MINERAL RESOURCES TASMANIA

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 near the Tolosa Street reservoir, Glenorchy

Tasmanian Geological Survey Record 2002/12

Tasmania
DEPARTMENT of INFRASTRUCTURE, ENERGY and RESOURCES

Mineral Resources Tasmania
Tasmanian Geological Survey
Record 2002/12

Natural Heritage Trust
Helping Communities Helping Australia

Drilling investigations to identify groundwater flow directions in the area north of the Tolosa Street Reservoir, Glenorchy

A. R. Ezzy

Introduction

Drilling undertaken in 2001 at the toe of the Chapel Street landfill footprint (Ezzy, 2002) identified contaminated groundwater (including chloride, ammonia, manganese and total petroleum hydrocarbons) at a depth of five metres. The Steering Committee supervising this Natural Heritage Trust project requested that additional drilling be undertaken between the Tolosa Street Reservoir and the Chapel Street waste depot, with the aim of assisting in determining groundwater flow directions in the area between the two sites.

Hydrogeology

Two additional monitoring boreholes were percussion drilled on the north side of the Tolosa Street reservoir (fig. 1) between 23 and 24 January 2002 using the down-hole hammer technique. Borehole TSR2002/1 was drilled to 24.5 metres and borehole TSR2002/2 was drilled to 30.5 metres. Both bores had a diameter of 170 mm and 100 mm casing was installed. Both bores were logged in accordance with AS1726-1993; engineering logs are presented in Appendix 1. Both holes were developed on 25 January 2002 using the air lifting method.

Both bores were drilled in Permian grey mudstone. Water was struck at 19.5 m in hole TSR2002/1 and at 25 m and 27.5 m in hole TSR2002/2. Standing water levels of 19.5 m (TSR2002/1) and 24.6 m (TSR2002/2) indicate that groundwater in both bores is unconfined.

Summary and conclusions

As detailed surveying of all the bores is still to be undertaken, the current data can only be generalised. Using current contour data, an initial review of groundwater gradients (fig. 1) implies that it is unlikely that contaminated groundwater (originating from the Chapel Street waste depot) is entering the reservoir. Local groundwater flow appears to move away from the toe of the waste depot to the east beneath Humphrey Rivulet.

Future work

Groundwater chemistry is awaited for the Tolosa Street boreholes. Pump tests are recommended for boreholes CS2001/1, TSR2002/1 and TSR2002/2. The application of hard-rock resistivity geophysical techniques may help to better refine groundwater flow within the local area. All future work in the area should consider potential vandalism of hardware and infrastructure.

Reference

EZZY, A. R. 2002. Groundwater quality investigations at the Chapel Street and Jackson Street waste depots, Glenorchy. *Record Tasmanian Geological Survey* 2002/11.

[30 May 2002]

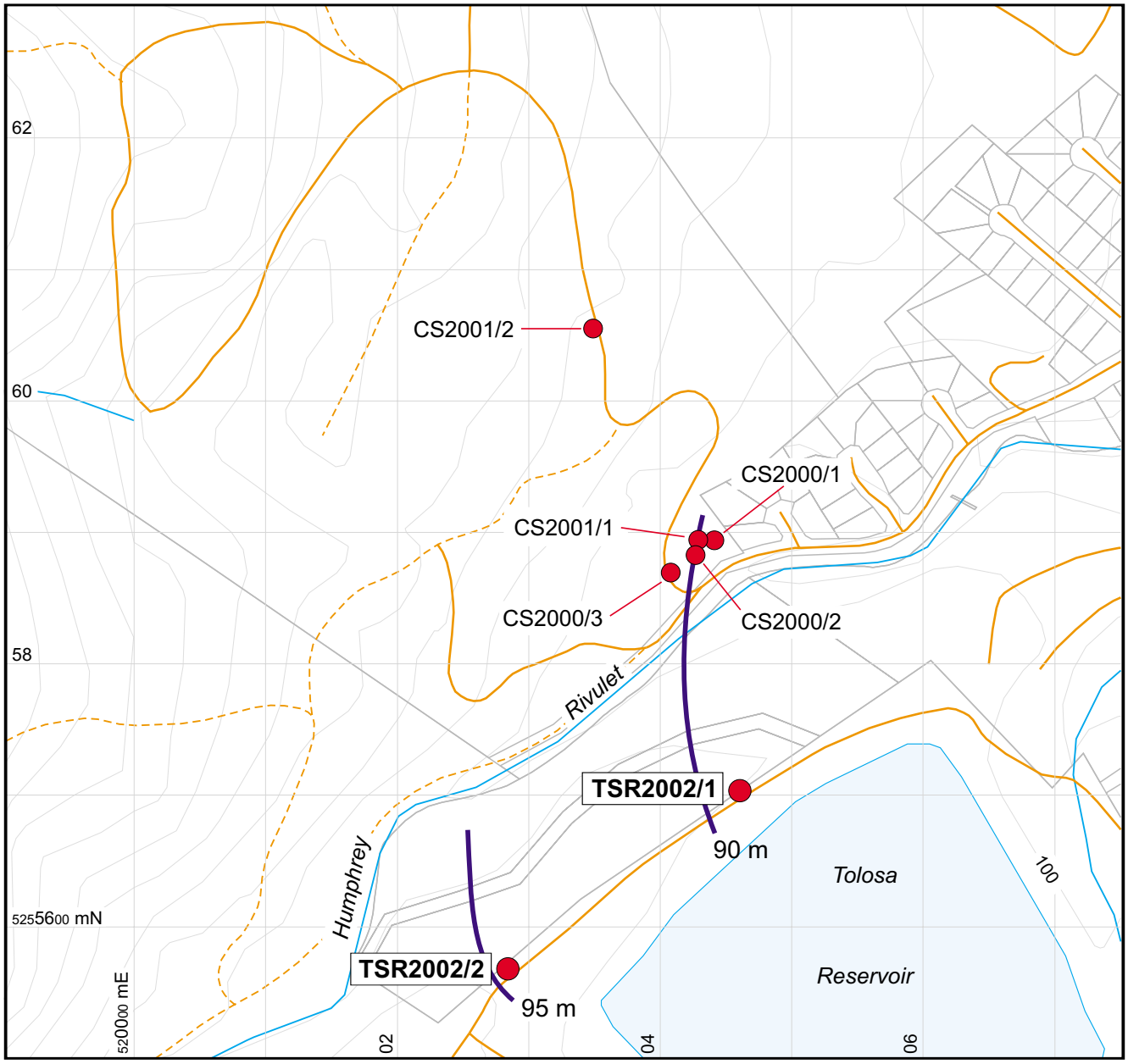


Figure 1

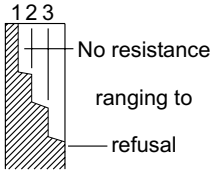
Locations of monitoring bores installed at the Chapel Street waste depot and Tolosa Street Reservoir. Interpretation of groundwater contours (RL heights) based on existing data sets.

Appendix 1

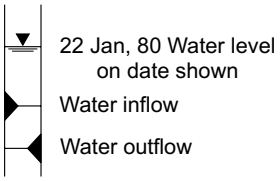
Engineering logs of boreholes

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

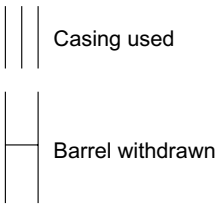
		%
VL	Very loose	0 – 15
L	Loose	15 – 35
MD	Medium dense	35 – 65
D	Dense	65 – 85
VD	Very dense	85 – 100

Fracture description

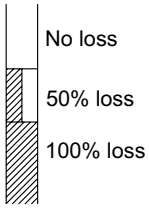
RP	Rough planar
RL	Rough irregular
SP	Smooth planar
SL	Smooth irregular

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 x 10^{-4} mm / sec.

Graphic log

No core

Rock substances represented by clear, contrasting symbols consistent for each project.

Weathering

Fr	Fresh
SW	Slightly weathered
HW	Highly weathered
EW	Extremely weathered

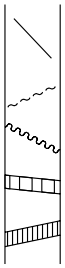
Strength

		point load strength index $I_{s\,(50)}$ (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



MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/1**
Sheet 1 of 5

Project	Chapel Street waste depot	Location	Chapel Street, Glenorchy
Co-ordinates	55 520285 mE 5255568 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	23 January 2002
Inclination	vertical	Hole completed	23 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
		Cement	D Sample ID 1	0.5		CI	CLAY - medium plasticity, brown, fragments of siltstone and sandstone to 50 mm recovered	M	F	Permian rocks- reworked weathered
		Back fill	D Sample ID 2	1.0 / 1.5			Interbedded MUDSTONE, SILTSTONE and SANDSTONE - white, grey, brown	D		Permian rock
	No screen		D Sample ID 3	2.0 / 2.5			MUDSTONE - grey	D		Permian rock
			D Sample ID 4	3.0 / 3.5 / 4.0 / 4.5						

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/1**
Sheet 2 of 5

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520285 mE 5255568 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	23 January 2002
Inclination	vertical	Hole completed	23 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
		Bentonite		5.5			(As sheet 1)			Permian rock
				6.0						
				6.5						
	No Screen		D Sample ID 5	7.0			MUDSTONE - grey, alternating layers of siltstone, green	D		Permian rock
		Sand pack		7.5						
				8.0						
				8.5						
				9.0						
				9.5						
			D Sample ID 6				MUDSTONE - grey	M		Permian rocks with some minor fracturing

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/1**
Sheet 3 of 5

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520285 mE 5255568 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	23 January 2002
Inclination	vertical	Hole completed	23 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
				10.5			(As sheet 2)			
				11.0						
				11.5						
				12.0						
	No Screen	Sand pack	D Sample ID 7	12.5			MUDSTONE - grey	D		Permian rocks
				13.0						
				13.5						
				14.0						
				14.5						

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/1**
Sheet 4 of 5

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520285 mE 5255568 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	23 January 2002
Inclination	vertical	Hole completed	23 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
							(As sheet3)			
	No Screen	Sand pack	D Sample ID 8	15.5			MUDSTONE - grey, pyrrhotite trace	D		Permian rocks with minor iron sulphide
				16.0						
				16.5						
				17.0						
				17.5						
				18.0						
			D Sample ID 9	18.5			MUDSTONE - grey	D		Permian rock
	100mm Screen, 1mm slots			19.0						
		▼	S.W.L. 24/01/02	19.5			MUDSTONE - grey	W		Fractured Permian rocks
			D Sample ID 10							

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/1**
Sheet 5 of 5

Project	Tolosa Street Reservoir			Location	Tolosa Street, Glenorchy
Co-ordinates	55 520285 mE 5255568 mN	Drill type	Percussion	Hole commenced	23 January 2002
		Drill method	Down hole hammer	Hole completed	23 January 2002
R.L.		Drill fluid	Air	Drilled by	KMR Drilling Pty Ltd
Inclination	vertical			Logged by	Mr Andrew Ezzy
Bearing				Checked by	Mr Adrian Waite

penetration 1 2 3	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
	100mm Screen, 1mm slots	Sand pack	D Sample ID 11	20.5			(As sheet 4)			
				21.0						
				21.5						
				22.0						
				22.5						
				23.0						
				23.5						
				24.0						
				24.5			End of hole			

Sample ID numbers refer to samples stored in MRT core shed

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 1 of 7

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520534 mE 5255764 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	24 January 2002
Inclination	vertical	Hole completed	24 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
		Cement	D Sample ID 1	0.5		CL	CLAY - medium plasticity, brown, mottled orange	M	St	Reworked weathered Permian rocks
			D Sample ID 2	1.0 / 1.5			Interbedded MUDSTONE, SILTSTONE and SANDSTONE - red, grey, mottled clay, brown recovered	D		Permian rock
	No screen	Back fill	D Sample ID 3	2.0 / 2.5 / 3.0			Interbedded MUDSTONE, SILTSTONE and SANDSTONE - light brown, grey	D		Permian rock
			D Sample ID 4	3.5 / 4.0 / 4.5			MUDSTONE - light brown, grey	D		Permian rock

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 2 of 7

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520534 mE 5255764 mN	Drill type	Percussion
		Drill method	Down hole hammer
R.L.		Drill fluid	Air
Inclination	vertical	Hole commenced	24 January 2002
Bearing		Hole completed	24 January 2002
		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
			D Sample ID 5	5.5			MUDSTONE - grey	D		Permian rock
				6.0						
			D Sample ID 6	6.5			MUDSTONE - grey	M		Permian rocks with some minor fracturing
	No Screen	Back fill		7.0						
				7.5						
				8.0						
				8.5						
				9.0						
			D Sample ID 7	9.5			MUDSTONE - grey	D		Permian rock

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 3 of 7

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520534 mE 5255764 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	24 January 2002
Inclination	vertical	Hole completed	24 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
		Bentonite		10.5			(As sheet 2)			
			D Sample ID 8	11.0			MUDSTONE - brown, grey, gravel, silt	M		Fractured weathered Permian rocks
				11.5						
				12.0						
	No Screen	Sand pack	D Sample ID 9	12.5			MUDSTONE - grey	M		Permian rock
				13.0						
			D Sample ID 10	13.5			MUDSTONE - grey	D		Permian rock
				14.0						
			D Sample ID 11	14.5						

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 4 of 7

Project Tolosa Street Reservoir — Location Tolosa Street, Glenorchy

Co-ordinates 55 520534 mE
5255764 mN
R.L.
Inclination vertical
Bearing

Drill type Percussion
Drill method Down hole hammer
Drill fluid Air

Hole commenced 24 January 2002
Hole completed 24 January 2002
Drilled by KMR Drilling Pty Ltd
Logged by Mr Andrew Ezzy
Checked by Mr Adrian Waite

penetration 1 2 3	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
							(As sheet 3)			
	No Screen	Sand pack	D Sample ID 12	15.5			MUDSTONE - grey,	M		Permian rocks minor fracture zones
			D Sample ID 13	16.0						
				16.5						
			D Sample ID 14	17.0						
				17.5						
				18.0						
			D Sample ID 15	18.5			MUDSTONE - grey	D		Permian rock
				19.0						
				19.5						

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 5 of 7

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520534 mE 5255764 mN	Drill type	Percussion
		Drill method	Down hole hammer
		Drill fluid	Air
R.L.		Hole commenced	24 January 2002
Inclination	vertical	Hole completed	24 January 2002
Bearing		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	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
	No Screen	Sand pack	D Sample ID 16	20.5			(As sheet 4)			
				21.0						
				21.5						
				22.0						
				22.5						
				23.0						
				23.5						
				24.0						
	Screen		S.W.L. 25/01/02	24.5						

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 6 of 7

Project	Tolosa Street Reservoir			Location	Tolosa Street, Glenorchy
Co-ordinates	55 520534 mE 5255764 mN	Drill type	Percussion	Hole commenced	24 January 2002
		Drill method	Down hole hammer	Hole completed	24 January 2002
R.L.		Drill fluid	Air	Drilled by	KMR Drilling Pty Ltd
Inclination	vertical			Logged by	Mr Andrew Ezzy
Bearing				Checked by	Mr Adrian Waite

penetration 1 2 3	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
	100mm Screen, 1mm slots		D Sample ID 17	25.5			MUDSTONE - grey, light grey	W		Fractured Permian rock aquifer
				26.0						
				26.5						
				27.0						
			D Sample ID 18	27.5						
				28.0						
		Sand pack		28.5						
				29.0						
				29.5						

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - BOREHOLE

Borehole no. **TSR 2002/2**
Sheet 7 of 7

Project	Tolosa Street Reservoir	Location	Tolosa Street, Glenorchy
Co-ordinates	55 520534 mE 5255764 mN	Drill type	Percussion
		Drill method	Down hole hammer
R.L.		Drill fluid	Air
Inclination	vertical	Hole commenced	24 January 2002
Bearing		Hole completed	24 January 2002
		Drilled by	KMR Drilling Pty Ltd
		Logged by	Mr Andrew Ezzy
		Checked by	Mr Adrian Waite

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
	Screen	Sand pack						(As sheet 6)			
					30.5						