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Adelaide and Mt Lofty Ranges Land Use Mapping Project

Project Summary and Accuracy Report

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PREMIUM
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ENVIRONMENT

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Table of Contents

Background

This land use survey has been completed for the Commonwealth Department of Agriculture. The survey was completed following the principles of the Australian Collaborative Land Use and Management Program. The purpose of this document is to detail the assumptions, limitations and outcomes of the survey. For detailed information regarding the survey structure please refer to Bureau of Rural Sciences 2011.

1.0 Land Use Survey Data Creation

Outlined below is the process and datasets that formed the basis of the 2016 land use dataset. The extent of the survey is a combination of the Adelaide Mount Lofty Ranges Natural Resource Management (NRM) Region and the western area of the South Australian Murray Darling Basin (SAMDB) NRM Region boundary (abutting the western boundary of the SAMDB 2014 land use extent).

1.1 Land use dataset

A copy of the 2008 Australian Collaborative Land Use and Management Program (ACLUMP) dataset was sourced from the South Australian Department for Environment Water and Natural Resources (DENWR). This dataset formed the basis for the 2016 survey.

The Australian Land Use and Management (ALUM) version 6 classifications from the 2008 land use dataset were converted to ALUM version 8 as detailed in ABARES 2016 (see Appendix A). This included code changes for some land use descriptions and the removal of 4.5.2 Irrigated seasonal nuts.

The project aimed to classify land use to the tertiary code level of the ALUM classification where possible, however version 8 also provides attribute fields for the collection of commodity and land management practice information. These extra fields allow for consistent recording of more detailed information about crops, livestock and management techniques which were determined at the time of mapping.

1.2 Imagery

In order to assist with the desktop interpretation component of the survey, high resolution aerial imagery was sourced from DEWNR. The imagery was used for the verification and adjustment of features in the desktop interpretation.

The details of the imagery used are shown in **Table 1** below:

Table 1: Aerial imagery details

Area covered	Capture year	Spatial resolution
Adelaide Mount Lofty Ranges	2011	0.5 m
Northern Adelaide Mount Lofty Ranges NRM Region	2014	0.5 m
Southern Fleurieu Peninsula	2014	0.3 m
Western Murraylands	2013	0.2 m

1.3 Background datasets

Reference feature data from several spatial datasets were used to assist with the desktop interpretation, these included:

- Forestry reserves
- Native vegetation heritage agreement areas
- Mining and production tenements
- Primary Industries Information Management System (PIIMS) livestock registrations
- Leased and licenced aquaculture areas
- Dairy locations
- National Parks and Reserves
- Aboriginal lands
- Property valuation details
- Vineyards

These data were used as a reference for the classification process rather than incorporating them directly into the land use dataset as this method can cause spatial alignment issues. Also a number of the datasets were not current and/or had not been field verified. It was deemed more appropriate to use these datasets in conjunction with aerial imagery to achieve the desired accuracy for the classification.

2.0 Survey Strategy

The large size of the survey area extent required a strategy to enable the desktop interpretation and field survey to occur in tandem. The project area was divided into 6 sub-regions (dubbed regions) enabling the desktop interpretation to complete and deliver subsets of data to the field teams upon completion and then move onto the next. This strategy enabled deadlines to be met and ensured the project was delivered on-time while also reducing the amount of downtime for both the field and desktop teams.

2.1 Desktop Interpretation Process

The desktop interpretation component was intended to significantly reduce the amount of both geometry and attribute edits required in the field survey. These edits are typically more efficient to complete in a desktop environment.

Utilising Esri ArcGIS software with the various source imagery (section 1.2) and reference datasets (section 1.3) loaded, the analyst was able to review each feature from the initial 2008 dataset by region and make a judgement on whether the boundary of the feature required adjustment and if the land use assigned was valid. The analyst would then make the necessary edits.

Over the course of the desktop interpretation process, spatial alignment issues such as gaps and slivers identified with the 2008 data were resolved through manual editing.

With the necessary edits complete, the land use dataset for that region was forwarded to the field teams for the survey to be conducted.

2.2 Field Survey

The field survey involved teams driving as many as possible of the approximately 17,000 kilometres of road in the survey area with a mobile computing device mounted in the vehicle. The device was configured with the same Esri ArcGIS software used in the desktop interpretation and was GPS enabled. The GPS tracked the movements of the vehicle allowing the field officer to identify the land use of each feature as they passed it. If the observed land use was deemed to be different to that already recorded on the device, the classification and/or the geometry were updated. Where a commodity was observed in the field, this information was also recorded against the feature.

Due to the difficult nature of performing complex geometry edits in the field, the officer had the opportunity to record a feature as *"office edit required"* and document the required change on the "Edits Identified for Office Fix form". These forms along with the region dataset were returned to the desktop analyst for review and updating.

3.0 Data Management

Data management was a critical component of the project, given the dataset was divided up into separate sub-regions. An instructional document was created that outlined the process for data upload and download and then the spatial analyst would perform a quality assurance check on each section prior to integration into the final dataset.

3.1 Data Review

On completion of the field survey the dataset was returned to the desktop analyst for final edits, including those identified by the field teams using the Edits Identified for Office Fix forms as well as any spatial and attribute anomalies which may have been inadvertently created in the field. All new features created by the field teams were extracted and reviewed for spatial accuracy and validity. This was done using the imagery as a reference and checking alignment. This process was necessary due to the difficult nature of creating complex features on a mobile device in the field.

Before all the regional datasets were merged together it was important to ensure there were no geometry errors. ArcGIS was used to perform topology checks over each region, ensuring there were no gaps or overlaps between features and the dataset was complete. Tiny features (slivers) were removed or merged with valid features. All errors identified by the topology check were individually reviewed and resolved.

3.2 Data Consolidation

When the field survey was complete for all regions and the attribute and spatial data had been reviewed and cleaned, the data was consolidated. A blank file geodatabase feature class was created and each regional dataset added using the ArcGIS *data load* function. A final topology check was performed to ensure the regions were merged correctly.

4.0 Data Validation

The target attribute accuracy rate to be achieved for the land use survey was at least 80 percent (Bureau of Rural Sciences 2011, p 46). Figure 1 shows the location and class of the randomly selected validation sites.

4.1 Validation Criteria

The validation process was undertaken as recommended by Bureau of Rural Sciences (2011, pp 44-46).

A number of classes were removed from the validation process as these land uses can in almost all cases be reliably determined based on land tenure data. The following classes were excluded:

- 1.1.0 - 1.1.7 – Nature conservation
- 1.2.0 - 1.2.5 – Managed resource protection
- 1.3.0 - 1.3.4 – Other minimal use
- 5.5.0 - 5.5.5 – Services
- 5.7.0 - 5.7.5 – Transport and communication
- 6.1.0 - 6.1.4 – Lake
- 6.2.0 - 6.2.3 – Reservoir/dam
- 6.3.0 - 6.3.3 – River/dam
- 6.4.0 - 6.4.3 – Channel/aqueduct
- 6.5.0 - 6.5.4 – Marsh/wetland
- 6.6.0 - 6.6.3 – Estuary/coastal waters

For the remaining data, a stratified random sampling method was used to select 1240 features for validation. The sample data were randomly selected with ArcGIS using the add-in *Sampling Design Tool for ArcGIS* (available at <www.arcgis.com>). The selection was performed as defined in Table 5 Bureau of Rural Sciences 2011 (p 45).

4.2 Validation Method

The validation was carried out in a similar fashion to the field survey. A team was provided with a mobile device with ArcGIS for Desktop software loaded with a feature class of the randomly selected features requiring validation. The field team then attempted to visit each of these sites to confirm whether the land use classification applied to it was correct or required adjustment. If the original land use classification was identified as incorrect, a revised classification was applied.

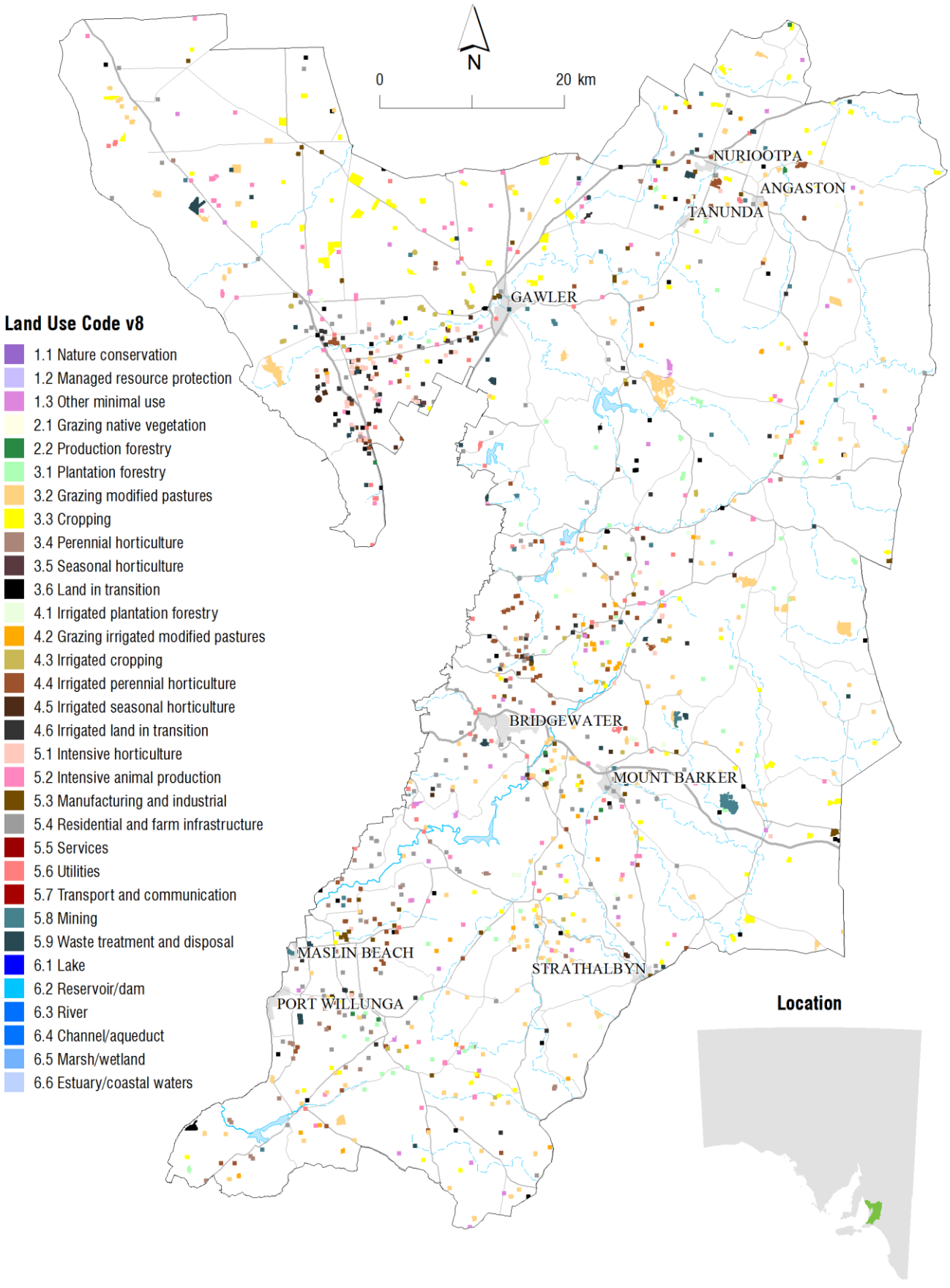


Figure 1: Location of validation sites by secondary class level

4.3 Validation Results

The validation survey returned an accuracy rating of 88%. Of the 1240 sites surveyed 145 were identified as having incorrect land use allocation and a revised land use category was applied to the site. There were an additional 46 sites which were unable to be observed during the validation process due to access issues (described in *5.0 Project Limitations*). If all of these 46 sites are assumed to be incorrect, the overall accuracy rating is reduced to 85%.

Table 1 depicts the error matrix at the secondary classification level for the validation survey. It suggests that sites were predominately correctly mapped in the initial desktop interpretation and field survey. For example, of 117 survey sites originally identified as *Cropping,* the validation survey found 110 to be mapped correctly. 6 were revised to *Grazing modified pastures* and 1 was revised to *Perennial Horticulture.*

The revised validation data were used to update and replace features in the master dataset. The complete dataset is shown in *Appendix B: Adelaide and Mt Lofty Ranges land use map, 2016*.

Table 1: Validation Error Matrix

	Independently observed land use																										
Mapped land use	1.3 Other minimal use	2.1 Grazing native vegetation	2.2 Production forestry	3.1 Plantation forestry	3.2 Grazing modified pastures	3.3 Cropping	3.4 Perennial horticulture	3.5 Seasonal horticulture	3.6 Land in transition	4.1 Irrigated plantation forestry	4.2 Grazing irrigated modified pastures	4.3 Irrigated cropping	4.4 Irrigated perennial horticulture	4.5 Irrigated seasonal horticulture	4.6 Irrigated land in transition	5.1 Intensive horticulture	5.2 Intensive animal production	5.3 Manufacturing and industrial	5.4 Residential and farm infrastructure	5.5 Services	5.6 Utilities	5.7 Transport and communication	5.8 Mining	5.9 Waste treatment and disposal	6.5 Marsh/wetland	**Total**	**Proportional error (%)**
1.3 Other minimal use	**39**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	**40**	**2.50**
2.1 Grazing native vegetation	0	**9**	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**	**10.00**
2.2 Production forestry	**1**	0	**5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	**7**	**28.57**
3.1 Plantation forestry	**1**	0	0	**54**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**55**	**1.82**
3.2 Grazing modified pastures	0	0	0	0	**178**	**1**	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	**180**	**1.11**
3.3 Cropping	0	0	0	0	**6**	**110**	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**117**	**5.98**
3.4 Perennial horticulture	0	0	0	**1**	**1**	**1**	**46**	0	**1**	0	0	0	**2**	0	0	0	0	0	**2**	0	0	0	0	0	0	**54**	**14.81**
3.5 Seasonal horticulture	0	0	0	0	0	0	0	**3**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**	**0.00**
3.6 Land in transition	0	0	0	0	**1**	0	0	0	**55**	0	0	0	0	**1**	0	0	0	0	**1**	0	0	0	0	0	0	**58**	**5.17**
4.1 Irrigated plantation forestry	0	0	0	**4**	**1**	0	0	0	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**12**	**41.67**
4.2 Grazing irrigated modified pastures	0	0	0	0	**14**	0	0	0	0	0	**25**	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	**40**	**37.50**
4.3 Irrigated cropping	0	0	0	0	**2**	**12**	0	0	0	0	0	**15**	**2**	**2**	0	0	0	0	0	0	0	0	0	0	0	**33**	**54.55**
4.4 Irrigated perennial horticulture	0	0	**1**	0	0	0	0	0	0	0	0	0	**102**	0	0	0	0	0	0	**1**	0	0	0	0	0	**104**	**1.92**
4.5 Irrigated seasonal horticulture	0	0	0	0	0	0	0	0	0	0	0	0	0	**31**	0	0	0	0	0	**1**	0	0	0	**1**	0	**33**	**6.06**
4.6 Irrigated land in transition	0	0	0	**1**	**1**	0	0	0	0	0	0	0	**2**	0	**45**	**2**	0	0	**1**	0	0	0	0	0	0	**52**	**13.46**
5.1 Intensive horticulture	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	**51**	0	0	**1**	**4**	0	0	0	0	0	**57**	**10.53**
5.2 Intensive animal production	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	**81**	0	**2**	0	0	0	0	0	0	**84**	**3.57**
5.3 Manufacturing and industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**45**	0	**1**	**1**	0	0	0	0	**47**	**4.26**
5.4 Residential and farm infrastructure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**119**	**1**	0	0	0	0	0	**120**	**0.83**
5.6 Utilities	0	0	0	0	0	0	0	0	**2**	0	0	0	0	0	0	0	0	0	**1**	**1**	**42**	**2**	0	0	**3**	**51**	**17.65**
5.8 Mining	**3**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	**35**	0	0	**39**	**10.26**
5.9 Waste treatment and disposal	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**	**1**	0	0	**2**	**37**	0	**44**	**15.91**
Total	**44**	**9**	**6**	**60**	**208**	**124**	**47**	**3**	**58**	**7**	**25**	**15**	**108**	**34**	**45**	**53**	**82**	**45**	**134**	**10**	**43**	**2**	**37**	**38**	**3**	**1240**	

5.0 Project Limitations

There are several limitations inherent in the 2016 land use dataset. These have arisen for various reasons as detailed below. It is important to be aware of the limitations when using the data.

5.1 Data

The 2008 land use dataset was used as a baseline for this survey. During the desktop interpretation a number of spatial anomalies in the baseline data were identified. These anomalies are the result of a number of factors, such as:

- Higher resolution imagery – the imagery used in the 2008 survey may not have been of a sufficient quality to accurately resolve fence lines and land use changes.
- Merged datasets – for the 2008 survey a number of datasets were merged to form the baseline. These included cadastre, remnant native vegetation and forestry data. Some slivers and overlaps were created as a result and not all of these were rectified.
- Spatial improved cadastre – since the 2008 land use survey, the South Australian Government has embarked on a program to improve the accuracy of the cadastre across the State. There are a number of urban areas across the survey area where this has occurred. As a consequence there is some variation between the features of the land use dataset and the updated cadastre. The difference was deemed to be inconsequential to the land use survey and no a further action was taken to address it.

5.2 Timing

Timing of the field survey was suitable (commencing 19th Sep 2016). Crop types and commodity were sometimes difficult to identify, particularly towards the end of the survey (end 13th Dec 2016) after harvesting had begun and only stubble remained in the paddock. There was some difficulty distinguishing between similar horticultural commodities such as apples and pears at the time of year. Timing of the survey can have a significant impact on the ability to reliably identify agricultural land uses to the tertiary level and commodity. It is recommended that timing for field work be considered in the planning of future land use surveys to ensure that the data can be collected with confidence.

5.3 Field Survey

The field survey was undertaken only on publically accessible roads. Field teams did not have permission to enter private property. In some instances, access or visual inspection of a site was not possible. In this case the desktop assigned land use was accepted.

Due to a major storm which occurred prior to the survey in September, a number of areas were flooded or roads washed out, contributing to accessibility issues.

Field teams approached the survey from an agricultural perspective. A priority was given to agricultural land use categories. Care should be taken when referencing Natural Environment classes such as remnant native vegetation and wetlands as these areas were not as thoroughly investigated.

5.4 Comparative Studies

Some key points when using this dataset for comparative analyses with those collected previously (2008 and others):

1. Additional classes have been added to ALUM Classification Version 8. These need to be accounted for so when comparing to previously collected data in order to avoid any statistical errors in the comparison.

2. Due to timing of the survey and other reasons, many more features were able to be classified to the tertiary level than the 2008 survey.

6.0 Land Use Classification Assumptions

Below is an outline of the assumptions used during the desktop interpretation when applying a selected class to a feature. Not all classes are listed, only those where general assumptions could be made. Note, these assumptions are specific to the AMLR study area and may not be transferrable to other land use mapping projects.

Conservation and Natural Environments (1.0.0)

Natural conservation (1.1.0 -1.1.6)

Sourced from National Parks and Reserves dataset. Some parks manually attributed as they were not present in the original data.

Other conserved area (1.1.7)

Typically Native Vegetation Heritage Agreements.

Landscape (1.2.4)

Areas of land in between the boundary of the cadastre and the coastline, or strips of land along the coastline.

Residual native cover (1.3.3)

Sourced from the SA Vegetation data.

Production from Relatively Natural Environments (2.0.0)

Grazing native vegetation (2.1.0)

Will generally be found in the pastoral region. Greater than 50 percent dominant native species.

Production from Dryland Agriculture and Plantations (3.0.0)

Environmental forest plantation (3.1.4)

Plantings for the prevention of land degradation, windbreaks, shade and shelter.

Grazing modified pastures (3.2.0)

Paddock has visible lines through the middle, at gates or at water points. Livestock sometimes visible.

Woody fodder plants (3.2.2)

Saltbush etc.

Cropping (3.3.0)

Visible cropping lines or a paddock of tall grasses.

Hay and silage (3.3.3)

Recently cut paddock visible with bales of hay within the paddock or to the side.

Land in transition (3.6.0)

Burnt off areas and areas under tillage.

Production from Irrigated Agriculture and Plantations (4.0.0)

Grazing irrigated modified pastures (4.2.0)

Paddock looks greener in comparison to surrounding pastures. Evidence of livestock or irrigation equipment.

Irrigated cropping (4.3.0)

Paddocks tend to look greener in comparison to surrounding land in aerial imagery. You may see cropping lines or a paddock of tall grasses. ***Centre pivots-*** If there is more than one visible land use type, do not separate them.

Irrigated perennial horticulture (4.4.0)

Trees which are square planted are generally olives.

Intensive Uses (5.0.0)

Manufacturing and Industrial (5.3.0)

Includes scrap yards.

Urban residential (5.4.1)

Shacks may be coded 5.4.0. Otherwise residential/vacant blocks within town or urban built-up areas. Car parks.

Rural residential with agriculture (5.4.2)

Hobby farms in the peri-urban region. Whole blocks should be mapped as 5.4.2 even if partially vegetated. Excludes livestock as pets and gardens. Do not distinguish between different land uses unless they are of sufficient area (0.25 ha).

Rural residential without agriculture (5.4.3)

Includes livestock as pets and gardens, may have native vegetation. No evidence of hobby agriculture.

Farm buildings/infrastructure (5.4.5)

Houses, buildings, sheds and other infrastructure associated with farming.

Roads (5.7.2)

Left as previously mapped.

Water (6.0.0)

Lake –conservation (6.1.1)

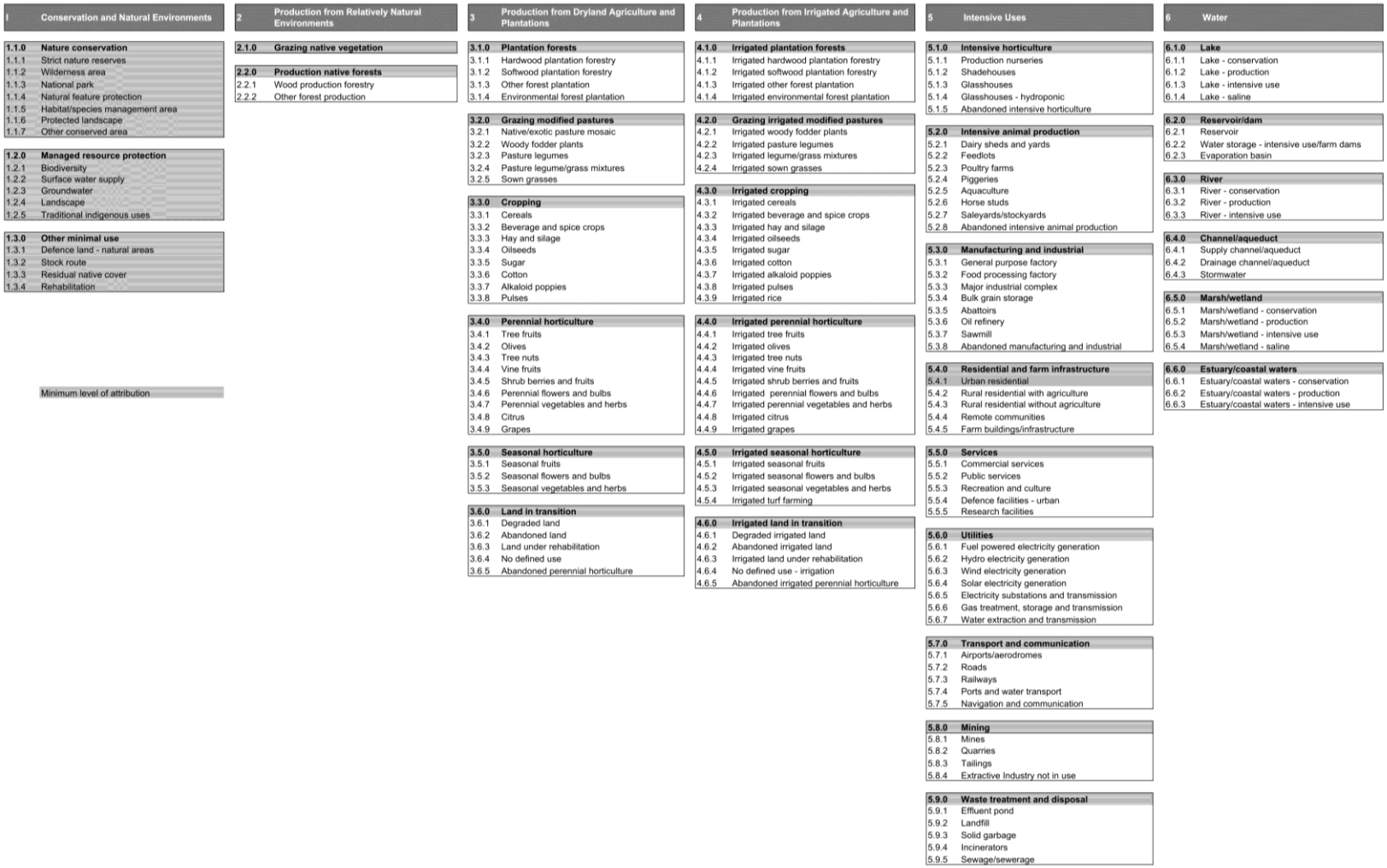
Lakes within national parks or other conserved areas (1.1.1 - 1.1.7) should be coded separately. This also applies to rivers, marsh/wetland and estuary/coastal waters.

7.0 References

Bureau of Rural Sciences 2011, *Guidelines for land use mapping in Australia: principles, procedures and definitions – A technical handbook supporting the Australian Collaborative Land Use and Management Program*, 4th edition, Bureau of Rural Sciences, Canberra

ABARES 2016, *The Australian Land Use and Management Classification Version 8*, Bureau of Agricultural and Resource Economics and Sciences, Canberra

Appendix A: Summary of the Australian Land Use and Management Classification version 8 (revision as at October 2016)



1	Conservation and Natural Environments
1.1.0	**Nature conservation**
1.1.1	Strict nature reserves
1.1.2	Wilderness area
1.1.3	National park
1.1.4	Natural feature protection
1.1.5	Habitat/species management area
1.1.6	Protected landscape
1.1.7	Other conserved area
1.2.0	**Managed resource protection**
1.2.1	Biodiversity
1.2.2	Surface water supply
1.2.3	Groundwater
1.2.4	Landscape
1.2.5	Traditional indigenous uses
1.3.0	**Other minimal use**
1.3.1	Defence land - natural areas
1.3.2	Stock route
1.3.3	Residual native cover
1.3.4	Rehabilitation

Minimum level of attribution

2	Production from Relatively Natural Environments
2.1.0	**Grazing native vegetation**
2.2.0	**Production native forests**
2.2.1	Wood production forestry
2.2.2	Other forest production

3	Production from Dryland Agriculture and Plantations
3.1.0	**Plantation forests**
3.1.1	Hardwood plantation forestry
3.1.2	Softwood plantation forestry
3.1.3	Other forest plantation
3.1.4	Environmental forest plantation
3.2.0	**Grazing modified pastures**
3.2.1	Native/exotic pasture mosaic
3.2.2	Woody fodder plants
3.2.3	Pasture legumes
3.2.4	Pasture legume/grass mixtures
3.2.5	Sown grasses
3.3.0	**Cropping**
3.3.1	Cereals
3.3.2	Beverage and spice crops
3.3.3	Hay and silage
3.3.4	Oilseeds
3.3.5	Sugar
3.3.6	Cotton
3.3.7	Alkaloid poppies
3.3.8	Pulses
3.4.0	**Perennial horticulture**
3.4.1	Tree fruits
3.4.2	Olives
3.4.3	Tree nuts
3.4.4	Vine fruits
3.4.5	Shrub berries and fruits
3.4.6	Perennial flowers and bulbs
3.4.7	Perennial vegetables and herbs
3.4.8	Citrus
3.4.9	Grapes
3.5.0	**Seasonal horticulture**
3.5.1	Seasonal fruits
3.5.2	Seasonal flowers and bulbs
3.5.3	Seasonal vegetables and herbs
3.6.0	**Land in transition**
3.6.1	Degraded land
3.6.2	Abandoned land
3.6.3	Land under rehabilitation
3.6.4	No defined use
3.6.5	Abandoned perennial horticulture

4	Production from Irrigated Agriculture and Plantations
4.1.0	**Irrigated plantation forests**
4.1.1	Irrigated hardwood plantation forestry
4.1.2	Irrigated softwood plantation forestry
4.1.3	Irrigated other forest plantation
4.1.4	Irrigated environmental forest plantation
4.2.0	**Grazing irrigated modified pastures**
4.2.1	Irrigated woody fodder plants
4.2.2	Irrigated pasture legumes
4.2.3	Irrigated legume/grass mixtures
4.2.4	Irrigated sown grasses
4.3.0	**Irrigated cropping**
4.3.1	Irrigated cereals
4.3.2	Irrigated beverage and spice crops
4.3.3	Irrigated hay and silage
4.3.4	Irrigated oilseeds
4.3.5	Irrigated sugar
4.3.6	Irrigated cotton
4.3.7	Irrigated alkaloid poppies
4.3.8	Irrigated pulses
4.3.9	Irrigated rice
4.4.0	**Irrigated perennial horticulture**
4.4.1	Irrigated tree fruits
4.4.2	Irrigated olives
4.4.3	Irrigated tree nuts
4.4.4	Irrigated vine fruits
4.4.5	Irrigated shrub berries and fruits
4.4.6	Irrigated perennial flowers and bulbs
4.4.7	Irrigated perennial vegetables and herbs
4.4.8	Irrigated citrus
4.4.9	Irrigated grapes
4.5.0	**Irrigated seasonal horticulture**
4.5.1	Irrigated seasonal fruits
4.5.2	Irrigated seasonal flowers and bulbs
4.5.3	Irrigated seasonal vegetables and herbs
4.5.4	Irrigated turf farming
4.6.0	**Irrigated land in transition**
4.6.1	Degraded irrigated land
4.6.2	Abandoned irrigated land
4.6.3	Irrigated land under rehabilitation
4.6.4	No defined use - irrigation
4.6.5	Abandoned irrigated perennial horticulture

5	Intensive Uses
5.1.0	**Intensive horticulture**
5.1.1	Production nurseries
5.1.2	Shadehouses
5.1.3	Glasshouses
5.1.4	Glasshouses - hydroponic
5.1.5	Abandoned intensive horticulture
5.2.0	**Intensive animal production**
5.2.1	Dairy sheds and yards
5.2.2	Feedlots
5.2.3	Poultry farms
5.2.4	Piggeries
5.2.5	Aquaculture
5.2.6	Horse studs
5.2.7	Saleyards/stockyards
5.2.8	Abandoned intensive animal production
5.3.0	**Manufacturing and industrial**
5.3.1	General purpose factory
5.3.2	Food processing factory
5.3.3	Major industrial complex
5.3.4	Bulk grain storage
5.3.5	Abattoirs
5.3.6	Oil refinery
5.3.7	Sawmill
5.3.8	Abandoned manufacturing and industrial
5.4.0	**Residential and farm infrastructure**
5.4.1	Urban residential
5.4.2	Rural residential with agriculture
5.4.3	Rural residential without agriculture
5.4.4	Remote communities
5.4.5	Farm buildings/infrastructure
5.5.0	**Services**
5.5.1	Commercial services
5.5.2	Public services
5.5.3	Recreation and culture
5.5.4	Defence facilities - urban
5.5.5	Research facilities
5.6.0	**Utilities**
5.6.1	Fuel powered electricity generation
5.6.2	Hydro electricity generation
5.6.3	Wind electricity generation
5.6.4	Solar electricity generation
5.6.5	Electricity substations and transmission
5.6.6	Gas treatment, storage and transmission
5.6.7	Water extraction and transmission
5.7.0	**Transport and communication**
5.7.1	Airports/aerodromes
5.7.2	Roads
5.7.3	Railways
5.7.4	Ports and water transport
5.7.5	Navigation and communication
5.8.0	**Mining**
5.8.1	Mines
5.8.2	Quarries
5.8.3	Tailings
5.8.4	Extractive Industry not in use
5.9.0	**Waste treatment and disposal**
5.9.1	Effluent pond
5.9.2	Landfill
5.9.3	Solid garbage
5.9.4	Incinerators
5.9.5	Sewage/sewerage

6	Water
6.1.0	**Lake**
6.1.1	Lake - conservation
6.1.2	Lake - production
6.1.3	Lake - intensive use
6.1.4	Lake - saline
6.2.0	**Reservoir/dam**
6.2.1	Reservoir
6.2.2	Water storage - intensive use/farm dams
6.2.3	Evaporation basin
6.3.0	**River**
6.3.1	River - conservation
6.3.2	River - production
6.3.3	River - intensive use
6.4.0	**Channel/aqueduct**
6.4.1	Supply channel/aqueduct
6.4.2	Drainage channel/aqueduct
6.4.3	Stormwater
6.5.0	**Marsh/wetland**
6.5.1	Marsh/wetland - conservation
6.5.2	Marsh/wetland - production
6.5.3	Marsh/wetland - intensive use
6.5.4	Marsh/wetland - saline
6.6.0	**Estuary/coastal waters**
6.6.1	Estuary/coastal waters - conservation
6.6.2	Estuary/coastal waters - production
6.6.3	Estuary/coastal waters - intensive use

Source: ABARES 2016, p26

Appendix B: Adelaide and Mt Lofty Ranges land use map, 2016