

MNA McNamara Land System

Very gently undulating plains occupying most of the Hundred of McNamara

Area: 428.5 km²

Annual rainfall: 495 – 540 mm average

Geology: The Land System is underlain by sediments of the Padthaway Formation, which includes clays and interbedded sands and limestones or dolomites, deposited in coastal lagoons as the sea gradually receded over the last few hundred thousand years. Superimposed on the sediments are Recent windblown sands (Molineaux Sands). There are minor outcrops of Bridgewater Formation calcarenites (remnants of old coastal dunes). Swamps which are common in low lying areas are frequently veneered by thin black clay layers.

Topography: The McNamara Land System is an extensive plain lying between two ancient coastal dune ridges (to the west and the east). There is virtually no fall from east to west, but drift sand deposits in the form of parabolic and jumbled dunes and low irregular rises provide internal relief of 5 - 20 m. There is a saline watertable within a metre or so of the surface over most of the flats, so they are characteristically marginally to highly saline. Swamps are common. These are considered to be pre-European features where water tables have been at the surface for substantial periods. Seasonal inundation is a feature of non swampy lower lying areas.

Elevation: 30 m on the highest dunes to 10 - 15 m over substantial areas of flats

Relief: Maximum relief is 20 m, but more usually flats to sand rise relief is 5 - 15 m

Soils: Sandy surfaced soils are dominant. Some are deep, while others have subsoils ranging from friable light sandy clay loams through to dispersive clays or calcrete. A variety of wet saline soils occur in depressions.

Main soils

Soils of poorly drained flats and swamps

N2/G4 Sand over yellow and grey saline clay

B7/N2 Sand over saline clay on calcrete

N2a Wet saline sand

N2b Wet highly saline grey clay

N2c Wet saline calcareous loam

Soils of moderately well drained flats

G4 Sand over dispersive brown clay

Soils of sandy rises

H3 Deep bleached sand

G2 Sand grading to sandy clay loam

Minor soils

Soils of sandy rises and moderately well drained flats

B7 Sand over brown clay on calcrete - flats and rises

B8/B7 Shallow sand over calcrete - rises

G3 Thick sand over friable clay - flats

H3/G2 Very thick sand over sandy clay loam - flats

Vegetation: Broombush, tea-tree and mallee.



Main features:

The McNamara Land System consists of three distinctive elements.

- Moderately well to poorly drained flats with sandy texture contrast soils of moderately low fertility and moderate to high salinity. Generally these are too saline for any plants other than tolerant species to persist.
- Sand dunes and rises with deep infertile soils prone to water repellence and wind erosion.
- Swampy depressions with highly saline watertables at the surface for most of the time. These have little agricultural value.

Soil Landscape Unit summary: 13 Soil Landscape Units (SLUs) mapped in the McNamara Land System:

SLU	% of area	Main features #
MJB	0.1	<p>Low calcarenite rises, partially covered by Molineaux Sand.</p> <p>Low ridges (relict coastal dunes) with a NNW-SSE orientation. The ridges are up 30 m high, with slopes of 3-10%. They are partially overlain by low parallel east - west sand dunes, which tend to be more common in the north, and on the eastern sides of the ridges. There is variable surface stone on the non sandy slopes.</p> <p>Main soils: <u>shallow stony loamy sand over calcrete</u> - B3 (C), <u>bleached sand over calcrete</u> - B8 (L) and <u>loamy sand over red sandy clay on calcrete</u> - B7/B3 (L) on stony areas, and <u>deep bleached sand</u> - H3 (C) and <u>sand grading to sandy clay loam</u> - G2 (L) on sand dunes.</p> <p>Key properties:</p> <p>Drainage: Rapidly to well drained.</p> <p>Fertility: Moderately low on stony soils, to very low on deep sands.</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: Very low to low on stony soils, due to shallow depth to hard calcrete. Moderate on sandy soils.</p> <p>Salinity: Low</p> <p>Erosion potential: Water: Low to moderate, depending on slope. Wind: Moderately low on stony ground to high on sand spreads.</p> <p>Water repellence: Low to slight on stony land. Strong on sand spreads.</p> <p>Rockiness: Variable to 50%, usually less than 20%. Nil on sand spreads.</p> <p>Other: The higher rises are exposed.</p> <p><u>Summary:</u> Shallow, stony soils of marginal fertility with deep, low fertility, water repellent and erodible sands.</p>
NAp	2.3	<p>Complex of well and imperfectly drained flats, low stony and sandy rises and swamps formed on sandy sediments of the Padthaway Formation, and Molineaux Sands.</p> <p>Main soils: <u>very thick sand over sandy clay loam</u> - H3/G2 (E) throughout, with <u>sand over brown clay on calcrete</u> - B7 (L) and <u>sand over dispersive brown clay</u> - G4 (L) on well drained flats (B7 on stony rises as well); <u>sand over yellow and grey saline clay</u> - N2/G4 (M) and <u>sand over saline clay on calcrete</u> - B7/N2 (M) on imperfectly drained flats; <u>wet saline soils</u> - N2a/N2b/N2c (M) in swamps.</p> <p>Key properties:</p> <p>Drainage: Sandy rises - rapidly drained Higher flats - moderately well drained Poorly drained flats - imperfectly to poorly drained Swamps - very poorly drained</p> <p>Fertility: Moderately low (flats and stony rises) to very low (sandy rises)</p> <p>Physical condition: No structural problems with surface soils. Dispersive subsoils in G4 soils restrict root growth.</p> <p>AWHC: Low to moderate.</p> <p>Salinity: Low (rises), moderate to high (flats), extreme (swamps). This land is being increasingly affected by rising saline watertables.</p> <p>Erosion potential: Water: Low. Wind: Low to high.</p> <p>Water repellence: High (sandy rises), slight elsewhere.</p>



		<p>Rockiness: Less than 2% surface calcrete stone on flats. Up to 10% on stony rises.</p> <p><u>Summary:</u> Complex of moderately well to poorly drained flats, sandy rises and swamps. Apart from marginal fertility, increasing salinity is the main issue on the flats. The rises have very low fertility but are unaffected by salinity.</p>
NDA	0.9	<p>Very gently undulating plains with 10-20% low sandy or stony rises and 10-20% swamps formed on calcreted sediments of the Padthaway Formation. Groundwater tables are within two metres of the surface in places.</p> <p>Main soils: <u>sand over dispersive brown clay</u> - G4 (E), <u>sand over brown clay on calcrete</u> - B7 (E) and <u>thick sand over friable clay</u> - G3 (E). <u>Wet saline soils</u> - N2a/N2b/N2c occur in swamps.</p> <p>Key properties:</p> <p>Drainage: Moderately well to imperfectly drained. Dispersive subsoils and/or shallow groundwater tables prevent good drainage.</p> <p>Fertility: Moderate to moderately low.</p> <p>Physical condition: Surface soils usually sandy (no limitations to root growth). Subsoils are commonly dispersive, preventing even root growth.</p> <p>AWHC: Moderate.</p> <p>Salinity: Moderate on flats, high in swamps, low on rises. This land is being increasingly affected by rising saline groundwater tables.</p> <p>Erosion potential: Water: Low. Wind: Moderately low.</p> <p>Water repellence: Slight to moderate.</p> <p>Rockiness: Less than 2% surface calcrete stone.</p> <p><u>Summary:</u> Gently undulating plains with increasing salinization, characterized by sandy soils with dispersive clay subsoils over rubbly calcrete. Drainage is impeded, fertility moderately low.</p>
O-A	0.5	<p>Moderate to steep longitudinal, parabolic or jumbled siliceous sand hills, more than 12 metres high, formed on Molineaux Sand, occasionally underlain by calcreted calcarenite.</p> <p>Main soils: <u>deep bleached sand</u> - H3 (V) throughout, <u>thick sand over friable clay</u> - G3 (L) on lower slopes and swales, and <u>sand grading to sandy clay loam</u> - G2 (L) 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>
OSS	22.2	<p>Moderate to steep longitudinal, parabolic or jumbled siliceous sand hills, more than 12 metres high, with about 10% swampy swales where the saline groundwater table is at the surface.</p> <p>Main soils: <u>deep bleached sand</u> - H3 (E) throughout, <u>thick sand over friable clay</u> - G3 (L) on lower slopes and well drained swales, and <u>sand grading to sandy clay loam</u> - G2 (L) and <u>shallow sand over calcrete</u> - B8/B7 (M) on low rises, with <u>wet saline sand</u> - N2a (C) and <u>sand over yellow and grey saline clay</u> - N2/G4 (C) in swampy swales.</p> <p>Key properties:</p> <p>Drainage: Rapid (rises). Poor (swampy swales).</p> <p>Fertility: Very low to low (rises). Moderate in swales.</p> <p>Physical condition: No limitations in surface soils. Clayey subsoils in some swales are dispersive and restrict root growth.</p> <p>AWHC: Moderately low (rises). Moderate (swales).</p> <p>Salinity: Low (rises). Very high (swales).</p> <p>Erosion potential: Water: Low. Wind: High. Low to moderate in swales.</p> <p>Water repellence: High (rises). Low in swampy swales.</p> <p>Rockiness: Nil.</p>



		<p><u>Summary:</u> The land is dominated by low fertility sandhills prone to water repellence and wind erosion. Swampy swales are generally confined between sandhills and the salinity is unlikely to expand significantly.</p>
OSX	14.5	<p>Undulating low to moderate sandy rises, with up to 25% poorly drained and saline swampy swales and flats. The rises are formed on Molineaux Sands with Tertiary? clayey sands and sandstones. Swamp clays and marls underlie the flats. Saline water tables are at or near the surface in the low points of the landscape.</p> <p>Main soils: <u>sand grading to sandy clay loam</u> - G2 (E) and <u>shallow sand over calcrete</u> - B8/B7 (M) on low rises and lower slopes, <u>deep bleached sand</u> - H3 (E) on higher ground, <u>thick sand over friable clay</u> - G3 (M) on better drained flats, <u>wet saline sand</u> - N2a (L) and <u>sand over yellow and grey saline clay</u> - N2/G4 (M) on poorly drained flats, and <u>wet saline grey clay / calcareous loam</u> - N2b/N2c (M) in swamps.</p> <p>Key properties:</p> <p>Drainage: Well drained (rises). Poorly drained (flats).</p> <p>Fertility: Very low to low (rises) to moderately low (flats).</p> <p>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.</p> <p>AWHC: Moderately low to moderately high.</p> <p>Salinity: Low to moderate low (rises). High to very high (flats).</p> <p>Erosion potential: Water: Low. Wind: Low (flats). Moderately high to high (rises).</p> <p>Water repellence: High on rises. Low on flats.</p> <p>Rockiness: Nil.</p> <p><u>Summary:</u> Most of the land comprises 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-	14.7	<p>Saline swamps formed on calcareous clays and marls, and commonly veneered by a layer of black clay. These are natural features, representing the lowest points in the local landscape. They are usually seasonally inundated. Highly saline watertables are at or near the surface all year. Typical vegetation is tea tree, cutting grass, samphire (or commonly bare).</p> <p>Main soils: <u>wet highly saline grey clay</u> - N2b (E) and <u>wet saline calcareous loam</u> - N2c (E) and wet saline sand - N2a (C).</p> <p>Key features:</p> <p>Drainage: Very poorly drained.</p> <p>Fertility: Not relevant.</p> <p>Physical condition: Not relevant.</p> <p>AWHC: Not relevant.</p> <p>Salinity: Very high to extreme.</p> <p>Erosion potential: Water: Low Wind: Low.</p> <p>Water repellence: Nil</p> <p>Rockiness: Nil.</p> <p><u>Summary:</u> The swamps have little or no agricultural value, and where original vegetation exists, damage by livestock is likely.</p>
ZnG	4.3	<p>Complex of saline flats (50%), low sand rises (40%) and swamps (10%), formed on limestones and clayey sediments of the Padthaway Formation, partially overlain by Recent windblown sands.</p> <p>Main soils: <u>sand over yellow and grey saline clay</u> - N2/G4 (E) and <u>sand over saline clay on calcrete</u> - B7/N2 (C) on flats, <u>deep bleached sand</u> - H3 (C) and <u>sand grading to sandy clay loam</u> - G2 (L) on sandy rises, and <u>wet saline soils</u> - N2a/N2b/N2c (L) in swamps.</p> <p>Key properties:</p> <p>Drainage: Imperfectly to poorly drained, due to shallow water tables and low permeability subsoils. Sandy rises are rapidly drained. Swamps are very poorly drained.</p> <p>Fertility: Moderately low (flats) to very low (sandy rises).</p> <p>Physical condition: Surface soils - no limitations. Subsoils - dispersive clays restrict root growth.</p> <p>AWHC: Moderate.</p> <p>Salinity: High (flats), low (sand rises), very high to extreme (swamps). This land is</p>



		<p>affected by rising saline groundwater tables.</p> <p>Erosion potential: Water: Low Wind: Low (flats). High (sand rises)</p> <p>Water repellence: Slight to nil (flats). High (sand rises)</p> <p>Rockiness: Nil.</p> <p><u>Summary:</u> Imperfectly to poorly drained saline flats, with low infertile sandy rises. Productive potential of the flats depends on establishment of salt tolerant species.</p>
ZnJ Znj	7.5 10.1	<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.</p> <p>Znj is land where salinity is higher and which is subject to inundation in wet years.</p> <p>Main soils: <u>sand over yellow and grey saline clay</u> - N2/G4 (E), <u>sand over saline clay on calcrete</u> - B7/N2 (C) and <u>sand over dispersive brown clay</u> - G4 (L-C), with variable wet saline soils - N2a, N2b, N2c (L-C) in swamps. <u>Sand grading to sandy clay loam</u> - G2, <u>thick sand over friable clay</u> - G3 and <u>sand over dispersive brown clay</u> - G4 are limited in better drained areas.</p> <p>Key features:</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 (ZnJ) to very high (Znj). This land is influenced by rising saline groundwater 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 (i.e. clovers and conventional perennial grasses will not persist on most of this land).</p>
ZnM Znm	1.1 1.3	<p>Very gently undulating plains with occasional small (unmappable) swamps, and approximately 25% of the area covered by sandy rises up to two metres high. The land is formed on clayey and limestone sediments of the Padthaway Formation, partially overlain by Recent windblown sands. The land is seasonally waterlogged and affected by saline groundwater tables.</p> <p>Znm is land where salinity is higher and which is subject to inundation in wet years.</p> <p>Main soils: <u>sand over yellow and grey saline clay</u> - N2/G4 (E), <u>sand over saline clay on calcrete</u> - B7/N2 (C) and <u>sand over dispersive brown clay</u> - G4 (L-C) on flats and swamp areas, with <u>deep bleached sand</u> - H3 (L) and <u>sand grading to sandy clay loam</u> - G2 (L) on rises.</p> <p>Key features:</p> <p>Drainage: Imperfectly to poorly drained, due to shallow water tables and dispersive clay subsoils. Well drained on rises.</p> <p>Fertility: Moderately low. Very low on rises.</p> <p>Physical condition: Surface soil is not limiting. Dispersive subsoils prevent satisfactory root growth. No limitations on rises.</p> <p>AWHC: Moderate.</p> <p>Salinity: Flats: High (ZnM) to very high (Znm). Rises: Low</p> <p>Erosion potential: Water: Low. Wind: Low. High on rises.</p> <p>Water repellence: Nil on flats. High on rises.</p> <p>Rockiness: Nil.</p> <p><u>Summary:</u> Flats with poorly drained saline soils requiring salt tolerant species for productive pasture growth (i.e. clovers and conventional perennial grasses will not persist on most of this land). The rises are not salt affected, but have very low fertility, water repellent soils.</p>
ZoP	20.5	<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 sandy sediments of the Padthaway Formation and calcareous clays and marls (swamp sediments), partially overlain by</p>



	<p>Recent windblown sands.</p> <p>Main soils: <u>wet saline sand</u> - N2a (C), <u>sand over yellow and grey saline clay</u> - N2/G4 (L), and <u>wet saline grey clay / calcareous loam</u> - N2b/N2c (L) on flats and in swamps, <u>deep bleached sand</u> - H3 (C) and <u>sand grading to sandy clay loam</u> - G2 (C) on rises, and <u>sand over dispersive brown clay</u> - G4 (M), <u>very thick sand over sandy clay loam</u> - H3/G2 (M) and <u>sand over brown clay on calcrete</u> - B7 (M) on better drained flats.</p> <p>Key features:</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 (sandy or friable).</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 saline flats, saline swamps and sandy rises with very low fertility, water repellent, but non saline sands. This is very difficult land to manage because of a) the severity of limitations, and b) the complexity of the landscape.</p>
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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:

Soils of moderately well drained flats

- B7** Sand over brown clay on calcrete (Petrocalcic, Brown Chromosol)
Medium thickness sand overlying a yellowish brown clay on limestone or calcreted sandy clay within 50 cm.
- G3** Thick sand over friable clay (Eutrophic / Calcic, Brown Chromosol)
Thick to very thick bleached sand to loamy sand with an organically darkened surface abruptly overlying a friable yellowish brown and red sandy clay, with or without soft carbonate accumulations, sometimes underlain by calcreted calcarenite below 100 cm.
- G4** Sand over dispersive brown clay (Lithocalcic / Petrocalcic, Brown Sodosol)
Medium thickness sand sharply overlying a coarsely structured dispersive brown and yellow mottled clay over rubbly or sheet calcrete.
- H3/G2** Very thick sand over sandy clay loam (Eutrophic, Brown Chromosol)
Very thick grey sand with a bleached A2 layer abruptly overlying a thin band of brown fine sandy clay loam with a limestone layer capping sandy Padthaway Formation sediments within 100 to 150 cm.

Soils of poorly drained flats and swamps (soils commonly veneered by black clay)

- N2/G4** Sand over yellow and grey saline clay (Hypercalcic / Lithocalcic, Grey Sodosol OR Sodosolic, Salic Hydrosol)
Medium thickness loamy sand abruptly overlying a grey and yellow brown mottled clay (seasonally saturated), with rubbly to soft carbonate at depth.
- B7/N2** Sand over saline clay on calcrete (Petrocalcic, Sodosolic, Salic Hydrosol)
Bleached sand overlying a coarsely structured mottled grey sandy clay loam to clay, with a calcrete pan



within 50 cm and a saline water table at depth.

- N2a** Wet saline sand (Sandy Calcarosolic / Tenosolic Salic Hydrosol)
Thick bleached (calcareous) sand over a grey and yellow mottled clayey sand in a water table at about 100 cm.
- N2b** Wet highly saline grey clay (Dermosolic, Salic 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 (Loamy Calcarosolic, Salic 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 of sandy rises

- B8/B7** Shallow sand over calcrete (Petrocalcic, Bleached-Leptic Tenosol / Petrocalcic, Brown Chromosol)
Medium to thick bleached sand with variable thin (often absent) brown clayey sand to sandy clay loam subsoil, over calcreted calcarenite within 50 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, sometimes underlain by calcreted calcarenite below 100 cm.
- 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, sometimes underlain by calcreted calcarenite.

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

