

# WAT Watchman Land System

Flats and sand hills north of the Wakefield River in the Balaklava area

**Area:** 44.5 km<sup>2</sup>

**Annual rainfall:** 375 – 425 mm average

**Geology:** The land system includes three distinctive geological materials:

- Clayey sediments of late Tertiary / early Pleistocene? age. They are generally red, strongly structured and commonly contain soft or crystalline gypsum. Some are similar to Hindmarsh Clay, others have similarities with Pooraka Formation clays.
- Very highly calcareous soft to rubbly carbonates (Woorinen Formation).
- Aeolian (Molineaux) sand.

All sediments are mantled by soft carbonates (reworked Woorinen materials).

**Topography:** The Watchman Land System includes elements of the Bowillia System to the north and the Balaklava System to the south. A dune - swale complex with associated low rises formed on highly calcareous Woorinen Formation sediments dominates the centre of the system. This landscape is separated from the Bowillia dune fields (which it closely resembles) by a broad flat which appears to be a former course of the River Wakefield. This flat also separates the dunes from the modern river flats. It is possible that the river cut a course through the dunes, then subsequently changed course to the south, leaving behind in its former bed a string of lagoons or billabongs which would account for the gypsum in the sediments.

**Elevation:** 55 to 80 m

**Relief:** Maximum relief is 15 m

**Soils:** Sandy loam to clay loam texture contrast or gradational soils with well developed red clayey subsoils are common in lower lying positions. Calcareous sandy loams to clay loams with variable rubble are extensive on rises and higher level flats. On sandhills, sand over sandy clay loam and deep sandy soils are characteristic.

#### Main soils

- D2** Loam over red clay - flats
- D3** Sandy loam over dispersive red clay - lower lying swales and flats
- D4** Loam over friable red clay - flats
- A4a** Rubbly calcareous loam - rises and higher level swales
- G1** Loamy sand over red sandy clay - sandy rises

#### Minor soils

- H2** Deep sand - dunes
- A6** Calcareous clay loam - swales
- C3** Gradational clay loam - flats
- A4b** Calcareous sandy loam - rises and higher level swales
- C1** Gradational sandy loam - rises



**Main features:**

The Watchman Land System comprises two distinctive elements:

The old river flats are dominated by loamy texture contrast soils which are deep and inherently fertile, but moderately high salinity and possibly boron within rootzone depths may restrict productive potential. The dunefields have mainly sandy soils with low fertility on the rises and a mixture of loamy calcareous and texture contrast soils in swales and flats. On the dunes, 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 swales 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 the clay is within 75 cm of the soil surface, as is often the case. Tolerant varieties are required in these situations.

**Soil Landscape Unit summary:** 4 Soil Landscape Units (SLUs) mapped in the Watchman Land System

SLU	% of area	Main features #
HXA	53.3	Flats formed on old alluvial or lake floor sediments, generally clayey and often gypseous. There are occasional stony areas on remnant Woorinen Formation carbonate deposits. Main soils: <u>loam over red clay</u> - <b>D2</b> (E), <u>loam over friable red clay</u> - <b>D4</b> (L), <u>sandy loam over dispersive red clay</u> - <b>D3</b> (L), <u>gradational clay loam</u> - <b>C3</b> (L) and <u>rubbly calcareous loam</u> - <b>A4a</b> (M). These soils are deep and moderately fertile with generally favourable structure, although hard setting surfaces are common. Subsoil chemical limitations may be significant, with most soils having moderately high salinity levels below 50 cm, and the widespread occurrence of subsoil gypsum indicates that there may also be high boron concentrations. However, selection of tolerant varieties will overcome this possible limitation.
IVA	2.9	Very gently undulating flats and low rises formed on Hindmarsh Clay. The clay is within 100 cm of the surface over about 60% of the land (mainly flats). There are sporadic low stony and sandy rises. Main soils are <u>loam over red clay</u> - <b>D2</b> (E) and <u>calcareous clay loam</u> - <b>A6</b> (E) with soils as for <b>SWB</b> and <b>UEI</b> on rises. 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. The land has moderate productive potential, provided that the underlying heavy clay is deeper than 75 cm, and that poor soil structure is ameliorated.
SWB	12.2	Rises with slopes of 2-5% formed on soft and rubbly medium textured carbonates of the Woorinen Formation, overlain by occasional very low sand dunes. Main soils are <u>rubbly calcareous loam</u> - <b>A4a</b> (E), <u>loamy sand over red sandy clay</u> - <b>G1</b> (C), <u>calcareous sandy loam</u> - <b>A4b</b> (C) and <u>gradational sandy loam</u> - <b>C1</b> (L). These soils are mostly alkaline to the surface (except the G1 soils), with moderate to low fertility and in the case of the rubbly soils, variable and often low waterholding capacity. All soils, and particularly the sandy G1 types, are prone to wind erosion, and must be kept covered.
UEI	31.6	Dunefields with 30-60% coverage of dunes 5-10 m high formed over Woorinen Formation soft to rubbly carbonates, overlying Hindmarsh Clay. Main soils are: Dunes - <u>deep sand</u> - <b>H2</b> (E) and <u>loamy sand over red sandy clay</u> - <b>G1</b> (E). Low rises and high level flats - <u>rubbly calcareous loam</u> - <b>A4a</b> (V), <u>calcareous sandy loam</u> - <b>A4b</b> (C) and <u>calcareous clay loam</u> - <b>A6</b> (C). Low lying flats - <u>sandy loam over dispersive red clay</u> - <b>D3</b> (E) and <u>calcareous clay loam</u> - <b>A6</b> (E). 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 root growth to maximize 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.



# 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:

- 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.
- A6** Calcareous clay loam (Pedal / Regolithic, Hypercalcic Calcarosol)  
10 - 20 cm calcareous loam to clay loam, more clayey and calcareous with depth over soft Class I carbonate at about 35 cm, grading to Hindmarsh Clay from about 90 cm.
- C1** Gradational sandy loam (Hypercalcic / Lithocalcic, Red Kandosol)  
Soft sandy loam grading to a red friable massive sandy clay loam, highly calcareous with variable rubbly carbonate from about 35 cm, over a very highly calcareous fine sandy clay loam continuing below 100 cm.
- C3** Gradational clay loam (Calcic, Red Dermosol)  
10 - 20 cm clay loam to light clay grading to a well structured red clay calcareous from 40 cm over a brownish clay (often gypseous) from 85 cm.
- D2** Loam over red clay (Calcic, Red Chromosol)  
5 - 20 cm firm loam to sandy loam abruptly overlying a well structured red clay, calcareous from 40 cm, grading to a brownish clay from 85 cm.
- D3** Sandy loam over dispersive red clay (Calcic, Red Sodosol)  
10 - 20 cm 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.
- D4** Loam over friable red clay (Calcic, Pedaric, Red Sodosol)  
5 - 20 cm firm loam to sandy loam abruptly overlying a very well structured and friable red clay, calcareous from 40 cm, grading to a brownish clay (gypseous in 65% of profiles) from 85 cm.
- G1** Loamy sand over red sandy clay (Calcic / Lithocalcic, Red Chromosol)  
15 - 40 cm soft loamy sand abruptly overlying a weakly structured red sandy clay with soft to rubbly carbonate at 45 cm, continuing below 100 cm.
- H2** Deep sand (Regolithic, Calcic Calcarosol OR Calcareous, Arenic, Red-Orthic Tenosol)  
Very thick calcareous (Calcarosol) or non calcareous (Tenosol) sand over a more clayey and calcareous subsoil usually deeper than 100 cm (Class IV or III A carbonate).

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

