

INN Innes Land System

Undulating to gently undulating rises and low hills with intervening saline flats and salt lakes; also with sand dune deposits along the coast which spread inland. The rises and low hills are relict calcreted calcarenite dune rises which have been extensively overlain in places by more recently deposited jumbled sand dunes. The main salt lakes are Chain of Lakes, Spider Lake, Snow Lake, Marion Lake and Deep Lake.

Area: 112.6 km²

Landscape: The main topographic features of this system are rises and low hills which are relict calcarenite dunes – although basement rock highs may underlie some of these. The calcarenite is calcreted at the surface. Shelly jumbled coastal sand dunes overlie the relict dune areas along the coast. A number of dune sand deposits also occur further inland, overlying older sediments and topography, mostly in the form of low jumbled sand dunes. The coastline is dominated by coastal cliffs along the south coast of the system, and by sandy beaches along the west coast of the system. The cliffs are mostly calcarenite. Rocky reefs are common, many are granitic.

The rises and low hills are separated in many places by flats and depressions. These are largely old backswamps. Gypsum-rich salt lakes, gypsum-rich lunette mounds, swampy flats, calcreted flats, low relict dune rises, carbonate sand flats, and a few low carbonate sand dunes all occur in these areas. Salinity levels are mostly marginal to extreme. The calcreted flats and carbonate sand flats are old salt lake areas where the lake sediments have been overlain by older and newer carbonate sand deposits. The older deposits have become calcreted.

However, it is also common to find lake sediments and associated lunette deposits underlain by carbonate sand deposits. Recent loamy lake sediments overlie calccrete in many low lying areas. It is clear that there have been numerous accessions of carbonate sand over this system in recent geological times. The salt lake sediments themselves mainly consist of gypsum-rich white silty clay loams and light clays.

Annual Rainfall: 460 – 520 mm average

Main soils:

- H1** *carbonate sand* (around 38% of area)
- B1** *shallow carbonate dominant soil on calccrete* (around 30% of area)
- N2** *saline soil* (around 22% of area)

Minor soils:

- A8** *gypseous calcareous loam* (around 5% of area)
- A1** *carbonate dominant soil* (approximately 3% of area)

Main features: Soils range from deep shell sands, to shallow loams and sands on calccrete, to deep clay loamy and light clayey saline soils. The main attributes of the soils and land within the system are salinity, the highly infertile nature of the carbonate-rich soils, wind erosion potential, stoniness and shallow soil depth, undulating terrain, and some water repellence. The salinity within this system is natural. The vast majority of the system lies within Innes National Park, and is predominantly covered by native scrub, so nature conservation is of primary importance. The main industry in the area since European settlement has been gypsum harvesting from salt lake surfaces. This has mainly occurred in Marion Lake, Snow Lake, and the small salt lake below Inneston.



Soil Landscape Unit summary: Innes Land System (INN)

SLU	% of area	Main features #
WGa	0.7	Coastal dunes and flats.
WGb	0.4	Main soils: mostly deep carbonate sands with little profile development (soil H1). With minor
WGC	3.8	to common shallow carbonate sand on calcrete in some flats and depressions (soil B1).
WGc	0.9	
WGD	2.7	<i>Mostly coastal sand dunes, sandy beaches and sand spreads:</i>
WGd	2.6	WGa – non arable mostly bare sandy beaches, foredunes, and some low jumbled coastal
WGE	3.1	dunes (7-5a, 3-2y).
WGe	0.1	WGb – non arable sandy beaches, coastal cliffs, sand spreads on cliff-slopes, and rocky
WGN	0.4	reefs (5-7a, 3-2y). Sandy beaches primarily occur in coves separated by rocky headlands.
WGE	2.4	WGC – non arable mostly high jumbled coastal sand dunes (dune height to over 40m,
WGEa	1.5	approx. 2-10% flats, 7-5a, 3-2y).
WGEr	1.4	WGc – non arable mostly bare high jumbled coastal sand dunes (7a, 3y).
WGK	1.0	WGD – non arable mostly moderate height jumbled coastal sand dunes (2-10% flats, 7-5a, 3-
WGKx	1.1	2y).
WGT	0.4	Wgd – non arable and mostly bare moderate height jumbled coastal sand dunes and sand
WGTx	0.2	spreads, with sandy beaches, and minor areas of rocky reef and coastal cliffs (7a, 3-2y).
WGU	0.5	WGE – non arable low coastal sand dunes: mostly clifftop, but some with dunes abutting
		sandy beaches. Includes minor areas of coastal cliff (1s, 7-5a, 3-2y).
		WGe – non arable mostly bare low coastal sand dunes (1s, 7a, 3y).
		WGN – non arable slopes with sand spreads or low dunes (slopes 10-30%, 1-2e, 4a, 2-1y).
		<i>Mostly near-coastal sand dunes:</i>
		WGE – non arable near-coastal low to moderate height jumbled sand dunes overlying
		plains (2-1s, 4-5a, 1-2y).
		WGEa – non arable near-coastal low to moderate height jumbled sand dunes overlying rises
		(1s, 5a, 2-3y).
		WGEr – non arable near-coastal low jumbled sand dunes overlying low hills (1s, 7-5a, 3-2y).
		<i>Low coastal sand dunes and flats:</i>
		WGK – non arable low coastal sand dunes and sandy flats (2-3s, 4a, 2-1y).
		WGKx – non arable raised plains with low coastal sand dunes and sand spreads (1-2s, 4-5a,
		2-3y).
		<i>Mostly coastal flats:</i>
		WGT – non arable to semi arable coastal flats with areas of very low sand dunes (2w, 3-2s,
		3a, 1-2y).
		WGTx – non arable coastal flats and slight slopes with areas of very low sand dunes (2-1w, 3-
		2s, 3-4a, 2y).
		WGU – non arable coastal depressions with areas of very low sand dunes and marginal
		salinity (3-4w, 4-3s, 3-2a, 1-2y).
WAB	1.7	Coastal cliffs (mostly calcarenite), with some rocky reef areas (including granite) and sandy
		beaches (cliff slopes mostly >100%, cliffs up to 80m high, 3y).
WU-	0.2	Rocky reefs, lagoons and sandy tidal flats.
M-A	0.4	Relict coastal plains and slopes.
M-B	0.04	Main soils: bare calcrete (code RR) and shallow carbonate sand on calcrete (soil B1).
		M-A – non arable clifftop coastal plains and slight slopes (slopes 0-4%, 1e, 1s, 2-3a, 5-4r, 3y).
		M-B – non arable clifftop coastal slopes (slopes 0-10%, 2-1e, 1s, 2-3a, 5-4r, 3y).
MaA	1.0	Relict dune rises and flats.
Maa	0.4	Main soils: shallow carbonate sand on calcrete (soil B1). With minor to common areas of
Mab	0.2	moderate depth to deep carbonate sand (soil H1).
Mae	0.1	MaA – non arable gently undulating plains (slopes 0-1.5%, 1e, 2-1s, 2a, 2-4r, 1y).
MaYA	0.3	Maa – non arable slightly raised gently undulating to level plains or slight rises (slopes 0-1%,
MaYB	1.4	1e, 3s, 2-3a, 3-4r, 1y).
MaYC	7.2	Mab – non arable slopes (slopes 1-5%, 1-2e, 2-3s, 2-3a, 2-4r, 1y).
		Mae – non arable depressions (slopes 0-1%, 1e, 2w, 3-2s, 2-3a, 2-4r, 1y).
		MaYA – non arable low to very low relict jumbled dune rises (slopes 0-1.5%, 1e, 2-3s, 2-3a, 3-
		4r, 1-2y).
		MaYB – non arable mostly moderate height to low relict jumbled dune rises and slopes
		(slopes 0-6%, 1-2e, 1-2s, 3-4a, 3-4r, 2-1y).
		MaYC – non arable mostly high relict jumbled dune rises and slopes (slopes 0-10%, 2-1e, 1s, 3-
		4a, 3-4r, 3-2y).
Mba	0.9	Relict coastal dune rises and flats: with many areas covered by more recent sand deposits.



MbB	1.4	Main soils: moderate depth to deep carbonate sand (soil H1) and shallow carbonate sand on calcrete (soil B1).
Mbb	0.2	
MbC	1.5	Mba – non arable to semi arable slightly raised gently undulating to level plains or slight rises (slopes 0-1%, 1e, 3-2s, 3-2a, 1-3r, 1y).
MbCx	0.1	
Mbe	1.9	MbB – non arable to semi arable slopes (slopes 0.5-3.5%, 1-2e, 1-2s, 3a, 1-3r, 2-1y).
Mbg	2.9	Mbb – non arable to semi arable slopes (slopes 1-3.5%, 1-2e, 2-3s, 3-2a, 1-3r, 1-2y).
MbYA	1.4	MbC – non arable to semi arable slopes (slopes 2-10%, 2-1e, 1-2s, 3-4a, 1-3r, 2y).
MbYB	6.1	MbCx – semi arable exposed slopes (slopes 2-10%, 2-1e, 1-2s, 4-3a, 1-3r, 3y).
MbYC	11.3	Mbe – non arable to semi arable near-coastal depressions (slopes 0-1%, 1e, 2-3w, 3-2s, 3-2a, 1-3r, 1-2y). Mbg – non arable to semi arable relatively low lying flats (slopes <1%, 1e, 3-4w, 4-3s, 3-2a, 1-3r, 1y). MbYA – non arable low to moderate height relict jumbled dune rises (slopes 0-3%, 1e, 2-3s, 3-4a, 1-3r, 1-2y). MbYB – non arable moderate height relict jumbled dune rises with extensive to very extensive overlying jumbled low sand dune deposits (slopes 0-6%, 1-2e, 1-2s, 4-5a, 1-3r, 2-3y). MbYC – non arable high relict jumbled dune rises and low hills with extensive to very extensive overlying jumbled low sand dunes (slopes 0-10%, 1-2e, 1-2s, 5-4a, 1-3r, 3-2y).
VoB	0.5	Old lake floor areas: mostly calcreted flats.
VoC	0.3	Main soils: shallow carbonate dominant soil on calcrete (soil B1). With gypsum-rich saline soil in highly saline depressions (soil N2); minor areas of carbonate dominant soil on some flats or slight mounds (soil A1), and a few gypseous calcareous soils on very low lunettes (soil A8).
VoF	7.4	VoB – semi arable to non arable calcreted flats with marginal salinity, and with some highly saline depressions (slopes <1%, 3w, 4s ⁺ , 2-3a, 3-4r, 1y). VoC – non arable calcreted depressions/flats (slopes <1%, 5-4w, 5-7s, 2a, 2-1r, 1y). Mostly covered with melaleuca, with some more saline samphire covered and bare areas. VoF – non arable calcreted flats with marginal salinity, with gypsum-rich highly saline depressions, some very low gypseous lunettes, and minor areas of low to very low relict jumbled dune rises (slopes <1%, 4-3w, 4-5s ⁺ , 2-3a, 3-4r, 1y). Very slight rise adjacent to near-coastal low sand dune.
VpB	2.9	Old lake floor areas: mostly flats with deep shelly soils. Carbonate sand deposits spread over old lake floor deposits.
VpC	0.7	
VpD	0.4	Main soils: carbonate dominant soil (soil A1). With shallow carbonate dominant soil on calcrete (soil B1), and gypsum-rich saline soil in highly saline depressions (soil N2). VpB – non arable flats (slopes 0-1%, 3-4w, 4s ⁺ , 3-2a, 1-2r, 1y): with some carbonate sand mounds (soil H1) VpC – non arable saline depressions/flats, with a few highly saline depressions (slopes <1%, 4-5w, 5s, 3-2a, 1-2r, 1y). Mostly covered with saprolitic shrubs. VpD – non arable highly saline depressions/flats (slopes <1%, 5w, 7-5s, 2-3a, 1-2r, 1y). Bare surfaces and saprolitic shrubs.
ZA-	0.1	Saline depressions/flats. Main soils: shallow carbonate dominant soil on calcrete (soil B1) With saline soil (soil N2), and possibly some deeper carbonate dominant soil (soil A1). ZA- – saline depressions/flats (slopes <1%, 3-4w, 5s, 2a, 1y).
ZW-	1.4	Saline flats and very low lunettes, and saline to highly saline depressions. Main soils: areas of carbonate dominant soil (soil A1), gypseous calcareous soils on very low lunettes (soil A8), gypsum-rich saline soil in depressions (soil N2), and shallow carbonate dominant soil on calcrete (soil B1). ZW- – depositional area with saline flats and very low lunettes, and some saline to highly saline depressions. Mostly covered with melaleuca (slopes <1%, 5-7w, 5-7s, 3-2a, 1y).
ZX-	5.6	Highly saline gypsum-rich depressions/flats, and some small extremely saline salt lakes. Main soils: gypsum-rich saline soil (soil N2). ZX- – highly saline depressions: margins of salt lakes with highly saline flats composed of gypsum-rich deposits, some in the form of very low lunettes, and some extremely saline salt lake depressions. Some very low and small mounds of carbonate sand can occur (soil H1). Mostly covered with saprolitic shrubs (slopes <1%, 7w, 7s, 2a, 1y).
ZY-	12.2	Extremely saline gypsum-rich salt lakes. Main soils: gypsum-rich saline soil (soil N2). ZY- – gypsum-rich salt lakes: sometimes with some very low gypsum-rich flats. Mostly bare ground with some samphire (slopes <1%, 7w, 8s, 2-1a, 1y).
ZL-	4.3	Very low gypsum lunettes, often as a series of mounds, and with some highly saline depressions/flats. Main soils: mostly gypseous calcareous soil (soil A8) on lunettes, and gypsum-rich saline soil



		(N2) in depressions/flats. ZL- – very low gypsum lunettes with some highly saline depressions/flats (slopes <1%, 3-5-4w, 5-7s, 3-2a, 1y).
ZL1	0.3	Old lunette: mostly calcreted. Main soils: mostly carbonate dominant soil on calcrete (soil B1). ZL1 – very low lunette (slopes <1%, 3w, 4-5s, 3a, 1y).
-S-	0.05	Gypsum dumps: flats and slight slopes with spreads and low hummocks of mined gypsum (man-made A8 soil overlying shallow soil on calcrete), with shallow carbonate dominant soil on calcrete on undisturbed patches (soil B1). (Slopes 0-1%, 2-3w, 4-3s, 3a, 2y).

Classes in the 'Soil Landscape Unit summary' table (eg. 2-1e, 3w, 2y, etc) describe the predominant soil and land conditions, and their range, found in Soil Landscape Units. The number '1' reflects minimal limitation, while increasing numbers reflect increasing limitation. Letters correspond to the type of attribute:

a - wind erosion	e - water erosion	f - flooding	g - gullyng
r - surface rockiness	s - salinity	w - waterlogging	y - exposure

Detailed soil profile descriptions:

Main soils:

- H1** *carbonate sand* [Shelly Rudosols, and some Shelly Calcarosols]
Loose grey brown loamy sand to fine loamy sand, overlying calcreted calcarenite at moderate depth or more. Dominantly composed of finely divided shell fragments. Grey organic stained topsoils overlie light coloured subsoils (pale brown to very pale brown). Most are very recently deposited coastal sands, and so have very little profile development. Found on coastal and near coastal sand dunes, slopes, coastal flats, and some inland dune rises.
- B1** *shallow carbonate dominant soil on calcrete* [Petrocalcic Shelly Calcarosols, some Petrocalcic Shelly Rudosols, and some Petrocalcic Suprarescent Calcarosols]
Loose to powdery highly calcareous to very highly calcareous grey brown loamy sand to silty clay loam; overlying calcreted calcarenite at shallow or very shallow depth. Topsoil textures of loam are found on flats and other low lying areas; silty clay loam textures are found on old lake floor areas; textures of fine loamy sand to loamy sand are found on coastal sand deposits; while textures of fine loamy sand to fine sandy loam are found elsewhere, and are the most common textures. These soils are dominantly composed of finely divided shell fragments; although some topsoils have experienced slight carbonate leaching. Variants with very little profile development are found on calcreted coastal dunes. Most of these soils are covered by native scrub. Found on relict dunes, coastal dunes, slopes, flats, and old lake floors.
- N2** *saline soil* [Hypersalic-Salic Hydrosol, with Gypsic subsoil horizons]
Saline to extremely saline calcareous soils. Deep to moderate depth variants are most extensive, however shallow variants over calcrete are common, especially on the margins of salt lakes. Topsoil textures are usually clay loamy to loamy. Subsoils are white with silty clay loam to light clayey textures. Gypsum and salt crystals accumulations occur in the profile. These soils can overlie carbonate sand deposits. Found in saline depressions.

Minor soils:

- A8** *gypseous calcareous sandy loams and sands* [Gypsic Calcarosol]
Moderate depth to deep gypsum-rich soils, with silty loam and silt topsoil textures grading to silty clay loam subsoils. Underlying carbonate sand sediments with shells where found to occur. These soils have naturally high salt levels. Found on very low lunette mounds.
- A1** *highly calcareous loams* [Shelly Hypercalcic Calcarosol]
Deep to moderate depth highly calcareous loams. Found on marginally saline and saline old lake floor flats and depressions, especially close to the coast, where carbonate sand accessions have been intimately mixed with, but dominate, lake sediments.

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

