



**ENSCO 102 - TREFOIL SITE INVESTIGATION
BASS STRAIT, VICTORIA**

for

ORIGIN ENERGY RESOURCES LIMITED

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DOCUMENT STATUS

<i>BGT Doc. No.</i>	<i>Rev.</i>	<i>Status</i>	<i>Issue Date</i>
5378	A	<i>Issued for Review</i>	01.10.04
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1. INTRODUCTION

Benthic Geotech (BGT) has recently completed a geotechnical sampling and in situ testing campaign at the Trefoil site, location T18/P, Bass Strait, Victoria. This work was undertaken on behalf of Origin Energy Resources Limited (OE), who is planning to deploy the Ensco 102 jackup drilling rig at the Trefoil site in the near future.

Drilling and in situ testing services were undertaken using BGT's Portable Remotely Operated Drill (PROD) onboard the Mermaid Raider, a Mermaid Marine vessel that was chartered directly by OE. Provision of surveying services was organised by Benthic Geotech, via subcontract to Lester Franks Hydrographic Surveys, Devonport, Tasmania.

The project was undertaken to investigate the composition and strength of shallow seabed strata at the site. The acquired data will be used to predict the penetration and stability of the jack up rig's spud cans. Interpretation of the data is to be undertaken by third party geotechnical consultants (Advanced Geomechanics on behalf of OE, and Fugro Survey on behalf of Ensco). Both of these companies provided representatives on the vessel for the duration of the project.

This factual closeout report provides a summary of key project events, the geotechnical data that was recovered at each testing location, and other project information.

2. SUMMARY OF COMPLETED SCOPE OF WORK

The project comprised the completion of 6 boreholes, all of which were located within the proposed footprint area of the Ensco 102 at Trefoil. The completed borehole locations are plotted on Figure 1 and are listed in Table 1.

The location of PROD relative to the vessel was tracked using a USBL system that was mounted on a pole and deployed through the vessel's moon pool. Location of the vessel was estimated using Differential GPS equipment.

Initially, one CPT borehole and one sampling borehole (boreholes TRE1 and TRE2) were proposed to a maximum penetration depth of about 30m at the site. This work program was rapidly completed over the course of approximately one day using PROD. A further borehole (TRE3) was completed using PROD's ball penetrometer to provide more accurate definition of the undrained shear strength profile at the site.

Continued good weather at the site led to OE's decision to extend the scope of work. Three further boreholes (TRE4, TRE5 and TRE6) were located at each of the proposed locations of the Ensco 102's footings. These holes were completed to investigate the spatial variability of the upper sediments at the site.

Table 1: Summary of Borehole Locations

Location & Borehole	Start Date	Easting (mE)*	Northing (mN)*	Maximum Penetration (ML -m)
TRE1	19.09.04	361,075	5,586,338	28.1
TRE2	19.09.04	361,079	5,586,333	27.4
TRE3	19.09.04	361,078	5,586,332	27.2
TRE4	20.09.04	361,093	5,586,320	13.0
TRE5	20.09.04	361,038	5,586,312	13.0
TRE6	20.09.04	361,055	5,586,358	13.0

Note: * = Coordinates Datum = GDA '94, Grid = Map Grid Australia (MGA , Zone 55, CM 147 Deg)

Graphical summaries of the sampling and CPT test data for each borehole are provided in Appendix 2 (CPT) and Appendix 3 (Sampling) of this factual report.

3. BGT PROJECT DOCUMENTATION

Several documents were prepared and issued by BGT for use on this project, they include:

- “Health Safety & Environment Management Plan, Trefoil Site Investigation Project”, 6 September 2004, BGT doc. no. 5373 rev 0.
- “Mobilisation & demobilisation plan, Trefoil Site investigation, Bass Strait, Victoria”, 6 September 2004, BGT doc. no. 5371 rev 0.
- “Project Procedures And Quality Plan Trefoil Site Investigation Project, Bass Strait, Victoria”, 6 September 2004, BGT doc. no. 5372 rev 0.

All of the above documents were issued to OE and other relevant parties prior to commencement of mobilisation in Melbourne on 7 September 2004.

4. TIMELINE OF KEY PROJECT EVENTS

The activities undertaken during the project phase are detailed in the daily reports, attached as Appendix 1 to this report. A brief summary of the major events are listed below:

07.09.04 - Mobilise equipment and personnel to Port Melbourne

08.09.04 - Project Induction (all BGT crew) facilitated by OE

08.09.04 - Commence vessel set-up and limited PROD mobilisation activities

10.09.04 - Commence PROD mobilisation onto vessel in parallel with continued vessel setup

14.09.04 – Vessel set-up and PROD mobilisation completed

15.09.04 - Depart to Port Philip Bay, test mooring system and standby for suitable weather window

16.09.04 – Transit to lee of King Island to standby for weather

17.09.04 – Transit to Trefoil, anchor and commence site operations

18.09.04 – Complete boreholes TRE1, TRE2, commence TRE3

19.09.04 – Complete boreholes TRE3, TRE4, TRE5, TRE6, recover anchors, transit to Melbourne

20.09.04 – Demobilise from vessel, packing BGT equipment

21.09.04 – Complete packing and depart Melbourne

5. BGT PERSONNEL

Ten BGT crewmembers were mobilised for this project. The names and roles of each are listed in Table 2. In addition to PROD crew, Benthic Geotech also mobilised a dedicated surveyor for the project under subcontract to Lester Franks Hydrographic Survey Pty Ltd.

Table 2: BGT Personnel Roles on Project

Shift A		Shift B	
Pat Kelleher	Team Leader / Supervisor/ Operator	James Shiels	Supervisor / Operator
Steve Payor	Operator / Electrical / Software	Phil Manning	Operator / Technician
Hugh Frazer	Operator / Engineer	Ross Barker	Operator / Geotechnician
Nazri	Geotechnician	Bob Wyers	Electrician / Technician
Aubrey Allwood	Technician	Paul Handidjaja	Geotechnician

6. MOBILISATION ACTIVITIES

6.1 Selection and Review of Vessel & Setup for PROD Operations

OE selected the use of the Mermaid Raider for this project, a 50 m rig tender equipped with a 15 tonne A-frame. A 4-point anchoring system was installed on the vessel to ensure that the vessel could maintain station adequately during the course of seabed drilling operations. The final deck layout for PROD equipment is presented on Figure 2.

6.2 Development of Launch and Recovery System

A launch and recovery sequence was developed and modelled by Hugh Frazer and Associates (HFA), who have experience in the design of launch and recovery systems for PROD operations.

The results of this initial study were issued to International Maritime Consultants (IMC), who are Mermaid Marine's naval architects. IMC undertook checking of the results to ensure that the A-frame had sufficient structural capacity to launch and recover PROD. Following confirmation of adequacy, IMC undertook the detailed design of all steelwork on the vessel.

Oil Patch Containers were commissioned by OE to undertake the fabrication and installation of steelwork on the vessel.

Proof load testing was completed to 15.6 tonnes winch line load once Benthic Geotech's winch and main sheave block were installed on the vessel. Magnetic Particle Inspection testing was also complete to provide additional proof of structural adequacy.



Plate 1 – Preparation for Proof Load Testing

6.3 Layout & Control of Equipment for Launch and Recovery System

A plan layout of BGT equipment on the main deck of the vessel is shown on Figure 2. The launch and recovery system comprised a tilting catcher table that was designed to pivot aft of the stern roller, enabling capturing and stabilisation of PROD in a vertical orientation before it was laid over on the deck. Once lowered to a horizontal position, PROD was then pulled forward onto a set of guide rails, to provide access for servicing.

A 5 t tugger winch was installed near the stern, to pull PROD aft wards for launch. A 10 t tugger, mounted just aft of the PROD main winch, was used to apply the force required to tilt PROD from a vertical to horizontal orientation.

The control locations for the A-Frame, tuggers and mooring system were located on the focsle deck, immediately above the survey room. The control position for the PROD main winch was located on the port side of the winch on the main deck.

Two gensets, a control container, workshop container, main winch and power pack comprised the remainder of the equipment installed on the vessel. The gensets were installed on the focsle deck, and are not shown on Figure 2.

Navigation equipment was installed in the survey room, which was located immediately ahead of the main winch and beneath the focsle deck. A separate monitor was provided in both the PROD control container and the bridge to enable real time monitoring of vessel and PROD positions.

6.4 System Integrity Tests

System Integrity Tests (SITs) were commenced and completed at OE's wharf in Port Melbourne, on 11 September 2004.

The SIT's were undertaken to ensure that PROD and the vessel were fully prepared for the project prior to arrival at the site. A summary of the completed SITs follows.

(a) SIT#1 – Demonstration of Structural Adequacy (wharf side, Port Melbourne)

This series of tests comprised the completion of Magnetic Particle Inspection Testing of all welds completed during the course of vessel set-up. Following completion of this work, a full load test of the winch, main sheave and A-Frame was completed on 11 September 2004. This involved applying a 15.6 tonne kentledge load to the PROD umbilical, and the luffing of the A-Frame between the fully aft and 10 degree aft positions, over an extended period of time. This test was completed successfully, with no flaws identified within the key structural components of the system.

(b) SIT#2- PROD / L&R System Functionality Tests (wharf side, Port Melbourne)

This series of tests were undertaken to assess the readiness of PROD for offshore operations. They were completed on or before 13 September 2004, and comprised:

- Function tests of all cone penetrometers;
- Pre-flight checks of all key functions to confirm that the PROD was fully functional and ready for deployment;
- Multiple deployments using the vessel launch & recovery system to refine equipment and procedures;
- Completion of underwater pre-flight tests to confirm that PROD was fully functional prior to departure; and
- Recovery of PROD onto the vessel and sea fastening, ready for departure.

(c) SIT#3 – Offshore Mooring Trials (Port Philip Bay)

Trial anchoring was undertaken in Port Philip Bay, and testing was completed to MM's satisfaction on 15 September 2004.

(d) SIT#4 – Vessel Station Holding Tests

The vessel arrived at the Trefoil site on 12 September. Following anchoring, a mooring trial was undertaken over a period of 2 hours to confirm the adequacy of the mooring system in 70m water depth. The vessel generally remained within a 5 m diameter circle during the period of this test, which was well within the maximum allowable diameter of 10m.



Plate 2 – Transit to Site

7. SITE OPERATIONS

Drilling and in situ testing operations were undertaken at the sites listed in Table 1. For simplicity, the results of the CPT testing and sampling operations are described separately below.

7.1 CPT Results

(a) Results

CPT testing was undertaken in all boreholes excluding TRE2 and TRE3. Prior to and at the completion of each CPT deployment, zero readings were taken with the probe located approximately 0.7m above the seabed.

Continuous CPT profiles were generated for all CPT testing completed in virgin ground, and these data are presented in Appendix 3. For each test interval completed, a plot of both uncorrected and corrected CPT data (for pore pressure effects) is included. The uncorrected data comprises plots of cone tip resistance, q_c ; sleeve friction, f_s ; and combined hydrostatic and pore water pressure, u ; versus depth below mudline. The corrected CPT data comprises plots of net cone resistance, q_{net} , friction ratio, f_s/q_t , and pore pressure parameter ratio, B_q ; versus depth below mudline. For further discussion of these parameters and the corrections that have been applied, refer to Section (c) following.

(b) Cone Calibrations and Data Quality

Appendix 3 includes a summary of the calibration results for all cones used on this project. The calibration exercise was undertaken with reference to a NATA calibrated reference test load cell and a NATA calibrated reference test pressure transducer. Initially, both the cone tip and sleeve friction load cells were calibrated directly in a load frame. No cross talk effects were identified. Each cone was then placed in a pressure chamber and subjected to triaxial stress conditions. This enabled the direct calibration of the pore pressure transducer within each cone, and estimation of the net area ratio factors for both the cone tip load cell ('a') and sleeve friction ('b').

Recalibration of all cone penetrometers is to be completed following demobilisation. Two CPT probes experienced significant damage to their cone tip load cells during this project. All damage occurred due to excessive bending, arising from the attempted probing of a hard layer encountered at approximately 28m. Where a significant zero shifts were identified in a cone, the cone was put aside and no longer used on the project. A correction for zero shift was applied for the ball penetrometer data (borehole TRE3), following the likely point at which it was damaged (maximum depth achieved of 27.2m).

Damaged cones are to be sent back to the manufacturer for repair and recalibration, the cost of these repairs will be back charged to OE.

(c) CPT Data Processing

The CPT probes are shoulder type, individual load cell cones with pore pressure measured on the cone shoulder, between the tip and friction sleeve.

Corrections to the CPT data were computed using the following formulae:

- The total cone resistance, q_t , was computed as $q_t = q_c + (1-a) u_2$

Where: q_c was zeroed relative to 0.7m above mudline

u is the total (excess + ambient hydrostatic) pore water pressure measured behind the cone tip, zeroed relative to the mudline;

a is the net cone area ratio ($a = 0.80$ for all cones used).

- The net cone resistance, $q_{net} = q_t - \sigma_{vo}$

Where: $\sigma_{vo} = 0.018 z$ MPa/m;

z = depth below mudline (m)

- and the pore water pressure ratio, $B_q = \delta u / (q_t - \sigma_{vo})$

Where: δu = excess pore water pressure, $\delta u = u - 0.01 z$

For the current preliminary interpretative purposes, the bulk density of the sub seabed strata was **assumed** to be 18 kN/m^3 . This estimate is based on an approximate average of the bulk densities measured during the course of soil logging (refer to bore log in Appendix 3). This assumption should be reviewed by the OE and Ensco geotechnical consultants employed to review the data acquired on this project.

The elevation of PROD relative to the mudline was monitored continually whilst on the seabed. It was found that the PROD base plate remained flush on the seabed at all times, with no visible settlement occurring during the entire course of drilling. In addition, the verticality of PROD was confirmed at regular intervals throughout the drilling process.

7.2 Spherical Ball Penetrometer (SBP) Results

(a) Introduction

The SBP has been developed in response to our client's needs for an improved continuous strength profiling capability in very soft to firm cohesive sediments. These types of soils are normally investigated using discrete down hole vane shear testing or CPT. The SBP offers a number of distinct advantages over these conventional tools (eg Chung and Randolph, 2000).

(b) SBP Tool Geometry

The PROD SBP tool comprises:

- A 60mm diameter, smooth spherical steel ball;
- The ball is attached to a 200mm long, 20mm diameter push shaft; and
- The push shaft is mounted on a modified, 36 mm diameter CPT assembly.

The push rod has been designed to eliminate frictional forces mobilised on its shaft during SBP probing. Pore water pressure can be monitored via a porous filter ring located at the midpoint of the ball. The CPT probes used for ball penetrometer testing have been calibrated for compression loading and water pressure in accordance with normal CPT testing guidelines.

(c) SBP Test Results

SBP testing was completed in borehole TRE3 only. The testing sequence was developed in conjunction with the OE client representative following a review of the CPT data acquired in borehole TRE1. The agreed testing sequence comprised:

- Monotonic installation to ML-6.5m;
- Cyclic testing over the depth interval ML-6.5m to ML-7m;
- Monotonic extraction to mudline;
- Monotonic installation to maximum borehole depth of 27.2m;
- Monotonic extraction to 21.04m
- Cyclic testing over the depth interval ML-20.52m to ML-21.04m;
- Monotonic extraction to ML-17.45m;
- Cyclic testing over the depth interval ML-16.95m to ML-17.45m;
- Monotonic extraction to ML-15m;
- Cyclic testing over the depth interval ML-15m to ML-14.5m;
- Monotonic extraction to ML-10m;
- Cyclic testing over the depth interval ML-10m to ML-9.48m;
- Monotonic extraction to mudline.

The SBP test results are provided in Appendix 4. The initial plot presents the entire depth range of probing. Subsequent plots illustrate the SBP response over the nominal depth intervals selected. It should be noted that 'positive' data generally represents 'downward' (penetration) of the SBP probe into the seabed, whilst 'negative' data represents 'upward' (extraction) of the SBP probe from the seabed. Also included on these plots are the data traces associated with the initial installation of the ball penetrometer through the soil profile prior to cycling, where appropriate. Some soil was noted both underneath and on top of the ball when the SBP tool was recovered from the borehole.

Overall velocity control of the tool during probing was relatively good, and maintained reasonably close to the nominal target rate of 20mm/second. The time interval between changes in the direction of cycling was approximately 10 seconds.

Cone 3402 was used for the deployment of the SBP (refer to Appendix 3 for standard calibration details).

7.3 Results of Seabed Sampling

(a) Sub Seabed Sampling Results

Sampling was undertaken in 2 boreholes (TRE2 and TRE6).

Borehole TRE2 was completed to 27.4m below mudline using PROD's piston sampling barrels. Excluding two sampling runs in which the piston sampling barrel blocked off before the end of stroke length (2.75m), good recovery was generally achieved for all remaining sampling runs. The sampling intervals that were completed, together with the sample recoveries that were achieved are presented in Appendix 2.

Borehole TRE6 comprised predominantly CPT testing to 13m below mudline. Piston sampling was undertaken over depth intervals of 9m to 10.3m, and 16.3m to 18.5m to obtain core sections not previously recovered during borehole TRE2.

The majority of core recovered during the site investigation was extruded and immediately logged on the vessel. A completed bore log, together with a summary of field test results completed and a sample inventory are presented in Appendix 2.

Where deemed necessary, additional laboratory testing should be completed to confirm the calcium carbonate content, density, particle size distribution and sample strengths as part of a third party geotechnical assessment of the acquired data.

The elevation of PROD relative to the mudline was monitored continually whilst on the seabed. It was found that the PROD base plate remained flush on the seabed at all times, with no visible settlement occurring during the entire course of drilling. In addition, the verticality of PROD was checked at regular intervals throughout the drilling process. Negligible (less than 25mm) fluctuations in PROD vertical position were observed during seabed operations.

7.4 Sample Storage and Processing

All sampling barrels were labelled prior to removal from PROD. Core sample liners were then re-labelled and marked with unique identification numbers (white ink) as they were extruded from the sediment and rock barrels. The individual liners were temporarily capped and then carefully carried to the logging container.

To enable vertical storage within a sample storage box, the liners were initially cut, end capped and relabelled, to reduce the length of each 'sub-liner' to less than 1.1m. Sample logging was then undertaken for the majority of soil samples recovered at the site. Following detailed logging, remaining (non-extruded) samples were end capped with close fitting plastic caps and sealed to preserve soil moisture content. The orientation of the sub samples is indicated via arrows, which indicate the correct orientation of each sample pointing down the hole.

Following logging, the samples were stored in customised vertical storage boxes. Soft foam was packed beneath and around the liners to minimise the transfer of vibration to the samples during transport. Following a direction by the OE client representative, custody of the samples was handed to the OE representative wharf side (Mr. Graham Firth) during the course of BGT's demobilisation from the vessel.

7.5 Electronic Data

Preliminary electronic copies of the following data was provided to the OE representative at or before the completion of demobilisation:

- Preliminary electronic copies of CPT data files and plots.
- Preliminary electronic copies of Ball penetrometer data files.
- Preliminary bore logs and sample summaries.

Final versions of the above data are included on a CD ROM, which will be attached to the final issue of this report.

8. DEMOBILISATION

Demobilisation was commenced on 21 September 2004, and completed the following day. Prior to commencement of demobilisation activities, a safety meeting was held for all hands. At this meeting a review of the project safety achievements was undertaken. Planned demobilisation activities were then discussed, and a review of the job hazard analyses relevant to these activities.

Key activities included:

- removal of the breakout box from PROD;
- disconnection of the main sheave and lowering to deck;
- wind in of umbilical and disconnection of main winch;
- disconnection and storage of electrical cables;
- removal of PROD from vessel;
- cutting and removal of the deck and slip guide rails, and access ramps;
- removal of miscellaneous sheaves and tugger wires;
- cutting sea fastenings on workshop and control containers, main winch, gensets;
- removal of remaining PROD equipment off vessel;
- grinding back of all welds associated with the vessel setup;
- removal of all personnel from vessel;
- final packing and equipment storage wharf side.

Demobilisation was completed successfully with no incidents or lost time injuries.

9. REVIEW OF HEALTH AND SAFETY PERFORMANCE

9.1 Key Performance Indicators - Results

This project was completed with the following key performance indicator results (Benthic Geotech related activities only):

- Zero incidents and lost time injuries, for 2,040 man hours worked;
- Completion of a HAZID during mobilisation period;
- JHA reviews were undertaken before starting each new higher risk activity;
- 16 toolbox meetings;
- 3 'all hands' vessel crew safety meetings;
- 1 vessel emergency musters;
- 2 equipment damage events – see Section 9.3(b).
- No Environmental Incidents.

9.2 Hazard Identification and Control

(a) Mobilisation Phase

A HAZID was conducted on 14 September by the BGT Party Chief and the 1st mate. This exercise was undertaken to identify hazards around the vessel, mainly arising from the installation of PROD and associated equipment on the vessel. In most cases simple engineering fixes were implemented to either mitigate, or eliminate the elevated risk to personnel and equipment. A summary of the identified hazards and the mitigative measures that were undertaken to control these are included in Appendix 5.

All of the mitigative actions were implemented prior to completion of mobilisation. A copy of the identified hazards was provided to the vessel master and was also placed on the safety noticeboard in the mess.

(b) Offshore Operations

Job Hazard Analyses (JHAs) were drafted prior to the commencement of the project and these were included in BGT's Project HSE manual. These JHAs were reviewed and refined by the BGT crew prior to the commencement of all major activities.

Safety meetings were held on a regular basis. Minutes of these meetings and attendees are briefly summarised in the daily reports. BGT conducted toolbox meetings on a daily (and often twice daily) basis, as required. These meetings included a review of relevant JHAs where new, or potentially more hazardous operations were to be undertaken. Where deemed appropriate, the 'take 5' principle was encouraged / applied as an alternative to the preparation of JHAs.

(c) Demobilisation Phase

Prior to the commencement of demobilisation, an 'all hands' safety meeting was held. A review of the project safety record was undertaken, and Job Hazard Analyses relevant to demobilisation activities were reviewed.

9.3 Incidents and Equipment Damage

(a) Incidents

Zero incidents were recorded for this project.

(b) Damage Sustained to BGT Equipment

Two cone penetrometers were damaged on separate occasions, arising from the probing of a hard strata located at approximately 28m below mudline. These events were reported in the daily reports. The CPTs were damaged throughout the course of offshore operations – however sufficient CPTs were carried on the project to ensure that offshore operations were not interrupted.

10. CONCLUSIONS

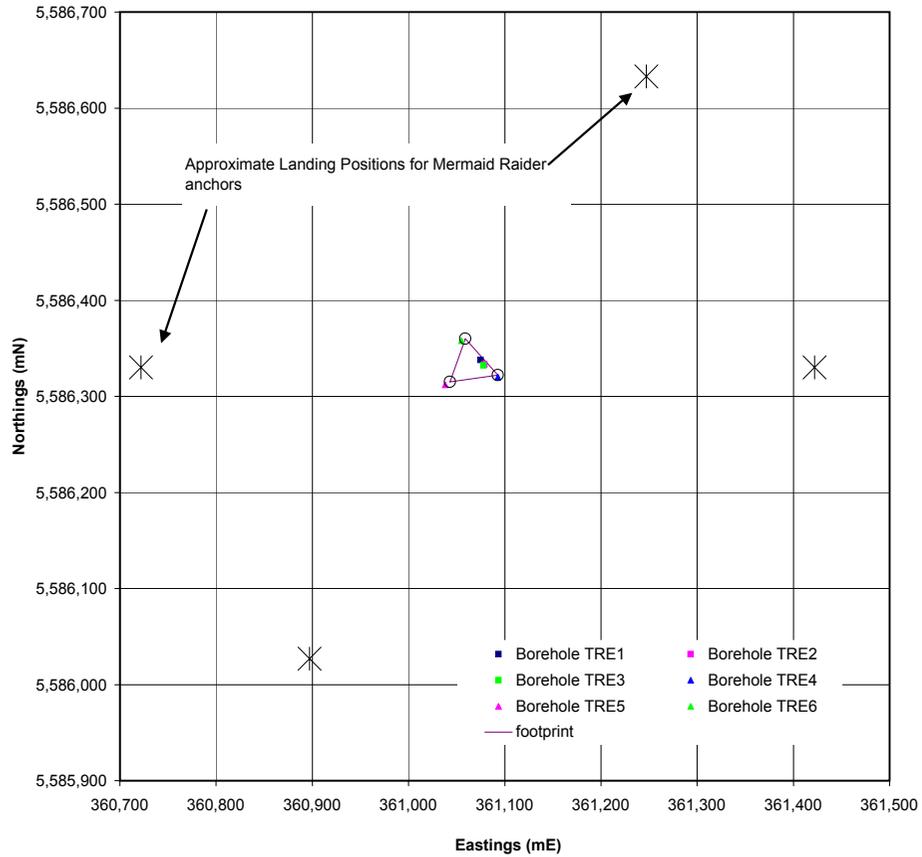
A number of comments and recommendations can be made following the completion of this project. Areas that could be improved on future projects are given below:

- Benthic Geotech are close to completing the fabrication of a dedicated launch and recovery system for PROD. This system would be most suited for future projects on reasonable sized vessels (possibly such as the Mermaid Raider), obviating the need for an A-frame and dedicated steelwork on the vessel, and reducing the time associated with vessel selection and setup on a project.
- The 4 point anchoring system worked very well on this project. However, in more marginal weather conditions significant delays would be expected with this system.
- Five penetrometer profiles were generated (four CPT and one ball penetrometer) at the site (refer to Figure 1 for locations).
- The project was completed with a good safety record, with no incidents or accidents.

* * *

FIGURES

Trefoil Site Investigation - Overall Location Plan



Trefoil Site Investigation -Detail of Enesco 102 Footprint Area

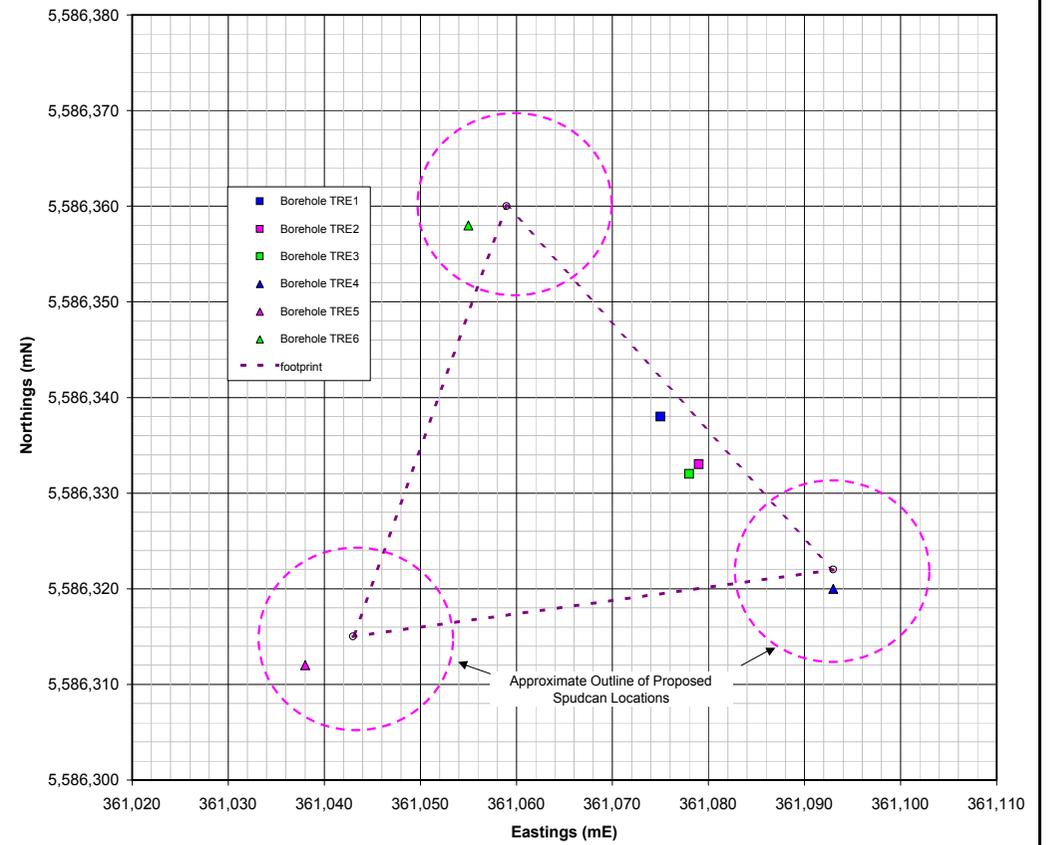
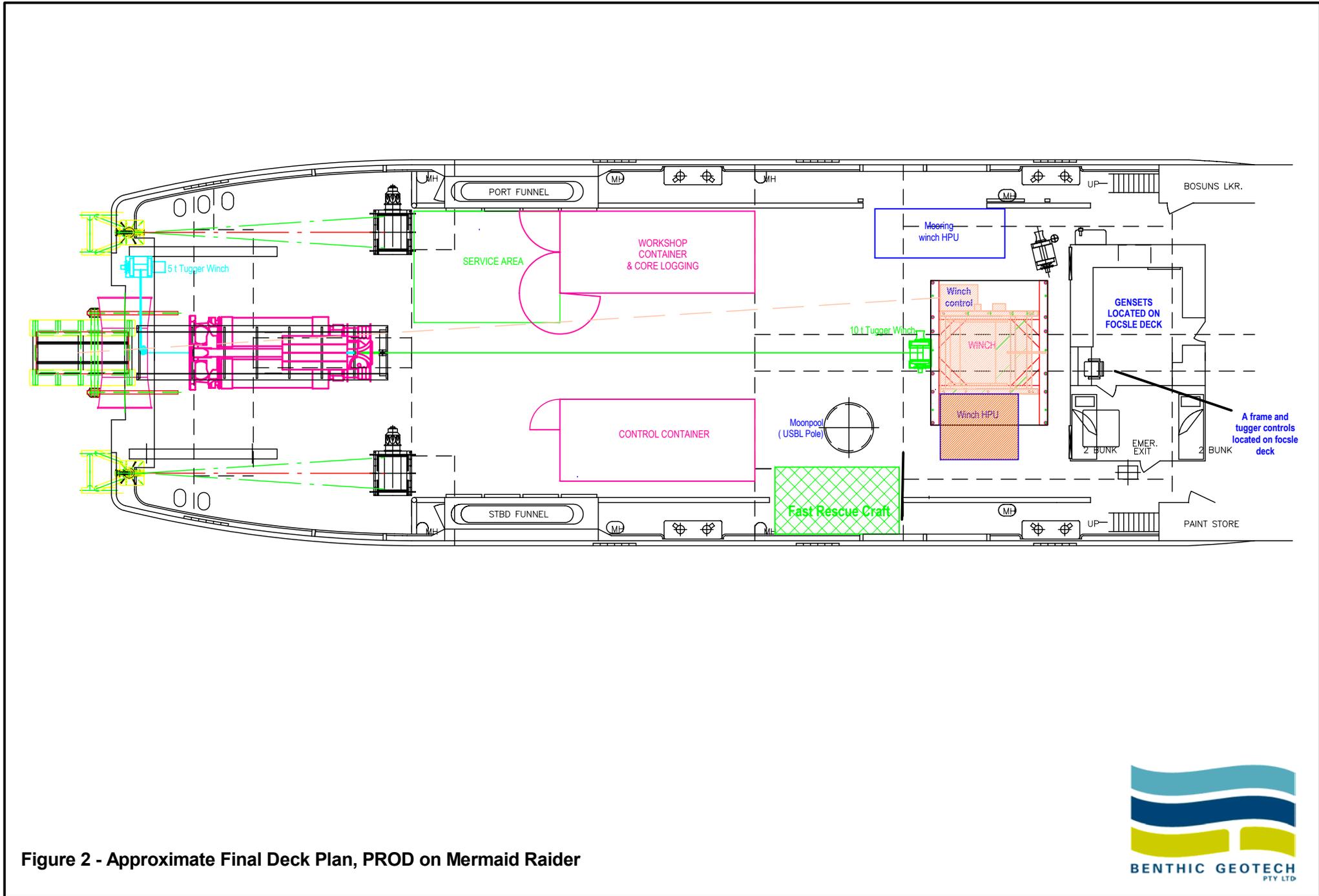


Figure 1 - Borehole and Anchor Location Details, Trefoil Site Investigation





APPENDIX 1
DAILY REPORTS

Daily Report No.1

(Post Mobilisation Reports only)

Report No: 1

Date: 15.09.04

ref #: bdr-oe2-1.xls

Client: Origin Energy Ltd

Project: Trefoil Site Investigation

Location: Bass Strait, Australia

Start date: 7.09.04

Equipment: PROD on Mermaid Raider

**A) Activities summary:** Period = 0000 - 2400 hrs, 15.09.04

<i>from</i>	<i>to</i>	<i>description</i>
0	1300	Standby to sail
1300		Slip lines, transit to Port philip Bay Mooring Trial Site
1300	2400	Standby during mooring trials

Planned activities next 24 hrs:

Standby in Port Philip Bay waiting on weather, further launch & recovery trials if possible

B) Production SummaryToday

All distances given in m

<i>Hole No.</i>	<i>Piston sampling</i>	<i>Rotary sampling</i>	<i>Thin wall sampling tube</i>	<i>CPT</i>	<i>SBP</i>	<i>Washbore</i>	<i>Casing</i>
-----------------	------------------------	------------------------	--------------------------------	------------	------------	-----------------	---------------

<i>Subtotal</i>	0	0	0	0	0	0	0
<i>Prev. total</i>	0.00	0.00	0.00	0	0.00	0	0.00
<i>Proj. Total</i>	0.00	0.00	0.00	0	0.00	0	0.00

C) Project Time Summary

<i>Cost code</i>	<i>previous</i>	<i>today</i>	<i>to date</i>	<i>description</i>
mob	91	0	91	Mobilisation activities
sta	7	24	31	Standby (weather & transit & vessel tests)
ops	0	0	0	PROD operations
stm	0	0	0	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	0	0	Demobilisation activities
<i>Total</i>		24	31	

D) Deployments Insurance Costs

<i>WEL cost</i>	<i>BGT cost</i>	<i>Total</i>	
0	0	0	Deployment in water < 100 m

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues

BGT Crewsize: 11 (including surveyor)

	<i>previous</i>	<i>today</i>	<i>to date</i>
<i>Onboard training</i>			
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

<i>Statistics</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Total manhrs	974	264	1238
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	1	0	1
# Toolbox meetings	8	1	9

*Daily Safety meetings*Meetings Day # **9**Vessel safety meeting

*Issued copy of PROD emergency procedures version 2 to Master
 Issued copy of PROD launch & recovery procedures version 2 to Master
 HAZID completed and displayed on safety board in mess*

Toolbox Meeting: #1

Minutes: *Vessel inductions, Emergnecy drill and safety meeting held today
 Discussed inherent hazards of PROD rails, mooring winch lines after vessel setup completed*

F) Weather (Port Philip Bay)

			Description
Wind	10-20	knots	<i>Weather in Bass Strait unsuitable for vessel mooring and PROD launch and recovery, standby in Port Philip Bay for suitable weather window</i>
Swell	1-1.5	m	

G) Lost and Damaged Equipment**H) Other comments**

Mobilisation completed successfully yesterday, Benthic Geotech on standby from 1700 hours 14 September 2004.

H) Clients comments**H) Signoff**

Pat Kelleher
 BGT Party Chief

Steve Neubecker
 Origin Client Rep.

Daily Report No.2

(Post Mobilisation Reports only)

Report No: 2

Date: 16.09.04

ref #: bdr-oe2-2.xls

Client: Origin Energy Ltd

Project: Trefoil Site Investigation

Location: Bass Strait, Australia

Start date: 7.09.04

Equipment: PROD on Mermaid Raider

**A) Activities summary:** Period = 0000 - 2400 hrs, 16.09.04

<i>from</i>	<i>to</i>	<i>description</i>
0	2400	Standby during anchor trials

Planned activities next 24 hrs:

Standby in Port Philip Bay until decision to steam to Trefoil

B) Production SummaryToday

All distances given in m

<i>Hole No.</i>	<i>Piston sampling</i>	<i>Rotary sampling</i>	<i>Thin wall sampling tube</i>	<i>CPT</i>	<i>SBP</i>	<i>Washbore</i>	<i>Casing</i>
-----------------	------------------------	------------------------	--------------------------------	------------	------------	-----------------	---------------

<i>Subtotal</i>	0	0	0	0	0	0	0
<i>Prev. total</i>	0.00	0.00	0.00	0	0.00	0	0.00
<i>Proj. Total</i>	0.00	0.00	0.00	0	0.00	0	0.00

C) Project Time Summary

<i>Cost code</i>	<i>previous</i>	<i>today</i>	<i>to date</i>	<i>description</i>
mob	91	0	91	Mobilisation activities
sta	31	24	55	Standby (weather & transit & vessel tests)
ops	0	0	0	PROD operations
stm	0	0	0	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	0	0	Demobilisation activities
<i>Total</i>		24	55	

D) Deployments Insurance Costs

<i>WEL cost</i>	<i>BGT cost</i>	<i>Total</i>	
0	0	0	Deployment in water < 100 m

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues BGT Crewsize: 11 (including surveyor)

	<i>previous</i>	<i>today</i>	<i>to date</i>
<i>Onboard training</i>			
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

	<i>previous</i>	<i>today</i>	<i>to date</i>
<i>Statistics</i>			
Total manhrs	1238	264	1502
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	1	0	1
# Toolbox meetings	9	1	10

Daily Safety meetings

Meetings Day # **10**

Vessel safety meeting

Toolbox Meeting: #10

Minutes: *Discussed planned activities for day with Benthic Geotech crew*

Discussed HAZID sheet, check to closeout actions today

F) Weather (Port Philip Bay)

			Description
Wind	10-20	knots	<i>Weather in Bass Strait unsuitable for vessel mooring and PROD launch and recovery, standby in Port Philip Bay for suitable weather window</i>
Swell	1-1.5	m	

G) Lost and Damaged Equipment

H) Other comments

nil

H) Clients comments

H) Signoff

Pat Kelleher
BGT Party Chief

Steve Neubecker
Origin Client Rep.

Daily Report No.3

(Post Mobilisation Reports only)

Report No: 3

Date: 17.09.2004

ref #: bdr-oe2-3.xls

Client: Origin Energy Ltd

Project: Trefoil Site Investigation

Location: Bass Strait, Australia

Start date: 7.09.04

Equipment: PROD on Mermaid Raider

**A) Activities summary:** Period = 0000 - 2400 hrs, 17.09.2004

<i>from</i>	<i>to</i>	<i>description</i>
0	1200	Standby IN Port Philip Bay
1200	2400	Transit to lee of King Island

Planned activities next 24 hrs:

Standby in lee of King Island for weather to improve at trefoil

B) Production Summary

<u>Today</u>	<i>All distances given in m</i>						
<i>Hole No.</i>	<i>Piston sampling</i>	<i>Rotary sampling</i>	<i>Thin wall sampling tube</i>	<i>CPT</i>	<i>SBP</i>	<i>Washbore</i>	<i>Casing</i>

<i>Subtotal</i>	0	0	0	0	0	0	0
<i>Prev. total</i>	0.00	0.00	0.00	0	0.00	0	0.00
<i>Proj. Total</i>	0.00	0.00	0.00	0	0.00	0	0.00

C) Project Time Summary

<i>Cost code</i>	<i>previous</i>	<i>today</i>	<i>to date</i>	<i>description</i>
mob	91	0	91	Mobilisation activities
sta	55	24	79	Standby (weather & transit & vessel tests)
ops	0	0	0	PROD operations
stm	0	0	0	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	0	0	Demobilisation activities
<i>Total</i>		24	79	

D) Deployments Insurance Costs

<i>WEL cost</i>	<i>BGT cost</i>	<i>Total</i>	
0	0	0	Deployment in water < 100 m

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues

BGT Crewsize: 11 (including surveyor)

<i>Onboard training</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

<i>Statistics</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Total manhrs	1380	132	1512
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	1	1	2
# Toolbox meetings	10	1	11

*Daily Safety meetings*Meetings Day # **12**Vessel safety meetingToolbox Meeting: #10Minutes: *Discussed planned activities for day with Benthic Geotech crew**Sea fastening of PROD, install tool loading for first hole, sea fasten all loose equipment, sail at 1200 hrs**Discussed hazards of tool loading***F) Weather (Port Philip Bay)**

Wind	10	knots	Description	<i>Weather at Trefoil unsuitable for vessel mooring and PROD launch and recovery.</i>
Swell	<1	m		

G) Lost and Damaged Equipment**H) Other comments**

nil

H) Clients comments**H) Signoff**

Pat Kelleher
BGT Party Chief

Steve Neubecker
Origin Client Rep.

Daily Report No.4

(Post Mobilisation Reports only)

Report No: 4

Date: 18.09.04

ref #: bdr-oe2-4.xls

Client: Origin Energy Ltd

Project: Trefoil Site Investigation

Location: Bass Strait, Australia

Start date: 7.09.04

Equipment: PROD on Mermaid Raider



A) Activities summary: Period = 0000 - 2400 hrs, 18.09.04

from	to	description
0	0100	Transit to lee of King Island
0100	0800	Standby in lee of King Island waiting on weather
0800	1415	Transit to Trefoil
1430	1445	Toolbox meeting to discuss weather conditions and station keeping requirements
1500	1930	Start running anchors to test holding capability
1930	2100	Position vessel at at launch position then move forward 25m
2100	2300	Vessel station keeping test
2100	2300	Start building and loading CPT tools
2330	2400	PROD pre flights for launch

Planned activities next 24 hrs:

Luanch and land, commence borehole TRE1

B) Production Summary

Today	All distances given in m						
Hole No.	Piston sampling	Rotary sampling	Thin wall sampling tube	CPT	SBP	Washbore	Casing

Subtotal	0	0	0	0	0	0	0
Prev. total	0.00	0.00	0.00	0	0.00	0	0.00
Proj. Total	0.00	0.00	0.00	0	0.00	0	0.00

C) Project Time Summary

Cost code	previous	today	to date	description
mob	91	0	91	Mobilisation activities
sta	79	23	102	Standby (weather & transit & vessel tests)
ops	0	1	1	PROD operations
stm	0	0	0	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	0	0	Demobilisation activities
Total	24	194		

D) Deployments Insurance Costs

WEL cost	BGT cost	Total	
0	0	0	Deployment in water < 100 m

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues BGT Crewsize: 11 (including surveyor)

	<i>previous</i>	<i>today</i>	<i>to date</i>
<i>Onboard training</i>			
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

<i>Statistics</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Total manhrs	1512	132	1644
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	2	0	2
# Toolbox meetings	11	1	12

Daily Safety meetings

Meetings Day # **13**

Vessel safety meeting

Toolbox Meeting: #10

Minutes: *Discussed planned activities for day with Benthic Geotech crew*

Toolbox and JHA review for first launch

F) Weather (Port Philip Bay)

Wind	10	knots	Description	<i>Weather at Trefoil becoming suitable for vessel mooring and PROD launch and recovery early tomorrow.</i>
Swell	2 to 5	m		

G) Lost and Damaged Equipment

H) Other comments

Vessel station keeping test completed successfully, generally maintained station within 5m diameter circle during trials, winching forward and aft also completed successfully.

H) Clients comments

H) Signoff

Pat Kelleher
BGT Party Chief

Steve Neubecker
Origin Client Rep.

Daily Report No.5

(Post Mobilisation Reports only)

Report No: 5

Date: 19.09.2004

ref #: bdr-oe2-5.xls

Client: Origin Energy Ltd

Project: Trefoil Site Investigation

Location: Bass Strait, Australia

Start date: 7.09.04

Equipment: PROD on Mermaid Raider

**A) Activities summary:** Period = 0000 - 2400 hrs, 19.09.2004

from	to	description
0000	0015	Toolbox meeting, JHA review before launch
0015	0100	Complete preflight testing
0100	300	Launch PROD from vessel, land PROD and setup catenary
0300	1045	Complete borehole TRE1 (CPT and dissipation testing) to 28.124 m
1045	1145	Move vessel over PROD, lift off bottom, swim to borehole location TRE2, reset catenary
1145	1200	Toolbox meeting to discuss recovery to vessel
1200	2030	Complete borehole TRE2 (piston sampling) to 27.488 m
2030	2100	Move vessel over PROD, lift off bottom, swim to borehole location TRE3, reset catenary
2100	2200	Setting up on location for ball penetrometer testing
2200	2400	Undertaking borehole TRE3 (ball penetrometer)

Planned activities next 24 hrs:

Complete borehole TRE3, recover PROD to deck, service tools & recovery of data, redeploy for spud can boreholes

B) Production Summary

Hole No.	All distances below given in m							
	Piston sampling (m)	Rotary sampling (m)	Thin wall sampling tube (m)	CPT (m)	Dissipation (no.)	SBP* (m)	Washbore (m)	Casing (m)
TRE1	0.0	0.0	0.0	28.1	10.0	0.0	63.1	0.0
TRE2	27.66	0.00	0.00	0	0	0.00	0	24.04
TRE3	0.00	0.00	0.00	0.00	0	62.16	0.00	0.00
Subtotal	27.655	0	0	28.117	10	62.16	63.14	24.037
Prev. total	0.00	0.00	0.00	0	0	0.00	0	0.00
Proj. Total	27.66	0.00	0.00	28.12	10	62.16	63.14	24.04

* Spherical ball penetrometer meterage includes distance covered during cyclic loops.

C) Project Time Summary

Cost code	previous	today	to date	description
mob	91	0	91	Mobilisation activities
sta	102	0	102	Standby (weather & transit & vessel tests)
ops	1	22	23	PROD operations
stm	0	2	2	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	0	0	Demobilisation activities
Total		24	218	

D) Deployments Insurance Costs

OEL cost	BGT cost	Total	
3	0	3	Deployment in water < 100 m

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues

		BGT Crewsize: 11 (including surveyor)	
	<i>previous</i>	<i>today</i>	<i>to date</i>
Onboard training			
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

<i>Statistics</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Total manhrs	1644	132	1776
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	2	0	2
# Toolbox meetings	12	1	13

*Daily Safety meetings*Meetings Day # **14**Vessel safety meetingToolbox Meeting: 11

Minutes: *Discussed method of recovering PROD from seabed at sea onto vessel*
Discussed method of moving PROD whilst in water column between locations

F) Weather (Port Philip Bay)

Wind	<10 knots	knots	Description	Weather at Trefoil suitable for vessel mooring and PROD seabed operations.
Swell	1 to 2	m		

G) Lost and Damaged Equipment*Cone 3402 (ball penetrometer) damaged due to hard geology, push shaft also bent***H) Other comments***Damaged ball penetrometer equipment arising due to interception with a hard, irregular geology.***H) Clients comments****H) Signoff**

Pat Kelleher
BGT Party Chief

Steve Neubecker
Origin Client Rep.

Daily Report No.6

(Post Mobilisation Reports only)

Report No: 6

Date: 20.09.2004

ref #: bdr-oe2-6.xls

Client: Origin Energy Ltd
 Project: Trefoil Site Investigation
 Location: Bass Strait, Australia
 Start date: 7.09.04
 Equipment: PROD on Mermaid Raider

**A) Activities summary:** Period = 0000 - 2400 hrs, 20.09.2004

from	to	description
0000	200	Complete borehole TRE3
200	230	PROD recovered to deck & sea fastened
230	800	CPT & sample unloading and processing, preflighting for next borehole
800	0845	Launch and land PROD and setup for drilling borehole TRE4
0845	0930	Complete borehole TRE4 to 13.025m (CPT)
0930	1030	Move vessel over PROD, pick up off seabed, and move to location TRE5
1030	1130	Complete borehole TRE5 to 13.025m
1130	1250	Move vessel over PROD, lift off seabed, move to location TRE6, land and reset catenary
1250	1645	Complete borehole TRE6 to 13.02m
1645	1815	Winch over PROD, recover to deck, sea fasten, unload tools
1815	2015	Standby whilst vessel recovers anchors, to commence unloading and processing of soil samples
2015	2100	Stern anchors recovered, processing of core samples and drill tools from borehole TRE6
2100	2400	Standby during transit for demobilisation

Planned activities next 24 hrs:

Transit to Port Melbourne for demobilisation, commence demobilisation

B) Production Summary

Hole No.	All distances below given in m							
	Piston sample (m)	Rotary sample (m)	Thin wall sample tube (m)	CPT (m)	Dissipation (no.)	SBP* (m)	Washbore (m)	Casing (m)
TRE3	0	0	0	0	na	18.83	0	0
TRE4	0.0	0.0	0.0	13.0	na	0.0	0.0	0.0
TRE5	0.00	0.00	0.00	13	na	0.00	0	0.00
TRE6	3.53	3.28	0.00	8.59	na	0.00	9.00	15.78
Subtotal	3.527	3.276	0	34.643	0	18.83	9	15.78
Prev. total	27.66	0.00	0.00	28	10	62.16	63	24.04
Proj. Total	31.18	3.28	0.00	62.76	10.00	80.99	72.14	39.82

* Spherical ball penetrometer meterage includes distance covered during cyclic loops.

C) Project Time Summary

Cost code	previous	today	to date	description
mob	91	0	91	Mobilisation activities
sta	102	5	107	Standby (weather & transit & vessel tests)
ops	23	19	42	PROD operations
stm	2	0	2	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	0	0	Demobilisation activities
Total	24	24		

D) Deployments Insurance Costs

6 liftoffs and landings from seabed, 2 launches and recoveries on and off vessel

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues BGT Crewsize: 11 (including surveyor)

	<i>previous</i>	<i>today</i>	<i>to date</i>
Onboard training			
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

<i>Statistics</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Total manhrs	1776	132	1908
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	2	0	2
# Toolbox meetings	13	1	14

*Daily Safety meetings*Meetings Day # **15**Vessel safety meetingToolbox Meeting: 13Minutes: *Discussed retrieval of PROD, unloading tools, processing of samples and what's for dinner tonight.***F) Weather (Port Philip Bay)**

		Description	
Wind	<10 knots		<i>Weather at Trefoil suitable for vessel mooring and PROD seabed operations.</i>
Swell	<1m		

G) Lost and Damaged Equipment**H) Other comments**

At request of client reps, 3 additional boreholes were completed today at proposed locations of spudcans. Two boreholes (TRE4 and TRE5) were completed to approximately 13m. On the third borehole (TRE6) CPT as well as limited sampling was undertaken to progress the borehole to a maximum depth of 18.54m. Due to urgency to commence vessel transit to Melbourne, the soil samples are to be processed once anchor recovery has been completed on the rear deck. Soil samples recovered from borehole TRE2 were processed on deck and logged during course of proceeding boreholes.

H) Clients comments**H) Signoff**

Pat Kelleher
BGT Party Chief

Steve Neubecker
Origin Client Rep.

Daily Report No. 7

(Post Mobilisation Reports only)

Report No: 7

Date: **21.09.2004**ref #: **bdr-oe2-7.xls**

Client: *Origin Energy Ltd*
Project: *Trefoil Site Investigation*
Location: *Bass Strait, Australia*
Start date: *7.09.04*
Equipment: *PROD on Mermaid Raider*

**A) Activities summary:** Period = 0000 - 2400 hrs, **21.09.2004**

<i>from</i>	<i>to</i>	<i>description</i>
0000	1130	Transit to Port Melbourne for demobilisation
1145	1200	Vessel safety and close out meeting
1200	2400	Benthic Geotech demobilisation

Planned activities next 24 hrs:

Demobilisation and equipment packing

B) Production SummaryToday*All distances below given in m*

<i>Hole No.</i>	<i>Piston sampling (m)</i>	<i>Rotary sampling (m)</i>	<i>Thin wall sampling tube (m)</i>	<i>CPT (m)</i>	<i>Dissipation (no.)</i>	<i>SBP* (m)</i>	<i>Washbore (m)</i>	<i>Casing (m)</i>
-----------------	----------------------------	----------------------------	------------------------------------	----------------	--------------------------	-----------------	---------------------	-------------------

<i>Subtotal</i>	0	0	0	0	0	0	0	0
<i>Prev. total</i>	31.18	3.28	0.00	63	10	80.99	72	39.82
<i>Proj. Total</i>	31.18	3.28	0.00	62.76	10.00	80.99	72.14	39.82

* Spherical ball penetrometer meterage includes distance covered during cyclic loops.

C) Project Time Summary

<i>Cost code</i>	<i>previous</i>	<i>today</i>	<i>to date</i>	<i>description</i>
mob	91	0	91	Mobilisation activities
sta	107	12	119	Standby (weather & transit & vessel tests)
ops	42	0	42	PROD operations
stm	2	0	2	Chargeable non routine maintenance
nil	0	0	0	Non chargeable non routine maintenance
dem	0	12	12	Demobilisation activities
<i>Total</i>		24	266	

D) Deployments Insurance Costs

6 liftoffs and landings from seabed, 2 launches and recoveries on and off vessel

NB: Chargeable deployments are calculated at completion of each borehole

E) HSE Issues BGT Crewsize: 11 (including surveyor)

<i>Onboard training</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Project inductions (BGT)	11	0	11
Vessel inductions (BGT)	13	0	13

<i>Statistics</i>	<i>previous</i>	<i>today</i>	<i>to date</i>
Total manhrs	1908	132	2040
# LTIs	0	0	0
# Incidents/Accidents	0	0	0
# Vessel ERP drills	2	0	2
# Toolbox meetings	14	1	15

*Daily Safety meetings*Meetings Day # **16**Vessel safety meetingToolbox Meeting: 14

Minutes: *Discussed planned emobilisation activities off vessel*
Review of HSE and safety record, reminder of demobilisation hazards

F) Weather (Port Philip Bay)

		Description
Wind	<10 knots	
Swell	<1m	

G) Lost and Damaged Equipment**H) Other comments****H) Clients comments****H) Signoff**

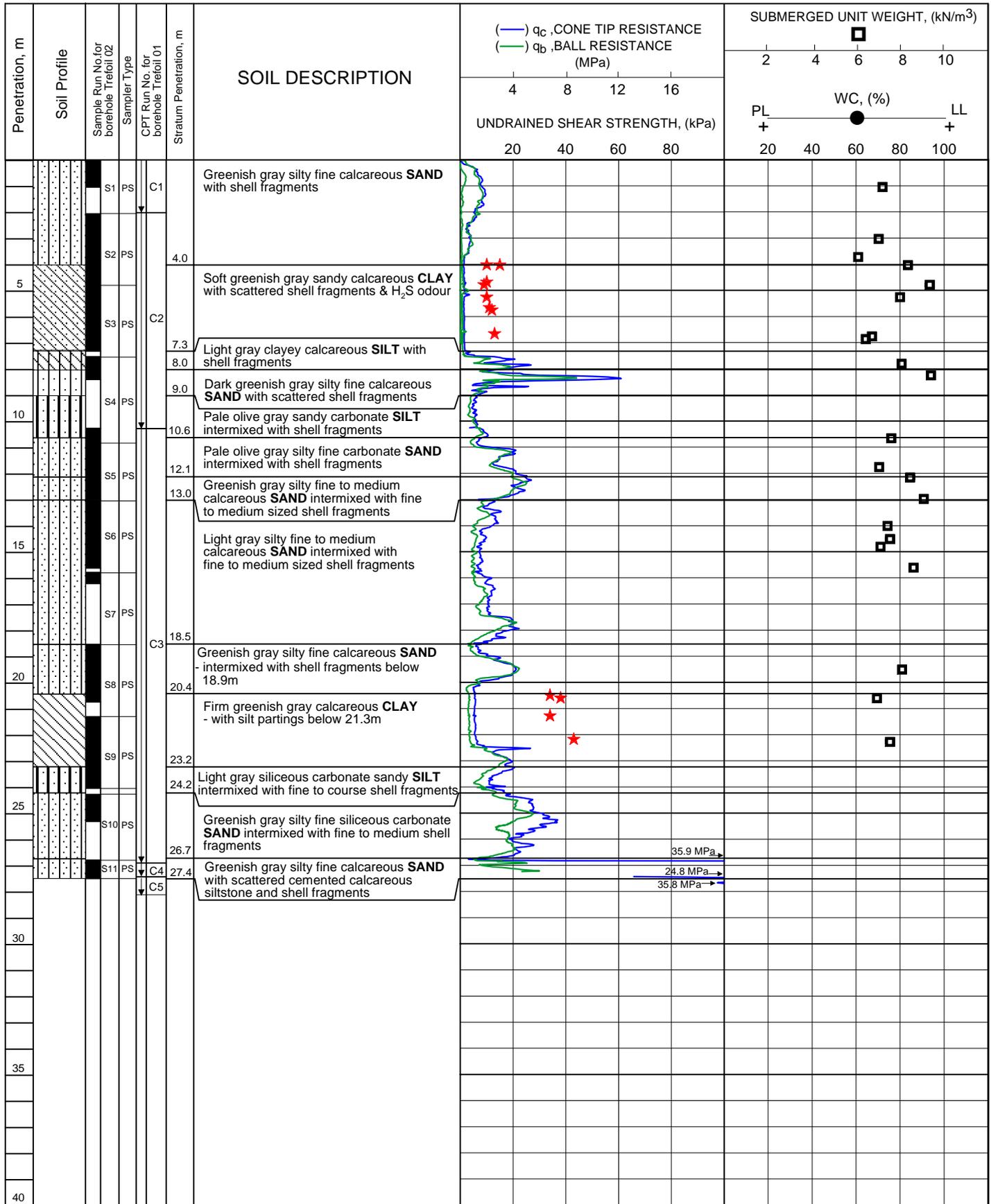
Pat Kelleher
BGT Party Chief

Steve Neubecker
Origin Client Rep.

APPENDIX 2
RESULTS OF SEABED SAMPLING ACTIVITIES

The following pages contain a summary of the sampling intervals completed, borelogs for the recovered samples, and a sample inventory.

Material types, states and compositions have been based on visual logging techniques only – confirmation of these logs can only be completed via further detailed laboratory testing at an onshore testing laboratory.



Date: September 20, 2004
 Project: Trefoil Soil Investigation
 Client: Origin Energy
 Location: Bass Strait, Victoria
 Coordinates: 361 079m E, 5586 333m N (Boring, Trefoil 02)
 361 075m E, 5586 338m N (CPT, Trefoil 01)
 361 078m E, 5586 332m N (SBP, Trefoil 03)
 Water Depth: 70 m
 Drilling Equipment: PROD

Legend
 Type of test for Undrained Shear Strength:
 ★ Torvane
Note
 1. Sampler Type: PS - Piston Sediment
 2. Standard Classification: ASTM D2487-00



TREFOIL SITE INVESTIGATION
SAMPLE RECOVERY ASSESSMENT

Sampler Type	Sample No.	Penetration, mm		Recovered Length, mm	% Recovery
		from	to		
PS	TRE-02-1	0	2037	1040	51.1
PS	TRE-02-2	2037	4787	2750	100.0
PS	TRE-02-3	4761	7537	2560	92.2
PS	TRE-02-4	7512	10827	890	26.8
PS	TRE-02-5	10260	13037	2720	97.9
PS	TRE-02-6	13011	15787	2600	93.7
PS	TRE-02-7	15761	18537	445	16.0
PS	TRE-02-8	18514	21287	2228	80.3
PS	TRE-02-9	21279	24037	2758	100.0
PS	TRE-02-10	24258	26787	1050	41.5
PS	TRE-02-11	26776	27488	712	100.0
PS	TRE-06-1	8996	10287	1264	97.9
RC	TRE-06-3	15780	16301	521	100.0
PS	TRE-06-4	16304	18537	1500	67.2

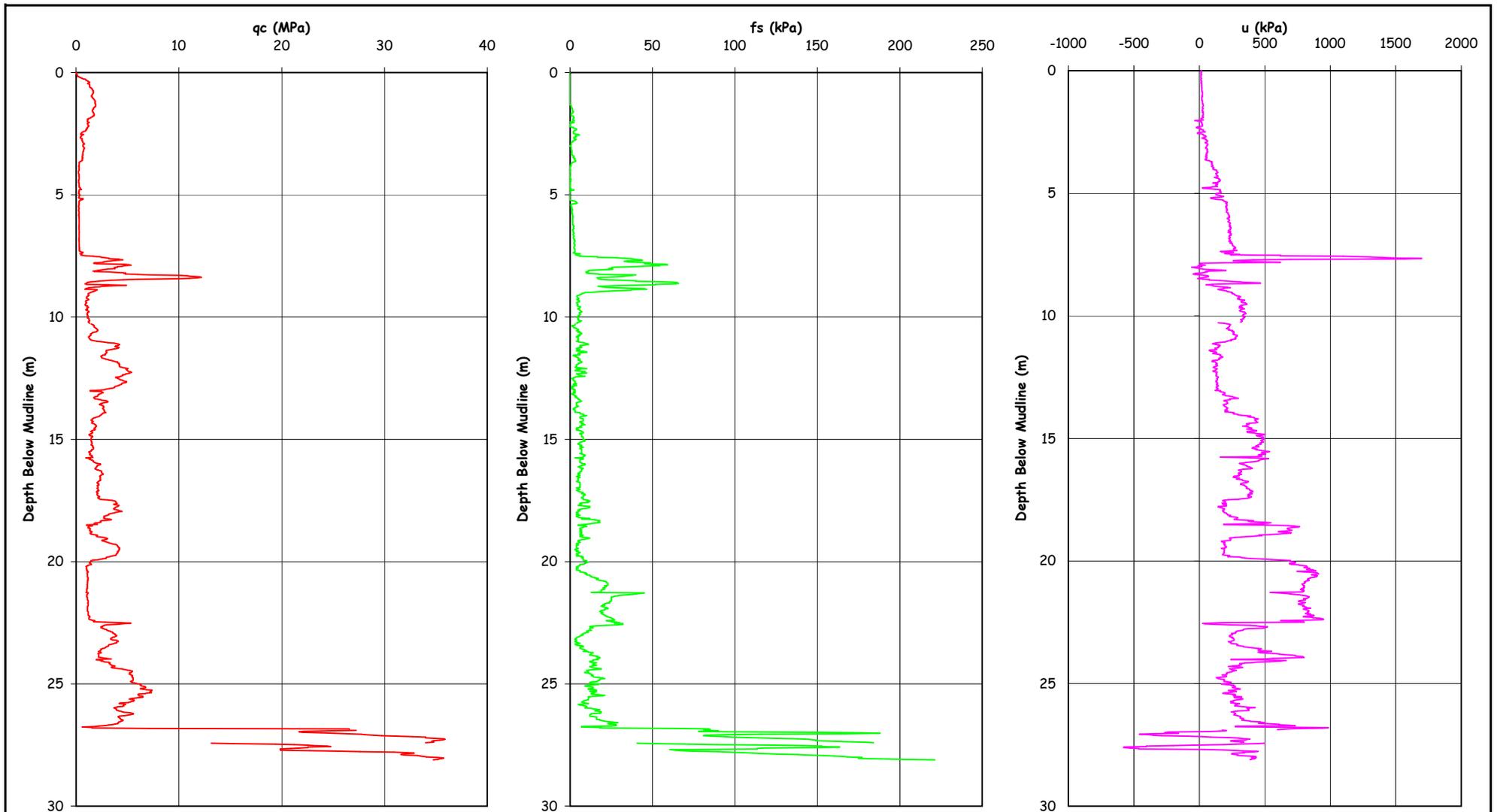
Note: PS - Piston sediment, RC - Rock core

TREFOIL SITE INVESTIGATION
LIST OF RECOVERED SAMPLES



BAG SAMPLES			TUBE SAMPLES	
Sample No.	Depth, mm	Bag No.	Sample Tubes	Depth, mm
1B	1040	B	1	0-920
2B	3027	B	2	2037-3017
2C	4027	B	3	3037-3717
2D	4027	B	4	4761-5261
2E	4787	B	5	5761-6661
2F	4774	B	6	8996-9996
3A	5261	B	7	9996-10260
3C	6761	B	8	16304-17304
3D	6800	B	9	17304-17804
3E	7300	B	10	19514-20442
4A	7812	B	11	21279-22179
4B	8402	B	12	22279-23179
5A	10760	A	13	23279-24077
5B	11260	B	14	24258-25148
5C	11260-11760	B	-	-
5D	11760-12260	A	-	-
5E	12260-12660	A	-	-
5F	12660-12980	A	-	-
6A	13011-13511	A	-	-
6B	13511-14011	A	-	-
6C	14011-14511	A	-	-
6D	14511-15011	A	-	-
6E	15011-15611	A	-	-
7	15761-16206	B	-	-
8A	19414-19514	A	-	-
8B	18514-18914	A	-	-
8C	18914-19414	A	-	-
9A	22179-22279	A	-	-
9B	23179-23279	A	-	-
10A	25158-25308	A	-	-
11	26776-27488	A	-	-

APPENDIX 3
RESULTS OF CPT PROBING

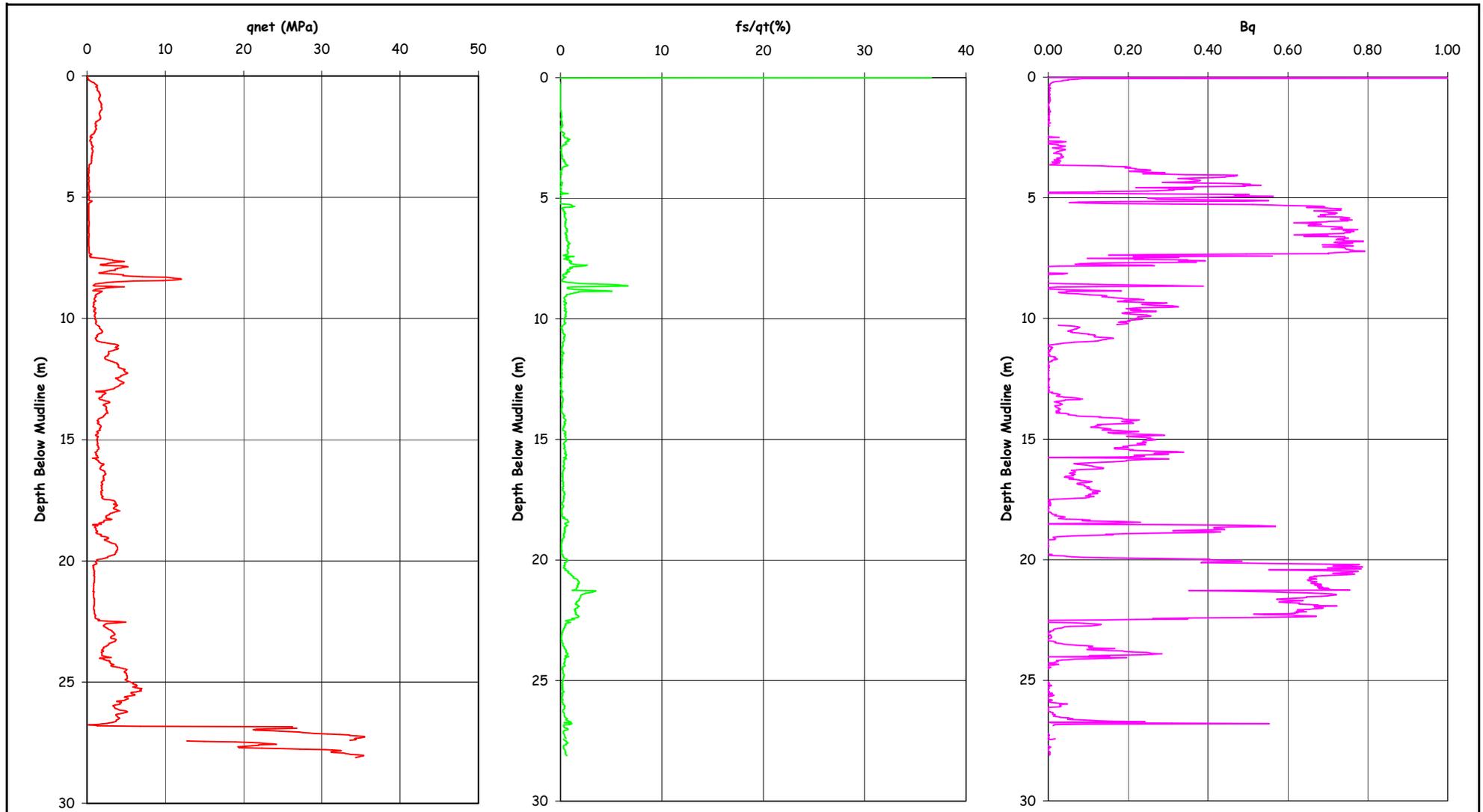


PROD CPT test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 18.Sep.2004
 Data Status Final

Borehole No. TRE1
 Eastings (mE) 361,075
 Northings (mN) 5,586,338
 Depth Datum Mudline





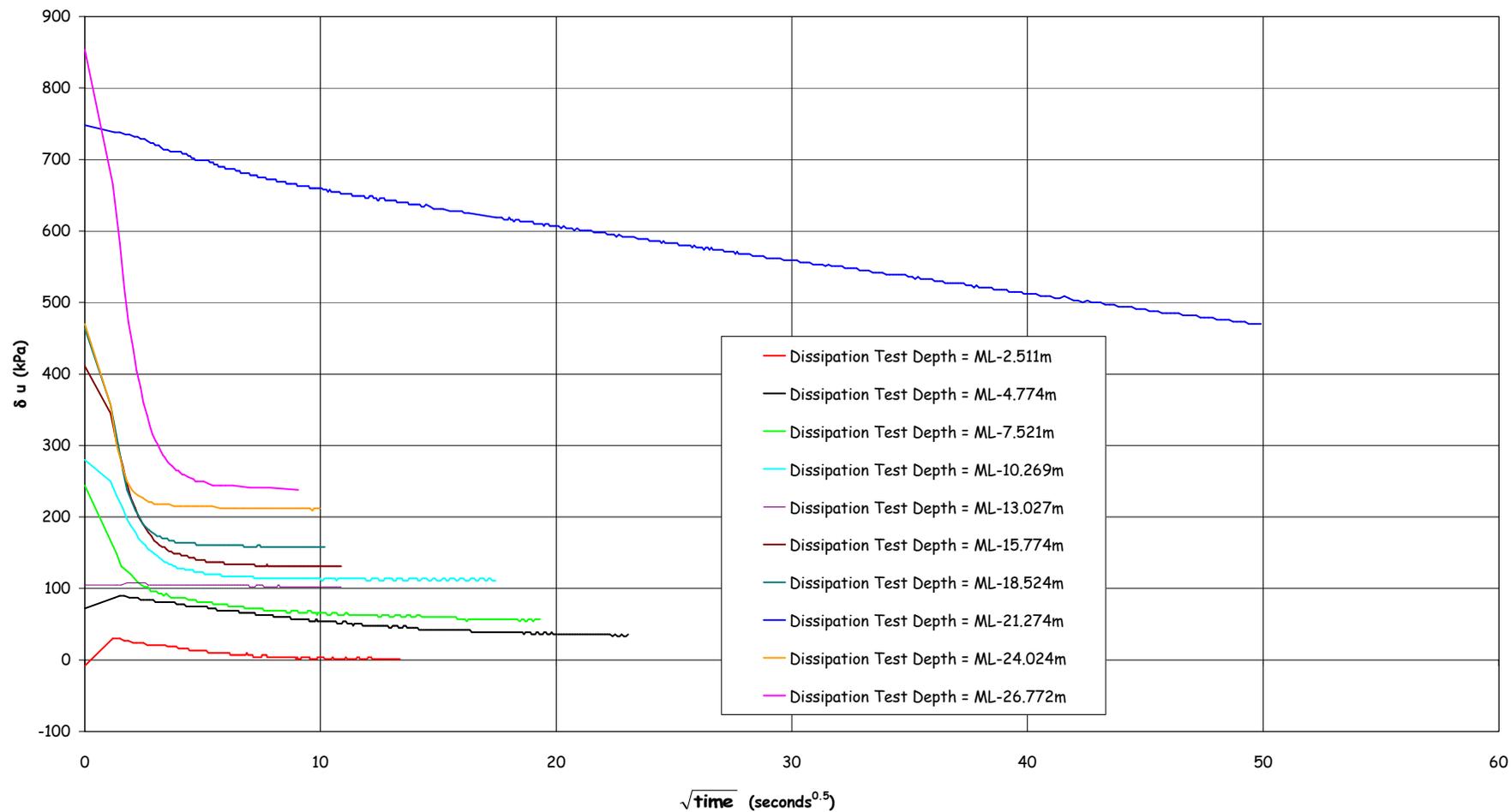
PROD CPT test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 18.Sep.2004
 Data Status Final

Borehole No. TRE1
 Eastings (mE) 361,075
 Northings (mN) 5,586,338.0
 Depth Datum Mudline

Assumed submerged soil density (kN/m^3) 8



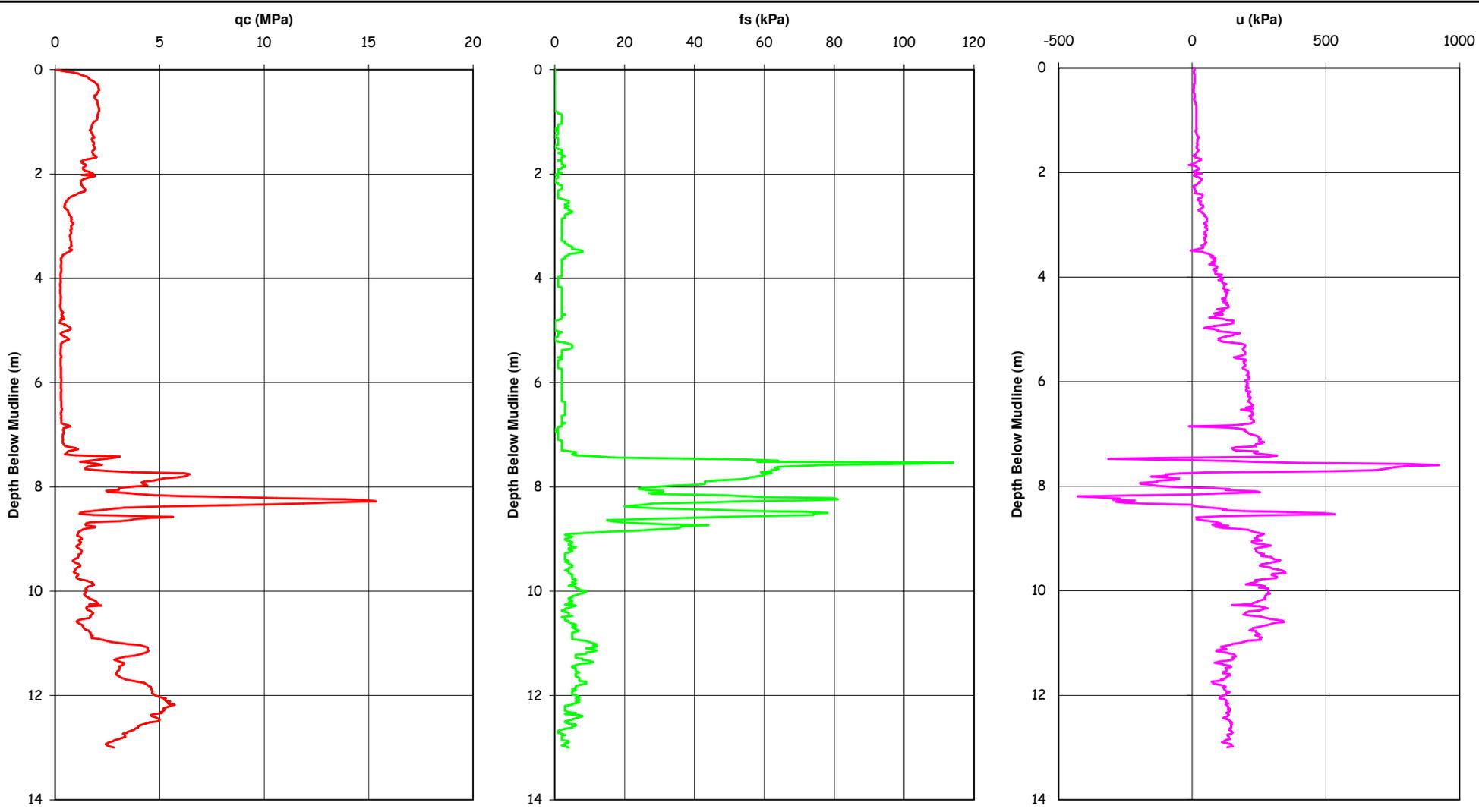


PROD CPT Dissipation Test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 18.Sep.2004
 Data Status Final

Borehole No. TRE1
 Eastings (mE) 361,075
 Northings (mN) 5,586,338
 Depth Datum Mudline



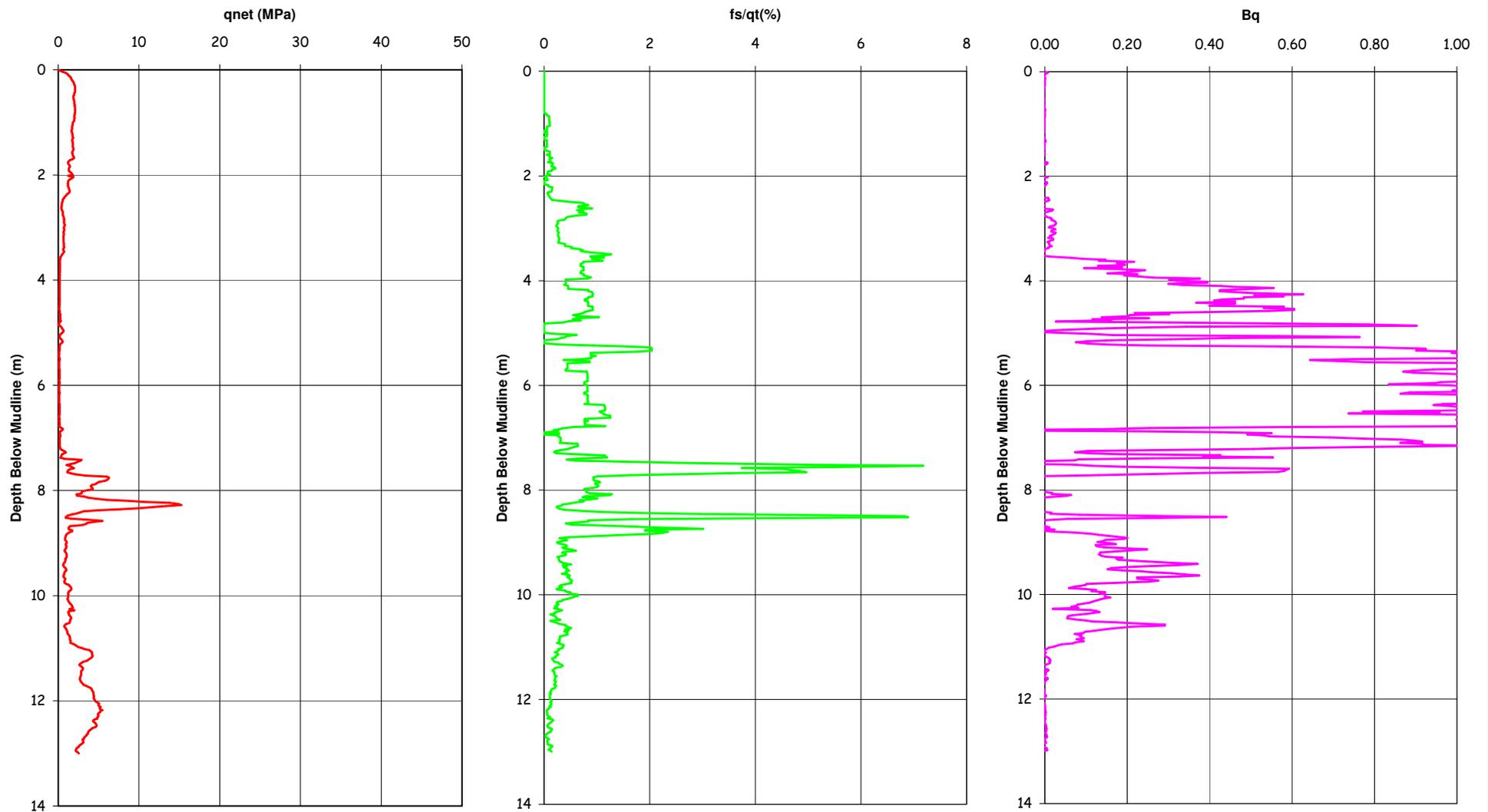


PROD CPT test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 20.Sep.2004
 Data Status Final

Borehole No. TRE4
 Eastings (mE) 361,093.0
 Northings (mN) 5,586,320.0
 Depth Datum Mudline





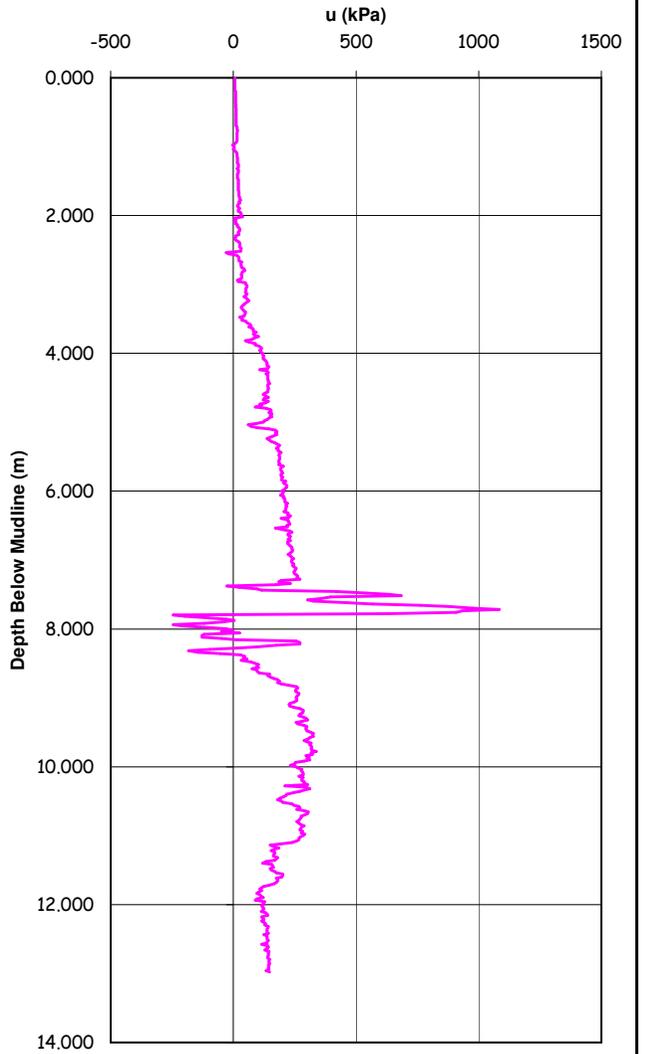
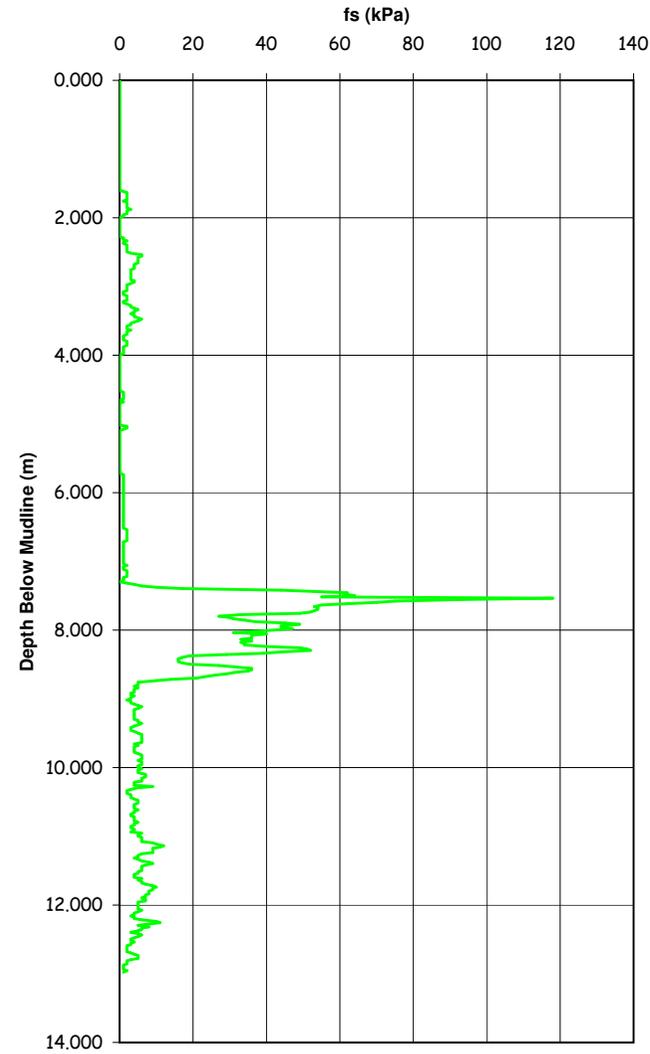
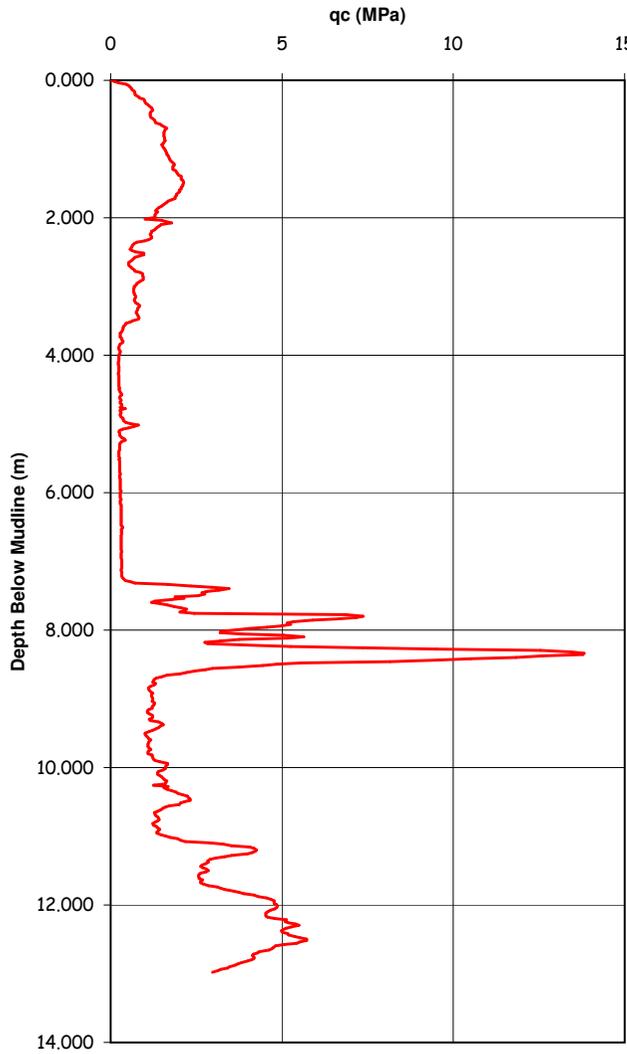
PROD CPT test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 20.Sep.2004
 Data Status Final

Borehole No. TRE4
 Eastings (mE) 361,093.0
 Northings (mN) 5,586,320.0
 Depth Datum Mudline

Assumed submerged soil density (kN/m³) 8



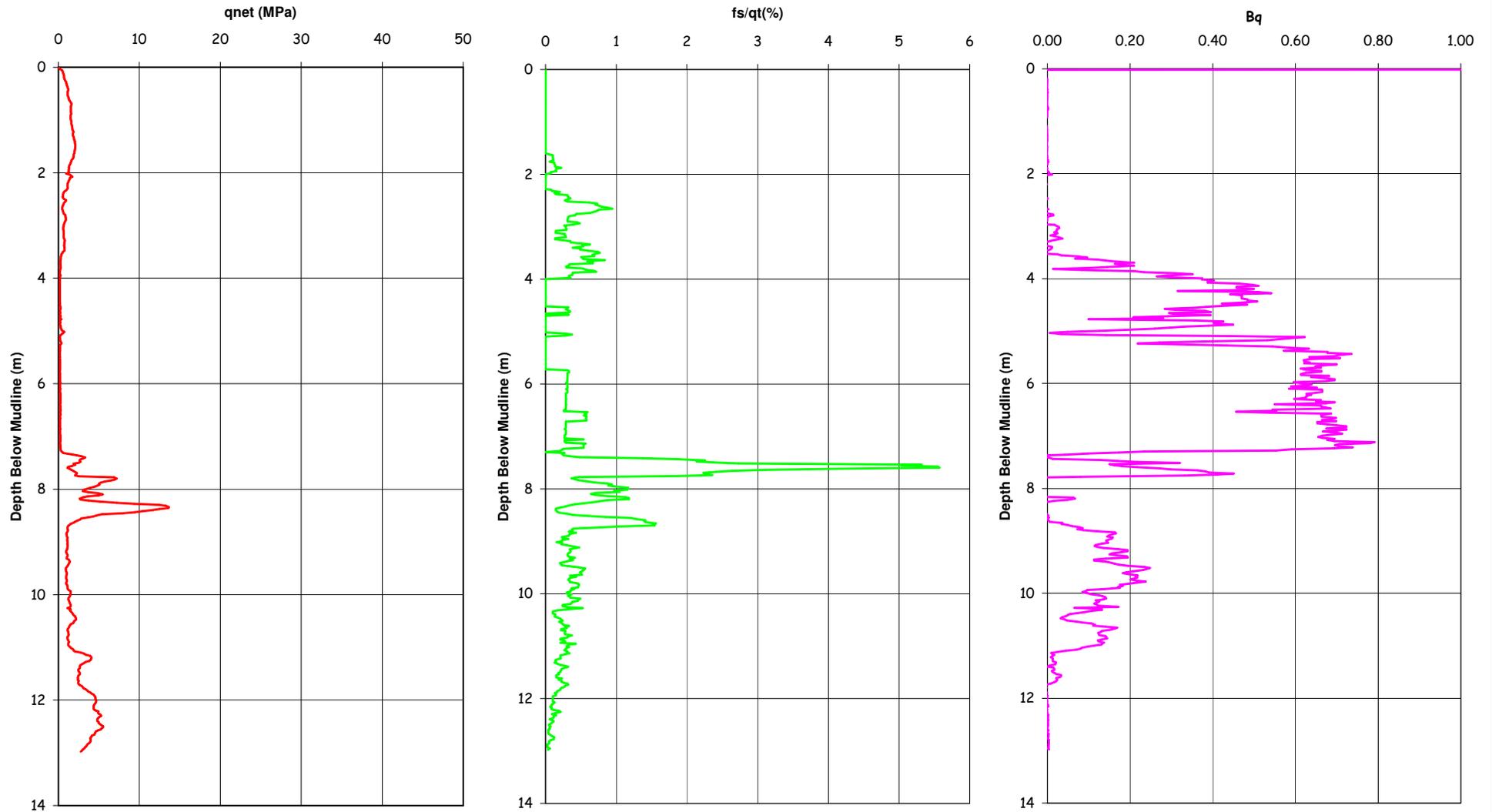


PROD CPT test

Client Origin Energy
Project Trefoil Site Investigation
Test Date 20.Sep.2004
Data Status Final

Borehole No. TRE5
Eastings (mE) 361,038.0
Northings (mN) 5,586,312.0
Depth Datum Mudline





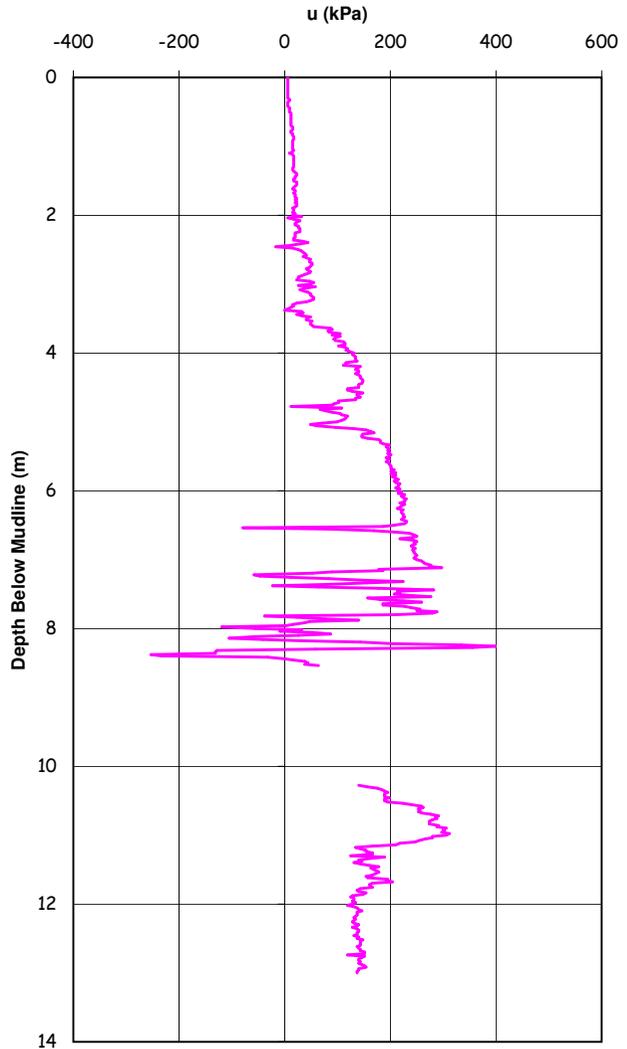
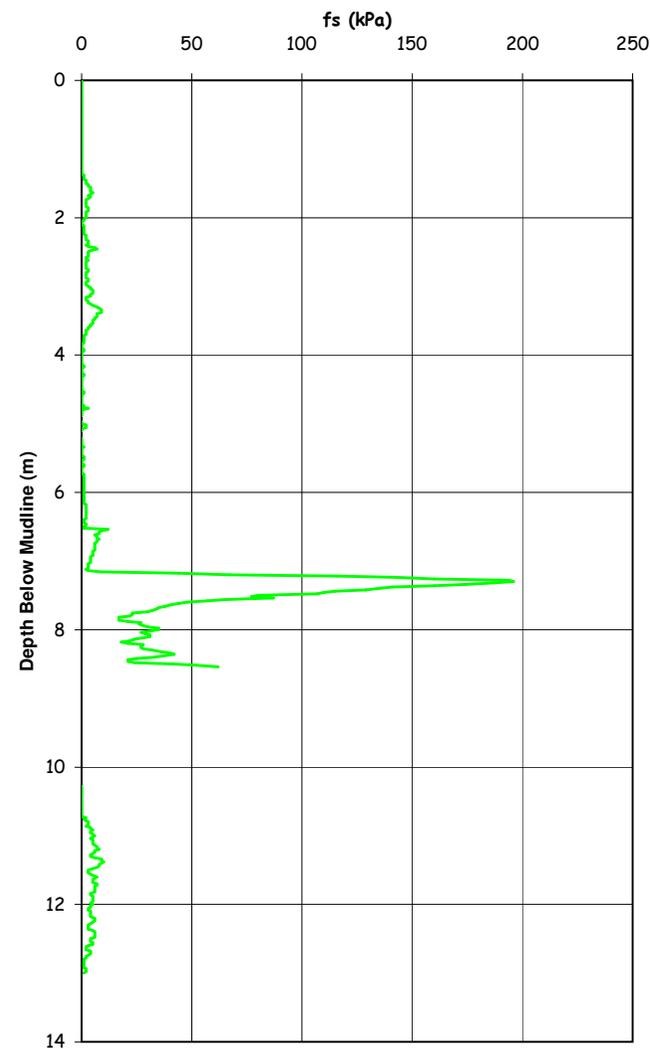
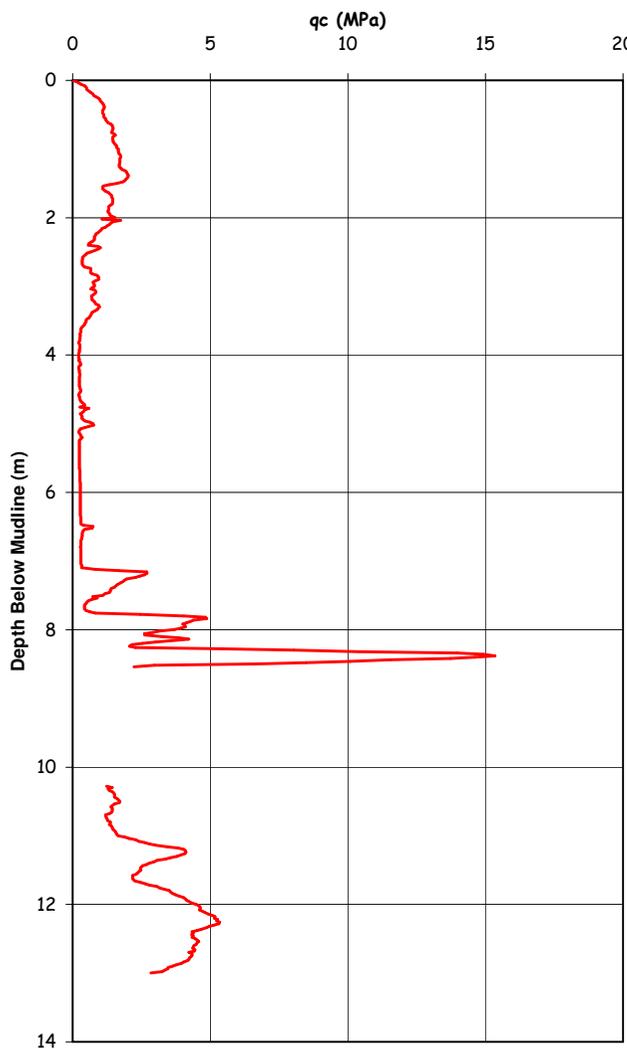
PROD CPT test

Client Origin Energy
Project Trefoil Site Investigation
Test Date 20.Sep.2004
Data Status Final

Borehole No. TRE5
Eastings (mE) 361,038.0
Northings (mN) 5,586,312.0
Depth Datum Mudline

Assumed submerged soil density (kN/m3) 8



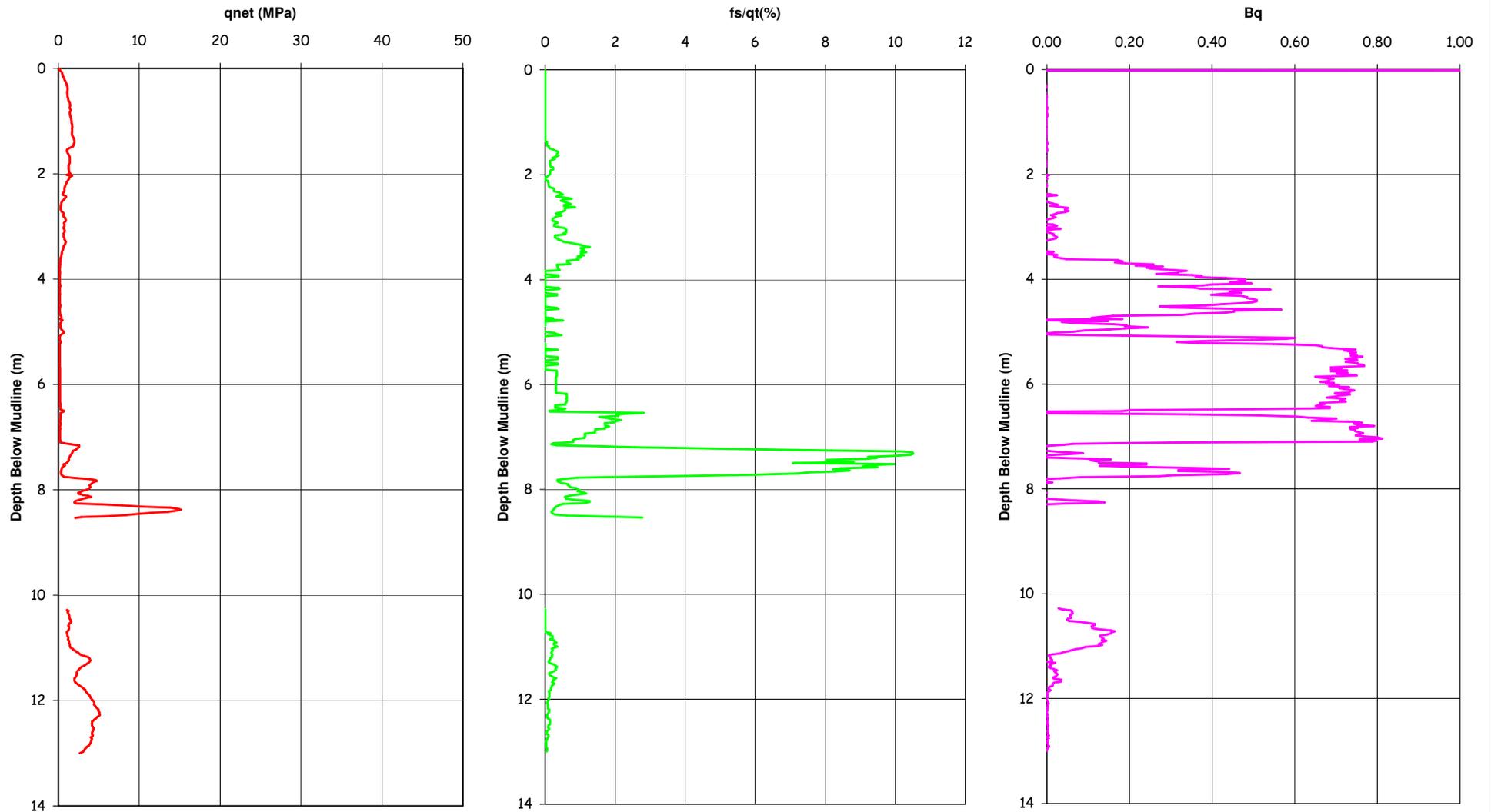


PROD CPT test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 20.Sep.2004
 Data Status Final

Borehole No. TRE6
 Eastings (mE) 361,055
 Northings (mN) 5,586,358
 Depth Datum Mudline





PROD CPT test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 20.Sep.2004
 Data Status Final

Borehole No. TRE6
 Eastings (mE) 361,055
 Northings (mN) 5,586,358
 Depth Datum Mudline

Assumed submerged soil density (kN/m³) 8





Steve Neubecker
Origin Energy Client Representative
Trefoil Site Investigation
MV Mermaid Raider

14 September 2004

RE : CALIBRATION OF CONE PENETROMETER EQUIPMENT FOR PROJECT

Dear Steve

We have undertaken calibration of our cone penetrometers using a NATA calibrated load cell and pressure transducers. Cone tip and sleeve friction calibrations were undertaken by applying concentric axial force to the load cells, whilst the pore water pressure transducers were calibrated in a pressure cell. During the pressure test confirmation of net area factor 'a' was also made.

Negligent cross talk effects were observed on the transducers not directly under load. Multiple load cycles were completed to check for hysteresis effects. All cones were found to produce high quality, repeatable test data, over their full-scale ranges.

From the acquired data, scaling factors were computed for all transducers. These results are summarized below.

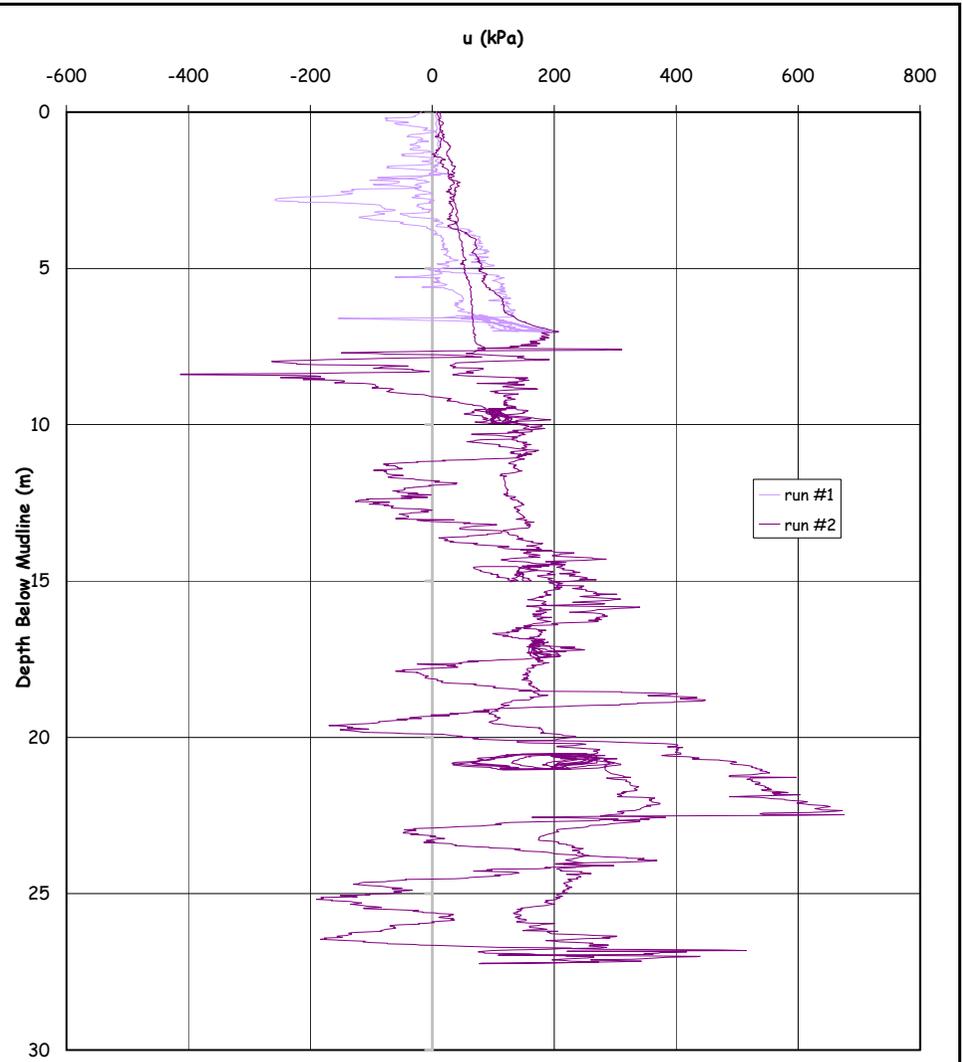
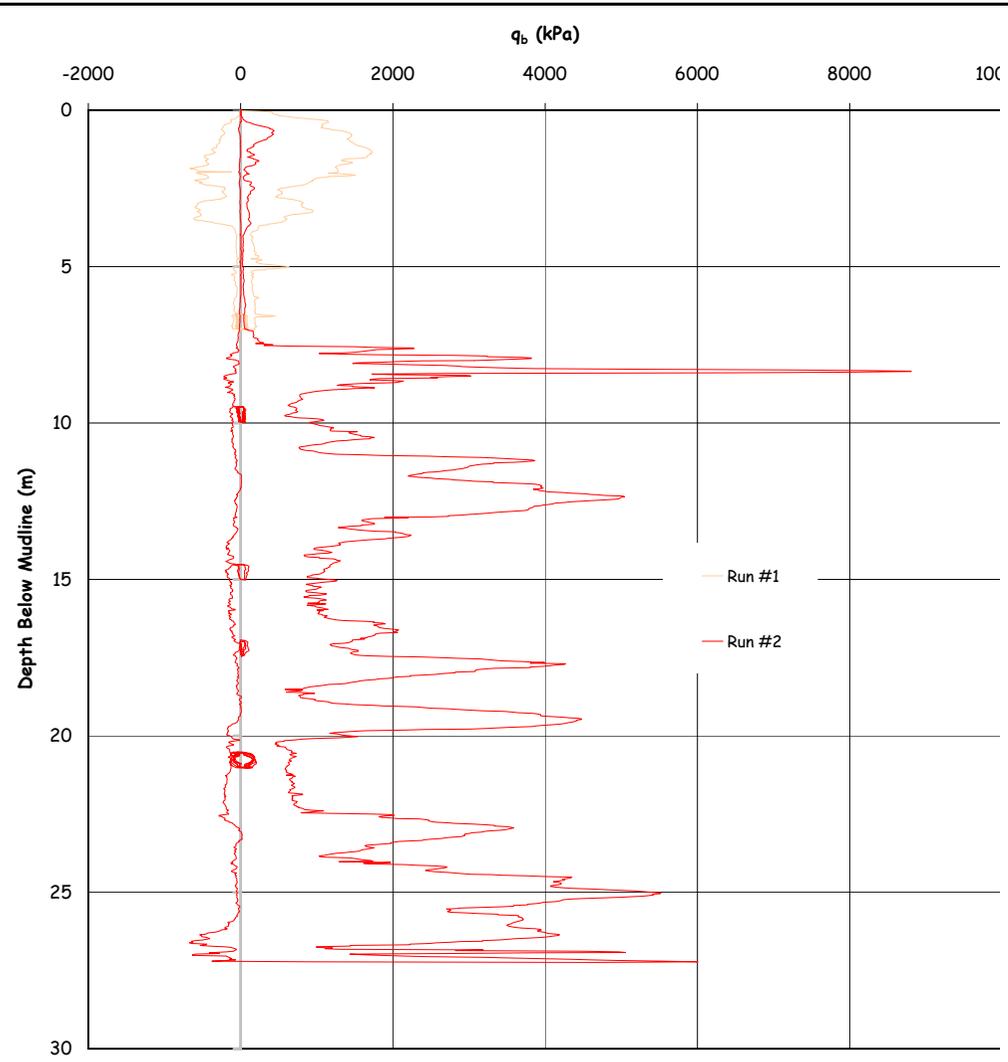
Parameter	Derived Scaling (Ramp) Coefficients				
	# 3401	# 3402	# 3490	# 3491	# 3492
qc	1725	1728	1209	1208	1206
a	0.80	0.80	0.80	0.80	0.80
fs	4165	4267	3934	3946	3935
b	0.00	0.00	0.00	0.00	0.00
u	821	851	899	838	883

Following the calibration exercise functionality tests were undertaken to confirm correct output. All cones were found to be in close agreement with the reference cells.

regards
Pat

Pat Kelleher
Team Leader
Benthic Geotech

APPENDIX 4
BALL PENETROMETER TEST DATA



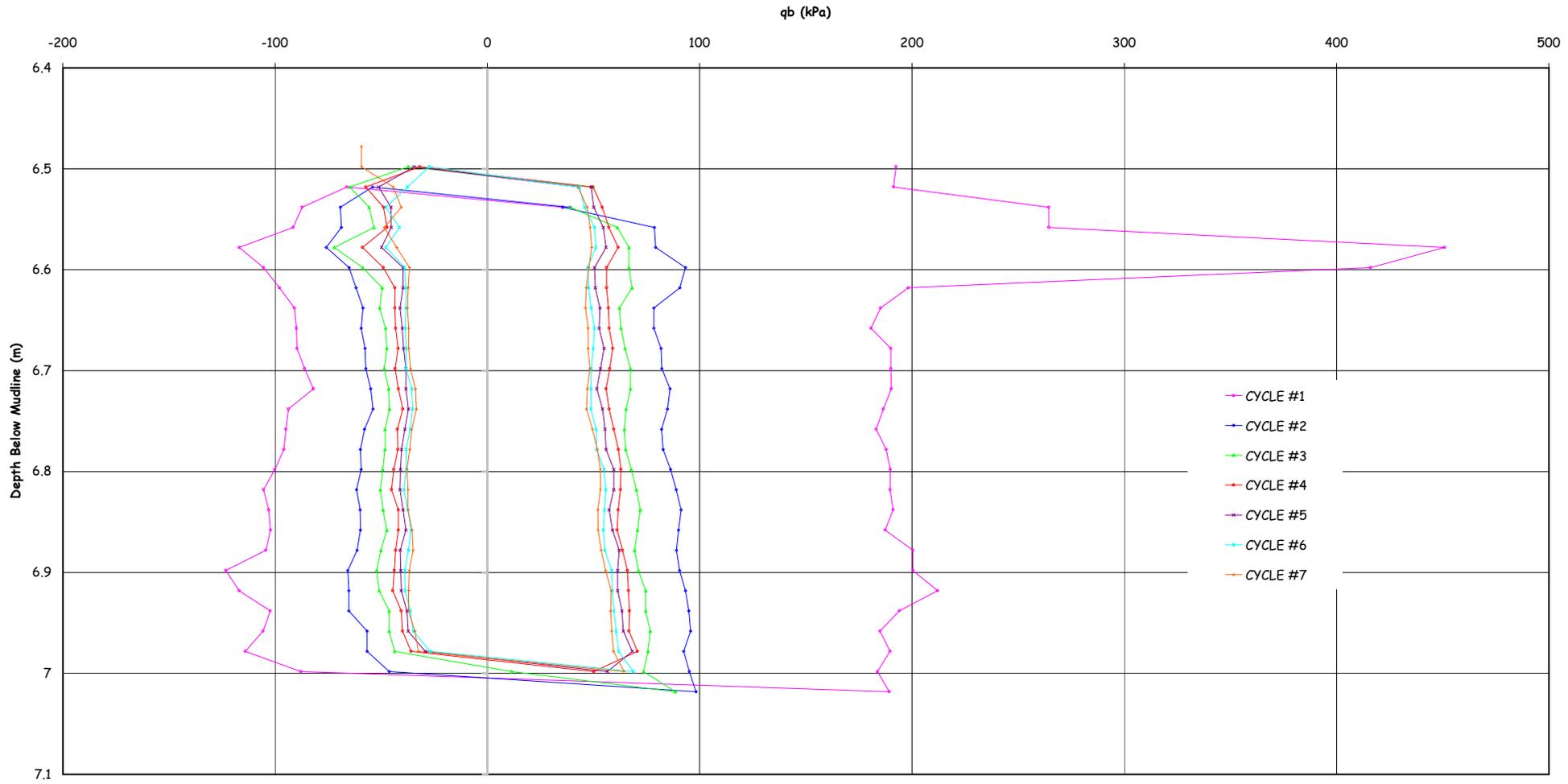
PROD Spherical Ball penetrometer test

Client Origin Energy
 Project Trefoil Site Investigation
 Test Date 20.09.2004
 Data Status Final
 Borehole No. TRE3

Eastings (mE) 361,078
 Northings (mN) 5,586,332
 Depth Datum Mudline
 Ball Diameter 60 mm



Cycle Set #1 - Cycling over depth interval 6.5m to 7.02m



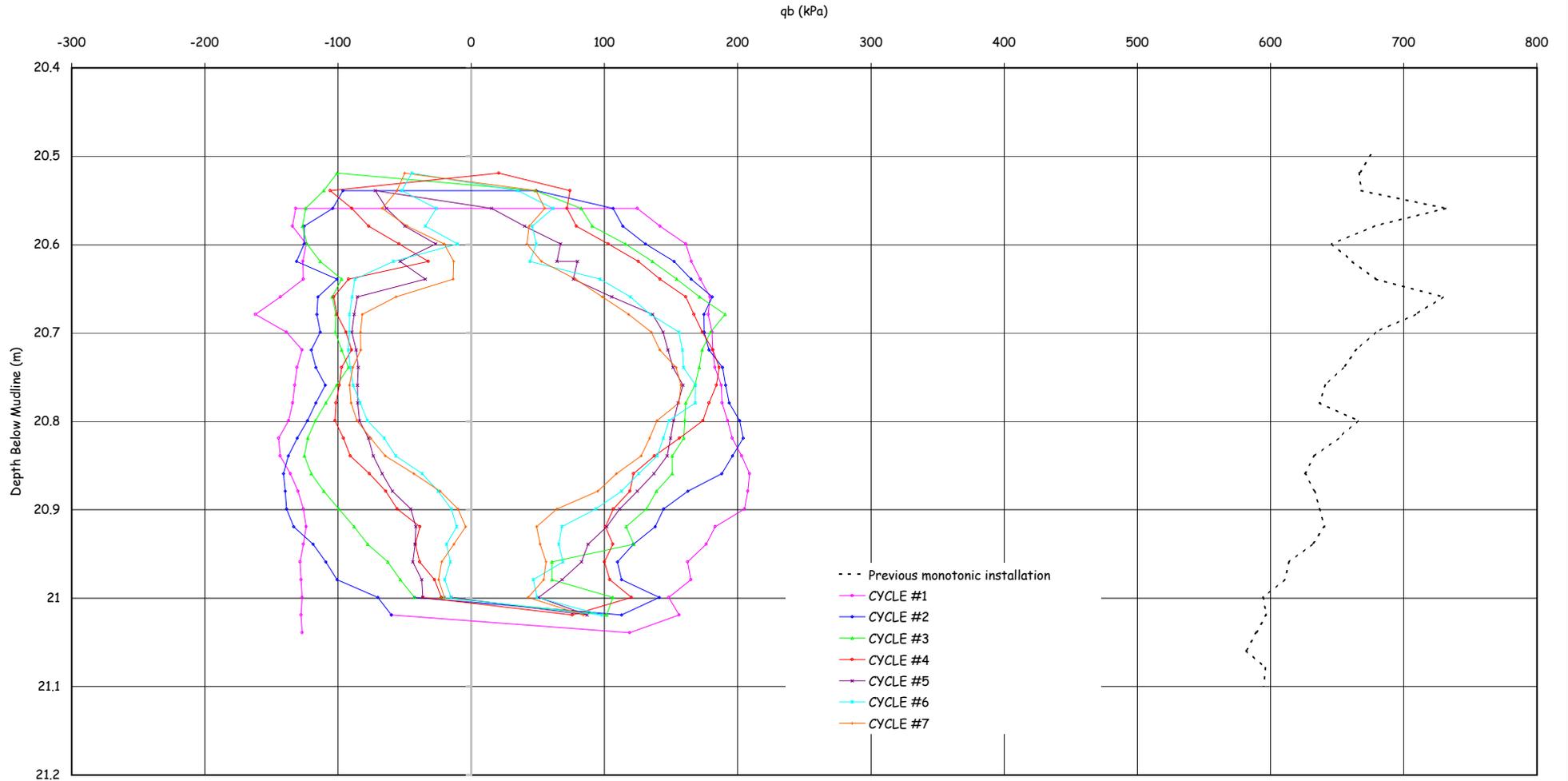
PROD Spherical Ball penetrometer test

Client Origin Energy
Borehole No. TRE3
Test Date 20.09.2004
Depth Datum Mudline
Data Status Final

Project Trefoil Site Investigation
Easting (mE) 361,078
Northing (mN) 5,586,332
Ball Diameter 60 mm



Cycle Set #2 - Cycling over depth interval 20.52m to 21.04m



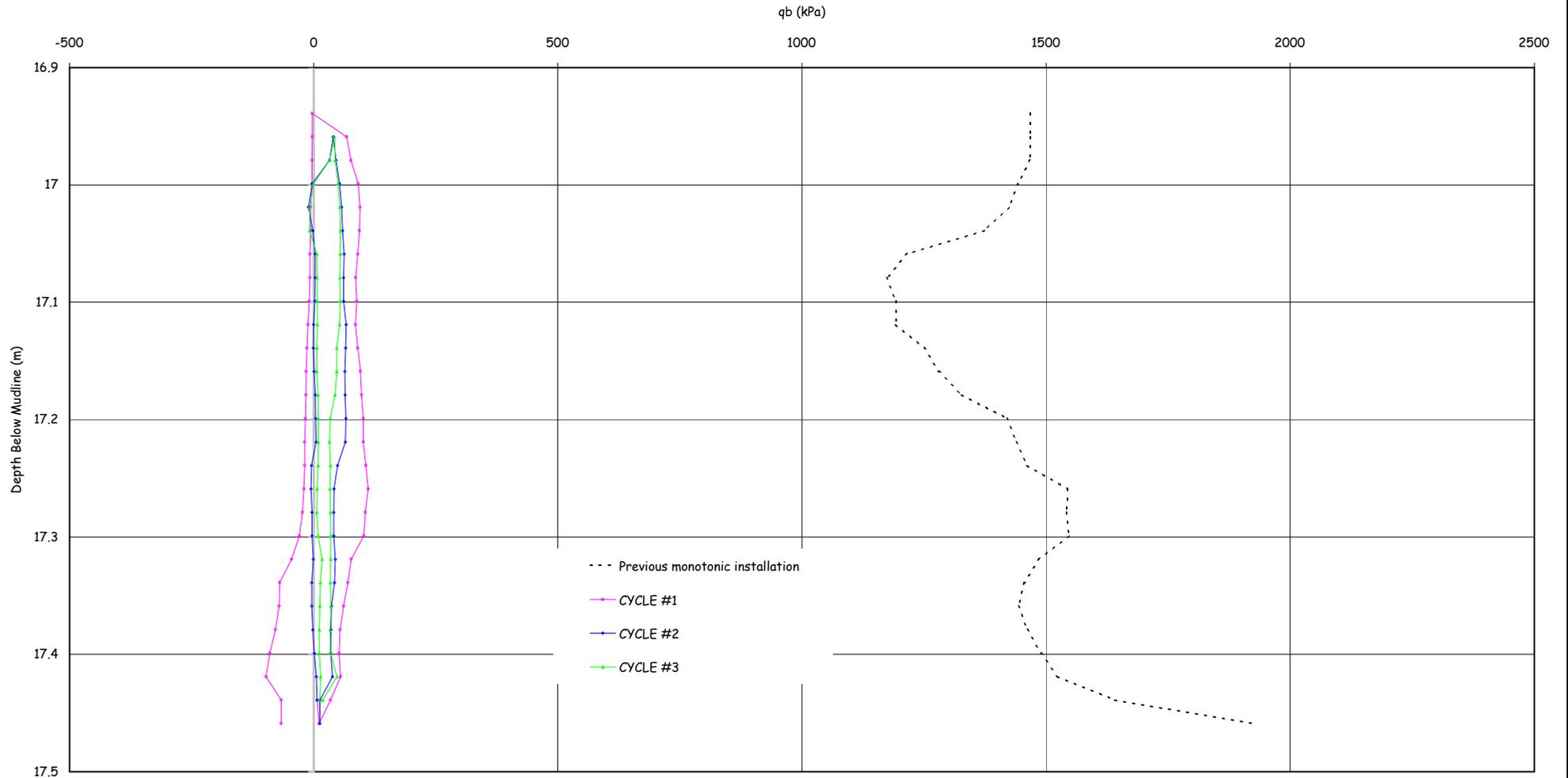
PROD Spherical Ball penetrometer test

Client Origin Energy
 Borehole No. TRE3
 Test Date 20.09.2004
 Depth Datum Mudline
 Data Status Final

Project Trefoil Site Investigation
 Eastings (mE) 361,078
 Northings (mN) 5,586,332
 Ball Diameter 60 mm



Cycle Set #3 - Cycling over depth interval 16.95m to 17.45m



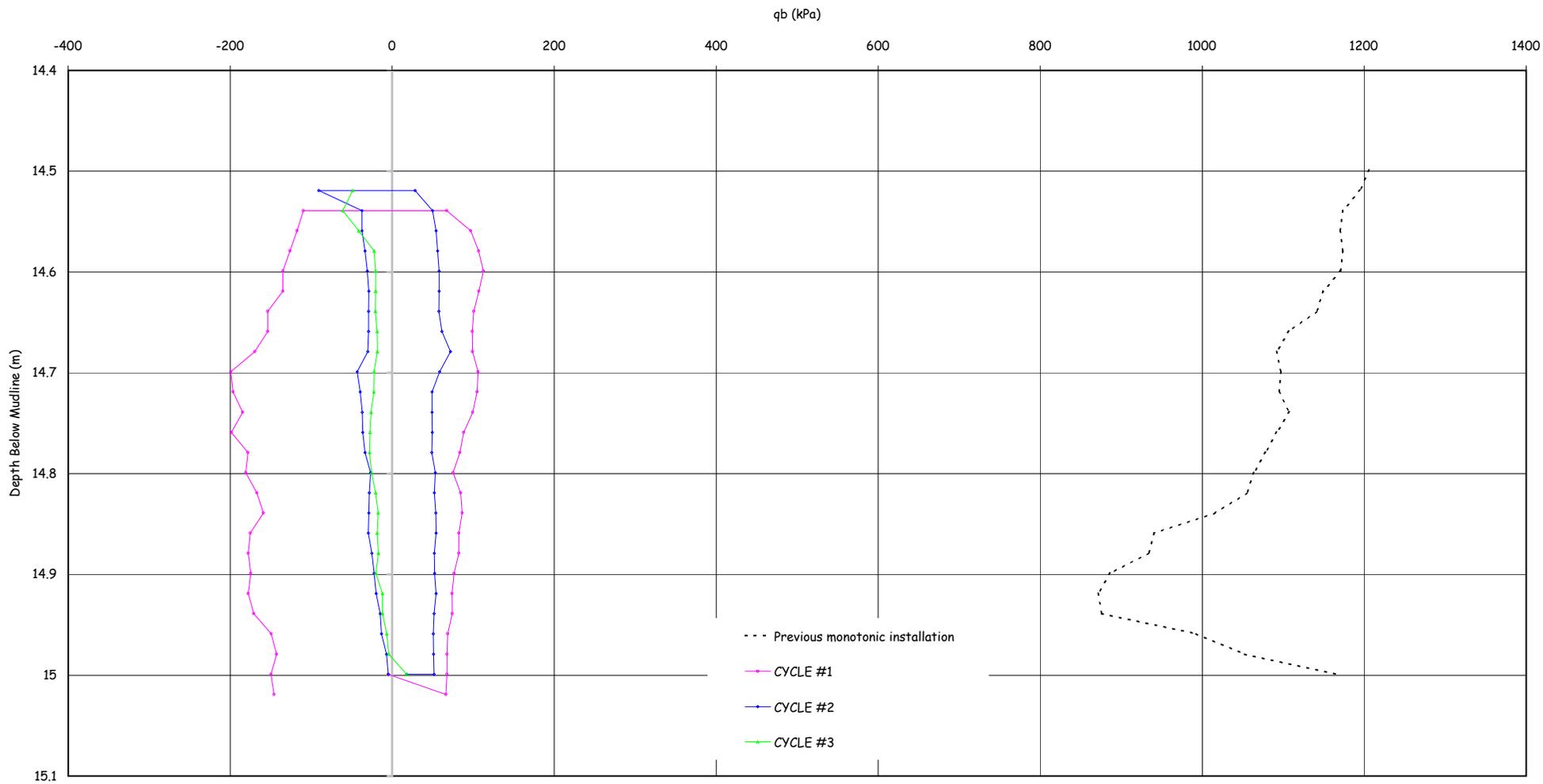
PROD Spherical Ball penetrometer test

Client Origin Energy
 Borehole No. TRE3
 Test Date 20.09.2004
 Depth Datum Mudline
 Data Status Final

Project Trefoil Site Investigation
 Eastings (mE) 361,078
 Northings (mN) 5,586,332
 Ball Diameter 60 mm



Cycle Set #4 - Cycling over depth interval 14.5m to 15m



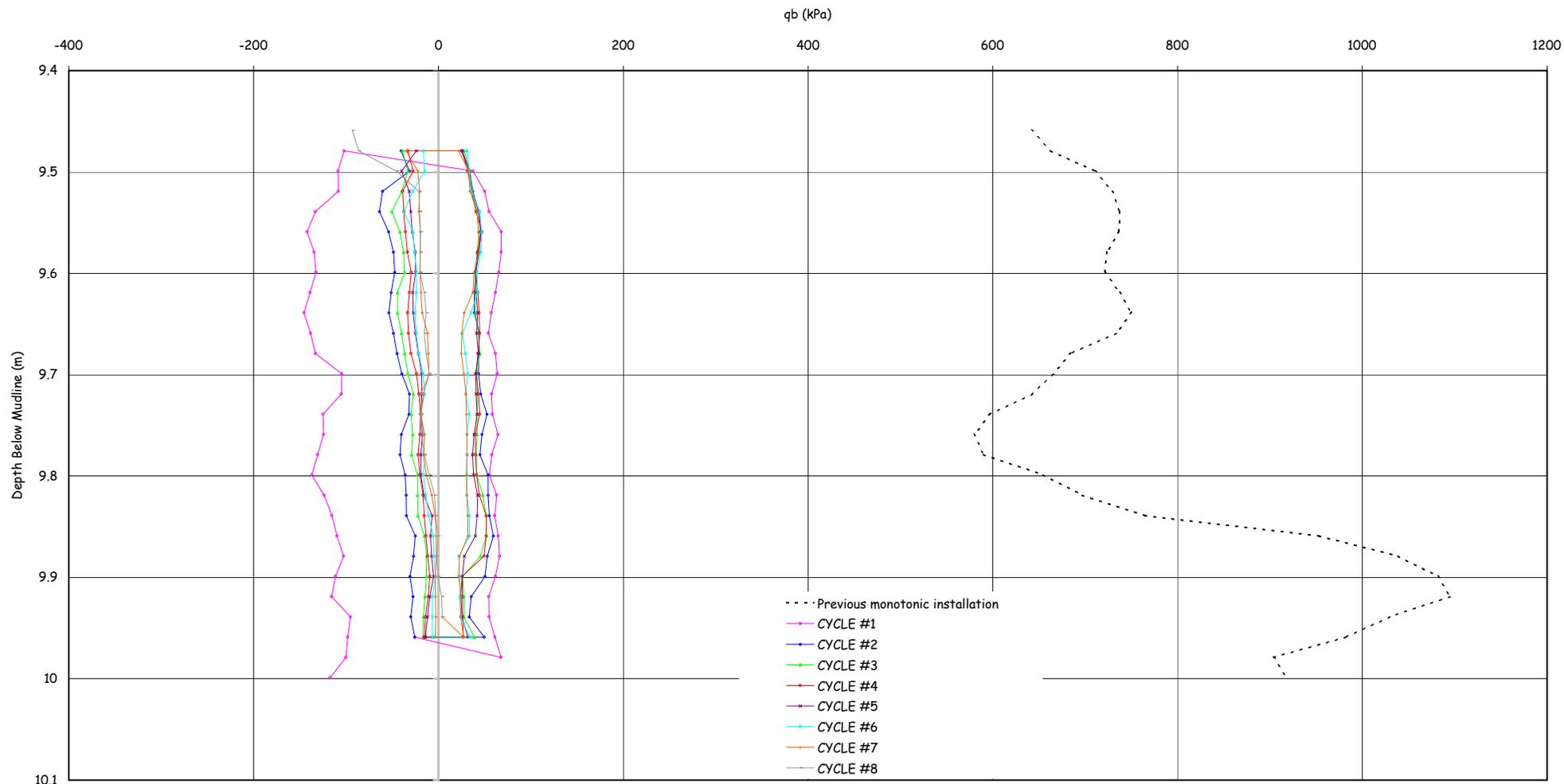
PROD Spherical Ball penetrometer test

Client Origin Energy
 Borehole No. TRE3
 Test Date 20.09.2004
 Depth Datum Mudline
 Data Status Final

Project Trefoil Site Investigation
 Eastings (mE) 361,078
 Northings (mN) 5,586,332
 Ball Diameter 60 mm



Cycle Set #5 - Cycling over depth interval 9.48m to 9.98m



PROD Spherical Ball penetrometer test

Client Origin Energy
 Borehole No. TRE3
 Test Date 20.09.2004
 Depth Datum Mudline
 Data Status Final

Project Trefoil Site Investigation
 Eastings (mE) 361,078
 Northings (mN) 5,586,332
 Ball Diameter 60 mm



APPENDIX 5
SAFETY INFORMATION

14-Sep-2004

Hazard Identification of Work Deck of Mermaid Raider
 Carried out by Steve (1st mate)
 Pat Kelleher (BGT team leader)

No.	Hazard	Action	Actioned	Inherent hazard, notify crew
1	Sharp edges on winch guard	Grind to radius	yes	
2	Core storage boxes under CC not sea-fastened	Restrain by arrangement of cable boxes and straps	yes	
3	Cable holes on stb side of CC open to rain and spray	Provide covering while still allowing ventilation egress	yes	
4	Sharp corners on installed steelwork	Identify, angle grind corners to radius or cut off	yes	
5	Hole in front of tilt table when vertical	Install mesh	yes	
6	Sharp edges on expanded mesh of PROD access ramps	Angle grind edges	yes	
7	Open deck to stern of PROD on deck	Instal safety chains behind PROD	yes	Inherent hazard
8	Stern is outside of deck rails and bulwarks	Require safety harness, life jacket and observer for access past ramp bulwarks	na	Inherent hazard
9	PROD rails are greased	Advise all personnel "DO NOT TREAD ON RAILS". Inspect regularly for grease on deck	na	Inherent hazard
10	Multiple trip hazards on deck, particularly around PROD and access ramps	Define as an inherent trip hazard area and warn all personnel to take care, mark with paint	yes	Inherent hazard
11	Mooring winches	Define as an inherent hazard area and warn all personnel to stay clear of winches, lines, hoses during operation	na	Inherent hazard
12	Forard aisle between survey room and PROD winch	Barrier tape and notify no access	yes	Inherent hazard
13	Broken line hazard for tugger operators	Inform, guard if considered necessary	yes	Inherent hazard
14	Moonpool open (fall hazard)	Cordon off when open	yes	
15	Handling USBL pole in rough weather	Brace and chain pole against movement	yes	Inherent hazard
16	Aft sheave hitting beam flange	Cut out flange to avoid contact	yes	
17	Winch lines under tension	advise personnel to keep clear when running	yes	Inherent hazard
18	Tugger creeping under load	Fit hydraulic lock valve	yes	
19	A frame hoses on deck a trip hazard	Move as far aft and paint for visibility	yes	Inherent hazard
20	Operators distracted by visitors	Provide orientation for vessel crew, maintain exclusion zone	yes	Inherent hazard

