

# GOO Goolwa Land System

Gently undulating rises around Goolwa and in the northern part of Hindmarsh Island

**Area:** 25.2 km<sup>2</sup>

**Annual rainfall:** 460 – 500 mm average

**Geology:** The system is underlain by Tertiary age clayey sands and sandy clays, with a veneer of younger Pleistocene heavy clay (Blanchetown Clay equivalent) in places. Most of these deposits are capped by highly calcareous deposits which have variably hardened to rubbly or sheet calcrete. Marking old sea shore lines are low ranges of calcreted calcarenite (Bridgewater Formation). These are old coastal dunes. Low lying and sometimes swampy depressions between the dunes are underlain by thin layers of black lake floor sediments. Randomly overlying all facets of the landscape are low to moderate dunes and sandspreads of siliceous sand (windblown Molineaux Sand).

**Topography:** The landscape comprises gently undulating rises and intervening flats, usually well drained, but sometimes with restricted drainage and swamps. Slopes rarely exceed 4%, except where Currency Creek has cut through the sedimentary cover. Distinctive topographic features include substantial amounts of surface calcrete on some stony rises, and jumbled and longitudinal sand hills draped over most pre-existing land surfaces.

**Elevation:** 0 m at lake level to 33 m near the north coast of Hindmarsh Island

**Relief:** Up to 25 m but typically 10 - 15 m

**Soils:** There is a variety of soils, but sandy types predominate. These include sand over sandy clay, often shallow on calcrete, and deep sands. There is a range of shallow loamier soils on calcrete. Rubbly calcareous sandy loams, cracking clays and swamp soils also occur.

## Main soils

- B2** Shallow calcareous sandy loam on calcrete (stony rises and flats)
- G4a** Sand over poorly structured clay (rises)
- G4b** Sand over poorly structured clay (flats)
- G2a** Bleached sand over sandy clay loam (sandy rises)

## Minor soils

### *Soils on sandy rises*

- B7a** Shallow sand over clay on calcrete

### *Soils on sandhills*

- G2b** Bleached sand over sandy clay loam
- H2** Siliceous sand
- H3** Bleached siliceous sand

### *Soils of stony rises and flats*

- A4** Deep calcareous sandy loam
- B3** Shallow gradational loamy sand on calcrete
- B6** Shallow sandy loam over sandy clay on calcrete
- B8** Shallow sand over calcrete

### *Soils on flats*

- B7b** Shallow sand over clay on calcrete



- C1** Gradational red sandy loam  
**D3** Loam over poorly structured red clay  
**E3** Brown-grey cracking clay  
**F2** Sandy loam over poorly structured brown clay  
*Soils on low lying and saline flats*  
**A7/N2** Wet, saline calcareous clay loam over marl  
**E1/N2** Wet, saline black cracking clay  
**F1** Loam over dark clay

**Main features:** The Goolwa Land System comprises several distinctive components. Sandy rises are characterized by low fertility soils, prone to wind erosion. Stony rises have a high proportion of shallow stony soils mixed with variable sandy soils and loamier soils on flats. The shallow stony soils have limited waterholding capacities, and are commonly difficult to work. Flats between the sandy and stony rises have mainly loamy surfaced (with subdominant sandy surfaced) texture contrast soils with poorly structured sodic subsoils. These are the most fertile of the System, but are subject to waterlogging and restricted rootzone depths. On Hindmarsh Island in particular, there are some swampy flats. Lake shore erosion is a problem or potential problem in places.

**Soil Landscape Unit summary:** 15 Soil Landscape Units (SLUs) mapped in the Goolwa Land System:

SLU	% of area	Main features #
GRB	19.3	Gently undulating low rises formed on clayey sands and sandy clays, overlain by very highly calcareous Woorinen Formation Class III carbonates, with varying amounts of rubble. Slopes are up to 4%. Low sand dunes occur sporadically. There is no surface drainage pattern and minor surface calcrete stone. Soils are generally sandy surfaced, often with rubbly calcrete at shallow depth. Main soils: <u>Sand over poorly structured clay</u> - <b>G4a</b> (V) on rises <u>Shallow sand over clay on calcrete</u> - <b>B7a</b> (L) on rises <u>Sand over poorly structured clay</u> - <b>G4b</b> (L) on flats <u>Bleached sand over sandy clay loam</u> - <b>G2b</b> (M) on sandhills These soils have low natural fertility and restricted waterholding capacities due to the often shallow depth to dispersive clayey subsoils and hostile carbonate layers. They are susceptible to wind erosion, and water erosion on sloping sites. Most have marginally saline subsoils. Some deeper sands are prone to acidification.
GSB	1.5	Gently undulating rises formed on Tertiary or Pleistocene sandy clays to clays, variably calcified by soft to hard Class III carbonates of the Woorinen Formation. Slopes are up to 4% and there is minor surface calcrete. There is no defined surface drainage pattern. Soils are either sandy or rubbly. Main soils: <u>Bleached sand over sandy clay loam</u> - <b>G2a</b> (V) <u>Deep calcareous sandy loam</u> - <b>A4</b> (L) The sandy soils are moderately deep to deep but infertile and prone to wind erosion. The calcareous soils are shallower, but are more fertile. All soils are well drained.
GcA	1.0	Flats formed on Pleistocene Clay. Soils are deep sandy to loamy texture contrast types with sodic subsoils. Soils are sandy to loamy texture contrast types. Main soils: <u>Sand over poorly structured clay</u> - <b>G4b</b> (V) <u>Sandy loam over poorly structured brown clay</u> - <b>F2</b> (C) These soils are imperfectly drained due to the tendency of water to perch on the dispersive clay subsoils. Root growth is also impeded by these clays. Salinity is moderately high in the subsoil. Fertility is low (sandy soils) to moderate (loamy soils).
GxA	3.0	Depressions with calcrete at shallow depth. Soils are sandy and shallow. Main soil: <u>Shallow sand over clay on calcrete</u> - <b>B7b</b> (D) These soils are marginally saline and imperfectly drained, with low fertility and waterholding capacity. Agricultural potential is very limited.
HaA	4.8	Flats and dissection slopes formed on clayey sediments.
HaD	0.6	<b>HaA</b> Flats. <b>HaD</b> Short moderately steep banks of Currency Creek.



		<p>Soils are loamy to sandy texture contrast types.  Main soils: <u>Loam over poorly structured red clay</u> - <b>D3</b> (E)  <u>Sand over poorly structured clay</u> - <b>G4b</b> (E)  <u>Sandy loam over poorly structured brown clay</u> - <b>F2</b> (L)</p> <p>Poor subsoil structure, restricting water movement and root growth is the main limitation. Otherwise, the soils are deep and moderately and fertile (D3 and F2) to marginally fertile (G4b). There is moderate potential for erosion on the slopes of <b>HaD</b>.</p>
MvE	8.9	<p>Lower slopes and depressions between stony rises of Bridgewater Formation calcarenites. The land is underlain at shallow depth by calcarenite. There is extensive surface calcrete stone and sheet rock. Soils are shallow.  Main soils: <u>Shallow calcareous sandy loam</u> - <b>B2</b> (V)  <u>Shallow sand over calcrete</u> - <b>B8</b> (C)</p> <p>The main limitation is shallow soil depth; although solution holes in lower lying areas are common, allowing additional effective rootzone depth.</p>
MxA	7.6	<p>Low rises on Bridgewater Formation calcarenites, capped by Class III carbonates with variable rubble content. There is up to 20% surface calcrete. Soils are mostly calcareous throughout with abundant soft or rubby carbonate at shallow depth.  Main soils: <u>Deep calcareous sandy loam</u> - <b>A4</b> (E)  <u>Shallow calcareous sandy loam</u> - <b>B2</b> (E)  <u>Gradational red sandy loam</u> - <b>C1</b> (C)  <u>Shallow sand over clay on calcrete</u> - <b>B7a</b> (L)</p> <p>Low to moderate waterholding capacities and occasional rocky reefs are the main limitations. This can lead to patchiness in crops due to variations in moisture stress. Fertility is affected to some extent by nutrient tie-up induced by the calcareous soils.</p>
MyB	28.1	<p>Undulating rises formed on calcreted calcareous sands of the Bridgewater Formation, overlain by significant areas of sand dunes and spreads. There are rocky patches where the sand is thin, but less than in the <b>MzB</b> Unit (below). Slopes are up to 10% and maximum relief is 20 metres. Soils are either shallow and stony, or moderately deep to deep and sandy.  Main soils: <u>Shallow calcareous sandy loam on calcrete</u> - <b>B2</b> (C) } on stony areas  <u>Shallow sand on calcrete</u> - <b>B8</b> (C) }  <u>Bleached sand over sandy clay loam</u> - <b>G2a</b> (C) } on sand spreads  <u>Bleached siliceous sand</u> - <b>H3</b> (L) } and dunes  <u>Siliceous sand</u> - <b>H2</b> (L) }</p> <p>Stony soils have limited waterholding capacities and sufficient rock to prevent or severely hinder cultivation. Sandy soils are mostly deep, but infertile and prone to wind erosion.</p>
MzB	5.7	<p>Undulating rises formed on calcreted calcareous sands of the Bridgewater Formation. Slopes are up to 10% and relief is less than 20 metres. There is extensive surface calcrete stone and sheet rock. Soils are shallow and stony.  Main soil: <u>Shallow calcareous sandy loam on calcrete</u> - <b>B2</b> (D)</p> <p>These soils have limited waterholding capacities and sufficient rock to prevent or severely hinder cultivation.</p>
O-B	8.5	<p>Jumbled to longitudinal dunes formed on loose, windblown medium to coarse sands. Soils are deep and sandy.  Main soils: <u>Siliceous sand</u> - <b>H2</b> (E)  <u>Bleached siliceous sand</u> - <b>H3</b> (E)</p> <p>These soils are infertile and prone to wind erosion. Water repellence is common.</p>
TTA	3.6	<p>Flats formed on Pleistocene Clay and characterized by gilgai microrelief. Soils are variable, but always underlain by heavy clay within 100 cm.  Main soils: <u>Brown-grey cracking clay</u> - <b>E3</b> (E)  <u>Sandy loam over poorly structured brown clay</u> - <b>F2</b> (C)  <u>Sand over poorly structured clay</u> - <b>G4b</b> (C)</p> <p>These soils are moderately fertile (exception is the sandy G4b soil), and deep, but are susceptible to waterlogging, mild salinity and boron toxicity.</p>
Vt-	0.5	<p>Discontinuous sections of lake shore. No soils data. Erosion is the main concern.</p>
VxA	1.7	<p>Low lying flats on Hindmarsh Island, characterized by thin black soils over shelly sands. Marginally saline water tables are commonly within 100 cm of the surface.  Main soil: <u>Loam over dark clay</u> - <b>F1</b> (D)</p> <p>These soils are inherently fertile and although moderately shallow, moisture from underlying water tables is likely to be available. The main limitation is marginal salinity. Irrigation potential is restricted by the water table.</p>
ZB-	5.2	<p>Marginally to highly saline flats characterized by thin black sediments overlying shell sands</p>



	<p>or buried sand over clay soils. Samphire is the dominant vegetation. Saline water tables are at or near the surface for extended periods.</p> <p>Main soils: Wet and saline <u>calcareous clay loam over marl</u> - <b>E1/N2</b> (E)  <u>Black cracking clay</u> - <b>A7/N2</b> (E)  <u>Loam over dark clay</u> - <b>F1</b> (E)</p> <p>This land is generally too waterlogged and saline for any uses other than light grazing.</p>
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# 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:

- A4** Deep calcareous sandy loam (Supracalcic Calcarosol)  
Medium thickness brown calcareous loamy sand to light sandy clay loam with minor calcrete nodules, overlying a brown highly calcareous massive sandy clay loam, grading to a pale brown, very highly calcareous clayey sand to light clay with up to 50% calcrete nodules (Class III B carbonate). The carbonate layer grades to a brown, yellow, grey and red sandy clay from 65 cm.
- A7/N2** Wet, saline calcareous clay loam over marl (Marly, Calcic / Lithocalcic Calcarosol)  
Medium thickness black moderately calcareous loam to fine sandy clay loam, overlying shell-grit, semi-hard limestone or soft marl, grading to highly calcareous grey clay. Buried sand over clay soil at 50 cm.
- B2** Shallow calcareous sandy loam on calcrete (Petrocalcic, Lithocalcic Calcarosol)  
Medium thickness brown calcareous loamy sand to sandy loam, with abundant calcrete fragments, overlying sheet calcrete up to 100 cm thick, grading to very highly calcareous shell sand.
- B3** Shallow gradational loamy sand on calcrete (Petrocalcic, Red Kandosol)  
Medium thickness loamy sand grading to a weakly structured reddish brown sandy clay loam on calcreted calcarenite.
- B6** Shallow sandy loam over sandy clay on calcrete (Petrocalcic, Red Chromosol)  
Medium thickness reddish brown soft sandy loam over a reddish brown massive sandy clay loam to sandy clay on sheet calcrete at 30 cm.
- B7a** Shallow sand over clay on calcrete (Petrocalcic, Brown Chromosol)  
Thin brown sand to sandy loam with a pink A2 horizon, overlying an orange sandy clay loam to light clay with calcrete fragments. At 30 cm is a layer of massive or rubbly calcrete, grading to a pale brown very highly calcareous clayey sand to sandy clay.
- B7b** Shallow sand over clay on calcrete (Lithocalcic, Brown Sodosol)  
Medium thickness dark brown sand to light sandy clay loam with a pale brown A2 horizon, overlying a dark brown and yellow sandy clay loam to light clay with coarse columnar, grading to coarse blocky structure. The profile is formed on a rubbly or platy calcrete pan (Class III C carbonate) from 40 cm. Under the pan is a yellow and grey highly calcareous clay.
- B8** Shallow sand over calcrete (Petrocalcic, Bleached-Leptic Tenosol)  
Medium thickness greyish brown loose sand with a bleached A2 horizon containing minor calcrete fragments, overlying sheet calcrete.
- C1** Gradational red sandy loam (Lithocalcic, Red Kandosol)  
Medium thickness reddish loamy sand to light sandy clay loam, grading to a red brown weakly structured sandy clay loam to light clay, over a highly calcareous layer with abundant carbonate nodules from 30 cm (Class III B carbonate). Brown, yellow, red and grey clayey sand to sandy clay underlies the carbonate at 70 cm.



- D3** Loam over poorly structured red clay (Calcic, Subnatric, Red Sodosol)  
Medium thickness reddish brown massive sandy loam to fine sandy clay loam with a paler A2 horizon, overlying a reddish brown and greyish brown mottled clay with strong blocky structure and soft Class I carbonate segregations from 55 cm. The soil overlies a dark brown mottled clay with decreasing amounts of carbonate.
- E1/N2** Wet, saline black cracking clay (Salic, Pedal, Aquic Vertosol)  
Medium thickness black clay with coarse blocky structure, overlying a dark grey clay with coarse prismatic structure, on a buried sand over clay soil at 50 cm.
- E3** Brown-grey cracking clay (Episodic-Epicalcareous, Pedal, Brown Vertosol)  
Thin grey brown, moderately calcareous coarse blocky clay, overlying a yellow brown and brown mottled calcareous heavy clay with coarse blocky structure, and soft carbonate segregations from 25 cm (Class I carbonate). The carbonate grades to Pleistocene Clay at 35 cm.
- F1** Loam over dark clay (Calcic, Black Chromosol)  
Thin to medium thickness dark grey loamy sand to sandy clay loam, overlying a black sandy clay to heavy clay with coarse prismatic structure, calcareous at shallow depth, grading to a white mottled shelly sand from about 50 cm.
- F2** Sandy loam over poorly structured brown clay (Calcic, Mottled-Subnatric, Brown Sodosol)  
Medium thickness grey brown massive loamy sand to sandy clay loam with a paler and sandier A2 horizon, overlying a brown, grey and yellow heavy clay with strong blocky structure, highly calcareous from 50 cm (Class I carbonate layer). Carbonate grades to Pleistocene Clay at 70 cm.
- G2a** Bleached sand over sandy clay loam (Lithocalcic, Mottled-Subnatric, Brown Sodosol)  
Very thick pale brown loose sand, overlying a yellowish brown and red mottled clayey sand to light sandy clay loam, grading to a sandy clay loam with soft to rubbly Class III carbonate from 85 cm. The profile becomes sandier with depth.
- G2b** Bleached sand over sandy clay loam (Bleached-Sodic, Calcic, Yellow Kandosol)  
Very thick white sand, organically darkened at the surface, overlying a reddish yellow massive clayey sand to light sandy clay loam with limited soft calcareous segregations (Class IV carbonate) from 90 cm, becoming sandier with depth.
- G4a** Sand over poorly structured clay (Supracalcic, Subnatric, Brown Sodosol)  
Medium thickness brown sand with a thin bleached A2 horizon, overlying a brown and red columnar sandy clay becoming more clayey and massive with depth, grading to a very highly calcareous pale brown clayey sand to sandy clay with up to 50% carbonate nodules (Class III A or B carbonate). This is underlain by a brown, yellow, grey and red sandy clay from 70 cm.
- G4b** Sand over poorly structured clay (Calcic, Mottled-Mesonatric, Brown Sodosol)  
Medium thickness brown sand to light sandy clay loam with a hard massive bleached A2 horizon, overlying a brown, grey and red mottled clay with coarse columnar structure, calcareous with soft carbonate segregations from 45 cm (Class I carbonate). The carbonate grades to sandy clay or heavy clay at 60 cm.
- H2** Siliceous sand (Calcareous, Regolithic, Brown-Orthic Tenosol)  
Very thick brown sand to loamy sand, overlying a thin layer of orange clayey sand on soft to rubbly Class III carbonate.
- H3** Bleached siliceous sand (Arenic, Bleached-Orthic Tenosol)  
Very thick white loose sand, organically darkened at the surface, overlying a yellow loose sand, grading to a pale brown sand from 125 cm.

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

