Agricultural Suitability Assessment of The Le Clos Verdun Estate, Sancrox New South Wales

Report No 104029

Report to:

Le Clos Redevelopment Committee

April 2004

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18 June 2004

Le Clos Redevelopment Committee
312 Sancrox Road
Sancrox NSW 2446

Attention: **Adrian Smith**

Dear Adrian

Re: Agricultural Suitability Assessment of the Le Clos Verdun Estate, Sancrox New South Wales

Environmental & Earth Sciences Pty Ltd is pleased to present this report number 104029 entitled *Agricultural Suitability Assessment of the Le Clos Verdun Estate, Sancrox New South Wales*.

Thank you for the opportunity to undertake this study. Should you have any further questions regarding the report please do not hesitate to call the undersigned on (02) 9922 1777.

Yours sincerely
Environmental & Earth Sciences Pty Ltd

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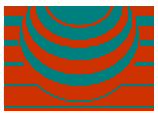

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1.0 INTRODUCTION

Environmental & Earth Sciences Pty Ltd was requested by Adrian Smith on behalf of the Le Clos Redevelopment Committee to undertake an Agricultural Suitability Assessment of the Le Clos Verdun Estate, Sancrox, New South Wales.

The assessment was undertaken to assess if the site comprised "prime agricultural land". The following definitions for prime agricultural land were used:

" land which occurs where the agronomic factors (e.g. soils and management) and environmental factors (e.g. climate, water quality and availability) combine so that the value to society from agriculture is greater than the value from alternative uses of the land." (Department of Agriculture Western Australia 2001)

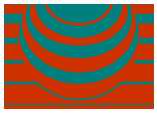
"the land best suited to food, feed, forage, fiber, and oilseed crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment" (The United States Department of Agriculture)

The project was undertaken as a land capability assessment and the land within the Verdun Estate was assessed for it's suitability for the following agricultural enterprises, which have been undertaken onsite or within the surrounding region, these include:

- Viticulture;
- General grazing land;
- Intense grazing land; and
- General horticulture.

Information for the capability assessment was gained by reviewing historical, geological, hydrogeological, soil and topographical information and a geotechnical investigation report. Further, limited laboratory analysis for selected chemical attributes was undertaken on soil samples collected in the geotechnical investigation. Data was compiled and landunits of specific soil physical and chemical attributes were derived.

These derived landunits were compared to the requirements of the abovementioned agricultural enterprises, and suitability ratings were provided for each landunit and the chosen agricultural enterprises.

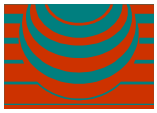


This project was undertaken by reviewing secondary sources of information and although professional judgement was used to extrapolate between inspected areas, even under ideal circumstances actual conditions may vary from those inferred to exist. This land capability assessment must be viewed in conjunction with the limitations of such a project.

Environmental & Earth Sciences Pty Ltd is not responsible any decisions which are made from the findings of this project.

The investigation has been conducted as per Environmental & Earth Sciences' proposal PO104024 dated 17 February 2004 and confirmation to conduct the work received by fax from Adrian Smith on 29 February 2004.

This report has been produced for, and is the property of Le Clos Redevelopment Committee. No other party can rely on this report.



2.0 OBJECTIVES

The objectives of this investigation were:

— to qualitatively assess the suitability of the Le Clos Verdun Estate (the site) for a range of general agricultural enterprises, taking into consideration the physical, chemical and social limitations of the site; and

— assess if the Le Clos Verdun Estate comprises "prime agricultural land".

This objective was achieved by:

— reviewing historical information;

— conducting a desktop geological, hydrogeological, soil and topography study;

— assessing site soils for their physical and chemical attributes;

— compiling all data into a local geographic information system (GIS);

— deriving landunits of varying characteristics; and

— assessing the suitability of these landunits by comparing the requirements of grape vines and other agricultural enterprises to the attributes of the landunits.

The work undertaken to achieve the above objectives is presented in the following sections.

3.0 SITE CHARACTERISTICS

3.1 Location and property description

The site is located nine kilometres west of Port Macquarie and is situated off (north) of Sancrox Road, Sancrox, New South Wales (Figure 1). The site covers a total area of approximately 186 ha and is zoned as Rural land within the local government area of Hastings. The site comprises a total of 171 separate lots (Figure 2) which are used for viticulture and residential purposes.

The site is bound by the Hastings River to the north and north west, Haydons Creek to the north east, Sancrox Road to the south and south east and Riverbend Road to the west.

3.2 Climate

Climatic data was obtained from the Bureau of Meteorology NSW.

Annual rainfall: 1289.3 mm

Annual evaporation: 1427.2 mm

Rainfall is at a maximum between January and April with each month averaging 184 to145 mm/month, while July through to October are the driest with each month receiving about 43 to 96 mm/month (Reference 5). Rainfall is most reliable during spring and summer and most variable during late autumn and winter. Rainfall events during the summer months consists of high intensity storm events which have the potential for erosion, especially in sloping and low ground cover environments.

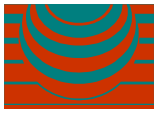
January and February are the warmest months and July is the coldest. Mean daily maximum temperatures in summer are around 27 ^{o}C while in winter 19 ^{o}C.

3.3 Site history

The site history has been gained by citing a letter provided by Jim Wade written on 24 January 2004 to Adrian Smith from Le Clos Redevelopment Committee.

Client: Le Clos redevelopment Committee		
Title: Site location	Drawn: DPS	Fig: 1
Location: Sancrox, NSW	Project Manager: DPS	
Source: Land Information Centre (2000)	Approved:	Date: 18/03/04

Client: Le Clos redevelopment Committee		
Title: Site layout	Drawn: DPS	Fig: 2
Location: Sancrox, NSW	Project Manager: DPS	
Source: Hasting Council	Approved:	Date: 18/03/04



The site was developed as a viticultural share farm in 1987 by G. Cassegrain & Company Pty Ltd. The development scheme was to provide a number of separate landowners with two parcels of land under a single title. One of the parcels was designated for a residential dwelling while the other parcel was designated for vineyards (~1.2 hectares). The parcels not necessarily adjacent to each other. The scheme was sold on the understanding that the vineyards would produce 15 tonnes/hectare in year five of the viticultural operation and were sold to about130 landowners. The viticulture management was undertaken by G. Cassegrain & Company Pty Ltd and land owners were required to pay a maintenance charge per annum for this service. When the lots were sold by G. Cassegrain & Company Pty Ltd, the company claimed to retain by way of an 88B instrument on the title, the right to farm the land in perpetuity.

During the first five years of operation, the goal of 15 tonnes/hectare was never met and investors did not receive any returns on their investments. Figure 3 shows the yields achieved and the losses incurred over the period between 1994 to 1999. This lead to over 25% of the land owners refusing to pay the maintenance fee placing significant pressure on the maintenance company G. Cassegrain & Company Pty Ltd. This lead to the cessation of viticultural management in 2000 by Cassegrain Wines, whom decided that the majority of the vineyards were not economic.

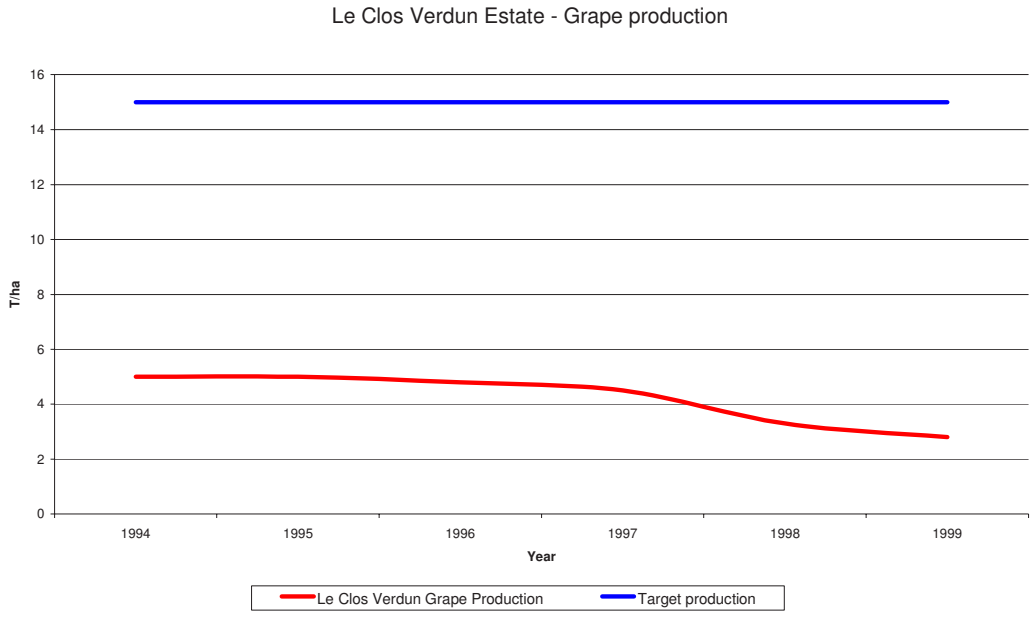
As a consequence, individual landowners were essentially left with small parcels of scattered rural land which was not providing any returns and could not be used due to the 88B Instrument on the title, which gave G. Cassegrain & Company Pty Ltd the right to farm the land in perpetuity. This right was challenged in court and was found to be invalid in December 2002.

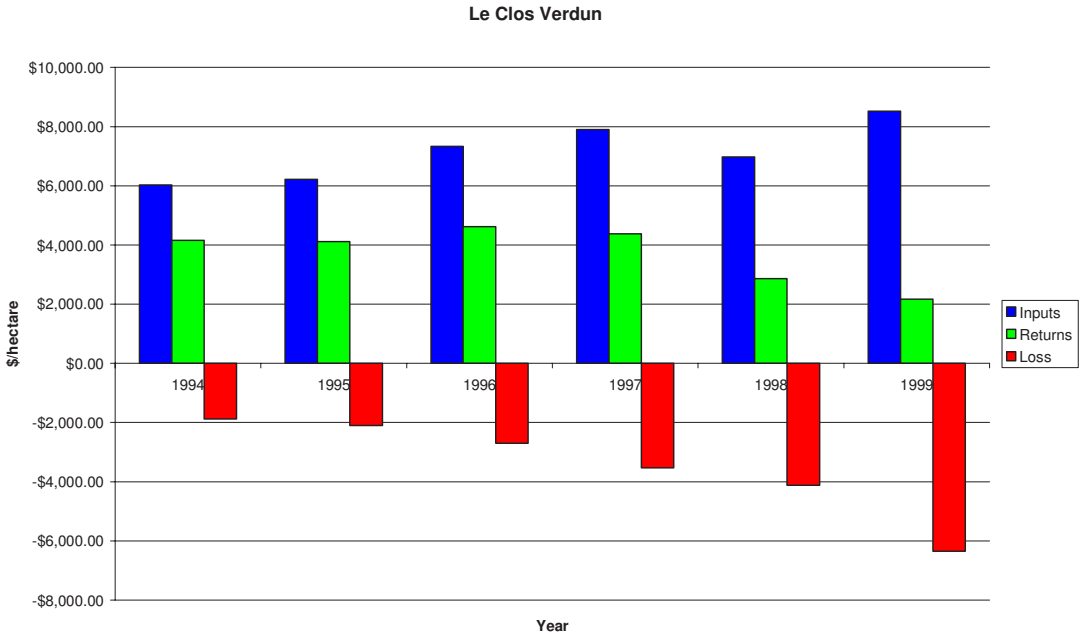
Currently, the vineyards have not been administered are in a dilapidated state, with many of the vines having died or been removed.

3.4 Regional geology, topography and soil

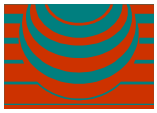
3.4.1 Geology

The local geology has been described in the *Hastings 1:250 000 Geological Series Sheet SH 56.14* (Reference 11) as mostly comprising the Carboniferous aged (292 to 354 million years of age) Byabarra Beds geological group with minor Quaternary aged (>1.81 million years of age) sediments. The Byabarra Beds geological group comprises lithic sandstone, siltstone, tuff, shale and limestone. The Quaternary aged sediments are found to overly the Byabarra





Client: Le Clos redevelopment Committee		
Title: Verdun yields and Losses	Drawn: DPS	Fig: 3
Location: Sancrox, NSW	Project Manager: DPS	
Source: XCEL	Approved:	Date: 18/03/04



Beds geological group in low relief areas and drainage channels and comprise alluvially deposited sand, silt, mud and gravel.

3.4.2 Topography

The topography of the area is described in References 2 and 13 as comprising undulating rises with broad crests, to low relief foot slopes and flood prone areas. Slopes range from 3 to 10% and local relief varies from less than five metres Australian Height Datum (AHD) to 30 metres AHD. The site is draped over a saddle and slopes in a north-easterly direction towards the Hastings River. Figure 4 represents the topography of the site.

3.4.3 Soils

The soils observed in the investigation area are related to the geology and topography of the area and are described in the *Soil landscapes of the Kempsey-Korongo Point 1:100 000 sheet* (Reference 2).

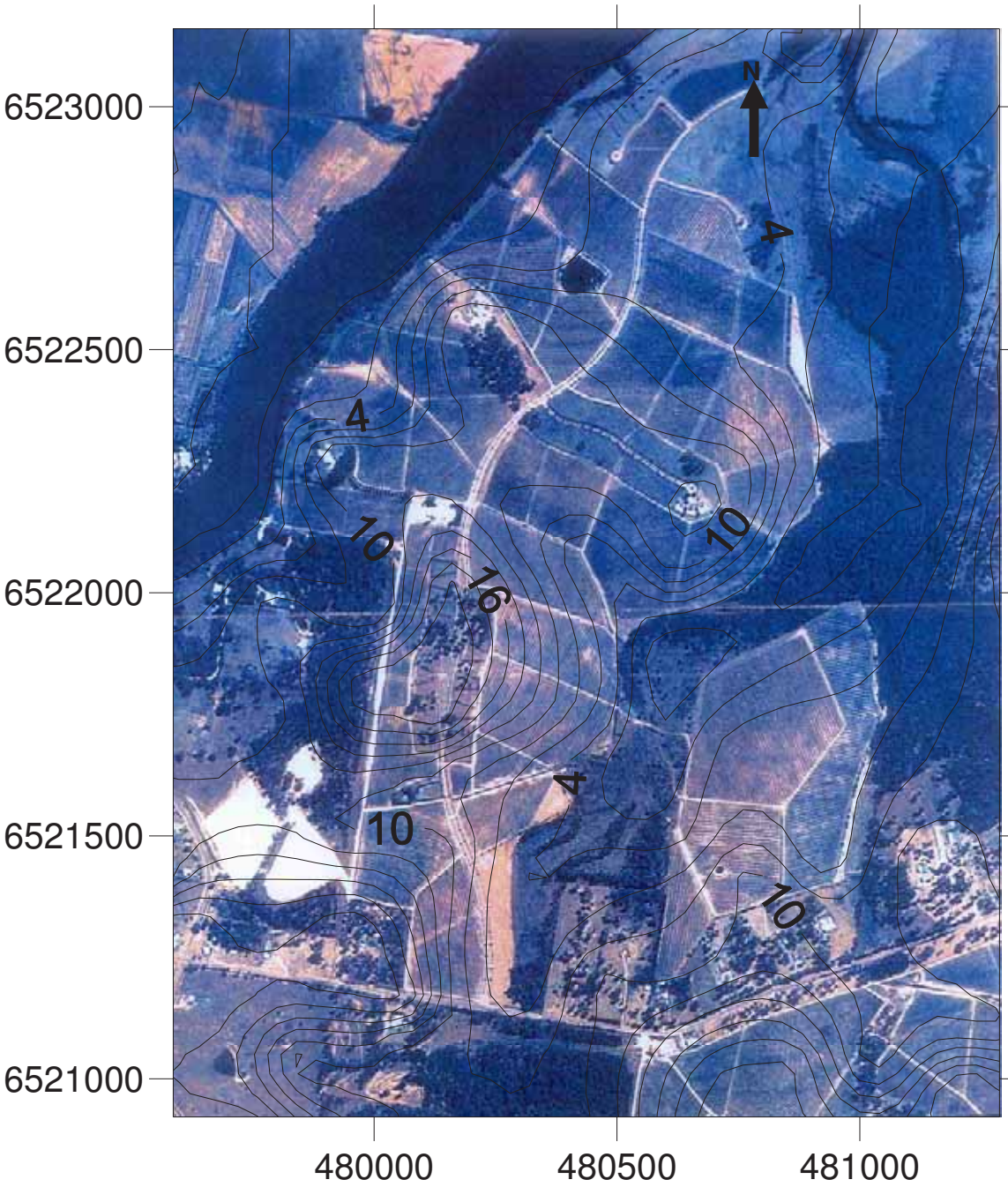
The site encompasses four separate soil landscapes including the:

- The residual Kundabung Soil Landscape;
- The transferral Cairncross Soil Landscape;
- The estuarine Blackmans Point Soil Landscape;
- The alluvial Austral Eden Soil Landscape; and the
- The alluvial Long Flat Soil Landscape.

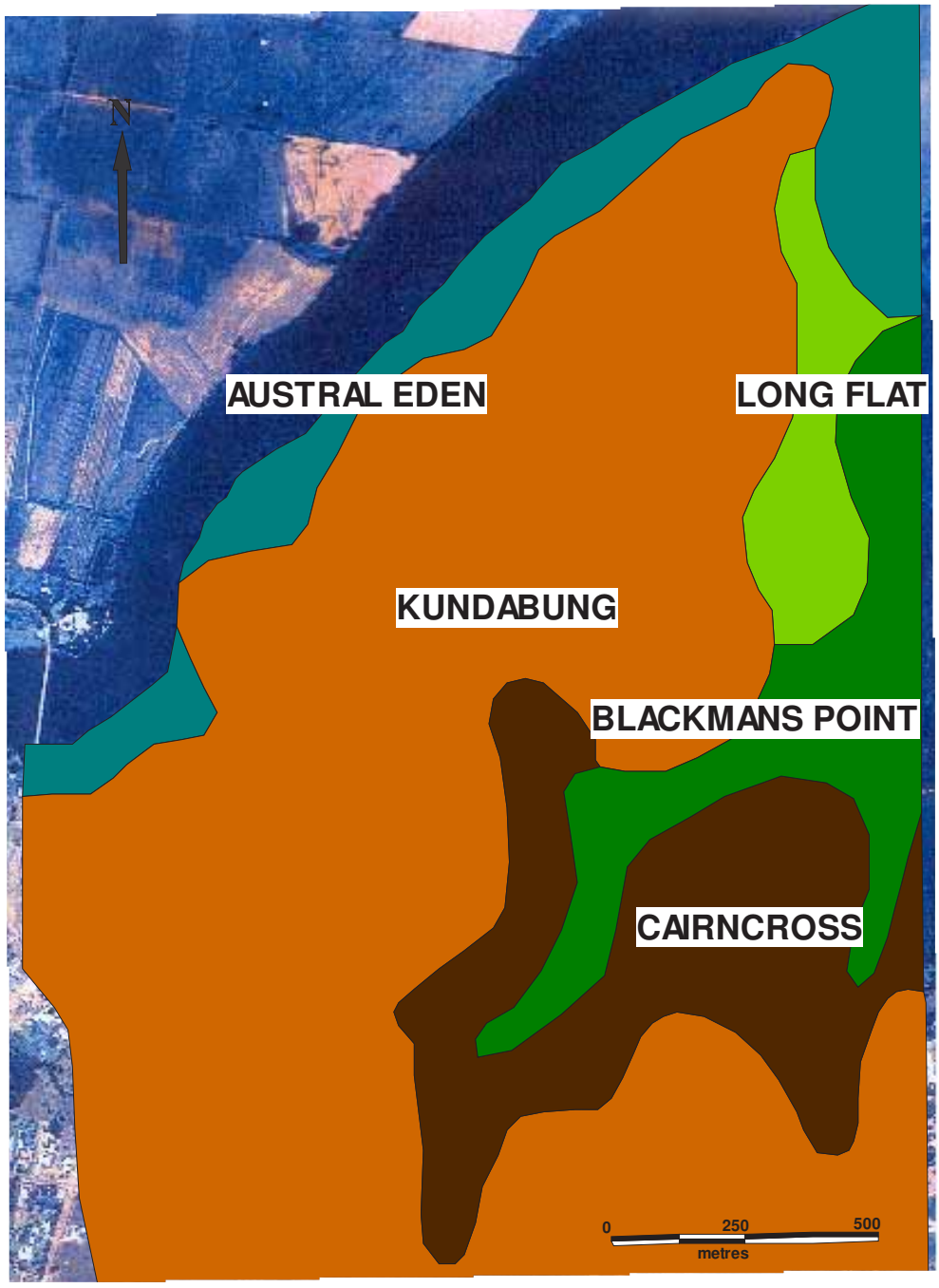
A soil landscape is an area of land that has recognisable and specifiable topographies and soils. The distribution of these soil landscapes in the vicinity of the site is presented in Figures 5 & 6. Descriptions of the expected soils contained within these landscapes are as follows:

Kundabung Soil Landscape

Shallow to deep (<100 to >300 cm), poorly drained hardsetting Soloths and Grey-brown, Yellow and Red Podzolic Soils on ridges and hill slopes with Gleyed Podzolic Soils with Humic Gleys in drainage depressions. The limitations of these soils include seasonal water logging; water erosion hazard; foundation hazards; run-on (localised); shallow soils (localised); hardsetting, erodable, sodic, acidic soils with low wet bearing strength, low permeability and high potential aluminium toxicity.



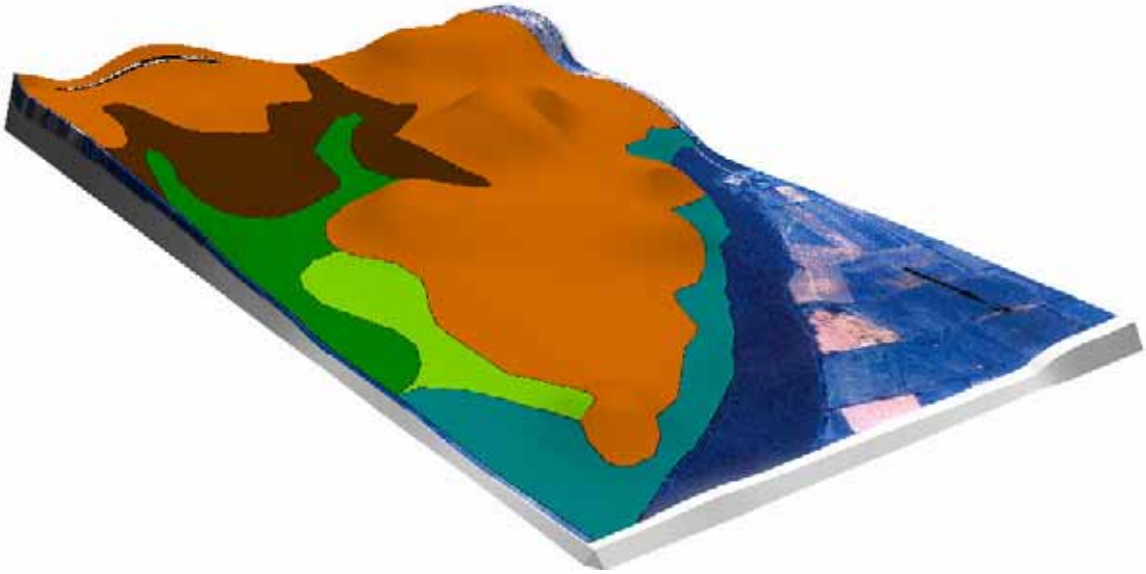
Client: Le Clos redevelopment Committee		
Title: Site topography	Drawn: DPS	Fig: 4
Location: Sancrox, NSW	Project Manager: DPS	
Source: Land Information Centre (2000)	Approved:	Date: 18/03/04



Soil Landscapes

- BLACKMANS POINT
- CAIRNCROSS
- KUNDABUNG
- LONG FLAT

Client: Le Clos redevelopment Committee		
Title: Soil Landscapes	Drawn: DPS	Fig: 5
Location: Sancrox, NSW	Project Manager: DPS	
Source: Reference 3	Approved:	Date: 18/03/04



Soil Landscapes

- BLACKMANS POINT
- CAIRNCROSS
- KUNDABUNG
- LONG FLAT

Client: Le Clos redevelopment Committee		
Title: Soil Landscapes 3D	Drawn: DPS	Fig: 6
Location: Sancrox, NSW	Project Manager: DPS	
Source: Reference 3	Approved:	Date: 18/03/04

Cairncross Soil Landscape

Moderate to deep (200 - >300 cm), poorly drained Humic Gleys, Soloths and yellow podsolic soils located on gently inclined, broad, open drainage depressions and footslopes of low relief. The limitations of this soil landscape include flooding hazard (localised); water logging; run-on; foundation hazards; low wet bearing strength; sodicity; high erodibility; very low permeability; strong acidity; high aluminium toxicity; low fertility; and moderate available water holding capacity.

Blackmans Point Soil Landscape

Deep (>300 cm) very poorly drained, saturated Solonchaks and Calcareous sands located within tidal flats and creeks in coastal inlets and estuaries. The limitations of this soil landscape include flooding hazard; water logging; low wet bearing strength; organic soils; acid sulfate soils; very strong sodicity; very strong salinity; and high erodibility.

Austral Eden Soil Landscape

Deep (>300 cm), well drained uniform loams forming alluvial soils and Chernozems with some gradational Yellow Earths. The limitations of this soil landscape includes flooding hazard; wind erosion hazard (localised); non cohesive soils; high plasticity; low wet bearing strength; high erodibility; and high permeability.

Long Flat Soil Landscape

Deep well drained Alluvial Soils ranging from uniform sands and loams to gradational profiles. The limitations of this soil landscape includes flooding hazard; stream bank erosion; and low wet bearing strength soil.

3.4.4 Additional soil information

A geotechnical investigation was undertaken in December 2003 (Reference 4) assessed the soil at 31 locations across the site using a backhoe and drill rig. Although the soils were described in geotechnical terms they were relatively consistent with those described in Section 3.4.2. The sample locations used in this investigation are presented on Figure 7. Laboratory analysis was undertaken on samples of top and subsoil from testpit locations TP3, TP6, TP11, TP13, TP19 and TP24. Laboratory analysis comprised cation exchange capacity (CEC),

native phosphorus, phosphorous sorption capacity, electrical conductivity (EC), pH, texture classification and bulk density. These results are compiled in Appendix C. The geotechnical soil bore/testpit logs are presented in Appendix A.

As the descriptions provided in the geotechnical borelogs were not suitable for this land capability study, supplementary information on the soil stratigraphy was gained from the Soil Profile Attribute Data Environment (SPADE) website (Reference 6). Soil profile information directly related to the site area was gained from viewing the soil profile reports (Soil Essentials Reports) from the Sancrox area.

According to the Department of Land & Water Conservation (DLWC) Wauchope/*Port Macquarie acid sulfate soil risk map* (Reference 7), there is a high potential for the occurrence of acid sulfate soil (ASS) at the site. The areas of potential ASS are associated with the Blackmans Point, Long Flat and Austral Eden Soil Landscapes.

3.5 Laboratory analysis

As soil samples from only six of the 31 geotechnical sampling locations had laboratory analysis conducted on them, additional laboratory analysis was required to further chemically characterise the site soils. Samples from Reference 4 were obtained from Chandler Geotechnical Pty Ltd. Samples of both top and subsoil were received from all locationsand were analysed for pH (1:5 soil water) and EC (1:5 soil:water). Additionally, similar samples of top and subsoil were composited into 10 composited samples (Table 1) and were analysed for CEC (including exchangeable Ca, Na, Mg, K & Al), pH (1:5 soil:water), pH (1:5 soil:$CaCl_2$), trace elements (DTPA extractable Cu, Zn, Mn, Fe), Nitrate (NO_3^-), Sulfate (SO_4^{2-}) and Phosphorous (Cowell method).

Samples that were composited were done so on the following basis:

— similar stratigraphy i.e. topsoil or subsoil;
— similar texture;
— similar location; and
— similar soil landscape.

The results of the composited analysis were attributed to each individual sample from that composited group. The results of the composited laboratory analysis are presented in Appendix C. The general chemical characteristics of the site soil are presented in the following section.

3.5.1 Root readily available water (RAW)

The root readily available water (RAW) was estimated by reviewing the soil tespit borelogs and the relevant soil textures. The depth of the estimated root zone (ERZ) of the grape vines was based on texture and pedality (structure) of the soil profile. Essentially ERZ was predicted by noting the depth to a restrictive layer in the soil profile. This depth was calculated as:

- a maximum of 1.0 metres if the soil stratigraphy permitted; or
- to the depth of the low permeable, hard consistence clay/bedrock; or
- into the top 0.2 metres of the subsoil.

As no water characteristics could be tested for in the soil samples, the total available water (TAW) (mm/m) for the expected soil textures was estimated from Reference 9 and 8. These values are presented in Appendix E.

The root RAW was then calculated by multiplying the TAW for each texture layer by a depletion factor of 50% (as essentially only 50% of the TAW is available to the plants)and then multiplying this value for each texture layer within the ERZ by the depth of each of the soil textures. For simplification purposes the top and subsoil was considered the same texture. These calculations are presented in Appendix E and the summary of the results for the entire site is presented in Table 2.

All soil chemical data was compiled and is presented in Appendix C. The descriptive statistics of the site soil fertility are presented in Table 2.

TABLE 1

COMPOSITED SAMPLES

Composite	Samples	Depth (m)	Composite	Samples	Depth (m)	Composite	Samples	Depth (m)	Composite	Samples	Depth (m)
COMP1	BH2	0-0.2	COMP4	TP1	0.25-0.5	COMP7	TP7	0-0.25	COMP9	TP12	0-1.0
COMP1	BH3	0-0.4	COMP4	TP2	0.25-0.5	COMP7	TP8	0-0.25	COMP9	TP13	0-0.25
COMP1	BH4	0-0.2	COMP4	TP3	0.25-0.5	COMP7	TP9	0-0.25	COMP9	TP14	0-0.30
COMP1	BH5	0-0.3	COMP4	TP5	0.25-0.5	COMP7	TP11	0-0.25	COMP9	TP15	0-0.25
COMP1	TP1	0-0.25	COMP5	BH1	0-0.20	COMP7	TP18	0-0.25	COMP9	TP17	0-0.25
COMP1	TP2	0-0.25	COMP5	TP4	0-0.25	COMP7	TP20	0-0.20	COMP9	TP19	0-0.25
COMP1	TP3	0-0.25	COMP5	TP6	0-0.25	COMP7	TP21	0-0.3	COMP10	TP12	1.0-4.5
COMP1	TP5	0-0.25	COMP5	TP23	0-0.25	COMP7	TP22	0-0.3	COMP10	TP14	0.3-0.6
COMP2	BH2	0.2-0.6	COMP5	TP24	0-0.25	COMP8	TP7	0.25-0.5	COMP10	TP15	0.25-0.5
COMP2	BH3	0.4-0.75	COMP5	TP25	0-0.25	COMP8	TP8	0.25-0.5	COMP10	TP17	0.25-1.0
COMP2	BH4	0.25-0.4	COMP5	TP26	0-0.25	COMP8	TP11	0.25-.5	COMP10	TP19	0.25-0.4
COMP2	BH5	0.3-0.6	COMP6	BH1	0.2-1.0	COMP8	TP18	0.25-0.4			
COMP3	TP23	0.25-0.6	COMP6	TP4	0.25-1.4	COMP8	TP21	0.3-0.6			
COMP3	TP24	0.25-0.6	COMP6	TP6	0.25-1.4	COMP8	TP22	0.3-0.5			
COMP3	TP25	0.25-0.6	COMP6	TP26	0.25-0.4						

Notes:

Samples TP9 (0.25-1.0m), TP20 (0.2-0.5m), & TP13 (0.25-0.3m) excluded fromcompositing due to differing physical attributes

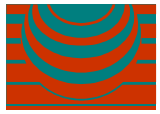


TABLE 2

VERDUN SOIL CHEMICAL CHARACTERISTICS – DESCRIPTIVE STATISTICS

	pH	pH	EC	ECe	NO_3	Phosphorus	Na	K	Ca	Mg
Units	**1:5 soil:water**	**1:5 ($CaCl_2$)**	**µs/cm**	**ds/m**	**mg/kg**	**mg/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**
Mean	5.4	4.5	113.9	0.9	5.4	4.09	0.74	0.17	4.77	2.96
Median	5.3	4.5	70.0	0.6	1.15	0	0.67	0.17	3.2	2.95
S.D.	0.5	0.58	144.1	1.0	7.86	7.19	0.40	0.12	4.5	1.09
Minium	4.4	3.73	15	0.13	0	0	0.02	0.04	0.18	1.49
Maximum	6.8	6.08	760	5.16	24	19	1.7	0.57	16.2	5.1

	Al	CEC	ESP	Cu	Zn	Mn	Fe	Ca:Mg	ERZ	RAW
Units	**$cmol_c$/kg**	**$cmol_c$/kg**	**%**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**Ratio**	**M**	**mm**
Mean	3.27	11.79	7.15	1.4	0.57	0.91	26.39	1.96	0.58	45.8
Median	1.6	10.96	6.66	0.81	0.12	0.38	3.5	0.97	0.5	40.5
S.D.	3.9	4.06	3.93	1.33	0.76	1.71	77.5	2.07	0.19	14.2
Minium	0.03	4.71	0.107	0.11	0.0	0.07	0.02	0.07	0.3	23.5
Maximum	13.3	19.23	14.69	3.9	2.1	6.0	260	7.35	1.0	77.5

4.0 LAND SUITABIITY ASSESSMENT

The land suitability assessment has been loosely based on "A Framework for Land Evaluation" - *FAO and Agriculture Organization of the United Nations (1976)* (Reference 10).

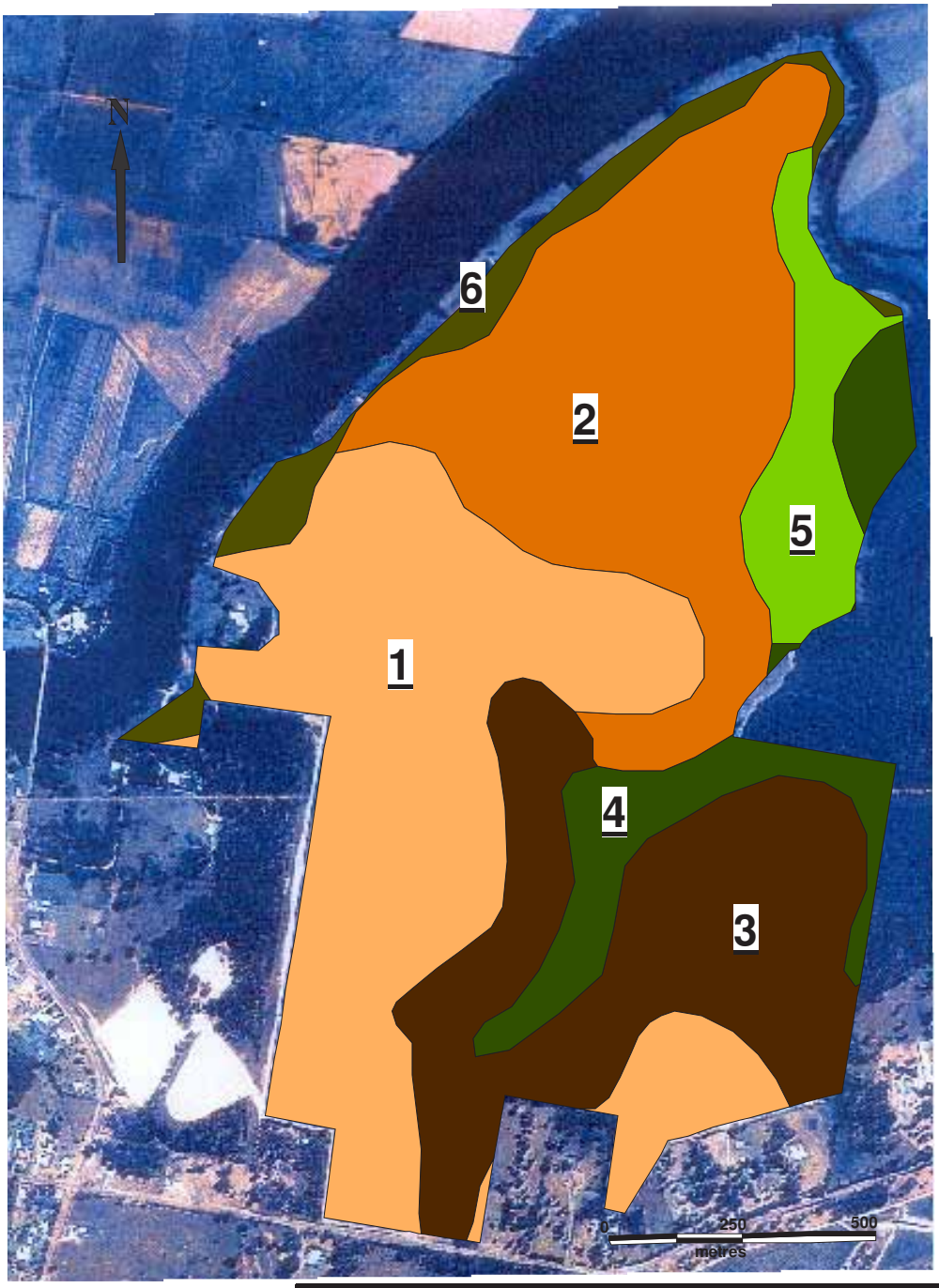
This principle of land evaluation embodies recognition of the fact that different kinds of land use have different requirements. The concept of land suitability is only meaningful in terms of specific kinds of land use, each with their own requirements, e.g. for soil moisture, rooting depth etc. The qualities of each type of land are compared with the requirements of the specific use. Thus the land itself and the land use are equally fundamental to land suitability evaluation. Although land evaluation is made in terms relevant to the physical, economic and social context of the area concerned, this report only deals with the physical resources and the relation with agricultural enterprise requirements.

4.1 Landunits

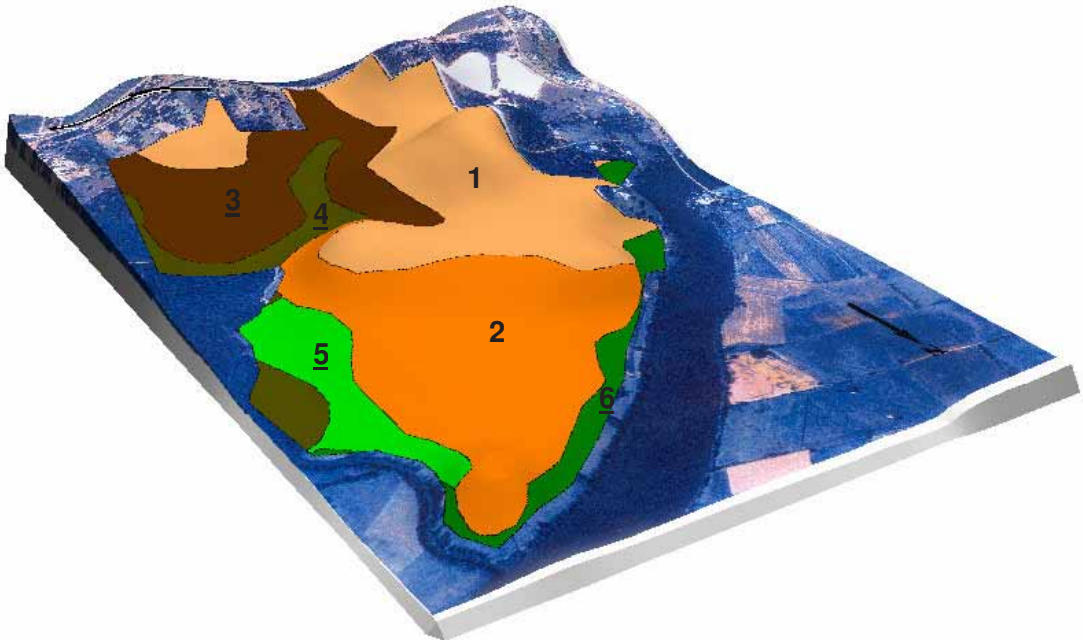
Taking into account the inherent variability of the site, a number of landunits have been derived. Each of these landunits has a specific range of topographical, soil physical and chemical characteristics. The definition of these landunits was derived by reviewing existing desktop physical resource information and compiling it into a geographic information system (GIS). These landunit were principally derived from the existing soil landscapes (Reference 3) as these soil landscapes are based on the types of soil and their topographic location. In addition, mean clustering (Ward's method) of relative levels (RLs) metres AHD, the soil pH and EC were also used to derive the various landunits. Samples collected from a former geotechnical investigation (Reference 4) were obtained and analysed to provide specific information of the chemical and physical properties of the soil of these locations. The data obtained from these sample locations was attributed to each of the derived landunits. Figure 7 shows the sample locations from the geotechnical investigation.

A total of six landunit were derived for the site and are presented in Figure 8 and 9. The characteristics of the landunits are provided in the following sections. These have been interpreted using References 12 and 14.

Client: Le Clos redevelopment Committee		
Title: Sample locations	Drawn: DPS	Fig: 7
Location: Sancrox, NSW	Project Manager: DPS	
Source: Reference 4	Approved:	Date: 18/03/04



Client: Le Clos redevelopment Committee		
Title: Derived Landunits	Drawn: DPS	Fig: 8
Location: Sancrox, NSW	Project Manager: DPS	
Source: Internal GIS	Approved:	Date: 18/03/04



Client: Le Clos redevelopment Committee		
Title: Derived Landunits 3D	Drawn: DPS	Fig: 9
Location: Sancrox, NSW	Project Manager: DPS	
Source: Internal GIS	Approved:	Date: 19/05/04

4.1.1 Landunit 1

Landunit 1 is based on the Kundabung Soil Landscape and is situated along the top of the ridges and the top of the hill slopes with an average RL of 11.27 metres AHD. Landunit 1 covers an area of 63.16 hectares.

Soils in this landunit include shallow to deep (<100 to >300 cm), poorly drained hardsetting Soloths and Grey-brown, Yellow and Red Podzolic Soils on ridges and hill. For Landunit 1, the average estimated root zone (ERZ) depth is 0.45 metres and the average root readily available water (RAW) is 36.25 mm. The soil physical characteristics of Landunit 1 are presented in Table 3.

TABLE 3

SOIL PHYSICAL ATTRIBUTES OF LANDUNIT 1

Units	RL metres	ERZ metres	RAW mm	Topsoil Texture	Subsoil Texture	Interpreted Permeability	Erodibility
Mean	11.27	0.45	36.25	Silty Clay Loam	Medium Clay	Low	Low

The chemical characteristics from top and subsoil in Landunit 1 are presented in Table 4. These results highlight that the topsoil has a low fertility (CEC <12 $cmol_c/kg$) and subsoils are moderately fertile (CEC 12-25 $cmol_c/kg$). In general, levels of soil phosphorous are considered moderate in the top soil and deficient in the subsoil. Levels of nitrate are generally considered low.

Both top and subsoil are strongly acidic and have excessive percentages of exchangeable aluminium. Both top and subsoil are considered non-saline (ECe <2 ds/m) and are not considered to be sodic (ESP% <6%), although sub soil at sampling location BH5 was found to be sodic. Overall the soil erodibilty at this land unit is low.

The Ca:Mg ratios indicate that Ca levels in the top soil are low in the top soil and deficient in the subsoil. Ca:Mg ratios of <2 are also thought to favour clay dispersion.

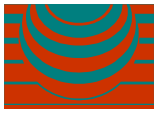


TABLE 4

SOIL CHEMICAL ATTRIBUTES OF LANDUNIT 1

Topsoil						
	pH	**pH**	**EC**	**Phosphorus**	**NO_3**	**Na**
Units	**soil:water**	**soil:$CaCl_2$**	**us/m**	**mg/kg**	**mg/kg**	**$cmol_c$/kg**
Mean	5.53	4.49	121.25	12.17	10.33	0.41
	K	**Ca**	**Mg**	**Al**	**CEC**	**ESP**
Units	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**%**
Mean	0.19	7.90	2.21	2.21	11.03	4.25
	Cu	**Zn**	**Mn**	**Fe**	**ECe**	**Ca:Mg**
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**ds/m**	**Ratio**
Mean	1.52	0.61	5.01	164.17	0.55	4.25

Subsoil						
	pH	**pH**	**EC**	**Phosphorus**	**NO_3**	**Na**
Units	**soil:water**	**soil:$CaCl_2$**	**us/m**	**mg/kg**	**mg/kg**	**$cmol_c$/kg**
Mean	5.10	3.75	85.00	<5.0	0.75	0.73
	K	**Ca**	**Mg**	**Al**	**CEC**	**ESP**
Units	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**$cmol_c$/kg**	**%**
Mean	0.12	1.11	3.27	3.27	12.32	5.84
	Cu	**Zn**	**Mn**	**Fe**	**ECe**	**Ca:Mg**
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**ds/m**	**Ratio**
Mean	0.02	0.12	0.59	26.91	0.60	0.36

4.1.2 Landunit 2

Landunit 2 is also based on the Kundabung Soil Landscape and is situated on the lower gentle hill slopes and foot slopes with an average RL of 5.24 metres AHD. Landunit 2 covers an area of 50.49 hectares.

Soils in this landunit include shallow to deep (<100 to >300 cm), poorly drained hardsetting Gleyed Podzolic Soils with Humic Gleys in drainage depressions. For Landunit 2, the average estimated root zone (ERZ) depth is 0.67 metres and the average root readily available water (RAW) is 52.65 mm. The soil physical characteristics of Landunit 2 are presented in Table 5.

The chemical characteristics from top and subsoil in Landunit 2 are presented Table 6.

TABLE 5

SOIL PHYSICAL ATTRIBUTES OF LANDUNIT 2

	RL	ERZ	RAW	Topsoil	Subsoil	Interpreted	Erodibility
Units	**metres**	**metres**	**mm**	**Texture**	**Texture**	**Permeability**	
Mean	5.24	0.67	52.56	Silty Clay Loam	Medium Clay	Extre. Low	High

These results highlight that the top and subsoil of this landunit have a low fertility (CEC <12 $cmol_c/kg$). Levels of soil phosphorous are considered low in the top soil and deficient in the subsoil. Levels of nitrate are generally considered low.

TABLE 6

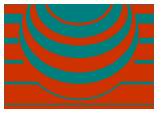
AVERAGE SOIL CHEMICAL ATTRIBUTES OF LANDUNIT 2

Topsoil

	pH	pH	EC	Phosphorus	NO_3	Na
Units	**soil:water**	**soil:$CaCl_2$**	**us/m**	**mg/kg**	**mg/kg**	**$cmol_c/kg$**
Mean	5.81	4.54	64.00	11.73	8.50	0.60
	K	**Ca**	**Mg**	**Al**	**CEC**	**ESP**
Units	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**%**
Mean	0.21	5.95	1.94	1.94	9.49	6.04
	Cu	**Zn**	**Mn**	**Fe**	**ECe**	**Ca:Mg**
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**ds/m**	**Ratio**
Mean	1.23	0.74	4.31	199.64	1.10	6.04

Subsoil

	pH	pH	EC	Phosphorus	NO_3	Na
Units	**soil:water**	**soil:$CaCl_2$**	**us/m**	**mg/kg**	**mg/kg**	**$cmol_c/kg$**
Mean	5.27	3.37	126.82	<5.0	2.15	0.85
	K	**Ca**	**Mg**	**Al**	**CEC**	**ESP**
Units	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**%**
Mean	0.11	1.09	2.19	2.19	8.23	8.49
	Cu	**Zn**	**Mn**	**Fe**	**ECe**	**Ca:Mg**
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**ds/m**	**Ratio**
Mean	0.06	0.20	2.53	32.45	0.87	0.43



Both top and subsoil are highly acidic and have high levels of exchangeable aluminium. Both top and subsoil are considered non-saline (ECe <2 ds/m) and are considered to be sodic (ESP% >6%). The sodicity can cause dispersion under saturated conditions which leads to a low wet bearing strength and severe erosion. The Ca:Mg ratios indicate that Ca and Mg levels in the top soil are balanced, but are deficient in the subsoil.

4.1.3 Landunit 3

Landunit 3 is based on the Cairncross Soil Landscape and is situated on the foot slopes towards drainage depressions and has an average RL of 4.41 metres AHD. Landunit 3 covers an area of 39.52 hectares.

Soils on Landunit 3 comprise moderate to deep (200 - >300 cm), poorly drained Humic Gleys, Soloths and yellow podsolic soils located on gently inclined, broad, open drainage depressions and footslopes of low relief. For Landunit 3, the average estimated root zone (ERZ) depth is 0.57 metres and the average root readily available water (RAW) is 45.42 mm. The soil physical characteristics of Landunit 3 are presented in Table 7

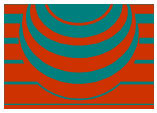
TABLE 7

SOIL PHYSICAL ATTRIBUTES OF LANDUNIT 3

	RL	ERZ	RAW	Topsoil	Subsoil	Interpreted	Erodibility
Units	**metres**	**metres**	**mm**	**Texture**	**Texture**	**Permeability**	
Mean	4.41	0.57	45.42	Silty Clay Loam	Medium Clay	Extre. Low	Extre. High

The chemical characteristics from top and subsoil in Landunit 3 are presented in Table 8. These results highlight that the top and subsoil of this landunit have a low fertility (CEC <12 $cmol_c/kg$). Levels of soil phosphorous are considered low in the top soil and deficient in the subsoil. Levels of nitrate are generally considered low.

Both top and subsoil are highly acidic and have high levels of exchangeable aluminium (higher than the other landunits). Both top and subsoil are considered non-saline (ECe <2 ds/m). However, sample location TP2 was found to have a high EC_e (>4 ds/m) which indicates high salinity levels at this location, which most likely extend along the creek area. Top and subsoil are considered to be highly sodic (ESP% >6%). The sodicity may cause dispersion under saturated conditions which leads to a low wet bearing strength and severe



erosion. The Ca:Mg ratios indicate that Ca and Mg levels in the top soil are balanced, but are deficient in the subsoil.

TABLE 8

AVERAGE SOIL CHEMICAL ATTRIBUTES OF LANDUNIT 3

Topsoil						
	pH	**pH**	**EC**	**Phosphorus**	**NO_3**	**Na**
Units	**soil:water**	**soil:$CaCl_2$**	**us/m**	**mg/kg**	**mg/kg**	**$cmol_c/kg$**
Mean	5.56	4.67	64.29	<5.0	7.43	0.69
	K	**Ca**	**Mg**	**Al**	**CEC**	**ESP**
Units	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**%**
Mean	0.10	3.16	2.07	2.07	6.86	10.91
	Cu	**Zn**	**Mn**	**Fe**	**ECe**	**Ca:Mg**
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**ds/m**	**Ratio**
Mean	0.18	0.49	3.50	310.00	1.22	10.91

Subsoil						
	pH	**pH**	**EC**	**Phosphorus**	**NO_3**	**Na**
Units	**soil:water**	**soil:$CaCl_2$**	**us/m**	**mg/kg**	**mg/kg**	**$cmol_c/kg$**
Mean	5.39	4.43	210.00	<0.5	0.47	1.28
	K	**Ca**	**Mg**	**Al**	**CEC**	**ESP**
Units	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**$cmol_c/kg$**	**%**
Mean	0.10	3.49	3.94	3.94	11.84	11.07
	Cu	**Zn**	**Mn**	**Fe**	**ECe**	**Ca:Mg**
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**ds/m**	**Ratio**
Mean	0.02	0.12	0.90	23.14	1.24	0.79

4.1.4 Landunit 4

Landunit 4 is based on the Blackmans Point Soil Landscape, is situated along deep drainage and creek lines and has an average RL of 0.96 metres AHD. Landunit 4 covers an area of 15.01 hectares.

Soils of Landunit 4 include deep (>300 cm) very poorly drained, saturated Solonchaks and Calcareous sands located within tidal flats and creeks in coastal inlets and estuaries. No soil test pits were undertaken on this landunit. However, the limitations include flooding hazard; water logging; low wet bearing strength; organic soils; acid sulfate soils; very strongly sodic; very strongly saline; high erodibility. Table 9 highlights the attributes of the soil of this landunit.

TABLE 9

ATTRIBUTES OF LANDUNIT 4

	RL	Interpreted	Erodibility	Flood hazard	ASS Hazard	Salinity Hazard
Units	**metres**	**Permeability**				
Mean	0.96	Exte. Low	Extre. High	High	High	High

4.1.5 Landunit 5

Landunit 5 is based on the Long Flat Soil Landscape and is situated along the broad open flats below the foot slopes with an average RL of 1.19 metres AHD. This landunit covers an area of 11.53 hectares.

Soils of Landunit 5 include deep well drained alluvial soils ranging from uniform sands and loams to gradational profiles. The limitations of this soil landscape include, flooding hazard; stream bank erosion; low wet bearing strength soil. The physical attributes of Landunit 5 (both inferred and measured) are presented in Table 10.

TABLE 10

SOIL PHYSICAL ATTRIBUTES OF LANDUNIT 5

	RL	Topsoil	Subsoil	Interpreted	Erodibility	Flood hazard	ASS
Units	**metres**	**Texture**	**Texture**	**Permeability**			
Mean	1.19	Silty Loam	Alluvial sand	High	Moderate	High	High

Only sampling location TP10 was established within this landunit and the testpit log describes the soil as residual soil, which is not consistent with alluvial profiles expected in this landunit. This testpit is considered to be located on the boundary between the Long Flat and Kundabung soil landscapes. Data from this location is considered representative of the top soil in Landunit 5. As such, limited soil chemical data is available for this landunit (Table 11).

TABLE 11

SOIL CHEMICAL ATTRIBUTES OF LANDUNIT 5

Topsoil					
	RL	pH	pH	EC	ECe
Units	metres	soil:water	soil:$CaCl_2$	us/m	ds/m
Mean	1.19	5.00	4.50	520.00	0.71

4.1.6 Landunit 6

Landunit 6 is based on the Austral Eden Soil Landscape which is situated along the steep riverbank of the Hastings River. It has an area of 8.39 hectares and has an average RL of 2.84 metres AHD.

Soils within this landunit comprise deep (>300 cm), well drained uniform loams forming alluvial soils and Chernozems with some gradational Yellow Earths.

The limitations of this soil landscape includes flooding hazard; wind erosion hazard (localised); non cohesive soils; high plasticity; low wet bearing strength; high erodibility; high permeability. The attributes of Landunit 6 are presented in Table 12. No chemical data was available for Landunit 6.

TABLE 12

ATTRIBUTES OF LANDUNIT 6

	RL	Topsoil	Subsoil	Interpreted	Erodibility	Flood hazard	ASS
Units	metres	Texture	Texture	Permeability			
Mean	2.84	Silty Loam	Alluvial sand	High	High	High	High

4.2 Land suitability structure

In order to assess the suitability of the landunits for various agricultural enterprises, the attributes of the landunits were compared to the requirements of these enterprises. The land suitability rating structure described in Table 13 was used.

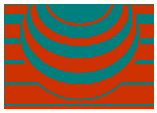


TABLE 13

LAND SUITABILITY STRUCTURE

Rating ID	Suitability	Description
N	Not suitable	Land having limitations so severe as to preclude any possibilities of successful sustained use of the land in the given manner
MS	Marginally suitable	Having limitations which in aggregate are moderately severe for sustained application of a given use; the limitations will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use. This land requires certain management in order to be suitable for an intended purpose
S	Suitable	Land having no significant limitations to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.
I	Ideal	Land having no limitations to a given application - optimal conditions

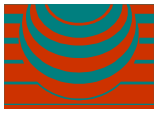
4.3 Soil physical & chemical characteristics for agricultural enterprises

4.3.1 Viticultural requirements

In order for wine grapes to grow at an optimum quantity and quality, soil physical and chemical attributes need to be within certain ranges. Currently in Australia it is the grape quality not quantity which has become the primary aim for viticulturalist.

Most limiting to wine grapes is the soil structural quality, texture and strength, which influences root development and soil moisture status. Wine grapes do not cope with water logged conditions, and their development is severely impeded by such conditions.

Essentially wine grapes require a rootzone of approximately 0.6 metres deep (if being irrigated) and 1.0 metres deep (without irrigation), and allow active root growth to the middle of the inter-rows. Soil infiltration rates need to exceed the rate of irrigation and/or precipitation and soils require a good water holding capacity i.e. approximately 50mm of root readily available water (RAW) at -60kPa soil moisture tension within the root zone without limiting a soil aeration of at least 15% at field capacity (saturation). Soils are required to be able to resist wind and water erosion for stability.



Chemically, topsoils are required to have a pH (1:5 $CaCl_2$) less than 7.5 and subsoils are required to have a pH (1:5 $CaCl_2$) of between 5.0 and 8.5 in the root zone. Soils do not need to be highly fertile.

Elevated levels of sodium (Na) and chloride (Cl) are limiting to wine grapes as well as the pH dependent availability of boron (Bo), aluminium (Al) and manganese (Mn). Additionally soils are required to have low concentrations of soluble salts, especially Na salts.

Table 14 summarises the general requirements for viticulture.

TABLE 14

GENERAL REQUIREMENTS FOR VITICULTURE

Attribute	Fertility	ERZ	RAW	Topsoil pH	Subsoil pH	Soil Erodibility	Water Infiltration
Units		metres	mm	($CaCl_2$)	($CaCl_2$)		
Value	NA	>1.0	>50	<7.5	5.0 – 8.5	Low	Moderately high

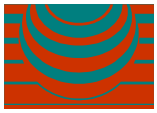
Attribute	Calcium			Magnesium		
	cmolc/kg	% CEC	mg/kg	cmolc/kg	% CEC	mg/kg
Value	6.0-7.5	60-80%	1200-1500	1.7	10-20%	200

Attribute	Sodium	Potassium			Aluminum
	% CEC	cmolc/kg	% CEC	mg/kg	% CEC
Value	<6%	0.5	3-8%	200	0-5%

4.3.2 Grazing and intense grazing land requirements

Depending on what animal enterprise is to be undertaken, and which pasture species are to be selected, certain soil physical and chemical attributes are required to be within certain ranges. The requirements for optimum grazing land are based on the lands ability to produce sustainable yield of pasture, be that improved or unimproved. This section presents a broad range of general requirements for grazing land, with an emphasis on the soil requirements for pasture. A difference between grazing land and intense grazing land has been made due to the increased requirements for intense grazing.

Generally, the more fertile the soil the better the pasture production. However, soil fertility can be improved by nutrient amendments as required. More important considerations are the soil physical properties which provide stability, access for water and gases. Most plants and



particularly dryland crops and pastures are robust in their cation requirements having a wide tolerance of cation ratios, with no optimum ratio being demonstrated in the field. There may, however be instances where specific plant species have requirements that cannot be met by a specific soil. All the information suggests that if the amount of each exchangeable cation is sufficient, ratios are usually not important.

Table 15 outlines the desirable land attributes for grazing and intense grazing land.

TABLE 15

REQUIREMENTS FOR GRAZING

Attribute	pH (water)	pH (CaCl2)	Calcium cmolc/kg	Calcium %	Calcium mg/kg	Magnesium cmolc/kg	Magnesium %	Magnesium mg/kg
Grazing	5.8-6.3	5.0-5.5	4.5-6.0	60-80%	900-1200	1.25-1.7	10-20%	150-200
Intensive grazing	6.3	5.5	6.0	60-80%	1200	1.7	10-20%	200

Attribute	Sodium %	Potassium cmolc/kg	Potassium %	Potassium mg/kg	Aluminum %	Phosphorous mg/kg	Nitrate mg/kg
Grazing	<6-15%	0.26	3-8%	100	0-5%	25-45	<20
Intensive grazing	<6%	0.4	3-8%	150	0-5%	24-45	<20

4.3.3 General horticulture requirements

The requirements for general horticulture are similar to those of viticulture and grazing. The most limiting factor is the soil structure and water availability. Water availability can be addressed by irrigation. However, soil structure is difficult and time consuming to improve. Most horticultural species are adversely affected by water logged conditions and require a certain amount of essential nutrients, these will vary depending on the species.

The general requirements for horticulture are presented in Table 16.

TABLE 16

REQUIREMENTS FOR GENERAL HORTICULTURE

Attribute	pH (water)	pH (CaCl2)	Calcium cmolc/kg	Calcium %	Calcium mg/kg	Magnesium cmolc/kg	Magnesium %	Magnesium mg/kg
Horticulture	6.5	6.5	6.5-7.0	60-80%	1200-1500	1.7	10-20%	200

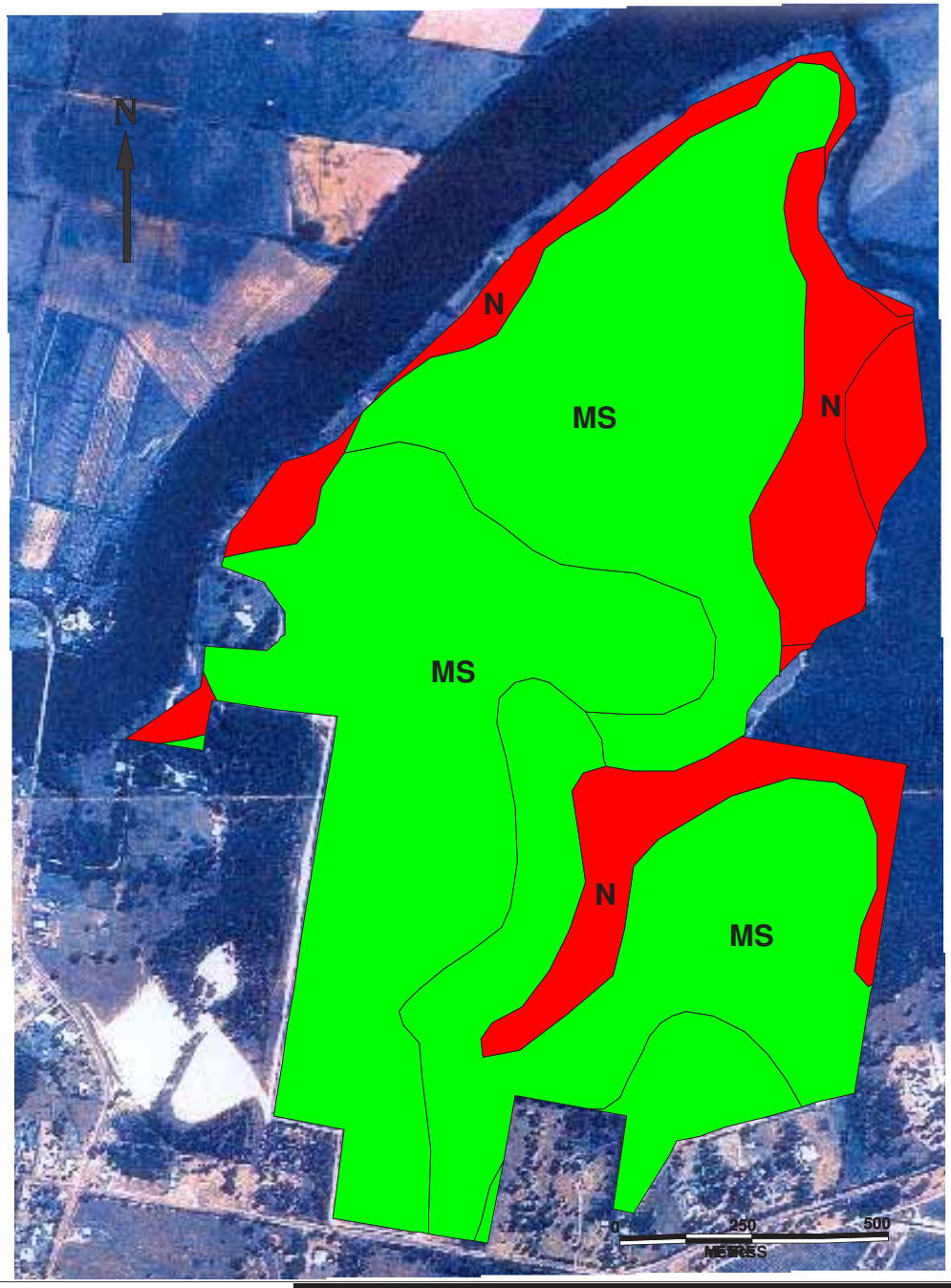
Attribute	Sodium %	Potassium cmolc/kg	Potassium %	Potassium mg/kg	Aluminum %	Phosphorous mg/kg	Nitrate mg/kg
Horticulture	<6-15%	0.5	3-8%	200	0-5%	30-35	<20

4.4 Land suitability rating maps

For each landunit, land suitability rating maps using the structure presented in Table 13, for each of the nominated agricultural enterprises were generated. They are presented in the following figures:

- Figure 10 -- land suitability for viticulture;
- Figure 11 -- land suitability for grazing land;
- Figure 12 -- land suitability for intense grazing land; and
- Figure 13 -- land suitability for general horticulture.

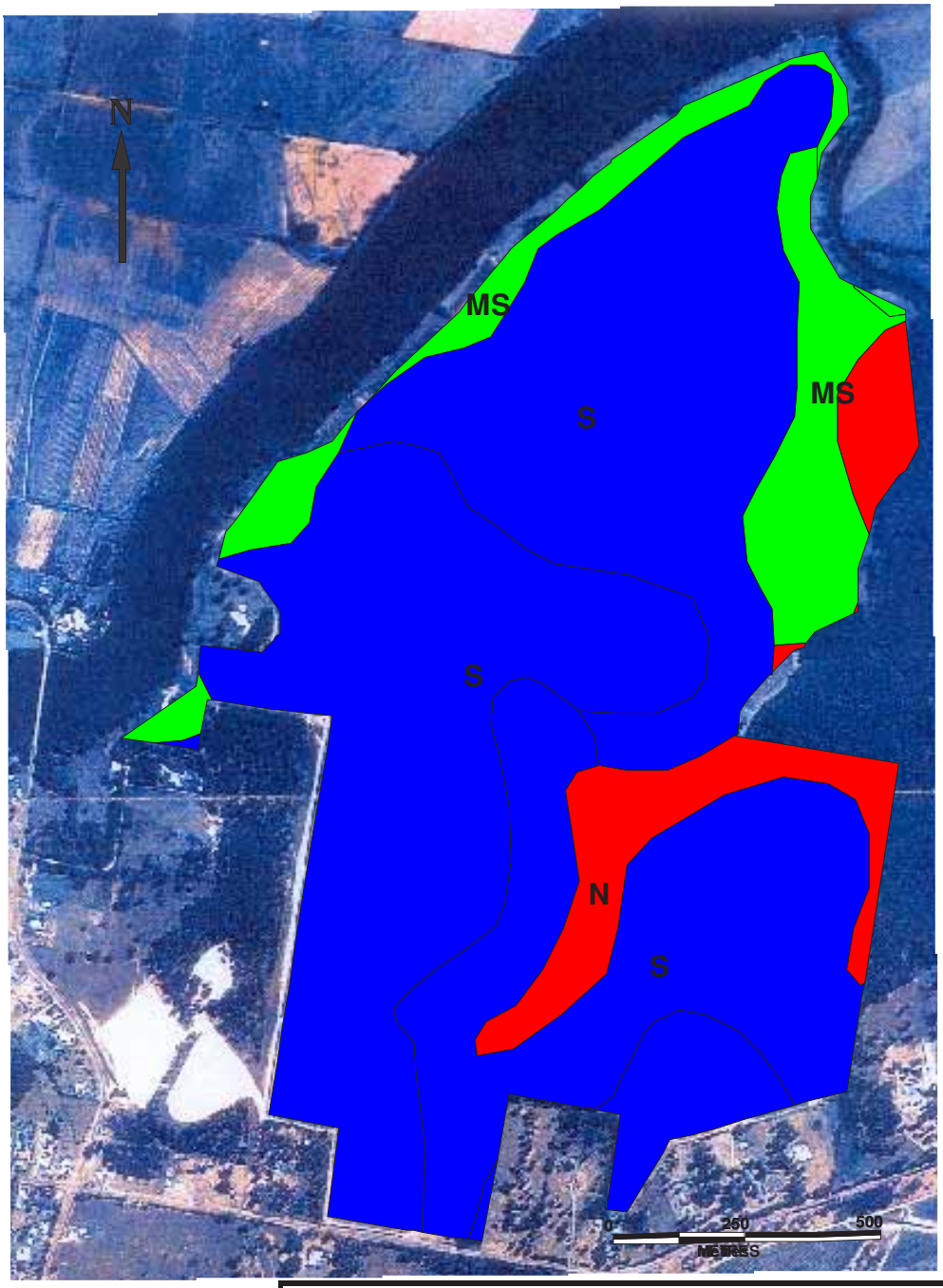
A discussion on the basis for the analysed land suitability ratings is presented in Section 5.0.



Vticulture Suitibilty

Marginally Suitable
Not Suitable

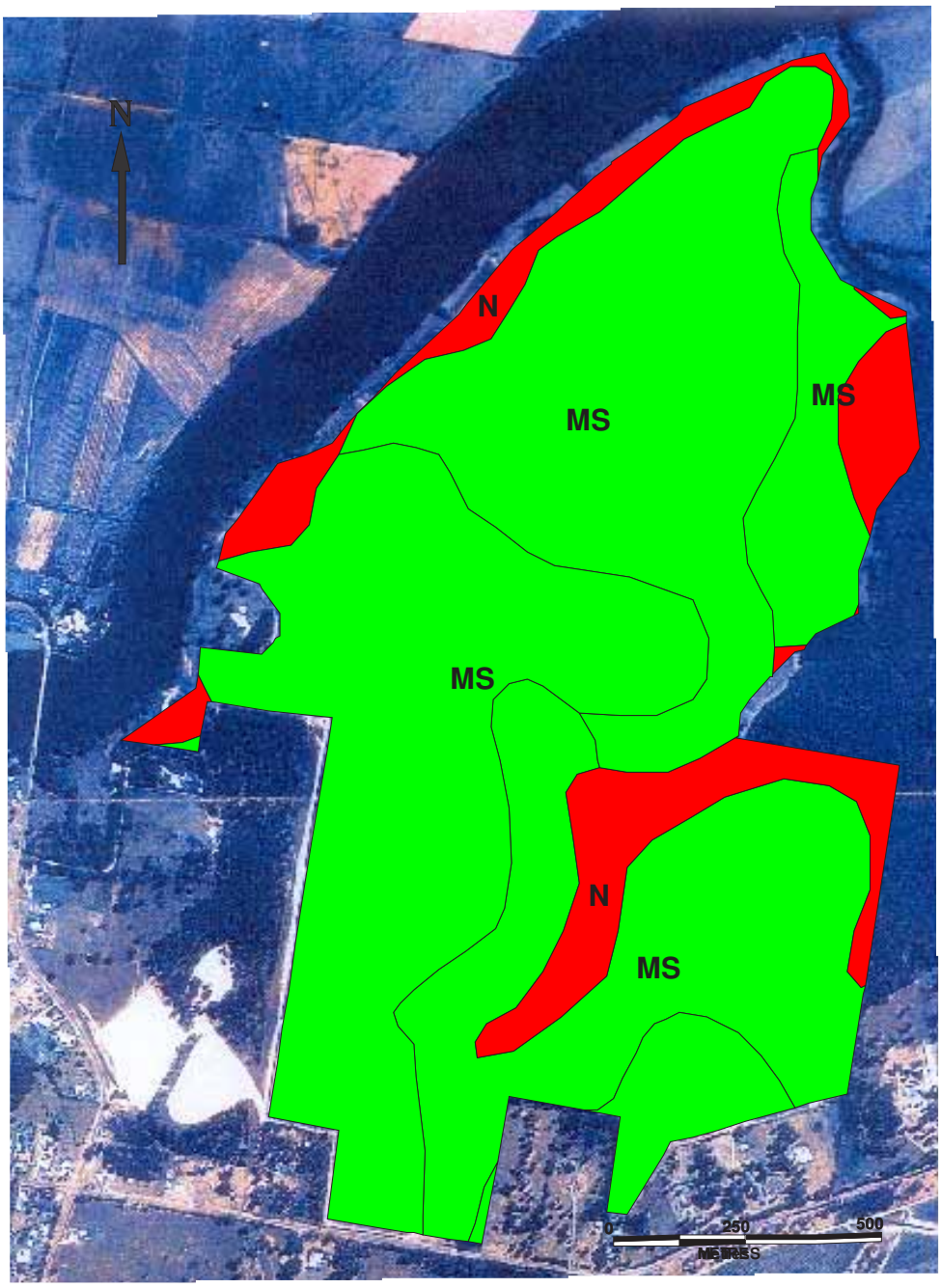
Client: Le Clos redevelopment Committee		
Title: Land suitability ratings for viticulture	Drawn: DPS	Fig: 10
Location: Sancrox, NSW	Project Manager: DPS	
Source: Internal GIS	Approved:	Date: 18/03/04



Grazing Suitability

- Marginally Suitable
- Not Suitable
- Suitable

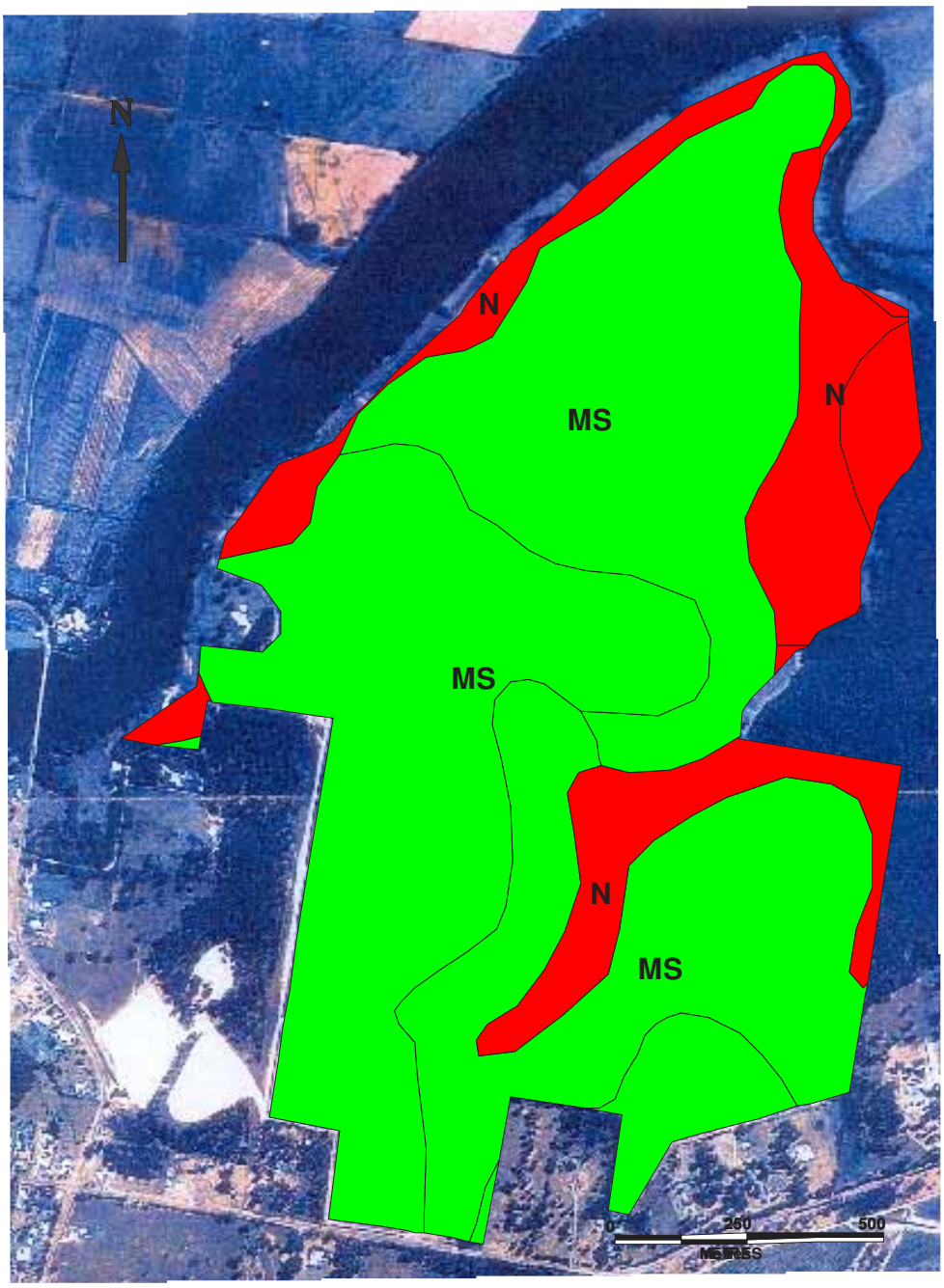
Client: Le Clos redevelopment Committee		
Title: Land suitability ratings for grazing land	Drawn: DPS	Fig: 11
Location: Sancrox, NSW	Project Manager: DPS	
Source: Internal GIS	Approved:	Date: 18/03/04



Intensive grazing suitability

- Marginally Suitable
- Not Suitable

Client: Le Clos redevelopment Committee		
Title: Land suitability ratings for intense grazing land	Drawn: DPS	Fig: 12
Location: Sancrox, NSW	Project Manager: DPS	
Source: Internal GIS	Approved:	Date: 18/03/04



General horticulture suitability

- Marginally Suitable
- Not Suitable

Client: Le Clos redevelopment Committee		
Title: Land suitability ratings for general horticulture	Drawn: DPS	Fig: 13
Location: Sancrox, NSW	Project Manager: DPS	
Source: Internal GIS	Approved:	Date: 18/03/04

5.0 DISCUSSION

5.1 Landunit 1

Landunit 1 was found to be marginally suitable for viticulture, intense grazing land and general horticulture and suitable for general grazing land.

The soils found within this landunit had physical and chemical attributes which generally limit plant production. Specifically, the pH of the soil within the root zone was found to be significantly low (<5.0) and the percent exchangeable aluminium was considered high (> 5%) and would result in aluminium toxicity to most plants grown within this landunit.

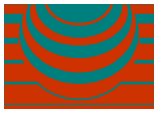
This landunit, as with most other landunits also generally exhibited low levels of exchangeable cations, with the exception of magnesium and low levels of essential nutrients (NPK). As this issue can be overcome by application of soil amendments, this factor was not considered a significant limit to plant production. However, the low fertility limits the suitability ratings of the landunits to less than ideal, as amendments are required to address the fertility.

For wine grapes and general horticulture, the estimated root zone (ERZ) for this landunit was low when compared to the requirements of horticulture plants that are not irrigated and the root readily available water (RAW) was found to be deficient for optimal plant performance. The low permeability of this subsoil highlights the potential for seasonal waterlogging within the root zone, a factor that is adverse to most horticultural production.

Topographically, this land unit is considered suitable for all of the nominated agricultural enterprises.

For both grazing and intense grazing applications, the carrying capacity of the landunit should be determined by a qualified expert who can recommend an optimum stocking rate for the chosen grazing animal. This stocking rate should be carefully monitored and should be reduced if land degradation issues arise.

Continuous inputs and land management techniques would be required to promote the sustainability of this landunit for the nominated agricultural enterprises. These include but are not limited to the following:



— The incorporation of agricultural lime into the subsoil to moderate the pH (1:5 soil:$CaCl_2$) of the soil to between 6 and 6.5. It is recommended that applications of no more than two tonnes/hectare be applied at anyone time. Ideally, the lime amendments would be required to be incorporated to a minimum depth of 0.3 metres;
— The ERZ for the grape vines can be improved by deep ripping to a depth of at least 0.6 metres. and
— Addition of essential nutrient fertiliser (ratios of NPK dependant on the horticultural or pasture species used).

5.2 Landunit 2

Landunit 2 was found to be marginally suitable for viticulture, intense grazing and general horticulture and was found to be suitable for general grazing land. The reasons are identical to those explained in Section 5.1 for landunit 1.

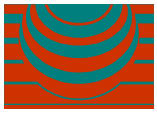
Additionally, the excessively high exchangeable sodium percentage (ESP) highlights the dispersive nature of the soils of this landunit. This impacts on the structural integrity of the soil which in turn will have a negative effect on water infiltration and increases the potential for land degradation if disturbed. Best soil management practices would be required to be implemented for this landunit. Care should be taken to moderate stock trampling in this landunit to minimise any structural degradation. Deep incorporation of gypsum could be used to address the sodicity of this landunit but, the cost to benefit ratio for grazing may not permit such an improvement.

The inputs and land management practices presented for landunit 1 also apply to this land unit. Additionally,

— The sodicity of this landunit can be amended by the deep incorporation of gypsum at a rate of between 2.4 and 4.0 tonnes/hectare; and
— Best management practices should be applied to limit the exposure of the sodic soils and mitigate any soil erosion issues.

5.3 Landunit 3

Landunit 3 was found to be marginally suitable for viticulture, intense grazing and general horticulture and was found to be suitable for general grazing land for the same reasons as for landunits 1 and 2. The above mentioned amendments and management techniques for landunits 1 and 2 also apply. Additionally, this land unit is significantly more sodic than



landunit 2 and has a relatively steeper topography. For these reasons more stringent management would be required, including:

- a reduction in stocking rates if used for grazing;
- minimising soil disturbance and tillage if (applicable);
- maintaining stringent erosion controls and maintaining soil cover.

5.4 Landunit 4

Landunit 4 was found to unsuitable for all of the nominated agricultural enterprises. This was mainly due to topographic limitations and the presence of Haydon's Creek. The topography in which Landunit 4 is situated causes water logged conditions within the soil. Soils within this landunit have an extremely low inferred permeability, exacerbating the water logging conditions, a significant flood hazard, acid sulfate soil hazard, have a low wet bearing strength, and are expected to contain sodic and acid soils.

5.5 Landunit 5

Landunit 5 was found to be unsuitable for viticulture and general horticulture and marginally suitable for general grazing and intense grazing land.

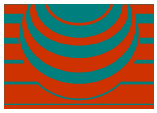
The close proximity of this landunit to the Hastings River and Haydon's Creek, the significant flood potential and ASS potential and water logged soil conditions of this landunit prohibit the undertaking of viticulture and general horticulture within this landunit.

For general grazing and intense grazing these factors can be overcome by best management practices. There is a high potential for structural degradation of this landunit if stocking rates are not carefully monitored. Land management requirements for this landunit include:

- Careful monitoring of stocking rates to limit land degradation;
- Fencing off of areas susceptible to erosion i.e. steep river banks; and
- Careful application of fertilisers as not to cause eutrophication of the river.

5.6 Landunit 6

Landunit 6 was found to be unsuitable for viticulture, general horticulture and intensive grazing and was found to be marginally suitable for general grazing.



The close proximity to the Hastings River and the inherent flood potential prohibit the undertaking viticulture and general horticulture on this landunit. The erosion prone alluvial soils of this land unit prohibit the use for intense grazing, as it would not be sustainable given the high stocking rates and the accompanying land degradation issues.

The same land management practices as landunit 5 apply to this landunit.

5.7 Practical considerations

The agricultural suitability of the Le Clos Verdun Estate was assessed as a single entity. No consideration was given to the fact that the estate is comprised of over 171 separate lots, owned by approximately 130 different landowners and used for both residential and rural landuse.

Considering the average parcel size of rural land is approximately 1.2 hectares, especially grazing and viticulture, the undertaking of an agricultural enterprise by a sole land owner is not considered to be environmentally or financially viable.

6.0 CONCLUSION

An agricultural suitability assessment was carried out for the Le Clos Verdun Estate, Sancrox, New South Wales. The suitability of agricultural enterprises, such as viticulture, general horticulture, intensive and general grazing land was assessed.

The assessment was carried by:

— reviewing historical information;
— conducting a desktop geological, hydrogeological, soil and topography study;
— assessing site soils for selected physical and chemical attributes;
— compiling all data into a local geographic information system (GIS);
— deriving landunits of varying characteristics; and
— assessing the suitability of these landunits by comparing the requirements of grape vines and other agricultural enterprises to the attributes of the landunits.

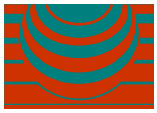
The assessment differentiated six landunits of varying physical and chemical attributes. The attributes of these landunits were compared to the requirements of the nominated agricultural enterprises. For each of the agricultural enterprises within each landunit the following classifications were made:

— Not suitable;
— Marginally suitable
— Suitable; and
— Ideal.

The majority of these landunits were found to be marginally suitable for the variety of agricultural enterprises chosen. This assessment was largely based on the highly acidic and sodic nature of the soils present onsite which is a limiting factor to optimum plant growth.

Implementing management plans for the identified limitations of the landunits is not likely to be practical due to the cost of such improvements. The improvements themselves may increase the potential for environmental impacts such as nutrient run-off, erosion and eutrophication of the nearby water courses. Additionally it is not known who will be responsible for the monitoring of the implementation.

The fact that the site is divided in to a number of separately owned parcels of an average are of 1.2 hectares limits the financial viability of most agricultural enterprises. Increasing the



viability of these parcels would require significant inputs and intense farming practices. This would result in significant environmental degradation of the land itself and the sensitive ecosystems surrounding the site (Hastings River).

As no landunit was found to be ideally suited to the chosen agricultural enterprises (viticulture, grazing land, and general horticulture) and that significant improvements or best management practices would be required to address the identified limitations, it is concluded that the Verdun Estate is not "prime agricultural land" as per the following definitions:

" land which occurs where the agronomic factors (e.g. soils and management) and environmental factors (e.g. climate, water quality and availability) combine so that the value to society from agriculture is greater than the value from alternative uses of the land." (Department of Agriculture Western Australia 2001)

"the land best suited to food, feed, forage, fiber, and oilseed crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment" (The United States Department of Agriculture)

This conclusion was reflected by the poor grape yields recorded for the Le Clos Verdun Estate between the years 1994 and 1999 and the financial losses incurred over this period.

7.0 LIMITATIONS

The work presented in this report is Environmental & Earth Sciences Pty Ltd's response to the specific scope of work set out in PO104024 requested by, planned with and approved by Adrian Smith on behalf of Le Clos Redevelopment Committee. Professional advice and opinion provided in this report No.104029 is for Le Clos Redevelopment Committee requesting the work only, in accordance with the agreed scope of work and is not to be relied on by any other third party for any and all purposes except with the prior written consent of Environmental & Earth Sciences Pty Ltd (which consent may or may not be given at its discretion).

A report is provided inclusive of all documentation sections, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

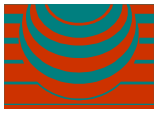
Interpretation of the collated data was undertaken based on the referred material and opinions between Environmental & Earth Sciences Pty Ltd may vary from that of other parties. Interpretation was based on the information received for the individual sampling locations and as Environmental & Earth Sciences were not contracted to undertake a site visit, information presented in this report may vary from actual reality.

The interpretation and derivation of the landunits was based on maps of varying scales and the actually accuracy of boundaries, relative levels or coordinates presented in figures may vary considerably to reality. As such these figures should only be used to provide approximate real world locations.

Site assessments identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Data obtained from the sampling and subsequent laboratory analyses are interpreted by scientists and opinions are presented regarding the overall soil conditions. Actual conditions between sampling locations may differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimise the impact. Sub-surface conditions can change by natural processes and site activities. This report presents the conditions assessed at the time the investigation/ study was undertaken.

Disclaimer

The preparation of this report has been undertaken for the purpose of providing the results of an agricultural assessment at the Le Clos Verdun Estate NSW and it is not intended that this report should be used for any other purpose. This report is provided on the condition that Environmental & Earth Sciences Pty Ltd disclaims all liability to any person or entity other than Le Clos Redevelopment Committee in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, of the contents of this report. Furthermore, Environmental & Earth Sciences disclaims all liability to Le Clos Redevelopment Committee in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental & Earth Sciences Pty Ltd's proposal number po104042 dated 22 September 2003 and according to Environmental & Earth Sciences general terms and conditions and specials terms and conditions.



8.0 GLOSSARY OF TERMS

The following descriptions are of terms used in this reports. A list of the references used in providing this glossary are presented in Section 9 of this report.

Abrupt boundary - boundary is less than 2 cm wide.

Acid Sulfate Soil (ASS) - soil containing iron sulfides deposited during either the Pleistocene or Holocene geological periods (Quaternary aged) as sea levels rose and fell.

Aeolian - the deposition of unconsolidated wind blown soil material.

Alluvial – describes material deposited by, or in transit in, flowing water.

Apedal - describes a soil in which none of the soil material occurs in the form of peds or soil aggregates in the moist state.

Borehole – an uncased well drill hole.

Cation Exchange Capacity (CEC) – maximum positive charge required to balance the negative charge on colloids (clays and other charged particles) is called the cation exchange capacity. The units are milliequivalents per 100 grams of material or centimoles of charge per kilogram of exchanger.

Cobble – rock fragment, rounded or abraded between 64 and 256 mm in diameter. Cobbles are larger than gravel and smaller than boulders.

Colluvial - soil and rock material moved downslope by gravity.

Composite sample - the bulking and thorough mixing of soil samples collected from more than one sampling location to form a single soil sample for chemical analysis.

Conductivity (EC) – conductivity of water is an expression of its ability to conduct an electric current. This property is related to the ionic content of the sample, which is in turn a function of the total dissolved (ionisable) solids (TDS) concentration. An estimate of TDS in fresh water can be obtained by multiplying EC by 0.65.

Confining layer – an aquitard or impermeable layer that confines the limits of an aquifer.

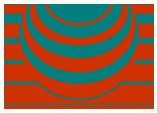
Discrete sample – samples collected from different locations and depths that will not be composited but analysed individually.

Dispersion – process by which species in solution mix with a second solution, thus reducing in concentration. In particular, relates to the reduction in concentration resulting from the movement of flowing groundwater.

Duplex - these soils show a strong texture differentiation within the A horizon, and generally comprise loose coarse sands to massive or weak platy loams and clay loams but coarser textures are common.

Earthy - the soil has few, if any, peds and most of the sand grains are covered by finer material.

Electrolytic conductivity (EC) - a measure of the extent to which water conducts an electrical current and is related to the total concentration and relative proportions of the



dissolved ionised substances within the water, and the temperature at which the determination is made.

Estuarine - pertaining to the area where a water body or river widens as it nears the sea.

Fluvial - material deposited by or in transit in streams or watercourses.

Gley - grey or greenish colouration found in soil that is often produced under poor drainage conditions.

Gradational - the lower boundary between soil layers (horizons) has a gradual transition to the next layer. The solum (soil horizon) becomes gradually more clayey with depth.

Horizon - individual soil layer, based on texture and colour, which differs from those above and below.

Humic/Humus - referring to organic matter within soil.

Hydraulic conductivity - the rate of water movement through soil.

Lithosol - shallow soils showing minimal profile development and dominated by the presence of weathered rock and rock fragments.

Massive - refers to the condition of the soil layer in which the layer appears to be as a coherent or solid mass which is largely devoid of peds.

Mottled - masses, blobs or blotches of sub-dominant colours with varying value/chroma (colour grades) in the soil matrix.

Nodule - a small, concretionary (hard) deposit, usually of iron and/or manganese.

Peat - organic matter partly decomposed by water, heat and microbes, and partly carbonised and mineralised.

Ped - an individual natural soil aggregate. In an undisturbed state peds will group together to form larger aggregates.

Pedal - refers to the proportion of peds in the soil.

Pedogenesis - formation of natural soil aggregates over time.

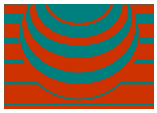
Pedomorphological - characteristic features of an individual natural soil aggregate.

Permeability - Property of porous medium relating to its ability to transmit or conduct liquid (usually water) under the influence of a driving force, ie. the rate of water movement through soil (or rock). Also refereed to as hydraulic conductivity.

pH - negative log of hydrogen ion activity, measurement of the acidity or alkalinity of the soil or water. A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.

Plastic - soil material which is in a condition that allows it to undergo permanent deformation without appreciable volume change or elastic rebound, and without rupture.

Podzolic - mottled texture and strongly differentiated profile contrast between A and B horizons. Horizon boundaries are usually clear to gradual.



Potential Acid Sulfate Soil (PASS) - soil that contains sulfidic material that has not been

Profile - the solum. This includes the soil A and B horizons and is basically the depth of soil to weathered rock.

Siliceous - having a proportion of quartz (mostly sands).

Sodic - the term given to soil with a level of exchangeable sodium cations greater than 10-15% of the soils cation exchange capacity (CEC), or soluble sodium cations greater than 10-15 times the square root of soluble calcium and magnesium cations. These terms are known as exchangeable sodium percentage (ESP) and sodium adsorption ratio (SAR) respectively.

Solod/Solodic - soil with strong gradational texture contrast between mildly leached, slightly alkaline loamy pale topsoil and alkaline clay subsoil with coarse blocky or columnar structure. Have bleached A_2 horizons and alkaline B and C horizons.

Solonchak - soils dominated by salt accumulation, which have a powdery structure and polygonal cracking and slaking of the surface.

Solonetz - soils with prominent texture differentiation, loamy topsoils and strongly alkaline clay subsoils. The subsoils have a coarse blocky or columnar structure.

Soloth - acid soil with strong texture contrast between pale topsoil and clay subsoil with coarse blocky or columnar structure.

Texture - is the size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

9.0 REFERENCES

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APPENDIX A

GEOTECHNICAL BORE/TEST PIT LOGS

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 2

TEST PIT No: 26
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.25	"D	ALLUVIM. Silty sandy CLAY, pale grey brown, medium to high plasticity, sands fine to medium grained, mc > wp.
0.50	"D"	RESIDUAL. sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75		
1.00		
1.25		
1.50		Test Pit terminated 1.5 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample py pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST BORE REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 5.1.04
Lot No: 109/110

BOREHOLE No 1
METHOD OF ADVANCE: Spiral Flight Auger

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL/ALLUVIUM. Clayey silty SAND, grey brown, sands fine to medium grained, low to non plastic fines, dry.
0.25	"D"	RESIDUAL. Silty sandy CLAY, yellow grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.50		
0.75		
1.00	"D"	RESIDUAL. Silty sandy CLAY, yellow/green grey, medium to high plasticity, sands fine to coarse grained, mc > wp.
1.25		
1.50		Becoming extremely weathered siltstone.
		Borehole terminated 1.5 metres.
1.75		
2.00		

RIG: Jacro
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST BORE REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 5.1.04
Lot No: 112/113

BOREHOLE No 2
METHOD OF ADVANCE: Spiral Flight Auger

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL/ALLUVIUM. Clayey silty SAND, grey brown, sands fine to medium grained, low to non plastic fines, dry.
0.25	"D"	RESIDUAL. Silty sandy CLAY, yellow grey green, medium to high plasticity, sands fine to medium grained, mc > wp.
0.50		
	"D"	Gravelly sandy CLAY, orange brown, medium to high plasticity, sands fine to coarse grained, trace of fine gravel, mc > wp.
0.75		
1.00	"D"	RESIDUAL. Silty sandy CLAY, pale grey, high plasticity, sands fine to medium grained, mc > wp.
1.25		
1.50		Borehole terminated 1.5 metres.
1.75		
2.00		

RIG: Jacro
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST BORE REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 5.1.04
Lot No: 115/110

BOREHOLE No 3
METHOD OF ADVANCE: Spiral Flight Auger

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE. STRENGTH. MOISTURE. COLOUR. ORIGIN)
0.25	"D"	TOPSOIL/ALLUVIUM. Silty SAND, dark brown, sands fine to medium grained, low to non plastic fines, dry.
0.50	"D"	RESIDUAL. Sandy CLAY, grey brown, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75		
1.00	"D"	RESIDUAL. Sandy CLAY, yellow/grey, medium to high plasticity, sands fine to medium grained, mc > wp.
1.25		
1.50		
1.75		Borehole terminated 1.5 metres.
2.00		

RIG: Jacro
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST BORE REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 5.1.04
Lot No: 118/119

BOREHOLE No 4
METHOD OF ADVANCE: Spiral Flight Auger

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL/ALLUVIUM. Clayey silty SAND, brown, sands fine to medium grained, fines of low to medium plasticity, dry.
0.25	"D"	SLOPEWASH. Silty sandy CLAY, orange & grey brown, medium plasticity, sands fine to medium grained, mc > wp.
0.50	"D"	RESIDUAL. Sandy CLAY, mottled red grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75	"D"	RESIDUAL. Sandy CLAY, pale grey with some red mottling, medium to high plasticity, sands fine to medium grained, mc > wp.
1.00		
1.25		
1.50		Borehole terminated 1.5 metres.
1.75		
2.00		

RIG: Jacro
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST BORE REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 5.1.04
Lot No: 120/121

BOREHOLE No 5
METHOD OF ADVANCE: Spiral Flight Auger

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL/ALLUVIUM. Silty SAND, dark brown, sands fine to medium grained, low to non plastic fines, dry.
0.50	"D"	RESIDUAL. Sandy CLAY, mottled yellow/grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75	"D"	RESIDUAL. Silty sandy CLAY, yellow grey, medium to high plasticity, sands fine to medium grained, mc > wp.
1.00		
1.25		
1.50		
1.75		Borehole terminated 1.5 metres.
2.00		

RIG: Jacro
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed core sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 104

TEST PIT No: 1
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, dark grey, sands fine to medium grained, low to non plastic fines, mc < wp.
0.50	"D"	RESIDUAL. Silty sandy CLAY, grey brown with some orange mottling, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75	"D"	RESIDUAL. Silty CLAY, pale grey with some orange staining, medium to high plasticity, sand fine to medium grained, mc > wp.
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample cp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 93 066 029 329

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 103

TEST PIT No: 2
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines, mc < wp.
0.25	"D"	ALLUVIUM/SLOPEWASH. Silty sandy CLAY, dark grey brown, medium to high plasticity, sands fine to medim grained, mc > wp.
0.50	"D"	RESIDUAL. Silty CLAY, yellow grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75		
1.00		
1.25		
1.50		Test Pit terminated 1.5 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 101

TEST PIT No: 3
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, pale grey, sands fine to medium grained, non plastic fines, dry.
0.35	"D"	RESIDUAL. Silty sandy CLAY, grey brown, medium to high plasticity, sands fine to medim grained, mc << wp.
0.60	"D"	SANDSTONE. Grey/white & orange, fractured.
0.75		Test Pit terminated 0.7 metres, backhoe refusal on bedrock.
1.00		
1.25		
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 86

TEST PIT No: 4
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, pale grey, sands fine to medium grained, non plastic fines, dry.
0.50	"D"	RESIDUAL. Silty sandy CLAY, grey brown with some orange mottling, medium to high plasticity, sands fine to medim grained, mc > wp.
0.75	"D"	
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample (p) pocket penetrometer

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 95

TEST PIT No: 5
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	ALLUVIUM. Clayey silty SAND, grey, sands fine to medium grained, fines of low to medium plasticity, mc < wp.
0.50	"D"	RESIDUAL. Silty sandy CLAY, orange grey brown, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75	"D"	RESIDUAL. Sandy CLAY, orange brown, medium to high plasticity, sands fine to medium grained, mc > wp.
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 88

TEST PIT No: 6
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	ALLUVIUM. Clayey silty SAND, grey, sands fine to medium grained, fines of low to medium plasticity, mc < wp.
0.50	"D"	RESIDUAL. Sandy CLAY, orange brown, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75		
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 79/80

TEST PIT No: 7
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, dark brown, sands fine to medium grained, low to non plastic fines.
0.50	"D"	RESIDUAL. Sandy CLAY, orange grey brown, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75	"D"	RESIDUAL. Silty CLAY, pale grey with some orange staining, medium to high plasticity, sand fine to medium grained, trace of fine gravel, mc > wp.
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

07/03

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 74

TEST PIT No: 8
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.80	"D"	ALLUVIUM. Silty SAND, grey brown, sands fine to medium grained, low to non plastic fines, dry.
1.50	"D"	RESIDUAL. Silty sandy CLAY, grey, medium to high plasticity, sands fine to medium grained, mc > wp.
2.00		Test Pit terminated 1.5 metres.

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 73

TEST PIT No: 9
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.50	"D"	RESIDUAL. Sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to coarse grained, mc > wp.
1.00	"D"	RESIDUAL. Sandy CLAY, pale grey with some orange mottling, medium plasticity, sands fine to coarse grained, mc > wp.
1.25		
1.50		Test Pit terminated 1.5 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 67/69

TEST PIT No: 10
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, dark grey, sands fine to medium grained, low to non plastic fines.
0.25	"D"	RESIDUAL. Sandy CLAY, grey brown with some orange mottling, medium to high plasticity, sands fine to medium grained, mc > wp.
0.60	"D"	RESIDUAL. Silty CLAY, pale grey with some orange staining, medium to high plasticity, sand fine to medium grained, mc > wp.
0.75		
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 64

TEST PIT No: 11
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, dark grey, sands fine to medium grained, low to non plastic fines.
0.80	"D"	SLOPEWASH. Silty sandy CLAY, grey brown, medim to high plasticity, sans fine o coarse grained, mc > wp.
1.50	"D"	RESIDUAL. Silty CLAY, pale grey brown with some orange staining, medium to high plasticity, sand fine to medium grained, mc > wp.
2.00		Test Pit terminated 1.5 metres.

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 59

TEST PIT No: 12
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Clayey silty SAND, dark grey, sands fine to medium grained, fines of low to medium plasticity, mc > wp.
0.25	"D"	RESIDUAL. Sandy CLAY, yellow grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.50	"D"	RESIDUAL. Sandy CLAY, grey with bright red mottling, medium to high plasticity, sands fine to medim grained, mc > wp.
0.75		
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 54/55

TEST PIT No: 13
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Clayey silty SAND, dark grey, sands fine to medium grained, low to non plastic fines, dry.
0.50	"D"	ALLUVIUM. Clayey silty SAND, grey, sands fine to medium grained, fines of low to medium plasticity, dry.
0.75	"D"	RESIDUAL. Silty sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to medium grained, mc > p.
1.00	"D"	RESIDUAL. Sandy CLAY, orange & grey, medium plasticity, sands fine to coarse grained, mc > wp.
1.25		Becoming extremely weathered sandstone.
1.50		
1.75		Test Pit terminated 1.5 metres.
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 49

TEST PIT No: 14
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	**TOPSOIL. Clayey silty SAND, dark grey, sands fine to medium grained, low to non plastic fines, dry.**
0.50	"D"	**RESIDUAL. Sandy Clay, mottled orange & grey, medium plasticity, sands fine to medium grained, mc < wp.**
0.75 1.00 1.25 1.50	"D"	**RESIDUAL. Silty sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to medium grained, mc > p.**
1.75 2.00		**Test Pit terminated 1.5 metres.**

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 46

TEST PIT No: 15
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Clayey silty SAND, dark grey, sands fine to medium grained, low to non plastic fines, dry.
0.50	"D"	RESIDUAL. Sandy Clay, mottled orange & grey, medium plasticity, sands fine to medium grained, mc < wp.
0.75	"D"	RESIDUAL. Silty sandy CLAY, yellow grey, medium to high plasticity, sands fine to medium grained, mc > wp.
1.00		
1.25		
1.50		
1.75		Test Pit terminated 1.5 metres.
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 41/42

TEST PIT No: 16
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.50	"D"	SLOPEWASH. Gravelly sandy CLAY, grey brown, medium to high plasticity, sands fine to medium grained, trace of fine gravel, mc > wp.
0.75	"D"	RESIDUAL. Gravelly sandy CLAY, grey, medium to high plasticity, sands fine to coarse grained, gravel fine to medium, mc . wp.
1.00		Moderately weathered sandstone, pale grey, highly fractured, with some interbedded seams of highly weathered material with soil like properties
1.25		Test Pit terminated 1.0 metre, backhoe refusal on bdrock.
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 38

TEST PIT No: 17
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.25	"D"	ALLUVIUM. Silty sandy CLAY, dark grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.50		
0.75		
1.00	"D"	RESIDUAL. Sandy CLAY, orange, medium to high plasticity, sands fine to medium grained, mc > wp.
1.25		
1.50		Test Pit terminated 1.5 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

U Undisturbed tube sample
B Bulk sample
pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 33/34

TEST PIT No: 18
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.25	"D"	ALLUVIUM. Clayey silty SAND, grey, sands fine to medium grained, fines of low plasticity, mc < wp.
0.50	"D"	RESIDUAL. Sandy CLAY, grey, medium to high plasticity, sands fine to medium grained, mc > wp.
0.75		
1.00		
1.25		
1.50		
		Test Pit terminated 1.5 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 29

TEST PIT No: 19
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, dark grey brown, sands fine to medium grained, low to non plastic fines.
0.25	"D"	SLOPEWASH. Gravelly silty sand, orange grey, sands fine to medium grained, low to non plastic fines, gravel fine to medium, mc < wp.
0.50	"D"	RESIDUAL. Clayey silty sand, orange, sands fine to medium grained, fines of low to medium plasticity, mc < wp.
0.75		
1.00	"D"	Moderately weathered sandstone, pale orange, highly fractured, with some interbedded seams of highly weathered material with soil like properties of clayey sand of low plasticity, mc < wp.
1.25		Test Pit terminated 1.0 metre, virtual backhoe refusal.
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 24

TEST PIT No: 20
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, dark grey brown, sands fine to medium grained, low to non plastic fines.
0.25	"D"	RESIDUAL. Silty sandy CLAY, orange grey, low to medium plasticity, sands fine to coarse grained, trace of fine to medium sandstone gravel, mc < wp.
0.50	"D"	Moderately weathered sandstone, pale grey, highly fractured, with some interbedded seams of highly weathered material with soil like properties of clayey sand of low plasticity, mc < wp.
0.75		
1.00		Test Pit terminated 1.0 metre, virtual backhoe refusal.
1.25		
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 19

TEST PIT No: 21
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, grey, sands fine to medium grained, low to non plastic fines.
0.50	"D"	ALLUVIUM. Silty sandy CLAY, grey brown, medium to high plasticity, sands fine to medium grained, mc < wp.
0.75	"D"	RESIDUAL. sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to medium grained, mc > wp.
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample po pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 17

TEST PIT No: 22
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
0.25	"D"	TOPSOIL. Silty SAND, grey brown , sands fine to medium grained, low to non plastic fines.
0.50		ALLUVIUM. Silty sandy CLAY, orange & grey brown, low to medium plasticity, sands fine to medium grained, mc < wp.
0.75	"D"	RESIDUAL. sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to coarse grained, mc > wp.
1.00		
1.25		
1.50		Test Pit terminated 1.4 metres.
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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PO Box 6720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 13

TEST PIT No: 23
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL, Silty SAND, grey brown , sands fine to medium grained, low to non plastic fines.
0.25	"D	RESIDUAL, Gravelly sandy CLAY, grey, low to medium plasticity, sands fine to coarse grained, with some fine to medium gravel, mc < wp.
0.50		
	"D"	Moderately weathered sandstone, pale grey, highly fractured, with some interbedded seams of highly weathered material with soil like properties of clayey sand of low plasticity, mc < wp.
0.75		
1.00		
1.25		Test Pit terminated 1.2 metres, virtual backhoe refusal.
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
LOGGED: SC
REMARKS:

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

ABN 83 066 029 329

PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 10

TEST PIT No: 24
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Gravelly silty SAND, grey brown , sands fine to medium grained, gravel fine to medium, low to non plastic fines.
0.28	"D	RESIDUAL. Gravelly sandy CLAY, grey, low to medium plasticity, sands fine to coarse grained, gravel fine to medium, mc < wp.
0.60		
	"D"	Moderately weathered sandstone, pale grey, highly fractured, with some interbedded seams of highly weathered material with soil like properties of clayey sand of low plasticity, mc < wp.
0.75		
1.00		
1.25		Test Pit terminated 1.2 metres, backhoe refusal.
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

Chandler Geotechnical Pty Ltd

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PO Box 5720 Port Macquarie NSW 2444 Phone (02)65810142 Fax (02)65810129

TEST PIT REPORT

CLIENT: Le Clos Redevelopment Comittee
PROJECT: Proposed Subdivision
LOCATION: Le Clos Verdun

PROJECT No: 23082
DATE: 11.11.03
Lot No: 4, 5, 6 & 7

TEST PIT No: 25
METHOD OF ADVANCE: Backhoe

DEPTH METRES	SAMPLES TESTS	DESCRIPTION OF STRATA (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
	"D"	TOPSOIL. Silty SAND, grey brown , sands fine to medium grained, low to non plastic fines.
0.25	"D	RESIDUAL. sandy CLAY, grey with some orange mottling, medium to high plasticity, sands fine to coarse grained, with some fine to medium gravel, mc > wp.
0.50		
0.75	"D"	RESIDUAL. Sandy GRAVEL, (moderately weathered sandstone), grey, gravel fine to coarse, sands fine to coarse, low to non plastic fines, dry.
1.00		
1.25		Test Pit terminated 1.2 metres, virtual backhoe refusal.
1.50		
1.75		
2.00		

RIG: Backhoe
GROUND WATER: None encountered
REMARKS:

LOGGED: SC

SAMPLES & TESTS

D Disturbed sample U Undisturbed tube sample
B Bulk sample pp pocket penetrometer

APPENDIX B

APPENDIX C

GEOLOGICAL BORELOGS

APPENDIX D

LABORATORY TRANSCRIPTS

APPENDIX E

ROOT RAW CALCULATIONS

RAW calculations - Verdun

Location	Depletion factor	Topsoil TAW mm/m of soil depth	Topsoil RAW mm/m of soil depth	Subsoil TAW mm/m depth of soil	Subsoil RAW mm/m of soil depth	Top soil depth m	Subsoil to base of root zone m	Estimated root zone depth (ERZ) m
BH1	0.5	170	85	150	75	0.2	0.25	0.45
BH2	0.5	170	85	150	75	0.2	0.2	0.4
BH3	0.5	170	85	150	75	0.4	0.25	0.65
BH4	0.5	170	85	150	75	0.2	0.4	0.6
BH5	0.5	170	85	150	75	0.3	0.2	0.5
TP1	0.5	170	85	150	75	0.25	0.2	0.45
TP2	0.5	170	85	150	75	0.25	0.75	1
TP3	0.5	170	85	150	75	0.25	0.2	0.45
TP4	0.5	170	85	150	75	0.25	0.2	0.45
TP5	0.5	170	85	150	75	0.25	0.2	0.45
TP6	0.5	170	85	150	75	0.25	0.25	0.5
TP7	0.5	170	85	150	75	0.25	0.2	0.45
TP8	0.5	170	85	150	75	0.25	0.45	0.7
TP9	0.5	170	85	150	75	0.25	0.2	0.45
TP10	0.5	170	85	150	75	0.25	0.2	0.45
TP11	0.5	170	85	150	75	0.25	0.75	1
TP12	0.5	170	85	150	75	0.1	0.2	0.3
TP13	0.5	170	85	150	75	0.25	0.45	0.7
TP14	0.5	170	85	150	75	0.3	0.2	0.5
TP15	0.5	170	85	150	75	0.25	0.2	0.45
TP16	0.5	170	85	150	75	0.3	0.5	0.8
TP17	0.5	170	85	150	75	0.25	0.75	1
TP18	0.5	170	85	150	75	0.25	0.4	0.65
TP19	0.5	170	85	150	75	0.25	0.55	0.8
TP20	0.5	170	85	150	75	0.2	0.15	0.35
TP21	0.5	170	85	150	75	0.3	0.3	0.6
TP22	0.5	170	85	150	75	0.25	0.45	0.7
TP23	0.5	170	85	150	75	0.25	0.35	0.6
TP24	0.5	170	85	150	75	0.25	0.2	0.45
TP25	0.5	170	85	150	75	0.25	0.2	0.45
TP26	0.5	170	85	150	75	0.25	0.35	0.6
		*Based on Clay loam -silty clay loam		*Based on Clay			RAW = TAW * Depletion factor*depth of ERZ	

References:

1. Department of Primary Industry – Queesnland ?'? www.dpi.qld.gov.au/fieldcrops/10908.html
2. Department Of Natural Resources Queensland – http://www.nrme.qld.gov.au/factsheets/pdf/water/w41.pdf