

***Survey and description of the Seasonal
Herbaceous Wetlands (Freshwater) of the
Temperate Lowland Plains in the South East
of South Australia.***



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Cover photo: *Craspedia paludicola* at a Seasonal Herbaceous Wetland in Bangham Conservation Park.

Disclaimer

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EXECUTIVE SUMMARY

The Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains ecological community is listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999*. Due to the difficulty in using existing coarse floristic data to accurately establish the extent of a community dominated by herbaceous species, the listing went ahead in 2012 in the knowledge that the South Australian mapping of the vegetation community would require future field verification.

This project used a combination of existing datasets, expert workshops and detailed field survey validation methods to improve the identification and mapping of the ecological community in South Australia.

A total of 174 wetlands were visited and assessed through the project; with 100 of these passing the initial visual validation test, leading to a full validation survey (see Table below). Of those sites surveyed in more detail, 95 sites (total area = 563.12 ha) were confirmed as Seasonal Herbaceous Wetlands.

A majority (54 sites) qualify for consideration as high value sites within the listing guidelines, from a total of 77 sites which met all the basic requirements of the listing advice, leaving 18 sites that were excluded on the basis of size or habitat condition.

The size of sites was variable however; it is significant to note that over 60% of Seasonal Herbaceous Wetlands were less than five hectares in area.

Assessment type	Category	# of wetlands
Visual verification	Not Seasonal Herbaceous Wetland	74
Full survey verification	SHW - High Value EPBC listing	54
	SHW - EPBC Listing	23
	SHW - too small	6
	SHW - low quality & too small	3
	SHW - low quality	9
	Not Seasonal Herbaceous Wetland	5
Total number assessed		174

In terms of general geography, the ecological community is distributed from Willalooka (in the north) to Mount Gambier (in the south) and from the SA-Victoria border to Padthaway in the west. South Australian Seasonal Herbaceous Wetlands conform well to the physical environment, hydrology, vegetation and fauna characteristics of the national listing advice. However, the surveys confirmed that Seasonal Herbaceous Wetlands in South Australia are highly variable in floristic composition and dynamic in nature. Six wetland vegetation types are suggested in this report (see following Table) to provide future guidance in the identification, management and conservation of this community.

Fringing Overstorey or Emergent Species (<10%)	Suggested Wetland Vegetation Type
① <i>Eucalyptus camaldulensis</i>	<i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland
② +/- emergent/isolated <i>Eucalyptus camaldulensis</i>	<i>Carex tereticaulis</i> +/- <i>Eleocharis acuta</i> +/- <i>Glyceria australis</i> +/- <i>Lachnagrostis</i> spp. +/- <i>Amphibromus</i> spp. +/- <i>Triglochin</i> spp. Seasonal Herbaceous Grass/sedge Wetland
③ +/- <i>Eucalyptus. camaldulensis</i>	<i>Glyceria australis</i> +/- <i>Amphibromus</i> spp. +/- <i>Lachnagrostis filiformis</i> , <i>Montia australasica</i> +/- <i>Triglochin</i> spp. Seasonal Herbaceous Grass/sedge Wetland
④ <i>Eucalyptus leucoxydon</i> +/- <i>Callistemon rugulosus</i> , +/- emergent <i>E. camaldulensis</i>	<i>Amphibromus</i> spp., +/- <i>Chorizandra enodis</i> , +/- <i>Craspedia paludicola</i> <i>Rytidosperma duttonianum</i> . +/- <i>Ornduffia reniformis</i> +/- <i>Utricularia</i> spp. Seasonal Herbaceous Wetland
⑤ +/- <i>E. camaldulensis</i> , +/- <i>Allocasuarina luehmannii</i> +/- <i>Duma (syn. Muehlenbeckia) florulenta</i>	<i>Amphibromus</i> spp., <i>Eleocharis acuta</i> , +/- <i>Swainsona procumbens</i> , +/- <i>Craspedia paludicola</i> , +/- <i>Schoenus tesquorum</i> Gilgai Seasonal Herbaceous Grass/sedge Wetland Mosaic
⑥	<i>Triglochin procera</i> , <i>Montia australica</i> , <i>Potamogeton</i> spp. <i>Myriophyllum</i> spp. +/- <i>Ornduffia reniformis</i> Seasonal Herbaceous Wetland

The dynamic nature of Seasonal Herbaceous Wetlands means that as conditions change, it is quite conceivable that currently verified sites may at some future time no longer meet the listing requirements. As a *critically endangered* community at the national level it raises the question as to whether management should (where possible) proactively seek to maintain present habitat condition, in spite of other natural factors that may result in a vegetation community shift away from being consistent with the listing? This is a philosophical question that land managers in the South East are advised to consider, because in the context of this report it is clear that inaction (passive management) is in itself a management decision that will have implications.

Finally, as a result of the work summarised in this report, it is recommended that:

- as surveys continue at Seasonal Herbaceous Wetlands in South Australia, the six suggested wetland vegetation types are further refined.
- the data set is supplemented to increase the volume of stored conservation measures in SAWID.
- recommended conservation management actions are undertaken at specified wetlands.
- the South Australian Seasonal Herbaceous Wetland mapping layer provided should be further developed, not thought of as a finished, static product.
- future survey priorities include:
 - the list of thirty wetlands still requiring verification provided in this report;
 - the Bool Lagoon Wetland Complex;
 - the Dismal Swamp Wetland Complex; and,
 - in the medium-term, periodic revisiting of previously surveyed sites to evaluate and monitor background change through time, and where relevant, response to management regime.

1 INTRODUCTION

1.1 Background

The Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains ecological community (herein referred to as Seasonal Herbaceous Wetlands or SHW) was formally listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) on the 14th of the March 2012. The ecological community occurs in southern New South Wales, throughout Victoria and into the South East of South Australia. In South Australia the community is described as occurring in the Naracoorte Coastal Plain, Murray Darling Depression and Victorian Volcanic Plain IBRA regions (TSSC 2012a).

1.2 Seasonal Herbaceous Wetland Description

The Seasonal Herbaceous Wetland ecological community is variable in its floristic composition across its range and this trend is also evident in South Australia. SHW correspond to two main wetland groups recognised in South Australia, Freshwater Meadows and, in part, Grass Sedge Wetlands. Herpich and Butcher (2009) describe these wetland types as occurring on temperate palustrine systems on generally flat landforms.

Freshwater Meadows are described as small, often less than one hectare, ephemeral wetlands, characterised by annual wetting and drying in average years, fringed by gum trees, and underlain by a clay base (Herpich and Butcher 2009).

The Grass Sedge Wetland group in South Australia is diverse and includes a number a wetland vegetation communities. Seasonal Herbaceous Wetlands only include Grass Sedge Wetlands that are fresh (seasonally supplied by local run-off) and are dominated by forbs and graminoids, as described in the listing advice (TSSC 2012a).

The key characteristics of Seasonal Herbaceous Wetlands, such as the physical environment, hydrology, vegetation and dependent fauna, are provided in detail in the listing advice of the ecological community (TSSC 2012a). Seasonal Herbaceous Wetlands occur on lowland plains, where they are generally associated with fertile, poorly draining clays; in some cases including Gilgai (shrinking/swelling mounded clay soil formations). For the listed community, rainfall predominantly occurs in winter and spring, with an average of between 400 to 800 mm per year; however, in the northern distribution of the ecological community the average rainfall can be as low as 350 mm per year.

Seasonal Herbaceous Wetlands are typically inundated by local seasonal rainfall events; not relying on flows associated with the distant catchments of riverine systems, but may occur in seasonal drainage lines and depressions. In some cases they have poor spatial definition due to the flat topography typical of their occurrence. While they are fed by local runoff, in some instances there may also be some groundwater influence that helps to retain inundation and/or moisture in the soil profile. In keeping with their name, in typical years Seasonal Herbaceous Wetlands will fill and dry annually, however, in a drought or unseasonal wet phase they may appear respectively ephemeral or permanent for occasional periods. Being rainfall-driven, Seasonal Herbaceous Wetlands are

generally very fresh, with salinities of less than 1000 mg/L, however, during drying it is possible that they may evapo-concentrate, with salinities increasing up to 3000 mg/L.

What constitutes a Seasonal Herbaceous Wetland, in terms of vegetation community, is highly variable both across the distribution of the ecological community and temporally, due to these seasonal nature of many of its constituent species. In this respect, the listing advice is a key classification tool, providing a reference of species for inclusion/exclusion (TSSC 2012a). Seasonal Herbaceous Wetland basins are generally treeless, with fringing trees or emergents with a projective foliage cover of less than 10%. Commonly occurring overstorey species include *Eucalyptus* spp., *Allocasuarina luehmannii* and *Duma* (syn. *Muehlenbeckia*) *florulenta*. The ground layer dominates the system and is herbaceous, often with a considerable graminoid component and may include freshwater algae. Typically *Amphibromus* spp., *Carex tereticaulis*, *Deyeuxia* spp., *Glyceria* spp., *Lachnagrostis* spp., *Poa labillardieri* and *Rytidosperma* (syn. *Austrodanthonia*) *duttonianum*, are present or common, including as a dominant or co-dominant. The majority of the community is composed of herbs, shorter sedges and graminoids; however, taller graminoids (described in the listing) may be present provided they are never dominant, with abundances less than 25%. Common genera include *Allittia*, *Asperula*, *Brachyscome*, *Craspedia*, *Epilobium*, *Eryngium*, *Lobelia*, *Marsilea*, *Montia* (syn. *Neopaxia*), *Ornduffia* (syn. *Villarsia*), *Pycnosorus* and *Ranunculus*.

Seasonal Herbaceous Wetlands are important for a number of faunal groups that are dependent on regular standing water for food and habitat. In particular, aquatic invertebrates (aquatic insects and crustaceans), frogs, reptiles and water birds which require shallow temporary wetlands frequently use these wetlands. Given the lack of permanency, both fishes and aquatic mammals tend to be absent from this community, however, mammals may move into the area for short periods of time during wetland abundance. A number of federally and state listed species, or other species of regional interest, have been recorded within Seasonal Herbaceous Wetlands, including (but not limited to) the Southern Bell-frog (*Litoria raniformis*), Glossy Grass-skink (*Pseudomoia rawlinsoni*), Southern Smooth Froglet (*Geocrinia laevis*), Brolga (*Grus rubicunda*), Shield Shrimp (*Lepidurus apus viridis*) and Fairy Shrimp. For full fauna details refer to the community listing advice (TSSC 2012a).

To qualify for listing under the EPBC Act 1999, Seasonal Herbaceous Wetlands are required to meet a minimum condition and size requirement, additional to meeting the previously mentioned physical, hydrological and biological criteria. Listed wetlands must retain greater than 50% total cover of vascular plants listed in the listing advice (TSSC 2012a) during the wet phase. The wetland must also be equal to or greater than 0.5 ha if it is an isolated wetland, or have a collective area of wetland of 0.5 ha within a 5 ha grouping if they are fine scale clusters (like Gilgai) or be within 1 ha of remnant vegetation if the wetland is 0.1 – 0.5 ha. Additionally, a wetland may qualify as high value if it has three or more of the high value species or genera described in the listing advice.

In the listing advice for Seasonal Herbaceous Wetlands is acknowledged that some wetlands would meet the physical, hydrological and biological criteria, but not the condition or size requirements. Failing to meet the condition or size criteria does not exclude the wetland from the Seasonal Herbaceous Wetland ecological community or mean that it is not important at a State level (TSSC 2012a). However, it does mean that such sites are not offered the formal legislative protections of the EPBC Act 1999.

1.3 The South Australian experience

Predictive mapping of Seasonal Herbaceous Wetlands was undertaken in South Australia for the ecological community using characteristics described in the then draft listing advice, on the best available data in 2011, and identified 126 wetland polygons for the EPBC Act 1999 listing advice. The initial mapping gave land-managers and government agencies an initial reference point for a subsequent (more accurate) determination of the geographic extent of the listed community. From expert knowledge within the South East region, it was apparent that the mapping required refining with a number of false positive and false negative sites already identified. Hence the listing description and correlating vegetation associations needed better definition in South Australia to both (a) enable the threatened ecological community to be more accurately identified and, (b) ultimately, to ensure the implementation of conservation measures capable of achieving a higher level of protection.

1.4 Project scope and objectives

The aim of the project and this summary report is to improve knowledge and mapping accuracy of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains in the South East of South Australia. This project helps to meet the first of the research priorities listed in the conservation advice for the community:

- *“Support and enhance existing surveys to identify and map the ecological community, particularly wetlands of high conservation priority, and to gain a better understanding of variation and condition across the ecological community” (TSSC 2011b).*

The requirements of this project were to:

- Hold a Technical Reference Workshop of key wetland ecologists to validate the current Seasonal Herbaceous Wetland mapping layer and identify potential wetlands to validate in the field;
- Identify the condition and locations of Seasonal Herbaceous Wetlands in the South East of South Australia through field validation using the listing advice;
- Ensure that all data is entered in the South Australian Wetland Inventory Database (SAWID);
- Produce a new ArcGIS layer of Seasonal Herbaceous Wetlands in the South East of South Australia, compatible with South Australian Government software; and
- Provide a concise report that identifies:
 - At least 40 Seasonal Herbaceous Wetlands and their condition;
 - Compares the Seasonal Herbaceous Wetland of South Australia with the National Listing Advice (TSSC 2012a);
 - Provides advice to what would be the best description for Seasonal Herbaceous Wetland in the South East; and
 - Identifies threats and management issues of Seasonal Herbaceous Wetland in the South East of South Australia.

2 METHODOLOGY

2.1 Project Location

The project was conducted in the South East of South Australia. Focal Interim Biogeographic Regionalisation for Australia (IBRA) regions of the project included Naracoorte Coastal Plain, Murray Darling Depression and Victorian Volcanic Plain. These IBRA regions include the sub-regions of Mount Gambier, Glenelg Plain, Lucindale, Tintinara and Lowan Mallee (southern portion). The annual average rainfall varies from 462 mm at Keith in the north of the region, to 712 mm at Mount Gambier in the south of the region (data from the Bureau of Meteorology www.bom.gov.au, accessed 12/02/2014).

The geographic extent of the focal survey area to identify the actual extent mirrors that of the original South Australian predictive mapping of Seasonal Herbaceous Wetlands in the South East Region (Figure 1).

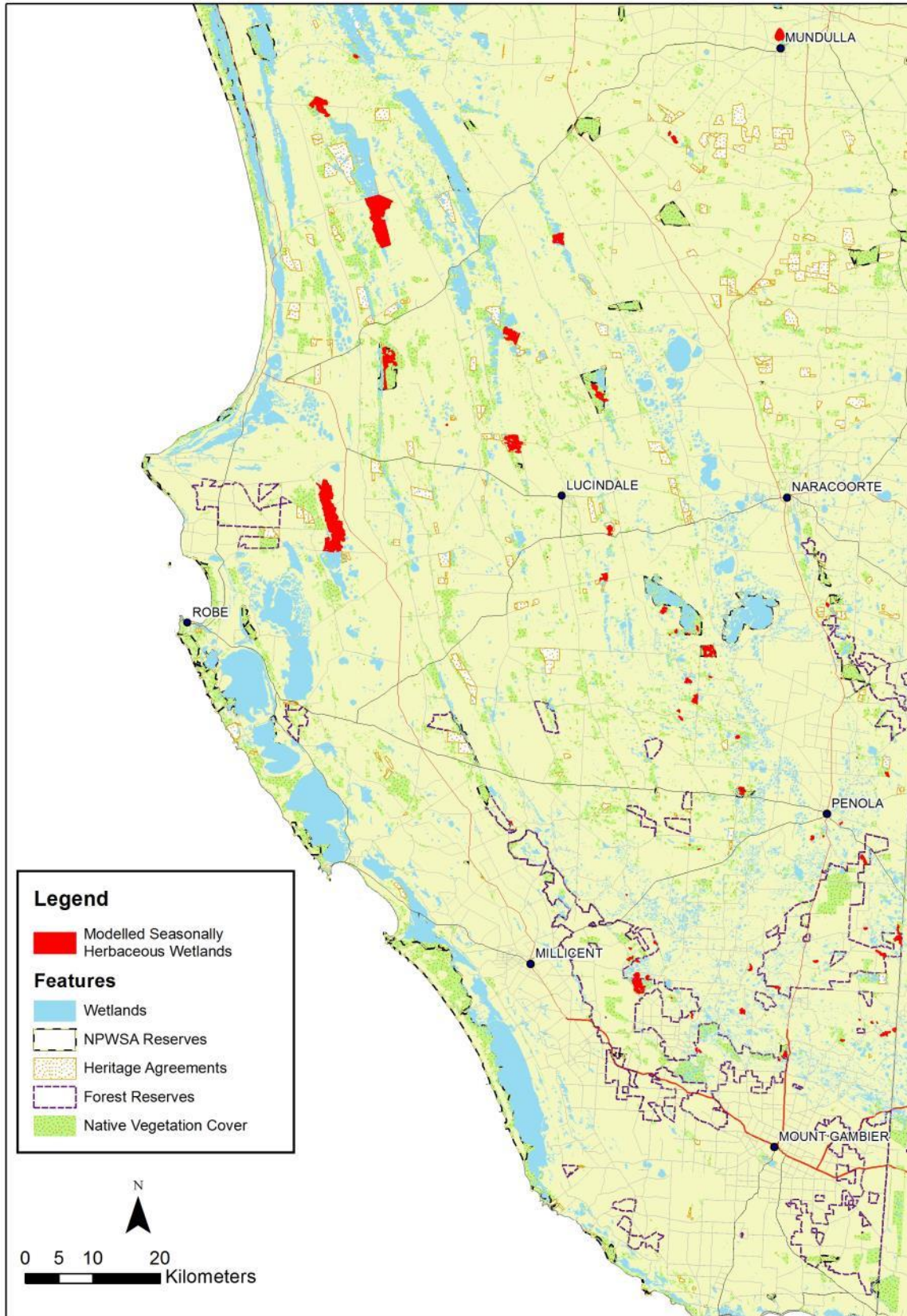


Figure 1: Seasonal Herbaceous Wetland project location in the South East of South Australia and the modelled distribution of Seasonal Herbaceous Wetlands, as determined by predictive mapping in 2011.

2.2 Technical Reference Workshop

A Technical Reference Workshop was held on the 24th of October 2013, with invitations extended to people with regionally specific expertise in wetlands and flora. Attendees included:

- Department of Environment, Water and Natural Resources (DEWNR): Steve Clarke, Jennifer Shilling, Ben Taylor, Abigail Goodman, Peter Tucker, Mark de Jong, Oisín Sweeney and Dan Duval.
- ForestrySA: Troy Horn and Bryan Haywood.
- Nature Glenelg Trust (NGT): Cath Dickson and Lachlan Farrington.

Prior to the workshop, attendees were provided with the listing advice and current map of Seasonal Herbaceous Wetlands across the South East of SA and asked to consider:

- Whether wetlands marked on the map fit the Seasonal Herbaceous Wetland description;
- Why the wetland either qualifies or fails to meet the national criteria as a Seasonal Herbaceous Wetland; and,
- If there are other wetlands in the region that may fit the description and what the tenure of the wetland is.

The current Seasonal Herbaceous Wetland GIS layer was critiqued and a list was compiled of wetlands that were known to:

- Qualify as a Seasonal Herbaceous Wetland and therefore do not need validating, as they have been formally surveyed and assessed to the satisfaction of the group;
- Not to be a Seasonal Herbaceous Wetland with clarified reasons; and,
- Need to be validated as the wetland potentially meets the Seasonal Herbaceous Wetland listing advice.

2.3 Site Validation – wetland surveys

Wetlands nominated at the workshop for validation as Seasonal Herbaceous Wetlands were mapped and then prioritised for site verification, determined by:

1. the rate at which they would dry (broadly relative to longitudinal location in region);
2. predicted condition (from local expert knowledge); and,
3. accessibility.

The wetlands in the Upper South East are known to be the most ephemeral, with warmer drying conditions occurring earlier in the season, hence they were prioritised for first visitation.

Site validation occurred over seventeen days between 6th of November and 12th of December 2013. Permission to undertake site visits was sought from all landholders prior to survey. Field data sheets were designed to collect data important for listing advice of Seasonal Herbaceous Wetlands and to be compatible with entering directly into the South Australian Wetland Inventory Database (SAWID).

Survey protocols given in the listing advice (TSSC 2012a) were followed to ensure that the field assessments were to an appropriate standard. The standards were as follows:

- The lead field assessor and many co-assessors have experience working and surveying wetlands in the South East of SA;
- Surveys were undertaken as the wetlands were beginning to recede, capturing maximum floristic diversity;
- Surveys were not conducted following recent modification through mowing or recent grazing (heavy) in the wetland basin itself;
- Condition was determined over a representative area of the wetland, following an overall assessment of the wetland, which included assessing areas of variability within the basin.

At each site an initial general appraisal was made as to whether it was likely to fit the criteria for listing as Seasonal Herbaceous Wetland. Wetlands that were clearly outside the ecological community were not assessed in further detail. At each wetland that appeared to meet the listing advice for being considered a Seasonal Herbaceous Wetland, the following information was recorded to assist in determining its type:

- Site information: Australian Wetland Number, wetland location information, local wetland name, tenure and landholder;
- Date visited and observers;
- Size class;
- Water quality: salinity (EC $\mu\text{S}/\text{cm}^2$), pH, dissolved oxygen (%), temperature ($^{\circ}\text{C}$), turbidity (NTU), maximum depth (m) and importantly frequency, length, and source of inundation;
- Soil description;
- Condition class (as defined in SAWID):
 - **Pristine – 5:** No obvious disturbance, with high native species diversity. Scored mostly intact rapid assessment scores. Usually formally conserved with the reserve system;
 - **Almost Pristine – 4.5:**
 - **Intact – 4:** Small amounts of disturbance evident, with high native species diversity. Damage easily rectifiable. Received mostly moderate - intact rapid assessment scores;
 - **Moderately Intact – 3.5:** Significant level of disturbance evident, although high native species diversity and values remain;
 - **Moderate – 3:** Significant level of disturbance evident, although high native species diversity and values remain;
 - **Moderately degraded – 2.5:** Significant level of disturbance evident, some natural values although verging on un-rectifiable damage;
 - **Degraded – 2:** High level of disturbance evident. Verging on un-rectifiable damage. Received mostly low rapid assessment scores;
 - **Severely degraded – 1:** Very high level of disturbance evident to the extent that wetland values are destroyed or irreversibly modified. Received mostly low or none rapid assessment scores.
 - **Completely degraded – 0:** Wetland completely degraded.
- Wetland type, vegetation community and/wetland vegetation component present;
- Tree cover (%);
- Native flora cover (%);

- Observational flora species list, with primary focus on identifying native and exotic species tabled in the listing advice (APPENDIX A), including species that may describe whether the wetland is of high value;
- Observational fauna species list, indicating whether the species was observed, identified through calls or by traces;
- Threats present (using SAWID codes): e.g. grazing, forestry, cropping, weeds, hydrological (drainage – both immediate vicinity and outside influences); and,
- Suggested management actions (using SAWID codes): e.g. fencing, hydrological restoration, weed control, altered grazing regime.

2.4 WetCAT assessments

The Wetland Condition Assessment Tool (WetCAT) is currently under review, as part of its development phase (Farrington *et al.*, under review 2013). While considerable modifications are required for WetCAT to be used (as intended) to provide a robust condition inference framework, the level of detail and baseline information generated from assessments can be supplemented with additional data to provide an additional description of the different wetland variations within the Seasonal Herbaceous Wetland ecological community.

A detailed methodology is provided in Farrington *et al.* (under review 2013).

During the current survey period, three wetland types/variations were chosen for WetCAT assessment, to be selected from sites already being investigated:

1. *Eucalyptus camaldulensis* var. *camaldulensis* seasonal herbaceous swamp;
2. Gilgai wetland mosaic seasonal herbaceous swamp; and,
3. Modified *Eucalyptus camaldulensis* var. *camaldulensis* seasonal herbaceous swamp, with higher grass-sedge dominance.

Temporary transects were established from the deepest point of the wetland and set to the shore, incorporating the most representative number of wetland vegetation components (WVCs) as possible. The three sites were surveyed while wet in late November and again during their dry phase in the first week of February. Information gathered also included landscape level data, such as:

- landscape context;
- infrastructure within the basin;
- altered hydrology both within and outside of the basin;
- landholder information;
- current land use;
- adjacent land uses;
- if the wetland was in a recovering or declining condition; and,
- whether recovery could be assisted through a change in land management practices.

Transects were visually separated into WVCs (as per Ecological Associates 2009) with the start and end position of each recorded and photographed. For each designated WVC the following was recorded:

- Water quality information (EC, pH, and depth) at the start and end of the transect;
- Percent cover of open water/bare ground, live vegetation and litter within the 30 x 30 m quadrat;
- All species within the 30x30m area, recording their abundance, dominance, life form and grazing pressure. Dominant flora species then require to have the number of life and stages, and health rating noted; and,
- Overall weediness of the WVC.

Using the information gathered the wetland condition is scored out of five for each the following components: buffer, soil disturbance, recruitment, shrub health, sedge/herb health, grazing and weeds. Five indicated excellent, four is good, three is moderate, two is poor and one is very poor.

As WetCAT is still under review, a full analysis of data is not possible. Most notably, the biotic components of WetCAT require refinement. However, the biotic components have been evaluated using the Victorian Index of Wetland Condition (IWC) (DSE, 2011) framework using benchmarks for Ecological Vegetation Components (EVCs) (DSE, 2010) which align with those observed in these surveys. The benchmarks provide an assessment of life form representation, evidence for altered processes, weediness and vegetation community structure and health. In this instance the Plains Grassy Wetland and Redgum Swamp EVC benchmarks were used.

2.5 Data Entry and Analysis

Data was entered directly into SAWID under project code **156 – Seasonal Herbaceous Wetland – NGT 2013**. In the Upper South East Bangham district this necessitated creating new polygons. The new wetland polygons were mapped before being given a unique Australian Wetland Number by Claire Harding (DEWNR).

Database queries from SAWID were used to interpret the data. Wetlands were assessed to determine whether they met:

- The physical and ecological description of Seasonal Herbaceous Wetlands; and,
- The condition and size requirements to qualify for listing under the EPBC Act 1999;

and, if so whether they had:

- three or more high quality species (APPENDIX A), to qualify them as a ‘high quality’ site under the EPBC Act 1999.

2.6 ArcGIS Seasonal Herbaceous Wetland Mapping Layer

Information gathered from the field validation was used to create the Seasonal Herbaceous Wetland mapping layer in ArcGIS. Only wetlands that met the ecological and physical Seasonal Herbaceous Wetland description were added to the layer. Each wetland polygon was verified with the digital elevation model (DEM) layer and ground-truthing. Wetland polygons were updated to reflect their true extent. The following additional fields were included within the shape file's attribute table:

- Aust_WetNr (Australian Wetland Number);
- If the site was verified on-ground: yes or no;
- EPBC Listing: yes, no or null (if unverified);
- High Value EPBC site: yes or no;
- Condition Score (as per SAWID: 0 = Degraded – 5 = Pristine); and,
- Weediness score, using the Braun-Blanquet Scale:

Table 1: Braun-Blanquet Scale

Cover Abundance Code	Cover Abundance Description
0	None
N	Not many (1 - 10 individuals)
T	Sparsely or very sparsely present; cover less than 5%.
1	Plentiful, but of small; cover less than 5%
2	Any number of individuals covering 5-25%
3	Any number of individuals covering 25-50%
4	Any number of individuals covering 50 - 75%
5	Covering more than 75% of area

During the mapping process, 12 wetland polygons were identified as potentially being part of the Seasonal Herbaceous Wetland ecological community based on visual observations at the time of adjacent field verifications. These wetlands were added to the Seasonal Herbaceous Wetland layer, labelled as unverified and do not have any EPBC Act 1999 or additional data attached.

3 RESULTS

3.1 Technical Reference Workshop and sites surveyed

During the workshop, the current South Australian State-wide Seasonal Herbaceous Wetland mapping layer was assessed for the region. All attendees actively participated in determining the status of each wetland polygon based on the EPBC Act 1999 listing advice of Seasonal Herbaceous Wetlands. Of the 126 mapped wetland polygons (described as 86 wetland “sites” in the listing advice) identified as Seasonal Herbaceous Wetlands, 3 wetland polygons were determined to meet the description on the basis of sufficient existing knowledge about them, 76 were determined not to meet the description and 47 required field verification (Table 2).

Reasons identified by the Technical Reference Group for the failure of 76 wetlands to meet the listing advice were:

- Floristic cover: Too much sedge cover, with very little herbaceous layer;
- Salinity: Too brackish – saline;
- Floristic composition: Wrong vegetation community, despite some of the indicator species being present;
- Water depth: Too deep (over a meter); and,
- Altered hydrology: habitat terrestrialised through changed land use.

The three wetlands identified by the Reference Group that met the description, Arcoona and two Swede Flat sites, were also field verified to gather additional data about the sites. Of the further 47 wetland polygons to be field assessed from the state-wide layer, 30 were surveyed, resulting in the confirmation of six being verified as Seasonal Herbaceous Wetlands (Table 2).

Table 2: Field validation results of polygons considered through the Technical Reference Workshop review of the Current Seasonal Herbaceous Wetland State-wide Mapping Layer

	Wetland Polygons Reviewed	# Field Verified	Results of verification		# Still TBC
			# SHW	# Other Type	
Workshop = No	76	10	0	76	0
Workshop = Yes	3	3	3	0	0
Workshop = Needs to be confirmed	47	30 (64%)	6 (20%)	24 (51%)	17 (36%)
Total Number of Polygons Identified	126	43 (34.1%)	9 (7.2%)	100 (79.3%)	17 (13.5%)

Note: Verified, SHW and TBC (To be confirmed) percentages are a proportion of the total in each category.

During the workshop and in subsequent conversations with the Technical Reference Group, 160 additional locations were added for validation. While a small proportion of these points occurred within polygons that already required validation, most were situated in new wetland sites. Only four were not field-validated due to problems with access or time restrictions.

Over the project, 174 wetland sites were assessed through visual validation, and of these, a full verification survey was undertaken on 102 wetlands (Table 3). Following entering the data into SAWID, it was apparent that two polygons had been surveyed twice, as they visually appeared to be separate wetlands in the field.

Table 3: Wetland sites surveyed and verified as Seasonal Herbaceous Wetlands

Wetland sites		Actual wetland polygons	Wetlands recorded	
Visually assessed	Formally field-verified		SHW	Other type
174 (30 from existing layer, 154 new from workshop, ~10 overlap)	102	100	95	5

SHW = Seasonal Herbaceous Wetland

3.2 Identified Seasonal Herbaceous Wetlands

During the survey period 77 wetlands were found to meet the listing advice under the EPBC Act 1999, representing 77% of the 100 wetlands assessed (Figure 2; Table 4). Of the wetlands that qualified for EPBC listing, 54 recorded 3 or more species or genera of high value, meaning 70% of those that qualify for EPBC Act listing are considered high ecological significance sites. A further 18 wetlands were assessed to be a Seasonal Herbaceous Wetlands, however, they did not qualify for listing under the EPBC Act 1999, either because of their small size, poor condition or both (Figure 2; Table 4), and four sites were found to be another wetland type.

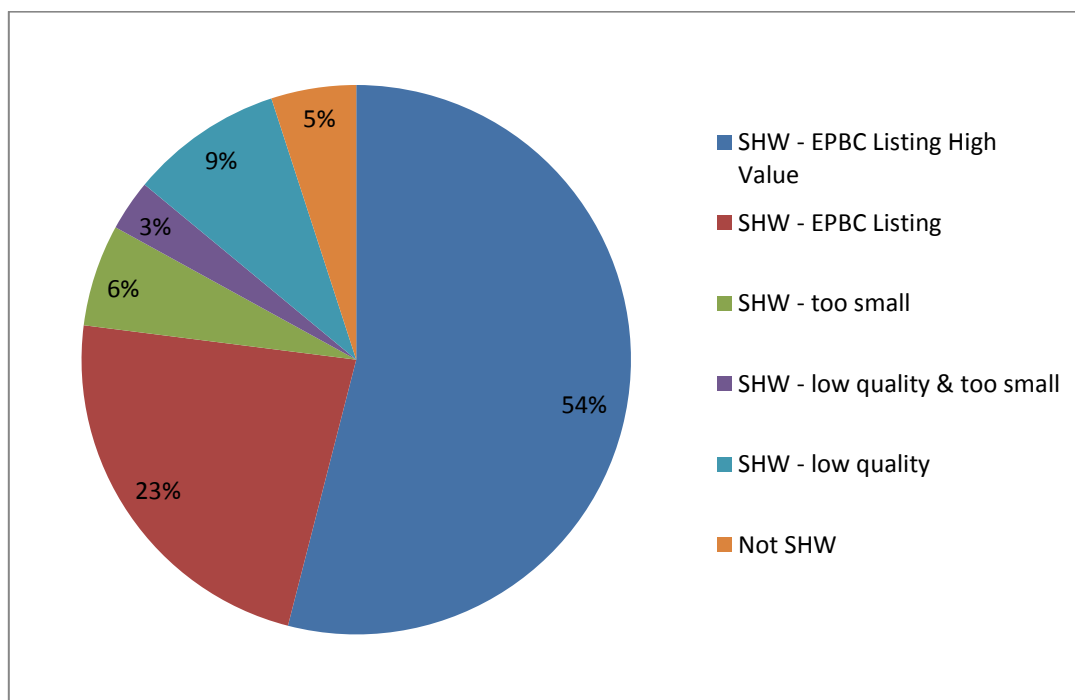


Figure 2: Seasonal Herbaceous Wetland (SHW) field verification results in the South East of South Australia (of 100 polygons assessed)

Seasonal Herbaceous Wetlands assessed to be moderately degraded or of lower condition score, indicating that they had a “significant level of disturbance evident, some natural values although verging on un-rectifiable damage” or worse, were assessed not to qualify under the EPBC Act 1999. However, although weedier than other wetlands in better condition classes, most of these wetlands in the wet phase did not have a weed cover greater than the 50 % threshold specified in the listing. There were four cases where wetlands with poor subjective condition scores recorded over three species described as high value. Hence, had these sites met the initial listing, they would have qualified as high value EPBC Act 1999 sites (in red text Table 4). In each of these four cases the wetlands were highly degraded with very low cover of high value species, hence, they are not recommended to be considered as having met listing requirements under the EPBC Act 1999.

Table 4: The 95 Seasonal Herbaceous Wetlands field verified in the South East of South Australia

Aus_WetNR (removed for website)	High Value Spp.	Other SHW Spp.	Condition scores (subjective)		EPBC	EPBC High Value	Comment for EPBC listing
X	16	17	Almost Pristine	4.5	yes	Yes	
X	16	16	Pristine	5	Yes	Yes	
X	15	17	Pristine	5	Yes	Yes	
X	15	14	Intact	4	Yes	Yes	
X	15	11	Intact	4	Yes	Yes	
X	14	14	Intact	4	Yes	Yes	
X	13	14	Pristine	5	Yes	Yes	Small but within native vegetation
X	12	18	Pristine	5	Yes	Yes	
X	12	15	Intact	4	Yes	Yes	
X	12	14	Intact	4	Yes	Yes	
X	11	17	Pristine	5	Yes	Yes	
X	11	14	Intact	4	Yes	Yes	
X	11	9	Pristine	5	Yes	Yes	
X	10	15	Intact	4	Yes	Yes	
X	10	14	Pristine	5	Yes	Yes	
X	10	12	Pristine	5	Yes	Yes	
X	9	9	Pristine	5	Yes	Yes	
X	8	14	Intact	4	Yes	Yes	
X	8	14	Intact	4	Yes	Yes	
X	8	10	Moderate	3	Yes	Yes	
X	7	15	Moderately Intact	3.5	Yes	Yes	
X	7	12	Intact	4	Yes	Yes	
X	7	8	Intact	4	Yes	Yes	Small but within native vegetation
X	6	17	Intact	4	Yes	Yes	Small but within native vegetation
X	6	15	Intact	4	Yes	Yes	
X	6	14	Intact	4	Yes	Yes	
X	6	13	Moderately Intact	3.5	Yes	Yes	

Aus_WetNR (removed for website)	High Value Spp.	Other SHW Spp.	Condition scores (subjective)	EPBC	EPBC High Value	Comment for EPBC listing
X	6	13	Moderate	3	Yes	Yes
X	6	12	Moderately Intact	3.5	Yes	Yes
X	6	11	Intact	4	Yes	Yes
X	6	9	Moderately Intact	3.5	Yes	Yes
X	6	9	Moderate	3	Yes	Yes
X	5	17	Intact	4	Yes	Yes
X	5	17	Moderate	3	Yes	Yes
X	5	15	Intact	4	Yes	Yes
X	5	13	Intact	4	Yes	Yes
X	5	13	Moderate	3	Yes	Yes
X	5	11	Pristine	5	Yes	Yes
X	5	11	Pristine	5	Yes	Yes Small but within native veg
X	5	10	Intact	4	Yes	Yes
X	5	9	Moderate	3	Yes	Yes
X	4	16	Almost Pristine	4.5	Yes	Yes
X	4	13	Intact	4	Yes	Yes
X	4	9	Intact	4	Yes	Yes
X	4	9	Moderate	3	Yes	Yes
X	4	1	Moderately Intact	3.5	Yes	Yes
X	3	12	Moderate	3	Yes	Yes
X	3	11	Intact	4	Yes	Yes
X	3	11	Moderately Intact	3.5	Yes	Yes
X	3	11	Moderate	3	Yes	Yes
X	3	10	Intact	4	Yes	Yes
X	3	10	Moderate	3	Yes	Yes
X	3	9	Intact	4	Yes	Yes
X	3	7	Intact	4	Yes	Yes
X	3	13	Moderate	3	Yes	No
X	2	14	Intact	4	Yes	No
X	2	14	Moderately Intact	3.5	Yes	No
X	2	12	Intact	4	Yes	No
X	2	12	Moderately Intact	3.5	Yes	No
X	2	11	Intact	4	Yes	No
X	2	11	Moderately Intact	3.5	Yes	No
X	2	10	Intact	4	Yes	No
X	2	10	Moderately Intact	3.5	Yes	No
X	2	10	Moderate	3	Yes	No

Aus_WetNR (removed for website)	High Value Spp.	Other SHW Spp.	Condition scores (subjective)	EPBC	EPBC High Value	Comment for EPBC listing	
X	2	9	Moderate	3	Yes	No	
X	2	8	Intact	4	Yes	No	
X	2	7	Moderate	3	Yes	No	
X	2	6	Moderate	3	Yes	No	
X	1	15	Moderately Intact	3.5	Yes	No	
X	1	12	Intact	4	Yes	No	
X	1	12	Intact	4	Yes	No	
X	1	10	Intact	4	Yes	No	
X	1	10	Moderate	3	Yes	No	
X	1	10	Moderate	3	Yes	No	
X	1	8	Intact	4	Yes	No	
X	1	8	Moderately Intact	3.5	Yes	No	
X		7	Intact	4	Yes	No	
X	7	14	Degraded	2	No	No	Poor condition
X	5	13	Moderately Degraded	2.5	No	No	Poor condition
X	5	12	Degraded	2	No	No	Poor condition
X	4	12	Moderate	3	No	No	Too small
X	3	11	Moderately Degraded	2.5	No	No	Poor condition
X	3	10	Intact	4	No	No	Too small
X	2	13	Degraded	2	No	No	Poor condition
X	2	10	Moderate	3	No	No	Too small
X	2	10	Degraded	2	No	No	Poor condition
X	2	9	Intact	4	No	No	Too small
X	2	9	Degraded	2	No	No	Poor condition
X	1	11	Moderate	3	No	No	Too small
X	1	10	Degraded	2	No	No	Poor condition
X	1	9	Moderately Intact	3.5	No	No	Too small
X		9	Degraded	2	No	No	Too small & poor condition
X		8	Degraded	2	No	No	Poor condition
X		8	Degraded	2	No	No	Too small & poor condition
X		6	Degraded	2	No	No	Too small & poor condition

Note: Sites in red indicates those that meet the listing advice for more than three high value species, but where site condition is too poor to justify inclusion.

Seasonal Herbaceous Wetlands in South Australia recorded between four and 33 character species (both high value and other), with an average of eleven species at each site. Generally the Seasonal Herbaceous Wetlands in the best condition had the highest number of character and high value species/genera. The number of high values species/genera recorded at wetlands ranged from zero

to 16, with 54 wetlands recording three or more high value species/genera and hence qualifying them as a high ecological value sites.

Seasonal Herbaceous Wetlands were recorded from Willalooka, east to the South Australian-Victorian border and south to Mount Gambier (Figure 3 and Figure 4). The wetlands have been shown in size classes to improve visual representation on the map, because with most wetlands being less than five hectares, when mapped at a regional scale they ordinarily become invisible. Wetlands are clustered in bands around the Bangham district in the north, Struan-Bool Lagoon district in mid-South East and Tarpeena in the South. During the mapping phase, an additional 12 wetlands were added to the Seasonal Herbaceous Wetland layer as sites that are highly likely to meet the criteria but need validation; these sites are recorded as presently having Insufficient Data (Figure 3 and Figure 4).

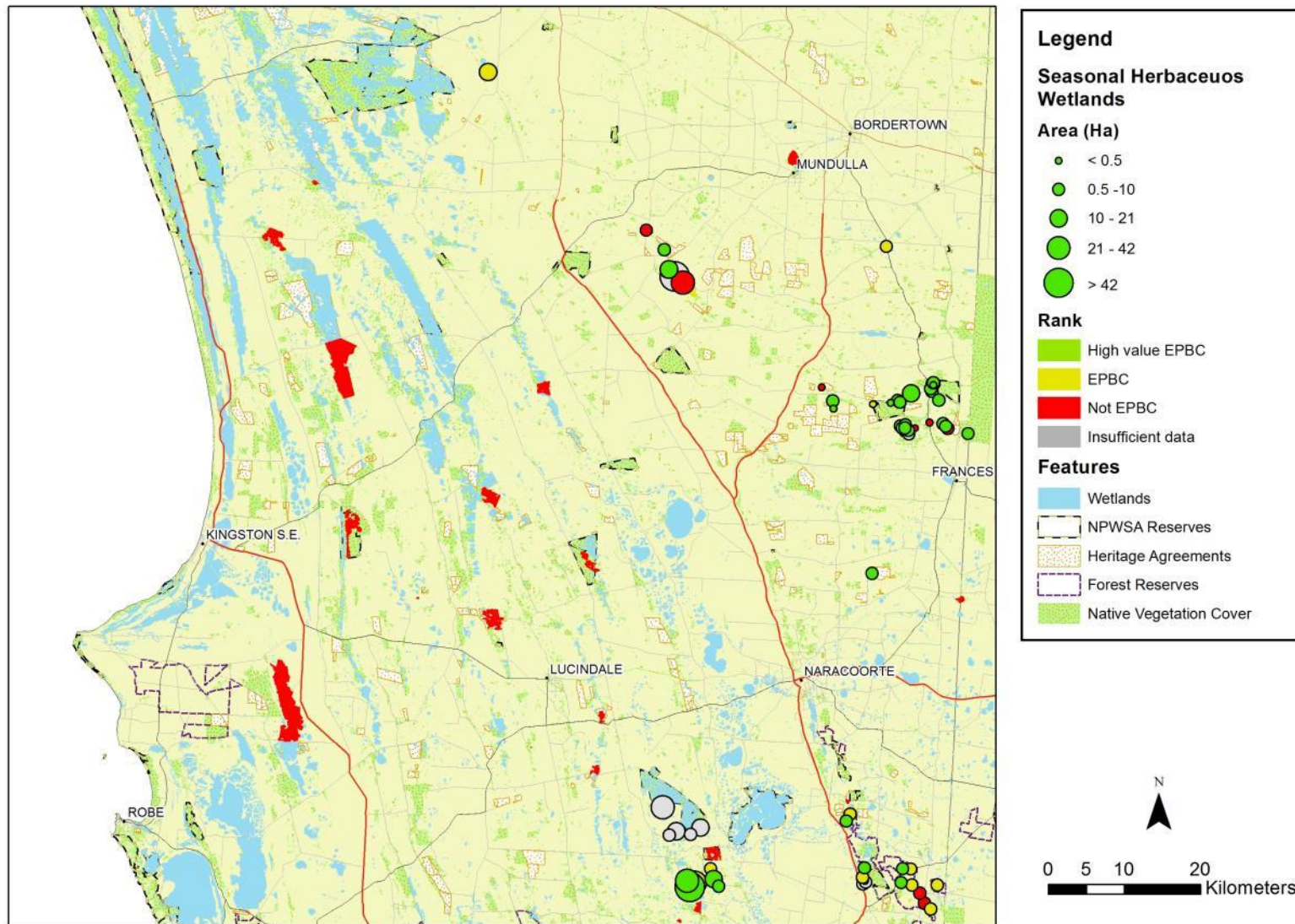


Figure 3: Seasonal Herbaceous Wetland field survey locations in the Upper South East of South Australia, including their suggested EPBC Act status.

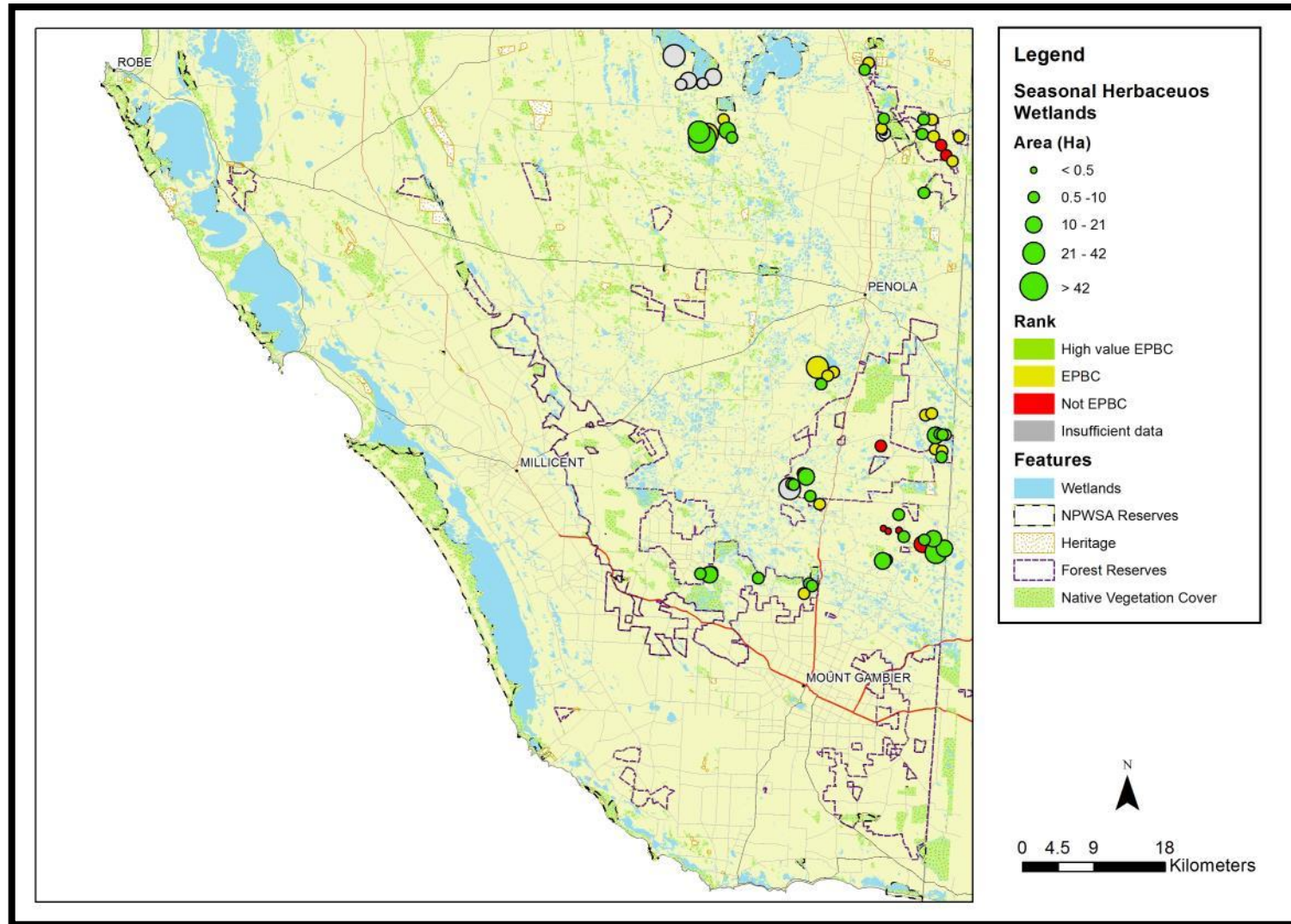


Figure 4: Seasonal Herbaceous Wetland field survey locations in the Lower South East of South Australia, including their suggested EPBC Act status.

3.3 Components of Seasonal Herbaceous Wetlands in the South East of SA

The wetlands were all assessed against the required components as described in the conservation listing advice (TSSC 2012a). The result of each main component is discussed below.

3.3.1 Physical Properties – Landscape, soils and size

Seasonal Herbaceous Wetlands occurred in the Naracoorte Coastal Plain, Murray-Darling Depression and Victorian Volcanic Plains IBRA Regions and the listed sub-regions (Table 5), as described in the listing advice. Over two thirds of the Seasonal Herbaceous Wetlands were recorded in the Lowan Mallee and Glenelg Plain (Table 5).

Table 5: IBRA Regions and Sub-regions where Seasonal Herbaceous Wetlands were recorded in South Australia

IBRA Region	IBRA Sub-Region	Seasonal Herbaceous Wetlands
Murray-Darling Depression	Lowan Mallee	35
	Wimmera	6
Naracoorte Coastal Plain	Tintinara	1
	Lucindale	14
	Glenelg Plain	38
Victorian Volcanic Plain	Mount Gambier	1

Soils recorded at Seasonal Herbaceous Wetlands ranged from Heavy Clay (5), to Clay (32), and Clay Loam (55). Eleven wetlands had some degree of Gilgai soil associated with them, creating a Gilgai mosaic seasonal herbaceous swamp, however, the area of Gilgai ranged from the whole wetland to less than 10 %.

The Seasonal Herbaceous Wetland ecological community was recorded in a total area of 635 hectares at 95 sites. Site size class was variable across the verified Seasonal Herbaceous Wetlands; however, over 60% of wetlands were less than five hectares (Table 6). The most commonly recorded size class was between one and 4.99 hectares.

Table 6: Size classes of Seasonal Herbaceous Wetlands in South Australia.

Size Class (ha)	Number of Seasonal Herbaceous Wetlands
0 - 0.49	15
0.50 - 0.99	12
1.00 - 4.99	32
5.00 - 9.99	19
10.00 - 19.99	11
20.00 - 39.99	5
40.00 – 75.00	1

3.3.2 Hydrology

The water quality recorded at verified Seasonal Herbaceous Wetlands generally consisted of neutral pH, very fresh (low conductivity) and with a relatively high dissolved percent oxygen (Table 7). Only four wetlands recorded EC values above 600 $\mu\text{S}/\text{cm}^2$ and all were drying at the time. The turbidity of the sites was highly variable, ranging from crystal clear to highly turbid (Table 7). Wetlands in the Upper South East generally had the highest turbidity values, often accompanied by pugging from feral animals or domestic livestock. The water depths recorded were all less than 70 cm, with the deepest wetlands occurring in the Lower South East.

Table 7: Water Quality Readings at Seasonal Herbaceous Wetlands in the South East of South Australia.

	pH	Conductivity ($\mu\text{S}/\text{cm}$)	Temperature ($^{\circ}\text{C}$)	Turbidity (NTU)	O2 (%)	Water Depth (m)
Average	6.56	231.25	19.14	70.25	77.31	0.42
Maximum	8.28	712.00	26.00	400.00	202.00	0.70
Minimum	4.97	0.07	6.66	0.00	12.90	0.10

All wetlands described as Seasonal Herbaceous Wetlands had depths less than one metre, held water as a result of winter/spring rainfall in 2013 and appear to be seasonally inundated (1 in 1) – as required under the listing advice. Over half had an inundation period of less than six months (Table 8).

Table 8: Hydrological Periods of Seasonal Herbaceous Wetlands in the South East of South Australia.

Hydrological Period	Hydrological Period Description	Number of Seasonal Herbaceous Wetlands
B	Winter - Spring fill; < 4 months inundation	36
C	Winter - Spring fill; 6 months inundation	55
D	Winter - Spring fill; 8 months inundation	1
data deficient		4

3.3.3 Vegetation Associations and Components

Prior to data entry, wetlands were remotely classified into wetland types based on their species composition and knowledge of the site ascertained from the data sheet. The wetland types created for SAWID do not align with traditional vegetation associations and were used to help analyse the community. Initially 13 different vegetation types were used and still exist within SAWID; these communities have been consolidated to create 6 different suggested vegetation types, as presented in Table 9. For images of the suggested wetland vegetation types refer to APPENDIX 7: IMAGES OF SUGGESTED WETLAND TYPES WITHIN THE SEASONAL HERBACEOUS WETLANDS IN SOUTH AUSTRALIA. It is possible to have two communities at one wetland, consequently 137 different occurrences of vegetation types was recorded during the survey – more than the number of wetlands surveyed. The wetlands did not clearly fit into the Wetland Vegetation Components (WVC), as described by Ecological Associates (2009), often relating to several WVCs (Table 9).

Table 9: Wetland vegetation types as recorded during the Seasonal Herbaceous Wetland survey in South Australia.

Fringing Overstorey / or Emergent Species (<10%)	Wetland Vegetation Type	Corresponding Wetland Vegetation Component (WVC)	Victorian Ecological Vegetation Class (EVC)	Occurrences
<i>Eucalyptus camaldulensis</i>	<i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland	Part: 1.1 2.20	EVC 292: Red Gum Swamp	53
+/- emergent/isolated <i>Eucalyptus camaldulensis</i>	<i>Carex tereticaulis</i> +/- <i>Eleocharis acuta</i> +/- <i>Glyceria australis</i> +/- <i>Lachnagrostis</i> spp. +/- <i>Amphibromus</i> spp. +/- <i>Triglochin</i> spp. Seasonal Herbaceous Grass/sedge Wetland	1.11	Part EVC 647: Plains Sedgy Wetland	25
+/- <i>Eucalyptus camaldulensis</i>	<i>Glyceria australis</i> +/- <i>Amphibromus</i> spp. +/- <i>Lachnagrostis filiformis</i> , <i>Montia australasica</i> +/- <i>Triglochin</i> spp.. Seasonal Herbaceous Grass/sedge Wetland	1.11	EVC 920: Sweet Grass Wetland (part)	20
<i>Eucalyptus leucoxylo</i> +/- <i>Callistemon rugulosus</i> , +/- emergent <i>E. camaldulensis</i>	<i>Amphibromus</i> spp., +/- <i>Chorizandra enodis</i> , +/- <i>Craspedia paludicola</i> <i>Rytidosperma duttonianum</i> . +/- <i>Ornduffia reniformis</i> +/- <i>Utricularia</i> spp. Seasonal Herbaceous Wetland	Part: 1.11 1.7 2.20		20
+/- <i>E. camaldulensis</i> , +/- <i>Allocasuarina luehmannii</i> +/- <i>Duma</i> (syn. <i>Muehlenbeckia florulenta</i>)	<i>Amphibromus</i> spp., <i>Eleocharis acuta</i> , +/- <i>Swainsona procumbens</i> , +/- <i>Craspedia paludicola</i> , +/- <i>Schoenus tesquorum</i> Gilgai Seasonal Herbaceous Wetland Mosaic	Part: 2.20	EVC 778: Gilgai Wetland or EVC 956: Herb-rich Gilgai Wetland	14
	<i>Triglochin procera</i> , <i>Montia australica</i> , <i>Potamogeton</i> spp. <i>Myriophyllum</i> spp. +/- <i>Ornduffia reniformis</i> Seasonal Herbaceous Wetland	2.2		5

WVCs: 1.1 = *Eucalyptus camaldulensis* woodland, 1.7 = *Callistemon rugulosus* Shrubland (under *Eucalyptus leucoxylo* Woodland), 1.11 = Seasonal freshwater emergent sedgeland, .2.20 = Seasonal freshwater aquatic bed.

The most commonly recorded wetland vegetation types were *Eucalyptus camaldulensis* fringing *Amphibromus* spp., *Ornduffia reniformis*, *Potamogeton* spp., *Montia australasica*, +/- *Allittia cardiochila*, +/- *Eryngium* spp. **Seasonal Herbaceous Wetland (53)**, and *Carex tereticaulis* +/- *Eleocharis acuta*, +/- *Glyceria australis*, +/- *Lachnagrostis* spp., +/- *Amphibromus* spp., +/- *Triglochin* spp. **Seasonal Herbaceous Grass/sedge Wetland – with emergent *E. camaldulensis* (25)**.

The most clearly defined vegetation types observed during surveys were the *Amphibromus* spp., *Eleocharis acuta*, +/- *Swainsona procumbens*, +/- *Craspedia paludicola*, +/- *Schoenus tesquorum* **Gilgai Seasonal Herbaceous Wetland Mosaic**, and *Eucalyptus leucoxylon* +/- *Callistemon rugulosus*, +/- emergent *E. camaldulensis* over *Amphibromus* spp., +/- *Chorizandra enodis*, +/- *Craspedia paludicola*, +/- *Rytidosperma duttonianum*, +/- *Ornduffia reniformis*, +/- *Utricularia* spp. **Seasonal Herbaceous Wetland**. Both wetland vegetation types were located in the Upper South East and were the most clearly consistent with the listing advice for Seasonal Herbaceous Wetlands.

During the survey, a total of 292 species were recorded at the wetlands surveyed (APPENDIX 2: SOUTH AUSTRALIAN SEASONAL HERBACEOUS WETLAND FLORA SPECIES LIST), 74.6% of which were native (Table 10). While an exhaustive species list was not compiled for each wetland, due to the focus on recording characteristic species of Seasonal Herbaceous Wetlands (APPENDIX 1: FLORA SPECIES INDICATIVE OF SEASONAL HERBACEOUS WETLANDS (TSSC 2012a)), most species encountered were recorded, including some of the fringing terrestrial species. Weed species were predominantly observed around the edge of the basin, above the height of maximum inundation. Given the quantity of data across 95 sites, flora species lists have not been provided in this report, however, all information is stored (and can be easily queried) within SAWID under **Project 156**.

Table 10: Flora statistics of verified Seasonal Herbaceous Wetlands in the South Australia

	# of Spp.	Percentage
Total number of Spp.	292	100.0
Native	217	74.3
Exotic	75	25.7
SHW Characteristic Genera/Spp.	64	21.2
SHW High Value Genera/Spp.	22	7.5
Nationally Vulnerable	1	0.3
SA Endangered	3	1.0
SA Vulnerable	11	3.8
SA Rare	26	8.9

Forty different species listed under the South Australian *National Parks and Wildlife Act 1972*, were recorded 475 times in the current survey at Seasonal Herbaceous Wetlands (Table 11). The most commonly recorded state listed threatened species were the state rare *Montia australasica* and *Triglochin alcockii*, occurring at 69 wetlands each. One record of the nationally vulnerable *Senecio psilocarpus* was made in the particularly diverse Border Swamp. Three state endangered species were recorded, *Myriophyllum glomeratum* in the Upper South East, *Diuris* sp. aff *chryseopsis* in the Lower South East and the newly described *Prasophyllum* sp. Waterholes in both the Upper and Lower South East. The highest condition wetlands generally supported the most number of rated species.

Table 11: Number of occurrences of State threatened species in Seasonal Herbaceous Wetlands in SA.

Species	National Parks & Wildlife Act 1972 Rating			
	Endangered	Vulnerable	Rare	Total
<i>Allittia cardiocarpa</i>			20	20
<i>Amphibromus macrorhinus</i>			6	6
<i>Asperula subsimplex</i>			21	21
<i>Brachyscome basaltica</i> var. <i>gracilis</i>			1	1
<i>Cardamine tenuifolia</i>			1	1
<i>Craspedia paludicola</i>		21		21
<i>Crassula peduncularis</i>			2	2
<i>Dianella longifolia</i> var. <i>grandis</i>			1	1
<i>Diuris chryseopsis</i>	1			1
<i>Elatine gratioloides</i>			18	18
<i>Eryngium vesiculosum</i>			26	26
<i>Goodenia gracilis</i>		5		5
<i>Isotoma fluviatilis</i> ssp. <i>australis</i>			20	20
<i>Juncus procerus</i>			7	7
<i>Juncus radula</i>		2		2
<i>Leptorhynchos tenuifolius</i>			1	1
<i>Lobelia pratioides</i>			30	30
<i>Mazus pumilio</i>		2		2
<i>Melaleuca squarrosa</i>			1	1
<i>Mentha diemenica</i>			1	1
<i>Microtis atrata</i>			4	4
<i>Microtis orbicularis</i>		9		9
<i>Montia australasica</i>			69	69
<i>Myriophyllum glomeratum</i>	3			3
<i>Myriophyllum integrifolium</i>			1	1
<i>Pentapogon quadrifidus</i> var. <i>quadrifidus</i>			5	5
<i>Prasophyllum</i> sp. Waterholes (R.Bates 9037)	6			6
<i>Pratia concolor</i>			2	2
<i>Ranunculus inundatus</i>			40	40
<i>Ranunculus robertsonii</i>			7	7
<i>Rumex dumosus</i>			1	1
<i>Schoenus latelaminatus</i>		4		4
<i>Schoenus tesquorum</i>			29	29
<i>Senecio psilocarpus</i>		1		1
<i>Swainsona procumbens</i>		19		19
<i>Thelymitra flexuosa</i>			1	1
<i>Thelymitra holmesii</i>		5		5
<i>Triglochin alcockiae</i>			69	69
<i>Triglochin turrifera</i>		1		1
<i>Utricularia beaugleholei</i>		12		12
Grand Total	10	81	384	475

During the surveys 64 genera or species characteristic of Seasonal Herbaceous Wetlands were recorded (APPENDIX 1: FLORA SPECIES INDICATIVE OF SEASONAL HERBACEOUS WETLANDS (TSSC 2012a)), representing 75.3% of the species described in the listing advice (TSSC 2012a). Four species listed as characteristic species of Seasonal Herbaceous Wetlands are not known to occur within South Australia (APPENDIX 1) and were not recorded in this survey. Ten of the 21 high value characteristic genera or species were also recorded during this current survey (APPENDIX 1). Given that characteristic species may be grouped to genera level in the listing advice, the actual number of high value species recorded in the survey was 34 (Table 12). The number of characteristic and high value species in each wetland were previously listed in Table 4: The 95 Seasonal Herbaceous Wetlands field verified in the South East of South Australia.

Table 12: High value species recorded in Seasonal Herbaceous Wetlands in South Australia.

Flora Species	Number of Seasonal Herbaceous Wetlands where species recorded
<i>Allittia cardiocarpa</i>	20
<i>Asperula conferta</i>	4
<i>Asperula subsimplex</i>	21
<i>Brachyscome basaltica</i> var. <i>gracilis</i>	1
<i>Craspedia paludicola</i>	21
<i>Diuris chryseopsis</i>	1
<i>Eryngium vesiculosum</i>	26
<i>Hypoxis</i> sp.	1
<i>Hypoxis vaginata</i> var. <i>vaginata</i>	18
<i>Isoetes drummondii</i> ssp.	7
<i>Lobelia pratioides</i>	30
<i>Marsilea costulifera</i>	7
<i>Microseris lanceolata</i>	16
<i>Microtis arenaria</i>	5
<i>Microtis atrata</i>	4
<i>Microtis orbicularis</i>	9
<i>Microtis</i> sp.	37
<i>Microtis unifolia</i> complex	2
<i>Prasophyllum</i> sp.	12
<i>Prasophyllum</i> sp. Waterholes (R.Bates 9037)	6
<i>Pratia concolor</i>	2
<i>Ranunculus inundatus</i>	40
<i>Senecio psilocarpus</i>	1
<i>Swainsona procumbens</i>	19
<i>Thelymitra antennifera</i>	1
<i>Thelymitra flexuosa</i>	1
<i>Thelymitra holmesii</i>	5
<i>Thelymitra pauciflora</i>	3
<i>Thelymitra</i> sp.	23
<i>Triglochin alcockiae</i>	69
<i>Triglochin striata</i>	6
<i>Utricularia beaugleholei</i>	12
<i>Utricularia dichotoma</i>	27
<i>Utricularia</i> sp.	3
<i>Villarsia reniformis</i>	46
Grand Total	506

3.3.4 Fauna

Seventy fauna species were opportunistically recorded during the Seasonal Herbaceous Wetlands surveys (APPENDIX 4: FAUNA SPECIES RECORDED DURING SURVEY). The most commonly recorded species or groups or species were unidentified tadpoles (25 wetlands), Common Froglets (17 wetlands), White-necked Herons (16 wetlands), and White-faced Herons (13 wetlands) (APPENDIX 4). For a detailed species list for each wetland please refer to SAWID under **Project 156 – Seasonal Herbaceous Wetland Survey – NGT 2013**.

Three species recorded were listed under the Australian *Environment Protection and Biodiversity Conservation Act 1999* and eleven species listed under the South Australian *National Parks and Wildlife Act 1972* were identified (Table 13). Dwarf Galaxias were noted through historic knowledge provided by landholders in the Mingbool area; however, surveys by NGT staff in subsequent weeks were unable to relocate the species. The nationally endangered Southern-eastern Red-tailed Black-Cockatoo was heard or observed calling in the proximity of wetlands in the Upper South region (in the Bangham district) and the nationally vulnerable Southern Bell-frog is known from a site in the Bool Lagoon region.

Table 13: Nationally and State Threatened Species recorded at Seasonal Herbaceous Wetlands in South Australia.

Species	Scientific Name	National Listing		State Listing			# of Wetlands where recorded
		E	V	E	V	R	
Blue-billed Duck	<i>Oxyura australis</i>					✓	①
Brolga	<i>Grus rubicunda</i>				✓		①
Brown Quail	<i>Coturnix ypsilophora</i>				✓		①
Dwarf Galaxias	<i>Galaxiella pusilla</i>		✓				①
Eastern Grey Kangaroo	<i>Macropus giganteus</i>					✓	①
Latham's Snipe	<i>Gallinago hardwickii</i>					✓	②
Little Egret	<i>Egretta garzetta</i>					✓	①
Peregrine Falcon	<i>Falco peregrinus</i>					✓	①
Southern Bell Frog	<i>Litoria raniformis</i>		✓		✓		①
South Eastern Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii graptogyne</i>	✓		✓			②
White-winged Chough	<i>Corcorax melanoramphos</i>					✓	①
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>				✓		②
Number of listed species		1	2	1	4	6	

E = Endangered, V = Vulnerable and R = Rare

Four species were observed to be breeding at Seasonal Herbaceous Wetlands during the survey period, including Black Swans (multiple wetlands), White-necked Herons (one wetland), Pacific Black Duck (one wetland) and one Peregrine Falcon pair. The Peregrine Falcons were located a wetland in the Bool Lagoon district after being alerted by the landholder to their presence and subsequently noting the birds' behaviour.

The ten most diverse Seasonal Herbaceous Wetlands with regards to faunal observations were all in the Lower South East (Table 14). The diversity was likely driven by the hydrological stage of the wetland, all of which were holding free-standing water at the time of survey.

Table 14: The ten most fauna diverse Seasonal Herbaceous Wetlands

Aus_WetNR (removed for website)	Number of fauna species recorded
X	15
X	11
X	11
X	10
X	10
X	10
X	10
X	9
X	9
X	8

3.3.5 Condition (Subjective) Scores

Condition scores were recorded at the 95 Seasonal Herbaceous Wetlands assessed, chosen from a sliding scale of nine descriptive categories used within SAWID ranging from “Pristine” to “Completely Degraded” (Table 15). Over half the wetlands received condition scores of “Intact” or greater, indicating they had *“Small amounts of disturbance evident, with high native species diversity. Damage easily rectifiable. Received mostly moderate - intact rapid assessment scores”* or less disturbance. The individual condition score for each wetland assessed is given in Table 4: The 95 Seasonal Herbaceous Wetlands field verified in the South East of South Australia.

Table 15: Subjective condition classes of Seasonal Herbaceous Wetlands in South Australia.

Wetland Condition (Subjective)	Condition Score	Number of Seasonal Herbaceous Wetlands	Weediness Range (Braun-Blanquette Scale)	Weediness Mode (Braun-Blanquette Scale)
Pristine	5	11 (11.5%)	T to 1	T
Almost pristine	4.5	2 (2.1 %)	T	T
Intact	4	35 (37.5%)	T to 2	2
Moderately Intact	3.5	13 (13.5%)	1 to 2	2
Moderate	3	21 (21.9%)	2 to 3	2
Moderately degraded	2.5	3 (3.1%)	2	2
Degraded	2	10 (10.4%)	2 to 5	3
Severely Degraded	1	0 (0%)	-	-
Completely Degraded	0	0 (0%)	-	-

The weed cover in all wetlands was concentrated around the margins of the basin. The weediness scores of “Pristine” or “Almost Pristine” wetlands ranged from “Sparsely or very sparsely” present; cover less than 5% (T) to Plentiful, but of small cover (less than 5%) (1) – for category information, refer to Table 1. Most weeds represented in this category were ubiquitous annual herbs and small grasses or sedges, for example **Aira cupaniana*, **Juncus capitatus*, **Isolepis hystrix*, or **Cypress tenellus* (considered naturalised in some places).

Ten weed species described in the listing advice as a “High Threat” to Seasonal Herbaceous Wetlands were identified in Seasonal Herbaceous Wetlands in South Australia (Table 16). The most commonly recorded high threat weed species was **Holcus lanatus* (40 wetlands), followed by **Mentha pulegium* (14 wetlands) and **Leontodon taraxacoides* spp. *taraxacoides* (10 wetlands). Four declared and eight other environmental weeds of note were also recorded in or on the immediate periphery of the surveyed Seasonal Herbaceous Wetlands (Table 16). The wetland location of all high threat, declared and environmental weeds is provided in APPENDIX 3: SIGNIFICANT WEED SPECIES SITE LOCATIONS.

Table 16: High Threat Weed Species recorded in Seasonal Herbaceous Wetlands in South Australia.

Weed Type	Weed Species	Number of Seasonal Herbaceous Wetlands
High Threat Weed to Seasonal Herbaceous Wetlands (TSSC 2012a)	<i>*Anthoxanthum odoratum</i>	7
	<i>*Cirsium vulgare</i>	8
	<i>*Holcus lanatus</i>	40
	<i>*Juncus articulatus</i>	1
	<i>*Leontodon taraxacoides</i> ssp. <i>taraxacoides</i>	10
	<i>*Mentha pulegium</i>	14
	<i>*Phalaris aquatica</i>	9
	<i>*Plantago lanceolata</i> var.	1
	<i>*Rumex crispus</i>	4
Declared Weed	<i>*Echium plantagineum</i>	4
	<i>*Genista monspessulana</i>	1
	<i>*Olea europaea</i>	1
	<i>*Rubus</i> sp.	7
Environmental Weed	<i>*Acacia longifolia</i> ssp. <i>longifolia</i>	2
	<i>*Asparagus asparagoides</i> f. <i>asparagoides</i>	2
	<i>*Disa bracteata</i>	12
	<i>*Ehrharta calycina</i>	7
	<i>*Festuca arundinacea</i>	1
	<i>*Phalaris</i> sp.	16
	<i>*Pinus radiata</i>	8
	<i>*Rosa</i> sp.	1

3.4 Wetland Condition Assessment Tool (WetCAT) Results

Three wetlands that met the Seasonal Herbaceous Wetland criteria were chosen for additional assessment using the WetCAT methodology, to gain a more in-depth understanding of species diversity within the wetlands and the different Wetland Vegetation Components (WVCs) as used in South Australia or Ecological Vegetation Components (EVCs) as used in Victoria. The three types chosen were:

- **Buloke:** partial 2.20 Seasonal Freshwater Aquatic Bed or EVC 778 Gilgai Wetland and suggested wetland vegetation type of :
 - +/- *E. camaldulensis*, +/- *Allocasuarina luehmannii* +/- *Duma* (syn. *Muehlenbeckia florulenta* **fringing** *Amphibromus* spp., *Eleocharis acuta*, +/- *Swainsona procumbens*, +/- *Craspedia paludicola*, +/- *Schoenus tesquorum* **Gilgai Seasonal Herbaceous Grass/sedge Wetland Mosaic**
- **Red Gum A:** WVC 1.1 Red Gum Swamp or EVC 292 Red Gum Swamp and suggested wetland vegetation type of :
 - *Eucalyptus camaldulensis* **fringing** *Amphibromus* spp., *Ornduffia reniformis*, *Potamogeton* spp., *Montia australasica*, +/- *Allittia cardiochila* +/- *Eryngium* spp. **Seasonal Herbaceous Wetland**
- **Red Gum B:** Modified WVC 1.1 Red Gum Swamp or EVC 125 Plains Grassy Wetland and suggested wetland vegetation type of :
 - +/- **emergent/isolated** *Eucalyptus camaldulensis* **fringing** *Carex tereticaulis* +/- *Eleocharis acuta* +/- *Glyceria australis* +/- *Lachnagrostis* spp. +/- *Amphibromus* spp. +/- *Triglochin* spp. **Seasonal Herbaceous Grass/sedge Wetland**

Note: flora species in grey were not present in the community assessed.

To accurately interpret WetCAT results it is important not to group component scores to reach a total score (Farrington *et al.* under review 2013). WetCAT provides the most useful information for interpretation by providing an overview of individual components, as presented in Table 17. Additional flora species that were recorded during the WetCAT survey have been added to SAWID, producing a more robust flora list for the three wetland vegetation types surveyed.

The Buloke and Red Gum A sites were both located in native vegetation under conservation management, while Red Gum B is currently being grazed. This was reflected in the poor buffer, recruitment and grazing scores for Red Gum B (Table 17), however, the poor result of shrub health at Red Gum B is due to no shrubs (naturally) being present at the site. As described in the methods section, WetCAT is currently under review and, as reported in Farrington *et al.* (under review 2013), demonstrates several biases, including a scoring bias towards systems with trees or shrubs naturally present. This is partially expressed in the recruitment results, which score the naturally sparsely-treed Buloke and Red Gum B sites poorly (Table 17). The comparative health of the system is much better represented by Sedge/Herb Health and the other components. The relevant results from WetCAT indicate that overall, the Buloke site is in the best condition, followed by Red Gum A and then Red Gum B. This concurs with what was generally observed in the field, in terms of the subjective condition assessment scores allocated to the three sites.

Table 17: Wetland Condition Assessment (WetCAT) Scores for Three Seasonal Herbaceous Wetlands in South Australia.

Site	Buffer		Soil Disturbance		Recruitment		Shrub Health		Sedge/Herb Health		Grazing		Weeds	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Buloke	5	5	5	5	1	3	0	5	5	5	5	5	5	5
Red Gum A	2	2	5	5	1	#N/A	0	0	5	3	2	2	5	5
Red Gum B	5	5	5	5	4	3	5	5	5	3	5	4	5	5

Score out of 5, where 5 = Excellent, 4 = good, 2 = moderate, 2 = poor, 1 = very poor and 0 = absent

As previously discussed, the primary limitation of WetCAT is its assessment of biotic factors, so to improve the condition analysis, a hybrid of WetCAT and the Index of Wetland Condition (IWC) was applied, using the Plains Grassy Wetland and Redgum Swamp EVC benchmarks (DSE, 2010). As the WetCAT field methodology was used, two (Buloke and Red Gum A) and three (Red Gum B) transects were completed, representing the number of WVCs present at each community. Although two to three WVCs were present, they were compared against the one EVC that represents the whole community, hence the naturally species-poor seasonal herbland (first transect for all sites) has scored poorly in critical life-forms for all wetlands (Table 18). The poor scores do not reflect the true health of this section of the wetland transects, but again reflect an unavoidable limitation in the method as described.

Table 18: Condition Assessment using a combination of the Victorian Index of Wetland Condition (IWC) and South Australian Wetland Condition Assessment Tool (WetCAT).

Site	Transect	EVC	Critical Lifeform Groups		Altered processes		Weeds		Structure and Health	
			Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Buloke	1	Plains Grassy Wetland	12.5	12.5	5.0	5.0	25.0	25.0	15.0	15.0
	2	Plains Grassy Wetland	18.8	18.8	25.0	25.0	18.0	12.0	25.0	25.0
Red Gum A	1	Plains Grassy Wetland	12.5	12.5	5.0	5.0	25.0	25.0	15.0	10.0
	2	Plains Grassy Wetland	14.6	12.5	5.0	5.0	25.0	25.0	25.0	20.0
	3	Plains Grassy Wetland	14.6	12.5	5.0	5.0	18.0	18.0	25.0	20.0
Red Gum B	1	Red Gum Swamp	13.9	13.9	5.0	5.0	25.0	25.0	15.0	10.0
	2	Red Gum Swamp	18.8	19.4	25.0	25.0	18.0	12.0	15.0	20.0

Score out of 25, where 0-10 Very Poor; >10-16.25 Poor; >16.25-20 Moderate; >20-22.5 Good; >22.5 Excellent

The hybrid WetCAT/IWC methodology has also shown that the most intact and least disturbed site is Buloke, followed by Red Gum A and then Red Gum B, which also agrees with the subjective condition scores allocated during the survey. The hybrid methodology has provided additional data to complement the WetCAT assessment and more rigour than the subjective assessment, highlighting that:

- the transects in the highest elevations of the Buloke and Red Gum A sites become weedier with summer annual weeds;
- there are issues with the deepest sections of Red Gum A and Red Gum B matching the suggested EVC benchmarks; and
- grazing is impacting on the critical life-forms and wetland processes at Red Gum B.

Interestingly, the scores are consistent between surveys in the wet and dry phase for all but weeds in the high wetland profiles at Buloke and Red Gum A. Such equivalent scores across most categories imply that this methodology may be robust enough to pick up a representative condition score, irrespective of the time of year that the survey is undertaken, and potentially allowing for condition assessments to be undertaken out of the wet phase if necessary.

4 THREATS and RECOMMENDED MANAGEMENT ACTIONS

4.1 Key Threats

Twenty-eight threats within 15 categories (disturbances classes) were recorded on 84 of the Seasonal Herbaceous Wetlands surveyed (Table 19). A full list of threats at each wetland is presented in APPENDIX 5: RECORDED THREATS AT EACH SEASONAL HERBACEOUS WETLAND. The most commonly recorded threat category was weeds (111), which represented five weed categories, environmental (15), noxious (8), pasture (81), pine forest encroachment (7) and woody (2). Wetlands may have more than one type of threat from one category; hence there were 113 records from 84 sites. Although weeds were generally always present, as previously mentioned they were usually at a very low cover of less than five percent.

Table 19: Threat Categories Recorded on Seasonal Herbaceous Wetlands in South Australia.

Threat/Disturbance Category	Seasonal Herbaceous Wetland Subjective Condition Class							Total
	5	4.5	4	3.5	3	2.5	2	
Altered Water Regime		1	4		1		2	8
Changed Soil Character			1		1			2
Cropping							1	1
Dams	2		6	2	4			14
Degraded buffer	1	1	19	12	16	3	7	59
Fragmentation			5	1	2		1	9
Overgrazing		2	11	7	16	2	7	45
Recreational			1					1
Tracks	1		6		1	1	2	11
Unidentified Threat			1		2		1	4
Vegetation destruction					1			1
Vermin	2		1		1		1	5
Water extraction	1		13	8	5	1	3	31
Water obstruction			1	1	2			4
Weeds	12	1	42	19	25	2	12	113
Total	19	5	111	50	77	9	37	308

5 = Pristine, 4.5 = Almost Pristine, 4 = Intact, 3.5 Moderately Intact, 3 = Moderate, 2.5 = Moderately Degraded and 2 = Degraded.

Over half of the Seasonal Herbaceous Wetlands were recorded as having a degraded buffer (partially or completely absent), however, the real figure is likely to be higher and some wetlands were data deficient. The overgrazing shown above (45 occurrences) represents both stock (41) and native fauna (4) grazing, which appeared to be either changing the species diversity or biomass in the wetland, or both.

A large proportion of wetlands recorded some level of changed water regime, through either Altered Water Regimes (8), Water Extraction (31), Dams (14), or Water Obstruction (4) (Table 19). The most commonly water affecting activity was Water Extraction – forestry uptake (28 instances).

Despite a number of sites being assessed as “pristine” or condition class 5, which means “*no obvious disturbance, with high native species diversity. Scored mostly intact rapid assessment scores. Usually formally conserved with the reserve system*”, 17 threats were recorded in this class. When the comments in this class are taken into consideration, it is clear that even very minor threats, like a track nearby or ubiquitous weeds have been recorded, likely demonstrating additional observer effort in threat identification at “Pristine” sites. However upon review, the two pristine wetlands with small wedge-holes (dams) present, theoretically require a change in condition score to 4, “*Small amounts of disturbance evident, with high native species diversity. Damage easily rectifiable. Received mostly moderate - intact rapid assessment scores*”.

4.2 Conservation Actions

During the survey phase, 122 conservation measures were suggested for verified Seasonal Herbaceous Wetlands. Suggested conservation measures focussed on the main threats that could be successfully addressed through localised on-ground works, including weed invasion in the wetland basin and overgrazing by stock. Weed control was the most commonly recommended action, relevant for 50 sites (Table 20). Weed control could represent management of pasture and environmental weeds, and could also represent control of trees or shrubs invading the wetland basin, a symptom of drying conditions. Changed stocking regimes (seasonal or no grazing) with fencing was recommended for 24 wetlands.

Table 20: Recommended Conservation Measures for Seasonal Herbaceous Wetlands in South East of South Australia.

Conservation Measures	Seasonal Herbaceous Wetland Subjective Condition Class							Total
	5	4.5	4	3.5	3	2.5	2	
Alternate stock water point	1							1
Buffer - increase buffer area			3	1	1			5
Changed stocking regime	1		6	4	7	1	5	24
Environmental - burning				1				1
Environmental - grazing				1				1
Fencing	1	1	5	4	8	1	4	24
Pest control - animal			3		1			4
Pest control - weed	8		18	10	10	1	3	50
Restoration of water regime			1	2	1	1	2	7
Restricted access			5					5
Total	11	1	41	23	28	4	14	122

5 = Pristine, 4.5 = Almost Pristine, 4 = Intact, 3.5 Moderately Intact, 3 = Moderate, 2.5 = Moderately Degraded and 2 = Degraded.

Management actions were most often suggested for the “intact” to “moderate” subjective condition classes (Table 20), as by their description, they are likely to respond best to conservation measures given that they still retain a recoverable suite of biological values. Recommended conservation measures for Seasonal Herbaceous Wetlands that qualify for EPBC Act 1999 listing have been prioritised based on the condition class of the wetland. Conservation measures are listed with field notes in APPENDIX 6: RECOMMENDED CONSERVATION MANAGEMENT ACTIONS FOR SEASONAL HERBACEOUS WETLANDS.

The method of data collection and entry into SAWID resulted in a problem with data transcription into SAWID; hence some conservation measures were not allocated descriptions codes, and have not been assessed as part of this report. An example of this was the removal of “Eucalypt saplings in the wetland basin”, which is missing from the above analysis, particularly for wetlands in the Upper South East. It is recommended that the data set is queried, reviewed and supplemented with additional raw field data to increase the volume of stored conservation measures in SAWID.

5 DISCUSSION

5.1 Comparison of the South Australian modelled 2011 Seasonal Herbaceous Wetland distribution to the 2013 verified Seasonal Herbaceous Wetland distribution

In 2011, prior to the national listing of the Seasonal Herbaceous Wetland ecological community, states were required to provide distribution maps of the community based on the best available knowledge at that time. South Australia modelled the Seasonal Herbaceous Wetland community based on information stored within the South Australian Wetland Inventory Database (SAWID), using the required physical and biological characters. The model predicted 86 sites (comprising of 126 wetland polygons) as Seasonal Herbaceous Wetlands, 29 of which had high to very high ecological significance (TSSC 2012a). The model provided an important baseline for natural resource management practitioners and landholders to begin to evaluate the occurrence of the Seasonal Herbaceous Wetland ecological community when the proposed listed was endorsed.

The 2013 field verification process and Technical Reference Workshop confirmed 9 of the modelled wetland polygons as Seasonal Herbaceous Wetlands, 100 as other wetland types, with 17 still remaining to be verified. The modelled wetlands contained most of the physical and biological characteristics; however, the model relied on data within SAWID, which itself is limited in data coverage for some districts. This was particularly true when assessing the dominance of different species in the ecological community, as despite SAWID being capable of capturing species dominance data, flora species are predominantly recorded in terms of presence/absence.

An improved understanding of the distribution of the Seasonal Herbaceous Wetland ecological community was achieved through an expert panel workshop and field verification process. The 2013 survey confirmed a total of 95 wetlands as being Seasonal Herbaceous Wetlands in South Australia. It is interesting to note that, although this is not dissimilar to the original total number of sites modelled, the finalised layer is now comprised of mostly different, often smaller wetlands.

The distribution of Seasonal Herbaceous Wetlands across the region has remained within similar latitudes, being situated from Willalooka in the north, to Mount Gambier in the south. However, the confirmed distribution has retracted east, with all Seasonal Herbaceous Wetlands confirmed to occur east of Padthaway, with the exception of one wetland near Willalooka. This has significantly refined the *extent of occurrence*¹ of Seasonal Herbaceous Wetlands in South Australia, from the predicted 12,500 km² to the now confirmed 7,500 km².

Similarly, the final mapped *area of occupancy*² for South Australian Seasonal Herbaceous Wetlands was markedly reduced following field surveys. The total combined area of Seasonal Herbaceous

¹ – *Extent of occurrence* is defined as the area which encompasses all the known, inferred or projected Seasonal Herbaceous Wetlands within the shortest continuous boundary.

² – *Area of occupancy* is defined as the actual area of physical occupancy of Seasonal Herbaceous Wetlands at their predicted maximum capacity.

wetlands was confirmed as 563.12 ha, which is a fraction (8 %) of the formerly predicted total combined area of 7,196 ha. This contraction was to be expected, as some large inter-dunal wetlands that had been mapped as Seasonal Herbaceous Wetlands did not meet the listing advice, and the majority of the newly verified wetlands are less than five hectares in size. However, it is important that the new mapping is not considered to be definitive or final, as there are still many areas of small wetlands to be verified, and new potential sites will emerge for future investigation. However, although the mapped area of occupancy of the ecological community is likely to increase a small amount in future years in response to additional field surveys, it is very unlikely to ever reach the scale of the formerly estimated area.

5.2 Observations on the variability of the national description and the ecological community's dynamic nature

Seasonal Herbaceous Wetlands in South Australia fit well in the national listing advice for Seasonal Herbaceous Wetlands. The listing advice allows for a comparatively high level of variability within the ecological community and this was reflected within the community in South Australia. It was quite clear that even within 10 or 20 hectares, different wetland vegetation communities were present in what seemed superficially similar systems. Very slight variations in soils, hydrology, duration of inundation and land-use resulted in different vegetation communities and eco-tones between them, with similar key species.

The listing advice acknowledges that a wetland may be functioning as a Seasonal Herbaceous Wetland through previous or current management regimes, which does not preclude it from listing if it meets the criteria (TSSC 2012a). Historical information gathered from landholders strengthened the opinion that Seasonal Herbaceous Wetlands are dynamic communities that change over time. Wetlands verified as Seasonal Herbaceous Wetlands during the survey were described by landholders as previously supporting a different vegetation community or depth of water, which would have previously disqualified them from being consistent with the listing. The flux in vegetation communities was particularly highlighted when fencing bisected the same wetland, resulted in different management techniques, or between similar types of wetlands owned by neighbouring landholders.

During the field surveys undertaken for this project, wetlands of the same general physical characteristics and flora species that were grazed by sheep were more likely to fit the Seasonal Herbaceous Wetland ecological community than those grazed by cattle. The cattle grazed wetlands were dominated by *Eleocharis acuta* to a much greater extent, with this being particularly evident at wetlands in the Dismal Swamp Complex. Vegetation responses to grazing can be influenced by the consumption of plant biomass, trampling of plants (below-ground parts and soil), nutrient inputs and bacterial contamination from dung and urine and the introduction and dispersal of seeds and other propagules (Reeves and Chapman, 2004). Hence the resulting vegetation community can vary depending on the scale at which each of these components is expressed and this ultimately depends on a combination of the type of stock, their stocking density and the period under which grazing occurs.

The dynamic nature of Seasonal Herbaceous Wetlands means that as conditions change (climatic, water use, vegetation shift, etc.), it is quite conceivable that currently verified sites may at some future time no longer meet the listing requirements. If conservation management recommendations given in this report are followed and wetlands are fenced to allow seasonal or even permanent grazing exclusion, it is possible that some species will respond more favourably than others and this, in itself, could cause a change in ecological community. Observed responses in wetlands which have been grazed by sheep suggest an increased herb and grass component compared to sites which are not grazed or those which are pugged by cattle. In light of these potential and observed responses to modified grazing regimes, it is recommended that wetlands which are fenced for conservation be regularly surveyed to determine the nature and trajectory of change in vegetation in response to any change in grazing regime.

Given the already naturally dynamic nature of Seasonal Herbaceous Wetlands, potential exists for increased climate variability or change (due to global climate change) to cause shifts in ecological character of sites within the listed community. While the precise nature of the impact is impossible to predict, suggested drying climate scenarios in south-eastern Australia in particular pose a significant threat to the conservation of Seasonal Herbaceous Wetlands (TSSC 2012a; TSSC 2012b). Therefore, it is also recommended that repeat monitoring should be undertaken at a sub-set of selected benchmark sites (see Section 5.3 and Table 21), as a way of helping to assess the potential impacts of climate change on this critically endangered ecological community; evaluating the vegetative response to both (a) seasonal patterns and (b) longer-term climatic trends through time. The complexity of the question requires that careful consideration be given to establishing a monitoring design that allows for the variables to be adequately isolated and causes attributed.

The above issues raise a practical (but also philosophical) question regarding how such a polymorphic vegetation community can be accurately “benchmarked” in the traditional sense. Dynamic seasonal responses, longer-term change through time and a high level of responsiveness to management regime (particularly inundation and grazing), are characteristics that potentially compromise the longer-term validity of contemporary spatial data.

The question of benchmarking, habitat condition assessment and classification is a general issue of wider relevance to wetland managers and researchers. Unlike the relative stability and predictable trajectory of ecological patterns in terrestrial systems, wetlands tend to be naturally dynamic as a result of the overt interaction of a variable inundation regime with annual floristic composition. Whilst at one end of the wetland habitat “spectrum” permanently saturated habitats (such as rising springs) share more of the perennial characteristics of terrestrial habitats, wetlands that are more seasonal or ephemeral have a greater in-built capacity for shorter-term (dynamic) responses and change – simply as a result of being constituted by species favoured by such conditions. Seasonal Herbaceous Wetlands are no exception.

It is not without irony today that, given alteration to regional hydrology in the South East has been so significant, extensive and complete, true reference sites or conditions (to identify spatially accurate pre-European vegetation communities for most wetland types) are almost impossible to locate. Yet the adaptability of wetland flora is so effective, that vegetation communities that may have only established in recent years or decades (as a result of communities moving down the elevation gradient in response to drying) can appear today as being “pristine”.

This discussion may not appear to have a clear and immediate application given that contemporary, specific data are crucial for the identification, classification and protection of an ecological community like Seasonal Herbaceous Wetlands. However, having used this project to create the first regional benchmark for more accurately understanding the distribution and character of Seasonal Herbaceous Wetlands, this context is provided simply to remind readers in the future that significant floristic change through time is expected to occur at the sites described in this report for the reasons provided.

For what is now listed as a *critically endangered* community at the national level it raises the question as to whether management should (where possible) proactively seek to maintain present habitat condition, in spite of other natural factors that may result in a vegetation community shift away from being consistent with the listing? This is also a philosophical question that land managers in the South East are advised to consider, because in this context inaction (passive management) is in itself a management decision that will have implications.

5.3 Establishing benchmark sites for the ecological community in South Australia

In spite of the clear challenges for defining a “benchmark condition” for Seasonal Herbaceous Wetlands (outlined in the previous section), modern policy and decision making tools require benchmarks to inform management and policy development in the future. Hence, with the previous discussion taken into account (and noting the quandary posed by the dynamic nature of the vegetation community in this instance), seven wetlands are cautiously recommended for use as potential benchmark sites for the Seasonal Herbaceous Wetland ecological community in South Australia.

These seven wetlands capture a diversity of good to pristine condition scores and composition (Table 21), that is; they are all in good condition and represent different current and historic management regimes. They represent variations of the most common vegetation association, Red Gum Seasonal Herbaceous Wetland, and the most distinct, Gilgai wetland mosaic Seasonal Herbaceous Wetland. Variations in the vegetation composition have been shown in bold (Table 21).

Based on the discussion in Section 5.2, it will be necessary for these sites to be periodically revisited and assessed in the future to ensure that they retain an ecological character that is consistent with both their:

- (a) classification as Seasonal Herbaceous Wetlands, and
- (b) selection as a benchmark site for the community in South Australia.

Table 21: Potential South Australian Seasonal Herbaceous Wetlands benchmark sites.

Aus_WetNR	Vegetation association	Land use
S0125090	+/- <i>E. camaldulensis</i> , +/- <i>Allocasuarina luehmannii</i> (dominant), +/- <i>Duma florenta</i> (absent) over <i>Amphibromus</i> spp, <i>Eleocharis acuta</i> , +/- <i>Swainsona procumbens</i> , +/- <i>Craspedia paludicola</i> , +/- <i>Schoenus tesquorum</i> Gilgai wetland mosaic seasonal herbaceous swamp	Private: Conservation – pristine
S0125070	+/- <i>E. camaldulensis</i> (dominant), +/- <i>Allocasuarina luehmannii</i> +/- <i>Duma florenta</i> (absent) over <i>Amphibromus</i> spp, <i>Eleocharis acuta</i> , +/- <i>Swainsona procumbens</i> , +/- <i>Craspedia paludicola</i> , +/- <i>Schoenus tesquorum</i> Gilgai wetland mosaic seasonal herbaceous swamp	Private: Conservation Agreement – site recovering from grazing
S0121519	+/- <i>E. camaldulensis</i> (dominant), +/- <i>Allocasuarina luehmannii</i> +/- <i>Duma florenta</i> (absent) over <i>Amphibromus</i> spp, <i>Eleocharis acuta</i> , +/- <i>Swainsona procumbens</i> , +/- <i>Craspedia paludicola</i> , +/- <i>Schoenus tesquorum</i> Gilgai wetland mosaic seasonal herbaceous swamp	Private: Lightly grazed – very good condition
S0125075	<i>Eucalyptus camaldulensis</i> over <i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland – northern form, +/- <i>E. leucoxyton</i> , <i>Chorizandra enodis</i> , and <i>Utricularia</i> spp.	Public: Bangham Conservation Park – pristine
S0125104	<i>Eucalyptus camaldulensis</i> over <i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland	Private: Heritage Agreement – site recovering from vehicle tracks
S0122579	<i>Eucalyptus camaldulensis</i> over <i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland	Private: Conservation – previously lightly grazed
S0117994	<i>Eucalyptus camaldulensis</i> over <i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland	Half Public: Native Forest Reserve – high quality and, Half Private: Grazed – low quality

5.4 Potential Wetland Descriptions for Seasonal Herbaceous Wetlands in South Australia

The variability of the Seasonal Herbaceous Wetland ecological community is demonstrated by the seven different Victorian Wetland Ecological Vegetation Classes suggested to correspond to the community in the listing advice (TSSC 2012a). This number is reflected by what appears to be natural groupings of vegetation types suggested by data gathered in this study. All wetlands surveyed fit within the two broad groups described by Herpich and Butcher (2010), Freshwater meadows and Grass sedge wetlands. As discussed in the listing advice, only part of the very broad Grass sedge wetland type meets the description of Seasonal Herbaceous Wetlands, where the wetlands are fresh, fed by local runoff, and seasonally inundated with the characteristic flora species (TSSC 2012a).

Using data gathered during the verification surveys, 13 temporary vegetation types were used within SAWID to allow for easy analysis. The thirteen temporary types were consolidated into 6 suggested wetland vegetation types, described in section 3.3.3 Vegetation Associations and Components. Of the six suggested vegetation types found in Seasonal Herbaceous Wetlands, two are consistent with Freshwater meadows and six with Grass sedge wetlands, as described by Herpich and Butcher (2010).

During the surveys, each Seasonal Herbaceous Wetland had a slightly different vegetation composition, even within the suggested types. Consistent with the high variability of the ecological community, the suggested wetland vegetation types do not neatly fit within the South Australian Wetland Vegetation Components (WVCs), Vegetation Associations used in the SA Bushland Condition Monitoring (which was not designed for wetlands) or the highly detailed Victorian Ecological Vegetation Classes.

Each suggested wetland vegetation type might represent two or more WVCs, which is consistent with their intention to acknowledge that wetlands are made up of components. Conversely EVCs attempt to describe most of the wetland, providing detailed descriptions of the vegetation association. The detail of the EVC has meant that many of the suggested wetland vegetation types only partially align with existing EVCs. It is recommended that as surveys continue at Seasonal Herbaceous Wetlands in South Australia, the six suggested wetland vegetation types are refined.

5.5 Limitations of the Seasonal Herbaceous Wetland Survey

The current project had a limited amount of time available (four weeks) to assess wetlands in South Australia for inclusion in the refined Seasonal Herbaceous Wetland ecological community mapping. To improve efficiency, a Technical Reference Workshop was held to identify sites for verification based on the collective expertise of participants. Sites were prioritised based on the time to drying, ecological value and site access. Over the four weeks 174 wetlands were either visually or formally verified depending on the likelihood of wetland meeting the requirements as a Seasonal Herbaceous Wetland, leaving 17 identified lower priority wetlands unverified.

It is likely that most of the high quality wetlands have been verified. However, given that the South East is a region home to numerous small wetlands; it is highly likely that many other sites could be included within the Seasonal Herbaceous Wetland ecological community in the future.

5.6 Future Survey Recommendations

The Seasonal Herbaceous Wetland survey data and mapping layer provided should not be considered a static, nor finished product. Given the small size, potential number and dynamic nature of Seasonal Herbaceous Wetlands, constant revision and addition is needed.

Future survey recommendations are drawn from wetlands that still need to be confirmed from the 2011 Seasonal Herbaceous Wetland mapping layer (Table 22), wetlands identified in the new Seasonal Herbaceous Wetland layer (marked as unverified) and from field observations. Two areas in South Australia that require a particular focus for future additional verification efforts are:

- Bool Lagoon – Coonawarra Complex; and,
- Dismal Swamp Complex.

During field verification surveys it was clear that more Seasonal Herbaceous Wetlands were likely to exist on private property, particularly in these two complexes. Potential Seasonal Herbaceous Wetlands were often observed over fences during the survey period. While it is likely that the highest quality wetlands have been assessed under this survey, it was also apparent that Seasonal Herbaceous Wetlands can persist in reasonable quality under stock grazing, particularly if grazed by sheep.

Wetlands that required verification from the 2011 layer and within the new mapping layer from this project (2013 Survey) are listed in Table 22.

Table 22: Wetlands requiring verification for inclusion as Seasonal Herbaceous Wetlands in South Australia.

Aus_WetNR	Wetland Complex	Source
S0108263	BOOL LAGOON - COONAWARRA	2011 Layer
S0110031	BOOL LAGOON - COONAWARRA	2011 Layer
S0107740	DISMAL SWAMP	2011 Layer
S0105388	AVENUE RANGE	2011 Layer
S0106156	BOOL LAGOON - COONAWARRA	2011 Layer
S0109443	BOOL LAGOON - COONAWARRA	2011 Layer
S0109799	BOOL LAGOON - COONAWARRA	2011 Layer
S0109805	BOOL LAGOON - COONAWARRA	2011 Layer
S0109947	BOOL LAGOON - COONAWARRA	2011 Layer
S0109980	BOOL LAGOON - COONAWARRA	2011 Layer
S0116900	BOOL LAGOON - COONAWARRA	2011 Layer
S0116890	BOOL LAGOON - COONAWARRA	2011 Layer
S0118188	BOOL LAGOON - COONAWARRA	2011 Layer
S0118587	BOOL LAGOON - COONAWARRA	2011 Layer
S0119176	BOOL LAGOON - COONAWARRA	2011 Layer
S0120644	BOOL LAGOON - COONAWARRA	2011 Layer
S0115069	DISMAL SWAMP	2011 Layer
S0121517		2013 Survey
S0119826		2013 Survey
S0116900		2013 Survey
S0116890		2013 Survey
S0116860		2013 Survey
S0110853		2013 Survey
S0108180		2013 Survey
S0107894		2013 Survey
S0107501		2013 Survey
S0100948		2013 Survey
TBA	NEW POLYGON	2013 Survey
TBA	NEW POLYGON	2013 Survey
TBA	NEW POLYGON	2013 Survey

6 REPORT SUMMARY AND FUTURE SURVEY RECOMMENDATIONS

6.1 Summary

Of 100 sites surveyed, ninety-five wetlands in South Australia were verified as meeting the ecological description of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains. Seventy-eight of these met the full listing requirements under the *Environment Protection and Biodiversity Conservation Act 1999*, with just over two thirds (54) of these sites are considered to be wetlands of high ecological value. A further 74 wetlands were excluded from full survey on the basis of an initial visually assessment, which found them not to be Seasonal Herbaceous Wetlands.

Assessment type	Category	Number of wetlands
Visual verification	Not Seasonal Herbaceous Wetland	74
Full survey verification	SHW - High Value EPBC listing	54
	SHW - EPBC Listing	23
	SHW - too small	6
	SHW - low quality & too small	3
	SHW - low quality	9
	Not Seasonal Herbaceous Wetland	5
Total number assessed		174

SHW = Seasonal Herbaceous Wetland

In terms of general geography, the ecological community was distributed from Willalooka (in the north), down to Mount Gambier and from the SA-Victoria border to Padthaway in the west. The Seasonal Herbaceous Wetland ecological community occurred over 563 hectares at 95 sites. The size class was variable; however, over 60% of Seasonal Herbaceous Wetlands were less than five hectares (Table 6).

South Australian Seasonal Herbaceous Wetlands conform well to the physical environment, hydrology, vegetation and fauna characteristics of the national listing advice. However, surveys confirmed that Seasonal Herbaceous Wetlands in South Australia are highly variable in floristic composition and dynamic in nature. Six suggested wetland vegetation types were produced to provide future guidance.

Fringing Overstorey or Emergent Species (<10%)	Wetland Vegetation Type
① <i>Eucalyptus camaldulensis</i>	<i>Amphibromus</i> spp., <i>Ornduffia reniformis</i> , <i>Potamogeton</i> spp., <i>Montia australasica</i> , +/- <i>Allittia cardiochila</i> +/- <i>Eryngium</i> spp. Seasonal Herbaceous Wetland
+/- ② <i>emergent/isolated Eucalyptus camaldulensis</i>	<i>Carex tereticaulis</i> +/- <i>Eleocharis acuta</i> +/- <i>Glyceria australis</i> +/- <i>Lachnagrostis</i> spp. +/- <i>Amphibromus</i> spp. +/- <i>Triglochin</i> spp. Seasonal Herbaceous Grass/sedge Wetland
③ +/- <i>Eucalyptus camaldulensis</i>	<i>Glyceria australis</i> +/- <i>Amphibromus</i> spp. +/- <i>Lachnagrostis filiformis</i> , <i>Montia australasica</i> +/- <i>Triglochin</i> spp.. Seasonal Herbaceous Grass/sedge Wetland
④ <i>Eucalyptus leucoxylon</i> +/- <i>Callistemon rugulosus</i> , +/- emergent <i>E. camaldulensis</i>	<i>Amphibromus</i> spp., +/- <i>Chorizandra enodis</i> , +/- <i>Craspedia paludicola</i> <i>Rytidosperma duttonianum</i> . +/- <i>Ornduffia reniformis</i> +/- <i>Utricularia</i> spp. Seasonal Herbaceous Wetland
⑤ +/- <i>E. camaldulensis</i> , +/- <i>Allocasuarina luehmannii</i> +/- <i>Duma</i> (syn. <i>Muehlenbeckia florulenta</i>)	<i>Amphibromus</i> spp., <i>Eleocharis acuta</i> , +/- <i>Swainsona procumbens</i> , +/- <i>Craspedia paludicola</i> , +/- <i>Schoenus tesquorum</i> Gilgai Seasonal Herbaceous Grass/sedge Wetland Mosaic
⑥	<i>Triglochin procera</i> , <i>Montia australica</i> , <i>Potamogeton</i> spp. <i>Myriophyllum</i> spp. +/- <i>Ornduffia reniformis</i> Seasonal Herbaceous Wetland

Over half of the verified Seasonal Herbaceous Wetlands in South Australia were regarded as having a condition of intact, almost pristine or pristine. Twenty-eight threats were recorded on 84 of the Seasonal Herbaceous Wetlands surveyed. The most commonly recorded threat category was weeds (111), which represented five weed categories, environmental (15), noxious (8), pasture (81), pine forest encroachment (7) and woody (2).

Wetland Condition (Subjective)	Condition Score	Number of Seasonal Herbaceous Wetlands
Pristine	5	11 (11.5%)
Almost pristine	4.5	2 (2.1 %)
Intact	4	35 (37.5%)
Moderately Intact	3.5	13 (13.5%)
Moderate	3	21 (21.9%)
Moderately degraded	2.5	3 (3.1%)
Degraded	2	10 (10.4%)
Severely Degraded	1	0 (0%)
Completely Degraded	0	0 (0%)

Suggested conservation measures have been provided for verified Seasonal Herbaceous Wetlands. Weed control was the most commonly recommended action (50 wetlands), followed by changed stocking regimes with fencing (24 wetlands).

6.2 Future Recommendations

As a result of the work summarised in this report, it is recommended that:

- as surveys continue at Seasonal Herbaceous Wetlands in South Australia, the six suggested wetland vegetation types are further refined.
- the data set is supplemented to increase the volume of stored conservation measures in SAWID.
- recommended conservation management actions are undertaken at specified wetlands.
- the South Australian Seasonal Herbaceous Wetland mapping layer provided should be further developed, not thought of as a finished, static product.
- future survey priorities include:
 - the list of thirty wetlands still requiring verification provided in this report;
 - the Bool – Lagoon Wetland Complex;
 - the Dismal Swamp Wetland Complex; and,
 - in the medium-term, periodic revisiting of previously surveyed sites to evaluate and monitor background change through time, and where relevant, response to management regime.

7 REFERENCES

- DSE 2010 EVC Benchmark for the Index of Wetland Condition. Department of Sustainability and Environment, East Melbourne, Victoria.
- DSE 2011 Index of Wetland Condition methods manual version 12, May 2011 (with field sheets v 13). Arthur Rylah Institute for Environmental Research, Biodiversity and Ecosystem Services, Department of Sustainability and Environment, Heidelberg, Victoria.
- Ecological Associates (2009) Final Report: Estimation of Water Requirements of Wetlands in the South East of South Australia. Report prepared for Department of Water, Land and Biodiversity Conservation. Ecological Associates report reference no. DG003-D
- Farrington, L., Bachmann, M. and Dickson, C. (DRAFT 2013) Field verification and review of the Wetland Condition Assessment Tool (WetCAT) in the South East of South Australia. Report to the Department of Environment, Water and Natural Resources, Government of South Australia. Nature Glenelg Trust, Mount Gambier, South Australia.
- Foulkes, J. N. and Heard, L. M. B. (2003). A Biological Survey of the South East, South Australia. 1991 and 1997. (Department for Environment and Heritage: Adelaide, South Australia.)
- Herpich M. and Butcher R. (2010). All wetlands great and small: a guide to the wetland diversity of the South East. Department of Environment and Natural Resources. Mount Gambier, SA.
Available on the Internet at:
<http://www.senrm.sa.gov.au/Portals/10/PDF/All%20Wetlands%20Great%20and%20Small.pdf>
- Reeves PN, Champion PD (2004) Effects of livestock grazing on wetlands: literature review. National Institute of Water and Atmospheric Research Ltd, Hamilton, New Zealand. Accessed online July 13, 2006: <http://www.wetlandtrust.org.nz/documents/grazing.pdf>
- Threatened Species Scientific Committee (TSSC) (2012a), Approved Conservation Advice for the Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains accessed 1/1/2013 at <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/97-conservation-advice.pdf>
- Threatened Species Scientific Committee (TSSC) (2012b), Advice to the Minister for Sustainability, Environment, Water, Population and Communities from the Threatened Species Scientific Committee (the Committee) on an Amendment to the List of Threatened Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), accessed 1/1/2013 at <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/97-listing-advice.pdf>

8 APPENDIX 1: FLORA SPECIES INDICATIVE OF SEASONAL HERBACEOUS WETLANDS (TSSC 2012a)

SPECIES	COMMONNAME	High Value Indicator Spp.	Recorded in survey
GRAMINOIDS			
<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass		Not in SA
<i>Amphibromus macrorhinus</i>	Long-nosed Swamp Wallaby-grass		Yes
<i>Amphibromus nervosus</i>	Veined Swamp Wallaby-grass		Yes
<i>Amphibromus sinuatus</i>	Wavy Swamp Wallaby-grass		
<i>Amphibromus</i> spp.	Swamp Wallaby-grass		Yes
<i>Rytidosperma duttonianum</i>	Brown-back Wallaby-grass		Yes
<i>Baumea arthrophylla</i>	Swamp Twig-rush		Yes
<i>Carex tereticaulis</i>	Rush Sedge		Yes
<i>Chorizandra enodis</i>	Black Bristle-rush		Yes
<i>Deyeuxia quadriseta</i>	Reed Bent-grass		Yes
<i>Eleocharis acuta</i>	Common Spike-rush		Yes
<i>Eleocharis macbarronii</i>	Grey Spike-rush		Not in SA
<i>Eleocharis pallens</i>	Pale Spike-rush		
<i>Eleocharis pusilla</i>	Small Spike-rush		Yes
<i>Eragrostis infecunda</i>	Barren Cane-grass		
<i>Isolepis</i> spp.	Club-rush		Yes
<i>Juncus</i> spp.	Rush		Yes
<i>Lachnagrostis aemula</i>	Blown-grass		Yes
<i>Lachnagrostis billardierei</i> ssp. <i>billardierei</i>	Coast Blown-grass		
<i>Lachnagrostis filiformis</i>	Common Blown-grass		Yes
<i>Pentapogon quadrifidus</i> var. <i>quadrifidus</i>	Five-awn Spear-grass		Yes
<i>Poa labillardieri</i> var. <i>labillardieri</i>	Common Tussock-grass		Yes
<i>Schoenus apogon</i>	Common Bog-rush		Yes
<i>Schoenus tesquorum</i>	Grassy Bog-rush		Yes
<i>Walwhalleya proluta</i>	Rigid Panic		Yes
FORBS (OTHER MONOCOTYLEDONS)			
<i>Damasonium minus</i>	Star-fruit		Yes
<i>Diuris</i> spp.	Donkey Orchid	H	Yes
<i>Hypoxis</i> spp.	Yellow Star	H	Yes
<i>Lepilaena australis</i>	Austral Water-mat		Yes
<i>Microtis</i> spp.	Onion-orchid	H	Yes
<i>Ottelia ovalifolia</i> ssp. <i>ovalifolia</i>	Swamp Lily	H	
<i>Potamogeton tricarinatus</i>	Floating Pondweed		Yes
<i>Potamogeton cheesemanii</i>	Pondweed	H	
<i>Prasophyllum</i> spp.	Leek-orchid	H	Yes
<i>Thelymitra</i> spp.	Sun-orchid	H	Yes
<i>Triglochin alcockiae</i>	Alcock's Water-ribbons	H	Yes
<i>Triglochin procera</i>	Water-ribbons		Yes

SPECIES	COMMONNAME	High Value Indicator Spp.	Recorded in survey
<i>Triglochin striata</i>	Streaked Arrowgrass	H	Yes
FORBS (BROAD-LEAF WILDFLOWERS)			
<i>Allittia cardiocarpa</i>	Swamp Daisy	H	Yes
<i>Alternanthera</i> spp.	Joyweed		Yes
<i>Asperula conferta</i>	Common Woodruff	H	Yes
<i>Asperula subsimplex</i>	Water Woodruff	H	Yes
<i>Brachyscome basaltica</i> var. <i>gracilis</i>	Swamp Daisy	H	Yes
<i>Calocephalus lacteus</i>	Milky Beauty-heads	H	
<i>Calotis</i> spp.	Burr-daisy	H	
<i>Centipeda</i> spp.	Common Sneezeweed		Yes
<i>Craspedia paludicola</i>	Swamp Buttons	H	Yes
<i>Craspedia variabilis</i>	Billy-buttons		Yes
<i>Crassula helmsii</i>	Swamp Crassula		Yes
<i>Eclipta platyglossa</i>	Yellow Twin-heads		
<i>Elatine gratioloides</i>	Waterwort		Yes
<i>Epilobium</i> spp.	Willow-herb		Yes
<i>Eryngium vesiculosum</i>	Prostrate Blue Devil	H	Yes
<i>Haloragis</i> spp.	Raspwort		Yes
<i>Helichrysum</i> sp. aff. <i>rutifolepis</i> (Lowland Swamps)	Pale Everlasting	H	Not in SA
<i>Limosella australis</i>	Australian Mudwort		Yes
<i>Lobelia pratoides</i>	Poison Lobelia	H	Yes
<i>Lythrum hyssopifolia</i>	Lesser Loosestrife		Yes
<i>Mentha satureioides</i>	Native Pennyroyal		Yes
<i>Microseris</i> sp.	Yam Daisy	H	Yes
<i>Montia australasica</i>	White Purslane	H	Yes
<i>Myriophyllum</i> spp.	Milfoil		Yes
<i>Persicaria decipiens</i>	Slender Knotweed		Yes
<i>Pratia concolor</i>	Poison Pratia	H	Yes
<i>Pratia irrigua</i>	Salt Pratia		Yes
<i>Pycnosorus globosus</i>	Drumsticks		
<i>Ranunculus diminutus</i>	Brackish-plains Buttercup		
<i>Ranunculus inundatus</i>	River Buttercup	H	Yes
<i>Ranunculus sessiliflorus</i> var.	Annual Buttercup		Yes
<i>Rumex bidens</i>	Mud Dock		Yes
<i>Samolus repens</i>	Creeping Brookweed		
<i>Selliera radicans</i>	Shiny Swamp-mat		
<i>Senecio psilocarpus</i>	Swamp Fireweed	H	Yes
<i>Stellaria angustifolia</i>	Swamp Starwort		Yes
<i>Swainsona</i> spp.	Swainsona Pea	H	Yes
<i>Teucrium racemosum</i>	Grey Germander	H	
<i>Utricularia</i> spp.	Bladderwort	H	Yes

SPECIES	COMMONNAME	High Value Indicator Spp.	Recorded in survey
<i>Xerochrysum palustre</i>	Swamp Everlasting	H	Not in SA
<i>Ornduffia reniformis</i>	Running Marsh-flower	H	Yes
FERN ALLIES			
<i>Isoetes</i> spp.	Quillwort	H	Yes
<i>Marsilea drummondii</i>	Common Nardoo		Yes
<i>Marsilea</i> spp.	Nardoo	H	Yes
<i>Pilularia novae-hollandiae</i>	Austral Pillwort	H	

9 APPENDIX 2: SOUTH AUSTRALIAN SEASONAL HERBACEOUS WETLAND FLORA SPECIES LIST

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
ALISMATACEAE	<i>Damasonium minus</i>	Star-fruit	Y			EN	Y
AMARANTHACEAE	<i>Alternanthera denticulata</i>	Lesser Joyweed	Y			NT	
AZOLLACEAE	<i>Azolla filiculoides</i>	Pacific Azolla	Y			NT	Y
AZOLLACEAE	<i>Azolla sp.</i>	Azolla	Y				Y
BORAGINACEAE	<i>Echium plantagineum</i>	Salvation Jane	N				
CAMPANULACEAE	<i>Isotoma fluviatilis ssp. australis</i>	Swamp Isotome	Y		R	RA	Y
CAMPANULACEAE	<i>Lobelia pratioides</i>	Poison Lobelia	Y		R	RA	Y
CAMPANULACEAE	<i>Lobelia sp.</i>	Lobelia	Y				
CAMPANULACEAE	<i>Monopsis debilis var. depressa</i>		N				
CAMPANULACEAE	<i>Pratia concolor</i>	Poison Pratia	Y		R	NT	Y
CAMPANULACEAE	<i>Pratia pedunculata</i>	Matted Pratia	Y			NT	Y
CAMPANULACEAE	<i>Wahlenbergia sp.</i>	Native Bluebell	Y				
CARYOPHYLLACEAE	<i>Petrorhagia dubia</i>	Velvet Pink	N				
CARYOPHYLLACEAE	<i>Stellaria angustifolia</i>	Swamp Starwort	Y			VU	Y
CARYOPHYLLACEAE	<i>Stellaria sp.</i>	Starwort	Y				Y
CASUARINACEAE	<i>Allocasuarina luehmannii</i>	Bull Oak	Y			NT	
CENTROLEPIDACEAE	<i>Aphelia gracilis</i>	Slender Aphelia	Y			NT	Y
CENTROLEPIDACEAE	<i>Centrolepis aristata</i>	Pointed Centrolepis	Y			NT	Y
CENTROLEPIDACEAE	<i>Centrolepis polygyna</i>	Wiry Centrolepis	Y			NT	Y
CENTROLEPIDACEAE	<i>Centrolepis strigosa ssp. strigosa</i>	Hairy Centrolepis	Y			NT	Y
COMPOSITAE	<i>Allittia cardiocarpa</i>	Swamp Daisy	Y		R	VU	Y
COMPOSITAE	<i>Arctotheca calendula</i>	Cape Weed	N				
COMPOSITAE	<i>Aster subulatus</i>	Aster-weed	N				Y
COMPOSITAE	<i>Brachyscome basaltica var. gracilis</i>	Swamp Daisy	Y		R	VU	Y
COMPOSITAE	<i>Carduus sp.</i>	Thistle	N				
COMPOSITAE	<i>Carduus tenuiflorus</i>	Slender Thistle	N				

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
COMPOSITAE	<i>Centipeda cunninghamii</i>	Common Sneezeweed	Y			DD	
COMPOSITAE	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Y				
COMPOSITAE	<i>Cirsium sp.</i>	Thistle	N				
COMPOSITAE	<i>Cirsium vulgare</i>	Spear Thistle	N				
COMPOSITAE	<i>Cotula coronopifolia</i>	Water Buttons	N				Y
COMPOSITAE	<i>Cotula vulgaris var. australasica</i>	Slender Cotula	Y			LC	Y
COMPOSITAE	<i>Craspedia paludicola</i>	Swamp Buttons	Y		V	VU	Y
COMPOSITAE	<i>Craspedia variabilis</i>	Billy-buttons	Y			NT	
COMPOSITAE	<i>Dittrichia graveolens</i>	Stinkweed	N				
COMPOSITAE	<i>Euchiton involucratus</i>	Star Cudweed	Y			RA	
COMPOSITAE	<i>Euchiton sp.</i>	Cudweed	Y				
COMPOSITAE	<i>Hypochaeris glabra</i>	Smooth Cat's Ear	N				
COMPOSITAE	<i>Hypochaeris sp.</i>	Cat's Ear	N				
COMPOSITAE	<i>Lagenophora huegelii</i>	Coarse Bottle-daisy	Y			RA	
COMPOSITAE	<i>Leontodon taraxacoides ssp. taraxacoides</i>	Lesser Hawkbit	N				
COMPOSITAE	<i>Leptorhynchos tenuifolius</i>	Wiry Buttons	Y		R	VU	
COMPOSITAE	<i>Microseris lanceolata</i>	Yam Daisy	Y			NT	
COMPOSITAE	<i>Myriocephalus rhizocephalus</i>	Woolly-heads	Y			RA	
COMPOSITAE	<i>Onopordum acanthium</i>	Scotch Thistle	N				
COMPOSITAE	<i>Pycnosorus sp.</i>		Y				Y
COMPOSITAE	<i>Senecio biserratus</i>	Jagged Groundsel	Y			NT	
COMPOSITAE	<i>Senecio cunninghamii var. cunninghamii</i>	Shrubby Groundsel	Y			VU	
COMPOSITAE	<i>Senecio picridioides</i>	Purple-leaf Groundsel	Y			NT	
COMPOSITAE	<i>Senecio psilocarpus</i>	Swamp Fire-weed	Y	VU	V	RA	Y
COMPOSITAE	<i>Senecio quadridentatus</i>	Cotton Groundsel	Y			LC	
COMPOSITAE	<i>Senecio sp.</i>	Groundsel	Y				
COMPOSITAE	<i>Solenogyne dominii</i>	Smooth Solenogyne	Y			RA	

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
COMPOSITAE	<i>Sonchus oleraceus</i>	Common Sow-thistle	N				
COMPOSITAE	<i>Vellereophyton dealbatum</i>	White Cudweed	N				
CONVOLVULACEAE	<i>Convolvulus sp.</i>	Bindweed	Y				
CONVOLVULACEAE	<i>Dichondra repens</i>	Kidney Weed	Y			LC	
CRASSULACEAE	<i>Crassula helmsii</i>	Swamp Crassula	Y			RA	Y
CRASSULACEAE	<i>Crassula peduncularis</i>	Purple Crassula	Y		R	RA	Y
CRASSULACEAE	<i>Crassula sp.</i>	Crassula/Stonecrop	Y				Y
CRUCIFERAE	<i>Cardamine lineariloba</i>	Annual Bitter-cress	Y			VU	
CRUCIFERAE	<i>Cardamine sp.</i>	Bitter-cress	Y				
CRUCIFERAE	<i>Cardamine tenuifolia</i>	Slender Bitter-cress	Y		R	VU	
CUPRESSACEAE	<i>Callitris gracilis</i>	Southern Cypress Pine	Y			NT	
CYPERACEAE	<i>Baumea arthrophylla</i>	Swamp Twig-rush	Y			NT	Y
CYPERACEAE	<i>Baumea juncea</i>	Bare Twig-rush	Y			LC	Y
CYPERACEAE	<i>Carex appressa</i>	Tall Sedge	Y			RA	Y
CYPERACEAE	<i>Carex inversa var.</i>	Knob Sedge	Y				Y
CYPERACEAE	<i>Carex inversa var. inversa</i>	Knob Sedge	Y			RA	Y
CYPERACEAE	<i>Carex sp.</i>	Sedge	Y				Y
CYPERACEAE	<i>Carex tereticaulis</i>	Rush Sedge	Y			RA	Y
CYPERACEAE	<i>Chorizandra enodis</i>	Black Bristle-rush	Y			NT	Y
CYPERACEAE	<i>Cyperus sp.</i>	Flat-sedge	Y				Y
CYPERACEAE	<i>Cyperus tenellus</i>	Tiny Flat-sedge	N				Y
CYPERACEAE	<i>Eleocharis acuta</i>	Common Spike-rush	Y			NT	Y
CYPERACEAE	<i>Eleocharis pusilla</i>	Small Spike-rush	Y			VU	Y
CYPERACEAE	<i>Eleocharis sphacelata</i>	Tall Spike-rush	Y			VU	Y
CYPERACEAE	<i>Ficinia nodosa</i>	Knobby Club-rush	Y			LC	Y
CYPERACEAE	<i>Isolepis cernua</i>	Nodding Club-rush	Y			RA	Y
CYPERACEAE	<i>Isolepis fluitans</i>	Floating Club-rush	Y			RA	Y
CYPERACEAE	<i>Isolepis hystrix</i>	Awned Club-rush	N				Y

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
CYPERACEAE	<i>Isolepis inundata</i>	Swamp Club-rush	Y			RA	Y
CYPERACEAE	<i>Isolepis sp.</i>	Club-rush	Y				Y
CYPERACEAE	<i>Lepidosperma laterale</i>	Tall Sword-sedge	Y			LC	Y
CYPERACEAE	<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge	Y			NT	Y
CYPERACEAE	<i>Lepidosperma sp.</i>	Sword-sedge/Rapier-sedge	Y				Y
CYPERACEAE	<i>Schoenoplectus pungens</i>	Spiky Club-rush	Y			NT	Y
CYPERACEAE	<i>Schoenus apogon</i>	Common Bog-rush	Y			LC	Y
CYPERACEAE	<i>Schoenus latelaminatus</i>	Medusa Bog-rush	Y		V	EN	Y
CYPERACEAE	<i>Schoenus nitens</i>	Shiny Bog-rush	Y			NT	Y
CYPERACEAE	<i>Schoenus sp.</i>	Bog-rush	Y				Y
CYPERACEAE	<i>Schoenus tesquorum</i>	Grassy Bog-rush	Y		R	RA	Y
DROSERACEAE	<i>Drosera auriculata</i>	Tall Sundew	Y			LC	Y
DROSERACEAE	<i>Drosera peltata</i>	Pale Sundew	Y				Y
DROSERACEAE	<i>Drosera sp.</i>	Sundew	Y				Y
ELATINACEAE	<i>Elatine gratioloides</i>	Waterwort	Y		R	VU	Y
EUPHORBIACEAE	<i>Poranthera sp.</i>	Poranthera	Y				
GENTIANACEAE	<i>Centaurium erythraea</i>	Common Centaury	N				Y
GENTIANACEAE	<i>Centaurium tenuiflorum</i>	Branched Centaury	N				
GENTIANACEAE	<i>Cicendia quadrangularis</i>	Square Cicendia	N				
GERANIACEAE	<i>Geranium sp.</i>	Geranium	Y				
GOODENIACEAE	<i>Brunonia australis</i>	Blue Pincushion	Y			NT	
GOODENIACEAE	<i>Goodenia gracilis</i>	Grampians Goodenia	Y		V		
GOODENIACEAE	<i>Goodenia humilis</i>	Swamp Goodenia	Y			VU	Y
GOODENIACEAE	<i>Goodenia pinnatifida</i>	Cut-leaf Goodenia	Y			RA	
GRAMINEAE	<i>Aira cupaniana</i>	Small Hair-grass	N				
GRAMINEAE	<i>Amphibromus macrorhinus</i>	Long-nosed Swamp Wallaby-grass	Y		R	VU	Y
GRAMINEAE	<i>Amphibromus neesii</i>	Marsh Swamp Wallaby- grass	Y			VU	Y

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
GRAMINEAE	<i>Amphibromus nervosus</i>	Veined Swamp Wallaby-grass	Y			RA	Y
GRAMINEAE	<i>Amphibromus sp.</i>	Swamp Wallaby-grass	Y				Y
GRAMINEAE	<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	N				
GRAMINEAE	<i>Austrostipa sp.</i>	Spear-grass	Y				
GRAMINEAE	<i>Avena barbata</i>	Bearded Oat	N				
GRAMINEAE	<i>Briza maxima</i>	Large Quaking-grass	N				
GRAMINEAE	<i>Briza minor</i>	Lesser Quaking-grass	N				
GRAMINEAE	<i>Bromus diandrus</i>	Great Brome	N				
GRAMINEAE	<i>Bromus hordeaceus ssp. hordeaceus</i>	Soft Brome	N				
GRAMINEAE	<i>Bromus sp.</i>	Brome	Y				
GRAMINEAE	<i>Cynosurus echinatus</i>	Rough Dog's-tail Grass	N				
GRAMINEAE	<i>Dichelachne crinita</i>	Long-hair Plume-grass	Y			NT	
GRAMINEAE	<i>Ehrharta calycina</i>	Perennial Veldt Grass	N				
GRAMINEAE	<i>Festuca arundinacea</i>	Tall Meadow Fescue	N				Y
GRAMINEAE	<i>Glyceria australis</i>	Australian Sweet-grass	Y			EN	Y
GRAMINEAE	<i>Gramineae sp.</i>	Grass Family	Y				
GRAMINEAE	<i>Holcus lanatus</i>	Yorkshire Fog	N				
GRAMINEAE	<i>Hordeum marinum</i>	Sea Barley-grass	N				Y
GRAMINEAE	<i>Hordeum sp.</i>		N				
GRAMINEAE	<i>Imperata cylindrica</i>	Blady Grass	Y			NT	
GRAMINEAE	<i>Lachnagrostis aemula</i>	Blown-grass	Y				Y
GRAMINEAE	<i>Lachnagrostis filiformis</i>	Common Blown-grass	Y				Y
GRAMINEAE	<i>Lachnagrostis sp.</i>	Blown-grass	Y				Y
GRAMINEAE	<i>Lagurus ovatus</i>	Hare's Tail Grass	N				
GRAMINEAE	<i>Lolium rigidum</i>	Wimmera Ryegrass	N				
GRAMINEAE	<i>Microlaena stipoides</i>		Y				
GRAMINEAE	<i>Pentapogon quadrifidus var. quadrifidus</i>	Five-awn Spear-grass	Y		R	VU	

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
GRAMINEAE	<i>Phalaris aquatica</i>	Phalaris	N				Y
GRAMINEAE	<i>Phalaris sp.</i>	Canary Grass	N				
GRAMINEAE	<i>Poa labillardieri var. labillardieri</i>	Common Tussock-grass	Y			NT	
GRAMINEAE	<i>Polypogon monspeliensis</i>	Annual Beard-grass	N				
GRAMINEAE	<i>Rostraria cristata</i>	Annual Cat's-tail	N				
GRAMINEAE	<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	Y			LC	
GRAMINEAE	<i>Rytidosperma duttonianum</i>	Brown-back Wallaby-grass	Y			RA	
GRAMINEAE	<i>Rytidosperma semiannulare</i>	Wetland Wallaby-grass	Y			RA	
GRAMINEAE	<i>Rytidosperma setaceum</i>	Small-flower Wallaby-grass	Y			LC	
GRAMINEAE	<i>Rytidosperma sp.</i>	Wallaby-grass	Y				
GRAMINEAE	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	N				
GRAMINEAE	<i>Vulpia sp.</i>	Fescue	N				
GRAMINEAE	<i>Walwhalleya proluta</i>	Rigid Panic	Y				
GUTTIFERAE	<i>Hypericum gramineum</i>	Small St John's Wort	Y			NT	
HALORAGACEAE	<i>Haloragis heterophylla</i>	Variable Raspwort	Y			VU	
HALORAGACEAE	<i>Haloragis sp.</i>	Raspwort	Y				
HALORAGACEAE	<i>Myriophyllum glomeratum</i>	Clustered Milfoil	Y		E		Y
HALORAGACEAE	<i>Myriophyllum integrifolium</i>	Tiny Milfoil	Y		R	RA	Y
HALORAGACEAE	<i>Myriophyllum sp.</i>	Milfoil	Y				Y
HALORAGACEAE	<i>Myriophyllum verrucosum</i>	Red Milfoil	Y			NT	Y
HYDATELLACEAE	<i>Trithuria submersa</i>	Trithuria	Y			NT	Y
HYPOXIDACEAE	<i>Hypoxis sp.</i>	Yellow Star-lily	Y				
HYPOXIDACEAE	<i>Hypoxis vaginata var. vaginata</i>	Yellow Star	Y			NT	
IRIDACEAE	<i>Romulea rosea var. australis</i>	Common Onion-grass	N				
ISOETACEAE	<i>Isoetes drummondii ssp.</i>	Plain Quillwort	Y				Y
JUNCACEAE	<i>Juncus articulatus</i>	Jointed Rush	N				Y
JUNCACEAE	<i>Juncus bufonius</i>	Toad Rush	Y			NT	Y
JUNCACEAE	<i>Juncus capitatus</i>	Dwarf Rush	N				Y

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
JUNCACEAE	<i>Juncus holoschoenus</i>	Joint-leaf Rush	Y			RA	Y
JUNCACEAE	<i>Juncus pallidus</i>	Pale Rush	Y			NT	Y
JUNCACEAE	<i>Juncus planifolius</i>	Broad-leaf Rush	Y			RA	Y
JUNCACEAE	<i>Juncus procerus</i>	Tall Rush	Y		R	RA	Y
JUNCACEAE	<i>Juncus radula</i>	Hoary Rush	Y		V	VU	Y
JUNCACEAE	<i>Juncus sp.</i>	Rush	Y				Y
JUNCACEAE	<i>Juncus subsecundus</i>	Finger Rush	Y			LC	Y
JUNCAGINACEAE	<i>Triglochin alcockiae</i>	Alcock's Water-ribbons	Y		R	RA	Y
JUNCAGINACEAE	<i>Triglochin procera</i>	Water-ribbons	Y			NT	Y
JUNCAGINACEAE	<i>Triglochin striata</i>	Streaked Arrowgrass	Y			LC	Y
JUNCAGINACEAE	<i>Triglochin turrifera</i>	Turret Arrowgrass	Y		V	VU	Y
LABIATAE	<i>Mentha diemenica</i>	Slender Mint	Y		R		
LABIATAE	<i>Mentha pulegium</i>	Pennyroyal	N				
LABIATAE	<i>Mentha sp.</i>	Mint	Y				
LEGUMINOSAE	<i>Acacia brachybotrya</i>	Grey Mulga-bush	Y			RA	
LEGUMINOSAE	<i>Acacia longifolia ssp. longifolia</i>	Sallow Wattle	N				
LEGUMINOSAE	<i>Acacia mearnsii</i>	Black Wattle	Y			LC	
LEGUMINOSAE	<i>Acacia melanoxylon</i>	Blackwood	Y			LC	
LEGUMINOSAE	<i>Acacia paradoxa</i>	Kangaroo Thorn	Y			NT	
LEGUMINOSAE	<i>Genista monspessulana</i>	Montpellier Broom	N				
LEGUMINOSAE	<i>Lotus subbiflorus</i>	Hairy Bird's-foot Trefoil	N				
LEGUMINOSAE	<i>Medicago lupulina</i>	Black Medic	N				
LEGUMINOSAE	<i>Medicago polymorpha var. polymorpha</i>	Burr-medic	N				
LEGUMINOSAE	<i>Medicago sp.</i>	Medic	N				
LEGUMINOSAE	<i>Swainsona procumbens</i>	Broughton Pea	Y		V	VU	Y
LEGUMINOSAE	<i>Trifolium angustifolium</i>	Narrow-leaf Clover	N				
LEGUMINOSAE	<i>Trifolium arvense var. arvense</i>	Hare's-foot Clover	N				
LEGUMINOSAE	<i>Trifolium sp.</i>	Clover	N				

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
LEGUMINOSAE	<i>Trifolium tomentosum</i>	Woolly Clover	N				
LEGUMINOSAE	<i>Vicia sp.</i>	Vetch	N				
LEMNACEAE	<i>Lemna disperma</i>	Common Duckweed	Y			LC	Y
LEMNACEAE	<i>Lemna sp.</i>	Duckweed	Y				Y
LENTIBULARIACEAE	<i>Utricularia beaugleholei</i>	Beauglehole's Bladderwort	Y		V	RA	Y
LENTIBULARIACEAE	<i>Utricularia dichotoma</i>	Purple Bladderwort	Y			RA	Y
LILIACEAE	<i>Arthropodium fimbriatum</i>	Nodding Vanilla-lily	Y			NT	
LILIACEAE	<i>Arthropodium strictum</i>	Common Vanilla-lily	Y			LC	
LILIACEAE	<i>Asparagus asparagoides f. asparagoides</i>	Bridal Creeper	N				
LILIACEAE	<i>Bulbine bulbosa</i>	Bulbine-lily	Y			RA	
LILIACEAE	<i>Burchardia umbellata</i>	Milkmaids	Y			LC	
LILIACEAE	<i>Chamaescilla corymbosa var. corymbosa</i>	Blue Squill	Y			NT	
LILIACEAE	<i>Dianella brevicaulis</i>	Short-stem Flax-lily	Y			LC	Y
LILIACEAE	<i>Dianella longifolia var. grandis</i>	Pale Flax-lily	Y		R	VU	
LILIACEAE	<i>Lomandra multiflora ssp.</i>	Many-flower Mat-rush	Y				
LYTHRACEAE	<i>Lythrum hyssopifolia</i>	Lesser Loosestrife	Y			LC	Y
MALVACEAE	<i>Sida sp.</i>	Sida	Y				
MARSILEACEAE	<i>Marsilea costulifera</i>	Narrow-leaf Nardoo	Y			VU	Y
MARSILEACEAE	<i>Marsilea drummondii</i>	Common Nardoo	Y			NT	Y
MENYANTHACEAE	<i>Ornduffia reniformis</i>	Running Marsh-flower	Y			LC	Y
MYRTACEAE	<i>Callistemon rugulosus</i>	Scarlet Bottlebrush	Y			NT	Y
MYRTACEAE	<i>Eucalyptus camaldulensis ssp. camaldulensis</i>	River Red Gum	Y			NT	Y
MYRTACEAE	<i>Eucalyptus leucoxylon ssp.</i>	South Australian Blue Gum	Y				
MYRTACEAE	<i>Eucalyptus leucoxylon ssp. pruinosa</i>	Inland South Australian Blue Gum	Y			NT	
MYRTACEAE	<i>Eucalyptus microcarpa</i>	Grey Box	Y			NT	

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
MYRTACEAE	<i>Leptospermum continentale</i>	Prickly Tea-tree	Y			NT	Y
MYRTACEAE	<i>Melaleuca brevifolia</i>	Short-leaf Honey-myrtle	Y			LC	Y
MYRTACEAE	<i>Melaleuca gibbosa</i>	Slender Honey-myrtle	Y			RA	
MYRTACEAE	<i>Melaleuca squarrosa</i>	Bottlebrush Tea-tree	Y		R	RA	Y
OLEACEAE	<i>Olea europaea ssp.</i>	Olive	N				
ONAGRACEAE	<i>Epilobium billardierianum ssp.</i>	Robust Willow-herb	Y				Y
ORCHIDACEAE	<i>Disa bracteata</i>	South African Weed Orchid	N				
ORCHIDACEAE	<i>Diuris chryseopsis</i>	Cowslip Orchid	Y		E	VU	
ORCHIDACEAE	<i>Microtis arenaria</i>	Notched Onion-orchid	Y			LC	
ORCHIDACEAE	<i>Microtis atrata</i>	Yellow Onion-orchid	Y		R	EN	
ORCHIDACEAE	<i>Microtis orbicularis</i>	Swamp Onion-orchid	Y		V	EN	Y
ORCHIDACEAE	<i>Microtis sp.</i>	Onion-orchid	Y				
ORCHIDACEAE	<i>Microtis unifolia complex</i>	Onion-orchid	Y				
ORCHIDACEAE	<i>Prasophyllum sp.</i>	Leek-orchid	Y				Y
ORCHIDACEAE	<i>Prasophyllum sp.</i> Waterholes (R.Bates 9037)	Pretty Waterholes Leek-orchid	Y		E	VU	
ORCHIDACEAE	<i>Thelymitra antennifera</i>	Lemon Sun-orchid	Y			RA	
ORCHIDACEAE	<i>Thelymitra flexuosa</i>	Twisted Sun-orchid	Y		R	VU	
ORCHIDACEAE	<i>Thelymitra holmesii</i>	Blue Star Sun-orchid	Y		V		
ORCHIDACEAE	<i>Thelymitra pauciflora</i>	Slender Sun-orchid	Y			NT	
ORCHIDACEAE	<i>Thelymitra sp.</i>	Sun-orchid	Y				
OXALIDACEAE	<i>Oxalis perennans</i>	Native Sorrel	Y			LC	
PINACEAE	<i>Pinus radiata</i>	Radiata Pine	N				
PLANTAGINACEAE	<i>Plantago bellardii</i>	Hairy Plantain	N				
PLANTAGINACEAE	<i>Plantago drummondii</i>	Dark Plantain	Y				
PLANTAGINACEAE	<i>Plantago lanceolata var.</i>	Ribwort	N				
PLANTAGINACEAE	<i>Plantago sp.</i>	Plantain	Y				
POLYGALACEAE	<i>Polygala monspeliaca</i>	Annual Milkwort	N				
POLYGONACEAE	<i>Acetosella vulgaris</i>	Sorrel	N				

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
POLYGONACEAE	<i>Duma florulenta</i>	Tangled Lignum	Y				
POLYGONACEAE	<i>Persicaria decipiens</i>	Slender Knotweed	Y			NT	Y
POLYGONACEAE	<i>Persicaria prostrata</i>	Creeping Knotweed	Y			NT	Y
POLYGONACEAE	<i>Rumex bidens</i>	Mud Dock	Y			RA	Y
POLYGONACEAE	<i>Rumex brownii</i>	Slender Dock	Y			LC	Y
POLYGONACEAE	<i>Rumex crispus</i>	Curled Dock	N				Y
POLYGONACEAE	<i>Rumex dumosus</i>	Wiry Dock	Y		R	EN	Y
POLYGONACEAE	<i>Rumex sp.</i>	Dock	Y				Y
PORTULACACEAE	<i>Montia australasica</i>	White Purslane	Y		R	RA	Y
POTAMOGETONACEAE	<i>Potamogeton sp.</i>	Pondweed	Y				Y
POTAMOGETONACEAE	<i>Potamogeton tricarinatus</i>	Floating Pondweed	Y			NT	Y
PRIMULACEAE	<i>Anagallis arvensis</i>	Pimpernel	N				
PROTEACEAE	<i>Hakea rostrata</i>	Beaked Hakea	Y			NT	
PROTEACEAE	<i>Hakea rugosa</i>	Dwarf Hakea	Y			NT	
RANUNCULACEAE	<i>Ranunculaceae sp.</i>	Buttercup Family	Y				
RANUNCULACEAE	<i>Ranunculus inundatus</i>	River Buttercup	Y		R	VU	Y
RANUNCULACEAE	<i>Ranunculus muricatus</i>	Pricklefruit Buttercup	N				
RANUNCULACEAE	<i>Ranunculus ophioglossifolius</i>	Snake-tongue Buttercup	N				
RANUNCULACEAE	<i>Ranunculus robertsonii</i>	Slender Buttercup	Y		R	VU	Y
RANUNCULACEAE	<i>Ranunculus sessiliflorus var.</i>	Annual Buttercup	Y				Y
RANUNCULACEAE	<i>Ranunculus sessiliflorus var. sessiliflorus</i>	Annual Buttercup	Y			LC	Y
RANUNCULACEAE	<i>Ranunculus sp.</i>	Buttercup	Y				Y
RESTIONACEAE	<i>Apodasmia brownii</i>	Coarse Twine-rush	Y			NT	Y
ROSACEAE	<i>Acaena echinata</i>	Sheep's Burr	Y			LC	
ROSACEAE	<i>Rosa sp.</i>	Wild Rose/Briar	N				
ROSACEAE	<i>Rubus sp.</i>	Blackberry	N				
RUBIACEAE	<i>Asperula conferta</i>	Common Woodruff	Y			LC	
RUBIACEAE	<i>Asperula subsimplex</i>	Water Woodruff	Y		R	RA	

FAMILY	SPECIES	COMMONNAME	ISINDIGENOUS	EPBC	NPWACT	SESTATUSCODE	SE_AQUATIC
RUBIACEAE	<i>Asperula wimmerana</i>	Wimmera Woodruff	Y			VU	
RUBIACEAE	<i>Galium divaricatum</i>	Slender Bedstraw	N				
SCROPHULARIACEAE	<i>Bartsia trixago</i>	Bellardia	N				
SCROPHULARIACEAE	<i>Gratiola peruviana</i>	Austral Brooklime	Y			RA	Y
SCROPHULARIACEAE	<i>Gratiola sp.</i>	Brooklime	Y				Y
SCROPHULARIACEAE	<i>Limosella australis</i>	Australian Mudwort	Y			RA	Y
SCROPHULARIACEAE	<i>Mazus pumilio</i>	Swamp Mazus	Y		V	VU	Y
SCROPHULARIACEAE	<i>Mimulus gracilis</i>	Slender Monkey-flower	Y			EN	Y
SCROPHULARIACEAE	<i>Parentucellia viscosa</i>	Yellow Bartsia	N				
STACKHOUSIACEAE	<i>Stackhousia monogyna</i>	Creamy Candles	Y			RA	
STYLIDIACEAE	<i>Stylidium despectum</i>	Hundreds And Thousands	Y			NT	Y
STYLIDIACEAE	<i>Stylidium graminifolium</i>	Grass Trigger-plant	Y			NT	Y
TYPHACEAE	<i>Typha domingensis</i>	Narrow-leaf Bulrush	Y			NT	Y
UMBELLIFERAE	<i>Centella cordifolia</i>	Native Centella	Y			RA	Y
UMBELLIFERAE	<i>Daucus glochidiatus</i>	Native Carrot	Y			LC	
UMBELLIFERAE	<i>Eryngium vesiculosum</i>	Prostrate Blue Devil	Y		R	VU	Y
UMBELLIFERAE	<i>Hydrocotyle sp.</i>	Pennywort	Y				Y
UMBELLIFERAE	<i>Lilaeopsis polyantha</i>	Australian Lilaeopsis	Y			RA	Y
ZANNICHELLIACEAE	<i>Lepilaena australis</i>	Austral Water-mat	Y			RA	Y

Y = Yes, E = Endangered, V = Vulnerable, R = Rare, EN = SE Endangered, VU = SE Vulnerable, RA = SE Rare, NT = SE Not Threatened, LC = Least Concern

10 APPENDIX 3: SIGNIFICANT WEED SPECIES SITE LOCATIONS

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Weed categories: S = high threat weed species for Seasonal Herbaceous Wetland, Env = environmental weed, Dec = declared.

11 APPENDIX 4: FAUNA SPECIES RECORDED DURING SURVEY

Class	Species	Common Name	National Listing	State Listing	SE Status	Breeding	Number of Wetlands
AMPHIBIA		Unidentified Frog				No	12
AMPHIBIA	<i>Crinia signifera</i>	Common Froglet			LC	No	17
AMPHIBIA	<i>Limnodynastes dumerilii</i>	Banjo Frog			LC	No	3
AMPHIBIA	<i>Limnodynastes peronii</i>	Striped Marsh Frog			LC	No	5
AMPHIBIA	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog			LC	No	1
AMPHIBIA	<i>Litoria raniformis</i>	Southern Bell Frog	V	V	VU	No	1
AMPHIBIA	<i>Tadpole sp.</i>	Tadpole				No	25
ANNELIDA	<i>Haemadipsa sp.</i>	Tiger Leech				No	2
AVES	<i>Anas gracilis</i>	Grey Teal			LC	No	10
AVES	<i>Anas rhynchotis rhynchotis</i>	Blue-winged Shoveler				No	1
AVES	<i>Anas superciliosa</i>	Pacific Black Duck			LC	Yes	8
AVES	<i>Aquila audax</i>	Wedge-tailed Eagle			RA	No	1
AVES	<i>Ardea alba modesta</i>	Great Egret, (White Egret)				No	3
AVES	<i>Ardea intermedia plumifera</i>	Intermediate Egret				No	1
AVES	<i>Ardea pacifica</i>	White-necked Heron			NT	No	16
AVES	<i>Aythya australis</i>	Hardhead			LC	No	6
AVES	<i>Cacatua galerita galerita</i>	Sulphur-crested Cockatoo				No	4
AVES	<i>Cacatua tenuirostris</i>	Long-billed Corella			LC	No	4
AVES	<i>Calyptorhynchus banksii samueli</i>	Red-tailed Black Cockatoo				No	2
AVES	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo		V	NT	No	2
AVES	<i>Chenonetta jubata</i>	Australian Wood Duck			LC	No	2

AVES	<i>Colluricincla harmonica</i>	Grey Shrikethrush		LC	No	4
AVES	<i>Corcorax melanoramphos</i>	White-winged Chough	R	VU	No	1
AVES	<i>Corvus coronoides coronoides</i>	Australian Raven			No	1
AVES	<i>Corvus tasmanicus</i>	Forest Raven		LC	No	1
AVES	<i>Coturnix ypsilophora</i>	Brown Quail	V	RA	No	1
AVES	<i>Cygnus atratus</i>	Black Swan		LC	Yes	6
AVES	<i>Dacelo leachii</i>	Blue-winged Kookaburra			No	1
AVES	<i>Dacelo novaeguineae</i>	Laughing Kookaburra		NT	No	1
AVES	<i>Dromaius novaehollandiae</i>	Emu		LC	No	1
AVES	<i>Egretta garzetta</i>	Little Egret	R	RA	No	1
AVES	<i>Egretta novaehollandiae</i>	White-faced Heron		LC	No	13
AVES	<i>Egretta novaehollandiae novaehollandiae</i>	White-face Heron			No	2
AVES	<i>Eolophus roseicapilla</i>	Galah		LC	No	2
AVES	<i>Erythrogonys cinctus</i>	Red-kneed Dotterel		RA	No	1
AVES	<i>Falco peregrinus</i>	Peregrine Falcon	R	RA	Yes	1
AVES	<i>Gallinago hardwickii</i>	Latham's Snipe	R	RA	No	2
AVES	<i>Grallina cyanoleuca</i>	Magpielark		LC	No	1
AVES	<i>Grus rubicunda</i>	Brolga	V	EN	No	1
AVES	<i>Gymnorhina tibicen</i>	Australian Magpie		LC	No	3
AVES	<i>Himantopus himantopus</i>	Black-winged Stilt		NT	No	1
AVES	<i>Hirundo neoxena</i>	Welcome Swallow		LC	No	3
AVES	<i>Malurus cyaneus cyanocephalus</i>	Superb Blue Wren			No	2
AVES	<i>Oxyura australis</i>	Blue-billed Duck	R	VU	No	1
AVES	<i>Phalacrocorax carbo</i>	Great Cormorant		LC	No	1
AVES	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant		LC	No	2
AVES	<i>Phalacrocorax varius hypoleucos</i>	Pied Cormorant			No	3
AVES	<i>Platalea flavipes</i>	Yellow-billed Spoonbill		RA	No	1
AVES	<i>Porphyrio porphyrio melanotus</i>	Purple Swamphen			Yes	3

AVES	<i>Porzana sp.</i>	Unidentified Crane		No	1	
AVES	<i>Rhipidura albiscapa</i>	Grey Fantail	LC	No	1	
AVES	<i>Rhipidura leucophrys leucophrys</i>	Willie Wagtail		No	2	
AVES	<i>Tadorna tadornoides</i>	Australian Shelduck	LC	No	7	
AVES	<i>Threskiornis moluccus</i>	Australian White Ibis	LC	No	3	
AVES	<i>Threskiornis spinicollis</i>	Straw-necked Ibis	LC	No	6	
AVES	<i>Turnix sp.</i>	Unidentified Quail		No	1	
AVES	<i>Vanellus miles</i>	Masked Lapwing	LC	No	5	
CRUSTACEA	<i>Lepidurus apus viridus</i>	Tadpole Shrimp		No	3	
FISH	<i>Galaxiella pusilla</i>	Dwarf Galaxias	VU	EN	No	1
INSECTA		Damselflies		No	12	
INSECTA		Dragonfly		No	6	
INSECTA	<i>Austracantha minax</i>	Australian Jewel Spider		No	1	
MAMMALIA	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC	No	2	
MAMMALIA	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	R	NT	No	1
MAMMALIA	<i>Macropus rufogriseus banksianus</i>	Red-necked Wallaby		No	1	
MAMMALIA	<i>Ovis aries</i>	Sheep (Feral Sheep)		No	1	
MAMMALIA	<i>Tachyglossus aculeatus multiaculeatus</i>	Short-beaked Echidna		No	3	
REPTILIA	<i>Austrelaps sp.</i>	Copperhead		No	1	
REPTILIA	<i>Chelodina longicollis</i>	Common Long-necked Tortoise		NT	No	1
REPTILIA	<i>Notechis scutatus</i>	Eastern Tiger Snake	ssp	NT	No	1

12 APPENDIX 5: RECORDED THREATS AT EACH SEASONAL HERBACEOUS WETLAND

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13 APPENDIX 6: RECOMMENDED CONSERVATION MANAGEMENT ACTIONS FOR SEASONAL HERBACEOUS WETLANDS

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14 APPENDIX 7: IMAGES OF SUGGESTED WETLAND TYPES WITHIN THE SEASONAL HERBACEOUS WETLANDS IN SOUTH AUSTRALIA



Eucalyptus camaldulensis fringing *Amphibromus* spp., *Ornduffia reniformis*, *Potamogeton* spp., *Montia australasica*, +/- *Allittia cardiochila* +/- *Eryngium* spp. Seasonal Herbaceous Wetland



+/- emergent/isolated *Eucalyptus camaldulensis* fringing *Carex tereticaulis* +/- *Eleocharis acuta* +/- *Glyceria australis* +/- *Lachnagrostis* spp. +/- *Amphibromus* spp. +/- *Triglochin* spp. Seasonal Herbaceous Grass/sedge Wetland



Emergent +/- *Eucalyptus camaldulensis* fringing *Glyceria australis* +/- *Amphibromus* spp. +/- *Lachnagrostis filiformis*, *Montia australasica* +/- *Triglochin* spp. Seasonal Herbaceous Grass/sedge Wetland



***Eucalyptus leucoxyton* +/- *Callistemon rugulosus*, +/- *E. camaldulensis* fringing *Amphibromus* spp., +/- *Chorizandra enodis*, +/- *Craspedia paludicola* *Rytidosperma duttonianum*. +/- *Ornduffia reniformis* +/- *Utricularia* spp. seasonal herbaceous swamp**



***+/- E. camaldulensis, +/-Allocasuarina luehmannii +/-Duma florulenta fringing Amphibromus spp.,
Eleocharis acuta, +/- Swainsona procumbens, +/- Craspedia paludicola, +/- Schoenus tesquorum***
Gilgai Seasonal Herbaceous Grass/sedge Wetland Mosaic



***Triglochin procera, Montia australica, Potamogeton spp. Myriophyllum spp. +/- Ornduffia
reniformis*** Seasonal Herbaceous Wetland