

LEL Lake Ellen Land System

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

Gently undulating plains and swamps south west of Tintinara

Area: 198.2 km²

Annual rainfall: 485 – 535 mm average

Geology: Sandy clays and limestones of the Padthaway Formation (lagoon floor sediments) with minor Bridgewater Formation calcarenites (remnants of ancient coastal dunes). Swamp floor sediments (mainly marls) occur in depressions. Molineaux Sand deposits are extensive, overlying the other geological units.

Topography: The Land System is a gently undulating plain characterized by sandy flats, low sandy rises, smaller areas of higher jumbled sand hills, and occasional stony rises. Scattered across the landscape are swampy depressions and salt lakes. These are increasing in area as saline groundwater tables rise to within a metre or so of the surface.

Elevation: 6 - 20 m

Relief: Less than 10 m

Soils: The soils include deep sands and minor shallow stony soils on rises, sandy texture contrast soils on well drained flats, and various wet saline soils in poorly drained depressions.

Main soils

Soils on well drained flats

G3 Thick sand over brown clay

Soils on sandy rises

H3 Deep bleached sand

G2 Sand grading to sandy clay loam

Minor soils

Soils in poorly drained and swampy depressions

N2a/G4 Sand over yellow and grey saline waterlogged clay

N2b Wet highly saline grey clay

N2c Wet saline calcareous loam

Soils on well drained flats

B7a Sand over yellowish brown clay on calcrete

Soils on stony rises

B3 Shallow stony loamy sand over calcrete

B7b Sand over yellowish brown clay on calcrete

Main features: The Lake Ellen Land System is characterized by low fertility and water repellent sandy flats and rises with high wind erosion potential, restricting land use primarily to perennial pastures. The land is being increasingly affected by rising saline ground water tables, so that approximately 25% is either salt affected or swampy.



Soil Landscape Unit summary: 14 Soil Landscape Units (SLUs) mapped in the Lake Ellen Land System:

SLU	% of area	Main features #
MHB	0.7	<p>Low rises formed on calcreted calcarenite and overlain by siliceous sand. Relief is up to 10 m. There is variable surface calcrete, depending on thickness of sand, but usually less than 20% stone cover. There are occasional reefs of sheet rock. Sand is sometimes in dune form.</p> <p>Main soils: <u>deep bleached sand</u> - H3 (C) and <u>sand grading to sandy clay loam</u> - G2 (C) on sandy slopes (about half the area), with <u>shallow stony loamy sand over calcrete</u> - B3 (C) and <u>sand over yellowish brown clay on calcrete</u> - B7b (L) on stony land.</p> <p>Key properties:</p> <p>Drainage: Rapidly to well drained.</p> <p>Fertility: Very low on deep sands to moderately low on stony soils.</p> <p>Physical condition: Surface soils are soft to loose and do not restrict root growth. Where subsoils occur they are friable and not restrictive to root growth.</p> <p>AWHC: Moderate on sandy soils. Very low to low on stony soils, due to shallow depth to hard calcrete.</p> <p>Salinity: Low.</p> <p>Erosion potential: Water: Low to moderate, depending on slope. Wind: High on sand spreads to moderately low on stony ground.</p> <p>Water repellence: Strong on sand spreads. Low to slight on stony land.</p> <p>Rockiness: Nil on sand spreads. Variable to 50%, usually less than 20%.</p> <p>Other: The higher rises are exposed.</p> <p><u>Summary:</u> Deep, low fertility, water repellent and erodible sands with shallow, stony soils of marginal fertility. Low rises formed on calcarenite.</p>
NAA NAa	4.1 2.8	<p>Flat plains with occasional very low stony or sandy rises formed on calcreted sediments of the Padthaway Formation. Groundwater tables are within two metres of the surface.</p> <p>NAa is where watertables are sufficiently close to the surface that soil is salt affected.</p> <p>Main soils: <u>sand over yellowish brown clay on calcrete</u> - B7a (E) and <u>shallow stony loamy sand over calcrete</u> - B3 (E).</p> <p>Key properties:</p> <p>Drainage: Well or moderately well (NAA) to imperfectly (NAa) drained.</p> <p>Fertility: Moderately low.</p> <p>Physical condition: There are no surface or subsurface soil structure impediments to root growth.</p> <p>AWHC: Moderately low.</p> <p>Salinity: Moderately low (NAA) to moderately high (NAa). This land is being increasingly affected by rising saline water tables.</p> <p>Erosion potential: Water: Low. Wind: Low to moderately low.</p> <p>Water repellence: Slight to moderate.</p> <p>Rockiness: Up to 5% surface calcrete stone with heavier patches.</p> <p><u>Summary:</u> Slightly to moderately saline flats dominated by soils with sandy surfaces and thin clayey subsoils over calcrete. Drainage is moderate, fertility is moderately low.</p>
NGD NGd NGp	1.1 13.5 34.8	<p>Gently undulating flats and sandy rises with some stony rises formed on calcreted sediments of the Padthaway Formation and Molineaux Sands. The land is underlain by saline water tables at moderately shallow depth.</p> <p>NGd is where watertables are shallower, resulting in higher soil salinity.</p> <p>NGp is where watertables are sufficiently close to the surface that saline swamps have developed in depressions.</p> <p>Main soils: <u>thick sand over brown clay</u> - G3 (E-V) on well drained flats, <u>sand grading to sandy clay loam</u> - G2 (M-L) and <u>deep bleached sand</u> - H3 (M-L) on sandy rises, <u>sand over yellowish brown clay on calcrete</u> - B7b (M) on stony rises, and <u>sand over yellow and grey clay, saline and</u></p>



		<p><u>waterlogged in places</u> - N2a/G4 (L-M), in more saline and swampy depressions.</p> <p>Key properties:</p> <p>Drainage: Rapidly to moderately well drained. Imperfectly to very poorly drained on more saline flats and swampy depressions.</p> <p>Fertility: Low.</p> <p>Physical condition: No surface limitations. Some subsoil clays (G4 soils) are dispersive and restrict root growth.</p> <p>AWHC: Low to moderately low.</p> <p>Salinity: Low on sandy and stony rises. Low to moderately high on sandy flats. High to extreme on poorer drained and swampy flats.</p> <p>Erosion potential: Water: Low. Wind: Moderately low to high (on sandy rises).</p> <p>Water repellence: High on sandy rises and flats.</p> <p>Rockiness: Nil generally, but 10-20% surface calcrete on stony rises.</p> <p><u>Summary</u>: Low fertility, water repellence and wind erosion potential limit productivity on sandy flats and rises. Increasing waterlogging and salinity are the main problems on lower lying areas.</p>
O-A	3.2	<p>Moderate to steep longitudinal, parabolic or jumbled siliceous sand hills, more than 12 metres high, formed on Molineaux Sand.</p> <p>Main soils: <u>deep bleached sand</u> - H3 (E) (throughout), <u>thick sand over brown clay</u> - G3 (E) on lower slopes and swales and <u>sand grading to sandy clay loam</u> - G2 (E) on low rises.</p> <p>Key properties:</p> <p>Drainage: Rapid.</p> <p>Fertility: Very low.</p> <p>Physical condition: No limitations (soft to loose sand). Clayey subsoils, where present, are friable.</p> <p>AWHC: Moderately low to moderate.</p> <p>Salinity: Low.</p> <p>Erosion potential: Water: Low. Wind: High to very high.</p> <p>Water repellence: High.</p> <p>Rockiness: Nil.</p> <p><u>Summary</u>: The land is dominated by high sandhills with very low fertility, and prone to water repellence and wind erosion.</p>
OAK	6.4	<p>Gently undulating flats with low sand rises and sand spreads formed on Padthaway Formation sediments overlain by Molineaux Sand.</p> <p>Main soils: <u>deep bleached sand</u> - H3 (E) on rises, and <u>sand grading to sandy clay loam</u> - G2 (C) and <u>thick sand over brown clay</u> - G3 (L) on flats and.</p> <p>Key properties:</p> <p>Drainage: Rapidly to well drained.</p> <p>Fertility: Low to very low.</p> <p>Physical condition: There are no impediments to root growth.</p> <p>AWHC: Moderately low to moderate.</p> <p>Salinity: Low.</p> <p>Erosion potential: Water: Low. Wind: Moderate to high.</p> <p>Water repellence: High.</p> <p>Rockiness: Nil.</p> <p><u>Summary</u>: Isolated low sandy rises with very low fertility, well drained soils prone to water repellence and erosion.</p>



OEK	0.3	<p>Low sandy rises with sporadic stony outcrops. Main soils: <u>deep bleached sand</u> - H3 (E), <u>thick sand over brown clay</u> - G3 (C) and <u>sand grading to sandy clay loam</u> - G2 (L), with <u>shallow stony loamy sand over calcrete</u> - B3 (L) on stony outcrops.</p> <p>Key properties:</p> <p>Drainage: Rapidly to well drained. Fertility: Low to moderately low. Physical cond. No limitations. AWHC: Moderate to low. Salinity: Low. Erosion potential: Water: Low. Wind: Moderately low to moderately high. Water repellence: Moderate to high. Rockiness: Mostly nil but up to 20% surface calcrete on stony outcrops.</p> <p><u>Summary:</u> Well drained and not at risk of salinization, but low fertility, water repellence and erosion potential limit production.</p>
OSS OSX	4.1 15.5	<p>Jumbled dunes and low sandy rises formed on Molineaux Sand, with swampy flats and swales. OSS Jumbled dunes up to 10 m high with saline swampy swales. OSX Undulating low to moderate sandy rises, with up to 25% poorly drained and saline swampy swales and flats.</p> <p>Main soils: <u>deep bleached sand</u> - H3 (E) and <u>sand grading to sandy clay loam</u> - G2 (E) on dunes, with <u>thick sand over brown clay</u> - G3 (L) on better drained flats and <u>sand over yellow and grey clay, saline and waterlogged in places</u> - N2a/G4 (M-C) in imperfectly drained and swampy swales.</p> <p>Key properties:</p> <p>Drainage: Rapidly drained (rises). Poor to very poor (swampy swales). Fertility: Very low (rises). Low to moderately low (flats). Physical condition: Surface soils are not limiting. Subsoils on rises are either sandy or friable clays, but on flats are dispersive and likely to impede root growth. AWHC: Moderately low to moderately high. Salinity: Low to moderate low (rises). High to very high (flats). Erosion potential: Water: Low. Wind: Low (flats). Moderately high to high (rises). Water repellence: High, except in swampy depressions. Rockiness: Nil.</p> <p><u>Summary:</u> Most of the land has deep to moderately deep low fertility sands prone to water repellence and wind erosion. Flats are saline with low productive potential unless sown to salt tolerant species.</p>
ZS-	4.5	<p>Saline swamps formed on calcareous clays and marls. These are natural features, representing the lowest points in the local landscape. They are usually seasonally inundated. Vegetation is commonly a reflection of the level of salinity. Cutting grass is common on moderately saline land, tea tree and samphire on highly saline land, while extremely saline land is usually bare. Main soils: <u>sand over yellow and grey saline waterlogged clay</u> - N2a (E), <u>wet highly saline grey clay</u> - N2b (E) and <u>wet saline calcareous loam</u> - N2c (E).</p> <p>Key properties:</p> <p>Drainage: Very poorly drained. Salinity: Very high to extreme. Erosion potential: Water: Low. Wind: Low. Water repellence: Nil. Rockiness: Nil. Other: Seasonal inundation.</p> <p><u>Summary:</u> The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered.</p>



ZnJ	2.9	<p>Flat plains with occasional small (unmappable) swamps, and sandy or stony rises formed on clayey and limestone sediments of the Padthaway Formation. The land is seasonally waterlogged and affected by saline groundwater tables. Main soil is <u>sand over yellow and grey clay, saline and waterlogged in places</u> - N2a/G4 (D).</p> <p>Key properties:</p> <p>Drainage: Imperfectly to poorly drained, due to shallow water tables and dispersive clay subsoils.</p> <p>Fertility: Moderately low.</p> <p>Physical condition: Surface soil is not limiting. Dispersive subsoils prevent satisfactory root growth.</p> <p>AWHC: Moderate.</p> <p>Salinity: High. This land is influenced by rising saline ground water tables.</p> <p>Erosion potential: Water: Low Wind: Low.</p> <p>Water repellence: Nil.</p> <p>Rockiness: Nil.</p> <p><u>Summary:</u> Flats with poorly drained saline soils requiring salt tolerant species for productive pasture growth (ie clovers and conventional perennial grasses will not persist on most of this land).</p>
ZoP	6.1	<p>Complex landscape of flats and swamps interspersed with sand dunes and rises. The ratio of flats and swamps to dunes and rises is about 50:50. The land is formed on clayey and limestone sediments of the Padthaway Formation and calcareous clays and marls (swamp sediments), partially overlain by Recent windblown sands. Main soils: <u>sand over saline waterlogged clay</u> - N2a (L), <u>wet highly saline grey clay</u> - N2b (L) and <u>wet saline calcareous loam</u> - N2c (L) in swamps; <u>deep bleached sand</u> - H3 (C) and <u>sand grading to sandy clay loam</u> - G2 (L) on rises; with <u>thick sand over brown clay</u> - G3 (M) on better drained flats, and <u>sand over yellow and grey clay</u> - G4 (M) on lower lying flats.</p> <p>Key properties:</p> <p>Drainage: Poor to very poor (flats and swamps). Rapid (rises and dunes).</p> <p>Fertility: Moderately low (flats). Very low to low (rises).</p> <p>Physical condition: Surface soils have no limitations. Subsoils on flats are dispersive and restrict root growth. Subsoil structure not limiting on rises.</p> <p>AWHC: Moderate (flats) to moderately low (rises).</p> <p>Salinity: High to extreme (flats and swamps). Low (rises).</p> <p>Erosion potential: Water: Low. Wind: Low (flats). Moderate to high (rises).</p> <p>Water repellence: Low (flats) to high (rises).</p> <p>Rockiness: Nil.</p> <p><u>Summary:</u> Complex of sandy rises with very low fertility, water repellent, but non saline sands, with saline flats and saline swamps. This is difficult land to manage because of the range and severity of limitations.</p>

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

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| (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

Soils on sandy rises

- H3** Deep bleached sand (Basic, Arenic, Bleached-Orthic Tenosol)
Thick to very thick bleached sand, organically darkened at the surface over yellow sand continuing below 100 cm.
- G2** Sand grading to sandy clay loam (Mesotrophic, Yellow Kandosol)
Thick bleached sand, organically darkened at surface, over a yellow and red friable massive sandy clay loam.

Soils on well drained flats

- G3** Thick sand over brown clay (Eutrophic / Calcic, Brown Chromosol)
Thick to very thick sand to loamy sand with bleached A2 layer, abruptly overlying a firm to friable yellowish brown and red sandy clay, with or without soft carbonate at depth.
- B7a** Sand over yellowish brown clay on calcrete (Petrocalcic, Brown Chromosol)
Medium thickness sand overlying yellow friable clay on limestone or calcreted sandy clay within 50 cm.

Soils in poorly drained and swampy depressions

- N2a/G4** Sand over yellow and grey saline waterlogged clay (Hypercalcic / Lithocalcic, Grey Sodosol OR Sodosolic Hydrosol)
Medium thickness loamy sand abruptly overlying a grey and yellow brown mottled clay (seasonally saturated), with rubbly to soft carbonate at depth.
- N2b** Wet highly saline grey clay (Dermosolic, Hypersalic Hydrosol)
Medium thickness dark grey to black clay loam to clay grading to a well structured dark grey clay with minor carbonates and a water table within 100 cm.
- N2c** Wet saline calcareous loam (Calcarosolic, Hypersalic Hydrosol)
Grey very highly calcareous loam grading to a pale grey clay loam over a white very highly calcareous silty clay loam by about 30 cm, with a water table within 100 cm.

Soils on stony rises

- B3** Shallow stony loamy sand over calcrete (Petrocalcic, Leptic Tenosol)
Loamy sand to loam with variable rubble and slight clay increase with depth overlying calcreted calcarenite shallower than 50 cm.
- B7b** Sand over yellowish brown clay on calcrete (Petrocalcic, Brown Chromosol)
(As for well drained flats – above).

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

