BRE Bremer Land System

Hills section of the Bremer River valley

Area: 54.6 km^2

Annual rainfall: 390 – 545 mm average

Geology: The dominant component of the geology is the suite of alluvial sediments deposited by the Bremer River and its tributaries. These are sandy, silty and less commonly clayey, and are distinctively micaceous. Basement rocks (metasandstones and greywackes, schists and phyllites of the Tappanappa and Tunkalilla Formations) protrude through the sediments in places. Tertiary sands and sandy clays, partly indurated and ferruginized, occur to a limited extent in the upper valley. The basement rocks and Tertiary sediments are commonly capped by windblown calcareous deposits, hardened in places to calcrete. Drift sand (Molineaux Sand) occurs mainly as banks piled against the eastern escarpment, or as discrete low rises on the valley floor.

Topography: The System is an elongate, north - south oriented river valley running along the base of the Bremer escarpment. The Bremer River rises in the north and flows south down the valley on its way to Lake Alexandrina. Narrow streams enter the valley from both the west and the east, but the only significant tributary is Kanmantoo Creek which is included in the System and enters the main valley about half way down its western side. The river has cut down through basement rocks and overlying Tertiary sediments. Remnants of these occur as rises and benches in the valley floor. Drift sand banks are distinctive features on the eastern edge adjacent to the escarpment.

Elevation: 40 m in the south to 270 m in the north

Relief: Up to 50 m, but usually less than 20 m

Soils: There is a wide variety of soils in the System, reflecting the diversity of geological materials. The soils have been grouped according to their geological setting.

Main soils

Soils formed on alluvial sediments

M4 Gradational sandy loam
D2 Sandy loam over red clay
M1 Deep sandy loam

Soils formed on sand

H2 Deep red sand

Soils formed on basement rock

D1/K3 Sandy loam over red / brown clay

Minor soils

Soils formed on basement rock

L1 Shallow stony loamy sand over hard rock (**L1a**) to sandy loam over calcified rock (**L1b**)
A2 Calcareous loam
G1a Sand over sandy clay loam

Soils formed on alluvial sediments

D3 Loam over dispersive red clay
G1b Sand over sandy clay

Soils formed on remnant Tertiary sediments
D6 Ironstone gravelly sandy loam
G1c Sand over red sandy clay
C1 Gradational sandy loam
A4 Calcareous sandy loam
Soils formed on calcrete
B2 Shallow stony sandy loam

Main features: The Bremer Land System is a long narrow valley characterized by a complex of deep soils over alluvium and shallow soils over basement rocks or Tertiary sediments. The deeper alluvial soils have mainly sandy to sandy loam surfaces with variable subsoils including sandy clays and clays, sandy clay loams or silty to clayey sands. They are well drained but often low in fertility and the sandier types without clay subsoils have low moisture holding capacity. The loamier types have poor surface structure. There is sporadic saline seepage. Water course erosion has been substantial in the past. Soils on the remnant rises are less than 100 cm and often less than 50 cm deep. They have sandy loam surfaces, often without clayey subsoils. Deep sands along the Bremer Escarpment are infertile and prone to wind erosion.

Soil Landscape Unit summary: 26 Soil Landscape Units (SLUs) mapped in the Bremer Land System:

SLU	% of area	Main features #
AKA AKB AKC	0.8 3.3 1.7	Very rocky rises and low hills formed on basement rocks. Extensive rock outcrop is the key feature of these landscapes. **AKA** Gently sloping rises with relief to 20 m and slopes of 3-10%. **AKB** Moderately inclined slopes with relief to 30 m and slopes of 10-20%. **AKC** Hillslopes with relief to 50 m and slopes of 20-30%. Most soils are: shallow over rock, but between outcrops, deeper profiles with loamy surfaces and red clay subsoils may occur. Main soils: Shallow stony loamy sand - **L1a** (E) Shallow loamy sand over calcified rock - **L1b** (E) Sandy loam over red clay - **K3** (E) This land is too rocky and mostly too steep for any cultivated agricultural uses. However the land is useful for rough grazing.
DaB DaC	3.5 10.0	Undulating to gently rolling low rises and footslopes formed on calcified basement rocks. There is minor to limited rock outcrop. **DaB** Gently undulating low rises with relief to 10 m and slopes of 1-3%. **DaC** Undulating rises with relief to 30 m and slopes of 3-10%. The soils are mostly underlain by rock within a metre, but have variable depths, subsoils and carbonate accumulations. Main soils: Sandy loam over red clay - **D1** (E) Shallow loamy sand over calcified rock - **L1b** (C) Calcareous loam - **A2** (C) These soils are generally moderately deep and fertile, although shallower stony soils with limited water holding capacity occur. Poor surface structure is a slight limitation, but overall there are no significant constraints to productivity.
EaC	1.0	Footslopes underlain by basement rock, with about 10% rocky outcrops. Slopes are 3-10%. The soils are underlain by rock within a metre, and are often shallow. Main soils: Shallow loamy sand over calcified rock - **L1b** (E) Sandy loam over red clay - **D1** (E) Calcareous loam - **A2** (E) This land is semi arable. Although many soils are moderately deep and fertile, there is a significant proportion of rocky outcrop and shallower stony soils with limited water holding capacity.
EfB	8.7	Undulating rises formed on deeply weathered strongly calcified basement schists. Relief is up to 20 metres and slopes are 2% to 6%. The soils are shallow to moderately deep over soft weathering rock. Main soils: Calcareous loam - **A2** (E) Sandy loam over red clay - **D1** (E)

		The main soils are alkaline and less fertile than the associated non calcareous types. They also tend to be moderately saline. Although the soils are somewhat shallow, the underlying soft rock is able to store significant moisture.
GDB	1.8	Very low rises, less than 10 metres high, with slopes of 1% to 3%, formed on gravelly Tertiary sandy clay loam to sandy clay, overlain by Class III carbonates of the Woorinen Formation. The soils have sand to sandy loam surfaces over reddish sandy clay loam to clay subsoils with abundant carbonate at relatively shallow depth. Main soils: Sand over red sandy clay - **G1c** (E) Gradational sandy loam - **C1** (E) These rises have low fertility soils prone to wind erosion.
HKC	1.1	Remnant benches up to 10 m high with side slopes to 10% and flatter crests, formed on sandy clays and clayey sands, partially calcreted and ferruginized. Slopes are 2% to 10%. Soils are mostly sand to sandy loam over red sandy clay to clay with variable ironstone. Main soils: Ironstone gravelly sandy loam - **D6** (E) Sand over red sandy clay - **G1c** (E) Calcareous sandy loam - **A4** (E) These small areas are stony with variable soils of low fertility. Occasional saline seepages.
JHJ	1.2	Narrow drainage depressions carrying runoff water from the Bremer Escarpment. The land is dominated by water courses which have been severely eroded in the past. Main soils: loam over dispersive red clay - **D3** (E) and deep sandy loam - **M1** (E). Maintaining the stability of creek banks and beds is the main management issue in this unit.
JUA JUC JUG JUJ JUO	0.1 1.5 10.2 0.8 9.2	Flats and outwash fans with slopes to 7% formed on alluvial silts, sands and sandy clays, weakly calcified. **JUA** Flats with slopes of 0-1%. **JUC** Gently inclined fans with slopes of 3-7%. **JUG** Very gently inclined alluvial flats with 1-3% slopes and severely eroded water courses. **JUJ** Eroded drainage depressions. **JUO** Alluvial flats affected by sporadic saline seepage. Main soils: Sandy loam over red clay - **D2** (E) Loam over dispersive red clay - **D3** (E) Deep sandy loam - **M1** (L) Gradational sandy loam - **M4** (C) The soils are deep and moderately fertile. Poor structure and high erodibility are significant limitations. The landscape is very severely gullied, with many water courses incised to depths of up to eight metres, so accessibility is a common problem. Saline seepage occurs sporadically in the upper reaches of the valley.
JWB JWC JWH	1.7 3.8 7.7	Gently inclined outwash fans at the foot of the Bremer Escarpment, lying between the sand banks (**U-u**), immediately adjacent to the escarpment, and the gentler sloping fans and drainage depressions of **JUO/KnA**. Slopes range from 2-8%. Underlying sediments are strongly calcified medium to coarse grained outwash deposits from Kanmantoo Group rocks. **JWB** Very gently sloping fans with slopes of 2-3%. **JWC** Gently sloping fans with slopes of 3-8%. **JWH** As for JWC but with eroded water courses. Main soils: Sand over sandy clay - **G1b** (E) Sandy loam over red clay - **D2** (E) Deep red sand - **H2** (L) These soils are mainly sandy with low natural fertility and a predisposition to wind erosion. They are well drained and do not have significant limitations to root growth except where the surface soil is thin.
JfA	3.2	River flats formed on clayey sand to silty clay loam alluvium. Main soils: Gradational sandy loam - **M4** (E) Sandy loam over red clay - **D2** (E) These soils are deep, moderately fertile and except for poorly structured surfaces which are liable to compaction, they have few limitations.
KnA	7.3	Gently undulating flats formed on sandy and silty micaceous alluvium. Main soils: Deep sandy loam - **M1** (E) Gradational sandy loam - **M4** (E) Soils are deep and well or even excessively drained, and have moderately low fertility.
QMD QMZ	0.4 1.8	Low rises and benches formed on sheet or rubbly calcrete. There is 20-50% surface calcrete and outcropping sheet rock. **QMD** Moderately steep rises with variable slopes to 40%. **QMZ** Flat topped benches.

		Main soils: Shallow stony sandy loam - **B2** (E) Calcareous sandy loam - **A4** (E) These soils are generally too shallow and stony for agriculture. They are often too steep as well. The land is well suited to grazing.
QVC	0.7	Gentle to moderate slopes formed on rubbly calcrete, with up to 20% surface stone. Slopes are up to 4%. Main soils: Calcareous sandy loam - **A4** (E) Shallow stony sandy loam - **B2** (E) These soils are shallow and stony, but have more productive potential than those of **QMB/QMZ**. Main limitations are restricted waterholding capacity and low fertility.
U-K	0.4	Low sand rises on the flats of the river. Main soil is: Deep red sand - **H2** (D) These soils are deep and well drained with no physical limitations, but low in natural fertility and prone to wind erosion.
U-u	11.3	Drift sand banks accumulated against the Bremer Escarpment. Slopes are up to 5%. Large gullies occur where the banks are subject to runoff from the escarpment. Main soil is: Deep red sand - **H2** (D). These soils are infertile and prone to both wind and water erosion.
XHT	6.8	Channel of the Bremer River, including its bed, banks and levees. The banks are commonly steep and unstable. Main soils: Deep sandy loam - **M1** (E) Gradational sandy loam - **M4** (E) The main issue is control of water course erosion and maintenance of a healthy aquatic environment in the river.

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:

Soils formed on basement rock

L1a Shallow stony loamy sand (Lithic, Leptic Rudosol)
Medium thickness reddish brown massive loamy sand to sandy loam with abundant rock fragments, overlying hard metamorphosed sandstone.

L1b Shallow sandy loam over calcified rock (Calcareous, Paralithic, Leptic / Red-Orthic Tenosol)
Medium to thick brown loamy sand to sandy loam with rock fragments throughout, overlying weakly calcified schist or metasandstone, usually within 50 cm, but often deeper on softer schistose rocks.

D1/K3 Sandy loam over red / brown clay (Calcic / Eutrophic, Red / Brown Chromosol)
Medium thickness stony sandy loam, overlying a red or brown well structured clay grading to weathering sandy schist or metasandstone, sometimes with soft carbonates in fractures.

A2 Calcareous loam (Paralithic, Calcic Calcarosol)
Medium thickness dark brown calcareous loamy sand to loam grading to a dark brown to grey brown, massive highly calcareous sandy clay loam to clay loam with variable content of carbonate nodules, over a pale brown soft carbonate layer with clay loam texture. Very soft, highly calcareous weathered mica schist occurs at about 100 cm.

G1a Sand over sandy clay loam (Hypercalcic, Red Chromosol)
Very thick reddish brown sand to loamy sand, overlying a thin reddish brown massive sandy clay loam, highly calcareous at the base, grading to weathering metamorphosed sandstone at about 100 cm.

Soils formed on alluvial sediments

D2 Sandy loam over red clay (Hypercalcic, Red Chromosol)
Medium thickness reddish brown loamy sand to light sandy clay loam, overlying a dark reddish brown sandy clay loam to light clay with moderate blocky structure and a yellowish, very highly calcareous sandy clay (Class III A carbonate) from 65 cm. The profile overlies a brown and red clayey sand to sandy clay, with decreasing carbonate content from 100 cm.

D3 Loam over dispersive red clay (Calcic, Red Sodosol)
Thick loamy surface soil with a paler coloured A2 horizon, overlying a dark reddish brown strongly structured clay subsoil, which is 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 (Basic, Lutic Rudosol or Basic / Calcareous, Regolithic, Brown-Orthic Tenosol)
Very thick brown loamy sand, sandy loam, silty loam or light sandy clay loam, often uniform to 150 cm or more, or with variable carbonate segregations, gritty or more clayey lenses at depth. The soil is formed in micaceous sandy, silty, gritty or clayey alluvial sediments.

M4 Gradational sandy loam (Hypocalcic, Red / Brown Kandosol)
Thick reddish brown sand to silt loam, grading to a reddish brown or dark brown massive silty sand to sandy clay loam with occasional carbonate nodules, grading to variable silty, sandy and clayey, layered alluvial sediments.

G1b Sand over sandy clay (Hypercalcic, Red Sodosol)
Thick reddish brown sand to loamy sand with a paler A2 horizon, overlying a red to orange coarsely prismatic sandy clay with a highly calcareous Class III A carbonate layer from 75 cm, grading to a clayey sand to sandy clay loam with decreasing calcareous segregations.

Soils formed on remnant Tertiary sediments

D6 Ironstone gravelly sandy loam (Calcic, Red Kandosol / Chromosol)
Medium thickness reddish brown loamy sand to sandy loam with a paler coloured and ironstone gravelly A2 horizon, grading to a well structured red clay with soft calcareous segregations (Class III A carbonate) from 70 cm, over soft ferruginized sandstone at 100 cm.

G1c Sand over red sandy clay (Hypercalcic, Red Sodosol)
Thick red brown loamy sand to sandy loam with a paler coloured A2 layer, overlying a red sandy clay with weak coarse columnar structure and soft Class III A carbonate from 55 cm. Semi-hard calcrete pans are common. Soft sandstone from 80 cm.

C1 Gradational sandy loam (Lithocalcic, Red Kandosol)
Medium thickness red brown sandy loam, overlying a red brown sandy clay loam with quartz gravel and calcrete nodules, grading to a yellow highly calcareous sandy clay with abundant calcareous nodules (Class III C carbonate).

A4 Calcareous sandy loam (Lithocalcic 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, grading to a pale brown very highly calcareous clay with more than 50% calcrete nodules (Class III C carbonate) from 50 cm. Weak calcrete pans occur sporadically.

Soils formed on calcrete

B2 Shallow stony sandy loam (Petrocalcic Calcarosol)
Medium thickness calcareous loamy sand to light sandy clay loam over sheet or rubbly calcrete, grading to soft very highly calcareous pale brown sandy loam to clay loam with decreasing rubble content.

Soils formed on sand

H2 Deep red sand (Basic, Arenic, Red-Orthic Tenosol)
Deep reddish sand grading to red clayey sand between 100 cm and 250 cm.

Further information: DEWNR Soil and Land Program