



Tasmania

DEPARTMENT of
INFRASTRUCTURE,
ENERGY and RESOURCES

NHT Funded Project NLP 13188



Natural
Heritage
Trust

Helping Communities
Helping Australia

The effects of waste disposal on groundwater quality in Tasmania



**Drilling & related
geotechnical
investigations of
the Jetsonville aquifer,
Scottsdale waste depot**

**Tasmanian Geological
Survey Record 2002/14**

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Drilling and related geotechnical investigations of the Jetsonville aquifer at the Scottsdale waste depot

A. R. Ezzy

Introduction

Mineral Resources Tasmania (MRT) initiated a project to investigate the effects of waste disposal on groundwater quality in Tasmania. The project was jointly funded by MRT and the Natural Heritage Trust (NHT) and included a number of sites for detailed study. The waste depot at Scottsdale (538 770 mE, 5 449 000 mN) was one of these sites.

Initial drilling at the waste depot found groundwater at an approximate depth of ten metres across the site. The Steering Committee supervising the project requested that additional drilling be undertaken at the site to identify the hydrostratigraphy of the Jetsonville aquifer in the vicinity of the depot.

Hydrogeology

Two additional environmental monitoring boreholes were rotary mud drilled, using a rock roller drill bit, between 19 and 21 November 2001. The holes were located on the northeast corner of the gravel pit to the north of the landfill footprint, with hole SWD2001/1 being drilled to 63 m and hole SWD2001/2 being drilled to 11.5 metres. Both holes had a diameter of 170 mm and 100 mm PVC casing was installed. Slotted screens with bentonite seals were installed in each hole. The holes were logged in accordance with AS1726-1993; engineering logs are presented in Appendix 1. Because of the nature of the drilling

technique, moisture contents were difficult to verify and in-flows were recorded by observations made of the drill rods and risings.

Seven inward flows at 9.0, 11.5, 14.5, 22.0, 25.0, 28.5 and 30.0 metres were identified during the drilling of SWD2001/1. Each aquifer level was underlain by an aquitard, with a main aquitard between 31 and 39 m overlying the weathered granite basement. Borehole SWD2001/1 was screened between 12.5 and 32.8 m to represent the combined hydraulic head of all the main aquifer levels, excluding the uppermost aquifer level (between 9 and 11 m). Borehole SWD2001/2 was drilled three metres east of SWD2001/1 and installation measured the hydraulic head of the uppermost aquifer level. On 21 November 2001 both holes had a standing water level of 10.80 metres.

Summary and conclusion

Drilling has confirmed that the Jetsonville aquifer exists in the area the Scottsdale waste depot between the approximate depths of 9 to 31 metres. The hydrostratigraphy of the aquifer consists of at least seven levels that appear to be all hydraulically connected. High plasticity clay, acting as a main aquitard, overlies the weathered granite beneath the Jetsonville aquifer.

[30 May 2002]

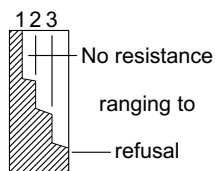
Appendix 1

Engineering logs of boreholes

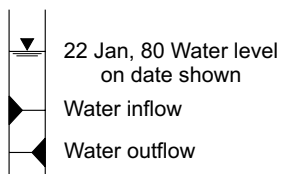
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration



Water



Notes — samples and tests

U50	Undisturbed sample 50 mm diameter
D	Disturbed sample
N	Standard penetrometer blow count for 300 mm
N*	SPT + Sample

Material classification

Based on Unified Soil Classification System.
In Graphic Log materials are represented by clear contrasting symbols consistent for each project.

Moisture content

D	Dry, looks and feels dry
M	Moist, no free water on hand when remoulding
W	Wet, free water on hand when remoulding
LL	Liquid limit
PL	Plastic limit
PI	Plasticity index
e.g. M>PL — Moist, moisture content greater than the plastic limit	

Consistency

		: hand penetrometer
VS	Very soft	<25 (kPa)
S	Soft	25 – 50
F	Firm	50 – 100
St	Stiff	100 – 200
VSt	Very stiff	200 – 400
H	Hard	>400
Fb	Friable	

Notes: X on log is test result
— is range of results

Density index

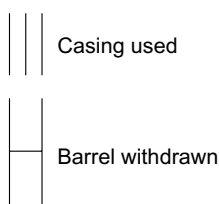
		%
VL	Very loose	0 – 15
L	Loose	15 – 35
MD	Medium dense	35 – 65
D	Dense	65 – 85
VD	Very dense	85 – 100

Fracture description

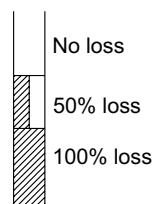
RP	Rough planar
RL	Rough irregular
SP	Smooth planar
SL	Smooth irregular

Cored borehole log

Case - lift



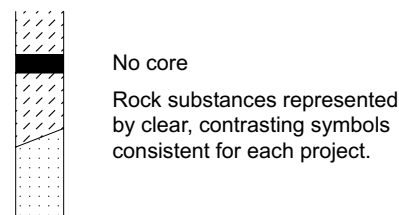
Fluid loss



Lugeons

Lugeon units (uL) are a measure of rock mass permeability. For a 46 to 74 mm diameter borehole 1 Lugeon is defined as a rate of loss of 1 litre per metre per minute. 1 Lugeon is roughly equivalent to a permeability of 1×10^{-4} mm / sec.

Graphic log



Weathering

Fr	Fresh
SW	Slightly weathered
HW	Highly weathered
EW	Extremely weathered

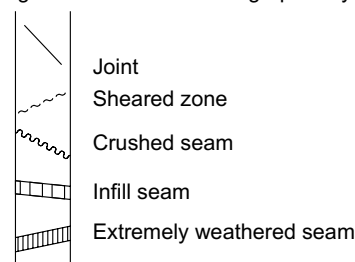
Strength

		point load strength index $1 \text{ s}_{(50)}$ (MPa)
EL	Extremely low	< 0.03
VL	Very low	0.03 – 0.1
L	Low	0.1 – 0.3
M	Medium	0.3 – 1
H	High	1 – 3
VH	Very high	3 – 10
EH	Extremely high	>10

Notes: X on log is test result.

Significant defects

Significant defects shown graphically



ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
Sheet 1 of 13

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		19 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			support	water	notes samples, tests	metres		graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
1	2	3				R.L.	depth						
					D Sample ID 1		0.5		CH	CLAY - high plasticity, white, sandy	M	F	Tertiary sediments
							1.0						
							1.5						
							2.0						
							2.5						
							3.0						
							3.5		SP	SAND - medium, brown		L	Tertiary sediments
					D Sample ID 2		4.0						
							4.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 3 of 13

Project			Scottsdale waste depot			Location		Bridport Road, Scottsdale		
Co-ordinates			55 538769 mE 5449020 mN		Drill type	Tri cone, Rock roller		Hole commenced	19 November 2001	
					Drill method	Rotary		Hole completed	21 November 2001	
R.L.					Drill fluid	Drillers mud		Drilled by	KMR Drilling Pty Ltd	
Inclination			Vertical					Logged by	Mr Andrew Ezzy	
Bearing								Checked by	Mr Adrian Waite	
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology
1 2 3			samples, tests	R.L. depth		symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
		Back in fill		10.5			(As sheet 2)			
		S.W.L. 21/11/01		11.0		CL	CLAY - iron oxide hard pan, gravel		VD	Tertiary sediments, Aquiclude
	No screen	Bentonite		11.5		GW	GRAVEL - approximately 85% quartz, brown, coarse sand, 5% quartz with iron oxide skins		VL	Tertiary sediments 2nd aquifer level (2A)
		D Sample ID 4		12.0						
				12.5						
	Screen	3 mm triple washed sand		13.0						
				13.5						
				14.0						
		D Sample ID 5		14.5		GW	GRAVEL - approximately 95% quartz, 5% coarse sand, brown		VL	Tertiary sediments 3rd aquifer level (2B)

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 4 of 13

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		19 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			support	water	notes samples, tests	metres		graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology													
1	2	3				R.L.	depth																			
(As sheet 3)																										
Screen 3 mm triple washed sand																										

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
Sheet 5 of 13

Project				Scottsdale waste depot				Location				Bridport Road, Scottsdale									
Co-ordinates				55 538769 mE 5449020 mN				Drill type				Tri cone, Rock roller									
								Drill method				Rotary									
R.L.								Drill fluid				Drillers mud									
Inclination				Vertical								Hole commenced									
Bearing												Hole completed									
												Drilled by									
												KMR Drilling Pty Ltd									
												Logged by									
												Mr Andrew Ezzy									
												Checked by									
												Mr Adrian Waite									
penetration		support		water		notes		metres		graphic log		classification		material		moisture		consistency		structure, geology	
1		2		3				R.L.		depth		symbol		soil type: plasticity or particle characteristics, colour, secondary and minor components.		condition		density index			
														(As sheet 3)							
										20.5											
										21.0		CL		CLAY - brown				VD		Tertiary sediments Aquiclude	
										21.5											
										22.0		GW		GRAVEL - medium, quartz				VL		Tertiary sediments 4th aquifer level (2C)	
										22.5											
										23.0											
										23.5											
										24.0		CL		CLAY - gravelly, brown				H		Tertiary sediments Aquiclude	
										24.5											

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
Sheet 6 of 13

Project				Scottsdale waste depot				Location				Bridport Road, Scottsdale									
Co-ordinates				55 538769 mE 5449020 mN				Drill type		Tri cone, Rock roller		Hole commenced		19 November 2001							
								Drill method		Rotary		Hole completed		21 November 2001							
R.L.								Drill fluid		Drillers mud		Drilled by		KMR Drilling Pty Ltd							
Inclination				Vertical								Logged by		Mr Andrew Ezzy							
Bearing												Checked by		Mr Adrian Waite							
penetration		support		water		notes		metres		graphic log		classification		material		moisture		consistency		structure, geology	
1 2 3						samples, tests		R.L. depth				symbol		soil type: plasticity or particle characteristics, colour, secondary and minor components.		condition		density index			
				Screen		D Sample ID 7		25.5				GW		GRAVEL - very coarse, quartz				VL		Tertiary sediments 5th aquifer level (3A)	
				3 mm triple washed sand				26.0													
								26.5													
								27.0													
								27.5													
								28.0													
								28.5				CL		CLAY - gravelly, brown				H		Tertiary sediments Aquiclude	
				D Sample ID 8				29.0				GW		GRAVEL - very coarse, quartz				VL		Tertiary sediments 6th aquifer level (3B)	
								29.5				CL		CLAY - gravelly, brown				H		Tertiary sediments Aquiclude	

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 7 of 13

Project				Scottsdale waste depot				Location		Bridport Road, Scottsdale											
Co-ordinates				55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller		Hole commenced		19 November 2001									
						Drill method		Rotary		Hole completed		21 November 2001									
R.L.						Drill fluid		Drillers mud		Drilled by		KMR Drilling Pty Ltd									
Inclination				Vertical						Logged by		Mr Andrew Ezzy									
Bearing										Checked by		Mr Adrian Waite									
penetration		support		water		notes		metres		graphic log		classification		material		moisture		consistency		structure, geology	
1 2 3						samples, tests		R.L. depth				symbol		soil type: plasticity or particle characteristics, colour, secondary and minor components.		condition		density index			
						D Sample ID 9		30.5				GW		GRAVEL - very coarse, quartz				VL		Tertiary sediments 7th aquifer level (3C)	
						D Sample ID 10		31.0				CL		CLAY - gravelly, brown				H		Tertiary sediments Aquiclude (Base of high permeability hydro-stratigraphy section of Jetsonville aquifer)	
						D Sample ID 11		33.0				CH		CLAY - high plasticity, grey, white, sandy, coarse gravel				F		Tertiary sediments Aquiclude	
								33.5				GC		CLAY - gravelly, brown				H		Tertiary sediments Aquiclude	

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 8 of 13

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		19 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology
1	2	3	samples, tests	R.L. depth		symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
						GC	GRAVEL - very coarse, quartz		VL	Tertiary sediments (no detectable inflows after 35 metres)
				35.5						
				36.0		CL	CLAY - gravelly, brown		H	Tertiary sediments Aquiclude
				36.5						
				37.0						
				37.5						
				38.0						
				38.5						
				39.0						
				39.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 9 of 13

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		19 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology
1	2	3	samples, tests	R.L. depth		symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
							(As sheet 8)			
				40.5						
				41.0						
				41.5						
				42.0						
			D Sample ID 12	42.0		CL	CLAY - orange, gravel		H	Tertiary sediments
				42.5						
				43.0						
				43.5						
				44.0						
				44.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
Sheet 10 of 13

Project		Scottsdale waste depot				Location		Bridport Road, Scottsdale																																									
Co-ordinates		55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller		Hole commenced		19 November 2001																																							
				Drill method		Rotary		Hole completed		21 November 2001																																							
R.L.				Drill fluid		Drillers mud		Drilled by		KMR Drilling Pty Ltd																																							
Inclination		Vertical						Logged by		Mr Andrew Ezzy																																							
Bearing								Checked by		Mr Adrian Waite																																							
<table><tr><td>penetration</td><td>support</td><td>water</td><td>notes</td><td>metres</td><td>graphic log</td><td>classification</td><td>material</td><td>moisture</td><td>consistency</td><td colspan="2">structure, geology</td></tr><tr><td>1</td><td>2</td><td>3</td><td>samples, tests</td><td>R.L.</td><td>depth</td><td>symbol</td><td>soil type: plasticity or particle characteristics, colour, secondary and minor components.</td><td>condition</td><td>density index</td><td colspan="2"></td></tr></table>													penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology		1	2	3	samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index															
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology																																							
1	2	3	samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index																																								
<table><tr><td rowspan="10">Back in fill</td><td rowspan="10">Back in fill</td><td rowspan="10">D Sample ID 13</td><td rowspan="10"></td><td>45.5</td><td rowspan="10">CL</td><td rowspan="10">(As sheet 9)</td><td rowspan="10"></td><td rowspan="10">VD</td><td rowspan="10">Tertiary sediments</td></tr><tr><td>46.0</td></tr><tr><td>46.5</td></tr><tr><td>47.0</td></tr><tr><td>47.5</td></tr><tr><td>48.0</td></tr><tr><td>48.5</td></tr><tr><td>49.0</td></tr><tr><td>49.5</td></tr><tr><td rowspan="10">D Sample ID 14</td><td rowspan="10"></td><td rowspan="10"></td><td rowspan="10"></td><td>49.0</td><td rowspan="10">CL</td><td rowspan="10">CLAY - orange, white, approximately 20% gravel</td><td rowspan="10"></td><td rowspan="10">H</td><td rowspan="10">Tertiary sediments</td></tr><tr><td>49.5</td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table>													Back in fill	Back in fill	D Sample ID 13		45.5	CL	(As sheet 9)		VD	Tertiary sediments	46.0	46.5	47.0	47.5	48.0	48.5	49.0	49.5	D Sample ID 14				49.0	CL	CLAY - orange, white, approximately 20% gravel		H	Tertiary sediments	49.5								
Back in fill	Back in fill	D Sample ID 13		45.5	CL	(As sheet 9)		VD	Tertiary sediments																																								
				46.0																																													
				46.5																																													
				47.0																																													
				47.5																																													
				48.0																																													
				48.5																																													
				49.0																																													
				49.5																																													
				D Sample ID 14									49.0	CL	CLAY - orange, white, approximately 20% gravel		H	Tertiary sediments																															
49.5																																																	

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 11 of 13

Project				Scottsdale waste depot				Location		Bridport Road, Scottsdale			
Co-ordinates				55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller		Hole commenced		19 November 2001	
						Drill method		Rotary		Hole completed		21 November 2001	
R.L.						Drill fluid		Drillers mud		Drilled by		KMR Drilling Pty Ltd	
Inclination				Vertical						Logged by		Mr Andrew Ezzy	
Bearing										Checked by		Mr Adrian Waite	
penetration		support	water	notes	metres	graphic log	classification	material		moisture	consistency	structure, geology	
1 2 3				samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.		condition	density index		
								(As sheet 10)					

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/1
 Sheet 13 of 13

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538769 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		19 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology
1	2	3	samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
							(As sheet 12)			
					60.5					
					61.0					
					61.5					
					62.0					
					62.5					
					63.0					
							End of hole			

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/2
Sheet 1 of 3

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538772 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		20 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			support	water	notes samples, tests	metres		graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
1	2	3				R.L.	depth						
									CH	CLAY - high plasticity, white, sandy	M	F	Tertiary sediments
							0.5						
							1.0						
							1.5						
							2.0						
							2.5						
							3.0						
							3.5		SP	SAND - medium, brown		L	Tertiary sediments
							4.0						
							4.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/2
Sheet 2 of 3

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538772 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		20 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
1	2	3										
									(As sheet 1)			
				Bentonite		5.5						
						6.0						
			No screen			6.5						
						7.0						
						7.5						
				3 mm triple washed sand		8.0						
						8.5						
						9.0						
			Screen			9.5		SW	SAND - medium, brown		VL	Tertiary sediments - 1st aquifer level (1A)

ENGINEERING LOG - BOREHOLE

Borehole no.
SWD 2001/2
 Sheet 3 of 3

Project		Scottsdale waste depot		Location		Bridport Road, Scottsdale	
Co-ordinates		55 538772 mE 5449020 mN		Drill type		Tri cone, Rock roller	
				Drill method		Rotary	
R.L.				Drill fluid		Drillers mud	
Inclination		Vertical		Hole commenced		20 November 2001	
Bearing				Hole completed		21 November 2001	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			support water	notes samples, tests	metres		graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
1	2	3			R.L.	depth						
			Screen 3mm triple washed sand S.W.L. 21/11/01						(As sheet 2)			
					10.5							
					11.0	CL	CLAY - iron oxide hard pan, gravel		VD	Tertiary sediments, Aquiclude		
				11.5		End of hole						