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PROJECT REPORT

SOILS AND IRRIGATION POTENTIAL OF THE CERATODUS AREA EIDSVOLD, QUEENSLAND

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Land Resources Branch

Department of Primary Industries
Queensland Government

Queensland Government Technical Report

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ERRATUM

The Austrlian Map Grid Zone for
the survey area is 56, not 55.
See pages 28 to 42.

SUMMARY

A medium intensity soil survey of 4260 ha adjacent to the Burnett River north of Eidsvold was undertaken to assess the irrigation potential of the area.

The survey identified and mapped nine soil types. These ranged from alluvial soils and prairie soils on stream levees to black earths, grey clays and solodic soils on higher lying stagnant alluvial plains.

An irrigated land capability classification showed 2990 ha of arable class 2 and 3 land, 820 ha of limited arable class 4 land and 450 ha of non arable class 5 land. Crops considered suitable range from citrus, grapes, melons, vegetables, peanuts and navy beans on the alluvial and prairie soils with good drainage to soybeans, maize, sorghum, wheat, barley and cotton on the black earths.

Salinity is not considered a significant hazard to irrigation development. The conductivities of water samples from the river and tributaries above the weir sites at a time of low flow ranged from 480 to 1700 µS/cm. Aquifers underlying the alluvium apparently connect with the sands of the river bed.

1. INTRODUCTION

The Queensland Water Resources Commission requested the Department of Primary Industries to provide information on the soils and their potential for irrigation along a section of the Burnett River north of Eidsvold. The area encompasses two possible weir sites at AMG Zone 56J, 314850 E, 7208900 N and 318100 E, 7212050 N. In response, a 1:50 000 soil survey was undertaken to map the soils and assess their suitability for irrigation.

The study area of 4260 ha extends along the Burnett River upstream from the Ceratodus railway siding to the confluence with Splinter Creek, the limit of storage. It also includes the lower reaches of Three Moon Creek, to the limit of storage at Abercorn. Survey area boundaries were set to exclude land more than 2 km from the streams or with slopes more than 4%. These areas are considered to be too far from water or too steep to be suitable for irrigation. The resulting survey was confined to the river alluvium along the Burnett River and Three Moon Creek.

2. PHYSICAL ENVIRONMENT

2.1 Climate

The climate in this area is sub-tropical with long hot summers and mild winters. Rainfall is summer dominant with median annual rainfall varying from 736 mm to 758 mm (Table 1). These records suggest that rainfall increases slightly towards the north of the area.

Table 1. Median monthly and annual rainfall for Abercorn, Eidsvold and Monto

Centre	Period of records (yrs)	Median rainfall * (mm)												Year
		J	F	M	A	M	J	J	A	S	O	N	D	
Abercorn	35	111	92	66	26	25	22	24	14	17	48	78	67	738
Eidsvold	94	100	74	59	32	31	31	26	21	22	50	65	83	736
Monto	55	115	93	55	36	30	32	23	17	17	44	65	80	758

* 50% probability of receiving this amount or more.

Source: Bureau of Meteorology

Climatic records for Monto (Table 2) show that summers are hot with mean daily maximum temperatures exceeding 30°C from November to February. Winters are mild with July mean daily maximum and minimum temperatures of 20.7°C and 4.7°C respectively. Frosts may occur from May to September with an average of nine frosts occurring in July.

Table 2. Evaporation, mean numbers of frosts and maximum and minimum temperatures for Monto

	Month												Year
	J	F	M	A	M	J	J	A	S	O	N	D	
Mean daily pan evaporation (mm)	6.1	5.2	4.6	4.1	2.8	2.4	2.4	3.4	4.8	5.7	6.3	6.7	-
Mean number of frost days	0	0	0	0	1	4	9	5	1	0	0	0	
Mean Daily Min Temperature (°C)	19.2	18.7	17.2	13.2	9.6	6.5	4.7	6.4	9.3	13.1	16.0	17.9	12.7
Mean Daily Max Temperature (°C)	31.7	30.9	29.8	27.8	24.1	21.1	20.7	22.8	25.9	28.8	31.1	31.7	27.2

Source: Bureau of Meteorology

Average annual pan evaporation at Monto and Brian Pastures, Gayndah, is 1656 and 1929 mm respectively and, at both centres it greatly exceeds average rainfall in all months.

2.2 Geology

The geology for the region has been described by Whitaker *et al* (1974).

The survey area occurs entirely within one of the larger occurrences of Quarternary alluvium in the region. Its width ranges from 0.5 km up to 3 km. These alluvial sand, silt, gravel and clay deposits are associated with the level to very gently undulating flood plain of the Burnett River and its major tributaries. Queensland Water Resources Commission test bores indicate the depth of alluvium to be 12 m to 21 m. A sand and gravel layer 2 m to 7.5 m thick occurs at the base of the deposits and is confined by overlying clay.

The recent alluvium landscape unit includes the levees, relict levees and drainage depressions adjacent to major stream channels. Small areas of alluvial fans also occur. Areas of older, higher-lying alluvium are remnants of stagnant alluvial plains separated from the river by the recent alluvium.

Predominantly porous sandstones of the Hutton Sandstone Formation surround most of the survey area. Many local creeks and gullies including Three Moon Creek and part of Splinter Creek drain this sandstone unit. This explains the high sand content of the recent alluvium. A band of less porous sandstones, siltstones and shales of the Evergreen Formation occurs along the eastern side of the Anyarro Fault which crosses the area. The Burnett River follows this fault for some distance upstream of Ceratodus.

2.3 Hydrology

Surface Hydrology. Three major streams, Three Moon Creek, Splinter Creek and Eastern Creek, join the Burnett River within the survey area. A number of smaller creeks and gullies flow into the river from surrounding areas. Major flows occur in all streams but they show marked variations both seasonally and from year to year.

Flood height and frequency data recorded at the bridge near Ceratodus were used to determine the flooding frequency of soil mapping units in that area. This information is given in Table 3. Other occurrences of these mapping units are likely to be flooded with similar frequency.

Table 3. Elevation and flood return period for soil mapping units at Ceratodus

Mapping unit	Elevation (m)	Return period (yrs)
Anyarro	170.7	25
Ceratodus	171.6	50
Yarrol	170.0	25
Abercorn-(lower slope)	171.2	50
(mid slope)	173.0	-
Eidsvold	177.7	-

Source: Queensland Water Resources Commission

Surface water was sampled in January 1985 at a number of sites as shown in Figure 1 (K. Hughes, pers. comm.). Conductivity of samples from the Burnett River, Three Moon Creek and Eastern Creek ranged from 480 (upstream) to 850 uS/cm indicating good quality water. Readings of 1250 - 1700 uS/cm along Splinter Creek indicate water of marginal quality for irrigation. Deeply weathered Tertiary sediments occur within this catchment and may be the source of salts causing the poorer water quality. Poor quality water (2800 uS/cm) was sampled from The Springs area in Eight Mile Creek but this creek drains into the Burnett River below the weir sites.

Subsurface Hydrology. Information available on underground water in the area indicates that adequate supplies are available for stock and domestic purposes but they are usually too limited for irrigation.

Conductivities of water samples taken by the Queensland Water Resources Commission near Ceratodus varied from 1700 to 1950 uS/cm in 1964 and 1300 to 1370 uS/cm in 1979. Higher than average rainfall occurred in 1978 prior to the collection of the more recent samples. Samples taken from the Burnett River alluvium in 1964 just upstream of its confluence with Three Moon Creek had conductivities of 780 to 1700 uS/cm. The readings in both locations show an increasing trend with distance from the river. The water is generally suitable for stock and domestic purposes but unsuitable for irrigation of salt-sensitive crops.

The influence of the tilting and fracturing of the sandstone beds along the Anyarro Fault on ground water hydrology is unknown. The river follows the fault for about 3 km within the storage area of the lower weir site.

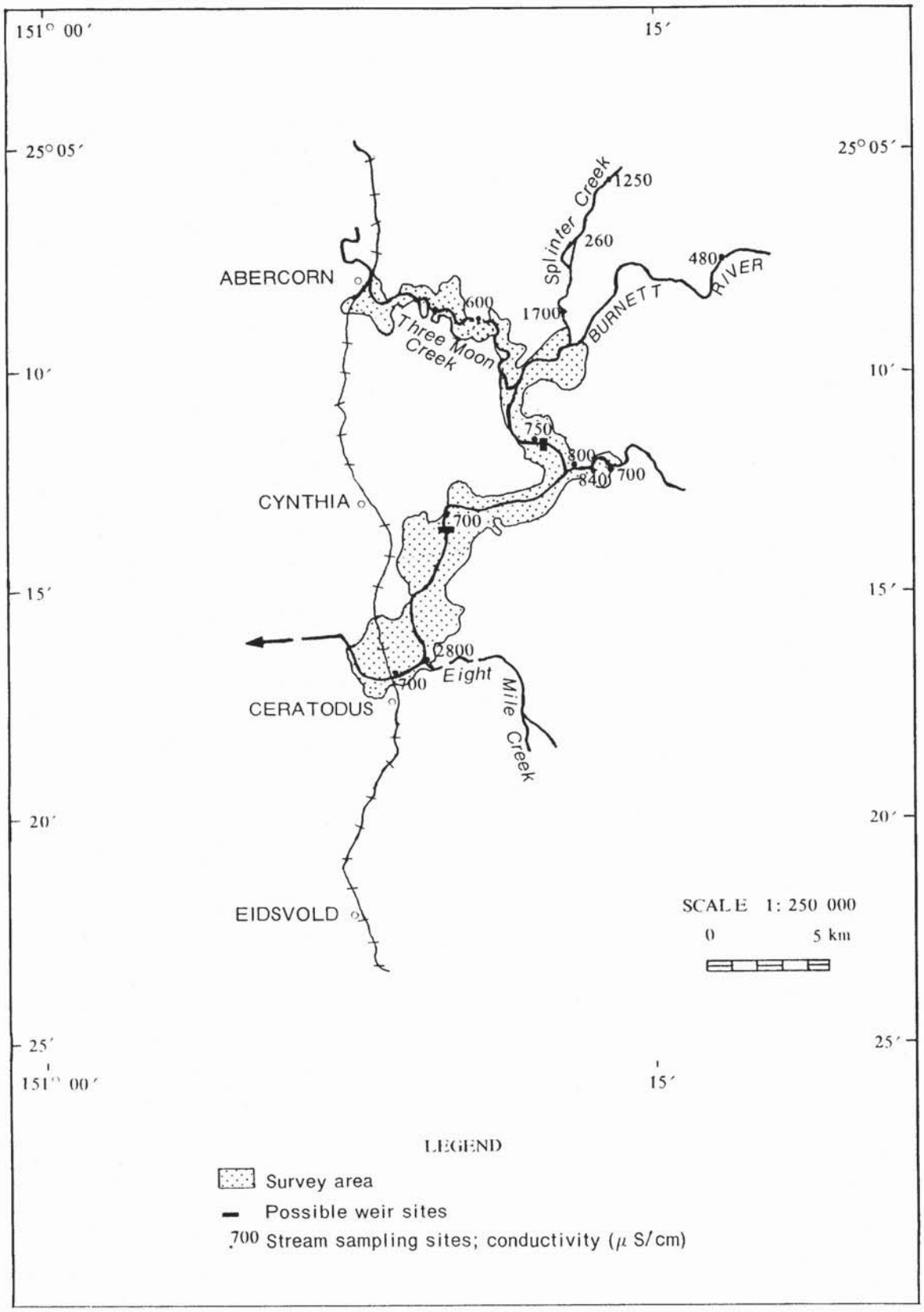

Figure 1. Location of survey area showing possible weir sites and stream sampling sites.

2.4 Vegetation

Much of the original vegetation has been cleared for cultivation or grazing but remnants occur along road reserves, drainage depressions and around edges of cultivation. Little regrowth has occurred in the area.

Vegetation communities associated with the soil mapping units are as follows:

Recent alluvial plains

Levees and relict levees with deep sandy loam and sandy clay loam soils (Anyarro, Ceratodus) support Queensland blue gum (*Eucalyptus tereticornis*), rough barked apple (*Angophora floribunda*) woodland to open forest. Silver-leaved ironbark (*E. melanophloia*) and Moreton Bay ash (*E. tessellaris*) are frequently associated, mainly on the relict levees. Poplar box (*E. populnea*) may occasionally occur.

The fans and levees with deep sandy loam A horizons (Hollywell) support a silver-leaved ironbark, narrow-leaved ironbark (*E. crebra*) woodland.

The drainage depressions and back plains (Bilboolan, Yarrol) support mainly poplar box or occasionally gum-topped box (*E. moluccana*) woodland to open forest. Silver-leaved ironbark, Moreton Bay ash and Queensland blue gum are often associated. An understorey of sandalwood (*Eremophila mitchellii*) may sometimes occur. Queensland blue gum is dominant in lower areas, especially on heavier clay soils.

Stagnant alluvial plains

Clay soils on the stagnant plains (Eidsvold, Dalgangal, Belvedere) support poplar box and occasional gum-topped box woodlands to open forests. Silver-leaved ironbark may be associated. Patches of brigalow (*Acacia harpophylla*) open forest with associated belah (*Casuarina cristata*) are prominant in some areas (Belvedere). Wilga (*Geijera parviflora*) commonly forms an understorey.

The marginal slopes of the higher plains with hardsetting texture contrast soils (Abercorn) support poplar box woodland to open forest. Queensland blue gum, silver-leaved ironbark and Moreton Bay ash are frequently associated.

3. SOILS

3.1 Survey Methods

A 1:50 000 soil survey was undertaken to identify and evaluate the soils of the area. Following reconnaissance of the area and photo interpretation of 1:25 000 aerial photos, ground observations were made along selected traverses in representative parts of the survey area. After tentative soil types had been defined, free survey and airphoto interpretation were used to map the soils.

Of the 176 ground observations made, 16 were sampled to a depth of 1.5 m for analysis. Two of these were sampled to depths greater than 3 m.

The distribution of soil mapping units is shown on the accompanying map. A total of 81 individual mapped areas or unique map areas (UMA's) were delineated. Descriptions of each UMA include records of the area, location and proportion of the unit occupied by the dominant soil type and each major associated soil type. Suitability for the production of a range of crops has also been assessed.

3.2 Distinguishing Features

Nine soil types were recognised. The soil types are groups of soil profiles such that there is less variation in key soil properties within types than there is between types. The major distinguishing features of the soil types are presented in Table 4.

Detailed descriptions of each soil type and the range of variation encountered are given in Appendix 1.

The two landscape units defined are areas with similar lithology, geomorphology and topography. Individual soil types usually occur within one landscape unit.

Soils on the levees and associated drainage depressions of the recent alluvial plains have higher sand contents than those on the stagnant alluvial plains. However, they are not as sandy as the uniform sandy loam soils on the recent levees of the Burnett River below the Nogo River confluence (Kent 1986). The stagnant alluvial plains are dominated by clay soils (Eidsvold, Dalgangal, Belvedere) with texture contrast soils (Abercorn) generally occurring on the marginal slopes.

3.3 Chemical and Physical Characteristics

Full morphological descriptions and soil test results for 15 profiles sampled within the survey area are given in Appendix 2. Samples from one profile (S11) were discarded when it was realised that the site was not representative. Hollywell soil type was not sampled because of its variability and small area.

Soil analytical methods and interpretation are from Bruce and Rayment (1982) except for chloride which was determined by automatic analyser. Exchangeable cations and cation exchange capacity (CEC) are determined by the method used for alkaline soils.

The moisture status of the soil test results are as shown in Appendix 2.

pH, chloride, sodicity and dispersion ratio. Soil reaction trends, ratings for chloride and sodicity and surface dispersion ratios for the sampled profiles are shown in Table 5. Soil surfaces vary from moderately acid to mildly alkaline so pH should not limit crop establishment or growth.

Table 4. Major distinguishing features of the soil types

Soil types	Major distinguishing features	PPF's*	Great soil group	Landscape unit	Landform
Anyarro	Dark to brown uniform and gradational soils with minimal profile development. Firm to hardsetting sandy loam to fine sandy clay loam A horizon. Acid to neutral soil reaction trend	Um1.43**, Um1.44, Um6.32, Gn3.22, Gn3.23	Alluvial soil, minimal prairie soil	Recent Alluvial Plain	Levees and scrolls 0-1.5% slope
Ceratodus	Dark to brown uniform and gradational soil with moderate to strong structure. Hardsetting clay loam fine sandy to silty clay loam to light clay A horizon. Neutral to slightly alkaline soil reaction trend	Gn3.22, Gn3.23, Gn3.42, Gn3.43, Uf6.32	Prairie soil	"	Relict levees 0-1.5% slope
Hollywell	Brown texture contrast soil with bleached hardsetting sandy loam to sandy clay loam A horizon > 0.3m. Acid to neutral soil reaction trend	Dy3.41, Db1.32, Db2.32, Dr2.32, Dy3.82	Soloth-solodic soil	"	Fans and leeves 0.1-1.5% slope
Bilboolan	Dark to grey, occasionally bleached, weakly self mulching and cracking clay with grey to brown occasionally mottled, lower B horizon. Alkaline soil reaction trend	Ug5.15, Ug5.16, Ug5.24, Ug3.2	Black earth - grey clay	"	Back plains and drainage depressions 0.1-1% slope
Yarrol	Frequently mottled brown texture contrast soil with frequently bleached hardsetting sandy clay loam to clay loam A horizon < 0.4m. Alkaline soil reaction trend	Db1.13, Db1.33, Db2.13, Db2.33, Dd1.33, Dy3.43	Solodic soil - solodized-solonetz, no suitable group	"	Drainage depressions and back plains 0.1-1.5% slope
Eidsvold	Dark to grey strongly self mulching and cracking clay with occasionally mottled grey to brown lower B horizon. Alkaline soil reaction trend	Ug5.24, Ug5.28, Ug5.15	Black earth - grey clay	Stagnant Alluvial Plain	Stagnant alluvial plains 0.1-2% slope
Dalgangal	Brown to grey hardsetting weakly cracking clay with frequently mottled or gleyed lower B horizon. Occasionally bleached A2 horizon. A & B horizons > 1.5m. Alkaline soil reaction trend	Ug5.15, Ug5.25 Ug5.34, Ug3.1	Grey clay - brown clay	"	Stagnant alluvial plains 0-2% slope
Belvedere	Dark to grey moderately self mulching and cracking clay with grey to brown lower B horizon. A & B horizons > 1.2m deep. Alkaline soil reaction trend	Ug5.15, Ug5.16 Ug5.11, Ug5.25	Black earth - grey clay	"	Stagnant alluvial plains 0.5-3% slope
Abercorn	Occasionally mottled dark to brown texture contrast soil with frequently bleached hard-setting sandy clay loam to clay loam A horizon < 0.3m. Alkaline soil reaction trend	Db1.13, Db1.33 Db2.13, Db2.33 Db2.43, Dy2.43 Dd2.43	Solodic soil - solodized-solonetz, no suitable group	"	Stagnant alluvial plains 0.1-3% slope

* Principal Profile Forms, Northcote (1979) ** Most frequently occurring only

All soil types except Anyarro and Ceratodus have alkaline soil reaction trends and chloride accumulations and are sodic or strongly sodic in the lower horizons. This suggests that depth of wetting may be limited even though subsoil textures indicate high water holding capacity. Slight chloride accumulations may also occur in Ceratodus soil type where it occupies lower landscape positions.

For the deep bored profiles sampled, both pH and chlorides peaked at approximately 0.6 m for Belvedere soil type and 1.2 m for Abercorn soil type. Belvedere soil became moderately acid (pH 5.6) with a slight decrease at 3.0m while Abercorn soil continued alkaline with chlorides decreasing to low levels. These near surface chloride peaks appear to correspond to the normal wetting depths.

All soils are non-sodic at the surface.

Table 5. Soil reaction trends, ratings* for chloride and sodicity and dispersion ratios in the sampled soil types

Soil type	Soil reaction trend	Chloride			Sodicity**			Dispersion ratio
		0-10 cm	50-60 cm	80-90 cm	0-10 cm	50-60 cm	80-90 cm	0-10 cm
Anyarro	Neutral	VL	VL	VL	NS	NS	NS	0.79
Ceratodus	Neutral	VL	VL	VL	NS	NS	NS	0.67
Bilboolan	Alkaline	VL	M	H	NS	SS	SS	0.77
Yarrol	Alkaline	VL	M-H	H	NS	SS	SS	0.53
Eidsvold	Alkaline	VL	M	H	NS	S	S	0.81
Dalgangal	Alkaline	VL	H	H	NS	SS	SS	0.77
Belvedere	Alkaline	VL	H	H	NS	S	S	0.69
Abercorn	Alkaline	VL	M	H-VH	NS	SS	SS	0.72

* Bruce and Rayment (1982) VL - very low M - medium H - high VH - very high

** Sodicity ratings as defined by Northcote and Skene (1972)

NS - non sodic S - sodic SS - strongly sodic

Particle size distribution. The levee soils of the recent alluvium have high sand contents. Coarse sand plus fine sand in Anyarro and Ceratodus soils ranges from 48% to 81% and coarse sand is consistently higher for the lower lying Anyarro.

Clay activity ratio. This ratio (CEC/clay, M. equiv. per g clay) gives an indication of clay mineralogy. Of the soils with more than 20% clay those on the recent alluvial plain have ratios below the surface layer in the range 0.55 to 0.85, although results for Yarrol are variable. This

indicates the presence of some smectite clays. Ratios in soils on the stagnant alluvial plain, except for Eidsvold soil, are in the range 0.45 to 0.70 indicating the presence of a higher proportion of highly weathered clay minerals.

Total phosphorus (P), potassium (K) and sulphur (S). Total P is not regarded as an indicator of plant available P but only of the reserves held in the soil. Levels of total P shown in Appendix 2 are rated as medium to very high for soils on the recent alluvial plains but only low to medium on the stagnant alluvial plains.

Total K values give some indication of parent material differences between soils. For all soils the total K values were very similar apart from some soils on the stagnant alluvial plain having slightly lower values in the upper B horizon. This suggests the soils are derived from similar parent materials and age differences are not great.

Total S levels are low in all soils except Bilboolan and Yarrol soils where they are medium. Medium levels of S also occur in the surface of Ceratodus and Belvedere soils.

Soil fertility. The fertility ratings for the sampled soil types shown in Table 6 are based on Bruce and Rayment (1982). These results cannot accurately predict deficiencies and should be used as guidelines only. The soils on the stagnant alluvial plain have low levels of phosphorus and zinc except for Belvedere soil which has medium zinc. Zinc deficiency is possible in Eidsvold soil when surface pH is neutral.

Soil water. The methods of Shaw and Yule (1978) may be used to estimate the plant available water capacity (PAWC) of the soils. The estimates from cation exchange capacity are as follows:

Anyarro	93 mm
Ceratodus	109 mm
Bilboolan	148 mm
Yarrol	107 mm
Eidsvold	148 mm
Dalgangle	145 mm
Belvedere	116 mm
Abercorn	129 mm

Depth of the active root zone was taken as the shallower of depth to maximum chloride or 0.9 m and bulk density was calculated according to the technique of Yule and Ritchie (1980).

Table 6. Ratings* for nutrients in the top 10 cm of analysed profiles

Soil type	Phosphorus		Extr. potassium	Copper	Zinc	Manganese	Total N	Organic C	Total S
	Acid	Bicarbonate							
Anyarro	v. high	high	v. high	medium	medium	medium	low	medium	low
Ceratodus	v. high	high	high	medium	medium	high	low	medium	medium
Bilboolan	v. high	high	high	medium	medium	high	medium	medium	medium
Yarrol	high	medium	high	medium	medium	high	low	medium	medium
Eidsvold	medium	medium	high	medium	low	medium	low	low	low
Dalgangal	medium	v. low	v. high	-	-	-	-	-	low
Belvedere	medium	low	high	medium	medium	high	medium	medium	medium
Abercorn	medium	low	high	medium	low	high	low	low	low

* Bruce and Rayment (1982)

These results may best be considered as a ranking because no data to verify the methods are available. They show that the lighter textured Anyarro and Ceratodus soils have low PAWC as does the Yarrol soil. In the latter case, maximum chloride at 0.6 m restricts the estimated active root zone. PAWC is high in the remaining soils except Belvedere soil where a chloride maximum again occurs at 0.6 m.

4. LAND USE POTENTIAL

4.1 General

The present land uses in the survey area are beef cattle grazing and agricultural cropping with limited dairying and some gravel extraction from the river bed. Grazing utilises the greatest area with most land cleared or selectively timber treated. An estimated 1330 ha were cropped or had irrigated pastures in the year to January 1985. A proportion of the cropped land was irrigated and some of this was double cropped. A further 210 ha had been cropped in the past but were not cropped in 1984. There is therefore considerable scope for further irrigation.

Land use potential for soil mapping units can be considered in two ways:-

- Land capability classifications.
- Crop-Soil suitability assessments.

Neither of these rank soils on potential yield differences. They rank soils on the difficulties a producer would face in obtaining an acceptable yield.

They also fail to take full account of differences in water use by the various crops, the soil chemical and physical limitations shown by analysis and the potential problems associated with an irrigation scheme that are not related to the soil mapping units.

4.2 Land Capability Classification

The land capability classification applied to the mapping units of this survey is based on that developed by Thompson (1977). It is a general irrigated crop system and is divided into five classes:

Class 1.	Arable.	Suitable for irrigation with no or few limitations.
Class 2.	Arable.	Suitable for irrigation with slight limitations.
Class 3.	Arable.	Suitable for irrigation with moderate limitations.
Class 4.	Limited arable	Unsuitable for irrigation until proven otherwise by further studies.
Class 5.	Non-arable.	Unsuitable

Land classes, limitations and areas for each mapping unit are given in Table 7. Appendix 3 fully describes the criteria and classes.

The areas in each land class within the survey area are:

Class 1	-
Class 2	1 820 ha
Class 3	1 170 ha
Class 4	820 ha
Class 5	450 ha

Total area assessed as suitable for irrigation (Classes 1 to 3) is 2990 ha. A further 820 ha were classified as marginal (Class 4). The Class 5 land includes stream channels, benches and banks and rock outcrops.

4.3 Crop-Soil Suitability

A range of crops have been considered for the area. It would be possible to grow a number of horticultural crops on the Anyarro or Ceratodus soil types but none would have the market advantage necessary for successful competition with established areas. Table 8 summarises soil limitations, crops considered suitable and management requirements for the mapping units.

4.4 Irrigation Requirements

Estimates of crop water use and irrigation requirements for a range of potential crops are given in Table 9. The crop water requirements were estimated according to the method of Doorenbos and Kassam (1979) using evaporation data from Brain Pastures and a pan coefficient of 0.85.

Irrigation requirements were calculated on decile 3 and decile 5 rainfalls. The decile 3 figures estimate a water requirement that is equalled or exceeded in the driest 3 out of 10 years. The decile 5 requirements are equalled or exceeded in 5 out of 10 years. Estimates with stored rainfall cover the one crop per year situation while those without stored rainfall cover the double cropping case where soil water is depleted prior to planting. If adequate water was available, double cropping might be expected on 70 to 80% of the irrigated area.

Table 7. Summary of soil properties and irrigated land capability classes

Landscape unit		Recent alluvial plain					Stagnant alluvial plain			
Mapping unit		Anyarro	Ceratodus	Hollywell	Bilboolan	Yarrol	Eidsvold	Dalgangal	Belvedere	Abercorn
Soil Factors Affecting Irrigation Suitability*	Soil depth	-	-	-	-	-	-	-	-	-
	Depth to moderately strong B horizon	-	-	-	-	2	-	-	-	2
	Surface crust	-	2	2	2	3	-	3	-	3
	Soil variability	2	-	-	-	2	-	-	-	-
	Surface texture	-	-	-	-	-	-	-	-	-
	Salinity	-	-	-	-	-	-	-	-	-
	Sodicity	-	-	2	2	2	2	3	2	2
	Topography	-	-	2	-	-	2	2	-	3
	Rockiness	-	-	-	-	-	-	-	-	-
	Micro relief	-	-	-	-	-	-	-	2	-
	Wetness	-	-	-	3	3	2	2	2	-
	Erosion	-	-	2	-	2	3	3	2	3
	Flooding	2	-	-	-	-	-	-	-	-
	Irrigated land capability classification	2	2	3	3	3	3	4	2	4
	Area (ha)	750	870	80	180	820	90	230	200	590

* Based upon values in Irrigated Land Capability Classification in Appendix 3.

Table 8. Specific soil limitations, suitable crops and management requirements for the mapping units under irrigation

Mapping unit	Major limitations	Well adapted crops	Marginally adapted crops	Management requirements and comments
Anyarro	Low plant available water capacity Soil variability Uneven topography Occassional flooding	Citrus Grapes Melons Vegetables Navy beans Peanuts	Lucerne Wheat Barley Maize	Suitable for spray or trickle irrigation only Presence of a buried clay layer in some areas requires citrus rootstocks tolerant of heavy soils Production of melons and vegetables limited by availability of markets
Ceratodus	Surface crusting Moderate plant available water capacity Occassional flooding	Grapes Melons Vegetables Peanuts Navy beans Maize Lucerne Wheat Barley	Citrus Potatoes Sorghum Mung beans Soybeans	Suitable for spray or trickle irrigation only Citrus requires rootstocks tolerant of heavy soils Production of melons and vegetables limited by availability of markets
Hollywell	Surface crusting Low plant available water capacity in A horizon Waterlogging in lower A horizon Low fertility Erosion potential	Sorghum Wheat Barley	Soybeans	Suitable for spray or trickle irrigation only
Bilboolan	Surface crusting Limited and variable depth of wetting associated with sodicity Waterlogging and poor surface drainage Moderate fertility Frosts	Sorghum Wheat Barley Soybeans	Peanuts Maize	Available area will be reduced by waterways and tail drains Planting on mounds will reduce waterlogging
Yarrol	Surface crusting Waterlogging and poor surface drainage Moderate fertility Frosts Occassional flooding Erosion potential	Sorghum Wheat Barley Soybeans	Maize	As above
Eidsvold	Waterlogging Variability associated with incipient gilgai Erosion potential	Sorghum Wheat Barley Cotton Soybeans	Maize Mung beans Lucerne	Planting on mounds will reduce waterlogging Crop establishment may be difficult

Table 8. (Continued)

Mapping unit	Major limitations	Well adapted crops	Marginally adapted crops	Management requirements and comments
Dalgangal	Surface crusting Limited and variable depth of wetting associated with sodicity Waterlogging Variability associated with incipient gilgai Erosion potential	Sorghum Wheat Barley	Soybeans Cotton	As above
Belvedere	Waterlogging Gilgai and associated soil variability Erosion potential	Soybeans Maize Sorghum Wheat Barley Cotton	Mung beans Lucerne	As above Diversion banks and grassed waterways needed to control run-on water Contour banks required in some areas Crop establishment may be difficult
Abercorn	Surface crusting Limited depth of wetting associated with sodicity Waterlogging in A horizon Erosion potential	Sorghum Wheat Barley Soybeans	Maize Peanuts	Contour banks required in most areas

Table 9. Estimated planting dates, water use and irrigation requirements for a range of crops in the study area

Crop	Planting date	Water use (Ml/ha)	Irrigation requirement (Ml/ha)			
			Decile 3		Decile 5	
			With stored rainfall	Without stored rainfall	With stored rainfall	Without stored rainfall
Soybeans	15 Dec	5.69	2.44	3.44	1.27	2.27
Peanuts	15 Nov	6.75	3.20	4.07	1.81	2.81
Navy beans*	15 Jan	3.38	0.96	1.96	0.00	1.00
Sorghum	1 Oct	6.25	3.29	-	2.11	-
Sorghum	1 Dec	5.48	1.96	2.96	0.88	1.88
Maize	1 Oct	7.28	3.99	-	2.66	-
Maize	1 Dec	6.34	2.82	3.82	1.63	2.63
Wheat (Barley)	15 May	4.77	3.01	4.01	2.31	3.31
Cotton	1 Nov	8.02	4.46	5.09	2.88	3.76
Citrus	-	11.48	7.59	-	5.40	-

* Navy beans are reported to be sensitive to water stress and poor extractors of soil water so actual irrigation requirements are likely to be about 1Ml/ha higher than those calculated.

Assumptions made in the calculations were as follows:

- Soil plant available water capacity is 100 mm
- Where specified, rainfall for the given decile for the three months prior to planting is stored up to 100mm
- If the sum of stored water and rainfall in any month exceeds crop water use, the excess up to 100 mm is carried forward to the next month as stored water.
- If the sum of stored water and rainfall in any month is less than crop water use, irrigation is applied to supply the difference.
- No account is taken of distribution losses.

Horticulture Branch staff estimate that trickle irrigated citrus in the area require 6 to 7 Ml/ha per year (J. Owen-Turner, pers. comm.). They also state that grapes require about 2 Ml/ha, applied at critical times (J. Baker, pers. comm.).

The estimated water requirement for lucerne is 7 to 8 Ml/ha (A.Jamieson, pers. comm.).

4.5 Potential hazards or problems

Several problems may be encountered with the expansion of irrigation in the area. These include salinity, location of weir, limited storage capacity, distance from markets and the cost of production.

Although salinisation is a potential problem in the region, it is not considered a major hazard. There is no evidence to suggest the development of watertable salting on the Burnett River alluvium but some further salinisation of the river and existing ground waters is possible.

Splinter Creek catchment is the main source of poor quality water affecting the river within the survey area (see section 2.3). This catchment constitutes a potential salinity hazard if measures are not taken to prevent further deterioration in water quality. Such measures include assessing the impact of major land use changes and timber clearing within the catchment on water quality (K. Hughes, pers. comm.). Seepage salting was not evident in the survey area. However, it may occur in areas adjoining the Burnett River alluvium where the porous Hutton Sandstones overlie the finer beds of the Evergreen Formation. No salting was observed in these areas but if problems did develop, they would contribute to a deterioration in water quality in storages along the Burnett River.

Watertable salting is not foreseen as a problem because of the depth of alluvium and the fact that the basal aquifers appear to connect with the sands of the river bed. Irrigation will leach salts out of those soil types with salt accumulations within the profile into the groundwater. This will contribute to a small deterioration in river water quality.

The water storage should be located to service the largest area of suitable irrigation soils possible. Suitable soils occurring downstream of the weir would have to be serviced by regulated flow releases. During periods of peak demand associated with low replenishment rates, continuous supply could not be guaranteed to those areas near the limits of storage.

The limited storage capacity of a weir on the Burnett River will restrict the irrigation development potential of the survey area. Individual crop water requirements and seasonal conditions will determine the area irrigated at any time.

Market accessability will influence the economic viability of irrigation development in the Ceratodus area. It is centrally located for, but still at some distance from outlets for horticultural and grain produce. Citrus can be railed from Ceratodus or handled through the cooperative at Gayndah, 90 km to the south. Brisbane is the nearest market for fruit and vegetables, but with the exception of early grapes, this area does not provide a marketing advantage for these crops. The nearest major rail grain handling facility is near Monto, about 60 km north. Peanuts are currently transported to a depot at Gayndah and navy beans to Kingaroy, about 250 km south. Biloela, 160 km north, is the nearest centre for cotton ginning.

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Ms Monika Bently for preparing the soil profile descriptions and laboratory data in Appendix 2 directly from coded computer data files.

APPENDIX 1

MAJOR DISTINGUISHING FEATURES OF THE SOIL TYPES

SOIL TYPE : ANYARRO

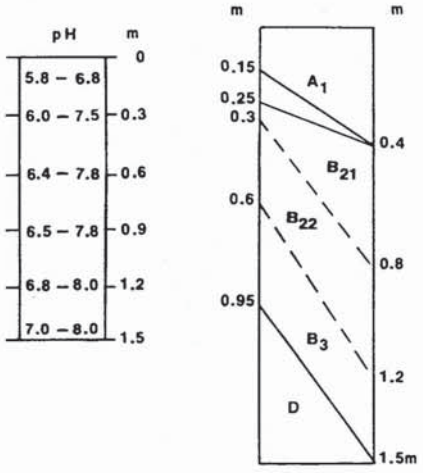
Principle Profile Form: Um1.43, Um1.44, Um6.12, Um6.32, Um6.42, Gn3.23, Gn3.22

Great Soil Group: Alluvial soils, minimal prairie soils

Parent Material: Alluvium

Brief Description: Dark to brown uniform and gradational soils with minimal profile development. Sandy loam to fine sandy clay loam surfaces. Acid to neutral soil reaction trend.

Modal Profile:



Surface: Firm to hardsetting

A_1 Brownish black to dark brown (7.5YR 10YR 2/3 3/3 moist) sandy loam to clay loam fine sandy, massive to weak fine subangular blocky, dry moderately weak to firm, earthy to sandy, gradual to:-

B_{21} Brownish black to brown (7.5YR 10YR 2/3 4/4 moist) loamy sand to light clay, massive to moderate fine angular blocky, dry moderately weak to stong, earthy to smooth-ped,gradual to:-

B_{22} As above except sandy clay loam to light medium clay, gradual to:-

B_3 As above except dull reddish brown to brown (5YR 7.5YR 4/4 4/6 moist) sandy clay loam to clay loam sandy, clear to:-

D Frequently brown, dark or yellow mottled brownish black to brown (7.5YR 10YR 2/4 4/6 moist) loamy sandy to medium clay, weak fine subangular blocky to strong medium angular blocky, dry moderately weak to strong, earthy to smooth-ped.

Variant: Sporadically bleached A_2 horizons may occur
Dark red brown colours (5YR 4/4 moist) may occur in B horizons
D horizons or other buried soil materials may be massive or bleached
Lower B and D horizons may have carbonate in moderate quantities

SOIL TYPE: CERATODUS

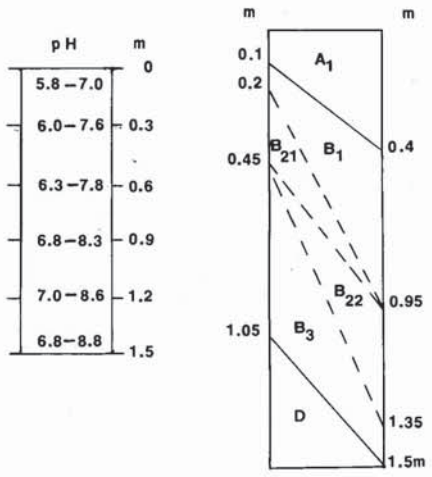
Principle Profile Form: Uf6.32, Uf6.31, Gn3.22, Gn3.23, Gn3.42, Gn3.43, Gn3.63, Dd1.12

Great Soil Group: Prairie soils

Parent Material: Alluvium

Brief Description: Dark to brown uniform and gradational soils with moderate to strong structure. Neutral to moderately alkaline soil reaction trend. Well drained.

Modal Profile:



Surface: Hardsetting

A_1 Brownish black to brown (7.5YR 10YR 2/2 4/4 moist) sandy clay loam to clay loam to light clay, moderate to strong fine angular blocky, dry moderately firm, smooth-ped, gradual to:-

B_1 Brownish black to dull reddish brown (5YR 10YR 2/3 4/4 moist) sandy clay loam to light medium clay, moderate to strong medium angular blocky, dry very firm, smooth-ped, gradual to:-

B_{21} Brownish black to brown (7.5YR 10YR 2/2 4/6 moist) clay loam fine sandy to medium clay, strong medium angular blocky, dry very firm, smooth ped, gradual to:-

B_{22} As above except light clay to medium heavy clay, occasionally with trace to small amounts of ferromanganiferous nodules and concretions, clear or abrupt to:-

B_3 Dark brown to brown (7.5YR 10YR 3/3 4/6 moist) fine sandy clay to light medium clay, strong fine to medium angular blocky, dry strong, smooth-ped, trace to small amounts ferromanganiferous concretions, clear or gradual to:-

D As above except weak to strong medium subangular to angular blocky, dry very firm to very strong, smooth-ped.

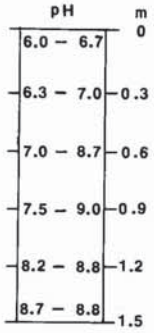
Variant: A horizons may be massive
B horizons may have faint dark brown, grey or yellow mottling
B horizons may have carbonate in moderate amounts
Lower B and D horizons may be strong medium prismatic and may have trace amounts of carbonate and ferromanganiferous inclusions.

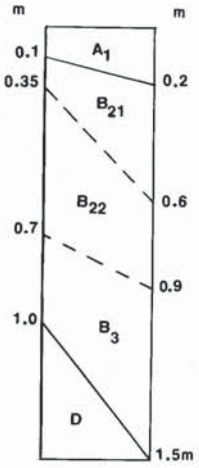
SOIL TYPE: BILBOOLAN **Principle Profile Form:** Ug5.15, Ug5.16, Ug3.2

Great Soil Group: Black earths, grey clays **Parent Material:** Alluvium

Brief Description: Occasionally bleached, dark to grey cracking clays with grey to brown, occasionally mottled lower B horizon. Alkaline soil reaction trend.

Model Profile:





Surface: Weakly self-mulching and cracking

A_1 Brownish black (7.5YR 10YR 2/2 3/1 moist) light clay to medium heavy clay, strong fine to medium angular blocky, dry moderately firm to strong, smooth-ped, gradual to:-

B_{21} Black to brownish black (7.5YR 10YR 2/1 3/2 moist) medium clay to medium heavy clay, strong medium to coarse angular blocky, dry strong to very strong, smooth-ped, trace amounts of ferromanganiferous nodules, gradual to:-

B_{22} Black to brownish black (7.5YR 2/1 3/2 moist) medium heavy clay to heavy clay, strong coarse angular blocky, dry moderately firm to very strong, smooth-ped, trace to small amounts of carbonate and ferromanganiferous concretions and nodules, gradual to:-

B_3 Black to brown (7.5YR 10YR 2/1 4/3 moist) light clay to medium heavy clay, strong medium angular blocky to coarse angular blocky, dry very strong, smooth-ped, trace to small amounts of carbonate concretions, small amounts of ferromanganiferous veins and segregations, abrupt to:-

D Brownish black (7.5YR 3/2 moist) light medium clay, then as above.

Variant: A horizons may have trace amounts of ferromanganiferous nodules
Bleached B_1 horizon sometimes present
B horizons may have dark, grey, orange or brown mottles
B horizons may have large accumulations of carbonate
B_3 horizon may be reddish brown (5YR 4/6 moist)

SOIL TYPE: YARROL

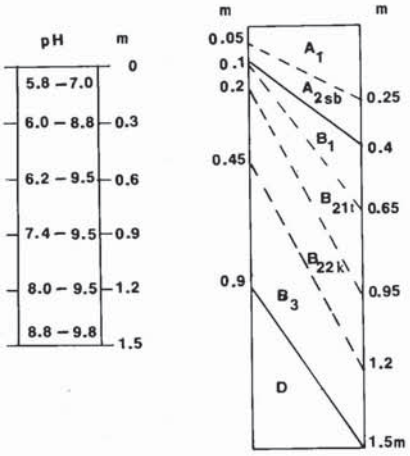
Principle Profile Form: Db1.13, Db1.33, Db2.13, Db2.33, Dd1.33, Dy3.43

Great Soil Group: Solodic soils, solodized-solonetz, no suitable group

Parent Material: Alluvium

Brief Description: Bleached, frequently mottled hardsetting texture contrast soils in drainage depressions and lower landscape positions.

Modal Profile:



Surface: Hardsetting

A_1 Brownish black to brown [7.5YR 10YR 2/2 4/4 moist] sandy clay loam fine sandy to silty clay loam, massive to strong fine to medium angular blocky, dry moderately firm, earthy to smooth-ped, gradual to:-

A_{2sb} Where present, sporadically or occasionally conspicuously bleached brownish black to dull brown [7.5YR 10YR 3/2 4/4 5/4 moist] then as above, clear to:-

B_1 Brown to dark mottled brown to dull brown [7.5YR 10YR 3/4 5/4 moist] light medium to medium clay, moderate to strong medium angular blocky, dry very strong, smooth-ped, moderate amounts of ferromanganiferous segregations and concretions, clear to:-

B_{21t} Frequently dark, yellow or grey mottled dark brown to brown [7.5YR 10YR 3/3 4/4 moist] light medium to medium heavy clay, strong medium to coarse angular blocky, then as above, gradual to:-

B_{22k} Occasionally brown, grey or dark mottled brownish black to dull brown [7.5YR 10YR 3/2 4/2 5/4 moist] medium to medium heavy clay, large amounts of carbonate segregations and concretions, then as above, gradual to:-

B_3 Brown, yellow or grey mottled brown to yellowish brown [7.5YR 10YR 4/3 5/6 moist] light medium clay to medium clay, strong medium angular blocky, dry strong, smooth-ped, moderate to large amounts of carbonate concretions, small to moderate amounts of ferromanganiferous concretions, clear to:-

D Greyish-yellow brown to dull yellowish brown [7.5YR 10YR 4/2 4/6 5/3 moist] light to medium heavy clay, moderate to strong fine to medium angular blocky, dry strong, smooth-ped, moderate amounts of ferromanganiferous concretions.

Variant: A horizons may range from 5cm up to 60cm deep
B_1 horizons may be bleached
B_2 horizons may have red yellow or grey mottles with varied depths of carbonate accumulations [B_{21k} or B_{22k}, etc]
B_3 horizon may be reddish brown [5YR 4/6 moist]
D horizons may be in the form of distinctive buried soil horizons ie $2B_2b$, $2B_3b$, etc and may include light clays with sandy inclusions or heavy clays.

SOIL TYPE: HOLLYWELL

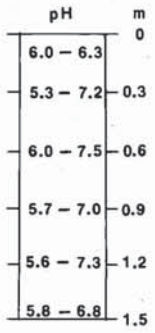
Principle Profile Form: Dy3.82, Db1.32, Db2.32, Dr2.32, Dy3.41

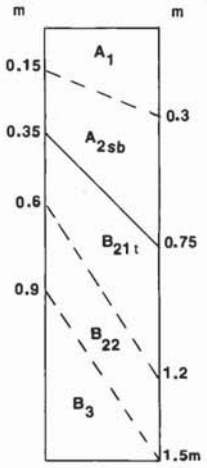
Great Soil Group: Soloths, solodic soils

Parent Material: Alluvium

Brief Description: Texture contrast soils with sandy loam to sandy clay loam A horizons > 300mm. Acid to neutral soil reaction trend.

Modal Profile:





Surface: Firm to hardsetting

A_1 Brownish black to brown (7.5YR 10YR 3/2 4/4 moist) sandy loam to sandy clay loam, massive to weak fine angular blocky, dry moderately weak to firm, sandy, clear to:-

A_{2sb} Sporadically or conspicuously bleached greyish brown to orange (7.5YR 10YR 4/2 6/6 moist 7/2 8/2 dry), then as above, abrupt to:-

B_{21t} Red, grey, yellow or dark mottled brown to yellowish brown (7.5YR 10YR 4/6 5/4 5/6 moist) light medium clay to medium heavy clay, strong medium subangular blocky to angular blocky, dry very strong, smooth-ped, coarse fraction of rounded quartz, gradual to:-

B_{22} As above except red, grey, yellow mottled dull reddish brown to bright reddish brown (5YR 7.5YR 10YR 4/4 5/6 moist), strong fine subangular blocky to fine prismatic, gradual to:-

B_3 Pale or grey mottled brown to orange (7.5YR 10YR 4/4 6/6 moist) sandy clay loam to light medium clay, massive to moderate fine angular blocky, smooth-ped, small amounts of ferromanganiferous segregations and concretions, coarse fraction of quartz sand and siliceous gravel.

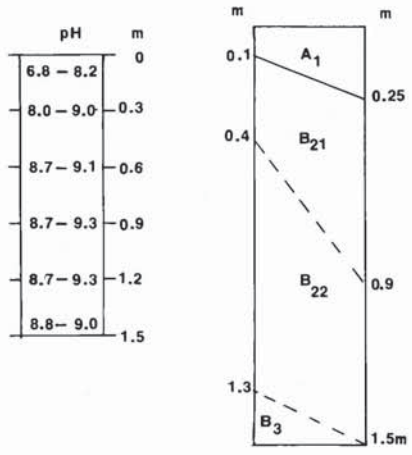
Variant: B_1 horizon may be present
B_{21} horizon may be dark reddish brown (2.5YR 3/6 moist) and may be massive and earthy
Alkaline variant may have carbonate in B_3 horizon

SOIL TYPE: EIDSVOLD Principle Profile Form: Ug5.15, Ug5.24, Ug5.28

Great Soil Group: Black earths, grey clays Parent Material: Alluvium

Brief Description: Dark to grey clays with occasionally mottled lower B horizons and alkaline soil reaction trend.

Modal Profile:



Surface: Strongly self-mulching and cracking.

A_1 Brownish black to greyish yellow brown (10YR 3/2 4/1 4/2 moist) light to medium clay, strong fine angular blocky, dry strong, smooth-ped, trace to small amounts of carbonate and ferromanganiferous concretions, clear to:-

B_{21} Brownish black to dark greyish yellow (10YR 2.5YR 3/2 4/2 moist) light medium to medium heavy clay, strong fine to strong medium angular blocky, dry strong, smooth-ped, then as above gradual to:-

B_{22} As above except occasionally yellow to grey mottled and strong medium angular blocky to very coarse lenticular, clear to:-

B_3 Grey to yellow mottled dull yellowish brown (10YR 4/3 5/4 moist) medium to medium heavy clay, strong fine to medium angular blocky, dry strong, smooth-ped, then as above.

Variant: Lower B horizons may be gleyed.

SOIL TYPE: DALGANGAL

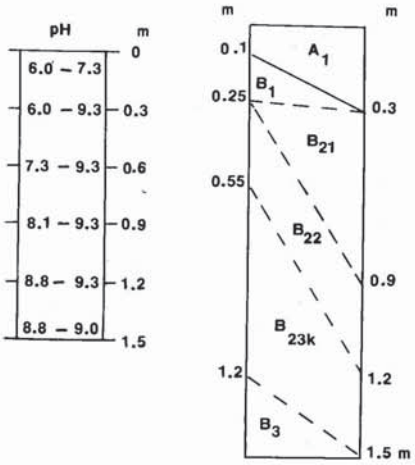
Principle Profile Form: Ug5.15, Ug5.25, Ug5.34, Ug3.1, Ug3.3

Great Soil Group: Brown clays, grey clays

Parent Material: Alluvium

Brief Description: Occasionally bleached, brown to grey clays with frequently mottled or gleyed lower B horizon.

Modal Profile:



Surface: Hardsetting and weakly cracking

A_1 Occasionally mottled, brownish black to brownish grey (7.5YR 10YR 3/2 4/1 moist) light clay to medium clay, moderate fine subangular blocky to strong medium angular blocky, dry firm to very strong, smooth ped, trace amounts of ferromanganiferous nodules and segregations, gradual to:-

B_1 Dark brown to brownish grey (10YR 3/3 4/1 moist) light medium clay to medium heavy clay, moderate medium to strong medium angular blocky, dry strong to very strong, smooth-ped, small to moderate amounts of ferromanganiferous nodules and segregations, gradual to:-

B_{21} Occasionally brown or dark mottled brownish black to dull yellowish brown (7.5YR 10YR 3/1 4/3 5/4 moist) light medium clay to heavy clay, moderate to strong medium coarse angular blocky, dry strong to extremely strong, smooth-ped moderate amounts of carbonate and ferromanganiferous segregations concretions and nodules, gradual to:-

B_{22} Occasionally brown or dark mottled brownish black to dull yellowish brown (7.5YR 10YR 3/2 5/4 moist) medium to heavy clay, strong medium to coarse angular blocky, then as above, gradual to:-

B_{23k} As above except frequently dark, yellow, brown or grey mottled, large amounts of carbonate segregations and concretions, clear or gradual to:-

B_3 Occasionally brown dark or grey mottled brown to greyish brown (7.5YR 10YR 4/4 4/6 5/2 moist) light medium to medium heavy clay, small to moderate amounts of carbonate and ferromanganiferous concretions, then as above.

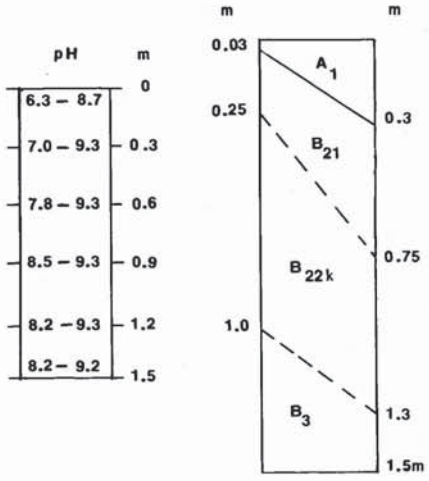
Variant: A horizons may be bleached (Ug3.1, Ug3.3) or have dark mottling.
Textures may be as light as clay loam or light clay minus (in gilgai depressions)
B_1 horizons may be bleached
B horizons may have red, yellow or gley mottling
B horizons may be dark olive brown (2.5Y 4/4 moist)

SOIL TYPE: BELVEDERE **Principle Profile Form:** Ug5.11, Ug5.15, Ug5.18, Ug5.25

Great Soil Group: Black earths, grey clays **Parent Material:** Alluvium

Brief Description: Dark to grey clays with grey to brown lower B horizons. A & B > 1200 mm deep. Alkaline soil reaction trend.

Modal Profile:



Surface: Moderately self-mulching and cracking clays

A_1 Brownish black [7.5YR 10YR 2/2 3/2 moist] light medium clay to medium heavy clay, moderate fine granular to strong fine angular blocky, dry firm to very strong, smooth-ped, occasionally trace to small amounts of carbonate and ferromanganiferous concretions, clear to:-

B_{21} Brownish black to dull yellowish brown [7.5YR 10YR 2/2 4/3 moist] medium clay to medium heavy clay, strong fine to medium angular blocky, dry firm to very strong, smooth-ped, small to moderate amounts of carbonate and manganiferous concretions and segregations, gradual to:-

B_{22k} Occasionally yellow, grey, brown or dark mottled brownish black to dull yellow orange [7.5YR 10YR 3/1 4/2 5/4 6/4 moist] medium heavy to heavy clay, strong medium to coarse angular blocky, dry very strong, smooth-ped, moderate to large amounts of carbonate concretions, small to moderate amounts of ferromanganiferous concretions, gradual to:-

B_3 Brown [10YR 4/4 4/6 moist] medium to heavy clay, strong fine to coarse angular blocky to coarse lenticular, dry very strong, smooth ped, moderate amounts of carbonate and ferromanganiferous concretions and segregations.

Variant: B_1 horizons may be present
B_3 horizon may have grey mottle [Ug5.25]
Quartz coarse fraction may be present in some profiles

SOIL TYPE: ABERCORN

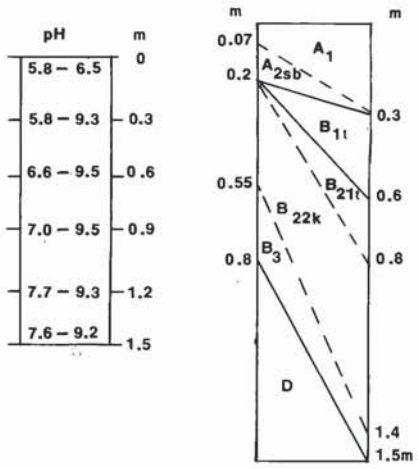
Principle Profile Form: Db1.13, Db1.33, Db2.13, Db2.32, Db2.43, Dy2.33, Dy3.33, Dd1.33

Great Soil Group: Solodic soils, solodized-solonetz, no suitable group

Parent Material: Alluvium

Brief Description: Dark to brown, hardsetting, frequently bleached texture contrast soils, alkaline soil reaction trend.

Modal Profile:



Surface: Hardsetting

A_1 Brownish black to brown (7.5YR 10YR 3/2 4/3 moist) sandy loam to sandy clay loam to clay loam, weak to moderate fine to medium granular to angular blocky, dry moderately weak to strong, earthy, clear to:-

A_{2sb} Sporadically bleached, or occasionally conspicuously bleached dark brown to orange (7.5YR 10YR 3/3 4/3 6/6 moist 7/2 8/2 dry), then as above, abrupt to:-

B_{1t} Occasionally brown, dark or orange mottled brownish black to dark brown (7.5YR 10YR 3/2 3/3 3/4 moist) light to medium heavy clay, strong medium angular blocky, dry strong, smooth-ped, moderate amounts of ferromanganiferous nodules and concretions, gradual to:-

B_{21t} Brown to yellow to dark mottled brownish black to brown (7.5YR 10YR 2/3 3/2 4/4 moist) light medium to medium heavy clay, strong medium to strong coarse angular blocky to medium prismatic, dry extremely strong, smooth-ped, small to moderate amounts of carbonate segregations and ferromanganiferous nodules and concretions, gradual to:-

B_{22k} Occasionally dark to yellow to grey mottled brownish black to yellowish brown (7.5YR 10YR 3/2 4/2 5/6 moist) medium to medium heavy clay, moderate to large amounts of carbonate concretions, then as above, gradual or clear to:-

B_3 Yellow, dark or grey mottled brown to reddish brown to bright brown (5YR 7.5YR 10YR 4/4 5/6 moist) light medium clay to medium heavy clay, strong fine to strong medium angular blocky, small to moderate or sometimes large amounts of carbonate concretions, then as above, clear to:-

D Dark to yellow to orange mottled brownish black to brown to reddish brown (5YR 7.5YR 10YR 2/3 4/6 5/4 moist) sandy clay loam to medium heavy clay, weak to strong fine to medium angular blocky, dry firm to strong, smooth-ped, small to moderate amounts of carbonate and ferromanganiferous concretions.

Variant: A horizons may be massive

A_2 horizon may have dark mottle and moderate amounts of ferromanganiferous nodules.

B_2 horizons may be grey in colour (2.5Y 4/2 moist) or reddish brown (5YR 3/4 moist) to bright reddish brown (2.5Y 6/3 moist)

D horizons may be massive and have loamy sand texture.

APPENDIX 2

MORPHOLOGICAL AND ANALYTICAL DATA FOR REPRESENTATIVE SOIL PROFILES

SOIL TYPE: ANYARRO
SITE NO: S1
A.M.G. REFERENCE: 314 450 mE 7 206 950 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Um6.32
SOIL TAXONOMY UNIT: Fluventic Haplustoll

SUBSTRATE MATERIAL:
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Level plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Surface crust, hard setting

HORIZON	DEPTH	DESCRIPTION
AP1	0 to .15 m	Dark brown (10YR3/3) moist; sandy clay loam, fine sandy; moderate 2-5mm granular; moist moderately firm. Clear to-
A12	.15 to .30 m	Brownish black (10YR3/2) moist; sandy clay loam, fine sandy; strong 5-10mm angular blocky; moderately moist moderately strong. Gradual to-
B2	.30 to .65 m	Dark brown (10YR3/4) moist; light sandy clay loam; moderate 5-10mm angular blocky; dry very strong. Clear to-
2A1b	.65 to 1.10 m	Dark brown (10YR3/3) moist; fine sandy clay; strong 10-20mm angular blocky; dry very strong. Gradual to-
2B2b	1.10 to 1.50 m	Dark brown (7.5YR3/3) moist; few fine faint brown mottles; light medium clay; strong 20-50mm angular blocky; dry very strong.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	6.3	.07	.002																	
.10	6.5	.04	.002	24	50	11	12	17	7.4	1.9	.14	1.1	.110	1.21	.018	1.7	14	08	.95	
.30	6.6	.02	.001	37	41	10	11	16	7.8	2.4	.14	.78	.100	1.15	.011	1.8	12	07	.67	
.60	6.8	.01	.001	42	38	9	8	12	6.6	2.2	.13	.20	.088	1.10	.007	1.6		06	.85	
.90	7.1	.01	.001	17	49	13	18	17	12	3.5	.13	.33	.072	1.16	.010	2.3	16	09	.63	
1.20	7.3	.02	.001	7	53	16	22	17	10	3.4	.16	.20	.069	1.21	.009	2.4				
1.50	7.5	.03	.001																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.5	.10	465	66	1.4	51	40	0.9	2.0

ERRATUM

The Austrlian Map Grid Zone for the survey area is 56, not 55. See pages 28 to 42.

SOIL TYPE: ANYARRO
SITE NO: S2
A.M.G. REFERENCE: 320 700 mE 7 210 900 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.23
SOIL TAXONOMY UNIT: Entic Haplustoll

SUBSTRATE MATERIAL: Sand
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Gently undulating plains

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated, firm

HORIZON	DEPTH	DESCRIPTION
AP	0 to .15 m	Dark brown (7.5YR3/3) moist; sandy loam; massive 2-5mm fragment; moist moderately firm. Clear smooth to-
B21	.15 to .50 m	Dark brown (7.5YR3/4) moist; sandy loam; moderate 10-20mm angular blocky; moist moderately firm. Gradual smooth to-
B22	.50 to .80 m	Dark brown (7.5YR3/4) moist; sandy clay loam; moderate 10-20mm angular blocky; moist moderately firm. Gradual smooth to-
B23	.80 to 1.10 m	Brown (7.5YR4/6) moist; light sandy clay loam; moderate 10-20mm angular blocky; moist moderately firm; very few medium carbonate concretions. Gradual smooth to-
B3	1.10 to 1.50 m	Brown (7.5YR4/6) moist; light sandy clay loam; moderate 5-10mm angular blocky; few distinct clay skins; moderately moist moderately firm. Gradual smooth to-

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.8	.07	.002																	
.10	7.0	.04	.001	21	56	11	10	14	4.6	2.9	.37	.61	.068	1.18	.014	1.4	14	07	.85	
.30	7.4	.05	.004	18	57	13	12	11	5.2	1.9	.62	.15	.055	1.14	.009	1.4	12	07	.76	
.60	7.9	.09	.007	21	53	11	14	11	5.9	2.4	.77	.03	.051	1.16	.009	1.6	13	08	.88	
.90	8.0	.07	.002	23	48	11	15	12	6.4	2.4	.75	.04	.038	1.16	.009	1.4	15	08	.99	
1.20	7.9	.09	.006	19	52	15	12	8	5.4	1.8	.51	.04	.032	1.12	.008	1.4				
1.50	7.9	.13	.011																	

Depth	Org.C (W&B)	Tot.N	Extr. Acid Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm	m.eq%	ppm			
Bulk .10	1.0	.07	90 48	.85	39	45	0.8	1.6

SOIL TYPE: ANYARRO
SITE NO: S3
A.M.G. REFERENCE: 317 650 mE 7 212 750 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Um1.43
SOIL TAXONOMY UNIT: Fluventic Haplustoll

SUBSTRATE MATERIAL: Sand
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Scroll
LANDFORM PATTERN TYPE: Gently undulating plains

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A11	0 to .15 m	Dark brown (10YR3/3) moist; sandy clay loam; weak 5-10mm subangular blocky; moist moderately firm. Gradual to-
A12	.15 to .60 m	Dark brown (10YR3/3) moist; light sandy clay loam; weak 2-5mm subangular blocky; dry moderately firm. Gradual to-
B21	.60 to .85 m	Dark brown (10YR3/4) moist; sandy loam; weak 5-10mm subangular blocky; dry moderately weak. Diffuse to-
B22	.85 to 1.00 m	Dark brown (10YR3/3) moist; sandy loam; weak 2-5mm subangular blocky; dry moderately weak. Diffuse to-
D1	1.00 to 1.30 m	Dark brown (10YR3/4) moist; sandy clay loam; weak 5-10mm subangular blocky; dry moderately weak. Diffuse to-
D2	1.30 to 1.50 m	Dark brown (10YR3/4) moist; clay loam,sandy; weak 5-10mm subangular blocky; dry moderately weak.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.4	.05	.004																	
.10	6.5	.03	.003	23	48	14	16	18	9.4	3.4	.13	.60	.152	1.22	.019	2.1	19	08	.57	
.30	7.0	.02	.002	41	37	9	12	12	8.5	2.3	.16	.22	.147	1.14	.012	1.6	13	06	.53	
.60	7.4	.02	.003	43	37	8	10	12	8.8	2.9	.15	.16	.129	1.12	.009	1.7	13	06	.70	
.90	7.5	.02	.003	39	42	7	10	11	8.2	3.4	.15	.15	.140	1.07	.007	1.7	12	06	.80	
1.20	7.7	.02	.002	22	45	12	18	13	9.6	4.6	.20	.17	.125	1.10	.009	2.1				
1.50	7.8	.03	.002																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.2	.14	700	61	1.2	52	34	1.1	2.7

SOIL TYPE: CERATODUS
SITE NO: S4
A.M.G. REFERENCE: 320 825 mE 7 210 800 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.23
SOIL TAXONOMY UNIT: Udic Argiustoll

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Level plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Firm, recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .18 m	Brownish black (7.5YR3/2) moist; clay loam,fine sandy; massive 2-5mm fragment primary; wet moderately firm. Clear smooth to-
B21	.18 to .30 m	Dark brown (7.5YR3/3) moist; clay loam,fine sandy; moderate 5-10mm angular blocky primary; moist very firm. Gradual smooth to-
B22	.30 to .50 m	Dark brown (7.5YR3/4) moist; light clay; moderate 10-20mm angular blocky primary; moist very firm. Gradual smooth to-
B23	.50 to .90 m	Dark brown (7.5YR3/4) moist; light clay; strong 5-10mm angular blocky primary; common prominent clay skins; moderately moist very firm; few fine ferromanganiferous nodules. Gradual smooth to-
B3	.90 to 1.50 m	Brown (7.5YR4/4) moist; sandy clay; moderate 10-20mm angular blocky primary; few prominent clay skins; moderately moist very firm. Gradual smooth to-

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.8	.12	.003																	
.10	7.0	.06	.002	3	57	23	18	19	6.7	3.6	.54	.62	.073	1.23	.021	1.9	22	09	.80	
.30	7.2	.12	.009	1	55	26	19	16	6.9	2.9	1.2	.20	.052	1.16	.013	2.0	20	09	.94	
.60	6.9	.28	.028	7	50	23	19	14	6.1	3.9	1.1	.16	.046	1.16	.015	2.1	20	10	.86	
.90	7.3	.39	.045	5	45	17	32	18	8.0	6.5	1.5	.27	.052	1.29	.015	3.1	24	13	.77	
1.20	7.7	.34	.044	4	51	17	29	17	7.6	6.0	1.8	.25	.052	1.31	.010	2.8				
1.50	8.1	.29	.039																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.7	.13	88	46	1.0	37	64	1.3	2.0

SOIL TYPE: CERATODUS
SITE NO: S5
A.M.G. REFERENCE: 313 550 mE 7 204 750 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.43
SOIL TAXONOMY UNIT: Entic Haplustoll

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: 2 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Gently undulating rises

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .18 m	Brownish black (7.5YR2/2) moist; clay loam; moderate 2-5mm angular blocky; moist moderately firm. Clear smooth to-
B21	.18 to .50 m	Brownish black (7.5YR3/2) moist; light clay; strong 5-10mm angular blocky; dry very firm. Clear smooth to-
B22	.50 to .80 m	Dark brown (7.5YR3/3) moist; light clay; strong 5-10mm angular blocky; dry very firm. Clear smooth to-
B23	.80 to 1.30 m	Dark brown (7.5YR3/4) moist; light clay; strong 5-10mm angular blocky; dry very firm. Clear smooth to-
B3	1.30 to 1.60 m	Dark brown (7.5YR3/4) moist; light clay; strong 5-10mm angular blocky; dry very firm.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.7	.08	.002																	
.10	6.6	.04	.001	6	52	20	22	21	10	3.2	.21	.76	.104	1.28	.025	2.5	26	10	.57	
.30	7.1	.03	.001	4	55	17	22	18	12	3.5	.15	.20	.092	1.25	.015	2.4	22	10	.64	
.60	7.6	.02	.001	6	50	18	25	17	11	3.6	.21	.16	.071	1.24	.011	2.5		10	.77	
.90	8.0	.03	.001	5	50	19	26	16	9.9	4.1	.30	.20	.069	1.24	.010	2.7	22	11	.68	
1.20	8.3	.03	.001	23	43	14	18	12	8.7	3.4	.30	.09	.054	1.17	.007	2.0				
1.50	8.3	.03	.001																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.1	.14	390	62	1.3	52	60	1.4	2.2

SOIL TYPE: CERATODUS
SITE NO: S6
A.M.G. REFERENCE: 315 060 mE 7 207 600 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.23
SOIL TAXONOMY UNIT: Udic Argiustoll

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Gently undulating plains

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Hard setting, recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .20 m	Dark brown (7.5YR3/3) moist; clay loam,fine sandy; moderate 5-10mm angular blocky; moist moderately firm. Clear smooth to-
A3	.20 to .35 m	Dark brown (7.5YR3/3) moist; clay loam,fine sandy; moderate 5-10mm angular blocky; moist moderately firm. Clear smooth to-
B21	.35 to .80 m	Dark brown (7.5YR3/4) moist; light clay; strong 5-10mm angular blocky; dry very firm. Gradual smooth to-
B22	.80 to 1.40 m	Dark brown (7.5YR3/4) moist; light medium clay; strong 5-10mm angular blocky; common prominent clay skins; dry very firm. Clear smooth to-
2B2b	1.40 to 1.50 m	Brown (7.5YR4/4) moist; light medium clay; strong 2-5mm angular blocky; dry very firm; very few fine ferromanganiferous nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.9	.06	.001																	
.10	5.8	.03	.002	3	55	20	21	17	5.1	2.7	.16	.44	.089	1.23	.018	2.1	25	09	.68	
.30	6.4	.02	.001	2	50	23	22	17	7.6	3.6	.24	.09	.075	1.23	.015	2.4	24	10	.69	
.60	7.1	.02	.001	2	48	21	28	17	9.2	4.0	.32	.12	.068	1.27	.010	2.9	24	12	.76	
.90	7.4	.02	.001	2	51	20	25	14	9.2	3.7	.31	.13	.049	1.21	.007	2.6	24	10	.77	
1.20	7.6	.03	.001	2	46	21	31	15	9.7	3.6	.34	.10	.051	1.23	.007	2.8				
1.50	7.8	.04	.001																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.8	.13	215	45	.85	92	59	1.5	2.0

SOIL TYPE: CERATODUS
SITE NO: S7
A.M.G. REFERENCE: 313 680 mE 7 218 300 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.42
SOIL TAXONOMY UNIT: Udic Argiustoll

SUBSTRATE MATERIAL:
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Alluvial plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .15 m	Brownish black (10YR3/2) moist; clay loam,fine sandy; moderate 5-10mm subangular blocky; dry very firm. Gradual to-
B1	.15 to .35 m	Brownish black (10YR3/2) moist; light medium clay; strong 5-10mm angular blocky; dry very firm. Gradual to-
B21	.35 to .65 m	Brownish black (10YR2/2) moist; medium clay; strong 10-20mm angular blocky; moderately moist very firm. Clear to-
B22	.65 to .80 m	Brownish black (10YR3/2) moist; few medium faint brown mottles; medium clay; strong 10-20mm angular blocky; moderately moist very firm. Clear to-
B3	.80 to 1.50 m	Brown (7.5YR4/4) moist; few medium distinct dark mottles; sandy clay; moderate 5-10mm subangular blocky; moderately moist moderately firm.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	7.0	.06	.004																	
.10	6.8	.06	.003	22	47	11	16	15	7.1	2.6	.30	.82	.069	1.11	.021	1.7	17	07	.64	
.30	6.7	.03	.003	11	46	14	27	20	12	3.8	.35	.36	.068	1.14	.018	2.8	23	11	.47	
.60	6.7	.03	.003	9	38	15	34	24	15	5.4	.34	.31	.071	1.20	.016	3.4	27	13	.46	
.90	7.0	.05	.006	17	39	10	31	19	12	4.8	.35	.28	.068	1.09	.013	3.0	23	11	.51	
1.20	7.1	.04	.005	24	47	6	20	12	7.0	3.2	.31	.22	.049	1.10	.010	2.0				
1.50	7.3	.03	.004																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.3	.08	125	62	.99	57	39	1.2	1.2

SOIL TYPE: BILBOOLAN
SITE NO: S8
A.M.G. REFERENCE: 320 950 mE 7 210 550 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Ug3.2
SOIL TAXONOMY UNIT: Entic Chromustert

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: 1 %
LANDFORM ELEMENT TYPE: Valley-flat
LANDFORM PATTERN TYPE: Level plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Surface crust, hard setting

HORIZON	DEPTH	DESCRIPTION
AP	0 to .10 m	Brownish black (10YR2/2) moist; light clay; strong 10-20mm angular blocky; wet very firm; few ferromanganiferous soft segregations. Clear to-
B1sb	.10 to .20 m	Greyish yellow-brown (10YR4/2) moist, dry sporadically bleached; common medium faint brown mottles; light clay; strong 5-10mm angular blocky; moist very firm; very few medium ferromanganiferous nodules. Clear to-
B21	.20 to .50 m	Greyish yellow-brown (10YR4/2) moist; medium clay; strong 2-5mm angular blocky; moist moderately strong; very few medium ferromanganiferous nodules. Gradual to-
B22	.50 to .80 m	Brownish black (10YR3/2) moist; medium clay; strong 2-5mm angular blocky; moist moderately strong; very few medium carbonate concretions. Gradual to-
B23	.80 to 1.20 m	Greyish yellow-brown (10YR4/2) moist; light medium clay; strong 2-5mm angular blocky; moist moderately strong; few medium carbonate concretions. Gradual to-
B24	1.20 to 1.60 m	Brownish black (10YR3/2) moist; common medium distinct grey mottles; light clay; strong 2-5mm angular blocky; moist very firm; few medium ferromanganiferous nodules. Abrupt to-
2B2	1.60 to 1.80 m	Brownish black (7.5YR3/2) moist; light medium clay; strong 2-5mm angular blocky; moist very firm; very few fine ferromanganiferous veins.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.6	.11	.006																	
.10	6.8	.09	.004	3	29	34	36	33	11	6.8	1.2	.67	.082	1.22	.023	4.0	33	16	.77	
.30	7.4	.16	.010	1	26	30	44	30	12	8.3	3.7	.30	.028	1.12	.013	4.5	31	18	.98	
.60	8.6	.52	.041	2	23	24	51	35	14	10	7.2	.21	.021	1.08	.023	5.6	36	19	.99	
.90	8.8	.93	.059	3	27	23	46	32	14	9.7	8.5	.20	.025	1.04	.039	5.3	34	19	.99	
1.20	8.8	1.0	.072	3	29	24	42	29	12	8.1	7.6	.28	.045	1.22	.038	4.8				
1.50	8.3	1.0	.090																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.2	.17	103	84	.80	142	112	2.0	2.9

SOIL TYPE: YARROL
SITE NO: S9
A.M.G. REFERENCE: 313 800 mE 7 207 200 mN ZONE 55

GREAT SOIL GROUP: Solodic soil
PRINCIPAL PROFILE FORM: Dd1.33
SOIL TAXONOMY UNIT: Mollic Natrustalf

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Back-plain
LANDFORM PATTERN TYPE: Gently undulating plains

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Brownish black (10YR3/2) moist; clay loam,fine sandy; moderate 5-10mm angular blocky; dry very firm. Clear smooth to-
A2sb	.15 to .30 m	Dull yellowish brown (10YR4/3) moist, dry sporadically bleached; many medium prominent pale mottles; clay loam,fine sandy; weak 5-10mm angular blocky; dry very firm. Abrupt smooth to-
B21t	.30 to .60 m	Brownish black (10YR3/2) moist; medium clay; strong 10-20mm prismatic; dry very strong; few fine ferromanganiferous nodules. Clear smooth to-
B22k	.60 to .90 m	Brownish black (10YR3/2) moist; medium clay; strong 5-10mm angular blocky strong; dry moderately strong; few medium carbonate concretions, very few fine ferromanganiferous nodules. Clear smooth to-
B23	.90 to 1.50 m	Brownish black (10YR3/2) moist; light medium clay; strong 5-10mm angular blocky; dry moderately strong; very few fine ferromanganiferous nodules.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.5	.06	.001										.045	0.98	.032	3.4	35	15	.50	
.10	6.3	.04	.001	5	35	31	31	29	11	5.6	.28	1.4	.042	0.92	.028	2.8	29	12	.74	
.30	7.1	.04	.001	4	42	29	28	22	11	5.2	1.3	.36	.033	0.76	.025	4.4	38	19	.99	
.60	8.5	.33	.036	3	24	27	49	34	17	10	6.4	.29	.116	1.26	.029	4.7	42	20	.98	
.90	8.4	1.0	.107	2	18	28	54	37	17	12	9.3	.29	.082	1.12	.012	5.1				
1.20	8.4	.89	.086	3	16	26	58	39	18	13	10	.27								
1.50	8.5	.86	.082																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.5	.18	210	96	1.6	104	58	2.3	3.0

SOIL TYPE: YARROL
SITE NO: S10
A.M.G. REFERENCE: 319 250 mE 7 216 250 mN ZONE 55

GREAT SOIL GROUP: Solodic soil
PRINCIPAL PROFILE FORM: Dd1.33
SOIL TAXONOMY UNIT: Mollic Natrustalf

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Back-plain
LANDFORM PATTERN TYPE: Level plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .12 m	Brownish black (7.5YR2/2) moist; clay loam,fine sandy; moderate 5-10mm angular blocky; dry very firm. Clear to-
A2sb	.12 to .20 m	Greyish brown (7.5YR4/2) moist, dry sporadically bleached; many fine distinct dark mottles; clay loam; moderate 5-10mm angular blocky; dry moderately firm. Abrupt to-
B1t	.20 to .35 m	Brownish black (7.5YR3/2) moist; few fine faint brown mottles; medium heavy clay; strong 20-50mm angular blocky; moderately moist very strong; common medium ferromanganiferous nodules. Gradual to-
B21	.35 to .55 m	Brownish black (10YR3/2) moist; medium heavy clay; 20-50mm angular blocky; moderately moist very strong; few medium ferromanganiferous nodules. Gradual to-
B22	.55 to .80 m	Dull yellowish brown (10YR4/3) moist; medium heavy clay; 20-50mm angular blocky; moderately moist very strong; common medium ferromanganiferous nodules, few medium carbonate concretions. Clear to-
B3k	.80 to 1.50 m	Dull yellowish brown (10YR4/3) moist; medium heavy clay; 20-50mm angular blocky; moderately moist very strong; common medium carbonate concretions, few medium ferromanganiferous nodules.

Depth	1:5 Soil/Water			Particle Size					Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.1	.07	.006																	
.10	6.0	.04	.003	6	29	28	34	27	6.4	5.0	.49	.45	.053	0.87	.030	3.3	33	13	.55	
.30	6.5	.30	.052	4	23	13	59	31	10	9.7	3.5	.26	.028	0.78	.024	5.1	38	20	.78	
.60	8.6	.95	1.05	6	28	11	52	24	9.2	10	5.4	.19	.017	0.74	.022	4.5	35	18	.95	
.90	8.8	1.0	1.05	7	29	14	46	22	7.7	9.5	5.6	.22	.016	0.75	.026	4.3		18		
1.20	8.8	1.0	1.00	7	27	14	52	23	7.5	10	6.3	.19	.016	0.79	.024	4.3				
1.50	8.8	1.0	1.00																	

Depth	Org.C (W&B)	Tot.N	Extr. Acid Phosphorus	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.3	.11	22	6	.70	98	90	1.5	0.7

SOIL TYPE: EIDSVOLD
SITE NO: S12
A.M.G. REFERENCE: 311 830 mE 7 204 050 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Ug5.24
SOIL TAXONOMY UNIT: Entic Chromustert

SUBSTRATE MATERIAL:
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE: Back-plain
LANDFORM PATTERN TYPE:

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking, self mulching

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Brownish grey (10YR4/1) moist; light medium clay; strong 5-10mm angular blocky; moist very firm; few medium carbonate nodules. Clear to-
B21	.25 to .90 m	Dark greyish yellow (2.5Y4/2) moist; very few medium faint yellow mottles; medium clay; strong 10-20mm angular blocky; moist moderately strong. Gradual to-
B3	.90 to 1.30 m	Dull yellowish brown (10YR5/4) moist; common medium distinct grey mottles; medium clay; strong 10-20mm angular blocky; moist moderately strong; few coarse manganiferous soft segregations.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	7.2	.25	.016																	
.10	7.1	.12	.008	4	19	24	52	32	15	9.8	1.1	.82	.036	0.61	.019	5.3	36	20	.81	
.30	7.0	.13	.011	2	12	28	56	34	15	12	2.4	.41	.017	0.59	.011	5.6	39	21	.96	
.60	7.4	.35	.041	2	12	28	59	34	14	13	4.0	.35	.013	0.54	.015	5.5	44	22	.99	
.90	8.3	.68	.071	2	12	26	60	35	15	14	4.7	.35	.013	0.61	.016	5.8	44	22	.91	
1.20	8.3	.80	.900	2	11	24	63	34	14	15	4.9	.34	.018	0.84	.014	5.9				
1.50	8.4	.87	.900																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.4	.12	31	28	.99	30	42	2.5	0.4

SOIL TYPE: DALGANGAL
SITE NO: S13
A.M.G. REFERENCE: 315 400 mE 7 208 900 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Ug5.25
SOIL TAXONOMY UNIT: Entic Pellustert
TYPE OF MICRORELIEF: Linear gilgai
VERTICAL INTERVAL: .08 m
HORIZONTAL INTERVAL: 5 m
COMPONENT OF MICRORELIEF SAMPLED: Mound

SUBSTRATE MATERIAL:
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: .5 %
LANDFORM ELEMENT TYPE: Plain
LANDFORM PATTERN TYPE: Alluvial plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Hard setting, periodic cracking

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .12 m	Brownish grey (7.5YR4/1) moist, dry sporadically bleached; common medium distinct pale mottles; medium clay; strong 5-10mm angular blocky; dry very firm.
B11	.12 to .30 m	Brownish grey (10YR4/1) moist; medium heavy clay; strong 20-50mm angular blocky; dry very strong.
B21	.30 to .60 m	Dull yellowish brown (10YR4/3) moist; few medium faint dark mottles; heavy clay; strong 20-50mm angular blocky; moderately moist very strong; very few fine carbonate nodules.
B22	.60 to .90 m	Dull yellowish brown (10YR5/4) moist; few medium faint dark mottles; heavy clay; strong 20-50mm angular blocky; moderately moist very strong; few medium carbonate nodules.
B23k	.90 to 1.00 m	Brown (7.5YR4/4) moist; few medium faint grey mottles; heavy clay; strong 20-50mm angular blocky; moderately moist very strong; common medium carbonate nodules.
B24	1.00 to 1.20 m	Brown (7.5YR4/4) moist; medium heavy clay; strong 20-50mm angular blocky; moderately moist very strong; few fine carbonate nodules.
B3	1.20 to 1.50 m	Brown (7.5YR4/6) moist; medium clay; strong 10-20mm angular blocky; moderately moist moderately strong; few fine carbonate nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	7.4	.17	.006																	
.10	7.5	.13	.006	8	35	25	35	27	13	8.2	1.2	.63	.068	1.02	.015	3.5	32	15	.77	
.30	8.0	.41	.051	2	17	18	60	34	14	14	3.9	.34	.021	0.73	.022	5.2	43	21	.95	
.60	8.8	.85	.093	3	16	18	59	30	12	14	5.5	.38	.017	0.78	.024	4.9	42	21	.99	
.90	8.7	1.0	.135	1	14	21	60	30	11	14	5.8	.47	.013	0.91	.016	5.0	44	22	.99	
1.20	8.7	.95	.109	1	16	21	59	29	9.7	13	6.0	.55	.016	1.06	.015	4.9				
1.50	8.8	.81	.084																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.5	.17	31	9	1.1	24	32	1.3	0.8

SOIL TYPE: BELVEDERE
SITE NO: S14
A.M.G. REFERENCE: 314 400 mE 7 204 250 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT: Typic Chromustert
TYPE OF MICRORELIEF: Normal gilgai
VERTICAL INTERVAL: .25 m
HORIZONTAL INTERVAL: 25 m
COMPONENT OF MICRORELIEF SAMPLED: Mound

SUBSTRATE MATERIAL:
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 0.5 %
LANDFORM ELEMENT TYPE: Plain
LANDFORM PATTERN TYPE: Level plain

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking, surface crust

HORIZON	DEPTH	DESCRIPTION
A1	0 to .06 m	Brownish black (10YR3/2) moist; medium clay; strong 5-10mm angular blocky; moist very firm. Clear to-
B21	.06 to .35 m	Brownish black (10YR3/2) moist, medium heavy clay; strong 10-20mm angular blocky; moderately moist very strong; very few fine ferromanganiferous nodules, very few medium carbonate concretions. Clear to-
B22	.35 to .75 m	Dark greyish yellow (2.5Y4/2) moist, common medium faint yellow mottles; medium heavy clay; very few small pebbles, subrounded quartz; strong 20-50mm angular blocky; moderately moist very strong; very few fine ferromanganiferous nodules, very few fine carbonate concretions. Gradual to-
B23	.75 to .90 m	Dull yellowish brown (10YR4/3) moist, many medium faint dark mottles; medium heavy clay; strong 20-50mm angular blocky primary; moderately moist moderately strong; few fine ferromanganiferous nodules, very few fine carbonate concretions. Gradual to-
B31	.90 to 2.70 m	Dull yellowish brown (10YR5/4) moist; medium heavy clay; strong 200-500mm lenticular primary, strong 10-20mm angular blocky secondary; dry moderately strong; few fine ferromanganiferous nodules, few medium ferromanganiferous veins. Gradual to-
B32	2.70 to 3.00 m	Dull yellowish brown (10YR5/4) moist; many coarse prominent grey mottles; medium clay; few medium ferromanganiferous veins.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS FS S C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C	m.eq/100g					%			% @ 105C				
Bulk .10	7.1	.14	.002														
.10	7.7	.13	.003	8 11 20 58	41	22	8.2	.90	.69	.038	0.99	.027	6.9	37	21	.69	
.30	8.4	.43	.043	6 11 20 61	38	20	9.7	2.7	.28	.026	0.95	.017	6.8	39	21	.87	
.60	8.3	.96	.125	4 9 18 65	34	18	12	4.2	.50	.023	1.01	.013	6.8	39	21	.86	
.90	8.4	.91	.115	3 10 18 65	33	17	13	4.6	.51	.019	1.07	.010	6.8	42	23	.99	
1.20	8.0	.80	.100	1 8 22 69	32	14	13	5.0	.57	.020	1.27	.010	6.5				
1.50	7.6	.76	.100														

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.6	.21	30	15	1.0	60	131	2.1	1.1
1.80	7.0	.77	.10	5					

SOIL TYPE: ABERCORN
SITE NO: S15
A.M.G. REFERENCE: 312 640 mE 7 204 250 mN ZONE 55

GREAT SOIL GROUP: Red brown earth
PRINCIPAL PROFILE FORM: Db1.13
SOIL TAXONOMY UNIT: Mollic Natrustalf

SUBSTRATE MATERIAL: Clay
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Almost certain or certain

SLOPE: 3 %
LANDFORM ELEMENT TYPE: Pediment
LANDFORM PATTERN TYPE: Gently undulating rises

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated, hard setting

HORIZON	DEPTH	DESCRIPTION
AP	0 to .18 m	Dark brown (7.5YR3/3) moist; silty clay loam; massive 2-5mm fragment; wet moderately firm; many very fine roots. Abrupt smooth to-
B21	.18 to .30 m	Very dark brown (7.5YR2/3) moist; common medium distinct brown mottles; medium clay; strong 2-5mm angular blocky; wet moderately strong; few fine ferromanganiferous nodules; many very fine roots. Clear smooth to-
B22	.30 to .60 m	Dull yellowish brown (10YR4/3) moist; medium clay; strong 5-10mm angular blocky; moist moderately strong; few fine ferromanganiferous nodules; many very fine roots. Clear smooth to-
B23	.60 to .70 m	Brownish black (10YR3/2) moist; medium heavy clay; strong 5-10mm angular blocky; moderately moist moderately strong; few medium ferromanganiferous nodules; common very fine roots. Clear smooth to-
B24	.70 to .75 m	Brown (10YR4/6) moist; common medium distinct grey mottles; medium clay; strong 5-10mm angular blocky; moderately moist moderately strong; common medium ferromanganiferous nodules; few very fine roots. Clear smooth to-
B25k	.75 to 1.20 m	Brown (10YR4/4) moist; common medium distinct grey mottles; medium clay; strong 2-5mm angular blocky; moderately moist very firm; few medium carbonate concretions, few medium ferromanganiferous nodules; no roots roots. Gradual smooth to-
B3	1.20 to 1.50 m	Bright brown (7.5YR5/6) moist; few medium distinct grey mottles; medium heavy clay; strong 2-5mm angular blocky; moderately moist very firm; few medium ferromanganiferous veins; no roots roots.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.9	.03	.002																	
.10	6.4	.03	.002	8	39	28	23	16	5.1	3.3	.42	.14	.040	0.64	.014	2.1	23	09	.69	
.30	8.0	.15	.015	3	22	17	56	30	9.9	13	4.4	.08	.022	0.63	.019	5.4	35	19	.92	
.60	8.8	.33	.036	5	27	20	49	26	8.0	11	6.6	.24	.020	0.64	.016	4.5	33	20	.99	
.90	8.7	1.2	1.51	4	24	20	52	27	7.9	12	8.8	.31	.017	0.73	.016	4.8	36	20	.99	
1.20	8.6	1.4	1.70	3	19	23	54	27	7.8	12	8.9	.29	.018	0.82	.017	5.3				
1.50	8.2	1.2	1.60																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.1	.11	38	26	.35	75	109	1.9	0.5

SOIL TYPE: ABERCORN
SITE NO: S16
A.M.G. REFERENCE: 318 400 mE 7 209 300 mN ZONE 55

GREAT SOIL GROUP: Solodic soil
PRINCIPAL PROFILE FORM: Db1.33
SOIL TAXONOMY UNIT: Typic Natrustalf

SUBSTRATE MATERIAL: Sand
CONFIDENCE SUBSTRATE IS PARENT MATERIAL: Doubtful

SLOPE: 2 %
LANDFORM ELEMENT TYPE: Plain
LANDFORM PATTERN TYPE: Gently undulating plains

PROFILE MORPHOLOGY:
CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Brownish black (7.5YR3/2) moist; clay loam,fine sandy; strong 10-20mm angular blocky; moderately moist moderately firm; very few fine ferromanganiferous concretions. Clear to-
A2sb	.10 to .21 m	Brown (7.5YR4/3) moist, dry sporadically bleached; many fine prominent pale mottles; clay loam,fine sandy; moderate 10-20mm angular blocky; dry moderately firm; very few fine ferromanganiferous nodules. Abrupt to-
B21t	.21 to .45 m	Dark brown (10YR3/3) moist; few fine faint brown mottles; medium clay; strong 10-20mm angular blocky primary; dry moderately strong; few fine ferromanganiferous nodules. Clear to-
B22	.45 to .80 m	Dark brown (10YR3/4) moist; medium heavy clay; strong 20-50mm angular blocky; dry very strong; few fine ferromanganiferous nodules. Gradual to-
B23	.80 to 1.55 m	Brown (7.5YR4/4) moist; few medium faint brown mottles; medium heavy clay; strong 20-50mm angular blocky; moderately moist moderately strong; common medium carbonate concretions, few medium ferromanganiferous nodules. Gradual to-
D1	1.55 to 2.40 m	Bright brown (7.5YR5/6) moist; common medium faint orange mottles; medium heavy clay; strong 10-20mm angular blocky; dry moderately strong; few fine manganiferous veins. Gradual to-
D2	2.40 to 3.60 m	Bright brown (7.5YR5/6) moist; sandy clay loam; massive fragment; dry very firm; very few fine manganiferous soft segregations. Diffuse to-
D3	3.60 to 3.90 m	Dull brown (7.5YR5/4) moist; loamy sand; massive; dry very weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	6.1	.07	.001																	
.10	6.2	.03	.001	5	39	31	26	21	7.3	4.6	.18	.48	.050	1.10	.020	2.2	31	11	.74	
.30	7.5	.07	.002	5	37	26	35	19	5.9	7.5	2.0	.29	.029	1.03	.013	2.5	28	14	.87	
.60	8.8	.32	.045	5	30	18	47	23	6.6	11	5.3	.30	.021	0.92	.014	3.3	33	18	.99	
.90	9.2	.76	.080	6	30	18	44	25	6.3	12	6.9	.33	.021	0.83	.011	3.5	34	18	.99	
1.20	9.2	.94	.099	8	28	20	44	24	6.6	13	7.1	.34	.025	0.79	.020	3.8				
1.50	9.3	.85	.080																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.3	.13	22	9	.76	64	58	1.4	2.0

APPENDIX 3

IRRIGATED LAND CAPABILITY CLASSIFICATION

Limiting factor	Degree of limitation	Capability class (if sole limiting factor	Sub-class symbol
Effective soil	>100 cm	1	d1
	60 - 100	2	d2
	45 - 60	3	d3
	25 - 45	4	d4
	<25	5	d5
Soil physical factors affecting plant growth and management	1. B horizon or sub-soil depth. Depth to B horizon with dry extremely hard consistence		
	>45 cm	1	pb1
	20 - 45	2	pb2
	10 - 20	3	pb3
	<10	4	pb4
	2. Surface crust. Surface soils likely to set hard if overworked	2	pc2
	Surface soils set hard		
	3. Distribution of soil profile classes.		
	Soil distribution is such that 2 or more different soil profile classes occur within a 300 m traverse.		
	Soil profile classes are different such that markedly different inputs are required:		
	For specific crops	3	pd3
	For any crop	4	pd4
	4. Texture of surface soils		
	Sands to sandy loams to:		
	45 - 60 cm	2	pt2
	60 - 90	3	pt3
	>90	4	pt4

Limiting factor	Degree of limitation	Capability class (if sole limiting factor)	Sub-class symbol
Soil salinity or sodicity	Electrical conductivity of 1:5 extract at 25°C is greater than 1 mS cm^{-1} at:		
	30 - 90 cm	3	sa3
	<30	4	sa4
	Exchangeable sodium percentage greater than 15		
	40 - 90 cm	2	so2
	20 - 40	3	so3
	<20	4	so4
Topography	Slopes 0.1 - 0.5%	1	t1
	0.5 - 1.0	2	t2
	1.0 - 3.0	3	t3
	3.0 - 6.0	4	t4
	6.0 - 8.0	5	t5
Rockiness and stoniness	Tillage restricted - stone picking required.	3	r3
	Tillage difficult - stone picking required	4	r4
	Tillage impossible	5	r5
Microrelief	Vertical interval of gilgai		
	<10 cm	1	g1
	10 - 25	2	g2
	25 - 60	3	g3
	>60	4	g4
Wetness	Requires accurate levelling and storm drains.	2	w2
	Requires permanent drainage	3	w3
	Requires subsurface drainage	4	w4
Susceptibility to water erosion	To reduce erosion to an acceptable level, require:		
	Simple practices	2	e2
	Intensive practices	3	e3
	Pasture phase	4	e4
Susceptibility to floowing	Areas subject to fast streamrise flooding at frequency less than 1 in 10 years.	2	f2
	Areas subjected to major overbank flood at frequency of more than 1 in 10 years	3	f3

LAND CLASSES

The following are modified versions of land classes as defined by the United States Bureau of Reclamation (1951).

CLASS 1 - ARABLE

Lands that are highly suitable for irrigation farming; being capable of producing sustained and relatively high yields of a wide range of climatically adapted crops at reasonable cost. They are smooth lying with gentle slopes. The soils are deep and of medium to fairly fine texture with mellow, open structure allowing easy penetration of roots, air and water and having free drainage yet good plant available water capacity. These soils are free from harmful accumulations of soluble salts or can be readily reclaimed. Both soil and topographic conditions are such that no specific farm drainage requirements are anticipated, minimum erosion will result from irrigation, and land development can be accomplished at relatively low cost.

CLASS 2 - ARABLE

Lands of moderate suitability for irrigation being lower than Class 1 in productive capacity. They are not so desirable nor of such high value as lands of Class 1 because of certain correctable or non-correctable limitations. They may have a lower plant available water capacity as indicated by coarse texture or limited soil depth; they may be only slowly permeable to water because of clay layers in the subsoil; or they also may be moderately saline which may limit productivity or involve moderate costs of leaching. Topographic limitations include uneven surface requiring moderate costs for levelling, short slopes requiring shorter length of runs, or steeper slopes necessitating special care and greater costs or loose rock or woody vegetation may have to be removed from the surface. Any one of the limitations may be sufficient to reduce the lands from Class 1 to Class 2 but frequently a combination of two or more of them is operating.

CLASS 3 - ARABLE

Lands that are suitable for irrigation development but are of restricted suitability because of greater deficiencies in the soil, topographic, or drainage characteristics than described for Class 2 lands. They may have good topography, but because inferior soils have restricted adaptability, require larger amounts of irrigation water or special irrigation practices and demand greater fertilisation or more intensive soil improvement practices. They may have uneven topography, moderate to high concentration of salts or restricted drainage, susceptible to correction but only at relatively high costs. Generally, greater risk may be involved in farming Class 3 lands than better classes of land, but under proper management they are expected to have adequate payment capacity.

CLASS 4 - LIMITED ARABLE OR SPECIAL USE

Lands that have an excessive, specific deficiency or deficiencies susceptible to correction at high cost; or they may have one or more excessive, non-correctible deficiencies thereby limiting their utility to pasture, orchard or other relatively permanent crops. The deficiency may be inadequate drainage, excessive salt content requiring extensive leaching, unfavourable position allowing periodic flooding or making water

distribution and removal very difficult, rough topography, excessive quantities of loose rock on the surface or in the plough zone. On these lands special economic and agronomic and/or engineering studies are required to show they are capable of sustained production and capable of supporting a farm family and meeting water charges if operated in units of adequate size or in association with better lands.

CLASS 5 - NON-ARABLE

Lands in this class are non-arable under existing conditions. They have specific soil deficiencies such as being excessively steep, shallow, rocky, rough, badly eroded, have very high salinity or are prone to excessive flooding.