

# MOA Monarto Land System

Undulating rises and broad flats in the Monarto area

**Area:** 66.5 km<sup>2</sup>

**Annual rainfall:** 370 – 540 mm average

**Geology:** The land is underlain by metamorphic rocks of the Kanmantoo Group. Characteristic lithologies include metasandstones and metagreywackes, schists and phyllites. These outcrop extensively in the east of the System and to a lesser extent in the west. At least parts of the area were covered by veneers of Tertiary clayey and sandy sediments, minor remnants of which are still present as soft subsurface materials or as indurated outcrops. These sediments in turn were capped by highly calcareous materials most of which have been indurated to calcretes. Remnants of the calcrete cap occur in the east. Erosion of the slopes formed on basement rocks removed soil and rock materials which were deposited downslope and on alluvial flats. These sedimentary areas are common throughout the system. Reworking of sandy surface soils (formed from the weathering of coarse grained rocks) resulted in small areas of wind deposited sand.

**Topography:** The land system is essentially a long dissected east facing slope. The Bremer Escarpment which bounds the western side of the System is an upthrust zone, from which the landscape falls away to the east. The present topographic pattern has been largely created by streams dissecting the slopes. Watercourses arising on these slopes flow in a general easterly direction. In the north they coalesce to form Preamimma Creek. In the south the watercourses flow together to form Rocky Gully Creek. Steep sided gullies with eroded watercourses are a feature of the western side. Towards the east the slopes flatten out to gently undulating rises on basement rock, interspersed with broad alluvial fans and flats. The steeper slopes and the low rises are characterized by reefs of outcropping rock. In the east are stony benches, remnants of an old calcreted land surface. There are occasional low sand ridges or sand spreads formed over Tertiary sediments or reworked coarse textured soils. Restricted drainage in the creek flats towards the eastern side has caused salinization of the flats and watercourses as salt, weathered out of the basement rocks, moves downslope into the drainage network and cannot be flushed out.

**Elevation:** 277 m on the escarpment crest in the northwest to 80 m at the outlet of Rocky Gully Creek.

**Relief:** Up to 50 m

**Soils:** The soils range from moderately shallow texture contrast, calcareous, skeletal or gradational over basement rock, through sand over clay types, to deep sandy loam over clay or deep sand formed over alluvium.

## Main soils

### *Basement rock / calcrete rises*

<b>D1</b>	Shallow sandy loam over red clay	}
<b>L1</b>	Shallow stony loamy sand	} on basement rock
<b>A2</b>	Calcareous loam	}
<b>B2</b>	Shallow stony sandy loam over calcrete	

## Minor soils



*Alluvial plains and creek flats*

- D3** Sandy loam over red clay  
**D5** Loamy sand over red sandy clay  
**M1** Deep alluvial loamy sand

*Sandy rises*

- G1** Sand over red sandy clay loam  
**G2** Thick sand over sandy clay loam

*Non sandy rises*

- C5** Dark gradational clay loam - over weathered rock (**C5a**) / hard sandstone (**C5b**)

**Main features:**

The Monarto Land System is a complex landscape of non-arable rocky slopes, arable rises, and creek flats. The rises have moderately deep to shallow reasonably fertile sandy loam soils, usually with a thin clayey subsoil. Although these have productive potential, they are mixed with shallow stony soils and moderately saline silty loams. The flats and watercourses between the rises have deep, generally fertile soils which are mostly productive. Limitations include poor surface structure, high erodibility, sporadic salinity (flats), with gullies and salinization (watercourses).

**Soil Landscape Unit summary:** 18 Soil Landscape Units (SLUs) mapped in the Monarto Land System:

SLU	% of area	Main features #
AKA AKB AKI	0.7 5.8 3.1	<p>Stony slopes formed on basement rock. Rocky outcrops are common and there is extensive surface stone.</p> <p><b>AKA</b> Low rises.  <b>AKB</b> Moderate slopes and steeper rises.  <b>AKI</b> Moderately steep slopes with eroded watercourses.</p> <p>Main soils: <u>shallow stony loamy sand over rock</u> - <b>L1</b> (V) and <u>shallow sandy loam over red clay</u> - <b>D1</b> (C). The frequency of rocky reefs and the extent of surface stone and shallow soils make this land non-arable, or semi arable (between the reefs) at best. The steeper slopes generate significant runoff so sheet erosion and erosion of watercourses has been substantial in the past. The isolated rises however are stable with no significant potential to erode.</p>
DaB DaC	17.1 8.9	<p>Slopes formed on basement rock. There is minor rocky outcrop and sporadic surface stone.</p> <p><b>DaB</b> Gentle slopes of up to 3%.  <b>DaC</b> Moderate slopes of 3-10%.</p> <p>Main soils: <u>shallow sandy loam over red clay</u> - <b>D1</b> (E), with <u>shallow stony loamy sand over rock</u> - <b>L1</b> (C), <u>calcareous loam</u> - <b>A2</b> (L), <u>dark gradational clay loam</u> - <b>C5a</b> (L), and <u>sand over red sandy clay loam</u> - <b>G1</b> (M). The soils on these slopes are usually moderately deep and generally fertile. Shallower soils have restricted waterholding capacity. There is a moderate potential for water erosion, particularly on DaC, due to moderate slopes and poorly structured surface soils.</p>
DsB DsC	1.6 1.7	<p>Sandy slopes underlain by basement rock mantled by windblown Molineaux Sand. There is minor rock outcrop and sporadic surface stone.</p> <p><b>DsB</b> Very gentle slopes.  <b>DsC</b> Undulating rises.</p> <p>Main soils: <u>sand over red sandy clay loam</u> - <b>G1</b> (V), with <u>shallow stony loamy sand over rock</u> - <b>L1</b> (L) and <u>shallow sandy loam over red clay</u> - <b>D1</b> (L). The soils are moderately deep to deep and well drained, but have low fertility and are prone to wind erosion. Water repellence may be a problem in some seasons.</p>



EaB EaC	9.7 8.8	<p>Stony slopes formed on basement rock and characterized by rocky reefs occupying up to 50% of the land surface, with extensive surface stone.</p> <p><b>EaB</b> Very gentle slopes. <b>EaC</b> Undulating rises.</p> <p>Main soils: <u>shallow stony loamy sand over rock</u> - <b>L1</b> (E) and <u>calcareous loam</u> - <b>A2</b> (C), with <u>shallow stony loamy sand over calcrete</u> - <b>B2</b> (L) and <u>shallow sandy loam over red clay</u> - <b>D1</b> (L). The land is only semi arable due the extent of rocky outcrop - cultivation is confined to the strips between the reefs. Most soils are shallow, so waterholding capacity is a major limiting factor. The steeper slopes have a moderate potential for water erosion.</p>
EbZ	0.3	<p>Crests formed on remnant Tertiary sandstones which outcrop sporadically.</p> <p>Main soil: <u>shallow dark gradational clay loam</u> - <b>C5b</b> (D). These small exposed areas have fertile but shallow soils.</p>
EfL	15.5	<p>Gentle slopes formed on schistose basement rocks. There is limited rock outcrop and surface stone. Sporadic saline scalds are a feature of this landscape.</p> <p>Main soils: <u>calcareous loam</u> - <b>A2</b> (V) with <u>shallow sandy loam over red clay</u> - <b>D1</b> (L), <u>shallow stony loamy sand over rock</u> - <b>L1</b> (L) and <u>shallow stony loamy sand over calcrete</u> - <b>B2</b> (L). The soils are moderately shallow but there is commonly a substantial depth of soft highly weathered rock. The soils are alkaline and commonly saline, a feature peculiar to this landscape unit.</p>
GGB	0.9	<p>Low sandy rises formed on remnant Tertiary sandy clays.</p> <p>Main soil: <u>thick sand over sandy clay loam</u> - <b>G2</b> (D). These soils are moderately deep, but the subsoil clays are dispersive and hard, restricting adequate root development. They also prevent free vertical drainage. The sandy surfaces are infertile and often water repellent. Wind erosion is a constant threat.</p>
JGA JGB JGK	0.2 5.0 3.4	<p>Flats and gentle slopes formed on medium to fine grained alluvium.</p> <p><b>JGA</b> Flats with slopes of less than 1%. <b>JGB</b> Outwash fans with slopes of 1-3%. <b>JGK</b> Flats with minor salinity.</p> <p>Main soils: <u>sandy loam over red clay</u> - <b>D3</b> (E) and <u>loamy sand over red sandy clay</u> - <b>D5</b>, with <u>shallow sandy loam over red clay</u> - <b>D1</b> (L) where basement rocks come close to the surface. These soils are deep, fertile and mostly well drained. Except for hard setting surfaces affecting workability and emergence, and slight erosion potential in JGB they have no significant limitations to productivity. JGK is potentially less productive with impeded drainage and moderate to high salt levels a feature of some soils.</p>
QMB	7.0	<p>Low stony rises formed on sheet calcrete remnants. Main soil is <u>shallow stony sandy loam over calcrete</u> - <b>B2</b> (D). These soils are too shallow and stony for cultivated agriculture and generally have not been cleared.</p>
XBK XBN	7.4 2.9	<p>Creek flats formed on modern alluvium and dominated by eroded watercourses, which are variably salinized.</p> <p><b>XBK</b> Creek flats with eroded watercourses. <b>XBN</b> Salinized creek flats with eroded watercourses.</p> <p>Main soils: <u>deep alluvial loamy sand</u> - <b>M1</b> (V) with <u>sandy loam over red clay</u> - <b>D3</b> (L) and <u>loamy sand over red sandy clay</u> - <b>D5</b> (L). Sols are deep and moderately fertile but the fragility of the watercourses due to past erosion, potential erosion and salinity limits their productive potential.</p>

## # PROPORTION codes assigned to soils within Soil Landscape Units (SLU):

- |  |                                       |
|--|---------------------------------------|
| (D) Dominant in extent (>90% of SLU)         | (C) Common in extent (20–30% of SLU)  |
| (V) Very extensive in extent (60–90% of SLU) | (L) Limited in extent (10–20% of SLU) |
| (E) Extensive in extent (30–60% of SLU)      | (M) Minor in extent (<10% of SLU)     |



**Detailed soil profile descriptions:***Stony rises*

- L1** Shallow stony loamy sand over rock (Calcareous, Paralithic, Leptic Tenosol / Calcic, Red Kandosol)  
Medium to thick gravelly loamy sand to sandy loam over weathering rock with variable red clay pockets and soft carbonate in cleavages. Depth to rock varies from 0 - 80 cm, average 25 cm.
- B2** Shallow stony sandy loam over calcrete (Petrocalcic Calcarosol)  
Medium thickness calcareous sandy loam with variable calcrete fragments and nodules over sheet or rubbly calcrete within 50 cm.

*Non sandy rises*

- D1** Shallow sandy loam over red clay (Calcic, Red Chromosol)  
Medium thickness hard loamy sand to sandy loam abruptly overlying a red well structured clay with soft carbonate from about 40 cm, grading to weathering rock at about 80 cm.
- A2** Calcareous loam (Paralithic, Hypercalcic Calcarosol)  
Medium thickness grey brown calcareous loamy fine sand to silty loam, becoming more clayey, more calcareous and paler coloured with depth over a pale brown very highly calcareous clay loam with variable content of carbonate nodules. Very soft highly calcareous weathered schist occurs from about 100 cm.
- C5a** Dark gradational clay loam (Hypercalcic, Black Dermosol)  
Medium thickness clay loam over a dark coloured well structured clay with thick soft carbonate from about 25 cm grading to weathering rock usually deeper than 100 cm.
- C5b** Shallow dark gradational clay loam (Paralithic, Calcic Calcarosol)  
Medium thickness dark calcareous clay loam over a calcareous well structured dark clay over sandstone at about 25 cm.

*Sandy rises*

- G1** Sand over red sandy clay loam (Hypercalcic, Red Sodosol)  
Very thick reddish brown sand to loamy sand, overlying a thin reddish brown massive sandy clay loam, highly calcareous at the base, grading to weathering metamorphosed sandstone at about 100 cm.
- G2** Thick sand over sandy clay loam (Calcic, Brown Sodosol)  
Thick grey sand with a strongly bleached A2 horizon, overlying a brown mottled sandy clay loam with coarse columnar structure, more clayey with depth, and highly calcareous Class I carbonate from 80 cm grading to Tertiary sandy clay.

*Alluvial plains and creek flats*

- D3** Sandy loam over red clay (Eutrophic, Red Sodosol)  
Medium to thick hard red brown sandy loam to loam abruptly overlying a red coarsely structured clay, with sporadic fine carbonate from about 50 cm, grading to alluvial sandy clay to sand.
- D5** Loamy sand over red sandy clay (Calcic, Red Sodosol)  
Medium to thick firm loamy sand abruptly overlying a weakly structured red sandy clay loam to light clay, calcareous with depth grading to medium textured alluvium.
- M1** Deep alluvial loamy sand (Stratic Rudosol / Arenic Tenosol)  
Very thick sand to sandy loam with alluvial layering and gravel seams.

**Further information:** [DEWNR Soil and Land Program](#)

