

1987/17. Geological investigation of a proposed refuse disposal site for the Evandale Municipality.

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Abstract

Tertiary clayey sediments occur at the proposed refuse disposal site for the Evandale Municipality. Whilst there is a potential for groundwater pollution, leachate is unlikely to enter the groundwater provided proper management of the site is undertaken.

INTRODUCTION

The proposed refuse disposal site for the Evandale Municipality is located in a valley [EP215996] to the north-east of Evandale township. An un-named tributary of Rose Rivulet rises in the valley from various seepages.

In November 1986 the Evandale Municipal Engineer requested that the Department of Mines undertake geological investigations for the project. An initial site inspection was followed by the excavation and logging of eleven test pits on 26 November. Standpipes were placed in two additional excavations for permeability testing. The distribution of surface materials has also been mapped (fig. 1).

This report presents the results of the investigation and discusses geological considerations of the proposal.

THE SITE

Topographic setting

The proposed site occupies a shallow valley with a moderate sloping (8-12°) south-facing slope and a more gentle sloping (4-8°) north-facing slope. An extension of the north-facing slope creates a small neck in the valley floor. The watercourse in the valley is poorly defined upstream of the neck, but downstream it is a well-defined, slightly incised stream.

Vegetation

Reedy grasses and water-tolerant plants are established in the valley floor where marshy conditions prevail. Elsewhere the vegetative cover is improved grassland. In the drier seasons patches of the grass wither earlier than elsewhere and their vegetative cover becomes thinner. These areas are significant geologically as they mark the occurrence of gravels and clayey gravels.

Geological setting

The entire proposed site is situated on Tertiary sediments known as the Launceston Beds. These are a mixture of clays, clays with thin lenses or interbeds of sand, clayey gravels and gravels. The gravels occur as lenticular masses and their location is indicated by poor vegetative cover during the drier seasons.

Recent alluvium, consisting of organic silty clay, has accumulated in the valley floor and marshy materials occur where wet conditions prevail.

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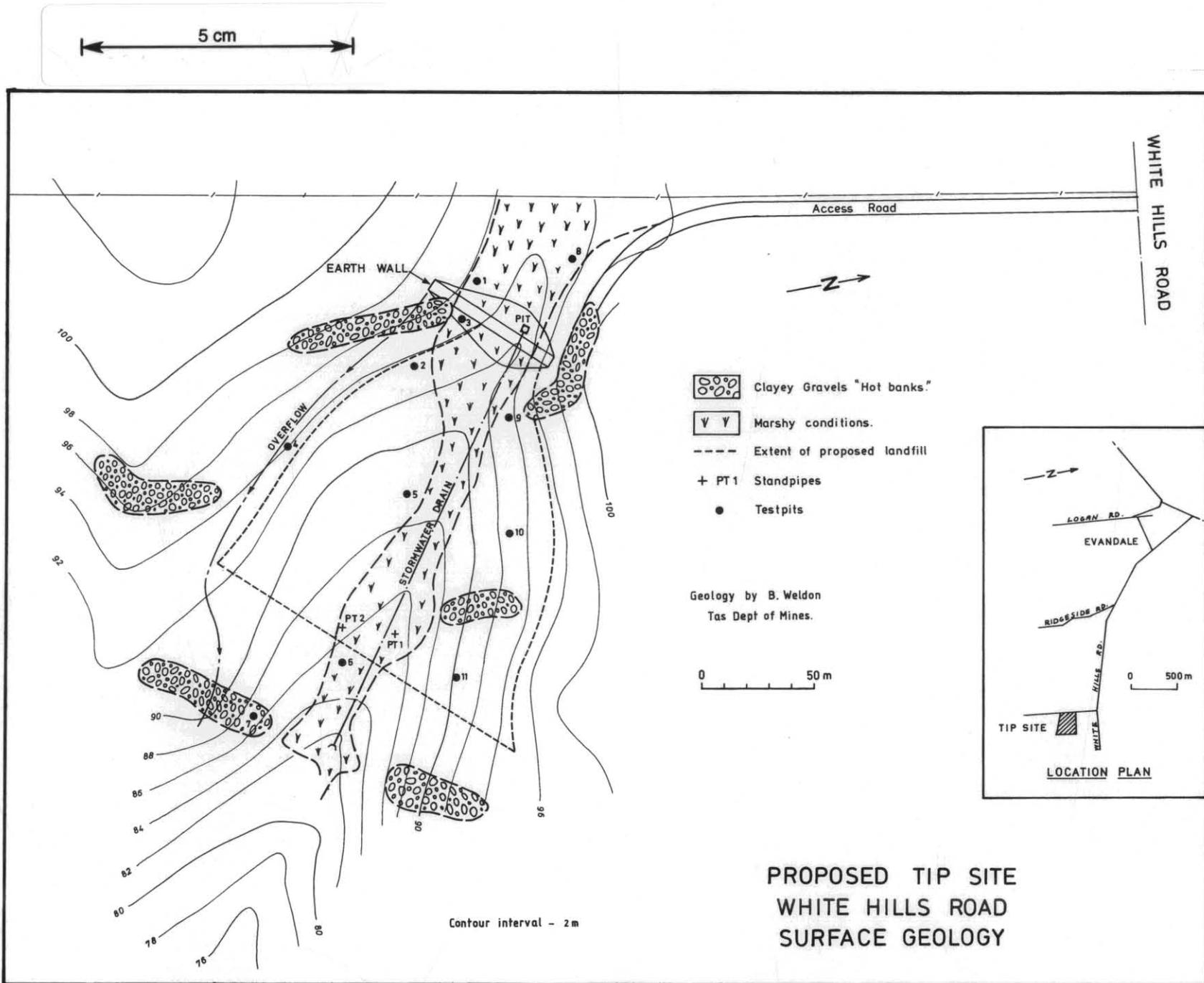


Figure 1

Proposed work

An access road is proposed to the refuse site from White Hills Road. Near the tip site this road will traverse the south-facing side of the valley. A bund is proposed at the head of the valley to collect water from seepages and overland flow. A 225 mm diameter concrete stormwater main is proposed to take water from the bund beneath the land fill to discharge into the well defined watercourse downstream of the neck in the valley.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were investigated by digging eleven test pits with an excavator. Detailed logs of each test pit are given in Appendix 1. A descriptive classification symbol interpreted for the soil is provided in the last column of the logs. The explanation of these symbols is:

O	organic-rich horizons
A	eluvial (washed out of) horizons comprising mostly mineral matter mixed with some humified organic matter.
B	illuvial (washed into) horizons characterised by concentrations of clay, iron and organic matter.
G	gleyed horizons, usually high in clay or iron formed under reducing conditions with impeded aeration.
BC, CB	transition zones between the illuviated B horizon above; and
C	weathered parent rock material

Two additional test pits were made for the purposes of constant head permeability tests. PVC standpipes were installed in hand-augered holes in the bottom of these pits to provide known cross-sectional areas. The pits were back-filled and constant head permeability tests prepared. The seal at the base of the standpipes was unsatisfactory and water leaked into the remainder of the excavation resulting in an unknown wetted area.

DISCUSSION

Soil development

A well-developed O horizon, which is variable in thickness, occurs in the floor of the valley where marshy conditions prevail. In some areas, which are constantly saturated, the layer is absent being replaced by a gleyed illuviated clay. The A horizon is poorly developed, possibly because of agricultural activity. A commonly iron-enriched B horizon is well developed.

Groundwater

Surface waters occurred in the vicinity of test pits 1, 3, 6 and 8. Water entered test pits 2 and 9 from fissures within a high plasticity clay; from clayey gravels in test pit 3; and from very thin lenses of sand within the clay of test pits 6 and 8.

Standpipes with open ends at 1.4 and 1.5 m depth were established in excavations PT1 and PT2 (see fig. 1). Although controlled permeability tests were not possible (because of unsatisfactory end seals), the water level stabilised in the standpipes after rain. No measurable drop in water level was observed over a two-day period. This indicates very low saturated permeability (estimated to be in the order of 10^{-6} m/day).

The O and B horizons appear to be effective barriers to the downward migration of surface waters (and leachate) or the upward flow of confined groundwater.

Fill

Apart from the hot banks of clayey gravels, the site does not contain any quantities of permeable materials which might be preferred as fill to cover the landfill daily. The upper 0.5 m or so of soil is generally (organic rich) clay which may be difficult to reclaim and use as daily fill without specialised (e.g. sheep foot) rollers. Stripping beyond about 0.5 m depth will generally encounter the impermeable B horizon. This is not desirable as the clay will shrink and crack, providing access for leachate to the confined groundwater.

Leachate control

Excavations for the concrete stormwater main may break the effective impermeable barrier of the O and A layers, allowing leachate access to the confined groundwater. This possibility could be guarded against by careful management of the trench back-fill. An impermeable clay barrier should be compacted over the trench.

Should clayey gravels be exposed during preparation of the site, an impermeable clay blanket should be compacted over them to prevent downward migration of leachate. The clayey gravels are probably lenticular masses and as such are unlikely to be interconnected.

A leachate dam downstream of the landfill area was not included in the proposal.

Excavation conditions

The materials encountered in the test pits will be capable of being excavated with a small, tractor-type excavator such as a Massey Ferguson 50B. Any long term excavations, such as for the access road, will need to be made with cut batter slopes no steeper than 1.5:1 (horizontal : vertical).

CONCLUSIONS AND RECOMMENDATIONS

There is a potential for groundwater pollution at the proposed Evandale Municipality refuse disposal site off White Hills Road. However, infiltration of leachate is considered unlikely and would be minimised by providing an impermeable clay blanket where the B horizon is penetrated (by excavations for the stormwater main beneath the landfill, or where clayey gravels are exposed).

A bund to intercept surface waters and overland flow upstream of the landfill site will divert the natural drainage away from the landfill.

A leachate dam should be provided between the landfill and the outfall of the stormwater main.

An overflow drain is provided on the north-facing slope of the valley. This will serve to collect overland flow if constructed as an open drain, as well as dispose of excess water from the bund during flash floods. It is recommended that an intercept drain be incorporated in the access road to cater for similar overland flow on the south-facing slope of the valley.

The site is considered feasible from a geological viewpoint. The likelihood of groundwater pollution is minimal provided the precautions mentioned above are followed.

A regular sampling procedure should be adopted to determine the water quality of Rose Rivulet before the site is used. The programme should be continued during the operation of the landfill.

[6 March 1987]

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ENGINEERING LOG - EXCAVATION

excavation no. **1**
sheet **1** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates _____ exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. _____ operator _____ logged by **B. Weldon**
 excavation dimensions _____ checked by _____

penetration 1 2 3	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	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			R.L.	depth							
			0.25		##	OH	CLAY: black organic high plasticity	W	F-St		'0'
				1.20		CH	CLAY mottled dark brown - brown high plasticity moisture content > plastic limit. trace of grit	M	St		'B'
				2.102		CH	CLAY grey with some brown mottling high plasticity M.C. > P.L. trace of sand	M	St		
				3.203		GC	CLAYEY GRAVEL: medium - coarse grain size gravel - mostly rounded basalt (to 300mm Ø) in brown high plasticity clay with very fine grained sand	M	D		'CB'
		END									

sketch

5 cm

ENGINEERING LOG - EXCAVATION

excavation no. **2**
sheet **1** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates _____ exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. _____ logged by **B. Weldon**
 excavation dimensions _____ operator _____ checked by _____

penetration 1 2 3	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	hand penetr- ometer kPa 25 100 200 400	structure, geology
			R.L.	depth							
				0.10		CH	SILTY CLAY black-brown medium-low plasticity, some rounded boulders, roots	M	St		'a'
				0.80		CH	CLAY dark brown, high plasticity, moderate organic content, rootlets	M	St		
				1		CH	CLAY mottled brown grey high plasticity moisture content > plastic limit	M	VSt		'b'
				2			as above but light grey				
				2.30			as above but some brown mottles and white (travertine like) material				'bc'
				3			as above but some brown mottles and white (travertine like) material				
				END 4.20							

sketch

ENGINEERING LOG - EXCAVATION

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excavation no. **3**
sheet **I** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**
 co-ordinates exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. logged by **B. Weldon**
 excavation dimensions operator checked by

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	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
1 2 3				0-90	#	OH	CLAY: black high plasticity clay organic rich contains roots and rootlets	M	F- St		0'
				2.30	○	GC	CLAYEY GRAVEL: brown medium-coarse gravel size fragments (mostly rounded basalt MW-HW) in a brown high plasticity clay matrix.	M	D		numerous inflows near this level
			END	3-60	○						
				4							

sketch

5 cm

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ENGINEERING LOG - EXCAVATION

excavation no.
 sheet **4** of 1

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. logged by **B. Weldon**
 excavation dimensions operator checked by

penetration 1 2 3	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	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			R.L.	depth							
				0.60	#	DH	CLAY: black organic medium-high plasticity; Mc ~ P.L.; roots; rootlets.	M	St-Fb		'0'
				1	#	CH	CLAY: mottled grey-brown high plasticity Mc > P.L. LIMONITE NODULE CLAY: as above but with blue-grey highly plastic M.E. > P.L. clay on some fissures. some travertine-like whitish material	M	St-Vsk		'1'
				2	#						'2'
				3	#						'3'
		END		3.60	#						'4'

sketch

5 cm

ENGINEERING LOG - EXCAVATION

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excavation no. **6**
sheet **1** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates _____ exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. _____ operator _____ logged by **B. Weldon**
 excavation dimensions _____ checked by _____

penetration 1 2 3	support water	notes samples, tests	metres		classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			R.L.	depth						
			0.40	#	DM CLAY		M	Sk		0'
				CL- CH	CLAY mottled brown-grey high plasticity moisture content > plastic limit fine grained basalt gravel		M	Sk- Vsk		6'
		END	3.20 3.40	3	SAND: medium grained brown grey wet		W			
				4						

sketch

5 cm

ENGINEERING LOG – EXCAVATION

excavation no. **7**
sheet **1** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates _____ exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. _____ logged by **B. Weldon**
 excavation dimensions _____ operator _____ checked by _____

penetration 1 2 3	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	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			R.L.	depth							
						GC	CLAYEY GRAVEL brown med-coarse gravel size basalt, rounded in brown mod-high plasticity silty clay matrix				'B'
		END	2.25	2							
				3							
				4							

sketch

5 cm

ENGINEERING LOG – EXCAVATION

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excavation no. **10**
sheet **1** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates _____ exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. _____ operator _____ logged by **B. Weldon**
 excavation dimensions _____ checked by _____

penetration 1 2 3	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	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			R.L.	depth							
				0.60	X # X X X	OH	CLAY: black organic rich, high plasticity MC > P.L.	M	st		'0'
				1 1:30		CH	CLAY: brown, medium plasticity M.C. > P.L.	M	st- vst		'8'
				2		CH	CLAY: light grey mottled purplish brown high plasticity M.C. > P.L.	M	vst		'6c'
				3			as above but mostly grey with network of veins/fissures				stickensides
		END		3.50							
				4							

sketch

5 cm

ENGINEERING LOG - EXCAVATION

excavation no. **11**
sheet **1** of **1**

project **EVANDALE COUNCIL REFUSE SITE** location **'HARLAND RISE'**

co-ordinates _____ exposure type **test pit** pit commenced **26-11-86**
 equipment **excavator** pit completed **26-11-86**
 R.L. _____ operator _____ logged by **B. Weldon**
 excavation dimensions _____ checked by _____

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	hand penetr- ometer kPa				structure, geology
									25	50	100	200		400
			0.80	X #X X# X	CL- CH	SILTY CLAY: black medium-low plasticity low organic content, roots, rootlets.	M	St					'0'
			1	.....	CH	CLAY: brown high plasticity M.C. > P.L.	M	St- VSt					'A'
			2	.....		as above but becoming mottled with grey							'B'
			2.40	.....	CH	CLAY grey, medium-high plasticity, M.C. ≈ P.L. with some whitish fine gravel material, some sand layers trace of mica	M	VSt					'C'
		END	3.60	.....								
			4	.....								

sketch

5 cm