Our Ref: J172
Your Ref: MP 07-0041

19 November 2008

The Manager
Development and Building
Port Stephens Council
PO Box 42
Raymond Terrace NSW 2324

Attention Ms Belinda Martin

Dear Belinda

Re: Major Projects 07 – 0041, Lot 224 and Part Lot 222, Waterfront Road, Swan Bay.

Further to my email of Tuesday, 18 November 2008 please find attached correspondence from Mr Mark Smith of Barker Harle Consulting Engineers regarding onsite sewage management following discussions with Mr A Weekes of Port Stephens Council.

Yours faithfully

per: vzacharka

Alan Wells
Attach: Barker Harle Correspondence dated 8 November, 2008.

582921

barker harle
consulting engineers

8 November 2008
BH Ref: 31406

Wells Environmental Services
PO Box 205
EAST MAITLAND NSW 2323

Attention: Mr Alan Wells

Dear Sir,

Re: Onsite Effluent Dispersal Investigation:
Lot 224 DP862015 Waterfront Road, Swan Bay

Further to our Onsite Effluent Dispersal Investigation Report dated 18 November 2005 and Mr Andrew Weekes (Port Stephens Councils Environmental Health Officer) email dated 6 November 2008, we have undertaken a review of our Onsite Effluent Dispersal Investigation Report dated 18 November 2005, Port Stephen Councils "Development Control Plan 2007" and "Standard Designs for Onsite Wastewater Management Systems in Tilligerry Creek". Following our review of the mentioned documents, we advise the following:

1. It is recommended that a secondary wastewater treatment system such as an aerated wastewater treatment system be utilised for any proposed residential development on the site.

   It is anticipated that proposed wastewater treatment system tank would be installed at the rear of each allotment (similar to other waste water treatment systems recently installed along Waterfront Road, Swan Bay. As such, the secondary wastewater treatment system is to be installed with a suitable volume of ballast weight so that the tank would remain stable during a 1 in 100 year flood event. Electrical components for the wastewater treatment system must be located above the 1 in 100 year flood level (2.0m AHD).

   Treatment system tank design and ballast requirements will be subject to the treatment system selected.

Macquarie Offices, 216 Macquarie Road, Warners Bay PO Box 63, Warners Bay NSW 2282
t: (02) 4978 5000 f: (02) 4956 8275 e: admin@barkerharle.com.au
Barker Harle is a division of Coeng Pty Ltd ABN 78 131 091 293

2. Disposal of treated wastewater from the secondary wastewater treatment system must be via a raised earth mound or Wisconsin mound. Table 1 below, extracted from Port Stephens Councils "Standard Designs for Onsite Wastewater Management Systems in Tilligerry Creek", shows the required mound size for a 2 – 5 bedroom home on tank water.

Table 1 – Size of raised earth or Wisconsin mound

Dwelling Size	2-bedroom	3-bedroom	4-bedroom	5-bedroom
Design Load (L/d)	560	700	840	980
Gravel Adsorption Bed Length (m)	9	11.5	14.5	17.5
Gravel Adsorption Bed Width (m)	1.8			
Gravel Adsorption Bed Thickness (m)	0.3			
Overall Mound Length (m)	15.4	18	21	24
Overall Mound Width (m)	8.1			
Overall Mound Downslope Width (m)	3.3			
Overall Mound Height (m)	1.2			
Overall Mound area (m^2)	125	146	170	194
Flowrate (L/min)	90	114	150	185
Residual Head (m)	1.51	1.53	1.57	1.64

3. It is understood that the calculated 1 in 100 year flood level for the subject site is 2.0m AHD in accordance with Port Stephens Council policy (27 January, 1998). Current standards/guidelines require that the distribution bed within a raised earth or Wisconsin mound for Swan Bay be installed in a raised bed 300mm above the existing natural ground level and that the bed be shaped so that no ponding occurs. Undertaking of the above works will ensure that the disposal of effluent meets the requirements of Port Stephens Council.

Should you have any further questions, please contact the undersigned.

Yours Faithfully
Barker Harle

Mark Smith

Mark Smith
B.E. (Environmental)
Environmental Engineer

Our Ref: J172
Your Ref: MP 07-0041

20 October 2008

The Manager
Development and Building
Port Stephens Council
PO Box 42
Raymond Terrace NSW 2324

Attention Ms Amanda Gale and Ms Belinda Martin

Dear Amanda and Belinda

Re: Major Projects 07 – 0041, Lot 224 and Part Lot 222, Waterfront Road, Swan Bay.

I refer to your correspondence of 11 September, 2008 concerning the above described Major Project Application 07-0041 involving the subdivision of the above described lands.

As requested within your correspondence, the following responses are provided to the issues raised within submissions in Table 1 below.

Table 1: Response to Submissions

Issue	Response
1. Department of Environment and Climate Change – Correspondence dated 25 August, 2008 and 29 August, 2008.	• It is noted that the DECC "can support the project in principle subject to the comments in regards to Aboriginal Cultural Heritage and aspects of Threatened Species and Biodiversity". With respect to Aboriginal Cultural Heritage we provided on 25 September, 2008 to you hard and electronic copies of the 'Aboriginal Stakeholder Register' for the Project. No objection is raised against the imposition of a condition of consent that requires work to stop if an aboriginal object is located and to notify the DECC and Worimi Local Aboriginal Land Council. • With respect to Threatened Species and Biodiversity we provided on 3 October, 2008 a copy of the specialist report (as an addendum) for the Bush Stone – curlew. We concur with the DECC's comments that "the development footprint is primarily restricted to the insitu cleared lands and as a

	whole is unlikely to have a significant impact on threatened species, their habitat an ecological communities". The DECC goes on to say that "due to the cleared nature of the development footprint, the previously cleared areas of the site offer limited habitat and/or resources for threatened species. DECC recognises that no trees are proposed to be removed or destroyed as a result of the proposed subdivision proceeding as outlined in the EA." • It is noted that the DECC supports the bush fire assessment and have formed the opinion that the subdivision in terms of access, effluent and provision of utilities does not pose any threats to Gir – um – bit National Park (Worimi Nature a Reserve).
2. Road and Traffic Authority (RTA)Correspondence dated 4 August, 2008.	• It is noted that the RTA doe not object to the project and that traffic is unlikely to impact the road network.
3. NSW Rural Fire Service Correspondence dated 14 August, 2008.	• The comments made by the NSW Rural Fire Service are noted. No objection is raised to the imposition of conditions as per the advice contained within the correspondence.
4. Department of Water and Energy	• Two (2) hard copies and one (1) electronic copy of Appendix 4 – On Site Effluent Assessment were forwarded to Council on 25 September, 2008. We note that the Department of Water and Energy sought information on the depth of excavations and provide the following information. The Environmental Assessment report described the proposed works that would need to be undertaken for the proposed subdivision as well as earthworks for any future dwellings proposed for each allotment. Works proposed for the subdivision involve the installation of 375mm pipes along the edge of the road.

	An interallotment drainage system has already been constructed to Council's standard – refer to DA 44-2-2004. With respect to the above works, ground waters were not encountered nor is it envisaged that it will be a problem. The Environmental Assessment report also discussed the disposal of effluent. It should be noted these works are not required for the subdivision – but rather at some stage in the future for dwellings that might be erected. The works identified involve the placement of a holding treatment tank in the ground and pipe work to the disposal area. The existing house already has a Port Stephens Council approved on-site effluent treatment system. The installation did not encounter ground water nor is it anticipated that the additional allotments would encounter or intercept groundwater. Barker Harle Pty Limited have provided additional information with respect groundwater (see **Attachment 1**) with respect to the NSW state Groundwater Policies. We cannot understand why a License under Part 5 of the Water Act is required for the proposed subdivision

I trust the above response is sufficient for the application to proceed to determination by way of conditional consent.

Yours faithfully

Alan Wells
Attach:

- Copy of Barker Harle Correspondence dated 16 October, 2008.

16 October 2008
BH Ref: 31406

barker harle
consulting engineers

Wells Environmental Services Pty Ltd
PO Box 205
EAST MAITLAND NSW 2323

Attention: Mr Alan Wells

Dear Sir,

Re: Proposed Residential Subdivision:
Lot 224 and Part Lot 222 DP862015 No1C Waterfront Road, Swan Bay

Further to NSW Department of Planning letter dated 11 September 2008, your email dated 25 September 2008 and our subsequent telephone conversations, we have undertaken a groundwater investigation on and around the subject site.

Item 3 of NSW Department of Planning letter dated 11 September 2008 stated:

"*The department further notes that the Environmental Assessment has not addressed the NSW State Groundwater Policies*".

The NSW Department of Land & Water Conservation's "NSW State Groundwater Policy Framework Document" states:

"***Policy Objectives***
It is the policy of the NSW Government to encourage the ecologically sustainable management of the State's groundwater resources so as to:

- *slow and halt, or reverse any degradation in groundwater resources;*
- *ensure long term sustainability of the systems biophysical characteristics;*
- *maintain the full range of beneficial uses of these resources; and*
- *maximise economic benefit to the Region, State and Nation".*

"Ecological Sustainable Development (ESD), in groundwater terms can be difficult to define, even in the best characterised groundwater systems. Sustainable management of a groundwater system involves management for the maintenance of a number of different aspects of the system, and includes consideration of:

- *beneficial use of the aquifer both now and in the future,*
- *average recharge over a specified time;*
- *long term and short term seasonal climatic variation;*
- *variation and change in quality;*
- *impact on the environment;*
- *the capacity of the aquifer storage to buffer seasonal variations;*
- *induced recharge;*
- *economic impacts of management options;*
- *social and cultural impacts; and*
- *access to the resource".*

It is believed that the proposed subdivision and residential development of the newly subdivided lots will not compromise policy and ecological sustainable development objectives detailed in the NSW Department of Land & Water Conservation's "NSW State Groundwater Policy Framework Document". Details of existing site conditions and proposed site uses have been assessed below.

Limited geotechnical investigations were previously undertaken on the subject site on 1 December 2003 and 30 October 2007. During the investigations 7 testpits were excavated up to 3.5m below the existing surface levels. Groundwater was encountered within three of the excavated testpits at a depth of approximately 3.2m below the existing surface level. Groundwater samples were not recovered for use in laboratory testing.

A groundwater bore search of the site and surrounding area was undertaken using Department of Natural Resource's "NRAtlas". The search identified 21 separate boreholes located within a 3km radius of the site. The nearest recorded borehole to the subject site was approximately 500m to the west of the subject site. Figure 1 below shows the borehole locations and the approximate location of the subject site.

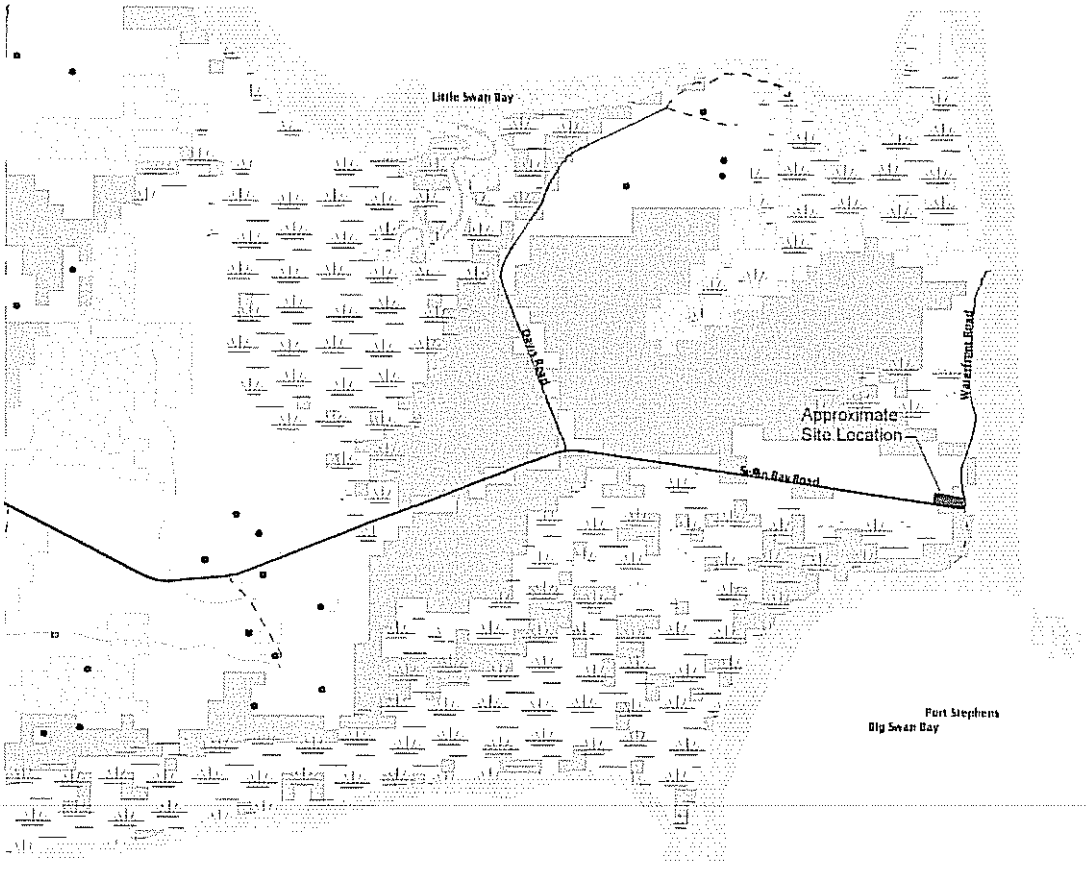


Figure 1 – Borehole locations and the subject site

Of the 21 boreholes identified, detailed information was only available for 3 boreholes which were located approximately 2km to the to the west of the subject site. The borehole logs show that bores were excavated to depths between 5.2 and 30.5m and that water bearing zones were encountered in two of the three bores at depths varying of 3.7m and between 12.5m and 26.5m. The quality of the groundwater located within these bores was not determined. Bore details including water bearing zones can be seen in the attachment section of this report.

Due to the topographic landform on and around the site as well as the close proximity to Port Stephens, a highly saline surfacewater body, it is anticipated that groundwater on and within the area surrounding the site would be unsuitable for domestic reuse, irrigation or livestock use due to moderate salinity levels.

It is proposed that the site be subdivided and that the newly subdivided lots will be developed with residential dwellings. It is believed that a typical residential land use will not lead to a reduction in the groundwater quality either on or around the subject site as stormwater runoff from all impervious areas will be controlled and all wastewater will be treated by a secondary wastewater treatment device prior to onsite disposal.

Barker Harle's Onsite Effluent Disposal Investigation report dated 18 November 2005 detailed suitable wastewater treatment and disposal options in accordance with Australian Standard (AS) 1547:2000. Section 2.2.1 of AS1547 states:

"***Performance objectives***

The key performance objectives for any on-site domestic-wastewater management system shall be:

(a) To protect public health by ensuring that:

(i) all discharges comply with the relevant public health requirements;

(ii) risks associated with the discharge of human waste and domestic-wastewater to the environment are minimized.

(b) To maintain and enhance the quality of the environment by ensuring that:

(i) environmental quality objectives set by the regulator are attained;

(ii) surface and groundwater are not polluted;

(iii) soil productivity is maintained or enhanced;

(iv) cumulative and adverse environmental effects comply with the relevant environmental requirements.

(c) To maintain and enhance community amenity by ensuring that:

(i) on-site domestic-wastewater systems are managed so as to achieve sustainable long-term performance;

(ii) the on-site system design and its implementation contribute to improving and sustaining aesthetic values within individual properties and groups of properties (such as subdivisions);

(iii) the requirements of any community resource utilization programme for the reuse of resources within wastewater are met".

Barker Harle's "Onsite Effluent Disposal Investigation" report was prepared in accordance with AS1547 including the above performance objectives. As such, development of the site in accordance with recommendations outlined in Barker Harle "Onsite Effluent Disposal

Investigation" will ensure that there will be no adverse environmental effects on groundwater quality resulting from the disposal of treated wastewater on the site.

No other sources of potential groundwater contamination could be identified.

Should you have any further questions, please don't hesitate to call me.

Yours Faithfully
Barker Harle

Mark Smith

Mark Smith
B.E. (Environmental)
Environmental Engineer

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Tuesday, October 7, 2008

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW022265

Works Details (top)

GROUNDWATER NUMBER	GW022265
LIC-NUM	20BL014856
AUTHORISED-PURPOSES	IRRIGATION POULTRY (GROUNDWATER) STOCK
INTENDED-PURPOSES	NOT KNOWN
WORK-TYPE	Well
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1965-02-01
FINAL-DEPTH (metres)	6.10
DRILLED-DEPTH (metres)	0.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	- SYDNEY BASIN
GW-ZONE	- ZONE 5 JEMALONG GAP TO CONDOBOLIN
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	209 - KARUAH RIVER
AREA-DISTRICT	
CMA-MAP	9232-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6380925.00
EASTING	402135.00
LATITUDE	32 42' 18"
LONGITUDE	151 57' 21"
GS-MAP	0053D3

AMG-ZONE	56
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	GLOUCESTER
PARISH	SUTTON
PORTION-LOT-DP	39

Licensed (top)

COUNTY	GLOUCESTER
PARISH	SUTTON
PORTION-LOT-DP	1 434383

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Nil	0.00	6.10	1829			(Unknown)

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary - 2.

For information on the meaning of fields please see Glossary
Document Generated on Tuesday, October 7, 2008

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW022286

Works Details (top)

GROUNDWATER NUMBER	GW022286
LIC-NUM	20BL014855
AUTHORISED-PURPOSES	DOMESTIC IRRIGATION
INTENDED-PURPOSES	NOT KNOWN
WORK-TYPE	Well
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1964-03-01
FINAL-DEPTH (metres)	5.20
DRILLED-DEPTH (metres)	5.20
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	- SYDNEY BASIN
GW-ZONE	- ZONE 5 JEMALONG GAP TO CONDOBOLIN
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	209 - KARUAH RIVER
AREA-DISTRICT	
CMA-MAP	9232-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6380831.00
EASTING	401979.00
LATITUDE	32 42' 21"
LONGITUDE	151 57' 15"
GS-MAP	0053D3

AMG-ZONE	56
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	GLOUCESTER
PARISH	SUTTON
PORTION-LOT-DP	39

Licensed (top)

COUNTY	GLOUCESTER
PARISH	SUTTON
PORTION-LOT-DP	1 434383

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Nil	0.00	5.20	2134			(Unknown)

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
3.70	3.70	0.00	Unconsolidated						0-500 ppm

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	Topsoil		
0.20	0.91	0.71	Clay Crumbly		
0.91	3.66	2.75	Clay Grey		
3.66	5.18	1.52	Clay Siliceous Water Bearing		

Groundwater Works Summary -3.

For information on the meaning of fields please see Glossary
Document Generated on Tuesday, October 7, 2008

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW078263

Works Details (top)

GROUNDWATER NUMBER	GW078263
LIC-NUM	20BL151109
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Abandoned - Backfilled
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1992-11-29
FINAL-DEPTH (metres)	30.50
DRILLED-DEPTH (metres)	30.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	- SYDNEY BASIN
GW-ZONE	- ZONE 5 JEMALONG GAP TO CONDOBOLIN
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6380578.00
EASTING	402111.00
LATITUDE	32 42' 30"
LONGITUDE	151 57' 20"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	Unidentified Location
REMARK	

Form-A (top)

COUNTY	GLOUCESTER
PARISH	SUTTON
PORTION-LOT-DP	B//101997

Licensed (top)

COUNTY	GLOUCESTER
PARISH	SUTTON
PORTION-LOT-DP	LTB 3839

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	30.50	164			Cable Tool

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
12.50	26.50	14.00		8.40					

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	top soil		
0.30	9.20	8.90	multi coloured clay		
9.20	12.00	2.80	grey sandy clay		
12.00	12.50	0.50	brown clay		
12.50	21.00	8.50	grey gravelly clay		
21.00	26.50	5.50	clayey gravel		
26.50	27.00	0.50	clay bands and gravel bands		
27.00	28.20	1.20	sandstone and clay bands		
28.20	30.50	2.30	sandstone		

ENGINEERING LOG

Barker Harle
Engineers and Scientists

Client: WELLS ENVIRONMENTAL SERVICES
Project: GEOTECHNICAL INVESTIGATION
Location: LOT 224 DP862015 WATERFRONT ROAD, SWAN BAY
Date: 30/10/07
Position: SEE SITE PLAN
Surface RL: EXISTING **Groundwater:** NIL ENCOUNTERED

Testpit No: TP1
DCP No:
Job No: 31406
Logged by: MS
Equipment: 300mm HAND

Drilling Information			Sampling Data			Profile Description			Structure and Additional Comments
Depth in metres	Progress	Water	Sample type	Graphic Log	USC	Material/Strata	Consistency / Rel. Density (VS Fb S VL F L St M VSt D H VD)	Moisture (D SM M W) / Plasticity	
0.25			D			FILL - BROWN SILTY SANDY CLAY WITH COMMON FINE TO COARSE GRAVEL			
						FILL - GREY GRAVELLY SAND			
0.50						BROWN CLAY WITH SOME SAND			
0.75			B			TERMINATED IN BROWN CLAY WITH SOME SAND			
1.00									
1.25									
1.50									
1.75									
2.00									
2.25									
2.50									

Key

Water

Plasticity
NP Non Plastic
T Trace
VL Very Low
L Low
M Medium
H High
VH Very High
EH Extra High

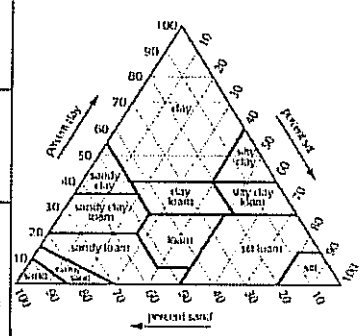
Moisture
D dry
SM slightly moist
M moist
W wet

Sampling Data
U50 undisturbed sample 50mm diameter
D disturbed sample
NC cone penetrometer
B bulk sample

Consistency
Relative Density

VS	very soft	Fb	friable
S	soft	VL	very loose
F	firm	L	loose
St	stiff	M	medium dense
VSt	very stiff	D	dense
H	hard	VD	very dense

Textural Classification Diagram



Site Plan N.T.S / Comments

ENGINEERING LOG

Barker Harle
Engineers and Scientists

Client: WELLS ENVIRONEMTNAL SERVICES
Project: GEOTECHNICAL INVESTIGATION
Location: LOT 224 DP862015 WATERFRONT ROAD, SWAN BAY
Date: 30/10/07
Position: SEE SITE PLAN
Surface RL: EXISTING **Groundwater:** NIL ENCOUNTERED

Testpit No: TP2
DCP No:
Job No: 31406
Logged by: MS
Equipment: 300mm HAND

Depth in metres	Progress	Water	Sample type	Graphic Log	USC	Material/Strata	Consistency / Rel. Density (VS Fb, S VL, F L, St M, VSt D, H VD)	Moisture (D, SM, M, W)	Plasticity	Structure and Additional Comments
0.00–0.30			D			BROWN LOAM	S / VL	SM		
0.30–0.75						GREY CLAYEY SAND	S / VL	SM		
0.75						TERMINATE IN GREY CLAYEY SAND				

Depth scale: 0.25, 0.50, 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.25, 2.50

Key

Water
- seeping
- free standing

Moisture
- D dry
- SM slightly moist
- M moist
- W wet

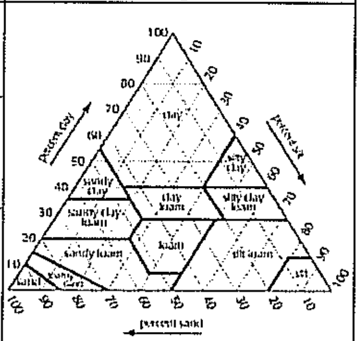
Sampling Data
- USD undisturbed sample 50mm diameter
- D disturbed sample
- NC cone penetrometer
- B bulk sample

Plasticity
- NP Non Plastic
- T Trace
- VL Very Low
- L Low
- M Medium
- H High
- VH Very High
- EH Extra High

Consistency / Relative Density

VS	very soft	Fb	friable
S	soft	VL	very loose
F	firm	L	loose
St	stiff	M	medium dense
VSt	very stiff	D	dense
H	hard	VD	very dense

Textural Classification Diagram



Site Plan N.T.S / Comments

ENGINEERING LOG

Barker Harle
Engineers and Scientists

Client: WELLS ENVIRONMENTAL SERVICES
Project: GEOTECHNICAL INVESTIGATION
Location: LOT 224 DP862015 WATERFRONT ROAD, SWAN BAY
Date: 30/10/07
Position: SEE SITE PLAN
Surface RL: EXISTING
Groundwater: NIL ENCOUNTERED

Testpit No: TP3
DCP No:
Job No: 31406
Logged by: MS
Equipment: 300mm HAND

Drilling Information: Depth in metres	Progress	Water	Sampling Data: Sample type	Graphic Log	USC	Profile Description: Material/Strata	Consistency / Rel. Density (VS Fb S VL F L St M VSt D H VD)	Moisture (D SM M W)	Plasticity	Structure and Additional Comments
0.00–0.25			D			BROWN LOAM	S	SM		
0.25						TERMINATED IN BROWN LOAM				
0.50										
0.75										
1.00										
1.25										
1.50										
1.75										
2.00										
2.25										
2.50										

Key

Water
- seeping
- free standing

Moisture
- D dry
- SM slightly moist
- M moist
- W wet

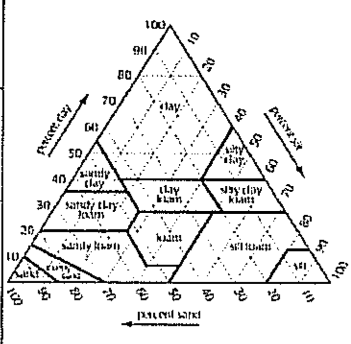
Sampling Data
- U50 undisturbed sample 50mm diameter
- D disturbed sample
- NC cone penetrometer
- B bulk sample

Plasticity
- NP Non Plastic
- T Trace
- VL Very Low
- L Low
- M Medium
- H High
- VH Very High
- EH Extra High

Consistency / Relative Density

VS	very soft	Fb	friable
S	soft	VL	very loose
F	firm	L	loose
St	stiff	M	medium dense
VSt	very stiff	D	dense
H	hard	VD	very dense

Textural Classification Diagram

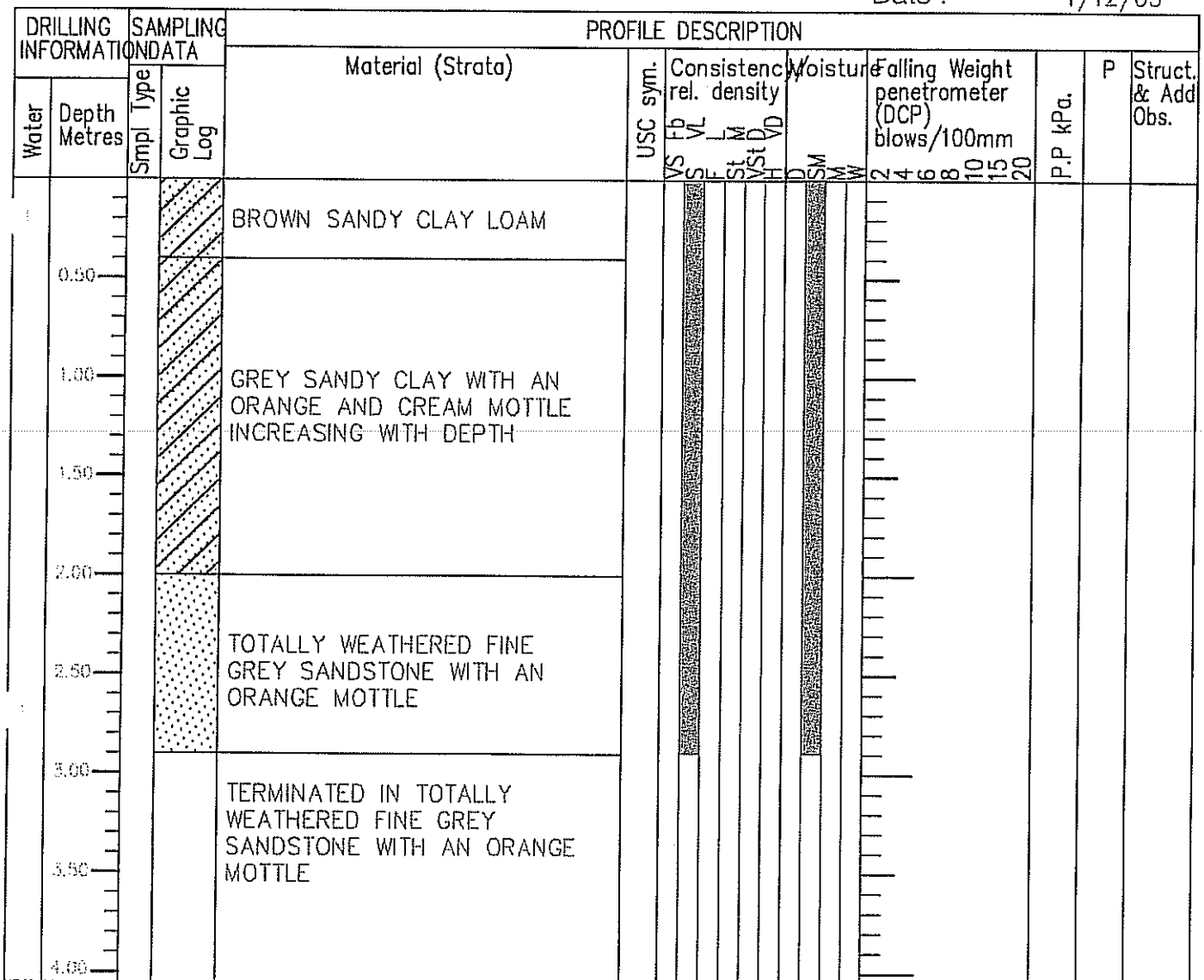


Site Plan N.T.S / Comments

Engineering Log

Barker Harle
Engineers and Scientists

Location :	LOT 224 WATERFRONT ROAD, SWAN BAY	Testpit :	TP1
Client :	R & L WELLS	Ref :	31406
Position :	SEE SKETCH 31406/ASS1	Logged By :	MS
Surface RL :	EXISTING	Equipment :	EXCAVATOR
Groundwater :	NIL ENCOUNTERED	Hole Size :	450mm
		Date :	1/12/03



Water

Water level – date or time shown

Water inflow

Sampling Data

U50 Undisturbed sample – 50mm dia.
D Disturbed Sample
NC Cone Penetrometer
B Bulk Sample

Consistency/rel. density

VS Very Soft
S Soft
F Firm
St Stiff
VSt Very Stiff
H Hard
Fb Friable
VL Very Loose
L Loose
M Med. dense
D Dense
VD Very Dense

Moisture

D Dry
SM Slightly Moist
M Moist
W Wet

Plasticity (P)

NP Non-Plastic
T Trace
VL Very Low
L Low
M Medium
H High
VH Very High
EH Extra High

Plan/Remarks

Engineering Log

Barker Harle
Engineers and Scientists

Location :	LOT 224 WATERFRONT ROAD, SWAN BAY	Testpit :	TP2
Client :	R & L WELLS	Ref :	31406
Position :	SEE SKETCH 31406/ASS1	Logged By :	MS
Surface RL :	EXISTING	Equipment :	EXCAVATOR
Groundwater :	NIL ENCOUNTERED	Hole Size :	450mm
		Date :	1/12/03

DRILLING INFORMATION		SAMPLING DATA		PROFILE DESCRIPTION								
Water	Depth Metres	Smpl Type	Graphic Log	Material (Strata)	USC sym.	Consistency/ rel. density	Moisture	Falling Weight penetrometer (DCP) blows/100mm	P.P kPa.	P	Struct. & Add. Obs.
	0.00			BROWN SANDY CLAY LOAM		VS S F St VSt H / Fb VL L M D VD	D SM M W	2 4 6 8 10 15 20			
	0.50										
	1.00			GREY SANDY CLAY WITH AN ORANGE AND CREAM MOTTLE INCREASING WITH DEPTH							
	1.50										
	2.00										
	2.50										
	3.00			TOTALLY WEATHERED FINE GREY SANDSTONE WITH AN ORANGE MOTTLE							
	3.50			TERMINATED IN TOTALLY WEATHERED FINE GREY SANDSTONE WITH AN ORANGE MOTTLE							
	4.00										

Water

water — Water level – date or time shown

Water inflow

Sampling Data

- U50 Undisturbed sample – 50mm dia.
- D Disturbed Sample
- NC Cone Penetrometer
- B Bulk Sample

Consistency/rel. density

- VS Very Soft
- S Soft
- F Firm
- St Stiff
- VSt Very Stiff
- H Hard
- Fb Friable
- VL Very Loose
- L Loose
- M Med. dense
- D Dense
- VD Very Dense

Moisture

- D Dry
- SM Slightly Moist
- M Moist
- W Wet

Plasticity (P)

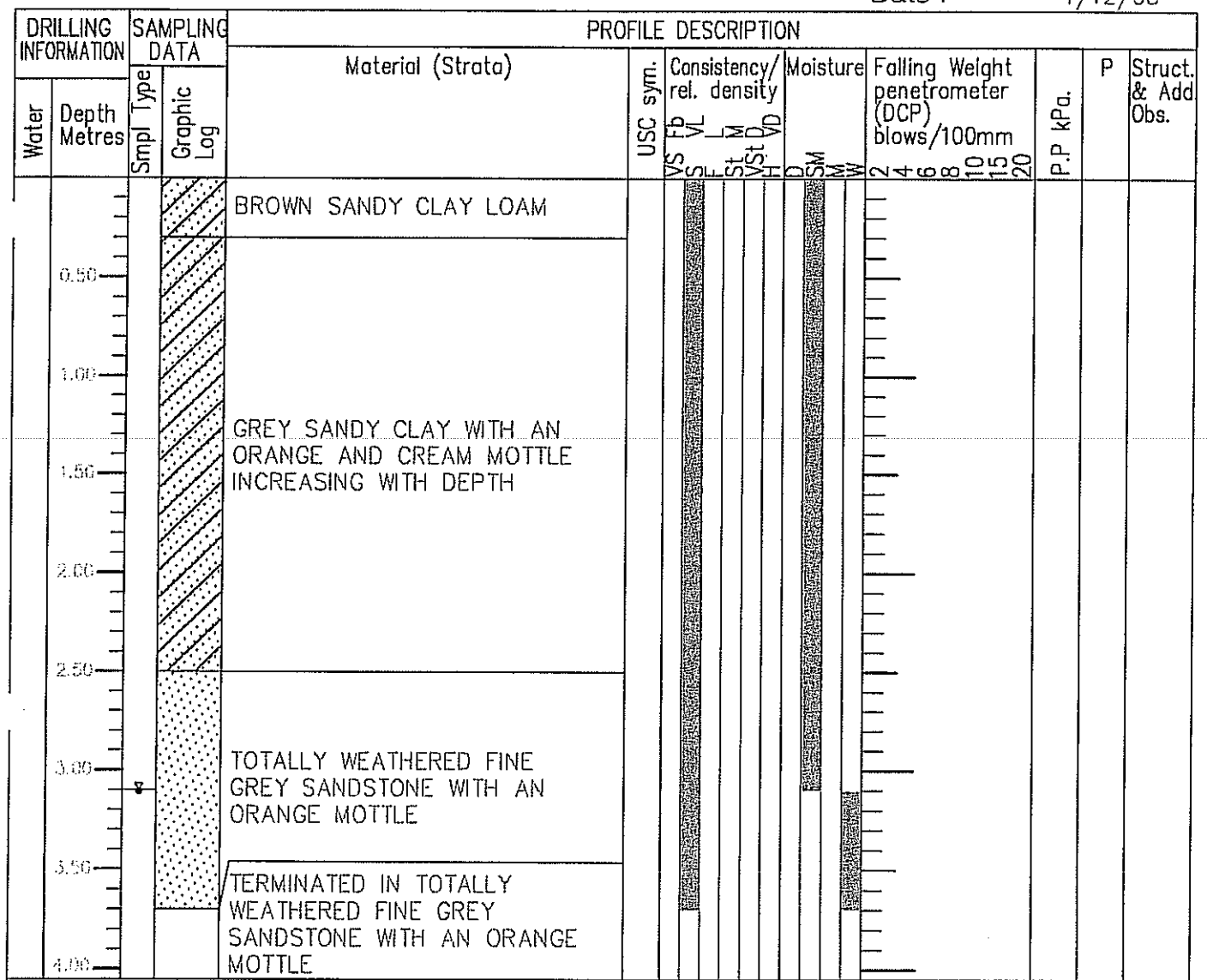
- NP Non-Plastic
- T Trace
- VL Very Low
- L Low
- M Medium
- H High
- VH Very High
- EH Extra High

Plan/Remarks

Engineering Log

Barker Harle
Engineers and Scientists

Location :	LOT 224 WATERFRONT ROAD, SWAN BAY	Testpit :	TP3
Client :	R & L WELLS	Ref :	31406
Position :	SEE SKETCH 31406/ASS1	Logged By :	MS
Surface RL :	EXISTING	Equipment :	EXCAVATOR
Groundwater :	NIL ENCOUNTERED	Hole Size :	450mm
		Date :	1/12/03



Water

Water level – date or time shown

Water inflow

Sampling Data

- U50 Undisturbed sample – 50mm dia.
- D Disturbed Sample
- NC Cone Penetrometer
- B Bulk Sample

Consistency/rel. density

VS	Very Soft
S	Soft
F	Firm
St	Stiff
VSt	Very Stiff
H	Hard
Fb	Friable
VL	Very Loose
L	Loose
M	Med. dense
D	Dense
VD	Very Dense

Moisture

D	Dry
SM	Slightly Moist
M	Moist
W	Wet

Plasticity (P)

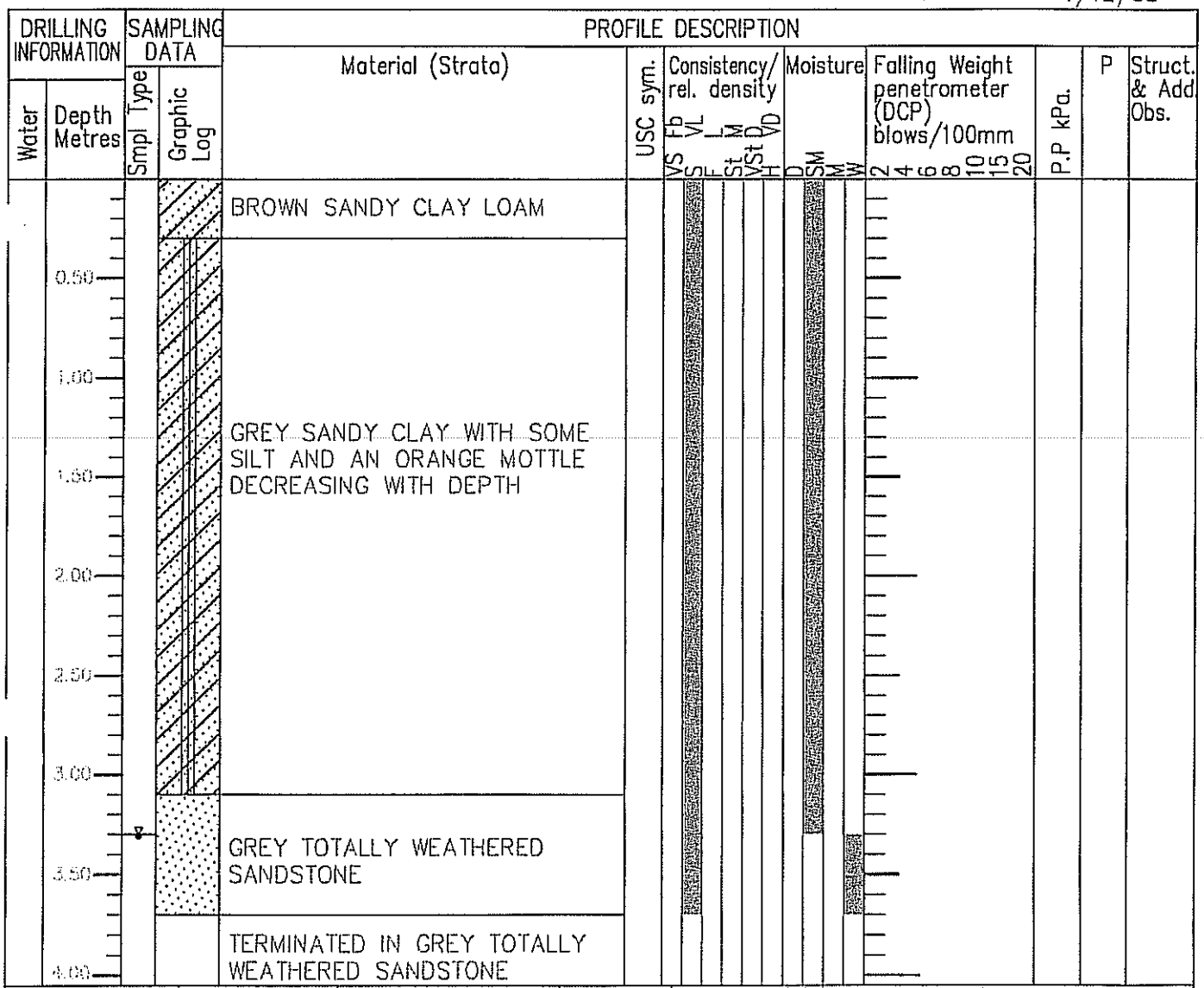
NP	Non-Plastic
T	Trace
VL	Very Low
L	Low
M	Medium
H	High
VH	Very High
EH	Extra High

Plan/Remarks

Engineering Log

Barker Harle
Engineers and Scientists

Location :	LOT 224 WATERFRONT ROAD, SWAN BAY	Testpit :	TP4
Client :	R & L WELLS	Ref :	31406
Position :	SEE SKETCH 31406/ASS1	Logged By :	MS
Surface RL :	EXISTING	Equipment :	EXCAVATOR
Groundwater :	NIL ENCOUNTERED	Hole Size :	450mm
		Date :	1/12/03



Water

water — Water level – date or time shown

Water inflow

Sampling Data

U50 Undisturbed sample – 50mm dia.
D Disturbed Sample
NC Cone Penetrometer
B Bulk Sample

Consistency/rel. density

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F Firm
St Stiff
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H Hard
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Plasticity (P)

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VL Very Low
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Plan/Remarks