

# KJH King John Hill Land System

Series of low hills in the Gulnare - Yacka - Rochester area

**Area:** 119.9 km<sup>2</sup>

**Annual rainfall** 395 – 545 mm average

**Geology:** Interbedded sandstones and siltstones of the Rhynie and Saddleworth Formations, deeply weathered in places and with remnant cappings of Tertiary clays, sands and sandstones on some upper slopes. Fine calcareous sediments which have blown onto the landscape have been leached into the weathered zone of the rocks and occur as soft or (less commonly) rubbly segregations. In places the carbonate has been indurated to calcrete. Locally derived fine grained alluvium occurs as valley infill. This is also coated by carbonates.

**Topography:** The Land System comprises a main range of irregular low hills extending from immediately west of Gulnare southwards to Yacka. There is a second range between Yacka and Rochester and a third (much smaller) north east of Yacka. Slopes are mainly in the range 10 - 30% but in the Broughton River valley there are some dissection slopes to 70%. Eroded watercourses are a feature of the system.

**Elevation:** The highest point is 360 m between Rochester and Yacka; the lowest point is 140 m where the Broughton River flows out on to the Koolunga plains.

**Relief:** Maximum relief is 60 m; the most common range is 30 - 50 m

**Soils:** Sandy loam over red clay soils predominate with shallow calcareous sandy loams and clays.

## Main soils

*Soils formed directly on basement rocks on hillslopes*

**A2a/B2** Shallow calcareous loam

**D1** Hard sandy loam over red clay on rock

*Soils formed on Tertiary sediments or very highly weathered rock on rises*

**C3/C2** Gradational loam on deeply weathered rock

**D2** Sandy loam over red clay

## Minor soils

*Soils formed on Tertiary sediments or very highly weathered rock on hillslopes*

**A2b** Shallow calcareous sandy loam

**A4b** Calcareous sandy loam

**C3b** Gradational clay loam

**D3b** Sandy loam over dispersive red clay

**D3/D7** Sandy loam over dispersive red clay on deeply weathered rock

**E2/E1** Red / black cracking clay

*Soils formed on alluvium on lower slopes*

**A4a** Calcareous sandy loam

**C3a** Gradational clay loam

**D3a** Sandy loam over dispersive red clay

*Soils formed directly on basement rocks on hillslopes*

**L1/B3** Shallow stony sandy loam



**Main features:** The King John Hill Land System comprises a mixture of non arable moderately steep and rocky low hills, and arable slopes. Surface soils are predominantly massive sandy loams to sandy clay loams with dispersive clayey subsoils. These soils have poor infiltration and reduced water holding capacity, are difficult to work effectively and may cause patchy emergence and early growth. Erodibility is high, so even gentle slopes are highly susceptible to erosion. Management of grazing pressure to conserve surface cover, and use of gypsum and modified tillage practices on arable land are necessary to control erosion and prevent further soil structural decline.

**Soil Landscape Unit summary:** 19 Soil Landscape Units (SLUs) mapped in the King John Hill Land System:

SLU	% of area	Main features #
AAB AAD AAI	0.5 0.8 5.4	<p>Rocky low hills formed on mainly fine grained rocks.</p> <p><b>AAB</b> Low hills with slopes of 10-20%</p> <p><b>AAD</b> Steep rocky slopes of 30-70%</p> <p><b>AAI</b> Rolling low hills of 10-30% slope with eroded watercourses</p> <p>Main soils: <u>shallow calcareous loam</u> - <b>A2a/B2</b> (V) with <u>shallow stony sandy loam</u> - <b>L1/B3</b> (L) and <u>hard sandy loam over red clay on rock</u> - <b>D1</b> (L). The hills are non arable due to the roughness of the terrain, moderate slopes and shallow stony soils. Rocky outcrops limit accessibility in places. Runoff is rapid and exposure is high, so a significant proportion of rainfall does not infiltrate the soil. However, areas of deeper soils are potentially productive for grazing.</p>
AXB AXC AXI AXJ AXi	0.1 3.5 6.9 0.9 0.3	<p>Rocky rises and low hills formed on basement rocks, commonly deeply weathered and variably capped by Tertiary sands which are partially silcreted.</p> <p><b>AXB</b> Short slopes of 15-25%.</p> <p><b>AXC</b> Rolling low hills of 10-35% slope.</p> <p><b>AXI</b> Rolling low hills of 10-35% slope with eroded watercourses.</p> <p><b>AXJ</b> Steep low hills of more than 30% slope with eroded watercourses.</p> <p><b>AXi</b> Rolling low hills of 10-35% slope with eroded watercourses and scalding.</p> <p>Main soils: <u>shallow stony sandy loam</u> - <b>L1/B3</b> (E), with <u>shallow calcareous sandy loam</u> - <b>A2b</b> (C), <u>sandy loam over dispersive red clay on deeply weathered rock</u> - <b>D3/D7</b> (L) and <u>hard sandy loam over red clay on rock</u> - <b>D1</b> (L). These slopes are non arable because of their slopes, severe erosion, extensive rockiness and shallow, low fertility soils. Deeply weathered, kaolinitic soils are often associated with high levels of stored salts, so recharge of groundwater should be controlled in these areas.</p>
DJC DJD DJH DJI	18.4 8.9 20.0 21.4	<p>Rises and low hills formed on basement rock, deeply weathered in places and partially overlain by Tertiary clay, sandstone and silcrete.</p> <p><b>DJC</b> Rises and low hills of 4-12% slope.</p> <p><b>DJD</b> Moderate slopes of 8-20%.</p> <p><b>DJH</b> Undulating low hills of 4-12% with eroded watercourses.</p> <p><b>DJI</b> Moderate slopes of 8-20% with eroded watercourses.</p> <p>Main soils: <u>sandy loam over red clay</u> - <b>D2</b> (E), <u>hard sandy loam over red clay on rock</u> - <b>D1</b> (C), with <u>shallow calcareous loam</u> - <b>A2a/B2</b> (C), <u>gradational loam on deeply weathered rock</u> - <b>C3/C2</b> (L) and <u>sandy loam over dispersive red clay on deeply weathered rock</u> - <b>D3/D7</b> (L). These slopes are dominated by severely eroded watercourses. This is partly the result of the moderate slopes and partly due to the high erodibility of the hard setting poorly structured soils which dominate. Apart from erosion potential, these soils suffer from poor infiltration and waterholding capacities, they are difficult to work without affecting structure and they are prone to patchy emergence. Surface stones are common and the quartzitic and ironstone types are highly abrasive.</p>



EQC EQD	0.7 1.5	Upper slopes of 6-12% slope ( <b>EQC</b> ) and breakaways ( <b>EQD</b> ) underlain by deeply weathered basement rocks or Tertiary sandstone. Main soils: <u>shallow calcareous sandy loam - A2b</u> (E) <u>gradational loam on deeply weathered rock - C3/C2</u> (C), with <u>hard sandy loam over red clay on rock - D1</u> (L), <u>sandy loam over red clay - D2</u> (L) and <u>shallow stony sandy loam - L1/B3</u> (L) associated with rocky land. These small areas are high in the landscape and very exposed. There is variable rocky outcrop and the slopes are irregular and steep on breakaways. Most soils are shallow on highly weathered rocks and therefore have moderately low fertility status. There are occasional scalded patches.
HJC HJH	3.7 4.1	Undulating slopes of 3-10% ( <b>HJC</b> ) and low hills of 4-10% slope with eroded watercourses ( <b>HJH</b> ) formed on Tertiary sandstones and related unconsolidated sediments. Main soils: <u>sandy loam over red clay - D2</u> (E) and <u>sandy loam over dispersive red clay - D3b</u> (E), with <u>calcareous sandy loam - A4b</u> (L) and <u>gradational loam - C3b</u> (L). The slopes are highly erodible due to their predominantly poorly structured soils. There has been substantial erosion in the past. The hard setting surfaces shed water, have reduced water storage capacity, are difficult to work and cause patchy emergence.
JJB JJJ	1.9 0.4	Very gentle slopes of 1-3% ( <b>JJB</b> ) and drainage depressions with eroded watercourses ( <b>JJJ</b> ) formed on fine grained outwash sediments. Main soils: <u>sandy loam over dispersive red clay - D3a</u> (E) and <u>gradational clay loam - C3a</u> (E) with <u>calcareous sandy loam - A4a</u> (L). The slopes are fully arable, the main limitation being the poor soil structure of the predominant D3a soils. Hard setting surfaces and dispersive subsoils restrict workability and cause excessive runoff and patchy emergence. Soil fertility is sub-optimal because of the generally sandy nature of the topsoil.
TAZ	0.6	Undulating upper slopes of less than 4% formed on remnant Tertiary clayey sediments. Main soils: <u>gradational clay loam - C3b</u> (E), <u>calcareous sandy loam - A4b</u> (E) and <u>red / black cracking clay - E2/E1</u> (E). This land has few limitations with predominantly deep, fertile, well drained soils and minimal erosion potential.

# 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:

- A2a/B2** Shallow calcareous loam (Paralithic / Petrocalcic, Hypercalcic / Lithocalcic Calcarosol)  
Calcareous stony sandy loam to clay loam grading to soft or rubbly carbonate at shallow depth over weathering rock or calcreted rock at about 50 cm.
- A2b** Shallow calcareous sandy loam (Petrocalcic, Lithocalcic Calcarosol)  
Shallow calcareous sandy loam over calcreted Tertiary sandstone.
- A4a** Calcareous sandy loam (Regolithic, Hypercalcic / Lithocalcic Calcarosol)  
Calcareous sandy loam to sandy clay loam grading to Class III A carbonate (sometimes rubbly) in a sandy clay loam to light clay matrix from about 40 cm, overlying alluvium.
- A4b** Calcareous sandy loam (Regolithic, Hypercalcic / Lithocalcic Calcarosol)  
Calcareous sandy loam to sandy clay loam grading to Class III A carbonate (sometimes rubbly) in a sandy clay loam to light clay matrix from about 40 cm, Tertiary sandstone or deeply weathered rock.
- C3/C2** Gradational loam on deeply weathered rock (Hypercalcic / Lithocalcic, Red Dermosol)  
Loam to clay loam grading to a well structured red clay with soft Class III A (occasionally rubbly) carbonate from about 60 cm, over very highly weathered basement rock.



- C3a** Gradational clay loam (Hypercalcic / Hypocalcic, Red Dermosol)  
Loam to clay loam grading to a well structured red clay overlying fine carbonate within 50 cm over alluvial sediments from about 100 cm.
- C3b** Gradational clay loam (Hypercalcic / Lithocalcic, Red Dermosol)  
Clay loam to loam grading to a well structured red clay with soft Class I (occasionally rubbly) carbonate from about 60 cm, over Tertiary clayey sediments.
- D1** Hard sandy loam over red clay on rock (Calcic / Supracalcic, Red Chromosol)  
Hard sandy loam to sandy clay loam abruptly overlying a well structured red clay with soft to sometimes rubbly carbonate from about 50 cm, grading to basement sandstone or siltstone by 100 cm.
- D2** Sandy loam over red clay (Hypercalcic / Calcic, Red Chromosol)  
Sandy loam to loam overlying a well structured red clay with soft Class I carbonate from about 60 cm, over Tertiary sandstone or clay on gentle slopes, or very highly weathered basement rock on hillslopes.
- D3a** Sandy loam over dispersive red clay on alluvium (Hypercalcic / Supracalcic, Red Sodosol)  
Hard setting loamy sand to sandy clay loam sharply overlying a poorly structured dispersive red clay with soft Class I (occasionally rubbly) carbonate from about 60 to 80 cm, over alluvial clay.
- D3b** Sandy loam over dispersive red clay on Tertiary sediments (Hypercalcic / Supracalcic, Red Sodosol)  
Hard setting loamy sand to sandy clay loam sharply overlying a poorly structured dispersive red clay with fine (occasionally rubbly) carbonate from about 70 cm, over sandy clay or weathered Tertiary sandstone.
- D3/D7** Sandy loam over dispersive red clay on deeply weathered rock (Hypercalcic / Calcic, Red Sodosol)  
Hard setting loamy sand to sandy clay loam sharply overlying a poorly structured dispersive red clay with soft Class I (occasionally rubbly) carbonate from about 60 to 80 cm, over deeply weathered basement rock.
- E2/E1** Red / black cracking clay (Self-mulching, Red Vertosol)  
Deep red to black cracking clay with a well structured surface, overlying Tertiary clay.
- L1/B3** Shallow stony sandy loam (Lithic / Petrocalcic / Silpanic, Leptic Tenosol / Rudosol)  
Shallow stony sandy loam to clay loam over hard basement rock, calcrete or silcrete. Carbonate may be present in rock fissures.

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

