JOY Joyce Land System

Area: 127.7 km^2

Landscape: Corridor plains with mostly sand over poorly structured clay. Calcareous gradational soils occupy the central, lower drainage areas. The plains surround low ranges along the eastern side. They are mostly non-saline which distinguishes them from the Woolumbool land system to the north.

Annual rainfall: 575 – 605 mm average

Geology: Mostly Pleistocene Padthaway Formation calcareous lacustrine clays, with occasional Pleistocene Bridgewater Formation calcreted calcarenite stranded beach ridge deposits. Younger Plistocene-Holocene Molineaux Sand siliceous sands have accumulated in places.

Main soils:
G3 (33%) Thick sand over clay (sandy Brown-Red Chromosol-Sodosol)
B7 (13%) Shallow sand over clay on calcrete (sandy Petrocalcic Sodosol-Chromosol)

Minor soils:
N3 (9%) Wet soil (non to moderately saline) (Sodosolic-Calcarosolic-Dermosolic Hydrosol)
G2 (8%) Bleached sand over sandy clay (sandy Brown-Red Sodosol-Chromosol)
B9 (6%) Shallow clay loam over brown or dark clay on calcrete (clay loamy Petrocalcic Sodosol)
I2 (5%) Wet highly leached sand (Aquic or Semi-Aquic Podosol)
M4 (5%) Deep hard gradational clay loam (Hard Brown-Dark Kandosol- Dermosol)

Summary: The thick sand over clay soils (G3) are subject to waterlogging, have low surface fertility and moderate wind erosion risk. Shallow soils on calcrete (B7, B9) have similar constraints but additionally, root development may be restricted due to the underlying calcrete pans. Wet soils (N3, I2) are common and are similarly susceptible to waterlogging as are the sand over clay soils.

Soil Landscape Unit summary: Joyce Land System (JOY)

SLU	% of area	Component	Main soils	Prop#	Notes
MEB	0.3	Stony rise	B3B8	D	**MEB** Stony rises with shallow sandy loam, occasionally over thin red sandy clay, on calcreted calcarenite, or shallow bleached sand over calcrete; 10-30% shallow sandy loam over red clay on calcrete, or deep bleached sand. **MEC** Stony rises with shallow sandy loam, occasionally over thin red sandy clay, on calcreted calcarenite; 10-30% shallow sandy loam over red clay on calcrete, or shallow bleached sand on calcrete. Main soils: Shallow sandy loam on calcrete - **B3** and Shallow sand on calcrete - **B8**.
MEC	0.1	Stony rise	B3	D	
NDO	3.6	Plain	G3B7	V	Plains with sand or sandy loam over poorly structured brown clay, often on calcrete20-30% sandy rises with deep bleached sands, with impeded drainage over coffee rock or brown clay. 10-20% stony rises with loam, mostly over red clay, on calcrete; but often thin loam on calcrete; 10-30% bare calcrete. Main soils: ***Plains and depressions:*** Thick sand over clay - **G3** and Sand
		Sandy rise	I2G3	C	
		Stony rise	B6B3	L	

					over friable brown clay on calcrete - **B7**. ***Sandy rises:*** Wet highly leached sand - **I2** and Thick sand over clay - **G3**. ***Stony rises:*** Shallow sandy loam over red-brown clay on calcrete - **B6** and Shallow sandy loam on calcrete - **B3**.
NkA	11.0	Plain	G3	D	**NkA** Plains with deep sandy loam over brown clay; 10-30% clay loam over olive-brown clay on calcrete, or shallow, dark, clay loam over dark clay on calcrete. Slightly noticeable salinity. **Nkf** Plains with shallow sandy loam over poorly structured brown clay; 10-30% clay loam over olive-brown clay on calcrete. 30-60% swamps with mostly wet deep clay loam over poorly structured dark clay; 10-30% clay loam over olive-brown clay on calcrete. **NkO** Plains with soils as for **NkA**. 10-20% stony rises with shallow sandy loam over calcrete; 10-30% shallow sandy loam over red clay, or poorly structured brown clay, on calcrete. Main soils: ***Plains:*** Thick sand over clay - **G3** and Sand over friable brown clay on calcrete - **B7**. ***Swamps:*** Wet clay loam - **N3** and Deep hard gradational sandy loam - **M4**. ***Stony rises:*** Shallow sandy loam on calcrete - **B3**. ***Sandy rises:*** Thick sand over clay - **G3**.
Nkf	10.8	Plain	B7	V	
		Swamp	N3M4	E	
NkO	6.6	Plain	G3	E	
		Stony rise	B3	L	
		Sandy rise	G3	L	
NMP	1.6	Plain	G3B7	V	**NMP** Plains with thick sand over brown clay, or shallow loamy sand over poorly structured brown clay on calcrete; 10-30% slightly lower areas with clay loam over olive-brown clay on calcrete. 10-20% sandy rises with deep siliceous acid sand, often with brown clay or coffee rock at depth. **NMV** Plains with soils as for **NMP**. 10-20% swamps with usually wet, moderately highly to slightly saline, loam over dark clay. Main soils: ***Plains:*** Thick sand over clay - **G3** and Sand over friable brown clay on calcrete - **B7**. ***Sandy rises:*** Thick sand over clay - **G3**, Bleached siliceous sand - **H3** and Wet highly leached sand - **I2**. ***Swamps:*** Wet saline clay loam - **N2c**, Wet clay loam - **N3**
		Sandy rise	G3H3 I2	L	
NMV	1.7	Plain	G3B7	V	
		Swamp	N2N3	L	
NSG	18.2	Drainage depression	G3	D	**NSG** Drainage depressions with deep, bleached sand over brown clay; 10-30% deep clay loam over poorly structured clay, or deep grey cracking clay, often wet. **NSs** Moderately saline drainage depressions with deep, bleached sand over brown clay; 10-30% wet. Main soils: Thick sand over clay - **G3**.
NSs	1.3	Drainage depression	G3	D	
NTk	5.4	Swampy plain	I2G2	D	Swampy plains with deep bleached sand over organic pans or brown clay, or bleached sand over brown sandy clay, 10-30% wet. Main soils: Wet highly leached sand - **I2** and Bleached sand over sandy clay loam - **G2**.
NuO	0.4	Plain	M4F2	V	Plains with clay loam over poorly structured dark brown clay; 10-30% dark clay loam over dark clay, or deep sand over brown clay. 10-20% sandy rises with deep bleached or highly leached sand; 10-30% thin sand over brown clay. 10-20% stony rises with shallow sandy loam over calcrete; 10-30% sandy loam over red clay on calcrete. Main soils: ***Plains:*** Deep hard gradational sandy loam - **M4** and Sandy loam over poorly structured brown or dark clay - **F2**. ***Sandy rises:*** Bleached siliceous sand - **H3** and Highly leached sand - **I1**. ***Stony rises:*** Shallow sandy loam on calcrete - **B3**.
		Sandy rise	H3I1	L	
		Stony rise	B3	L	

NZE	5.1	Sandy rise	G5I2	E	**NZE** Plains with mixed rises. 30-60% sandy rises with deep, acidic, bleached sand over acid brown clay, or with organic pans in subsoils. 30-60% stony rises with shallow texture contrast, loam over red clay on calcrete, or shallow calcareous sandy loam on calcrete; 10-30% gradational clay loam over red clay on calcrete. <10% swamps with mostly wet soils; 10-30% deep sand over brown clay, deep sand over organic pans, or shallow dark clay loam over dark clay on calcrete. **NZO** Plains with shallow sand over poorly structured brown clay on calcrete; 10-30% deep sand over brown clay. 10-20% sandy rises with deep acidic sand, often over acidic brown clay. 10-20% stony rises with shallow texture contrast, loam over red clay, on calcrete; 10-30% shallow gradational clay loam over red clay on calcrete. **NZP** Plains and sandy rises with soils as for **NZO**. 10-20% sandy rises, no stony rises. **NZs** Plains with deep sand over brown clay, or bleached sand over red-brown sandy clay; 10-30% thin sand over brown clay. Very slight salinity. 10-20% swamps with mostly wet deep loam over poorly structured brown clay. Main soils: ***Plains:*** Sand over friable brown clay on calcrete - **B7** or Thick sand over clay - **G3** and Bleached sand over sandy clay loam - **G2**. ***Sandy rises:*** Sand over acidic clay - **G5** and Wet highly leached sand - **I2**. ***Swamps:*** Wet clay loam - **N3** and Sandy loam over poorly structured brown or dark clay - **F2**. ***Stony rises:*** Shallow sandy loam over red-brown clay on calcrete - **B6**, Shallow calcareous loam on calcrete - **B2**.
		Stony rise	B6B2	E	
		Swamp	N3	M	
NZO	7.4	Plain	B7	V	
		Sandy rise	G5I2	L	
		Stony rise	B6B2	L	
NZP	1.4	Plain	B7	V	
		Sandy rise	G5I2	L	
NZs	16.3	Plain	G3G2	V	
		Swamp	N3F2	L	
OFC	0.4	Dune	I1	D	**OFC** Dunes with deep, bleached, acid , water repellent, siliceous sand; 10-30% less well-drained, deep sand over organic pans, or acidic brown clay. **OFD** Low dunes as above; 10-30% sand over red-brown sandy clay, or shallow sand over poorly structured brown clay on calcrete. Main soils: Highly leached sand - **I1**.
OFD	2.4	Low dune	I1	D	
OHC	0.4	Dune	I1H3	D	Dunes with deep, water repellent acid, bleached siliceous sand. <10% stony rises with shallow sandy loam, occasionally over red clay, on calcreted calcarenite, which outcrops occasionally also. Main soils: ***Dunes:*** Highly leached sand - **I1** and Bleached siliceous sand - **H3**. ***Stony rises:*** Shallow sandy loam on calcrete - **B3**.
		Stony rise	B3	M	
OQD	1.3	Low dune	H3I1	D	**OQD** Low dunes with deep, bleached, acidic, water repellent sand; 10-30% deep sand over brown clay or sandy clay, especially on lower slopes. **OQF** Dunes with soils as above; 10-20% stony rises with shallow sandy loam over red clay on calcrete. **OQJ** Low dunes with deep bleached siliceous sand; 10-30% sand over brown clay. Co-dominant plains with deep sand over brown clay, or deep bleached sand, often over organic pans, occasionally over brown sandy clay. Main soils: ***Dunes:*** Bleached siliceous sand - **H3** and Highly leached sand - **I1**. ***Stony rises:*** Shallow sandy loam on calcrete - **B3** and Shallow sandy loam over red-brown clay on calcrete - **B6**. ***Flats:*** Bleached sand over sandy clay loam - **G2** and Thick sand over clay - **G3**.
OQF	0.4	Dune	H3I1	V	
		Stony rise	B3B6	L	
		Flat	G2G3	M	
OQJ	0.6	Low dune	H3I1	E	
		Plain	G3H3 I2	E	

					Plains: Thick sand over clay - **G3**, Bleached siliceous sand - **H3** and Wet highly leached sand - **I2**.
Xl-	0.5	Lake	WW	D	Water filled fresh-water lakes or swamps.
XqC	0.3	Swamp	N3N1 M2	D	Swamps with mostly wet, organic loam, or peat, over dark clay; 10-20% water filled or deep sand over brown clay. Main soils: Wet clay loam - **N3**, Peaty soil – **N1** and Deep friable gradational clay loam - **M2**.
Xud	0.1	Swamp	N3	V	**Xud** Non-peaty clay loamy swamps with 20-30% sandy rises with deep sand over brown clay, or organic pans. **XuF** Swamps as above; 10-30% water filled or moderately saline, 2-10% highly saline patches. Main soils: ***Swamps:*** Wet clay loam - **N3**. ***Sandy rise:*** Thick sand over clay - **G3** and Wet highly leached sand - **I2**.
		Sandy rise	G3I2	L	
XuF	1.0	Swamp	N3	D	
XwC	1.3	Swamp	N3N2	D	Swamps with wet non-saline and moderately saline sandy loam over dark clay; 10-30% water filled or with bleached sand over brown clay. Main soils: Wet clay loam - **N3**, Wet saline clay loam - **N2c**.

PROPORTION codes assigned to Soil Landscape Unit (SLU) components:

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:

B2 Shallow calcareous sandy loam on calcrete (Petrocalcic Calcarosol)
Up to 40 cm calcareous loamy sand to sandy loam with variable calcrete rubble overlying calcreted calcarenite - rises.

B3 Shallow sandy loam on calcrete (Petrocalcic Rudosol)
Medium thickness non calcareous sandy loam, often having a slight clay increase with depth, over calcreted calcarenite shallower than 50 cm - rises.

B6 Shallow sandy loam over red-brown clay on calcrete (Petrocalcic, Red Kandosol)
Medium thickness sandy loam with slight ironstone gravel overlying a weakly structured reddish brown sandy clay on calcarenite within 50 cm - rises.

B7 Shallow sand over sandy clay on calcrete (Petrocalcic, Brown Chromosol)
Medium thickness sand overlying brown friable sandy clay to clay on limestone or calcreted sandy clay within 50 cm - flats.

B8 Shallow sand on calcrete (Petrocalcic, Bleached-Leptic Tenosol)
Thick bleached sand over calcreted calcarenite within 50 cm - rises.

F2 Sandy loam over poorly structured brown or dark clay (Brown-Dark Sodosol-Chromosol)
Topsoil <30 cm over a poorly structured subsoil. Loamy, often sandy loam, to clay loamy texture contrast soil with a sodic/dispersive/poorly structured brown clayey subsoil. Often sandy loam, usually with a bleached horizon, and thin topsoil over a poorly structured B.

G2 Bleached sand over sandy clay loam (sandy Brown-Red Chromosol)
Sandy texture contrast soil with a bleached A2 and a friable brown-red sandy clay loam to sandy loam subsoil.

G3 Thick sand over clay (Hypercalcic, Brown Sodosol/ Chromosol)
Thick bleached sand with an organically darkened surface abruptly overlying a massive to coarsely structured brown to reddish yellow sandy clay to clay, calcareous with depth - rises.

G5 Sand over acidic clay (Sandy Brown Kurosol)
Sandy texture contrast soil with a friable brown strongly acidic clayey to clay loamy subsoil. Very acidic soil; incipient Bh horizons; moderate depth topsoils. Some with ironstone.

H3 Deep bleached sand (Basic, Arenic, Bleached-Orthic Tenosol)
Grey sand over a very thick bleached sand grading to yellow sand continuing below 100 cm.

I1 Highly leached sand (Fragic, Pipey, Aeric Podosol)
Grey sand with a very thick bleached A2 layer, over dark brown and yellow massive soft to semi-hard clayey sand (coffee rock), grading to softer yellow and brown sand to sandy clay loam from about 80 cm.

I2 Wet highly leached sand (Fragic, Humic, Aquic Podosol)
Grey sand with a thick bleached A2 horizon, overlying a thin to thick layer of coffee rock, grading to pale brown sand sharply overlying a grey, brown and yellow mottled sandy clay loam to light clay.

M2 Deep friable gradational clay loam (Red-Brown-Grey- Black Dermosol)
Deep well structured red clay loamy soil.

M4 Deep hard gradational sandy loam (Hard Brown-Dark Kandosol- Dermosol)
Deep dark brown loamy to clay loamy soil grading to clay at depth. Hardsetting surface often with prismatic structures in the subsoil.

N1 Peat (Organosol)
Peaty soil

N2c Wet saline clay loam (Dermosolic, Salic Hydrosol)
Medium thickness dark grey to black clay loam to clay grading to well-structured dark grey clay with minor carbonates and a water table within 100 cm.

N3 Seasonally waterlogged, non to marginally saline equivalents of soils listed above, viz.:
N3c Wet **G3**
N3d Wet **B5**
N3e Wet **B7**

WW Water

Further information: DEWNR Soil and Land Program