

# NOA Noarlunga Land System

Undulating rises extending along the Gulf St. Vincent coast from O'Halloran Hill to Aldinga

**Area:** 80.6 km<sup>2</sup>

**Annual rainfall:** 500 – 685 mm average

**Geology:** The majority of the land is underlain by Hindmarsh Clay. The clay is mantled by a veneer of fine carbonates of aeolian origin. Most is in the form of fine segregations in the upper parts of the clay, but nodular forms are common. Where watercourses have dissected the landscape, older Tertiary sediments (limestones and sandstones) or basement shales and siltstones are exposed. Unconsolidated medium to fine grained alluvium occurs in major drainage depressions associated with the watercourses. There is a large area of estuarine clay at the mouth of the Onkaparinga River and an accumulation of reworked coastal sand in the Aldinga Scrub. Coastal sands occur along most of the shoreline.

**Topography:** The landscape is typically very gently undulating to undulating, with a gradual fall from the northeast to the southwest. The land surface was probably originally a flat plain, with the elevated plain at O'Halloran Hill a remnant of the older surface. Dissection by watercourses flowing west to the sea has created the present day topography. In places the down cutting has produced steep sided valleys. The Onkaparinga Valley is the largest of the dissected areas. In the south is a small dune field which supports the unique flora of the Aldinga Scrub.

**Elevation:** 0 m along the coast to 200 m at O'Halloran Hill

**Relief:** Up to 40 m

**Soils:** The main soils are moderately deep over Hindmarsh Clay, usually within a metre depth. Typical profiles include medium textured calcareous and non-calcareous soils, texture contrast soils and cracking clays. There are limited areas of gradational and texture contrast soils on alluvium, with minor shallow rubbly soils and deep siliceous sands.

## Main soils

### *Soils formed on Hindmarsh Clay*

- A5** Rubbly calcareous loam
- E1/E3** Black to grey cracking clay
- D2a** Loam over red clay

## Minor soils

### *Soils formed on Hindmarsh Clay*

- A6** Gradational calcareous clay loam
- F2** Sandy loam (sandy clay loam) over dispersive brown clay
- G4** Sand over dispersive brown clay
- M2** Dark gradational clay loam

### *Soils formed on Quaternary alluvium*

- A3** Deep calcareous loam
- A4b** Deep rubbly calcareous loam
- C1** Gradational red sandy loam
- D2b** Loam over red clay
- M1** Deep sandy loam
- N2** Wet saline soil



*Soils formed on calcreted Tertiary sediments***A4a** Calcareous sandy loam**B2** Shallow calcareous sandy loam*Soils formed on reworked sands***G2** Thick sand over sandy clay loam**H3** Deep bleached siliceous sand

**Main features:** The Noarlunga Land System is a gently undulating landscape characterized by a variety of calcareous, clayey and texture contrast soils overlying Hindmarsh Clay at shallow depth. The soils are mostly deep and inherently fertile, although often imperfectly drained due to the very low permeability of the clay. They are excellent cropping soils, but only marginally suitable for irrigation due to the risk of waterlogging and salt accumulation. Substantial areas are however developed for urban uses. The location of the Land System relative to existing urban development suggests that rural activities will probably decline in future. There are two significant areas of conservation value, viz. the Onkaparinga Estuary and the Aldinga Scrub.

**Soil Landscape Unit summary:** 22 Soil Landscape Units (SLUs) mapped in the Noarlunga Land System:

SLU	% of area	Main features #
-Q-	0.2	Quarry
AYC AYD	1.0 0.5	<p>Moderately inclined to steep slopes occurring in two geomorphic environments, viz: a) escarpment slopes at Darlington and Hackham, 50-100 m high with slopes of 12-30% and b) dissection slopes where the Onkaparinga River has cut through the frontal slopes at Noarlunga, and where the Pedlar Creek and Field River systems have cut through the undulating Tertiary sedimentary cover to expose the underlying basement rocks. These landforms typically consist of steep sided V-shaped gullies with slopes up to 100% (but usually less than 75%) and relief to 100 metres, grading to more gently sloping upper slopes and crests, where slopes are as low as 5%, but overall steeper than 12%. Rock outcrop is extensive on the steeper ground, but negligible on upper slopes and crests. Watercourses are very well defined in narrow drainage depressions. In all the above situations the parent rocks are strongly calcified siltstones, slates and fine sandstones.</p> <p><b>AYC</b> Moderate slopes with relief to 60 m and slopes of 12-30%.</p> <p><b>AYD</b> Steep to very steep rocky hillslopes with relief to 100 m and slopes of 30-75%.</p> <p>The majority of soils are shallow over calcified siltstone, or siltstone mantled with a thick layer of soft to semi-hard carbonate.</p> <p>Main soils: <u>Shallow calcareous loam on rock or calcreted rock</u> - <b>A2/B2</b> (V-E)  <u>Shallow loam over red clay on rock or calcreted rock</u> - <b>D1/B6</b> (L-M)  <u>Shallow stony loam</u> - <b>L1a</b> (M-C)  <u>Shallow gradational red loam</u> - <b>C2</b> (L)</p> <p>These soils are shallow and the slopes are steep. Land use is restricted to grazing only.</p>
DCD	0.2	<p>Undulating rises and rolling low hills formed on calcified siltstones, slates and fine sandstones. Slopes range from 4% to 18%. Rock outcrop is sporadic, but there is up to 10% surface stone.</p> <p><b>DCD</b> Moderate slopes of 10-18%, up to 40 m high.</p> <p>Most soils are moderately deep to shallow over calcified siltstone, or siltstone mantled by soft to semi hard carbonate.</p> <p>Main soils: <u>Shallow loam over red clay</u> - <b>D1/B6</b> (V-E)  <u>Shallow calcareous loam</u> - <b>A2/B2</b> (C)  <u>Shallow gradational red loam</u> - <b>C2</b> (L)  <u>Shallow stony loam</u> - <b>L1a</b> (M)  <u>Loam over red clay</u> - <b>D2</b> (M) on lower slopes and creek flats</p> <p>The soils are fertile and well drained, although often shallow, thereby restricting waterholding capacity. Surface soils set hard, creating workability and emergence problems, and increasing</p>



		erosion susceptibility. The land is potentially productive although most of the northern areas are either urbanized or in reserves. In the south DCC is suitable for cropping provided that adequate erosion control measures are used, but DCD is marginal due to the potential for erosion. The land is suited to horticultural development where water is available.
GNA	2.8	<p>Flats and depressions formed on Tertiary sandy clays to clays, partly overlain by low sandy rises, in a ratio of about 50:50. The dominant soils of the flats are sandy to loamy texture contrast types, with deep sands on the rises.</p> <p>Main soils: <u>Loamy sand over dispersive brown clay</u> - <b>G4</b> (E) } on flats  <u>Loam over red clay</u> - <b>D2a</b> (C) }  <u>Thick sand over sandy clay loam</u> - <b>G2</b> (C) } on sand rises  <u>Deep bleached siliceous sand</u> - <b>H3</b> (L) }</p> <p>The flats are imperfectly drained due to perching of water by the dispersive clayey subsoils of the dominant soil. They are also mildly saline. The rises are infertile and subject to water repellence and wind erosion. Although the rises have irrigation potential, there is a significant risk of seepage on to the adjacent flats.</p>
IUC IUD IUDD	0.4 2.7 1.1	<p>Short gentle to moderately inclined slopes adjacent to watercourses, with slopes from 4% to 16% and relief up to 50 metres. The down cutting which created the slopes has exposed Tertiary limestones and sandstones which are calcreted. Hindmarsh Clay is exposed on upper slopes. There is up to 10% surface calcrete stone.</p> <p><b>IUC</b> Undulating rises and gentle slopes with relief to 50 m and slopes of 4-10%.  <b>IUD</b> Moderately inclined slopes with relief to 30 m and slopes of 8-16%.  <b>IUDD</b> Moderate to steep slopes and short cliffs adjacent to the Onkaparinga estuary. Relief is up to 40 m and slopes are 5-40%.</p> <p>Most soils are calcareous with variable rubble. There are some texture contrast types.  Main soils: <u>Calcareous sandy loam</u> - <b>A4a</b> (E)  <u>Rubbly calcareous loam</u> - <b>A5</b> (L)  <u>Gradational calcareous clay loam</u> - <b>A6</b> (L)  <u>Loam over red clay</u> - <b>D2a</b> (L)  <u>Shallow calcareous sandy loam</u> - <b>B2</b> (C) in IUDD only</p> <p>Much of this land has been developed as Port Noarlunga expands, while soil variability (and steep rocky slopes in places) restrict land use on undeveloped slopes. The most common soils are calcareous, well drained and moderately deep. They are suitable for vines, but productive potential for other crops is limited. Most other soils have Hindmarsh Clay at shallow depth which restricts irrigation development.</p>
JBB	0.6	<p>Very gently inclined outwash fans with slopes of 1.5-3% formed on sandy clays and clays derived from the erosion and deposition of soil and rock materials from the escarpments to the east. Most soils have texture contrast profiles with a range of surface textures from loamy sand to clay loam, overlying thick clayey subsoils, calcareous with depth.</p> <p>Main soils: <u>Sandy loam over dispersive red clay</u> - <b>D3b</b> (V)  <u>Sandy loam over dispersive brown clay</u> - <b>F2b</b> (C)</p> <p>These soils are deep and inherently fertile; their main limitations are physical. Poorly structured, hard setting surfaces and dispersive clayey subsoils contribute to poor infiltration, perched water tables, difficult workability and patchy emergence. Conservative soil management and gypsum application can overcome these limitations.</p>
KHA KHB KHC KHE	2.0 1.0 0.8 2.7	<p>Flats, gentle slopes and drainage depressions formed on medium grained alluvium.</p> <p><b>KHA</b> Valley flats with slopes of 0-2%.  <b>KHB</b> Very gently inclined outwash fans with slopes of 2-4%.  <b>KHC</b> Gently inclined outwash fans with slopes of 4-8%.  <b>KHE</b> Drainage depressions with slopes of 1-5%.</p> <p>The dominant soils are deep calcareous loams, with deep gradational loams, loamy texture contrast soils and deep sandy loams.</p> <p>Main soils: <u>Deep calcareous loam</u> - <b>A3</b> (E)  <u>Deep rubbly calcareous loam</u> - <b>A4b</b> (C)  <u>Gradational red sandy loam</u> - <b>C1</b> (L)  <u>Loam over red clay</u> - <b>D2b</b> (L)  <u>Deep sandy loam</u> - <b>M1</b> (L)</p> <p>These soils are deep, moderately fertile and well drained. Although they have high horticultural</p>



		potential, much of the land has been built on.
OAK	2.9	Undulating irregular sand dunes formed on white siliceous sands, overlying calcarenites. The dunes have relief to 20 metres. The soils are mainly moderately deep to deep sands. Main soils: <u>Deep bleached siliceous sand</u> - <b>H3</b> (E) <u>Thick sand over sandy clay loam</u> - <b>G2</b> (E) Most of this land is contained within the Aldinga Scrub or adjacent suburban developments.
TEA TEB TEC	24.1 20.8 24.0	Level plains and gently undulating to undulating rises with slopes up to 12% and maximum relief of 40 metres, formed on Hindmarsh Clay, altered by variable amounts of aeolian carbonate, deposited and washed into the clay. Surface drainage patterns are very poorly defined on the plains, but on the undulating ground, there are well defined watercourses in shallow drainage depressions. <b>TEA</b> Level to very gently undulating plains with relief to 10 m and slopes of 0-2%. <b>TEB</b> Gently undulating rises with relief to 30 m and slopes of 2-4%. <b>TEC</b> Undulating rises with relief to 40 m and slopes of 4-12%. The principal soils are calcareous loam, dark cracking clay, loam over red clay and sandy loam over a brown mottled sodic clay. These soils have significant accumulations of soft to nodular carbonate in the lower profile, grading to Hindmarsh Clay, which is typically red and grey mottled, coarsely blocky in structure with well developed slickensides, and containing pockets of soft carbonates, decreasing with depth. Main soils: <u>Rubbly calcareous loam</u> - <b>A5</b> (E) <u>Black to grey cracking clay</u> - <b>E1/E3</b> (C) <u>Loam over red clay</u> - <b>D2a</b> (L) <u>Sandy loam (sandy clay loam) over dispersive brown clay</u> - <b>F2</b> (L) <u>Gradational calcareous clay loam</u> - <b>A6</b> (L) <u>Dark gradational clay loam</u> - <b>M2</b> (M) <u>Calcareous sandy loam</u> - <b>A4a</b> (M) on sloping margins These soils are excellent cropping soils, deep and moderately to highly fertile, although commonly imperfectly drained and difficult to work when wet. However, with impermeable Hindmarsh Clay usually within a metre of the surface, they are poor irrigation soils. Significant areas are urbanized.
TMZ	2.2	Elevated plains formed on Hindmarsh Clay, calcified by low to moderate amounts of aeolian carbonate. Slopes range from 0%-5%, but are usually < 3%. There are no defined surface drainage patterns. Gilgai microrelief is apparent in places. Soils are dark and medium to fine grained. Main soils: <u>Black to grey cracking clay</u> - <b>E1/E3</b> (V) <u>Dark gradational clay loam</u> - <b>M2</b> (C) These soils are deep and highly fertile but imperfectly drained. They are excellent cropping soils but unfavourable for irrigated uses. The highly reactive clayey substrates are also poor for building.
WA- WE D WE W WEa	2.4 0.7 2.9 0.6	Coastal landscapes. <b>WA-</b> Unconsolidated coastal cliffs of calcarenites, sands and clays, variably calcified and partially indurated. There is often basement rock in the lower sections. Cliffs are not always mappable due to their limited horizontal extent. The height of the cliffs varies from 10 metres to 50 metres and slopes are usually more than 100%. They are frequently very unstable. <b>WED</b> Coastal dunes of calcareous and siliceous sand. <b>WEW</b> Complex of coastal dunes and beaches. <b>WEa</b> Beaches. Many beaches are too narrow to map at 1:50,000 scale.
ZA-	3.4	Tidal swamps at the mouth of the Onkaparinga River at Port Noarlunga. The underlying sediments are estuarine saline clays. Main soil: <u>Wet saline soil</u> - <b>N2</b> (D) This land is too wet and saline for agriculture, but has wetland value.

# 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 formed on calcreted Tertiary sediments*

- A4a** Calcareous sandy loam (Supracalcic Calcarosol)  
Medium thickness dark brown calcareous sandy loam to sandy clay loam, overlying a dark brown highly calcareous clay loam with up to 50% carbonate nodules (Class III C carbonate), becoming more clayey with depth. Weak calcrete pans occur sporadically. Highly calcareous sandstone or limestone from 120 cm.
- B2** Shallow calcareous sandy loam (Petrocalcic Calcarosol)  
Up to 50 cm calcareous sandy loam with variable nodular carbonate over sheet calcrete.

*Soils formed on Hindmarsh Clay*

- A5** Rubby calcareous loam (Supracalcic Calcarosol)  
Medium thickness dark brown moderately calcareous loam, overlying a dark brown weakly structured calcareous loam to clay loam, grading to a pale, very highly calcareous light clay with up to 50% carbonate nodules. The carbonate horizon changes diffusely to a red and grey clay (Hindmarsh Clay) by 100 cm.
- A6** Gradational calcareous clay loam (Hypercalcic Calcarosol)  
Thick moderately calcareous dark brown clay loam, overlying a dark brown highly calcareous clay with subangular blocky structure and increasing soft carbonate with depth (Class I carbonate). The soil grades to Hindmarsh Clay at 100 cm.
- D2a** Loam over red clay (Hypercalcic, Red Chromosol)  
Medium thickness red brown sandy loam to clay loam with weak structure, overlying a dark reddish brown clay with strong blocky structure, highly calcareous from 30 cm, with abundant soft carbonate segregations. The carbonate grades to Hindmarsh Clay at 90 cm.
- E1/E3** Black to grey cracking clay (Self-mulching, Black Vertosol / Epipedal, Grey Vertosol)  
Medium thickness very dark grey to black moderately calcareous light clay with fine blocky structure, overlying a black to grey brown coarsely prismatic heavy clay becoming paler coloured and more calcareous with depth. Hindmarsh Clay is evident from about 70 cm.
- F2** Sandy loam (sandy clay loam) over dispersive brown clay (Calcic, Brown Sodosol)  
Medium thickness grey brown massive sandy loam to sandy clay loam with a bleached and sandier A2 horizon, overlying a brown, grey and yellow mottled heavy clay with coarse prismatic structure. There is abundant soft carbonate from 55 cm, grading to Hindmarsh Clay from 70 cm.
- G4** Sand over dispersive brown clay (Hypercalcic, Brown Sodosol)  
Medium thickness brown sand to light sandy loam with a bleached A2 horizon, sharply overlying a yellowish brown, greyish brown and red mottled clay with strong columnar structure, grading to a Class I carbonate layer of soft calcareous segregations at 45 cm. This grades to heavy clay with depth.
- M2** Dark gradational clay loam (Calcic, Black Dermosol)  
Medium thickness black clay loam to light clay with strong granular structure, overlying a very dark clay with blocky structure and variable amounts of soft calcareous segregations.

*Soils formed on Quaternary alluvium*

- A3** Deep calcareous loam (Calcic Calcarosol)  
Medium to thick calcareous loam to clay loam grading to a red calcareous weakly structured light to medium clay, continuing below 100 cm.
- A4b** Deep rubby calcareous loam (Supracalcic Calcarosol)  
Medium thickness reddish brown calcareous loam, overlying a reddish brown calcareous clay loam, becoming more clayey and calcareous with depth. The soil grades to a yellowish very highly calcareous



clay loam with abundant carbonate nodules (Class III B carbonate), and sometimes a weak discontinuous calcrete pan (Class III C carbonate).

**C1** Gradational red sandy loam (Calcic, Red Kandosol)

Thick reddish brown loamy sand to sandy loam with a pink A2 horizon, overlying a yellowish red weakly structured clay loam to clay, calcareous with depth.

**D2b** Loam over red clay (Calcic, Red Chromosol)

Thick hard fine sandy loam to clay loam with a paler coloured A2 horizon, overlying a dark reddish brown, well structured clay, highly calcareous (Class I carbonate) from about 60 cm. The soil grades to medium to fine grained alluvium below 100 cm.

**M1** Deep sandy loam (Regolithic, Brown-Orthic Tenosol / Eutrophic, Brown Kandosol)

Thick brown sandy loam to clay loam, overlying a grey to brown silt loam to clay loam with weak prismatic structure, weakly calcareous with depth. The soil overlies variable sandy, gritty and clayey alluvial deposits.

**N2** Wet saline soil (Dermosolic, Oxyaquic Hydrosol)

Medium thickness dark grey clay loam to light clay, overlying a dark grey and dark brown clay, grading to a grey and yellow clay with depth. The profile overlies variable sandy to clayey sediments from 100 cm. Soil is usually saturated from about 20 cm.

*Soils formed on reworked sands*

**G2** Thick sand over sandy clay loam (Petrocalcic, Red Kandosol)

Thick to very thick brown sand with a bleached A2 horizon, overlying an orange massive clayey sand grading to highly calcareous brown massive sandy clay loam to sandy clay with abundant soft calcareous segregations (Class III A carbonate). The profile overlies semi-hard calcrete at 100 cm.

**H3** Deep bleached siliceous sand (Arenic, Bleached-Orthic Tenosol)

Grey sand with a very thick bleached A2 layer, overlying a yellow loose sand, grading to pale brown sand.

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

