BAV Barossa Valley Land System

Gently inclined plains and undulating rises of the Barossa Valley

Area: 144.9 km^2

Annual rainfall: 465 – 595 mm average

Geology: The Barossa Valley is an elongate tectonic feature formed by the upthrusting of blocks of the earth's crust now evident as the Greenock Hills and Angaston Hills to the west and east respectively. Prior to these earth movements, the area was a wide plain formed on Tertiary age sediments, mainly sandy clays and clayey sands, capped by heavy clay deposits. Following the crustal movements, there was considerable erosion or burial of these old sediments by younger materials washing off the ranges. Today, only scattered remnants of the Tertiary sediments are evident in the northern part of the valley (along the western side), but in the south (Tanunda - Rowland Flat area), there are extensive deposits remaining. These overlie basement rocks which are near the surface around the fringes. There has been reworking of these sediments over time by water and wind into sandy clay alluvium and drift sand deposits respectively. The more recent alluvial deposits on the valley floor derive from the escarpment bounding the eastern side of the valley. These are mainly fine grained except for a belt of sandy and micaceous sediments between Bethany and Nuraip which appear to have granitic origins (possibly the Mt. Kitchener Land System). Windblown carbonates would have been deposited on most of the land in more recent times, but much of it, particularly on the rises, has been leached out. Most alluvial and colluvial sediments contain soft carbonate segregations.

Topography: The Land System is dominated by a gently inclined outwash fan with west facing slopes of usually less than 3%, but up to 7% along the eastern margins. The central northern part of the valley is flat. Several streams flow across the fans - Stockwell and St. Kitts Creeks flow across the north end and exit in the north west corner, while the North Para River (joined by Angaston Creek) flows in a south westerly to southerly direction and drains the majority of the System. In the south numerous streams, including Jacob's Creek, flow westwards across the fan to join the North Para. Along the western side, the remnant Tertiary deposits form a strip abutting the upthrust zone of basement rock forming the valley boundary. They have been dissected by east flowing streams resulting in a regular pattern of rises and shallow valleys. The rises commonly have a pronounced east - west orientation, enhanced by reworking of sands by westerly winds into linear dunes (this dune morphology may have determined stream patterns in the first place). Side slopes of the rises are up to 12%, and relief is up to 25 m. In the south there has been less dissection of the Tertiary sediments. Large areas of Tertiary land surface remain intact as elevated clay plains.

Elevation: 330 m in the north west and 320 m in the east to 200 m in the south west where the North Para flows out of the System.

Relief: Maximum relief is 25 m

Soils: The complex geology of the system gives rise to a diverse range of soils. Texture contrast types dominate, with surface textures varying from sand to sandy clay loam. Subsoils include well structured and well drained red clays, friable brown sandy clays, and dispersive red and brown mottled clays. Less common soils include cracking clays, deep sandy to loamy alluvial soils, deep sands and ironstone soils.

Main soils

Soils of flats and lower slopes

D2a Hard sandy loam over red clay
D3 Hard sandy loam over dispersive red clay
G3a Thick sand over sodic clay
F2a Loamy sand over poorly structured brown clay

Minor soils

Soils of flats and lower slopes

A6 Calcareous clay loam
C5 Dark clay loam over semi hard carbonate
D2b Clay loam over red clay
D5a Hard loamy sand over red clay
E3 Brown cracking clay
F1 Sandy loam over brown clay
F1/G3 Sandy loam over brown mottled clay
G3/F1 Loamy sand over brown and red clay
G3b Thick loamy sand over red clay
G4 Sand over poorly structured clay

Soils on rises

D5b Loamy sand over red clay
D6 Ironstone gravelly loamy sand over clay
D7 Sandy loam over red clay on rock
E1 Black cracking clay
F2b Sandy loam over poorly structured brown clay
G3c Thick sand over sandy clay
H3 Deep sand
M2a Deep gradational clay loam

Soils formed on recent alluvium

M1 Sandy alluvial soil
M2b Deep clay loam
M4 Gradational sandy loam

Main features: The Barossa Valley Land System comprises a flat to gently sloping valley floor, with undulating rises in the west and elevated plains in the south. The valley floor can be divided into two main types of land - i) hard sandy loams over red clays which are deep, inherently fertile and moderately well drained, and ii) sands over dispersive brown clays which are moderately shallow, inherently infertile and imperfectly drained. Waterlogging and sporadic salinity in lower lying areas are the main limitations to land use, although poor surface structure (and associated erosion potential) is a major management issue. In the western undulating areas the dominant soils are sands and sandy loams over brown clays. Waterlogging, fertility and wind erosion are the main management concerns. The elevated plains of the south are dominated by clay soils which are highly fertile; excellent cropping soils but difficult soils for viticultural development.

Soil Landscape Unit summary: 24 Soil Landscape Units (SLUs) mapped in the Barossa Valley Land System:

SLU	% of area	Main features #
AZm	0.2	Short steep river cliffs eroded into mixed basement rocks and Tertiary sediments. These small isolated areas have little agricultural value.
GAB GAC	1.1 5.2	Rises and dunes formed on Tertiary sandy clays, clayey sands and sandstones, and reworked drift sand deposits. **GAB** Low dunes less than 10 m high and with slopes of less than 4%. **GAC** Rises and dunes to 25 m high with slopes of 3-12%.

		Main soils: thick sand over sandy clay - **G3c** (E), sandy loam over poorly structured brown clay - **F2b** (L), sand over poorly structured clay - **G4** (L), ironstone gravelly loamy sand over clay - **D6** (L) and deep sand - **H3** (L). These soils are generally sandy and have low levels of natural fertility. Drainage is variable depending on depth to and nature of the clay - the soils with poorly structured subsoil clays at shallow depth are most prone to waterlogging. On rises there is some degree of lateral seepage through the sand along the top of the clay. The deeper the thickness of sand over clay, the lower the likelihood of waterlogging being a limiting factor. All soils are susceptible to wind erosion, and on the steeper slopes there is also potential for water erosion.
GBB GBC GBD	2.4 4.9 0.1	Rises formed on Tertiary sandy clays, clayey sands and sandstones. **GBB** Low rises to 15 m high with slopes of 2-4%. **GBC** Rises to 20 m high with slopes of 4-12%. **GBD** Rises to 40 m high with slopes of 8-16%. Main soils: thick sand over sandy clay - **G3c** (E), ironstone gravelly loamy sand over clay - **D6** (L), loamy sand over red clay - **D5b** (L), sandy loam over poorly structured brown clay - **F2b** (L), sand over poorly structured clay - **G4** (L), loamy sand over brown and red clay - **G3/F1** (L) and deep sand - **H3** (M). Sandy loam over red clay on rock - **D7** occurs where underlying basement rock is close to the surface. These soils are generally low in fertility and imperfectly drained. Thickness of topsoil over clay is critical in determining the degree of waterlogging. All soils are erodible - there is potential for both wind and water erosion.
GFB GFC	8.4 0.3	Lower slopes and flats with slopes of 1-3% formed on reworked Tertiary sandy clay sediments. **GFB** Very gently inclined lower slopes and flats with slopes of 1-3%. **GFC** Gently inclined lower slopes of 3-10%. Main soils: thick sand over sandy clay - **G3a** (E), loamy sand over poorly structured clay - **F2a** (C), sand over poorly structured clay - **G4** (L) and loamy sand over brown and red clay - **G3/F1** (L). The main soils are infertile and poorly drained, with seepage from adjacent rising ground (GA* and GB*) contributing to the problem. They rely on having an adequate thickness of surface soil above their dispersive clay subsoils (more than 30 cm and preferably more than 60 cm) to avoid waterlogging problems. The thick sand over clay soils are better drained (although not ideal). There is a slight potential for both water and wind erosion throughout.
JCA	1.8	Outwash fans formed on fine grained alluvium, with slopes of 1-2%. Main soils: hard sandy loam over red clay or dispersive red clay - **D2a/D3** (E), dark clay loam over semi hard carbonate - **C5** (E) and brown cracking clay - **E3** (C). These soils occur in a red and black "mosaic pattern". The range in surface soils (self-mulching clay to hard sandy loam) and waterlogging over short distances makes management difficult. However, all soils are inherently fertile and productive.
JGA JGB JGC JGD JGJ JGP	13.0 9.6 6.5 0.7 1.2 3.2	Outwash fans and flats formed on clay and sandy clay alluvium. **JGA** Fans and flats with slopes of less than 1%. **JGB** Fans with slopes of 1-3%. **JGC** Fans with slopes of 3-12%. **JGD** Moderately inclined slopes of 12-20%. **JGJ** Eroded water courses and immediately adjacent outwash fan slopes. **JGP** Alluvial flats with slopes of less than 1% and marginal salinity (Stockwell Creek flood plains), overlain by up to 45 cm clay loamy flood sediment. Main soils: hard sandy loam over red clay - **D2a** (E) and clay loam over red clay - **D2b** (C) with hard sandy loam over dispersive red clay - **D3** (L), thick loamy sand over red clay - **G3b** (L), sandy loam over brown mottled clay - **F1/G3** (L), sandy loam over poorly structured clay - **F2a** (M) and calcareous clay loam - **A6** (M). Soils of JGD in particular are very stony. The dispersive soils are dominant in JGP. Soils are deep and moderately fertile, and generally well drained, although dispersive subsoils cause water tables to develop on top of the clay in winter. The main limitation is poor surface structure which restricts water entry, reduces water holding capacity, impedes good shallow root growth and predisposes the soils to erosion, particularly if excessively worked. All sloping land is at risk of erosion if disturbed. Erosion has been severe in the past, especially in **JGJ**. The problem of imperfect drainage in JGP is exacerbated in places by salinity.
JQA	2.5	Flats with slopes of less than 1%, generally adjacent to modern river flood plains. Main soil: sandy loam over brown clay - **F1** (D). These soils have somewhat impeded drainage due to their heavy coarsely structured subsoils, particularly where topsoils are thin. They also have hard, compact surfaces which impede water entry, reduce water holding capacity and retard emergence and root growth. However, fertility is moderately high and

		profiles are deep.
JRA JRC	6.1 1.4	Flats and outwash fans formed on alluvial sandy clay and sandy sediments. **JRA** Flats with slopes of less than 1%. **JRC** Fans with slopes of 3-7%. Main soils: loamy sand over brown and red clay - **G3/F1** (E), sandy loam over poorly structured clay - **F2a** (E), sand over poorly structured clay - **G4** (E) and hard loamy sand over red clay - **D5a** (L) in JRA; and thick sand over clay - **G3b** (E), sandy loam over brown mottled clay - **F1/G3** (C) sandy loam over brown clay - **F1** (C) in **JRC**. These soils are characterized by thick sandy surfaces over coarsely structured subsoils which impede water movement (perched watertable development) and root growth. The deeper soils of **JRC** are not particularly affected, but the shallower soils of **JRA** can be seriously affected. The low lying topographic position or **JRA** adds to the problem of seasonal waterlogging. Surface structure varies from soft (sandy soils) to hard and massive (sandy loam soils). The former have low fertility and are prone to wind erosion. The latter have moderate fertility, but have low infiltration rates, poor water storage capacities and impede seedling and root growth. Water erosion is a potential problem in **JRC**.
KWK	1.5	Low lying flats with gilgai microrelief (mounds and hollows) formed on clayey sediments. Main soils: brown cracking clay - **E3** (E) and sand over poorly structured clay - **G4** (E). This land is characterized by poor drainage, related to topographic position and slowly permeable clay close to the surface. Associated with the impeded drainage is sporadic salinity. Inherent fertility is variable, moderate to high in the alkaline cracking clays, low in the neutral sand over clay soils. The differences in texture and pH, together with the uneven surface and waterlogging, make these soils very difficult to manage.
LSA LSB	6.4 5.3	Outwash fans formed on micaceous silty sands to sandy clays. **LSA** 0-2% slope. **LSB** 2-5% slope. Main soils: thick sand over sandy clay - **G3a** (E), sand over poorly structured clay - **G4** (C), gradational sandy loam - **M4** (L), sandy alluvial soil - **M1** (L) and sandy loam over poorly structured clay - **F2a** (L). These soils generally have sufficient surface soil thickness that unfavourable subsoil conditions are manageable. Where surface sands are less than 30 cm thick, perched water tables develop on top of the clay, particularly in **G4** soils. Natural fertility levels are low due to the predominantly sandy surface soils, which are also liable to wind erosion. On sloping ground, water erosion may also be a problem. The land is widely and successfully used for viticulture.
TAB TAZ	0.8 9.4	Low rises, gentle slopes and low plateaux formed on Tertiary clay. **TAB** Low rises and gentle slopes to 4%. **TAZ** Gently undulating flat topped rises or plateaux. Slopes are 2-4%. Drainage depressions are broad with weakly defined water courses. Main soils: black and grey cracking clay - **E1** and **E3** (V), with sandy loam over poorly structured clay - **F2b** (L) and deep gradational clay loam - **M2a** (L). The cracking clays are deep and inherently fertile, but are difficult to manage when wet, prone to waterlogging and have high water retention, causing moisture stress in plants. However, because of their high nutrient status and favourable surface structure, they have high productive potential.
XHJ	8.0	Flats and depressions associated with the North Para River and Angaston Creek. Soils are variable alluvial types including sandy alluvial soil - **M1** (E), gradational sandy loam - **M4** (C), sandy loam over brown clay - **F1** (L), deep clay loam - **M2b** (L) and hard sandy loam over red clay - **D2a** (L). The sandier types are deep and free draining, with low to moderate fertility, while the clay loams are less well drained and salty in places, although more fertile. Lower flats are subject to flooding.

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 on flats and lower slopes

C5 Dark clay loam over semi hard carbonate (Hypercalcic, Brown Dermosol)
15 - 20 cm self-mulching dark clay loam overlying soft to weakly platy carbonate, gradually decreasing with depth to mottled clay from about 120 cm.

D2a Hard sandy loam over red clay (Calcic, Red Chromosol)
10 - 60 cm hard massive to platy loamy fine sand to fine sandy loam abruptly overlying a well structured red clay with soft carbonate from 50 cm (range 30 - 100 cm).

D2b Clay loam over red clay (Calcic, Red Chromosol)
Medium thickness firm to hard clay loam over a well structured red medium to heavy clay, calcareous from about 50 cm.

D3 Hard sandy loam over dispersive red clay (Hypercalcic, Red Sodosol)
10 - 25 cm hard massive sandy loam abruptly overlying a coarsely prismatic dispersive red clay, calcareous from 50 cm, continuing below 150 cm.

D5a Hard loamy sand over red clay (Calcic, Red Sodosol)
Hard setting loamy sand to light sandy loam with a bleached sub-surface layer, abruptly overlying a red clay with coarse prismatic to columnar structure, calcareous with depth.

G3/F1 Loamy sand over brown and red clay (Calcic, Brown Chromosol / Sodosol)
Thick brown loamy sand with a bleached A2 horizon, overlying a red and brown mottled clay with prismatic structure, weakly calcareous with depth.

E3 Brown cracking clay (Brown Vertosol)
5 - 10 cm seasonally cracking friable clay becoming coarser structured, more clayey and calcareous with depth.

F1 Sandy loam over brown clay (Calcic, Brown Chromosol / Sodosol)
5 - 70 cm poorly structured sandy loam to sandy clay loam with a paler coloured A2 layer, abruptly overlying a brown to black prismatic clay, calcareous from 100 cm.

F1/G3 Sandy loam over brown mottled clay (Eutrophic, Brown Sodosol)
30 - 60 cm soft brown loamy sand to sandy loam with variable gravel and a pinkish A2 horizon, abruptly overlying a brown, grey and red mottled coarsely structured clay, becoming sandier with depth and grading to gravelly medium textured alluvium.

F2a Sandy loam over poorly structured brown clay (Calcic, Brown Sodosol)
15 - 20 cm firm loamy sand to sandy clay loam abruptly overlying a columnar structured yellow brown, grey brown and red mottled clay, frequently calcareous from 50 cm.

G3a Thick sand over sodic clay (Hypocalcic, Brown Sodosol)
50 - 65 cm soft to loose sand with a bleached A2 layer, sharply overlying a coarsely structured yellowish brown, grey and red mottled clay, weakly calcareous with depth, grading to clayey alluvium.

G3b Thick loamy sand over red clay (Hypocalcic, Red Chromosol)
30 - 50 cm loamy sand with variable gravel and a bleached A2 horizon, abruptly overlying a coarsely structured red and brown mottled clay, weakly calcareous with depth, grading to medium textured micaceous alluvium.

G4 Sand over poorly structured clay (Calcic, Brown Sodosol)
10 - 30 cm sand to light sandy loam with a conspicuously bleached A2 layer, abruptly overlying a coarsely columnar dispersive brown, grey and red mottled clay, calcareous at depths ranging from 40 to 100 cm, continuing below 100 cm.

A6 Calcareous clay loam (Hypercalcic Calcarosol)
Thick calcareous clay loam becoming more clayey and calcareous with depth

Soils on rise

D5b Loamy sand over red clay (Calcic, Red Sodosol)
15 - 30 cm firm to hard loamy sand to light sandy loam over a coarsely structured red sandy clay, grading to a yellowish Tertiary clayey sand to sandy clay. There is variable carbonate in the lower profile.

D6 Ironstone gravelly loamy sand over clay (Ferric, Red Chromosol / Sodosol)
20 - 40 cm ironstone gravelly sand to loamy sand abruptly overlying a massive ironstone gravelly red, grey brown, and yellow clay grading to Tertiary sandy clay to clayey sand at about 110 cm.

D7 Sandy loam over red clay on rock (Calcic, Red Sodosol)
Medium thickness hard quartz gravelly sandy loam with a bleached A2 layer, over a red dispersive clay, calcareous from about 40 cm, grading to weathering quartzitic basement rock.

E1 Black cracking clay (Self-mulching Black Vertosol)
Medium thickness very dark grey moderately calcareous light clay with fine blocky structure, overlying a black to dark grey coarsely prismatic heavy clay becoming paler coloured and more calcareous with depth. Hindmarsh Clay is evident from about 70 cm.

F2b Sandy loam over poorly structured brown clay (Calcic, Brown Sodosol)
15 - 25 cm hard grey loamy sand to sandy loam abruptly overlying a coarsely structured brown mottled clay, calcareous from 45 cm, grading to pale grey cemented sand with pipeclay (pallid zone) from 100 cm.

G3c Thick sand over clay (Calcic, Brown Sodosol)
30 - 60 cm loose bleached sand, organically darkened at the surface, abruptly overlying a yellowish brown, grey and red coarsely structured sandy clay grading to Tertiary sandy clay to clayey sand at about 100 cm.

H3 Deep sand (Arenic, Bleached-Orthic Tenosol)
40 - 50 cm loose bleached sand, organically darkened at the surface, grading to a yellow loose sand, continuing below 100 cm.

M2a Deep gradational clay loam (Calcic, Brown Dermosol)
Medium thickness dark clay loam grading to a well structured brown clay, calcareous with depth, continuing below 100 cm.

Soils formed on recent alluvium

M1 Sandy alluvial soil (Arenic / Stratic Rudosol)
30 - 60 cm layered alluvial loamy sand overlying dark silty loam and / or micaceous clay.

M2b Deep clay loam (Grey Dermosol)
10 - 30 cm grey clay loam grading to grey to black silty clay loam to clay.

M4 Gradational sandy loam (Eutrophic, Brown Kandosol)
15 - 90 cm sand to sandy loam over variable brown and red micaceous sandy clay loam to sandy clay.

Further information: DEWNR Soil and Land Program