CLIENT	D'ALBORA MARINAS	**COMMENCED**	13/12/07	**COMPLETED**	13/12/07	**REF**	**BH9**
PROJECT	STAGE 2 & GEOTECH ASSESSMENT	**LOGGED**	JF	**CHECKED**	AN	**Sheet**	2 of 3
SITE	THE SPIT MARINA	**GEOLOGY**	SAND	**VEGETATION**	NONE	**PROJECT NO.**	P0701675
EQUIPMENT	4WD Mounted Auger	**EASTING**	NA	**RL SURFACE**	1.5 m AHD		
EXCAVATION DIMENSIONS	95mm x 10500mm	**NORTHING**	NA	**ASPECT**	W	**SLOPE**	<1°

EXCAVATION DATA						MATERIAL DATA					SAMPLING & TESTING		
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE (L M H R)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS
		Y	W	5.0			SP	SAND - LIGHT BROWN, WET, MED. DENSE, MEDIUM COARSE GRAINED		MD			
				6.0									
				7.0									
				8.0							B	7.5	1675/9/7.5
				9.0									

EQUIPMENT / METHOD
N Natural exposure
X Existing excavation
BH Backhoe bucket
E Excavator
HA Hand auger
S Hand spade
PT Push tube
A Auger

SUPPORT
SH Shoring
SC Shotcrete
RB Rock Bolts
Nil No support

WATER
N None observed
X Not measured
Water level
Water outflow
Water inflow

MOISTURE
D Dry
M Moist
W Wet
Wp Plastic limit
Wl Liquid limit

PENETRATION
L Low
M Moderate
H High
R Refusal

CONSISTENCY
VS Very Soft
S Soft
F Firm
St Stiff
VSt Very Stiff
H Hard
F Friable

DENSITY
VL Very Loose
L Loose
MD Medium Dense
D Dense
VD Very Dense

SAMPLING & TESTING
A Auger sample
B Bulk sample
U Undisturbed sample
D Disturbed sample
M Moisture content
Ux Tube sample (x mm)

pp Pocket penetrometer
S Standard penetration test
VS Vane shear
DCP Dynamic cone penetrometer
FD Field density
WS Water sample

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
Y USCS
N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

Quality Sheet No. 4

martens

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Engineering Log - Borehole

CLIENT	D'ALBORA MARINAS	**COMMENCED**	13/12/07	**COMPLETED**	13/12/07	**REF**	**BH9**
PROJECT	STAGE 2 & GEOTECH ASSESSMENT	**LOGGED**	JF	**CHECKED**	AN	**Sheet**	3 of 3
SITE	THE SPIT MARINA	**GEOLOGY**	SAND	**VEGETATION**	NONE	**PROJECT NO.**	P0701675
EQUIPMENT	4WD Mounted Auger	**EASTING**	NA	**RL SURFACE**	1.5 m AHD		
EXCAVATION DIMENSIONS	95mm x 10500mm	**NORTHING**	NA	**ASPECT**	W	**SLOPE**	<1°

EXCAVATION DATA						MATERIAL DATA					SAMPLING & TESTING		
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE (L M H R)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS
A	NIL	N	M	10.0			SP	SAND - LIGHT BROWN, WET, MEDIUM DENSE, MEDIUM-COARSE GRAINED		MD	B	10.0	
				11.0				BH TERMINATED @ 10.5m ON SAND					
				12.0									
				13.0									

EQUIPMENT / METHOD
N Natural exposure
X Existing excavation
BH Backhoe bucket
E Excavator
HA Hand auger
S Hand spade
PT Push tube
A Auger

SUPPORT
SH Shoring
SC Shotcrete
RB Rock Bolts
Nil No support

WATER
N None observed
X Not measured
Water level
Water outflow
Water inflow

MOISTURE
D Dry
M Moist
W Wet
Wp Plastic limit
Wl Liquid limit

PENETRATION
L Low
M Moderate
H High
R Refusal

CONSISTENCY
VS Very Soft
S Soft
F Firm
St Stiff
VSt Very Stiff
H Hard
F Friable

DENSITY
VL Very Loose
L Loose
MD Medium Dense
D Dense
VD Very Dense

SAMPLING & TESTING
A Auger sample
B Bulk sample
U Undisturbed sample
D Disturbed sample
M Moisture content
Ux Tube sample (x mm)
pp Pocket penetrometer
S Standard penetration test
VS Vane shear
DCP Dynamic cone penetrometer
FD Field density
WS Water sample

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
Y USCS
N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - Borehole

CLIENT	**D'ALBORA MARINAS**	**COMMENCED**	13/12/07	**COMPLETED**	13/12/07	**REF**	**BH10**
PROJECT	**STAGE 2 & GEOTECH ASSESSMENT**	**LOGGED**	JF	**CHECKED**	AN	**Sheet**	**1 of 1**
SITE	**THE SPIT MARINA**	**GEOLOGY**	SAND	**VEGETATION**	NONE	**PROJECT NO.**	P0701675
EQUIPMENT	4WD Mounted Auger	**EASTING**	NA	**RL SURFACE**	1.5 m AHD		
EXCAVATION DIMENSIONS	95mm x 4300mm	**NORTHING**	NA	**ASPECT**	W	**SLOPE**	<1°

EXCAVATION DATA						MATERIAL DATA					SAMPLING & TESTING			
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE (L M H R)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS	
A	Nil	N	M	0.1			-	CONCRETE						
A	Nil	N	D	0.4			GP	BLUE METAL GRAVEL FILL & SAND		D	A	0.25	1675/10/0.25	
A	Nil	N	M	1.0			EW	RIPPED SANDSTONE FILL (SANDY CLAY) - ORANGE AND GREY MOTTLED	F		A	0.5	1675/10/0.5	
			▽	1.6							A	1.0	1675/10/1.0	1.0
											A	1.5	1675/10/1.5	
A	Nil	Y	W	2.0			SM	SILTY SAND- BROWN, WET, MEDIUM DENSE, MEDIUM COARSE GRAINED		MD	A	2.0	1675/10/2.0	2.0
				2.5										
				3.0										3.0
A	Nil	Y	W				SP	SAND - LIGHT BROWN, WET, MEDIUM DENSE, MEDIUM COARSE GRAINED		MD	A	3.0	1675/10/3.0	
				4.0										4.0
				4.3							A	4.3	1675/10/4.3	
								BH TERMINATED @ 4.3m ON SAND						

EQUIPMENT / METHOD
N Natural exposure
X Existing excavation
BH Backhoe bucket
E Excavator
HA Hand auger
S Hand spade
PT Push tube
A Auger

SUPPORT
SH Shoring
SC Shotcrete
RB Rock Bolts
Nil No support

WATER
N None observed
X Not measured
▽ Water level
◁ Water outflow
▷ Water inflow

MOISTURE
D Dry
M Moist
W Wet
Wp Plastic limit
Wl Liquid limit

PENETRATION
L Low
M Moderate
H High
R Refusal

CONSISTENCY
VS Very Soft
S Soft
F Firm
St Stiff
VSt Very Stiff
H Hard
F Friable

DENSITY
VL Very Loose
L Loose
MD Medium Dense
D Dense
VD Very Dense

SAMPLING & TESTING
A Auger sample
B Bulk sample
U Undisturbed sample
D Disturbed sample
M Moisture content
Ux Tube sample (x mm)

pp Pocket penetrometer
S Standard penetration test
VS Vane shear
DCP Dynamic cone penetrometer
FD Field density
WS Water sample

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
Y USCS
N Agricultural

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

Quality Sheet No. 4

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Engineering Log - Borehole

12 Attachment C – Laboratory Results

Envirolab Services Pty Ltd
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54 Frenchs Rd Willoughby NSW 2068
ph 02 9958 5801 fax 02 9958 5803
email: tnotaras@envirolabservices.com.au

CERTIFICATE OF ANALYSIS 15921

Client:
Martens & Associates
6/37 Leighton Place
Hornsby
NSW 2077

Attention: Jeff Fulton

Sample log in details:

Your Reference:	**P0701675, The Spit Marina**
No. of samples:	19 Soils, 4 Waters
Date samples received:	17/12/07
Date completed instructions received:	17/12/07

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	7/01/08
Date of Preliminary Report:	Not Issued
Issue Date:	2/01/08

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This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
Tests not covered by NATA are denoted with *.

Results Approved By:

Jacinta Hurst
Operations Manager

David Springer
Business Development & Quality Manager

vTPH & BTEX in Soil						
Our Reference:	UNITS	15921-1	15921-2	15921-3	15921-4	15921-5
Your Reference	----------	1675/1/1.0	1675/3/0.25	1675/7/1.5	1675/10/0.25	1675/3/1.0
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007
vTPH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
m + p-Xylene	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
o-Xylene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%	83	81	84	92	87

vTPH & BTEX in Soil						
Our Reference:	UNITS	15921-6	15921-7	15921-8	15921-9	15921-10
Your Reference	----------	1675/5/1.5	1675/6/1.0	1675/6/2.0	1675/7/3.0	1675/7/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007
vTPH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
m + p-Xylene	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
o-Xylene	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%	90	82	77	80	78

vTPH & BTEX in Soil					
Our Reference:	UNITS	15921-11	15921-12	15921-13	15921-14
Your Reference	----------	1675/8/1.5	1675/8/2.0	1675/8/3.0	1675/8/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007
vTPH C_6 - C_9	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1.0	<1.0	<1.0	<1.0
m + p-Xylene	mg/kg	<2.0	<2.0	<2.0	<2.0
o-Xylene	mg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%	84	83	85	80

sTPH in Soil (C10-C36)						
Our Reference:	UNITS	15921-1	15921-2	15921-3	15921-4	15921-5
Your Reference	----------	1675/1/1.0	1675/3/0.25	1675/7/1.5	1675/10/0.25	1675/3/1.0
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007
TPH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TPH C_{15} - C_{28}	mg/kg	<100	<100	160	<100	<100
TPH C_{29} - C_{36}	mg/kg	120	<100	240	100	<100
Surrogate o-Terphenyl	%	115	118	122	125	117

sTPH in Soil (C10-C36)						
Our Reference:	UNITS	15921-6	15921-7	15921-8	15921-9	15921-10
Your Reference	----------	1675/5/1.5	1675/6/1.0	1675/6/2.0	1675/7/3.0	1675/7/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007
TPH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TPH C_{15} - C_{28}	mg/kg	240	<100	<100	<100	<100
TPH C_{29} - C_{36}	mg/kg	300	<100	<100	<100	<100
Surrogate o-Terphenyl	%	129	118	118	132	78

sTPH in Soil (C10-C36)					
Our Reference:	UNITS	15921-11	15921-12	15921-13	15921-14
Your Reference	----------	1675/8/1.5	1675/8/2.0	1675/8/3.0	1675/8/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007
TPH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TPH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TPH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100
Surrogate o-Terphenyl	%	132	138	126	119

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-1 1675/1/1.0 14/12/2007 Soil	15921-2 1675/3/0.25 14/12/2007 Soil	15921-3 1675/7/1.5 14/12/2007 Soil	15921-4 1675/10/0.25 14/12/2007 Soil	15921-5 1675/3/1.0 14/12/2007 Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.2	0.2	2.2	0.4	<0.1
Anthracene	mg/kg	<0.1	<0.1	0.7	0.1	<0.1
Fluoranthene	mg/kg	1.0	0.7	5.0	1.2	<0.1
Pyrene	mg/kg	1.1	0.7	4.5	1.2	<0.1
Benzo(a)anthracene	mg/kg	0.6	0.5	2.4	0.7	<0.1
Chrysene	mg/kg	0.7	0.6	2.4	0.7	<0.1
Benzo(b,k)fluoranthene	mg/kg	1.3	1.2	4.2	1.5	<0.2
Benzo(a)pyrene	mg/kg	0.9	0.7	2.7	0.9	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.6	0.6	1.7	0.6	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	0.3	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.9	0.6	1.5	0.7	<0.1
Surrogate p-Terphenyl-d_{14}	%	124	121	121	134	127

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-6 1675/5/1.5 14/12/2007 Soil	15921-7 1675/6/1.0 14/12/2007 Soil	15921-8 1675/6/2.0 14/12/2007 Soil	15921-9 1675/7/3.0 14/12/2007 Soil	15921-10 1675/7/4.2 14/12/2007 Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007	21/12/2007
Naphthalene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.3	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	1.3	0.3	<0.1	0.2	<0.1
Anthracene	mg/kg	0.5	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	7.5	1.3	0.1	1.2	0.2
Pyrene	mg/kg	7.2	1.2	0.1	1.2	0.2
Benzo(a)anthracene	mg/kg	4.7	0.7	<0.1	0.8	<0.1
Chrysene	mg/kg	4.8	0.8	<0.1	0.8	<0.1
Benzo(b,k)fluoranthene	mg/kg	10	1.6	<0.2	1.6	<0.2
Benzo(a)pyrene	mg/kg	6.6	1.0	0.1	1.0	0.08
Indeno(1,2,3-c,d)pyrene	mg/kg	4.1	0.7	<0.1	0.7	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.7	0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	3.9	0.6	<0.1	0.6	<0.1
Surrogate p-Terphenyl-d_{14}	%	132	130	127	133	135

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-11 1675/8/1.5 14/12/2007 Soil	15921-12 1675/8/2.0 14/12/2007 Soil	15921-13 1675/8/3.0 14/12/2007 Soil	15921-14 1675/8/4.2 14/12/2007 Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007	21/12/2007	21/12/2007
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.4	0.7	0.3	0.1
Pyrene	mg/kg	0.4	0.6	0.3	0.1
Benzo(a)anthracene	mg/kg	0.2	0.4	0.2	<0.1
Chrysene	mg/kg	0.3	0.5	0.2	<0.1
Benzo(b,k)fluoranthene	mg/kg	0.6	0.9	0.3	<0.2
Benzo(a)pyrene	mg/kg	0.3	0.5	0.2	0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.2	0.4	0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.3	0.4	0.1	<0.1
Surrogate p-Terphenyl-d_{14}	%	135	127	132	124

Organochlorine Pesticides in soil					
Our Reference:	UNITS	15921-1	15921-2	15921-3	15921-4
Your Reference	----------	1675/1/1.0	1675/3/0.25	1675/7/1.5	1675/10/0.25
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	24/12/2007	24/12/2007	24/12/2007	24/12/2007
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	88	86	89	89

Organophosphorus Pesticides Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-1 1675/1/1.0 14/12/2007 Soil	15921-2 1675/3/0.25 14/12/2007 Soil	15921-3 1675/7/1.5 14/12/2007 Soil	15921-4 1675/10/0.25 14/12/2007 Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	24/12/2007	24/12/2007	24/12/2007	24/12/2007
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	88	86	89	89

PCBs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-1 1675/1/1.0 14/12/2007 Soil	15921-2 1675/3/0.25 14/12/2007 Soil	15921-3 1675/7/1.5 14/12/2007 Soil	15921-4 1675/10/0.25 14/12/2007 Soil
Date extracted	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	24/12/2007	24/12/2007	24/12/2007	24/12/2007
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	88	86	89	89

Acid Extractable metals in soil						
Our Reference:	UNITS	15921-1	15921-2	15921-3	15921-4	15921-5
Your Reference	----------	1675/1/1.0	1675/3/0.25	1675/7/1.5	1675/10/0.25	1675/3/1.0
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Arsenic	mg/kg	<4.0	<4.0	14	<4.0	<4.0
Cadmium	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	10	10	33	25	10
Copper	mg/kg	3.5	160	570	61	1.7
Lead	mg/kg	28	140	710	120	18
Mercury	mg/kg	<0.10	0.31	8.3	0.72	<0.10
Nickel	mg/kg	<1.0	38	27	28	<1.0
Zinc	mg/kg	4.0	93	230	77	1.1
Tin	mg/kg	<1.0	14	21	20	<1.0

Acid Extractable metals in soil						
Our Reference:	UNITS	15921-6	15921-7	15921-8	15921-9	15921-10
Your Reference	----------	1675/5/1.5	1675/6/1.0	1675/6/2.0	1675/7/3.0	1675/7/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Arsenic	mg/kg	25	5.8	<4.0	<4.0	<4.0
Cadmium	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	18	9.5	5.0	8.5	7.7
Copper	mg/kg	680	110	47	83	30
Lead	mg/kg	580	390	120	130	44
Mercury	mg/kg	7.3	2.6	0.67	1.8	0.75
Nickel	mg/kg	21	5.3	2.0	5.2	5.1
Zinc	mg/kg	520	190	100	120	71
Tin	mg/kg	49	15	2.7	12	2.9

Acid Extractable metals in soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-11 1675/8/1.5 14/12/2007 Soil	15921-12 1675/8/2.0 14/12/2007 Soil	15921-13 1675/8/3.0 14/12/2007 Soil	15921-14 1675/8/4.2 14/12/2007 Soil
Date digested	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Arsenic	mg/kg	6.4	6.7	<4.0	<4.0
Cadmium	mg/kg	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	6.9	9.0	6.3	4.8
Copper	mg/kg	120	130	68	16
Lead	mg/kg	280	320	120	14
Mercury	mg/kg	5.7	4.1	2.4	0.45
Nickel	mg/kg	1.8	3.0	1.7	<1.0
Zinc	mg/kg	120	240	150	100
Tin	mg/kg	6.1	14	5.3	1.3

Moisture						
Our Reference:	UNITS	15921-1	15921-2	15921-3	15921-4	15921-5
Your Reference	----------	1675/1/1.0	1675/3/0.25	1675/7/1.5	1675/10/0.25	1675/3/1.0
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Moisture	%	13	12	26	10	16

Moisture						
Our Reference:	UNITS	15921-6	15921-7	15921-8	15921-9	15921-10
Your Reference	----------	1675/5/1.5	1675/6/1.0	1675/6/2.0	1675/7/3.0	1675/7/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Moisture	%	29	20	26	24	24

Moisture					
Our Reference:	UNITS	15921-11	15921-12	15921-13	15921-14
Your Reference	----------	1675/8/1.5	1675/8/2.0	1675/8/3.0	1675/8/4.2
Date Sampled	----------	14/12/2007	14/12/2007	14/12/2007	14/12/2007
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007	20/12/2007	20/12/2007
Moisture	%	24	24	28	29

vTPH & BTEX in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-15 1675/GW1 14/12/2007 Water	15921-16 1675/GW2 14/12/2007 Water	15921-17 Trip Blank 14/12/2007 Water	15921-18 Trip Spike 14/12/2007 Water
Date extracted	-	24/12/2007	24/12/2007	24/12/2007	24/12/2007
Date analysed	-	24/12/2007	24/12/2007	24/12/2007	24/12/2007
TPH C_6 - C_9	µg/L	<10	700	[NA]	[NA]
Benzene	µg/L	<1.0	28	<1.0	99%
Toluene	µg/L	2.4	530	<1.0	116%
Ethylbenzene	µg/L	<1.0	6.0	<1.0	114%
m+p-xylene	µg/L	<2.0	290	<2.0	121%
o-xylene	µg/L	<1.0	170	<1.0	120%
Surrogate Dibromofluoromethane	%	97	93	100	99
Surrogate toluene-d8	%	103	95	94	103
Surrogate 4-BFB	%	97	121	84	101

sTPH in Water (C10-C36) Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-15 1675/GW1 14/12/2007 Water	15921-16 1675/GW2 14/12/2007 Water
Date extracted	-	20/12/2007	20/12/2007
Date analysed	-	21/12/2007	21/12/2007
TPH C_{10} - C_{14}	µg/L	<50	<50
TPH C_{15} - C_{28}	µg/L	<100	<100
TPH C_{29} - C_{36}	µg/L	<100	<100
Surrogate o-Terphenyl	%	105	101

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-15 1675/GW1 14/12/2007 Water	15921-16 1675/GW2 14/12/2007 Water
Date extracted	-	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007
Naphthalene	µg/L	<1	<1
Acenaphthylene	µg/L	<1	<1
Acenaphthene	µg/L	<1	<1
Fluorene	µg/L	<1	<1
Phenanthrene	µg/L	<1	<1
Anthracene	µg/L	<1	<1
Fluoranthene	µg/L	<1	<1
Pyrene	µg/L	<1	<1
Benzo(a)anthracene	µg/L	<1	<1
Chrysene	µg/L	<1	<1
Benzo(b,k)fluoranthene	µg/L	<2	<2
Benzo(a)pyrene	µg/L	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1
Surrogate p-Terphenyl-d_{14}	%	117	104

Organochlorine Pesticides in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-15 1675/GW1 14/12/2007 Water	15921-16 1675/GW2 14/12/2007 Water
Date extracted	-	20/12/2007	20/12/2007
Date analysed	-	23/12/2007	23/12/2007
HCB	µg/L	<0.2	<0.2
alpha-BHC	µg/L	<0.2	<0.2
gamma-BHC	µg/L	<0.2	<0.2
beta-BHC	µg/L	<0.2	<0.2
Heptachlor	µg/L	<0.2	<0.2
delta-BHC	µg/L	<0.2	<0.2
Aldrin	µg/L	<0.2	<0.2
Heptachlor Epoxide	µg/L	<0.2	<0.2
gamma-Chlordane	µg/L	<0.2	<0.2
alpha-Chlordane	µg/L	<0.2	<0.2
Endosulfan I	µg/L	<0.2	<0.2
pp-DDE	µg/L	<0.2	<0.2
Dieldrin	µg/L	<0.2	<0.2
Endrin	µg/L	<0.2	<0.2
pp-DDD	µg/L	<0.2	<0.2
Endosulfan II	µg/L	<0.2	<0.2
DDT	µg/L	<0.2	<0.2
Endrin Aldehyde	µg/L	<0.2	<0.2
Endosulfan Sulphate	µg/L	<0.2	<0.2
Methoxychlor	µg/L	<0.2	<0.2
Surrogate TCLMX	%	78	89

OP Pesticides in water			
Our Reference:	UNITS	15921-15	15921-16
Your Reference	----------	1675/GW1	1675/GW2
Date Sampled	----------	14/12/2007	14/12/2007
Type of sample		Water	Water
Date extracted	-	20/12/2007	20/12/2007
Date analysed	-	23/12/2007	23/12/2007
Diazinon	µg/L	<0.20	<0.20
Dimethoate	µg/L	<0.2	<0.2
Chlorpyriphos-methyl	µg/L	<0.2	<0.2
Ronnel	µg/L	<0.2	<0.2
Chlorpyriphos	µg/L	<0.2	<0.2
Fenitrothion	µg/L	<0.2	<0.2
Bromophos ethyl	µg/L	<0.2	<0.2
Ethion	µg/L	<0.2	<0.2
Surrogate TCLMX	%	78	89

PCBs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-15 1675/GW1 14/12/2007 Water	15921-16 1675/GW2 14/12/2007 Water
Date extracted	-	20/12/2007	20/12/2007
Date analysed	-	23/12/2007	23/12/2007
Arochlor 1016	µg/L	<2	<2
Arochlor 1232	µg/L	<2	<2
Arochlor 1242	µg/L	<2	<2
Arochlor 1248	µg/L	<2	<2
Arochlor 1254	µg/L	<2	<2
Arochlor 1260	µg/L	<2	<2
Surrogate TCLMX	%	78	89

HM in water - dissolved Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-15 1675/GW1 14/12/2007 Water	15921-16 1675/GW2 14/12/2007 Water
Date prepared	-	20/12/2007	20/12/2007
Date analysed	-	20/12/2007	20/12/2007
Arsenic-Dissolved	µg/L	1.8	4.5
Cadmium-Dissolved	µg/L	1.0	2.0
Chromium-Dissolved	µg/L	1.6	<1.0
Copper-Dissolved	µg/L	19	330
Lead-Dissolved	µg/L	<1.0	22
Mercury-Dissolved	µg/L	<0.50	0.50
Nickel-Dissolved	µg/L	7.5	13
Zinc-Dissolved	µg/L	170	460
Tin-Dissolved	µg/L	<1.0	<1.0

sPOCAS Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-19 1675/1/2.5 14/12/2007 Soil	15921-20 1675/2/2.0 14/12/2007 Soil	15921-21 1675/2/4.0 14/12/2007 Soil	15921-22 1675/2/5.0 14/12/2007 Soil	15921-23 1675/4/3.0 14/12/2007 Soil
pH $_{kcl}$	pH units	9.86	9.76	10.0	9.92	9.94
TAA pH 6.5	moles H^+/ tonne	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	7.7	7.6	7.7	7.6	7.3
TPA pH 6.5	moles H^+/ tonne	<5.0	<5.0	<5.0	<5.0	<5.0
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+/ tonne	<5.0	<5.0	<5.0	<5.0	<5.0
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	7.5	5.0	5.0	5.0	5.0
a-ANC_E	moles H^+/ tonne	1,500	1,000	1,000	1,000	1,000
s-ANC_E	%w/w S	2.4	1.6	1.6	1.6	1.6
S_{KCl}	%w/w	0.037	0.034	0.036	0.058	0.043
S_P	%w/w	0.061	0.050	0.056	0.14	0.065
S_{POS}	%w/w	0.024	0.016	0.020	0.078	0.022
a-S_{POS}	moles H^+/ tonne	15	10	13	49	14
Ca_{KCl}	%w/w	0.17	0.17	0.17	0.17	0.18
Ca_P	%w/w	2.3	1.8	2.0	1.9	1.9
Ca_A	%w/w	2.1	1.6	1.8	1.7	1.8
Mg_{KCl}	%w/w	0.044	0.040	0.044	0.054	0.048
Mg_P	%w/w	0.20	0.16	0.18	0.18	0.18
Mg_A	%w/w	0.16	0.12	0.14	0.13	0.13
SRAS	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
S_{HCl}	%w/w	0.086	0.074	0.14	0.15	0.14
S_{NAS}	%w/w	0.049	0.040	0.11	0.096	0.095
a-S_{NAS}	moles H^+/ tonne	23	19	49	45	44
a-S_{NAS}	%w/w S	0.037	0.030	0.079	0.072	0.071
a-Net Acidity	moles H^+/ tonne	#	#	#	#	#
Liming rate	kg $CaCO_3$/tonne	#	#	#	#	#

Method ID	Methodology Summary
GC.16	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
GC.14	Soil samples extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
GC.3	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
GC.12	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
GC-5	Soil samples are extracted with hexane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
GC.8	Soil samples are extracted with hexane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
GC-6	Soil samples are extracted with hexane/acetone and waters with dichloromethane and analysed by GC-ECD.
Metals.20 ICP-AES	Determination of various metals by ICP-AES.
Metals.21 CV-AAS	Determination of Mercury by Cold Vapour AAS.
LAB.8	Moisture content determined by heating at 105 deg C for a minimum of 4 hours.
GC.13	Water samples are analysed directly by purge and trap GC-MS.
Metals.22 ICP-MS	Determination of various metals by ICP-MS.
LAB.64	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL vTPH & BTEX in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	15921-5	20/12/2007 || 20/12/2007	LCS-1	20/12/07%
Date analysed	-			21/12/07	15921-5	21/12/2007 || 21/12/2007	LCS-1	21/12/07%
vTPH C_6 - C_9	mg/kg	25	GC.16	<25	15921-5	<25 || <25	LCS-1	111%
Benzene	mg/kg	0.5	GC.14	<0.5	15921-5	<0.5 || <0.5	LCS-1	121%
Toluene	mg/kg	0.5	GC.14	<0.5	15921-5	<0.5 || <0.5	LCS-1	101%
Ethylbenzene	mg/kg	1	GC.14	<1.0	15921-5	<1.0 || <1.0	LCS-1	96%
m + p-Xylene	mg/kg	2	GC.14	<2.0	15921-5	<2.0 || <2.0	LCS-1	98%
o-Xylene	mg/kg	1	GC.14	<1.0	15921-5	<1.0 || <1.0	LCS-1	93%
Surrogate aaa-Trifluorotoluene	%		GC.14	90	15921-5	87 || 83 || RPD: 5	LCS-1	91%

QUALITY CONTROL sTPH in Soil (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	15921-5	20/12/2007 || 20/12/2007	LCS-1	20/12/07%
Date analysed	-			20/12/07	15921-5	21/12/2007 || 21/12/2007	LCS-1	20/12/07%
TPH C_{10} - C_{14}	mg/kg	50	GC.3	<50	15921-5	<50 || <50	LCS-1	101%
TPH C_{15} - C_{28}	mg/kg	100	GC.3	<100	15921-5	<100 || <100	LCS-1	78%
TPH C_{29} - C_{36}	mg/kg	100	GC.3	<100	15921-5	<100 || <100	LCS-1	126%
Surrogate o-Terphenyl	%		GC.3	122	15921-5	117 || 118 || RPD: 1	LCS-1	120%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	15921-5	20/12/2007 || 20/12/2007	LCS-1	20/12/07%
Date analysed	-			21/12/07	15921-5	21/12/2007 || 21/12/2007	LCS-1	21/12/07%
Naphthalene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	LCS-1	108%
Acenaphthylene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	LCS-1	114%
Phenanthrene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	LCS-1	119%
Anthracene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	LCS-1	120%
Pyrene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	LCS-1	127%
Benzo(a)anthracene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	LCS-1	140%
Benzo(b,k)fluoranthene	mg/kg	0.2	GC.12	<0.2	15921-5	<0.2 || <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	GC.12	<0.05	15921-5	<0.05 || <0.05	LCS-1	137%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Benzo(g,h,i)perylene	mg/kg	0.1	GC.12	<0.1	15921-5	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		GC.12	128	15921-5	127 || 124 || RPD: 2	LCS-1	130%
QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-1	20/12/07%
Date analysed	-			24/12/07	[NT]	[NT]	LCS-1	24/12/07%
HCB	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	97%
gamma-BHC	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	102%
Heptachlor	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	98%
delta-BHC	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	96%
Heptachlor Epoxide	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	98%
gamma-Chlordane	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	100%
Dieldrin	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	94%
Endrin	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	88%
pp-DDD	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	100%
Endosulfan II	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	LCS-1	100%
Methoxychlor	mg/kg	0.1	GC-5	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		GC-5	86	[NT]	[NT]	LCS-1	87%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-1	20/12/07%
Date analysed	-			24/12/07	[NT]	[NT]	LCS-1	24/12/07%
Diazinon	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	[NR]	[NR]
Dimethoate	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	[NR]	[NR]
Ronnel	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	LCS-1	111%
Fenitrothion	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	LCS-1	87%
Bromophos-ethyl	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	0.1	GC.8	<0.1	[NT]	[NT]	LCS-1	117%
Surrogate TCLMX	%		GC.8	86	[NT]	[NT]	LCS-1	85%
QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-1	20/12/07%
Date analysed	-			24/12/07	[NT]	[NT]	LCS-1	24/12/07%
Arochlor 1016	mg/kg	0.1	GC-6	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	GC-6	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	GC-6	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	GC-6	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	GC-6	<0.1	[NT]	[NT]	LCS-1	132%
Arochlor 1260	mg/kg	0.1	GC-6	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		GC-6	86	[NT]	[NT]	LCS-1	90%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			20/12/07	15921-5	20/12/2007 || 20/12/2007	LCS-1	20/12/07%
Date analysed	-			20/12/07	15921-5	20/12/2007 || 20/12/2007	LCS-1	20/12/07%
Arsenic	mg/kg	4	Metals.20 ICP-AES	<4.0	15921-5	<4.0 || <4.0	LCS-1	96%
Cadmium	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	<1.0 || <1.0	LCS-1	99%
Chromium	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	10 || 9.9 || RPD: 1	LCS-1	100%
Copper	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	1.7 || 2.6 || RPD: 42	LCS-1	101%
Lead	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	18 || 20 || RPD: 11	LCS-1	96%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Mercury	mg/kg	0.1	Metals.21 CV-AAS	<0.10	15921-5	<0.10 || <0.10	LCS-1	107%
Nickel	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	<1.0 || 1.0	LCS-1	99%
Zinc	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	1.1 || 2.0 || RPD: 58	LCS-1	98%
Tin	mg/kg	1	Metals.20 ICP-AES	<1.0	15921-5	<1.0 || <1.0	LCS-1	99%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD
Date prepared	-			[NT]	15921-5	20/12/2007 || 20/12/2007
Date analysed	-			[NT]	15921-5	20/12/2007 || 20/12/2007
Moisture	%	0.1	LAB.8	<0.10	15921-5	16 || 16 || RPD: 0

QUALITY CONTROL vTPH & BTEX in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			24/12/07	[NT]	[NT]	LCS-W	24/12/07%
Date analysed	-			24/12/07	[NT]	[NT]	LCS-W	24/12/07%
TPH C_6 - C_9	µg/L	10	GC.16	<10	[NT]	[NT]	LCS-W	102%
Benzene	µg/L	1	GC.13	<1.0	[NT]	[NT]	LCS-W	119%
Toluene	µg/L	1	GC.13	<1.0	[NT]	[NT]	LCS-W	99%
Ethylbenzene	µg/L	1	GC.13	<1.0	[NT]	[NT]	LCS-W	105%
m+p-xylene	µg/L	2	GC.13	<2.0	[NT]	[NT]	LCS-W	101%
o-xylene	µg/L	1	GC.13	<1.0	[NT]	[NT]	LCS-W	105%
Surrogate Dibromofluoromethane	%		GC.13	94	[NT]	[NT]	LCS-W	107%
Surrogate toluene-d8	%		GC.13	104	[NT]	[NT]	LCS-W	95%
Surrogate 4-BFB	%		GC.13	103	[NT]	[NT]	LCS-W	110%

QUALITY CONTROL sTPH in Water (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-W1	20/12/07%
Date analysed	-			21/12/07	[NT]	[NT]	LCS-W1	21/12/07%
TPH C_{10} - C_{14}	µg/L	50	GC.3	<50	[NT]	[NT]	LCS-W1	88%
TPH C_{15} - C_{28}	µg/L	100	GC.3	<100	[NT]	[NT]	LCS-W1	132%
TPH C_{29} - C_{36}	µg/L	100	GC.3	<100	[NT]	[NT]	LCS-W1	122%
Surrogate o-Terphenyl	%		GC.3	105	[NT]	[NT]	LCS-W1	123%
QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-W1	20/12/07%
Date analysed	-			20/12/07	[NT]	[NT]	LCS-W1	20/12/07%
Naphthalene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	95%
Acenaphthylene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	103%
Phenanthrene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	106%
Anthracene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	102%
Pyrene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	96%
Benzo(a)anthracene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	120%
Benzo(b,k)fluoranthene	µg/L	2	GC.12	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	GC.12	<1	[NT]	[NT]	LCS-W1	107%
Indeno(1,2,3-c,d)pyrene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	GC.12	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		GC.12	127	[NT]	[NT]	LCS-W1	128%

QUALITY CONTROL Organochlorine Pesticides in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-W1	20/12/07%
Date analysed	-			23/12/07	[NT]	[NT]	LCS-W1	23/12/07%
HCB	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
alpha-BHC	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	82%
gamma-BHC	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
beta-BHC	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	96%
Heptachlor	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	67%
delta-BHC	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
Aldrin	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	79%
Heptachlor Epoxide	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	84%
gamma-Chlordane	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
alpha-Chlordane	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan I	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
pp-DDE	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	86%
Dieldrin	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	97%
Endrin	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	97%
pp-DDD	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	89%
Endosulfan II	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
DDT	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	LCS-W1	90%
Methoxychlor	µg/L	0.2	GC-5	<0.2	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		GC-5	118	[NT]	[NT]	LCS-W1	92%

QUALITY CONTROL OP Pesticides in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-W1	20/12/07%
Date analysed	-			23/12/07	[NT]	[NT]	LCS-W1	23/12/07%
Diazinon	µg/L	0.2	GC.8	<0.20	[NT]	[NT]	[NR]	[NR]
Dimethoate	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos-methyl	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	[NR]	[NR]
Ronnel	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	LCS-W1	106%
Fenitrothion	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	LCS-W1	85%
Bromophos ethyl	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	[NR]	[NR]
Ethion	µg/L	0.2	GC.8	<0.2	[NT]	[NT]	LCS-W1	108%
Surrogate TCLMX	%		GC.8	118	[NT]	[NT]	LCS-W1	92%
QUALITY CONTROL PCBs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			20/12/07	[NT]	[NT]	LCS-W1	20/12/07%
Date analysed	-			23/12/07	[NT]	[NT]	LCS-W1	23/12/07%
Arochlor 1016	µg/L	2	GC-6	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	µg/L	2	GC-6	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	µg/L	2	GC-6	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	µg/L	2	GC-6	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	µg/L	2	GC-6	<2	[NT]	[NT]	LCS-W1	93%
Arochlor 1260	µg/L	2	GC-6	<2	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		GC-6	118	[NT]	[NT]	LCS-W1	86%
QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			20/12/07	[NT]	[NT]	LCS-W3	20/12/07%
Date analysed	-			20/12/07	[NT]	[NT]	LCS-W3	20/12/07%
Arsenic-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	107%
Cadmium-Dissolved	µg/L	0.1	Metals.22 ICP-MS	<0.10	[NT]	[NT]	LCS-W3	110%
Chromium-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	108%
Copper-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	102%
Lead-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	105%
Mercury-Dissolved	µg/L	0.5	Metals.21 CV-AAS	<0.50	[NT]	[NT]	LCS-W3	80%

QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Nickel-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	103%
Zinc-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	106%
Tin-Dissolved	µg/L	1	Metals.22 ICP-MS	<1.0	[NT]	[NT]	LCS-W3	108%
QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
pH $_{kcl}$	pH units		LAB.64	[NT]	15921-19	9.86 || 9.79 || RPD: 1	LCS	100%
TAA pH 6.5	moles H^+/ tonne	5	LAB.64	<5	15921-19	<5 || <5	LCS	83%
s-TAA pH 6.5	%w/w S	0.01	LAB.64	<0.01	15921-19	<0.01 || <0.01	[NR]	[NR]
pH $_{Ox}$	pH units		LAB.64	[NT]	15921-19	7.7 || 7.7 || RPD: 0	LCS	96%
TPA pH 6.5	moles H^+/ tonne	5	LAB.64	<5.0	15921-19	<5.0 || <5.0	LCS	99%
s-TPA pH 6.5	%w/w S	0.01	LAB.64	<0.01	15921-19	<0.01 || <0.01	[NR]	[NR]
TSA pH 6.5	moles H^+/ tonne	5	LAB.64	<5.0	15921-19	<5.0 || <5.0	LCS	99%
s-TSA pH 6.5	%w/w S	0.01	LAB.64	<0.01	15921-19	<0.01 || <0.01	[NR]	[NR]
ANC_E	% $CaCO_3$	0.05	LAB.64	<0.05	15921-19	7.5 || 7.5 || RPD: 0	[NR]	[NR]
a-ANC_E	moles H^+/ tonne	5	LAB.64	<5	15921-19	1500 || 1500 || RPD: 0	[NR]	[NR]
s-ANC_E	%w/w S	0.05	LAB.64	<0.05	15921-19	2.4 || 2.4 || RPD: 0	[NR]	[NR]
S_{KCl}	%w/w	0.005	LAB.64	<0.005	15921-19	0.037 || 0.036 || RPD: 3	LCS	102%
S_P	%w/w	0.005	LAB.64	<0.005	15921-19	0.061 || 0.063 || RPD: 3	LCS	101%
S_{POS}	%w/w	0.005	LAB.64	<0.005	15921-19	0.024 || 0.027 || RPD: 12	[NR]	[NR]
a-S_{POS}	moles H^+/ tonne	5	LAB.64	<5.0	15921-19	15 || 17 || RPD: 12	[NR]	[NR]
Ca_{KCl}	%w/w	0.005	LAB.64	<0.005	15921-19	0.17 || 0.17 || RPD: 0	LCS	108%
Ca_P	%w/w	0.005	LAB.64	<0.005	15921-19	2.3 || 2.7 || RPD: 16	LCS	108%
Ca_A	%w/w	0.005	LAB.64	<0.005	15921-19	2.1 || 2.5 || RPD: 17	[NR]	[NR]
Mg_{KCl}	%w/w	0.005	LAB.64	<0.005	15921-19	0.044 || 0.044 || RPD: 0	LCS	101%
Mg_P	%w/w	0.005	LAB.64	<0.005	15921-19	0.20 || 0.22 || RPD: 10	LCS	103%
Mg_A	%w/w	0.005	LAB.64	<0.005	15921-19	0.16 || 0.18 || RPD: 12	[NR]	[NR]
SRAS	%w/w	0.005	LAB.64	<0.005	15921-19	<0.005 || <0.005	[NR]	[NR]

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
SHCl	%w/w	0.005	LAB.64	<0.005	15921-19	0.086 || 0.10 || RPD: 15	LCS	94%
SNAS	%w/w	0.005	LAB.64	<0.005	15921-19	0.049 || 0.066 || RPD: 30	[NR]	[NR]
a-SNAS	moles H^+/ tonne	5	LAB.64	<5	15921-19	23 || 31 || RPD: 30	[NR]	[NR]
a-SNAS	%w/w S	0.01	LAB.64	<0.01	15921-19	0.037 || 0.049 || RPD: 28	[NR]	[NR]
a-Net Acidity	moles H^+/ tonne	10	LAB.64	<10	15921-19	# || #	LCS	100%
Liming rate	kg $CaCO_3$ /tonne	0.1	LAB.64	<0.1	15921-19	# || #	[NR]	[NR]

Report Comments:

Net acidity not determined due to the high acid neutralizing capacity of the samples.
Asbestos was analysed by Approved Identifier: Not applicable for this job

INS: Insufficient sample for this test	NT: Not tested	PQL: Practical Quantitation Limit
RPD: Relative Percent Difference	NA: Test not required	LCS: Laboratory Control Sample
NR: Not requested	<: Less than	>: Greater than

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria:

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable. Surrogates: Generally 60-140% is acceptable.

Envirolab Services Pty Ltd
ABN 37 112 535 645
54 Frenchs Rd Willoughby NSW 2068
ph 02 9958 5801 fax 02 9958 5803
email: tnotaras@envirolabservices.com.au

CERTIFICATE OF ANALYSIS 15921-A

Client:
Martens & Associates
6/37 Leighton Place
Hornsby
NSW 2077

Attention: Jeff Fulton

Sample log in details:

Your Reference:	**P0701675, The Spit Marina**
No. of samples:	Additional Testing on 3 Soils
Date samples received:	17/12/07
Date completed instructions received:	09/01/08

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	16/01/08
Date of Preliminary Report:	Not Issued
Issue Date:	10/01/08

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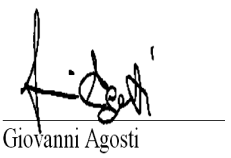
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025.
Tests not covered by NATA are denoted with *.

Results Approved By:



Giovanni Agosti
Senior Inorganic Chemist

Metals in TCLP Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	15921-A-1 1675/1/1.0 14/12/2007 Soil	15921-A-2 1675/3/0.25 14/12/2007 Soil	15921-A-5 1675/3/1.0 14/12/2007 Soil
Date extracted	-	9/01/2008	9/01/2008	9/01/2008
Date analysed	-	10/01/2008	10/01/2008	10/01/2008
pH of soil for fluid# determ.	pH units	8.20	9.00	7.90
pH of soil for fluid # determ. (acid)	pH units	1.60	1.60	1.60
Extraction fluid used	-	1	1	1
pH of final Leachate	pH units	4.80	4.80	4.80
Chromium in TCLP	mg/L	<0.01	<0.01	<0.01
Lead in TCLP	mg/L	<0.03	<0.03	<0.03
Nickel in TCLP	mg/L	[NA]	0.06	[NA]

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Metals.20 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL Metals in TCLP	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			10/1/08	[NT]	[NT]	LCS-W1	10/1/08%
Date analysed	-			10/1/08	[NT]	[NT]	LCS-W1	10/1/08%
Chromium in TCLP	mg/L	0.01	Metals.20 ICP-AES	<0.01	[NT]	[NT]	LCS-W1	101%
Lead in TCLP	mg/L	0.03	Metals.20 ICP-AES	<0.03	[NT]	[NT]	LCS-W1	100%
Nickel in TCLP	mg/L	0.02	Metals.20 ICP-AES	<0.02	[NT]	[NT]	LCS-W1	100%

Report Comments:

Asbestos was analysed by Approved Identifier: Not applicable for this job

INS: Insufficient sample for this test	NT: Not tested	PQL: Practical Quantitation Limit
RPD: Relative Percent Difference	NA: Test not required	LCS: Laboratory Control Sample
NR: Not requested	<: Less than	>: Greater than

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria:

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable. Surrogates: Generally 60-140% is acceptable.

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email: tnotaras@envirolabservices.com.au

CERTIFICATE OF ANALYSIS 16042

Client:
Martens & Associates
6/37 Leighton Place
Hornsby
NSW 2077

Attention: Jeff Fulton

Sample log in details:

Your Reference:	**P0701675, The Spit Marina**
No. of samples:	8 Sediment Samples
Date samples received:	21/12/07
Date completed instructions received:	21/12/07

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:	8/01/08
Date of Preliminary Report:	Not issued
Issue Date:	23/01/08

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Tests not covered by NATA are denoted with *.

Results Approved By:

Jacinta Hurst
Operations Manager

Acid Extractable metals in soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	16042-1 A-surface 19/12/2007 Sediment	16042-2 B-surface 19/12/2007 Sediment	16042-3 C-surface 19/12/2007 Sediment	16042-4 D-surface 19/12/2007 Sediment	16042-5 A-200mm 19/12/2007 Sediment
Date digested	-	2/01/2008	2/01/2008	2/01/2008	2/01/2008	2/01/2008
Date analysed	-	3/01/2008	3/01/2008	3/01/2008	3/01/2008	3/01/2008
Arsenic	mg/kg	4.2	10	<4.0	<4.0	<4.0
Cadmium	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	6.7	19	4.7	6.7	5.2
Copper	mg/kg	12	350	5.7	10	10
Lead	mg/kg	25	120	15	19	19
Mercury	mg/kg	<0.10	1.8	0.12	<0.10	<0.10
Nickel	mg/kg	<1.0	3.9	<1.0	1.1	<1.0
Zinc	mg/kg	26	180	16	21	19
Tin	mg/kg	1.9	28	1.7	1.4	1.4

Acid Extractable metals in soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	16042-6 B-200mm 19/12/2007 Sediment	16042-7 C-200mm 19/12/2007 Sediment	16042-8 D-200mm 19/12/2007 Sediment
Date digested	-	2/01/2008	2/01/2008	2/01/2008
Date analysed	-	3/01/2008	3/01/2008	3/01/2008
Arsenic	mg/kg	5.1	<4.0	<4.0
Cadmium	mg/kg	<1.0	<1.0	<1.0
Chromium	mg/kg	19	4.7	6.0
Copper	mg/kg	230	6.8	10
Lead	mg/kg	83	17	19
Mercury	mg/kg	0.76	0.15	<0.10
Nickel	mg/kg	2.2	<1.0	1.0
Zinc	mg/kg	96	17	20
Tin	mg/kg	10	2.0	1.3

Moisture						
Our Reference:	UNITS	16042-1	16042-2	16042-3	16042-4	16042-5
Your Reference	----------	A-surface	B-surface	C-surface	D-surface	A-200mm
Date Sampled	----------	19/12/2007	19/12/2007	19/12/2007	19/12/2007	19/12/2007
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	2/01/2008	2/01/2008	2/01/2008	2/01/2008	2/01/2008
Date analysed	-	3/01/2008	3/01/2008	3/01/2008	3/01/2008	3/01/2008
Moisture	%	37	49	24	31	33

Moisture				
Our Reference:	UNITS	16042-6	16042-7	16042-8
Your Reference	----------	B-200mm	C-200mm	D-200mm
Date Sampled	----------	19/12/2007	19/12/2007	19/12/2007
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	2/01/2008	2/01/2008	2/01/2008
Date analysed	-	3/01/2008	3/01/2008	3/01/2008
Moisture	%	33	24	31

Organtin Compounds Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	 16042-2 B-surface 19/12/2007 Sediment
Monobutyltin	µgSn/kg	19
Dibutyltin	µgSn/kg	62
Tributyltin	µgSn/kg	240
Surrogate (Tripropyltin)	%	80

Method ID	Methodology Summary
Metals.20 ICP-AES	Determination of various metals by ICP-AES.
Metals.21 CV-AAS	Determination of Mercury by Cold Vapour AAS.
LAB.8	Moisture content determined by heating at 105 deg C for a minimum of 4 hours.
Ext-020	Analysis subcontracted to Australian Government - National Measurement Institute. NATA Accreditation No: 198

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			02/01/08	16042-1	2/01/2008 || 2/01/2008	LCS-4	02/01/08%
Date analysed	-			03/01/08	16042-1	3/01/2008 || 3/01/2008	LCS-4	03/01/08%
Arsenic	mg/kg	4	Metals.20 ICP-AES	<4.0	16042-1	4.2 || 4.9 || RPD: 15	LCS-4	100%
Cadmium	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	<1.0 || <1.0	LCS-4	100%
Chromium	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	6.7 || 6.7 || RPD: 0	LCS-4	102%
Copper	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	12 || 13 || RPD: 8	LCS-4	101%
Lead	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	25 || 24 || RPD: 4	LCS-4	100%
Mercury	mg/kg	0.1	Metals.21 CV-AAS	<0.10	16042-1	<0.10 || 0.11	LCS-4	104%
Nickel	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	<1.0 || <1.0	LCS-4	100%
Zinc	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	26 || 24 || RPD: 8	LCS-4	102%
Tin	mg/kg	1	Metals.20 ICP-AES	<1.0	16042-1	1.9 || 1.6 || RPD: 17	LCS-4	102%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			2/01/08
Date analysed	-			3/01/08
Moisture	%	0.1	LAB.8	<0.10

QUALITY CONTROL Organtin Compounds	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Monobutyltin	µgSn/kg	0.5	Ext-020	<0.5	[NT]	[NT]	LCS-1	113%
Dibutyltin	µgSn/kg	0.5	Ext-020	<0.5	[NT]	[NT]	LCS-1	100%
Tributyltin	µgSn/kg	0.2	Ext-020	<0.2	[NT]	[NT]	LCS-1	100%
Surrogate (Tripropyltin)	%		Ext-020	[NT]	[NT]	[NT]	LCS-1	95%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date digested	-	[NT]	[NT]	16042-2	02/01/08%
Date analysed	-	[NT]	[NT]	16042-2	03/01/08%
Arsenic	mg/kg	[NT]	[NT]	16042-2	112%
Cadmium	mg/kg	[NT]	[NT]	16042-2	108%
Chromium	mg/kg	[NT]	[NT]	16042-2	103%
Copper	mg/kg	[NT]	[NT]	16042-2	127%
Lead	mg/kg	[NT]	[NT]	16042-2	94%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Mercury	mg/kg	[NT]	[NT]	16042-2	#140
Nickel	mg/kg	[NT]	[NT]	16042-2	94%
Zinc	mg/kg	[NT]	[NT]	16042-2	92%
Tin	mg/kg	[NT]	[NT]	16042-2	102%

Report Comments:

Trace Elements #: the high spike recovery obtained for Mercury is due to the non homogenous nature of the sample for this particular element. However, an acceptable recvoery has been obtained for the Laboratory Control Sample.

Organotins analysed by NMI Report No: RN659668.
Asbestos was analysed by Approved Identifier: Not applicable for this job

INS: Insufficient sample for this test	NT: Not tested	PQL: Practical Quantitation Limit
RPD: Relative Percent Difference	NA: Test not required	LCS: Laboratory Control Sample
NR: Not requested	<: Less than	>: Greater than

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria:

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable. Surrogates: Generally 60-140% is acceptable.

13 Attachment D – DCP ‘N Counts’

martens
consulting engineers since 1989

DYNAMIC CONE PENETROMETER
FIELD TESTING RECORD

Project	Geotechnical Assessment			**File Reference**	
Location	The Spit Marina - Mosman			**P0701675DCP01_v1**	
Tested by	M Shelley	**Checked by**	J Fulton	**Date**	13/12/07

DCP No 1			**1a**	**1b**	**1c**		**2a**	**2b**	**2c**		**3a**	**3b**
Depth (m)			**Field 'N-count' Test Data (blows / 150 mm)**									
a	**b**	**c**										
0.15	**5.10**	**10.05**	28	9	30		-	19	12		-	18
0.30	**5.25**	**10.20**	25	15	32		15	14	12		-	12
0.45	**5.40**	**10.35**	12	18	39		15	10	15		16	6
0.60	**5.55**	**10.50**	7	20	38		11	11	14		13	9
0.75	**5.70**	**10.65**	8	17	37		14	11	15		8	13
0.90	**5.85**	**10.80**	22	15	27		8	9	14		17	13
1.05	**60**	**10.95**	14	14	33		4	10	14		13	14
1.20	**6.15**	**11.10**	28	15	33		3	8	15		24	13
1.35	**6.30**	**11.25**	13	15	31		2	8	14		9	0
1.50	**6.45**	**11.40**	14	15	33		1	8	18		15	11
1.65	**6.60**	**11.55**	17	17	33		4	9	14		9	12
1.80	**6.75**	**11.70**	8	20	38		7	8	16		30	12
1.95	**6.90**	**11.85**	12	22	42		7	8	15		20	15
2.10	**7.05**	**120**	17	28	43		7	8	16		40	10
2.25	**7.20**	**12.15**	14	27	38		6	10	13		12	10
2.40	**7.35**	**12.30**	12	25	40		6	12	14		13	10
2.55	**7.50**	**12.45**	13	22	40		7	11	13		8	11
2.70	**7.65**	**12.60**	11	24	40		10	12	12		10	13
2.85	**7.80**	**12.75**	10	25	31		12	11			13	12
3.00	**7.95**	**12.90**	10	28	30		11	16			21	9
3.15	**8.10**	**13.05**	10	26	29		10	16			10	12
3.30	**8.25**	**13.20**	9	30	26		9	18			10	10
3.45	**8.40**	**13.35**	9	28	28		14	16			11	12
3.60	**8.55**	**13.50**	13	28			12	14			10	
3.75	**8.70**	**13.65**	15	21			17	12			9	
3.90	**8.85**	**13.80**	12	24			15	12			10	
4.05	**90**	**13.95**	12	26			11	12			12	
4.20	**9.15**	**14.10**	8	28			10	11			13	
4.35	**9.30**	**14.25**	9	22			11	12			8	
4.50	**9.45**	**14.40**	9	26			13	11			14	
4.65	**9.60**	**14.55**	10	22			16	12			21	
4.80	**9.75**	**14.70**	13	19			17	11			21	
4.95	**9.90**	**14.85**	13	20			18	11			15	

Field Testing Notes / Comments

Groundwater	
Moisture	
Termination Depth	

14 Attachment E - Notes About This Report

Information

Important Information About Your Report

Subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all of course, are necessarily relevant to all reports, but are included as general reference.

Engineering Reports - Limitations

Geotechnical reports are based on information gained from limited sub-surface site testing and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel and are based on the information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relative if the design proposal is changed (eg. to a twenty storey building). Your report should not be relied upon if there are changes to the project without first asking Martens to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes if they are not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced and therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use For Tendering Purposes

Where information obtained from this investigation is provided for tendering purposes, Martens recommend that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Attention is drawn to the document 'Guidelines for the Provision of Geotechnical Information in Tender Documents', published by the Institution of Engineers, Australia.

The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings *etc* are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions - the potential for will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency which are often limited by project imposed budgetary constraints.

- Changes in guidelines, standards and policy or interpretation of guidelines, standards and

policy by statutory authorities.

- The actions of contractors responding to commercial pressures.

- Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

  The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions

If these conditions occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those that were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved at the time when conditions are exposed, rather than at some later stage well after the event.

Report Use By Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a report, retain Martens to work with other project professionals who are affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions - Geoenvironmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of the Company's proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geoenvironmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geotechnical reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognize their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Soil Data

Explanation of Terms (1 of 3)

Definitions

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material does not exhibit any visible rock properties and can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726 and the S.A.A Site Investigation Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

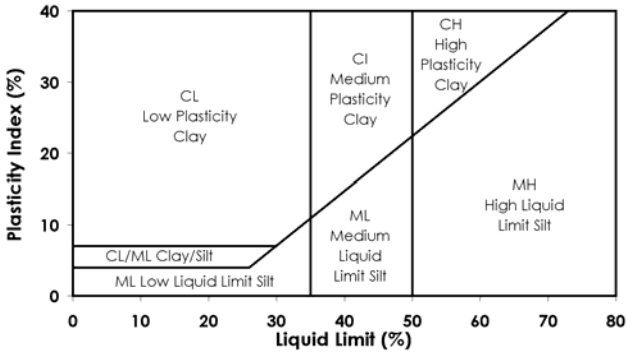
Particle Size

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay). Unless otherwise stated, particle size is described in accordance with the following table.

Division	Subdivision	Size
BOULDERS		>200 mm
COBBLES		60 to 200 mm
GRAVEL	Coarse	20 to 60 mm
	Medium	6 to 20 mm
	Fine	2 to 6 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties

Plasticity properties can be assessed either in the field by tactile properties, or by laboratory procedures.



Moisture Condition

Dry — Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist — Soil feels cool and damp and is darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet — As for moist but with free water forming on hands when handled.

Consistency of Cohesive Soils

Cohesive soils refer to predominantly clay materials.

Term	C_u (kPa)	Approx SPT "N"	Field Guide
Very Soft	<12	2	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	2 to 4	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	4 – 8	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	8 – 15	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	15 – 30	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	> 200	> 30	The surface of the soil can be marked only with the thumbnail.
Friable	-		Crumbles or powders when scraped by thumbnail

Density of Granular Soils

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration test (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	%	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c Mpa)
Very loose	< 15	< 5	< 2
Loose	15 – 35	5 - 10	2 -5
Medium dense	35 – 65	10 - 30	5 - 15
Dense	65- 85	30 - 50	15 - 25
Very dense	> 85	> 50	> 25

Minor Components

Minor components in soils may be present and readily detectable, but have little bearing on general geotechnical classification. Terms include:

Term	Assessment	Proportion of Minor component In:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: < 5 % Fine grained soils: < 15 %
With some	Presence easily detectable by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 – 12 % Fine grained soils: 15 – 30 %

Soil Data

Explanation of Terms (2 of 3)

Soil Agricultural Classification Scheme

In some situations, such as where soils are to be used for effluent disposal purposes, soils are often more appropriately classified in terms of traditional agricultural classification schemes. Where a Martens report provides agricultural classifications, these are undertaken in accordance with descriptions by Northcote, K.H. (1979) *The factual key for the recognition of Australian Soils*, Rellim Technical Publications, NSW, p 26 - 28.

Symbol	Field Texture Grade	Behaviour of moist bolus	Ribbon length	Clay content (%)
S	Sand	Coherence nil to very slight; cannot be moulded; single grains adhere to fingers	0 mm	< 5
LS	Loamy sand	Slight coherence; discolours fingers with dark organic stain	6.35 mm	5
CLS	Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain	6.35mm - 1.3cm	5 - 10
SL	Sandy loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible	1.3 - 2.5	10 - 15
FSL	Fine sandy loam	Bolus coherent; fine sand can be felt and heard	1.3 - 2.5	10 - 20
SCL-	Light sandy clay loam	Bolus strongly coherent but sandy to touch, sand grains dominantly medium size and easily visible	2.0	15 - 20
L	Loam	Bolus coherent and rather spongy; smooth feel when manipulated but no obvious sandiness or silkiness; may be somewhat greasy to the touch if much organic matter present	2.5	25
Lfsy	Loam, fine sandy	Bolus coherent and slightly spongy; fine sand can be felt and heard when manipulated	2.5	25
SiL	Silt loam	Coherent bolus, very smooth to silky when manipulated	2.5	25 + > 25 silt
SCL	Sandy clay loam	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix	2.5 - 3.8	20 - 30
CL	Clay loam	Coherent plastic bolus; smooth to manipulate	3.8 - 5.0	30 - 35
SiCL	Silty clay loam	Coherent smooth bolus; plastic and silky to touch	3.8 - 5.0	30- 35 + > 25 silt
FSCL	Fine sandy clay loam	Coherent bolus; fine sand can be felt and heard	3.8 - 5.0	30 - 35
SC	Sandy clay	Plastic bolus; fine to medium sized sands can be seen, felt or heard in a clayey matrix	5.0 - 7.5	35 - 40
SiC	Silty clay	Plastic bolus; smooth and silky	5.0 - 7.5	35 - 40 + > 25 silt
LC	Light clay	Plastic bolus; smooth to touch; slight resistance to shearing	5.0 - 7.5	35 - 40
LMC	Light medium clay	Plastic bolus; smooth to touch, slightly greater resistance to shearing than LC	7.5	40 - 45
MC	Medium clay	Smooth plastic bolus, handles like plasticine and can be moulded into rods without fracture, some resistance to shearing	> 7.5	45 - 55
HC	Heavy clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to shearing	> 7.5	> 50

Soil Data

Explanation of Terms (3 of 3)

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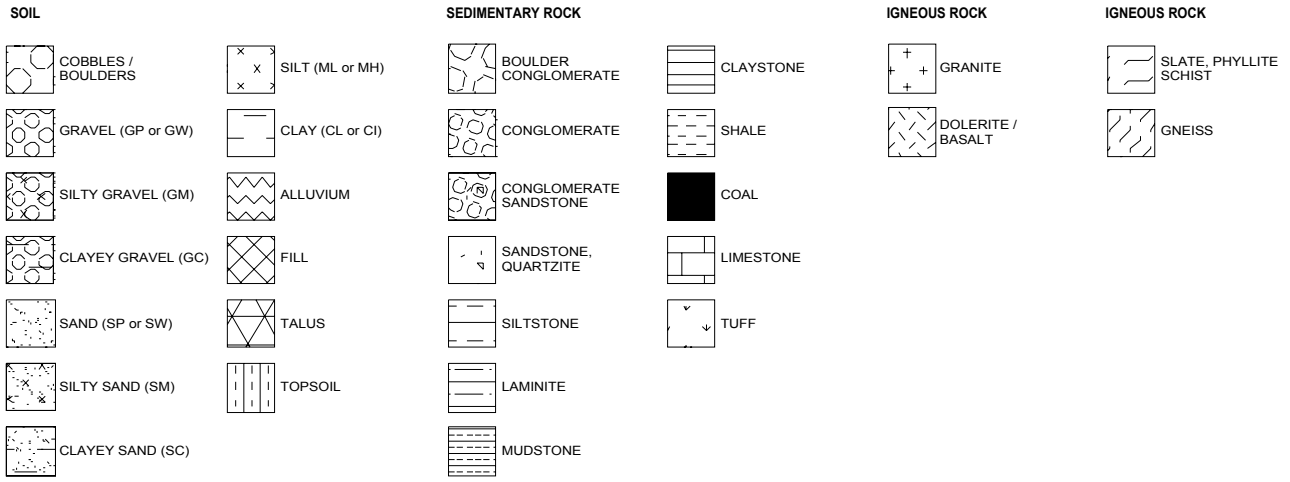
Symbols for Soil and Rock



Unified Soil Classification Scheme (USCS)

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)					USCS	Primary Name
COARSE GRAINED SOILS More than 50 % of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm.	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Gravel
				Predominantly one size or a range of sizes with more intermediate sizes missing	GP	Gravel
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	GM	Silty Gravel
				Plastic fines (for identification procedures see CL below)	GC	Clayey Gravel
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of intermediate sizes missing.	SW	Sand
				Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Sand
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	SM	Silty Sand
				Plastic fines (for identification procedures see CL below)	SC	Clayey Sand

FINE GRAINED SOILS More than 50 % of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.2 MM					
	DRY STRENGTH (Crushing Characteristics)	DILATANCY	TOUGHNESS	DESCRIPTION	USCS	Primary Name
	None to Low	Quick to Slow	None	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	ML	Silt
	Medium to High	None	Medium	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays	CL	Clay
	Low to Medium	Slow to Very Slow	Low	Organic slits and organic silty clays of low plasticity	OL	Organic Silt
	Low to Medium	Slow to Very Slow	Low to Medium	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	Silt
	High	None	High	Inorganic clays of high plasticity, fat clays	CH	Clay
	Medium to High	None	Low to Medium	Organic clays of medium to high plasticity	OH	Organic Silt
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	Peat

Low Plasticity – Liquid Limit W_L < 35 % Medium Plasticity – Liquid limit W_L 35 to 60 % High Plasticity - Liquid limit W_L > 60 %

Rock Data

Explanation of Terms (1 of 2)

Definitions

Descriptive terms used for Rock by Martens are given below and include rock substance, rock defects and rock mass.

Rock Substance — In geotechnical engineering terms, rock substance is any naturally occurring aggregate of minerals and organic matter which cannot, unless extremely weathered, be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Rock substance is effectively homogeneous and may be isotropic or anisotropic.

Rock Defect — Discontinuity or break in the continuity of a substance or substances.

Rock Mass — Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

Degree of Weathering

Rock weathering is defined as the degree in rock structure and grain property decline and can be readily determined in the field.

Term	Symbol	Definition
Residual Soil	Rs	Soil derived from the weathering of rock. The mass structure and substance fabric are no longer evident. There is a large change in volume but the soil has not been significantly transported.
Extremely weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - ie. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decrease compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable.
Moderately weathered	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Slightly weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fr	Rock substance unaffected by weathering

Rock Strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance is the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics.

Term	Is (50) MPa	Field Guide	Symbol
Extremely weak	< 0.03	Easily remoulded by hand to a material with soil properties.	EW
Very weak	0.03 - 0.1	May be crumbled in the hand. Sandstone is 'sugary' and friable.	VW
Weak	0.1 - 0.3	A piece of core 150mm long x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	W
Medium strong	0.3 - 1	A piece of core 150mm long x 50mm diameter can be broken by hand with considerable difficulty. Readily scored with a knife.	MS
Strong	1 - 3	A piece of core 150mm long x 50mm diameter cannot be broken by unaided hands, can be slightly scratched or scored with a knife.	S
Very Strong	3 - 10	A piece of core 150mm long x 50mm diameter may be broken readily with hand held hammer. Cannot be scratched with pen knife.	VS
Extremely strong	> 10	A piece of core 150mm long x 50mm diameter is difficult to break with hand held hammer. Rings when struck with a hammer.	ES

Rock Data

Explanation of Terms (2 of 2)

Degree of Fracturing

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but excludes fractures such as drilling breaks.

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20mm, and mostly of width less than core diameter.
Highly fractured	Core lengths are generally less than 20mm-40mm with occasional fragments.
Fractured	Core lengths are mainly 30mm-100mm with occasional shorter and longer sections.
Slightly fractured	Core lengths are generally 300mm-1000mm with occasional longer sections and occasional sections of 100mm-300mm.
Unbroken	The core does not contain any fractures.

Rock Core Recovery

TCR = Total Core Recovery

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\%$$

SCR = Solid Core Recovery

$$= \frac{\Sigma \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100\%$$

RQD = Rock Quality Designation

$$= \frac{\Sigma \text{Axial lengths of core} > 100\,\text{mm long}}{\text{Length of core run}} \times 100\%$$

Rock Strength Tests

- ▼ Point load strength Index (Is50) - axial test (MPa)
- ▶ Point load strength Index (Is50) - diametrall test (MPa)
- ● Unconfined compressive strength (UCS) (MPa)

Defect Type Abbreviations and Descriptions

Defect Type (with inclination given)

BP	Bedding plane parting
X	Foliation
L	Cleavage
JT	Joint
F	Fracture
SZ	Sheared zone (Fault)
CS	Crushed seam
DS	Decomposed seam
IS	Infilled seam
V	Vein

Coating or Filling

Cn	Clean
Sn	Stain
Ct	Coating
Fe	Iron Oxide

Planarity

Cu	Curved
Ir	Irregular
Pl	Planar
St	Stepped
Un	Undulating

Roughness

Po	Polished
Ro	Rough
Sl	Slickensided
Sm	Smooth
Vr	Very rough

Inclination

The inclination of defects are measured from perpendicular to the core axis.

Test Methods

Explanation of Terms (1 of 2)

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Sampling

Sampling is carried out during drilling or excavation to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples may be taken by pushing a thin-walled sample tube into the soils and withdrawing a soil sample in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Other sampling methods may be used. Details of the type and method of sampling are given in the report.

Drilling Methods

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Hand Excavation – in some situations, excavation using hand tools such as mattock and spade may be required due to limited site access or shallow soil profiles.

Hand Auger - the hole is advanced by pushing and rotating either a sand or clay auger generally 75-100mm in diameter into the ground. The depth of penetration is usually limited to the length of the auger pole, however extender pieces can be added to lengthen this.

Test Pits - these are excavated with a backhoe or a tracked excavator, allowing close examination of the *in-situ* soils if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) - the hole is advanced by a rotating plate or short spiral auger, generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling - the hole is advanced by pushing a 100mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength *etc.* is only marginally affected.

Continuous Spiral Flight Augers - the hole is advanced using 90 - 115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or *in-situ* testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface or, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling - similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling - a continuous core sample is obtained using a diamond tipped core barrel, usually 50mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in AS 1289 Methods of Testing Soils for Engineering Purposes - Test F3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

(i) In the case where full penetration is obtained with successive blow counts for each 150mm of say 4, 6 and 7 blows:

as 4, 6, 7
N = 13

(ii) In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm

as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally, the test method is used to obtain samples in 50mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

CONE PENETROMETER TESTING AND INTERPRETATION

Cone penetrometer testing (sometimes referred to as Dutch Cone - abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in AS 1289 - Test F4.1.

In the test, a 35mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on separate 130mm long sleeve, immediately behind the cone. Tranducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output on continuous chart

recorders. The plotted results given in this report have been traced from the original records.

The information provided on the charts comprises:
Cone resistance - the actual end bearing force divided by the cross sectional area of the cone - expressed in MPA.
Sleeve friction - the frictional force of the sleeve divided by the surface area - expressed in kPa.
Friction ratio - the ratio of sleeve friction to cone resistance - expressed in percent.

There are two scales available for measurement of cone resistance. The lower (A) scale (0 - 5 Mpa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main (B) scale (0 - 50 Mpa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%-2% are commonly encountered in sands and very soft clays rising to 4%-10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

q_c (Mpa) = (0.4 to 0.6) N (blows/300mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes *etc.* This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

DYNAMIC CONE (HAND) PENETROMETERS
Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods. Two relatively similar tests are used.

Perth sand penetrometer - a 16 mm diameter flat ended rod is driven with a 9kg hammer, dropping 600mm (AS 1289 - Test F 3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
Cone penetrometer (sometimes known as the Scala Penetrometer) - a 16mm rod with a 20mm diameter cone end is driven with a 9kg hammer dropping 510mm (AS 1289 - Test F 3.2). The test was developed initially for pavement sub-grade investigations, with correlations of the test results with California bearing ratio published by various Road Authorities.

LABORATORY TESTING
Laboratory testing is carried out in accordance with AS 1289 Methods of Testing Soil for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

TEST PIT / BORE LOGS
The test pit / bore log(s) presented herein are an engineering and/or geological interpretation of the sub-surface conditions and their reliability will depend to some extent on frequency of sampling and the method of excavation / drilling. Ideally, continuous undisturbed sampling or excavation / core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variation between the boreholes.

GROUND WATER
Where ground water levels are measured in boreholes, there are several potential problems:

In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all during the time it is left open.
A localised perched water table may lead to an erroneous indication of the true water table.
Water table levels will vary from time to time with seasons or recent prior weather changes. They may not be the same at the time of construction as are indicated in the report.
The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.