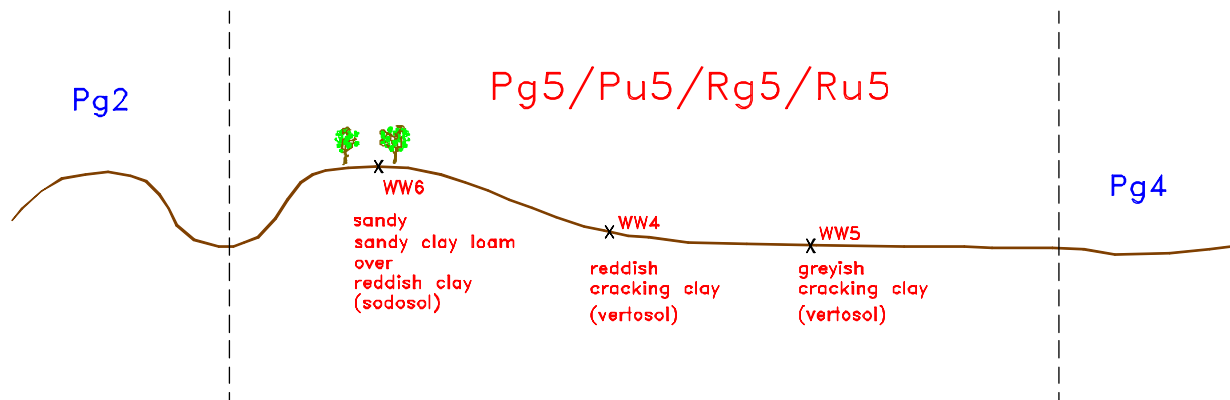


## 6.2.5 GREY AND RED PLAINS AND RISES -5 LAND SYSTEM

Map units Pg5, Pu5, Rg5, Ru5



### Landscape

The landscape of this land system has gently undulating plains with gentle rises and slopes that may lead to depressions. The landscape is occasionally dissected by more prominent rises that may have deeper sand deposits on top of the clay. Sandstone may be close to the surface in some places. When the depressions are large enough they have been separated from this land system and delineated as the Northern Cracking Clay Plains-4 land system.

The land system has been divided and mapped into four land units:

- gently undulating plains - Pg5
- gently undulating plains (closer spaced undulations) - Pu5
- gently undulating rises - Rg5 and
- gently undulating rises (closer spaced undulations) - Ru5

### Native Vegetation

Yellow Gum is the most common tree species.

### Soil types

There is a common and distinct pattern to the soils in this landscape. The crests are often red or brown sodosols (duplex) with a strong textural contrast between the lightly textured topsoils and the sodic clay subsoil (WW6). There are usually slickensides in the subsoil, indicating cracking at depth. There is some evidence of surface cracking.

The upper and mid slopes off the crests often have more uniform clay soils that crack on drying and are referred to as red vertosols (WW4). The colour of the soil is variable due to the occurrence of gilgai micro-relief (see Plate 12).



**Plate 11** Note the colour change of the soil on the better drained upper slope (background) and the poorer drained lower slope (foreground).

On the lower and less well drained slopes are grey vertosols (uniform clay soils) that crack on drying (WW5).

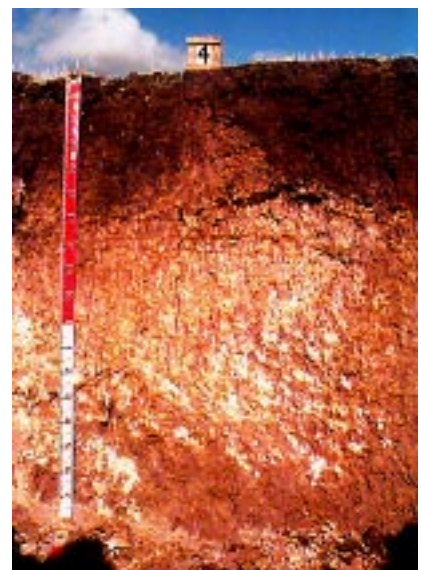
The colour of the soil is important in determining the soil drainage. The better drained soils on the crests and upper slopes are often red or reddish brown due to more aerobic conditions. The lower slopes are often greyer in colour due to more runoff accumulating on the lower reaches of the landscape and poorer drainage, which results in longer periods of anaerobic conditions.

As the soil tends to crack, gilgai micro-relief is common. This results in a number of soil types occurring over a very small area. The poorer drained depressions tend to have a darker greyer colour (WW4b) and the hummocks tend to be redder, indicating better drainage (WW4a). There is also chemical variation between the hummocks and depressions.

### **Current land use**

A range of land uses occur on this land type. Grazing is the most common land use, although cropping can also occur. The lower slopes and clay plains (Pg4) are often sown to canola and safflower in the summer.

**Plate 12** clearly show gilgai micro-relief with the mixed topsoil



**Representative soil type of land units**

The four land units (Pg5, Pu5, Rg5 and Ru5) are differentiated only on landscape characteristics. The soil types are predominantly the same on all the land units.

Although the land suitability assessments have been conducted for a range of land elements on the four land units (crest (WW6), upper slope (WW4), lower slope (WW5)), the lower slope (WW5) is regarded as the most appropriate element to represent these land units. The long gentle lower slopes where this soil type occurs represents the largest element in the landscape.

**REPRESENTATIVE SOIL TYPE FOR THE GREY AND RED PLAINS AND RISES  
- 5 -Pg5/Pu5/Rg5/Ru5 LAND UNITS**

**MAP UNIT:** Pg5, Pu5, Rg5, Ru5

**Site No.:** WW5

**Position in Landscape:** Lower slope

**Grid Ref:** 512 234 E, 597 7974 N

**Aust. Soil Class.:** Endocalcareous-Endohypersodic, Self-mulching, Brown VERTOSOL

**Northcote Factual Key:** Ug5.3

**Great Soil Group:** red brown clays

**General Landscape Description:**

This soil type occurs on the lower slope associated with the red vertosols above (WW4a) and the red and brown sodosols (WW6) on the crests. The major land element in these land units is the long gentle slopes, therefore this soil type (WW5) on the lower slope is regarded as the most appropriate soil type to represent the land units of the Grey and Red Plains and Rises-5 land system. This soil type has a high shrink/swell potential, therefore gilgai have formed leading to a variety of soil colours. A greyish topsoil is the most common and occurs to various depths.



**Soil Profile Morphology:**

**Topsoil**

**A1** 0-10 cm Dark greyish brown (10YR4/2) *light medium clay*, moderate blocky structure, (peds 20-50 mm), breaking to moderate polyhedral structure, (peds 5-10 mm), self mulching surface condition, firm consistence when dry. pH 8.2.

**Subsoil**

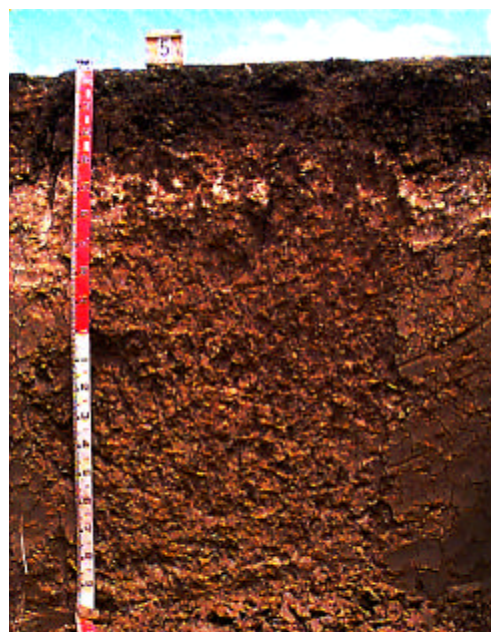
**B21** 10-30 cm Dark brown (7.5YR4/4) *light medium clay*, strong polyhedral structure, (peds 10-20 mm breaking to 5-10 mm and 2-5 mm), strong consistence when slightly moist. pH 8.6.

**B22** 30-45 cm Dark brown (7.5YR4/4) *medium heavy clay*, strong blocky structure (peds 20-50 mm), very strong consistence when dry. Complete dispersion when worked. pH 9.1.

**B23** 45-60 cm Reddish yellow (7.5YR7/6) *medium heavy clay*, strong blocky structure, (peds 20-50 mm), strong consistence when slightly moist, soft calcium carbonate segregations are common (10-20%). pH 9.5.

**B24** 60-90 cm Light yellowish brown (10YR6/4) *light medium clay*, weak to moderate prismatic structure, (peds 20-50 mm), very firm consistence when slightly moist, very few (2%) calcium carbonate /silica nodules. pH 9.1.

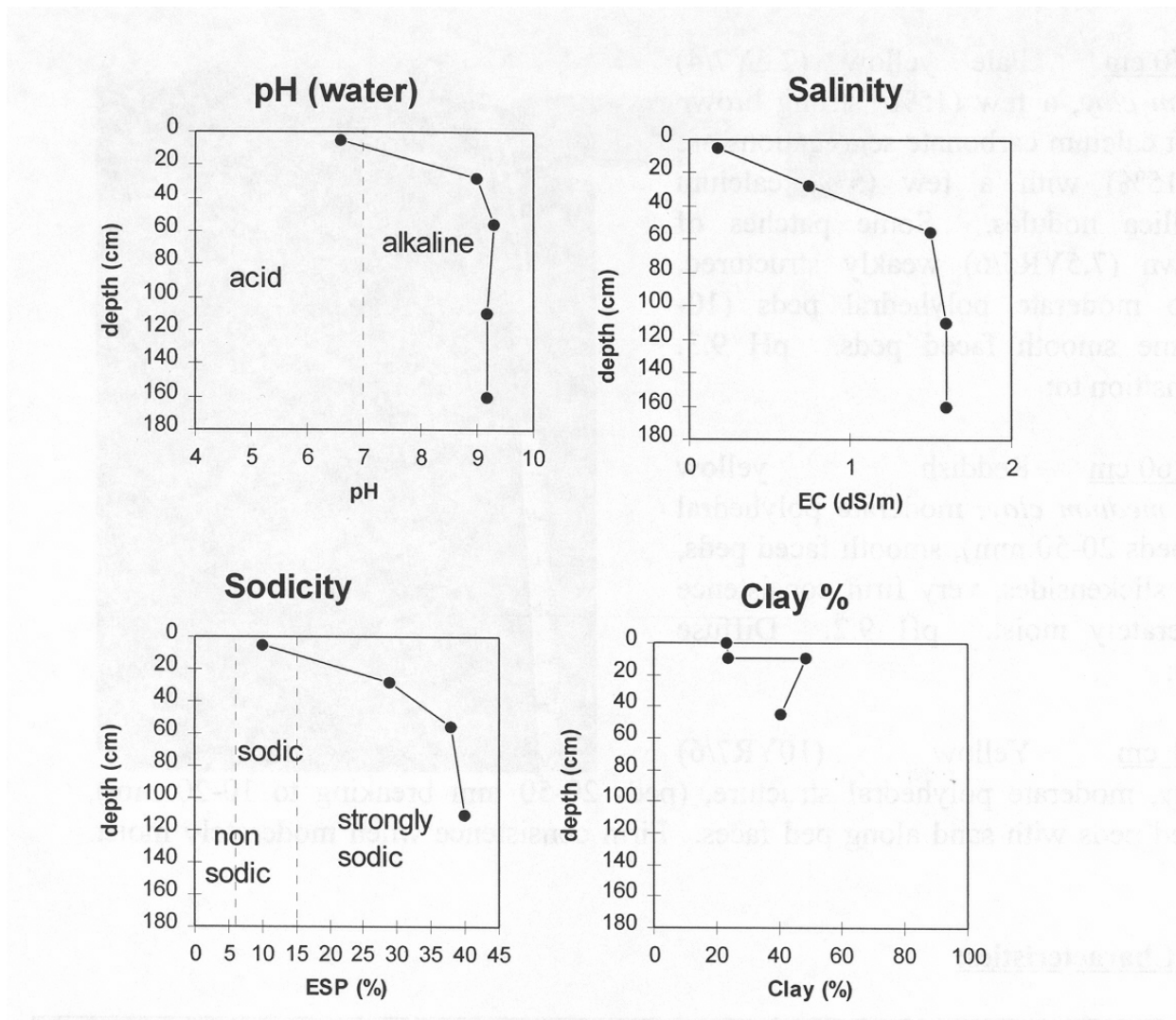
**B25** 90-180 cm+ Pale yellow (2.5Y7/4) *medium clay*, strong polyhedral structure, (peds 20-50 mm), firm consistence when slightly moist, very few manganese flecks, a few calcium carbonate/silica nodules, (2-20 mm). Slickensides occur with many large slickensides occurring below 140 cm. pH 9.1.



**Soil Profile Characteristics:**

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
<b>Surface (A1 horizon)</b>	moderately alkaline	very low	non-sodic	nil	Moderately well drained	nil
<b>Subsoil (B21 horizon)</b>	strongly alkaline	very low	sodic	moderate <sup>1</sup>		
<b>Deeper subsoil (at 1 metre)</b>	very strongly alkaline	high	strongly sodic	nil <sup>2</sup>		

- 1 strong dispersion after remoulding
- 2 possibly due to high total soluble salts



### Key profile features

- B22 horizon (30-45 cm) completely disperses when reworked
- Alkaline topsoil and subsoil
- Soil salinity high at 60 cm depth
- Self-mulching surface condition
- Surface cracking in summer
- Well structured B21 horizon
- Plant Available Water Capacity (PAWC) is considered to be high (estimated at 190 mm) for this site profile based on an Effective Rooting Depth (ERD) of 60 cm. Rooting depth will be restricted by subsoil conditions, such as strongly sodic (Exchangeable Sodium Percentage >20%), high soluble salt levels (Chloride >0.1%), poor structure (e.g. massive or very coarse, columnar or prismatic), very high carbonate (lime) content (not applicable to all plant species) or hard rock.

### Soil Restrictions and Management Prescriptions

<b>Feature</b>	<b>Result</b>	<b>Management Prescription</b>
Sodic clay subsoil	Poor water and air movement into the subsoil resulting in waterlogging (impeded internal drainage). Poor root growth into the subsoil reducing the volume of the soil able to be exploited.	Gypsum applications if the subsoil is close to the surface and topsoil textures are light. <i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention. <i>Horticulture</i> - deep ripping with gypsum, install tile drainage (if appropriate).
Dispersion when reworked	Indication of soil sodicity. Soil structure collapses following tillage and wetting Results in poor soil structure that reduces water movement and plant root growth (see sodic subsoil) Increases water erosion hazard.	Do not cultivate wet soil (cultivate when moist.) Apply gypsum if growing high value crops.
Alkaline topsoil	Potential nutrient imbalance. Unsuitable for alkaline intolerant plants.	Grow alkaline tolerant species. Supply trace elements (zinc) in fertiliser.
Alkaline subsoil	Potential nutrient imbalance. Unsuitable for alkaline intolerant plants. May indicate subsoil sodicity.	Grow shallow rooted species. Grow alkaline tolerant plants.
Soil salinity at depth	Poor or no plant growth for deeper rooted species. Indication of waterlogging (impeded internal drainage) or high water table.	Grow shallow rooted species. Increase plant water use throughout the catchment. Install subsoil drainage (if appropriate). Minimise irrigation water loss below the root zone (improve irrigation efficiency).

## Land Suitability Rating Table

LAND USE	SUITABILITY CLASS	MAJOR LIMITING COMPONENT
<b>Wheat</b>	1	No major limitation
<b>Canola</b>	2	Soil
<b>Chickpeas</b>	2	Soil
<b>Lentils</b>	2	Soil
<b>White clover seed</b>	2	Soil
<b>Lucerne for seed production</b>	3	Soil
<b>Viticulture</b>	3	Soil
<b>Apples</b>	3	Soil
<b>Potatoes</b>	3	Soil
<b>Carrots</b>	2	Soil
<b>Onions</b>	3	Soil
<b>Sweet corn</b>	2	Soil
<b>Radiata Pine</b>	3	Climate, soil
<b>Blue Gum</b>	3	Climate, soil

## Land Suitability Assessment and Primary Limitations

<b>Wheat</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	1	No major limitation
<b>Canola</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Subsoil texture, soil salinity, slightly alkaline pH
<b>Chickpeas</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Topsoil and subsoil texture, slightly alkaline subsoil pH, slightly impeded internal drainage
<b>Lentils</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Topsoil and subsoil texture, slightly alkaline subsoil pH, slightly impeded internal drainage
<b>White clover seed</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Slightly alkaline pH throughout



<b>Lucerne for seed production</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity
<b>Viticulture</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity
<b>Apples</b>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline pH throughout, soil salinity
<b>Potatoes</b>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Clay topsoil, alkaline topsoil
<b>Carrots</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Clay topsoil, slightly alkaline topsoil pH, soil salinity, slightly impeded internal drainage
<b>Onions</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline pH
<b>Sweet corn</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Clay topsoil, slightly alkaline pH throughout
<b>Radiata Pine</b>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline subsoil pH, salinity
<b>Blue Gum</b>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline subsoil pH, salinity

**ASSOCIATED SOIL TYPE FOR THE GREY AND RED PLAINS AND RISES - 5 -  
Pg5/Pu5/Rg5/Ru5 LAND UNITS**

**MAP UNIT:** Pg5, Pu5, Rg5, Ru5

**Site No.:** WW4a

**Position in Landscape:** Upper slope

**Grid Ref:** 512 282 E, 5978 312 N

**Aust. Soil Class.:** Epicalcareous-Endohypersodic, Epipedal., Red VERTOSOL

**Northcote Factual Key:** Ug5.3

**Great Soil Group:** red and brown clays

**General Landscape Description:**

This soil type occurs on the upper slope and is associated with the lower slope (WW5). WW5 is used to represent the four land units of the Grey and Red Plains and Rises land system. The soil cracks when dry leading to formation of gilgai. Due to the gilgai micro-relief the soils, although prominently red, can have grey soil occurring in the depressions of the gilgai. Description WW4b shows the variety found in the soil profile.



**Soil Profile Morphology:**

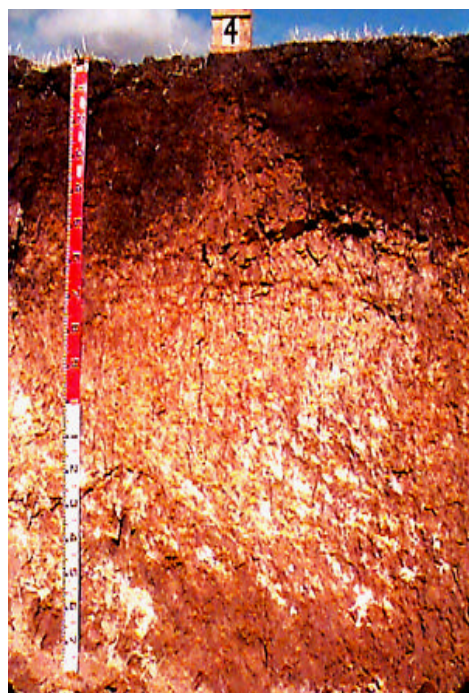
**Topsoil**

**A1** 0-10 cm Dark brown (10YR3/3) *light medium clay*, moderate subangular blocky to polyhedral structure, (peds 5-10 mm), very firm consistence when dry, very few ferruginised iron nodules. pH 8.1. Abrupt transition to:

**Subsoil**

**B21** 10-50 cm Yellowish red (5YR5/8) *medium clay*, (increasing to medium heavy clay at depth), strong angular blocky structure, (peds 20-50 mm, breaking to 10-20 mm), smooth faced peds, some slickensides with shear plains at depth, strong consistence when slightly moist, a few ferruginised iron nodules. pH 8.7. Clear and wavy boundary to:

**B22k 50-80 cm** Reddish yellow (7.5YR7/6) *light medium clay*, moderate prismatic structure, (peds 50-100 mm) breaking to strong subangular blocky structure, (peds 20-50 mm) and moderate blocky structure (peds 10-20 mm), smooth faced peds, very firm consistence when slightly moist, many soft calcium carbonate segregations. pH 9.7. Gradual and wavy transition to:



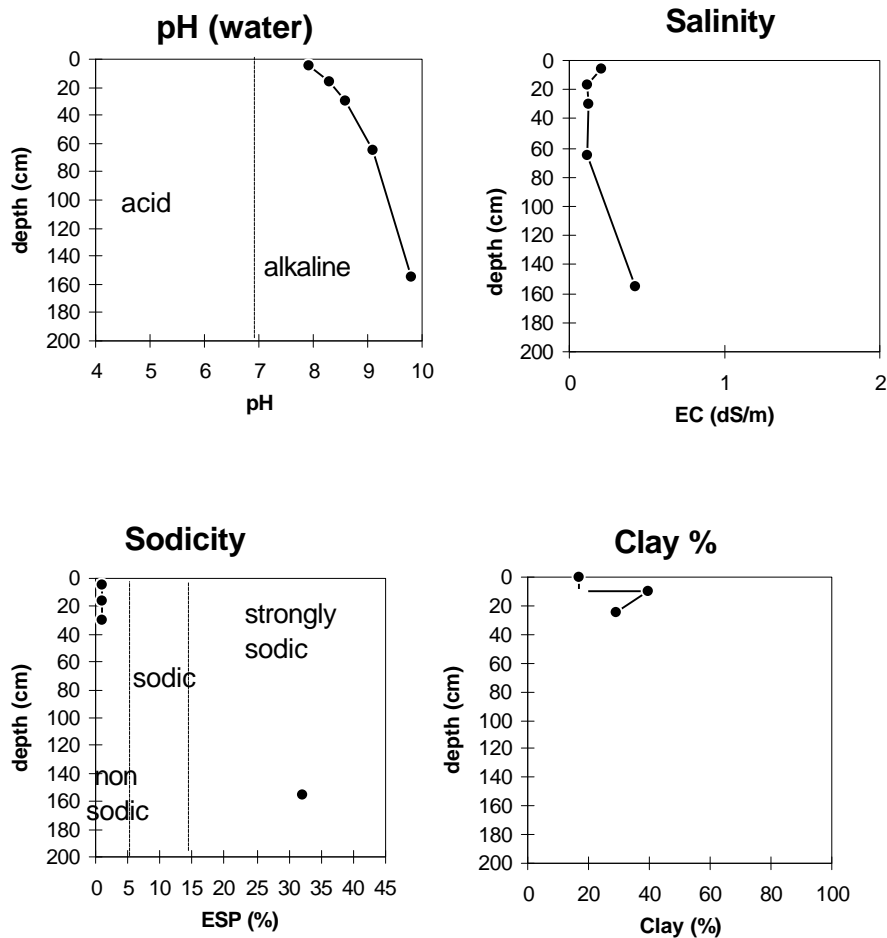
**B23k 80-130 cm** Reddish yellow (7.5YR6/6) *light medium clay*, a few fine mottles, strong prismatic structure, (peds 50-100 mm), breaking at depth to moderate lenticular structure, (peds 20-50 mm), smooth faced peds, firm consistence when moderately moist, many (although patchy) soft calcium carbonate segregations. pH 9.7. Gradual and wavy transition to:

**B24 130-180 cm +** Reddish yellow (7.5YR6/6) *medium clay*, very few fine faint light grey mottles, strong lenticular structure, (peds 20-50 mm breaking to 5-10 mm), smooth fabric, strong consistence when slightly moist, very few soft calcium carbonate segregations. pH 9.6.

**Soil Profile Characteristics:**

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
<b>Surface (A1 horizon)</b>	moderately alkaline	low	non-sodic	nil	moderately well drained	nil
<b>Subsoil (B21 horizon)</b>	strongly alkaline	very low	non-sodic	nil		
<b>Deeper subsoil (at 1 metre)</b>	extremely alkaline	medium-high	strongly sodic	moderate <sup>1</sup>		

1 strong dispersion after remoulding



### Key Profile Features:

- Calcium carbonate horizons
- Alkaline topsoil and subsoil
- Profile becomes strongly sodic in deeper subsoil (from 50 cm depth)
- Soil salinity is medium to high at 80 cm depth
- Compaction can occur if soils are excessively cultivated, especially when soil is wet
- Slickensides and gilgai micro-relief indicate significant shrinking and swelling occurs during the wetting and drying cycles
- Gilgai micro-relief, caused by the soil cracking when dry, has lead to grey soil occurring in the depressions. See description WW4b
- Plant Available Water Capacity (PAWC) is considered to be medium (estimated at 145 mm) for this site profile based on an Effective Rooting Depth (ERD) of 50 cm. Rooting depth will be restricted by subsoil conditions, such as strongly sodic (Exchangeable Sodium Percentage >20%), high soluble salt levels (Chloride >0.1%), poor structure (e.g. massive or very coarse, columnar or prismatic), very high carbonate (lime) content (not applicable to all plant species ) or hard rock.

### Soil Restrictions and Management Prescriptions

<b>Feature</b>	<b>Result</b>	<b>Management Prescription</b>
Carbonate layer (lime)	Highly alkaline layer. Can restrict root growth of sensitive plant species. Potential for nutrient imbalance. May restrict water movement if layer is hard rock.	Grow alkaline tolerant species. Supply trace elements ie zinc. Considered sub-surface drainage (if appropriate).
Alkaline topsoil	Potential nutrient imbalance. Unsuitable for alkaline intolerant plants.	Grow alkaline tolerant species. Supply trace elements (zinc) in fertiliser.
Alkaline subsoil	Potential nutrient imbalance. Unsuitable for alkaline intolerant plants. May indicate subsoil sodicity.	Grow shallow rooted species. Grow alkaline tolerant plants.
Sodic clay subsoil	Poor water and air movement into the subsoil resulting in waterlogging (impeded internal drainage). Poor root growth into the subsoil reducing the volume of the soil able to be exploited.	Gypsum applications if the subsoil is close to the surface and topsoil textures are light. <i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention. <i>Horticulture</i> - deep ripping with gypsum, install tile drainage (if appropriate).
Soil salinity at depth	Poor or no plant growth for deeper rooted species. Indication of waterlogging (impeded internal drainage) or high water table.	Grow shallow rooted species. Increase plant water use throughout the catchment. Install subsoil drainage (if appropriate). Minimise irrigation water loss below the root zone (improve irrigation efficiency).

## Land Suitability Rating Table

LAND USE	SUITABILITY CLASS	MAJOR LIMITING COMPONENT
Wheat	1	No major limitation
Canola	2	Soil
Chickpeas	2	Soil
Lentils	2	Soil
White clover seed	2	Soil
Lucerne for seed production	2	Soil
Viticulture	3	Soil
Apples	3	Soil
Potatoes	3	Soil
Carrots	2	Soil
Onions	3	Soil
Sweet corn	2	Soil
Radiata Pine	3	Climate, soil
Blue Gum	3	Climate, soil

## Land Suitability Assessment and Primary Limitations

<i>Wheat</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	1	No major limitation
<i>Canola</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Soil salinity, slightly alkaline pH
<i>Chickpeas</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Clay subsoil, slightly alkaline subsoil pH, slightly impeded internal drainage
<i>Lentils</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Clay subsoil, slightly alkaline subsoil pH, slightly impeded internal drainage
<i>White clover seed</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Slightly alkaline pH, soil salinity

<b>Lucerne for seed production</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Slightly alkaline subsoil pH, soil salinity, slightly impeded internal drainage
<b>Viticulture</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity
<b>Apples</b>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity, alkaline pH
<b>Potatoes</b>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline topsoil pH
<b>Carrots</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Clay topsoil, alkaline topsoil pH, soil salinity, slightly impeded internal drainage
<b>Onions</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline pH
<b>Sweet corn</b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Slightly alkaline topsoil pH, slightly impeded internal drainage
<b>Radiata Pine</b>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline subsoil pH
<b>Blue Gum</b>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Alkaline subsoil pH

**ASSOCIATED SOIL TYPE FOR THE GREY AND RED PLAINS AND RISES  
- 5 -Pg5, Pu5, Rg5, Ru5 LAND UNITS**

**MAP UNIT:** Pg5,Pu5, Rg5, Ru5

**Site No.:** WW4b

**Position in landscape:** Upper slope

**Grid Ref:** 512 282 E, 5978 312 N;

**Aust. Soil Class.:** Endocalcareous, Epipedal, Brown VERTOSOL

**Northcote Factual Key:** Ug5.3

**Great Soil Group:** red and brown clay

**General Landscape Description:**

This soil type is a variation of WW4a that can occur on the upper slopes of these land units. No ratings have been conducted for this soil description as WW4a is considered the major soil type for this land element.

**Soil Profile Morphology:**

**Topsoil**

**A1** 0-10 cm Very dark greyish brown (10YR3/2) *light clay*; moderate blocky structure, (peds 20-50 mm), breaking to polyhedral structure, (peds 5-10 mm).

**Subsoil**

**B21** 10-50 cm Dark brown (10YR3/3) *light clay*; structure same as above. pH 8.7.

**B22k** 50-140 cm Reddish yellow (7.5YR7/6) *light clay*; strong prismatic structure, (peds 50-100 mm, breaking to 20-50 mm), breaking to subangular blocky structure (peds 10-20 mm), many (20-50%) soft calcium carbonate segregations. pH 9.1



**B23k** 140-170 cm Reddish yellow (7.5YR6/6) *medium clay*; moderate prismatic structure (peds 50-100 mm) breaking to strong subangular blocky structure, (peds 20-50 mm), and further to moderate blocky structure, (peds 10-20 mm), smooth faced peds, many soft calcium carbonate segregations.



### **Key Profile Features:**

- Subsoil dispersive when worked when wet
- Strongly alkaline subsoil
- Gilgai micro-relief evident. See description 4a

### **Soil Profile Characteristics:**

<b>Horizon</b>	<b>pH</b>	<b>Salinity</b>	<b>Sodicity</b>	<b>Dispersion</b>	<b>Internal Drainage</b>	<b>Hydrophobicity</b>
<b>Surface (A1 horizon)</b>	-	-	-	-	moderately well drained	nil
<b>Subsoil (B21 horizon)</b>	strongly alkaline	low	non-sodic	nil <sup>1</sup>		
<b>Deeper subsoil (at 1 metre)</b>	extremely alkaline	low	non-sodic	nil		

<sup>1</sup> strong dispersion after remoulding

### **Problem Soil Features and Management Prescriptions**

<b>Feature</b>	<b>Result</b>	<b>Management Prescription</b>
Dispersion when reworked	Indication of soil sodicity. Soil structure collapses following tillage and wetting Results in poor soil structure that reduces water movement and plant root growth (see sodic subsoil) Increases water erosion hazard.	Do not cultivate wet soil (cultivate when moist.) Apply gypsum if growing high value crops.
Alkaline subsoil	Potential nutrient imbalance. Unsuitable for alkaline intolerant plants. May indicate subsoil sodicity.	Grow shallow rooted species. Grow alkaline tolerant plants.

**ASSOCIATED SOIL TYPE FOR THE GREY AND RED PLAINS AND RISES - 5 -  
Pg5, Pu5, Rg5, Ru5 LAND UNITS**

**MAP UNIT:** Pg5, Pu5, Rg5, Ru5

**Site No.:** WW6

**Position in Landscape:** Crest

**Grid Ref:** 512 415 E, 5979 317N

**Aust. Soil Class.:** Vertic (and Calcic), Hypernatric, Brown SODOSOL

**Northcote Factual Key:** Dbl.13

**General Landscape Description:**

This soil occurs on the crests in association with red cracking clay soils (vertisols) (WW4) on the upper slopes and the brown or grey cracking clay soils (vertisols) of the lower slopes (WW5). WW5 is regarded as the most appropriate soil type to represent the whole unit. Surface and subsoil cracking can occur on the crests



**Soil Profile Morphology:**

**Topsoil**

**A1** 0-10 cm Very dark greyish brown (10YR3/2) *fine sandy clay loam*, structureless, strong consistence when dry. pH 6.6. Abrupt transition to:

**Subsoil**

**B21** 10-45 cm Strong brown (7.5YR4/6) *medium heavy clay*, moderate blocky structure, (peds 20-50 mm, breaking to 10-20 mm), strong consistence when slightly moist. Dark yellowish brown organic staining on ped faces. Complete dispersion. pH 9.0. Clear and wavy boundary to:

**B22k** 45-70 cm Pale yellow (2.5Y7/4) *light medium clay*, a few (15%) strong brown mottles, soft calcium carbonate segregations are common (15%) with a few (5%) calcium carbonate/silica nodules. Some patches of strong brown (7.5YR5/6) weakly structured, breaking to moderate polyhedral peds (10-20mm), some smooth faced peds. pH 9.3. Gradual transition to:

**B23** 70-160 cm Reddish yellow (7.5YR7/6) *medium clay*, moderate polyhedral structure, (peds 20-50 mm), smooth faced peds, some small slickensides, very firm consistence when moderately moist. pH 9.2. Diffuse transition to:

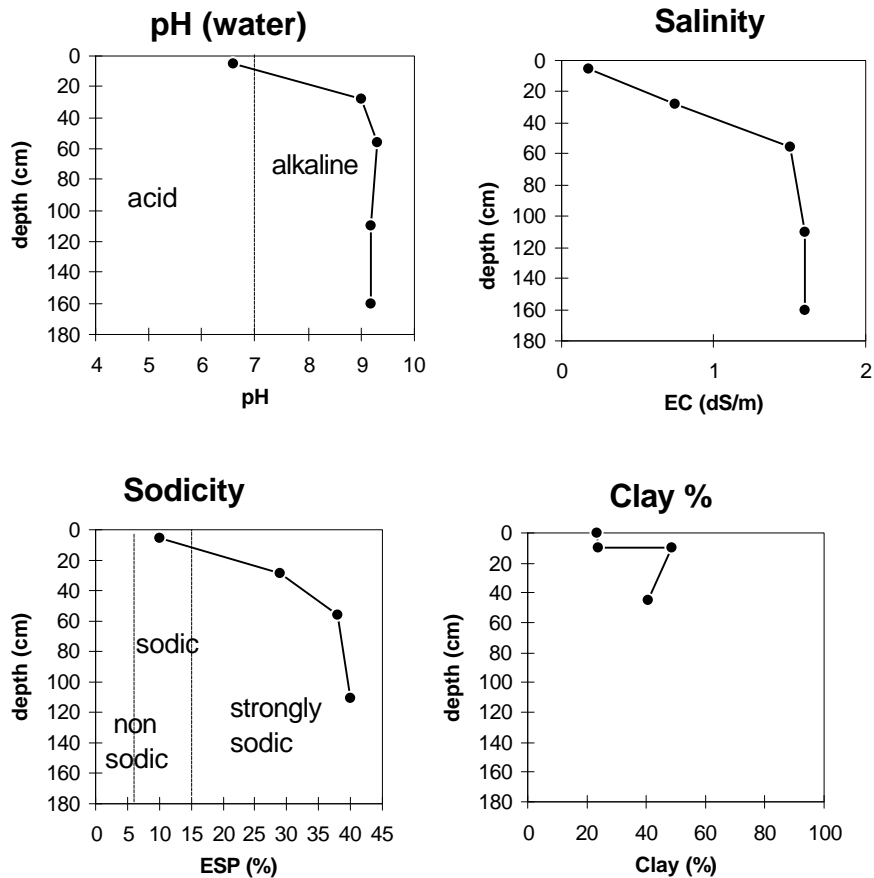
**B24** 160+ cm Yellow (10YR7/6) *medium clay*, moderate polyhedral structure, (peds 20-50 mm breaking to 10-20 mm), smooth faced peds with sand along ped faces. Firm consistence when moderately moist. pH 9.2.



**Soil Profile Characteristics:**

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
<b>Surface (A1 horizon)</b>	slightly acid	low	sodic	slight <sup>1</sup>		nil
<b>Subsoil (B21 horizon)</b>	strongly alkaline	medium-high	strongly sodic	complete	imperfectly drained <sup>#</sup>	
<b>Deeper subsoil (at 1 metre)</b>	very strongly alkaline	very high	strongly sodic	nil <sup>2</sup>		

- 1 strongly dispersion after remoulding
- 2 possibly due to high total soluble salts
- # most impeding horizon of the profile that will affect plant growth



### Key profile features:

- Strong textural contrast between A and B horizons
- Slightly acidic topsoil
- Alkaline subsoil
- Carbonate layer at 45 cm
- Strongly sodic subsoil
- Topsoil dispersive after reworking
- Dispersive subsoil
- Plant Available Water Capacity (PAWC) is considered to be very low (estimated at 17 mm) for this site profile based on an Effective Rooting Depth (ERD) of 10 cm. Rooting depth will be restricted by subsoil conditions, such as strongly sodic (Exchangeable Sodium Percentage >20%), high soluble salt levels (Chloride >0.1%), poor structure (e.g. massive or very coarse, columnar or prismatic).
- Subsoil cracks

## Soil Restrictions and Management Prescriptions

<b>Feature</b>	<b>Result</b>	<b>Management Prescription</b>
Strong textural contrast between topsoil and subsoil (duplex)	Strong texture and structure difference between the topsoil and the subsoil. Can result in impeded internal drainage and restricted root growth	Improve organic matter through maintenance of vegetative cover and growing green manure crops. Reduce tillage. Optimise plant growth through regular balanced fertiliser programme.
Acidic topsoil	Potential nutrient imbalance. Unsuitable for acid intolerant plants.	Apply lime.
Alkaline subsoil	Potential nutrient imbalance. Unsuitable for alkaline intolerant plants. May indicate subsoil sodicity.	Grow shallow rooted species. Grow alkaline tolerant plants.
Carbonate layer (lime)	Highly alkaline layer. Can restrict root growth of sensitive plant species. Potential for nutrient imbalance. May restrict water movement if layer is hard rock.	Grow alkaline tolerant species. Supply trace elements i.e. zinc.
Soil salinity at depth	Poor or no plant growth for deeper rooted species. Indication of waterlogging (impeded internal drainage) or high water table.	Grow shallow rooted species. Increase plant water use throughout the catchment.
Sodic clay subsoil	Poor water and air movement into the subsoil resulting in waterlogging (impeded internal drainage). Poor root growth into the subsoil reducing the volume of the soil able to be exploited.	Gypsum applications if the subsoil is close to the surface and topsoil textures are light. <i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention.

Dispersion when reworked	Indication of soil sodicity. Soil structure collapses following tillage and wetting Results in poor soil structure that reduces water movement and plant root growth (see sodic subsoil) Increases water erosion hazard.	Do not cultivate wet soil (cultivate when moist). Apply gypsum if growing high value crops.
Dispersion (dry soil)	Indication of soil sodicity. Soil structure collapses following wetting resulting in poor soil structure that reduces water movement and plant root growth (see sodic subsoil). Increases water erosion hazard.	<i>Dryland cropping</i> - apply gypsum, include deep rooted crops in the rotation, minimum tillage and stubble retention.
Very low and low Plant Available Water Holding Capacity (PAWC)	Poor plant available water holding capacity. Indication of light soil texture or shallow effective plant rooting depth (i.e. presence of restrictive layers, salinity, pH or structure).	Improve organic matter through maintenance of vegetative cover and growing green manure crops. Increase effective rooting depth by reducing the effect of the restrictive layer.

## Land Suitability Rating Table

LAND USE	SUITABILITY CLASS	MAJOR LIMITING COMPONENT
Wheat	2	Soil
Canola	3	Soil
Chickpeas	3	Soil
Lentils	3	Soil
White clover seed	3	Soil
Lucerne for seed production	3	Soil
Viticulture	3	Soil
Apples	3	Soil
Potatoes	3	Soil
Carrots	3	Soil
Onions	3	Soil
Sweet corn	3	Soil
Radiata Pine	3	Climate, soil
Blue Gum	3	Climate, soil

## Land Suitability Assessment and Primary Limitations

<i>Wheat</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2*	High soil salinity (12 ECe (dS/m) at 45-70 cm), slightly impeded internal drainage, slightly alkaline subsoil pH
<i>Canola</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	High soil salinity
<i>Chickpeas</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage
<i>Lentils</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage
<i>White clover seed</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	High soil salinity

<b><i>Lucerne for seed production</i></b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage, soil salinity
<b><i>Viticulture</i></b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity, impeded internal drainage
<b><i>Apples</i></b>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity, alkaline subsoil pH
<b><i>Potatoes</i></b>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Shallow depth of topsoil, alkaline topsoil pH, impeded internal drainage
<b><i>Carrots</i></b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Shallow depth of topsoil, alkaline pH, impeded internal drainage
<b><i>Onions</i></b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Shallow depth of topsoil, impeded internal drainage, alkaline pH
<b><i>Sweet corn</i></b>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage, shallow depth of topsoil
<b><i>Radiata Pine</i></b>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity
<b><i>Blue Gum</i></b>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity

\* Some areas may have a high soil salinity and therefore may be potentially unsuitable