MAJ Marmon Jabuk Land System

(Based on the description by A. K. McCord in "A Description of Land in the Southern Mallee of South Australia")

Prominent range and back slopes extending in an arc from Naturi to Geranium, with some scattered remnants further to the south east.

Area: 539.5 km^2

Annual rainfall: 350 – 425 mm average

Geology: The System is underlain by sandy Tertiary sediments of the Loxton and Parilla Sand Formations. These are generally only exposed at the surface in depressions. These sediments are partially covered by Blanchetown Clay deposits, which in turn are usually capped by sheet or rubbly calcrete, or less commonly by softer carbonates of the Woorinen Formation. The landscape is sporadically overlain by dunes of aeolian Molineaux Sand. On the southern margin in particular, alluvial outwash deposits have accumulated. These are commonly coarse to medium grained, gravelly and capped by hard carbonate layers.

Topography: The Marmon Jabuk Land System represents the remnants of an ancient coastal ridge and associated back plains. The present day topography is an undulating land surface with stony rises and a generally well defined ridge and south west facing slopes along the southern edge. The landscape is overlain by parallel and (in places) jumbled sand dunes.

Elevation: 20 - 130 m

Relief: 5 - 40 m

Soils: Shallow stony soils are extensive, and sandy soils, with or without clayey subsoils are common. Red loamy soils occur to a limited extent.

Main soils

B2a	Shallow rubbly calcareous sandy loam	(Extensive on stony rises)
G1	Loamy sand over brown light clay	(Common on sandy slopes)
H3	Deep siliceous sand	(Common on sand dunes)
G2	Bleached sand over sandy clay loam	(Limited on sand dune)

Minor soils

B2b	Shallow gravelly calcareous loam	(Outwash slopes.)
C3/D2	Loam over red clay	(Swales)
C1	Gradational red sandy loam	(Swales)

Main features: The Marmon Jabuk Land System is characterized by undulating slopes with either shallow stony soils or sand over clay soils, both of which have agricultural limitations; restricted moisture holding capacity, low fertility, water repellence and wind erosion potential. Sporadic sand dunes are highly susceptible to erosion and repellence. The limited areas of loamy depressions have few limitations for agriculture. Saline seepages adjacent to some sandhills are probably associated with localized rather than regional watertables.

Soil Landscape Unit summary: 21 Soil Landscape Units (SLUs) mapped in the Marmon Jabuk Land System:

SLU	% of area	Main features #
HrA HsA HsK	3.4 1.3 0.4	Closed depressions formed on clayey sands, sandy clays and occasionally heavy clays. Low sandy rises occupy up to 30% of the area. There are limited areas of gilgai on clayey sediments. **HrA** Flats with less than 10% sandy rises. **HsA** Flats with 10-30% sandy rises. **HsK** Flats with 10-30% sandy rises and up to 10% wet saline depressions. Main soils: loam over red clay - **C3/D2** (including some clayey variants) (E), with gradational red sandy loam - **C1** (C), loamy sand over brown light clay - **G1** (L). Deep siliceous sand - **H3** (M-L) and bleached sand over sandy clay loam - **G2** (M-L) occur on sandy rises. Key properties: Drainage: Well to moderately well drained. Marginally saline depressions are imperfectly to poorly drained. Fertility: Moderate. Physical condition: Good in surface. Fair in subsoils on lower ground. AWHC: Low to moderate. Salinity: Low, except in HsK depressions. Erosion potential: Water: Moderately low. Wind: Moderately low. Water repellence: Nil Rockiness: Minor sandstone and ironstone gravel. Summary: Flat land with few limitations and generally good productive potential.
O-B	0.2	Moderate jumbled sandhills with less than 10% swale area. Main soils: deep siliceous sand - **H3** (E) and bleached sand over sandy clay loam - **G2** (E). Key properties: Drainage: Rapidly drained. Fertility: Very low. Physical condition: Good. AWHC: Low to moderately low. Salinity: Low. Erosion potential: Water: Low. Wind: High. Water repellence: Strong. Rockiness: None. Summary: Jumbled dunes with soils that are highly susceptible to wind erosion and water repellence. The soils are also highly infertile. This land has little value for dryland agriculture.
ODa ODb ODc ODe ODf ODi	2.2 4.6 4.3 7.0 9.2 2.6	Undulating rises formed on calcreted Tertiary sediments overlain by more than 30% moderate sandhills formed on Molineaux Sand. **ODa** 60-90% large sandhills. **ODb** 60-90% moderate sandhills. **ODc** 60-90% low sandhills. **ODe** 30-60% moderate sandhills. **ODf** 30-60% low sandhills. **ODi** 60-90% moderate sandhills with up to 10% wet saline swales. Main soils: deep siliceous sand - **H3** (L-E) and bleached sand over sandy clay loam - **G2** (L-E) on sandhills, and shallow rubbly calcareous loam - **B2a** (E) with loamy sand over brown light clay - **G1** (L) on rises and flats. Key properties: Drainage: Rapid to well drained. Imperfect to poor in minor wet swales (ODi). Fertility: Very low (sandhills) to moderately low (flats). Physical condition: Good. AWHC: Low to moderately low. Salinity: Low, but moderate at depth on flats. Moderate in wet swales (ODi).

		Erosion potential: Water: Low. Wind: Moderate to high (sandhills). Water repellence: Strong (sandhills), moderate (sandy flats) and nil (loamy flats). Rockiness: None on sandhills, sporadic in flats. Summary: Very gently undulating land with mainly sandy surfaced soils. On dunes the soils are highly susceptible to wind erosion and water repellence. The soils are also highly infertile. The flats are more favourable, but the alternating dune-flat landscape is difficult to manage.
ORE ORG ORH	<0.1 1.2 1.0	Gently undulating flats formed on Tertiary sediments overlain by more than 30% sandhills formed on Molineaux Sand. **ORE** 60-90% large sandhills. **ORG** 60-90% low sandhills. **ORH** 30-60% moderate sandhills. Main soils: loam over red clay - **C3/D2** (L-C), gradational red sandy loam - **C1** (M-L), and loamy sand over brown light clay - **G1** (M-L) on flats, and deep siliceous sand - **H3** (L-E) and bleached sand over sandy clay loam - **G2** (L-E) on sandhills. Key properties: Drainage: Rapid to well drained. Fertility: Very low (sandhills) to moderately low (flats). Physical condition: Good. AWHC: Low to moderately low. Salinity: Low, but moderate at depth on flats. Erosion potential: Water: Low. Wind: Moderate to high (sandhills). Water repellence: Strong (sandhills), moderate (sandy flats) and nil (loamy flats). Rockiness: None on sandhills, sporadic in flats. Summary: Very gently undulating land with mainly sandy surfaced soils. On dunes the soils are highly susceptible to wind erosion and water repellence. The soils are also highly infertile. The flats are more favourable, but the alternating dune-flat landscape is difficult to manage.
QKB QKE	6.8 1.5	Slopes and flats formed on alluvial outwash sediments. Surface calcrete stone is extensive. **QKB** Lower slopes with gradients of up to 4%. **QKE** Flats and depressions. Main soil: shallow gravelly calcareous loam - **B2b** (D). Key properties: Drainage: Well drained. Fertility: Moderate. Physical condition: No soil restrictions to emergence or root growth. AWHC: Low due to sheet calcrete or heavy rubble at shallow depth. Salinity: Low at surface, but moderate to high below the calcrete. Erosion potential: Water: Low to moderately low depending on slope. Wind: Low. Water repellence: Nil. Rockiness: Extensive surface stone and some sheet rock. Summary: The slopes and flats are generally arable although water availability is limited by shallow soil depth, and cultivation is hampered by surface stone and rocky reefs.
QLB	5.4	Stony slopes formed on sheet calcrete. There is extensive surface stone, but the land is generally arable. Main soil: shallow rubbly calcareous loam - **B2a** (D). Key properties: Drainage: Well drained Fertility: Moderate. Physical condition: No soil restrictions to emergence or root growth. AWHC: Moderate to moderately low. Salinity: Low at surface, but moderate below the calcrete. Erosion potential: Water: Moderately low. Wind: Low.

		Water repellence: Nil. Rockiness: Surface stone is common, but generally not a hindrance to cultivation. Summary: These slopes are transitional between the very rocky QMB, and the less rocky QXB/C. Although shallow and stony, the land is virtually 100% arable, the main limitation being restricted waterholding capacity and rootzone depth.
QMB	2.3	Very stony slopes with sheet calcrete at or near the surface over most of the area. Main soil: shallow rubbly calcareous loam - **B2a** (D). Key properties: Drainage: Well to rapidly drained. Fertility: Low. Physical condition: No soil restrictions to emergence or root growth. AWHC: Low to very low due to calcrete at shallow depth. Salinity: Low, although moderate below the calcrete cap. Erosion potential: Water: Low to moderately low. Wind: Low. Water repellence: Nil. Rockiness: Extensive outcrop and surface stone - these areas are essentially non-arable. Summary: The slopes are too rocky for farming, and generally remain under scrub.
QOB QOL	13.6 7.3	Undulating rises formed on calcreted Tertiary sediments. There is variable surface calcrete. The landscape is overlain by up to 30% jumbled sand hills. **QOL** differs from **QOB** in having scattered saline seepages adjacent to some sandhills. Main soils: shallow rubbly calcareous loam - **B2a** (E), with loamy sand over brown light clay - **G1** (L) on rises and deep siliceous sand - **H3** (L) and bleached sand over sandy clay loam - **G2** (L) on sand hills. Key properties: Drainage: Well to rapidly drained. Imperfect to poor in some QOL flats. Fertility: Moderately low (low on sandhills). Physical condition: No restrictions in the soil above the calcrete. AWHC: Low (H3 soils), moderate (G2/G1 soils) and very low (B2a soils). Salinity: Low, but often moderate in calcareous subsoils. Moderate to highly saline seepage in some QOL flats. Erosion potential: Water: Moderately low. Wind: Low (B2a soils), moderately low (G1 soils) and moderately high (H3/G2 soils). Water repellence: Strong (H3/G2 soils), moderate (G1 soils) and nil (B2a soils). Rockiness Up to 20% surface stone and calcrete outcrop on stony slopes. Nil elsewhere. Summary: The slopes consist of mainly shallow stony soils with productive potential limited mainly by low water holding capacity. The sub- dominant sandy soils are infertile and prone to water repellence and wind erosion. Deeper sands on sandhills are most susceptible.
QXB QXC	22.3 3.4	Undulating rises formed on calcreted Tertiary sediments, silicified in places. There is variable surface stone and up to 10% outcropping calcrete. The landscape is overlain by about 10% sand spreads and occasional jumbled sand hills. **QXB** Gently undulating slopes of up to 5%, with about 10% depressions underlain by Tertiary sediments (as for HsA). **QXC** Undulating slopes of up to 10%. Main soils: shallow rubbly calcareous loam - **B2a** (E), with loamy sand over brown light clay - **G1** (E) on rises, sandspreads and flats, deep siliceous sand - **H3** (L) and bleached sand over sandy clay loam - **G2** (L) on sand spreads, and loam over red clay - **C3/D2** (L-M) and gradational red sandy loam - **C1** (M) in depressions. Key properties: Drainage: Generally well to rapidly drained. Fertility: Low (sandy soils) to moderately low/moderate (loamy and calcareous soils). Physical cond.: No physical limitations to root growth above calcrete layers. Surface stone and calcrete reefs make some areas difficult to work. AWHC: Low to moderately low.

		Salinity:	Low at the surface, but often moderate in the subsoil.
		Erosion potential:	Water: Low to moderately low. Wind: Moderately low to moderate.
		Water repellence:	Nil to low generally. Moderate to strong on sand spreads.
		Rockiness	Variable, up to 20% or more surface calcrete stone and outcrop.
		Summary: The slopes consist of mainly shallow calcareous loams with fair productive potential, limited by shallow depth and stone. The sub- dominant sandy soils are infertile and prone to water repellence and wind erosion.	

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

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

Detailed soil profile descriptions:

B2a Shallow rubbly calcareous loam (Petrocalcic, Lithocalcic Calcarosol)
Calcareous rubbly sandy loam to light sandy clay loam becoming more clayey with depth with variable rubble throughout, overlying hard calcrete (sheet or boulder) at depths of between 20 and 50 cm, becoming softer below 100 cm and overlying Blanchetown Clay.

B2b Gravelly shallow calcareous loam (Petrocalcic, Lithocalcic Calcarosol)
Medium thickness calcareous sandy loam to sandy clay loam with variable rubble, abruptly overlying sheet calcrete grading to coarse to medium textured and very gravelly slope wash sediments.

C1 Gradational red sandy loam (Calcic, Red Kandosol)
Thin to medium thickness sandy loam grading to a red weakly structured sandy clay loam, highly calcareous from about 20 cm, over Parilla Sand within 100 cm.

C3/D2 Loam over red clay (Calcic, Red Dermosol / Chromosol)
Thin sandy loam to sandy clay loam (sometimes ironstone gravelly) overlying a red sandy to medium clay with soft carbonate at about 40 cm, grading to Parilla Sand within 100 cm.

G1 Loamy sand over brown light clay (Lithocalcic, Brown Chromosol)
Medium thickness loamy sand overlying a brown sandy clay loam to light clay with abundant Class III C rubbly carbonate within 40 cm, becoming softer with depth. Blanchetown Clay or Loxton/Parilla Sands underlie the soil below 100 cm.

G2 Bleached sand over sandy clay loam (Bleached, Red / Brown Kandosol)
Thick to very thick bleached sand with a thin grey surface, over a red or brown light sandy clay loam becoming sandier and slightly calcareous with depth.

H3 Deep siliceous sand (Calcareous, Arenic, Bleached-Orthic Tenosol)
Grey loose sand with a bleached A2 layer becoming yellow with depth and grading to a moderately calcareous loamy sand to sandy loam at about 100 cm.

Further information: DEWNR Soil and Land Program