UMV Upper Murray Valley Land System

(Based on the description by Wetherby et al in "A Description of the Land in County Albert, County Alfred and Part of County Eyre, South Australia")

Detailed soil surveys for various irrigation areas within the Upper Murray Valley have been carried out in the past. Information from these surveys has been incorporated into this description where possible, given the constraints of scale differences. The surveys are listed at the end of this description.

The division between the Upper Murray Valley and the Lower Murray Valley Land Systems at Morgan is purely arbitrary, as there is a gradation in the type of landscape elements along the length of the river.

Area: 956.7 km^2

Annual rainfall: 225 – 275 mm average

Geology: The land system includes the river flats, and the slopes and cliffs created by the downcutting of the river. The dominant sediment of the flats is the Coonambidgal Formation, a deposit of clays and silts laid down under low energy conditions. More recent sediments associated with modern activity of the river overlie the Coonambidgal materials near the channel. These include mixed sands, silts and clays. The slopes are cut into older Tertiary sediments, mainly Loxton / Parilla Sands, usually blanketed by highly calcareous Woorinen Formation materials which have either been blown or washed in. Consolidated Morgan - Mannum Limestone (lying below the Loxton / Parilla Sands) is the material usually exposed in the more or less vertical cliffs. Overlying both slopes and flats are deposits of Molineaux Sand. These are more frequent on the slopes.

Topography: The topographic pattern includes several main elements:

- Predominantly wet flats, including the modern river channel, billabongs and swamps.
- Low terraces (lignum and box flats) comprise the next level up from current water level and include flats, dissected flats and low sand rises. These terraces are flooded every five to seven years.
- High terraces (saltbush and box flats) represent the next level up again, and are subject to occasional flooding. There are sporadic sandhills on these terraces.
- Slopes and cliffs range from gentle grades of less than 10% to moderately steep slopes many of which are severely eroded by water flowing from the highlands above. Variable sandhills and spreads are common on the slopes. Near vertical cliffs are common along some stretches of the river.
- Old lake systems including salinas and associated lunettes are a minor component in the north.

Elevation: 60 m on the cliff tops in the north east, to less than 10 m on the river at Morgan.

Relief: Relief from cliff top to river level varies from 45 m to 15 m.

Soils: The soils of the river terraces include grey clays, grey loamy sands and several types of sandy loam texture contrast soils. Deep sands and calcareous sandy loams characterize the slopes and cliffs.

Main soils

Lower terraces

E3 Grey cracking clay
F2 Sandy loam over grey sodic clay

Minor soils

Upper terraces

A6 Calcareous loam
D2 Sandy loam over friable red clay
F1 Sandy loam over grey brown clay
G3 Thick sand over grey clay
M1a Deep sandy loam
M1b Gradational grey sand
M2 Gradational grey brown clay loam
M4 Gradational sandy loam

Slopes and remnant rises

A4a Rubbly calcareous sandy loam
A4b Calcareous sandy loam
B2 Shallow calcareous sandy loam
B8 Sand over calcrete
G1 Sand over red sandy clay loam

Sandhills and sand spreads on flats and slopes

H2a Deep sand - slopes
H2b Deep sand - flats

Main features: The Upper Murray Valley Land System is a complex landscape of wetlands and older terraces, with slopes and cliffs running up to the adjacent highlands. The soils are highly variable depending on the nature of the alluvium (on flats), or the older material exposed (on slopes) by the downcutting of the river. The wetlands and low terraces are little used for primary production, but have high conservation and recreation value. The higher terraces dominated by medium to fine textured soils are commonly used for horticultural irrigation. The slopes with a range of sandy to sandy loam soils over highly calcareous subsoils are also widely used for horticulture, except where they are too steep and / or eroded.

Soil Landscape Unit summary: 39 Soil Landscape Units (SLUs) mapped in the Upper Murray Valley Land System. The soil landscapes are grouped according to general landscape position, rather than alphabetically, viz.:

- Wetlands
- Low terraces
- High terraces
- River flats with more than 30% sandhills
- Slopes and cliffs between the river flats and the highlands
- Saline land

SLU	% of area	Main features
Xr- Xs- Xl- Xw- Xn-	5.0 0.3 1.9 2.7 2.7	Wetlands **Xr-** River channel. **Xs-** Swamps. **Xl-** Billabongs of fresh water adjacent to the river channel. **Xw-** Abandoned billabongs of variable salinity, not connected to the river. **Xn-** Complex of 25-75% billabongs, swamps and low terraces. These landscapes are predominantly or entirely wetlands with water resource and / or conservation value. They have no direct agricultural development potential.
XmA XmD	24.6 2.7	Low terraces. These are lignum and box flats, the majority of which are dry. **XmA** Terraces with up to 25% billabongs or swamps and up to 10% low sandy rises.

Xma XmB Xmo	1.5 22.3 0.6	**XmD** Salty terraces. **Xma** Terraces with up to 25% billabongs or swamps and 10-30% low sandy rises. **XmB** Dissected terraces - i.e. terraces with extensive channels which carry water during high river flows. May have up to 10% low sandy rises. **Xmo** Dissected terraces with 10-30% low sandy rises. Typical soils of the lower terraces are grey cracking clay - **E3** and sandy loam over grey sodic clay - **F2** with deep sand - **H2b** on the sand rises. Most of the lower terraces are undeveloped, but there is some irrigation of pastures or fodder crops, rather than of horticultural crops. Problems of waterlogging and salinity may be expected. The low terraces are subject to periodic although not common flooding.
XCA XCD XSA XSD XTA	0.2 0.6 7.1 0.2 3.4	High terraces. Much of this area is used for irrigation. **XCA** Flats with mainly sandy soils **XCD** Flats with mainly sandy soils and saline seepage **XSA** Loamy and clayey flats **XSD** Saline loamy and clayey flats **XTA** Complex of loamy, clayey and sandy flats Main soils: **XCA/XCD:** gradational grey sand - **M1b** thick sand over grey clay - **G3** **XSA/XSD:** gradational grey brown clay loam - **M2** grey cracking clay - **E3** gradational sandy loam - **M4** calcareous loam - **A6** deep sandy loam - **M1a** **XTA:** sandy loam over friable red clay - **D2** sandy loam over grey brown clay - **F1** with soils as for **XCA** and **XSA** (above). These soils have variable productive potential, which in irrigated situations is largely determined by their drainage characteristics. Those with sandy lenses and beds are more freely draining and less susceptible to waterlogging and salt accumulation. Most soils are fertile and deep. The saline variations are generally unsuitable for irrigated crops. The highly saline flats are discharge areas with no horticultural use.
UfE UfF UfG UfI UfJ UfK UrK	0.1 0.4 0.1 0.4 1.6 1.2 1.1	River flats with more than 30% sandhills **UfE** High terraces with 60-90% high sandhills. **UfF** High terraces with 60-90% moderate sandhills. **UfG** High terraces with 60-90% low sandhills. **UfI** High terraces with 30-60% moderate sandhills. **UfJ** High terraces with 30-60% low sandhills. **UfK** High terraces with sand spreads. **UrK** Low terraces with sand spreads. Main soil: deep sand - **H2b** on rises with soils as for the flats as described above under high and low terraces. The sandy soils are infertile and prone to wind erosion, but being deep and well drained are suitable for irrigation. The soils of the flats have variable irrigation suitability depending on drainage and salinity, but flats associated with sandhills are susceptible to seepage problems.
A-l QMC SXB SXC SXD SXH SXI SXII ShB U-u UDp UDs UDu UMF	0.1 0.1 0.2 1.2 1.2 0.2 0.8 6.5 0.1 2.2 0.5 0.3 2.5 0.02	Slopes and cliffs. This land is generally called 'cliff face', even though only 40% is steep. The slopes and cliffs define the edge of the river valley. Occasional highland remnants rising from the river flats are included. Most gentle to moderately steep slopes are overlain by low sandhills or sand spreads. **A-l** Limestone cliffs. **QMC** Low remnant calcrete rises. **SXB** Gentle slopes. **SXC** Moderate slopes. **SXD** Moderately steep slopes. **SXH** Moderate slopes with erosion gullies. **SXI** Moderately steep slopes with erosion gullies. **SXII** Steep slopes with erosion gullies. **ShB** Undulating rises (highland remnants). **U-u** Sandy slopes. **UDp** Slopes with 60-90% moderate sandhills.

		UDs Slopes with 30-60% moderate sandhills. **UDu** Slopes with sand spreads. **UMF** Remnant rises with 60-90% moderate sandhills. Main soils: rubbly calcareous sandy loam - **A4a**, calcareous sandy loam - **A4b**, sand over calcrete - **B8** and sand over red sandy clay loam - **G1** on slopes, with deep sand - **H2a** on sandhills and spreads. Shallow calcareous sandy loam - **B2** is predominant on remnant calcrete rises. Provided that they are not too steep, these slopes have high productive potential for irrigated crops. The soils are mainly deep and well drained. The main limitations are wind erosion potential on the sandier soils, water erosion potential on steeper slopes, and restricted water holding capacity on some shallower soils. Cultivation should be avoided on the steeper slopes, and the eroded slopes of **SXII** are not suited to any agricultural activity without substantial remedial and erosion control management.
ZA- ZC- ZL-	0.1 1.3 2.0	Saline land. **ZA-** Highly saline flats **ZC-** Salt pans or salt lakes **ZL-** Lunettes No soils data. This land is non arable due to low rainfall and high salinity.

Detailed soil profile descriptions:

Lower terraces

E3 Grey cracking clay (Grey / Brown Vertosol)
Thick very hard coarse blocky cracking brown to grey clay with red sandy lenses, and commonly gypseous at depth. Clay continues to 100-200 cm before grading to sandy clay loam, silty loam or silty sand.

F2 Sandy loam over grey sodic clay (Grey Sodosol)
Medium to thick grey sandy loam over a grey coarsely structured heavy clay, continuing below 100 cm.

Upper terraces

A6 Calcareous loam (Hypercalcic Calcarosol)
Calcareous sandy loam to sandy clay loam, becoming more clayey and calcareous with depth grading to a red and brown medium clay with gypsum crystals below 100 cm.

D2 Sandy loam over friable red clay (Calcic, Red Chromosol)
Medium thickness red brown to grey brown sandy loam to sandy clay loam over a red brown to brown friable clay loam to clay with moderate soft carbonate overlying fine sand to silt deeper than 100 cm.

F1 Sandy loam over grey brown clay (Gypsic, Calcic, Brown / Red Chromosol)
Medium thickness grey to grey brown sandy loam over a grey brown to red brown friable clay loam to clay with variable carbonate and bands of gypsum at variable depths, overlying fine sand deeper than 100 cm.

G3 Thick sand over grey clay (Calcic, Grey Sodosol)
Thick grey sand over a grey sandy clay becoming more clayey and calcareous with depth, over a clayey sand deeper than 150 cm.

M1a Deep sandy loam (Regolithic, Brown-Orthic Tenosol)
Very thick brown sandy loam overlying calcareous sand to clayey sand.

M1b Gradational grey sand (Calcic, Grey Kandosol)
Thick grey sand grading to a grey calcareous clayey sand with variable nodular carbonate, over a grey brown sand.

M2 Gradational grey brown clay loam (Gypsic, Brown Vertosol / Dermosol)
Thin grey brown platy clay loam to light clay grading to a grey or brown friable clay, with sandy lenses and gypsum from about 80 cm.

M4 Gradational sandy loam (Sodic, Calcic, Brown Kandosol)
Sandy loam to sandy clay loam grading to a poorly structured brown sandy clay loam to sandy clay, calcareous with depth, over silty and sandy alluvium.

Slopes and remnant rises

A4a Rubbly calcareous sandy loam (Regolithic, Lithocalcic / Supracalcic Calcarosol)
Medium thickness calcareous loamy sand to sandy loam becoming more clayey and calcareous with depth over Class III C / III B carbonate within 30 cm, grading to a very highly calcareous sandy clay loam.

A4b Calcareous sandy loam (Hypercalcic Calcarosol)
Medium thickness sandy loam becoming more clayey and calcareous with depth over a Class III A carbonate layer within 30 cm grading to a very highly calcareous sandy clay loam to sandy clay.

B2 Shallow calcareous sandy loam (Petrocalcic Calcarosol)
Medium thickness calcareous loamy sand to sandy loam with variable calcrete rubble over sheet calcrete or heavy rubble.

B8 Sand over calcrete (Petrocalcic, Leptic Tenosol / Calcareous, Petrocalcic, Red-Orthic Tenosol)
Medium to very thick sand, calcareous with depth over rubbly calcrete.

G1 Sand over red sandy clay loam (Hypercalcic, Red Sodosol)
Thick loamy sand over a red to brown massive sandy clay loam, highly calcareous from about 55 cm.

Sandhills and sand spreads on flats and slopes

H2a Deep sand (Calcareous, Arenic / Regolithic, Red-Orthic Tenosol)
Very thick reddish to brownish sand, generally with soft carbonate accumulations or calcrete and slight clay increase at variable depths depending on erosional history, but commonly more than 100 cm.

H2b Deep sand (Basic, Arenic, Red-Orthic Tenosol)
Deep reddish sand overlying buried river flat soil below 100 cm.

Reference List of Detailed Soil Surveys - Upper Murray Valley

Herriot, R.I. and Johnston, E.J. (1941). A Soil Survey of the Waikerie Irrigation Area, South Australia. CSIR Bulletin No. 141.

Marshall, T.J. and Hooper, P.D. (1932). A Soil Survey of Blocks A, B, C, D, and F, Renmark Irrigation District, South Australia. CSIR Bulletin No. 56.

Marshall, T.J. and Hooper, P.D. (1935). A Soil Survey of the Berri, Cobdogla, Kingston, and Moorook Irrigation Areas, and the Lyrup Village District, South Australia. CSIR Bulletin No. 86.

Marshall, T.J. and King, N.J. (1932). A Soil Survey of the Cadell Irrigation Area and New Era, South Australia. CSIR Bulletin No. 62.

Taylor, J.K. and England, H.N. (1929). A Soil Survey of Blocks E (Renmark) and Ral Ral (Chaffey) Irrigation Areas. CSIR Bulletin No. 42.

Further information: DEWNR Soil and Land Program