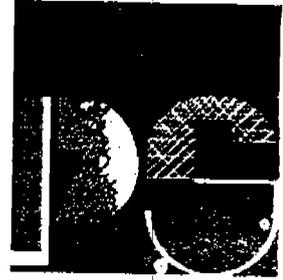


See file 75115. Letter 13/7/00.

CONSULTING ENGINEERS
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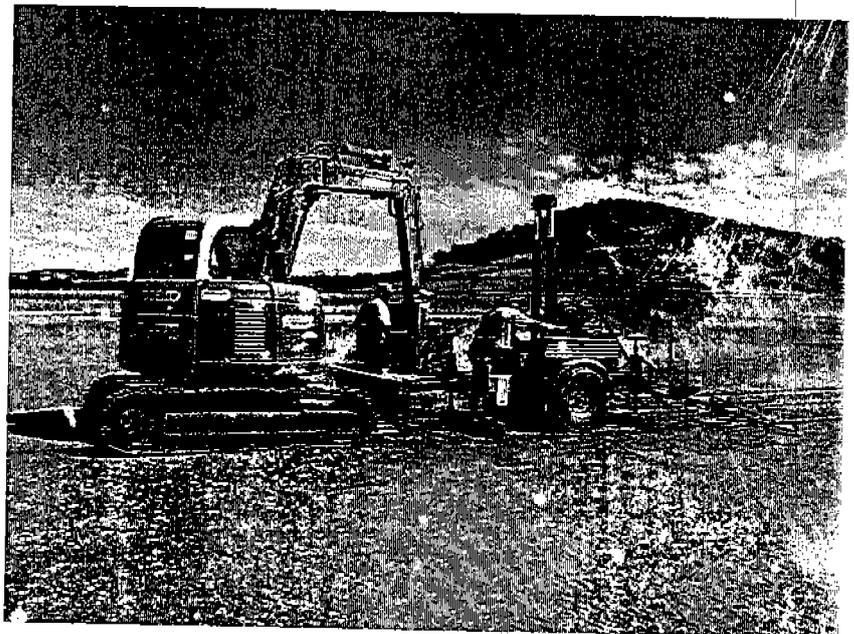
**PITT
&
SHERRY**
Incorporating
Morgan Kirk & Nelsen

MINERAL RESOURCES		
FILE REF: 75115	DOC. REF:	
15 APR 2003		
OFFICER	FOR ACTION	FOR INFO
See folio 22		

TOMINEX HOLDINGS PTY LTD

Ralphs Bay Geotechnical Investigation

MARCH 2000



ISO9001 Lic 4522
Standards Australia

Quality
Endorsed
Company

E99092H019.Rep/30.1/RG:jad
Rev 00

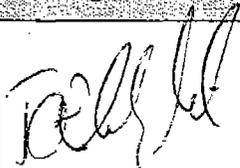
PITT & SHERRY

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APPENDICES

- A Schematic Geological Cross Sections
- B Water Jetting Logs
- C Electric Cone Penetrometer Testing Logs
- D Sampling Hole Logs
- E Laboratory Test Results
- F Photographs

	Name	Signature	Date
Authorised by:	John-Eckersley Maslin		16 March 2000

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1. INTRODUCTION

At the request of Peacock Darcey & Anderson, for Tominex Holdings Pty Ltd, Pitt & Sherry have undertaken a preliminary geotechnical investigation for proposed marinas and residential development at Ralph's Bay, Lauderdale (see *Figure 1 Location Plan*). Proposed works include:

- Dredging to establish marinas, boat harbours and access channels;
- Land reclamation by constructing embankments and
- Construction of breakwaters, bund walls, marinas & buildings.

The object of this report is to comment on geotechnical issues associated with the proposed development, based on our investigations.

2. SCOPE OF WORK

The scope of work involved:

- Establishing material characteristics across the site;
- Establishing foundation conditions across the site;
- Identifying geotechnical issues that may impact on site development.

It is understood that the depth of interest from a dredging perspective is 5m below the existing sea bed.

3. METHODOLOGY

The geotechnical investigation was conducted in 2 stages – a desk study with water jetting and shallow sampling in December 1999, followed by cone penetrometer testing and deep sampling in February 2000. A summary of the investigation is given below. Refer to *Figure 2* for the location of all testing and sampling sites. Photos are attached in *Appendix F*.

3.1 Desk Study

A desk study supported by surface mapping and aerial photographs was undertaken to establish site geology.

3.2 Field Investigations

3.2.1 *Soft Sediment Water Jetting*

This was done as an "Introductory Investigation" to give an initial indication of site conditions. Testing was done at 8 locations (WJ1 – WJ8 in *Figure 2*), to a maximum depth of 6m below existing sea bed level. Logs are attached in *Appendix B*.

What is this?

3.2.2 Electric Cone Penetrometer Testing (CPT)

Cone Penetrometer testing was done for detailed depth profiling. It formed the main thrust of the investigation. Testing was done at 23 locations (PT1 - PT22 & PT23), to a maximum depth of 16m below existing sea bed level. Logs are attached as *Appendix C*, with a description of the CPT procedure.

3.3 Sampling

Disturbed samples were taken at 6 locations, as follows:

- Shallow samples (to maximum depth of 0.85m below sea bed) were taken from 3 locations (AH1 - AH3), using a hand auger.
- Deep samples (to maximum depth of 5.3m below sea bed) were taken from 3 locations (DS1 - DS3), using an excavator with an auger attachment.

Logs are attached as *Appendix D*.

3.4 Laboratory Testing

Testing was done on representative samples as follows:

- Grading (x 10)
- Atterberg limits (x 4)
- Particle Density (x 3)
- Setting characteristics of fines (x 2)
(hydrometer)
- Dispersion (x 1)
- Organic content assessment (x 2)

Results from the organic content assessment were not available at the time of writing this report. Results from the remaining tests are attached as *Appendix E*.

4. SITE BACKGROUND

The site covers 175 ha in the tidal flats of Ralphs Bay, west of Lauderdale, 20 km east of Hobart. The tidal flats extend approximately 800m out to sea before dropping down to deeper water. The tidal range is in the order of 1 metre. The area is bordered by urban fringe and rural land, and is popular for recreational water sports. The northern area of the bay is a Conservation Area.

Ralphs Bay Canal is a feature of the area, constructed in the 1920's to provide access from Ralphs Bay to Frederick Henry Bay. The entrances on both sides of the canal have silted up and the canal is no longer operational.

5. GEOLOGY

Ralphs Bay Neck evolved from the formation of a sand spit on the Frederick Henry Bay side, contemporaneously with the formation of a shingle and shell spit on the Ralphs Bay side (*ref 1*). As the strait closed up, salt marshes developed between the spits and in the quiet areas of Ralphs Bay.

The 1:50,000 geological plan of the site (*ref 2*) shows Ralphs Bay Neck covered by surficial dune, windblown sand and swamp deposits of Quaternary age. These sediments are underlain by Permian age rocks (siltstone, sandstone and mudstone), which have been intruded by Jurassic age dolerite.

On the tidal flats, shingle is evident on the foreshore around the canal, extending about 140m out to sea. The shingle is composed of rounded to subrounded country rock (dolerite, sedimentary rocks) to 150mm diameter. The shingle has been quarried historically. Shells (~25mm diameter) cover the surface of the site to varying degrees.

6. DISCUSSION OF RESULTS

6.1 Interpretation of Cone Penetrometer Test (CPT) Results

Interpretations of the CPT data have been made and are presented as *Schematic Geological Cross Sections Appendix A*. At two locations, deep sampling holes (DS1 & DS3) were augered within ~10m of a CPT hole. The CPT logs show good correlation with the deep sampling logs (see *Figures 3A & 3B Comparison of Logs*). The material types and strengths compare well. The location of material boundaries varies by up to 700mm. This discrepancy cannot be attributed to either investigation method, and is most likely due to the variability of geology.

A number of apparently very hard bands (to 72 MPa in PT12) were encountered at varying depths. A limitation of the CPT method is that it works well for materials of size less than the measuring tip (10 cm², or 40mm dia). Large stones, when encountered, will give a cone resistance greater than actual, because of the greater bearing area. The method is also unable to determine the exact nature of any hard bands (ie whether they are shell, shingle, gravel or cemented layers). The rig operator felt the response in most cases was caused by dense shelly layers.

6.2 Summary of Laboratory Test Results

Testing was done on representative samples of sands and clays, taken from the upper 4m sediment layers. A summary of results is presented below. Test results and grading curves are presented in *Appendix E*.

Test	Material	Results
Grading	Sands	typically fine to medium, with varying shell content
Atterberg Limits	Clays	high plasticity clays
Particle Density	Sands	2.66 g/m ³
	Clays	2.72 g/m ³
Organic content	Sand	<i>Results not available</i>
	Clay	<i>Results not available</i>
Hydrometer	Clay Sand, clayey	Solution still cloudy after 2 weeks ¹ (see <i>Photo 7 Appendix F</i>)
Dispersion	Clay, high PI	Emerson Class 5. No dispersion after remoulding. The soil should not crust and erode particularly readily.

6.3 Geology and Material Characteristics

Based on the interpretation of CPT and laboratory results, it is speculated that:

- Most of the site is covered by a surficial layer of loose shelly sand, up to 6m deep in places.
- Underlying sediments in the northern open area of the site (PT1 to PT18) are loose to moderately dense sands, stiff silts and clays (some high plasticity), with layers of moderately dense to dense shelly material (shell bands) in places.
- Underlying sediments in the southern sheltered waters (PT19 to PT22) are silts and high plasticity clays, often firm to stiff, but with some soft spots.
- Sediment layering does not appear to have any broad continuity across the site (see *Schematic Cross Sections Appendix A*).

7. GEOTECHNICAL ISSUES

7.1 Dredgeability

The site should be dredgeable to at least 5m depth below sea bed level, using conventional excavating equipment. The presence of dense layers of uncohesive material (to 6m thick) should be noted if pumping is considered as an excavation technique. These layers have been interpreted as shelly sand bands, but there is a risk they could include stones of coarse gravel or cobble size.

¹ Hydrometer analysis done to NATA standards, using distilled water.

7.2 Foundation Conditions

Embankments

No significant embankment stability issues are expected for embankments up to 4m. The majority of cohesive materials in the upper 5m profile appear to be of reasonable strength (stiff). Local soft areas may be encountered, particularly at the southern end of the site and around the canal. The soft layers encountered during this investigation were a maximum of 3m depth, and underlain by stiff material.

Settlement & Consolidation

No highly compressible materials were found. Settlement of the loose surficial shelly sand layers should occur as construction takes place. Some consolidation will occur in the clays and silts.

Piling

The CPT is a model pile, and its use is specifically aimed at design of piles, including their type and loading capacity. In general, most materials encountered should have sufficient strength to give moderate side support to piles.

8. OTHER ISSUES

A dispersion test was done on a typical high plasticity, grey clay from 2.0 – 3.5m depth (Sample Hole DS1). Results indicate this material is not prone to dispersion or erosion.

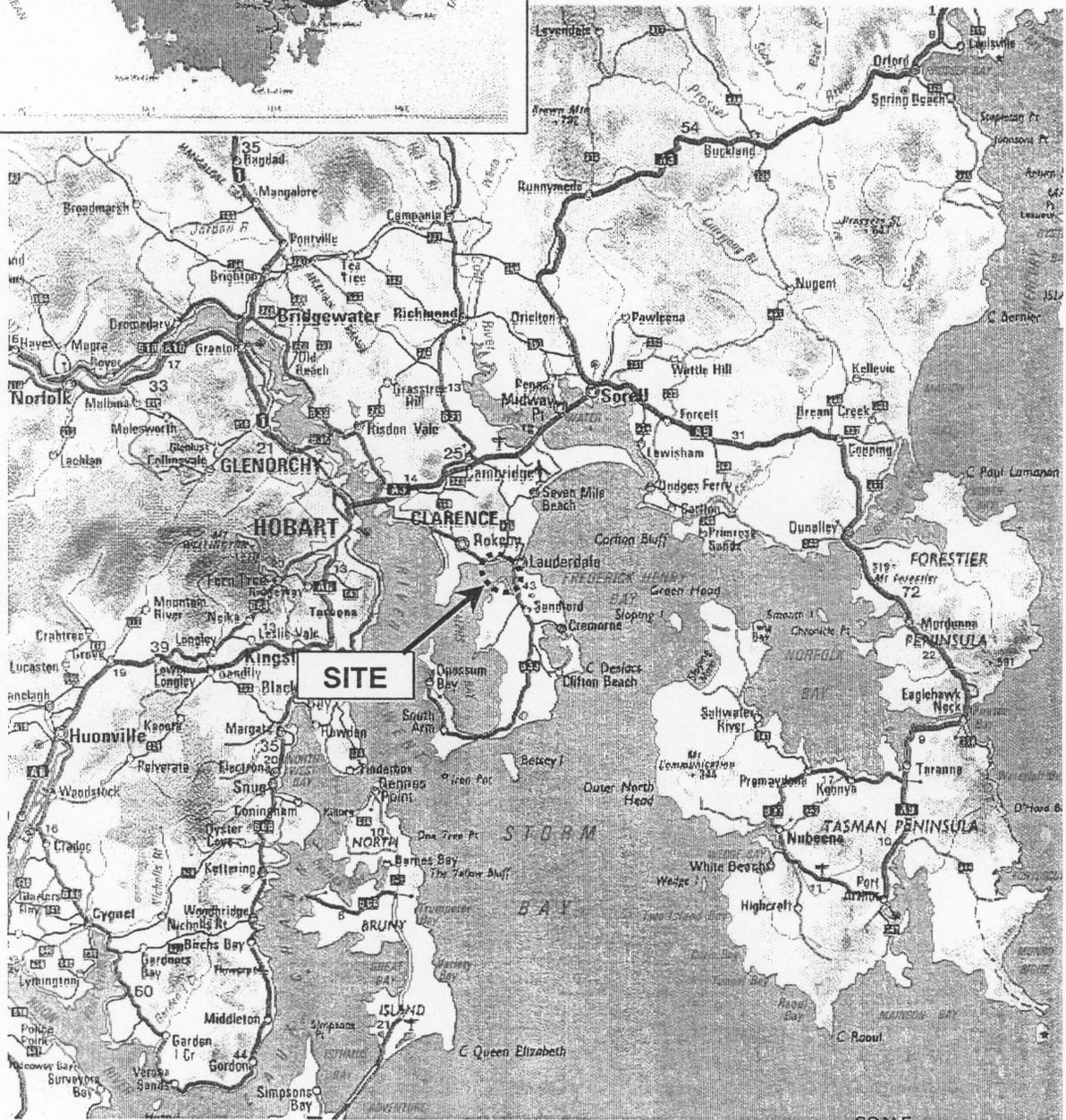
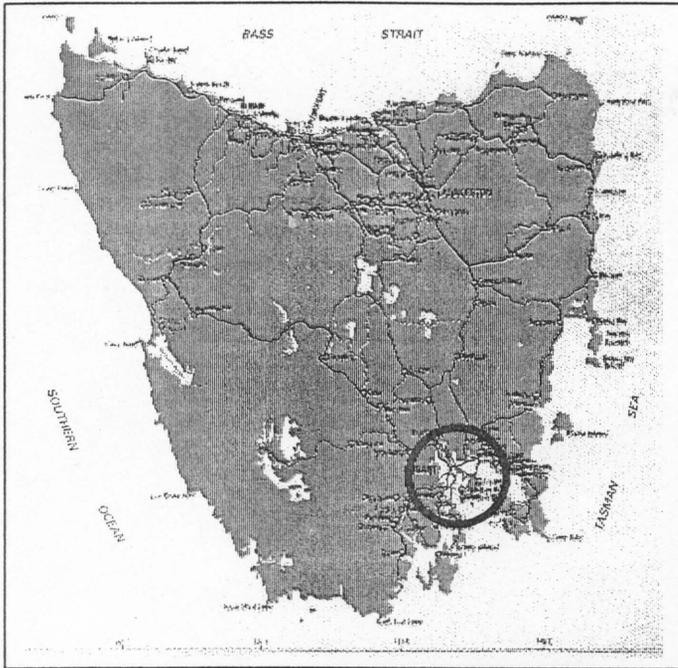
organic debris?
Hydrometer analysis indicates that there is a high proportion of fine material in the silty sands and clays that does not readily settle out of suspension in distilled water (as per NATA test conditions). Conditions under salt water conditions may be more favourable. (Note: This is currently being evaluated). ✓

9. FURTHER WORK

The sampling methods and testing programme for this investigation were designed to provide an overview of the site. Further testing will be required to provide information for the design (and possibly feasibility) of specific works. Ensuing field work may include obtaining undisturbed samples for material identification and laboratory testing.

10. REFERENCES

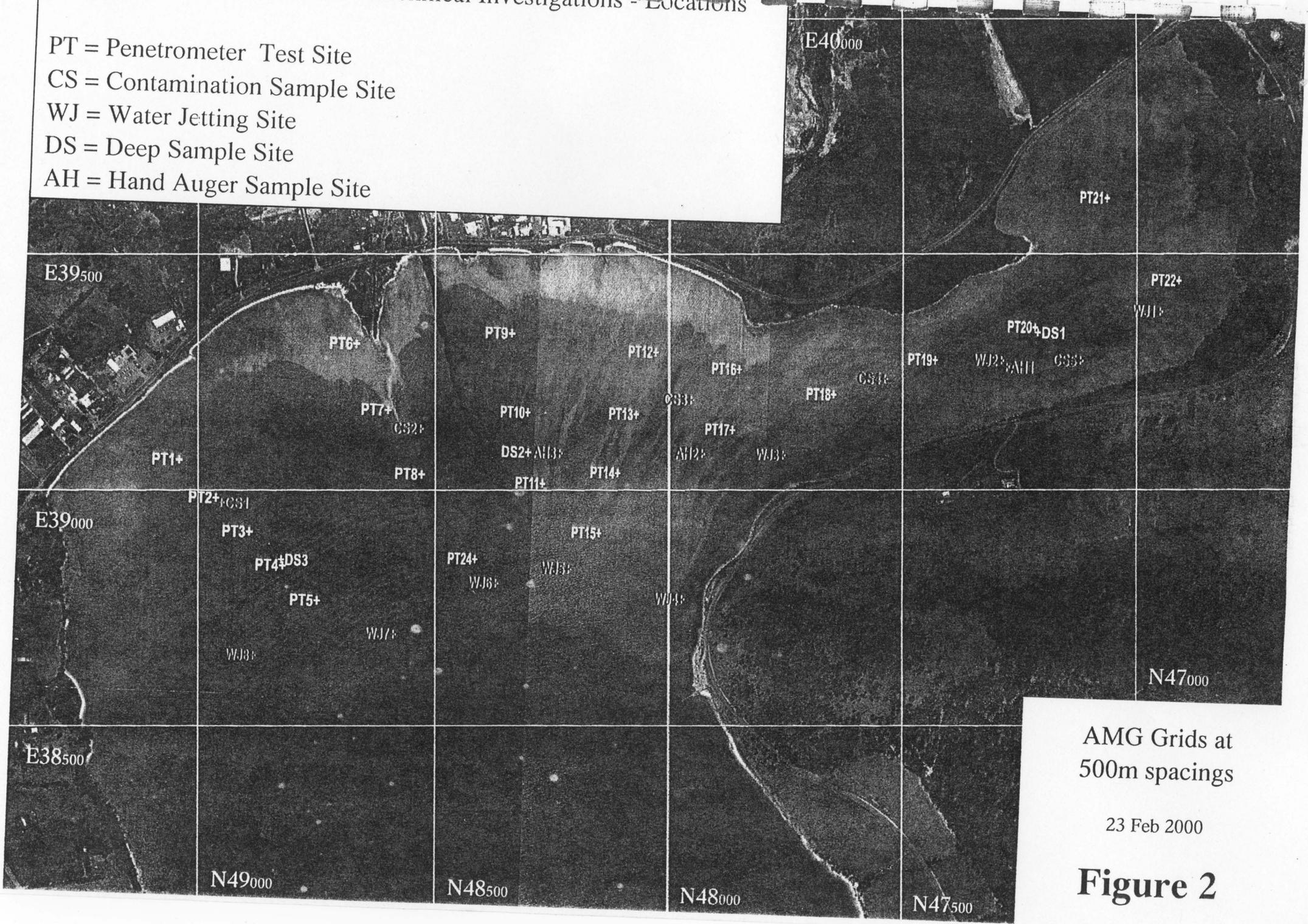
1. Davies JL, 1959. Sea Level Change and Shoreline Development in South-Eastern Tasmania. Papers & Proceedings of the Royal Society of Tasmania, 93:89.
2. Leaman DE, 1976. Hobart Geological Atlas 1:50,000 Series, Geological Survey Explanatory Report. Dept of Mines Tas.
3. Meigh AC. Cone Penetration Testing – methods and interpretation. CIRIA Ground Engineering Report: In-situ Testing.



TITLE			Figure 1 - Location Plan		
JOB NO.	E99092	SCALE	NON STANDARD	DATE	MARCH 2000

Ralphs Bay - Lauderdale - Geotechnical Investigations - Locations

PT = Penetrometer Test Site
 CS = Contamination Sample Site
 WJ = Water Jetting Site
 DS = Deep Sample Site
 AH = Hand Auger Sample Site



AMG Grids at
 500m spacings
 23 Feb 2000
Figure 2

Project: **Ralphs Bay Geotechnical Investigation**
 borehole location: **Sample Hole 23 (BS1)**
 hole commenced: **18/02/00**
 hole completed: **18/02/00**
 supervised by: **NJs**
 log checked by: **JG:edl**

drill model and mounting: **Kabota excavator (12E) w.** slope: **90 deg.** R.L. surface: **-** m
 hole diameter: **300 mm Auger** bearing: **- deg.** return: **-** operator: **NJs**

method	penetration	sample	water	notes samples, tests, etc	depth metres	graphic log	classification symbol	material soil type; plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency, rel. density	hardness	structure and additional observations
123												
				23/1	0.5	SMY GM	0-0.5 SAND fine grey silty, very shelly	M	L			shells to 1" diameter
				23/2		CL	0.5-1.0 CLAY dk grey med PI	M	F	X		
				23/3		CL	1.0-1.5 CLAY med PI, grey green silty	M	F-St	X		
				23/4		CH	1.5-2.0 CLAY, high PI, brown	M	St	X		150-200 kPa pp
				23/5		CH	2.0-3.5 CLAY, high PI, pale grey mottled orange	M	St	Y		200-250
				23/6								Test 23/6 ref 26/8 LL 108, PI 84, SG 2.68 Emerson class N1.5
				23/7		CH	3.5-4.0 CLAY, high PI, pale grey + orange w. coarse sand (weathered inclusions) + occasional ironstone	M	St	Y		150 kPa
				23/8								
												Hole terminated at 5.3m.

key method AS - auger screwing AD - auger drilling R - roller/bit cone W - washbore CT - cable tool * bit shown by suffix: B - blank bit V - "V" bit T - TC bit e.g. ADT	symbol C - casing M - mud consistency no resistance ranging to refusal water 10 Oct, 73 water level on date shown water inflow water outflow	notes - samples and tests U50 - undisturbed sample 50 mm diameter D - disturbed sample N - standard penetration test: figure = result N - SPT - sample Nc - cone penetrometer	classification symbols and soil description based on unified classification system moisture D - dry M - moist W - wat < PL PL > PL	consistency/relative density VS - very soft S - soft F - firm SI - stiff VSt - very stiff H - hard Fb - friable VL - very loose L - loose MD - moderately dense D - dense VD - very dense
---	---	---	---	--

Client: **Peacock Darcey & Anderson**
 Job Details: **Ralphs Bay Geotechnical Investigation**
 Test Location: **rb45520 (PT20)**
 Surface R.L.: **-** Date: **17/02/00**

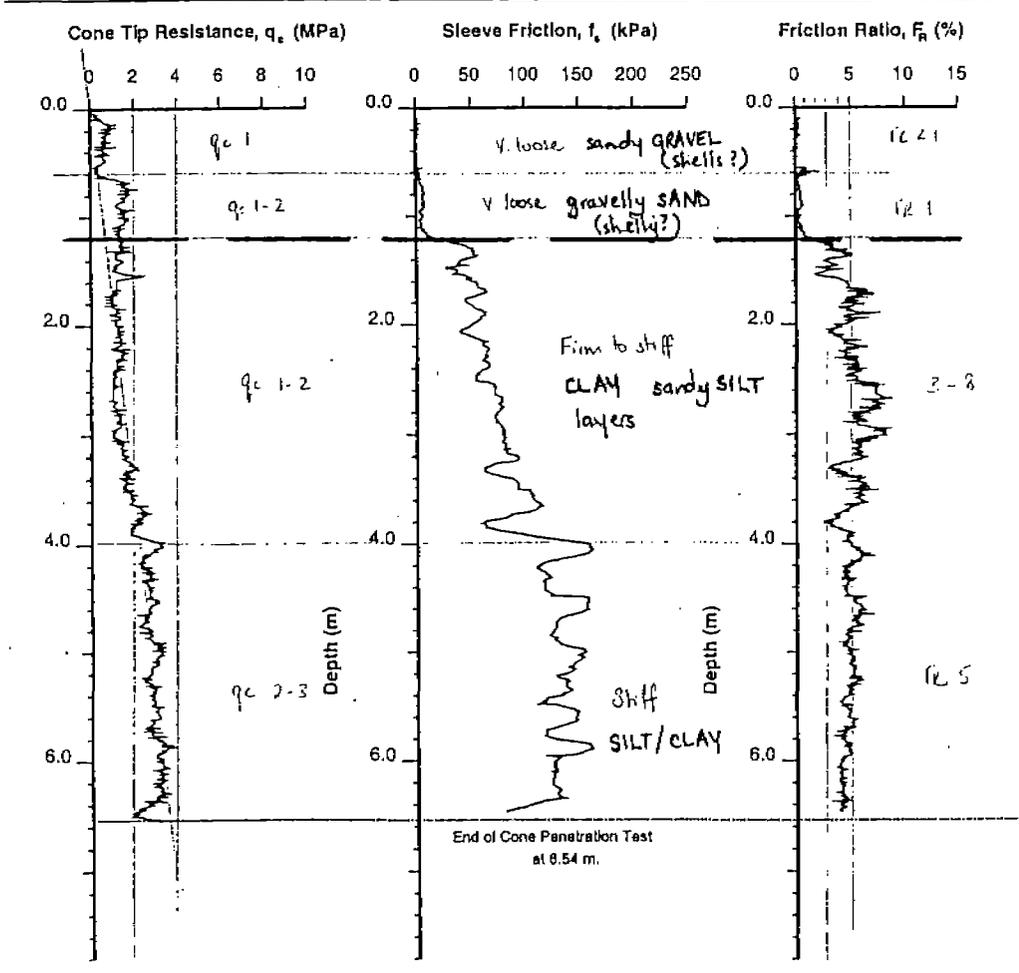
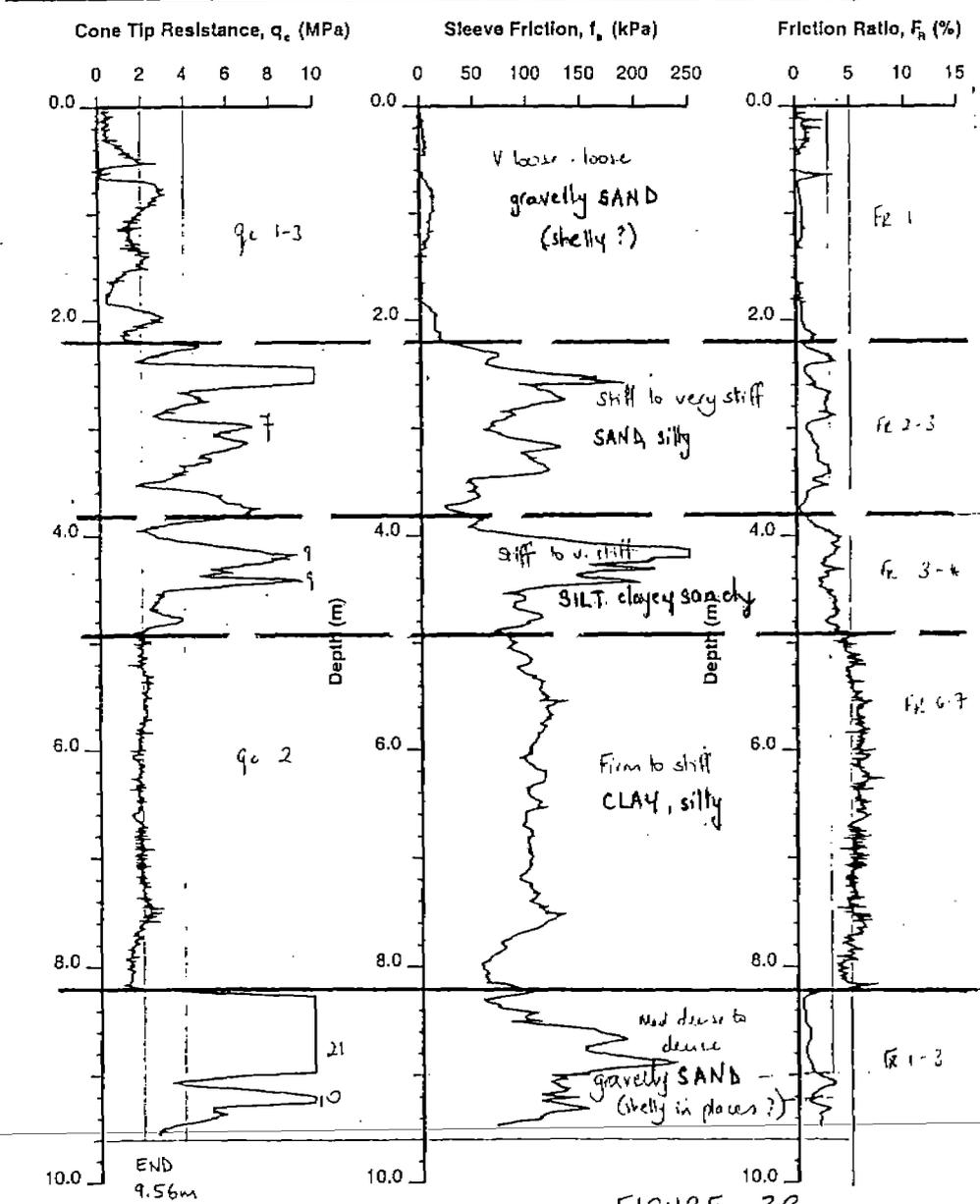


FIGURE 3 A
 COMPARISON OF LOGS

Cone Penetration Test

project: Ralphs Bay Geotechnical Investigation				hole commenced: 18/02/00								
borehole location: 26 Sample Hole (DS3)				hole completed: 18/02/00								
drill model and mounting: Kabota excavator (12t) with				slope: 90 deg.								
hole diameter: 300 mm (light auger)				bearing: - deg.								
				R.L. surface: - m								
				datum: -								
				operator: NJo.								
method	penetration	support	notes	RL	depth	classification	material	moisture	consistency	hand	structure and	
1 2 3			samples, tests, etc	metres	log	symbol	soil type; plasticity or particle characteristics, colour, secondary and minor components.	condition	ref. density	penetration	additional observations	
			26/1			SP	0-0.5 SAND fine grey, very shelly	M				
			26/2			SP	0.5-1.0 SAND fine grey, some shells	M				
			26/3			SP	1.0-1.5 SAND fine dk grey, some shell fragments	W			Test 26/3 SG 2.66	
			26/4			SP	1.5-2.0 SAND fine brown	W				
			26/5			SC	2.0-2.5 SAND fine clayey				Est 26/5 LL 34, PI 14 SG 2.65 (-236mm) 2.72 (-0.075mm)	
			26/6			SP	3.5-4.0 SAND fine, fossil, brown grey	W				
			26/7			ML/SM	4.0-4.5 SILT, pale grey, clayey but sandy	M				
			26/8			CH	5.0-5.3 CLAY grey, mottled orange by PI	M	St		150 kPa @ ref 23/6	
Hole terminated at 5.3m												
key			support			notes			classification symbols and soil description		consistency/relative density	
method AS auger screwing AD auger drilling R roller/fricone W washbore CT cable tool * bit shown by suffix B - blank bit V - "V" bit T - TC bit e.g. ADT			C casing M mud penetration no resistance ranging to refusal water 10 Oct. 70 water level on date shown water inflow water outflow			- samples and tests USO - undisturbed sample 50 mm diameter D - disturbed sample N - standard penetration test; figure = result N* - SPT + sample No - cone penetrometer			based on unified classification system moisture D - dry M - moist W - wet < PL = PL > PL		VS - very soft S - soft F - firm SI - stiff VSI - very stiff H - hard Fb - friable VL - very loose L - loose MD - moderately dense D - dense VD - very dense	

Client: Peacock Darcey & Anderson
 Job Details: Ralphs Bay Geotechnical Investigation
 Test Location: rb45504 (PT4)
 Surface R.L.: - Date: 18/02/00



**FIGURE 3B
COMPARISON OF LOGS**

Appendix A
Schematic Geological Cross Sections

Legend for Schematic Cross Sections

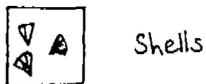
CONSISTENCY TERMS—COHESIVE SOILS (from AS 1726-1993)

Abbreviation	Term	Undrained shear strength kPa	Field guide to consistency
VS	Very soft	≤12	Exudes between the fingers when squeezed in hand
S	Soft	>12 ≤25	Can be moulded by light finger pressure
F	Firm	>25 ≤50	Can be moulded by strong finger pressure
St	Stiff	>50 ≤100	Cannot be moulded by fingers Can be indented by thumb
VSt	Very stiff	>100 ≤200	Can be indented by thumb nail
H	Hard	>200	Can be indented with difficulty by thumb nail

CONSISTENCY TERMS—NON-COHESIVE SOILS (from AS 1726-1993)

Abbreviation	Term	Density-index %
VL	Very loose	≤15
L	Loose	>15 ≤35
MD	Medium dense	>35 ≤65
D	Dense	>65 ≤85
VD	Very dense	>85

Key



Shells



Sand



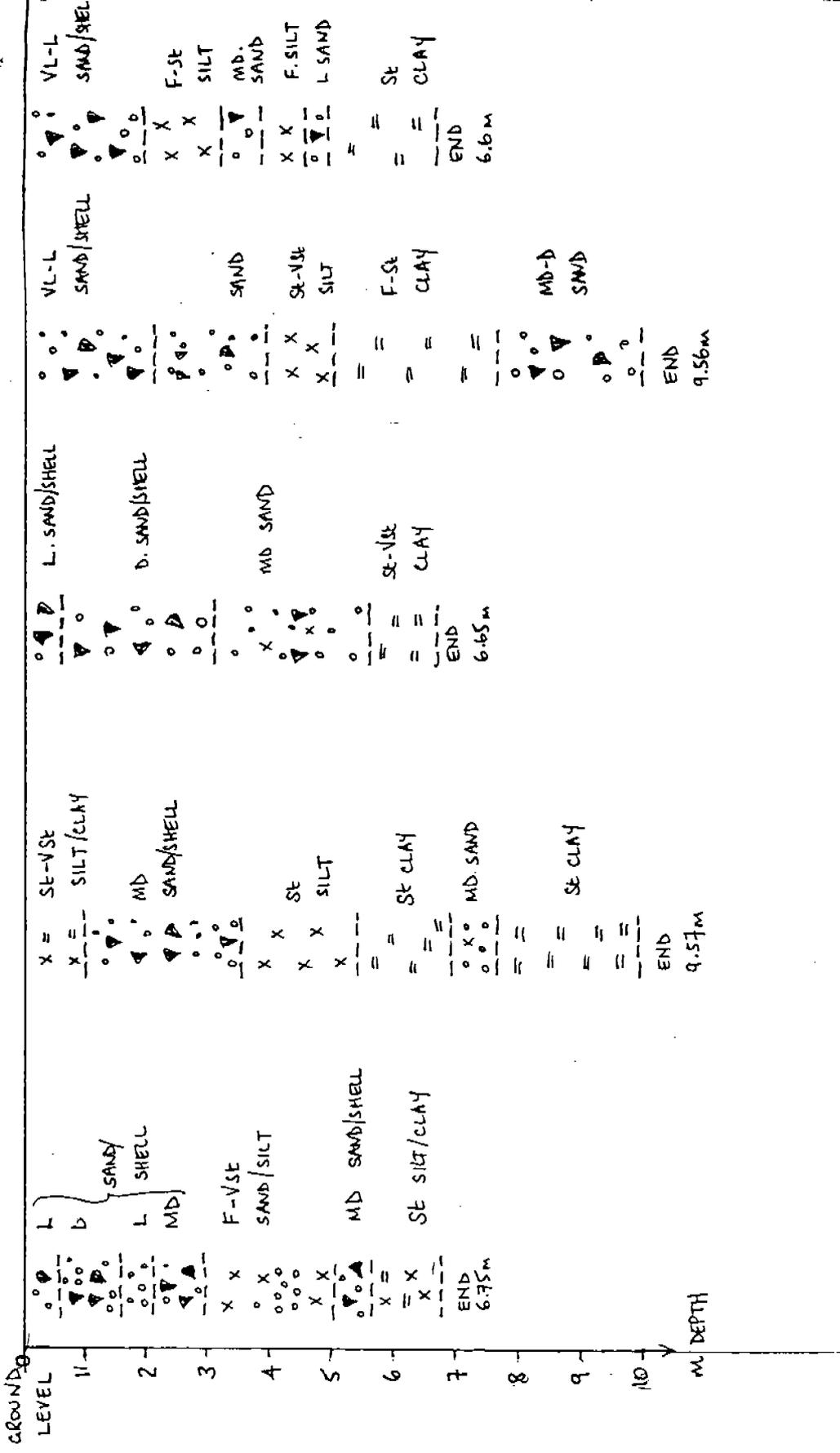
Silt



Clay

← East

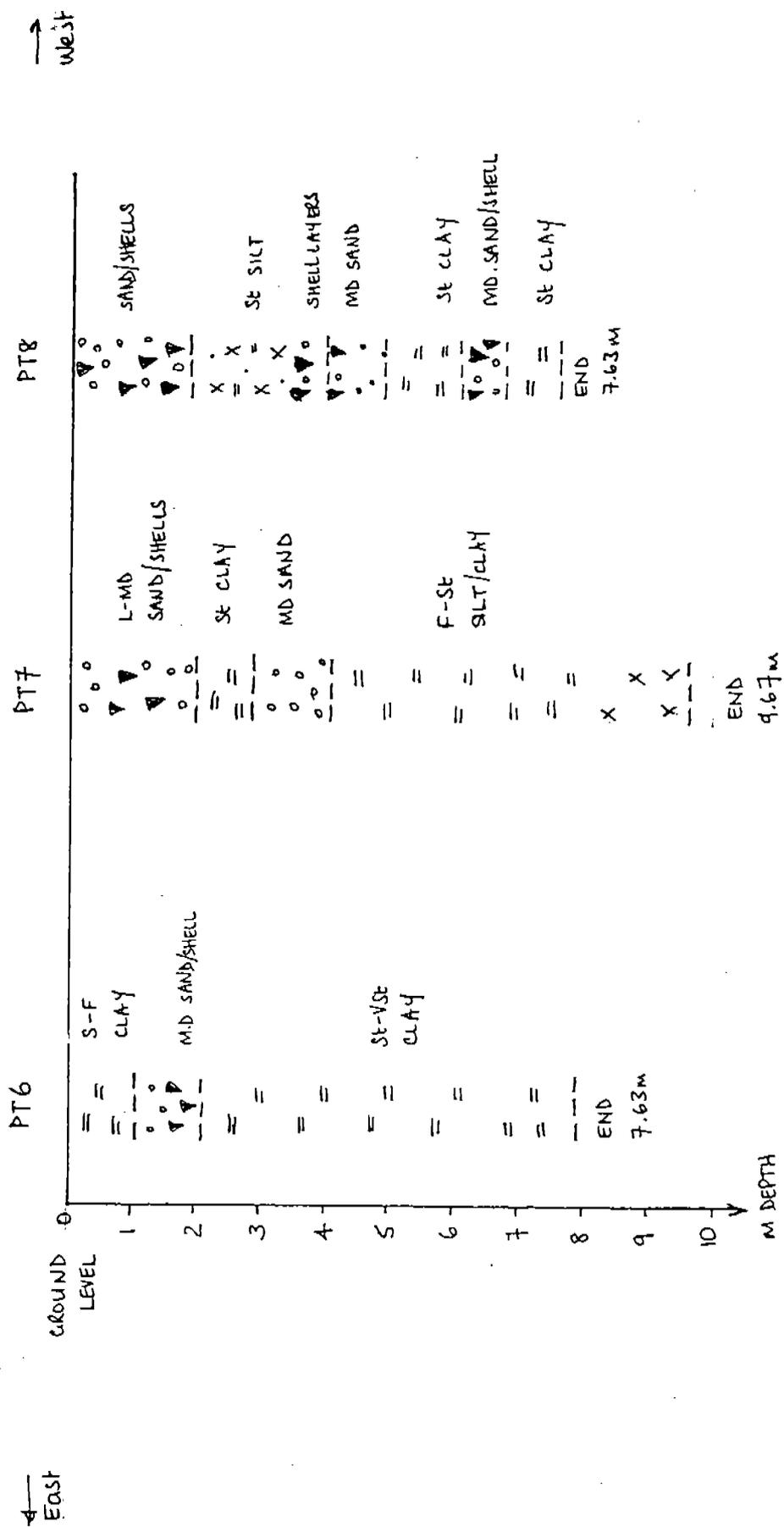
→ West



Appendix A
Schematic Cross Section
PT1 - PT5

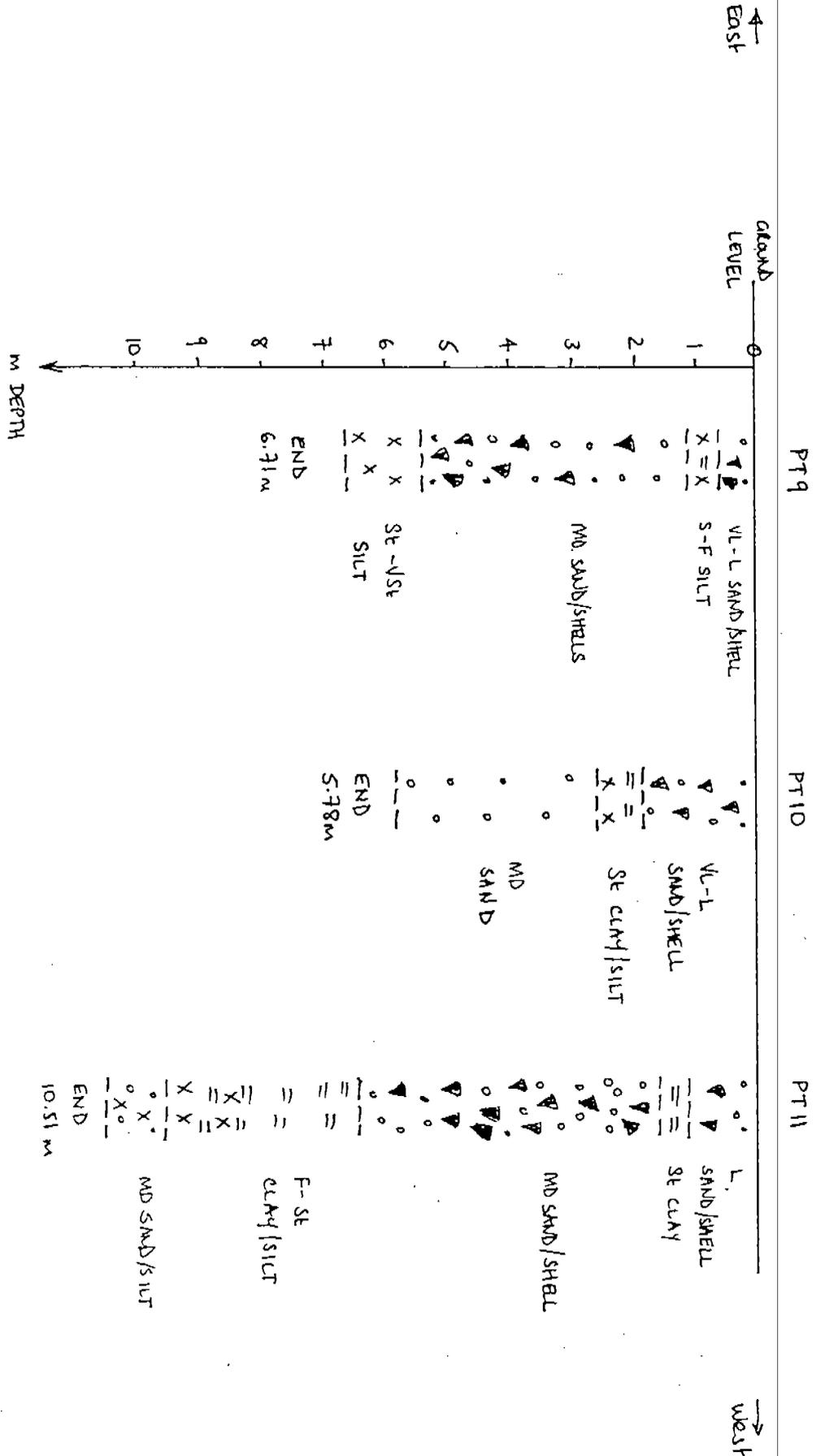
Schematic
Geological Cross Section
PT6, PT7, PT8

LINE 2



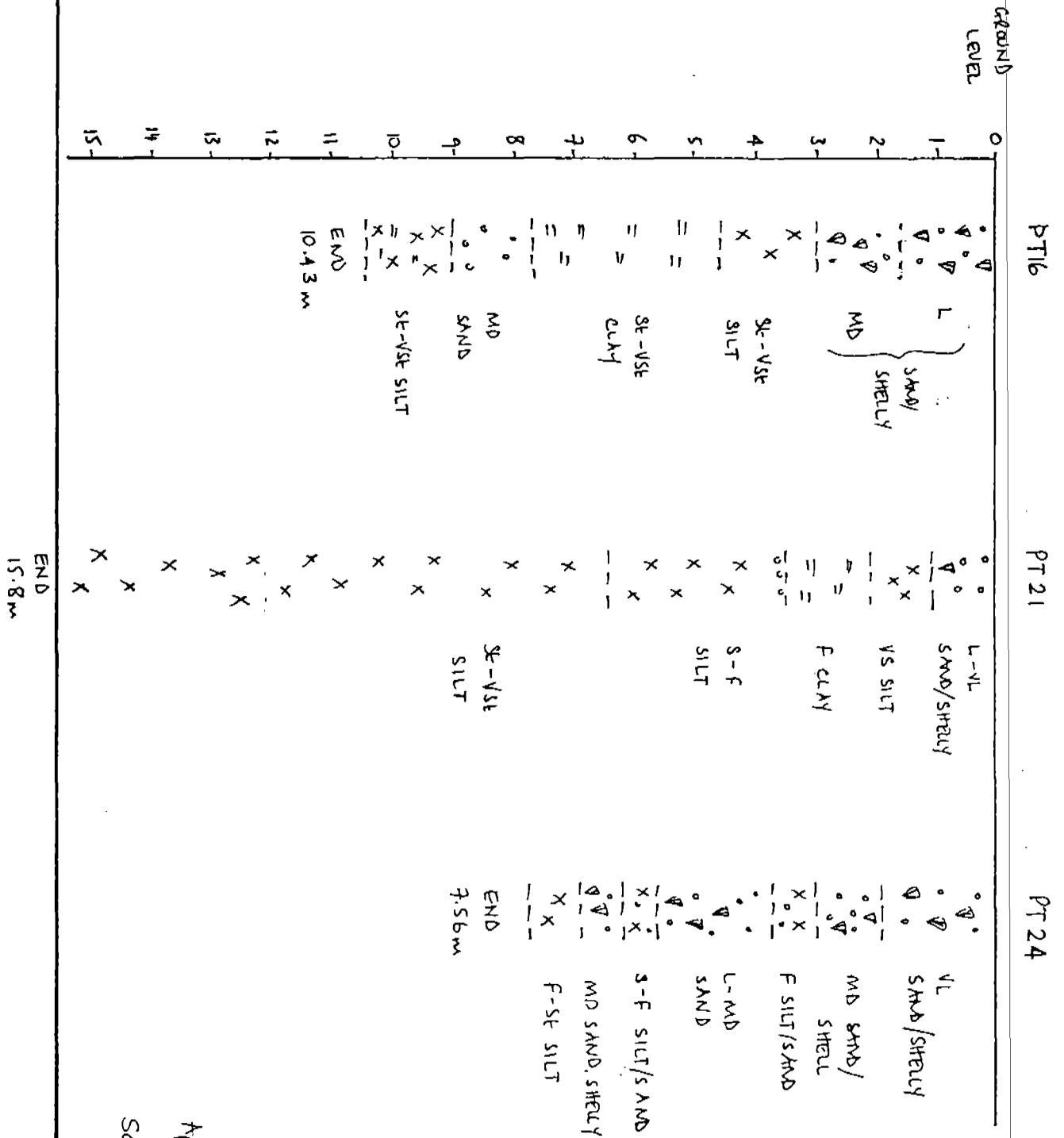
PROJECT: Ralphs Bay Geotech Investigation
NO. E99092

LWC 3



sketchwork
Geological Cross Section
PT9, PT10, PT11

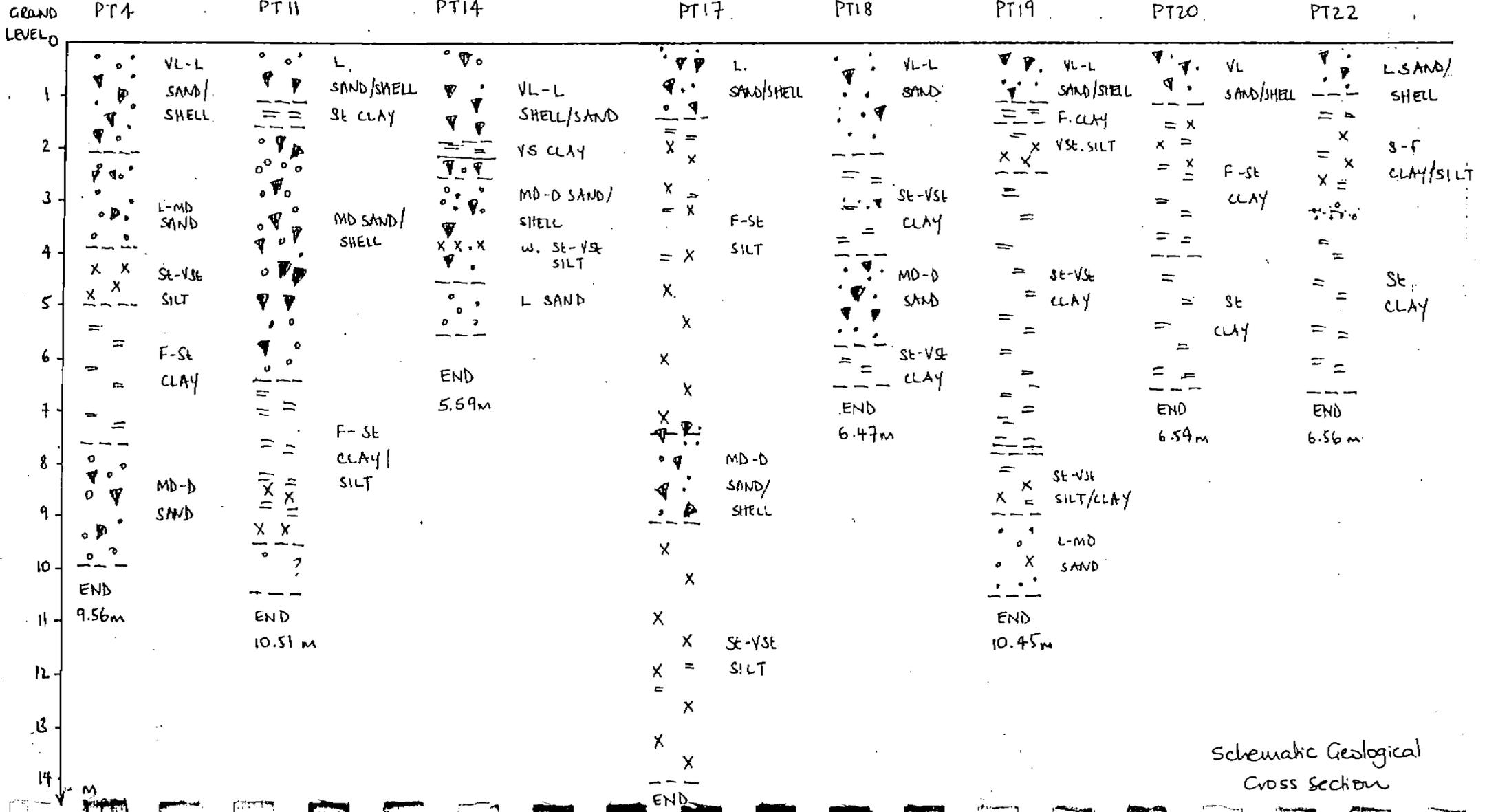
PROJECT: Ralphs Bay Geotech Investigation
NO. E99092



Appendix A
 Schematic Geological Cross Section

NORTH
←

→
SOUTH



Schematic Geological Cross Section

Appendix B

Water Jetting Logs

Ralphs Bay - Water Jetting

10/12/99 - Low Water 5:43 / 0.70m

Hole Number	Location	Depth (mm)	Layer Of Materials
WJ1	0539433 5247015	0.00 to 1.20 1.20 to 3.50 3.50 to 3.80 3.80 to 4.00 4.00 to 6.00	sand, fine gravels and shells clays, sandy silty gravel - hard gravel clay - hard
WJ2	0539320 5247337	0.0 to 1.20 1.20 to 4.00 4.00 to 5.00 5.00 to 5.40 5.40 to 6.00	sand, fine gravels and shells clays, sandy silty clay coarse gravel shingle clays - hard
WJ3	0539113 5247803	0.0 to 1.50 1.50 to 3.00 3.00 to 4.00 4.00 to 4.30 4.30 to 4.60 4.60	sand, fine gravels and shells clays, sandy silty clay coarse gravel clays - hard hard layer - clay?
WJ4	0538816 5248020	0.0 to 1.50 1.50 to 3.10 3.10 to 3.30 3.30 to 4.20 4.20 to 4.50 4.50 to 6.00	sand, fine gravels and shells clay gravel - hard clay gravel - hard sandy clays - hard
WJ5	0538873 5248264	0.0 to 1.00 1.0 to 5.50 5.50 to 6.00	sand, fine gravels and shells sand and fine gravel / shell layers sands - hard (hw sanstone ?)
WJ6	0538835 5248420	0.0 to 2.00 2.00 to 4.00 4.00 to 5.50 5.50 to 6.00	sand, fine gravels and shells clays, sandy clays sands - hard (hw sandstone ?)
WJ7	0538743 5248616	0.0 to 2.50 2.50 to 3.00 3.00 to 4.00 4.00 to 6.00	sand, fine gravels and shells gravel clays sandy sands - hard (hw sandstone ?)
WJ8	0538683 5248883	0.0 to 1.50 1.50 to 3.90 3.90	sand, fine gravels and shells clays sandy sands - very hard (hw sandstone ?)

Appendix C

Electric Cone Penetrometer Test Logs

Pitt & Sherry
Laboratory and Field Testing Services
Electric Cone Penetrometer Testing at Ralphs Bay

1. SCOPE

The electric cone penetrometer is a device for measuring the point resistance (qc) and frictional properties (fs) of soil, as the probe is pushed into the soil. The equipment is trailer mounted weighing 1.5 tonnes and can be towed around the site by a small excavator (7 to 10 tonne).

2. APPARATUS

- (a) Trailer mounted Penetrometer (20 tonne driving capacity).
- (b) Excavator 10 tonnes
- (c) Probe driving rods 35mm
- (d) Electric cone probe tip and sleeve assembly (10 & 5 tonne)
- (e) Soil sampling device
- (f) CPT Data acquisition system
- (g) GPS Data logger
- (h) Site ranging poles (4 off)
- (i) Measuring tapes

3. PROCEDURE

The survey was carried out by two technicians. Ranging poles were used to determine approximate locations of the penetrometer testing. GPS was then used to determine accurate position. All depths were measured from ground surface level.

The location for each penetrometer hole was predetermined and the shortest route selected for traversing between them, thus minimising surface disturbance. The access route was then checked for stability using a Farnell (hand) penetrometer. An excavator towed the penetrometer into position.

Once the penetrometer was located over a selected site, the four mechanical legs on timber blocks were adjusted to ensure that the hydraulic rams were in a vertical position. The machine was then anchored by means of one 300mm anchor at each corner. These screw anchors were driven 1 meter into the ground by means of a hydraulic spanner. Very little disturbance of the surface materials was created by this method.

Once the machine was secured, the testing could commence by pushing with the penetrometer machine a 35mm probe into the ground to the desired depth.

The survey started at the northern end of the bay and progressed in a southerly direction along two main transects. Tidal position determined the starting location. Tidal periods determined how many times the penetrometer would have to enter/exit the site to complete the transects.

The disturbance to the environment was considered minimal with this form of survey. The excavator employed had wider than normal tracks, was lightweight, and avoided slewing as far as practicable, resulting in limited surface disturbance. Advancing and withdrawing the probe created virtually no disturbance around the probe. Any disturbances were usually quickly moderated by tidal action.

No hazardous materials were utilised in this process - on board fuel being the only potential contaminant, and only in small quantities. All reasonable measures were taken to avoid any fuel spillage into the bay, eg no refuelling was undertaken over the water.

Cone Penetration Test

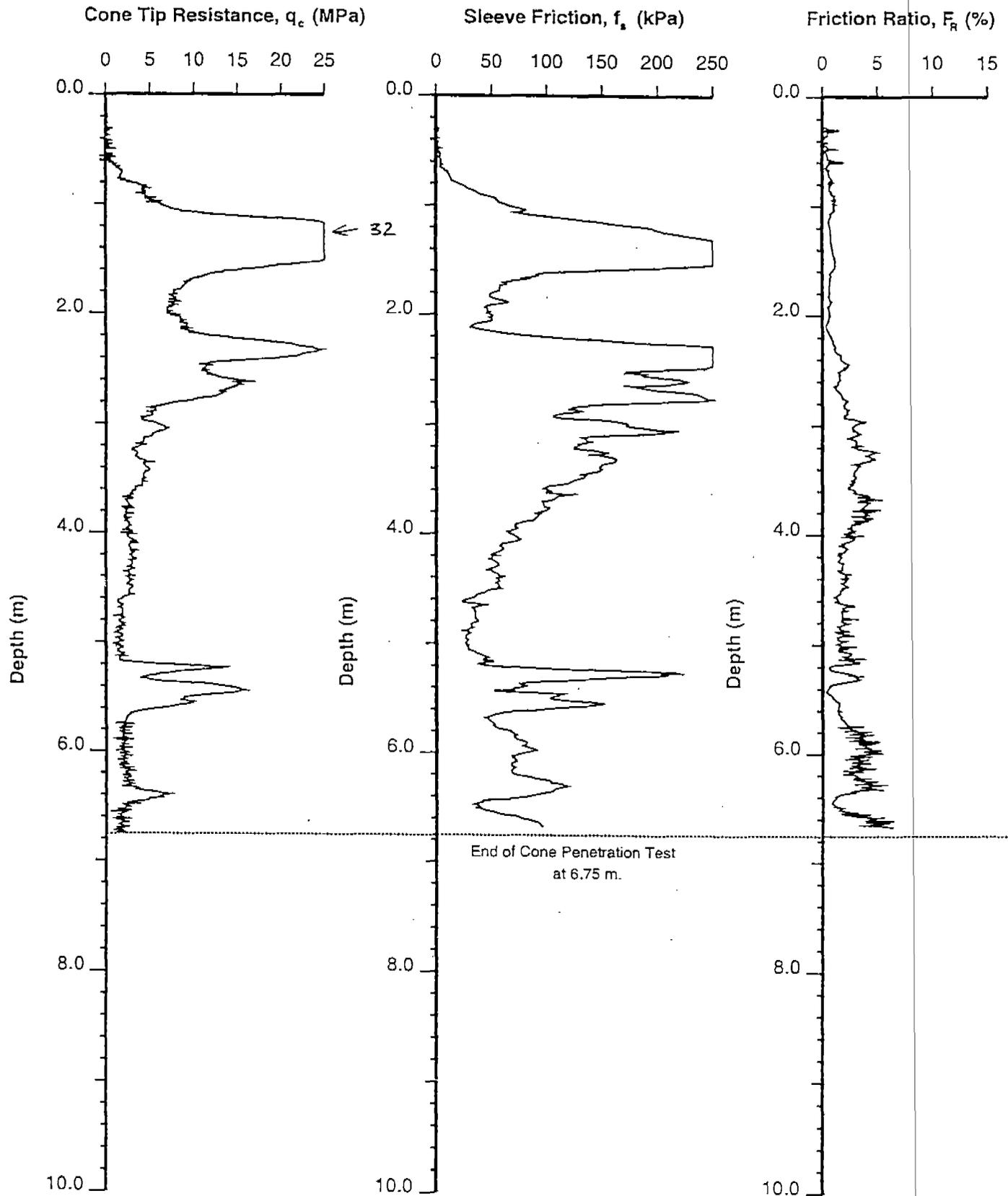
Client: Tommex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2201 (PT1)

Surface R.L.: -

Date: 15/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

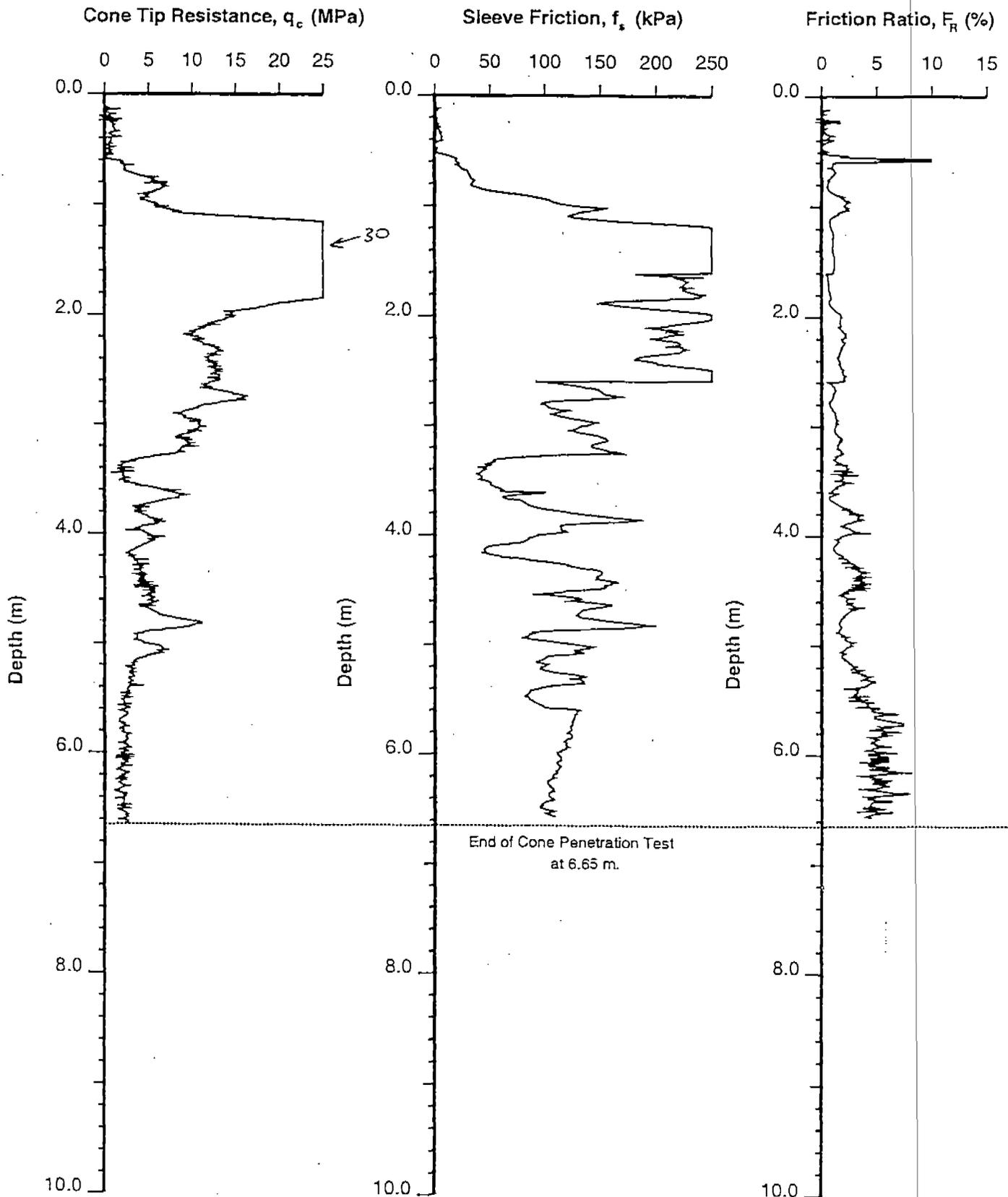
Client: Tommex Holdings Pty Ltd.

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2203 (PT3)

Surface R.L.: -

Date: 15/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

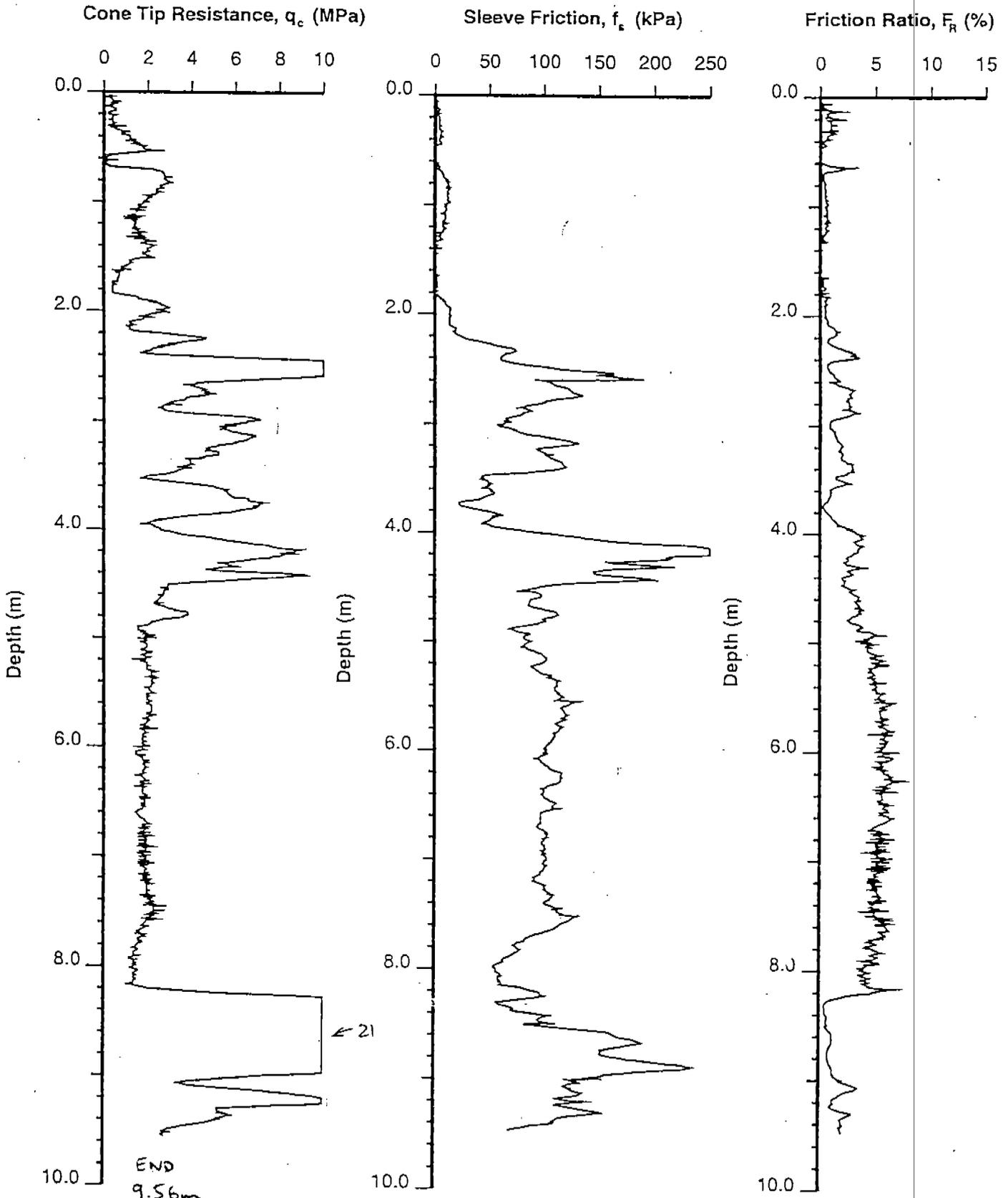
Client: Tominec Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45504 (PT4)

Surface R.L.: -

Date: 18/02/00



Comments: 5t cone (no.455)

Cone Penetration Test

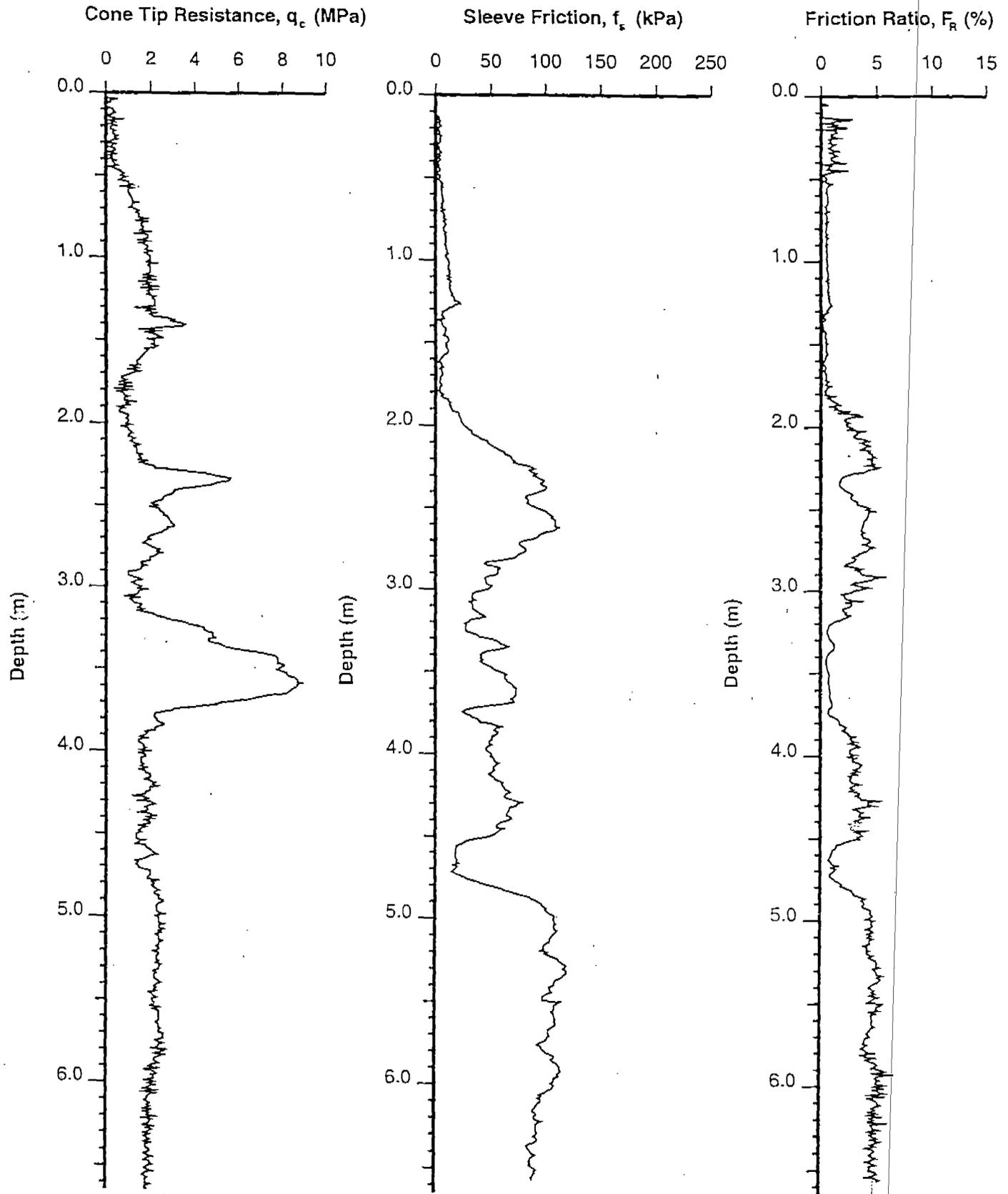
Client: Tomirex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45505 (PT5)

Surface R.L.: -

Date: 16/02/00



END
6.6m

Comments: 5t cone (no.455)

Cone Penetration Test

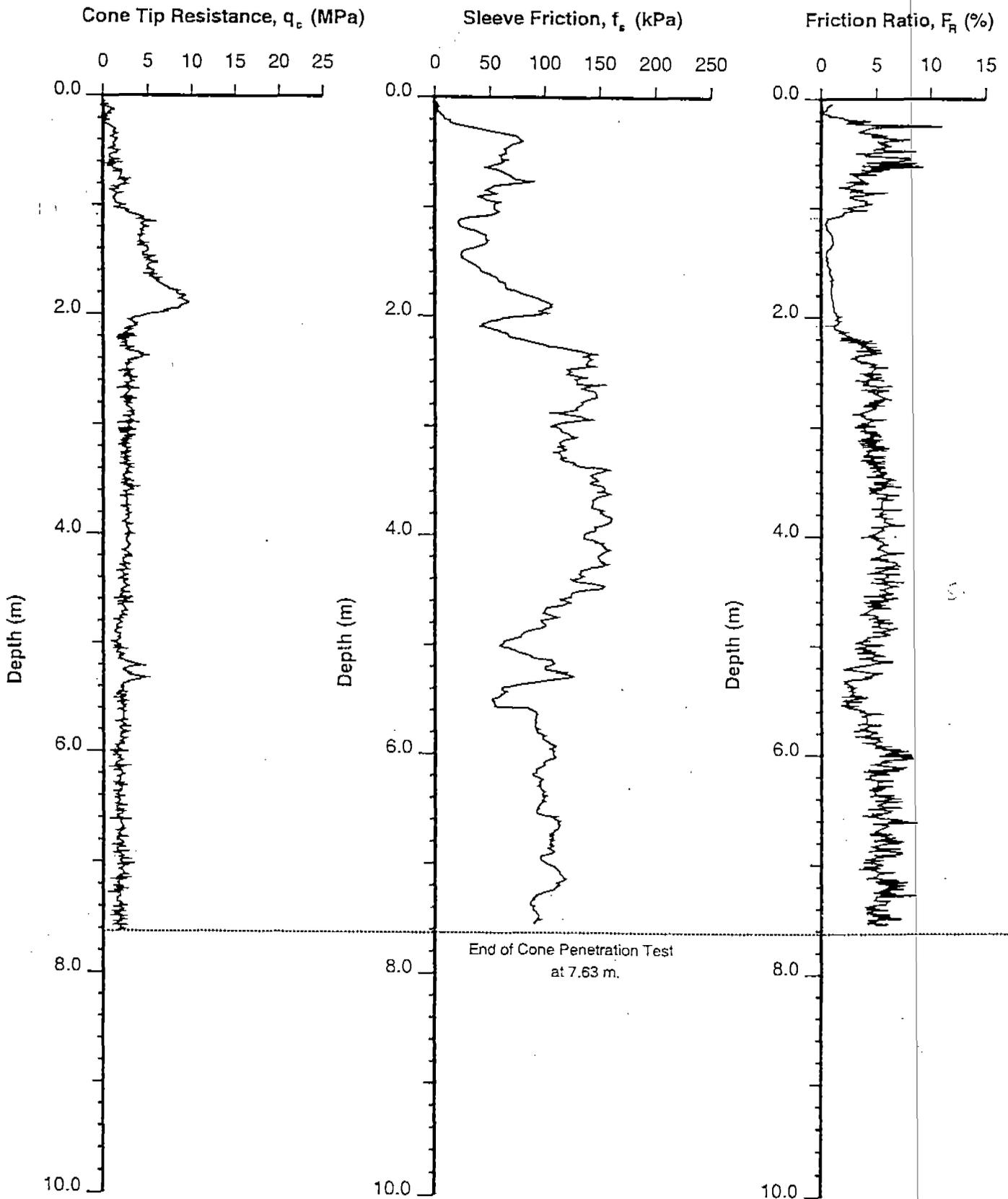
Client: Tomlinex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2206 (PT6)

Surface R.L.: -

Date: 15/02/00



Comments: 20 t cone (no.22)

Cone Penetration Test

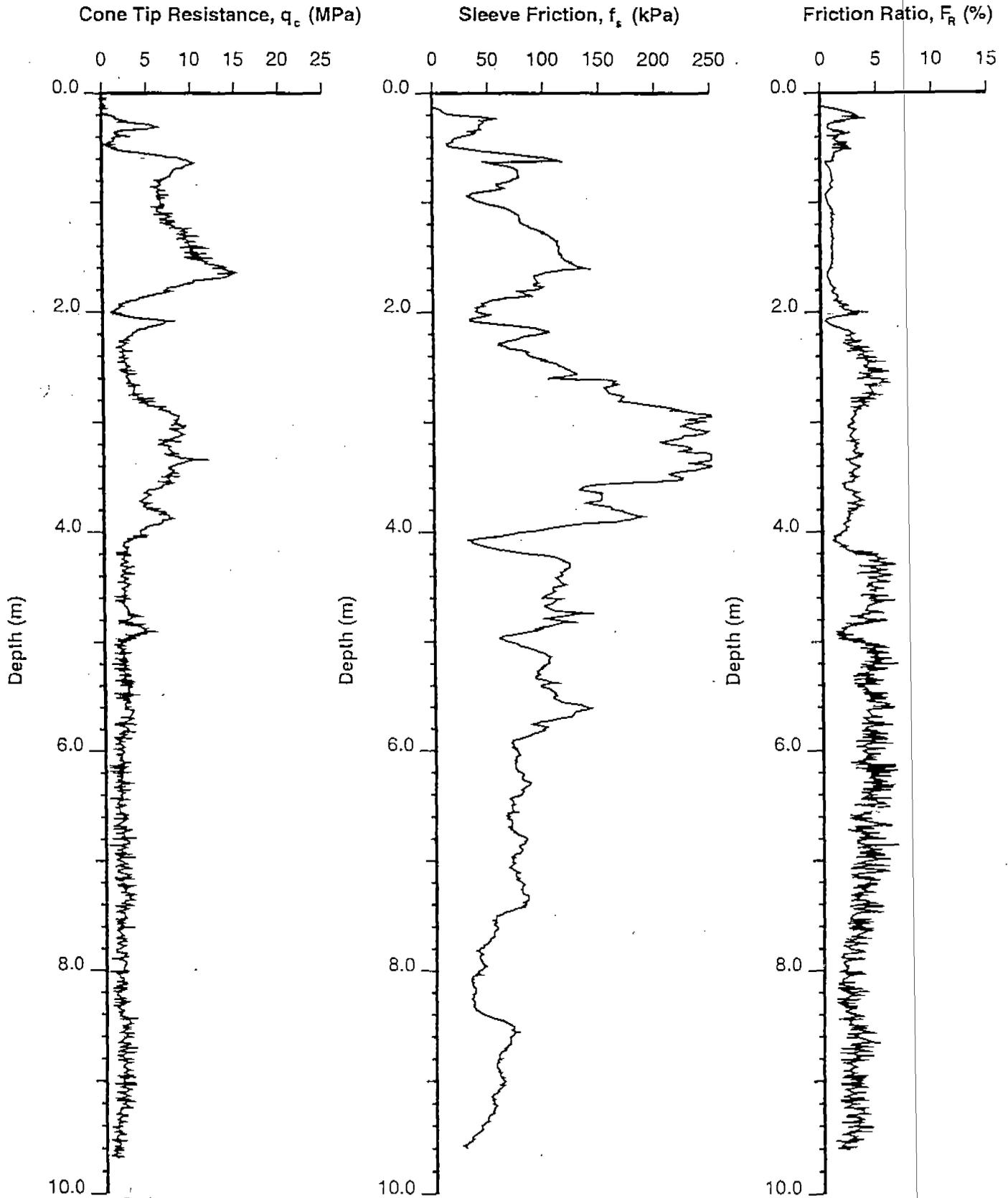
Client: Tominec Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2207 (PT 7)

Surface R.L.: -

Date: 15/02/00



END
9.67m

Comments: 20t cone (no.22)

Cone Penetration Test

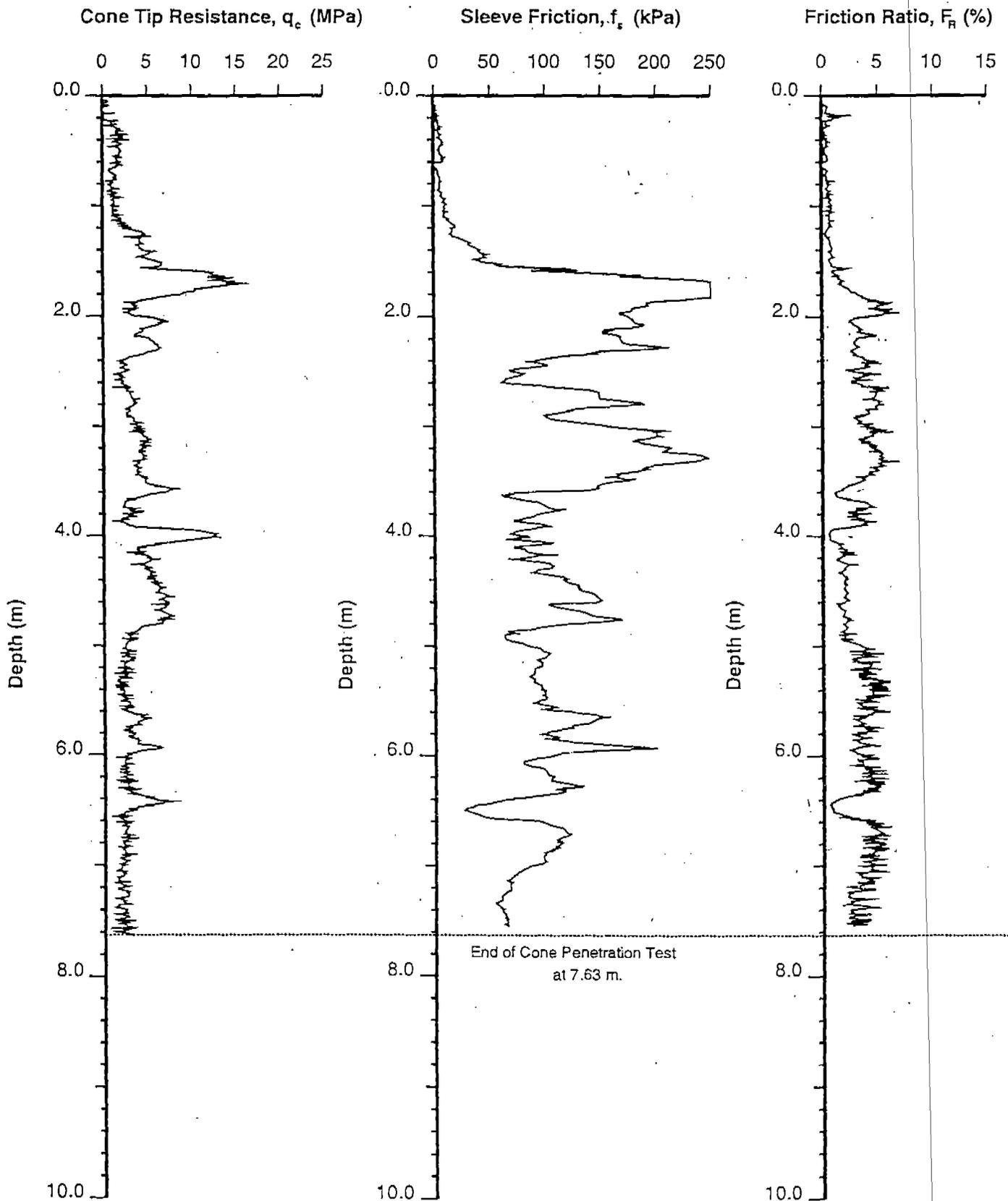
Client: Tomnex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2208 (PT8)

Surface R.L.: -

Date: 15/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

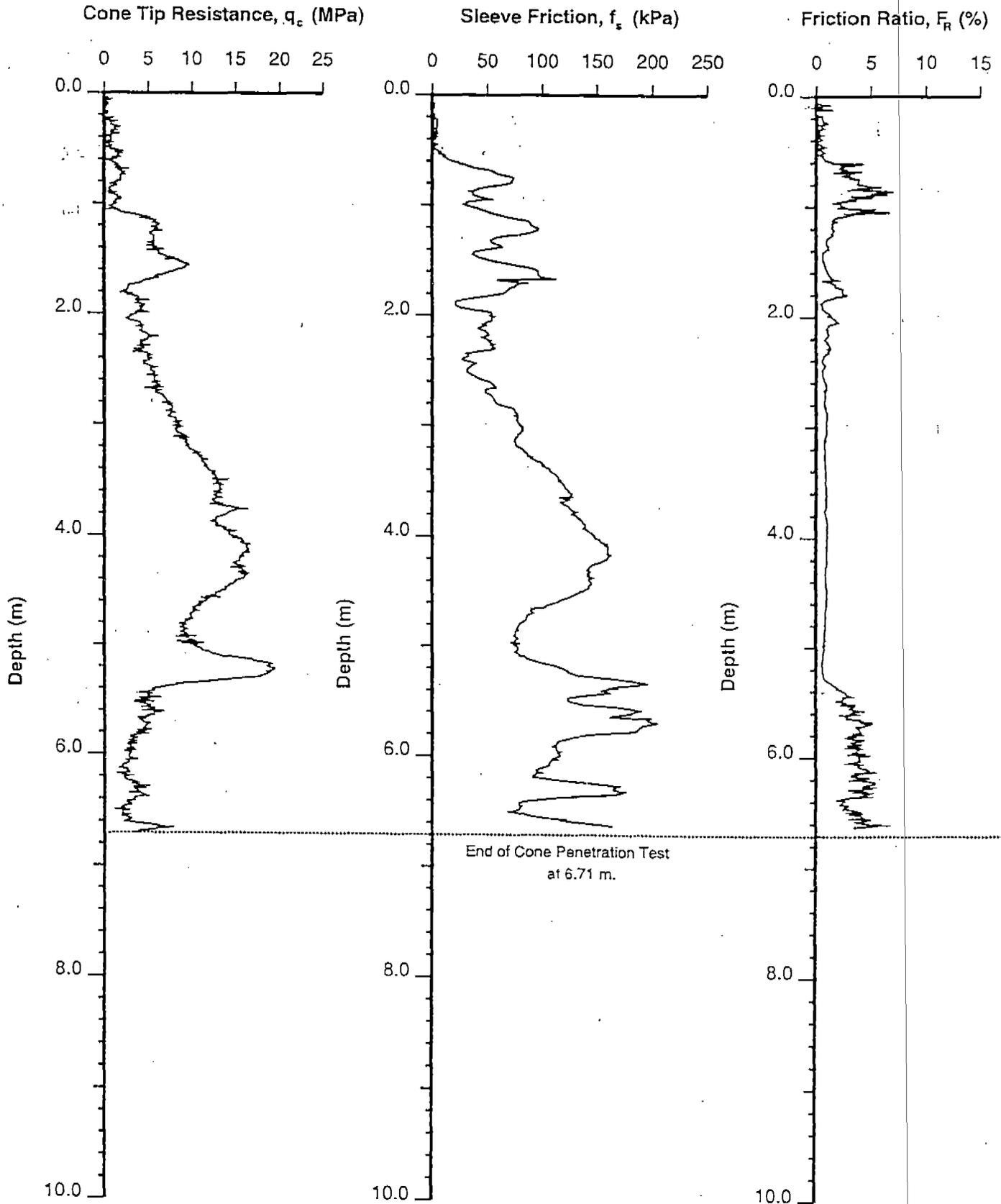
Client: Tominex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2209 (PT9)

Surface R.L.: -

Date: 16/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

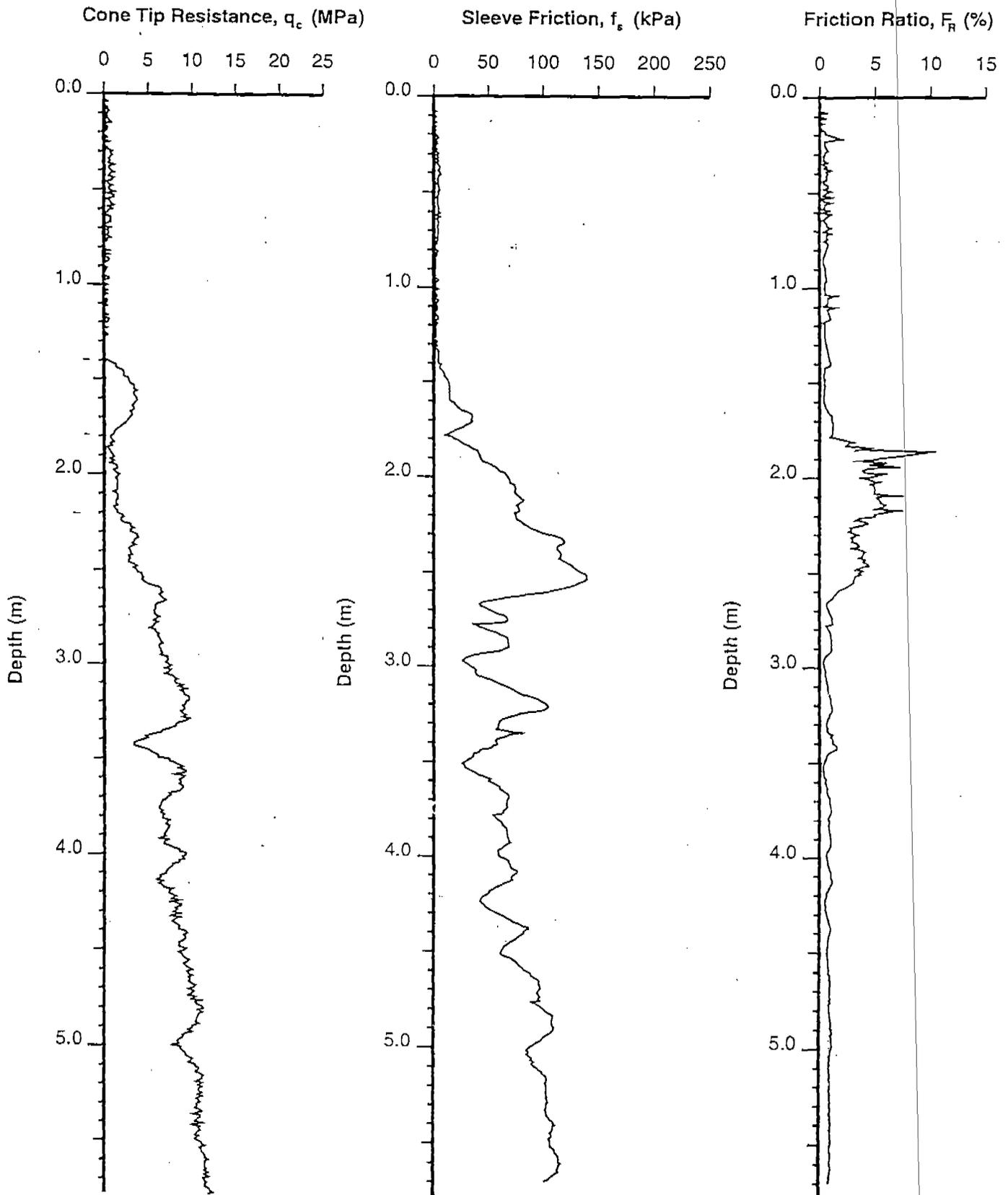
Client: Tomiex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2210 (PT.10)

Surface R.L.: -

Date: 15/02/00



END
5.78m

Comments: 20t cone (no.22)

Cone Penetration Test

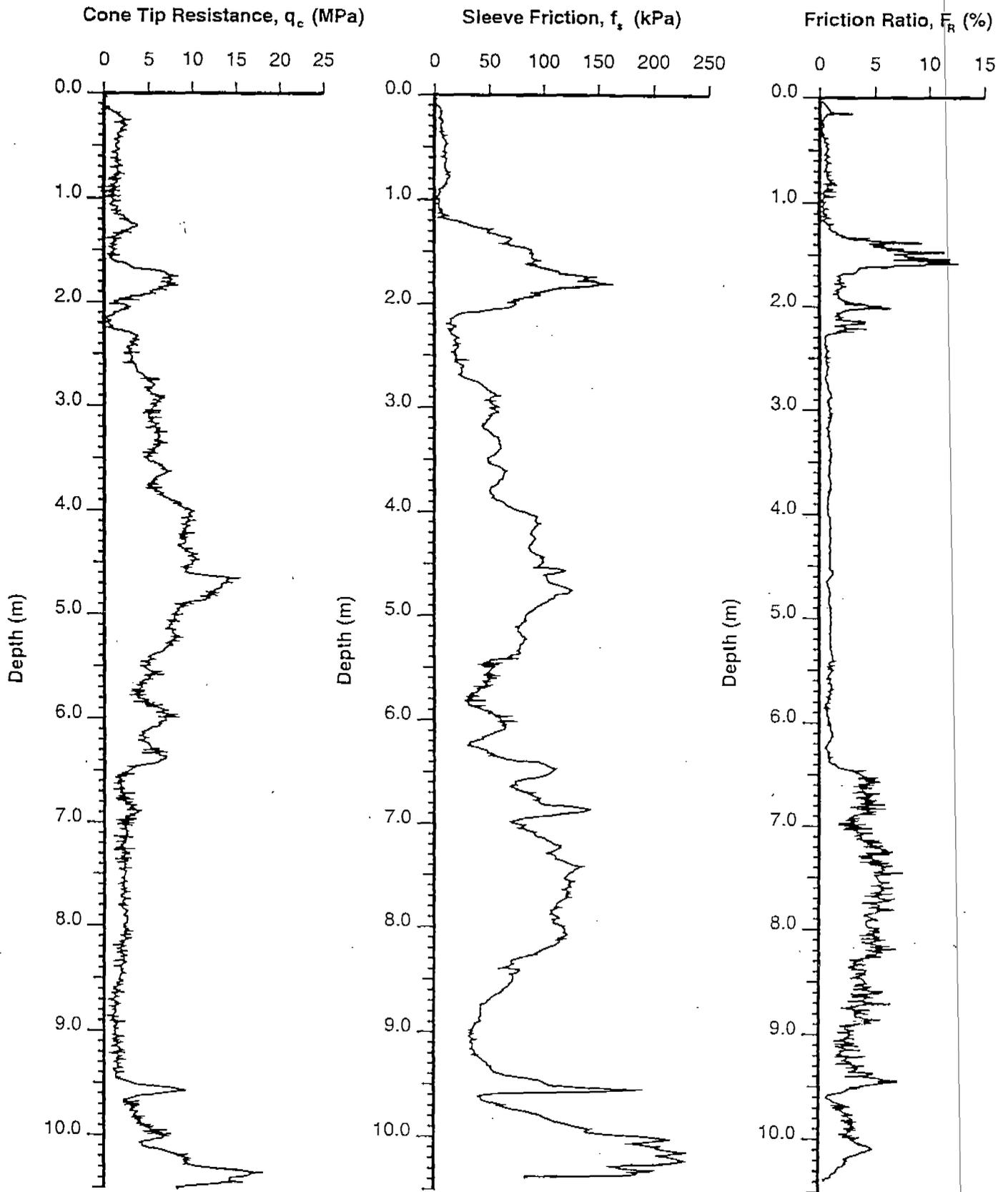
Client: Tomminex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2211

Surface R.L.: -

Date: 16/02/00



END
10.51m

Comments: 20t cone (no.22)

Cone Penetration Test

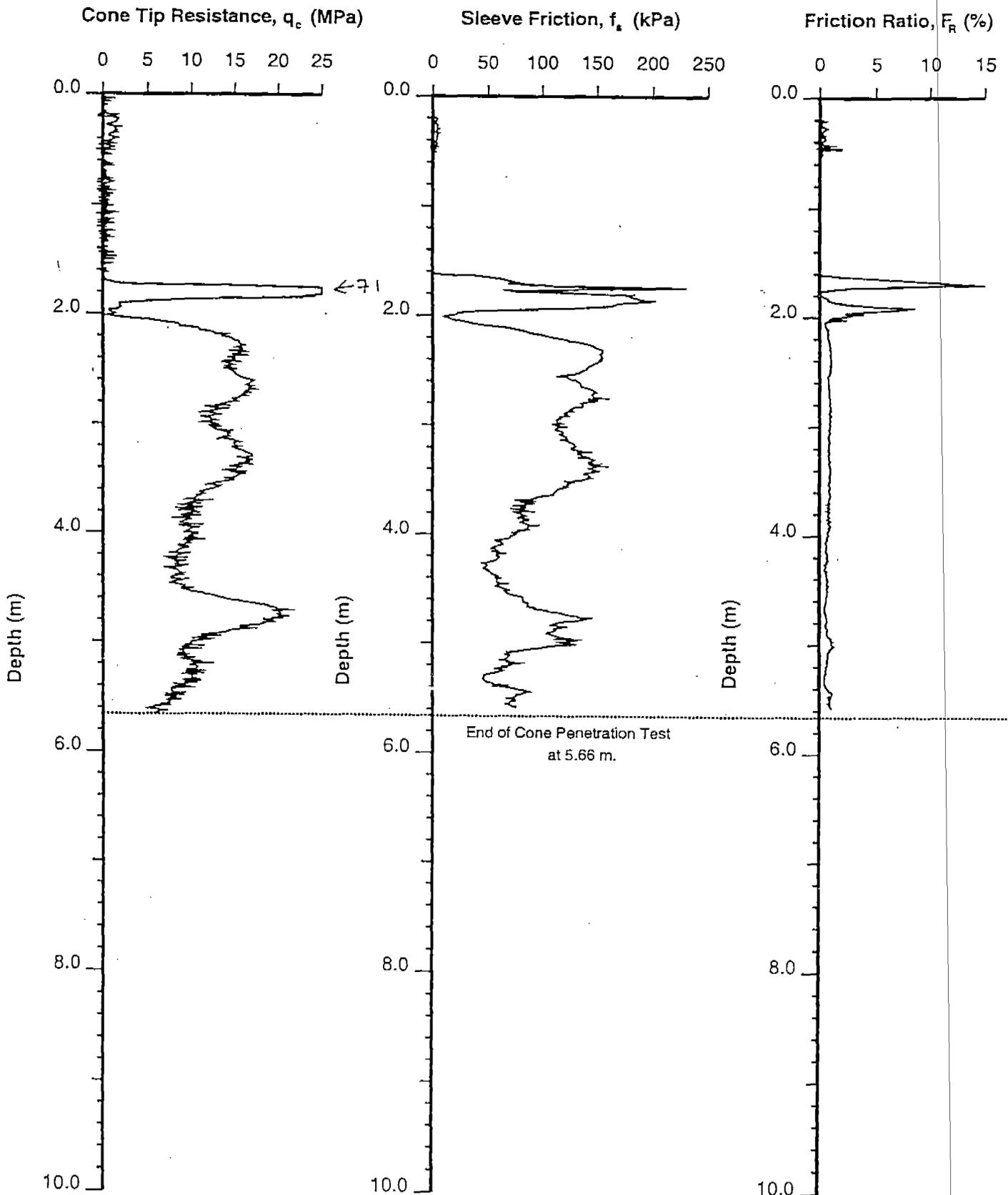
Client: Tomminex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2212 (PT12)

Surface R.L.: -

Date: 16/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

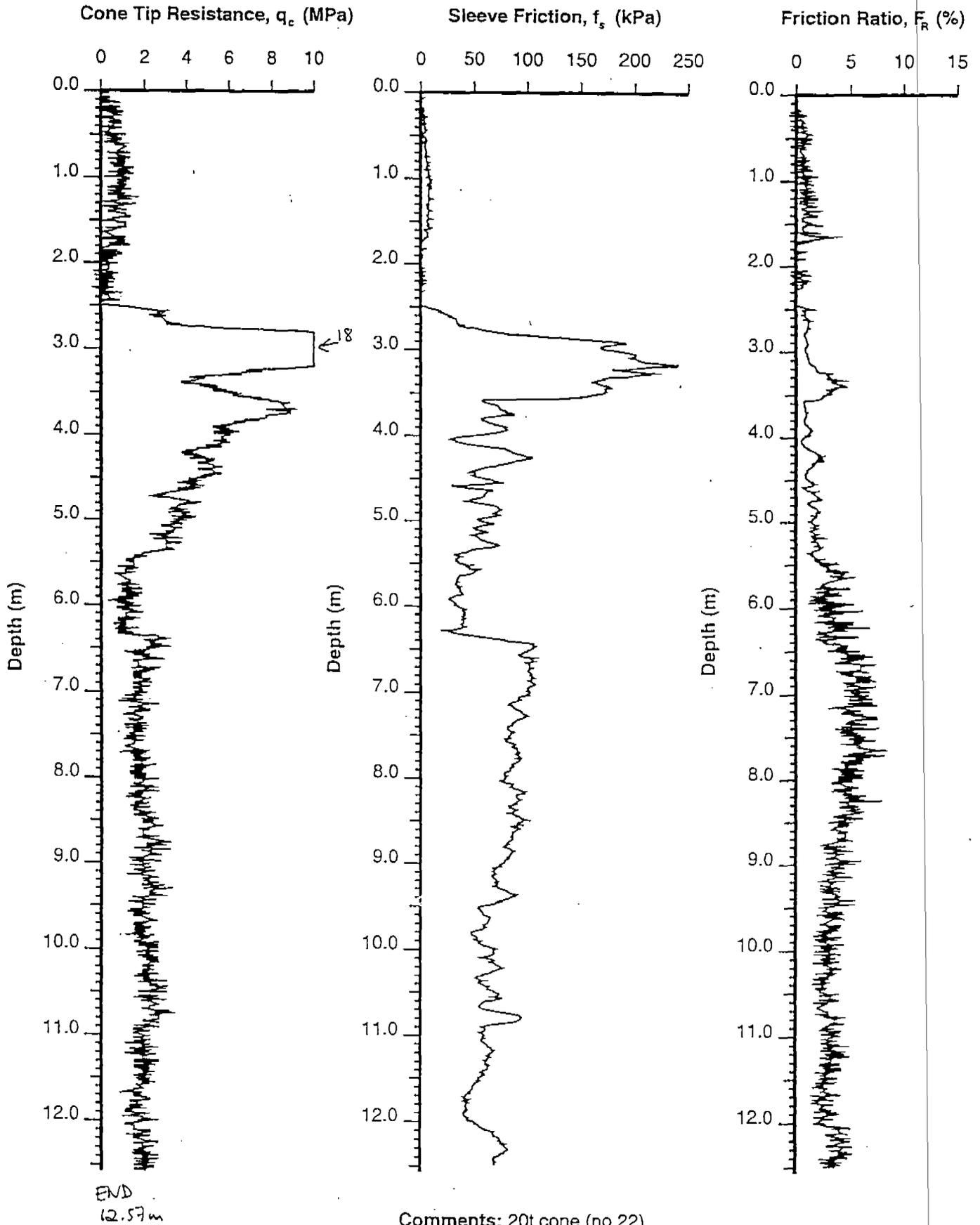
Client: Tomlinex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2213 (PT13)

Surface R.L.: -

Date: 16/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

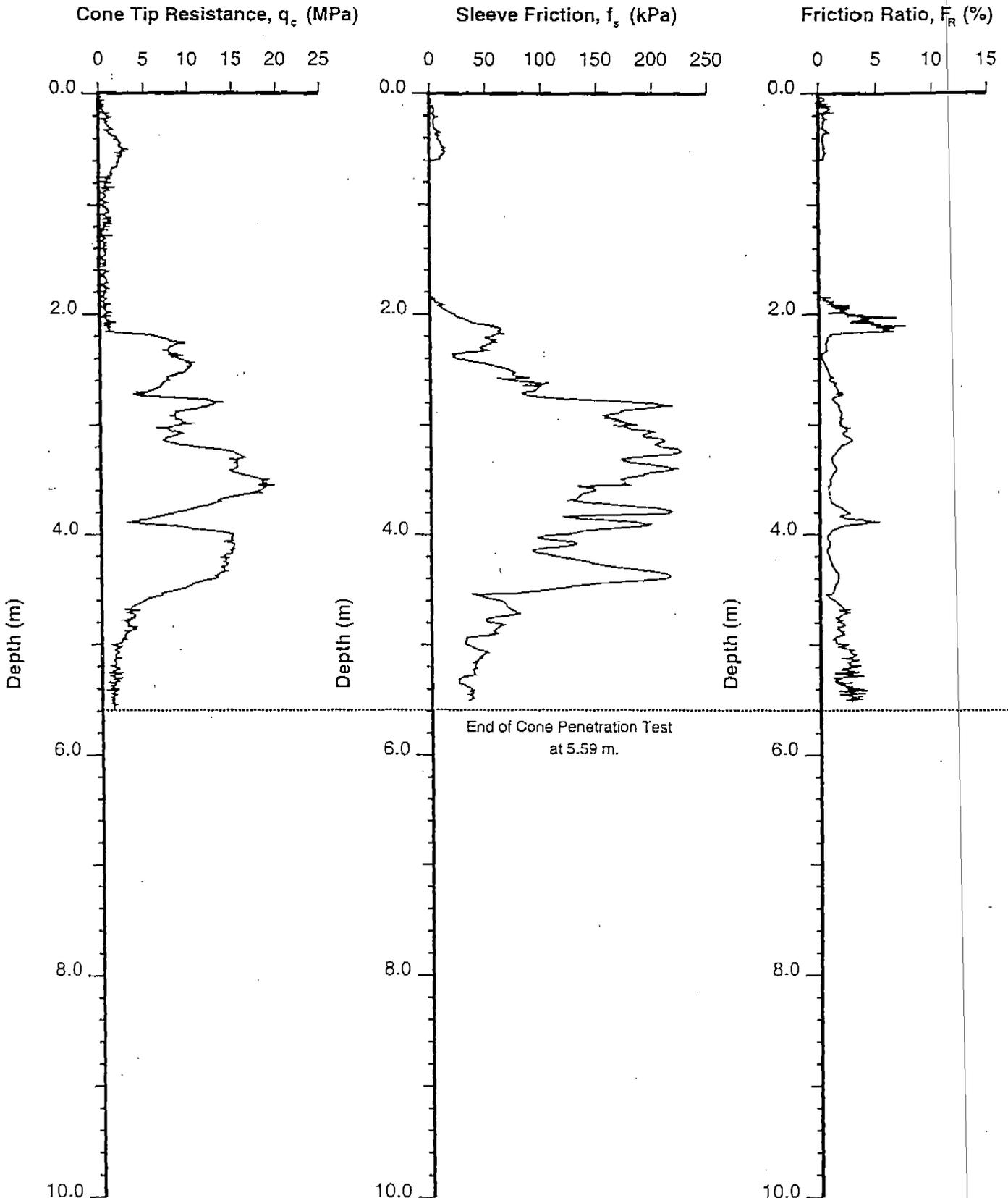
Client: Tomnex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2214 (PT14)

Surface R.L.: -

Date: 16/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

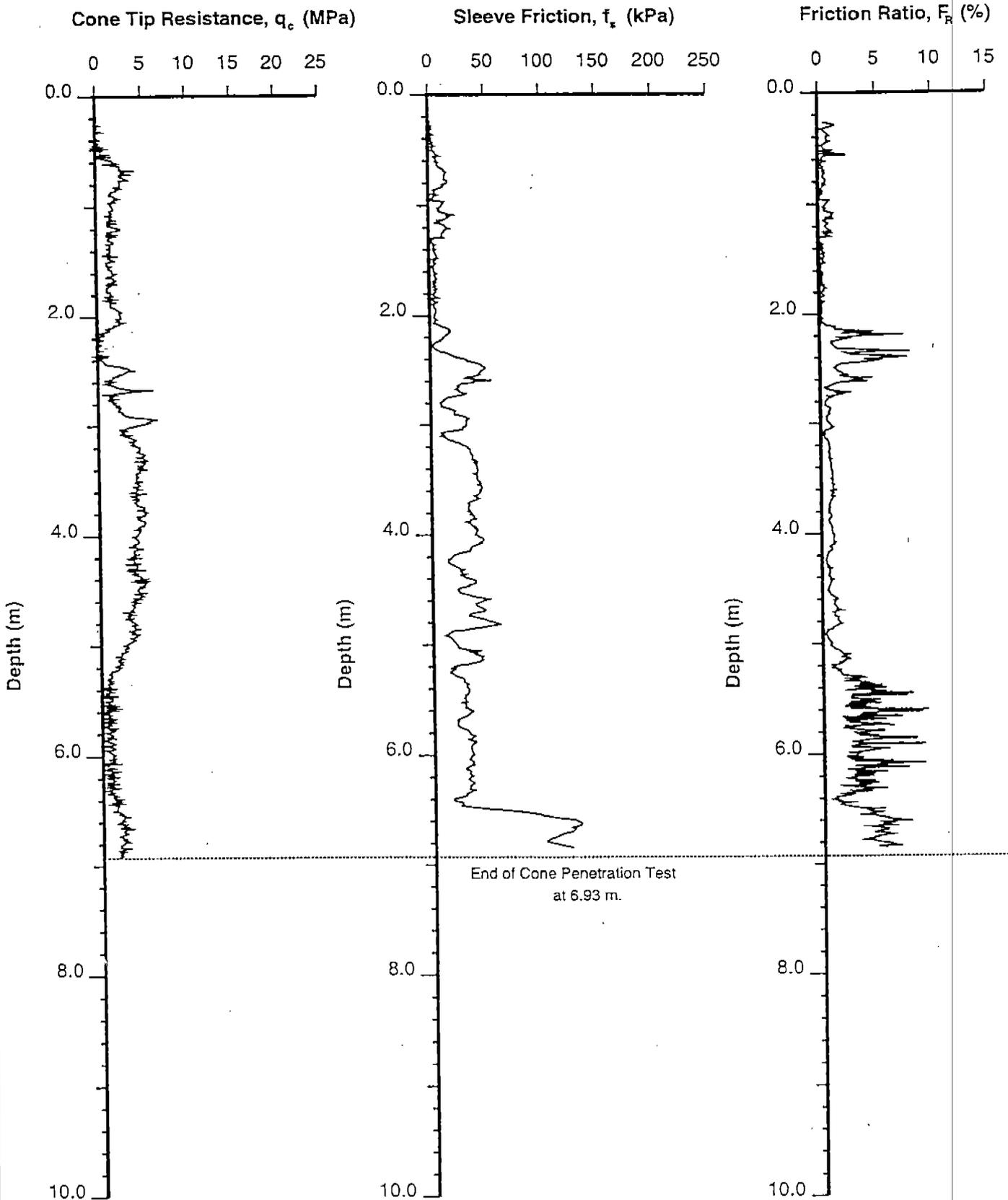
Client: Tomlinex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb2215 (PT15)

Surface R.L.: -

Date: 16/02/00



Comments: 20t cone (no.22)

Cone Penetration Test

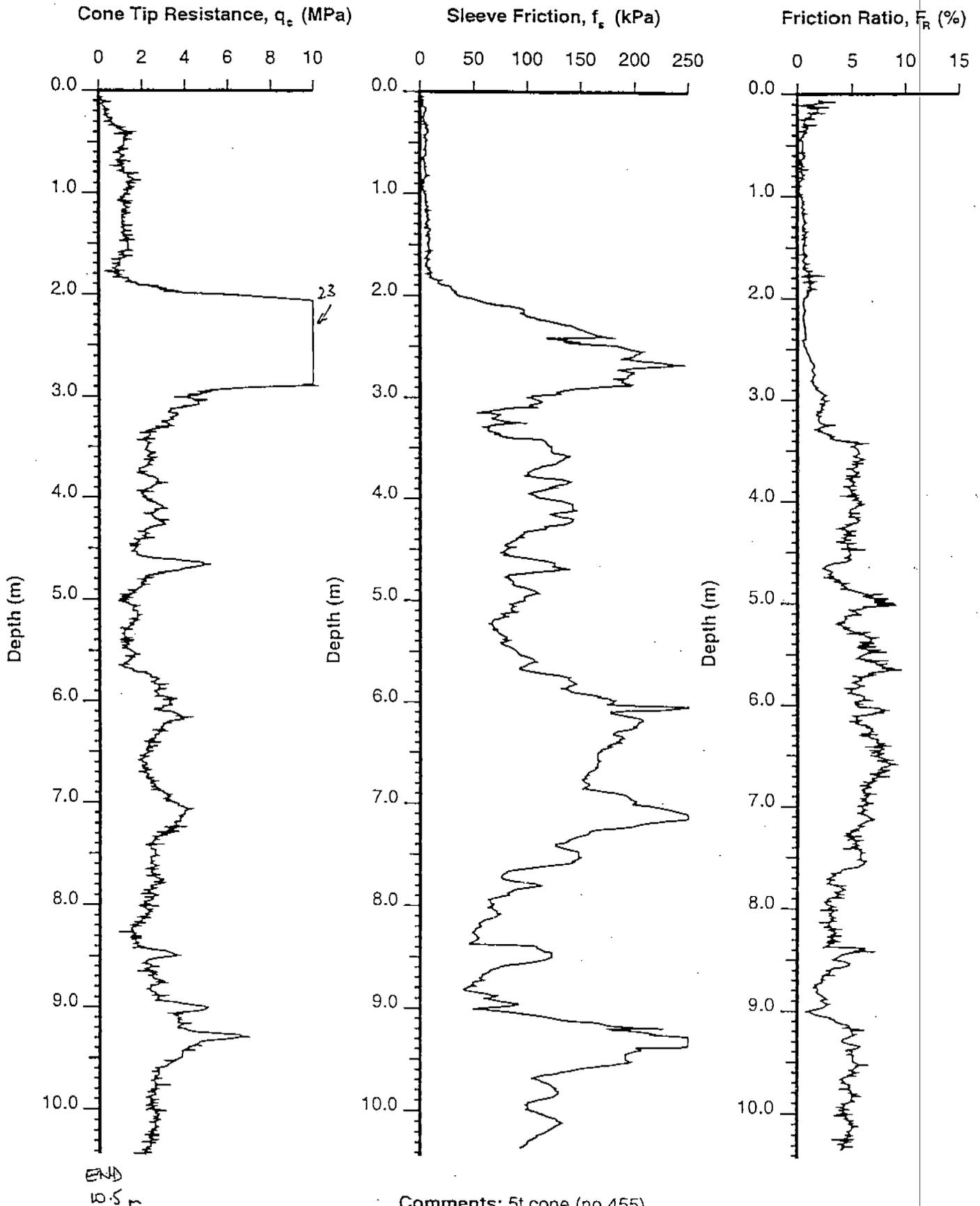
Client: Tomlinex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45516 (PT16)

Surface R.L.: -

Date: 17/02/00



Comments: 5t cone (no.455)

Cone Penetration Test

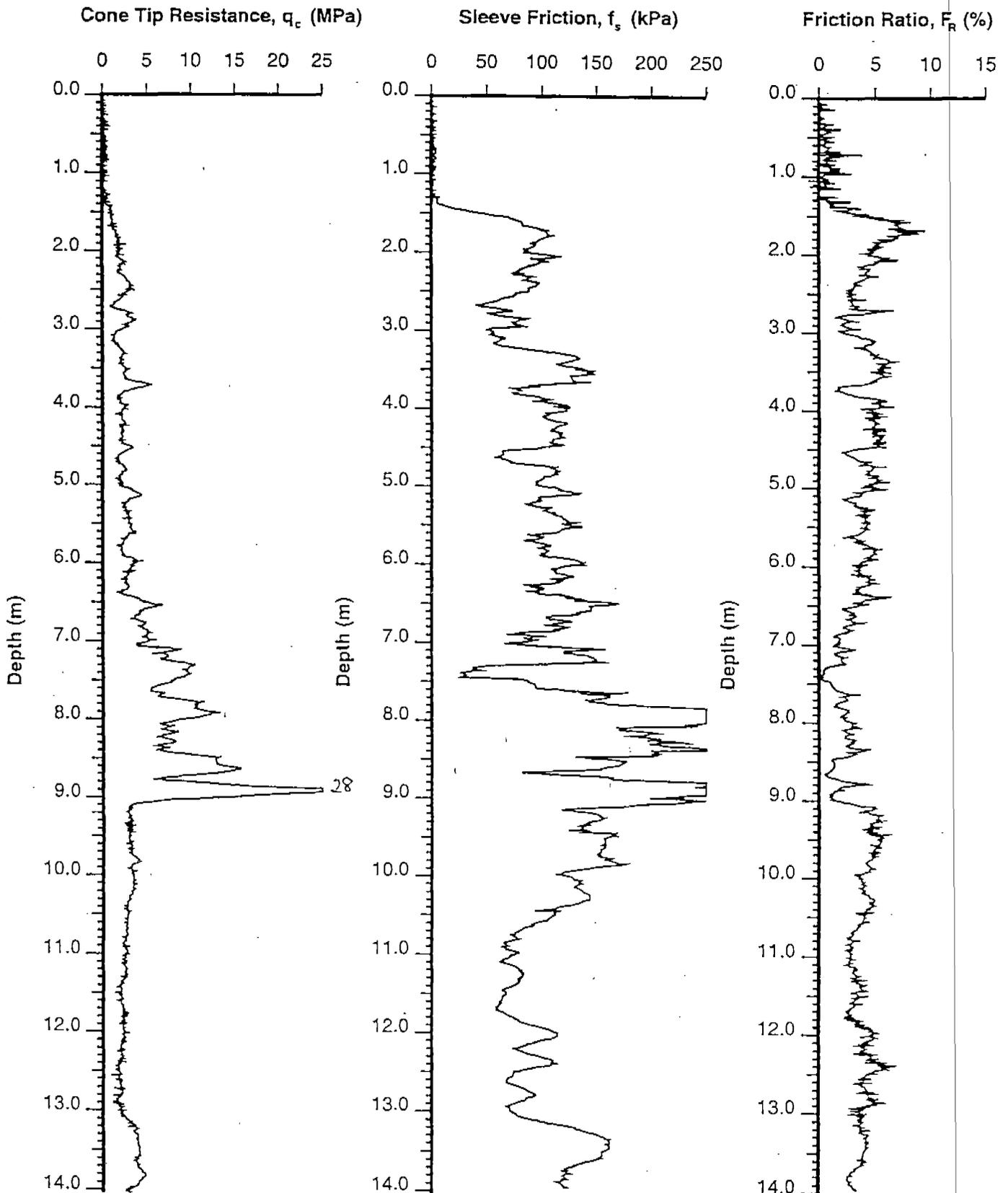
Client: Tomnex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45517 (PT17)

Surface R.L.: -

Date: 17/02/00



END
14.04m

Comments: 5t cone (no.455)

Cone Penetration Test

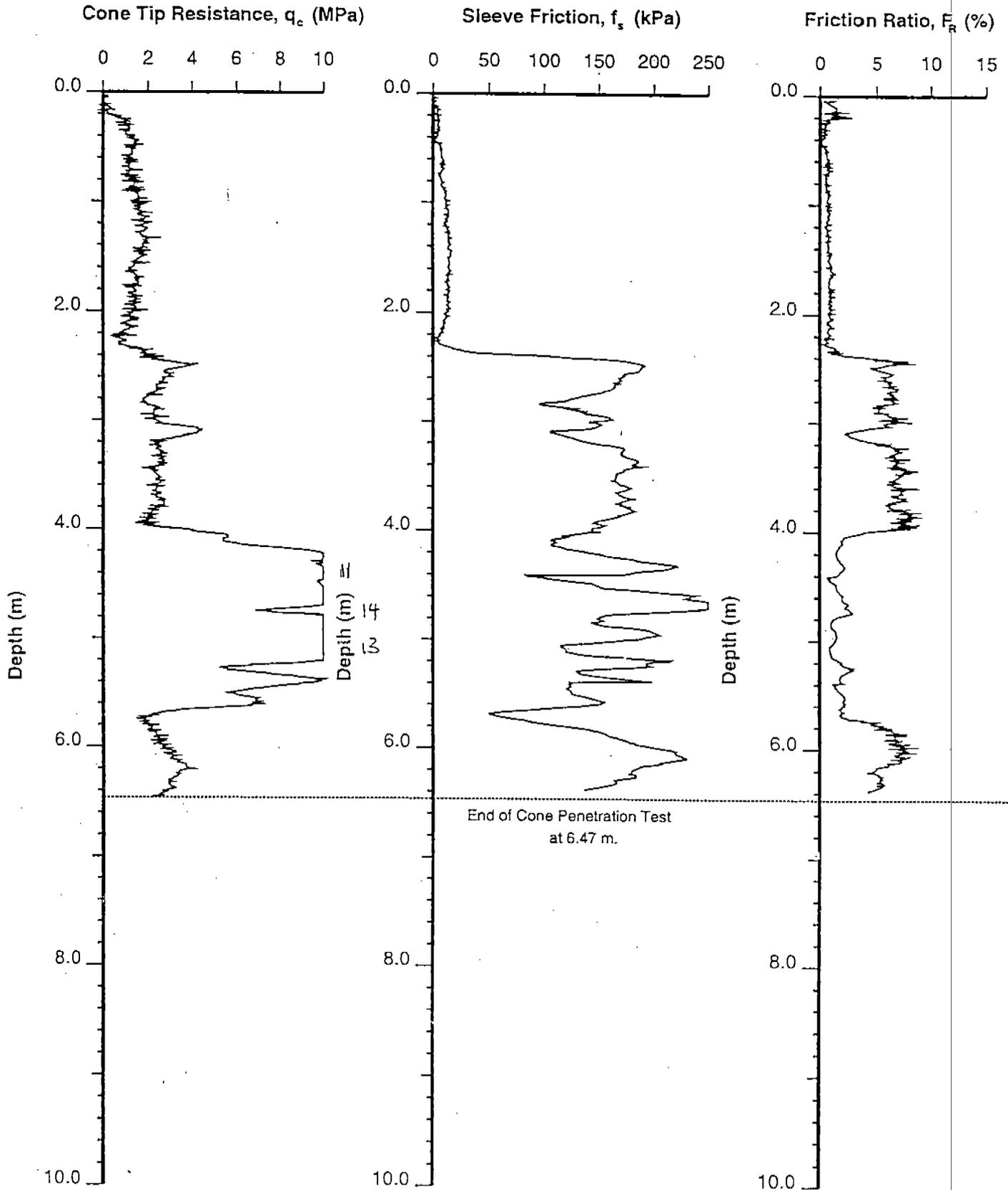
Client: Tomirex Holdings Pty Ltd

Job Details: Ralphs Bay GEotechnical Investigation

Test Location: rb45518 (PT18)

Surface R.L.: -

Date: 17/02/00



Comments: 5t cone (no.455)

Cone Penetration Test

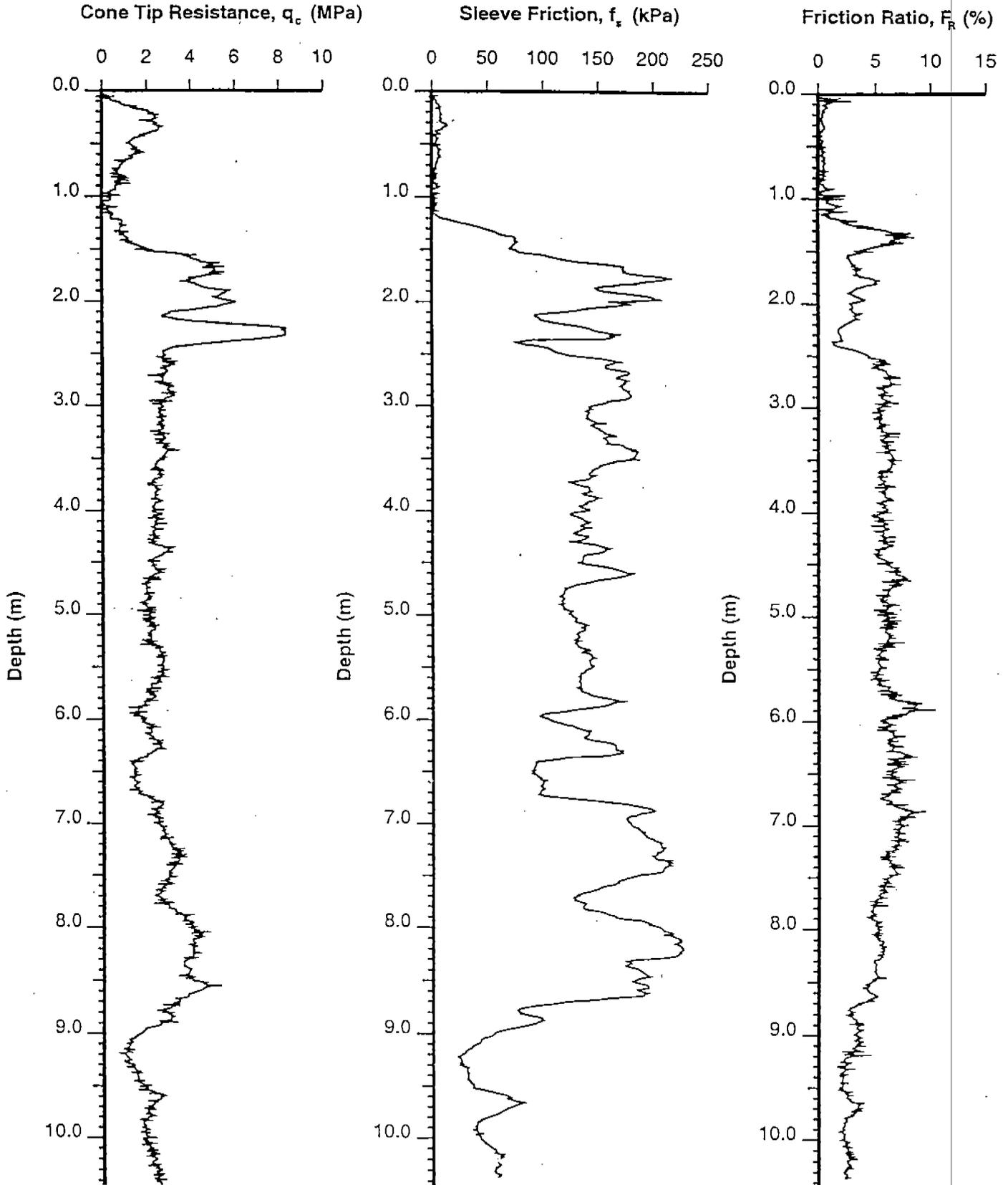
Client: Tominex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45519 (PT19)

Surface R.L.: -

Date: 17/02/00



END
10.45m

Comments: 5t cone (no.455)

Cone Penetration Test

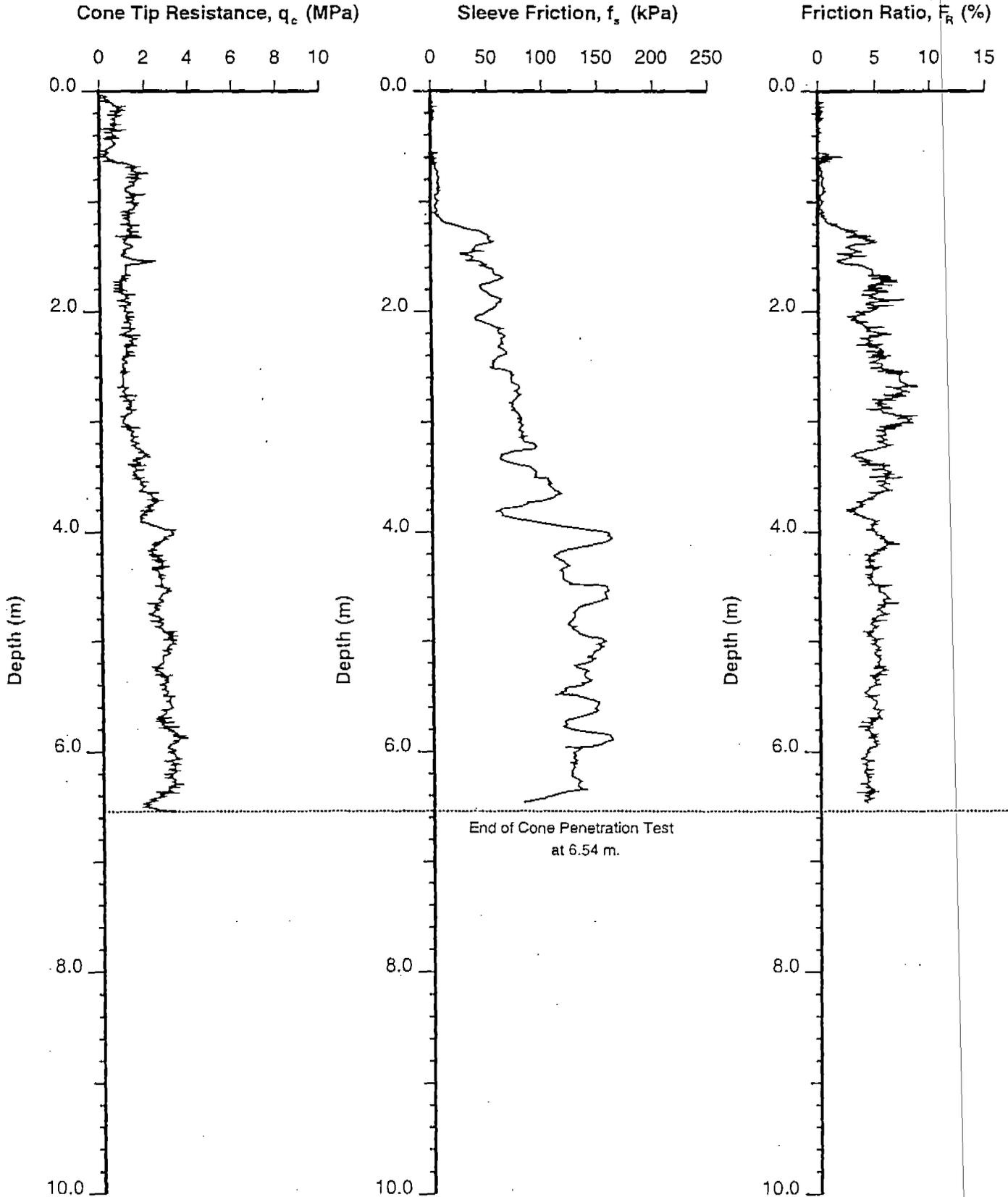
Client: Tomminex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45520 (PT20)

Surface R.L.: -

Date: 17/02/00



End of Cone Penetration Test
at 6.54 m.

Comments: 5t cone (no.455)

Cone Penetration Test

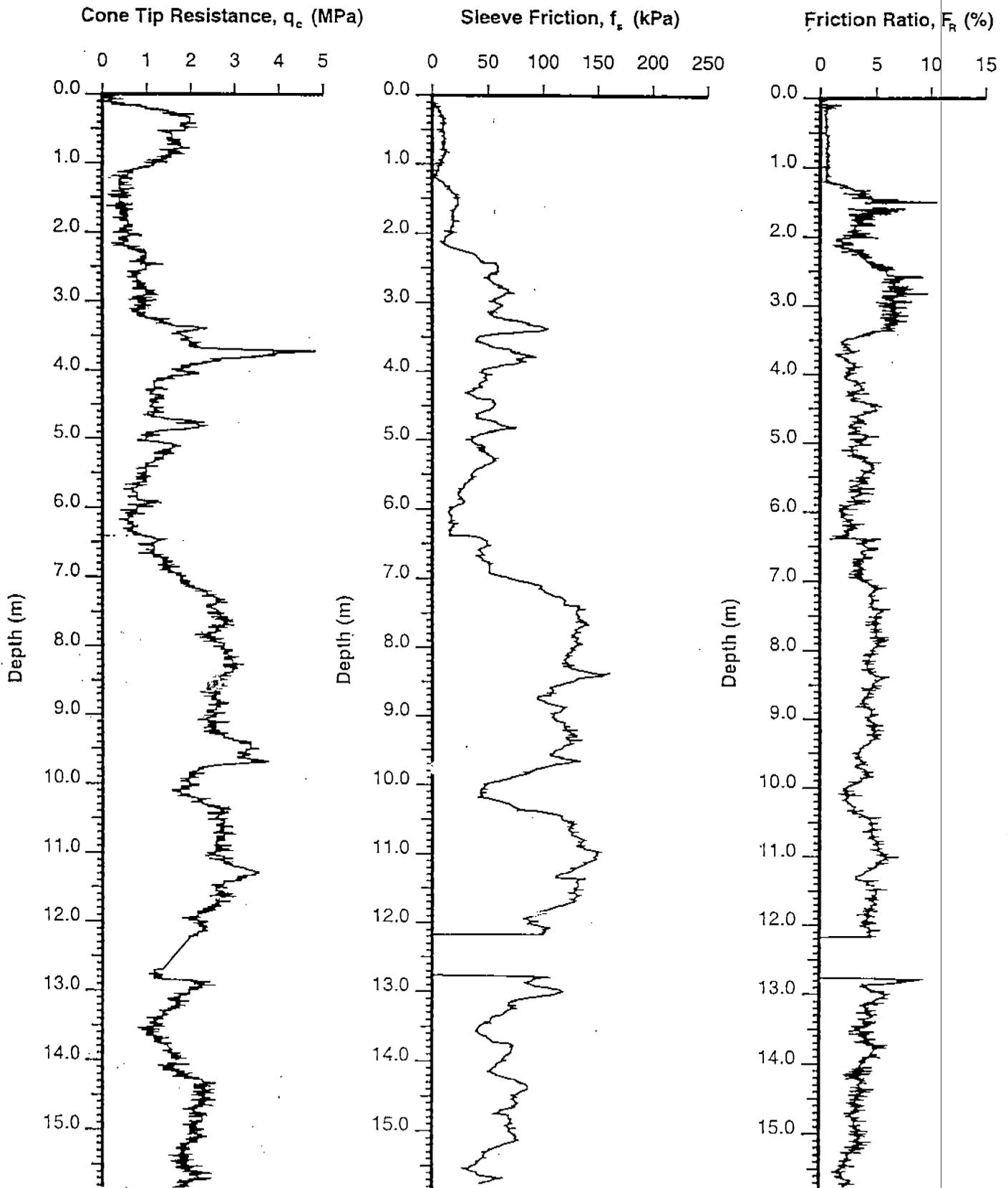
Client: Tomlinex Holdings Pty Ltd.

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45521 (PT 21)

Surface R.L.: -

Date: 17/02/00



Comments: 5t cone (no.455)

Cone Penetration Test

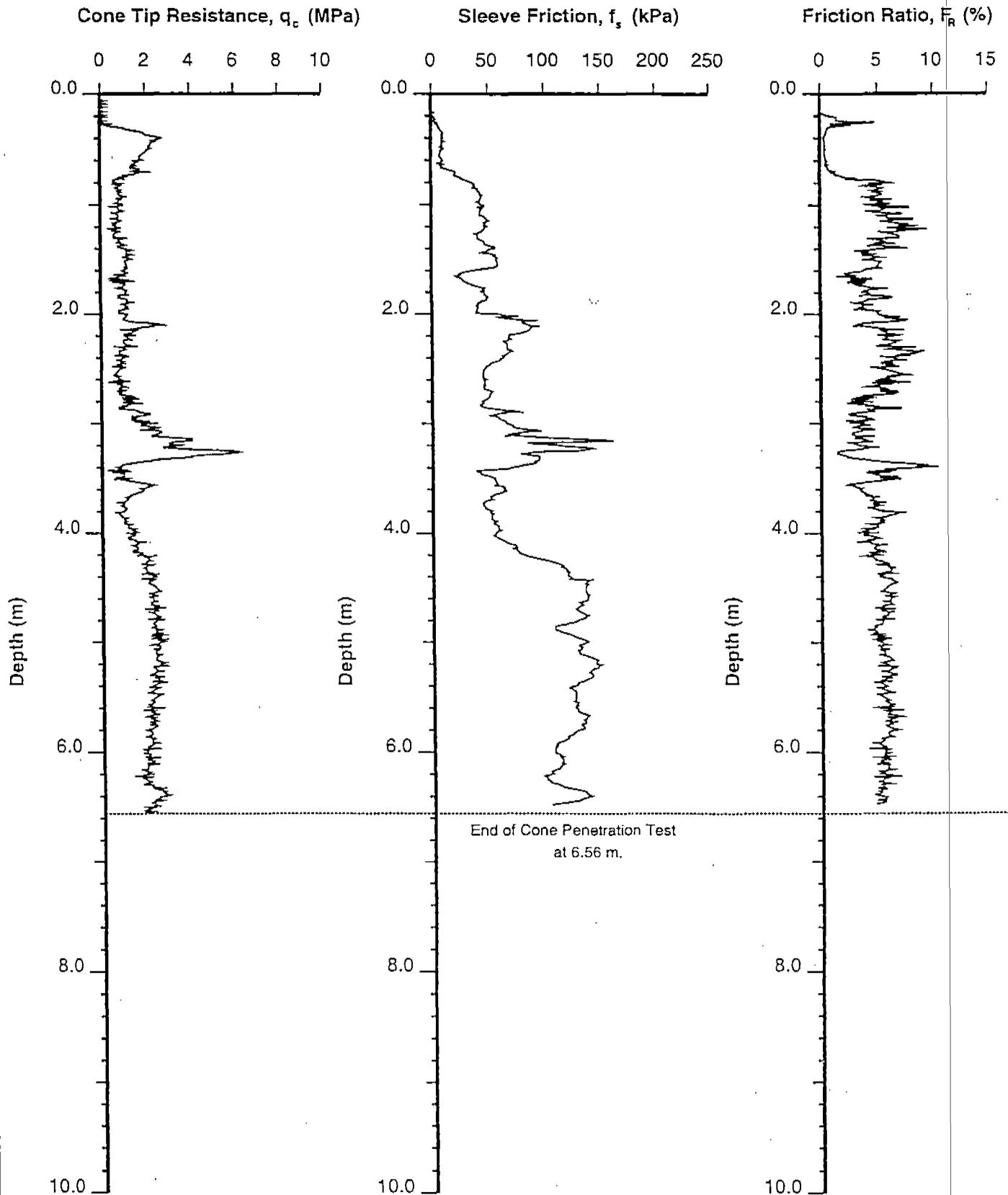
Client: Tomnax Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45522 (PT22)

Surface R.L.: -

Date: 16/02/00



Comments: 5t cone (no.455)

Cone Penetration Test

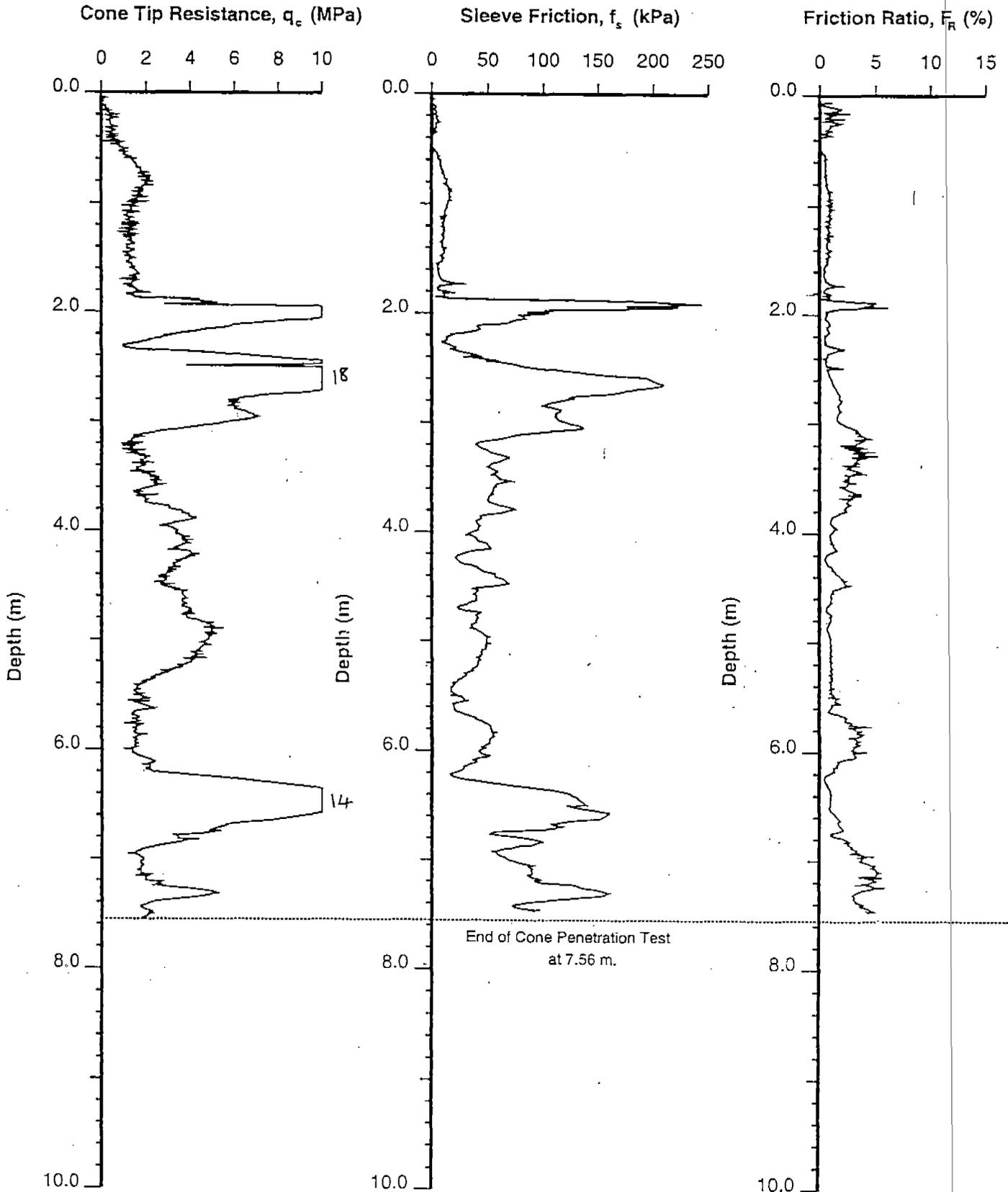
Client: Tomlinex Holdings Pty Ltd

Job Details: Ralphs Bay Geotechnical Investigation

Test Location: rb45524 (PT24)

Surface R.L.: -

Date: 17/02/00



End of Cone Penetration Test
at 7.56 m.

Comments: 5t cone (no.455)

Appendix D

Sampling Holes Logs

Ralphs Bay - Auger Holes

12/12/99 - Low Water 6:15 / 1.00m

Hole Number	Location	Depth (mm)	Layer of Materials
AH1	0539304	0.00 to 0.30	sand, very fine, slightly shelly, slightly organic, grey
	5247297	0.30 to 0.70	coarse shell layer with sand fines, grey-white
		0.70 to 0.85	sand, very fine, slightly plastic, organic, grey-black
AH2	0539108	0.00 to 0.30	sand, very fine, slightly shelly, slightly organic, grey
	5247967	0.30 to 0.70	coarse shell layer with sand fines, grey-white
AH3	0539110	0.00 to 0.20	sand, very fine, slightly shelly, slightly organic, grey
	5248239	0.20 to 0.60	very coarse shell layer with sand fines, grey-white

engineering log - borehole

job no: E99092

file: E99092/85

project: Ralphs Bay Geotechnical Investigation
borehole location: Sample Hole 23 (DS1)
hole commenced: 18/02/00
hole completed: 18/02/00
supervised by: NJo
log checked by: JGiedl

drill model and mounting: Kabota excavator (12E) w. slope: 90 deg. R.L. surface: - m
hole diameter: 300 mm flight auger bearing: - deg. datum: - operator: NJo

method	penetration	support	water	notes samples, tests, etc	R.L. depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency, rel. density	hand penetro- meter kPa 100 200 300 400	structure and additional observations
123												
				23/1	0.5	SM GM	0-0.5 SAND fine grey silty, very shelly	M	L			shells to 1" diameter
				23/2	1	CL	0.5-1.0 CLAY dk grey med PI	M	F	X		
				23/3	1.5	CL	1.0-1.5 CLAY med PI, grey green silty	M	F-St	X		
				23/4	2	CH	1.5-2.0 CLAY high PI, brown	M	St	X		150-200 kPa pp
				23/5	2.5	CH	2.0-3.5 CLAY high PI, pale grey mottled orange	M	St-VSt	X		200-250
				23/6	3							Test 23/6, ref 26/8 LL 108, PI 84, SG 2.68 Emerson class No 5
				23/7	3.5		3.5-4.0 CLAY high PI, pale grey + orange w. coarse sand (weathered inclusions) + occasional ironstones	M	St	X		150 kPa
				23/8	5.3							
Hole terminated at 5.3m.												

key method AS auger screwing AD auger drilling R roller/tricone W washbore CT cable tool * bit shown by suffix: B - blank bit V - "V" bit T - TC bit e.g. ADT	SUPPORT C casing M mud penetration  no resistance ranging to refusal water  10 Oct, 73 water level on date shown  water inflow  water outflow	notes - samples and tests U50 - undisturbed sample 50 mm diameter D - disturbed sample N - standard penetration test: figure = result N* - SPT + sample Nc - cone penetrometer	classification symbols and soil description based on unified classification system moisture D - dry M - moist W - wet < PL = PL > PL	consistency/relative density VS - very soft S - soft F - firm St - stiff VSt - very stiff H - hard Fb - friable VL - very loose L - loose MD - moderately dense D - dense VD - very dense
--	--	--	--	--

engineering log - borehole

borehole no:
25 (DSZ)
sheet 1 of 1

job no: E99092

file: E99092/85

project: **Ralphs Bay Geotechnical Investigation**
 borehole location: **Sample hole 25 (DSZ)**
 hole commenced: **18/02/00**
 hole completed: **18/02/00**
 supervised by: **NJo**
 log checked by: **JGiedl**
 drill model and mounting: **Kabota excavator (12 t) w.** slope: **90 deg.** R.L. surface: **-** m
 hole diameter: **300 mm flight auger** bearing: **- deg.** datum: **-** operator: **NJo**

method	penetration	support	water	notes samples, tests, etc	R.L. depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency, rel. density	hand penetro- meter 100 200 300 400	structure and additional observations
				25/1	0.5	SP	SP	0-0.5 SAND fine-med pale grey, very shelly	M			
				25/2				0.5-1.0 SAND fine-med grey some shells	M			
				25/3	1.5	CH	CH	1.0-1.5 CLAY, grey green, occasional rounded coarse gravel LL 51, PI 35	M	F		Test 25/3 (ref 23/4) LL 51, PI 35
				25/4	2	CL	CL	1.5-2.0 CLAY med PI, fine sandy w. some leucopisous nodules	M	S-F		nodules rounded to 30 mm
				25/5	2.5	SC	SC	2.0-2.5 SAND, med dk green grey clayey	W			
				25/6	3	SP	SP	2.5-3.0 SAND, med green	W			
				25/7	3.5	SP	SP	3.5-4.0 SAND, fine med grey	W			Test 25/7
				25/8	4.5							
				25/9	5	SP	SP	5.0-5.3 SAND, fine med grey brown, occ. shell fragments.				
Hole terminated at 5.3m												

key method AS auger screwing* AD auger drilling* R roller/tricone W washbore CT cable tool * bit shown by suffix: B - blank bit V - "V" bit T - TC bit e.g. ADT	support C casing M mud penetration  no resistance ranging to refusal water  10 Oct, 73 water level on date shown  water inflow  water outflow	notes - samples and tests U50 - undisturbed sample 50 mm diameter D - disturbed sample N - standard penetration test: figure = result N* - SPT + sample Nc - cone penetrometer	classification symbols and soil description based on unified classification system moisture D - dry M - moist W - wet < PL = PL > PL	consistency/relative density VS - very soft S - soft F - firm St - stiff VSt - very stiff H - hard Fb - friable VL - very loose L - loose MD - moderately dense D - dense VD - very dense
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engineering log - borehole

borehole no:
26 (DS3)
sheet 1 of 1

job no: E99092

file: E99092/85

project: Ralphs Bay Geotechnical Investigation

hole commenced: 18/02/00

hole completed: 18/02/00

supervised by: NJo

log checked by: JGried

borehole location: 26 Sample Hole (DS3)

drill model and mounting: Kabota excavator (12t) with
hole diameter: 300 mm flight auger

slope: 90 deg.
bearing: - deg.

R.L. surface: - m
datum: -
operator: NJo.

method	penetration	support	water	notes samples, tests, etc	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency, rel. density	hand penetrometer kPa	structure and additional observations
123											100 200 300 400	
				26/1	0.5	∇	SP	0-0.5 SAND fine grey, very shelly	M	L		
				26/2	1	∇		0.5-1.0 SAND fine grey some shells	M			
				26/3 //	1.5	P		1.0-1.5 SAND hard dk grey some shell fragments	W			Test 26/3 SG 2.66
				26/4	2	∇	SP	1.5-2.0 SAND fine brown	W			
				26/5 //	2.5	=	SC	2.0-2.5 SAND fine clayey				Test 26/5 LL 34, PI 14 SG 2.65 (-236mm) 2.72 (-0.075mm)
				26/6	3.5	∇	SP	3.5-4.0 SAND fine med. brown grey	W			
				26/7	4.5	X	ML/SM	4.0-4.5 SILT, pale grey, clayey fine sandy	M			
				26/8	5.3	=	CH	5.0-5.3 clay grey, mottled orange high PI	M	St		150 kPa PP ref 23/6
Hole terminated at 5.3m												

key method AS auger screwing* AD auger drilling* R roller/tricone W washbore CT cable tool * bit shown by suffix: B - blank bit V - "V" bit T - TC bit e.g. ADT	support C casing M mud penetration  no resistance ranging to refusal water  10 Oct. 73 water level on date shown  water inflow  water outflow	notes - samples and tests U50 - undisturbed sample 50 mm diameter D - disturbed sample N - standard penetration test: figure = result N' - SPT + sample Nc - cone penetrometer	classification symbols and soil description based on unified classification system moisture D - dry M - moist W - wet < PL = PL > PL	consistency/relative density VS - very soft S - soft F - firm St - stiff VSt - very stiff H - hard Fb - friable VL - very loose L - loose MD - moderately dense D - dense VD - very dense
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Appendix E

Laboratory Test Results & Grading Curves

PITT & SHERRY

LABORATORY AND FIELD TESTING SERVICES

TEST REPORT

Report N ^o : N1970
File N ^o : 14.000

LAB No: A1220 PITT & SHERRY JOB No: E99092 DATE RECEIVED: 13.12.1999

JOB: Ralph's Bay Canal – Geotechnical Investigation.

MATERIAL: Various fine sands, shells and clay, as below.

SOURCE: Lauderdale Tidal Area.

From shallow sample holes

SUBMITTED BY: Field Testing Services for Pitt & Sherry.

AH 1 to AH 3

Sample Reference:	1A	1B	1C	2A	2B	3A	3B	Test Method
Material:	Fine sand and shells		Clay, sandy	Fine sand and shells				
% Pass AS 75mm					100			AS 1289.3.6.1 (1)
53mm					96			
37.5mm					89			
26.5mm		100		100	86		100	
19mm	100	97		99	82	100	96	
9.5mm	99	94	100	95	79	99	86	
4.75mm	98	89	99	94	74	99	80	
2.36mm	98	86	99	94	68	99	79	
0.425mm	95	78	97	91	55	98	71	
0.075mm	1	2	56	1	1	2	<1	
Liquid Limit, %:			42					AS 1289.3.1.1, 3.2.1 3.3.1 & 3.4.1 Condition – oven dried 50°C Preparation – dry sieved
Plastic Limit, %:			12					
Plastic Index, %:			30					
Linear Shrinkage, %:			13.5					

NOTE: (1) All samples, except ref. 1C, were dry sieved.

R. Absolom
Laboratory Manager 16.12.1999



REGISTRATION N^o 1025

THIS LABORATORY IS ACCREDITED BY THE NATIONAL ASSOCIATION OF TESTING AUTHORITIES, AUSTRALIA. THE TESTS REPORTED HEREIN HAVE BEEN PERFORMED IN ACCORDANCE WITH ITS TERMS OF ACCREDITATION. THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL.

PITT & SHERRY

LABORATORY AND FIELD TESTING SERVICES



TEST REPORT

Report N°:	A1253/1
File N°:	E99092

LAB No: A1253 PITT & SHERRY JOB No: E99092 DATE RECEIVED: 19.02.2000
JOB: Ralph's Bay Canal – Geotechnical Investigation.
MATERIAL: Various sands silts and clays.
SOURCE: Ralphs Bay Canal, Lauderdale. *from Deep sample holes*
SUBMITTED BY: Laboratory & Field Testing Services, Pitt & Sherry DS1 to DS3

MOISTURE CONTENT

Test Method: AS 1289.2.1.1

Sample Reference:	23/2	23/3	23/4	23/5	25/3	25/4
Moisture Content, %:	32.2	23.6	41.4	24.0	34.4	19.6

ATTERBERG LIMITS

Sample Reference:	23/6	25/3	26/5
Liquid Limit, %:	108	51	34
Plastic Limit, %:	24	16	20
Plastic Index, %:	84	35	14
Linear Shrinkage, %:	20	14	5.5

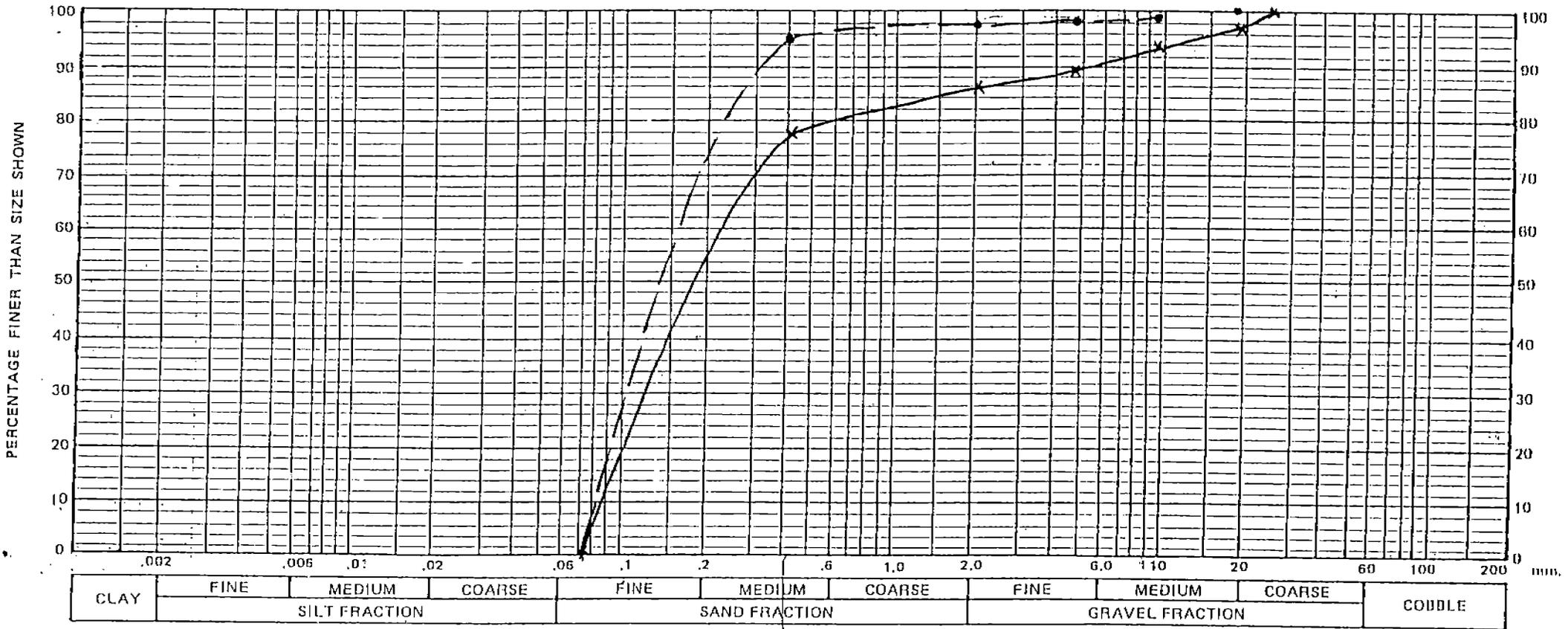
SIEVE ANALYSIS

Sample Reference:	23/6	25/7	26/5
% Pass AS 9.5mm		100	
4.75mm		98	
2.36mm	100	98	
1.18mm		97	
0.600mm		97	100
0.425mm	98	96	99
0.300mm		94	98
0.150mm		28	62
0.075mm	96	6	22

MECHANICAL ANALYSIS

LAB. No.	
REF. No.	

MATERIAL: *Fine sand + shells* samples *IA + IB* SOURCE: *Ralphs Bay - shallow water bed A.H.1*



Effective Size.....mm.
 Uniformity Coefficient.....
 Classification.....
 Organic Matter.....%
 Particle Density (-15µm).....
 Soluble Solids.....%

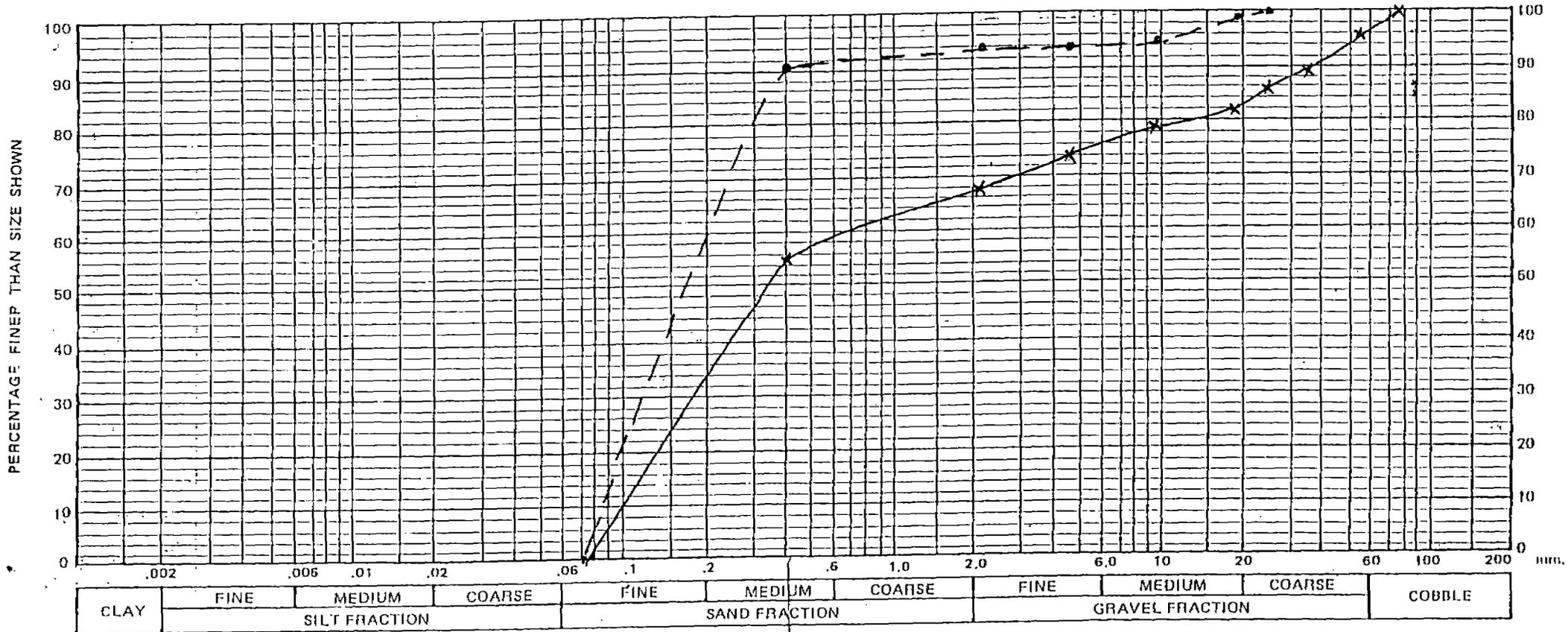
SIZE	%	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass
COBBLE		150		19.0		600	
GRAVEL		75		9.5		425	
SAND		53		4.75		300	
SILT		37.5		2.36		150	
CLAY		26.5		1.18		75	

Remarks:.....
 --- IA *fine sand w. shells*
 — IB *fine sand w. shells*

MECHANICAL ANALYSIS

LAB. No. _____
REF. No. _____

MATERIAL: Fine sand + shells samples 2A + 2B SOURCE: Ralphs Bay - shallow auger hole AH2



Effective Size.....mm.
Uniformity Coefficient.....
Classification.....
Organic Matter.....%
Particle Density (2.65).....
Soluble Solids.....%

SIZE	%	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass
COBBLE		150		19.0		600	
GRAVEL		75		9.5		425	
SAND		53		4.75		300	
SILT		37.5		2.36		150	
CLAY		26.5		1.18		75	

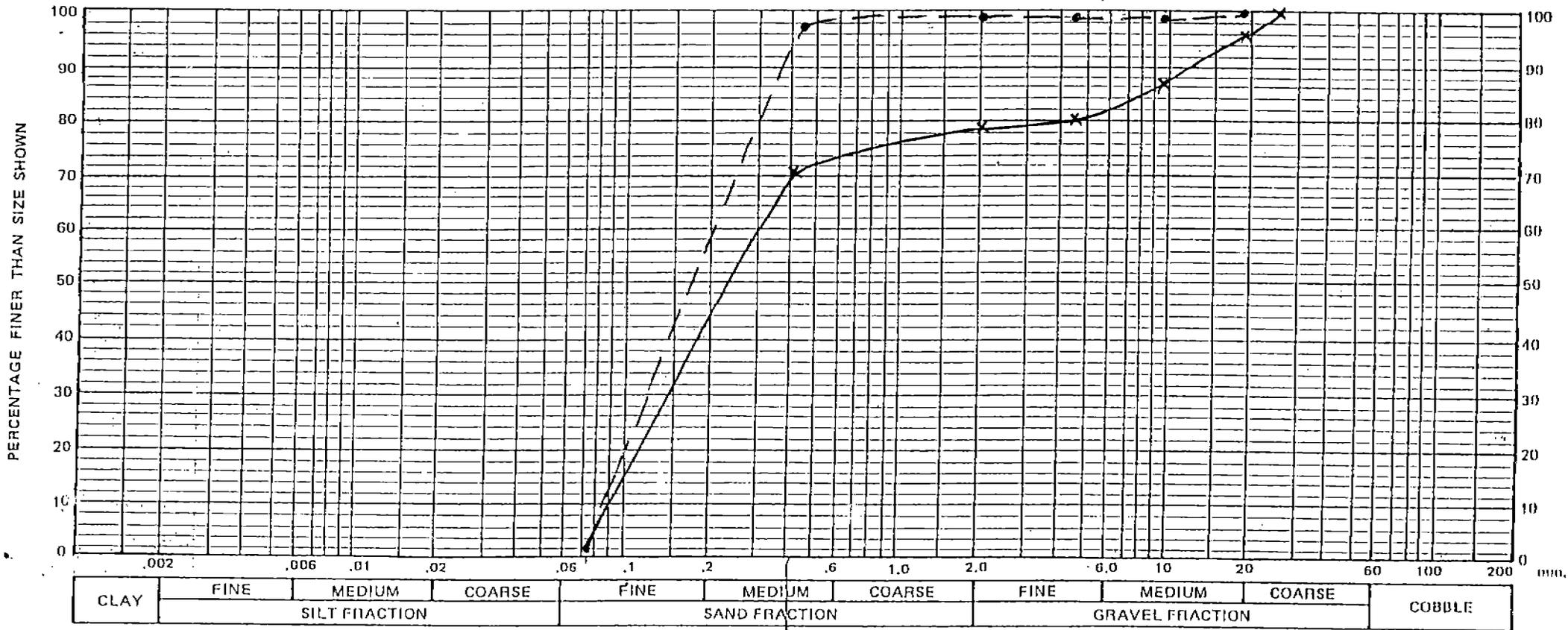
Remarks:.....
-- 2A fine sand w. shells
— 2B fine to med. sand w. shells

MECHANICAL ANALYSIS

LAB. No.

REF. No.

MATERIAL: Fine shells & sand Samples 3A+3B SOURCE: Ralphs Bay - shallow auger hole A113



Effective Size.....mm.

Uniformity Coefficient.....

Classification.....

Organic Matter.....%

Particle Density (-75µm).....

Soluble Solids.....%

SIZE	%	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass
COBBLE		150		19.0		600	
GRAVEL		75		9.5		425	
SAND		53		4.75		300	
SILT		37.5		2.36		150	
CLAY		26.5		1.18		75	

Remarks:.....

-- 3A fine sand w. minor shell

— 3B fine to med sand w. shells

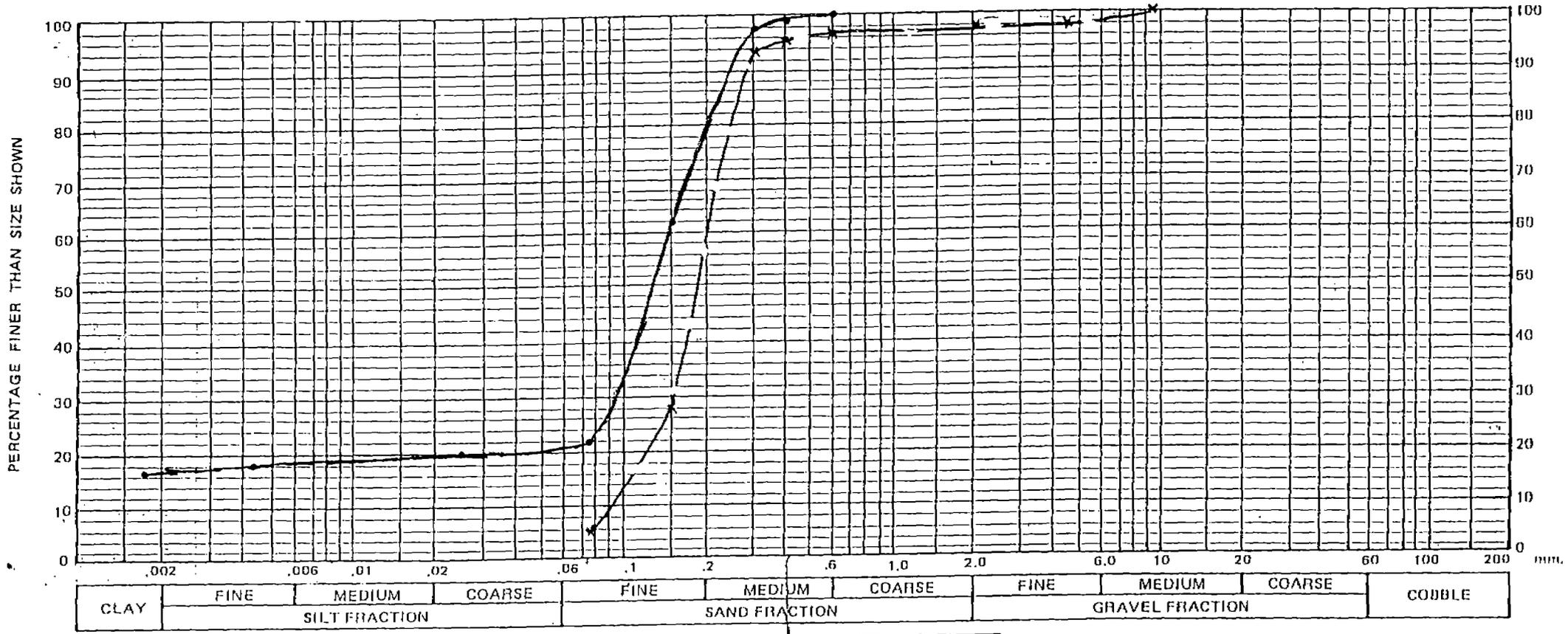
MECHANICAL ANALYSIS

MATERIAL: Fine sand samples 25/7, 26/5

SOURCE: Ralphs Bay - deep sample holes 25 + 26

(b52) (b53)

LAB. No.	
REF. No.	



Effective Size.....mm.
 Uniformity Coefficient.....
 Classification.....
 Organic Matter.....%
 Particle Density (-15µm).....
 Soluble Solids.....%

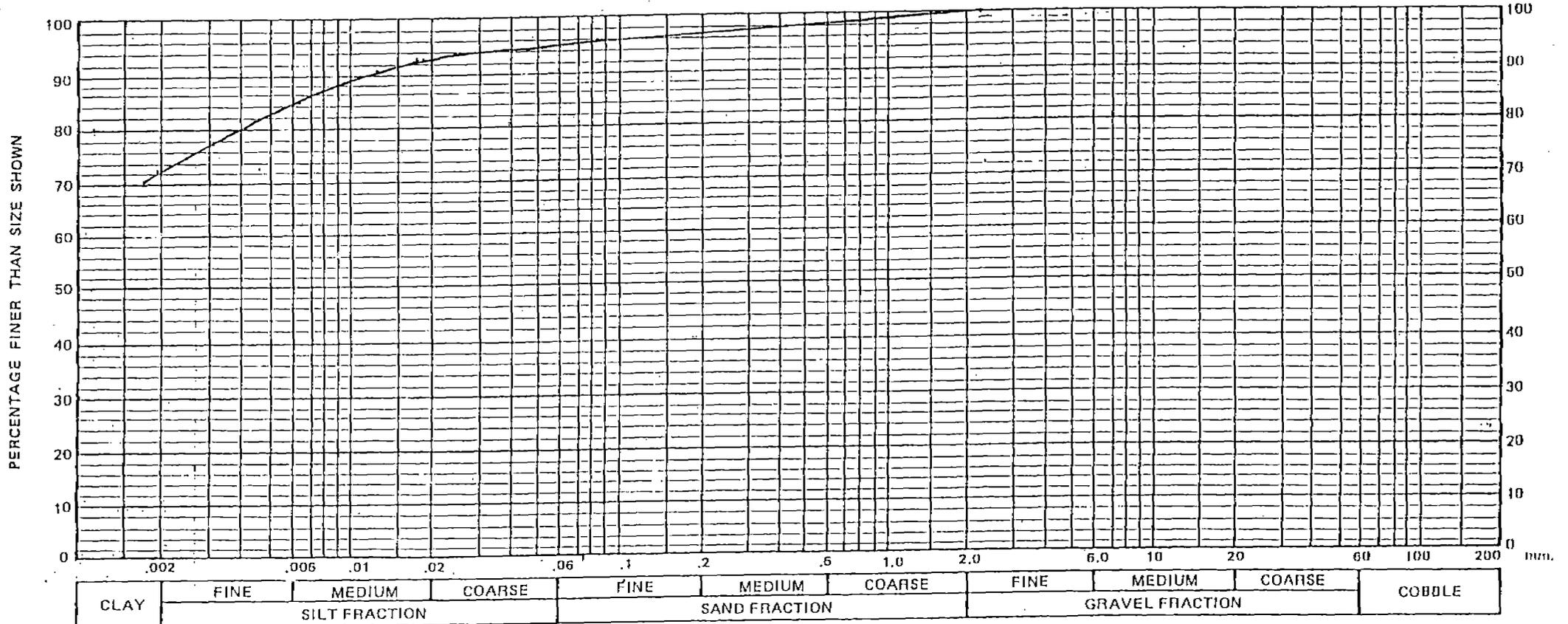
SIZE	%	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass
COBBLE		150		75		600	
GRAVEL		75		4.75		300	
SAND		4.75		2.36		150	
SILT		2.36		0.85		75	
CLAY		0.85		0.425		0.25	

Remarks:.....
 - - 25/7 fine sand
 — 26/5 clayey sand

MECHANICAL ANALYSIS - Hydrometer

LAB. No. **A1253**
REF. No. **23/6**

MATERIAL: **CLAY** sample **23/6** SOURCE: **Ralphs Bay - deep sample hole DS1**



Effective Size.....mm.
 Uniformity Coefficient.....
 Classification..... **CH**
 Organic Matter.....%
 Particle Density ^{2.36} (~~1.5~~) **2.68**
 Soluble Solids.....%

SIZE	%	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass
COBBLE		150		19.0		600	
GRAVEL		75		9.5		425	
SAND	5	53		4.75		300	
SILT	23	37.5		2.36		150	
CLAY	72	26.5		1.18		75	

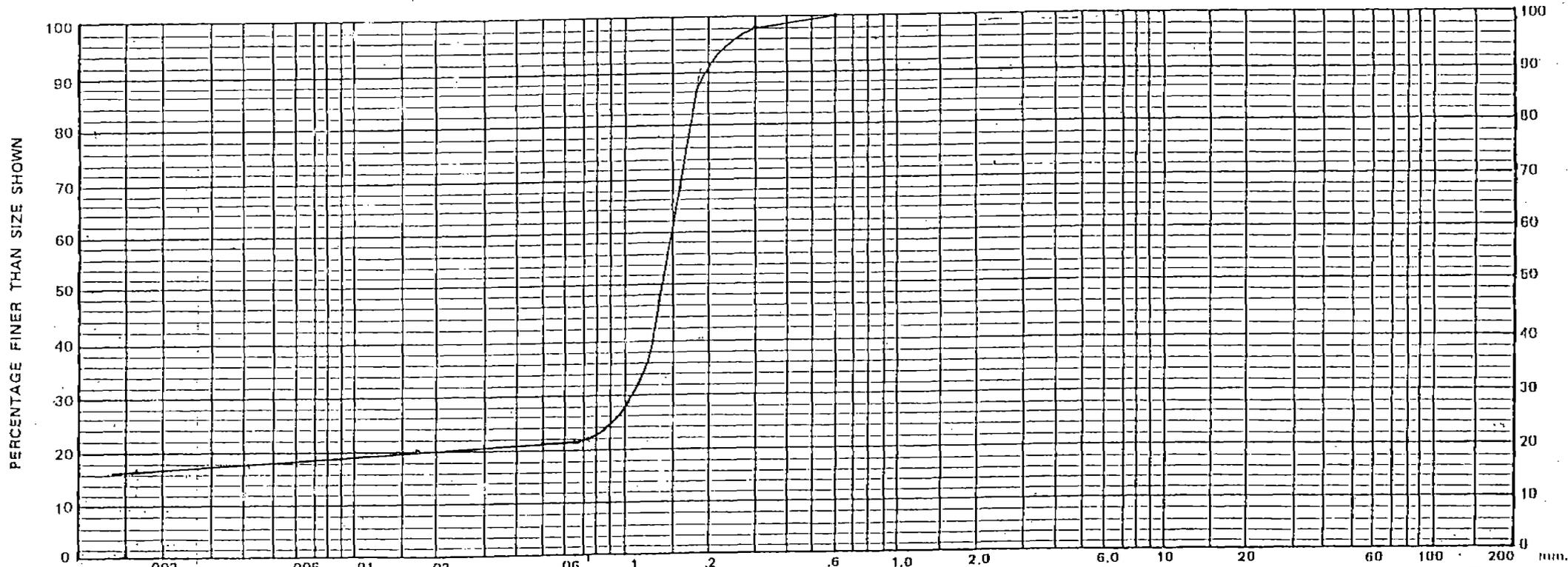
Remarks:.....

Date: **3-3-2000** Prepared by: *[Signature]* Approved by:

MECHANICAL ANALYSIS + Hydrometer

LAB. No. **A-1253**
REF. No. **26/5**

MATERIAL: **Sand, Clayey** SOURCE:



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLE
	SILT FRACTION			SAND FRACTION			GRAVEL FRACTION			

Effective Size.....mm.
Uniformity Coefficient.....
Classification..... **SC**
Organic Matter.....%
Particle Density (75µm) **2.72**
Soluble Solids.....%

SIZE	%	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass	A.S. Sieve (mm)	% Pass
COBBLE		150		19.0		600	
GRAVEL		75		9.5		425	
SAND	79	53		4.75		300	
SILT	4	37.5		2.36		150	
CLAY	17	26.5		1.18		75	

Remarks:.....
.....
.....
.....
.....

Date **3-3-2000** Prepared by *[Signature]* Approved by.....

Appendix F

Photographs

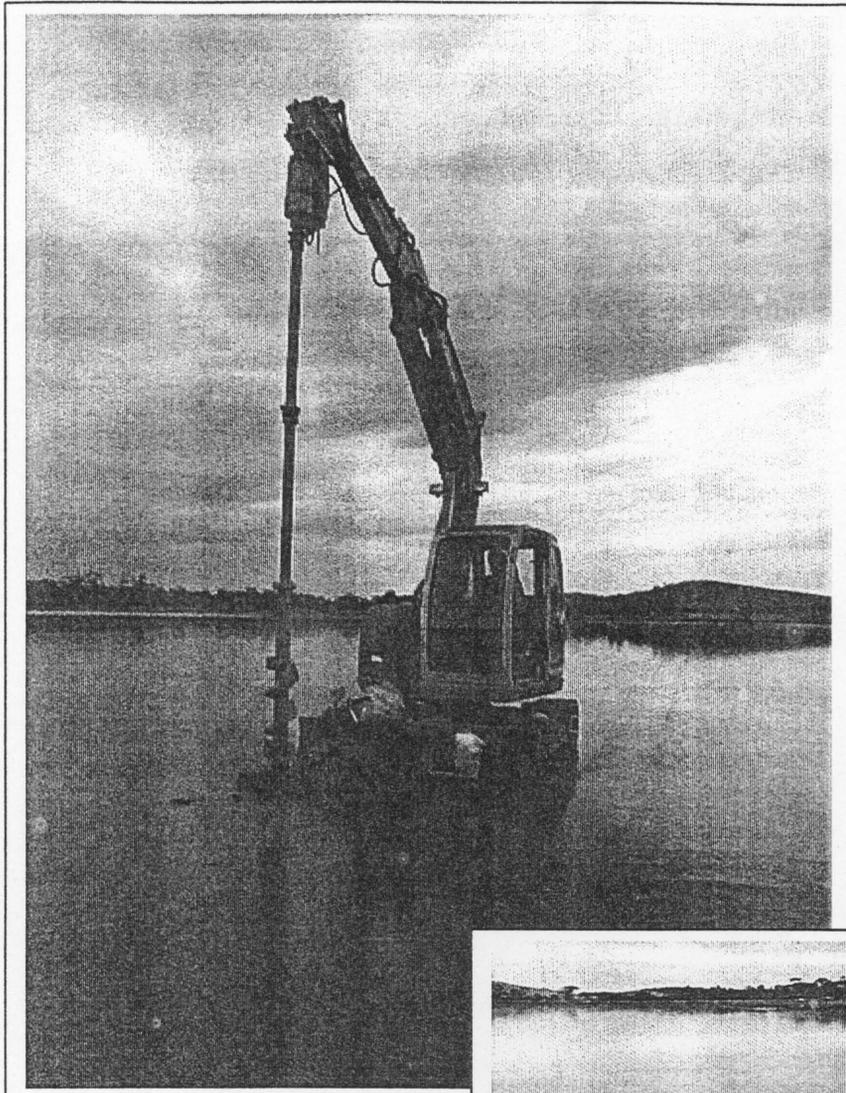


Photo 1
Deep sampling using the 7t
excavator with auger
attachment.

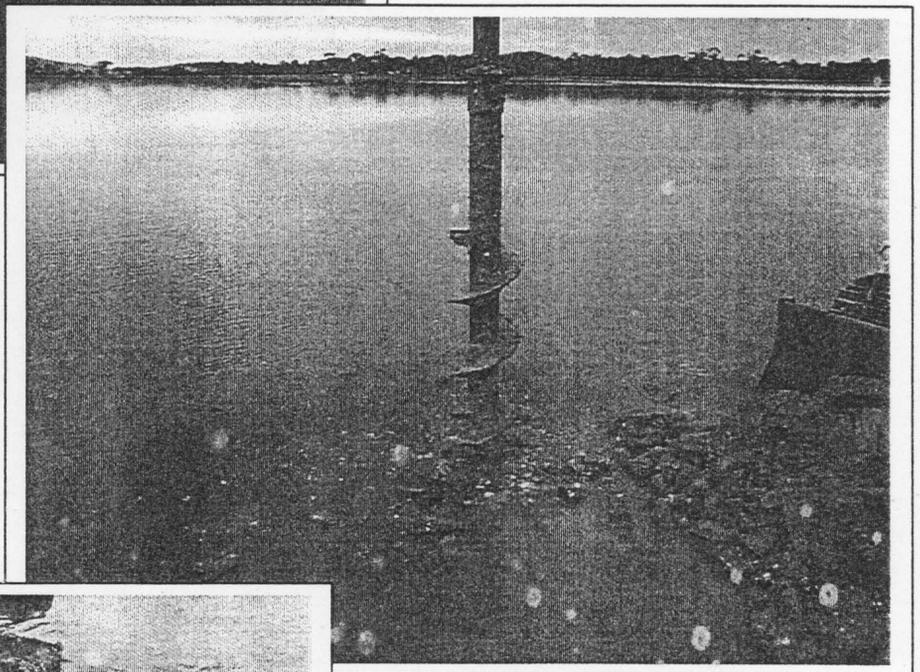


Photo 2

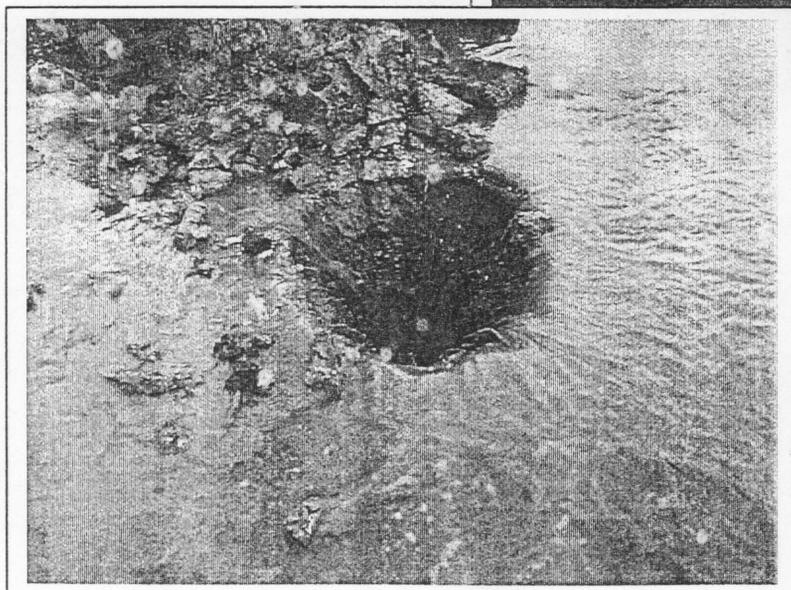


Photo 3

DEEP SAMPLING

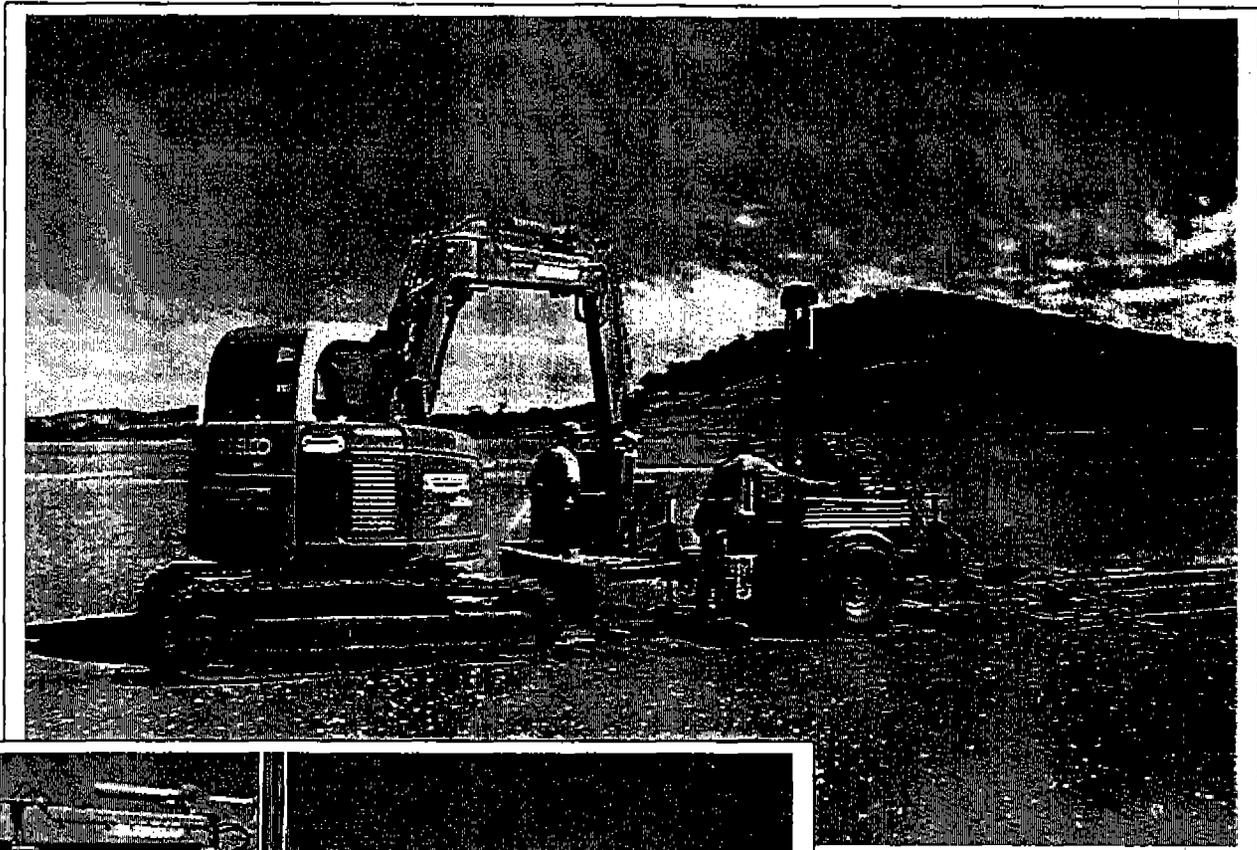


Photo 4 (above)
The Cone Penetrometer Testing
Rig showing the 7t excavator
used to move it around the site.

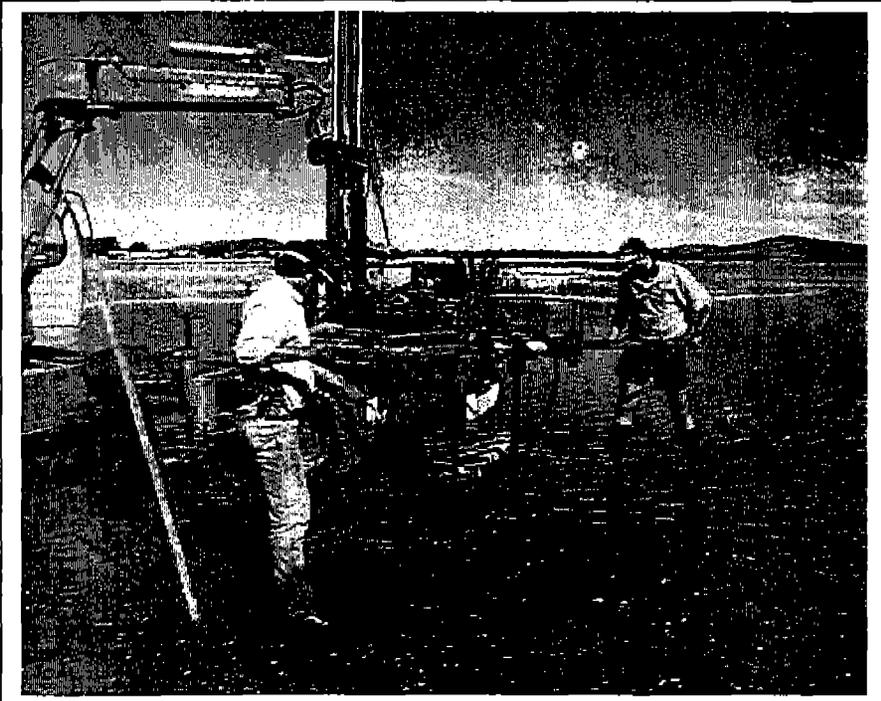


Photo 5

Photo 6
The CPT data
acquisition system.



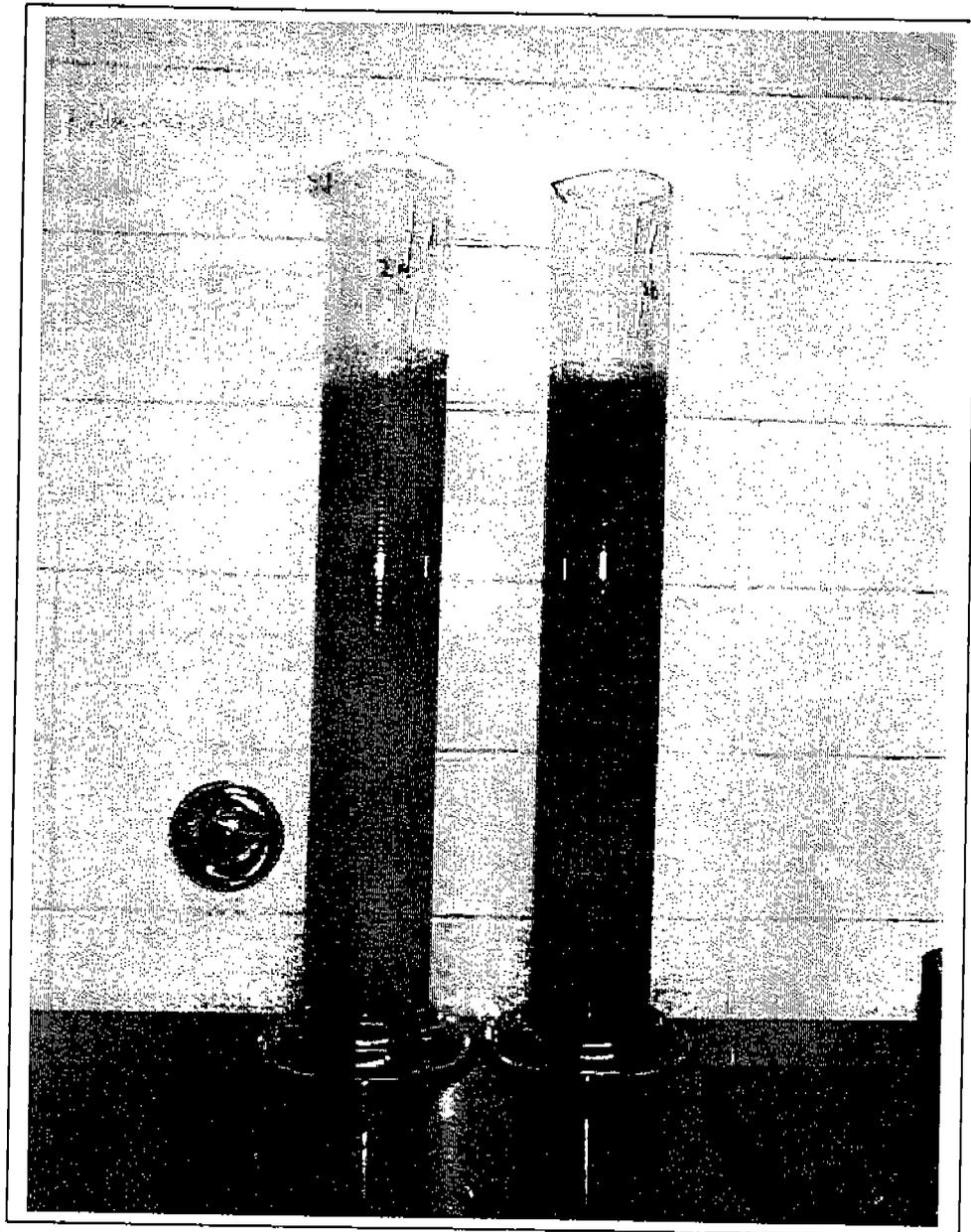


Photo 7

Particle Size Distribution by Hydrometer Analysis
Samples 23/6 (from hole DS1) and 26/5 (from hole DS3) after 2 weeks,
showing fine material still in suspension.

NOTE: Test done to NATA standards using distilled water -
results using sea water would be different.

OUR REF: E555 E99092h029.let/30.1/RGi:bs

YOUR REF:

11 May 2000

Tominex
2nd Floor, 135 Collins Street
MELBOURNE Vic 3000

Attention Mr Neil Thomas

Dear Neil

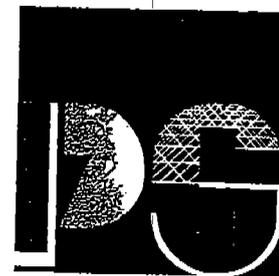
Ralph's Bay Canal - Geotechnical Investigation

Please find enclosed 5 copies of Addendum to Section 8, Pitt & Sherry Geotechnical Report (Mar. 2000).

Yours faithfully


Rowenna Gilbertson
Geotechnical Engineer

Enc. 5 copies of Addendum to Section 8
Cc: Mr Max Darcey; Peacock, Darcey & Anderson



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1. CLIENT: TOMINEX HOLDINGS PTY LTD

2. ADDENDUM TO SECTION 8.0 – OTHER GEOTECHNICAL ISSUES

2.1 Organic Content

An assessment of organic content was done on a clay sample (23/2) and a sand sample (26/3), considered representative of material to 1.5m below sea bed level. Laboratory test results (attached) indicate the materials have a 4-5% organic content. This may contribute to odours when dredged.

2.2 Sedimentation Rate

An assessment of sedimentation rate in seawater was undertaken as a comparison against the hydrometer analysis previously undertaken in distilled water. As shown in Figure 1, a much faster rate of sedimentation can be expected in seawater than distilled water.



PITT & SHERRY

LABORATORY AND FIELD TESTING SERVICES



TEST REPORT

Report N°: A1253/2
File N°: E99092

LAB No: A1253 PITT & SHERRY JOB No: E99092 DATE RECEIVED: 19.02.2000

JOB: Ralph's Bay Canal – Geotechnical Investigation.

MATERIAL: Various sands.

SOURCE: Ralphs Bay Canal, Lauderdale.

SUBMITTED BY: Laboratory & Field Testing Services, Pitt & Sherry

ORGANIC CONTENT

Test Method: AS 1289.4.1.1

Sample Identification:	Organic Matter, %
23/2	4.9
26/3	4.1

R. Absolom
Laboratory Manager

4.5.2000

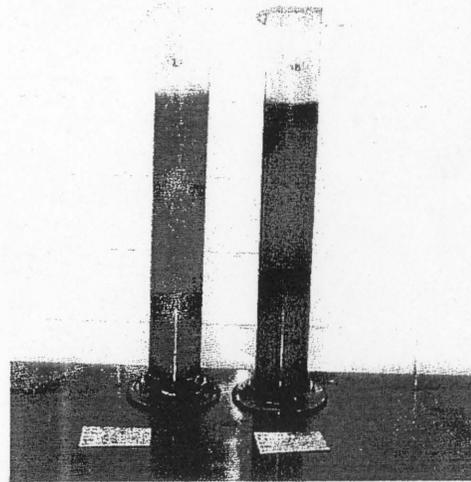


Photo 1 – At time 00:00

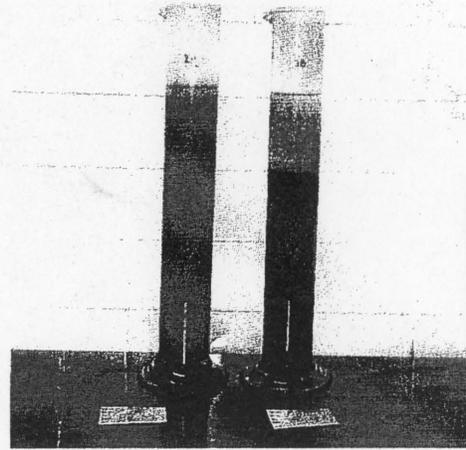


Photo 2 – After 35 minutes

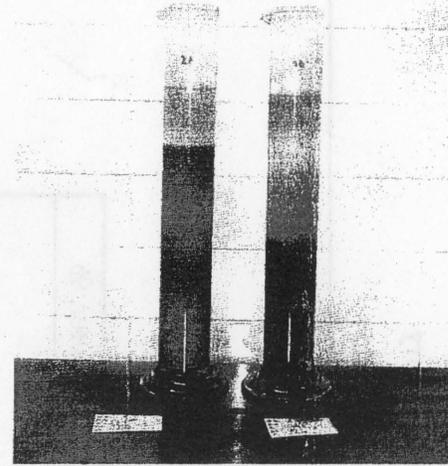


Photo 3 – After 3 hours

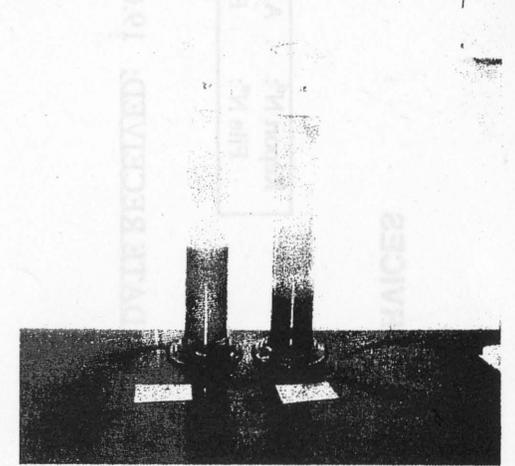


Photo 4 – After 24 hours

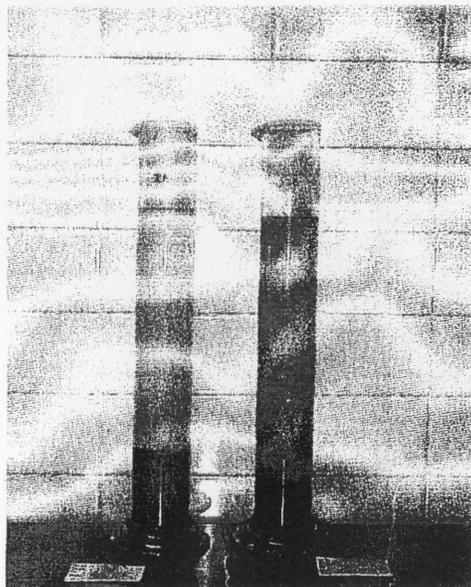


Photo 5 – After 2 weeks

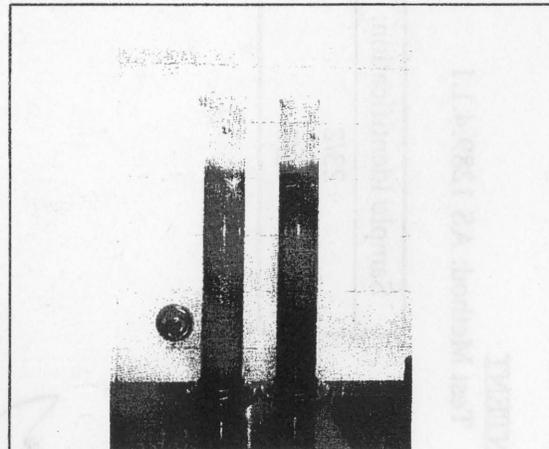


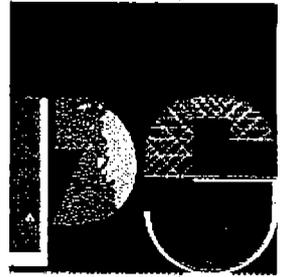
Photo 5 can be compared with the above photo, which shows settlement after 2 weeks in *distilled* water (as per NATA specification for hydrometer analysis)

FIGURE 1

TIME LAPSE PHOTOS OF SEDIMENT SETTLEMENT IN SEA WATER

- Sample 23/6 from hole DS1 (LHS) and
- Sample 26/5 from hole DS3 (RHS)

CONSULTING ENGINEERS
ENVIRONMENTAL SCIENTISTS
PROJECT MANAGERS
BUILDING SURVEYORS

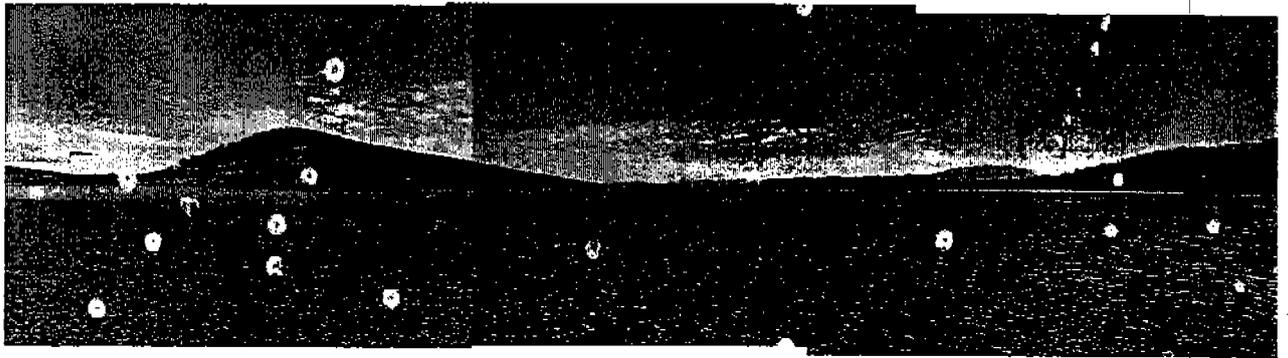


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Morgan Klok & Nelissen

TOMINEX HOLDINGS PTY LTD

**Ralphs Bay
Contamination Investigation**

MARCH 2000



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E99092H023.Rep/30.1/JGG
Rev 00

PITT & SHERRY

TABLE OF CONTENTS

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2.	SCOPE OF WORK	1
3.	METHODOLOGY	1
4.	DISCUSSION	1

APPENDICES

A Heavy Metals Analyses - Results

	Name	Signature	Date
Authorised by:	John-Eckersley Maslin		17 March 2000

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1. INTRODUCTION

Pitt & Sherry have undertaken and reported on a geotechnical feasibility investigation for proposed marinas and residential development at Ralph's Bay, Lauderdale (see *Figure 1 Location Plan*). Proposed works include:

- Dredging to establish marinas, boat harbours and access channels;
- Land reclamation by constructing embankments and
- Construction of breakwaters, bund walls, marinas & buildings.

The object of this report is to comment on any heavy metal contamination of the sediments in Ralphs Bay around the site of the proposed developments.

2. SCOPE OF WORK

The scope of work involved:

- Selectively sampling the upper sediment horizon of the tidal flats;
- Analysing the samples for heavy metal content;
- Identifying heavy metal contamination issues if any.

3. METHODOLOGY

The sampling was conducted on 19 Feb 2000 at various locations across the site (*Figure 1*).

Sampling methods ?

Some samples were taken in the ranges 0-50mm, 50-150mm and 150-300mm from the surface to define any horizontal stratification of contamination if present. Together with these samples, additional samples were taken in the range 0-300mm from the surface, spread across the site to define the lateral extent of contamination if present.

The samples were sent to the government laboratory for analyses; Analytical Services Tasmania that is NATA registered. Samples were analysed for heavy metals: arsenic, cadmium, cobalt, chromium, copper, manganese, nickel, lead, zinc and mercury. The results are given in the attached table (*Appendix A*).

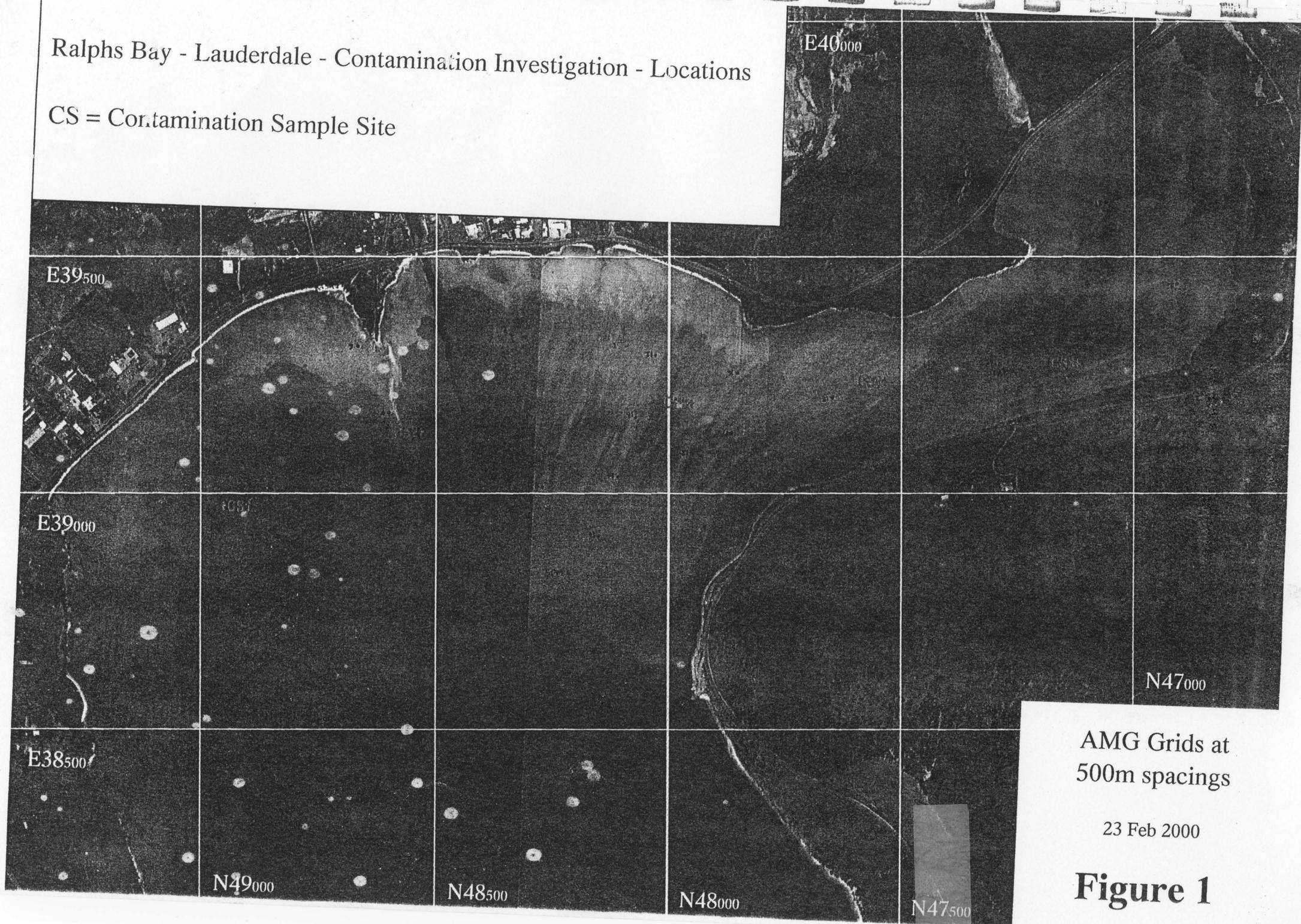
4. DISCUSSION

All 9 samples analysed showed concentrations below the Department of Primary Industries Water & Environment (DPIWE) environmental investigation levels (EILs). The EILs define the trigger level at which further consideration of environmental impacts are required. Thus, with all samples showing no evidence of contamination, no further work is expected to be required.

→ Disagree w/ this
So do I
[Signature]

Ralphs Bay - Lauderdale - Contamination Investigation - Locations

CS = Contamination Sample Site



AMG Grids at
500m spacings
23 Feb 2000
Figure 1

Appendix A

Heavy Metal Analyses - Results

