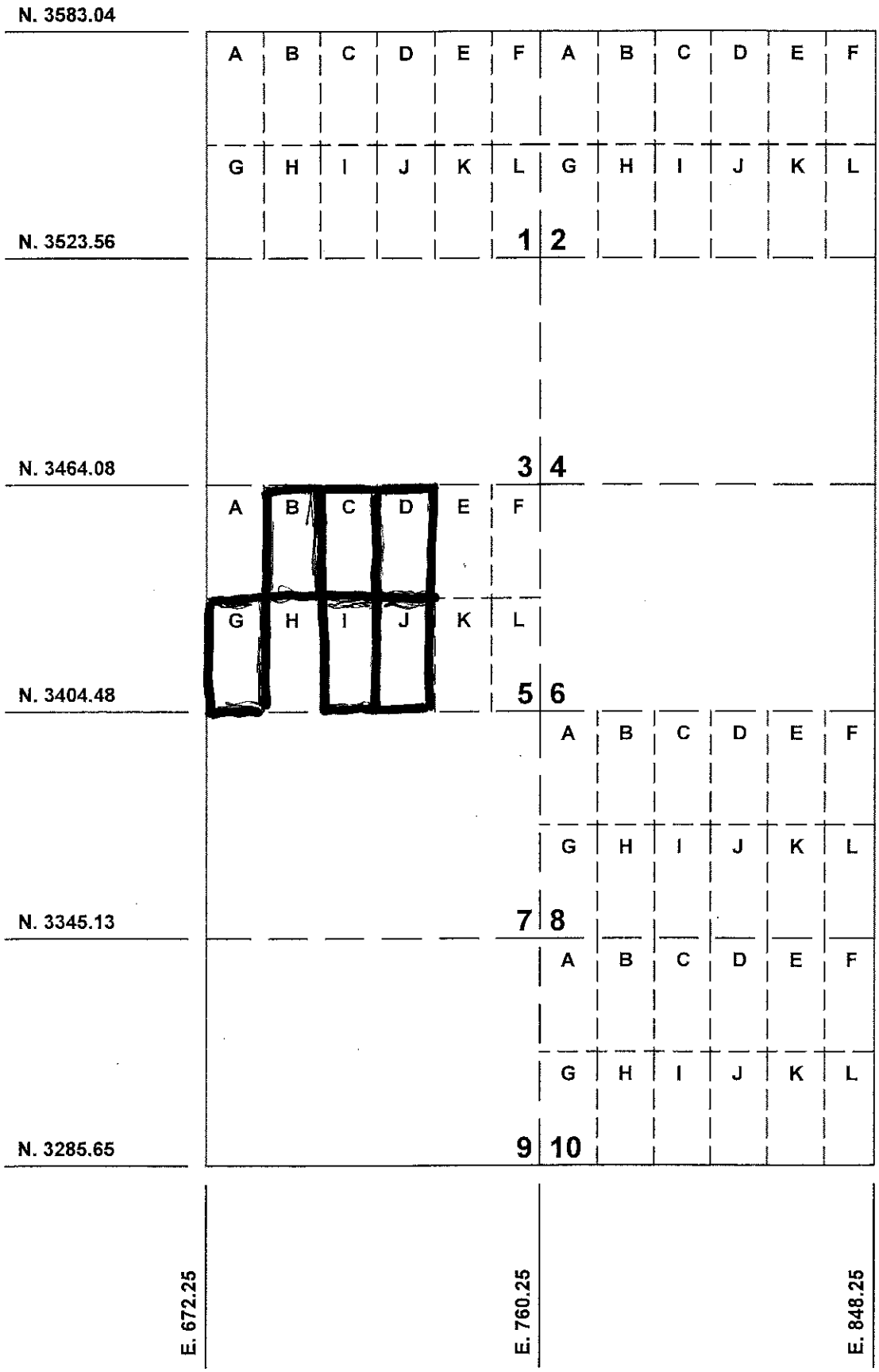
Shell SET East/West Basin Closure

0412-16-4967

11/16/16

West Basin

w/o 57043



Project No: 0412.16-4967
Project Name: Shell SET East/West Basin Closure

Date: 11-16-16

W/O 570143

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
5 / B	10065983	43906816	7:37 Am	600	8:12 Am	8:14 Am	8:27 Am	8:40 Am	9:50 Am
5 / G	10036367	43906868	7:50 Am	200	8:32 Am	8:39 Am	8:47 Am	8:50 Am	9:38 Am
5 / I	10063934	43907454	10:16 Am	400	11:02 Am	11:04 Am	11:10 Am	11:16 Am	12:54 pm
5 / D	10036002	43907513	10:30 Am	500	11:16 Am	11:19 Am	11:23 Am	11:43 Am	1:10 Pm
5 / J	10064696	43908069	1:06 pm	500	1:58 pm	2:00 Pm	2:32 pm	2:42 pm	4:00 pm
5 / C	10063917	43908072	1:20 pm	500	2:06 pm	2:09 pm	2:37 pm	2:44 pm	3:55 pm

* Grid 5 cell G water in cell entering through bottom of paving

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/17/2016
		Report Date:	11/18/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0037
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for the stabilization of sludge material of west basin, (SET compond). Observed pulverization of excavated materials (stabilized sand) , pulverization of lime stabilized sand/stabilized sand mix in the excavated pit, observation of mixing the cement slurry with lime stabilized sand/stabilized sand mix, recording the information of the cement slurry batch, picking up the truck tickets, recording the discharge time of cement slurry, mixing times, finishing times and water added. The contractor performed re-working (stabilization of sludge material on cell/grid # 5/K, 5/F, 5/L, 5/E, 2/F and 2/D, (See Attached Sketch).

Fugro Representative: Ilanga Priyanke

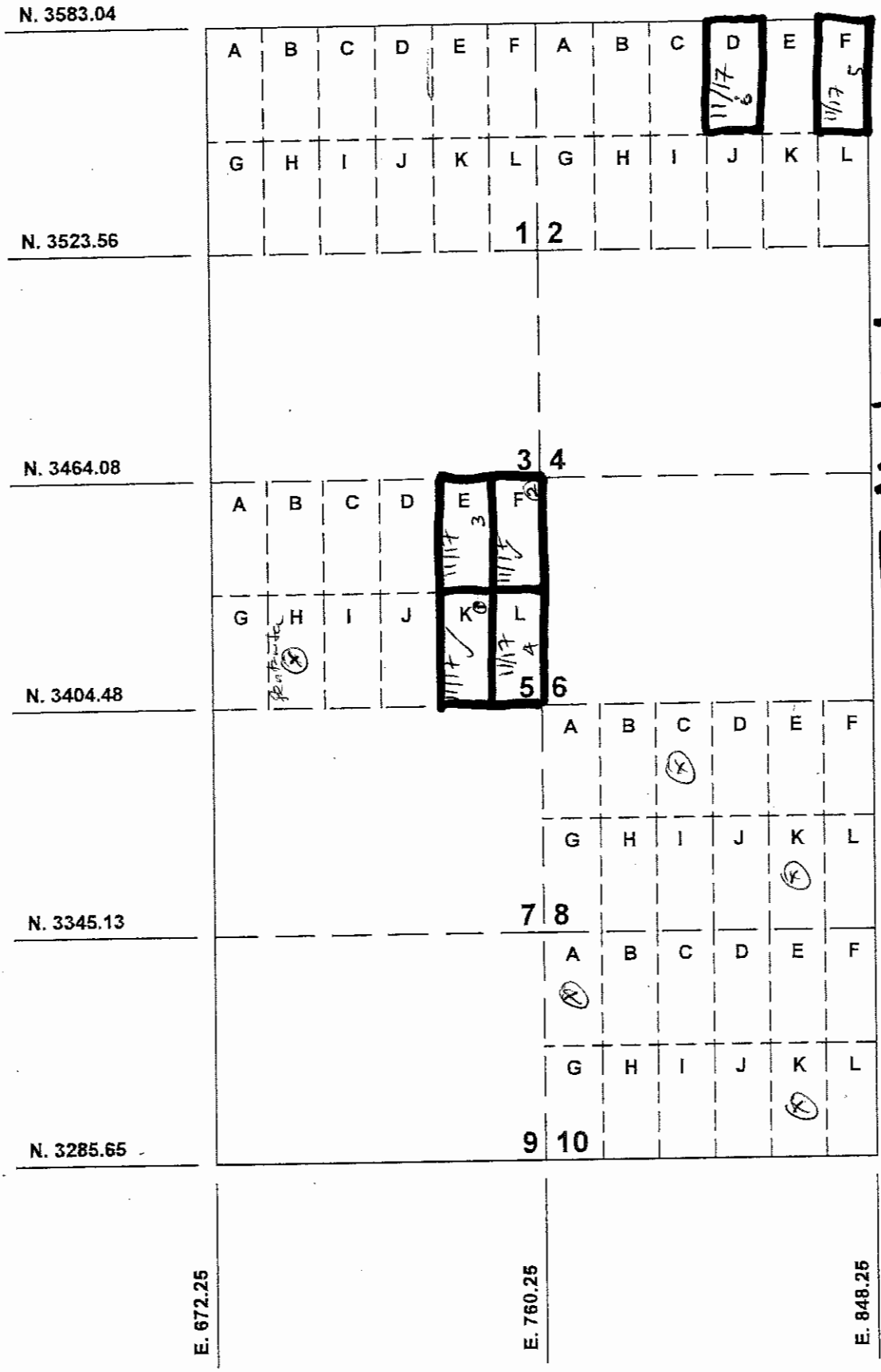
Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

West Basin

11/17/16
W.O.#



Re-worked Grids. 5/K, 5/F, 5/E, 5/L, 2/F, 2/D. [06 Grids]

Information Log sheet

0037

Project No: 4967
Project Name: Shell SET East/West Basin, Phase 1, West Basin
W.O.#: --

Date: 11/17/16

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER (Gallons) ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
5/K	10037529	43909128	7.34AM	550	8.09	8.12	8.17	8.25	9.44AM
5/F	10036368	43909123	7.26AM	550	8.08	8.11	8.27	8.39	9.46AM
5/L	10037529	43909853	10.40AM	500	11.10	11.14	11.18	11.32	12.43pm
5/E	10064476	43909850	10.40AM	600	11.24	11.28	11.33	11.43	01.31pm
2/F	10066000	43910475	01.40PM	300	02.23	02.27	02.34	02.46	03.48pm
2/D	10063938	43910531	01.59pm	400	02.44	02.48	02.52	03.03	04.00pm

RECEIVED
NOV 18 2016

Technician :- I.M. Supun Priyanka

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/18/2016
		Report Date:	11/21/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0038
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation, (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded times of cement slurry batching at the plant, start to finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed. CPT soundings were also performed and locations were marked on the grid/cell, (See Attached Sketch).
Results of CPT soundings are also attached. We have annotated the cone (tip) resistance (qc plats) using a cone factor of 18 to indicate the minimum required unconfined compressive strength of 25 psi.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

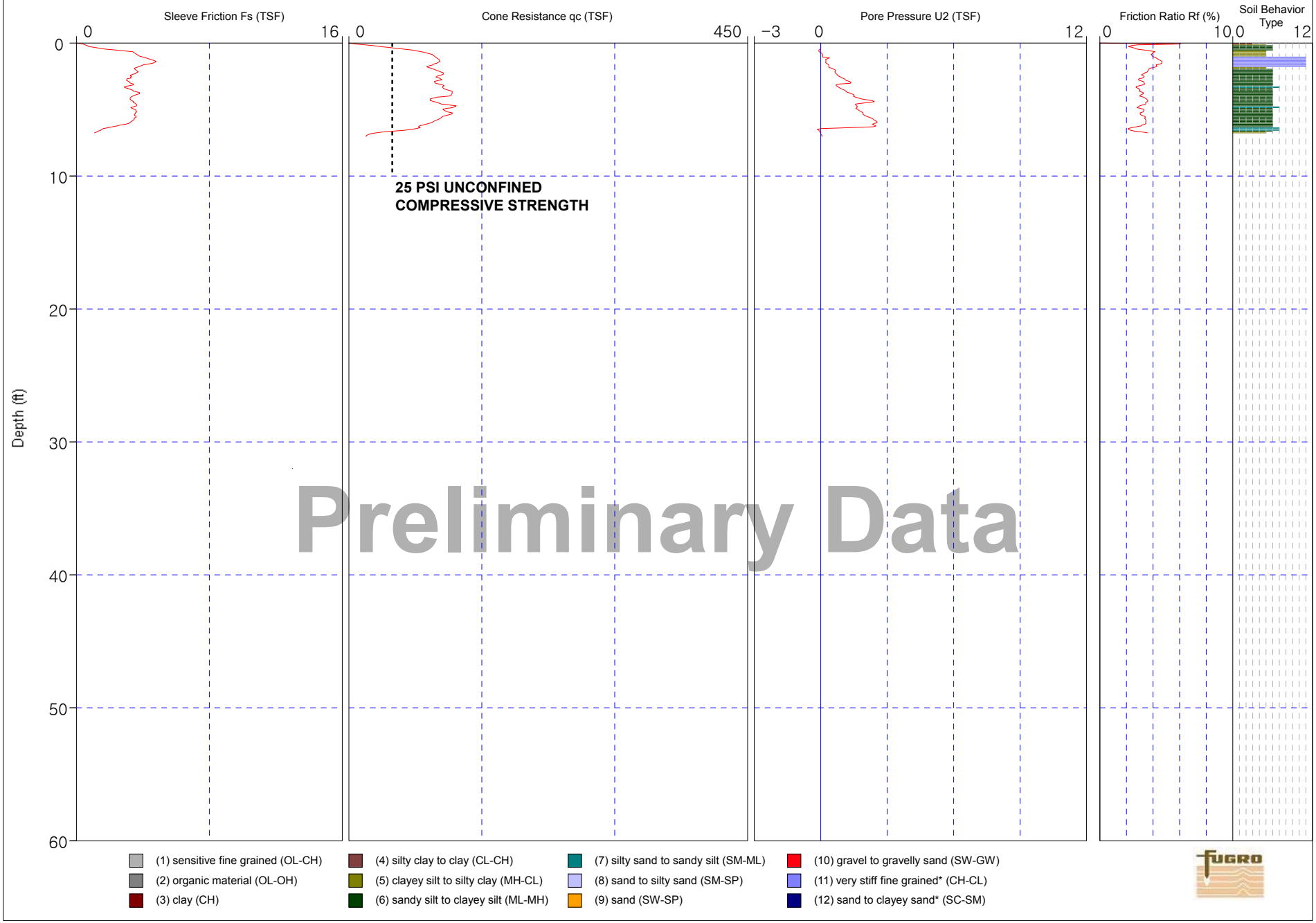
Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-5H
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

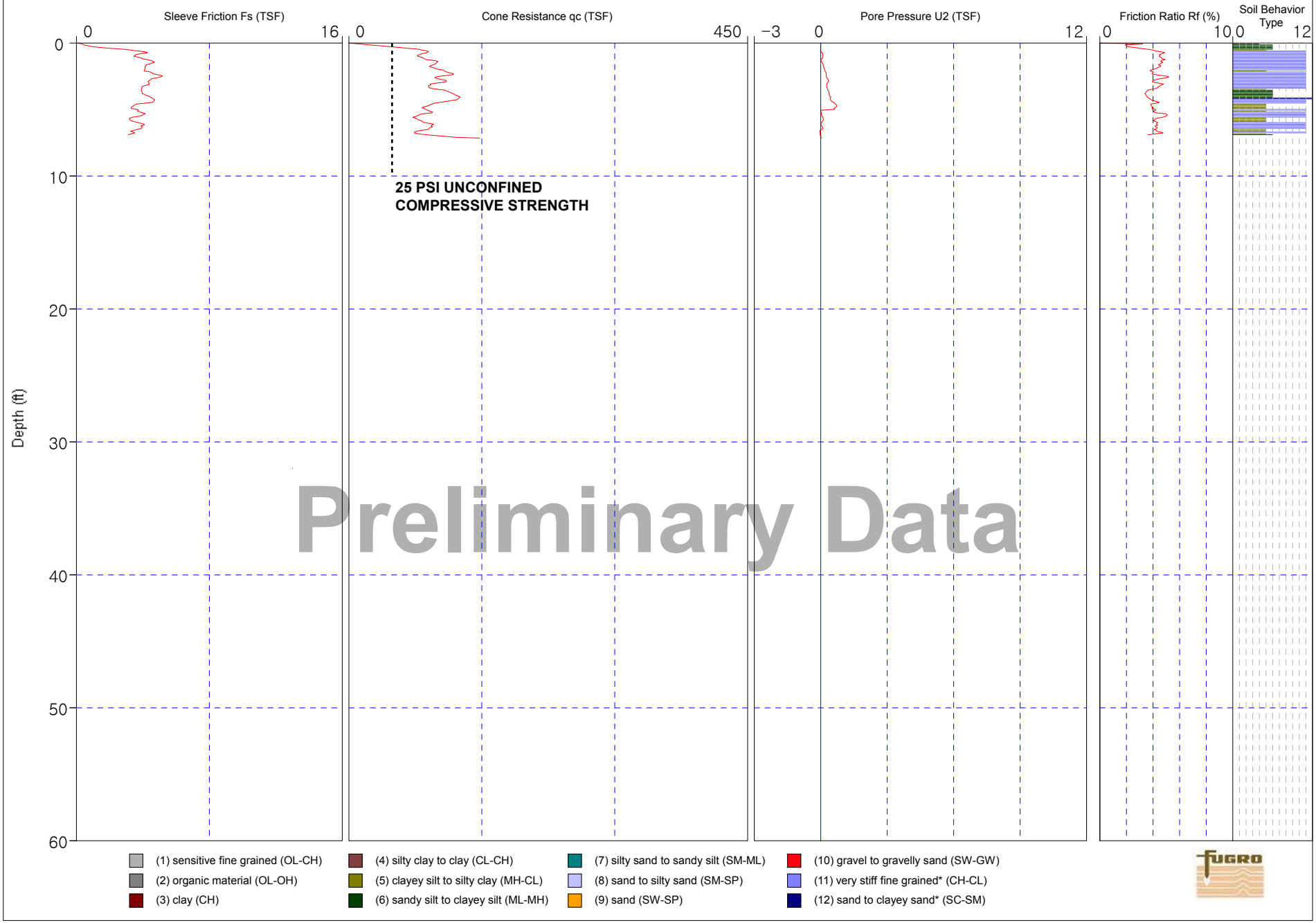


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-7A
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

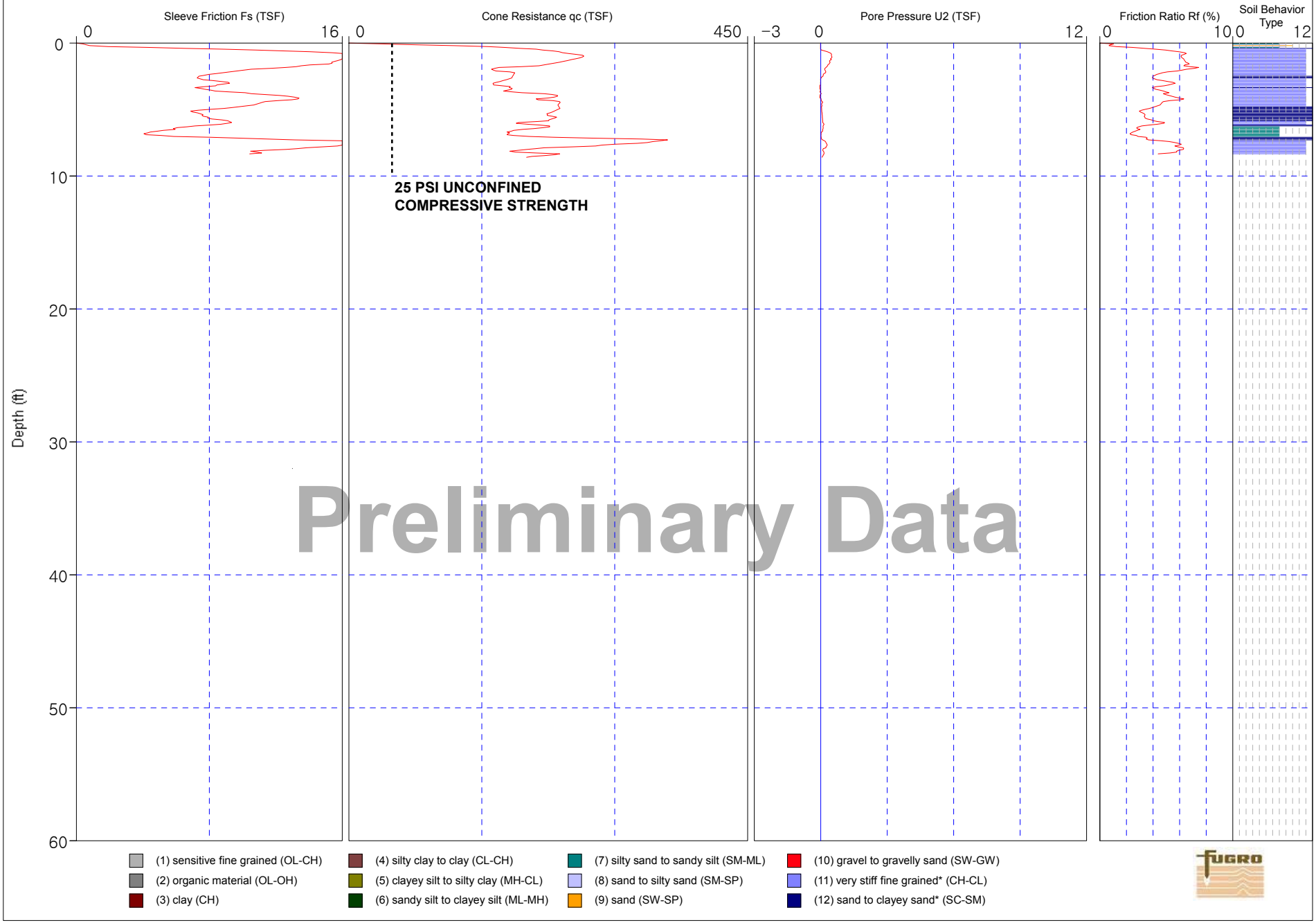


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-8C
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

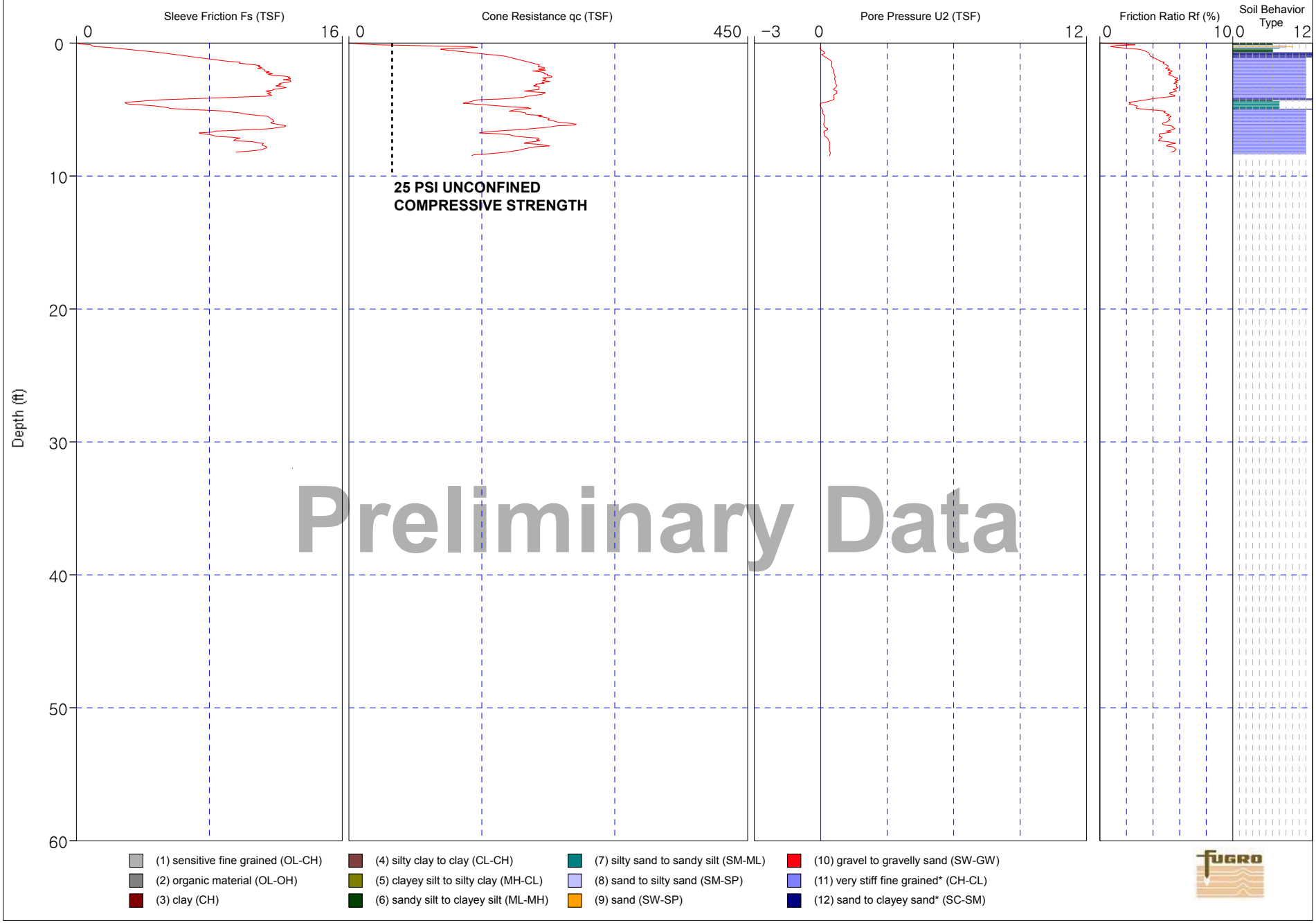


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-8D
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

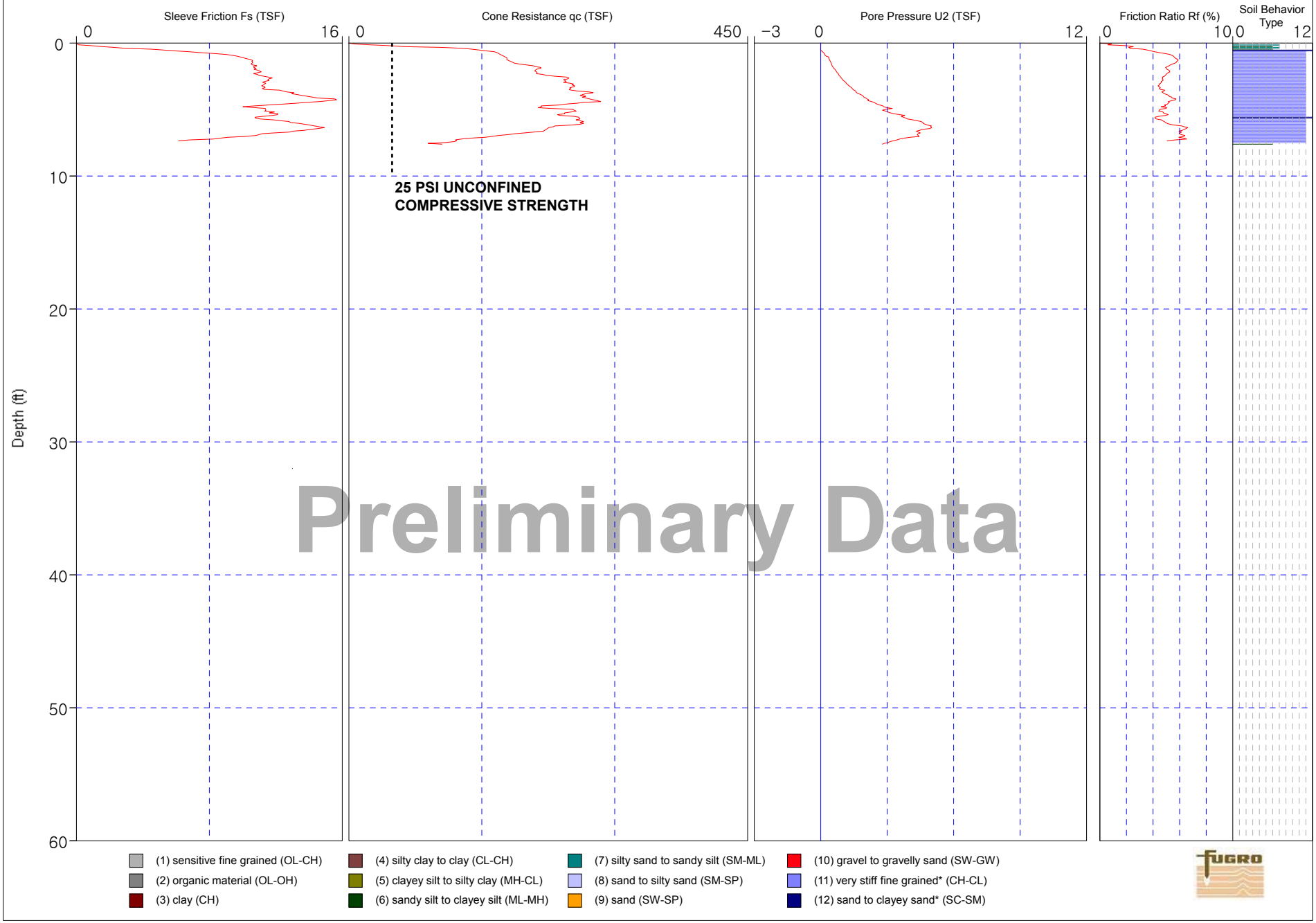


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-8K
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

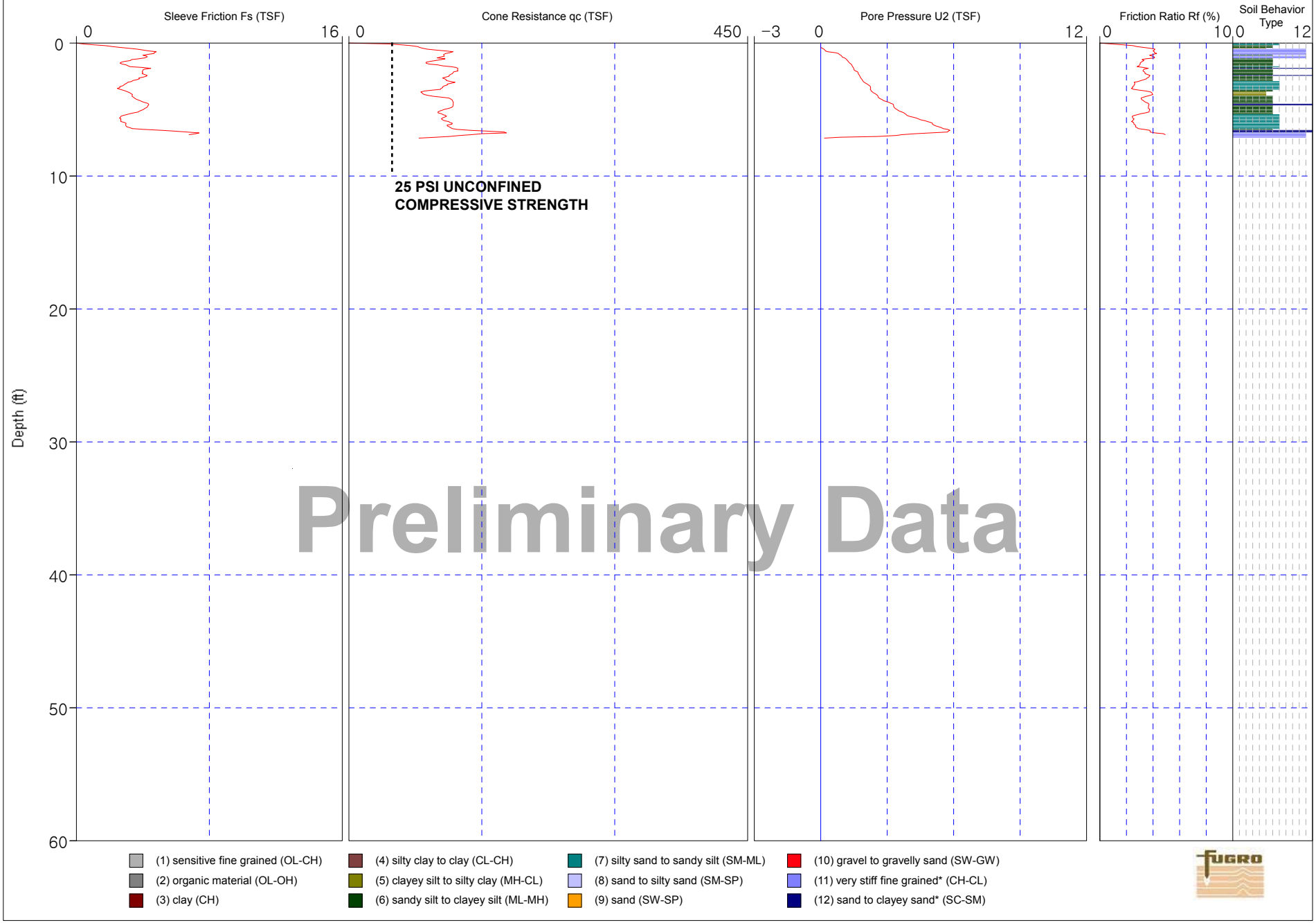


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-9A
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

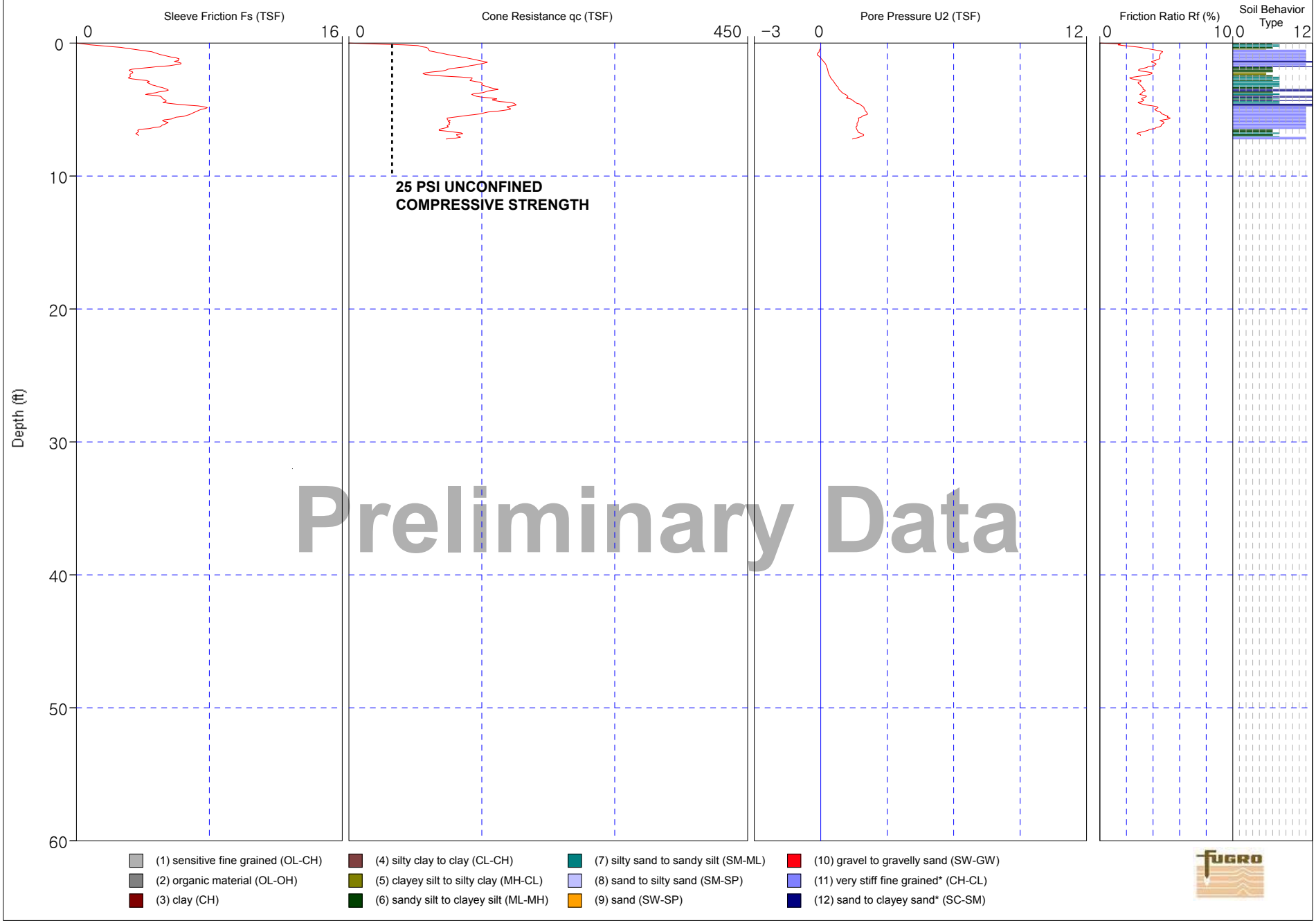


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10A
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

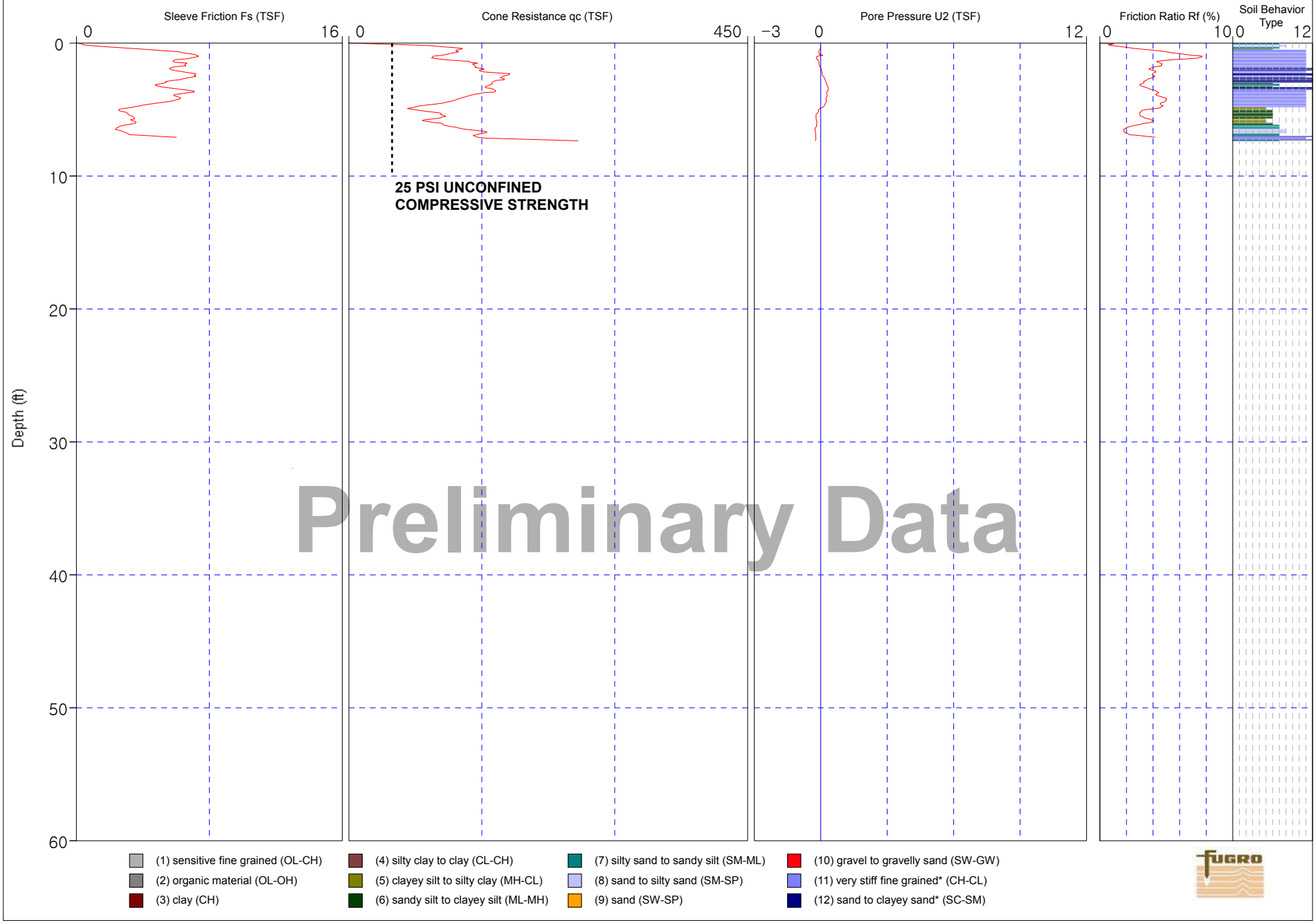


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10C
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

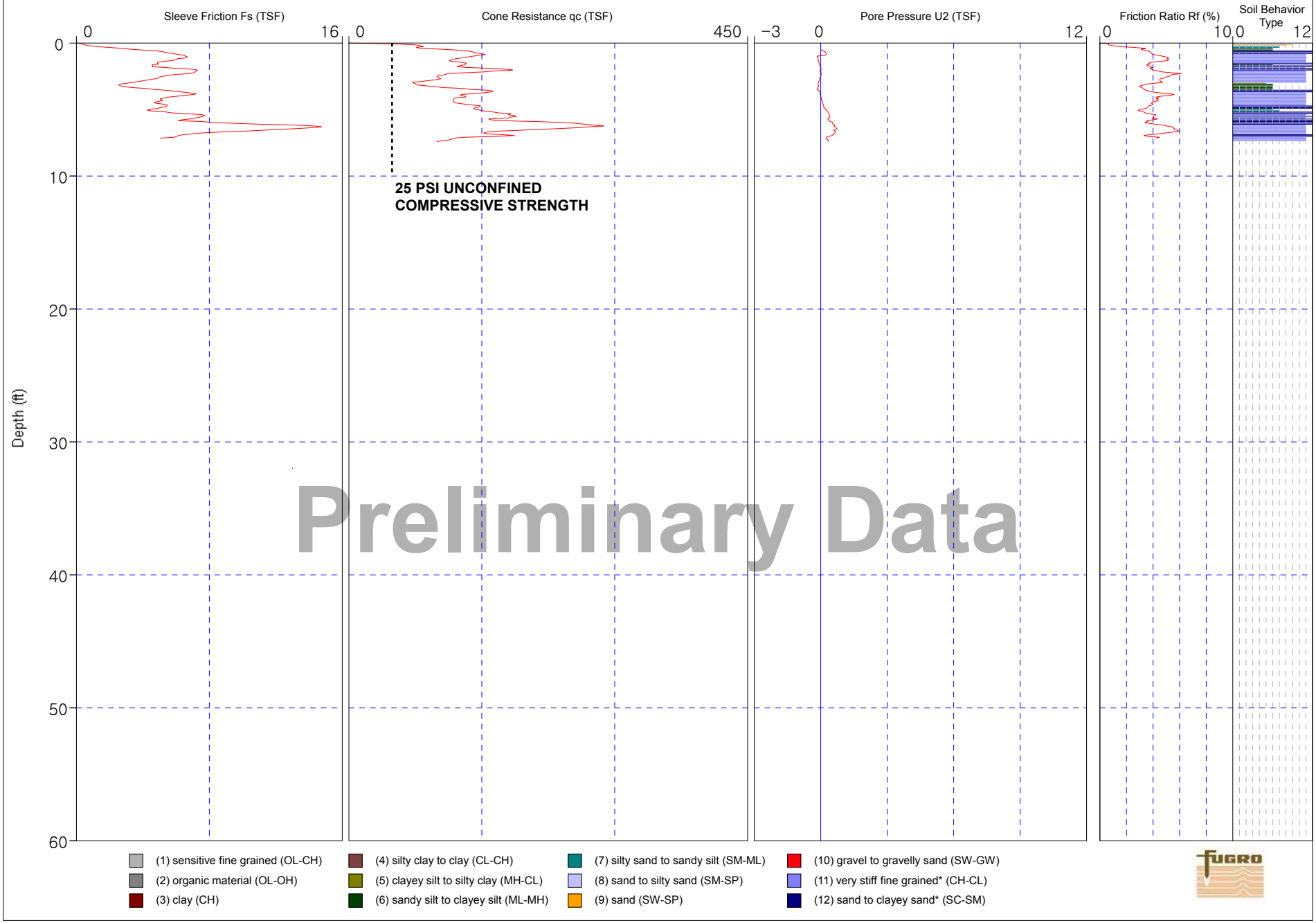


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10D
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

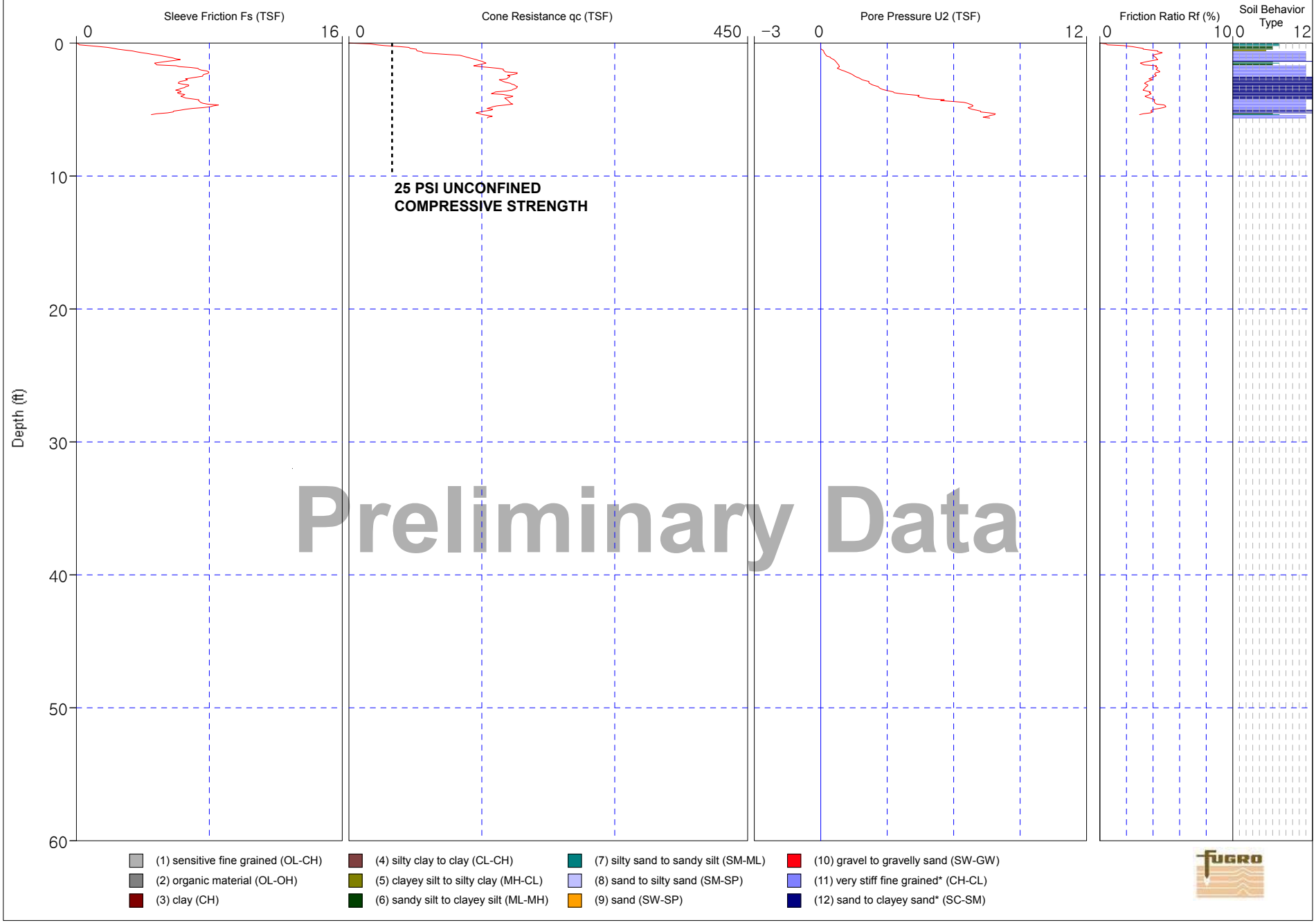


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10H
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

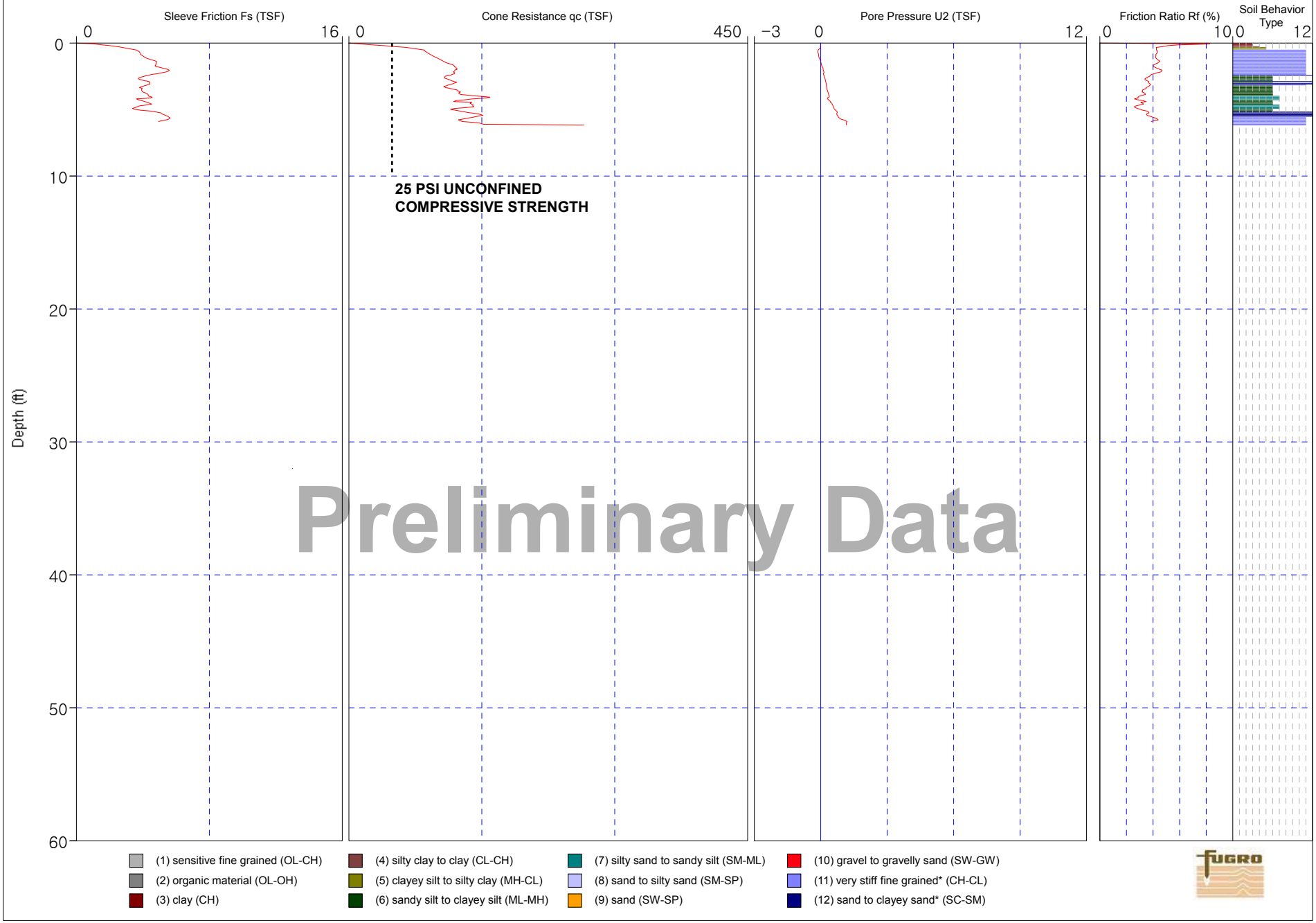


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

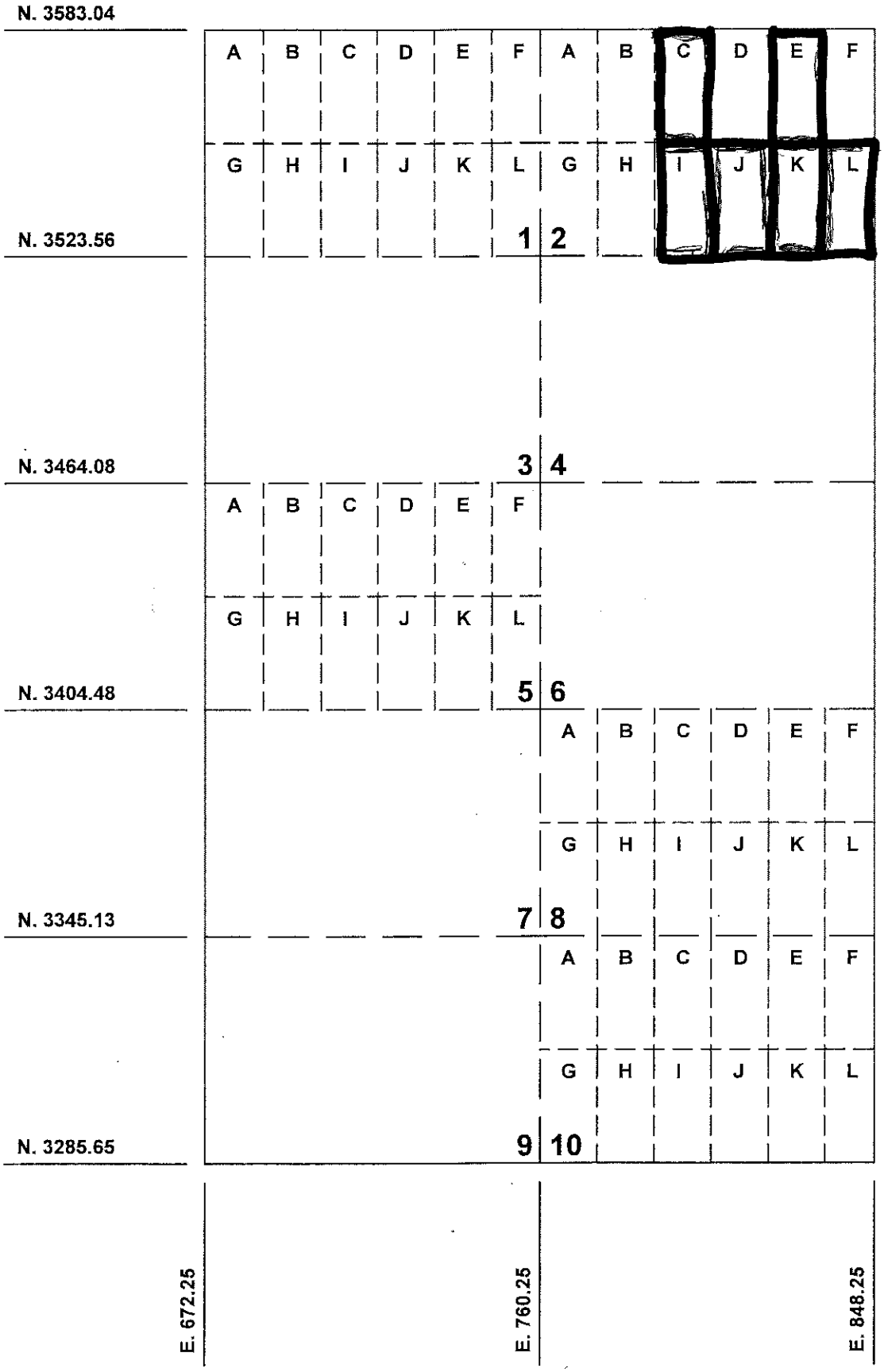
CPT Number: CPT-10K
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



Robertson et al. 1986 *Overconsolidated or Cemented

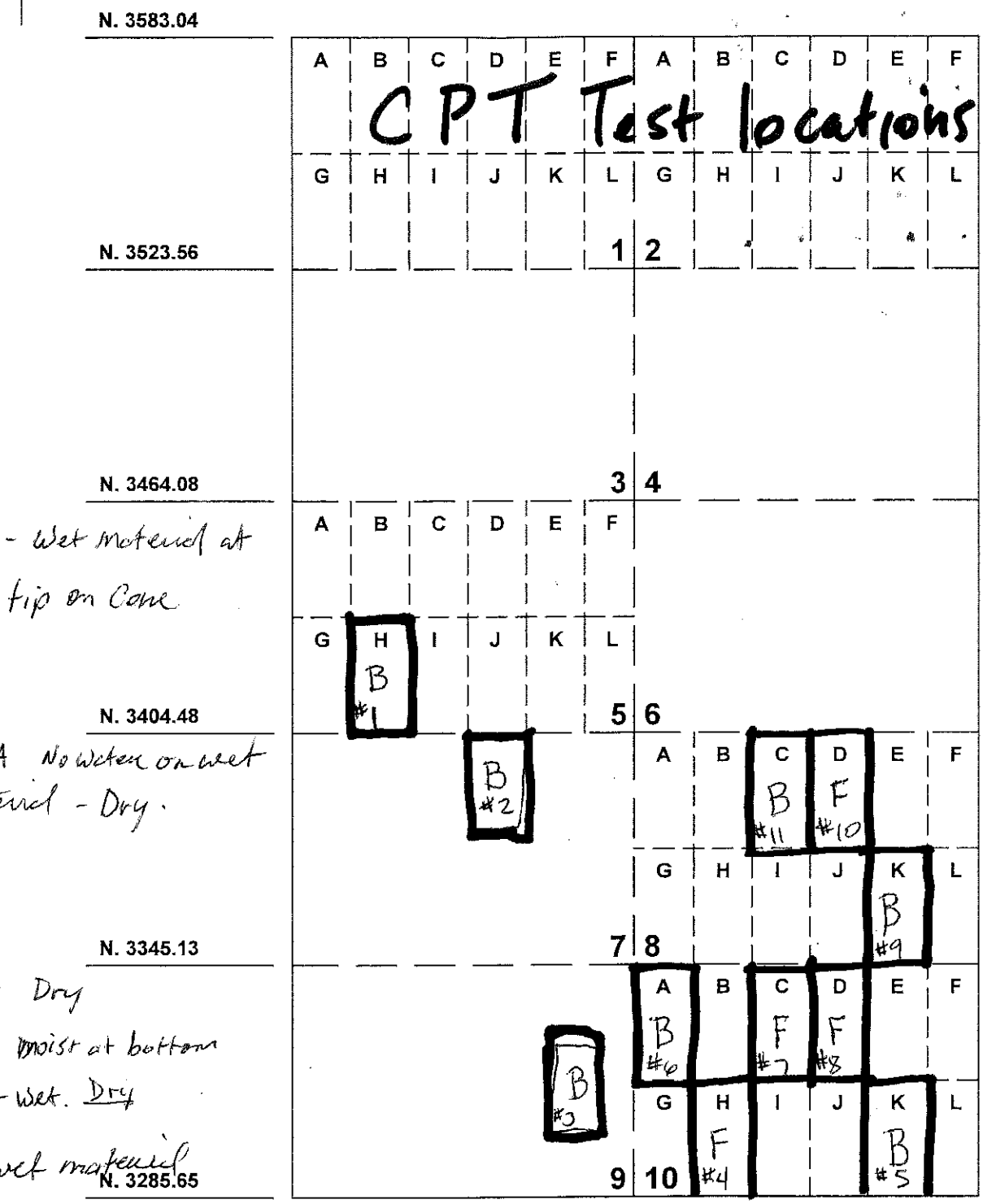
Shell SET East/West Basin Closure
0412-16-4967
11/18/16 W/O 57097



Shell SET East/West Basin Closure
0412-16-4967
11/18/16

West Basin

w/o 57097



#1 - 5/H
#2 - 7/A
#3 - 9/A
#4 - 10/H
#5 - 10/K
#6 - 10/A
#7 - 10/C
#8 - 10/D
#9 - 8/K
#10 - 8/D
#11 - 8/C

5/H - Wet material at the tip on Cone

7/A No water on wet material - Dry.

9/A Dry

10/H moist at bottom but Not Wet. Dry

10/K wet material at bottom

10/A moist material at bottom

8/C Dry

5/H had a shiny looking material coating the cone, all others were dry or had moist soil at top of cone as it backed out of hole - cone was very polished w/no soil attached

Project No: 0412-16-4967
Project Name: Shell SET East/West Basin Closure

Date: 11-18-16

W/O 570977

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD F.S.S.	finish Mixing
2 / E	10064434	43911401	7:46 Am	200	8:17 Am	8:19 Am	8:35 Am	8:41 Am	9:39 Am
2 / C	10037511	43911445	7:47 Am	200	8:17 Am	8:20 Am	8:33 Am	8:43 Am	9:38 Am
2 / L	10036393	43912017	10:25 Am	400	11:03 Am	11:06 Am	11:17 Am	11:27 Am	1:10 pm
2 / J	10064434	43912020	10:38 Am	400	11:03 Am	11:07 Am	11:20 Am	11:27 Am	1:20 pm
2 / I	10036393	43912500	1:23 pm	400	2:13 pm	2:16 pm	2:32 pm	2:44 pm	3:51 pm
2 / K	10065982	43912498	1:25 pm	400	2:13 pm	2:16 pm	2:24 pm	2:34 pm	3:47 pm

RECEIVED
NOV 21 2016

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/21/2016
		Revised Report Date:	12/05/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0039
Contractor:	Bo-Mac Contractors	**Previous Report Date:**	11/23/2016

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded times of cement slurry batching at the plant, start to finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed, (See Attached Sketch).

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

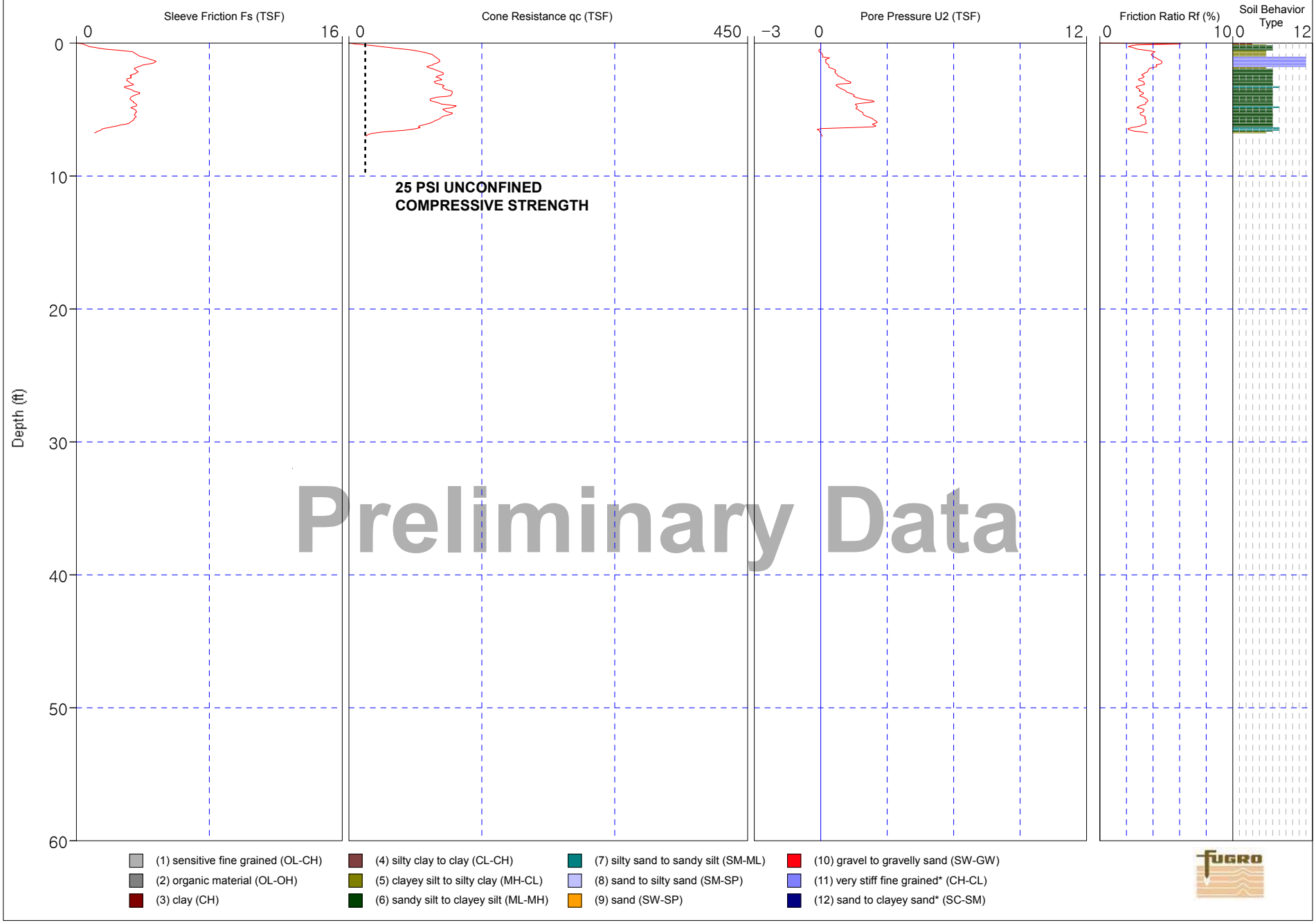
Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-5H
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

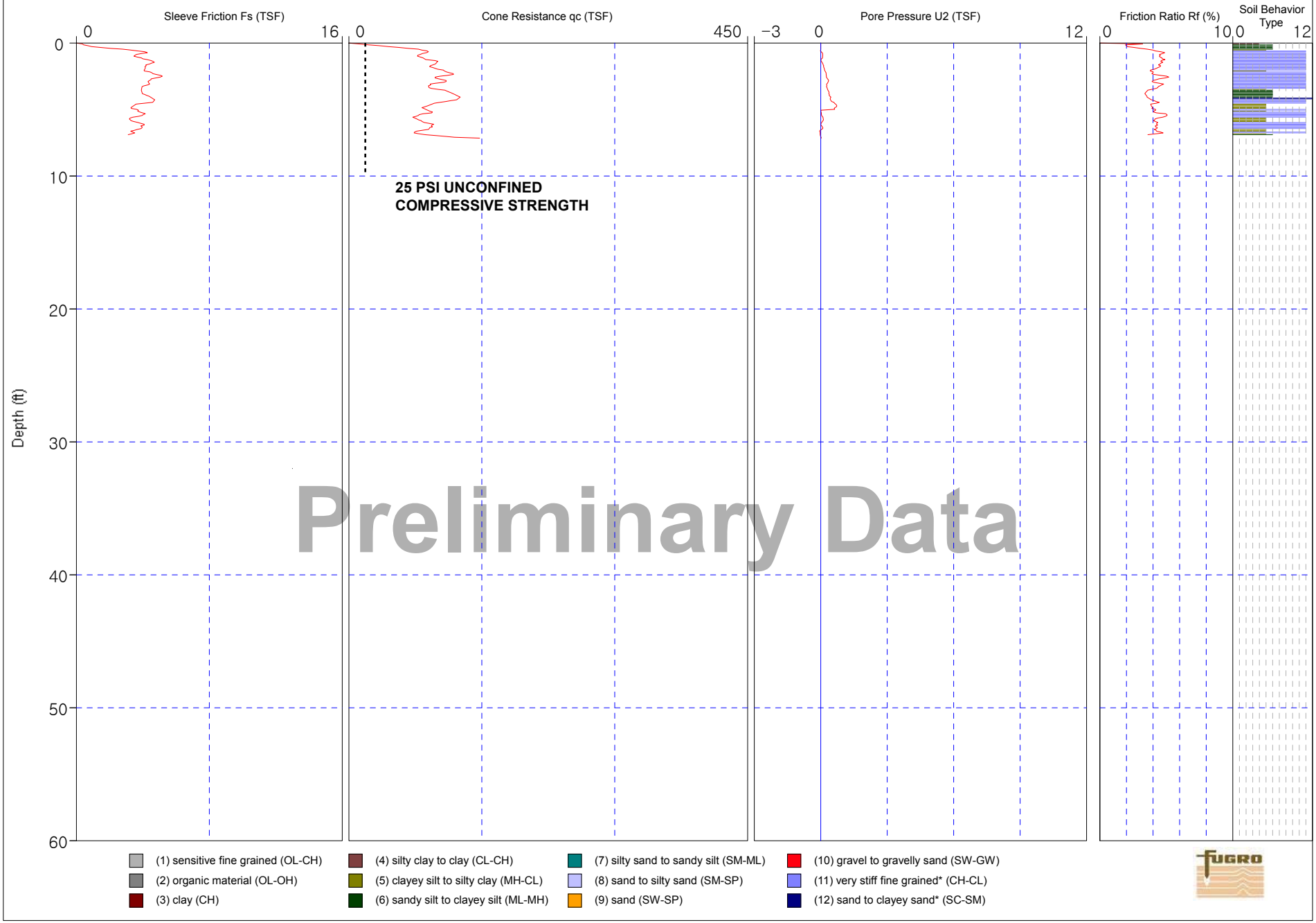


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-7A
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

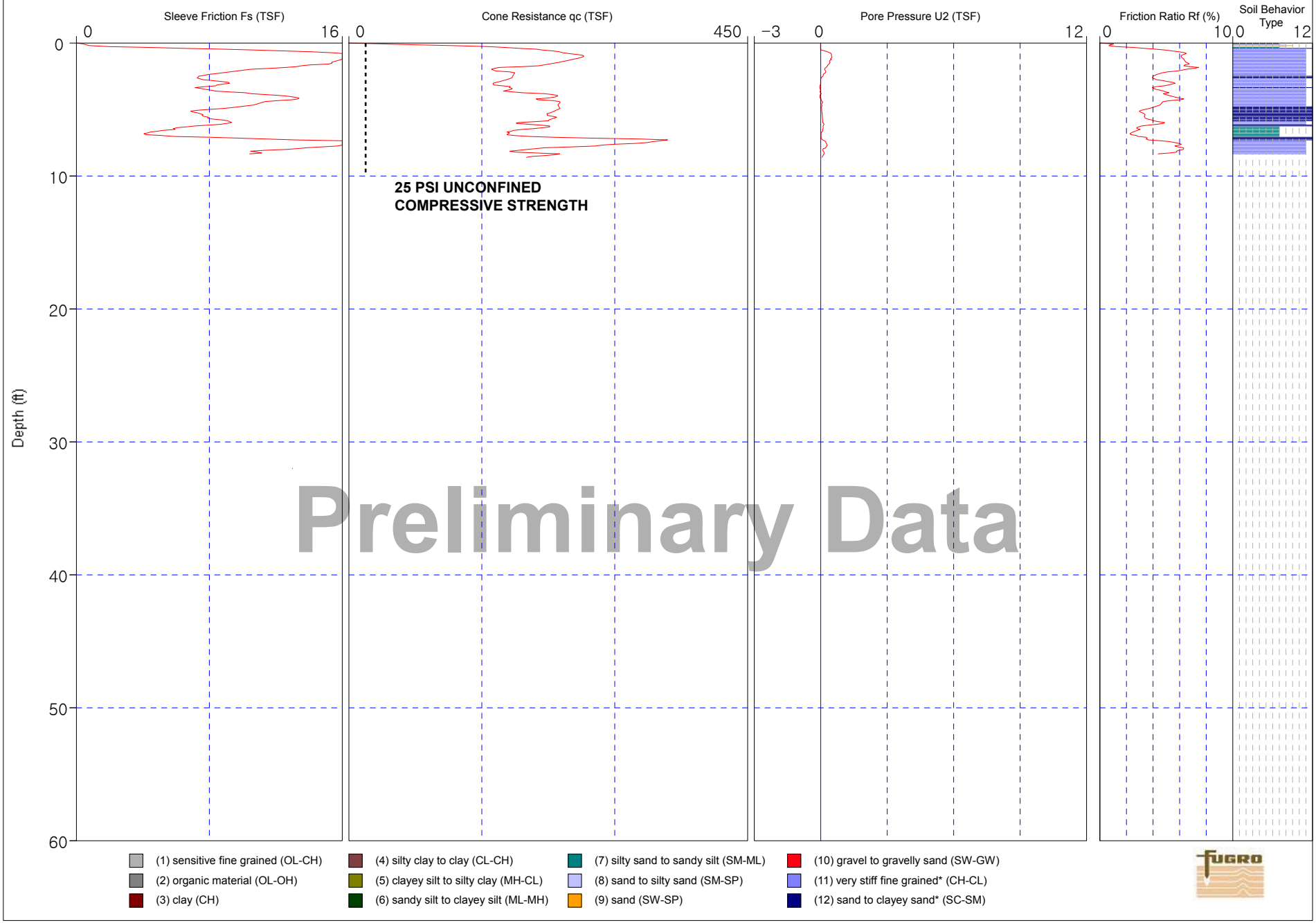


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-8C
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-8D
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

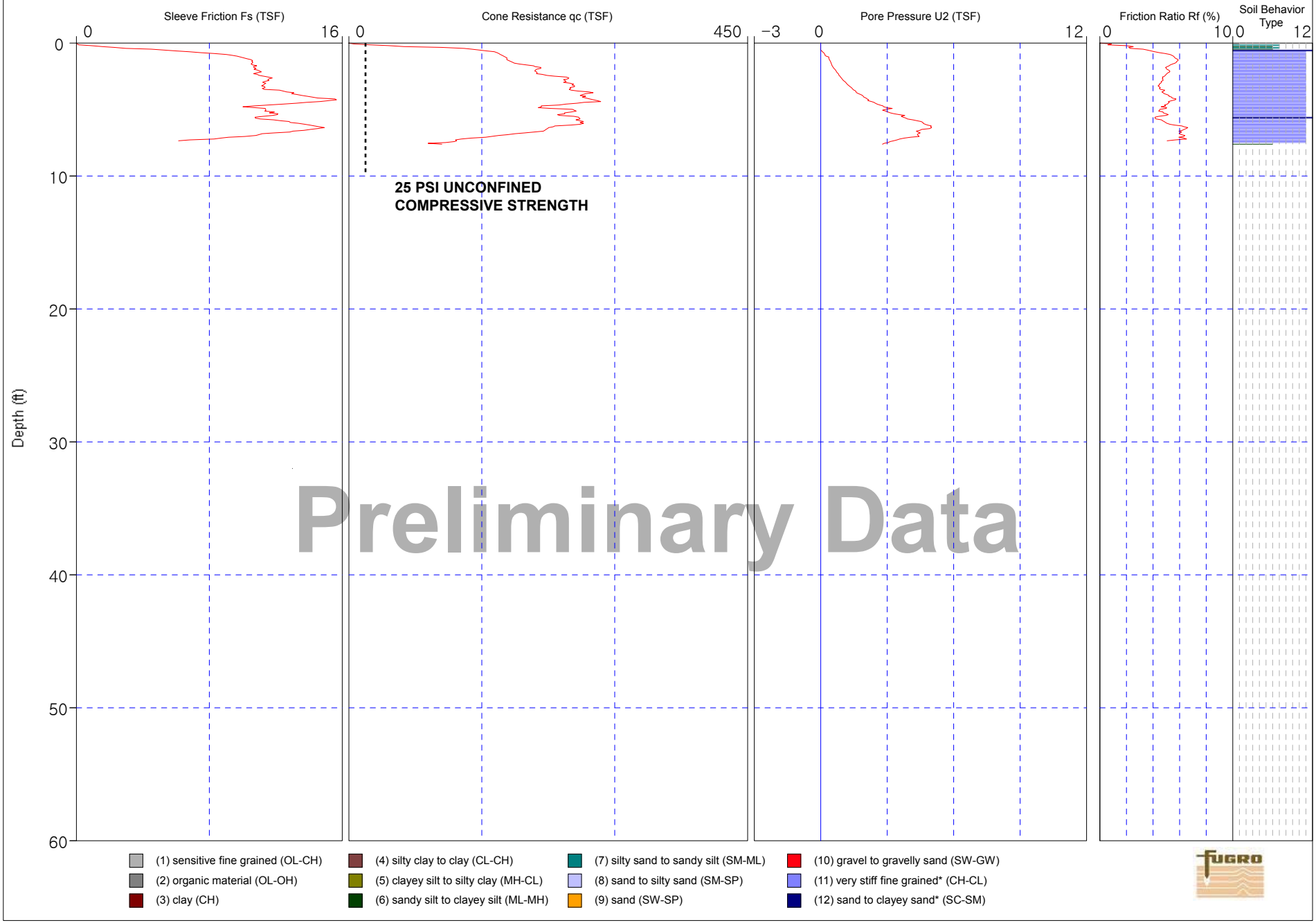


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-8K
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

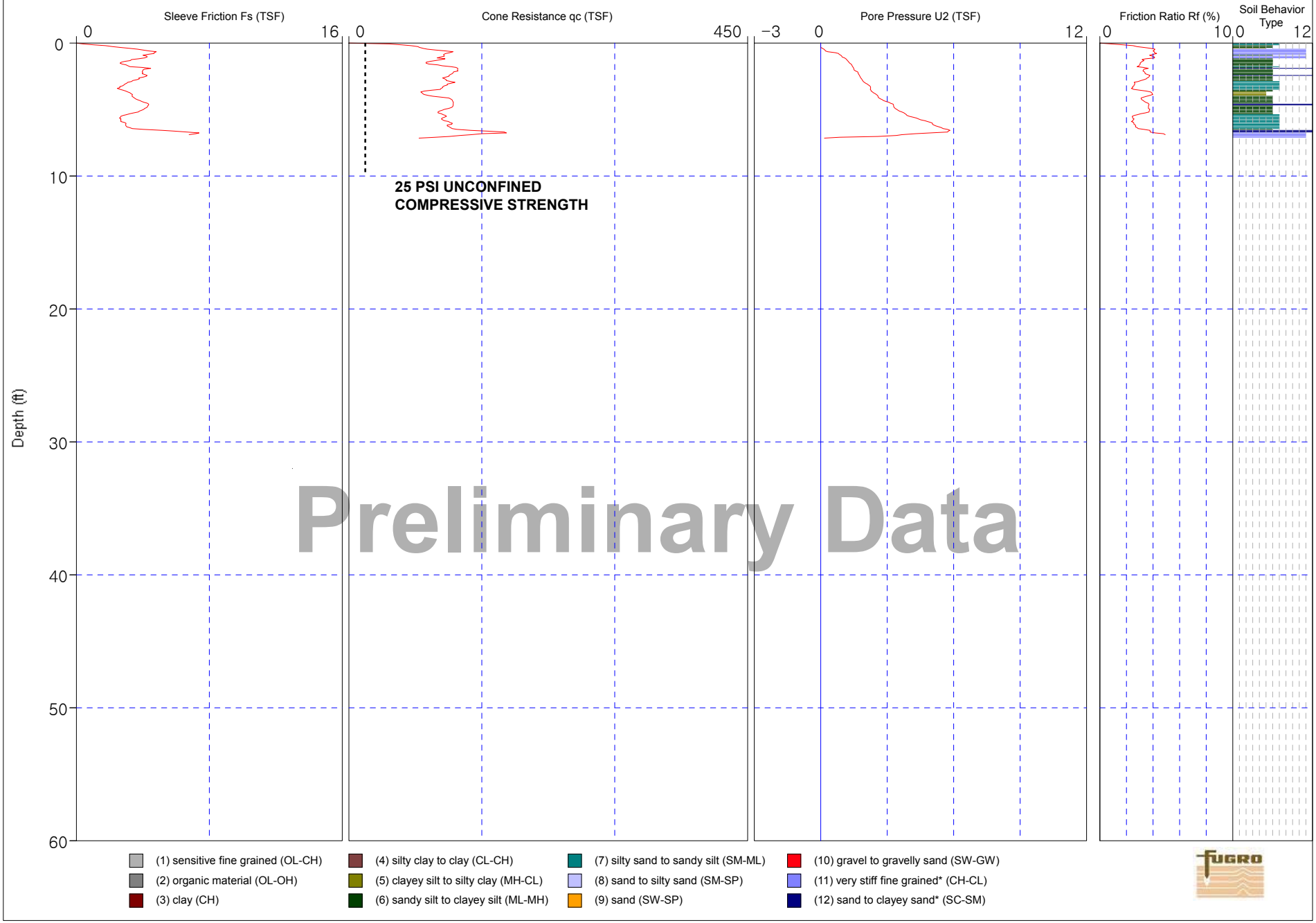


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-9A
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

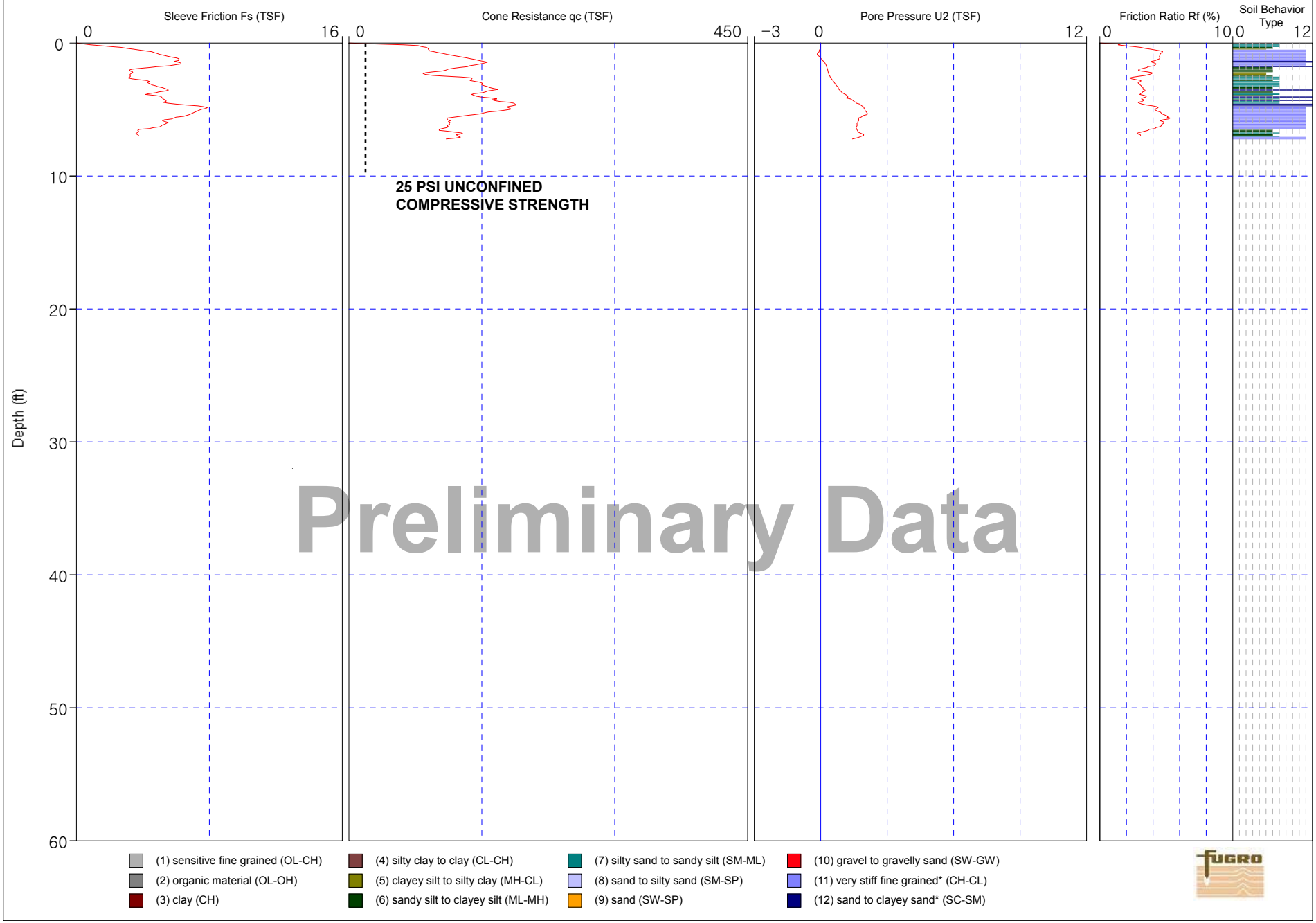


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10A
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

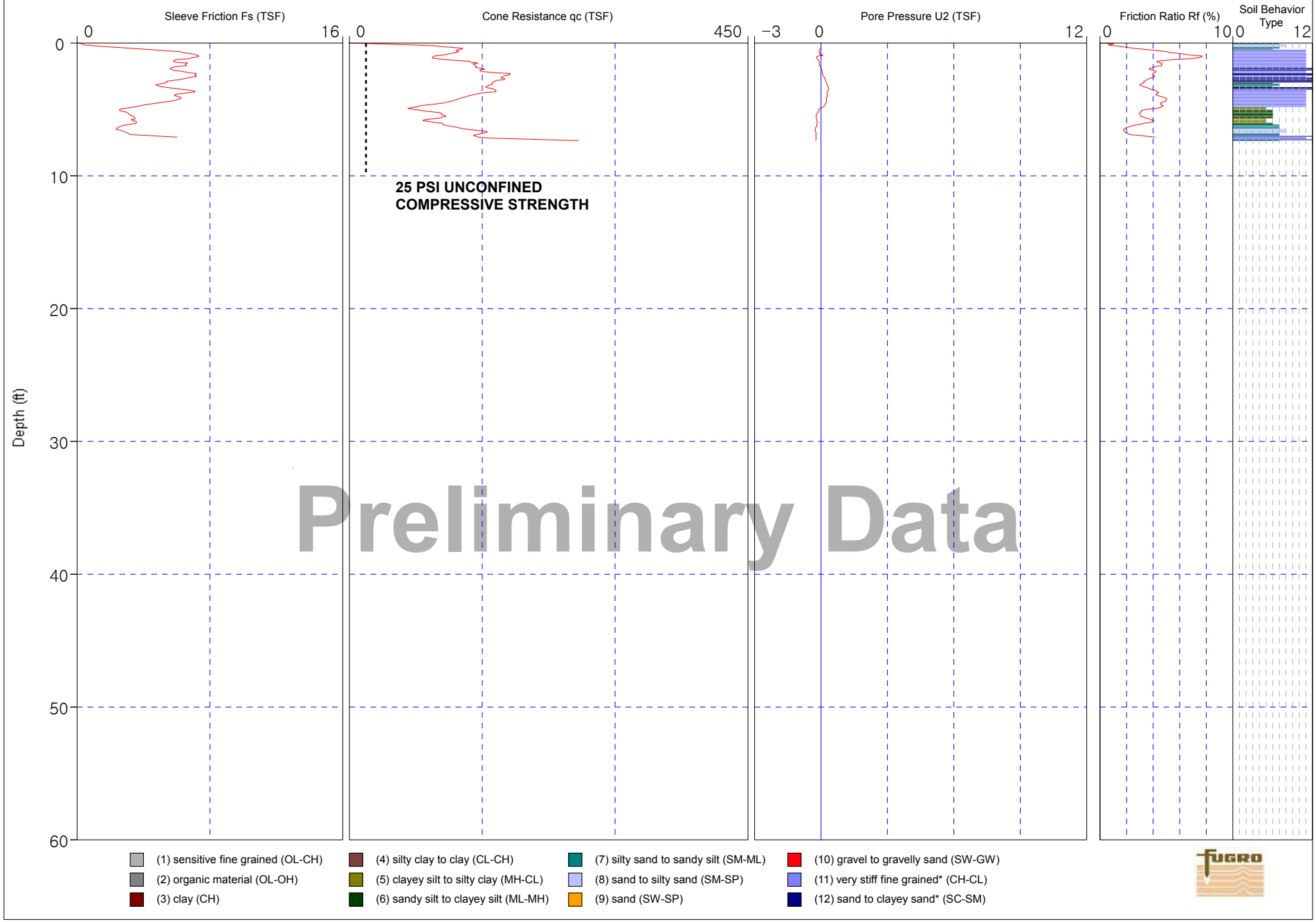


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10C
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

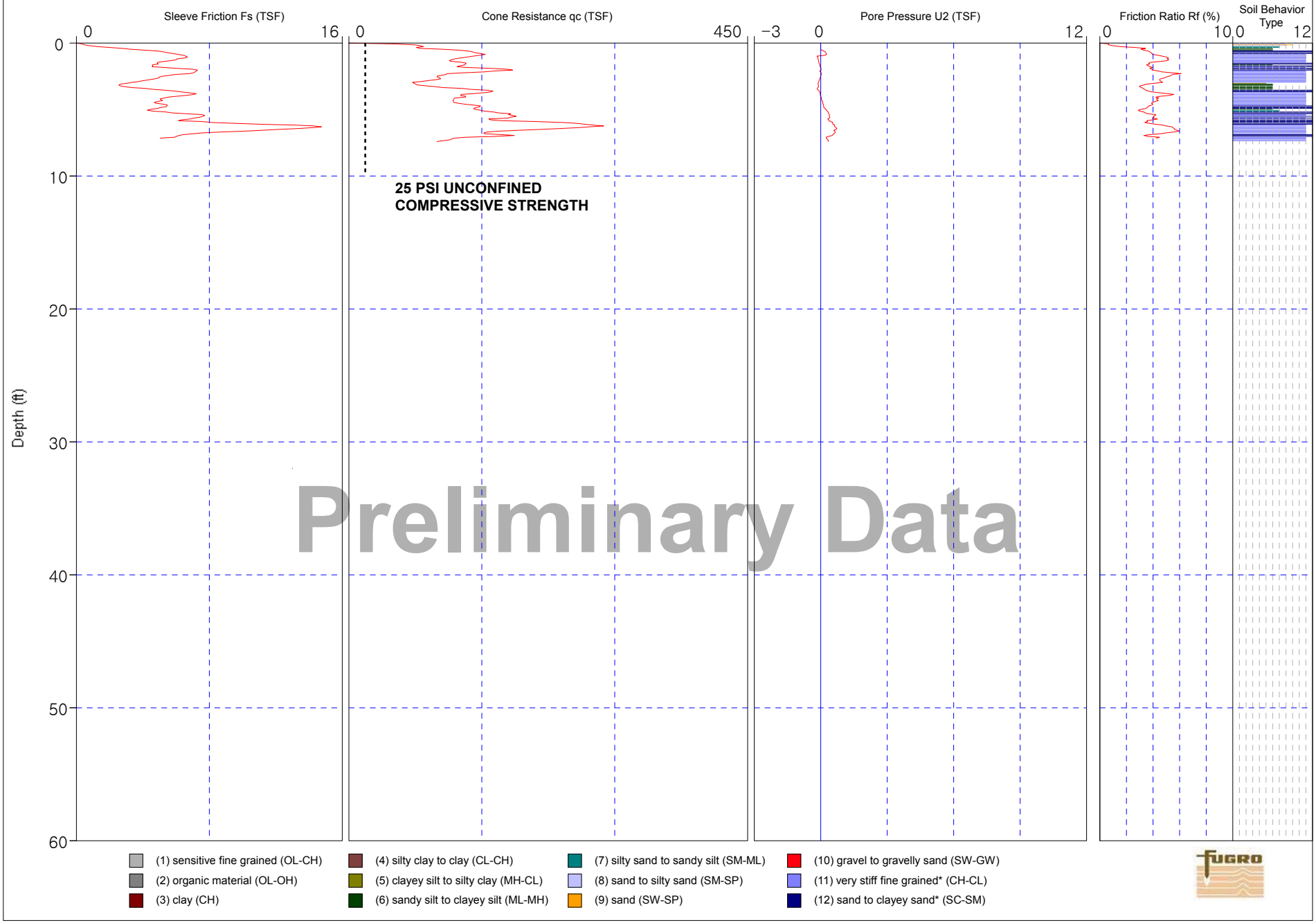


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10D
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

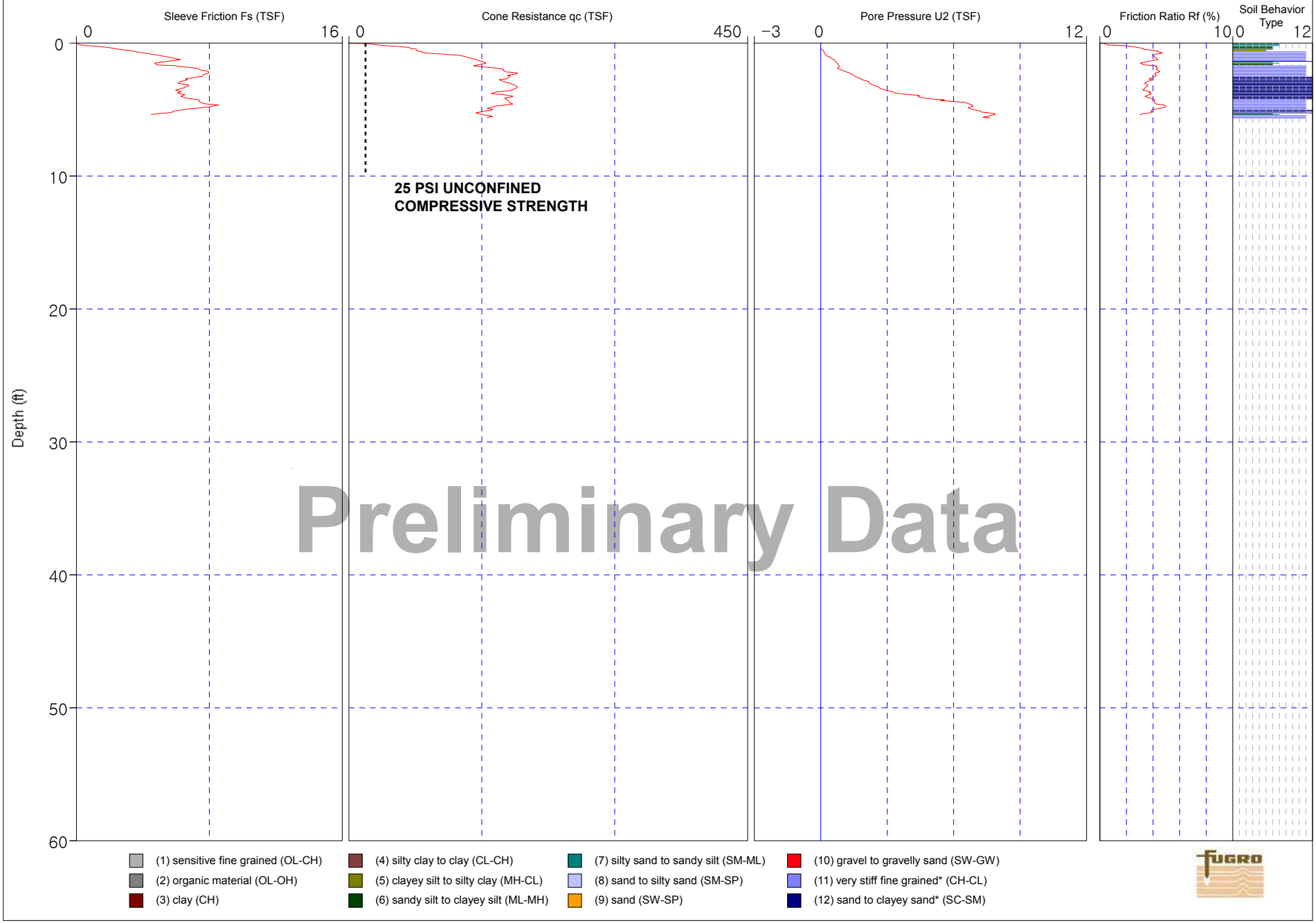


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10H
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

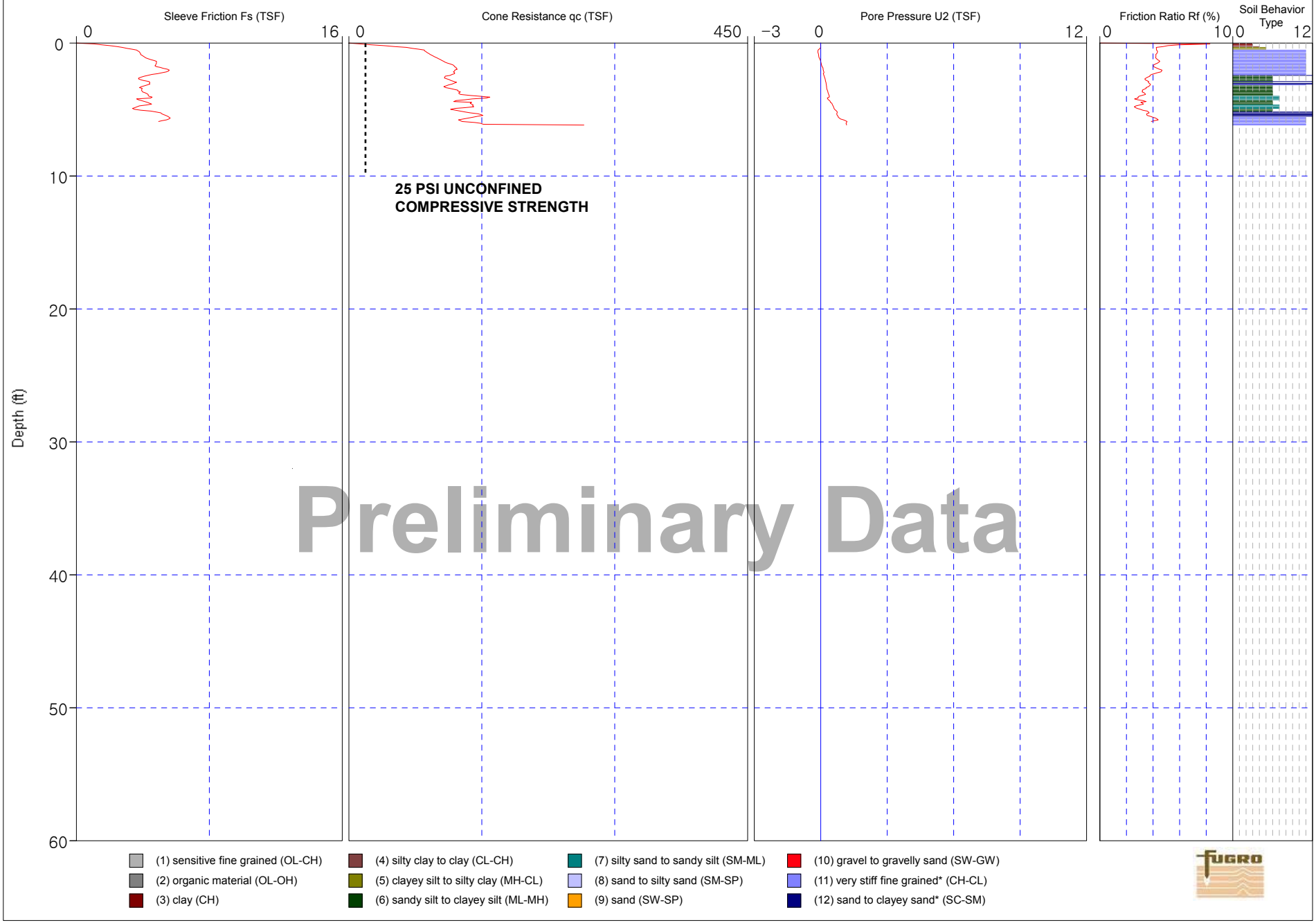


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park

CPT Number: CPT-10K
Date: 18-Nov-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



Robertson et al. 1986 *Overconsolidated or Cemented

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

DAILY FIELD ACTIVITY REPORT

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors

Sample Date: 11/21/2016
Revised Report Date: 01/04/2017
Project No.: 04.12164967
Report No.: 0039
Previous Report Date: 12/05/2016

As requested, a representative of Fugro USA Land, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded times of cement slurry batching at the plant, start to finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed, (See Attached Sketch).

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

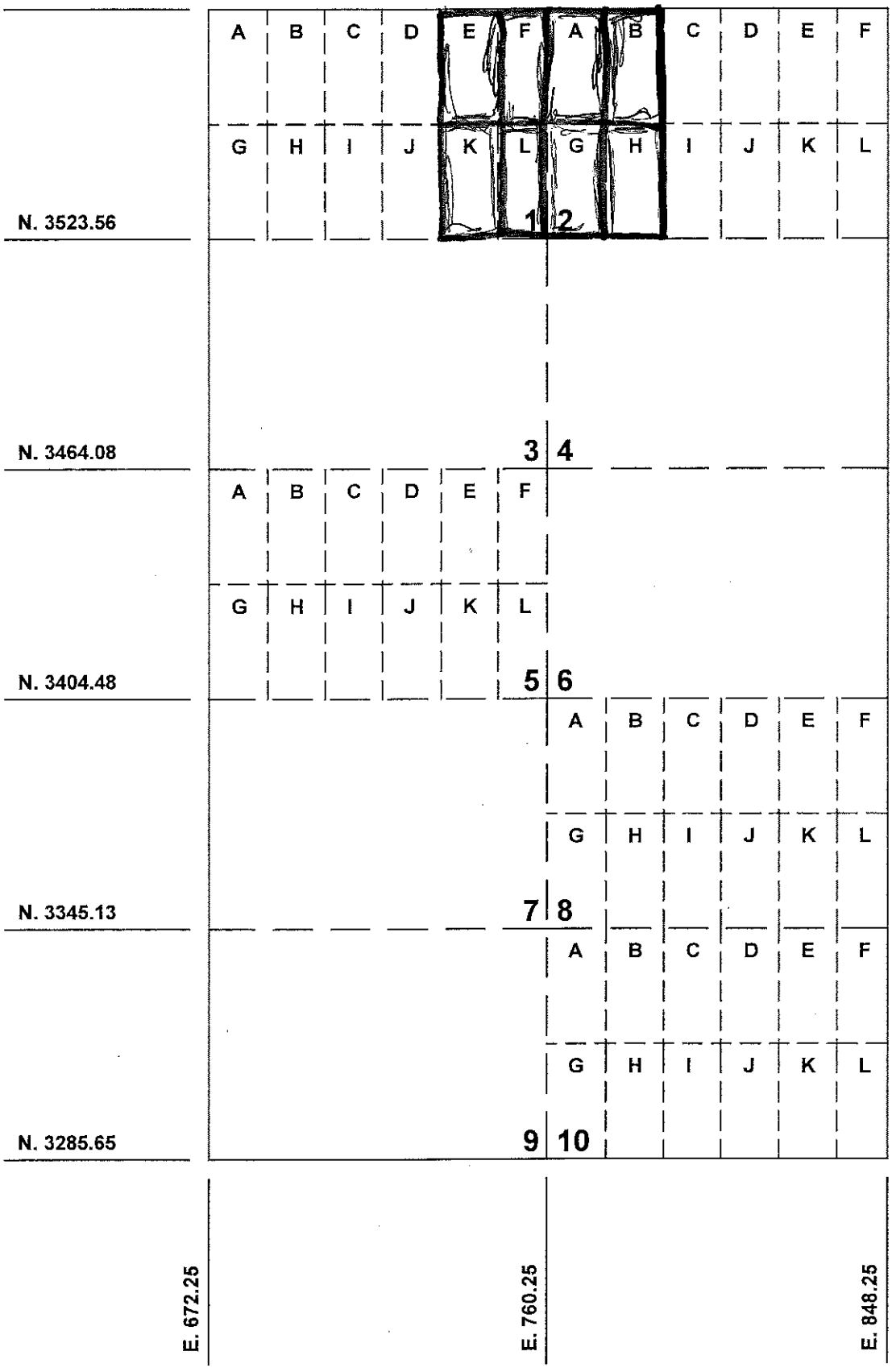
Shell SET East/West Basin Closure

04.12.16.4967

11/21/16

West Basin

W/O 57116



Project No: 0412-164967
Project Name: Shell SBT East/West Basin Closure

Date: 11-21-16

W/O 57116

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
2 / B	10063759	43913540	6:25 am	200	7:05 Am	7:09 Am	7:20 Am	7:30 Am	8:33 Am
1 / B	10064477	43913535	6:20 am	500	7:05 pm	7:09 Am	7:25 Am	7:45 Am	8:45 Am
2 / A	10036367	43913916	9:07 Am	500	9:43 Am	9:46 Am	9:54 Am	10:11 Am	11:19 Am
1 / E	10064475	43913920	9:22 Am	795	10:02 Am	10:05 Am	10:14 Am	10:30 Am	11:48 Am
2 / H	10037798	43914364	11:48 Am	600	12:39 pm	12:42 pm	12:55 pm	1:06 pm	2:29 pm
1 / L	10067237	43914390	12:00 pm	600	12:54 pm	12:57 pm	1:03 pm	1:20 pm	2:34 pm
2 / G	10035992	43914730	2:10 pm	600 *	3:10 pm	3:12 pm	3:33 pm	3:42 pm	4:33 pm
1 / K	10067237	43914762	2:15 pm	600 *	3:25 pm	3:27 pm	3:30 pm	3:53 pm	4:46 pm

* Grid 1 Cell E Very Dry - Fly ash powder.
Grid 1 cell L very Dry - Fly ash powder.
Grid 1 cell K very Dry - Fly ash powder

*Water meter on Water truck Broke on Grid/cell 2/G and 1/K - water amount was AN ESTimate

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/22/2016
		Report Date:	11/23/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0040
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded times of cement slurry batching at the plant, start to finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed, (See Attached Sketch).

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

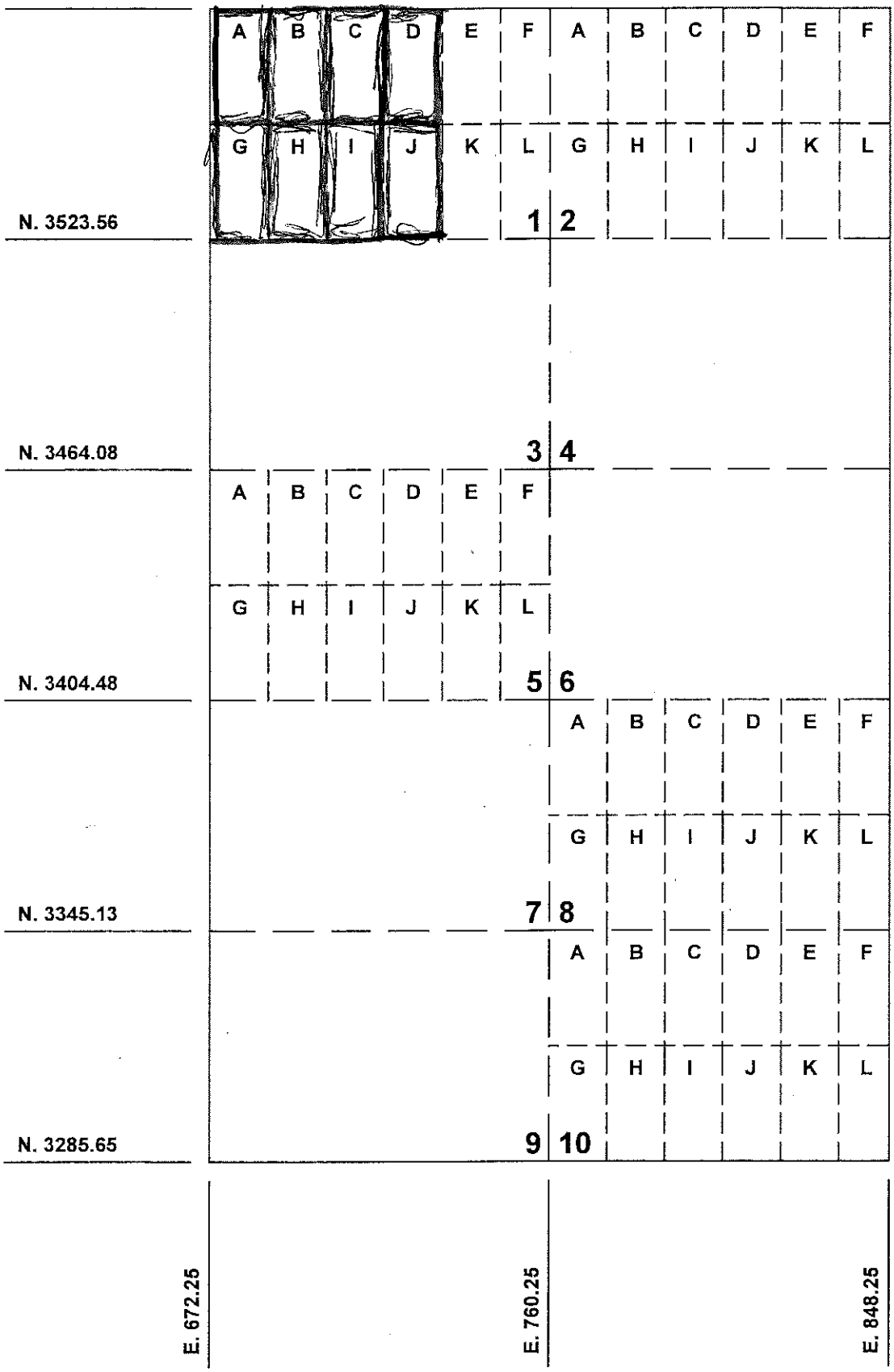
Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Shell SET East/West Basin Closure
0412-16-4967
11/22/16

West Basin

W/O 57117



Project No: 0412-16-4967
Project Name: Shell SET East/West Basin Closure

Date: 11-22-16

W/O 57117

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
1 / B	10063765	43915476	6:39 Am	400	7:16 Am	7:19 Am	7:35 Am	7:46 Am	8:49 Am
1 / D	10037511	43915478	6:43 Am	500	7:22 Am	7:26 Am	7:36 Am	7:50 Am	8:58 Am
1 / A	10064476	43916024	9:15 Am	600	10:00 Am	10:04 Am	10:13 Am	10:24 Am	11:15 Am
1 / C	10065995	43915994	9:01 Am	600	9:39 Am	9:44 Am	9:54 Am	10:12 Am	11:23 Am
1 / H	10037798	43916562	11:40 Am	600	12:22 pm	12:24 pm	12:40 pm	12:56 pm	2:03 pm
1 / J	10065994	43916610	11:55 Am	600	12:32 pm	12:35 pm	12:42 pm	12:57 pm	2:04 pm
1 / G	10063765	43917116	2:23 pm	500	2:57 pm	3:00 pm	3:17 pm	3:24 pm	4:13 pm
1 / I	10037555	43917117	2:30 pm	600	3:07 pm	3:09 pm	3:20 pm	3:27 pm	4:10 pm

* Grid 1 cell D - very dry - gray powder

Water added was an estimate as water meter was broken.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/23/2016
		Report Date:	11/28/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0041
Contractor:	Bo-Mac Contractors		

On 11/23/2016, a representative of Fugro Consultants, Inc. visited the above referenced project site to perform the scheduled sludge mixing observation. After arrival to the job site, the testing was cancelled by the contractor due to weather conditions.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/28/2016
		Report Date:	12/01/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0043
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site for sludge mixing observation (west basin). Observed the excavation and pulverization of stabilized sludge, adding of 6 cu.yds. of cement slurry to cell, mixing of slurry and pulverized stabilized sludge. Cement delivery tickets were collected, recorded time of cement slurry batching at plant, start to finish of cement slurry discharge from trucks, mixing, addition of pulverized stabilized sludge and time cell completed, (see attached sketch). Grid 4, cell A and grid 6, cell A, (cell size 28'x15') were excavated based on visual observation of the edge faces of these cells. No visual clues to the strength of the materials were apparent but mixing in the adjacent areas appeared to be somewhat uniform in color, (brownish gray with no large pockets of sludge, clay or fly-ash) in the cell face. Large pockets of sludge were in the bottom of the cell. Adjacent areas may need CPT tests performed to verify strength.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

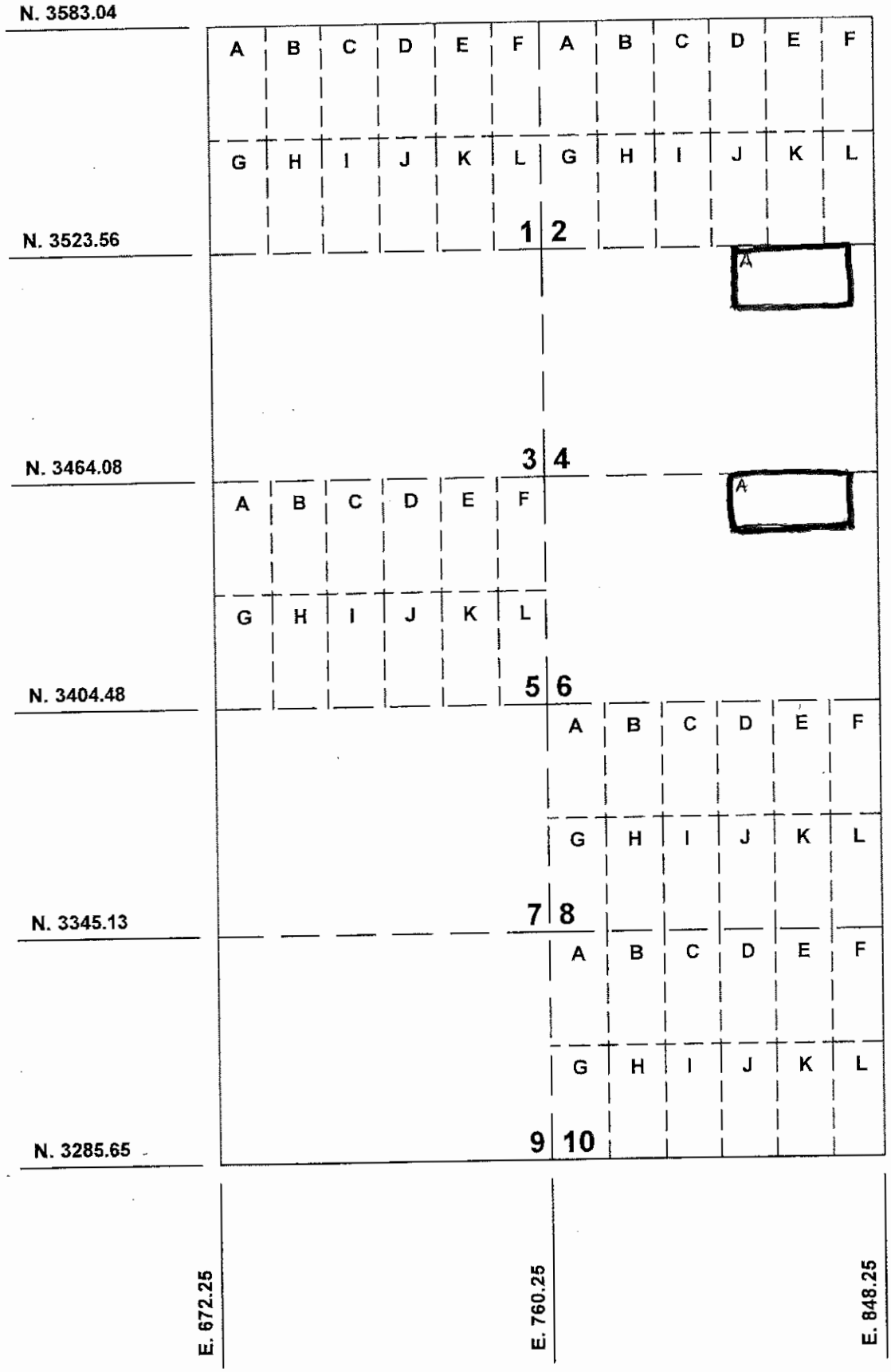
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Shell SET East / West Basin Closure

0412-16-4967

West Basin

11/28/16 w/o 57179



Project No: 04.12-16-4967
Project Name: Shell SGT East/West Basin Closure

Date: 11-28-16

location Grid / Cell	TRUCK #	TICKET #	Batch Time	WATER ADDED	START Discharge	finish Discharge	START Mixing	ADD P.S.S.	finish Mixing
4 / A	10064696	43918841	7:21 Am	600	8:13 Am	8:15 Am	8:20 Am	8:32 Am	10:07 Am
6 / A	10065648	43918850	7:40 Am	600	8:13 Am	8:14 Am	8:22 Am	8:35 Am	10:11 Am

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

DAILY FIELD ACTIVITY REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/02/2016
		Report Date:	12/06/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0049
Contractor:	Bo-Mac Contractors		

As requested, a representative of Fugro Consultants, Inc. went to the project site to assist technician with Cone Penetrometer Testing.

Fugro Representative: Ilanga Priyanke

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

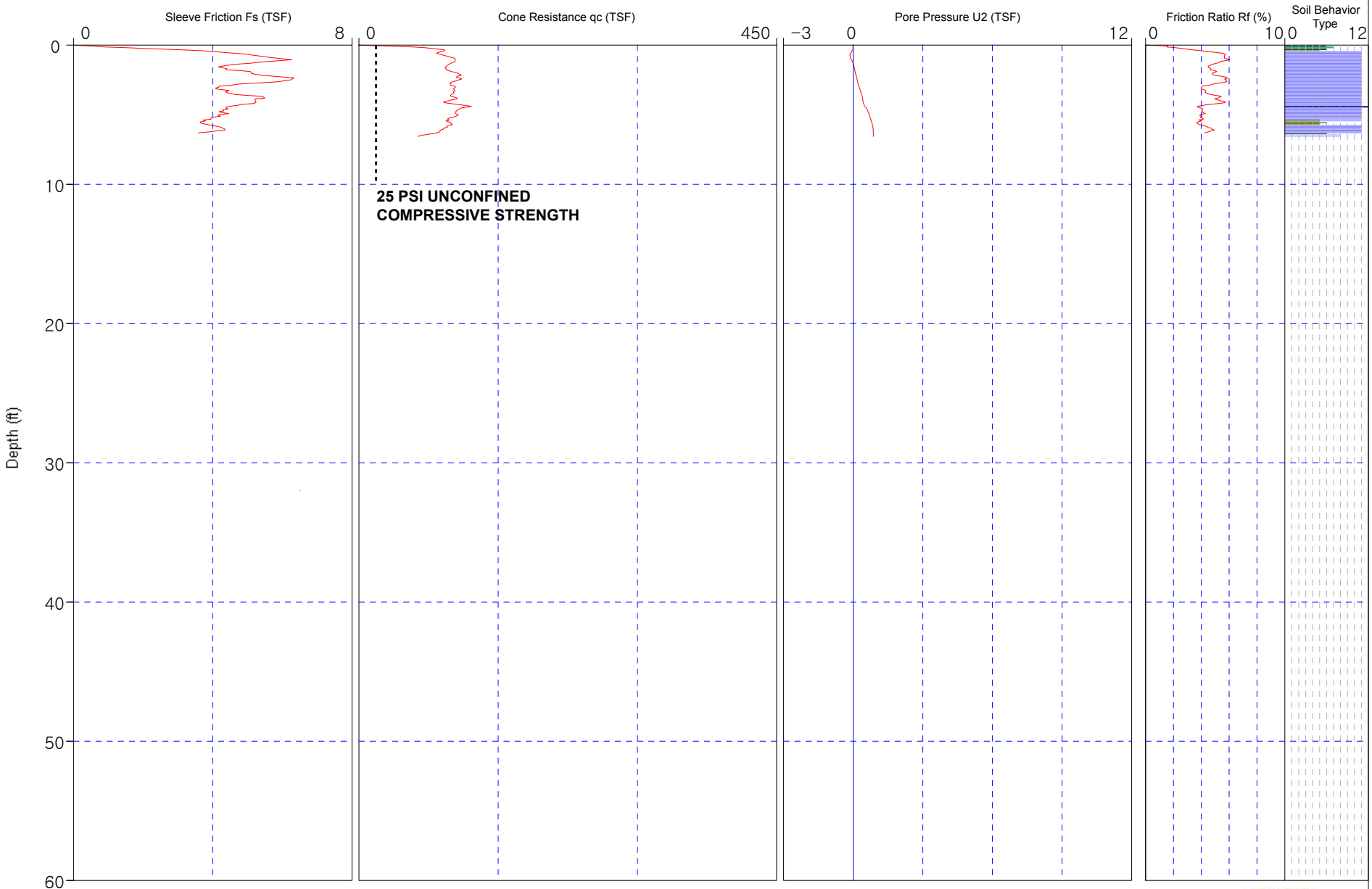
Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-1B
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

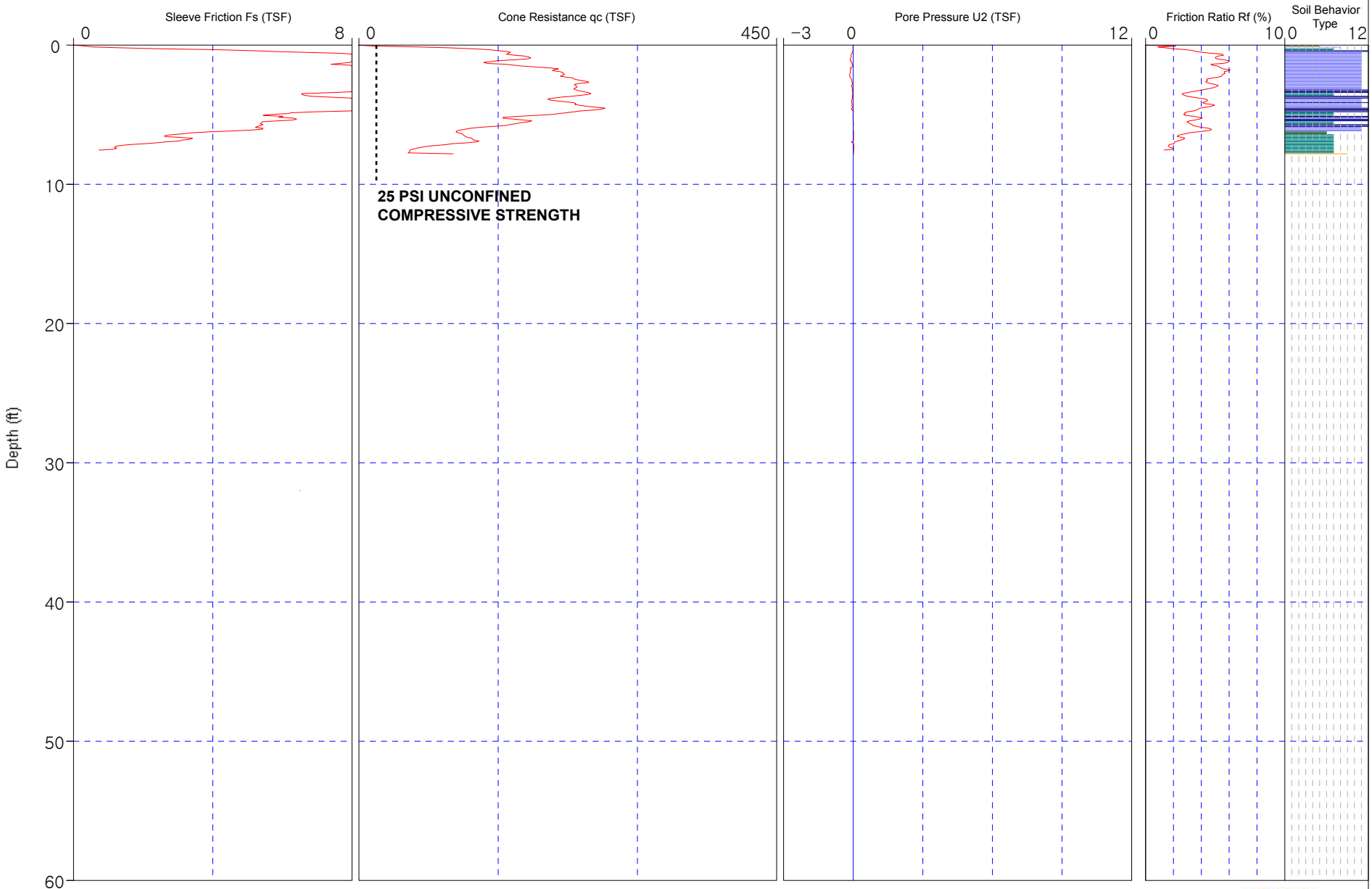


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-1E
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



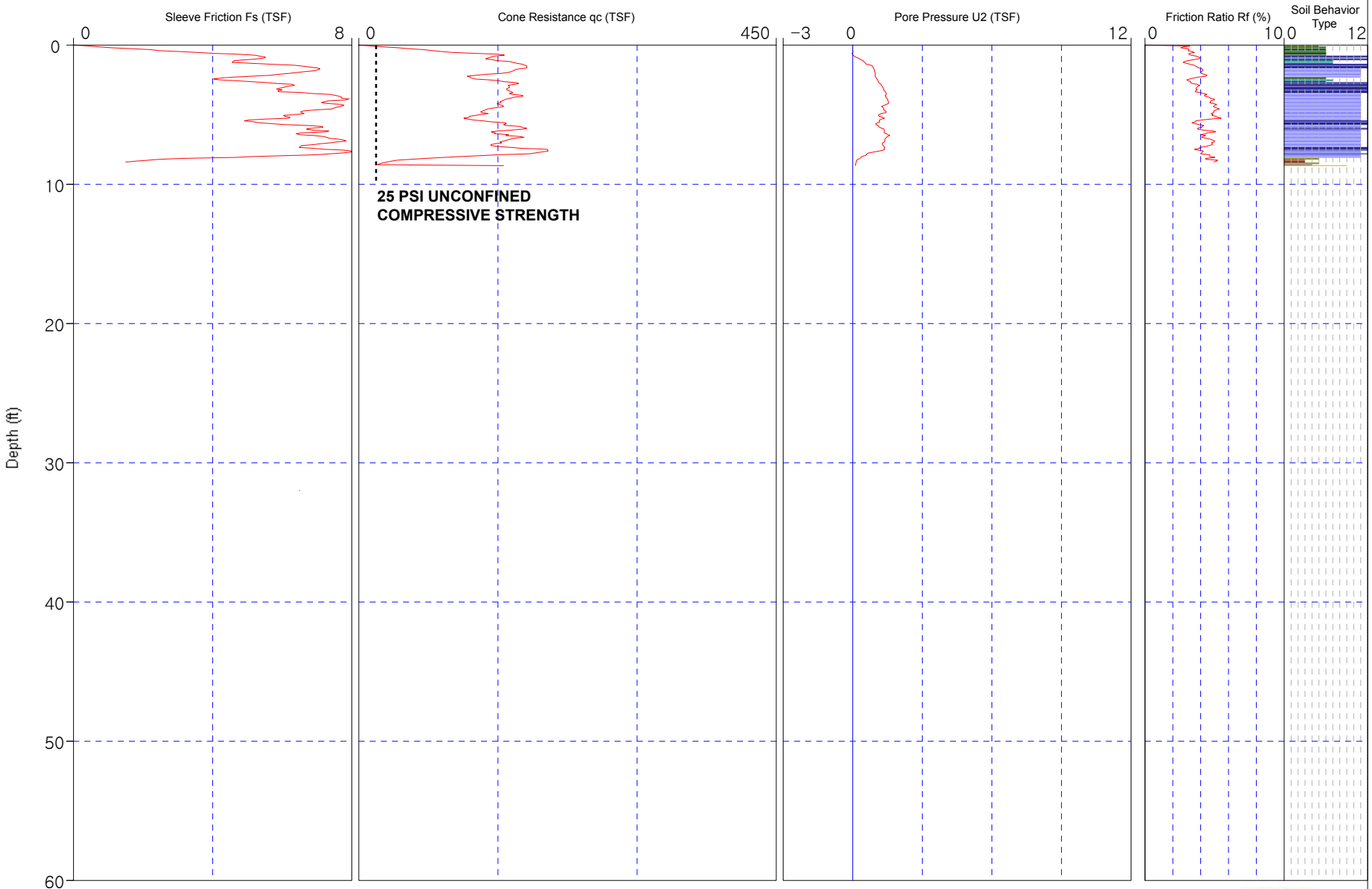
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-1J
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

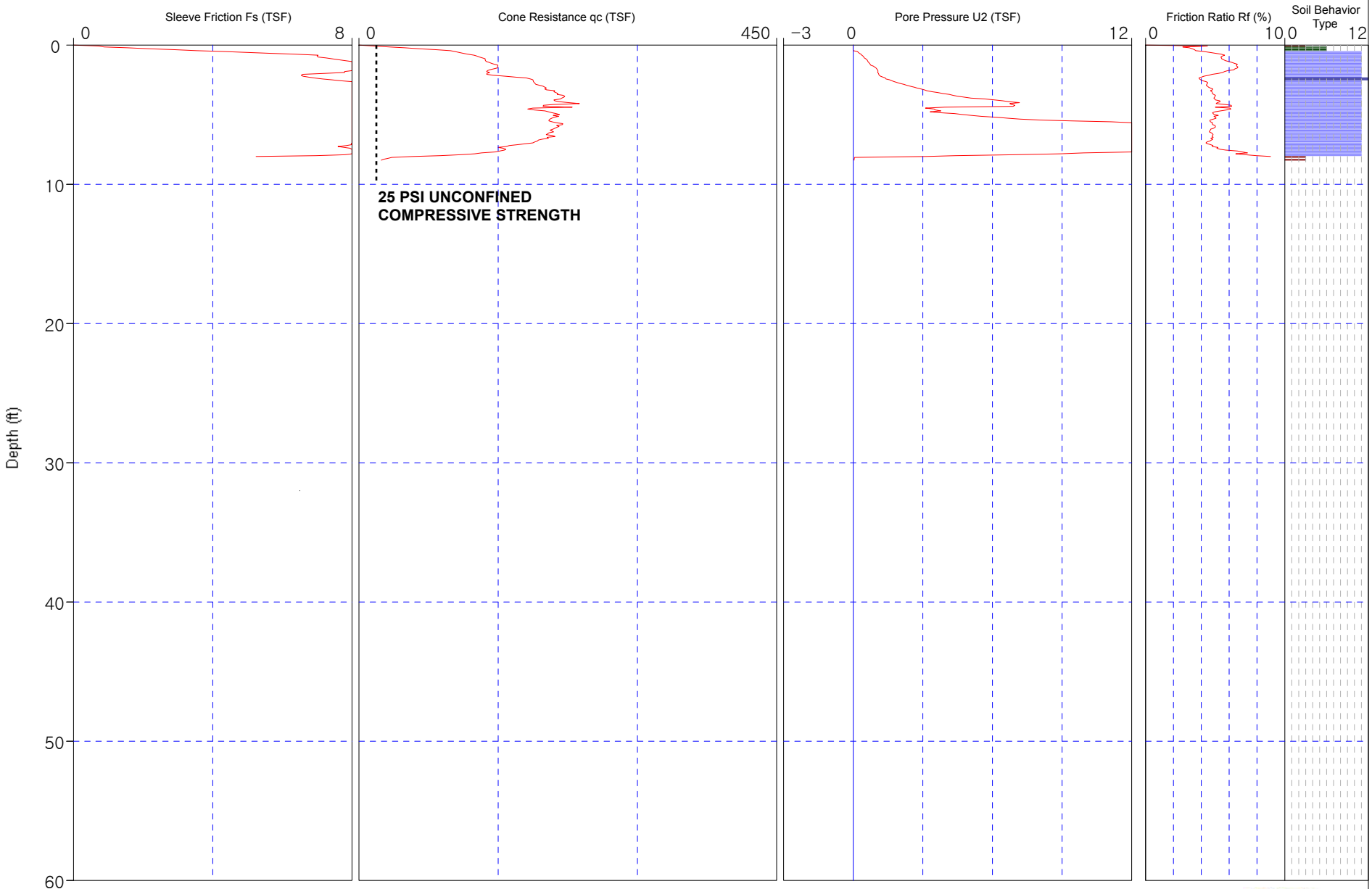


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-2D
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

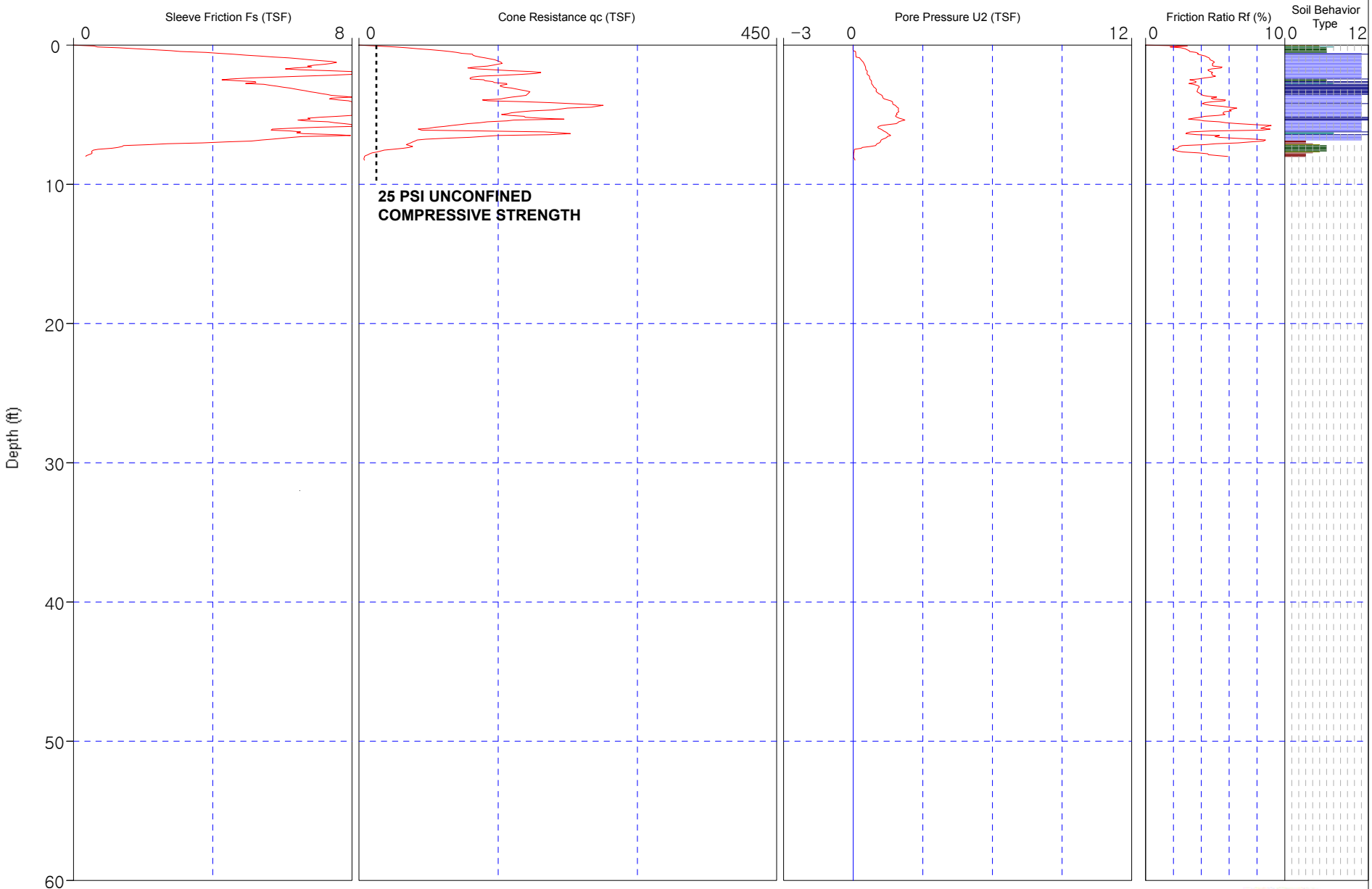


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-2G
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



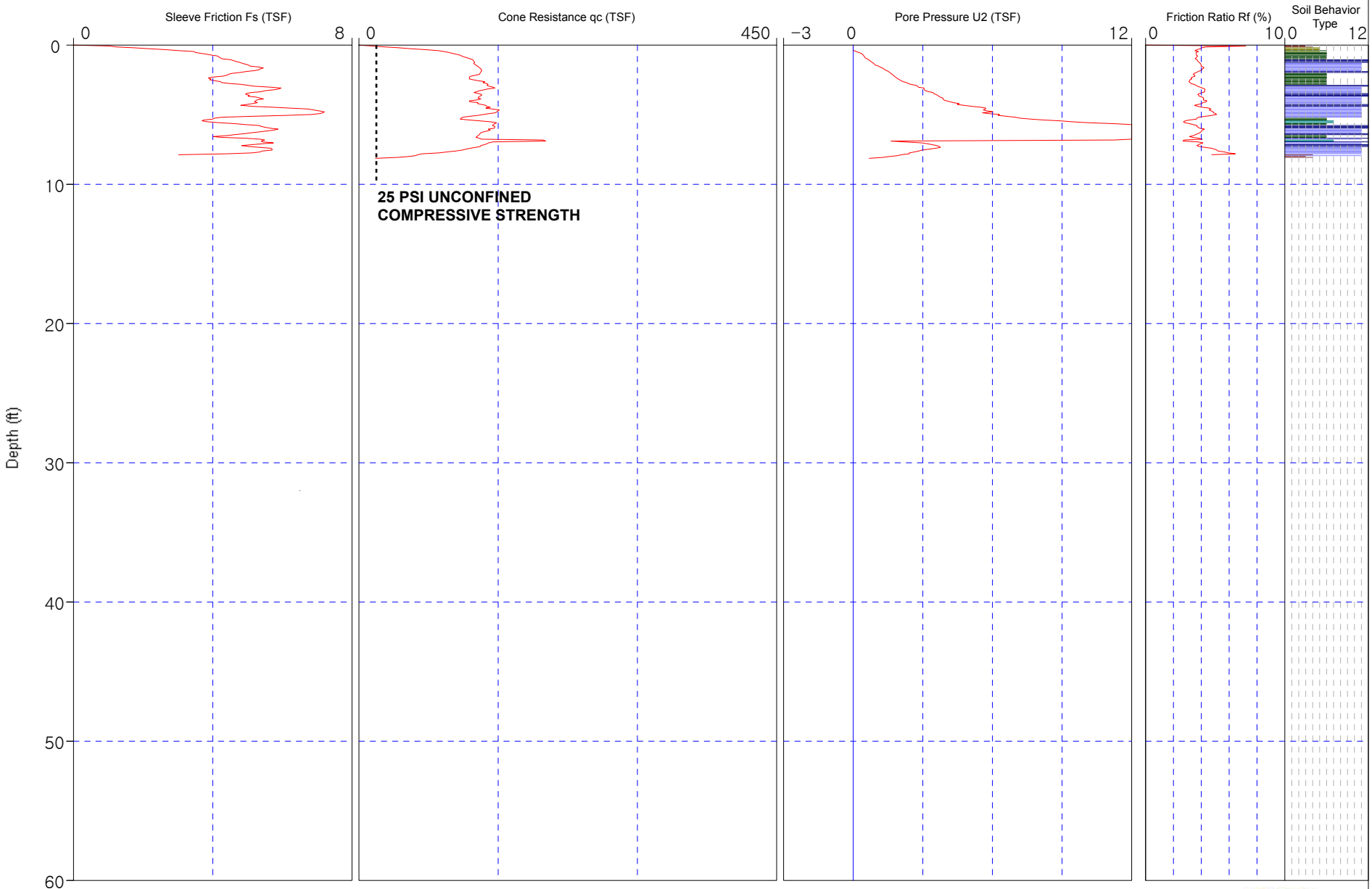
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-2K
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

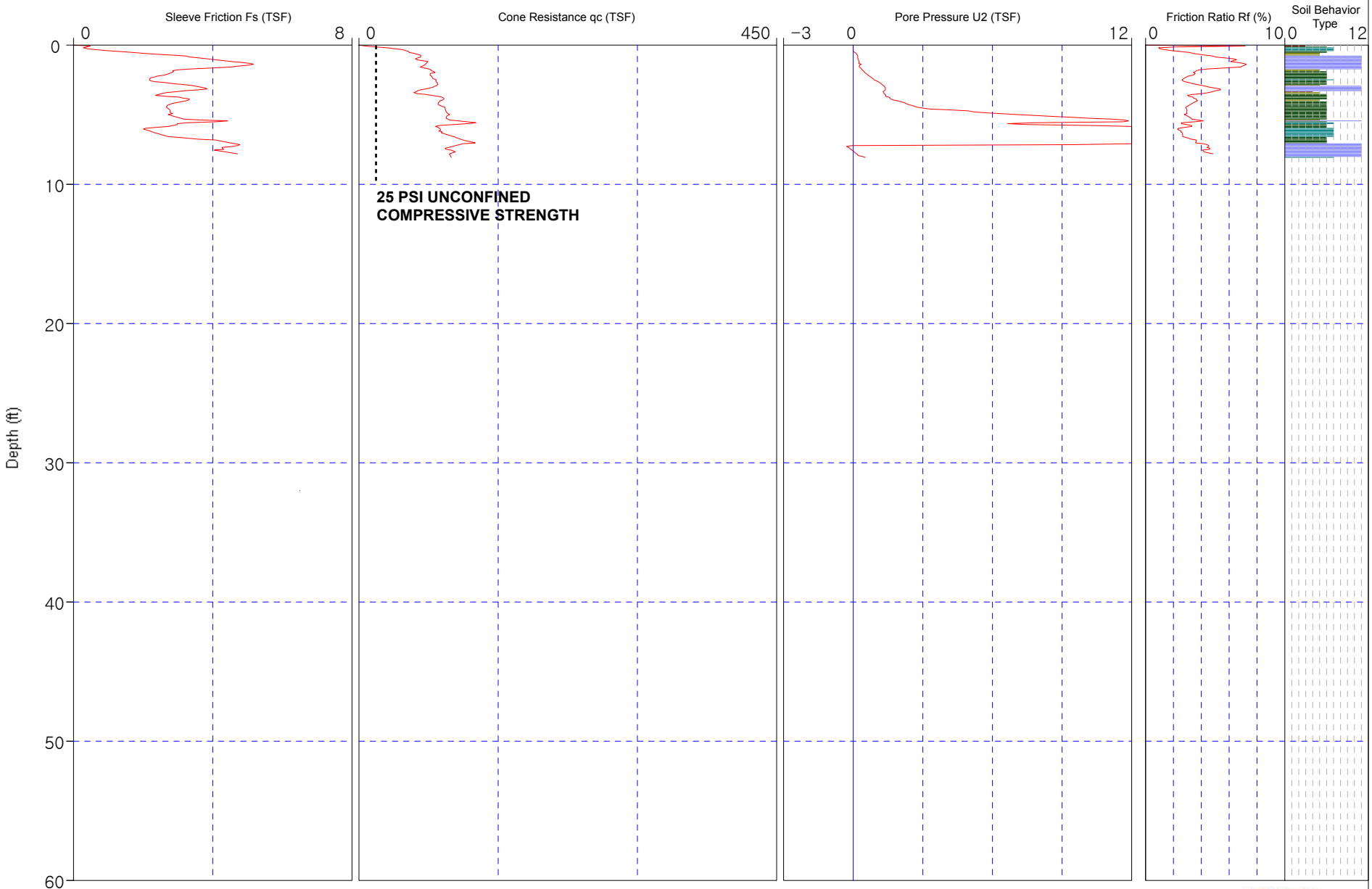


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-4A
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

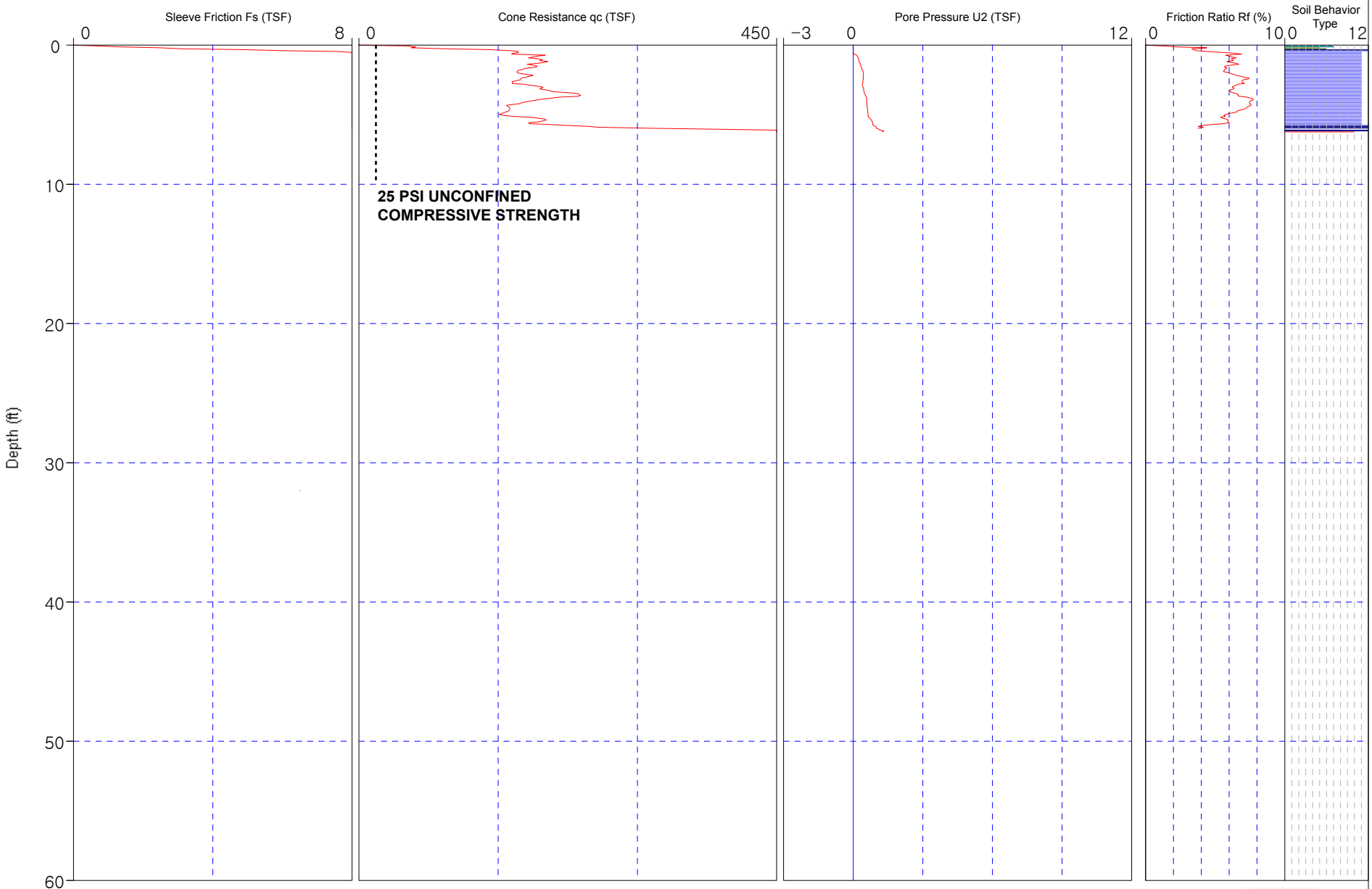


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-5C
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



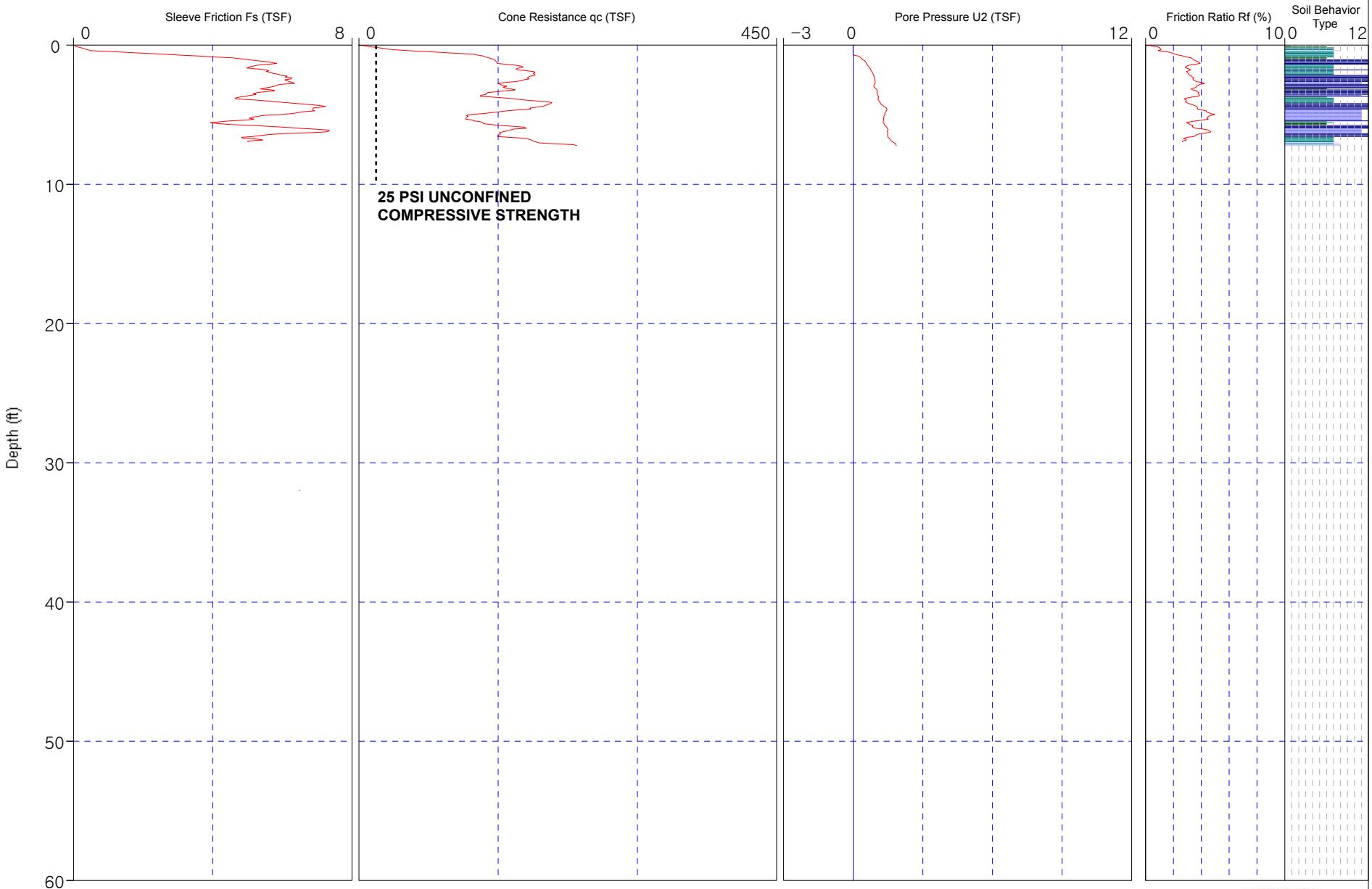
(1) sensitive fine grained (OL-CH)
(2) organic material (OL-OH)
(3) clay (CH)
(4) silty clay to clay (CL-CH)
(5) clayey silt to silty clay (MH-CL)
(6) sandy silt to clayey silt (ML-MH)
(7) silty sand to sandy silt (SM-ML)
(8) sand to silty sand (SM-SP)
(9) sand (SW-SP)
(10) gravel to gravelly sand (SW-GW)
(11) very stiff fine grained* (CH-CL)
(12) sand to clayey sand* (SC-SM)

Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-5E
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874

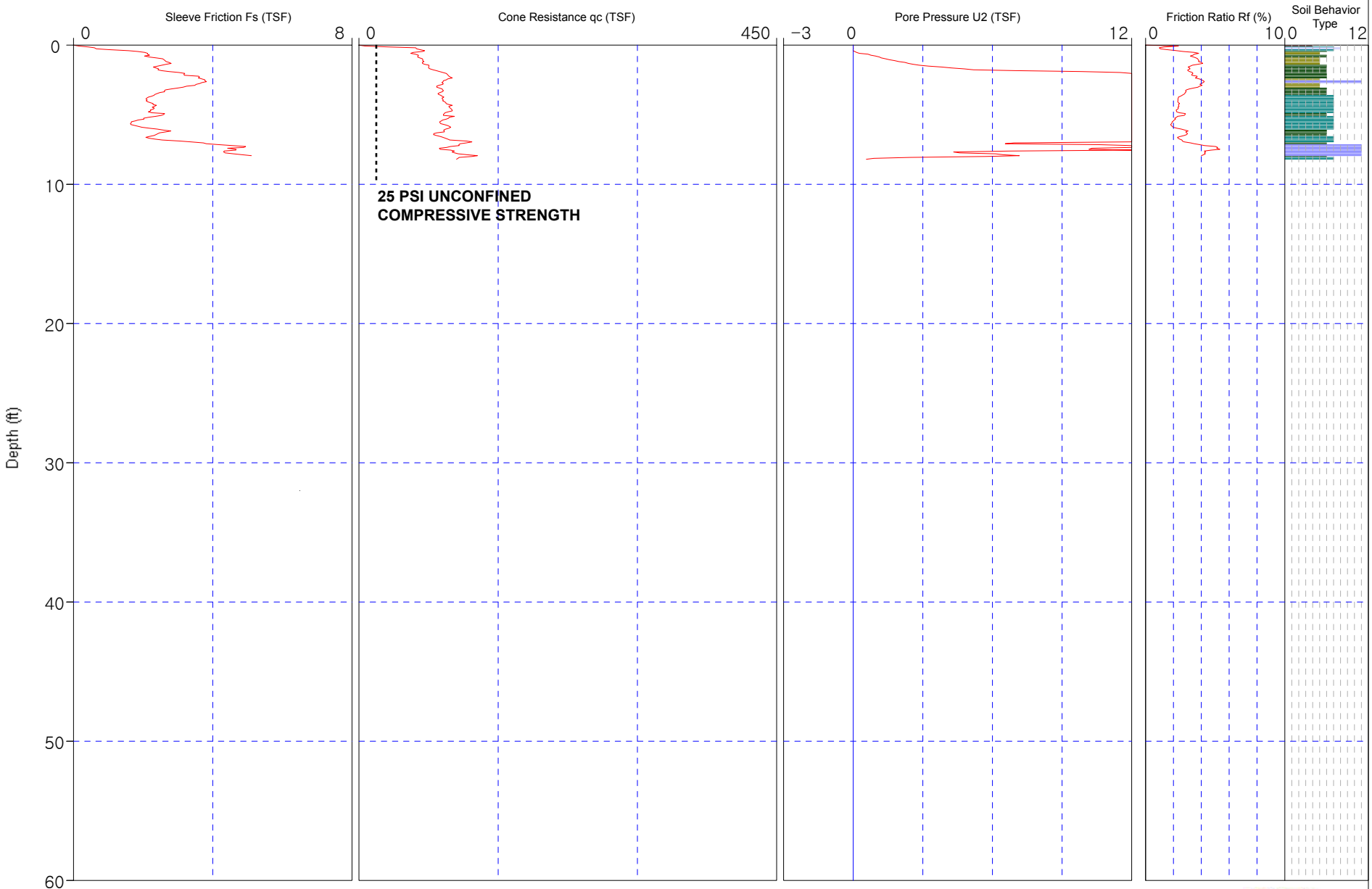


Robertson et al. 1986 *Overconsolidated or Cemented

Job Number: 04.1216-4967
Operator: Bobby Brandt
Location: Shell Deer Park TX

CPT Number: CPT-6A
Date: 02-Dec-2016
Elevation: 0.00

Coordinates:
Cone Number: CP15-CF75PB7SN2-P1E1 2874



Robertson et al. 1986 *Overconsolidated or Cemented

Appendix I – Structural Fill CQC Documentation

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

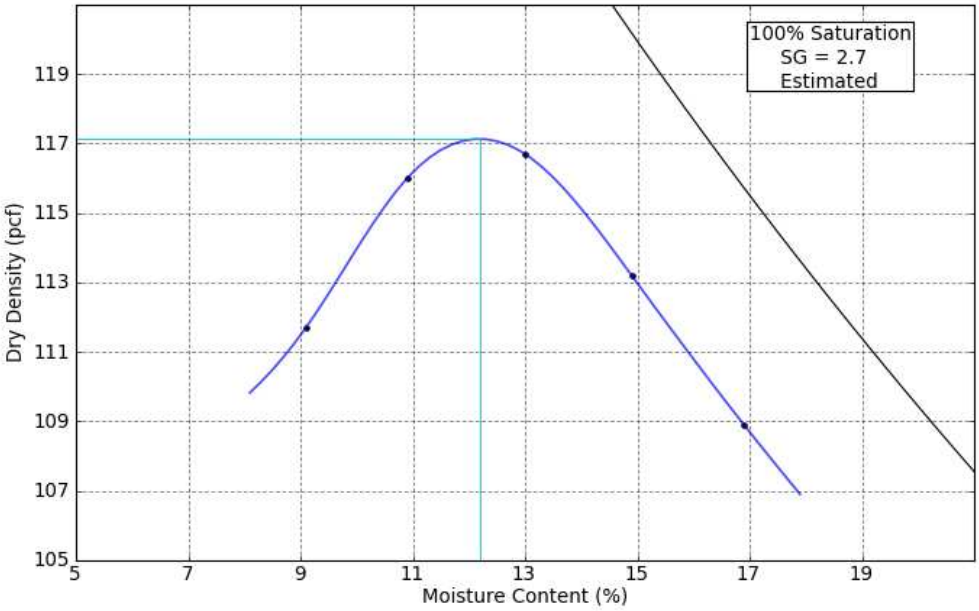
Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Sample Date: 11/22/2016
Report Date: 11/29/2016
Project No.: 04.12164967
Report No.: 0042

Visual Classification: Brown Clayey Sand
Sample Source: Offsite, Mega Sand, 11501 Crosby Lynchburg Rd., Crosby, TX
Supplier: Mega Sand, 11501 Crosby Lynchburg Rd., Crosby, TX
Material Application:

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 117.1 pcf
Optimum Water Content: 12.2 %

Properties:	ASTM D4318
Liquid Limit	30
Plastic Limit	16
Plasticity Index	14
	ASTM D1140
% Passing 200:	46.6

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Mazhar Hassan

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	11/29/2016
		Report Date:	12/01/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0044
Contractor:	Bo-Mac Contractors		

On 11/29/2016, a representative of Fugro Consultants, Inc. visited the above referenced project site to perform the scheduled Field Density Testing. After arrival to the job site, the technician was placed on "stand-by". Testing was later cancelled by the contractor.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors

Sample Date: 11/30/2016
Report Date: 12/01/2016
Project No.: 04.12164967
Report No.: 0045

Construction: Structural Fill, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0042	Brown / Clayey Sand	98	-1/+3	ASTM D698	30	16	14	117.1	12.2

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0042	1		Grid Area 9	6	128.6	108.2	18.9 *	92*

Gauge No.: 1283 Density Std.: 2399 Moisture Std.: 501

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

0412-16-4967

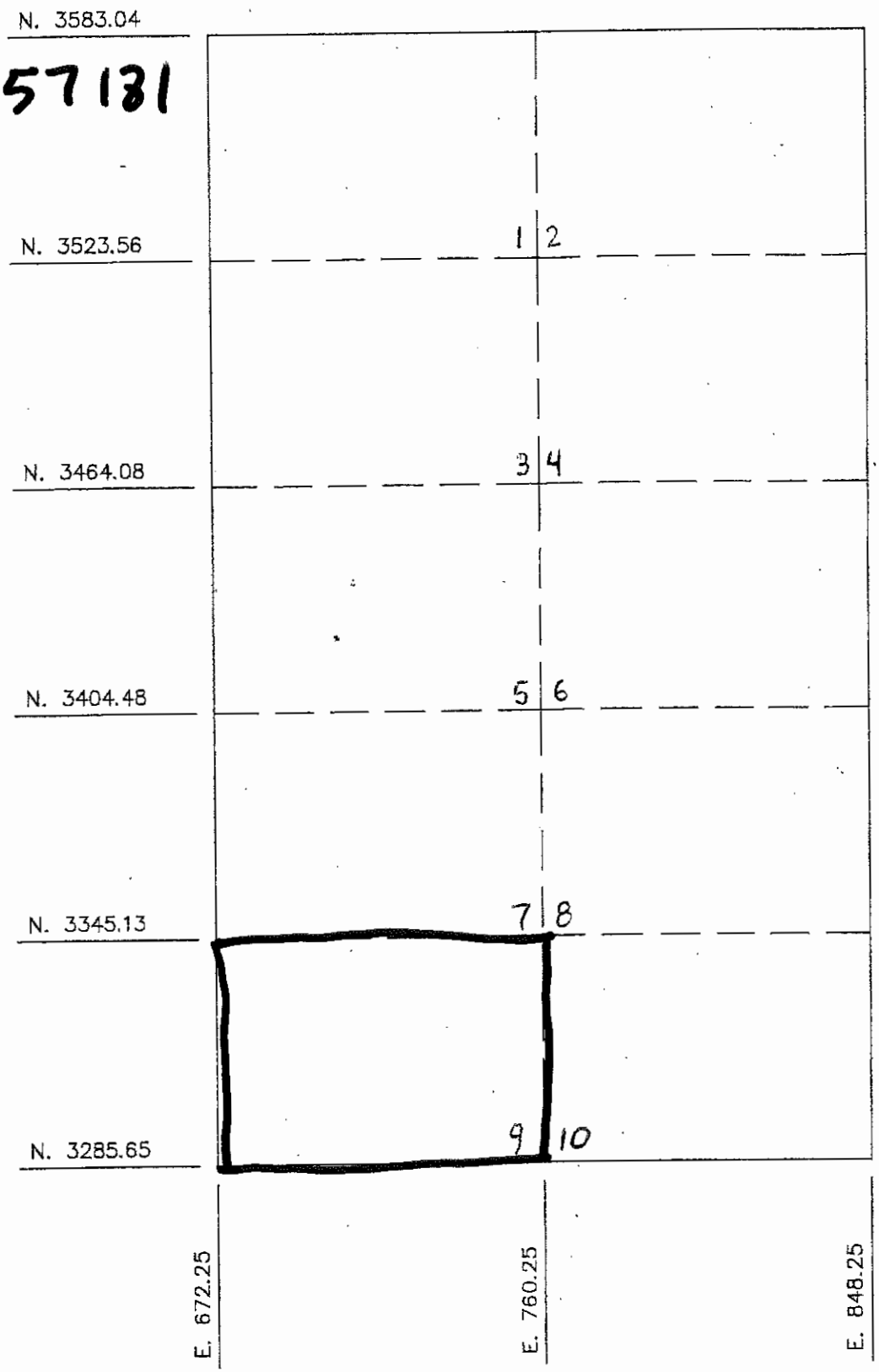
11/30/16

West Basin

Density testing

N

W/O 57181



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors

Sample Date: 12/01/2016
Report Date: 12/02/2016
Project No.: 04.12164967
Report No.: 0046

Construction: Structural Fill, West Basin, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0020	Tan and Light Gray / Sandy Lean Clay	98	-1/+3	ASTM D698	33	13	20	115.6	14.0

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0020	1		RETEST OF TEST NO. 1 FROM REPORT NO. 0045, DATED 11-30-16	6	131.8	114.2	15.4	99
2	0020	1		Area 10	6	131.4	113.6	15.7	98
3	0020	1		Area 7	6	129.4	112.9	14.6	98
4	0020	1		Area 5	6	130.9	114.0	14.8	99
5	0020	1		Area 3	6	130.3	113.1	15.2	98
6	0020	1		Area 10, North End, (Extra)	6	130.5	113.2	15.3	98

Gauge No.: 1283 Density Std.: 2409 Moisture Std.: 504

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

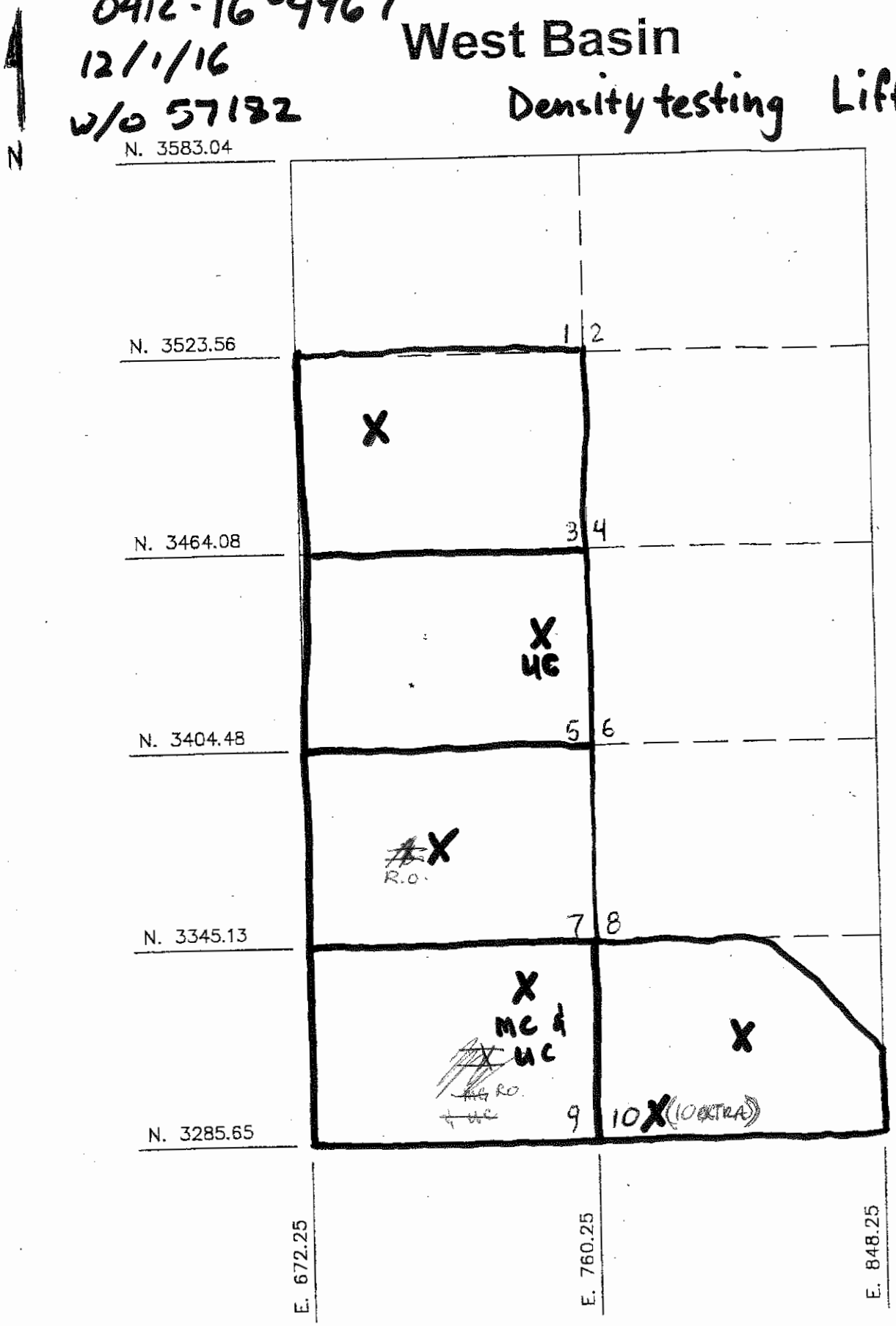
0412-16-4967

12/1/16

w/o 57182

West Basin

Density testing Lift 1



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/01/2016
		Report Date:	12/02/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0046A
Contractor:	Bo-Mac Contractors		

As requested, a Fugro Representative obtained a sample of the structural fill material for moisture content testing.

Sample Location: Density Re-test, Area #9 (See Report 0046)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As received (in-situ) moisture content: 15.3%

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

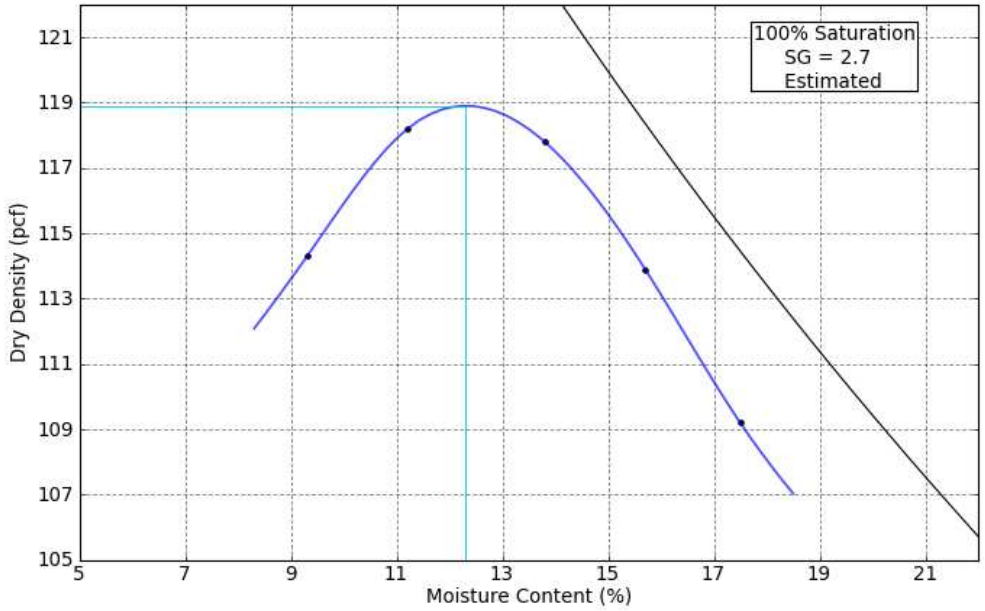
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors

Sample Date: 12/01/2016
Report Date: 12/05/2016
Project No.: 04.12164967
Report No.: 0047

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: Onsite, Area 8, West Basin, Lift 1
Supplier: Mega Sand, Crosby, TX
Material Application: Sturctural Fill

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 118.9 pcf
Optimum Water Content: 12.3 %

Properties:	ASTM D4318
Liquid Limit	31
Plastic Limit	16
Plasticity Index	15
	ASTM D1140
% Passing 200:	50.1

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/01/2016
		Report Date:	12/02/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0048
Contractor:	Bo-Mac Contractors		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/01/2016
Report Date: 12/02/2016
Project No.: 04.12164967
Report No.: 0048

Visual Classification: Backfill; Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin

Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Areas 5 and 7 (Lift 1)	2,300 psf, See Note-1	1,150 psf, See Note-1
Areas 9 and 10 (Lift 1)	2,160 psf, See Note-1	1,080 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 12/14/2016
Report Date: 12/16/2016
Project No.: 04.12164967
Report No.: 0054

Construction: Fill, West Basin, Structural Fill

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0047	Tan and Light Gray / Sandy Lean Clay	98	-1/+3	ASTM D698	31	16	15	118.9	12.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0047	1		Area # 1, (See Attached Sketch)	6	134.1	116.6	15.0	98
2	0047	2		Area # 3, (See Attached Sketch)	6	134.0	116.4	15.1	98

Gauge No.: 1283 Density Std.: 2414 Moisture Std.: 502

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

0412-16-4967

12/14/16

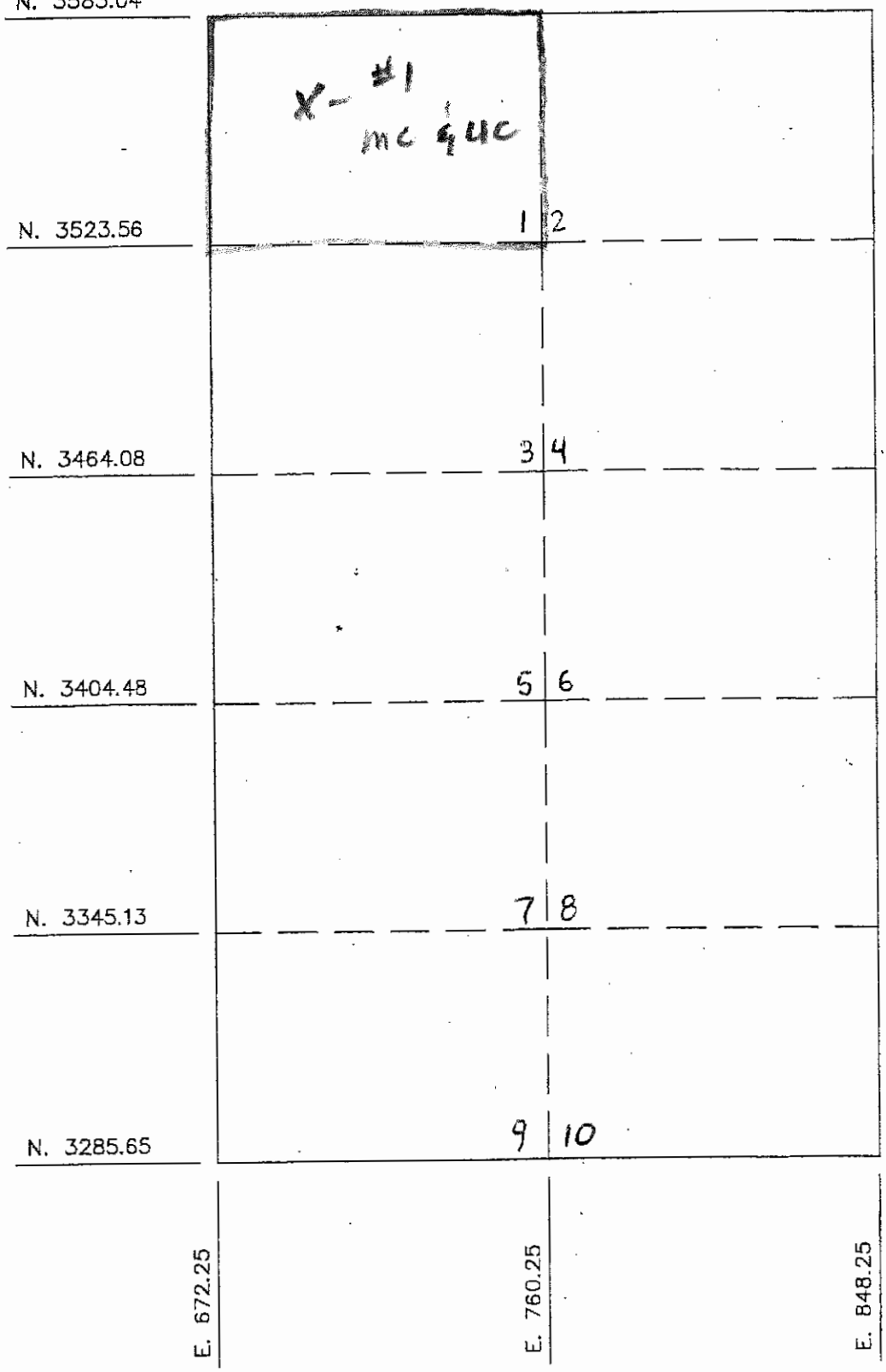
WO 57450-1

West Basin

Density test

1st lift

N



Shell SET East/West Basin Closure

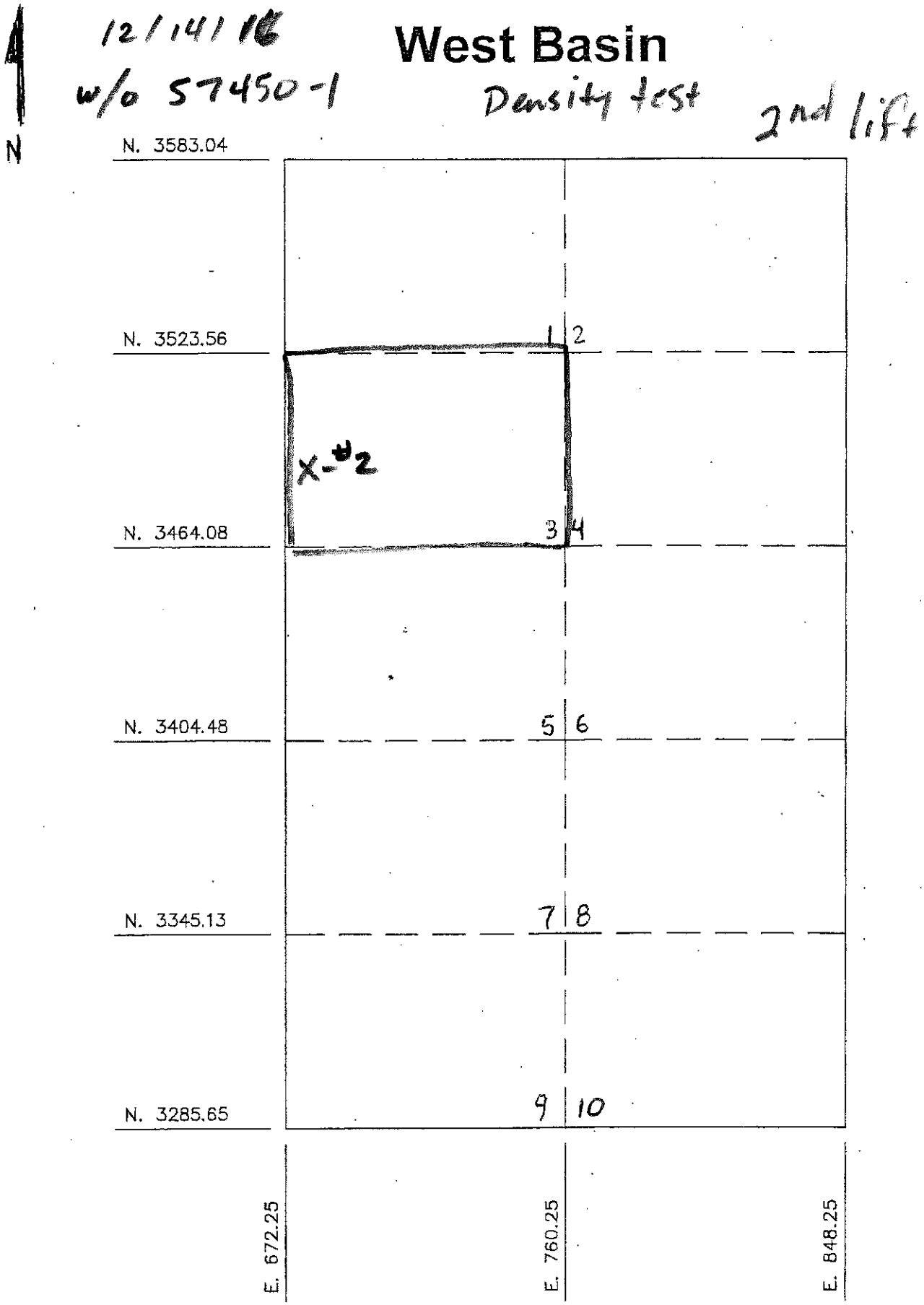
0412-16-4967

12/14/16

w/o 57450-1

West Basin

Density test 2nd lift



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/14/2016
		Report Date:	12/15/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0054A
Contractor:	Bo-Mac Contractors, LTD		

As requested, a Fugro Representative obtained a sample of the structural fill material for moisture content testing.

Sample Location: Density Test #1, Area 1, Lift 1 (See Report 0054)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As received (in-situ) moisture content: 14.1%

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/14/2016
		Report Date:	12/15/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0055
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/14/2016
Report Date: 12/15/2016
Project No.: 04.12164967
Report No.: 0055

Visual Classification: Backfill; Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin

Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Areas 1 and 3 (Lift 1)	3,890 psf, See Note-1	1,945 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 12/15/2016
Report Date: 12/19/2016
Project No.: 04.12164967
Report No.: 0056

Construction: Fill, Structural Fill, West Basin, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0047	Tan and Light Gray / Sandy Lean Clay	98	-1/+3	ASTM D698	31	16	15	118.9	12.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0047	2		Area # 5	6	132.4	117.2	13.0	99
2	0047	2		Area # 7	6	133.2	116.8	14.0	98

Gauge No.: 33077 Density Std.: 2369 Moisture Std.: 561

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East / West Basin Closure
0412-16-4967
12/15/16
W/O 574454

West Basin

Density testing Lift 2

N

N. 3583.04

N. 3523.56

N. 3464.08

N. 3404.48

N. 3345.13

N. 3285.65

1 2

3 4

X-11

5 6

X-12
UC

7 8

9 10

E. 672.25

E. 760.25

E. 848.25

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/15/2016
		Report Date:	12/16/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0057
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/15/2016
Report Date: 12/16/2016
Project No.: 04.12164967
Report No.: 0057

Visual Classification: Backfill; Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin

Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Areas 7 and 5 (Lift 2)	2,450 psf, See Note-1	1,225 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors

Sample Date: 12/16/2016
Report Date: 01/03/2017
Project No.: 04.12164967
Report No.: 0058

Construction: Fill, Structural Fill West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0047	Tan and Light Gray / Sandy Lean Clay	98	-1 to +3	ASTM D698	31	16	15	118.9	12.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0047	2		Area #10	6	133.9	118.7	12.8	100
2	0047	2		Area #9 see attached sketch	6	133.7	117.0	14.3	98
3	0047	2		Area #10 see attached sketch	6	131.5	116.2	13.2	98

Gauge No.: 33077 Density Std.: 2371 Moisture Std.: 553

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East / West Basin Clean

0412-16-4967

12/16/16

W/O 57495

West Basin

Density testing Lift 2

N

N. 3583.04

N. 3523.56

N. 3464.08

N. 3404.48

N. 3345.13

N. 3285.65

E. 672.25

E. 760.25

E. 848.25

1 2

3 4

5 6

7 8

9 10

Ramp

X UC

X UC

X MC

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/16/2016
		Report Date:	12/19/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0058A
Contractor:	Bo-Mac Contractors, LTD		

As requested, a Fugro Representative obtained a sample of the structural fill material for moisture content testing.

Sample Location: Area 9, Lift 2, Density Test #2 (See Report 0058)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As Received (in-situ) Moisture Content: 14.2%

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/16/2016
Report Date: 12/19/2016
Project No.: 04.12164967
Report No.: 0059

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 8 (Lift 2)	7,920 psf, See Note-1	3,960 psf, See Note-1
Areas 10 (Lift 2)	4,610 psf, See Note-1	2,305 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 12/16/2016
Report Date: 12/20/2016
Project No.: 04.12164967
Report No.: 0060

Fugro Consultants, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	Onsite, Area 2, Lift 1	32	15	17	52.3	Tan and Light Gray Sandy Lean Clay

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, Ltd

Sample Date: 12/19/2016
Report Date: 12/27/2016
Project No.: 04.12164967
Report No.: 0061

Construction: Fill, Structural Fill, West Basin, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0047	Tan and Light Gray / Sandy Lean Clay	98	-1/+3	ASTM D698	31	16	15	118.9	12.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0047	3		Area 3	6	133.5	119.4	11.8	100+
2	0047	2		Area 1	6	132.3	117.0	13.1	98
3	0047	1		Area 2	6	131.4	117.7	11.6	99
4	0047	1		Area 4	6	131.7	115.9	13.6	98

Gauge No.: 33077 Density Std.: 2382 Moisture Std.: 555

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET Eastward Basin closure

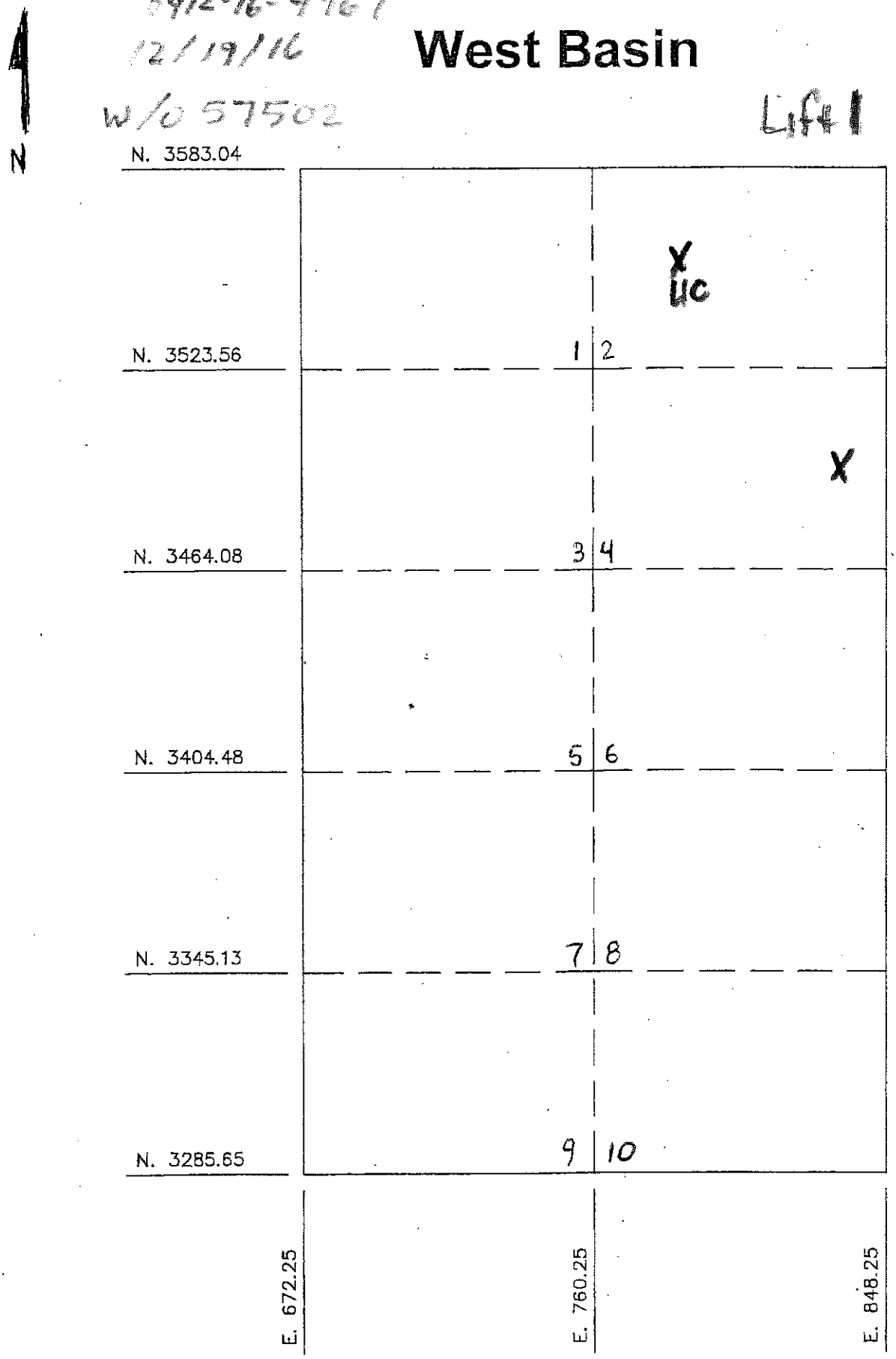
912-16-4967

12/19/16

w/o 57502

West Basin

Lift 1



Shell SET East/west Basin Closure

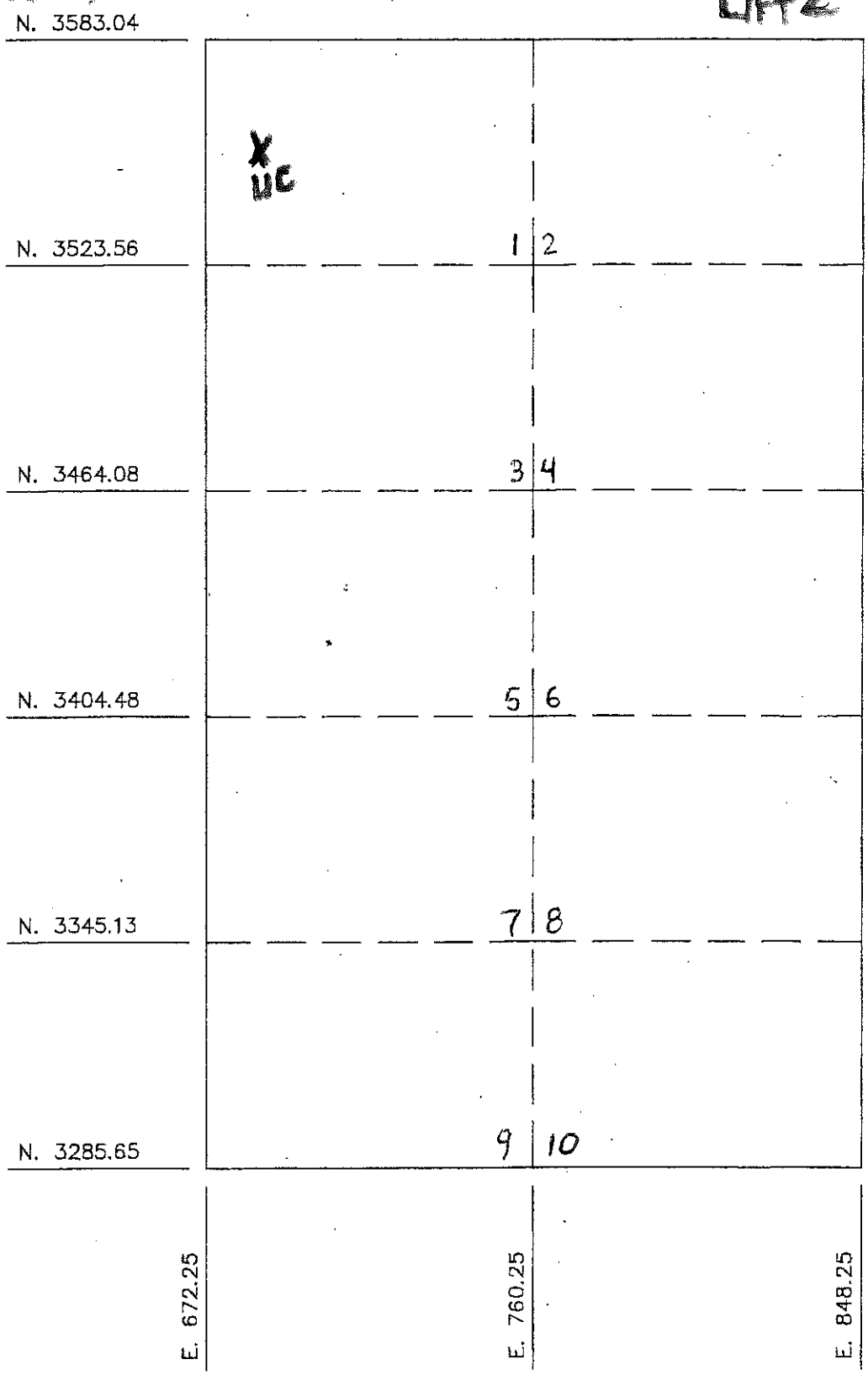
D412-16-9967

12/19/16

WO 57502

Lift 2

West Basin



Shell SET East/West Basin closure

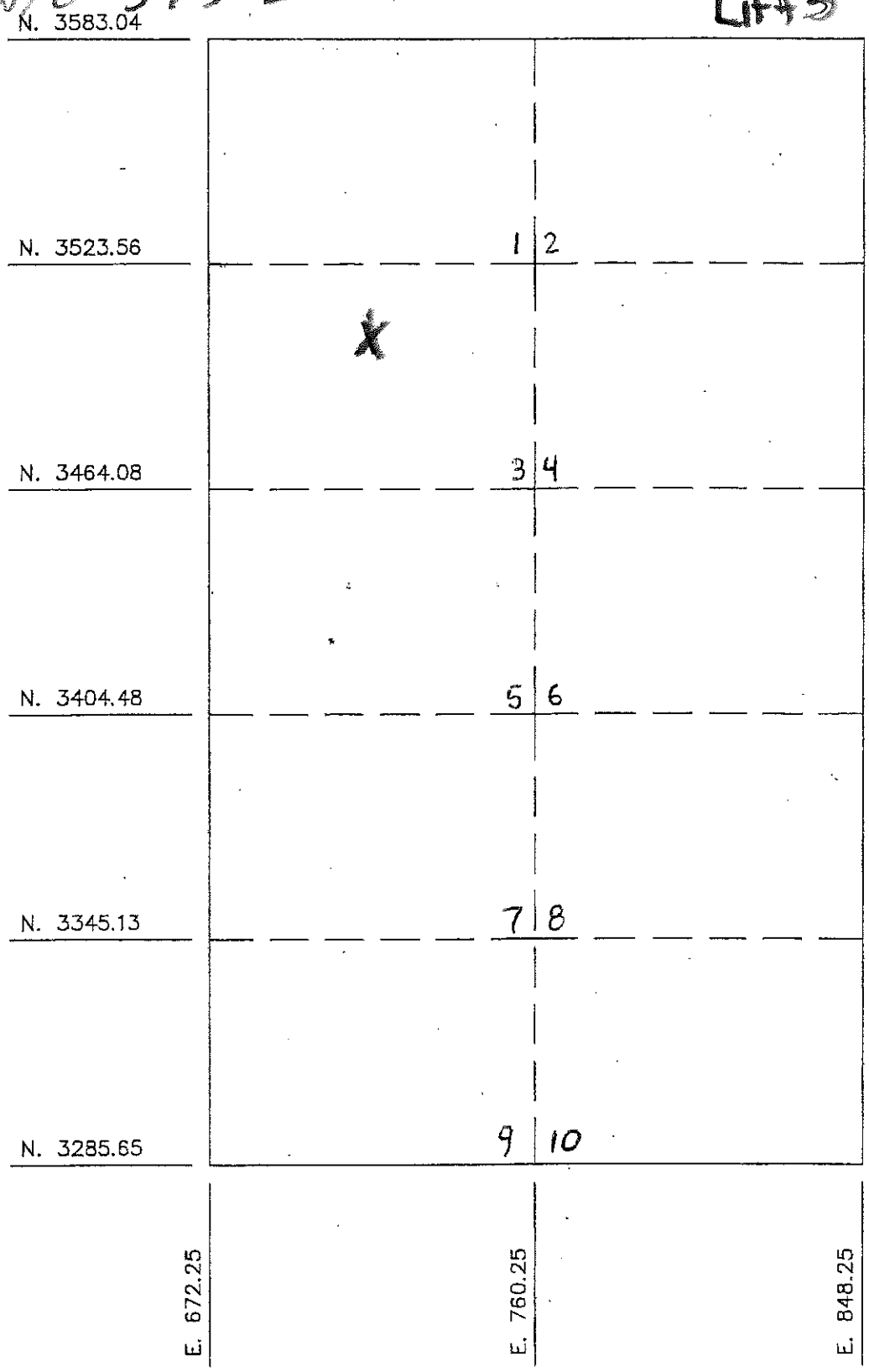
0412-16-4967

12/19/16

W/O 57502

West Basin

Lift 3



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/19/2016
		Report Date:	12/20/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0062
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/19/2016
Report Date: 12/20/2016
Project No.: 04.12164967
Report No.: 0062

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 2 (Lift 1)	2,160 psf, See Note-1	1,080 psf, See Note-1
Areas 1 (Lift 2)	3,025 psf, See Note-1	1,515 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, Ltd

Sample Date: 12/20/2016
Report Date: 12/27/2016
Project No.: 04.12164967
Report No.: 0063

Construction: Fill, Structural Fill, West Basin, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0047	Tan and Light Gray / Sandy Lean Clay	98	-1/+3	ASTM D698	31	16	15	118.9	12.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0047	3		Area 5 See Attached Sketch	6	130.3	116.0	12.3	98

Gauge No.: 33077 Density Std.: 2374 Moisture Std.: 560

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

0412-16-4967

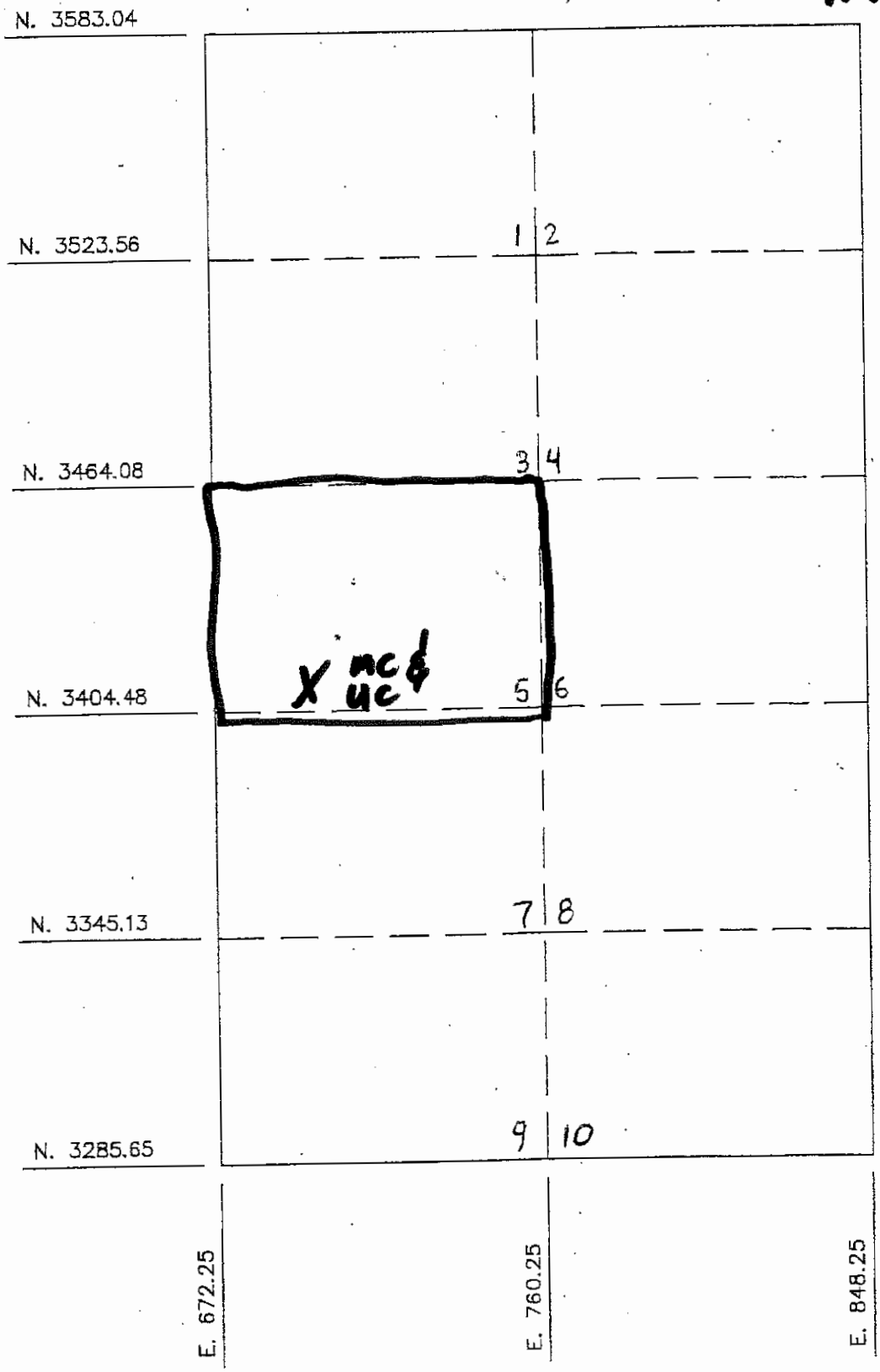
12/20/16

W/O 57538

West Basin

Density testing Lift 3

N



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/20/2016
		Report Date:	12/22/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0063A
Contractor:	Bo-Mac Contractors, LTD		

As requested, a Fugro Representative obtained a sample of the structural fill material for moisture content testing.

Sample Location: Area 5, Lift 3 (See Report 0063)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As Received (in-situ) Moisture Content: 11.9%

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/20/2016
		Report Date:	12/21/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0064
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/20/2016
Report Date: 12/21/2016
Project No.: 04.12164967
Report No.: 0064

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 5 (Lift 3)	2,160 psf, See Note-1	1,080 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

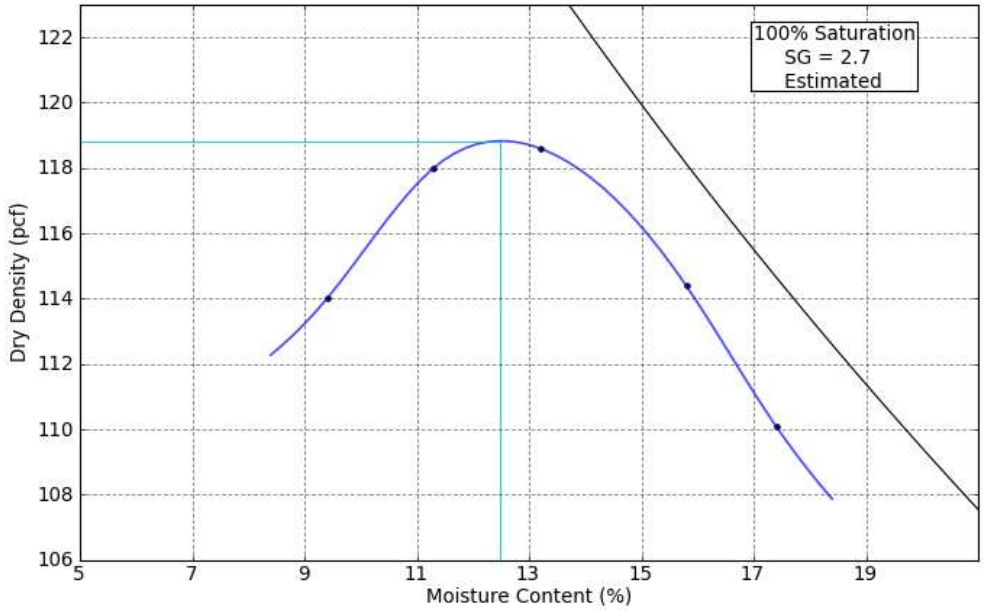
Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/20/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Report Date:**	12/27/2016
		Project No.:	04.12164967
		Report No.:	0065
Contractor:	Bo-Mac Contractors, LTD		

Visual Classification: Tan and Light Gray Clayey Sand
Sample Source: Onsite, Area 5, Lift 3
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 118.8 pcf
Optimum Water Content: 12.5 %

Properties:	ASTM D4318
Liquid Limit	34
Plastic Limit	15
Plasticity Index	19
	ASTM D1140
% Passing 200:	46.7

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

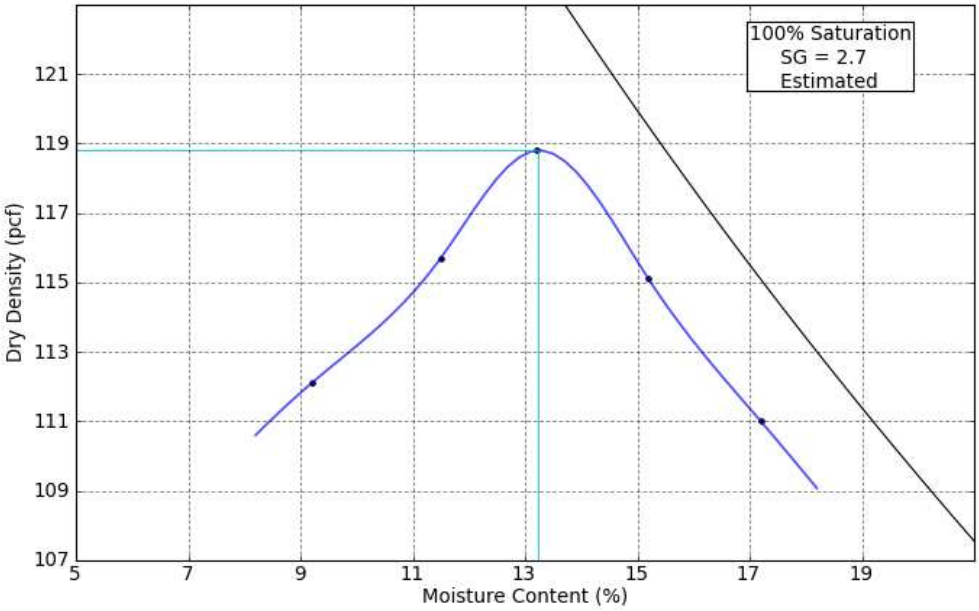
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 12/20/2016
Report Date: 12/27/2016
Project No.: 04.12164967
Report No.: 0066

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: Onsite, Area 3, Lift 4
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 118.8 pcf
Optimum Water Content: 13.2 %

Properties:	ASTM D4318
Liquid Limit	36
Plastic Limit	15
Plasticity Index	21
	ASTM D1140
% Passing 200:	50.0

Remarks: CMT Form S-003ELM (Revised 08/11)
TEST RESULTS FOR PLASTICITY INDEX (PI) DO NOT MEET PROJECT SPECIFICATIONS: MINIMUM 10, MAXIMUM 20

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/21/2016
		Report Date:	12/22/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0068
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/21/2016
Report Date: 12/22/2016
Project No.: 04.12164967
Report No.: 0068

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Backfill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 6 (Lift 1)	5,760 psf, See Note-1	2,880 psf, See Note-1
Area 8 (Lift 3)	2,590 psf, See Note-1	1,295 psf, See Note-1
Area 9 (Lift 3)	2,880 psf, See Note-1	1,440 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, Ltd

Sample Date: 12/22/2016
Report Date: 12/29/2016
Project No.: 04.12164967
Report No.: 0069

Construction: Fill, Structural Fill, West Basin, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0065	Tan and Light Gray / Clayey Sand	98	-1/+3	ASTM D698	34	15	19	118.8	12.5

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0065	4		Area 4	6	131.2	116.1	13.0	98

Gauge No.: 1283 Density Std.: 2411 Moisture Std.: 496

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09) Due to variations in the starting elevations of the recycled sludge bottom and leveling up of structured fill across the West basin, starting 12/22/16 all areas moved the 4th lift to make tracking and reporting of tests easier. 4th lift if the first lift to cover all recycled sludge high areas. Area 1, lift 3 skipped and moved to lift 4, Areas 2, 4, and 6, lifts 2 and 3 skipped and moved to lift 4. See attached sketch

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East / West Basin Closure

0412-16-4967

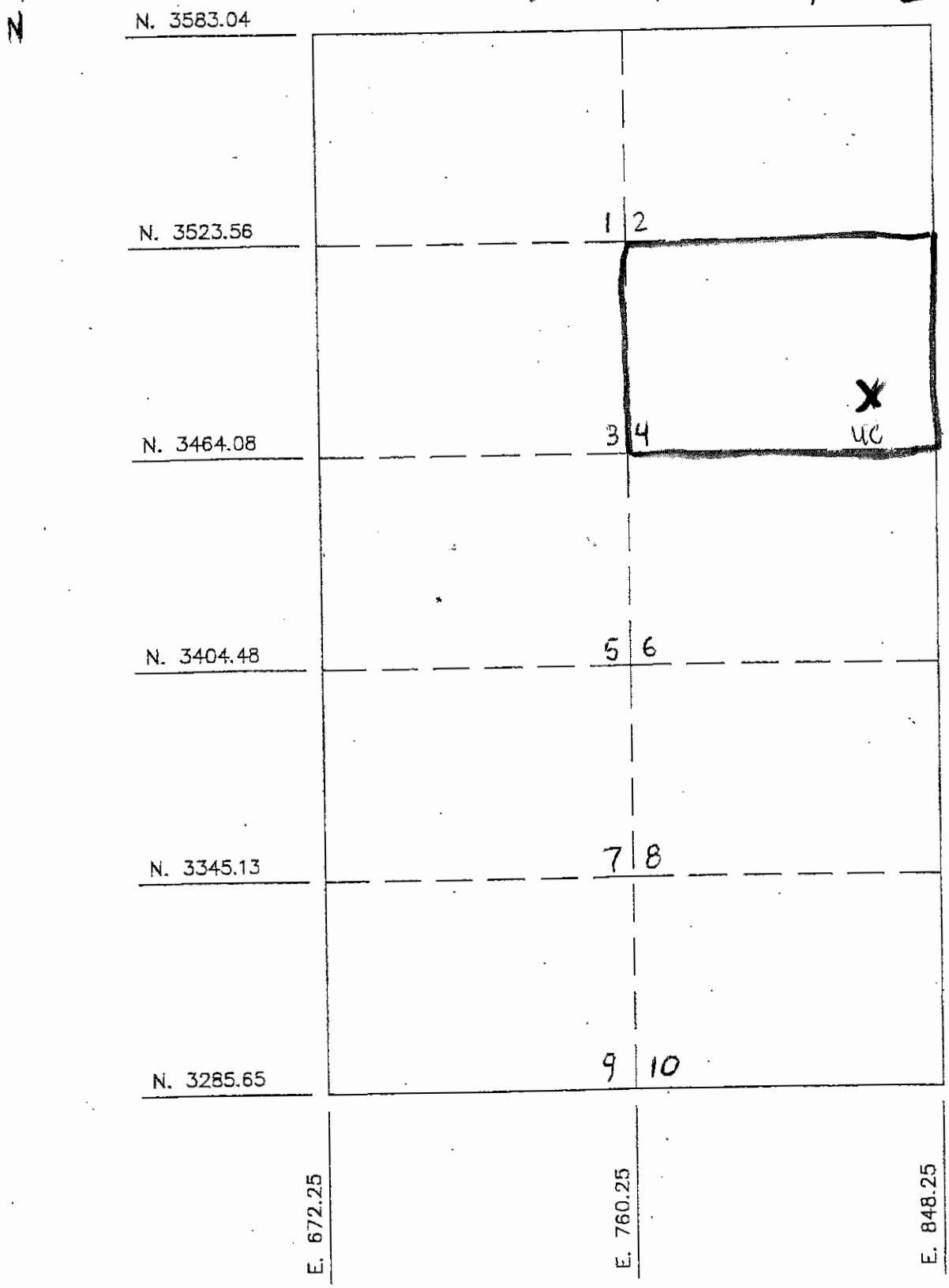
12/22/16

w/o 57595

West Basin

Density Testing

Lift 4

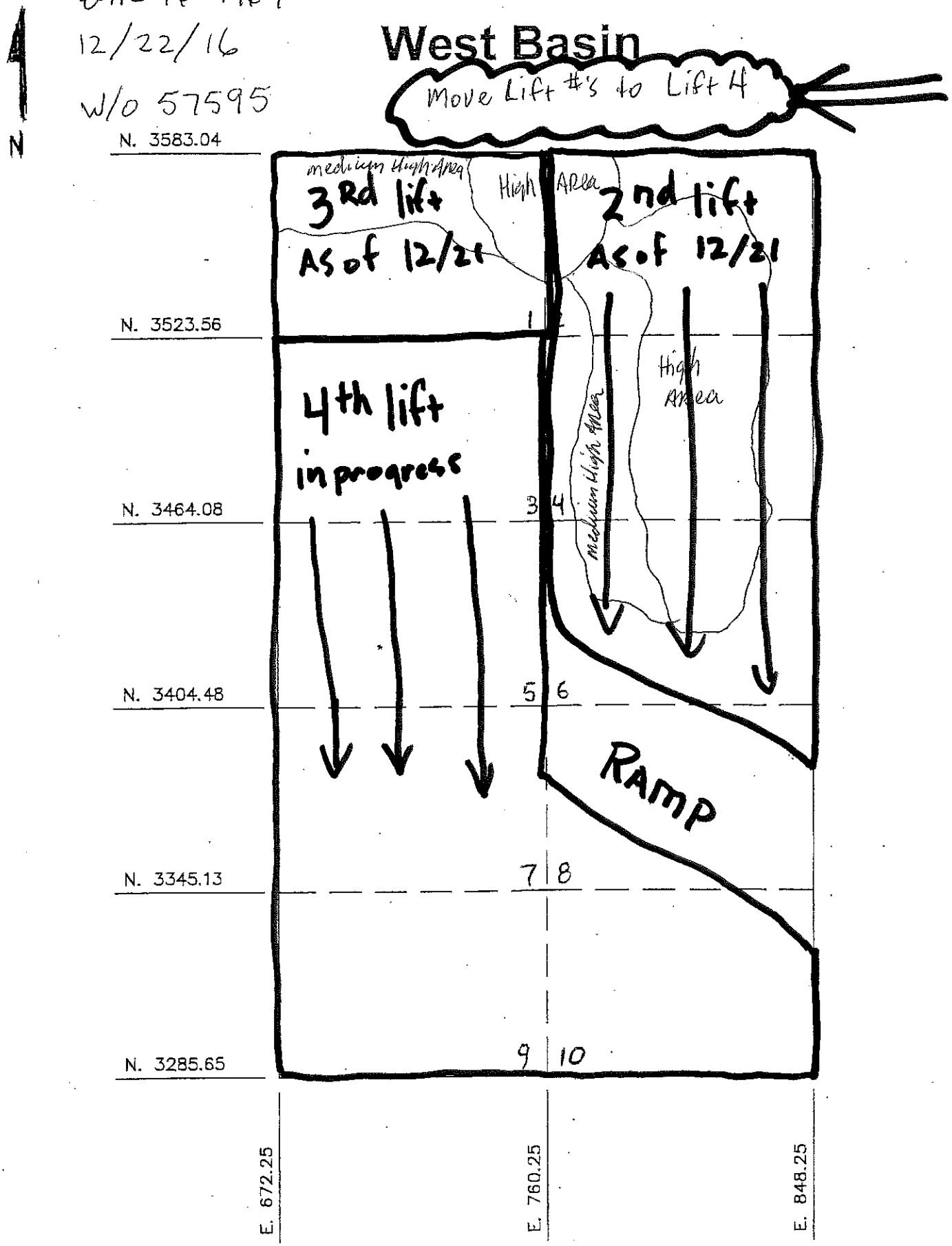


Shell SET East/West Basin Closure

0412.16-4967

12/22/16

W/O 57595



Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	12/22/2016
		Report Date:	12/27/2016
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0070
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro Consultants, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro Consultants, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424
CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 12/22/2016
Report Date: 12/27/2016
Project No.: 04.12164967
Report No.: 0070

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 4 (Lift 4)	2,015 psf, See Note-1	1,010 psf, See Note-1

Note-1: Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/03/2017
		Report Date:	01/04/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0071
Contractor:	Bo-Mac Contractors, LTD		

On 01/03/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Field Density Testing. After arrival to the job site, the testing was cancelled by the contractor due to plant access issues.

Technician arrived at gate # 34, proceeded to the TWIC activation area to update TWIC card.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/10/2017
Report Date: 01/12/2017
Project No.: 04.12164967
Report No.: 0072

Construction: Structural Fill, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0065	Tan and Light Gray / Clayey Sand	98	-1/+3	ASTM D698	34	15	19	118.8	12.5

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0065	4		Area 5, (See Attached Sketch)	6	132.1	116.0	13.9	98

Gauge No.: 1283 Density Std.: 2393 Moisture Std.: 497

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

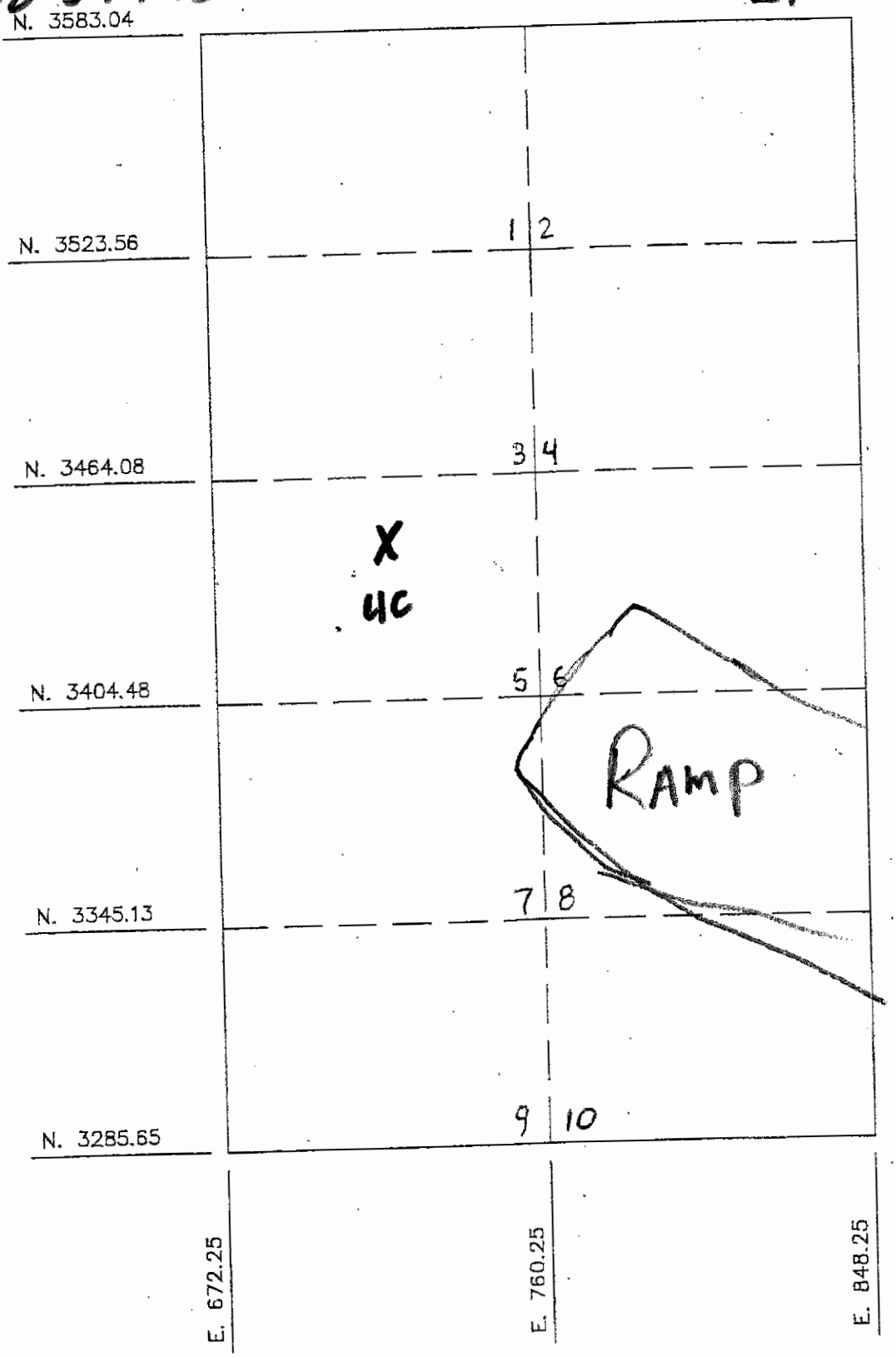
REPORT CREATED BY ElmTree SYSTEM

Shell SGT East/West Basin Closure

0412-16-4967
1/10/17
w/o 57773

West Basin

Lift 4



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/10/2017
		Report Date:	01/11/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0073
Contractor:	Bo-Mac Contractors, LTD		

Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Anwar S. Akhtar, P.E.
Construction Services Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/10/2017
Report Date: 01/11/2017
Project No.: 04.12164967
Report No.: 0073

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 5 (Lift 4), See Attached Sketch	2,020 psf, See Note-1	1,010 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

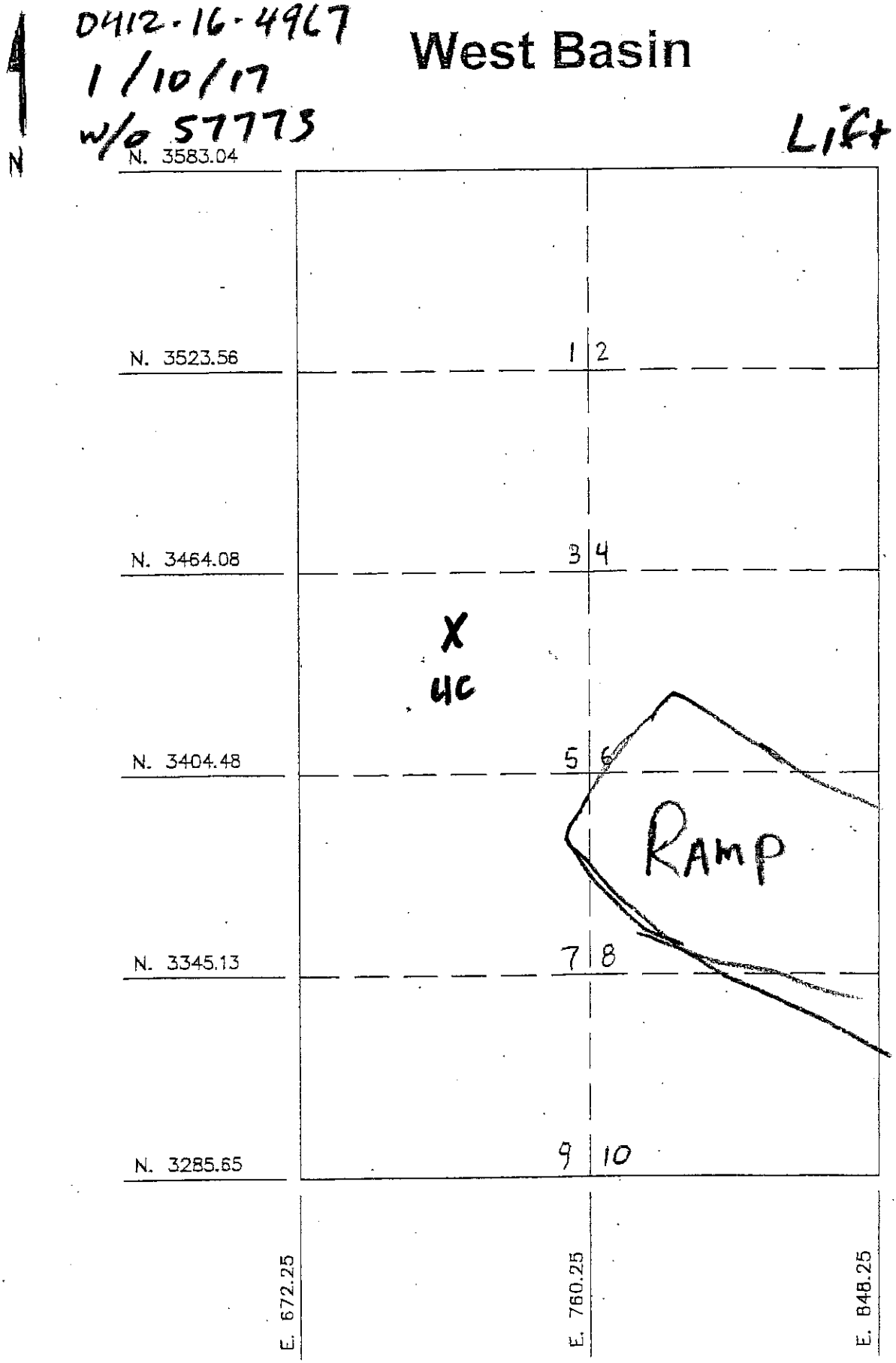
The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SGT East/West Basin Closure

0412-16-4967
1/10/17
w/o 57773

West Basin

Lift 4



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/11/2017
Report Date: 01/12/2017
Project No.: 04.12164967
Report No.: 0074

Construction: Fill, Structural Fill, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0065	Tan and Light Gray / Clayey Sand	98	-1/+3	ASTM D698	34	15	19	118.8	12.5

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0065	4		Area 3, (See Attached Sketch)	6	135.7	117.9	15.1	99
2	0065	4		Area 1, (See Attached Sketch)	6	133.4	116.2	14.8	98
3	0065	4		Area 2, (See Attached Sketch)	6	134.0	118.1	13.5	99

Gauge No.: 1283 Density Std.: 2390 Moisture Std.: 504

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

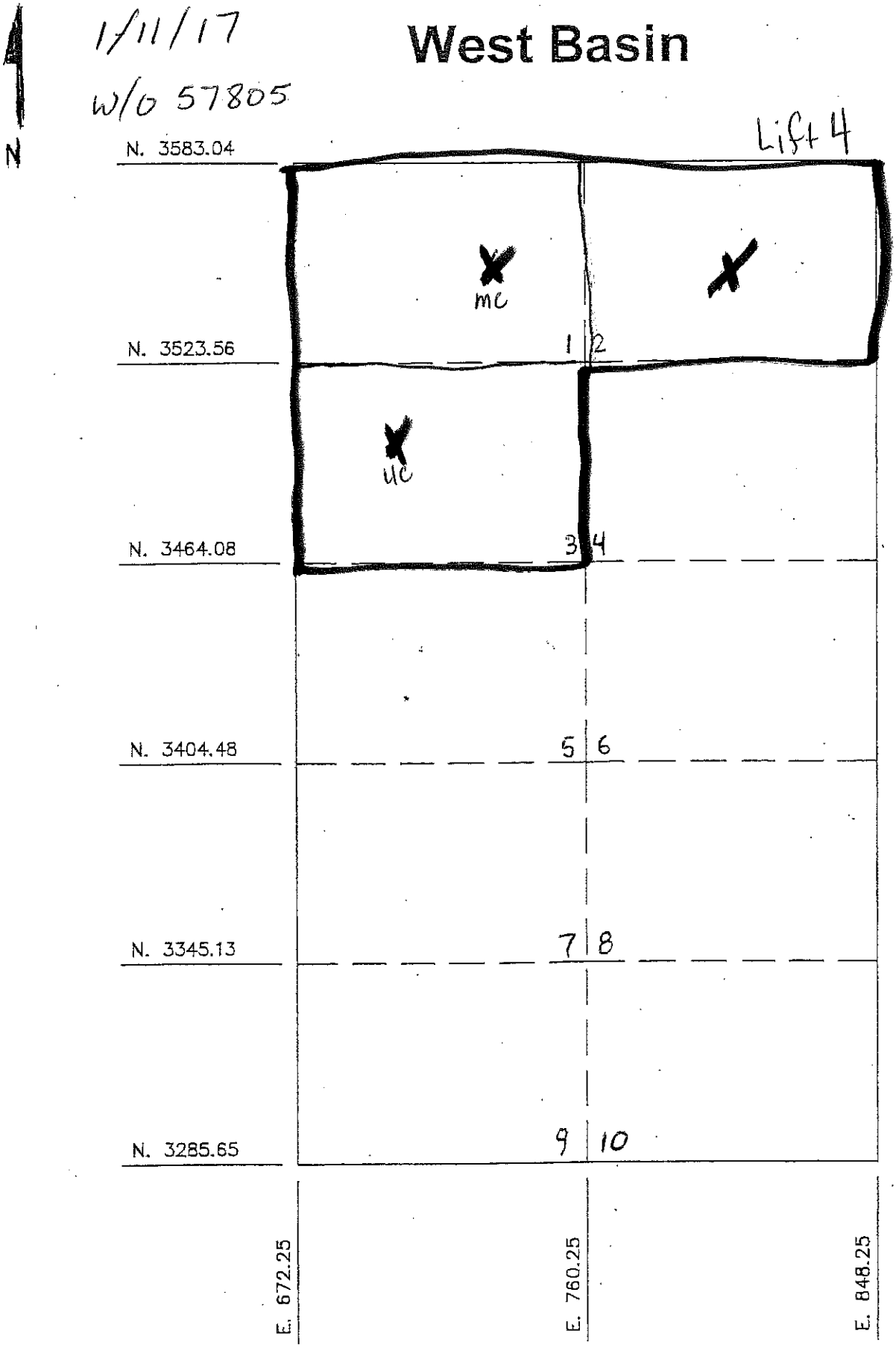
Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East / West Basin Closure
0412-16-4967
1/11/17
W/O 57805

West Basin



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/11/2017
		Report Date:	01/13/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0074A
Contractor:	Bo-Mac Contractors, LTD		

As requested, a Fugro Representative picked up sample of the structural fill material for moisture content testing.

Sample Location: Area 1, Lift 4 (See Report 0074)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As Received (in-situ) Moisture Content: 13.7%

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/11/2017
		Report Date:	01/12/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0075
Contractor:	Bo-Mac Contractors, LTD		

Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/11/2017
Report Date: 01/12/2017
Project No.: 04.12164967
Report No.: 0075

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 3 (Lift 4), See Attached Sketch	2,160 psf, See Note-1	1,080 psf, See Note-1

Note-1:

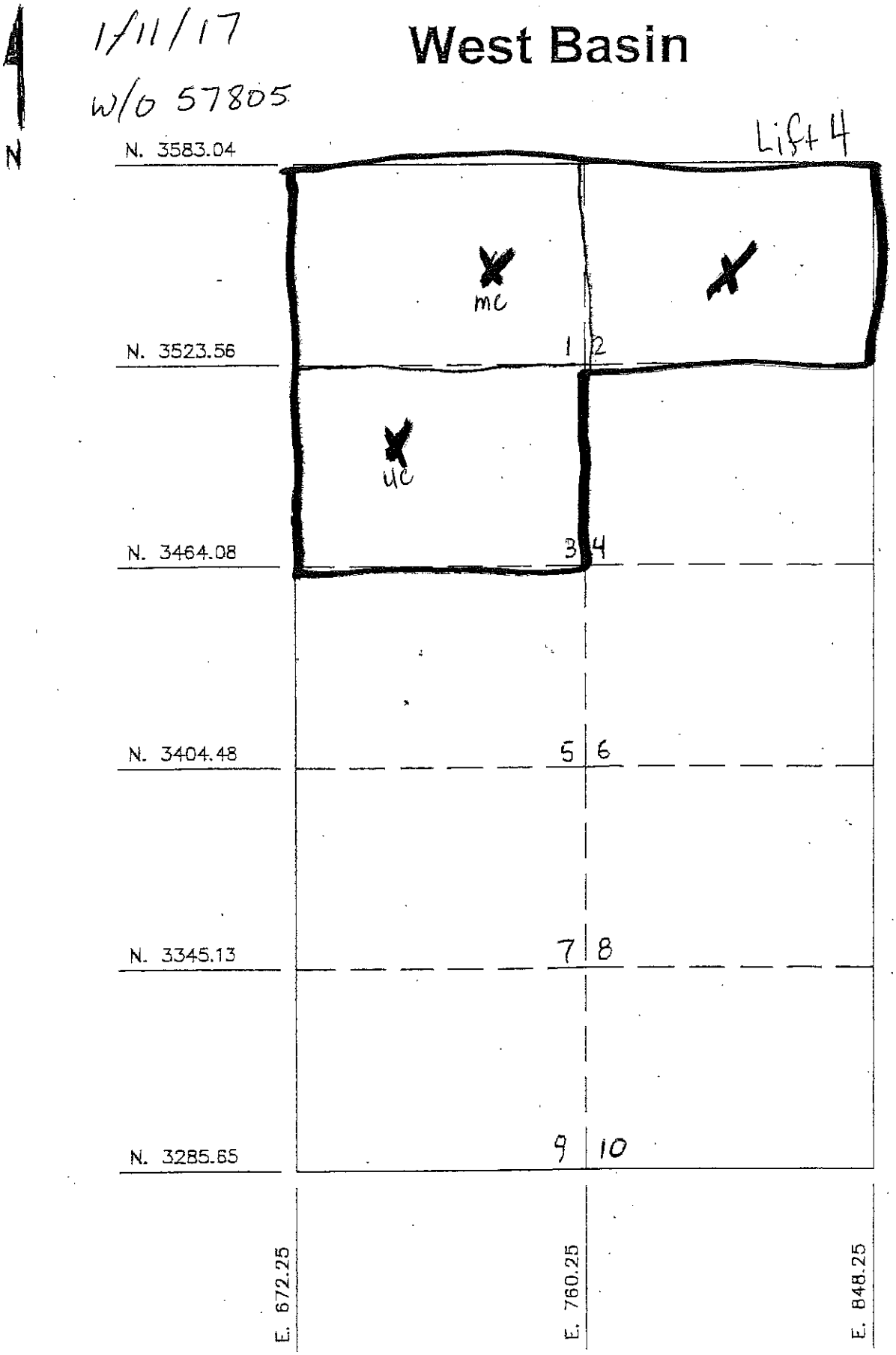
-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East / West Basin Closure
0412-16-4967
1/11/17
w/o 57805



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/12/2017
Report Date: 01/16/2017
Project No.: 04.12164967
Report No.: 0076

Construction: Fill, Structural Fill, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0065	Tan and Light Gray / Clayey Sand	98	-1/+3	ASTM D698	34	15	19	118.8	12.5
0066	Tan and Light Gray / Sandy Lean Clay	98	-1/+3	ASTM D698	36	15	21	118.8	13.2

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0065	4		Area 7, (See Attached Sketch)	6	134.0	116.7	14.8	98
2	0066	5		Area 1, (See Attached Sketch)	6	134.4	116.3	15.6	98

Gauge No.: 1283 Density Std.: 2405 Moisture Std.: 503

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

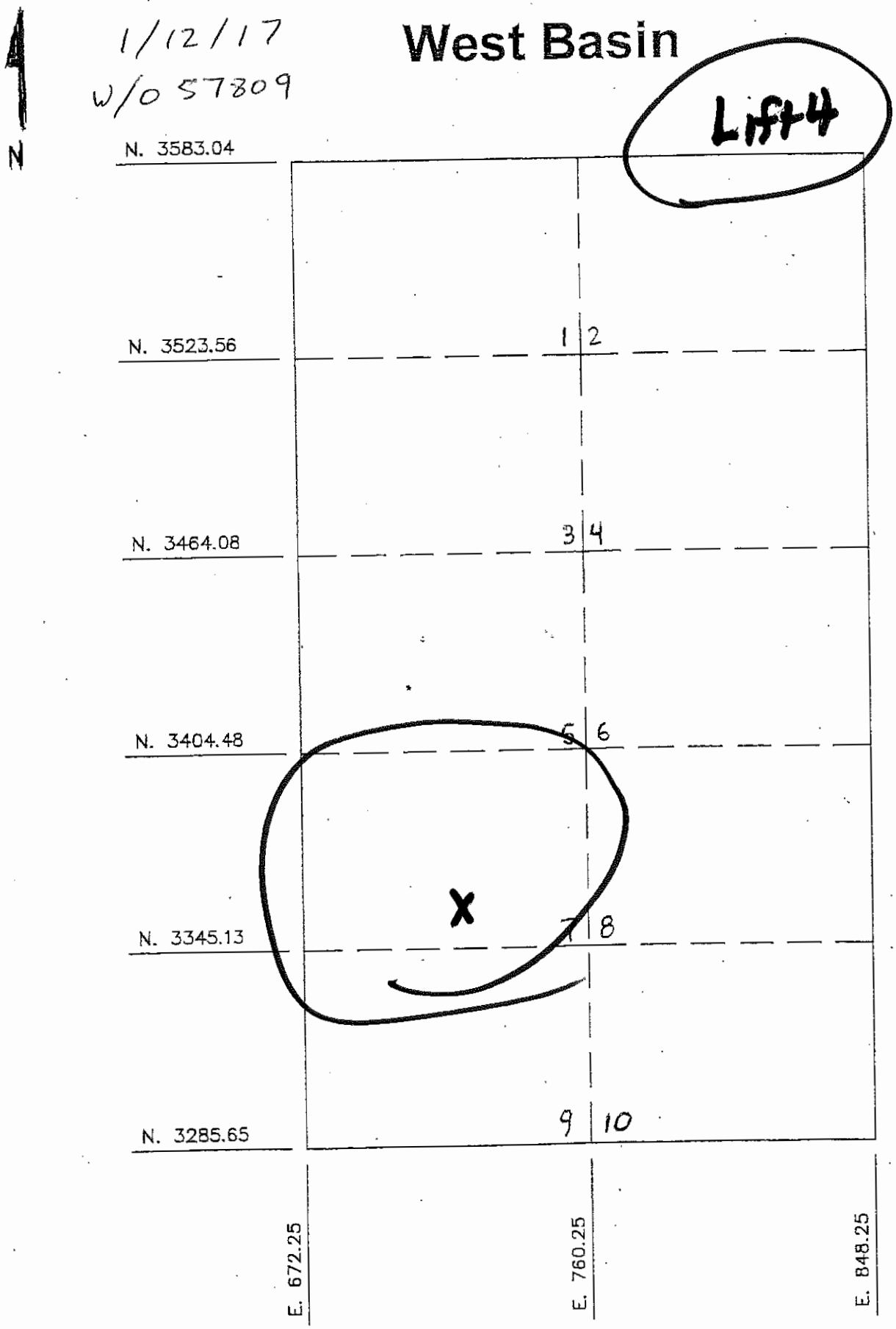
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure
0412.16.4967
1/12/17
W/O 57809



Shell SET East / West Basin Closure
0412-16-4967
1/12/17
W/O 57809

West Basin

Lift 5

N

N. 3583.04
N. 3523.56
N. 3464.08
N. 3404.48
N. 3345.13
N. 3285.65

E. 672.25
E. 760.25
E. 848.25

X
UC

-200
4 PI

1 2
3 4
5 6
7 8
9 10

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/12/2017
		Report Date:	01/13/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0077
Contractor:	Bo-Mac Contractors, LTD		

Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/12/2017
Report Date: 01/13/2017
Project No.: 04.12164967
Report No.: 0077

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 1 (Lift 5), See Attached Sketch	2,300 psf, See Note-1	1,150 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

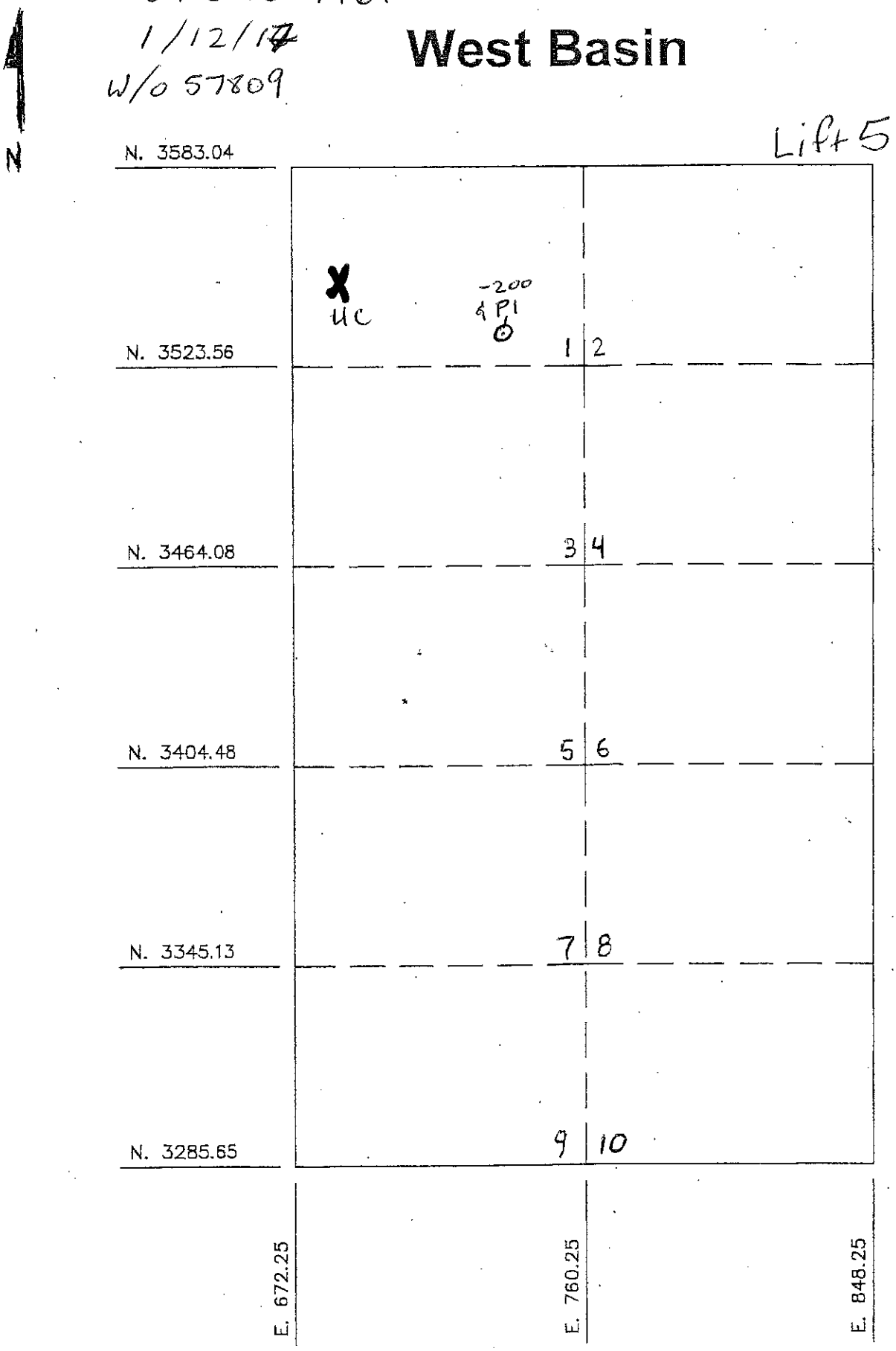
-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East / West Basin Closure
0412-16-4967
1/12/17
W/O 57809

West Basin



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/12/2017
Report Date: 01/18/2017
Project No.: 04.12164967
Report No.: 0078

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	Onsite, Area 1, Lift 5	26	15	11	50.1	Tan and Light Gray Sandy Lean Clay

Project Specification: Plasticity Index (PI): Minimum 10 Maximum 20

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/13/2017
Report Date: 01/19/2017
Project No.: 04.12164967
Report No.: 0079

Construction: Structural Fill, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0065	Tan and Light Gray / Clayey Sand	98	-1/+3	ASTM D698	34	15	19	118.8	12.5

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0065	5		Area 2, (See Attached Sketch)	6	134.1	116.6	15.0	98
2	0065	4		Area 6, (See Attached Sketch)	6	135.3	118.2	14.5	100

Gauge No.: 1283 Density Std.: 2401 Moisture Std.: 507

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

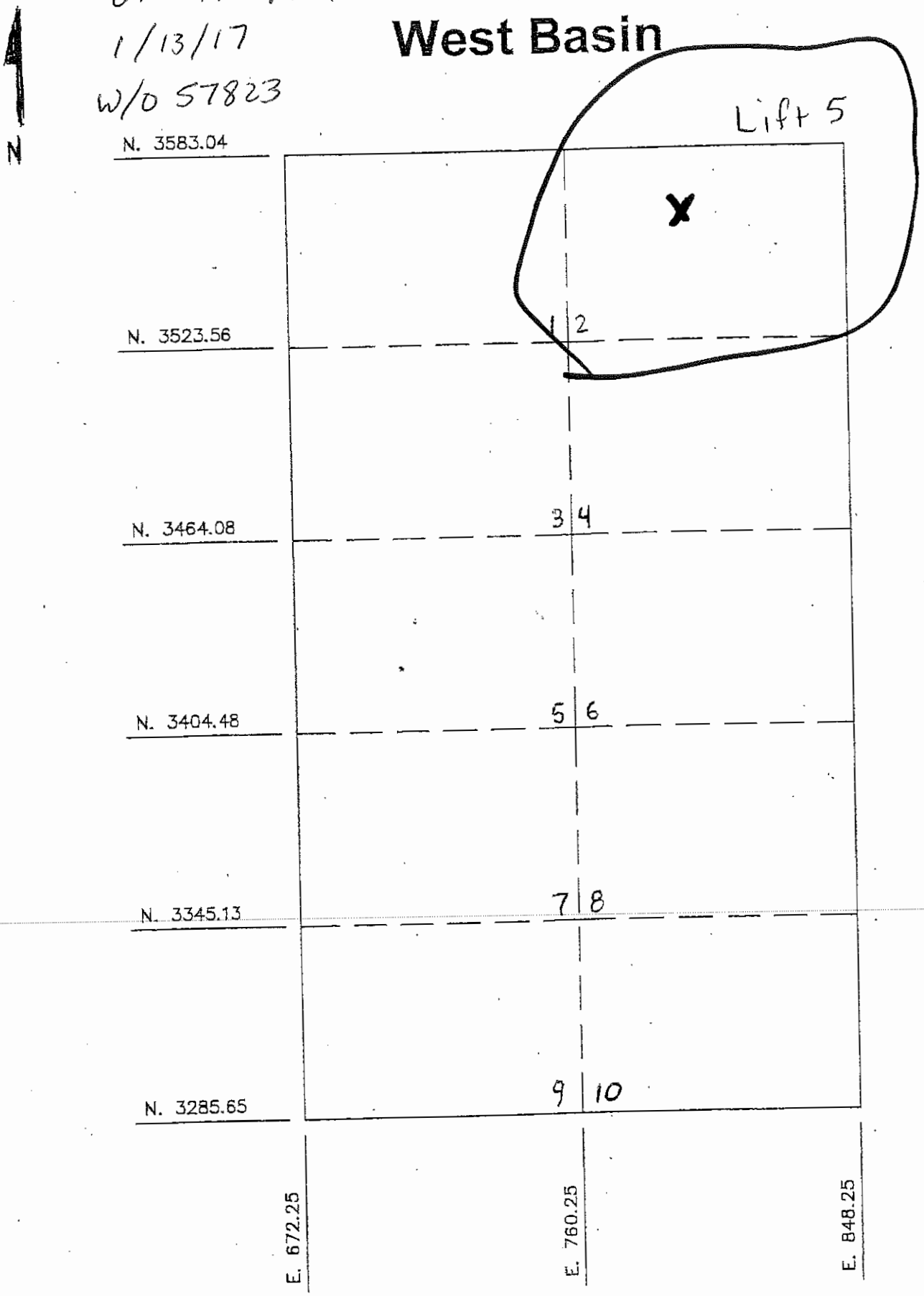
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

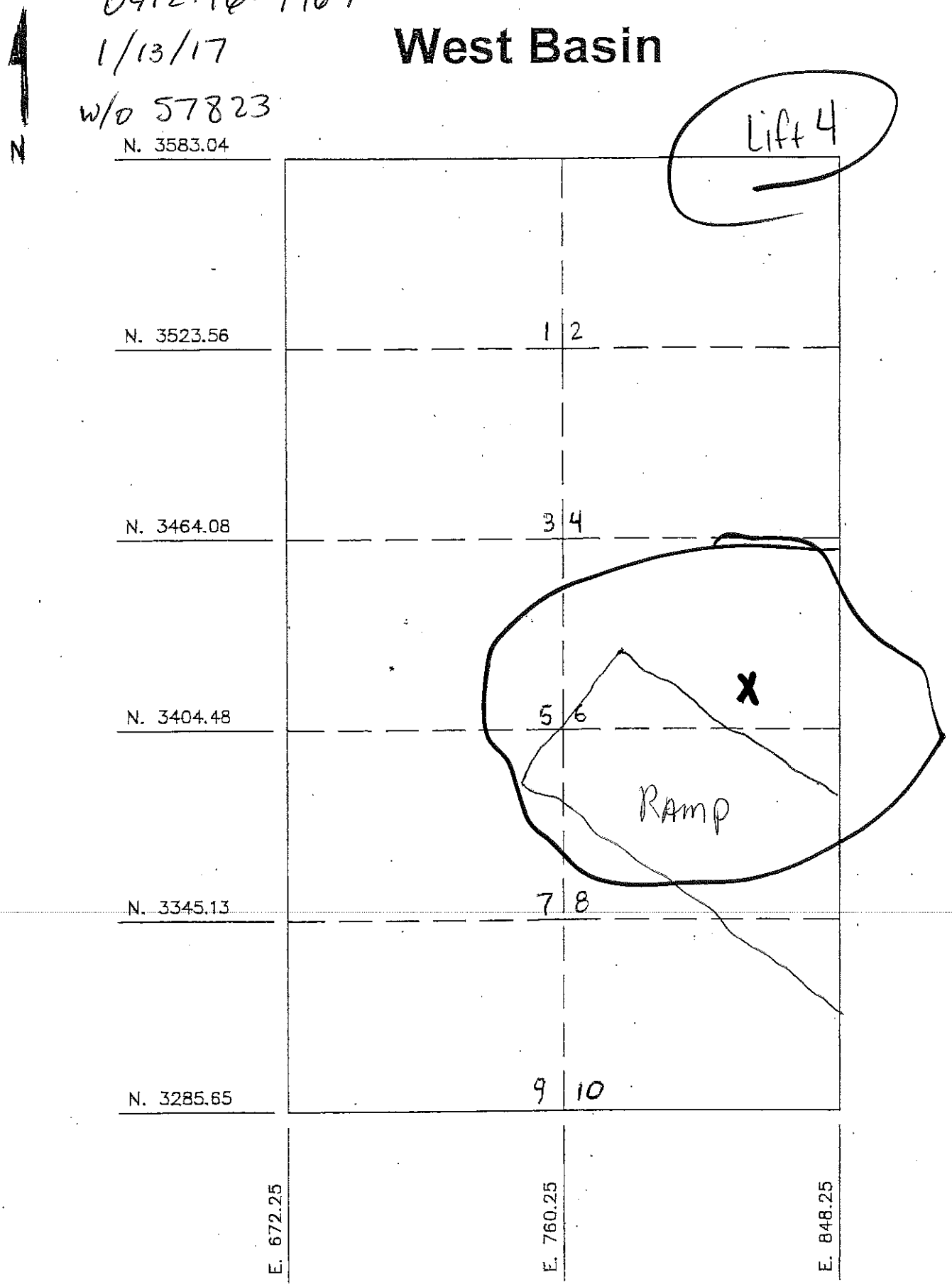
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET ~~East~~ / West Basin Closure
0412-16-4967
1/13/17
W/O 57823



Shell SET East/West Basin Closure
0412-16-4967
1/13/17
w/o 57823



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/13/2017
		Report Date:	01/16/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0080
Contractor:	Bo-Mac Contractors, LTD		

Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/13/2017
Report Date: 01/16/2017
Project No.: 04.12164967
Report No.: 0080

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 6 (Lift 4), See Attached Sketch	2,880 psf, See Note-1	1,440 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

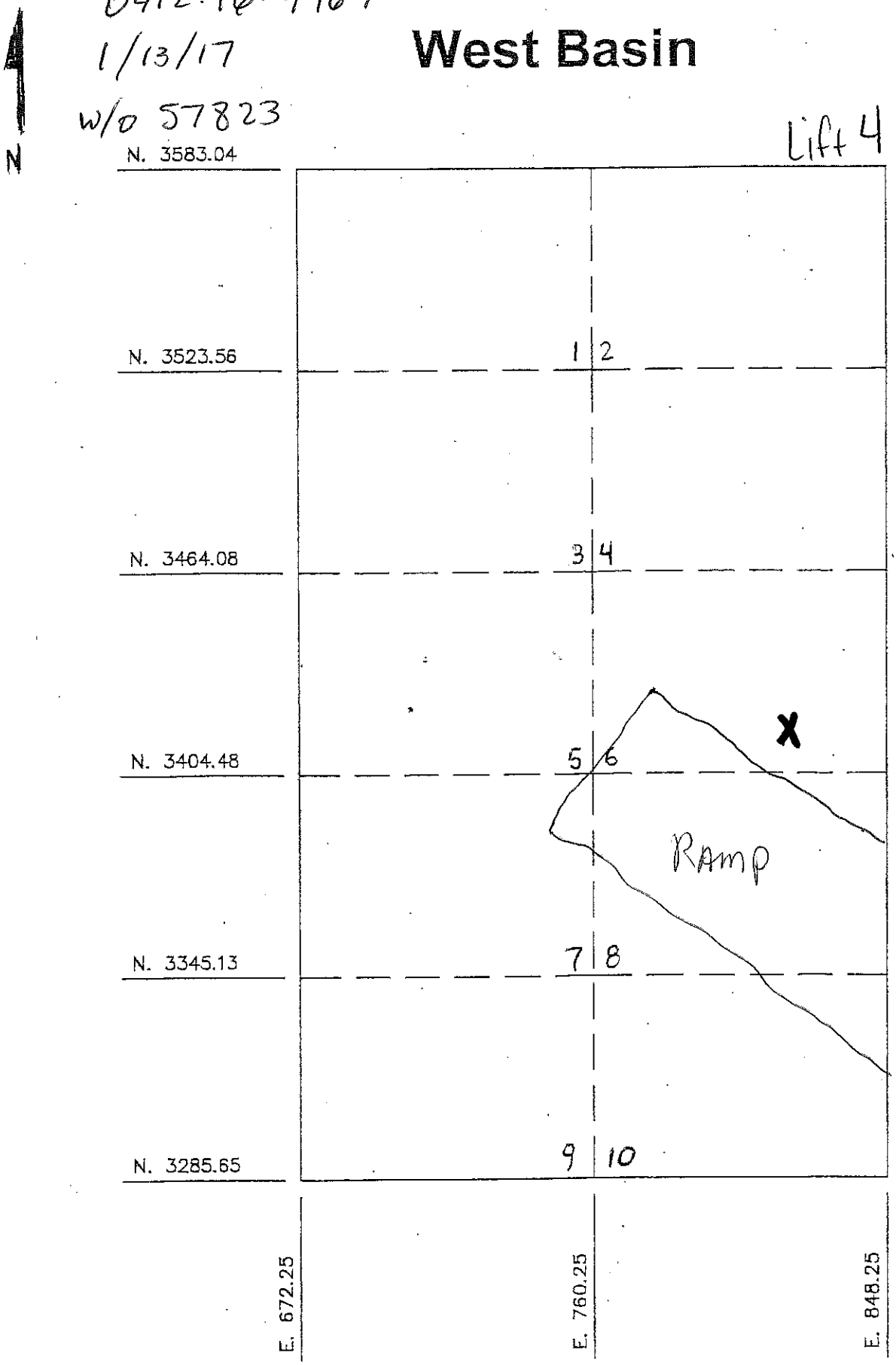
-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East/West Basin Closure
0412-16-4967
1/13/17
w/o 57823

West Basin



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/16/2017
Report Date: 01/18/2017
Project No.: 04.12164967
Report No.: 0082

Construction: Structure Fill, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0065	Tan and Light Gray / Clayey Sand	98	-1/+3	ASTM D698	34	15	19	118.8	12.5

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0065	5/Final		Area 4, (See Attached Sketch)	6	130.2	116.0	12.2	98
2	0065	4/Final		Area 9, (See Attached Sketch)	6	132.6	115.9	14.4	98
3	0065	5/Final		Area 3, (See Attached Sketch)	6	133.0	116.9	13.8	98
4	0065	4/Final		Area 8, (See Attached Sketch)	6	132.9	116.5	14.1	98
5	0065	4/Final		Area 10, (See Attached Sketch)	6	134.3	116.5	15.3	98
6	0065	5/Final		Area 6, (See Attached Sketch)	6	132.9	116.6	14.0	98

Gauge No.: 1283 Density Std.: 2378 Moisture Std.: 502

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

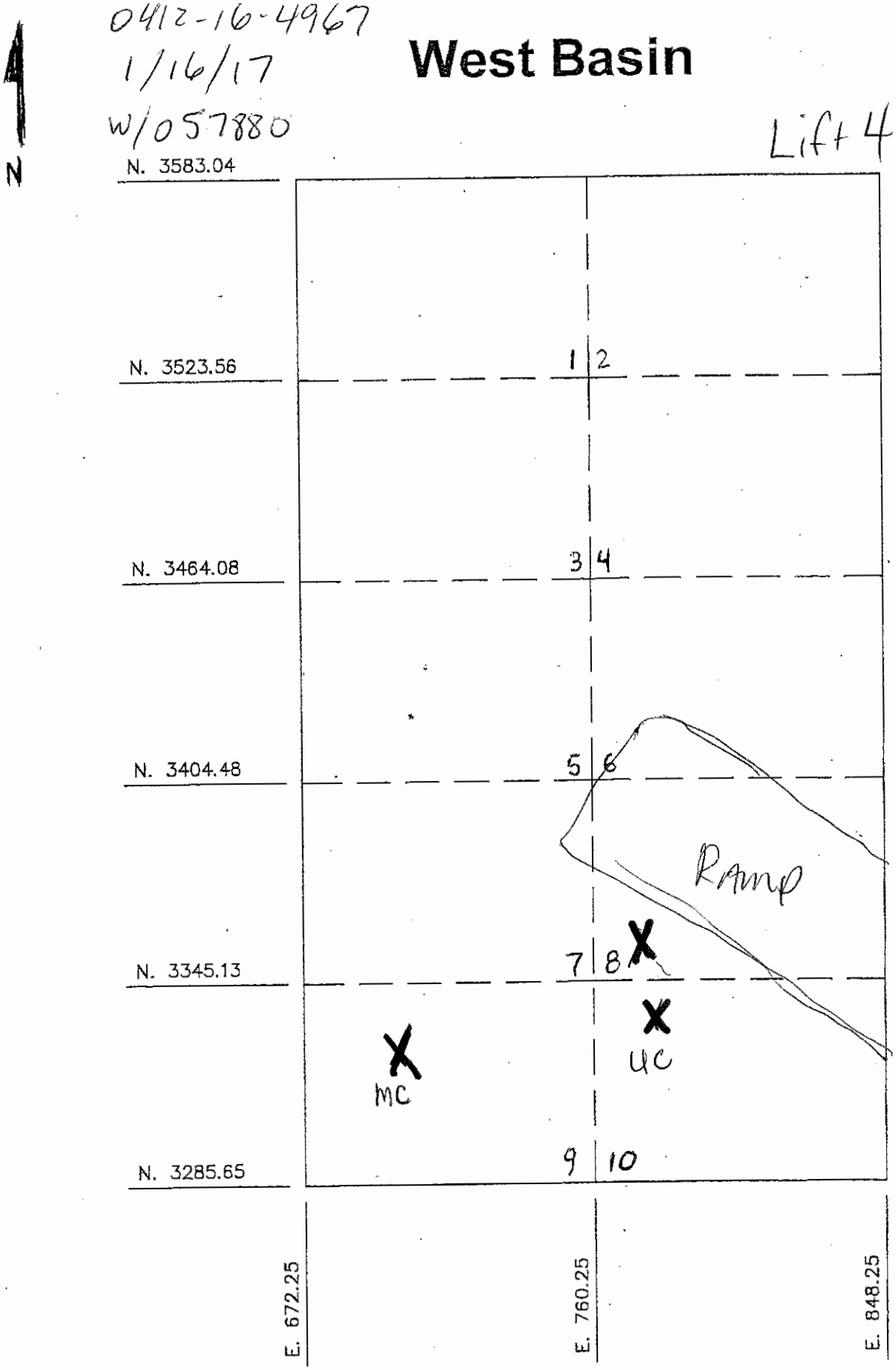
REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

0412-16-4967

1/16/17

W/057880



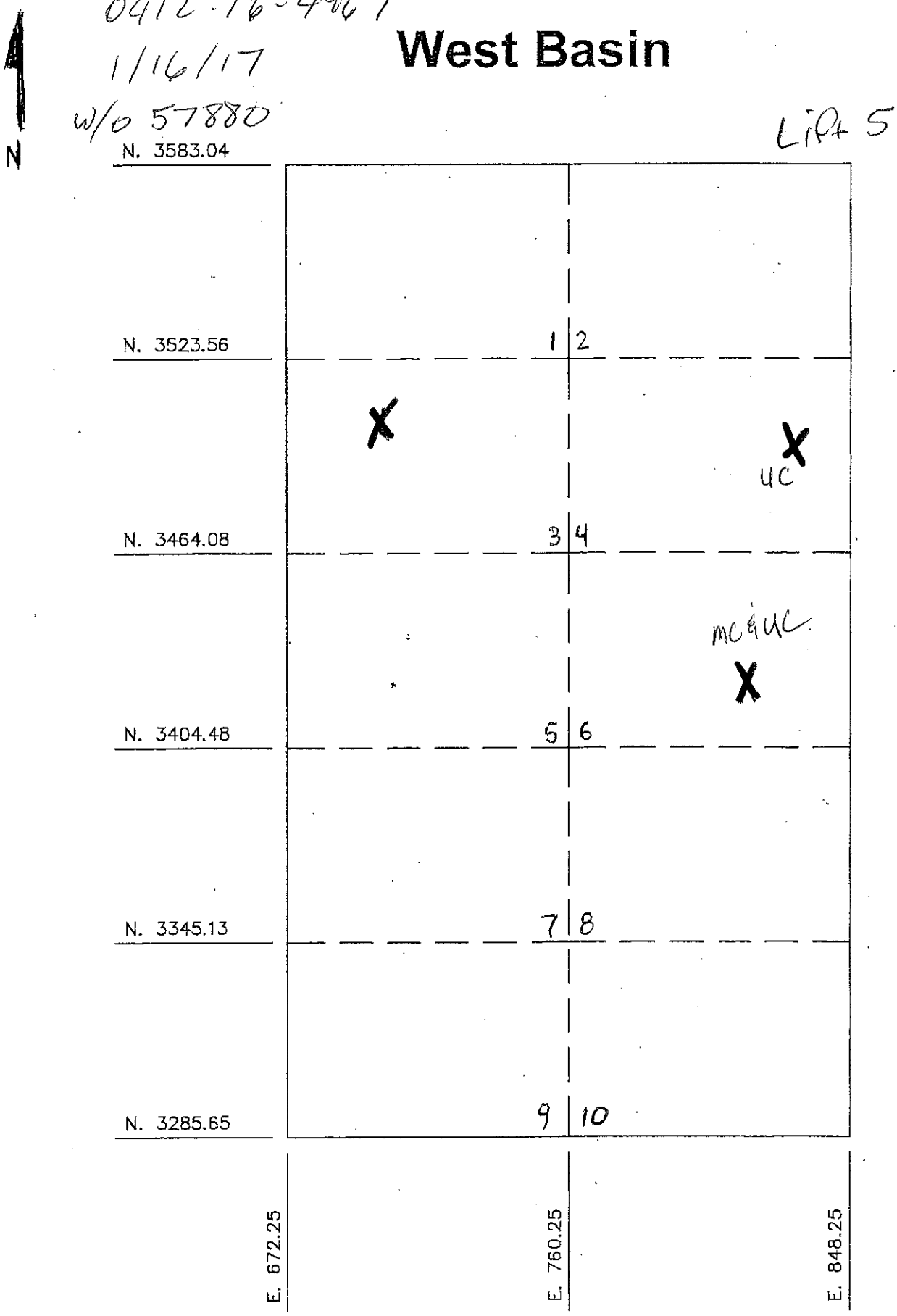
Shell SET East/West Basin Closure

0412-16-4967

1/16/17

w/o 57880

West Basin



Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/16/2017
		Report Date:	01/17/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0082A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained samples of the structural fill material for Moisture Content testing.

Sample Location: Onsite, Area 9, Lift 4 (See Report 0082, Test No. 2)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As Received (in-situ) Moisture Content: 13.1%

Sample Location: Onsite, Area 6, Lift 5 (See Report 0082, Test No. 6)
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill
As Received (in-situ) Moisture Content: 13.0%

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/16/2017
		Report Date:	01/17/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0083
Contractor:	Bo-Mac Contractors, LTD		

Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/16/2017
Report Date: 01/17/2017
Project No.: 04.12164967
Report No.: 0083

Visual Classification: Tan and Light Gray Sandy Lean Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Structural Fill

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 4 (Lift 5),	2,020 psf, See Note-1	1,010 psf, See Note-1
Area 6 (Lift 5)	5,040 psf, See Note-1	2,520 psf, See Note-1
Area 10 (Lift 4) See Attached Sketch	2,740 psf, See Note-1	1,370 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East/West Basin Closure

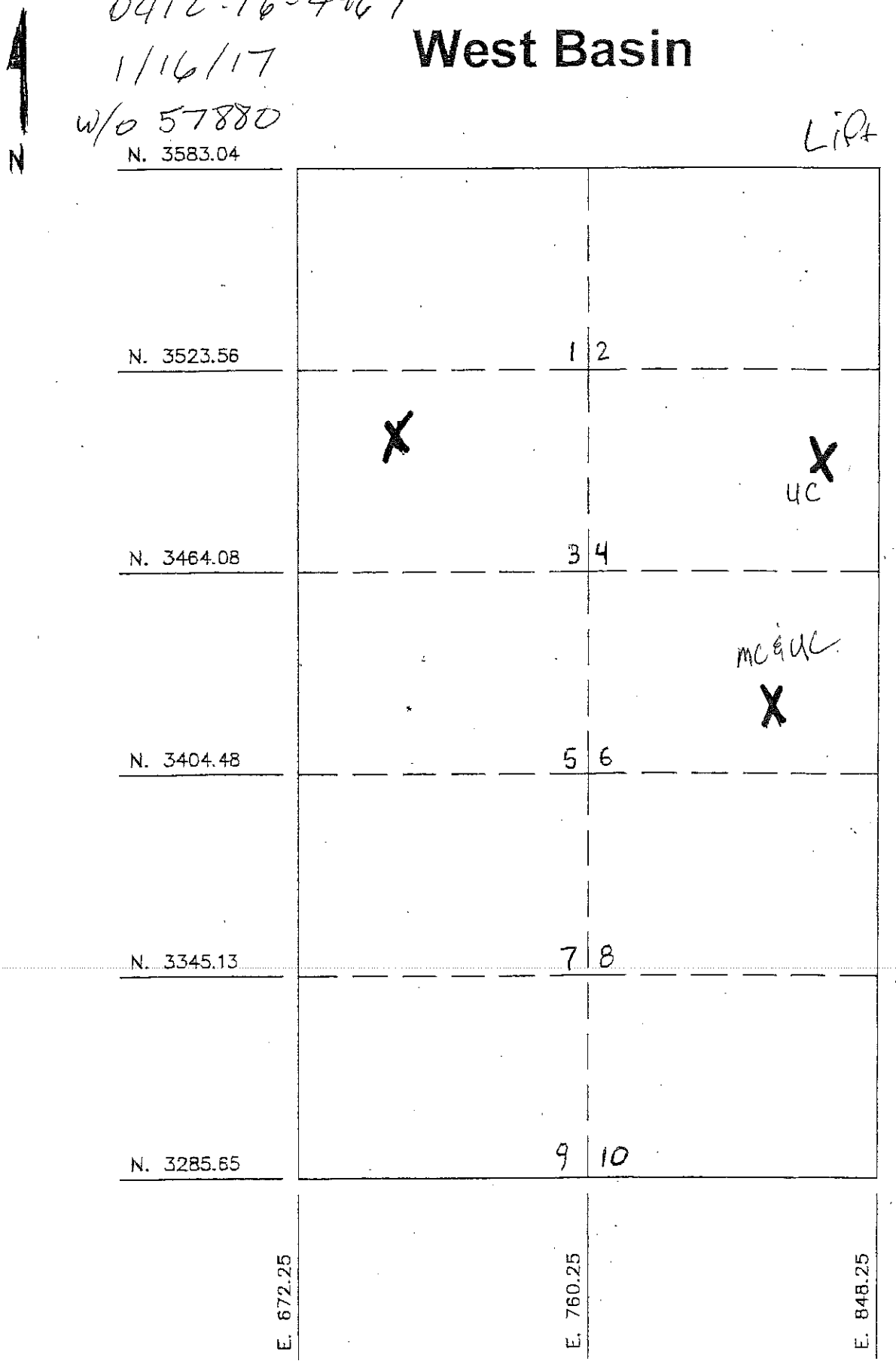
0412-16-4967

1/16/17

w/o 57880

West Basin

Lift 5



Shell SET East / West Basin Closure

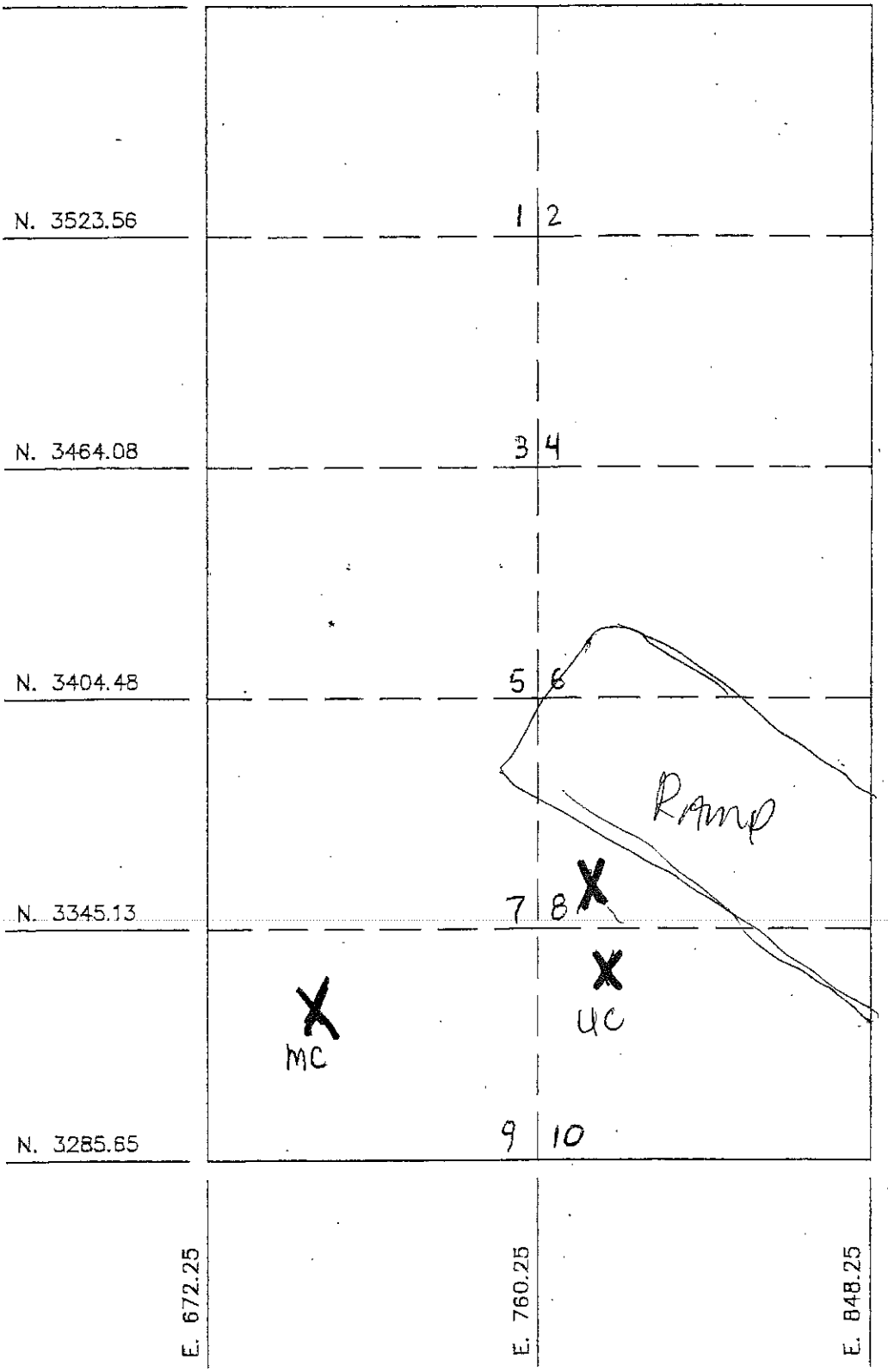
0412-16-4967

1/16/17

W/O 57880

West Basin

Lift 4



Appendix J – Clay Cap CQC Documentation

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/24/2017
Report Date: 03/02/2017
Project No.: 04.12164967
Report No.: 0102

Construction: Clay Cap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	4		Area 9, (See Attached Sketch)	6	124.3	105.4	17.9	98
2	0081	4		Area 10, (See Attached Sketch)	6	125.9	106.6	18.1	99

Gauge No.: 000 Density Std.: 1583 Moisture Std.: 550

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bomac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

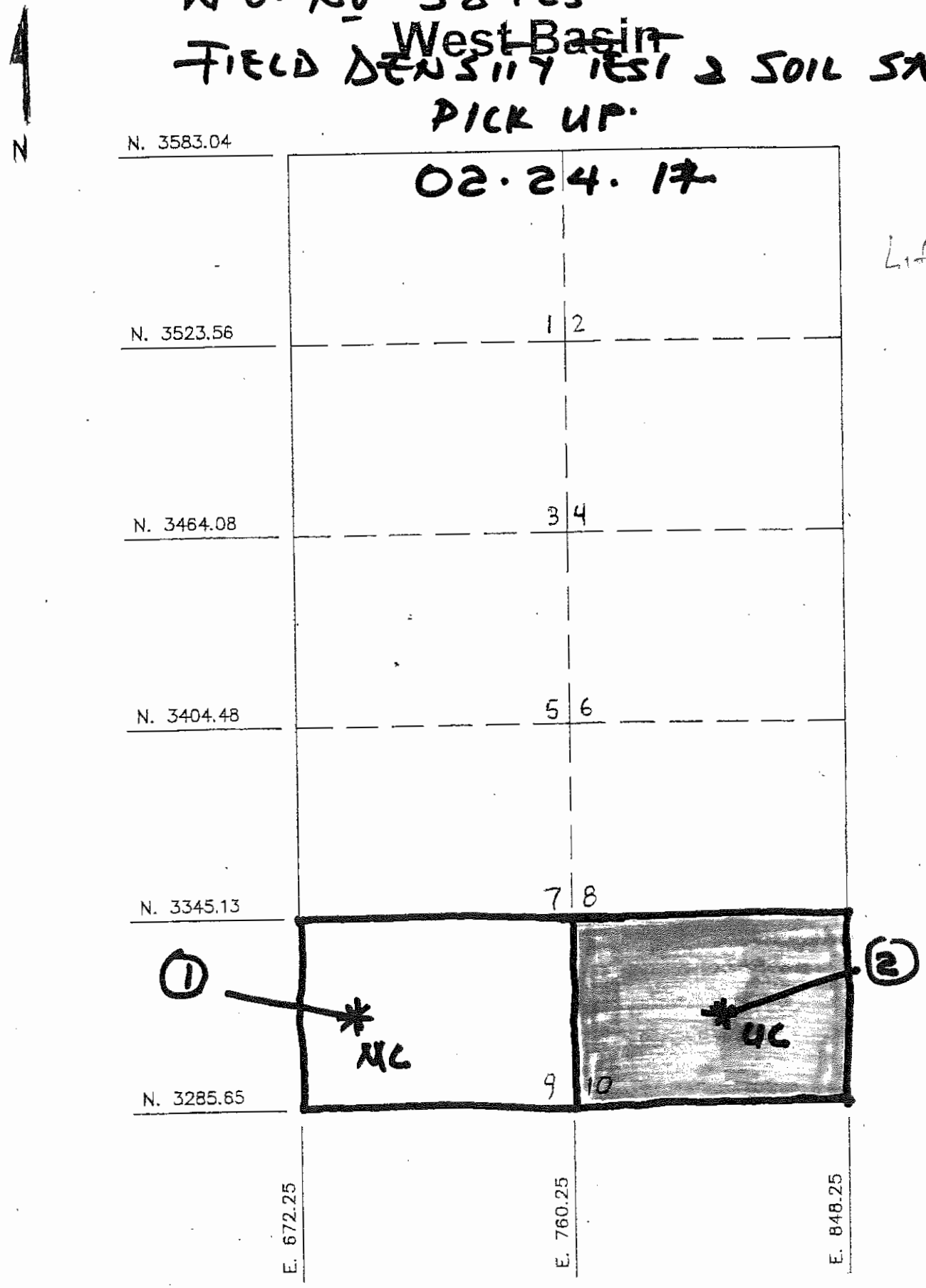
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

FAGRO PROJECT 04.12164967
W.O. NO 38425
West Basin
FIELD DENSITY TEST & SOIL SAMPLE PICK UP.



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/24/2017
		Report Date:	02/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0102A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 9, Lift 4 (See Report 0102, Test #2)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 18.7%

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/24/2017
		Report Date:	02/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0103
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/24/2017
Report Date: 02/28/2017
Project No.: 04.12164967
Report No.: 0103

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 10 (Lift 4),	6,480 psf, See Note-1	3,240 psf, See Note-1

See Attached Sketch

Note-1:

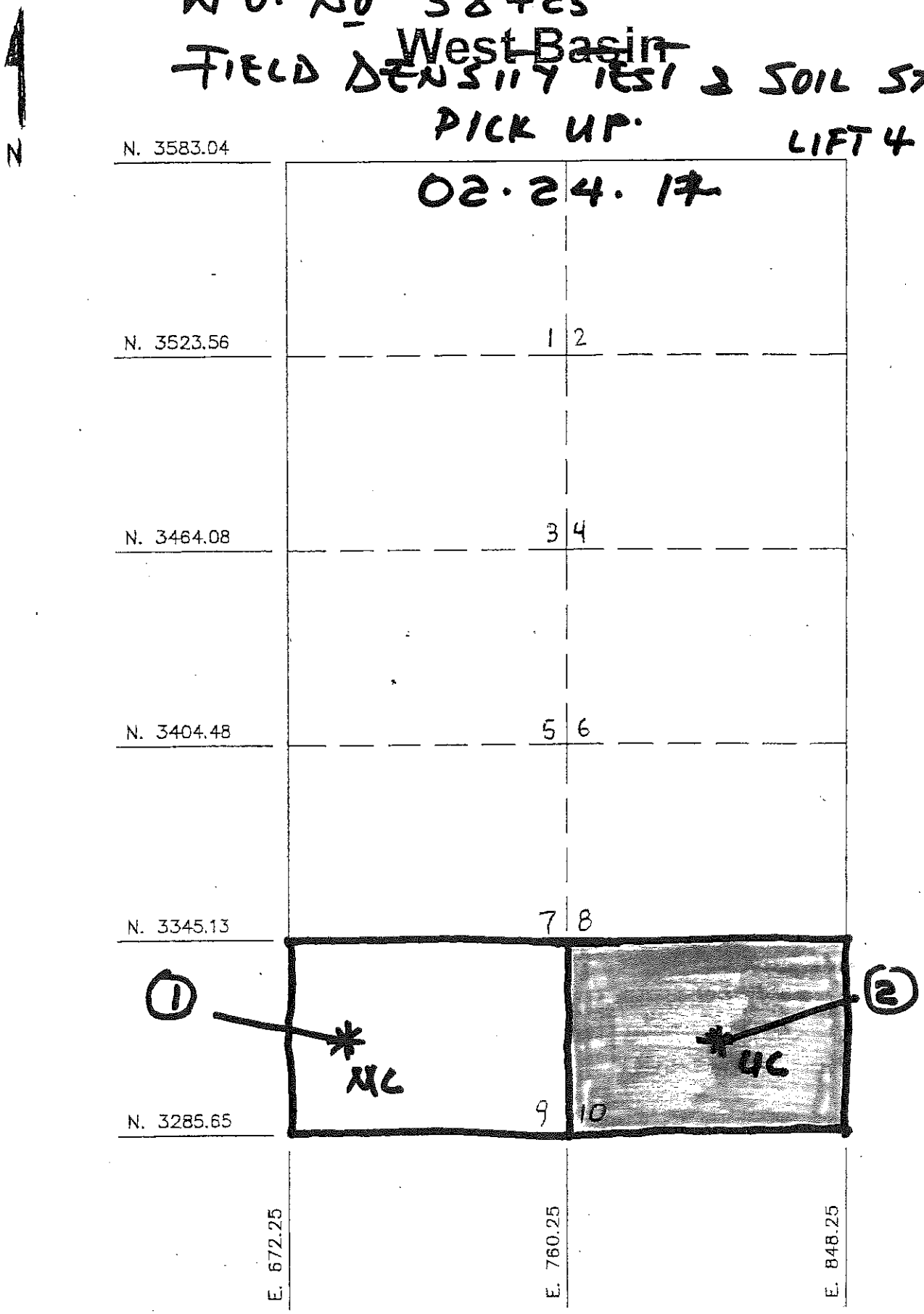
-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fagro Project 04.12164967
W.O. No 38425
West Basin
Field Density Test & Soil Sample
Pick up.
Lift 4
02.24.17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/25/2017
		Report Date:	03/02/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0104
Contractor:	Bo-Mac Contractors, LTD		

On 02/25/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Field Density Testing. After arrival to the job site, the technician was placed on "stand-by". Testing was later cancelled by the contractor.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/27/2017
Report Date: 03/02/2017
Project No.: 04.12164967
Report No.: 0105

Construction: FIll, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	4		Area 2, (See Attached Sketch)	6	127.6	107.2	19.0	99
2	0081	4		Area 4, (See Attached Sketch)	6	127.2	108.2	17.6	100+
3	0081	4		Area 6, (See Attached Sketch)	6	127.2	106.9	19.0	99
4	0081	4		Area 8, (See Attached Sketch)	6	128.2	105.5	21.5 *	98
5	0081	4		Area 7, (See Attached Sketch)	6	127.8	105.6	21.0 *	98

Gauge No.: 15036 Density Std.: 1583 Moisture Std.: 550

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

FUGRO PROJECT 04.12164967

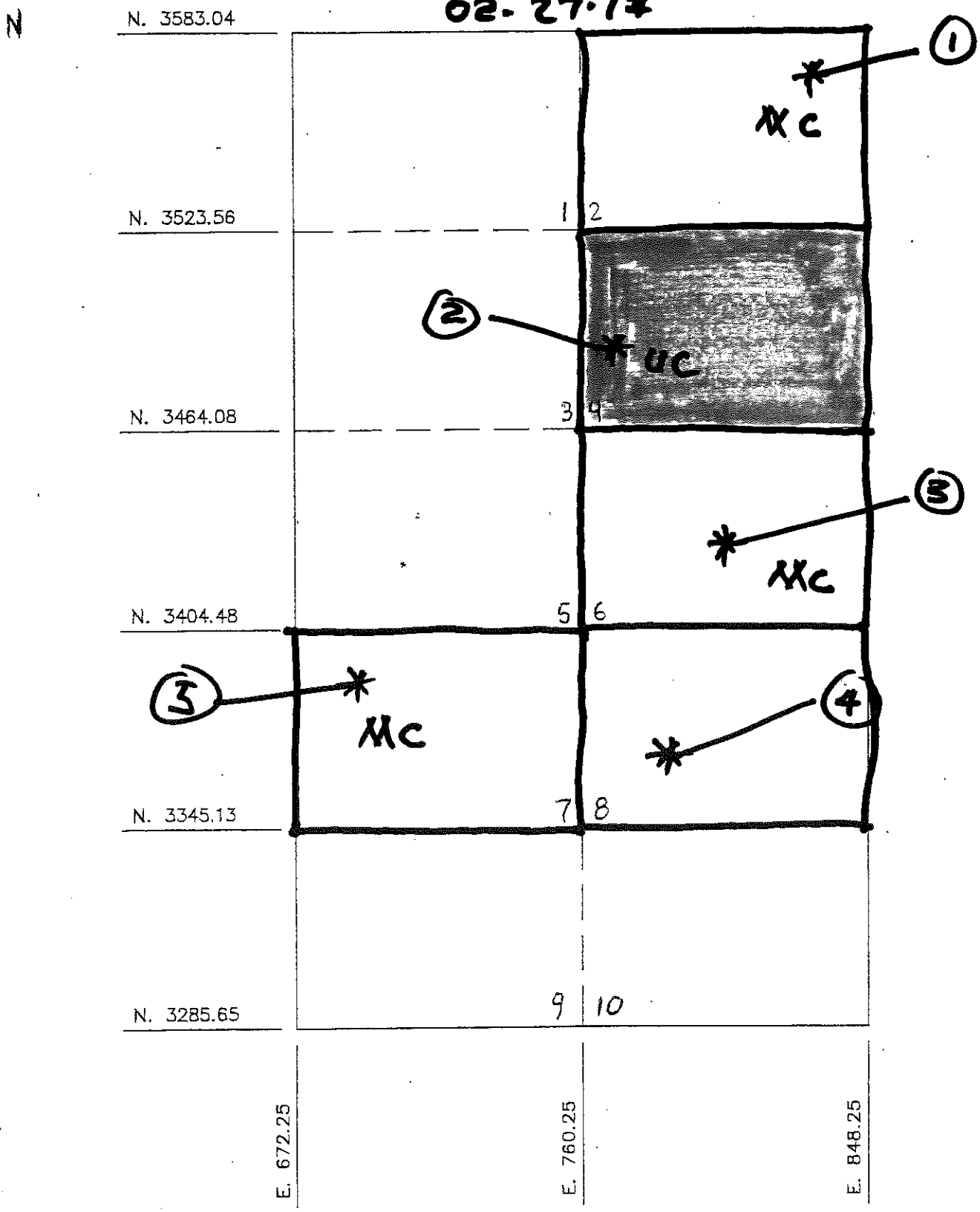
W.O. NY 58478

LIFT 4

West Basin

FIELD DENSITY TESTING & SOIL SAMPLE P/U

02-27-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/27/2017
		Report Date:	02/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0106
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/27/2017
Report Date: 02/28/2017
Project No.: 04.12164967
Report No.: 0106

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 4 (Lift 4),	2,300 psf, See Note-1	1,150 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

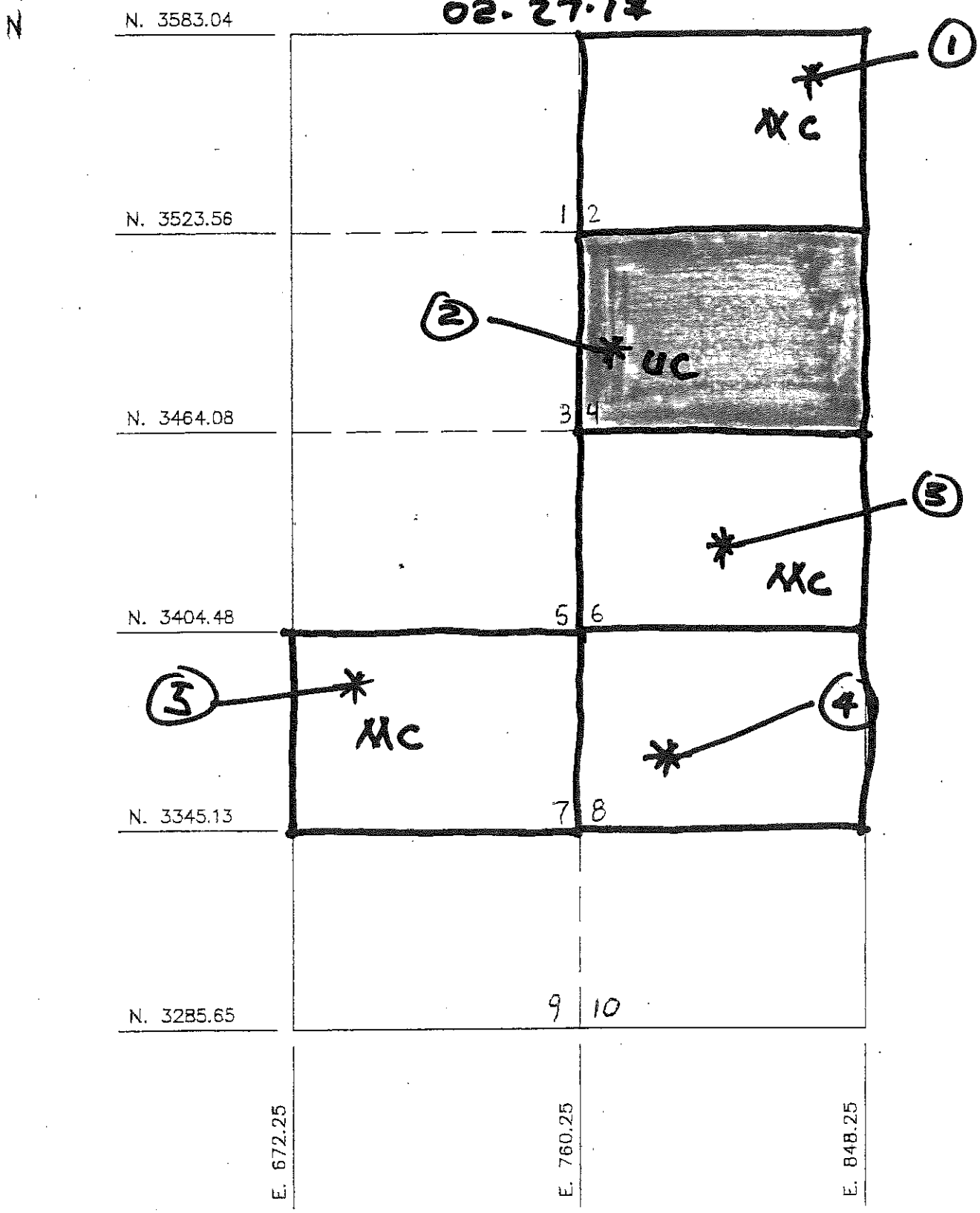
Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

FUGRO PROJECT 04.12164967
W.O. NY 58478
LIFT 4

West Basin

FIELD DENSITY TESTING & SOIL SAMPLE P/U
02.27.18



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/28/2017
		Report Date:	03/02/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0108
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/28/2017
Report Date: 03/01/2017
Project No.: 04.12164967
Report No.: 0108

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 5 (Lift 4),	4,320 psf, See Note-1	2,160 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

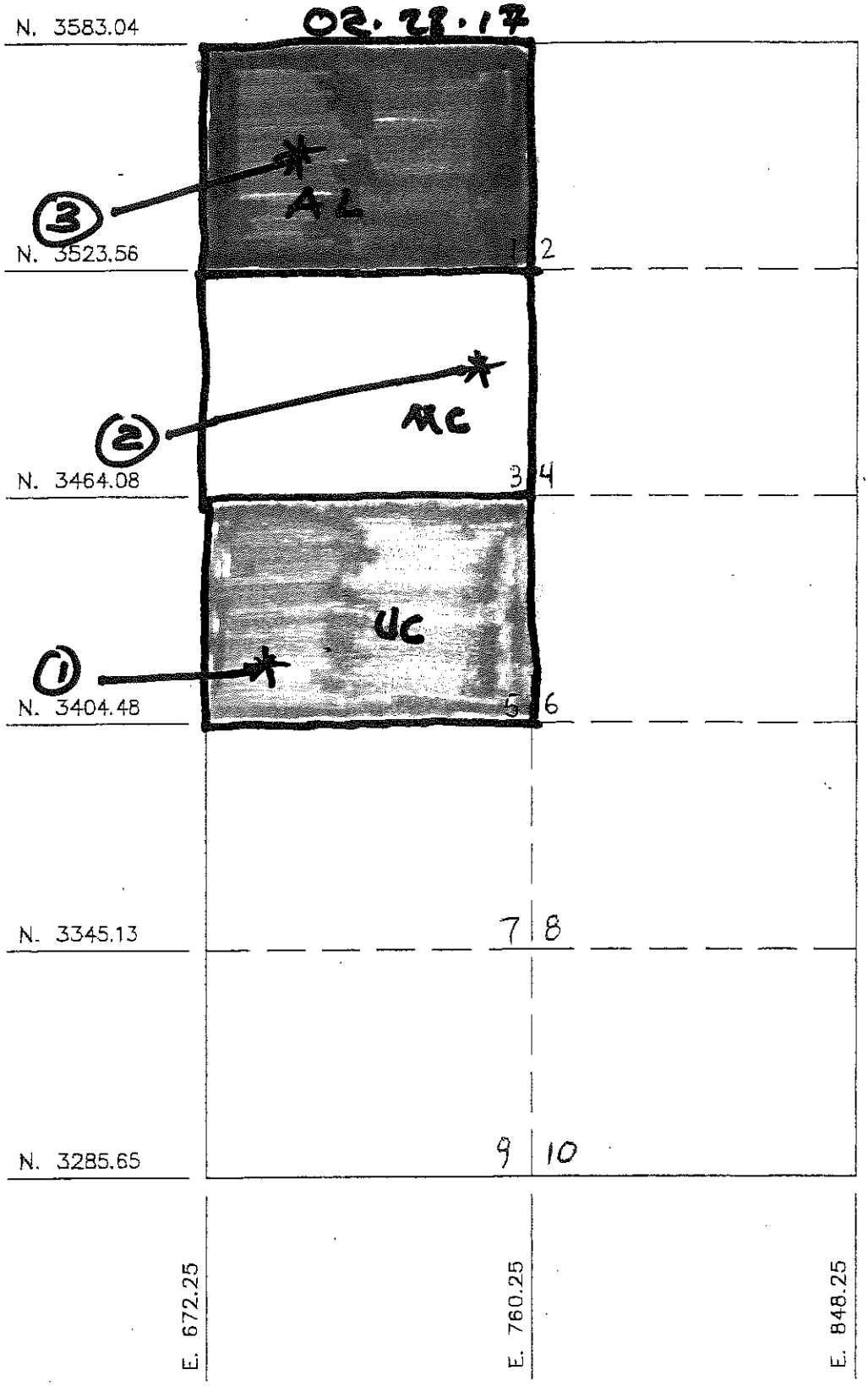
The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

TUGRD PROJECT 04.12154967
W.O. NO 5814.

West Basin

FIELD DENSITY TESTING & SOIL SAMPLE P/U

02.28.17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/28/2017
Report Date: 03/03/2017
Project No.: 04.12164967
Report No.: 0109

Construction: Fill, Clay Clap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	4		Area 5, (See Attached Sketch)	6	130.1	110.1	18.2	100+
2	0081	4		Area 3, (See Attached Sketch)	6	132.0	110.2	19.8	100+
3	0081	4		Area 1, (See Attached Sketch)	6	127.9	107.1	19.4	99

Gauge No.: 15036 Density Std.: 1583 Moisture Std.: 550

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

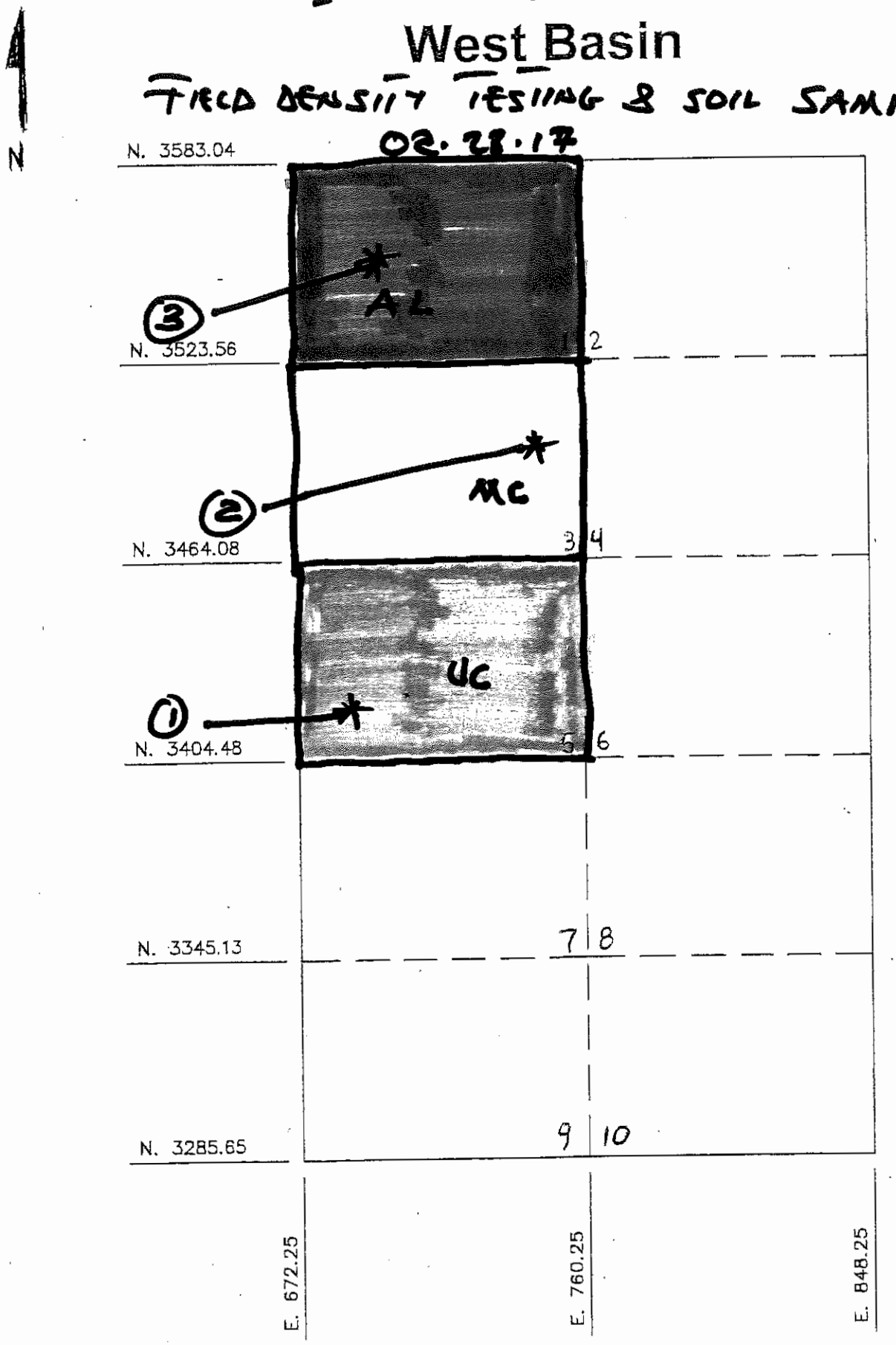
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

FUGRO PROJECT 04.1216 4967
W.O. NU 38514.

West Basin

FIELD DENSITY TESTING & SOIL SAMPLE P/U
02.28.17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/28/2017
		Report Date:	03/03/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0109A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 3, Lift 4 (See Report 0109, Test #2)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 20.4%

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/28/2017
Report Date: 03/03/2017
Project No.: 04.12164967
Report No.: 0110

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	Fill, Area 1, Lift #4	54	18	36	71.2	Gray Tan Sandy Fat Clay

Project Specifications:
Liquid Limit (LL): Minimum 30
Plasticity Index (PI): Minimum 50
Percent Passing the No. 200 Sieve: Minimum 30%

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/02/2017
Report Date: 03/09/2017
Project No.: 04.12164967
Report No.: 0111

Construction: FIll, Clay Clap, West Basins

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	5		Area 9, (See Attached Sketch)	6	129.3	108.1	19.6	100+

Gauge No.: 15036 Density Std.: 1583 Moisture Std.: 550

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

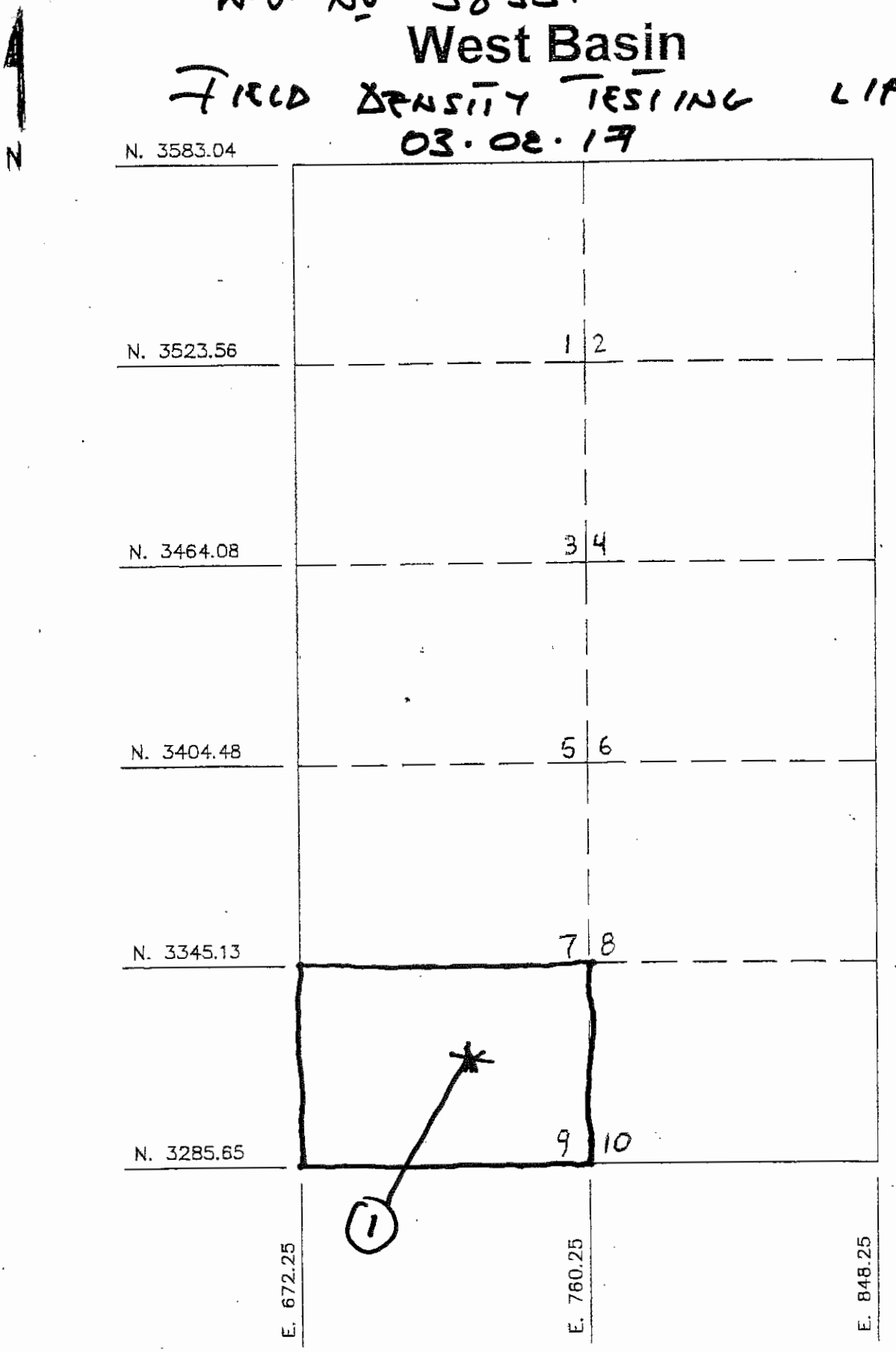
TERRACON PROJECT 04.12164967

W.O. NO 38351

West Basin

FIELD DENSITY TESTING LIFTS

03.02.17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/03/2017
Report Date: 03/09/2017
Project No.: 04.12164967
Report No.: 0112

Construction: Clay Clap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	5		Area 10, (See Attached Sketch)	6	132.0	109.7	20.3	100+
2	0081	5		Area 3, (See Attached Sketch)	6	126.6	108.2	17.0	100+
3	0081	5		Area 5, (See Attached Sketch)	6	125.9	107.4	17.2	100
4	0081	5		Area 1, (See Attached Sketch)	6	129.7	109.3	18.7	100+
5	0081	5		Area 6, (See Attached Sketch)	6	128.8	109.5	17.6	100+
6	0081	5		Area 4, (See Attached Sketch)	6	123.6	105.7	16.9	98
7	0081	5		Area 2, (See Attached Sketch)	6	128.8	106.7	20.7 *	99

Gauge No.: 15036 Density Std.: 1583 Moisture Std.: 550

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

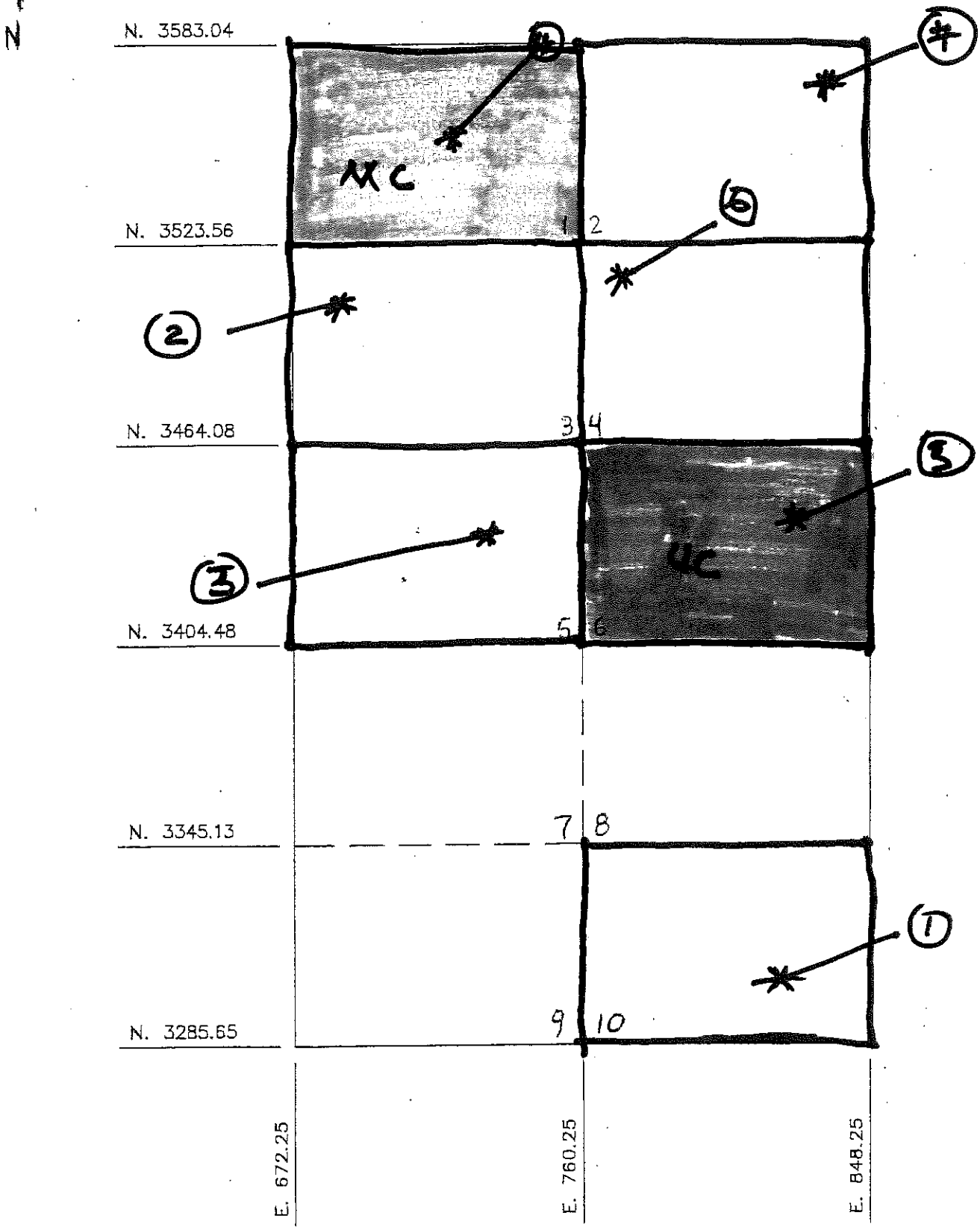
TUGRO PROJECT 04.12164967

W.O. NU 38560

FIELD DENSITY TESTING & SOIL SAMPLE P/U

West Basin

03.23.17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/16/2017
Report Date: 03/20/2017
Project No.: 04.12164967
Report No.: 0114

Construction: Fill, Clay Clap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	6		Area 10, (See Attached Sketch)	6	126.9	106.7	18.9	99

Gauge No.: 15036 Density Std.: 1583 Moisture Std.: 552

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-MacContractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

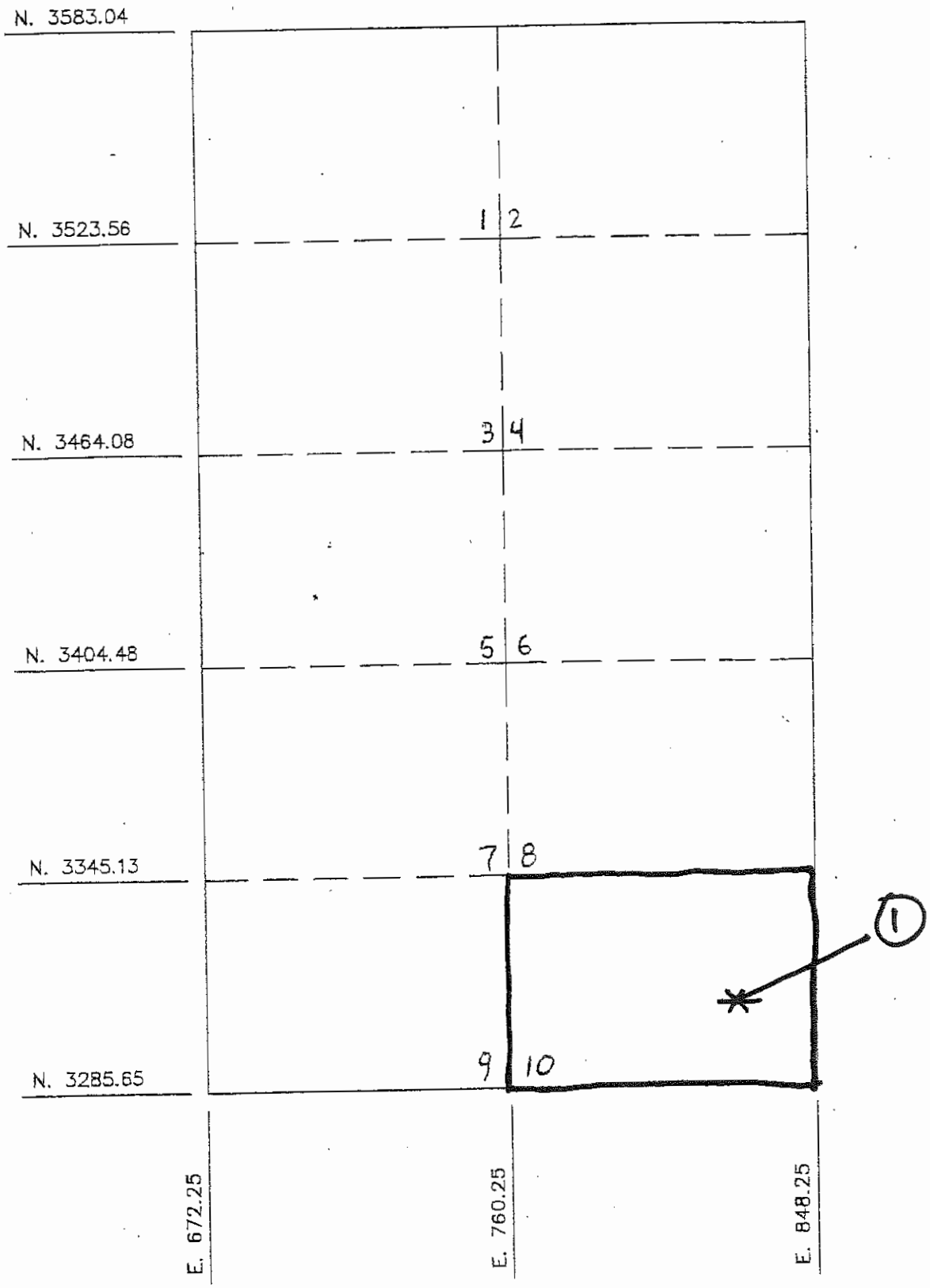
REPORT CREATED BY ElmTree SYSTEM

TUGRO PROJECT 04.12164967

W.O. NO 58817, LIFT 6

West Basin

FIELD DENSITY TESTING 03-16-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/20/2017
Report Date: 03/22/2017
Project No.: 04.12164967
Report No.: 0115

Construction: Fill, Clay Cap, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	5		Area 7	6	126.9	105.6	20.2	98
2	0081	5		Area 8	6	127.5	105.9	20.4	98
3	0081	6		Area 2	6	124.5	105.7	17.8	98
4	0081	6		Area4	6	126.5	108.2	16.9	100+
5	0081	6		Area 6	6	125.0	106.1	17.8	98
6	0081	6		Area 3	6	126.0	107.2	17.5	99
7	0081	6		Area 1	6	123.6	105.9	16.7	98

Gauge No.: 15036 Density Std.: 1583 Moisture Std.: 552

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

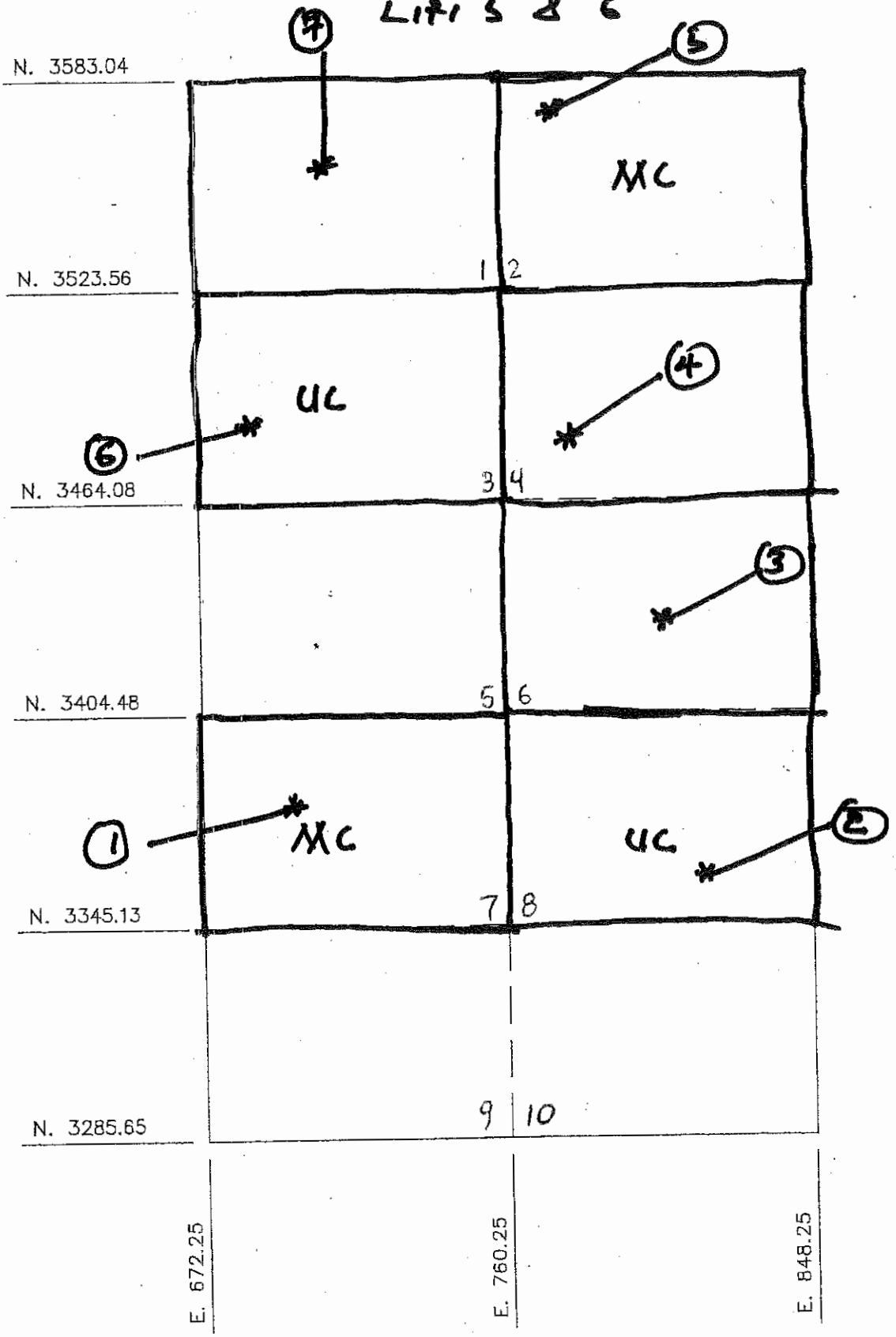
REPORT CREATED BY ElmTree SYSTEM

TUGRO PROJECT 04.12164967

W.O. NO 38851

FIELD DENSITY West Basin ICSING, SOIL SAMPLE PICKUP.

LIFT 5 & 6



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/20/2017
		Report Date:	03/22/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0115A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 7, Lift 5 (See Report 0115, Test #1)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Clap
As Received (in-situ) Moisture Content: 19.1%

Sample Location: Area 2, Lift 6 (See Report 0115, Test #3)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 18.3%

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/20/2017
		Report Date:	03/22/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0116
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 03/20/2017
Report Date: 03/22/2017
Project No.: 04.12164967
Report No.: 0116

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 3 (Lift 6)	3,460 psf, See Note-1	1,730 psf, See Note-1
Area 8 (Lift 5)	4,030 psf, See Note-1	2,015 psf, See Note-1

See Attached Sketch

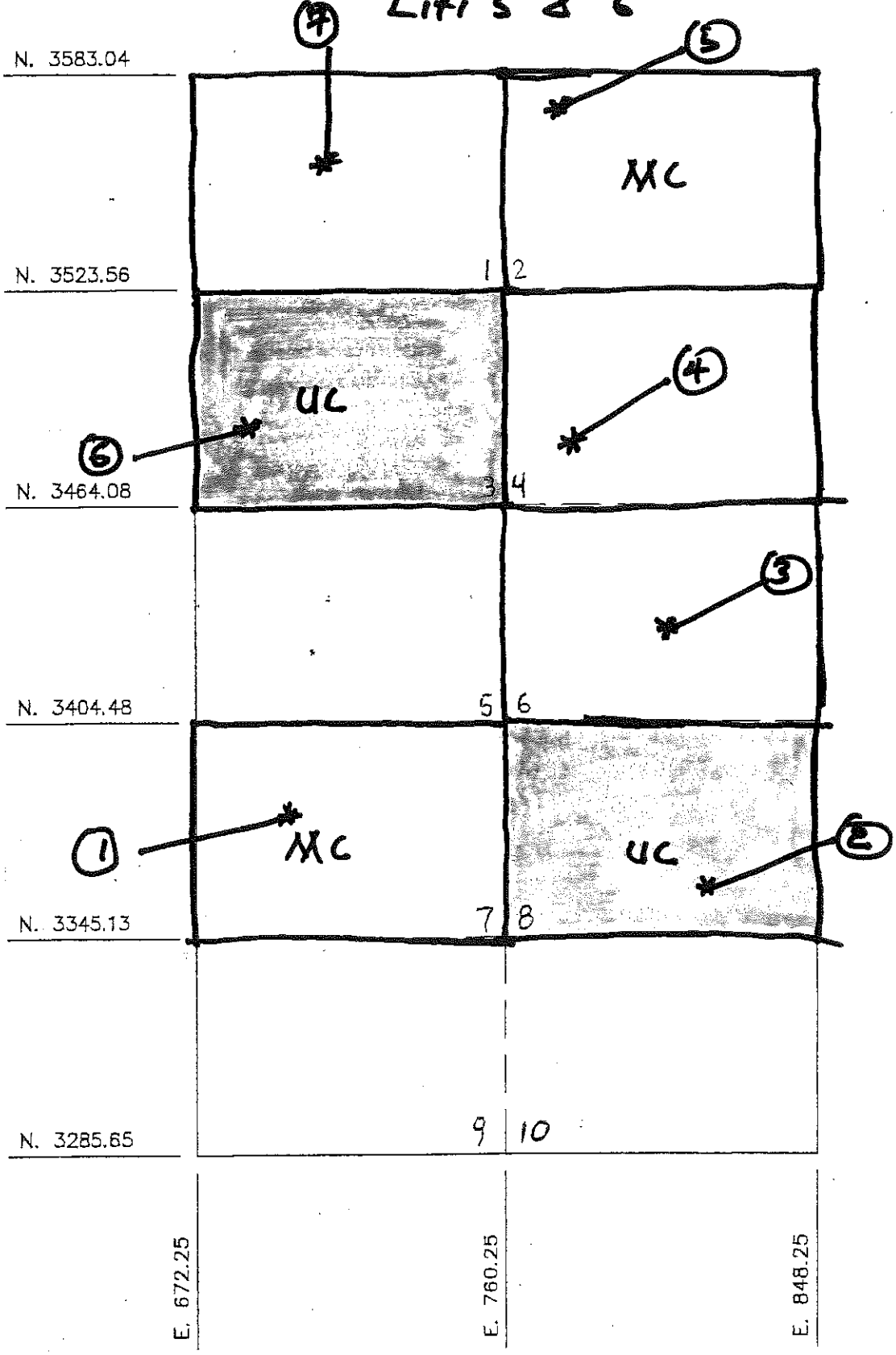
Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

TUGRO PROJECT 04.12154967
W.O. NO 38851
FIELD DENSITY West Basin TESTING, SOIL SAMPLE PICKUP.
LIFTS 5 & 6



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/17/2017
		Report Date:	03/22/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0117
Contractor:	Bo-Mac Contractors, LTD		

On 03/17/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Field Density Testing. After arrival to the job site, the technician was placed on "stand-by". Testing was later cancelled by the contractor.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/21/2017
Report Date: 03/23/2017
Project No.: 04.12164967
Report No.: 0118

Construction: FIll, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	1		See Attached Sketch	6	124.1	105.5	17.6	98
2	0081	2		See Attached Sketch	6	125.6	105.7	18.8	98
3	0081	3		See Attached Sketch	6	126.5	106.4	18.9	99
4	0081	6		See Attached Sketch	6	131.4	109.5	20.0	100+
5	0081	6		See Attached Sketch	6	128.7	110.2	16.8	100+

Gauge No.: 15036 Density Std.: 1590 Moisture Std.: 538

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

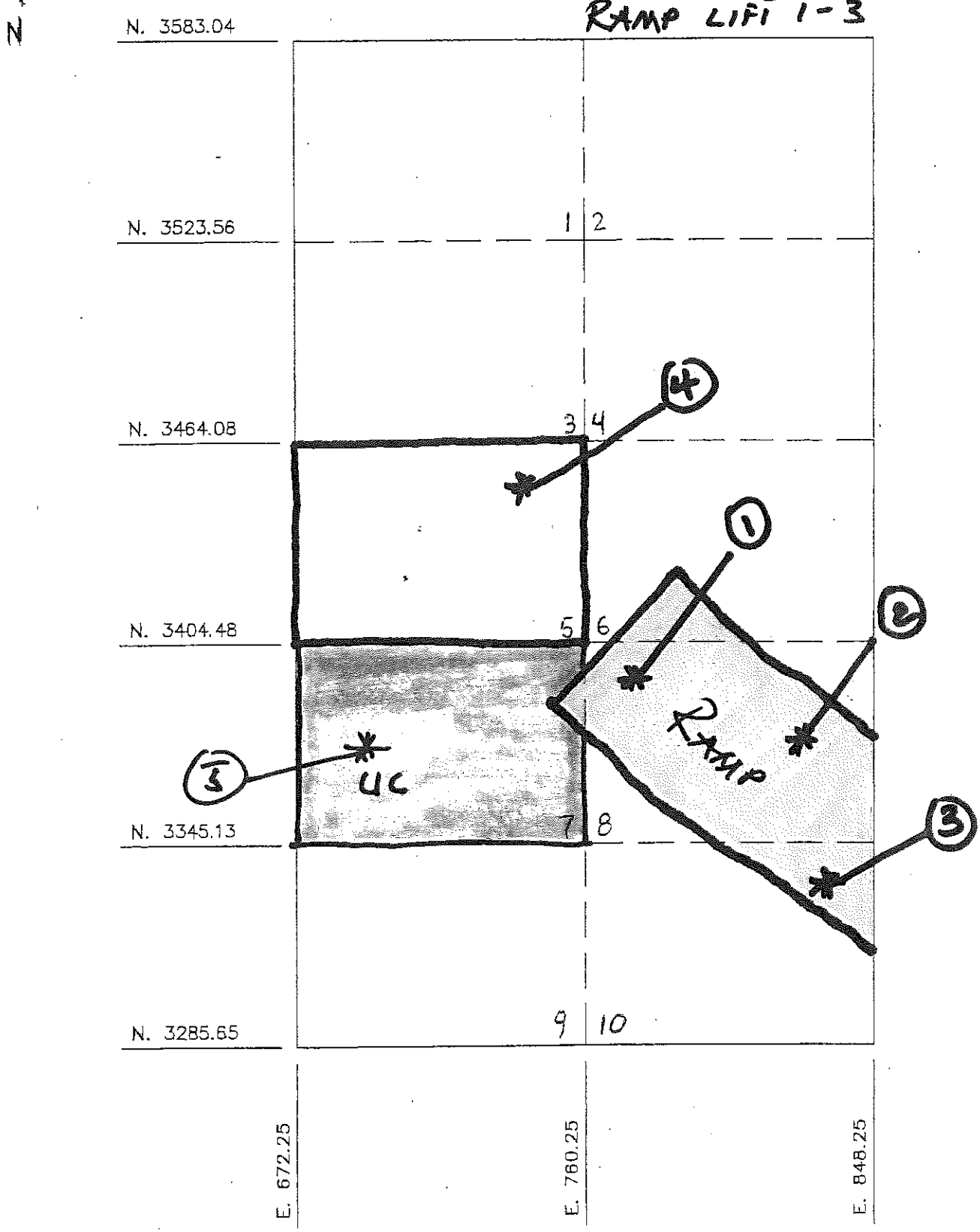
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

HUGO PROJECT 04.12164967
W.O. NO 58878
FIELD DENSITY TESTING,

West Basin

03.21.17. AREA 3 & 4 LIFT 6
RAMP LIFT 1-3



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/21/2017
		Report Date:	03/22/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0119
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 03/21/2017
Report Date: 03/22/2017
Project No.: 04.12164967
Report No.: 0119

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 7 (Lift 6)	5,330 psf, See Note-1	2,670 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

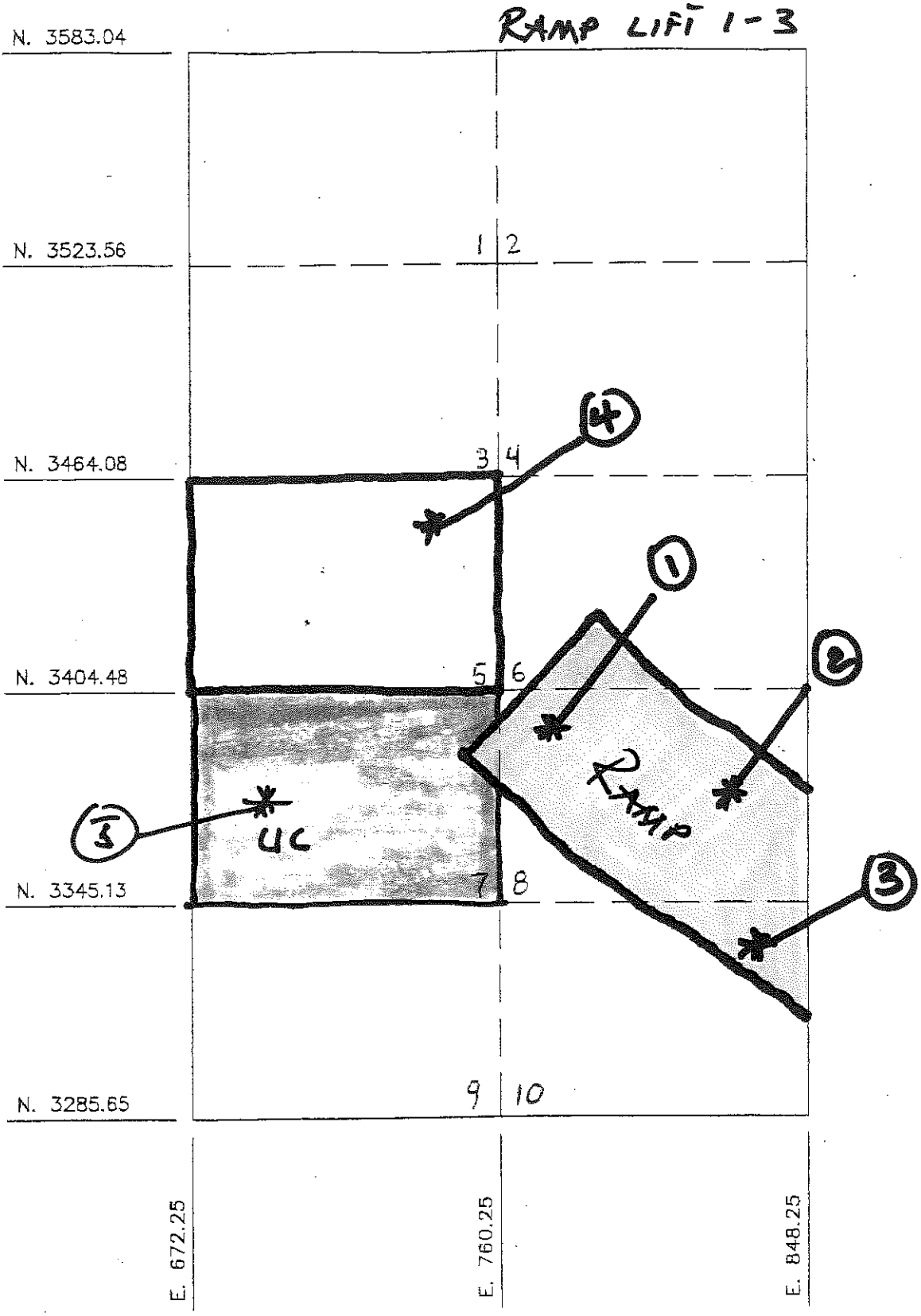
The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

FUGRO PROJECT 04.12164967
W.O. NU 58878
FIELD DENSITY TESTING.

West Basin

03.21.17.

AREA 3 & 4 LIFT 6
RAMP LIFT 1-3



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/22/2017
Report Date: 03/24/2017
Project No.: 04.12164967
Report No.: 0120

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	7		Area 2, (See Attached Sketch)	6	132.9	109.9	20.9 *	100+
2	0081	7		Area 4, (See Attached Sketch)	6	129.8	109.1	19.0	100+
3	0081	7		Area 6, (See Attached Sketch)	6	124.5	105.6	17.9	98

Gauge No.: 27464 Density Std.: 1976 Moisture Std.: 599

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

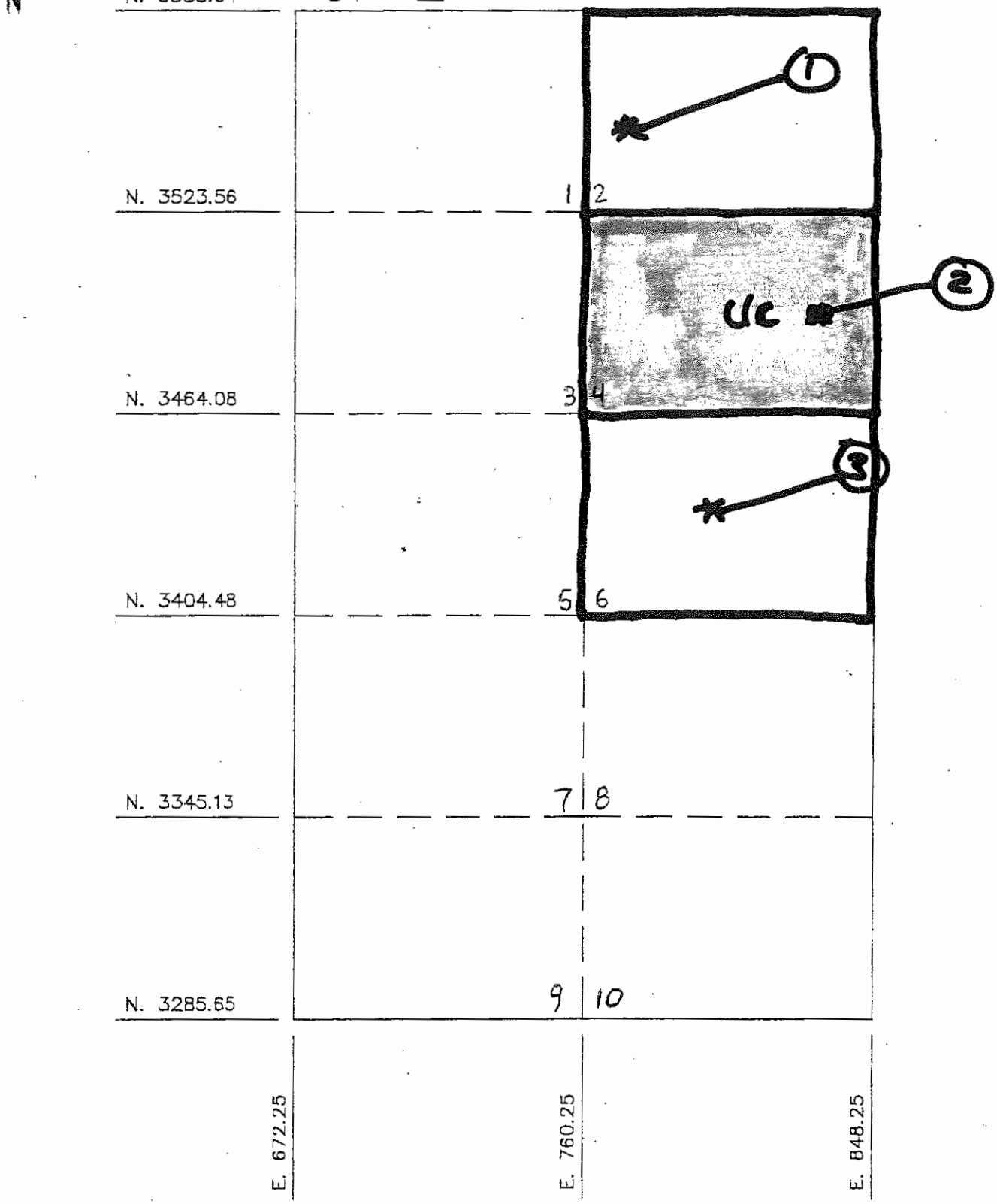
REPORT CREATED BY ElmTree SYSTEM

FUGRO PROJECT 04.12164967
W.O. NO 58906.

West Basin

FIELD DENSITY TESTING, SOIL SAMPLE PICK

03.22.19 LIFT #



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/22/2017
		Report Date:	03/23/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0121
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 03/22/2017
Report Date: 03/23/2017
Project No.: 04.12164967
Report No.: 0121

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 4 (Lift 7)	2,880 psf, See Note-1	1,440 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

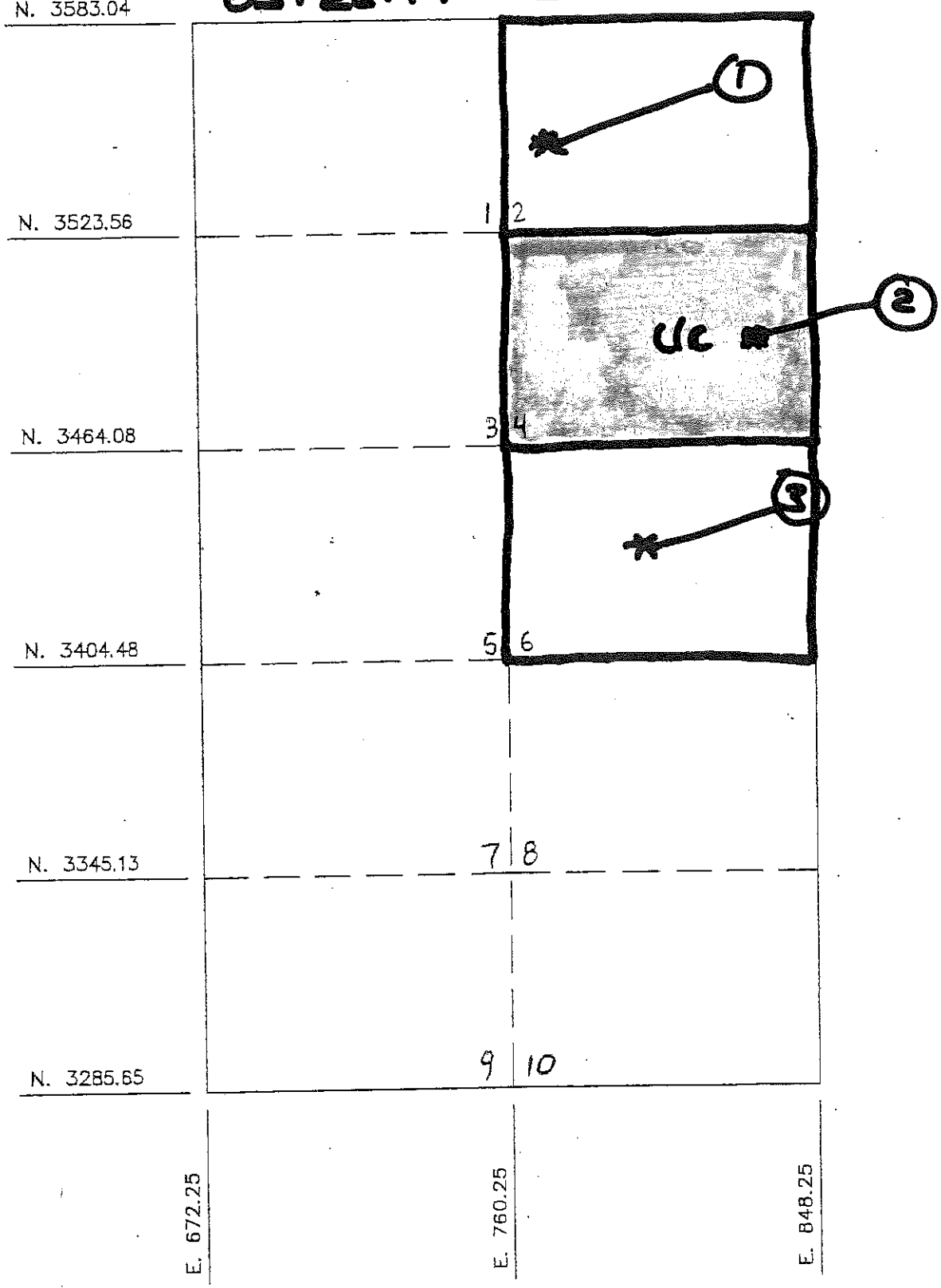
Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

FUGRO PROJECT 04.12164967
W.O. No 38906.

West Basin

FIELD DENSITY TESTING, SOIL SAMPLE PICK
03.22.17 LIFT #



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/23/2017
Report Date: 03/31/2017
Project No.: 04.12164967
Report No.: 0123

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	7		Area 8, (See Attached Sketch)	6	127.0	105.5	20.4	98
2	0081	7		Area 10, (See Attached Sketch)	6	127.5	105.9	20.4	98
3	0081	6		Area 9, (See Attached Sketch)	6	126.9	105.6	20.2	98

Gauge No.: 27464 Density Std.: 1976 Moisture Std.: 599

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

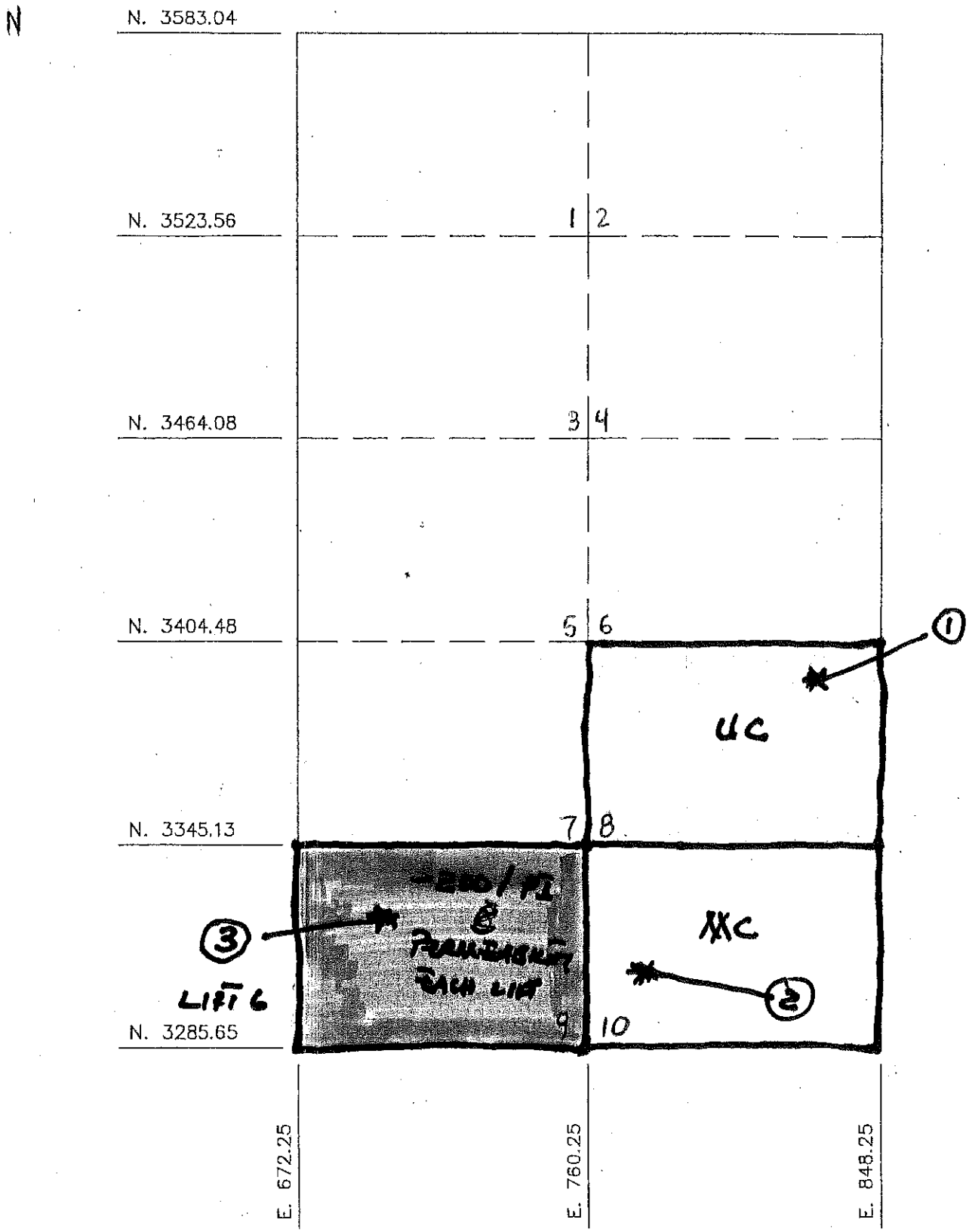
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

+UGRD PROJECT 04.12164967

W.O. NO 38937 03-23-17

West Basin



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/23/2017
		Report Date:	03/24/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0124
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424
CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 03/23/2017
Report Date: 03/24/2017
Project No.: 04.12164967
Report No.: 0124

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 8 (Lift 7)	3,456 psf, See Note-1	1,728 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

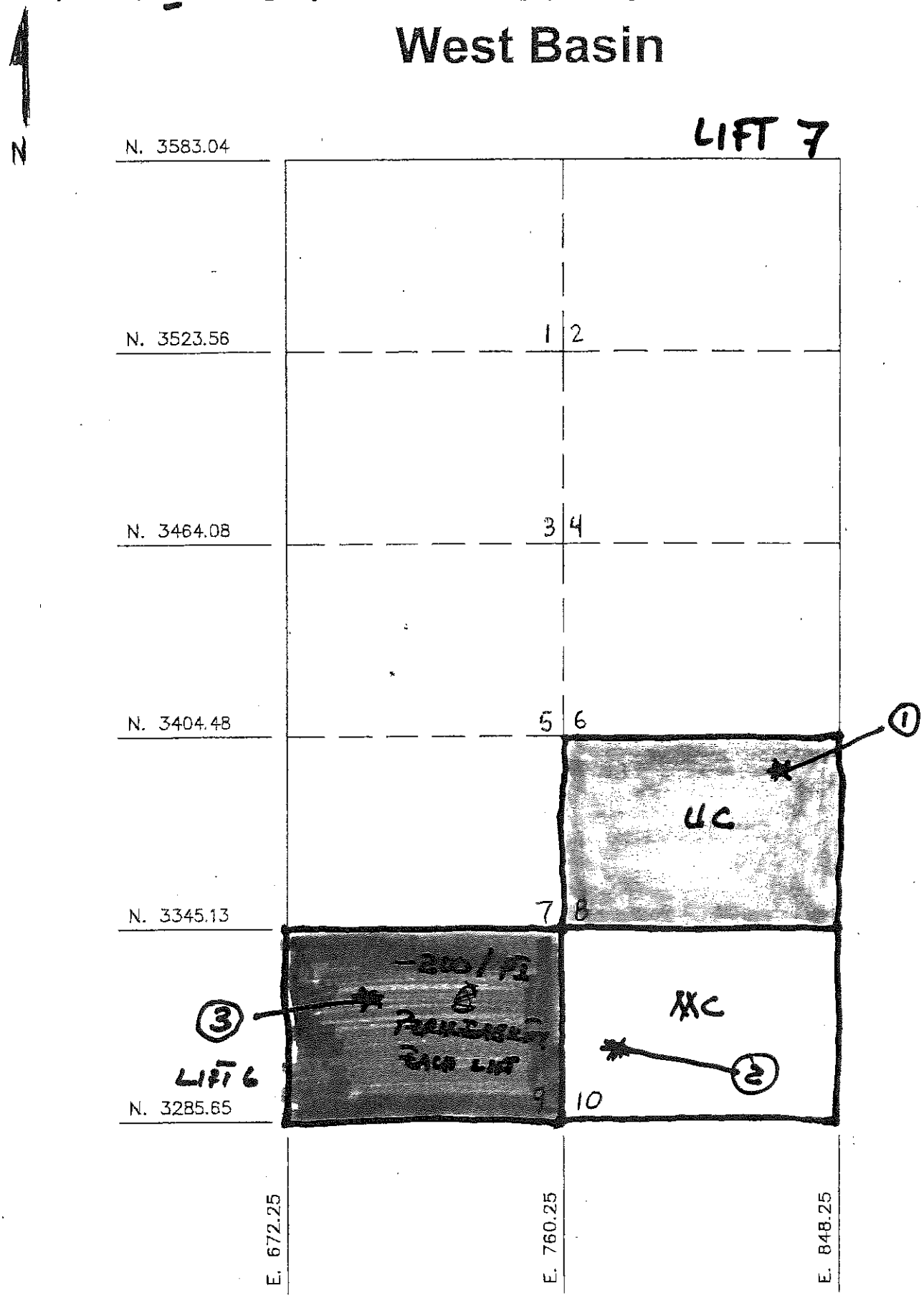
-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro Project 04.12164967
W.O. No 38937 03-23-17

West Basin



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/23/2017
Report Date: 03/28/2017
Project No.: 04.12164967
Report No.: 0125

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	Onsite, Area 9, Lift 6	60	16	44	62.4	Gray and Tan Sandy Fat Clay

Project Specifications:
Liquid Limit (LL): Minimum 30
Plasticity Index (PI): Minimum 15
Percent Passing the No. 200 Sieve: Minimum 30%

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/28/2017
Report Date: 03/31/2017
Project No.: 04.12164967
Report No.: 0126

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	8		Area 4, (See Attached Sketch)	6	133.5	110.8	20.5	100+
2	0081	8		Area 6, (See Attached Sketch)	6	132.6	110.2	20.3	100+
3	0081	8		Area 8, (See Attached Sketch)	6	129.3	107.3	20.5	99
4	0081	8		Area 10, (See Attached Sketch)	6	130.4	109.5	19.1	100+

Gauge No.: 15036 Density Std.: 1973 Moisture Std.: 599

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

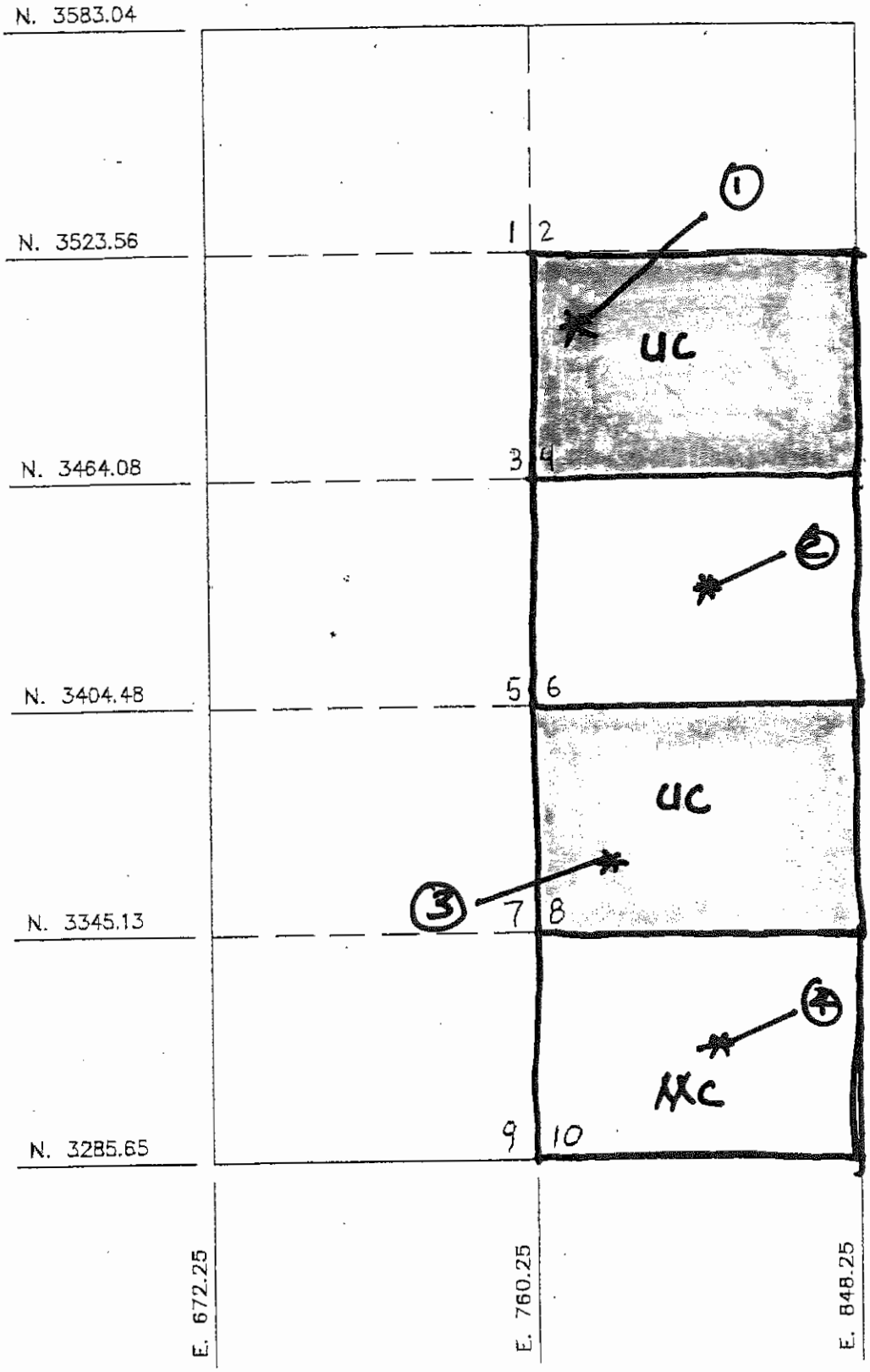
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

FUGRO PROJECT 04.12164967
W.O. NO 59012. 05.26.17

West Basin

LIFT 8 FIELD DENSITY TESTING & SOIL SAMPLE PICK UP



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/28/2017
		Report Date:	03/30/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0126A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 10, Lift 8 (See Report 0126, Test #4)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap
As Received (in-situ) Moisture Content 22.7%

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/28/2017
		Report Date:	03/29/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0127
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 03/28/2017
Report Date: 03/29/2017
Project No.: 04.12164967
Report No.: 0127

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 4 (Lift 8)	4,752 psf, See Note-1	2,376 psf, See Note-1
Area 8 (Lift 8)	6,336 psf, See Note-1	3,168 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

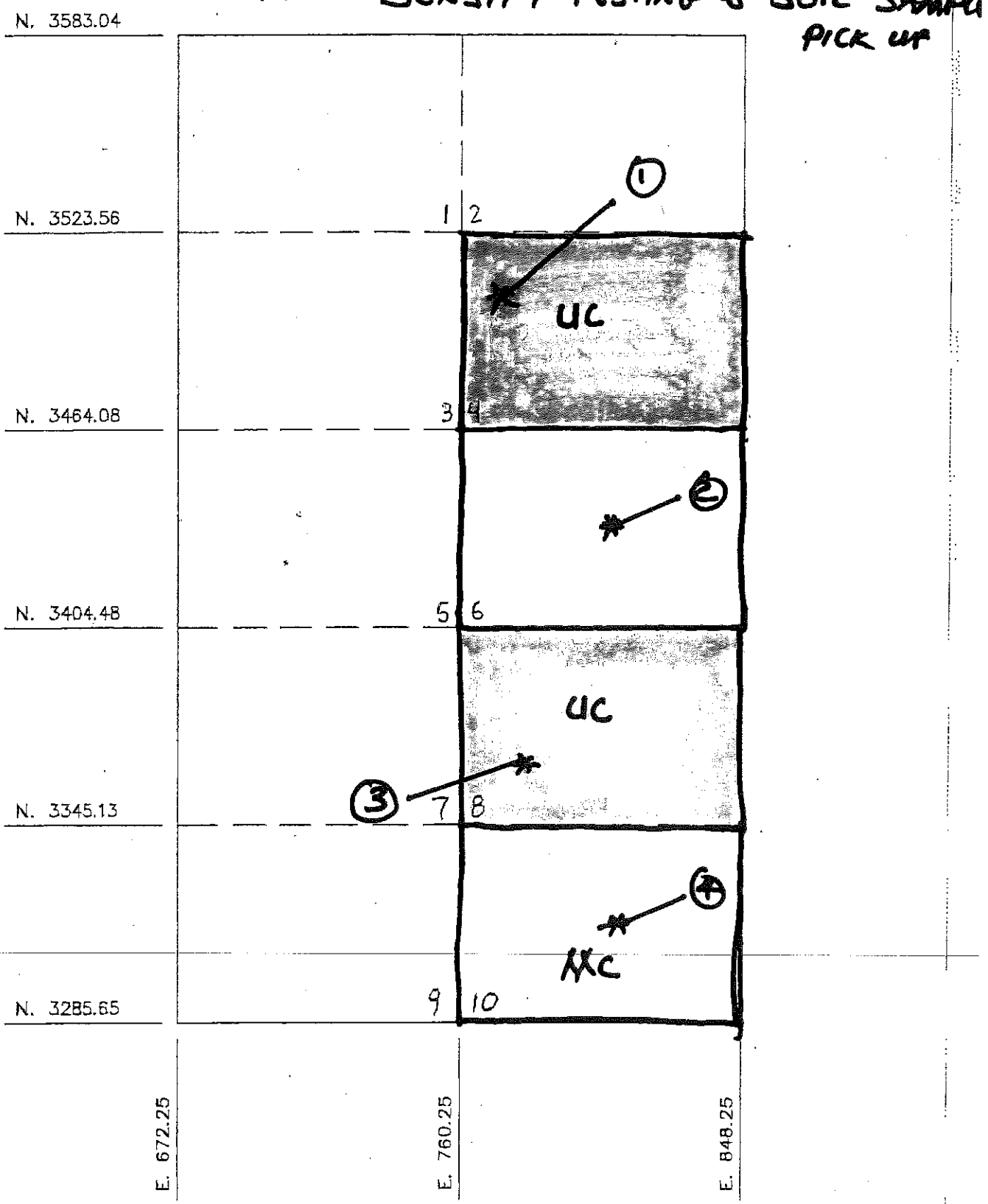
Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

TUGRO PROJECT 04.12164967
W.O. NO 39012. 05.26.17

West Basin

LIFT & FIELD DENSITY TESTING & SOIL SAMPLE PICK UP



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 03/24/2017
Report Date: 03/31/2017
Project No.: 04.12164967
Report No.: 0128

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	8		Area 2, (See Attached Sketch)	6	129.8	109.1	19.0	100+

Gauge No.: 27464 Density Std.: 1976 Moisture Std.: 599

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

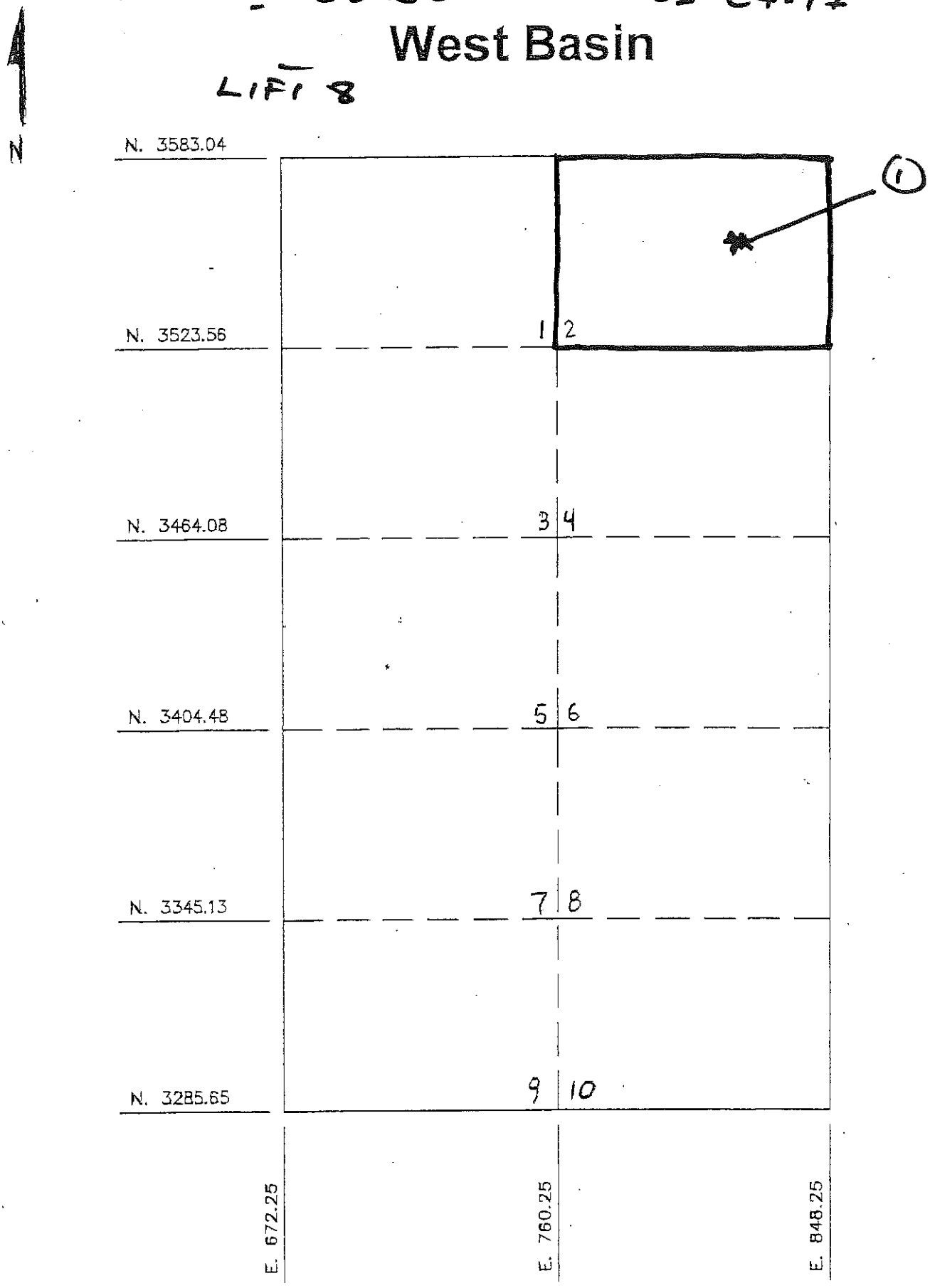
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

FUGRO PROJECT 04.12164967
W.O. NO 58956 05-24-17

West Basin

LIFT 8



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/05/2017
		Report Date:	04/07/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0132
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/05/2017
Report Date: 04/06/2017
Project No.: 04.12164967
Report No.: 0132

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 8 (Lift 8)	8,640 psf, See Note-1	4,320 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

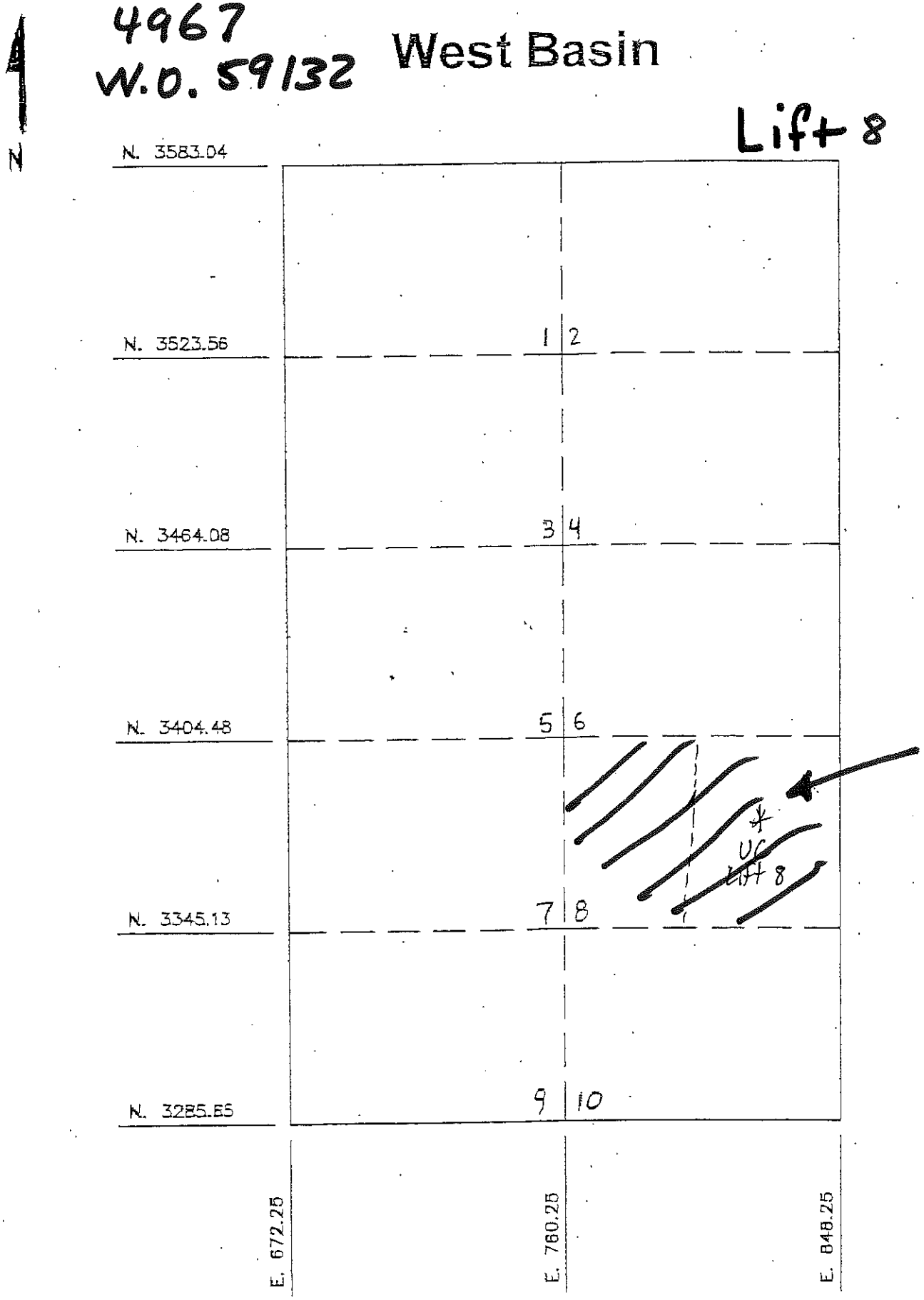
Shell SET East/West Basin Closure

4967

W.O. 59132

West Basin

Lift 8



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/06/2017
Report Date: 04/11/2017
Project No.: 04.12164967
Report No.: 0133

Construction: SET, West Basin, Clay Cap, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	8		Area 10, East Half	6	124.9	106.5	17.3	99
2	0081	8		Area 1, East Half	6	125.3	106.9	17.2	99
3	0081	8		Area 3, East Half	6	122.8	99.3	23.7 *	92*
4	0081	9		Area 2, East Half	6	125.4	106.9	17.3	99
5	0081	9		Area 4, East Half	6	124.0	106.0	17.0	98
6	0081	9		Area 6, East Half	6	124.9	106.5	17.3	99

Gauge No.: 36787 Density Std.: 2107 Moisture Std.: 727

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

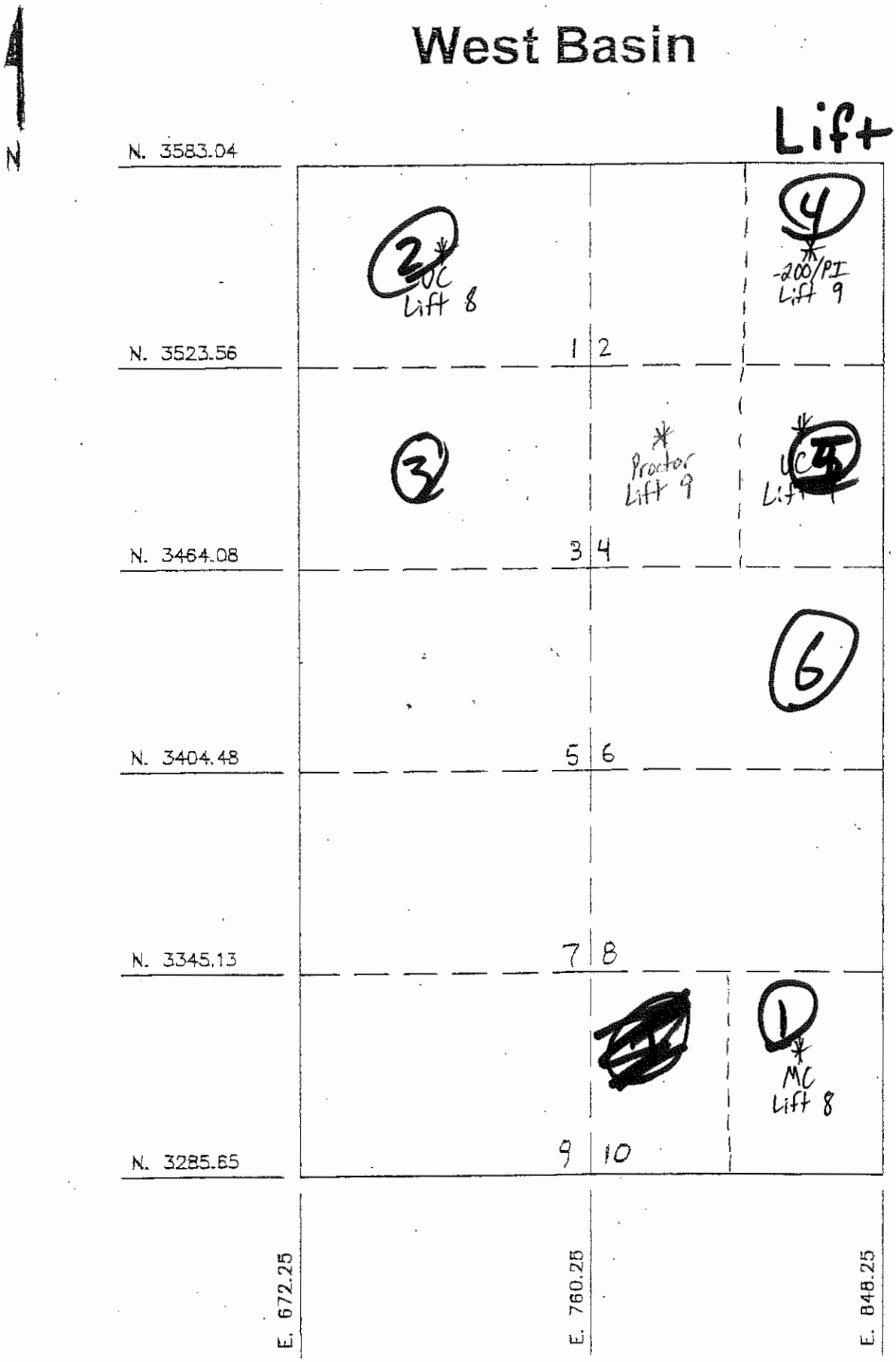
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/06/2017
		Report Date:	04/11/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0133A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 10, East Half, Lift # 8 (See Report 0133 Test # 1)
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 17.3%

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/06/2017
		Report Date:	04/07/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0135
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/06/2017
Report Date: 04/07/2017
Project No.: 04.12164967
Report No.: 0135

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 1 (Lift 8)	5,180 psf, See Note-1	2,590 psf, See Note-1
Area 4 (Lift 9)	4,030 psf, See Note-1	2,015 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

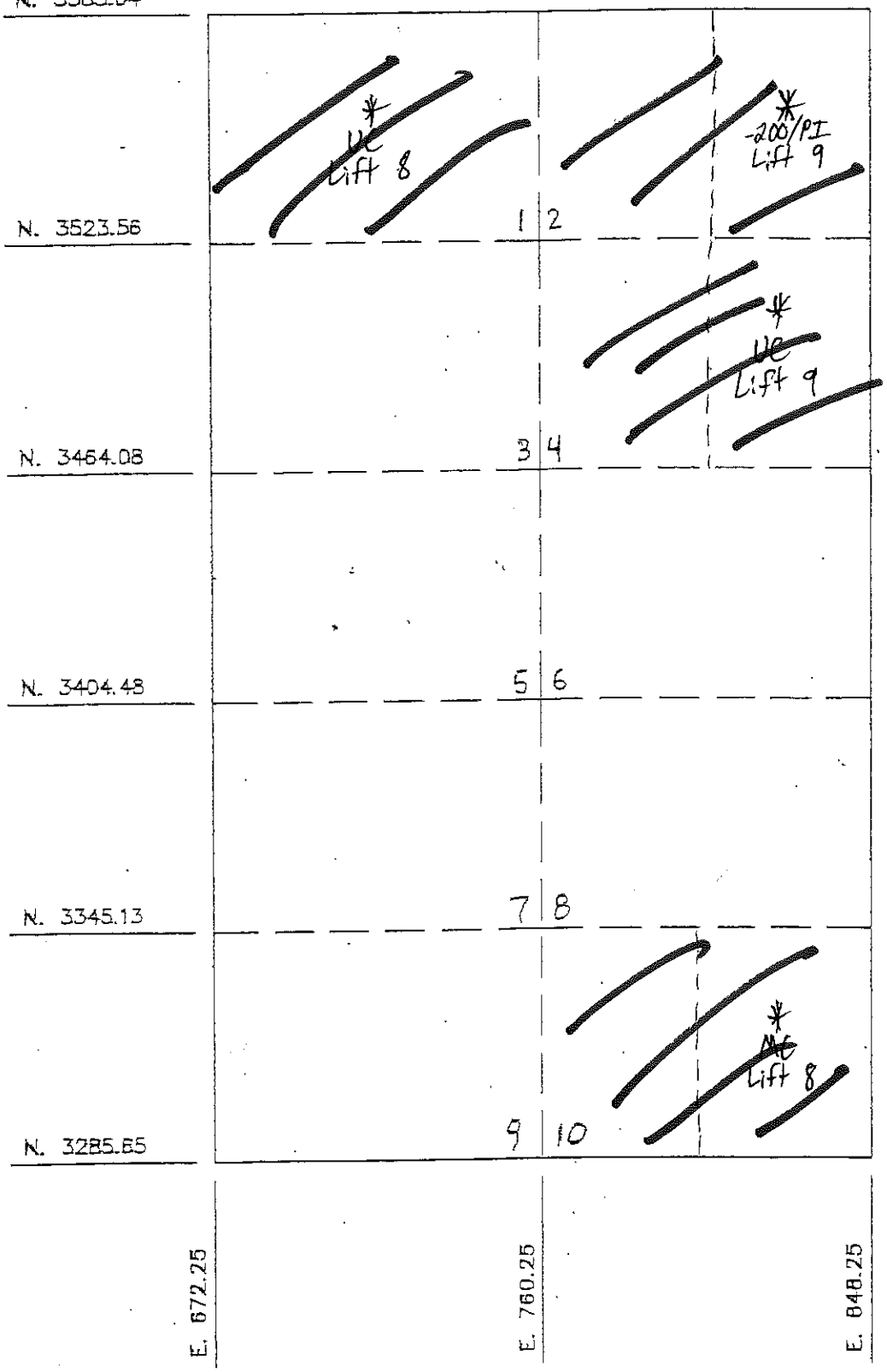
The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East/West Basin Closure

4967
59156

West Basin

Lift 8 & 9



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/06/2017
Report Date: 04/10/2017
Project No.: 04.12164967
Report No.: 0136

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	Onsite, Area 2, Lift 9, East Half	69	24	45	85.2	Gray and Tan Fat Clay

As received (in-situ) moisture content: 18.3%

Test Methods (If Applicable):ASTM D4318, ASTM D1140, ASTM D2216

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

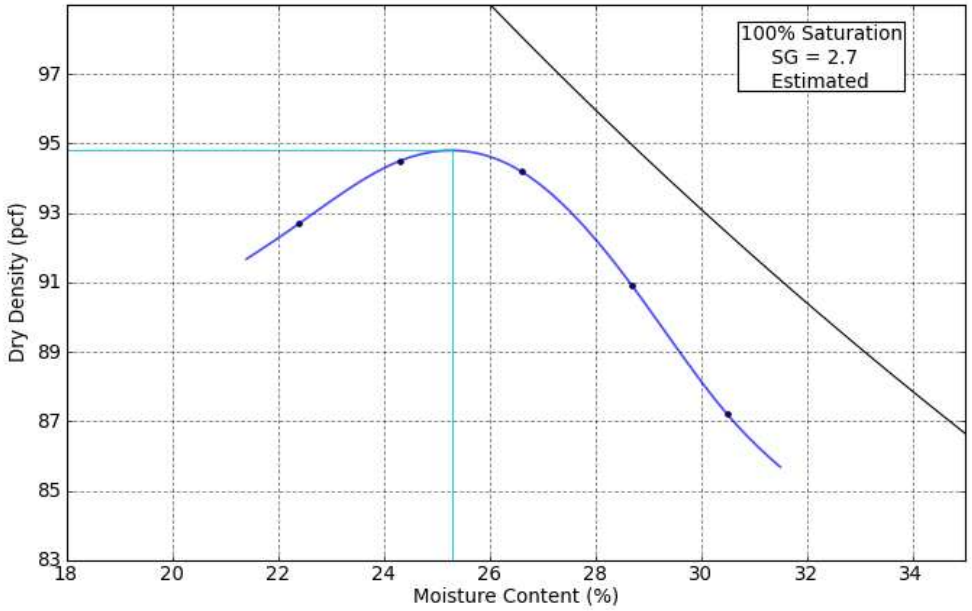
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/06/2017
Report Date: 04/10/2017
Project No.: 04.12164967
Report No.: 0137

Visual Classification: Gray Fat Clay
Sample Source: Onsite, Area 4, Lift 9, West half
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 94.8 pcf
Optimum Water Content: 25.3 %

Properties:	ASTM D4318
Liquid Limit	75
Plastic Limit	26
Plasticity Index	49
	ASTM D1140
% Passing 200:	87.5

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/07/2017
		Report Date:	04/11/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0138A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 9, Lift # 8 (See Report 0138 Test # 1)
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 16.7%

Sample Location: Area 5, Lift # 8 (See Report 0138 Test # 6)
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 17.5%

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/07/2017
		Report Date:	04/11/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0139
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/07/2017
Report Date: 04/11/2017
Project No.: 04.12164967
Report No.: 0139

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 8 (Lift 9)	7,340 psf, See Note-1	3,670 psf, See Note-1
Area 3 (Lift 8)	6,190 psf, See Note-1	3,095 psf, See Note-1
Area 10 (Lift 9)	5,620 psf, See Note-1	2,810 psf, See Note-1
Area 9 (Lift 8)	4,900 psf, See Note-1	2,450 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/08/2017
Report Date: 04/12/2017
Project No.: 04.12164967
Report No.: 0140

Construction: SET, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	9		Area 4, West Half, (See Attached Sketch)	6	118.7	98.2	20.9 *	100+
2	0137	9		Area 2, West Half, (See Attached Sketch)	6	119.3	100.2	19.1 *	100+
3	0137	9		Area 9, West Half, (See Attached Sketch)	6	125.4	106.2	18.1 *	100+

Gauge No.: 36787 Density Std.: 2075 Moisture Std.: 734

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

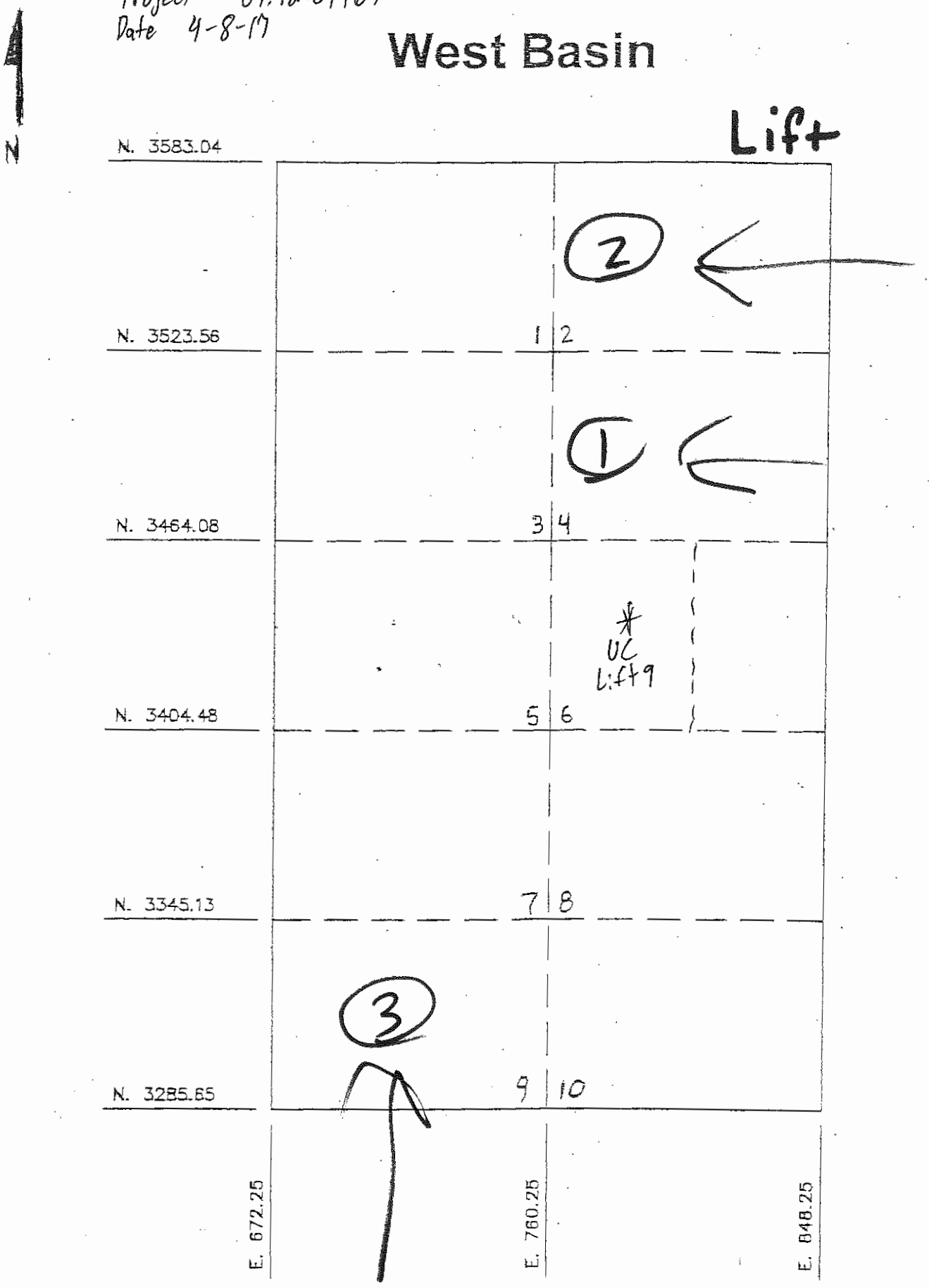
Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project # 04.12164967
Date 4-8-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/08/2017
		Report Date:	04/11/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0141
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/08/2017
Report Date: 04/11/2017
Project No.: 04.12164967
Report No.: 0141

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 6 (Lift 9)	2,880 psf, See Note-1	1,440 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/10/2017
		Report Date:	04/11/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0142A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 7, Lift # 9 (See Report 0142 Test # 1)
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 24.3%

Sample Location: Area 8, Lift # 10 (See Report 0142 Test # 7)
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 24.9%

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/12/2017
		Report Date:	04/17/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0145
Contractor:	Bo-Mac Contractors, LTD		

On 04/12/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Field Density Testing. After arrival to the job site, the testing was cancelled by the contractor.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/13/2017
		Report Date:	04/17/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0146
Contractor:	Bo-Mac Contractors, LTD		

On 04/13/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Field Density Testing. After arrival to the job site, the testing was cancelled by the contractor.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	03/23/2017
		Report Date:	04/17/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0147
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: ASTM D 5084, METHOD F:
Using Flexible Wall Permeameter and Mercury Constant Volume - Falling Head Hydraulic System

Project Number: 04.12164967 | Test Type: Permeability Vert. | Cell No.: Perm-1 | Boring/Exploration No.: 0
Task Number: | Test Stage: 1 of 1 | Test Station No.: 8 | Sample No.: 58937-1
Project Name: | Test No.: NA | Hyd. App. No. (Permometer): 1 | Penetration/Depth (ft):
Test Series No.: NA | File Name: 58937-1aV | Composite Sample No.:
Axial Load Cell No.: NA | Factor, (lbf/V/V): NA | Excit. Volt, V: NA | Ch. No.: NA | Ht. Reading before Perm. (mm): 5.280
Vert. Dial/DT No.: DG-071 | Factor, (mm/V/V): | Excit. Volt, V: | Ch. No.: | Ht. Reading at σ_c = 0 (mm): 5.450

Permeation & Specimen Information			
Permeant: X Tap Water;			
Direction of Flow: X Up; Down			
Perm. Orientation: X Vertical; Horizontal			
Specimen: X "Intact;" X Reconstituted;			
Back Pressure, U_b (psi) = 90.0	Stage	Height, $L_{t,n}$ (mm)	Area, $A_{t,n}$ (cm^2)
	Preliminary:	53.680	20.94
	Final:	53.680	21.83
Prelim. change in height during consol., $\Delta H_{c,p}$ (mm) = -3.08			

Hydraulic System Constants	
Mercury U-Tube Manometer	
Area headwater tube, a_{in} (cm^2):	0.7671
Area tailwater tube, a_{out} (cm^2):	0.03142
ΔHg_{eq} at equilibrium (cm):	0.4
Fluid Density Const. (15-25°C):	12.57

Remarks:

Mercury Head Settings (D 5084)			
Estimated k_t (cm/sec)	Max. Gradient ($i_o = h/L_{t,p}$)	Permometer ΔHg Setting (cm)	Min. Cell Pressure (psi)
1.0E-4 to 1.0E-5	≤5	1.8	90.8
1.0E-5 to 1.0E-6	≤10	3.9	91.5
1.0E-6 to 1.0E-7	≤20	8.2	93.0
<1.0E-7 or <3.0E-2 (m/yr)	≤30	12.4	94.6
For Special Gradient, i_o			

Trial No.	Read-ings By	Date y= 2017 (m/d)	Time (1) hr:min	Temp. °C	Δt (min)	Axial Force (volt)	Pressure Cell, σ_c (psi)	Pressure Back, U_b (psi)	X Dial DT Reading (mm)	Mercury Head Readings (2) Tail, tw_r (cm) (3&4)	Mercury Head Readings (2) Head, hw_r (cm)	Total Head Loss (cm of water)	Initial Hyd. Gradient, i_o Preliminary Final	Hydraulic Conductivity, k Preliminary, k_t (m/yr) (cm/s)	Hydraulic Conductivity, k Final, $k_{20°C}$ (m/yr) (cm/s)	Minimum Allowable tw_r (cm)
	rc,jr	4/11	7:32:40	22.0	21.3	NA	95.0	90.0	5.280	10.00	1.8	107.7	20.1	2.83E-02	2.58E-02	7.94
1	rc,jr	4/11	7:54:00	22.0		NA	95.0	90.0	5.280	8.60	XXXXX	89.4	20.1	8.97E-08	8.20E-08	
	rc,jr	4/11	7:54:39	22.0	14.3	NA	95.0	90.0	5.280	10.00	1.8	107.7	20.1	2.93E-02	2.68E-02	7.94
* 2	rc,jr	4/11	8:08:57	22.0		NA	95.0	90.0	5.280	9.00	XXXXX	94.6	20.1	9.29E-08	8.49E-08	
	rc,jr	4/11	8:09:47	22.0	15.5	NA	95.0	90.0	5.280	10.00	1.8	107.7	20.1	2.70E-02	2.47E-02	7.94
* 3	rc,jr	4/11	8:25:18	22.0		NA	95.0	90.0	5.280	9.00	XXXXX	94.6	20.1	8.56E-08	7.83E-08	
	rc,jr	4/11	8:25:57	22.0	17.4	NA	95.0	90.0	5.280	10.00	1.8	107.7	20.1	2.66E-02	2.43E-02	7.94
* 4	rc,jr	4/11	8:43:23	22.0		NA	95.0	90.0	5.280	8.90	XXXXX	93.3	20.1	8.44E-08	7.72E-08	
	rc,jr	4/11	8:43:56	22.0	16.5	NA	95.0	90.0	5.280	10.00	1.8	107.7	20.1	2.82E-02	2.59E-02	7.94
* 5	rc,jr	4/11	9:00:23	21.7		NA	95.0	90.0	5.280	8.90	XXXXX	93.3	20.1	8.95E-08	8.21E-08	

Average $k_{20°C}$:	8.06E-08	cm/s
Max. Dev. from Mean:	5.4%	
Avg. Initial Gradient (i_o) :	20.1	
Intrinsic (Absolute) Permeability, *K*:	8.26E-13	cm^2

(*) Indicates trials used for calculations of: Average $k_{20°C}$, Max. Dev. from mean, and Average (i_o).

(1) If a stopwatch is used to obtain Δt, only record the initial time reading.

(2) Read both mercury levels at top of meniscus.

(3) The tailwater column is the column of mercury which is higher than the other (headwater) column.

(4) To meet the reading accuracy requirement of 5%, the drop in the tail water reading has to be > 1 cm. For CMT testing with k < about 5×10^{-8} cm/sec, that requirement can be reduced by about ½.

Prelim. Calc. By: RC,jr | Final Calc. By: RC,jr | Reviewed By:

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/17/2017
Report Date: 04/19/2017
Project No.: 04.12164967
Report No.: 0149

Construction: Clay Cap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	10		Area 4, West Half, (See Attached Sketch)	6	116.1	92.9	25.0	98
2	0137	10		Area 2, West Half, (See Attached Sketch)	6	115.6	93.0	24.3	98
3	0081	10		Area 9, (See Attached Sketch)	6	124.6	106.4	17.1	99
4	0137	10		Area 7, (See Attached Sketch)	6	116.9	93.1	25.6	98
5	0137	10		Area 5, (See Attached Sketch)	6	116.3	92.9	25.2	98
6	0137	10		Area 3, (See Attached Sketch)	6	115.7	93.0	24.4	98

Gauge No.: 36787 Density Std.: 2067 Moisture Std.: 730

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

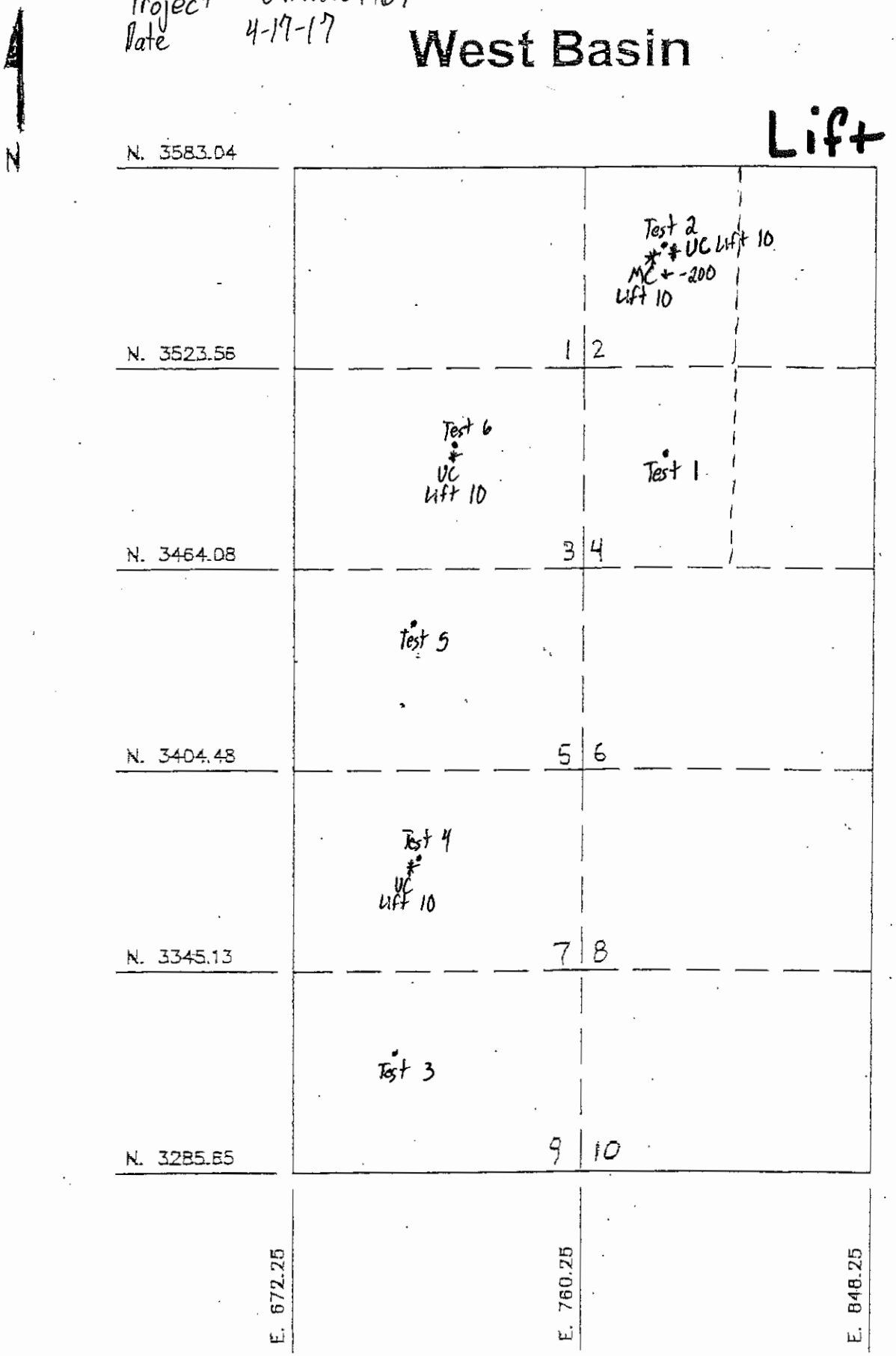
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project # 04.12164967
Date 4-17-17

West Basin



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/17/2017
		Report Date:	04/20/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0149A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro USA Land, Inc. obtained a sample of the clay cap material for moisture content testing.

Sample Location: West Half, Area 2, Lift 10
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 24.3%

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/17/2017
		Report Date:	04/19/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0150
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/17/2017
Report Date: 04/19/2017
Project No.: 04.12164967
Report No.: 0150

Visual Classification: Gray Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 2 (Lift 10)	2,300 psf, See Note-1	1,150 psf, See Note-1
Area 3 (Lift 10)	2,740 psf, See Note-1	1,370 psf, See Note-1
Area 7 (Lift 10)	3,740 psf, See Note-1	1,870 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/17/2017
Report Date: 04/20/2017
Project No.: 04.12164967
Report No.: 0151

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	West Half, Area 2, Lift 10	79	25	54	90.8	Light gray fat clay

Project Specification:
Liquid Limit (LL): Minimum 30
Plasticity Index (PI): Minimum 15
Percent Passing the No. 200 Sieve: Minimum 30%

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/24/2017
Report Date: 04/25/2017
Project No.: 04.12164967
Report No.: 0155

Construction: SET, West Basin, Clay Cap, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	11		Area 10, West Half	6	117.2	94.2	24.4	99
2	0081	11		Area 6, West Half	6	127.2	106.0	20.0	98
3	0137	11		Area 8, West Half	6	117.5	94.0	25.0	99
4	0137	11		Area 4, West Half	6	116.9	92.9	25.8	98

Gauge No.: 28749 Density Std.: 1914 Moisture Std.: 663

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

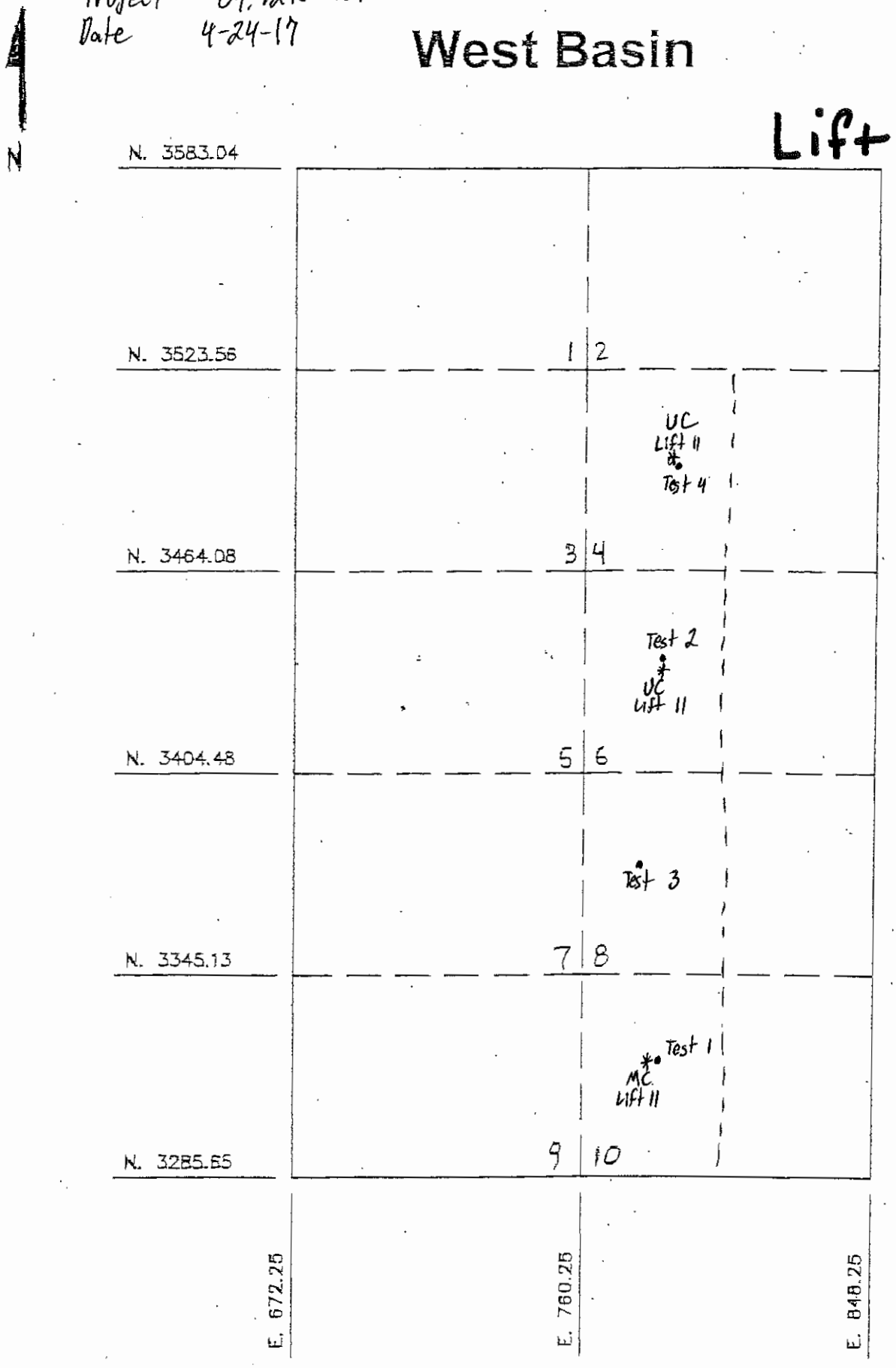
Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project # 04.12164967
Date 4-24-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/24/2017
		Report Date:	04/26/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0155A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro USA Land, Inc. obtained a sample of the clay cap material for moisture content testing.

Sample Location: West Basin, Area 10, Lift 11
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 24.4%

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/24/2017
		Report Date:	04/25/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0156
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/24/2017
Report Date: 04/25/2017
Project No.: 04.12164967
Report No.: 0156

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 6 (Lift 11)	2,740 psf, See Note-1	1,370 psf, See Note-1
Area 4 (Lift 11)	3,170 psf, See Note-1	1,590 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/25/2017
Report Date: 04/26/2017
Project No.: 04.12164967
Report No.: 0158

Construction: SET, West Basin, Clay Cap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	10		Area 1, (See Attached Sketch)	6	117.0	93.8	24.7	99
2	0137	10		Area 5, East Half, (See Attached Sketch)	6	119.8	93.9	27.6	99
3	0137	10		Area 3, East Half, (See Attached Sketch)	6	119.0	93.1	27.8	98

Gauge No.: 28749 Density Std.: 1915 Moisture Std.: 668

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

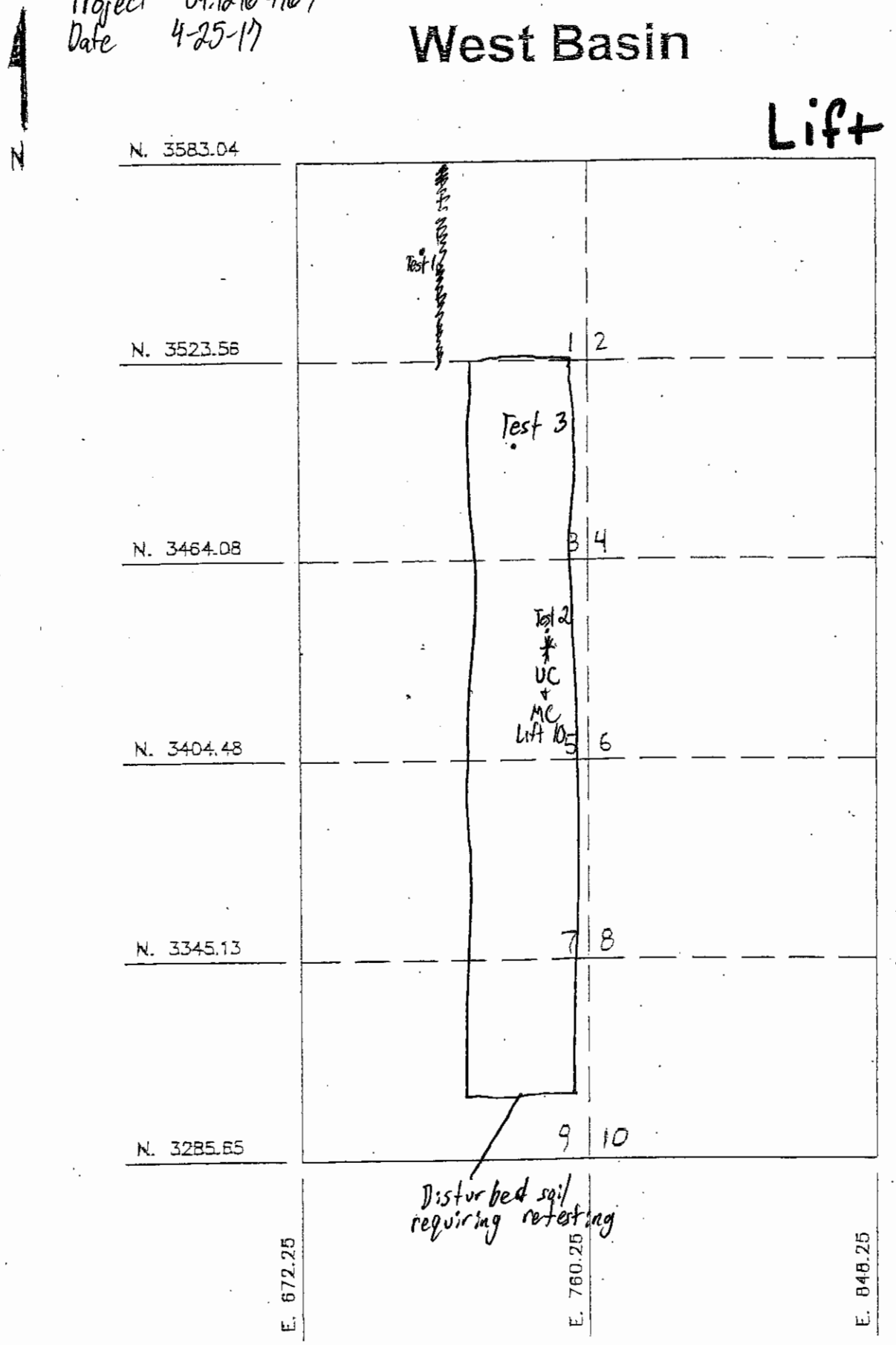
Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project #04.12164967
Date 4-25-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/25/2017
		Report Date:	04/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0158A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro USA Land, Inc. obtained a sample of the clay cap material for moisture content testing.

Sample Location: East Basin, Area 5, Lift 10
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 27.6%

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/25/2017
		Report Date:	04/26/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0159
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/25/2017
Report Date: 04/26/2017
Project No.: 04.12164967
Report No.: 0159

Visual Classification: Gray Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 5 (Lift 10)	2,880 psf, See Note-1	1,440 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/26/2017
Report Date: 04/28/2017
Project No.: 04.12164967
Report No.: 0161

Construction: SETR, West Basin, Clay Cap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	11		Area 9, West Half, (See Attached Sketch)	6	119.5	94.3	26.7	100
2	0137	10		Area 7, East Half, (See Attached Sketch)	6	120.3	94.7	27.0	100
3	0137	10		Area 9, East Half, (See Attached Sketch)	6	119.1	94.4	26.2	100
4	0137	12		Area 8, West Half, (See Attached Sketch)	6	116.9	94.0	24.4	99
5	0137	12		Area 6, West Half, (See Attached Sketch)	6	119.7	94.7	26.4	100
6	0137	12		Area 4, West Half, (See Attached Sketch)	6	118.6	93.8	26.4	99
7	0137	11		Area 9, East Half, (See Attached Sketch)	6	119.2	93.4	27.6	99

Gauge No.: 28749 Density Std.: 1913 Moisture Std.: 672

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

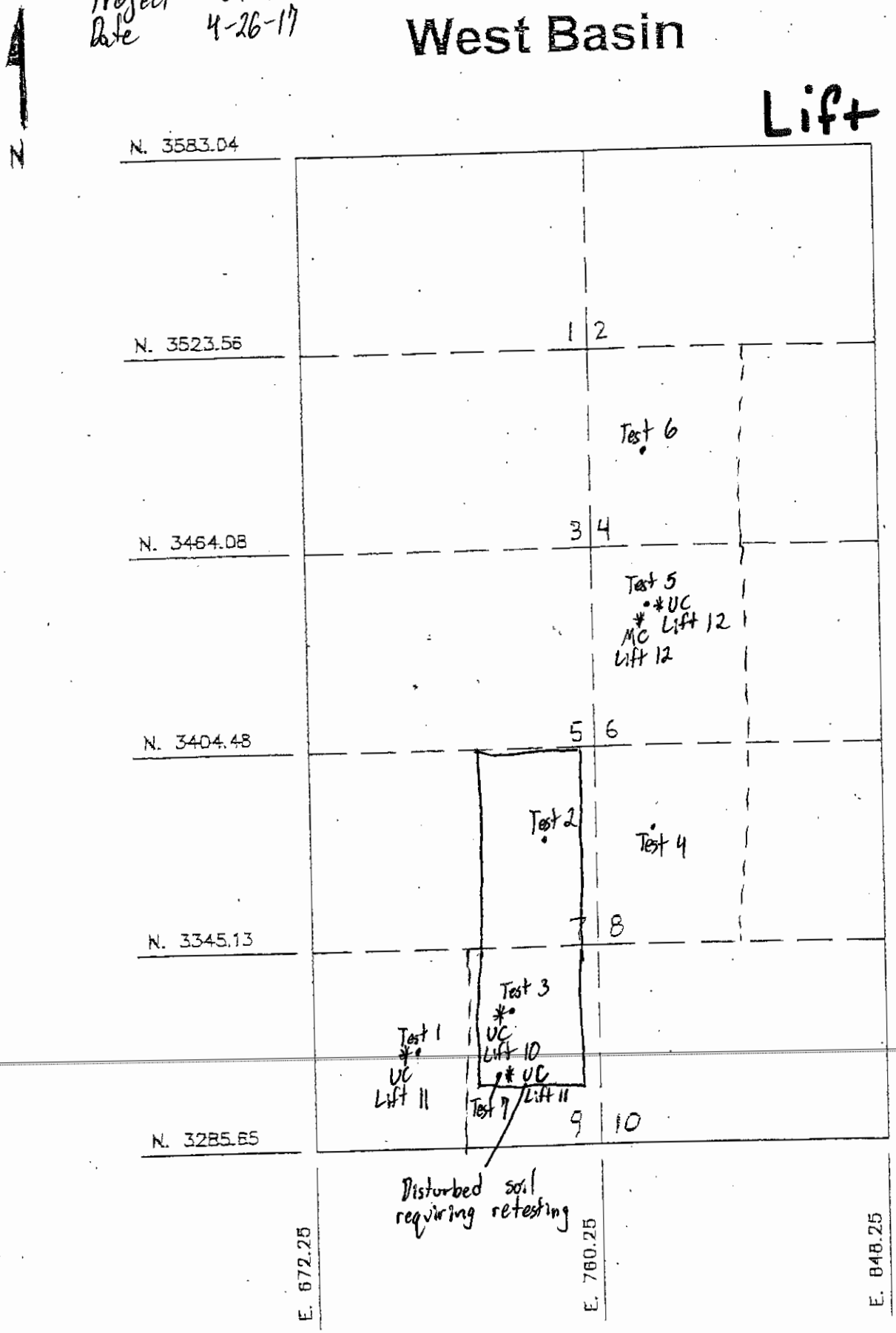
Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project #04.12164967
Date 4-26-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/26/2017
		Report Date:	04/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0161A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro USA Land, Inc. obtained a sample of the clay cap material for moisture content testing.

Sample Location: West Basin, Area 6, Lift 12
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 26.4%

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/26/2017
		Report Date:	04/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0162
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/26/2017
Report Date: 04/28/2017
Project No.: 04.12164967
Report No.: 0162

Visual Classification: Gray Fat Clay
Sample Source: On-Site, West/East Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 9 (Lift 11)	3,020 psf, See Note-1	1,510 psf, See Note-1
Area 6 (Lift 12)	2,880 psf, See Note-1	1,440 psf, See Note-1
Area 9 (Lift 10)	3,890 psf, See Note-1	1,950 psf, See Note-1
Area 9 (Lift 11)	3,310 psf, See Note-1	1,660 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/27/2017
Report Date: 05/04/2017
Project No.: 04.12164967
Report No.: 0164

Construction: SET West Basin Clay Cap, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	11		East Half of Area 7	6	119.4	93.1	28.2	98
2	0137	11		East Half of Area 5	6	120.6	94.7	27.4	100
3	0137	11		East Half of Area 3	6	116.9	93.0	25.7	98
4	0137	12		West Half of Area 10	6	120.9	94.6	27.8	100
5	0137	11		East Half of Area 1	6	119.8	93.4	28.3	99

Gauge No.: 28749 Density Std.: 1919 Moisture Std.: 674

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

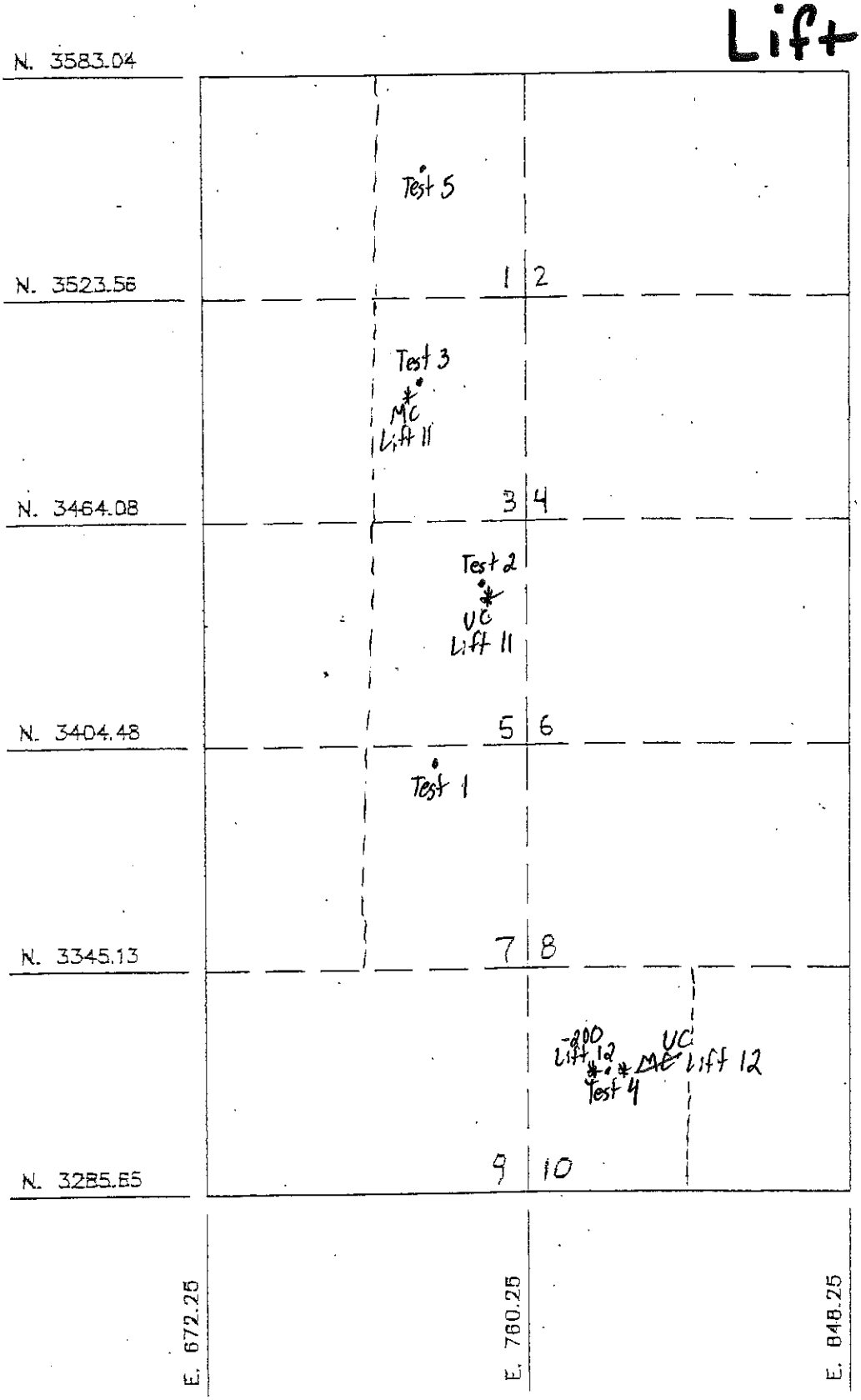
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project # 04.12164967
Date 4-27-17

West Basin



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/27/2017
		Report Date:	05/04/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0164A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro USA Land, Inc. obtained a sample of the clay cap material for moisture content testing.

Sample Location: West Basin, Area 3, Lift 11, East Half
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 27.5%

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/27/2017
Report Date: 05/04/2017
Project No.: 04.12164967
Report No.: 0165

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	West Half, Area 10, Lift 12	82	28	54	92.0	Gray Fat Clay

Project Specification:
Liquid Limit (LL): Minimum 30
Plasticity Index (PI): Minimum 15
Percent Passing the No. 200 Sieve: Minimum 30%

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/27/2017
		Report Date:	04/28/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0166
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 04/27/2017
Report Date: 04/28/2017
Project No.: 04.12164967
Report No.: 0166

Visual Classification: Gray Fat Clay
Sample Source: On-Site, East Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 5 (Lift 11)	3,310 psf, See Note-1	1,660 psf, See Note-1

Note-1:

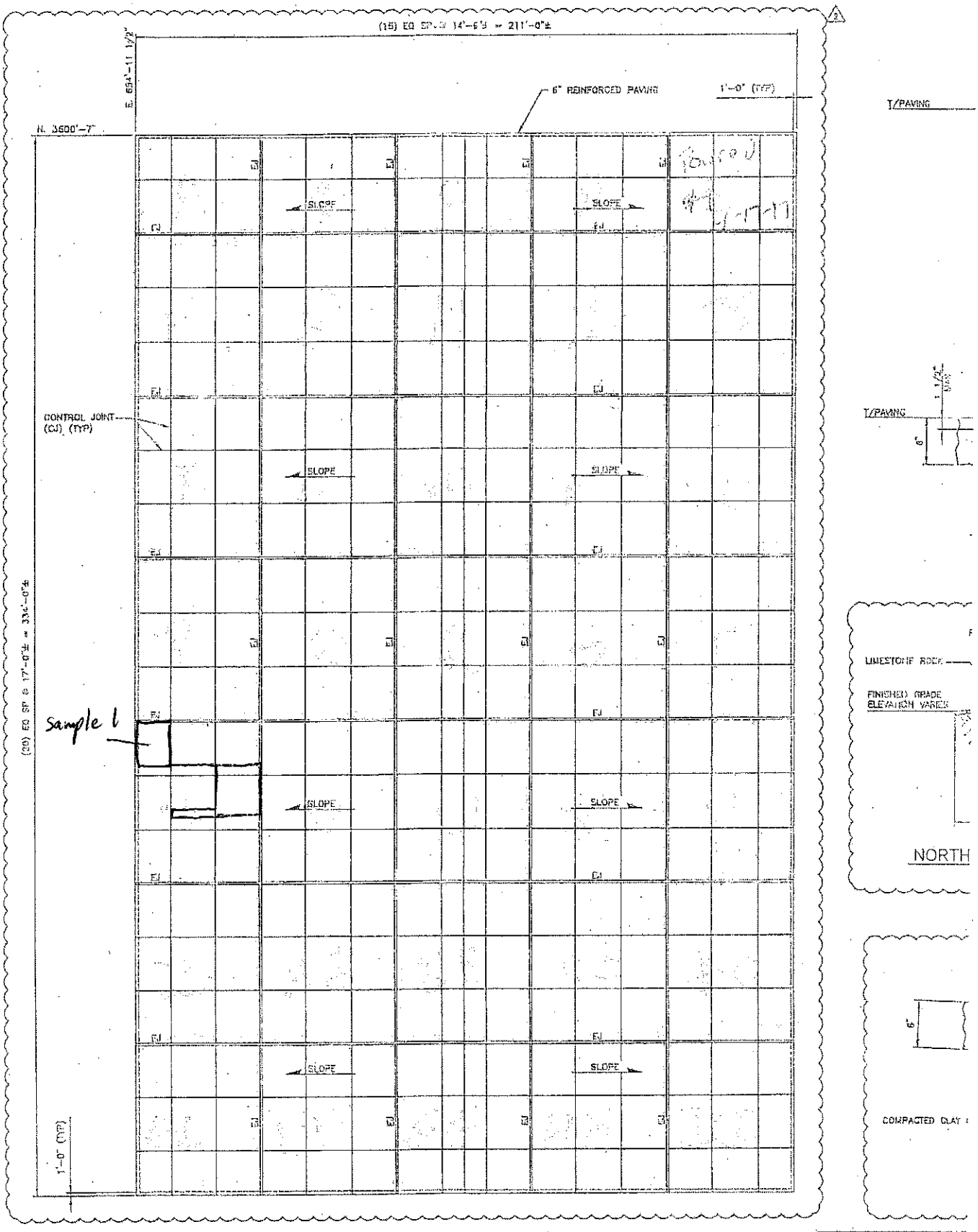
-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

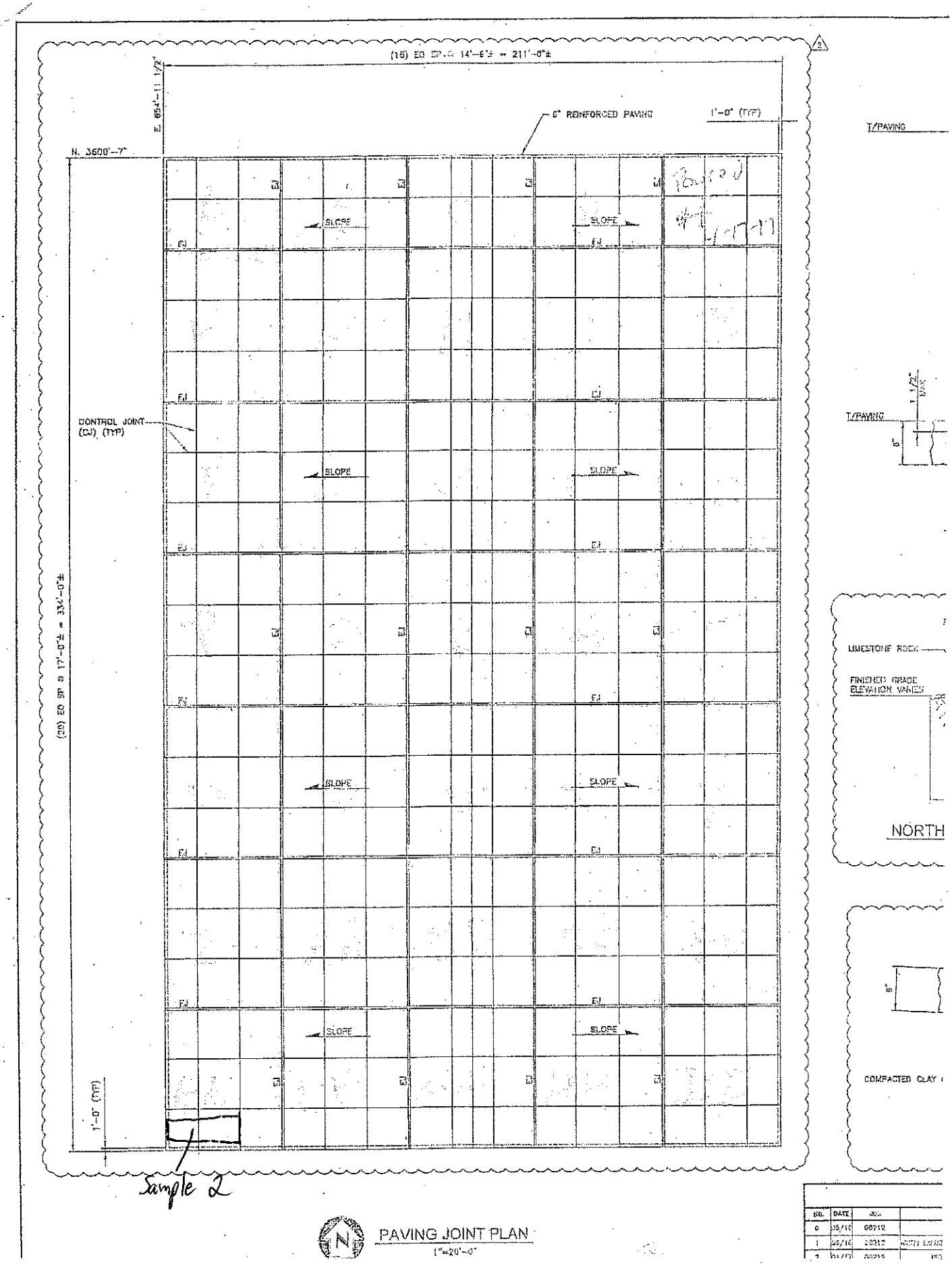
The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

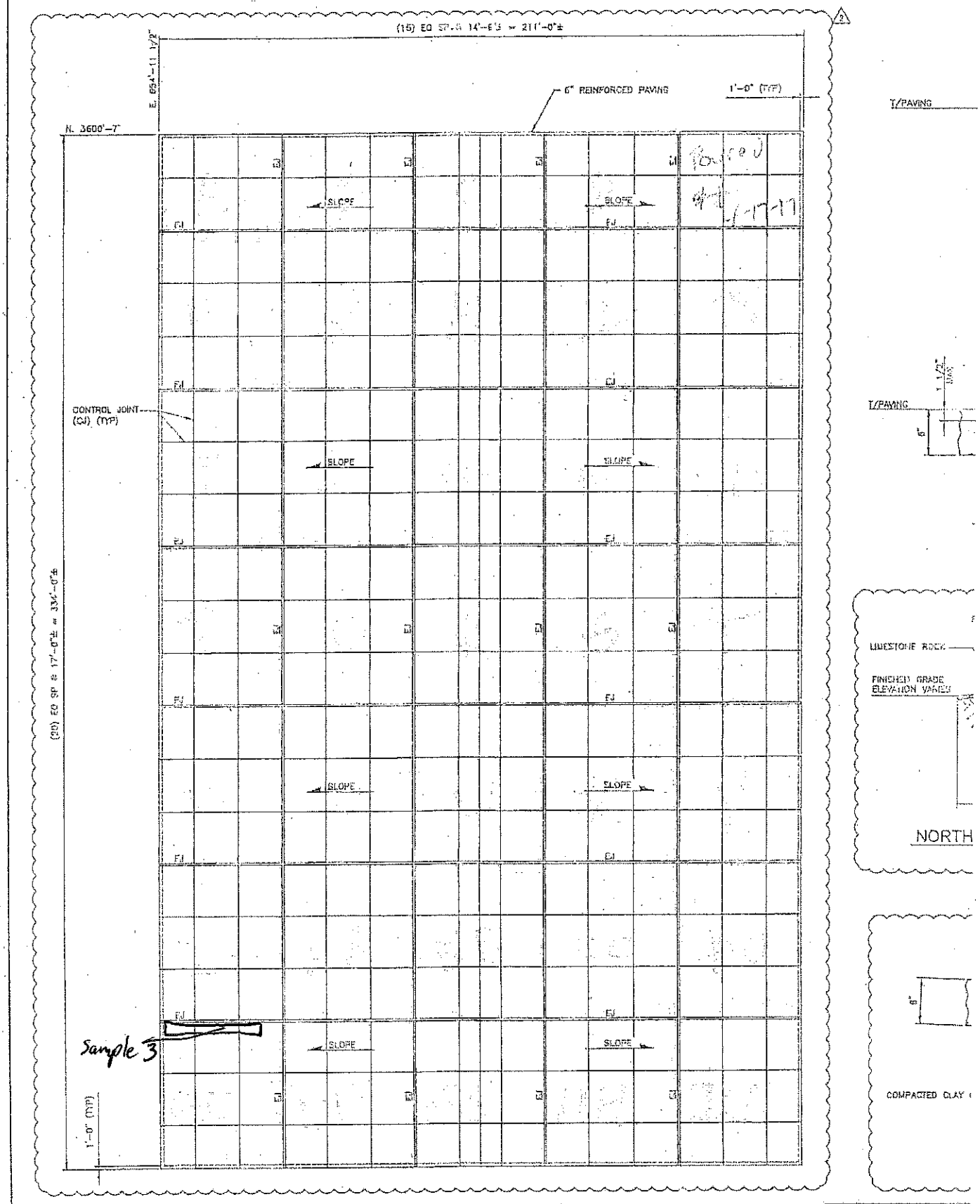
Project 04.12164967
Date 5-1-17



PAVING JOINT PLAN
1"=20'-0"

Project #04.12164967
Date 5-1-17




(15) EQ SP @ 14'-6"± = 211'-0"±
E. 654'-11 1/2"
N. 3600'-7"
6" REINFORCED PAVING
1'-0" (TYP)
T/PAVING
SLOPE
EJ
CONTROL JOINT (CJ) (TYP)
(20) EQ SP @ 17'-0"± = 334'-0"±
Sample 3
LIMESTONE ROCK
FINISHED GRADE ELEVATION VARIES
NORTH
COMPACTED CLAY
PAVING JOINT PLAN
1"=20'-0"

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/01/2017
Report Date: 05/05/2017
Project No.: 04.12164967
Report No.: 0168

Construction: SET West Basin Clay Cap, (See Attached Sketch)

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	95	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	11		West Half of Area 2	6	116.9	93.6	24.9	99
2	0137	12		East Half of Area 1	6	119.1	94.1	26.6	99
3	0137	12		East Half of Area 9	6	117.6	94.5	24.4	100
4	0137	12		East Half of Area 7	6	118.8	94.7	25.4	100
5	0137	12		East Half of Area 5	6	119.3	94.3	26.5	100
6	0137	13		East Half of Area 1	6	118.5	93.5	26.7	99

Gauge No.: 28749 Density Std.: 1916 Moisture Std.: 662

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

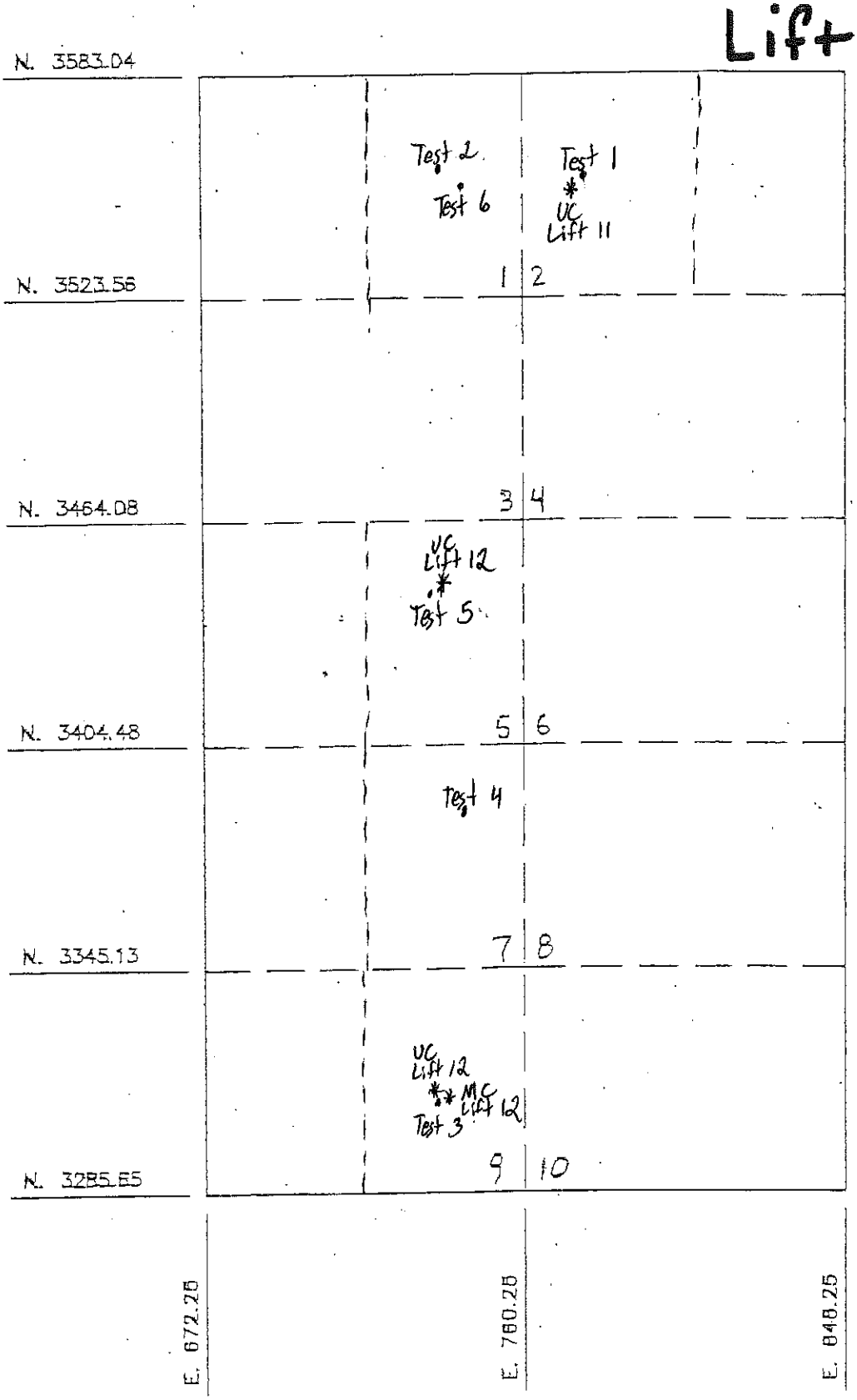
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

Project # 04-12164967
Date 5-1-17

West Basin



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/01/2017
		Report Date:	05/08/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0168A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro USA Land, Inc. obtained a sample of the clay cap material for moisture content testing.

Sample Location: West Basin, Area 9, Lift 12, East Half
Supplier: Mega Sand, Crosby, Texas
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 24.9%

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/01/2017
		Report Date:	05/05/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0169
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 05/01/2017
Report Date: 05/05/2017
Project No.: 04.12164967
Report No.: 0169

Visual Classification: Gray Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 2 (Lift 11)	11,090 psf, See Note-1	5,540 psf, See Note-1
Area 5 (Lift 12)	4,750 psf, See Note-1	2,380 psf, See Note-1
Area 9 (Lift 12)	4,030 psf, See Note-1	2,020 psf, See Note 1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/02/2017
Report Date: 05/05/2017
Project No.: 04.12164967
Report No.: 0171

Construction: Clay Cap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	95	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	12		East Half of Area 3	6	119.7	94.0	27.3	99

Gauge No.: 36787 Density Std.: 2076 Moisture Std.: 719

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Kevin Gore with Bo-Mac of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/02/2017
		Report Date:	05/09/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0172
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 05/02/2017
Report Date: 05/09/2017
Project No.: 04.12164967
Report No.: 0172

Visual Classification: Gray Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 3 (Lift 12)	4,900 psf, See Note-1	2,450 psf, See Note-1

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 06/09/2017
Report Date: 06/12/2017
Project No.: 04.12164967
Report No.: 0192

Construction: Backfill

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0137	Gray / Fat Clay	98	-1/+3	ASTM D698	75	26	49	94.8	25.3

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0137	Final		See Attached Sketch	6	112.5	83.4	34.9 *	88*
2	0137	Final		See Attached Sketch	6	111.9	84.0	33.2 *	89*

Gauge No.: 26491 Density Std.: 1624 Moisture Std.: 638

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed James K. Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Mohammad Akbar

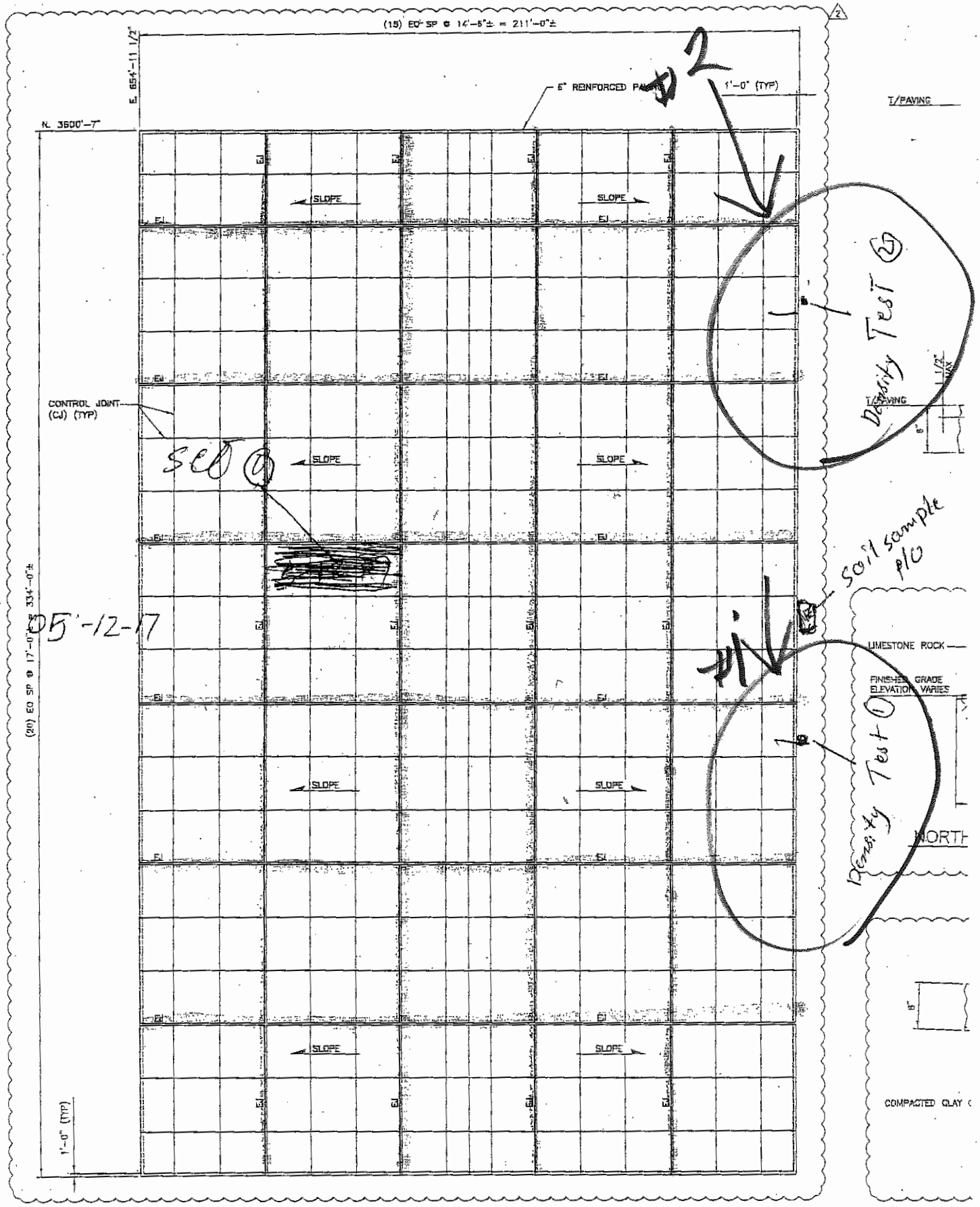
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



PAVING JOINT PLAN

NO.	DATE	JOB
0	05/15	00212

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

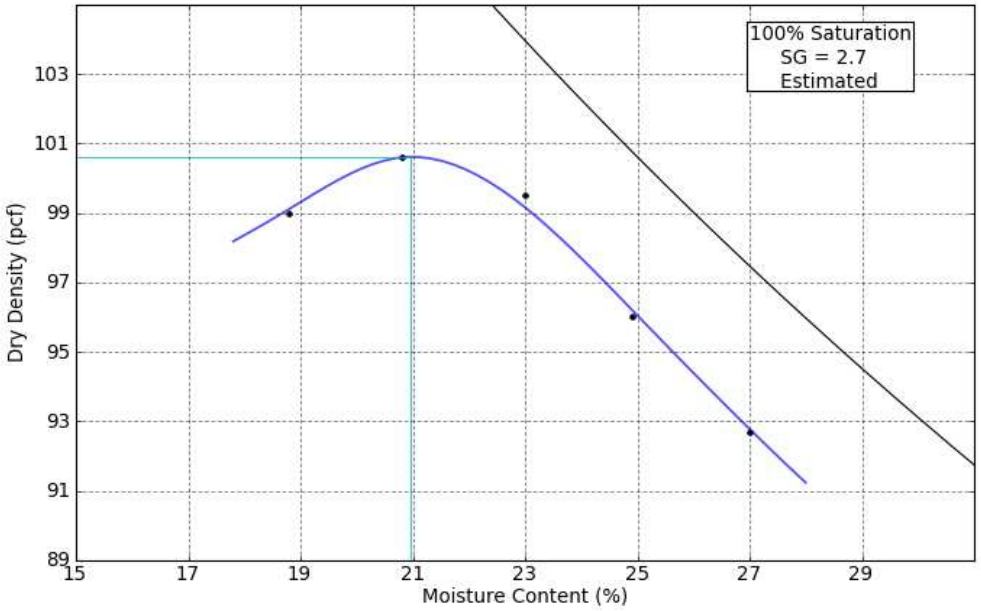
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 06/09/2017
Report Date: 06/12/2017
Project No.: 04.12164967
Report No.: 0193

Visual Classification: Gray and Tan Fat Clay with Sand
Sample Source: Onsite - Work Area
Supplier:
Material Application: Backfill for Paving

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 100.6 pcf
Optimum Water Content: 21.0 %

Properties:	ASTM D4318
Liquid Limit	63
Plastic Limit	18
Plasticity Index	45
	ASTM D1140
% Passing 200:	82.0

Remarks: CMT Form S-003ELM (Revised 08/11)

Fugro Representative: Mohammad Akbar

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 06/19/2017
Report Date: 06/29/2017
Project No.: 04.12164967
Report No.: 0194

Construction: See Attached Sketch

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0193	Gray and Tan / Fat Clay with Sand	98	-1/+3	ASTM D698	63	18	45	100.6	21.0

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0193	1		North of Slope Paving	6	118.2	100.2	18.0 *	100

Gauge No.: 27646 Density Std.: 2164 Moisture Std.: 607

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed James K. Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Mamoudou Sylla

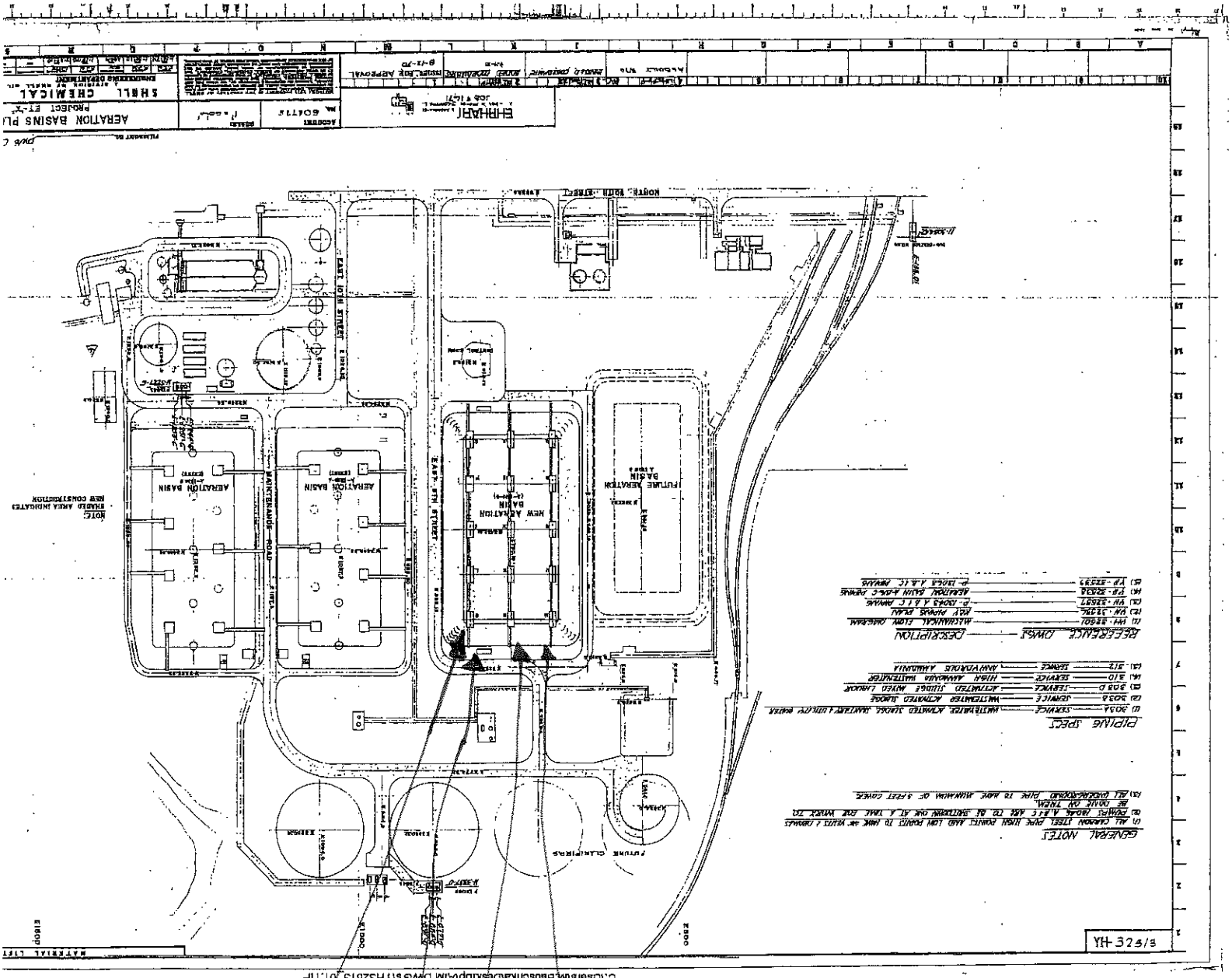
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



Test 004 Test ~~005~~ 006 Test ~~003~~ 003 Test ~~002~~ 002 Test ~~001~~ 001

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 06/20/2017
Report Date: 06/29/2017
Project No.: 04.12164967
Report No.: 0195

Construction: See Attached Sketch

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0193	Gray and Tan / Fat Clay with Sand	98	-1/+3	ASTM D698	63	18	45	100.6	21.0

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0193	1		North of Slope Paving	6	119.3	102.0	17.0 *	100+
2	0193	1		North of Slope Paving	6	113.5	93.0	22.0	92*
3	0193	1		North of Slope Paving	6	113.5	93.0	22.0	92*

Gauge No.: 27646 Density Std.: 2176 Moisture Std.: 615

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed James K. Gore with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Mamoudou Sylla

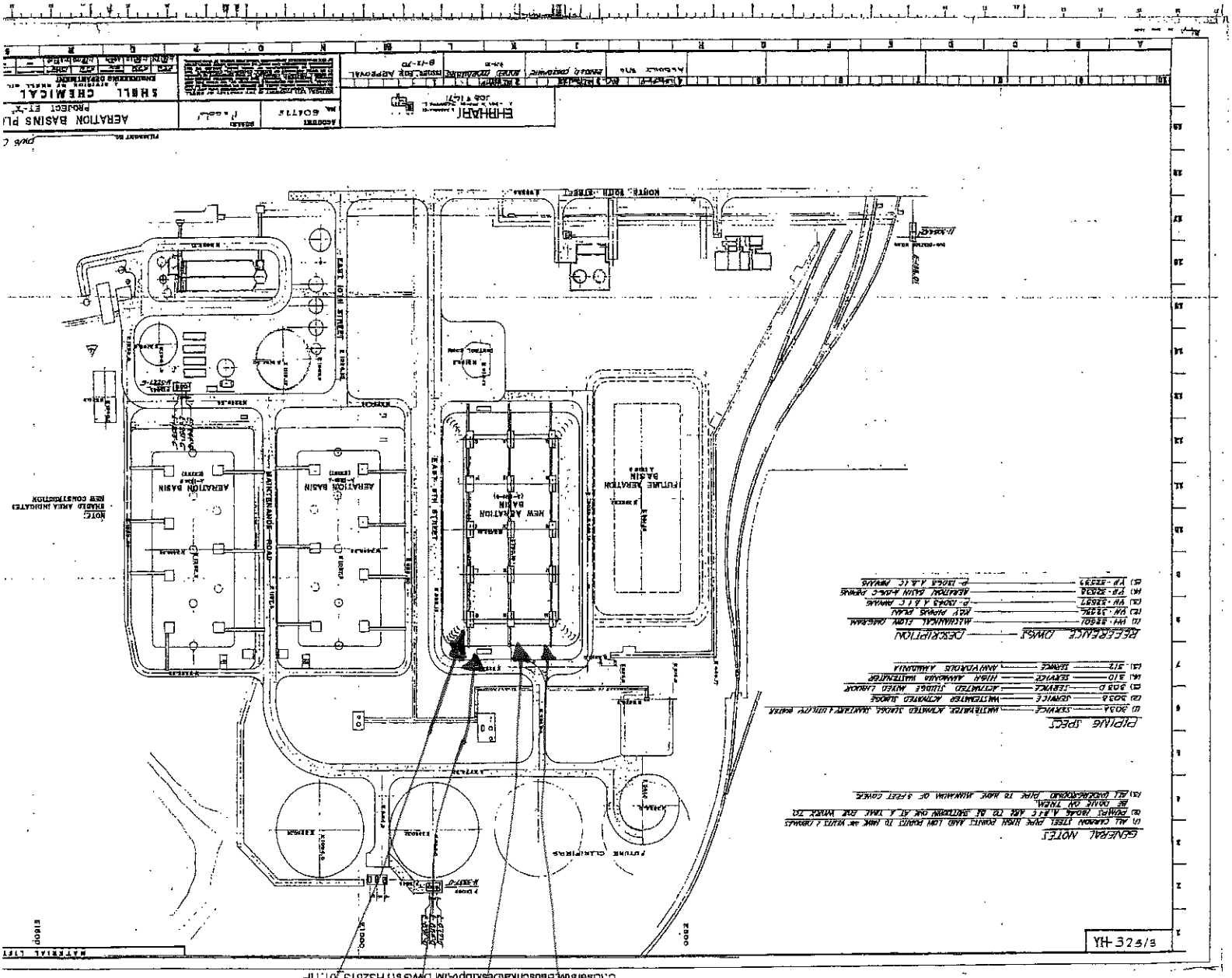
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



Test 004 Test 003 Test 002 Test 001

Fugro USA Land, Inc.
formerly Fugro Consultants, Inc.
6100 Hillcroft St.
Houston, TX 77081

REPORT OF LABORATORY COMPACTION

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

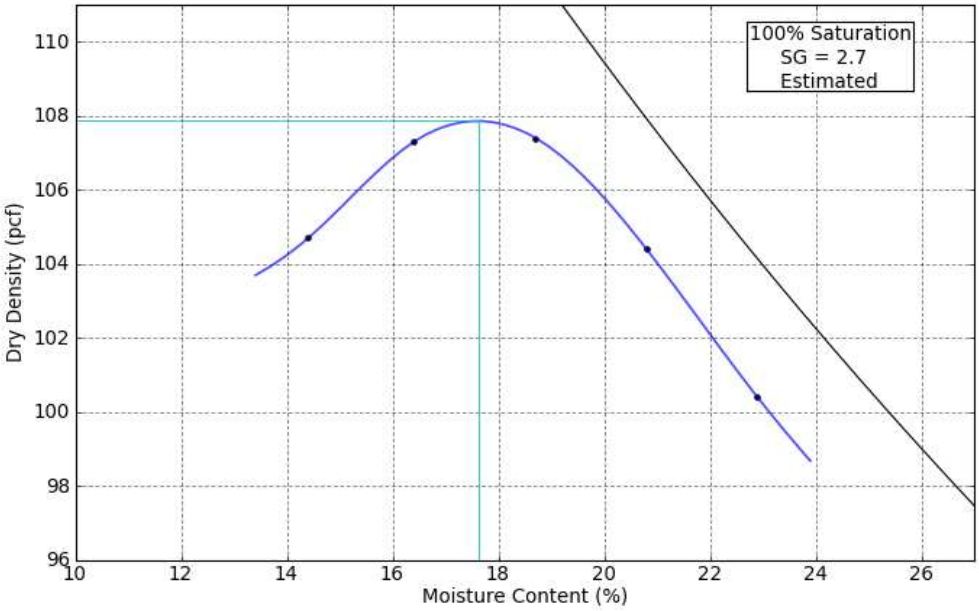
Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/13/2017
Report Date: 01/23/2017
Project No.: 04.12164967
Report No.: 0081

Visual Classification: Gray and Tan Fat Clay
Sample Source: Offsite, Mega Sand, Crosby, TX
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

Test Method: ASTM D698 Method-A
Rammer Type: Mechanical
Prep. Method: Moist



Test Results:
Maximum Dry Unit Weight: 107.9 pcf
Optimum Water Content: 17.6 %

Properties:	ASTM D4318
Liquid Limit	54
Plastic Limit	18
Plasticity Index	36
	ASTM D1140
% Passing 200:	98.1

Remarks: CMT Form S-003ELM (Revised 08/11)
As received (in-situ) moisture content: 15.7%

Fugro Representative: Michael Cartafalsa

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.
REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/30/2017
Report Date: 02/02/2017
Project No.: 04.12164967
Report No.: 0085

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	1		Area 1, (See Attached Sketch)	6	125.7	106.8	17.7	99
2	0081	1		Area 2, (See Attached Sketch)	6	124.1	106.3	16.7	99
3	0081	1		Area 4, (See Attached Sketch)	6	125.9	107.7	16.9	100
4	0081	1		Area 3, (See Attached Sketch)	6	123.9	105.7	17.2	98

Gauge No.: 1283 Density Std.: 2399 Moisture Std.: 509

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

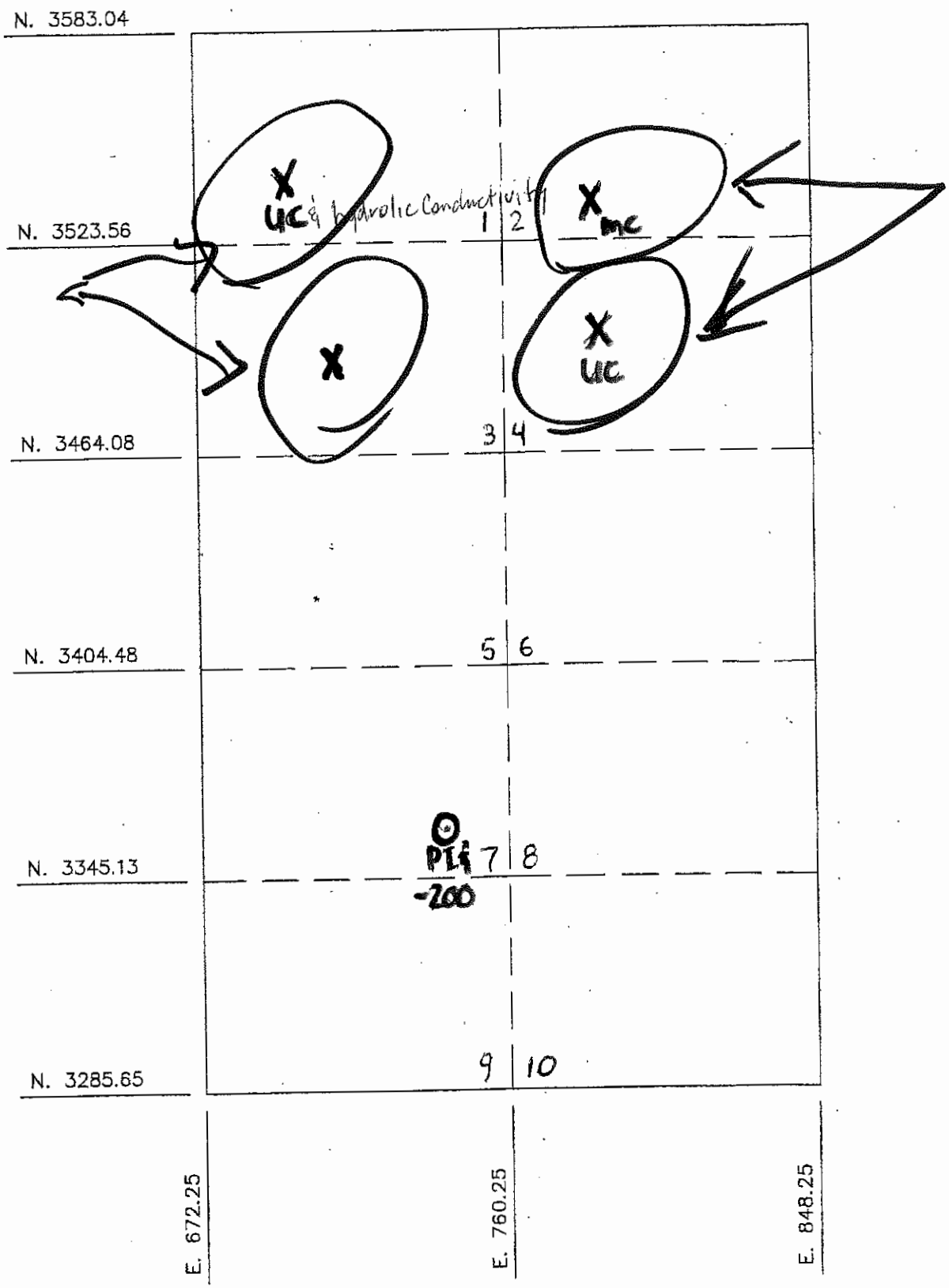
REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure
0412-16-4967
1/30/17
W/O 58055

Clay Cap
Lift 1

West Basin

N



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/30/2017
		Report Date:	02/02/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0085A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the fill material for moisture content testing.

Sample Location: Area 2, Lift 1 (See Report 0085, Test #2)
Supplier: Mega Sand, Crosby, TX
Material Application: Fill, Clay Cap
As Received (in-situ) Moisture Content: 18.6%

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/30/2017
		Revised Report Date:	02/03/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0086
Contractor:	Bo-Mac Contractors, LTD	**Previous Report Date:**	02/02/2017

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/30/2017
Report Date: 01/31/2017
Project No.: 04.12164967
Report No.: 0086

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 1 (Lift 1),	6,050 psf, See Note-1	3,025 psf, See Note-1
Area 4 (Lift 1)	4,750 psf, See Note-1	2,375 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

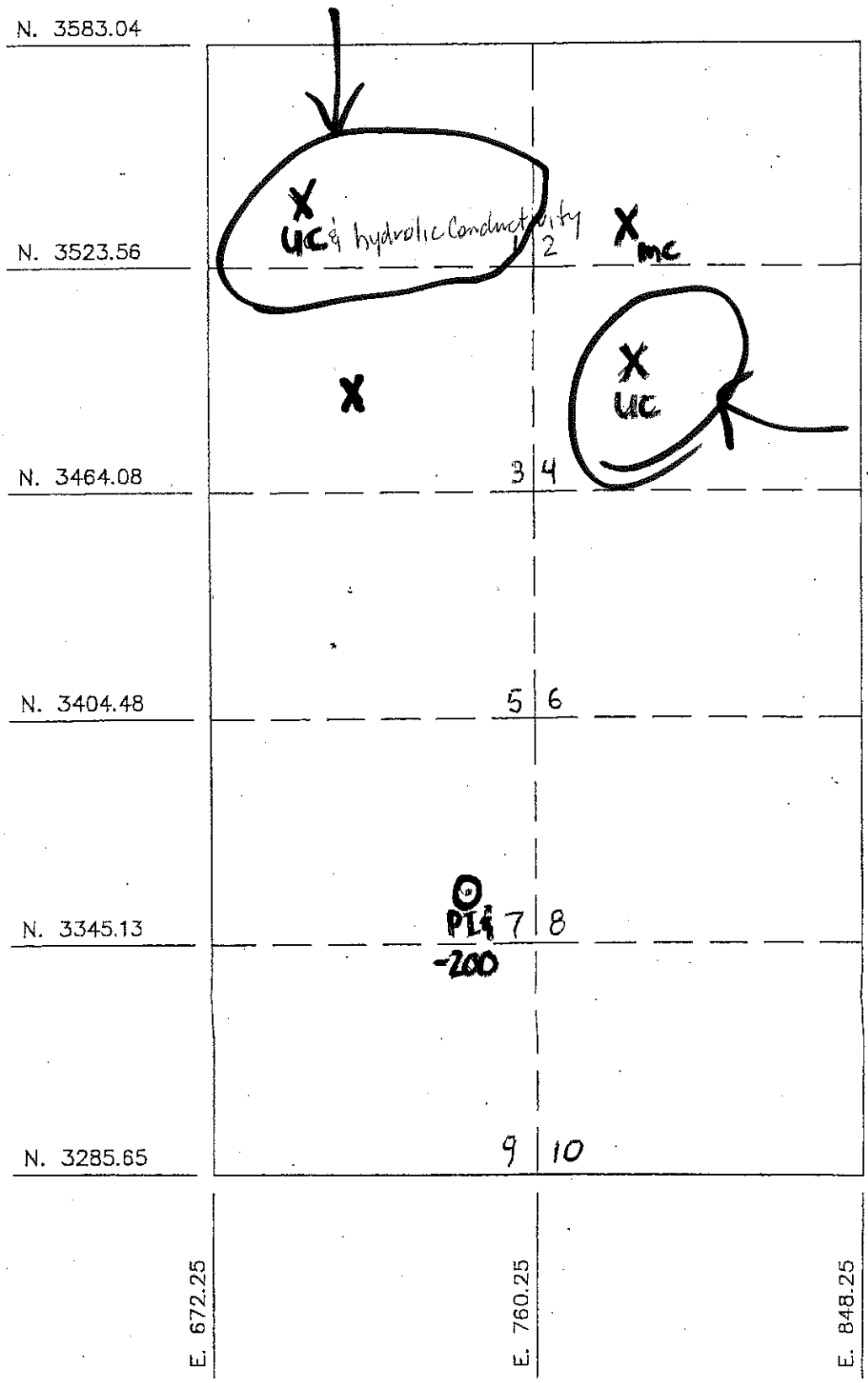
Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East/West Basin Closure
0412-16-4967
1/30/17
w/o 58055

Clay Cap
Lift 1

West Basin



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/31/2017
Report Date: 02/02/2017
Project No.: 04.12164967
Report No.: 0087

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	1		Area 5, (See Attached Sketch)	6	125.4	106.7	17.5	99
2	0081	1		Area 6, (See Attached Sketch)	6	125.7	106.4	18.1	99
3	0081	1		Area 7, (See Attached Sketch)	6	126.6	106.4	19.0	99
4	0081	1		Area 8, (See Attached Sketch)	6	126.3	107.0	18.0	99

Gauge No.: 1283 Density Std.: 2404 Moisture Std.: 497

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East / West Basin Closure

0412.16.4967

1/31/17

w/o 58072

West Basin

Clay Cap
Lift 1

N

N. 3583.04

N. 3523.56

N. 3464.08

N. 3404.48

N. 3345.13

N. 3285.65

E. 672.25

E. 760.25

E. 848.25

1 2

3 4

5 6

7 8

9 10

X
UC

X mc

X

X
UC

Ramp

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/31/2017
		Report Date:	02/02/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0087A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the material for moisture content testing.

Sample Location: Area 6, Lift 1 (See Report 0087, Test #2)
Supplier: Mega Sand, Crosby TX
Material Application: Fill Clay Cap
As Received (in-situ) Moisture Content: 19.1%

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	01/31/2017
		Revised Report Date:	02/03/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0088
Contractor:	Bo-Mac Contractors, LTD	**Previous Report Date:**	02/02/2017

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 01/31/2017
Report Date: 02/01/2017
Project No.: 04.12164967
Report No.: 0088

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 5 (Lift 1),	4,900 psf, See Note-1	2,450 psf, See Note-1
Area 8 (Lift 1)	5,180 psf, See Note-1	2, 590 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East / West Basin Closure

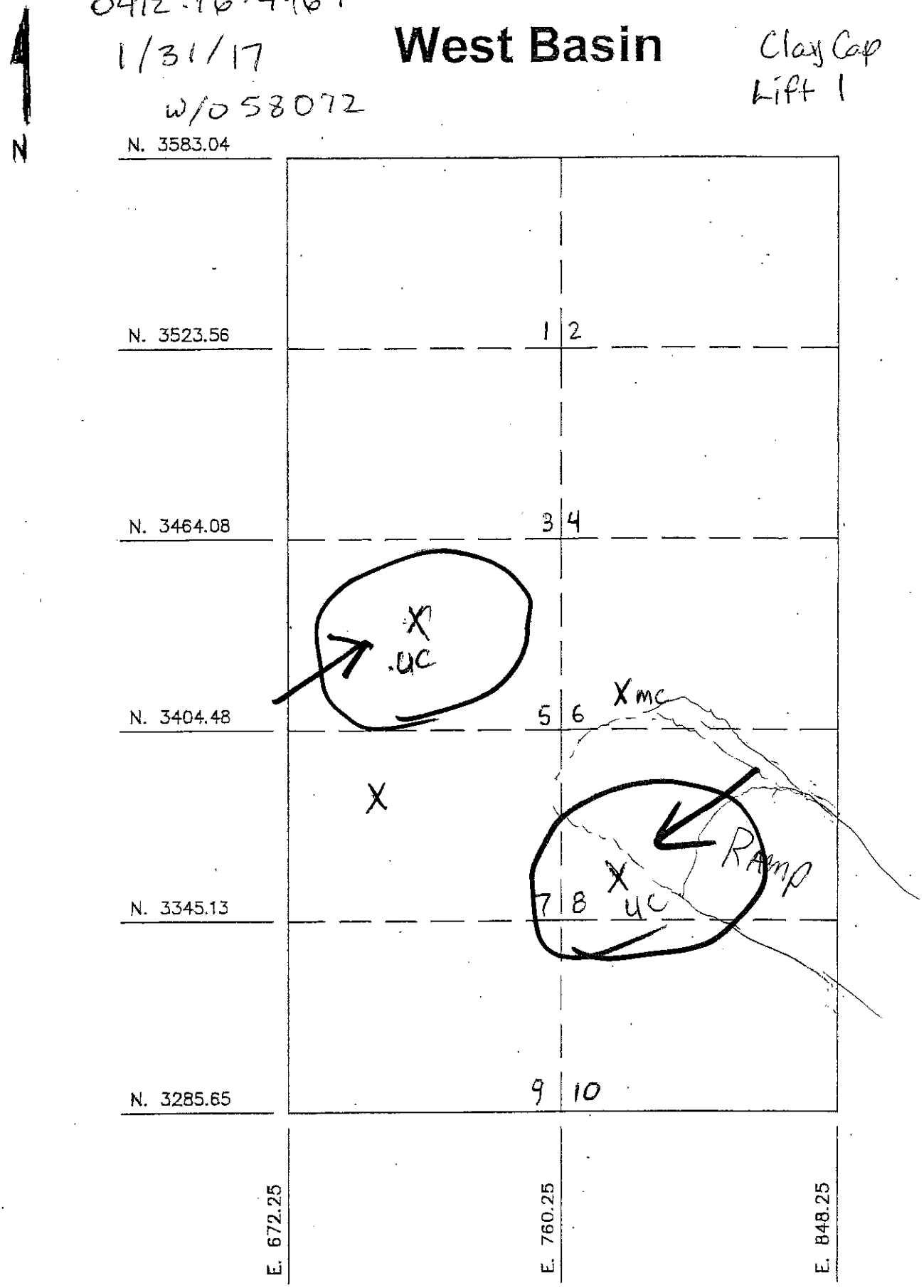
0412-16-4967

1/31/17

w/o 58072

West Basin

Clay Cap
Lift 1



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY SOIL INDEX TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 01/30/2017
Report Date: 02/02/2017
Project No.: 04.12164967
Report No.: 0089

Fugro USA Land, Inc., obtained samples of the placed fill material from the referenced project to evaluate index properties. Laboratory testing was performed in accordance with appropriate ASTM test methods.

Sample No.	Location	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Percent Finer than No. 200 Sieve	Classification
1	Onsite, Area 7, Lift 1	63	17	46	54.6	Gray and Tan Sandy Fat Clay

Project Specifications:
Liquid Limit (LL): Minimum 30
Plasticity Index (PI): Minimum 15
Percent Passing the No. 200 Sieve: Minimum 30%

Test Methods (If Applicable):ASTM D4318, ASTM D1140

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/01/2017
Report Date: 02/02/2017
Project No.: 04.12164967
Report No.: 0090

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	1		Area 10, (See Attached Sketch)	6	126.4	107.4	17.7	100
2	0081	1		Area 9, (See Attached Sketch)	6	126.3	107.1	17.9	99

Gauge No.: 1283 Density Std.: 2394 Moisture Std.: 500

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure

0412.16-4967

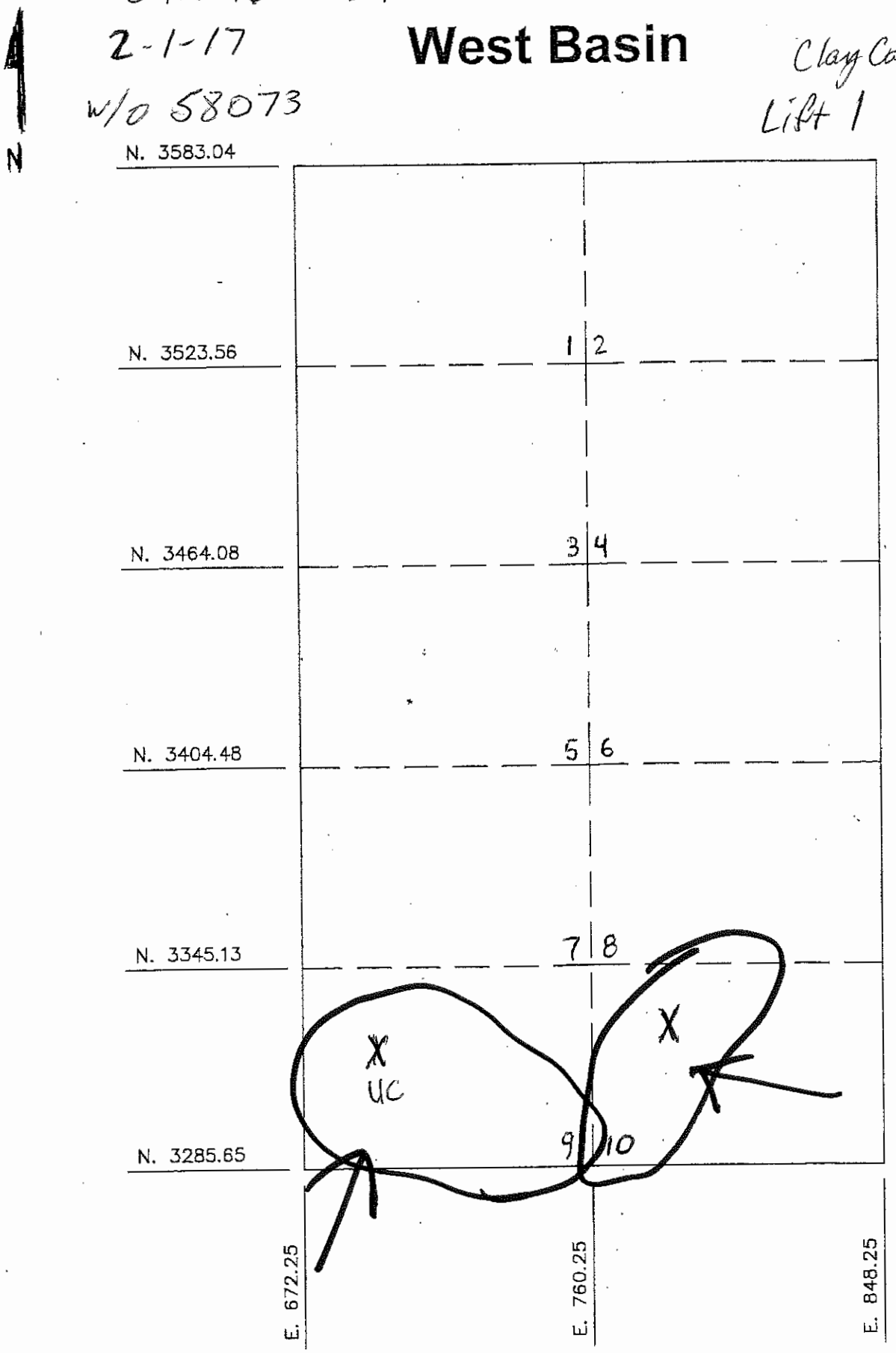
2-1-17

w/o 58073

West Basin

Clay Cap

Lift 1



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/01/2017
		Revised Report Date:	02/03/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0091
Contractor:	Bo-Mac Contractors, LTD	**Previous Report Date:**	02/02/2017

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/01/2017
Report Date: 02/02/2017
Project No.: 04.12164967
Report No.: 0091

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 9 (Lift 1),	4,750 psf, See Note-1	2,375 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SET East / West Basin Closure

0412.16-4967

2-1-17

w/o 58073

West Basin

Clay Cap

Lift 1

N

N. 3583.04

N. 3523.56

N. 3464.08

N. 3404.48

N. 3345.13

N. 3285.65

1 2

3 4

5 6

7 8

9 10

X

UC

X

E. 672.25

E. 760.25

E. 848.25

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/02/2017
Report Date: 02/06/2017
Project No.: 04.12164967
Report No.: 0092

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	2		Area 1, (See Attached Sketch)	6	127.3	105.9	20.2	98

Gauge No.: 1283 Density Std.: 2414 Moisture Std.: 495

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

SHEET SRT East/West Basin Closure

0412.16.4967

2/2/17

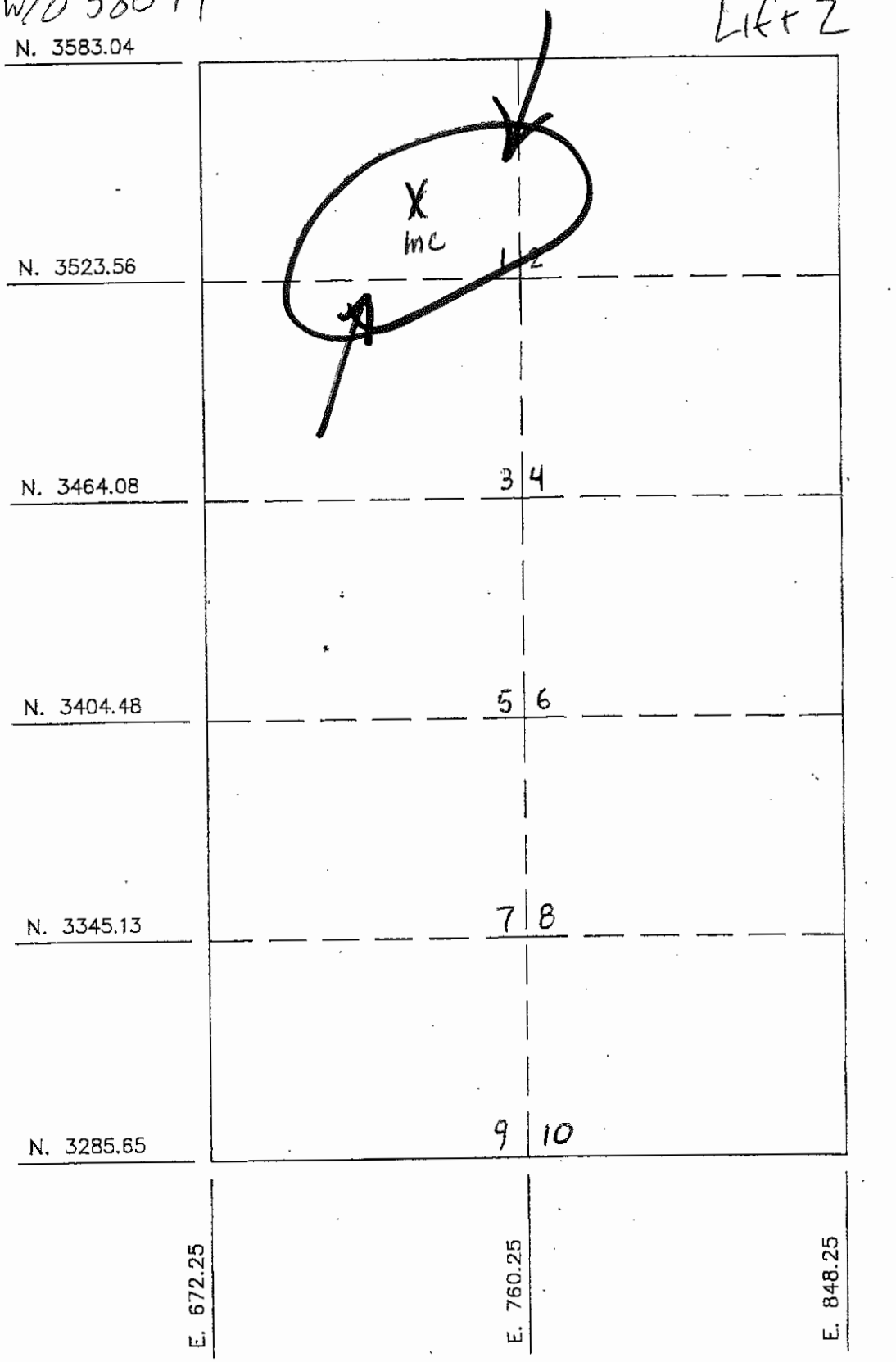
W/O 58074

West Basin

Clay Cap

Lift 2





Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/02/2017
		Report Date:	02/06/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0092A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 1, Lift 2 (See Report 0092, Test #2)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 19.2%

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/02/2017
Report Date: 02/06/2017
Project No.: 04.12164967
Report No.: 0093

Construction: Clay Cap

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	2		See Attached Sketch	6	126.3	105.2	20.1	98

Gauge No.: 1283 Density Std.: 2414 Moisture Std.: 495

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

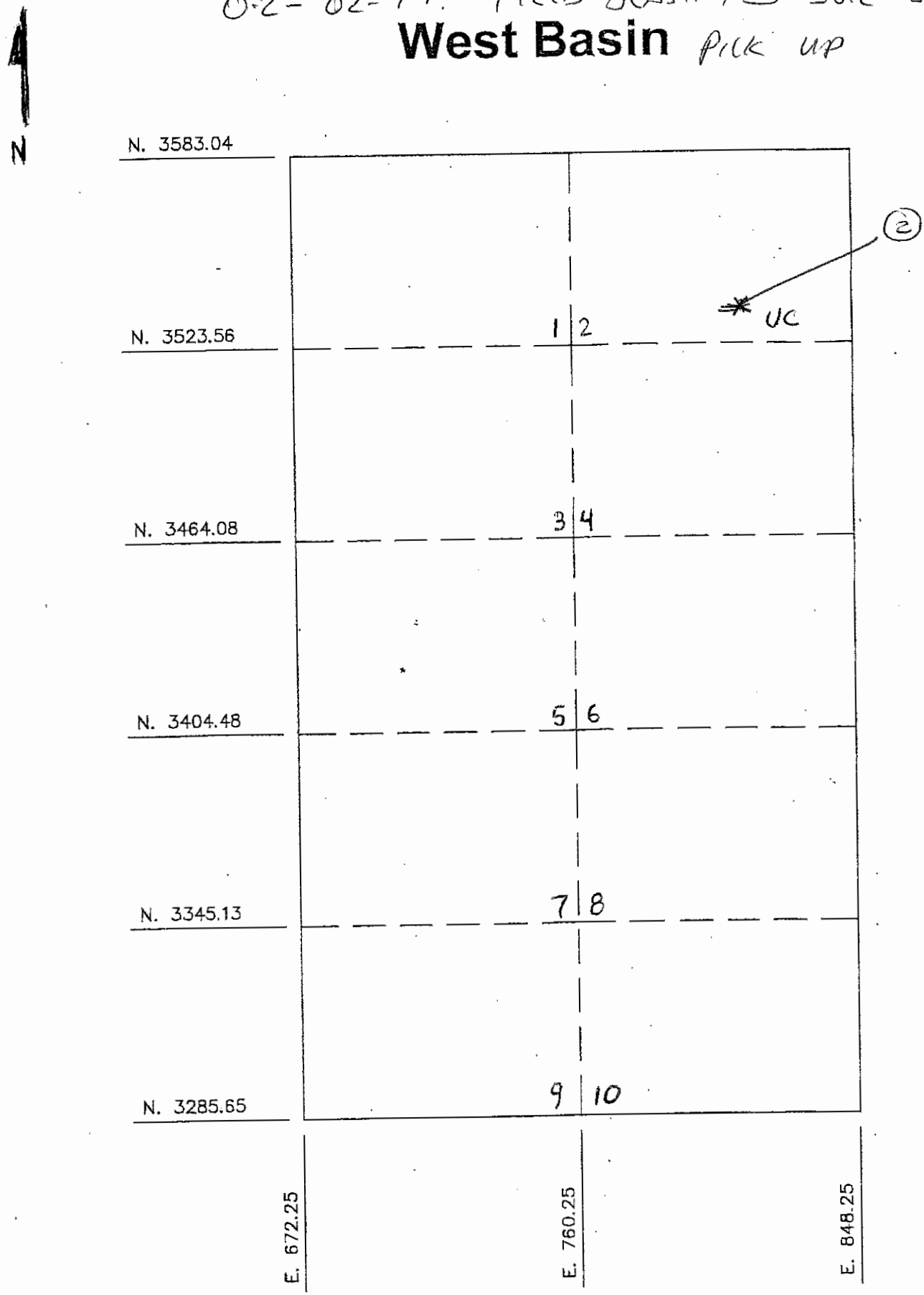
Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

FUGRO PROJECT 04.12164967
02-02-17. FIELD DENSITY & SOIL SAMPLE

West Basin PICK UP



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/02/2017
		Report Date:	02/03/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0094
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Adebayo Anifowoshe

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/02/2017
Report Date: 02/03/2017
Project No.: 04.12164967
Report No.: 0094

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 4 (Lift 2),	5,760 psf, See Note-1	2,880 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

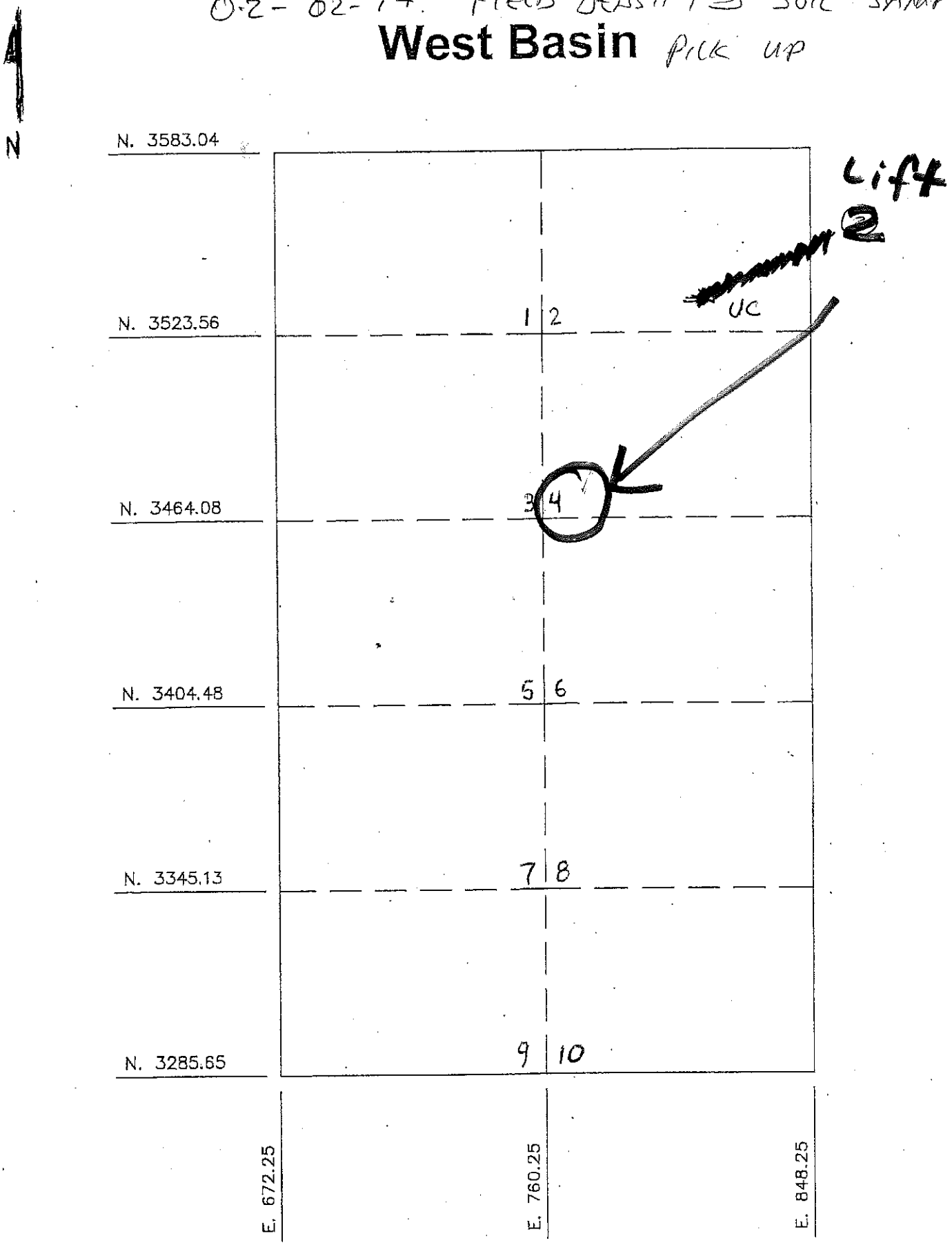
-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

FUGRO PROJECT 04.12154967
02-02-17. FIELD DENSITY & SOIL SAMPLE

West Basin PICK UP



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/03/2017
Report Date: 02/06/2017
Project No.: 04.12164967
Report No.: 0095

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	2		Area 2, (See Attached Sketch)	6	127.0	107.8	17.8	100
2	0081	2		Area 3, (See Attached Sketch)	6	125.5	105.4	19.1	98
3	0081	2		Area 7, (See Attached Sketch)	6	128.5	107.8	19.2	100
4	0081	2		Area 8, (See Attached Sketch)	6	127.6	107.2	19.0	99

Gauge No.: 1283 Density Std.: 2381 Moisture Std.: 504

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, Ltd. of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

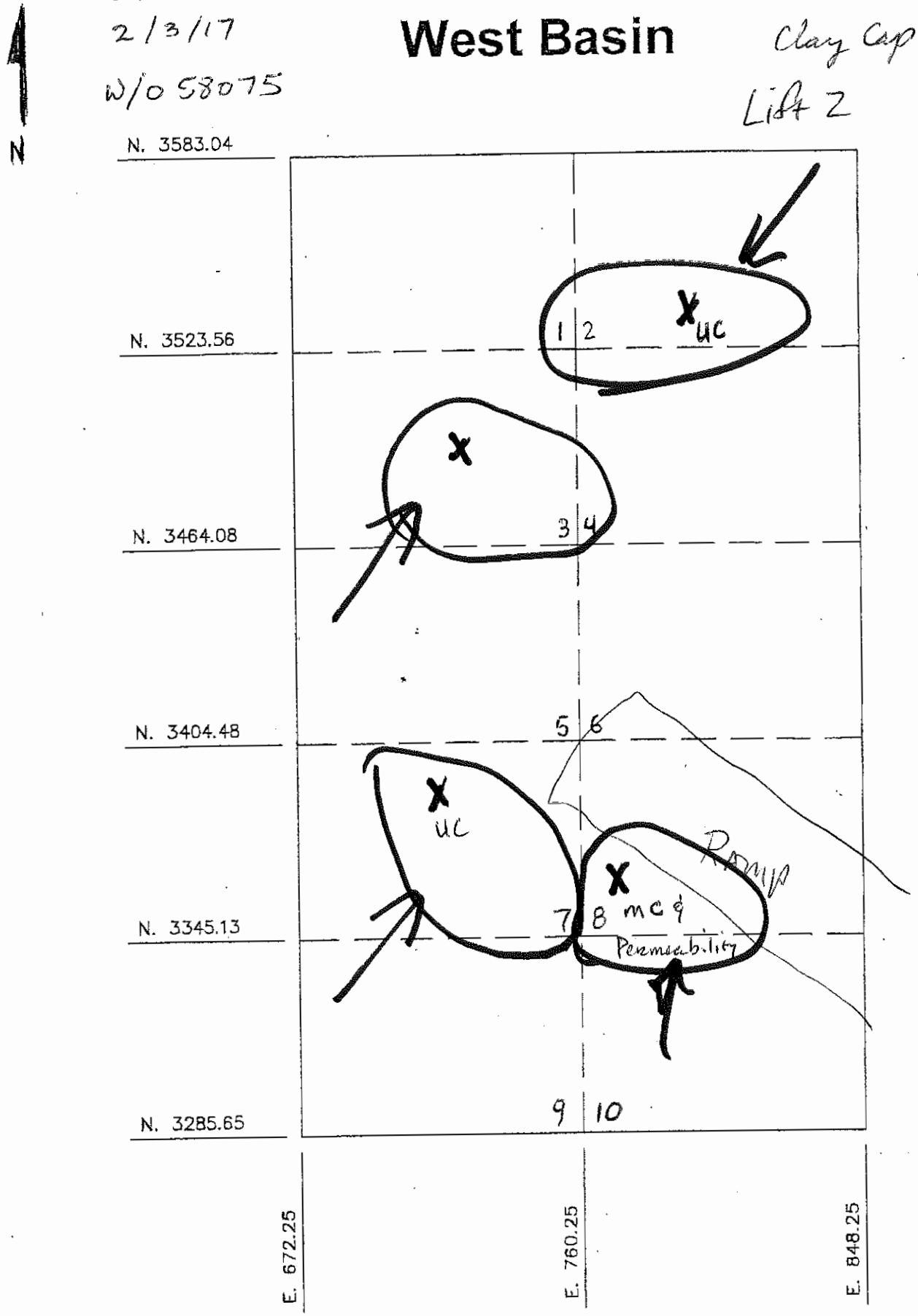
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SET East/West Basin Closure
0412-16-4967
2/3/17
W/O 58075

West Basin

Clay Cap
Lift 2



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/03/2017
		Report Date:	02/07/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0095A
Contractor:	Bo-Mac Contractors, LTD		

As requested, Fugro obtained a sample of the clay cap material for moisture content testing.

Sample Location: Area 8, Lift 2 (See Report 0095, Test #4)
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap
As Received (in-situ) Moisture Content: 18.7%

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/03/2017
		Report Date:	02/06/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0096
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/03/2017
Report Date: 02/06/2017
Project No.: 04.12164967
Report No.: 0096

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 2 (Lift 2),	5,040 psf, See Note-1	2,520 psf, See Note-1
Area 7 (Lift 2)	5,180 psf, See Note-1	2,590 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/03/2017
		Report Date:	02/13/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0097
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: ASTM D 5084, METHOD F:
Using Flexible Wall Permeameter and Mercury Constant Volume - Falling Head Hydraulic System

Project Number:	04.12164967	Test Type:	Permeability Vert.	Cell No.:	Perm-1	Boring/Exploration No.:	0
Task Number:		Test Stage:	1 of 1	Test Station No.:	8	Sample No.:	58055-2
Project Name:		Test No.:	NA	Hyd. App. No. (Permometer):	1	Penetration/Depth (ft):	0.55
		Test Series No.:	NA	File Name:	_58055-2aV	Composite Sample No.:	
Axial Load Cell No.:	NA	Factor, (lbf/V/V):	NA	Excit. Volt, V:	NA	Ch. No.: NA	Ht. Reading before Perm. (mm): 3.630
Vert. Dial/DT No.:	DG-071	Factor, (mm/V/V):		Excit. Volt, V:		Ch. No.:	Ht. Reading at σ_c = 0 (mm): 3.680

Permeation & Specimen Information

Permeant:	X	Tap Water;		
Direction of Flow:	X	Up;		Down
Perm. Orientation:	X	Vertical;		Horizontal
Specimen:	X	"Intact;"		Reconstituted;

Back Pressure, U_b (psi)	Stage	Height, $L_{t,n}$ (mm)	Area, $A_{t,n}$ (cm^2)
= 60.0	Preliminary:	74.842	19.94
	Final:	74.842	20.02

Prelim. change in height during consol., $\Delta H_{c,p}$ (mm) = 0.25

Hydraulic System Constants

Mercury U-Tube Manometer

Area headwater tube, a_{in} (cm^2):	0.7671
Area tailwater tube, a_{out} (cm^2):	0.03142
ΔHg_{eq} at equilibrium (cm):	0.4
Fluid Density Const. (15-25°C):	12.57

Remarks:

Mercury Head Settings (D 5084)

Estimated k_t (cm/sec)	Max. Gradient ($i_o = h/L_{t,p}$)	Permometer ΔHg Setting (cm)	Min. Cell Pressure (psi)
1.0E-4 to 1.0E-5	≤5	2.6	61.1
1.0E-5 to 1.0E-6	≤10	5.6	62.1
1.0E-6 to 1.0E-7	≤20	11.5	64.3
<1.0E-7 or <3.0E-2 (m/yr)	≤30	17.5	66.4
For Special Gradient, i_o			

Trial No.	Read-ings By	Date y= 2017 (m/d)	Time (1) hr:min	Temp. °C	Δt (min)	Axial Force (volt)	Pressure Cell, σ_c (psi)	Pressure Back, u_b (psi)	X Dial DT Reading (mm)	Mercury Head Readings (2) Tail, tw_r (cm) (3&4)	Mercury Head Readings (2) Head, hw_r (cm)	Total Head Loss (cm of water)	Initial Hyd. Gradient, i_o Preliminary	Initial Hyd. Gradient, i_o Final	Hydraulic Conductivity, k Preliminary, k_t (m/yr) (cm/s)	Hydraulic Conductivity, k Final, $k_{20°C}$ (m/yr) (cm/s)	Minimum Allowable tw_r (cm)
	rc,jr	2/7	5:51:10	22.4	45.0	NA	65.0	60.0	3.630	15.00	1.6	173.1	23.1		1.60E-03	1.51E-03	11.69
1	rc,jr	2/7	6:36:12	22.2		NA	65.0	60.0	3.620	14.80	XXXXX	170.5	23.1		5.08E-09	4.79E-09	
	rc,jr	2/7	6:37:55	22.2	191.5	NA	65.0	60.0	3.620	17.00	1.1	204.5	27.3		4.79E-04	4.53E-04	13.09
* 2	rc,jr	2/7	9:49:28	22.1		NA	65.0	60.0	3.620	16.70	XXXXX	200.6	27.3		1.52E-09	1.44E-09	
	rc,jr	2/7	9:50:32	22.1	280.7	NA	65.0	60.0	3.620	17.00	1.1	204.5	27.3		4.38E-04	4.15E-04	13.09
* 3	rc,jr	2/7	14:31:16	21.9		NA	65.0	60.0	3.620	16.60	XXXXX	199.3	27.3		1.39E-09	1.32E-09	
	rc,jr	2/8	5:17:32	22.4	250.1	NA	65.0	60.0	3.620	17.00	1.1	204.5	27.3		4.29E-04	4.05E-04	13.09
* 4	rc,jr	2/8	9:27:37	22.1		NA	65.0	60.0	3.630	16.65	XXXXX	199.9	27.3		1.36E-09	1.28E-09	
	rc,jr	2/8	9:30:47	22.1	274.5	NA	65.0	60.0	3.630	17.00	1.1	204.5	27.3		4.48E-04	4.25E-04	13.09
* 5	rc,jr	2/8	14:05:16	21.9		NA	65.0	60.0	3.630	16.60	XXXXX	199.3	27.3		1.42E-09	1.35E-09	

(*) Indicates trials used for calculations of: Average $k_{20°C}$, Max. Dev. from mean, and Average (i_o).

(1) If a stopwatch is used to obtain Δt, only record the initial time reading.

(2) Read both mercury levels at top of meniscus.

(3) The tailwater column is the column of mercury which is higher than the other (headwater) column.

Average $k_{20°C}$:	1.35E-09	cm/s
Max. Dev. from Mean:	6.8%	
Avg. Initial Gradient (i_o) :	27.3	
Intrinsic (Absolute) Permeability, *K*:	1.38E-14	cm^2

(4) To meet the reading accuracy requirement of 5%, the drop in the tail water reading has to be > 1 cm. For CMT testing with k < about 5×10^{-8} cm/sec, that requirement can be reduced by about ½.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF SOIL COMPACTION TESTS IN THE FIELD

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 02/13/2017
Report Date: 02/15/2017
Project No.: 04.12164967
Report No.: 0098

Construction: Fill, Clay Cap, West Basin

Material No.	Material Description	Specified Compaction (%)	Specified Moisture (%)	Test Method	LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture (%)
0081	Gray and Tan / Fat Clay	98	-1/+3	ASTM D698	54	18	36	107.9	17.6

Test No.	Material No.	Lift/ Elev.	Sta. No.	Location	Gauge Depth	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Relative Compaction (%)
1	0081	2		Area 5, (See Attached Sketch)	6	126.9	105.6	20.2	98
2	0081	2		Area 6, (See Attached Sketch)	6	125.1	105.7	18.4	98
3	0081	2		Area 9, (See Attached Sketch)	6	131.7	111.3	18.3	100+
4	0081	2		Area 10, (See Attached Sketch)	6	128.4	107.7	19.2	100

Gauge No.: 1283 Density Std.: 2406 Moisture Std.: 500

Remarks: The test results at the above described location(s) comply with the requirements of the project specifications except those marked (*). Informed Edmond Hall with Bo-Mac Contractors, LTD of the field test results prior to leaving the jobsite.
CMT Form S-004ELM (Revised 11-09)

Test Methods: ASTM D6938

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

REPORT CREATED BY ElmTree SYSTEM

Shell SRT East/West Basin Closure

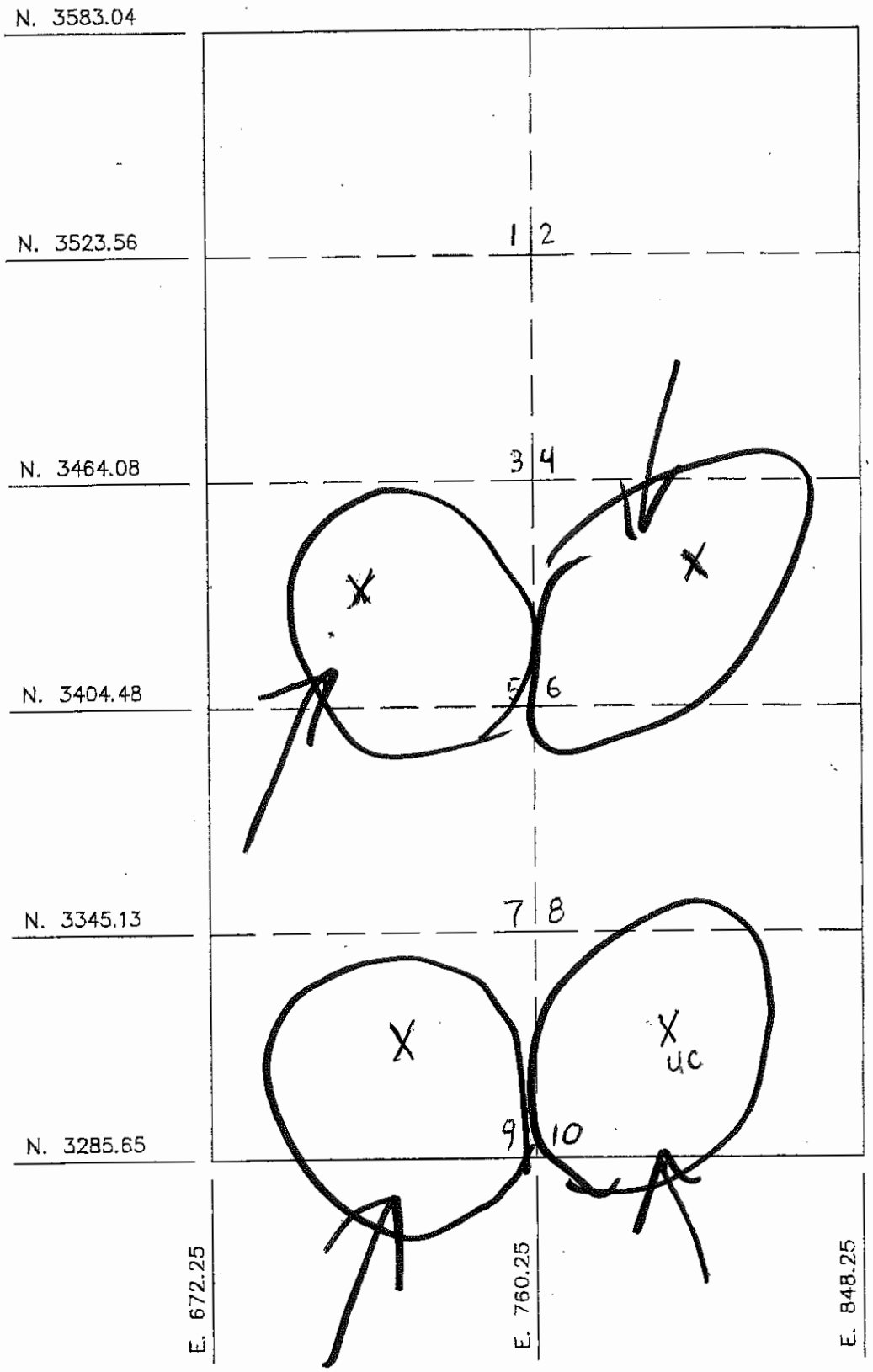
0412-16-4967

2-13-17

W/O 58261

West Basin

Clay Cap
Lift 2



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF LABORATORY TEST RESULTS

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/13/2017
		Report Date:	02/14/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0099
Contractor:	Bo-Mac Contractors, LTD		

Remarks: Please find attached the report for the referenced project.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Fugro USA Land, Inc.
6100 Hillcroft, 77081
P.O. Box 740010
Houston, TX 77274
Phone: (713) 369-5500
Fax: (713) 369-5424

CMT Form S-006
Rev. 1/09

REPORT OF UNCONFINED COMPRESSION TEST

PROJECT: Shell SET East/West Basin Closure
Phase 1 - West Basin
CLIENT: Shell Oil Company
5900 Highway 224
Deer Park, TX 77536
Contractor: Bo-Mac Contractors

Sample Date: 02/13/2017
Report Date: 02/14/2017
Project No.: 04.12164967
Report No.: 0099

Visual Classification: Gray and Tan Fat Clay
Sample Source: On-Site, West Basin
Supplier: Mega Sand, Crosby, TX
Material Application: Clay Cap

TEST RESULTS:

Sample Location	Unconfined Compressive Strength	Shear Strength
Area 10 (Lift 2),	4,610 psf, See Note-1	2,305 psf, See Note-1

See Attached Sketch

Note-1:

-Samples were obtained by pushing a 3-inch diameter thin-wall tube sampler.

-A minimum of 1,000 psf shear strength is required by design for fill material.

Test Methods: ASTM D2166, ASTM D2216, ASTM D7263

The above test results apply only to the items tested.
This report shall not be reproduced except in full without the approval of Fugro Consultants, Inc

Shell SRT East/West Basin Closure

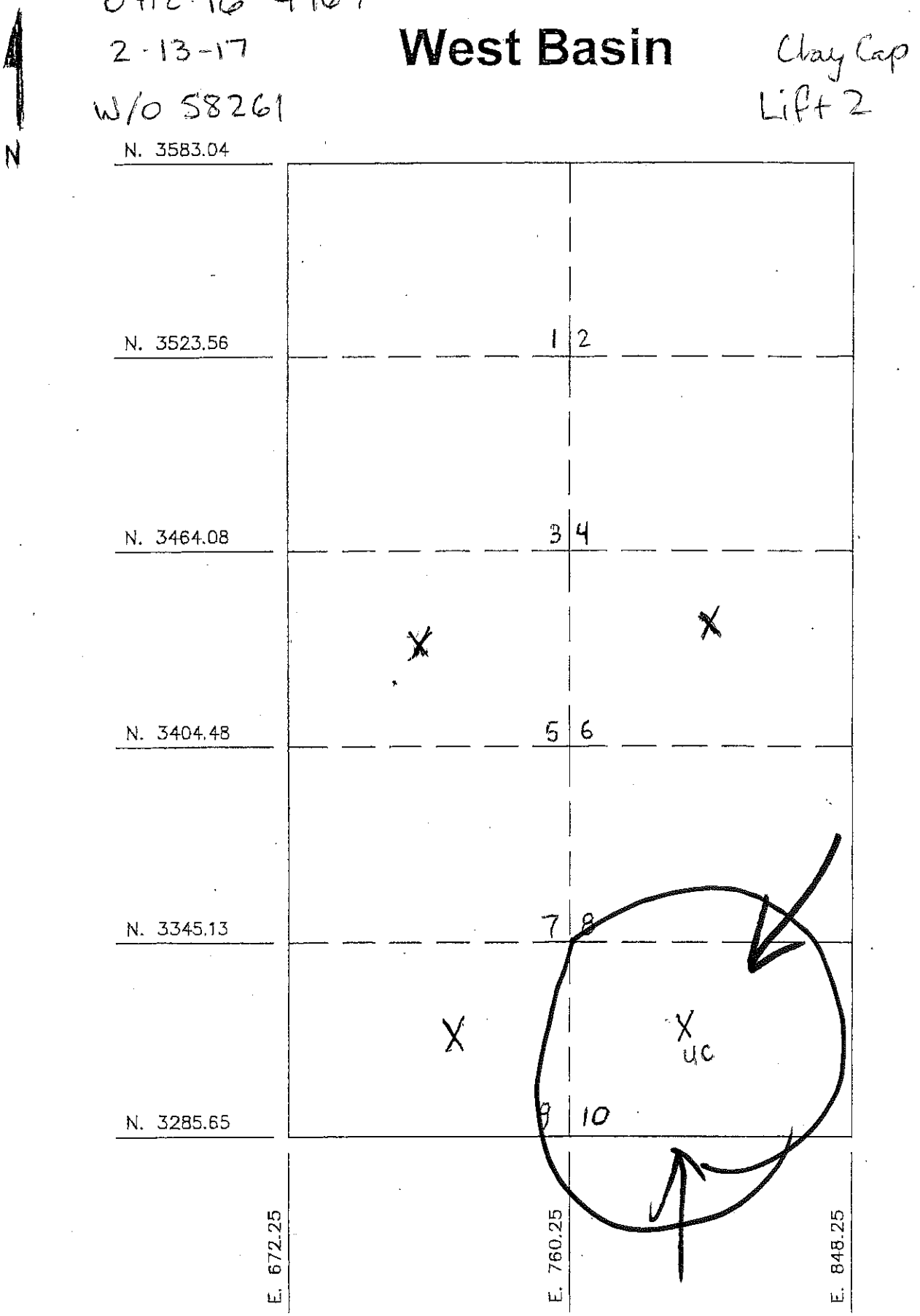
0412-16-4967

2-13-17

W/O 58261

West Basin

Clay Cap
Lift 2



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	02/14/2017
		Report Date:	02/15/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0100
Contractor:	Bo-Mac Contractors, LTD		

On 02/14/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Field Density Testing . After arrival to the job site, the technician was placed on "stand-by". Testing was later cancelled by the contractor due to weather conditions.

Fugro Representative: Richard Osborne

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO CONSULTANTS, INC.

Appendix K – Concrete CQC Documentation

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/17/2017
Revised Report Date: 05/15/2017
Project No.: 04.12164967
Report No.: 0148
Previous Report Date: 04/24/2017

Set: 1 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	86	
Concrete Temp. (ºF):	88	90 Max
Slump (in.):	4¼*	6-8
Air Content by Vol. (%):	2.8	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 11:06 am
Time Sampled: 12:15 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037557 / 44096118
Yards Placed/ Total Yards: 20 cu. yds. / 40 cu. yds.
Cylinders Molded: 4
Water Added: 15.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	04/24/17	7	5.99	28.180	155,160	Unbonded	5,510	5,510
B	05/15/17	28	6.00	28.274	173,160	Unbonded	6,120	
C	05/15/17	28	6.00	28.274	177,990	Unbonded	6,300	6,210
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/17/2017
Revised Report Date: 05/15/2017
Project No.: 04.12164967
Report No.: 0148
Previous Report Date: 04/24/2017

Set: 2 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	90	
Concrete Temp. (ºF):	92*	90 Max
Slump (in.):	5¾*	6-8
Air Content by Vol. (%):	2.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 12:07 pm
Time Sampled: 1:37 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067224 / 44096223
Yards Placed/ Total Yards: 30 cu. yds. / 40 cu. yds.
Cylinders Molded: 4
Water Added: 75.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	04/24/17	7	5.99	28.180	120,310	Unbonded	4,270	4,270
B	05/15/17	28	6.00	28.274	177,170	Unbonded	6,270	
C	05/15/17	28	6.00	28.274	181,080	Unbonded	6,400	6,340
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

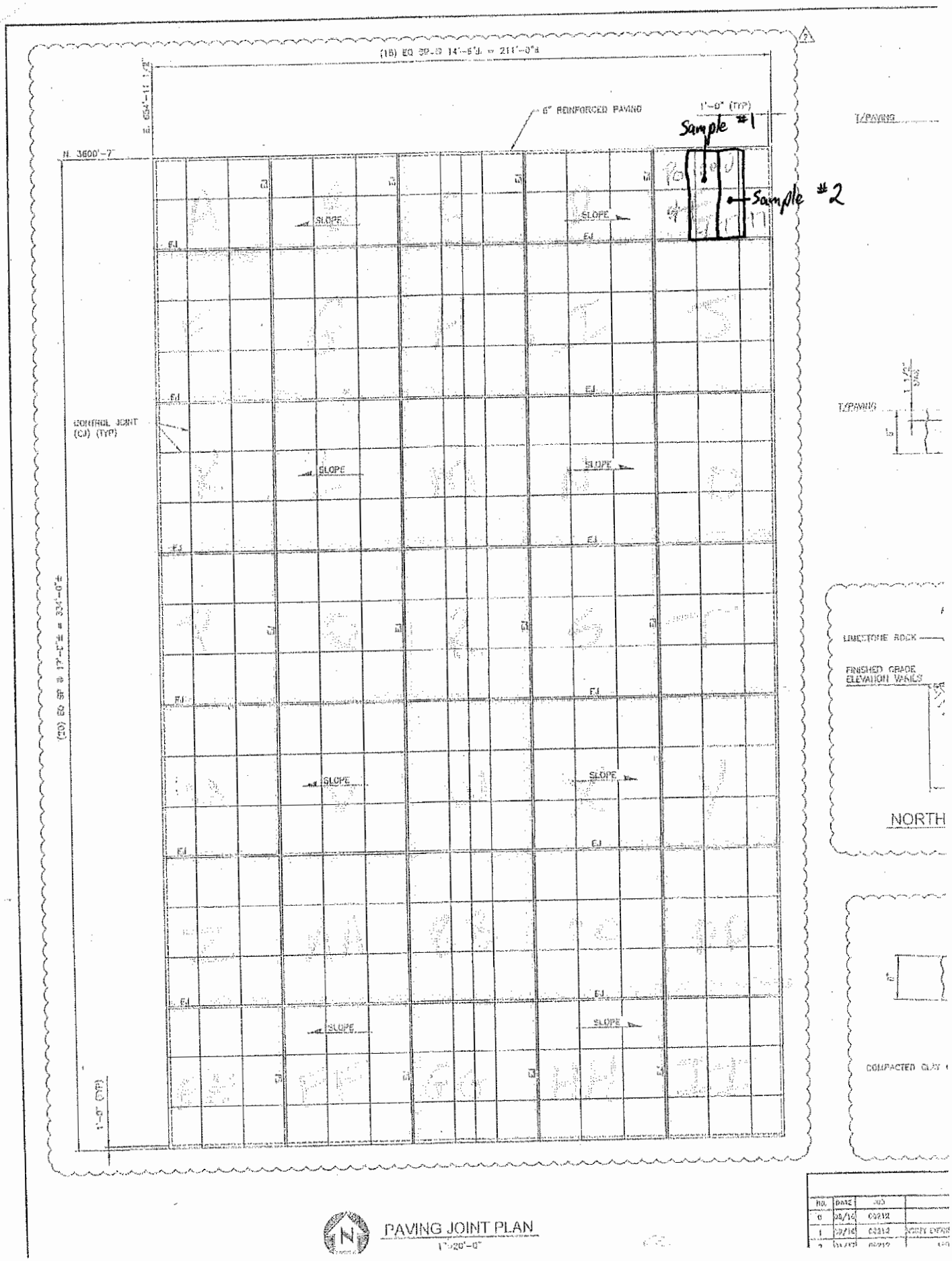
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Project # 04.12164967
Date 4-17-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/19/2017
Revised Report Date: 05/17/2017
Project No.: 04.12164967
Report No.: 0152
Previous Report Date: 04/25/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	71	
Concrete Temp. (ºF):	84	90 Max
Slump (in.):	8	6-8
Air Content by Vol. (%):	4.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 8:54 am
Time Sampled: 9:55 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067951 / 44098050
Yards Placed/ Total Yards: 20 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	04/26/17	7	5.99	28.180	125,780	Unbonded	4,460	4,460
B	05/17/17	28	6.00	28.274	161,880	Unbonded	5,730	
C	05/17/17	28	6.00	28.274	155,150	Unbonded	5,490	5,610
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/19/2017
Revised Report Date: 05/17/2017
Project No.: 04.12164967
Report No.: 0152
Previous Report Date: 04/25/2017

Set: 2 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	75	
Concrete Temp. (ºF):	85	90 Max
Slump (in.):	6½	6-8
Air Content by Vol. (%):	2.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 11:59 am
Time Sampled: 1:10 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064673 / 44098488
Yards Placed/ Total Yards: 70 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	04/26/17	7	5.99	28.180	122,200	Unbonded	4,340	4,340
B	05/17/17	28	6.00	28.274	163,370	Unbonded	5,780	
C	05/17/17	28	6.00	28.274	172,290	Unbonded	6,090	5,940
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

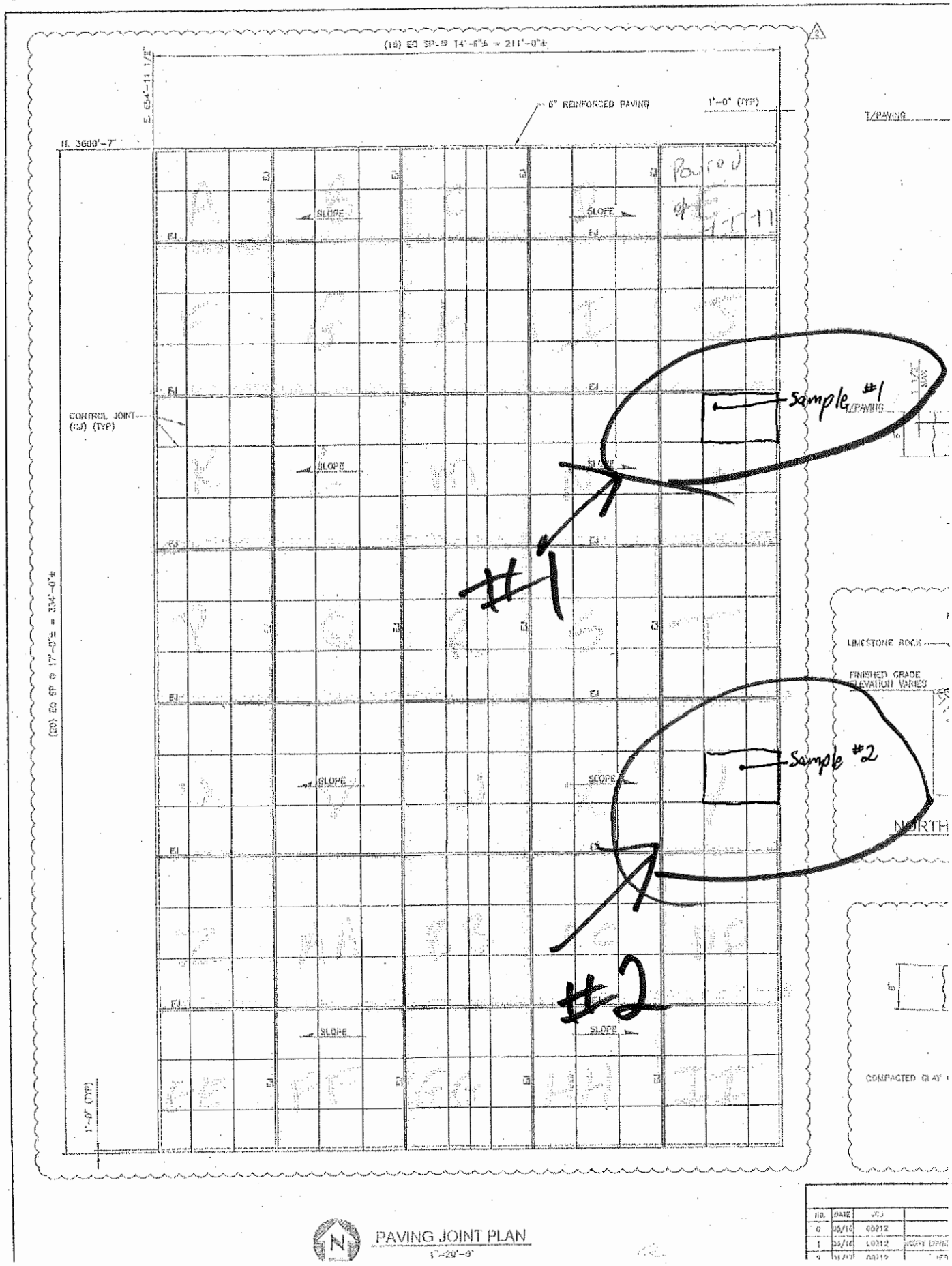
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Project # 04.12164967
Date 4-19-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

SAMPLE PICK UP REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	04/20/2017
		Report Date:	04/21/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0153
Contractor:	Bo-Mac Contractors, LTD		

A Fugro representative arrived onsite to pick up 2 sets of 4 concrete cylinders, cast on 19-APR-2017. The specimens were transported to our laboratory for curing and/or testing.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/24/2017
Revised Report Date: 05/22/2017
Project No.: 04.12164967
Report No.: 0154
Previous Report Date: 05/01/2017

Set: 1 of 3

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	65	
Concrete Temp. (ºF):	80	90 Max
Slump (in.):	6	6-8
Air Content by Vol. (%):	4.3	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 7:49 am
Time Sampled: 9:20 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067224 / 44105009
Yards Placed/ Total Yards: 20 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 30.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/01/17	7	6.00	28.274	119,170	Unbonded	4,210	4,210
B	05/22/17	28	6.00	28.274	160,370	Unbonded	5,670	
C	05/22/17	28	6.00	28.274	151,390	Unbonded	5,350	5,510
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Earnest Terrell
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/24/2017
Revised Report Date: 05/22/2017
Project No.: 04.12164967
Report No.: 0154
Previous Report Date: 05/01/2017

Set: 2 of 3

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	79	
Concrete Temp. (ºF):	86	90 Max
Slump (in.):	8	6-8
Air Content by Vol. (%):	2.3	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 11:34 am
Time Sampled: 12:40 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10018151 / 44105738
Yards Placed/ Total Yards: 70 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/01/17	7	6.00	28.274	121,670	Unbonded	4,300	4,300
B	05/22/17	28	6.00	28.274	154,000	Unbonded	5,450	
C	05/22/17	28	6.00	28.274	150,450	Unbonded	5,320	5,380
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Earnest Terrell
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/24/2017
Revised Report Date: 05/22/2017
Project No.: 04.12164967
Report No.: 0154
Previous Report Date: 05/01/2017

Set: 3 of 3

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	87	
Concrete Temp. (ºF):	88	90 Max
Slump (in.):	8	6-8
Air Content by Vol. (%):	4.0	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 2:53 pm
Time Sampled: 3:50 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10029381 / 44106281
Yards Placed/ Total Yards: 110 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/01/17	7	6.00	28.274	110,660	Unbonded	3,910	3,910
B	05/22/17	28	6.00	28.274	160,640	Unbonded	5,680	
C	05/22/17	28	6.00	28.274	156,650	Unbonded	5,540	5,610
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

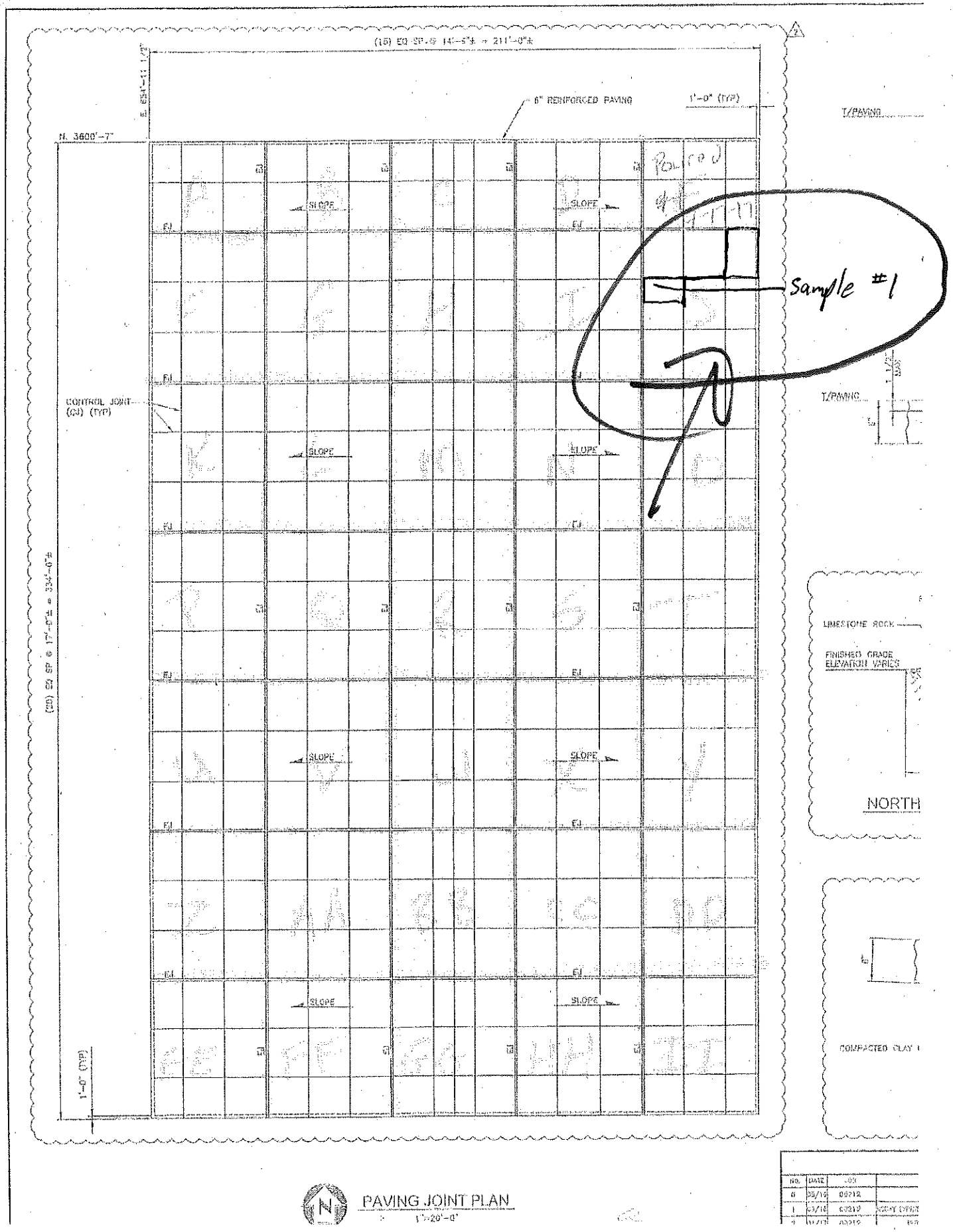
Earnest Terrell
CMET Project Manager

Construction Materials
Certificate No. 0023-02

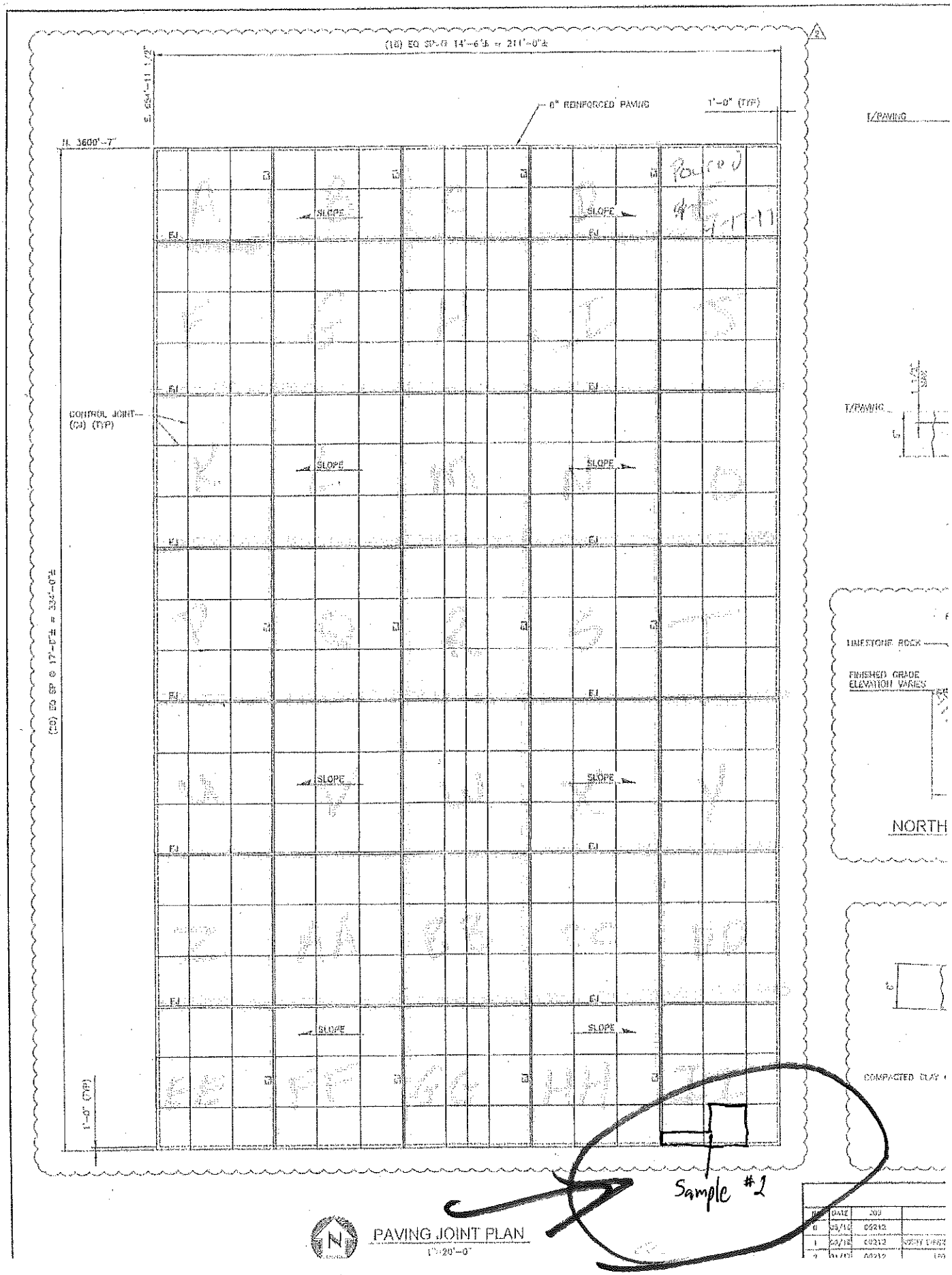
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Project # 04.12164967
Date 4-24-17

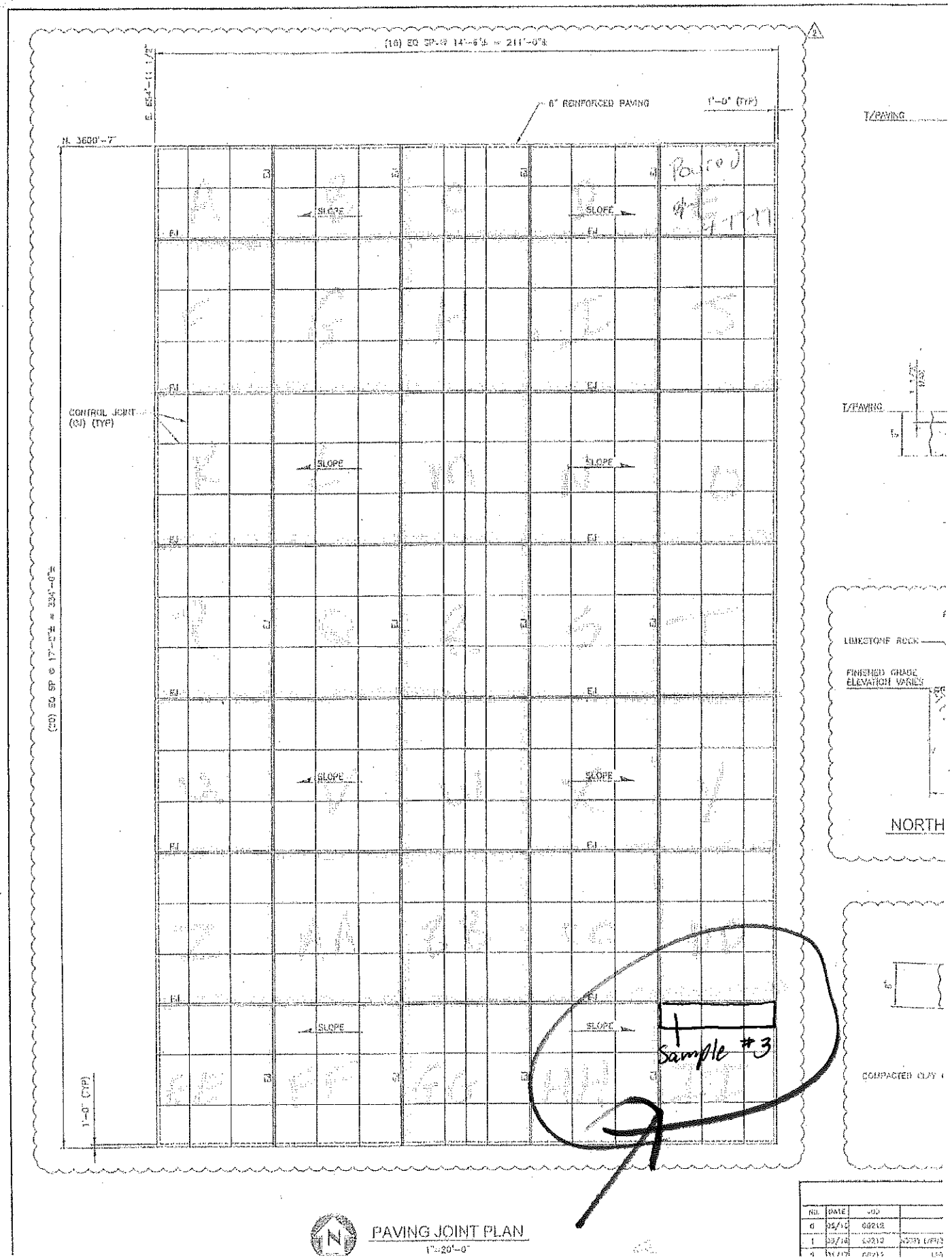


Project # 04.12164967
Date 4-24-17



PAVING JOINT PLAN
1"=20'-0"

Project #04.12164967
Date 4-24-17



PAVING JOINT PLAN
1"=20'-0"

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/25/2017
Revised Report Date: 05/25/2017
Project No.: 04.12164967
Report No.: 0157
Previous Report Date: 05/25/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	71	
Concrete Temp. (ºF):	83	90 Max
Slump (in.):	7	6-8
Air Content by Vol. (%):	3.0	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 8:30 am
Time Sampled: 9:35 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037693 / 44103744
Yards Placed/ Total Yards: 20 cu. yds. / 86 cu. yds.
Cylinders Molded: 4
Water Added: 5.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/02/17	7	5.99	28.180	121,960	Unbonded	4,330	4,330
B	05/23/17	28	6.00	28.274	144,740	Unbonded	5,120	
C	05/23/17	28	6.00	28.274	160,600	Unbonded	5,680	5,400
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Andrew Martinez
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/25/2017
Revised Report Date: 05/25/2017
Project No.: 04.12164967
Report No.: 0157
Previous Report Date: 05/25/2017

Set: 2 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	84	
Concrete Temp. (ºF):	88	90 Max
Slump (in.):	5¾*	6-8
Air Content by Vol. (%):	2.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 11:34 am
Time Sampled: 12:35 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037568 / 44107918
Yards Placed/ Total Yards: 70 cu. yds. / 86 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/02/17	7	5.99	28.180	126,280	Unbonded	4,480	4,480
B	05/23/17	28	6.00	28.274	158,600	Unbonded	5,610	
C	05/23/17	28	6.00	28.274	166,920	Unbonded	5,900	5,760
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

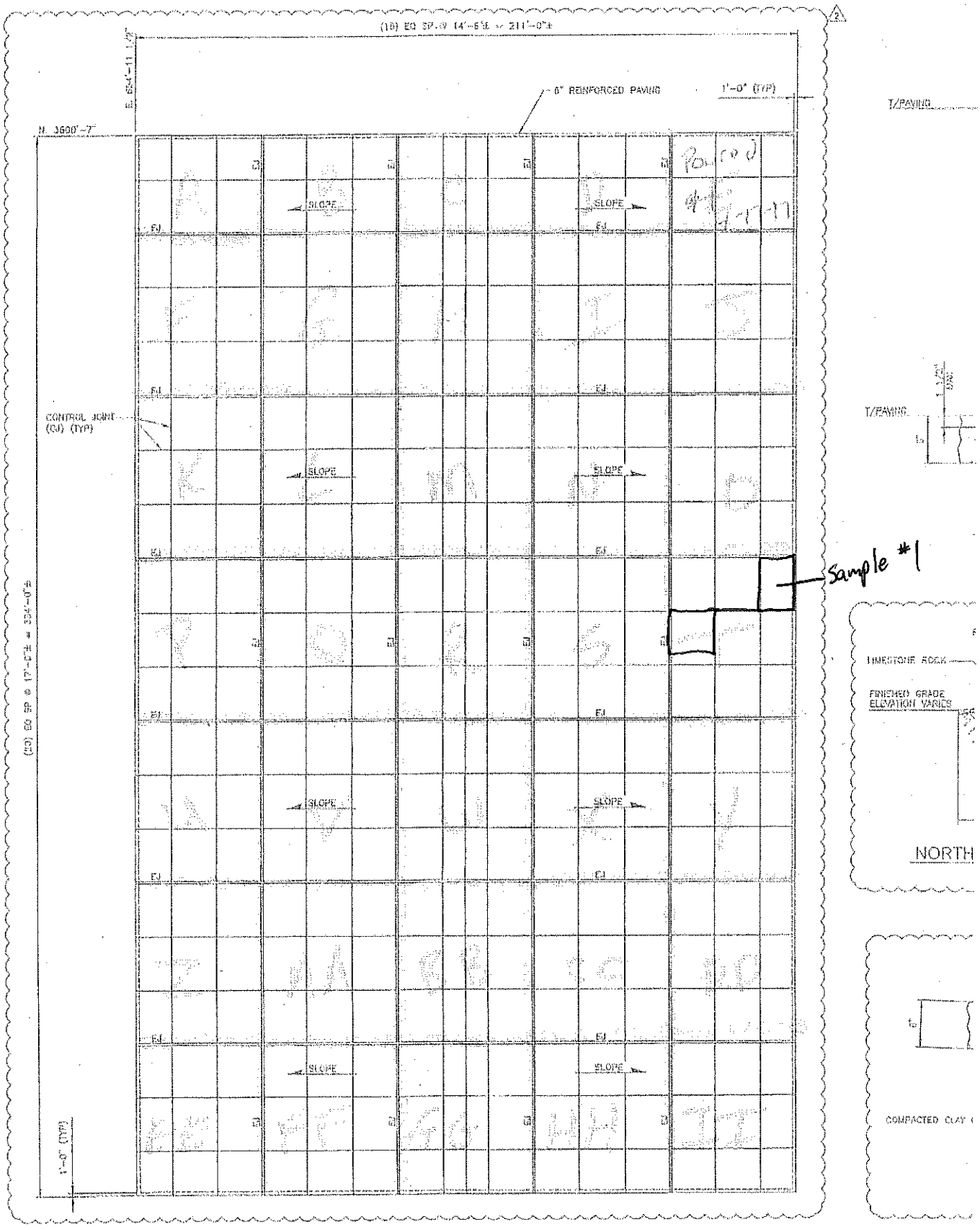
Andrew Martinez
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

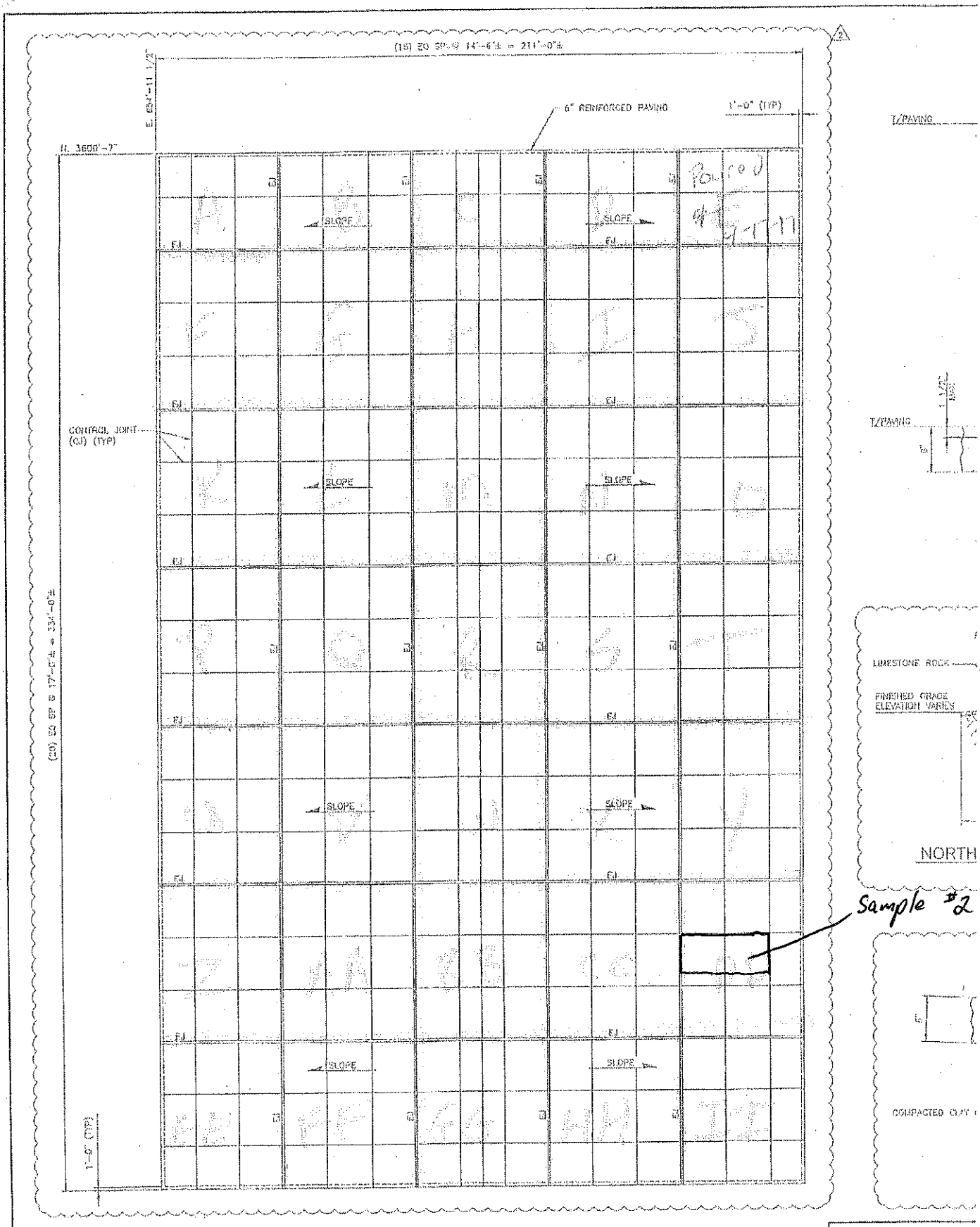
REPORT CREATED BY ElmTree SYSTEM

Project # 04.12164967
Date 4-25-17



PAVING JOINT PLAN
1"=20'-0"

Project #04-12164967
Date 4-25-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/26/2017
Revised Report Date: 05/26/2017
Project No.: 04.12164967
Report No.: 0160
Previous Report Date: 05/03/2017

Set: 1 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	80	
Concrete Temp. (ºF):	86	90 Max
Slump (in.):	7¼	6-8
Air Content by Vol. (%):	5.0	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 8:34 am
Time Sampled: 9:35 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064405 / 44109440
Yards Placed/ Total Yards: 20 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 15.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/03/17	7	5.99	28.180	138,270	Unbonded	4,910	4,910
B	05/24/17	28	6.00	28.274	181,690	Unbonded	6,430	
C	05/24/17	28	6.00	28.274	163,570	Unbonded	5,790	6,110
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Earnest Terrell
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/26/2017
Revised Report Date: 05/26/2017
Project No.: 04.12164967
Report No.: 0160
Previous Report Date: 05/03/2017

Set: 2 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	86	
Concrete Temp. (ºF):	87	90 Max
Slump (in.):	8¼*	6-8
Air Content by Vol. (%):	1.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 1:05 pm
Time Sampled: 2:25 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10018151 / 44110471
Yards Placed/ Total Yards: 70 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 30.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/03/17	7	5.99	28.180	111,820	Unbonded	3,970	3,970
B	05/24/17	28	6.00	28.274	145,760	Unbonded	5,160	
C	05/24/17	28	6.00	28.274	141,230	Unbonded	4,990	5,080
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

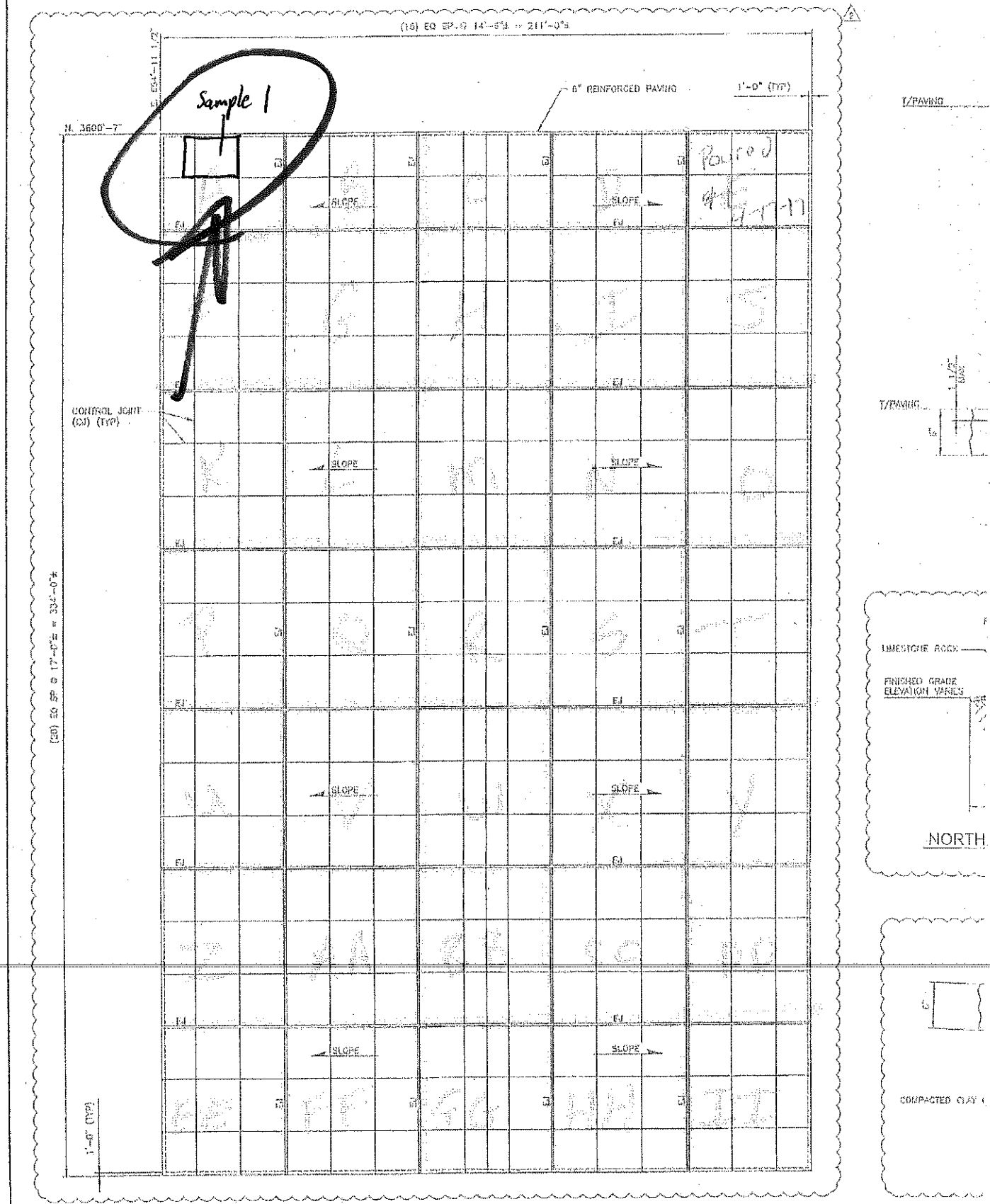
Earnest Terrell
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

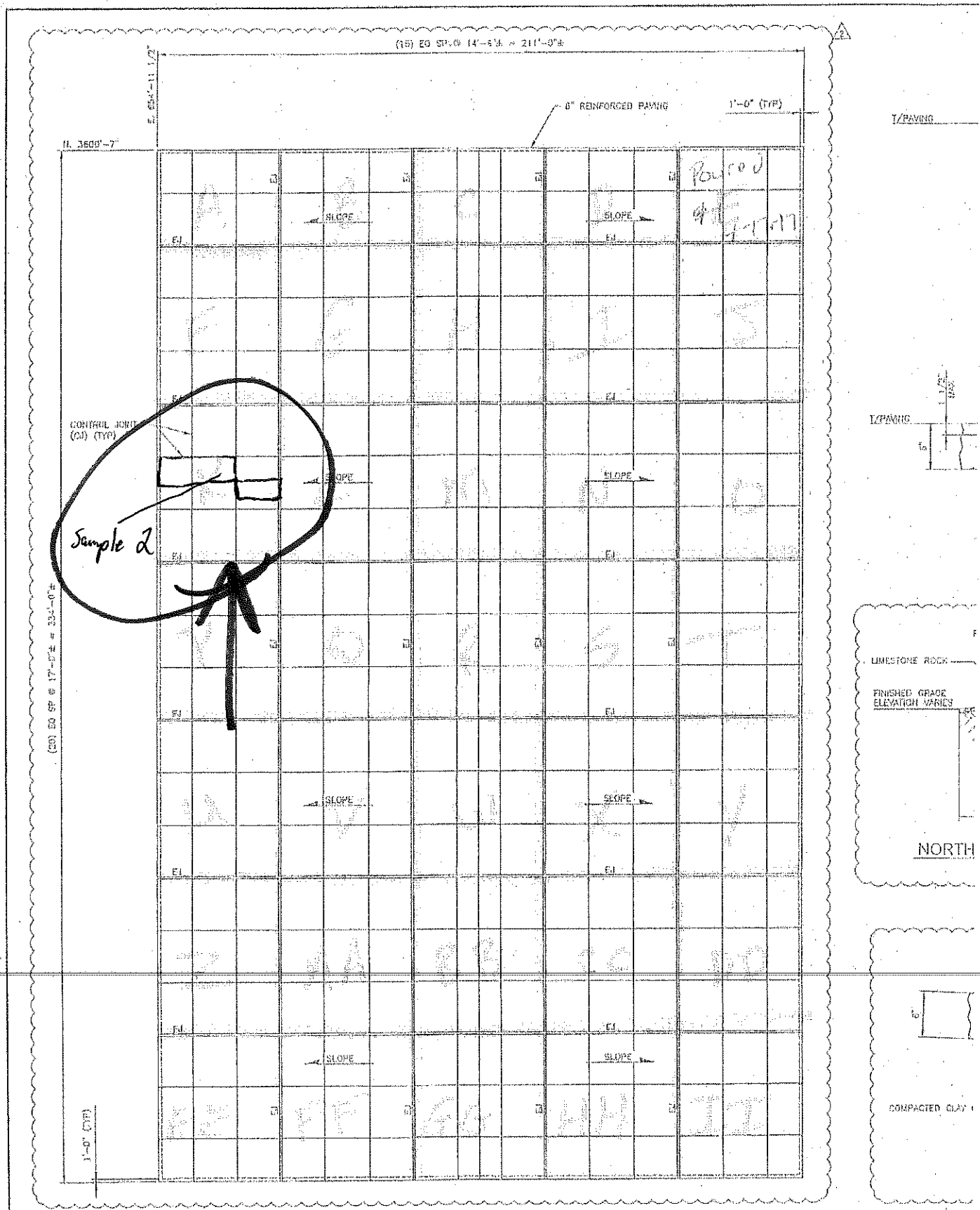
REPORT CREATED BY ElmTree SYSTEM

Project # 04.12164967
Date 4-26-17



PAVING JOINT PLAN
1"=20'-0"

Project 04-12164967
Date 4-26-17



PAVING JOINT PLAN
1"=20'-0"

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 04/27/2017
Revised Report Date: 05/26/2017
Project No.: 04.12164967
Report No.: 0163
Previous Report Date: 05/04/2017

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	71	
Concrete Temp. (ºF):	77	90 Max
Slump (in.):	7½	6 - 8
Air Content by Vol. (%):	1.8	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 7:40 am
Time Sampled: 9:05 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037798 / 44111696
Yards Placed/ Total Yards: 20 cu. yds. / 50 cu. yds.
Cylinders Molded: 4
Water Added: 5.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/04/17	7	5.99	28.180	132,720	Unbonded	4,710	4,710
B	05/25/17	28	6.00	28.274	183,010	Unbonded	6,470	
C	05/25/17	28	6.00	28.274	174,080	Unbonded	6,160	6,310
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Earnest Terrell
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/01/2017
Revised Report Date: 05/30/2017
Project No.: 04.12164967
Report No.: 0167
Previous Report Date: 05/08/2017

Set: 1 of 3

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	76	
Concrete Temp. (ºF):	79*	90 Max.
Slump (in.):	7¼	6 - 8
Air Content by Vol. (%):	2.0	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 7:50 am
Time Sampled: 8:55 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064673 / 44117006
Yards Placed/ Total Yards: 20 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/08/17	7	5.99	28.180	109,630	Unbonded	3,890	3,890
B	05/29/17	28	6.00	28.274	159,140	Unbonded	5,630	
C	05/29/17	28	6.00	28.274	165,660	Unbonded	5,860	5,740
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/01/2017
Revised Report Date: 05/30/2017
Project No.: 04.12164967
Report No.: 0167
Previous Report Date: 05/08/2017

Set: 2 of 3

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	87	
Concrete Temp. (ºF):	86*	90 Max.
Slump (in.):	8	6 - 8
Air Content by Vol. (%):	3.0	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 11:33 am
Time Sampled: 12:45 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067950 / 44117719
Yards Placed/ Total Yards: 70 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/08/17	7	5.99	28.180	93,650	Unbonded	3,320	3,320
B	05/29/17	28	6.00	28.274	146,000	Unbonded	5,160	
C	05/29/17	28	6.00	28.274	143,660	Unbonded	5,080	5,120
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/01/2017
Revised Report Date: 05/30/2017
Project No.: 04.12164967
Report No.: 0167
Previous Report Date: 05/08/2017

Set: 3 of 3

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	86	
Concrete Temp. (ºF):	90*	90 Max.
Slump (in.):	6¾	6 - 8
Air Content by Vol. (%):	3.0	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 2:46 pm
Time Sampled: 3:40 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067226 / 44118308
Yards Placed/ Total Yards: 110 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/08/17	7	5.99	28.180	107,640	Unbonded	3,820	3,820
B	05/29/17	28	6.00	28.274	157,300	Unbonded	5,560	
C	05/29/17	28	6.00	28.274	144,450	Unbonded	5,110	5,340
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/02/2017
Revised Report Date: 07/03/2017
Project No.: 04.12164967
Report No.: 0170
Previous Report Date: 05/30/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete	Field Measurements	Specification Requirements
Air Temp. (ºF):		
Concrete Temp. (ºF):	*	90 Max.
Slump (in.):	8¾*	6 - 8
Air Content by Vol. (%):	*	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:42 am
Time Sampled: 10:55 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067223 / 44119562
Yards Placed/ Total Yards: 20 cu. yds. / 100 cu. yds.
Cylinders Molded: 4
Water Added: 15.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/09/17	7	6.00	28.274	89,530	Unbonded	3,170	3,170
B	05/30/17	28	6.00	28.274	118,590	Unbonded	4,190	
C	05/30/17	28	6.00	28.274	127,270	Unbonded	4,500	4,350
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12) Equipment malfunction responsible for lack of above measurements

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/02/2017
Revised Report Date: 07/03/2017
Project No.: 04.12164967
Report No.: 0170
Previous Report Date: 05/30/2017

Set: 2 of 2

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):		
Concrete Temp. (ºF):	*	90 Max.
Slump (in.):	5¼*	6 - 8
Air Content by Vol. (%):	*	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 1:42 pm
Time Sampled: 2:45 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10018519 / 44120377
Yards Placed/ Total Yards: 70 cu. yds. / 100 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/09/17	7	6.00	28.274	114,480	Unbonded	4,050	4,050
B	05/30/17	28	6.00	28.274	181,540	Unbonded	6,420	
C	05/30/17	28	6.00	28.274	189,890	Unbonded	6,720	6,570
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

SAMPLE PICK UP REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/08/2017
		Report Date:	05/08/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0173
Contractor:	Bo-Mac Contractors, LTD		

A Fugro representative arrived onsite to pick up 2 sets of 4 concrete cylinders, cast on 2-May-2017. The specimens were transported to our laboratory for curing and/or testing.

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/09/2017
Revised Report Date: 06/06/2017
Project No.: 04.12164967
Report No.: 0174
Previous Report Date: 05/16/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	80	
Concrete Temp. (ºF):	85	90 Max
Slump (in.):	7	6 - 8
Air Content by Vol. (%):	6.3*	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched:
Time Sampled: 8:35 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No:
Yards Placed/ Total Yards: 20 cu. yds. / 86 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/16/17	7	6.00	28.274	112,950	Unbonded	3,990	3,990
B	06/06/17	28	6.00	28.274	139,130	Unbonded	4,920	
C	06/06/17	28	6.00	28.274	143,390	Unbonded	5,070	5,000
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Jose Cisneros with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite. CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/09/2017
Revised Report Date: 06/06/2017
Project No.: 04.12164967
Report No.: 0174
Previous Report Date: 05/16/2017

Set: 2 of 2

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	73	
Concrete Temp. (ºF):	84*	90 Max.
Slump (in.):	6	6 - 8
Air Content by Vol. (%):	3.3	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 10:45 am
Time Sampled: 11:55 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10036842 / 44130238
Yards Placed/ Total Yards: 70 cu. yds. / 86 cu. yds.
Cylinders Molded: 4
Water Added: 15.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/16/17	7	6.00	28.274	119,570	Unbonded	4,230	4,230
B	06/06/17	28	6.00	28.274	162,640	Unbonded	5,750	
C	06/06/17	28	6.00	28.274	157,670	Unbonded	5,580	5,660
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Jose Cisneros with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite. CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

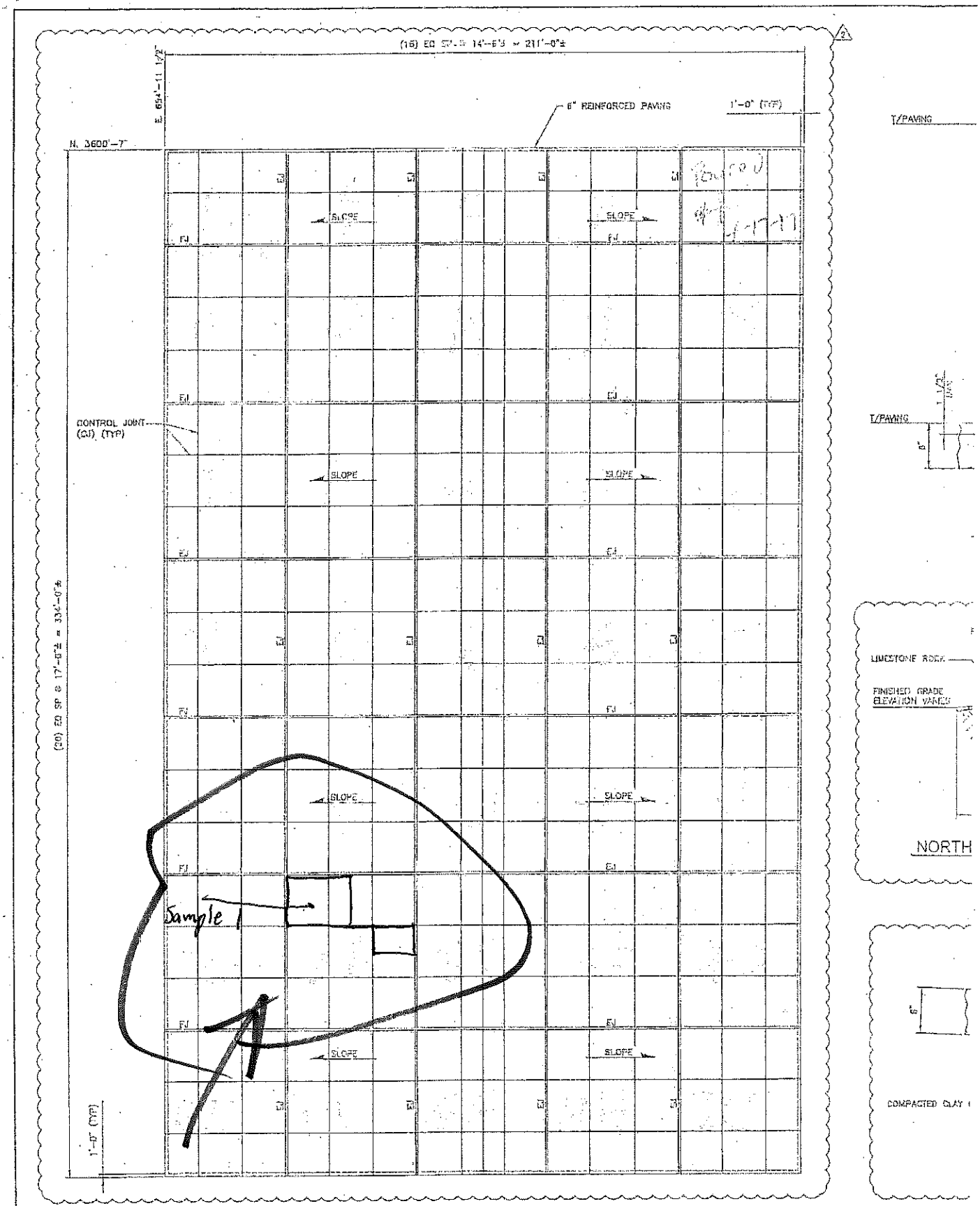
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

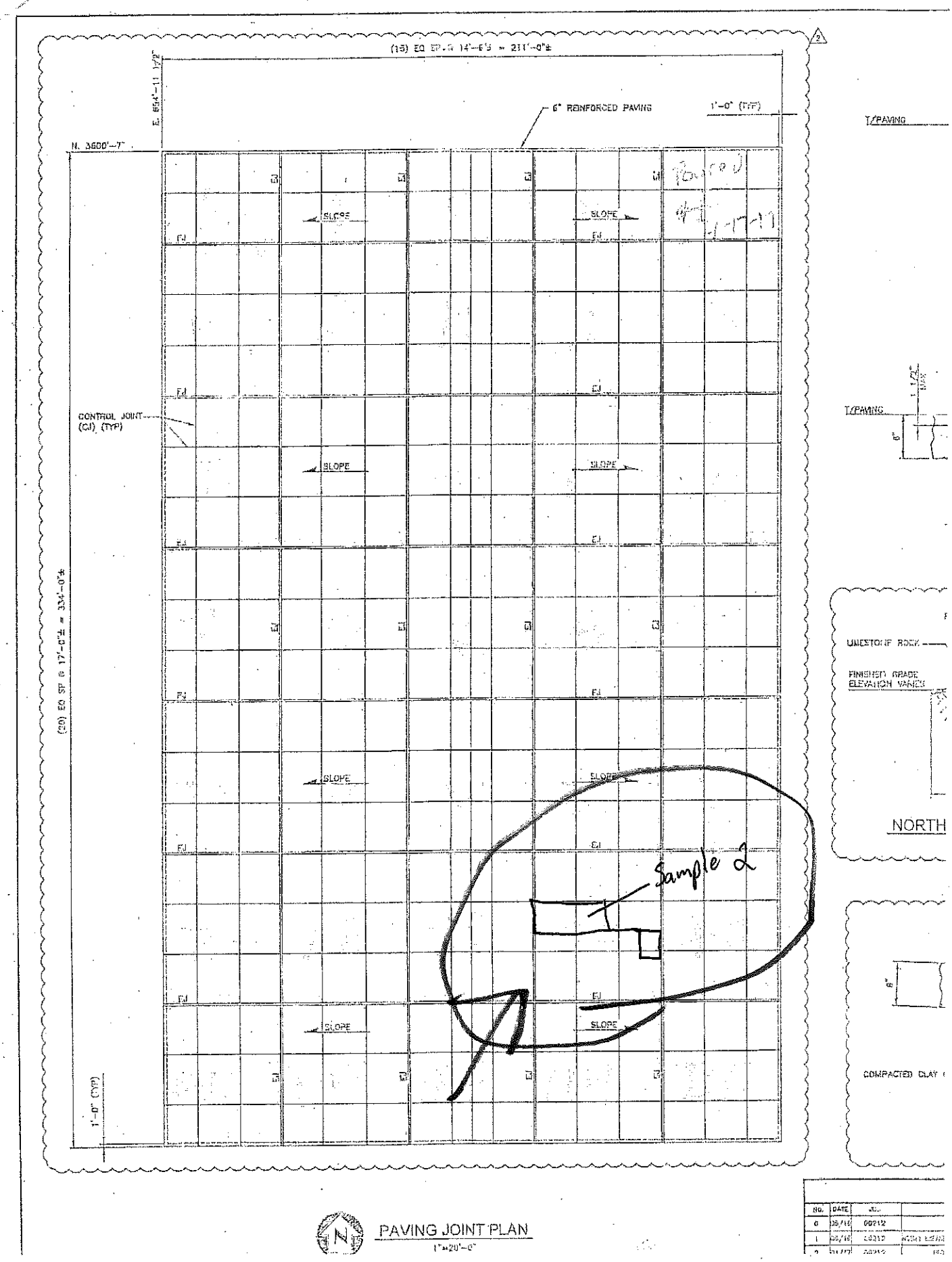
REPORT CREATED BY ElmTree SYSTEM

Project #04.12164967
Date 5-9-17



PAVING JOINT PLAN
1"=20'-0"

Project #04.12164967
Date 5-9-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/10/2017
Revised Report Date: 06/07/2017
Project No.: 04.12164967
Report No.: 0175
Previous Report Date: 05/17/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
3,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	75	
Concrete Temp. (ºF):	81*	90 Max.
Slump (in.):	6¼	6 - 8
Air Content by Vol. (%):	5.0	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:40 am
Time Sampled: 8:10 am
Yards in Truck Sampled: 20 cu. yds.
Truck/ Ticket No: 10065994 / 44131468
Yards Placed/ Total Yards: 20 cu. yds. / 101 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: Area Paving (Joint Plant). (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/17/17	7	6.00	28.274	119,020	Unbonded	4,210	4,210
B	06/07/17	28	6.00	28.274	159,450	Unbonded	5,640	
C	06/07/17	28	6.00	28.274	166,650	Unbonded	5,890	5,770
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/10/2017
Revised Report Date: 06/07/2017
Project No.: 04.12164967
Report No.: 0175
Previous Report Date: 05/17/2017

Set: 2 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
3,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	79	
Concrete Temp. (ºF):	77*	90 Max.
Slump (in.):	7	6 - 8
Air Content by Vol. (%):	4.5	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:17 am
Time Sampled: 10:35 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064675 / 44132048
Yards Placed/ Total Yards: 60 cu. yds. / 101 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Area Paving (Joint Plant). (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/17/17	7	6.00	28.274	99,960	Unbonded	3,540	3,540
B	06/07/17	28	6.00	28.274	149,840	Unbonded	5,300	
C	06/07/17	28	6.00	28.274	154,610	Unbonded	5,470	5,380
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

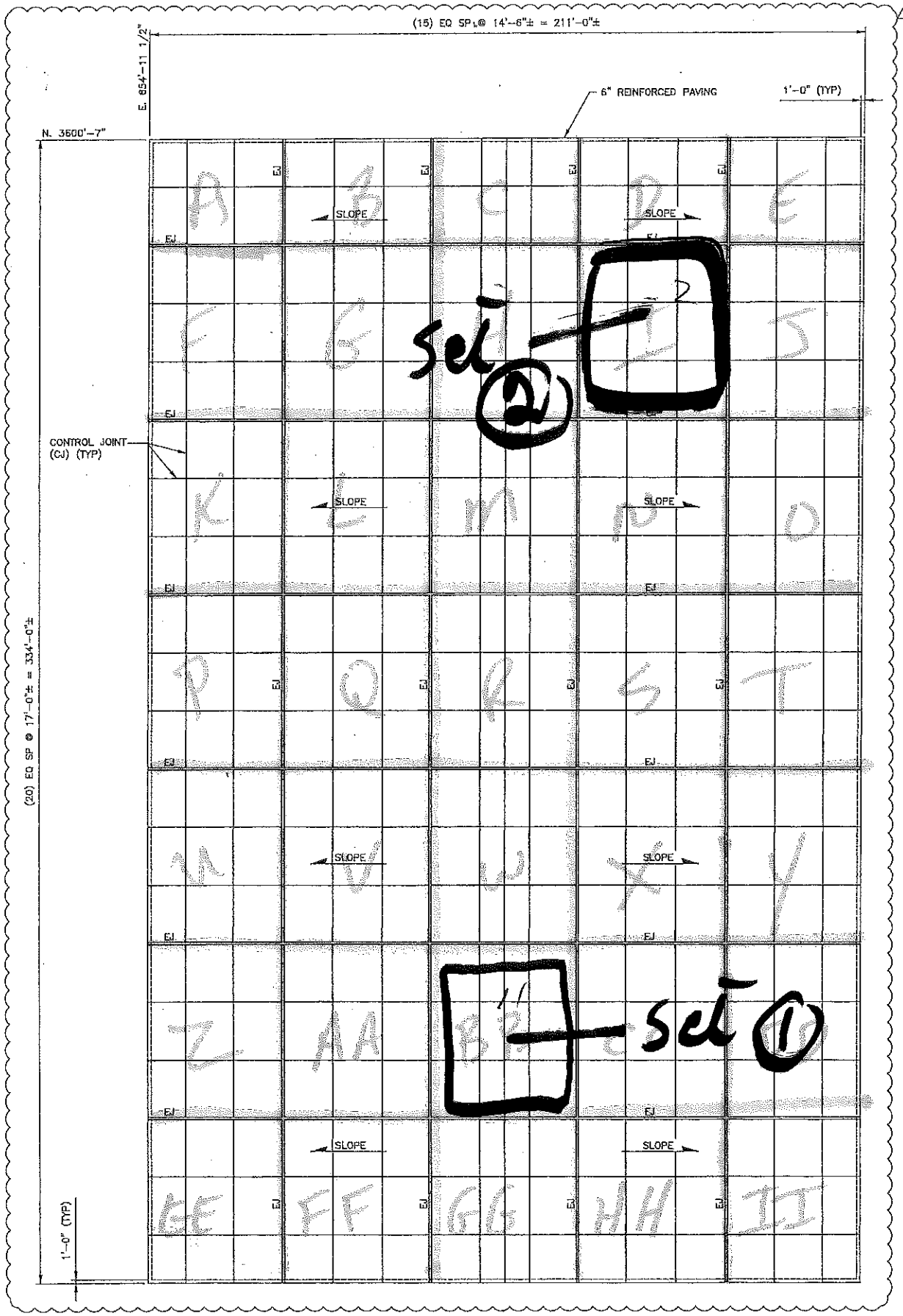
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

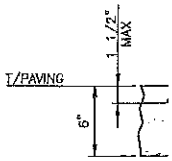
Scott A. Buchanan
CMET Project Manager

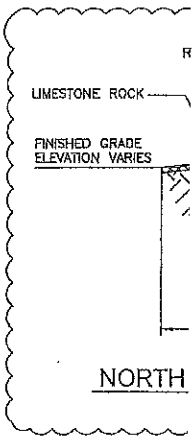
Construction Materials
Certificate No. 0023-02

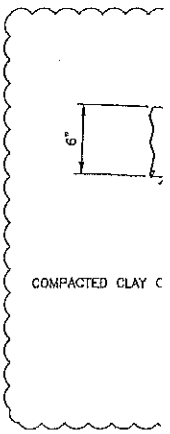
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM









PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	MODIFY EXPANSI
2	01/17	00212	UPDA

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/11/2017
Revised Report Date: 06/08/2017
Project No.: 04.12164967
Report No.: 0176
Previous Report Date: 05/18/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	76	
Concrete Temp. (ºF):	74	
Slump (in.):	9¼*	6-8
Air Content by Vol. (%):	2.3	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:22 am
Time Sampled: 7:35 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067950 / 44133476
Yards Placed/ Total Yards: 10 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: Area Paving. (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/18/17	7	6.00	28.274	85,900	Unbonded	3,040	3,040
B	06/08/17	28	6.00	28.274	139,020	Unbonded	4,920	
C	06/08/17	28	6.00	28.274	139,760	Unbonded	4,940	4,930
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/11/2017
Revised Report Date: 06/08/2017
Project No.: 04.12164967
Report No.: 0176
Previous Report Date: 05/18/2017

Set: 2 of 2

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
3,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	76	
Concrete Temp. (ºF):	88	
Slump (in.):	6	6-8
Air Content by Vol. (%):	3.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:00 am
Time Sampled: 10:05 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067960 / 44133983
Yards Placed/ Total Yards: 70 cu. yds. / 110 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: Area Paving. (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/18/17	7	6.00	28.274	116,110	Unbonded	4,110	4,110
B	06/08/17	28	6.00	28.274	177,010	Unbonded	6,260	
C	06/08/17	28	6.00	28.274	182,330	Unbonded	6,450	6,350
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

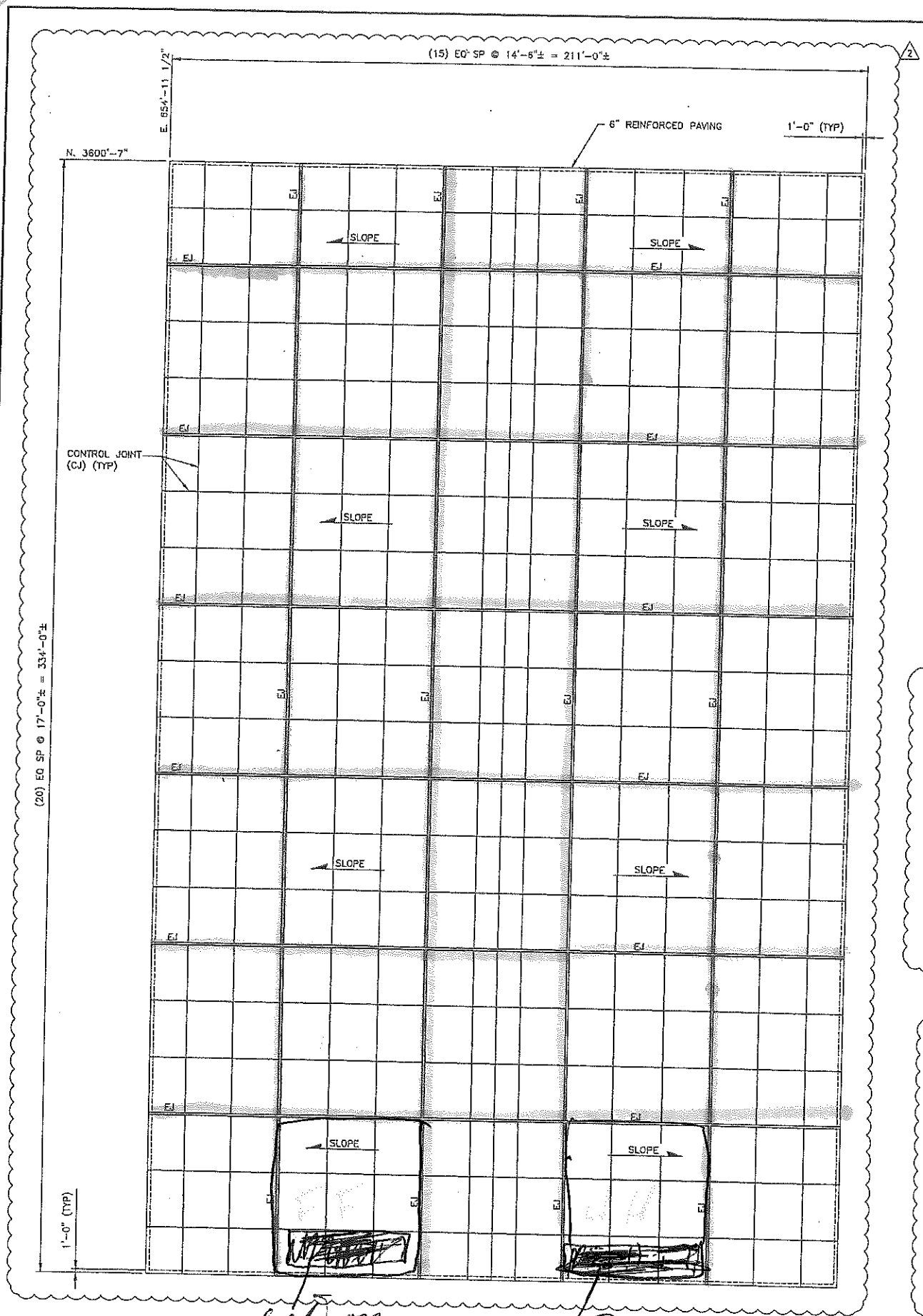
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



set on set ② 05-11-17

PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	JODEY EVANS

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/12/2017
Revised Report Date: 06/09/2017
Project No.: 04.12164967
Report No.: 0177
Previous Report Date: 05/22/2017

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	75	
Concrete Temp. (ºF):	74	90 Max
Slump (in.):	5½*	6 - 8
Air Content by Vol. (%):	3.0	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:08 am
Time Sampled: 7:30 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10065645 / 44135834
Yards Placed/ Total Yards: 10 cu. yds. / 46 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Area Paving. (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/19/17	7	6.00	28.274	127,050	Unbonded	4,490	4,490
B	06/09/17	28	6.00	28.274	161,800	Unbonded	5,720	
C	06/09/17	28	6.00	28.274	177,750	Unbonded	6,290	6,000
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

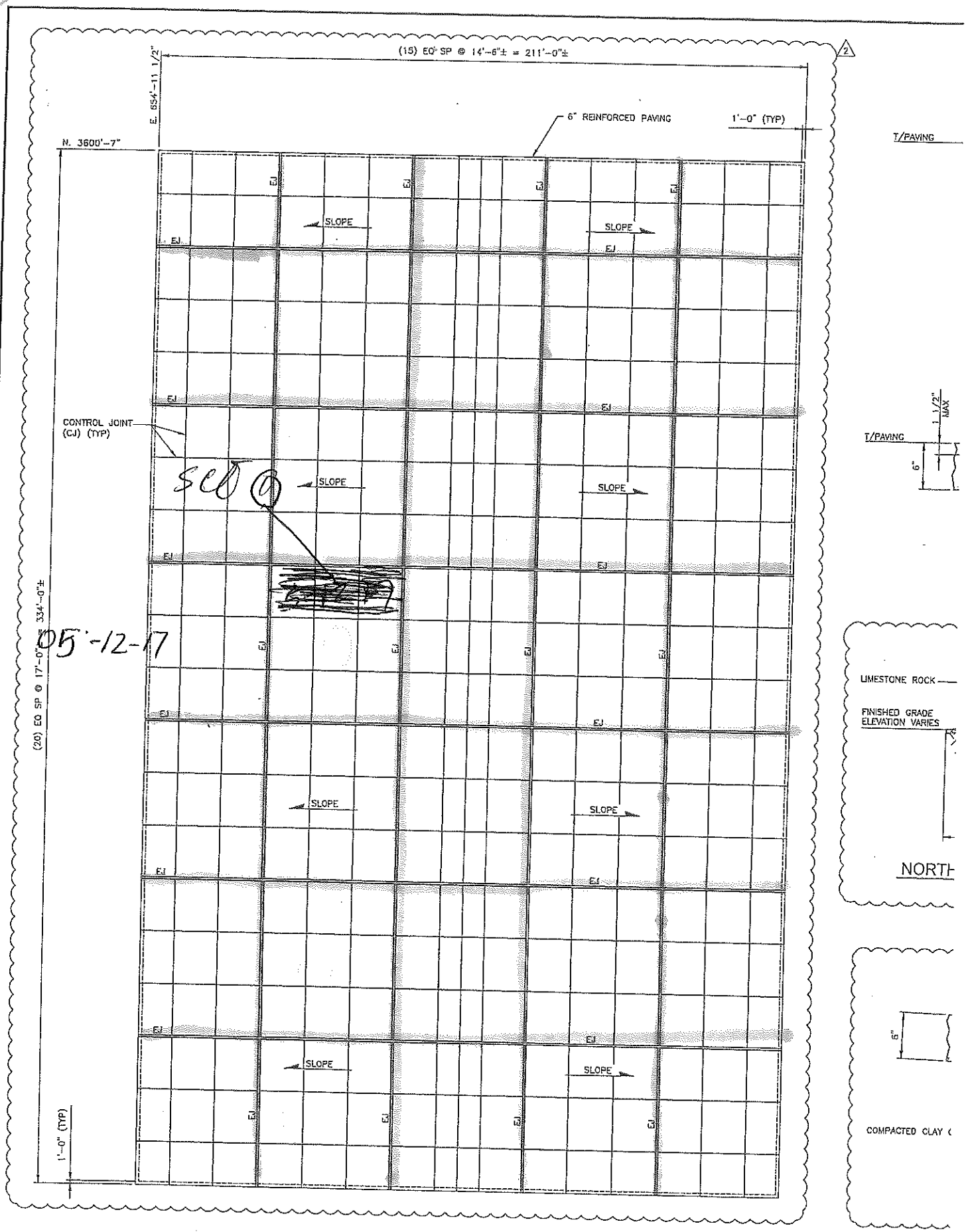
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	ADDITIV EXPANSI

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

SAMPLE PICK UP REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/13/2017
		Report Date:	05/15/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0178
Contractor:	Bo-Mac Contractors, LTD		

A Fugro representative arrived onsite to pick up 1 set of 4 concrete cylinders, cast on 13-MAY-2017. The specimens were transported to our laboratory for curing and/or testing.

Fugro Representative: Mohammad Akbar

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/15/2017
Revised Report Date: 06/12/2017
Project No.: 04.12164967
Report No.: 0179
Previous Report Date: 05/22/2017

Set: 1 of 2

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	65	
Concrete Temp. (ºF):	74	90 Max
Slump (in.):	6½	6 - 8
Air Content by Vol. (%):	3.1	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:16 am
Time Sampled: 7:20 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064434 / 44138525
Yards Placed/ Total Yards: 10 cu. yds. / 100 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: Area Paving. (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/22/17	7	6.00	28.274	126,630	Unbonded	4,480	4,480
B	06/12/17	28	6.00	28.274	176,960	Unbonded	6,260	
C	06/12/17	28	6.00	28.274	172,420	Unbonded	6,100	6,180
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/15/2017
Revised Report Date: 06/12/2017
Project No.: 04.12164967
Report No.: 0179
Previous Report Date: 05/22/2017

Set: 2 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
3,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	80	
Concrete Temp. (ºF):	79	90 Max
Slump (in.):	5*	6 - 8
Air Content by Vol. (%):	3.5	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 8:27 am
Time Sampled: 9:30 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037798 / 44138931
Yards Placed/ Total Yards: 80 cu. yds. / 100 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: Area Paving. (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/22/17	7	6.00	28.274	128,220	Unbonded	4,530	4,530
B	06/12/17	28	6.00	28.274	162,060	Unbonded	5,730	
C	06/12/17	28	6.00	28.274	170,020	Unbonded	6,010	5,870
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mohammad Akbar

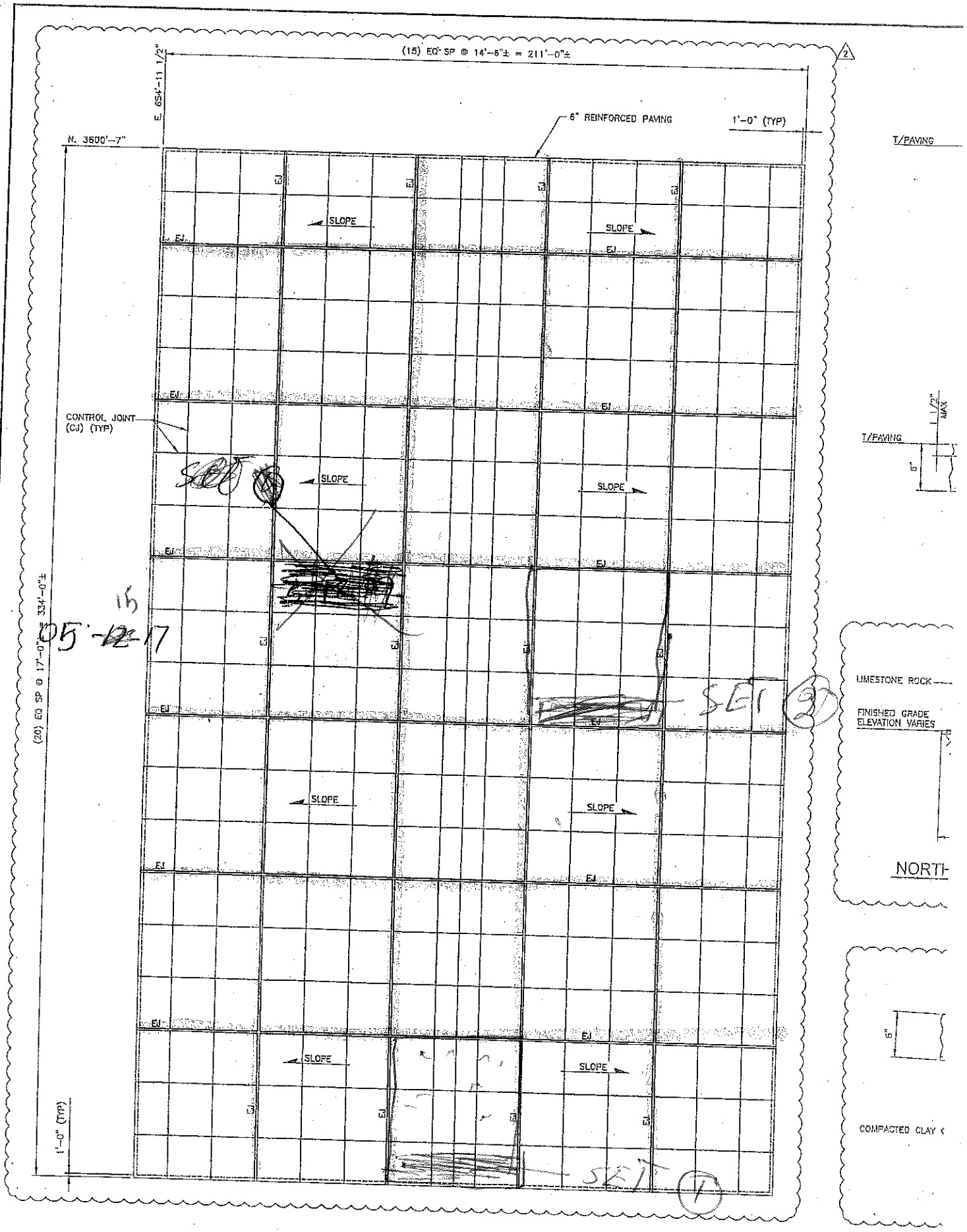
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



PAVING JOINT PLAN

NO.	DATE	JOB
0	05/15	00212

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/16/2017
Report Date: 05/25/2017
Project No.: 04.12164967
Report No.: 0180

Set: 1 of 2

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	82	
Concrete Temp. (ºF):	84	90 Max
Slump (in.):	8	6 - 8
Air Content by Vol. (%):	1.3	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:41 am
Time Sampled: 7:50 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10065994 / 44140457
Yards Placed/ Total Yards: 20 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/23/17	7	6.00	28.274	104,080	Unbonded	3,680	3,680
B	06/13/17	28	6.00	28.274		Unbonded		
C	06/13/17	28	6.00	28.274		Unbonded		
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Jose Cisneros with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite. CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Andrew Martinez
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/16/2017
Report Date: 05/25/2017
Project No.: 04.12164967
Report No.: 0180

Set: 2 of 2

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	94	
Concrete Temp. (ºF):	87	90 Max
Slump (in.):	8	6 - 8
Air Content by Vol. (%):	1.5	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:22 am
Time Sampled: 10:40 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037798 / 44141085
Yards Placed/ Total Yards: 70 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/23/17	7	6.00	28.274	108,010	Unbonded	3,820	3,820
B	06/13/17	28	6.00	28.274		Unbonded		
C	06/13/17	28	6.00	28.274		Unbonded		
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Jose Cisneros with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

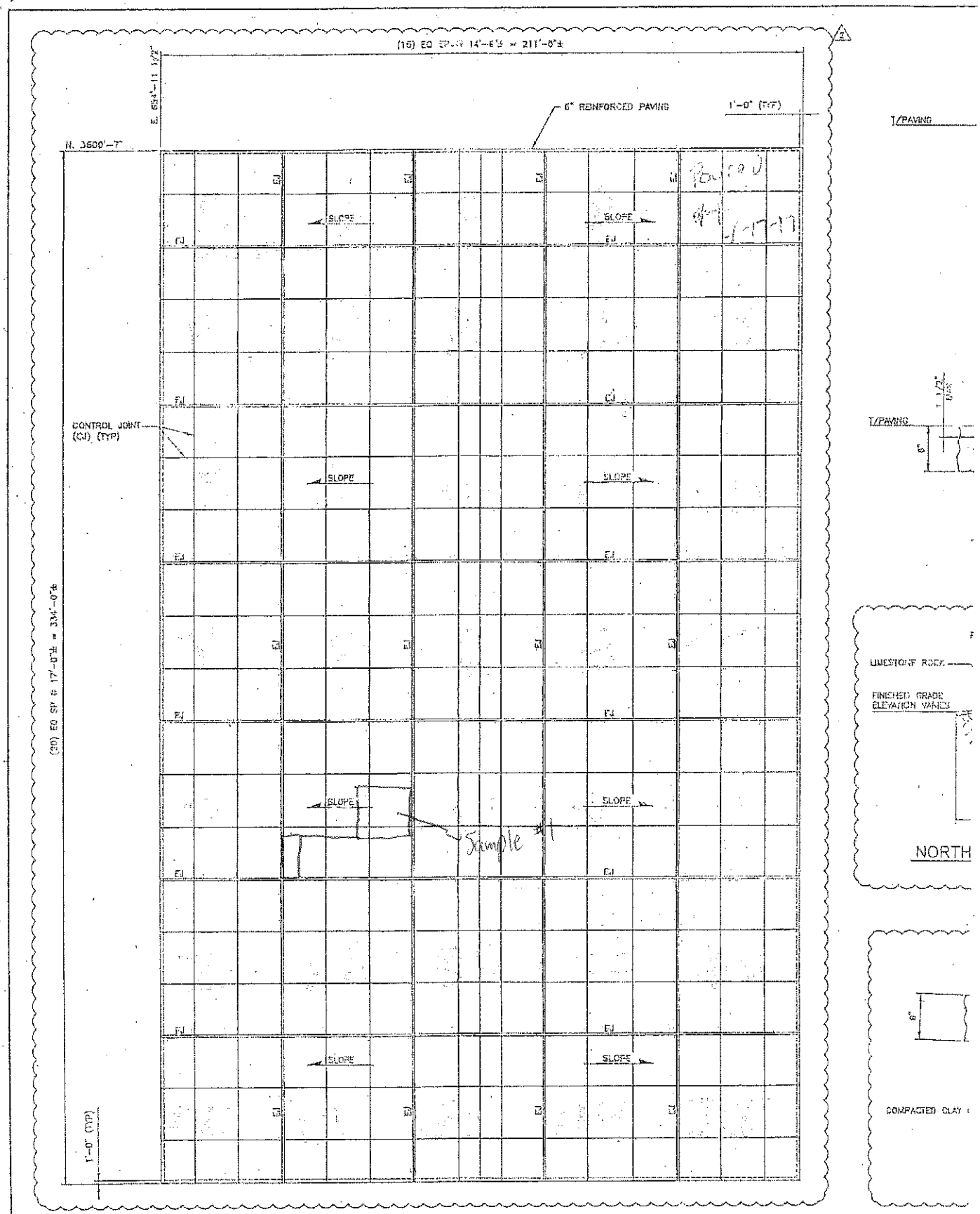
Andrew Martinez
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

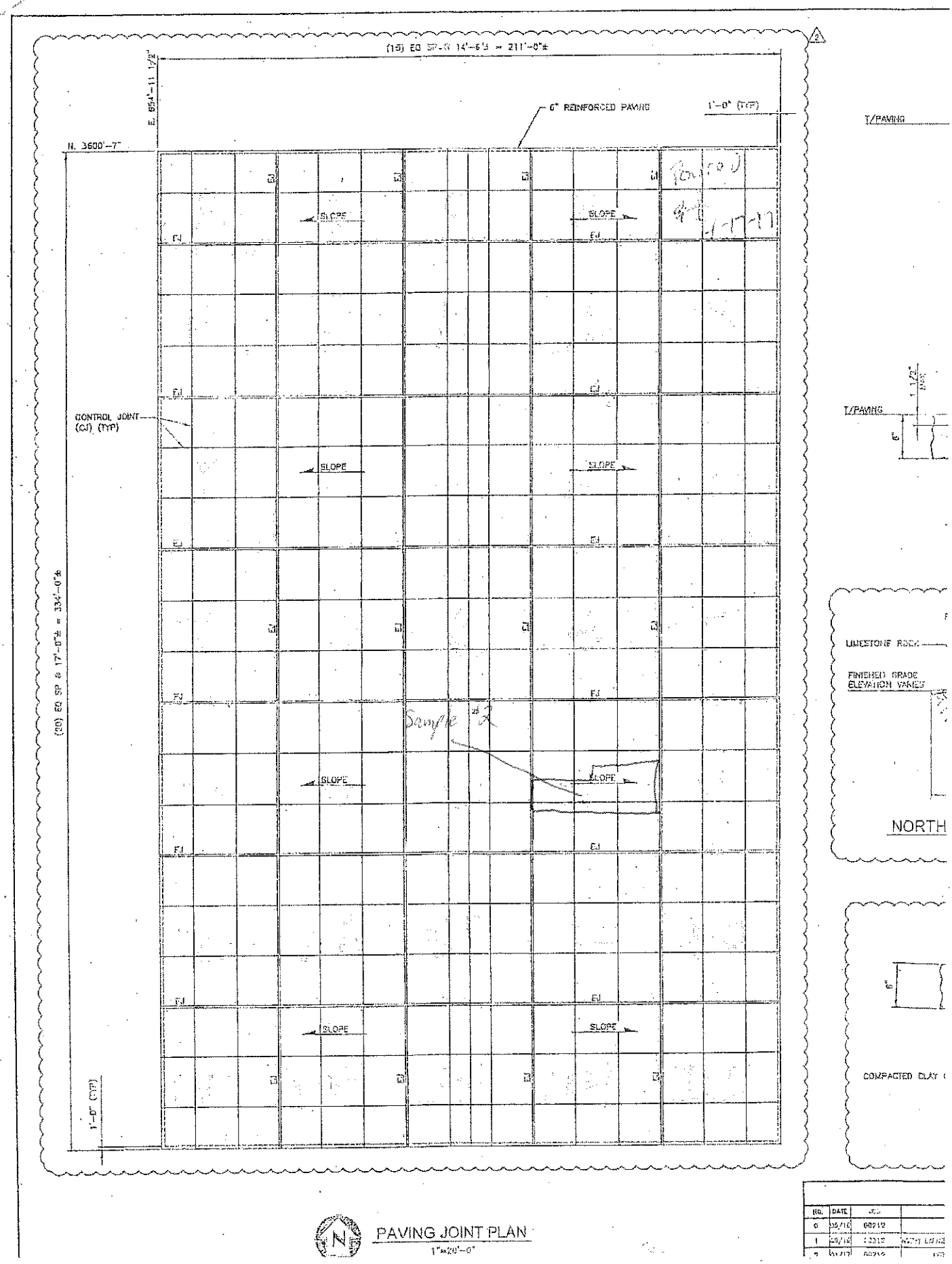
REPORT CREATED BY ElmTree SYSTEM

Project 04.12154967
Date 5-16-17



PAVING JOINT PLAN
1"=20'-0"

Project #04.12154967
Date 5-16-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/17/2017
Revised Report Date: 06/14/2017
Project No.: 04.12164967
Report No.: 0181
Previous Report Date: 05/26/2017

Set: 1 of 2

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	86	
Concrete Temp. (ºF):	85	90 Max
Slump (in.):	7½	6 - 8
Air Content by Vol. (%):	1.5	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:42 am
Time Sampled: 7:50 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10018151 / 44142479
Yards Placed/ Total Yards: 20 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/24/17	7	6.00	28.274	118,520	Unbonded	4,190	4,190
B	06/14/17	28	6.00	28.274	162,060	Unbonded	5,730	
C	06/14/17	28	6.00	28.274	163,850	Unbonded	5,790	5,760
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/17/2017
Revised Report Date: 06/14/2017
Project No.: 04.12164967
Report No.: 0181
Previous Report Date: 05/26/2017

Set: 2 of 2

Supplier: CEMEX
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	93	
Concrete Temp. (ºF):	90	90 Max
Slump (in.):	6¾	6 - 8
Air Content by Vol. (%):	1.5	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:50 am
Time Sampled: 10:45 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067224 / 44143070
Yards Placed/ Total Yards: 70 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 10.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch.

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/24/17	7	6.00	28.274	110,590	Unbonded	3,910	3,910
B	06/14/17	28	6.00	28.274	142,220	Unbonded	5,030	
C	06/14/17	28	6.00	28.274	153,170	Unbonded	5,420	5,220
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

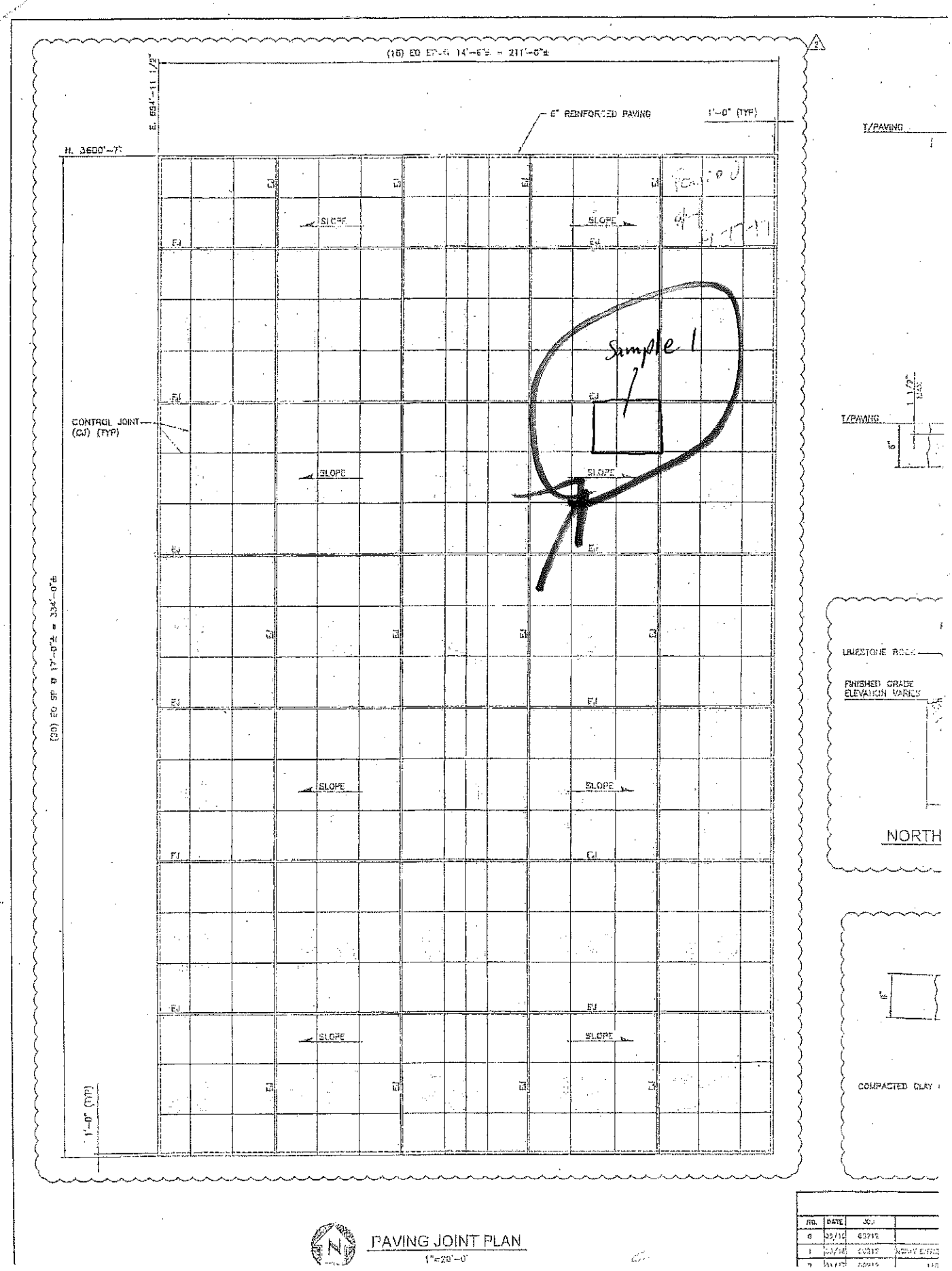
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

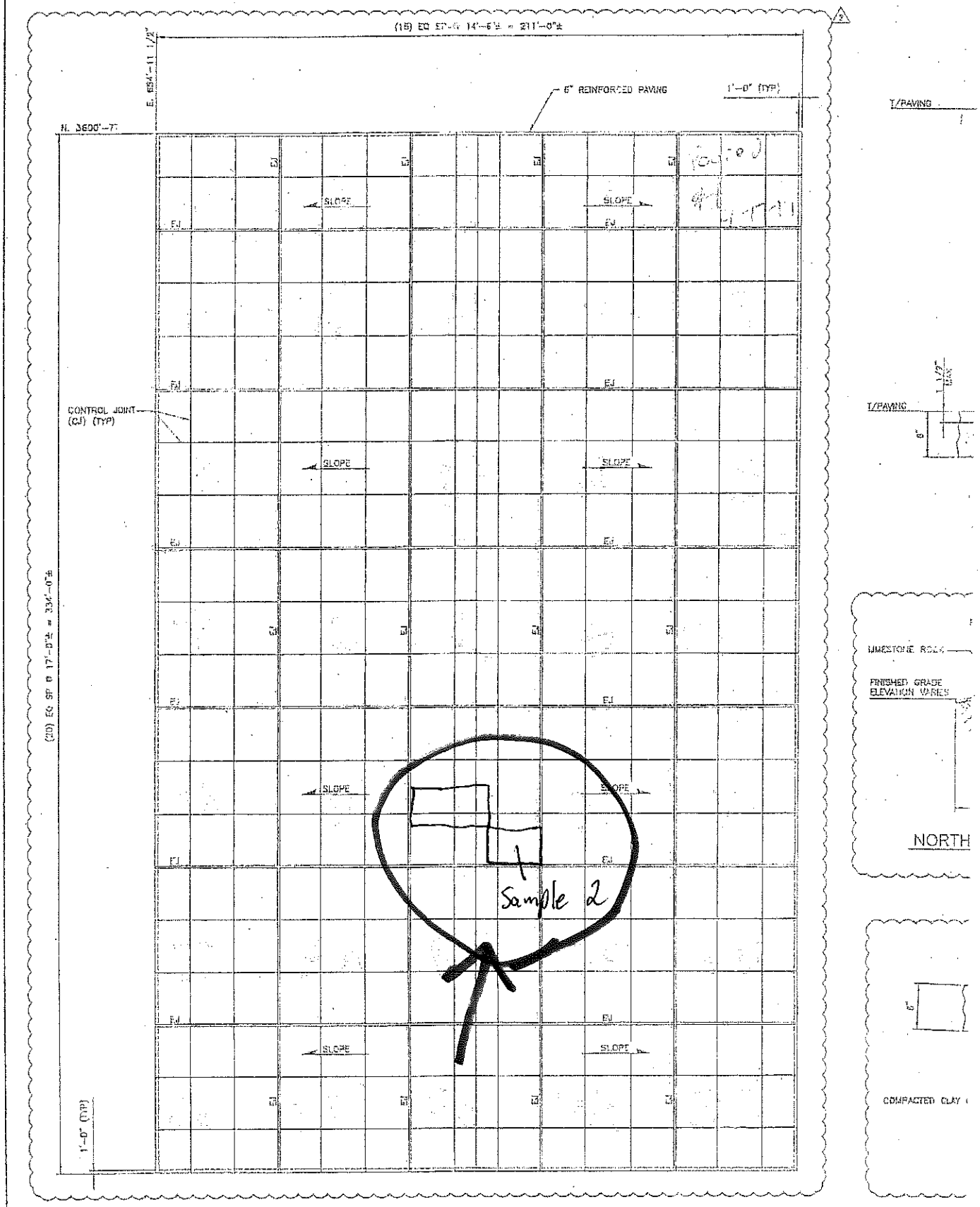
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Project #04.12164967
Date 5-17-17



Project #04.12164967
Date 5-17-17



PAVING JOINT PLAN
1"=20'-0"

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/18/2017
Revised Report Date: 06/15/2017
Project No.: 04.12164967
Report No.: 0182
Previous Report Date: 05/25/2017

Set: 1 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	84	
Concrete Temp. (ºF):	87	90 Max
Slump (in.):	8	6-8
Air Content by Vol. (%):	1.3	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:56 am
Time Sampled: 8:15 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10063921 / 44144427
Yards Placed/ Total Yards: 20 cu. yds. / 100 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/25/17	7	6.00	28.274	95,310	Unbonded	3,370	3,370
B	06/15/17	28	6.00	28.274	151,090	Unbonded	5,340	
C	06/15/17	28	6.00	28.274	156,390	Unbonded	5,530	5,440
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Jose Cisneros with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite. CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/18/2017
Revised Report Date: 06/15/2017
Project No.: 04.12164967
Report No.: 0182
Previous Report Date: 05/25/2017

Set: 2 of 2

Supplier: Cemex
Class/Design: 1595167

MEETS REFERENCE VALUE

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	90	
Concrete Temp. (ºF):	88	90 Max
Slump (in.):	7½	6-8
Air Content by Vol. (%):	1.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:45 am
Time Sampled: 10:50 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064477 / 44145003
Yards Placed/ Total Yards: 70 cu. yds. / 100 cu. yds.
Cylinders Molded: 4
Water Added: 20.0 Gal
Final Curing Method: Standard

Placement Location: See Attached Sketch

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/25/17	7	6.00	28.274	110,450	Unbonded	3,910	3,910
B	06/15/17	28	6.00	28.274	170,840	Unbonded	6,040	
C	06/15/17	28	6.00	28.274	163,890	Unbonded	5,800	5,920
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Jose Cisneros with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite. CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

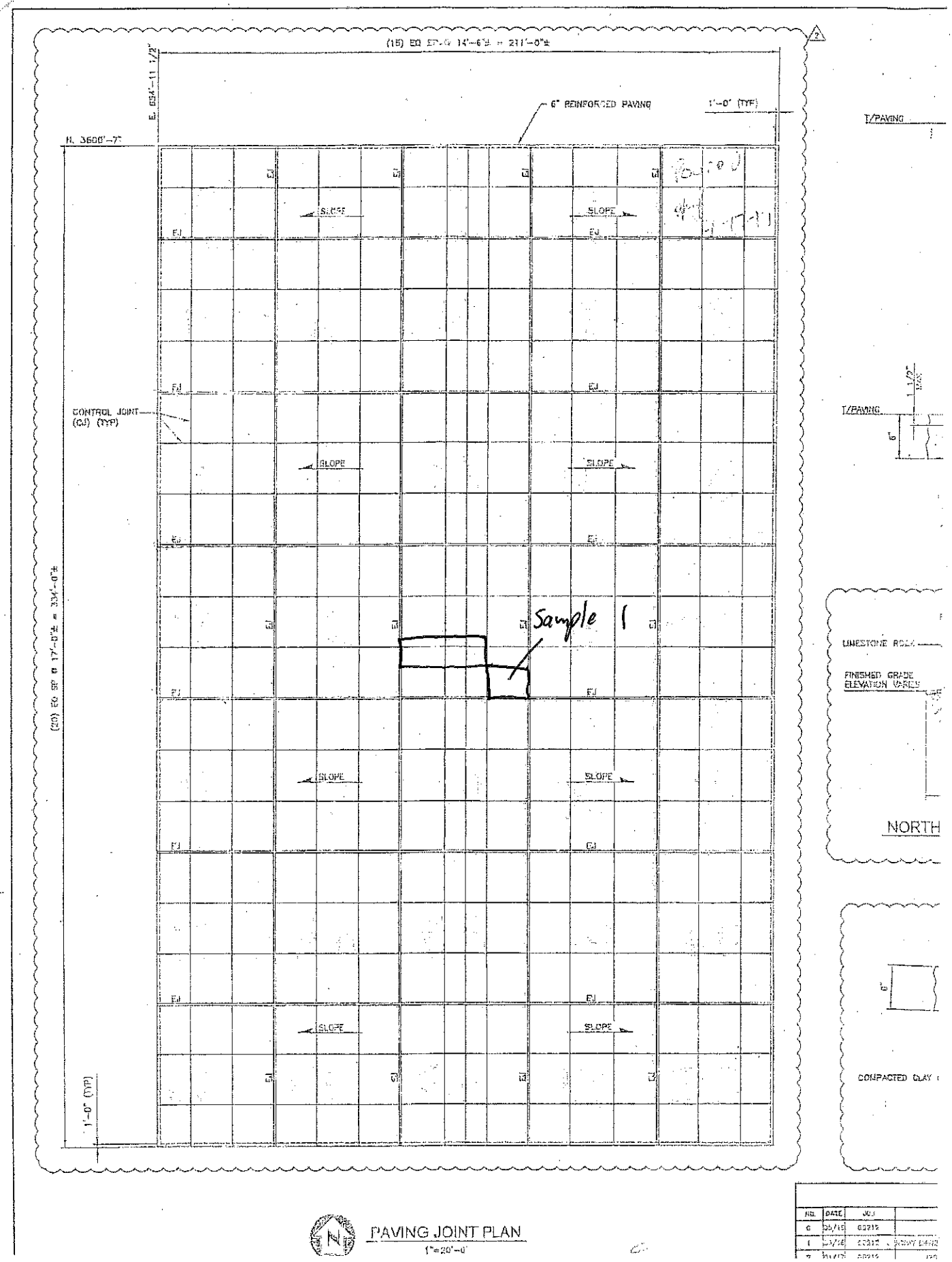
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

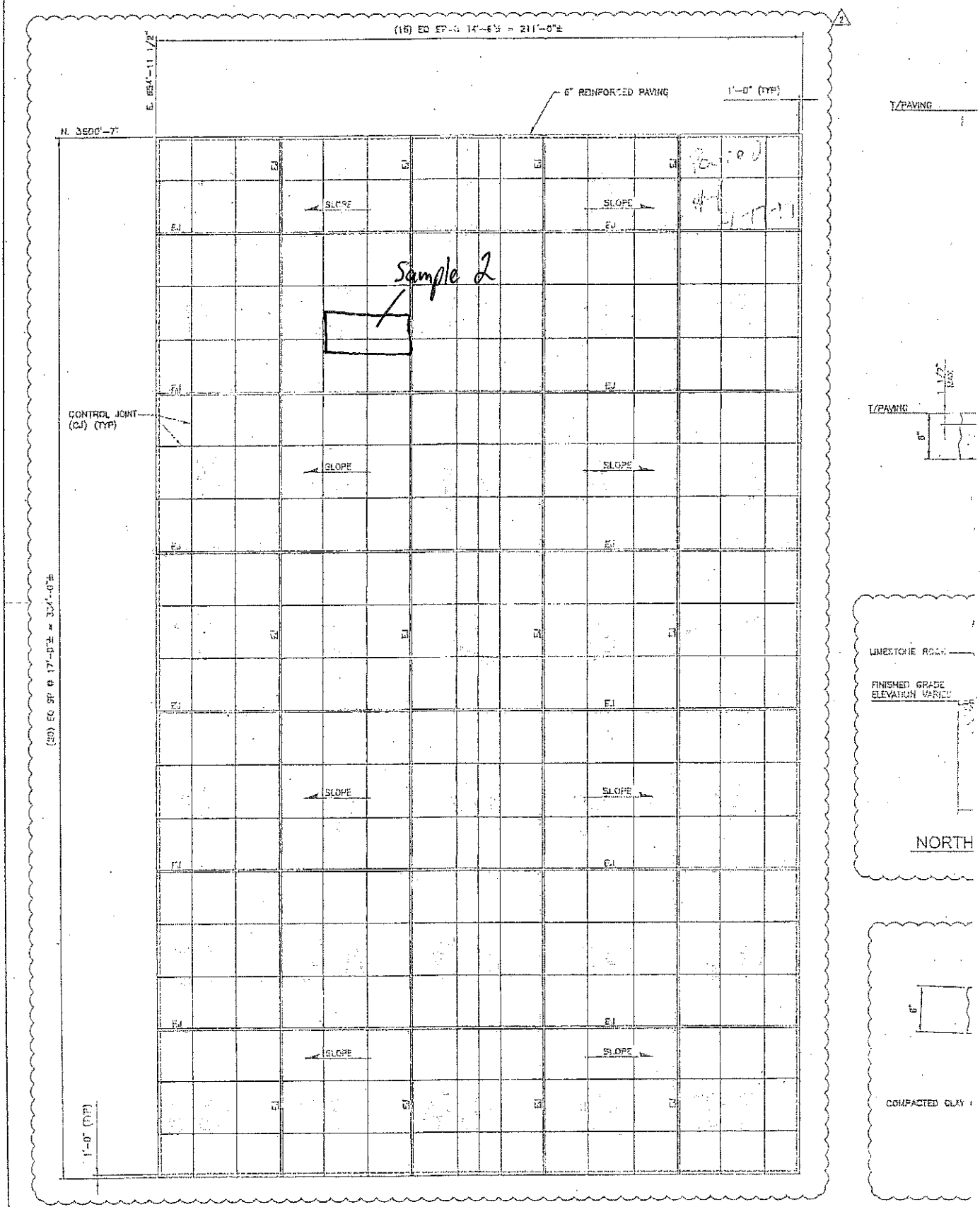
THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Project 04.12164967
Date 5-18-17



Project 04.12164967
Date 5-18-17



Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/19/2017
Report Date: 06/16/2017
Project No.: 04.12164967
Report No.: 0183

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	81	
Concrete Temp. (ºF):	85	90 Max
Slump (in.):	7½	6 - 8
Air Content by Vol. (%):	1.8	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:19 am
Time Sampled: 7:20 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10065991 / 44146675
Yards Placed/ Total Yards: 10 cu. yds. / 80 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Area Paving, Control Joint. (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	05/26/17	7	6.00	28.274	108,580	Unbonded	3,840	3,840
B	06/16/17	28	6.00	28.274	160,010	Unbonded	5,660	
C	06/16/17	28	6.00	28.274	152,640	Unbonded	5,400	5,530
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mamoudou Sylla

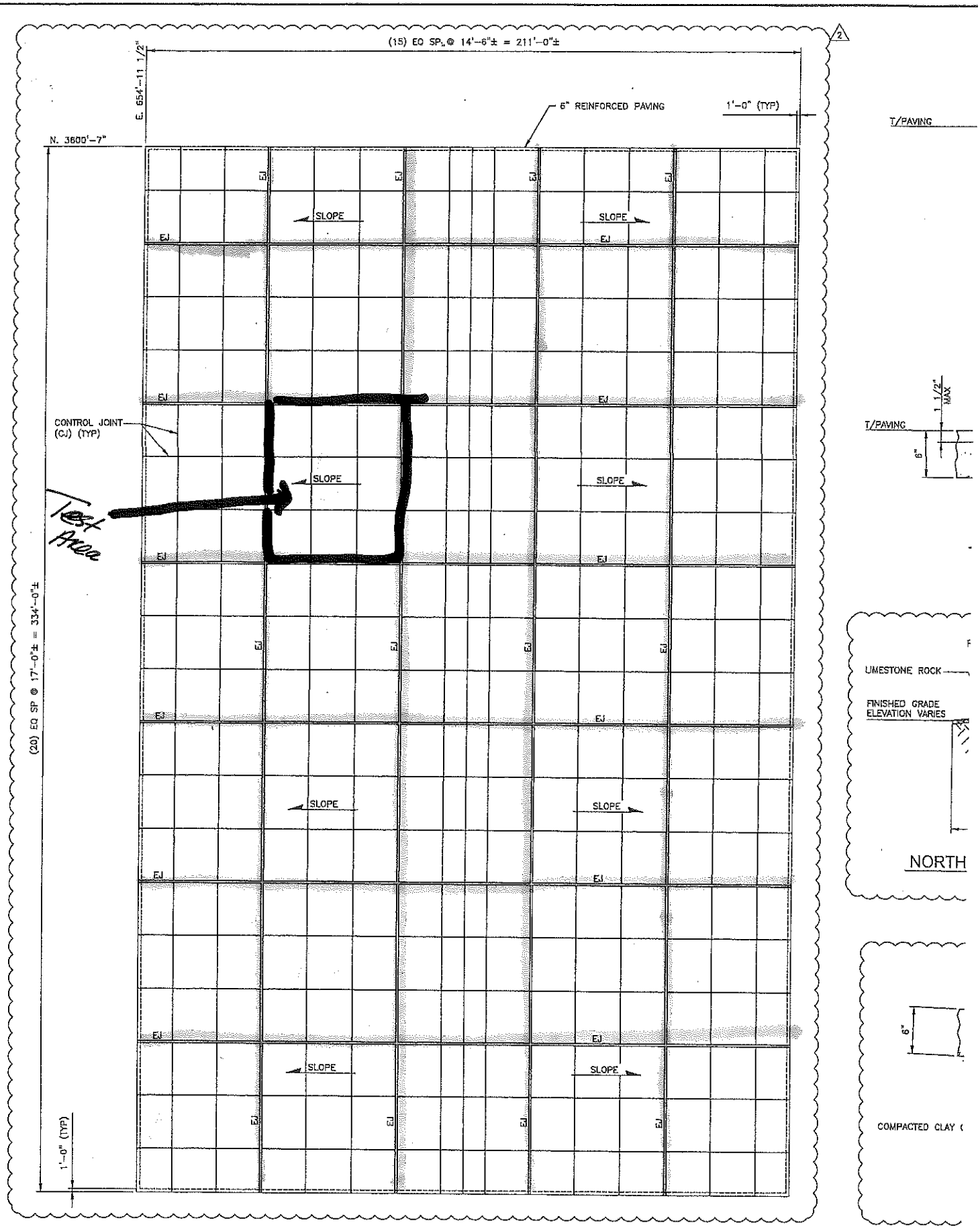
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	MODIFY EXPANS
2	01/17	00212	UPDA

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/22/2017
		Report Date:	05/23/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0184
Contractor:	Bo-Mac Contractors, LTD		

On 05/22/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Concrete Sampling and Testing. After arrival to the job site, the technician was placed on "stand-by". Testing was later cancelled by the contractor due to weather conditions.

Fugro Representative: Mamoudou Sylla

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Earnest Terrell
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/25/2017
Revised Report Date: 06/27/2017
Project No.: 04.12164967
Report No.: 0185
Previous Report Date: 06/08/2017

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	87	
Concrete Temp. (ºF):	84	
Slump (in.):	7½	
Air Content by Vol. (%):	2.1	
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:11 am
Time Sampled: 10:20 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037511 / 44154343
Yards Placed/ Total Yards: 10 cu. yds. / 80 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Paving Area "D", (See Attached Sketch)

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	06/01/17	7	6.00	28.274	89,260	Unbonded	3,160	3,160
B	06/22/17	28	5.93	27.619	118,590	Unbonded	4,290	
C	06/22/17	28	5.93	27.619	125,930	Unbonded	4,560	4,430
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed James K. Gore with Bo-Mac Contractors, LTD. of field test results prior to leaving the jobsite. CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mamoudou Sylla

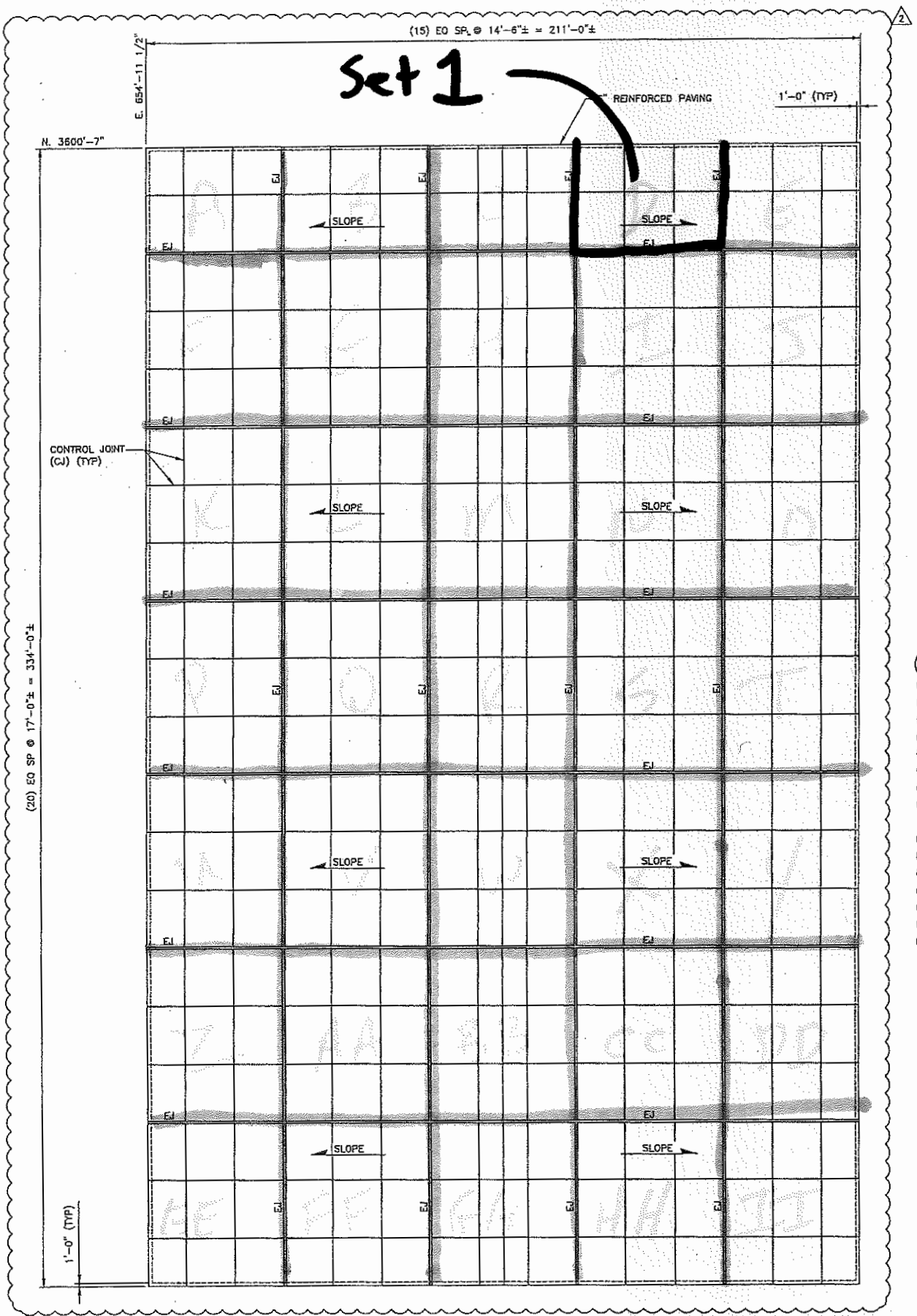
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



Set 1

T/PAVING

1 1/2" MAX

6"

LIMESTONE ROCK

FINISHED GRADE ELEVATION VARIES

NORTH

COMPACTED CLAY

PAVING JOINT PLAN

1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	MODIFY EXPANS
2	01/17	00212	UPD

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF JOB CANCELLATION

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/24/2017
		Report Date:	06/01/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0186
Contractor:	Bo-Mac Contractors, LTD		

On 05/24/2017, a representative of Fugro USA Land, Inc. visited the above referenced project site to perform the scheduled Concrete Sampling and Testing. While in enroute to the job site, the testing was cancelled by the contractor.

Fugro Representative: Mamoudou Sylla

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/26/2017
Revised Report Date: 06/27/2017
Project No.: 04.12164967
Report No.: 0187
Previous Report Date: 06/08/2017

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	85	
Concrete Temp. (ºF):	86	90 Max
Slump (in.):	6½	6 - 8
Air Content by Vol. (%):	1.8	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:18 am
Time Sampled: 10:40 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067223 / 44156714
Yards Placed/ Total Yards: 10 cu. yds. / 80 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Paving Area M (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	06/02/17	7	6.00	28.274	96,710	Unbonded	3,420	3,420
B	06/23/17	28	5.93	27.619	123,190	Unbonded	4,460	
C	06/23/17	28	5.93	27.619	123,850	Unbonded	4,480	4,470
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mamoudou Sylla

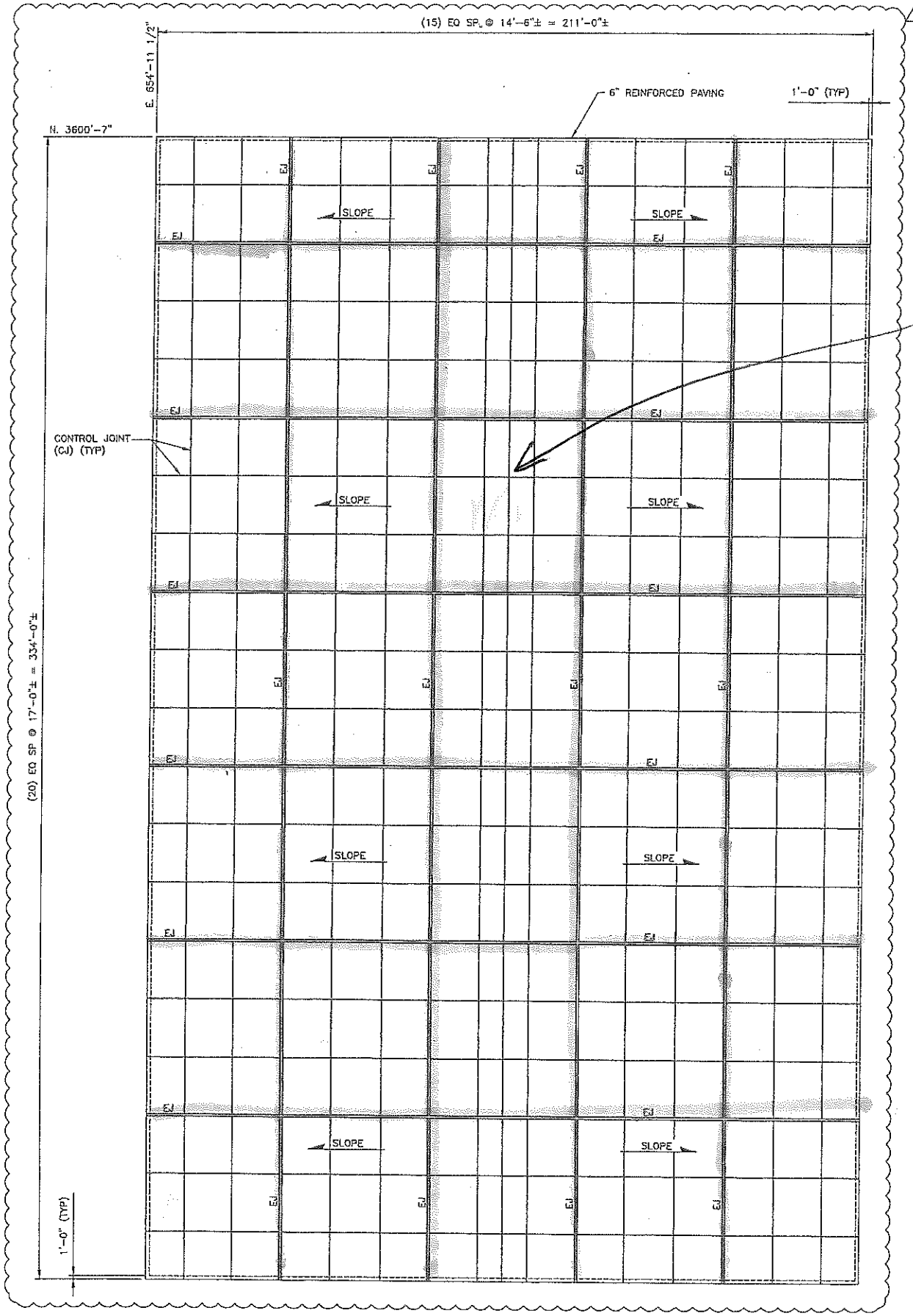
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	MODIFY EXPANS
2	01/17	00212	UPD

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/30/2017
Revised Report Date: 06/27/2017
Project No.: 04.12164967
Report No.: 0188
Previous Report Date: 06/08/2017

Set: 1 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):		
Concrete Temp. (ºF):	85	90 Max
Slump (in.):	7	6 - 8
Air Content by Vol. (%):	2.2	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:14 am
Time Sampled: 10:25 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10037557 / 44158657
Yards Placed/ Total Yards: 20 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Paving Area B (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	06/06/17	7	6.00	28.274	104,520	Unbonded	3,700	3,700
B	06/27/17	28	6.00	28.274	148,940	Unbonded	5,270	
C	06/27/17	28	6.00	28.274	150,850	Unbonded	5,340	5,300
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mamoudou Sylla

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 05/30/2017
Revised Report Date: 06/27/2017
Project No.: 04.12164967
Report No.: 0188
Previous Report Date: 06/08/2017

Set: 2 of 2

MEETS REFERENCE VALUE

Supplier: CEMEX
Class/Design: 1595167

Specified Strength
3,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):		
Concrete Temp. (ºF):	87	90 Max
Slump (in.):	7	6 - 8
Air Content by Vol. (%):	2.3	1 - 6
Unit Weight (pcf):		

Sampling Data

Time Batched: 11:41 am
Time Sampled: 1:15 pm
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10064673 / 44159012
Yards Placed/ Total Yards: 70 cu. yds. / 90 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Paving Area H (See Attached Sketch).

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	06/06/17	7	6.00	28.274	106,070	Unbonded	3,750	3,750
B	06/27/17	28	6.00	28.274	145,260	Unbonded	5,140	
C	06/27/17	28	6.00	28.274	144,430	Unbonded	5,110	5,120
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mamoudou Sylla

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

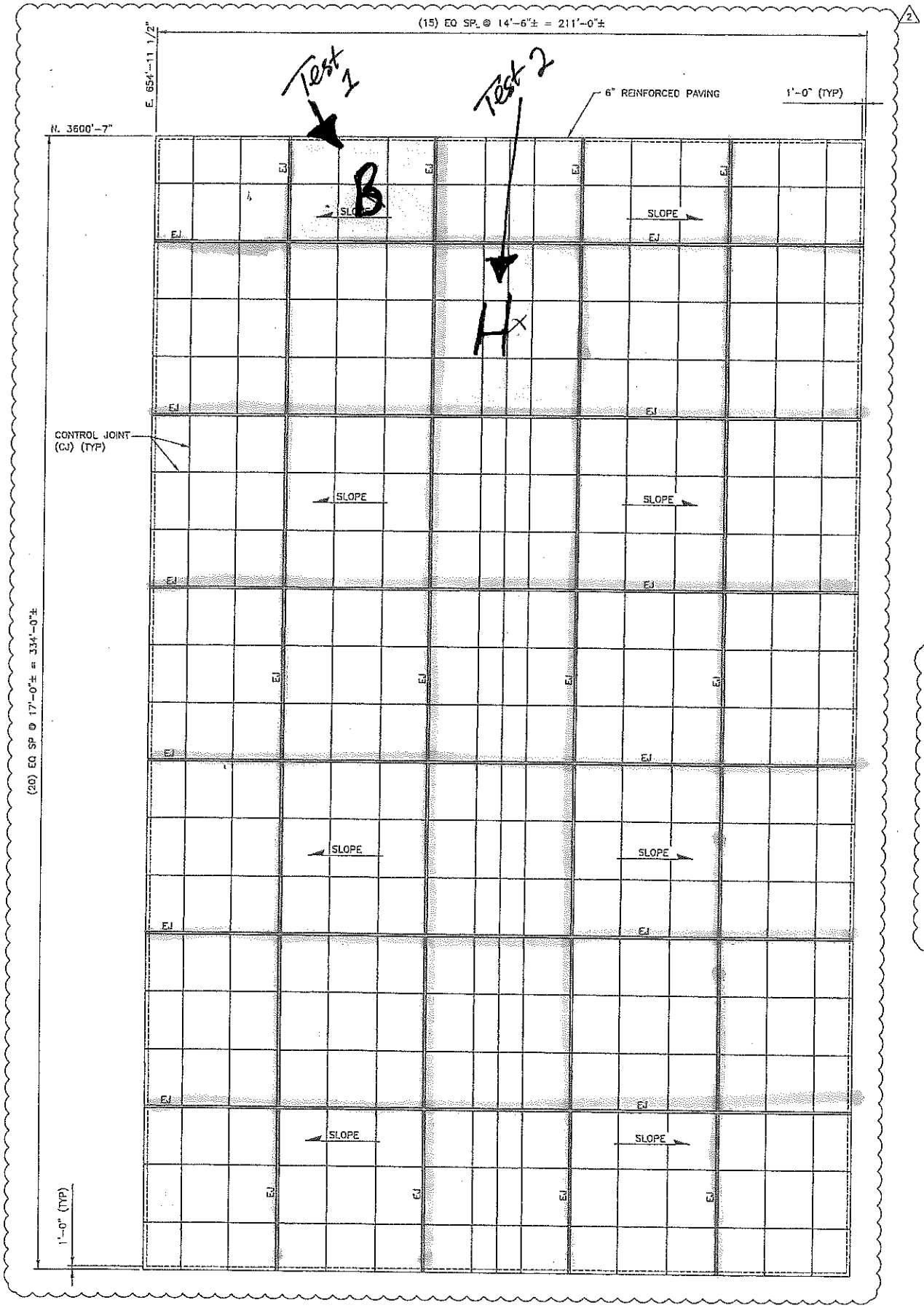
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

BoMAC



PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/16	00212	
1	09/16	00212	MODIFY EXPANS
2	01/17	00212	UPD

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

SAMPLE PICK UP REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	05/31/2017
		Report Date:	06/01/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0189
Contractor:	Bo-Mac Contractors, LTD		

A Fugro representative arrived onsite to pick up 2 sets of 4 concrete cylinders, cast on 30-MAY-2017. The specimens were transported to our laboratory for curing and/or testing.

Fugro Representative: Mamoudou Sylla

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 06/01/2017
Revised Report Date: 06/29/2017
Project No.: 04.12164967
Report No.: 0190
Previous Report Date: 06/08/2017

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):		
Concrete Temp. (ºF):	82	
Slump (in.):	6	6-8
Air Content by Vol. (%):	2.0	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 6:18 am
Time Sampled: 7:30 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10065749 / 44161713
Yards Placed/ Total Yards: 10 cu. yds. / 10 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Paving Area "C", (See Attached Sketch)

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	06/08/17	7	6.00	28.274	123,380	Unbonded	4,360	4,360
B	06/29/17	28	6.00	28.274	177,470	Unbonded	6,280	
C	06/29/17	28	6.00	28.274	164,590	Unbonded	5,820	6,050
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Mamoudou Sylla

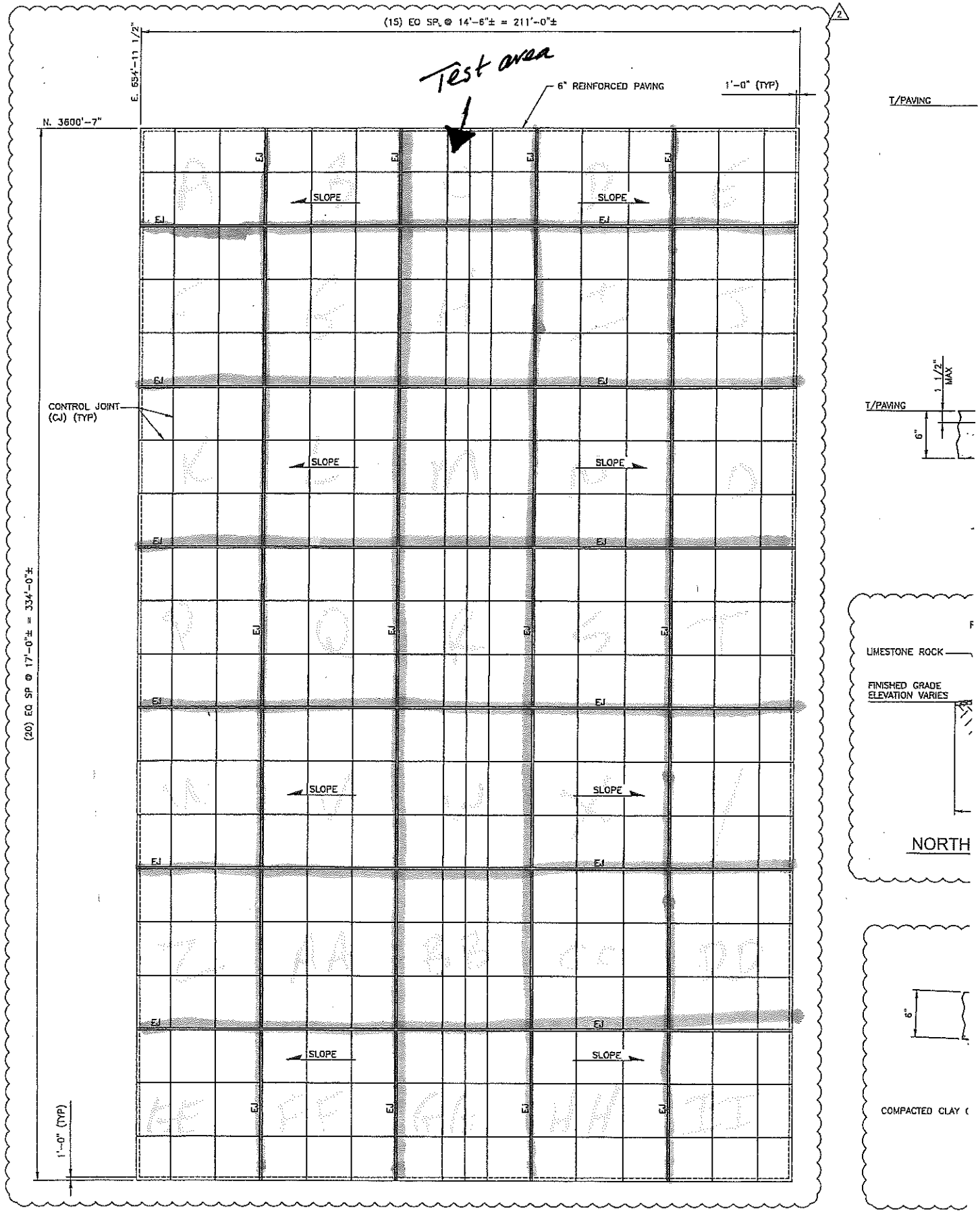
Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM



PAVING JOINT PLAN
1"=20'-0"

NO.	DATE	JOB	
0	05/15	00212	
1	09/15	00212	MODIFY EXPANS
2	01/17	00212	UPD

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

Project: Shell SET East/ West Basin Closure
Phase 1 - West Basin

Client: Shell Oil Company
5900 Highway 225
Deer Park, TX 77536

Contractor: Bo-Mac Contractors, LTD

Sample Date: 07/26/2017
Revised Report Date: 08/24/2017
Project No.: 04.12164967
Report No.: 0198
Previous Report Date: 08/02/2017

MEETS REFERENCE VALUE

Supplier: Cemex
Class/Design: 1595167

Specified Strength
4,000 psi @ 28 days

Properties of Plastic Concrete

	Field Measurements	Specification Requirements
Air Temp. (ºF):	96	
Concrete Temp. (ºF):	96*	90 Max
Slump (in.):	6½	6-8
Air Content by Vol. (%):	1.5	1-6
Unit Weight (pcf):		

Sampling Data

Time Batched: 9:49 am
Time Sampled: 11:05 am
Yards in Truck Sampled: 10 cu. yds.
Truck/ Ticket No: 10067951 / 44237413
Yards Placed/ Total Yards: 20 cu. yds. / 30 cu. yds.
Cylinders Molded: 4
Water Added: 0 Gal
Final Curing Method: Standard

Placement Location: Pavling (See Attached Sketch)

COMPRESSIVE STRENGTH RESULTS

Cylinder Number	Test Date	Age (days)	Diameter (in)	Area (sq. in.)	Maximum Load (lbs)	Type Cap	Compressive Strength (psi)	Average Strength (psi)
A	08/02/17	7	6.00	28.274	128,090	Unbonded	4,530	4,530
B	08/23/17	28	6.00	28.274	154,240	Unbonded	5,460	
C	08/23/17	28	6.00	28.274	152,930	Unbonded	5,410	5,430
D		HOLD						

Remarks: Onsite Curing Box Available: No
The test results shown above comply with the project specification requirements except those marked by an asterisk(*). The type of fracture is recorded and available upon request. The initial curing conditions will be recorded if specified procedures and equipment are provided by the contractor in the field. If the curing box is not available or not temperature controlled, the initial curing procedures may not be in accordance with ASTM C31. Informed Kevin Gore with Bo-Mac Contractors, LTD of field test results prior to leaving the jobsite.
CMT Form C-003ELM (Revised 5-24-12)

Test Method: ASTM C31, C143, C172, C173, C231, C1064, C39, C617 and /or C1231

Fugro Representative: Nathanial Barrow

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

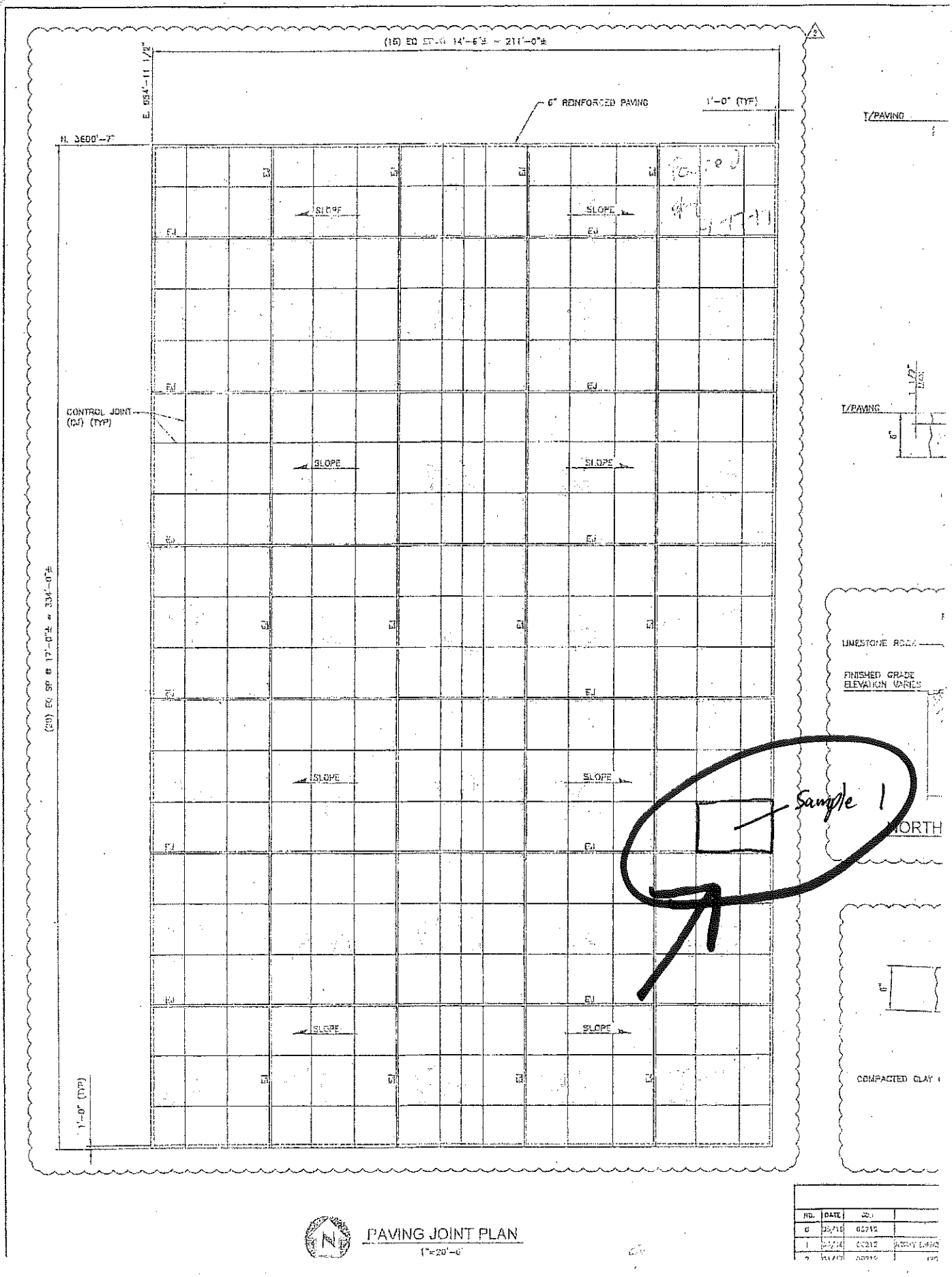
Scott A. Buchanan
CMET Project Manager

Construction Materials
Certificate No. 0023-02

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

REPORT CREATED BY ElmTree SYSTEM

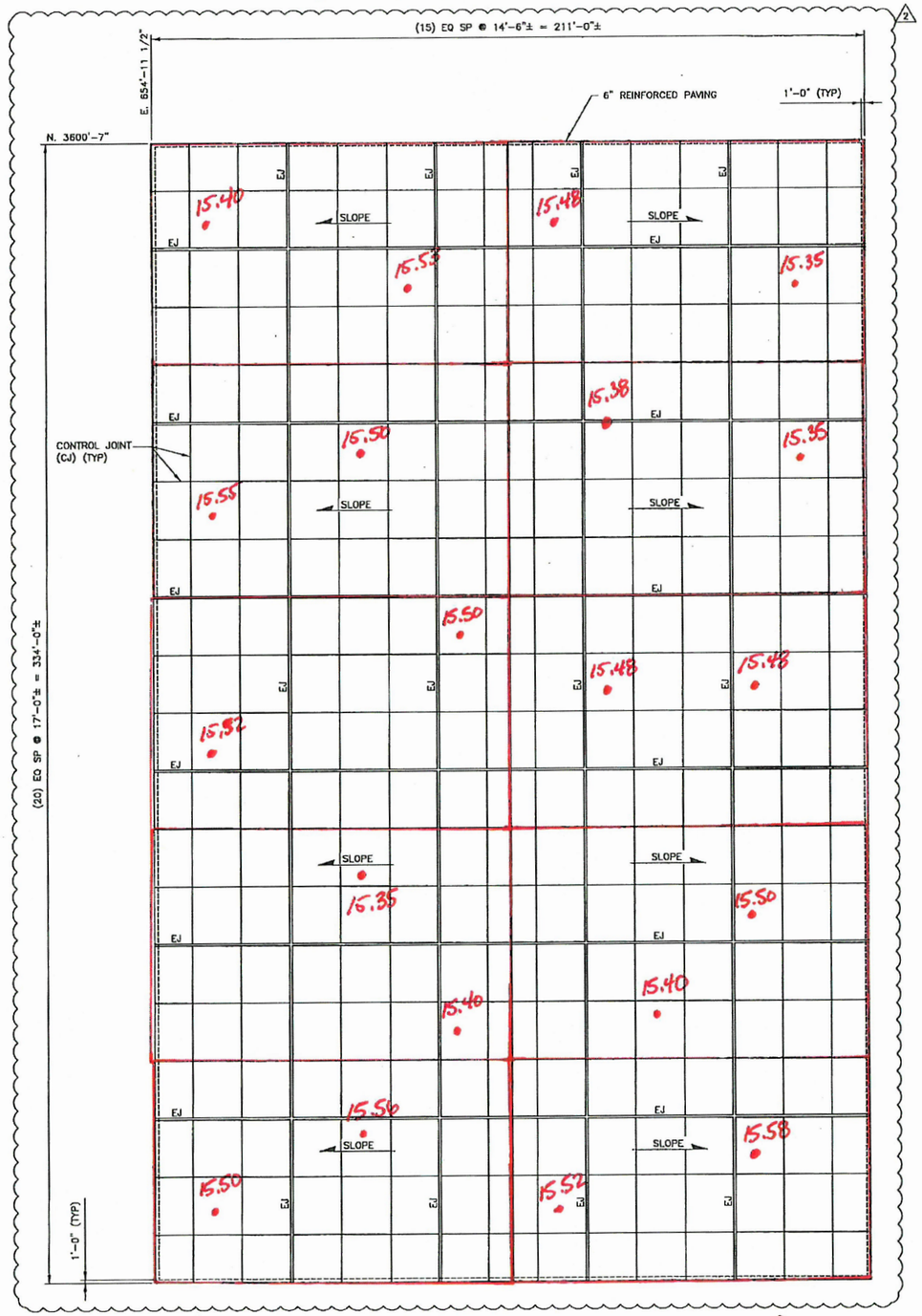
Project # 04.12164967
WO # 61223
Date 7-26-17



PAVING JOINT PLAN
1"=20'-0"

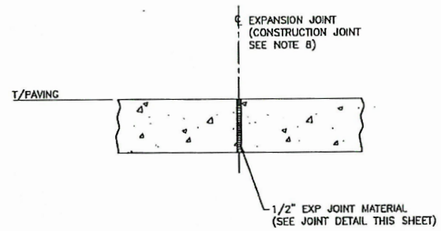
Appendix L – Top of Structural Backfill, Clay Cap, and Concrete Pavement Spot Elevation Figures

BO-MAC CONTRACTORS, LTD 2/15/17

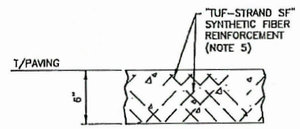


(TOP OF STRUCTURAL FILL SPOT ELEVATIONS)

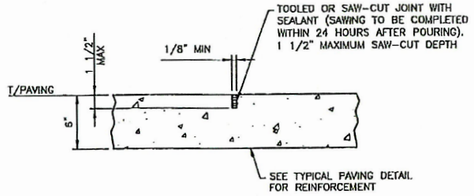
PAVING JOINT PLAN
1"=20'-0"



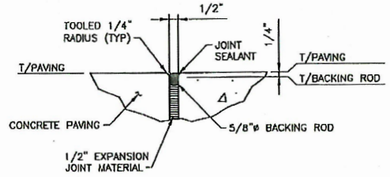
EXPANSION JOINT DETAIL
1 1/2"=1'-0"



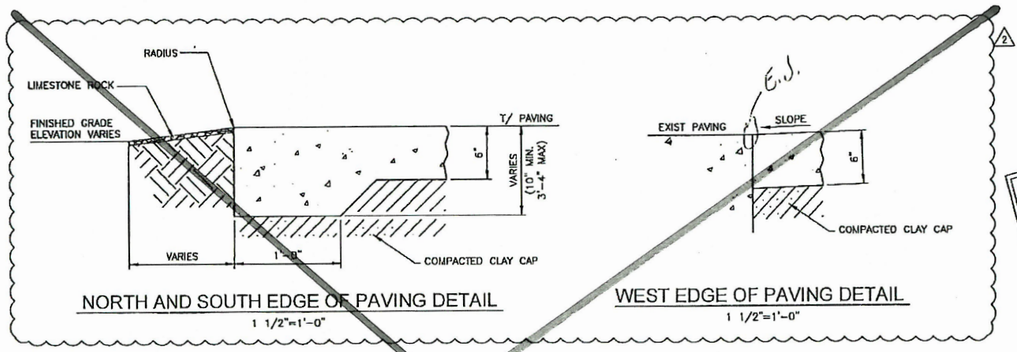
TYPICAL PAVING DETAIL
1 1/2"=1'-0"



CONTROL JOINT DETAIL
1 1/2"=1'-0"

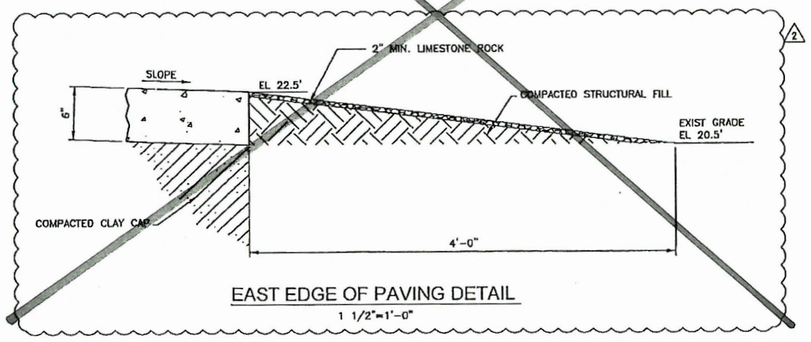


JOINT DETAIL @ EJ
3"=1'-0"



NORTH AND SOUTH EDGE OF PAVING DETAIL
1 1/2"=1'-0"

WEST EDGE OF PAVING DETAIL
1 1/2"=1'-0"



EAST EDGE OF PAVING DETAIL
1 1/2"=1'-0"

NOTES:

1. FOR FOR GENERAL NOTES & DRAWING INDEX, SEE DRAWING E-146761.
2. FOR CONCRETE NOTES, SEE SECTION "F" ON DRAWING E-146761.
3. LIMITS OF PAVING SHOWN ARE APPROXIMATE, AND SHOULD COINCIDE WITH THE REQUIREMENTS OF SECTION A-A OF DRAWING E-146762. MINIMUM PROJECTION OF PAVING AND COMPACTED CLAY CAP BEYOND THE PERIMETER OF THE EXISTING BASIN SHOULDER SHALL BE 3'-0".
4. NEW CONCRETE PAVING SHALL BE 6" MINIMUM THICKNESS. SEE ELEVATIONS AND SLOPES AS SHOWN ON PLAN AND SECTIONS OF THIS DRAWING AND E-146762.
5. PAVING REINFORCEMENT SHALL BE "TUF-STRAND SF" MACRO SYNTHETIC STRUCTURAL FIBERS, BY EUCLID CHEMICAL COMPANY, AT A DOSAGE RATE OF 5.8 POUNDS PER CUBIC YARD. FIBERS SHALL CONFORM TO ASTM C1116, "STANDARD SPECIFICATION FOR FIBER REINFORCED CONCRETE".
6. CONCRETE PAVING WILL BE PLACED OVER A MIN. 4 FEET THICK CLAY CAP. PENETRATIONS INTO THE CLAY CAP SHALL BE MINIMIZED. TEMPORARY PENETRATIONS FOR SURVEY MARKERS, FORM STAKES, ETC., INTO THE PROTECTIVE CLAY CAP, SHALL BE BACKFILLED WITH CEMENT BENTONITE GROUT.
7. CONTROL JOINT SPACING SHALL BE A MAXIMUM OF 17'-0" AND EQUALLY SPACED BETWEEN EXPANSION JOINTS, UNLESS NOTED OTHERWISE. CONTROL JOINTS IN CONCRETE PAVING SHALL BE SAW-CUT OR TOOLED, WITH SEALANT APPLIED AT JOINT SURFACE. FOR SAW-CUT JOINT, SAWING SHALL TAKE PLACE WITHIN 24 HOURS AFTER PLACING CONCRETE.
8. EXPANSION JOINT DETAIL SHALL BE USED AS CONSTRUCTION JOINTS, WHERE THE STARTING AND STOPPING OF CONCRETE PLACEMENT ACTIVITIES IS REQUIRED.
9. JOINT SEALANT FOR GENERAL PURPOSE USE SHALL BE THIOKOL 2235M TWO-PART POLYSULFIDE JOINT SEALANT AS MANUFACTURED BY THIOKOL, OR APPROVED EQUIVALENT.

LEGEND:

CJ — DENOTES CONTROL JOINT

EJ — EXPANSION JOINT

ISSUED FOR CONSTRUCTION
01/31/17

CDI Corporation
11200 RICHMOND AVE, SUITE 500
HOUSTON, TEXAS 77082
P: 713-280-2600, F: 713-280-2206
TEXAS ENGINEERING FIRM F-3045

CONSTRUCTION

STATE OF TEXAS — JOSHUA KERCH — 109487 — LICENSED PROFESSIONAL ENGINEER

DRAWING CODE: Y705-SET-EFLO

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
0	05/16	00212	ISSUED FOR CONSTRUCTION	JDB	DLH	.	.	.
1	09/16	00212	MODIFY EXPANSION JOINT DETAIL, CHANGE REINFORCEMENT TO SYNTHETIC FIBERS	JDB	DLH	.	.	.
2	01/17	00212	UPDATED PAVING SLOPE ARRANGEMENT AND ADDED DETAILS	JR	JK	RF	.	.

ACCOUNT NUMBER: 00212
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREON SHALL BE USED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISTRIBUTED, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. BY TAKING POSSESSION OF THIS DOCUMENT WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL – PLAN & ELEVATION
BACKFILL PLAN
WEST (A-1316C) SET BASIN CLOSURE

		DATE			DATE
DRAWN:	JDB	04/16	APPROVED:	.	.
CHECKED:	DLH	04/16	APPROVED:	.	.
APPROVED:			APPROVED:		

SCALE: AS NOTED
ISSUE DATE: 01/31/17
LOC: C
DWG. No. E-146763-2

June 3, 2024

Shell
SET Front Ends Project
Deer Park, TX
Worley Project No: 218004-00196

Subject: Acknowledgment of Design Requirements at the SET Front End West Basin

Mr. Javier Garza:

WORLEY has been engaged by Shell Deer Park to provide engineering services in connection with the SET Front End West Basin Project located in Deer Park, TX.

As part of the project, a new effluent treatment facility is proposed to be located at the existing SET Front End West Basin (West Basin) which was closed in 2017 in accordance with the Closure Certification Report accepted by the Texas Commission on Environmental Quality (TCEQ) on February 13, 2018. Worley will be performing detailed design for the foundations that will be placed in/on the existing West Basin. The purpose of this letter it to confirm that the foundations designed by Worley for the proposed new effluent treatment facility will comply with the recommendations of the SET Front Ends Upgrade Project Geotechnical Report dated February 22, 2022, follow on recommendations, and all required codes and applicable permit application requirements. Engineering design, calculations, design drawings, and specifications developed for the project will ensure that the integrity of the cap is maintained, and the bearing pressures of the foundations will not exceed allowable bearing pressures recommend by the geotechnical engineer in the SET Front Ends Upgrade Project Geotechnical Report. Additional site investigations may be obtained during the detailed design phase, as recommended by the geotechnical engineer, to confirm recommendations provided in the February 22, 2022, Geotechnical Report. These additional investigations will be performed, as necessary, to complete the final engineering design and for preparation of the design drawings and details.

Worley's Civil/Structural Engineering group understands that the stability of the existing West Basin shall not be compromised or damaged and is considered in the preliminary design as described in the plans (2025 *West SET Front Ends Upgrade Conceptual Modification Plan, West South Effluent Treater, June 2024* and related closure plans and the 2017 closure certification report) as they relate to the design and construction of the proposed effluent treatment facility.

In addition, the permeability requirements of the existing clay cap shall be maintained and the portions of the cap at the facility and foundations will be repaired or sealed with an equivalent or superior impermeable material during construction. The cap will be monitored during construction and any damages will be recorded and rectified to the design tolerances as recommended by the design engineers. The cap will be maintained to meet its original intended function, including permeability requirements post-construction and during operation of the facility, as described in the 2017 closure certification report.

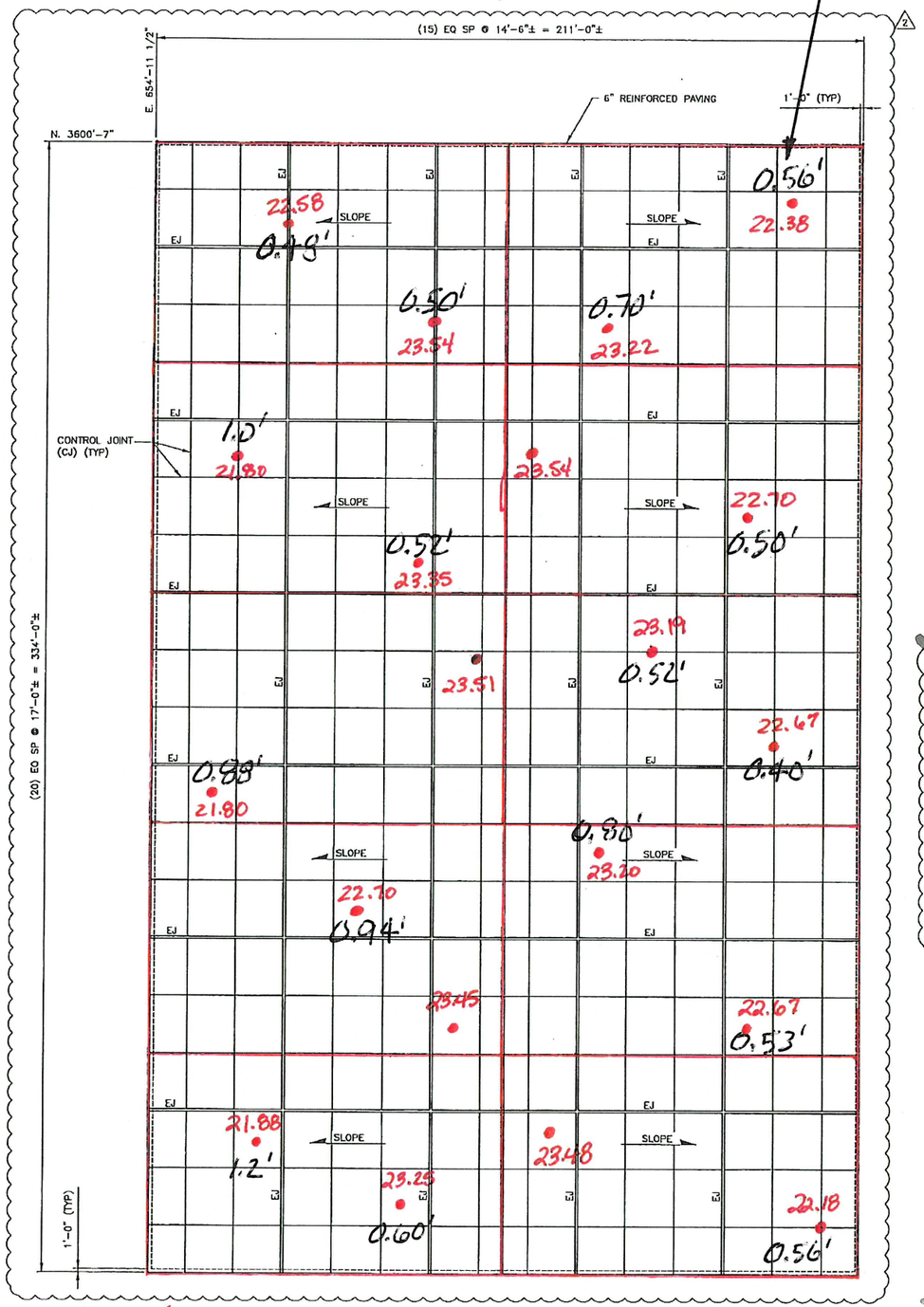
Respectfully,
Hay Chan



Hay Chan

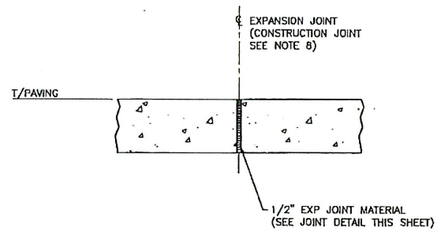
BO-MAC CONTRACTORS, LTD 5/3/17

RPS
Calculated Conc. Pavement Thickness (Typ.) 9/5/17

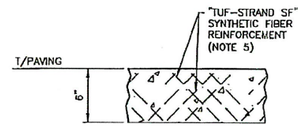


(TOP OF CLAY FILL SPOT ELEVATIONS)

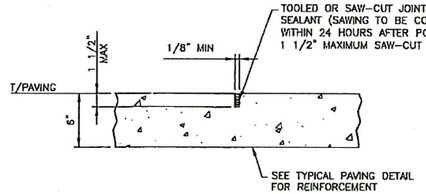
PAVING JOINT PLAN
1"=20'-0"



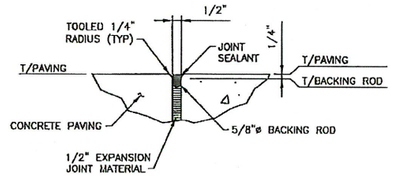
EXPANSION JOINT DETAIL
1 1/2"=1'-0"



TYPICAL PAVING DETAIL
1 1/2"=1'-0"



CONTROL JOINT DETAIL
1 1/2"=1'-0"



JOINT DETAIL @ EJ
3"=1'-0"

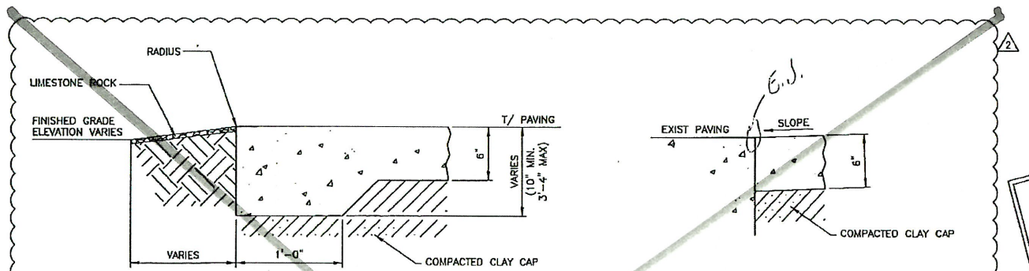
NOTES:

1. FOR FOR GENERAL NOTES & DRAWING INDEX, SEE DRAWING E-146761.
2. FOR CONCRETE NOTES, SEE SECTION "F" ON DRAWING E-146761.
3. LIMITS OF PAVING SHOWN ARE APPROXIMATE, AND SHOULD COINCIDE WITH THE REQUIREMENTS OF SECTION A-A OF DRAWING E-146762. MINIMUM PROJECTION OF PAVING AND COMPACTED CLAY CAP BEYOND THE PERIMETER OF THE EXISTING BASIN SHOULDER SHALL BE 3'-0".
4. NEW CONCRETE PAVING SHALL BE 6" MINIMUM THICKNESS. SEE ELEVATIONS AND SLOPES AS SHOWN ON PLAN AND SECTIONS OF THIS DRAWING AND E-146762.
5. PAVING REINFORCEMENT SHALL BE "TUF-STRAND SF" MACRO SYNTHETIC STRUCTURAL FIBERS, BY EUCUD CHEMICAL COMPANY, AT A DOSAGE RATE OF 5.8 POUNDS PER CUBIC YARD. FIBERS SHALL CONFORM TO ASTM C1116, "STANDARD SPECIFICATION FOR FIBER REINFORCED CONCRETE".
6. CONCRETE PAVING WILL BE PLACED OVER A MIN. 4 FEET THICK CLAY CAP. PENETRATIONS INTO THE CLAY CAP SHALL BE MINIMIZED. TEMPORARY PENETRATIONS FOR SURVEY MARKERS, FORM STAKES, ETC., INTO THE PROTECTIVE CLAY CAP, SHALL BE BACKFILLED WITH CEMENT BENTONITE GROUT.
7. CONTROL JOINT SPACING SHALL BE A MAXIMUM OF 17'-0" AND EQUALLY SPACED BETWEEN EXPANSION JOINTS, UNLESS NOTED OTHERWISE. CONTROL JOINTS IN CONCRETE PAVING SHALL BE SAW-CUT OR TOOLED, WITH SEALANT APPLIED AT JOINT SURFACE. FOR SAW-CUT JOINT, SAWING SHALL TAKE PLACE WITHIN 24 HOURS AFTER PLACING CONCRETE.
8. EXPANSION JOINT DETAIL SHALL BE USED AS CONSTRUCTION JOINTS, WHERE THE STARTING AND STOPPING OF CONCRETE PLACEMENT ACTIVITIES IS REQUIRED.
9. JOINT SEALANT FOR GENERAL PURPOSE USE SHALL BE THIOKOL 2235M TWO-PART POLYSULFIDE JOINT SEALANT AS MANUFACTURED BY THIOKOL, OR APPROVED EQUIVALENT.

LEGEND:

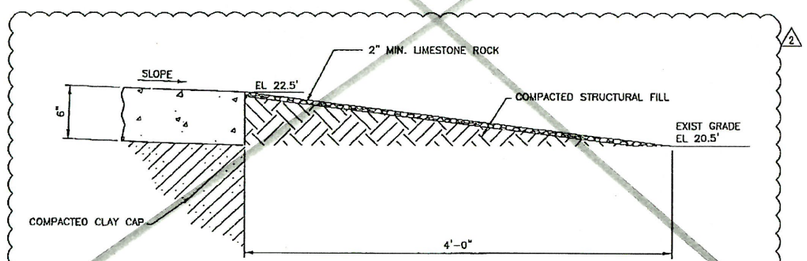
CJ — DENOTES CONTROL JOINT

EJ — EXPANSION JOINT



NORTH AND SOUTH EDGE OF PAVING DETAIL
1 1/2"=1'-0"

WEST EDGE OF PAVING DETAIL
1 1/2"=1'-0"



EAST EDGE OF PAVING DETAIL
1 1/2"=1'-0"

ISSUED FOR CONSTRUCTION
01/31/17

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
0	05/16	00212	ISSUED FOR CONSTRUCTION	JDB	DLH	.	.	.
1	09/16	00212	MODIFY EXPANSION JOINT DETAIL, CHANGE REINFORCEMENT TO SYNTHETIC FIBERS	JDB	DLH	.	.	.
2	01/17	00212	UPDATED PAVING SLOPE ARRANGEMENT AND ADDED DETAILS	JR	JK	RF	.	.

ACCOUNT NUMBER: 00212
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, NOR DISCLOSED TO OTHERS OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION

CDI Corporation
11200 RICHMOND AVE, SUITE 500
HOUSTON, TEXAS 77082
P: 713-280-2600, F: 713-280-2206
TEXAS ENGINEERING FIRM F-3045

CONSTRUCTION

STATE OF TEXAS -JOSHUA KERCH- -109487- LICENSED PROFESSIONAL ENGINEER

DRAWING CODE: Y705-SET-EFLO

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL – PLAN & ELEVATION
BACKFILL PLAN
WEST (A-1316C) SET BASIN CLOSURE

		DATE			DATE	SCALE: AS NOTED	ISSUE DATE: 01/31/17	LOC: C
DRAWN:	JDB	04/16	APPROVED:	.	.			
CHECKED:	DLH	04/16	APPROVED:	.	.	DWG. No. E-146763-2		

Fugro USA Land, Inc.
6100 Hillcroft St.
Houston, TX 77081
Phone (713) 369-5500, Fax (713) 369-5424

SAMPLE PICK UP REPORT

Project:	Shell SET East/ West Basin Closure Phase 1 - West Basin	**Sample Date:**	07/31/2017
		Report Date:	09/07/2017
Client:	Shell Oil Company 5900 Highway 225 Deer Park, TX 77536	**Project No.:**	04.12164967
		Report No.:	0199
Contractor:	Bo-Mac Contractors, LTD		

A Fugro representative arrived onsite to pick up 1 set of 4 concrete cylinders, cast on 26-JUL-2017. The specimens were transported to our laboratory for curing and/or testing.

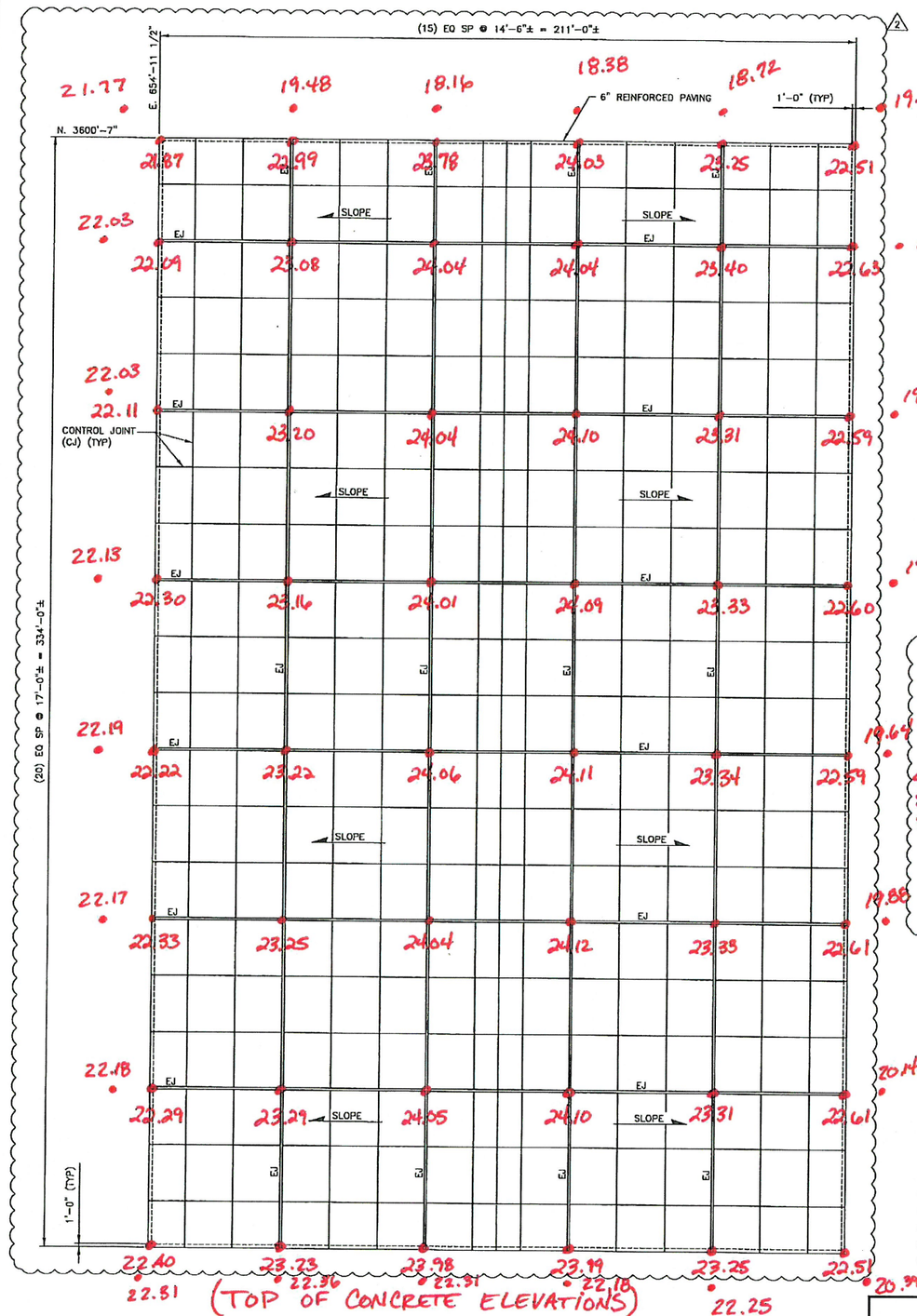
Fugro Representative: Mamoudou Sylla

Fugro USA Land, Inc.
TBPE Firm Registration No. F-299

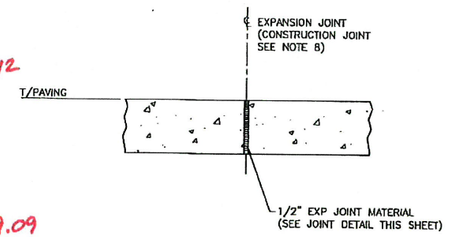
Scott A. Buchanan
CMET Project Manager

THE ABOVE TEST RESULTS APPLY ONLY TO THE ITEMS TESTED.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF FUGRO USA LAND, INC.

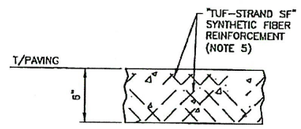
BO-MAC CONTRACTORS, LTD 8/21/17



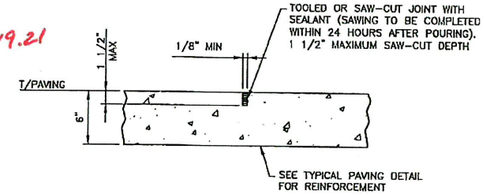
PAVING JOINT PLAN
1"=20'-0"



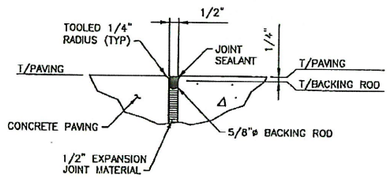
EXPANSION JOINT DETAIL
1 1/2"=1'-0"



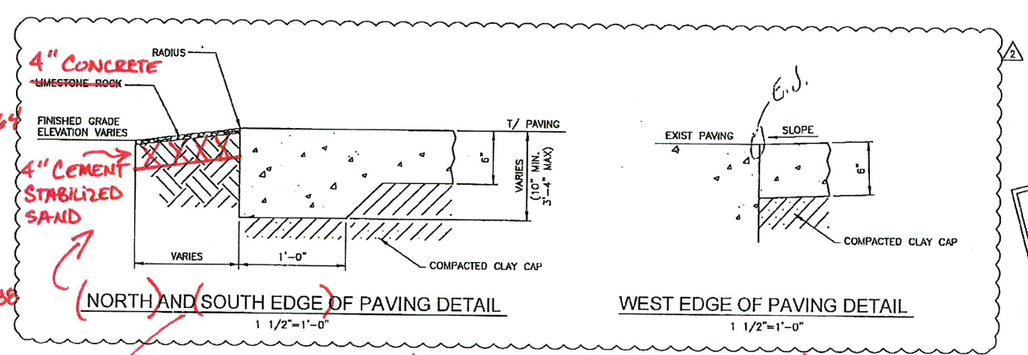
TYPICAL PAVING DETAIL
1 1/2"=1'-0"



CONTROL JOINT DETAIL
1 1/2"=1'-0"



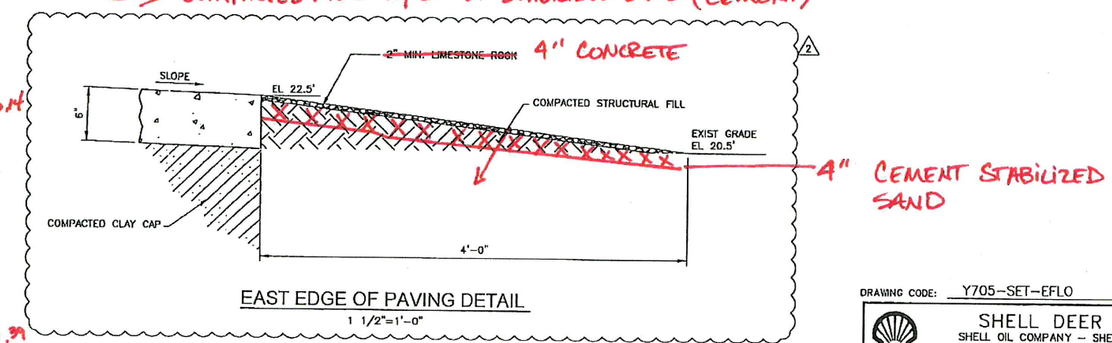
JOINT DETAIL @ EJ
3"=1'-0"



NORTH AND SOUTH EDGE OF PAVING DETAIL
1 1/2"=1'-0"

WEST EDGE OF PAVING DETAIL
1 1/2"=1'-0"

COMPACTED FILL W/ 2" OF STABILIZED SAND (CEMENT)



EAST EDGE OF PAVING DETAIL
1 1/2"=1'-0"

NOTES:

1. FOR FOR GENERAL NOTES & DRAWING INDEX, SEE DRAWING E-146761.
2. FOR CONCRETE NOTES, SEE SECTION "F" ON DRAWING E-146761.
3. LIMITS OF PAVING SHOWN ARE APPROXIMATE, AND SHOULD COINCIDE WITH THE REQUIREMENTS OF SECTION A-A OF DRAWING E-146762. MINIMUM PROJECTION OF PAVING AND COMPACTED CLAY CAP BEYOND THE PERIMETER OF THE EXISTING BASIN SHOULDER SHALL BE 3'-0".
4. NEW CONCRETE PAVING SHALL BE 6" MINIMUM THICKNESS. SEE ELEVATIONS AND SLOPES AS SHOWN ON PLAN AND SECTIONS OF THIS DRAWING AND E-146762.
5. PAVING REINFORCEMENT SHALL BE "TUF-STRAND SF" MACRO SYNTHETIC STRUCTURAL FIBERS, BY EUCLID CHEMICAL COMPANY, AT A DOSAGE RATE OF 5.8 POUNDS PER CUBIC YARD. FIBERS SHALL CONFORM TO ASTM C1116, "STANDARD SPECIFICATION FOR FIBER REINFORCED CONCRETE".
6. CONCRETE PAVING WILL BE PLACED OVER A MIN. 4 FEET THICK CLAY CAP. PENETRATIONS INTO THE CLAY CAP SHALL BE MINIMIZED. TEMPORARY PENETRATIONS FOR SURVEY MARKERS, FORM STAKES, ETC., INTO THE PROTECTIVE CLAY CAP, SHALL BE BACKFILLED WITH CEMENT BENTONITE GROUT.
7. CONTROL JOINT SPACING SHALL BE A MAXIMUM OF 17'-0" AND EQUALLY SPACED BETWEEN EXPANSION JOINTS, UNLESS NOTED OTHERWISE. CONTROL JOINTS IN CONCRETE PAVING SHALL BE SAW-CUT OR TOOLED, WITH SEALANT APPLIED AT JOINT SURFACE. FOR SAW-CUT JOINT, SAWING SHALL TAKE PLACE WITHIN 24 HOURS AFTER PLACING CONCRETE.
8. EXPANSION JOINT DETAIL SHALL BE USED AS CONSTRUCTION JOINTS, WHERE THE STARTING AND STOPPING OF CONCRETE PLACEMENT ACTIVITIES IS REQUIRED.
9. JOINT SEALANT FOR GENERAL PURPOSE USE SHALL BE ~~THIOKOL 2235M~~ TWO-PART POLYSULFIDE JOINT SEALANT AS MANUFACTURED BY THIOKOL, OR APPROVED EQUIVALENT.

SIKA 1A

LEGEND:

CJ — DENOTES CONTROL JOINT

EJ — EXPANSION JOINT

ISSUED FOR CONSTRUCTION 01/31/17

CDI Corporation
11200 RICHMOND AVE, SUITE 500
HOUSTON, TEXAS 77082
P: 713-280-2600, F: 713-280-2206
TEXAS ENGINEERING FIRM F-3045

CONSTRUCTION

STATE OF TEXAS -JOSHUA KERCH- -109487- LICENSED PROFESSIONAL ENGINEER

DRAWING CODE: Y705-SET-EFLO

REVISIONS								
NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
0	05/16	00212	ISSUED FOR CONSTRUCTION	JDB	DLH	.	.	.
1	09/16	00212	WOODY EXPANSION JOINT DETAIL, CHANGE REINFORCEMENT TO SYNTHETIC FIBERS	JDB	DLH	.	.	.
2	01/17	00212	UPDATED PAVING SLOPE ARRANGEMENT AND ADDED DETAILS	JR	JK	RF	.	.

ACCOUNT NUMBER: 00212
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED, WRITTEN, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, BY ACCEPTANCE OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL – PLAN & ELEVATION
BACKFILL PLAN
WEST (A-1316C) SET BASIN CLOSURE

		DATE			DATE	SCALE:	ISSUE DATE:	LOC:
DRAWN:	JDB	04/16	APPROVED:	.	.	AS NOTED	01/31/17	C
CHECKED:	DLH	04/16	APPROVED:	.	.			

DWG. No. E-146763-2

Appendix C
Certifications/Engineering Opinions

FUGRO
Fugro USA Land, Inc.
13501 Katy Freeway, Suite 1050
Houston, Texas 77079

Worley
13501 Bay Area Blvd
Pasadena, Texas 77507

March 18, 2024

Fugro Ref: 04.00203021 LT1

Subject: Shell SET Front Ends Project
Opinion as to the Permeability of the "Structural Fill"

Patrick Langley

During a Teams meeting on March 13, 2024, with representatives from Worley and Shell, Fugro was asked to offer an opinion as to the permeability of the structural fill (fill) used for basin backfill below the clay cap for the Shell SET Front Ends Project.

The fill was specified to be a sandy clay soil having a Liquid Limit (LL) no greater than 40, a Plasticity Index (PI) between 10 and 20, and be free of cinder, brick, asphalt and other deleterious materials. The fill was further specified to have clay clod sizes no larger than 3 inches at time of placement. The fill was to be placed in loose lifts of 8 inches or less and uniformly compacted to at least 98 percent maximum dry density at a moisture content of 1 percent dry to 3 percent wet of optimum as determined by ASTM D698 (Standard Proctor Test).

During construction, Fugro was retained to obtain and test potential fill materials from borrow pits, as identified by the contractor. During fill placement, Fugro was onsite to: 1) verify that acceptable material was used for fill and the fill was placed in accordance with specification, 2) perform insitu compaction tests of each lift of the compacted fill, and 3) obtain samples of the compacted fill for laboratory strength testing. Records indicate the fill met specified material properties and was placed in accordance with specifications.

Fugro searched its files for permeability tests results on compacted fill materials with similar engineering properties as that specified for the structural fill. That search identified permeability test results ranging between 1.1 x 10^{-7} cm/sec to 3.0 x 10^{-8} cm/sec. Fugro believes the structural fill, as placed, i.e., limited loose lift thickness and compacted to at least 98 percent standard Proctor, has a permeability no greater than 1 x 10^{-7} cm/sec, similar to that specified for the clay cap.

Regards,

Robert P. Ringholz, P.E.
Senior Consultant
713-369-5450 | [redacted]

Fugro USA Land, Inc.
Texas Engineering Firm F-299



Shell
Shell Set Front Ends
Deer Park, TX

April 19, 2024

SUBJECT: Helical Pile Design and Installation
Acknowledgment of Design Requirements

TorcSill Project No: GULF230077

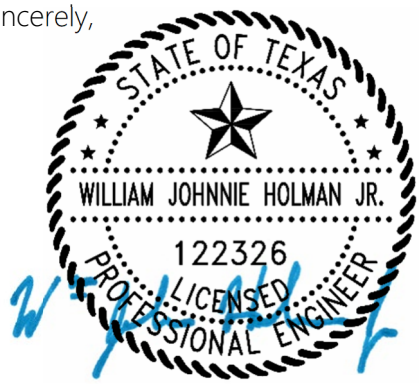
The purpose of this letter is to confirm that the helical piles specified for this project shall be designed in accordance with the information provided in Geotechnical Report 203021-REP1 Version 1 by Fugro dated February 2022. Only end bearing shall be considered in the calculation of axial capacity and shall correspond with the Ultimate axial curves provided in Plates 3 thru 7 (attached).

We understand the lateral loads placed on the helical piles are designed to minimize the lateral motion to prevent side pressures on the top clay and concrete liner of the closed basin. To ensure that water does not vertically make its way into the closed basin by following any annular voids on the edge of the piles, hydrated granular bentonite, followed by compacted clay will be utilized where the concrete and clay cap is penetrated. Lastly, a concrete cap that further restricts surface water from approaching the annular space around each pile will be installed. Please see the attached detail provided to TorcSill for further information.

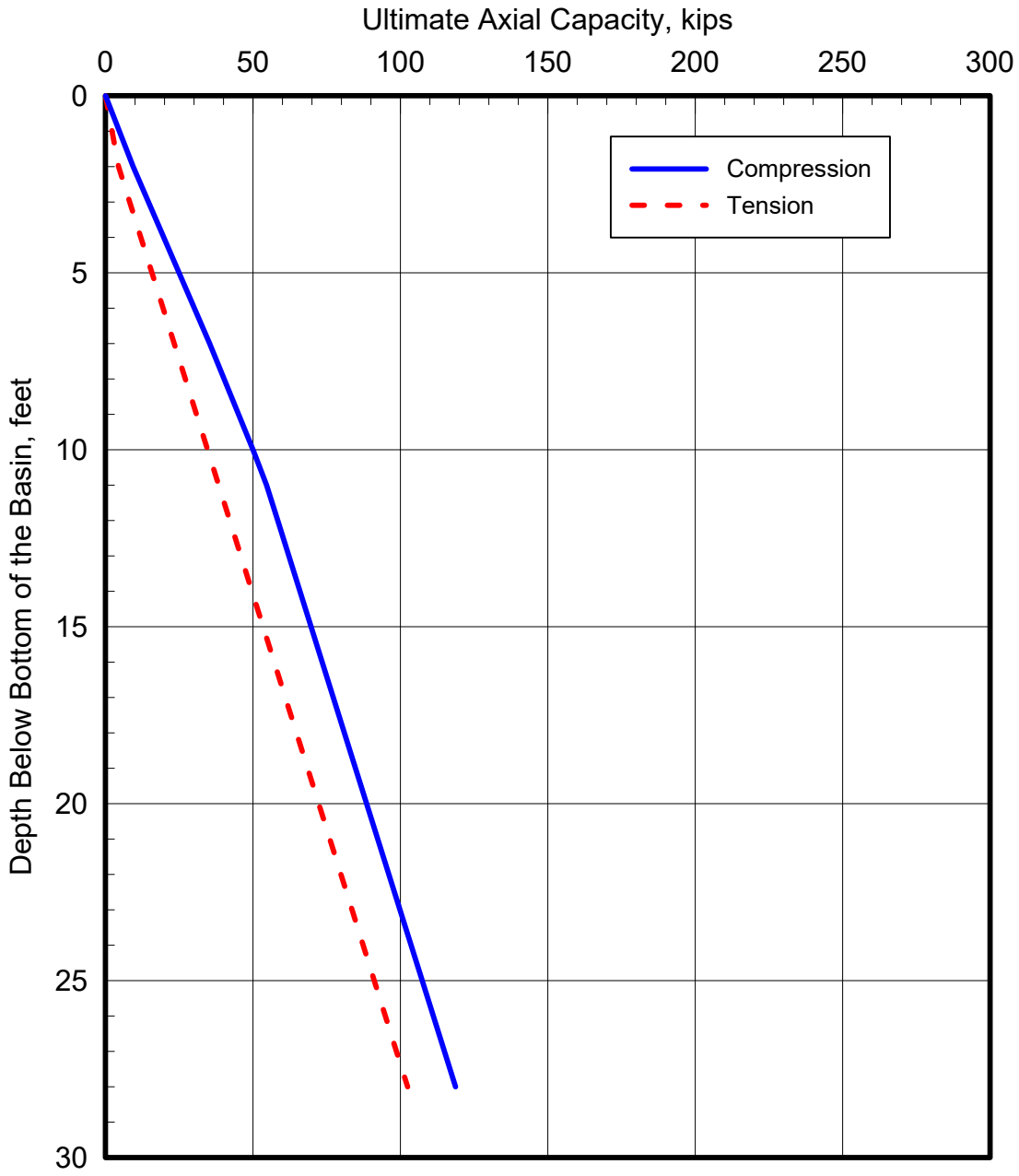
TorcSill's operations and design teams understand that helical piles shall not be permitted to penetrate the concrete bottom of the basin. Helical piles shall not be designed nor installed deeper than 15 ft (or 2 ft above the concrete liner) in the stabilized sludge.

Please do not hesitate to contact us if we can be of further assistance on this project.

Sincerely,



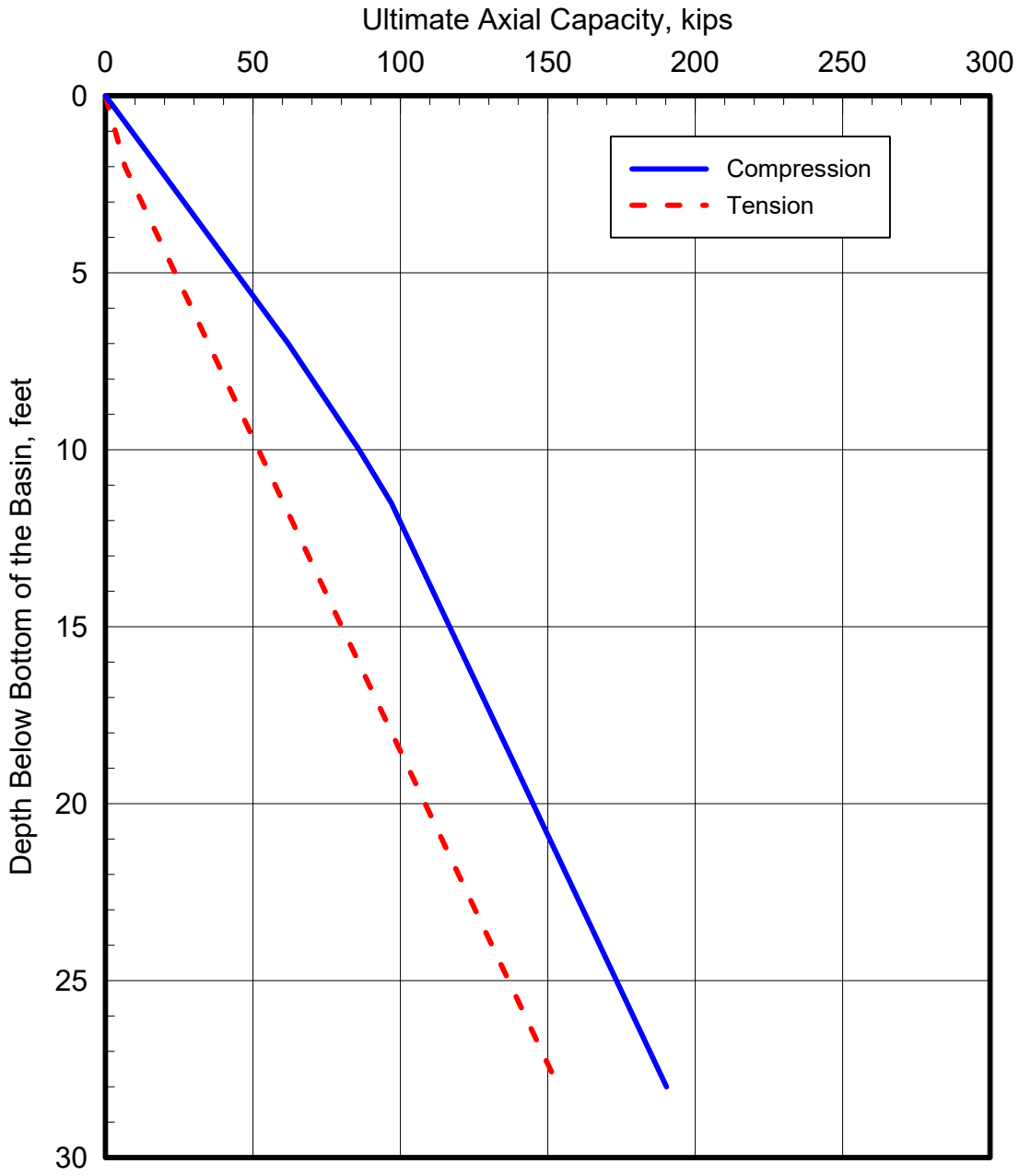
Wm. John Holman Jr., M.S., P.E.
Vice President of Engineering
TorcSill Foundations, LLC



Notes:

1. The bottom of the basin is assumed to be 18 feet below the existing ground surface.
2. The piles are assumed to be permanently cased through the closure material and axial capacity has been neglected in the closure material.
3. These curves represent the ultimate value for compression and tension. Factors of safety for compressive and tensile loading are discussed in the report.
4. The ultimate axial compressive capacity curve includes 50 percent of the end bearing capacity.
5. The capacity curves are for a single isolated pile. Group effects are discussed in the report.
6. See report for additional information when using this capacity curve.

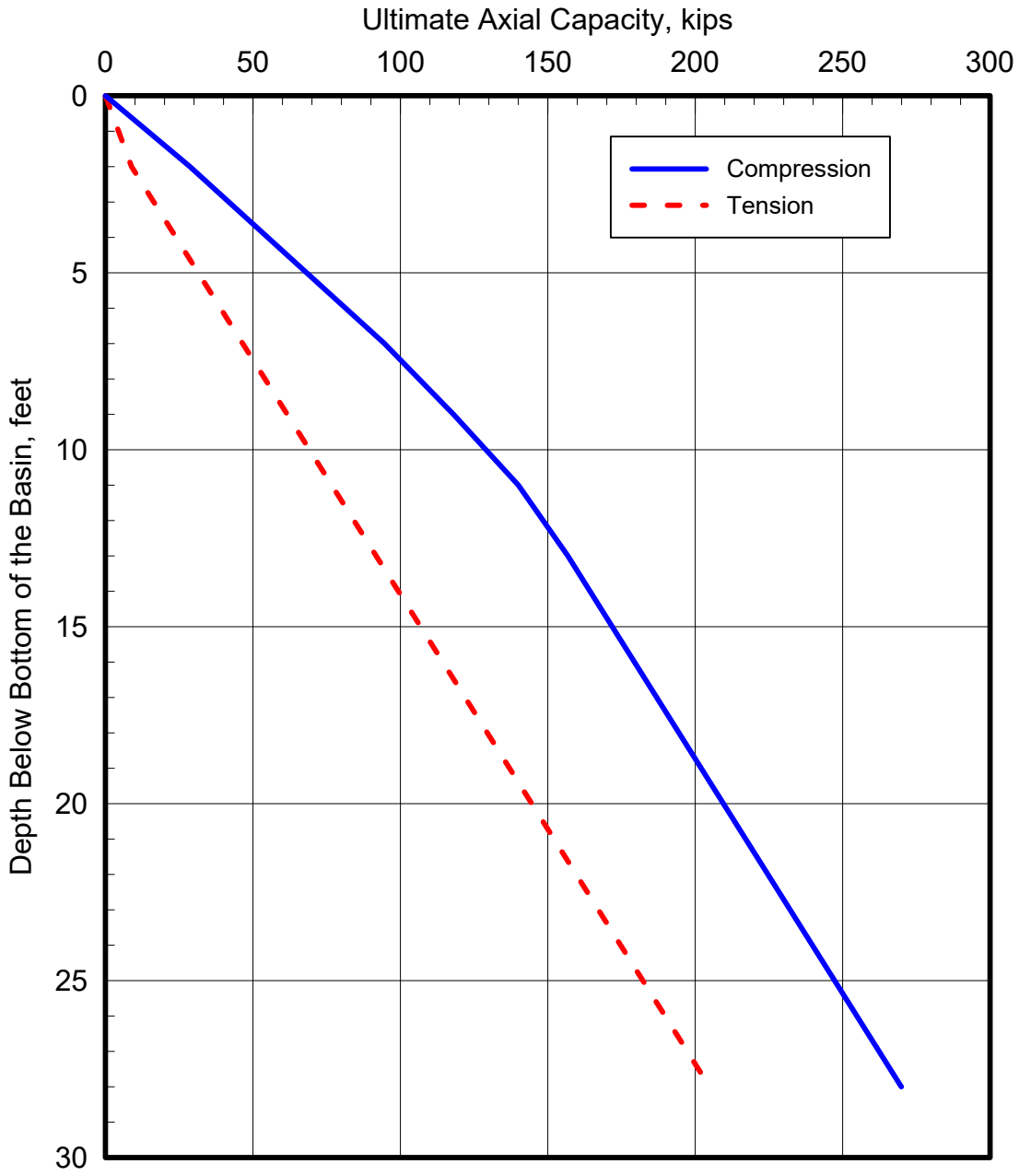
ULTIMATE AXIAL CAPACITY CURVES -- 12-INCH-DIAMETER DRILLED DISPLACEMENT PILE
SET FRONT ENDS UPGRADE PROJECT
SHELL DEER PARK CHEMICAL
DEER PARK, TEXAS



Notes:

1. The bottom of the basin is assumed to be 18 feet below the existing ground surface.
2. The piles are assumed to be permanently cased through the closure material and axial capacity has been neglected in the closure material.
3. These curves represent the ultimate value for compression and tension. Factors of safety for compressive and tensile loading are discussed in the report.
4. The ultimate axial compressive capacity curve includes 50 percent of the end bearing capacity.
5. The capacity curves are for a single isolated pile. Group effects are discussed in the report.
6. See report for additional information when using this capacity curve.

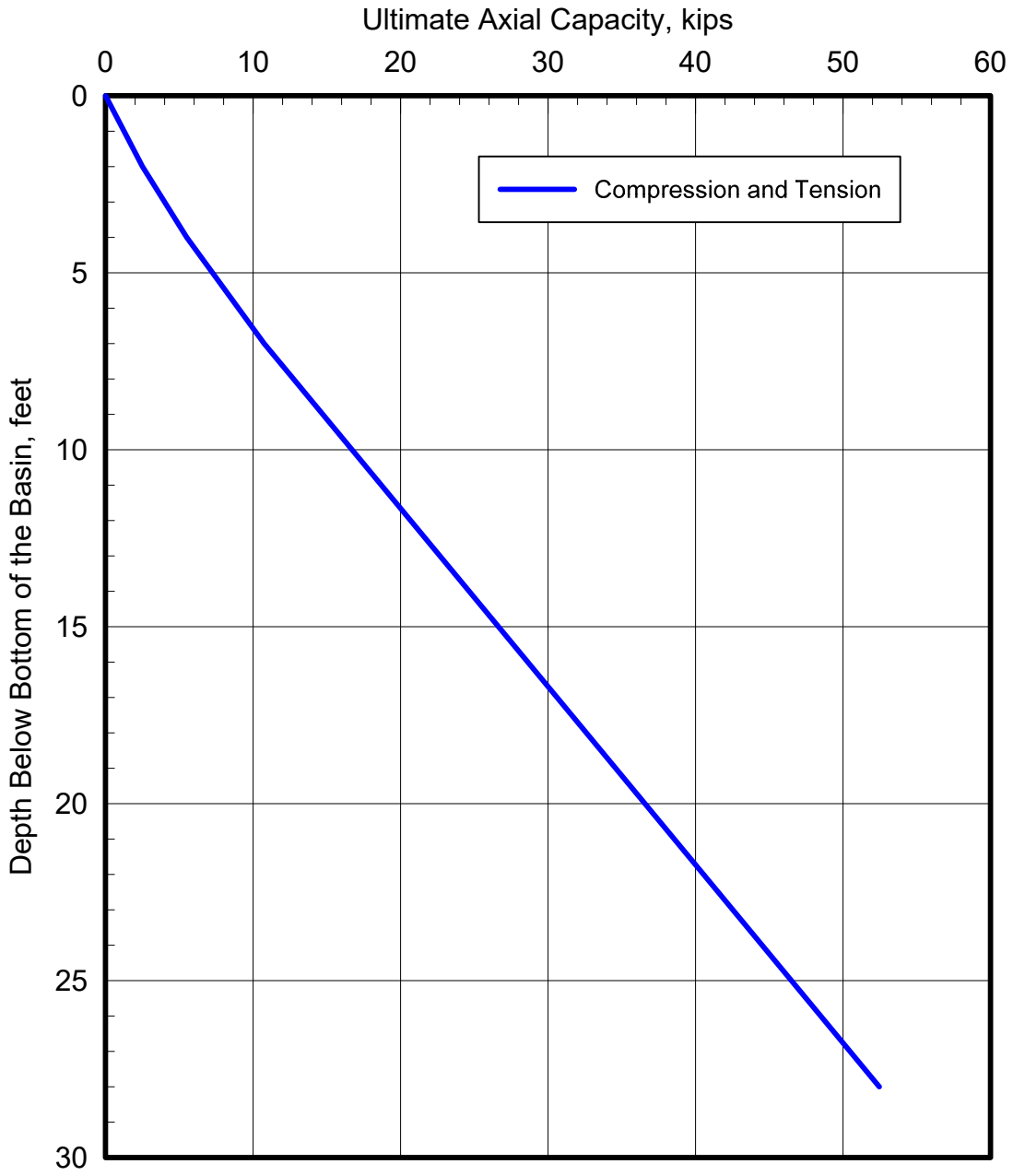
ULTIMATE AXIAL CAPACITY CURVES -- 18-INCH-DIAMETER DRILLED DISPLACEMENT PILE
SET FRONT ENDS UPGRADE PROJECT
SHELL DEER PARK CHEMICAL
DEER PARK, TEXAS



Notes:

1. The bottom of the basin is assumed to be 18 feet below the existing ground surface.
2. The piles are assumed to be permanently cased through the closure material and axial capacity has been neglected in the closure material.
3. These curves represent the ultimate value for compression and tension. Factors of safety for compressive and tensile loading are discussed in the report.
4. The ultimate axial compressive capacity curve includes 50 percent of the end bearing capacity.
5. The capacity curves are for a single isolated pile. Group effects are discussed in the report.
6. See report for additional information when using this capacity curve.

ULTIMATE AXIAL CAPACITY CURVES -- 24-INCH-DIAMETER DRILLED DISPLACEMENT PILE
SET FRONT ENDS UPGRADE PROJECT
SHELL DEER PARK CHEMICAL
DEER PARK, TEXAS



Notes:

1. The bottom of the basin is assumed to be 18 feet below the existing ground surface.
2. The piles are assumed to be permanently cased through the closure material and axial capacity has been neglected in the closure material.
3. This curve represents the ultimate value for compression and tension. Factors of safety for compressive and tensile loading are discussed in the report.
4. The capacity curve is for a single isolated pile. Group effects are discussed in the report.
5. See report for additional information when using this capacity curve.
6. To obtain the ultimate axial capacity for a different diameter pile, the curve should be scaled by a value of d/6, where d is the design diameter, in inches, of the micropile.

ULTIMATE AXIAL CAPACITY CURVES -- 6-INCH-DIAMETER MICROPILE
SET FRONT ENDS UPGRADE PROJECT
SHELL DEER PARK CHEMICAL
DEER PARK, TEXAS

PLATE 6

Recommended Soil Type and Model	Depth		Total Unit Weight,γ	Undrained Shear Strength, Su	Friction Angle, ϕ	Static Stiffness, k	ε 50
	(feet)		(pcf)	(psf)		(psi/in)	(in/in)
Stiff Clay w Free Water (Reese) (Clay Cap)	Top	0.0	126	1000	_	100	0.01
	Bot	4.0	126	1000	_	100	0.01
Stiff Clay w Free Water (Reese) (Structural Fill)	Top	4.0	133	1000	_	100	0.01
	Bot	12.0	133	1000	_	100	0.01
Stiff Clay w Free Water (Reese) (Stabilized Sludge)	Top	12.0	115	1800	_	500	0.007
	Bot	16.0	115	1800	_	500	0.007
Stiff Clay w Free Water (Reese) (Stabilized Sludge)	Top	16.0	110	300	_	30	0.02
	Bot	17.5	110	300	_	30	0.02
Concrete Liner	Top	17.5					
	Bot	18.0					
Stiff Clay w Free Water (Reese)	Top	18.0	125	700	_	100	0.01
	Bot	20.0	125	700	_	100	0.01
Stiff Clay w Free Water (Reese)	Top	20.0	128	1700	_	500	0.007
	Bot	25.0	128	1700	_	500	0.007
Stiff Clay w Free Water (Reese)	Top	25.0	128	2300	_	1000	0.005
	Bot	50.0	128	2300	_	1000	0.005

Notes

1. Depth is referenced from existing grade defined as the top of the clay cap, assumed to be about 4-foot-thick.
2. Soil type corresponds to LPILE soil layer models.
3. Groundwater level is assumed at the ground surface.
4. Static stiffness, "k", values for clay assume static loading conditions. We recommend decreasing static stiffness values, "k", in clay by at least 60 percent for cyclic loading conditions.

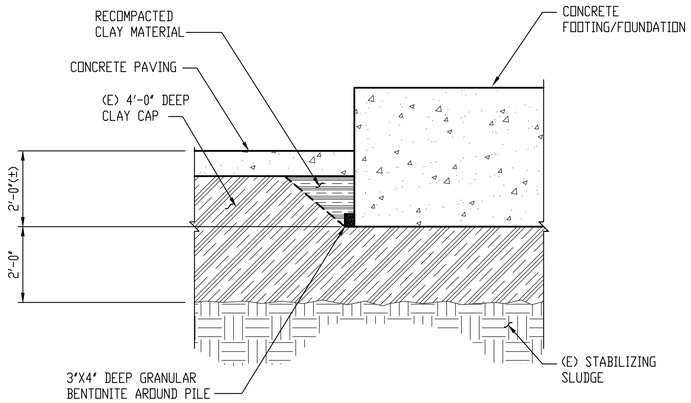
SOIL PARAMETERS FOR PILE LATERAL LOAD ANALYSES
SET FRONT ENDS UPGRADE PROJECT
SHELL DEER PARK CHEMICAL
DEER PARK, TEXAS

NOTES:

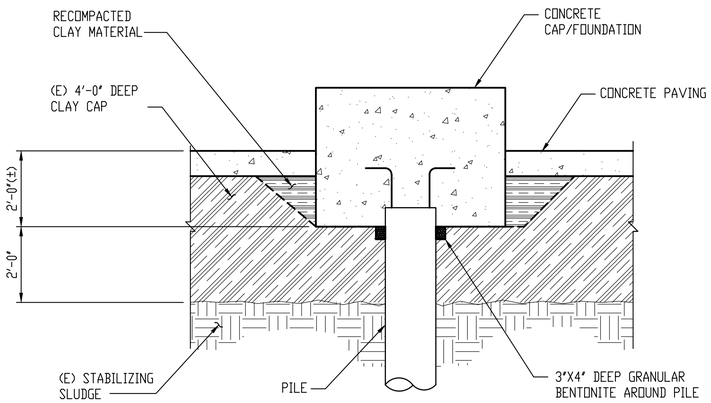
1. FOR NOTES AND REFERENCE DRAWINGS SEE DRAWING SDPMCP-00185-CS-DSK-0001.
2. (E) DENOTES EXISTING.

REFERENCE DRAWING:

SDPMCP-00185-CS-DSK-0001	FOUNDATION AND PILE LOCATION PLAN



TYPICAL FOUNDATION FILL DETAIL



TYPICAL PILE CAP FILL DETAIL

DRAWING CODE: Y705-SET-ETSS-BASINS

SHELL DEER PARK SITE
SHELL OIL COMPANY – SHELL CHEMICAL COMPANY
DEER PARK REFINING LIMITED PARTNERSHIP

CIVIL ENG DETAIL DRAWING
WEST BASIN PILE CAP FILL DETAIL – BASINS
ETSS NORTH AND SOUTH BASINS

		DATE		DATE	SCALE: 1/2"=1'-0"	ISSUE DATE: .	LOC: C
DRAWN:	RC	04/01/24	APPROVED: .	.			
CHECKED:	TR	04/05/24	APPROVED: .	.	DWG. No. E-		.
APPROVED:	PL	.	APPROVED: .	.			

WORLEY
STATE OF TEXAS
REGISTRATION NO. F-1480

JOB NO.: 153358

Worley
energy | chemicals | resources

REVISIONS

NO.	DATE	JOB	DESCRIPTION	MADE	CHK'D	APP'D	APP'D	APP'D
A	04/24	05700S	ISSUE FOR TECQ – PERMITTING	RC	TR	PL	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

ACCOUNT NUMBER: USMF/00185
FILM DATES:

NOTICE: THIS DOCUMENT IS THE PROPERTY OF SHELL OIL COMPANY. NEITHER THIS DOCUMENT NOR ANY DATA OR INFORMATION HEREIN SHALL BE COPIED OR REPRODUCED IN ANY MANNER, LOANED OR OTHERWISE DISPOSED OF, OR USED FOR ANY PURPOSE WHATSOEVER, WITHOUT THE PRIOR WRITTEN PERMISSION OF SHELL OIL COMPANY. IF THIS DOCUMENT IS LOANED BY OR WITH THE AUTHORITY OF SHELL OIL COMPANY, THE BORROWER, IN CONSIDERATION OF SUCH LOAN, AGREES TO THE FOREGOING CONDITIONS AND TO RETURN THIS DOCUMENT UPON REQUEST OR UPON COMPLETION OF THE SPECIFICALLY AUTHORIZED WORK FOR WHICH IT WAS ISSUED.

SDPMCP-00185-CS-DSK-0004

Appendix D
Clay Cap Construction Quality Control Plan

Note: This cap modification plan is conceptual and full design plans are in the process of being finalized. This Clay Cap Construction Quality Control document is extracted from the March 2016 Revised Closure Plan, East and West South Effluent Treater Basins

Appendix D

Clay Cap Construction Quality Control Plan

Low-Permeability Soil Cap Construction Quality Control Plan

Table of Contents

List of Sections

Section D1 Introduction D-1
D1.1 General D-1
D1.2 Cover System Components D-1
Section D2 Specified Testing Procedures D-3
Section D3 Low-Permeability Soil Cap Component Materials Requirements D-4
Section D4 Low-Permeability Cap Component Materials Pre-Construction Testing D-5
Section D5 Low-Permeability Soil Cap Construction D-6
Section D6 Construction QA/QC Testing and Observation D-8
D6.1 Quality Control/Quality Assurance Responsibilities D-8
D6.2 Construction Testing-Soil Liner Component Construction D-8
D6.3 Construction Monitoring D-9
Section D7 Surveying D-10
Section D8 Documentation Presentation D-11

Section D1
Introduction

D1.1 General

This Low-Permeability Soil Cap Construction Quality Control Plan has been prepared for the installation of the low-permeability soil cap component of the cover system for the East and West SET Basins at the Shell Deer Park facility. The Construction Quality Control Plan is intended to provide guidance during installation of the low-permeability soil cap component and identifies general construction procedures, and Quality Assurance/Quality Control (QA/QC) testing and documentation.

QA/QC testing will be the responsibility of the Quality Control Professional (QCP). The QCP will be an engineer or engineering geologist experienced in QA/QC testing. The QCP will directly supervise the QA/QC program. The QCP may be a representative of the owner, the contractor or a third party laboratory. Actual QA/QC testing and documentation may be performed by a qualified technician designated by the QCP.

Material requirements for installation of the low-permeability soil cap component are also specified in this plan. Material requirements, specific test requirements and testing frequencies presented in this Plan for the low-permeability soil cap component of the cover system were developed based on accepted industry practice and TCEQ and EPA guidance for hazardous waste landfill cover systems.

D1.2 Cover System Components

Soil cap options for the East and West Basins are a 4-foot thick low-permeability cap component consisting of compacted soil or an 18 inch (min.) thick low-permeability cap component consisting of compacted soil overlain by a 60-mil (min.) flexible membrane liner (FML-Clay composite) installed over the contoured fill. Source materials may include imported clayey soils or onsite soils and/or sediments that meet the soil reuse criteria specified in Appendix C of the SET Basin Closure Plan. The onsite materials may be amended to provide the required permeability for the cap component. The low permeability soil component will be constructed of soils with a minimum in-place hydraulic conductivity of 1×10^{-7} cm/s. For the West Basin, stabilized clay will be used in order to provide the necessary bearing strength for the basin's intended use. A protective cover will be placed over the low-permeability cap. For the East Basin, the surficial layer of the protective cover will be either 8 inches (min.) of base

material consisting of very low fines crushed limestone rock or 6 inches (min.) of reinforced concrete pavement. Based on the type of cap used, the below additional layer(s), from the bottom up, will be installed under the surficial protective cover layer to enhance the long term functionality of the cover system:

- Four Feet of Clay with Base Material: 8 mil (min.) moisture barrier, nonwoven geotextile fabric cushion, and structural geogrid;
- Four Feet of Clay with Concrete Pavement: 18 inches of sandy clay or lime stabilized clay;
- FML-Clay Composite with Base Material: nonwoven geotextile fabric cushion and structural geogrid;
- FML-Clay Composite with Concrete Paving: 12 inches (min.) sandy clay or lime stabilized clay.

For the West Basin, the surficial layer of the protective cover will be 6 inches (min.) of reinforced concrete pavement. Based on the type of cap used, the below additional layer(s), from the bottom up, will be installed under the surficial protective cover layer to enhance the long term functionality of the cover system:

- Four Feet of Stabilized Clay: No additional layer required;
- FML-Stabilized Clay Composite: 12 inches (min.) sandy clay or lime stabilized clay.

Section D2
Specified Testing Procedures

The following tests will be performed in accordance with the designated testing standard when specified for the low-permeability soil cap component of the cover system:

Specified Test	Test Standard
Coefficient of Permeability	ASTM D5084 flexible wall parameter method; or Corps of Engineers EM 1110-2-1906, App VII falling head method
Sieve Analysis (percent passing the on-inch, No. 40 and No. 200 sieves)	ASTM D422 (percent passing the on-inch and No. 40 sieves); and ASTM D1140 (percent passing the NO. 200 sieve)
Atterberg Limits (PI and LL)	ASTM D4318
Standard Proctor Moisture-Density Relationship	ASTM D698
Moisture Content (Laboratory)	ASTM D2216
In-Place Density	ASTM D2922 (nuclear gauge); or ASTM D2937 (drive cylinder); or ASTM D2937 (sand cone)
In-Place Moisture Content	ASTM D3017 (nuclear gauge); or ASTM D2216 (oven); ASTM D4643 (microwave); or ASTM D4959 (direct heating)

Section D3
Low-Permeability Soil Cap Component Materials Requirements

The following table presents the materials requirements for the cap component of the cover system when unamended clay soil is used to construct the clap.

Test Parameters	Value
Plasticity Index	15, Minimum
Liquid Limit	30, Minimum
Percent Passing the No. 200 Sieve	30% Minimum
Percent Passing the one-inch sieve	100% Minimum
In-Place Hydraulic Conductivity	1×10^{-7} cm/s, Minimum
In-Place Density	95% of Standard Proctor Density, Minimum
In-Place Moisture Content	0% to 5% over the Standard Proctor Optimum Moisture Content

The following table presents the materials requirements for the cap component of the cover system when amended soil is used to construct the clap.

Test Parameters	Value
In-Place Hydraulic Conductivity	1×10^{-7} cm/s, Minimum
In-Place Density	95% of Standard Proctor Density, Minimum
In-Place Moisture Content	0% to 5% over the Standard Proctor Optimum Moisture Content

Soil amendments that may be added to onsite soils/sediments for stabilization and to decrease the permeability of the soils include, but are not limited to Portland cement, cement kiln dust, and fly ash.

Section D4
Low-Permeability Cap Component Materials Pre-Construction Testing

Preconstruction testing will be performed to check that soil materials planned for use in the low-permeability soil cap meet the materials properties requirements specified in Section D3. The following table presents the minimum preconstruction frequencies when unamended clay soil is used to construct the clap.

Required Tests	Testing Frequency
Atterberg Limits; Sieve Analysis (percent passing 1 ½-inch, No. 40 and No. 200 Sieve); Moisture Content (laboratory); Standard Proctor; Permeability (soil remolded to 95% of its Standard Proctor Density at 0% to 5% above its optimum moisture content)	1 per each soil type or significant change in soil; or 1 per change in borrow source

The following table presents the minimum preconstruction frequencies when amended soil is used to construct the clap.

Required Tests	Testing Frequency
Moisture Content (laboratory); Standard Proctor; Permeability (soil remolded to 95% of its Standard Proctor Density at 0% to 5% above its optimum moisture content)	1 per each soil type or significant change in soil; or 1 per change in borrow source

Section D5
Low-Permeability Soil Cap Construction

Prior to beginning construction of the low-permeability soil cap component of the cover system, preconstruction testing as specified in Section D4 will be performed to identify materials which meet project requirements. Also, the subgrade to receive the low-permeability soil cap will be properly graded and smoothed. Areas of the subgrade containing soft or otherwise unstable soils will typically be repaired by undercutting and backfilling to grade with compacted soil. After proper grades have been established, the subgrade will be surveyed so the thickness of the low-permeability soil cap component may be confirmed after construction.

Prior to placement, the soils may require processing to breakup any large clods and to adjust the moisture content. The soil may be processed in a staging area or it may be placed as a loose 6 to 8-inch thick lift and processed in place prior to compaction. For moisture adjustments, water should be spread evenly on the surface of the soil and then be thoroughly mixed and evenly distributed throughout the lift by disking, tilling or other satisfactory means. If water adjustments are not needed, disking or tilling may still be required to breakup large clods. If amended soils are being used to construct the cap, the soil amendment should incorporated into the soil matrix using similar methods as described above for adding water.

After processing, approximate 6 to 8-inch thick loose lifts should be compacted with a large sheeps-foot or tamp-foot roller with prongs long enough to totally penetrate the thickness of the lift. The roller will make sufficient passes to produce a relatively homogenous blend of the low-permeability soil cap materials. It is recommended that the compaction equipment produce at least 1500 pounds of force along each linear foot of its drum length and make a sufficient number of passes (a minimum of six) to produce the desired blending effect. Roller weights may be varied provided that the soil fill is satisfactorily blended during compaction.

The lift will be compacted to specifications and tested to check that proper compaction has been achieved prior to placement of the overlying lift. Any areas which fail to meet the compaction criteria will be reworked and retested. Also, the surface of each lift will be scarified one to two inches deep so that it bonds to each subsequent lift. The finished surface of the low-permeability soil cap component will be surveyed to check its thickness prior to placing overlying components.

The surface of the low-permeability soil cap will be covered as soon as possible after completion to prevent desiccation. Areas where the low-permeability soil cap has been exposed for extended periods will be inspected for desiccation cracks. If significant cracks are present, the surface of the low-permeability soil cap will be wetted and reworked to close the cracks before overlying components are placed.

Section D6
Construction QA/QC Testing and Observation

D6.1 Quality Control/Quality Assurance Responsibilities

Construction quality control of the low-permeability soil cap will be the responsibility of the Contractor. The Contractor's quality control efforts to meet project specifications shall include:

- Checks that the subgrade has been properly prepared;
- Checks that only soil from approved borrow sources are used and to provide modification to the Construction Quality Control Plan prior to switching borrow sources;
- Check of loose lift thickness;
- Checks that a consistent application of water is used, if necessary, to provide a uniform moisture content throughout the lifts; and
- Checks for consistent operation of the compactor to achieve uniform density throughout the lift.

The QCP will be responsible for quality assurance testing, and construction monitoring and documentation of the low-permeability soil cap quality assurance procedures. Further, the QCP will record the lift and location of all in-place density tests and be responsible for developing plan layouts of the low-permeability soil cap showing the test locations for each six-inch thickness of constructed liner. After soil liner installation is completed, the test results will be included in the final certification report for the closure project.

D6.2 Construction Testing-Soil Liner Component Construction

During construction of the low-permeability soil cap component, the QCP will test the in-place density and moisture content of compacted lifts. Density will be measured using the nuclear density gauge, drive cylinder or sand cone methods. Moisture content may be determined in the field using either the nuclear gauge, oven, direct-heating or microwave methods. Confirmatory laboratory moisture content determinations will also be performed periodically to check for any systematic errors in the field moisture content determinations.

Any testing area which does not meet the project specifications will require reworking and retesting until a passing condition is achieved. The QCP will document all test locations, elevations or lift numbers, test dates, and test results. Voids resulting from density testing or undisturbed sampling will be filled with bentonite or a bentonite and soil mixture by the QCP.

The minimum testing frequencies for the low-permeability soil cap component are listed below.

Test	Frequency
In-place density	Minimum of 1 test per 5,000 ft^2 per 6 inches of depth (but no less than 5 tests per each 6-inch lift)
In-place moisture content	1 per density test
Standard Proctor moisture-density relationship	1 per every significant change in soil or change in borrow (these tests may be considered pre-construction tests)
Percent passing No. 200 sieve	Minimum 1 per each 20 field densities, or major fraction thereof
Atterberg Limits	Minimum 1 per each 20 field densities, or major fraction thereof
Laboratory moisture content	Minimum 1 per each 5 field densities, or major fraction thereof

D6.3 Construction Monitoring

The QCP will periodically monitor low-permeability soil cap component construction to check that proper materials and techniques are utilized. Each construction day the QCP is on-site, the QCP will observe and document at a minimum:

- Work area and elevation or lift;
- Soil material source;
- Loose lift thickness;
- Maximum particle size;
- Lift placement technique;
- Moisture adjustment technique;
- Compaction equipment type; and
- Verification that nuclear gauge test probe, drive cylinder, sand cone, and thin wall tube sampler voids are backfilled with bentonite or a bentonite and soil mixture.

Any observations by the QCP that indicate the soil component construction is not meeting the project specifications shall immediately be brought to the attention of the Contractor Superintendent. Any discrepancy which is not corrected shall be brought to the attention of Shell Oil.

Section D7
Surveying

The Contractor is responsible that components of the final cover system are constructed to the specified thicknesses and grades. The low-permeability soil cap subgrade, top of the low-permeability soil cap, and top of the cover protective layer will be surveyed at the minimum frequency of one point per 5,000 square feet (e.g., 70 feet by 70 feet grid). Based on the survey data, the QCP will verify the low-permeability soil cap has a minimum thickness of four feet.

The QCP will also determine that each soil-based protective cover layer installed as part of a final cover system has the minimum thickness specified in the closure plan.

Section D8
Documentation Presentation

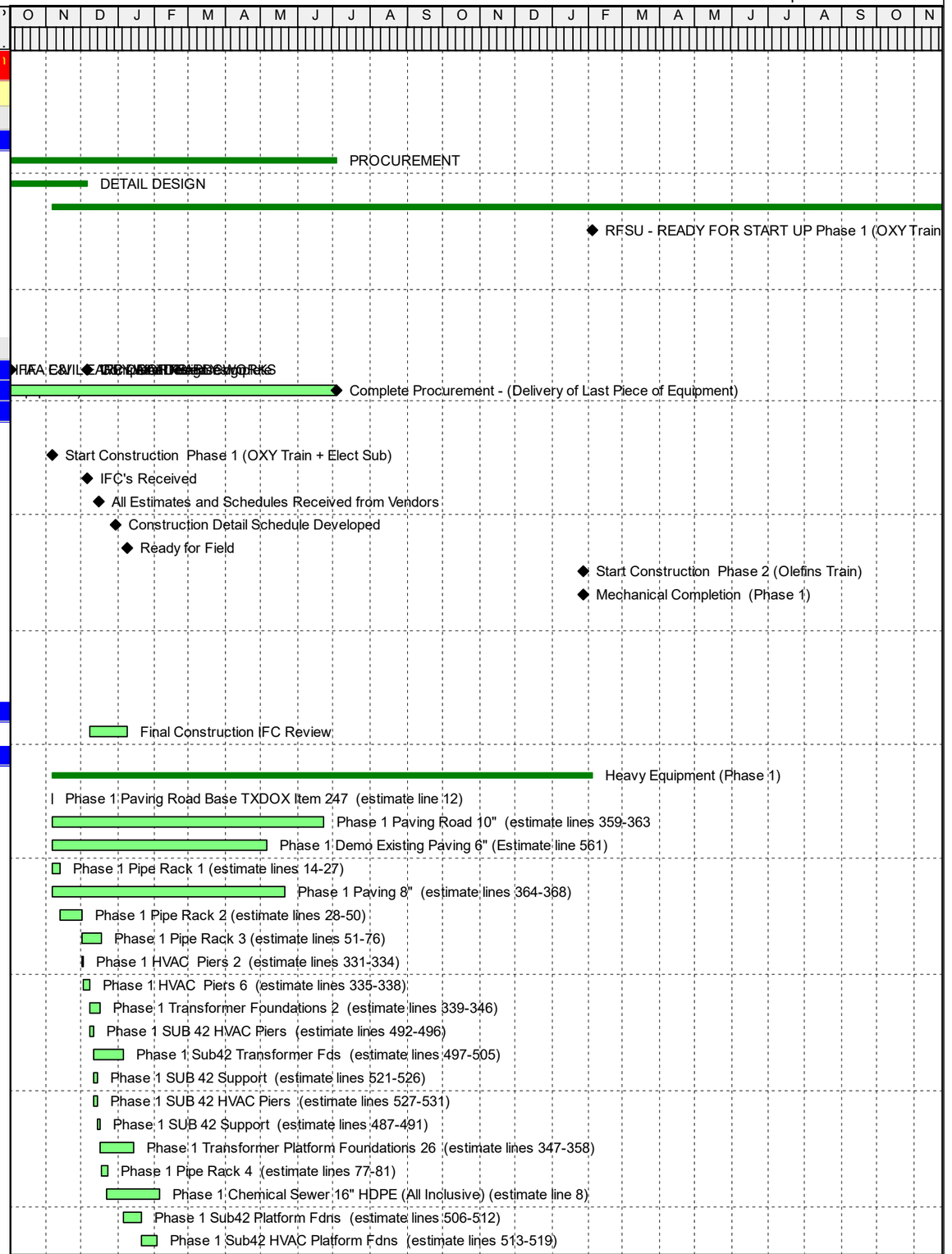
After the project is completed, summaries of the QA/QC test results will be included in the formal closure certification report for submittal to the TCEQ. The report will contain preconstruction test data, construction test data, survey data, the results of tests performed for or by the QCP, and other data considered pertinent to the construction quality assurance effort.

Appendix E
Preliminary Construction Schedule

Monthly Schedule Update Pre Reads

24-Apr-2024 **:Run Date**

Activity ID	Activity Name	Budgeted Labor Units	Original Duration	Duration % Complete	Start	Finish
Garza, Javier		363282.98	12778.00	0%	21-Nov-2024	06-Apr-2029
00185 Set Front End Upgrade		363282.98	12778.00	0%	21-Nov-2024	06-Apr-2029
Project Milestones		399.23	11326.88	0%	24-Feb-2025	09-Jan-2029
Project Milestones		399.23	11326.88	0%	24-Feb-2025	09-Jan-2029
A1260	PROCUREMENT	0.00	11856.00	0%	24-Feb-2025	03-Jul-2026
MM.0350.DD	DETAIL DESIGN	355.23	1590.88	0%	24-Feb-2025	05-Dec-2025
MM.0370.CN	CONSTRUCTION	0.00	5835.00	0%	06-Nov-2025	20-Sep-2028
A3940	RFSU - READY FOR START UP Phase 1 (OXY Train + E	0.00	0.00	0%		03-Feb-2027
A4060	RFSU - READY FOR START UP Phase 2 (Olefins Train)	0.00	0.00	0%		05-Jan-2028
A1320	Commisioning	44.00	100.00	0%	29-Aug-2028	15-Sep-2028
A1010	RFSU - READY FOR START UP Phase 3 (Primary Train)	0.00	0.00	0%		15-Sep-2028
A1340	CLOSING	0.00	632.00	0%	18-Sep-2028	09-Jan-2029
Project Execution		362883.75	12776.00	0%	21-Nov-2024	05-Apr-2029
Detail Design - Project Management		0.00	1590.88	0%	24-Feb-2025	05-Dec-2025
Procurement		0.00	2752.00	0%	24-Feb-2025	03-Jul-2026
Construction - Summary & Milestones		0.00	11200.00	0%	21-Nov-2024	20-Sep-2028
A1370	Survey and Probing (Construction Schedule Starts)	0.00	0.00	0%	21-Nov-2024	
PH1.STCONST.10	Start Construction Phase 1 (OXY Train + Elect Sub)	0.00	0.00	0%	06-Nov-2025	
CON.SM.0221	IFC's Received	0.00	0.00	0%		05-Dec-2025
CON.SM.0222	All Estimates and Schedules Received from Vendors	0.00	0.00	0%		16-Dec-2025
CON.SM.0223	Construction Detail Schedule Developed	0.00	0.00	0%		30-Dec-2025
CON.SM.0224	Ready for Field	0.00	0.00	0%		08-Jan-2026
PH2.STCONST.10	Start Construction Phase 2 (Olefins Train)	0.00	0.00	0%	27-Jan-202	
PH1.COMCONST.	Mechanical Completion (Phase 1)	0.00	0.00	0%		27-Jan-2027
PH3.STCONST.10	Start Construction Phase 3 (Primary Train)	0.00	0.00	0%	29-Dec-202	
PH2.COMCONST.	Mechanical Completion (Phase 2)	0.00	0.00	0%		29-Dec-2027
PH3.COMCONST.	Mechanical Completion (Phase 3)	0.00	0.00	0%		29-Aug-2028
CON.SM.5000	Construction Complete	0.00	0.00	0%		20-Sep-2028
Construction - Contractor Review IFC Package		0.00	175.00	0%	08-Dec-2025	08-Jan-2026
A2520	Final Construction IFC Review	0.00	175.00	0%	08-Dec-2025	08-Jan-2026
Construction - Project Work		362883.75	5833.00	0%	06-Nov-2025	14-Sep-2028
A2790	Heavy Equipment (Phase 1)	13566.00	2529.92	0%	06-Nov-2025	03-Feb-2027
PH1.CON.1000	Phase 1 Paving Road Base TXDOX Item 247 (estimate li	6.00	0.75	0%	06-Nov-2025	06-Nov-2025
PH1.CON.1220	Phase 1 Paving Road 10" (estimate lines 359-363	9995.00	1249.38	0%	06-Nov-2025	22-Jun-2026
PH1.DEMO.CON.	Phase 1 Demo Existing Paving 6" (Estimate line 561)	9750.00	1000.00	0%	06-Nov-2025	06-May-2026
PH1.CON.1010	Phase 1 Pipe Rack 1 (estimate lines 14-27)	261.00	32.63	0%	06-Nov-2025	13-Nov-2025
PH1.CON.1230	Phase 1 Paving 8" (estimate lines 364-368)	8717.00	1089.63	0%	06-Nov-2025	21-May-2026
PH1.CON.1020	Phase 1 Pipe Rack 2 (estimate lines 28-50)	701.00	87.63	0%	13-Nov-2025	01-Dec-2025
PH1.CON.1030	Phase 1 Pipe Rack 3 (estimate lines 51-76)	857.00	107.13	0%	01-Dec-2025	18-Dec-2025
PH1.CON.1180	Phase 1 HVAC Piers 2 (estimate lines 331-334)	91.00	11.38	0%	01-Dec-2025	02-Dec-2025
PH1.CON.1190	Phase 1 HVAC Piers 6 (estimate lines 335-338)	241.00	30.13	0%	02-Dec-2025	08-Dec-2025
PH1.CON.1200	Phase 1 Transformer Foundations 2 (estimate lines 339-3	441.00	55.13	0%	08-Dec-2025	17-Dec-2025
PH1.CON.1300	Phase 1 SUB 42 HVAC Piers (estimate lines 492-496)	174.00	21.75	0%	08-Dec-2025	11-Dec-2025
PH1.CON.1310	Phase 1 Sub42 Transformer Fds (estimate lines 497-505)	930.00	116.25	0%	11-Dec-2025	05-Jan-2026
PH1.CON.1340	Phase 1 SUB 42 Support (estimate lines 521-526)	92.00	11.50	0%	11-Dec-2025	15-Dec-2025
PH1.CON.1350	Phase 1 SUB 42 HVAC Piers (estimate lines 527-531)	72.00	9.00	0%	11-Dec-2025	15-Dec-2025
PH1.CON.1290	Phase 1 SUB 42 Support (estimate lines 487-491)	217.00	27.13	0%	15-Dec-2025	17-Dec-2025
PH1.CON.1210	Phase 1 Transformer Platform Foundations 26 (estimate	1094.00	136.75	0%	17-Dec-2025	14-Jan-2026
PH1.CON.1040	Phase 1 Pipe Rack 4 (estimate lines 77-81)	142.00	17.75	0%	18-Dec-2025	23-Dec-2025
PH1.CV.1000	Phase 1 Chemical Sewer 16" HDPE (All Inclusive) (estima	822.00	240.00	0%	22-Dec-2025	04-Feb-2026
PH1.CON.1320	Phase 1 Sub42 Platform Fdns (estimate lines 506-512)	735.00	91.88	0%	05-Jan-2026	20-Jan-2026
PH1.CON.1330	Phase 1 Sub42 HVAC Platform Fdns (estimate lines 513-	565.00	70.63	0%	20-Jan-2026	03-Feb-2026

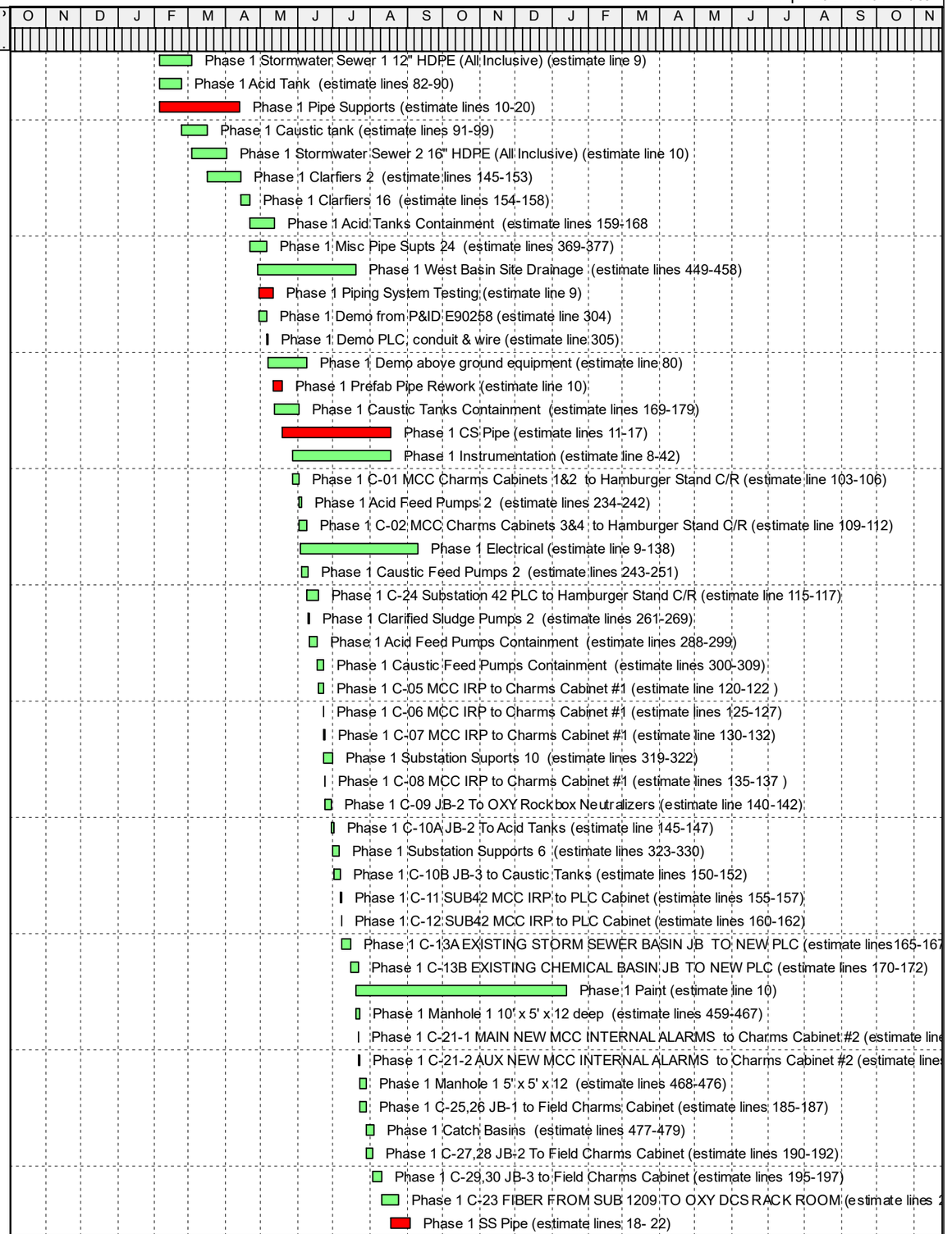


Remaining Level of Effort | Actual Level of Effort | Actual Work | Remaining Work | Critical Remaining Work | Turnaround Window | Outage Window ◆ ◆ Milestone

Monthly Schedule Update Pre Reads

24-Apr-2024 **:Run Date**

Activity ID	Activity Name	Budgeted Labor Units	Original Duration	Duration % Complete	Start	Finish
PH1.CV.1010	Phase 1 Stormwater Sewer 1 12" HDPE (All Inclusive) (es	641.00	160.00	0%	04-Feb-2026	04-Mar-2026
PH1.CON.1050	Phase 1 Acid Tank (estimate lines 82-90)	804.00	100.50	0%	04-Feb-2026	23-Feb-2026
PH1.STR.1000	Phase 1 Pipe Supports (estimate lines 10-20)	7618.00	380.00	0%	04-Feb-2026	13-Apr-2026
PH1.CON.1060	Phase 1 Caustic tank (estimate lines 91-99)	1036.00	129.50	0%	23-Feb-2026	17-Mar-2026
PH1.CV.1020	Phase 1 Stormwater Sewer 2 16" HDPE (All Inclusive) (es	685.00	170.00	0%	04-Mar-2026	02-Apr-2026
PH1.CON.1070	Phase 1 Clarfiers 2 (estimate lines 145-153)	1232.00	154.00	0%	17-Mar-2026	14-Apr-2026
PH1.CON.1080	Phase 1 Clarfiers 16 (estimate lines 154-158)	446.00	55.75	0%	14-Apr-2026	22-Apr-2026
PH1.CON.1090	Phase 1 Acid Tanks Containment (estimate lines 159-168	865.00	108.10	0%	22-Apr-2026	12-May-2026
PH1.CON.1240	Phase 1 Misc Pipe Supts 24 (estimate lines 369-377)	621.00	77.63	0%	22-Apr-2026	06-May-2026
PH1.CON.1250	Phase 1 West Basin Site Drainage (estimate lines 449-45	3646.00	455.75	0%	28-Apr-2026	20-Jul-2026
PH1.PIPE.1000	Phase 1 Piping System Testing (estimate line 9)	2403.00	60.07	0%	29-Apr-2026	11-May-2026
PH1.DEMO.INST.1	Phase 1 Demo from P&ID E90258 (estimate line 304)	302.00	37.75	0%	29-Apr-2026	06-May-2026
PH1.DEMO.INST.1	Phase 1 Demo PLC, conduit & wire (estimate line 305)	52.00	6.50	0%	06-May-2026	07-May-2026
PH1.DEMO.MECH	Phase 1 Demo above ground equipment (estimate line 80)	780.00	160.00	0%	07-May-2026	08-Jun-2026
PH1.PIPE.1010	Phase 1 Prefab Pipe Rework (estimate line 10)	1770.00	44.25	0%	11-May-2026	19-May-2026
PH1.CON.1100	Phase 1 Caustic Tanks Containment (estimate lines 169-	892.00	111.50	0%	12-May-2026	02-Jun-2026
PH1.PIPE.1020	Phase 1 CS Pipe (estimate lines 11-17)	20515.00	512.87	0%	19-May-2026	18-Aug-2026
PH1.INST.1000	Phase 1 Instrumentation (estimate line 8-42)	3382.00	475.00	0%	27-May-2026	18-Aug-2026
PH1.INST.1010	Phase 1 C-01 MCC Charms Cabinets 1&2 to Hamburger	286.00	35.75	0%	27-May-2026	02-Jun-2026
PH1.CON.1110	Phase 1 Acid Feed Pumps 2 (estimate lines 234-242)	150.00	18.75	0%	02-Jun-2026	04-Jun-2026
PH1.INST.1020	Phase 1 C-02 MCC Charms Cabinets 3&4 to Hamburger	246.00	30.75	0%	02-Jun-2026	09-Jun-2026
PH1.ELEC.1000	Phase 1 Electrical (estimate line 9-138)	13326.00	562.25	0%	03-Jun-2026	10-Sep-2026
PH1.CON.1120	Phase 1 Caustic Feed Pumps 2 (estimate lines 243-251)	155.00	19.38	0%	04-Jun-2026	09-Jun-2026
PH1.INST.1030	Phase 1 C-24 Substation 42 PLC to Hamburger Stand C/F	527.00	65.90	0%	09-Jun-2026	18-Jun-2026
PH1.CON.1130	Phase 1 Clarified Sludge Pumps 2 (estimate lines 261-26	142.00	17.75	0%	09-Jun-2026	11-Jun-2026
PH1.CON.1140	Phase 1 Acid Feed Pumps Containment (estimate lines 2	234.00	29.25	0%	11-Jun-2026	17-Jun-2026
PH1.CON.1150	Phase 1 Caustic Feed Pumps Containment (estimate line	222.00	27.75	0%	17-Jun-2026	22-Jun-2026
PH1.INST.1040	Phase 1 C-05 MCC IRP to Charms Cabinet #1 (estimate l	57.00	7.12	0%	18-Jun-2026	22-Jun-2026
PH1.INST.1050	Phase 1 C-06 MCC IRP to Charms Cabinet #1 (estimate l	47.00	5.88	0%	22-Jun-2026	22-Jun-2026
PH1.INST.1060	Phase 1 C-07 MCC IRP to Charms Cabinet #1 (estimate l	50.00	6.25	0%	22-Jun-2026	23-Jun-2026
PH1.CON.1160	Phase 1 Substation Suports 10 (estimate lines 319-322)	401.00	50.13	0%	22-Jun-2026	30-Jun-2026
PH1.INST.1070	Phase 1 C-08 MCC IRP to Charms Cabinet #1 (estimate l	39.00	4.88	0%	23-Jun-2026	24-Jun-2026
PH1.INST.1080	Phase 1 C-09 JB-2 To OXY Rock box Neutralizers (estima	209.00	26.13	0%	24-Jun-2026	29-Jun-2026
PH1.INST.1090	Phase 1 C-10A JB-2 To Acid Tanks (estimate line 145-147	180.00	22.50	0%	29-Jun-2026	01-Jul-2026
PH1.CON.1170	Phase 1 Substation Supports 6 (estimate lines 323-330)	176.00	22.00	0%	30-Jun-2026	06-Jul-2026
PH1.INST.1100	Phase 1 C-10B JB-3 to Caustic Tanks (estimate lines 150	198.00	24.75	0%	01-Jul-2026	07-Jul-2026
PH1.INST.1110	Phase 1 C-11 SUB42 MCC IRP to PLC Cabinet (estimate	50.00	6.25	0%	07-Jul-2026	07-Jul-2026
PH1.INST.1120	Phase 1 C-12 SUB42 MCC IRP to PLC Cabinet (estimate	49.00	6.13	0%	07-Jul-2026	08-Jul-2026
PH1.INST.1130	Phase 1 C-13A EXISTING STORM SEWER BASIN JB TO	290.00	36.25	0%	08-Jul-2026	15-Jul-2026
PH1.INST.1140	Phase 1 C-13B EXISTING CHEMICAL BASIN JB TO NE	304.00	38.00	0%	15-Jul-2026	22-Jul-2026
PH1.PAINT.1000	Phase 1 Paint (estimate line 10)	10016.50	1000.00	0%	20-Jul-2026	13-Jan-2027
PH1.CON.1260	Phase 1 Manhole 1 10' x 5' x 12 deep (estimate lines 459-	263.00	32.88	0%	20-Jul-2026	23-Jul-2026
PH1.INST.1150	Phase 1 C-21-1 MAIN NEW MCC INTERNAL ALARMS to	23.00	2.88	0%	22-Jul-2026	22-Jul-2026
PH1.INST.1160	Phase 1 C-21-2 AUX NEW MCC INTERNAL ALARMS to	114.00	14.25	0%	22-Jul-2026	23-Jul-2026
PH1.CON.1270	Phase 1 Manhole 1 5' x 5' x 12 (estimate lines 468-476)	164.00	20.50	0%	23-Jul-2026	28-Jul-2026
PH1.INST.1170	Phase 1 C-25,26 JB-1 to Field Charms Cabinet (estimate	182.00	22.75	0%	23-Jul-2026	28-Jul-2026
PH1.CON.1280	Phase 1 Catch Basins (estimate lines 477-479)	335.00	41.88	0%	28-Jul-2026	04-Aug-2026
PH1.INST.1180	Phase 1 C-27,28 JB-2 To Field Charms Cabinet (estimate	216.00	27.00	0%	29-Jul-2026	03-Aug-2026
PH1.INST.1190	Phase 1 C-29,30 JB-3 to Field Charms Cabinet (estimate	341.00	42.63	0%	03-Aug-2026	10-Aug-2026
PH1.INST.1200	Phase 1 C-23 FIBER FROM SUB 1209 TO OXY DCS RA	605.00	75.63	0%	10-Aug-2026	24-Aug-2026
PH1.PIPE.1030	Phase 1 SS Pipe (estimate lines 18- 22)	4210.00	105.25	0%	18-Aug-2026	03-Sep-2026

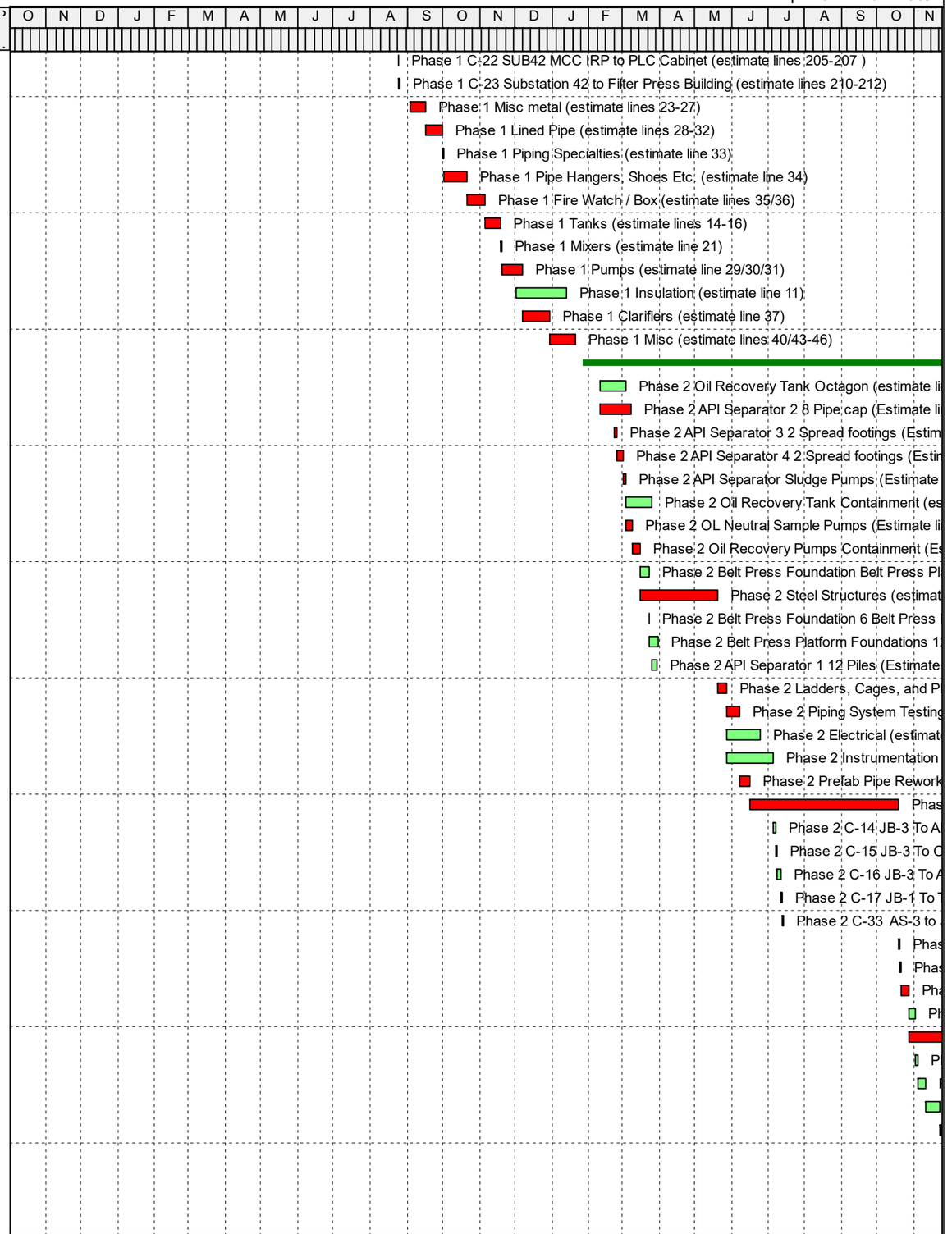


Remaining Level of Effort | Actual Level of Effort | Actual Work | Remaining Work | Critical Remaining Work | Turnaround Window | Outage Window ◆ | ◆ Milestone

Monthly Schedule Update Pre Reads

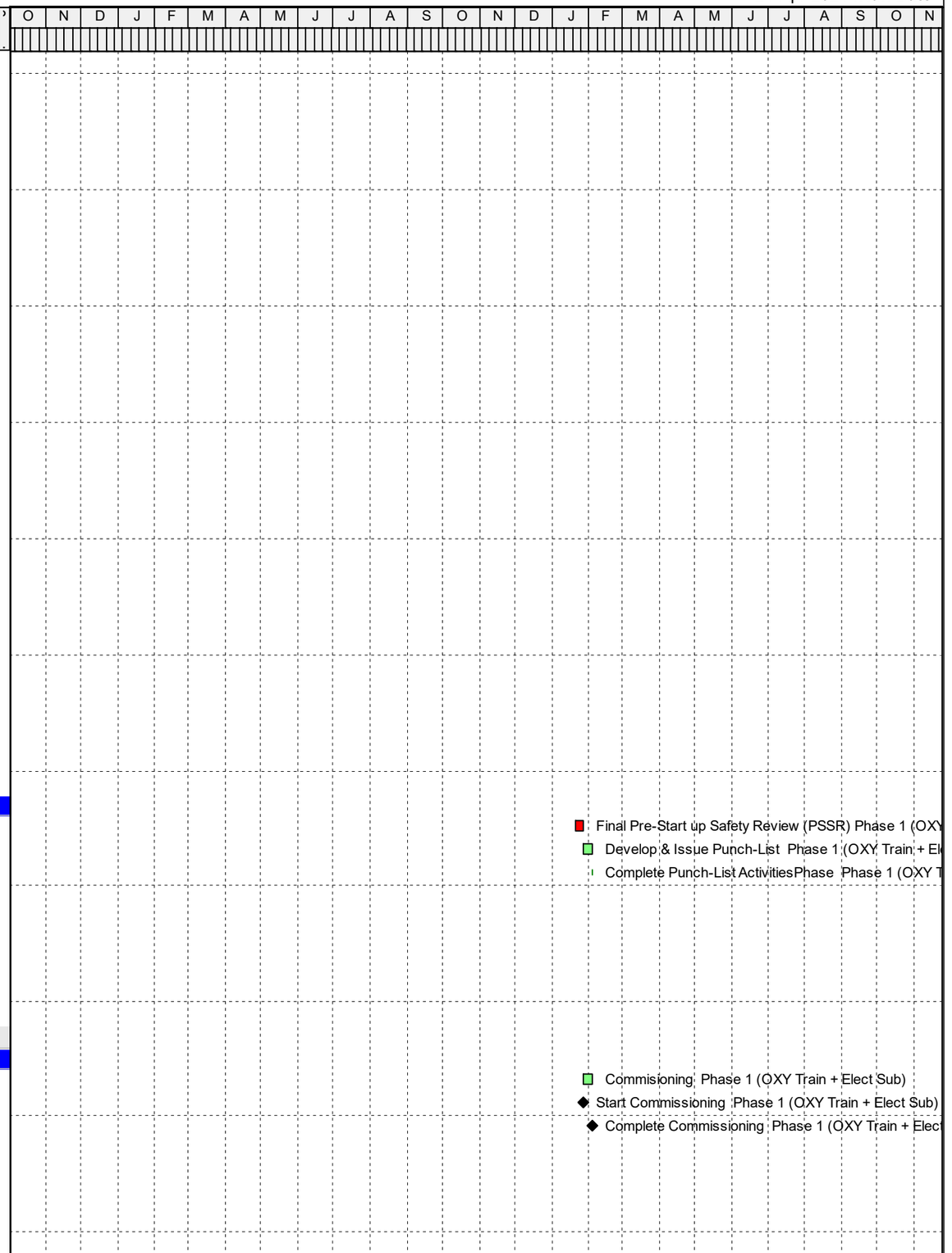
24-Apr-2024 **:Run Date**

Activity ID	Activity Name	Budgeted Labor Units	Original Duration	Duration % Complete	Start	Finish
PH1.INST.1210	Phase 1 C-22 SUB42 MCC IRP to PLC Cabinet (estimate	32.00	4.00	0%	24-Aug-2026	24-Aug-2026
PH1.INST.1220	Phase 1 C-23 Substation 42 to Filter Press Building (estim	84.00	10.50	0%	24-Aug-2026	25-Aug-2026
PH1.PIPE.1040	Phase 1 Misc metal (estimate lines 23-27)	2348.00	58.70	0%	03-Sep-2026	16-Sep-2026
PH1.PIPE.1050	Phase 1 Lined Pipe (estimate lines 28-32)	3375.00	84.37	0%	16-Sep-2026	01-Oct-2026
PH1.PIPE.1060	Phase 1 Piping Specialties (estimate line 33)	133.00	3.33	0%	01-Oct-2026	01-Oct-2026
PH1.PIPE.1070	Phase 1 Pipe Hangers, Shoes Etc. (estimate line 34)	4427.00	110.67	0%	01-Oct-2026	21-Oct-2026
PH1.PIPE.1080	Phase 1 Fire Watch / Box (estimate lines 35/36)	3515.00	87.87	0%	21-Oct-2026	05-Nov-2026
PH1.MECH.1000	Phase 1 Tanks (estimate lines 14-16)	332.00	70.05	0%	05-Nov-2026	18-Nov-2026
PH1.MECH.1010	Phase 1 Mixers (estimate line 21)	47.00	9.50	0%	18-Nov-2026	19-Nov-2026
PH1.MECH.1020	Phase 1 Pumps (estimate line 29/30/31)	416.00	85.00	0%	19-Nov-2026	07-Dec-2026
PH1.INSUL.1000	Phase 1 Insulation (estimate line 11)	1932.00	241.47	0%	01-Dec-2026	13-Jan-2027
PH1.MECH.1030	Phase 1 Clarifiers (estimate line 37)	598.00	125.00	0%	07-Dec-2026	29-Dec-2026
PH1.MECH.1040	Phase 1 Misc (estimate lines 40/43-46)	637.00	133.00	0%	29-Dec-2026	20-Jan-2027
A4120	Heavy Equipment (Phase 2)	7537.00	1925.58	0%	27-Jan-2027	05-Jan-2028
PH2.CON.1000	Phase 2 Oil Recovery Tank Octagon (estimate lines 100-	974.00	121.75	0%	10-Feb-2027	03-Mar-2027
PH2.CON.1030	Phase 2 API Separator 2 8 Pipe cap (Estimate lines 190-2	1111.00	138.87	0%	10-Feb-2027	08-Mar-2027
PH2.CON.1040	Phase 2 API Separator 3 2 Spread footings (Estimate lines	176.00	22.00	0%	22-Feb-2027	24-Feb-2027
PH2.CON.1050	Phase 2 API Separator 4 2 Spread footings (Estimate lines	140.00	17.50	0%	24-Feb-2027	01-Mar-2027
PH2.CON.1060	Phase 2 API Separator Sludge Pumps (Estimate lines 270	211.00	26.37	0%	01-Mar-2027	03-Mar-2027
PH2.CON.1010	Phase 2 Oil Recovery Tank Containment (estimate lines 1	999.00	124.87	0%	03-Mar-2027	25-Mar-2027
PH2.CON.1070	Phase 2 OL Neutral Sample Pumps (Estimate lines 279-2	224.00	28.00	0%	03-Mar-2027	09-Mar-2027
PH2.CON.1080	Phase 2 Oil Recovery Pumps Containment (Estimate lines	287.00	35.87	0%	09-Mar-2027	16-Mar-2027
PH2.CON.1090	Phase 2 Belt Press Foundation Belt Press Platform Footin	296.00	37.00	0%	16-Mar-2027	23-Mar-2027
PH2.STR.1000	Phase 2 Steel Structures (estimate lines 24-34)	7256.00	376.30	0%	16-Mar-2027	19-May-2027
PH2.CON.1100	Phase 2 Belt Press Foundation 6 Belt Press Platform Ped	63.00	7.87	0%	23-Mar-2027	23-Mar-2027
PH2.CON.1110	Phase 2 Belt Press Platform Foundations 12 Belt Press Pl	362.00	45.25	0%	23-Mar-2027	31-Mar-2027
PH2.CON.1020	Phase 2 API Separator 1 12 Piles (Estimate lines 190-194)	184.00	23.00	0%	25-Mar-2027	30-Mar-2027
PH2.STR.1010	Phase 2 Ladders, Cages, and Platforms (Equipment) (est	967.00	48.35	0%	19-May-2027	27-May-2027
PH2.PIPE.1000	Phase 2 Piping System Testing (estimate line 38)	1134.00	37.80	0%	27-May-2027	07-Jun-2027
PH2.ELEC.1000	Phase 2 Electrical (estimate line 140-173)	1758.00	150.00	0%	27-May-2027	24-Jun-2027
PH2.INST.1000	Phase 2 Instrumentation (estimate line 45-74)	1581.00	197.60	0%	27-May-2027	05-Jul-2027
PH2.PIPE.1010	Phase 2 Prefab Pipe Rework (estimate line 39)	1670.00	55.67	0%	07-Jun-2027	16-Jun-2027
PH2.PIPE.1020	Phase 2 CS Pipe (estimate lines 40-44)	21037.00	701.23	0%	16-Jun-2027	19-Oct-2027
PH2.INST.1010	Phase 2 C-14 JB-3 To API Separators (estimate lines 216	178.00	22.25	0%	05-Jul-2027	07-Jul-2027
PH2.INST.1020	Phase 2 C-15 JB-3 To Oil Transfer Tank (estimate lines 2	84.00	10.50	0%	07-Jul-2027	08-Jul-2027
PH2.INST.1030	Phase 2 C-16 JB-3 To API #3 Separators (estimate lines 2	75.00	9.38	0%	08-Jul-2027	12-Jul-2027
PH2.INST.1040	Phase 2 C-17 JB-1 To T-1319 (estimate lines 231-233)	71.00	8.87	0%	12-Jul-2027	13-Jul-2027
PH2.INST.1050	Phase 2 C-33 AS-3 to JB 3 (estimate lines 236-238)	48.00	6.00	0%	13-Jul-2027	14-Jul-2027
PH2.PIPE.1030	Phase 2 SS Pipe (estimate lines 45-49)	498.00	16.60	0%	19-Oct-2027	20-Oct-2027
PH2.PIPE.1040	Phase 2 Piping Specialties (estimate line 50)	17.00	0.57	0%	20-Oct-2027	21-Oct-2027
PH2.PIPE.1050	Phase 2 Pipe Hangers, Shoes Etc. (estimate line 51)	1274.00	42.47	0%	21-Oct-2027	28-Oct-2027
PH2.PIPE.1060	Phase 2 Fire Watch (estimate line 52)	769.00	25.63	0%	28-Oct-2027	02-Nov-2027
PH2.PAINT.1000	Phase 2 Paint (estimate line 13)	5190.90	300.00	0%	28-Oct-2027	22-Dec-2027
PH2.MECH.1000	Phase 2 Tanks (estimate line 11)	59.00	12.50	0%	02-Nov-2027	04-Nov-2027
PH2.MECH.1010	Phase 2 Pumps (estimate lines 25/26)	208.00	44.00	0%	04-Nov-2027	11-Nov-2027
PH2.MECH.1020	Phase 2 API Seperators (estimate line 34)	254.00	53.70	0%	11-Nov-2027	22-Nov-2027
PH2.MECH.1030	Phase 2 Misc (estimate line 42)	33.00	7.00	0%	22-Nov-2027	23-Nov-2027
A2610	Scaffolding	80243.00	1362.50	0%	29-Dec-2027	29-Aug-2028
A4130	Heavy Equipment (Phase 3)	17421.85	1457.50	0%	29-Dec-2027	14-Sep-2028
PH3.DEMO.CON.	Phase 3 Demo Existing Sub 42 (estimate lines 562-564)	1758.00	346.00	0%	29-Dec-2027	28-Feb-2028
PH3.CON.1130	Phase 3 Sump Anchor 50 Hilti Anchors (estimate line 13)	65.00	8.12	0%	29-Dec-2027	30-Dec-2027



Remaining Level of Effort | Actual Level of Effort | Actual Work | Remaining Work | Critical Remaining Work | Turnaround Window | Outage Window ◆ | ◆ Milestone

Activity ID	Activity Name	Budgeted Labor Units	Original Duration	Duration % Complete	Start	Finish
PH3.CON.1170	Phase 3 Transfer Tank Octagon Mat 27 (estimate lines 13	1126.00	140.75	0%	29-Dec-2027	24-Jan-2028
PH3.PIPE.1000	Phase 3 Piping System Testing (estimate line 55)	1313.00	32.85	0%	29-Dec-202	04-Jan-2028
PH3.CON.1140	Phase 3 Olefins Neutralizer Tank 1 Octagon Mat (estimat	1297.00	162.12	0%	30-Dec-2027	27-Jan-2028
PH3.PIPE.1010	Phase 3 Prefab Pipe Rework (estimate line 56)	1033.00	25.82	0%	04-Jan-2028	10-Jan-2028
PH3.PAINT.1000	Phase 3 Paint (estimate line 16)	5284.50	660.57	0%	04-Jan-2028	01-May-2028
PH3.PIPE.1020	Phase 3 CS Pipe (estimate lines 57-61)	13122.00	328.05	0%	10-Jan-2028	06-Mar-2028
PH3.CON.1180	Phase 3 Transfer Pumps 3 Horizontal Pump Block FDNS	562.00	70.25	0%	24-Jan-2028	03-Feb-2028
PH3.CON.1150	Phase 3 Olefins Neutralizer Tank 2 Octagon Mat (estimat	1534.00	191.75	0%	27-Jan-2028	01-Mar-2028
PH3.CON.1190	Phase 3 Misc Pipe Supts 20 T-poles (estimate lines 378-3	1392.00	174.00	0%	03-Feb-2028	06-Mar-2028
PH3.CON.1210	Phase 3 Sump Basin Walls Chemical Sewer Sump Long V	3089.00	386.25	0%	03-Feb-2028	12-Apr-2028
PH3.STR.1000	Phase 3 Pipe Supports (estimate lines 45-54)	548.00	200.00	0%	21-Feb-2028	27-Mar-2028
PH3.CON.1160	Phase 3 Olefins Neutralizer Tank 3 Octagon Mat (estimat	1171.00	146.37	0%	01-Mar-2028	28-Mar-2028
PH3.CON.1200	Phase 3 Sump Basin Bottom Chemical Sewer Sump Slab	2530.00	316.25	0%	06-Mar-2028	02-May-2028
PH3.PIPE.1030	Phase 3 SS Pipe (estimate line 62-66)	258.00	6.45	0%	06-Mar-2028	07-Mar-2028
PH3.PIPE.1040	Phase 3 Lined Pipe (estimate lines 67-71)	10950.00	273.75	0%	07-Mar-2028	25-Apr-2028
PH3.CON.1220	Phase 3 Sump Basin Walls Chemical Sewer Interior Walls	297.00	37.12	0%	12-Apr-2028	19-Apr-2028
PH3.CON.1230	Phase 3 New Trench to Sump New Trench to Sump (estir	272.00	34.00	0%	19-Apr-2028	26-Apr-2028
PH3.PIPE.1050	Phase 3 Piping Specialties (estimate line 72)	4.00	0.10	0%	25-Apr-2028	25-Apr-2028
PH3.PIPE.1060	Phase 3 Pipe Hangers, Shoes Etc.(estimate line 73)	1644.00	41.10	0%	25-Apr-2028	03-May-2028
PH3.STR.1010	Phase 3 Ladders, Cages, and Platforms (Equipment) (est	775.00	300.00	0%	02-May-2028	26-Jun-2028
PH3.MECH.1000	Phase 3 Tanks (estimate lines 12/13/17)	1599.00	300.00	0%	03-May-2028	27-Jun-2028
PH3.PIPE.1070	Phase 3 Fire Watch (estimate line 74)	853.00	21.32	0%	03-May-2028	08-May-2028
PH3.ELEC.1000	Phase 3 Electrical (estimate line 177-218)	2002.00	250.30	0%	26-Jun-2028	09-Aug-2028
PH3.INST.1010	Phase 3 Instrumentation (estimate line 77-98)	1589.00	198.58	0%	26-Jun-2028	01-Aug-2028
PH3.MECH.1010	Phase 3 Mixers (estimate lines 20/22)	683.00	7.00	0%	27-Jun-2028	27-Jun-2028
PH3.MECH.1020	Phase 3 Pumps (estimate lines 27/28)	1346.00	300.00	0%	27-Jun-2028	21-Aug-2028
PH3.INST.1020	Phase 3 C-20 JB-1 To Oil Neutralizers (estimate lines 24:	303.00	37.82	0%	01-Aug-2028	08-Aug-2028
PH3.INST.1030	Phase 3 C-20 JB-1 To Oil Neutralizers (estimate lines 24:	164.00	20.47	0%	08-Aug-2028	10-Aug-2028
PH3.INST.1040	Phase 3 C-20 JB-1 To Oil Neutralizers (estimate lines 24:	366.00	45.78	0%	10-Aug-2028	17-Aug-2028
PH3.INST.1050	Phase 3 C-20 JB-1 To Oil Neutralizers (estimate lines 24:	72.00	8.98	0%	17-Aug-2028	21-Aug-2028
PH3.INST.1060	Phase 3 C-20 JB-1 To Oil Neutralizers (estimate lines 24:	77.00	9.62	0%	21-Aug-2028	22-Aug-2028
PH3.MECH.1030	Phase 3 Misc (estimate lines 41/48)	572.00	7.00	0%	21-Aug-2028	22-Aug-2028
Construction - PSSR		0.00	6451.08	0%	20-Jan-2027	05-Apr-2029
PH1.PSSR.1000	Final Pre-Start up Safety Review (PSSR) Phase 1 (OXY T	0.00	40.00	0%	20-Jan-2027	27-Jan-2027
A3960	Develop & Issue Punch-List Phase 1 (OXY Train + Elect	0.00	40.00	0%	27-Jan-2027	03-Feb-2027
PH1.PSSR.1010	Complete Punch-List ActivitiesPhase Phase 1 (OXY Trair	0.00	0.00	0%	03-Feb-2027	03-Feb-2027
PH2.PSSR.1000	Final Pre-Start up Safety Review (PSSR) Phase 2 (Olefins	0.00	40.00	0%	22-Dec-2027	29-Dec-2027
A4020	Develop & Issue Punch-List Phase Phase 2 (Olefins Trai	0.00	40.00	0%	29-Dec-2027	05-Jan-2028
PH2.PSSR.1010	Complete Punch-List ActivitiesPhase Phase 2 (Olefins Tr	0.00	0.00	0%	05-Jan-2028	05-Jan-2028
PH3.PSSR.1010	Final Pre-Start up Safety Review (PSSR) Phase 3 (Primar	0.00	40.00	0%	22-Aug-2028	29-Aug-2028
A2840	Develop & Issue Punch-List Phase 3 (Primary Train)	0.00	40.00	0%	29-Aug-2028	06-Sep-2028
PH3.PSSR.1000	Complete Punch-List ActivitiesPhase 3 (Primary Train)	0.00	1195.00	0%	06-Sep-2028	05-Apr-2029
Operate		0.00	3347.08	0%	27-Jan-2027	15-Sep-2028
Operate - Commissioning		0.00	3347.08	0%	27-Jan-2027	15-Sep-2028
PH1.COMM.1010	Commisioning Phase 1 (OXY Train + Elect Sub)	0.00	40.00	0%	27-Jan-2027	03-Feb-2027
PH1.COMM.1000	Start Commissioning Phase 1 (OXY Train + Elect Sub)	0.00	0.00	0%	27-Jan-2027	
PH1.COMM.1020	Complete Commissioning Phase 1 (OXY Train + Elect Su	0.00	0.00	0%		03-Feb-2027
PH2.COMM.1010	Commisioning Phase 2 (Olefins Train)	0.00	40.00	0%	29-Dec-2027	05-Jan-2028
PH2.COMM.1000	Start Commissioning Phase 2 (Olefins Train)	0.00	0.00	0%	29-Dec-2027	
PH2.COMM.1020	Complete Commissioning Phase 2 (Olefins Train)	0.00	0.00	0%		05-Jan-2028
PH3.COMM.1010	Commisioning Phase 3 (Primary Train)	0.00	100.00	0%	29-Aug-2028	15-Sep-2028
PH3.COMM.1000	Start Commissioning Phase 3 (Primary Train)	0.00	0.00	0%	29-Aug-2028	



Activity ID	Activity Name	Budgeted Labor Units	Original Duration	Duration % Complete	Start	Finish
PH3.COMM.1020	Complete Commissioning Phase 3 (Primary Train)	0.00	0.00	0%		15-Sep-2028
Closing		0.00	1150.00	0%	13-Sep-2028	06-Apr-2029
Closing		0.00	1070.00	0%	27-Sep-2028	06-Apr-2029
A2850	Final Documentation / Red-Line Drawings	0.00	160.00	0%	27-Sep-2028	25-Oct-2028
A2860	Project Close-out (Complete Project Closeout Procedure	0.00	560.00	0%	29-Dec-2028	06-Apr-2029
A1020	Project Complete and Financially Closed	0.00	0.00	0%		06-Apr-2029*
Closing - Performance Testing		0.00	80.00	0%	13-Sep-2028	27-Sep-2028
A2870	Confirm that RCM Analysis is complete per RCM	0.00	80.00	0%	13-Sep-2028	27-Sep-2028
Closing - Independent Project Analysis (IPA)		0.00	632.00	0%	18-Sep-2028	09-Jan-2029
A2880	PS16 - Contact Regional Bench marking Specialist	0.00	8.00	0%	18-Sep-2028	18-Sep-2028
A2890	PS16 - Prepare PBS Form & Submit to Regional Benchma	0.00	40.00	0%	19-Sep-2028	25-Sep-2028
A2900	PS16 - Submit PBS Form to IPA	0.00	8.00	0%	03-Oct-2028	03-Oct-2028
A2910	PS16 - Update IPA Workbooks	0.00	160.00	0%	04-Oct-2028	31-Oct-2028
A2920	PS16 - Submit Workbooks to IPA	0.00	40.00	0%	08-Nov-2028	14-Nov-2028
A2930	PS16 - Conduct IPA Post Investment Review	0.00	8.00	0%	22-Nov-2028	22-Nov-2028
A2940	PS16 - Review IPA Draft Report/Presentations & Return C	0.00	40.00	0%	18-Dec-2028	22-Dec-2028
A1030	PS16 - Receive Final IPA Report/Conduct Final Presentati	0.00	8.00	0%	09-Jan-2029	09-Jan-2029

