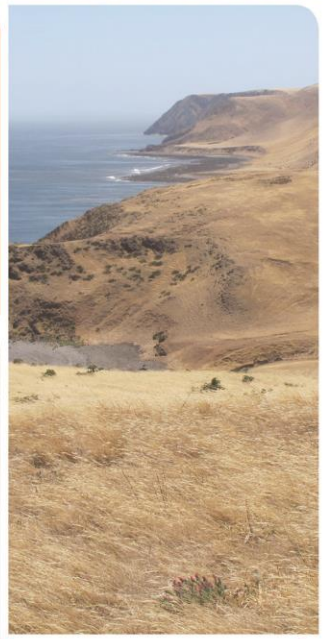
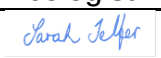
RESOURCE CONDITION ASSESSMENT

SOUTHERN FLEURIEU ESTUARIES



ecological evaluation

Document Information	
Client	Adelaide & Mt Lofty Ranges Natural Resources Management Board
Issue Date	9 April 2014
Version	FINAL
Author	Sarah Telfer
Title	Ecologist
Signature	
Verified by	Tim Milne
Title	Director
Signature	

Document History	
Version	**Issue Date**
1.0	6 March 2014
2.0	9 April 2014

EAC- Ecological Evaluation Pty Ltd
5/26 Hack St
Mount Barker, South Australia 5251
Telephone: (08) 8185 3225
eac@eacpl.com.au

Ecological Evaluation

Executive Summary

Fourteen estuaries of the southern Fleurieu Peninsula were assessed on two occasions across the spring and summer of 2014. The purpose was to characterise the ecological and physical condition of these estuaries and to identify threats to their biodiversity, in order to provide the information necessary to identify and prioritise on-ground management actions.

Estuary condition assessments focussed on terrestrial vegetation condition and pest issues. A regional condition and risk assessment of nearshore marine habitats has been undertaken by Bryars 2013, which summarises marine habitat values, threats, actions and priorities and further investigations within and adjacent to estuaries. The two reports (Bryars 2013 and this report) should be used in conjunction to provide an overall assessment of estuary and nearshore risks and values.

Estuaries with the highest overall conservation significance were Deep Creek and Boat Harbour Creek, which contained vegetation communities of state conservation significance, as well as state and regionally threatened plant species and habitats for species of state conservation significance. All estuaries were considered to provide habitat for at least one bird species of State conservation significance. With regard to estuary condition and habitat values, a general pattern was that higher condition and habitat values occurred on the south coast of the Peninsula, with the seven estuaries to the east of Blowhole Creek being assessed as high or very high for condition and habitat values. Estuaries contained within National Parks generally scored higher when both conservation significance and condition and habitat values were considered together, indicating the assets within the parks are generally of higher value than in other areas.

All estuaries were exposed to an array of threats, including weed invasion, pest animals, and anthropogenic impacts. Weeds of particular concern included Western Coastal Wattle, Bridal Creeper, African Boxthorn, Wild Rose/Briar, Gorse, Arum Lily and Evening Flower Gladiolus. It is also notable that nine of the fourteen estuaries assessed were exposed to stock grazing, including three estuaries (Waitpinga, Boat Harbor and Blowhole) on National Parks land that had sheep present. Two estuaries, First Creek and Tunkalilla, scored high for overall condition and habitat, but were also exposed to a broad array of threats, leading to a high overall threat score. These estuaries may be priorities for management to reduce the level of exposure to threat.

Based on the outcome of the assessments, a series of recommended management actions for each estuary are provided.

Contents

1. INTRODUCTION

1.1 Aims and objectives of the project

The aim of the *Resource Condition Assessment Southern Fleurieu Estuaries* project was to assess the ecological and physical condition of 16 small estuaries on the Southern Fleurieu Peninula and to identify threats to their biodiversity, in order to provide the information necessary to identify and prioritise on-ground management actions. The long-term goal is to implement these management actions to improve terrestrial biodiversity and stream bank condition, and to reduce threats in order to improve overall estuary condition.

Specific objectives of the project were to:

- Take stock of the biodiversity assets present;
- Map major weed threats and other land management issues such as stock access and vertebrate pests; and
- Provide recommendations and prioritisation of actions necessary to improve the conservation, management and protection of the estuaries.

Results of this resource condition assessment will assist in regional prioritisation of estuaries for planning, management, conservation and on-ground works activities.

Estuary condition assessments focussed on terrestrial vegetation condition and pest issues. A regional condition and risk assessment of nearshore marine habitats has been undertaken by Bryars 2013, which summarises marine habitat values, threats, actions and priorities and further investigations within and adjacent to estuaries. The two reports (Bryars 2013 and this report) should be used in conjunction to provide an overall assessment of estuary and nearshore risks and values.

The estuaries surveyed were:

Congeratinga – Anacotilla Rivers	Boat Harbor Creek
Parananacooka River	New Salt Creek (Fleurieu)
Yattagolinga River	First Creek
Yohoe Creek	Tunkalilla Creek
Fishery Creek	Callawonga Creek*
Cooalinga Creek	Ballaparudda Creek*
Blowhole Creek	Coolawang Creek
Deep Creek (Fleurieu)	Waitpinga Creek

*Note that access was denied to the Callawonga Creek and Ballaparudda Creek estuaries so these estuaries were not assessed.

See Figure 1 for location of the estuaries listed above which are all situated within the District Council of Yankalilla except for Waitpinga which is in the City of Victor Harbor. Maps showing the extent of each estuary are included in Appendix 1.

Figure 1: Location of Southern Fleurieu Estuaries Assessed

1.2 Background

The Southern Fleurieu Coastal Action Plan (Caton et al 2007) (SFCAP) has been developed for the Adelaide and Mount Lofty Ranges Resources Management Board (AMLR NRM Board). The SFCAP, which covers the coast from Sellicks Beach to Hindmarsh Island, provides a detailed review of the state of natural coastal resources across the region. Recommendation 3 of the SFCAP states:

> "Within the Southern Fleurieu coastal region encompassed by this study there are 23 estuaries. Many of them are tiny creek outlets (such as the Yattagolinga River at Rapid Bay), others are rivers of regional note (such as the Hindmarsh, Inman or Bungala, and the Murray Mouth). Other than the Murray, little is known about these estuaries, their function, water quality or sediment load. They are all seasonally barred entrances. For some the artificial opening of entrances is an issue, although the criteria for opening or closing is unexamined. There is a regional need to examine the biological function of these estuaries (as well as the impact of their pollution load on neighbouring marine areas)."

Definition of an estuary

The *Natural Resources Management Act 2004* defines an estuary as:

'A partially enclosed coastal body of water that is either permanently, periodically, intermittently or occasionally open to the sea within which there is a measurable variation in salinity due to the mixture of seawater with water derived from on or under the land'.

The Act also notes that an estuary may include any ecosystem processes or biodiversity associated with an estuary and estuarine habitats adjacent to an estuary.

The AMLR NRM Board Estuaries Information Package (DEH 2007) defines estuaries and the land that surrounds them as:

> "...places of transition - where water from the land meets and mixes with the sea. They may be large or small systems, influenced by tidal exchange, stormwater discharge or groundwater intrusion. Fluctuating salinity levels occur in estuaries. A variety of flora and fauna species have been able to adapt to these conditions and live within the estuaries. Estuaries are generally highly productive systems that are essential for the health and well-being of the marine environment. The health of the estuary is very dependent on the catchment-coast-ocean connection. Land management practices and land uses occurring upstream and on the adjacent lands have the potential to affect water quality, animal life and habitats within the estuary."

Register of the National Estate

Estuaries which were assessed as part of this project which are included on the Register of the National Estate (DEH 2007) are:

Place on Register	Estuary	Significance
Landsend to Fishery Beach (natural)	Fishery Creek	Geologically significant and a significant site for *Eucalyptus porosa* and *Melaleuca lanceolata* – 'Uncommon' on the Fleurieu Peninsula.

Deep Creek Conservation Park & Deep Creek CP – extension (natural)	Deep Creek Blowhole Creek	Provides important habitat for a range of bird and animal species, including the Yellow-tailed Black Cockatoo.
Tunkalilla Creek – Tunkalilla Beach area (natural)	Tunkalilla Creek First Creek	Significant vegetation including two rare ferns: the coral and the water fern.
Newland Heads area (natural)	Waitpinga Creek	The only area of the Fleurieu Peninsula with a high diversity of habitats and floristic and faunal diversity.

Source: Register of the National Estate (http://www.ahc.gov.au/register/) cited in DEH (2007), *Estuaries Information Pack Estuaries of the Adelaide & Mount Lofty Ranges Natural Resources Management Region*.

Marine issues

Whilst outside the scope of this report, introduced marine species which may be of concern to estuaries and adjacent marine habitats include European Shore Crab (*Carcinus maenas*) and European Fan Worm (*Sabella spallanzanii*). For further information on marine pest risks and presence in estuaries refer to Wiltshire et al (2010).

2. Methodology

The preparation of this Resource Condition Assessment has included the following steps.

2.1 Review of previous biodiversity surveys and related studies

Key resources included the 2007 Southern Fleurieu Coastal Action Plan and the 2008 Draft Estuaries Technical Report (Appendix 2 of the Natural Resources Management Plan for the AMLR Region, Volume A).

Data from Biological Survey of SA (BSSA) survey sites, State Herbarium records and DEWNR floristic mapping were also accessed in order to gain an understanding of the information that already exists for the estuaries surveyed.

2.2 Stakeholder consultation

Key staff from the AMLR NRM Board, local council and DEWNR, as well as private landholders, were consulted to gain information on access, land ownership, relevant historical information, current land use, biodiversity assets and management issues/threats.

2.3 Field survey

Two field assessments were undertaken for each of the estuaries – the first between late August – early December 2013 when estuary flow rates were expected to be high and a second visit from 29th January – 4th February 2014 when flow rates were low. This enabled the diversity of plants present to be more thoroughly assessed, as well as a greater understanding of threats such as erosion and stock access.

Tasks undertaken as part of the field survey included recording information on the biodiversity assets of the estuary, including :

- Major vegetation associations recorded and mapped;
- Native plant species present by vegetation association;

- Presence of potential habitat for threatened fauna species; and
- Any fauna observations.

Actual/potential threats to biodiversity were also recorded, including:

- Current uses of the site;
- Anthropogenic impacts (i.e. infrastructure, pollution, vehicle access, development, etc);
- Streambank condition / level of erosion;
- Identifying and mapping stock access points;
- Mapping of woody weeds;
- Vertebrate pest sightings/evidence; and
- Describing other potential threats/threatening processes observed.

Note that investigation and monitoring of water quality and aquatic biodiversity assessment was not required as part of this project.

2.4 Estuary Assessments

An individual evaluation of each estuary was undertaken (see Section 4 below). These assessments included:

- A physical description of the estuary and its environs;
- Land use/ownership and current usage;
- Habitat parameters – these were derived using information adapted from AUSRIVAS Physical Assessment Protocol Field Data Sheets (Parsons et al 2002) and Department of Environment & Primary Industries Victoria's *Index of stream condition* (2006). See Appendix 1 for data sheets used in the field.
- An assessment of the terrestrial vegetation – DEWNR's Bushland Rapid Assessment Technique ('BushRAT') was used to gather information on vegetation association/ community (as defined by the Nature Conservation Society of SA's Bushland Condition Monitoring method[1]) , plant species diversity (See Appendix 4 for a full list of species recorded at each estuary), plant species of conservation significance, weeds and vegetation condition which was scored using BushRAT's Vegetation Condition Score[2]. See BushRAT data sheets in Appendix 2.
- Priority weed species, which were determined using several sources including:
  - Declared plants as regulated under the *Natural Resources Act 2004*;
  - Weeds of National Significance (WONS) as listed by Biosecurity SA (http://www.pir.sa.gov.au/biosecuritysa/nrm_biosecurity/weeds/weeds_of_national_significance);
  - the list of priority environmental weeds for the Southern Fleurieu coastal region (Caton et al, 2007); and

[1] Croft, SJ et al, 2006. Bushland Condition Monitoring Manual: SOuthern Mount Lofty Ranges. Coastal Vegetation Communities of the Southern Mount Lofty Ranges. Nature Conservation Society of South Australia, Adelaide.

[2] The **Vegetation Condition Score** measures the attributes Native Plant Species Diversity, Weediness, Native Plant Life Form Diversity, Regeneration, Native:Exotic Understorey Biomass, Bare Ground, Tree Health, Tree Hollows, Fallen Timber and Grazing Evidence

  - Red Alert Weeds as listed in the Nature Conservation Society's Bushland Condition Monitoring Manual for the Coastal Vegetation Communities of the Southern Mt Lofty Ranges (2006).
- Other biodiversity threats.
- Recommended priority on-ground management actions.
- A series of maps which show:
  - estuary extent (as previously mapped by DEWNR and identified in the draft Estuaries Policy and Action Plan (2007);
  - major terrestrial vegetation associations;
  - location of woody weeds; and
  - stock access points.

3. Summary of findings

3.1 Vegetation and condition

The following table summarises the vegetation communities, plant species diversity, plant species of conservation and vegetation condition score (based on calculations from the BushRAT metric) recorded for each estuary surveyed.

Table 1: Estuary vegetation and condition summary

Estuary	Vegetation community	Conservation significance of vegetation community[3]	Plant species diversity	Plant species of conservation significance	Vegetation condition score
Congeratinga – Anacotilla	*Typha domingensis, Juncus kraussii* Sedgeland		16	*Calystegia sepium, Centella asiatica* – Uncommon regionally	60
Parananacooka	*Phragmites australis +/- Typha domingenis* Sedgeland		14	*Calystegia sepium, Leiocarpa supina* – regionally Uncommon	56
Yattagolinga	*Phragmites australis +/- Typha domingensis* Closed sedgeland		6	*Calystegia sepium* – regionally Uncommon	49
Yohoe	*Typha domingensis, Cyperus vaginatus* Sedgeland with *Phragmites australis* and *Gahnia trifida*.		10	*Gahnia trifida*, *Leiocarpa supina, Schoenoplectus pungens* – Uncommon regionally	50.5
New Salt	*Typha domingensis, Juncus karusii* Sedgeland with *Cyperus vaginatus*		7	Nil	45
Fishery Creek	*Juncus kraussii, Cyperus vaginatus +/- Dianella brevicaulis* Open sedgeland		12	*Leiocarpa supina* – Regionally Uncommon	49
Cooalinga	*Typha domingensis* Sedgeland		14	Nil	59

[3] Department for Environment, Water and Natural Resources (2012). Provisional List of Threatened Ecosystems in South Australia. Unpublished and Provisional List.

Blowhole	*Typha domingensis* Sedgeland with emergent *Myoporum insulare*		15	*Leptospermum lanigerum*, *Samolus repens* – Regionally Uncommon	48
Deep Creek	*Melaleuca decussata, Leptospermum lanigerum* Shrubland	Vulnerable	36	*Correa eburnea* – Vulnerable in South Australia and regionally *Selliera radicans, Solanum laciniatum* – regionally Rare *Centella asiatica, LeptospermInum lanigerum, Samolus repens, Villarsia umbricola* – regionally Uncommon	63
Boat Harbor	*Myoporum petiolaris, Correa eburnea +/- Leptospermum lanigerum* Shrubland	Vulnerable	31	*Correa eburnea* – Vulnerable in South Australia and regionally *Lepidosperma gladiatum, Leptospermum lanigerum, Myoporum petiolatum, Triglochin procerum* – regionally Uncommon	47
First Creek	*Typha domingensis* Sedgeland		17	*Gahnia trifida, Triglochin procerum* – Regionally Uncommon	58.7
Tunkalilla Creek	*Phragmites australis, Typha domingensis* Closed sedgeland		12	*Melaleuca halmaturorum* – Regionally Vulnerable *Leptospermum lanigerum, Triglochin procerum* – Regionally Uncommon	58.7
Coolawang	*Phragmites australis, Typha domingensis* Sedgeland with *Juncus krausii* and *Cyperus vaginatus* on edges		16	*Callistemon sieberi, Leptospermum lanigerum, Triglochin procerum* – Regionally Uncommon	56
Waitpinga	*Muehlenbeckia florulenta* Tall open shrubland *Sarcocornia quinqueflora* Saltmarsh		19 9	*Wilsonia rotundifolia* – Regionally Vulnerable *Mimulus repens, Muehlenbeckia florulenta, Selliera radicans* – Regionally Rare *Triglochin procerum* – Regionally Uncommon	61.4 3 7

3.2 Threats/Management issues

Estuarine ecosystems are generally vulnerable to a number of threats and the management issues of particular concern in terms of biodiversity conservation within the estuaries surveyed as part of this project include:

- Weed invasion;
- Stock grazing;
- Grazing and predation by pest animals (foxes, dogs, cats, rabbits, hares, rats, mice);
- Recreation activities such as fishing, boating, swimming and hiking;
- Loss of connectivity to the sea; and
- Climate change
- Anthropogenic impacts

Photographic examples of particular threats at individual estuaries are included in Appendix 5.

3.2.1 Invasive weeds

The diversity and structure of the estuarine vegetation communities on the Southern Fleurieu is threatened by introduced weedy species and Table 2 lists the weeds of concern found in the estuaries surveyed . A full list of weeds recorded is included in Appendix 3.

Table 2: List of priority weeds recorded

Species	Common Name	[4]Declared	[5]WONS	[6]SFCAP Threat Level	[7]Red Alert Weed Rating
Acacia cyclops	Western Coastal Wattle			7	3
Ammophila arenaria	Marram Grass				3
Arctotheca calendula	Cape Weed			1	
Asparagus asparagoides	Bridal Creeper	Y	Y	9	5
Atriplex prostrata	Creeping Saltbush			1	
Avena barbata	Bearded Oat			1	
Bromus diandrus	Great Brome			1	
Bromus hordaceus ssp. hordaceus	Soft Brome			1	
Bromus madritensis	Compact Brome			1	
Carduus tenuiflorus	Slender Thistle	Y		1	
Cynodon dactylon var. dactylon	Couch			3	
Echium plantagineum	Salvation Jane	Y		2	
Ehrharta longiflora	Annual Veldt Grass			2	
Euphorbia paralias	Sea Spurge			5	3
Euphorbia terracina	False Caper	Y		5	3
Hedera helix	Ivy				4
Hypochaeris spp.	Cat's Ear			1	
Lagurus ovatus	Hare's Tail Grass			2	
Limonium companyonis	Sea-lavender			2	
Lolium perenne	Perennial Ryegrass			1	
Lycium ferocissimum	African Boxthorn	Y	Y	7	3
Malva parviflora	Small-flower Marshmallow			3	

[4]Biosecurity SA Weeds and Pest Animals. Declared plants in South Australia, October 2012 http://www.pir.sa.gov.au/biosecuritysa/nrm_biosecurity/weeds/declared_plants_in_south_australia,_October_2012

[5] Australian Weeds Committee (2012), Weeds of National Significance 2012. Department of Agriculture, Fisheries and Forestry, Canberra, ACT http://www.weeds.org.au/WoNS/

[6] Southern Fleurieu Coastal Action Plan, AMLR Natural Resources Management Board

[7] Croft, S.J., J.A. Pedler & T.I. Milne (2006) Bushland Condition Monitoring Manual – Coastal vegetation communities of the Southern Mount Lofty Ranges. Nature Conservation Society of SA Inc.

Species	Common Name	[4]Declared	[5]WONS	[6]SFCAP Threat Level	[7]Red Alert Weed Rating
Medicago spp.	Medic			1	
Oenothera stricta	Evening Primrose			1	
Oxalis pes-caprae	Soursob	Y		5	3
Paspalum distichum	Water Couch				3
Pennisetum clandestinum	Kikuyu			2	3
Phalaris aquatica	Phalaris				3
Plantago spp.	Plantain			3	
Reichardia tingitana	False Sow-thistle			3	
Romulea rosea var. australis	Common Onion-grass			1	
Rosa sp.	Wild Rose/Briar	Y		2	
Scabiosa atropurpurea	Pincushion			3	
Senecio pterophorus	African Daisy			2	3
Silybum marianum	Variegated Thistle	Y			
Solanum linnaeanum	Apple of Sodom			4	
Sonchus oleraceus	Common Sow-thistle			1	
Sparaxis sp.	Sparaxis				3
Trifolium spp.	Clover			1	
Ulex europaeus	Gorse	Y	Y	7	
Zantedeschia aethiopica	White Arum Lily			3	

SFCAP Threat Levels: The threat value allocation process undertaken as part of the SFCAP identified a total of 85 priority environmental weeds for the Southern Fleurieu coastal region, each featuring a weed threat value between 1 and 9.

Red Alert Weed Categories 3-5 (Note - Categories 1&2 are not Red Alert Weeds):

3 – Invasive in intact bushland with moderate potential to reduce native species diversity. Rate of spread is slower than Category 4 and 5 weeds but once present will persist and threaten biodiversity. May produce dense stands over a wide area but can be controlled with sustained effort.

4 – Highly invasive in either disturbed or intact remnant bushland, with the potential to spread rapidly and produce very dense stands given favourable habitat and/or vectors. High potential to reduce native species diversity and abundance. Can be controlled with sustained effort.

5 – Highly invasive in either disturbed or intact bushland, spreads rapidly producing very dense stands and a blanket cover. Potential to eliminate almost all native understorey species. Very difficult to control without outside help.

Weeds of particular concern are:

- Western Coastal Wattle – only recorded at Fishery Creek where active control was undertaken between the 1st and 2nd site assessments. Follow-up control of seedlings is recommended.
- Bridal Creeper – recorded at Fishery and Waitpinga Creeks and control should be a high priority.
- Sea Spurge – widespread at the lower reaches of estuaries.
- African Boxthorn – scattered individuals recorded at New Salt, Cooalinga and Fishery Creeks. Note that active control was undertaken between the 1st and 2nd site assessments at Fishery Creek, where follow-up control only is required.
- Wild Rose/Briar - scattered individuals recorded at several estuaries and control should be a high priority.
- Gorse – only recorded at Anacotilla – Congeratinga estuary and control should be a high priority.
- Arum Lily – recorded from a number of estuaries and should be a high priority for control to reduce further spread within creeklines.

In addition, weeds not listed in Table 2 which should be a high priority for control are:

- Poplars – a stand of mature poplars is situated in the upper reaches of Parananacooka River estuary (above Finniss Vale Road) and there is a chance that they could spread downstream.
- Evening Flower Gladiolus (*Gladiolus tristris*) – recorded at Waitpinga and Deep Creek Cove. This bulbous species which is native to South Africa is considered to be an environmental weed in South Australia.

3.2.2 Stock grazing

A number of the estuaries surveyed are being negatively impacted by stock, and the damage (pugging, grazing, other physical damage to vegetation, stock camps) was much greater during the summer (2nd site assessment), perhaps due to the presence of water and green feed. Estuaries where evidence of stock was noted are:

- Yohoe Creek – sheep have unimpeded access to the estuary which is on largely private land
- New Salt Creek – sheep have unimpeded access to the estuary, the upper and middle reaches of which is on private land
- Fishery - sheep observed on adjacent back dune during second site assessment and were able to access the estuary
- Cooalinga Creek - sheep have unimpeded access to the estuary, the upper reaches of which is on private land
- Blowhole – sheep have unimpeded access to the upper reaches of the estuary which is on private land and unfenced. Lower reaches are within Deep Creek CP, however a number of sheep were within the Park boundaries during the second site assessment and were actively grazing on estuarine vegetation.
- Boat Harbor – although this estuary is within Deep Creek CP, a number of sheep were within the Park boundaries during the second site assessment and were actively grazing on estuarine vegetation.
- First Creek – sheep and cattle have unimpeded access to the estuary, the upper reaches of which is on private land
- Tunkalilla Creek – sheep & cattle have unimpeded access to the estuary, the upper and middle reaches of which is on private land
- Coolawang – cattle have access to the eastern side of the estuary. The western side is fenced.

3.2.3 Abundant native fauna

Pressure from kangaroo grazing was evident at the Boat Harbor and Waitpinga estuaries. Kangaroo grazing threatens natural regeneration and revegetation efforts.

3.2.4 Pest animals

Grazing and predation by pest animals can have a significant negative impact on biodiversity and estuaries where evidence of pest animals was noted include:

- Cooalinga Creek – active rabbit warrens, diggings and dung heaps on slopes adjacent estuary
- First Creek – dog and/or fox footprints – of concern particularly because the State Vulnerable Hooded Plover nests on Tunkalilla Beach

- Tunkalilla Creek – dog and/or fox footprints – of concern particularly because the State Vulnerable Hooded Plover nests on Tunkalilla Beach
- Waitpinga – dog and/or fox footprints

3.2.5 Recreation activities

Due to limited access the impact of recreational activities are fairly minimal within several of the estuaries surveyed and are restricted largely to fishing, boating and walking. Activities which may have an impact on biodiversity include:

- trampling or crushing of vegetation;
- compaction of soil which limits natural regeneration;
- disturbance of soil and erosion which encourages weeds;
- disturbing normal animal behaviour and breeding success, such as dogs chasing birds;
- predation on native animals by domestic pets such as cats and dogs; and
- the wash up of marine debris

Estuaries where recreation activities are having a negative impact include:

- Congeratinga – Anacotilla River – adjacent marina
- Parananacooka River – popular beach for swimming, fishing
- Yattagolinga River - popular beach for swimming, fishing. Adjacent caravan park
- Fishery Creek - popular beach for swimming, fishing
- Cooalinga Creek - accessed by walkers via the Heysen Trail
- Blowhole Creek - popular beach for swimming, fishing
- Deep Creek – accessed by walkers on the Heysen Trail
- Boat Harbor – accessed by walkers. Popular beach for swimming, fishing
- First Creek – accessed by walkers via the Heysen Trail
- Tunkalilla Creek – accessed by walkers via the Heysen Trail
- Coolawang Creek – accessed by walkers via the Heysen Trail
- Waitpinga Creek - popular beach for swimming, fishing

3.2.6 Connectivity to the sea

Many of the estuaries within the AMLR NRM Board region are considered to have poor flow to the sea, with upstream modification such as dams and weirs and extensive groundwater extraction decreasing environmental flows and potentially changing channel morphology (DEH, 2007). However, connectivity such that sea and fresh water can readily interchange through the estuary mouth provides the foundation for important habitat for estuarine fish species, such as the Black Bream (*Acanthopagrus butcheri*). As such, connectivity is considered to be an important habitat attribute for estuaries.

The following information re connectivity to the sea was noted for the estuaries surveyed as part of this project:

Estuary	Connectivity		Flows		Comments
	Spring	Summer	Spring	Summer	
Congeratinga – Anacotilla River	Yes	Yes	Medium	Low	Some connectivity and tidal influence still occurring in the summer via the marina.
Parananacooka River	Yes	Yes	Medium	Low	Tidal movement influences the lower reaches (beach).
Yattagolinga River	No	No	Medium	Low	Stream width and direction have been modified with the construction of banks, resulting in a loss of connectivity to the sea.
Yohoe Creek	Yes	Yes	Medium	Low	Tidal movement enters the estuary.
New Salt Creek	Minimal	No	Low	Minimal	Tidal movement enters the estuary.
Fishery Creek	Yes	No	Medium	Minimal	In January 2014 there was standing water in rock pools only. Tidal movement enters the estuary.
Cooalinga Creek	No	No	Low	Minimal	Due to the build-up of the pebbly beach there is no surface water connectivity to the sea, although water may flow beneath the rocky surface as it flows across the beach.
Blowhole Creek	Yes	Minimal	Medium	Low	Connectivity perhaps at high tide in the summer?
Deep Creek	Yes	Yes	Medium	Low	
Boat Harbor	Yes	No	Medium	Low	
First Creek	Yes	Minimal	Low	Minimal	Tidal movement influences the estuary to a limited extent. Spring-fed?
Tunkalilla Creek	Yes	Yes	Low	Low	Tidal movement influences the estuary to a limited extent. Spring-fed? There are several open pools or ponds present.
Coolawang Creek	Yes	Yes	Medium	Low	Tidal movement influences the estuary to a limited extent. Spring-fed? There are several open pools or ponds present.
Waitpinga Creek	Yes	No	Medium	Medium – low	Connectivity perhaps at high tide in the summer?

3.2.7 Climate change

Caton et al 2007 describe the likely impacts of climate change on coastal areas of the Fleurieu Region as follows:

> "Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Given the range of sea level rise projected by the IPCC (2001 report), many talus slopes at the base of sea cliffs will be trimmed back. Tide and water depth dependent habitats on reefs will be impacted by sea level rise. Some intertidal sloping reefs will accommodate species migration. Flat low tide reef platforms will see species change."

3.3 Comparative analysis of assets and threats within estuaries

There was no suitable metric available in the literature that adequately described and assessed the array of assets and threats within the Southern Fleurieu estuaries. As discussed in the methodology, components of AUSRIVAS Physical Assessment Protocol Field Data Sheets (Parsons et al 2002), Department of Environment & Primary Industries Victoria's *Index of stream condition* (2006), and DEWNR's BushRAT methodology were used to provide a degree of objectivity to the assessment. Table 3 is a summary of the presence and condition of assets within the estuaries, as well as the type of threats present and the current level of exposure to those threats. The scores assigned are derived from both the metrics described above, as well as the expert opinion of the authors. This will help the relevant management authorities prioritise investment where it can be most effective.

Estuaries with the highest overall conservation significance were Deep Creek and Boat Harbour Creek, which contained vegetation communities of state conservation significance, as well as state and regionally threatened plant species and habitats for species of state conservation significance. With regard to estuary condition and habitat values, a general pattern was that higher condition and habitat values occurred on the south coast of the Peninsula, with the seven estuaries to the east of Blowhole Creek being assessed as high or very high for condition and habitat values. Estuaries contained within National Parks generally scored higher when both conservation significance and condition and habitat values are considered together, indicating the assets within the parks are generally of higher value than in other areas.

All estuaries were exposed to threats, with all overall threat scores assessed as moderate or above. Two estuaries, First Creek and Tunkalilla, scored high for overall condition and habitat, but were also exposed to a broad array of threats, leading to a high overall threat score. These estuaries may be priorities for management to reduce the level of exposure to threat. It is also notable that nine of the fourteen estuaries assessed were exposed to stock grazing, including three estuaries (Waitpinga, Boat Harbor and Blowhole) on National Parks land that had sheep present.

Table 3: Overall Asset and Threat Summary for Southern Fleurieu Peninsula Estuaries

Estuary	Conservation significance				Estuary Condition and habitat values						Threats					
	Conservation significance of vegetation community	Conservation significance of plant species	Habitat values for fauna of conservation significance	Overall conservation significance value[8]	Plant species richness for estuarine vegetation	Native: exotic under storey biomass[9]	In-stream habitat values	Connectivity to the sea	Open water habitat [10]	Overall condition and habitat score	Weed score	Stock grazing	Anthropo-genic impacts	Erosion issues	Introd./ abundant fauna species impact	Overall threat score
Congeratinga – Anacotilla	Low	Low	Medium	Low	Excellent	Excellent	Poor	Moderate	Mod	High	Mod	N	Y	Y	N	Moderate
Parananacooka	Low	Low	Medium	Low	Excellent	Good	Poor	Moderate	Poor	Moderate	Mod	N	Y	Y	Y	Moderate
Yattagolinga	Low	Low	Medium	Low	Moderate	Excellent	Mod	No surface connectivity	Poor	Low	Mod	N	Y	N	N	Moderate

[8] **Conservation significance score** includes: threatened vegetation communities, threatened plant species, threatened fauna species, % native vegetation remaining in IBRA association, if site contains a riparian/swamp/wetland zone.

[9] **Native:exotic understory biomass**: Very High = 81-100%; High = 61-80%; Medium = 41-60%; Low = 21-40%; Very Low = 0-20%

[10] **Open water habitat:** Excellent = pools/expanses of open water present all year round; Good = some shallow pools/ standing water present all year round; Moderate = some water flows all year round; Poor = very minor or no open water during the summer months.

Estuary	Conservation significance				Estuary Condition and habitat values						Threats					
	Conservation significance of vegetation community	Conservation significance of plant species	Habitat values for fauna of conservation significance	Overall conservation significance value[8]	Plant species richness for estuarine vegetation	Native: exotic under storey biomass[9]	In-stream habitat values	Connectivity to the sea	Open water habitat [10]	Overall condition and habitat score	Weed score	Stock grazing	Anthropo-genic impacts	Erosion issues	Introd./ abundant fauna species impact	Overall threat score
Yohoe	Low	Low	Medium	Low	Good	Poor	Good	Moderate	Poor	Moderate	Mod	Y	N	Y	Y	High
New Salt	Low	Low	Medium	Low	Moderate	Good	Mod	Poor	Poor	Moderate	Mod	Y	N	Y	Y	High
Fishery	Low	Low	High	Moderate	Excellent	Poor	Good	Moderate	Poor	Moderate	Mod	Y	Y	Y	N	High
Coolalinga	Low	Low	Medium	Low	Excellent	Excellent	Mod	No surface connectivity	Mod	Moderate	Mod	Y	Y	Y	Y	High
Blowhole	Low	Low	High	Moderate	Excellent	Good	Mod	Moderate	Mod	High	Good	Y	Y	N	N	Moderate
Deep Creek	High	High	High	High	Excellent	Excellent	Excellent	Moderate	Good	Very High	Mod	N	Y	N	N	Moderate

Estuary	Conservation significance				Estuary Condition and habitat values						Threats					
	Conservation significance of vegetation community	Conservation significance of plant species	Habitat values for fauna of conservation significance	Overall conservation significance value[8]	Plant species richness for estuarine vegetation	Native: exotic under storey biomass[9]	In-stream habitat values	Connectivity to the sea	Open water habitat [10]	Overall condition and habitat score	Weed score	Stock grazing	Anthropo-genic impacts	Erosion issues	Introd./ abundant fauna species impact	Overall threat score
Boat Harbor	High	High	High	High	Excellent	Good	Good	Moderate	Good	High	Poor	N	Y	N	N	Moderate
First	Low	Low	Medium	Low	Excellent	Good	Good	Poor	Mod	High	Mod	Y	Y	Y	Y	High
Tunkalilla	Low	Medium	Medium	Moderate	Excellent	Excellent	Mod	Poor	Mod	High	Mod	Y	Y	Y	Y	High
Coolawang	Low	Low	Medium	Low	Excellent	Mod	Good	Mod	Excellent	High	Mod	Y	Y	N	N	Moderate
Waitpinga (1)	Low	Medium	High	Moderate/ High	Excellent	Excellent	Excellent	Moderate	Excellent	Very high	Good	Y	Y	N	N	Moderate

Estuary	Conservation significance				Estuary Condition and habitat values						Threats					
	Conservation significance of vegetation community	Conservation significance of plant species	Habitat values for fauna of conservation significance	Overall conservation significance value[8]	Plant species richness for estuarine vegetation	Native: exotic under storey biomass[9]	In-stream habitat values	Connectivity to the sea	Open water habitat [10]	Overall condition and habitat score	Weed score	Stock grazing	Anthropo-genic impacts	Erosion issues	Introd./ abundant fauna species impact	Overall threat score
Waitpinga (2)	Low	Medium	High	Moderate/ High	Excellent	Poor	Excellent	Moderate	Mod	High	Good	Y	Y	Y	N	Moderate

4 Results of estuary assessments

4.1 Congeratinga – Anacotilla River (Wirinna)

Physical description	Situated at the mouth of the Congeratinga – Anacotilla River system at Wirinna Cove, within Southern Fleurieu Coastal Action Plan Cell 22 – Second Valley to Lady Bay Cove. The estuary is approximately 10-15m wide and has been modified by the construction of the adjacent Wirinna Marina with flow of the creekline having been diverted, with the estuary now connecting to the sea through the marina. Stream flow height during August 2013 was estimated to be medium. Stream flow height in February 2014 was low, with some connectivity to the sea and tidal influence occurring via the marina.
Adjacent land use / Land ownership	Marina and resort development at Wirrina Cove and in the neighbouring Congeratinga valley and slopes. Grazing land to the south.
Habitat parameters	Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be poor with <10% stable habitat present. No visible instream wood/logs were noted. Many rocks, boulders have been placed on the banks as part of the marina construction. Sediment deposition: Moderate deposition of sediment. Bank stability: Areas of erosion occur on both banks with some roots exposed. Bank condition: Rock sea wall constructed for the marina has impacted the height and location of toe of bank. Vegetative protection: Streambank surfaces have <50% covered by native vegetation. Disturbance is obvious with a high cover of weedy herbs and grasses. Riparian zone: Human activities have impacted riparian zone to a large extent.
Vegetation community	*Typha domingensis, Juncus kraussii* Sedgeland (*Phragmites australis* occurs upstream of estuary boundary)
Plant species diversity	A total of 16 native plant species was recorded, indicating an "Excellent" level of diversity for this type of plant community (NCS SA's SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plant species of conservation significance	*Calystegia sepium, Centella asiatica* – Uncommon regionally.
Vegetation condition	BushRAT[11] vegetation condition score: 60 Weed abundance and threat was scored as "Moderate" with weeds of concern including Boxthorn, Soursob and Dog Rose. 81-90% of biomass present within the estuary was estimated to be native.
Potential habitat for threatened fauna species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status			Comments
		AUS	SA	MLR	
Common Sandpiper	*Actitus hypoleucos*		R	R	Possible non-breeding summer visitor

BIODIVERSITY THREATS				
Priority weed species	**Scientific Name**	**Common Name**	**Threat Value**	**Red Alert**
	Atriplex prostrata	Creeping Saltbush	1	
	Cynodon dactylon	Couch	3	
	Euphorbia paralias	Sea Spurge	5	Y
	Euphorbia terracina	False Caper	5	Y
	Gazania sp.	Gazania	8	Y
	Gomphocarpus cancellatus	Broad-leaf Cotton-bush	1	
	Helminthotheca echioides	Ox-tongue	1	

[11] Department Environment, Water & Natural Resources, 2013.

	Lycium ferocissimum	African Boxthorn	7	Y
	Oxalis pes-caprae	Soursob	5	Y
	Pennisetum clandestinum	Kikuyu	2	Y
	Plantago lanceolata	Ribwort	3	
	Scabiosa atropurpurea	Pincushion	3	
	Rosa canina	Dog Rose	2	
Erosion	Erosion has led to some bank instabilities and raised sediment transport. There is a small amount of exposed woody roots on the eroded banks.			
Adjacent land use	Wirinna Marina and resort development			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Including Arum Lily immediately upstream of estuary. NB: Gazania, Nasturtium, Fennel, Fig Trees and Broad-leaf Cotton-bush also in adjoining areas.
Reduce erosion	Bank stabilization and revegetation to reduce further erosion and weed cover.
Revegetation	To provide habitat for native fauna

Congeratinga – Annacotilla Estuary (Wirinna Cove)

August 2013 – Human impacts have impacted the estuary to a significant degree.

February 2014 – Low flows still occurring, with tidal influence evident.


Congeratinga - Anacotilla River Estuary
Fig Tree
Boxthorn
Arum Lily
Rosa sp.
Rosa sp.
Fig Tree
10 5 0 10 20 30 Meters
Legend
Estuary Extent
Weeds
Vegetation
Typha domingensis Juncus kraussii Sedgeland

4.2 Parananacooka River (Second Valley)

Physical description	Situated at the mouth of the Parananacooka River system at Second Valley this estuary is within Southern Fleurieu Coastal Action Plan Cell 22 – Second Valley to Lady Bay Cove. The estuary is approximately 15-30 metres wide. The width and/or course of the estuary appears to have been modified in its upper reaches where it crosses Finniss Vale Road. The estuary was connected to the sea in October 2013, when stream flow height was estimated to be medium. In February 2014 stream flow was low, however there was still some connection to the sea. Tidal movement impacts the lower reaches (beach). Revegetation on adjacent banks/slopes has occurred in the past few years.
Adjacent land use / Land ownership	Car park to the north, council reserve and recreational beach to the south.
Habitat parameters	**Epifaunal substrate/available cover:** The habitat potential of the estuary is considered to be poor with <10% stable habitat present. No visible instream wood/logs/snags or other stable habitat were noted. Sediment deposition: Moderate - heavy deposit of gravel, sand or fine sediment due to the dense cover of reeds. **Bank stability:** Erosion due to past clearance on surrounding slopes has led to bank instability with many eroded areas and obvious bank sloughing. The substrate is soft shale/sand and rabbit diggings/holes are contributing to erosion on surrounding slopes. **Bank condition:** The banks are undercut –the northern bank has been modified by construction of the carpark with concrete footings and other structures, under which the sand has eroded away. **Vegetative protection:** Streambank surfaces have 50% covered by native vegetation and disturbance is obvious with a high cover of weedy grasses and herbs. Surrounding lower slopes have been revegetated with terrestrial species. **Riparian zone:** Human activities have impacted riparian zone to a large extent. Large, mature poplar trees dominate upstream of Finniss Vale Road (Note this section is not considered to be estuarine).
Vegetation community	*Phragmites australis +/- Typha domingenis* Sedgeland
Plant species diversity	A total of 14 native plant species was recorded, indicating an "Excellent" level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plant species of conservation significance	*Calystegia sepium, Leiocarpa supina* – regionally Uncommon.
Vegetation condition	BushRAT vegetation condition score: 56 Weeds largely confined to the estuarine edges and surrounding slopes, although **Berula erecta* occurs throughout. 71-80% of biomass present within the estuary was estimated to be native with 5-25% bare ground present.
Potential habitat for threatened fauna species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status*			Comment
		AUS	SA	MLR	
Common Sandpiper	*Actitus hypoleucos*		R	R	Possible non-breeding summer visitor
Spotless Crake	*Porzana tabuensis*		R	R	Extensive reedbeds

BIODIVERSITY THREATS				
Priority weed species	Scientific Name	Common Name	Threat Value	Red Alert
	Avena barbata	Wild Oat	1	
	Bromus diandrus	Great Brome	1	

	Cynodon dactylon	Couch	3	
	Euphorbia paralias	Sea Spurge	5	Y
	Galenia pubescens var. pubescens	Coastal Galenia	3	
	Helminthotheca echioides	Ox-tongue	1	
	Lagurus ovatus	Hare's Tail Grass	2	
	Limonium companyonis	Sea-lavender	2	
	Oxalis pes-caprae	Soursob	5	Y
	Pennisetum clandestinum	Kikuyu	2	Y
	Plantago lanceolata	Ribwort	3	
	Trifolium spp.	Clover	1	
	Zantedeschia aethiopica	White Arm Lily	3	
Erosion	Erosion has led to some bank instabilities and raised sediment transport. There is a small amount of exposed woody roots on the eroded banks.			
Adjacent land use	Recreation on beach – contributing to erosion and degradation of vegetation.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Arum Lily, Kikuyu, Sea Spurge
Reduce erosion	Continue revegetation of surrounding slopes.
Visitor access	Signage to control access

Parananacooka Creek Estuary (Second Valley)

October 2013 – Lower reaches adjacent the beach – tidal influence is evident.

October 2013 – Upper reaches – note revegetation on adjacent slopes.

February 2014 – some flow and connection to the sea.


Parananacooka River Estuary
Norfolk Island Pines
FINNISS VALE
Rosa sp.
Rosa sp.
Heavily infested
with Poplars upstream of bridge
Legend
Estuary Extent
Weeds
Vegetation
Phragmites australis +/- Typha domingensis Sedgeland
8.5 4.25 0 8.5 17 25.5 Meters

4.3 Yattagolinga River (Rapid Bay)

Physical description	Within the Southern Fleurieu Coastal Action Plan Cell 21 – Rapid Bay, this estuary is situated at the mouth of the Yattagolinga River and is approximately 20-25m wide. Stream width and direction have been modified with the construction of banks, resulting in a loss of connectivity to the sea. Stream flow height during August 2013 was estimated to be medium and low in January 2014. In its upper reaches the slope of the southern estuarine bank is >45^{o} , with a gentler northern slope.
Adjacent land use / Land ownership	Caravan park, roadway, recreation beach.
Habitat parameters	**Epifaunal substrate/available cover:** The habitat potential of the estuary is considered to be fair with 10-30% of stable habitat present. No visible instream wood/logs/snags or other stable habitat were noted. **Sediment deposition:** Moderate deposition of gravel, sand or fine sediment due to the dense cover of reeds. **Bank stability:** Banks are prone to erosion and moderately unstable. **Bank condition**: Unstable toe of bank; vertical bank surface. No trees and no exposed woody roots present. **Vegetative protection:** Streambank surfaces have <50% covered by vegetation. Disturbance is obvious with a high cover of weedy grasses and herbs. **Riparian zone:** Human activities over many years have impacted riparian zone to a large extent. Presence of bridge at the eastern extent.
Vegetation community	*Phragmites australis +/- Typha domingensis* Closed sedgeland
Plant species diversity	A total of 6 native plant species was recorded, indicating a "Moderate" level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plant species of conservation significance	*Calystegia sepium* – regionally Uncommon.
Vegetation condition	BushRAT[12] vegetation condition score: 49 Weeds confined to estuarine edges. 81-90% of biomass present within the estuary was estimated to be native with <5% bare ground present.
Potential habitat for threatened species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status*			Comment
		AUS	SA	MLR	
Hooded Plover	*Thinornis rubricollis*		V	V	Occasionally recorded from this site
Common Sandpiper	*Actitus hypoleucos*		R	R	Possible non-breeding summer visitor

BIODIVERSITY THREATS				
Priority weed species	**Scientific Name**	**Common Name**	**Threat Value**	**Red Alert**
	Atriplex prostrata	Creeping Saltbush	1	
	Euphorbia paralias	Sea Spurge	5	Y
	Lagurus ovatus	Hare's-tail Grass	2	
	Limonium companyonis	Sea Lavender	2	
	Pennisetum clandestinum	Kikuyu	2	Y

[12] Department Environment, Water & Natural Resources, 2013.

	Plantago spp.	Ribwort	3	
	Rosa canina	Dog Rose	2	
	Scabiosa atropurpurea	Pincushion	3	
	Trifolium spp.	Clover	1	
Adjacent land use	Release of 'grey water' from caravans into the estuary through an offtake pipe.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Dog Rose, Kikuyu
Revegetation	Of adjacent banks to slow down erosion
Manage human impacts	Removal of 'grey water' pipe/hose from the estuary.

Yattagolinga estuary

August 2013 – moderate stream flow with connection to the sea across the sandy beach

August 2013 – the banks adjacent to the estuary are prone to erosion

February 2014 – a bank of sand is preventing connection to the sea.

February 2014


Yattagolinga River Estuary
Myoporum insulare
Dog Rose
COLONEL LIGHT
ESSINGTON LEWIS
Legend
Estuary Extent
Weeds
Vegetation
Phragmites australis +/- Typha domingensis Sedgeland
8.5 4.25 0 8.5 17 25.5 Meters

4.4 Yohoe Creek (Rapid Bay)

Physical description	Within the Southern Fleurieu Coastal Action Plan Cell 20 – Cape Jervis to Rapid Head, this estuary is situated at the mouth of Yoho Creek and is approximately 10-20m wide. The estuary appears to follow the natural flow path and tidal movement enters the estuary. Stream flow height during October 2013 was estimated to be medium and low in January 2014, when there was still some connectivity to the sea (Yohoe Creek is spring fed). In its upper reaches the slope of the southern estuarine bank is >45^{o} , with a gentler northern slope. The estuary is confined by a steep slope to the south with the northern bank following a more unconfined course.
Adjacent land use / Land ownership	The estuary is situated on private land which is used for sheep grazing.
Habitat parameters	**Epifaunal substrate/available cover:** The habitat potential of the estuary is considered to be good with 30-50% mix of stable habitat, although no visible instream wood/logs/snags were noted. **Sediment deposition:** Some deposit of gravel, sand or fine sediment from upstream areas. **Bank stability:** Erosion due to past heavy clearance of surrounding slopes has led to some bank instability. **Bank condition:** Some isolated bare eroding banks, although banks are not vertical and undercut. **Vegetative protection:** Streambank surfaces have <50% cover of native vegetation. Cover on surrounding slopes is provided largely by introduced grasses and herbs only. **Riparian zone:** Subject to grazing pressure (sheep and kangaroos).
Vegetation community	*Typha domingensis, Cyperus vaginatus* Sedgeland with *Phragmites australis* and *Gahnia trifida*.
Plant species diversity	A total of 10 native plant species was recorded, indicating an 'Excellent' level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plant species of conservation significance	*Gahnia trifida*, *Leiocarpa supina, Schoenoplectus pungens* – Uncommon regionally
Vegetation condition	BushRAT vegetation condition score: 50.5 71-80% of biomass present within the estuary was estimated to be native with <5% bare ground present.
Potential habitat for threatened species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status			Comments
		AUS	SA	MLR	
Peregrine Falcon	*Falco peregrinus*		R	R	Rocky coastline – flying over
Eastern Reef Egret	*Egretta sacra*		R	R	Possible at site
Common Sandpiper	*Actitus hypoleucos*		R	R	Possible non-breeding summer visitor

BIODIVERSITY THREATS

Priority weed species

Scientific Name	Common Name	Threat Value	Red Alert
Arctotheca calendula	Cape Weed	1	
Avena barbata	Wild Oat	1	
Bromus diandrus	Great Brome	1	
Echium plantagineum	Salvation Jane	2	
Ehrharta longiflora	Annual Veldt Grass	2	
Euphorbia paralias	Sea Spurge	5	Y
Gomphocarpus cancellatus	Broad-leaf Cotton-bush	1	

	Helminthotheca echioides	Ox-tongue	1		
	Oxalis pes-caprae	Soursob	5	Y	
	Reichardia tingitana	False Sow-thistle	3		
	Solanum linnaeanum	Apple of Sodom	4		
	Sonchus oleraceus	Sow Thistle	1		
	Trifolium campestre	Hop Clover	1		
	Zantedeschia aethiopica	White Arum Lily	3		
Erosion	Surrounding steep cliffs and incised gullies are subject to erosion.				
Adjacent land use	Sheep grazing.				

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Arum Lily, Broad-leaf Cotton-bush, Apple of Sodom
Fencing from stock	The estuary is presently unfenced

Yohoe Creek estuary

October 2013

January 2014


Yohoe Creek Estuary
Cotton-bush
Cotton-bush
Cotton-bush
Cotton-bush
Cotton-bush
Cotton-bush
Boxthorn
Cotton Bush
Apple of Sodom
Legend
Estuary Extent
Weeds
Vegetation
Typha domingensis Cyperus vaginatus Sedgeland
Leptospermum lanigerum Shrubland
10 5 0 10 20 30 Meters

4.5 New Salt Creek (Rapid Bay)

Physical description	Within the Southern Fleurieu Coastal Action Plan Cell 20 – Cape Jervis to Rapid Head, this estuary is situated at the mouth of New Salt Creek and is approximately 8-15m wide. The estuary appears to follow the natural flow path and surface water was just connecting with the sea in October 2013 when stream flow height was estimated to be low. Tidal movement enters the estuary.
Adjacent land use / Land ownership	The estuary is situated on private land which is used for sheep grazing.
Habitat parameters	**Epifaunal substrate/available cover:** the habitat potential of the estuary is considered to be moderate with a 10-30% mix of stable habitat present. No visible instream wood/logs/snags were. **Sediment deposition:** Some deposition of gravel, sand or fine sediment from upstream areas. **Bank stability/bank condition:** Erosion due to past heavy clearance on surrounding slopes has led to some undercutting and bank instability. Rocky outcrops are present **Vegetative protection:** Stream bank surfaces have less than 50% covered by native vegetation – it is largely introduced grassy and herbaceous cover (no woody vegetation present). **Riparian zone:** Subject to grazing pressure (sheep and kangaroos).
Vegetation community	*Typha domingensis, Juncus kraussii* Sedgeland with *Cyperus vaginatus.*
Plant species diversity	A total of 7 native plant species was recorded, indicating a 'Moderate' level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plants of conservation significance	Nil
Vegetation condition	BushRAT vegetation condition score: 45 51-60% of biomass present within the estuary was estimated to be native with <5% bare ground present. Weeds such as Soursob and False Caper are widespread.
Potential habitat for threatened species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status			Comments
		AUS	SA	MLR	
Peregrine Falcon	*Falco peregrinus*		R	R	Rocky coastline – flying over
Eastern Reef Egret	*Egretta sacra*		R	R	Possible at this site
Common Sandpiper	*Actitus hypoleucos*		R	R	Possible non-breeding summer visitor

BIODIVERSITY THREATS

Priority weed species

Scientific Name	Common Name	Threat Value	Red Alert
Arctotheca calendula	Cape Weed	1	
Atriplex prostrata	Creeping Saltbush	1	
Avena barbata	Wild Oat	1	
Bromus hordaceus	Soft Brome	1	
Echium plantagineum	Salvation Jane	2	
Ehrharta longiflora	Annual Veldt Grass	2	
Euphorbia paralias	Sea Spurge	5	Y
Lycium ferocissimum	African Boxthorn	7	Y
Oxalis pes-caprae	Soursob	5	Y
Reichardia tingitana	False Sow-thistle	3	
Trifolium spp.	Clover	1	

	Zantedeschia aethiopica	White Arum Lily	3	
Erosion	Surrounding steep cliffs and incised gullies are subject to erosion.			
Adjacent land use	Sheep grazing.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Arum Lily, African Boxthorn
Fencing from stock	The estuary is presently unfenced.

New Salt Creek estuary

October 2013

January 2014


New Salt Creek Estuary
Boxthorn
Arum LilyDog Rose
Arum Lily
Arum Lily
25 12.5 0 25 50 75 Meters
Legend
Estuary Extent
Weeds
Vegetation
Typha domingensis, Juncus kraussii Sedgeland

4.6 Fishery Creek (Cape Jervis)

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 19 – Fishery Beach to Cape Jervis, this rocky estuary is situated at the mouth of Fishery Creek and is approximately 15-25m wide. The estuary appears to follow the natural flow path and surface water was flowing to the sea in October 2013 when stream flow height was estimated to be medium. In January 2014 there was standing water in rock pools only. The estuary is situated on coastal lowland and tidal movement enters the estuary.
Significant rocky outcrop occurs within the stream-bed.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The estuary is situated on both council and coastal reserve and is managed by the District Council of Yankalilla. Adjacent landuse includes a recreational fishing beach and a parcel of revegetation/conservation land to the south (Glossy Black Cockatoo Recovery Program).</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be good with a 30-50% mix of stable habitat present. However no visible instream wood/logs/snags were noted.
Sediment deposition: Slope instability adjacent to lower Fishery Creek is due to off-road vehicle activity, leading to inshore and estuarine turbidity[13].
Bank stability/condition: Erosion due to past heavy clearance on surrounding slopes has led to undercutting and bank instability.
Vegetative protection: Provided on surrounding slopes largely by introduced grasses and herbs only. 50-70% of the streambank surfaces are covered by vegetation.
Riparian zone: Subject to the impact of weeds, off-road vehicles, fishing, walkers.</td></tr>
<tr><td>Vegetation community</td><td>Juncus kraussii, Cyperus vaginatus +/- Dianella breicaulis Open sedgeland.</td></tr>
<tr><td>Plant species diversity</td><td>A total of 12 native plant species was recorded, indicating an ‘Excellent’ level of diversity for this type of plant community (NCS SA’S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).</td></tr>
<tr><td>Plants of conservation significance</td><td>Leiocarpa supina – Regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>BushRAT vegetation condition score: 49

Only 31-40% of biomass present within the estuary was estimated to be native with substantial rock outcrop (approximately 35%) present. Weeds such as Soursob, Annual Veldt Grass and Wild Oat are widespread.</td></tr>
<tr><td>Potential habitat for threatened fauna species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th rowspan="2">Comments</th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th></tr>
<tr><td>Eastern Reef Egret</td><td>Egretta sacra</td><td></td><td>R</td><td>V</td><td>Occasionally recorded from this site</td></tr>
<tr><td>Hooded Plover</td><td>Thinornis rubricollis</td><td></td><td>V</td><td>V</td><td>Occasionally recorded from this site</td></tr>
</table>
*Note that Elegant Parrot (Neophema elegans) – Rare in SA – feed in nearby area but would not generally associate with the estuary.

Crinia signifera heard during field assessment.</td></tr>
</table>

BIODIVERSITY THREATS

Priority weed species

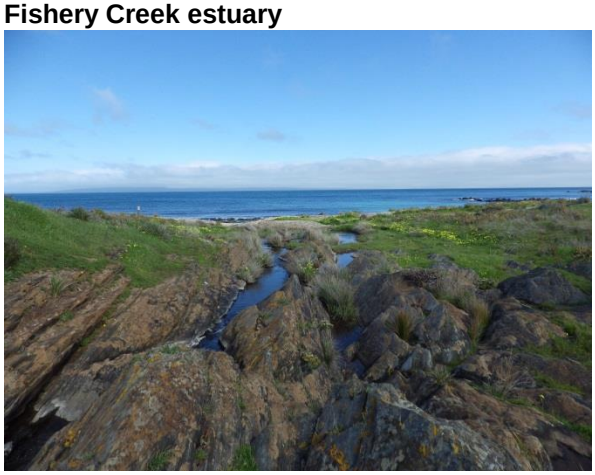
Scientific Name	Common Name	Threat Value	Red Alert
Acacia cyclops	Western Coastal Wattle	7	
Asparagus asparagoides	Bridal Creeper	9	Y
Atriplex prostrata	Creeping Saltbush	1	
Avena barbata	Wild Oat	1	
Ehrharta longiflora	Annual Veldt Grass	2	

[13] Southern Fleurieu Coastal Action Plan and Conservation Priority Study, 2007.

	Euphorbia terracina	False Caper	5	Y
	Lycium ferocissimum	African Boxthorn	7	Y
	Oxalis pes-caprae	Soursob	5	Y
	Romulea rosea var. australis	Common Onion-grass	1	
	Scabiosa atropurpurea	Pincushion	3	
	Trifolium spp.	Clover	1	
Sheep grazing	Sheep were observed on the back-beach in January 2014			
Recreation	Off-road vehicles – exacerbates erosion and leads to increased inshore and estuarine turbidity.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Bridal Creeper, African Boxthorn, *Acacia cyclops*
Fencing	To exclude off-road vehicles, sheep

Fishery Creek estuary



August 2013 – A rocky substrate with numerous pools, the creek is connecting with the sea across a gravelly beach

January 2014 – Standing water in rock pools only. No connectivity to the sea.

January 2014 – Note that *Acacia cyclops* and Boxthorn (*Lycium ferocissimum*) have been controlled since the first site assessment.


Fishery Creek Estuary
Boxthorn
Legend
Estuary Extent
Weeds
Vegetation
Juncus kraussii, Cyperus vaginatus +/- Dianella brevicauis Sedgeland
4.5 2.25 0 4.5 9 13.5 Meters

4.7 Cooalinga Creek

Physical description	Within the Southern Fleurieu Coastal Action Plan Cell 18 – Deep Creek CP to Fishery Beach, this tiny estuary is situated at the mouth of Cooalinga Creek and is approximately 3-5m wide. The estuary appears to follow the natural flow path. Due to the build-up of the pebbly beach there is no surface water connectivity to the sea, although water may flow beneath the rocky surface as it flows across the beach. In November 2013 stream flow height was estimated to be low, with minimal flow in February 2014. The estuary is situated within a confined valley with a very steep rocky slope on the western boundary and a moderately steep slope to the east.
Adjacent land use / Land ownership	The estuary is largely situated within coastal reserve (conservation), with the northern-most tip extending onto private land which is grazed by sheep.
Habitat parameters	**Epifaunal substrate/available cover:** The estuary was assessed as having moderate potential habitat in terms of large wood/snags. **Sediment deposition:** Some deposition of gravel, sand or fine sediment from upstream areas. **Bank stability/condition:** The estuary banks are undercut on the eastern side due to erosion caused by extensive past clearance and coastal slope instability. **Vegetative protection:** Vegetative cover is present on majority of the estuary, and only minor erosion was noted in the upper stretches of the estuary where sheep have access to the creek. **Riparian zone:** Human impacts are limited due to the steep surrounding slopes and limited access. Sheep were observed grazing on surrounding slopes. **Adjacent vegetation:** Minor amounts of degraded coastal shrubland vegetation, dominated by weeds. Upstream and surrounding slopes are heavily cleared and have a long history of grazing. Of interest is the very steep rocky western slope which supports a moderate diversity of coastal species such as *Adriana quadripitarta, Dianella brevicaulis*, *Leucophyta brownii, Muehlenbaeckia adpressa, Rhagodia candolleana, Lecopogon parviflorus.*
Vegetation community	*Typha domingensis* Sedgeland.
Plant species diversity	A total of 14 native plant species was recorded, indicating an 'Excellent' level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plants of conservation significance	Nil
Vegetation condition	BushRAT vegetation condition score: 59 Native to exotic biomass ratio was estimated to be approximately 90% native to 10% exotic, although the adjacent areas are highly degraded with a range of weedy grasses and herbs dominating.
Potential habitat for threatened species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status			Comments
		AUS	SA	MLR	
Common Sandpiper	*Actitus hypoleucos*		R	R	Possible non-breeding summer visitor
Eastern Reef Egret	*Egretta sacra*		R	V	Rocky coastline

BIODIVERSITY THREATS

Priority weed species

Scientific Name	Common Name	Threat Value	Red Alert
Asparagus asparagoides	Bridal Creeper	9	Y
Atriplex prostrata	Creeping Saltbush	1	
Avena barbata	Wild Oat	1	
Bromus spp.	Brome	1	
Ehrharta longiflora	Annual Veldt Grass	2	

	Euphorbia paralias	Sea Spurge	5	Y
	Lagurus ovatus	Hare's Tail Grass	2	
	Lolium perenne	Perennial Ryegrass	1	
	Oxalis pes-caprae	Soursob	5	Y
	Lycium ferocissimum	African Boxthorn	7	Y
	Medicago minima var. minima	Little Medic	1	
	Solanum linnaeanum	Apple of Sodom	4	
	Sonchus oleraceus	Sow Thistle	1	
	Trifolium angustifolium	Narrow-leaf Clover	1	
	Zantedeschia aethiopica	White Arum Lily	3	
Sheep grazing	Heavy chewing, widespread pugging/compaction evident, particularly during 2nd (summer) site assessment.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Arum Lily, African Boxthorn, Apple of Sodom, Bridal Creeper
Fencing	To exclude stock
Rabbit control	On adjacent slopes

Cooalinga Creek estuary

November 2013 – The estuary is confined by steep rocky slopes. No connectivity to the sea, however water may flow beneath the pebbly beach.


Cooalinga Creek Estuary
Boxthorn
Boxthorn
Apple of Sodom
Legend
Estuary Extent
Weeds
Vegetation
Typha domingensis Sedgeland
5.52.75 0 5.5 11 16.5 Meters

4.8 Blowhole Creek (Deep Creek Conservation Park)

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 18 – Deep Creek CP to Fishery Beach, this estuary is approximately 15m wide and is situated at the mouth of Blowhole Creek within Deep Creek Conservation Park. The estuary follows the natural flow path and surface water was flowing to the sea in October 2013 when stream flow height was estimated to be medium. In February 2014 stream flow height was low with little connectivity to the sea – perhaps at high tide.
The estuary is situated on coastal lowland in its lower reaches and follows a more confined valley in its upper reaches. The eastern bank is gently sloping, while the western bank comprises steeper, rocky slopes.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The estuary is largely situated within Deep Creek Conservation Park, near the western boundary, extending for a short distance onto private grazing land in its upper reaches.</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be moderate with a 10-30% mix of stable habitat present, however no visible instream wood/logs/snags were noted.
Sediment deposition: Some deposition of gravel, sand or fine sediment from upstream areas has built up in the reed beds.
Bank stability/condition: Some bank instabilities caused by extensive past clearance and coastal slope instability, but largely a gentle slope.
Vegetative protection: A mix of sedges and introduced grasses and herbs – cover has been reduced due to high levels of kangaroo grazing and, in the upper reaches, stock grazing.
Riparian zone: Impacted by human visitors – swimming, walking, illegal camping. Also sheep grazing.</td></tr>
<tr><td>Vegetation community</td><td>Typha domingensis Sedgeland with emergent Myoporum insulare.</td></tr>
<tr><td>Plant species diversity</td><td>A total of 15 native plant species was recorded, indicating an ‘Excellent’ level of diversity for this type of plant community (NCS SA’S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps.</td></tr>
<tr><td>Plant species of conservation significance</td><td>Leptospermum lanigerum, Samolus repens – Regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>BushRAT vegetation condition score: 48

Native understorey biomass was estimated to be approximately 71-80%.</td></tr>
<tr><td>Potential habitat for threatened species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th>Comments</th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th><th></th></tr>
<tr><td>Common Sandpiper</td><td>Actitus hypoleucos</td><td></td><td>R</td><td>R</td><td>Non-breeding summer visitor</td></tr>
<tr><td>Beautiful Firetail</td><td>Stagonopleura bella bella</td><td></td><td>R</td><td>E</td><td>Occur in low numbers in adjacent coastal scrub</td></tr>
<tr><td>Eastern Reef Egret</td><td>Egretta sacra</td><td></td><td>R</td><td>V</td><td>Rocky coastline</td></tr>
<tr><td>Peregrine Falcon</td><td>Falco peregrinus</td><td></td><td>R</td><td>R</td><td>Rocky coastline – flying over only</td></tr>
</table>
NB: Bush Rat/Water Rat hole observed during field assessment.</td></tr>
</table>

<table>
<tr><th colspan="5">BIODIVERSITY THREATS</th></tr>
<tr><td>Priority weed species</td><td>Scientific Name</td><td>Common Name</td><td>Threat Value</td><td>Red Alert</td></tr>
<tr><td></td><td>Arctotheca calendula</td><td>Cape Weed</td><td>1</td><td></td></tr>
<tr><td></td><td>Ehrharta longiflora</td><td>Annual Veldt Grass</td><td>2</td><td></td></tr>
<tr><td></td><td>Euphorbia paralias</td><td>Sea Spurge</td><td>5</td><td>Y</td></tr>
</table>

	Oxalis pes-caprae	Soursob	5	Y
	Rosa sp.	Rose	2	
	Sonchus sp.	Sow-thistle	1	
	Zantedeschia aethiopica	White Arum Lily	3	
Adjacent land use	Damage by grazing animals to steep coastal slopes both outside and inside Park boundaries.			
Recreation	Line fishing, walking and swimming.			
Sheep grazing	From adjacent private property			

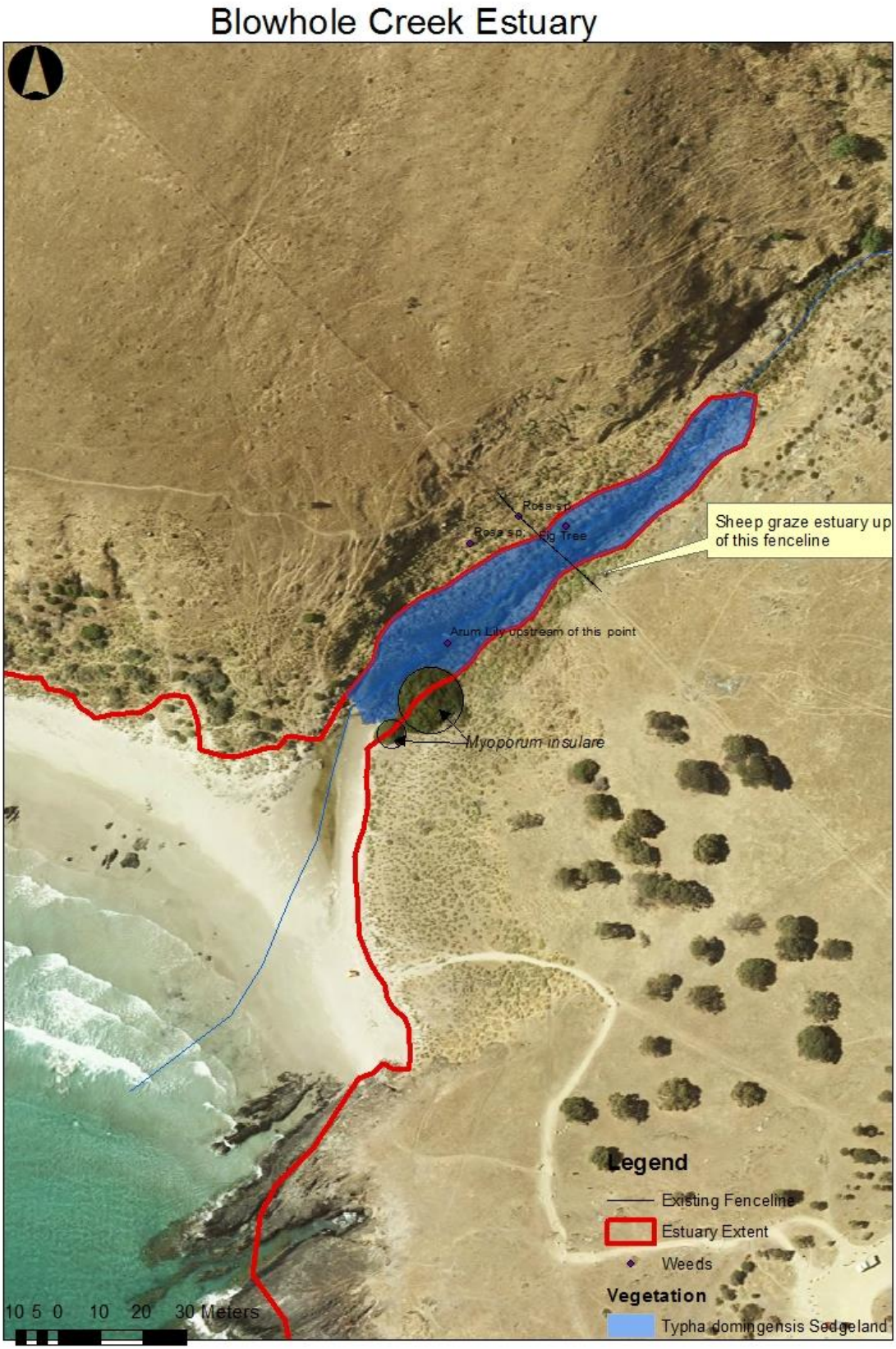
RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Arum Lily, Rosa sp., Fig Tree
Fencing	Fence from stock in upper reaches (on private land). Note: sheep gaining access to lower reaches of estuary (within CP boundaries) at time of 2nd (summer) site assessment.
Kangaroo management	Kangaroos appear to be having a grazing impact on native plant species. Ongoing management may be required.

Blowhole Creek estuary

August 2013 – The estuary is confined within a moderately steep valley in its upper reaches before spilling out onto the beach and connectig with the sea.

February 2014 – Sheep accessing the estuary from adjacent property.

February 2014


Blowhole Creek Estuary
Rosa sp.
Rosa sp.
Fig Tree
Sheep graze estuary up of this fenceline
Arum Lily upstream of this point
Myoporum insulare
Legend
Existing Fenceline
Estuary Extent
Weeds
Vegetation
Typha domingensis Sedgeland
10 5 0 10 20 30 Meters

4.9 Deep Creek (Deep Creek Conservation Park)

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 18 – Deep Creek CP to Fishery Beach, this estuary is situated at the mouth of Blowhole Creek and varies in width from 5m to 50m. The estuary follows its natural flow path and surface water was flowing to the sea in October 2013 when stream flow height was estimated to be medium. In February 2014 stream flow height was low but there was still minimal connectivity to the sea.
The estuary is confined within steep slopes before ‘spilling out’ onto the beach.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The estuary is situated within Deep Creek Conservation Park.</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be excellent with more than 50% of the substrate favourable for epifaunal colonisation and fish cover. There is a mix of snags, submerged logs, undercut banks, rocky outcrops present.
Sediment deposition: Some deposition of gravel, sand or fine sediment, in particular in areas of dense Typha.
Bank stability/condition: Banks are relatively stable due to dense vegetation cover, with little potential for future problems.
Vegetative protection: Dense native vegetation surrounds the estuary.
Riparian zone: Impacts such as walking, swimming, fishing, are limited to the coast due to inaccessibility of upper reaches.</td></tr>
<tr><td>Vegetation community</td><td>Melaleuca decussata, Leptospermum lanigerum Shrubland.</td></tr>
<tr><td>Plant species diversity</td><td>A total of 36 native plant species was recorded, indicating an ‘Excellent’ level of diversity for this type of plant community (NCS SA’S SMLR Community 7.2 – Coastal Shrublands and Talll Shrublands).</td></tr>
<tr><td>Plant species of conservation significance</td><td>Correa eburnea –Vulnerable in South Australia and regionally
Selliera radicans, Solanum laciniatum – regionally Rare
Centella asiatica, LeptospermInum lanigerum, Samolus repens, Villarsia umbricola – regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>BushRAT vegetation condition score: 63

Estuarine vegetation is in excellent condition, with 91+% of biomass estimated to be native.</td></tr>
<tr><td>Potential habitat for threatened species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th>Comments</th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th><th></th></tr>
<tr><td>Common Sandpiper</td><td>Actitus hypoleucos</td><td></td><td>R</td><td>R</td><td>Non-breeding summer visitor</td></tr>
<tr><td>Beautiful Firetail</td><td>Stagonopleura bella bella</td><td></td><td>R</td><td>E</td><td>Occur in low numbers in adjacent coastal scrub and Silky Tea-tree shrubland along the creek</td></tr>
<tr><td>Eastern Reef Egret</td><td>Egretta sacra</td><td></td><td>R</td><td>V</td><td>Rocky coastline</td></tr>
<tr><td>Peregrine Falcon</td><td>Falco peregrinus</td><td></td><td>R</td><td>R</td><td>Rocky coastline – flying over only</td></tr>
</table>
Note also that the Southern Emu-wren (MLR subspecies - E) and Chestnut-rumped Heathwren (MLR subsepecies – E) occur in the vicinity of the creek and adjacent coast but would not be directly associated with the estuary. Also Sooty Oystercatcher (R,R) would be vagrant to this sea.</td></tr>
</table>

BIODIVERSITY THREATS				
Priority weed species	Scientific Name	Common Name	Threat Value	Red Alert

	Arctotheca calendula	Cape Weed	1	
	Atriplex prostrata	Creeping Saltbush	1	
	Avena barbata	Wild Oat	1	
	Euphorbia paralias	Sea Spurge	5	Y
	Oxalis pes-caprae	Soursob	5	Y
	Rosa canina	Dog Rose	2	
	Senecio pterophorus	African Daisy	2	Y
	Also *Gladiolus tristris*			
Recreation	Line fishing, walking and swimming.			
Adjacent land use	Damage by grazing animals to steep coastal slopes outside Park boundaries.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Dog Rose, African Daisy, *Gladiolus tristris*

Deep Creek Cove estuary

September 2013 – The estuary is confined within steep, heavily vegetated slopes before spillout out onto the beach.

February 2014 – Streamflow height low but still some connectivity to the sea.


Deep Creek Estuary
Dog Rose
Legend
Estuary Extent
Weeds
Vegetation
Melaleuca decussata, Leptospermum lanigerum Shrubland
10 5 0 10 20 30 Meters

4.10 Boat Harbor (Deep Creek Conservation Park)

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 18 – Deep Creek CP to Fishery Beach, this estuary is situated at the mouth of Boat Harbor Creek and varies in width from 15m to 50m. The estuary follows the natural flow path and surface water was flowing to the sea in October 2013 when stream flow height was estimated to be medium. Stream flow height in February 2014 was low and there was no connection to the sea.
The estuary is confined within a gentle to steeply sloping valley before ‘spilling out’ onto coastal lowland and the beach. Significant rocky outcrop occurs within the stream-bed.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The estuary is largely situated within Deep Creek Conservation Park, with the northern-most tip on privately owned grazing land.</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be good with a 30-50% mix of stable habitat present, including instream wood, rocky outcrops and overhangs.
Sediment deposition: Minor sediment deposition in pools, in particular towards the lower (beach) reaches.
Bank stability/condition: Banks are relatively stable due to dense surrounding vegetation cover with minimal erosion occurring.
Vegetative protection: Dense vegetation surrounds the estuary.
Riparian zone: Impacts such as walking, swimming, fishing on the coast; grazing pressure in upper reaches. Note that sheep were present within the Park boundaries during the summer assessment.</td></tr>
<tr><td>Vegetation community</td><td>Myoporum petiolatum, Correa eburnea +/- Leptospermum lanigerum Shrubland</td></tr>
<tr><td>Plant species diversity</td><td>A total of 31 native plant species was recorded, indicating a ‘Good’ level of diversity for this type of plant community (NCS SA’S SMLR Community 7.2 – Coastal Shrublands and Tall Shrublands).</td></tr>
<tr><td>Plant species of conservation significance</td><td>Correa eburnea –Vulnerable in South Australia and regionally
Lepidosperma gladiatum, Leptospermum lanigerum, Myoporum petiolatum, Triglochin procerum – regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>BushRAT vegetation condition score: 47
Vegetation condition is moderate to good with less than 5% bare ground.</td></tr>
<tr><td>Potential habitat for threatened species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th rowspan="2">Comments</th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th></tr>
<tr><td>Common Sandpiper</td><td>Actitus hypoleucos</td><td></td><td>R</td><td>R</td><td>Non-breeding summer visitor</td></tr>
<tr><td>Beautiful Firetail</td><td>Stagonopleura bella bella</td><td></td><td>R</td><td>E</td><td>Occur in low numbers in adjacent coastal scrub and Silky Tea-tree shrubland along the creek</td></tr>
<tr><td>Eastern Reef Egret</td><td>Egretta sacra</td><td></td><td>R</td><td>V</td><td>Rocky coastline</td></tr>
<tr><td>Peregrine Falcon</td><td>Falco peregrinus</td><td></td><td>R</td><td>R</td><td>Rocky coastline</td></tr>
</table>
Note also that the Southern Emu-wren (MLR subspecies – E) occurs in the vicinity of the creek and adjacent coast but would not be directly associated with the estuary.</td></tr>
</table>

BIODIVERSITY THREATS

Priority weed species

Scientific Name	Common Name	Threat Value	Red Alert
Arctotheca calendula	Cape Weed	1	
Avena barbata	Wild Oat	1	
Bromus diandrus	Great Brome	1	
Ehrharta longiflora	Annual Veldt Grass	2	
Euphorbia paralias	Sea Spurge	5	Y
Gomphocarpus cancellatus	Broad-leaf Cotton-bush	1	

	Lagurus ovatus	Hare's Tail Grass	2	
	Oxalis pes-caprae	Soursob	5	Y
	Senecio pterophorus	African Daisy	2	
Sheep grazing	Exclude stock from the Park. Note: sheep gaining access to estuary (within CP boundaries) at time of 2nd (summer) site assessment.			
Recreation	Line fishing, walking and swimming.			
Adjacent land use	Damage by grazing animals to steep coastal slopes outside Park boundaries.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Broad-leaf Cotton-bush
Fencing	Improve Park boundary fencing to exclude stock from neighbouring property

Boat Harbor estuary

September 2013 – The estuary is confined within a gentle to steeply sloping valley before it spills out onto coastal lowland.

February 2014 – Connectivity with the sea has been lost. Sheep were present at the time of assessment – causing pugging, grazing damage.


Boat Harbor Estuary
Cotton-bush
Cotton-bush
Cotton-bush
Legend
Estuary Extents
Weeds
Vegetation
Myoporum petiolatum, Correa eburnea +/- Leptospermum lanigerum Shrubland
Ficinia nodosa, Cyperus vaginatus Sedgeland
10 5 0 10 20 30 Meters

4.11 First Creek

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 17 – Tunk Head to Deep Creek CP, this tiny estuary comprises the downstream reaches of First Creek which flows out near the western end of Tunkalilla Beach .
The estuary varies in width from 6-15m and surface water was connecting with the sea in November 2013, when stream height was low. Water was still flowing in the estuary in February 2014 (spring fed?), however it was only just connecting with the sea across the flat, sandy beach.
Tidal movement enters the estuary to a limited extent.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The estuary is situated on land owned by the Minister for Environment and Conservation and a “goat track” leads down to Tunkalilla Beach from a car park at the end of Tunkalilla Road. This enables access to surfers and walkers who can link up with the Heysen Trail which extends along Tunkalilla Beach.
Adjacent land use is cropping/grazing land.</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be good with a 30-50% mix of stable habitat present, including pools and dense sedges.
Sediment deposition: Some sediment deposition is occurring, mainly closer to the beach.
Bank stability/ condition: There is much erosion and undercutting of the heavily cleared banks.
Vegetative protection: Poor due to erosion. Cover is provided largely by introduced grasses and herbs.
Riparian zone: Human activities have impacted the riparian zone a great deal and sheep were grazing within the estuary in February 2014.
Adjacent vegetation: Heavily cleared hillslopes and flats</td></tr>
<tr><td>Vegetation community</td><td>Typha domingensis Sedgeland</td></tr>
<tr><td>Plant species diversity</td><td>A total of 17 native plant species was recorded, indicating an ‘Excellent’ level of diversity for this type of plant community (NCS SA’S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).</td></tr>
<tr><td>Plant species of conservation significance</td><td>Gahnia trifida, Triglochin procerum – Regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>BushRAT vegetation condition score: 58.7
Native to exotic understorey biomass ratio was estimated to be approximately 80-90% native.</td></tr>
<tr><td>Potential habitat for threatened fauna species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th>Comments</th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th><th></th></tr>
<tr><td>Hooded Plover</td><td>Thinornis rubricollis</td><td></td><td>V</td><td>V</td><td>Occur on beach</td></tr>
</table>
Tawny Dragon sighted under rocks.
Pair of Hooded Plovers sighted between First Creek and Tunkalilla Creek.</td></tr>
</table>

BIODIVERSITY THREATS

Priority weed species

Scientific Name	Common Name	Threat Value	Red Alert
Arctotheca calendula	Cape Weed	1	
Atriplex prostrata	Creeping Saltbush	1	
Bromus spp.	Brome	1	
Cynodon dactylon	Couch	3	
Euphorbia paralias	Sea Spurge	5	Y
Hypochaeris spp.	Cat’s Ear	1	
Lagurus ovatus	Hare’s Tail Grass	2	
Lolium perenne	Perennial Rye Grass	1	
Medicago spp.	Medic	1	

	Pennisetum clandestinum	Kikuyu	2	Y
	Planatago lanceolata	Ribwort	3	
	Solanum linnaeanum	Apple of Sodom	4	
	Sonchus oleraceus	Sow Thistle	1	
	Trifolium sp.	Clover	1	
	Zantedeschia aethiopica	White Arum Lily	3	
Dogs, foxes	A threat to native fauna, including Hooded Plovers (footprints seen)			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Arum Lily, Apple of Sodom, Kikuyu, Couch
Dog and fox control	Maintain fox control. Signage re controlling dogs in Hooded Plover territory

First Creek estuary

November 2013 – Steeply incised and heavily eroded banks. The estuary connects with the sea across Tunkalilla Beach.

February 2014 – Still connecting to the sea. Sheep and cattle access to the estuary is exacerbating erosion, particularly in the summer months.


First Creek Estuary
Apple of Sodom
Arum Lily
Apple of Sodom
Legend
Estuary Extent
Weeds
Vegetation
Typha domingensis Sedgeland
Ficinia nodosa, Spinifex hirsutus
10 5 0 10 20 30 Meters

4.12 Tunkalilla Creek

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 17 – Tunk Head to Deep Creek CP, this estuary comprises the downstream reaches of Tunkalilla Creek which flows out at the eastern end of Tunkalilla Beach. The estuary traverses a coastal lowland and varies in width from 15-30m. Surface water was connecting with the sea in November 2013, when stream height was low. Water was still flowing in the estuary in February 2014 (spring fed?), and it was still connecting with the sea across the flat, sandy beach.
There are several open pools or ponds present.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The estuary is largely situated on privately owned land which is grazed by cattle – widespread grazing and pugging within the estuary was evident in February 2014. The beach portion of the estuary is within coastal reserve (conservation).</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The habitat potential of the estuary is considered to be moderate – a small amount of instream wood/logs/snags was noted.
Sediment deposition: High sediment deposition, building up around dense Phragmites and also on the beach.
Bank stability/condition: The bank is moderately unstable with erosion caused by widespread cattle, sheep grazing and pugging.
Vegetative protection: Streambank surfaces have <50% covered by vegetation. Disturbance is obvious with a high cover of weedy grasses and herbs, plus heavily grazed Phargmites and Juncus.
Riparian zone: Stock grazing has had a negative impact on the riparian zone.
Adjacent vegetation: Dune vegetation comprising Spinifex hirsutus and Ficinia nodosa on the beach with heavily cleared hillslopes and flats inland.</td></tr>
<tr><td>Vegetation community</td><td>Phragmites australis, Typha domingensis Closed sedgeland</td></tr>
<tr><td>Plant species diversity</td><td>A total of 12 native plant species was recorded, indicating an ‘Excellent’ level of diversity for this type of plant community (NCS SA’S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).</td></tr>
<tr><td>Plant species of conservation significance</td><td>Melaleuca halmaturorum – Regionally Vulnerable
Leptospermum lanigerum, Triglochin procerum – Regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>BushRAT vegetation condition score: 58.7
Native to exotic biomass ratio was estimated to be approximately 80-90% native within the actual estuary.</td></tr>
<tr><td>Potential habitat for threatened species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th rowspan="2">Comments</th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th></tr>
<tr><td>Hooded Plover</td><td>Thinornis rubricollis</td><td></td><td>V</td><td>V</td><td>Breed on beach</td></tr>
</table>
Tawny Dragon sighted.
Pair of Hooded Plovers sighted between First Creek and Tunkalilla Creek.
Flushed a Stubble Quail
Blue Wrens observed in tussocks</td></tr>
</table>

<table>
<tr><th colspan="5">BIODIVERSITY THREATS</th></tr>
<tr><td rowspan="10">Priority weed species</td><th>Scientific Name</th><th>Common Name</th><th>Threat Value</th><th>Red Alert</th></tr>
<tr><td>Atriplex prostrata</td><td>Creeping Saltbush</td><td>1</td><td></td></tr>
<tr><td>Bromus diandrus</td><td>Great Brome</td><td>1</td><td></td></tr>
<tr><td>Ehrharta longiflora</td><td>Annual Veldt Grass</td><td>2</td><td></td></tr>
<tr><td>Euphorbia paralias</td><td>Sea Spurge</td><td>5</td><td>Y</td></tr>
<tr><td>Hypochaeris spp.</td><td>Cat’s Ear</td><td>1</td><td></td></tr>
<tr><td>Lagurus ovatus</td><td>Hare’s Tail Grass</td><td>2</td><td></td></tr>
<tr><td>Lolium perenne</td><td>Perennial Rye Grass</td><td>1</td><td></td></tr>
<tr><td>Medicago spp.</td><td>Medic</td><td>1</td><td></td></tr>
<tr><td>Pennisetum clandestinum</td><td>Kikuyu</td><td>2</td><td>Y</td></tr>
</table>

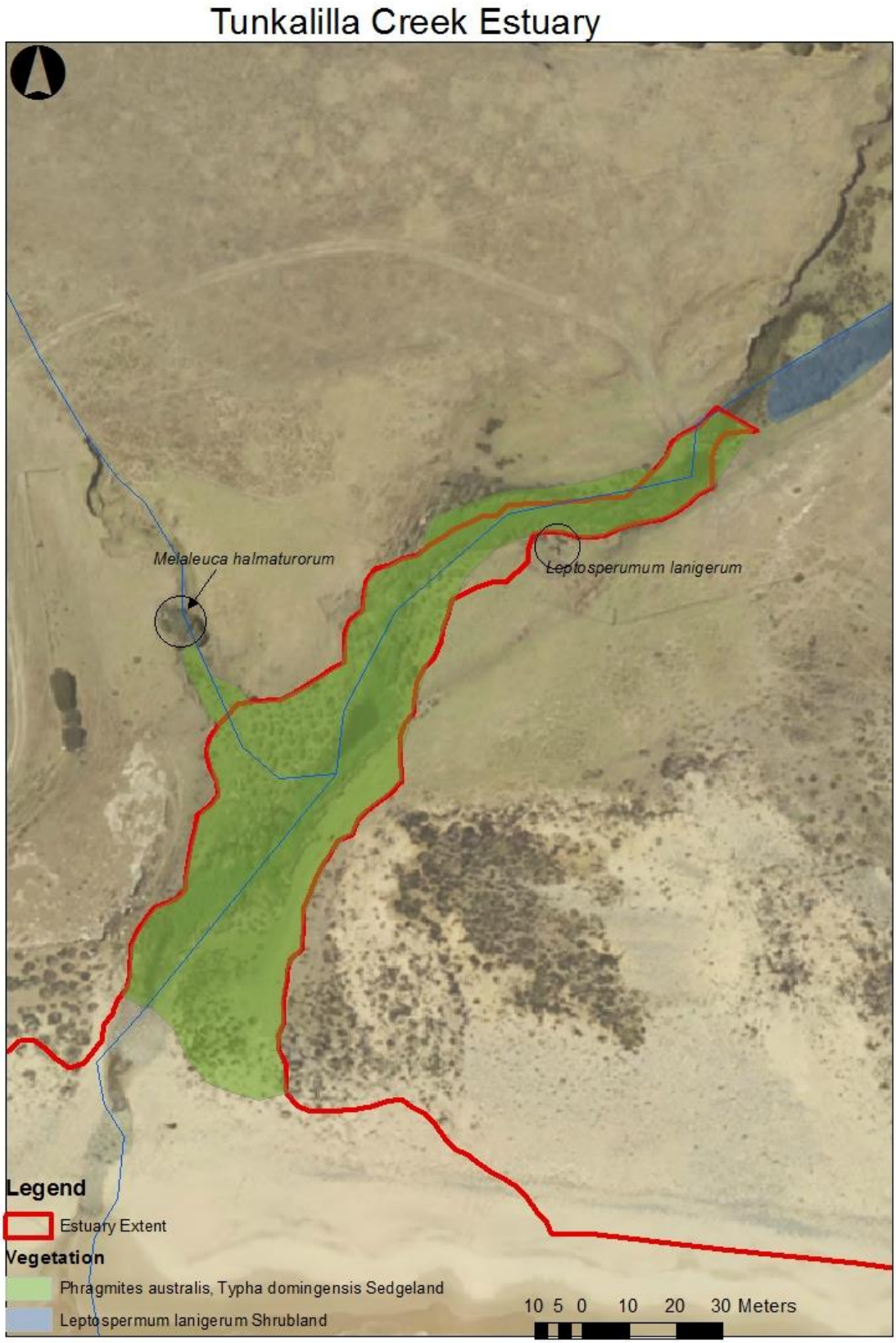
	Sonchus oleraceus	Sow Thistle	1	
	Trifolium fragiferum	Strawberry Clover	1	
Dogs, foxes	A threat to native fauna, including Hooded Plovers (footprints seen)			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Sea Spurge, Kikuyu
Dog and fox control	Maintain fox control. Signage re controlling dogs in Hooded Plover territory

Tunkalilla Creek estuary

November 2013 – The estuary traverses a coastal lowland and there are several pools of open water present.

February 2014 – Still connecting with the sea across Tunkalilla Beach. There is widespread pugging, grazing and other damage to native vegetation, which increases erosion damage.


Tunkalilla Creek Estuary
Melaleuca halmaturorum
Leptosperumum lanigerum
Legend
Estuary Extent
Vegetation
Phragmites australis, Typha domingensis Sedgeland
Leptospermum lanigerum Shrubland
10 5 0 10 20 30 Meters

4.13 Coolawang Creek

Physical description	This estuary is at the mouth of Coolawang Creek within Southern Fleurieu Coastal Action Plan Cell 16 – Parsons Beach to Tunk Head. The estuary traverses a coastal lowland and varies in width from 3m in its upper reaches to 30m as it flows out across the beach. Tidal movement enters the lower sections of the estuary and surface water was connecting with the sea in November 2013, when stream height was medium - low. Water was still flowing in the estuary in February 2014 (spring fed), and connecting with the sea. There are several open pools or ponds present.
Adjacent land use / Land ownership	The estuary is largely situated on privately owned land which is grazed by cattle. The lower (southern) portion of the estuary is fenced and stock cannot access the beach. The eastern side of the upper reaches is fenced, with stock being able to access the western side. The beach portion of the estuary is within coastal reserve (conservation).
Habitat parameters	**Epifaunal substrate/available cover:** The estuary was assessed as good potential habitat with a 30-50% mix of stable habitat, although there was little large wood/logs/snags present. **Sediment deposition:** Some deposition of gravel, sand and fine sediment, largely around Typha patches. Also deposition of sand and rock on the beach section. **Bank stability/condition:** Vertical banks with some undercutting. Moderately unstable with 30-60% of bank having areas of erosion. High erosion potential during floods. **Vegetative protection:** Many areas of the estuary banks are bare and eroded with less than 50% of the bank surfaces covered by vegetation. Vegetation has been heavily grazed. **Riparian zone:** Impacted by grazing – stock still access the eastern side of the estuary and can gain access to the whole creek at low flow. **Adjacent vegetation:** Dune vegetation comprising *Olearia axillaris* Low shrubland with *Leucophyta brownii* and *Ficinia nodosa* on the coast, with heavily cleared hillslopes and flats inland.
Vegetation community	*Phragmites australis, Typha domingensis S*edgeland with *Juncus krausii* and *Cyperus vaginatus* on edges
Plant species diversity	A total of 16 native plant species was recorded, indicating an 'Excellent' level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
Plant species of conservation significance	*Callistemon sieberi, Leptospermum lanigerum, Triglochin procerum* – Regionally Uncommon
Vegetation condition	BushRAT vegetation condition score: 56 Native to exotic understorey biomass ratio was estimated to be approximately 60-70% native within the estuary, with a wide variety of weeds present, most notably Yorkshire Fog, Dog Rose, Sea Barley-grass, Celery, African Daisy, Apple of Sodom and Slender Thistle.
Potential habitat for threatened fauna species	Birds of conservation significance which may use the estuary as habitat are:

Common name	Bird species	Conservation status			Comments
		AUS	SA	MLR	
Hooded Plover	*Thinornis rubricollis*		V	V	Occur on beach, probably nest occasionally on this and the nearby Sheepies Beach.

BIODIVERSITY THREATS

Priority weed species

Scientific Name	Common Name	Threat Value	Red Alert
Atriplex prostrata	Creeping Saltbush	1	
Avena barbata	Bearded Oat	1	
Bromus diandrus	Great Brome	1	
Carduus tenuiflorus	Slender Thistle	1	
Cynodon dactylon	Couch	3	
Euphorbia paralias	Sea Spurge	5	Y
Hypochaeris radicata	Rough Cat's Ear	1	
Lagurus ovatus	Hare's Tail Grass	2	
Lolium perenne	Perennial Rye Grass	1	

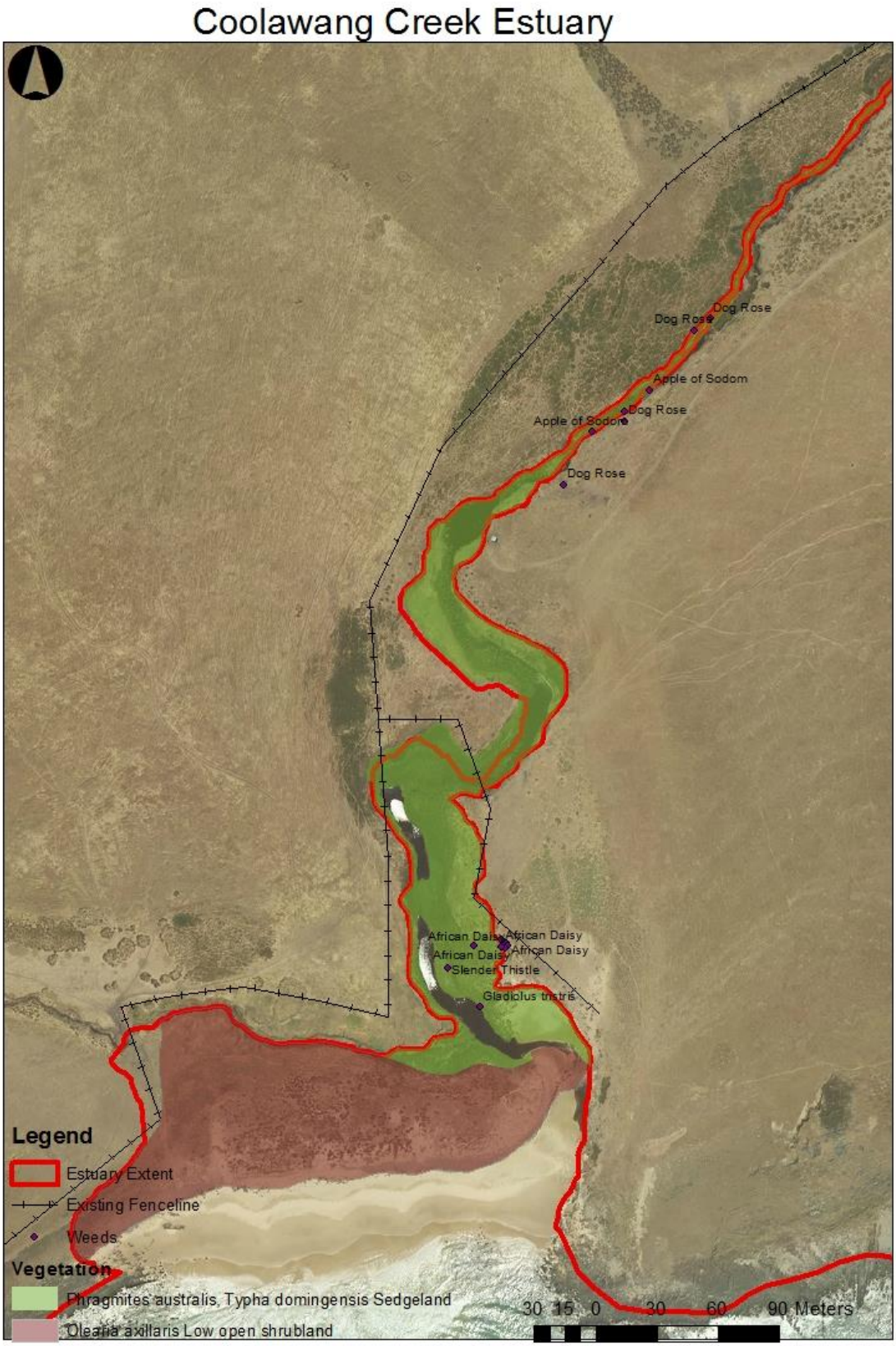
	Pennisetum clandestinum	Kikuyu	2	
	Plantago lanceolata	Ribwort	3	
	Rosa sp.	Wild Rose/Briar	2	
	Senecio pterophorus	African Daisy	2	
	Solanum linnaeanum	Apple of Sodom	4	
	Sonchus oleraceus	Sow Thistle	1	
	Trifolium spp.	Clover	1	
	Also *Gladiolus tristris*			
Grazing	Cattle have access to the upper reaches of the estuary on the eastern side – grazing, pugging, tracks, manure, damage to vegetation and banks.			
Dogs, foxes	A threat to native fauna, including Hooded Plovers (footprints seen)			
Water extraction	Pump shed and pipes present on the eastern bank of the creek.			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Slender Thistle, African Daisy, Apple of Sodom, *Gladiolus tristris*.
Fencing	Eastern side of estuary to exclude stock

Coolawang Creek estuary

December 2013

February 2014 – Cattle and sheep grazing is impacting the estuary, which is still connected to the sea and includes several large, open pools of water.


Coolawang Creek Estuary
Dog Rose
Dog Rose
Dog Rose
Apple of Sodom
Apple of Sodom
Dog Rose
Dog Rose
African Daisy
African Daisy
African Daisy
African Daisy
Slender Thistle
Gladiolus tristis
Legend
Estuary Extent
Existing Fenceline
Weeds
Vegetation
Phragmites australis, Typha domingensis Sedgeland
Olearia axillaris Low open shrubland
30 15 0 30 60 90 Meters

4.14 Waitpinga Creek (Newland Head Conservation Park)

<table>
<tr><td>Physical description</td><td>Within the Southern Fleurieu Coastal Action Plan Cell 15 – Newland Head to Parsons Beach, this relatively large estuary comprises the downstream reaches of Waitpinga Creek in Newland Head Conservation Park. At its widest point the estuary is approximately 500m and at its narrowest it is approximately 30m.
The estuary closely follows the natural flow path of Waitpinga Creek, spreading out across flatter coastal areas and forming saltmarshes in parts. Surface water was flowing to the sea in Spring 2013 when stream flow height was estimated to be Medium.</td></tr>
<tr><td>Adjacent land use / Land ownership</td><td>The larger southern half of the estuary is situated within Newland Head Conservation Park and abuts coastal dune vegetation. The narrower northern upper reach of the estuary is on private land which is grazed by sheep and is unfenced.</td></tr>
<tr><td>Habitat parameters</td><td>Epifaunal substrate/available cover: The estuary was assessed as having excellent habitat with >50% of the substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat is present. Numerous pieces of instream wood are present.
Sediment deposition: Little sediment deposition was noted, apart from the sand which naturally builds up on the beach.
Bank stability/condition: The estuarine banks are stable with minimal evidence of erosion or bank failure and little potential for future problems due to dense Lignum cover at the water's edge.
Vegetative protection: Vegetative cover is present on majority of the estuary, and only minor erosion was noted in the upper stretches of the estuary where sheep have limited access to the creek.
Riparian zone: The lower reaches of the estuary are protected within conservation park. Some adverse impact in the upper reaches caused by sheep.
Adjacent vegetation: Southern half of estuary is adjacent to intact dune vegetation comprising Olearia axillaris, Myoporum insulare +/- Acacia longifolia var. sophorae Shrubland.
Northern half of estuary is surrounded by largely cleared grazing land with scattered Allocasuarina verticillata Woodland.</td></tr>
<tr><td>Vegetation community</td><td>1. Muehlenbeckia florulenta Tall open shrubland
2. Sarcocornia quinqueflora Saltmarsh</td></tr>
<tr><td>Plant species diversity</td><td>1. A total of 19 native plant species was recorded, indicating an 'Excellent' level of diversity for this type of plant community (NCS SA'S SMLR Community 6.2 – Common Reed, Bulrush & Lignum Swamps in permanent water).
2. A total of 9 native plant species was recorded, indicating an Excellent level of diversity for this type of plant community (NCS SA'S SMLR Community 8.1 – Coastal Samphire Shrublands).</td></tr>
<tr><td>Plant species of conservation significance</td><td>Wilsonia rotundifolia – Regionally Vulnerable
Mimulus repens, Muehlenbeckia florulenta, Selliera radicans – Regionally Rare
Triglochin procerum – Regionally Uncommon</td></tr>
<tr><td>Vegetation condition</td><td>1. BushRAT vegetation condition score: 61.4
2. BushRAT vegetation condition score: 37
Within the Park boundaries the native:exotic understorey biomass is up to 90%, with low levels of disturbance, although exotic species such as Paspallum distichum, Asparagus asparagoides and Gladiolus tristris are present. Higher levels of disturbance due to past clearance and stock grazing occur outside the Park boundaries.</td></tr>
<tr><td>Potential habitat for threatened species</td><td>Birds of conservation significance which may use the estuary as habitat are:
<table>
<tr><th rowspan="2">Common name</th><th rowspan="2">Bird species</th><th colspan="3">Conservation status</th><th rowspan="2"></th></tr>
<tr><th>AUS</th><th>SA</th><th>MLR</th><th>Comments</th></tr>
<tr><td>Baillon's Crake</td><td>Porzana pusilla</td><td></td><td>R</td><td>R</td><td>Observed in small wetland between creek and road.</td></tr>
<tr><td>Cape Barren Goose</td><td>Cereopsis novaehollandiae</td><td></td><td>R</td><td>R</td><td>Non-breeding mostly summer visitor</td></tr>
</table></td></tr>
</table>

	Common Sandpiper	*Actitus hypoleucos*		R	R	Non-breeding mostly summer visitor
	Buff-banded Rail	*Rallus philippensis*		U	V	Recorded at edge of wetland
	Hooded Plover	*Thinornis rubricollis*		V	V	Occurs & breeds on beach. Sometimes move into estuary to roost in bad weather.
	Beautiful Firetail	*Stagonopleura bella interposita*		R	E	Occur in low numbers in adjacent coastal scrub and Drooping Sheoaks along Waitpinga Creek, also drink at pools along Waiptinga Creek.
	Note that Elegant Parrots (R, K) feed in the nearby area and drink at waterholes along Waitpinga Creek but would not generally associate with the estuary.					

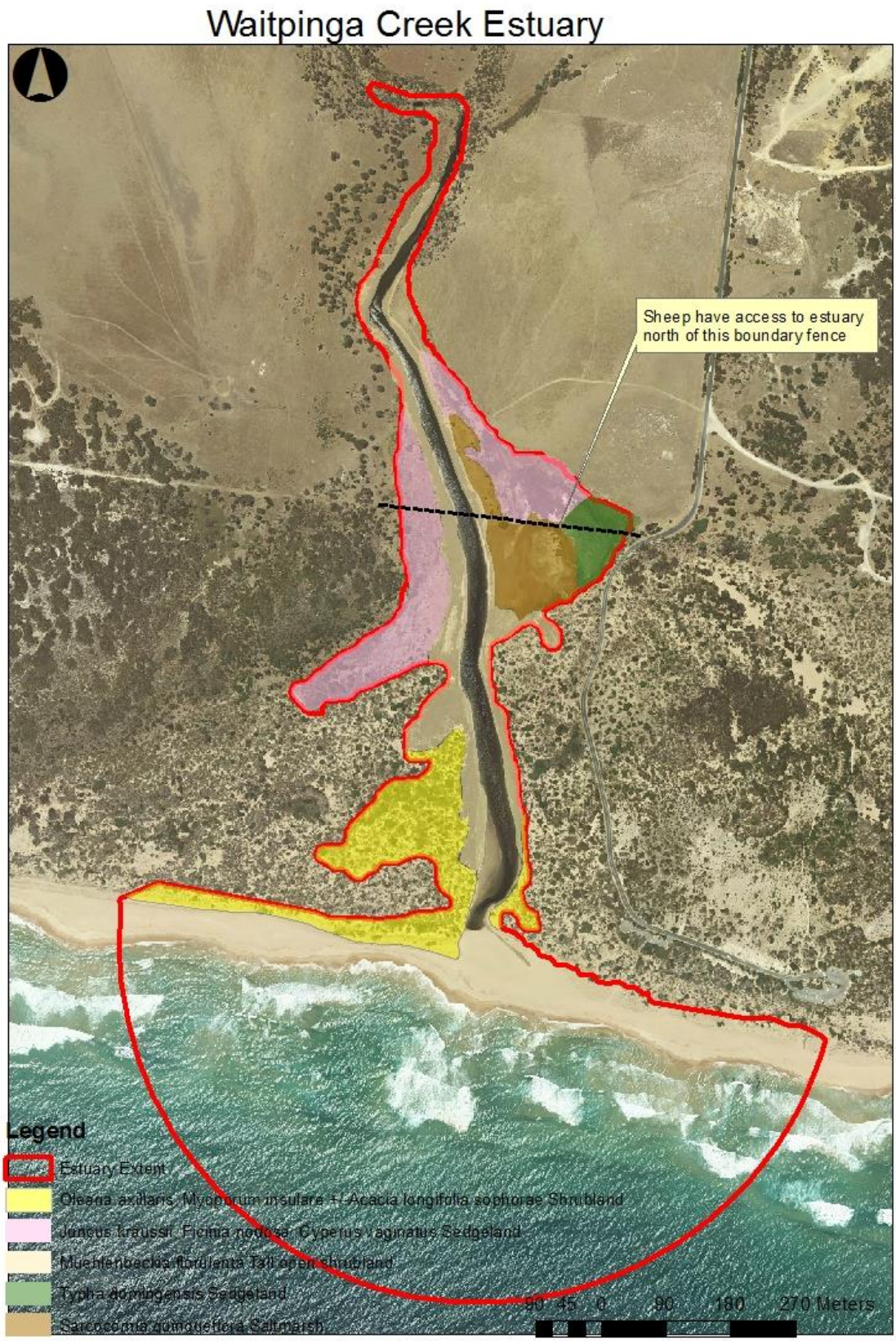
BIODIVERSITY THREATS				
Priority weed species	**Scientific Name**	**Common Name**	**Threat Value**	**Red Alert**
	Arctotheca calendula	Cape Weed	1	
	Asparagus asparagoides	Bridal Creeper	9	Y
	Atriplex prostrata	Creeping Saltbush	1	
	Carduus tenuiflorus	Slender Thistle	1	
	Euphorbia paralias	Sea Spurge	5	Y
	Euphorbia terracina	False Caper	5	Y
	Lagurus ovatus	Hare's Tail Grass	2	
	Malva parviflora	Small-flower Marshmallow	3	
	Oenothera stricta	Evening Primrose	1	
	Oxalis pes-caprae	Soursob	5	Y
	Paspalum distichum	Water Couch	-	Y
	Pennisetum clandestinum	Kikuyu	2	
	Plantago coronopus	Bucks-horn Plantain	3	
	Reichardia tingitana	False Sowthistle	3	
	Romulea rosea var. australis	Common Onion-grass	1	
	Solanum linnaeanum	Apple of Sodom	4	
	Trifolium sp.	Clover	1	
	Plus *Gladiolus tristris* – scattered patches			
Recreation	Line fishing - discarded bait and fish offal are regularly left on the beach, attracting high numbers of scavenging bird species such as ravens and gulls, as well as foxes. Surfing, walking, swimming			
Domestic stock grazing	Damage by grazing animals to unfenced northern section of estuary (private land).			
Dogs, foxes	A threat to native fauna, including Hooded Plovers			

RECOMMENDED ON-GROUND MANAGEMENT ACTIONS	
Weed control	Bridal Creeper, *Gladiolus tristris*
Fencing	Fence off upper reaches of estuary/creekline from stock.
Dog and fox control	Maintain fox control and prohibition of dogs within the Park

Waitpinga Creek estuary

August 2013 – The larger southern half of the estuary is within Newland Head Conservation Park and is surrounded by coastal dune vegetation. The narrower northern section is on private land which is grazed by sheep and is unfenced.

February 2014 – The estuary closely follows the natural flow path of Waipinga Creek, spreading out across flatter coastal areas to form saltmarsh.


Waitpinga Creek Estuary
Sheep have access to estuary north of this boundary fence
Legend
Estuary Extent
Olearia axillaris, Myoporum insulare +/- Acacia longifolia sophorae Shrubland
Juncus kraussii, Ficinia nodosa, Cyperus vaginatus Sedgeland
Muehlenbeckia florulenta Tall open shrubland
Typha domingensis Sedgeland
Sarcocornia quinqueflora Saltmarsh
90 45 0 90 180 270 Meters

5 References

Bryars, S. (2013). Nearshore marine habitats of the Adelaide and Mount lofty Ranges NRM region: values, threats and actions. A report to the Adelaide and Mount lofty Ranges Natural Resources Management Board.

Caton, B., Fotheringham, D., Lock C., Royal, M., Sandercock, R., Taylor, R., 2007. *Southern Fleurieu coastal action plan and conservation priority study*, prepared for Adelaide & Mount Lofty Ranges Natural Resources Management Board, Alexandrina Council, City of Victor Harbor, District Council of Yankalilla, Goolwa to Wellington Local Action Plan and Department for Environment & Heritage.

Croft, SJ, Pedler, JA & TI Milne, 2006. *Coastal vegetation communities of the Southern Mount Lofty Ranges*, Nature Conservation Society of SA.

Department for Environment Water & Natural Resources SA, 2007. *Estuaries policy and action plan for South Australia*.

Department of Environment & Heritage, 2007. *Adelaide & Mount Lofty Range Natural Resources Management Region estuaries information package*.

Department of Environment & Primary Industries Victoria, 2006. *Index of stream condition*, 2nd Edition.

Parsons, M., Thoms, M. and Norris, R., 2002, *Australian River Assessment System: AusRivAS Physical Assessment Protocol*, Monitoring River Heath Initiative Technical Report no 22, Commonwealth of Australia and University of Canberra, Canberra.

SA Department of Environment, Water & Natural Resources, 2013. *BushRAT Manual for native vegetation*, Native Vegetation & Biodiversity Management Unit, May 2013.

Wiltshire, K., Rowling, K. and Deveney, M. (2010*). Introduced marine species in South Australia: A review of records and distribution mapping*. South Australian Research and Development Institute and Development Institute (Aquatic Sciences). SARDI Research Report Series No. 468.

Appendix 1: Estuary extents

Congeratinga - Anacotilla

Parananakooka

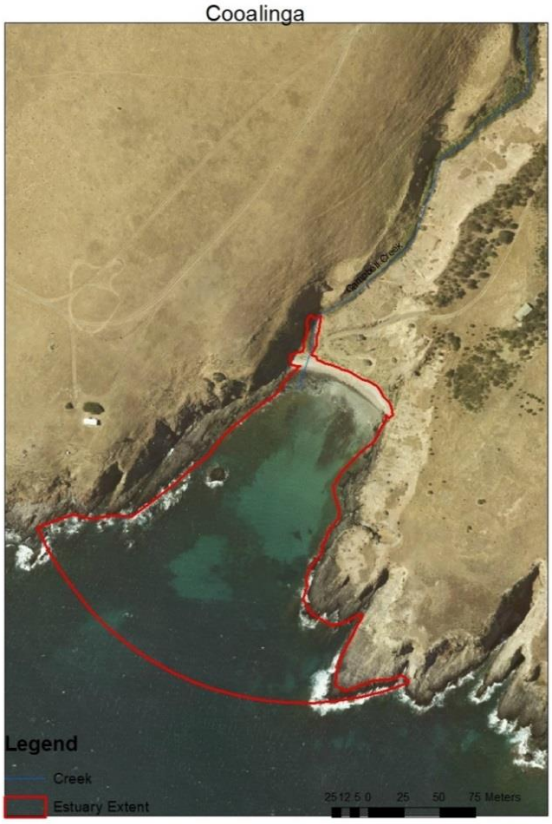
Yattagolinga

Yohoe Creek

New Salt Creek

Fishery Creek

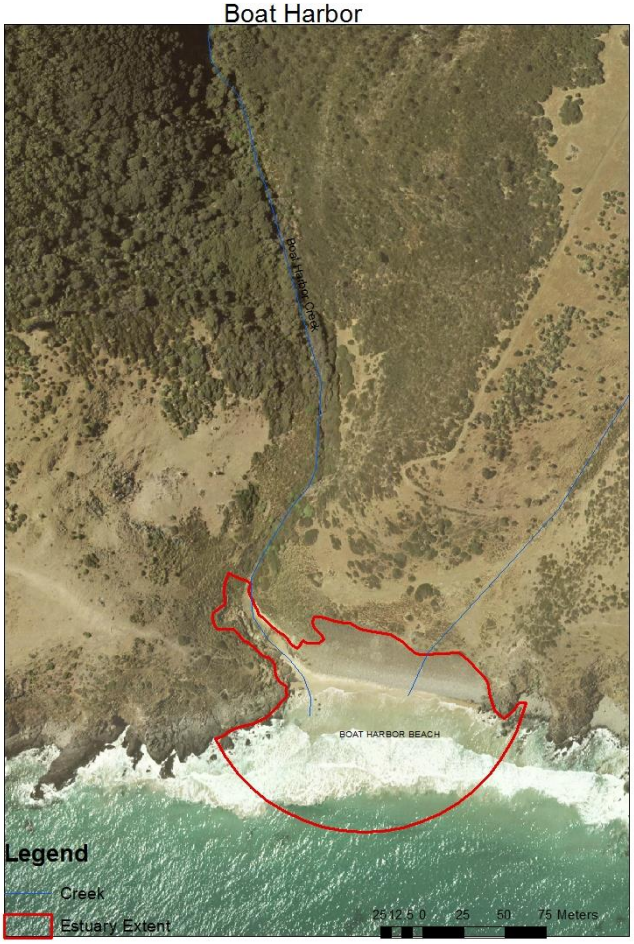
Cooalinga



Blowhole

Deep Creek

Boat Harbor



First Creek

Tunkalilla Creek

Coolawang Creek Estuary

Waitpinga Creek Estuary

Appendix 2: Physical habitat assessment data sheet

……..Estuary Date: ……

Habitat parameter	Condition category							
	Excellent (Very Good)		**Good**		**Fair (Moderate)**		**Poor**	
Epifaunal substrate / available cover	>50% of substrate favourable for epifaunal colonisation & fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat & at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)		30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation.		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed		<10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
Sediment deposition	Little or no enlargement of islands or point bars and <20% of the bottom affected by sediment deposition		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.		Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstruction, constrictions & bends; moderate deposition in pools prevalent		Heavy deposits of fine material, increased bar development; >80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
Bank stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected		Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion		Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods		Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-80% of bank has erosional scars.	
	Left bank	Right bank	Left bank	Right bank	Left bank	Right bank	Left bank	Right bank
Vegetative protection	>90% of the streambank surfaces and immediate riparian zone covered by **native** vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.		70-90% of the streambank surfaces covered by native vegetation, but 1 class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than ½ of the potential plant stubble height remaining		50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ of the potential plant stubble height remaining.		<50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5cm or less in average stubble height.	
	Left bank	Right bank	Left bank	Right bank	Left bank	Right bank	Left bank	Right bank
Riparian zone	Width of riparian zone >18m; human activities (i.e. roads, lawns, crops etc) have not impacted the riparian zone		Width of riparian zone 12-18m; human activities have impacted the riparian zone only minimally		Width of riparian zone 6-12m; human activities have impacted the riparian zone a great deal		Width of riparian zone <6m; little or no riparian vegetation is present because of human activities	
	Left bank	Right bank	Left bank	Right bank	Left bank	Right bank	Left bank	Right bank

……Estuary Date: ……

	Bank condition rating	Comments
4	Very few bare eroding banks, none of which are at the toe of the ban Banks are **not** vertical and undercut (unless composed of bedrock and/or located in a gorge) Continuous cover of vegetation (predominantly woody) Gentle batter Very few exposed woody roots No evidence of livestock damage	
3	Some isolated bare eroding banks, though generally not at the toe of the bank Banks are not vertical and undercut Cover of vegetation is nearly continuous Exposed roots present, <33% cover Gentle bank slope	
2	Some bank instabilities that extend to the toe of the bank Bank may have gentle or vertical slope Discontinuous vegetation May have >33% cover of woody vegetation roots	
1	Mostly unstable toe of the bank, may be vertical bank with a toe Minimal vegetation on bank >33% cover of exposed woody roots Obvious signs of livestock damage to banks	
0	Unstable toe of bank No vegetation Very recent bank movement (blocks of sediment may be present in channel and trees may have recently fallen into stream Vertical bank surface May have numerous exposed woody roots (>33% cover) Clear evidence of livestock damage to banks.	

	Large wood (instream physical habitat) rating	Comments
Excellent 4	Abundant instream wood from indigenous woody vegetation taxa Site probably never desnagged Streamside vegetation probably never cleared	
Good 3	Numerous pieces of instream wood from indigenous species Perhaps limited instream wood from exotic species present also Limited impact of desnagging or streamside vegetation clearance	
Marginal 2	Moderate pieces of instream wood from indigenous species in channel Abundant pieces of exotic instream wood in channel Moderate impact of desnagging Streamside vegetation clearing evident	
Poor 1	Few visible pieces of instream wood in channel (either from indigenous or exotic species)	
Very Poor 0	No instream wood visible	

Appendix 3: BushRAT field datasheet

Native Plant Life Forms	Cover Rating			
include height of flowering head & dead branches, # = life form rep'd largely by annuals not in full foliage				
Trees >15 m				
Trees 5 – 15 m				
Trees < 5m				
Mallee > 5m				
Mallee ≤ 5m				
Shrubs > 2 m				
Shrubs 0.5–2m				
Shrubs < 0.5 m				
Herbs				
Mat Plants				
Grasses >0.2m				
Grasses ≤ 0.2m				
'Sedges' > 1m				
'Sedges' ≤ 1m				
Hummock grass				
Vines,scramblers				
Mistletoe				
Ferns				
Grass-trees				
Total				

Cover Rating	
not many, cover <1%	1
Plentiful, cover <1%	1a
Covering 1 - 5%	2
Covering 6 – 25%	3
Covering 26 –50%	4
Covering 51 – 75%	5
Covering > 75%	6

Fallen Timber				
log size refers to that of canopy species (+ emergent species if present)				
Log diameter	None	<1 per 10 adult trees	≥1 per 10 adult trees	Score
Branch-sized	0	1	2	
Trunk sized	0	2	3	

Tree Hollows				
Hollow diameter	None	<20 per ha	≥20 per ha	Score
2-10cm	0	1	2	
>10cm	0	2	3	

Native:exotic Understorey Biomass		
include dead material if attached & recognisable as native		
% native		
91%+	10	
81-90	9	
71-80	8	
61-70	7	
51-60	6	
41-50	5	
31-40	4	
21-30	3	
11-20	2	
0-10	1	

Bare Ground		
exclude soil crust, litter, exposed rock		
> 51% of site bare ground	0	
26-50% bare ground	1	
5–25 % bare ground	2	
< 5% bare ground	3	

Grazing Evidence (*score 4 minus 1 for each sign below*)	
heavy/severe chewing	
widespread pugging/compaction	
grazing animals observed /widespread dung &/or fur;	
active warren/stock camp	

Tree Health (excl. long-dead trees)		
<10% dieback	5	
10-25% dieback, few branches dead	4	
26-50% dieback, many branches dead	3	
51-75% dieback, most branches dead +/- epicormic growth	2	
76-99% dieback, most epicormic growth dead	1	
100% dieback	0	

Date:……………
Zone:……………
Datum:…………

Easting:…………… Northing:…………
Photo direction:………..

Recorder:………… Soil Type:…………. …. Aspect:……………… O/S Ave. Ht………..

Vegetation Association Description…………………………………………………………….
……………………………………………………………………. 'Treeless' in its natural state (refer to manual)? Y/N

NVBMU BushRAT Assessment

Application No: …………………… Site:……………

Native spp. d=dominant, v=voucher, e=edge, p=planted, R=regen (**perennials**)				C	C			**Weed spp.** (# = annuals that are not with full foliage)	C	C		

notes	
Substantial rock outcrop or cover Y/N	
Substantial leaf litter Y/N	
Substantial moss and/or lichen Y/N	
Are long-dead trees present? Y/N	
Do mature trees have adequate lateral branching? Y/N	
Optional tree health information: Dieback estimates species by species:	

The tables below are for data pertaining to the **site in general** (i.e. can be **external** to the surveyed quadrat, such as species only encountered when moving between quadrats. Note, weed covers are not required.

Native spp								Weed spp			

Photographs		
No.	**Description**	**Waypoint**
1	Photo representative of surveyed quadrat	

Notes (fencing/exclusions/other issues)

Appendix 4: Plant species list

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
Acacia paradoxa	Kangaroo Thorn													✓					
Acacia provincialis	Wirilda												✓	✓					
Acaena novae-zelandiae	Biddy-biddy										✓	✓		✓					
Adiantum aethiopicum	Common Maiden-hair													✓					
Apium prostratum var. filiforme	Native Celery				✓				✓		✓		✓	✓	✓			✓	
Austrostipa sp.	Spear-grass											✓			✓				
Baumea juncea	Bare Twig-rush												✓	✓					
Callistemon sieberi	River Bottlebrush			U													✓		
Calystegia sepium	Large Bindweed			U	✓	✓	✓												
Calytrix tetragona	Common Fringe-myrtle				✓														
Carpobrotus rossii	Native Pigface												✓						
Cassytha pubescens	Downy Dodder-laurel												✓	✓					
Centella asiatica	Asian Centella			U	✓								✓						
Correa eburnea			V	V									✓	✓					
Cyperus gymnocaulos	Spiny Flat-sedge																		
Cyperus vaginatus	Stiff Flat-sedge				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Dianella brevicaulis	Short-stem Flax-lily				✓					✓									
Dysphania pumilio	Clammy Goosefoot																✓		
Disphyma crassifolium ssp. clavellatum	Round-leaf Pigface					✓							✓						
Distichlis distichophylla	Emu-grass			N						✓	✓			✓	✓		✓		✓
Dodonaea viscosa ssp. spatulata	Sticky Hop-bush													✓					
Enchylaena tomentosa var. tomentosa	Ruby Saltbush				✓	✓	✓			✓	✓	✓		✓	✓				
Epilobium billardierianum ssp. billardierianum	Robust Willow-herb			N								✓							

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
Ficinia nodosa	Knobby Club-rush				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gahnia trifida	Cutting Grass			U				✓							✓				
Goodenia amplexans	Clasping Goodenia			U									✓						
Hydrocotyle verticillata	Shield Pennywort			K											✓		✓		
Isolepis cernua	Nodding Club-rush					✓					✓		✓				✓		
Isolepis inundata	Swamp Club-rush													✓					
Isolepis marginata	Little Club-rush														✓	✓		✓	
Juncus kraussii	Sea Rush				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Juncus pallidus	Pale Rush											✓	✓			✓		✓	✓
Juncus subsecundus	Finger Rush																		✓
Lachnagrostis filiformis	Perennial Blown-grass																✓		
Leiocarpa supina	Coast Plover-daisy			U		✓		✓		✓									
Lepidosperma gladiataum	Coast Sword-sedge			U										✓					
Leptospermum lanigerum	Silky Tea-tree			U								✓	✓	✓		✓	✓		
Leucophyta brownii	Coast Cushion Bush				✓	✓					✓		✓	✓					
Leucopogon parviflorus	Coast Beard-heath									✓			✓						
Lobelia anceps	Angled Lobelia				✓			✓					✓	✓	✓	✓	✓		
Lycopus australis	Australian Gypsywort												✓	✓					
Lythrum hyssopifolia	Lesser Loosestrife					✓			✓								✓		
Melaleuca decussata	Totem-poles												✓	✓				✓	
Melaleuca halmaturorum	Swamp Paper-bark			V												✓			
Mimulus repens	Creeping Monkey-flower			R														✓	
Muehlenbeckia adpressa	Climbing Lignum												✓						
Muehlenbeckia florulenta	Lignum			R														✓	

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
Muehlenbeckia gunnii	Coastal Climbing Lignum				✓			✓	✓	✓	✓		✓					✓	
Myoporum insulare	Common Boobialla				✓	✓	✓					✓	✓					✓	✓
Myoporum petiolatum	Sticky Boobialla			U										✓					
Nicoteana maritima													✓						
Olearia axillaris	Coast Daisy-bush				✓							✓							
Oxalis perennans	Native Sorrel									✓									
Pelargonium littorale	Native Pelargonium											✓							
Persicaria decipiens	Slender Knotweed														✓				
Phragmites australis	Common Reed					✓	✓	✓								✓	✓	✓	
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower														✓				
Pimelea stricta	Erect Riceflower													✓					
Pteridium esculentum	Bracken Fern												✓						
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush									✓	✓	✓	✓	✓				✓	
Rytidosperma pilosum	Velvet Wallaby-grass										✓		✓						
Rytidosperma sp.	Wallaby-grass									✓									
Samolus repens	Creeping Brookweed			U								✓	✓					✓	✓
Sarcocornia quinqueflora	Beaded Samphire					✓													
Schoenoplectus pungens	Spiky Club-rush			U				✓										✓	✓
Selliera radicans	Shiny Swamp-mat			R									✓					✓	
Senecio odoratus	Scented Groundsel												✓	✓					
Senecio pinnatifolius	Variable Groundsel					✓							✓						
Solanum laciniatum	Cut-leaf Kangaroo-apple			R									✓						
Spinifex hirsutus	Rolling Spinifex													✓	✓	✓			
Spergularia marina	Salt Sand-spurrey				✓														

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
Sporobulus virginicus	Salt Couch													✓					
Suaeda australis	Austral Seablite																	✓	
Tecticornia sp.	Samphire																		
Tetragonia implexicoma	Bower Spinach					✓					✓		✓					✓	
Threlkeldia diffusa	Coast Bonefruit																	✓	
Triglochin procerum	Water-ribbons			U										✓	✓	✓	✓		✓
Triglochin striatum	Streaked Arrowgrass			N									✓		✓	✓			✓
Typha domingensis	Narrow-leaf Bulrush				✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	
Villarsia umbricola var. umbricola	Lax Marsh-flower			U									✓	✓					
Wilsonia rotundifolia	Round-leaf Wilsonia			V															✓
TOTAL NATIVE SPECIES					**16**	**14**	**6**	**10**	**7**	**12**	**14**	**15**	**36**	**30**	**17**	**12**	**16**	**19**	**9**
**Acacia cyclops*	Western Coastal Wattle									✓									
**Acetosella vulgaris*	Sorrel												✓						✓
**Agrostis stolonifera*					✓														
**Ammophila arenaria*	Marram Grass																		
**Anagallis arvensis*	Pimpernel													✓			✓		
**Apium graveolens*	Celery							✓	✓								✓		
**Arctotheca calendula*	Cape Weed							✓	✓			✓	✓	✓	✓				✓
**Asparagus asparagoides*	Bridal Creeper									✓								✓	
**Atriplex prostrata*	Creeping Saltbush				✓		✓		✓	✓	✓		✓		✓	✓	✓	✓	✓
**Avena barbata*	Bearded Oat					✓		✓	✓	✓	✓			✓			✓		✓
**Avena sp.*	Oat												✓						
**Berula erecta*	Water Parsnip					✓		✓				✓	✓						

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
**Briza maxima*	Large Quaking-grass																		
**Bromus diandrus*	Great Brome					✓		✓			✓			✓	✓	✓	✓		
**Bromus hordaceus ssp. hordaceus*	Soft Brome								✓										✓
**Bromus madritensis*	Compact Brome										✓				✓				
**Cakile maritima ssp. maritima*	Two-horned Sea Rocket					✓	✓	✓		✓	✓				✓	✓	✓		
**Carduus tenuiflorus*	Slender Thistle																✓		✓
**Catapodium rigidum*	Rigid Fescue						✓												
**Cirsium vulgare*	Spear Thistle													✓					✓
**Cotula coronopifolia*	Water Buttons															✓	✓	✓	✓
**Cucumis myriocarpus*	Paddy Melon							✓									✓		
**Cynodon dactylon var. dactylon*	Couch				✓	✓									✓				
**Cynosurus echinatus*	Rough Dog's-tail Grass													✓			✓		✓
**Dactylis glomerata*	Cocksfoot				✓														
**Echium plantagineum*	Salvation Jane							✓	✓										
**Ehrharta erecta*	Panic Veldt Grass												✓						
**Ehrharta longiflora*	Annual Veldt Grass							✓	✓	✓	✓	✓		✓		✓			
**Erodium sp.*														✓					
**Euphorbia paralias*	Sea Spurge				✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
**Euphorbia terracina*	False Caper				✓					✓								✓	
**Ficus sp.*	Fig Tree											✓							
**Fumaria capreolata*	White-flower Fumitory					✓	✓	✓										✓	
**Galenia pubescens var. pubescens*	Coastal Galenia					✓													
**Gazania sp.*	Gazania				✓														
**Geranium purpureum*													✓						

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
**Gladiolus tristis*	Evening-flower Gladiolus												✓				✓	✓	
**Gomphocarpus cancellatus*	Broad-leaf Cotton-bush							✓						✓					
**Gramineae sp.*										✓				✓					
**Hedera helix*	Ivy					✓													
**Helminthotheca echioides*	Ox-tongue				✓	✓													
**Holcus lanatus*	Yorkshire Fog				✓			✓			✓				✓	✓	✓		
**Hordeum marinum*	Sea Barley-grass					✓		✓	✓	✓	✓						✓		✓
**Hypochaeris radicata*	Rough Cat's Ear									✓					✓	✓	✓		
**Juncus articulatus*	Jointed Rush														✓	✓			
**Lagurus ovatus*	Hare's Tail Grass					✓	✓				✓			✓	✓	✓	✓	✓	
**Lactuca serriola*	Prickly Lettuce				✓				✓										
**Limonium companyonis*	Sea-lavender					✓	✓												
**Lolium perenne*	Perennial Ryegrass								✓		✓				✓	✓	✓		
**Lycium ferocissimum*	African Boxthorn								✓	✓	✓								
**Malva parviflora*	Small-flower Marshmallow																		✓
**Medicago minima var. minima*	Little Medic										✓				✓	✓			
**Medicago polymorpha var. polymorpha*	Burr-medic														✓	✓			
**Medicago sp.*	Medic														✓				
**Moraea setifolia*	Thread Iris									✓									
**Oenothera stricta*	Evening Primrose																	✓	
**Oxalis pes-caprae*	Soursob				✓	✓		✓	✓	✓		✓	✓	✓					✓
**Oxalis purpurea*	One-o'clock																		✓
**Paspalum dilatatum*	Paspalum					✓								✓					
**Paspalum distichum*	Water Couch																	✓	

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
**Pennisetum clandestinum*	Kikuyu				✓	✓	✓								✓	✓	✓		✓
**Phalaris aquatica*	Phalaris				✓	✓					✓			✓		✓	✓		
**Piptatherum miliaceum*	Rice Millet				✓		✓												
**Plantago coronopus*	Bucks-horn Plantain						✓			✓									✓
**Plantago lanceolata*	Ribwort				✓	✓	✓								✓		✓		
**Polycarpon tetraphyllum*	Fourleaf Allseed									✓									
**Polypogon monspeliensis*	Annual Beard-grass							✓	✓	✓					✓	✓	✓	✓	
**Populus sp.*	Poplar					✓													
**Rapistrum rugosum ssp. rugosum*	Turnip Weed					✓					✓								
**Reichardia tingitana*	False Sow-thistle							✓											✓
**Romulea rosea var. australis*	Common Onion-grass									✓					✓				✓
**Rorippa nasturtium-aquaticum*	Watercress				✓			✓							✓	✓	✓		
**Rosa sp.*	Wild Rose/Briar				✓		✓					✓	✓				✓		
**Rumex conglomeratus*	Clustered Dock																✓		
**Rumex crispus*	Curled Dock				✓	✓	✓	✓		✓		✓			✓	✓			
**Salvia verbenaca form*	Wild Sage					✓				✓									
**Scabiosa atropurpurea*	Pincushion				✓		✓			✓									
**Senecio pterophorus*	African Daisy												✓	✓			✓		
**Silybum marianum*	Variegated Thistle						✓	✓	✓			✓							
**Solanum linnaeanum*	Apple Of Sodom							✓			✓				✓		✓		✓
**Solanum nigrum*	Black Nightshade							✓									✓		
**Sonchus oleraceus*	Common Sow-thistle					✓		✓			✓	✓			✓	✓	✓		
**Sparaxis sp.*	Sparaxis									✓		✓		✓				✓	✓
**Sporobolus africanus*	Rat-tail Grass																✓		

Species Name	Common Name	Conservation Statues*			Congeratinga-Anacotilla Creek	Parananacooka Creek	Yattagolinga Creek	Yohoe Creek	New Salt Creek	Fishery Creek	Cooalinga Creek	Blowhole Creek	Deep Creek Cove	Boat Harbor	First Creek	Tunkalilla Creek	Coolawang Creek Estuary	Waitpinga Creek Lignum	Witpinga Creek Saltmarsh
		AUS	SA	SL															
**Trifolium angustifolium*	Narrow-leaf Clover				✓	✓	✓		✓	✓	✓						✓		
**Trifolium campestre*	Hop Clover					✓		✓	✓								✓		
**Trifolium dubium*	Suckling Clover						✓			✓									
**Trifolium fragiferum var. fragiferum*	Strawberry Clover														✓	✓			
**Trifolium scabrum*	Rough Clover									✓									
**Trifolium sp.*	Clover										✓				✓				✓
**Ulex europaeus*	Gorse				✓														
**Verbascum virgatum*	Twiggy Mullein												✓						
**Vicia sativa ssp. sativa*	Common Vetch				✓														
**Vulpia myuros f. megalura*	Fox-tail Fescue																	✓	
**Zantedeschia aethiopica*	White Arum Lily				✓	✓		✓	✓		✓	✓			✓				
TOTAL INTRODUCED SPECIES					**23**	**26**	**17**	**25**	**18**	**24**	**20**	**12**	**13**	**17**	**26**	**20**	**31**	**13**	**20**

*Conservation Status

AUS = Australia *EPBC Act 1999*: CR = Critically Endangered, EN = Endangered, VU = Vulnerable

SA = South Australia *NPW Act 1972:* E = Endangered, V = Vulnerable, R = Rare

SL = Southern Lofty Botanical Region:[14] E=Endangered, T=Threatened, V=Vulnerable, R=Rare, K=status uncertain, but considered likely to be either rare, vulnerable or endangered, U=Uncommon, Q=Not yet assessed but flagged as being of possible significance, N=Common

[14] Definitions based on regional ratings obtained from Lang, P.J. & Kraehenbuehl, D.N. (2008). *Plants of Particular Conservation Significance in South Australia's Agricultural Regions*. July 2008 update of unpublished database. Department for Environment and Heritage.

Appendix 5: Photographic examples of threats

Congeratinga – Anacotilla Estuary (Wirinna) – marina development

Parananacooka Estuary (Second Valley) – recreation on the beach

Yattagolinga Estuary (Rapid Bay) – runoff from adjacent caravan park

Yoho Creek – Grazing of estuarine vegetation by both sheep and kangaroos. Also**Euphorbia paralias*

New Salt Creek – erosion caused by clearance of surrounding slopes

Fishery Creek – sheep observed within coastal reserve on second site visit have access to the estuary

Cooalinga Estuary – erosion of surrounding slopes caused by stock grazing and rabbits

Blowhole Creek – invasion of Arum Lily

Deep Creek Cove Estuary – line fishing, walking, swimming

Boat Harbor Estuary – adjacent grazing land

First Creek – dogs/foxes

Tunkalilla Creek Estuary – pugging and damage to vegetation caused by sheep and cattle

Coolawang Estuary – stock access in upper reaches, western side is unfenced

Waitpinga Estuary – fishing and other recreational pursuits

Coolawang Estuary – extraction of water for stock

Waitpinga Estuary –recreational pursuits