A REPORT ON RESIDENTIAL LAND CAPABILITY AND AGRICULTURAL LAND SUITABILITY IN THE SHIRE OF CAMPASPE

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Natural Resources an

Further Information

This report has been prepared to assist with land use planning in the Shire of Campaspe. The information in the report has been derived from existing land resource information and limited field examination and verification. The scale of mapping adopted has necessitated some generalisations from the information collated. While the land capability/suitability classes indicate the likely performance of land for residential land use or an agricultural enterprise, site specific information will still be required for on-site planning.

The precision of mapped boundaries is affected by the scale of the map. Any enlargement of the map will distort information and is unlikely to improve its accuracy.

The complete set of maps which accompany this report can be viewed at the Shire of Campaspe Municipal Office.

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SUMMARY

Land use and land management practices will continue to change. If the community is concerned about the long-term sustainability of various forms of land use, then the physical limitations imposed by the land, the various processes of land degradation, and the possibility of off-site impacts, must be recognised. Once the physical limitations for a particular land use are identified, steps can be taken to match that particular land use with a suitable land type(s), develop and implement relevant management practices (ie. Victorian Code of Cattle Feedlots), and overcome or minimise the potential long-term impacts of land and water degradation.

The Shire of Campapse through it's Integrated Strategy Plan (1996), has recognised the need for a land capability/suitability study to assist in achieving sustainable agricultural and rural residential development throughout the Shire. In addition, this report will be listed as a reference document in the new planning scheme for the Shire of Campaspe. The report will therefore become a statutory part of the planning scheme.

For the purpose of this report, land capability and land suitability assessments are concerned with the physical constraints imposed by the landform and soils. No social or economic criteria were considered in this report. Land capability assessments have five capability classes and refer to land utilised for rural residental/urban development, while land suitability assessments have three suitability classes and refer to land utilised for agriculture.

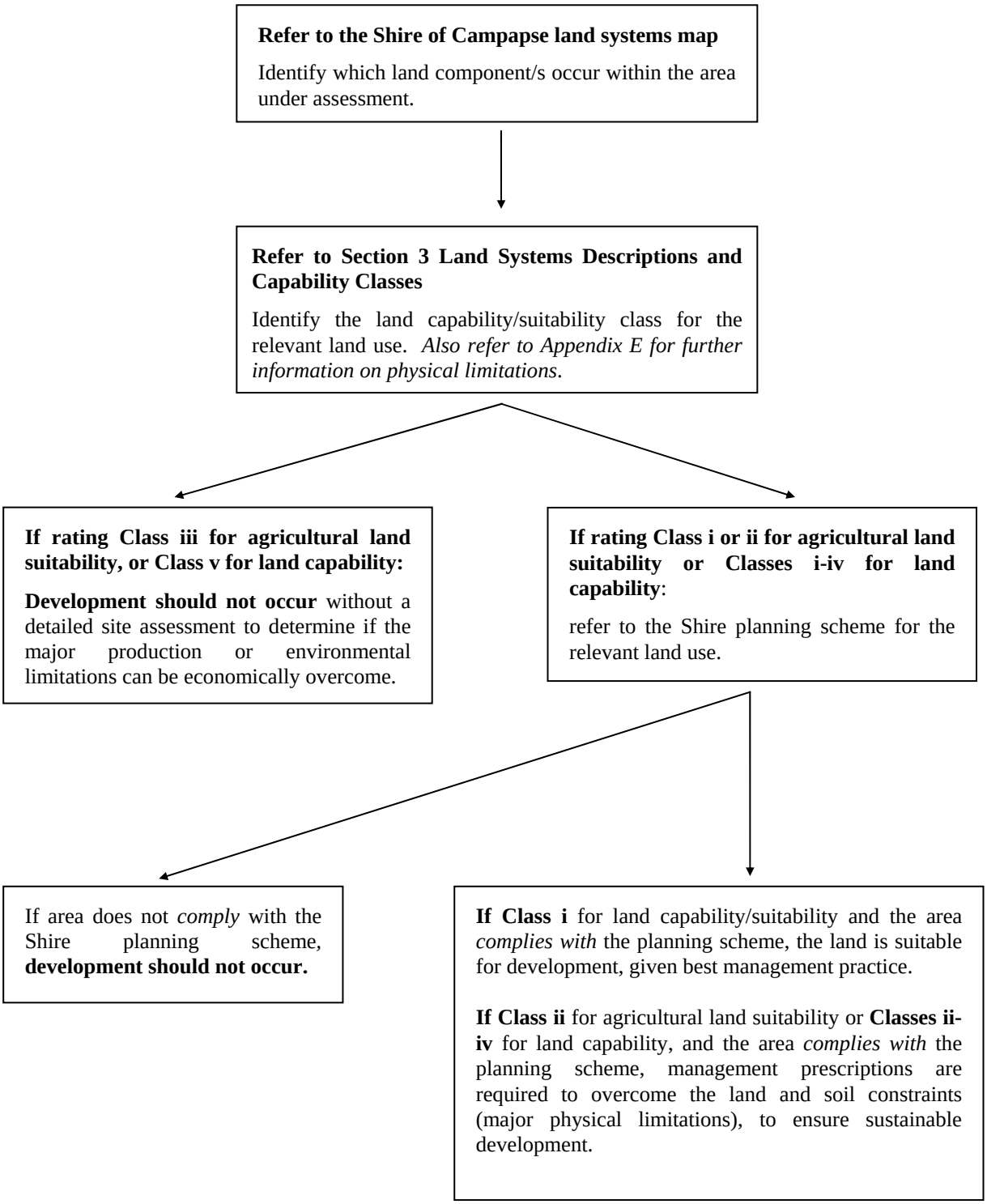
Land capability/suitability classes have been determined for each land system and land component within the Shire of Campaspe (Please refer to Table i.i below, in conjunction with the Shire of Campapse Land Systems Map). For greater planning detail, please refer to Section Three of this report.

TABLE i.i Summary of land capability/suitability classes

Land system		Land suitability class								Land capability class				
Name and component		**Rice**	**Irrigated cropping**	**Irrigated perennial pasture**	**Irrigated perennial horticulture**	**Irrigated tomatoes**	**Irrigated farm forestry**	**Dryland olives**	**Dryland viticulture**	**Broadacre effluent (Feedlots)**	**Septic tanks**	**Secondary roads**	**Low density**	**Rural living**
Murray and Campaspe active floodplains	***1***	iii	ii	ii	iii	ii	ii	iii	iii	v	v	iv	v	v
	2	ii	iii	iii	iii	ii	iii	iii	iii	v	v	v	v	v
	3	i	iii	iii	iii	ii	iii	iii	iii	v	v	v	v	v
	4	iii	ii	ii	iii	i	ii	iii	iii	v	v	v	v	v
Corop wetland complex	***1***	ii	iii	iii	iii	ii	iii	iii	iii	iv	iv	iv	v	iv
	2	ii	iii	iii	iii	ii	iii	iii	iii	iv	iv	iv	v	iv
	3	iii	iii	iii	i	i	iii	i	i	ii	ii	ii	ii	ii
	4	ii	ii	ii	iii	ii	iii	iii	iii	iv	iv	iv	v	iv
Prior streams alluvial plain	***1***	i	iii	iii	iii	i	iii	iii	iii	v	v	iv	v	iv
	2	i	iii	iii	iii	ii	iii	iii	iii	v	v	iv	v	iv
	3	ii	ii	ii	ii	ii	ii	ii	ii	iv	iv	iv	iv	iv
	4	iii	i	ii	ii	i	ii	ii	ii	iv	iv	iii	iv	iii
	5	iii	i	i	i	i	i	i	i	ii	ii	iii	iii	iii
Treeless alluvial plain	***1***	i	iii	iii	iii	ii	iii	iii	iii	v	v	iv	v	iv
	2	i	iii	iii	iii	ii	iii	iii	iii	v	v	iv	v	iv
	3	ii	iii	iii	iii	ii	iii	iii	iii	v	v	iv	v	iv
	4	iii	ii	ii	ii	ii	ii	ii	ii	ii	ii	iv	v	iv
	5	iii	ii	i	ii	ii	ii	ii	ii	ii	ii	iv	iv	iv
Knowsley low sedimentary hills	***1***	iii	iii	iii	iii	iii	iii	iii	iii	iv	iv	iii	iv	iii
	2	iii	iii	iii	ii	ii	iii	ii	ii	ii	ii	iii	iii	iii
	3	iii	iii	ii	iii	ii	iii	iii	iii	ii	ii	iv	iv	iv
Rushworth low sedimentary hills	***1***	iii	iii	iii	iii	iii	iii	iii	iii	v	v	iii	v	iv
	2	iii	iii	iii	ii	ii	iii	ii	ii	iii	iii	iii	iii	iii
	3	iii	iii	ii	iii	ii	iii	iii	iii	iv	iv	iv	iv	iv
Myola east low sedimentary hills	***1***	iii	iii	iii	iii	iii	iii	iii	iii	iv	iv	iv	iv	iv
	2	iii	iii	ii	ii	ii	iii	ii	ii	iii	iii	iii	iii	iii
	3	iii	iii	ii	iii	ii	iii	iii	iii	iv	iv	iv	iv	iv
	4	iii	iii	iii	iii	iii	iii	iii	iii	iii	iii	ii	iii	ii
Mt Camel rolling low volcanic hills	***1***	iii	iii	iii	iii	iii	iii	iii	iii	v	v	v	v	v
	2	iii	iii	iii	ii	ii	iii	ii	ii	iii	iii	iv	iv	iv
	3	iii	ii	ii	iii	ii	ii	iii	iii	iv	iv	iv	iv	iv

USER GUIDE

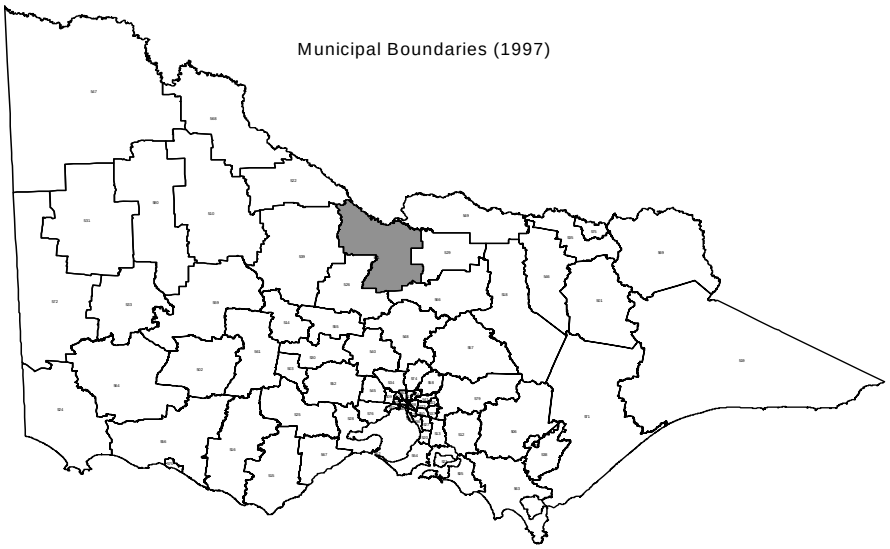
Procedure for applying land capability/land suitability information



1. INTRODUCTION

The Shire of Campaspe is situated in northern Victoria adjacent to the Murray River (see Figure 1.1). The Shire is predominantly rural and supports a wide range of conventional dryland and irrigated agriculture. In particular, broadacre cropping, mixed farming and grazing in dryland areas, with dairying, broadacre cropping and intensive horticulture in irrigated districts. More recently, other agricultural enterprises have been established such as piggeries, feedlots and vineyards.

Figure 1.1 Location of the Shire of Campaspe



The Shire of Campaspe has a range of landforms and soils that are capable of sustaining a wide variety of agricultural pursuits. A large opportunity therefore exists for the expansion of existing or emerging agricultural enterprises, which have the potential to provide a major regional development stimulus.

The continued development of existing and new agricultural enterprises is seen as fundamental to the future well being of the Shire. Therefore, in further developing the agricultural sector, the Shire has acknowledged that it must be sustainable agricultural development. This has been highlighted in the Shire of Campaspe - Integrated Strategy Plan (1996). The Objective Statement for agriculture is listed below:

Viable and sustainable agriculture is seen as fundamental to the existing and future well being of the Shire and its residents. The Shire encourages traditional and emerging agricultural activities and practices that:

- are ecologically sustainable;
- incorporate best management principles;
- introduce diversity and productivity improvements; and
- will assist in the development of value adding enterprises.

Sustainable agricultural development requires that each agricultural enterprise be suited to the particular climate, landform and soil type so that optimum production can be achieved without causing on-site or off-site land and/or water degradation.

A number of local policies were established in the Integrated Strategy Plan to support the sustainable development of agriculture in the Shire. The implementation of these specific agricultural policies will now occur through the Shire's new planning scheme. The planning scheme will incorporate these policies, and have additional overlays and provisions to encourage appropriate land use and management.

A number of actions were recommended in the Integrated Strategy Plan to assist in achieving the Shire's agricultural objective and policies. The preparation of a land capability study was one of these actions. The intent of a land capability study is to provide base information on the nature of the land, and the likely performance of various land types, given a range of land use activities. This information can underpin many land use and management decisions made by the municipality, both now and in the future. There is a long list of costs associated with inappropriate land use and management. Planning schemes

developed with access to land capability information have now overcome many of the recurring planning mistakes which led to land and water degradation. Common benefits obtained through utilisation of the land capability information include:

- Reduced nutrient movement to surface and ground waters;
- Reduced soil erosion and other forms of land degradation and more insidious loss of environmental quality;
- Reduced costs to the community through unwise investment and prematurely obsolete infrastructure; and
- Minimisation of agricultural lands lost to less productive competing uses.

1.1 Purpose of the Study

This report aims to provide the Shire of Campaspe with a key reference document to support land use planning and management. In particular the report will enable the following:

- a comprehensive comparison between competing land uses;
- identification of suitable agricultural enterprise/land type combinations;
- identification of areas capable of supporting emerging agricultural enterprises;
- determination of best practice management for preferred land use/land type combinations; and
- determination of the susceptibility to land degradation of various land use/land type combinations.

1.2 Project Objectives

The objectives of the study are listed below.

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1. To map and describe freehold land in the Shire of Campaspe. The Shire will be mapped at 1:100 000 scale. This will involve identifying land components (including geology, soil types, topography, climatic zones) and other features relevant to the assessment of the land.

2. To determine land capability classes for low density residential development based on standardised rating tables for:

- septic tank effluent disposal; and
- secondary (gravel) roads.

3. To prepare standardised planning responses to overcome or manage the physical limitations identified for the following residential land use activities:

- septic tank effluent disposal; and
- secondary roads.

4. To determine the land suitability of a selected range of alternative agricultural land uses in dryland and irrigation areas, these include:

- broadacre effluent disposal (feedlots);
- rice;
- irrigated cropping (cereals, oilseeds, legumes);
- irrigated pasture (dairying);
- irrigated horticulture (stone fruits, pome fruits, viticulture, olives);
- irrigated tomatoes;
- irrigated agroforestry;
- dryland olives; and
- dryland viticulture.

2 LAND CAPABILITY/SUITABILITY ASSESSMENT

For the purpose of this report land capability and land suitability assessments are concerned with the physical constraints imposed by the land. The only distinction being that land capability is related to land utilised for residental/urban development, while land suitability is related to land utilised for agriculture. No social of economic criteria have been included in the land capability/suitability assessments.

Land capability/suitability assessment is a rational and systematic method of determining the ability of land to sustain a range of specified uses without causing significant long-term degradation.

The objectives of land capability/suitability assessments are:

i) to assist land managers and land use planners to identify areas of land with physical constraints for a range of specified land uses;

ii) to identify management requirements that will ensure a specified land use can be sustained without causing significant on-site or off-site land and water degradation.

iii) to promote both productive and sustainable development of rural land and industries.

To achieve these objectives, it is necessary to know the physical characteristics of the land, and understand the effects that a specified land use may have on the land and the water derived from it.

In land capability/suitability assessment, recurring land systems (landform patterns eg. low undulating hills) and components (landform elements eg. crests) are mapped, and the dominant landform, soil and climate characteristics are recorded. This information is then analysed to determine the ability of each land component to sustain a specified land use given standard management practices.

The ratings provided by a land capability/suitability assessment are not intended to restrict development of land, but rather to identify the principal constraints of that land for a specified land use. It is a matter for the land manager or land use planner to decide if the cost of overcoming the constraints is justified. Where particularly severe physical constraints exist, the planning authority has the option of excluding land from that use, or permitting the use only under strict management conditions. The placement of conditions on development permits is quite a proper exercise of planning responsibility.

2.1 Methodology and constraints

Due to the scale of mapping adopted for this study (1:100 000) and the inherent variability within some landscapes, it is possible that unrepresentative areas will occur within the land components mapped. In some cases, these areas may have a capability class exceeding that of the relevant land component.

The climate, landform and soils information presented in this study therefore represent the most common climate, landform and soil conditions identified within each land component. This information has been collated from both field investigation and a range of technical publications. These publications are referred to in the general text and Reference section of the report.

The land systems map prepared for this study is based upon the Victorian land systems coverage and soil association mapping held by the Department of Natural Resources and Environment.

Due to mapping restrictions, land components are not represented over the entire land systems map. Where this has occurred, the capability/suitability class for the most common land component has been used as a default class for the entire land system.

The following procedure has been adopted for this study:

i) Natural resource information from existing technical publications was compiled.

ii) The broad land systems and land components were mapped utilising a range of methods including: interpretation from aerial photos, digital elevation models, radiometrics, existing map sources and field verification.

iii) The land system/land component boundaries were entered into a Geographic Information System where the data was combined with base-map information on roads, contours and streams to produce a final base map of the study area.

iv) Representative landform and soils information was collated from relevant technical publications for each land component. The potential for land degradation in each map unit was also determined.

v) Where gaps in landform and soils information existed, detailed field examination was undertaken.

vi) Land suitability assessment tables were developed for each agricultural land use specified, while existing land capability assessment tables were used for effluent disposal and secondary roads.

vii) Land capability/suitability classes were determined for each land component by comparing climatic, landform and soils information against each of the land capability/suitability assessment tables.

viii) Where physical limitations were identified within land components, a standardised planning response was

developed in conjunction with municipal staff to overcome or suitably manage the specified land uses.

2.2 Land capability/suitability assessment tables

The land capability/suitability assessment tables presented in Section 2 contain landform, soil and climatic parameters which strongly influence the ability of the land to sustain a desired land use. There has been no attempt to rank these parameters in order of importance.

The parameters have been further divided to give three land suitability classes for land uses related to agricultural development (refer to Table 2.1), or five land capability classes related to low density residential development (refer to Table 2.2).

Capability/suitability classes are determined by comparing the parameters set out in the land capability/suitability assessment tables (refer Table 2.3 - 2.14) against the specific landform or soil conditions identified for each land component (refer to Section 3). The most limiting capability/suitability class identified in each assessment table will determine the overall class for the desired land use activity.

The land capability/suitability assessment tables are only concerned with the physical aspects of the land and soil. The overall land capability/land suitability class does not include the socio-economic aspects of development. If the land capability class is v (very poor capability) or the agricultural land suitability class is iii (unsuited), this rating should override the socio-economic considerations. If the land capability class is i - iv (very good to poor) and the agricultural land suitability class is i - ii (suited to generally suited), any socio-economic considerations outlined in the planning scheme or appropriate code of practice should still be considered.

Table 2.1 Land suitability classes for agriculture.

CLASS	SUITABILITY	DEFINITION
i	Suitable	Suited, with no major limitations to production and/or environmental damage given best management practice, and provided the development complies with the appropriate Code of Practice and the Planning Scheme.
ii	Generally suitable	Suited, but with some major limitations that increase the risk of production loss and/or environmental damage given best management practice, and provided the development complies with the appropriate Code of Practice and Planning Scheme. Management prescriptions are commonly required to overcome the major production and/or environmental limitations and ensure sustainable land use.
iii	Not suitable	Unsuited - due to severe limitations that significantly increase the risk of production loss and/or environmental damage. Best management practice and current technology cannot commonly overcome these limitations. Development should not occur without a detailed site assessment to determine whether the major production and/or environmental limitations can be overcome.

Table 2.2 Land capability classes for broadacre effluent disposal (feedlots), septic tanks and secondary roads.

CLASS	CAPABILITY	DEFINITION
i	Very good	Very high capability for the specified use; standard design and management techniques are satisfactory.
ii	Good	High capability for the specified use; standard design and improved management techniques are satisfactory
iii	Moderate	Moderate capability for the specified use; moderate land degradation hazard and/or engineering difficulties present; improved design and management techniques are required for development to take place.
iv	Poor	Low capability for the specified use, high land degradation hazard and/or considerable engineering difficulties present; extensively modified design and management techniques are required for development to take place.
v	Very poor	Long term land degradation hazard and/or severe engineering difficulties present; normally unsatisfactory for development unless specialised design and management techniques exist. These limitations are frequently too expensive to overcome with current technology.

Table 2.3 Land suitability assessment for irrigated rice production .

PARAMETERS INFLUENCING RICE PRODUCTION		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%) (assumes flood irrigation) +	0 - 0.5	0.5 - 1.0	> 1.0
Soil	Electrical conductivity (dS/m EC_e)**	< 3.8	3.8 - 8.6	> 8.6
	Estimated subsoil permeability	Very slowly permeable	Slowly permeable	Moderately, highly, very highly permeable
	Depth of sodic, heavy - medium clay in the top 3.6 m of the profile (m)*,++	> 3.0	-	< 3.0

+ Slope classes beyond the scope of the study, further information required

** Saturation extract

* 1997/98 GMW Guidelines for land suitability assessment for rice growing

++ Available information restricted to 1.5 - 2.0 metres, further on-site information is required

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability and quality of irrigation water;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc;

Table 2.4 Land suitability assessment for irrigated cropping (e.g. cereals, oilseed, legumes).

PARAMETERS INFLUENCING IRRIGATED CROPPING PRODUCTION		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%) (assumes furrow irrigation)*,+	0.5 - 0.25	0.25 - 0.05	> 0.5 < 0.05
	Site drainage	Well drained, moderately well drained, imperfectly drained	Poorly drained	Very poorly, rapidly drained
Soil	Depth of topsoil (cm)	>10	<10	-
	Depth to hard rock (m)	>1.0	1.0 - 0.5	< 0.5
	Proportion of stones and boulders (%)	<10	10 - 40	> 40
	Susceptibility to surface crusting	Low	Moderate, high	-
	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.0	< 1.0
	Total amount of water available to plants (mm)	> 150	150 - 30	< 30
	Electrical conductivity (dS/m EC_e)**	< 3.8	3.8 - 8.6	> 8.6
	Estimated subsoil permeability	Highly, moderately, slowly permeable	-	Very slow, very highly permeable

* From Irrigation and Drainage Practice, p55

+ Slope classes beyond the scope of the study, further information required

** Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability and quality of irrigation water;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc;

Table 2.5 Land suitability assessment for irrigated perennial pasture (dairying).

PARAMETERS INFLUENCING IRRIGATED PASTURE PRODUCTION		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%) (Assumes checkbank flood irrigation)*	0.06 - 1.0	0.1 - 2.0	< 0.06 >2.0
	Site drainage	Well, moderately well, imperfectly drained	Poorly drained	Very poorly, rapidly drained
Soil	Depth of topsoil (cm)	> 5	< 5	-
	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.0	< 1.0
	Total amount of water available to plants (mm)	> 150	150 - 50	< 50
	Electrical conductivity (dS/m EC_e)**	< 3.8	3.8 - 8.6	> 8.6
	Estimated subsoil permeability	Highly, moderately, slowly permeable	-	Very slowly, very highly permeable

* From Irrigation and Drainage Practice, p40

** Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability and quality of irrigation water;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc.

Table 2.6 Land suitability assessment for irrigated perennial horticulture (stone fruits, pome fruits).

PARAMETERS INFLUENCING PERENNIAL HORTICULTURE PRODUCTION		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%) (Assumes microspray/trickle irrigation)	< 20%	-	> 20%
	Site drainage	Well, moderately well drained	Imperfectly drained	Poorly, very poorly, rapidly drained
	Susceptibility to gully erosion	Low	Moderate , high	-
	Susceptibility to sheet/rill erosion	Low	Moderate, high	-
Soil	Depth of topsoil (cm)	> 10	< 10	-
	Depth to hard rock (m)	> 1.0	1.0 - 0.5	< 0.5
	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.0	< 1.0
	Electrical conductivity (dS/m EC_e)**	< 3.8	3.8 - 8.6	> 8.6
	Estimated subsoil permeability	Highly, moderately permeable	Slowly permeable	Very slowly , very highly permeable

** Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability and quality of irrigation water;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc;

Where access to irrigation and drainage infrastructure is unavailable, please refer to Table 2.9 for dryland olive production and Table 2.10 for dryland viticulture production.

Table 2.7 Land suitability assessment for irrigated tomato production.

PARAMETERS INFLUENCING TOMATO PRODUCTION		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%) (trickle or microspray irrigation)*,+	< 20	-	> 20
	Susceptibility to gully erosion	Low	Moderate - high	-
	Susceptibility to sheet/rill erosion	Low	Moderate - high	-
Soil	Depth of topsoil (cm)	> 5	< 5	-
	Depth to hard rock (m)	> 1.0	1.0 - 0.5	< 0.5
	Proportion of stones and boulders (%)	<10	10 - 40	> 40
	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.0	< 1.0
	Susceptibility to surface crusting	Low	Moderate, high	-
	Total amount of water available to plants (mm)	> 150	150 - 50	< 50
	Electrical conductivity (dS/m EC_e)**	< 3.8	3.8 - 8.6	> 8.6

* From TomCHECK Management Guidelines, pp2-3.

+ Slope classes beyond the scope of the study, further information required

** Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability and quality of irrigation water;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc;

Table 2.8 Land suitability assessment for irrigated farm forestry > 40 ha (Bluegum, Eucalyptus globulus).

PARAMETERS INFLUENCING IRRIGATED FARM FORESTRY		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%) (assumes flood irrigation)+	> 0.2	0.2 - 0.05	< 0.05
	Site drainage	Well, moderately well, imperfectly	Poorly	Very poorly, rapidly drained
Soil	Depth of topsoil (cm)	> 5	< 5	-
	Depth to seasonal watertable (m)	> 3.0	3.0 - 1.0	< 1.0
	Depth to hard rock (m)	> 150	150 - 80	< 80
	Electrical conductivity (dS/m EC_e)*	< 4.0	4.0 - 6.0	> 6.0
	Estimated subsoil permeability	Highly, moderately, permeable	Slowly permeable	Very slowly, very highly permeable

+ Slope classes beyond the scope of the study, further information required

* Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability and quality of irrigation water;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc;

Table 2.9 Land suitability assessment for dryland olive production.

PARAMETERS INFLUENCING OLIVE PRODUCTION		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%)	< 20	-	> 20
	Site drainage	Well, moderately well drained	Imperfectly drained	Poorly, very poorly, rapidly
	Susceptibility to gully erosion	Low	Moderate - high	-
	Susceptibility to sheet/rill erosion	Low	Moderate - high	-
Soil	Topsoil depth (cm)	> 10	< 10	-
	Depth to hard rock (m)	> 1.0	1.0 - 0.8	< 0.8
	Total amount of water available to plants (mm)	> 150	150 - 50	< 50
	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.0	< 1.0
	Electrical conductivity ($dS/m\ EC_e$)*	< 1.5	1.5 - 3.0	> 3.0
	Estimated subsoil permeability	Highly, moderately permeable	Slowly permeable	Very slowly, very highly permeable

* Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability of supplementary water supply;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc.

It is recommended that commercial vineyards or orchards not be established without access to a supplementary water supply for irrigation. Throughout the growing season, evapotranspiration exceeds rainfall in the Shire of Campaspe. As a result crops need to use water stored in the soil profile. In most seasons, water stored in the soil profile and rainfall during the growing season would be insufficient to meet the needs of the crop. Therefore, the risk of crop loss due to water deficits would be high in most seasons.

Table 2.10 Land suitability for dryland viticulture.

PARAMETERS INFLUENCING VITICULTURE		LAND SUITABILITY RATINGS		
		Class 1	**Class 2**	**Class 3**
Landscape	Slope (%)	< 20	-	> 20
	Site drainage	Well, moderately well	Imperfectly drained	Poorly, very poorly, rapidly drained
	Susceptibility to gully erosion	Low	Moderate - high	-
	Susceptibility to sheet/rill erosion	Low	Moderate - high	-
Soil	Topsoil depth (cm)	> 10	< 10	-
	Depth to hard rock (m)	> 2.0	1.0 - 2.0	< 1.0
	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.0	< 1.0
	Total amount of water available to plants (mm)	> 150	150 - 50	50
	Electrical conductivity (dS/m EC_e)*	< 1.5	1.5 - 3.0	> 3.0
	Estimated subsoil permeability	Highly , moderately permeable	Slowly permeable	Very slowly, very highly permeable

* Saturation extract

Note: The above table has been developed from regional data to provide a general assessment of land suitability and does not provide sufficient information for the evaluation of specific sites.

Additional site specific factors that would require consideration prior to development may include:

- site size and layout;
- access to services and utilities;
- availability of supplementary water supply;
- access to surface and/or subsurface drainage;
- water table conditions and groundwater quality;
- soil factors such as pH, organic matter content, nutrient status, sodicity, etc.

It is recommended that commercial vineyards or orchards not be established without access to a supplementary water supply for irrigation. Throughout the growing season, evapotranspiration exceeds rainfall in the Shire of Campaspe. As a result crops need to use water stored in the soil profile. In most seasons, water stored in the soil profile and rainfall during the growing season would be insufficient to meet the needs of the crop. Therefore, the risk of crop loss due to water deficits would be high in most seasons.

Table 2.11 Land capability assessment for broadacre effluent disposal (ground absorption) for feedlots.

PARAMETERS INFLUENCING BROADACRE EFFLUENT DISPOSAL		LAND CAPABILITY RATINGS				
		Class 1	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Landscape	Slope (%)*	< 3	3 - 10	11 - 20	21 - 32	> 32
	Flooding risk*	Nil	Low	Moderate	High	Very high
Soil	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.5	1.5 - 1.0	1.0 - 0.5	< 0.5
	Depth to hard rock/impermeable layer (m)	> 1.5	1.0 - 1.5	1.0 - 0.75	0.75 - 0.5	< 0.5
	Estimated subsoil permeability*	Highly permeable	Moderately permeable	-	Slowly permeable	Very slowly, very highly permeable

* See Appendix C

Note: 10 mm/day is equivalent to disposing of 1000 l/day along a 0.5 x 200 m trench

Table 2.12 Land capability assessment (ground absorption) for septic tanks.

PARAMETERS INFLUENCING SEPTIC TANK EFFLUENT DISPOSAL		LAND CAPABILITY RATINGS				
		Class 1	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Landscape	Slope (%)*	< 3	3 - 10	11 - 20	21 - 32	> 32
	Flooding risk*	Nil	Low	Moderate	High	Very high
Soil	Depth to seasonal watertable (m)	> 2.0	2.0 - 1.5	1.5 - 1.0	1.0 - 0.5	< 0.5
	Depth to hard rock/impermeable layer (m)	> 1.5	1.0 - 1.5	1.0 - 0.75	0.75 - 0.5	< 0.5
	Estimated subsoil permeability*	Highly permeable	Moderately permeable	-	Slowly permeable	Very slowly, very highly permeable

* See Appendix C

Note: Areas capable of absorbing effluent from a standard anaerobic, all-waste, septic tank connected to a single family dwelling (approximate output of 1000 litres per day).

10 mm/day is equivalent to disposing of 1000 l/day along a 0.5 x 200 m trench

Table 2.13 Land capability assessment for secondary (gravel) roads.

PARAMETERS INFLUENCING SECONDARY ROADS		LAND CAPABILITY RATINGS				
		Class 1	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Landscape	Slope (%)	0 - 1	2 - 5	6 - 10	11 - 30	> 30
	Site drainage*	Rapidly drained	Well drained	Moderately, imperfectly drained	Poorly, very poorly drained	-
	Flooding risk*	Nil	Low	Moderate	High	Very high
	Susceptibility to sheet / rill erosion*	Very low	Low	Moderate	High	Very high
	Susceptibility to gully erosion*	Very low	Low	Moderate	High	Very high
	Susceptibility to slope failure*	Very low	Low	Moderate	High	Very high
Soil	Depth to seasonal watertable (m)	> 5	5 - 2	2 - 1	1 - 0.5	< 0.5

* See Appendix C

Note: Areas capable of being used for the construction of earthen roads for light vehicles without sealed surfaces or concrete drainage and kerbing.

Table 2.14 Land capability assessment for low density residential and rural living development.

LOW DENSITY RESIDENTIAL DEVELOPMENT (0.4 ha - 2.0 ha)		RURAL LIVING DEVELOPMENT (2.0-40 ha)	
Secondary roads	No change to capability class	Secondary roads	No change to capability class
Septic tanks	No change to capability class	Effluent disposal	**Improve rating by one class** if major limitation is due to permeability, drainage and depth to hard rock. No change to rating class if another criteria is the major limitation present

Rural residential development involves a range of land uses including effluent disposal, secondary roads, building foundations and earthen dams. For this study, land capability assessments have been conducted for septic tank effluent disposal and secondary roads, as inappropriate siting of these land uses may lead to significant engineering difficulties and environmental problems.. It is thought that current technologies can overcome most land and soil constraints in the construction of earthen dams and building foundations, therefore they have not been included in the capability assessment.

The landform and soils within certain land components can vary substantially in the Shire. This variation within a component is more likely to occur with large size allotments. It is recognised that in areas greater than 5 ha, detailed site inspection can highlight areas with a higher or lower capability to support a given land use.

For example, septic tanks as a form of effluent disposal may be restricted by slow permeability on a small allotment (less than 2 ha), however on a larger allotment better drained soils may be found that are more capable of supporting septic tanks. Larger allotments also allow for greater flexibility in management and design, while an allotment of 0.4 ha will place absolute limits on options for development.

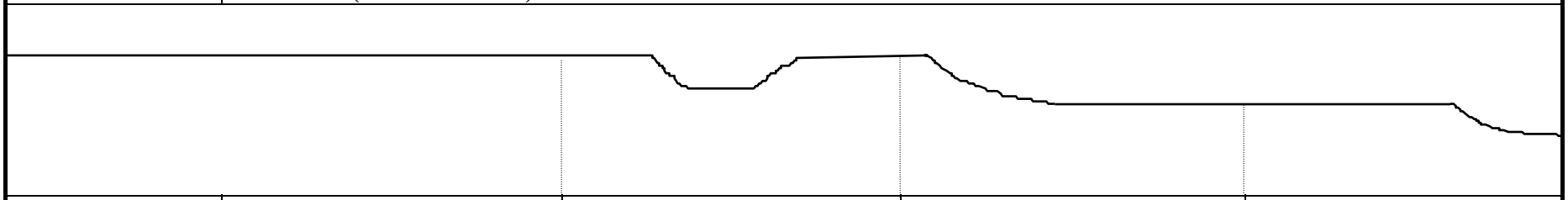
In assessing the overall capability for rural residential development, the capability of septic tanks effluent disposal and secondary roads has been combined to determine the overall capability class.

For the purpose of this study, low density residential development has been defined as allotment sizes between 0.4 - 2.0 ha, while rural living has been defined as allotment sizes between 2.0 - 40 ha.

3 LAND SYSTEM DESCRIPTIONS

3.1 Active floodplains - Murray & Campaspe Rivers

General Description

Land System: 4.1Ffc3, 4.1Ffc4, 4.1FLfc4				
Parent material	Quaternary alluvial sediments			
Climate	300 - 500 mm (mean annual rainfall)			
				
Land component	1	2	3	4
Soil association & dominant soil types	**Kanyapella** (Kanyapella clay loam, Kanyapella clay)	**Wallenjoe** (Wallenjoe Clay)		**Campaspe** (Campaspe Suite Type1, Type 2, Type 3)
Landform element	Higher active floodplain	Swamp, Oxbow lake, Site drainage depression	Murray lower active floodplain	Campaspe lower active floodplain
Slope range	0 - 1 %	0 - 1 %	0 - 1 %	0 - 1 %
General soil description	Strongly structured, heavy textured cracking grey clays	Low lying, heavy textured cracking grey clays.	Low lying heavy textured clays and variable soils.	Low lying high texture contrast soils and heavy textured clays.
Factual Key	Dy3.12	Ug5.2	Ug5.2, Uf	Dd2.43, Uf
Australian Soil Classification	Grey Sodosol (3)	Grey Vertosol (2)	Grey Vertosol (3) Grey Sodosol (2)	(2)
Site Drainage	Poorly drained	Very poorly drained	Very poorly drained	Poorly drained
Estimated permeability (subsoil)	Moderately permeable	Slowly permeable	Very slowly permeable	Moderately permeable
Rock outcrop	Nil	Nil	Nil	Nil
Depth to hardrock	> 200 cm	> 200 cm	> 200 cm	> 200 cm
Susceptibility to land degradation	Sheet and rill: Low Wind erosion: Low Gully erosion: Low	Sheet and rill: Low Wind erosion: Low Gully erosion: Low	Sheet and rill: Low Wind erosion: Low Gully erosion: Low	Sheet and rill: Low Wind erosion: Low Gully erosion: Low
Broad Vegetation Type	Northern Riverine Grassy Woodlands Complex, Swamp Scrub Complex			
Current land use	Dryland grazing, irrigated horticulture	Dryland grazing, irrigated horticulture	Dryland grazing, irrigated horticulture	Dryland grazing, irrigated horticulture

3.1 Active floodplains - Murray & Campaspe Rivers (continued)

Detailed Soil Description

Land component	1	2	3	4
Representative soil type	**A1** 0 - 10 cm Brownish grey (2.5Y 5/1) *clay loam or light clay*, moderate subangular blocky structure, slight buckshot gravel, gradual transition to: **B1** 10 - 45 cm Yellowish grey(2.5Y 5/2) *light or medium clay*, moderate angular blocky structure, slight ferruginous concretions, gradual transition to: **B21** 45 - 85 cm Weakly mottled yellow brown and grey *medium clay*, slight soft calcium carbonate and concretions, gradual transition to: **B23** 85 - 120+ cm Mottled yellow brown and grey *light clay*	**A1** 0 - 10 cm Grey (N 4/0) *heavy clay*, moderate angular blocky structure, gradual transition to: **B1** 10 - 60 cm Steel grey (N 5/0) *heavy clay*, moderate angular blocky structure, gradual transition to: **B2** 60 - 120+ cm *Heavy clay* with calcium carbonate	**A1** 0 - 5 cm Very dark greyish brown (10YR 3/2) *loam*, strong subangular blocky structure, pH 7.0, abrupt transition to : **B11** 5 - 15 cm Light grey (10YR 7/2) *silty clay*, weak subangular blocky structure, few mottles, pH 7.0, diffuse transition to: **B12** 15 - 30 cm Light grey (10YR 7/2) *light medium clay*, moderate subangular blocky structure, common mottles, pH 7.0, diffuse transition to: **B21** 30 - 70+ cm Yellowish brown (10YR 5/4) *medium clay*, strong subangular blocky structure, few mottles, pH7.0	**A1** 0-15 cm Grey brown (7.5YR4/2) loam **A2** 15-25 cm loam abrupt transition to: **B21** 25-40cm Dark greysih brown (7.5YR 3/2) medium clay, gradual transition to: **B22** 40-75cm Greyish-brown medium clay, gradual transition to: **B23** 75-120+cm Yellowish and greyish brown medium clay, diffusely mottled.
Source of detailed soils information	Skene, J.K.M. (1963) Kanyapella clay profile 29	Skene, J.K.M. & Harford, L.B. (1964) Wallenjoe clay profile 24	Field sampling	Skene, J.K.M. & Harford, L.B. (1964) Campaspe suite 1 profile 18

3.1 Active floodplains - Murray & Campaspe Rivers (continued)

Standard Planning Responses

Land System 4.2Flf3, 4.2Flf4				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	iii	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Estimated subsoil permeability	Must comply with the Planning Scheme Refer to Assessment of Land Suitability for Rice Growing Guidelines Seek advice from the Industry Development Officer within DNRE
	3	i	Nil	As above
	4	iii	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Irrigated cropping	1	ii	Site drainage Depth of topsoil	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
	2	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	3	iii	Site drainage	As above
	4	ii	Site drainage	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
Irrigated perennial pasture	1	ii	Site drainage	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
	2	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	ii	Site drainage	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE

3.1 Active floodplains - Murray & Campaspe Rivers (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated perennial horticulture	1	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	iii	Site drainage	As above
Irrigated tomatoes	1	ii	Susceptibility to surface crusting	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	2	ii	Susceptibility to surface crusting	As above
	3	ii	Susceptibility to surface crusting	As above
	4	i	Nil	As above
Irrigated farm forestry	1	ii	Site drainage	Must comply with the Planning Scheme Refer to the Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	2	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	ii	Site drainage	Must comply with the Planning Scheme Refer to the Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)

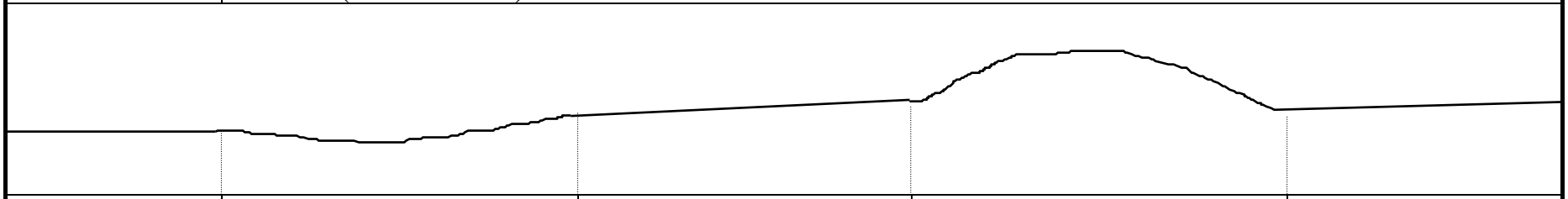
3.1 Active floodplains - Murray & Campaspe Rivers (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Dryland olives	1	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	iii	Site Drainage	As above
Dryland viticulture	1	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	iii	Site drainage	As above
Broadacre Effluent disposal (feedlots)	1	iv	Flooding risk	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	iv	Estimated subsoil permeability Flooding risk	As above
	3	v	Estimated subsoil permeability Flooding risk	As above
	4	v	Flooding risk	As above
Effluent disposal (septic tank)	1	iv	Flooding risk	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	iv	Estimated subsoil permeability Flooding risk	As above
	3	v	Estimated subsoil permeability Flooding risk	As above
	4	v	Flooding risk	As above
Secondary roads	1	iv	Site drainage	Must comply with the Planning Scheme
	2	v	Flood risk	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome
	3	v	Flooding risk	As above
	4	v	Flooding risk	As above

3.2 Corop wetland complex

General Description

Land System: 4.2Flf3, 4.2Flf4				
Parent material	Quaternary alluvial sediments			
Climate	300-500 mm (mean annual rainfall)			
				
Land component	1	2	3	4
Soil association & dominant soil types	**Carag** (Carag Clay) **Wallenjoe** (Wallenjoe clay) **Moora-Wallenjoe** (Wallenjoe Clay, Moora clay loam, Yuga clay)	**Corop** (Corop clay)	Unclassified variable soils	**Koga** (Koga Clay) **Cornella** (Cornella clay) **Karook** (Karook loam, Arkoo loam, Moora clay loam)
Landform element	Swamp / Site drainage depression	Minor alluvial plain	Lunette	Low alluvial plain
Slope range	0 - 1 %	0 - 1 %	0 - 10 %	0 - 1 %
General soil description	Heavy textured grey or black cracking clay soils	Heavy textured grey cracking clay soils	Strongly structured heavy textured brown clay soils	High texture contrast soils with mottled yellow clay subsoils and strongly structured, heavy textured grey cracking clays
Factual Key	Ug5.2, Ug5.1	Ug5.2	Uf, Dr, Dy	Db1.33, Dy3.13, Dy3.23, Ug5.2
Australian Soil Classification	Grey Vertosol (2), Brown Vertosol (2)	Grey Vertosol (2)	Brown Deromosol (3)	Brown Vertosol (2), Grey Vertosol (2), Grey Sodosol (2) Brown Sodosol (2)
Site Drainage	Very poorly drained	Very poorly drained	Well drained	Poorly drained
Estimated permeability (subsoil)	Slowly permeable	Slowly permeable	Moderately permeable	Slowly permeable
Rock outcrop	Nil	Nil	Nil	Nil
Depth to hardrock	> 200 cm	> 200 cm	> 200 cm	> 200 cm
Susceptibility to land degradation	Sheet and rill: Low Wind erosion: Low Gully erosion: Low-med	Sheet and rill: Low Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Low Gully erosion: Medium
Broad Vegetation Type	Northern Plains Grassy Woodland Complex, Swamp Scrub Complex, Mallee Heath Complex			
Current land use	Dryland grazing and cropping	Dryland grazing and cropping	Dryland grazing and cropping	Dryland grazing and cropping

3.2 Corop wetland complex (continued)

Detailed Soil Description

Land component	1	2	3	4
Representative soil type	**A1** 0 - 10 cm Grey (N 4/0) *heavy clay*, moderate angular blocky structure, gradual transition to: **B1** 10 - 60 cm Steel grey (N 5/0) *heavy clay*, moderate angular blocky structure, gradual transition to: **B2** 60 - 120+ cm *Heavy clay* with calcium carbonate	**A1** 0 - 10 cm Grey (10YR 5/1) *medium clay*, weak angular blocky structure, sharp transition to: **B1** 10 - 45 cm Grey (5Y 4/1) *heavy clay*, moderate subangular blocky structure, gradual transition to: **B21** 45 - 100 cm Yellowish grey (5Y 5/2) *heavy clay*, moderate subangular blocky structure, slight calcium carbonate and gypsum, gradual transition to: **B22** 100 - 180 + cm Mottled yellowish grey *heavy clay*, slight calcium carbonate	**A1** 0 - 15 cm Reddish brown (5YR 5/3) *medium heavy clay*, strong subangular blocky structure, pH 6.0, gradual transition to: **B21** 15 - 35 cm Reddish brown (10YR 4/4) *medium clay*, strong subangular blocky structure, pH 8.5, gradual transition to: **B22** 35 - 60 cm Strong brown (7.5YR 5/6) *light medium clay*, weak subangular blocky structure, pH 9.0, gradual transition to: **B23** 60 - 80+ cm Reddish yellow (10YR 6/6) *light medium clay*, weak subangular blocky structure, pH 10.0	**A1** 0 - 10 cm Mottled grey brown (7.5YR 4/4) *clay loam* **A2** 10 - 15 cm Sporadically bleached, sharp transition to: **B1** 15 - 50 cm Brown (7.5YR 4/3) to yellowish grey-brown (10YR 4/3) *heavy clay*, moderate angular blocky structure, gradual transition to: **B21** 50 - 75 cm Yellowish brown (10YR 5/4) *heavy clay*, moderate subangular blocky structure, slight calcium carbonate, gradual transition to: **B22** 75 - 120 cm Yellowish brown *medium clay*, slight calcium carbonate and gypsum **B23** 120+ cm Mottled brownish yellow-grey and brown *medium clay*, slight calcium carbonate
Source of detailed soils information	Skene, J.K.M. & Harford, L.B. (1964) Wallenjoe clay profile 24	Skene, J.K.M. (1963) Corop clay profile 14	Field sampling	Skene, J.K.M. & Harford, L.B. (1964) Koga clay loam profile 27

3.2 Corop wetland complex (continued)

Standard Planning Responses

Land System 4.2Flf3, 4.2Flf4				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	ii	Estimated subsoil permeability	Must comply with the Planning Scheme Refer to Assessment of Land Suitability for Rice Growing Guidelines Seek advice from the Industry Development Officer within DNRE
	2	ii	Estimated subsoil permeability	As above
	3	iii	Slope Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	4	ii	Estimated subsoil permeability	Must comply with the Planning Scheme Refer to Assessment of Land Suitability for Rice Growing Guidelines Seek advice from the Industry Development Officer within DNRE
Irrigated cropping	1	iii	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Estimated subsoil permeability	As above
	3	iii	Slope	As above
	4	ii	Site drainage Susceptibility to surface crusting	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
Irrigated perennial pasture	1	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage	As above
	3	iii	Slope	As above
	4	ii	Site drainage Available water capacity	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
Irrigated perennial horticulture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above

3.2 Corop wetland complex (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated perennial horticulture	3	i	Nil	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
	4	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Irrigated tomatoes	1	ii	Susceptibility to surface crusting	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	2	ii	Susceptibility to surface crusting Available water capacity	As above
	3	i	Nil	As above
	4	ii	Susceptibility to surface crusting Available water capacity	As above
Irrigated farm forestry	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Slope	Must comply with the Planning Scheme Refer to the Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
	4	iii	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Dryland olives	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	i	Nil	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
	4	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

3.2 Corop wetland complex (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Dryland viticulture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	i	Nil	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE
	4	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Broadacre Effluent disposal (feedlots)	1	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	v	Estimated subsoil permeability	As above
	3	ii	Nil	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
	4	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
Effluent disposal (septic tank)	1	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	v	Estimated subsoil permeability	As above
	3	ii	Nil	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
	4	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered

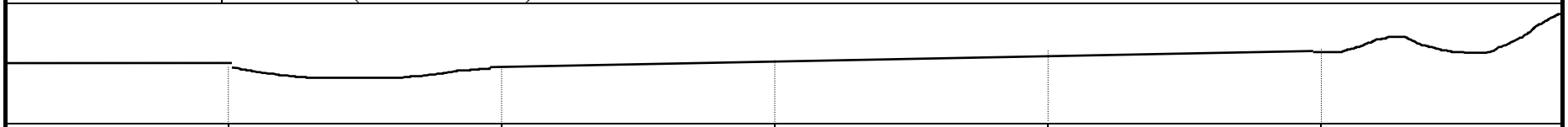
3.2 Corop wetland complex (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-v)*	*Major Physical Limitations*	*Planning Response*
Secondary roads	1	iv	Site drainage Flooding risk	Must comply with the Planning Scheme
	2	iv	Site drainage	As above
	3	ii	Nil	As above
	4	iv	Site drainage	As above

3.3 Prior streams alluvial plain

General Description

Land System : 4.2Pf4.2					
Parent material	Quaternary alluvium				
Climate	400 - 500 mm (mean annual rainfall)				
					
Land component	1	2	3	4	5
Soil association & dominant soil types	**Carag** (Carag clay) **Congupna** (Congupna clay)	**Coomboona** (Congupna clay , Congupna clay loam)	**Goulburn** (Goulburn loam, Goulburn clay loam) **Coomboona** (Goulburn loam, Goulburn clay loam)	**Wanalta** (Wanalta loam, Wana loam) **Lemnos** (Lemnos loam) **Wanurp** (Wanurp sandy loam)	**Naneela** (Naneela fine sandy loam) **Timmering** (Timmering loam) **Shepparton** (Shepparton fine sandy loam)
Landform element	Site drainage depression	Low alluvial plain	Mid alluvial plain	Higher alluvial plain	Prior stream beds & levees
Slope range	0 - 1 %	0 - 1 %	0 - 1 %	0 - 1 %	0 - 3 %
General soil description	Heavy textured grey cracking clay soils	Heavy textured grey cracking clay soils, or high texture contrast soils with yellow mottled clay subsoils	High texture contrast soils with clay loams topsoils and mottled yellow clay subsoils	High texture contrast soils with brown loamy topsoils, bleached A2 horizons and mottled red clay subsoils	High texture contrast soils with brown loamy topsoils, occassional bleached A2 horizons, and red clay subsoils
Factual Key	Ug5.2	Ug, Dy3.23	Dy3.13	Dr3.33 Dr3.23, Dr3.43	Dr2.13, Dr2.33, Dr3.33
Australian Soil Classification	Brown Vertosol (2)	Brown Vertosol (2), Grey Sodosol (2)	Brown Sodosol (2)	Red Sodosol (2)	Red Sodosol (2)
Site Drainage	Very poorly drained	Poorly drained	Imperfectly drained	Imperfectly drained	Moderately well drained
Estimated permeability (subsoil)	Very slowly permeable	Very slowly permeable	Slowly permeable	Moderately permeable	Moderately permeable
Rock outcrop	Nil	Nil	Nil	Nil	Nil
Depth to hardrock	> 200 cm	> 200 cm	> 200 cm	> 200 cm	> 200 cm
Susceptibility to land degradation	Sheet and rill: Low Wind erosion: Low Gully erosion: Low	Sheet and rill: Medium Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Medium Gully erosion: Low	Sheet and rill: Low Wind erosion: Medium Gully erosion: Low	Sheet and rill: Low Wind erosion: Medium Gully erosion: Low
Broad Vegetation Type	Northern Plains Grassy Woodland Complex, Northern Riverine Grassy Woodland Complex				
Current land use	Grazing	Grazing, irrigated pasture	Grazing, irrigated pasture	Dryland cropping and grazing, irrigated pasture, dairying, stonefruits, tomatoes	Dryland cropping and grazing , irrigated pasture, dairying, stonefruits, irrigated horticulture

3.3 Prior streams alluvial plain (continued)

Detailed Soil Description

Land component	1	2	3	4	5
Representative soil type	**A1** 0 - 10 cm Dark grey brown 10YR 3/3) cracking *clay*, moderate subangular blocky structure, sharp transition to: **B1** 10 - 50 cm Yellow grey (2.5Y 5/3) *heavy clay*, weak angular blocky structure, gradual transition to: **B21** 50 - 90 cm Yellow grey (2.5Y 5/3) *heavy clay*, weak angular blocky structure, slight soft calcium carbonate and gypsum, gradual transition to: **B22** 90 - 190+ cm Brownish or mottled grey *medium clay*, slight calcium carbonate	**A1** 0 - 10 cm Grey (2.5Y 4/1 to 10YR 4/1) *clay loam*, weak to moderate angular blocky structure, buckshot gravels, sharp transition to: **B1** 10 - 50 cm Brownish grey (2.5Y 4/2) *heavy clay*, moderate angular blocky structure, gradual transition to: **B2** 50+ cm Brownish yellow grey (2.5Y 4/4) *medium clay*, apedal, slight calcium carbonate	**A1** 0 - 10 cm Grey brown (10TR 4/2) *loam*, weak angular blocky structure, slight buckshot gravel, sharp transition to: **B1** 10 - 45 cm Yellowish brown (7.5YR 5/6) *medium clay*, weak to moderate prismatic structure, gradual transition to: **B21** 45 - 80 cm Yellowish brown (10YR 5/6) *heavy clay*, weak subangular blocky structure, slight calcium carbonate, gradual transition to: **B22** 80 - 120+ cm Yellowish grey or mottled light yellowish grey (2.5Y 5/2) *medium or heavy clay*, slight calcium carbonate	**A1** 0 - 10 cm Brown (5YR 5/4) to greyish brown (7.5YR 5/4) *loam*, **A2** 10 - 15 cm *Loam* , sporadically bleached at boundary of B1, sharp transition to: **B1** 15 - 50 cm Red-brown (5YR 3/4) *heavy clay*, moderate prismatic to weak blocky structure, gradual transition to: **B21** 50 - 70 cm Brown *medium clay*, soft calcium carbonate, gradual transition to: **B22** 70 - 120 cm Mottled greyish brown and yellowish grey brown *light clay* **B23** 120+ cm Moderately mottled grey and grey brown *medium clay*	**A1** 0 - 15 cm Brown (7.5YR 4/4) *loam* **A2** 15 - 25 cm *Loam* sporadically bleached, sharp transition to: **B1** 25 - 50 cm Red-brown (2.5YR 3/6) *medium clay*, moderate subangular blocky structure, gradual transition to: **B21** 50 - 95 cm Brown or yellowish brown *light clay*, strong subangular blocky structure, slight calcium carbonate, gradual transition to: **B22** 95 - 120+ cm Mottled yellowish grey-brown *light clay*, slight calcium carbonate
Source of detailed soils information	Skene, J.K.M. & Harford L.B. (1964) Carag clay profile 16	Skene, J.K.M. & Poutsma, T.J. (1962) Congupna clay loam profile 47	Skene, J.K.M. & Poutsma, T.J. (1962) Goulburn clay loam profile 16	Skene, J.K.M. & Harford, L.B. (1964) Wanalta loam profile 5	Skene, J.K.M. & Harford, L.B. (1964) Timmering loam profile 35

3.3 Prior streams alluvial plain (continued)

Standard Planning Responses

Land System				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	i	Nil	Must comply with the Planning Scheme Refer to Assessment of Land Suitability for Rice Growing Guidelines Seek advice from the Industry Development Officer within DNRE
	2	i	Nil	As above
	3	ii	Estimated subsoil permeability	As above
	4	iii	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	5	iii	Estimated subsoil permeability	As above
Irrigated cropping	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Estimated subsoil permeability	As above
	3	ii	Depth of topsoil Available water capacity	As above
	4	i	Nil	As above
	5	i	Nil	As above
Irrigated perennial pasture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Estimated subsoil permeability	As above
	3	ii	Available water capacity	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	4	ii	Depth of topsoil Estimated subsoil permeability	As above
	5	i	Nil	As above

3.3 Prior streams alluvial plain (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated perennial horticulture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	ii	Site driainage Depth of topsoil Estimated subsoil permeability	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	4	ii	Site drainage Estimated subsoil permeability	As above
	5	i	Nil	As above
Irrigated tomatoes	1	i	Nil	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	2	ii	Susceptibility to surface crusting Available water capacity	As above
	3	ii	Available water capacity	As above
	4	i	Nil	As above
	5	i	Nil	As above
Irrigated farm forestry	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Estimated subsoil permeability	As above
	3	ii	Estimated subsoil permeability	Must comply with the Planning Scheme Refer to the Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	4	ii	Estimated subsoil permeability	As above
	5	i	Nil	As above

3.3 Prior streams alluvial plain (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Dryland olives	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	ii	Site drainage Depth of topsoil available water capacity Estimated subsoil permeability	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	4	ii	Site drainage Depth of topsoil Estimated subsoil permeability	As above
	5	i	Nil	As above
Dryland viticulture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	ii	Site drainage Depth of topsoil available water capacity Estimated subsoil permeability	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	4	ii	Site drainage Depth of topsoil Estimated subsoil permeability	As above
	5	i	Nil	As above

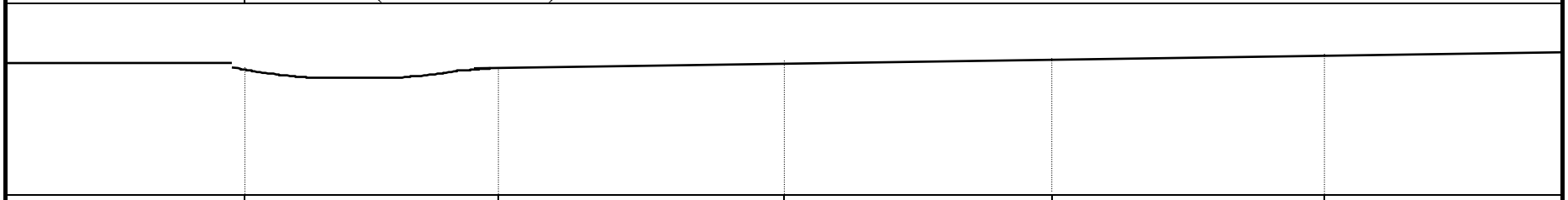
3.3 Prior streams alluvial plain (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-v)*	*Major Physical Limitations*	*Planning Response*
Broadacre Effluent disposal (feedlots)	1	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	v	Estimated subsoil permeability	As above
	3	iv	Estimated subsoil permeability	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
	4	iv	Estimated subsoil permeability	As above
	5	ii	Nil	As above
Effluent disposal (septic tank)	1	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	v	Estimated subsoil permeability	As above
	3	iv	Estimated subsoil permeability	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
	4	iv	Estimated subsoil permeability	As above
	5	ii	Nil	As above
Secondary roads	1	iv	Site drainage Flooding risk	Must comply with the Planning Scheme
	2	iv	Site drainage	As above
	3	iv	Site drainage	As above
	4	iii	Site drainage	As above
	5	iii	Site drainage	As above

3.4 Treeless alluvial plain

General Description

Land System: 4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5					
Parent material	Quaternary alluvial sediments				
Climate	300 - 500 mm (mean annual rainfall)				
					
Land component	1	2	3	4	5
Soil association & dominant soil types	**Carag** (Carag clay) **Wallenjoe** (Wallenjoe clay)	**Restdown** (Restdown clay) **Rochester** (Rochester clay)	**Yuga - Wallenjoe** (Yuga clay, Wallenjoe clay)	**Koga** (Koga clay loam)	**Koyuga** (Koyuga clay loam)
Landform element	Swamp / Site drainage depressions	Low alluvial /gilgai plains	Lower alluvial plain	Mid alluvial plain	Higher alluvial plain
Slope range	0 - 1 %	0 - 1 %	0 - 1 %	0 - 1 %	0 - 1 %
General soil description	Heavy textured grey cracking clay soils	Heavy textured black cracking clay soils and gilgai formations	Heavy textured black cracking clay soils	High texture contrast soils with clay loam topsoils and mottled brown clay subsoils	High texture contrast soils with clay loam topsoils, bleached A2 horizons and either mottled or whole colored red clay subsoils
Factual Key	Ug5.2	Ug5.1	Ug5.1	Db1.33	Dr2.33, Dr3.43, Dr2.13, Dr3.13
Australian Soil Classification	Grey Vertosol (2)	Black Vertosol (2)	Black Vertosol (2)	Brown Sodosol (2)	Red Sodosol (2)
Site Drainage	Very poorly drained	Very poorly drained	Very poorly drained	Imperfectly drained	Imperfectly drained
Estimated permeability (subsoil)	Very slowly permeable	Very slowly permeable	Very slowly permeable	Moderately permeable	Moderately permeable
Rock outcrop	Nil	Nil	Nil	Nil	Nil
Depth to hardrock	> 200 cm	> 200 cm	> 200 cm	> 200 cm	> 200 cm
Susceptibility to land degradation	Sheet and rill: Low Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Low Gully erosion: Low	Sheet and rill: Medium Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Low Gully erosion: Low-med
Broad Vegetation Type	Northern Plains Grassy Woodland Complex, Northern Plains Grasslands				
Current land use	Dryland Grazing	Dryland grazing	Dryland grazing	Dryland cropping and grazing, irrigated pastures	Dryland cropping and grazing, irrigated pasture, dairying

3.4 Treeless alluvial plain (continued)

Detailed Soil Description

Land component	1	2	3	4	5
Representative soil type	**A1** 0 - 10 cm Grey (N 4/0) *heavy clay*, moderate angular blocky structure, gradual transition to: **B1** 10 - 60 cm Steel grey (N 5/0) *heavy clay*, moderate angular blocky structure, gradual transition to: **B2** 60 - 120+ cm *Heavy clay* with calcium carbonate	**A** 0 - 10 cm Dark grey (10YR 3/1) cracking *medium clay*, moderate subangular blocky structure, sharp transition to: **B1** 10 - 50 cm Dark brownish grey (10YR 3/2) *heavy clay*, moderate angular blocky structure, gradual transition to: **B2** 50 - 120+ cm Brownish grey *heavy clay* with calcium carbonate	**A1** 0 - 10 cm Brownish grey to grey (2.5Y 4/2) *light clay*, diffusely mottled, sharp transition to: **B1** 10 - 40 cm Dark brownish grey (10YR 3/2) *heavy clay*, moderate angular blocky structure, gradual transition to: **B21** 40 - 55 cm Brownish yellow grey *heavy clay*, weak angular blocky structure, slight calcium carbonate, gradual transition to: **B22** 55 - 120+ cm Yellow grey *heavy clay*, slight calcium carbonate and gypsum	**A1** 0 - 10 cm Mottled grey brown (7.5YR 4/4) *clay loam* **A2** 10 - 15 cm Sporadically bleached, sharp transition to: **B1** 15 - 50 cm Brown (7.5YR 4/3) to yellowish grey-brown (10YR 4/3) *heavy clay*, moderate angular blocky structure, gradual transition to: **B21** 50 - 75 cm Yellowish brown (10YR 5/4) *heavy clay*, moderate subangular blocky structure, slight calcium carbonate, gradual transition to: **B22** 75 - 120 cm Yellowish brown *medium clay*, slight calcium carbonate and gypsum **B23** 120+ cm Mottled brownish yellow-grey and brown *medium clay*, slight calcium carbonate	**A1** 0 - 10 cm Brown (7.5YR 5/4) clay loam, weak angular blocky structure **A2** 10 - 15 cm Sporadically bleached, apedal, sharp transition to: **B1** 15 - 50 cm Dark reddish brown (2.5YR 3/4) heavy clay, moderate angular blocky structure, gradual transition to: **B21** 50 - 75 cm Yellowish brown heavy clay, slight calcium carbonate, gradual transition to: **B22** 75 - 120 cm Diffusely mottled yellowish brown medium clay , slight calcium carbonate and gypsum **B23** 120+ cm Moderately mottled brownish yellow-grey and brown medium clay, slight calcium carbonate
Source of detailed soils information	Skene, J.K.M. (1963) Wallenjoe clay profile no.24	Skene, J.K.M. & Harford, L.B. (1964) Rochester clay profile 10	Skene, J.K.M. & Harford, L.B. (1964) Yuga clay profile 7	Skene, J.K.M. & Harford, L.B. (1964) Koga clay loam profile 27	Skene, J.K.M. & Harford, L.B. (1964) Koyuga clay loam profile 4

3.4 Treeless alluvial plain (continued)

Standard Planning Responses

Land System				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	i	Nil	Must comply with the Planning Scheme Refer to Assessment of Land Suitability for Rice Growing Guidelines Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	2	i	Nil	As above
	3	ii	Estimated subsoil permeability	As above
	4	iii	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	5	iii	Estimated subsoil permeability	As above
Irrigated cropping	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	ii	Available water capacity Susceptibility to surface crusting	Must comply with the Planning Scheme Refer to Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Ground water overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	5	ii	Susceptibility to surface crusting	As above
Irrigated perennial pasture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	ii	Available water capacity	Must comply with the Planning Scheme Refer to Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Ground water overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	5	i	Nil	As above

3.4 Treeless alluvial plain (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated perennial horticulture	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	ii	Site drainage Estimated subsoil permeability	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	5	ii	Site drainage Estimated subsoil permeability	As above
Irrigated tomatoes	1	ii	Susceptibility to surface crusting	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	2	ii	Susceptibility to surface crusting	As above
	3	ii	Available water capacity Susceptibility to surface crusting	As above
	4	ii	Available water capacity Susceptibility to surface crusting	As above
	5	ii	Susceptibility to surface crusting	As above
Irriagted farm forestry	1	iii	Site drainage Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Site drainage Estimated subsoil permeability	As above
	3	iii	Site drainage Estimated subsoil permeability	As above
	4	ii	Estimated subsoil permeability	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	5	ii	Estimated subsoil permeability	As above

3.4 Treeless alluvial plain (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Dryland olives	1	iii	Estimated subsoil permeability Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Estimated subsoil permeability Site drainage	As above
	3	iii	Estimated subsoil permeability Site drainage	As above
	4	ii	Site drainage Available water capacity Estimated subsoil permeability	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	5	ii	Estimated subsoil permeability Site drainage	As above
Dryland viticulture	1	iii	Estimated subsoil permeability Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Estimated subsoil permeability Site drainage	As above
	3	iii	Estimated subsoil permeability Site drainage	As above
	4	ii	Site drainage Available water capacity Estimated subsoil permeability	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	5	ii	Estimated subsoil permeability Site drainage	As above

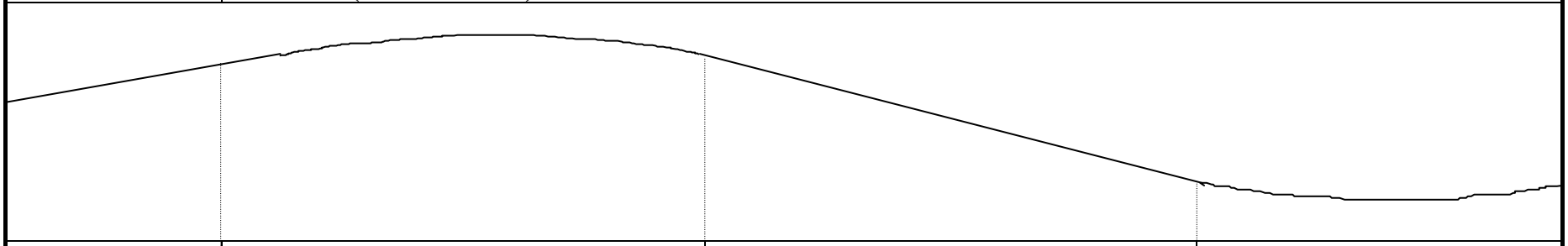
3.4 Treeless alluvial plain (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-v)*	*Major Physical Limitations*	*Planning Response*
Broadacre Effluent disposal (feedlots)	1	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	v	Estimated subsoil permeability	As above
	3	v	Estimated subsoil permeability	As above
	4	v	Estimated subsoil permeability	As above
	5	iv	Estimated subsoil permeability	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
• Effluent disposal (septic tank)	1	v	Estimated subsoil permeability	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	v	Estimated subsoil permeability	As above
	3	v	Estimated subsoil permeability	As above
	4	v	Estimated subsoil permeability	As above
	5	iv	Estimated subsoil permeability	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
• Secondary roads	1	iv	Site drainage Flooding risk	Must comply with the Planning Scheme
	2	iv	Site drainage	As above
	3	iv	Site drainage	As above
	4	iv	Site drainage	As above
	5	iv	Site drainage	As above

3.5 Knowsley low undulating sedimentary hills

General Description

Land System: 2.1Gs4-7			
Parent material	Permian glacial sediments (tillite, conglomerate, sandstone)		
Climate	500 - 550 mm (mean annual rainfall)		
			
Land component	1	2	3
Soil association	N/A	N/A	N/A
Landform element	Gentle crest	Gentle slope	Site drainage depression
Slope range	1 - 4 %	1 - 8 %	0 - 2 %
General soil description	Strong texture contrast soil with mottled yellow clay subsoils and a conspicuously bleached A2 horizon, often with buckshot and quartz gravels present	Strong texture contrast soil with mottled yellow clay subsoils and a conspicuously bleached A2 horizon, often with buckshot and quartz gravels present	Strong texture contrast soil with mottled yellow clay subsoils and a conspicuously bleached A2 horizon
Factual Key	Dy3.41, Dr2.41, Dr3.43	Dy3.41, Dr2.41, Dr3.43	Dy3.41, Dy3.42
Australian Soil Classification	Yellow Sodosol (3) Red sodosol (3)	Yellow Sodosol (3) Red sodosol (3)	Yellow Sodosol (2)
Site Drainage	Well drained	Well drained	Poorly drained
Estimated permeability (subsoil)	Moderately permeable	Moderately permeable	Moderately permeable
Rock outcrop	0 - 10 %	0 - 5 %	Nil
Depth to hardrock	50 - 150 cm	> 100 cm	> 200 cm
Susceptibility to land degradation	Sheet and rill: Medium Wind erosion: Medium Gully erosion: Medium - Low	Sheet and rill: Medium Wind erosion: Medium Gully erosion: Medium - Low	Sheet and rill: Low Wind erosion: Medium Gully erosion: Low - High
Broad Vegetation Type	Northern Plains Grassy Woodland Complex, Box/Ironbark Forest + Woodland Complex		
Current land use	Grazing, cereal cropping	Grazing, cereal cropping	Grazing

3.5 Knowsley low undulating sedimentary hills (continued)

Detailed Soil Description

Land component	1	2	3
Representative soil type	**A1** 0 - 10 cm Dark brown (10YR 3/3) *loam*, weak subangular blocky structure, few gravel fragments, abrupt transition to: **A2** 10 - 20 cm Brown (10YR 4/3) *fine sandy loam*, massive, abundant gravel fragments, abrupt transition to: **B21** 20 - 30 cm Brown (10YR 4/3) *heavy clay*, moderate angular blocky structure, few gravel fragments **B22** 30 - 120+ cm Reddish brown (5YR5/4) *heavy clay*, strong angular blocky structure, few gravel fragments	**A1** 0 - 10 cm Dark reddish brown (5YR 3/3) *fine sandy loam*, weak subangular blocky structure, few stone fragments, abrupt transition to: **A2** 10 - 15 cm Dark reddish brown (5YR 3/3) *fine sandy loam*, apedal, abundant stone fragments, clear transition to: **B1** 15 - 45 cm Dark reddish brown (5YR 6/3) *heavy clay*, weak angular blocky structure, abrupt transition to: B2 45 - 90cm reddish yellow (7.5YR 7/8) *medium clay*, strong angular blocky structure, few stone fragments, abrupt transition to: **BC** 90 - 150+ cm Reddish brown (2.5YR 5/4) *medium clay*, strong angular blocky structure, many stone fragments	**Alluvial wash** 0 - 5 cm Dark brown (7.5YR 3/3) *silty loam*, apedal, pH 5.5, abrupt transition to: **A1** 5 - 15 cm Dark brown (10YR 3/3) *silty loam*, apedal, pH 6.5, gradual transition to: **A21** 15 - 30 cm Yellowish brown (10YR 5/4) *sandy loam fine sandy*, apedal, pH 6.5, abrupt transition to: **A22** 30 - 45 cm White (10YR 7/3) loamy sand, apedal, pH 6.5, clear transition to: **B2** 45 -75 cm Light brownish grey (10YR 6/2) *sandy clay loam*, apedal, pH 5.5, abrupt transition to: **C** 75 - 85+ cm Weathered sedimentary rock
Source of detailed soils information	Lorimer, M.S, & N.R. Shoknecht (1987) Knowsley Land System (site 723)	Lorimer, M.S, & N.R. Shoknecht (1987) Knowsley Land System (site 722)	Lorimer, M.S, & N.R. Shoknecht (1987) Knowsley Land System (site 1124)

3.5 Knowsley low undulating sedimentary hills (continued)

Standard Planning Responses

Land System 2.1Gs4.7				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	iii	Slope Estimated subsoil permeability Depth of sodic clay	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope Estimated subsoil permeability Depth of sodic clay	As above
	3	iii	Slope Estimated subsoil permeability	As above
Irrigated cropping	1	iii	Slope Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	iii	Slope	As above
Irrigated perennial pasture	1	iii	Slope	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	ii	Slope Site drainage	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
Irrigated perennial horticulture	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

3.5 Knowsley low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated tomatoes	1	iii	Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Available water capacity Susceptibility to sheet/rill erosion Susceptibility to gully erosion Proportion of stones and boulders	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	ii	Available water capacity	As above
Irrigated farm forestry	1	iii	Slope Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	iii	Slope	As above
Dryland olives	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Available water capacity	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Dryland viticulture	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

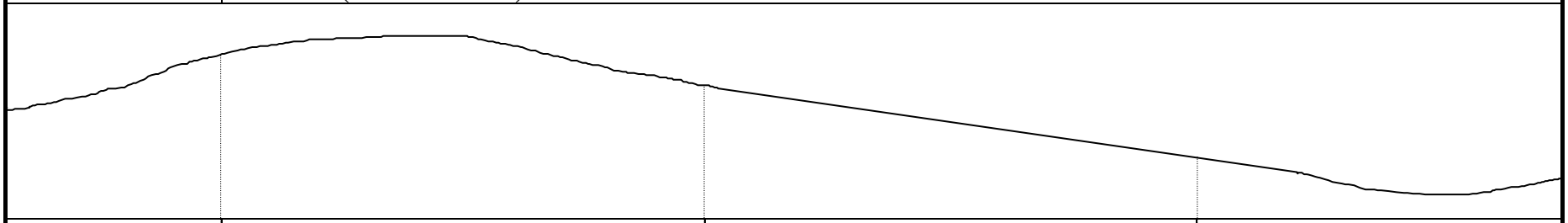
3.5 Knowsley low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Broadacre Effluent disposal (feedlots)	1	iv	Depth to hard rock	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
	2	ii	Nil	As above
	3	iv	Estimated subsoil permeability	As above
Effluent disposal (septic tank)	1	iv	Depth to hard rock	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
	2	ii	Nil	As above
	3	iv	Estimated subsoil permeability	As above
Secondary roads	1	iii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion	Must comply with the Planning Scheme
	2	iii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion	As above
	3	iv	Site drainage	As above

3.6 Rushworth low undulating sedimentary hills

General Description

Land System: 1.1Gs4-1, 1.1Gs4-2, 1.1Gs5-1			
Parent material	Rushworth low undulating sedimentary hills (mudstone, sandstone)		
Climate	400-600 mm (mean annual rainfall)		
			
Land component	1	2	3
Soil association & dominant soil types	Erwen (Erwen loam shallow phase)	Erwen (Erwen loam, Wenora loam)	Erwen (Wenora loam)
Landform element	Gentle crest	Gentle slopes	Site drainage depressions
Slope range	1 - 8 %	1 - 5 %	0 - 2 %
General soil description	Strong texture contrast soils with brown loam topsoils and red clay subsoils	Strong texture contrast soils with brown loam topsoils, occasional bleached A2 horizons and red clay subsoils	Strong texture contrast soils with loam or clay loam topsoils, bleached A2 horizons and yellow clay subsoils
Factual Key	Gn3.13, Dr2.13	Dr2.13, Dr2.43, Dy3.12, Dy3.42	Dy3.43
Australian Soil Classification	Red Sodosol (2)	Red Sodosol (2)	Yellow Sodosol (3)
Site Drainage	Well drained	Well drained	Poorly drained
Estimated permeability (subsoil)	Moderately permeable	Moderately permeable	Slowly permeable
Rock outcrop	0 - 3 %	Nil	Nil
Depth to hardrock	0 - 60 cm	60 - 150 cm	> 100 cm
Susceptibility to land degradation	Sheet and rill: Medium Wind erosion: Low Gully erosion: Low	Sheet and rill: Medium Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Medium-Low Gully erosion: Medium
Broad Vegetation Type	Box/Ironbark Forest + Woodland Complex		
Current land use	Grazing	Grazing	Grazing

3.6 Rushworth low undulating sedimentary hills (continued)

Detailed Soil Description

Land component	1	2	3
Representative soil type	**A1** 0 - 10 cm Greyish brown *loam* with buckshot gravel **B21** 10 - 45 cm Red brown *heavy clay* **B22** 45 - 60 cm Mottled red *clay* **C** 60+ cm Weathered sedimentary rock	**A1** 0 - 10 cm Greyish brown (5YR 3/2) *loam* weakly bleached in lower part with buckshot and sedimentary gravels, sharp transition to: **B1** 10 - 45 cm Red brown (2.5YR 3/6) *heavy clay*, gradual transition to: **B2** 45 - 70 cm Reddish brown (5YR 4/6) *heavy clay*, light calcium carbonate, gradual transition to: **B23** 70 - 120 cm Mottled red to brownish grey *heavy clay*, light calcium carbonate, gradual transition to: **C** 120+ cm Weathered sedimentary rock	**A1** 0 - 10 cm Dark brownish grey *loam* or *clay loam*, gradual transition to: **A2** 10 - 15 cm Bleached grey-brown *loam* or *clay loam*, slight to moderate buckshot and sedimentary gravels, sharp transition to: **B1** 15 - 45 cm Yellowish brown *heavy clay*, gradual transition to: **B21** 45 - 110 cm Mottled grey , yellow, brown *clay*, few sedimentary fragments, soft calcium carbonate, gradual transition to: **B22** 110 - 210 cm Mottled grey and brown *silty clay*, many sedimentary fragments **C** 210+ cm Weathered sedimentary rock
Source of detailed soils information	Skene, J.K.M. & Poutsma, T.J. (1962) Erwen Loam shallow phase profile 31	Skene, J.K.M. & Poutsma, T.J. (1962) Erwen loam profile 30	Skene, J.K.M. & Poutsma, T.J. (1962) Wenora loam profile 54

3.6 Rushworth low undulating sedimentary hills (continued)

Standard Planning Responses

Land System 1.1Gs4-1, 1.1Gs4-2, 1.1Gs5-1				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	iii	Slope Estimated subsoil permeability Depth of sodic clay	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope Estimated subsoil permeability Depth of sodic clay	As above
	3	iii	Slope	As above
Irrigated cropping	1	iii	Slope Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	iii	Slope	As above
Irrigated perennial pasture	1	iii	Slope	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	ii	Slope Site drainage	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
Irrigated perennial horticulture	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion Depth to hard rock	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

3.6 Rushworth low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated tomatoes	1	iii	Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion Depth to hard rock Proportion of stones and boulders Available water capacity	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	ii	Susceptibility to gully erosion Available water capacity	As above
Irrigated farm forestry	1	iii	Slope Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	iii	Slope	As above
Dryland olives	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Dryland viticulture	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

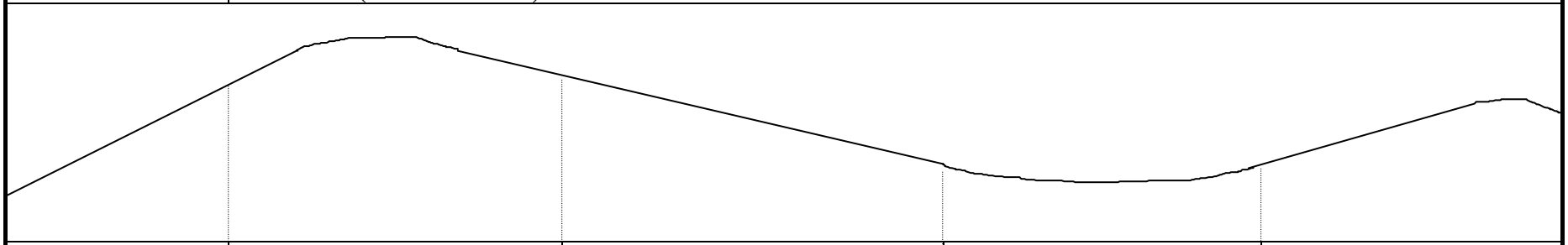
3.6 Rushworth low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-v)*	*Major Physical Limitations*	*Planning Response*
Broadacre Effluent disposal (feedlots)	1	v	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	iii	Depth to hard rock	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
	3	iv	Estimated subsoil permeability	As above
Effluent disposal (septic tank)	1	v	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	iii	Depth to hard rock	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
	3	iv	Estimated subsoil permeability	As above
Secondary roads	1	iii	Susceptibility to sheet/rill erosion	Must comply with the Planning Scheme
	2	iii	Susceptibility to sheet/rill erosion Susceptibility to gully erosion	As above
	3	iv	Site drainage	As above

3.7 Myola East low undulating sedimentary hills

General Description

Land Systems : 2.1Gs4-5, 2.1Gs4-4, 2.1Gs5.5				
Parent material	Myola East low undulating sedimentary hills (sandstone, mudstone, silicified shale)			
Climate	400 - 520 mm (mean annual rainfall)			
				
Land component	1	2	3	4
Soil association	N/A	N/A	N/A	N/A
Landform element	Steeper crest and slopes	Gentle slope	Broad Site drainage depression	Gentle crest
Slope range	3 - 20 %	1 - 4 %	0 - 3 %	1 - 4 %
General soil description	Strong texture contrast soil with red clay subsoils, a pale or conspicuously bleached A2 horizon, and ironstone gravel is common in the surface horizons	Strong texture contrast soil with red clay subsoils, a pale or conspicuously bleached A2 horizon, and ironstone gravel is common in the surface horizons	Strong texture contrast soil with mottled yellow clay subsoils and a conspicuously bleached A2 horizon	Strong texture contrast soil with red clay subsoils, a pale or conspicuously bleached A2 horizon, and ironstone gravel is common in the surface horizons
Factual Key	Gn3.71, Gn3.13, Dr2.13, Dr2.41	Dr2.13, Dr2.41, Dr2.22, Dr2.32, Dr3.41	Dy3.42, Dy3.43, Dr2.42	Dr2.42, Dr2.43, Dr2.41, Dr2.22, Dr3.32
Australian Soil Classification	Red Dermosol (2), Red Sodosol (2)	Red Sodosol (2), Red Kurosol (2)	Yellow Sodosol (2)	Red Sodosol (2), Red Kurosol (2)
Site Drainage	Rapidly drained	Well drained	Poorly drained	Well drained
Estimated permeability (subsoil)	Highly permeable	Moderately permeable	Moderately permeable	Moderately permeable
Rock outcrop	0 - 20 %	0 - 5 %	Nil	0 - 5 %
Depth to hardrock	40 - 70 cm	60 - 120 cm	100 - 200 cm	20 - 60 cm
Susceptibility to land degradation	Sheet and rill: High Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Medium Gully erosion: Medium	Sheet and rill: Medium Wind erosion: Low Gully erosion: Medium	Sheet and rill: Low Wind erosion: Medium Gully erosion: Low
Broad Vegetation Type	Northern Plains Grassy Woodland Complex, Box/Ironbark Forest + Woodland Complex			
Current land use	Grazing	Grazing	Grazing	Grazing

3.7 Myola East low undulating sedimentary hills (continued)

Detailed Soil Description

Land component	1	2	3	4
Representative soil type	**A1** 0 - 10 cm Reddish brown (5YR 5/4) *clay loam*, weak subangular blocky structure, many gravel and stone fragments, pH 4.5, gradual transition to: **B2** 10 - 50 cm Reddish brown (5YR 5/4) *silty clay*, moderate subangular blocky structure, many gravel and stone fragments pH 6.0 **BC** 50 cm + Weathered shale and clay material	**A1** 0 - 10 cm Dark brown (7.5YR 4/4) *fine sandy loam*, pH6.0, clear transition to: **B21** 10 - 50 cm Red (2.5YR 4/6) *light medium clay*, sub angular blocky structure, pH 8.5, abrupt transition to: **B22** 50 - 90 cm Yellowish red (5YR 5/8) *light medium clay*, moderate subangular blocky structure, pH 9.0, gradual transition to: **BC** 90+ cm *medium clay*	**Alluvial wash** 0 - 10 cm Yellowish red (5YR 4/6) *clay loam*, moderate sub angular blocky structure, few gravel fragments, pH 6.0, clear transition to: **A1** 10 - 20 cm Dark reddish brown (5YR 3/4) *fine sandy clay loam*, weak sub angular blocky, common gravel fragments, pH 6.5, clear transition to: **A2** 20 - 30 cm Pink (7.5YR 8/4) *sandy clay loam*, massive, abundant gravel fragments, pH 6.5, clear transition to: **B1** 30 - 45 cm Strong brown (7.5YR 5/6) *sandy clay*, massive, many gravel fragments, pH 7.0, gradual transition to: **B2** 45 - 60 cm Strong brown (7.5YR 5/6) *medium clay*, moderate sub angular blocky structure, many gravel fragments, pH 7.0 abrupt transition to: **C** 60+ cm Weathered sedimentary rock	**A11** 0 - 5 cm Dusky red (2.5YR 3/2) *loam*, weak subangular blocky structure, few gravel and stone fragments, pH 6.0, clear transition to; **A12** 5 - 10 cm Dark reddish brown (5YR 3/2) *loam*, weak subangular blocky structure, many gravel and stone fragments, pH 5.5, clear transition to: **A2** 10 - 20 cm Yellowish red (5YR 5/6) *clay loam*, moderate subangular blocky structure, abundant gravel and stone fragments, pH 5.0, clear transition to: **B2** 20+ cm Reddish yellow (5YR 6/6) *silty clay*, moderate subangular blocky structure, many gravel and stone fragments, pH4.5
Source of detailed soils information	Lorimer, M.S, & N.R. Shoknecht (1987) Myola East Land System (site 1018)	Lorimer, M.S, & N.R. Shoknecht (1987) Myola East Land System (site 1021)	Lorimer, M.S, & N.R. Shoknecht (1987) Myola East Land System (site 1020)	Lorimer, M.S, & N.R. Shoknecht (1987) Myola East Land System (site 1019)

3.7 Myola East low undulating sedimentary hills (continued)

Standard Planning Responses

Land System 2.1Gs4.5, 2.1Gs4.4, 2.1Gs5.5				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	iii	Slope Estimated subsoil permeability Depth of sodic clay	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope Estimated subsoil permeability Depth of sodic clay	As above
	3	iii	Slope Estimated subsoil permeability	As above
	4	iii	Slope Estimated subsoil permeability Depth of sodic clay	As above
Irrigated cropping	1	iii	Slope Site drainage Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	iii	Slope	As above
	4	iii	Slope Depth to hard rock Proportion of stones and boulders	As above
Irrigated perennial pasture	1	iii	Slope	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Slope	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	ii	Slope Available water capacity Estimated subsoil permeability	As above
	4	iii	Slope	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

3.7 Myola East low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated perennial horticulture	1	iii	Site drainage Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Depth of topsoil Depth to hard rock	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	4	iii	Depth to hard rock	As above
Irrigated tomatoes	1	iii	Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Depth to hard rock Proportion of stones and boulders Available water capacity	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion Available water capacity	As above
	4	iii	Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Irrigated farm forestry	1	iii	Slope Site drainage Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	Must comply with the Planning Scheme Refer to the Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)

3.7 Myola East low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated farm forestry	3	iii	Slope Site drainage	As above
	4	iii	Slope Depth to hard rock	As above
Dryland olives	1	iii	Site drainage Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity Depth of topsoil	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	4	iii	Depth to hard rock	As above
Dryland viticulture	1	iii	Site drainage Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity Depth of topsoil	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	4	iii	Depth to hard rock	As above
Broadacre Effluent disposal (feedlots)	1	iv	Depth to hard rock	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
	2	iii	Depth to hard rock	As above
	3	iv	Estimated subsoil permeability	As above
	4	iii	Depth to hard rock	As above

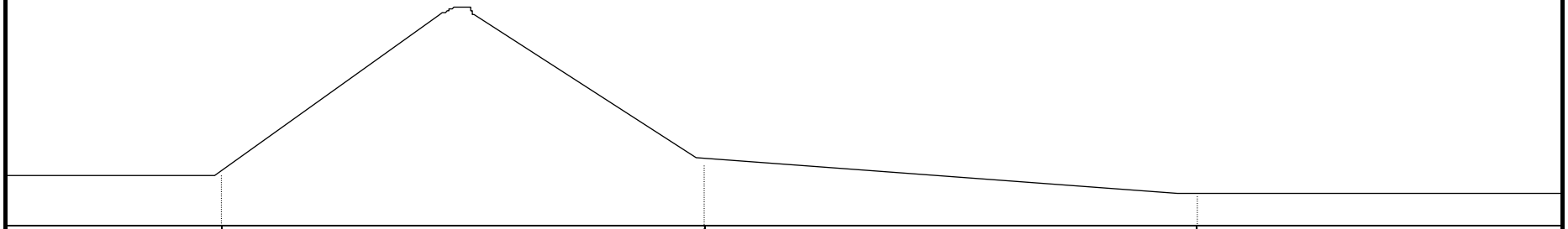
3.7 Myola East low undulating sedimentary hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-v)*	*Major Physical Limitations*	*Planning Response*
Effluent disposal (septic tank)	1	iv	Depth to hard rock	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
	2	ii	Depth to hard rock	As above
	3	iv	Estimated subsoil permeability	As above
	4	iii	Depth to hard rock	As above
Secondary roads	1	iv	Slope Susceptibility to sheet/rill erosion	Must comply with the Planning Scheme
	2	iii	Susceptibility to gully erosion	As above
	3	iv	Site drainage	As above
	4	ii	Nil	As above

3.8 Mount Camel rolling low volcanic hills

General Description

Land System: 2.1Gv4, 2.1Gf4			
Parent material	Cambrian volcanics (greenstones and cherts)		
Climate	450 - 550 mm (mean annual rainfall)		
			
Land component	1	2	3
Soil association and dominant soil types	Colbinabbin (Colbinabbin clay loam, Colbinabbin clay)	Colbinabbin (Colbinabbin clay loam, Colbinabbin clay)	Binabbin (Binabbin clay, Cornella clay)
Landform element	Crest and steep rocky slopes	Moderate to gentle colluvial slopes	Very gentle colluvial slopes and alluvial plain
Slope range	5 - 40 %	5 - 20 %	0 - 5 %
General soil description	Moderately structured soils lacking strong texture contrast with red clay loam topsoils and red clay subsoils	Moderately structured soils lacking strong texture contrast with red clay loam topsoils and red clay subsoils	Moderately structured brown cracking clay soils
Factual Key	Gn4.12, Gn3.12, Dr2.13	Gn3.12, Dr2.13, Uf	Ug5.3
Australian Soil Classification	Red Dermosol (2)	Red Dermosol (2)	Brown Vertosol (2)
Site drainage	Rapidly drained	Well drained	Poorly drained
Estimated permeability (subsoil)	Highly permeable	Moderately permeable	Slowly permeable
Rock outcrop	0 - 20 %	Nil	Nil
Depth to hardrock	30 - 100 cm	> 100 cm	> 200 cm
Susceptibility to land degradation	Sheet and rill: High Wind erosion: Low Gully erosion: Medium - Low	Sheet and rill: Medium Wind erosion: Low Gully erosion: Medium - High	Sheet and rill: Medium Wind erosion: Low Gully erosion: Medium - High
Broad Vegetation Type	Northern Plains Grassy Woodland Complex		
Current land use	Grazing, minor cropping	Grazing, minor cropping	Grazing, cereal cropping

3.8 Mount Camel rolling low volcanic hills (continued)

Detailed Soil Description

Land component	1	2	3
Representative soil type	**A1** 0 - 10 cm Dark red (2.5YR 3/6) *fine sandy clay loam*, moderate blocky structure, pH 5.6 **B21** 10 - 20 cm Dark red (2.5YR 3/6) *light medium clay*, moderate blocky structure, few quartz and greenstone fragments, pH 6.0 **B22** 20 - 35 cm Dark red (2.5YR 3/6) *light clay*, moderate blocky structure, pH 6.6 **B23** 35 - 60 cm Red (2.5YR 4/8) *sandy clay loam* **C** 60 - 100 cm Weathered greenstone rock	**A1** 0 - 10 cm Dark red (2.5YR 3/6) *fine sandy clay loam*, moderate blocky structure, pH 5.6 **B21** 10 - 20 cm Dark red (2.5YR 3/6) *light medium clay*, moderate blocky structure, few quartz and greenstone fragments, pH 6.0 **B22** 20 - 35 cm Dark red (2.5YR 3/6) *light clay*, moderate blocky structure, pH 6.6 **B23** 35 - 60 cm Red (2.5YR 4/8) *sandy clay loam* **C** 60 - 100 cm Weathered greenstone rock	**A** 0 - 10 cm Dark grey brown (7.5YR 3/3) cracking *clay* with slight calcium carbonate **B21** 10 - 40 cm Dark greyish brown (7.5YR 3/4) *heavy clay* with slight calcium carbonate **B22** 40 - 75 cm Dark brown (2.5YR 3/4) *heavy clay*, with slight calcium carbonate and gypsum **B23** 75 - 180 cm Brown (2.5YR 4/5) *heavy clay* with light calcium carbonate
Source of detailed soils information	Mt Camel Landcare Group - Soil Pit Field Day Notes, Soil Pit No. LP99	Mt Camel Landcare Group - Soil Pit Field Day Notes, Soil Pit No. LP99	Skene, J.K.M. & Harford, L.B. (1964) Binnabbin clay profile 34

3.8 Mount Camel rolling low volcanic hills (continued)

Standard Planning Responses

Land System 2.1Gv4, 2.1Gf4				
Land Use Activity	***Land Component***	***Class (i-iii)***	***Major Physical Limitations***	***Planning Response***
Rice	1	iii	Slope Estimated subsoil permeability Depth of sodic clay	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope Estimated subsoil permeability Depth of sodic clay	As above
	3	iii	Slope	As above
Irrigated cropping	1	iii	Slope	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	ii	Slope Site Drainage Depth to hard rock Proportion of stones and boulders	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
Irrigated perennial pasture	1	iii	Slope Site Drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	ii	Slope Site Drainage	Must comply with the Planning Scheme. Refer to the Irrigation and Planning Practice. Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
Irrigated perennial horticulture	1	iii	Slope Site Drainage Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion Depth of topsoil	Must comply with the Planning Scheme Refer to the Irrigated and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site Drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

3.8 Mount Camel rolling low volcanic hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-iii)*	*Major Physical Limitations*	*Planning Response*
Irrigated tomatoes	1	iii	Slope Depth to hard rock Proportion of stones and boulders	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion	Must comply with the Planning Scheme Refer to TomCHECK, Guidelines to Successful processing tomato production Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	ii	Susceptibility to gully erosion Susceptibility to sheet/rill erosion	As above
Irrigated farm forestry	1	iii	Slope Site Drainage Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iii	Slope	As above
	3	ii	Slope Site Drainage	Must comply with the Planning Scheme Refer to the Irrigation and Site drainage Practice Refer to Salinity Management Plan Campaspe West Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
Dryland olives	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site Drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome

3.8 Mount Camel rolling low volcanic hills (continued)

Standard Planning Responses (continued)

Land Use Activity	*Land Component*	*Class (i-v)*	*Major Physical Limitations*	*Planning Response*
Dryland viticulture	1	iii	Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	ii	Depth to hard rock Available water capacity	Must comply with the Planning Scheme Refer to Campaspe Catchment Salinity Management Plan Refer to Groundwater overlay Seek advice from the Industry Development Officer within DNRE Manage to overcome physical limitations (Refer to Appendix A)
	3	iii	Site Drainage	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
Broadacre Effluent disposal (feedlots)	1	v	Slope Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	iii	Slope	Must comply with the Planning Scheme Must comply with the Guidelines for the conduct of intensive animal industries Must comply with the Victorian code for Cattle Feedlots or; Must comply with the Code of practice for piggeries or; Must comply with the Code of accepted farming practice for the welfare of domestic fowl Manage to overcome physical limitations (Refer to Appendix A)
	3	iv	Estimated subsoil permeability	As above
Effluent disposal (septic tank)	1	v	Slope Depth to hard rock	Development should not occur without a detailed site assessment to determine whether the major engineering or environmental limitations can be economically overcome An alternative form of effluent disposal should be considered
	2	iii	Slope	Must comply with the planning scheme Must comply with the Code of Practice - Septic Tanks
	3	iv	Estimated subsoil permeability	As above
Secondary roads	1	v	Slope	Development should not occur without a detailed site assessment to determine whether the major production or environmental limitations can be economically overcome
	2	iv	Slope	Must comply with the Planning Scheme
	3	iv	Site drainage	As above

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APPENDIX A. GUIDELINES AND REFERRAL DOCUMENTS

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APPENDIX B. RESPONSES TO OVERCOME IDENTIFIED LIMITATIONS

B.1 Agricultural land suitability

Category	Result	Management response
Slope	Steep slopes may impact upon machinery access to crops or paddocks, particularly under wet conditions. Steep slopes are more susceptible to sheet and rill erosion and are not appropriate for furrow or check bank irrigation.	Fence out paddocks with steep slopes, maintain groundcover, manage for light grazing or forestry purposes.
Site drainage	Poor site drainage in clay soils result in waterlogging and ponded surface water. Plant growth is inhibited under these conditions. Alternatively, rapid site drainage in sandy soils may result in insufficient water available for plant growth.	Avoid cropping and horticulture in areas with very poor site drainage. Establish surface/ubsurface drainage where appropriate. Regulate irrigation regime to suit soil type and pasture species, or return to dryland farming practices.
Susceptibility to sheet/rill, gully and wind erosion	Loss of topsoil through erosion reduces the soils water and nutrient holding capacity. Plant growth is therefore restricted. Soil erosion will also result in off-site siltation of streams and waterways.	Maintain vegetative ground cover. Establish wind protection barriers.
Susceptibility to surface crusting	Soil surface forms a water resistant crust which leads to increased runoff and reduced seedling establishment.	Maintain vegetative groundcover . Apply gypsum if the topsoil is sodic. Increase organic matter content to impoprove topsoil structure.
Topsoil depth (cm)	Reduced water and nutrient holding capacity. Reduced volume of soil that can be exploited by plants. For perennial horticulture, shallow topsoils provide inadequate material for mounding.	Increase amount of organic matter by incorporating surface mulch such as green manure crops, stubble or manure. Avoid deep ripping where shallow topsoils are present.
Depth to hard rock (m)	Shallow soil depth restricts the rooting depth of plants and thereby limits the amount of water and nutrients available for plant growth.	Fence out paddocks with shallow soils, generally manage for light grazing or forestry purposes.
Proportion of stones and boulders (%)	High proportions of stones and boulders increase the maintenance required for farm machinery and reduce the water and nutrients available for plant growth.	Avoid cropping stony rises and rocky plains.
Depth to seasonal watertable (m)	Waterlogging in the root zone of plants occurs, as may transportation of soluble salts into the rootzone . Both lead to inhibited plant growth or death of the plant under severe situations.	Plant deep rooted plant species. Establish surface/subsurface drainage where appropriate. Regulate irrigation regime to suit soil type and pasture species, or return to dryland farming practices.
Amount of water available to plants	Under dry conditions , insufficient soil-water storage capacity may limit plant growth or lead to plant death.	Increase organic matter by growing green manure crops. Increase the rooting depth of plants by reducing the restrictive layer (ie. deep rip with gypsum if sodic subsoil is restricting root penetration).
Electrical conductivity	Electrical conductivity measures the soluble salts stored with the soil, where high soluble salt levels are present in the rootzone, growth is restricted or plant death may occur.	Fence off saline discharge areas and avoid cropping or disturbance of soils. Maintain and improve vegetative cover and reduce grazing pressure in discharge areas.
Estimated subsoil permeability	Very poor permeability results in restricted water and air movement in the soil, usually in the clayey subsoil. Therefore, waterlogging is a common problem leading to poor root growth and plant death in severe situations.	Plant deep rooted plant species. Establish surface/subsurface drainage where appropriate. Regulate irrigation regime to suit soil type and pasture species, or return to dryland farming practices.

B.2 Low density residential and rural living capability

Category	Result	Management response
Slope	As the slope increases, so does the difficulty and cost in establishing roads and other infrastructure required to support both urban and rural development.	Where slope is excessive, existing engineering limits will restrict roading, effluent disposal , construction of farm dams and building foundations. Careful planning is required to ensure development is located in appropriate locations.
Site drainage	Poor site drainage can lead to failure in the foundations of roads and buildings, and will restrict the effectiveness of septic tanks.	Avoid development in areas of poor drainage. Establish flat bottomed and broad drains up slope to reduce runoff, improve drains down slope where poor site drainage occurs. Consider alternative forms of effluent disposal. Where poor permeability is restrictive but not prohibitive, modify trench length , depth and width ,and utilise evapotranspiration from vegetation to increase the effectiveness of standard septic tanks.
Flooding risk	Floods may cause severe damage to roads, bridges buildings and other infrastructure.	Avoid development in areas where there is a significant flood risk.
Susceptibility to sheet/rill, gully and wind erosion	Loss of groundcover and increased run-off, particularly on steep slopes, leads to soil erosion. This can result in eroded table drains, blocked cut-off drains, and undercutting of roads and bridges. In addition, runoff contributes to off-site siltation and eutrophication of streams and waterways.	Maintain vegetative ground cover. Identify erosion prone land types, utilise sealed roads with appropriate drainage. Prohibit secondary or gravel roads.
Depth to seasonal watertable	The Septic Tank Code of Practice (Environment Protection Authority 1996) requires greater than 0.75 m of unsaturated soil for the proper functioning of effluent disposal trenches. Ideally, the groundwater table should be much lower than one metre, thereby reducing the risk of a rising groundwater table influencing the effectiveness of the absorption trenches. The risk of salinity problems also increase when a water table rises to within 1.0-1.5 m of the soil surface.	Avoid development on areas with shallow watertables. Consider alternative forms of effluent disposal.
Depth to hard rock or impermeable layer	The depth to hard rock provides a measure of the effectiveness of the soil profile in filtering the nutrient and bacterial content from the effluent. The Septic Tank Code of Practice (Environment Protection Authority *et. al.* 1990) requires a depth of at least one metre. In addition, the presence of hard rock may require removal for the purpose of constructing roading, building and dams etc.	Where shallow soils are present, consider alternative forms of effluent disposal , and carefully site roading, buildings and dams etc.
Estimated subsoil permeability	Poor subsoil permeability can result in failure of septic tanks and ineffective broadacre effluent disposal, particularly in high rainfall areas. Alternatively, very high permeability may result in rapid leaching of nutrients into groundwater systems or local streams.	Avoid standard septic tanks where very poor/high permeability is present. Seek an alternative form of effluent disposal. Where poor permeability is restrictive but not prohibitive, modify trench length , depth and width ,and utilise evapotranspiration from vegetation to increase the effectiveness of standard septic tanks.

APPENDIX C. SPECIFIC NOTES TO ACCOMPANY LAND CAPABILITY/SUITABILITY ASSESSMENT TABLES

C.1 Total amount of water available to plants

Available Water Capacity (AWC) is a measure of the amount of useable water in the soil for plant growth. It is determined from the difference between the amount of water retained by the soil after drainage (field capacity) and the moisture content of a soil at wilting (permanent wilting point). There is a reasonable correlation between soil texture and AWC (Salter and Williams 1969).

Available water capacity of soils

Range (mm/m)	Average value for calculations (mm/m)	Sands	Sandy loams	Loams	Clay loams	Clays
76 - 100	90	KS				
101 - 125	110	LKS	KSL			
126 - 150	130	S				SC, C
151 - 175	160	CS, LS	SL	L	SCL	
176 - 200	190	FS	FSL	CL, ZL	ZCL	ZC
201 - 225	210	LFS				

The total amount of water available to plants can be calculated by adding the amount of available water in each horizon down to a maximum depth of two metres or the rooting depth, e.g. if the subsoil is very sodic the total amount of water available to plants is calculated to the sodic horizon.

Note that gravel content of the soil horizons should be taken into account.

Soil horizon	Texture	Depth of horizon (m)	AWC of horizon (mm/m)	Available water in horizon (mm)
A	SL	0.15	160	24
B2	SC	1.25	130	143

For example, the total amount of water in the worked example above = 167 (Class 2)

C.2 Electrical conductivity

The following correlation between the electrical conductivity of soil samples taken from the 0 - 50 cm layer of the soil profile and soil salinity has been established. It illustrates the relationship between rating class, soil salinity, EC and site characteristics such as plant growth.

The effects of soil salting on plant growth

Class	Severity of salting	E.C. dS/m *	Site characteristics
1	Nil/very low	< 0.3	Plant growth unaffected
2	Low	0.30 - 0.53	Growth of salt-sensitive plants, eg cereals and clover is restricted
3	Moderate	0.53 - 1.26	Patchy pasture growth; salt-sensitive plants are replaced with species that are more salt-tolerant
4	High	1.26 - 2.5	Small areas of bare ground; surviving plant species have high salt tolerance
5	Very high/severe	> 2.5	Large areas of bare ground; highly salt-tolerant plants; trees may be dead or dying

*** NB: 1000 μS/cm = 1 dS/m**

C.3 Flooding risk

Building regulations prohibit building on flood-prone land, therefore land with some risk of flooding must be identified. Flooding is unlikely to cause a septic tank to fail, however the risk of polluting the floodwaters with phosphorus, nitrogen and bacterial organisms increases with the number of effluent disposal fields involved. The dilution factor will be dependent on the quantity of floodwater.

Dams are built to intercept and store run-off water. It is not possible in these tables to distinguish between seasonal run-off and seasonal flooding; the latter poses a threat to the stability of the dam, and the risk of flooding will depend on the intensity and duration of rainfall, the run-off characteristics of the catchment and the land use within the catchment. Flooding risk is rated below.

Flooding risk

Risk	Class	Limitation	Condition of flood
Nil	1	No limitation	No flooding
Low	2	Minor	Minor inundation No debris Flood return period: 1 in 100 years
Moderate	3	Significant	Broad, slow moving No debris Flood return period: 1 in 100 years
High	4	Major	Broad, slow moving Little debris Flood return period: 1 in 20 years
Severe	5	Prohibitive	Deep channel, fast flowing Debris carrying Flood return period: annual

C.4 Estimated permeability of a soil profile

Permeability is controlled by the least permeable layer of a soil profile and its ability to transmit water. Permeability is independent of climate and surface drainage. The rate at which water moves down through the soil profile is an indicator of the tendency of a soil to saturate. It is an important feature if plant growth is to be maintained in areas where rainfall is spasmodic or unreliable.

Permeability provides a measure of the rate at which a saturated soil profile will conduct water to depth. Permeability measurements may over-estimate the value for the disposal of effluent because the soil macropores are transmitting water, whereas the real situation must take into account the clogging effect of effluent on the bottom of effluent disposal trenches, thereby reducing the rate of water movement into the soil.

The measurement of permeability often produces quite variable results. Therefore, the setting of class limits is difficult and by necessity must be very broad. Estimates of permeability can be made for both dry and irrigated lands.

Permeability is influenced by key physical and chemical properties of the soil. By identifying the presence or absence of these properties, an estimate of soil permeability can be determined.

Estimated subsoil permeability

Parameter	Category	Score
Principle Profile Form	Uc Gc, Gn, Um Uf, Ug, D	1 2 3
Subsoil texture (field texture)	(< 20 % clay) sands, loamy sands, sandy loams (25 - 35 % clay) loams, sandy clay loams, clay loams, silty loams, sandy clays, light clays (> 40 % clay) light-medium clay, medium clays, heavy clays	1 2 3
Subsoil sodicity (ESP)/structure	< 6 (strong to moderate blocky structure/single grain) 6 - 15 > 15 (weak structure, large peds)	1 2 3
Linear shrinkage (%)/presence of cracking soils	0 - 12 (no cracking) 13 - 22 > 22 (cracks at least 5mm wide)	1 2 3

Total score	Estimated permeability	Estimated absorption rate (mm/day)	Time taken for saturated soil to drain to field capacity
11 - 12	Very slowly permeable	< 10	Months
9 - 10	Slowly permeable	10 - 100	Weeks
7 - 8	Moderately permeable	100 - 500	Days
5 - 6	Highly permeable	500 - 1500	Hours
4	Very highly permeable	> 1500	Rarely saturated

C.5 Susceptibility to gully erosion

No single factor can adequately represent the susceptibility of an area to the gully erosion process. A number of factors are involved and each should be scored independently and then the sum of the scores can be related back to a 5 - class rating.

Susceptibility to gully erosion

Criteria	Description	Score
Slope	< 1 %	1
	1 - 3 %	2
	4 - 10 %	3
	11 - 32 %	4
	> 32 %	5
Subsoil ESP	< 6	1
	6 - 15	4
	> 15	5
Subsoil structure	Apedal , massive	1
	Weak	
	fine < 2 mm	3
	mod 2 - 10 mm	2
	coarse > 10 mm	1
	Moderate	
	fine < 2 mm	4
	mod 2 - 10 mm	3
	coarse > 10 mm	2
	Strong	
	fine < 2 mm	5
	mod 2 - 10 mm	3
	coarse > 10 mm	1
	Apedal single grained	5
Rating for susceptibility to gully erosion:	**Class**	**Total score**
	Low	3 - 8
	Medium	9 - 12
	High	13 - 15

C.6 Susceptibility to slope failure

The instability of slopes in a catchment area of a dam poses a threat to the storage capacity of that dam. Additional costs are also involved if the dam requires regular desludging. This assessment considers that land slips are the result of factors such as soil depth, slope, soil texture, volume of water held in the soil, permeability of the solum and the underlying parent material. Since the quantity of water in a profile is itself a function of soil texture, depth and permeability, the table below is presented as a first attempt to assess the susceptibility of land to slope failure by relating the total amount of water in the soil profile to the slope.

Susceptibility to slope failure

Slope	**Total amount of water in the soil profile**		
	Low (< 70 mm H_20)	Moderate (70 - 170 mm H_20)	High (> 170 mm H_20)
Gentle < 10 %	Very low	Very low	Low
Moderate 10 - 32 %	Low	Moderate	High
Steep > 32 %	Moderate	High	Very high

C.7 Susceptibility of soil to sheet and rill erosion by water

The following table has been adapted from Elliott and Leys (1991). The erodibility index for a range of soil properties closely relates to the susceptibility of soils to erosion by water, and in the tables below, the same soil properties have been used (texture, structure grade, topsoil depth and dispersibility (Emerson aggregate test)) and then related to slope to determine a rating for susceptibility. The final rating for susceptibility to sheet/rill erosion is read from the second table, once the erodibility of the topsoil and the slope of the area have been assessed.

Erodibility of topsoils

Soil parameters			Soil Dispersibility		
Texture group (A1)	**Structure grade (A1)**	**Horizon depth (A1 + A2)**	**Very Low - Low ESP <6**	**Medium - High ESP 6 -15**	**Very High ESP >15**
Sand	apedal	< 0.2 m	M		
		0.2 - 0.4 m	L		
		> 0.4 m	L		
Sandy loam	apedal	< 0.2 m	M	H	
		0.2 - 0.4 m	L	M	
		> 0.4 m	L		
	weakly pedal	< 0.2 m	H	E	
		0.2 - 0.4 m	M	V	
		> 0.4 m	M		
Loam	apedal	< 0.2 m	M	H	
		0.2 - 0.4 m	L	M	
		> 0.4 m	L		
	weakly pedal	< 0.2 m	H	E	
		0.2 - 0.4 m	M	V	
		> 0.4 m	M		
	peds evident	< 0.2 m	H	E	
		0.2 - 0.4 m	H		
		> 0.4 m	H		
Clay loam	apedal	< 0.2 m	M	H	
		0.2 - 0.4 m	L	M	
		> 0.4 m	L		
	weakly pedal	< 0.2 m	H	E	
		0.2 - 0.4 m	M	V	
		> 0.4 m	M		
	peds evident	< 0.2 m	H	E	
		0.2 - 0.4 m	H	E	
		> 0.4 m	M		
Light clay	weakly pedal	< 0.2 m	H	E	E
		0.2 - 0.4 m	M	V	E
		> 0.4 m	M	V	E
	peds evident	< 0.2 m	M	V	E
		0.2 - 0.4 m	M	H	E
		> 0.4 m	M	H	E
	highly pedal	< 0.2 m	H	E	
		0.2 - 0.4 m	M	V	
		> 0.4 m	M	V	
Medium to heavy clay	weakly pedal	< 0.2 m	M	H	E
		0.2 - 0.4 m	M	H	V
		> 0.4 m	M	H	V
	peds evident	< 0.2 m	H	E	E
		0.2 - 0.4 m	M	V	E
		> 0.4 m	M	V	E
	highly pedal	< 0.2 m	H	E	E
		0.2 - 0.4 m	M	V	E
		> 0.4 m	M	V	E

L - Low M - Moderate H - High V - Very high E - Extreme

Susceptibility of soil to sheet and rill erosion*

Slope	Topsoil erodibility (from Table C.10)				
	Low	Moderate	High	Very high	Extreme
< 1 %	Low	Low	Low	Medium	Medium
1 - 3 %	Low	Low	Medium	Medium	Medium
4 - 10 %	Low	Medium	Medium	Medium	High
11 - 32 %	Medium	Medium	Medium	High	High
> 32 %	Medium	Medium	High	High	High

*** Note:** Topsoil erodibility is determined from the texture, structure, depth and dispersibility of the topsoil (Table C.7). The susceptibility of the topsoil to sheet and rill erosion relates to the combined effect of slope and topsoil erodibility (Table C.8).

C.8 Susceptibility of soil to erosion by wind

The susceptibility of land to wind erosion is a function of soil erodibility, the probability of erosive winds when the soil is dry and the exposure of the land component to wind (Lorimer 1985). Soil erodibility is a very important factor to consider in land capability rating tables.

Soil erodibility

Soil type		Rating
1	Surface soil has a strong blocky structure (aggregates > 0.8 mm), or is apedal and cohesive or has a dense layer of stones, rock or gravel	Low
	Surface soil has strong fine structure (aggregates < 0.8 mm)	Medium
	Surface soil has a weak-moderate structure or is apedal and loose	Go to 2
2	Surface soils with organic matter > 20 %	Medium
	Surface soils with organic matter 7 - 20 %	Medium
	Surface soils with organic matter < 7 %	Go to 3
3	Surface soils with the following textures:	
	Fine-medium sands	High
	Loamy sands	High
	Sandy loams, silty loams	Medium
	Loams, coarse sands	Medium
	Clay loams	Low
	Clays	Low

C.9 Susceptibility to surface crusting

A surface crust typically forms when raindrops impact on unstable soil surfaces.

In order to compensate for limited information, such as dispersion results and Exchangeable Sodium Percentage (ESP), the table has been produced to estimate the potential susceptibility of a soil to surface crusting.

Estimating susceptibility to surface crusting

Criteria	Description	Score
ESP (topsoil)	> 6	3
	< 6	1
Topsoil texture	Silty clay loam	3
	Silty clay	3
	Fine sandy clay loam	3
	Clay	3
	Clay loam	2
	Coarse sandy clay loam	2
	Sandy loam	2
	Silty loam	2
	Loam	1
	Organic clay loam	1
Topsoil structure	Apedal	3
	Weak	3
	Moderate	2
	Strong	1
	Self-mulching	1
Class		**Score**
Low		3 - 5
Moderate		6 - 7
High		8 - 9

APPENDIX D. PHYSICAL AND CHEMICAL LABORATORY RESULTS

Site/Laboratory Number	Horizon	Horizon Depth cm	Particle Size Distribution					pH H2O	EC dS/m	Total Soluble Salts %	Organic Carbon %	Total Nitrogen %	Skene K mg/kg	Olsen P mg/kg	Exchangeable Al+++ mg/kg	Exchangeable Bases				Total of Extractable Bases	Exchangeable H+ meq/100g
			Gravel > 2mm %	Coarse sand %	Fine Sand %	Silt %	Clay %									Ca ++ meq/100g	Mg++ meq/100g	K+ meq/100g	Na+ meq/100g		
Field sample, Murray River floodplain																					
Land System: 4.1Ffc3, 4.1Ffc4, 4.1Flfc4. Land component: 3																					
970275	A1	0-5	0	14	35	34	16	5.8	0.22	0.07	10	0.87	570	12	< 10	15	7.3	1.5	1.2	25.0	21.0
970276	B21	5-16	0	2	24	49	25	6.4	0.13	0.04	0.54	< 0.05	260	2	< 10	3.1	3.6	0.71	0.95	8.4	3.6
970277	B23	30-70	0	2	21	36	41	6.5	0.12	0.04	0.30	< 0.05	250	2	< 10	3.1	7	0.79	1.3	12.0	4.5
Mount Camel Landcare Group, Soil Pit Field Day.																					
Land System: 2.1Gv4, 2.1Gf4. Land components: 1, 2																					
LP99	A1	0-7		6	34	25	30	5.6	< 0.05		3.0	0.34				12	5.0	0.2	0.4	17.6	
LP99	B21	7-20		7	32	21	38	6.0	< 0.05							19	7.3	0.2	0.2	26.7	
LP99	B22	20-35		9	31	20	33	6.6	< 0.05							36	16	0.2	0.2	52.4	
LP99	B23	35-60						6.9	< 0.05							39	19	0.1	0.3	58.4	
LP99	C	60-100						7.9	< 0.05							32	18	0.1	0.4	50.5	
Skene & Poutsma (1962). Soils and Land Use in part of the Goulburn Valley, Victoria. Technical Bulletin, 14																					
Congupna clay loam: Profile 47. Land System: 4.2Pf4-2. Land component: 2																					
19077		0-8	-	12	40	16	29	6.6	0.061	0.02	1.42	0.10				5.3	5.6	0.8	0.9	12.6	
19078		8-33	-	7	23	12	57	7.4	0.182	0.06	0.61	0.07				10.5	11.2	1.3	3.5	26.5	
19079		33-56	-	6	21	12	59	8.3	0.576	0.19											
19081		56-84	-	6	24	15	53	8.7	0.878	0.29						8.9	12.2	1.1	5.7	27.9	
19080		94-152	-	9	36	14	40	8.6	0.697	0.23											
Erwen Loam: Profile 30. Land System: 1.1Gs4-1, 1.1Gs4-2, 1.1Gs5-1. Land component: 2																					
27019		0-10	-	13	39	20	24	6.7	0.061	0	1.52	0.11				5.5	3.8	1	0.9	11.2	
27020		10-43	-	6	18	9	66	8.1	0.182	0.1	0.53	0.08				4.7	12.8	1.8	3.9	23.2	
27021		43-58	-	5	18	10	66	8.7	0.636	0.2											
27022		58-94	13	4	18	12	57	9.0	0.878	0.3						5.9	15.2	1.9	6	29	
27023		94-119	30	5	22	12	51	9.1	0.878	0.3											
Erwen Loam, shallow phase: Profile 31. Land System: 1.1Gs4-1, 1.1Gs4-2, 1.1Gs5-1. Land component: 1																					
27025		0-8	51	10	52	17	20	6.2	0.061	0											
27026		8-13	14	11	50	16	23	6.5	0.030	0											
27027		13-33		6	26	11	55	7.2	0.061	0											
27028		33-58		3	18	19	48	8.6	0.182	0.1											
Goulburn clay loam: Profile 16. Land System: 4.2Pf4-2. Land component: 3																					
11323		0-15	-	10	39	24	26	6.9	0.061	0	1.08	0.08				6.1	3.5	1.1	0.5	11.2	
11324		15-51	-	8	29	18	45	8.1	0.121	0						7.2	7.9	1.1	2.3	18.5	
11325		51-61	-	6	28	18	46	8.7	0.212	0.1											
11326		61-84	-	8	33	20	40	8.9	0.394	0.1											
11327		84-104	-	9	33	22	35	9.0	0.545	0.2						4.9	7.2	1.2	3.9	17.2	
11328		104-127	-	6	31	19	43	8.7	0.636	0.2											
Wenora Loam: Profile 54. Land Systems: 1.1Gs4-1, 1.1Gs4-2, 1.1Gs5-1. Land component: 3																					
27964		0-8	28	4	38	28	28	5.8	0.091	0											
27965		8-13	67	5	42	29	22	6.4	0.091	0											
27966		13-28	10	2	26	16	56	7.8	0.242	0.1											
27967		28-51	10	1	19	13	65	8.4	0.515	0.2											
27968		51-81	5	1	22	20	56	8.8	0.818	0.3											
27969		81-130	-		9	21	69	7.8	1.24	0.4											
27970		130-213	16	1	14	42	42	5.4	0.606	0.2											
Skene (1963). Soils and Land Use in the Deakin Irrigation Area, Victoria. Technical Bulletin, 16																					
Corop Clay: Profile 14. Land System: 4.2Flf3, 4.2Flf4. Land component: 2																					
9717		0-8	-	3	27	14	54	6.5	0.125	0	1.4	0.15									
9718		8-46	-	1	12	10	77	8.1	0.500	0.2						9.4	19.8	1.6	6.2	37	
9719		46-61	-	1	10	8	77	8.0		*											

Site/Laboratory Number	Horizon	Horizon Depth cm	Particle Size Distribution					pH H2O	EC dS/m	Total Soluble Salts %	Organic Carbon %	Total Nitrogen %	Skene K mg/kg	Olsen P mg/kg	Exchangeable Al+++ mg/kg	Exchangeable Bases				Total of Extractable Bases	Exchangeable H+ meq/100g
			Gravel > 2mm %	Coarse sand %	Fine Sand %	Silt %	Clay %									Ca ++ meq/100g	Mg++ meq/100g	K+ meq/100g	Na+ meq/100g		
9720		61-117	1	1	8	10	77	8.0		*											
9721		117-183	-	1	7	13	77	8.0	2.53	0.8											
Kanyapella Clay: Profile 29. Land System: 4.1Ffc3, 4.1Ffc4, 4.1Flfc4. Land component: 1																					
8718		0-10	-	6	32	30	29	6.3	0.093	0	2.5	0.2									
8719		10-30	-	3	25	28	42	7.6	0.125	0											
8720		30-43	-	2	16	28	52	8.9	0.563	0.2											
8721		43-86	-	1	14	28	57	8.7	1.00	0.3											
8723		86-127	-	2	12	27	57	8.2	1.13	0.4											
8724		127-183	-	2	16	29	52	8.1	1.06	0.3											
Skene & Harford (1963). Soils and Land Use in the Deakin Irrigation Area, Victoria. Technical Bulletin, 16																					
Binabbin Clay: Profile 34. Land System: 2.1Gv4, 2.1Gf4. Land component: 3																					
13055		0-5	-	6	25	10	54	7.6	0.156	0.1	2.11	0.19									
13056		5-23	-	6	23	11	58	7.9	0.156	0.1	1.17	0.14				32.4	8.4	1.3	0.7	42.8	2.5
13057		23-43	-	5	23	10	59	8.2	0.219	0.1						27.8	12.4	1	2.4	43.6	-
13058		43-71	-	5	21	9	56	8.7	0.344	0.1											
13059		71-94	-	5	20	10	55	8.9	0.531	0.2						14.8	16.7	1.1	8.1	40.7	-
13061		122-160	-	3	20	11	58	8.5	1.69	0.5											
13063		183-234	-	3	19	10	65	8.2	1.94	0.6											
Carag Clay: Profile 16. Land System: 4.2Pf4-2. Land component: 1																					
20722		0-8	-	2	23	13	58	6.2	0.188	0.1	2.48	0.22									
20723		8-28	-	1	13	8	75	7.5	0.250	0.1	0.79	0.10									
20724		28-66	-	1	17	13	67	8.7	0.594	0.2											
20725		66-89	-	2	22	13	61	9.0	1.00	0.3											
20726		89-137	-	2	27	13	55	9.2	0.969	0.3											
Koga Clay Loam: Profile 27. Land System: 4.2Pf3-1, 4.2Pf4-1, 4.2Pf4-5. Land component: 4																					
20662		0-8	-	6	41	18	33	7.1	0.063	0	1.03	0.1				2.7	5.2	1.1	1.4	10.4	6.7
20663		8-38	-	3	20	12	64	8.2	0.281	0.1	0.62	0.09				8.3	12.6	1.0	5.0	26.9	-
20664		38-64	-	3	20	15	59	8.7	1.47	0.5											
20665		64-107	-	3	20	16	59	8.2								4.9	13.9	1.1	9.1	29.0	-
20666		107-137	-	2	19	18	59	9.0	1.47	0.5											
20667		152-193	-	5	25	20	49	8.7	1.16	0.4											
Koyuga Clay Loam: Profile 4. Land System: 4.2Pf3-1, 4.2Pf4-1, 4.2Pf4-5. Land component:5																					
23353		0-10	-	2	50	23	23	6.5	0.031	0.01	0.82	0.09				2.3	2.8	0.80	0.50	6.4	5.5
23354		10-33	-	1	24	14	60	7.0	0.250	0.08	0.86	0.11				5.8	10.1	1.00	3.50	20.4	7.7
23355		33-58	-	1	26	16	54	8.1	1.06	0.34											
23356		58-76	-	1	28	17	46	8.0		*											
23357		76-97	-	1	32	20	45	8.6	1.25	0.40											
23358		97-122	-	3	34	23	38	8.5	1.00	0.32											
23359		122-145	-	2	21	18	57	8.5	1.25	0.40											
23361		168-213	-	2	21	25	49	8.8	1.16	0.37											
Rochester Clay 'Gilgai Shelf': Profile 10. Land System: 4.2Pf3-1, 4.2Pf4-1, 4.2Pf4-5. Land component: 2																					
20684		0-15	-	5	27	18	48	7.3	0.063	0.02	1.49	0.15				15.7	6.2	0.4	1.6	23.9	5.6
20685		15-25	-	6	25	18	50	8.0	0.094	0.03	0.61	0.07									
20686		25-53	-	6	24	17	50	8.7	0.156	0.05						15.2	7.2	0.7	0.8	23.9	-
Timmering Loam: Profile 35. Land System: 4.2Pf4-2. Land component: 5																					
17853		0-13	-	3	53	23	17	6.5	0.094	0.03	2.42	0.21				6.5	2.9	0.5	0.4	10.3	6.8
17854		13-18	-	3	52	25	19	7.1	0.063	0.02											
17855		18-46	-	2	35	18	45	7.3	0.250	0.08						4.3	8.4	0.5	2.6	15.8	5.2
17856		46-76	4	1	41	12	44	9.3	0.531	0.17						4.1	12.9	0.9	4.0	21.9	-
17857		76-91	-	1	44	9	43	9.4	0.407	0.13											
17858		91-107	-	5	39	11	43	9.3	0.282	0.09											
Wallenjoe Clay: Profile 24. Land System: 4.1Ffc3, 4.1Ffc4, 4.1Flfc4. Land component: 2																					
17891		0-15	-	1	8	22	66	6.6	0.125	0.04	1.18	0.13									
17892		15-56	-	2	10	26	60	7.0	0.156	0.05											
17893		56-81	-	2	10	24	62	7.0	0.469	0.15											

Site/Laboratory Number	Horizon	Horizon Depth cm	Particle Size Distribution					pH H2O	EC dS/m	Total Soluble Salts %	Organic Carbon %	Total Nitrogen %	Skene K mg/kg	Olsen P mg/kg	Exchangeable Al+++ mg/kg	Exchangeable Bases				Total of Extractable Bases	Exchangeable H+ meq/100g
			Gravel > 2mm %	Coarse sand %	Fine Sand %	Silt %	Clay %									Ca ++ meq/100g	Mg++ meq/100g	K+ meq/100g	Na+ meq/100g		
17894		81-122	-	1	11	23	64	7.9	0.656	0.21											
Wanalta Loam: Profile 5. Land System: 4.2Pf4-2. Land component: 4																					
23347		0-13	-	1	52	25	21	5.9	0.031	0.01	1.14	0.11				4.6	2.1	0.5	0.2	7.4	5.8
23348		13-48	-	-	25	18	55	8.0	0.125	0.04	0.68	0.09				11.4	10.3	1.0	1.3	24.0	3.0
23349		48-71	-	-	31	23	42	8.8	0.406	0.13											
23350		71-102	-	-	31	28	38	8.1	0.938	0.30						7.2	10.4	0.7	3.2	21.5	
23351		114-137	-	1	21	29	46	7.6	2.19	0.70											
23352		137-198	-	1	27	24	46	7.1	1.97	0.63											
Yuga Clay: Profile 7. Land System: 4.2Pf3-1, 4.2Pf4-1, 4.2Pf4-5. Land component: 3																					
20705		0-8	-	5	39	18	35	6.6	0.094	0.03	1.10	0.08				3.3	6.2	0.9	1.8	12.2	8.4
20706		8-36	-	1	14	10	72	8.3	0.344	0.11	0.65	0.09				8.2	15.3	1.3	6.8	31.6	-
20707		36-64	-	1	14	11	71	8.7	1.19	0.38											
20708		64-104	-	1	19	15	60	8.5		*						2.3	14.9	1.2	9.3	27.7	-
20709		104-157	-	1	21	16	56	8.2		*											
20710		157-198	-	2	25	15	57	8.5	1.91	0.61											
Lorimer & Schoknecht (1987). A Study of the Land in the Campaspe River Catchment																					
Myola East Land System. Land System: 2.1Gs4-5, 2.1Gs4-4, 2.1Gs5-5. Land component: 1																					
1018	A	0-10	30	19	32	20	25	4.6	0.250		2.3	0.15	320	28		0.9	1.7	0.60	0.40	3.6	
1018	B	13-20	41	16	22	24	36	4.7	0.210		0.93	0.08	400	8		0.3	2.5	0.50	0.40	3.7	
1018	B	20-30	12	9	18	28	42	4.9	0.210		0.58	0.08	360	10		0.2	3.7	0.60	0.50	5.0	
1018	B	30-53	17					5.9	0.260												
Myola East Land System. Land System: 2.1Gs4-5, 2.1Gs4-4, 2.1Gs5-5. Land component: 4																					
1019	A11	0-6	15	17	37	19	16	5.5	0.220		8.3	0.25	720	150		10.4	3.5	1.0	0.3	15.2	
1019	A12	6-10	77	12	45	20	17	5.3	0.370		3.5	0.11	340	55							
1019	A2	12-18	52	12	42	21	21	5.0	0.550		1.7	0.12	460	25		2.3	2.7	0.4	0.6	6.0	
1019	B	20-30	8	10	33	22	33	4.4	0.650		0.77	0.06	420	10		0.7	3.2	0.4	0.5	4.8	
Myola East Land System. Land System: 2.1Gs4-5, 2.1Gs4-4, 2.1Gs5-5. Land component: 3																					
1020	Aw	0-7	3	7	36	23	29	6	0.100		2.3	0.14	640	17		6.9	5.6	1.2	0.2	13.9	
1020	A1	7-10	5	10	37	25	27	6.2	0.038		1.1	0.10	520	13		6.2	4.9	0.9	0.3	12.3	
1020	A1	10-17	30					6.5	0.031		0.58	0.05	440	18							
1020	A2	17-20	21					7.3	0.025		0.17	0.03	360	35							
1020	A2	20-29	23	21	30	14	32	7.1	0.045		0.20	0.02	400	17		4.1	6.2	0.6	1.0	11.9	
1020	B1	30-46	19	26	28	10	33	7.0	0.120							3.7	6.9	0.6	1.9	13.1	
1020	B2	46-59	20	13	20	8	57	7.6	0.620							6.1	14.4	0.9	4.4	25.8	
1020	C	60-90	40	35	13	6	45	8.7	0.590							4.9	13.3	0.7	5.2	24.1	
Myola East Land System. Land System: 2.1Gs4-5, 2.1Gs4-4, 2.1Gs5-5. Land component: 2																					
1021	A	0-10	5	25	55	5	12	5.7	0.055		1.2	0.09	560	18		1.7	1.9	0.7	0.1	4.4	
1021	B21	10-20	4	15	37	4	40	6.8	0.080		0.70	0.06	620	28		2.1	6.7	1.1	0.9	10.8	
1021	B21	20-30	1					7.5	0.190		0.44	0.05	640	27							
1021	B21	30-50	3					8.7	0.650												
1021	B22	50-60	3	9	24	4	56	9.1	1.100							2.9	12.2	1.3	4.7	21.1	
1021	B22	60-90	1					9.1	1.200												
1021	BC	90-120	5	8	24	5	58	9.0	1.400							2.1	11.3	0.8	5.3	19.5	
Knowsley Land System. Land System: 2.1Gs4-7. Land component: 2																					
722	A1	0-7	13	13	52	12	17	5.5	0.068		3.3	0.24	240	14		3.9	1.3	0.70	0.07	6.0	
722	A2	7-10	57					5.4	0.029		1.1	0.09	100	7							
722	A2	10-15	53	19	54	12	19	5.7	0.028		0.51	0.04	90	6		1.7	0.88	0.29	0.08	3.0	
722	B1	15-20	23					6.6	0.077		0.51	0.06	240	3							
722	B1	20-30	20	3	12	6	76	7.2	0.110		0.51	0.06	380	3		8.7	5.9	1.6	0.80	17.0	
722	B2	50-60	21	3	14	9	71	7.9	0.280							7.8	8.0	1.4	1.6	18.8	
722	B-C	80-90	25	6	25	22	45	8.5	0.390							3.9	6.0	0.60	1.3	11.8	
722	B-C	110-120	38					8.4	0.480												
722	B-C	140-150	42					8.3	0.530												
Knowsley Land System. Land System: 2.1Gs4-7. Land component: 1																					

Site/Laboratory Number	Horizon	Horizon Depth cm	Particle Size Distribution					pH H2O	EC dS/m	Total Soluble Salts %	Organic Carbon %	Total Nitrogen %	Skene K mg/kg	Olsen P mg/kg	Exchangeable Al+++ mg/kg	Exchangeable Bases				Total of Extractable Bases	Exchangeable H+ meq/100g
			Gravel > 2mm %	Coarse sand %	Fine Sand %	Silt %	Clay %									Ca ++ meq/100g	Mg++ meq/100g	K+ meq/100g	Na+ meq/100g		
723	A1	0-7	8	16	59	13	9	5.4	0.028		1.5	0.11	140	15		2.0	0.77	0.42	0.08	3.3	
723	A2	7-10	29					5.3	0.024		0.75	0.05	80	3							
723	A2	10-17	31	19	60	15	5	5.8	0.017		0.62	0.04	80	3		1.3	0.55	0.20	0.13	2.2	
723	B	17-20	34					6.1	0.089		0.42	0.04	160	3							
723	B	20-30	26	10	31	9	4 9	6.1	0.100		0.33	0.04	200	4		4.7	9.3	0.91	1.9	16.8	
723	B	50-60	22					7.3	0.330												
723	B	80-90	21	9	40	12	3 7	8.0	0.500							3.0	9.9	0.61	3.6	17.1	
723	B	110-120	22					7.6	0.560												
723	B-C	140-150	13					5.1	0.780												
723	B-C	170-180	15					4.6	0.780												
Knowsley Land System. Land System: 2.1Gs4-7. Land component: 3																					
1124	Aw	0-4	<1	10	39	29	18	5.4	0.075		2.2	0.20	215	3.0		4.3	3.9	0.8	0.3	9.3	
1124	A1	4-10	1	8	37	31	21	5.7	0.091		1.5	0.13	164	1.6		4.8	3.7	0.7	0.4	9.6	
1124	A1	10-15	1					5.7	0.120		1.0	0.09	141	1.1							
1124	A21	15-20	3					5.9	0.090		0.70	0.06	128	0.9							
1124	A12	20-30	9	18	44	25	11	6.4	0.022		0.30	0.03	81	0.6		5.1	1.4	0.2	0.2	6.9	
1124	A22	30-46	7	21	50	21	8	6.6	0.016							0.7	0.9	0.3	0.1	2.0	
1124	B21	46-60	5	22	41	6	29	6.2	0.057							1.5	5.3	0.2	0.1	7.1	
1124	B21	60-76	5					5.9	0.100												
1124	C	90-106	10	15	28	19	36	6.0	0.400							1.0	10	<0.1	4.2	15.3	

APPENDIX E. LAND CAPABILITY/SUITABILITY CLASS TABLES

Land suitability assessment for irrigated rice production

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	-	-	-	-	-	-	3	-	-	-	-	-	-
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	2	1	3	2	2	3	2	1	1	2	3	3
Depth of sodic, heavy - medium clay in the top 3.6 m	-	-	-	-	-	-	-	-	-	-	-	-	-

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	-	-	-	-	-	3	3	3	3	3	3
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	2	3	3	3	3	3	3	3	2
Depth of sodic, heavy - medium clay in the top 3.6 m	-	-	-	-	-	3	3	-	3	3	-

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	3	3	3	3	3	3	3
EC (dS/mECe)	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	3	3	3	2
Depth of sodic, heavy - medium clay in the top 3.6 m	3	3	-	3	3	3	-

Land suitability assessment for irrigated cropping

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	-	-	-	-	-	-	3	-	-	-	-	-	-
Site drainage	2	3	3	2	3	3	1	2	3	2	1	1	1
Depth of topsoil (cm)	2	2	2	1	2	2	1	1	2	2	2	1	1
Depth to hard rock	1	1	1	1	1	1	1	1	1	1	1	1	1
Proportion of stones and boulders	1	1	1	1	1	1	1	1	1	1	1	1	1
Total amount of water available to plants (mm)	1	1	1	1	1	2	1	2	1	2	2	1	1
Susceptibility to surface crusting	2	2	2	1	2	2	1	2	1	2	1	1	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	3	1	1	1	1	1	3	3	1	1	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	-	-	-	-	-	3	3	3	3	3	3
Site drainage	3	3	3	1	1	1	1	2	1	1	2
Depth of topsoil (cm)	2	2	2	1	1	1	1	1	2	1	1
Depth to hard rock	1	1	1	1	1	3	2	1	3	2	1
Proportion of stones and boulders	1	1	1	1	1	3	2	1	3	2	1
Total amount of water available to plants (mm)	1	1	2	2	1	2	2	2	2	2	2
Susceptibility to surface crusting	2	2	2	2	2	1	2	2	1	2	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	1	1	1	1	1	1	1	1

Land suitability assessment for irrigated cropping (continued)

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	3	3	3	3	3	3	3
Site drainage	3	1	2	1	3	1	2
Depth of topsoil (cm)	2	2	1	1	2	2	2
Depth to hard rock	3	2	1	3	3	1	1
Proportion of stones and boulders	3	2	1	3	3	1	1
Total amount of water available to plants (mm)	2	2	2	2	2	2	1
Susceptibility to surface crusting	2	2	1	1	2	2	1
EC (dS/mECe)	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	1	1	1	1	2

Land suitability assessment for irrigated perennial pasture (dairying)

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	-	-	-	-	-	-	3	-	-	-	-	-	-
Site drainage	2	3	3	2	3	3	1	2	3	2	1	1	1
Depth of topsoil (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1
Total amount of water (mm) available to plants	1	1	1	1	1	2	1	2	1	2	2	1	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	3	1	1	1	1	1	3	3	1	1	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	-	-	-	-	-	3	3	2	3	3	2
Site drainage	3	3	3	1	1	1	1	2	1	1	2
Depth of topsoil (cm)	1	1	1	1	1	1	1	1	2	1	1
Total amount of water available to plants (mm)	1	1	2	2	1	2	1	1	2	1	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	1	1	1	1	1	1	1	1

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	3	2	2	3	3	3	2
Site drainage	3	1	2	1	3	1	2
Depth of topsoil (cm)	2	1	1	2	2	1	1
Total amount of water available to plants (mm)	2	2	2	2	2	2	1
EC (dS/mECe)	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	1	1	1	1	1

Land suitability assessment for irrigated perennial horticulture

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Site drainage	3	3	3	3	3	3	1	3	3	3	2	2	1
Susceptibility to gully erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Depth of topsoil (cm)	2	2	2	1	2	2	1	1	2	2	2	1	1
Depth to hard rock (m)	1	1	1	1	1	1	1	1	1	1	1	1	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	2	3	3	1	3	3	1	3	3	3	2	2	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1
Site drainage	3	3	3	2	2	1	1	3	1	1	3
Susceptibility to gully erosion	1	1	1	1	1	1	2	1	1	2	2
Susceptibility to sheet/rill erosion	1	1	1	1	1	2	2	1	2	2	1
Depth of topsoil (cm)	2	2	2	1	1	1	1	1	2	1	1
Depth to hard rock (m)	1	1	1	1	1	2	1	1	3	2	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	2	2	1	1	2	1	1	2

Land suitability assessment for irrigated perennial horticulture (continued)

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	1	1	1	1	3	1	1
Site drainage	3	1	3	1	3	1	3
Suceptibility to gully erosion	2	2	2	1	2	2	2
Suceptibility to sheet/rill erosion	2	1	2	1	2	2	2
Depth of topsoil (cm)	2	2	1	1	2	2	2
Depth to hard rock (m)	3	2	1	3	3	1	1
EC (dS/mECe)	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	1	1	1	1	2

Land suitability assessment for irrigated tomato production

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Suceptibility to gully erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Suceptibility to sheet/rill erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Depth of topsoil (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1
Depth to hard rock (m)	1	1	1	1	1	1	1	1	1	1	1	1	1
Proportion of stones and boulders (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to surface crusting	2	2	2	1	2	2	1	2	1	2	1	1	1
Total amount of water available to plants (mm)	1	1	1	1	1	2	1	2	1	2	2	1	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1	1	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to gully erosion	1	1	1	1	1	1	2	1	1	2	2
Susceptibility to sheet/rill erosion	1	1	1	1	1	2	2	1	2	2	1
Depth of topsoil (cm)	1	1	1	1	1	2	1	1	2	1	1
Depth to hard rock (m)	1	1	1	1	1	3	1	1	3	2	1
Proportion of stones and boulders (%)	1	1	1	1	1	3	2	1	3	2	1
Susceptibility to surface crusting	2	2	2	2	2	1	2	2	1	2	1
Total amount of water available to plants (mm)	1	1	2	2	1	2	2	2	2	2	2
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1

Land suitability assessment for irrigated tomato production (continued)

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	1	1	1	1	3	1	1
Susceptibility to gully erosion	2	2	2	1	2	2	2
Susceptibility to sheet/rill erosion	2	1	2	1	2	2	2
Depth of topsoil (cm)	2	1	1	2	2	1	1
Depth to hard rock (m)	3	2	1	3	3	1	1
Proportion of stones and boulders (%)	3	2	1	3	3	1	1
Susceptibility to surface crusting	2	2	1	1	2	2	1
Total amount of water available to plants (mm)	2	2	2	2	2	2	1
EC (dS/mECe)	1	1	1	1	1	1	1

Land suitability assessment for irrigated farm forestry

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope	-	-	-	-	-	-	3	-	-	-	-	-	-
Site drainage	2	3	3	2	3	3	1	2	3	2	1	1	1
Depth of topsoil (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1
Depth to hardrock	1	1	1	1	1	1	1	1	1	1	1	1	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	1	2	3	1	3	3	1	3	3	3	2	2	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	-	-	-	-	-	3	3	3	3	3	3
Site drainage	3	3	3	1	1	1	1	2	1	1	2
Depth of topsoil (cm)	1	1	1	1	1	2	1	1	2	1	1
Depth to hardrock	1	1	1	1	1	3	1	1	3	2	1
EC (dS/mECe)	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	2	2	1	1	2	1	1	2

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	3	3	3	3	3	3	3
Site drainage	3	1	3	1	3	1	3
Depth of topsoil (cm)	2	1	1	2	2	1	1
Depth to hardrock	3	2	1	3	3	1	1
EC (dS/mECe)	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	1	1	1	1	2

Land suitability assessment for dryland olive production

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope	1	1	1	1	1	1	1	1	1	1	1	1	1
Site drainage	3	3	3	3	3	3	1	3	3	3	2	2	1
Susceptibility to gully erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Depth of topsoil (cm)	2	2	2	1	2	2	1	1	2	2	2	1	1
Depth to hard rock (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1
Total amount of water available to plants (mm)	1	1	1	1	1	2	1	2	1	2	2	1	1
Soil salinity (dS/m)	1	1	1	1	1	1	1	1	1	1	1	2	1
Estimated subsoil permeability	2	3	3	1	3	3	1	3	3	3	2	2	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1
Site drainage	3	3	3	2	2	1	1	3	1	1	3
Susceptibility to gully erosion	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	1	1	1	1	1	1	1	1	1	1	1
Depth of topsoil (cm)	2	2	2	1	1	1	1	1	2	1	1
Depth to hard rock (cm)	1	1	1	1	1	3	1	1	3	2	1
Total amount of water available to plants (mm)	1	1	2	2	1	2	2	2	2	2	2
Soil salinity (dS/m))	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	2	2	1	1	2	1	1	2

Land suitability assessment for dryland olive production (continued)

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	1	1	1	1	3	1	1
Site Drainage	3	1	3	1	3	1	3
Susceptibility to gully erosion	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	2	1	1	1	2	1	1
Depth of topsoil (cm)	2	2	1	1	2	2	2
Depth to hard rock (cm)	3	2	1	3	3	1	1
Total amounts of water available to plants (mm)	2	2	2	2	2	2	1
Soil salinity (dS/m))	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	1	1	1	1	2

Land suitability assessment for dryland viticulture

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Site drainage	3	3	3	3	3	3	1	3	3	3	2	2	1
Susceptibility to gully erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	1	1	1	1	1	1	1	1	1	1	1	1	1
Depth of topsoil (cm)	2	2	2	1	2	2	1	1	2	2	2	1	1
Depth to hard rock (cm)	1	1	1	1	1	1	1	1	1	1	1	1	1
Total amount of water available to plants (mm)	1	1	1	1	1	2	1	2	1	2	2	1	1
Soil salinity (dS/m)	1	1	1	1	1	1	1	1	1	1	1	2	1
Estimated subsoil permeability	2	3	3	1	3	3	1	3	3	3	2	2	1

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1
Site drainage	3	3	3	2	2	1	1	3	1	1	3
Susceptibility to gully erosion	1	1	1	1	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	1	1	1	1	1	1	1	1	1	1	1
Depth of topsoil (cm)	2	2	2	1	1	1	1	1	2	1	1
Depth to hard rock (cm)	1	1	1	1	1	3	1	1	3	2	1
Total amount of water available to plants (mm)	1	1	2	2	1	2	2	2	2	2	2
Soil salinity (dS/m)	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	3	3	3	2	2	1	1	2	1	1	2

Land suitability assessment for dryland viticulture (continued)

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	1	1	1	1	3	1	1
Site drainage	3	1	3	1	3	1	3
Susceptibility to gully erosion	1	1	1	1	1	1	1
Susceptibility to sheet/rill erosion	2	1	1	1	2	1	1
Depth of topsoil (cm)	2	2	1	1	2	2	2
Depth to hard rock (cm)	3	2	1	3	3	1	1
Total amount of water available to plants (mm)	2	2	2	2	2	2	1
Soil salinity (dS/m)	1	1	1	1	1	1	1
Estimated subsoil permeability	1	1	1	1	1	1	2

Land capability assessment for broadacre effluent disposal (ground absorption) for feedlots

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Flooding risk	4	4	5	5	4	3	1	3	4	3	2	2	2
Depth to hard rock or impermeable layer (m)	1	1	1	1	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	2	4	5	2	4	4	2	4	5	5	4	2	2

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	1	2	1	2	2	1
Flooding risk	4	3	3	2	2	1	1	2	1	1	2
Depth to hard rock or impermeable layer (m)	1	1	1	1	1	4	2	1	5	3	1
Estimated subsoil permeability	5	5	5	2	2	2	2	2	2	2	4

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	3	2	2	2	5	3	2
Flooding risk	1	1	2	1	1	1	1
Depth to hard rock or impermeable layer (m)	4	3	2	3	5	2	1
Estimated subsoil permeability	1	2	4	2	1	2	4

Land capability assessment (ground absorption) for septic tanks

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Flooding risk	4	4	5	5	4	3	1	2	4	3	2	2	2
Depth to hard rock or impermeable layer (m)	1	1	1	2	1	1	1	1	1	1	1	1	1
Estimated subsoil permeability	2	4	5	2	4	4	2	4	5	5	4	2	2

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	1	2	1	2	2	1
Flooding risk	4	3	3	2	2	1	1	2	1	1	2
Depth to hard rock or impermeable layer (m)	1	1	1	1	1	4	2	1	5	3	1
Estimated subsoil permeability	5	5	5	2	2	2	2	2	2	2	4

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	3	2	2	2	5	3	1
Flooding risk	1	1	2	1	1	1	1
Depth to hard rock or impermeable layer (m)	4	3	2	3	5	2	1
Estimated subsoil permeability	1	2	4	2	1	2	4

Land capability assessment for secondary (gravel) roads

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Slope (%)	1	1	1	1	1	1	1	1	1	1	1	1	1
Drainage	4	4	4	4	4	4	2	4	4	4	4	3	3
Susceptibility to sheet / rill erosion	2	2	2	1	2	2	2	2	2	2	2	2	2
Susceptibility to gully erosion	2	2	2	1	2	2	2	2	2	2	2	2	2
Susceptibility to slope failure	1	1	1	1	1	1	1	1	1	1	1	1	1
Flood risk	4	5	5	5	4	3	1	3	4	3	2	2	2

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Slope (%)	1	1	1	1	1	2	2	1	2	2	1
Drainage	4	4	4	4	4	2	2	4	2	2	4
Susceptibility to sheet / rill erosion	2	2	2	2	2	3	3	2	3	3	2
Susceptibility to gully erosion	2	2	2	2	2	3	3	2	2	3	3
Susceptibility to slope failure	1	1	1	1	1	1	1	1	1	1	1
Flood risk	4	3	3	2	2	1	1	2	1	1	2

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Slope (%)	4	2	2	2	5	4	2
Drainage	1	2	4	2	1	2	4
Susceptibility to sheet / rill erosion	4	2	3	2	4	3	3
Susceptibility to gully erosion	3	3	3	2	3	3	3
Susceptibility to slope failure	1	1	1	1	1	1	1
Flood risk	1	1	2	1	1	1	1

Land capability assessment for low density residential development

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Secondary roads	4	5	5		4	4	2	4	4	4	4	3	3
Effluent disposal	5	5	5		5	5	2	5	5	5	4	4	2

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Secondary roads	4	4	4	4	4	3	3	4	3	3	4
Effluent disposal	5	5	5	5	4	4	2	4	5	3	4

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Secondary roads	4	3	4	2	5	4	4
Effluent disposal	4	3	4	3	5	3	4

Land capability assessment for rural living development

Land System	4.1Ffc3, 4.1Ffc4 4.1Flfc4 Active floodplains Murray & Campaspe Rivers				4.2Flf3, 4.2Flf4 Corop wetland complex				4.2Pf4.2 Prior streams alluvial plain				
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**5**
Secondary roads	4	5	5		4	4	2	4	4	4	4	3	3
Effluent disposal	5	5	5		4	4	2	4	4	4	3	3	2

Land System	4.2Pf3.1, 4.2Pf4.1, 4.2Pf4.5 Treeless alluvial plain					2.1Gs4.7 Knowsley low undulating sedimentary hills			1.1Gs4.1, 1.1Gs4.2 1.1Gs51-21 Rushworth low undulating sedimentary hills		
Map components	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**1**	**2**	**3**
Secondary roads	4	4	4	4	4	3	3	4	3	3	4
Effluent disposal	4	4	4	4	3	3	2	3	4	2	3

Land System	2.1Gs4.5, 2.1Gs4.4 2.1Gs5.5 Myola East low undulating sedimentary hills				2.1Gv4, 2.1Gf4 Mt Camel rolling low volcanic hills		
Map components	**1**	**2**	**3**	**4**	**1**	**2**	**3**
Secondary roads	4	3	4	2	5	4	4
Effluent disposal	3	2	3	2	5	3	3

GLOSSARY

Angular blocky structure: A cube-shaped ped bounded by six faces (sides)

Apedal: Describes a soil in which none of the soil material occurs as peds in the moist state. Such a soil is without apparent structure and is typically massive or single-grained.

Available water for plant growth: The amount of water in the soil that can be held between field capacity and the moisture content at which plant growth ceases.

Australian Soil Classification (Isbell 1996): A soil classification recently developed by Ray Isbell. The classification scheme operates using a hierarchical system and is based on Australian soils data that is significant with regard to land management.

Bleached horizon: Horizons that are paler than adjacent horizons and are best seen when the soil is dry. A bleach is generally associated with the A2 horizon, although it is not restricted to it. It generally occurs over a much less permeable subsoil, pan or hard rock. A conspicuously bleached horizon is one in which 80% or more of the horizon is bleached, whereas a sporadic bleach occurs irregularly throughout the horizon or as blotches at the interface of the A and B horizons (Northcote, 1979). This horizon is the most leached part of the soil. Organic matter, clay, iron, aluminium and nutrient elements have been removed leaving an accumulation of silica, which gives the horizon its whitish colour. Field observations have established that bleached horizons are often saturated with water and their occurrence is usually an indication of periodic waterlogging. This can indicate sodic subsoils where this is a strong texture contrast between A and B horizons.

Blocky structure: See Angular blocky structure

CEC (cation exchange capacity): The measure of the capacity of a soil to hold the major cations: calcium, magnesium, sodium and potassium (including hydrogen, aluminium and manganese in acid soils). It is a measure of the potential nutrient reserve in the soil and is therefore an indicator of inherent soil fertility. An imbalance in the ratio of cations can result in soil structural problems. High levels of individual cations (e.g. aluminium and manganese) can also be toxic to plants.

Colour Soil colour is assessed in the moist condition using a Munsell Colour Chart (Munsell Colour Company, 1975) to assess the dominant colour. Secondary colours, bleaches and mottles are also recorded. Colour provides a useful indication of a number of profile attributes. Dark surface soils, for instance indicates a high level of organic matter. In subsurface horizons (i.e. A2), bleached colours indicate low levels of plant nutrients and that seasonal or periodic waterlogging occurs. In subsoils, the colour sequence from red to brown and yellow to grey colours, indicate a sequence from well aerated and well drained soils to poorly aerated and poorly drained soils.

Columnar structure: Soil particles are arrange around a vertical axis with flat faced peds. The tops of the columns have clearly defined domes. Columnar structure is often associated with subsoil sodicity.

Compaction: The process whereby soil density is increased as a result of tillage, stock trampling and/or vehicular trafficking. Compaction can lead to lower soil permeability, poorer soil aeration resulting in increased erosion hazard and poorer plant productivity. Deep ripping and conservation tillage can alleviate the condition.

Drainage: Drainage is a term used to summarise local soil wetness conditions. It is affected by internal attributes which include soil structure, texture, porosity, hydraulic conductivity, water holding capacity, and external attributes such as evapotranspiration, gradient and length of slope and position in the landscape. Categories are as follows:

Very poorly drained: Free water remains at or near the surface for most of the year. Soils are usually strongly gleyed. Typically a level or depressed site and/or a clayey subsoil.

Poorly drained: All soil horizons remain wet for several months each year. Soils are usually gleyed, strongly mottled and/or have orange or rusty linings of root channels.

Imperfectly drained: Some soil horizons remain wet for periods of several weeks. Subsoils are often mottled and may have orange or rusty linings of root channels.

Moderately well-drained: Some soils may remain wet for a week after water addition. Soils are often whole coloured, but may be mottled at depth and of medium to clayey texture.

Well-drained: No horizon remains wet for more than a few hours after water addition. Soils are usually of medium texture and not mottled.

Rapidly drained: No horizon remains wet except shortly after water addition. Soils are usually of coarse texture, or shallow, or both, and are not mottled.

Duplex profile form: A primary profile form of the Northcote Factual Key (1979) classification. It describes a soil where there is a sharp contrast in the texture between the A and B horizons (often sandy or loamy surface horizons with a sharp to clear boundary to clay subsoils).

EC (electrical conductivity): A measure of the conduction of electricity through water. The value can reflect the amount of soluble salts in an extract and therefore provide an indication of soil salinity. Saline soils are defined as those with an EC of grater than 1.5 dS/m for a 1:5 soil water extract.

Value range (dS/m)	*Interpretation*
< 0.30	Very low
0.30 - 0.53	Low
0.53 - 1.26	Moderate
1.26 - 2.50	High
> 2.50	Very high

ECe (electrical conductivity of the saturation extract): Using the EC of a 1:5 soil/water suspension and converting to an approximate ECe value by multiplying by appropriate factors for different soils textures.

ESP (exchangeable sodium percentage): Is a calculation as the proportion of the cation exchange capacity occupied by the sodium ions and is expressed as a percentage. Sodic soils are categorised as soils with an ESP of 6-14% and strongly sodic soils have an ESP of greater than 15% (see Sodicity).

Factual Key (Northcote 1979): A soil classification system used in Australia that groups soils into recognisable profile forms. These are based on visible morphological properties and simple chemical properties and simple chemical properties of a soil and are labelled used an alphanumeric code.

Gully erosion: Erosion of soil or soft rock material by running water that forms channels larger and deeper than rills (i.e 300 mm).

Gypsum: A naturally occurring soft crystalline material that is a hydrated form of calcium sulphate. Deposits occur naturally in inland Australia. Gypsum contains approximately 23% calcium and 18% sulphur. It is used to improve soil structure and reduce crusting in hard setting clay soils.

Hardsetting: The condition of a dry surface that is compact and hard with no apparent pedal development.

Horizons: A layer within the soil profile having morphological characteristics (e.g. colour, texture, and structure) differing from the layer above and or/below it.

A horizon: consists of one or more surface mineral horizons and can be subdivided into:

> **A1 horizon:** this is the mineral horizon at or near the surface, usually with some accumulation of organic matter making the colour darker than the underlying horizon. This horizon is usually high in biological activity. The A1 horizon can be further subdivided into the A11 horizon: more organic matter, darker colour with relatively high amounts of biological activity; A12 horizon varies in colour usually lighter, but not pale enough to be and A2 horizon. A13 and A14 horizons are further options if necessary.
>
> **A2 horizon:** this is the mineral horizon having either less organic matter; and/or less clay than the surrounding horizons. It can be differentiated from the A1 and the B horizon by its paler colour.
>
> **A3 horizon:** this is a transitional horizon between the A and B horizon that is dominated by A horizon properties.

B horizon: consists of one or more mineral soil layers characterised by one or more of the following: a concentration of silicate clays, iron, aluminium, and/or organic matter; a structure and/or consistence unlike the A horizon or any horizon below; stronger colours than the above or below horizon. The B horizon is subdivided into:

> **B1 horizon:** the transition between the A and B horizons where the underlying B2 horizon properties dominate (as opposed to the A horizon properties).
>
> **B2 horizon:** the dominant feature is one of the following maximum horizon of clay or pedological development within the profile i.e. different structure; consistence and/or stronger colours than the A horizon or any horizon below. The B2 horizon can further be divided into B21, B22 and B23 horizons.
>
> **B3 horizon:** a transition between the B and C horizon where the B2 horizon characteristic dominate.

C horizon: The layer below the B horizons, that consists of consolidated or unconsolidated parent material and is not significantly affected by soil forming processes. It is easily recognised by its lack of soil characteristic development and visible geologic structure.

Impeding layer: Physical barriers (hardpans, rock etc.) or chemical barriers (high salinity or pH layers) that restrict rooting depth and therefore the volume of soil that plants can exploit for nutrients and moisture.

Internal drainage: Is an indication of waterlogging potential.

Land capability assessment: A systematic and rational method of determining the relative ability of different areas of land to sustain a specific land use under a nominated level of management without being degraded or causing any long term off-site degradation.

Land units or components: An area of land, distinct from adjacent units or components because of specific slope, soil, or geomorphological characteristics, e.g. crest, gentle slope, drainage depression.

Land system: An area of land, distinct from surrounding terrain, that has a specific climatic range, parent material and modal slope. Made up of a recurring sequence of land elements or components, e.g. sedimentary rolling hills.

Lime: A naturally occurring calcareous material used to raise the pH of an acidic soil and/or supply calcium for plant growth. It is effective for treating acid soils.

Land capability assessment: A systematic and rational method of determining the relative ability of different areas of land to sustain a specific land use under a nominated level of management without being degraded or causing any long term off-site degradation.

Land units or components: An area of land, distinct from adjacent units or components because of specific slope, soil, or geomorphological characteristics, eg. crest, lower slope.

Land pattern/system: An area of land, distinct from surrounding terrain, that has a specific climatic range, parent material and modal slope. Made up of a recurring sequence of land elements or components, eg. sedimentary rolling hills.

Lunettes: Crescent shaped aeolian deposits of fine sediment located on the eastern sides (or the lee sides) of lake beds or swamps in semi-arid areas of southern Australia.

Mottling: The presence of more than one soil colour in a horizon. The soil may differ in colour either within peds or aggregates, or between them. Mottling occurs as blotches or streaks of subdominant colour throughout the main (ie. matrix) colour. it does not refer to stains or coloured deposits on ped faces. Mottling is often an indication of poor profile drainage but may also be caused by the weathering of the parent material.

Nutrient status: Sum of exchangeable base cations (Ca, Mg, K)

Value range (meq/100g)	*Interpretation*
< 4	Very low
4 - 8	Low
9 - 18	Moderate
19 - 30	High
> 30	Very high

Organic matter: All constituents of the soil arising from living matter ie. plant and microfauna detritus, fresh or decomposed. The following values for organic matter have been used in this report:

Value range (%)	*Interpretation*
< 1	Very low
1 - 2	Low
2 - 3	Moderate
> 3	High

(***** indicates estimated value)

(organic matter % = organic C% x 1.72)

Parent material/rock: The geological material from which a soil profile develops. It may be bed-rock or unconsolidated materials including alluvium, colluvium, aeolian deposits or other sediments.

Peds: The natural unit of soil structure formed by the soil's tendency to fracture along plains of weakness.

Permeability: The characteristic of a soil, soil horizon or soil material which governs the rate at which water moves through it. It is a composite expression of soil properties and depends largely on soil texture, soil structure, the presence of compacted or dense soil horizons and the size and distribution of pores in the soil. In this study, the permeability has been measured as K_{sat} (saturated hydraulic conductivity). Where estimates have been made, based on the properties of the soil profile, this is clearly indicated.

Value range (mm/day)	*Interpretation*
< 10	Very slow
10 - 100	Slow
100 - 500	Moderate
500 - 1500	Rapid
1500 - 3000	Very rapid
> 3000	Excessive

pH (Soil): A measure of soil acidity and soil alkalinity on a scale of 0 (extremely acidic) to 14 (extremely alkaline), with a pH of 7 being neutral. It gives an indication of the availability of plant nutrients and relates to the growth requirements of particular crops. Acid soils are usually deficient in necessary nutrients e.g. calcium and magnesium.

Plant available water capacity (PAWC): The amount of soil water that can be extracted by the plant. It is defined as the difference in soil moisture content between the field capacity and the wilting point. It is expressed as millimetres of plant-available water within the root zone.

Prismatic structure: Soil particles are arranged around a vertical axis and bound by relatively flat faces. The top of the prisms are also relatively flat. Prismatic structure is often associated with subsoil sodicity.

Profile: The vertical section of the soil from the soil surface down through the horizons including the parent material.

Rill erosion: Erosion by small channels less than 300 mm deep which can be completely smoothed by normal cultivation.

Recharge: Movement of surface water down into the underlying groundwaters.

Rock outcrop: Any exposed area of rock that is inferred to be continuous with the underlying parent material.

Salinity: A measure of the total soluble salts in a soil. A saline soil is one with an accumulation of free salts at the soil surface

and/or within the profile affecting plant growth and/or land use. It is generally attributed to changes in land use or natural changes in drainage or climate that affects the movement of water through the landscape. Salinity levels of soil or water can be tested using Electrical Conductivity (see EC).

Self-mulching: A structural condition of soils, notably found in the surface soils of Vertosols, where there is a high degree of pedality and the peds naturally fall apart as the soil dries to form a loos surface mulch.

Sheet erosion/sheet wash: The relatively uniform removal of soil from an area without the development of conspicuous channels.

Slope: Landform element that is neither a crest or a depression and that has an inclination greater than 1%. Slope can be broken up into the following categories:

Value range (%)	*Interpretation*
< 1%	Level
1 - 3%	Very gentle slope
4 - 10%	Gentle slope
11 - 20%	Moderate slope
21 - 32%	Moderately steep slope
> 32%	Steep slope

Sodicity: Is a measure of exchangeable sodium in relation to other exchangeable cations. It is expressed as the Exchangeable Sodium Percentage (see ESP). A sodic soil contains sufficient exchangeable sodium to interfere with the growth of plants, including crops. A soil with an ESP greater than 6 is generally regarded as being a sodic soil in Australia (Northcote and Skene, 1972). ESP levels are further classified in the Australian Soil Classification (Isbell, 1996).

Sodosol: A soil order of the Australian Soil Classification (Isbell, 1996). These soils have a clear or abrupt textural change between A horizons and sodic B horizons.

Soil colour: Determined by comparison with a standard Munsell soil colour chart or its equivalent. It includes three variables of colour: hue, value and chroma.

Soil horizon: A layer within the soil profile with distinct morphological characteristics which are different from the layers above and/or below. Horizons are more or less parallel to the land surface, except that tongues of material from one horizon may penetrate neighbouring horizons.

Soil profile: A portion of a soil exposed in a vertical section, extending usually from the land surface to the parent material. In very general terms, a profile is made of three major layers designated A, B and C horizons. The A and B horizons are those modified by soil development. The C horizon is weathering parent material that has not yet been significantly altered by soil forming processes.

Soil texture: The relative proportions of sand, silt and clay particles in a sample of soil. The field assessment of texture is based on the characteristics of a bolus of wetted soil moulded by hand. Six main soil texture groups are recognised

Texture group	*Approx. clay content (%)*
1. Sands	< 10
2. Sandy loams	10 - 20
3. Loams	20 - 30
4. Clay loams	30 - 35
5. Light clays	35 - 40
6. Heavy clays	> 45

Soil texture groups: The topsoil and subsoil texture classes were grouped according to Northcote (1979).

S	Sand, loamy sand, clayey sand
SL	Sandy loam, fine sandy loam, light sandy clay loam
L	Loam, loam fine sandy, silt loam, sandy clay loam
CL	Clay loam, silty clay loam, fine sandy clay loam
LC	Sandy clay, silty clay, light clay, light medium clay
MHC	Medium heavy clay, medium clay, heavy clay

Structure: Describes the way the soil particles are arranged to form peds. Peds are units of soil structure that are separated from each other by natural plains of weakness. They differ from clods that are formed as a result of soil disturbance such as ploughing.

Structure is defined by three characteristics: grade, size and type.

1. GRADE measures the degree of development and the distinctiveness of the peds. It varies depending on the soil water status and can be divided into five groups:

1. Single grained; loose and incoherent mass of individual particles (Referred to as structureless);

2. Massive; hardsetting coherent mass of soil (also referred to as structureless);

3. Weak; peds indistinct;

4. Moderate; peds are well formed and visible but not distinctive in undisturbed soil, adhesion between peds is usually firm and when displaced between one third and two thirds of the soil material consists of peds;

5. Strong; peds distinct in undisturbed soil, adhesion between peds is firm and when displaced, two thirds or more of the soil material consists of peds.

2. SIZE is measured and described based on the average least dimension of the peds.

3. TYPE of structure has been described throughout the glossary. For example, prismatic, columnar, blocky structure.

A number of different grades and sizes of peds may occur within a horizon. An example of this is when prismatic structure exists that then breaks down to small blocky peds.

Subangular blocky structure: A ped bound by six faces intersecting round edges (i.e. like a rounded cube).

Subsoil: The B horizon and its subdivisions, excluding the C horizon.

Texture: The relative proportions of sand, silt and clay particles in a sample of soil. The field assessment of texture is based on the characteristics of a bolus of wetted soil mould by hand. Six main soil texture groups are recognised:

Texture	*Approx. clay content (%)*
1. Sands	< 10
2. Sandy loams	10 - 20
3. Loams	20 - 30
4. Clay loams	30 - 35
5. Light clays	35 - 40
6. Heavy clays	> 45

Uniform profile form: A Primary Profile form of the Factual Key Classification (Northcote, 1979). These soil profiles have little, if any texture change throughout the profile. There is generally no textural boundary found within the profile, except for possibly a surface crust.

Vertic properties: This term is used to describe a subsoil with a field texture of 35% or more clay which experiences significant shrinking and swelling resulting from drying and wetting. This often results in the development of features such as surface cracking and gilgai formation. Evidence of vertic properties include the presence of slickensides and/or lenticular peds in the subsoil. The amount of swelling is dependent of the type of clay present. These features are of significant importance for engineering purposes such as road construction. (see Vertosols).

Vertosols: A soil Order of the Australian Soil Classification (Isbell, 1996). These clay soils with shrink/swell properties that display strong cracks when dry and have slickensides and/or lenticular structural peds at depth.