

BOW Bowillia Land System

Dunefields in the Bowillia - Watchman area

Area: 153.6 km²

Annual rainfall : 360 – 430 mm average

Geology: The Land System includes three distinctive geological materials. Heavy Pleistocene age clay (Hindmarsh Clay) underlies the area and is exposed in low lying flats and swales. This has been extensively covered by highly calcareous windblown sediments (Woorinen Formation) which occur as fine or rubbly accumulations in the subsoil. This material in turn is overlain by Molineaux Sand, which has been reworked by the wind into more or less parallel low dunes.

Topography: Gently undulating land characterized by moderate to low dunes. The land underlying the dunes is a gently inclined outwash fan in the west grading to an undulating rise in the east. The dunes all have a north west - south east orientation. The flats or swales between the dunes are generally less than 500 m wide. There is no surface drainage except for a small area in the east where water courses from the Hoyleton - Halbury area discharge into the dune fields.

Elevation: 150 m in the north east, grading to 50 m in the south west

Relief: Maximum relief from dune crest to swale is about 15 m

Soils: Deep sands and calcareous sandy loams are the characteristic soils, with sandy and loamy texture contrast soils, deep gradational sandy loams and cracking clays.

Main soils

- A4a** Rubbly calcareous loam - rises and higher level swales
- G1** Loamy sand over red sandy clay - dunes and rises
- A6** Calcareous clay loam - swales
- D3** Sandy loam over dispersive red clay - lower lying swales and flats
- H2a** Deep siliceous sand - dunes

Minor soils

- A5** Rubbly calcareous loam over clay - rises and higher level flats
- A4b** Calcareous sandy loam - rises and higher level flats
- H2b** Calcareous sand - dunes
- E2** Red cracking clay - lower lying swales
- C3** Gradational clay loam - lower lying swales
- B2** Shallow calcareous sandy loam on calcrete - rises and higher level flats

Main features: The Bowillia Land System is dune - swale country with typical diversity of soils. The dunes have mainly sandy soils with low fertility. Careful management of diseases and nutrition can result in reasonable productivity, but wind erosion potential is moderate to high, so protective cover is required at all times. The lower lying ground includes calcareous and often rubbly sandy loams on rises and higher level flats, and more clayey calcareous soils, loamy texture contrast soils and clay soils on lower level flats. These soils are moderately fertile and less prone to erosion, but productivity is commonly limited by the unfavourable properties of the underlying clayey sediments. High boron concentrations, high pH and moderate salinity affect root growth when within 75 cm of the soil surface, as is often the case. Tolerant varieties are required in these situations.



Soil Landscape Unit summary: 8 Soil Landscape Units (SLUs) mapped in the Bowillia Land System:

SLU	% of area	Main features #
IAA IAE	2.5 3.4	<p>Low lying areas formed over Hindmarsh Clay.</p> <p>IAA Flats and swales with minor stony and sandy rises.</p> <p>IAE Drainage depressions and flats with water courses and minor stony and sandy rises. Flooding can occur after heavy rain.</p> <p>Main soils: <u>calcareous clay loam - A6 (E)</u> and <u>sandy loam over dispersive red clay - D3 (E)</u> with <u>gradational clay loam - C3 (L)</u>. In places in IAE, clayey sediments from flood events overlie sandier surface D3 soils. These flats have deep, generally non rubbly loamy to clayey soils with moderate inherent fertility. Poorly structured subsoils in D3 soils affect root growth and cause temporary waterlogging in wet seasons. The main limitations however are associated with the underlying heavy impermeable clay which prevents leaching of salts including boron. Deeper subsoils are characterized by moderate salinity, high pH and boron concentrations. Where shallower than about 75 cm these conditions affect plant productivity.</p>
IVA	11.3	<p>Very gently undulating flats up to 1000 m wide within the dune system, underlain by coarsely structured heavy clay (Hindmarsh Clay). The clay is within 100 cm of the surface over about 60% of the land (mainly flats). Low rises (about 30% of the land area) are formed on lighter textured or rubbly Woorinen Formation carbonates. About 10% of the area is covered by sand dunes.</p> <p>Main soils on flats: <u>calcareous clay loam - A6 (E)</u>, with <u>sandy loam over dispersive red clay - D3 (C)</u>, <u>gradational clay loam - C3 (C)</u>, <u>rubbly calcareous loam - A4a (C)</u> and <u>red cracking clay - E2 (L)</u>.</p> <p>Main soils on Woorinen Formation rises: <u>rubbly calcareous loam over clay - A5 (E)</u> and <u>rubbly calcareous loam - A4a (E)</u>. On sandhills, soils are as for UEI. These soils are deep and moderately fertile, but underlain by heavy, impermeable alkaline clays with associated high boron (average concentrations in the 60-100 cm layers are 30 mg/kg), high pH and moderate salinity levels. Poor soil structure in D3 soils restricts infiltration and causes some waterlogging. The cracking clays are especially prone to wetness, but have high fertility. Reduced fertility and water holding capacity can be expected on the rises. There is moderate potential for wind erosion on the sand hills. The land has moderate productive potential, provided that the underlying heavy clay is deeper than 75 cm, and that poor soil structure is ameliorated.</p>
SWB	1.9	<p>Rises with slopes of 2-5% formed on fine and rubbly medium textured carbonates of the Woorinen Formation, overlain by occasional very low sand dunes.</p> <p>Main soils: <u>rubbly calcareous loam - A4a (E)</u>, <u>loamy sand over red sandy clay - G1 (E)</u> and <u>calcareous sandy loam - A4b (C)</u>. These soils are mostly alkaline to the surface (except G1 soils), with moderate to low fertility and in the case of the rubbly soils, variable and often low water holding capacity. All soils, and particularly the sandy types, are prone to wind erosion, and must be kept covered.</p>
U-C	0.5	<p>Low discrete linear sandhills with mainly <u>deep siliceous sand - H2a</u> and <u>calcareous sand - H2b</u>. These soils are deep, low in fertility, have limited water holding capacity, and are prone to wind erosion, a condition made worse by their exposure on dunes.</p>
UEF UEI UEf	10.6 67.4 2.4	<p>Dunefields superimposed on a gently inclined to undulating landscape of Woorinen Formation fine to rubbly carbonates, overlying heavy clay sediments (Hindmarsh Clay). Sand dune size and frequency varies:</p> <p>UEF 60-90% coverage of dunes 5-10 m high UEI 30-60% coverage of dunes 5-10 m high UEf 30-60% coverage of dunes 5 m high, superimposed on a broad undulating rise.</p> <p>Main soils: <u>Dunes</u>: - <u>Deep siliceous sand - H2a (E)</u>, <u>loamy sand over red sandy clay - G1 (E)</u> and <u>calcareous sand - H2b (C)</u>. <u>Low rises and high level flats</u>: - <u>rubbly calcareous loam - A4a (V)</u>, <u>calcareous sandy loam - A4b (C)</u> and <u>rubbly calcareous loam over clay - A5 (L)</u>, with <u>shallow calcareous sandy loam on calcrete - B2 (M)</u>. <u>Low lying flats</u>: - <u>sandy loam over dispersive red clay - D3 (E)</u> and <u>calcareous clay loam - A6 (E)</u> with <u>red cracking clay - E2 (L)</u>.</p> <p>This is typical dune-swale country with the inherent problem of frequent changes in soil types across the landscape. Control of wind erosion is the main concern on the sandy rises, along with fertility maintenance and the need to encourage deep rooting plants to maximize</p>



		water use efficiency. On the more clayey swales, there is a range of minor limitations mainly associated with the underlying Hindmarsh Clay. These include boron toxicity, waterlogging, poor soil structure and salinity. Fertility, particularly of the highly calcareous soils is also an issue.
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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:

- A4a** Rubbly calcareous loam (Regolithic, Supracalcic / Lithocalcic Calcarosol)
10 - 20 cm calcareous sandy loam to clay loam over rubbly Class III C or III B carbonate from about 30 cm. The rubble grades to a very highly calcareous fine sandy clay loam continuing below 100 cm.
- A4b** Calcareous sandy loam (Regolithic, Hypercalcic Calcarosol)
10 - 20 cm calcareous sandy loam becoming more clayey and slightly rubbly (Class III A carbonate) with depth, grading to a very highly calcareous fine sandy clay loam continuing below 100 cm.
- A5** Rubbly calcareous loam over clay (Regolithic, Lithocalcic / Supracalcic Calcarosol)
Calcareous loam to clay loam over rubbly Class III B or III C carbonate from about 25 cm grading to a very highly calcareous clay loam, over Hindmarsh Clay at about 90 cm.
- A6** Calcareous clay loam (Pedal, Hypercalcic Calcarosol)
10 - 20 cm calcareous loam to clay loam, more clayey and calcareous with depth over fine Class I carbonate at about 35 cm, grading to Hindmarsh Clay from about 90 cm.
- B2** Shallow calcareous sandy loam on calcrete (Petrocalcic Calcarosol)
15 - 25 cm calcareous sandy loam grading to a highly calcareous sandy clay loam with variable rubble over sheet calcrete at about 35 cm.
- C3** Gradational clay loam (Sodic, Hypercalcic, Red Dermosol)
10 - 20 cm clay loam to light clay grading to a well structured red clay, calcareous from 40 cm over Hindmarsh Clay from 70 cm.
- D3** Sandy loam over dispersive red clay (Calcic, Red Sodosol)
10 - 20 cm hard sandy loam to sandy clay loam abruptly overlying a coarsely structured dispersive red clay, calcareous from 40 cm grading to Hindmarsh Clay from 65 cm.
- E2** Red cracking clay (Red Vertosol)
10 - 15 cm strongly structured seasonally cracking calcareous light clay over a red coarsely structured heavy clay, with fine carbonate from 35 cm and slickensided heavy clay from 60 cm.
- G1** Loamy sand over red sandy clay (Calcic / Lithocalcic, Red Chromosol)
15-40 cm soft loamy sand to sandy loam abruptly overlying a weakly structured red sandy clay loam to light clay with soft to rubbly carbonate at 45 cm, continuing below 100 cm.
- H2a** Deep siliceous sand (Calcareous, Arenic, Red-Orthic Tenosol)
Very thick loose non calcareous sand gradually becoming more clayey and with variable Class IV or III A carbonate accumulations below 100 cm.
- H2b** Calcareous sand (Regolithic, Calcic / Hypercalcic Calcarosol)
Calcareous soft loamy sand grading to a highly calcareous light sandy loam over massive very highly calcareous clayey sand (Class III A carbonate).

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

