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South Australian Murray-Darling Basin

Landscape Assessment for the Western Portion of the Murray Mallee IBRA Sub-region Version 1.0

August 2011

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Contents

The Western Murray Mallee

Landscape assessment background, methodology and context within conservation planning endeavour are outlined in a companion document 'Landscape Assessment for the Murray Mallee – Evaluation of Current Status, July 2011'.

Landscape definition

Each landscape used in this landscape assessment is based on one or more Land systems (Potter et al. 1973; McCord 1995; DWLBC Soil and Land Program 2007). Land systems (strictly land system polygons) have been lumped together where their component soil types are similar, they co-occur within the region and their landuse history is similar. The name used for each landscape is that of the most well known land system (i.e. a subjective decision was made by the authors).

Figure 1 shows the landscapes of the Western Murray Mallee and their context within IBRA Sub-regions. The digital elevation model displayed in Figure 1 demonstrates the difference between the low relief Murray Mallee and the highlands of the Mount Lofty Ranges to the west. The gradual slope from the ranges to the river that characterises much of the Western Murray Mallee can also be seen.

There are some large areas that have not been cleared for agriculture in the Western Murray Mallee, leaving the landscapes either Variegated or Fragmented (Table 1). However, even within the uncleared areas, a large proportion of the land is used for primary production.

Table 1: Landscapes of the Western Murray Mallee

Landscape Classification on the basis of McIntyre and Hobbs (1999; 2000)

Landscape	Vegetation Area (ha)	Landscape Area (ha)	Proportion Vegetation	Landscape Classification	Mean Rainfall (mm)			
					Minimum	Maximum	Range	Mean
Blanchetown	104161	140392	0.74	Variegated	242	330	88	274
Mount Mary	110089	142792	0.77	Variegated	221	315	94	249
Punthari	9639	74929	0.13	Fragmented	269	421	152	326
Stonefield	17168	93014	0.18	Fragmented	255	387	132	300

Environmental settings

Environmental settings are based on the soil types classified in the *Soils of southern South Australia* (Hall et al. 2009). Soils with greater than 5% probability of occurrence within a landscape are described in the following section. Landscape specific environmental settings are the combination of soil type and typical location within landscape topography (e.g. A4 soils are typically found in depressions in some landscapes, but typically on rises in other landscapes).

A2 (calcareous loam on rock – Figure 2) soils are found predominantly on the edge of the Mount Lofty Ranges on the slopes of the ranges. Two other isolated occurrences occur – both associated with local elevated areas – one around Black & White Hill in the centre of Stonefield and the other around Black Hill at the very south of Blanchetown.

A3 (Deep moderately calcareous loam – Figure 3) are generally associated with drainage lines and/or outwash from the ranges. Within a landscape they are part of a continuum from A4 soils on the extensive flats through A3 to drainage line soils – e.g. A5 soils are often found lower on the landscape profile than A3 soils.

A4 (Deep (rubbly) calcareous loam – Figure 4) is widespread in the western mallee, and forms part of a continuum from A4 to B2 soils. While being widespread, the topographic situation in which A4 soils occur varies across the region dependent on geomorphology.

A5 (Rubbly calcareous loam on clay – Figure 5) occur in lower areas of the landscape where clay sediments underlie the calcareous loam. These areas are likely to be periodically inundated with water.

A6 (Gradational calcareous clay loam – Figure 6) occurs mainly in the Mount Mary landscape, although also a little into the northern parts of Stonefield. These soils occur in the lower parts of the landscape, more common in the western portion of Mount Mary, while in the eastern portion the same topographic areas may have D4 soils instead.

B2 (Shallow calcareous loam on calcrete – Figure 7) soils occur throughout the Western Murray Mallee but dominate the Blanchetown landscape. B2 soils almost always occur as a gently undulating plain. Are B2 soils solely Bungunnia limestone? While A4 soils are Woorinen formation?

D4 (Loam over pedaric red clay – Figure 8) soils occur at low points in the landscape in both Mount Mary and Stonefield landscapes. Presumably the main difference between A6 and D4 soils is the removal (through erosion or solution) of calcrete from the soil profile?

G1 (Sand over sandy clay loam – Figure 9) occurs as sandy flats and sandhills in the Punthari landscape.

H2 (Siliceous sand – Figure 10) occurs as sandhills in the Punthari landscape.

M1 (Deep sandy loam – Figure 11) occurs on alluvial fans and flats, particularly in the Punthari landscape. A5 do not occur in conjunction with M1 soils – the later being present on mid-slope drainage lines or drainage lines that reach the River Murray, while the former (A5) soils occur on the lower slope drainage lines and floodout areas associated with internal drainage.

Vegetation types

The soil types, being themselves a function of geomorphology, topography and climate, are reasonable predictors of the vegetation type found at a site. This relationship works best at landscape scale, and is in part responsible for helping define landscape boundaries.

The associations between vegetation types and soil types made in this section were undertaken by first classifying biological survey sites to soil type and then correlating that soil classification of sites with the vegetation classification of sites. All biological survey sites in the Western Mallee that had used standard Biological Survey of South Australia methodology (Heard and Channon 1997) were assessed for inclusion in the analysis. Table 2 includes the number of biological survey sites classified into each soil type. Appendix 4 lists the proportion of sites classified to a soil type in which a plant species was recorded.

A2 soils generally support an open mallee woodland vegetation type, very similar to the A4 soils (see below).

The A3 soils are associated with drainage lines in the Western Murray Mallee and generally support an open, grassy woodland with *Eucalyptus porosa* a common overstorey species. Along Burra Creek, *E. camaldulensis* also occurs on A3 soils.

The widespread A4 soils support the *Eucalyptus gracilis*, *E. oleosa* open mallee woodland typical of the Murray Mallee IBRA sub-region. There are a few variants of this vegetation type, driven by differences within the A4 soils. *E. oleosa* is co-dominant with *E. brachycalyx* (instead of *E. gracilis*) in the A4 soils that have formed in outwash sediments from the Mount Lofty Ranges, thus this variant occurs primarily along the western portion of the Western Murray Mallee. *E. socialis* is co-dominant with *E. gracilis* (instead of *E. oleosa*), probably in areas with slightly greater sand component within the soil. This variant does not occur in the Mount Mary landscape.

The vegetation type found on A5 soils can be split further on inundation regime, supporting *E. largiflorens* where more frequently inundated and *Maireana aphylla* shrubland elsewhere. In southern areas, the inundation regime is greater, leading to dominance by *E. largiflorens* while further north *M. aphylla* dominates. The water that inundates these areas drains from

the Mount Lofty Ranges in a series of, often terminal, drainage lines. A5 often grades into A4 soils further up the topographic profile. The shrubland component of A5 soils usually has a grassy component between shrubs.

A6 soils, only found in Mount Mary and northern Stonefield support a vegetation type typified by *Maireana sedifolia*. Sometimes these *M. sedifolia* areas have an overstorey of one of *E. gracilis*, *Myoporum platycarpum* or *Casuarina pauper*. It is possible that the clay in the profile drives the presence of the chenopod while the presence of overstorey is determined more by the other components of the soil, in similar manner to A4 and B2b soils. Thus A6 soils could be considered a clay side-track of the A4, B2, B2b continuum. *C. pauper* replaces *E. gracilis* in the same setting north of the Burra Creek land system. The shrubland component of A6 soils usually has a grassy component between shrubs.

The B2 soils support one of two vegetation types (excluding 'B2b' soils), depending on location on a climate gradient. Using the Marne river as a rough surrogate for the climate threshold marking the difference between the two vegetation types, south of the Marne river B2 soils support *Callitris gracilis* woodland. North of the Marne, at the scale of a site, B2 soils support a range of vegetation types, all considered part of *Myoporum platycarpum* ssp. *platycarpum* open woodland, including *Austrostipa* grasslands, *Geijera parviflora* shrubland and *Acacia nyssophylla* shrubland. The dynamics or subtle environmental setting differences that drive the changes between these groups are not clearly understood, although grazing is almost certainly an important process.

B2b is a term used in this document to separate B2 soils (DWLBC Soil and Land Program 2007) into those supporting *Myoporum* woodland and those supporting mallee, generally *E. gracilis*, *E. oleosa*. Figure 12 shows the different vegetation types within the mapped soil type B2 (compare with Figure 7).

D4 soils support similar vegetation type to A6 soils. We hypothesise that the D4 soils are those areas in which *M. sedifolia* is dominant with no overstorey.

G1 soils, only occurring in the Punthari landscape, support *E. calycogona*, *E. leptophylla*. Remaining areas of this vegetation type are generally small and highly influenced by the surrounding agricultural matrix.

H2 soils, again only occurring in the Punthari landscape, support *E. incrassata*, *E. leptophylla*. As for G1 soils remaining patches of this vegetation are highly influenced by the surrounding agricultural matrix.

It is likely that both G1 and H2 soils supported *Triodia* in the understorey, ranging from present to dominant, while H2 soils supported in part shrubby understorey – as for other areas of sand mallee in the Murray Mallee and Lowan Mallee (Bradstock 1989; White 2006).

M1 soils support *Eucalyptus camaldulensis* woodlands.

Table 2: Proportion of the soils of southern South Australia in each landscape.

Detailed soil descriptions are available in Hall et al (2009). Blank cells indicate that a soil type is not present in that landscape. Only soil types likely to occur over >5% of a landscape are included. The number of biological survey sites classified to each soil type are also given. Sites classified as A6 are likely to include some D4 sites.

SA Soil	Sites	Soil Description	Blanchetown	Mount Mary	Punthari	Stonefield
A2	4	Calcareous loam on rock				0.05
A3	8	Deep moderately calcareous loam		0.08		0.08
A4	56	Deep (rubbly) calcareous loam	0.01	0.24	0.26	0.46
A5	13	Rubbly calcareous loam on clay	0.01	0.08	0.03	0.12
A6	26	Gradational calcareous clay loam		0.22		0.04
B2	37	Shallow calcareous loam on calcrete	0.96	0.27	0.24	0.11
D4		Loam over pedaric red clay		0.06		0.04
G1	3	Sand over sandy clay loam			0.05	
H2	6	Siliceous sand	0.01		0.13	
M1	6	Deep sandy loam			0.06	

Figure 1: Landscape of the Western Murray Mallee

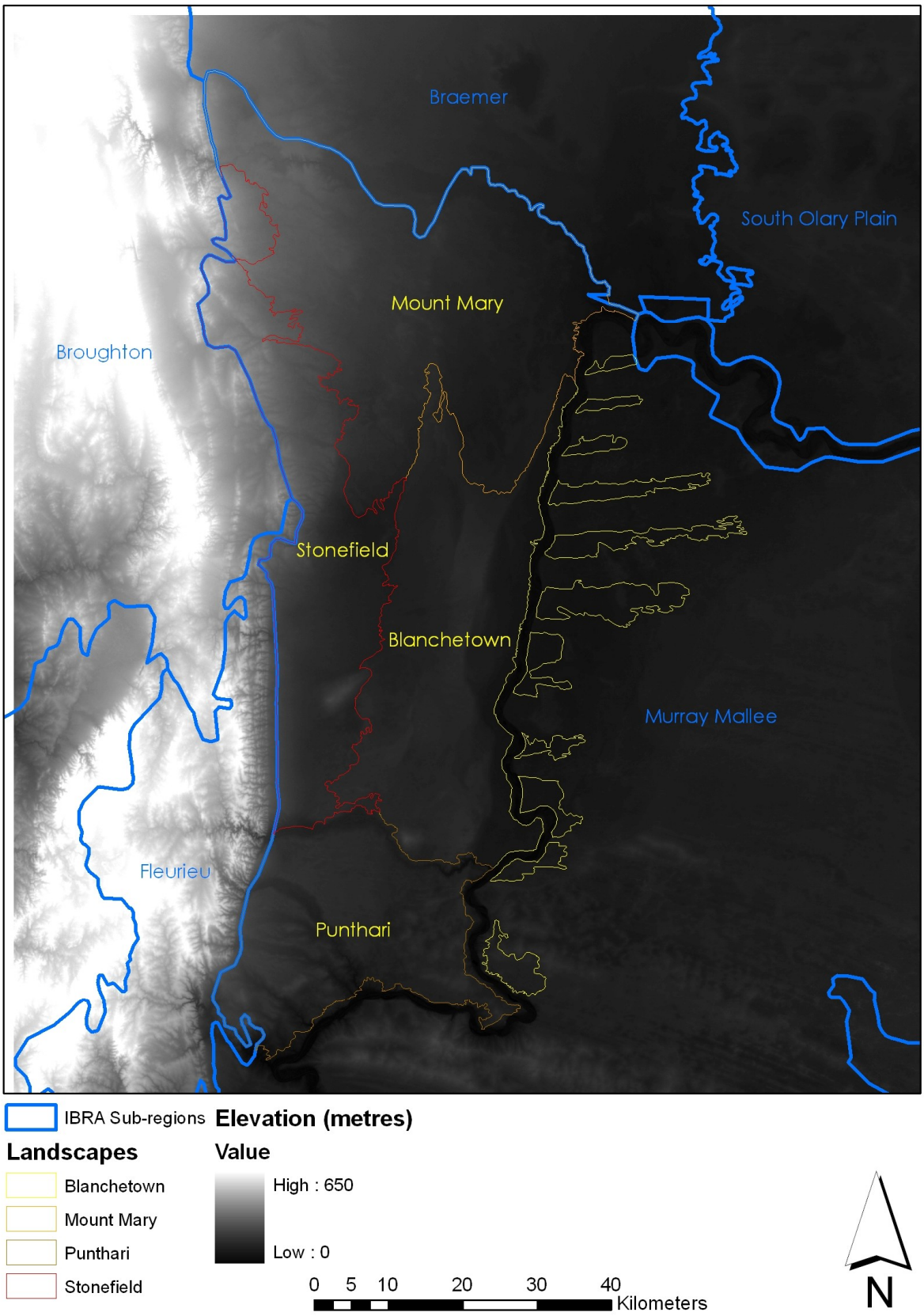


Figure 2: Distribution of soil A2 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

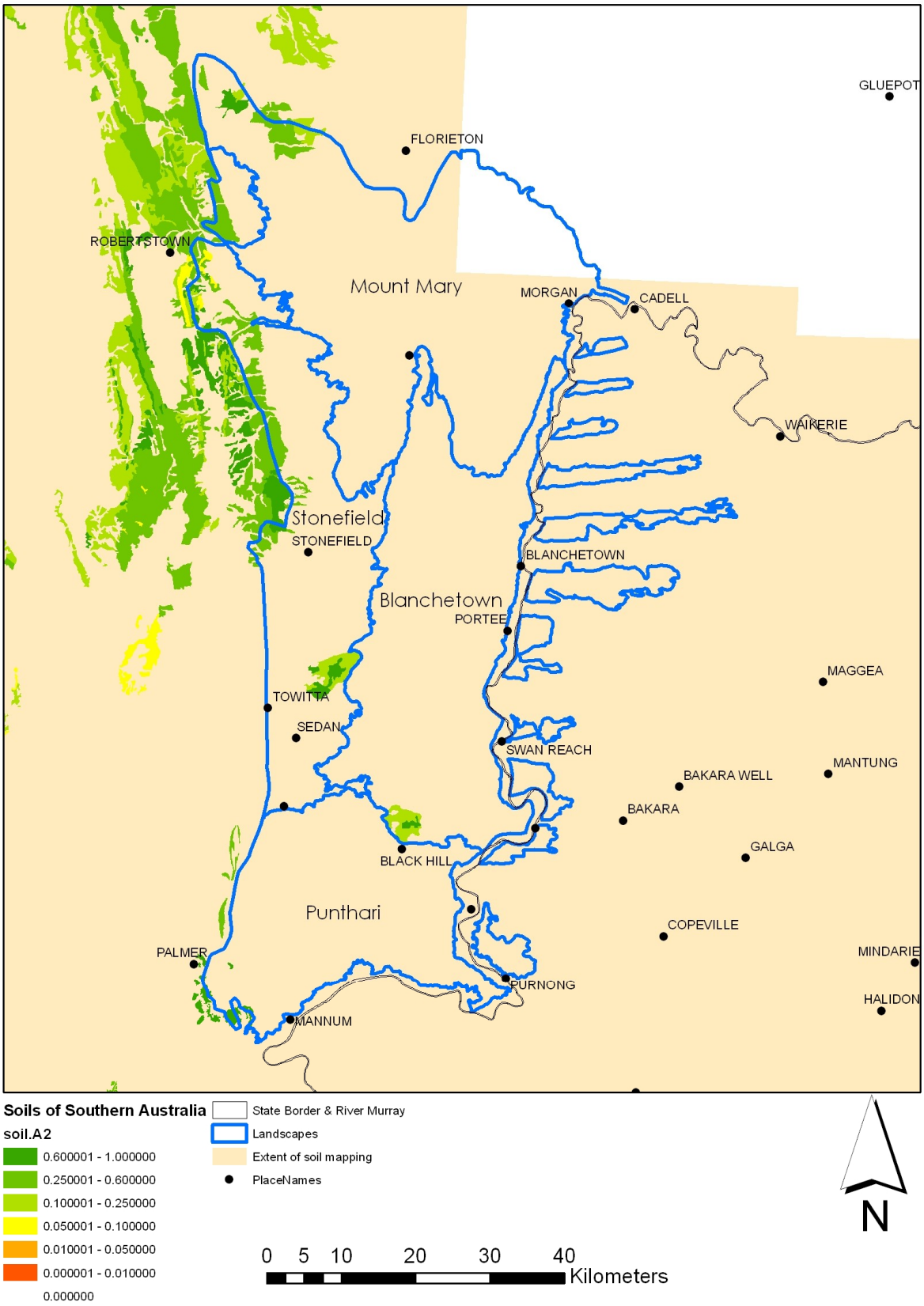


Figure 3: Distribution of soil A3 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

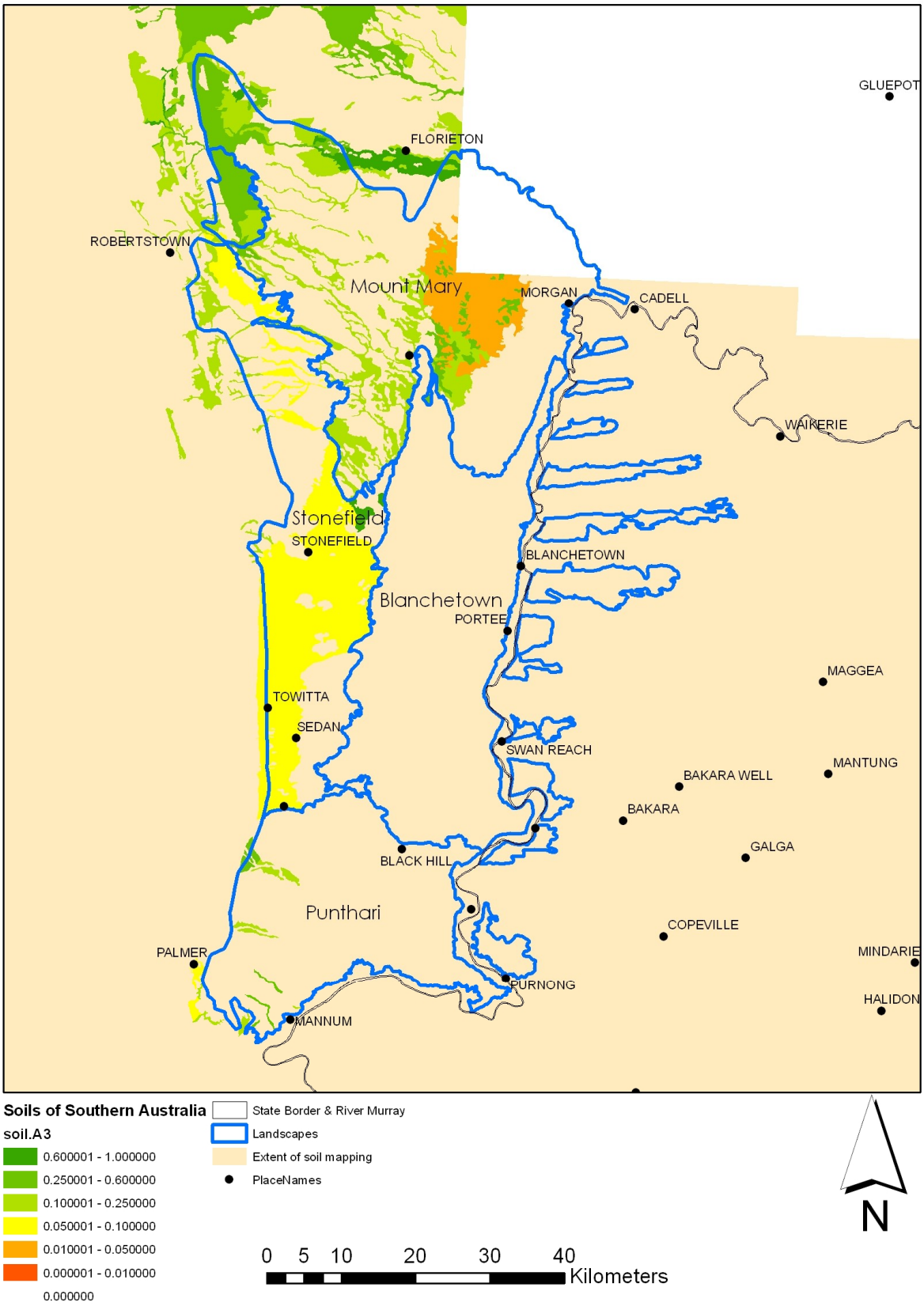


Figure 4: Distribution of soil A4 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

Figure 5: Distribution of soil A5 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

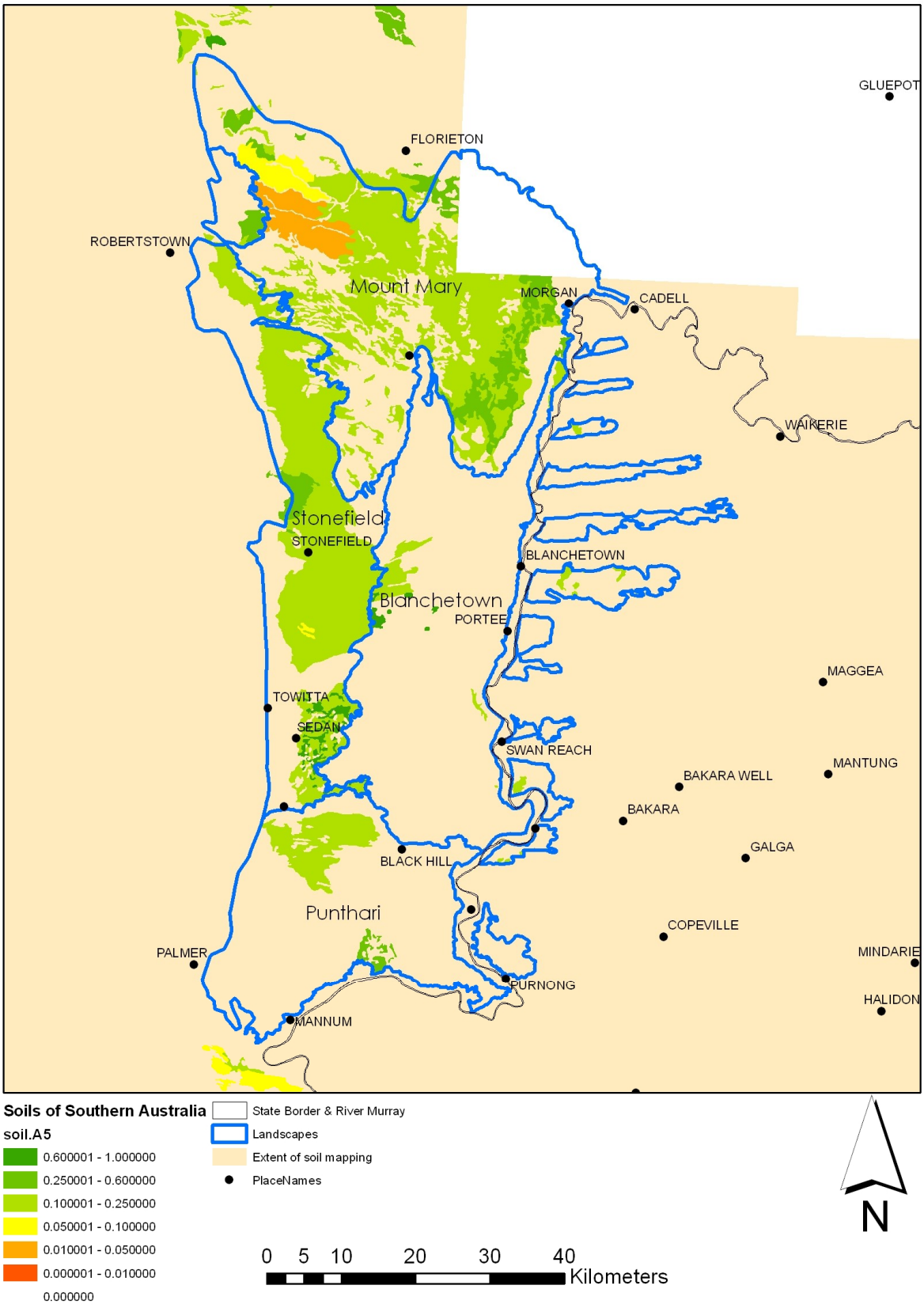


Figure 6: Distribution of soil A6 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

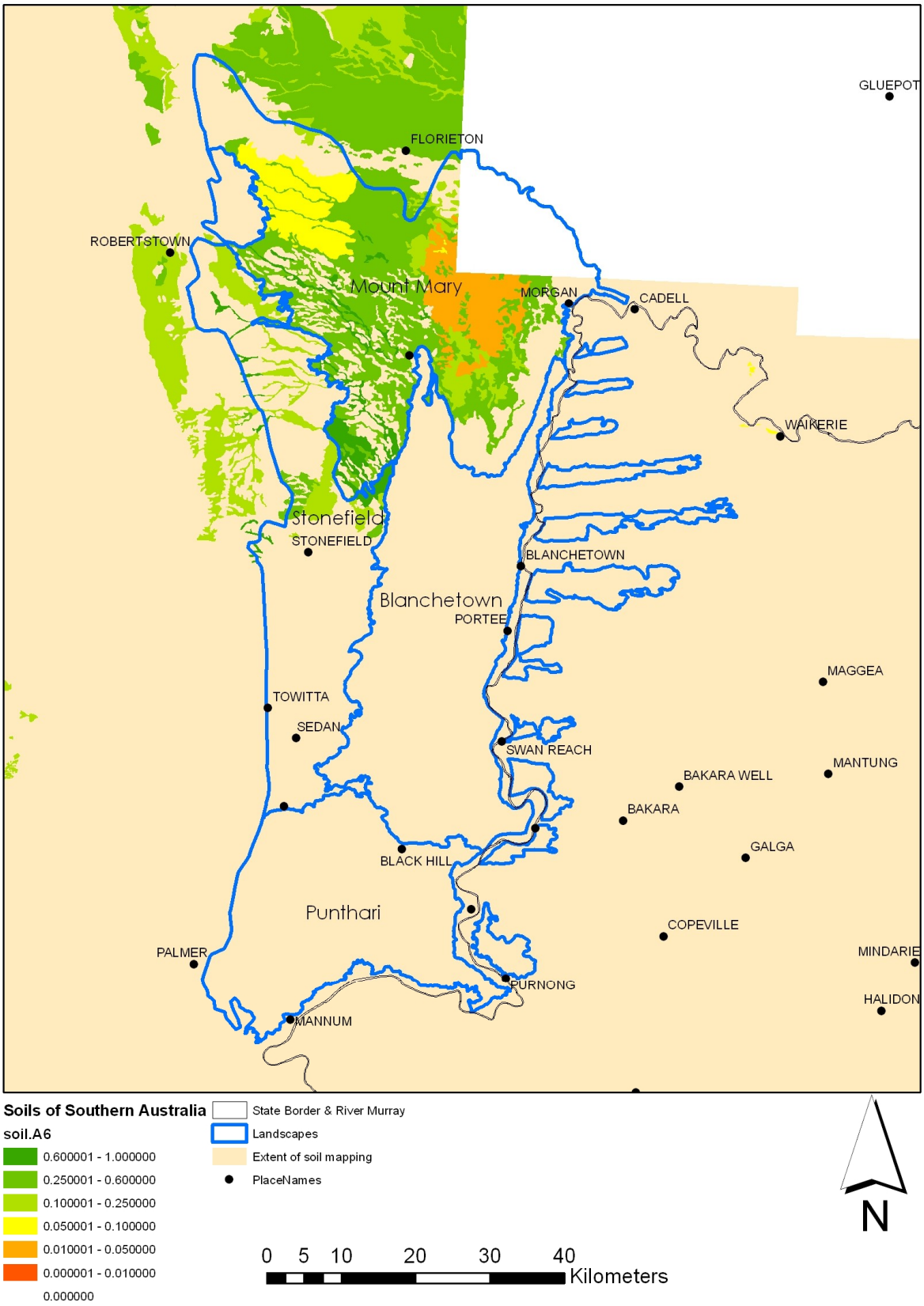


Figure 7: Distribution of soil B2 in the Western Murray Mallee. See also Figure 12 for distribution of 'B2b'

Coloured proportions are the likelihood of encountering the soil type.

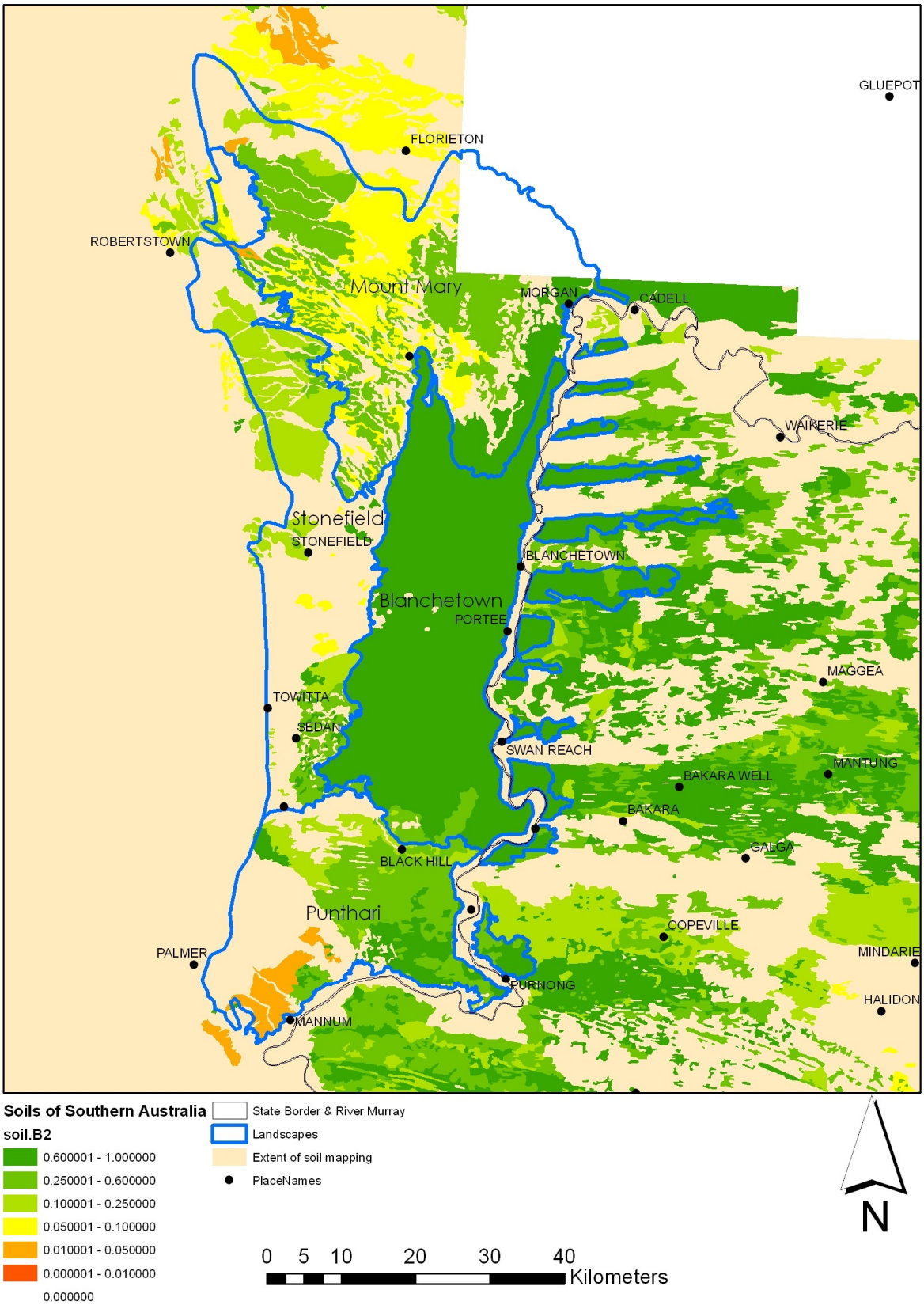


Figure 8: Distribution of soil D4 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

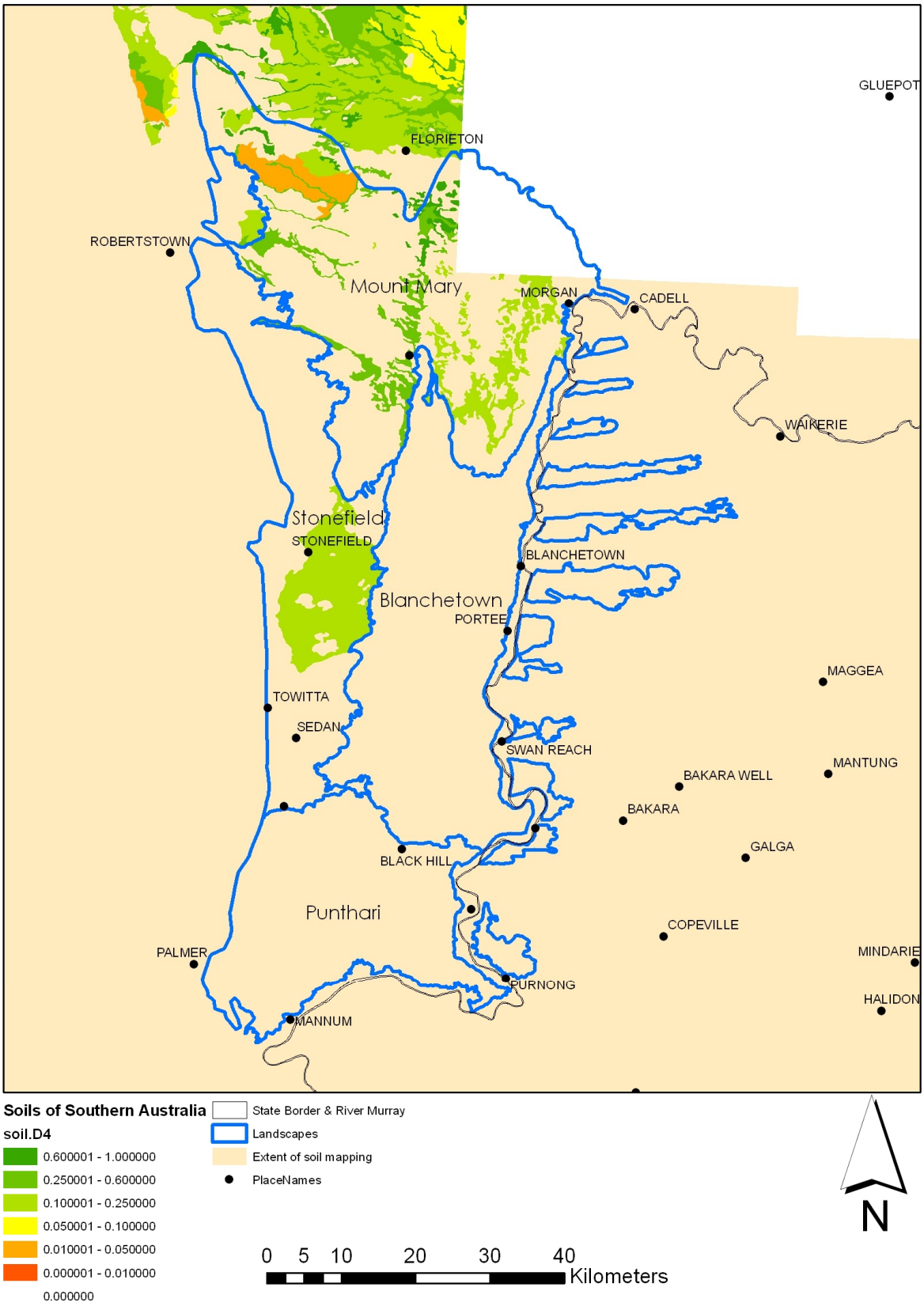


Figure 9: Distribution of soil G1 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

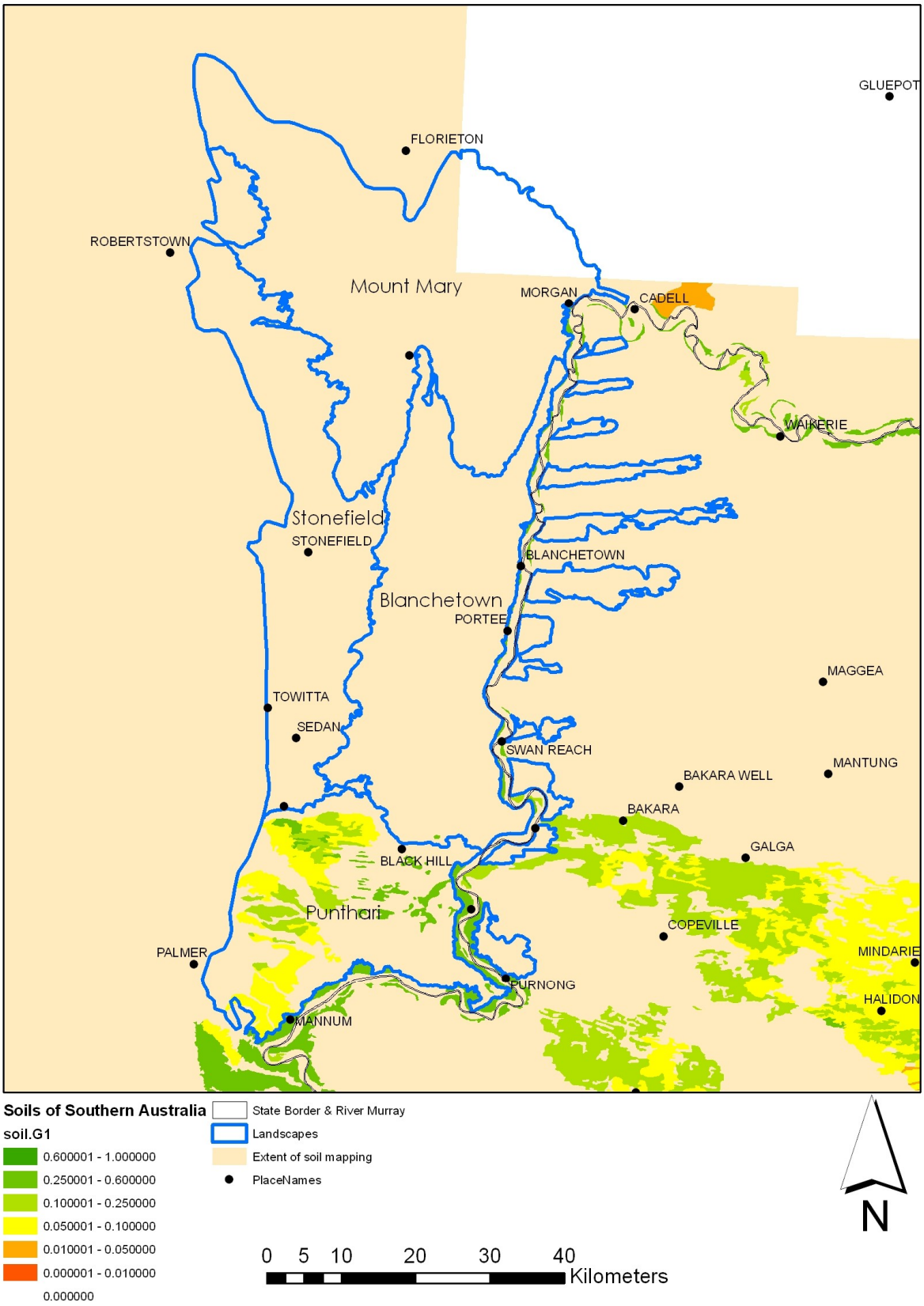


Figure 10: Distribution of soil H2 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

Figure 11: Distribution of soil M1 in the Western Murray Mallee

Coloured proportions are the likelihood of encountering the soil type.

Response groups

The process used in this version of Landscape Assessment to prioritise the coarse-filter component of conservation planning uses bird-based ecological response groups to indicate components of the landscape with stable, declining, extinct or increasing desirable function. This was a three step process. Firstly, ecological response groups are defined. Secondly, the current status and trajectory of each species characteristic of a landscape is determined. Finally, the proportion of species in each ecological response group that are declining provides an indication of the current status and trajectory of the component of the landscape that the ecological response group is indicating.

To define ecological response groups, the following steps were undertaken:

- using the ecological vegetation hierarchy, ecological response groups were defined – these are groups of species for which a shared ecological trait at the scale of the landscape can be defined
- bird species typical of a landscape were defined
- each of the species typical of a landscape were assigned to an ecological response group

The current status and trajectory of each species was then assessed using a series of different approaches, including expert opinion and a number of metrics.

Besides the response groups directly related to vegetation types within environmental settings, a number of other response groups were recognised. The honeyeater response group was included as an indicator of habitat complimentarity (see Paton 2000). The generalist response group may have individuals that spend their whole lives in one habitat, but at the population level, utilise several different habitats without any substantial preference. The 'continental' response contains species unlikely to be responding to events at scales well beyond the landscapes of the Western Murray Mallee. Finally, The agricultural increaser response group was included to provide a contrast for declining species.

Table 3: Ecological response groups identified in the Western Murray Mallee

Note that *Geijera* shrubland is assigned the Mallee shrubland response group, although it does not have a mallee overstorey. The birds closely associated with this component of the landscape are very similar to the Mallee shrubland response group.

Soil	Vegetation component	Structure	Response Group
A2, A4, B2b	Calcareous loam mallee	Open woodland	Mallee woodland
A3	*E. porosa* woodland	Open woodland	Drainage line
A5	*M. aphylla* shrubland	Chenopod shrubland	Shrubland
A5	*E. largiflorens* woodland	Open woodland	Drainage line
A6	*M. sedifolia* shrubland with *E. gracilis*, *C. pauper* or *M. platycarpum* overstorey	Open woodland	Non-eucalypt woodland
A6, D4	*M. sedifolia* shrubland	Chenopod shrubland	Shrubland
A5, A6, D4	*Austrostipa* grassland	Grassy understorey	Grassland
B2	*Austrostipa* grassland	Grassland	Grassland
B2	*Geijera* shrubland	Open shrubland	Mallee shrubland
B2	*Myoporum* woodland	Open woodland	Non-eucalypt woodland
G1	*E. calycogona, E. leptophylla* mallee	*Triodia* mallee	*Triodia* mallee
H2	*E. incrassata, E. leptophylla* mallee	Shrubby mallee	Mallee shrubland
H2	*E. incrassata, E. leptophylla* mallee	*Triodia* mallee	*Triodia* mallee
M1	*E. camaldulensis* woodland	Open woodland	Drainage line

Blanchetown landscape

Blanchetown landscape consists of the Black Hill, Blanchetown, Moorunde and Nagel Hills land systems (DWLBC Soil and Land Program 2007), although Nagel Hills may be better placed with Punthari landscape due to its greater proportion of both A4 and H2 soils. The Moorunde land system rises about 10m above the Blanchetown land system and Stonefield landscape to the east.

The Blanchetown landscape is overwhelmingly dominated by B2 soils (Table 4, Figure 7 and Figure 12) which occur on a gently undulating plain. The A4 soils occur only occasionally in depressions while the H2 soils occur as small localised areas where wind blown sand has accumulated on hill slopes and as low sand dunes. The A5 soils are associated with the transition to the Stonefield landscape, where these soils are more common, usually in depressions or at the end of internal drainage lines.

Within the extensive undulating plain are areas of shallow linear depressions which may be drainage lines after heavy rain and circular depressions in which silty to clayey sediments have accumulated. The area of Brookfield Conservation Park containing chenopod shrubland (e.g. NPWSA 1980) is presumably a larger version of these depressions – thus B2 merging to A6 or D4 soil? The long grazing history of the Blanchetown landscape (Appendix 2) may mask other areas of similar soils that potentially support *M. sedifolia* shrubland.

Within the soils mapped as B2 in the Blanchetown landscape, there are two main vegetation types present that we hypothesise have different environmental settings. Due to the lack of discrimination in the soil mapping in this instance, Pre-European vegetation mapping has been used to give an indication of where there is a probable difference in depth of calcareous loam over calcrete, leading to a meaningful ecological difference (Figure 12). Areas with soil type B2 but where mallee is the dominant vegetation type will be referred to as soil type 'B2b'.

Coarse-filter priorities

The response groups for the Blanchetown landscape shown in Table 5 indicate the following coarse-filter priorities (taken from Table 3, where it applies to this landscape):

Soil	Vegetation component	Structure	Response Group
B2	*Geijera* shrubland	Open shrubland	Mallee shrubland
A5, A6, D4	*Austrostipa* grassland	Grassy understorey	Grassland
B2	*Austrostipa* grassland	Grassland	Grassland

Table 4: Soils of southern South Australia (Hall et al. 2009) present in the Blanchetown landscape

Only soils likely to occur over >1% of the landscape are included

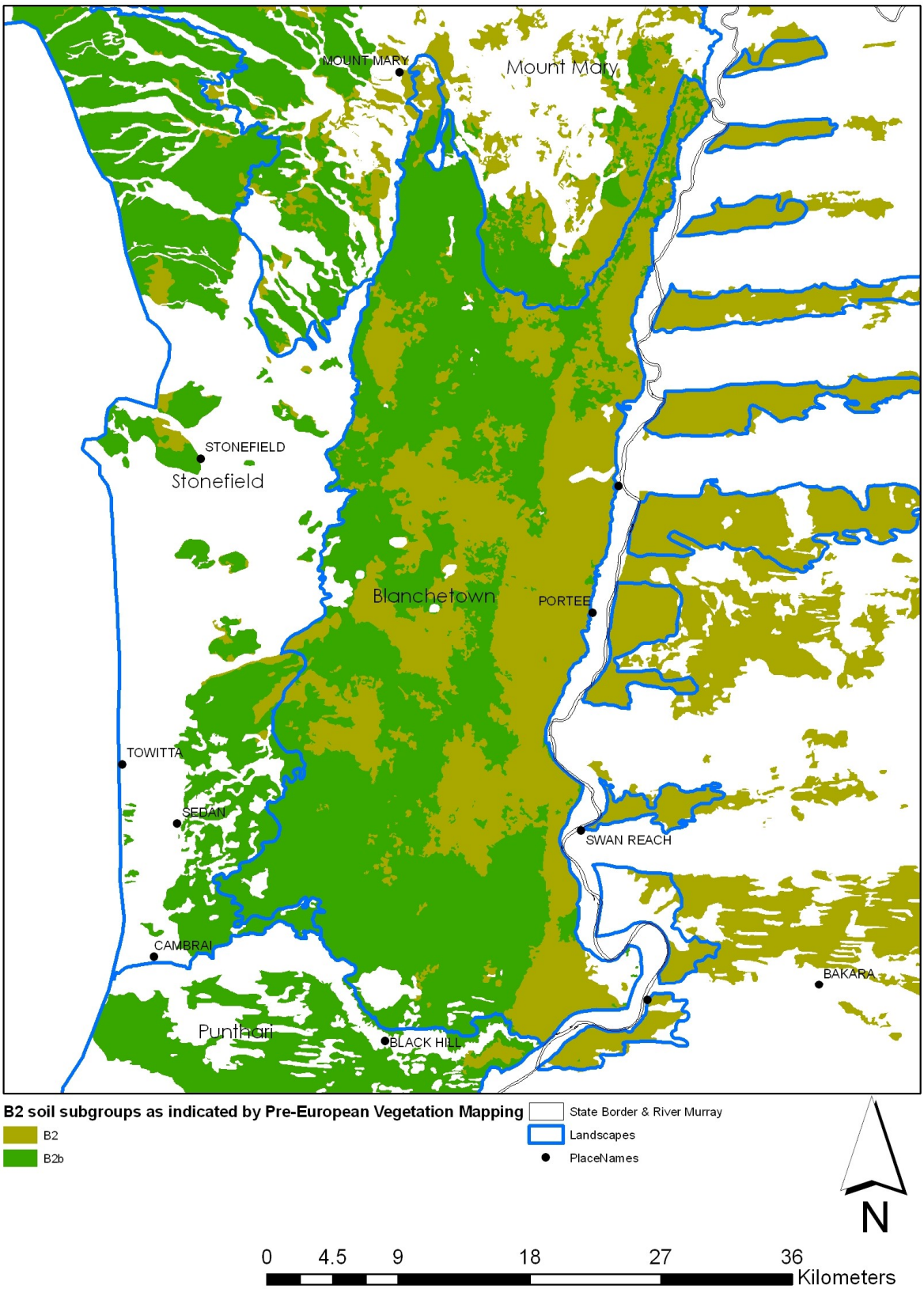
SA Soil	Soil Description	Proportion
B2	Shallow calcareous loam on calcrete	0.96
A4	Deep (rubbly) calcareous loam	0.01
A5	Rubbly calcareous loam on clay	0.01
H2	Siliceous sand	0.01

Table 5: Coarse-filter trajectories as indicated by bird response groups

No. species is the number of species in the response group in this landscape. Declining is the proportion of No. species declining in this landscape. Extinct is the proportion of No. species extinct in this landscape. Both is the sum of Declining and Extinct.

Response Group	No. Species	Declining	Extinct	Both
Mallee shrubland	8	0.88	0.00	0.88
Grassland	13	0.46	0.23	0.69
Shrubland	8	0.50	0.13	0.63
Drainage line	5	0.40	0.00	0.40
Honeyeater	10	0.40	0.00	0.40
Non-eucalypt woodland	5	0.40	0.00	0.40
Generalist	58	0.40	0.00	0.40
Mallee woodland	17	0.29	0.00	0.29
Continental	7	0.29	0.00	0.29
Agricultural increaser	12	0.17	0.08	0.25

Figure 12: Soil types in the Blanchetown Landscape, as indicated by Pre-European vegetation mapping



Mount Mary landscape

The Mount Mary landscape is partly outside the area covered by land system mapping (DWLBC Soil and Land Program 2007), but the land systems it does contain (at least in part) are Burra Creek Plain (BCP), Eba (EBA), Eurovale (EUV), Florieton (FLR), Frying Pan Hut (FPH), Hallelujah Hills (HLU), Mount Mary (MMA), Thistlebeds (THB), Tiger Plain (TIG) and Wonga (WOG) (see DWLBC Soil and Land Program 2007).

The Mount Mary landscape slopes gently from the Northern Mount Lofty Ranges towards the River Murray, with the slope lessening and eventually disappearing before reaching the river. This slope is formed on outwash fans from the ranges which have been covered by a calcrete capping. This capping has then been partially eroded by streams and/or dissolved. The resulting land surface includes depressions with clayey alluvial sediments where the calcrete cap has been entirely removed. There are also undulating plains where the cap has been partially removed and rises where it is largely intact. Moving from the ranges to the river, the alluvial flats are more likely to be narrow drainage lines towards the ranges and grade into broad lacustrine flats, often internally draining or partially connected to other flats further east. Most of these drainage lines and drainage depressions do not connect to the Murray River (at least on the surface). The benches are more likely to be flat with the depressions in the west, but raised in the east around the lacustrine flats with relief around 10-15m.

The Burra Creek Plain land system occurs towards the north of the Mount Mary landscape, providing an extreme case of the other drainage lines. The soils are deeper, silty and gravelly compared with others in the Mount Mary area. This land system also marks the boundary between mallee woodlands to the south and *Casuarina pauper* dominated woodlands to the north.

Following this topography, the Mount Mary landscape is a mosaic of soil types, with B2, B2b, A4 and A6 being most prominent (Table 6). A3 soils occur along the Burra Creek. Mount Mary is also notable for the complete absence of H2 soils, one of the few landscapes in the Murray Mallee with no notable sandy component.

Coarse-filter priorities

The response groups for the Mount Mary landscape shown in Table 7 indicate the following coarse-filter priorities (taken from Table 3, where it applies to this landscape):

Soil	Vegetation component	Structure	Response Group
A3	*E. porosa* woodland	Open woodland	Drainage line
M1	*E. camaldulensis* woodland	Open woodland	Drainage line
A5, A6, D4	*Austrostipa* grassland	Grassy understorey	Grassland
B2	*Austrostipa* grassland	Grassland	Grassland

Table 6: Soils of southern South Australia (Hall et al. 2009) present in the Mount Mary landscape

Only soils likely to occur over >1% of the landscape are included

SASoil	Soil Description	Proportion
B2	Shallow calcareous loam on calcrete	0.2714
A4	Deep (rubbly) calcareous loam	0.2429
A6	Gradational calcareous clay loam	0.2198
A5	Rubbly calcareous loam on clay	0.0820
A3	Deep moderately calcareous loam	0.0768
D4	Loam over pedaric red clay	0.0643
C3	Friable gradational red-brown clay loam	0.0307

Table 7: Coarse-filter trajectories as indicated by bird response groups

No. species is the number of species in the response group in this landscape. Declining is the proportion of No. species declining in this landscape. Extinct is the proportion of No. species extinct in this landscape. Both is the sum of Declining and Extinct. Table is ordered descending on Both.

Response Group	No. Species	Declining	Extinct	Both
Drainage line	14	0.64	0.21	0.86
Grassland	12	0.50	0.17	0.67
Honeyeater	8	0.50	0.13	0.63
Non-eucalypt woodland	5	0.40	0.20	0.60
Mallee shrubland	5	0.60	0.00	0.60
Shrubland	10	0.50	0.00	0.50
Continental	7	0.43	0.00	0.43
Generalist	55	0.40	0.00	0.40
Mallee woodland	13	0.31	0.08	0.38
Agricultural increaser	12	0.08	0.08	0.17

Punthari landscape

The Punthari landscape contains parts of the Apamurra (APA), Avalon (AVA), Burdett (BUR), Mantung (MAN), Milendella (MID), Marne (MRN), Nagel Hill (NAH), North Boundary (NOB), Punthari (PUN), Ridley (RID), Saunders (SAU) and Stone Ridge (STN) land systems (see DWLBC Soil and Land Program 2007). The main land systems are Avalon, Nagel Hill and Stone Ridge interspersed with the drainage line land systems of Marne and Saunders.

The large number of land systems, the higher rainfall and position between the Mount Lofty Ranges and the River Murray contribute to the more complex set of environmental settings in the Punthari landscape.

The non-drainage line land systems are reasonably similar in their environmental settings. Plains and rises are often sheet or rubbly calcrete (B2 or A4 soils) and occur throughout. Closer to the ranges these occur on outwash sediments and gently slope down from the ranges. Molineaux Sand (H2 soils) occurs as low linear dunes or spreads in some areas, overlying the landscape, particularly further south. At times the calcrete has been eroded or dissolved, leaving the underlying heavier soils of the Blanchetown Clay exposed ('D' soils), usually in depressions. Where sand has been blown over these areas G1 soils occur. There are water courses through some areas of the sheet or rubbly calcrete that range from weakly defined through to narrow and well defined – mainly in response to position relative to the Mount Lofty Ranges (e.g. streams that flow from the ranges are much better defined.

Milendella land system against the ranges has much greater proportion of outwash sediments which vary depending on source materials and depositional environment. Moving away from the ranges, the outwash sediments generally get less gravelly and more clayey. Calcrete capping is not a feature of this land system.

The drainage line land systems are much more complicated. The creeks that flow from the Mount Lofty Ranges to the River Murray have gouged deep valleys, exposing underlying materials of older depositional environments. A number of distinct components are recognised in the land systems fans, flats and gentle slopes. The fans occur near the ranges and include many small drainage lines feeding the main water courses. The flats occur throughout the land system, wider in the upstream sections, becoming narrower as the creeks dissect further into the land system moving east. The gentle slopes occur throughout and merge into the surrounding land systems. While a range of soils have developed in various parts of these land systems, the entirety of the drainage line land system really provides the environmental setting within the landscape.

Coarse-filter priorities

The response groups for the Punthari landscape shown in Table 9 indicate the following coarse-filter priorities (taken from Table 3, where it applies to this landscape):

Soil	Vegetation component	Structure	Response Group
B2	*Geijera* shrubland	Open shrubland	Mallee shrubland
H2	*E. incrassata, E. leptophylla* mallee	Shrubby mallee	Mallee shrubland
B2	*Austrostipa* grassland	Grassland	Grassland
	E. porosa woodland	Open woodland	Drainage line
	E. camaldulensis woodland	Open woodland	Drainage line

Mallee *Triodia* is indicated as extinct in the landscape, so is not included here.

Table 8: Soils of southern South Australia (Hall et al. 2009) present in the Punthari landscape

Only soils likely to occur over >1% of the landscape are included

SA Soil	Soil Description	Proportion
A4	Deep (rubbly) calcareous loam	0.2600
B2	Shallow calcareous loam on calcrete	0.2400
H2	Siliceous sand	0.1300
B3	Shallow sandy loam on calcrete	0.0600
M1	Deep sandy loam	0.0600
G1	Sand over sandy clay loam	0.0500
D2	Loam over red clay	0.0400
D5	Hard loamy sand over red clay	0.0400
A5	Rubbly calcareous loam on clay	0.0300
C1	Gradational red-brown sandy loam	0.0300
D3	Loam over poorly structured red clay	0.0100
G3	Thick sand over clay	0.0100
G4	Sand over poorly structured clay	0.0100

Table 9: Coarse-filter trajectories as indicated by bird response groups

No. species is the number of species in the response group in this landscape. Declining is the proportion of No. species declining in this landscape. Extinct is the proportion of No. species extinct in this landscape. Both is the sum of Declining and Extinct. Table is ordered descending on Both.

Response Group	No. Species	Declining	Extinct	Both
Mallee Triodia	4	0.00	1.00	1.00
Mallee shrubland	11	0.64	0.27	0.91
Drainage line	16	0.69	0.06	0.75
Grassland	12	0.50	0.17	0.67
Generalist	53	0.42	0.02	0.43
Non-eucalypt woodland	5	0.20	0.20	0.40
Shrubland	5	0.20	0.20	0.40
Mallee woodland	13	0.23	0.15	0.38
Honeyeater	11	0.27	0.09	0.36
Agricultural increaser	12	0.17	0.17	0.33
Continental	7	0.00	0.00	0.00

Stonefield landscape

The Stonefield landscape consists of the Brownlow (BRN), Black and White Hill (BWH), Craigie Plains (CRP), North Hills (NOH), Peep Hill (PEH), Scrubby Range (SCR), Sedan (SED), Stonefield (STO), Sutherlands (SUT), Thistlebeds (THB) and Towitta (TOW) land systems although many of these are limited to those parts that occur within the Murray Mallee IBRA Sub-region. The main land systems are Brownlow, Sedan, Stonefield and Towitta.

The western section of Stonefield against the Mount Lofty Ranges is formed on outwash sediments, generally calcreted, and slopes gently away from the ranges. Drainage depressions cross this at regular intervals, many now eroded. Where these drainage lines terminate in wide depressions (without reaching the River Murray, although some drain into the Mount Mary landscape) the gravelly sediments they carried from the ranges have mixed with Blanchetown clay (or similar). In a few areas the old calcreted land surface remains on higher ground, but it has generally been eroded or dissolved.

The Craigie Plains area has more gypsum in the underlying sediments and drains from north to south, terminating in a series of old lake beds. This is set in the same old calcreted landscape as the rest of Stonefield landscape.

Scalded areas occur along some drainage lines in the Sutherlands land system indicating severe sheet erosion in the past.

Black and White Hill is an intrusion of granite which is at or near the surface over about half the area of the land system. Elsewhere, it is capped by Woorinen formation carbonates similar to other areas of Stonefield.

Coarse-filter priorities

The response groups for the Punthari landscape shown in Table 9 indicate the following coarse-filter priorities (taken from Table 3, where it applies to this landscape):

Soil	Vegetation component	Structure	Response Group
A5	*M. aphylla* shrubland	Chenopod shrubland	Shrubland
A6, D4	*M. sedifolia* shrubland	Chenopod shrubland	Shrubland
A5, A6, D4	*Austrostipa* grassland	Grassy understorey	Grassland
B2	*Austrostipa* grassland	Grassland	Grassland
A3	*E. porosa* woodland	Open woodland	Drainage line
A5	*E. largiflorens* woodland	Open woodland	Drainage line
M1	*E. camaldulensis* woodland	Open woodland	Drainage line

Table 10: Soils of southern South Australia (Hall et al. 2009) present in the Punthari landscape

Only soils likely to occur over >1% of the landscape are included

SA Soil	Soil Description	Proportion
A4	Deep (rubbly) calcareous loam	0.4600
A5	Rubbly calcareous loam on clay	0.1200
B2	Shallow calcareous loam on calcrete	0.1100
A3	Deep moderately calcareous loam	0.0800
A2	Calcareous loam on rock	0.0500
D4	Loam over pedaric red clay	0.0400
A6	Gradational calcareous clay loam	0.0400
D2	Loam over red clay	0.0400
C1	Gradational red-brown sandy loam	0.0200
A8	Gypseous calcareous loam	0.0100

Table 11: Coarse-filter trajectories as indicated by bird response groups

No. species is the number of species in the response group in this landscape. Declining is the proportion of No. species declining in this landscape. Extinct is the proportion of No. species extinct in this landscape. Both is the sum of Declining and Extinct. Table is ordered descending on Both.

Response Group	No. Species	Declining	Extinct	Both
Shrubland	10	0.50	0.30	0.80
Grassland	12	0.58	0.17	0.75
Drainage line	15	0.60	0.13	0.73
Mallee woodland	14	0.36	0.14	0.50
Non-eucalypt woodland	6	0.33	0.17	0.50
Generalist	54	0.44	0.04	0.48
Honeyeater	10	0.40	0.00	0.40
Agricultural increaser	12	0.17	0.08	0.25
Continental	7	0.00	0.00	0.00

Summary

Two main coarse-filters were indicated across all Western Murray Mallee landscapes as functioning poorly: structural layers exposed to browsing and grazing and drainage lines.

Total grazing pressure seems a likely candidate as the stress causing inadequate function across the shrubland and grassland components. There is perhaps an interaction with clearance for agriculture and grazing – Stonefield was the only landscape where the shrubland component was highlighted (and was, in fact, highest) and is the only landscape where chenopod shrubland has been both cleared and subject to grazing.

Drainage lines are often relatively important areas of a landscape for a range of reasons but also experience greater human impacts for many of the same reasons (e.g. Mac Nally et al. 2000). Failing function in these areas is likely to have impacts extending to other components of the landscape – perhaps as honeyeaters are indicating.

The results presented here provide a landscape assessment for the Western Murray Mallee. This is simply the situation assessment component of a planning cycle. The next step is situation model – what is happening in those coarse-filter priorities to create problems in the landscape.

Implementation

The information provided by the data summarised in this landscape assessment is adequate to initiate restoration focussed on the prioritised components of each landscape. Situation models, state-and-transition models and spatial priority models are due to be completed in 2011-2012 and can then evolve through adaptive management with on-ground works.

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Appendix 1: Glossary

term	defintion
BDBSA	Biological Databases of South Australia
landscape	landscapes as described in this document. We are aiming to describe landscapes at a scale that directly inform any patches they contain
land system	land systems as described by (Potter et al. 1973; McCord 1995; DWLBC Soil and Land Program 2007)
Fragmented (landscape)	10-30 % destroyed and/or mostly highly modified (McIntyre and Hobbs 1999; 2000)
Intact (landscape)	< 10 % destroyed and/or low levels of modification (McIntyre and Hobbs 1999; 2000)
Relictual (landscape)	>90 % destroyed and/or mostly highly modified (McIntyre and Hobbs 1999; 2000)
Variegated (landscape)	40-90 % destroyed and/or low-high levels of modification (McIntyre and Hobbs 1999; 2000)

Appendix 2: Landuse History

This section was written by David Armstrong, Science Resource Centre, Department for Environment and Natural Resources.

References appear in the references section of this document, not in this appendix.

Aboriginal History

Aboriginal culture along the River Murray was diverse, with several languages and numerous dialects spoken along the South Australian section. Early European scholars used Meru, a river aboriginal term for "humankind", to describe the collective aboriginal population along the Murray River from north of the Lower Lakes to the Darling River junction (Clarke 2009). There are conflicting records of the exact clan boundaries of the Meru, but it appears that the majority of the Western Murray Flats survey area from about the Marne River north was inhabited or used by the Ngaiawang, whilst the area from just south of Mannum, north to the Marne was occupied by the Nganguruku. Their languages were reportedly similar (Clarke 2009). These two clans are known to have extended into the mallee on both sides of the Murray and into the adjacent areas of the eastern Mount Lofty Ranges (Tindale 1974; Clarke 2009). However, within this area the river was the main focus of activity.

Aboriginal people are believed to have been present on the Western Murray Flats for several tens of millennia, although the exact length of this occupation is unknown. Based on the manner of distribution on the landscape of a variety of occupational and other sites and the qualitative differences in the finish of stone artefacts, at least two distinct culture phases have been identified, the Older Stone Age (Pleistocene) and the Younger Stone Age (post-Pleistocene) extending from about 4,000 years ago to the 1850s (Pretty 1974).

Very few Older Stone Age sites have been found. However, archaeological work at Roonka Flat has obtained carbon dates back to around 18,000 years ago. Cobble cooking places and Older Stone Age tools dating back to about 12,000 years have been found on the slopes of the Craigie Plain Lakebed system. This is a series of ancient dry lakebed depressions in a north-south line on the Twelve Mile Plain. An ancient trail dating from this period referred to as the Ngaiawang Trackway was rediscovered in 1973, leading from a significant assemblage of rock paintings on the River Murray and opening out on to the Craigie Plain Lakebed system. Stone artefacts suggest that man was perhaps more widely dispersed during this period, than in more recent times.

It is believed that there was a major change in the distribution of man on the landscape at the end of the Pleistocene period about 10,000 years ago. In the more recent Younger Stone Age period the Ngaiawang have been the inhabitants of the majority of the Western Murray

Flats. The range of sites identified for this period is more extensive and varied than during the Older Stone Age. Stone artefacts and cooking stones from both the Older and Younger Stone Age periods are strewn across the ancient shoreline of the Craigie Plain Lakebed system. However, the presence of artefacts from only the Older Stone Age period on the upper shoreline slopes of these ancient lakes indicates a consistent reduction in water level over time. The sites recorded from the recent period include occasional open campsites, most associated with water-courses; sustained open camp sites, usually associated with more permanent supplies of food and water particularly along the River Murray; rock shelters, many of these are along the eroded cliffs of the river; cave paintings, including a significant site at Eden Valley; a cemetery site, fish traps and numerous canoe trees along the river; and sink holes used as water sources when travelling away from the river. More comprehensive information on many of the points covered above is available in The Ngaiawang Folk Province (Pretty 1977).

With expanding European occupation of the flats and stock using their land and controlling their waterholes from the 1850s onwards, it became increasingly difficult for aboriginal people to maintain their traditional lifestyle. Around the start of the 1900s the remnants of several Ngaiawang tribal groups gathered at Swan Reach. Many worked for the European settlers, others continued to continue to live in a more traditional manner (Tuckwell 1996). In 1925 the United Aborigines Mission established a mission at Swan Reach for the indigenous inhabitants of the River Murray who had been dispossessed. In 1945 land was purchased near Loxton and the Gerard Mission was founded. Many of the inhabitants of the Swan Reach Mission moved there, but others remained at the Swan Reach locality until flooded out in 1956, whilst others took up residence in the town (Tuckwell 1996). Control of the Gerard mission was passed to the South Australian government in 1961 and to the Gerard Council in 1974.

European Exploration

The first European to have seen the Western Murray Flats was Charles Sturt as he travelled down the Murray River in his whaleboat in 1830. On the evening of the 2nd of February, the day before reaching the northwest bend, the current site of the town of Morgan, he observed mountains (Mount Lofty Ranges) to the west and commented, "the country between the river and these ranges appeared to be very low and darkly wooded" (Sturt 1833). He also described the miserable state of disease and infirmities, including what he considered leprosy, amongst the aboriginal people to the south of the north-west bend. In a later trip along the river as an overlander in 1838, he stated that he did not see the "hundreds to thousands" of aboriginal people he had previously seen and assumed that this was caused by the smallpox, which he observed raging among them on the Darling in 1828 and Murray in 1829 (Cumpston 1951).

The first Europeans known to actually enter and cross the Western Murray Flats were Messers Hill, Wood, Willis and Oakden, who after leaving Adelaide on March 1st 1838, following a north-east course from Cockatoo Valley through Lyndock Valley, would have reached the edge of the hills of the Mount Lofty Ranges to the east of the present location of Truro. They first observed the Murray Flats at 11:00 am on Sunday 4th March, descended on to the flats and after watering at a "small lagoon" travelled through a short scrub, describing the land as "stony and barren, not a blade of grass on it" (Oakden 1838). As they progressed the scrub got thicker the further they went. After travelling for the remainder of the day and into the night by moonlight, "with nothing for the horses to eat and no water" they eventually arrived at a clearing where they camped for the night, on the following morning discovering they were within only 400 meters of the River Murray. They travelled north along the river for two days, in frequent contact with aboriginal people, until reaching the north west bend. At 4:00am on 7th March they began the return journey west across the flats. Travelling through dense scrub they suffered greatly due to oppressive heat, hot winds and no water, soon after sunset arriving at the hills, which were "barren and no water, the horses completely tired". They eventually arrived back in Adelaide early on the 12th March "after an arduous and fatiguing journey of 12 days" (Oakden 1838).

Overlanders

Very shortly after, the first overlanders led by Joseph Hawdon and Charles Bonney followed the west bank of the river south from the Bend for about 30-40 miles (50-65 km) which would have brought them to about where Swan Reach stands today, before turning west across the flats (SA Museum 1977). They arrived in Adelaide with 335 bullocks on 3rd April after a ten-week journey from Sydney (Schirmer 2001). The initial stock route was along the northern bank of the Murray to North West Bend thence south following the water to McLean's Pound and on to the Marne River, which was followed across the flats to the hills, then on to Adelaide (Pretty 1974). Some of the prominent drovers were Edward Eyre and Charles Sturt (both now well known explorers), Evelyn Sturt (Charles's brother), Phillip Levi, J.C. Hawker, E.B. Scott and Sidney Kidman, all of whom became well known pastoralists, and George Hamilton who became a commissioner of police (Munchenberg 2002). Overlanding of stock across the flats was short lived, continuing only until the mid 1840s but it had opened up the area to settlement.

Three main stock routes developed across the flats from the Murray River and are still visible on cadastral maps of the area. These were: (1) from Von Riebens Hotel, about eight kilometres south of the northwest bend west to Eudunda; (2) McBeans Pound (north of Blanchetown) west to Narcoota Springs and the River Light; (3) west along the Marne River from Wongulla on the Murray. The track from Truro to Moorundie was proclaimed a main road

in December 1851 and eventually modified to the existing road from Blanchetown, after Moorundie was abandoned.

The first settlement on the flats was established in 1841 on land claimed by E.J.Eyre as part of a special survey in 1839. Although named Sturt it was generally known as Moorundie after the name of Eyre's station. Increasing conflict between aboriginal groups further up river and overlanders caused the government to station a garrison of troopers at the site and appoint Eyre as Protector of Aborigines, in an attempt to improve relations between the two groups. Moorundie was abandoned by 1856 with the rise of the river trade, for the more favourable port site at Blanchetown established in 1855 about five kilometres to the north.

Pastoralism

During 1839 and 1840 the first special surveys were made of lands along the Murray, including that applied for by E.J. Eyre, which became Moorundie. Throughout the 1840s most of the land on the Western Murray Flats was taken up by pastoralists, some of who were already squatters in the area, under occupational licences. These included Donald McDonald's Worlds End Run near Burra Creek; Lachlan and Alexander McBean who held several properties including to the north of Moorundie, in the Hundred of Anna and Baldon Station near Truro; and Eardley Heywood's Swan Reach and Portee Stations. Notable amongst many others was George Melrose of Rosebank near Mt pleasant, who took up Rhine Station and established Dishers Plains and Tungapa Stations in the Sedan-Cambrai area. These licences allowed for the erection of a hut or dwelling, clearance of timber for domestic but not commercial purposes and set fees payable for stock, at six pence per head for cattle, horses and mules, and one penny for sheep, goats and pigs. Rent in 1850 was between ten shillings and one pound per square mile (Munchenberg 2002). Initially the pastoralists kept thousands of cattle, but by the 1860s markets for wool were more favourable so cattle made way for sheep. Shepherds were employed to manage the sheep and protect them from dingos, which were a great menace. These shepherds often lived in isolated locations in one roomed stone huts built near water sources, with a fenced area which held the sheep at night.

Hundreds

The proclamation of the Murray hundred in 1853 which extended for two miles from the shores of the Lower Lakes and along the river to the Victorian border was bitterly opposed by the pastoralists. The reasons for its creation were not explained, but it was possibly intended to promote settlement, which was expected to follow the development of river navigation and boat trade with the interior of Victoria and New South Wales (Williams 1974). The Murray hundred was subsequently cancelled out by the1860 proclamation, equally unpopular with the pastoralists, of 24 new hundreds encompassing all the land on either side of the river south of the North West Bend (Williams 1974). The hundreds along the eastern side of the hills

extending onto the flats had been proclaimed earlier. The remaining hundreds on the northern flats were established progressively after 1875, the last Brownlow south west of Mt. Mary in 1883. With the proclamation of the Hundreds and subsequent surveying the land was then offered for sale and leases cancelled.

In many cases stock routes were included in the surveying phase to allow for continued movement of stock throughout the area. Their use for long distance overlanding of stock decreased dramatically with the advent of railways, particularly the arrival of rail to Bourke, which brought overlanding from western NSW to a halt. They were still however important for local stock movements, but even this ceased with the gradual improvements in roads and motor vehicles. In the 1880s many stock routes were subdivided in to small blocks in an attempt to increase settlement. This scheme largely failed as the blocks were mostly too small to earn a living from. Some are currently occupied, but the ruins of many of the "blockers" homes are still to be seen.

The pastoralists bought the majority of land which they had previously leased. The remainder went to farmers and speculators. Eventually the potential arable land of the pastoralists and speculators was leased or sold to farmers. Between the 1850s and 1880s much of the land on the flats and the hills bordering them was sold (Munchenberg 2002).

The Scrub Lands Act 1866 was designed to encourage the settlement of the difficult lands of the mallee areas. It allowed for an increase in the size of survey land sections above the previous maximum of 80 acres. It was soon followed by the Strangways Act 1869 which allowed for the first time the purchase of land on credit, in farm blocks of up to 640 acres laid out in sections of no more than 320 acres in size, within specially designated agricultural areas (Williams 1974). This was particularly important in promoting development of mallee country as the lower fertility of the soils meant that greater areas of land per property were required to ensure profitable farming.

Development of Farming

The more intensive settlement of the flats for farming is heavily interwoven with the communities of the Barossa Valley and hills to the west. The majority of settlers were of German descent, as is clear from the original names of many of the town and settlement locations in the area. Numerous place names were changed or anglicised towards the end of World War One, with some since returned to their original German names (Leadbeater 2010). Many of the settlers were the sons of the earlier settlers of the Barossa valley (Pretty 1977; MacDonnell 1980).

As throughout much of South Australia surface water on the flats was scarce. Most early settlement occurred along the river or in association with springs on other watercourses. As early as 1856, twenty four local farmers petitioned the government for a customs house at Blanchetown so that they might transport their produce by river rather than overland to Adelaide (Pretty 1977). Some government wells and dams had been dug along stock routes for drovers and other travellers. These were of vital importance to the early settlers on the flats, particularly in summer and drought years before private bores were sunk or dams constructed (Munchenberg 2002). Water was often carted long distances from the river and even by train from Morgan to Mt Mary and Bower prior to their mains connection to the Warren reservoir in 1918 (Zerner 1986).

Land clearing in the mallee was a laborious task, done by hand with axes and stump jacks, and horse drawn scrub rollers. The process known as Mullenizing was introduced in 1868, whereby mallee was knocked down with a heavy roller, the trash and exposed roots burnt and soil opened up by dragging a heavy spiked log over it, then seed sown. Burning the stubble after harvest kept down the suckering roots and the stumps could be grubbed out later (Williams 1974). The development in South Australia of a number of inventions that transformed grain farming accelerated this process. The Ridley and Bull stripper, first demonstrated at Koonunga Station between Nuriootpa and Kapunda in 1842, and Smith's stump-jump plough, which as its name indicates allows ground to be prepared for sowing without having to first investing the considerable time required to remove the stumps, are most notable amongst these (Pretty 1974).

Towns and Settlements

Prior to the expansion of farming the only towns on the flats were at North West Bend and Blanchetown. Both had originally developed as transport hubs for the river boat trade. Blanchetown was a government town surveyed in 1855, whilst North West Bend was not surveyed until 1878, when the railway from Kapunda was completed and the site was renamed Morgan. This rail link was important in opening up the northern flats to farming and several towns developed beside it. Although developed to enable South Australians to compete more favourably with the Victorians in the river trade, the railway started the decline of Blanchetown through reducing its significance as a port. Morgan came to prominence through the construction of a rail link, but its decline, significantly for the same reason, began a few years later in 1885 with the extension of rail to Bourke in New South Wales. With regular transport guaranteed for their produce the pastoralists of western New South Wales abandoned riverboats for rail (Pretty 1977).

The 1870s were boom years with good prices and prospects. With increased land sales and farmers expanding into new areas new towns were developed on the flats. Most were near

water points, on former stock routes or major roads. In the 19th century it was South Australian government policy to establish a town in each new hundred surveyed. These were invariably drawn up as a rectangular block containing regularly spaced straight roads surrounded by parklands, as had been adopted for Adelaide. Unfortunately, the agricultural boom of the 1870s was not a sustained as the farmers had hoped. As a result many of these towns were never developed and many, which were, have all but disappeared.

Other towns formed through convenience, the site being near the centre of a farming group. Sedan, at the intersection of six roads, is the most notable example of this. Sometime between 1869 and 1871 a community of farmers had begun to establish in the area, so for convenience the year 1870 is taken as the year of its birth, although it was not surveyed until 1875. By 1873, when the post office was established, there were 61 farms occupied in the area (Royal and Glastonbury 1986). A flour mill was built in Sedan in 1881 and ran on a variety of fuels, including steam, charcoal gas, diesel and finally from 1958 until its close in 1966 on electricity which had arrived in Sedan in 1956. This was the only mill on this part of the flats and was of great benefit in the rapid development of the town. It also solved the transport problems of the farmers who had previously had to cart grain up through the hills to the rail line at Freeling or Angaston.

The only other currently existing town of significant size on the central flats is Cambrai (originally Rhine Villa). The first sections of land in the area (hundred of Angas) were surveyed in 1866 and the town in1882. The town is situated near the Marne River (formerly Rhine) and an old travelling stock route. A foundry employing many locals commenced operation in 1886. Around 1906 a stock market operated in Cambrai. It ceased in the early 1940s when improved vehicle transport allowed stock to be taken to bigger and better markets (Schirmer 2001).

Beginning in the 1880s a number of proposals for a train line to service the flats over varying routes were assessed by several committees. A committee sitting in 1916 concluded the best way to link to the existing system was to construct a line north from Monarto South to Sedan, as had originally been proposed in 1884. The railway was opened to the first scheduled train on 13th October 1919. Mixed trains carrying passengers, grain, stock and firewood to Monarto South and thence to Adelaide, ran three times per week, with seven other stops on the flats, returning on the same day. This scheduled reduced to one or two trains per week. With deregulation of road transport, rail traffic to Sedan dwindled to almost nothing, eventually carrying only bulk grain. Following the construction of silos in the early 1960s Cambrai became the new terminus of the line, the Sedan section closing from December 1st 1964. Other sidings were closed as grain traffic was concentrated at Cambrai and Apamurra. By

1988 trains ran only to Apamurra and by the 1995-96 grain season Australian National had standardised the line only as far as Apamurra (Callaghan 1996).

Woodcutting

Mallee timber and roots, initially a by product of land clearing, have been used for a variety of purposes and at times were critical to the local economy of the flats. It is believed that much of the wood used to fuel the Burra mine machinery was mallee from areas east and southeast of the town (Harris and Young 1989). Before the rail line to Morgan was constructed in 1878 wood was carted to Kapunda and Burra to fuel the mine furnaces (Munchenberg 2002). Settlers carted wood to Morgan to be used by the paddle steamers and huge heaps of wood were stacked at various other locations along the river.

As the state's population grew, the need for firewood for domestic use in Adelaide also grew. By the early twentieth century much of this was being supplied from the flats. The Morgan (and later the Sedan) rail link was particularly important, with the town serving as a railhead for cutters operating over a wide area of the flats (Harris and Young 1989). Wood was stockpiled at several railway sidings along the Morgan line and saw benches were operated at Mount Mary and Eba. By July 1896 over 2,000 tons of wood a month was delivered to the yards (Munchenberg 2002). In drought years, particularly those of 1914 and 1928-29, the sole means of income for many farmers was the selling of mallee for firewood (MacDonnell 1980).

The annual total for firewood transported on the Sedan rail line to Adelaide in 1936 was 2016 tons. By 1956 this had dropped to only 60 tons (Callaghan 1996). This is more likely a reflection of the improvements in road transport than reduction in timber cut, as following a post Second World War slump in demand for firewood 1989 state government estimates were of consumption approaching of 300,000 tons (Harris and Young 1989).

Unless subsequently cleared for agriculture mallee re-shoots from the stumps remaining in the ground. This coppice regrowth is characteristic of most of the remaining scrub on the flats and throughout the Murray Mallee. It is described locally as second or third growth depending on the number of times it has been cut (Harris and Young 1989). The number of times an individual tree can be cut remains a major unknown. Some areas of the flats are likely to have been cut three times, possibly four (Neagle 1994).

Since 1985, in seeking to minimise environmental impact, the Native Vegetation Management Act has, set conditions to control the cutting of naturally growing mallee (Harris and Young 1989). There are currently no woodcutting licences active on the Western Murray Flats (G. Carpenter pers. comm. 2011).

The use of mallee to produce charcoal has taken place on the flats since the last decades of the 19th century (Pretty 1977). Pretty (1974)describes the scores of huts in the mallee left by the charcoal burners who supplied the nearby copper smelters. Both stems and roots are used, with about three tonnes of roots or four tonnes of stems required to produce one tonne of charcoal. Pits vary in size but are rectangular, up to four metres in length, three metres wide and two metres deep (Pretty 1977). After being cut then left to dry for a few weeks, the mallee is stacked and burnt in pits for two to three days. The pits are covered with sheet iron which is propped slightly open to allow air flow and combustion to occur. The charcoal is then given about eight days to cool, before being bagged and sent to market (Neagle 1994).

During the Second World War when demand for alternative fuels was high, labour camps using Italian internees engaged in the production of charcoal, were established on the flats and other locations within the Murray Mallee (Harris and Young 1989).

Numerous charcoal production pits are still visible throughout the flats, particularly to the southwest of Morgan in the scrub down to Sedan. Despite a revival in demand for charcoal in both domestic and commercial barbeque food production, as no timber cutting licences are currently operating in the area, it is presumed that charcoal production has also ceased on the flats.

Mining

Despite the significance to the state of the numerous mines in the hills to the west, particularly at Kapunda and Burra, very little mining has ever taken place on the flats. Two commercial quarries have been extracting granite at Black Hill east of Cambrai since 1947, with the second quarry opening in 1968. Black granite from this site has been sold to all parts of Australia, New Zealand, Japan and America. This material featured in the former building of John Martins and David Jones in Adelaide and the New Parliament House and Library in Canberra. Gypsum has been extracted from a quarry at Craigie Plains, now closed. A lime kiln employing five or six people operated in Sedan from the early 1920s until 1971 when hydrated lime was introduced (Royal and Glastonbury 1986). Local limestone outcrops were exploited to produce lime for local, regional and state sale (Pretty 1977). Large brown coal deposits have been found at and north of Sedan (Royal and Glastonbury 1986). As yet there is no commercial operation exploiting this resource.

Key changes in landuse

From the mid 1880s into the 1890s South Australia was in a long economic depression. Successive droughts during this same period forced many farmers to leave the flats, particularly in the marginal areas of the northern flats. The run of good seasons in the early

1870s had led to farmers ignoring Goyder's Line, established in 1865, roughly following the 10 inch rainfall boundary and delineating land suitable for farming from that useful only for pastoralism. Goyder's Line runs from around Burra, south parallel with the hills then arcs across the flats roughly through Sedan to Blanchetown, indicating land to the north as too marginal for farming. Salt Bush, Blue Bush and much of the mallee had already been cleared. In the Bundey-Florieton (on the Burra to Morgan road) area from 1895 to 1902, "The Gums" station bought out 14 farms (Munchenberg 2002).The situation was exacerbated by the arrival of rabbits in the 1870s. In 1876-77 the Apoinga Council (south of Burra) paid scalp money on 278,340 rabbits, whilst in 1878 a rabbit canning works was established at Mt. Misery to the north of Eudunda and operated into the early 1900s (Munchenberg 2002).

There was a general abandonment of wheat farming on the flats after the 1915 drought (Pretty 1974). Farm properties were mostly bought by some who stayed or those who lived in the more reliable hills areas. The more marginal country was bought by pastoralists or some who stayed also became pastoralists (Munchenberg 2002). Improvements in transport, modern farming methods and larger machinery have also progressively contributed to the reduction in the number of residents, businesses and farms throughout the area. The numerous abandoned farm houses and other ruins scattered throughout are clear evidence of the much larger population and level of activity on the flats in its heyday.

Since the drought and accompanying disruption to population of World War One, the flats have experienced little substantial change in dominant land use practices. Farming in the south and pastoralism in the north have continued. The adoption of recommendations under the Marginal Lands Act 1940, aimed at preventing over production and erosion problems, including less frequent cropping, crop rotation with sheep grazing and subsidised amalgamation of farms to produce larger holdings, helped to ensure more viable farming across the state. Other improvements in farming practices, such as the introduction of pneumatic tyred tractors from the 1930s, increased automation in harvesters and grain carting in trucks, and the introduction of legumes and the use of cereal rye on light soils have progressively improved life for the farming community, but with the necessary increase in property size the number of people on the land has continued to slowly decline.

Table 12: Comparison of number of active communities and public institutions on the Western Murray Flats historically and in more modern times.

Numbers derived from (Munchenberg 2002).

	Pre 1950	2002
Settlements	71	34
Schools	81	8
Churches	73	27

Two more recently developed land uses have emerged on the flats beginning during the 1960s. These are the use of subdivided land for weekend recreational retreats and in some cases as residential locations, and the reserving of land primarily managed for conservation of natural resources. Initially land subdivided and acquired for recreational or weekend getaway shacks was concentrated at various sites along the Murray River. Subsequently there has been some similar development on the flats, in particular in the areas of uncleared land in the vicinities of the towns of Sedan and Cambrai and to the north in the belt of uncleared land on the eastern side of the flats.

Conservation Land

An area from Black Hill to Morgan extending west for some ten or more miles was not sold to farmers. By the time this was surveyed it was found that it was not suitable for farming. As a result this area is still bush and scrub (Munchenberg 2002). Considerable portions of this land are now managed for conservation purposes within Brookfield (5,534 ha) and Swan Reach (2,024) Conservation Parks, managed by the SA Dept. of Environment and Natural Resources (DENR), The Natural History Society's Moorundie Reserve (2,000 ha) and Yookamurra Sanctuary (1,100 ha) managed by the Australian Wildlife Conservancy. Four other smaller DENR conservation parks are located on the flats. These are Ridley (414 ha) and White Dam (894 ha) which are both are linear remnants of old stock routes, Marne Valley (94 ha) set aside to conserve an example of the riverine woodland crossing the flats, and Roonka (102 ha) which protects a significant aboriginal heritage site.

Both Brookfield and Swan Reach Conservation parks and the Moorundie Reserve resulted from concerns over the preservation of the Southern hairy-nosed Wombat population on the flats. The Field Naturalists Society had made the first submission to acquire land for this purpose to the state government in 1964 (Cockington 1968). Glen Leslie Station was purchased by the Chicago Zoological Society in 1971 and originally named the Brookfield Zoo Wombat Reserve. Management was offered to the state government and the property renamed Brookfield Conservation Park in 1978 (National Parks and Wildlife Service 1983).

Appendix 3: Geomorphology overview of the Murray Mallee

This section attempts to provide an overview of the ecologically relevant geomorphology of the Murray Mallee in South Australia. It is based on previous geology and geomorphology texts (Potter et al. 1973; Brown 1988; Wasson 1989; Brown and Stephenson 1991; McCord 1995; Bowler et al. 2006), more recent work in South Australia, particularly (DWLBC Soil and Land Program 2007; Hall et al. 2009) and finally, an edit by James Hall (DENR, Science Resource Centre).

Heavy soils

Tertiary-age Loxton-Parilla Sand (clayey sand to sandy clay) were deposited as strandlines north and east of the Marmon-Jabuk Range and form the underlying and occasionally surface materials over most of the Murray Mallee.

In the late Tertiary and early Pleistocene a wetter climate and tectonics combined to create the mega inland Lake Bungunnia and nearby satellite lakes which covered much of the Murray Mallee (Stephenson 1986), although again only north and east of the Mamon-Jabuk Range. This lake and its sediments influence a large proportion of the current soils, especially the heavier soils. The Blanchetown Clay (heavy clay) was initially laid down throughout the lake. As the lake dried up, it formed a number of discontinuous lobes in which Bungunnia Limestone occurs.

Calcrete

Calcrete – an important component of most Murray Mallee soils – is formed by leaching of carbonate within soil profiles and cycles of wetting and drying. There are four important calcretes in current Murray Mallee soils: Bungunnia Limestone, Padthaway Formation Limestone, Ripon Calcrete and Bakara Calcrete.

Where shallow enough to be affected by soil-forming processes the Bungunnia Limestone has developed a calcrete capping.

During the Pleistocene the sea advanced again as far as the Marmon Jabuk Range, eroding the Loxton/Parilla Sands and depositing the limestone Coomandook Formation. As the sea retreated it left a coastal plain and then the Bridgewater Formation, a series of beach dune systems with associated interdunal lagoons, each of which would have been similar to the current Coorong. On the coastal plain, a limestone layer developed, similar to and formed at the same time as, the Bungunnia Limestone, and referred to as the Padthaway Formation.

Calcareous loess was deposited as a blanket across the Murray Mallee during various episodes of coastal dune, which occurred during times of strong south-westerly winds, an arid climate and exposed sea beds. This loess left behind calcreted landscapes and is generally termed Ripon Calcrete.

Newer loess (Woorinen Formation) has resulted in loamy calcareous soils with the calcrete referred to as Bakara Calcrete.

Sand

Sand, deposited by wind (aeolian), in the Murray Mallee soils is referred to as Molineaux Sand and is derived from a number of sources:

- newly derived (from exposed seabeds)
- reworked from soils formed in Loxton-Parilla Sand
- reworked Woorinen Formation

In some places the coastal sands have spread far inland, which, after leaching of lime, exist as bleached dune sands (Lowan Sand: a form of Molineaux Sand). Extensive areas where Lowan sand is the dominant component of the current landscape have been classed as a different IBRA Sub-region – the Lowan Mallee – due to the effect this has on the ecology of those areas. The Lowan Mallee typically has a denser, shrubby understorey and is therefore more fire prone than the Murray Mallee.

Western Murray Mallee

The Western Murray Mallee (Murray Plains) is a little more complicated, including all of the above, but as well, some areas are underlain by Adelaide Geosyncline rocks, and some areas are underlain by outwash materials. As a general rule, the landscapes have shallow slopes from west to east, steeper in the west. Closer to the ranges, the outwash sediments have been incorporated into the surface materials.

The Morgan fault (XXXX?????) runs along the boundary of the Stonefield and Blanchetown landscapes, creating a relatively sharp jump in elevation moving from west to east in contrast to the overall trend for the Western Murray Mallee. This has created a barrier to drainage lines from the Mount Lofty Ranges reaching the Murray River in the Stonefield landscape.

Appendix 4: Proportion of sites in a soil type at which a plant species was recorded

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Acacia ancistrophylla var. lissophylla	2			0.036												
Acacia argyrophylla	3		0.125							0.5	0.2					
Acacia brachybotrya	2							0.027					0.333			
Acacia colletioides	2					0.077										
Acacia euthycarpa	6										0.4			0.167	0.333	1
Acacia hakeoides	4			0.018				0.054						0.167		
Acacia ligulata	6		0.125	0.018						0.5	0.6					
Acacia lineata	3								0.07							
Acacia microcarpa	2			0.018								1				
Acacia nyssophylla	46			0.071	0.308	0.346	0.25	0.568	0.163							
Acacia oswaldii	12		0.25	0.018		0.192		0.081	0.023							
Acacia pycnantha	7								0.023		0.8				0.333	
Acacia rigens	2							0.027					0.333			
Alectryon oleifolius ssp. canescens	29		0.125			0.5		0.27	0.07	0.5	0.2					
Amyema linophylla ssp. orientale	2					0.077										
Amyema miquelii	6		0.125	0.036					0.07							
Amyema miraculosa ssp. boormanii	1							0.027								
Amyema preissii	8			0.018	0.077			0.162								
Arabidella trisecta	1							0.027								
Aristida behriana	1		0.125													
Atriplex acutibractea ssp.	16			0.125				0.108	0.093			1				
Atriplex eardleyae	2	0.25					0.25									
Atriplex lindleyi ssp. inflata	1			0.018												
Atriplex lindleyi ssp. lindleyi	1														0.167	

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Atriplex pseudocampanulata	1		0.125													
Atriplex pumilio	1			0.018												
Atriplex semibaccata	15	0.5	0.125	0.107					0.047			1			0.5	
Atriplex stipitata	63	0.75	0.625	0.268	0.308	0.038		0.459	0.302		0.2		0.333	0.333	0.167	
Atriplex suberecta	1			0.018												
Atriplex vesicaria ssp.	21	0.25	0.125	0.161	0.077	0.154		0.027	0.093							
Austrodanthonia caespitosa	36	0.25	0.25	0.089	0.154	0.308	0.75	0.27	0.093							1
Austrodanthonia setacea	4					0.115							0.333			
Austrodanthonia sp.	34		0.125	0.125	0.154	0.038		0.189	0.233	0.5			0.333	0.5	0.167	
Austrostipa acrociliata	19			0.143		0.115			0.163				0.333			
Austrostipa drummondii	18	0.25	0.125	0.054		0.038		0.216	0.07				0.333			
Austrostipa elegantissima	19		0.125	0.036		0.192		0.189	0.047				0.333			1
Austrostipa eremophila	12	0.25			0.077	0.115		0.162	0.023							
Austrostipa nitida	70		0.25	0.179	0.462	0.577	0.75	0.568	0.279				0.333			
Austrostipa pilata	2		0.125					0.027								
Austrostipa platychaeta	8		0.125	0.018		0.077		0.054	0.047							
Austrostipa puberula	6			0.018		0.115	0.25	0.027								
Austrostipa scabra ssp.	4			0.018				0.054								1
Austrostipa sp.	7			0.054		0.038			0.07							
Austrostipa trichophylla	8			0.018		0.038	0.25	0.054					0.667			1
Beyeria lechenaultii	14			0.036				0.054	0.116	0.5	0.4			0.333		
Billardiera cymosa ssp.	3								0.047					0.167		
Boerhavia dominii	1		0.125													
Boronia inornata ssp. leptophylla	1								0.023							
Brachyscome ciliaris var. brachyglossa	1					0.038										

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Brachyscome ciliaris var. lanuginosa	4							0.054	0.023				0.333			
Brachyscome trachycarpa	1							0.027								
Bursaria spinosa ssp. lasiophylla	2		0.125													1
Callitris canescens	3								0.047					0.167		
Callitris gracilis	5							0.108								1
Callitris verrucosa	2													0.333		
Carex bichenoviana	1														0.167	
Carpobrotus modestus/rossii	11		0.125	0.071					0.07				0.333	0.333		
Cassinia sp.	1														0.167	
Cassytha melantha	2			0.018							0.2					
Casuarina pauper	14				0.077	0.462		0.027								
Chamaesyce drummondii	2						0.25	0.027								
Chenopodium curvispicatum	50	0.75		0.268	0.231	0.154		0.351	0.233			1		0.167		
Chenopodium desertorum ssp.	36	0.5		0.196	0.154			0.108	0.186		0.4	1	0.667	0.333	0.167	1
Chrysocephalum apiculatum	5										0.4		0.667			1
Chrysocephalum semipapposum	2										0.4					
Clematis microphylla	3		0.125										0.333		0.167	
Comesperma volubile	1			0.018												
Convolvulus angustissimus ssp. angustissimus	3							0.081								
Correa glabra var. turnbullii	1			0.018												
Cratystylis conocephala	6			0.071				0.027	0.023							
Cryptandra sp. Floriferous (W.R.Barker 4131)	7							0.054	0.093					0.167		
Cymbopogon ambiguus	1														0.167	
Cyperus gymnocaulos	1														0.167	
Cyperus vaginatus	2														0.333	

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Daviesia arenaria	1												0.333			
Dianella revoluta var. revoluta	11			0.036				0.027	0.07	0.5	0.2	1		0.333		
Dissocarpus paradoxus	4			0.036		0.038									0.167	
Distichlis distichophylla	1			0.018												
Dodonaea baueri	2							0.027				1				
Dodonaea bursariifolia	2			0.018					0.023							
Dodonaea hexandra	1								0.023							
Dodonaea lobulata	1														0.167	
Dodonaea stenozyga	8			0.036	0.077				0.116							
Dodonaea viscosa ssp. angustissima	7							0.162					0.333			
Dodonaea viscosa ssp. spatulata	3							0.027			0.2				0.167	
Einadia nutans ssp. nutans	53	0.5	0.375	0.232	0.462		0.25	0.216	0.233		0.6	1	0.667	0.167	0.333	1
Enchylaena tomentosa var. tomentosa	157	1	0.75	0.75	0.692	0.731	0.5	0.811	0.628	0.5	0.8	1	1	0.5	0.833	1
Enteropogon acicularis	1		0.125													
Eremophila alternifolia	2			0.018				0.027								
Eremophila deserti	2			0.018		0.038										
Eremophila glabra ssp. glabra	8				0.077	0.077		0.054	0.07							
Eremophila longifolia	2							0.054								
Eremophila oppositifolia ssp. oppositifolia	3					0.077		0.027								
Eremophila scoparia	21			0.161	0.077	0.077		0.027	0.186							
Eriochiton sclerolaenoides	100	0.25	0.125	0.321	0.385	0.577	0.25	0.676	0.721	0.5			0.333	0.167		
Eucalyptus brachycalyx	28	0.25	0.125	0.304		0.038			0.186							
Eucalyptus calycogona ssp. trachybasis	2								0.023			1				
Eucalyptus camaldulensis ssp. camaldulensis	5														0.833	
Eucalyptus dumosa	7	0.25		0.018					0.093			1				

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Eucalyptus dumosa complex	2			0.018					0.023							
Eucalyptus gracilis	86	0.5	0.125	0.643	0.231	0.038	0.25	0.081	0.814	0.5			0.333	0.333		
Eucalyptus incrassata	5			0.018									0.333	0.5		
Eucalyptus largiflorens	2				0.154											
Eucalyptus leptophylla	14							0.027	0.163				0.667	0.667		
Eucalyptus leucoxylon ssp.	1		0.125													
Eucalyptus odorata	1				0.077											
Eucalyptus oleosa ssp.	77	0.5	0.125	0.75		0.038	0.25	0.027	0.581	0.5				0.5		
Eucalyptus phenax ssp. phenax	7								0.093				1			
Eucalyptus porosa	9		0.75	0.018	0.077					0.5						
Eucalyptus socialis ssp. socialis	34	0.25		0.089	0.077	0.192	0.25		0.326		0.6	1	0.333	0.333		
Eucalyptus sp.	2			0.018					0.023							
Eucalyptus yalatensis	1								0.023							
Eutaxia diffusa	1							0.027								
Exocarpos aphyllus	31		0.25	0.107	0.077	0.231		0.297	0.116							
Frankenia sp.	1					0.038										
Gahnia lanigera	3								0.047		0.2					
Geijera linearifolia	69			0.268	0.154	0.269		0.595	0.465	0.5				0.333		
Geranium retrorsum	1		0.125													
Glischrocaryon behrii	1			0.018												
Goodenia fascicularis	4			0.018		0.038	0.25	0.027								
Goodenia willisiana	3								0.023		0.2		0.333			
Grevillea huegelii	4			0.036					0.047							
Grevillea ilicifolia ssp. ilicifolia	1										0.2					
Hakea leucoptera ssp. leucoptera	1					0.038										

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Halgania andromedifolia	5							0.027	0.093							
Halgania cyanea	2			0.018									0.333			
Helichrysum leucopsideum	23		0.25	0.018				0.054	0.14	0.5	1	1		0.667		1
Hibbertia sp. Glabriuscula (D.J.Whibley 9012)	1													0.167		
Hibbertia virgata	1												0.333			
Hybanthus floribundus ssp. floribundus	1												0.333			
Juncus kraussii	2														0.333	
Lawrencia glomerata	1			0.018												
Lawrencia squamata	16			0.054	0.154	0.385		0.027								
Lepidium leptopetalum	3			0.036					0.023							
Lepidosperma viscidum	1										0.2					
Leptomeria aphylla	1			0.018												
Linum marginale	1								0.023							
Logania linifolia	1			0.018												
Lomandra collina	1		0.125													
Lomandra densiflora	1										0.2					
Lomandra effusa	23		0.5					0.108	0.116	0.5	0.8	1		0.5		1
Lomandra leucocephala ssp. robusta	3			0.018									0.333	0.167		
Lomandra multiflora ssp. dura	3		0.125								0.4					
Lycium australe	35		0.125	0.054	0.385	0.731	0.25	0.135	0.023							
Lysiana exocarpi ssp. exocarpi	22		0.125			0.115	0.25	0.378	0.047		0.2					
Maireana aphylla	7	0.25		0.036	0.154			0.027	0.023							
Maireana appressa	3								0.07							
Maireana brevifolia	59	0.75	0.5	0.304	0.385			0.216	0.326	0.5	0.6	1			0.5	
Maireana ciliata	5			0.054	0.077				0.023							

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.													
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Maireana enchylaenoides	15			0.036				0.216	0.093							1
Maireana erioclada	75	0.25		0.446	0.385	0.077	0.25	0.351	0.535	0.5				0.5	0.167	
Maireana georgei	2			0.018							0.2					
Maireana lobiflora	11			0.018	0.077	0.038	0.25	0.162	0.023							
Maireana pentatropis	39			0.393		0.115		0.027	0.279				0.333			
Maireana pyramidata	12	0.25	0.25	0.071		0.115		0.027							0.167	
Maireana radiata	19			0.214					0.116						0.333	
Maireana rohrlachii	4				0.154			0.027	0.023							
Maireana sedifolia	64		0.125	0.321	0.385	0.923		0.216	0.186							
Maireana trichoptera	58		0.25	0.304	0.154	0.385		0.297	0.349		0.2					
Maireana turbinata	13			0.071	0.077	0.231		0.054								
Marsilea drummondii	1				0.077											
Melaleuca acuminata ssp. acuminata	2								0.023				0.333			
Melaleuca lanceolata	6		0.25		0.077			0.027	0.047							
Minuria cunninghamii	3					0.115										
Minuria leptophylla	15		0.125		0.077	0.269	0.25	0.027	0.07		0.2					
Muehlenbeckia florulenta	2				0.154											
Muehlenbeckia horrida ssp. horrida	1				0.077											
Myoporum montanum	5			0.036											0.5	
Myoporum parvifolium	2			0.018	0.077											
Myoporum platycarpum ssp. perbellum	6			0.036							0.2		0.333	0.333		
Myoporum platycarpum ssp. platycarpum	26					0.115	0.25	0.568	0.023							
Nitraria billardierei	8			0.036	0.077	0.115	0.5									
Olearia brachyphylla (NC)	4								0.07						0.167	
Olearia decurrens	3			0.018	0.077	0.038										

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Olearia floribunda var. floribunda	2								0.047							
Olearia lepidophylla	2							0.027					0.333			
Olearia magniflora	9			0.071		0.038		0.027	0.07							
Olearia magniflora X Olearia muelleri	1			0.018												
Olearia muelleri	32			0.054				0.081	0.581					0.167		
Olearia pimelioides	3		0.125					0.027			0.2					
Oxalis perennans	30	0.25	0.375	0.018	0.077	0.115	0.25	0.243	0.023	0.5	0.8	1		0.167	0.333	1
Philotheca angustifolia ssp. angustifolia	1								0.023							
Pimelea stricta	4										0.6				0.167	
Pittosporum angustifolium	9		0.375					0.135	0.023							
Plantago hispida	2			0.018									0.333			
Poa labillardieri var. labillardieri	2														0.333	
Podolepis jaceoides	2								0.047							
Podolepis rugata var. rugata	5							0.027	0.023				0.333	0.333		
Pomaderris paniculosa ssp. paniculosa	2							0.027			0.2					
Prostanthera aspalathoides	3								0.047				0.333			
Ptilotus erubescens	1										0.2					
Ptilotus seminudus	24			0.143		0.038		0.081	0.209				0.667			1
Ptilotus spathulatus	33	0.5	0.125	0.089	0.154			0.135	0.326	0.5	0.4				0.167	
Rhagodia candolleana ssp. candolleana	6		0.125	0.036				0.054	0.023							
Rhagodia crassifolia	52		0.125	0.304				0.216	0.419	0.5		1	0.667	0.667		
Rhagodia parabolica	21	0.5	0.5	0.054	0.154	0.077		0.135	0.023						0.167	1
Rhagodia preissii ssp. preissii	4			0.036					0.047							
Rhagodia spinescens	60	0.75	0.625	0.179	0.462	0.462	0.25	0.324	0.163	1	0.2			0.167		
Rhagodia ulicina	41	0.25		0.161	0.385	0.577	0.5	0.108	0.116							

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Rumex sp.	4										0.2				0.5	
Santalum acuminatum	13			0.089		0.115			0.07		0.2			0.167		
Scaevola spinescens	24			0.071	0.231	0.308		0.162	0.07							
Schoenus breviculmis	1								0.023							
Sclerolaena brevifolia	1							0.027								
Sclerolaena diacantha	94	0.25	0.5	0.589	0.385	0.346		0.216	0.535		0.8	1	0.667	0.5		1
Sclerolaena obliquicuspis	67	0.75	0.125	0.375	0.385	0.462	0.25	0.351	0.233						0.167	
Sclerolaena parviflora	2								0.023				0.333			
Sclerolaena patenticuspis	38	0.25	0.125	0.054	0.462	0.154	0.75	0.378	0.116						0.167	
Sclerolaena stelligera	1													0.167		
Senecio picridioides	1	0.25														
Senna artemisioides ssp. filifolia	13			0.071				0.135	0.093							
Senna artemisioides ssp. petiolaris	14		0.125	0.018	0.077			0.189	0.047		0.2	1				
Senna artemisioides ssp. X coriacea	9		0.125			0.077		0.081	0.047						0.167	
Setaria constricta	1		0.125													
Setaria jubiflora	2														0.333	
Sida corrugata var. corrugata	4		0.125					0.081								
Sida intricata	1							0.027								
Sida petrophila	1														0.167	
Spyridium eriocephalum var. eriocephalum	2								0.023				0.333			
Stackhousia monogyna	1															1
Templetonia egena	11			0.054	0.077	0.231			0.023							
Teucrium racemosum	2		0.125		0.077											
Teucrium sessiliflorum	1										0.2					
Threlkeldia diffusa	1			0.018												

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Triodia irritans	1								0.023							
Triodia scariosa	15			0.036					0.14		0.2			1		
Velleia arguta	5		0.125					0.054	0.023		0.2					
Velleia paradoxa	1							0.027								
Vittadinia blackii	2		0.125												0.167	
Vittadinia cervicularis var. cervicularis	2		0.125		0.077											
Vittadinia cuneata var.	10	0.25	0.125					0.054	0.07		0.4			0.167		
Vittadinia dissecta var. hirta	2								0.023					0.167		
Vittadinia gracilis	6					0.077		0.081							0.167	
Vittadinia megacephala	1							0.027								
Wahlenbergia luteola	5		0.25								0.4					1
Wahlenbergia stricta ssp. stricta	1										0.2					
Westringia rigida	28			0.089	0.154	0.038		0.162	0.279					0.333		
Zygophyllum apiculatum	49		0.125	0.304	0.077	0.038		0.027	0.605						0.333	
Zygophyllum aurantiacum ssp. aurantiacum	98	0.75	0.125	0.518	0.385	0.154	0.75	0.676	0.558	1	0.2			0.167		
Zygophyllum confluens	1										0.2					
Zygophyllum glaucum	4	0.25	0.125			0.077										

Appendix 5: Proportion of sites in a soil type at which introduced plants were recorded

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Acetosella vulgaris*	1														0.17	
Adonis microcarpa*	1						0.25									
Aira cupaniana*	2										0.2			0.17		
Ajuga iva*	1							0.03								
Alyssum linifolium*	12			0.03	0.08	0.23	0.5	0.03								
Arctotheca calendula*	6		0.1		0.08								0.67		0.17	1
Arenaria leptoclados*	2			0.02					0.02							
Asparagus asparagoides f. asparagoides*	3		0.1	0.02												1
Asparagus officinalis*	1														0.17	
Asphodelus fistulosus*	6			0.02				0.03						0.17	0.5	
Avena barbata*	8	0.25	0.2		0.08			0.03			0.2				0.17	1
Avena fatua*	4		0.1								0.4	1				
Brassica tournefortii*	34		0.4	0.13				0.03	0.21	0.5	0.8		1	0.5		1
Briza maxima*	1										0.2					
Bromus catharticus*	1														0.17	
Bromus diandrus*	3		0.1								0.2				0.17	
Bromus rubens*	29	0.5	0.5	0.1	0.23	0.12	0.25	0.11	0.07		0.2					1
Buglossoides arvensis*	1												0.33			
Bupleurum semicompositum*	5	0.25		0.02				0.08								
Carrichtera annua*	101	0.75	0.3	0.36	0.62	0.88	0.25	0.76	0.23	0.5					0.33	
Carthamus lanatus*	4			0.02			0.25	0.03	0.02							
Centaurea melitensis*	2						0.25	0.03								
Chondrilla juncea*	1							0.03								
Cirsium vulgare*	2				0.08										0.17	

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.													
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Cynara cardunculus ssp. flavescens*	2						0.25								0.17	
Diplotaxis muralis var. muralis*	2			0.02				0.03								
Echium plantagineum*	12		0.3		0.15			0.05			0.2				0.5	1
Ehrharta longiflora*	6		0.1								0.2		0.33		0.33	1
Erodium aureum*	1					0.04										
Erodium botrys*	4		0.1						0.02		0.2					1
Erodium brachycarpum*	5				0.23			0.05								
Erodium cicutarium*	19			0.03	0.15	0.12	0.25	0.27	0.02							
Euphorbia terracina*	3			0.02									0.33		0.17	
Fumaria capreolata*	4														0.67	
Fumaria densiflora*	2			0.02											0.17	
Genista linifolia*	1								0.02							
Hedypnois rhagadioloides ssp.*	6		0.2						0.05		0.2		0.33			
Herniaria cinerea*	19			0.02	0.08	0.27	0.5	0.19	0.02							
Hordeum glaucum*	37	0.25	0.3	0.08	0.38	0.15	0.5	0.19	0.09				1		0.33	1
Hornungia procumbens*	3			0.03					0.02							
Hypochaeris glabra*	22		0.3	0.07	0.08			0.19	0.07				0.67		0.17	1
Hypochaeris radicata*	3		0.2					0.03								
Lamarckia aurea*	4		0.1		0.08						0.2					1
Lepidium africanum*	2										0.4					
Limonium lobatum*	1				0.08											
Lolium rigidum*	5			0.02	0.15		0.25								0.17	
Lycium ferocissimum*	22	0.5	0.4	0.07	0.08	0.04		0.05	0.02	0.5	0.6	1			0.33	
Malva parviflora*	6				0.38		0.25									
Marrubium vulgare*	8						0.25	0.05		0.5					0.67	

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Medicago minima var. minima*	75	0.25	0.5	0.18	0.54	0.62	1	0.62	0.12				0.33		0.33	
Medicago polymorpha var. polymorpha*	6				0.23			0.03							0.33	
Medicago truncatula*	6		0.1	0.02	0.08	0.04	0.5									
Mesembryanthemum aitonis*	3	0.25	0.1												0.17	
Mesembryanthemum crystallinum*	3			0.05												
Mesembryanthemum nodiflorum*	11	0.25	0.2	0.03		0.08	0.5	0.03							0.17	
Moraea setifolia*	41		0.3	0.03	0.38	0.15	0.75	0.49	0.07				0.33		0.17	1
Oxalis pes-caprae*	16	0.5	0.5	0.02	0.23		0.25								0.5	1
Papaver hybridum*	1						0.25									
Pennisetum clandestinum*	1														0.17	
Pentaschistis airoides*	5		0.1								0.2		0.67			1
Phalaris minor*	1														0.17	
Plantago bellardii*	1												0.33			
Reichardia tingitana*	5		0.1		0.08	0.04		0.05								
Romulea minutiflora*	2		0.1								0.2					
Romulea rosea var. australis*	3			0.02				0.05								
Rostraria cristata*	7					0.04	0.5	0.05	0.02		0.2					
Rostraria pumila*	9			0.02		0.19	0.25		0.02						0.17	
Rostraria sp.*	1										0.2					
Salvia verbenaca var. verbenaca*	2														0.33	
Salvia verbenaca var. vernalis*	2							0.03							0.17	
Schinus molle*	2														0.33	
Schismus barbatus*	30	0.25	0.4	0.11	0.31	0.12	0.75	0.08	0.05				0.67		0.17	
Sherardia arvensis*	1										0.2					
Silene apetala*	39		0.2	0.05	0.23	0.19	0.5	0.41	0.12				1			1

Species	Total Sites	Soil type. Numbers are the proportion of sites in the soil type at which a species was recorded.														
		A2	A3	A4	A5	A6	A8	B2	B2b	B3	C1	D5	G1	H2	M1	M4
Silene gallica var.*	6			0.05					0.02	0.5				0.17		
Silene nocturna*	1										0.2					
Sisymbrium erysimoides*	65		0.5	0.3	0.23	0.42	0.25	0.41	0.19		0.2				0.33	1
Sisymbrium irio*	16		0.1	0.02	0.23	0.12	0.5	0.08	0.02			1			0.17	
Solanum nigrum*	1														0.17	
Sonchus asper ssp. glaucescens*	1															1
Sonchus oleraceus*	57	0.25	0.4	0.13	0.23	0.31	0.25	0.43	0.14		0.4		1		0.67	1
Sparaxis sp.*	1										0.2					
Spergularia diandra*	33	0.25		0.08	0.08	0.46	1	0.24	0.02							
Stellaria media*	2		0.1	0.02												
Trifolium angustifolium*	1							0.03								
Trifolium arvense var. arvense*	5		0.2								0.2				0.17	1
Trifolium fragiferum var. fragiferum*	1															1
Trifolium glomeratum*	1										0.2					
Vicia monantha ssp. monantha*	1		0.1													
Vulpia bromoides*	1	0.25														
Vulpia ciliata*	1															1
Vulpia muralis*	6			0.02	0.15	0.08			0.02							
Vulpia myuros f. myuros*	5				0.08				0.02				0.67			1
Zaluzianskya divaricata*	1												0.33			

Appendix 6: Bird species classified as typical of each landscape

An individual location in a year (irrespective of how many records there are at that location) is considered 1 record. Years is the number of years in which at least one location had a record. Ext =1 indicates those species classified as extinct in the landscape. Dec =1 indicates those species classified as declining in the landscape. Table is ordered by landscape, response group and species name.

Landscape	Response Group	Species	Records	Years	Ext	Dec
Blanchetown	Mallee woodland	Australian Owlet-nightjar	30	13	0	1
Blanchetown	Mallee woodland	Brown Treecreeper	180	20	0	0
Blanchetown	Mallee woodland	Bush Stone-curlew	2	2	0	1
Blanchetown	Mallee woodland	Dusky Woodswallow	69	17	0	0
Blanchetown	Mallee woodland	Hooded Robin	104	19	0	0
Blanchetown	Mallee woodland	Jacky Winter	74	20	0	0
Blanchetown	Mallee woodland	Little Crow	3	2	0	0
Blanchetown	Mallee woodland	Mistletoebird	53	17	0	0
Blanchetown	Mallee woodland	Red-backed Kingfisher	7	4	0	1
Blanchetown	Mallee woodland	Regent Parrot	14	7	0	1
Blanchetown	Mallee woodland	Restless Flycatcher	35	13	0	0
Blanchetown	Mallee woodland	Sacred Kingfisher	16	7	0	1
Blanchetown	Mallee woodland	Tree Martin	105	18	0	0
Blanchetown	Mallee woodland	White-winged Chough	149	20	0	0
Blanchetown	Mallee woodland	Yellow-plumed Honeyeater	119	18	0	0
Blanchetown	Mallee woodland	Yellow-rumped Thornbill	106	20	0	0
Blanchetown	Mallee woodland	Yellow-throated Miner	70	17	0	0
Blanchetown	Mallee Triodia	Red-lored Whistler	3	2	0	0
Blanchetown	Mallee shrubland	Fan-tailed Cuckoo	2	2	0	0
Blanchetown	Mallee shrubland	Gilbert's Whistler	97	20	0	1
Blanchetown	Mallee shrubland	Golden Whistler	30	13	0	1
Blanchetown	Mallee shrubland	Malleefowl	9	6	0	1
Blanchetown	Mallee shrubland	Painted Button-quail	1	1	0	1
Blanchetown	Mallee shrubland	Purple-gaped Honeyeater	5	4	0	1
Blanchetown	Mallee shrubland	Shy Heathwren	3	3	0	1
Blanchetown	Mallee shrubland	Southern Scrub-robin	55	14	0	1
Blanchetown	Non-eucalypt woodland	Ground Cuckoo-shrike	1	1	0	1
Blanchetown	Non-eucalypt woodland	Major Mitchell's Cockatoo	1	1	0	1
Blanchetown	Non-eucalypt woodland	Peaceful Dove	25	9	0	0
Blanchetown	Non-eucalypt woodland	Rufous Whistler	44	16	0	0
Blanchetown	Non-eucalypt woodland	Yellow Thornbill	15	9	0	0
Blanchetown	Grassland	Australasian Pipit	43	14	0	0
Blanchetown	Grassland	Australian Bustard			1	0
Blanchetown	Grassland	Banded Lapwing	2	2	0	1
Blanchetown	Grassland	Blue-winged Parrot	1	1	0	0
Blanchetown	Grassland	Brown Quail			1	0
Blanchetown	Grassland	Brown Songlark	12	6	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Blanchetown	Grassland	Elegant Parrot	5	3	0	1
Blanchetown	Grassland	Eurasian Skylark			1	0
Blanchetown	Grassland	Little Button-quail	1	1	0	0
Blanchetown	Grassland	Masked Lapwing	25	9	0	1
Blanchetown	Grassland	Rufous Songlark	13	8	0	1
Blanchetown	Grassland	Stubble Quail	5	4	0	1
Blanchetown	Grassland	Zebra Finch	7	3	0	1
Blanchetown	Agricultural increaser	Australian Magpie	207	20	0	0
Blanchetown	Agricultural increaser	Australian Raven	117	19	0	0
Blanchetown	Agricultural increaser	Blue Bonnet	32	14	0	1
Blanchetown	Agricultural increaser	Common Starling	55	18	0	1
Blanchetown	Agricultural increaser	Crested Pigeon	112	19	0	0
Blanchetown	Agricultural increaser	European Goldfinch	1	1	0	0
Blanchetown	Agricultural increaser	Galah	220	20	0	0
Blanchetown	Agricultural increaser	Little Corella	29	11	0	0
Blanchetown	Agricultural increaser	Long-billed Corella			1	0
Blanchetown	Agricultural increaser	Magpie-lark	43	13	0	0
Blanchetown	Agricultural increaser	Sulphur-crested Cockatoo	30	11	0	0
Blanchetown	Agricultural increaser	Willie Wagtail	154	20	0	0
Blanchetown	Continental	Black Honeyeater	2	2	0	0
Blanchetown	Continental	Black-headed Honeyeater			0	0
Blanchetown	Continental	Crimson Chat	10	3	0	1
Blanchetown	Continental	Diamond Dove	1	1	0	0
Blanchetown	Continental	Orange Chat	2	2	0	0
Blanchetown	Continental	Pied Honeyeater	6	2	0	1
Blanchetown	Continental	White-winged Triller	28	12	0	0
Blanchetown	Generalist	Apostlebird	3	3	0	1
Blanchetown	Generalist	Australian Barn Owl	3	3	0	1
Blanchetown	Generalist	Australian Hobby	11	8	0	1
Blanchetown	Generalist	Australian Ringneck	189	20	0	0
Blanchetown	Generalist	Black Falcon	5	4	0	1
Blanchetown	Generalist	Black Kite	25	10	0	1
Blanchetown	Generalist	Black-eared Cuckoo	16	8	0	1
Blanchetown	Generalist	Black-faced Cuckoo-shrike	80	18	0	0
Blanchetown	Generalist	Black-faced Woodswallow	7	5	0	1
Blanchetown	Generalist	Black-shouldered Kite	6	4	0	1
Blanchetown	Generalist	Brown Falcon	36	15	0	0
Blanchetown	Generalist	Brown Goshawk	17	9	0	1
Blanchetown	Generalist	Budgerigar	7	4	0	1
Blanchetown	Generalist	Chestnut Quail-thrush	75	16	0	1
Blanchetown	Generalist	Chestnut-rumped Thornbill	134	20	0	0
Blanchetown	Generalist	Cockatiel	8	6	0	1

Landscape	Response Group	Species	Records	Years	Ext	Dec
Blanchetown	Generalist	Collared Sparrowhawk	6	5	0	1
Blanchetown	Generalist	Common Bronzewing	93	17	0	1
Blanchetown	Generalist	Crested Bellbird	98	19	0	0
Blanchetown	Generalist	Crimson Rosella	33	12	0	0
Blanchetown	Generalist	Emu	49	13	0	0
Blanchetown	Generalist	Grey Butcherbird	99	19	0	0
Blanchetown	Generalist	Grey Currawong	117	19	0	0
Blanchetown	Generalist	Grey Fantail	46	15	0	0
Blanchetown	Generalist	Grey Shrike-thrush	168	20	0	0
Blanchetown	Generalist	Horsfield's Bronze-cuckoo	42	13	0	1
Blanchetown	Generalist	Laughing Kookaburra	18	6	0	0
Blanchetown	Generalist	Letter-winged Kite			0	0
Blanchetown	Generalist	Little Raven	87	18	0	0
Blanchetown	Generalist	Masked Woodswallow	19	10	0	1
Blanchetown	Generalist	Mulga Parrot	128	21	0	0
Blanchetown	Generalist	Nankeen Kestrel	47	15	0	0
Blanchetown	Generalist	Pallid Cuckoo	15	7	0	1
Blanchetown	Generalist	Peregrine Falcon	11	7	0	1
Blanchetown	Generalist	Pied Butcherbird	15	6	0	0
Blanchetown	Generalist	Rainbow Bee-eater	34	12	0	0
Blanchetown	Generalist	Red Wattlebird	111	19	0	0
Blanchetown	Generalist	Red-capped Robin	99	19	0	0
Blanchetown	Generalist	Red-rumped Parrot	75	18	0	0
Blanchetown	Generalist	Rock Dove	5	3	0	1
Blanchetown	Generalist	Silvereye	26	15	0	0
Blanchetown	Generalist	Southern Boobook	14	9	0	1
Blanchetown	Generalist	Spiny-cheeked Honeyeater	191	20	0	0
Blanchetown	Generalist	Splendid Fairy-wren	106	18	0	0
Blanchetown	Generalist	Spotted Harrier			0	0
Blanchetown	Generalist	Spotted Nightjar	12	8	0	1
Blanchetown	Generalist	Spotted Pardalote	99	19	0	0
Blanchetown	Generalist	Striated Pardalote	176	19	0	0
Blanchetown	Generalist	Swamp Harrier	7	6	0	0
Blanchetown	Generalist	Varied Sittella	67	18	0	1
Blanchetown	Generalist	Variegated Fairy-wren	118	19	0	0
Blanchetown	Generalist	Wedge-tailed Eagle	56	15	0	0
Blanchetown	Generalist	Weebill	157	20	0	0
Blanchetown	Generalist	Welcome Swallow	67	16	0	0
Blanchetown	Generalist	White-backed Swallow	2	2	0	0
Blanchetown	Generalist	White-breasted Woodswallow	1	1	0	0
Blanchetown	Generalist	White-browed Babbler	141	19	0	0
Blanchetown	Generalist	White-browed Woodswallow	20	11	0	1

Landscape	Response Group	Species	Records	Years	Ext	Dec
Blanchetown	Shrubland	Chestnut-crowned Babbler	126	19	0	0
Blanchetown	Shrubland	Inland Thornbill	19	12	0	1
Blanchetown	Shrubland	Redthroat	5	4	0	1
Blanchetown	Shrubland	Singing Honeyeater	203	21	0	0
Blanchetown	Shrubland	Slender-billed Thornbill			1	0
Blanchetown	Shrubland	Southern Whiteface	179	19	0	0
Blanchetown	Shrubland	White-fronted Chat	40	14	0	1
Blanchetown	Shrubland	White-winged Fairy-wren	15	7	0	1
Blanchetown	Settlements	Common Blackbird	10	7	0	0
Blanchetown	Settlements	House Sparrow	25	9	0	0
Blanchetown	Settlements	Spotted Dove	4	3	1	0
Blanchetown	Drainage line	Fairy Martin	10	6	0	0
Blanchetown	Drainage line	Little Eagle	26	11	0	1
Blanchetown	Drainage line	Noisy Miner	15	6	0	0
Blanchetown	Drainage line	Whistling Kite	62	15	0	1
Blanchetown	Drainage line	White-plumed Honeyeater	37	11	0	0
Blanchetown	Honeyeater	Brown-headed Honeyeater	71	18	0	1
Blanchetown	Honeyeater	Grey-fronted Honeyeater	14	7	0	0
Blanchetown	Honeyeater	Musk Lorikeet	11	5	0	0
Blanchetown	Honeyeater	Purple-crowned Lorikeet	91	17	0	0
Blanchetown	Honeyeater	Rainbow Lorikeet	1	1	0	0
Blanchetown	Honeyeater	Striped Honeyeater	22	11	0	1
Blanchetown	Honeyeater	White-eared Honeyeater	74	19	0	1
Blanchetown	Honeyeater	White-fronted Honeyeater	94	20	0	0
Blanchetown	Honeyeater	White-naped Honeyeater	3	3	0	1
Blanchetown	Honeyeater	Yellow-faced Honeyeater	3	3	0	0
Mount Mary	Mallee woodland	Australian Owlet-nightjar	6	5	0	0
Mount Mary	Mallee woodland	Brown Treecreeper	41	7	0	0
Mount Mary	Mallee woodland	Bush Stone-curlew			1	0
Mount Mary	Mallee woodland	Dusky Woodswallow	9	5	0	1
Mount Mary	Mallee woodland	Hooded Robin	21	6	0	1
Mount Mary	Mallee woodland	Jacky Winter	31	6	0	0
Mount Mary	Mallee woodland	Little Crow	5	3	0	0
Mount Mary	Mallee woodland	Regent Parrot	4	3	0	1
Mount Mary	Mallee woodland	Restless Flycatcher	11	4	0	1
Mount Mary	Mallee woodland	White-winged Chough	44	8	0	0
Mount Mary	Mallee woodland	Yellow-plumed Honeyeater	34	8	0	0
Mount Mary	Mallee woodland	Yellow-rumped Thornbill	25	9	0	0
Mount Mary	Mallee woodland	Yellow-throated Miner	46	8	0	0
Mount Mary	Mallee shrubland	Gilbert's Whistler	9	3	0	0
Mount Mary	Mallee shrubland	Golden Whistler	3	2	0	0
Mount Mary	Mallee shrubland	Malleefowl	2	2	0	1

Landscape	Response Group	Species	Records	Years	Ext	Dec
Mount Mary	Mallee shrubland	Purple-gaped Honeyeater	1	1	0	1
Mount Mary	Mallee shrubland	Shy Heathwren	6	4	0	1
Mount Mary	Non-eucalypt woodland	Ground Cuckoo-shrike	5	4	0	1
Mount Mary	Non-eucalypt woodland	Major Mitchell's Cockatoo			1	0
Mount Mary	Non-eucalypt woodland	Peaceful Dove	9	5	0	0
Mount Mary	Non-eucalypt woodland	Rufous Whistler	22	8	0	1
Mount Mary	Non-eucalypt woodland	Yellow Thornbill	4	3	0	0
Mount Mary	Grassland	Australasian Pipit	26	7	0	0
Mount Mary	Grassland	Australian Bustard	1	1	0	1
Mount Mary	Grassland	Banded Lapwing	5	2	0	1
Mount Mary	Grassland	Blue-winged Parrot	1	1	0	0
Mount Mary	Grassland	Brown Quail			1	0
Mount Mary	Grassland	Brown Songlark	8	1	0	0
Mount Mary	Grassland	Elegant Parrot	6	4	0	0
Mount Mary	Grassland	Eurasian Skylark			1	0
Mount Mary	Grassland	Little Button-quail	1	1	0	1
Mount Mary	Grassland	Masked Lapwing	1	1	0	1
Mount Mary	Grassland	Rufous Songlark	2	2	0	1
Mount Mary	Grassland	Stubble Quail	1	1	0	1
Mount Mary	Agricultural increaser	Australian Magpie	120	13	0	0
Mount Mary	Agricultural increaser	Australian Raven	61	11	0	0
Mount Mary	Agricultural increaser	Blue Bonnet	44	11	0	0
Mount Mary	Agricultural increaser	Common Starling	28	9	0	0
Mount Mary	Agricultural increaser	Crested Pigeon	52	11	0	0
Mount Mary	Agricultural increaser	Galah	121	12	0	0
Mount Mary	Agricultural increaser	Little Corella	14	6	0	0
Mount Mary	Agricultural increaser	Long-billed Corella			1	0
Mount Mary	Agricultural increaser	Magpie-lark	20	8	0	0
Mount Mary	Agricultural increaser	Pied Butcherbird	8	6	0	0
Mount Mary	Agricultural increaser	Sulphur-crested Cockatoo	7	3	0	1
Mount Mary	Agricultural increaser	Willie Wagtail	51	10	0	0
Mount Mary	Continental	Black Honeyeater	2	2	0	1
Mount Mary	Continental	Black-headed Honeyeater			0	0
Mount Mary	Continental	Crimson Chat	1	1	0	1
Mount Mary	Continental	Diamond Dove			0	0
Mount Mary	Continental	Orange Chat	1	1	0	0
Mount Mary	Continental	Pied Honeyeater	1	1	0	1
Mount Mary	Continental	White-winged Triller	7	4	0	0
Mount Mary	Generalist	Apostlebird	7	5	0	1
Mount Mary	Generalist	Australian Barn Owl	1	1	0	0
Mount Mary	Generalist	Australian Hobby	2	2	0	1
Mount Mary	Generalist	Australian Ringneck	64	8	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Mount Mary	Generalist	Black Falcon	2	1	0	1
Mount Mary	Generalist	Black Kite	7	5	0	1
Mount Mary	Generalist	Black-faced Cuckoo-shrike	28	8	0	0
Mount Mary	Generalist	Black-faced Woodswallow	6	3	0	1
Mount Mary	Generalist	Black-shouldered Kite	3	3	0	1
Mount Mary	Generalist	Brown Falcon	10	6	0	1
Mount Mary	Generalist	Brown Goshawk	7	2	0	1
Mount Mary	Generalist	Budgerigar	7	4	0	1
Mount Mary	Generalist	Chestnut Quail-thrush	20	5	0	0
Mount Mary	Generalist	Chestnut-rumped Thornbill	63	12	0	0
Mount Mary	Generalist	Cockatiel	4	3	0	1
Mount Mary	Generalist	Collared Sparrowhawk	3	3	0	1
Mount Mary	Generalist	Common Bronzewing	36	8	0	0
Mount Mary	Generalist	Crested Bellbird	32	7	0	0
Mount Mary	Generalist	Emu	34	8	0	0
Mount Mary	Generalist	Grey Butcherbird	59	12	0	0
Mount Mary	Generalist	Grey Currawong	21	6	0	0
Mount Mary	Generalist	Grey Fantail	2	2	0	0
Mount Mary	Generalist	Grey Shrike-thrush	54	9	0	0
Mount Mary	Generalist	Horsfield's Bronze-cuckoo	20	5	0	1
Mount Mary	Generalist	Letter-winged Kite			0	0
Mount Mary	Generalist	Little Raven	78	10	0	0
Mount Mary	Generalist	Masked Woodswallow	4	2	0	1
Mount Mary	Generalist	Mistletoebird	11	8	0	0
Mount Mary	Generalist	Mulga Parrot	52	10	0	0
Mount Mary	Generalist	Nankeen Kestrel	25	10	0	0
Mount Mary	Generalist	Pallid Cuckoo	1	1	0	1
Mount Mary	Generalist	Peregrine Falcon	3	3	0	1
Mount Mary	Generalist	Rainbow Bee-eater	19	4	0	0
Mount Mary	Generalist	Red Wattlebird	37	8	0	0
Mount Mary	Generalist	Red-capped Robin	48	8	0	0
Mount Mary	Generalist	Rock Dove	7	5	0	1
Mount Mary	Generalist	Silvereye	3	2	0	0
Mount Mary	Generalist	Southern Boobook	3	2	0	1
Mount Mary	Generalist	Spiny-cheeked Honeyeater	110	12	0	0
Mount Mary	Generalist	Splendid Fairy-wren	40	12	0	0
Mount Mary	Generalist	Spotted Harrier	1	1	0	1
Mount Mary	Generalist	Spotted Nightjar	2	2	0	1
Mount Mary	Generalist	Spotted Pardalote	14	7	0	0
Mount Mary	Generalist	Striated Pardalote	58	11	0	0
Mount Mary	Generalist	Swamp Harrier	1	1	0	0
Mount Mary	Generalist	Tawny Frogmouth	1	1	0	1

Landscape	Response Group	Species	Records	Years	Ext	Dec
Mount Mary	Generalist	Varied Sittella	6	4	0	1
Mount Mary	Generalist	Variegated Fairy-wren	30	9	0	0
Mount Mary	Generalist	Wedge-tailed Eagle	17	8	0	0
Mount Mary	Generalist	Weebill	59	8	0	0
Mount Mary	Generalist	Welcome Swallow	30	8	0	0
Mount Mary	Generalist	White-backed Swallow	1	1	0	0
Mount Mary	Generalist	White-breasted Woodswallow			0	0
Mount Mary	Generalist	White-browed Babbler	28	8	0	0
Mount Mary	Generalist	White-browed Woodswallow	6	3	0	1
Mount Mary	Shrubland	Black-eared Cuckoo	18	4	0	1
Mount Mary	Shrubland	Chestnut-crowned Babbler	70	13	0	1
Mount Mary	Shrubland	Inland Thornbill	13	5	0	1
Mount Mary	Shrubland	Redthroat	44	9	0	0
Mount Mary	Shrubland	Rufous Fieldwren	1	1	0	0
Mount Mary	Shrubland	Singing Honeyeater	57	8	0	0
Mount Mary	Shrubland	Slender-billed Thornbill	1	1	0	0
Mount Mary	Shrubland	Southern Whiteface	84	11	0	0
Mount Mary	Shrubland	White-fronted Chat	25	7	0	1
Mount Mary	Shrubland	White-winged Fairy-wren	20	7	0	1
Mount Mary	Settlements	Common Blackbird	4	3	0	0
Mount Mary	Settlements	House Sparrow	10	5	0	0
Mount Mary	Settlements	Spotted Dove	1	1	0	0
Mount Mary	Drainage line	Crested Shrike-tit			1	0
Mount Mary	Drainage line	Crimson Rosella	21	8	0	0
Mount Mary	Drainage line	Diamond Firetail	1	1	0	1
Mount Mary	Drainage line	Fairy Martin	4	4	0	1
Mount Mary	Drainage line	Laughing Kookaburra	11	5	0	1
Mount Mary	Drainage line	Little Eagle	10	5	0	1
Mount Mary	Drainage line	Noisy Miner	9	6	0	1
Mount Mary	Drainage line	Red-backed Kingfisher	10	5	0	1
Mount Mary	Drainage line	Red-rumped Parrot	18	5	0	1
Mount Mary	Drainage line	Sacred Kingfisher	2	2	0	1
Mount Mary	Drainage line	Tree Martin	13	7	0	1
Mount Mary	Drainage line	Whistling Kite	17	7	1	0
Mount Mary	Drainage line	White-plumed Honeyeater	8	5	0	0
Mount Mary	Drainage line	Zebra Finch			1	0
Mount Mary	Honeyeater	Brown-headed Honeyeater	8	3	0	1
Mount Mary	Honeyeater	Grey-fronted Honeyeater	3	2	0	0
Mount Mary	Honeyeater	Musk Lorikeet	1	1	0	0
Mount Mary	Honeyeater	Purple-crowned Lorikeet	9	6	1	0
Mount Mary	Honeyeater	Rainbow Lorikeet			0	0
Mount Mary	Honeyeater	Striped Honeyeater	4	3	0	1

Landscape	Response Group	Species	Records	Years	Ext	Dec
Mount Mary	Honeyeater	White-eared Honeyeater	3	3	0	1
Mount Mary	Honeyeater	White-fronted Honeyeater	17	6	0	1
Punthari	Mallee woodland	Australian Owlet-nightjar	4	3	0	0
Punthari	Mallee woodland	Brown Treecreeper	23	8	0	0
Punthari	Mallee woodland	Bush Stone-curlew			1	0
Punthari	Mallee woodland	Dusky Woodswallow	4	3	0	1
Punthari	Mallee woodland	Hooded Robin	9	6	0	1
Punthari	Mallee woodland	Jacky Winter	9	5	0	0
Punthari	Mallee woodland	Little Crow			0	0
Punthari	Mallee woodland	Regent Parrot			1	0
Punthari	Mallee woodland	Restless Flycatcher	7	4	0	0
Punthari	Mallee woodland	White-winged Chough	43	10	0	0
Punthari	Mallee woodland	Yellow-plumed Honeyeater	14	7	0	1
Punthari	Mallee woodland	Yellow-rumped Thornbill	25	7	0	0
Punthari	Mallee woodland	Yellow-throated Miner	8	1	0	0
Punthari	Mallee Triodia	Black-eared Miner			1	0
Punthari	Mallee Triodia	Mallee Emu-wren			1	0
Punthari	Mallee Triodia	Red-lored Whistler			1	0
Punthari	Mallee Triodia	Striated Grasswren			1	0
Punthari	Mallee shrubland	Fan-tailed Cuckoo	3	3	0	1
Punthari	Mallee shrubland	Gilbert's Whistler	2	2	0	1
Punthari	Mallee shrubland	Golden Whistler	7	6	0	1
Punthari	Mallee shrubland	Inland Thornbill	2	2	0	1
Punthari	Mallee shrubland	Malleefowl			1	0
Punthari	Mallee shrubland	Painted Button-quail			1	0
Punthari	Mallee shrubland	Purple-gaped Honeyeater	2	2	0	1
Punthari	Mallee shrubland	Shy Heathwren	2	2	0	1
Punthari	Mallee shrubland	Southern Scrub-robin	2	2	0	1
Punthari	Mallee shrubland	Western Whipbird			1	0
Punthari	Mallee shrubland	White-browed Babbler	28	8	0	0
Punthari	Non-eucalypt woodland	Major Mitchell's Cockatoo			1	0
Punthari	Non-eucalypt woodland	Peaceful Dove	29	9	0	0
Punthari	Non-eucalypt woodland	Rufous Whistler	17	6	0	1
Punthari	Non-eucalypt woodland	Superb Fairy-wren	7	6	0	0
Punthari	Non-eucalypt woodland	Yellow Thornbill	12	6	0	0
Punthari	Grassland	Australasian Pipit	11	4	0	0
Punthari	Grassland	Australian Bustard	1	1	0	1
Punthari	Grassland	Banded Lapwing	3	3	0	1
Punthari	Grassland	Blue-winged Parrot			0	0
Punthari	Grassland	Brown Quail			1	0
Punthari	Grassland	Brown Songlark	9	2	0	0
Punthari	Grassland	Elegant Parrot			1	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Punthari	Grassland	Eurasian Skylark	3	2	0	1
Punthari	Grassland	Little Button-quail			0	0
Punthari	Grassland	Masked Lapwing	2	2	0	1
Punthari	Grassland	Rufous Songlark	2	2	0	1
Punthari	Grassland	Stubble Quail	9	3	0	1
Punthari	Agricultural increaser	Australian Magpie	76	12	0	0
Punthari	Agricultural increaser	Australian Raven	13	7	0	0
Punthari	Agricultural increaser	Blue Bonnet	2	1	0	1
Punthari	Agricultural increaser	Common Starling	21	5	0	0
Punthari	Agricultural increaser	Crested Pigeon	31	8	0	0
Punthari	Agricultural increaser	European Goldfinch			1	0
Punthari	Agricultural increaser	Galah	73	11	0	0
Punthari	Agricultural increaser	Little Corella	26	9	0	0
Punthari	Agricultural increaser	Long-billed Corella			1	0
Punthari	Agricultural increaser	Magpie-lark	12	6	0	0
Punthari	Agricultural increaser	Sulphur-crested Cockatoo	2	2	0	1
Punthari	Agricultural increaser	Willie Wagtail	42	9	0	0
Punthari	Continental	Black Honeyeater			0	0
Punthari	Continental	Black-headed Honeyeater			0	0
Punthari	Continental	Crimson Chat			0	0
Punthari	Continental	Diamond Dove			0	0
Punthari	Continental	Orange Chat			0	0
Punthari	Continental	Pied Honeyeater			0	0
Punthari	Continental	White-winged Triller	1	1	0	0
Punthari	Generalist	Australian Barn Owl	5	3	0	1
Punthari	Generalist	Australian Hobby	2	2	0	1
Punthari	Generalist	Australian Ringneck	53	11	0	0
Punthari	Generalist	Black Falcon	3	3	0	1
Punthari	Generalist	Black Kite	7	4	0	0
Punthari	Generalist	Black-eared Cuckoo	3	2	0	1
Punthari	Generalist	Black-faced Cuckoo-shrike	21	5	0	0
Punthari	Generalist	Black-faced Woodswallow	1	1	0	1
Punthari	Generalist	Black-shouldered Kite	2	2	0	1
Punthari	Generalist	Brown Falcon	13	7	0	1
Punthari	Generalist	Brown Goshawk	3	3	0	1
Punthari	Generalist	Budgerigar	1	1	0	1
Punthari	Generalist	Chestnut Quail-thrush	2	2	0	0
Punthari	Generalist	Chestnut-rumped Thornbill	20	8	0	0
Punthari	Generalist	Cockatiel	8	6	0	1
Punthari	Generalist	Collared Sparrowhawk	1	1	0	0
Punthari	Generalist	Common Bronzewing	25	6	0	1
Punthari	Generalist	Crested Bellbird	3	2	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Punthari	Generalist	Emu	1	1	0	0
Punthari	Generalist	Grey Butcherbird	21	6	0	0
Punthari	Generalist	Grey Currawong	20	6	0	0
Punthari	Generalist	Grey Fantail	15	8	0	0
Punthari	Generalist	Grey Shrike-thrush	42	9	0	0
Punthari	Generalist	Horsfield's Bronze-cuckoo	9	7	0	1
Punthari	Generalist	Letter-winged Kite			0	0
Punthari	Generalist	Little Raven	51	9	0	0
Punthari	Generalist	Masked Woodswallow	2	2	0	1
Punthari	Generalist	Mulga Parrot	13	4	0	0
Punthari	Generalist	Nankeen Kestrel	12	7	0	0
Punthari	Generalist	Pallid Cuckoo	2	1	0	1
Punthari	Generalist	Peregrine Falcon	6	5	0	1
Punthari	Generalist	Rainbow Bee-eater	19	5	0	0
Punthari	Generalist	Red Wattlebird	21	8	0	0
Punthari	Generalist	Red-capped Robin	9	4	0	0
Punthari	Generalist	Rock Dove	2	1	0	1
Punthari	Generalist	Silvereye	3	3	0	0
Punthari	Generalist	Southern Boobook	4	4	0	1
Punthari	Generalist	Spiny-cheeked Honeyeater	25	10	0	0
Punthari	Generalist	Splendid Fairy-wren			1	0
Punthari	Generalist	Spotted Harrier			0	0
Punthari	Generalist	Spotted Nightjar	1	1	0	1
Punthari	Generalist	Spotted Pardalote	21	6	0	0
Punthari	Generalist	Striated Pardalote	49	10	0	0
Punthari	Generalist	Swamp Harrier			0	0
Punthari	Generalist	Tawny Frogmouth	4	4	0	1
Punthari	Generalist	Varied Sittella	7	4	0	1
Punthari	Generalist	Variegated Fairy-wren	15	8	0	0
Punthari	Generalist	Wedge-tailed Eagle	11	7	0	1
Punthari	Generalist	Weebill	41	10	0	0
Punthari	Generalist	Welcome Swallow	22	8	0	0
Punthari	Generalist	White-backed Swallow			0	0
Punthari	Generalist	White-breasted Woodswallow	1	1	0	0
Punthari	Generalist	White-browed Woodswallow	2	2	0	1
Punthari	Shrubland	Chestnut-crowned Babbler	3	1	0	0
Punthari	Shrubland	Singing Honeyeater	43	10	0	0
Punthari	Shrubland	Southern Whiteface	9	6	0	0
Punthari	Shrubland	White-fronted Chat			1	0
Punthari	Shrubland	White-winged Fairy-wren	1	1	0	1
Punthari	Settlements	Common Blackbird	6	5	0	0
Punthari	Settlements	House Sparrow	17	8	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Punthari	Settlements	Spotted Dove	3	3	0	1
Punthari	Drainage line	Crested Shrike-tit	1	1	0	1
Punthari	Drainage line	Crimson Rosella	34	10	0	0
Punthari	Drainage line	Diamond Firetail	4	2	0	1
Punthari	Drainage line	Fairy Martin	2	2	0	1
Punthari	Drainage line	Laughing Kookaburra	17	6	0	1
Punthari	Drainage line	Little Eagle	2	2	0	1
Punthari	Drainage line	Mistletoebird	9	5	0	0
Punthari	Drainage line	Noisy Miner	18	10	0	1
Punthari	Drainage line	Pied Butcherbird	2	1	0	0
Punthari	Drainage line	Red-backed Kingfisher			1	0
Punthari	Drainage line	Red-rumped Parrot	23	8	0	1
Punthari	Drainage line	Sacred Kingfisher	3	3	0	1
Punthari	Drainage line	Tree Martin	19	9	0	1
Punthari	Drainage line	Whistling Kite	14	10	0	0
Punthari	Drainage line	White-plumed Honeyeater	30	9	0	1
Punthari	Drainage line	Zebra Finch	1	1	0	1
Punthari	Honeyeater	Brown-headed Honeyeater	13	6	0	1
Punthari	Honeyeater	Grey-fronted Honeyeater			0	0
Punthari	Honeyeater	Musk Lorikeet			0	0
Punthari	Honeyeater	Purple-crowned Lorikeet	8	6	0	0
Punthari	Honeyeater	Rainbow Lorikeet			0	0
Punthari	Honeyeater	Striped Honeyeater	3	3	0	1
Punthari	Honeyeater	Tawny-crowned Honeyeater			1	0
Punthari	Honeyeater	White-eared Honeyeater	6	4	0	1
Punthari	Honeyeater	White-fronted Honeyeater	8	6	0	0
Punthari	Honeyeater	White-naped Honeyeater	2	1	0	0
Punthari	Honeyeater	Yellow-faced Honeyeater	2	2	0	0
Stonefield	Mallee woodland	Australian Owlet-nightjar	3	3	0	1
Stonefield	Mallee woodland	Brown Treecreeper	80	9	0	0
Stonefield	Mallee woodland	Bush Stone-curlew			1	0
Stonefield	Mallee woodland	Dusky Woodswallow	11	5	0	1
Stonefield	Mallee woodland	Hooded Robin	26	8	0	1
Stonefield	Mallee woodland	Jacky Winter	13	5	0	1
Stonefield	Mallee woodland	Little Crow			0	0
Stonefield	Mallee woodland	Pied Butcherbird	2	2	0	0
Stonefield	Mallee woodland	Regent Parrot			1	0
Stonefield	Mallee woodland	Restless Flycatcher	9	4	0	0
Stonefield	Mallee woodland	White-winged Chough	66	10	0	0
Stonefield	Mallee woodland	Yellow-plumed Honeyeater	23	9	0	1
Stonefield	Mallee woodland	Yellow-rumped Thornbill	18	4	0	0
Stonefield	Mallee woodland	Yellow-throated Miner	45	9	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Stonefield	Non-eucalypt woodland	Ground Cuckoo-shrike	1	1	0	0
Stonefield	Non-eucalypt woodland	Major Mitchell's Cockatoo			1	0
Stonefield	Non-eucalypt woodland	Peaceful Dove	14	3	0	0
Stonefield	Non-eucalypt woodland	Rufous Whistler	7	5	0	1
Stonefield	Non-eucalypt woodland	Superb Fairy-wren	1	1	0	0
Stonefield	Non-eucalypt woodland	Yellow Thornbill	4	4	0	1
Stonefield	Grassland	Australasian Pipit	25	7	0	0
Stonefield	Grassland	Australian Bustard			1	0
Stonefield	Grassland	Banded Lapwing	1	1	0	1
Stonefield	Grassland	Blue-winged Parrot			0	0
Stonefield	Grassland	Brown Quail			1	0
Stonefield	Grassland	Brown Songlark	22	3	0	0
Stonefield	Grassland	Elegant Parrot	1	1	0	1
Stonefield	Grassland	Eurasian Skylark	5	3	0	1
Stonefield	Grassland	Little Button-quail	3	2	0	1
Stonefield	Grassland	Masked Lapwing	4	4	0	1
Stonefield	Grassland	Rufous Songlark	8	1	0	1
Stonefield	Grassland	Stubble Quail	10	2	0	1
Stonefield	Agricultural increaser	Australian Magpie	120	10	0	0
Stonefield	Agricultural increaser	Australian Raven	42	9	0	1
Stonefield	Agricultural increaser	Blue Bonnet	5	3	0	1
Stonefield	Agricultural increaser	Common Starling	51	7	0	0
Stonefield	Agricultural increaser	Crested Pigeon	64	7	0	0
Stonefield	Agricultural increaser	European Goldfinch	1	1	0	0
Stonefield	Agricultural increaser	Galah	103	11	0	0
Stonefield	Agricultural increaser	Little Corella	9	3	0	0
Stonefield	Agricultural increaser	Long-billed Corella			1	0
Stonefield	Agricultural increaser	Magpie-lark	18	5	0	0
Stonefield	Agricultural increaser	Sulphur-crested Cockatoo	1	1	0	0
Stonefield	Agricultural increaser	Willie Wagtail	69	9	0	0
Stonefield	Continental	Black Honeyeater			0	0
Stonefield	Continental	Black-headed Honeyeater			0	0
Stonefield	Continental	Crimson Chat	2	1	0	0
Stonefield	Continental	Diamond Dove			0	0
Stonefield	Continental	Orange Chat	2	2	0	0
Stonefield	Continental	Pied Honeyeater			0	0
Stonefield	Continental	White-winged Triller	3	2	0	0
Stonefield	Generalist	Apostlebird	3	2	0	1
Stonefield	Generalist	Australian Barn Owl	3	2	0	1
Stonefield	Generalist	Australian Hobby	2	1	0	1
Stonefield	Generalist	Australian Ringneck	79	10	0	0
Stonefield	Generalist	Black Falcon	1	1	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Stonefield	Generalist	Black Kite	7	5	0	1
Stonefield	Generalist	Black-faced Cuckoo-shrike	30	7	0	0
Stonefield	Generalist	Black-faced Woodswallow	2	1	0	0
Stonefield	Generalist	Black-shouldered Kite	3	2	0	1
Stonefield	Generalist	Brown Falcon	18	5	0	1
Stonefield	Generalist	Brown Goshawk	4	2	0	1
Stonefield	Generalist	Budgerigar	6	4	0	1
Stonefield	Generalist	Chestnut Quail-thrush	4	1	0	1
Stonefield	Generalist	Chestnut-rumped Thornbill	11	5	0	0
Stonefield	Generalist	Cockatiel	9	4	0	1
Stonefield	Generalist	Collared Sparrowhawk	3	2	0	1
Stonefield	Generalist	Common Bronzewing	14	4	0	1
Stonefield	Generalist	Crested Bellbird	2	2	0	0
Stonefield	Generalist	Emu	13	7	0	1
Stonefield	Generalist	Grey Butcherbird	22	8	0	0
Stonefield	Generalist	Grey Currawong	17	6	0	1
Stonefield	Generalist	Grey Fantail	3	3	0	0
Stonefield	Generalist	Grey Shrike-thrush	49	9	0	0
Stonefield	Generalist	Horsfield's Bronze-cuckoo	7	2	0	1
Stonefield	Generalist	Letter-winged Kite			0	0
Stonefield	Generalist	Little Raven	82	7	0	0
Stonefield	Generalist	Masked Woodswallow	6	2	0	0
Stonefield	Generalist	Mulga Parrot	20	7	0	0
Stonefield	Generalist	Nankeen Kestrel	21	6	0	0
Stonefield	Generalist	Pallid Cuckoo	5	2	0	1
Stonefield	Generalist	Peregrine Falcon	3	2	0	1
Stonefield	Generalist	Rainbow Bee-eater	29	4	0	0
Stonefield	Generalist	Red Wattlebird	25	7	0	0
Stonefield	Generalist	Red-capped Robin	13	5	1	0
Stonefield	Generalist	Rock Dove	3	3	0	1
Stonefield	Generalist	Silvereye			1	0
Stonefield	Generalist	Southern Boobook			0	1
Stonefield	Generalist	Spiny-cheeked Honeyeater	28	6	0	0
Stonefield	Generalist	Splendid Fairy-wren	3	2	0	0
Stonefield	Generalist	Spotted Harrier	1	1	0	0
Stonefield	Generalist	Spotted Nightjar	1	1	0	1
Stonefield	Generalist	Spotted Pardalote	12	6	0	0
Stonefield	Generalist	Striated Pardalote	82	10	0	0
Stonefield	Generalist	Swamp Harrier	1	1	0	0
Stonefield	Generalist	Tawny Frogmouth	1	1	0	1
Stonefield	Generalist	Varied Sittella	11	3	0	1
Stonefield	Generalist	Variegated Fairy-wren	23	7	0	0

Landscape	Response Group	Species	Records	Years	Ext	Dec
Stonefield	Generalist	Wedge-tailed Eagle	13	6	0	1
Stonefield	Generalist	Weebill	36	7	0	0
Stonefield	Generalist	Welcome Swallow	25	7	0	0
Stonefield	Generalist	White-backed Swallow	5	3	0	1
Stonefield	Generalist	White-breasted Woodswallow	1	1	0	0
Stonefield	Generalist	White-browed Babbler	13	5	0	0
Stonefield	Generalist	White-browed Woodswallow	6	2	0	0
Stonefield	Shrubland	Black-eared Cuckoo	2	2	0	1
Stonefield	Shrubland	Chestnut-crowned Babbler	29	6	0	1
Stonefield	Shrubland	Inland Thornbill			1	0
Stonefield	Shrubland	Redthroat	4	2	0	1
Stonefield	Shrubland	Rufous Fieldwren			1	0
Stonefield	Shrubland	Singing Honeyeater	61	8	0	0
Stonefield	Shrubland	Slender-billed Thornbill			1	0
Stonefield	Shrubland	Southern Whiteface	45	8	0	0
Stonefield	Shrubland	White-fronted Chat	21	5	0	1
Stonefield	Shrubland	White-winged Fairy-wren	15	5	0	1
Stonefield	Settlements	Common Blackbird	2	2	0	0
Stonefield	Settlements	House Sparrow	29	6	0	0
Stonefield	Settlements	Spotted Dove			1	0
Stonefield	Drainage line	Crested Shrike-tit			1	0
Stonefield	Drainage line	Crimson Rosella	50	7	0	0
Stonefield	Drainage line	Diamond Firetail	10	5	0	1
Stonefield	Drainage line	Fairy Martin			0	0
Stonefield	Drainage line	Laughing Kookaburra	10	3	0	1
Stonefield	Drainage line	Little Eagle	2	1	0	1
Stonefield	Drainage line	Mistletoebird	9	4	0	0
Stonefield	Drainage line	Noisy Miner	11	4	0	1
Stonefield	Drainage line	Red-backed Kingfisher	9	2	0	1
Stonefield	Drainage line	Red-rumped Parrot	39	9	0	1
Stonefield	Drainage line	Sacred Kingfisher			1	0
Stonefield	Drainage line	Tree Martin	36	7	0	1
Stonefield	Drainage line	Whistling Kite	4	3	0	1
Stonefield	Drainage line	White-plumed Honeyeater	40	7	0	0
Stonefield	Drainage line	Zebra Finch	1	1	0	1
Stonefield	Honeyeater	Brown-headed Honeyeater	3	3	0	1
Stonefield	Honeyeater	Grey-fronted Honeyeater			0	0
Stonefield	Honeyeater	Musk Lorikeet			0	0
Stonefield	Honeyeater	Purple-crowned Lorikeet	28	7	0	0
Stonefield	Honeyeater	Rainbow Lorikeet			0	0
Stonefield	Honeyeater	Striped Honeyeater	1	1	0	1
Stonefield	Honeyeater	White-eared Honeyeater	2	2	0	1

Landscape	Response Group	Species	Records	Years	Ext	Dec
Stonefield	Honeyeater	White-fronted Honeyeater	3	3	0	1
Stonefield	Honeyeater	White-naped Honeyeater	1	1	0	0
Stonefield	Honeyeater	Yellow-faced Honeyeater			0	0