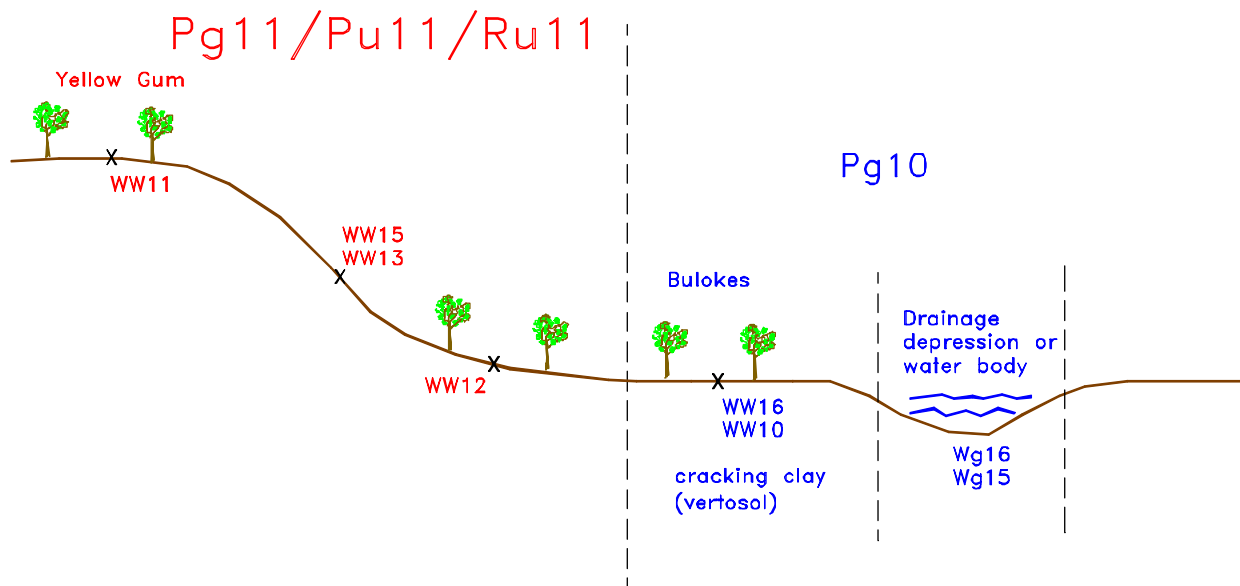


6.2.11 YELLOW GUM PLAINS AND RISES - 11 LAND SYSTEM

Map units Pg11, Pu11, Ru11



Landscape

This land system consists mostly of gently undulating plains (Pg11) and undulating plains (closer spaced undulations) (Pu11), with small rises and long gentle slopes. There are also areas of undulating rises (closer spaced undulations) (Ru11) that have slightly higher relief than the surrounding plains. Small areas on low lying land, or drainage depressions, with soils similar to the Southern Cracking Clay Plains (Pg10) may occur between the rises. There are common indications of gilgai micro-relief, as the subsoil tends to shrink and swell at depth, but little evidence of surface cracks. This land system is difficult to separate from the Red Gum Plains and Rises - 12 land system. The landscape is similar and the ferric sodosol soils can occur in association with these soils (e.g. at the southern transition of this land system and the Red Gum Plains and Rises -12 land system and south east of Goroke). However they have not been mapped individually due to restrictions in the scale of mapping. In these areas, solodised solonetz are dominant. This land system occurs mostly between the Little Desert and Edenhope.

Vegetation

The main tree species is Yellow Gum, although there are incidences of Red Gum. When Red Gums occur soils should be checked to determine whether they are solodised solonetz or ferric sodosols.

Soil Types

The dominant soils on these units have the distinctive conspicuously bleached capping over large hardsetting columns or prisms of clay (see Plate 20). A sandy or sandy loam topsoil occurs above the capping to varying depths. (Similar soils also occur in the transitional country of the Big and Little Deserts).

The hardsetting nature of the bleached capping and the large hardsetting structure of the clay, makes direct penetration difficult for roots through to the subsoil, with many roots having to follow the cracks between the column blocks. The clay is sodic (meaning it has a high sodium content), making the soil strongly dispersive, which destroys the structure of the subsoil.

The bleached horizon (A2) and the mottled subsoil are indicators of impeded internal drainage.

The shrinking and swelling of the clay means that the colour of the soil and the depth of the horizons are variable. Plates 21a and b show two views of the same soil pit, on different aspects. The differences in soil type in such close proximity is due to gilgai micro-relief.

The four sites described for this land system (WW11, WW12, WW15 and WW13) show the spatial distribution of this soil type.

Soils on the top of the crests may have Parilla sand occurring at depth (see WW11).

Representative soil type of land units

Although four soil types have been described for the units, the soil found at WW12 is regarded as the most appropriate to represent the land system. It is located on a long gentle slope just south of the Little Desert where this soil type is most dominant. It must be noted that WW13 and WW15 are located further south, and have a pH trending to acid in the hardsetting columns at the top of the subsoil. The further south in the shire the more acid the pH of the B21 horizon.



Plate 20 The bleached capping over the large columns of clay

Plates 21a and b show two different soil types in the same soil pit due to gilgai micro-relief.



REPRESENTATIVE SOIL TYPE FOR THE YELLOW GUM PLAINS AND RISES -11 -Pg11/Pu11/Ru11 LAND UNITS

MAP UNIT: Pg11, Pu11, Ru11

Site No.: WW12

Position in Landscape: Lower slope **Grid Ref:** 516 130 E, 5934 955 N;

Aust. Soil Class.: Vertic (and Calcic), Subnatric, Grey SODOSOL

Northcote Factual Key: Dy3.43 **Great Soil Group:** solodised solonetz

General Landscape Description:

This soil type occurs in association with the crests of WW11 and Pg10 when the slope flattens out to form clay plains or drainage depressions. It is similar to WW13 and WW15. This soil type is regarded as the most appropriate to represent these land units as it is located on a long gentle slope which is a common land element in the Shire. The land tends to have gilgai micro-relief. Soil profile variability (ie when darker pockets of soil are close to the surface) is also an indication of the gilgaied nature of the soil. The common soil type on the crests and slopes are sodosols with a hardsetting bleached sandy surface horizon over large hardsetting clay columns or prisms (solodised solonetz). There are scattered occurrences of ferric sodosols (soils with an 'ironstone' horizon below the bleached horizon and above the clay (see land system 12)). The small rises are commonly divided by low lying flat clay plains which support Bulokes. The vegetation is a reasonable indication of the soil type. Yellow gums tend to occur on solodised solonetz (land system 11), Red gums on the ferric sodosols (land system 12) and Bulokes on the heavy clay soils (land system 10). When this soil type occurs further south, the hardsetting columns in the top of the subsoils are more acidic.



Soil Profile Morphology:

Topsoil

A1 0-15 cm Very dark greyish brown (10YR3/2) *sandy loam*; structureless, weak consistence when dry. Structure increases to weak blocky structure, (peds 20-50 mm) when roots penetrate. pH 6.3. Sharp and wavy transition to:

A2 15-20 cm Pale brown (10YR6/3) *loamy sand*; conspicuously bleached, strong consistence when dry. Occurs as capping on top of domes. pH 6.7. Sharp and wavy transition to:

Subsoil

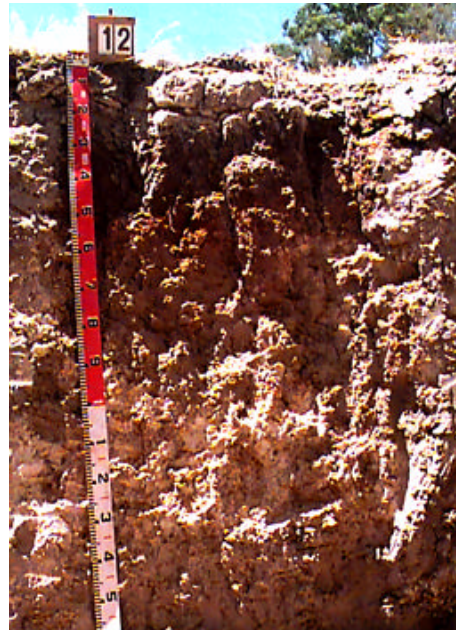
B21 20-40 cm Brown (7.5YR5/2) *medium heavy clay*; many very coarse distinct red mottles, strong columnar structure, (peds >200 mm), breaking to weak blocky structure (peds 50-100 mm), dispersive when worked. pH 7.5. Gradual transition to:

B22 40-60 cm Yellowish red (5YR5/8) *medium heavy clay*; moderate blocky structure, (peds 20-50 mm), completely dispersive. pH 8.8.

B23 60-90 cm Light yellowish brown (10YR6/4), *medium clay*; soft calcium carbonate segregations are common. pH 9.4.

B24k 90-130 cm Very pale brown (10YR7/3) *light clay (sandy)*; moderate polyhedral structure, (peds 10-20 mm breaking to 5-10 mm), many soft calcium carbonate segregations and a few hard carbonate/silica nodules, (5-15 mm in size). pH 9.5.

B25 130-170+ Light grey (2.5Y7/2) *medium clay*, moderate to strong lenticular structure, with some slickensides, smooth fabric, with sand along ped faces. pH 9.5.



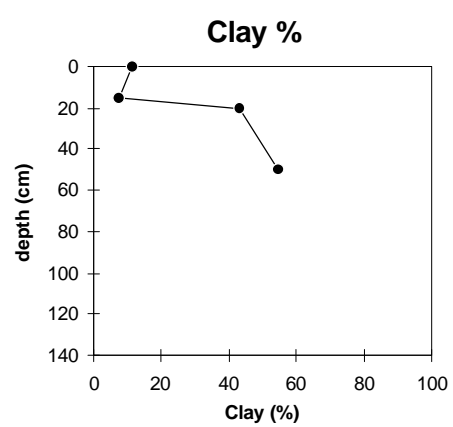
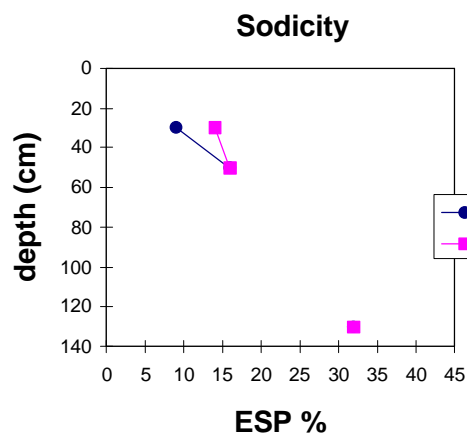
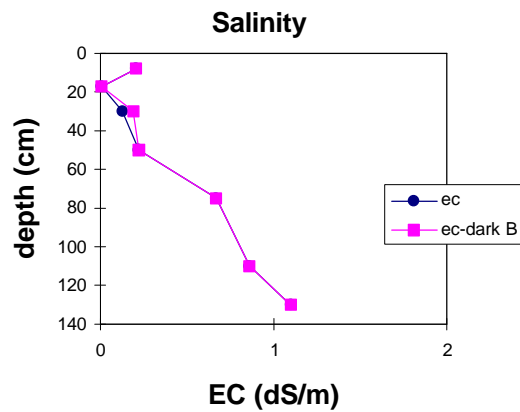
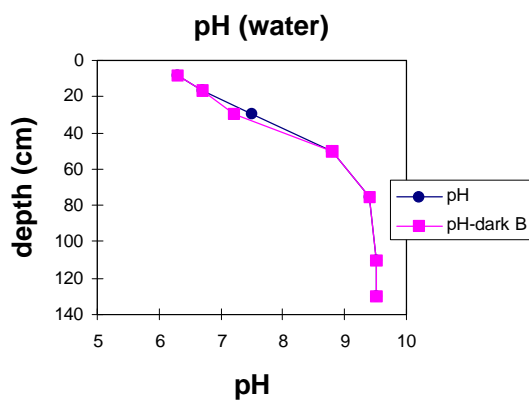
Soil Profile Characteristics:

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
Surface (A1 horizon)	slightly acid	low	non-sodic	-		moderate
Subsoil (B21 horizon)	slightly alkaline	low	sodic	slight ¹	Imperfectly drained [#]	
Deeper subsoil (at 1 metre)	very strongly alkaline	high	-	nil ²		

1 complete dispersion after remoulding

2 possible due to high soluble salts (moderate dispersion after remoulding)

most impeding horizon of the profile that will affect plant growth



Key Profile Features:

- Sandy topsoil
- Hydrophobic topsoil
- Strong texture contrast between the topsoil and subsoil
- Shallow depth of topsoil
- Thin hardsetting bleached capping (A2) forming domes on top of large columns
- Sodic subsoil
- Columnar subsoil structure
- Subsoil mottling
- Top of the subsoil is dispersive following cultivation when wet
- Alkaline subsoil
- Soil salinity at depth
- Plant Available Water Capacity (PAWC) is considered to be very low (estimated at 40 mm) for this site profile based on an Effective Rooting Depth (ERD) of 20 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 (eg. massive or very coarse, columnar or prismatic), very high carbonate (lime) content (not applicable to all plant species) or hard rock
- Vertic properties (ie lenticular structure) in the deeper subsoil.

Soil Restrictions and Management Prescriptions

Feature	Result	Management Prescription
Sandy topsoil	Poor plant available water holding capacity. Poor nutrient holding capacity. Increased risk of wind erosion. Potential for hydrophobicity.	<i>Dryland cropping</i> - minimum tillage and stubble retention, improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers.
Hydrophobic topsoil	Poor infiltration of water into the soil. Increased risk of water erosion. Poor seed germination.	Maintenance of surface vegetative cover. Claying.
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. Consider sub-surface drainage (if

		appropriate).
Shallow topsoil depth	Reduced water and nutrient holding capacity. Reduced root growth. Potential for waterlogging.	Improve organic matter through maintenance of vegetative cover and growing green manure crops. Reduce tillage to protect against water and wind erosion. Optimise plant growth through a regular and balanced fertiliser programme. Consider sub-surface drainage (if appropriate).
Bleached A ₂ horizon	Indication of waterlogged condition (impeded internal drainage) within the topsoil. Poor soil structure (often massive). Low organic matter, water holding capacity and nutrition within the horizon.	<i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. Install subsoil drainage (if appropriate).
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. Very difficult to cultivate particularly if topsoil is shallow.	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.
Columnar or prismatic subsoil structure	Indication of sodic clay subsoil. See Sodicity.	See Sodicity These soil are difficult to manage, not suitable for high levels of production unless substantial modification can be achieved.
Mottled subsoil	Indication of periodic waterlogging, particularly if grey and yellow mottles predominate.	Consider sub-surface drainage (if appropriate). Apply gypsum if subsoil is sodic and close to the surface.

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.	Don't 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.
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).
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 (ie 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	Climate, soil
Canola	2	Climate, soil
Chickpeas	3	Soil
Lentils	3	Soil
White clover seed	2	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
Blue Gum	3	Climate

Land Suitability Assessment and Primary Limitations

<i>Wheat</i>	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity
<i>Canola</i>	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Soil salinity, hydrophobicity, slightly impeded internal drainage
<i>Chickpeas</i>	<i>Climate</i>	2*	Moderate frost risk, moderate to high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
<i>Lentils</i>	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<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>	2	Soil salinity, slightly impeded internal drainage, hydrophobicity

Lucerne for seed production	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity, impeded internal drainage
Viticulture	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity, impeded internal drainage
Apples	<i>Climate</i>	2	Moderate frost risk, slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Soil salinity
Potatoes	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Shallow topsoil, impeded internal drainage
Carrots	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Shallow topsoil, impeded internal drainage
Onions	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
Sweet corn	<i>Climate</i>	2	Slightly low mean monthly temperature (October - March)
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage
Radiata Pine	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitations
	<i>Soil</i>	2	Soil salinity, slightly impeded internal drainage
Blue Gum	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	1	No major limitations
	<i>Soil</i>	2	Soil salinity, slightly impeded internal drainage

* Some areas may have high rainfall

**ASSOCIATED SOIL TYPE FOR THE YELLOW GUM PLAINS AND RISES -11 -
Pg11/Pu11/Ru11 LAND UNITS**

MAP UNIT: Pg11, Pu11, Ru11

Site No.: WW11

Position in Landscape Crest **Grid Ref:** 516 418 E, 593 4930 N;

Aust. Soil Class.: Hypercalcic Mottled-Hypernatric, Brown SODOSOL

Northcote Factual Key: Db4.43

Great Soil Group: solodised solonetz

General Landscape Description:

This site is on the crest of a low rise. It occurs in association with WW12 (lower slope) which is used to represent these land units and in some cases Pg10 (flat below the slope). Older weathered sandstone can occur at depth. The soil formed on top of the Parilla Sand is recent windblown deposits.



Soil Profile Morphology:

Topsoil

A1 0-20 cm Dark brown (10YR3/3) *loamy sand*; structureless, weak consistence when dry. pH 6.1.

A2 20-25 cm Pale brown (10YR6/3) *loamy sand*; conspicuously bleached, structureless, weak consistence when dry. Discontinuous. pH 6.9. Sharp transition to:

Subsoil

B21 25-65 cm Brown (10YR4/3) *medium heavy clay*; many coarse distinct yellowish brown and red mottles, strong columnar structure, (peds >200 mm), breaking to moderate blocky structure (peds 50-100 mm), very strong consistence when dry, complete

dispersion. Colour changes to strong brown (7.5YR5/6) at depth and mottle abundance decreases. pH 7.5.

B22k 65-100 cm Pink (7.5YR7/4) *medium clay (fine sandy)*; fine distinct reddish yellow mottles are common, moderate prismatic structure, (peds 50-100 mm), breaking to blocky structure, (peds 20-50 mm), many (40%) soft calcium carbonate segregations, and a few (5%) hard silica/carbonate nodules, strong dispersion. Horizon is discontinuous, with the carbonate forming large patches in places. pH 9.6.

B23 100-130 cm Reddish yellow (7.5YR7/6) *medium clay (coarse sandy)*; yellowish red mottles are common. pH 9.7.

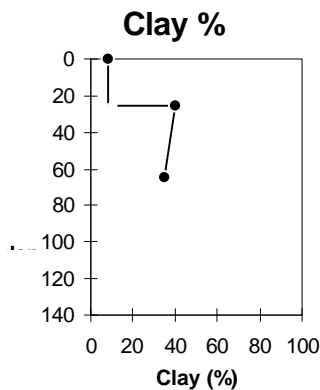
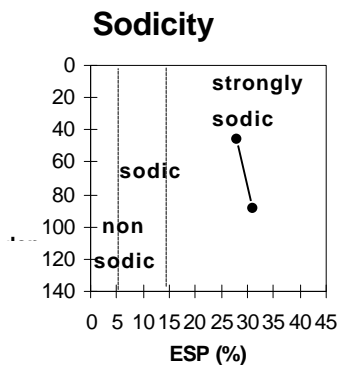
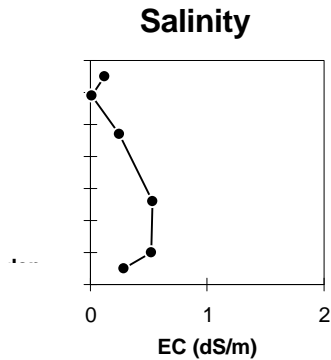
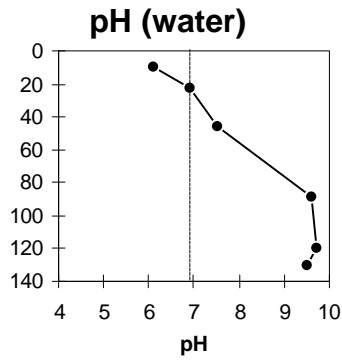
BC 130-180 cm+ Partially weathered sandstone



Soil Profile Characteristics:

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
Surface (A1 horizon)	slightly acid	low	-	-		moderate
Subsoil (B21 horizon)	slightly alkaline	low	strongly sodic	complete	imperfectly drained [#]	
Deeper subsoil (at 1 metre)	extremely alkaline	medium	-	strong		

most impeding horizon of the profile that will affect plant growth



Key Profile Features:

- Sandy topsoil
- Hydrophobic topsoil
- Strong texture contrast between topsoil and subsoil
- Bleached A2 horizon
- Sodic clay subsoil
- Coarse columnar structure in upper subsoil
- Dispersive subsoil
- Mottled subsoil
- Weathered sandstone comes in at around 130 cm
- Plant Available Water Capacity (PAWC) is considered to be low (estimated at 50 mm) for this site profile based on an Effective Rooting Depth (ERD) of 25 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 (eg. 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

Feature	Result	Management Prescription
Sandy topsoil	Poor plant available water holding capacity. Poor nutrient holding capacity. Increased risk of wind erosion. Potential for hydrophobicity.	<i>Dryland cropping</i> - minimum tillage and stubble retention, improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers. <i>Horticulture</i> - improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers. Increase frequency of fertiliser (eg side dressings) and irrigations.
Hydrophobic topsoil	Poor infiltration of water into the soil. Increased risk of water erosion. Poor seed germination.	Maintenance of surface vegetative cover. Claying.
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. Mounding for orchards. Optimise plant growth through regular balanced fertiliser programme. Consider sub-surface drainage (if appropriate).
Bleached A ₂ horizon	Indication of waterlogged condition (impeded internal drainage) within the topsoil. Poor soil structure (often massive). Low organic matter, water holding capacity and nutrition within the horizon.	<i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. <i>Horticulture</i> - improve organic matter through maintaining optimum plant growth and growing green manure crops between the rows. Minimum tillage and surface vegetative cover. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. Install subsoil drainage (if appropriate).

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).
Columnar or prismatic subsoil structure	Indication of 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. Very difficult to cultivate particularly if topsoil is shallow.	Apply gypsum 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). These soil are difficult to manage, not suitable for high levels of production unless substantial modification can be achieved.
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. <i>Horticulture</i> - apply gypsum, maintain optimum plant growth in between the rows. Minimum tillage and surface vegetative cover.
Mottled subsoil	Indication of periodic waterlogging, particularly if grey and yellow mottles predominate.	Consider sub-surface drainage (if appropriate). Apply gypsum if subsoil is sodic and close to the surface.
Very low and low Plant Available Water Holding Capacity (PAWC)	Poor plant available water holding capacity. Indication of light soil texture or shallow	Improve organic matter through maintenance of vegetative cover and growing green manure crops. Increase effective rooting depth by reducing the effect of the restrictive

	effective plant rooting depth (ie presence of restrictive layers, salinity, pH or structure).	layer.
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Land Suitability Rating Table

LAND USE	SUITABILITY CLASS	MAJOR LIMITING COMPONENT
Wheat	2	Climate, landscape, soil
Canola	2	Climate, landscape, soil
Chickpeas	3	Soil
Lentils	3	Soil
White clover seed	2	Soil
Lucerne for seed production	3	Soil
Viticulture	3	Soil
Apples	2	Climate, 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

Wheat	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity
Canola	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity
Chickpeas	<i>Climate</i>	2*	Moderate frost risk, moderate to high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil texture, impeded internal drainage
Lentils	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard

	<i>Soil</i>	3	Sandy topsoil texture, 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 subsoil pH, soil salinity, slightly impeded internal drainage, hydrophobicity
<i>Lucerne for seed production</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
<i>Viticulture</i>	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage
<i>Apples</i>	<i>Climate</i>	2	Moderate frost risk, slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Soil salinity, slightly impeded internal drainage, hydrophobicity
<i>Potatoes</i>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
<i>Carrots</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage, shallow topsoil
<i>Onions</i>	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
<i>Sweet corn</i>	<i>Climate</i>	2	Slightly low mean monthly temperature (October-March)
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil
<i>Radiata Pine</i>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Depth to sandstone

Blue Gum	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Depth to sandstone

* Some areas may have higher rainfall

ASSOCIATED SOIL TYPE FOR THE YELLOW GUM PLAINS AND RISES -11 -
Pg11/Pu11/Ru11 LAND UNITS

MAP UNIT: Pg11, Pu11, Ru11

Site No.:WW13

Position in Landscape: Mid to lower slope **Grid Ref:** 525 813 E, 5920 286 N;
Aust. Soil Class.: Calcium Mottled Mesonatric, Grey SODOSOL
Northcote Factual Key: Dg4.43 **Great Soil Group:** solodised solonetz

General Landscape Description:

This soil occurs on the gently undulating plains (Pg11), gently undulating plains (closer spaced undulations) (Pu11) and undulating rises (closer spaced undulations) (Ru11) land units of the Yellow Gum Plains and Rises. This soil is similar to WW12 that has been used to represent these land units. This site is located on a roadside reserve area, hence the organic accumulation at the soil surface.



Soil Profile Morphology:

Topsoil

AO 0-3 cm Organic layer

A1 3-10 cm Brown (7.5YR4/2) *loamy sand*; weakly structured. pH 6.6.

A2 10-20 cm Pink (7.5YR7/4) *sand*; structureless. pH 6.3.

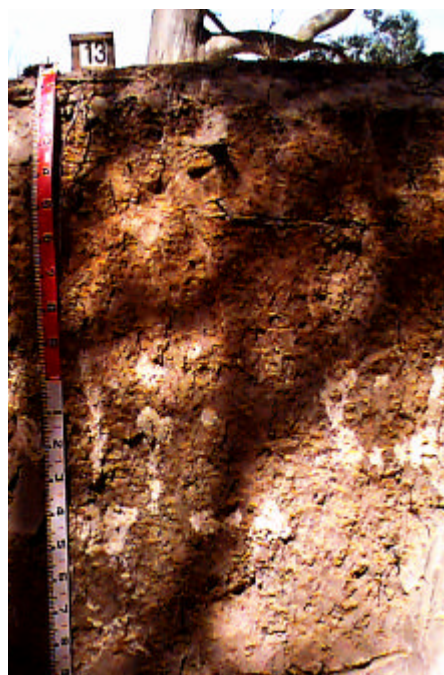
Subsoil

B21 20-40 cm Very pale brown (10YR7/3) *medium heavy clay*; many distinct brownish yellow mottles, columnar structure (peds >200 mm), breaking to strong

polyhedral structure, (peds 10-20 mm), breaking to moderate polyhedral structure, (peds 5-10 mm), clay skins, dispersive when worked. pH 5.8.

B22 40-70 cm Brownish yellow (10YR6/8) *sandy clay*; completely dispersive. pH 7.2.

B23 70-90 cm Pale yellow (2.5Y7/4) *medium heavy clay (sandy)*; a few faint brownish yellow mottles, moderate prismatic structure, (peds 20-100 mm), breaking to strong blocky structure, (peds 20-50 mm), a few manganese flecks, completely dispersive. pH 8.5



B24k 90-150 cm Light grey (2.5Y7/2) *medium heavy clay (sandy)*; moderate prismatic structure, (peds 50-100 mm), breaking to strong blocky structure, (peds 20-50 mm), soft calcium carbonate segregations are common, with a few hard calcium carbonate nodules. Carbonate occurs in patches. pH 9.6.

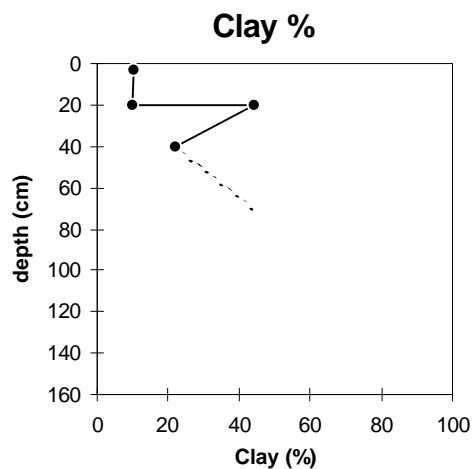
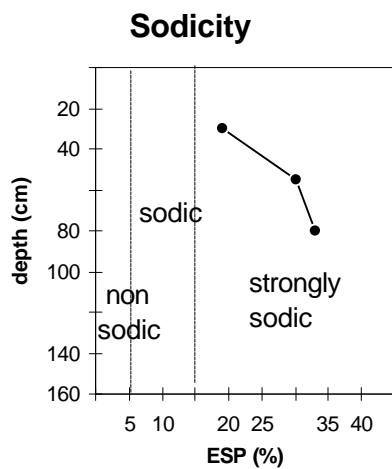
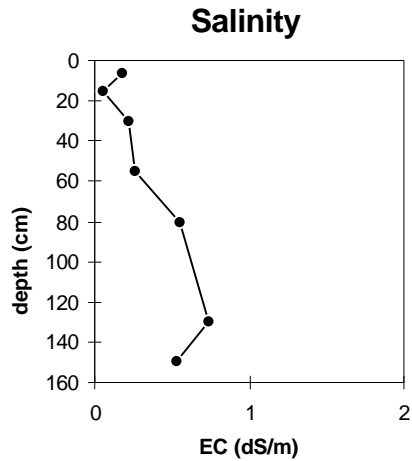
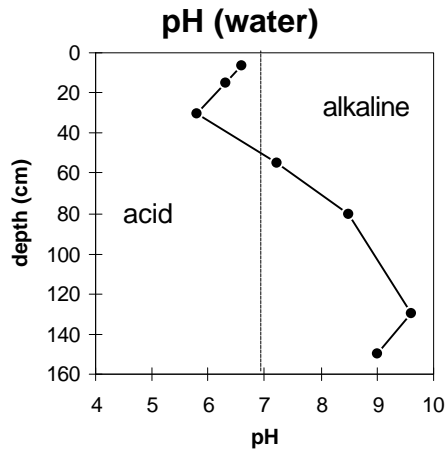
B25 150-200 cm+ Light grey (2.5Y7/2) *medium clay (sandy)*; moderate polyhedral structure, (peds 20-50 mm), breaking to strong polyhedral structure, (peds 10-20mm). pH 9.0.

Soil Profile Characteristics:

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
Surface (A1 horizon)	slightly acid	low	non-sodic	-		moderate
Subsoil (B21 horizon)	moderately acid	low	strongly sodic	nil ¹	imperfectly drained [#]	
Deeper subsoil (at 1 metre)	extremely alkaline	medium-high	strongly sodic	moderate		

1 complete dispersion after remoulding

most impeding horizon of the profile that will affect plant growth



Key Profile Features:

- Sandy topsoil
- Hydrophobic topsoil
- Strong textural contrast between topsoil and subsoil
- Bleached capping A2 over large hardsetting clay columns
- Sodic subsoil
- Columnar structure
- Subsoil mottling
- Top of the subsoil is dispersive following cultivation when wet
- Acidic topsoil
- Alkaline subsoil
- Plant Available Water Capacity (PAWC) is considered to be low (estimated at 90 mm) for this site profile based on an Effective Rooting Depth (ERD) of 40 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.
- Clay skins on the B21 horizon repel water.

Soil Restrictions and Management Prescriptions

Feature	Result	Management Prescription
Sandy topsoil	Poor plant available water holding capacity. Poor nutrient holding capacity. Increased risk of wind erosion. Potential for hydrophobicity.	<i>Dryland cropping</i> - minimum tillage and stubble retention, improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers. <i>Horticulture</i> - improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers. Increase frequency of fertiliser (eg side dressings) and irrigations.
Hydrophobic topsoil	Poor infiltration of water into the soil. Increased risk of water erosion. Poor seed germination.	Maintenance of surface vegetative cover. Claying.
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. Mounding for orchards. Optimise plant growth through regular balanced fertiliser programme. Consider sub-surface drainage (if appropriate).
Bleached A ₂ horizon	Indication of waterlogged condition (impeded internal drainage) within the topsoil. Poor soil structure (often massive). Low organic matter, water holding capacity and nutrition within the horizon.	<i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. <i>Horticulture</i> - improve organic matter through maintaining optimum plant growth and growing green manure crops between the rows. Minimum tillage and surface vegetative cover. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. Install subsoil drainage (if appropriate).

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).
Columnar or prismatic subsoil structure	Indication of 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. Very difficult to cultivate particularly if topsoil is shallow.	Apply gypsum 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). These soil are difficult to manage, not suitable for high levels of production unless substantial modification can be achieved.
Mottled subsoil	Indication of periodic waterlogging, particularly if grey and yellow mottles predominate.	Consider sub-surface drainage (if appropriate). Apply gypsum if subsoil is sodic and close to the surface.
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.
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.
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 (ie 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	Climate, landscape, soil
Canola	2	Climate, landscape, soil
Chickpeas	3	Soil
Lentils	3	Soil
White clover seed	2	Landscape, soil
Lucerne for seed production	3	Soil
Viticulture	3	Soil
Apples	2	Climate, soil
Potatoes	3	Soil
Carrots	3	Soil
Onions	3	Soil
Sweet corn	3	Soil
Radiata Pine	3	Climate
Blue Gum	3	Climate

Land Suitability Assessment and Primary Limitations

Wheat	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity
Canola	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard

	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity, slightly acid subsoil pH
<i>Chickpeas</i>	<i>Climate</i>	2*	Moderate frost risk, moderate to high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil, impeded internal drainage
<i>Lentils</i>	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil, impeded internal drainage
<i>White clover seed</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Sandy topsoil texture, soil salinity, slightly impeded internal drainage, hydrophobicity
<i>Lucerne for seed production</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
<i>Viticulture</i>	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage
<i>Apples</i>	<i>Climate</i>	2	Moderate frost risk, slightly high mean maximum January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Depth of topsoil, slightly acidic pH, soil salinity, slightly impeded internal drainage, hydrophobicity
<i>Potatoes</i>	<i>Climate</i>	2	Slightly high mean maximum January temperature
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Shallow depth of topsoil, impeded internal drainage
<i>Carrots</i>	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Shallow depth of topsoil, impeded internal drainage, soil salinity
<i>Onions</i>	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage

<i>Sweet corn</i>	<i>Climate</i>	2	Slightly low mean monthly temperature (October - March)
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Shallow depth of topsoil, impeded internal drainage
<i>Radiata Pine</i>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity
<i>Blue Gum</i>	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity

* Some areas may be higher rainfall

ASSOCIATED SOIL TYPE FOR THE YELLOW GUM PLAINS AND RISES -11 - Pg11/Pu11/Ru11 LAND UNITS

MAP UNIT: Pg11, Pu11, Ru11

Site No.: WW15

Position in landscape: Mid-slope

Grid Ref: 500 640 E, 5924 825 N;

Aust. Soil Class.: Hypercalcic, Mottled-Subnatric, Brown SODOSOL

Northcote Factual Key: Dy5.43

Great Soil Group: solodic

General Landscape Description:

The landscape in these units consists of gently undulating plains (Pg11), gently undulating plains (closer spaced undulations) (Pu11) and gently undulating rises (closer spaced undulations) (Ru11). Ferric sodosols (land system 12) may occur in association with this soil type, particularly north of Apsley where this site is located. This soil description is used to show the increasing acidity of the subsoil further south in this land system. WW12 has been used to represent these land units on the map.



Soil Profile Morphology:

Topsoil

A1 0-10 cm Very dark greyish brown (10YR3/2) *loamy sand*; weakly structured, firm consistence when dry. pH 7.8. Abrupt transition to:

A2 10-35 cm Light brown (7.5YR6/4) *sand*; conspicuously bleached when dry, structureless, very firm consistence when dry, a few ferruginised iron nodules. pH 8.4. Sharp transition to:

Subsoil

B21 35-75 cm Yellowish brown (10YR5/4) *light medium clay*; many coarse distinct red mottles, strong prismatic structure (peds >200 mm) breaking down to prismatic and blocky structure, (peds 20-50 mm) breaking further to moderate blocky structure (10-20 mm); dark organic staining on the faces of the prisms, strong consistence when dry, dispersive when worked. pH 5.8 Clear transition to:

B22 75-100 cm Light grey (2.5Y7/2) *light medium clay*; (fine sandy), with yellowish red mottles, same structure as horizon above, very firm consistence when slightly moist, dispersive when worked. pH 7.3. Clear transition to:

B23k 100-130 cm Light grey (2.5Y7/2) *sandy clay* with strong brown mottles, very firm consistence when moderately moist, soft (and a few hard) calcium carbonate segregations are abundant (50%). pH 8.9.

B3 130-180 cm Light grey (2.5Y7/2) *sandy clay* (becoming *light sandy clay loam* at depth); with yellow mottles, structureless, firm consistence when moderately moist. pH 9.0.

BC 180-200+ *Loamy sand*; structureless, weak consistence when moderately moist. pH 8.8.

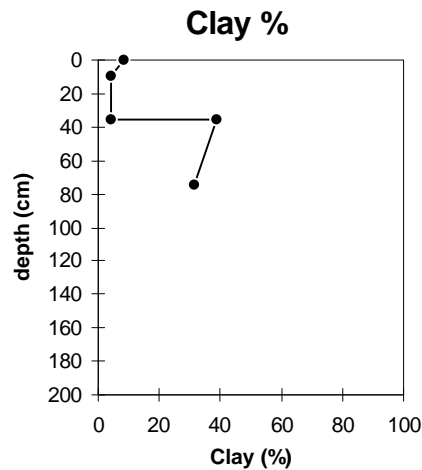
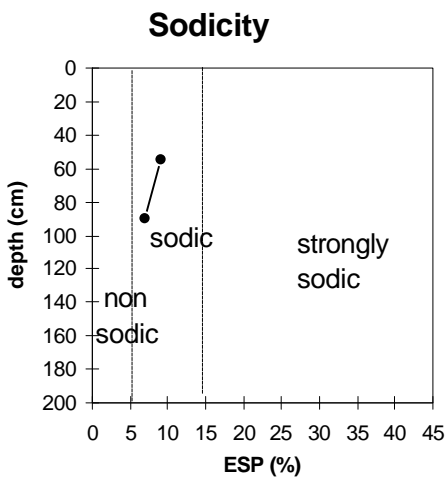
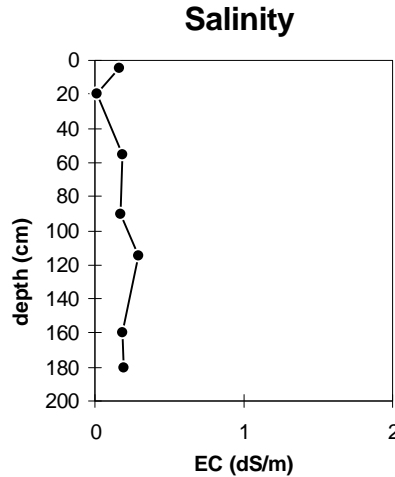
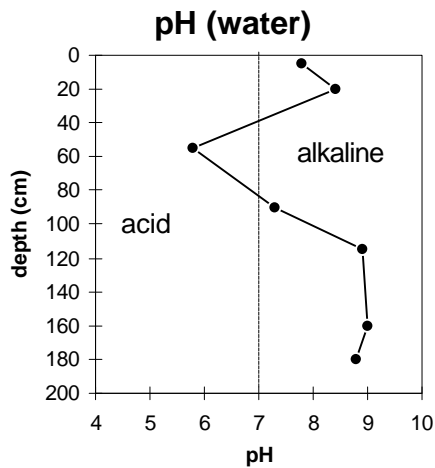


Soil Profile Characteristics:

Horizon	pH	Salinity	Sodicity	Dispersion	Internal Drainage	Hydrophobicity
Surface (A1 horizon)	slightly alkaline	low	non-sodic	-		moderate
Subsoil (B21 horizon)	moderately acid	low	sodic	nil ¹	Imperfectly drained [#]	
Deeper subsoil (at 1 metre)	strongly alkaline	low-medium	sodic	nil ¹		

1 strongly to complete dispersion after remoulding

most impeding horizon of the profile that will affect plant growth



Key Profile Features:

- Sandy topsoil
- Hydrophobic topsoil
- Strong texture contrast between topsoil and subsoil
- Bleached A2 horizon
- Sodic subsoil
- Prismatic structure
- Mottled subsoil
- Dispersive subsoil following cultivation when wet
- Acidic subsoil
- Plant Available Water Capacity (PAWC) is considered to be medium (estimated at 140 mm) for this site profile based on an Effective Rooting Depth (ERD) of 100 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 (eg. massive or very coarse, columnar or Prismatic), very high carbonate (lime) content (not applicable to all plant species) or hard rock
- Top of the subsoil (B21) is acidic
- Weathered sandstone occurs at 2m depth

Soil Restrictions and Management Prescriptions

Feature	Result	Management Prescription
Sandy topsoil	Poor plant available water holding capacity. Poor nutrient holding capacity. Increased risk of wind erosion. Potential for hydrophobicity.	<i>Dryland cropping</i> - minimum tillage and stubble retention, improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers. <i>Horticulture</i> - improve organic matter through maintenance of vegetative cover and growing green manure crops. Establish wind protection barriers. Increase frequency of fertiliser (eg side dressings) and irrigations.
Hydrophobic topsoil	Poor infiltration of water into the soil. Increased risk of water erosion. Poor seed germination.	Maintenance of surface vegetative cover. Claying.
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. Mounding for orchards. Optimise plant growth through regular balanced fertiliser programme. Consider sub-surface drainage (if appropriate).
Bleached A ₂ horizon	Indication of waterlogged condition (impeded internal drainage) within the topsoil. Poor soil structure (often massive). Low organic matter, water holding capacity and nutrition within the horizon.	<i>Dryland cropping</i> - include deep rooted crops in the rotation, minimum tillage and stubble retention. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. <i>Horticulture</i> - improve organic matter through maintaining optimum plant growth and growing green manure crops between the rows. Minimum tillage and surface vegetative cover. Apply gypsum if the topsoil is sodic. Optimise plant growth through a regular and balanced fertiliser programme. Install subsoil drainage (if appropriate).

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).
Columnar or prismatic subsoil structure	Indication of 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. Very difficult to cultivate particularly if topsoil is shallow.	Apply gypsum 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). These soil are difficult to manage, not suitable for high levels of production unless substantial modification can be achieved.
Mottled subsoil	Indication of periodic waterlogging, particularly if grey and yellow mottles predominate.	Consider sub-surface drainage (if appropriate). Apply gypsum if subsoil is sodic and close to the surface.
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.
Acidic subsoil	Potential nutrient imbalance. Unsuitable for acid intolerant plants.	Grow acid tolerant species or varieties.

Land Suitability Rating Table

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

Land Suitability Assessment and Primary Limitations

Wheat	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity
Canola	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, hydrophobicity, slightly acid subsoil pH
Chickpeas	<i>Climate</i>	2*	Moderate frost risk, moderate to high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil texture, impeded internal drainage
Lentils	<i>Climate</i>	2	Moderate frost risk, slightly high rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil texture, impeded internal drainage
White clover seed	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly impeded internal drainage, slightly acid topsoil pH, soil salinity, hydrophobicity

Lucerne for seed production	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
Viticulture	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	3	Impeded internal drainage
Apples	<i>Climate</i>	2	Moderate frost risk, slightly high mean maximum mean January temperature
	<i>Landscape</i>	1	No major limitation
	<i>Soil</i>	2	Slightly alkaline topsoil pH, slightly acidic subsoil, soil salinity, slightly impeded internal drainage, hydrophobicity
Potatoes	<i>Climate</i>	2	Slightly high mean maximum mean January temperature
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
Carrots	<i>Climate</i>	1	No major limitation
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
Onions	<i>Climate</i>	2	Moderate frost risk
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Impeded internal drainage
Sweet corn	<i>Climate</i>	2	Slightly low mean monthly temperature (October - March)
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	3	Sandy topsoil texture
Radiata Pine	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly alkaline subsoil pH, slightly impeded internal drainage, hydrophobicity
Blue Gum	<i>Climate</i>	3	Low rainfall
	<i>Landscape</i>	2	Wind erosion hazard
	<i>Soil</i>	2	Slightly alkaline subsoil pH, slightly impeded internal drainage, hydrophobicity

* Some areas may have higher rainfall