4 Soils

Soils are variable in space and this reflects the influence of environmental factors such as climate (past and present), parent material (lithology), position in landscape (topography) and time. Vegetation types are also a part of this process and form an integral relationship with soil development, accumulation of organic matter and recycling of nutrients.

As a consequence of variable climate (mainly rainfall), parent material and topography, there is a large range of soils in this region. This range of environments is reflected in the geomorphology of the region, providing the framework for the range of soil types.

Given the large number of soils identified by previous studies and surveys (Table 1) in different parts of the WCMA (e.g. Sibley 1967; Badawy 1981a,b; Badawy 1984) a scheme of 41 soil groups (Wimmera Soil Groups) has been adopted to simplify presentation in this report. Groups largely reflect the classifications made in the earlier surveys and, as classifications change and understanding evolves, revision of these groups will undoubtedly be made in future.

Sites representing soils in these groups are accessable via the 'soil site' drop-down list. Accompanying the written soil descriptions are chemical data. Methodologies relating to this chemical data can be accessed via the appendix drop-down list for the Otway soil descriptions, and for all remaining descriptions. Surveyors and studies of sites presented in this report are listed in Table 1.

4.1 Wimmera Soil Groups

The description of the Wimmera Soil Groups (WSG) is based on the texture profile of the soil, predominantly the amount and distribution of clay with depth. This is an indication of soil development and the age of the soil. This approach has been the basis for describing Australian soils for the last 30 to 40 years through the Factual Key (**FK**: Northcote 1971) and the Australian Soil Classification (**ASC**: Isbell 1996). Linked to this is the distribution of nutrients which has a major influence on soil behaviour and performance. The sodicity of the soil is seen as a major (unfavourable) determinant of soil behaviour by influencing soil physical properties through increased dispersion of soil aggregates.

Soil texture groups include those with little change with depth such as sands (coarse), loams (medium) and clays (fine); those such as earths with a gradational change (increasing clay) with depth. Soils with a clear change from a light textured (sandy or loamy) surface over a heavy (clay) subsoil are referred to as having texture contrast profiles (minimum difference of 20% clay between surface and subsoil). 'Texture contrast' is the current terminology (Isbell 1996) that replaced the term 'duplex' used in the Factual Key (Northcote 1971).

Broad soil groups are:

(i) Sodic texture contrast soils
(ii) Non-sodic texture contrast soils
(iii) Gradational (earths) or uniform soils
(iv) Sands
(v) Clays
(vi) Seasonally wet soils

The 41 Wimmera Soil Groups were derived by further dividing these broad soil groups using the geomorphological divisions (Section 2) and other soil characteristics, as outlined below:

- Sodic texture contrast soils: subdivided on colour. Sodic is defined as the upper subsoil having an ESP greater than 6.
- Non-sodic texture contrast soils: subdivided on colour. Non-sodic is defined as the upper subsoil having an ESP of less than 6.
- Gradational (earths) or uniform soils: subdivided on colour or calcareous nature. Many of the gradational soils have heavy (clayey) subsoils.
- Sands: subdivided on the basis of depth and the presence or absence of pans such as 'coffee rock'.
- Clays: subdivided according to colour and whether cracking and/or self-mulching.
- Seasonally wet soils

Other soil properties such as mottling, structure, total depth of soil, and depth of surface and subsurface (horizons) soils are outlined in the soil group descriptions.

A number of soil site examples (usually three key sites) are given for each Wimmera Soil Group which aims to give an indication of the major soils, with other sites mentioned if they occur (see also unit descriptions). A distribution figure is presented for all soil groups (dark moroon text indicating dominance in these areas).

Within the Wimmera Soil Groups (WSGs) there are a range of soils, and some outliers in terms of classification. Where the area of a broad lithology and number of soil sites is limited a larger range of soils may be tolerated to minimise the number of soil groups. For example, sodic and non-sodic soils may be in the same WSG as are gradational and uniform soils of Cainozoic landscapes.

Trends

Some broad trends include the association of particular soils or soil properties in conjunction with the broad parent materials. For example, the texture contrast soils on the Cainozoic landscapes have lighter surface soils than texture contrast soils on the basic volcanics (basalt). There is a significant silt component to soils associated with the Palaeozoic sediments in the Western Uplands which contributes to their dispersibility and higher susceptibility to water erosion. Another trend is the increasing sodicity of texture contrast soils on sedimentary terrain from south to north as rainfall (and leaching) decreases. There are often very sharp changes in soil type on the clay plains (gilgai) and the sedimentary plains (sands to texture contrast).

More specific inferences require more detailed work, which would complement these broad soil groupings.

Table 4 Study titles and survey codes for soil site prefix (e.g. WLRA)

Soil survey or study prefix	Surveyor/s, year of publication and report title	Total number of sites	Number of sites included in this report
ALRA	Robinson N, Rees D, Boyle G, Bluml M, Reynard, K, Youman K, Sheffield K (2004) Ararat Rural City land capability pilot project. Department of Primary Industries.	87	8
DOAAR	Badawy N, Lewis N (1982) Soils of the vineyards of the Ararat district. Department of Agriculture.	19	0
DOAGW	Badawy N, Lewis N (1982) Soils of the vineyards of the Great Western district. Department of Agriculture.	76	5
DOAHG	Badawy N, Lewis N (1982) Soils of the vineyards of the Halls Gap district. Department of Agriculture.	11	4
GL	Baxter N, Robinson N, Rees D, Boyle G, Imhof M (2001) A land resource assessment of the Glenelg-Hopkins region. Department of Natural Resources and Environment Victoria.	175	1
GRAMP	Sibley GT (1967) A study of the land in the Grampians area. Soil Conservation Authority.	>20	20
GW	Bluml M, Boyle G (1999) Feasability study for vineyard development Great Western area - a land suitability analysis. Department of Natural Resources and Environment Victoria.	31	3
HOR	Martin J, Imhof M (1992) North West Reconnaissance Survey (unpublished). Department of Agriculture and Rural Affairs.	>400	3
LP	Imhof M et al. (unpublished) Navarre and Districts Landcare Group - soil pits. Department of Primary Industries.	4	4
LS	Imhof M, Thompson S, Rees D (1997) Lowan land inventory and assessment. Department of Natural Resources and Environment	27	27
NA	Maher J, Martin J (1990) Natimuk. Department of Agriculture and Rural Affairs (unpublished).	81	4
TopCrop	Imhof M (unpublished) TopCrop state focus site - soil pits. Department of Natural Resources and Environment.	6	6
WIA	Martin J, Imhof M, Thompson S (1996) Major agricultural soils of the Wimmera Irrigation Area. Department of Natural Resources and Environment.	>36 pits >100 auger	36
WIM	Brown A (unpublished) Department of Primary Industries	5	5
WLRA	Robinson N, Rees D, Reynard K, Imhof M, Boyle G, Youman K, MacEwan R (2005) A land resource assessment of the Wimmera region. Department of Primary Industries.	148	34
WW	Baxter N, Imhof M, Brown A, Rees D (1996) Agricultural and horticultural land suitability for the West Wimmera Shire. Volumes 1 & 2. Department of Natural Resources and Environment.	31	31

1. Red texture contrast soils/Dissected Uplands: Palaeozoic non-granitic plateaux, mountains, hills and plains

This soil has developed on mainly sedimentary and metamorphic material (rock or colluvial material) and occasionally on acid volcanics in the Western Uplands. This soil is slightly acidic, often tending to neutral with depth.

The surface soil is usually a dark weakly structured sandy loam to sandy clay loam. It overlies a reddish brown weakly structured sandy clay loam to fine sandy clay loam subsurface horizon that is also weakly structured and contains variable amounts of coarse sandstone fragments. This horizon may be bleached. There is a clear change to a yellowish red medium clay upper subsoil horizon. This is strongly structured (with medium to fine sized peds) and contains weathered sandstone fragments. At depth the profile grades into lighter textured material and the underlying bedrock (Palaeozoic sandstone). The depth is about 60 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 15 cm for the subsurface.

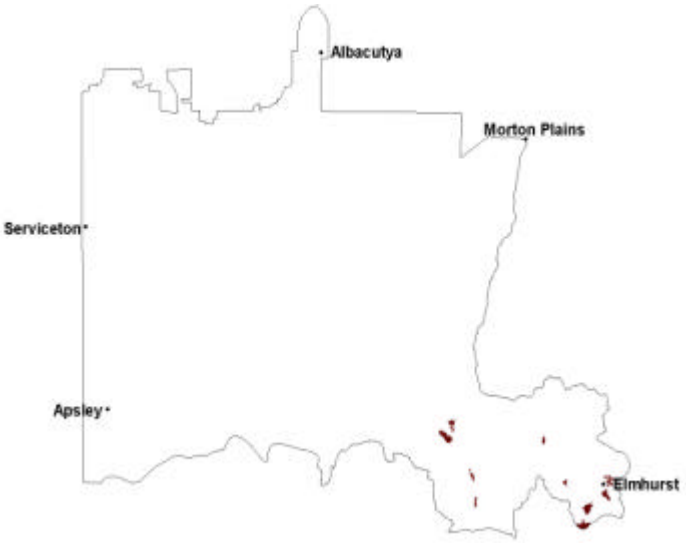
Notable features include:

- Texture contrast and associated structure differences between the surface horizons and subsoil.
- Variants may be browner or paler in poorer drainage situations and possibly more dispersive.
- The deeper subsoil may become sodic, calcareous and contains manganese segregations.
- The lighter textured topsoil may be susceptible to sheet, rill and wind erosion.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LP83	Landsborough footslopes	Hillcrest	Haplic, Mesotrophic, Red Chromosol	Dr2.21	T7254 – ST ARNAUD
DOAGW32	Rhymney hills	Hillslope	?-Sodic, Mesotrophic, Red Chromosol	Dr2.12	T7423 - ARARAT
LP82	Pyrenees Ranges	Hillslope	Bleached-Sodic, Mesotrophic, Brown Chromosol	Dy2.42	T7254 – ST ARNAUD

2. Sodic red texture contrast soils/Dissected Uplands: Palaeozoic non-granitic plateaux, mountains, hills and plains



This soil has developed on sedimentary and metamorphic material (rock or colluvial material) in the Western Uplands. This soil is slightly acidic, often tending to neutral or alkaline with depth.

The surface soil is often a dark moderately structured sandy loam to sandy clay loam. It overlies a brown loamy/clayey sand subsurface horizon that is massive, sporadically bleached and contains variable amounts of coarse sandstone fragments. There is a clear change to a yellowish red, medium to medium heavy clay subsoil horizon, which is mottled (light olive brown). This is strongly structured (with medium to fine sized peds), with weathered sandstone fragments. At depth this grades into lighter textured weathered material and the underlying bedrock (Palaeozoic metasediments). The depth is about 70 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 10 cm for the subsurface (up to 25 cm or more). Lower slopes have deeper profiles. Includes red-mottled brown and yellow variants.

Notable features include:

- Texture contrast and associated structure differences between the surface horizons and subsoil.
- Variants may be browner or paler in poorer drainage situations and possibly more dispersive.
- The deeper subsoil is strongly sodic and highly dispersive.
- The lighter textured topsoil may be susceptible to sheet, rill and wind erosion.
- Some susceptibility to upper subsoil compaction.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
ALRA81	Mount Dryden	Middle slope	Eutrophic, Mottled-Subnatric, Red Sodosol	Dr3.32	T7423 - ARARAT
DOAGW22	Rhymney hills	Middle slope	Mesotrophic, Mottled-Subnatric, Red Sodosol	Dr3.32	T7423 - ARARAT
WLRA141	Pyrenees Ranges	Lower slope	Eutrophic, Mottled-Subnatric, Brown Sodosol	Db2.43	T7523 - BEAUFORT
WLRA143	Pyrenees Ranges	Lower slope	Eutrophic, Mottled-Hypernatric, Brown Sodosol	Dy3.42	T7523 - BEAUFORT

3. Yellow texture contrast soils/Dissected Uplands: Palaeozoic granitic plateaux, mountains, hills and plains

This soil has developed on mainly granitic (rock or colluvial material) in the Western Uplands. The soil is strongly acidic at the surface, becoming slightly acidic or neutral with depth.

The surface soil is usually a dark brown clayey sand to silty loam with sand and is weakly structured. It overlies a conspicuously bleached clayey sand/silty loam, sandy to sandy light clay subsurface horizon. It is massive (no structure) and contains variable amounts of coarse quartz fragments. There is a clear change to a dark yellowish brown (occasionally very pale brown) strongly medium to finely structured medium clay. Generally it has pale, orange and red mottles and contains some quartz or rock fragments and grades into lighter textured weathered material. The depth is about 120 cm or more with variable depths of the surface horizons, generally 10-20 cm for the surface and 10-40 cm for the subsurface (often deeper). Topographic position is important for depth and profile development.

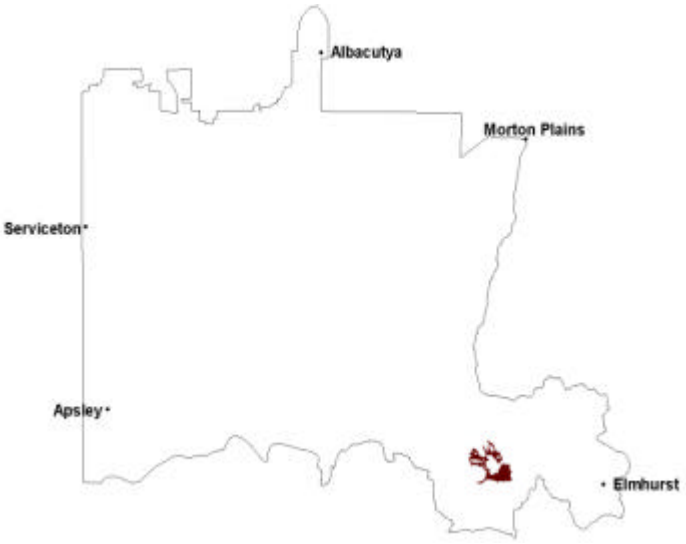
Notable features include:

- Texture contrast between surface horizons and the stronger and coarser structured subsoil.
- Deeper subsoil can occasionally be sodic.
- The subsoil generally has a low to moderate nutrient status.
- These features make these soils vulnerable to erosion, particularly on sloping terrain given poor drainage characteristics and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
GW31	Sugarloaf granitic hills	Rise	Bleached-Sodic,?, Yellow Chromosol	Dy5.42	T7423 - ARARAT
WLRA91	Rocky Point low hills and rises	Crest	Bleached-Sodic, ?, Brown Chromosol	Dy3.41/ Dy5.41	T7423 - ARARAT

4. Sodic, yellow texture contrast soils/Dissected Uplands:.Palaeozoic granitic plateaux, mountains, hills and plains



This soil has developed on mainly granitic (rock or colluvial material) in the Western Uplands. The soil is strongly acidic at the surface, becoming slightly acidic or neutral with depth.

The surface soil is usually a dark brown coarse clayey sand which is massive to weakly structured. It overlies a conspicuously bleached clayey sand subsurface horizon which is massive (not structured). There is a clear change to a very pale brown (occasionally reddish yellow), often with orange and red mottles medium clay upper subsoil. This is strongly structured (with medium to fine sized peds) and grades into lighter weathered material. The profile depth is generally greater than 80 cm or more with variable depths of the surface horizons, generally 5-15 cm for the surface and 20-30 cm for the subsurface (often deeper). Topographic position is important for depth and profile development variations.

Notable features include:

- Strong texture contrast and associated structure differences between the surface horizons and subsoil.
- Possible strongly sodic lower subsoil.
- The sandy surface horizons have a low nutrient status, low water holding capacity and are highly permeable. The clayey subsoil will restrict water movement and waterlogging may occur in the surface soil as a result after heavy rains.
- These features make these soils vulnerable to erosion, particularly on sloping terrain given poor drainage characteristics and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
GW28	Sugarloaf granitic hills	Rise	Eutrophic, Mottled-Subnatric, Yellow Sodosol	Dy.5.41	T7423 - ARARAT
GW30	Sugarloaf granitic hills	Hillslope	Eutrophic, Mottled-Subnatric, Yellow Sodosol	Dy.5.42	T7423 - ARARAT

5. Sodic and non-sodic, yellow and brown texture contrast soils/Dissected Uplands: Low plateaux on Cainozoic sediments

This soil has developed on mainly Cainozoic (generally gravels and associated unconsolidated material) in the Western Uplands. There are associated minor gradational soils (Kandosols). The soil is slightly acidic at the surface becoming neutral to alkaline with depth.

The surface soil is usually a brown sandy loam, silty to sandy clay loam, with no structure (massive). It overlies a conspicuously bleached loamy sand to sandy clay loam subsurface horizon with no structure (massive) and contains variable amounts of coarse quartz fragments.

There is a clear change to a mottled (pale, yellow and red) yellowish brown to brownish yellow, light to medium clay. This is moderately structured (with coarse to medium sized peds) and grades into lighter textured weathered material. The profile depth is about 140 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 15-40 cm for the subsurface horizon.

Notable features include:

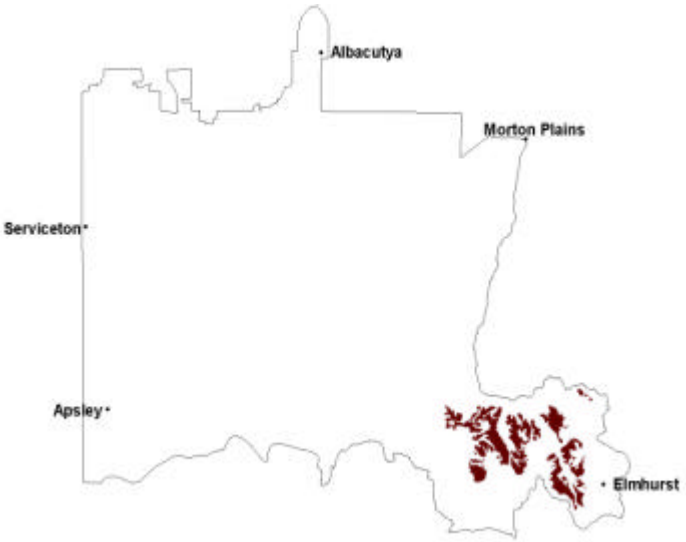
- Texture contrast and associated structure differences between the surface horizons and subsoil.
- The occasionally strongly sodic subsoil.
- Coarse fraction component of the soil and subsurface horizon with low nutrient capacity and low water holding capacity and the densipan above the subsoil.
- These features make these soils vulnerable to sheet and rill erosion particularly on sloping terrain given poor drainage characteristics and lighter surface materials and compaction of the subsurface and upper subsoil horizons.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
DOAGW15	Great Western rises	Hillslope	Bleached-Mottled, Mesotrophic, Yellow Chromosol	Dy.3.42	T7423 - ARARAT

6. Sodic and non-sodic, brown and red texture contrast soils/Dissected Uplands: Low Plateaux on Cainozoic sediments

This soil has developed on mainly Cainozoic (generally gravels and associated unconsolidated material) in the Western Uplands. There are associated minor gradational soils (Kandosols). The soils are slightly acidic at the surface becoming neutral to alkaline with depth. Subsoils have strong red mottling.



The surface soil is often a brown sandy loam (silty) to sandy clay loam, which is not structured (massive). It overlies a conspicuously bleached loamy sand to sandy clay loam subsurface horizon which is also massive with few coarse quartz fragments and common ferruginous nodules (buckshot).

There is a clear change to a mottled (red, yellow and brown) brown to yellowish brown, light to medium clay upper subsoil horizon. This is moderately structured (with coarse to medium sized peds) and grades into lighter textured weathered material. The profile depth is about 140 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 15-40cm for the subsurface horizon.

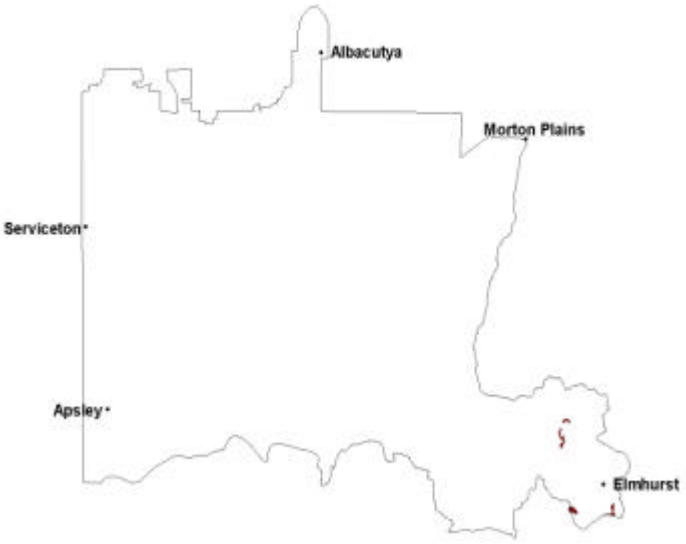
Notable features include:

- Texture contrast and associated structure differences between the surface horizons and subsoil.
- The occasionally strongly sodic subsoil, highly dispersive.
- Coarse fraction component of the upper soil with low nutrient capacity and low water holding capacity and the densipan above the subsoil.
- These features make these soils vulnerable to sheet, rill erosion particularly on sloping terrain given poor drainage characteristics and lighter surface materials and compaction, of the subsurface and upper subsoil horizons.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA141	Great Western rises	Footslope	Eutrophic, Motttled-Subnatric, Brown Sodosol	Db2.42	T7523 - BEAUFORT
WLRA142	Great Western rises	Footslope	Eutrophic, Motttled-Hypernatric, Brown Sodosol	Dy3.43	T7523 - BEAUFORT
WLRA143	Great Western rises	Hillslope	?, Mesotrophic, Yellow Sodosol	Dy.3.42	T7523 - BEAUFORT

7. Red gradational or uniform soils/Dissected Uplands: Low Plateaux on Cainozoic sediments



This soil has developed on mainly Cainozoic (generally gravels and associated unconsolidated material) in the Western Uplands. A minor soil type often on upper slopes, sitting on cemented gravel deposits. This soil is acidic, becoming increasingly acidic with depth.

The surface soil is usually a dark to strong brown sandy loam with no structure (massive) and contains variable amounts of coarse quartz fragments. There is a gradual change to a yellowish red sandy clay loam which is weakly structured (medium to fine sized peds), contains abundant fine and medium quartz gravels and grades into lighter textured weathered gravel material. The depth is about 90 cm or more with variable depths of the surface horizons, generally 30-50 cm for the surface.

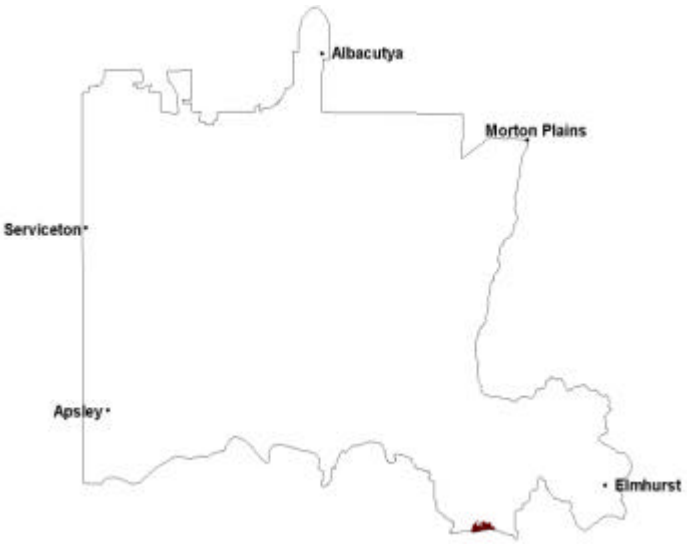
Notable features include:

- Gradual texture change with depth.
- High gravel and coarse fraction component of the soil with low nutrient capacity and low water holding capacity, though well drained.
- Reduced nutrient holding capacity with increasing acidity.
- These features make these soils vulnerable to erosion, particularly on sloping terrain with lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA138	Great Western rises	Hillslope	Acidic, Eutrophic, Red Kandosol	Gn2.11	T7523 - BEAUFORT

8. Cracking clay soils/Dissected Uplands: Eruption points and volcanic plains



This soil has developed mainly on Quaternary basic (basaltic) volcanics in the Western Uplands. Some areas have had varying amounts of sand covering the basaltic material. These soils often have slightly acidic to neutral surface horizons becoming neutral to alkaline with depth.

The surface soil is usually a dark brown (occasionally self-mulching) clay loam to heavy clay with moderate structure (with fine to medium sized peds). It occasionally overlies a bleached subsurface horizon (local gilgai feature) with common ferruginised nodules. There is a clear change to a brown to yellow brown, heavy clay upper subsoil horizon. This is strongly structured (coarse sized peds), parting to weakly structured (medium sized peds) with ferruginised nodules in the upper and mid subsoil, becoming more mottled (light grey and yellowish red) in colour and with slickensides with depth, and grades into weathered parent material (basalt). The profile depth is about 120 cm or more with variable depths of the surface horizons, generally 1-10 cm for the surface and 10 cm for the subsurface, occasionally deeper.

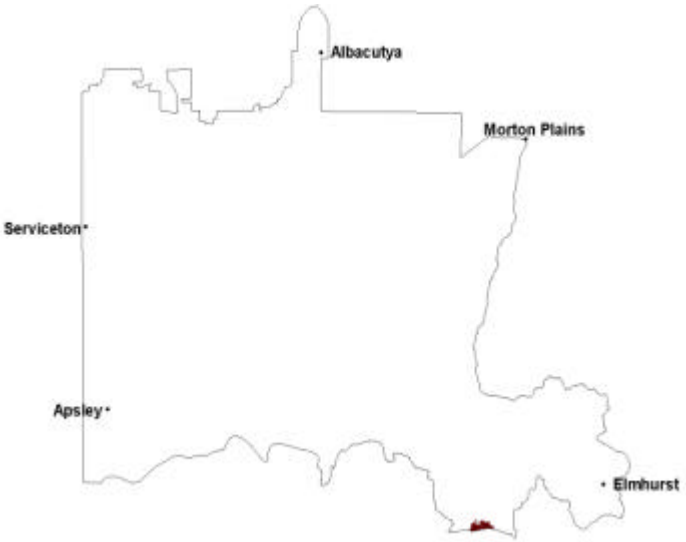
Notable features include:

- Cracking clay soil.
- Variable surface friability (occasional apedal surface, generally pedal).
- Very strong consistence (strength) when dry, particularly the subsoil.
- Ferruginised nodules (buckshot) in the upper soil and occasional calcium carbonate at depth.
- Yellow hued subsoil has restricted soil drainage, generally sodic at depth.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
GRAMP269	Barton lava plains	Plain	Endohypersodic, Epipedal, Brown Vertosol	Ug5.33/ Ug5.35	T7423 - ARARAT

9. Sodic brown, yellow and grey texture contrast soils/Dissected Uplands: Eruption points and volcanic plains



This soil has developed on mainly Quaternary basic volcanics (basaltic) in the Western Uplands. Some areas have had varying amounts of sand covering the basaltic material. These soils often have acidic surface horizons becoming alkaline with depth.

The surface soil is usually a dark greyish brown, clay loam with strong structure (with fine sized peds) with weak consistence (strength). This grades into a greyish brown, conspicuously bleached clay loam upper subsurface horizon which has no structure (massive). There is an abrupt wavy change to a mottled greyish brown, clay loam lower subsurface horizon. This is weakly structured and sporadically bleached, often with many ferromanganiferous concretions. There is a clear wavy boundary to red mottled light olive brown, medium to heavy clay. This has weak to moderate structure (with coarse to medium sized peds) generally vertic (slickensides with depth). This grades into weathered basaltic regolith. The profile depth is about 120 cm or more with variable depths of the surface horizons, generally 15 cm for the surface and 20 cm for the subsurface, often deeper (0–40 cm).

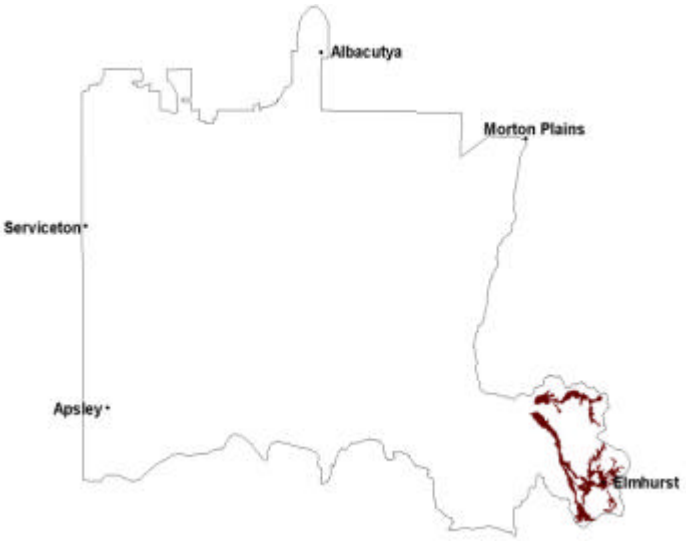
Notable features include:

- Texture contrast (sharp or clear change in clay percentage with depth).
- Vertic properties (including variable topsoil depth and slickensides).
- Strongly sodic subsoil and associated dispersive characteristics.
- Lower nutrient capacity and low water holding capacity of the more acidic, lighter upper soil.
- Limited internal drainage, once moist.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
ALRA69	Barton lava plains	Plain	Vertic (Ferric), Mottled-Hypernatric, Brown Sodosol	Dy3.42	T7423 - ARARAT

10. Red texture contrast soils/Dissected Uplands: Terraces and floodplains



This soil has developed on mainly Quaternary alluvial and colluvial unconsolidated material in the Western Uplands. This soil is often strongly acidic at the surface, tending to neutral at depth.

The surface soil is usually a brown sandy loam to sandy clay loam, with no structure (massive). It overlies a conspicuously bleached loamy sand to sandy clay loam subsurface horizon which is also massive. There is a clear change to a yellowish red medium to heavy clay. This has strong structure (with coarse parting to medium sized peds). There is often a brown, pale and red mottle at depth. This grades into lighter textured weathered unconsolidated material. The profile depth is about 100 cm or more with variable depths of the surface horizons, generally 15 cm for the surface and 10-40 cm for the subsurface horizon, occasionally deeper. There is a sandy lighter variant with sandy light clay subsoil with weak structure.

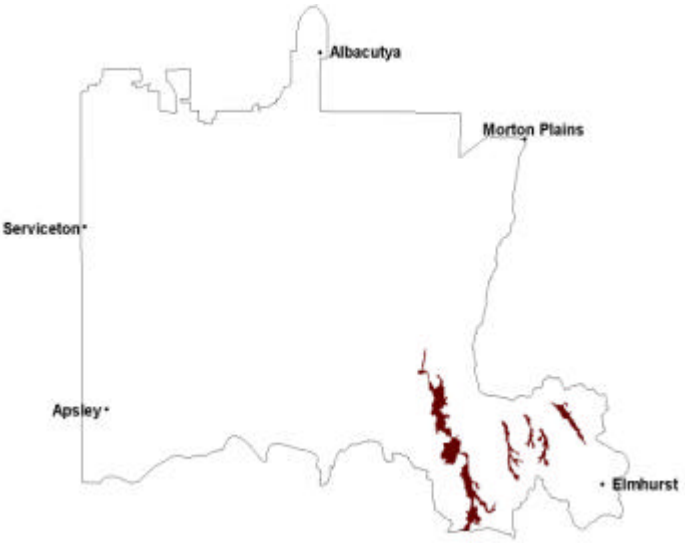
Notable features include:

- Texture contrast and associated structure differences between the surface horizons and subsoil (some restrictive drainage).
- The subsurface horizon sometimes not bleached.
- The lower subsoil may be sodic.
- The coarse fraction component of the upper soil has low nutrient capacity and low water holding capacity, particularly if low in organic matter and leached.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
DOAGW17	Six-Seven Mile creeks	Plain	Bleached-Mottled, Mesotrophic, Red Chromosol	Dr2.62	T7423 - ARARAT
DOAGW2	Six-Seven Mile creeks	Plain	Bleached, Mesotrophic, Red Chromosol	Dr2.42	T7423 - ARARAT
LP80	Wattle Creek covered plain	Terrace	Bleached, Eutrophic, Red Chromosol	Dr2.22	T7254 – ST ARNAUD

11. Yellow and brown gradational and texture contrast soils/Dissected Uplands: Terraces and floodplains



This soil has developed on mainly Quaternary alluvial and colluvial unconsolidated material in the Western Uplands.

The surface soil is usually a brown loamy sand, which is massive to weakly structured. It overlies a light yellowish brown conspicuously bleached loamy sand to sandy loam subsurface horizon which has no structure (massive).

There is a gradual change to a (brown) mottled light yellowish brown (occasionally yellowish red) heavy sandy loam which is massive. This grades into a silty light clay, which is strongly structured and grades into lighter textured weathered unconsolidated parent material (alluvium). The depth is about 130 cm or more with variable depths of the surface horizons, generally 5-10 cm for the surface and 20-50cm for the subsurface, occasionally deeper.

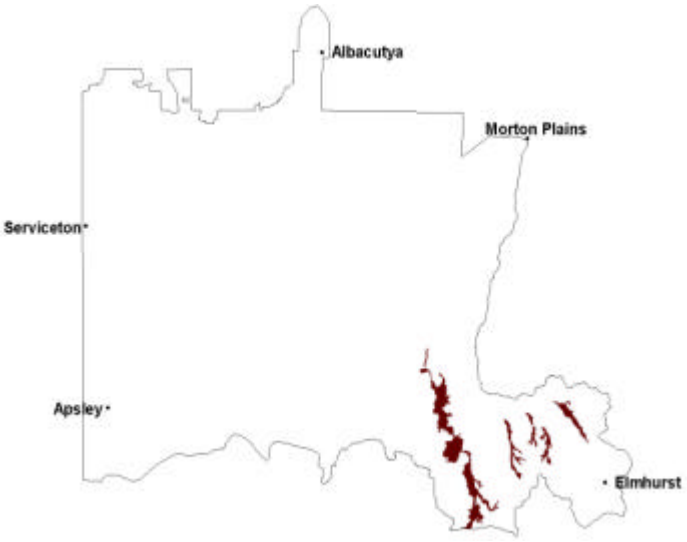
Notable features include:

- Gradational or texture contrast change in clay percentage with depth.
- Variable depth of lighter upper soil with low nutrient capacity variable rooting depth and low water holding capacity.
- Weakly developed structure.
- These features make these soils vulnerable to sheet and rill erosion, particularly on sloping terrain given the lighter surface soils with variable organic matter content.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA66	Mount Cole Creek	Terrace	Bleached-Sodic, Yellow Kandosol	Gn2.96	T7523 - BEAUFORT
WLRA63	Mount Cole Creek	Plain	Bleached-Sodic, Red Kandosol	Dr2.42/ Gn3.19	T7423 - ARARAT

12. Sodic brown, yellow and grey texture contrast soils/Dissected Uplands: Terraces and floodplains



This soil has developed on mainly Quaternary alluvial and colluvial unconsolidated material in the Western Uplands. These soils often have acidic surface horizons becoming alkaline with depth

The surface soil is usually a dark greyish brown, sandy loam to sandy clay loam, which is weakly structured. It generally overlies a yellowish brown silty loam to sandy clay loam subsurface horizon, which is massive and conspicuously bleached. There is a clear change to a mottled (red) yellowish brown, medium to heavy clay, which is often vertic. This soil has weak to moderate structure (medium parting to fine sized peds). Occasionally, calcium carbonate occurs in the mid to lower subsoil. The subsoil grades into lighter textured weathered material (alluvium). The profile depth is about 130 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 25 cm for the subsurface, often deeper (0–40 cm).

Notable features include:

- Sharp or clear change in clay percentage with depth.
- Vertic properties (including variable topsoil depth).
- Strongly sodic subsoil and associated dispersive characteristics.
- Low nutrient capacity and low water holding capacity of the more acidic, lighter upper soil.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
DOAGW12	Six-Seven Mile creeks	Plain	Eutrophic, Motled-Subnatric, Brown Sodosol	Dy3.33	T7423 - ARARAT
WLRA144	Six-Seven Mile creeks	Plain	Eutrophic, Hypernatric, Brown Sodosol	Dy3.42	T7523 - BEAUFORT
WLRA145	Mount Cole Creek	Plain	Eutrophic, Mesornatric, Brown Sodosol	Dy3.43	T7423 - ARARAT
WLRA148	Mount Cole Creek	Plain	Vertic, Mottled-Subnatric, Grey Sodosol	Dy3.43	T7423 - ARARAT

13. Shallow and sandy weakly developed soils/Strike ridges and valleys: Cuesta landscapes

This soil has developed on mainly Palaeozoic sandstone and colluvial material in the Western Uplands, primarily on the Grampian Ranges.

The surface soil is usually a grey or brown loamy sand which is weakly structured. It overlies a conspicuously bleached loamy sand to sandy loam subsurface horizon. This is massive to weakly structured and contains many coarse grained quartz sand. There may be a gradual to clear change to a yellow brown silty or clay loam. This is moderately structured (with medium sized peds), often with some quartz or rock fragments or grading directly into lighter textured subsoil which is apedal (sandy) and then weathered parent material (sandstone). The profile depth is about 70 cm or more with variable depths of the surface horizons, generally 5-15 cm for the surface and 10-20 cm for the subsurface, often deeper.

Notable features include:

- Gradational or uniform change in clay percentage with depth.
- Variable depth to parent material (may be shallow).
- Occasional indurated or accumulation zones with in the predominantly coarse soil (Podosols).
- These soils have low nutrient capacity and low water holding capacity.
- These features make these soils vulnerable to erosion, particularly on sloping terrain given low consistence/coherence and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA54	Grampians Ranges	Hillslope	Bleached-Leptic Tenosol	Gn1.84/ Uc2.21	T7324 - HORSHAM
GRAMP lith*	Grampians Ranges	Hillslope	Acidic, Lithic, Leptic Rudosol	Uc5.11	Unknown

* Refers to the lithosol description (no site identification provided) on page 185 (Appendix 1A) of the Grampians landsystem report (Sibley 1967).

14. Sandy gradational soils/Strike ridges and valleys: Cuesta landscapes

These soils have developed on mainly Palaeozoic sandstone and colluvial material in the Western Uplands, primarily the Grampian Ranges. These soils are a heavier than Type 13, but have a comparative coarse sand component and are of minor occurrence.

The surface soil is usually a grey or brown loamy sand to sandy loam, which is weakly structured. It overlies a conspicuously bleached loamy sand to sandy clay loam subsurface horizon. This is massive to weakly structured with many coarse grained quartz sand. There may be a gradual to clear change to a yellow brown silty or clay loam subsoil horizon, with moderate medium structure (with medium sized peds) or sandy clay loam subsoil, which is weakly structured. This often has few to common quartz or rock fragments or grades directly into weathered sandstone parent material. The profile depth is about 70 cm or more with variable depths of the surface horizons, generally 5-15 cm for the surface and 10-20 cm for the subsurface, often deeper.

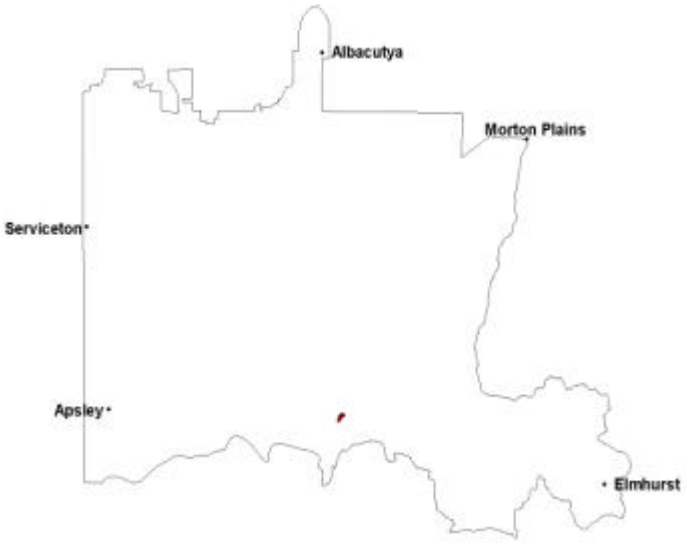
Notable features include:

- Gradational or uniform change in clay percentage with depth.
- Occasional indurated or accumulation zones with in the predominantly coarse soil (Podosols).
- These soils have with low nutrient holding capacity and low water holding capacity.
- These features make these soils vulnerable to erosion, particularly on sloping terrain given low consistence/coherence and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA54	Grampians Ranges	Hillslope	Basic, Lithic, Yellow-Orthic, Tenosol	Gn2.21	T7324 - HORSHAM
GRAMP335	Grampians outwash slopes	Hillslope	Acidic, Mesotrophic, Brown Kandosol	Gn2.21	T7323 - GRAMPIANS

15. Sandy soils with pans/Strike ridges and valleys: Sandstone hills, valleys



These soils have developed on mainly associated colluvial material of Palaeozoic sandstone in the Western Uplands, primarily the Black Range as well as the Grampians Ranges. This is a strongly acidic soil tending to slightly acidic/neutral at depth.

The surface soil is usually a dark brownish grey loamy sand, which is apedal (sandy) and has very weak consistence (strength). It clearly overlies a conspicuously bleached pale loamy sand subsurface horizon, which is apedal (sandy). This soil also has very weak consistence (strength). There is a clear change to a yellow organic and sesquioxide discontinuous pan (coffee rock) sitting clearly over a mottled (yellow) medium clay, which is massive. This grades into lighter textured weathered material. The profile depth is about 130 cm or more with variable depths of the surface horizons, generally 15-30 cm for the surface and 20-30 cm for the subsurface, often deeper.

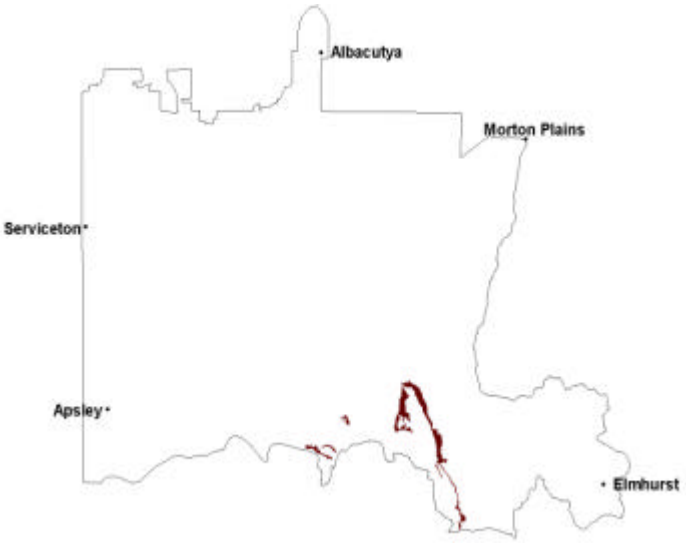
Notable features include:

- Deep uniform sands over a pan, in turn over variable amounts of clay at depth.
- Pan type, depth (up to 40 cm at site example) and continuity will vary.
- These soils have low nutrient capacity and low water holding capacity.
- These features make these soils vulnerable to sheet and wind erosion, particularly on sloping terrain given low consistence/coherence and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
ALRA66	Grampians plains	Hillslope	Humisesquic, Parapanic, Aeric Podosol	Uc2.31	T7423 - ARARAT

16. Acidic, grey texture contrast soils (sandy surfaces)/Strike ridges and valleys: Sandstone hills



These soils have developed on mainly associated colluvial material of Palaeozoic sandstone in the Western Uplands, primarily the Black Range as well as the Grampians Ranges. This is a strongly acidic soil, more so at depth in one instance.

The surface soil is usually a dark loamy sand, which is weakly structured and has weak consistence (strength). It clearly overlies a conspicuously bleached pale loamy sand subsurface horizon, which is massive. This has weak consistence (strength). There is a clear change to a (yellow and occasionally red) mottled light grey, heavy silty clay loam to light medium clay. This has moderate structure (with coarse parting to medium sized peds). This soil grades into lighter textured weathered material with very few fine quartz. The profile depth is about 120 cm or more with variable depths of the surface horizons, generally 5 cm for the surface and 15 cm for the subsurface, often deeper.

Notable features include:

- Texture contrast soil, variable depth sandy upper soil over yellow and red-brown mottled pale clay.
- The upper soil has low nutrient holding capacity and low water holding capacity.
- These features make these soils vulnerable to sheet and wind erosion, particularly on sloping terrain, given low consistence/coherence and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA55	Grampians outwash slopes	Hillslope	Bleached-Mottled Mesotrophic, Grey Kurosol	Dy5.41	T7324 - HORSHAM

17. Brown and yellow texture contrast soils (sandy surfaces)/Strike ridges and valleys: Terraces and floodplains

These soils have developed on mainly associated alluvial and colluvial material of Palaeozoic sandstone in the Western Uplands, primarily in the Victoria Valley. This soil is generally slightly acidic throughout.

The surface soil is usually a dark greyish brown loamy sand, which is massive and has weak consistence (strength) or sometimes a hardsetting surface. It clearly overlies a conspicuously bleached yellow loamy sand subsurface horizon, which is massive and has weak consistence (strength). There is a clear change to a (red and yellow-brown) mottled yellow medium clay. This is strongly structured (coarse parting to medium sized peds) with few ferruginous nodules and some quartz or rock fragments, grading into lighter textured mottled clay with weathered sandstone fragments. The profile depth is about 100 cm or more with variable depths of the surface horizons, generally 15 cm for the surface and 20-30 cm for the subsurface, often deeper.

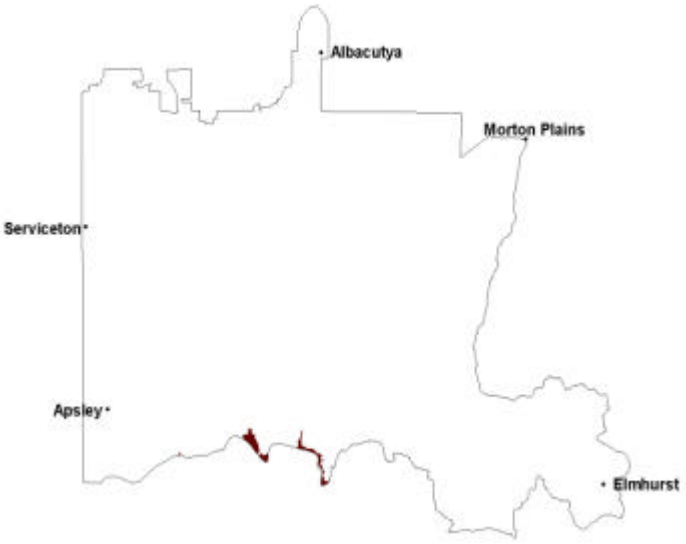
Notable features include:

- Texture contrast soil, hardsetting or non-hardsetting surface.
- Bleached subsurface soil often with some ferruginised nodules (buckshot).
- Mottled pale subsoil has restricted soil drainage, often sodic at depth.
- The upper soil has low nutrient capacity and limited water holding capacity.
- These features make these soils vulnerable to sheet and wind erosion, particularly on sloping terrain given low consistence/coherence and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
DOAHG6	Grampians plains	Hillslope	Bleached-Mottled, Mesotrophic, Brown Chromosol	Dy5.41	T7423 - ARARAT
DOAHG7	Grampians plains	Hillslope	Melacic-Mottled, Magnesic, Brown Chromosol	Dy3.81	T7423 - ARARAT
DOAHG5	Grampians plains	Hillslope	Bleached-Mottled, Mesotrophic, Brown Chromosol	Dy3.41/ Dy5.41	T7423 - ARARAT

18. Sodic brown and yellow texture contrast soils (sandy surfaces)/Low elevation plateaux: High relief, low drainage density and Low relief, low drainage density



These soils have developed on mainly of Neogene sands (often indurated) and associated colluvial material in the Western Uplands, predominantly on the Dundas Tableland.

The surface soil is usually a dark loamy sand, which is weakly structured and has weak consistence (strength). It clearly overlies a conspicuously bleached pale loamy sand subsurface horizon, which is massive and has weak consistence (strength). There is a clear change to a (brown, brown and red) mottled yellow or yellowish brown medium to heavy clay. This soil has strong structure (with coarse to medium ped size) and some quartz or ironstone fragments. This grades into lighter textured weathered material of clay and ferruginised sandstone. The profile depth is about 120 cm or more with variable depths of the surface horizons, generally 15 cm for the surface and 20 cm for the subsurface, shallower on upper topographic positions.

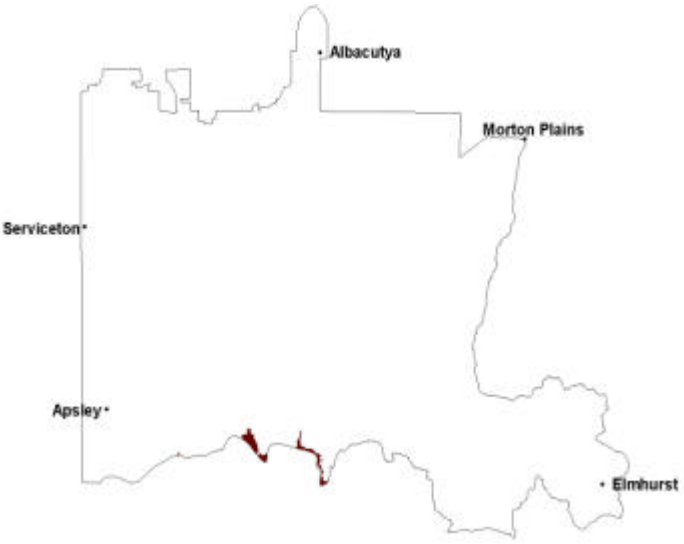
Notable features include:

- Texture contrast soil, hardsetting or non-hardsetting surface.
- Bleached subsurface soil, often with some ferruginised nodules (buckshot).
- Mottled subsoil has restricted soil drainage, often sodic at depth.with ferruginised material at depth and can have some calcium carbonate at depth.
- The upper soil has low nutrient capacity and depth limited water holding capacity.
- These features make these soils vulnerable to sheet, wind erosion and compaction, given low consistence/coherence and lighter surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA136	Balmoral undulating plain	Footslope	Bleached-Vertic (& Sodic), Eutrophic, Brown Chromosol	Dy5.43	T7223 - BALMORAL

19. Brown and yellow texture contrast soils/Low elevation plateaux: High relief, low drainage density and Low relief, low drainage density



These soils have developed on weathered material of Neogene sands (often indurated) in the Western Uplands, predominantly on the Dundas Tableland. The soil is acidic throughout.

The surface soil is generally a dark greyish brown sandy loam, which is weakly structured. This soil grades into a subsurface horizon, occasionally bleached. There is a clear, wavy change to a dark yellowish brown, light medium to medium clay. This has weak structure (with fine sized peds), becoming with depth, more yellow and mottled in colour with ferruginous and manganiferous concretions/nodules. This soil grades into the ferruginous rich discontinuous pan material which abruptly overlies a red and pale horizontal mottled layer. The depth is about 80-100 cm or more with variable depths of the surface horizons, generally 20 cm for the surface and 10 cm for the subsurface, occasionally deeper.

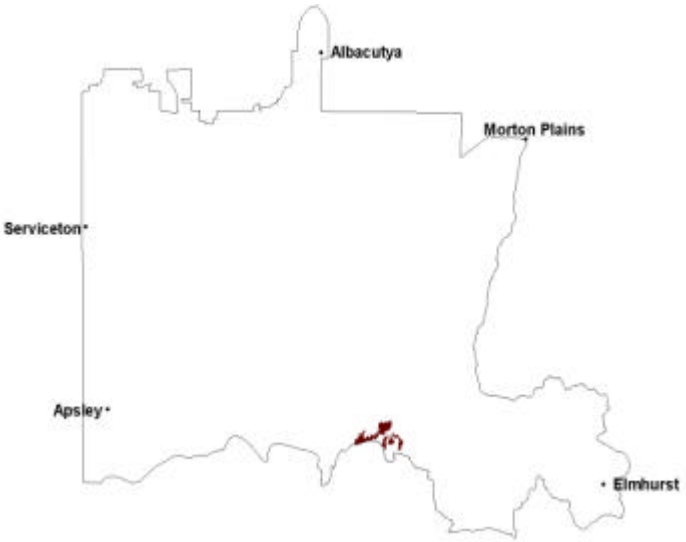
Notable features include:

- Texture contrast soil, acidic but not strongly at depth.
- A ferric pan as well as ferruginous concretions/nodules are generally present.
- Roots tend to be confined to upper soil.
- Weathered substrate material often displays distinctive red and white horizontal mottling (tiger mottles).
- The ferruginised pan and coarse mottled material indicate restricted drainage.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
GL164	Balmoral undulating plain	Flat	Mottled, Petroferric, Brown Chromosol	Dy3.21/ Dy3.41	T7223 - BALMORAL

20. Cracking clay soils/Low elevation plateaux: Low relief, low drainage density



These soils have developed on associated alluvium and colluvial material of Neogene sands (often indurated) in the Western Uplands, predominantly on the Dundas Tableland. The soil has an acidic surface but the subsoil is alkaline not far below the surface horizon.

The surface soil is usually a dark (occasionally self-mulching) light to light medium clay which is structured. This may overlie an occasional bleached subsurface horizon. These soils have strong consistence (strength) depending on moisture condition. There is a clear change to a dark grey, heavy clay. It has strong structure (with medium parting to fine sized peds), becoming more yellow in colour and with slickensides at depth. This soil grades into lighter textured weathered alluvium parent material. The profile depth is about 180 cm or more with variable depths of the surface horizons, generally 5 cm for the surface and 10 cm for the subsurface, occasionally deeper.

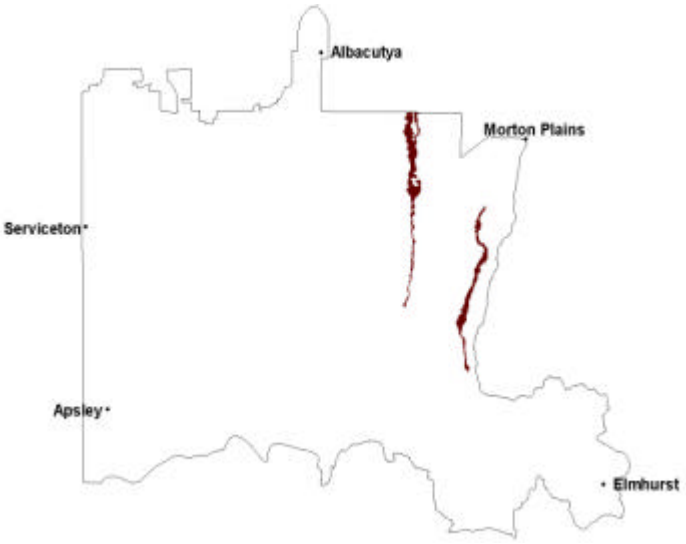
Notable features include:

- Cracking clay soil, variable surface friability (coarser pedality).
- Strong consistence (strength) when dry.
- Occasional ferruginised nodules (buckshot) and calcium carbonate at depth.
- Yellow hued subsoil has restricted soil drainage, generally sodic at depth.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA 137	Balmoral undulating plain	Footslope	Endocalcareous-Endohypersodic, Epipedal, Grey Vertosol	Ug5.28	T7223 - BALMORAL

21. Sodic, grey texture contrast soils/Modern floodplains: Meander belt below flood level



These soils have developed on alluvium of Recent unconsolidated material in the North West Dunefields and Plains, predominantly on the Wimmera River floodplain. This soil has a slightly acidic to neutral surface, grading to alkaline in the subsoil.

The surface soil is usually a grey sandy clay loam. It is weakly structured and hardsetting. It occasionally overlies a bleached subsurface horizon, generally thin. There is a clear change to a grey (occasionally light grey) light clay. This is weakly structured (coarse ped size) and sodic. At depth this grades into alluvial regolith. The sodicity increases with depth and minor carbonate nodules are visible below the upper subsoil. The profile depth is 2 m or more with variable depths of the surface horizons (generally 5-10 cm for the topsoil) and 10 cm for the subsurface (A2 horizon).

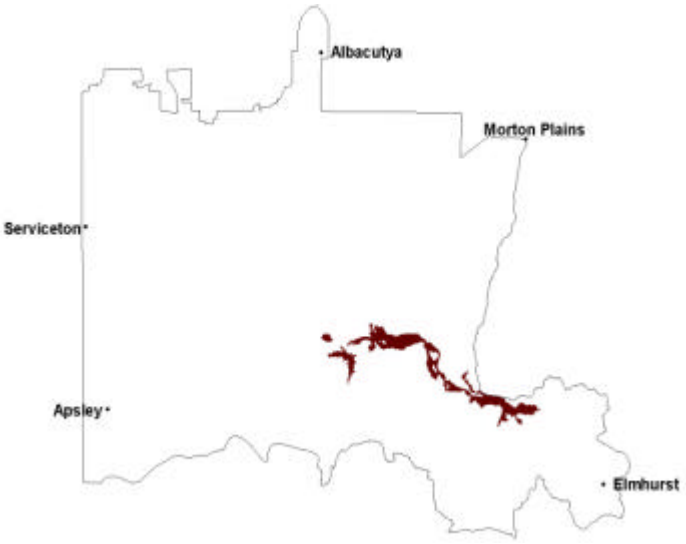
Notable features include:

- Texture contrast soil, variable surface friability (generally hardsetting).
- Strong consistence (strength) when dry.
- This soil has subplastic subsoil and likely to be vertic.
- The pale subsoil indicates poor drainage, often sodic at depth.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WIA20	Wimmera River	Terrace flat	Calcic, Subnatric, Grey Sodosol	Dy3.33	T7324 - HORSHAM

22. Cracking clay soils/Modern floodplains: Meander belt below flood level



These soils have developed on alluvium of Recent unconsolidated material in the Northern Riverine Plains, predominantly on the Wimmera River floodplain. The soil has a slightly acidic surface becoming neutral and then more acidic with depth.

The surface soil is usually a light clay, massive (occasionally weakly structured). It occasionally overlies a bleached subsurface horizon. These soils have strong consistence (strength) depending on moisture condition. There is a clear change to a grey (occasionally light grey) heavy clay (occasionally light medium upper subsoil). It has moderate structure (with coarse to medium ped size) and often with very few carbonate nodules or soft segregations. This grades into lighter textured weathered alluvial parent material. The profile depth is about 160 cm or more with variable depths of the surface horizons, generally 5 cm for the surface.

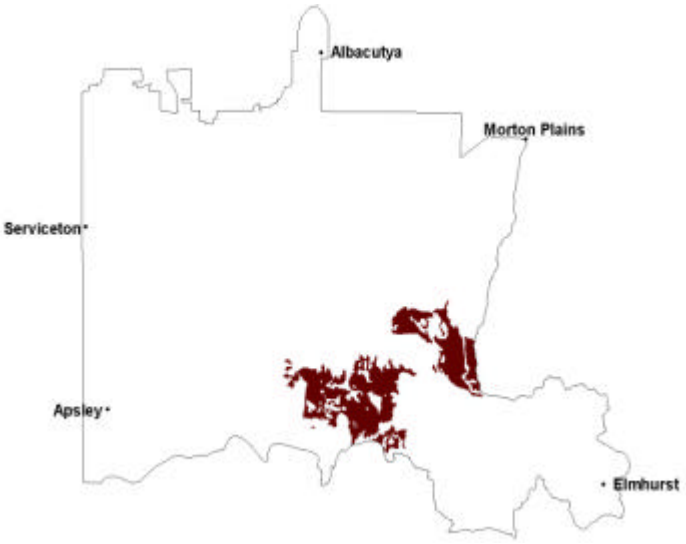
Notable features include:

- Cracking clay soil, variable surface friability (massive or weak to moderate structure on cultivation).
- Strong consistence (strength) when dry; workability is more difficult than for than self-mulching soils.
- Whole coloured (grey) but has restricted soil drainage.
- Sodic subsoil, often strongly sodic at depth, but acidic trend at depth.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WIA22	Wimmera River	Terrace flat	Endocalcareous-Endohypersodic, Massive, Grey Vertosol	Ug5.24	T7324 - HORSHAM

23. Cracking clay soils/Older alluvial plains: Plains with and without leveed channels and Alluvial fans and aprons



These soils have developed on alluvium of Quaternary unconsolidated material in the Northern Riverine Plains, predominantly on the Wimmera River older alluvial plains (with and without prior streams). This soil is alkaline throughout.

The surface soil is usually a light to medium clay, usually structured (occasionally massive). These soils have strong consistence (strength) depending on moisture condition. There is a clear change to a dark grey (occasionally grey) heavy clay. This has moderate structure (with coarse size peds), subplastic often with few calcium carbonate nodules throughout the profile. The subsoil has slickensides indicating high shrink-swell characterisitics. This often grades into lighter textured alluvial material at depth. The profile depth is about 160 cm or more with variable depths of the surface horizons, generally 5 cm for the surface.

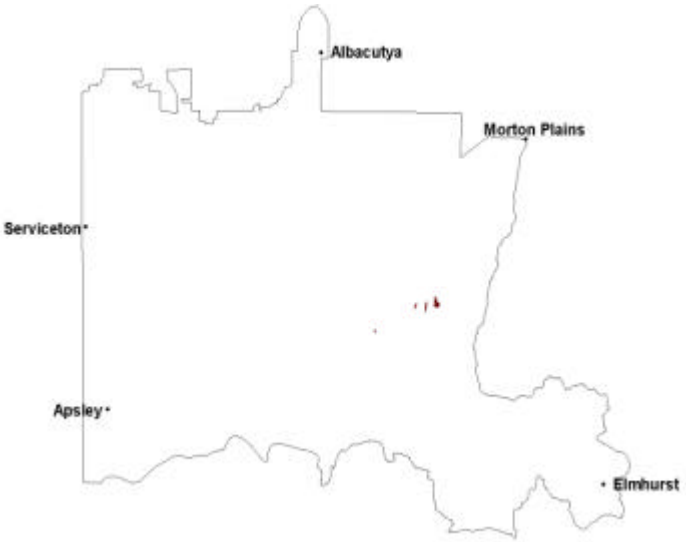
Notable features include:

- Cracking clay soil, variable surface friability (may be massive or slightly self-mulching).
- Strong consistence (strength) when dry.
- The surface soil is subplastic and the subsoil is sodic, strongly at depth and has vertic properties.
- The paler, yellower hued subsoil has restricted soil drainage.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WIA11	Murtoa flats	Plain	Epicalcareous-Endohypersodic, Epipedal, Grey Vertosol	Ug5.28	T7324 - HORSHAM
WIA12	Longerenong prior stream plains	Plain	Endocalcareous-Endohypersodic, Epipedal, Grey Vertosol	Ug5.29	T7324 - HORSHAM
WIA17	Drung alluvial plain	Plain	Endohypersodic, Epipedal, Grey Vertosol	Ug5.24	T7324 - HORSHAM
HOR04	Horsham south sand-clay plain	Plain	Episodic, Epipedal, Grey Vertosol	Ug5.24	T7324 - HORSHAM

24. Cracking and self-mulching clay soils/Older alluvial plains: Plains with and without leveed channels



These soils have developed on alluvium of Quaternary unconsolidated material in the Northern Riverine Plains, predominantly on the Wimmera River prior stream plains. This soil is alkaline throughout.

The surface soil is a dark greyish brown light to medium clay, which is subplastic and self-mulching (occasionally moderately structured). These upper soils have strong consistence (strength) depending on moisture condition. There is a clear change to a dark grey (occasionally grey) medium to heavy clay. This upper subsoil is weakly structured (fine sized peds) but coarsely structured below the upper subsoil. It is subplastic, often with calcium carbonate and is sodic (occasionally high in the profile). The profile depth is about 2 m or more grading into fine alluvial sediments with variable depths of the surface horizons, generally 5-15 cm for the surface soil.

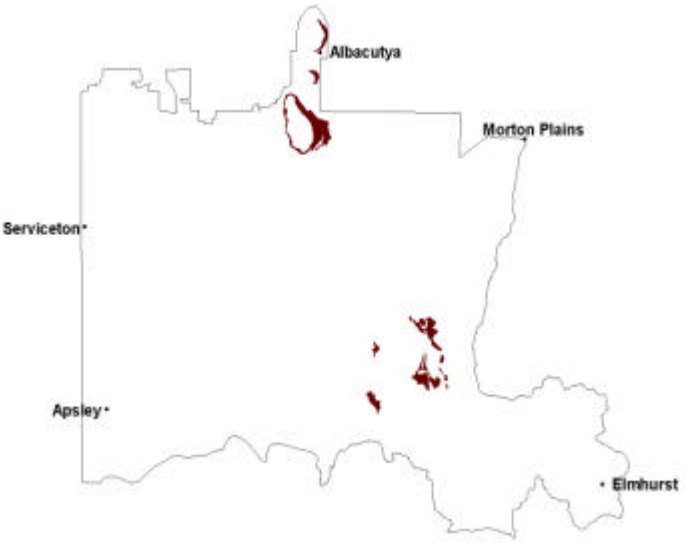
Notable features include:

- Cracking clay and self-mulching soil, variable surface friability (mainly self-mulching).
- Strong consistence (strength) when dry.
- The soil is sodic, occasionally including the surface and strongly sodic at depth, as well as some calcium carbonate nodules and soft segregations.
- Restricted drainage when moist (shrink-swell, slickensides).

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WIA10	Longerenong prior stream plains	Plain	Endocalcareous-Endohypersodic, Self-Mulching, Grey Vertosol	Ug5.24	T7324 - HORSHAM
WIA19	Longerenong prior stream plains	Plain	Episodic-Endocalcareous, Self-Mulching, Grey Vertosol	Ug5.24	T7324 - HORSHAM
WIA33	Wimmera River	Plain	Epicalcareous, Self-Mulching, Grey Vertosol	Ug5.5	T7324 - HORSHAM

25. Sodic, red texture contrast soils/Older alluvial plains: Plains with and without leveed channels



These soils have developed on alluvium of Quaternary unconsolidated material in the Northern Riverine Plains, predominantly on the Wimmera River older alluvial plains (with and without prior streams). Some soils may be gradational and brown in places. The soil is slightly acidic at the surface but becomes alkaline just above or in the subsoil.

The surface soil is usually a dark yellowish brown sandy clay loam, which is weakly structured. This often overlies a bleached subsurface horizon, which is massive and just above the subsoil. There is a clear change to a yellowish red (occasionally brown) medium sodic clay. This is weakly structured (coarse sized peds, sometimes columnar). This grades into lighter textured, mottled lower subsoil often with calcium carbonate soft segregations or nodules, and occasional heavier regolith or buried soils. The profile depth is about 180 cm or more with variable depths of the surface horizons, generally 5 cm for the surface and 15 cm for the subsurface, occasionally deeper.

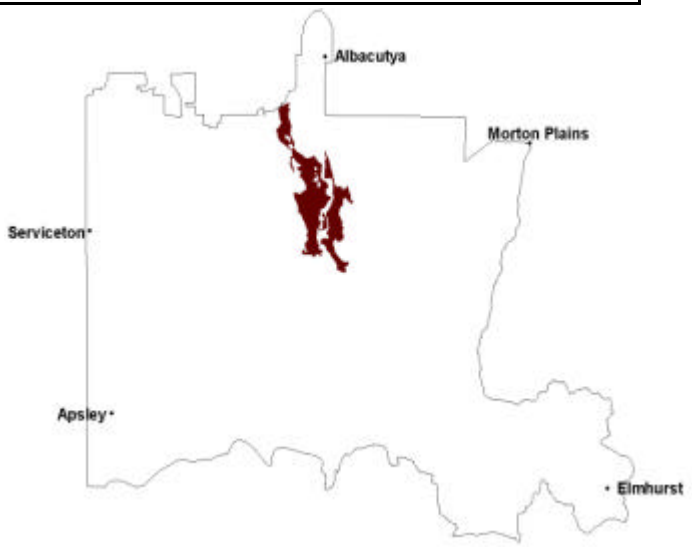
Notable features include:

- Texture contrast soil, generally low surface friability (generally hardsetting).
- Weak upper soil consistence, but very strong lower subsurface and upper subsoil consistence (strength) when dry).
- Mottled subsoil only at depth; slightly restricted soil drainage.
- Soils often sodic at depth, if not sodic in upper subsoil.
- Occasional brown subsoil variants.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WIA16	Longerenong prior stream plains	Levee	Calcic, Mesonatric, Red Sodosol	Dr2.43	T7324 - HORSHAM
WIA14	Longerenong prior stream plains	Plain	Calcic, Subnatric, Red Sodosol	Dr2.33	T7324 - HORSHAM
WLRA105	Drung alluvial plain	Terrace	Bleached-sodic, Eutrophic, Red Chromosol	Dr2.42	T7424 - RUPANYUP

26. Calcareous gradational soils/Calcareous dunefields: Linear dunes subdominant



These soils have developed on Quaternary unconsolidated material in the North West Dunefields, particularly with linear dunefields. The soil is alkaline and calcareous throughout.

The surface soil is usually a very dark greyish brown clay loam (sandy), which is weakly structured (coarse sized peds).

This abruptly and clearly overlies a reddish yellow light clay. This is moderately structured (medium sized peds) with calcium carbonate soft segregations (weaker structure with greater calcium carbonate). This soil grades into a heavier redder lower subsoil, with moderate structure and with calcium carbonate soft segregations and manganese flecks. The profile depth is about 150 cm or more with variable depths of the surface horizons, generally 10-15 cm for the surface, occasionally deeper.

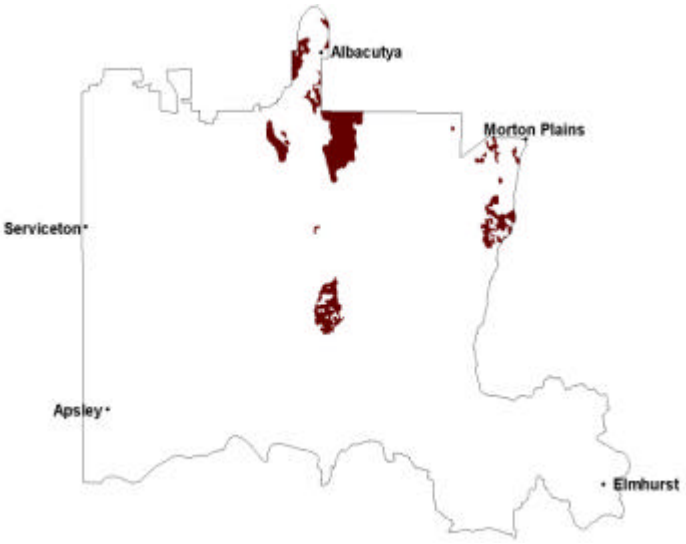
Notable features include:

- Gradational profile with a heavier textured subsoil at depth.
- Highly calcareous upper soil with some free carbonate but high exchangeable sodium and soluble salts at depth.
- Limited surface friability (generally hardsetting), strong consistence (strength) when dry.
- Sodic, often strongly at depth, restricting drainage but reddish colours would indicate slight restriction to water movement.
- Occasional brown subsoil variants.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
TopCrop4	Dimboola rises	Plain	Endohypersodic, Pedal, Hypocalcic Calcarosol	Gc2.2	T7325 - WARRACKNABEAL

27. Sodic, red texture contrast soils/Calcareous dunefields: Linear dunes subdominant, Hummocky dunes subdominant and Plains



These soils have developed on Quaternary unconsolidated material, generally of aeolian origin in the North West Dunefields and Plains, in the north of the WCMA. The soils are neutral to alkaline in the surface and alkaline and calcareous in the subsoil.

The surface soil is usually a dark brown sandy loam to sandy clay loam, with weak structure. It occasionally overlies a bleached subsurface horizon. The contact with the subsoil will often have strong consistence (hard). There is a clear change to a dark red to yellowish red (occasionally yellowish brown) medium clay. It has strong structure (with coarse parting to medium sized peds). With depth there is less structure and clay content, grading into lighter textured highly calcareous material, with weak structure. Some soils may have yellow subsoils with red mottling or red deep subsoil. The profile depth is about 120 cm or more with subtle change into unconsolidated regolith or less alkaline clay on less alkaline parent material, with variable depth of the surface horizon, generally 10-15 cm.

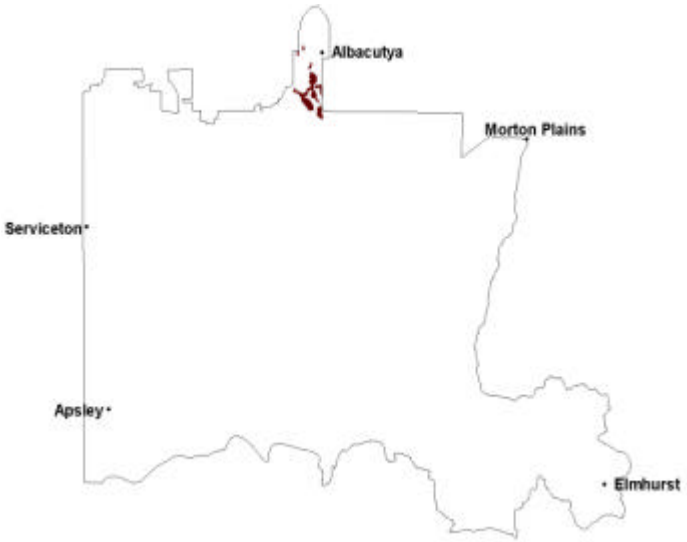
Notable features include:

- Texture contrast soil, variable surface friability (generally hardsetting).
- Strong consistence of lower surface and upper subsoil (strength) when dry.
- Occasional sporadic bleached subsurface soil.
- Decreasing pedality of subsoil with depth, with increasing calcium carbonate content.
- Occasional brown or yellow subsoil variants.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
TopCrop2	Dimboola rises	Plain	Hypercalcic, Mesonatric, Red Sodosol	Dr3.13	T7325 - WARRACKNA BEAL
LS17	Perenna undulating sand plains and rises	Dunecrest	Hypercalcic, Mottled-Subnatric, Yellow Sodosol	Dy3.43	T7225 - NHILL
TopCrop1	Hopetoun rises and swales	Plain	Hypercalcic, Subnatric, Red Sodosol	Dr2.13	T7325 - WARRACKNA BEAL
WIA3	Murra Warra East gentle rises	Plain	Calcic, Subnatric, Red Sodosol	Dr2.33	T7424 - RUPANYUP

28. Sodic, yellow and grey texture contrast soils/Calcareous dunefields: Linear dunes subdominant, Hummocky dunes subdominant



These soils have developed on Quaternary unconsolidated material, generally of aeolian origin in the North West Dunefields and Plains, in the north of the region. The soil has a neutral to alkaline surface over a strongly alkaline subsoil.

The surface soil is a yellowish brown to light yellowish brown loamy sand, with apedal (sandy) to weak structure. It overlies a bleached fine sand subsurface horizon, which is apedal (sandy). There is a sharp/abrupt change to a mottled yellow brown (occasionally brown) sandy clay loam to medium clay, often with a red mottle. This is strongly structured (with coarse parting to medium sized peds). This may grade into a lighter calcareous horizon before grading into a sodic medium clay at depth. Some soils may have yellow subsoils with red mottling or red/brown deep subsoil. The profile depth is about 150 cm or more with slightly variable depths of the surface horizons, generally 10 cm for the surface and 5 cm for the subsurface, often deeper.

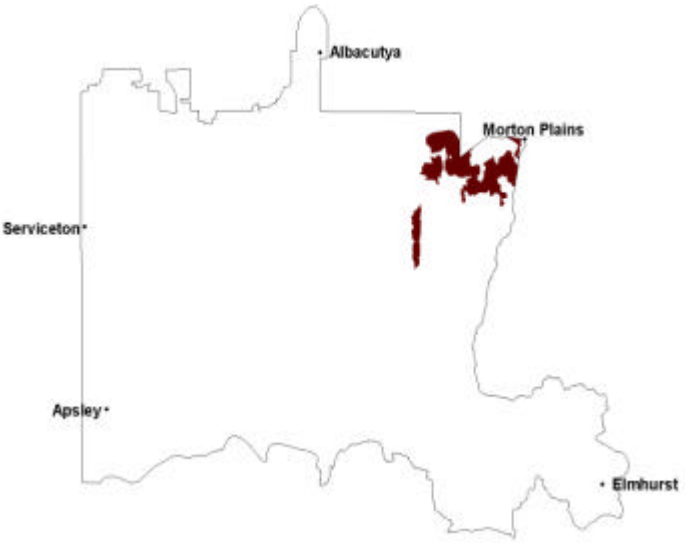
Notable features include:

- Texture contrast soil, variable surface friability (generally can be soft or slightly hardsetting).
- Strong consistence of the subsoil (strength) when dry.
- Occasional bleached subsurface soil.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LS17	Perenna undulating sand plains and rises	Dunecrest	Hypercalcic, Mottled-Subnatric, Yellow Sodosol	Dy3.43/ Dy5.43	T7225 - NHILL
WAR33	Hopetoun rises and swales	Plain	Melanic, Hypernatric, Yellow Sodosol	Dy2.13	T7325 - WARRACKNA BEAL
WLRA128	Charlton gentle rises	Plain	Hypercalcic, Mottled-Subnatric, Yellow Sodosol	Dy2.13	T7425 - DONALD

29. Cracking clay soils/Calcareous dunefields: Hummocky dunes subdominant, Linear dunes subdominant



These soils have developed on Quaternary unconsolidated material, generally of aeolian and lacustrine origin in the North West Dunefields and Plains, in the north of the WCMA region. These soils occupy the plains and swales, and may occur in association with vertic sodic texture contrast soils (i.e. sodosols). This distribution of soils can relate to gilgai microrelief e.g. gilgai.

The surface soil is often a dark pedal (often self-mulching) fine sandy clay loam to light clay. It occasionally overlies a bleached subsurface horizon. There is a clear change to a dark grey (occasionally dark greyish brown) light to medium clay subsoil horizon. This is vertic (cracking and usually slickensides) and strongly structured (coarse parting to fine sized peds). This grades into a heavier horizon, becoming heavier with depth and less obvious fine structure, but slickensides may be present. Calcareous material (carbonate) may be visibly present only in the deeper soil but the profile may still be calcareous throughout. Colour may or may not lighten within a metre depth (indicating restricted drainage). The profile depth is about 150 cm or more grading into sediments, with variable depths of the surface horizons, generally 15 cm for the surface.

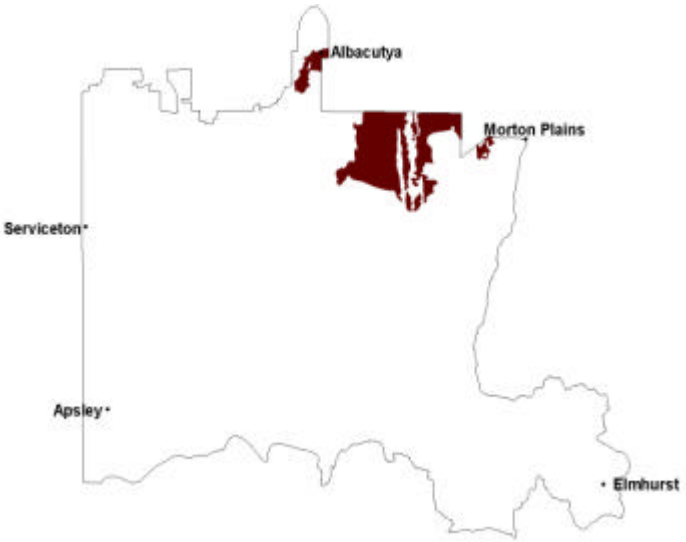
Notable features include:

- Cracking clay soil, variable surface friability/surface condition (pedal or self-mulching).
- Strong consistence (strength) when dry.
- Occasional bleached subsurface horizon.
- Mottled or yellower subsoil has more restricted soil drainage.
- The soils are often sodic at the surface and strongly sodic at depth with manganiferous material (usually flecks or small concretions).

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA126	Charlton gentle rises	Plain	Episodic-Epicalcareous, Self-Mulching, Grey Vertosol	Ug5.28	T7425 - DONALD
WLRA127	Charlton gentle rises	Plain	Episodic-Endocalcareous Epipedal, Grey Vertosol	Ug5.28	T7425 - DONALD

30. Calcareous gradational soils/Calcareous dunefields: Hummocky dunes subdominant



These soils have developed on Quaternary unconsolidated material in the North West Dunefields, particularly with hummocky dunefields including lunettes. This is a minor soil type for this land type.

The surface soil is usually a dark brown sandy clay loam, which is apedal (massive) to weakly structured. It occasionally overlies a weakly structured subsurface transitional horizon. There is a clear change to a dark greyish brown to yellowish red, light clay subsoil horizon. This is weakly to moderately structured (with coarse parting to medium sized peds). This soil grades with depth into decreasing structure (pedality) with increasing calcium carbonate soft segregations. This grades into a heavier textured yellowish red clay which is structured, which in turn grades into lighter textured browner clayey material with slickensides (less aerated) at depth. The profile depth is about 150 cm or more, grading into unconsolidated material (regolith) with variable depths of the surface horizons, generally 5-10 cm for the surface and 15 cm for the subsurface, where it occurs.

Notable features include:

- Gradational soil, calcareous throughout with highly calcareous upper soil with some free carbonate but high sodium and salts at depth.
- Variable surface friability (generally hardsetting, weak strength).
- Weaker consistence (strength) with high free carbonate.
- Occasional manganiferous flecks at depth.
- Noticeable increase in clay at depth, slickensides (vertic), browner and mottled and more restrictive drainage.
- Generally strongly sodic at depth (and likely to be dispersive), occasionally sodic at the surface.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA130	Hopetoun rises and swales	Plain	Epihypersodic, Marly, Hypercalcic Calcarosol	Gc1.2	T7325 - WARRACKNA BEAL
WLRA15	Hopetoun rises and swales	Plain	Epibasic, Pedal, Calcic Calcarosol	Gc2.2	T7325 - WARRACKNA BEAL
WLRA13	Hopetoun rises and swales	Plain	Endohypersodic, Pedal, Calcic Calcarosol	Gc2.2	T7325 - WARRACKNA BEAL

31. Sandy soils with and without pans/Siliceous dunefields: Parabolic and linear dunes

These soils have developed on Quaternary unconsolidated material (mainly aeolian) in the North West Dunefields, particularly the siliceous dunefields including parabolic and linear dunes.

The surface soil is usually a brown sand to loamy sand, which is apedal. This grades into a deep sand subsurface horizon, which is apedal (sandy) and conspicuously bleached. There is a clear to gradual change to a darker (brown) sandy subsoil horizon, which is apedal (massive) and has organic and iron/aluminium concentrations (humosesquic). There is a clear change to a mottled brownish yellow (occasionally light grey) coarse sandy clay loam to sandy clay. This is weakly structured and acidic, often with very pale brown and dark reddish brown mottles and some quartz gravel. This soil grades into lighter textured weathered material or regolith. The profile depth is about 150 cm or more with variable depths of the surface horizons, generally 10-15 cm for the surface and 70 cm for the subsurface, often deeper. The pan is about 20-40 cm thick.

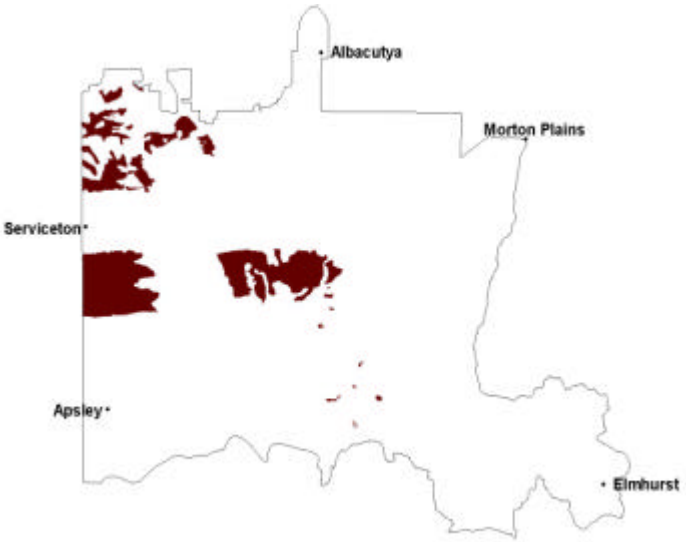
Notable features include:

- Gradational or limited (uniform) change in clay percentage with depth.
- There may be a mottled clayey base at depth (deep Sodosol).
- There may be occasional indurated or accumulation zones with in the predominantly coarse soil (Podosols).
- Despite neutral to slightly alkaline pH these soils have low nutrient capacity and low water holding capacity.
- These soils are susceptible to wind and sheet erosion, particularly on sloping terrain given weak consistence (strength)/low coherence and lighter textured surface materials.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA74	Big Desert jumbled dunes	Plain	Basic, Arenic, Bleached-Orthic Tenosol	Uc2.31	T7225 - NHILL
WLRA85	Big Desert dense dunes	Duneslope	Fragic, Humosesquic, Aeric Podosol	Uc2.32	T7124 - GOROKE

32. Sodic, yellow and grey texture contrast soils/Siliceous dunefields: Parabolic and linear dunes



These soils have developed on Quaternary unconsolidated material, generally of aeolian origin in the North West Dunefields and Plains, in swales, flats or plains amongst the dunefields. Soils are generally whole coloured, but some may have yellow subsoils with red mottling or red/brown deep subsoil. The soils have acidic surfaces with alkaline subsoils.

The surface soil is usually a dark greyish brown loamy sand to sandy loam, which are apedal (sandy) and have loose consistence. This soil occasionally overlies a loamy sand to sandy clay subsurface horizon, which is bleached and apedal either sandy or massive. There is a clear change to a light yellowish brown (occasionally brownish yellow, yellow or light grey) medium to heavy sodic clay upper subsoil. This is strongly structured (with coarse parting to medium sized peds), often with a reddish yellow mottle. This grades into similar material with few carbonate and manganese segregations and is less well structured. This soil then grades into a paler medium to heavy clay, strongly mottled, with slickensides and occasionally with weathered sandstone. The profile depth is about 120 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 5-15 cm for the subsurface, occasionally deeper.

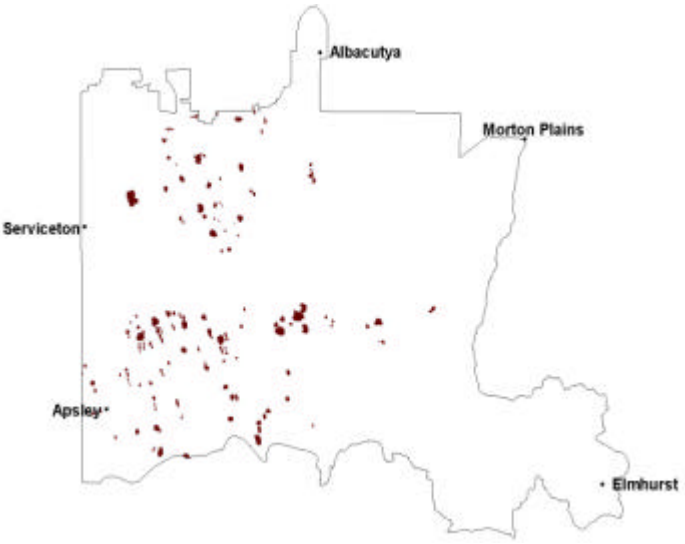
Notable features include:

- Texture contrast soil, variable surface friability (generally sandy and soft but can be hardsetting).
- Occasional bleached subsurface soil (may be loose or cemented).
- Mottled subsoil strong consistence (strength) when dry, has restricted soil drainage as strongly sodic at depth.
- Subsoils are calcareous but few carbonate segregations.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LSWW8	Big Desert dense dunes	Riseslope	Hypercalcic, Mottled-Subnatric, Yellow Sodosol	Dy5.43	T7125 - KANIVA
LSWW7	Big Desert dense dunes	Riseslope	Hypercalcic, Mottled-Subnatric, Grey Sodosol	Dy3.43	T7125 - KANIVA
WIA24	Quantong dunes and swales	Dune	Calcic, Mottled-Mesonatric, Yellow Sodosol	Dy3.43	T7324 - HORSHAM
WIA31	Quantong dunes and swales	Swale	Calcic, Mottled-Mesonatric, Yellow Sodosol	Dy2.33	T7324 - HORSHAM

33. Seasonally wet soils; Sodic, yellow and grey texture contrast soils/Depressions: Saline depressions



These soils have developed on Recent unconsolidated material, generally of riverine origin in the North West Dunefields and Plains, in swales, flats or plains and occasional sandsheets of the Douglas Depression. Some soils may have yellow subsoils with red mottling or red/brown deep subsoil. Calcareous gradational soils (often red) also occur.

The surface soil is usually a brown sandy to sand to loamy sand. This is apedal to weakly structured. It abruptly overlies a light yellowish brown fine sand subsurface horizon, which is bleached. There is a clear change to a yellow brown (occasionally light grey) sandy clay to medium clay subsoil horizon. This is weakly (sandy) or moderately structured (coarse to medium sized peds), often with a red mottle and some quartz gravel. This soil grades into a lighter clay, sometimes with calcium carbonate segregations which then grades into weathered regolith. The profile depth is about 100 cm or more with variable depths of the surface horizons, generally 15 cm for the surface and 20 cm for the subsurface, occasionally deeper.

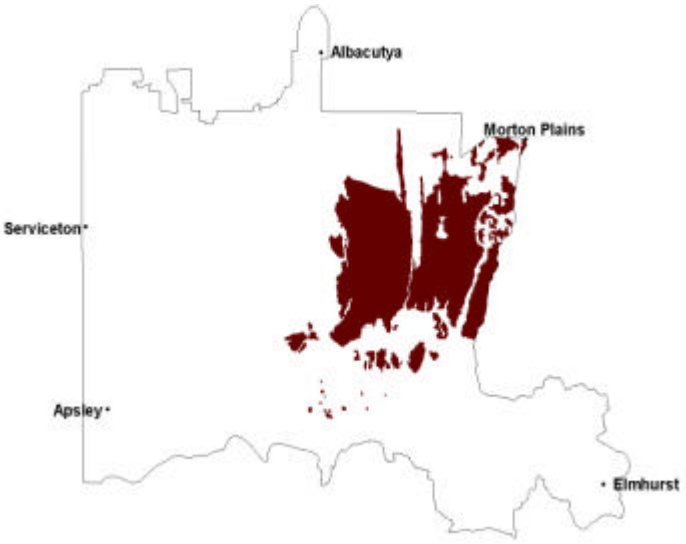
Notable features include:

- Texture contrast soil, seasonally wet in much of the unit, associated with a series of lakes and depressions, most of which are saline.
- Site drainage is very slow.
- Variable surface friability (generally sandy and soft, occasionally hardsetting).
- Occasional bleached subsurface soil.
- Mottled subsoil has restricted soil drainage, often strongly sodic at depth, highly dispersive and strong consistence (strength) when dry.
- Some better drained variants do occur in the unit.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
NA171	Natimuk-Douglas valley	Playa	Eutrophic, Mottled-Subnatric, Brown Sodosol	Dy5.42	T7224 - NATIMUK
NA141	Natimuk-Douglas valley	Hillslope	Calcic, Mottled-Subnatric, Brown Sodosol	Dy3.43/ 5.43	T7224 - NATIMUK
NA178	Natimuk-Douglas valley	Crest	Haplic, Calcic, Red Kandosol	Gc1.2	T7224 - NATIMUK

34. Cracking clay soils/Clay plain with subdued ridges



These soils have developed on Quaternary unconsolidated material, generally of aeolian and lacustrine origin in the North West Dunefields and Plains, to the north of Horsham. They occupy plains and swales, and may occur in association with occasional vertic, sodic texture contrast soils. The Sodosols are associated with gilgai micro relief (Vertosol/Sodosol complex). The soil is alkaline throughout and calcareous.

The surface soil is usually a dark grey, light to medium clay. This is self-mulching, subplastic and has weak structure (coarse granular). There is a clear change to a dark grey (occasionally grey) heavy clay subsoil horizon. This is strongly structured with coarse to medium sized peds, occasionally slightly mottled and with few calcium carbonate segregations below the upper subsoil. This soil grades into a yellower heavy clay at depth. The profile depth is about 130 cm or more to the paler clay continuing below 2 m, with depth of the surface horizon generally about 10 cm.

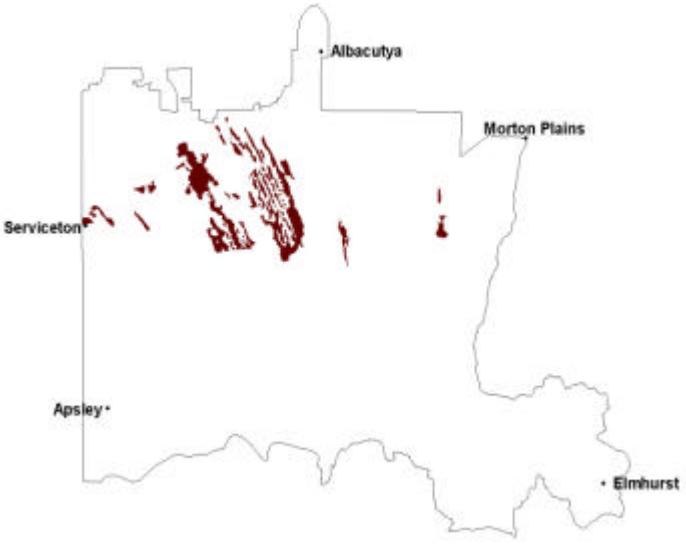
Notable features include:

- Cracking clay with highly self-mulching surface (high calcium content).
- Surface generally friable (self-mulching or pedal), strong consistence (strength) when dry.
- Very occasional bleached subsurface soil.
- Mottled or pale subsoil at depth has restricted soil drainage, often strongly sodic and likely to be dispersive.
- Occasional red or brown subsoil variants.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WIA6	Kalkee plains	Summit surface	Epicalcareous-Endohypersodic, Self-Mulching, Grey Vertosol	Ug5.28	T7125 - KANIVA
WIA9	Kalkee plains	Hillslope	Endocalcareous-Endohypersodic, Self-Mulching, Grey Vertosol	Ug5.25	T7125 - KANIVA
WIA5	Kalkee plains	Plain	Endocalcareous-Endohypersodic, Self-Mulching, Grey Vertosol	Ug5.3	T7125 - KANIVA

35. Sodic, red texture contrast soils/Ridges with sand and flats: Prominent ridge tops and oriented swales



These soils have developed on Quaternary unconsolidated material, generally of aeolian origin in the North West Dunefields and Plains, north of the Little Desert. They usually have neutral to alkaline surfaces and alkaline subsoils.

The surface soil is usually a dark brown sandy clay loam, which is weakly structured. It occasionally overlies a sporadically bleached subsurface horizon, occasionally capping the subsoil. There is a clear change to a reddish brown (occasionally yellowish red) medium clay subsoil horizon. This is strongly structured (coarse parting to medium sized peds) and sodic. This soil grades into a red, heavy sodic clay which is moderately structured. This becomes lighter in texture with many calcium carbonate soft segregations with depth. This grades into a lighter textured and paler (light yellowish brown) sandy clay which will grade into weathered regolith either unconsolidated or sandstone. The profile depth is about 100 cm or more (depending on topographic position) with variable depths of the surface horizons, generally 10 cm for the surface and 10 cm for the subsurface, occasionally deeper surface soil.

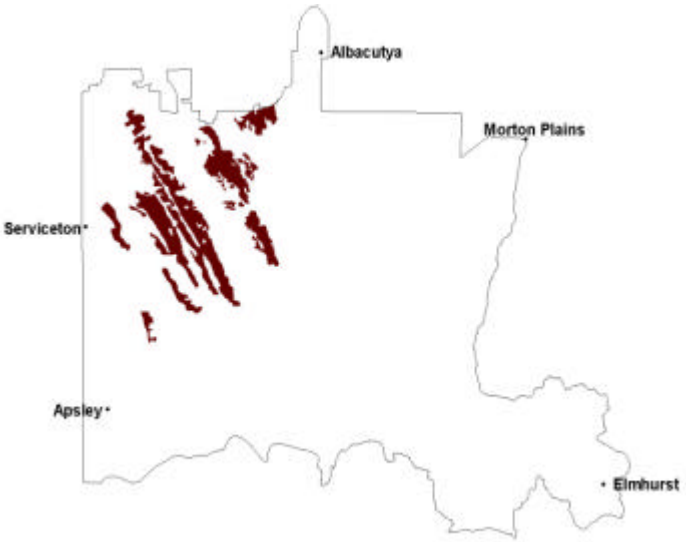
Notable features include:

- Texture contrast soil, variable surface friability (generally hardsetting).
- Strong consistence (strength) when dry, occasional sporadic bleached subsurface soil. Strong consistence contrast (strength) between shallow surface soil and sodic subsoil.
- Strongly sodic at depth, also high dispersion.
- Free (visible) calcium carbonate is common to dominant in subsoil.
- Mottling generally absent until transition to parent material.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LS15	Kiata rises	Plain	Hypercalcic, Hypernatric, Red Sodosol	Dr2.33	T7225 - NHILL
LS8	Broughton undulating plains	Dunecrest	Vertic, Mesonatric, Red Sodosol	Dr2.13	T7125 - KANIVA
LS23	Woorak clay plains	Plain	Hypercalcic, Subnatric, Red Sodosol	Dr4.33	T7225 - NHILL

36. Sodic, brown, yellow and grey texture contrast soils/Ridges with sand and flats: Prominent ridge tops and oriented swales



These soils have developed on Quaternary unconsolidated material, generally of aeolian origin in the North West Dunefields and Plains, north of the Little Desert. The soil has a slightly acidic surface, slightly alkaline upper subsoil and strongly alkaline below the upper subsoil.

The surface soil is usually a dark brown, sandy clay loam, which is apedal (sandy) to weakly structured. It occasionally overlies a bleached apedal subsurface horizon. There is a sharp to abrupt change to a yellowish brown, medium heavy clay subsoil horizon. This is moderately structured (coarse to medium sized peds), often with a red mottle and a few ferruginous concretions. This soil grades into a light brownish grey or yellowish brown, medium heavy clay with some to many calcium carbonate segregations. This then grades into a yellower heavy clay with slickensides and may lighten in texture with depth and be mottled where grading into weathered sandstone. The profile depth is about 100 cm or more with variable depths of the surface horizons, generally 5-15 cm for the surface and 10 cm for the subsurface.

Notable features include:

- Texture contrast soil.
- Little surface friability (generally hardsetting).
- Strong consistence (strength) when dry.
- Occasional sporadic bleached subsurface soil.
- Strong consistence contrast (strength) between shallow surface soil and subsoil.
- Free (visible) calcium carbonate is common to dominant in subsoil.
- Mottling generally absent except where grading into parent material.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LS2 or LS13	Kiata rises	Hillslope	Vertic, Mottled-Subnatric, Brown Sodosol	Db2.13	T7225 - NHILL
LS24 or LS6	Lorquon undulating plains	Riseslope	Hypercalcic, Subnatric, Brown Sodosol	Dy2.13	T7225 - NHILL
LS10 or LS22	Diapur ridge	Hillslope	Calcic, Mottled-Mesonatric, Yellow Sodosol	Dy4.43	T7225 - NHILL

37. Grey and brown cracking clay soils/Ridges with sand and flats

These soils have developed on Quaternary unconsolidated material, generally of aeolian and lacustrian origin in the North West Dunefields and Plains, north and south of the Little Desert. This soil is alkaline and generally calcareous throughout.

The surface soil is usually a dark grey medium clay. This is strongly structured and self-mulching. There is a clear change to a grey (occasionally light grey), heavy clay subsoil horizon. This is strongly structured (with coarse sized peds), sodic and occasionally has very few ferromanganiferous concretions. This soil grades into a paler, light olive grey, medium heavy clay. This is strongly structured (with coarse sized peds), has slickensides and some to many calcium carbonate concretions. This soil grades into weathered regolith at depth. The profile depth is about 2 m or more with variable depth of the surface horizons, generally 5-10cm for the surface and 5-10 cm for the subsurface, where it exists.

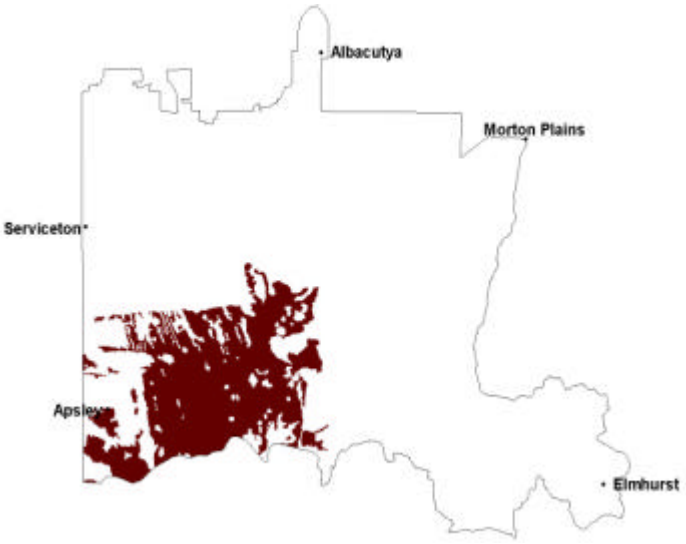
Notable features include:

- Cracking clay soil with self-mulching surface.
- Generally self-mulching and pedal surface condition.
- Strong consistence (strength) when dry.
- Very occasional sporadic bleached subsurface soil.
- Free (visible) calcium carbonate is common to abundant in subsoil.
- Mottling generally absent.
- There is a brown to red variant (subsoil colour).

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LS3	Woorak clay plains	Swale	Epicalcareous-Epihypersodic, Self-Mulching, Grey Vertosol	Ug5.24	T7225 - NHILL
LSWW9	Lillimur South clay plains	Plain	Epicalcareous-Endohypersodic, Self-Mulching, Grey Vertosol	Ug5.28	T7125 - KANIVA
LSWW5	Diapur ridge	Riseslope	Epicalcareous-Epihypersodic Self-Mulching, Brown Vertosol	Ug5.35	T7125 - KANIVA

38. Sodic brown, yellow and grey texture contrast soils/Ridges with sand and flats: Low remnant ridge tops with aeolian sands and oriented swales



These soils have developed on Quaternary unconsolidated material, generally of riverine, aeolian and lacustrine origin in the North West Dunefields and Plains, south of the Little Desert. The soil has a slightly acidic surface with a slightly acidic to slightly alkaline upper subsoil becoming strongly alkaline below. Variations may be influenced by climate variation.

The surface soil is usually a dark brown loamy sand which is apedal (massive or sandy) to weakly structured. It overlies a pale brown subsurface horizon which is bleached, apedal (massive or sandy) occasionally with ferruginous nodules (buckshot). There is a sharp/abrupt change to a brown to strong brown (occasionally yellow) medium heavy clay subsoil horizon. This is strongly structured (with coarse (columnar) to medium sized peds) and sodic. This overlies a pink, medium clay (fine sandy) horizon with a faint mottle, moderately structured (coarse sized peds), sodic and with variable free calcium carbonate. This soil grades into a reddish yellow mediuim clay, which is mottled before grading into weathered regolith (often sandstone). The profile depth is about 130 cm or more (at least 2 m) with variable depths of the surface horizons, generally 10 cm (5-20 cm) for the surface and 15 cm (5-30cm) for the subsurface, often deeper.

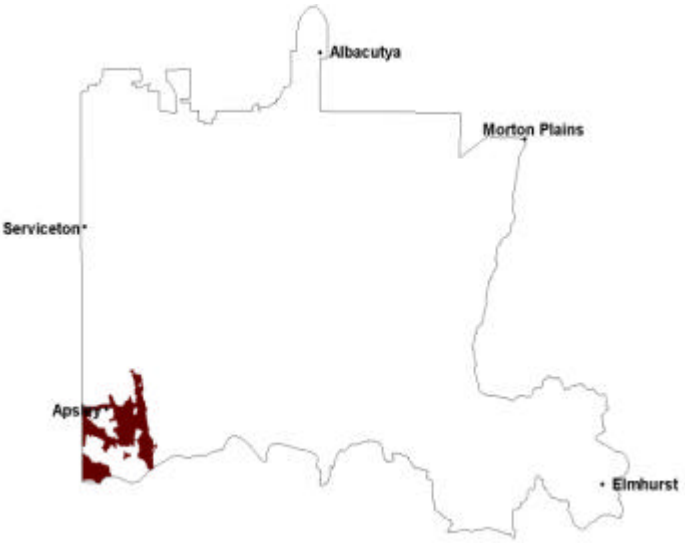
Notable features include:

- Texture contrast soil, subsoil is sodic.
- Variable surface condition (generally soft, occasionally hardsetting) with sandy surfaces.
- Strong consistence (strength) contrast between the lighter shallow surface and subsurface soil and heavy subsoil.
- Free (visible) calcium carbonate is common to dominant in mid subsoil.
- Subsoil mottling generally absent in drier environments, apart from transition to weathered regolith at depth.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
LSWW11	Kybybolite plains	Hillslope	Hypercalcic, Mottled-Hypernatric, Brown Sodosol	Db4.43	T7124 - GOROKE
LSWW17	Kowree undulating sand plains and ridges	Riseslope	Calcic, Mottled-Mesonatric, Yellow Sodosol	Dy5.43	T7123 - EDENHOPE
LSWW13	Ullswater plains and rises	Riseslope	Calcic, Mottled-Mesonatric, Grey Sodosol	Dg4.43	T7124 - GOROKE

39. Sodic red texture contrast soils/Ridges with sand and flats: Low remnant ridge tops with aeolian sands and oriented swales



These soils have developed on Quaternary unconsolidated material, generally of riverine, aeolian and lacustrine origin in the North West Dunefields and Plains, south of the Little Desert. This soil has a slightly acidic surface and subsurface over a neutral to alkaline subsoil.

The surface soil is usually a dark yellowish brown, sandy loam, which is weakly structured. It sharply overlies a red sandy loam subsurface horizon, which is bleached and weakly structured. There is a sharp/abrupt change to a yellowish red medium clay upper subsoil horizon. This is moderately structured (with medium sized peds) and sodic to strongly sodic. This soil grades into mottled deeper subsoil, and/or weathered parent material. The profile depth is about 100 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 20 cm for the subsurface.

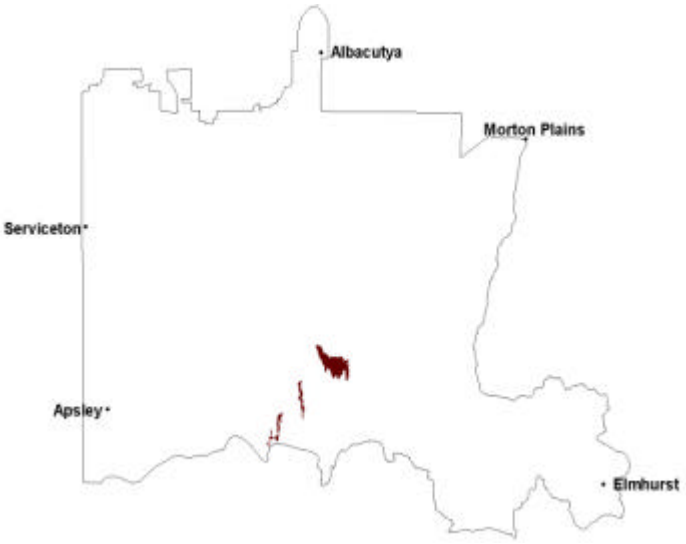
Notable features include:

- Texture contrast soil.
- Variable surface condition (generally hardsetting).
- Generally has a conspicuously bleached subsurface soil.
- Strong consistence (strength) of subsoil when dry.
- Strong consistence contrast (strength) between shallow surface soil and subsoil.
- The subsoil is sodic, often strongly sodic and dispersive.
- Free (visible) calcium carbonate may be present in subsoil.
- Mottling generally absent in upper subsoil.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
NA174	Fairview plains	Hillcrest	Eutrophic, Mesonatric, Red Sodosol	Dy2.32	T7224 - NATIMUK

40. Sodic red and brown texture contrast soils/Ridges with sand and flats: Prominent ridges with eroded ferruginised spurs



These soils have developed on Quaternary unconsolidated material, generally of riverine, aeolian and lacustrine origin in the North West Dunefields and Plains, south of the Little Desert. This soil has a slightly acidic surface with a neutral to alkaline subsoil.

The surface soil is usually a dark brown loamy sand, which is apedal (sandy) to weakly structured and loose consistence. It generally abruptly overlies a brownish yellow loamy sand subsurface horizon. This is bleached and has some ferro-manganiferous concretions or indurated rock fragments. There is a sharp/abrupt change to a red, medium clay upper subsoil horizon. This is sodic, often with a brown mottle, strongly structured (with coarse to medium sized peds) and some ferro-manganiferous concretions or indurated rock fragments. This grades into more mottled and less structured subsoil which in turn grades into weathered material, often ferruginised (indurated) sandstone. The profile depth is about 80 cm or more with variable depths of the surface horizons, generally 10 cm for the surface and 5 cm for the subsurface, occasional deeper or absent on some crests.

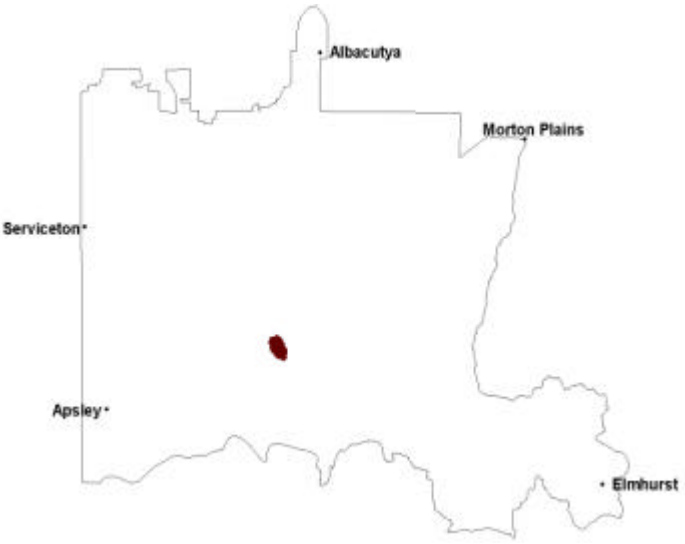
Notable features include:

- Texture contrast soil.
- Variable surface friability (generally soft) with sandy surfaces.
- Strong consistence (strength) contrast between weak surface and strong subsoil when dry.
- Generally has a bleached subsurface soil.
- Ferro-manganiferous concretions or ferruginised sandstone occur on soil surface and in the surface and subsurface soil in particular.
- The sodic subsoil may be strongly sodic and highly dispersible.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
HOR1	Darragan rolling rises	Summit surface	Eutrophic, Mesonatric, Red Sodosol	Dr4.12	T7324 - HORSHAM
HOR2	Darragan rolling rises	Summit surface	Eutrophic, Mesonatric, Red Sodosol	Dr5.42	T7324 - HORSHAM

41. Shallow and sandy soils, sodic brown texture contrast soils/Hills and low hills



These soils have developed on Palaeozoic sediments, generally of Grampians sandstone making up Mount Arapiles, outlying in the North West Dunefields and Plains, south of the Little Desert. Soils are either Rudosols, sandy soils such as Tenosols or heavier soils such as Sodosols on the footslopes. The soils are acidic in higher positions but may be alkaline in lower positions (accumulation zones).

The surface soil is usually a dark greyish brown loamy sand which is apedal to weakly structured. This sharply overlies a yellowish brown sandy clay loam with an occasional bleached subsurface horizon in between. There is a clear change to a brown sandy clay loam to sandy clay upper subsoil horison. This is mottled, weakly structured (coarse to medium sized peds) with some quartz or rock fragments. This soil grades into lighter textured weathered material (sandstone). The profile depth is about 60 cm, less or more depending on topographic position with variable depths of the surface horizons, generally 5 cm for the surface, occasionally more.

Notable features include:

- Gradational and texture contrast soils.
- Variable surface condition (generally soft, occasionally hardsetting) with sandy surfaces.
- Occasional sporadic or conspicuously bleached subsurface soil.
- Strong consistence (strength) of heavier subsoil when dry.
- Texture contrast may not be spatially consistent depending on topographic position and rock formation.
- The heavier soils may be mottled, indicating restricted drainage and often sodic.

Soil sites

Site code	Soil-landform unit	Component	ASC	FK	1:100 000 mapsheet
WLRA54	Arapiles steep hills	Hillslope	Bleached-Leptic Tenosol	Gn1.84/ Uc2.21	T7324 - HORSHAM
NA172	Arapiles steep hills	Hillslope	Eutrophic, Mesonatric, Brown Sodosol	Dr3.43	T7224 - NATIMUK