Opal Vale Pty Ltd
Class 1 Landfill

Gravel Salt Valley Road

Salt Valley Road

Gravel internal roads
used to transport clay

Existing bitumen road

LOT 11

Active
Sand excavation

Transport route

Active
Sand excavation

500 metre s
from the edge
of the landfill

Gravel road
Chitty Road

Landholders dwelling

Clay excavation

Gravel internal roads
used to transport clay

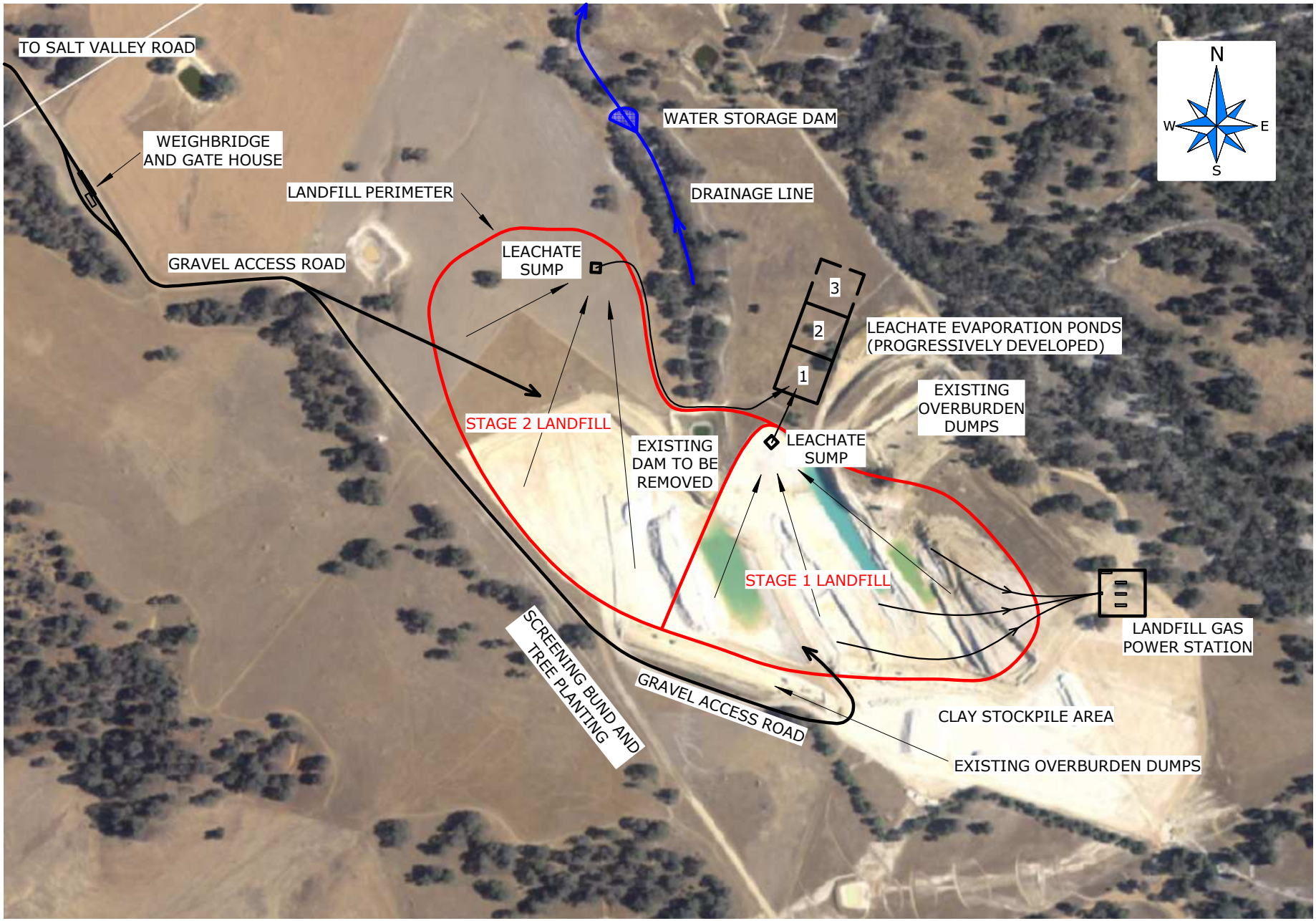
PART OF THE LAND HOLDING
THAT INCLUDES LOT M2027

Landholders dwelling

0 450m

Figure 1

OPAL VALE PTY LTD	
PROPOSED CLASS 11 LANDFILL LOT M2027, CHITTY ROAD, TOODYAY	
LOCATION - LAND USES AND BUFFERS	
Landform Research	December 2011
Basemap LANDGATE	1 : 22 500



PROPOSED LANDFILL SITE LAYOUT

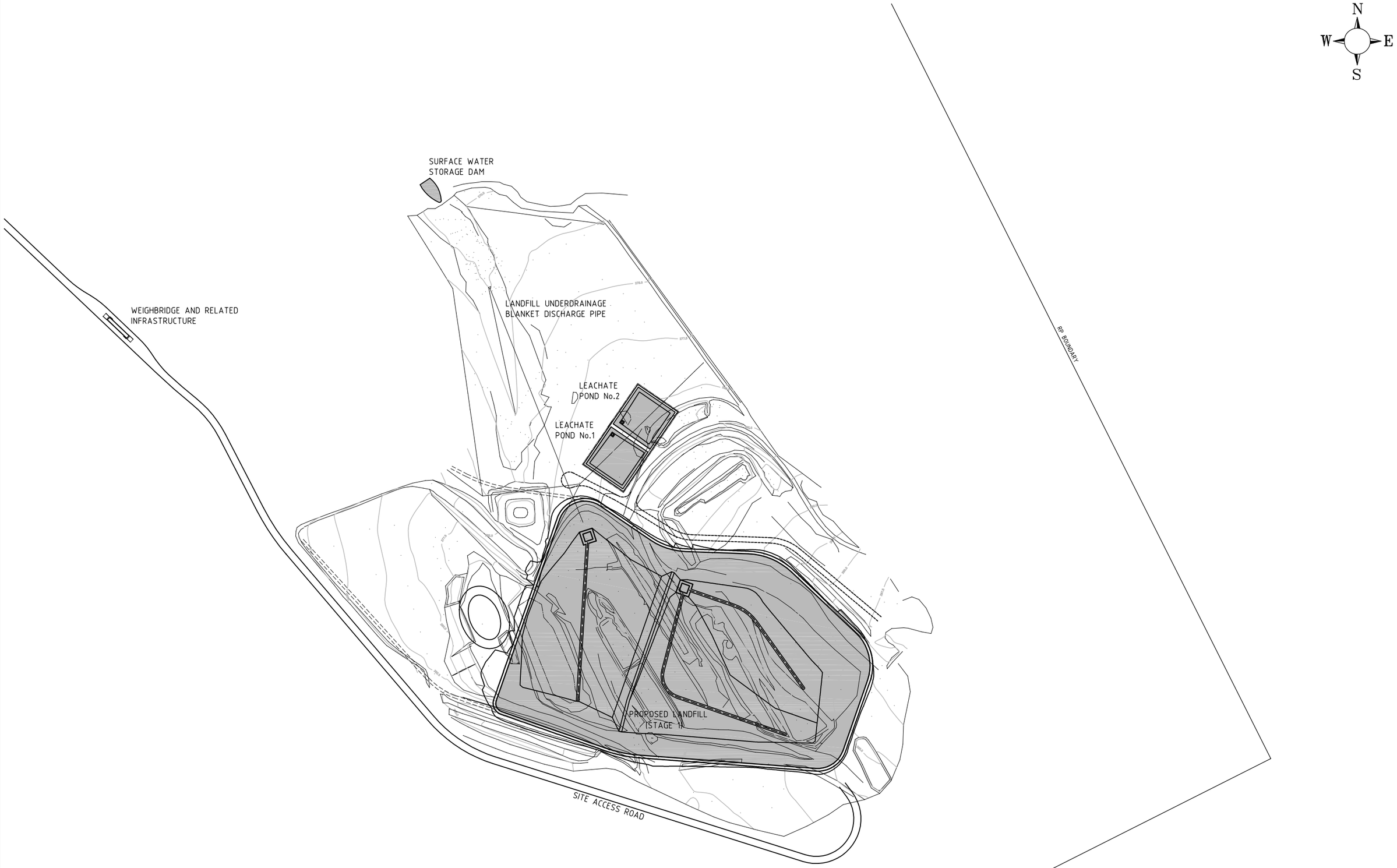
iw Projects
Email -iwatkins@iwprojects.com.au
Mobile - 0402 909 291
Address - 6 Anembo Close Duncraig 6023

OPAL VALE

LOT M2027
CHITTY ROAD, TOODYAY

SITE LAYOUT

DATE	16 SEP 11	**SCALE**	NTS
DWG	001	**REV**	1



FOR WORKS APPROVAL
01 JULY 2013

SCALE 20 0 20 40 80 100 (metres)
1 : 2,000 (A1); 1 : 4,000 (A3)

REVISIONS

No.	BY	DATE	DESCRIPTION
B	S.BY.	01/07/13	GENERAL AMENDMENTS
A	S.BY.	10/05/12	ISSUED FOR APPROVAL

DRG. FILE	OV-WA-01&02	DATE
DESIGN	I.W / S.B.Y	05/12
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DES. CHK.	I.W.	
DWG. CHK.	I.W.	

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OPAL VALE PTY LTD

PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LANDFILL OVERALL LAYOUT PLAN

SCALE	AS SHOWN
SHEET	01 of 09
DRG No.	REVISION B OV–WA–01

NOTE:
THE SURFACE SHOWN ON THIS PLAN IS THE EARTHWORKS SURFACE (UNDERSIDE OF LINER)

N
W E
S

PROPOSED LEACHATE POND

FUTURE STAGE 2 EXPANSION

NEW WATER STORAGE DAM

SUMP 2

SUMP 1

CELL 5

CELL 1

CELL 6

CELL 2

CELL 3

CELL 4

PROPOSED LANDFILL STAGE 1

FOR WORKS APPROVAL
01 JULY 2013

SCALE 7.5 0 7.5 15 30 37.5 (metres)
1 : 750 (A1); 1 : 1500 (A3)

REVISIONS

No.	BY	DATE	DESCRIPTION
B	S.BY.	01/07/13	GENERAL AMENDMENTS
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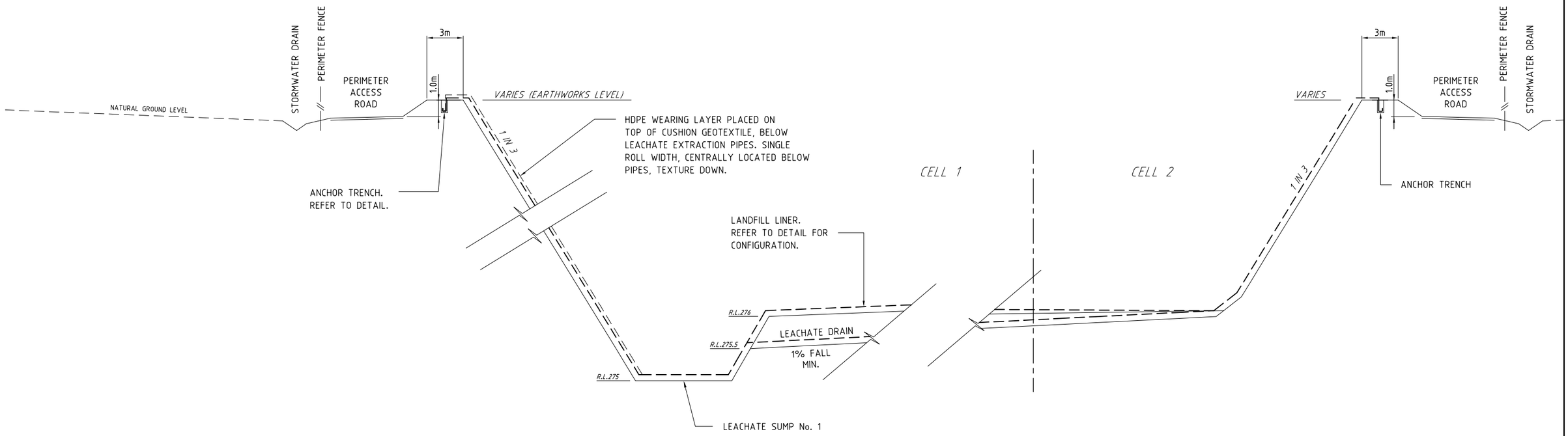
OPAL VALE PTY LTD

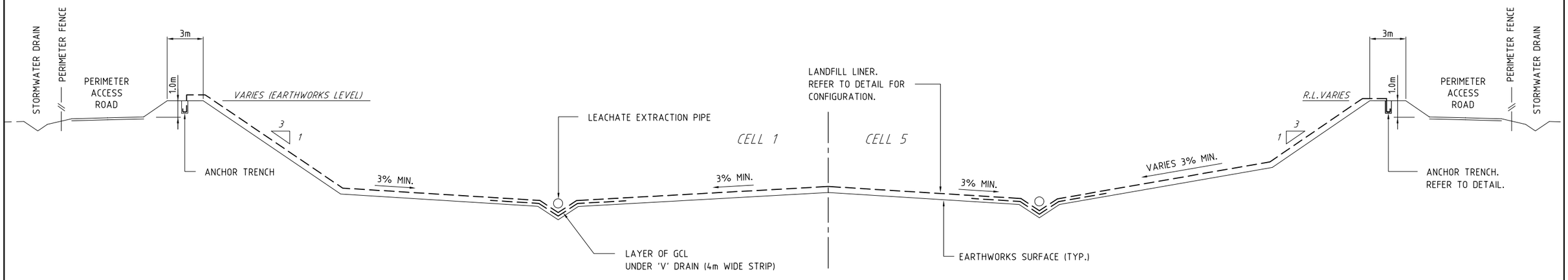
PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LANDFILL EARTHWORKS LAYOUT PLAN

SCALE	AS SHOWN
SHEET	02 of 09
DRG No.	OV–WA–02
REVISION	B



LEACHATE SUMP No. 1 SECTION

NOT TO SCALE



LANDFILL TYPICAL CROSS SECTION

NOT TO SCALE

FOR WORKS APPROVAL

01 JULY 2013

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	A	S.BY.	10/05/12	ISSUED FOR APPROVAL	DES. CHK.	I.W.	
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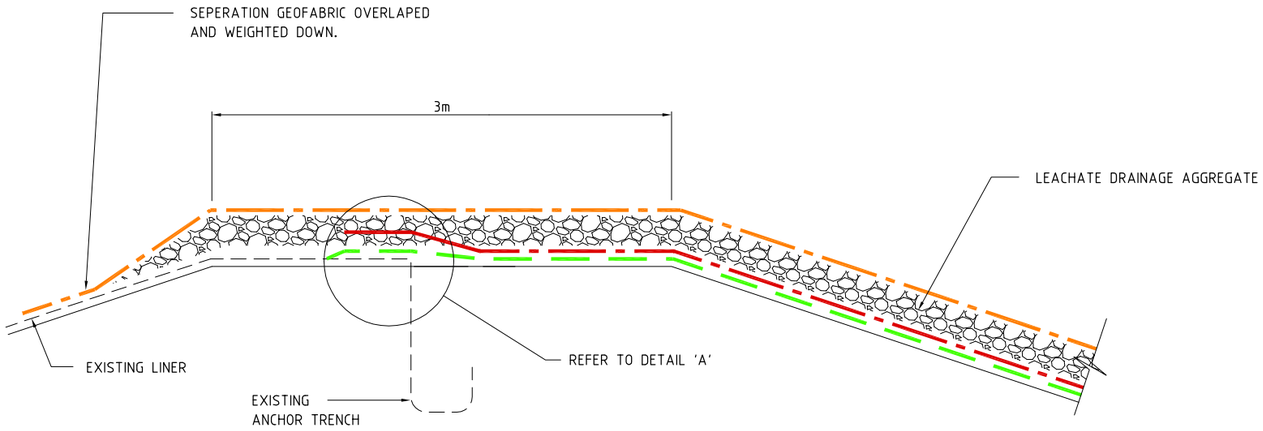
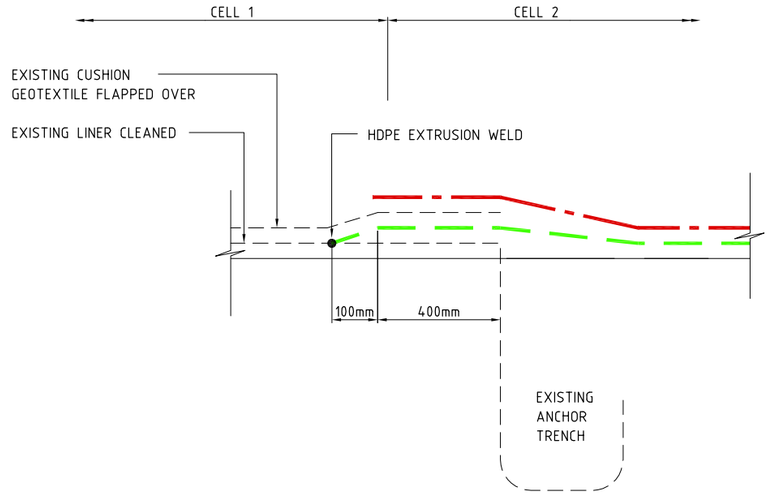
OPAL VALE PTY LTD

PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LINER DETAILS – SHEET 1 OF 2

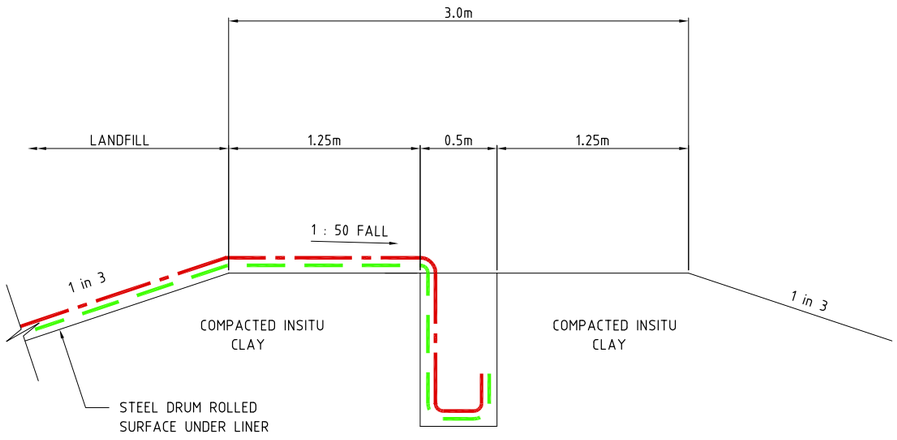
SCALE	AS SHOWN
SHEET	03 of 09
DRG No.	REVISION B
	OV-WA-03



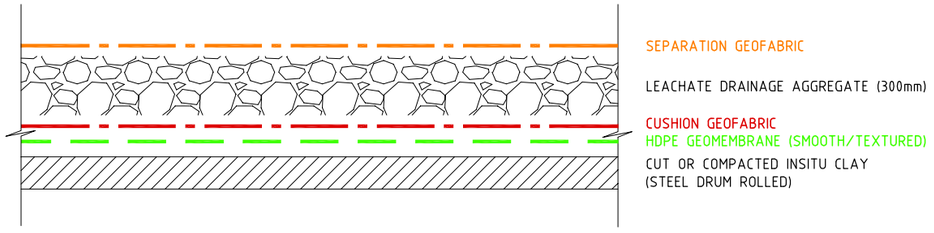
TIE-IN DETAIL TO EXISTING LINER
INTERMEDIATE BUND BETWEEN CELLS
NOT TO SCALE



DETAIL 'A'
NOT TO SCALE



BUND AND ANCHOR TRENCH DETAIL
NOT TO SCALE



LANDFILL LINER CONFIGURATION
NOT TO SCALE

FOR WORKS APPROVAL
01 JULY 2013

REVISIONS

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B	S.BY.	01/07/13	GENERAL AMENDMENTS
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DES. CHK.	I.W.		
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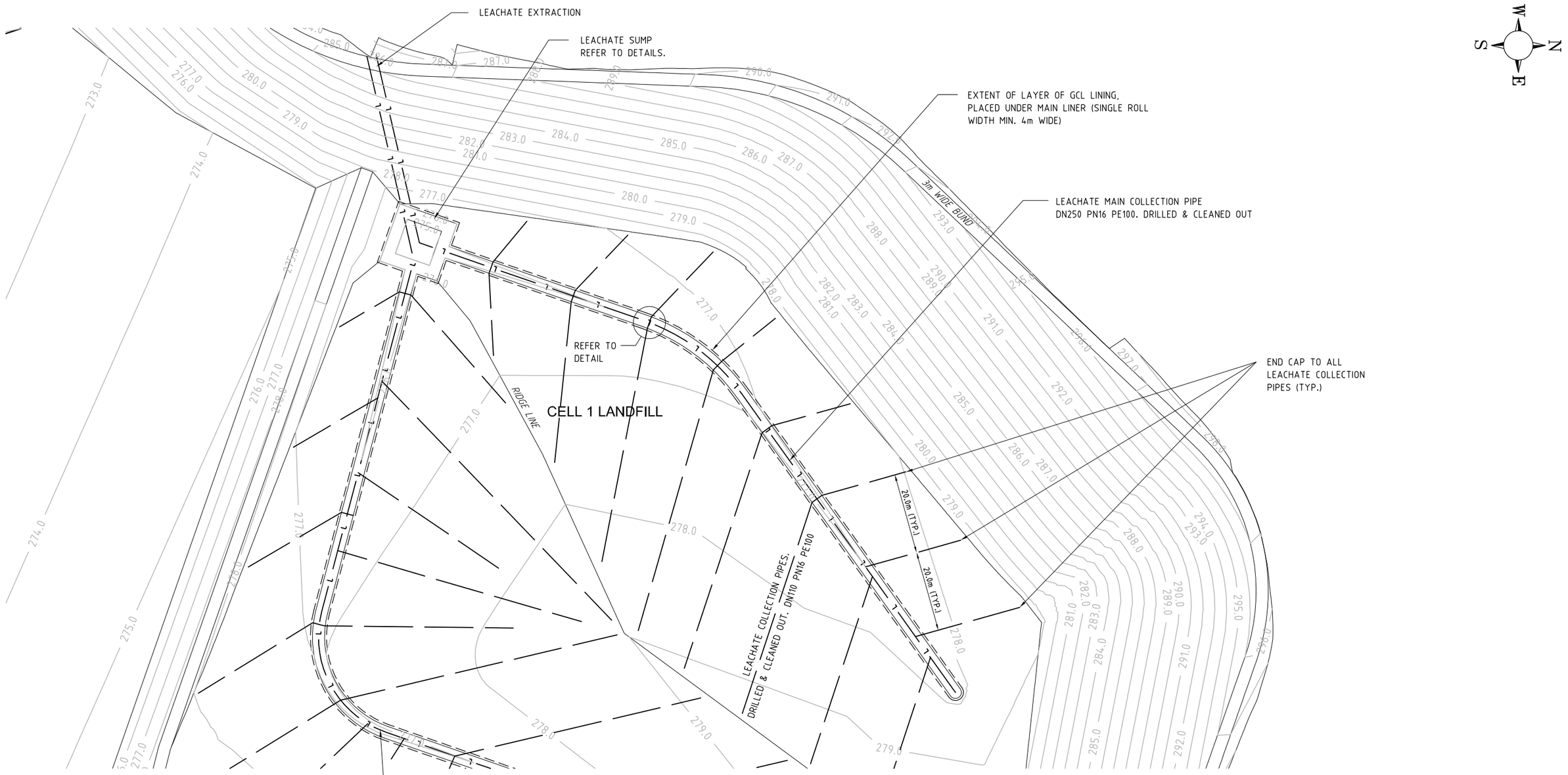
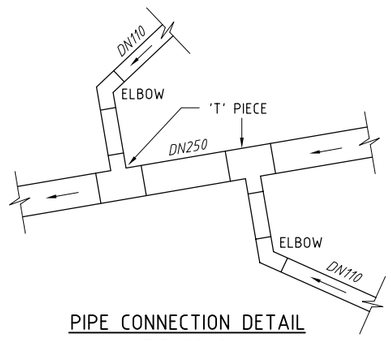
OPAL VALE PTY LTD

PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LINER DETAILS – SHEET 2 OF 2

SCALE	AS SHOWN
SHEET	04 of 09
DRG No.	REVISION B OV-WA-04



LAYOUT PLAN
SCALE 1 : 500 (A1)



PIPE CONNECTION DETAIL
NOT TO SCALE

SCALE 5m 0 10 20 25m 1 : 500 (A1)

FOR WORKS APPROVAL
01 JULY 2013

REVISIONS					DRG. FILE	OV-WA-05	DATE
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	B	S.BY.	01/07/13	GENERAL AMENDMENTS	DRAWN	S.B.Y.	05/12
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	No.	BY	DATE	DESCRIPTION	DWG. CHK.	I.W.	

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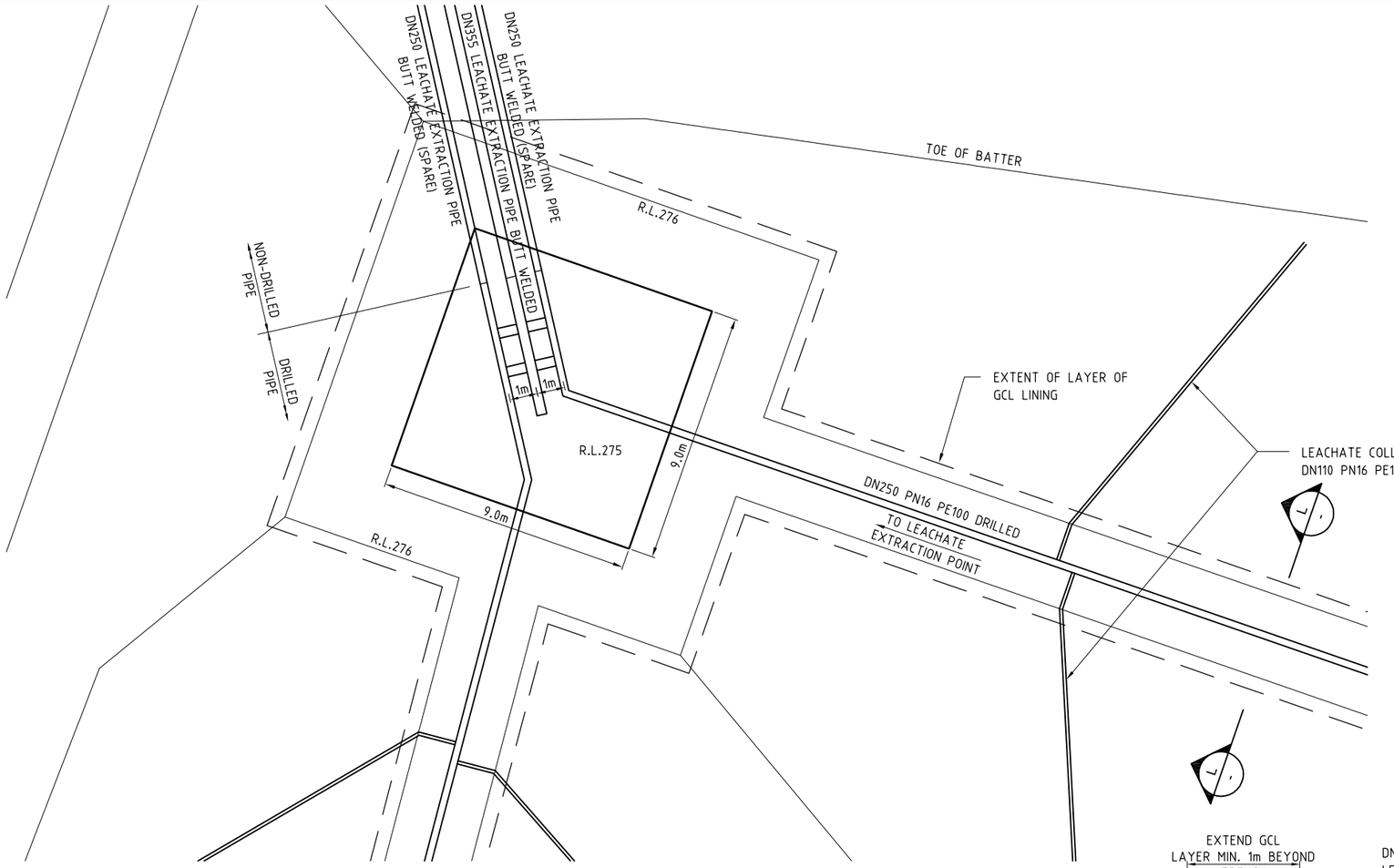
OPAL VALE PTY LTD

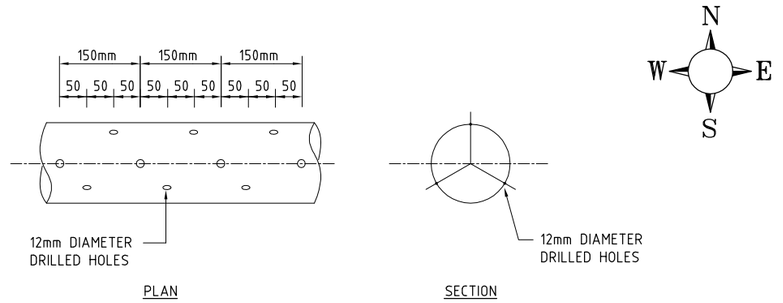
PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LEACHATE EXTRACTION LAYOUT PLAN

SCALE	AS SHOWN
SHEET	05 of 09
DRG No.	REVISION B OV-WA-05



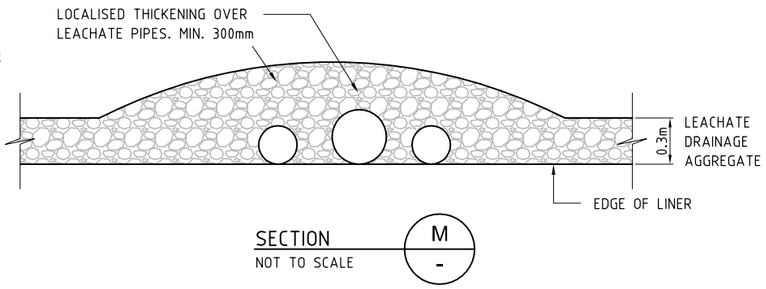
LEACHATE SUMP PLAN

NOT TO SCALE



DRILLED PIPE DETAILS

N.T.S.



SECTION — M / -

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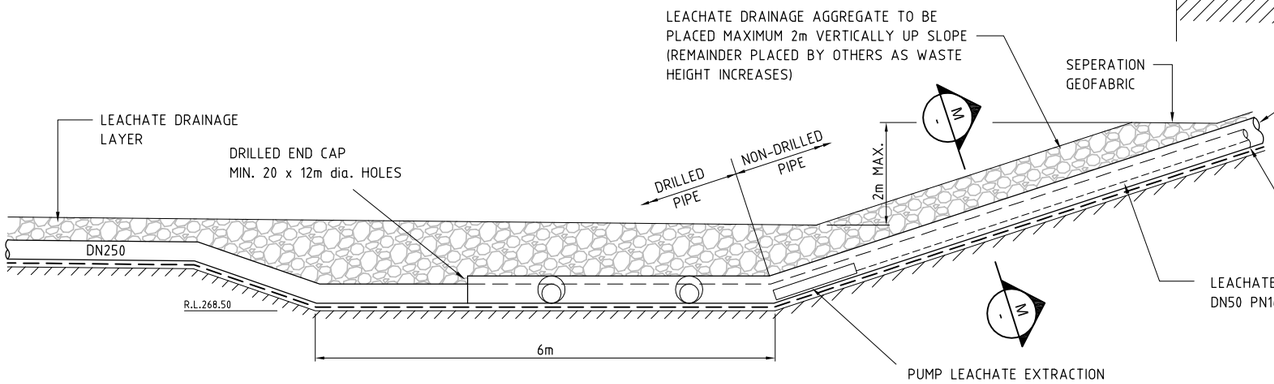

LEACHATE SUMP DETAIL

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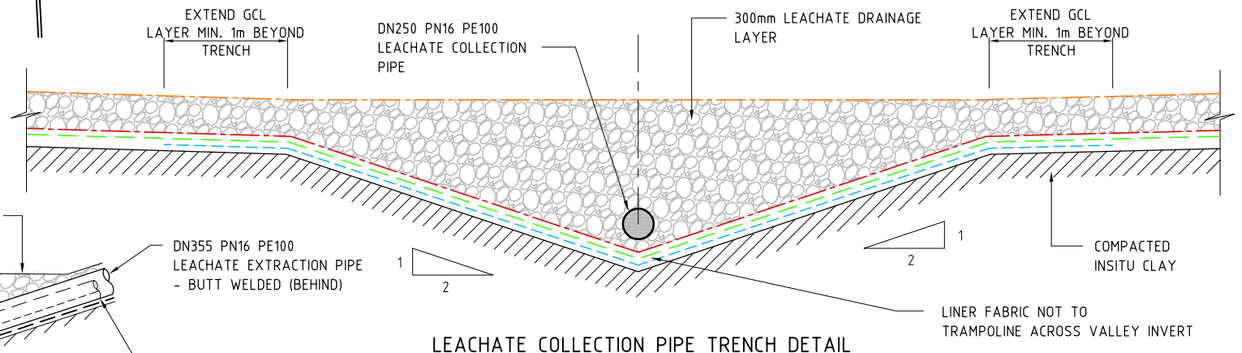

LEACHATE COLLECTION PIPE TRENCH DETAIL

SECTION — L / -

NOT TO SCALE

FOR WORKS APPROVAL

01 JULY 2013

REVISIONS					DRG. FILE	OV-WA-06&07	DATE
					DESIGN	I.W / S.B.Y	05/12
B	S.B.Y.	01/07/13	GENERAL AMENDMENTS		DRAWN	S.B.Y.	05/12
A	S.B.Y.	10/05/12	ISSUED FOR APPROVAL		DES. CHK.	I.W.	
No.	BY	DATE	DESCRIPTION		DWG. CHK.	I.W.	

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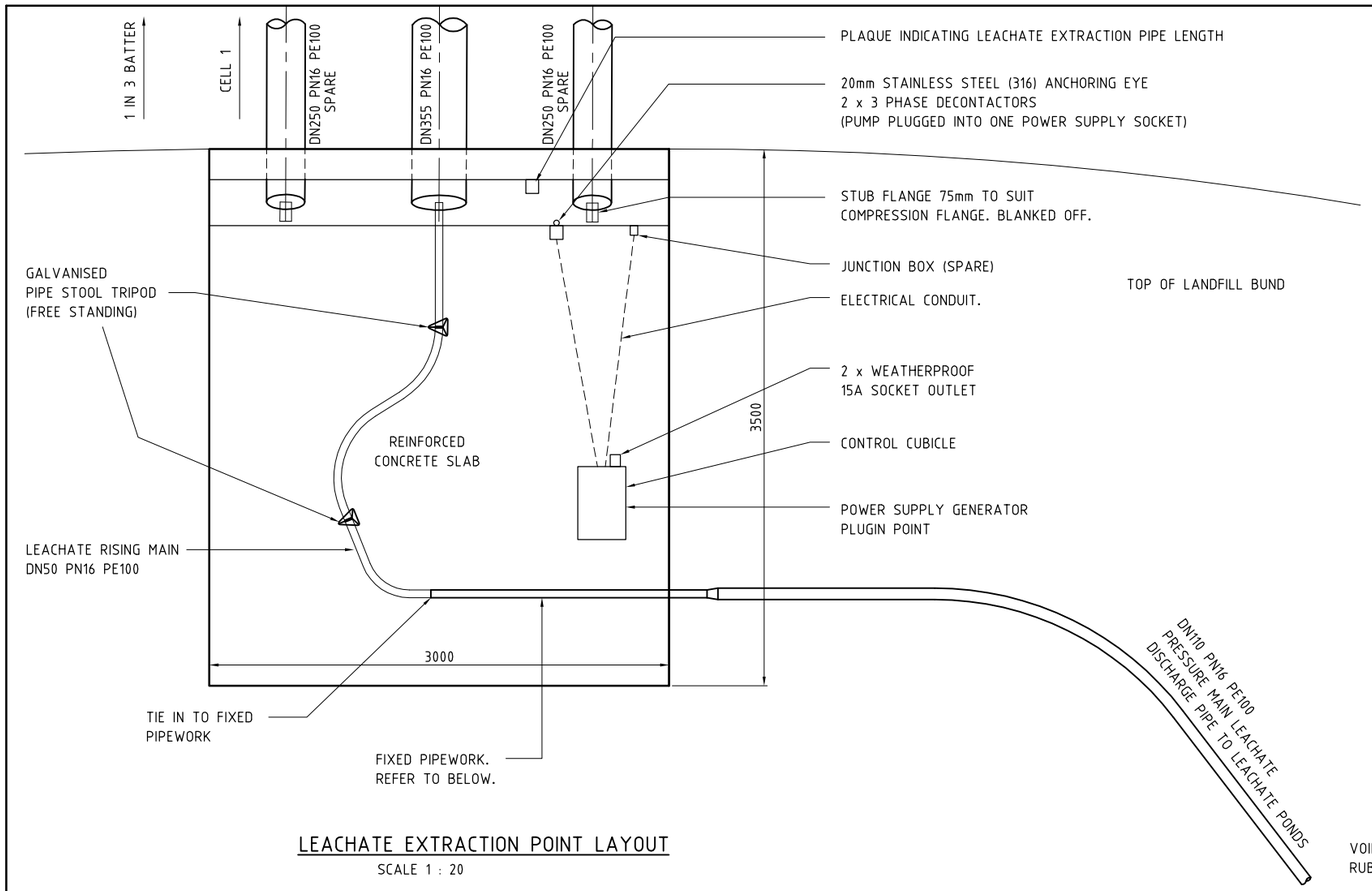
OPAL VALE PTY LTD

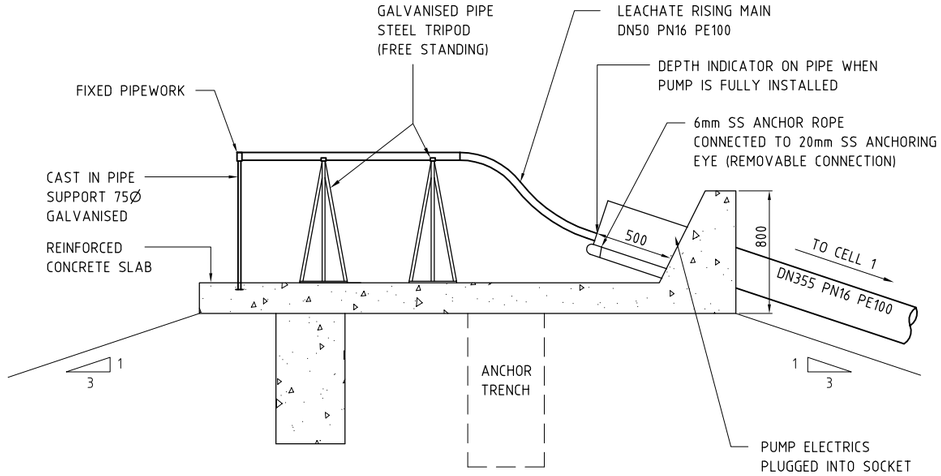
PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LEACHATE EXTRACTION DETAILS – SHEET 1 OF 2

SCALE	AS SHOWN
SHEET	06 of 09
DRG No.	REVISION B
	OV-WA-06



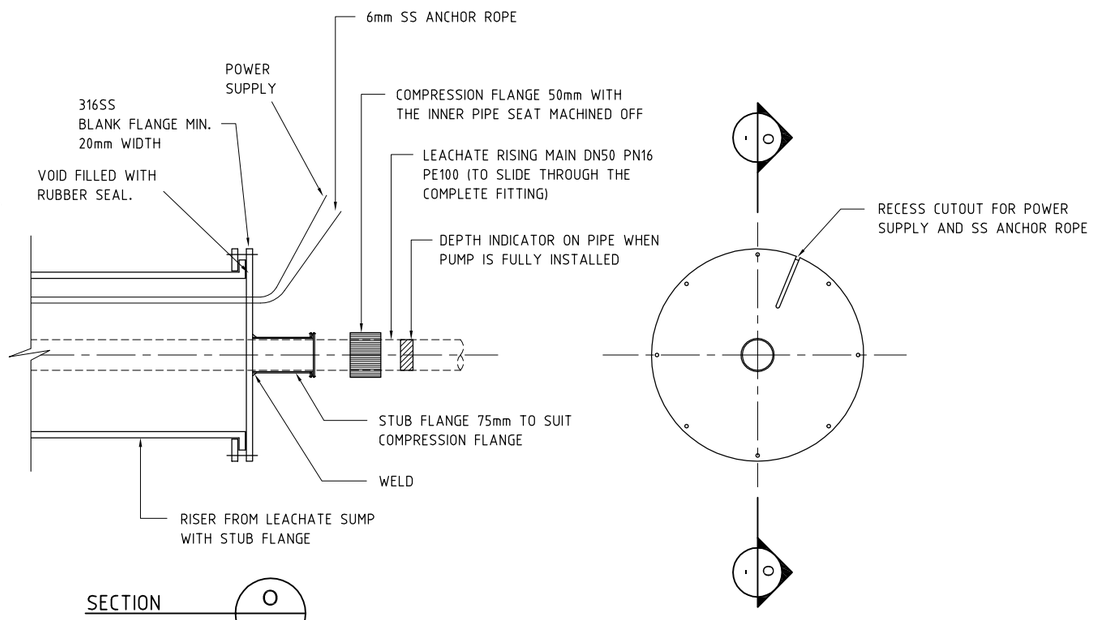
LEACHATE EXTRACTION POINT LAYOUT

SCALE 1 : 20



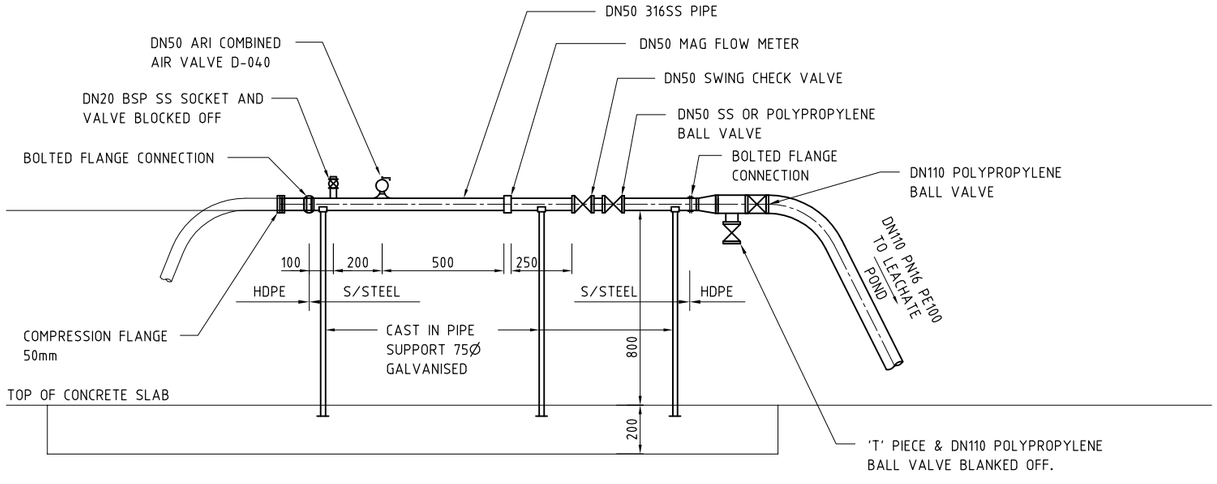
LEACHATE SUMP EXTRACTION POINT

SCALE 1 : 20



LEACHATE ACCESS DETAIL

NOT TO SCALE



FIXED PIPEWORK - LEACHATE EXTRACTION POINT PIPEWORK

NOT TO SCALE

FOR WORKS APPROVAL
01 JULY 2013

SCALE 200 0 200 400 600 800 1000mm 1 : 20

REVISIONS					DRG. FILE	OV-WA-06&07	DATE
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B	S.BY.	01/07/13	GENERAL AMENDMENTS		DRAWN	S.B.Y.	05/12
A	S.BY.	10/05/12	ISSUED FOR APPROVAL		DES. CHK.	I.W.	
No.	BY	DATE	DESCRIPTION		DWG. CHK.	I.W.	

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OPAL VALE PTY LTD

PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LEACHATE EXTRACTION DETAILS – SHEET 2 OF 2

SCALE	AS SHOWN
SHEET	07 of 09
DRG No.	REVISION B
	OV-WA-07

N
W E
S

CONTOUR 2m ABOVE HIGHEST
ANTICIPATED GROUNDWATER LEVEL (TYP.)

SIDE SLOPE
UNDERDRAINAGE

PERIMETER
UNDERDRAINAGE

DETAIL 'Y'

DETAIL 'Z'

UNDERDRAINAGE BLANKET 2m BELOW LANDFILL
LINER WHERE GROUNDWATER MAY INTERSECT

FOR WORKS APPROVAL
01 JULY 2013

SCALE 7,5 0 7,5 15 30 37,5 (metres)
1 : 750 (A1); 1 : 1500 (A3)

REVISIONS				
No.	BY	DATE	DESCRIPTION	
B	S.BY.	01/07/13	GENERAL AMENDMENTS	
A	S.BY.	10/05/12	ISSUED FOR APPROVAL	

DRG. FILE	OV-WA-08	DATE
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DWG. CHK.	I.W.	

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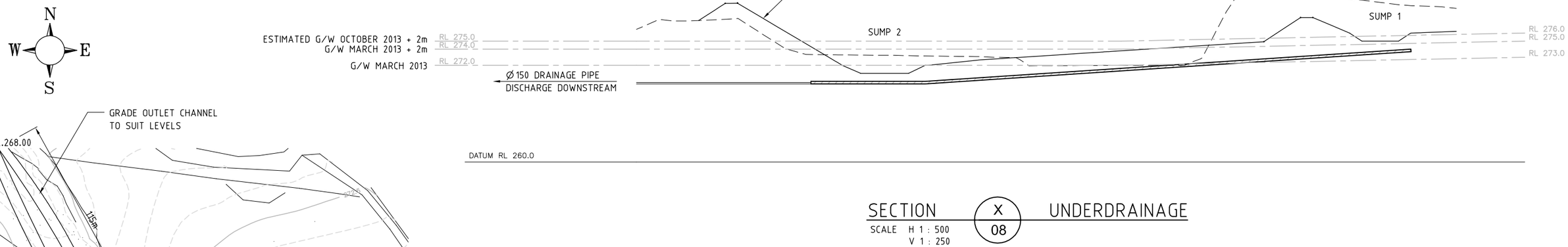
OPAL VALE PTY LTD

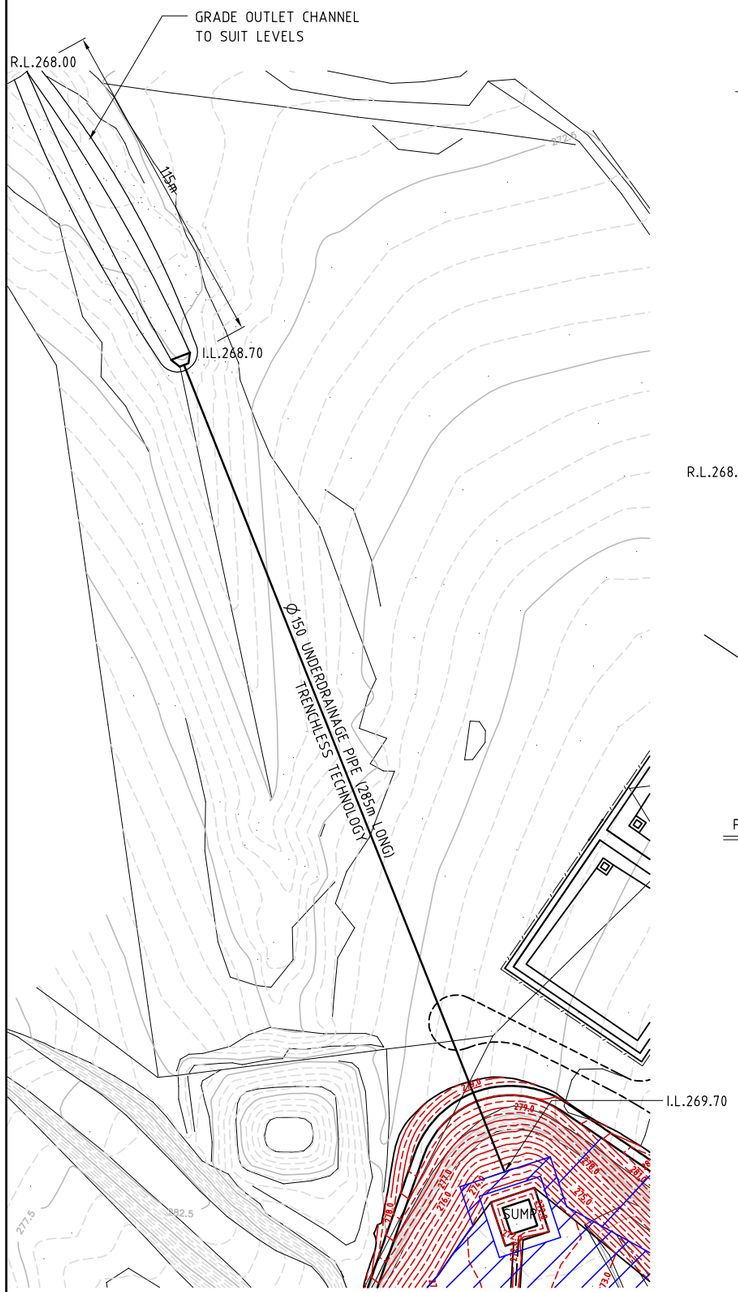
PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LANDFILL UNDERDRAINAGE BLANKET

SCALE	AS SHOWN
SHEET	08 of 09
DRG No.	REVISION B OV-WA-08



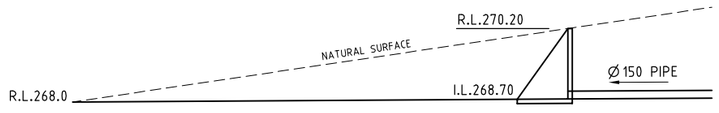
SECTION X 08 UNDERDRAINAGE

SCALE H 1 : 500
V 1 : 250



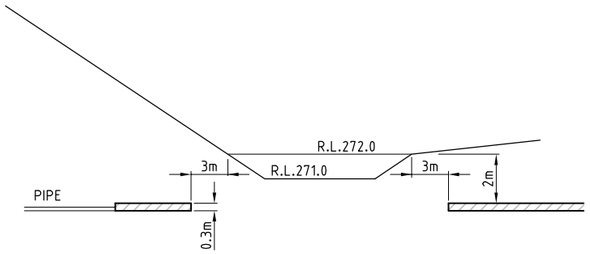
DRAINAGE PIPE LAYOUT PLAN

SCALE 1 : 1000



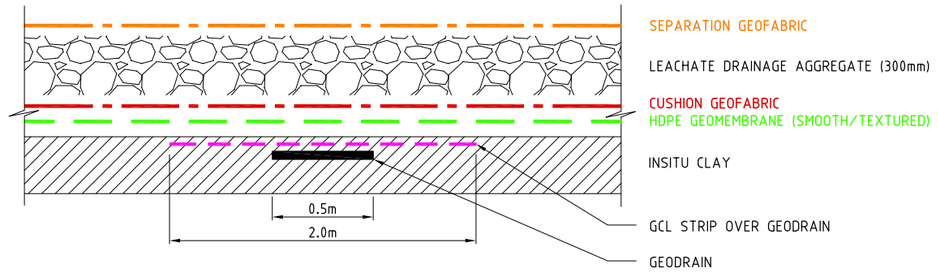
OUTLET DETAIL

NOT TO SCALE



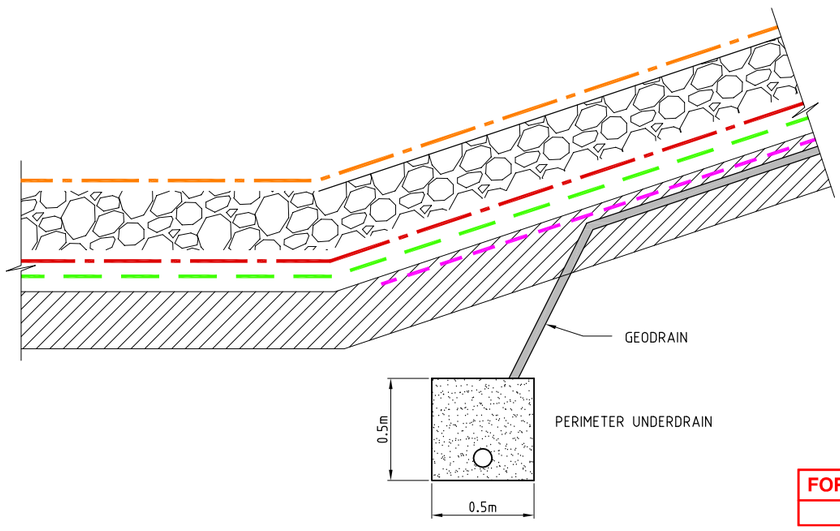
UNDER SUMP DETAIL

NOT TO SCALE



SIDE SLOPE UNDERDRAINAGE DETAIL 'Y'

NOT TO SCALE



PERIMETER UNDERDRAINAGE DETAIL 'Z'

NOT TO SCALE

FOR WORKS APPROVAL
01 JULY 2013

SCALE 10 0 10 20 30 40 50 (metres)
1 : 1,000 (A1), 1 : 2,000 (A3)

REVISIONS					DRG. FILE	OV-WA-08	DATE
					DESIGN	I.W / S.B.Y	05/12
B	S.BY.	01/07/13	GENERAL AMENDMENTS		DRAWN	S.B.Y.	05/12
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No.	BY	DATE	DESCRIPTION		DWG. CHK.	I.W.	

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OPAL VALE PTY LTD

PROPOSED CLASS II LANDFILL
LOT 11 CHITTY ROAD, TOODYAY
LANDFILL UNDERDRAINAGE DETAILS

SCALE	AS SHOWN
SHEET	09 of 09
DRG No.	REVISION B
	OV-WA-09

OPAL VALE PTY LTD

REPORT ON:

GROUND WATER ASSESSMENT,

11 CHITTY ROAD,

TOODYAY, WA

JANUARY 2012

Stass Environmental

Environmental Science & Engineering

REPORT TITLE: **GROUND WATER ASSESSMENT, 11 CHITTY ROAD, TOODYAY, WA.**

DATE: January 2012

REPORT VERSION: Version 1.3

P.O. Box 11
Kalamunda
WA 6926

Tel: +618 63635276
Fax: + 618 9454 7615

web: www.stass.com.au
email:info@stass.com.au

TABLE OF CONTENTS

FIGURES

APPEDICES

Stass Environmental
Environmental Science & Engineering

ABN 73 976 537 552

July 2011

GROUND WATER ASSESSMENT,
11 CHITTY ROAD ,
TOODYAY, WA

1 INTRODUCTION

Opal Vale Pty Ltd (Opal Vale) intends to develop a landfill on this site of the old clay pit at 11 Chitty Road, Toodyay, at some stage. To fulfill regulatory requirements, a ground water review had to be undertaken.

To be able to define the ground water conditions at the site, four ground water monitoring bores were installed to provide information on:

1. the depth of the water table,
2. the ground water quality; and
3. the geology below the site

The regional geology and hydrology of the area was reviewed by a literature review of available data on the region obtained from the Geological Survey of Western Australia.

The site was found to be located on fine clayey geologic materials with expected low transmissivity and ground water yield. This would suggest that the site is suitable for the activities which are intended by Opal Vale in that the impact on ground water from the proposed landfill is expected to be minimal if any.

This report provides the detail of the groundwater investigations and monitoring bore installation programme as well as the groundwater quality analytical results for the site.

2 OBJECTIVES

The objectives of this study are to:

- Review of available regional groundwater and geology data.
- Install groundwater monitoring bores to suit the proposed landfill
- Obtain baseline groundwater quality data from the site.
- Provide a detailed report on the work

3 TERMS OF REFERENCE

Mr. Sam Magione of Opal Vale Pty Ltd requested that Stass Environmental submit a proposal for the groundwater site assessment, baseline groundwater quality database and installation of groundwater monitoring bores at the Opal Vale facility.

4 SCOPE OF WORK

The following scope of work was carried out:

a) Review of all available data and reports

Review all available data on the ground water studies performed to date for the development.

b) Provide a short synthesis of the available information

The reviewed reports are to be synthesized into a short form format, to provide a summary of the groundwater status at the site.

c) Assessment of available information

The available information is to be assessed for correctness and adequacy in terms of the proposed development and installation and logging of monitoring bores.

d) Reporting

The information and the interpretation of the data are presented in this document as a stand-alone report.

5 DISCRIPTION OF THE REGION

5.1 LOCATION

The Toodyay geological zone lies approximately 70km east of Perth in Western Australia and covers an area of approximately 2km2 (Figure 1).

5.2 CLIMATE

The region experiences a Mediterranean climate, characterised by warm dry summers and cool wet winters. During summer (September to March) a belt of anticyclones lies over the region producing dry easterly winds and high temperatures. During winter this belt moves north and the predominant winds blow onshore from the south-west bringing cool temperatures and cold fronts that produce 90% of the region's total annual rainfall. Average annual rainfall varies between 300mm and 420mm and the average daily temperatures range from 17^{o}C to 30^{o}C in summer and from 6 ^{o}C to 17^{o}C in winter.

TABLE 1 Rainfall Records, Northam Station No 010111 (shown as mm/month)

Month	Mean 1902-2010	Mean 1980-2010	2010	2011
January	10.4	17.7	0.0	26.2
February	13.2	16.9	0.2	8.4
March	18.3	16	16.2	0.8
April	23.3	20.2	0.8	12.2
May	55.5	51.1	31.6	50
June	80.4	69.8	24.7	68.8
July	82.8	74.7	68.1	93.9
August	60.7	55.6	29.2	
September	37.0	39.2	16.6	
October	24.5	22.1	3.9	
November	12.2	17.3	9.5	
December	9.2	10.1	31.8	
TOTAL ANNUAL	427.2	410.8	232.6	

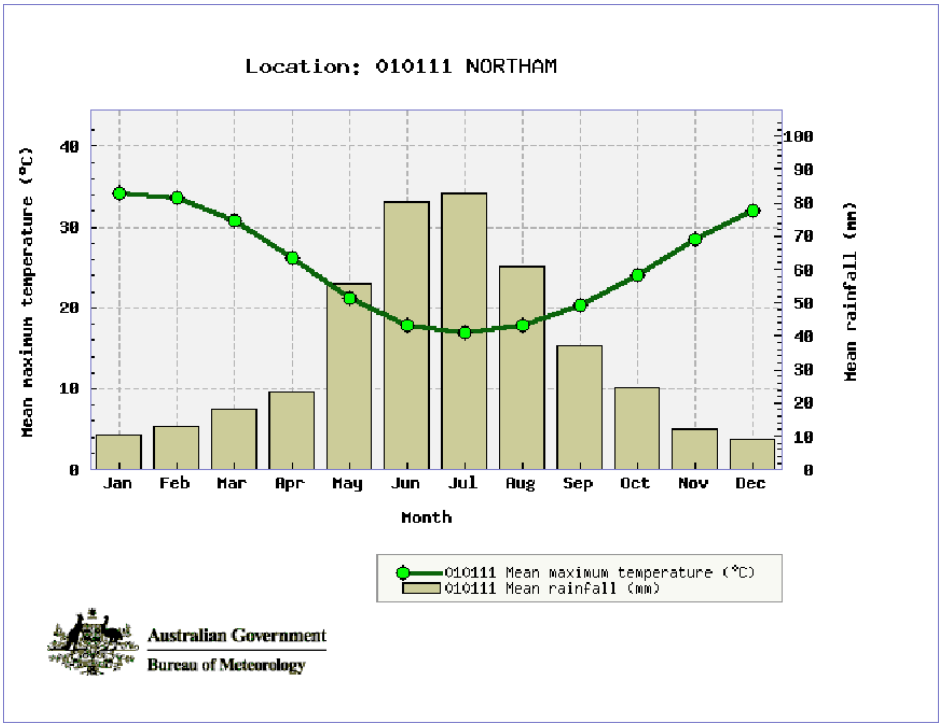
Over the period 1877 to the present the following rainfall statistics apply:

Mean – 427.2 mm/yr *Median* – N/A mm/yr

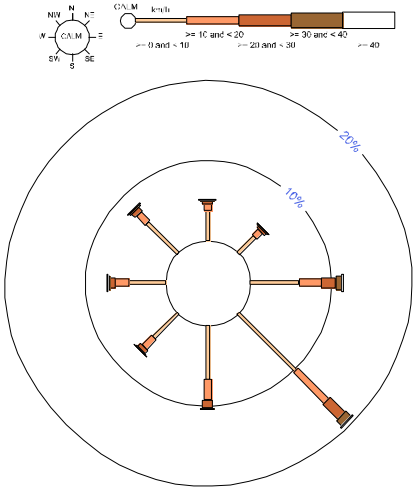
Lowest – 194.1 mm/yr *Highest* – 710.9 mm/yr

TABLE 2 Mean maximum temperature records, Northam, Station No.010111 (in degrees C)

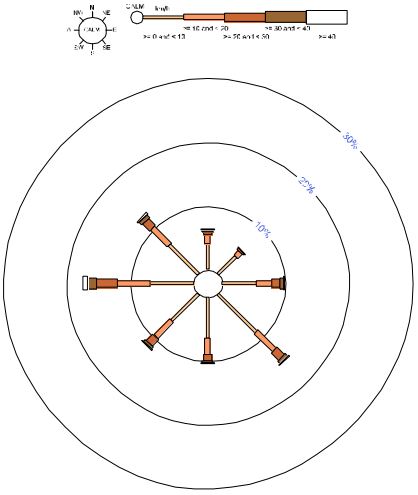
Month	Mean 1902-2010	2009	2010
January	34.2	36.4	37.3
February	33.7	33.9	36.1
March	30.8	30.7	32.0
April	26.1	28.1	27.6
May	21.2	23.7	22.3
June	17.9	18.6	18.4
July	16.9	16.7	17.1
August	17.9	18.7	18.6
September	20.4	18.5	22.1
October	24.0	25.2	26.6
November	28.5	29.8	31.7
December	32.1	34.4	32.1
Annual Average	25.3	26.2	26.8



Wind Roses – Annual wind direction and velocity statistics



Morning winds



Afternoon winds

5.3 GEOLOGY AND LANDFORMS

5.3.1 Geology - Regional

Main geological components of the southwest Yilgarn Craton

The area is characterized by discrete, linear metamorphic belts enveloped by diffiise areas of migmatite, containing isolated rafts of the earlier gneissic sequences (Wilde, 1990). The present distribution of gneiss and migmatite is largely controlled by the emplacement of Late Archaean granitoids which typically post-date metamorphism and regional tectonism. The high-grade gneisses and supracrustal rocks have been grouped within the Jimperding, Chittering and Balingup Metamorphic Belts (Wilde, 1980 and 1990). Migmatite is locally developed at the margins of these belts and also forms more extensive areas in the eastern part of the region. There are also a number of small greenstone belts, ranging in metamorphic grade from greenschist to granulite facies, widely distributed across the region (Fig. 1). All these sequences are intruded by a variety of granitoids, including charnockites in the east.

Metamorphic Belts

The chief rock-type in the Jimperding, Chittering and Balingup Metamorphic Belts is layered quartz-feldsparbiotite gneiss. Some units are paragneiss and show gradations to arkosic quartzite and quartz-mica schist and are interleaved with orthoquartzite, banded iron formation

and rare calc-silicate rocks. This association is a characteristic feature of the Jimperding Metamorphic Belt east and southeast of Toodyay and of the southeastern part of the Balingup belt. It has been interpreted as indicating stable shelf sedimentation on a pre-existing sialic basement (Gee ***et al.,*** 1981; Wilde, 1990). In contrast, the Chittering and western portion of the Balingup Metamorphic Belt consist mainly of pelite, semi-pelite and greywacke. Banded iron formation and quartzite are absent and this association has been interpreted to be the result of rapid, trough-style sedimentation along a continental margin (Gee ***et*** al.,1981; Wilde, 1990).

The Jimperding Metamorphic Belt shows a progressive eastward increase in metamorphic grade fiom lower amphibolite to granulite facies, with the presence of andalusite, sillimanite and cordierite indicating low pressure. In contrast, the Chittering and Balingup Metamorphic Belts are chiefly at amphibolite facies, with the presence of kyanite, sillimanite and staurolite indicating moderate pressure, Barrovian-type metamorphism (Wilde, 1990). This contrast in grade between the metamorphic belts appears to be in part related to their location, with the higher pressure assemblages occurring at the western margin of the craton, associated with ductile shear zones related toearly movement along the Darling Fault Zone (Blight ***et*** *aZ.,* 1981; Bretan, 1985). This zone has been reactivated at several later periods, resulting in local retrogression to greenschist facies assemblages.

Greenstone Belts

There are a number of small greenstone belts present in the Western Gneiss Terrain. In the southeastern portion (Fig. l), areas of mafic and felsic granulite are interleaved with a variety of metasedimentary rocks. These were interpreted as 'keels' of original greenstone belts by Wilson (1969) and this interpretation is supported by more recent work on the mafk granulites (Wilde and Pidgeon, 1987; Nemchin ***et aZ.,*** in press). The mineralogical features indicate that this area underwent low to moderate pressure granulite facies metamorphism and the enclosing granitoids commonly include hypersthene-bearing charnockites (Wilde, 1990).

Three lower grade greenstone belts are present near the western margin of the Yilgam Craton; the Saddleback, Morangup and Wongan Hills Greenstone Belts. The Saddleback Greenstone Belt (Wilde, 1976 and 1990) near Boddington (Fig. 1) is poorly-exposed due to an extensive cover of Tertiary laterite. It is composed of mafic and felsic volcanic rocks, with minor sedimentary units, metamorphosed to greenschist facies and generally in faulted contact with orthogneiss, migmatite and granite. However, in the extreme southwest, granite intrudes metasediments and felsic pyroclastic rocks (Wilde, 1976). The Morangup Greenstone Belt near Toodyay (Wilde and Pidgeon, 1990) consists predominantly of metabasalt with a greenschist facies assemblage of tremolite-actinolite, albite and clinozoisite. Porphyritic andesite and fine grained metasedimentary rocks are also present. The sequence is also poorly exposed and the full extent of the belt is unknown. The Wongan Hills Greenstone Belt consists predominantly of basalt, dacite, chert, banded iron formation and mica schist, interleaved with paragneiss and intruded by small ultramafic units, all metamorphosed to

upper amphibolite facies (Carter and Lipple, 1982). The presence of cordierite indicates low pressure conditions, similar to those in the nearby Jimperding Metamorphic Belt (Pidgeon ***et al.,*** 1990).

Granitoids

Granitoids occur as two large batholiths that occupy a considerable portion of the southwest Yilgarn Craton. The granitoids east of Meckering and Quairading and around Lake Grace were informally referred to as the "Wheat Belt" granites by Wilson (1958), whereas the western area has been termed the Darling Range Batholith (Wilde and Low, 1978). The zone of mignatite referred to above separates the two batholithic areas.

Around Katanning), many porphyritic granites are hypersthene-bearing and petrographically and geochemically identical to those developed further east within the zone of migmatite and gneiss south of Quairading and in the "Wheat Belt" batholith. Wilde and Pidgeon (1987) describe reaction textures from near Lake Grace which indicate that hypersthene and subsequent mafic minerals followed a ma,matic crystallisation sequence and that these charnockites are of igneous origin.

The ,mnitoids of the Darling Range Batholith are quite diverse and show considerable textural variation. They range in composition from granodiorite to granite; the compositional variations being commonly independent of textural changes. Where cross-cutting relations can be identified, granodiorite is invariably the earliest phase. Most granitoids are undeformed, although plutons of porphyritic granite that occur close to the eastern boundaries of the Chittering and Balingup Metamorphic Belts show evidence of intense ductile shearing. There is a westward increase in deformation, resulting in a progressive change from porphyritic granite to augen gneiss, mylonite and ultramylonite (Blight ***et aL,*** 1981). This deformation is related to early movement along the Darling Fault Zone, accompanied by medium pressure, amphibolite facies metamorphism (Wilde, 1990).

There are also a number of small bodies of quartz-poor granitoids of dioritic, monzonitic and syenitic affinity within the granite batholiths. More extensive areas of quartz monzonite occur south of Darkan (Fig. 1) and these are rich in amphibolite xenoliths. A distinctive, tectonised quartz monzonite (the Gibralter Quartz Monzonite) forms a narrow, discontinuous zone along the eastern boundary of the Balingup Metamorphic Belt (Wilde and Walker, 1982 and 1984) in association with migmatite.

5.3.2 Geology - Site

The site is located on the dissected Darling Plateau. The locality consists of an elongate narrow plateau remnant that runs north west along the ridge line in the west, at an elevation of 280 metres AHD ranging down to about 240 metres in the north west.

The general area is located in a drainage basin of the Avon River system and geologically, is are part of the Pre-Cambrian meta sedimentary complex which is known as the Jimperding Metamorphic Belt. The Jimperding Metamorphic Belt Series extends as a 120 kilometre long belt in a northwesterly direction from York to Clackline and from there to Jimperding and then Chittering, where it becomes the higher grade metamorphic Chittering Metamorphic Belt.

Williamson's Pit is located on the crest of a hill, at an elevation of about 290 metres AHD.

To the west of the pit the land is gently undulating before sloping relatively uniformly to the river flat. To the immediate east of the pit the land slopes gently down to a small drainage line (draining from south to north) at about 280 metres and from there the land slopes gently upwards to about 330 metres.

The Jimperding Series consists of inter-bedded schists, quartzites and minor metamorphosed volcanics. They are steeply dipping and trend northerly and then northwesterly. However under the void only weathered schists are encountered, because these are the only parts of the regolith that are suitable for brick manufacture.

The area to be filled is a void cut into deep micaceous clays formed from the weathering of schists of the Jimperding Metamorphic Belt. The rocks are predominantly weathered andalusite and kaolin-quartz-mica schists that are near vertical and striking generally north. These schists have been subjected to a long period of weathering, in the Mesozoic - Cainozoic, to produce the laterite erosion surface, of which a remnant caps the nearby hills.

Weathering of the rocks is deep, and, from a drilling program conducted by Austral Brick, shows the depth of weathering as over 30 metres. The base of the weathered material was not found because the clay quality reduced with depth and drilling was stopped.

Williamson's Pit is located in an area of micaceous silty clay which becomes fresher with depth and shows some laterisation. Clayey sands are present in small amounts.

Only clays suitable for brick making are excavated.

5.3.3 Soils

The soils which overly the clay belong to the Yalanbee and Leaver soil landscape units. In the vicinity of Williamson's Pit is a yellow gravelly loamy sand and loam which overlies sandy clay at a depth of about 0.5 metres.

6 SITE HYDROGEOLOGY

6.1 Regional Hydrogeology – Previous Investigations

The local hydrogeology has been characterised from an interpretation of the exploration drilling undertaken by Austral Brick and hydrogeological studies completed by Martinick McNulty in 1998.

On 24 March 1998 ten holes were drilled by Wallis Drilling with a Mantis drilling rig which was mounted on a Toyota Landcruiser, to assess the local geology and groundwater conditions.

Water was generally not encountered during drilling, with the exception of some holes which are located approximately 1 kilometre to the northwest of the pit. In these holes granite was intersected and water was found to be present in weathered basement.

Hydraulic testing of all of the monitoring bores (WF 1 to WF 11) was undertaken by Martinick McNaulty to determine the in-situ hydraulic properties of the schistose clay. Testing comprised injection of a known volume of water into the bore and subsequently monitoring the rate at which the water level declined. Analysis of the response was completed using the Bower and Rice method.

From the results of the hydraulic testing it was concluded by Martinick McNulty, that the schistose clay present in the pit and its vicinity has a low to very low permeability and that the ground water regime in that area is classified as an aquiclude. That is to say, although groundwater is present there is no defined aquifer system. The sandy clays are partially saturated and the local groundwater levels vary with changes in topography.

6.1.1 Permeability

Six piezometers were installed by Martinick/McNulty around the perimeter and another four within the clay pit at that time. Whilst the clay pit has been enlarged in the past decade, the results provide a good indication of the geotechnical properties of the weathered schist.

In each piezometer a PVC standpipe of 50 millimetre diameter was installed immediately after the hole was drilled. The casing was slotted for the entire depth of the hole and all of the

piezometers were surveyed by Scanlan Surveying in May 1998. A summary of monitoring bore details is provided in Table 3 (Martinick McNaulty 2002).

Two clay samples were collected by Martinick/McNaulty from the floor of Williamson's Pit adjacent to bores WF2 and WF4. These samples were analysed for particle size distribution, optimal moisture content for compaction and permeability of the con Site clay.

Table 3 Permeability Testing (Martinick McNaulty 1998)

Drill Hole	East	North	Top of Casing	SWL mAHD	Permeability m/d	Permeability m/s
WF1	449865	6449588	88.41	81.91	0.0164	1.1 x 10-7
WF2	449915	6495825	89.2	81.69	0.0041	4.7 x 10-8
WF3	449761	6495895	82.07	80.71	0.0037	4.2 x 10-8
WF4	449870	6495734	86	81.2	0.0064	7.4 x 10-8
WF5	449756	6496127	85.5	80.49	0.038	4.4 x 10-7
WF6	49956 6	495896	99.57	85.3	0.00034	3.0 x 10-9
WF7	449845	6495626	86.37	80.99	0.0017	1.9 x 10-8
WF9	449658	6495750	90.5	86.89	0.006	6.9 x 10-8
WF10	0449632	6495903	86.44	83.90	0.0030	3.4 x 10-8
WF11	1449606	6495610	84.62	80.88	0.0204	2.4 x 10-7

The distribution of particle sizes demonstrated that the material in Williamson's Pit consists of a clayey silty sand with minor gravel. The clay content varies from 4 to 8%, the silt content varies from 26% to 33% silt, and the sand content varies from 53 to 56%.

The falling head permeability tests for samples compacted to 90% standard compaction at optimal moisture content, gave coefficients of permeability of $3.12xI0^{-9}$ and $1.49x10^{-8}$ metres per second respectively for WF2 and WF4. The compaction tests indicate that maximum dry densities of 1.87 and 1.74 tonnes per cubic metre at optimum moisture contents of 13% and 17% could be achieved for the material obtained from WF2 and WF4, respectively.

The above tests indicate that the clay can be used as landfill liner material, if compacted.

6.2 REGIONAL GROUNDWATER QUALITY

The regional ground water quality is highly variable, with water quality ranging from 500 mg/l as TDS to 3000 mg/l TDS. Ground water tends to be slightly acidic with pH in the range of 4 to 5 not uncommon.

7 MONITORING BORE INSTALLATION

Drilling at the site commenced in June 2011 and was completed in 5 days. All fieldwork undertaken, including a summary of the investigation methodology utilised is summarised in the following sections in chronological order.

7.1 LOCATION OF GROUNDWATER MONITOR WELLS

7.1.1 Previously Installed Monitor Wells

No previously installed wells are present on site. Other bores in the general area to 2 km radius, registered with Department of Water are shown below. No registered bores are located within a radius of 2 km from the site. The nearest bore is located 2.2 km up hydraulic ground water gradient, to the east of the site.

7.1.2 Monitor Well Site Selection

Four new groundwater monitor wells (designated SE-1 to SE 4) were installed at the site during this investigation. The locations for these wells were selected after an evaluation of the regional groundwater flow direction (previous ground water monitoring).

Monitor wells SE-1 to SE 3 were installed within the south-western (downgradient of the proposed landfill) areas. Monitor well SE 4 targeted the aquifer up-hydraulic gradient boundaries of the site. Prior to the commencement of drilling activities, all services within the site area were identified and located to prevent potential damage. Accurate locations of the four newly installed monitoring bores are shown on Figure 6.

7.1.3 Drilling

The four monitor wells (SE1 to SE4) were installed by Mick Lewis Drilling under supervision by Stass Environmental using the downhole hammer rotary drilling technique (refer Appendix A, Photographs 1). At all drilling locations, natural clays and muscovite schists were encountered throughout the entire profile therefore allowing trouble free well completion.

Drilling locations SE 1 to SE 4

- After positioning the drill rig, 150mm diameter holes were drilled to approximately 60m.
- The casing was inserted and sand packed to one metre above the slotted interval (see Figure 8 to 11).

- Bentonite pellets were placed immediately above the sand packing and measured with a weighted tape until a one metre thick seal was formed.

- The annulus of the hole was backfilled with local drilled materials to the ground surface and sealed with bentonite at the surface to prevent surface water leakage to groundwater.

Steel protective surface covers, protruding approximately 600mm above the ground surface were also installed over all PVC casings and lockable with padlocks. Monitor well logs and construction diagrams are contained within Appendix B.

7.1.4 Development

Immediately following well installation, monitor wells SE-1 SE 4 were developed to remove sediment initially using compressed air from the drill rig and later an electric submersible pump (Grundfoss MP1).

7.1.5 Position and level survey

A position and level survey was undertaken by a licensed surveyor to determine Australian Map Grid (AMG) coordinates and Australian Height Datum (AHD) elevations of each monitor well casing including the pre-existing and newly installed monitor wells. During the level survey, elevations of each monitor well were obtained from the highest point on the bore protective cover opening, which was also permanently marked for future reference. These reference points were used during the collection of water levels as described in Section 7.6. The results of this position and level survey are shown below:

Table 4 MONITOR WELL SURVEY DATA

Monitor Well	Easting (mAMG)	Northing (mAMG)	PVC Casing Elevation (mAHD)	Ground Level (mAHD)	Descriptive Location
SE1	449807.2	6495636	274.4	273.9	Close to drainage line
SE 2	449616.1	6495914	285.58	285.08	Along the downgrad. Road
SE 3	449383	6496194	291.64	291.14	Along the downgrad. Road
SE 4	450377.9	6495786	299.86	299.36	Upstream of quarry

Note: mAHD – metres above Australian Height Datum

mAMG – metres relative to Australian Map Grid

All positions were determined by a licensed surveyor using a differential GPS instrumentation, calibrated to within +/- 2m accuracy. AHD elevations were surveyed to +/- 1mm. These levels of accuracy are judged to be within the requirements of this study.

7.1.6 Water Level Measurement

Water levels were measured in all monitor wells on-site prior to the purging and sampling of each well (described in Section 7). These levels were assessed to be suitable for hydrogeological interpretation. These levels, reduced to AHD using the level survey data are shown below.

Table 5 WATER LEVEL DATA

	Easting	Northing	Collar RL	Stick up mBTOC	SWL	SWL mAHD
SE 1	449807.2	6495636	274.4	0.5	7.41	266.49
SE 2	449616.1	6495914	285.58	0.5	13.39	271.69
SE 3	449383	6496194	291.64	0.5	14.52	276.62
SE 4	450377.9	6495786	299.86	0.5	18.21	281.15

Note: mAHD – metres above Australian Height Datum

mBTOC – metres below top of survey mark on monitor well casing

7.1.7 Purging and Sampling

Groundwater samples were obtained from a total of 4 locations on and around the site from the 4 new monitoring wells. Prior to sampling, each monitor well was purged at a rate of approximately 5 L/min using a decontaminated submersible pump for a minimum of 15 minutes (i.e. purge volume of greater than 75L).

Groundwater samples were collected in laboratory supplied and preservative treated containers from each monitor well after withdrawing the submersible pump. A new disposable bailer was used for sample collection at each well. All samples were stored on ice and

transported to Analytical Reference Laboratories (ARL) of Welshpool for analysis with appropriate chain-of-custody documentation. In addition, one blank sample (designated SE 5) obtained by passing scheme water through the sampling equipment were obtained and submitted for quality control purposes.

The results of these analyses are provided in the Appendix D.

7.1.8 Field Water Quality Data

Water quality of the ground water samples was tested in the field. The following results were recorded:

Table 6 Field water quality record (June 2011)

Bore ID	pH	Elect. Cond Us/cm	TDS ppm	REDOX	TEMP
SE 1	4.28	4060	2340	145	16
SE 2	4.99	4890	2830	105	15.5
SE 3	4.41	8090	4790	136	16.2
SE 4	6.2	430	223	38	16

8 LABORATORY ANALYSIS

8.1 Analytes

All groundwater and quality control samples were analysed using National Association of Testing Authorities (NATA) registered methods and analytical techniques for the following determinants.

- Major anions and cations, pH, conductivity, ammoniacal nitrogen and total dissolved solids (TDS);
- Heavy metals including arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury;

The chain-of-custody documentation and analytical data as presented by ARL appears within Appendix C.

8.2 Quality Control

The following sections describe the testing methodologies and quality assurance/quality control (QA/QC) procedures used for analysis of the water samples obtained during the field activities.

8.3 Field Duplicates and Blank Samples

One field blank sample (designated SE-5) was obtained. The results of the field duplicate and blank analyses are included in the Appendix C.

The Relative Percentage Difference (RPD) values calculated for the duplicated groundwater analysis ranged from incalculable where results were below laboratory practical quantitation limits (PQLs).

Analysis of the blank groundwater sample (designated SE 5) reported concentrations below the respective practical quantization limits (PQLs). Expected background concentrations were reported for major anions, cations and the heavy metals analyses conducted.

8.4 Laboratory Control Samples, Spike Recoveries, Duplicates and Blanks

Laboratory control and spiked spike samples were analysed by ARL for all analytes (where applicable). All recovery results were within recommended control limits, indicating the results of the sample analyses are adequate for the purposes of this report, with a general tendency to slightly overestimate the concentrations of each individual analyte. All laboratory blank samples reported concentrations less than the PQL.

Laboratory duplicate analysis was conducted for heavy metals, cations, anions, ammoniacal nitrogen and total nitrogen. All RPDs were well within acceptable limits.

9 GROUNDWATER QUALITY

The groundwater analytical results are summarised in Appendix C. Based on the analytical results obtained, the following conclusions can be derived.

9.1 Major Ions and Groundwater Parameters

Analysis of groundwater samples reported all major ions and parameters

9.2 Heavy Metals

Analysis of all downgradient groundwater reported dissolved heavy metal concentrations above the DEC (2010) water guidelines. Bores SE 1, SE 2 and SE 3 are located downgradient of the proposed landfill and water within these bores is characterised by relatively high salinity (ranging some 2000 to 5000 mg/l as TDS), the presence of some heavy metals (arsenic, cadmium, copper, nickel, lead and zinc) and low (acidic) pH. In general, the water quality downgradient of the proposed landfill can be described as poor to very poor, and few recognised beneficial uses (see Table 7 below). It is not compatible with DEC fresh water guidelines or the Australian Drinking Water Guidelines (2004).

Analysis of all groundwater samples from bore SE4 which is located upgradient of the proposed site, reported all relevant analytical determinant concentrations were below the DEC (2010) water quality guideline values for ecological levels. The water quality in this bore can be considered as very good (TDS less than 300 mg/l and pH close to neutral) and compatible with domestic (health) and ecological water quality guidelines.

Table 7 – Water Quality Results (Heavy Metals)

Determinant	MDL	MB SE 1	MB SE 2	MB SE 3	MB SE 4	CONTROL
Arsenic	0.001	0.002	0.006	0.002	0.001	<0.0001
Cadmium	0.002	<0.002	<0.002	**0.037**	<0.002	<0.002
Chromium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.01	0.45	0.30	**4.4**	0.01	0.01
Manganese	0.01	0.20	**0.79**	**1.7**	0.05	<0.01
Nickel	0.01	**0.17**	**0.48**	**3.4**	0.01	<0.01
Lead	0.01	**0.06**	**0.02**	**0.03**	<0.01	<0.01
Zinc	0.01	0.21	0.48	2.6	0.01	<0.001

Notes on the table:

MDL – Method Level of Detection.
All results in mg/l.
Values in bold exceed drinking water guidelines

10 GROUNDWATER CONDITIONS

10.1 Groundwater Hydraulics

Ground water was inferred to be flowing in a south-westerly direction, based on the measured depth to groundwater in each monitor well and the results of the level survey. Figure 4 illustrates the direction of groundwater flow based on lines of equal potential derived from the groundwater elevation in each monitor well (Section 7).

Ground water (as a deep confined aquifer) appears to exist underneath the whole of the proposed landfill. The flow direction is to the south west, with a relatively steep hydraulic gradient of approximately 0.013.

10.2 Ground Water Calculations of Flow and Fate

Darcy's Law is the basic equation which describes fluid flow through porous media. The Darcy velocity equation is:

$$V = -K(\Delta H/\Delta L)$$

where;

K - is the conductivity term in m/day
V – is the velocity term in m/day
H- is the head term in metres
L – is distance in metres.

The flux inflow from the site would be expected along the full breadth of the site (1000 m). The ground water elevation difference is 13 m, so the gradient can be calculated as 0.013.

Hydraulic conductivity is assumed as 0.04 m/day (silty clay) to allow for the worst case conditions scenario. The porosity value of 8% refers to the effective porosity (sometimes described as specific yield or drainable porosity) which is used in calculations. The equivalent total porosity in clays/silts would be in the order of 46% (ref. "Field Hydrogeology", 2007, Rick Brassington, pp.30-31).

From this, the output to the calculation is that:

- Linear flow velocity is 0.0065 m/day (6.5 mm/day)
- Darcy Flux is – 0.00052 m^3/day/m (0.5 litres/day)

The resulting computation for flow velocity and flux suggest that the local aquifer should be considered an aquitard rather than an aquifer, and not a beneficial water resource (irrespective of water quality). The potential water yield from this water body is well below the acceptable abstraction rate of 0.5l/sec for domestic usage.

The water strikes, which were close to 50 m below the surface and were from a confined water body, took 24 and up to 48 hours to stabilise in the bores, further showing that the natural ground hydraulic conductivity is very low indeed.

10.3 Conceptual Hydrogeological Model

A conceptual groundwater model has been derived from a review of previous reports relating to the drilling, and the recent installation of piezometers in the area.

Figure 7 illustrates the major features of the conceptual hydrogeological model of the quarry area and surrounds. The major elements of the model are:

- A steep ground water gradient.
- The aquifer/aquitard which is located in weathered micaceous schists at depth and is confined by between 30 and 50 m thick bed of micaceous to gritty clays, from the ground surface (see Figure 5). This indicates that the aquifer/aquitard is separated from the surface by 30m (in the east) to 50m (in the west) of clay beds. This indicates that the depth to water increases westwards.
- Conclusion is that this is a deep sitting confined aquifer, with relatively poor water yield.
- Significant upward piezometric pressure due to confinement by clay rich stratigraphy and steep aquifer gradient.
- Stabilised potentiometric head relatively close to the surface (within 10 to 20 m from the surface). Potentiometric head is the result of the confining pressure at the aquifer level. Lateral ground water flow is likely to be restricted by the clay rich mineralisation, resulting in poor transmissivity. This was shown by the relatively long time it took the monitoring bores to stabilise a SWL.
- Geological logs for the bores drilled during June 2011 are shown in Figures 8 to 11.

10.3.1 Groundwater flow

The potentiometric water-table elevation is shown in Figure 4 and the aquifer/aquitard location is derived from the water strikes recorded during drilling of the monitoring bores.

The local land gradient is towards the North West, but the ground water flow direction is recorded to the South West, calculated from the potentiometric isoclines.

11 CONCLUSIONS

On the basis of this study, the following conclusions are reached:

- The site is underlain by a confined aquifer/aquitard of limited extent which is confined by thick beds of clays and weathered schist/quartzite.
- Based on the water yield and aquifer physical characteristics, the water body can be defined as a confined aquitard.
- The water quality in downgradient bores is poor, indicating impacts from salinity and geological weathering of in situ mineralisation (presence of heavy metals).
- While the yield from the aquifer has not been tested, the geological materials recovered from the drilling suggest that this aquifer is potentially low yielding with poor aquifer transmissivity (low hydraulic conductivity).
- The recently installed bores are adequately located to define the local aquifers and are suitably positioned for monitoring of the ground water below the site.
- The groundwater conditions at the site are favorable for the development of a waste management facility as the aquifer below and adjacent to the site cannot be considered a beneficial water resource due to likely low yielding water characteristics and poor water quality. This observation is related to the significant clay content in the matrix of the geologic materials recorded during installation of the site groundwater monitoring bores".

- The beneficial ground water use in the area is considered to be sufficient for “stock watering”.

- Water yields from bores adjacent to the site are likely to be poor.

12 RECOMMENDATIONS

The following recommendations are made, based on the investigations to date:

- Ground water monitoring pre commissioning and at the start of operations should be more frequent to develop a good seasonally adjusted data base for the site. Therefore we recommend that a quarterly frequency be adopted for the first two years and thereafter a decision can be as to the most suitable monitoring frequency in consultation with the DEC.

- As the downgradient ground water quality exceeds the DEC guidelines for fresh waters, it is recommended that the baseline water quality survey data is used as water quality triggers. If required, these water quality analyses can be performed again to confirm the water quality data base currently available.

- Static water level (SWL) of the ground water should be monitored at a monthly interval for the first 12 months after monitoring bore installation to develop a record of water level variability between the seasons.

13 REFERENCES

- Department of Environment and Conservation, 2010. – Contaminated Sites Management Series.

- Department of Environment and Conservation, 2005. – The use of risk assessment in contaminated site assessment.

- Wilde, S. A. 1994. Crustal Evolution OF The South Western Yilgam Craton. Geological Society OF Australia (WA, DIVISION) EXCURSION GUIDEBOOK, 7,20P.

- Landform Research, 2009. Management and Rehabilitation Program of Clay Pit Class 11 Landfill, Lot M2027, Chitty Road, Toodyay, Opal Vale Pty Ltd.

14 GLOSSARY OF TERMS

Abstraction Pumping groundwater from an aquifer.

AHD Australian Height Datum; equivalent to: Mean Sea Level (MSL) + 0.026 m; Low Water Mark Fremantle (LWMF) + 0.756 m.

Alluvium Unconsolidated sediments transported by streams and rivers and deposited.

AMG Australian Map Grid.

Anticline Sedimentary strata folded in an arch.

Aquifer A geological formation or group of ormations able to receive, store and transmit significant quantities of water.

Confined A permeable bed saturated with water and lying between an upper and a lower confining layer of low permeability.

Baseflow Portion of river and streamflow coming from groundwater discharge.

Basement Competent rock formations underneath sediments.

Bore Small diameter well, usually drilled with machinery.

bns Below natural surface.

Colluvium Material transported by gravity downhill of slopes.

Confining bed Sedimentary bed of very low hydraulic conductivity.

Conformably Sediments deposited in a continuous sequence without a break.

Conductivity The flow through a unit crosssectional area of an aquifer under a unit hydraulic gradient.

Dewatering Abstraction of groundwater from bores to assist in mining.

Evapotranspiration A collective term for evaporation and transpiration.

Gradient The rate of change of total head per unit distance of flow at a given point and in a given direction.

Head The height of the free surface of a body of water above a given subsurface point.

Hydraulic Pertaining to groundwater motion.

Flux Flow.

Fault A fracture in rocks or sediments along which there has been an observable displacement.

Formation A group of rocks or sediments which have certain characteristics in common, were deposited about the same geological period, and which constitute a convenient unit for description.

Porosity The ratio of the volume of void spaces, to the total volume of a rock matrix.

Potentiometric An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a bore.

Specific yield The volume of water than an unconfined aquifer releases from storage per unit surface area of the surface.

Semi-confined A semi-confined or a leaky aquifer is saturated and bounded above by a semi-permeable layer and below by a layer that is either impermeable or semi-permeable.

Semi-unconfined Intermediate between semiconfined and unconfined, when the upper semi-permeable layer easily transmits water.

Unconfined A permeable bed only partially filled water and overlying a relatively impermeable layer. Its upper boundary is formed by a free watertable or phreatic level under atmospheric pressure.

Transmissivity The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.

Transpiration The loss of water vapour from a plant, mainly through the leaves.

Watertable The surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

Well Large diameter bore, usually dug by hand.

15 LIMITATIONS

1. The conclusions presented in this report are relevant to the condition of the site and the state of legislation currently enacted as at the date of this report. We do not make any representation or warranty that the conclusions in this report will be applicable in the future as there may be changes in the condition of the site, applicable legislation or other factors that would affect the conclusions contained in this report.

2. Stass Environmental has used a degree of skill and care ordinarily exercised by reputable members of our profession practicing in the same or similar locality. Conclusions are based on representative samples or locations at the site, the intensity of those samples being in accordance with the usual levels of testing carried out for this type of investigation. Due to the inherent variability in natural soils we cannot warrant that the whole overall condition of the site is identical or substantially similar to the representative samples.

3. This report has been prepared for Opal Vale and for the specific purpose to which it refers. No responsibility is accepted to any third party and neither the whole of the report or any part or reference thereto may be published in any document, statement or circular nor in any communication with third parties without our prior written approval of the form and context in which it will appear.

4. This report and the information contained in it is the intellectual property of Stass Environmental. Opal Vale is granted an exclusive licence for the use of the report for the purpose described in the report.

APPENDIX A

Figures

Figure 1 : Location of the Site

Stass Environmental

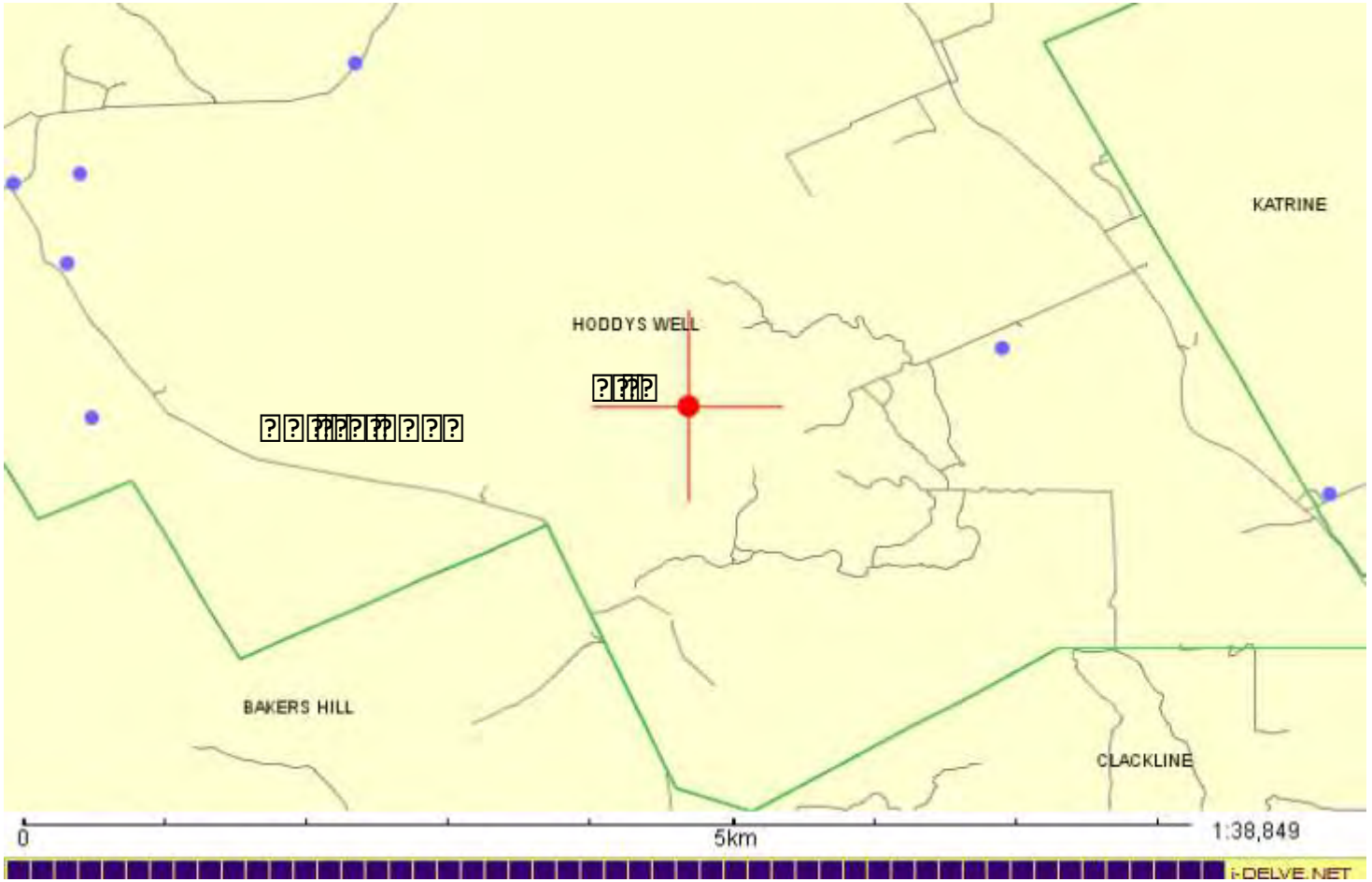
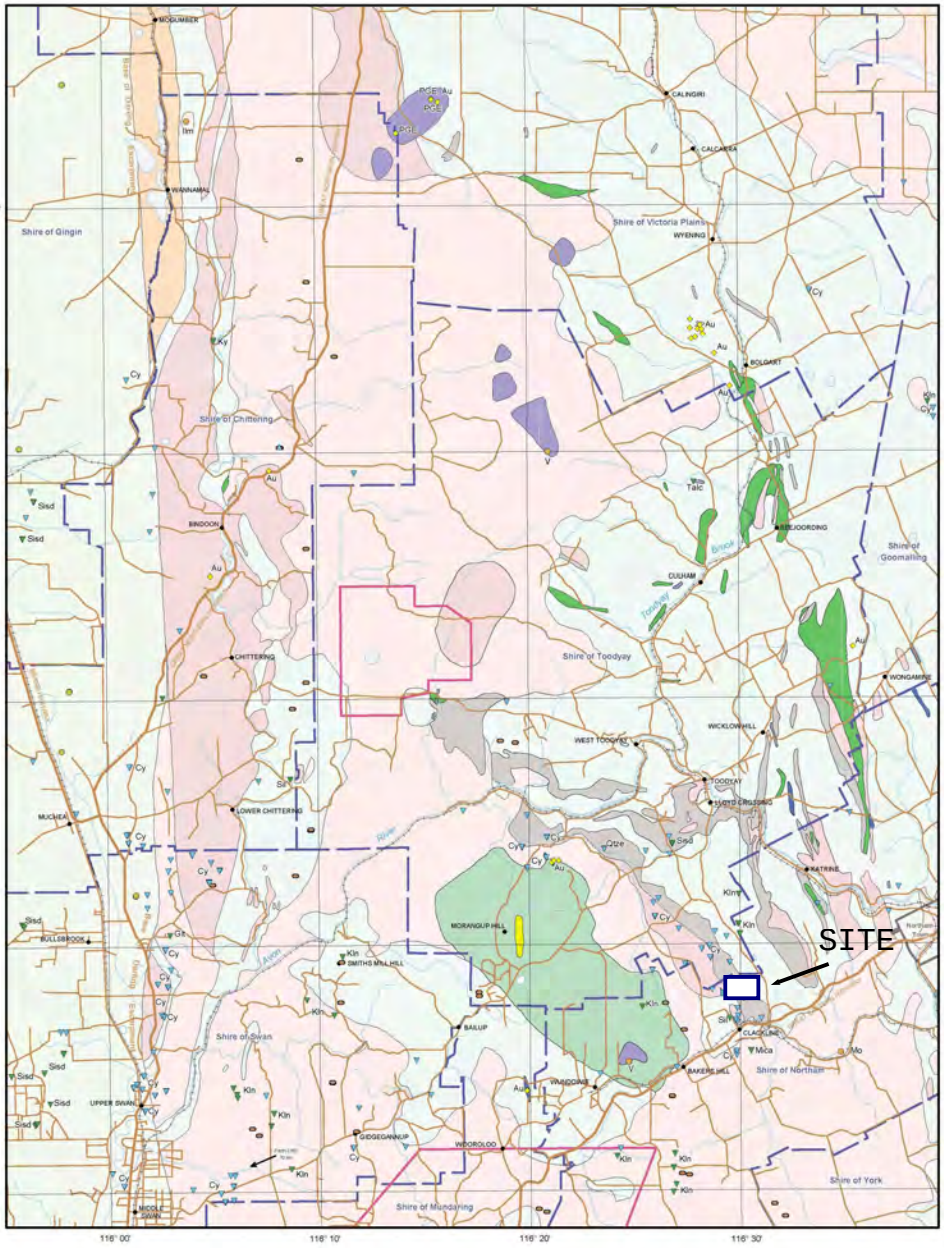


Figure 1a : Registered bores adjacent to site

Figure 2 : Site Layout and Monitoring Bore Locations

Stass Environmental



RESOURCE POTENTIAL FOR LAND USE PLANNING

TOODYAY AREA

Rock types	Mineral potential	Regional planning implications
Sedimentary rocks of the Perth Basin		
Granitic rock	Low for gold, high for dimension stone	
Granite, gneiss, migmatite	Unknown	
Schist, granofels	High for industrial minerals (sillimanite, kyanite, graphite)	
Calc-silicate gneiss, mylonite	High for base and other metals (copper, zinc, and lead)	
Banded iron-formation, metamorphosed	High for iron ore	
Quartzite	High for construction materials (crushed rock) and building stone	
Felsic volcanic rock, metamorphosed	High for gold and base metals	
Mafic volcanic rock, metamorphosed	Very high for gold	
Altered mafic intrusive to volcanic rock, metamorphosed	Very high for gold	
Mafic to ultramafic rock, metamorphosed	Very high for platinum group metals and steel industry metals	

Overlying weathered materials (widespread but not shown on map)

Laterite; widespread on hills	Very high for bauxite, gold, and ironstone gravel
Alluvial and eolian sand; in valleys	Very high for construction sands

Mineral occurrences, deposits, and mines by groups	Resource
Precious metal	Gold (Au), platinum-group metals (PGE)
Steel industry metal	Vanadium (V), molybdenum (Mo)
Specialty metal	Heavy mineral sands (zircon and titanium minerals)
Iron	Iron ore
Alumina	Bauxite
Industrial mineral	Ilmenite (Ilm), glauconite (Glt), kyanite (Ky), sillimanite (Sil), silica sand (Sisd), kaolin (Kln), mica, talc
Construction material	Unspecified unless indicated; rock, sand, gravel, clay (Cy), quartzite as dimension stone (Qtze)

(Note, may not include mines authorized by Shires)

- Geological boundary
- Major road / Highway
- Minor road
- Railway
- Localities
- Town of Northam
- Shire boundary
- Watercourse
- Waterbody
- Bauxite tenement (Mining Lease 1SA)

N

Department of Industry and Resources

Geological Survey of Western Australia

SCALE 1: 200 000

5000 0 10

Metres Kilometres

Figure 3 - Geology of the Area

Stass Environmental

Figure 4 : Static Water Level and Ground Water Flow Direction - June 2011

Stass Environmental

Figure 5 : Depth to water strikes recorded during drilling

Stass Environmental

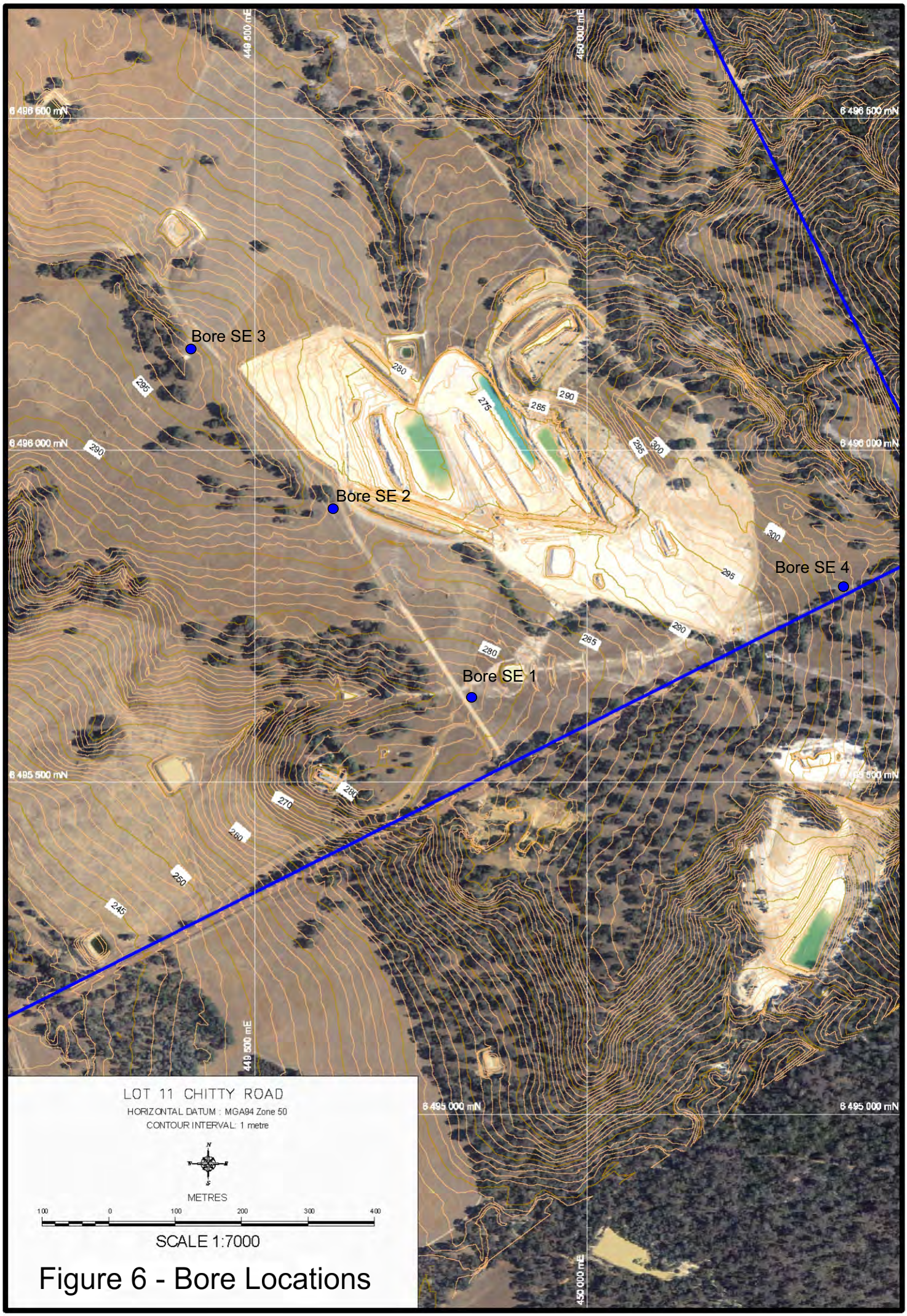


Figure 6 - Bore Locations

Opalvale Quarry, Chitty Road
Ground Water Conceptual Model

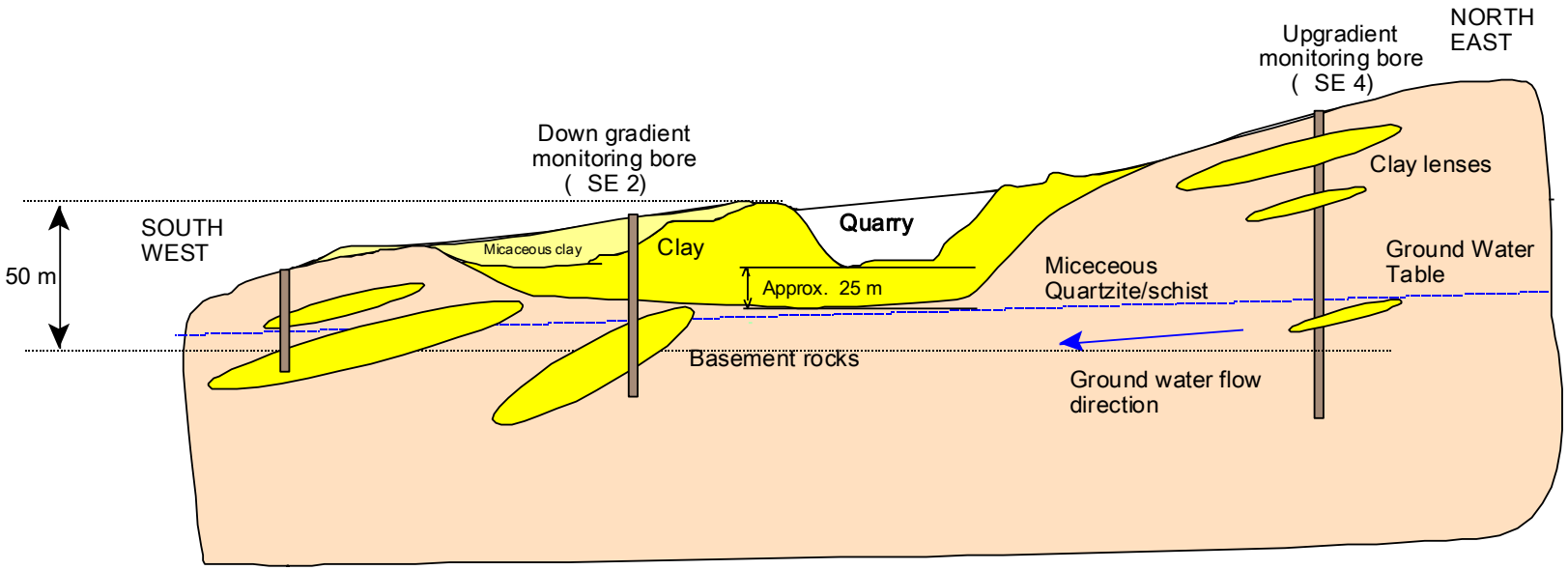


Figure 7 : Geohydrological Conceptual Model

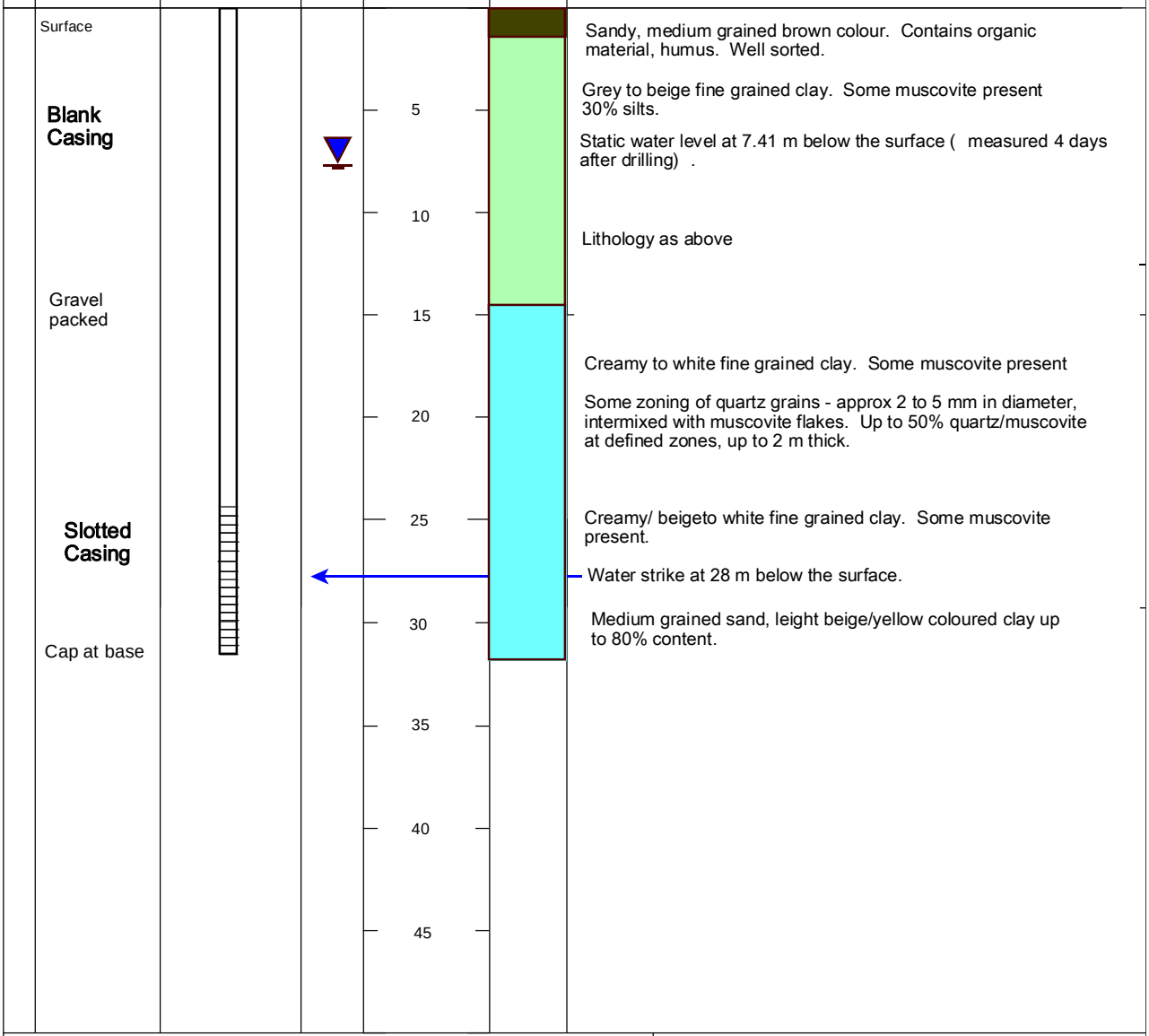
Stass Environmental

BORE CONSTRUCTION

Stass Environmental

Coords: 449807.2 East 6495636 North

Drill Rig: Mick Lewis Drilling DHH	Date Drilled: 27 June 2011	Logged By: A. Stass
Boring Dia: Auger 150 mm	Boring Number: Bore SE 1	



Completion Notes:

Piezometer SE1

Class 12, 55 mm blank PVC casing from 0 to 26m bgs;
Class 12, 55 mm, slotted, PVC casing from 26 to 32 mbgs;

Colar is set at 0.55 m above gs

Water field quality: pH = 4.28, EC = 4060 uS/cm, TDS 2340 mg/l
REDOX = 145 mV

Piezometer was capped at base.

Site:

Opalvale Clay Quarry
11 Chitty Road
Toodyay

Project No.: Ovale 001

Page 1

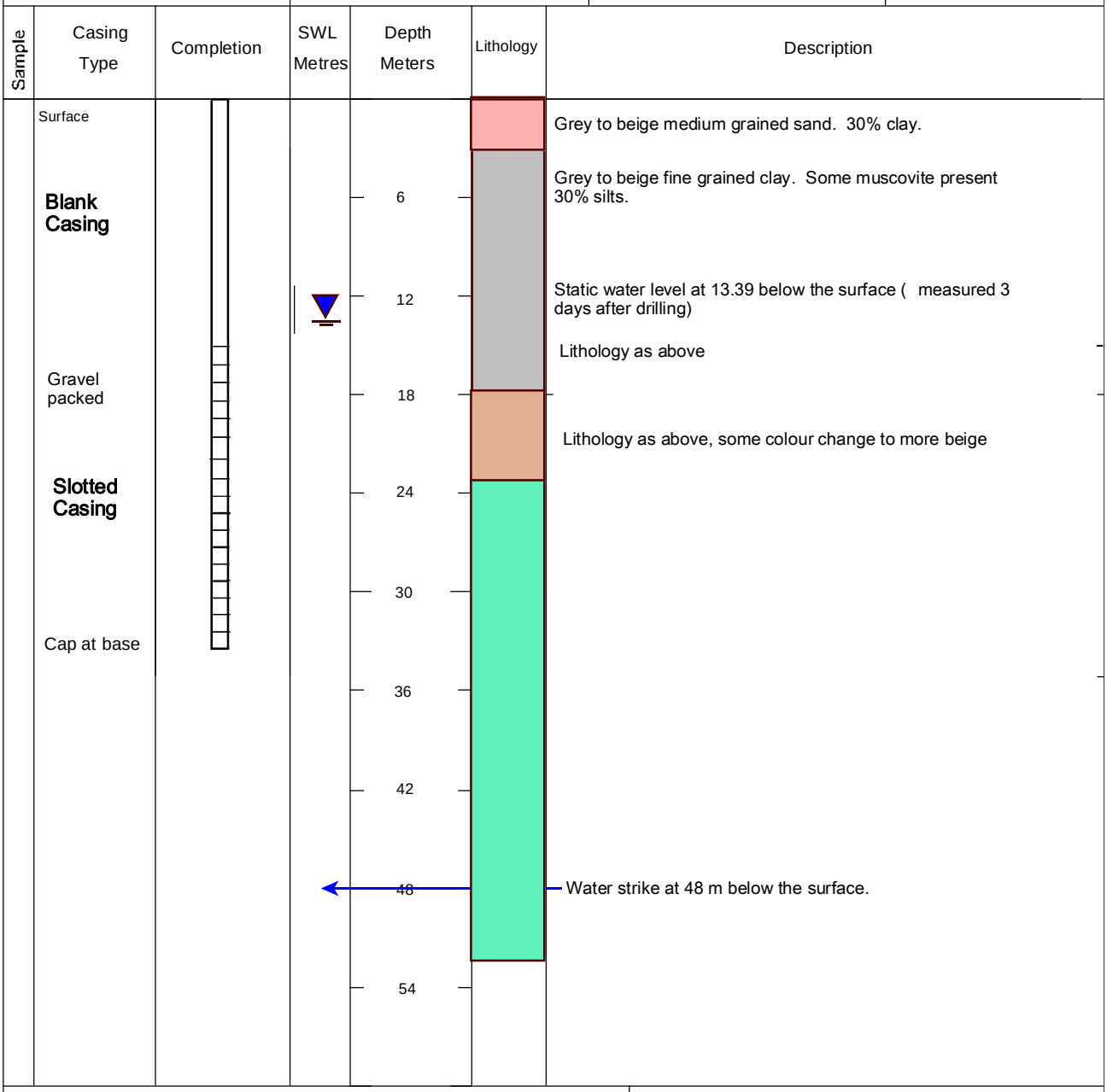
Figure 8 - Geological and construction log of Bore SE 1

BORE CONSTRUCTION

Stass Environmental

Coords: 449616.1East by 6495914 North

Drill Rig: Mick Lewis Drilling DHH	Date Drilled: 27 June 2011	Logged By: A. Stass
Boring Dia: DHH 150 mm	Boring Number: Bore SE 2	



Completion Notes:

Piezometer SE 2

Class 12, 55 mm blank PVC casing from 0 to 47 mbgs;
Class 12, 55 mm, slotted, PVC casing from 47 to 53 mbgs;
Colar is set at 0.55 m above g.s.

Water field quality: pH = 4.99, EC = 4890 uS/cm, TDS 2830 mg/l
REDOX = 105 mV

Piezometer was capped at base.

Site:

Opalvale Clay Quarry
11 Chitty Road
Toodyay

Project No.: Ovale001 | Page 1

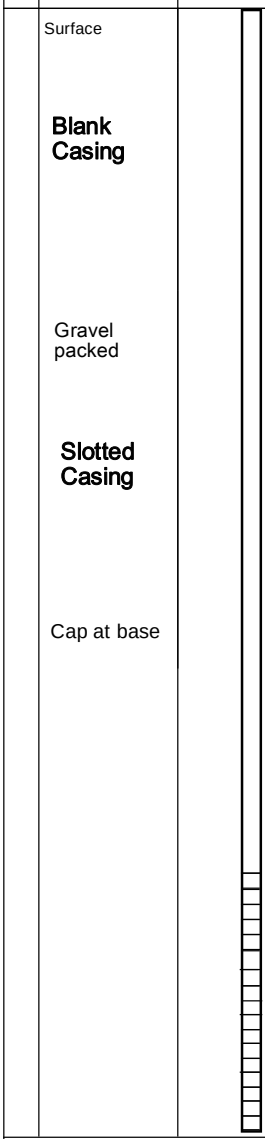
Figure 9 - Geological and construction log of Bore SE 2

BORE CONSTRUCTION

Stass Environmental

Coords: 449382.96 East by 6496193 North, RL 291.64 mAHD

Drill Rig: Mick Lewis Drilling DHH	Date Drilled: 30 June 2011	Logged By: A. Stass
Boring Dia: DHH 150 mm	Boring Number: Bore SE 3	



Depth Meters	Description
	Grey to beige medium grained sand. 30% clay.
6	Creamy white clay. Some muscovite present 30% silts.
12	Static water level at 14.52 below the surface (measured 1 day after drilling)
18	Grey clay, some visible mica, then some colour change to more beige/cream
24	Yellow to beige clay
30	light grey to beige clay - visible mica some muscovite mica 1mm to 15 mm across
36	
42	Creamy to grey clay, gritty with quartz grains, also some plagioclase feldspar. Clay becoming moist at 47 m depth
48	Water strike at 48 m below the surface.
54	Wet grey clay very gritty with quartz grains - grit up to 40% of content. Grit at approx 1 mm diameter
58	

Completion Notes:

Piezometer SE 2

Class 12, 55 mm blank PVC casing from 0 to 46 mbgs;
Class 12, 55 mm, slotted, PVC casing from 46 to 58mbgs;
Colar is set at 0.55 m above g.s.

Water field quality: pH = 4.41, EC = 8090 uS/cm, TDS 4790 mg/l
REDOX = 135 mV

Piezometer was capped at base.

Site:

Opalvale Clay Quarry
11 Chitty Road
Toodyay

Project No.: Ovale001

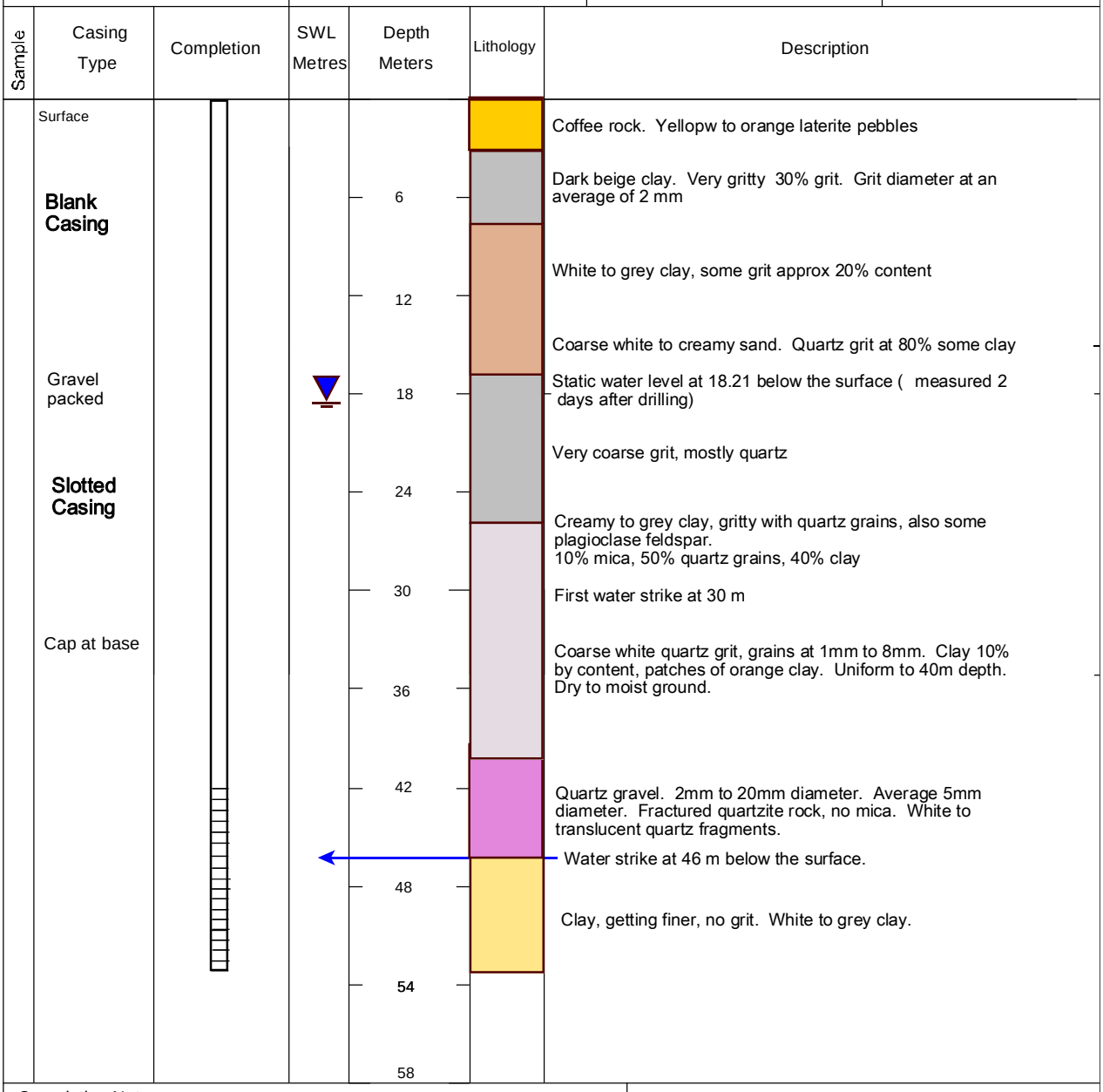
Figure 10 - Geological and construction log of Bore SE 3

BORE CONSTRUCTION

Stass Environmental

Coords: 450377.89 East by 6495785.76 North, RL 299.86 mAHD

Drill Rig: Mick Lewis Drilling DHH	Date Drilled: 29 June 2011	Logged By: A. Stass
Boring Dia: DHH 150 mm	Boring Number: Bore SE 4	



Completion Notes:

Piezometer SE 2
Class 12, 55 mm blank PVC casing from 0 to 42 mbgs;
Class 12, 55 mm, slotted, PVC casing from 42 to 53mbgs;
Colar is set at 0.55 m above g.s.

Water field quality: pH = 6.2, EC = 430 uS/cm, TDS 223 mg/l
REDOX = 38 mV

Piezometer was capped at base.

Site:

Opalvale Clay Quarry
11 Chitty Road
Toodyay

Project No.: Ovale001 | Page 4

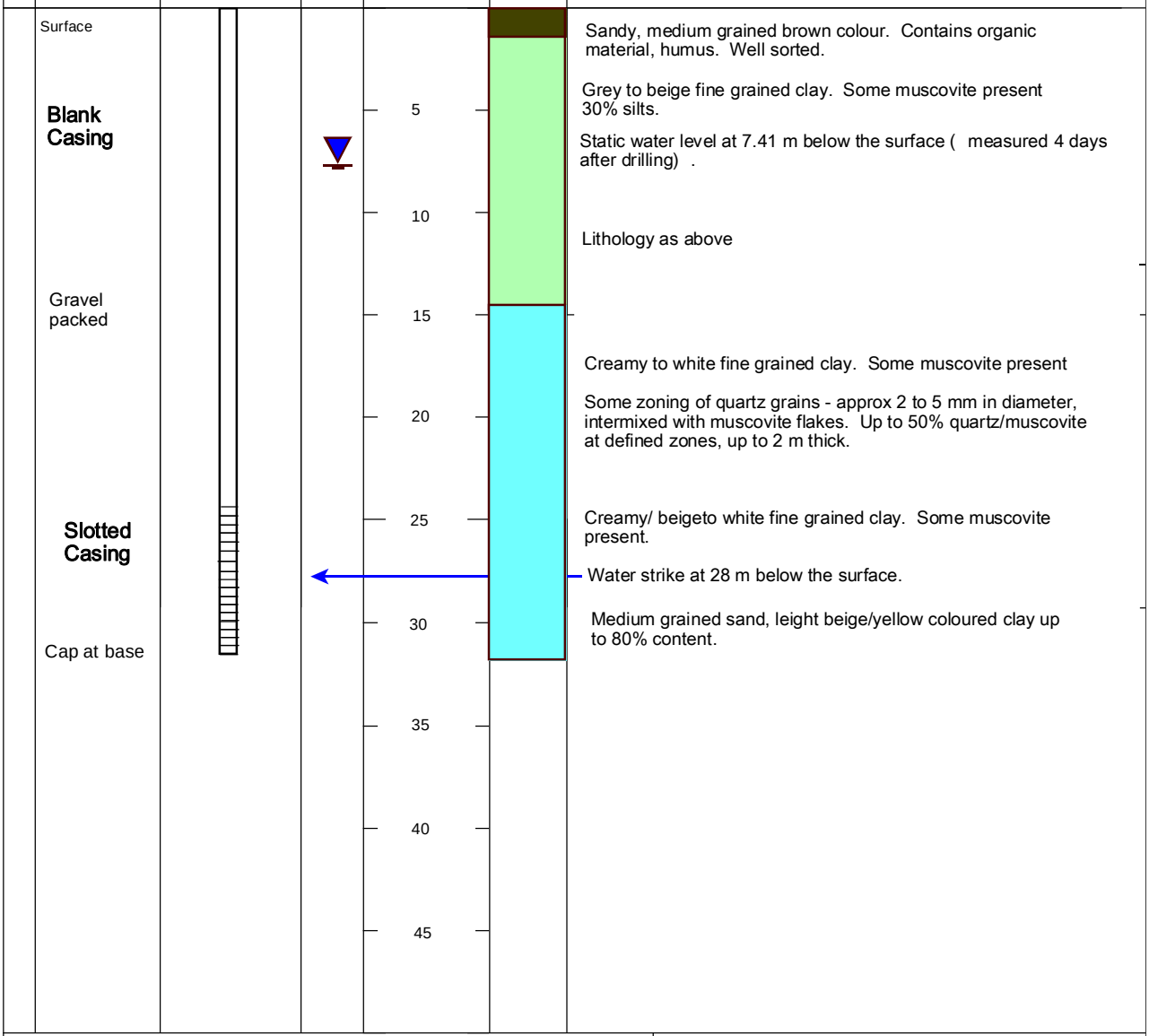
Figure 11 - Geological and construction log of Bore SE 4

BORE CONSTRUCTION

Stass Environmental

Coords: 449807.2 East 6495636 North

Drill Rig: Mick Lewis Drilling DHH	Date Drilled: 27 June 2011	Logged By: A. Stass
Boring Dia: Auger 150 mm	Boring Number: Bore SE 1	



Completion Notes:

Piezometer SE1

Class 12, 55 mm blank PVC casing from 0 to 26m bgs;
Class 12, 55 mm, slotted, PVC casing from 26 to 32 mbgs;

Colar is set at 0.55 m above gs

Water field quality: pH = 4.28, EC = 4060 uS/cm, TDS 2340 mg/l
REDOX = 145 mV

Piezometer was capped at base.

Site:

Opalvale Clay Quarry
11 Chitty Road
Toodyay

Project No.: Ovale 001

Page 1

Figure 8 - Geological and construction log of Bore SE 1

APPENDIX B

Photographs

Visible geology in quarry embankments

Bore SE 1 – recovered materials

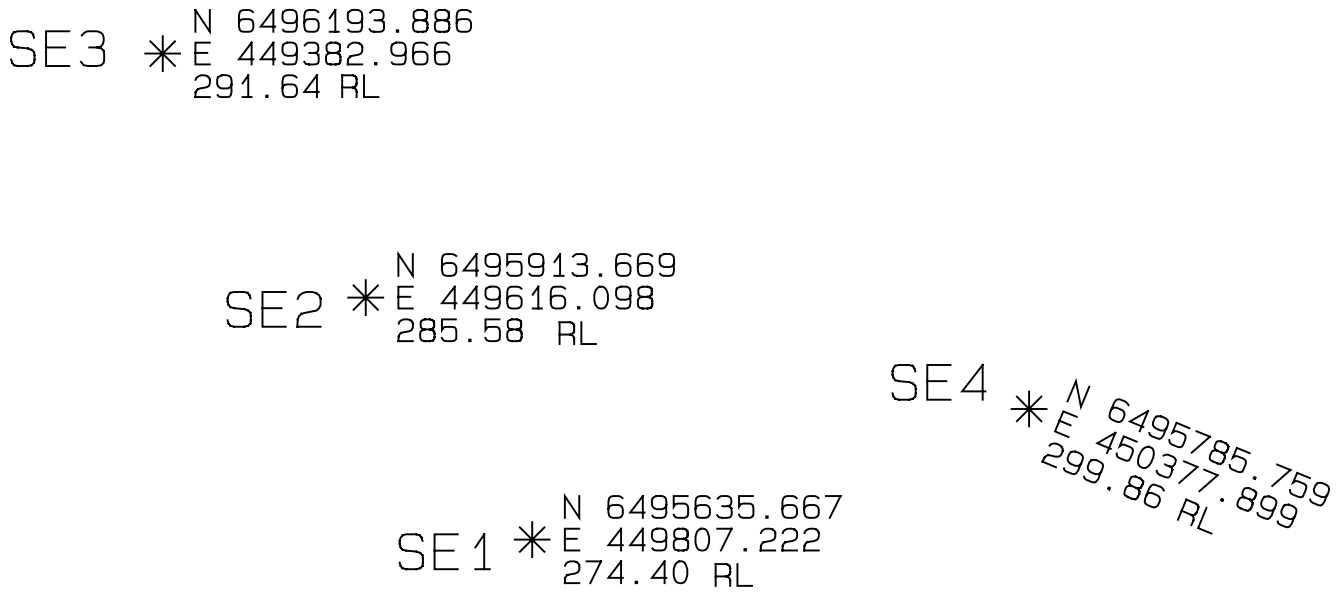
Bore SE 2 Drilling logs

Bore SE 3 – recovered materials

Bore SE 4 – recovered materials

APPENDIX C

Survey Report



BORE LOCATION: LOT 11 CHITTY RD
TOODYAY.

HORIZONTAL DATUM : GDA MGA ZONE 50

VERTICAL DATUM : AHD

APPENDIX D

Chain of Custody

11-4452

Stass Environmental
PO Box 11
Kalamunda, WA 6926
Ph (08) 63635276
Fx (08) 94547615

CHAIN OF CUSTODY & ANALYSIS REQUEST

LAB ARL
ADDRESS
LAB CONTACT
PHONE

PROJECT # OV01
PROJECT NAME: Opalvale CHITTY
COLLECTORS NAME: AWS
LAB JOB #

PRELIM. RESULTS BY: ☐ VERBAL ☐ FAX ☑ EMAIL
andre@stass.com.au
FINAL REPORT BY:
LAB QUOTE REF:

SAMPLE ID	DEPTH (metres)	LAB #	MATRIX: WATER	SOIL	SWAB	SLUDGE	PRESERVATION METHOD: ICE	ACIDIFIED	OTHER	NONE	SAMPLING DATE	No. OF CONTAINERS	PHENOL SP.	ANALYSIS REQUIRED & METHOD CODE: TPH	BTEX (PURGE & TRAP)	CO3 HCO3	PAH	Total Nitrogen	Na, Ca, K, Mg	NO3, NH4	scan	As, Cd, Cr, Cu, Mn, Ni, Pb, Zn	FILTER prior to testing	pH	Conductivity (mS/m)	TDS (mg/l)	REMARKS
DISCRETE SAMPLE REQUEST:																											
SE1			*				*				1-Jul-11	1						*				*	*	*	*	*	email results to
SE2			*				*				1-Jul-11	1						*				*	*	*	*	*	andre@stass.com.au
SE3			*				*				1-Jul-11	1						*				*	*	*	*	*	
SE4			*				*				4-Jul-11	1						*				*	*	*	*	*	
SE5			*				*				4-Jul-11	1						*				*	*	*	*	*	
COMPOSITE SAMPLE REQUEST:																											

6/7/11
Amanda
S
S

Relinquished by: Andre Stasikowski — Date 6/7/11 — Time
Received by: — Date 07/07/2011 — Time 1:40

Relinquished by: — Date — Time
Received by: — Date — Time

Custody Seals Intact? Yes / No
Samples Received Chilled? Yes / No

Additional Comments:
Queries to Andre at 6363 5276

APPENDIX E

Laboratory Certificate and Results

LABORATORY REPORT

ARL Lab No: 11-4452
Date: 25 July 2011

CLIENT: Stass Environmental
PO Box 11
KALAMUNDA WA 6926

ATTENTION: Andre Stasikowski

SAMPLE DESCRIPTION: Five water samples as received for analysis of conductivity, total nitrogen, pH, total dissolved solids and metals.

DATE RECEIVED: 06 July 2011

LOCATION / JOB NO: OV01 - Opalvale CHITTY

PURCHASE ORDER: NA

METHOD REFERENCES:

pH in Water	ARL No. 014
Total Dissolved Solids in Water	ARL No. 017
Conductivity and Salinity in Water	ARL No. 019
Metals in Water	ARL No. 402, 403
Total Nitrogen	ARL No. 330

Kim Rodgers
Laboratory Manager

Analytical Reference Laboratory (WA) Pty. Ltd.
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsimile: 08 6253 4440
www.arlwa.com.au ABN: 91 050 159 898

Metals Quality Control Data

	Matrix Spike	Certified Reference Material
	% Recovery	
Arsenic	104%	122%
Cadmium	118%	114%
Chromium	89%	113%
Copper	94%	98%
Manganese	96%	97%
Nickel	98%	101%
Lead	104%	107%
Zinc	106%	101%

Nutrients Quality Control Data

	Matrix Spike	Certified Reference Material
	% Recovery	
Total Nitrogen	104%	108%

Inorganics Quality Control Data

	Matrix Spike	Certified Reference Material
	% Recovery	
pH	-	101%
Conductivity	-	105%
Total Dissolved Solids	-	97%

Nutrients

Date Prepared **6/07/2011**
Date Analysed **7/07/2011**

ARL Lab No	Method Detection Limit	11-4452-1	11-4452-2	11-4452-3	11-4452-4	11-4452-5
Sample Marks		SE1	SE	SE3	SE4	SE5
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Total Nitrogen	0.2	0.4	0.3	0.4	7.1	< 0.2

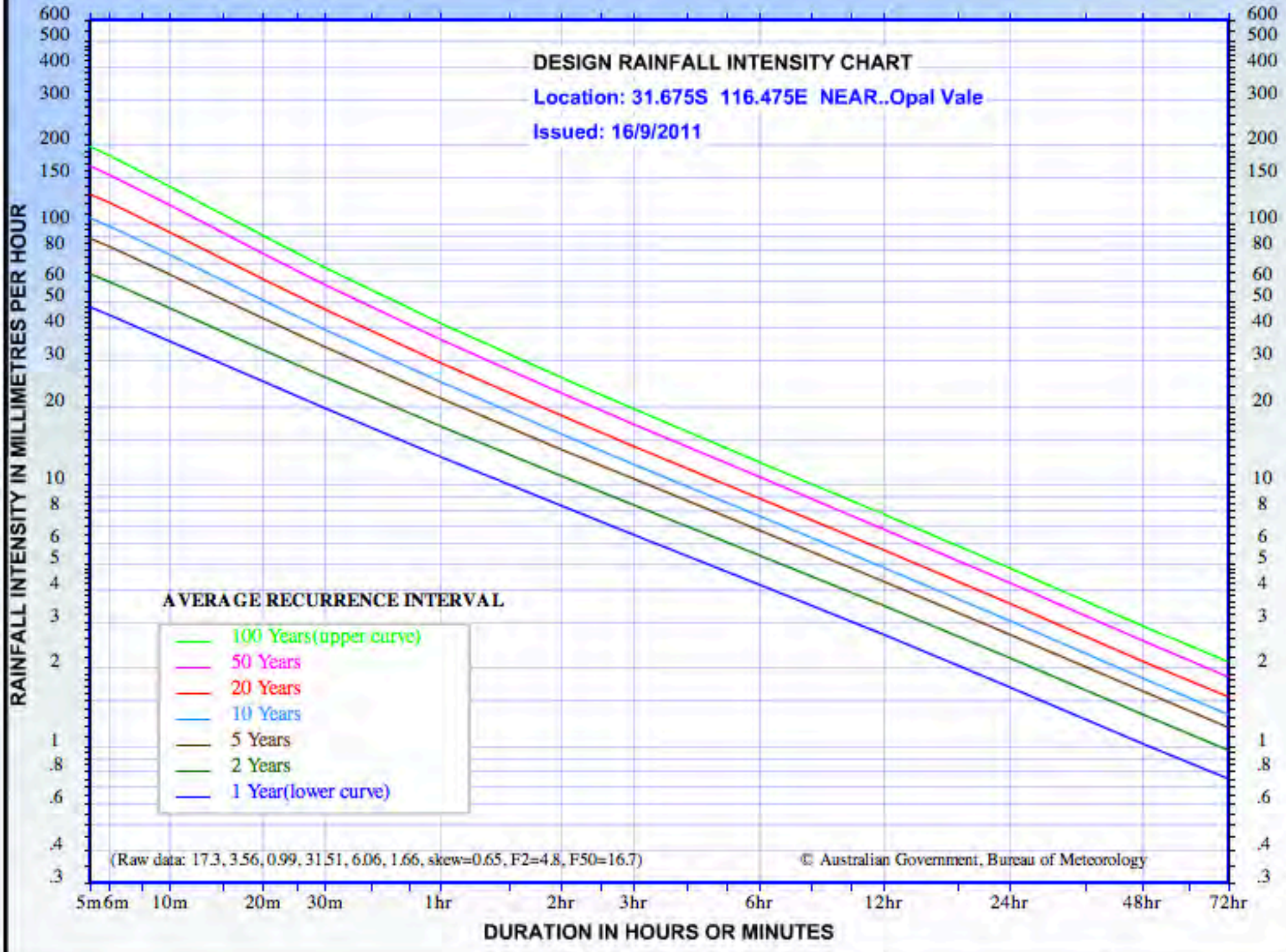
Metals

Date Prepared **7/07/2011**
Date Analysed **8/07/2011, 14/07/2011**

ARL Lab No	Method Detection Limit	11-4452-1	11-4452-2	11-4452-3	11-4452-4	11-4452-5
Sample Marks		SE1	SE	SE3	SE4	SE5
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Arsenic	0.001	0.002	0.006	0.002	0.001	< 0.001
Cadmium	0.002	< 0.002	< 0.002	0.037	< 0.002	< 0.002
Chromium	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Copper	0.01	0.45	0.30	4.4	0.01	0.01
Manganese	0.01	0.20	0.79	1.7	0.05	< 0.01
Nickel	0.01	0.17	0.48	3.4	0.01	< 0.01
Lead	0.01	0.06	0.02	0.03	< 0.01	< 0.01
Zinc	0.01	0.21	0.48	2.6	0.01	< 0.01

Stass Environmental
ARL Lab No: 11-4452
25 July 2011

ARL Lab No	Date Analysed	Units	Method Detection Limit	11-4452-1	11-4452-2	11-4452-3	11-4452-4	11-4452-5
Sample Marks				SE1	SE	SE3	SE4	SE5
pH	7/07/2011	#	-	4.4	4.9	4.3	6.4	7.5
Conductivity	7/07/2011	mS/cm	0.01	4.8	5.6	9.0	0.50	0.60
Total Dissolved Solids	7/07/2011	mg/l	5	2800	3500	5700	280	310


DESIGN RAINFALL INTENSITY CHART
Location: 31.675S 116.475E NEAR..Opal Vale
Issued: 16/9/2011
RAINFALL INTENSITY IN MILLIMETRES PER HOUR
600
500
400
300
200
150
100
80
60
50
40
30
20
10
8
6
5
4
3
2
1
.8
.6
.4
.3
AVERAGE RECURRENCE INTERVAL
100 Years(upper curve)
50 Years
20 Years
10 Years
5 Years
2 Years
1 Year(lower curve)
(Raw data: 17.3, 3.56, 0.99, 31.51, 6.06, 1.66, skew=0.65, F2=4.8, F50=16.7)
© Australian Government, Bureau of Meteorology
5m 6m 10m 20m 30m 1hr 2hr 3hr 6hr 12hr 24hr 48hr 72hr
DURATION IN HOURS OR MINUTES

Opal Vale Evaporation Calculations

Northam Weather Data (with the exception of the evaporation data, which comes from Perth Airport)

	Summer					Winter			Summer				
Month	January	February	March	April	May	June	July	August	September	October	November	December	Total
Days per Month	31	28	31	30	31	30	31	31	30	31	30	31	365
Temperature (Highest)	46.20	48.10	43.90	39.50	35.20	27.20	25.20	28.30	34.60	39.40	44.10	45.60	
Temperature (Lowest)	7.3	7.9	4.9	0.6	-2.2	-3.9	-3.2	-1.7	-1.4	-0.3	2.1	4.5	
Rainfall (mm/month)	10.40	13.20	18.30	23.30	55.50	80.40	82.90	60.70	37.00	24.50	12.20	9.20	427.60
Evaporation (mm/day)*	10.20	9.60	7.80	5.00	3.00	2.20	2.10	2.60	3.60	5.30	7.40	9.00	
Evaporation (mm/Month)	316.20	268.80	241.80	150.00	93.00	66.00	65.10	80.60	108.00	164.30	222.00	279.00	2054.80
80% of Evaporation (mm/month)	252.96	215.04	193.44	120.00	74.40	52.80	52.08	64.48	86.40	131.44	177.60	223.20	1643.84
70% of Evaporation (mm/month)	221.34	188.16	169.26	105.00	65.10	46.20	45.57	56.42	75.60	115.01	155.40	195.30	1438.36
Net Evaporation (80%)	242.56	201.84	175.14	96.70	18.90	-27.60	-30.82	3.78	49.40	106.94	165.40	214.00	1216.24
Net Evaporation (70%)	210.94	174.96	150.96	81.70	9.60	-34.20	-37.33	-4.28	38.60	90.51	143.20	186.10	1010.76
Net Summer Evaporation (80%)	242.6	201.8	175.1	96.7		Ponds Emptied and Cleaned Out				106.9	165.4	214.0	1202.58
Net Summer Evaporation (70%)	210.94	174.96	150.96	81.70		Ponds Emptied and Cleaned Out				90.51	143.20	186.10	1038.37

* Evaporation Data from Perth Airport (nearest BoM evaporation data)

Pond Evaporation Potential (each)

	Dimensions			Evaporation m^3/year			
	Width (m)	Length (m)	Area (m^2)	Net 80%	Net 70%	Summer 80%	Summer 70%
Evaporation Surface	50.0	50.0	2,500	3,041	2,527	3,006	2,596

Commentary
Weather data is from the Northam Station
Evaporation data from Perth Airport as the nearest available data.
Theoretical evaporation is not a true reflection of actual evaporation.
Actual evaporation should be somewhere between 80% and 70 % of theoretical evaporation (allowance for large surface body, salinity and surface area reduction due to floating crust).
Conservative approach is to adopt 70% evaporation (DEC use 80%).
Summer operation will require ponds to be emptied and cleaned out before the onset of winter rains.
Due to the minimal difference in net evaporation between emptying the pond in winter and no emptying the ponds, it is not worth the effort of emptying and cleaning out the ponds each year.

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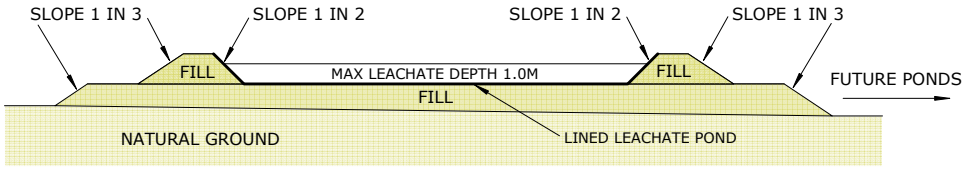

SECTION A - A

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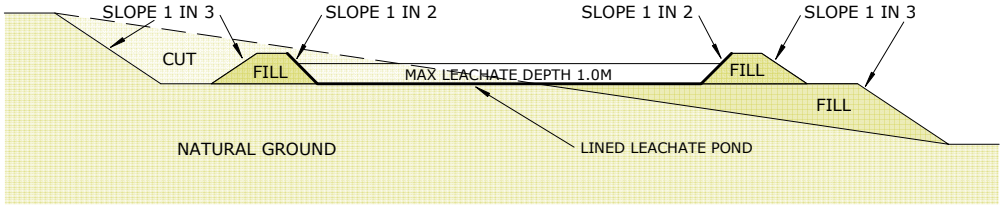

SECTION B - B

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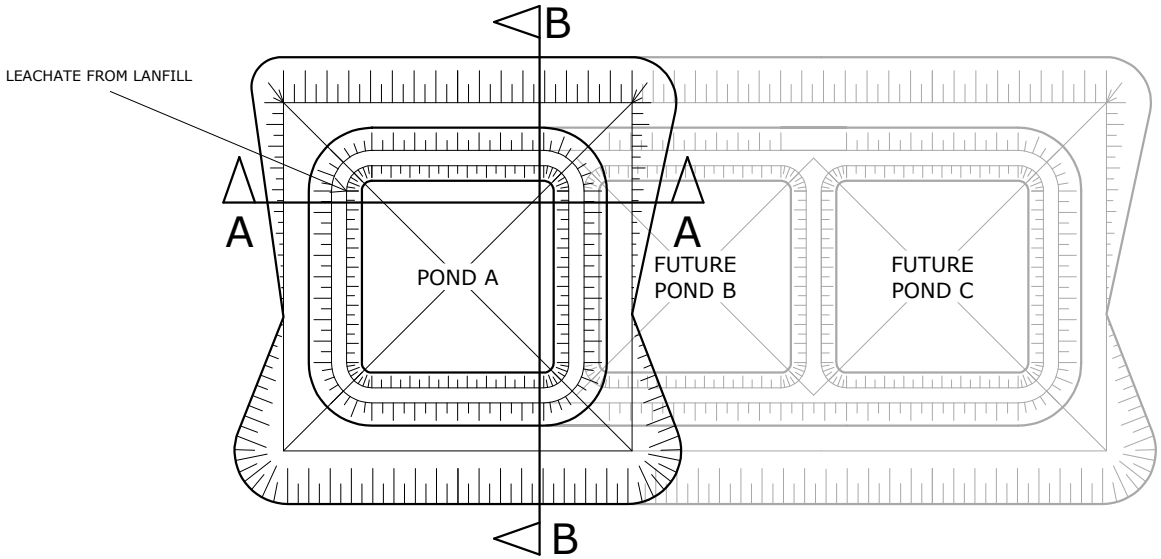

LEACHATE POND CONCEPT LAYOUT

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OPAL VALE

LOT M2027
CHITTY ROAD, TOODYAY

LEACHATE POND CONCEPT DETAIL

DATE	28/06/11	**SCALE**	NTS
DWG	040	**REV**	0

LANDFILL CAP CONTOURS

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OPAL VALE
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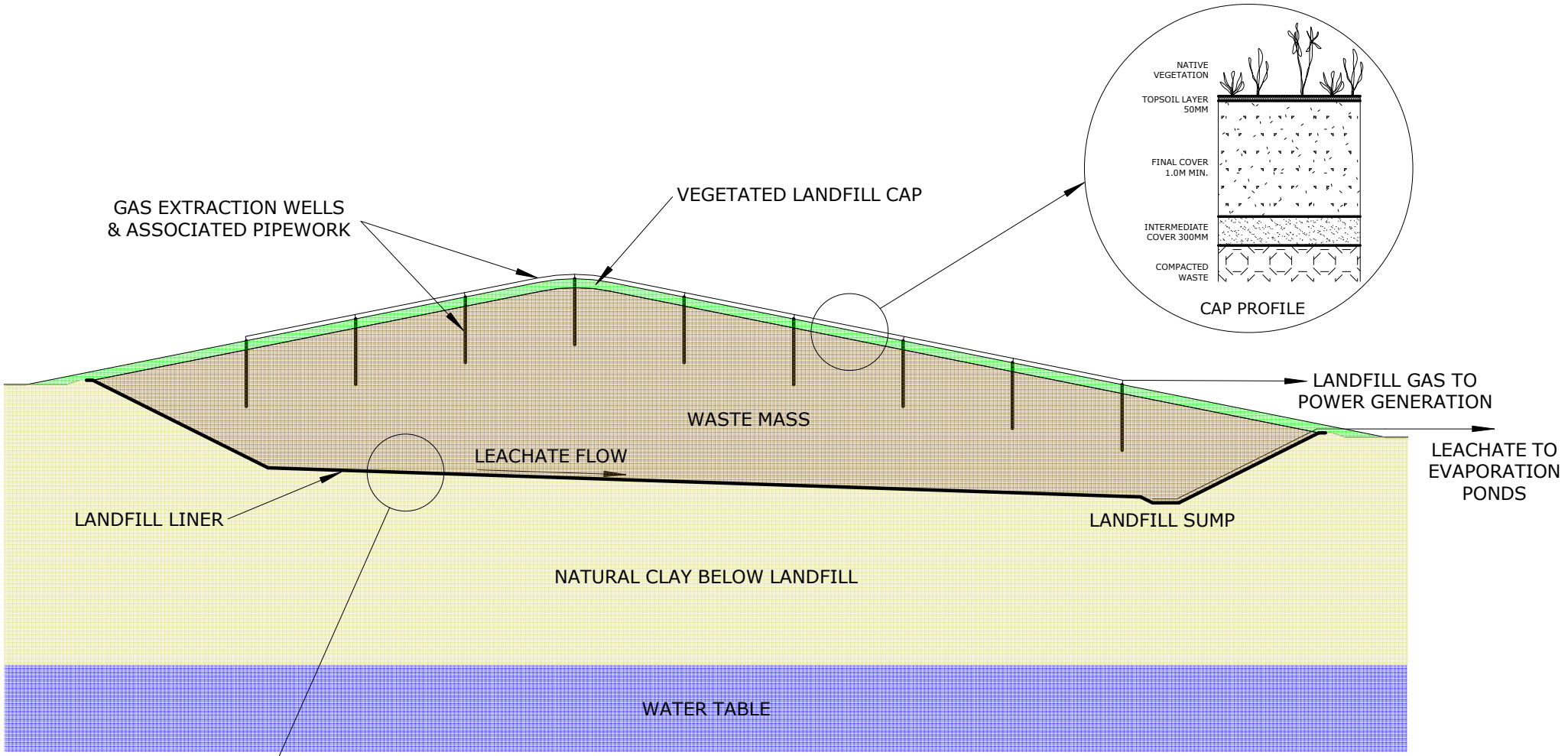
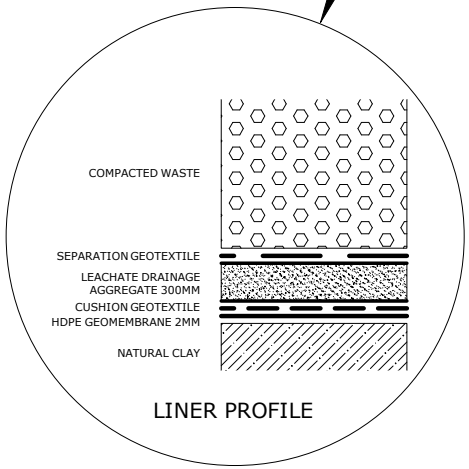
CHITTY ROAD, TOODYAY

LANDFILL CAP CONTOURS

DATE	16 SEP 11	**SCALE**	NTS
DWG	020	**REV**	1



TYPICAL LANDFILL SECTION



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OPAL VALE
LOT M2027
CHITTY ROAD, TOODYAY

TYPICAL LANDFILL SECTION

DATE	29 JUN 11	**SCALE**	NTS
DWG	030	**REV**	0

Opal Vale Class II Landfill Chitty Road Toodyay

Rehabilitation Management Plan

1. Introduction

The environmental and social impacts of a closed and rehabilitated landfill are a function of the type and quantity of waste contained within the landfill, the quality of landfill closure/rehabilitation and the distance from the facility to the nearest receptor(s).

The capping system incorporated within the closed landfill will have a significant impact on the long-term sustainability of the closed landfill. Consequently, it is imperative that the capping system be developed to achieve a long-term stable vegetated cover over the deposited waste.

2. Environmental Impacts

The Opal Vale landfill facility is located approximately 13 km to the south west of the town of Toodyay (town centre) and 20 km to the west of Northam (town centre). The nearest single residential property (farmhouse on the landfill property) is approximately 0.4 km from the landfill in a south westerly direction and the next nearest residential property is 1.4 km to the north east on an adjacent property. The landfill site is surrounded by agricultural properties and natural bush.

In order to minimise the environmental impact to the adjoining properties Opal Vale will concentrate on the following operational activities:

- Stormwater control, diversion and retention.
- Waste compaction.
- Adequate cover material placement.
- Progressive closure, capping and rehabilitation of completed portions of the landfill.
- Regular litter collection and site cleanup activities.
- Planting of trees to screen waste management activities.

3. Site End Use

The end use of the landfill will be to pasture and shrubland native vegetation with clumps of trees in strategic locations.

4. Flora and Fauna

The area is pasture, and is currently a void created by clay excavation

The final land surface will be returned to pasture with clumps of strategically planted trees or native bush.

5. Rehabilitation

The objectives of rehabilitation are to "restore the facility to a land surface compatible with the surrounding landform and to create a cover of self sustaining parkland pasture".

6. Completion Criteria

The Completion Criteria will include the following:

- A landform compatible with the surrounding contours;
- A cover of native shrubs or a self sustaining cover of pasture depending on the nature of the fill;
- Trees at the rate of 50 stems per hectare in clumps to maintain an appearance of parkland pasture and to provide shelter without compromising the integrity of the cover: and,
- Weed species at levels not likely to threaten the native species and pasture.

7. Vegetation Clearing

The site is substantially cleared of all native vegetation with the exception of the odd isolated tree or small clump of isolated trees. There will be no clearing required for the active landfill area and the vast majority of the operational areas. There will however be a requirement to clear three isolated trees for the construction of the evaporation ponds and a small cluster of approximately 15 trees for the construction of the water storage dam downstream of the landfill site. The required Clearing Permit will be obtained prior to any clearing of native vegetation.

8. Topsoil and Overburden Removal

There is minimal topsoil within the cleared areas of the site. During clay extraction, overburden will be removed and stored in separate dumps for use in future landfill rehabilitation.

9. Landform Reconstruction and Contouring

The ultimate final contours are a function of optimising available landfill airspace, ensuring a long-term sustainable capped profile over the waste and adequate control of surface water run-off.

The cap profile is to be constructed to have a varying post settlement slope of between 1 (vertical) to 7 (horizontal) and 1 (vertical) to 17 (horizontal). This is seen as an acceptable slope to achieve sufficient stormwater runoff without causing excessive erosion and ensure the long-term sustainability of the cap. Typically a capping layer will be a minimum of 1.0 m thick over the waste.

Care is to be taken to minimise the flat areas on top of the cap profile, as these areas generally occur at the point of the deepest waste depth and hence are prone to the most settlement resulting in depressions forming in the cap profile which will collect stormwater and result in excessive leachate generation.

10. Capping Material

The intention of the waste cap is to provide a long-term sustainable barrier between the waste and the environment. The capping material is not necessarily required to “entomb” the waste as moisture assists in the waste decomposition process and hence allowing controlled amounts of water through the cap is beneficial to the long-term overall stability of the closed landfill.

The intended purpose of the landfill cap includes:

- Provision of a barrier between the waste and the environment.
- Control of moisture ingress.
- Provides a habitat for the establishment of native vegetation.
- Control of erosion of the cap material.
- Prevent vermin access to the decomposing waste.

- Control odour emissions.
- Encourage stormwater runoff.
- Divert water from the area of waste placement.
- Ability to accommodate waste settlement.
- Oxidise limited amounts of landfill gas.

The natural soil in the immediate area has a high clay content and hence a relatively low permeability. This soil is well suited as landfill capping material. A landfill cap of 1 m to 1.5 m thick is deemed sufficient. This will allow the cap to absorb and retain a portion of the rainfall while the majority of the surface water is shed off the landfill into perimeter drains; hence, reducing the volume of stormwater entering the waste mass.

As a result of the existing clay operations in the void, there are significant quantities overburden available for use as capping material. This excavated and stockpiled material is ideal for capping material and will be utilised as part of the progressive closure of the landfill.

If there are different types of soil used in the cap, where possible, the soils should be blended to achieve a uniform soil type to prevent there being cap areas with distinctly different characteristics as this will affect the water balance and vegetation growth.

The use of naturally occurring, on-site soils in the cap is advantageous as these are the soils that the surrounding native vegetation is thriving in and hence the cap rehabilitation using native vegetation will be far more successful than using imported soils.

When constructing the final cap, there is no need to attempt to compact the cap material other that what is achieved via the placement machinery tracking over the surface during the material placement and spreading operation. From a rehabilitation point of view, greater vegetation survival and growth will be achieved if the soil is only lightly compacted (if at all).

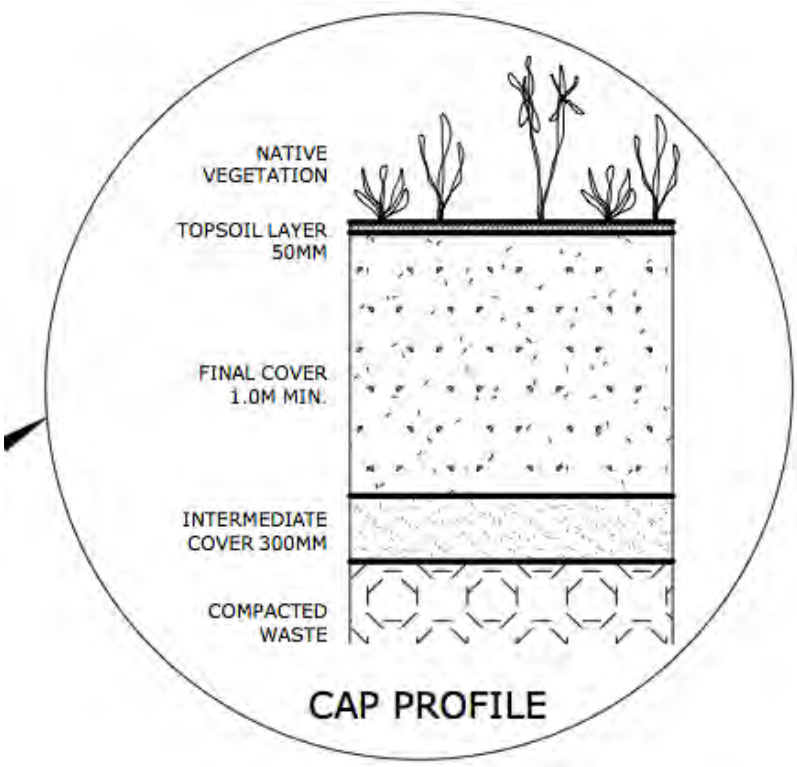
The overall domed shape of the cap will shed some of the stormwater off the cap and away from the landfilled waste areas. The cap material, being of relatively low permeability and uncompacted, will absorb an amount of stormwater, some of which will pass through the cap and into the waste mass and the remainder will be utilised by the vegetation on the cap. Over time, as the vegetation growth increases the amount of water being utilised by the vegetation will increase and hence the amount of water passing through to the waste mass will decrease.

A shortfall with the majority of the on-site capping material is that it contains very little organic matter and hence will not necessarily actively support the rapid development of a vegetated cap. To improve the vegetation survival and growth rates, a thin layer of native topsoil is to be applied to the top of the cap profile. This topsoil has and will continue to be stockpiled as part of the clay pit expansion. The topsoil layer is important in establishing plant growth; however, also encourages weed growth. The topsoil to be used should ideally be sourced from the surrounding areas and be free of weed infestation. The layer is to be applied as thin as is practical (maximum 50 mm thick). The native species in the area do not require a significant topsoil layer to establish and flourish.

Should a suitable supply of topsoil not be readily available, it is better to leave it out, or only partially apply good topsoil than import quantities of substandard material that will simply encourage weed development. Without topsoil, the cap will still sustain vegetation growth; however, it will develop more slowly.

There should be no use of composted mulch in the cap as this will simply promote weed infestation and potentially provide too many nutrients in the soil and negatively impact on the survival and growth of native plant species. A limited amount of woody mulched vegetation (non-composted) can be used in the cap to improve stability, reduce surface erosion and increase methane oxidation.

Diagram of the typical landfill cap profile (refer Appendix No. 24 - DWG 030 Opal Vale Landfill Typical Section)



11. Vegetation Establishment

The vegetation to be used on the capped surface is to be native species, consistent with the naturally occurring vegetation on-site, ideally sourced from seeds collected on site or in the immediate vicinity.

Due to the thickness of the cap (1 m to 1.5 m) it will not be possible to sustain large tree species. Typically low shrubs are more suited for growth on the capped areas. It is possible to thicken up the cap in localised areas (clumps) to enable deeper rooted species to be planted.

The choice of plant species and planting density is to be consistent with the surrounding areas so that the final vegetative surface blends into the native bushland. Over time, on-site experience will determine which local species thrive on the capped surface and these species should be concentrated on.

Weeds likely to significantly impact on the rehabilitation will be selectively sprayed with Roundup or similar herbicide or grubbed out, depending on the species involved.

Rehabilitation will take place during the first winter months following the restoration earth works. Leaving the completed earth works for one season will reduce the success of rehabilitation by at least 50 %, due to compaction effects.

Shrubs will be installed as seeds or tube plants during June – July (depending on the timing of the onset of winter rains) and will be provided with a 10 g tree fertiliser tablet placed beside the plant.

Clumps of trees and tree belts will be fenced as necessary to exclude stock and rabbit guards installed if deemed necessary at the time of planting.

If necessary, fertiliser containing nitrogen, phosphorous, potassium and trace elements will be spread at rates of up to 100 kg/hectare to assist pasture establishment.

12. Surface Water Management

The cap profile and thickness has been designed to allow surface water runoff from the capped areas and also to limit the amount of moisture seeping through into the waste mass.

Provided that the post-closure works are constructed in accordance with post-closure design there should be no contaminated surface water leaving the closed landfill area.

13. Erosion Control

Water erosion will be controlled by leaving the surface only gently sloping and establishing a dense shrub or pasture cover.

Upslope contour banks and cutoff drains are proposed to prevent stormwater entering the active and completed cells.

Contour banks on the completed fill itself may be used to increase the water shedding qualities of the cover.

14. Weeds

The management of weeds is essentially similar to that for plant diseases. The impact of weeds is really the impact within the local area and in particular adjoining crops and nearby native vegetation.

Weeds can be declared under the *Agriculture and Related Resources Protection Act 1976* which requires that Declared weeds are eradicated. Other weeds are not Declared but may be classified as Environmental Weeds because they are well known for impacting on vegetation. There are also weeds that can impinge on agricultural production such as species toxic to stock or may interfere with cropping and harvesting.

A key aspect of weed control is to treat any significant weeds promptly no matter how few there are. Several weeds pulled out by hand and destroyed, may save many dollars in spraying at a later stage.

All vehicles and equipment to be used during land clearing or land reinstatement, are to be clean and free from soil or plant material when arriving at a site.

Plants to be used in rehabilitation should be free from weeds.

Unwanted access is to be discouraged through, external fencing and site induction of workers.

A weed monitoring and control program will be used for the landfill. This will be conducted at least three times per year in autumn, winter and spring, to minimise germination, growth and seeding of weeds.

The site will be fenced, with locked gates maintained and the public excluded to minimise illegally dumped rubbish.

Weeds will be sprayed with broad spectrum spray, and grasses sprayed with grass selective spray for control, in consultation with the landholder, to ensure that weed control is compatible with the surrounding agricultural practices.

15. Species List

Hardened tube plants or seeds from the following local trees will be used for the vegetation of screening belts and tree barriers:

- Acacia acuminata
- Acacia microbotrya
- Allocasuarina fraseriana
- Allocasuarina huegeliana
- Eucalyptus accedens
- Eucalyptus calophylla
- Eucalyptu marginata
- Eucalyptus loxophleba
- Eucalyptus occidentalis
- Eucalyptus salmonophloia
- Eucalyptus wandoo

16. Monitoring Of Rehabilitation

During late summer an assessment of the success of the rehabilitation of pasture and tree clumps will be made to determine the rehabilitation requirements for the following winter.

Monitoring and restoration of the rehabilitation will continue for at least three years post closure of each stage of the landfill, and for a similar time to the DER required post closure monitoring of the landfill.

17. Rehabilitation Commitments

OPERATION	MANAGEMENT - COMMITMENTS	TIMING	SIGN OFF
Rehabilitation	The land surface will be reformed to a stable surface. Rehabilitation will utilise the methods outlined above. Revegetation will be undertaken as soon as practicable on a progressive basis to reduce the potential for wind or water erosion. Rehabilitation will be completed to achieve the Completion Criteria using the above Species List. A weed monitoring program will be used to minimise the impact of weeds. Monitoring of the pasture will be carried out for a period of three years with restoration made as required and concurrent to DEC requirements for monitoring of the landfill.	Ongoing	Operator

Appendix A

Opal Vale Class II Landfill Chitty Road Toodyay

Construction Quality Assurance Plan

1. Introduction

The Construction Quality Assurance (CQA) is defined as a planned system of activities that provide assurance that the landfill was constructed as specified in the design and documentation. It is an important factor in ensuring that design and installation of the works is done in accordance with the standards and specifications agreed with the Department of Environment and Conservation (DEC).

For this purpose, an independent third party CQA consultant with experience in landfill construction and more specifically geomembrane and geotextile performance characteristics must be appointed to verify that the works have been carried out to the agreed standards. The duties of the third-party CQA consultant include inspections, verification, audits and evaluation of materials and workmanship, provision of advice on installation, testing, repair and covering of the critical aspects of construction and issuing a final CQA report documenting the quality of the constructed facility.

2. Critical Aspects of Construction

The critical aspects of construction relating to this particular project include the following:

- Geomembrane installation.
- Cushion geotextile installation.
- Leachate extraction pipework.
- Leachate drainage aggregate.
- Separation geotextile installation.
- Leachate sump construction and extraction pipework.

3. CQA Activities

a. <u>Geomembrane installation</u>

- Verification and review of the quality control certificates of the resins and the quality of the resins used to manufacture the geomembrane roles assigned to the project. The same applies to the extrudate rods.

- Verification and review of the property values certified by the manufacturer. The same applies to the extrudate rods.
- Verification of the measurements of properties by the manufacturer are properly documented, test methods are acceptable, sampling procedure detailed and verification that the geomembrane meets the project specifications. The same applies to the extrudate rods.
- Verification and review of the quality control certificates of the geomembrane rolls assigned to the project.
- Confirm acceptance of the planned geomembrane storage on site prior to installation.
- Verification of the suitability of the geomembrane handling equipment used on site.
- Agree rejection criteria of the geomembrane sheets.
- Confirm details of installation staff's accreditations and verification of their experience.
- Conformance tests to be undertaken on the geomembrane delivered to site. Any laboratory tests must be performed by a third-party independent accredited geosynthetics laboratory.
- Agree action taken if the membrane fails a conformance test.
- Approval of the subgrade and anchor trenches prior to geomembrane installation.
- Establishment of a field geomembrane panel identification system (panel layout diagram).
- Confirmation that the panel layout is in accordance with the panel layout diagram.
- Confirmation that protection of the liner in the event of inclement weather is appropriate.
- Agreement on the frequency of trial welds and procedures for sampling and evaluation.
- Agreement on the procedures for inspecting seam preparation, trial welds, welds, testing and sampling welds.
- Verification of welding equipment calibration and welding conditions.
- Confirmation of appropriate actions taken after cutting of each destructive test sample from the production seam.
- Confirmation of appropriate actions taken in the event of a defective weld, including retesting procedures.
- Agreement on procedures for rejection of the geomembrane if test results indicate failure.
- Confirmation of compliance with agreed rejection procedures.
- Inspection of laid geomembrane for damage or excessive wrinkles and bridging.
- Accumulation of geomembrane lining contractor QA documentation (provided by the lining contractor).

- Receipt and confirmation of accuracy of completed as-built drawing of liner installation.

b. Cushion geotextile installation
   - Verification and review of the quality control certificates of the geotextile manufacturer, the fibre suppliers and the polymer manufacturers, with a list of characteristics of the material.
   - Verification and review of the property values certified by the manufacturer.
   - Verification of the measurements of properties by the manufacturer are properly documented, test methods are acceptable and verification that the geotextile meets the project specifications.
   - Verification and review of the quality control certificates of the geotextile rolls assigned to the project.
   - Confirm acceptance of the planned geotextile storage on site prior to installation.
   - Verification of the suitability of the geotextile handling equipment and restraining methods used on site.
   - Agree rejection criteria of the geotextile rolls.
   - Confirm details of installation staff's accreditations and verification of their experience.
   - Conformance tests to be undertaken on the geotextile delivered to site. Any laboratory tests must be performed by a third-party independent accredited geosynthetics laboratory.
   - Agree action taken if the geotextile fails a conformance test.
   - Approval of the underlying geomembrane and anchor trenches prior to geotextile installation.
   - Agree the installation and jointing techniques.
   - Confirm compliance with the agreed installation and jointing techniques.
   - Confirmation that protection of the geotextile in the event of inclement weather is appropriate.
   - Agreement on the frequency of sampling and evaluation.
   - Agreement on the procedures for inspecting joint preparation.
   - Inspection of laid geotextile for damage or excessive bridging.
   - Accumulation of geotextile lining contractor QA documentation (provided by the lining contractor).
   - Receipt and confirmation of accuracy of completed as-built drawing of geotextile installation.

c. Leachate extraction pipework
   - Verification and review of the quality control certificates of the pipe manufacturer with a list of characteristics and specifications of the material.

- Confirm acceptance of the planned pipe storage on site prior to installation.
- Verification of the suitability of the pipe handling equipment and laying methods used on site.
- Agree rejection criteria of the pipes.
- Approval of the underlying geotextile prior to pipe installation.
- Agree the installation and jointing techniques.
- Inspection of the works for damage to the pipes or the underlying liner layers.
- Receipt and confirmation of accuracy of completed as-built drawing of pipe installation.

d. Leachate drainage aggregate

- Verification of the quality of the proposed aggregate with a list of specifications of the material.
- Confirm acceptance of the planned aggregate storage on site prior to installation.
- Verification of the suitability of the aggregate laying methodology used on site to ensure that the underlying pipes and liner layer works are not damaged and that the required thickness of layer is achieved.
- Inspection of the works for damage to the pipes or the underlying liner layers.
- Receipt and confirmation of accuracy of completed layer thickness and as-built drawing of the aggregate installation.

e. Separation geotextile installation

- Verification and review of the quality control certificates of the geotextile manufacturer, the fibre suppliers and the polymer manufacturers, with a list of characteristics of the material.
- Verification and review of the property values certified by the manufacturer.
- Verification of the measurements of properties by the manufacturer are properly documented, test methods are acceptable and verification that the geotextile meets the project specifications.
- Verification and review of the quality control certificates of the geotextile rolls assigned to the project.
- Confirm acceptance of the planned geotextile storage on site prior to installation.
- Verification of the suitability of the geotextile handling equipment and restraining methods used on site.
- Agree rejection criteria of the geotextile rolls.
- Confirm details of installation staff's accreditations and verification of their experience.
- Approval of the underlying aggregate layer prior to geotextile installation.

- Agree the installation and jointing techniques.
- Confirm compliance with the agreed installation and jointing techniques.
- Confirmation that protection of the geotextile in the event of inclement weather is appropriate.
- Agreement on the procedures for inspecting joint preparation.
- Inspection of laid geotextile for damage.

f. Leachate sump construction and extraction pipework

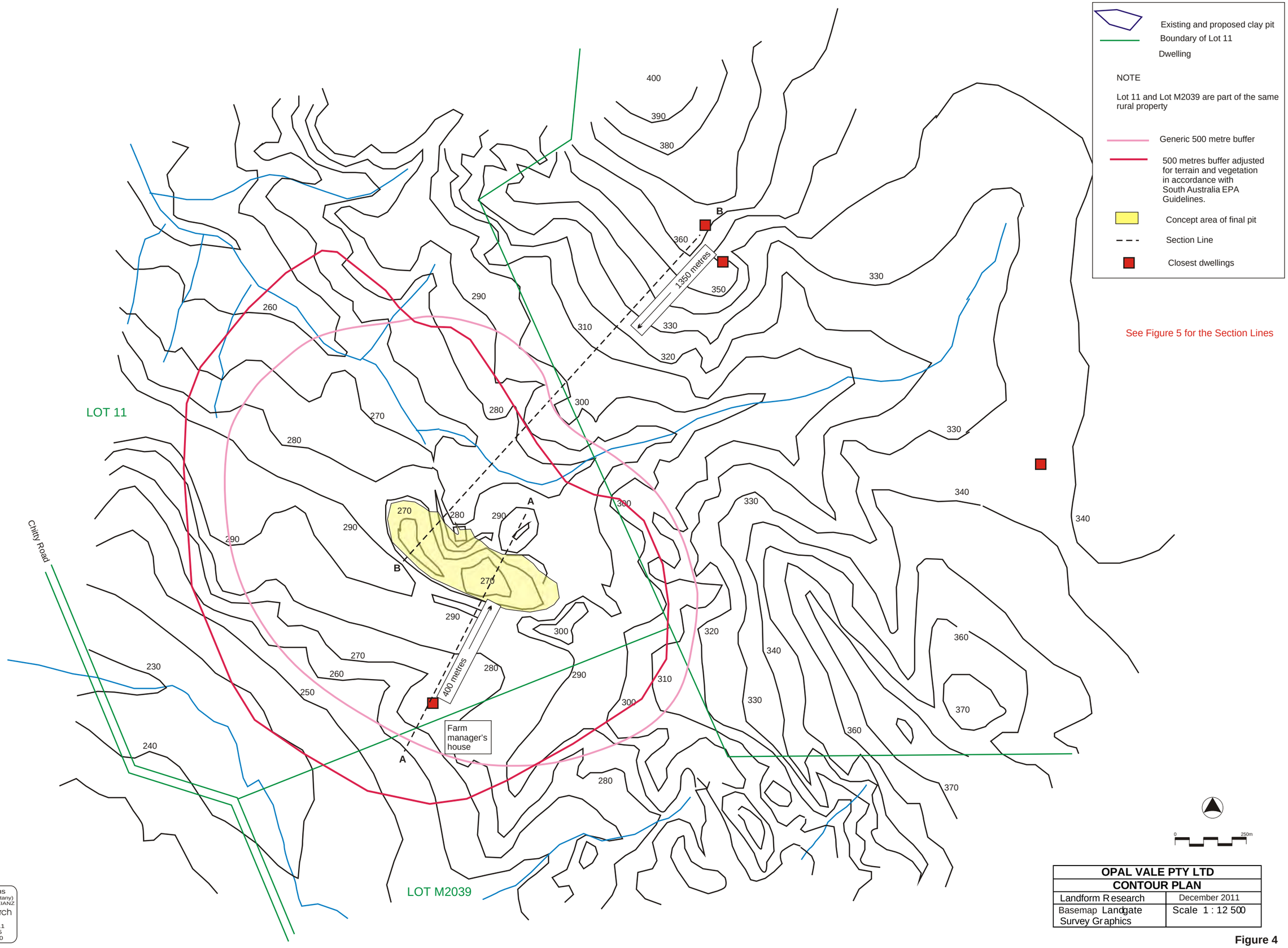
- Verification and review of the quality control certificates of the leachate extraction pipe manufacturer with a list of characteristics and specifications of the material.
- Verification of the suitability of the pipe handling equipment and laying methods used on site.
- Agree rejection criteria of the pipes.
- Approval of the underlying geotextile prior to pipe installation.
- Agree the installation and jointing techniques.
- Inspection of the works for damage to the pipes or the underlying liner layers.
- Receipt and confirmation of accuracy of completed as-built drawing of the sump installation.

4. Reporting

Following the completion of the above CQA activities, the CQA consultant shall compile and submit a final CQA report to demonstrate that all requirements of the project specifications and CQA plan have been complied with.

This CQA report shall be submitted to the DEC as soon as practical on completion of the works, but no later than four weeks after the issue of the Certificate of Practical Completion.

It is acknowledged that the CQA plan will take a number of weeks to finalise following the completion of the site works (maximum four weeks). So as not to delay the License Approval process, on completion of the site construction works, the CQA consultant shall provide a written statement confirming that the works have been carried out to the appropriate standard and in accordance with the design and documentation intent. This written statement shall be included with the Works Approval Compliance Document submitted by Opal Vale to the DEC on completion of the works and prior to the commencement of the License Approval process.



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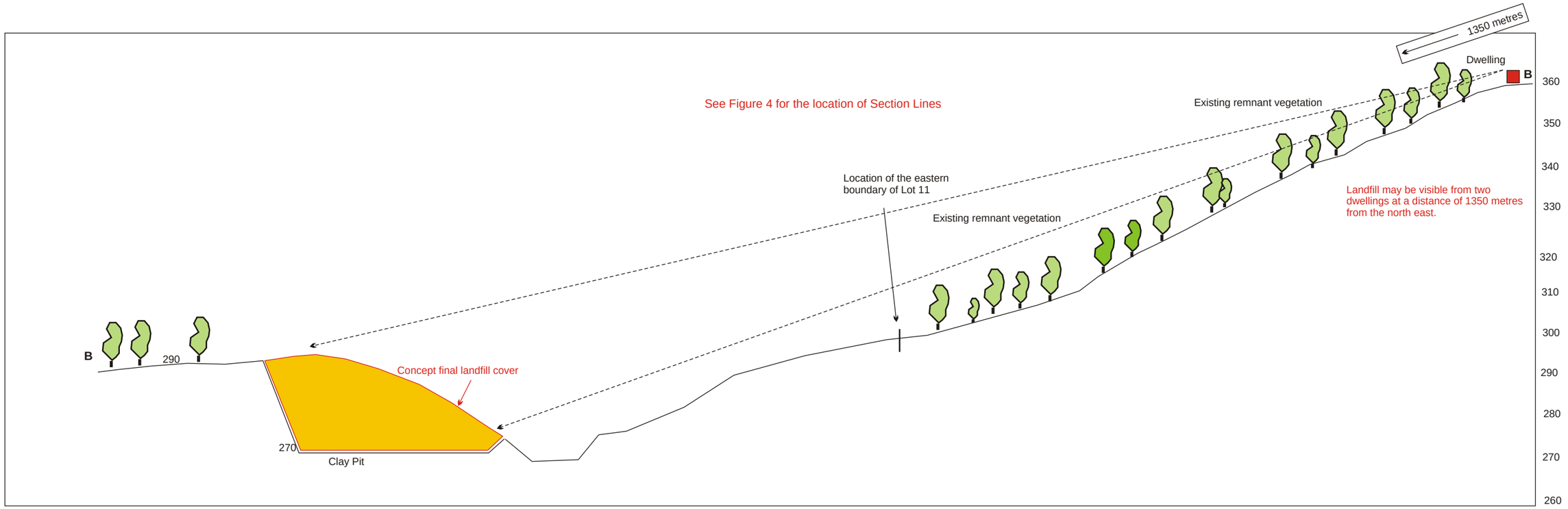
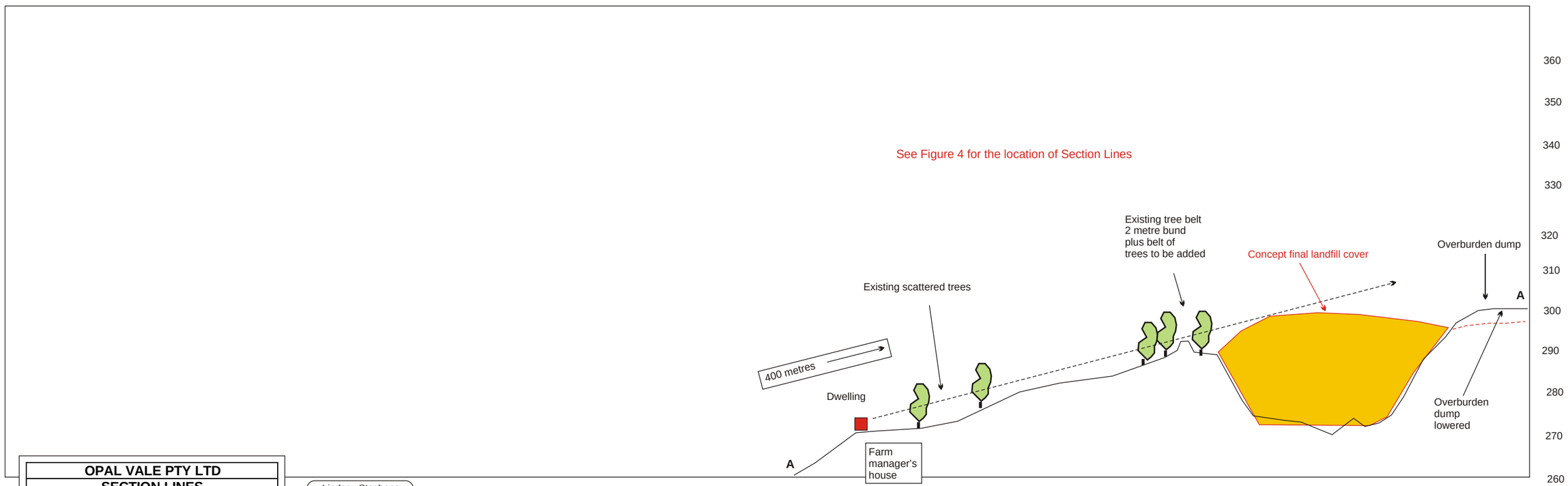
OPAL VALE PTY LTD	
CONTOUR PLAN	
Landform Research	December 2011
Basemap Landgate Survey Graphics	Scale 1 : 12 500

Figure 4



HORIZONTAL SCALE 1 : 5 000



HORIZONTAL SCALE 1 : 5 000

Landfill unlikely to be visible from Farm manager's house with the existing and additional tree belts.

OPAL VALE PTY LTD	
SECTION LINES	
Landform Research	December 2011
Basemap Landgate Survey Graphics	Scale 1 : 5 000

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Figure 5

Stakeholder and Community Consultation – July 2010

As part of the Shire of Toodyay Development Approval assessment in 2009/10 the Shire undertook an extensive stakeholder and community consultation process.

The 2009 proposal documentation was circulated to Government Departments and Authorities through the Shire's normal application processes.

The proposal was advertised and considered by Council (Shire of Toodyay) on 19 August 2010. At that meeting Council voted to defer the approval until such time as the Department of Environment and Conservation issued a Works Approval to enable construction of the site.

During the community consultation the Shire of Toodyay placed an advertisement in the Avon Advocate (16 September 2009) and in the October edition of the Toodyay Herald.

The proposal was listed on the Shire of Toodyay website.

A sign was placed on site and all local residents and adjoining landowners within 500 m were advised of the proposal.

The proposal was also referred to Austral Bricks, BGC, the Department of Environment and Conservation and the Department of Water.

A total of 13 submissions were received by the Shire as a result of the advertising.

A copy of the submissions are listed below (extract from the Shire's Council Agenda Item dated 27 July 2010):

1.	Martin Revell Department of Water	1. No objection subject to the following included in the approval: a. The proposal should be in accordance with the Water Quality Protection Note 111 "Landfills for disposal of putrescible materials" (WQPN 111) b. The proposal is located within a proclaimed water area. In accordance with the *Rights in Water Irrigation Act 1914*, the extraction of surface water for intensive activities may require a licence. Modification to a watercourse, its bed or banks requires a permit from the Department of Water. c. The subject property is located within a non-proclaimed area for groundwater under the *Rights in Water and Irrigation Act 1914*. The presence of and yield from groundwater aquifers in the subject area is not guaranteed; test holes should be drilled to locate a suitable groundwater supply. Extraction of any groundwater aquifers is subject to licensing by the Department of Water. 2. Note that the proposal is located within a declared waterways management area (Avon Catchment) in accordance with the *Waterways Conservation Act* 1976, making it a "sensitive water resource area" for the purposes of the above-mentioned Water Quality Protection Note. 3. The proposal report indicates that the small dam at the top of the water course draining to the north, away from the landfill site, is to be retained. Given the	1. Noted. a. Noted. b. Noted. It is recommended that a note be placed on the approval advising the proponent of this. c. Noted. 2. Noted. 3. Noted.	It is recommended that the submission be noted. An advice note be placed on the approval to advise the proponent of the Department of Water's comments.

		proximity of this dam to the proposed landfill site, and that such dams used for human, stock or commercial purposes are regarded as "sensitive water resources", more information is required regarding the proposed use of this dam beyond the life-span of the landfill. 4. Where soil testing for this proposal has indicated that permeability is higher that 10^{-9} m/sec, suitable soil should be imported and compacted to reduce permeability to that figure or otherwise a suitable synthetic liner should be used. 5. The proposal appears to be particularly close to the recommended 100m buffer from surface waters, ephemeral waterways and watercourses (WQPN 111)	4. Noted. The adequacy of the liner of the landfill site is addressed in the licence issued by the Department of Environment and Conservation (DEC). 5. Noted. The applicant would have to comply with licence conditions imposed by the DEC in this respect.	
2.	D & V Street 134 Cobbler Pool Road	1. We think the reasons this proposal was rejected in 1998 still hold. 2. Our particular concern is the facility situation in a drainage basin of the Avon River System. The risk of liner or basal failure or leakage should have no risk, not a low risk. The idea of self regulation or monitoring for something so critical is not tenable. 3. Claims of geological stability are dubious and the figures given for highest maximum temperatures December to February being 31 to 33 degrees are patently wrong as we have on record for	1. The previous proposal was for a Class IV waste site and is a different application than the one presently proposed. 2. Concerns are noted. The regulation and environmental impacts from waste disposal sites is regulated and monitored by the DEC. 3. The figures for the temperature are likely to be mean maximum temperatures.	That the submission be noted.

		last summer a period of three consecutive weeks over 40 degrees. 4. Our duty of care should be to any landholder downstream of this proposal and to the long term health of the Avon.	4. Noted.	
3.	Claire Richards Greg Rowe and Associates For Agett Investments	The following provides a summary of our Clients grounds for objecting to the proposed landfill facility: 1. The report for the proposed development does not indicate whether the clay pit has reached its operational life. In absence of such information, it is considered premature to approve a development proposal that will result in the closure of an operating facility identified by the Shire of Toodyay as being of regional significance 2. The proposal is inconsistent with the purpose and intent of the Western Australian Planning Commissions State Planning Policy 2.4 – Basic Raw Materials Policy. Under this policy the site is identified as a "Priority Clay Resource". Areas identified as a priority clay resource are considered "*locations of regionally significant resources which should be recognised for future basic raw materials extraction and not be constrained by incompatible uses or development*". 3. The proposal is inconsistent with the Shire of Toodyay's Local Planning Strategy which identifies the strategic importance of protecting "Priority Resource Locations" 4. Given the nature and scale of the	1. Noted. The landfill is going to be staged to avoid sterilising the existing clay resource. An agreement has been reached between Austral Bricks and the owners of the site that if the landfill encroaches into the resource area, the clay resource will be stockpiled so it can still be used into the future. 2. Noted, see comments above. 3. Noted, see comments above. 4. The proposal complies with the buffer	That the submission be noted. That a condition is placed on planning approval that vehicles using the development must not access the site through Chitty Road. That a condition is placed on the planning approval that no tyres are to be stored on site. That conditions are placed on the planning approval regarding management measure which are to be implemented to address possible off-site impacts. That a condition is placed on the

		proposed development, the application of a generic buffer setback is not considered adequate or appropriate in protecting the health and wellbeing of surrounding residents. A site-specific technical analysis which addresses factors, such as noise, dust and odour, should be undertaken in respect of the proposed development prior to any determination being made by the Shire of Toodyay. 5. A site-specific analysis which addresses off-site impacts based on factors such as the scale of the facility, the types of materials deposited, wind patterns and topography should be undertaken prior to any determination being made by the Shire of Toodyay. 6. Concerns with regard to the adequacy of vermin control measures. The report for the proposal states that in order to control vermin and feral animal activity on the site, the waste will be covered at least once a week. The concern with this proposed management technique is that for the remainder of the week, waste deposited on the site will be potentially open to the air. As a consequence our client in concerned this will result in increased number of feral animals in the area and potentially threaten existing bird life and grazing stock. 7. Potential for off-site impacts generated by increased traffic. Off-site traffic impacts generated by the proposed facility need to be addressed.	distances prescribed in the EPA document "Separation Distance between Industrial and Sensitive Land Uses". As noted in the DEC's document "Siting, Design, Operation and Rehabilitation of Landfills", management measure need to be implemented to ensure that buffers are acceptable. These are detailed within the application. 5. The applicant has detailed within the proposal management measures to address possible off-site environmental implications. It is recommended that these form specific conditions of planning approval if the application is supported. 6. As detailed within the application, if putrescible wastes are being disposed, the waste will be covered daily. This should address possible issues with vermin. The other types of wastes to be disposed of are unlikely to result in increase in feral animals as it would be clean fill, inert wastes or solid wastes. 7. Noted, the Shire of Toodyay will take this into consideration in the assessment of the application and conditions would be imposed relative to this.	planning approval detailing that tyres are not be to stored onsite.

		8. Concerns regarding the control of vehicle movements – i.e. Access via Chitty Road. What measures have been or will be put in place to ensure that Chitty Road is not used for access?	8. The Shire of Toodyay has the capacity to impose a condition of planning approval detailing that Chitty Road cannot be used for access to the site as a result of this development. Under the provisions of the *Planning and Development Act*, the applicant must comply with the conditions of planning approval, otherwise they would have committed an offence. The applicant is proposing to use access from Salt Valley road so this issue has been addressed.	
		a) An access arrangement currently exists between our client and the owner of the subject site permitting access between Chitty Road and the Williamson Clay Pit through the northern portion of our Client's property. This access arrangement exists at out clients' discretion and will not be permitted for use by vehicles associated with the proposed landfill operations.	a) Noted, as stated above, the applicant is proposing to access the site from Salt Valley Road.	
		9. The proposed development does not appear to take into consideration the specific provision of Local Planning Scheme No 4 resulting from the subject site's location within the Swan Avon Valley Special Control Area. Clause 6.2.3 of the Shire of Toodyay Local Planning Scheme No 4 requires the local government, in considering planning proposals in land identified within the Swan Avon Valley Special Control Area, to consider a range of criteria before making determination. One of these is	9. The application has been referred through to the DEC and Department of Water for comment. The Department of Water have noted that the facility is to be positioned close to a water course however has not raised objections to the application. During the works approval and licence stage, the applicants would have to demonstrate that there would be no leachate from the site to adjoining environs. This would address the issues with catchment management.	

		consideration for the effects of the proposal on catchment management and the measures to be taken to mitigate such effects. We do not believe this has been directly addressed in the report. 10. The proposed facility will result in increased levels of noise, dust and odour, which although may be minimised by various management controls, cannot be avoided and will adversely impact the amenity of the area. Although the proponent intends to minimise these impacts wherever possible, the impacts will exist nonetheless. This will reduce our clients enjoyment of his property and therefore adversely impact its amenity 11. The report for the proposal states that some degree of storage will occur. The fire risk associated with storage of certain materials, such as tyres, is of concern to our client given his proximity to the subject site and substantial vegetated areas in between.	10. The applicant has identified the possible offsite implications for the proposal and has established management provisions to address this. Again, this would be further considered by the DEC when the applicant applies for works approval and a licence. Further to this, the proposal complies with the requirements for buffers for this type of facility. 11. Concerns raised with respect to the storage of tyres are noted. It is recommended that a condition of planning approval is imposed that no tyres are to be stored on site.	
4.	Richard Wilkinson Endorsed by The Avon Valley Environmental Society	1. Strongly opposed to the proposal by Opal Vale to create a Class II Waste Facility at Lot 11 Chitty Road, a proposal which is purported to be a Rehabilitation of the Clay Pit. 2. The proposal contains many statements which suggest best practice is to be used but does not support these statements as to how the pit is to be adequately controlled and managed in either the short term or the long term. These	1. Noted. 2. Noted.	That the submission be noted. It is recommended that Council resolve to defer consideration of planning application until the applicant has obtained a licence and works

		matters are vital as the proposed facility is situated adjacent to pristine farmlands and waterways which are important to the Shire of Toodyay. 3. The Council is reminded that a similar proposal for a Class IV Waste Facility at the site was rejected in 1998 by the Council, followed by a well attended Public Meeting at the site, and there is no evidence to suggest that the situation has changed significantly since that time. 4. Class II Waste can be nearly as unpleasant and hazardous as Class IV Waste and this factor and other matters are discussed below in the form of a series of questions to which Council should obtain clear and precise answers before giving even preliminary acceptance to the proposal. 5. A justification for the proposed Class II landfill is that the neighbouring site cannot meet the Class I acceptance criteria. The company should improve their sorting criteria rather than be allowed to build a new landfill. 6. A submission to the EPA regarding the 1998 proposal by the Avon Valley Environmental Society, on which considerable research was carried out, is included as Attachment 1 to support this submission and some direct quotes from it are used in this submission since they still apply. 7. What is Class II Waste? Class II Waste can contain hazardous and contaminating	3. This application was for a different proposal and was being considered under a different Town Planning Scheme. 4. The different forms of waste classification are set out in the Landfill Waste Classification and Waste Definitions 1996 (as amended). 5. The type of material that can be accepted in a Class I site is restricted to certain materials. The applicant is seeking approval for Class II to allow for a wider range of wastes to be disposed of on site. 6. Noted. 7. Noted.	approval from the DEC and the DEC has agreed to receive and manage a financial assurance from the applicant.

		material. It can include asbestos and asbestos cement product, biomedical waste, putrid household and animal waste and contaminated solids. The contaminated solids are defined as solids which have been in contact with material which is hazardous to the environment and human health. 8. Is there a need for the facility? a) The need for Landfill facilities for this type of Waste will decrease as WA moves towards a Zero Waste situation and currently the Red Hill Facility is considered adequate until the year 2020 when Zero Waste comes to fruition. b) New sites are not needed to take the Waste from Perth or other Shires and the only consideration should be to dispose of such Waste from the Toodyay Shire itself. It is understood that the proposed facility will start to operate in 2012 and thus will have a limited life cycle. Toodyay has no obligation to accept waste from outside the Shire. c) A justification for the new site is that Opal Vale is currently unable to dispose of Class II waste in the local area. The trucks using the current landfill drive past the Red Hill or Northam tips and the Class II waste could be taken there. The onus should be on the company to sort the waste and not on the Shire. d) The proposal also states that "only	8. Disposal of non-recyclable waste will be an ongoing need. a) With the zero waste initiative it is intended that the amount of waste disposed of in landfill sites decreases, however there are still certain types of wastes which cannot be recycled or reused presently. b) It is common that waste disposal sites receive waste from areas outside their own Shire. The DEC recommended in the document "Siting, Design, Operation and Rehabilitation of Landfills" that quarries and excavation areas are used for waste disposal subject to satisfying environmental criteria. c) The applicant has applied for a Class II waste facility so that additional materials can be disposed of than that permitted in a Class I site. As an application has been made, the Shire must give a determination based on the considerations listed in the Scheme. This matter is not considered suitable grounds to refuse the application. d) The application details the type of wastes	

		materials for which there is no viable re-use will be placed in the waste facility". It is understood that most of this material is wood which can be chipped and used as mulch or composted or used as a final cover on the current landfill. e) The proposal also states that municipal waste could be accepted in the future. The Shire should require that municipal waste is ONLY accepted in Class III landfill with appropriate lining, leachate collection and treatment systems and gas collection. This is current best practice for the State and should be a minimum requirement, the only exception being remote towns where transport of waste is a problem. f) Since the landfill is not to be open to the public it will only benefit the company and not the Shire which is taking all the risk for no return to the community? 9. Is it safe or necessary to transport this type of Waste. Although not as hazardous as Class IV Waste, any spillage en route whilst moving Class II Waste would be unpleasant and in some cases dangerous if asbestos and biomedical waste was involved and the packaging split or was otherwise damaged. Putrid waste in truck loads would be difficult to clear away. Every effort should be made to use Waste facilities nearby rather than transporting it 100km or so from Perth. 10. Are Private Companies able to manage such facilities?	to be disposed of within the facility. Some wood waste material may be unsuitable for mulching or alternative uses due to it being treated wood products hence it being disposed in landfill. e) The regulations which prescribe the types of waste disposed that can be disposed of in different landfill classes is set by the DEC. The DEC do allow for municipal waste to be disposed of within the type of facility proposed. f) The applicant has not proposed to open the facility to the public so that there are controls on the types of wastes and the source of the waste to the facility. 9. There are risks involved in the transportation of waste and regulations are put in place to reduce these risks, this is regulated through the *Environmental Protection (Controlled Waste) Regulations 2004.* 10. Concerns are noted, however private companies can and do operate landfill	

		a) It is believed that a Class II Waste facility should not be allowed in private hands. The commitment is long term and the income flow short term. There is a need to monitor, keep records and archives, fund emergency action caused by unforseen events, act expeditiously to minimise danger caused by accidents etc, list which goes on forever. Private firms disappear, go bankrupt, get sold and can easily abrogate their responsibilities. Private institutions by their very nature are interested in profit and not long term commitment and some of the pollutants do not break down with time. 11. What is the experience and history of Opal Vale in managing this type of project? The short time allowed to prepare this submission has not been sufficient too obtain the past history of Opal Vales in managing similar projects. Have they or their employees had long term experience in the field of Waste Management? Has there been any history of polluting accidents, inadequate quality control of the Waste or criticisms of their performance? Are they financially viable in the long term? These and other questions need to be answered. 12. What Financial Levies will be imposed? To ensure a private company fulfils its short term and long term obligations. The Bond must cover the short term, full time quality monitoring of the waste by the	sites. a) The applicants would be required through the works approval and licence conditions to monitor the landfill site to ensure that any potential environmental impact is detected. An off-site impact is likely to be a breach of licence but this can also be addressed by the *Environmental Protection (Unauthorised Discharge) Regulations 2004*. When the landfill is closed it will be registered as a contaminated site and monitored by the Contaminated Sites Branch. Should the site require remediation, the original owner will be responsible for the costs of that remediation. 11. Opal Vale operate the Class 1 landfill site on another site in the Shire of Toodyay. No other details are known in this respect. 12. Concerns raised are noted. The DEC has the capacity under the *Environmental Protection Act* 1986, to require the applicant to provide a financial assurance through a condition	

		Shire or an independent authority, the landscaping and tidy up at the end of the operation and, not least, the cost of cleaning up if any accident of leakage of pollutants occurs, possibly years after the facility ceases to operate. a) Undoubtedly, such a Bond will be large but the behavioural history of some developers and similar companies suggest that it may be necessary. b) The Shire should be aware that a similar landfill situation occurred over at Cardup in the Shire of Serpentine-Jarrahdale when a Bank Bond was a condition of approval. 13. Is the topography and geological structure of the site suitable? The site is situated close to the Jimperding Brook and in an area which drains into the Harper Brook, both important streams into the Toodyay Shire which eventually flow into the Avon River. Harper Brook in particular flows through important farm lands and vineyards. Last year, the Council expressed extreme concern when considering a proposal by the local vet to establish a new facility near Harper Brook because of waste water leakage. Any leakage from the Waste Facility will almost certainly pollute these streams. a) The site does not meet acceptance criteria for a house and creek line has a risk of polluting the groundwater. b) The proposed site is also believed to be	on the works approval and/or licence. It is recommended that the application is deferred until the proponent obtains the licence and works approval and the DEC agrees to receive and manage a financial assurance that is acceptable to the Shire of Toodyay. a) Noted, see comments above. b) Noted. 13. The environmental characteristics are assessed in detail by the DEC at the works approval and licensing stage. The applicant has detailed within their application that they can demonstrate compliance with the DEC requirements for this. The applicant is required to establish a liner and a leachate collection system. Also in addition to this the applicant is required to establish monitoring bores to detect if there are any issues with the landfill site. a) See comments above. b) The Siting, Design and Rehabilitation of	

		close to or over a significant geological fault line which extends for many kilometres and earth tremors have occurred in the Shire to an extent that houses must be built to earthquake standards. Therefore landfill dumps must be considered at risk too. UWA research results in 1998 suggest that the likelihood of earth tremors is far more significant that suggested in the proposal. These points are believed not to be adequately addressed in the proposal.	Landfills – Best Practice Environmental Management Guidelines from the DEC state that landfill site should not be positioned within 100 metres of a fault line displaced in the Holocene period. The proposal complies with this requirement.	
		14. Have the proposed containment methods been tested worldwide? Overall the containment methods cannot be considered safe in the harsh Australian environment in the short, medium or long term and the risks to the unspoilt environment of the Toodyay Shire and the Avon Valley is considered unacceptable.	14. This aspect of the proposal requires approval from the DEC and is assessed as a part of the licence and works approval process.	
		a) Preparation of the clay base has to be done when the clay is wet and it is proposed that three metres of clay is to be used. How are vehicles going to, in these conditions, compact the clay to be used to prepare the base? Clay cracks when it dries out and expands when wet and the base with over time allow water leakage. Has the hundred year flood level been considered and any effects the overflow might cause?	a) The suitability and minimum standards of the clay liner is assessed by the DEC. The site is not positioned in an area that is affected by the 1 in 100 year floodway.	
		b) Membranes may be more waterproof but are easily punctured and, as those of us with water tanks know, they are subject to attacks by rats and termites. Has an	b) The applicant is not proposing a membrane.	

		authority in the world developed a safe containment method that has never failed?		
		15. How is the water to be tested and monitored? Every load needs to be properly inspected and weighed by and independent authority accountable to the Shire. The proposal states that the Owner of the waste is responsible for its quality which gives the impression that the site operators will carry out little or no inspection. It appears that trucks currently dumping waste at a nearby site drive in and dump their loads without inspection.	15. As detailed in the application, monitoring will be undertaken in accordance with the DEC Guidelines for Groundwater monitoring adjacent to landfill sites. The monitoring for compliance of this is undertaken by the DEC. A manager is placed on site and inspects the loads. If trucks bring the wrong types of wastes they are refused entry to dump the wastes. This is also monitored by the DEC.	
		a) The groundwater monitoring does not state for what tests will be made or what standard the level will be compared to. The company should be required to meet the standard of a similar landfill in Henderson.	a) See comments above.	
		16. What will be the effect on the local landowners? It seems appropriate that the Council consult directly with those landowners most effected, informing them of the obvious increase in heavy traffic and the level of risk involved to their health and land. The EPA separation distance to sensitive premises is 500 metres and 150 metres to a single residence. The landholder has a house within this area which will make the site unsuitable.	16. Letters were sent to adjoining and near by landowners detailing the proposal and providing them with an opportunity to comment. In addition to this, a notice was placed in the newspaper on Council's website and a sign was erected on site.	
		17. Are the local and adjoining roads suitable for the additional traffic? Accepting that the local roads are already used for	17. The local roads in the area presently have heavy traffic movement on them due to extractive industries operating in	

		extractive industry traffic, can they absorb the additional heavy trucks or is upgrading necessary by the proponent? a) The roads will need to be sealed to avoid frequent upgrading by the Shire and to minimise dust. b) Further a field, can the Toodyay Road and other main roads cope. There are already complaints about the number of heavy trucks and road trains and any increase will make the journey from Toodyay to Perth more difficult or untenable. 18. If contamination occurs can it be contained or even cleaned up adequately? The likely forms and extent of possible contamination needs to be considered and plans formulated to deal with it quickly. It has been shown in the past that it is often difficult or impossible to deal adequately with the type of contamination that is likely to occur and these are grounds on which the proposal should be proposed. 19. Who is responsible for the long term if leakage occurs? a) In the event of a leakage or contamination, the company must be held responsible for cleaning up. As discussed earlier, there is a strong likelihood that the company may no longer exist; therefore the Shire must ensure that adequate	the area. In addition to this it is proposed that a condition is placed on the planning approval seeking a road maintenance contribution for the life of the facility. a) All roads proposed to gain access are sealed. b) It is noted that Toodyay Road presently has a large volume of heavy traffic on the road. The application was referred to MRWA and no comments in this respect were raised. 18. The landfill will be a licensed facility and subject to specific operating conditions. An off-site impact is likely to be a breach of licence but this can also be addressed by the *Environmental Protection (Unauthorised Discharge) Regulations 2004*. When the landfill is closed it will be registered as a contaminated site and monitored by the Contaminated Sites Branch. 19. Please see comments above. Also, it is recommended that the application is deferred until financial assurance arrangements can be made. a) See comments above.	

		funds are held in the long term for it to act quickly and effectively.		
		20. Have the reasons for the rejection of the 1998 proposal been studied? In considering the current proposal, the Council need to study the papers from the 1998 rejection of the earlier proposal. Apart from having the support of Max Trenorden and Judy Edwards, two quotes are worth nothing. From the March 1998 Council Minutes, the Director Development Services recommend: " Council vehemently opposes the proposal for a class IV waste disposal site ". In a letter to the Avon Valley Environmental Society from the Shire President dated August 14 1998: "Council at its' most recent Ordinary Meeting resolved to refuse all current and future development of Class IV Waste Facilities in the Toodyay Region."	20. Yes. This was a different application and was considered under a different Town Planning Scheme.	
		21. In conclusion in listening to Council debates over the past few years, it has become apparent that the majority of the Council do not consider the full implications that their decisions may have on the environment, now or in the future. They need to ask why the request is necessary and what effect will it have on the flora and fauna and human health. Advice given to the Council by the Administration rarely mentions or discusses environmental issues. In a case like the proposed Landfill Facility	21. The application was referred to the DEC and Department of Water who are the advisory bodies on such matters. Their advice would be taken into consideration in the application.	

		independent advice may be required in many areas to support the claims made in the proposal.		
5	Roberts Day on behalf of Louise and Kim Roberts	1. Clients property abuts the eastern boundary of the proposed Class II landfill facility, and currently overlooks portion of the clay pits. 2. While the proposal has generally been prepared in accordance with the Department of Environment and Conservation (DEC) Guideline "*Siting, Design, Operation and Rehabilitation of Landfills*" we would like to raise the following deficiencies in the proposal. Rural and Visual Amenity a) It is important that the operation and management of the landfill facility is not detrimental to the environmental quality and rural amenity of the area. Sufficient landscaping to screen the landfill from adjoining properties and Chitty Road. b) The reports states that the existing pit is "not visible from any dwelling not located on Lot 11". The owners of the adjacent Lot 115 can currently see around one-third of the existing clay pit, and as such, will then be able to view the landfill facility when operating, especially if there is to be 2 metre high fencing placed on top of the site perimeter bunds which act as litter traps.	1. Noted. 2. Noted. a) Noted. The proposed landfill site is going to be contained within the existing clay extraction area. This scar of the extraction area presently cannot be viewed from any public place (Chitty Road or Salt Valley Road) due to the landform and existing vegetation. b) It is noted that the dwelling on this property will be able to view the landfill site. While a landscaping plan could be prepared, it is unlikely that it could have any impact on the views from this dwelling, due to its position high in the landscape. The proposed landfill site is to be contained within the area that presently has approval for an Extractive Industry therefore it is not considered that the proposed development would detract from the existing views from the house.	That the submission be noted. A condition is imposed on planning approval requiring the applicant to provide a 50,000 litre water supply adjacent to the landfill site for fire fighting purposes. The applicant is required by 30 June each year to submit a survey of the landfill disposal site. It is recommended that planning approval is issued for a maximum 5 year period. A condition is imposed requiring the applicant to prepare and implement a fire management plan.

		c) Should be conditions that require a comprehensive landscaping assessment and management plan prior to operation. d) The report states that Lot 11 is currently bounded by rural fencing which is in keeping with the rural character of the area. However, this type of fencing is not sufficient to manage trespassers and unauthorised access. Any proposal for new fencing must consider the potential impacts of non-rural fencing on the rural amenity of the area. e) Signage should be minimal and in keeping with the rural character of the area. f) Continuing clay extraction and the new landfill activities – The report states that it will encourage backfilling of trucks to reduce truck movements, but does not provide details on how this will be achieved. It is likely there will be an increase in truck traffic resulting from the landfill as it operates 6 days per week, unlike the existing clay pit operations which are intermittent. g) The potential impact of litter pollution is a serious concern and if it occurs it will have a major impact on the amenity of the immediate surrounding area. The report states that a litter fence is to be erected and the escaped litter collected either weekly or monthly depending on the problem, we do not believe these measure are sufficient and should be review to ensure that no litter can escape	c) Noted, please see above. d) As detailed in the report, a two metre mesh fence would be erected around the perimeter of the landfill site to act as a litter trap. This would also further restrict access to the site in addition to the existing fencing. This fence should not be viewable from adjoining public places. e) Noted. f) Noted. Conditions are recommended to ensure that contributions are made towards maintenance of local roads. Backfilling would be achieved where extractive industry trucks who would otherwise come to Toodyay empty are loaded with rubbish to be disposed of within the facility. This is presently being achieved within the other Class I facility. g) The litter that is likely to escape the site would be plastic bags and the like in putrescible waste. As detailed in the report, putrescible waste would be covered daily, this would reduce the likelihood of any potential litter escape. Further to this, conditions are recommended that the site is to be kept clear of rubbish.	

		the site. 3. Water Source for Fire Fighting. Landfill fires can be difficult to extinguish and there is potential for fires to spread to adjoining bushland. DEC guideline states that equipment to extinguish a fire must be readily available at all times, when reticulated water supply is not available a minimum of 50,000 litres should be stored on site for small fires and that for larger fires additional water sources will be required. a) The proposal does not outline the volume of water that will be available from the bore and nearby farm and what equipment will be available on site to ensure suitable supply. It does not address where water will be sourced for larger fires. b) A proven and reliable water supply needs to be provided at the site to ensure that fires can be managed appropriately and reduce risk of fires spreading. 4. Inadequate Waste Compaction and cover. The use of a sheep's foot roller or dozer may not achieve the level of compaction proposed. a) It does not clearly outline when a compactor will be used at the site based on changes in the waste stream and what amount of putrescible waste will prompt the need for daily coverage rather than weekly. b) Inadequate compaction can lead to	3. As detailed in the report, there is a bore that is positioned on the same site as the landfill facility. Concerns raised in regards to emergency fire supply are noted and it is recommended that a condition of planning approval be imposed requiring the applicant to prepare and implement a fire management plan. A footnote is also recommended specify that a minimum of 200,000 litre supply would need to be provided in addition to foam. a) Noted, proposed condition would address this concern. b) Noted, the implementation of a fire management plan would assist to address this. 4. The applicant through the works approval and licensing requirements is required to ensure that minimum compaction rates are achieved. a) As detailed within the application, putrescible waste would be covered daily and when putrescible waste is not being dumped, the landfill would be covered on a minimum of weekly basis. b) As detailed in the report the amount and	

		excessive wind blown litter and an increase in the odours, which ultimately encourages the breeding of vermin and vectors. These factors are and environmental nuisance and also significantly reduce the amenity of the surrounding properties.	level of cover would vary depending upon the nature of wastes proposed to be placed within the landfill.	
		5. Limited Detail on Liner Composition. The proposal states that the existing base of the pit excavation contains clay that is suitable for use as a landfill liner and achieves the required permeability of 1 x 10^{-9} m/s as outlined in DEC guidelines. States clay will be rolled to achieve the required compaction for the construction of the landfill liner. Does not outline the depth to which this will be undertaken.	5. All the issues and points raised are addressed by the DEC through the works approval and licence. The applicant through this process must demonstrate how compliance with the DEC requirements would be achieved and this is monitored by the DEC.	
		a) DEC guideline states that a compacted clay liner should be a minimum of 1 metre thick and be placed a minimum of four to six lifts to ensure appropriate bonding between each lift.	a) Noted.	
		b) Clay liner should also achieve a hydraulic conductivity of 1 x 10^{-9} m/s.	b) Noted.	
		c) Poor construction of the landfill liner can lead to hydraulic conductivity which may result in a breach of the liner that allows landfill leachate to infiltrate into the underlined groundwater thus resulting in contamination.	c) Noted.	
		d) Although the groundwater is classified as saline in this area there is potential that freshwater lenses may exist down gradient of the site and this may be used as a water source by surrounding	d) Concerns relating to this are noted. As detailed previously, the applicant is required to demonstrate through the works approval process, how the facility is going to be construction to address	

		residents. e) Further information is required on the construction of the liner to confirm that the risk of a liner breach and subsequent groundwater contamination is minimised. A thorough understanding of the local groundwater hydrology should be undertaken to confirm that no groundwater users or ecosystems are at risk from potential leachate contamination. 6. Absence of Noise and Dust Monitoring. The proposal outlines appropriate environmental control that will be implemented to manage noise and dust at the site. It does not allow for any dust or noise monitoring. Excessive dust and noise presents an environmental nuisance to surrounding properties which can reduce the amenity of the area. Routine dust and noise monitoring should be undertaken at the site to confirm that the site is compliant with the adopted guideline levels and provide evidence to this effect. 7. Potential Impact on Flora and Fauna. The proposal states that the uncleared part of the property contains native eucalyptus trees and native shrubs and no clearing will be undertaken as part of the landfill. It also states that a fauna report was not conducted as the site lies on pasture land. a) It is acknowledged that the site is an operational clay pit and that much of the	possible offsite contamination. e) The information contained within the application details how the facility is going to be constructed to comply with DEC guidelines. This would be further assessed through the works approval and licence process by the DEC. 6. It is noted that excessive dust and noise is a nuisance. There are legislative requirements established which regulate the amount of noise that can be emitted and also regulations on dust. The applicant has detailed within the report management measures which would be implemented to reduce the potential of these issues arising. 7. Noted. a) Noted.	

		surrounding land has been cleared, some areas of bushland remain and landfill operations are considered a significant land use that could impact upon the native flora and fauna. b) Vermin and other disease vectors can potentially impact upon the integrity of the existing habitats of surrounding bushlands. Consideration of potential off-site impacts to surrounding bushland should be undertaken to verify the status of the existing habitats and how vulnerable they ma be to introduced vermin etc. 8. No contingency for a 1 in 100 year rainfall event is outlined. The DEC guideline indicates that consideration must be given to 1 in 100 year rainfall event. High rainfall events and subsequent sediment loading may impact the surrounding environment if not managed appropriately. Information on contingency plans for 1 in 100 year flood event and sediment controls are required to ensure that the potential impact to surrounding surface water bodies is minimised. 9. Hours of Operation, the hours of operation need to be clearly stated in the report as they do not make sense. 10. Periodic Review of Operations. The estimated lifespan of the landfill is 20 years are there is a potential for a change in operation over time to accept municipal waste and/or provide access to the public.	b) Noted, as detailed in the report the applicant is proposing measures to address the potential issue of vermin and vector. 8. The Siting, Design and Rehabilitation of Landfills – Best Practice Environmental Management Guidelines from the DEC state that landfills should not be located in a 1 in 100 year watertable floodplain (that is, where there is a one per cent chance in any year that the site will flood) unless it can be demonstrated that the facility would be protected from flooding and erosion by flood waters. This proposal is not proposed to be located within a 1 in 100 year floodplain area. 9. The hours of operation of the facility is proposed to form a condition of planning approval and would be consistent with extractive industry operators in the area. 10. Noted. A condition would be recommended that the applicant is require to provide an annual survey of the landfill site demonstrating how much fill has been placed within the facility. In	

		As such we would recommend that the Council conduct a periodic community review of the facility. a) Our client and the community in general accept that the disposal of waste is a necessary part of life. However, if not managed in strict accordance with best practice and approvals, then it can have major detrimental impacts on surrounding landowners and the amenity and environmental quality of the rural landscape. As such, we believe this type of land use warrants close attention on a regular basis. 11. Changes in Operations. Any changes in operation or management should be considered as a land use change and be the subject of a new application for approval that is advertised to adjoining landowners and community for comment. 12. In light of the above comment, we respectfully request that Council give serious consideration to the potential impacts of the proposed landfill facility on adjoining landowners and the wider district ensuring the facility is suitable and adequately managed.	addition to this, the application would be monitored by the DEC under the works approval and licence system. It is also recommended, that should the application be supported, approval is issued for a maximum of five years. a) Noted. 11. The applicants have detailed in the development application the proposal for the landfill site. A condition is recommended to be imposed stating that development would need to conform with the application that is submitted and approved. Any extension beyond this would require further approval of Council so would require further consultation with the public and adjoining landowners. 12. Concerns are noted and would be taken into consideration in the assessment and determination of the application.	
6.	Trevor Strickland	1. Concerned about the proposed landfill	1. Noted.	That the submission

		facility on the basis of health risks to local residents and the environmental dangers to the Swan/Avon catchment. 2. Airborne contaminants from this site could easily be deposited onto roof of houses, thereby ending up in water tanks. Locals do not have scheme water available. 3. Odours from the site would have the potential to affect peoples health, especially as the prevailing wind would take those odours to nearby homes. 4. Visual impact and noise from a landfill site would impact quality of life. 5. Loss of value to nearby properties. Even at this point in time any attempt to sell-up and get out of the area would mean a huge financial loss (if anyone would be interested in buying a property next to a landfill site). 6. Of greater environmental concern on a much larger scale is the fact that any water courses (winter creeks) are located close by and they feed into Jimperding Creek – part of the Swan-Avon catchment.	2. The applicant has detailed in the report that the landfill site would be covered on a regular basis to address the potential issue of rubbish leaving the site. 3. Odour concerns are noted, as detailed above the applicant has detailed that the landfill would be covered regularly to address potential odours from the site. 4. Please see comments above. 5. Any link to the decrease in value of land is not demonstrated. 6. Noted. The applicant would be required to comply with the DEC requirements for the landfill site and would also have to obtain works approval and licence in addition to the need to obtain planning approval from the Shire.	be noted.
7.	Wal Chitty	My concerns include: 1. The route to be taken. If Chitty Road is used, the dust from the unsealed road could be a problem. Chitty Road should be bituminised before use. 2. The times and days of travel. 3. That the loads are covered and checked before leaving or entering the site. 4. The number of trucks to be entering and	1. The applicant is not proposing to use Chitty Road. The site would be accessed from Salt Valley Road which is bituminised to the entry to the site. 2. The proposal would have conditions limiting the hours of operation. 3. As detailed in the application, the loads would be covered. 4. The applicant has detailed that 50,000m^3	That the submission be noted.

		leaving the site per day. 5. The expected starting date and duration of tip life. 6. Where the rubbish is coming from. 7. That it is likely to be on a school bus route. 8. The effect on the ground water i.e. bores. 9. If the above concerns are addressed and plans are in place then I have no real problems if the rules and regulations are followed.	of waste is proposed to be disposed of per annum. 5. The start date would depend upon the applicant obtaining the necessary approval to operate. It is predicted that the landfill would have a life of 20 years. 6. The different streams of rubbish proposed to be disposed of are detailed in the application. The waste will generally be coming from the metropolitan area. 7. Noted. 8. The applicant is required to comply with the DEC requirements for landfill development which would address possible offsite contamination issues. 9. Noted.	
8.	Bridget & Monica Leggett	1. We strongly support the Shire of Toodyay's Strategic Waste Management Plan. Relevant to this proposal is the principle of applying local solutions to local problems. The importation of Type 2 waste into the Shire is inconsistent with this principle. 2. We consider a Class II unlined Landfill is inappropriate for this site. It does not require adequate monitoring of inputs, and it leaves major responsibility with the owners of the waste, not with the operator, whilst allowing more noxious	1. The Strategic Waste Management Plan is a plan adopted by the Shire to improve waste management techniques within the Shire and improve education. It is not a statutory document that controls land use. This facility potentially could be used by the Shire for the disposal of its wastes which would support the plan. 2. The DEC establishes the guidelines to prevent any possible environmental implications in landfill sites. The applicant would be required to obtain a licence and works approval from the DEC and compliance with conditions would be	That the submission be noted. That a condition is placed on the planning approval that no tyres are to be stored on site.

		wastes than a Class I Landfill. 3. There are a number of shortcomings with the proposal. Of particular concern are the following: a) The site is to be used for the 'temporary' storage of bald tyres, which pose a fire and pollution hazard. Above ground storage has nothing to do with landfill so baled tyres should not be imported, and burial of tyres is unacceptable. The timeframe is also ambiguous: "until they can be recovered or recycled". b) We consider the broader environmental issues have not been adequately addressed in this proposal. For example, what will be the short and long term impacts on Jimperding Brook? c) The proposal depends on groundwater measurements taken on 24 March 1998, at the end of a particularly dry summer. More recent and comprehensive data is needed. d) The monitoring regime outlined is vague and inadequate. Given that the proposed Landfill will be unlined and that there will be no complete inventory of the waste stream, the monitoring regime needs to be appropriate for a worst-case-scenario. e) We have been unable to find substantiating evidence (even an ABN number) for the claims made for Opal Vale's reputation and experience, beyond their operation of the existing Chitty Road	monitored by the DEC. 3. Please see comments below. a) Noted. It is recommended that a condition is placed on the planning approval that no tyres are to be stored on site. b) The applicant has demonstrated within the application that these concerns and the DEC guidelines have been taken into account in the assessment of the application. This would also be further reviewed by the DEC at the licence and works approval stage. c) This issue would be reviewed by the DEC as a part of the works approval and licence process. d) Through the works approval and licensing process the applicant would be required to undertaken monitoring which would be audited by the DEC. e) The applicant also operates under the name of Instant Waste.	

		Class I Landfill. Do they operate under another name? 4. Given the above, we strongly urge Council to reject the proposal.	4. Noted.	
9.	M Redfern	1. I believe the site is unsuitable for a Class 2 landfill as it does not meet acceptance criteria for a house and creek line and has great risk of polluting groundwater. 2. The justification for Class II landfill in the document is that the current landfill next door cannot meet the Class I acceptance criteria. The company should improve their sorting mechanisms rather than be allowed to build this landfill. 3. A second justification is that Opal Vale is currently unable to dispose of Class II waste in the local area. The truck coming to the current landfill drive past the Red Hill or Northam tip so this is not a good justification. The Class II waste could be removed from the site and taken to these landfills. The company should seek a solution to their lack of sorting, not the Shire. 4. The document states in 1.2 "only material for which there is no viable re-use will be placed in the waste facility". Under this statement wood should not be allowed as it can be chipped and used as a mulch or composted. It could be used as final cover on top of the current landfill. 5. I do not believe the site is suitable for a class II landfill as it is at the top of a water	1. The application was referred to the DEC and Department of Water so that they could provide advice on these matters. While it was noted that it was in close proximity, no objections were raised in this respect. 2. The type of material that can be accepted in a Class I site is restricted to certain materials. The applicant is seeking approval for Class II to allow for a wider range of wastes to be disposed of on site. 3. With the zero waste initiative it is intended that the amount of waste disposed of in landfill sites decreases, however there are still certain types of wastes which cannot be recycled or reused presently. 4. The application details the type of wastes to be disposed of within the facility. 5. The applicant would be required to comply with the DEC requirements for	That the submission be noted. It is recommended that Council resolve to defer consideration of planning application until the applicant has obtained a licence and works approval from the DEC and the DEC has agreed to receive and manage a financial assurance from the applicant.

		shed. 4.1 states "the locality consists of a elongate narrow plateau that runs north west along the ridge line." Landholders who use the creeks down stream could be affected by leachate. An inert landfill which has no leachate would be more appropriate.	the establishment of a landfill site. This would be further assessed when the applicant submits for a licence and works approval through the DEC.	
		6. The document also states that municipal waste could be accepted in the future. The Shire should require that municipal waste is only accepted in a class III landfill with appropriate lining, leachate collection and treatment systems and gas collection. This is current best practice for the state and should be a minimum requirement. Class II landfills are only appropriate for remote towns such as Halls Creek where an alternative is many hundreds of kilometres away.	6. The regulations setting the types of wastes disposed of within a facility are not set by the Shire of Toodyay.	
		7. The document also states that the public will not be able to use the landfill. I can see no benefit to the people of Toodyay from this proposal. It will not only benefit the company and may pollute the creek and ground water. A big risk for the Council to take for no benefit to the community.	7. The applicant has not proposed to open the facility to the public so that there are controls on the types of wastes and the source of the waste to the facility.	
		8. 4.6.3 states that just to the north east of the current pit is the beginning of a small drainage line. A 100 metre buffer should be mandatory.	8. The applicant has been referred to the DEC and DoW who have not objected to the proposal.	
		9. The roads to the landfill should be sealed to allow for heavy trucks or the Shire will need to continually upgrade the road surface. It will also minimise dust from	9. The applicant is proposing to access the site through Salt Valley Road which is a sealed road. Further to this, it is proposed that a road maintenance	

		truck movements. 10. The EPA separation distance to sensitive premises is 500 metres and 150 metres to a single residence. The document states a house belonging to the landholder is within this area, this means the site is unsuitable. 11. The earthquake risk has not been adequately addressed. Closest fault lines should be indicated. 12. The actual management of the landfill seems to be well addressed. However I believe the site should require a weighbridge so that amounts of waste can be accurately determined. The operator of the weighbridge should also be required to visually inspect each load. 13. The groundwater monitoring does not state what the tests will be for or what standard the levels will be compared to. The company should be required to meet the standard of a similar landfill in Henderson. 14. I do not believe the site is suitable for a Class II landfill. However if the Shire approves the application then it should require a bank bond for the rehabilitation of the land similar to the one the Shire of Serpentine-Jarrahdale has for the landfill	condition is placed on the planning approval. 10. The landowner has consented to the application being submitted on his land and he is aware of the position of the landfill site. These buffers are established by the DEC and they have not raised objection to this. 11. The Siting, Design and Rehabilitation of Landfills – Best Practice Environmental Management Guidelines from the DEC state that landfill site should not be positioned within 100 metres of a fault line displaced in the Holocene period. The proposal is positioned more than 100m from a fault line. 12. Noted. If supported it is recommended that a condition is imposed that the applicant is required to detail to the Shire, through the submission of a surveyors certificate, the amount of material disposed of within the site. 13. As detailed in the application, monitoring will be undertaken in accordance with the DEC Guidelines for Groundwater monitoring adjacent to landfill sites. 14. Concerns raised are noted. The DEC has the capacity under the *Environmental Protection Act* 1986, to require the applicant to provide a financial assurance through a condition on the works approval and/or licence. It	

		at Cardup. This would not make the company not the Shire responsible for any rehabilitation.	is recommended that the application is deferred until the proponent obtains the licence and works approval and the DEC agrees to receive and manage a financial assurance that is acceptable to the Shire of Toodyay.	
10	Paul Tholen Department of Environment and Conservation	1. My role as the District Land Use Planning Officer for DEC, is to look at the Conservation Assets surrounding the proposed site and provide general advice on the suitability of the location for such a development. 2. It should be noted that my advice is general in nature and only a full application to the Environmental Regulations Branch will provide detailed information on the suitability of the site for this development. 3. I have completed a desktop assessment which shows the location of remnant vegetation, threatened species, hydrological waterways and DEC estate, in relation to 11 Chitty Road Toodyay: 4. Fauna Endangered Birds have been recorded at two separate locations within close proximity to the proposed site, approximately 2 km to the North and West of Lot 11. This indicates that threatened fauna species utilise habitat close by for feeding and possibly nesting purposes. Any and all remnant vegetation on Lot 11 is important for the support of cockatoo species and the Shire needs to look at restricting the removal of remnant	1. Noted. 2. Noted. 3. Noted. 4. Noted, the application is in an existing clay extraction area and no further removal of vegetation is proposed.	That the submission be noted.

		vegetation at this site. 5. Flora Priority 2, 3 and 4 species of flora have been recorded in locations within 2 km of the subject site to the east and south. Remnant vegetation on Lot 11 may contain examples of these populations; however their Priority status will not entirely restrict the development. Again the Shire will need to look at restricting the removal of remnant vegetation at this site. 6. Hydrology Small creek lines and ephemeral streams seem to move in a south east to north west direction. DEC supports the monitoring of water quality in groundwater bores; however water quality should also be considered in the creek lines and streams. 7. DEC Reserves Clackline Nature Reserve: R32400 is located approximately 2 km to the south of Lot 11. There are no perceived impacts upon this Reserve from this development at this stage. Nanamoolan Nature Reserve: R33254 is located approximately 2 km to the east of Lot 11. There are no perceived impacts upon this Reserve from this development at this stage. 8. Acid Sulfate Soils Being high in the landscape, there is a reduced chance of Acid Sulfate Soils being an issue – this needs to be	5. Noted, please see comments above. 6. Noted. 7. Noted. 8. Noted.	

		confirmed through the Environmental Regulations Branch 9. Dust, Noise and Odour Being 500 metres from the closest neighbor, EMB will look closely at the buffer distance and proposals to mitigate Dust, Noise and Odours on-site. EPA guidance Statement 3 refers to a Class 2 Landfill site having a minimum buffer distance to a single residence of 150 m; however the site must have processes in place to address these issues. 10. Rehabilitation DEC supports the rehabilitation of disturbed areas with flora endemic to the area. A weeds management plan as well as a rehabilitation plan needs further consideration. 11. Summary The Perth Hills District DEC Office does not object to the proposal for a Waste Facility Class II Landfill site to be further investigated at the site of Lot 11 Chitty Road, Toodyay. Environmental concerns such as the protection of threatened flora and fauna, remnant vegetation and DEC Nature Reserves and the rehabilitation of the site can fall under the scope of this project where mitigating actions are put in place. 12. Please note that this is general advice and does not constitute acceptance of the	9. Noted. 10. Noted, as detailed in the report at the completion of the landfill the site would be rehabilitated. As detailed in the rehabilitation plan, weeds would be sprayed or grubbed out. The recommended condition of planning approval would require a maintenance period following the installation of rehabilitation on site. 11. Noted.	

		Waste Facility in its entirety. A full Works Approval application is required to be made to the Environmental Regulations Branch of DEC were the Shire to accept the existence of the facility at this location.	12. Noted.	
11	Main Roads Western Australia	1. Whilst the proposal indicates that site access will be from Salt Valley Road, it appears that the vehicles carrying landfill will exit and enter Toodyay Road at the Fernie Road intersection to travel along Salt Valley Road. 2. The impact of this proposal on this intersection cannot be determined without further information from the proponent. Information required included at a minimum: • Proposed number of vehicles per day servicing the site; • Type of vehicle (as of right or restricted access vehicles) and proposed load size. 3. Once this information is provided, MRWA can assess how the proposal may impact the intersection and then be able to provide requirements regarding upgrading and possible signage. 4. There is no intention of MRWA to upgrade the Fernie Road intersection in the medium term, and any additional vehicle movement may impact safe movement through this intersection.	1. Noted. 2. Noted. 3. Noted. 4. Noted.	That the submission be noted.

		The further information required (as above) was obtained, MRWA provided the following comments. 5. As the proponent has advised that no additional heavy vehicle movements will be generated to service the Landfill Facility, MRWA are not able to advise any suitable conditions appropriate to the upgrading of Fernie Road and Toodyay Road. 6. Considering the state of the intersection, the Shire of Toodyay may consider imposing a condition on the proponent to resurface Fernie Road where it approaches the intersection to minimize the migration of gravel onto the sealed highway. 7. Should the proponent change the type of vehicle or frequency, MRWA reserves the right to reassess any impact on the intersection.	5. Noted. 6. Noted, the monies collected as a part of the road maintenance contribution could be used towards this upgrade. 7. Noted.	
12	Kershaw Legal on behalf of Karratta Pty Ltd	1. Karratta is the trustee of a trust which vested Lot 11 Chitty Road, Toodyay to Simon Farrell, the current registered proprietor of Lot 11 on Deposited Plan 34937. Under the terms of the vesting deed, Karratta retained all rights over the property in relation to the extraction of clay and other minerals for a period expiring in 14 April 2024. 2. It has come to my client's notice that Opal Vale Pty Ltd has made some arrangement with the registered	1. Noted. 2. Noted.	That the submission be noted.

		proprietor, Simon Farrell, proposing to fill parts of the clay pit on the property known as "Williamson's Clay Pit" 3. My Client was not notified of this proposal. It wishes to oppose to the proposal as it affects his rights under the vesting deed. My client has lodged a caveat on the land at Landgate as is its rights under the vesting deed and intends to take the matter further. 4. It is noted that in the proposal submitted to you by Opal Vale Pty Ltd, it states at Item 2B of the Project Summary that there are no mineral tenements over the site. Although the vesting deed is a confidential document my client has instructed me to provide you with a copy so that you can understand the extent of my clients rights in relation to that clay pit and also to any other clay pit on the land. 5. In my client's submission, you cannot approve the proposed landfill as it currently stands unless my client makes a suitable arrangement with Opal Vale Pty Ltd. Doing so would adversely affect my client's rights to clay extraction from the property. 6. My client has informed Opal Vale Pty Ltd of its right in relation to the clay extraction from the property and that it opposes the proposed landfill arrangement.	3. Noted. The terms and conditions of the Deed are matters outside the Shire of Toodyay's control. The Shire has sought advice from its solicitors who have advised that the Shire is in a position where it must determine the application. 4. Noted. 5. Advice received from the Shire's solicitors confirms that the Shire is in a position to make a determination on the application. 6. Noted.	
13	C O'Connor Austral Bricks	1. Following discussion with Mr. Tony Farrell and Mr. Simon Farrell, owners of LotM2027 Chitty Road and Mr. Sam Mangione, Director of Opal Vale Pty Ltd	1. Noted.	That the submission be noted.

No	Contact	Submission	Comments	Recommendation
		and reviewing of the Management and Rehabilitation programme of the clay pit on Lot M2027, I can confirm the following:		
		2. The proposed programme will not interfere with the planned clay extraction activities over the life of the clay resource.	2. Noted.	
		3. Austral Bricks has extracted all clays suitable for brick and tile making from the southern end of the existing pit and the rehabilitation and extraction will be coordinated so that all economic clays are extracted from the overall resource (please refer paragraph 4.3 of the landfill proposal of Opal Vale which refers to salt levels in the clay).	3. Noted.	
		4. The remaining economic resource comprises approximately one million tonnes. Because of exhaustion of the red and orange clays, future planned extraction is expected to reduce to approximately the current level of 45,000tpa for the next twenty years.	4. Noted.	
		5. So that future clay extraction is not impacted by longer term rehabilitation of the pit, it has been agreed between the Farrell's and Austral Bricks that the Farrell's will, if required, and at their expense, stockpile sufficient clay tonnages not to impact on Austral Bricks' requirements.	5. Noted.	
		6. Austral Bricks therefore has no objection to the granting of a license for the proposed Class II Waste Facility at Lot 11 Chitty Road, Toodyay.	6. Noted.	

16 August 2012 Document Ref. 2013-0007AC

Instant Waste
PO Box 419
Morley Business Centre
Morley, WA, 6943

Attention: Mr Sam Mangione

RE: GEOTECHNICAL STABILITY REVIEW, OPAL VALE LANDFILL, CHITTY ROAD, TOODYAY, WA

1 INTRODUCTION AND BACKGROUND INFORMATION

CMW Geosciences Pty Ltd (CMW) was authorised by Instant Waste (Sam Mangione) to undertake embankment stability assessments of a proposed landfill under pseudo static seismic loading conditions at the Opal Vale Landfill, located at Chitty Road, Toodyay, WA. We understand that the Department of Environment and Conservation (DEC) require this additional information before they can accept the overall landfill design.

The proposed landfill is located in a disused site previously used to mine clay materials for brick making. The existing slopes of the clay pit excavation are up to approximately 12 metres high and have been cut back to an angle of approximately 1V:0.36H (70 degrees). We have been advised that the batters have not been the subject of instability and have remained stable for approximately the last 10 years despite exposure to the elements i.e. rainfall events. We understand that the landfill will comprise Class II waste, defined as a mixture of:

- Clean Fill
- Type 1 Inert Waste
- Putrescible Wastes
- Contaminated solid waste materials that meets the acceptance criteria specified for Class II landfills (possibly with specific licence conditions)
- Type 2 Inert Wastes (with specific licence conditions)
- Type 1 and Type 2 Special Wastes (for registered sites as approved under the Controlled Waste Regulations).

We have liaised with I W Projects (Ian Watkins) to determine the staging associated with the construction of the landfill cells, the methodology associated with the installation of the liner and the backfilling of the Class II waste.

We understand that the construction of Cell One will include a cut to fill (actual quantum of earthworks is unknown) to form 1V:3H (18 degree) batter slopes. Cell One will be contained by a temporary clay bund near the Cell One boundary but it is our understanding that this will not be designed to support any loads from the waste materials. We also understand that the base of the landfill will be graded

back slightly into the pit wall to assist with global stability and the control of leachate. Once this cell has been backfilled with Class II waste the remaining 6 cells will be constructed in succession, over a number of years, to complete the landfill. This sequential development will require that the existing slope heights and angles remain 'as is' until the construction occurs at each future cell location.

The scope of work and associated terms and conditions of our engagement were detailed in our proposal letter referenced 2013-0007AB dated 26 July 2012.

2 SUMMARY OF DATA SUPPLIED

We have been supplied with SGS laboratory test results, dated December 2010, which included 6 Atterberg Limit and permeability tests on the clay samples for liner design purposes. We have also been supplied with a copy of the Stass Environmental (Stass) Groundwater Review report dated June 2011.

We have not currently had the opportunity to complete a site investigation to quantify a ground model or obtain specific strength properties of the materials present. We have used the Atterberg Limits obtained during laboratory testing (Table 1 below) and published correlations between the Liquidity Index (LI) and undrained shear strength (Su) to estimate the likely strength of the materials present on site. Based on the laboratory tests provided we would expect the clay undrained shear strength (Su) to be in excess of 200kPa.

Table 1: Laboratory Test Results – SGS Australia Pty Ltd dated December 2010

Sample	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Linear Shrinkage	Bulk Density (t/M^3)	Moisture Content (%)
OPAL 1	38	24	14	4.0	1.75	15.8
OPAL 2	35	22	13	5.5	1.63	20.2
OPAL 3	36	23	13	5.0	1.81	14.5
OPAL 4	39	24	15	2.5	1.67	18.5
OPAL 5	35	24	11	2.5	1.76	15.0
OPAL 6	39	23	16	4.5	1.67	18.5

Where the insitu moisture content is less than the PL as is the case with the samples tested, the soil type is likely to be desiccated and pseudo over consolidated (due to drying). Based on this model we would expect the type of failure to be brittle if sheared. This has an implication on safe working distances from the existing slope which are discussed later in this report.

3 GEOLOGICAL MODEL

The 1:250,000 (Perth) Sheet produced by the Geological Survey of Western Australia (GSWA) indicates that the site area is located within the geological units outlined in Table 2 below.

Table 2: Geological Units (1:250,000 Perth GSWA)

Unit	Description
Czl	Laterite chiefly massive, but includes overlying pisolithic gravel and laterised sand.

Alm	Muscovite – chlorite phyllitic schist.
Qrc	Colluvium including valley filled deposits variably laterised and podsolised.
Note: The map also depicts the presence of nearby quarries and abandoned quarries for pisolithic laterite gravel, clay, building stone and iron. It also suggests areas where bedrock is obscured by both residual and colluvium deposits.	

The Stass report described the area to be filled is a void cut into deep micaceous clays formed from the weathering of schists of the Jimperding Metamorphic Belt. These schists have been subjected to a long period of weathering, in the Mesozoic - Cainozoic, to produce the laterite erosion surface, of which a remnant caps the nearby hills. The groundwater level was measured at 4 locations by Stass during their groundwater study which indicated depths ranging from 7.41m (266.49 mAHD) to 18.21m (281.15 mAHD) below ground levels. These monitoring wells were located around the southern boundary of the proposed landfill area.

We have reviewed photographs of the cuts provided in the Stass Report which show slopes with no signs of instability despite being exposed to the elements for approximately 10 years, other than signs of surficial weathering.

4 STABILITY ASSESSMENT

The degree of stability of a slope is expressed as the factor of safety, which is the ratio of the forces resisting failure to the driving forces causing instability. Theoretical failure of a slope is possible when the factor of safety is ≤1.0, while increasing values above 1.0 indicate improving stability. Conventional slope stability analyses usually result in a minimum value of 1.5 being adopted for permanent slopes under static conditions but other considerations such as the geology, slope geometry, groundwater and history of the site, site use etc are taken into account in assessing the acceptable degree of risk.

Cross sections were drawn through strategic areas of the project where shown on the appended site plan. These sections were selected as being the most appropriate for computer stability analyses because the slopes were the steepest and the before and after earthworks profiles are significantly different. The cross-sections were analysed for deep seated circular slips. The slope stability software program used was SLIDE version 6.0.

Strength values for overconsolidated clays and clay shales range from peak undrained shear strengths down to as low as residual shear strength after displacement has occurred. The decision process regarding the selection of the design strength of these materials includes both technical and non-technical issues such as:

- Structural and groundwater conditions of the material
- Presence and inclination of bedding planes
- Presence of relict landslides in the area
- Other discontinuities in the mass
- Design life of the project.

There are also a multitude of variable properties relating to the landfill waste including grain size distribution, porosity, moisture content, hydraulic conductivity, changes in ground / surface water conditions, unit weight, strength, compressibility etc. However, the properties most germane to slope stability analysis are unit weight and shear strength which we have estimated based on our research into typical engineering properties of landfill waste.

We have reviewed the consistency terms provided in AS1726-1993 for cohesive soils which depict stiff to very stiff clays with undrained shear strengths ranging from >50kPa to 200kPa. These published values correlate to the LI / Su correlation provided above. Further anecdotal evidence provided by I W Projects suggests that the exposed slopes have not been the subject of any slope instability and there are no signs of instability or tension cracks. On this basis we have analysed the worst case (steepest and highest) existing slopes using soil strength parameters as presented in Table 3 below.

Table 3: Soil Strength Parameters

Description	Undrained	Drained	
	Su (kPa)	C' (kPa)	Ø' (degrees)
Very Stiff clayey silts and silty clays	100	8 to 12	28 to 32
Very Stiff Engineered Fill	150	10	32
Class II Landfill Materials	40	3 to 5	20 to 25

The earthquake ground motion used for pseudo static analysis was determined using AS1170.4-2007, part 4 Earthquake Actions in Australia. We assigned a Level 4 for the structural importance of the site and used a class of Ce to depict a shallow soil site. The design working life of the landfill provided for an annual probability of exceedance (P) 1/2500 with an earthquake design category (EDC) of II. Following our Dynamic analysis calculation we determined that the horizontal design response spectrum was 0.23. The minimum factors if safety obtained for each scenario analysed in provided in Table 4 below.

Table 4: Minimum Factors of Safety

Soil Parameters	Conditions of analysis	Type of Failure	Factor of Safety
Drained (Long Term)	Existing slope height and angle (70 degrees) with highly saturated ground conditions - drained soil shear strength parameters	Circular	0.9
Drained (Long Term)	Existing slope height and angle (70 degrees) with no groundwater - drained soil shear strength parameters	Circular	1.1
Undrained (Short Term)	Existing slope height and angle (70 degrees) (Su ≥ 100kPa)	Circular	2.9
Undrained (Short Term)	Existing slope height and angle with Seismic Load - horizontal ground acceleration 0.23 (70 degrees) (Su ≥ 100kPa)	Circular	2.3
Drained (Long Term)	Proposed slope angle (1V:3H) with highly saturated ground conditions	Circular	2.1

Undrained (Short Term)	Proposed slope angle (1V:3H) with Seismic Load - horizontal ground acceleration 0.23	Circular	1.5
Drained (Long Term)	Cell One Completed without Seismic Load	Circular	1.3
Undrained (Short Term)	Cell One Completed with Seismic Load - horizontal ground acceleration 0.23	Circular	1.1

As can be seen from the above results, with drained soil shear strength parameters, the cross-section was found to have a minimum factor of safety of 0.9 for an overburden slip extending approximately 3 metres back from the crest of the slope. This factor is for 'worst case' highly saturated ground conditions, which should not occur on the site other than during temporary extreme storm conditions and accordingly the result is considered to be satisfactory. The analysis of a dry slope with drained soil strength parameters produced a factor of safety of 1.1.

Using undrained soil shear strength parameters the factor of safety was 2.9. Then using conservative undrained soil strength parameters under pseudo-static loading produced a factor of safety in excess of 2. The slope was then analysed at proposed angles of 1V:3H (18 degrees) with minor cuts at the crest and bulk filling placed and compacted at the toe of the slope. This produced a factor of safety in excess of 2 for a high phreatic surface while a factor of safety of 1.5 using undrained soil shear strength parameters under pseudo-static loading was determined.

Cell One was then analysed under seismic loading to access approximate safe batter angles of the waste materials. This produced a factor of safety of 1.1 for slope angles not exceeding 1V:2H (approximately 26 degrees). A design factor of safety >1.0 is satisfactory under seismic loading.

5 COMMENTS

We have reviewed and relied upon laboratory testing, a site specific groundwater report, geological maps and Australian Standards where appropriate. There are still a number of variables that affect the stability of the cut slopes and landfill. Despite these limitations we consider that once the batter slopes have been earthworked to form 1V:3H batter slope angles, the stability of the site should improve even under pseudo static loading. The following comments and qualifications must be noted:

- The lowest factors of safety were generated from the natural slopes during drained shear strength parameters. This analysis leads to slope failure when the land profile analysed was highly saturated. We therefore consider that the proposed landfill will ease the land contours and improve stability of the site. As suggested, the construction of each cell will happen sequentially so all existing slopes that are not affected by earthworks will need to be monitored for signs of instability and we should be contacted for further advice should slope movements occur.
- Based on the slip circle stability assessment, setback distances from the top and bottom of exposed natural slopes should be imposed as elevated ground conditions or high surcharge loads are likely to cause slope instability. We therefore suggest a setback / exclusion distance of approximately ≥10 metres be adopted in the absence of site specific shear strength parameters.
- We have analysed the soil fill materials to reflect a level of compaction suitable for Engineer certification. We therefore require that site won materials from excavations (excluding topsoil) should be compacted in layers not exceeding 300 mm in loose thickness compacted with a suitable roller at ±3% of the optimum moisture content. We understand that the specification

for this project includes compaction of materials to not less than 95% of the maximum (standard) Dry Density Ratio in accordance with the Main Road Specification 302 - Earthworks.

- During earthworks, site visits must be made by a suitably experienced Geotechnical Engineer or Engineering Geologist, who is familiar with the contents of this report, to ensure that topsoil stripping is carried out adequately (where appropriate), that the cut to fill earthworks are conducted in accordance with the specification and to audit compaction of earthworks. CMW would be pleased to perform this function if required.
- We have not undertaken settlement analysis and suggest that the likely depth of filling be determined so that the quantum of differential and total settlements can be established.
- The factor of safety for the completion of Cell One suggested finished slope angles of 1V:2H (approximately 26 degrees) should be appropriate for the interim exposed face of the landfill materials. This angle should not be exceeded unless consistent landfill shear strengths parameters can be confirmed and provided to us for use in additional stability analysis or onsite trails can be conducted to assess appropriate batter angles. The finished slopes of each cell could be benched to increase the overall stability of the slope but this will reduce landfill volume until the new cell is ready for filling.
- Site specific geotechnical investigations should be undertaken to confirm our findings with consideration given to relevant laboratory testing. As discussed above, we have adopted assumed shear strength parameters for the natural soils, filled ground and the Class II landfill materials. There are a number of variables that influence these parameters and our research into these correlations must be validated.

6 CONCLUSION

In the short term, the existing 70 degree slope during static conditions has an adequate factor of safety. However, the lowest factors of safety were obtained in the long term for the existing steep slopes when the phreatic surface is highly elevated. Unfortunately we are unable to determine what time period long term could be. Once the slopes are recontoured to 18 degrees, then they are stable even under seismic loading with the parameters used.

7 CLOSURE

Should you require any further information or clarification regarding our proposal, please do not hesitate to contact the undersigned.

For and on behalf of
CMW Geosciences Pty Ltd

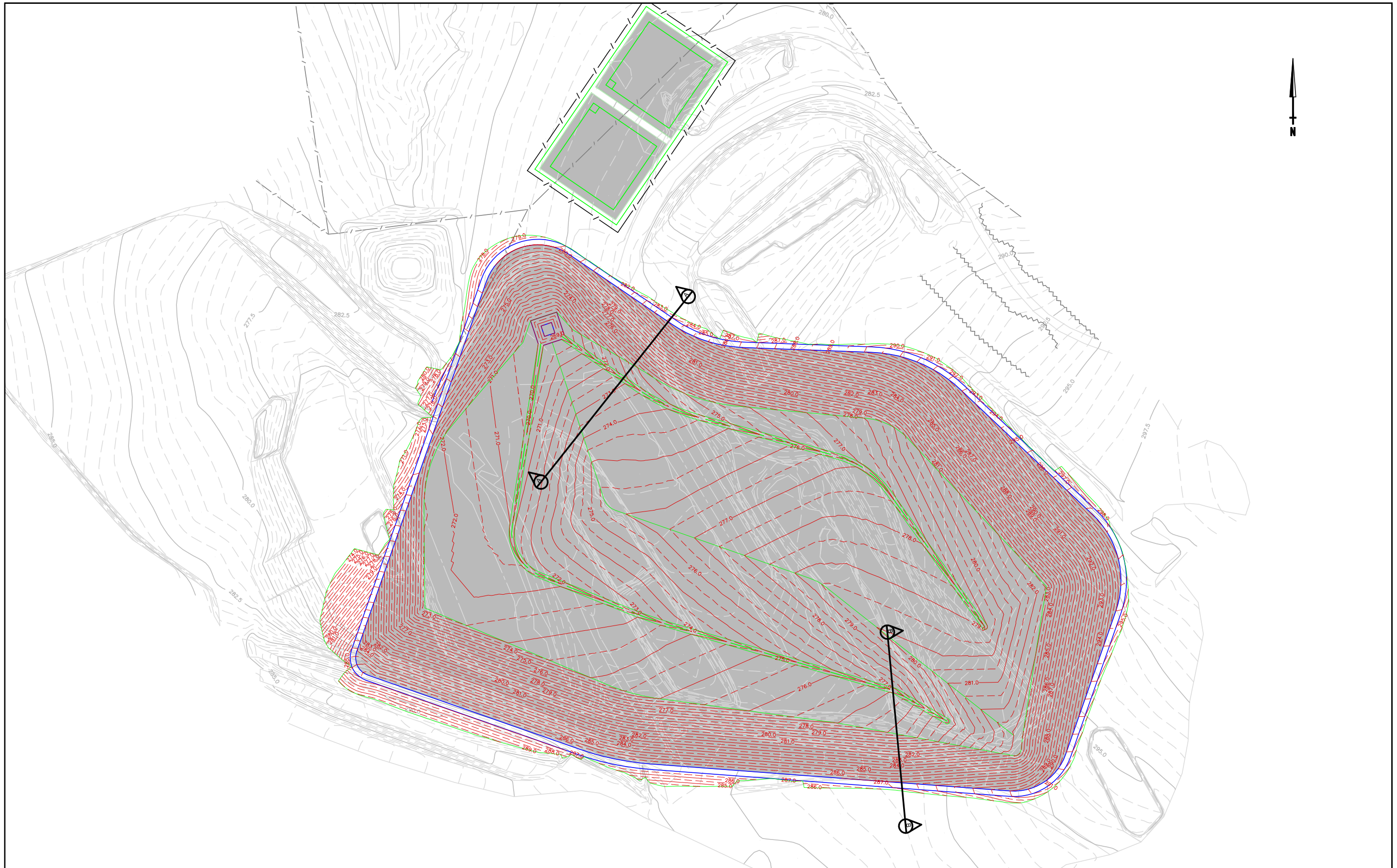
Phil Chapman

Managing Director

Distribution: 1 copy to Opal Vale Landfill (electronic) Original held by CMW Geosciences Pty Ltd

Appendix A

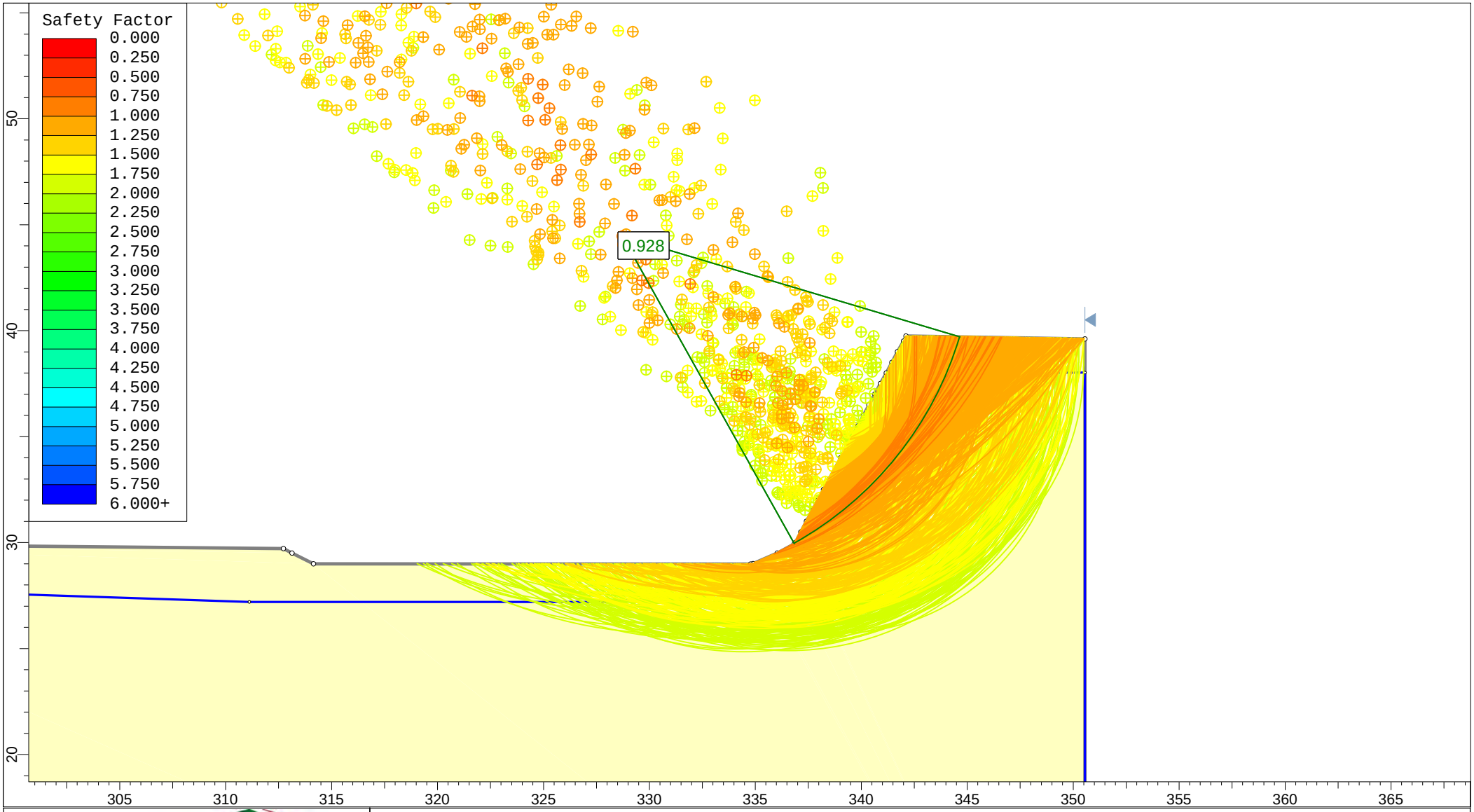
Site Plan



CMW Geosciences Pty Ltd Chapman Morton Woodward	CLIENT: **OPAL VALE PTY LTD**	DRAWN: LJT	DATE: 20/08/12	
	PROJECT: **PROPOSED CLASS II LANDFILL LOT 11 CHITTY ROAD, TOODYAY**	CHECKED: PDC	DATE: 20/08/12	
		PROJECT No. 2013-0007	FIGURE No. 01	
		SCALE: 1:2000	0 20 40 60 80 100 Metres	
	TITLE: **SITE PLAN**	REVISION: A	DATE: 20/08/12	A3

Appendix B

Stability Analysis



CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Existing Slope Height and Angle (70 Deg) with highly saturated ground conditions - drained soil shear strength parameters		
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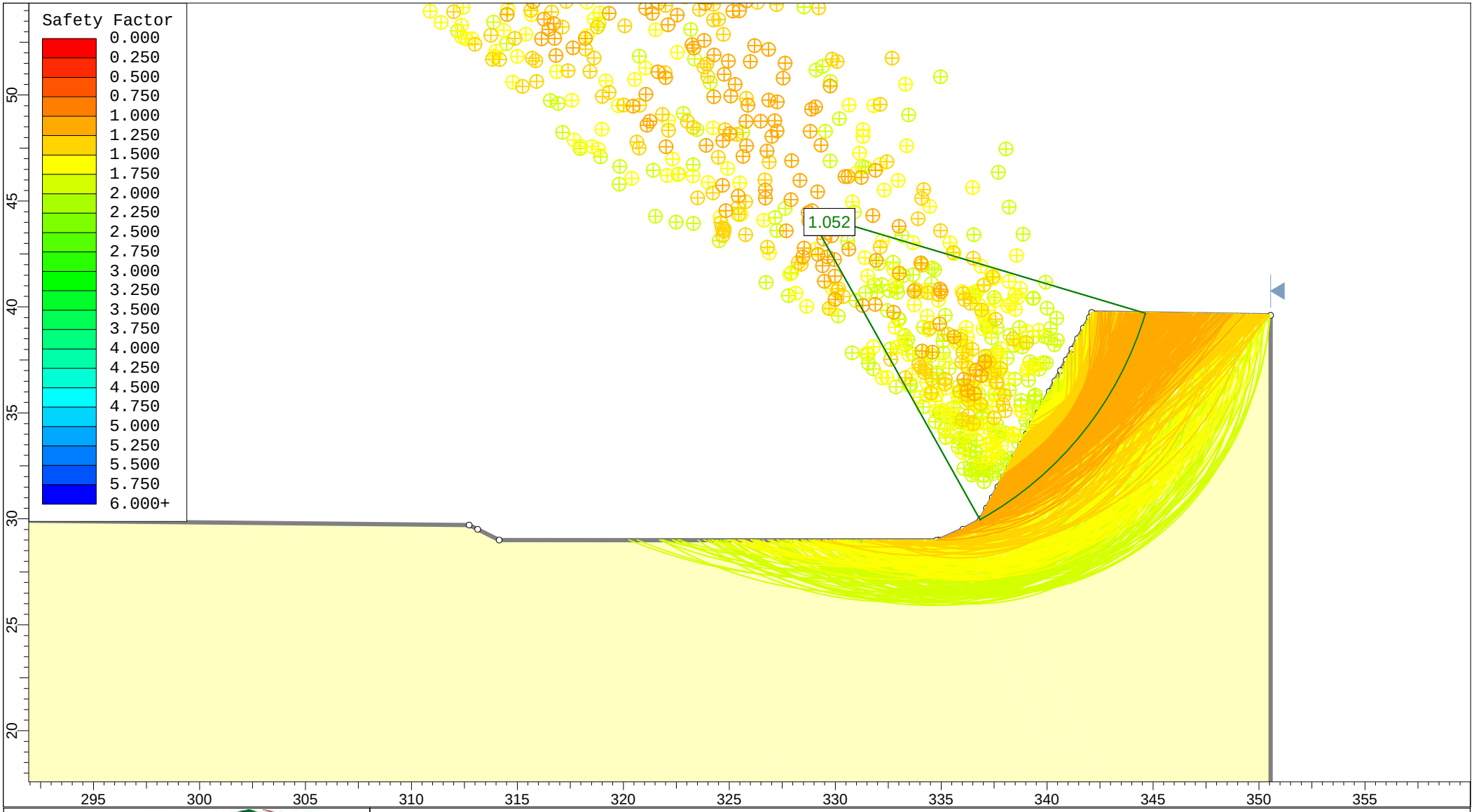
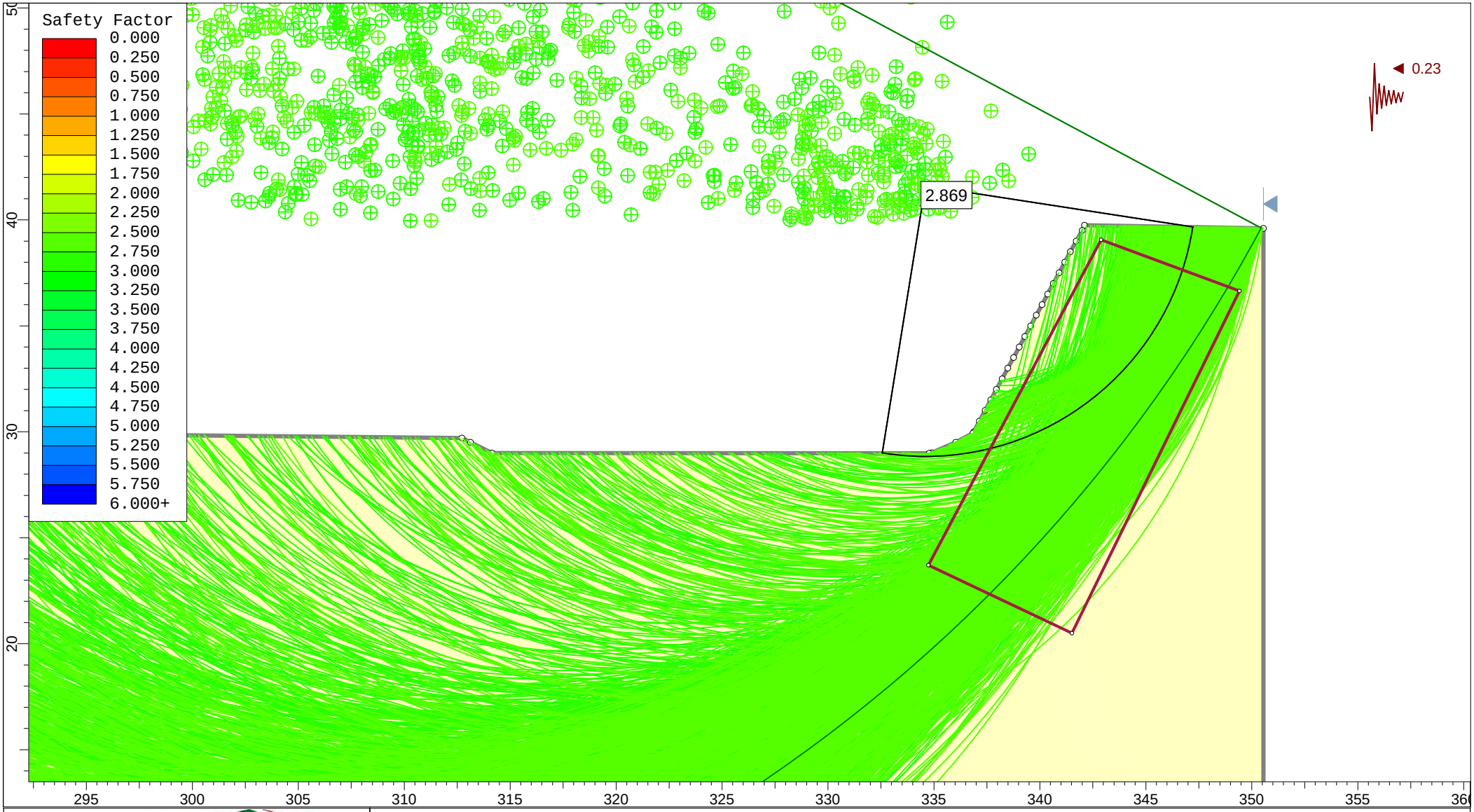


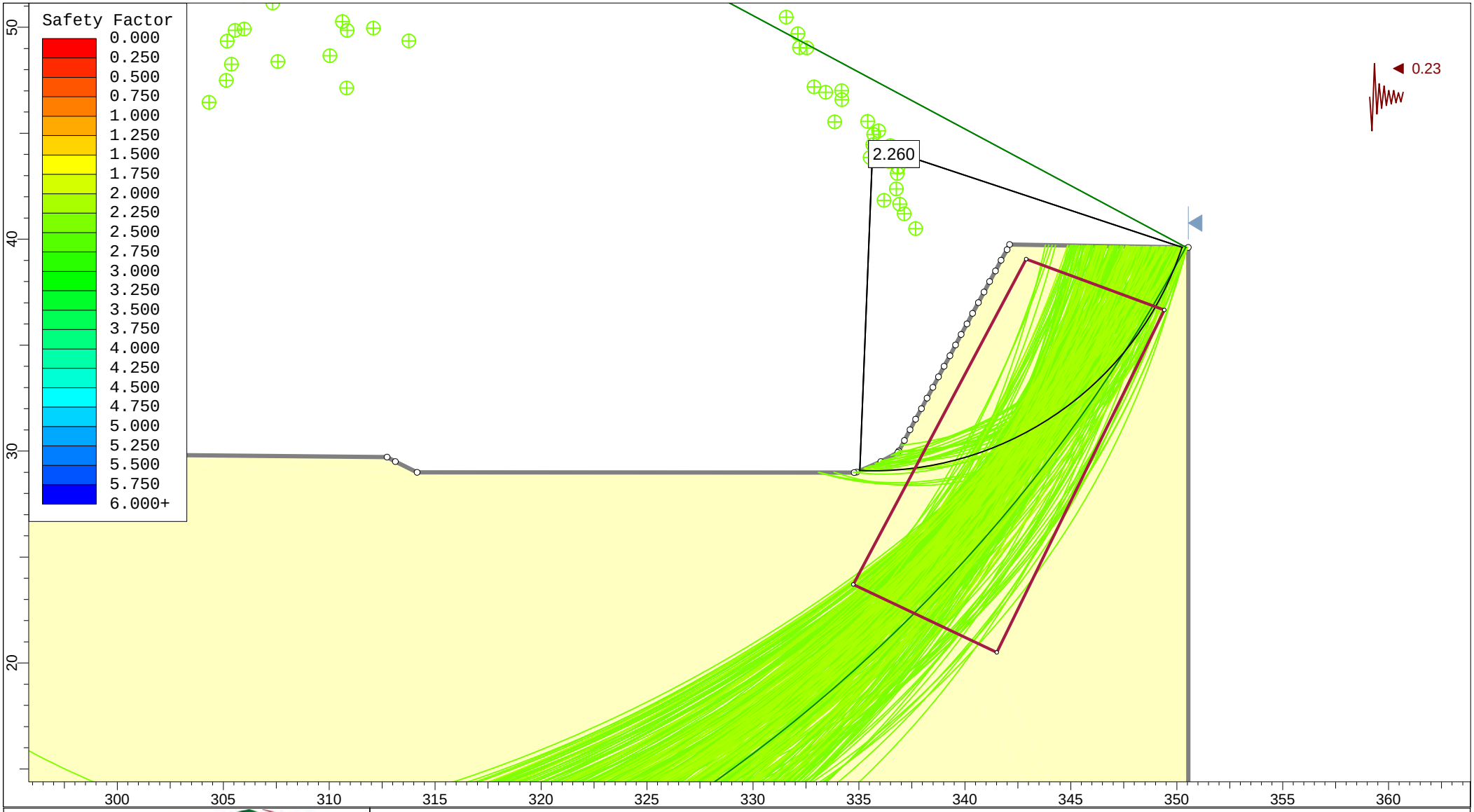
CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Existing Slope Height and Angle (70 Deg) with no ground conditions - drained soil shear strength parameters		
Drawn By	PDC	*Scale*	1:250
Date	2/08/2012, 1:04:52 PM	*File Name*	Existing Slope noGW NON SEISMIC.slim



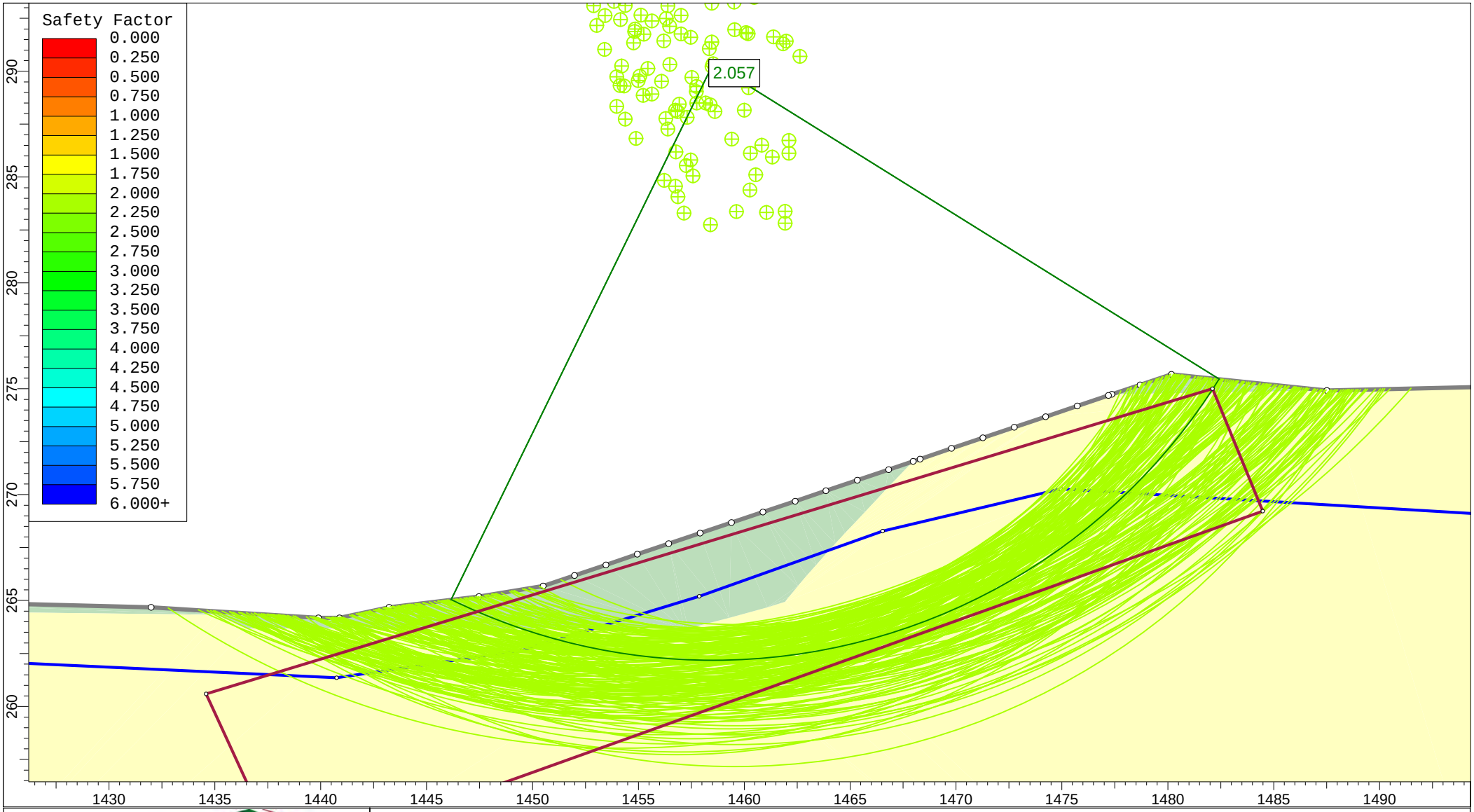
CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Existing slope height and angle (70 deg) (Su>100kPa)		
Drawn By	PDC	*Scale*	1:250
Date	2/08/2012, 1:04:52 PM	*File Name*	Existing Slope UNDRAINED NON SEISMIC.slim



CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Existing slope height and angle with Seismic Load - horizontal ground acceleration 0.23 (70 deg) (Su>100kPa)		
Drawn By	PDC	*Scale*	1:250
Date	2/08/2012, 1:04:52 PM	*File Name*	Existing Slope UNDRAINED SEISMIC 0.23.slim



CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Proposed slope angle (1V:3H) with highly saturated ground conditions		
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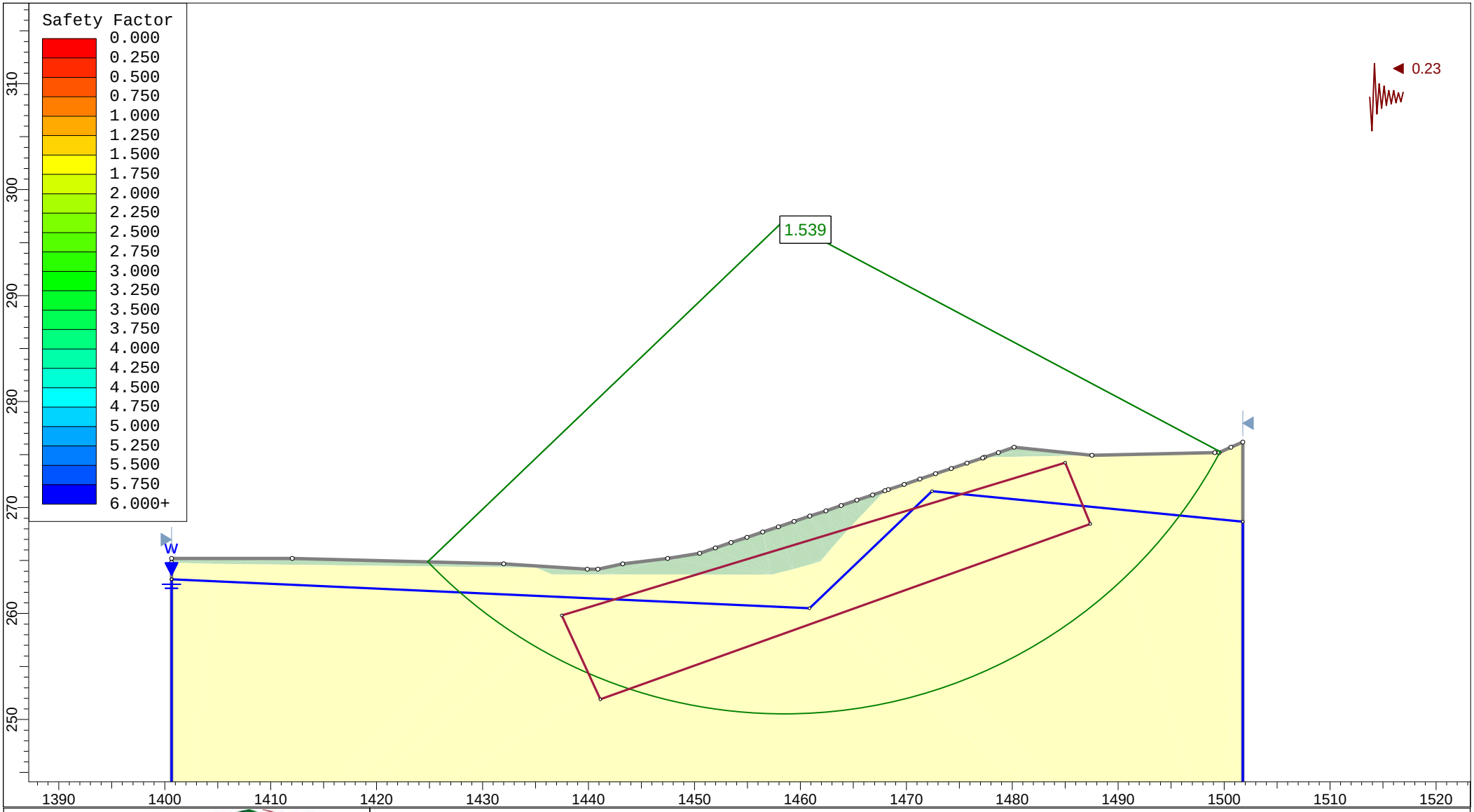
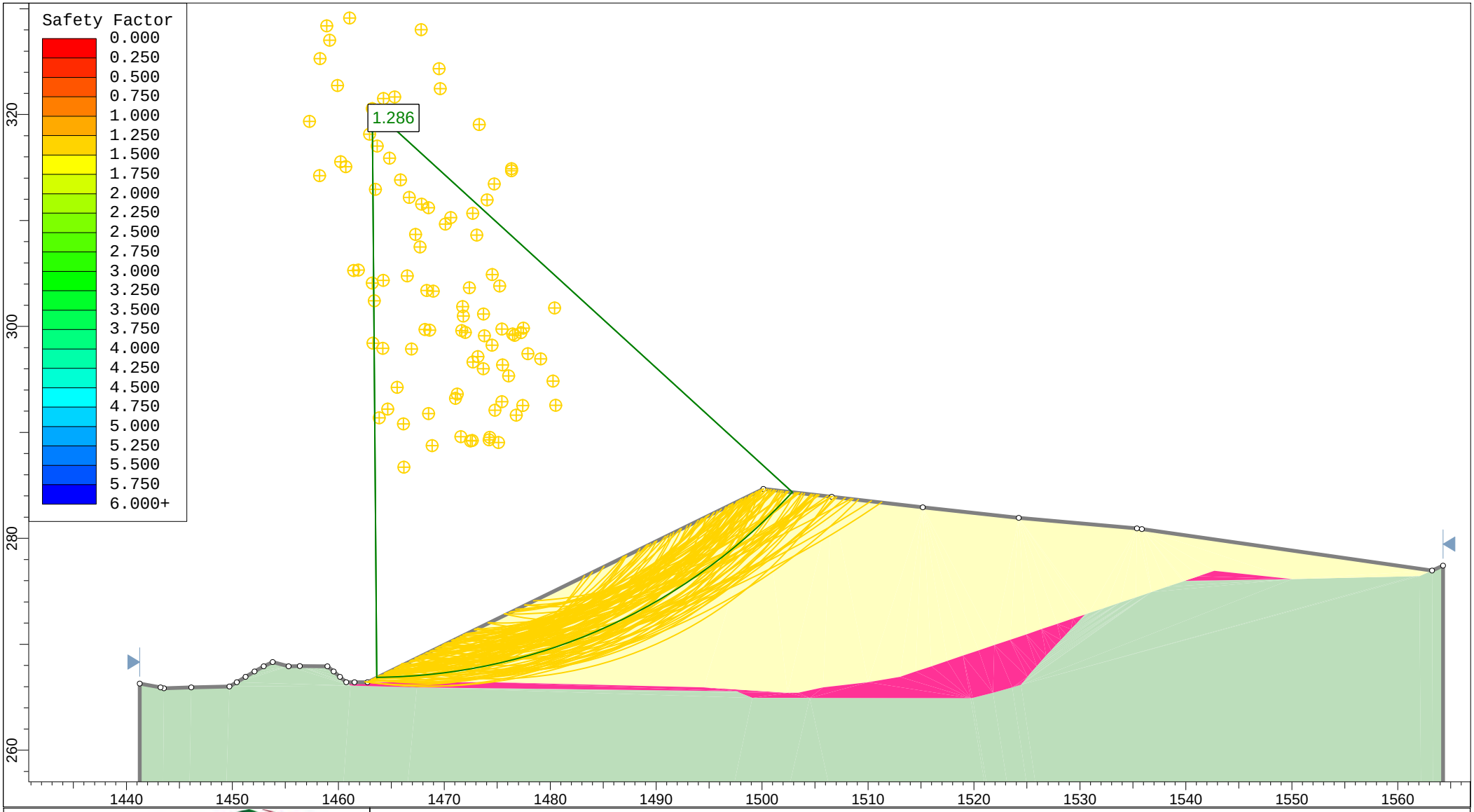


CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Cell One Completed with Seismic Load - Horizontal ground acceleration 0.23		
Drawn By	PDC	*Scale*	1:500
Date	7/08/2012, 10:06:38 AM	*File Name*	Proposed Slope SIESMIC LOAD 0 23 grid.slim



CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Cell One Completed without Seismic Load		
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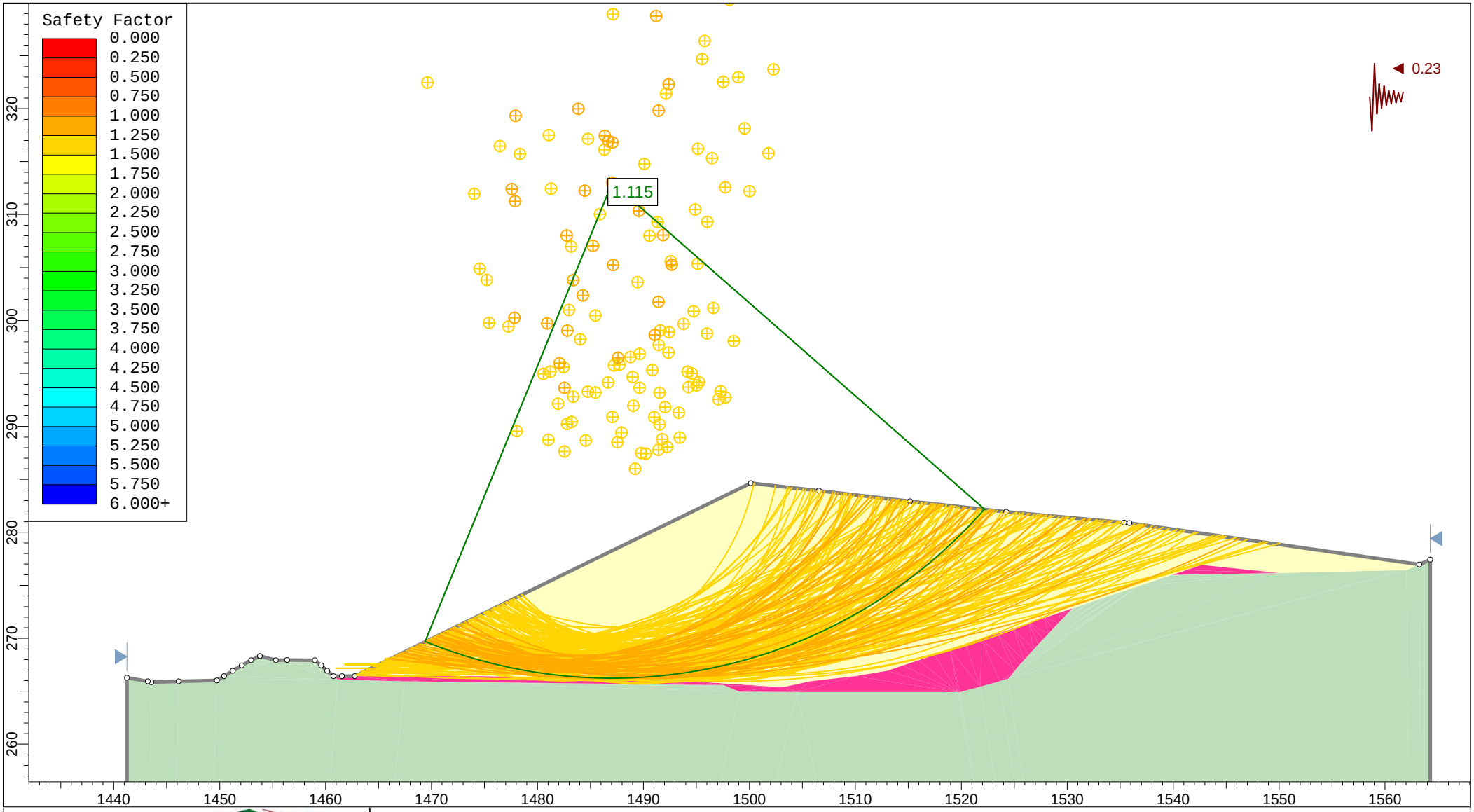

CMW Geosciences Pty Ltd
Chapman Morton Woodward

Project	OPAL VALE LANDFILL		
Slope stability analysis condtion	Cell One Completed with Seismic Load - Horizontal ground acceleration 0.23		
Drawn By	PDC	*Scale*	1:500
Date	20/08/2012, 10:37:58 AM	*File Name*	Cell One Completed SEISMIC LOAD 0.23 ver2.slim

Stakeholder and Community Consultation – June 2012

As part of the Shire of Toodyay Development Approval assessment in 2012/13 the Shire undertook an extensive stakeholder and community consultation process.

In accordance with Council's Policy M.2 – Public Consultation Formal Matters, consultation on the proposed development was undertaken in accordance with Level 'E'.

An advertisement was placed in the April and May 2012 edition of the Toodyay Herald. A notice was also placed on Council's website, a sign was located on the site and all adjoining landowners located within 500 m of the site were advised of the proposal and were provided with an opportunity to make comment.

The application was also referred to relevant government authorities including the adjoining Shire of Northam.

Advertising was undertaken in excess of the required public consultation period of 28 days (38 days in total) and concluded on 11 May 2012.

In total, 12 submissions were received, six from government agencies, five from adjoining landowners or owners within proximity of the site and one from an environmental advocacy group. The details of the submissions and the Officer's comments relating to them are detailed in the attached schedule of submissions.

Prior to the application being advertised for public comment, Council undertook a site inspection with the applicant and the consultant. This inspection provided an opportunity for Councillors to view the proposed landfill site and raise questions in regards to the application. No discussions were held as to whether Council would approve the application or not, the purpose was so Council could be informed and made aware of the nature of the application prior to the public consultation period commencing.

A copy of the submissions are listed below (extract from the Shire's Council Agenda Item dated 19 June 2012):

No	Contact	Submission	Comments	Recommendation
1.	Department of Health	1. **Mosquito-borne disease control Programs and Services.** The site is in a region that occasionally experiences problems with nuisance and disease carrying mosquitoes. The mosquitoes can disperse several km from the breeding sites and are known carriers of Ross River (RRV) and Barmah Forest (BFV) viruses. 13 cases of RRV were reported for Shire of Toodyay in 2011/12 season. Consideration needs to be given to the design of all on-site infrastructures as they may become mosquito breeding habitat. The proponent must ensure proposed infrastructure does not create additional mosquito breeding habitats as follows: • Changes to topography must prevent run-off from creating surface ponding; • Water tanks and other water holding containers must be sealed and screened to prevent mosquito access and breeding. Regular monitoring for larvae and treatment of larvicide may also be required; • Waste items (tyres, drums, etc) should be filled with sand/soil; kept undercover or punctures to reduce the chances of these items holding water; • Constructed water bodies must be located, designed and maintained so they do not create or contribute to mosquito breeding and may require regular monitoring and application of herbicides and/or removal of invasive vegetation to prevent the harbourage of mosquito larvae; and • The chironomid midge and mosquito risk assessment guide for constructed water	1. Noted. The application presently has not addressed or provided management measures to identify how mosquito would be addressed. Considering the increases in reported RRV cases, it is considered essential that the application identifies potential mosquito management sites and states management measures that would be implemented to reduce potential breeding habitats and measures that would be implemented	That the submission be noted. It is recommended that the proponent detail within the application how mosquito management that will be implemented to prevent mosquito breeding habitats from being created within the development site.

No	Contact	Submission	Comments	Recommendation
		bodies should be referred to during the early stages of planning to ensure that the potential for on-site mosquito breeding is minimised. **2. Pesticide Safety Programs and Services.** All applications of pesticides must be undertaken in accordance with the *Health (Pesticides) Regulations 2011*. Pest Management should be implemented in such a manner to ensure that pests are controlled, the use of pesticides are minimise, with minimal risk to public health. **3. Toxicology Programs and Services.** Proponents need to comply with the condition set out in the general odour management guidelines and ensure odour control measures are in place.	2. Noted. 3. Noted.	
2.	Main Roads WA	1. The traffic study by Shawmac Pty Ltd is acknowledged. Although the traffic data for this area is limited, the assumptions and findings numeric conflict are not challenged. 2. The current geometry of the intersection of Toodyay Road and Fernie Road is less than adequate in terms of safety for current vehicle movements. Issues of horizontal and vertical geometric conflict, significantly reduce intersection definition and sight distance. Therefore any increase in vehicle movements, as a result of the proposed land fill facility, will decrease the level of safety. MRWA therefore is reluctant to endorse the proposal.	1. Noted. 2. Noted. As approval of the application would result in increase in traffic movements on an already unsafe intersection. It is recommended that a resolution of the safety issues and funding of the intersection upgrade is resolved prior to entertaining further development that requires heavy vehicle use of this intersection.	That the submission be noted. That the applicant is required to address the present safety issues with the intersection of Fernie and Toodyay Road.
3.	Department of Water (DoW)	1. The proposal is located within a Proclaimed Surface Water Area – Avon River Catchment. In accordance with the *Rights in Water and*	1. Noted.	That the submission be noted.

No	Contact	Submission	Comments	Recommendation
		Irrigation Act 1914, the extraction of surface water may require a Surface Water Licence. Additionally, modifications to a watercourse, its bed or banks may also require a permit. 2. The subject property is located within a non-proclaimed area for groundwater. The presence of and yield from groundwater aquifers is not guaranteed. Extraction of any groundwater aquifers is subject to licensing by the DoW. 3. The development should comply with the DoW's Water Quality Protection Note No. 111 "Landfills for disposal of putrescibles materials". Further advice was sought from the Department of Water in relation to the proximity of the site to watercourses and the following advice was provided: 4. The DoW has considered the issues raised regarding the proximity of the proposed landfill site to identified waterways and compliance with the DoW's WQPN Landfills for Disposal of Putrescible Materials, the DoW would like to provide the following advice: As noted by the proponent the DoW's WQPN No. 111 is a general guideline on the management of water issues associated with landfills and the requirements for a 100m setback to waterways is meant as a guide and depends on an onsite assessment of the value and extent of onsite waterways. In considering the information provided by the proponent the DoW agrees with that the waterways in closest proximity to the landfill footprint is a major watercourse which only flows in response to	2. Noted. 3. Noted. 4. Noted.	It is recommended that if the application is approved, advice notes are placed on the approval to detail responsibility of the applicant to obtain approvals from DoW in regards to extraction of surface water and extraction from groundwater aquifers.

No	Contact	Submission	Comments	Recommendation
		storm events. The DoW's database has this waterway mapped as a minor, non-perennial waterway. The DoW does not consider the proposal to have the potential for significant impact on this waterway and the issue of water quality management can be addressed through the licensing and works approvals requirements of the Department of Environment and Conservation. The DoW is confident that some form of setback can be achieved to the closest waterway and it appears that the 100m setback can be achieved for all other waterways on site.		
4.	Department of Environment and Conservation (DEC)	1. The DEC has also received a copy of this application for works approval. The application is currently being assessed. 2. The risks of emissions and discharges from the operation of these premises will be assessed in due course. Generally the main issues associated with a Class II Putrescibles landfill are landfill gas, dust, odour, groundwater and leachate management.	1. Noted. 2. Noted.	That the submission be noted.
5.	Shire of Northam	1. Please be advised that the Shire of Northam objects to the proposed Class II Waste Management Facility for the below indicated reasons: a) The proposal does not demonstrate any significant gain to the Shire of Northam or Toodyay community versus the potential long term environmental risks associated with a Class II landfill facility. As Local Government's generally own and operate most landfill facilities within its prescribed area it is in their interests to preserve the life of the site and manage the site to minimize the future	1. Noted. a) Concerns are noted. The operation and compliance of a landfill site is controlled and monitored by the DEC. It is also in the interest of private operators of landfill sites to minimize future environmental impacts, as they would not be able to operate without a licence	That the submission be noted.

No	Contact	Submission	Comments	Recommendation
		environmental impact. Should the proposed company not exist at some point in the future it may be considered an issue to rectify any detrimental issues the site may cause to the Shire of Toodyay community.	from the DEC. It is recommended that the Shire request the DEC to impose a financial assurance on the applicant to rectify any issues that may be caused.	
		b) The proposal is located in the Avon River Special Control area as defined under the Shire of Toodyay's Local Planning Scheme No. 4. This land has been identified as having particular environmental significance due to its water ways and flora. Locating a landfill facility within its confines would not reflect the intentions of this Special Control Area.	b) The Scheme sets out provisions that the local government must take into account in assessment of applications within the SCA. In line with the provisions, the application has been referred through to the DEC and DoW for comment. The Department of Water have noted that the facility is to be positioned close to a water course however has not raised objections to the application.	
		c) The ground water report submitted by Strass Environmental identifies that the proposed landfill is located above a groundwater aquifer. It further states that this water is not considered to be beneficial water source, however it also states this water has not been tested.	c) The groundwater was tested and the results are shown on page 15 of the report.	
		d) The proposed ground water report indicates that the local aquifer ducts that have been tested had an acidity range as low as PH 4. Would a 2.00mm thick HDPE liner be considered adequate and what number of years could its integrity be guaranteed, in order to prevent the leaching of leachate from the landfill degradation in the future.	d) The liner is designed to last 400 years, however, the liner system can fail, this is generally associated with installation faults, rather than breakdown of the liner. The DEC review this information as a part of the works approval assessment and the applicant and the applicant	

No	Contact	Submission	Comments	Recommendation
			has shown that with regard to possible leakages from the liner, the site is well in excess of the DEC minimum standards.	
		e) Should the Shire of Toodyay send their community waste to the proposed site it should be acknowledgement that the site is proposed to be filled within a14 to 20 year period which is a relatively short period of time.	e) No consideration has been given to the Shire disposing its own landfill at this site. This is not a planning consideration.	
		f) As the site proposing to landfill approximately 150,000 tonnes of Class II waste per year, the site would be subject to Carbon Tax of $26.00 a tonne on top of the sites tipping fees would likely be approximately $50.00 per tonne. Should the Shire of Toodyay utilize this facility they would likely be required to pay a total of approximately $76.00 per tonne for general waste.	f) This does not form part of the proposal or Council's consideration in the assessment of the planning application.	
		g) It should also be noted that Shire of Northam's Old Quarry Road Landfill Facility currently charges $47.00 a tonne for general commercial waste and is not subject to the Carbon Tax at present it accepts less than 25,000 tonnes of putrescible waste per year.	g) Noted.	
		h) The Shire of Northam is also proposing the implementation of kerbside recycling which will aid the prolonging of the Old Quarry Waste Management Facility.	h) Noted.	
		i) It should further be noted that the faster the proposed site is filled up with putrescibles waste the more money the site will make for the owners and royalties receivers. Therefore there is no incentive to prolong the life for the benefit of the community and there is no	i) Noted.	

No	Contact	Submission	Comments	Recommendation
		consideration is given to the Shire of Toodyay's Waste management requirements in the long term. j) The Shire of Northam acknowledges that the proposed land use 'Waste Disposal and Treatment Facility' is an A use under the *Shire of Toodyay's Local Planning Scheme No. 4*, however it also acknowledges that the degree to which the proposed landfill facility can be permitted to operate at, is also not specified. 2. As such the Shire of Northam objects to the proposed Class II Waste Management Facility for the above indicated reasons and further recommends that the Shire of Toodyay condition the proposal to only accept Class I (inert) landfill in accordance with the *Department of Environment and Conservation Landfill Waste Classification and Waste Definitions 1996.* Alternatively should the proposed waste management facility be approved then the Shire of Northam requests a condition be placed to ensure that the developer is required to reimburse the Shire of Northam should any damage to the Northam's road network be sustained as a result of trucks visiting the proposed development.	j) Noted. 2. Noted.	
6.	Department of Planning	1. Assessment and determination of the proposal is a matter for the local government. The Department of Planning has no comment.	1. Noted.	That the submission is noted.
7.	LJ Roberts – Carine	1. As our house sits towards the top of the hill at Lot 115 Frank Venn Road (off Clackline – Toodyay Rd) overlooking the disused clay pit that will be used for this proposed facility we will be directly affected by this development. 2. The house is designed to take in the	1. Noted. 2. Noted.	That the submission is noted. That the development

No	Contact	Submission	Comments	Recommendation
		panoramic view of the entire valley and about one third of the pit is currently visible from the front verandah and windows of the house. Although the house is situated about a kilometre away from the actual pit, the fact that we are well above the valley floor means that the proposed landfill operation is highly visible. 3. We accept that the pit is currently in view but at present there is no activity at this site. The scar on the landscape is less than desirable but we can accommodate that on the basis that eventually the vegetation will re – establish itself. 4. A rubbish facility at the site is a totally different and unacceptable proposition. Not only then is the scar itself an issue but the negative aspects of an active refuse facility. 5. Regardless of how comprehensive the procedures adopted by or imposed on the operators, there will always be the detrimental impacts of a rubbish site in clear view of our house. It would be impossible for us ignore the operation of the facility as it fills part of our view directly in front of us. No amount of screening or other efforts would be able to minimize this. Not only will there be the visual impact but also the noise, dust, odour and increased fire risks that are associated with such activities. There would also be significant increase in the movement of vehicles and the operation of the compactors.	3. Noted. 4. Noted. 5. Noted. The landfill site is proposed within the current approved footprint area of the clay extraction. The most significant difference between the operation of the landfill site opposed to the extractive industry is that extractive industry occurs on an intermittent basis, whereas, the landfill site is proposed to operate more frequently. The application complies with the buffer requirements for this site and the applicant has submitted noise reports and undertaken additional modelling to show that offsite impacts have been addressed.	application report is updated to refer to consistent hours of operation.

No	Contact	Submission	Comments	Recommendation
		6. We commissioned a report in 2009 which we made as a submission when the proposal was raised at that time. This covered several specific issues that potentially still exist and we enclosed a copy of that report herewith. 7. We remain staunchly opposed to the site being utilized as proposed and are strongly of the view that it would be detrimental to the area as a whole. Although we appreciate that dealing with waste is an ever increasing problem we believe that the impact on the environment in this area far outweighs the benefits that will be derived. It is obviously a commercially driven solution to a problem rather than an eco, lifestyle or environmentally sound option. 2009 Commissioned report: 1. Client's property abuts the eastern boundary of the proposed Class II landfill facility, and currently overlooks portion of the clay pits. 2. While the proposal has generally been prepared in accordance with the Department of Environment and Conservation (DEC) Guideline "*Siting, Design, Operation and Rehabilitation of Landfills"* we would like to raise the following deficiencies in the proposal. Rural and Visual Amenity a) It is important that the operation and management of the landfill facility is not detrimental to the environmental quality and rural amenity of the area. Sufficient landscaping to screen the landfill from adjoining properties and Chitty Road.	6. Noted. 7. Noted. The applicant is required to meet environmental requirements established by the DEC. 1. Noted. 2. Noted. a) Noted. The proposed landfill site is positioned within the area that is presently approved for clay extraction area. This scar of the extraction area presently cannot be viewed from any public place (Chitty Road or Salt Valley Road) due to the landform and	

No	Contact	Submission	Comments	Recommendation
			existing vegetation. It is visible from adjoining properties.	
		b) The report states that the existing pit is "not visible from any dwelling not located on Lot 11". The owners of the adjacent Lot 115 can currently see around one-third of the existing clay pit, and as such, will then be able to view the landfill facility when operating, especially if there is to be 2 metre high fencing placed on top of the site perimeter bunds which act as litter traps.	b) The report has been updated to reflect that the site is visible. While a landscaping plan could be prepared, it is unlikely that it could have any impact on the views from this dwelling, due to its position high in the landscape. The proposed landfill site is to be contained within the area that presently has approval for an Extractive Industry therefore, the scar that is created will not be larger than that created to facilitate the extractive industry.	
		c) Should be conditions that require a comprehensive landscaping assessment and management plan prior to operation.	c) Please see above.	
		d) The report states that Lot 11 is currently bounded by rural fencing which is in keeping with the rural character of the area. However, this type of fencing is not sufficient to manage trespassers and unauthorised access. Any proposal for new fencing must consider the potential impacts of non-rural fencing on the rural amenity of the area.	d) As detailed in the report, a two metre mesh fence would be erected around the perimeter of the landfill site to act as a litter trap. This would also further restrict access to the site in addition to the existing fencing. This fence should not be viewable from adjoining public places.	
		e) Signage should be minimal and in keeping with the rural character of the area.	e) Noted.	
		f) Continuing clay extraction and the new landfill activities – The report states that it will encourage backfilling of trucks to reduce truck	f) Noted, if the application was approved conditions would be recommended to ensure that	

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		movements, but does not provide details on how this will be achieved. It is likely there will be an increase in truck traffic resulting from the landfill as it operates 6 days per week, unlike the existing clay pit operations which are intermittent.	contributions are made towards maintenance of local roads. Backfilling would be achieved where extractive industry trucks who would otherwise come to Toodyay empty are loaded with rubbish to be disposed of within the facility. Also, since originally proposed the applicant has changed proposed operation days to 5 days a week.	
		g) The potential impact of litter pollution is a serious concern and if it occurs it will have a major impact on the amenity of the immediate surrounding area. The report states that a litter fence is to be erected and the escaped litter collected either weekly or monthly depending on the problem, we do not believe these measures are sufficient and should be review to ensure that no litter can escape the site.	g) The litter that is likely to escape the site would be light weight material such as plastic bags in putrescible waste. As detailed in the report, putrescible waste would be covered daily, this would reduce the likelihood of any potential litter escape.	
		3. Water Source for Fire Fighting. Landfill fires can be difficult to extinguish and there is potential for fires to spread to adjoining bushland. DEC guideline states that equipment to extinguish a fire must be readily available at all times, when reticulated water supply is not available a minimum of 50,000 litres should be stored on site for small fires and that for larger fires additional water sources will be required.	3. Concerns raised in regards to emergency fire supply are noted and the applicant has acknowledged that a fire management plan would have to be prepared if the facility was approved.	
		a) The proposal does not outline the volume of water that will be available from the bore and nearby farm and what equipment will be available on site to ensure suitable supply. It does not address where water will be sourced	a) Noted, proposed condition would address this concern.	

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		for larger fires. b) A proven and reliable water supply needs to be provided at the site to ensure that fires can be managed appropriately and reduce risk of fires spreading. 4. Inadequate Waste Compaction and cover. The use of a sheep's foot roller or dozer may not achieve the level of compaction proposed. a) It does not clearly outline when a compactor will be used at the site based on changes in the waste stream and what amount of putrescible waste will prompt the need for daily coverage rather than weekly. b) Inadequate compaction can lead to excessive wind-blown litter and an increase in the odours, which ultimately encourages the breeding of vermin and vectors. These factors are and environmental nuisance and also significantly reduce the amenity of the surrounding properties. 5. Limited Detail on Liner Composition. The proposal states that the existing base of the pit excavation contains clay that is suitable for use as a landfill liner and achieves the required permeability of 1 x 10^{-9} m/s as outlined in DEC guidelines. States clay will be rolled to achieve the required compaction for the construction of the landfill liner. Does not outline the depth to which this will be undertaken.	b) Noted, the implementation of a fire management plan would assist to address this. 4. The applicant through the works approval and licensing requirements is required to ensure that minimum compaction rates are achieved. a) As detailed within the application, putrescible waste would be covered daily and when putrescible waste is not being dumped, the landfill would be covered on a minimum of weekly basis. b) As detailed in the report the amount and level of cover would vary depending upon the nature of wastes proposed to be placed within the landfill. 5. All the issues and points raised are addressed by the DEC through the works approval and licence. The applicant through this process must demonstrate how compliance with the DEC requirements would be achieved and this is monitored by the DEC. Further to this as a part of the revised proposal, the applicant has proposed a liner.	

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		a) DEC guideline states that a compacted clay liner should be a minimum of 1 metre thick and be placed a minimum of four to six lifts to ensure appropriate bonding between each lift. b) Clay liner should also achieve a hydraulic conductivity of 1 x 10^{-9} m/s. c) Poor construction of the landfill liner can lead to hydraulic conductivity which may result in a breach of the liner that allows landfill leachate to infiltrate into the underlined groundwater thus resulting in contamination. d) Although the groundwater is classified as saline in this area there is potential that freshwater lenses may exist down gradient of the site and this may be used as a water source by surrounding residents. e) Further information is required on the construction of the liner to confirm that the risk of a liner breach and subsequent groundwater contamination is minimised. A thorough understanding of the local groundwater hydrology should be undertaken to confirm that no groundwater users or ecosystems are at risk from potential leachate contamination. 6. Absence of Noise and Dust Monitoring. The proposal outlines appropriate environmental control that will be implemented to manage noise and dust at the site. It does not allow for any dust or noise monitoring. Excessive dust and noise presents an environmental nuisance to surrounding properties which can reduce	a) Noted. b) Noted. c) The need for an appropriate liner is required to prevent leachate into external environments. These factors are required as a part of works approval and the liner is inspected prior to issue of the licence. d) Concerns relating to this are noted. The applicant has undertaken further groundwater analysis and identified potential sources. Groundwater monitoring will be ongoing and required by the DEC. e) The information contained within the application details how the facility is going to be constructed to comply with DEC guidelines. This would be further assessed through the works approval and licence process by the DEC. 6. It is noted that excessive dust and noise is a nuisance. There are legislative requirements established which regulate the amount of noise that can be emitted and also regulations on dust. The applicant has detailed	

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		the amenity of the area. Routine dust and noise monitoring should be undertaken at the site to confirm that the site is compliant with the adopted guideline levels and provide evidence to this effect.	within the report management measures which would be implemented to reduce the potential of these issues arising. The applicant has also undertaken noise monitoring to demonstrate that the site would meet the regulations.	
		7. Potential Impact on Flora and Fauna. The proposal states that the uncleared part of the property contains native eucalyptus trees and native shrubs and no clearing will be undertaken as part of the landfill. It also states that a fauna report was not conducted as the site lies on pasture land. a) It is acknowledged that the site is an operational clay pit and that much of the surrounding land has been cleared, some areas of bushland remain and landfill operations are considered a significant land use that could impact upon the native flora and fauna. b) Vermin and other disease vectors can potentially impact upon the integrity of the existing habitats of surrounding bushlands. Consideration of potential off-site impacts to surrounding bushland should be undertaken to verify the status of the existing habitats and how vulnerable they may be to introduced vermin etc. 8. No contingency for a 1 in 100 year rainfall event is outlined. The DEC guideline indicates that consideration must be given to 1 in 100	7. Noted. a) Noted. b) Noted, as detailed in the report the applicant is proposing measures to address the potential issue of vermin and vector. The Department of Health have raised concern with regard to mosquitos and it is recommended that the applicant provide further information in this regard. 8. The Siting, Design and Rehabilitation of Landfills – Best Practice Environmental	

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		year rainfall event. High rainfall events and subsequent sediment loading may impact the surrounding environment if not managed appropriately. Information on contingency plans for 1 in 100 year flood event and sediment controls are required to ensure that the potential impact to surrounding surface water bodies is minimised.	Management Guidelines from the DEC state that landfills should not be located in a 1 in 100 year watertable floodplain (that is, where there is a one per cent chance in any year that the site will flood) unless it can be demonstrated that the facility would be protected from flooding and erosion by flood waters. This proposal is not proposed to be located within a 1 in 100 year floodplain area.	
		9. Hours of Operation, the hours of operation need to be clearly stated in the report as they do not make sense.	9. The hours of operation of the facility if approved would form a condition of planning approval. It is noted that there are some inconsistent reference to hours of operation within the report and it is recommended that this is clarified.	
		10. Periodic Review of Operations. The estimated lifespan of the landfill is 20 years are there is a potential for a change in operation over time to accept municipal waste and/or provide access to the public. As such we would recommend that the Council conduct a periodic community review of the facility.	10. Noted.	
		a) Our client and the community in general accept that the disposal of waste is a necessary part of life. However, if not managed in strict accordance with best practice and approvals, then it can have major detrimental impacts on surrounding landowners and the amenity and	a) Noted.	

No	Contact	Submission	Comments	Recommendation
		environmental quality of the rural landscape. As such, we believe this type of land use warrants close attention on a regular basis. 11. Changes in Operations. Any changes in operation or management should be considered as a land use change and be the subject of a new application for approval that is advertised to adjoining landowners and community for comment. In light of the above comment, we respectfully request that Council give serious consideration to the potential impacts of the proposed landfill facility on adjoining landowners and the wider district ensuring the facility is suitable and adequately managed.	11. The applicants have detailed in the development application the proposal for the landfill site. If approved, a condition is recommended to be imposed stating that development would need to conform with the application that is submitted and approved. Any extension beyond this would require further approval of Council so would require further consultation with the public and adjoining landowners. Concerns are noted and would be taken into consideration in the assessment and determination of the application.	
8.	Avon Valley Environmental Society Inc	1. Documents seeking a non-complying development have been supplied to the Shire of Toodyay. The developer seeks a variation of regulations which are based on legislation and community expectations. The decision is at the discretion of Councillors. Such judgment requires Councillors' prudence in assessing relevant facts, because they must be able to justify their decision. The Avon Valley Environmental Society Inc. has reviewed the documents made available to Councillors and	1. The application is a discretionary decision of Council's. The reference to the proposal requiring a variation to regulations is unknown. The site does not meet the 100m setback recommended within the DoW's Water Quality Protection Note. However as stated in the DoW's comments taking into account the site	That the submission be noted. It is recommended that Section 2.1 within the report (page 4) is updated to reflect that it is a Class II landfill application.

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		for public comment. The Society's comments: • In several parts, the information is incomplete; in other parts it is inconclusive. In total, it does not provide Councillors with adequate information on which to reach a decision. While some of contentious issues raised previously have been addressed, questions remain which make a discretionary decision difficult. • In the absence of firm and final proposals, underwritten by acceptable accurate information, Councillors are not in a position to reach a discretionary determination – either in favour or against – and should not be expected to do so. The Avon Valley Environmental Society's detailed response highlights gaps where technical claims have not been tested by independent experts, and provides examples of inconclusive details in the document. The Society also enunciates a recommended course of action for the time when Councillors might be provided with sufficient accurate information to feel confident of making an informed decision. 2. **Overview -** The Toodyay district has a well-deserved reputation for environmental excellence. This has been gained over many years of commitment to ideals of sustainability based on expanding knowledge and improvements in technology. Toodyay Shire Council is in tune with community aspirations in this regard, and its past determinations reflect this. 3. **Avon Valley Environmental Society -** Since 1991, the Avon Valley Environmental Society	characteristics, it does not consider the proposal to have the potential for significant impact on this waterway and issues of water quality management can be addressed through licensing and works approval requirements. 2. Noted. 3. Noted.	It is recommended that the safety issues associated with the use of the Fernie and Toodyay Road intersection are resolved. It is recommended that section 10.1 in regards to the rehabilitation of the site is updated to reflect that portions of the site to be rehabilitation in clumps of trees will have a greater soil depth. It is recommended that the development application is updated to reflect that groundwater monitoring will be undertaken at intervals recommended by the Strass groundwater report.

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		Inc. has been active in a wide range of environmental projects which have benefited many local communities. This success is acknowledged by local leaders and residents, and was recognised in 2011 by a State environmental award. The Society has among its members professional expertise in many environmentally related disciplines. It has on occasion commissioned specific expertise in support of its activities, and has received considerable financial support from government and non-government organisations. It has established a reputation for innovation and excellence in environmental management across a range of projects. 4. **Apology -** The applicant has commissioned advice from expert professional consultants on a range of technical issues over a period of years. Since the penultimate application (2010) no timeframe has been imposed on the applicant's progress. This is reasonable given the highly technical nature of the application – and the close scrutiny it deserves from government agencies, the Council and the community. It is unfortunate that the public comment period does not enjoy similar flexibility. The limited response period does not allow for detailed analysis and criticism, nor for comprehensive, constructive observations. This is particularly so when the response is put together by members of the public who are volunteers. For any shortfall, the Avon Valley Environmental Society apologises. 5. **Background -** The Shire of Toodyay deferred	4. The proposal was advertised for public comment for a period of 38 days. This is consistent in excess of the requirements detailed within Council's Public Consultation Policy and is above the minimum period specified with Local Planning Scheme No 4. Furthermore, with regard to environmental concerns, the DEC will also advertise the works approval application and once approved, the public is then provided another opportunity to make submissions. This process also applies to the application that will have to be made for a licence. 5. Noted. The applicant still has	

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		an application in 2010 following intense public opposition. The sequel is the applicant's present revised application. Council officers have advised that, in accordance with Local Planning Scheme No 4, the use specified in the application is **not** permitted. However, the local government may exercise its discretion and grant planning approval after giving special notice in accordance with Scheme requirements. Council officers' previous recommendation was that Council defer consideration until the developer had obtained a licence and works approval from the Department of Environment and Conservation and that an arrangement of financial assurance had been set up in accordance with the Environmental Protection Act 1986. There is no evidence in the documentation that this has been completed. 6. **Difficulties in discretionary judgment -** In exercising their discretionary powers, Councillors must be confident they have been fully and accurately informed. Until this is the case, the documentation is unacceptable and a discretionary determination cannot be made. It may be that Councillors are eventually satisfied with the quality and veracity of information supplied, and proceed to approval. Even then, there remains a responsibility to ensure that the standards and procedures promised by the developer – and on which approval is granted – are observed to the letter. The only way this can be guaranteed is	not obtained works approval and financial assurances have not been resolved. It is recommended that Council defer consideration until financial assurances arrangements with the DEC have been resolved. The applicants would not be able to commence development until the DEC issues a works approval and therefore it is not essential that this is obtained prior to planning approval being issued. It is not possible for a licence to be obtained prior to the issue of planning approval, as development (construction of the liners, etc) would have to commence prior to the licence being issued. 6. The applicant has engaged a consultant to review the applicant and gain the works approval from the DEC. Furthermore, all environmental documentation is reviewed by the DEC, an independent body, which has a section dedicated to assessing, monitoring and reviewing landfill sites. The applicant has detailed that they will continue the relationship with the consultant beyond the approval period to monitor and	

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		by independent monitoring and transparent, tightly scheduled reporting. Even where the developer has promised to commission a monitoring program through its own consultants, it must be verified by independent scrutineers with complete freedom of access. The documentation supplied to Council has been rightly derived in an atmosphere which could be described as adversarial. It is a fact that proceedings such as these are not conducive to future agreements which must be based on confidence and trust. Thus the appointment of an independent monitor to complement statutory agency scrutiny is mandatory. This could be reinforced through the appointment of a community reference group. Environmental challenges continue to grow more complex as the realities of modern living lead to ever-increasing risk to the environment and, consequently, to society. Against this background, Councillors must assess the wide range of risks contained in the documentation, present and future. The risks include issues of road safety, potential river pollution; visual amenity, possible future financial imposts occasioned by a catastrophic eventuality, and inferior site rehabilitation, among many. The conclusion is that many technical claims made in the present documentation need to be verified (or otherwise) by independent experts in various sciences and other disciplines. This is beyond the scope of the Society, or even Council officers. This applies in particular to compliance monitoring of four groundwater	report on compliance related issues. It is recommended that if the application is approved, this form a condition of planning approval and that independent audit report, submitted by a suitably qualified consultant at the applicants costs, are to be submitted to the Shire annually. The DEC officers have advised that through licence conditions on landfill site, similar annual reporting requirements will be imposed. Furthermore, concerned community representatives can make submissions to the DEC during their consultation process for licences requesting particular monitoring conditions.	

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		bores, records of waste delivered to the site, including “ownership”, and the management of leachates. Across a range of activities where standards are specified in the present documentation, they seem to reflect the minimum. These are set by government agencies, or are based on precedents from other sites which are not directly relevant to the present proposal. Minimum standards prescribed by regulation do not match the higher expectations of a community like Toodyay, with a proven record of environmental excellence. In representing the best interests of the Toodyay community, Councillors are required to consider the full implications that their decisions may have on the environment, now and in the future. The community needs to be certain that inherent risks have been minimised and managed to the highest levels of present scientific knowledge. To be fully satisfied they have been accurately informed, Councillors need further information on the document’s inconclusive and incomplete statements as detailed below. Until this is the case, a discretionary determination cannot be made in confidence. 7. **Need for further information -** The developer’s documents include an amended proposal with reports from several expert consultants commissioned subsequent to the original proposal. The issues initially raised are contentious: claims should be verified by independent experts. Liaison with the Department of Environment	7. As stated above, all documentation is reviewed by the DEC’s, Industry Regulation branch which is responsible for the issue of the licence and works approval.	

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		and Conservation previously raised points for clarification. The amended proposal states: "These discussions are on-going". In other words, no firm conclusions are available. There are also many instances of suppositional claims ("Provided that …" "… will be achieved if …" "… could be issued …" "… not easy to accurately predict …" etc. a) Document - Title of application: "Environmental Management for rehabilitation of clay pit - This is misleading. The application is for a non-conforming use. The application addresses a range of issues, only one of which is rehabilitation, which is a revision to the original rehabilitation plan. b) Document - Introduction to Management Plan: **"**Opal Vale Pty Ltd is a well-regarded company operating in the resource recovery industry" (statement) - Clarification required regarding directors, locations and periods of operation. The claims relate to the resource recovery industry; is there any prior experience in Waste Management? Is there any record of pollution, industrial accidents, and inadequate quality control? c) **Document -** 2.1 "Type of Landfill Applied for: - Class III (sic), Category 64 (lined landfill)". Should be Class II. d) **Document -** Page 25 "Submission (sic) endorsed by the Avon Valley Environmental Society" - This is misleading by omission: the quoted submission by a private individual strongly opposed the application, and this opposition carried the complete endorsement of the Avon Valley Environmental Society.	a) The planning application form clearly shows that the proposed development is a Class II landfill, this is reiterated throughout the application documentation. b) These details do not form a valid planning consideration. c) Noted this is a typing error, it is recommended that Council require this to be corrected. d) Intent of comment unknown.	

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		The final dot-point in this section is incomplete and meaningless. e) **Document -** 6.6.3 “Buffers - Clay excavation has operated on this site for many years without buffer issues and there is no reason why the landfill will not similarly operate”. There is every reason why the landfill will operate differently to a clay pit: litter, odour, potential pests and vermin nuisance, and weed impact. f) **Document – “**A dwelling on the property belonging to the landowner is within the 150 meters buffer requirement (DEC)” - Does not comply with regulation distances. g) **Document -** 6.5 “Aboriginal heritage”. Only a website search has been made. No contact with local Aboriginal representatives. Similarly with European heritage. h) **Document -** 6.6 “Responsible authorities Relevant local and State authorities and responsibilities are listed”. There is no record of applicant contact, nor of responses, from three of those cited: Department of Commerce, Health Department, Department of Mines and Petroleum. If relevant, their opinion must be provided. i) **Document -** 7.2.1 “…Ideally recycling and transfer stations will be used to sort waste.” This is a poor guarantee of compliance with materials specified. j) **Document -** 9.3 “Management of waste	e) The DEC’s document – Separation Distances between Industrial and Sensitive Land Uses states the following as an acceptable buffers – ‘500 for sensitive uses (subdivisions), 150 for single residences & an internal buffer of 35 from boundary’. The proposal meets with the generic buffer detailed in this document. f) The report states that the single dwelling on the property is 400m from the landfill site. This is in excess of the minimum of 150m recommended by the DEC. g) The Department of Indigenous Affairs website is the site which contains the register of aboriginal heritage sites. h) As stated in the document the Department of Commerce and Department of Mines are involved in safety issues once operating. The other authorities required to be contacted/consulted prior to commencement has occurred. i) If the site ends up accepting municipal waste collection the waste would not go through a sorting process first. j) DEC officers have advised that	

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		disposal. The site will be regularly monitored by the operator" - There is no guarantee of compliance in this method. An independent monitor, and transparent recording which is available at all times for independent scrutiny, is essential.	as a part of the assessment works approval and licence they have stringent requirements to establish background data from which the licence conditions require ongoing monitoring of to determine if there are possible impacts. The monitoring for various aspects is generally on a quarterly basis and the operators is required to report to the DEC in respect to compliance with licence conditions. This is reviewed by the Industry Regulation and Waste Management section of the DEC and conditions of approval would be recommended that this information is also submitted to the Shire.	
		k) **Document:** 9.4 "Supervision. The operator or a representative will be on site at all times when the landfill is accepting waste". This statement offers no guarantee that the operator is accepting maximum responsibility for non-complying arrivals, and their management.	k) This statement is outlining that the site will be manned when it is operating.	
		l) **Document:** 9.7 "Access and transport. Traffic study claims the proposed development does not result in any requirement to undertake any additional road works". There is no evidence that this opinion is shared by Main Roads or the local authority.	l) Noted. Both MRWA and the Shire raise concern in regards to conclusions arrived in the traffic report. In particularly, it is recommended that safety issues associated with the intersection are resolved.	

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		m) **Document -** 10.1 “Rehabilitation plan. Completion criteria: Trees to be planted”. Previously stated that tree coverage will be limited by the topsoil cover (5mm). The larger trees specified will not survive in shallow soils.	m) The site is proposed rehabilitated with a 50mm layer of topsoil over the landfill cap. As detailed in the rehabilitation plan, the site is proposed to be returned to pasture with clumps of strategically planted trees and shrubs. The applicant has advised that in these sections more overburden/topsoil will be placed to allow the deeper rooted species to establish. This is presently not reflected in the application in this manner. It is recommended that this is updated.	
		n) **Document:** “The situation is the same as that occurring with respect to the clay excavations”. Not so. Waste facility hours of operation are to be Monday to Friday, 7.00am to 6.00pm. Clay excavation is intermittent.	n) It is noted that clay excavation is intermittent.	
		8. **Incomplete documentation -** This section addresses issues where documentation – including revisions – has not completely satisfied the initial query; it also raises more current issues which have not been addressed at all.	8. Noted.	
		a) **Carbon permits:** There is no information concerning the Commonwealth’s requirement, from July 1, that landfill operators must purchase carbon permits for future emissions (if any). Such future liabilities need to be included upfront, particularly as permits are required for the lifetime of the waste – up to 40 years. The documentation is unclear regarding	a) The requirements for the operator to meet with the future Carbon Tax does not form part of the planning considerations for the site.	

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		methane emissions, the only mitigating factor in carbon tax liabilities. b) **Quake zone:** The site is believed to be within a geological fault zone; earth tremors have occurred in the Shire to an extent that houses must be built to earthquake standards. Therefore landfill dumps must also be considered at risk. UWA research results used in 1998 suggest that the likelihood of earth tremors is far more significant than suggested in the documentation. c) **Clay stockpiles:** There is an agreement between the developer and the landowner that supplies of clay will be stockpiled on site if necessary. There is no documentation of how much, the likely impacts, nor how this will be managed. d) **Particular concerns:** The areas of major concern in the present documentation are listed below: • Monitoring of groundwater at four bores should be monthly. This is in line with the consultant's recommendation (Stass Environmental Page 21). Less frequent testing drastically reduces times available for reaction and rectification. • The documentation states the landfill site is 20ha and the worst case scenario for the site's leachate through the barrier is specified at 94.05l/ha/day. This potential total of 2,000l of leachate reaching the underlying clay each day, is within the current Department of Environment and	b) The potential risks associated with landfills are detailed within the report and due to the characteristics of the landfill site (being within a void as opposed to other possible landfill configurations) the risk from faults from earthquakes is low. c) There are existing stockpile areas to the south east of the site which can be utilised to stockpile clay. d) Noted. • It is noted that the Strass Groundwater Report identifies higher frequencies of groundwater monitoring. It is recommended that the development application report is updated to reflect this recommendation. • The information submitted by the application demonstrates that the liner design and separation of the landfill site to the natural groundwater table is in excess of the DEC requirements. The DEC will be	

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		Conservation guidelines of a maximum permissible leachate from landfill of 1,000l/ha/day. However, it is not acceptable so close to Jimperding Brook, and in an area which drains into Harper Brook, both important streams which eventually reach the Avon River. Harper Brook in particular flows through important farm lands and vineyards, with potential impacts on commerce and the community. • Leakage and flash flooding need to be considered and plans formulated to deal with it quickly. It has been shown in the past that it is often difficult or impossible to deal adequately with the type of contamination that is likely to occur. • The traffic study states that the likely increase in movements "should not result in unacceptable impacts on the road environment". This must be confirmed by an independent authority. • It is acknowledged that the developer must receive Works Approval and a Licence to operate from the Department of Environment and Conservation, which will be granted only after satisfying the Department's requirements. However, these are, as discussed in this submission, minimal guidelines which Councillors should not accept per se in a pristine location. • It is noted that the developer has furnished a Construction Quality Assurance Plan,	the ultimate authority which concludes whether the proposal can meet environmental criteria. • The applicant is required to submit Quality and Assurance Plans for approval by the DEC to address such occurrences. As the site sits high in the landscape the risks associated with flash flooding would be low. • Noted, MRWA have been consulted and they have raised concerns with the proposal and use of the transport route which already has an unsafe intersection. • The facility would not be able to operate if the minimum standards established by the DEC are not met. • This applicant has submitted this documentation to the DEC	

No	Contact	Submission	Comments	Recommendation
		with provision for an independent and appropriate third party CQA consultant to verify that work is to the agreed standard. This standard must be acceptable to the Shire of Toodyay, not only to the relevant government agencies. 9. **Recommendations for future landfill requirements -** In requesting clarification and additional information before exercising discretionary powers, Councillors are presented with a window of opportunity for a more detailed examination of options. This is because final resolution by relevant government agencies to queries and clarifications is not yet forthcoming. In particular, the Department of Environment and Conservation's Works Approval is required prior to commencement. At this stage, it is worth considering Council's options if and when sufficient information has been received to exercise discretionary judgment for planning approval: **Refusal:** This decision would trigger the tortuous appeals process. This could be exhausted successfully in Council's favour (problematical). But the challenge does not disappear – rather it is merely moved sideways. The not-in-my-backyard syndrome is becoming socially unacceptable. **Approval:** Councillors can justify approval of this non-conforming application if they are satisfied that they represent the best interests of the Toodyay community, and have considered the full implications that their decisions may have on the environment, now	as a part of the works approval application. A copy has also been provided to the Shire of Toodyay. 9. It is noted that further clarification is required to be obtained from the applicant. It is recommended that Council seek this further information prior to making a determination on the matter.	

No	Contact	Submission	Comments	Recommendation
		and in the future. 10. **New approach -** This would call for a new approach which is cognizant of changing social and environmental attitudes, has the imprimatur of government and relevant experts, and demonstrates that Council – and the community it represents – are serious about the future and the environment. This would require Council to establish higher environmental standards than the present to satisfy the local community's already high expectations and performance in excellent environmental management. In setting a new standard of excellence, with appropriate independent monitoring of all activities in a totally transparent atmosphere, Toodyay would establish a paradigm for confronting a looming global catastrophe. Any applicant prepared to work in close partnership with the local community to meet the new requirements for world's best practice in management and restoration, would share the kudos. It would be achieved by raising the criteria in specified areas of activity to a much higher standard than the minima currently specified. It would require commissioning considerable expertise to establish standards which meet the community's expectations of excellence in operation – before, during and on completion. Any applicant would then be required to meet the requirements of all relevant agencies – but conscious that in the final plan to Council, criteria acceptable and significantly higher than agency specifications must be met for approval.	10. Noted.	

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		Where an applicant has specified a performance level based on a precedent, Council would require a re-assessment based on the current situation, including prevailing and future costs. This would also be reflected in any guarantee bonds to be lodged. Finally, Council would require independent monitoring and reporting in addition to any scrutiny offered by the developer, or monitoring required by a government agency. By raising acceptance criteria well in excess of present levels, Council would also demonstrate the community's support for the government initiative for Western Australia to progress towards a position of zero waste to landfill by facilitating planning for waste management and recycling. This scheme will take some time to achieve and in the meantime, disposal and storage of certain types of waste which cannot be viably reused must be developed – but only under higher criteria. The pristine nature of the district, its proximity and influence on important streams, and ultimately the health of the Avon/Swan river system, fully justifies much higher margins in every category. The Shire of Toodyay has a cherished reputation for environmental excellence. Setting the bar higher than elsewhere for this kind of application is completely in line with commitment to the community's expectations for world's best practice in its own backyard. 11. **Conclusion -** In summary, the developer's current documentation is inconclusive or incomplete in many areas of vital importance.	11. As per comments above, it is recommended that clarification is sought from the applicant in	

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		Accordingly, it would not be possible for Councillors to exercise their discretion based on accurate information. Until these points are resolved, Councillors cannot be expected to make an important discretionary determination which they can confidently defend to the community. The community must be assured that inherent risks have been minimised and managed to the highest levels of present scientific knowledge. Council should defer consideration until the developer has obtained a licence and works approval from the Department of Environment and Conservation and an arrangement of financial assurance acceptable to Council has been finalised.	regards to particular matters and that the application is deferred until financial assurance arrangements have been made. The applicant will not be able to commence development on site until a works approval has been obtained and it is not possible for a licence to be obtained prior to development approval and works on site must commence before a licence is issued.	
9.	John Beamish	1. Please find an amended copy of my letter on this topic, dated 7/10/2010. On carrying out a little research it became quickly apparent that the proposal has, for the vast majority of ratepayers of Toodyay Shire, including myself, nothing to recommend it. Reference to the DEC documentation available on Landfill sites soon revealed many pitfalls for owners, operators and indeed, local Councils. For example; Section 4.1.1 of Siting, Design, and Operation & Rehabilitation of Landfills states that a landfill should not be located where it is not needed for the disposal of a community's waste. Generally, local government is *responsible* for providing a framework for the orderly development of waste management facilities for both public and *private* sectors and *ensuring* that a reliable system of waste management, including *landfill airspace*, is	1. Noted. This forms one of the considerations outlined in the DEC's guidelines.	That the submission be noted.

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		maintained within a region. This puts an onus on the local authority which prevents it from passing all responsibility to another, e.g. “The owners of the waste”. Clause 4.1 DEC shows a table which lists the hierarchy of aspects to be considered in relation to possible land fill sites and the first of these is Community needs. Others are 2. Landfill types 3. Buffer distances 4. Groundwater 5.Surface water 6. Flora & fauna 7. Infrastructure 8. Geology 9. Land ownership. 2. Telephone discussions with the DEC elicited the information that the main difference between type I & type II (category 64) landfills is the inclusion of putrescible and toxic waste. Opal Vale Pty Ltd’s current report, states that putrescible waste would constitute only an inconsiderable proportion of the waste being processed, however, once the licence has been issued the landfill operator would be legally able to accept a level of up to 50% putrescible waste without recourse to the Council or other body. The major gases produced by this process are methane and carbon dioxide which are at the top of the greenhouse gas scale. Opal Vale also asserts that, in clause 9.3 of their submission, that measures would be taken to minimise (but not eliminate) gas odour. Having stated that gas volumes would be inconsiderable Opal Vale later states that gas collection will be considered to best capitalise on landfill gas resources! What would be the purpose of considering options to capitalise on gas collection resources if these are indeed	2. It is correct that one of the differences between class I and II sites is that a class II site can accept putrescible waste. A class II site can also accept special wastes (asbestos and clinical waste not requiring incineration) and contaminated solid wastes meeting the class II criteria. The following hazardous wastes are not acceptable; toxic waste, flammable wastes, corrosive wastes, carcinogenic wastes, poisons, infectious wastes or radioactive wastes.	

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		"inconsiderable"? This is a contradiction. Regulation of the site would be entirely in the hands of, and at the discretion of Opal Vale. There would be few people in Western Australia not aware of the situation arising when the fox is left to supervise the hen house. 3. Concerning buffer zones; Clause 4.1.3 of the DEC Best Practice Environmental management document referred to above includes the statement that "Land within the buffer area may be used for purposes that are adversely affected by landfilling. It is preferred that this land is *owned* or *at least under control* of the landfill operator." Such is not the case since the 500m distance from the limit of the landfill crosses the boundaries of at least three other, independently owned properties. It may be argued that these are not "sensitive" areas but there is ample legal precedent confirming that property owners have the right to the quiet enjoyment of their without vexatious interference, including odours and noxious gases. Much more can be stated on this and other items already referred to and yet to come. For the time being I will pass over groundwater and surface water and flora and fauna. 4. Opal Vale's program and report is in my opinion, disarmingly misleading and cite, as example, their clause 4.4 on earthquake stability which quotes data up to 2000. Reference to seismic information from	3. The guidelines outline that wherever practical environmental impacts should not extend upon the boundary of a particular industrial site. Where this is not possible, adverse environmental impacts should not extend beyond the boundaries of a buffer area, which should contain only compatible land uses. New sensitive land uses are not appropriate in the buffer. Sensitive land uses include residential developments, hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, shopping centres, playgrounds, and some public buildings. No sensitive land uses are located in the buffer area. 4. The potential risks associated with landfills are detailed within the report and due to the characteristics of the landfill site (being within a void as opposed	

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		Geoscience Australia and UWA, available via the internet, will reveal that there has been significant seismic activity since 2000. It will further reveal that not only does Toodyay lie within the South West Seismic Zone (SWSZ), which is the most active seismic area in Australia; it also lies within the most active portion of that zone. Since 2000 there have thousands of seismic incidences in western wheat belt, some of them being large (>4.5 on the Richter scale) at Burakin between Sept. 2001 & Jun. 2005. Several of magnitude 4, at York and magnitude 2.2 at Wooroloo. During a period of six months 18,000 minor seismic incidences occurred in late 2002. About 400 earthquakes per annum are currently detected by seismographs between Geraldton and Albany. It appears from the from the topography surrounding the landfill site that the area has been considerable seismic activity in the past and it should be noted that the greatest activity at Meckering took place in a spot which had been inactive for tens of thousands of years previously, according to seismologists. Relying on the fact that little has recently happened at Toodyay, seismological speaking is, given Toodyay's location, of no reassurance whatsoever. It is not so much a case of if seismic activity will occur but when it will do so. Another point of relative interest is that all of the seismic activity in recent times is believed to have taken place within 2000m of the surface. 5. The matter of toxic waste is potentially serious in the long and short terms and the probable	to other possible landfill configurations) the risk from faults from earthquakes is low. 5. As detailed above, toxic waste is not accepted in a Class II landfill	

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		consequences of harbouring and concentrating toxic wastes should, by now, be known to anyone who has access to news media. 6. There are other points of contention concerning this matter but it is apparent, to me at least, that the aforementioned points and there are a number of others not mentioned here, should be enough to give the Council more than sufficient grounds to doubt the necessity and the safe viability of this proposal and to act in the interest of their community ratepayers by declining approval. I therefore submit that this be done accordingly. Please note that the objection would not apply to a class I landfill since there would be no additional propensity for hazardous substance events.	facility. 6. Noted. While it has been identified that some points require clarification from the applicant once the financial assurance arrangements are made and intersection safety issues are addressed, there are known valid grounds for refusal.	
10.	Trevor Strickland	1. I oppose strongly the development of any such facility. As an adjacent landowner, my concerns are many, not just for me but for the Toodyay community and environment. 2. The property I purchased in 2001 was marketed as a beautiful scenic bush block with expansive, lovely views and with a small weekender shed. My intentions in buying the property was to set up a respite retreat for people who do great voluntary and community work and provide them an inexpensive, restful and quiet break. After 2 years of research, the property I purchased seemed ideal for the intended purpose. 3. One month after settlement, I stayed overnight in the weekender shed only to be awoken by a large explosion which shook the ground for	1. Noted. 2. Noted. 3. Not in a position to provide a comment in relation to this statement.	That the submission be noted.

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		several seconds. The following morning I went to the Shire Office to enquire as to the possible source of the explosion. I was introduced to the appropriate Shire officer to whom I explained the location of the property and about the large explosion. He said 'look it was probably a roo shooter'. I replied 'no it was a large explosion and I am now concerned that there will be more explosions and noise… and who would be using explosives anyway? His reply shocked me. 'Look if you want to come in here and complain about a clay excavation pit, you just might end up with a toxic waste dump next door instead!' Further intimidation tactics followed. 4. Months later the noise of the excavation from the clay quarry at Lot 11 Chitty Road and of the trucks coming and going and the dust, was proving so irritating that I went to the Shire Office again to complain. This time I requested someone different about my concerns but the same Officer came to the desk and he refused to note my complaint. At that point, I put on hold plans to build a brand new home on my property. I did speak to an Environmental Officer at the Shire who said that in a few years the quarry would completely excavate and restored to its original beauty. 5. In the meantime, I had one visitor come from Perth but he ended up going home because of the constant (although not loud) noise: especially the beep-beep-beep of reversing trucks. Another visitor came on a public holiday in 2005 when another lot of explosives	4. As above. 5. As above.	

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		went off. This caused him to be extremely concerned and asked me 'what was that' I explained to him what I had been told. Furthermore, the lovely scenic views I originally had, became increasingly marred by a large expanding clay quarry. 6. In 2005, representatives from the Department of Lands met with myself and the owners of the rural lot next to mine, to see if the activities at Lot 11 Chitty Road were affecting our respective property values due to the increased view of the quarry and its associated noises. Their ruling was that it was impacting on the value of our properties. 7. Following an earlier application for a Class 2 Landfill Facility at Lot 11 Chitty Road, I wrote to the WA Health Department in 2009 to ascertain if there could be any health hazards due to being in close proximity to such a site. In this letter the following issues were raised. • Airborne contamination of water tanks used for human consumption – bearing in mind the prevailing southwest wind brought dust over my property. • The frequency of willy –willy's in lifting large quantities of potentially toxic substances onto surrounding properties. • Also inhaling of such substances, especially when doing prolonged firebreak work. 8. In a follow up phone call, the Health Department worker who had previously corresponded with me said 'if the Class 2 Landfill Facility goes ahead it'd be wise to be	6. As above. Impacts on property values are not a planning consideration. 7. The Department of Health had reviewed the application and provided comment, as detailed above. 8. The Department of Health have not made comments that reflect this. The application meets with buffer requirements prescribed	

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		indoors from 7am to 6pm and to get special filters on the water tank and air conditioner'.	by the DEC, which were originally developed in consultation with DoH.	
		9. Whilst there has been has been history of issues regarding noise, dust and visual scarring, the threat of a fire outbreak, especially overnight is terrifying. Lot 11 Chitty Road, Toodyay is surrounded by extremely dense bush; and yet its location is so close to Bakers Hill and Clackline communities and only 13 kilometres from Toodyay township. All in all making it a potentially devastating location for a landfill site in the event of a fire regardless of wind direction – it's too close to community centres. While fire management may be possible during proposed hours of operation; what happens in the event of a fire starting at night? The Toodyay community do not want another devastating fire or even an increased risk of such.	9. The applicant has acknowledged that if the proposal is approved it would be subject to the preparation and implementation of a fire management plan.	
		10. Lot 11 Chitty Road is located within the Avon catchment and Jimperding Brook drainage lines which run on two sides of the clay pit and eventually flow into the Avon River. Whilst the types of wastes being dumped may be checked, is there absolute certainty that some contaminants won't leach into or flow into these waterways? Furthermore, what about legal dumping at the entrance gate out of hours?	10. Minimum standards are established by the DEC in regards to landfill sites. This will be assessed by the DEC as a part of the works approval process. In regards to concerns about potential contamination, it is recommended that the Shire request the DEC to impose financial assurances to address risks associated with this.	
		11. In reading the Environmental Management report, it states that issues such as dust, litter, vermin and odours will be monitored and attempts will be made to minimise such	11. Noted.	

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		impacts. 12. In the same report under the heading 'Aesthetics 10.2.1' it in part states "during operations the waste will be placed into the base of the excavation below natural ground level but as the void is filled in stages the upper part may be visible from the two dwellings to the northeast". As one of the dwelling owners to the northeast, I advise that from the lounge area of my weekender and entire building envelope, you can see more than just 'the upper part of the quarry site' referred to. 13. Obviously, any approval given for a Class 2 Landfill facility would devalue my property and others nearby. I am currently seeking legal advice re this matter before acting further. I trust wisdom prevails and that this proposed Landfill facility is not allowed to be established.	12. Noted. The landfill site is proposed to be located within the existing approved extractive industry footprint. 13. Property values and impacts an application can have on this is not a planning consideration.	
11.	Robert Pearce	1. I am the owner of the property at 740 Salt Valley Road. Once again am going through the process of putting in a submission, which history has shown that Shire Officers view with very little regard. 2. I find it extremely unprofessional when officers provide information to residents affected by the proposal that is incorrect – it amounts to misinformation. I was sent a map that indicated that Chitty Road is a gravel Road. Chitty Road has been upgraded by the Toodyay Shire in conjunction with the current holder of the extractive licence, Austral Bricks – to a bitumen seal of which the Shire Officer is aware. How can concerned residents or	1. All submissions that are received for any application are tabled for consideration by Council. 2. It is noted that the site plan that is contained within the development application has not been updated to reflect that Chitty Road is now sealed to the entrance to Lot 11 from that road. It is recommended that this is updated.	That the submission be noted. It is recommended that the applicant update the site plan to reflect that Chitty Road is now a sealed road.

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		Shire Councillors make an informed decision based on misinformation? If the Shire Officers allow proponents to provide incorrect and out-dated information on a map, how do we know that the technical information provided in the proponent's submission is also not out of date or incorrect? 3. Increasingly a trend has developed in Western Australia for partnerships to be established between extractive industries and waste management companies to 'dig and fill' rural land holdings thereby maximising the value of their operations. This has led to a concentration of Development Approvals for landfills in peripheral metropolitan areas associated with extractive industry for materials such as clay, limestone and hard rock. While this makes economic sense for the industries directly concerned, it can have significant and uncosted social and environmental impacts – especially if the operations are concentrated in a single locality. It is apparent the proponents have placed an incentive in the proposal – the eventuality that other Shires Toodyay/Goomalling/Northam/York/Chittering/ Victoria Plains might use this site for their land fill needs. This proposed landfill will have long term environmental impact on Toodyay. The proposal will devalue surrounding land. It will become a contaminated site unsuitable for residential use or food production. It sends the wrong image of Toodyay as a friendly clean and green tourist destination. 4. Over a number of years there have been many	3. It is understood that a landfill site can have negative connotations; however this is not a valid reason for refusal. If the application can meet with the requirements and while the land use is a discretionary land use, there must be sound reasons for refusal. The impact that a development proposal could have upon adjoining property values is not a planning consideration. 4. If the application is approved by	

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		applications by the owners of the property in Chitty Road for Landfill – one a Class IV toxic landfill. I have witnessed not just these owners by also other applicants that many submissions use the correct language, appropriate terminology and consultant reports to gain approval. However once approval has been gained, the operators fail to comply. 5. Last year the Shire approved the extraction of clay by Boral Brick from Lot M1919 Chitty Road. The proponents had many conditions to fulfil – one for the construction of an access route. Boral removed clay prior to the construction of the route, with Shire approval, until road access had been established. However no attempt to construct a road was made until I made Shire Officers aware of the breach. Boral also illegally accessed water during this period from a creek for dust suppression. This had an impact on the availability of water in summer for my stock. It is very apparent Shire Officers sign off on documentation and no follow or inspection of conditions takes place. 6. Opal Vale states in the submission they have an “approved track record”. How has this been determined? Opal Vale continues to operate outside the agreed hours of operation. When Opal Vale started operations on Lot 1 Salt Valley Road, they did so without the relevant licence and then proceeded to dump rubbish outside the designated area. They were reported to the Department of Environment and Conservation who investigated the breach and I was informed of the findings. After	Council it is recommended that a condition is imposed requiring the application to undertaken and submit annual reporting on compliance with conditions of approval. The DEC has similar requirements in regards to their licence conditions. 5. The Boral application was granted by Council and was approved allowing the use of a temporary access track as a clearing permit had to be obtained to install the permanent access. The activities undertaken in relation to access to the site were consistent with the approval issued by Council. The use of the water discontinued once it was raised. 6. No comments can be made in regards to complaints lodged with DEC and their investigations into such issues as the Shire was not involved.	

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		having been informed of the findings, I am of the opinion that the, I am of the opinion that the DEC is a toothless tiger as no prosecutions resulted despite huge fines applicable to these breaches. Another example of failure to comply once approval is gained. Opal Vale has also not fulfilled the conditions of the Class I landfill. They are 7 years into a 10 year licence and as yet there has been no attempt to plant trees or rehabilitation to the site, as they said would happen in their original submission. 7. I am very concerned at what may have been dumped in the adjoining Class I landfill – to my knowledge no inspection has occurred of materials. I am also concerned that if Opal Vale holds the licence for both Lot 1 Salt Valley and the proposed Class II at Lot 11 Chitty Road, what safeguards will ensure Class II waste is not deposited in Lot 1. Opal Vale has stated in their submission, documentation will be kept for all waste and contractors will be responsible for their documentation. Has this documentation been kept for Lot 1? Has this documentation ever been inspected by Shire Officers/Environmental Officers? Who keeps or checks the validity of this documentation? 8. **Road/Traffic Report: -** I read with mirth the report from Shawmac Pty Ltd – Consulting Civil and Traffic Engineers & Risk Managers – who were engaged by the proponents to determine and assess traffic impact associated with the proposed Landfill application. The map produced on page 15 of	7. The DEC is the authority responsible for reviewing the material that is disposed of in a land fill site. DEC officers have advised that they have visited the Lot 1 site and reviewed documentation. It is recommended that if the application is approved that annual reporting is also submitted to the Shire. 8. It is noted that the site plan included in this report does not reflect the updated road condition. It is recommended that this is addressed.	

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		the report is incorrect – it shows Chitty Road as a gravel Road and therefore the report draws a conclusion that Salt Valley should be used to access the pit as there will be no dust suppression issues. It is of concern, when proponents employ consultants and reports are produced to suit the purpose of the application. How can the Toodyay residents have confidence in a proponent when the submission report, misinformation is presented. 9. The residents of Toodyay aspire to a rural lifestyle. Page 7 of the report states… "Toodyay Road is classified as a state Road and has a primary function of carrying large volumes of high speed traffic (private, commercial, heavy and oversize) between regional centres". This statement would be of concern to Toodyay residents. 10. Page 9 of the report states …"Adjacent to the proposed development site Salt Valley Road is sealed to a width of 6.0 to 6.2 metres with 1.0 to 1.5 metre wide unsealed shoulders. It is classified as a Local Distributor (rural access road) and has a primary function of providing vehicular access to rural residential properties and connection to higher order roads. Austroads Rural Roads guidelines indicate that a road of similar construction is suitable for flows of up to 3,000 vehicles per day". It seems once again a conclusion is drawn about the suitability of Salt Valley Road to support the proponent's application and no consideration is made to the quality of the residents' lifestyle.	9. This is the classification of the road and is consistent with MRWA classifications. 10. The consultant is referring to guidelines with classify road networks.	

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		11. It was with interest that the report on Page 9 states and I quote…. "No recent traffic counts are available for Salt Valley however 2009 counts taken by the Shire of Toodyay near BGC Quarry are available and are shown on Figure 5. The counts represent a snapshot of the traffic environment and are understood not to include the current clay carting traffic". Once again this suits the proponents preferred option for the use of Salt Valley Road as a route to access the proposed Landfill. I note with interest that when the Shire puts down the traffic counters, surprisingly the clay trucks cease carting for that period or greatly reduce the volume. With the recent approval for Boral Brick to take clay from Lot M1919 Chitty Road, the truck movements on Salt Valley are horrendous. 12. I quote from the engineers report…"The assessment indicates that traffic generated by the landfill site is estimated at about at about 40 vpd initially and 160 vpd at ultimate operating levels. Depending on whether clay carting is occurring in conjunction with landfill operations, traffic flows could increase from existing flows during concurrent clay carting of 417 vehicles per day to 505 vehicles per day with concurrent clay carting and landfill operations. This should not result in unacceptable adverse impacts on the road environment. The expected additional trips are of a small magnitude and will not impact measurable on the existing road network or affected intersections". Do the Shire Officers truly consider 417 to 505 vehicles per day not	11. Noted. The traffic management plan has identified this as a limitation and has also modelled scenarios, based on maximum tonnages to show likely traffic movements if clay transportation was occurring at the same time as transportation of waste. 12. The report is providing advice in regards to road network, it does not comment on adjoining landowners or their expectations. This is the accepted process of how a traffic impact assessment is prepared, as verified by MRWA. Concerns are raised with regard to increase in traffic movements, particularly with regard to safety concerns associated with the use of Fernie Road and Toodyay Road intersection.	

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		have an impact on the existing road works or to the surrounding residents' lifestyle? 13. I quote from the background report… "While the applicant has detailed in the application that Salt Valley Road is going to be used to gain access to the property, there were a number of concerns raised that Chitty Road would be used as an access road to the site". Can the Officer inform of these concerns and explain how the applicant has this knowledge as to who has raised these concerns? For the past 30 years, the majority of the clay removed from the proposed landfill site has been carted on Chitty Road route that has now been upgraded to a bitumen seal. Is this another case of misinformation to support the applicant's preferred option to use Salt Valley Road? 14. I quote from the background report – "there is an existing agreement with Austral Bricks who have contributed to the upgrading of Salt Valley Road ….. Trucks would be accessing site on the bitumen portion of Salt Valley Road therefore any concerns relative to dust should be addressed". There is no mention that bituminising of Chitty Road was also part of the agreement and that Chitty Road has been used for more than thirty years to transport materials and the removal of clay. There is no dust concern to be raised. I am concerned that once again the proponents have provided this misinformation to create the impression that the trucks should travel up Salt Valley Road to access the pit. This pit has been accessed for many years from Chitty Road. If the	13. The report referred to is the previous report prepared for a Class II application made for the site in 2010. The concerns at the time were obtained during the public consultation when this application was submitted. This was made available to the public as a part of the Council agenda item in August 2010. 14. This information is from the report prepared in August 2010, which reflect the public submissions received at that time.	

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		proponents want a Class II landfill why can't they be burdened with and all the associated problems trucks bring and have the trucks travel past the residence on the property. The Salt Valley Road route already has 3 different companies using the road for the carting of clay or Class I landfill. 15. **Proposed Route: -** The Toodyay Shire needs to address the issue of the proposed truck route. The engineers report that a possible 417 – 505 vehicles per day is a great concern. There have been many requests for the upgrade of the Toodyay – Perth road due to community concern over huge increase in truck movements as result of clay extraction and landfill. These upgrades have not happened and probably never will. The Federal and State Government have spent millions of dollars upgrading Great Eastern Highway. It has many passing lanes and is a major heavy, truck transport route. The trucks could use the major route of Great Eastern Highway and turn left or north into Chitty Road and travel 5kms of **bitumen seal** road and a further 2.4kms of gravel road to the Chitty Road pit entrance and use the same route to return. The distance travelled may be similar to the Toodyay Road route but it would be safer route and would prevent the further increase of heavy truck movements on the Toodyay, Fernie, Salt Valley and Chitty Roads. This proposed route would also be of a benefit to Northam/York Shires in the event they access the Landfill site. If the Shire has the power to grant permission for a landfill site	15. The Shire of Toodyay and MRWA raise concern with the proposed route and recommend that the application is deferred until safety and maintenance issues are resolved.	

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		then surely it should have the power to dictate the designated truck route. This may not be palatable to the Northam Shire but Toodyay being subjected to constant requests and refusal by companies to contribute to road upgrade maintenance now the seal has been completed. The Shire Councillors need to make decisions for the benefit of Toodyay residents. 16. **Hours of Operation: -** I have read two documents on the website – one states operation hours to be Monday to Friday 7am – 6pm; Saturday 7am – 1pm; the other Monday to Friday 7am – 6pm. Which is the correct version? To be consistent the hours should be that granted to Opal Vale for Lot 1 Salt Valley road 7am – 5pm, and Boral operating from Lot M1919 Chitty Road "7am – 5pm Monday to Friday excluding public holidays and may be further restricted in specific cases as determined appropriate by Council". Residents are entitled to a break from noise associated with truck movements. A rural lifestyle is sort by residents to escape the noise pollution of city living. 17. **Odour: -** This is an issue, the proponents attempt to address. Have the Shire Officers or Councillors travelled past the Red Hill Landfill and experienced the odour from the putrescible waste? Covering once a week I do not think is sufficient to reduce to reduce the effect of the odour. Who will monitor this compliance?	16. The applicant has clarified that the hours of operation would be Monday to Friday 7am – 6pm. If the application was approved it would be recommended that this form a condition of approval. It is recommended that the hours of operation are updated in the development application reports. 17. The DEC sets recommended buffer distances to address these issues. The application meets with these distances. The extent of coverage will depend upon they proportion of putrescibles waste being disposed of. As detailed in the report, putrescibles waste is covered daily. This is an	

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			accepted practice for addressing odour issues associated with a landfill.	
		18. **Leaking Landfills: -** As new technologies for processing waste into useful resources continue to enter the market, old practices such as landfilling are increasingly under scrutiny. A number of US studies have indicated that all landfills will leak eventually and those responsible for creating and approving them have usually moved on by the time the problems are apparent. It is noted that the Shire have requested for improved liner for the landfill site. Paradoxically a landfill that leaks quickly after construction can better be rectified because the financial backers and approving authorities can be still be located and held accountable. Remediation of older landfills is costly and the expense is usually met by ratepayer or the taxpayer via state government.	18. The applicant has proposed implementation of a liner system, which in addition to the depths and characteristics of the clay and the low water table, exceed the DEC's minimum requirements for this. Concerns raised in regards to costs associated if the systems failed are noted, and it is recommended that Council seek that financial assurance arrangements are made with the DEC prior to commencement of the development.	
		19. **Council Policy: -** Was the vast number of existing and proposed extractive industry sites operating in Toodyay and the State Government policy of filling these sites with landfill, surely it would be of benefit to the Toodyay community if the Shire made it policy that only Class I landfill to be used to fill the sites within Shire of Toodyay. It would also benefit if Great Eastern Highway is the determine truck route.	19. Council is currently in the process of initiating an omnibus amendment, of which one of the considerations is making this land use an 'X' land use.	
		20. **Summary: -** It is known that Perth is being consumed by its own waste and that the Minister and the DEC is desperate to move it out of Perth. The Shire of Toodyay has for	20. Concerns in relation to this are noted and this is the reason Council is requested to initiate an amendment to make such a	

No	Contact	Submission	Comments	Recommendation
		some time been the subject of a number of waste disposal development applications – predominantly for Class 1 – 4 landfills. Community members regularly oppose such applications and for good reason. There are generic concerns about long – term groundwater contamination, odour, amenity, blight and community stigma attached with siting of multiple landfills in a single locality. These landowners have many more sites similar to Lot 11 and because of the financial rewards are very keen to accommodate more of Perth's rubbish. If this proposal is successful, I believe more proposals for transporting Perth's waste to Toodyay will be forth coming. This proposal will be the beginning of the end. Toodyay will become Perth's rubbish tip. 21. I would like the Councillors and Shire Officers to consider an alternative route to Toodyay/ Fernie /Salt Valley proposal and maybe limit the landfill to Class I inert waste as Opal Vale is now operating. Councillors should also consider how many landfill sites does Toodyay need and should Toodyay be taking other regions waste? I urge Councillors and Shire Officers to consider the true costs associated with landfills over time and who bears these costs, (water quality issues, monitoring, remediation, property devaluation, amenity and blight). I urge all Shire Councillors and in particular the three Shire Councillors representing the West Ward, to consider your ratepayers concerns and have the courage and to see the big picture on this proposal.	land use not a permitted land use. 21. Noted.	

No	Contact	Submission	Comments	Recommendation
12.	Phillip Judge	The following provides a summary of grounds for objecting to the proposed landfill facility: 1. The report for the proposed development does not indicate whether the clay pit has reached its operational life. In absence of such information, it is considered premature to approve a development proposal that will result in the closure of an operating facility identified by the Shire of Toodyay as being of regional significance 2. The proposal is inconsistent with the purpose and intent of the Western Australian Planning Commissions State Planning Policy 2.4 – Basic Raw Materials Policy. Under this policy the site is identified as a "Priority Clay Resource". Areas identified as a priority clay resource are considered "*locations of regionally significant resources which should be recognised for future basic raw materials extraction and not be constrained by incompatible uses or development"*. 3. The proposal is inconsistent with the Shire of Toodyay's Local Planning Strategy which identifies the strategic importance of protecting "Priority Resource Locations" 4. Given the nature and scale of the proposed development, the application of a generic buffer setback is not considered adequate or appropriate in protecting the health and wellbeing of surrounding residents. A site-specific technical analysis which addresses factors, such as noise, dust and odour, should be undertaken in respect of the proposed	1. Noted. The landfill is going to be staged to avoid sterilising the existing clay resource. An agreement has been reached between Austral Bricks and the owners of the site that if the landfill encroaches into the resource area, the clay resource will be stockpiled so it can still be used into the future. 2. Noted, see comments above. 3. Noted, see comments above. 4. The proposal complies with the buffer distances prescribed in the EPA document "Separation Distance between Industrial and Sensitive Land Uses". As noted in the DEC's document "Siting, Design, Operation and Rehabilitation of Landfills",	That the submission be noted.

No	Contact	Submission	Comments	Recommendation
		development prior to any determination being made by the Shire of Toodyay. 5. A site-specific analysis which addresses off-site impacts based on factors such as the scale of the facility, the types of materials deposited, wind patterns and topography should be undertaken prior to any determination being made by the Shire of Toodyay. 6. Concerns with regard to the adequacy of vermin control measures. The report for the proposal states that in order to control vermin and feral animal activity on the site, the waste will be covered at least once a week. The concern with this proposed management technique is that for the remainder of the week, waste deposited on the site will be potentially open to the air. As a consequence our client is concerned this will result in increased number of feral animals in the area and potentially threaten existing bird life and grazing stock. 7. Potential for off-site impacts generated by increased traffic. Off-site traffic impacts generated by the proposed facility need to be addressed.	management measure need to be implemented to ensure that buffers are acceptable. These are detailed within the application. The applicant has modelled the buffer based on topographical, vegetation and site features and also undertaken a noise assessment. 5. The applicant has detailed within the proposal management measures to address possible off-site environmental implications. 6. As detailed within the application, if putrescible wastes are being disposed, the waste will be covered daily. This is proposed to address possible issues with vermin. The other types of wastes to be disposed of are unlikely to result in increase in feral animals as it would be clean fill, inert wastes or solid wastes. 7. Noted. A traffic management plan has been prepared however MRWA has raised concerns over safety of the intersection proposed. These concerns are shared by the	

No	Contact	Submission	Comments	Recommendation
			Shire and it is considered that this is resolved prior to determining the application.	
		a) Concerns regarding the control of vehicle movements – i.e. Access via Chitty Road. What measures have been or will be put in place to ensure that Chitty Road is not used for access?	a) Council has the capacity of conditioning applications of this nature if concerns are raised in regards to transport routes.	
		b) An access arrangement currently exists between our client and the owner of the subject site permitting access between Chitty Road and the Williamson Clay Pit through the northern portion of our Client's property. This access arrangement exists at our clients' discretion and will not be permitted for use by vehicles associated with the proposed landfill operations.	b) Noted, the applicant is proposing to gain access from Salt Valley Road. If Council considers this access point unsatisfactory, an alternative access track would have to be constructed.	
		8. The proposed development does not appear to take into consideration the specific provision of Local Planning Scheme No 4 resulting from the subject site's location within the Avon Valley Special Control Area. Clause 6.2.3 of the Shire of Toodyay Local Planning Scheme No 4 requires the local government, in considering planning proposals in land identified within the Swan Avon Valley Special Control Area, to consider a range of criteria before making determination. One of these is consideration for the effects of the proposal on catchment management and the measures to be taken to mitigate such effects. We do not believe this has been directly addressed in the report.	8. The application has been referred through to the DEC and Department of Water for comment. The Department of Water have noted that the facility is to be positioned close to a water course however has not raised objections to the application. During the works approval and licence stage, the applicants would have to demonstrate that there would be no leachate from the site to adjoining environs. This would address the issues with catchment management.	
		9. The proposed facility will result in increased levels of noise, dust and odour, which	9. The applicant has identified the possible offsite implications for	

No	Contact	Submission	Comments	Recommendation
		although may be minimised by various management controls, cannot be avoided and will adversely impact the amenity of the area. Although the proponent intends to minimise these impacts wherever possible, the impacts will exist nonetheless. This will reduce our client's enjoyment of his property and therefore adversely impact its amenity. 10. The report for the proposal states that some degree of storage will occur. The fire risk associated with storage of certain materials, such as tyres, is of concern to our client given his proximity to the subject site and substantial vegetated areas in between.	the proposal and has established management provisions to address this. Again, this would be further considered by the DEC when the applicant applies for works approval and a licence. Further to this, the proposal complies with the requirements for buffers for this type of facility. 10. Concerns raised with respect to the storage of tyres are noted. The applicant has acknowledged that if the application is approved that a fire management plan would need to be prepared an implemented to address such concerns.	

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as
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LANDFORM RESEARCH

PROPOSED LANDFILL SITE
Lot 11 CHITTY ROAD, TOODYAY

ENVIRONMENTAL NOISE ASSESSMENT

DECEMBER 2010

OUR REF: 12677-1-10237

DOCUMENT CONTROL PAGE

ENVIRONMENTAL NOISE ASSESSMENT
TOODYAY

Job No: 10237

Document Reference : 12677-1-10237

FOR

LANDFORM RESEARCH

DOCUMENT INFORMATION			
Author:	Tim Reynolds	Checked By:	Tim Reynolds
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REVISION HISTORY

Revision	Description	Date	Author	Checked

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Copy No.	Version No.	Destination	Hard Copy	Electronic Copy
1	1	Landform Research		✓

CONTENTS

APPENDIX

1. INTRODUCTION

Landform Research commissioned Herring Storer Acoustics to carry out an acoustical assessment of noise emissions from the proposed Landfill Site to be located at Lot 11 Chitty Road, Toodyay. The objectives of the study were to:

- Determine, by modelling, noise propagation from the Landfill Site.
- Assess the predicted noise levels received at the closest noise sensitive premises, for compliance with the *Environmental Protection (Noise) Regulations 1997.*
- If exceedances are predicted, investigate possible noise control options that will reduce noise emissions to achieve compliance with the regulations.

For information, an area plan is attached in Appendix A.

2. SUMMARY

It is understood that it is proposed that the landfill site would only operate during the day period (i.e. between 0700 and 1800 hours Monday to Saturday) excluding public holidays. Therefore, noise received at the neighbouring residence from the landfill site needs to comply with the assigned L_{A10} noise level of 45 dB(A) for the day period.

In terms of compliance with the regulations, although there are residence located to the north, north east and south west of the site, the neighbouring residence of concern is the one located to the south west. For the proposed operating hours, noise received at the residence to the north / north east and east will comply with the Regulatory requirements. However, for compliance to be achieved at the residence to the south west a 2metre high bund is required to be constructed along the western side of the pit.

3. CRITERIA

The *Environmental Protection (Noise) Regulations 1997* stipulate the allowable noise levels that can be received at a premise from other premises. The allowable noise level when received at a residence is determined by the calculations of an influencing factor, which is then added to base noise levels. In this case the influencing factor for closest noise sensitive premises located around the quarry has been calculated at 0.

The assigned noise levels for the neighbouring noise sensitive premises are listed in Table 1.

TABLE 1 - ASSIGNED NOISE LEVEL

Time of Day	Type of Assigned Noise Level		
	L_{A10}	L_{A1}	L_{max}
0700 - 1900 hours - Monday to Saturday (Day Period)	45	55	65
0900 - 1900 hours - Sunday & Public Holidays (Evening Period)	40	50	65
1900 - 2200 hours - All Days (Evening Period)	40	50	55
2200 - 0700 hours - Monday to Saturday (Night Period)	35	45	55
2200 - 0900 hours - Sunday & Public Holidays (Night Period)	35	45	55

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
The L_{A1} noise level is the noise that is exceeded for 1% of the time.
The L_{Amax} noise level is the maximum noise level recorded.

It is a requirement that noise received at another premises, be free of annoying characteristics (tonality, modulation and impulsiveness), defined below as per Regulation 9.

"impulsiveness" means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax\ Slow}$ is more than 15dB when determined for a single representative event;

"modulation" means a variation in the emission of noise that –

(a) is more than 3dB $L_{A\ Fast}$ or is more than 3dB $L_{A\ Fast}$ in any one-third octave band;
(b) is present for more at least 10% of the representative assessment period; and
(c) is regular, cyclic and audible;

"tonality" means the presence in the noise emission of tonal characteristics where the difference between –

(a) the A-weighted sound pressure level in any one-third octave band; and
(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

If the above characteristics exist and cannot be practicably removed, then any measured level is adjusted according to Table 2 below.

TABLE 2 - ADJUSTMENTS TO MEASURED LEVELS

Where **tonality** is present	Where **modulation** is present	Where **impulsiveness** is present
+5 dB(A)	+5 dB(A)	+10 dB(A)

Note: these adjustments are cumulative to a maximum of 15 dB.

4. OPERATIONS

We understand that the landfill site will operate between the hours of 0700 and 1800 Monday to Saturday, but excluding public holidays. Therefore, noise received at the neighbouring residence from the activities on site will need to comply with the assigned L_{A10} noise level of 45 dB(A) for the day period.

We understand that the equipment used on site will be a small (D7) dozer and a roller. However, it is also understood that the dozer and roller would not be used at the same time.

It is also understood that the site will receive up to 20 trucks per day or about 2.5 per hour. This equates to around 5 movements per hour.

5. METHODOLOGY / MODELLING

Noise received at the neighbouring residence was determined using the noise modelling computer program "SoundPlan". SoundPlan uses the theoretical sound power levels determined from measured sound pressure levels to calculate the noise level received at a specific location.

The calculations used the following input data:

a) Ground contours.

b) Sound power levels used in the model were based on file data of similar operations. The sound power data is summarised in Table 4.

Weather conditions for the modelling were as stipulated within the Environmental Protection Authority's *"Draft Guidance for Assessment of Environmental Factors No. 8 - Environmental Noise"* for the day and night periods were as listed in Table 3.

TABLE 3 - WEATHER CONDITIONS

Condition	Day Period	Night Period
Temperature	20 °C	15 °C
Relative Humidity	50%	50%
Pasquill Stability Class	E	F
Wind Speed	4m/s*	3 m/s*

* From sources, towards receivers.

TABLE 4 - SOUND POWER LEVELS dB(A)

Item	Sound Power Level dB(A)
Dozer	112
Roller	113
Truck	105

As in this case the operational relative ground level of the equipment will increase over time, noise modelling was undertaken with the mobile equipment positioned at the final ground level.

Based on the proposed operations, noise modelling was carried out for the following scenarios:

1A Dozer operating in southern section of site, with 2 trucks movements.

1B Dozer operating in northern section of site, with 2 trucks movements.

2A Front End Loader operating in southern section of site, with 2 trucks movements.

2B Front End Loader operating in northern section of site, with 2 trucks movements.

For the above scenarios, additional noise modelling was undertaken with the inclusion of a 2metre bund along the west side of the site.

6. RESULTS

Single point calculations were carried out for the residence located around the proposed pits, and the results of the single point calculations for the worst case locations for each scenario are listed in Table 5.

The residential locations are shown on the attached locality plan attached in Appendix A.

TABLE 5 - CALCULATED NOISE LEVELS AT CLOSEST RESIDENCES

Receiver Location/ Direction from Site	Scenario/Calculated Noise Level dB(A)							
	1A	1B	2A	2B	1A with 2m Bund	1B with 2m Bund	2A with 2m Bund	2B with 2m Bund
1 - SW	43	44	42	45	38	40	39	39
2 - East	30	29	32	31	30	29	32	31
3 - NE	36	35	37	37	36	35	37	37
4 - North	35	35	37	37	35	35	37	37

Note: If the dozer and roller were operated together, to achieve compliance, the western bund would need to be 4m high.

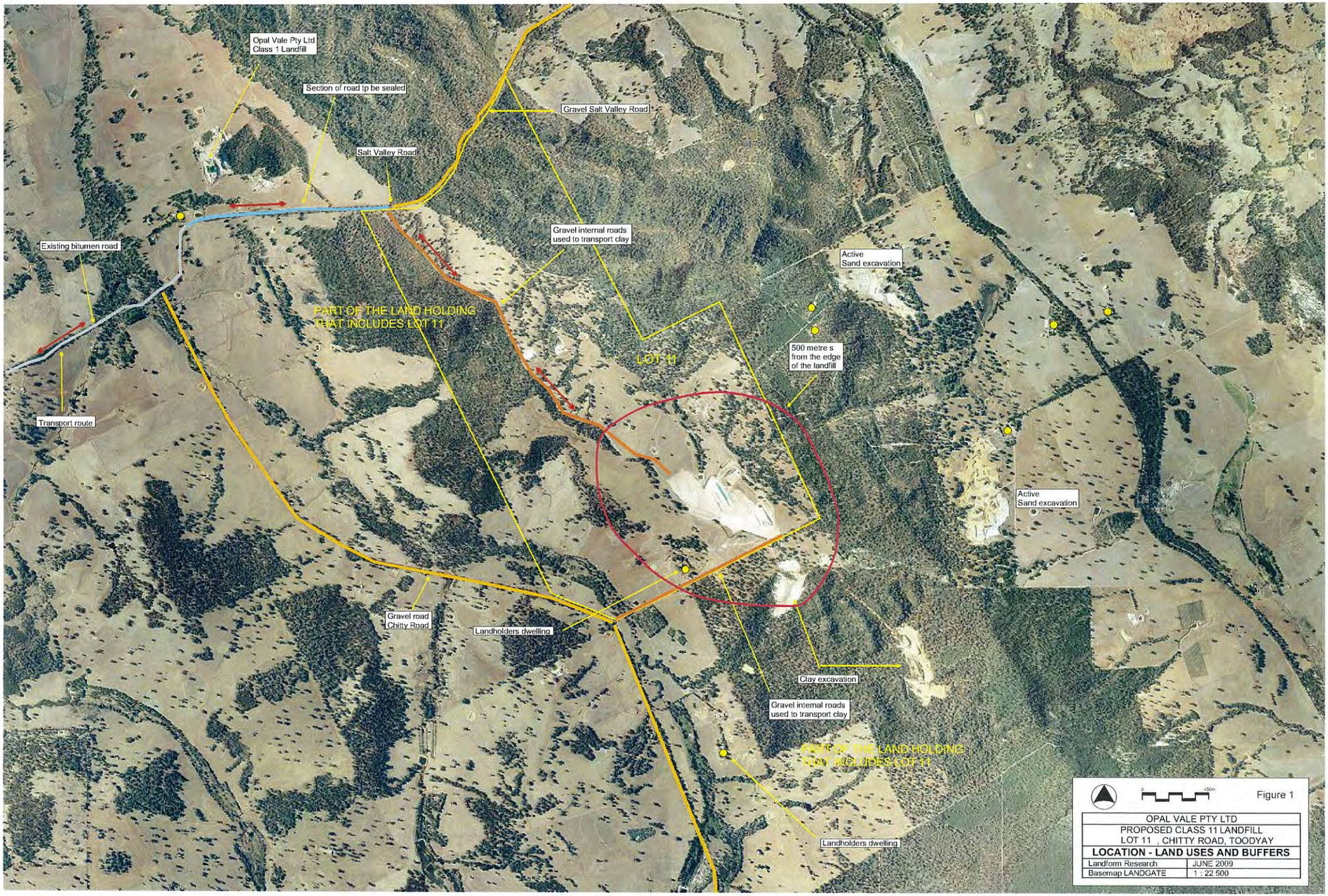
7. DISCUSSION

We understand that it is proposed that the proposed landfill site will operate between 0700 and 1800 hours Monday to Saturday (excluding public holidays). As the landfill will only operate during the day period, noise received at the neighbouring residence from the quarry needs to comply with the assigned L_{A10} noise level of 45 dB(A) for the day period. Although we believe that at the calculated noise level, noise received at the neighbouring residence would not be tonal, to be conservative, an allowance for the +5 dB(A) penalty for a tonal component has been included in the assessment.

In terms of compliance with the regulations, although there are residence located to the north, north east and south west of the site, the neighbouring residence of concern is located to the south west. For the proposed operating hours, noise received at the residence to the north / north east and east will comply with the Regulatory requirements. However, for compliance to be achieved at the residence to the south west a 2metre high bund is required to be constructed along the western side of the pit. Additionally, if the dozer and roller were operated together, then to achieve compliance, the bund at the western side of the pit would need to be 4m high.

APPENDIX A

Locality Plan


Opal Vale Pty Ltd
Class 1 Landfill
Section of road tp be sealed
Gravel Salt Valley Road
Salt Valley Road
Existing bitumen road
Gravel internal roads
used to transport clay
Active
Sand excavation
PART OF THE LAND HOLDING
THAT INCLUDES LOT 11
LOT 11
500 metre s
from the edge
of the landfill
Transport route
Active
Sand excavation
Gravel road
Chitty Road
Landholders dwelling
Clay excavation
Gravel internal roads
used to transport clay
PART OF THE LAND HOLDING
THAT INCLUDES LOT 11
Landholders dwelling
Figure 1
OPAL VALE PTY LTD
PROPOSED CLASS 11 LANDFILL
LOT 11 , CHITTY ROAD, TOODYAY
LOCATION - LAND USES AND BUFFERS
Landform Research
JUNE 2009
Basemap LANDGATE
1 : 22 500

11 February 2013 Document Ref. 2013-0007AC

Opal Vale Pty Ltd
c/- Instant Waste
PO Box 419
Morley Business Centre
Morley, WA, 6943

Attention: Mr Sam Mangione

RE: GEOTECHNICAL SITE INSPECTION AND REVIEW OF STABILITY ANALYSIS, OPAL VALE LANDFILL, CHITTY ROAD, TOODYAY, WA

1 INTRODUCTION

CMW Geosciences Pty Ltd (CMW) was authorised by Instant Waste (Sam Mangione) to undertake a site inspection to assess the stability of the exposed pit wall materials at the proposed Opal Vale Landfill site, located at Chitty Road, Toodyay, WA. In addition to this work, CMW were also required to further investigate the calculation of seismic risk by referencing both AS4678-2002 and AS1170.4-2007.

Our engagement was to satisfy conditions of a Conferral of Expert Witnesses for the State Administration Tribunal in the matter of Opal Vale Pty Ltd and the Shire of Toodyay and this report must be read in conjunction with our earlier report dated 16 August 2012, Ref. 2013-007AC.

2 SITE INSPECTION

The existing clay pit has been predominantly cut through the crest of a ridge which runs in an approximately south-east to north-west direction.

The majority of the pit walls have been reworked to reduce slope angles and during the time of our inspection were typically covered with track compacted fill materials (Plate 1). Large quantities of fill has been placed in the eastern portion of the site covering the near vertical cut slopes, which are visible in the aerial photograph provided (Figure 1 and Plate 2). However, two steep cut slopes in the northern portion of the site (marked on Figure 1 as Exposure 1 and 2) exposed the subsurface profiles which were logged during our time onsite.

Our inspection involved a site walkover and classification of the exposed pit materials plus the assessment of the schistosity and defect orientation exposed in the cut slopes. As mentioned above, the majority of the pit slopes have been reworked, therefore our assessment was limited to only two areas of the clay pit (Exposure 1 and Exposure 2).

3 EXPOSED GEOLOGY

A discussion of the published geological information is presented in our earlier report dated 16 August 2012. However, based on our limited inspection (only two areas) including portions of the clay pit floor, the subsurface geology can be generalised as follows:

Table 1: Geological Profile Logged at Exposures 1 and 2

MATERIAL	NOMINAL THICKNESS (m)	DESCRIPTION
FILL / CLAYEY SANDY GRAVEL (GC)	0 – 3**	Red brown, fine to coarse grained, of angular quartzite and rounded laterite.
SILTY SAND (SM)	0 – 0.5**	Pale brown, fine to coarse grained, trace gravel, very weakly cemented.
SANDY CLAYEY SILT (ML/CL)	1 – 2	Mottled pale grey and orange brown, low to medium plasticity, with gravel of rounded laterite and angular quartzite, variable very weak iron cementation; Stiff to Very hard.
Extremely Weathered PHYLITE / SCHIST	Lithology logged to the base of the pit	Pale grey with some orange mottles, fine grained, extremely low to very low strength, extremely to highly weathered; schistosity typically sub horizontal, extremely closely spaced, wavy, rough, clean, closed; Defects typically joints, sub vertical, closely to widely spaced, planar, very rough, typically clean, some with iron staining, closed to open up to 15mm, occasional quartz veins.
Note: ** Layer is surficial and not continuous		

In addition, based on the geological references for the area, other units are likely to exists although were not logged during our time onsite.

4 ASSESMENT OF PIT SLOPE STABILITY

4.1 General

The reworked slopes which comprise the majority of the pit have not been considered for assessment in this report. However, the pit walls that are exposed have been subject to instability especially in the location of Exposure 2 and these areas are the focus of the following information.

As described in Table 1, these slopes typically comprised a surficial layer of sandy clayey silt overlying an extremely low to very low strength, highly to extremely weathered schist. CMW's previous analysis (Ref: 2013-0007AB) modelled the insitu materials as a hard residual soil which was based on a desktop review of existing information but did not include a site visit. The typically extremely low strength material that is exposed confirms that the material will technically behave as a soil (defined in AS1726-1993, section A2.6, as a material which can be broken down by hand in either water or air) and therefore the failure mechanisms analysed in our previous report is still valid. However, defects and weaker planes (schistosity) in the exposed materials were observed during our site visit. Preliminary assessments of the slopes for potential rock type slope failures are therefore required and are presented below.

4.2 Exposure 1

The materials encountered at Exposure 1 are presented in Figure 2 which shows that the underlying lithology contains planes of weakness that comprise the following:

- *Sub-horizontal Schistosity*: typically extremely closely spaced, wavy, rough, clean and closed; and
- *Sub-vertical Defects*: typically joints, sub vertical, closely to widely spaced, planar, very rough, clean, with some iron staining, closed.

A stereographic projection of the dominant defects measured in the field is presented in Figure 1. Based on our interpretation of the stereograph and the observed quality of the defects, the following can be concluded about the potential for rock slope type failures at the location of Exposure 1:

- Although the orientation of the schistosity would kinematically allow for planar failures, it is judged that the roughness and waviness (Plate 3) of the schistosity would generate too much friction for a planar failure to occur. In other words, we would anticipate that the friction angle of the schistosity is larger than the dip angle (typically measured at approximately 15 to 30 degrees). In addition, there is no evidence of planar failure at this location;
- Some defects intersect the schistosity at an orientation to the face that could allow for wedge type failures. However, it is considered that the dip of such wedge type failures is less than the friction angle of any weak planes and therefore will not be activated;
- Two of the sub vertical defects have similar dip directions to the slope which indicates a potential for toppling failure, although basal release is required through planar failure mechanisms.

4.3 Exposure 2

The materials encountered in Exposure 2 are presented in Figure 3 which shows that the lithology has a sub-horizontal schistosity and sub-vertical jointing similar to that of Exposure 1. However, unlike Exposure 1, several of the defects were found to have partings of up to 15mm which is probably due to stress release from the removal of clay during previous land use. These partings became tighter with depth.

A stereographic projection of the dominant defects measured in the field is presented in Figure 1. Based on our interpretation of the stereograph and the observed quality of the defects, the following can be concluded about the potential for rock slope type failures at the location of Exposure 2:

- Although the orientation of the schistosity would allow for planar failures, as described above, the roughness and waviness (Plate 3) of the schistosity would generate too much friction for a planar failure to occur;
- Some defects intersect the schistosity at an orientation to the face that will allow for wedge type failures to occur. The likelihood of wedge type failures was confirmed on site by the presence of open sub vertical joints and the presence of some boulders at the base of the slope (Plate 4, Figure 3); and
- The dip direction of the defects in comparison to the face indicates that there is not potential for toppling failure at this location.

4.4 Proposed Slope

We have assessed the possibility of slope failures along defect planes following the recontouring of the slope to proposed angles of 1V:3H (18 degrees). Based on the dip angles of the measured discontinuities, it is unlikely that kinematic failure can occur from a slope face angle of 18 degrees, considering the condition of the defects and assumed friction angles.

5 SEISMIC VELOCITY

In CMW's previous stability analyses, a horizontal design response spectrum of 0.23m/s^2 was calculated using AS1170.4 (2007) *Structural Design Actions Part 4: Earthquake actions in Australia*. It was requested during the Conferral of Expert Witnesses for the State Administration Tribunal that the horizontal design response spectrum be compared to that calculated using AS4768 (2002) *Earth Retaining structures*. We have therefore reassessed the proposed slope with a seismic horizontal coefficient of acceleration of 0.065m/s^2 that was calculated from AS4768 (2002) which produced a factor of safety for the proposed slope case in excess of 1.5, which is satisfactory. CMW maintain that AS1170.4 is the appropriate code for the proposed landfill which also provided a more conservative coefficient of ground acceleration.

6 CONCLUSION

Based on our site inspection, defects and schistosity was identified at two exposures and further analysis was therefore completed to assess the effect of these discontinuities have on slope instability. It was concluded that it is kinematically possible for toppling type failures at Exposure 1 and for wedge type failures at Exposure 2.

However, once the slopes are recontoured to 18 degrees then we maintain they should be stable against general slip failures through the insitu material, (even under seismic loading with the parameters used) and against rock slope type failures along existing discontinuities.

As mentioned in our previous report, site specific geotechnical investigations should be undertaken to confirm our findings with consideration given to relevant laboratory testing. As discussed previously, there are a number of variables that influence shear strength parameters and our research into these correlations must be validated.

7 CLOSURE

Should you require any further information or clarification regarding our proposal, please do not hesitate to contact the undersigned.

For and on behalf of

CMW Geosciences Pty Ltd

Tyrone Mardesic

Project Geotechnical Engineer

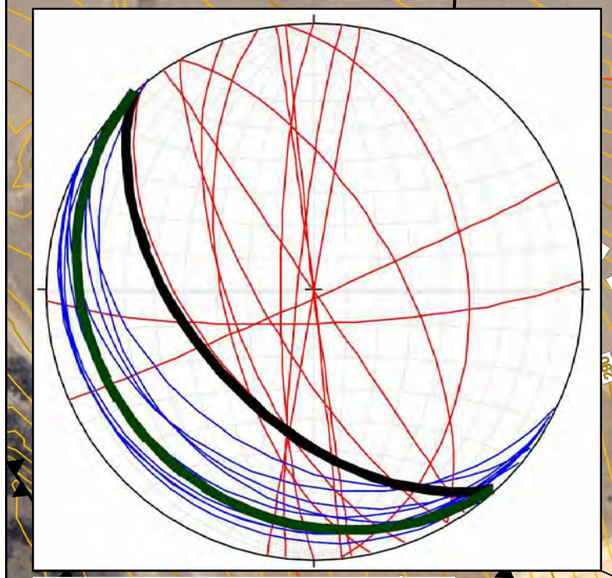
Reviewed by:

Phil Chapman

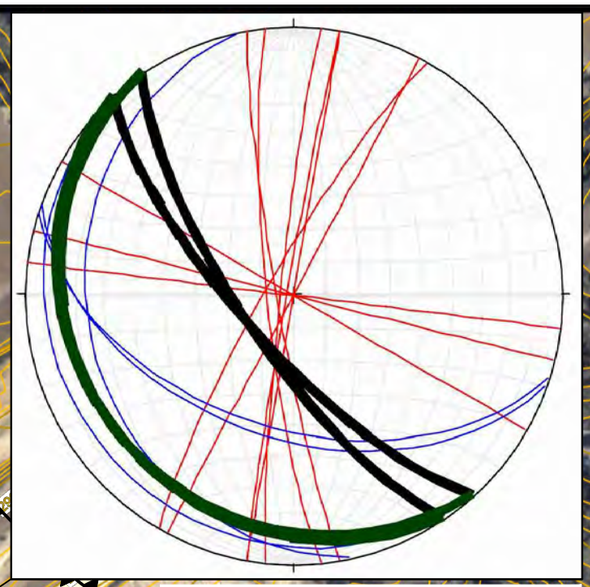
Managing Director / Principal

Distribution: 1 copy to Opal Vale Landfill (electronic) Original held by CMW Geosciences Pty Ltd

FIGURES



EXPOSURE 1 STEREONET



EXPOSURE 2 STEREONET

OPAL VALE

LOT 11 CHITTY ROAD

LANDFILL DEVELOPMENT

N

W E

S

METRES

0 50 100

SCALE 1: 2500

EXPOSURE 1

EXPOSURE 2

LEGEND:

Denotes Ridge

EXPOSURE 2 — Denotes Exposure

STEREONET LEGEND:

Denotes Face of Exposure

Denotes Proposed Recontoured Face

Denotes Plane of Schistocity

Denotes Plane of Defect

CMW Geosciences Pty Ltd

Chapman Morton Woodward

CLIENT:	OPAL VALE PTY LTD		
PROJECT:	OPAL VALE LANDFILL PROJECT		
TITLE:	GEOTECHNICAL SITE PLAN		
DRAWN: TM	DATE: 08/02/13		
CHECKED: PDM	DATE: 08/02/13		
PROJECT No. 2013-0007	FIGURE No. 01		
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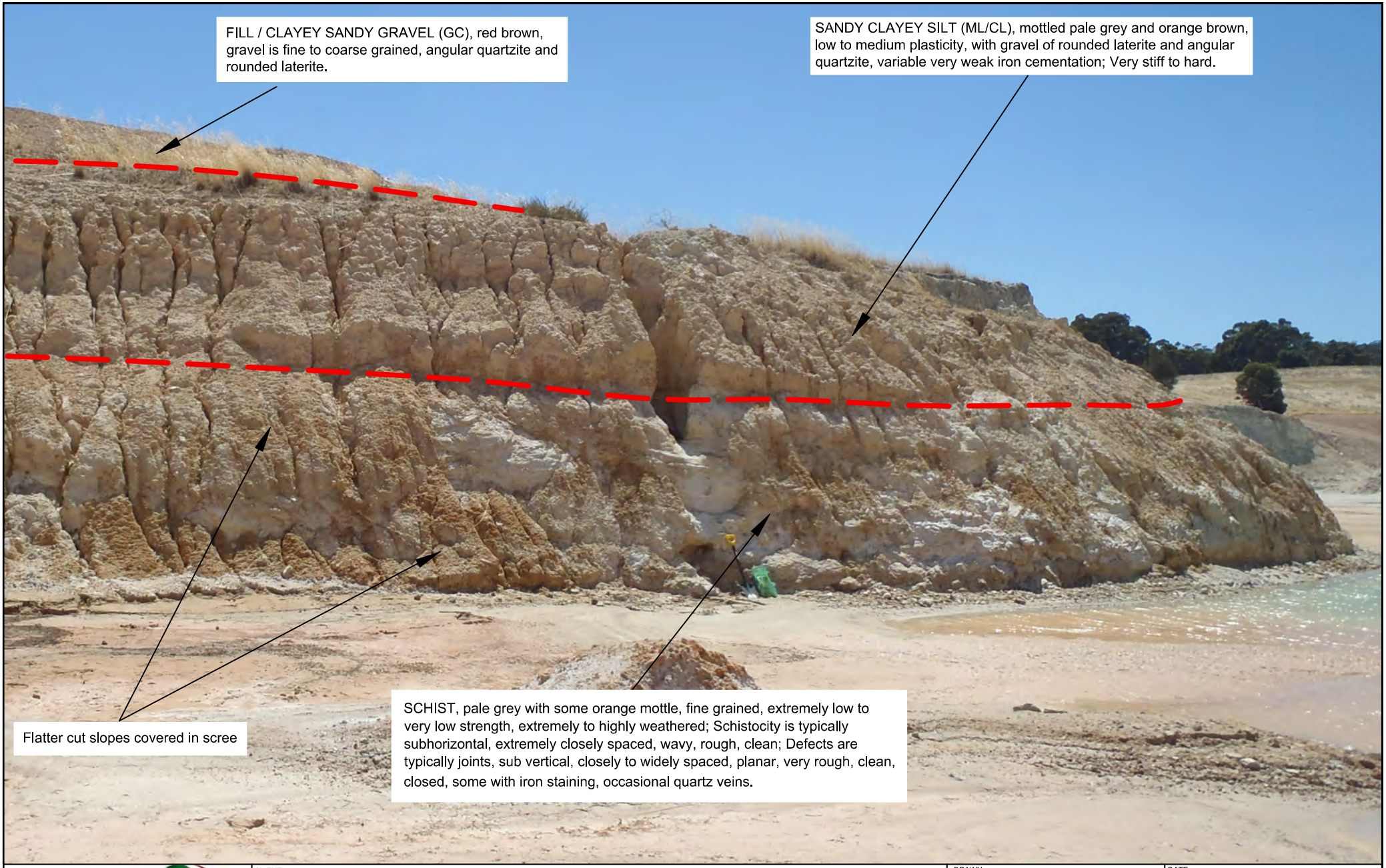
REVISION: A	DATE: 08/02/12	A3	



CMW Geosciences Pty Ltd
Chapman Morton Woodward

CLIENT:	OPAL VALE PTY LTD		
PROJECT:	OPAL VALE LANDFILL PROJECT		
TITLE:	EXPOSURE 1		
DRAWN:	TM	DATE:	08/02/13
CHECKED:	PDM	DATE:	08/02/13
PROJECT No.	2013-0007	FIGURE No.	02
SCALE:	NTS		
REVISION:	A	DATE:	08/02/13
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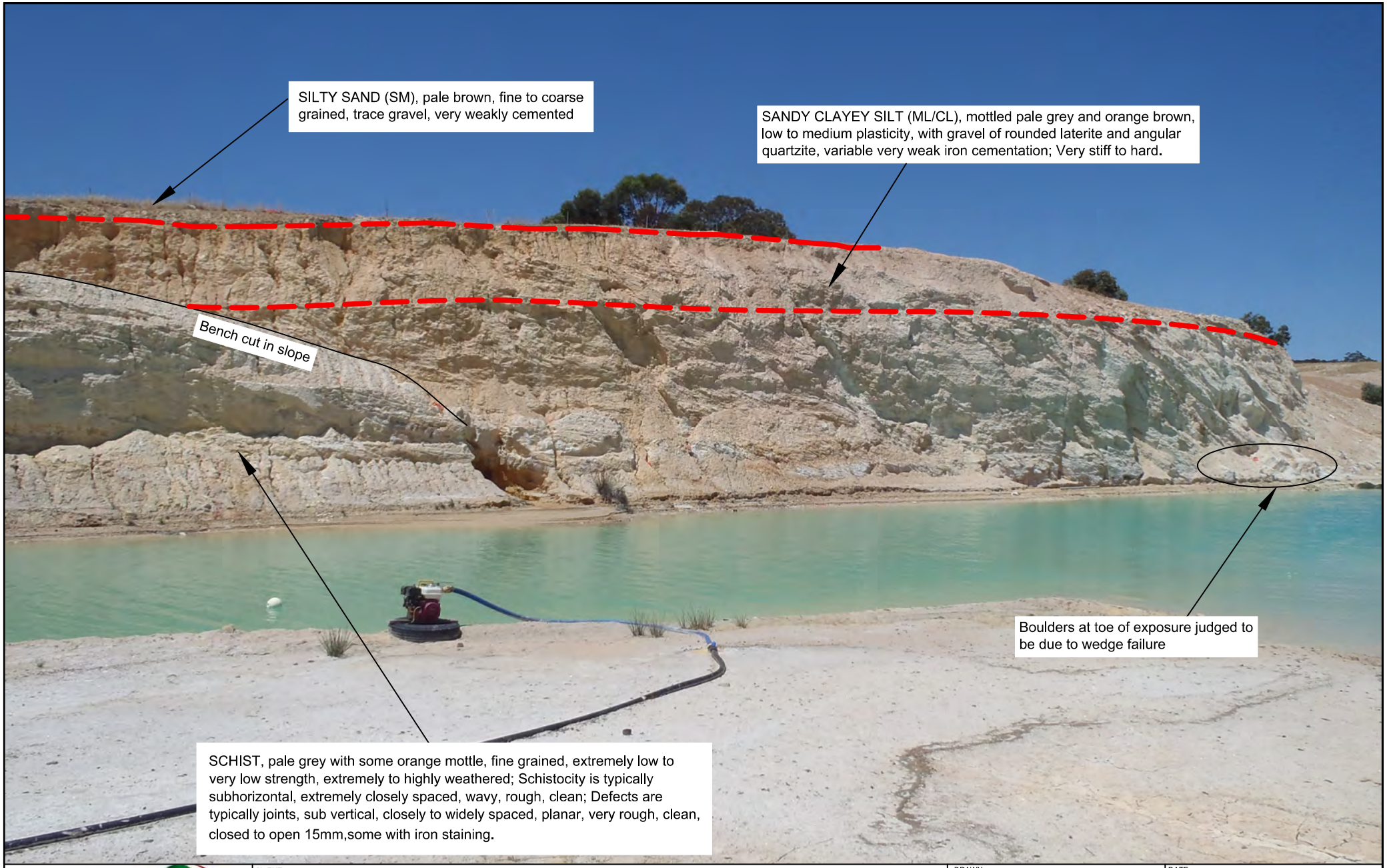

CMW Geosciences Pty Ltd
Chapman Morton Woodward

CLIENT:	OPAL VALE PTY LTD		
PROJECT:	OPAL VALE LANDFILL PROJECT		
TITLE:	EXPOSURE 2		
DRAWN: TM		DATE: 08/02/13	
CHECKED: PDC		DATE: 08/02/13	
PROJECT No. 2013-0007		FIGURE No. 03	
SCALE: NTS			
REVISION: A		DATE: 08/02/13	A4

PLATES

PLATE 1 - Site Photo

PLATE 2 - Site Photo

PLATE 3 – Typical Rock Schistocity

PLATE 4 – Open Jointing and Slope Debris at Base of Slope Observed in Exposure 2

Depth modified to > 12 m – excavate
– higher than current

WUNDA-Y CLASS IV LANDFILL
CHITTY ROAD
BAKER'S HILL

CONSULTATIVE ENVIRONMENTAL REVIEW
(EPA ASSESSMENT NUMBER 1202)

June 1998

DRAFT

Prepared for

WUNDA-Y FARM PARTNERSHIP

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ENVIRONMENTAL + WATER RESOURCE CONSULTANTS

SUMMARY OF ISSUES AND RELEVANT ENVIRONMENTAL FACTORS

A primary purpose of a Consultative Environmental Review is to provide detailed information on a proposal to the Environmental Protection Authority, and the community with a focus on relevant environmental factors which have been identified by the Proponent and the Department of Environmental Protection as having the potential to impact on the physical, biological and social environment of the area relevant to the proposal. The relevant environmental factors for the proposed disposal facility for Class IV wastes at Wunda-Y are summarised in Table 1 and described within the body of the document.

Table 1: Summary of Issues and Relevant Environmental Factors.

Environmental Factor	Site Specific Factor	Status of the Environment	Value of site on regional scale	Potential Environmental Impacts	Management Objective	Management Response	Predicted Outcome
Biophysical							
Terrestrial flora	Vegetation communities	The proposed waste disposal facility will be located in an extensive clay pit which is surrounded by agricultural land with a few isolated remnant native trees of the Jarrah/Marri/ Powderbark Woodlands.	The proposed waste disposal site contains no vegetation. The surrounding agricultural land is common in the region and has no outstanding conservation value.	• No clearing of vegetation will be required. • Introduction of weeds and pests onto Wunda-Y by earthmoving machinery and trucks.	• Rehabilitate the site to its former agricultural landuse. • Prevent introduction of weeds and other pests.	• Rehabilitate progressively. • Enforce strict hygiene policy to ensure trucks and Earthmoving machinery arrive at Wunda-Y free of weed seeds and soil.	Agricultural land will be re-established on the restored landform.
	Declared Rare and Priority Flora	No Declared Rare and Priority Flora occur on the Project Area.	The pit is currently a scar on the landscape.	No impact on any Declared Rare and Priority Flora.	Rehabilitate to agricultural landuse.	Rare flora is not a management issue for the operation.	No Declared Rare and Priority Flora will be affected by the proposal.
Wetlands	Wetland	No wetlands occur on the proposed waste disposal site. One wetland occurs on Wunda-Y along Jimperding Brook	Not Applicable.	No wetland will be affected by the proposed waste disposal operations.	Minimise impact of operations on existing environment.	Ensure that the proposed waste disposal operations are confined to the existing pit and site infrastructure.	A wetland along Jimperding Brook will not be affected by the proposed waste disposal operations.

		approximately kilometres away.					
	Watercourses	No major or minor drainage lines occur within the Project Area and no such drainages will be affected by the proposed waste disposal operations. Wunda-Y is drained by Jimperding Brook which is located about 1 kilometre to the west of the pit.	The site is located on the crest of a hill and does not affect any regional drainages.	No drainage lines will be affected by the proposed waste disposal operations.	Prevent any detrimental impact on Jimperding Brook.	Ensure that the proposed waste disposal operations are confined to the existing pit and site infrastructure.	Jimperding Brook and other local to regional drainage will not be affected by the proposed waste disposal operations.
Land	Rehabilitation	The proposed waste disposal operations will be confined to an existing clay pit and will not result in any additional land disturbance. The existing Williamson's Pit will be back filled by the proposed operations and restored its pre-excavation landform.	The disturbances which surround the clay pits are visible from locations as a small scar.	Provides the opportunity to rehabilitate the pit to its previous landform and restore pre-excavation landuses.	• Rehabilitate progressively. • Return the land to its pre-excavation agricultural landuse.	Rehabilitate progressively by backfilling the pit with Class IV wastes.	• Existing Williamson's Pit will be refilled. • Agricultural land will be re-established on the restored landform.
Pollution Management							
Water	Surface Water Quality	The proposed waste disposal operations are located on the crest of a hill at the top of the catchment and they do not interfere with any surface drainage. A drainage line exists to	The existing drainage line is dry for most of the year and located at the top of the catchment. Therefore has little value on a regional scale.	• No detrimental impact on the quality of the surface water. • Run-off from the existing disturbances at times have	Prevent any detrimental impact on the surface water in the vicinity of the proposed waste disposal operations.	• Rehabilitate to promote surface runout rather than percolation.	Quality of Surface water will not be affected by the proposed waste disposal operations.

		the east of Williamson's Pit. Jimperding Brook exists on the west of Wunda-Y about 1 kilometre away from Williamson's Pit.		suspended solids. The proposed rehabilitation will prevent this.			
	Groundwater quality	Groundwater has been detected in some of the ten bores drilled in and around Williamson's Pit. Hydraulic testing showed that water present in these piezometers was part of an aquiclude.	There are no regional groundwater bores on the property or surrounds despite several searches for a groundwater resource.	• Contaminate aquiclude. • In the absence of a groundwater aquifer, there is no potential to affect an aquifer.	Prevent any seepage of contaminated water from the waste disposal facility existing or regional groundwater resources.	• Construct waste disposal cells which are lined and managed to avoid leachate escaping. • Monitor quality and level of groundwater in piezometers.	Quality of water in aquiclude will not be affected by the proposed waste disposal operations.
Non-chemical emissions	Noise	The proposed waste disposal operations will be wholly contained within Williamson's Pit. A substantial buffer exists between the pit and nearby residences.	The site is located in a rural environment. The nearest neighbours are located 1.5 kilometres from the proposed operations.	The operations will generate noise which has the potential to become a public nuisance and/or pose an occupational risk to workers in the disposal facility.	• Ensure that proposed waste disposal operations do not generate noise to a level which creates nuisance for the surrounding area. • Ensure that noise is not an occupational problem for the workforce.	• Undertake all waste disposal operations within the existing pit. • Fit and maintain noise mufflers on machinery. • Ensure operators wear approved equipment for noise protection.	Surrounding residences and landusers will not be affected by noise from the proposed operations.
	Vibration	The proposed waste disposal operations will be wholly contained within Williamson's Pit which is 600 m from	Vibrations from the proposed operations will only be detected on a local scale.	No vibrations generated by the proposed disposal facility will cause nuisance to	Ensure that the proposed waste disposal operations do not generate vibration to a level	• Undertake all waste disposal operations within the pit.	Surrounding residences and landusers will not be affected by vibration.

		the nearest residence.		surrounding residences and land users.	which affects neighbours.		
Air	Odour	The wastes to be accepted at the proposed waste disposal facility will be relatively odourless.	Not Applicable.	The waste disposal facility will not be a source of odour.	Only dispose of wastes which have low odour generating potential, to minimise impact on surrounding residences and land users.	• Check and classify all wastes which arrive on site prior to their disposal. • Check that wastes arriving on site are not likely to develop an odour which would be a nuisance problem.	No offensive odours will be generated by the proposed waste disposal operations.
	Particulates/dust	Williamson's Pit is relatively free of dust and the extraction of clay does not generate a dust problem.	Not Applicable	Wastes could be dispersed by wind during unloading.	Ensure that wastes do not generate dust which is an environmental and health hazard.	• Do not unload wastes when windy conditions prevail. • Apply water spray if wastes are very dry and likely to generate dust during unloading and spreading. • Spread wastes evenly immediately after unloading, and subsequently cover wastes. • Keep size of active burial area to a minimum.	Surrounding residences and landusers will not be affected by dust or particulates.
Social surroundings							
Public health and safety	Road Traffic	The wastes are likely to be transported along	Toodyay Road is a major regional road	Waste disposal will not be continuous,	Minimise adverse impacts of trucking.	Apply water to unsealed roads on a	The proposed dust suppression will

		the same route that clays are currently being trucked from Wunda-Y. From Perth this is along Toodyay Road via the unsealed surfaces of Salt Valley, Fernie and Chitty Roads. Along this unsealed section three houses are located within about 150 metres of the road frontage.	which is constructed to highway standards. The other three roads are district roads which are maintained by the Shire of Toodyay.	but will only occur when contracts for such disposal have been secured. Trucking will then be at a high rate over a few days. It is estimated that on about 26 days per year trucking will be increased by up to 50 movements per day.		needs basis for dust suppression. To be undertaken in consultation with the Shire of Toodyay.	avoid dust becoming a public nuisance.
	Risk and Hazard	The proposed waste disposal facility is located in a relatively remote rural environment within a large property. The existing clay pit is a scar on the landscape but it is not a source of pollution.	The proposal provides the opportunity to bury low hazard wastes in an environmentally safe and geologically stable manner. Such a facility will be of great benefit to Western Australia, especially the Perth Metropolitan Area.	Contamination of the environment by spillage, wind dispersal and seepage.	Undertake operations in an environmentally responsible manner.	• Ensure cells are constructed and operated in a manner which will prevent the escape of contaminants. • Prevent access to public. • Site operators follow Operations Procedures Manual. • Site operators to wear appropriate safety clothing and equipment.	Care will be taken to ensure that risk or hazard presented by the proposed waste disposal operations is minimal and acceptable.
Aesthetic	Visual Amenity	The disturbances (clay stockpiles) which surround Williamson's Pit are just visible from a number of local vantage points. The	The proposed operations will not be visible outside the pit. Trucks entering and leaving the pit will be visible to the	• The proposed disposal of wastes will permit the restoration of the original landform and pastures, and	Restore the pre-excavation landform and re-establish agricultural landuse.	• Ensure that rehabilitated contours reflect the pre-excavation landform. • Ensure that the	• No short term impact on the visual amenity of the area. • Long term improvement of

to approximate

		actual pit is not readily visible. The proposed waste disposal operations will be located within the existing Williamson's Pit and will not be visible to the public from the surrounding area.	surrounding area.	thereby remove a scar from the landscape. • The proposed operations will improve visual amenity of the area.		proposed waste disposal operations are contained within Williamson's Pit.	the visual amenity of the area.

ENVIRONMENTAL COMMITMENTS

In this Consultative Environmental Review the preponent makes a number of commitments. For convenience all of these commitments are collated in Table 2 in a form which will permit ready appraisal by the Proponent and officers of the Department of Environmental Protection to ensure compliance with the commitments.

Table 2: Environmental Commitments

Commitment	Objective	Action	Timing	Whose advice	Measurement/Compliance Criteria
1. Design, construct and manage the disposal facility in accordance with practice.	Ensure that operations are carried out without detriment to the surrounding environment and amenity of local residents.	(a) Follow procedures outlined in this Consultative Environmental Review (CER). (b) Follow guidelines of the Department of Environmental Protection (DEP). (c) Consult with the Shire of Toodyay. (d) Discuss with DEP amendments to design criteria described in this CER	Pre-construction and ongoing.	Proponent's Environmental Consultants and Department of Environmental Protection.	- Check that environmental management procedures outlined in the Consultative Environmental Review have been carried out. - DEP Environmental Licence.
2. Accept responsibility for the wastes buried in the waste disposal facility.	Ensure that buried in remain safely encapsulated.	Wunda-Y Farm Partnership (WFP) will accept responsibility buried wastes.	Immediately on arrival of wastes.	Proponent's Environmental Manager.	- Ongoing checks by Site Manager and post closure Monitoring and Maintenance Programme.

Commitment	Objective	Action	Timing	Whose advice	Measurement/Compliance Criteria
3. Keep a record of all wastes accepted.	Ensure that quanitites and types of wastes disposed of in the landfill facility are recorded.	Inspect wastes arriving on site and record their type and quantity.	Continuously.	Site Manager.	- Quarterly reports to Proponents Environmental Management
4. Restore the existing Williamson's Pit to stable, pre-excavation contours and re-establish landuse of grazing and cropping.	Restore the pre-excavation landform and landuse, blend the restored landform into surrounding landscape, and re-establish pasture suitable for grazing	(a) Establish a uniformly sloping floor with a slope not less than 2%. (b) Spread and compact wastes evenly. (c) Create final contours which reflect pre-excavation contours. (d) Establish a stable soil cover on the capping layer of the landfill facility. (e) Establish pasture.	Continuously.	Site Manager and Proponent's Environmental Manager.	- Daily Log - Post closure Monitoring and Maintenance Programme - Performance Compliance Report
5. Operate in an occupationally safe manner.	Protect the public and site operators.	(a) Ensure operators wear appropriate clothing and safety masks when required. (b) Prepare Operational Procedures Manual	Prior to first disposal of waste and from then continuously	Site Manager and Proponent's Environmental Manager.	- Operational Procedures Manual - Health and Safety Policy
6. Implement an Environmental Management System.	Ensure the site is operated under procedures of best practice and good environmental management.	Establish an Environmental Management System complete with Environmental Management Plan and Operations Procedure Manual, using the principles and procedures described in ISO 14000 Series	Pre-construction	Proponents Environmental Manager.	- Environmental Management System documentation - Environmental Management System audit and review

Commitment	Objective	Action	Timing	Whose advice	Measurement/Compliance Criteria
7. Enforce strict policy of site hygiene.	Ensure that weed seeds, especially Doublegee seed, and soil borne diseases are not introduced onto the Wunda-Y.	(a) Check that trucks and earth moving machinery arrive at Wunda-Y free of seeds, soil and organic matter.	Continuously.	Site Manager.	- Hygiene policy. - Inspection completed and signed off by. Contractor and Site Manager.
8. Protect ground and surface water.	Avoid contamination of ground and surface water.	(a) Install inpervious liners to prevent the escape of leachate. (b) Monitor the presence and quality of groundwater below and in the vicinity of the waste disposal facility on a three monthly basis.	a) construction phase of each cell. b) Continuously.	Site Manager and Proponent's Environmental Manager.	- Performance Compliance Report.
9. Control dust generation	Avoid or minimise dust generation.	(a) In consultation with the Shire of Toodyay water access roads during periods of trucking. (b) Delay tipping (in very windy weather) until windless conditions prevail. (c) Cover wastes as soon as practically possible.	Continuously.	Site Manager.	-Compliance with Environmental Management Plan.

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4. BACKGROUND

4.1 LANDFILL WASTE CLASSIFICATION AND DEFINITIONS

In Western Australia landfill facilities are divided into five classes as illustrated in Table 3.

Table 3: Landfill Classes and Waste Types.

Landfill Type	Landfill Class	Waste Types Accepted
Inert	I	Inert wastes: including construction and demolition waste and uncontaminated soil.
Putrescible	II	Inert waste; Putrescible waste; Low hazard waste (Class II Type 1) and Special waste (Class II Type 1)
Putrescible	III	Inert waste Putrescible waste Low hazard waste (Class III Type 1) Special waste (Class III Type 1)
Secure	IV	Low hazard waste (Type 2) Special waste (Type 2)
Intractable	V	Intractable waste only

Source: Department of Environmental Protection (1996 (b).

A Class IV (Secure) Landfill Type is able to accept Low Hazard Waste (Type 2) and Special Waste (Type 2). These wastes are defined by the Waste Management Division of the Department of Environmental Protection as follows:

a) Low Hazard Waste (Type 2)

- Waste containing low levels of heavy metals, polycyclic aromatic hydrocarbons or other organic compounds in either low concentrations or in forms which do not pose an acute hazard.

b) Special Waste (Type 2)

- Asbestos waste, which is appropriately packaged for disposal, as defined by and managed within the *Legislative Requirements for the Management of Waste Material Containing Asbestos* (Waste Management Division, 1996).
- Clinical and Related wastes which are suitable for disposal to landfill as defined in the *Code of Practice for the Management of Clinical and Related Wastes* (Waste Management Division, 1997).

Low Hazard Wastes (Type 2) include contaminated soils and low hazardous wastes generated by industries and processes such as: Adhesives manufacture; Battery manufacture; Bitumen Products; Brewery waste; Cable manufacture; Cardboard manufacture; Drawing film and material manufacture; Electrical goods manufacture; Electrical goods servicing; Explosives manufacture; Engineering workshops; Fertiliser production; Fibre glass manufacture and removal; Fibrous plaster manufacture; Foundry and waste dumps; Insulation material manufacture; Lime manufacture; Market garden; Mechanical workshops; Metal manufacture; Minerals processing; Pest control/ pesticides; Petrol service stations; Petroleum/oil refinery;

Photographic works; Plastics manufacture; Power generation; River sediment; Tank cleaning; Timber processing, and Wool scouring.

4.2 RECOGNITION OF THE NEED FOR DISPOSAL FACILITIES FOR CONTAMINATED WASTES

There is growing recognition of the problems which are associated with contaminated sites and the need for their remediation. These problems have become apparent as old sites are re-developed. There is also increased awareness of the environmental threats posed by contaminated sites, especially to groundwater and of the need to remove low hazardous materials such as asbestos from our everyday environments. The emphasis is often on their removal for off-site disposal in a safe and environmentally sound manner, rather than on in-situ treatment.

Halpern Glick Maunsell (June 1996) estimated that over the next 20 years between 2.2 and 4.9 million cubic metres of contaminated wastes from the Perth Metropolitan Area would become available for disposal.

The Water Authority of Western Australia (May 1997) identified *the lack of strategically placed Type IV and Type V (intractable) landfill sites to provide a cost effective way of disposing of contaminated soils, which cannot be dealt with effectively by in-situ management or remediation techniques* (Department of Environmental Protection, 1997). In 1995 the Western Australian Government in their Select Committee Report on Recycling and Waste Management (1995) supported a recommendation that *the Waste Management Division of the Department of Environmental Protection should create a disposal facility for low level hazardous wastes* and suggested that such a disposal facility be established within a 100 kilometre radius of the Perth Metropolitan Area. The Western Australian Government regarded this as a matter of high priority and stated that *some contaminated sites issues in the metropolitan area would be resolved more readily with such a facility available.*

To establish arrangements for the identification, investigation, remediation and disposal of contaminated wastes the Western Australian Government In the report entitled*Assessment and management of contaminated land and groundwater in Western Australia* recommended new legislative powers in to the Environmental Protection Act of 1986 (Department of Environmental Protection, 1997). The establishment by the Department of Environmental Protection of a hierarchy of responsibility and liability for sites which pose a contamination risk and development of the *polluter pays principle* has resulted in recognition of the need for clean-up measures and the provision of suitable facilities for the disposal of contaminated wastes.

4.3 WASTE ACCEPTANCE CRITERIA FOR CLASS IV LANDHILLS

Low hazardous and special wastes are categorised by type and contaminant concentration, and often chemical analysis is required to determine the latter. In Western Australia the current standards for the assessment of wastes which are suitable for disposal at a Class IV waste disposal facility are based on the:

- Maximum concentration of contaminants; and
- Toxicity Characteristic Leaching Procedure which measures leave the leachability of each contaminant in the waste.

The analysis to determine the concentration of total soil contamination is based upon the Australian Guidelines for the Assessment and Management of Contaminated Sites (Australian and New Zealand Environment and Conservation Council, and National Health and Medical Research Council, 1992).

The Toxicity Characteristic Leaching Procedure, based upon Method 1311 of the Environmental Protection Authority of the United States of America, provides a laboratory method for determining the suitability of a waste material for disposal to landfill (Department of Environmental Protection, 1996(b)). This method is used to determine whether toxic components of wastes are likely to leach at rates which might result in unacceptable environmental impacts.

All wastes accepted at the proposed disposal facility will be classified prior to their arrival at Wunda-Y. Classification will be assigned following analysis of the material by a laboratory registered with the National Australian Testing Authority. The maximum contaminant concentration and Toxicity Characteristic Leaching Procedure for leachable fractions of Class IV waste are defined by the Department of Environmental Protection (1996(b)) (Table 4).

4.4 SITE SELECTION CRITERIA FOR CLASS IV LANDFILLS

The Department of Environmental Protection (1996(b)) has identified geological, hydrogeological and additional criteria for selecting sites for the safe disposal of Class IV wastes (Department of Environmental Protection, 1996 (b). These criteria are outlined in Table 4.

Table 4: Site Selection Criteria for Class IV Landfills

Factor	Selection Criteria	Characteristics
Geological	Lithology	Rock or sediment type. Shales, clays and loams are preferred.
	Uniformity	Uniform rock or sediment type preferred.
	Stability	Positioned in a geologically stable area.
	Permeability	Clays are preferred.
Hydrogeological	Depth to groundwater	Minimum of 10 metres.
	Thickness of saturation zone	The existence of groundwater and its distance from the surface must be established.
	Groundwater use	The use of groundwater in the surrounding area requires consideration.
Additional	Surface water	The site should not be in proximity of surface water bodies.
	Resources potential	The site should not comprise resource extraction potential.
	Environmental value of the site	The site should not be located in national parks or nature reserves.
	Flora and Fauna	The site should not be positioned in habitats of rare or endangered flora or fauna.
	Heritage value	The site should not be positioned in areas of particular cultural or historical significance.

Source: Department of Environmental Protection, (1996(b)).

All of the site selection criteria listed in Table 4 are met by the proposed disposal site on the Wunda-Y.

4.5 WUNDA-Y: OPPORTUNITY FOR A WASTE DISPOSAL FACILITY

Since 1991 Metro Brick have been extracting clay for the manufacture of bricks from Wunda-Y. This clay extraction is ongoing and has resulted in the establishment of three pits (Plate 1) on Wunda-Y which supply about 10% of the clays used for brick manufacture in Perth.

Williamson's Pit has ideal geological, topographical and hydrogeological features for the secure encapsulation of contaminated soils and low hazard materials. To date about 600,000 cubic metres of clay and soil have been excavated from this pit. Some of this material has been backfilled to give a net void available for waste disposal of about 530,400 cubic metres. It is anticipated that with the ongoing extraction of clay a further 2 to 3 million cubic metres of storage space will progressively become available over the next 20 years.

The proposal is to use Williamson's Pit for the disposal of Class IV wastes because of its geological and hydrogeological properties, absence of native vegetation, location and especially size.

5. THE PROPOSAL

5.1 OVERVIEW

A purpose designed disposal facility for Class IV wastes will be constructed in the void that has resulted from clay extraction on Wunda-Y. The pit will be shaped to the approximate landforms which existed prior to clay extraction. This will permit the re-establishment of the regional landuses of cropping and grazing.

The proposal is to accept contaminated soils and solid low hazardous wastes. **No liquid wastes will be accepted.**

The burial of Class IV wastes will be integrated with the ongoing excavation of clay. The wastes will be buried and encapsulated by clay within individual cells which will be established in a geologically stable environment. Principles of best practice in design and management will be used for the operations. Guidelines produced in 1996 by the Waste Management Division of the Department of Environmental Protection for the disposal of Class IV wastes will be followed (Department of Environemntal Protection, 1996( )). Advice will also be obtained from Officers of the Shire of Toodyay (**Commitment 1**).

5.2 COMMENCEMENT OF WASTE DISPOSAL AND LIFE OF PROPOSED OPERATIONS

Design and construction of the Cell-1, first cell will begin after approval has been received for the proposal and immediately after a contract has been secured to dispose of Class IV wastes. It is envisaged that this will occur in 1999.

The proposed waste disposal will be a stop-start operation which is dependant on the need for such disposal, and it is expected to be operating for at least 20 years.

5.3 OWNERSHIP AND LIABILITY OF WASTES

Once wastes are accepted by a disposal facility, they become the property of the owner of the facility (the Proponent). The Proponent will also be responsible for ensuring that the wastes accepted are suitable for disposal in the facility : Appropriate Environmental Management Plans and waste handling plans will be established for the proposed facility **(Commitment 2).**

Following burial of the wastes the Proponents will accept the responsibility of long term and post closure management of the disposal facility for Class IV wastes (**Commitment 2**).

5.4 ENVIRONMENTAL APPROVALS

After approval for the proposed waste disposal has been secured, construction of the facility can commence only after a Works Approval has been obtained from the Department of Environmental Protection. Waste disposal is then permitted to commence after an Environmental Licence for the operations has been obtained from the Department of Environmental Protection . This licences is issued after the Department of Environmental

Protection has determined that the facility has been constructed in compliance with the Works Approval. The Environmental Licence is renewed annually.

5.5 PROJECT JUSTIFICATION

It is estimated that over the next 20 years up to 4.9 million cubic metres of low hazardous wastes may become available for disposal in the Perth Metropolitan Area (Halpern Glick Maunsell, 1996). Currently the only Class IV landfill facility in Western Australia is located within the Red Hill landfill facility of the Eastern Metropolitan Regional Council. This facility has a total capacity of about 500,000 cubic metres (Eastern Metropolitan Regional Council, 1997(a)).

The Mt Walton East disposal facility, which is 475 kilometres to the northeast of Perth, is licensed to accept wastes which are highly toxic, radioactive or intractable (Class V wastes). It is not economically viable to transport low hazardous wastes to this landfill facility and such disposal would use up valuable disposal space.

The Secure Landfill Committee of the Joint Government Agency identified the need for a secure disposal facility for Class IV wastes within a 100 kilometre radius of the Perth Metropolitan Area. The provision of a second disposal facility for Class IV wastes in the vicinity of the Perth Metropolitan Area will meet Government objectives. The proposed facility has the capacity to accept large quantities of low hazardous wastes, and it provides an opportunity to clean-up contaminated sites and safely disposal of low hazardous wastes.

The proposed disposal also has the advantage of filling in an existing pit to approximate Iy its original landform. The subsequent rehabilitation of the pit will return the land to its former landuse of cropping and grazing.

In the event that the proposed facility is not developed, the Perth Metropolitan Area will be deprived of an additional facility for the environmentally safe burial of contaminated wastes and the filling and rehabilitation of Williamson's Pit to its near original landform and landuse will be prevented.

5.6 COMMUNITY CONSULTATION

The proposal has been discussed with Officers and Councillors of the Shire of Toodyay and with Officers of the Shire of Northam. These discussions are ongoing. The proposal has also been discussed with the nearest neighbour to Wunda-Y and they expressed no concerns.

6.14 HERITAGE

No sites of cultural significance to people of European or Aboriginal descent are located within the Project Area. No such sites have been reported elsewhere on Wunda-Y.

6.15 NEARBY RESIDENCES AND PROPERTY BOUNDARIES

The nearest residence to Williamson's Pit is more than 600 metres away and it is one of two residences on Wunda-Y. The nearest residence outside of Wunda-Y is located about 1.5 kilometres to the southwest of Williamson's Pit. The distance from Williamson's Pit to the nearest boundary, the eastern boundary, is about 280 metres. The pit is separated from this boundary by a minor creekline lined with trees followed by a gentle rise. The distance from the pit to the next nearest boundary (Chitty Road in the west) is about 1.25 kilometres.

6.16 TRANSPORT ROUTE

Access to Wunda-Y from the south is from Great Eastern Highway along Chitty Road. Access from the north access is from Toodyay Road via Salt Valley, Fernie and Chitty Roads. Toodyay Road and Great Eastern Highway are public highways. Salt Valley and Fernie Roads are both unsealed and the southern most 3 kilometres of Chitty Road has a bitumen surface.

The current route for the haulage of clay is along the unseded surfaces of Chitty, Fernie and Salt Valley Roads toToodyay Road and from there to Perth. Three residences are visible from the roads along the unseded section of this route, one of which is located. One of these residence is located on Chitty Road, one is located on Salt Valley Road and another is located at the junction of Fernie and Salt Valley Roads. The latter is within 50 metres of the road frontage whilst the former are within 150 metres of their respective road frontages.

Fourteen residences are located along Chitty Road between Great Eastern Highway and the entrance to Wunda-Y, and all of these are within 200 metres of Chitty Road.

decomposable organic matter and they will contain no free water on deposition prior to being encapsulated within impervious material. Consequently, there will be no potential for the generation of methane gas in any of the cells.

8.19 ENVIRONMENTAL MANAGEMENT SYSTEM

The Proponent will develop and implement an Environmental Management System (EMS) appropriate to the proposal and consistent with the principles outlined in the AS/NZS ISO 14000 series. It will include provisions for performance review and a commitment to continuous improvement.

The key components of the Environmental Management System will be:

- The Environmental Policy which is given in the front of this Consultative Environmental Review;
- An Environmental Management Plan;
- Management hierarchy and responsibilities;
- A training programme;
- A monitoring and measurement program;
- A programme of implementing corrective and preventative action;
- A procedure for assessing compliance with the environmental objectives and conditions; and,
- Environmental management reviews.

DRAFT

EXECUTIVE SUMMARY

The owners of the Wunda-Y farm in the Shire of Toodyay **propose to develop a disposal facility for Class IV wastes in an existing pit, Williamson's Pit, from which clay has been extracted** by Metro Brick since 1991, and **extraction is likely to continue for a further 20 years.** Class IV wastes are low hazardous wastes, consisting predominantly of contaminated soils. **No liquid wastes will be accepted.** It is estimated that over the next 20 years up to 4.9 million cubic metres of Class IV wastes may become available from the Perth Metropolitan Area. Presenttly such wastes can be buried in the Red Hill landfill facility of the Eastern Metropolitan Regional Council, which has a current capacity to accept 0.5 million cubic metres of such wastes. The proposed facility on Wunda-Y would then become **the second such facility** in Western Australia.

The proposed facility will provide the opportunity to bury contaminated wastes in an environmentally safe manner and in a geologically stable environment. It will also provide the opportunity to backfill Williamson's Pit and thereby restore it to approximately its pre-mining landform and re-establish the landuses of grazing and cropping.

About 530,400 cubic metres of space is currently available within the pit for waste disposal, and it is estimated that a further three million cubic metres of space may become available over the next 20 years. **The proposal is to bury wastes in a number of self contained cells.** The shape and size of the individual cells will vary depending on the configuration of the space in the pit which becomes progressively available. The proposal is for Cell-1 to occupy some of the available space in the southern most part of Williamson's Pit after some reshaping to establish an even and uniformly sloping floor and sides. The pit will be extended progressively in a north-northwesterly direction, and the subsequent cells will thus also progress in that direction, with Cell-2 adjoining Cell-1, and Cell-3 ultimately adjoining Cell-2, and so on.

The wastes in each cell will be fully encapsulated with compacted clay of very low permeability and a Flexible Membrane Liner. A drainage system will be established in the base of each cell to collect all leachate and then pump it to a lined evaporation pond.

Wastes will be securely covered whilst being transported to the facility. On arrival at the facility the wastes will be inspected to confirm their condition and origin. Following acceptance of the wastes by the waste disposal facility, the wastes become the responsibility of the facility. The wastes will then be transported to Cell-1 for burial which will progress in a northward direction from the southern perimeter of the cell. Wastes will be tipped into the nominated location, spread out evenly by a front-end-loader or similar machinery, compacted regularly, and stacked to a final height. **The compacted wastes will be covered with an impervious cover of compacted clay, a Flexible Membrane Liner and a drainage layer of graded sand followed by soil and topsoil.** Vegetation will then be established on the surface to provide surface stability. By these means exposure of uncovered wastes is minimised and waste disposal within the cell advances as an encapsulated mass.

The entire waste disposal operation will be located within the existing Williamson's Pit and the established roads and parking areas which surround the pit for the purpose of excavating

clay. Consequently, **the proposed operation will require no further terrain disturbance and destruction of surrounding pasture. No clearing of native vegetation is required and no fauna habitats will be affected. Similarly, the proposed disposal of wastes will not affect surface drainage.**

Small volumes of groundwater are present in the sandy clays which surround and underlie Williamson's Pit, but site specific hydrogeological investigations have confirmed that **there is no defined aquifer system below or immediately adjacent to Williamson's Pit. Consequently, there is no potential for the buried wastes to adversely affect an aquifer.** The risk of aquifer contamination is further minimised by the proposed encapsulation of wastes, complete with a leachate recovery system.

Construction of Cell-1 will commence after the necessary approvals have been obtained to construct and operate the proposed facility, and **as soon as possible after a contract for waste disposal has been negotiated.**

The volumes of wastes which will be buried annually are dependent on the need to remediate contaminated sites. Consequently, these volumes **are difficult to predict and they are likely to vary greatly.** Trucking of wastes will be confined to periods of waste disposal. During such periods it is expected that wastes will be trucked to Wunda-Y at a rate which will permit rapid remediation of a contaminated site. Based on the assumption that about 50,000 cubic metres of wastes will be buried annually, it is estimated that wastes will be transported on about 26 days per year and at a rate of up to 50 truck movements per day.

Most, and probably **all of the wastes to be disposed of will come from the Perth Metropolitan Area**, from where two transport routes are available, namely from either Great Eastern Highway or Toodyay Road. Clay from Wunda-Y is trucked to Perth via Toodyay Road and this **is the route which is expected to be used for the trucking of most, and probably all, of the wastes to Wunda-Y**. From Toodyay Road, which is constructed to a highway standard, access is via the unsealed surfaces of Fernie, Salt Valley and Chitty Roads. Along this route one house is located within 50 metres and two houses are located within 150 metres of their respective road frontages. Access from Great Eastern Highway is via Chitty Road and 14 houses are located along this route, all of which are within about 200 metres of the road frontage.

The proposed waste disposal will result in a substantial increase in **truck movements** and this is likely to be noticed by residents along the unsealed access roads to Wunda-Y. However, the **impact will be confined to short periods and few residences will be affected.** The main potential impact will be the generation of dust by trucks travelling on the unsealed roads. To reduce this impact, the Proponent will water these road sections on a needs basis and in consultation with the Shire of Toodyay.

An **Environmental Management System will be established** for the proposed waste disposal facility to ensure that the objective of environmentally safe disposal of wastes is achieved efficiently, on schedule and in compliance with all statutory conditions.

1. INTRODUCTION

This Consultative Environmental Review addresses a proposal to develop a Class IV Landfill facility on the Wunda-Y Farm.

The Wunda-Y Farm is located within the Shire of Toodyay, approximately 20 kilometres to the west of Northam, 14 kilometres to the south of Toodyay, 6 kilometres to the north of Bakers Hill and 75 kilometres to the northeast of Perth. The property comprises Lots M2027 and PTM2039 of Avon Location 1953 (Plate 1 and Figure 2).

There are three pits on the property from which clay is currently being extracted for brick making. The proposal is to use one of these, Williamson's Pit, for the disposal of Class IV wastes. Williamson's Pit is situated on the southeastern part of Lot M2027, approximately 1.25 kilometres to the east of Chitty Road (Plate 1). A well formed gravel road leads from Williamson's Pit to Chitty Road.

Williamson's Pit has ideal geological, topographical and hydrogeological features for the secure encapsulation of contaminated soils and low hazard materials. To date about 600,000 cubic metres of clay and soil have been excavated from this pit. It is anticipated that a further 2 to 3 million cubic metres of storage space will progressively become available over the next 20 years with the ongoing extraction of clay.

The proposed facility will accept contaminated soils and solid low hazardous wastes. **No liquid wastes will be accepted.**

The burial of Class IV wastes will be integrated with the ongoing excavation of clay. The pit will be filled and shaped to the approximate landforms which existed prior to clay extraction. This will permit the re-establishment of the regional landuses of cropping and grazing.

This document provides an overview of the existing site conditions, design criteria and a description of the operation of the facility. Potential environmental impacts are identified and management of these potential impacts is addressed. The proponent has made a number of commitments to ensure that the design, construction and operation of the Class IV Landfill meets regulatory requirements.

2. OBJECTIVES

The overall objective of this Consultative Environmental Review is to secure approval from the Environmental Protection Authority for the proposed disposal facility for Class IV wastes on the Wunda-Y Farm.

Specific objectives are to:

- Describe the proposed disposal facility.
- Outline design, construction and management criteria for the proposed disposal facility and ensure that they are based on the principles of best practice.
- Identify environmentally and socially sensitive issues and outline how these are addressed in the design, construction and management of the disposal facility.
- Identify tasks and procedures which will ensure that environmental objectives are achieved.

Guidelines for the preparation of this Consultative Environmental Review were issued by the Environmental Protection Authority on 29 May 1998 and they are included in Appendix A.

3. THE PROPONENT

The Proponent for the proposed disposal facility is the Wunda-Y Farm Partnership of Messrs Simon J Farrell and Kenneth P Judge.

Wunda-Y Farm Partnership	Telephone:	(08) 9384 2182
PO Box 291	Facsimile:	(08) 9385 6028
NEDLANDS WA 6909		

All correspondence pertaining to the proposed waste disposal facility is to be directed to Martinick McNulty Pty Ltd at the following address:

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WEST PERTH WA 6005	E-mail:	info@martinick.com.au

Attn: Dr Wolf Martinick

6. THE EXISTING ENVIRONMENT

6.1 CLIMATE

Wunda-Y and its surrounds have a Mediterranean climate which is characterised by seven to eight warm dry months per year. The nearest relevant climatic data have been recorded at Baker's Hill for the past 33 years, and these are summarised in Table 6.

Table 5: Climatic data for Baker's Hill.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Mean monthly rainfall (mm)	11.9	16.1	17.0	31.8	74.8	119.4	118.7	86.7	59.7	33.9	21.5	9.7	601.2
Highest monthly rainfall (mm)	126.4	99.4	92.6	114.5	178.4	262.4	282.7	167.2	150.8	75.4	88.2	54.0	1692
Mean number of rain days (mm)	2.0	2.9	3.0	6.6	10.6	16.2	16.0	14.7	12.2	7.4	4.9	2.3	98.8
Mean daily pan evaporation (mm)	11.4	10.5	8.2	4.9	2.9	1.9	1.8	2.3	3.2	5.0	7.5	9.9	2126.5
Mean daily maximum temperature (°C)	31.9	31.7	28.5	23.5	19.2	16.1	15.1	15.6	17.5	21.4	25.7	29.9	-
Mean daily minimum temperature (°C)	15.8	16.1	14.6	12.3	9.4	7.8	6.7	6.3	7.1	8.9	11.2	13.9	-

6.1.1 Air Temperature

Hottest summer temperatures occur in January when the mean daily maximum temperature is 31.9 °C. The lowest mean daily minimum temperature occurs in July and August, when mean daily minimum temperatures of 6.3°C prevail. During the winter months frost occurs infrequently and typically only in low lying areas.

6.1.2 Rainfall

The annual rainfall of Baker's Hill is 601.2 mm, with the highest number of rain days (about 16) occurring in the winter months of June and July, respectively.

The mean monthly rainfall at Baker's Hill is lowest in December (9.7 mm) and highest in June (119.4 mm).

6.1.3 Evaporation

The mean annual pan evaporation is 2126.5 mm and this exceeds the mean annual rainfall of 601.2 mm by 1525.3 mm.

6.1.4 Wind

Wind data are not available for Baker's Hill. Wind roses which show the monthly wind pattern of the region as occurring at 9.00 am and 3.00 pm are available from the weather station at Northam and these are indicative of the wind patterns at Wunda-Y.

Strong southeasterlies (between 21 and 30 kilometres per hour) are common in the mornings during the months of October to April. In the afternoon light westerlies (up to 20 kilometres per hour) are common from October to December and light southeasterlies (up to 20 kilometres per hour) prevail from January to March. During the winter months moderate to strong winds are common and they are associated with low pressure systems which are moving from the northwest to the southeast across the continent.

6.2 LANDUSE

Wunda-Y is zoned Rural and the dominant landuse of the farm and its surrounds is cropping and grazing. Sheep husbandry for wool and meat is common in the area, as is the growing of oats for hay and cereal crops. A breeding herd of Limousin stud cattle is maintained on Wunda-Y. About 2.5 kilometres to the east of Wunda-Y is a commercial vineyard.

The following three pits have been established on Wunda-Y for the purpose of clay extraction:

- **Williamson's Pit** (Plates 1 and 2): This pit is presently the largest from which clay is being extracted. It is located in the eastern part of Lot M2027 and has the potential to produce a further 2 to 3 million cubic metres of clay. It is located entirely on land which has been cleared of native forest and is used for cropping and grazing.

- **White Pit:** This pit is located in forest n the northeastern corner of Lot PTM2039, about 300 metres to the month of Williamson's Pit. It has unproven potential to provide clay for brick making for the next 20 years.

- **Red Pit:** This pit is also located in forest the northeastern corner of Lot PTM2039 about 1300 metres to the north of Williamson's Pit and has a further life of up to 10 years.

The southeastern boundary of Lot PTM2039 forms of the northern boundary of Clackline Reserve (Reserve Number 32400) which was designated in 1973 for the conservation of flora and fauna and is vested with the Western Australian Wildlife Authority (now the National Parks and Nature Conservation Authority). Williamson's Pit is 2.25 kimlometres to the north of Clackline Reserve which supports a vegetation which consists predominantly of forests which were typical of the region prior to agricultural development. Wandoo (*Eucalyptus wandoo)* occur lower in the landscape, Powderbark (*Eucalyptus accedens)* dominate on the breakaways and breakaway slopes and jarrah/marri (*Eucalyptus marginata/Eucalyptus calophylla*) forest occurs on the higher ground. When the Reserve was designated in 1973, 52 bird species were recorded in the Reserve along with Brushtail Possums, Short-eared Bandicoots, Grey Kangaroo, Black-gloved Wallaby and Red Wallaroo (CALM, 1987).

The excavation of clay is a well established landuse in the region, including within Clackline Reserve. Initially the clay was used for the manufacture of crucibles at the Clackline refactories and more recently for brick manufacture. Consequently there are several small abandoned clay pits in the region. Clay extraction is currently being undertaken at 16 sites

within a 12 kilometre radius of Wunda-Y by Clackline Refractories, Boral Midland Brick, IBT, Prestige Brick, Metro Brick and Bristile Clay Tiles.

6.3 TERRAIN

Wunda-Y is located on the eastern side of the Darling Plateau at an elevation ranging from about 240 metres in the west to about 400 metres Australian Height Datum in the east.

The terrain of Wunda-Y and its surrounds is given at 10 metre contour intervals in Figures 1 and 2. The property consists of a narrow river flat in the west, at an elevation of 210 to 240 metres, which drains approximately from south to north. Undulating plains rise gently to the east of the flat into hills which rise more steeply up to 400 metres and are aligned approximately from south to north.

Williamson's Pit is located on the crest of a hill, at an elevation of about 290 metres. To the west of the pit the land is gently undulating before sloping relatively uniformly to the river flat. To the immediate east of the pit the land slopes gently down to a small drainage line (draining from south to north) at about 280 metres, from there the land slopes gently upwards to about 330 metres.

6.4 EARTHQUAKE RISK

Based upon the Earthquake Hazard Map of Australia (1991) of the Australian Geological Survey Organisation, Wunda-Y is located in a zone which has an acceleration coefficient of between 0.1 and 0.11 centimetres per second squared. A seismic risk of 0.1 centimetres per second squared is considered normal for Australia. For comparison, the town of Meckering in Western Australia is in a zone which has an acceleration co-efficient of 0.22 centimetres per second squared and is considered to be a high risk area for earthquakes. The risk of an earthquake occurring in the region of the Project Area is negligible.

6.5 GEOLOGY AND SOILS

6.5.1 Regional Geology

Wunda-Y and its surrounds are located in a drainage basin of the Avon River system and geologically they are part of the Pre-Cambrian meta sedimentary complex which is known as the Jimperding Series. The Jimperding Series extends as a 120 kilometres long belt in a northwesterly direction from York to Clackline and from there to Jimperding and then Chittering where it becomes a higher grade metamorphic series which is known as the Chittering series. The trend in the southern part of the area is northerly and in the northwestern area it is west-northwestwards.

The Jimperding Series consists of inter-bedded sandstones, mudstones, basaltic sills and other pelitic sediments, all of which were deposited in the Pre-Cambrian sea which was later buried and folded. The changes from sediment to sediment are often gradational, suggesting that slowly altering conditions prevailed during the deposition process. Over a very prolonged period granites were intruded, often under stress, and these gave rise to predominantly thermal metamorphism of the in-situ sediments by invading magma having occured.

The last phase of igneous activity is the invasion of basic dykes which have intruded the granites and metamorphosed sediments along tension joints which are parallel to the direction of primary stress. These too have locally altered the intrusive solutions to the metamorphosed sediment. Since then the area has been subjected to prolonged erosion with no further deposition of sediments from the Pre-Cambrian.

6.5.2 Soils and Site Geology

The soils which overly the various clay deposits at Wunda-Y belong to the Yalanbee and Leaver soil landscape units. In the Wunda-Y region they are common along drainage lines which dissect slopes and ridges. The soil in the vicinity of Williamson's Pit is a yellow gravelly loamy sand which overlies sandy clay at a depth of about 0.5 metres.

Drilling by Metro Brick on the Wunda-Y showed the extensive presence of clays which are suitable for brick making. The following two materials are targeted for brick making:

- A white Kaoline-quartz-muscovite schist. This is a metamorphosed sedimentary material which is excavated from the Williamson's and White Pits.
- A greeny brown, sandy, argillaceous Muscovite-Biotite-Kaolin-Quartz schist in which minor quantities of epidote and hornblende are also present is found in Red Pit. This is fissile, iron stained, sandy, argillaceous meta sediment which increases in basic minerals such as amphiboles and becomes distinctly greener with depth. It also contains minor bars of haematite quartz jasper.

These target schists are interbedded with flaggy quartzites with fuchsite mica layers which originate from a vertically compressed, metamorphosed sandstone. In the pit areas the schist strikes north-northwestwards and dips at 35 to 40 degrees to the southwest. The quartzites are conformable with the mica schists and they form areas of high relief due to their resistance to weathering (*pers comm,* Mr Brian Nolan, Metro Brick, 11 March 1998).

Williamson's Pit is located in an area of micaceous silty clay which becomes fresher with depth and shows some laterization. Clayey sands are present in small amounts. The clays overlie granitic bedrock and they have doleritic intrusions coming in from the west.

Clays which are suitable for brick making are being excavated from Williamson's Pit to an average depth of about 12 metres. The clays continue to a depth of at least a further 15 metres below the floor of the existing pit. Whilst these clays may not be ideal for brick making their low permeability renders them very suitable for the environmentally safe encapsulation of wastes. Data obtained from piezometers within Williamson's Pit and immediate surrounds show the clay sequence and the permeability of the clays (Appendix B).

6.6 HYDROGEOLOGY

The local hydrogeology has been characterised from an interpretation of the exploration drilling undertaken by Metro Brick and hydrogeological studies completed by Martinick McNulty in the course of site investigations for this Consultative Environmental Review.

On 24 March 1998 ten holes were drilled by Wallis Drilling with a Mantis drilling rig which was mounted on a Toyota Landcruiser to assess the local geology and groundwater

conditions. Six piezometers were installed around the perimeter and another four within the clay pit (Figure 3).

In each piezometer a PVC standpipe of 50 millimetre diameter was installed immediately after the hole was drilled. The casing was slotted for the entire depth of the hole and all of the piezometers were surveyed by Scanlan Surveying in May 1998. Lithological logs for the holes are included in Appendix B and a summary of monitoring bore details is provided in Table 6.

Table 6: Summary of Monitoring Bore Details.

Bore	Easting (mAMG)	Northing (mAMG)	Top of Casing (m)	Static Water Level(m)	Permeability (m/day)	Permeability (m/s)
WF1	449865	6495880	88.41	81.91	0.0164	1.1×10^{-7}
WF2	449915	6495825	89.20	81.69	0.0041	4.7×10^{-8}
WF3	449761	6495895	82.07	80.71	0.0037	4.2×10^{-8}
WF4	449870	6495734	86.00	81.20	0.0064	7.4×10^{-8}
WF5	449756	6496127	85.50	80.49	0.038	4.4×10^{-7}
WF6	49956	6495896	99.57	85.30	0.00034	3.0×10^{-9}
WF7	449845	6495626	86.37	80.99	0.0017	1.9×10^{-8}
WF9	449658	6495750	90.50	86.89	0.0060	6.9×10^{-8}
WF10	449632	6495903	86.44	83.90	0.0030	3.4×10^{-8}
WF11	449606	6495610	84.62	80.88	0.0204	2.4×10^{-7}

Note: Water levels measured 24 May 1998; Top of casing and static water levels are to local datum.

The soils in the vicinity of Williamson's Pit are relatively shallow and they overlie koalinitic clays and weathered granite with occasional dolerite intrusions. Water was generally not encountered during drilling, with the exception of some holes which are located approximately 1 kilometre to the northwest of the current pit. In these holes granite was intersected and water was found to be present in weathered basement.

Hydraulic testing of all of the monitoring bores (WF1 to WF10) was undertaken to determine the in-situ hydraulic properties of the sandy clay. Testing comprised injection of a known volume of water into the bore and subsequently monitoring the rate at which the water level declined. Analysis of the response was completed using the Bower and Rice method. Plots of water level versus time included in Appendix C and the results are summarised in Table 6.

From the results of the hydraulic testing it is concluded that the sandy clay present in the pit and its vicinity has a low to very low permeability and that the ground water regime in that area is classified as an aquiclude. That is to say, although groundwater is present there is no defined aquifer system. The sandy clays are partially saturated and the local groundwater levels vary with changes in topography.

6.7 PERMEABILITY

Two clay samples were collected from the floor of Williamson's Pit adjacent to piezometers WF2 and WF4. These samples were analysed for particle size distribution, optimal moisture content for compaction and permeability of the compacted clay. The results of these tests are given in Appendix D, with the distribution of particle sizes demonstrating that the material in Williamson's Pit consists of a clayey silty sand with minor gravel. The clay content varies

from 4 to 8%, the silt content varies from 26% to 33% silt, and the sand content varies from 53 to 56%.

The falling head permeability tests for samples compacted to 90% standard compaction at optimal moisture content, gave coefficients of permeability of 3.12×10^{-9} and 1.49×10^{-8} metres per second respectively for WF2 and WF4. It is concluded that whilst without compaction the clay in the base of the pit does not meet the requirement for landfill lining, when compacted this clay has a very low permeability and becomes very suitable as a liner for a landfill site.

The compaction tests indicate that maximum dry densities of 1.87 and 1.74 tonnes per cubic metre at optimum moisture contents of 13% and 17% could be achieved for the material obtained from WF2 and WF4, respectively.

6.8 SURFACE WATER AND DRAINAGE

From Figure 2 and Plate 1 it can be seen that the property supports a well defined brook (Jimperding Brook) which drains approximately from south to north. This brook is fed by several drainage lines from the surrounding hills. Fresh water typically flows in Jimperding Brook during the early winter months following the opening rainfall events of the winter and autumn seasons. The first rains typically result in a run-off of fresh water, but the water in Jimperding Brook becomes progressively brakish during the spring months when subsoil drainage contributes to the flow in the brook. A small wetland is located along the brook.

Williamson's Pit (Plates 1 and 2) is located on the crest of a hill. Consequently, it does not intersect any drainage lines and receives no run-off water. About 100 metres to the east of the pit is the beginning of a small drainage line which in that area drains approximately from south to north.

6.9 VEGETATION AND FLORA

Wunda-Y consists of river flats, undulating plains and foot slopes all of which support parkland cleared pasture (Plate 1). The original native forests on these areas were cleared progressively from the 1960's onwards for pasture and cropping purposes. The uncleared mountainous terrain of the property supports a forest of predominantly Jarrah (*Eucalyptus marginata*), Marri (*Eucalyptus calophylla*), Wandoo (*Eucalyptus wandoo*) and Powderbark Wandoo (*Eucalyptus accedens*) trees with an understorey of a range of native shrubs, herbs and grasses. These forests are well represented throughout the Shires of Toodyay and Northam, including Clackline Reserve (Moore, *et al* 1985).

In several cleared areas on the flats and lower slopes of Wunda-Y groves of a range of *Eucalyptus* trees have been established to provide shelter for stock and to reduce or avoid rising water tables and associated salinity problems.

Williamson's Pit is located on the crest of a rise which supports pasture and cropping land with very occasional Marri trees. No clearing of native vegetation is required for the construction and management of the proposed waste disposal facility. Similarly, no such clearing is required for the ongoing extraction of clay. The small drainage line which is located about 100 metres to the east of Williamson's Pit is fringed by Marri and Wandoo trees.

9. STUDY TEAM

Martinick McNulty Pty Ltd:

Dr Wolf Martinick:	Project Leader - Environmental Scientist
Dr Tony McNulty:	Technical Director - Civil Engineer
Ms Glenda Martinick	Director - Management
Ms Rebecca Holmes:	Environmental Scientist
Mr Michael Dufty:	Senior Environmental Engineer - Hydrology
Ms Dayna Simpson	Senior Environmental Scientist
Ms Gwen Cherry:	Wordprocessor
Ms Mary Bogharian:	Secretary/Wordprocessor

Metro Brick:

Mr Brian Nolan:	General Manager Brick Operations - Geologist
Mr Craig O'Connor:	Resources Manager - Mining Issues

Wunda-Y Partnership:

Mr Simon Farrell:	Management and Liaison

10. REFERENCES

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The Project Area does not support any rare or priority listed flora.

6.10 DIEBACK

The Project Area, including the access road from Chitty Road, is located entirely on pasture and cropping lands which drain across cleared land to Jimperding Brook. These cleared areas are similar to the remaining cleared areas on Wunda-Y and they do not support species which are susceptible to Dieback (*Phytophthora cinnamomi)* fungus. Consequently, dieback disease is not considered to be an issue for the management of the farming operations and clay extraction on Wunda-Y and for the proposed waste disposal facility.

6.11 HABITATS AND FAUNA

Williamson's Pit does not support any vegetation, habitats, shelter or amenity for fauna. The surrounding pasture and cropping lands are grazed by kangaroos and occasionally by emus.

The Project Area does not support habitats which are likely to be frequented by declared rare or endangered fauna, and no such fauna has been recorded on the property.

Vermin such as wild pigs, foxes, feral cats, rats, mice and rabbits have all been seen at Wunda-Y.

6.12 SALINITY

Clay required for brick making must be free of salts. Consequently, the excavated clay is regularly tested for salinity. The results indicate that a substantial resource of salt free clay is present on Wunda-Y, but that pockets of saline clay may be encountered.

Evidence of salinity is present in a number of isolated areas on the flats along Jimperding Brook and the lower slopes. The planting of trees since the late 1970's appears to have retarded and in some areas reversed the spread of salinity.

6.13 AREA OF IMPACT

The proposed disposal facility will be located entirely within the existing Williamson's Pit from which clay excavation commenced in 1991 and is expected to continue for at least the next 20 years. The clay extraction operations occupy about 165,000 square metres of cleared and disturbed land, of which 44,200 square metres are occupied by the pit. Due to these existing clay operations and their associated infrastructure, such as a quality access road, there will be a minimal need for additional land disturbance and site infrastructure there may be a need to establish a weighbridge and a portable on side office. All of the proposed burial of wastes will occur within the pit area.

The proposed facility will be designed and managed in a manner which will ensure that potential dust and noise problems are avoided or minimised. All of the wastes which will be buried in the facility are expected to be free of noticeable or unpleasant odours.

7. DESCRIPTION OF THE CLASS IV LANDFILL FACILITY

In the following section the proposed design, construction and operation of the waste disposal facility are described. The final design of the proposed waste disposal facility has not been completed. However, the design will follow the criteria outlined in this Consultative Environmental Review and on completion it will be submitted to the Department of Environemntal Protection. Any marked amendment from these design criteria will be discussed with the Department of Environmental Protection and will only be implemented with their approval (**Commitment 1, Action (a)**).

The general operational measures which are described in this section will be incorporated into an Environmental Management System which will be established to ensure that the waste disposal facility is at all times operated efficiently and with appropriate attention to environmental management and monitoring (**Commitment 3**).

The key characteristics of the proposed disposal facility for are outlined in Table 7.

Table 7: Key Characteristics of the Proposed Disposal Facility for Class IV Wastes.

ELEMENT	DESCRIPTION
Life of project	Approximately 20 years
Purpose	• Disposal of Class IV wastes. • Rehabilitate Williamson's Pit. • Re-establish landuse of cropping and grazing.
Space currently available in Williamson's Pit for waste disposal	Approximately 260 x 170 x 12 metres (depth) = 530,400 cubic metres
Area of disturbance associated with current clay extraction	• Pit : 44,200 square metres • Clay and topsoil stockpile areas roads = 163,500 square metres • Access: 1.25 kilometres x 5 metres = 6,250 square metres • Total: 213,950 square metres (21.4 hectares)
Area required for proposed waste disposal	Will be located entirely within the pit. Existing access roads will be utilised. No additional disturbances will be required.
Water: • Source • Water used mainly for dust suppression when trucking • maximum daily requirement for roads • frequency of watering	 • reticulated supply and from dams on the property. • currently undertaken by Metro Brick • 300 kilolitres. • 10 trips per day (for one water truck)
Fuel (diesel)	Stored on site in bunded tanks
Trucking of wastes to Wunda-Y • estimated number of trucking days • truck movements (maximum)	 • about 26 days per year, but difficult to estimate • about 50 per day, but difficult to estimate
Power Supply	• Western Power

Details of the proposed design, construction and management of the proposed waste disposal facility are given in the following sections.

7.1 OVERALL CONCEPT

The overall concept is to bury Class IV wastes in appropriately sized waste disposal cells within Williamson's Pit. This will require minor amendments to the shape of the existing Williamson's Pit and integration with ongoing extraction of clay for brick manufacture. Each cell will be an individual disposal unit. The cells will vary in their capacity to bury wastes, with their respective configurations being determined by the shape of the pit which becomes progressively available for waste storage.

Class IV wastes will be disposed into the active cell such that the finished ground level approximates the ground level which existed prior to clay extraction.

Each cell will be fully encapsulated with impervious material upon completion of waste disposal into the cell to prevent the ingress of rainwater and they will have under drainage systems which collect all leachate in a drainage sump (Primary Leachate Collection and Removal System). Water from the drainage sump will be pumped regularly to an evaporation pond which is suitably lined to prevent seepage losses. The evaporation pond will be of sufficient size to contain a 1 in 100 years rainfall event for the combined area of the evaporation pond and the active cell.

7.2 ARRIVAL OF CLASS IV WASTES

Class IV wastes will arrive at the facility in covered trucks. The wastes will then be inspected to confirm their type and quantity (**Commitment 3**) before being trucked to the disposal face of the active cell for unloading by tipping.

7.3 WASTE DISPOSAL CELL DESIGN

7.3.1 Cell Location

The first cell, Cell-1, will be located within the currently excavated space of Williamson's Pit (Plate 2). This pit occupies an area of about 44,200 square metres (as of April 1998) and it has the approximate surface dimensions of 260 by 170 metres. The pit is being excavated to an average depth of about 12 metres, with the current depth varying from 8 to 12 metres. All of this space will be used for Cell-1.

Concurrent with waste disposal into Cell-1, Metro Brick will continue to extract clay, resulting in the pit advancing progressively in a northerly direction. The resultant extension of Williamson's Pit will provide the void which will ultimately become Cell-2 and subsequently Cell-3, and so on.

7.3.2 Construction and Development Sequence

The construction of Cell-1 will commence after the appropriate environmental approvals and Works Approval from the Department of Environmental Protection has been secured and as soon as possible after a contract for the disposal of Class IV wastes has been secured. The sequence of construction is given in Table 7 together with a summary of the construction tasks which are described in the following sections.

Table 8: Sequence of Construction for Class IV Waste Disposal Cells

STAGE OF CONSTRUCTION	DESCRIPTION OF COMPONENTS
1. Final shaping of pit floor and walls to permit construction of the base and wall liners and the leachate collection and removal systems.	Shaping of walls to obtain an even surface, probably with a slope of 1 in 1. Forming an even floor on the pit with a slope of at least 2%.
2. Covers	1s m layer of clay deposited in layers no greater than 0.2 metres thick with permeability no greater than $1x10^{-9}$ metres per second. Flexible Membrane Liner emplaced with minimum thickness of 0.75 millimetres.
3. Secondary Leachate Collection and Removal System	A sand layer of no less than 0.3 metres thick with a permeability no less than $1x10^{-3}$ metres per second. Perforated drainage pipes embedded in sand to drain leachate into the Recovery System. Whole layer will have minimum slope of 2% and minimum thickness 0.3 metres. Flexible Membrane Liner with minimum thickness 0.75 metres.
4. Primary Leachate Collection System	Sand in a layer of minimum thickness 0.3 metres and with a permeability no less than $1x10^{-3}$ metres per second and minimum slope of 2%. Perforated drainage pipes embedded in sand.
5. Wall Cover	1 m layer of clay deposited in layers no greater than 0.2 metres thick with permeability no greater than $1x10^{-9}$ metres per second. Flexible Membrane Liner with minimum thickness 0.75 millimetres.
6. Evaporation Pond	Filter layer overlying compacted clay 2 layers of 1.0 millimetres Flexible Membrane Liner.
8. Capping Cover	Clay layer no less than 0.5 m thick with permeability no greater than $1x10^{-9}$ metres per second. Flexible Membrane Liner with minimum thickness 0.75 millimetres. Drainage material (sand) with permeability no less than $1x10^{-3}$ metres per second. Filter layer of graded sand. Soil layer no less than 0.6 m thick with topsoil being final surface material Establish vegetation.
9. Final Landform	Landform restored to approximate height and shape of pre-excavation contours. Land returned to agricultural landuse.

For the construction of Cell-1 the remaiming clay of brick making quality will be excavated to establish a uniformly sloping pit floor which will have a slope of no less than 2% (**Commitment 4, Action (a)**). Similarly, the walls of the existing pit will be shaped to establish even surfaces, probably with a slope of approximately 1 in 3.

Once a suitable floor and wall surface has been created, the liner system will be constructed, complete with the leachate collection and recovery system (Section 8.3.5).

Cell-2 will be constructed immediately adjacent to Cell-1 (Figure 4), with subsequent cells being constructed progressively in a north-northwesterly direction, following the configuration of the northwards advancing pit.

7.3.3 Liner design

The liner and leachate collection and recovery system will be about 1.75 metres thick and will extend across the floor and sides of the landfill site (Figure 4) and it will be constructed in the following sequence in accordance with guidelines prepared by the Department of Environmental Protection (Department of Environmental Protection, 1996(c)):

- A clay liner which is placed onto the floor of the cell. It will consist of 1 metre of clay placed in layers not exceeding 0.2 metres and compacted to a permeability not greater than 1×10^{-9} metres per second.
- The clay liner will be covered by a Flexible Membrane (Geosynthetic) Liner which will be selected to maintain it's integrity when in contact with the wastes disposed of into the cell. The Flexible Membrane Liner will have a minimum thickness of 0.75 to 1.5 mm.
- The Flexible Membrane Liner will be covered by not less than 0.3 metres of granular drainage material (sand) to form the Secondary Leachate Collection and Removal System. This sand layer will have a permeability of not less than $1x10^{-3}$ metres per second. Perforated drainage collection pipes will be embedded in the sand. The minimum slope of the drainage layer will be 2%.
- The Secondary Leachate Collection and Removal System will be covered by another Flexible Membrane Liner of similar design to the lower Flexible Membrane Liner.
- The upper Flexible Membrane Liner will also be covered by no less than 0.3 metres of sand to form the Primary Leachate Collection and Removal System. It will be similar in design to the Secondary Leachate Collection and Removal System, and it will be designed to limit the hydraulic head on the underlying Flexible Membrane Liner to no more than 0.3 metres.
- The Primary Leachate Collection and Removal System will be covered by a filter layer of graded granular material (sand) with a thickness of not less than 0.15 metres.

Clay from the White Pit will be used as base, wall and capping liner for the individual cells in which wastes will be encapsulated, because this clay when compacted has infiltration rates of less than $1x10^{-9}$ metres per second whereas compacted sandy clays from Williamson's Pit did not meet this infiltration requirement. Sand from an existing sand pit on Wunda-Y will be used to construct the drainage layers.

The Flexible Membrane Liner which will be used in these installations has not yet been determined, however selection will be based upon the following characteristics:

- Flexibility, durability and tensile strength.
- Chemical and biological resistance.
- Heat and UV resistance.
- Pest resistance.
- Puncture resistance.
- Ease of placement.
- Cost and implications for long term maintenance.

7.3.4 Final Capping Cover

On completion of waste disposal to each cell the top surface will be shaped to promote rainfall runoff (ie. with a convex surface). The final capping which will cover the compacted wastes will be constructed in the following sequence (Figure 4):

- The wastes will be covered by a clay layer which is not less than 0.5 metres in thickness and is of low permeability.
- The clay layer will be covered by a Flexible Membrane Liner with a minimum thickness of 0.5 mm.
- The Flexible Membrane Liner will be covered by a drainage layer composed of a granular drainage material (sand) no less than 0.1 metres thick.
- The drainage layer will be covered by a filter layer.
- The filter layer will be covered by a soil layer (includes stockpiled topsoil) not less than 0.6 metres thick which is capable of supporting vegetation.

The drainage layer will be above the Flexible Membrane Liner and will provide a path for infiltrating rainwater to drain to a collection point.

The filter layer will facilitate water infiltration whilst preventing the downward migration of fine soil particles from the topsoil into the sand drainage layer, which may otherwise block the drainage layer. The filter layer will also promote gradual percolation of any through flow into the drainage layer and therefore prevent erosion of the drainage layer caused by rapidly draining through flow.

The final soil layer will be fertilised and seeded with oats, lupins and/or subterranean clovers so that vegetation is established which will stabilise the surface, reduce soil erosion and return the site to the land uses of cropping and grazing. The rehabilitated surface and its vegetation will be inspected regularly, especially for the presence of burrowing animals such as rabbits.

The surface of the restored landform will have a slope which will promote run-off, without causing erosion. This will be designed to limit percolation and prevent the development of an hydraulic head on the liner. Surface water is expected to be removed from the final soil cover by evapotranspiration and sub-surface drainage. Trees will be established adjacent to the rehabilitated pit to remove most, if not all, of the water which has drained laterally from the rehabilitated surface.

7.3.5 Leachate Generation and Recovery Systems

Tthe wastes which will be buried in the proposed disposal facility will have a the low moisture content. Consequently, it is expected that only small volumes of leachate will be generated. This leachate will be collected by the drainage system on the floor of the cell and directed to a drainage sump (the Primarily Leachate Collection and Removal System).

7.3.5.1 Primary leachate collection system

The Primary Leachate Collection and Removal System will be located in the northwestern corner of each cell. Leachate from this system will be pumped to an evaporation pond which will be located to the west or northwest of the pit (Section 8.3.8).

The design of the Primary Leachate Collection System will meet the specific dimensions and slopes of each cell. Conceptually, it will consist of a pipe arrangement which will run across and down slope on the base of each cell (Figure 5). A larger capacity pipe will be used in the lowest run to cater for the combined run-off of the other pipes leading into it. This larger pipe will discharge the water into a drainage sump (Primary Leachate Collection System) from where the leachate will be pumped to the evaporation pond.

7.3.5.2 Leakage detection system

The Secondary Leachate Collection System below the Primary Flexible Membrane Liner acts as a leakage detection system. If any leachate is generated and collected from this system then the Primary Flexible Membrane Liner or the Primary Leachate Collection System has failed. In this event the Secondary Leachate Collection System will replace the primary System. Leachate from the Secondary Leachate Collection System will be pumped to the evaporation pond.

7.3.6 Evaporation Pond

Any leachate collected from a cell will be discharged into an evaporation pond which will be located to the west or northwest of the pit. The pond will be designed to contain a 1 in 100 years annual rainfall from a catchment area equal to the area of the evaporation pond and active cell area. A High Density Polyethelene (HDPE) pipe will carry leachate between the collection point in the respective cells and the evaporation pond.

The pond will consist of a filter layer which is sandwiched between two layers of Flexible Membrane Liner each of 1.0 mm thickness, placed above compacted clay. The pond will be located in an area which overlies clay.

7.3.7 Stormwater Drainage

Williamson's Pit is located on the crest of a hill at the top of a catchment, and thus it receives no regional run-off. There is therefore no need to direct surface drainage away from the proposed waste disposal facility.

7.3.8 Management of Waste Disposal

Disposal of wastes into Cell-1 can commence after the covers have been placed on the floor and the sides of the cell. Disposal will progressd from the southern to the northern perimeter of the cell. During and immediately after the wastes have been be tipped into the cell, they will be spread out evenly and compacted to a density of up to 1300 kilograms per cubic metre. Care will be taken to ensure that the wastes are compacted evenly to avoid excessive settlement of the wastes in the future which could otherwise affect the slope of the restored surface and the stability of the capping layer (**Commitment 4, Action (a)**). Approximately 9 metres of compacted wastes will be placed onto the liner which will be established on the floor of the pit and which will be about 1.75 metres in thickness. A capping cover (Section 8.3.4) of about 1.4 metre thickness will then be placed onto the compacted wastes. This will ensure that Williamson's Pit is backfilled with about 12 metres of material, thereby returning the surface of the backfilled pit to the approximate ground level which prevailed prior to the commencement of clay extraction.

At all times the area of the active face of waste disposal will be kept to a minimum. This will permit efficient compaction and covering, minimise leachate generation and prevent the dispersal of wastes by winds.

7.4 SECURITY

The proposed waste disposal facility will be situated on privately owned land and will not be open to the general public. Warning signs indicating the presence of a clay pit and waste disposal facility and prohibiting public access, will be erected and maintained at the entrance to Wunda-Y.

The Manager's residence of Wunda-Y overlooks the access road to Williamson's Pit. This ensures that unauthorised vehicle entry is readily noticed.

The entry gate from the direction of Chitty Road to the paddock on which Williamson's Pit is located will be locked outside of operating hours.

7.5 TRUCKING

Trucking of wastes is likely to be from the Perth Metropolitan Area via Toodyay Road (Figures 1 and 2) although on occasions it may be along Great Eastern Highway.

Access from Great Eastern Highway to Wunda-Y is via Chitty Road, whilst access from Toodyay Road is via Fernie, Salt Valley and Chitty Roads.

During periods of waste disposal the disposal of Class IV wastes will result in an increase in the number of truck movements from Wunda-Y. Such trucking will be confined to relatively short periods of waste disposal. It is difficult to accurately determine the trucking requirements. On the basis that about 50,000 cubic metres of wastes are buried annually, it is estimated that about 1,285 truck movements are required per annum. These movements are likely to occur at rates of about 50 per day, thus occurring on about 26 days per year. By comparison, up to 20 truck movements per day occur when clay is being transported from Wunda-Y.

During periods of frequent trucking of wastes, the Proponent will water the unsealed surfaces which will be used on Chitty, Salt Valley and Fernie. This will be undertaken in consultation with the Shire of Toodyay and representatives of Metro Brick who may also be transporting clay along this route at that time. It is estimated that up to 300 kilolitres of water will be applied daily during intensive trucking in the dry summer months. This may require up to 10 applications of water per day by a water tanker.

7.6 WASTE MANAGEMENT

An Operations Procedure Manual will be prepared once the proposed disposal facility has been approved (**Commitment 6**). This Manual will contain all daily procedures which have to be followed to ensure that at all times all of the operations are undertaken in a manner which meets all occupational health requirements and all of the environmental objectives of the operation. The Manual will also outline procedures for all of the tasks associated with the proposed waste disposal, allocate responsibilities and establish a reporting procedure to ensure that all tasks will be undertaken in compliance with nominated procedures.

The wastes will arrive on-site in a dry and inert form and will remain covered until they are about to be tipped at the active disposal face. Care will be taken to ensure that during tipping dust generation of the wastes is kept to a minimum. This may require the application of water to the wastes if they are too dry and delaying tipping until windless conditions prevail (**Commitment 5, Action (b)**).

Once the wastes have been disposed of they will be compacted and covered as soon as possible. These actions will ensure that dispersal of wastes by wind is prevented.

All site operators will be required to wear appropriate protective clothing and safety masks when handling Class IV wastes. This will be in compliance with requirements of the Department of Health. This policy will be strictly enforced (**Commitment 5**).

7.7 FIRE MANAGEMENT

Class IV wastes will arrive on-site in a dry, inert form and will not pose a fire risk. The various cells of the disposal facility will all be located within the clay pit which is surrounded by stockpiles of clay and topsoil and surrounded by roads which form a substantial fire buffer. Consequently, there is a low risk of a fire affecting the waste disposal facility.

Fire fighting equipment is available on Wunda-Y for normal farming operations. This equipment is available to the waste disposal facility in the event of fire.

7.8 SCREENING

Trees will be planted around the proposed facility to further screen the site from the few view points from which the stockpiles of clay and overburden adjacent to Williamson's Pit are visible. These trees are also planted for the purpose of removing, by evapotranspiration, all water which drains laterally from the rehabilitated waste disposal facility.

7.9 WEEDS, PESTS AND SITE HYGIENE

The property is currently free of the weed Doublegee (*Emex australis*) and the owners of Wunda-Y are determined to prevent Doublegees being introduced to the property. A strict hygiene policy will be implemented to ensure that the seeds of Doublegee and other weeds as well as soil borne diseases are not introduced to the property. To achieve this all vehicles and earthmoving machinery will be required to arrive on site in a clean condition, free of seeds, soil and vegetative matter. This will be strictly supervised (**Commitment 7**).

Where machinery and/or trucks come from Doublegee infected areas, the wheels, cabs and undercarriage of the machinery and trucks will be inspected for the presence of seed. Similarly, the soles of footwear will be inspected. All Doublegee seed will be removed and destroyed.

7.10 LANDFORM REHABILITATION AND END USE

Once a cell has been filled, the terrain of that section of the Williamson's Pit will have been restored approximately to the terrain which existed prior to clay extraction. The establishment of the restored surface profile and the subsequent establishment of vegetation is described in

Section 8.3. On decommissioning the rehabilitated land will be stable and will have been returned to its previous landuses of grazing and cropping.

A rehabilitation and post closure management plan will be prepared prior to decommissioning and it will outline measures such as:

- Precautions to ensure that future access to the wastes is prevented ie. no further earthworks or building activities will be allowed.
- Post operational leachate control and groundwater monitoring.
- Precautions to ensure that the decommissioned waste disposal facility remains geologically stable.
- Ensure that the landuses of grazing and cropping are undertaken without damage to the rehabilitated landform.

8. ENVIRONMENTAL IMPACTS AND MANAGEMENT

The potential environmental impacts of the proposed operations are described in the following sections together with design and management procedures which will be employed to avoid or minimise such impacts. This is summarised in Table 1.

8.1 LANDFORMS AND SOILS

The proposed facility for the disposal of Class IV wastes provides the opportunity to fill Williamson's Pit to approximately the terrain which prevailed prior to clay extraction. Details of the landform rehabilitation are given in Section 8.3.1.

8.2 LANDUSE

On completion of rehabilitation the land uses of cropping and grazing which prevailed prior to clay extraction will be re-established.

8.3 SURFACE WATER

The proposed waste disposal facility will not interfere with or affect any of the nearby drainage lines or Jimperding Brook, and it will not affect the quality of surface run-off.

The final capping cover will prevent water infiltration below the impervious layers. This cover, as described in Section 8.3.4 will be carefully designed and constructed to permit lateral drainage without causing erosion. Lateral drainage is expected to be removed by evapotranspiration by trees which will be planted on the perimeter of the facility.

8.4 GROUNDWATER

There is no aquifer below Williamson's Pit and the impervious cover below the buried wastes will ensure that no leachate escapes from the proposed disposal site. Consequently, the proposed burial of wastes will not affect local or regional groundwater resources.

The standing level of groundwater in six piezometers located on the perimeter of Williamson's Pit (WF5, WF6, WF7, WF9, WF10 and WF11 shown on Figure 3) will be monitored at 3 monthly intervals **(Commitment 8, Action (b)).**

8.5 VEGETATION AND FLORA

The proposed operations require no clearing of vegetation. The proposed burial of wastes in the pit, and thus the filling of the pit, permits the re-establishment of pasture and cropping land.

8.6 HABITATS AND FAUNA

The proposed waste disposal will not destroy any common or regionally important habitats and consequently it will not affect common, rare or endangered fauna.

The wastes are inert and they will not attract fauna. All wastes will be compacted during disposal and covered daily. Consequently there is almost no scope for straying fauna to be exposed to the wastes. On completion of rehabilitation the vegetation which will be established on the restored landform is expected to attract kangaroos and on occasions emus.

8.7 DIEBACK DISEASE

Dieback disease is not currently known to exist in the vicinity of Williamson's Pit. The hygiene procedures outlined in Section 8.10 will ensure that dieback fungus is not introduced to the disposal facility, and from there to other parts of Wunda-Y.

8.8 VERMIN

Foxes, wild pigs, rabbits, mice and rats are known to exist on the property. None of these animals are expected to be attracted to the proposed waste disposal facility since it contains no food scraps or attractive habitats. Regular compaction and covering of wastes, and the proposed encapsulation will minimise the possibility of vermin burrowing into the buried wastes. Vermin control is part of the ongoing management of the agricultural land use at Wunda-Y, and this will include searching for evidenc of fauna burrowing into the surfacve of the rehabilitated waste disposal facility.

8.9 WEEDS

All trucks and earthmoving machinery will be required to arrive on-site in a clean condition free of soil and vegetative matter to prevent the introduction of weeds and other pests. Of particular concern is the introduction of seeds of the weed Doublegee (*Emex australis*). The hygiene procedures outlined in Section 8.10 will ensure that weed invasion is prevented or kept at a very low risk of occurrence.

8.10 NOISE

The proposed operations have the potential to generate noise which, if not properly managed, could become a nuisance. Noise generation will be confined entirely to the periods of cell construction, waste disposal, compaction and covering. These operations will be undertaken during relatively short periods, with noise generation being confined to earthmoving machinery such as a bulldozer, a large front-end loader, a tractor and trucks. The noise which has the potential to be a nuisance is that emanating from the beeper on the front-end-loader when reversing. This is a safety requirement and it can not be avoided. However, since all of the operations are confined to the hours of daylight, the potential for the noise to develop into a nuisance to nearby residents is minimal. The nearest residence from the waste disposal facility is 600 metres and it is occupied by the Manager of Farm Wunda-Y. The next nearest residence is that of a neighbour and it is more than 1.5 kilometres away, and most of the operations will be confined to the floor of a pit which is located on a crest. For these reasons it is concluded that operational noise is unlikely to become a public nuisance. The appropriate maintenance of mufflers on all machinery will further ensure that noise levels are not excessive.

It is thus concluded that the proposed operations will not generate noise which will be a nuisance to the public.

All machine operators occupationally exposed to noise will be required to wear approved noise protection equipment when operating machinery or in the vicinity of machinery.

8.11 DUST

All of the wastes delivered to the facility will be securely covered to prevent spillage of material and dust generation and to ensure that no contaminated materials escape during transport along the trucking route. This will be strictly supervised by the respective trucking operators and consequently the trucking of these wastes is not expected to result in spillages and associated dust problems.

Trucking along unsealed roads has the potential to create dust problems. Metro Brick currently control dust generation on these roads by watering on a needs basis. Water trucks are present on site for 10 to 12 hours per day to spread up to 300 kilolitres of water daily. Similar watering will be undertaken by the Proponent if the trucking of wastes causes dust problems on the unsealed roads. Details will be negotiated with the Shire of Toodyay (**Commitment 9, Action (a)**).

Dust generation during disposal and burial of wastes will be strictly controlled by applications of water and by covering with clay, to prevent dispersal of contaminants (**Commitment 9, Actions (b) and (c)**).

Consequently, it is concluded that the waste disposal facility will not become a source of dust.

8.12 HEALTH AND EXPOSURE

The risks associated with the disposal of Class IV wastes are confined to exposure to dust and direct ingestion.

Exposure to the wastes will be avoided by appropriate handling procedures and the wearing of protective clothing and equipment as outlined in Section 8.7. Consequently, occupational risks will be appropriately managed and maintained at acceptable levels.

8.13 ODOUR

The Class IV wastes will consist mainly of contaminated soils and solid low hazardous wastes all of which are relatively free of noticeable odours. Consequently, it is concluded that the proposed operations will not result in odour problems.

8.14 VISUAL AMENITY

The proposed waste disposal facility is located within a pit which is located on the crest of a hill. The disturbances which surround the pit because of clay extraction are visible from a number of distant viewpoints but the proposed waste disposal operations will not be visible from these viewpoints because they will be confined entirely to within the pit. Tree planting around the pit (see Section 8.9) will ensure that the waste disposal facility will be further screened from distant vantage points. On completion of rehabilitation the proposed waste disposal will remove the visual impact of Williamson's Pit which existed prior to the commencement of waste disposal operations.

Trucking of wastes from Chitty Road to Williamson's Pit will be visible. This is a short term impact which occurs only during periods of disposal (about 26 days per year) and is thus considered to be a minimal impact.

8.15 TRUCKING

Trucking of wastes to the proposed waste disposal facility will be periodic and the duration will depend on each individual contract. The maximum number of truck movements per day is anticipated to be 50, and this is likely to be confined to about 26 days per year.

The main environmental impacts associated with trucking are the generation of noise and dust along the trucking route. The control of dust generation has been addressed in Section 8.7.

When trucking from Great Eastern Highway, 14 residences along Chitty Road will be passed, and all of these are within about 200 metres of the road. Their residents may notice the increased trucking traffic, however, it is likely that only minimal numbers or no trucks will use this route for waste disposal. Under such circumstances these residents will not be affected by the trucking of wastes to the disposal facility.

Three houses are located along the more likely of the two route options, namely from Toodyay Road to Wunda-Y. Two of these houses are within about 150 metres from their respective road frontages and one is about 50 metres from the road, and their residents will probably become aware of the trucking. As the trucking will be confined to short periods only, it is considered that this trucking will be acceptable to residents along this route and that it is in compliance with the purpose for which these roads were established. Dust generation due to trucking has the potential to become a problem, however it will be controlled by the proposed application of water on a regular basis during dry conditions (Section 8.6).

8.16 VIBRATION

The proposed waste disposal operations will result in vibrations within Williamson's Pit and immediate surrounds. However, this will be in an isolated location which is removed from nearby residences. Consequently, excessive vibration is not considered to be a problem.

Vibrations generated along the trucking route are not expected to exceed the vibrations currently created by the trucking of clay by Metro Brick. Consequently, vibrations associated with the trucking of wastes is not considered to be a problem.

8.17 LITTER

No litter will be generated during the disposal of Class IV wastes given that these wastes consist of contaminated soils and solid low hazardous wastes and not general domestic waste.

8.18 GENERATION OF METHANE GAS

The generation of methane gas within a landfill site depends on the presence of decomposable organic matter and an abundant supply of water. Most, if not all of the wastes which will be buried in the proposed waste disposal facility will contain no, or minimal, amounts of

ADJUSTED IN RED

Showing 6 Jan 2010
100 m
300 ft
Terms of use

OPAL VALE - TOODYAY LANDFILL
AMG - GDA ADJUSTED
UPDATED AERIAL PHOTOGRAPH

Location of Bores - Opal Vale

Soil Test Results - SGS

ABN 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16259
Lab:	Welshpool	Sample ID:	Opal 1

DETERMINATION OF EMERSON CLASS NUMBER OF A SOIL

AS1289.3.8.1

Soil Description	Off white silty clay
EMERSON CLASS NUMBER:	**6**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

SGS

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16259
Lab:	Welshpool	Sample ID:	Opal 1

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2	
Liquid Limit (%)	38
AS 1289.3.2.1	
Plastic Limit (%)	24
AS 1289.3.3.2	
Plasticity Index (%)	14
AS 1289.3.4.1	
Linear Shrinkage (%)	4.0
History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved
Nature of Shrinkage	Flat
Length of mould (mm)	125

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

SGS

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

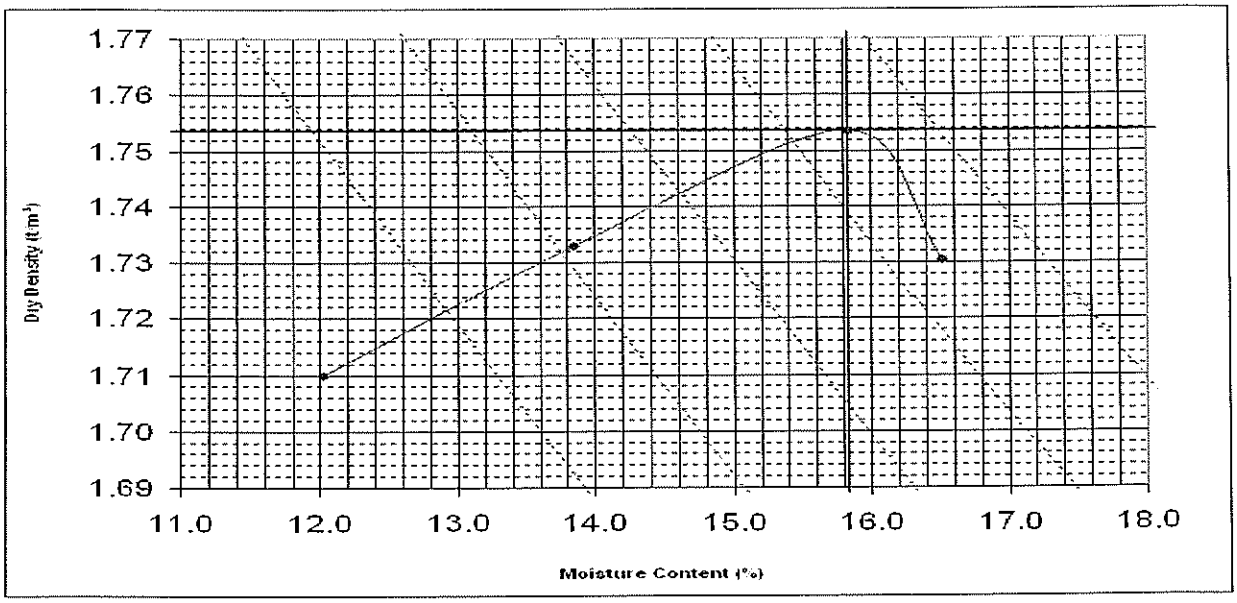
TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	15/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16259
Lab:	Welshpool	Sample ID:	Opal 1

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.1.1 (Standard Compactive Effort)



Standard Effort	
Maximum Dry Density (t/m^3):	**1.75**
Optimum Moisture Content (%)	**16.0**
% Retained 37.5 mm	0
% Retained 19.0mm	0
Air Voids:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.47

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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fx: (08) 9458 3700

TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	20/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16259
Lab:	Welshpool	Sample ID:	Opal 1

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Std.Max Dry Density (t/m³):
Max. Dry Density :	1.75 t/m³
Optimum Moisture Content	15.8 %
Dry Density	1.71 t/m³
Dry Density Ratio :	97.7 %
Moisture Content:	15.9 %
Moisture Ratio:	100.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,610 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	2
COEFFICIENT OF PERMEABILITY	
m/sec at 20 ° C	**7.2E-09**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

SGS

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TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16260
Lab:	Welshpool	Sample ID:	Opal 2

DETERMINATION OF EMERSON CLASS NUMBER OF A SOIL

AS1289.3.8.1

Soil Description	Grey white clay
EMERSON CLASS NUMBER:	**6**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	22/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16260
Lab:	Welshpool	Sample ID:	Opal 2

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2	
Liquid Limit (%)	35
AS 1289.3.2.1	
Plastic Limit (%)	22
AS 1289.3.3.2	
Plasticity Index (%)	13
AS 1289.3.4.1	
Linear Shrinkage (%)	5.5
History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved
Nature of Shrinkage	Flat
Length of mould (mm)	126

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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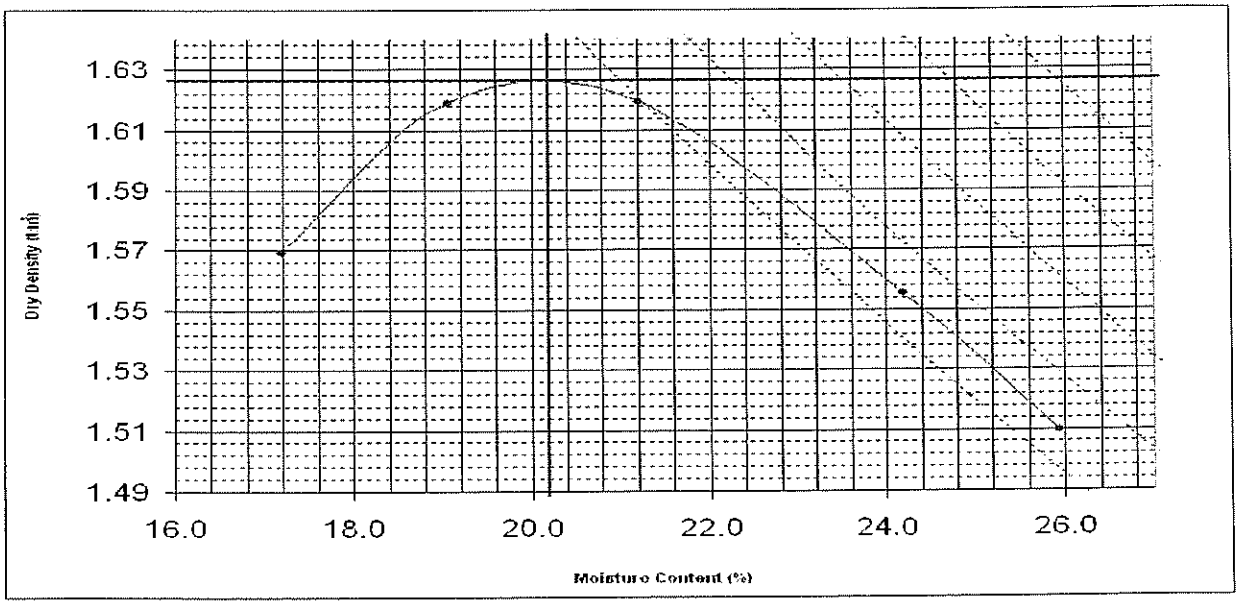
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	18/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16260
Lab:	Welshpool	Sample ID:	Opal 2

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.1.1 (Standard Compactive Effort)



Standard Effort	
Maximum Dry Density (t/m^3):	**1.63**
Optimum Moisture Content (%)	**20.0**
% Retained 37.5 mm	0
% Retained 19.0mm	0
Air Voids:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.81

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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SGS Australia Pty Ltd
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Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16260
Lab:	Welshpool	Sample ID:	Opal 2

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Std.Max Dry Density (t/m³):
Max. Dry Density :	1.63 t/m³
Optimum Moisture Content	20.2 %
Dry Density	1.60 t/m³
Dry Density Ratio :	98.4 %
Moisture Content:	19.9 %
Moisture Ratio:	98.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,606 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	0
COEFFICIENT OF PERMEABILITY	
m/sec at 20 ° C	**3.9E-09**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

Site No.: 2411
Cert No.: 10-MT-16260-S800
Page: 1

Client Address: 25 Heather Road Roleystone WA 6111

ABN: 44 000 964 278
ph: 1300 781 744
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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16261
Lab:	Welshpool	Sample ID:	Opal 3

DETERMINATION OF EMERSON CLASS NUMBER OF A SOIL

AS1289.3.8.1

Soil Description	Off white silty clay
EMERSON CLASS NUMBER:	6

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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PO Box 219 Bentley WA 6982
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Welshpool WA 6106

ABN. 44 000 964 278
ph: 1300 781 744
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Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	22/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16261
Lab:	Welshpool	Sample ID:	Opal 3

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2	
Liquid Limit (%)	**36**
AS 1289.3.2.1	
Plastic Limit (%)	**23**
AS 1289.3.3.2	
Plasticity Index (%)	**13**
AS 1289.3.4.1	
Linear Shrinkage (%)	**5.0**
History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved
Nature of Shrinkage	Flat
Length of mould (mm)	125

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

ABN: 44 000 964 278
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fx: (08) 9458 3700

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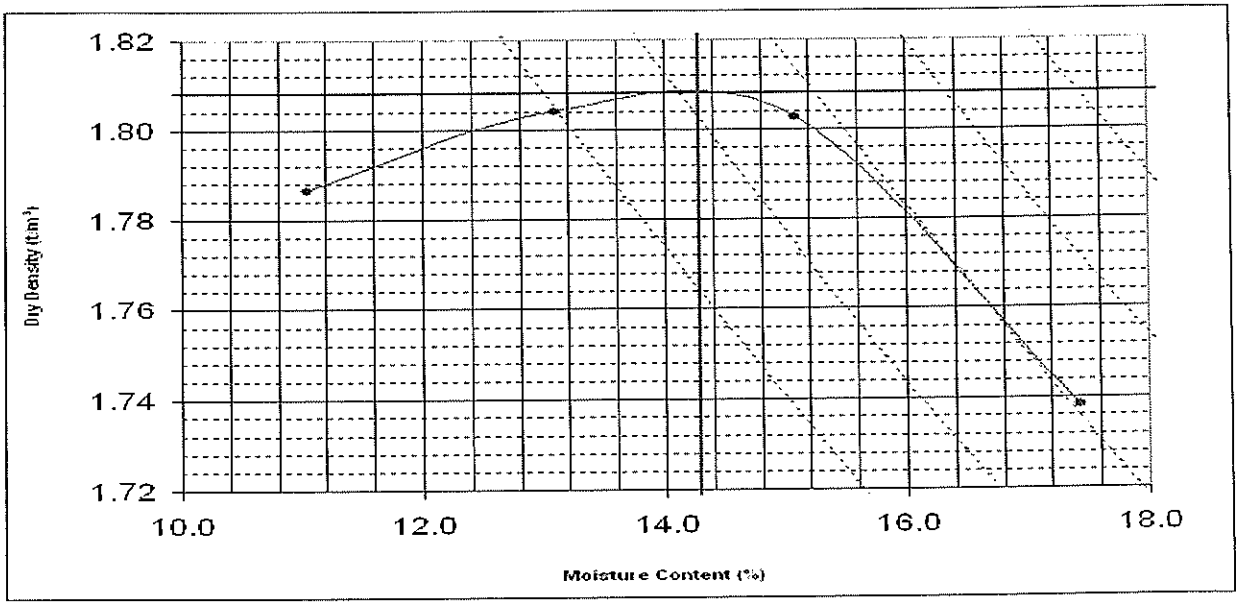
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	15/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16261
Lab:	Welshpool	Sample ID:	Opal 3

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.1.1 (Standard Compactive Effort)



Standard Effort

Maximum Dry Density (t/m^3):	1.81
Optimum Moisture Content (%)	14.5
% Retained 37.5 mm	0
% Retained 19.0mm	0
Air Voids:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.64

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	20/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16261
Lab:	Welshpool	Sample ID:	Opal 3

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Std.Max Dry Density (t/m³):
Max. Dry Density :	1.81 t/m³
Optimum Moisture Content	14.3 %
Dry Density	1.76 t/m³
Dry Density Ratio :	97.4 %
Moisture Content:	14.1 %
Moisture Ratio:	99.0 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,598 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	1
COEFFICIENT OF PERMEABILITY	
m/sec at 20 ° C	**5.8E-09**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews)

Date: 24/12/2010

Site No.: 2411
Cert No.: 10-MT-16261-S800
Page: 1

Client Address: 25 Heather Road Roleystone WA 6111

SGS

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ph: 1300 781 744
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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16262
Lab:	Welshpool	Sample ID:	Opal 4

DETERMINATION OF EMERSON CLASS NUMBER OF A SOIL

AS1289.3.8.1

Soil Description	Grey white clay
EMERSON CLASS NUMBER:	**6**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16262
Lab:	Welshpool	Sample ID:	Opal 4

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2	
Liquid Limit (%)	39
AS 1289.3.2.1	
Plastic Limit (%)	24
AS 1289.3.3.2	
Plasticity Index (%)	15
AS 1289.3.4.1	
Linear Shrinkage (%)	2.5
History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved
Nature of Shrinkage	Flat
Length of mould (mm)	125

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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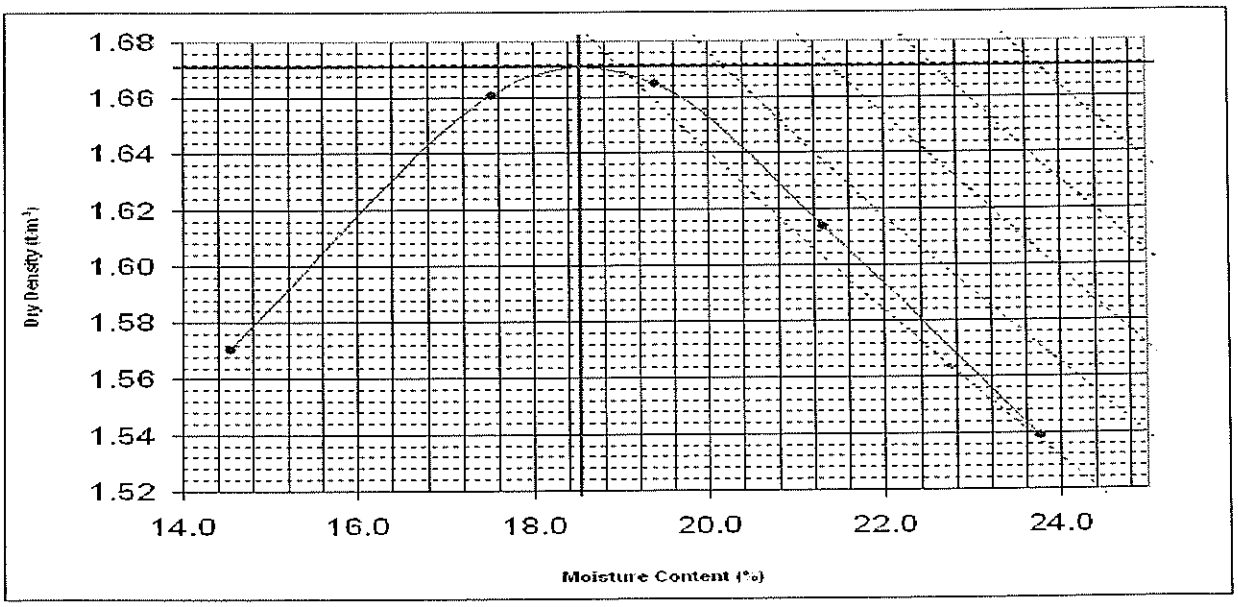
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16262
Lab:	Welshpool	Sample ID:	Opal 4

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.1.1 (Standard Compactive Effort)



Standard Effort	
Maximum Dry Density (t/m^3):	**1.67**
Optimum Moisture Content (%)	**18.5**
% Retained 37.5 mm	0
% Retained 19.0mm	0
Air Voids:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.77

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16262
Lab:	Welshpool	Sample ID:	Opal 4

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Std.Max Dry Density (t/m³):
Max. Dry Density :	1.67 t/m³
Optimum Moisture Content	18.5 %
Dry Density	1.64 t/m³
Dry Density Ratio :	98.1 %
Moisture Content:	18.2 %
Moisture Ratio:	98.0 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,597 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	2
COEFFICIENT OF PERMEABILITY	
m/sec at 20 ° C	**6.8E-08**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews)

Date: 24/12/2010

Site No.: 2411
Cert No.: 10-MT-16262-S800
Page: 1

Client Address: 25 Heather Road Roleystone WA 6111

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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16263
Lab:	Welshpool	Sample ID:	Opal 5

DETERMINATION OF EMERSON CLASS NUMBER OF A SOIL

AS1289.3.8.1

Soil Description	white silty clay
EMERSON CLASS NUMBER:	6

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	22/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16263
Lab:	Welshpool	Sample ID:	Opal 5

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2	
Liquid Limit (%)	35
AS 1289.3.2.1	
Plastic Limit (%)	24
AS 1289.3.3.2	
Plasticity Index (%)	11
AS 1289.3.4.1	
Linear Shrinkage (%)	2.5
History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved
Nature of Shrinkage	Flat
Length of mould (mm)	125

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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SGS Australia Pty Ltd
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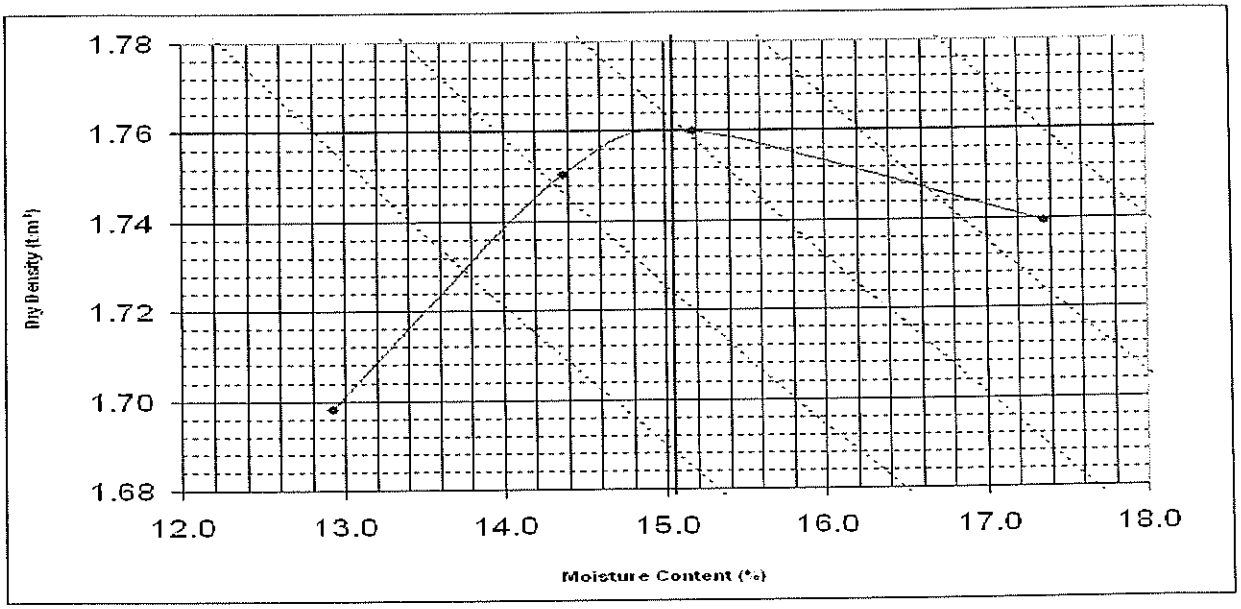
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	16/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16263
Lab:	Welshpool	Sample ID:	Opal 5

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.1.1 (Standard Compactive Effort)



Standard Effort

Maximum Dry Density (t/m^3):	**1.76**
Optimum Moisture Content (%)	**15.0**
% Retained 37.5 mm	0
% Retained 19.0mm	0
Air Voids:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.53

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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ph: 1300 781 744
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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16263
Lab:	Welshpool	Sample ID:	Opal 5

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Std.Max Dry Density (t/m³):
Max. Dry Density :	1.76 t/m³
Optimum Moisture Content	15.1 %
Dry Density	1.72 t/m³
Dry Density Ratio :	98.0 %
Moisture Content:	15.1 %
Moisture Ratio:	100.0 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,592 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	9
COEFFICIENT OF PERMEABILITY	
m/sec at 20 ° C	**2.2E-08**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

Client Address: 25 Heather Road Roleystone WA 6111

SGS

ABN: 44 000 964 278
ph: 1300 781 744
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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	17/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16264
Lab:	Welshpool	Sample ID:	Opal 6

DETERMINATION OF EMERSON CLASS NUMBER OF A SOIL

AS1289.3.8.1

Soil Description	White silty clay
EMERSON CLASS NUMBER:	6

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

ABN: 44 000 964 278
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fx: (08) 9458 3700

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16264
Lab:	Welshpool	Sample ID:	Opal 6

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2	
Liquid Limit (%)	**39**
AS 1289.3.2.1	
Plastic Limit (%)	**23**
AS 1289.3.3.2	
Plasticity Index (%)	**16**
AS 1289.3.4.1	
Linear Shrinkage (%)	**4.5**
History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved
Nature of Shrinkage	Flat
Length of mould (mm)	125

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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SGS Australia Pty Ltd
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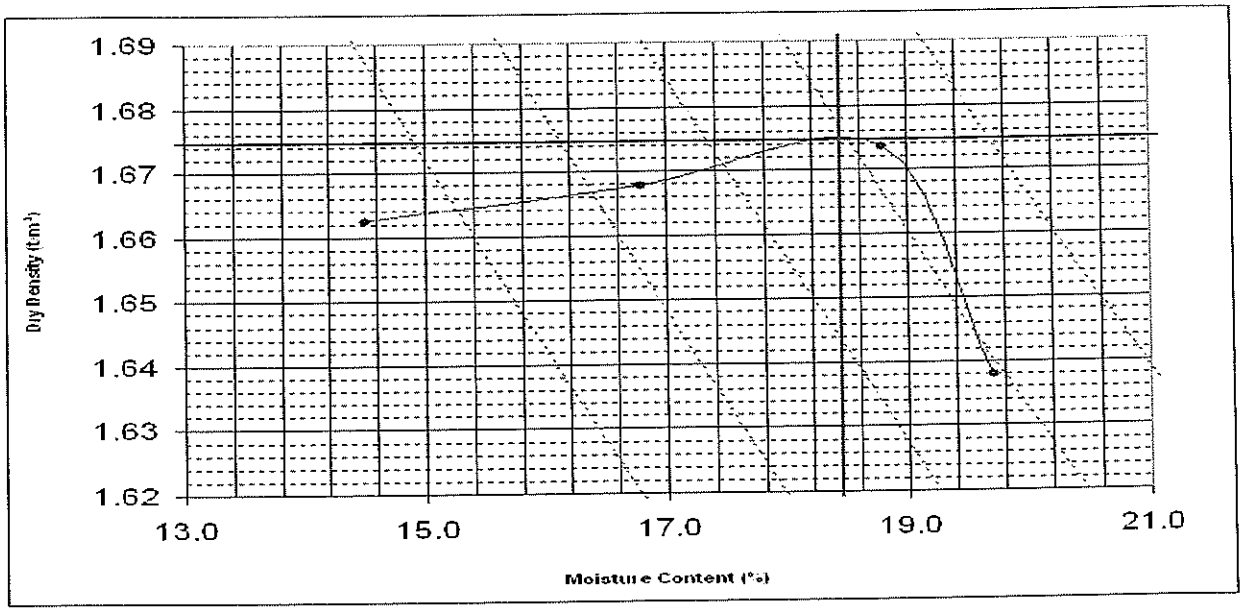
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	16/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16264
Lab:	Welshpool	Sample ID:	Opal 6

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.1.1 (Standard Compactive Effort)



Standard Effort	
Maximum Dry Density (t/m^3):	1.67
Optimum Moisture Content (%)	18.5
% Retained 37.5 mm	0
% Retained 19.0mm	0
Air Voids:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.50

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

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Accreditation No.: 2418 Form No.PF-(AU)-[IND(MTE)]-TE-S400.LCER/A/01.01.2009

Client Address: 25 Heather Road Roleystone WA 6111

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Landform Research	Client Job No:	
Order No:		Project:	Opal Vale
Tested Date:	21/12/2010	Location:	Toodyay Pit
SGS Job Number:	10-01-3080	Sample No:	10-MT-16264
Lab:	Welshpool	Sample ID:	Opal 6

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Std.Max Dry Density (t/m³):
Max. Dry Density :	1.67 t/m³
Optimum Moisture Content	18.4 %
Dry Density	1.64 t/m³
Dry Density Ratio :	98.2 %
Moisture Content:	18.3 %
Moisture Ratio:	99.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,598 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	2
COEFFICIENT OF PERMEABILITY	
m/sec at 20 ° C	**9.1E-09**

Note: Sample supplied by client.

Approved Signatory: (Mark .Matthews) Date: 24/12/2010

Site No.: 2411
Cert No.: 10-MT-16264-S800
Page: 1

Client Address: 25 Heather Road Roleystone WA 6111


OPAL VALE - TOODYAY LANDFILL
LOCATION OF PERMEABILITY SAMPLES
5
3
6
4
2
1
Showing 6 Jan 2010
50 m
200 ft
Terms of use

OPAL VALE

LOT 11 CHITTY ROAD

LANDFILL DEVELOPMENT

N

W E

S

METRES

0 50 100

SCALE 1: 2500

Perimeter Bore

Pit Bore

LOT 11 BOUNDARY

ANNEXURE A - AGREED BORE LOCATIONS

Opal Vale Class II Landfill - Groundwater Levels (m AHD)

Bore ID	SE1	SE2	SE3	SE4	WF5	SE 5	SE 6	SE 7	SE 8	SE 9	Pit 1	Pit 2	Pit 3	Pit 4	Pit 5
Northings	6495635.667	6495913.669	6496193.886	6495785.759	6496265.311	6495858.19	6495855.090	6496095.83	6496172.63	6496373.32	6496054.7	6496122.8	6496067.8	6496037.5	6495948.4
Eastings	449807.222	449616.098	449382.966	450377.899	449882.903	449809.33	450039.370	450043.12	449770.44	449643.15	449813.3	449804.3	449783.51	449911.15	449707.85
23/03/13	266.850	271.635	273.240	277.590	272.503	271.450	272.870	273.275	271.820	269.750					
23/04/13	266.790	271.555	273.160	277.520	272.503	271.430	272.840	273.210	271.735	269.690					
23/05/13	266.735	271.480	273.125	277.520	280.553	271.395	272.880	273.210	271.765	269.740	270.050	271.715	270.060	270.240	270.325
23/06/13	266.720	271.470	273.090	277.495	280.553	271.355	272.885	273.170	271.795	269.775	270.100	271.640	270.200	270.320	270.430
24/07/13	266.625	271.430	272.980	277.400	280.553	271.290	272.805	273.085	271.72	269.71	Flooded	Flooded	Flooded	Flooded	Flooded