APPENDIX P
PORT TERRESTRIAL ECOLOGY BASELINE SURVEY

COPYRIGHT

DISCLAIMER

Iron Road Limited has taken all reasonable steps to review the information contained in this document and to ensure its accuracy as at the date of submission. Note that:

(a) in writing this document, Iron Road Limited has relied on information provided by specialist consultants, government agencies, and other third parties. Iron Road Limited has reviewed all information to the best of its ability but does not take responsibility for the accuracy or completeness; and

(b) this document has been prepared for information purposes only and, to the full extent permitted by law, Iron Road Limited, in respect of all persons other than the relevant government departments, makes no representation and gives no warranty or undertaking, express or implied, in respect to the information contained herein, and does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting or refraining from acting on any information contained within it.

ABN: 51 128 698 108

REPORT

CENTRAL EYRE IRON PROJECT:
PORT SITE
ECOLOGICAL SURVEY

E-F-34-RPT-0015

Revision	Issue Date	Revision Description	Document Writer	Authorised By
A	20/03/2012	Draft for Client Review	E Marchant	N Bull
B	12/05/2014	Final Draft	Z Bull	N Bull
0	22/05/2014	Final	Z Bull	N Bull

ABN: 51 128 698 108

Contents

List of Figures

List of Tables

List of Plates

See Appendix B for additional Plates B-1 to B-16

Executive summary

Sinclair Knight Merz (now Jacobs) was engaged by Iron Road Limited (Iron Road) to undertake an investigation of ecological values at a proposed Port and Ship Loader Facility site at Cape Hardy, near Port Neill on the Eyre Peninsula, South Australia. The investigation will inform Iron Road of any particular values which need management during construction and/or operation of the proposed facility, and of further legislative obligations that will need to be fulfilled in order to seek approval for proposed construction and operation of the facility.

A desktop analysis was undertaken (in 2011 and updated in 2013) to determine the potential presence of matters of conservation significance within the study area, as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and South Australian *National Parks and Wildlife Act 1972* (NPW Act). A flora and fauna survey was undertaken between 5 and 9 November 2011, to record baseline data of flora and fauna present across common habitat types within the study area. The survey described all vegetation present within the study site.

Context of Cape Hardy Port Study Area
The study site occurs within the Eyre Hills subregion of the Eyre Yorke Block bioregion, as described by Thackway and Cresswell (1995) in the Interim Bioregionalisation of Australia. The Eyre Hills subregion comprises old alluvium plains and calcarenite adjacent to the coast, with some low dunes present along the coast. Shallow loams are present inland from the coast and often feature rock outcropping. The climate of the study area is semi-arid with mean annual rainfall of approximately 402.3 mm over the past 30 years (sourced from nearest meteorological station at Cleve Aerodrome, Bureau of Meteorology, 2014). Rainfall is typically winter dominant with relatively dry summer months which are characterised by warm to hot temperatures, with mean summer monthly maximums in the high 20s.

Proposed designs for the port and wharf facilities have been developed and include:

- Land infrastructure located behind the coastal dune system including stockpiles, conveyors, rail yards and, loading and unloading facilities and equipment
- Marine infrastructure includes a wharf capable of accommodating Capesize vessels, a module loading facility and tug facilities.

Environment
The desktop study identified 48 conservation significant (state and national) species as having the potential to occur within the study area, based upon records from the Biological Database of South Australia, as well as results from the EPBC Act Protected Matters Search Tool. Additional species of conservation significance were also identified at the site by the field survey. A total of 56 species of conservation significance have therefore been considered by this study. Of the 56 species, 25 are considered unlikely to occur within the study area, 17 are considered to have potential to occur in the study area and 14 were actually observed in the study area by the survey team (13 birds and 1 plant).

During the field survey, a total of 13 fauna species listed under the EPBC Act were observed within the study area, all Listed Marine birds (3 also listed as Migratory, 4 also listed under the NPW Act Schedules). Species observed included: Australian Pelican, Black-faced Cuckoo Shrike, Caspian Tern, Common Sandpiper, Hooded Plover, Little Raven, Nankeen Kestrel, Nankeen Night Heron, Pacific Gull, Rock Parrot, Silver Gull, Stubble Quail

and White-bellied Sea-eagle. Additionally, one flora species (Hop-bush Wattle) listed only under the NPW Act was identified within the study area. No flora species listed under the EPBC Act were observed within the study area during the field survey.

Remnant vegetation throughout the study area was predominantly highly degraded or absent, the site having been historically cleared for pastoral use. Subsequent weed infestations throughout pastoral land and into isolated remnant vegetation patches have further degraded available habitat for fauna and flora species. Discontinuous and isolated patches of remnant vegetation that are present within the study area do still provide some habitat opportunities for local fauna, but are not likely to be critical for conservation significant species that occur in the area. Clearance of any native vegetation will be subject to the *Native Vegetation Act 1991* (Native Vegetation Act).

1 Introduction

Sinclair Knight Merz (SKM) (now Jacobs) was engaged by Iron Road Limited (Iron Road) to undertake an investigation of ecological values at the proposed Central Eyre Iron Project (CEIP) port and ship loading facility site at Cape Hardy (hereafter referred to as 'the port site') near Port Neill on the Eyre Peninsula, South Australia. The proposed port site will cater for loading and transport of iron concentrate produced at the proposed CEIP mine near Warramboo on the central Eyre Peninsula and is being developed as a multi-user facility. This report forms part of a suite of environmental impact and baseline studies associated with a proposal to develop the port site. The outcomes of this and other studies will characterize the site, provide data on any ecological values at the site which may warrant particular management during construction and/or operation, and provide the necessary information to facilitate the approvals process under state and federal legislation.

The desktop component of this report summarises information on the existing environment of the project area derived from Commonwealth and State databases (e.g. Protected Matters Database, Biological Database of South Australia) as well as general distribution texts and published information from previous ecological investigations in the region. This report also presents the outcomes of a detailed in-field flora and fauna survey of the site, which has further refined the desktop dataset and improved our knowledge and understanding of the local environment.

1.1 Iron Road deposits

The proposed CEIP project is located centrally on the Eyre Peninsula in South Australia. The project includes a mine near Warramboo, approximately 25km to the south east of Wudinna and south of the Eyre Highway. The focus of this report is the proposed port site at Cape Hardy, which will be required in order to transport materials mined at Warramboo.

1.2 Iron Road Limited and EL4849

Iron Road is a South Australian focused resource company who target exploration, evaluation and development of iron ore projects in South Australia (SA) and Western Australia (WA). Iron Road acquired EL 3699 from Adelaide Resources Limited in June 2008. Previous work undertaken by Adelaide Resources included the drilling of six Reverse Circulation (RC) drill holes during 2000 and performing associated metallurgical test work on samples collected. Iron Road is currently undertaking a staged drilling program within the EL. Since the timing of this study the EL has been updated to EL4849.

1.3 CEIP infrastructure requirements

The location of the CEIP near Warramboo is favourable in terms of proximity to power and transport infrastructure, and the geological and metallurgical results are considered outstanding. Iron Road have narrowed the options available for product transport since their pre-feasibility studies, and their preferred option is currently for a new, purpose built rail line delivering product to multi-user port facilities located on the east coast of the Eyre Peninsula near Cape Hardy. Other major infrastructure required to support the mine is a borefield and water pipeline and a 275kv transmission line proposed to use the same infrastructure corridor as the rail line. The Yadnarie transmission line spur is a section on the 275 kv transmission line that is between the Yadnarie substation and the infrastructure corridor.

1.4 Port site selection and infrastructure requirements

SKM was engaged by Iron Road to prepare a briefing document addressing port options on the Eyre Peninsula. The assessment was delivered in three stages including a regional suitability assessment, site identification and preliminary ranking, and conceptual development (SKM 2010). An area from 50 km north of Elliston on the west coast of the Peninsula, to Cowell on the east coast was investigated for options, and all suitable sites assessed from a broad environmental, social and engineering perspective. Three zones were identified as potentially suitable for port development, namely:

- Upper West Eyre Peninsula – near Elliston in Anxious Bay on the north east lee side of Waldergrave Island.
- Lower West Eyre Peninsula – between Drummond Point and Coles Point
- Spencer Gulf – between Lipson Cove and Port Gibbon

The second stage identified seven potential sites within these zones, three on the west coast (Elliston, Drummond Point, Coles Point) and four on the east coast (Lipson Cove, Cape Hardy, Arno Bay, Gibbon Point). Based on an un-weighted ranking of the evaluation criteria, including environmental, social and engineering measures, the most preferred site was Cape Hardy. The final stage of the assessment involved the conceptual development of the port infrastructure, further desktop based evaluation of environmental issues, and an order of magnitude cost estimate for the preferred Cape Hardy site. Investigations from the final stage were favourable.

The detailed designs for the port and wharf facilities are yet to be undertaken, but it is expected that they will include:

- Land infrastructure located behind the coastal dune system including stockpiling, loading and unloading facilities and equipment
- Marine infrastructure including a wharf capable of accommodating Capesize vessels, loading facilities and tug facilities

1.5 Study area

The proposed Cape Hardy port site area lies entirely within the District Council of Tumby Bay. The location of the proposed port and wharf is considered favourable in terms of proximity to power and transport infrastructure. The location of the proposed port site is indicated on Figure 1-1.

For the purposes of this baseline assessment, we have defined the ‘study area’ to comprise the proposed port site, with an additional one km buffer around the port site, excluding the marine area. While the study area is the main focus for this report, flora and fauna records have been sourced from a wider area (up to 10 kilometres from the site) due to the paucity of records in the region.

The desktop and in-field baseline ecological assessments for the additional infrastructure developments associated with the project are the subject of further studies undertaken by Jacobs (2014a, b, c, d).

Figure 1-1 Site Overview

1.5.1 Bioregion

The study area is located within the Eyre Yorke Block (EYB) bioregion as described by the Interim Bio-regionalisation of Australia (IBRA) of Thackway and Cresswell (1995).

Due to the diverse landscapes and habitats found within the bioregion, sub-regions are used for the purposes of describing biodiversity issues. Within the EYB bioregion, there are three sub-regions located within the Eyre Peninsula (Eyre Hills, Talia and Eyre Mallee). The Project site is located within the Eyre Hills subregion (see 4.1.2 for further detail).

1.5.2 Landscape, geology and soils

The Eyre Hills subregion comprises undulating old alluvium plains (primarily to the south and west) and calcarenite near the coastal fringe, with some low dunes present along the coast. Shallow loams are present inland from the coast and often feature rock outcropping (DEH 2002).

1.5.3 Watercourses and wetlands

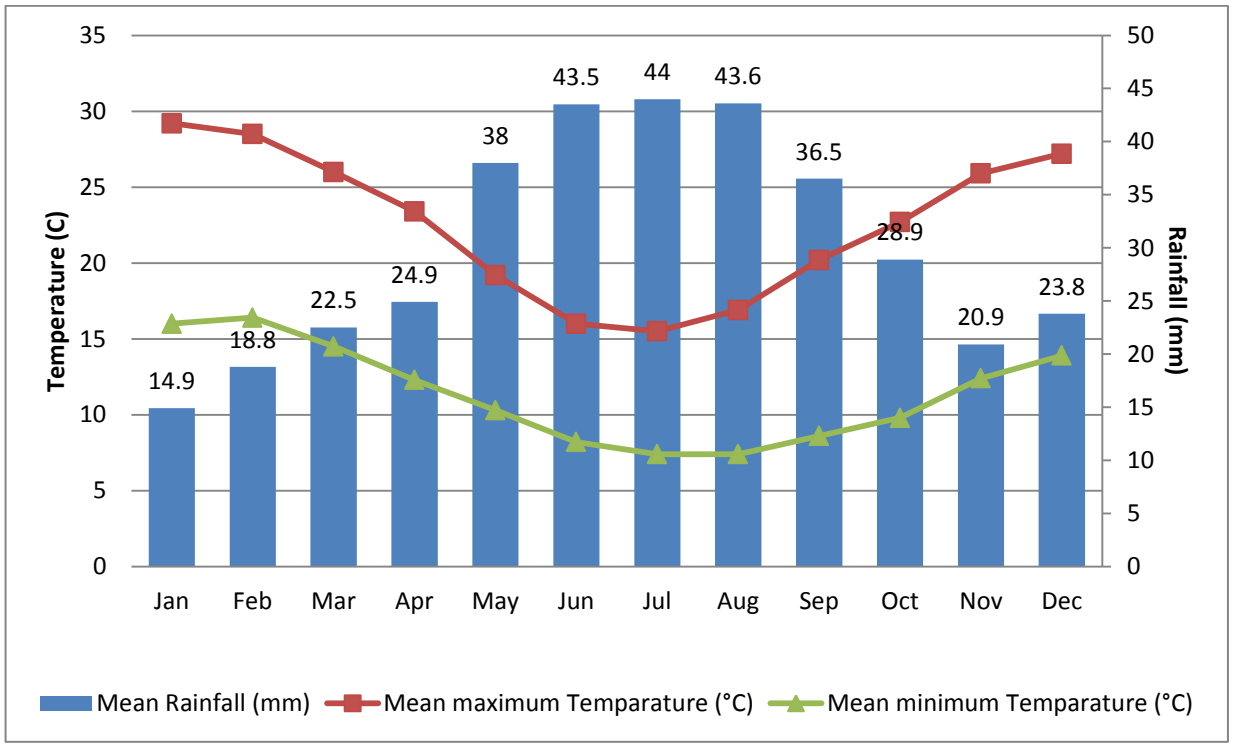
No major watercourses occur within the study area. Minor drainage channels occur. The closest watercourse is Salt Creek, which intersects the Lincoln Highway south of the study area. No major wetlands occur within the study area.

1.5.4 Climate

The climate of the study area is semi-arid with mean annual rainfall of approximately 402.3 mm over the past 30 years (sourced from nearest meteorological station at Cleve Aerodrome, Bureau of Meteorology, 2014). Rainfall is typically winter dominant with relatively dry summer months which are characterised by warm to hot temperatures, with mean summer monthly maximums in the high 20s.

Climatic conditions at the site indicate that from an ecological perspective, a spring time flora and fauna survey would likely yield the greatest diversity as plants respond to increased rainfall and warming ground conditions during this time, and fauna are consequently likely to time their breeding and peak activity with this period. Monthly average rainfall and temperatures recorded at Cleve Aerodrome (approximately 60km from Cape Hardy, closest long-term climate statistics to Cape Hardy) between 1981 and 2012 are provided in Figure 1-2.

Figure 1-2 Climate, Cleve Aerodrome (closest long-term climate data to Cape Hardy)



Source: Bureau of Meteorology (Cleve Aerodrome) 19/02/2014

1.6 Study objectives

A robust assessment of environment values is critical for any proposed major infrastructural development as it seeks to:

- Identify sensitive issues and sites that are implicated by state and federal legislation, and that may need to be factored into infrastructure design
- Provide data that can be used to predict potential impacts of the proposed development
- Offer a judgement on the 'significance' of potential effects
- Contribute to safety in design and other risk elimination or mitigation measures, and shape environmental management planning, and rehabilitation strategies and outcomes
- Establish a background against which the potential impacts of the proposed infrastructure can be measured in future, and against which future operational and closure data can be compared.

The key objectives of this report are therefore to identify any ecological values within the study site, determine likely and potential impacts to these values, provide information to assist in the mitigation of potential environmental impacts, inform regulatory authorities, and to determine the need for any additional approvals (e.g. formal 'referral' under Commonwealth legislation).

This study provides an assessment of terrestrial and onshore coastal matters only. An assessment of the marine environment adjacent to the proposed port site is also being undertaken independent to this report (Jacobs 2014a).

2 Legislation

This section presents key legislation relevant to ecological values and for government approval for development for the proposed port.

2.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as matters of national environmental significance (MNES). Under the environmental provisions of the EPBC Act, actions that are likely to have a significant impact on a matter of National Environmental Significance are identified as "controlled actions" and cannot be undertaken without referral to the Department of the Environment for consideration and approval under the EPBC Act.

The nine matters of national environmental significance identified in the EPBC Act are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Threatened species and ecological communities;
- Migratory species as listed under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- Nuclear actions (including uranium mining) and
- A water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act is the applicable Commonwealth environmental legislation governing Iron Road's activities at the port site and Iron Road are required to comply with the EPBC Act to ensure protection of the environment and heritage values within its tenements.

The Matters of National Environmental Significance that are considered of particular relevance to this terrestrial and coastal flora and fauna study of the proposed port site are:

- Listed threatened species and ecological communities;

In addition to the above listings, some species are listed as 'Marine' under the EPBC Act in recognition of the EPBC Act's role in the protection of Commonwealth waters. Listed-Marine species occur commonly within Australian Commonwealth Marine Areas. The Commonwealth marine area stretches from 3 to 200 nautical miles from the coast and is therefore not considered relevant to the terrestrial and coastal nature of the proposed port site.

2.2 Commonwealth policy

The Commonwealth government is also directed by the following policies and strategies relevant to native habitats, communities and species:

- Australia's Biodiversity Conservation Strategy 2010-2030 (Natural Resource Management Ministerial Council (NRMMC) 2010)
- National Principles and Guidelines for Rangeland Management (ANZECC and ARMCANZ 1999), the draft National Strategy for Rangeland Management (NRMWG 1996), and the National Land and Water Resources Audit on Rangelands (Karfs *et al.* 2000).

2.3 South Australian legislation

National Parks and Wildlife Act 1972

The National Parks and Wildlife Act 1972 (NPW Act) allows for the protection of habitat and wildlife through the establishment of parks and reserves (both on land and in State waters) and provides for the use of wildlife through a system of permits allowing certain actions, i.e. keeping, selling, trading, harvesting, farming, hunting and the destruction of native species.

The NPW Act assigns species to state conservation categories; *Endangered* (Schedule 7), *Vulnerable* (Schedule 8), and *Rare* (Schedule 9).

Native Vegetation Act 1991

The *Native Vegetation Act 1991* (NV Act) outlines incentives and assistance to land owners relative to the enhancement of native vegetation and acts to control the clearance of native vegetation. The broad objectives of this Act relevant to Iron Road's proposed development of the port include:

- The conservation, protection and enhancement of the native vegetation of the State and, in particular, remnant native vegetation, in order to prevent further:
  - reduction of biological diversity and degradation of the land and its soil
  - loss of quantity and quality of native vegetation in the State
  - loss of critical habitat
- The provision of incentives and assistance to landowners to encourage the commonly held desire of landowners to preserve, enhance and properly manage the native vegetation on their land;
- The limitation of the clearance of native vegetation to clearance in particular circumstances including circumstances in which the clearance will facilitate the management of other native vegetation or will facilitate the sustainable use of land for primary production;
- The encouragement of research into the preservation, enhancement and management of native vegetation; and
- The encouragement of the re-establishment of native vegetation in those parts of the State where native vegetation has been cleared or degraded.

Natural Resources Management Act 2004

The *Natural Resources Management Act 2004* (NRM Act) is to assist in the achievement of ecologically sustainable development in the State by establishing an integrated scheme to promote the use and management of natural resources that recognises and protects the intrinsic values of natural resources.

Environment Protection Act 1993

The *Environment Protection Act 1993* provides for the protection of the environment and defines the Environment Protection Authority's (EPA) functions and powers. The Act promotes ecologically sustainable development and the use of precautionary principles to minimise environmental harm. It requires polluters to bear an appropriate share of the costs and responsibilities of protecting the environment from their activities.

2.4 South Australian policy

The SA government is guided by an additional policy and strategy regarding the conservation of native habitats, communities and species through the implementation of the following documents:

- No Species Loss: A Nature Conservation Strategy for South Australia 2007-2017 (DEH 2007)

This is a key policy for protection of biodiversity in the State and is applicable to the project.

3 Methodology

3.1 Ecological desktop review

A desktop review of relevant literature and databases was completed to determine the suite of ecological communities and species which may be present in the study area. The desktop review involved evaluation of the following:

- Environment Protection and Biodiversity Conservation (EPBC) Act Protected Matters database – modelled distributions of Commonwealth listed threatened species, habitat, vegetation communities and any other matters covered by Commonwealth Environmental legislation
- Biological Database of South Australia (BDBSA) flora and fauna records – records are provided to the SA Government (Department of Environment, Water and Natural Resources) (DEWNR 2011) and include data from the following sources:
    - South Australian Herbarium
    - Birds Australia
    - South Australian Museum
- General distribution texts
- Information published by the South Australian and Commonwealth Governments, including the EPBC Species Profile and Threats Database (SPRAT, managed by the Department of the Environment)
- Information available from relevant local authorities
- Previously published ecological investigations from the region (e.g. Biodiversity Plan for Eyre Peninsula, DEH 2002; 23 Threatened Flora of the EP, Pobke, 2007; EP Biological Survey, Brandle 2010, EP Coastal Action Plan, Caton *et al*. 2011).

The EPBC Act Protected Matters Database is maintained by the Department of the Environment. This database includes mapped locations of World Heritage properties and wetlands listed under the Ramsar Convention, and modelled distributions of threatened, migratory and marine species, threatened ecological communities and protected areas. A search of the EPBC Protected Matters database was undertaken targeting the study area and initially a buffer of 5 kilometres, but was updated and refined to 1km in 2013 as more information about the proposed project footprint was available. Search results from the Protected Matters Search Tool are presented in Error! Reference source not found. (p 87).

The BDBSA data base searches undertaken as part of the desktop study cover the proposed port study area including a buffer of 5 km, due to a paucity of records in the immediate project area. The data obtained from the searches comprises historic flora and fauna records, including threatened flora and fauna and ecological communities. Data was initially obtained in 2011, and subsequently in 2012 and the end of 2013, to ensure the most recent records were included. Results from the BDBSA search are presented in Error! Reference source ot found. (p 101).

Protected fauna and flora species that *may* occur within the project area are highlighted by the search tool. These searches use information such as species distributions, habitat requirements, migratory paths, and previous records to determine which threatened species *may* occur within the area of interest. The results from such searches are not necessarily based upon actual records and are therefore indicative only and should not take the place of on-ground investigations in terms of identifying the actual faunal composition of a site.

The search was used to identify migratory species that may be found on the site, and threatened terrestrial and non-migratory species that may be found within the area. The conservation significance of flora, fauna and habitats was assessed with reference to:

- Species classified as threatened nationally in accordance with the EPBC Act
- Species classified as migratory and protected under the EPBC Act by bilateral agreements; the Bonn Convention, the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
- Species classified as threatened in accordance with the NPW Act (as amended in 2000).

3.2 Flora and fauna field survey

Field surveys involved detailed fauna surveys, habitat and landform descriptions, detailed survey of vegetation monitoring plots, and land impact assessments. Table 3-1 outlines broad survey methodologies employed to collect ecological information for the sites established within the project area. Broadly, methodologies followed vegetation and vertebrate guidelines developed for Biological Survey of South Australia (Heard and Channon 1997, Owens 2000). Further details regarding methodologies for each of the survey components are provided below.

Table 3-1 Broad survey components for 2011 flora and fauna survey, Cape Hardy

Component	Target
Establish and survey approx. 100 m square plot	Vegetation community
Physical and Landscape description	Soils, biological crust, underlying geology / topography – overall habitat
Nights & day trapping (Pitfall trapline, Elliott traps, cage traps)	Terrestrial mammals and reptiles
Nightly spotlighting and 'eyeshine' searches	Nocturnal mammals, birds and reptiles (geckos)
Call playback	Targeted species including nocturnal birds, limited mammals.
Anabat recording	Bats
Diurnal active and opportunistic reptile search / capture	Reptiles
Diurnal active and opportunistic scat and track searches	Mammals, birds, reptiles
Morning and afternoon bird surveys (audio/visual)	Birds

3.2.1 Permitting

Undertaking research and handling/trapping of animals in South Australia can only legally be undertaken with relevant permits and licences in place. Relevant permits and licences were obtained prior to field survey commencement. All works were undertaken in accordance with permit and licence conditions. These include:

- Permit to Undertake Scientific Research – Warramboo, Eyre Peninsula - Flora and fauna survey, permit Number U25967-1
- Wildlife Ethics Approval – Iron Road Warramboo, Eyre Peninsula - Baseline Fauna and Flora, application Number 29/2011
- Permit to Undertake Scientific Research – State-wide Vegetation Surveys. Permit Number U25967-1
- Licence for teaching, research or experimentation involving animals (required under the Prevention of Cruelty to Animals Act, 1985), Licence Number 228
- Licence to 'Possess and Administer an S4 Drug', for possession and use of a controlled substance (required under the Controlled Substances Act, 1984), Licence Number 2011-75049.

A condition of the Scientific Research Permit is that 'best practice' for biological survey work is undertaken, including vouchering of specimens of interest for the South Australian Museum. This condition is included on permits as a means of maximising the value obtained from survey work across the State, and to encourage survey records to be included in the Biological Database of South Australia for broader knowledge. As such, the project team liaised with the South Australian Museum prior to undertaking the survey to ascertain whether the Museum had particular interest in the region being surveyed, and whether the data was of particular interest to the Biological Database of South Australia. A 'Licence to Possess and Administer an S4 Drug' (for use of pentobarbitone sodium) was obtained from the South Australian Department of Health to euthanize specimens. No reptile vouchers were requested for this survey, only small mammal vouchers.

3.2.2 Survey site selection

Effective survey of flora and fauna across a broad area involves detailed survey of all major habitat types within the target area. Based on this, a preliminary site selection process was undertaken using aerial imagery to capture all broad habitat types potentially impacted by the proposed port site development footprint. All broad habitat types which were intersected by areas of likely, probable or potential impacts were considered during the site selection process.

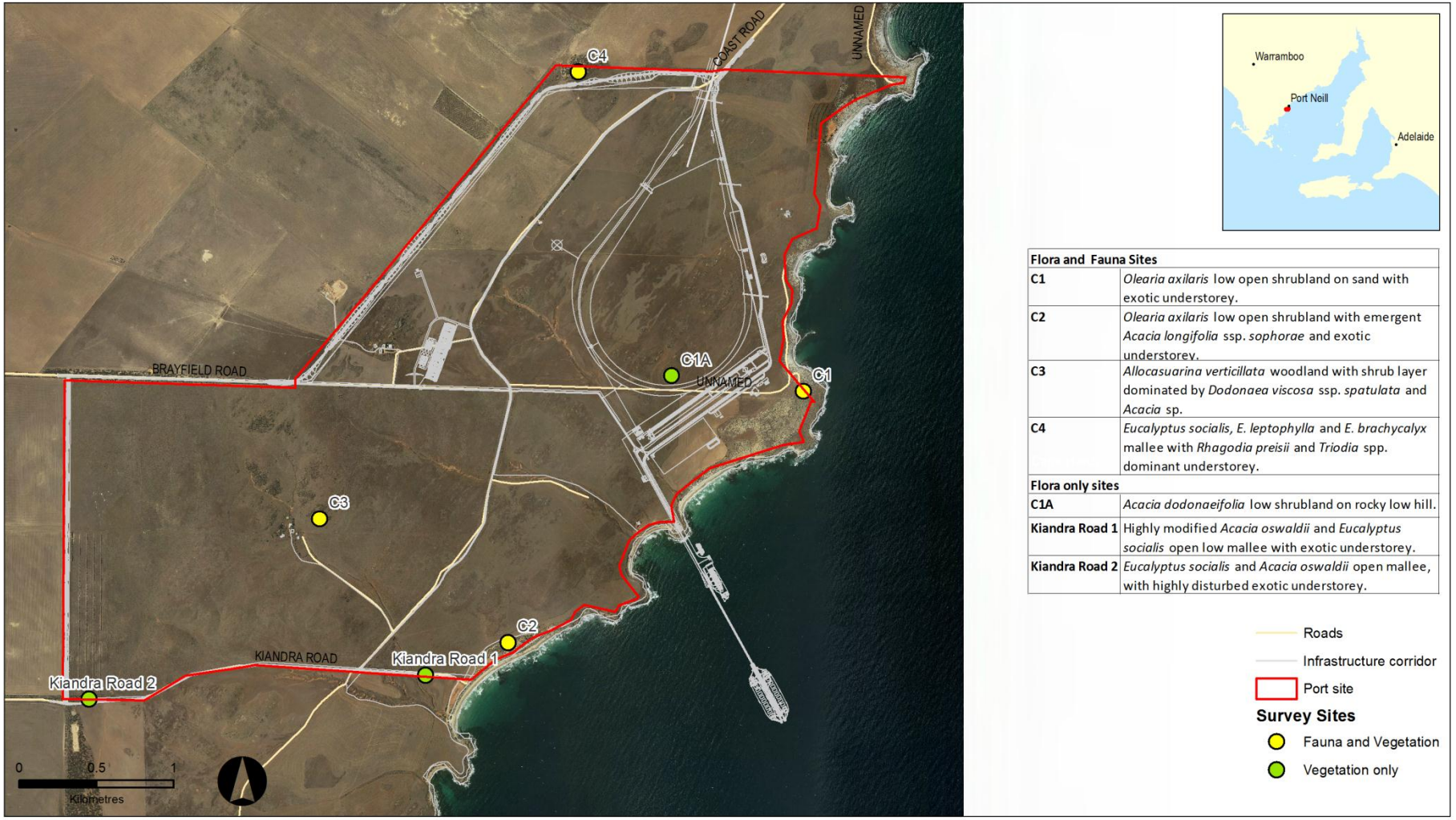
The project area is currently broadly impacted by existing agricultural practices, including extensive clearance of native vegetation communities and weed infestations caused through disturbance of native vegetation. However, several areas exist throughout the study area that support some native vegetation and associated habitat features which are of value to local fauna. Survey sites targeted these areas with the aim of capturing the greatest biodiversity and maximising the chances of recording ecological values within the study area.

Final in-field site selection was undertaken by the field team on 5 November 2011. The final in-field selection process was aimed at specifically identifying survey sites which were indicative of the target habitat types they were representing. Final survey site locations are shown in Figure 3-1 and northings and eastings of each site are listed in Table 3-2. Flora and fauna surveys were undertaken at survey sites C1 to C4, flora only surveys were undertaken at remaining sites. The methodology of each survey is detailed in Section 3.2.3 and 3.2.4.

Table 3-2 Field survey site locations

Site	Easting[1]	Northing[1]	Broad Habitat Type	Survey Target
C1	621965	6217223	*Olearia axillaris* low open shrubland on sand with weedy dominant understorey.	Fauna, Vegetation Community & Landform
C2	620056	6215601	*Olearia axillaris* open shrubland with emergent *Acacia longifolia* ssp. *sophorae*. Weedy understorey.	Fauna, Vegetation Community & Landform
C3	618838	6216398	*Allocasuarina verticillata* woodland with shrub layer dominated by *Dodonaea viscosa* ssp. *spatulata* and *Acacia* sp.	Fauna, Vegetation Community & Landform
C4	620509	6219284	*Eucalyptus socialis*, *E. leptophylla* and *E.brachycalyx* mallee scrub with *Rhagodia priesii* and *Triodia* spp. dominant understorey.	Fauna, Vegetation Community & Landform
C1A	621113	6217322	*Acacia dodonaeifolia* low shrubland on rocky low hill.	Vegetation Community & Landform
Kiandra Road 1	619521	6215391	Highly modified *Acacia oswaldii* and *Eucalyptus socialis* mallee with understorey dominated by weeds.	Vegetation Community & Landform
Kiandra Road 2	617346	6215236	*Eucalyptus socialis* and *Acacia oswaldii* open mallee, with highly disturbed understorey dominated by weeds.	Vegetation Community & Landform

[1] Locations recorded in GDA94, Z53



I:\VESA\Projects\VE23730\Technical\Spatial_Data\ArcGIS\Port Ecology\Fig3-1 Port Survey Site Locations_Rev0.mxd

Figure 3-1 Survey Site Locations

3.2.3 Flora survey and landscape description

The flora survey component of this study involved a detailed vegetation survey at each of the 4 fauna survey sites along with an additional 3 sites which were only surveyed for vegetation and landform characteristics. Methodologies followed those presented in Heard and Channon (1997). This was undertaken to provide a detailed inventory of species present, to note the occurrence of any threatened species or assemblages, to provide detailed habitat information, and to document any existing disturbance or degradation of the sites. Floristic and geological information was recorded for each survey site as described below. The habitat of each survey site was described, measured, and recorded on data sheets. Information recorded included:

- GPS Coordinates using a hand-held 12-satellite GPS set to GDA94 (accuracy +/- 5 m)
- General Site description
- Description of physical environment
- Description of the level of disturbance, if any
- Vegetation classification and all species present identified
- Fire history and impact
- Evidence of weeds and feral animals
- Soil, rock, crust and groundcover description
- Digital photograph numbers and
- Any other relevant information.

In addition to survey of the characteristics listed above, reference photographs were taken at each site, in each of the four compass bearings. These images are presented in Appendix B.

Any indigenous plant species that could not confidently be identified in the field were sampled and preserved using plant presses for later identification at base-camp or for independent identification by the SA Herbarium in Adelaide so that the confirmed species names could be incorporated into this report. Field identifications of plant species were made using a variety of books and reference materials, including:

- Plants of Western New South Wales (Cunningham *et a*l. 1993)
- Eucalypts of South Australia (Nicolle 1997)
- Flora of South Australia (Black 1986)
- Field Guide to Eucalypts – Volume 2: South-western and Southern Australia (Brooker and Kleinig 2001)
- Grasses of South Australia (Jessop *et al*. 2006)
- Mangroves to Mallee (Berkinshaw 2009)
- Weeds of the south-east: an identification guide for Australia (Richardson *et al*. 2011)

3.2.4 Fauna survey

A total of 4 sites were established and surveyed for faunal assemblages. Sites were marked in-field with flagging tape at the nearest access point and at the survey site to assist with relocation during the survey. Site locations were recorded by GPS (Datum: MGA 53). Site locations are provided in Table 3-2 above and shown in Figure 3.1. Photographs of each survey site are provided in Appendix B.

Trapping (mammals and reptiles)

Pitfall lines and trap lines were established at each site and monitored continuously over four nights and four days. Four sites were established and monitored concurrently (from 5 to 9 November, 2011). All equipment and flagging tape was removed from each site at the end of the survey period, and the pit trap holes were filled and compacted to ground level.

The layout of traps within each survey site involved:

- A drift fence line, approximately 60 m x 0.3 m, dug into the ground approximately 5-10 cm depth with five pitfall traps spaced evenly along the length. Where terrain was unsuitable for pitfall traps, funnel traps were installed along the drift fence line
- 20 ('type A') Elliott traps, 10 on each side of the pit-line, placed within shade beneath low shrubs or fallen branches approximately 10 m apart. The trap lines were generally placed extending outward diagonally from each side of the pit line
- Two cage traps – one at the end of each Elliot trap line.

This trap layout is based on the *Guidelines for Vertebrate Surveys in South Australia* publication (Owens 2000). The pit traps consisted of poly-plastic sheets (455 mm x 380 mm) rolled into a tube with a mesh base bound around one end. These were dug into the ground to be flush with the surface approximately every 8-10 m along the drift-fence. Where possible, the pits were located within different microhabitats along the line. The pit traps remained in place over four nights, and were checked early each morning and rechecked during the afternoon (for nocturnal and diurnal captures respectively). The Elliott traps and cage traps also remained in place over four nights and were checked early each morning then closed for the day (to avoid daytime captures and heat stress). All traps were re-opened late each afternoon and rebaited if required. The bait involved a mixture of oats, honey and peanut butter rolled into a small ball for the Elliot traps, and sardines and/or bait balls for the cages.

Any trapped animals were bagged for identification back at base camp and released near the capture point at a later time. There was no need to mark captured animals in this instance because species diversity rather than abundance was being investigated.

Bird survey

Bird surveys were conducted at each site on a minimum of two mornings and two afternoons. If weather conditions or timing were not considered optimal, repeat surveys were undertaken. A conscious effort to rotate field personnel between sites was made, given the documented 'observer bias' (Alldredge *et al.* 2006) which occurs during bird survey work (e.g. some observers are better at identifying inconspicuous birds by calls than others, some tend to focus on canopy birds, others on ground-level species). Bird surveys occurred during the early morning (beginning 0645 hours to approximately 0730 hours) and early evening (from 1630 until dusk), with occasional additional surveys conducted throughout the day if conditions were good. Each survey ran for a minimum of 30 minutes and recorded all species seen or heard (and identified), utilising the site or flying over (e.g. raptors, if they were observed hunting overhead). Birds that were noted outside of the time of bird count, or outside the survey sites, were noted as opportunistic observations and recorded elsewhere (this is also true of any records of mammals and reptiles).

Less common bird calls, or those which observers were unsure of, were confirmed using an audio playback system (MP3 player). This system was also used to confirm, or double-check, observations of any significant species which were recorded.

Active reptile, track and scat searches

Each site was also actively searched a minimum of twice for reptiles, along with any indications of mammal, bird or reptile activity evidenced by tracks, scats and traces (e.g. burrows, diggings, shed skin, etc). Any reptiles noted during these searches were either identified in-field, or captured (where possible), bagged and identified back at base camp using taxonomic keys and magnifying aids. If search conditions were not considered optimal during any search (i.e. due to inclement weather conditions, or poor timing), additional searches were undertaken. Searches were undertaken for a minimum of 30 minutes and involved:

- Turning rocks and logs, raking through leaf litter and grasses beneath trees, looking under bark, in crevices, in hollows
- Recording the number of individuals of each species seen
- Recording scats, tracks and other signs or traces where they could be confidently attributed to species (e.g. 'triangular' diggings within ant nests would be considered evidence of echidnas at the site, distinctive scats of foxes, Malleefowl mounds, lizard or snake skins, etc).

Spotlighting and call play-back

One nocturnal search was conducted at each site which involved spotlighting and listening for nocturnal vertebrate species, as well as call play-back. Searches were undertaken for a minimum of 30 minutes. Spotlighting was conducted using high-voltage spotlights with battery packs (Lightforce Walkabout Kit) and with head mounted LED torches. The high voltage spotlights were used to systematically scan tree canopies, trunks and branches and distant ground for any movement or 'eyeshine' from nocturnal mammals and birds. Head mounted torches were used to actively search more proximate areas for nocturnal reptiles (geckos), again using 'eyeshine' techniques and actively searching fallen timber, tree trunks and beneath bark.

Call playback units were used to periodically play calls of targeted species (i.e. those known from the broader region and/or suspected from the project area) in an attempt to get individuals to respond and thus alert the survey team of their presence. In this instance, calls of Southern Boobook Owls, Tawny Frogmouths, Spotted Nightjar, Owlet Nightjar and Brush-tailed Possum were played at each site.

Bat trapping and recording

Bats were surveyed using an Anabat bat detector, which was set up during late afternoons to record overnight call activity at a central location within survey sites. The Anabat recorded calls at sites C1, C2, C3 and C4.

Opportunistic observations

Opportunistic observations make up an important component of a fauna survey and constitute any observations made while travelling around the project area or between the survey sites. Any animal species identified opportunistically, either via direct observation or by evidence, were recorded on data sheets, along with location of sighting and any useful notes. These species were added to site species lists if identified at a survey site, or to a general survey species list if from the broader project area (i.e. not attributed to a particular habitat type).

Identification

The following reference materials were used for species identification and classification:

Reptiles

- A Complete Guide to Reptiles of Australia 2nd edition (Wilson and Swan 2008)
- Reptiles and Amphibians of Australia (Cogger 2000)

Birds

- The Field Guide to the Birds of Australia (Pizzey and Knight 1997)
- Field Guide to the Birds of Australia, 7th edition (Simpson and Day 2004)

Mammals

- A Field Guide to the Mammals of Australia (Menkhorst & Knight 2001)
- Mammals of Australia (Strahan 1995)
- Tracks, Scats and Other Traces (Triggs 1996)
- An Interim Guide to Identification of Insectivorous Bats of South-eastern Australia (Parnaby 1992)
- Australian Bats 2nd Edition (Churchill 2008)

Trapping effort over field survey duration

Total survey effort over the duration of the survey was calculated by number of trapping nights (number of traps multiplied by the number of nights the traps were set for) and the total number of active surveys and searches. In total, 320 Elliot Trap Nights, 32 Cage Trap Nights and 80 Pitfall Trap Nights were undertaken throughout the field survey. Results are summarised below in Table 3-3.

Table 3-3 Total trapping effort during field survey

Site	Site	Elliot Traps (No. of Trap Nights)	Cage Traps (No. of Trap Nights)	Anabat (No. of Nights)	Active Reptile and Track / Scat Searches	Bird Surveys	Spotlighting / Call Playback
C1	C1	80	8	1	2	4	1
C2	C2	80	8	1	2	4	1
C3	C3	80	8	1	2	3	1
C4	C4	80	8	1	2	4	1
Total	Total	320	32	4	8	15	4

Fauna survey limitations

The limitations associated with this fauna survey, as with any stand alone fauna survey, are as follows:

- The results of the fauna surveys are only a 'snapshot' in time and cannot describe seasonal variation or migrations.
- Scats could not always be correctly attributed to species, however where they could be confidently identified, they provide an accurate indication of the presence and habitat preferences of certain species (Triggs 1996).
- Detection of nocturnal species by spotlighting potentially does not detect all of the animals present and is affected by environmental factors (Wayne *et al*. 2005).
- Another study (Read & Moseby 2001) concluded that environmental factors affected the capture rates of small reptiles. Unfortunately, planning logistics for fauna surveys around specific environmental conditions is very difficult. Planning to survey during spring (as was done here) allows the best chance for favourable conditions and species identification. It is noted that conditions were considered favourable during this survey.

3.2.5 Evaluation of conservation significance

The conservation significance of flora, fauna and habitats recorded on this survey within and surrounding the project area was assessed with reference to:

- Species classified as threatened Nationally in accordance with the EPBC Act
- Species classified as migratory in accordance with the EPBC Act
- Species classified as threatened in South Australia in accordance with the NP&W Act (as amended in 2000)

4 Results of desktop flora and fauna study

4.1 Eyre Yorke Block bioregion

The study area is located within the Eyre Yorke Block (EYB) bioregion as described by the Interim Bioregionalisation of Australia (IBRA) of Thackway and Cresswell (1995).

The bioregion is characterised by Archaean basement rocks and Proterozoic sandstones overlain by undulating to occasionally hilly calcarenite and calcrete plains and areas of aeolian quartz sands, with mallee woodlands, shrublands and heaths on calcareous earths, duplex soils and calcareous to shallow sands. Habitat fragmentation and degradation are the key threatening processes for native flora and fauna in the bioregion as a result of the significant clearance of native vegetation which has occurred for agriculture and grazing. The bioregion comprises an overlap point for several species at the western or eastern range of their distribution. The area also contains the transition from semi-arid to arid plant and animal species, with at least 25 plant species endemic to the bioregion.

Feral animals including rabbits, foxes, cats, goats and horses present threats to native plant and animal species through grazing, competition and predation. Competition from exotic weed species such as bridal creeper, wild oats and veldt grass presents a further threat to native vegetation.

The landscape of the bioregion is unique and varied, comprising limestone rolling plains, granite inselbergs, coastal and inland wetlands, salt lakes, ephemeral lakes, stands of mangroves and offshore islands.

4.1.1 Eyre Hills (EYB3) sub-region

The Eyre Hills subregion has two areas (southern and eastern uplands) that occur spatially either side of the Eyre Mallee subregion. Consistent with the history of the broader bioregion, the mallee vegetation that previously dominated the subregion has been significantly cleared for agriculture and livestock grazing (DEH 2002). This sub-region only has 25% of native vegetation in reserves and those areas are primarily located in the Eyre Hills eastern subregion, apart from a section of Lincoln National Park in Eyre Hills southern. The proposed Port Facility will be located in the southern area of this subregion (at least 75km north of Lincoln National Park).

This subregion consists of undulating plains with an extensive cover of dunes and sand sheets. The plains to the south and west are predominantly formed on old alluvium or on calcarenite near the coastal fringe. Shallow reddish loams with rock outcrops support Mallee (*Eucalyptus incrassata),* with Broombush (*Melalueca uncinata)* on the plains or *Melaleuca lanceolata* Woodland occurring along the coast fringe (DEH 2002).

Nationally endangered flora species that occur within this subregion include: *Acacia cretacea* (Chalky Wattle), *Acacia enterocarpa* (Jumping-jack Wattle), *Acacia pinguifolia* (Fat-leaved Wattle), *Acacia whibleyana* (Whibley Wattle), *Haloragis eyreana* (Prickly Raspwort) and *Thelymitra epipactoides* (Metallic Sun-orchid) (ANRA, 2009).There are also a number of flora species with Vulnerable or Rare ratings under the EPBC Act and the NPW Act, see Section 4.4 for further detail.

The Eyre Hills subregion has the highest occurrence of endemism within the EYB bioregion. Nineteen endemic plant species and two endemic plant communities have been recorded within the area; Eyre Peninsula Blue Gum (*Eucalyptus petiolaris)* Grassy Woodland on heavy fertile soils on plains and *E. Peninsularis* (Cummins Mallee)*, E. Dumosa complex* Mallee on loams or clay-loam flats (DEH 2002). The Eyre Peninsula Blue Gum

Woodland community has recently been listed under the EPBC Act, as endangered (August 2013). Areas where this community are known to occur and may occur have been mapped (SPRAT Profile August 2013). These key areas occur south of Ungarra and North of Cleve. It should be noted that previous records for *E. dumosa* on the Eyre Peninsula are now considered to be *E. calcareana* (Nundroo Mallee) (Nicolle 2013).

Landcover within the Eyre Hills sub-region includes (DEH 2002):

- Grazing – native pastures (42.9%)
- Conservation (6.9%)
- Native forest outside public land (7.4%)
- Vacant Crown land and Crown Reserves (0.8%)

4.2 Biodiversity and conservation context

Remnant native vegetation is scattered throughout the broader region primarily within conservation areas (Parks, Reserves, Wilderness Protection Area (WPA) and Heritage Agreements (HA)), but also as discrete and isolated patches within cleared private land, as well as along roadsides and in rail reserves. These areas are managed to protect species and generally contain larger numbers of protected flora and fauna than smaller isolated patches that occur within the agricultural landscape. The proposed port site avoids a key biodiversity planning area on the Eyre Peninsula, classified as a 'Large Remnant Area' (Nature Maps 2013, DEH 2002). Similarly more recent biodiversity planning for coastal areas, EP Coastal Action Plan, rates the coastal section of the study area with lowest priority (Figure 5.1 of Caton *et al.* 2011). In addition, the proposed study area is not within one of the 10 nationally significant shorebird coastal areas that occur on the EP (Caton *et al.* 2011). Shorebird areas are considered internationally significant if they "*regularly support greater than 1% of the populations of one of a species that migrates to Australia or regularly supports greater than 20,000 shorebirds*" (p 122, Caton *et al.* 2011).

Ten South Australian Wetlands of National Importance occur within the coastal areas of the Eyre Peninsula and of these 6 are considered to be Nationally Important. None of these wetlands occur within the study area. The closest important wetland is at Tumby Bay and this does not support nationally significant numbers of migratory or shorebird species (Caton *et al.* 2011).

4.3 Regional vegetation associations

Vegetation at the proposed port site study area is patchy, scattered and predominantly degraded, having been historically cleared for pastoral use. Subsequent weed infestations throughout pastoral land, as well as any remnant vegetation have further degraded available habitat. Aerial imagery suggests, there are however fragmented patches of remnant vegetation present at the proposed port site.

The regional IBRA vegetation associations that were mapped as occurring in the Port Facility study area include the Butler Association and the Waretta Association (Laut *et al.* 1977). The Warretta Association is defined as undulating plains and low hills on metasediments, with cliffs along the coastline. Vegetation includes cultural grassland cover used for rotation of cereal crops and livestock grazing. The Butler Association is defined as undulating plains on partly calcreted alluvium with isolated quartzite hills and low hills along the coastline. Similar to Warretta, the vegetation includes grassland for rotation of cropping and grazing (Laut *et al.* 1977). The Warretta and Butler IBRA Vegetation Associations are poorly conserved within the region (DEWNR stats 2013a). Less than 2 % of the study area is mapped as 'Butler Association', however this area is mostly cleared of native vegetation and used for cropping. The majority of remaining native vegetation within the study area

(62.28 ha, based on DEWNR data) occurs within the Warretta IBRA Vegetation Association boundary, comprising approximately 4% of the remaining association (1501 ha, DEWNR 2013a).

Remnant vegetation in the study area would have originally been defined by three broad Eyre Peninsula Community Types, as per Milne *et al*. (2008). The community types are EP 11.1, EP 11.2 and EP 12.2. EP 11.1 comprises Inland Mallee and Low Woodlands with mid-dense sclerophyll scrub understory on limestone soils. EP 11.2 comprises Sub-coastal and Coastal low mallee and woodlands with mid-dense sclerophyll on limestone soils. EP 12.2 comprises coastal shrublands of stable dunes and cliff-top dunes. Original compositions of these community types can be used as a benchmark for assessing the current condition of remnant vegetation in the study area.

4.4 Listed flora and ecological communities

The desktop review identified nine flora species of national or state conservation significance as potentially occurring in the survey area (based on EPBC PMST and BDBSA results). No threatened communities of national significance were identified for the study area.

The EPBC Protected Matters Search Tool (EPBC PMST) was examined using a 1 km buffer zone from the proposed port site and results were compared to BDBSA records for the study area (see Appendix A and C). Six plant species were identified as potentially present in the search results (Table 4-1). The Greencomb Spider-orchid (*Caladenia tensa*, endangered), Jumping-jack Wattle (*Acacia enterocarpa*, endangered) and Frankenia (*Frankenia plicata,* endangered) are classified as 'likely' to occur or 'suitable habitat likely' to occur in the area. The other three species, Tufted Bush-pea (*Pultenaea trichophylla*, endangered), Fat-leaved Wattle (*Acacia pinguifolia*) and Ironstone Mulla Mulla (*Ptilotus beckerianus*) were classified as 'may occur' or 'may have suitable habitat occurring' within the study area. Historical presence of these species is reported below and conservation significance is discussed further in Section 6.

Historic records (BDBSA) of threatened species within the study area and buffer, including species listed under the EPBC Act and NPW Act, are shown below in Table 4-1. The BDBSA records indicate that only one EPBC listed species, Jumping-jack Wattle *Acacia enterocarpa* (endangered), has previously been recorded within the study area. Presence of the other EPBC listed species in Table 4-1 was not supported by BDBSA records. Conservation significance is discussed further in Section 6.

Table 4-1 EPBC listed flora potentially present (EPBC PMST) within the study area (1 km buffer)

Species Name	Common Name	EPBC Act[1]	SA NPW Act[2]	Comments
Acacia enterocarpa	Jumping-jack Wattle	EN	E	Species or species habitat likely to occur within area
Caladenia tensa	Greencomb Spider-orchid	EN	-	Species or species habitat likely to occur within area
Frankenia plicata	Frankenia	EN	V	Species or species habitat likely to occur within area
Ptilotus beckerianus	Ironstone Mulla Mulla	V	V	Species or species habitat may occur within the area
Pultenaea trichophylla	Tufted Bush-pea	EN	R	Species or species habitat may occur within the area
Acacia pinguifolia	Fat-leaved Wattle	EN	E	Species or species habitat may occur within the area

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU)
[2]South Australian *National Parks and Wildlife Act 1972* (NPWA) Status: Endangered (E), Vulnerable (V), Rare (R).
PMST = Protected Matter Search Tool

Table 4-2 Threatened flora species previously recorded (BDBSA) within 5 km of the study area

Species Name	Common Name	EPBC Act[1]	SA NPW Act[2]	Comments
Acacia enterocarpa	Jumping-jack Wattle	EN	E	Records within 5 km (most recent 2000, 2001). Closest records from 1967 (970 m)
Acacia montana	Mallee Wattle	-	R	Records within 5 km (1995)
Poa drummondiana	Knotted Poa	-	R	Records within 5 km (Port Neil 1996)
Scaevola myrtifolia	Myrtle Fanflower	-	R	Records within 5 km (1991, Port Neil)

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU), Migratory (MI), Marine (MA), Extinct (EX)
[2]South Australian *National Parks and Wildlife Act 1972* (NPWA) Status: Endangered (E), Vulnerable (V), Rare (R).
[3] BDBSA records

4.5 Weeds

The desktop study revealed six significant weeds that may or are likely to occur (according to the EPBC PMST) in the study area. These weeds include Bridal Creeper (*Asparagus asparagoides f. asparagoides*), Boneseed (*Chrysanthemoides monilifera ssp. Monilifera*), African Boxthorn (*Lycium ferocissimum*), Olive (*Olea europaea),* Blackberry (*Rubus fruticosus aggregate)* and Gorse (*Ulex europaeus).* These weeds are all 'Declared' and are known to exist in the greater Eyre Peninsula region (DEH 2002, Brandle 2010). Bridal Creeper, Boneseed, African Boxthorn, Blackberry and Gorse are also recognised as Weeds of National Significance (WoNS).

BDBSA records indicated 49 exotic flora species that have been recorded within 5 km of the port site study area (Appendix B). The majority of these species are considered to be minor weeds, however several Declared weed species have been recorded including Bridal Creeper, Boxthorn, False Caper (*Euphorbia terracina*) and Horehound (*Marrubium vulgare*). Only 23 of the 49 exotic species have records within 1 km of the port site area, including Boxthorn and Horehound. Horehound is the only Declared weed that has previously been recorded within the study area boundary.

Table 4-3 Invasive flora potentially present (EPBC PMST) within the study area

Species Name	Common Name	EPBC[1] Likelihood of Occurrence	BDBSA record within 5 km of proposed port site
Asparagus asparagoides	Bridal Creeper	Species of species habitat likely to occur within the area	Y
Chrysanthemoides monilifera ssp. monilifera	Boneseed	Species of species habitat may occur within the area	N
Lycium ferocissimum	African Boxthorn	Species of species habitat likely to occur within the area	Y
Olea europaeus	Olive	Species of species habitat may occur within the area	N
Rubus fruticosus aggregate	Blackberry	Species of species habitat likely to occur within the area	N
Ulex europaeus	Gorse	Species of species habitat likely to occur within the area	N

[1] Based on EPBC Protected Matters Search Tool (PMST) results August 2013 (Appendix A)

4.6 Listed fauna

A total of 39 fauna species of national or state conservation significance were identified as potentially present within the survey area, including Migratory birds and Listed Marine birds. Actual likelihood and justification is discussed in Section 6 below.

Similar to the desktop flora assessment, an EPBC Protected Matters Search was conducted using a 1 km buffer zone around the proposed port site and compared to BDBSA records for a 5 km buffer around the proposed port site (due to a paucity of records for 1 km). Regional records (~ 10 km buffer from study area) were also reviewed where records for a species were limited.

A review of the EPBC Act Protected Matters database revealed that the study area is considered 'likely' to contain habitat suitable for 12 protected bird species (mostly Migratory and Listed Marine, but also including Malleefowl, Hooded Plover and the recently delisted Slender-billed Thornbill). The EPBC Act Protected Matters Search also suggested the study area 'may' provide habitat for or presence of a further 12 bird species (mostly Migratory and Listed Marine, as well as the Western Whipbird) (Table 4-4). Conservation significance and actual likelihood of occurrence is discussed in Section 6. Marine mammals and marine reptiles that were highlighted during the search are not discussed in this report, see Marine Technical Report (Jacobs 2014a).

A review of the Biological Database of South Australia indicated records within 1 km of the study area for 3 bird species with national conservation ratings, namely the Oriental Plover, Silver Gull and Pacific Gull. In total there were records for 21 bird species within conservation ratings within 5 km of the study area. Sixteen of these species are Migratory and / or 'Listed Marine' species (see Table 4-5). As mentioned earlier (Section 2.2), the four birds that only have 'Listed Marine' status are only protected under the EPBC Act when they are in a Commonwealth Marine area. Five birds species with state conservation ratings have records within 5 km of the study area and only one of these birds, the Australian Bustard, has a record within 1 km of the study area (from 1980). Conservation significance and actual likelihood of occurrence is discussed further in Section 6.

Table 4-4 EPBC listed fauna potentially present (EPBC PMST) within study area

Common Name	Species Name	EPBC Act[1]	SA NPW Act[2]	Comments
Antipodean Albatross	*Diomedea antipodensis*	VU*, MM, LM	-	Foraging, feeding or related behaviour likely to occur within area
Australian Fairy Tern	*Sternula nereis nereis*	VU	E	Species or species habitat likely to occur within area
Black-faced Cormorant	*Phalacrocorax fuscescens*	LM[4]	-	Foraging, feeding or related behaviour likely to occur within area
Buller's Albatross	*Thalassarche bulleri*	VU, MM, LM	V	Species or species habitat may occur within area
Campbell Albatross	*Thalassarche melanophris impavida / T. impavida*	VU*, MM, LM	-	Species or species habitat may occur within area
Cattle Egret	*Ardea ibis*	MW, LM	R	Species or species habitat likely to occur within area
Eastern Osprey /Osprey	*Pandion cristatus / P. haliatus*	LM, MM	E	Species or species habitat may occur within area
Flesh-footed Shearwater	*Puffinus carneipes*	MM, LM	R	Foraging, feeding or related behaviour likely to occur within area
Fork-tailed Swift	*Apus pacificus*	MM, LM	-	Species or species habitat likely to occur within area
Great Egret	*Ardea alba*	MW, LM	-	Species or species habitat likely to occur within area
Hooded Plover (eastern)	*Thinornis rubicollis rubicollis*	LM[4]	V	Species or species habitat likely to occur within area
Latham's Snipe	*Gallinago hardwickii*	MT, LM	R	Species or species habitat may occur within area
Malleefowl	*Leipoa ocellata*	VU, MT	V	Species or species habitat likely to occur within area
Northern Giant-Petrel	*Macronectes halli*	VU, MM, LM	-	Species or species habitat may occur within area
Oriental Plover	*Charadrius veredus*	MW, LM	-	Species or species habitat may occur within area
Painted Snipe	*Rostratula benghlensis (sensu lato) / R. australis*	EN*, MW, LM	V	Species or species habitat may occur within area
Rainbow Bee-eater	*Merops ornatus*	MT, LM	-	Species or species habitat may occur within area
Shy Albatross	*Thalassarche cauta cauta / T. cauta (sensu stricto)*	VU*, MM, LM	V	Species or species habitat may occur within area
Slender-billed Thornbill (western)[5]	*Acanthiza iredalei iredalei*		R	Species or species habitat likely to occur within area
Southern Giant-Petrel	*Macronectes giganteus*	EN, MM, LM	V	Species or species habitat may occur within area
Tristan Albatross	*Diomedea exulans exulans / D. dabbenena*	EN*, MM, LM	-	Species or species habitat may occur within area
Wandering Albatross	*Diomedea exulans (sensu lato)*	VU, MM, LM	V	Foraging, feeding or related behaviour likely to occur within area

Common Name	Species Name	EPBC Act[1]	SA NPW Act[2]	Comments
Western Whipbird	*Psophodes nigrogularis leucogaster*	VU	E	Species or species habitat may occur within area
White-bellied Sea-eagle	*Haliaeetus leucogaster*	MT, LM	E	Species or species habitat likely to occur within area

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU), Migratory Marine (MM),Migratory Terrestrial (MT), Migratory Wetland (MW), Listed Marine (LM), Extinct (EX), '*' denotes species listed under different scientific name on EPBC Act Threatened Species List;

[2] South Australian *National Parks and Wildlife Act 1972* (NPWA) Status: R, Rare; V, Vulnerable; E, Endangered;

[3] EPBC PMST - Environment Protection and Biodiversity Conservation Protected Matters Search Tool

[4] Listed Marine species are only 'protected' in Commonwealth Waters.

[5] Delisted in from EPBC protection in 2014; discussed as a NPW Act species in Section 6.

Table 4-5 Conservation significant fauna previously recorded within the port site (BDBSA, 5 km buffer)

Common Name	Species Name	EPBC Act[1]	SA NPW Act[2]	BDBSA Records[3]	Within 5 km
Australian Bustard	*Ardeotis australis*	-	V	One record within study area (1980)	Yes
Australian Pied Oystercatcher	*Haematopus longirostris*	-	R	No records in study area or within 1 km. Six records 4-5 km (1999, 2000,2001)	Yes
Black-browed Albatross	*Thalassarche melanophris*	VU, MM, LM	V	No records in study area or within 1 km. One record 4-5 km (1989).	Yes
Black-faced Cormorant	*Phalacrocorax fuscescens*	LM		No records in study area or within 1 km, 7 records within 5 km (1998-2004).	Yes
Black-faced Cuckoo Shrike	*Coracina novaehollandiae*	LM		No records in study area or within 1 km. Five records 4-5 km from study area (2000-2001).	Yes
Brown Quail	*Coturnix ypsilophora*	-	V	No records in study area or within 1 km. One record 4-5 km from study area (1975).	Yes
Cape Barren Goose	*Cereopsis novaehollandiae*	LM	R	No records in study area or within 1 km. Two records 4-5 km from site (91/12/1998)	Yes
Common Sandpiper	*Actitis hypoleucos*	MM, LM	R	No records in study area or within 1 km. Four records 4-5 km from study area (most recent 2009)	Yes
Eastern Osprey	*Pandion cristatus*	LM, MM	E	No records in study area or within 1 km. Two records 2 km and 4 km from study area (2009, 2001)	Yes
Fairy Tern	*Sternula nereis*[4]	LM, VU[4]	E	No records in study area or within 1 km. One record 4-5 km (1998).	Yes
Grey-tailed Tattler	*Tringa brevipes*	MM, LM	R	No records in study area or within 1 km. One record 4-5 km (2000).	Yes
Hooded Plover	*Thinornis rubricollis*	LM	V	No records in study area or within 1 km. Fifteen records 1.8 – 4.9 km from study area (1998-2009).	Yes
Oriental Plover	*Charadrius veredus*	MW, LM	-	One record within study area (1977)	Yes
Pacific Golden Plover	*Pluvialis fulva*	MM, LM	R	No records in study area or within 1 km. One record 4-5 km (2009).	Yes
Pacific Gull	*Larus pacificus*	LM		One record within 1km of study area (2009)	Yes
Peregrine Falcon	*Falco peregrinus*	-	R	No records in study area or within 1 km. One record 4-5 km (2007).	Yes
Rock Parrot	*Neophema petrophila*	LM	R	No records in study area or within 1 km. Two records 4-5 km (2000, 2001)	Yes
Ruddy Turnstone	*Arenaria interpres*	LM, MM	R	No records in study area or within 1 km. Eight records 4-5 km Last	Yes

Common Name	Species Name	EPBC Act[1]	SA NPW Act[2]	BDBSA Records[3]	Within 5 km
				BDBSA record (most recent 2009)	
Silver Gull	*Chroicocephalus novaehollandiae / Larus novaehollandiae*	LM		One record within 1km of study are (2009)	Yes
Sooty Oystercatcher	*Haematopus fuliginosus*	-	R	No records in study area or within 1 km. Six records 4-5 km (2001, 2008).	Yes
White-bellied Sea-eagle	*Haliaeetus leucogaster*	MT, LM	E	No records in study area or within 1 km. Two records 4-5 km (1998, 2001)	Yes

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU), Migratory Marine (MM),Migratory Terrestrial (MT), Migratory Wetland (MW), Listed Marine (LM), Extinct (EX), '*' denotes species listed under different scientific name on EPBC Act Threatened Species List;
[2] South Australian *National Parks and Wildlife Act 1972* (NPWA) Status: R, Rare; V, Vulnerable; E, Endangered;
[3] Biological Database of South Australia source 2011;
[4] There are 3 subspecies of Fairy Tern (breed in Australia, New Zealand and New Caledonia), *Sterna nereis nereis* is the Australian subspecies. It is likely that this record is for the *S. n. nereis*.

4.7 Introduced fauna

A total of eleven pest species, four mammals and seven birds, were identified by the desktop review as potentially occurring in the study area.

The EPBC Protected Matters Search (Appendix A) indicated the potential presence of 11 pest species, all were classified as 'likely' to occur or have habitat that is 'likely' to occur in the study area (Table 4-6).

There were no BDBSA records within the study area for any of the pest species, or within a 1km buffer of the study area. There were records within 5 km of the study area for the Cat, Common Starling, Common Blackbird, House Sparrow, Rabbit, Rock Pigeon, Skylark and Spotted Turtle Dove. There are regional BDBSA records for all of the pest species in Table 4-6, with the exception of the European Goldfinch (see Table 4-6). All of these species are common to the greater Eyre Peninsula; the Goldfinch was present in the southern EP in 1960s, but has not been located in recent Biological Surveys of the EP region (Brandle 2010).

Table 4-6 Pest fauna potentially present within the study area and surrounds

Species Name	Common Name	EPBC[1] Likelihood of Occurrence	BDBSA[2] record
Felis catus	Cat	Species or species habitat likely to occur within the area	No records within study area, record within 5 km (2008)
Sturnus vulgaris	Common Starling	Species or species habitat likely to occur within the area	Records within 5 km (1998-2007)
Carduelis Carduelis	European Goldfinch	Species or species habitat likely to occur within the area	No records within region
Turdus merula	Common Blackbird	Species or species habitat likely to occur within the area	No records within study area, records within 5 km (1998-2001)
Vulpes vulpes	European Red Fox	Species or species habitat likely to occur within the area	No records within 5km, nearest records > 19km 2004
Mus musculus	House Mouse	Species or species habitat likely to occur within the area	No records within 5 km, nearest records 5.1 km (2008)
Passer domesticus	House Sparrow	Species or species habitat likely to occur within the area	Records within 5 km (1998-2001)
Oryctolagus cuniculus	Rabbit	Species or species habitat likely to occur within the area	No records within study area, record within 5 km (2008)
Columbia livia	Rock Pigeon	Species or species habitat likely to occur within the area	No records within study area, records within 5 km (1998-2001)
Alauda arvensis	Skylark	Species or species habitat likely to occur within the area	No records within study area, 1 record 4.2 km (2007).
Stigmatopelia / Streptopelia chinensis	Spotted Turtle Dove	Species or species habitat likely to occur within the area	No records within study area. Nearest records 4.5 km (1998-2001).

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status (Protected Matters Search Tool); [2] Biological Database of South Australia records, search buffer 5 km from study area.

5 Results of field survey

The following sections describe the outcomes of the baseline fauna and flora survey of the Cape Hardy study area conducted between 5 and 9 November 2011.

5.1 Weather conditions

The field survey was undertaken in sunny, warm weather, with no rain events observed. No extreme weather events had occurred within the region prior to the field survey. The weather conditions during survey are summarised by Table 5-1, presenting data from the Cummins Airport weather station (18217). Conditions were relatively warm, with the minimum overnight temperature ranging between 13.0°C and 19.3°C and the maximum daily temperatures ranging between 24.4°C and 34.5°C. The night of 5 November was the warmest for November 2011. The 5 November also experienced the highest wind speed at 15:00 and was the only day in November with prevailing west-north westerly winds. Overall, conditions were considered suitable for the survey, and no additional survey effort was deemed to be required to account for poor conditions.

Table 5-1 Field Survey Weather (Cummins Airport, weather station 018217)

Observation[1]	5/11	6/11	7/11	8/11	9/11	Average
Maximum temp (°C)	34.5	25.9	31.7	33.4	24.4	30.0
Minimum temp (°C)	19.3	15.4	13.8	13.0	13.9	15.1
Total rainfall (mm)	-	1.8	-	1.4	-	0.6
3pm relative humidity (%)	36	45	46	26	47	40
3pm wind speed (km/h)	37	13	13	15	33	22.2
3pm wind direction	WNW	W	NE	N	WSW	-

[1] *Source BOM 2012*

5.2 Vegetation Communities

Broadly, 14 vegetation communities occur across the Eyre Peninsula as defined in detail by Milne *et al.* 2008. These Bushland Condition Monitoring descriptions are useful for benchmarking current condition. As mentioned earlier three of these communities are representative of the vegetation in the port site study area: EP11.1 “Inland Mallee and Low Woodlands with mid-dense sclerophyll scrub understory on limestone soils”; EP 11.2 “Sub-coastal and Coastal low mallee and woodlands with mid-dense sclerophyll on limestone soils”; and EP 12.2 “Coastal shrublands of stable dunes and cliff-top dunes”.

Typical of the district, the majority of the study area has been cleared for agriculture and remnant vegetation is restricted to scattered and isolated scrub blocks of varying size on farmland and roadside vegetation.

Six broad vegetation types were identified during the flora survey of the port site study area as presented below in Table 5-2. The table also shows how the field descriptions relate to the broad BCM vegetation communities for the Eyre Peninsula. Site specific vegetation associations are described in more detail in Section 5.2.1.

Table 5-2 Vegetation types identified at the port site study area

Broad Vegetation Type	Vegetation Type Description	Original EP Vegetation Community[1]
Coast Daisy Bush *(Olearia axillaris)* low open shrubland on sandy fore-dune	Coast Daisy Bush (*Olearia axillaris)* low open shrubland on sandy fore-dune with sparse midstorey predominantly comprising *Leucophyta brownii*, *Enchylaena tomentosa*, *Rhagodia candolleana* and *Maireana brevifolia*. Understorey species mainly comprise *Dianella revoluta*, *Ficinia nodosa*, *Threlkeldia diffusa* and *Lomandra effusa*.	EP 12.2 Coastal Shrublands of stable dunes and cliff-top dunes
Coast Daisy Bush *(Olearia axillaris)* and *Acacia longifolia* ssp. *sophorae* open shrubland on beach ridge plain	Coast Daisy Bush *(Olearia axillaris)* and *Acacia longifolia* ssp. *sophorae* open shrubland on beach ridge plain over same midstorey and understorey species as the *Olearia axillaris* low open shrubland on sandy fore-dune (above)	EP 12.2 Coastal Shrublands of stable dunes and cliff-top dunes
Drooping She-oak *(Allocasuarina verticillata)* woodland on rocky hill slope	Drooping She-oak *Allocasuarina verticillata* woodland on rocky hill slope over dense midstorey dominated by *Dodonaea viscosa* ssp. *spatulata*, *Bursaria spinosa* and *Acacia oswaldii*. Understorey species mainly comprise *Austrodanthonia* and *Austrostipa* species, *Dianella revoluta* and *Vittadinia cuneata cuneata*	EP 11.1 Inland Mallee and Low Woodlands with mid-dense sclerophyll scrub understorey on limestone soils
Summer Red Mallee *(Eucalyptus socialis) /*Narrow-leaved Mallee *(E. leptophylla) /*Gilga *(E. brachycalyx)* mallee scrub on low hill slope	*Melaleuca uncinata*, *Melaleuca lanceolata*, *Pittosporum angustifolium* and *Exocarpos aphylla* in the midstorey. The low shrub layer dominated by *Enchylaena tomentosa*, *Prostanthera serpyllifolia* ssp. *microphylla* and *Rhagodia candolleana*. Understorey species mainly comprise *Austrostipa* species, *Lepidosperma carphoides* and *Triodia* species.	EP 11.1 Inland Mallee and Low Woodlands with mid-dense sclerophyll scrub understorey on limestone soils
Hop-bush Wattle *Acacia dodonaeifolia* low shrubland on rocky, low hill crest	Hop-bush Wattle *Acacia dodonaeifolia* low shrubland with *Myoporum brevipes*, *Pittosporum angustifolium* and *Eremophila longifolia*. Understorey species mainly comprise *Lomandra effusa* and the highly invasive weed *Asphodelus fistulosus*.	EP 11.2 Sub-coastal and Coastal low mallee and woodlands with mid-dense sclerophyll on limestone soils.
Highly modified Umbrella Wattle *(Acacia oswaldii)* and Summer Red Mallee *(Eucalyptus socialis)* mallee on low hill slope	Highly modified Umbrella Wattle *(Acacia oswaldii)* and Summer Red Mallee *(Eucalyptus socialis)* mallee scrub over sparse *Maireana brevifolia* and *Enchylaena tomentosa* in the low shrub layer, with weeds dominating the understorey, including *Asphodelus fistulosus*, *Euphorbia terracina*, *Brassica tournefortii*, *Avena barbata* and *Galenia pubsecens*	EP 11.1 Inland Mallee and Low Woodlands with mid-dense sclerophyll scrub understorey on limestone soils

[1] As per corresponding EP community or subgroup description based on EP Bush Condition Monitoring in Milne, Croft and Pedler 2008. Note: Nicolle 2013 now considers *E. foecunda* (Freemantle Mallee) on the EP is *E. leptophylla* (Narrow-leaved Mallee); hence records of *E. foecunda* from the field survey were updated to *E. leptophylla* and BCM summaries would include *E. foecunda*.

A summary of the vegetation association at each site is provided in Table 5-3 below**.** Full descriptions per site are provided in Section 5.2.1 below.

Table 5-3 Summary of site specific vegetation associations of the port site study area

Site	Site Specific Vegetation Association	Corresponding Summary description (as per Fig 3-1)
	Flora and fauna sites	
C1	Coastal Daisybush (*Olearia axillaris)* low open shrubland +/- very sparse Umbrella Wattle (*Acacia oswaldii)* and Nitre Bush (*Nitraria billardieri)* over Chenopod low very open shrubland dominated by weeds (e.g. False Caper, *Euphorbia terracina*; Onion Weed, *Asphodelus fistulosus*).	*Olearia axillaris* low open shrubland on sand with exotic understorey.
C2	Coastal Daisybush (*Olearia axillaris)* low open shrubland on a sandy beach ridge with emergent Coastal Wattle (*Acacia longifolia* ssp. *Sophorae)*, with a Chenopod low very open shrubland dominated by weeds (e.g. Onion Weed, *Asphodelus fistulosus;* African Boxthorn, *Lycium ferocissimum*; Horehound, *Marrubium vulgare).*	*Olearia axillaris* low open shrubland with emergent *Acacia longifolia ssp. sophorae* and exotic understorey.
C3	Drooping Sheoak (*Allocasuarina verticillata)* woodland on loamy sand and rocky slope, with a Sticky Hopbush (*Dodonaea viscosa* ssp. *Spatulata)* and Umbrella Wattle (*Acacia oswaldii)* tall open shrubland	*Allocasuarina verticillata* woodland with shrub layer dominated by *Dodonaea viscosa ssp. spatulata* and *Acacia sp*.
C4	Summer Red Mallee (*Eucalyptus socialis)*, Narrow-leaved Mallee (*E. leptophylla)* and Gilja (*E. brachycalyx)* Mallee with Mallee Saltbush (*Rhagodia preisii)* and Spinifex (*Triodia* spp).	*Eucalyptus socialis, Eucalyptus foecunda*[1] and *E. brachycalyx* mallee with *Rhagodia priesii* and *Triodia spp*. dominant understorey.
	Flora only sites	
C1A	Hop-bush Wattle (*Acacia dodonaeifolia)* low shrubland on rocky low hill with Onion Weed (*Asphodelus fistulosus)*	*Acacia dodonaeifolia* low shrubland on rocky low hill
Kiandra Road 1	Umbrella Wattle (*Acacia oswaldii)* very open shrubland and Red Summer Mallee (*Eucalyptus socialis)* open low mallee over Chenopod low very open shrubland dominated by weeds (e.g. False Caper, *Euphorbia terracina*; Onion Weed, *Asphodelus fistulosus,* Wild Turnip, Wild Oats, Coastal Galenia).	Highly modified *Acacia oswaldii* and *Eucalyptus socialis* open low mallee with exotic understorey.
Kiandra Road 2	Red Summer Mallee *(Eucalyptus socialis)* open mallee and Dryland Tea Tree (*Melaleuca lanceolata)* +/- Umbrella Wattle (*Acacia oswaldii)* tall very open shrubland on loamy sand, dominated by weeds (predominantly False Caper, *Euphorbia terracina*)	*Eucalyptus socialis and Acacia oswaldii* open mallee, with highly disturbed exotic understorey.

[1]Note: Nicolle 2013 now considers *E. foecunda* (Freemantle Mallee) on the EP is *E. leptophylla* (Narrow-leaved Mallee); hence records of *E. foecunda* from the field survey were updated to *E. leptophylla* and BCM summaries would include *E. foecunda.*

5.2.1 Survey site vegetation descriptions

Descriptions of the vegetation characteristics at each of the four flora and fauna survey sites as well as the flora only survey sites are provided below, and illustrated by Plates 5-1 to 5-7. Additional photos for each site (facing north, south, east and west) are provided in Appendix B. It is noted that sites were selected because they represented the highest biodiversity of native species across the whole study area. The majority of the site is cleared agricultural land.

Flora (and fauna) site C1

Site C1 comprised Coastal Daisybush (*Olearia axillaris)* low open shrubland on a sandy fore-dune with a weedy understorey. Coastal Daisybush (*O. axillaris*) dominated the taller shrub layer, with scattered Umbrella Bush (*Acacia oswaldii)* and Nitre Bush (*Nitraria billardieri)*. The lower shrub layer comprised mainly Cushion Bush (*Leucophyta brownii)*, with scattered Seaberry Saltbush (*Rhagodia candolleana)*, Ruby Saltbush (*Enchylaena tomentosa)* and Short-leaved Bluebush (*Maireana brevifolia)*. The understorey layer was dominated by weeds, however native grasses and sedges (Black-anther Flax-lily, *Dianella revoluta* and Knobby Club-rush, *Ficinia nodosa)* were relatively abundant throughout the site. Coast Bone-fruit (*Threlkeldia diffusa)* and Scented Mat-rush (*Lomandra effusa)* were scattered very sparsely throughout the site.

The dominant weed in the understorey was False Caper (*Euphorbia terracina)*, which is a Declared Weed throughout South Australia. Additionally, Onion Weed (*Asphodelus fistulosus)*, a Declared Weed for the EP, is abundant throughout the site. Minor weeds included Brome (*Bromus arenacea)*, Pimpernel (*Anagallis arvensis)* and Slender Ice-plant (*Mesembryanthemum nodiflorum)*.

No species of conservation significance were recorded at Site C1.

Plate 5-1 Site C1 dominated by Coastal Daisy Bush low open shrubland

Flora (and fauna) site C2

Site C2 comprised a Coastal Daisybush (*Olearia axillaris)* low open shrubland on a sandy beach ridge with emergent Coastal Wattle (*Acacia longifolia* ssp. *Sophorae)*, with an understorey dominated by weeds.

Coastal Daisybush dominated the taller shrub layer, with scattered Coastal Wattle. The lower shrub layer comprised Short-leaved Bluebush (*Maireana brevifolia)*, Ruby Saltbush (*Enchylaena tomentosa)* and Cushion Bush (*Leucophyta brownii)*, with scattered Declared Weed African Boxthorn (*Lycium ferocissimum)*. Additionally, Needle-leaf Honey-myrtle (*Melaleuca armillaris)*, Swamp Paper-bark (*M. halmaturorum)*, Old-man Saltbush (*Atriplex nummularia)* and Declared Weed Athel Pine (*Tamarix aphylla)* were found to have been planted at the edge of the site, adjacent to the access road. The understorey layer was generally dominated by weeds and but also contained natives; Knobby Club-rush (*Ficinia nodosa)*, Black-anther Flax-lily (*Dianella revoluta)*, Coast Bonefruit (*Threlkeldia diffusa)* and Scented Matt-grass (*Lomandra effusa),* at relatively high abundance.

Weeds dominated the understorey layer at Site C2. Onion Weed (*Asphodelus fistulosus)* was abundant, along with Horehound (*Marrubium vulgare)*, a Declared Weed throughout all of South Australia. Both species are highly invasive. Sea Spurge (*Euphorbia paralias)* was common throughout the site.

No species of conservation significance were recorded at Site C2.

Plate 5-2 Site C2 Coastal Daisy Bush low open shrubland with Onion Weed

Flora (and fauna) site C3

Site C3 comprised Drooping Sheoak (*Allocasuarina verticillata)* woodland on loamy sand, interspersed with rocky outcropping on a slope, with a mid-storey layer dominated by Sticky Hopbush (*Dodonaea viscosa* ssp. *Spatulata)* and Umbrella Wattle (*Acacia oswaldii)*. Notably, prolific regeneration of Drooping Sheoak was observed at Site C3, resulting in stands of mixed age, with old and young trees.

Drooping Sheoak (*Allocasuarina verticillata)* was the dominant overstorey species at Site C3. The mid-storey comprised Umbrella Wattle (*Acacia oswaldii)*, Sticky Hopbush (*Dodonaea viscosa* ssp. *spatulata)*, and Christmas Bush (*Bursaria spinosa)*, with scattered Ruby Saltbush (*Enchylaena tomentosa)*. The understorey layer was dominated by Wallaby and Spear grasses (*Austrodanthonia* and *Austrostipa* species), as well as Black-anther Flax-lily (*Dianella revoluta)* and New Holland Daisy (*Vittadinia cuneata cuneata)*.

Weeds were present in the midstorey and understorey strata. Declared weed African Boxthorn (*Lycium ferocissimum)*, occurred in the midstorey, while the understorey contained Onion Weed (*Asphodelus fistulosus)*, Coastal Galenia (*Galenia pubescens)* and Common Sow-thistle (*Sonchus oleraceus)*. Veldt Grass (*Ehrharta)* and Cat's Ear (*Hypochaeris* species) were also scattered throughout the site.

No species of conservation significance were recorded at Site C3.

Plate 5-3 Site C3 Drooping She-oak woodland

Flora (and fauna) site C4

Site C4 comprised Mallee on loamy sand dominated by Summer Red Mallee (*Eucalyptus socialis)*, Narrow-leaved Mallee (*E. leptophylla)* with Gilja (*E. brachycalyx)*, with an understorey dominated by Mallee Saltbush (*Rhagodia preisii)* and Spinifex (*Triodia* spp).

Summer Red Mallee and Narrow-leaved Mallee were the dominant overstorey species at Site C4. Tall midstorey species included Broombush (*Melaleuca uncinata)*, Dryland Tea-tree (*M. lanceolata)*, Native Apricot (*Pittosporum angustifolium)* and Leafless Cherry (*Exocarpos aphylla)*. Low midstorey species included Ruby Saltbush (*Enchylaena tomentosa)*, Small-leaf Mintbush (*Prostanthera serpyllifolia* ssp. *microphylla)* and Seaberry Saltbush (*Rhagodia candolleana)*. The understorey layer was dominated by Spear Grasses (*Austrostipa* species), Black Rapier-sedge (*Lepidosperma carphoides)* and Spinifex (*Triodia* species).

Weed species were present in the understorey layer and included the Declared Weed False Caper (*Euphorbia terracina)*. Minor weeds comprised Common Sow-thistle (*Sonchus oleraceus)*, Tree Tobacco (*Nicotiana glauca)* and Smooth Cat's Ear (*Hypochaeris glabra)*.

No species of conservation significance were recorded at Site C4.

Plate 5-4 Site C4 Mallee dominated by Red Summer Mallee, Gilja and Narrow-leaved Mallee

Flora site C1a

Site C1a comprised a Hop-bush Wattle (*Acacia dodonaeifolia)* low open shrubland on loamy sand, on a rocky low hill.

Hop-bush Wattle (*A. dodonaeifolia)* dominated the overstorey layer, with Warty Boobialla (*Myoporum brevipes)*. Hop-bush Wattle is classified as Rare (Schedule 9 of the SA National Parks and Wildlife Act 1972). Native Apricot (*Pittosporum angustifolium)* and Weeping Emubush (*Eremophila longifolia)* were emergent at the site. The understorey layer was dominated by Scented Matt-grass *(Lomandra effusa)* and the highly invasive Onion Weed (*Asphodelus fistulosus)*.

Weeds were identified throughout the overstorey and understorey strata. Declared weed African Boxthorn (*Lycium ferocissimum)* was present in the overstorey layer. As mentioned above, Onion Weed dominated the understorey, along with Coastal Galenia (*Galenia pubescens)* and Saffron Thistle (*Carthamus lanatus)*. Minor weeds that were present included Smooth Cat's Ear (*Hypochaeris glabra)* and Common Ice-plant (*Mesembryanthemum crystallinum)*.

No species of national conservation significance were recorded at Site C4.

Plate 5-5 Site C1a was adjacent to cleared, weed infested pasture typical of the study area

Kiandra Road Site 1

Kiandra Road Site 1 comprised highly modified Umbrella Wattle (*Acacia oswaldii)* and Red Summer Mallee (*Eucalyptus socialis)* Open Low Mallee on loamy sand with high weed abundance in the midstorey and understorey. The overstorey layer comprised sparse Umbrella Wattle (*Acacia oswaldii)* and Red Summer Mallee (*Eucalyptus socialis)*. The sparse nature and low height of the overstorey vegetation is consistent with historic clearance. Understorey vegetation was dominated by weeds, predominantly the highly invasive Onion Weed (*Asphodelus fistulosus)* and Declared False Caper (*Euphorbia terracina)*. Wild Turnip (*Brassica tournefortii)*, Wild Oats (*Avena barbata)* and Coastal Galenia (*Galenia pubescens)* were common. Short-leaved Bluebush (*Maireana brevifolia)* and Ruby Saltbush (*Enchylaena tomentosa)* were scattered through the understorey along the roadside.

No species of conservation significance were recorded along Kiandra Road.

Plate 5-6 Kiandra Road Site 1 was highly infested with weeds, adjacent to cleared land typical of the site

Kiandra Road site 2

Kiandra Road Site 2 comprised highly modified Red Summer Mallee (*Eucalyptus socialis)* open mallee and Dryland Tea Tree (*Melaleuca lanceolata)* +/- Umbrella Wattle (*Acacia oswaldii)* tall very open shrubland on loamy sand, with high weed abundance (predominantly False Caper).

Overstorey vegetation was dominated by Dryland Tea Tree and Red Summer Mallee, with scattered Umbrella Wattle (*Acacia oswaldii)*. Midstorey vegetation included scattered Native Apricot (*Pittosporum angustifolium)* and Broombush (*Melaleuca uncinata)*. Declared Weed African Boxthorn (*Lycium ferocissimum)* was also present within the midstorey.

Understorey vegetation was dominated by the highly invasive Declared Weed False Caper (*Euphorbia terracina)*. Several other weeds were present in the understorey layer, including Coastal Galenia (*Galenia pubescens)*, Sow-thistle (*Sonchus)*, *Lolium* and Barley-grass (*Hordeum* species), as well as Wild Oats (*Avena barbata)* and a Weed of National Significance Bridal Creeper (*Asparagus asparagoides)*. Very sparse native understorey species predominantly comprised Black-anther Flax-lily (*Dianella revoluta)*, Spear Grasses (*Austrostipa* species) and Austral Seablite (*Suaeda australis)*.

No species of conservation significance were recorded along Kiandra Road.

Plate 5-7 Kiandra Road Site 2, Open Mallee with highly disturbed understorey adjacent cleared land

5.2.2 Species richness

A total of 106 plant species, comprising 72 native and 34 introduced species, were recorded during the survey of the study area (see Appendix D). The most diverse community observed was a Drooping Sheoak (*Allocasuarina verticillata)* woodland occurring on sandy loam with scattered rocky outcropping on hillslope.

The least diverse community observed was the Coastal Daisybush (*Olearia axillaris)* low open shrubland on sand with weedy dominant understorey.

5.2.3 Threatened communities and threatened species

As mentioned above, Hop-bush Wattle (*Acacia dodonaeifolia)*, listed as Rare under Schedule 9 of the NPW Act, was recorded at Site C1a during the field survey. No other floral species of conservation significance were recorded during the field survey.

Several EPBC Listed Marine and Migratory birds were also observed in coastal habitat nearby at site C1 and / or C2. Refer to Section 6.1.3 for further detail.

5.3 Vegetation condition assessment

The majority of native vegetation within the study area occurs in fragmented and isolated patches and is degraded to some extent as described above. Primary causes are historic land clearance, vegetation isolation and subsequent weed infestations. It is likely that weed infestation in some areas is a direct result of the historic clearance of vegetation, which may have facilitated invasion through removal of competing vegetation.

Most degradation was observed within the understorey layer at each site. Herbaceous and grassy weeds comprised the majority of weeds observed throughout the field survey. The proportion of weeds at each site compared with native species was generally high. Site C1 was observed to support 42 % weedy species, Site C2 supported 50 % weedy species, Site C3 supported 31 % weedy species and Site C4 supported 26 % weedy species. Site C1a was found to support 37 % weedy species. The sites with highest proportionate weed diversity were Kiandra Road 1 and 2, with 53 % and 58 % of vegetation comprised of weeds respectively. Plate 5-8, below, shows common exotics Onion Weed (*Asphodelus fistulosus*) and Coastal Galenia (*Galenia pubescens*) dominating the Kiandra Road roadside reserve. The high proportion of weeds within the Kiandra Road sites is indicative of their location within the road reserve for Kiandra Road, adjacent to previously cleared pastoral land. Opportunities for weed invasion through diverse dispersal mechanisms have been numerous. Consequently, weeds have spread locally and are successfully competing with native species in these areas.

Generally, native vegetation present throughout the study area was mature, however some recruitment was observed at Site C3, where Drooping Sheoak (*Allocasuarina verticillata)* and Sticky Hopbush (*Dodonaea viscosa* ssp. *spatulata)* were seen to be recruiting in the community.

Spring counts of species diversity, cover and weed presence at the field sites were compared with the equivalent EP communities in the EP Bush Condition Monitoring manual (as per Section 4.3 above). Broadly these estimates suggested sites at Kiandra Road were in poor condition, Sites C1A, C1 and C2 were in moderate condition, C3 was moderate to good and C4 was in good condition. The BCM manual indicators range from very poor to excellent (Milne *et al.* 2008).

Plate 5-8 Onion Weed and Coastal Galenia dominate a localised patch of vegetation along Kiandra Road

5.3.1 Disturbance levels

A large proportion of native vegetation in the region has been cleared for agriculture, and many areas are severely infested with weeds. Remnant vegetation typically comprises small, disjunct scrub blocks on farmland, as well as coastal fringes.

Native vegetation at the port site study area was generally observed to be in relatively poor condition in most places. Small, discontinuous, isolated and degraded patches of remnant vegetation occur, scattered throughout the study area. Highest biodiversity values were observed within small woodland patches comprising *Allocasuarina* woodland, or mallee scrub. No recent fire scars were observed at any of the data collection sites or throughout the wider study area.

Clearance of vegetation for agricultural land use is the biggest contributing factor to disturbance of native vegetation within the study area. Small patches of remnant vegetation occur within private property, and along roadsides, however, surrounding clearance has resulted in weed incursions into these areas. Faunal diversity may be restricted in the study area due to the highly fragmented nature of remnant vegetation and available habitat.

Grazing

The study area is situated within predominantly agricultural land that has been subject to prior use as pasture for sheep. Sheep were observed in paddocks near Site C1 and were grazing amongst a large infestation of Onion Weed (*Asphodelus fistulosus)*.

Throughout the survey, rabbits (*Oryctolagus cuniculus)* were observed in abundance, particularly throughout Site C1 and C2. Evidence of grazing by rabbits was observed within these study sites. Euros (*Macropus robustus*) were observed at Site C3 and C4 although vegetation at these sites did not appear to have suffered significant browsing or grazing damage.

5.3.2 Weeds

Weeds, including some species Declared under the *Natural Resources Management Act 2004* (NRM Act) and some listed as Weeds of National Significance (WoNS), are prevalent throughout the study area. It is likely that clearance of native vegetation, whether for agricultural or infrastructural development, has been a major contributing factor for weed invasion, through the provision of opportunities for establishment (Robertson 2005). Specifically, vegetation along Kiandra Road, which occurs adjacent to cleared land, is in very poor condition and supports many weed species. Land adjacent to Site C1 and C2 is infested with Onion Weed (*Asphodelus fistulosus) (*Declared for the EP) in particular, but also hosts other weeds.

As suggested by the EPBC Protected Matters Search Tool (PMST) Report, Declared Weeds Bridal Creeper (*Asparagus asparagoides*) and Boxthorn (*Lycium ferocissimum*) were found on site. Other species predicted to occur, by the EPBC PMST report, were however not found in the study area, including Boneseed (*Chrysanthemoides monilifera ssp. monilifera*), Olive (*Olea europaea*), Blackberry (*Rubus fruticosus*) and Gorse (*Ulex europaeus*).

As mentioned earlier, a total of 34 introduced flora species were recorded during the survey (see Appendix D). All of these species have previously been recorded in the region or are known to occur in the wider area.

5.3.3 Environmental offset

The Native Vegetation Act provides several principles guiding the clearance of native vegetation in South Australia. An underlying assumption of the clearance principles is that an environmental offset commensurate with the condition of vegetation being cleared will be put in place for any clearance undertaken. DWLBC (2005) outline a guideline to determine a ratio of clearance area to offset area based on high level condition indicators with a ratio of 10:1 representing pristine remnant vegetation and 2:1 representing highly degraded vegetation. The EP BCM Manual (Milne *et al.* 2008) describes a series of indicators for 14 key vegetation communities on the Eyre Peninsula, and provides a benchmark for condition of vegetation communities ranging from very poor to excellent. Based on the NVC principles, the offset guideline, the documented benchmarks and the field assessment of vegetation condition at the survey sites, offset ratios have been allocated for the survey sites as summarised in Table 5-4 below.

Table 5-4 Preliminary offset value summary

Vegetation Survey Site	Condition Indicators	SEB Offset Ratio[1]
C1	Coastal Daisybush (*Olearia axillaris)* low open shrubland with significantly weedy understorey. Signs of digging and grazing by rabbits. Common suite of understorey and midstorey species.	4:1
C2	Coastal Daisybush low open shrubland with emergent Coastal Wattle (*Acacia longifolia* ssp. *sophorae)* shrubland with understorey dominated by Onion Weed (*Asphodelus fistulosus)*. Degraded site with signs of human impact - refuse dumping.	2:1
C3	Drooping Sheoak (*Allocasuarina verticillata)* woodland with dense midstorey and diverse understorey species. Recruitment obvious. Good quality vegetation amidst extensively cleared landscape. Weeds present, including African Boxthorn and Onion Weed.	6:1
C4	Mallee (Summer Red Mallee and Narrow-leaved Mallee) with mature overstorey, diverse midstorey and understorey layers. Good quality vegetation amidst extensively cleared and modified surrounding landscape. Weeds present, including Bridal Creeper.	6:1
C1a	Hop-bush Wattle *(Acacia dodonaeifolia)* low open shrubland. *A. dodonaeifolia* listed as Rare under NPW Act. Understorey dominated by weeds, including Boxthorn and Onion Weed. Extensively cleared surrounding landscape contributing to weed infestation.	4:1
Kiandra Road 1	Highly modified vegetation along roadside. Highly weed infested, adjacent to cleared land.	1:1
Kiandra Road 2	Modified open mallee and tall very open shrubland along roadside. Highly weed infested understorey, featuring some common understorey species. Adjacent to previously cleared land. Weeds included False Caper and Bridal Creeper	2:1

[1] Ratios as defined by Table 1 of DWLBC 2005.

The offsets described above represent an assessment based on the criteria suggested in DLWBC (2005). The final decision of offset ratios rests with the Native Vegetation Council (NVC) during clearance approval. The low values in general are representative of the generally poor condition observed including high proportion and coverage of weeds. These SEB ratios are also broadly consistent with EP Bush Condition Monitoring indicators for the broad vegetation communities that occur in the area. The final offset ratios can be modified by the type of offset undertaken. For example, offsets may be reduced if made directly within the study area, or if designed to directly benefit threatened species.

5.4 Fauna survey

Several habitat types are present within the study area, which in turn support a range of fauna.

- Coastal - Low open shrublands fringing beaches, situated on sand (Site C1 and C2)
- Woodland – *Allocasuarina* woodland situated on sandy, loam with granite outcropping (Site C3)
- Mallee – *Eucalyptus socialis* dominated mallee scrub featuring diverse midstorey and understorey species, situated on loamy sand with granite strew (Site C4)
- Highly modified environments – crops, historically cleared land including roadside reserves, weed infestations (Site C1a, Kiandra Road reserve)

All habitat types provide micro-habitat features for a range of reptiles, mammals and birds, including leaf litter and under-bark habitats in mallee and woodland communities, and grassy tussocks amongst the coastal communities. Diversity of fauna within different habitat types is discussed below in Section 5.4.4.

5.4.1 Fauna observations

The fauna survey identified a total of 62 (43 birds, 13 reptiles and 6 mammals) vertebrate species at the four sites surveyed and opportunistically within the study area. Of the 43 bird species, 38 have been recorded previously within 5 km of the study area. Newly recorded species include the Black-tailed Native Hen, Brush Bronzewing, Nankeen Night Heron, Stubble Quail and Zebra Finch. These species have all been recorded (BDBSA records) in the wider region, with the exception of the Nankeen Night Heron. The Nankeen Night Heron is a common species that has a wider distribution throughout Australia, feeding nocturnally and roosting in trees or wharfs near water by day (Simpson and Day 2004).

Only 4 of the 13 reptile species had previously been recorded within 5 km of the study area, however all of the reptile species have regional records, with the exception of the Tiger Snake. The Mainland Tiger Snake is widespread in southern Australia and known to occur on the southern and western Eyre Peninsula.

Thirteen of the 62 species of fauna hold conservation significance at a national or state level. These species are all birds, and primarily migratory birds or Marine Listed. See section 6 for further discussion.

Eight of the 62 species were not native species (four birds and four mammals). See 5.4.3 below for further discussion.

Birds

Forty-three (43) bird species were observed across the study area during the field survey. The greatest bird diversity was observed at Site C1 and C4, whilst the lowest diversity was observed at Site C2 and Site C3. Generally, most species observed during the field survey are common in South Australia. Thirteen species recorded during the field survey are protected under the EPBC Act under the Marine and Migratory categories, presented in Table 5-5.

Table 5-5 Birds recorded by site at the port study area

Common Name	Species Name	Site C1	Site C2	Site C3	Site C4	Opportunistic	EPBC Act Status[1]	NPW Act Status[2]
Australian Magpie	*Cracticus tibicen*				X			
Australian Pelican	*Pelecanus conspicillatus*		X				LM	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*				X		MT	
Black-tailed Native Hen	*Trybonix ventralis*		X					
Brown Falcon	*Falco berigora*					X		
Brown Songlark	*Cincloramphus cruralis*		X	X	X			
Brush Bronzewing	*Phaps elegans*				X			
Budgerigar	*Melopsittacus undulates*			X				
Caspian Tern	*Hydroprogne caspia*	X					LM; MM	
Common Blackbird*	*Turdus merula*		X					
Common Sandpiper	*Actitis hypoleucos*	X					LM; MM	R
Common Starling*	*Sturnus vulgaris*	X	X	X	X			
Crested Pigeon	*Ocyphaps lophotes*	X	X	X	X			
Dusky Woodswallow	*Artamus cyanopterus*			X				
Eurasian Skylark*	*Alauda arvensis*	X	X	X	X			
Galah	*Eolophus roseicapilla*	X		X	X			
Grey Butcherbird	*Cracticus torquatus*				X			
Hooded Plover	*Thinornis rubricollis*	X					LM	V
Horsfield's Bronze Cuckoo	*Chalcites basalis*					X		
Little Black Cormorant	*Phalacrocorax sulcirostris*	X	X					
Little Pied Cormorant	*Microcarbo melanoleucos*	X						
Little Raven	*Corvus mellori*	X	X	X	X		LM	
Magpie-lark	*Grallina cyanoleuca*			X	X			
Masked Woodswallow	*Artamus personatus*				X			
Nankeen Kestrel	*Falco cenchroides*	X	X		X		LM	

Common Name	Species Name	Site C1	Site C2	Site C3	Site C4	Opportunistic	EPBC Act Status[1]	NPW Act Status[2]
Nankeen Night Heron	*Nycticorax caledonicus*					X	LM	
Pacific Gull	*Larus pacificus*	X	X				LM	
Red Wattlebird	*Anthochaera carunculata*			X				
Richard's Pipit / Australasian Pipit	*Anthus novaeseelandiae*	X						
Rock Dove*	*Columba livia*	X						
Rock Parrot	*Neophema petrophila*	X					LM	R
Silver Gull	*Larus novaehollandiae*	X	X				LM	
Singing Honeyeater	*Lichenostomus virescens*	X	X	X	X			
Spotted Pardalote	*Pardalotus punctatus*				X			
Striated Pardalote	*Pardalotus striatus*				X			
Stubble Quail	*Coturnix pectoralis*	X					LM	
Welcome Swallow	*Hirundo neoxena*	X		X	X			
White-bellied Sea-eagle	*Haliaeetus leucogaster*	X					MT; LM	E
White-browed Babbler	*Pomatostomus superciliosus*			X	X			
White-faced Heron	*Egretta novaehollandiae*	X						
Willie Wagtail	*Rhipidura leucophrys*			X	X			
Yellow-throated Miner	*Manorina flavigula*				X			
Zebra Finch	*Taeniopygia guttata*	X						
TOTAL SPECIES:	**43**	**22**	**13**	**14**	**20**	**3**	**13**	**4**

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU), Migratory Marine (MM), Migratory Terrestrial (MT), Listed Marine (LM), LM species are only afforded protection within the Commonwealth Marine Area, therefore not applicable to the terrestrial component of the port site.

[2] *South Australian National Parks and Wildlife Act 1972 (NPWA)* Status: Endangered (E), Rare (R), Vulnerable (V).

*Introduced species

Site C1, situated directly adjacent to a small cove, supports low coastal vegetation on sand, with rocky outcrops. Consequently, the habitat provides food and habitat resources for shorebirds, as well as other species. Twenty two (22) bird species were observed at the site. Additionally, the site hosts marine birds that prey on fish off shore. Of note, Hooded Plovers (*Thinornis rubricollis)*, listed under the EPBC Act as Marine and under the NPW Act as Vulnerable, were consistently observed on large boulders along the shoreline at Site C1. No signs of nesting were directly observed for the Hooded Plover however the shoreline may still provide feeding opportunities.

Site C2, also situated directly adjacent to a small cove, provides similar habitat resources as Site C1. Site C2 was found to host fewer bird species (13 species recorded) than C1, despite similar habitat features. In particular, coastal and marine species including the Caspian Tern (*Hydroprogne caspia)*, Common Sandpiper (*Actitis hypoleucos)*, Rock Parrot (*Neophema petrophila)*, Little Pied Cormorant (*Microcarbo melanoleucos)*, White-bellied Sea-eagle (*Haliaeetus leucogaster)* and Hooded Plover (*Thinornis rubricollis)* were not observed at Site C2 for the duration of the survey. Additionally, no signs of nesting were observed at Site C2 to indicate past presence of the species. This may suggest that habitat available at Site C2 is not as suitable for the range of species found at Site C1.

Fourteen bird species were observed at Site C3. White-browed Babblers (*Pomatostomus superciliosus)* and Singing Honeyeaters (*Lichenostomus virescens)* were the most common species observed within Site C3. Throughout the survey, the White-browed Babblers at Site C3 displayed highly sociable behaviour, suggesting they may have comprised a familial group. Singing Honeyeaters were often observed in pairs, which may suggest the site was used for breeding.

Twenty bird species were observed at Site C4. This site was the only fauna site to comprise mallee habitat, with associated micro-habitat features, including copious leaf litter, under bark habitat and copious nectar resources. Seven species recorded at Site C4 did not occur at any of the other study sites, namely the Australian Magpie (*Cracticus tibicen)*, Black-faced Cuckoo-shrike (*Coracina novaehollandiae)*, Brush Bronzewing (*Phaps elegans)*, Grey Butcherbird (*Cracticus torquatus)*, Masked Woodswallow (*Artamus personatus)*, Spotted Pardalote (*Pardalotus punctatus)* and Striated Pardalote (*Pardalotus striatus)*. Micro-habitat features at Site C4 may provide additional feeding resources for these species, either directly through floral resources, or through provision of habitat for prey, including small reptiles and invertebrates.

A further three species were observed opportunistically in the study area (but away from the survey sites), including Horsfield's Bronze Cuckoo (*Chalcites basalis),* Nankeen Night Heron (*Nycticorax caledonicus)* and Brown Falcon (*Falco berigora)*. All three are common birds and hold no particular conservation significance.

Reptiles

Thirteen (13) reptile species were observed across the study area during the field survey. The greatest reptile diversity was encountered at Site C1 and C3, with eight species being recorded at C1 and six species recorded at C4. No species that are listed under the EPBC Act or NPW Act were recorded at any site. Reptiles identified during the field survey are considered relatively common and are described below in Table 5-6.

Table 5-6 Reptiles observed by site at the port study area

Species Name	Common Name	Site C1	Site C2	Site C3	Site C4	Opportunistic
Ctenophorus fordi	Mallee Dragon	X	X		X	
Ctenophorus pictus	Painted Dragon	X	X			
Hemiergis peronii ssp. peronii	Four-toed Earless Skink				X	
Heteronotia binoei	Bynoe's Gecko			X		
Lampropholis delicata	Delicate Skink				X	
Menetia greyii	Dwarf Skink	X		X	X	
Morethia adelaidensis	Adelaide Snake-eye	X			X	
Notechis scutatus	Mainland Tiger Snake	X			X	
Pseudonaja inframacula	Peninsula Brown Snake			X		
Pseudonaja affinis[1]	Dugite					X*
Tiliqua occipitalis	Western Blue-tongue	X				
Tiliqua rugosa	Sleepy Lizard	X	X			X
Varanus gouldii	Sand Goanna	X				
TOTAL SPECIES:	**13**	**8**	**3**	**3**	**6**	**2**

[1]Species range overlap, could be either Pseudonaja inframacula or Pseudonaja affinis (M. Hutchinson pers. com)

Mammals

Six (6) mammals were observed across the study area during the field survey. Of the mammals observed during the field survey, only the Euro (*Macropus robustus)* and White-striped Freetail Bat (*Tadarida australis)* are native. All of the other species that were observed were feral species. Table 5-7 outlines the mammals observed during the field survey.

Table 5-7 Mammals observed by site at the port study area

Species Name	Common Name	Site C1	Site C2	Site C3	Site C4	Opportunistic
*Felis catus**	Feral Cat	X			X	
Macropus robustus	Euro			X	X	
*Mus musculus**	House Mouse	X	X	X		
*Oryctolagus cuniculus**	Rabbit	X	X		X	
Tadarida australis	White-striped Freetail Bat				X	
*Vulpes vulpes**	European Red Fox	X				X
TOTAL SPECIES:	**6**	**4**	**2**	**2**	**4**	**1**

* Introduced Species

Other natives

No amphibians were recorded during the survey with weather conditions being unsuitable for frog sightings during this time. The BDBSA search does provide one species for the area, the Burrowing Frog (*Neobatrachus pictus*), which has no conservation rating under state or national legislation. The closest record of this frog is just over 5 km from the study area from 2008.

5.4.2 Tracks, scats and traces

European Rabbit (*Oryctolagus cuniculus*) diggings and scats were abundant throughout the study area, particularly at Site C1 and C2, where multiple individuals were consistently observed. European Red Fox (*Vulpes Vulpes)* scats were also reasonably common throughout the study area. In terms of other mammalian traces, none were obvious during the field survey, which may indicate that the study area does not support a wide range of mammals.

Tracks made by reptiles were particularly obvious at Site C1 and C2, which are both sandy sites. Frequent observations were made of Mallee Dragon (*Ctenophorus fordi)* individuals, often responsible for tracks at these sites.

No other obvious signs or traces of fauna were observed throughout the field survey during on-ground searches.

5.4.3 Introduced fauna

Several introduced species were observed frequently over the duration of the field survey at all of the fauna monitoring sites, and opportunistically throughout the wider study area. Four introduced mammal species and four introduced bird species were observed during the field survey. Of all mammals recorded, only the House Mouse (*Mus musculus)* was caught in fauna traps, on consecutive occasions at Site C1 and C2 and on a single night at Site C3.

Four introduced bird species were recorded during the field survey, namely the Rock Dove (*Columba livia)*, Eurasian Skylark (*Alauda arvensis)*, Common Blackbird (*Turdus merula)* and Common Starling (*Sturnus vulgaris)*. These species occur widely throughout southern Australia and their presence within the study area was not unexpected. Native birds comprised the majority of bird species recorded during the field survey.

5.4.4 Fauna Diversity within Broad Habitat Types

In general native fauna diversity across the study area was low, commensurate with the highly degraded nature of the site. Some differences in fauna diversity were however observed between habitat types during the field survey. Fauna diversity was found to be highest at Site C1, a coastal dune community, and C4, a mallee community. Fauna diversity was found to be lower at Site C2 and C3 during the field survey.

Fauna diversity was high at Site C1 (Plate 5-9) relative to Site C2 (Plate 5-10) despite Site C2 representing very similar habitat to Site C1. Both are coastal habitats, featuring large stone boulders along sandy shores. Additionally, both sites support similar vegetation communities, being dominated by Coastal Daisybush (*Olearia axillaris)* low open shrubland, with typical coastal understorey species. Both sites have been subject to disturbance through weed invasion and clearance of adjacent vegetation for cropping land. Ten species listed under the EPBC Act were identified at Site C1, whilst 4 were identified at Site C2. Hooded Plovers, Listed Marine under the EPBC Act, were observed on consecutive days at Site C1 and are thought to use the habitat there, however this species was not observed at Site C2.

Plate 5-9 Shoreline adjacent Site C1

Plate 5-10 Shoreline adjacent Site C2

Site C3 was situated in a mature Drooping Sheoak (*Allocasuarina verticillata)* woodland community, with dense midstorey and diverse understorey layers (Plate 5-11). This community also showed evidence of recruitment, with younger *A. verticillata* individuals present amongst mature trees. Over time, this community has established key habitat features, including food resources, as well as rocks and vegetation structure for shelter and nesting. Microhabitat features were also present, including leaf litter and fallen timber. Three reptile species and 14 bird species were observed within Site C3 during the field survey.

Plate 5-11 Mature Drooping Sheoak woodland and Euro at Site C3

Similar to Site C3, Site C4 (Plate 5-12) was also a mature community, however this site was dominated by Red Summer Mallee (*Eucalyptus socialis)*, Narrow-leaved Mallee (*E. leptophylla)* and Gilja (*E. brachycalyx)* mallee. A greater number of reptiles and birds were observed at site C4 than site C3 (6 reptile, 20 bird and 3 reptile species and 14 bird species, respectively). Whilst both communities represent mature vegetation, there are differences which may influence the diversity of fauna at each location. Site C4, was dominated by *Eucalyptus* species, hence greater microhabitat resources were present, including abundant leaf litter, fallen timber and flaky bark for under-bark shelter. Additionally, more floral food resources were present at Site C4 due to the presence of flowering *Eucalyptus* species.

Plate 5-12 Mature mallee scrub at Site C4

Fauna diversity within disturbed areas

The majority of available habitat within the study area is disturbed to some extent. Highly disturbed areas occur throughout the study area, including cleared paddocks and weed infested roadside reserves. However, a variety of fauna was observed using these habitat types during the field survey. Nankeen kestrels (*Falco cenchroides)* were frequently observed searching for prey among weed-infested pasture, presumably the House Mouse (*Mus musculus)*. Additionally, several other bird species were observed using degraded habitats, including Stubble Quail (*Coturnix pectoralis)* and Richard's Pipit (*Anthus novaeseelandiae)*. One Nankeen Night Heron (*Nycticorax caledonicus)* was observed roosting adjacent to cleared and degraded habitat.

6 Matters of Conservation Significance

Vegetation and habitat values within the study area are generally degraded. Degradation of native vegetation is predominantly the result of historic clearance and subsequent invasion by weeds. Vegetation is clearly fragmented, in many cases only forming small isolated patches, which do not form continuous habitat.

Within the study area and surrounds discrete patches of remnant vegetation occur within cleared private land, as well as along roadsides and directly along the coastline. However, most vegetation patches observed during the field survey supported diverse weed species, suggesting that vegetation is not in optimal condition. Native vegetation within the study area comprises mostly common species. One listed floral species, Hopbush Wattle (*Acacia dodonaeifolia)*, listed as Rare under Schedule 9 of the NPW Act, was observed at Site C3. No other vegetation of conservation significance was observed during the field study.

6.1 Significant species summary

A total of fifty-six species of conservation significance are discussed here, the majority of which were identified through the desktop study (eg EPBC PMST and or historic BDBSA records). Of these 56 species, 25 are considered unlikely to occur on site due to a lack of suitable habitat, or a known distribution that is distant from the study site. Seventeen species have the potential to occur within the study area and surrounding region due to the presence of suitable habitat, associative species and or based on past BDBSA records. The remaining 14 species of conservation significance were actually recorded on site during the field survey, including 1 plant (NPW Act) and 13 birds (3 Migratory / threatened EPBC Act, 8 Listed Marine, 2 Listed Marine / NPW Act status).

6.1.1 Species with low likelihood of occurrence

Twenty five conservation significant species identified by the desktop assessment, including 6 flora and 19 fauna, are considered unlikely to occur in the study area. Justification is provided below.

Significant flora unlikely to be present

Six flora identified by the desktop assessment and considered unlikely to be present in the study area, are summarised in Table 6-1, including the rationale for why they are considered unlikely to occur.

Table 6-1 Likelihood of occurrence - EPBC / NPW listed flora species considered unlikely at port site

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Why unlikely to occur?
Caladenia tensa	Greencomb Spider-orchid	EN	-	Known from south-east South Australia, rather than Eyre Peninsula (Todd 2000). Key threats include habitat fragmentation, clearance, grazing pressure. Taxonomic confusion in SA relating to *C. tensa* and *C. clavula* (not protected), with EP BDBSA records likely to be *C. clavula* (Todd 2000).
Frankenia plicata	Frankenia	EN	-	Known to occupy a wide range of habitats. However, species more commonly known from further north in South Australia and so is not expected to be present within the study area (DSEWPaC 2008).
Pultenaea trichophylla	Tufted Bush-pea	EN	R	Endemic to Eyre Peninsula, estimated to have a small area of occupancy. Fragmented subpopulations occur in isolated remnant vegetation interspersed by cleared land and roads[3]. Occurs in roadside vegetation in DC of Tumby Bay; Ungurra, Tucknott Scrub CP[5]. No records within 5 km of study area[4]. Nearest record (1970)[4] is 16 km away. Most records > 20 km (2002) in roadside vegetation near Ungarra. Has been recorded in Broombush (*M. uncinata*) tall shrubland over Silver Broombush and Cup Fringe-myrtle low shrubs with or without Spinifex and Hibbertia species [3]. Inhabits 400-500mm rainfall zones[3]. Suitable habitat has not been identified in the study area.
Acacia pinguifolia	Fat-leaved Wattle	EN	E	Priority 1 regional species[3]. Occurs within roadside reserves and rail reserves (e.g. near Cummins). Prefers a variety of subsoils[6] and occurs with *E. dumosa*[5], *E. phenax, E. foecunda* and *E. calycogona*[3]. No records[4] within 5 km. Records 16 km from site (1970). Known from 3 disjunct subpopulations (Ungarra and Butler Tanks, Cummins and Hundreds of Koppio and Hutchinson)[3]. Prefers the 400-500 mm rainfall zone, apart from two outlying recorded sub-populations that require verification[3].
Ptilotus beckerianus	Ironstone Mulla Mulla	VU	V	Priority 1 species on EP[3]. Species is endemic to South Australia, occurring on Kangaroo Island and lower Eyre Peninsula[3]. No records[4] within study area or within 50 km. Grows on Ironstone gravel to yellow brown sandy loam. Known populations in Wanilla CP and Tucknott's Scrub CP[5].
Acacia montana	*Mallee Wattle*	-	R	Known to occupy a wide variety of soil types within open forest and tall shrubland communities. Two records[4] (from 1995) within 5 km of the study area just south-west of the township of Port Neil (1995). Four other records[4] 76-100 km from the study area, primarily in Caralue Bluff Conservation Reserve (1984). Was not observed on site or in subsequent surveys for the Hop Bush Wattle. If present on site, it would not be present in significant number, hence the development is unlikely to have a significant impact on a local population.

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU), Migratory (MI), Marine (MA), Extinct (EX)
[2] *South Australian National Parks and Wildlife Act 1972 (NPWA)* Status: R, Rare; V, Vulnerable; E, Endangered; [3] *Pobke* 2007; [4] BDBSA records; [5] Note: Nicolle 2013 now suggests *E. dumosa* on the EP is *E. calcareana* (Nundroo Mallee) and *E. foecunda* (Freemantle Mallee) on the EP is now considered to be *E. leptophylla* (Narrow-leaved Mallee); [6] SPRAT 2013; [7] Flora of Australia 2001

Significant fauna unlikely to be present

Nineteen fauna species (all birds) highlighted by the desktop assessment, but considered unlikely to be present in the study area, are summarised in Table 6-2. Justification for why they are considered unlikely to occur is also provided. These bird species are not considered to be directly reliant on habitat in the study area. These species are also highly mobile and if individuals did occur they would be rare and occasional visitors. Consequently, it is not anticipated that project activities would cause significant impacts to these species.

Table 6-2 Likelihood of occurrence - EPBC / NPW listed fauna species considered unlikely at the port site

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Why unlikely to occur?
Diomedea exulans antipodensis	Antipodean Albatross	VU, MM, LM	-	Unlikely. Marine, pelagic and aerial species that is endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea[5]. Subspecies of the Wandering Albatross[5]. No records within 5km of the project site[3]. Not considered to be directly reliant upon habitat near the study area. Infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]
Ardeotis australis	Australian Bustard	-	V	Unlikely. Known to occupy grasslands, low shrublands, grassy woodlands, saltbush plains and occasionally artificial habitats including croplands[4,7]. May be occasionally present however not considered likely to occur commonly within study area[4,7]. Last historical record[3] (in 1980) within 1 km of corridor close to proposed port site.
Thalassarche melanophris	Black-browed Albatross	V, LM, MM	V	Unlikely. Marine bird that inhabits Antarctic, subantarctic, temperate waters and occasionally the tropics[4,5]. Known to breed on Heard and Macdonald Islands and occupy open ocean and waters near the continental shelf[4,9]. No records in study area, one record 4-5 km from study area (Port Neil, 1989). Infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]. Highly mobile species, likely to be a rare or occasional visitor to the region. Not considered directly reliant on habitat within the study area.
Coturnix ypsilophora	Brown Quail	-	V	Unlikely. Species known to use diverse habitats including grasslands, cropping land, heaths and grassy woodlands[4]. Most recent BDBSA record within 5 km (Port Neill), 3/01/1975. Considered to be a vagrant to the EP[7].
Thalassarche bulleri	Buller's Albatross	V, MM, LM	V	Unlikely. Large, migratory bird that predominantly inhabits oceanic and coastal habitats[4]. Buller's Albatross breeds on sub-Antarctic islands south of New Zealand[10], however this species is also known to visit south-eastern Australian waters during the non-breeding season, as far west as the Eyre Peninsula [9]. No records[3] within 25 km. Likely to be an infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]. Given the broad distribution of this species, it is not expected to be reliant on specific habitat features within the study area or nearby. Due to its highly mobile nature, it is not expected that the development and operation of a port facility at Cape Hardy will significantly impact this species.
Thalassarche melanophris impavida	Campbell Albatross	VU, MI, MA	-	Unlikely. Species is known to visit south-eastern Australian waters but generally restricted to New South Wales, Victoria and Tasmania (Simpson and Day 2004, DEWHA 2010). Not considered to be directly reliant upon habitat near the study area. No records within 5 km[3]. Infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]
Puffinus carneipes	Flesh-footed Shearwater	MM,	R	Unlikely. Species is a trans-equatorial migrant, known to use oceanic and coastal habitats[4,5]. Locally common visitor to continental shelf waters from south-western Western Australia to south-eastern

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Why unlikely to occur?
		LM		Queensland. Known to breed on 41 Islands primarily from the southern coast of WA, but also SE of the Eyre Peninsula[5] (e.g. Smith Island). No records within 5 km[3]. One historical record from 1975 (140 Km from the study area, near Elliston)[4]. Not considered directly on the habitat near the study area, highly mobile species that may be a rare visitor.
Ardea alba	Great Egret	LM, MW	-	Unlikely. Known to use floodwaters, rivers and shallow wetlands, as well as intertidal mudflats[4]. Species may retreat to permanent wetlands or costal environments with the fluctuation of wet and dry seasons and with drought. No suitable habitat within study area identified during field assessment. Not considered to be directly reliant on habitat near study area. No records within 5 km.
Tringa brevipes	Grey-tailed Tattler	MM, LM	R	Unlikely. Medium-sized shorebird that has global distribution. Within Australia this species primarily occurs in northern coastal areas[5]. These shorebirds are known to use coastal habitats including sheltered coasts, reefs, rock platforms and intertidal mudflats[6]. There are no records[3] for this species within the study area, however there is one record within 4-5 km from the study area from 2000. Historically, this species has rarely been recorded in South Australia[5]. Whilst habitat exists within the study area for this species, given the highly mobile nature of this species and known rare occurrence in SA, it is unlikely that habitat within the study area and surrounds is critical to the species. Consequently, if individuals do visit the study area it is not expected that the construction and operation of a port facility would significantly impact the species.
Gallinago hardwickii	Latham's Snipe	MT, LM	R	Unlikely. Uses fresh wetlands and saltmarsh habitats[4]. Breeds outside Australia and migrates to Eastern Australia[6].Suitable habitat not identified within study area. No records[3] within 25 km. Considered unlikely to occur or be very uncommon within coastal EP region[11].
Leipoa ocellata	Malleefowl	VU, MT	V	Unlikely. Known to inhabit sandy dune/ mallee habitats throughout the EP[7]. Requires deep organic matter to build mounds for egg incubation (best provided by long unburnt remnants). Will also utilise habitat adjacent cropping areas, and feed on grain[8]. Key threats include clearance of remnants, habitat fragmentation, inappropriate fire regimes, predation and competition from feral mammals[8]. Higher densities of malleefowl occur in White Mallee open scrub near Lock, and records are also for Ridge-fruited Mallee open scrub[7]. No records[3] within 5 km. Multiple regional records[3], closest records are 16 km (1999), most recent records (2006) are 30-60 km away. Searches within the survey sites did not locate this species. Remnant patches near the study area are small and highly fragmented from larger patches and nearby conservation areas. If present, only as a rare visitor.
Macronectes halli	Northern Giant-Petrel	VU, MM, LM	-	Oceanic bird that inhabits Antarctic and sub-Antarctic territory but has been known to use Australian coastal waters during winter[4,5]. No records within 5 km. No regional records. Infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]. Conspicuous and highly mobile

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Why unlikely to occur?
				species. It is unlikely that unique habitat is provided within the study area.
Charadrius veredus	Oriental Plover	LM, MW		Known to use dry plains and coastal habitat areas[4]. Breeds in China and Mongolia and migrates annually to northern Australia[6]. Stragglers sometimes found in southern Australia, where the EP is at the eastern edge of potential distribution area[6]. One record[3] within 1 km (from 1977). Given the highly mobile nature of this species, it is considered unlikely that it relies directly upon habitat within the study area and surrounding districts.
Rostratula benghlensis (sensu lato) / R. australis	Painted Snipe / Australian Painted Snipe	EN, LM, MW	V	Unlikely. Wader bird, preferred habitat includes wetlands, temporary and permanent lakes, swamps and clay pans. Typical habitat includes sedges, rushes, reeds or samphire with scattered clumps or Lignum and sometimes *Melaleuca*[5]. No suitable habitat in study area. No previous records within 5 km of study area.
Thalassarche cauta cauta	Shy Albatross	VU, MM, LM	-	Unlikely. Endemic Australian species that occurs in subantarctic and subtropical waters. Species known to use southern Australian waters as far north as southern Queensland and as far west as Western Australia[4,5]. Breeding colonies occur off Tasmania (Albatross Island, the Mewstone, Pedra Branca), most adults remain in the waters[5]. No records within 25 km. Infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]. Highly mobile large bird. Not reliant upon habitat within the study area.
Macronectes giganteus	Southern Giant-Petrel	EN, MM, LM	V	Unlikely. Species is widespread throughout the Southern ocean, known to occur in Antarctic to subtropical waters. Breeding occurs on the Antarctic Continent, Peninsula, and Islands and on subantarctic islands and South America[5]. They are known to over-winter in south-eastern Australian waters, along with South America, South Africa and New Zealand[5]. No records[9] within 5-10 km. Highly mobile and conspicuous species. One regional record[3] in 2003 from Waldegrave Island (>150 km from study area). Not considered relevant to the area in EP Coastal Action Plan, however more recently known from the West Coast of EP and may be a useful species for monitoring environmental change[11]. It is unlikely that coastal habitat in the study area is critical to this species. Species is large and highly mobile, not expected that the study area provides essential habitat for this species.
Diomedea exulans exulans s	Tristan Albatross	EN, MI, MA	-	Only one record known from Australian waters (near Wollongong). Known to inhabit southern Atlantic oceanic territory[4,9,10]. Not considered to be directly reliant upon habitat near the study area. No records within 25 km. Infrequent visitor to coastal EP and not considered in Coastal Action Plan[11]
Diomedea exulans (sensu lato)	Wandering Albatross	VU, LM, MM	V	Unlikely. Large, migratory seabird most commonly occupying oceanic and coastal sea habitats. On rare occasions, this species has been known to use coastal bay habitats[4,9] but is generally aerial and flies over pelagic, off-shore and in-shore water[5]. No records within 25 km. Not considered relevant to the area in EP Coastal Action Plan[11]. Species is large and highly mobile, not expected that the

Species Name	Common Name	EPBC Act[1]	NPW Act[2]	Why unlikely to occur?
				study area provides essential habitat for this species.
Psophodes nigrogularis leucogaster	Western Whipbird (eastern)	VU	EN (east ssp.)	Unlikely. Species known to prefer dense mallee scrub[4]. Has recently been recorded in dense Mallee and Dryland Teatree in the Uley Basin[7]. Known population on the Eyre Peninsula is restricted to sites around Coffin Bay National Park and Lincoln National Park[5,7,11]. Although small remnant patches of suitable habitat may occur within the study area, they are isolated, fragmented and surrounded by agricultural land. No BDBSA records within 25 km.

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Endangered (EN), Vulnerable (VU), Migratory Marine (MM), Migratory Wetland (MW), Migratory Terrestrial, Listed Marine (LM), Extinct (EX); [2] *South Australian National Parks and Wildlife Act 1972 (NPWA)* Status: R, Rare; V, Vulnerable; E, Endangered; [3] BDBSA extraction 2011, 2012, 2013; [4] Simpson and Day 2004; [5] SPRAT (Species Profile and Threat Database) Profiles, http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl accessed October-November 2013; [6] Geering *et al*. 2008; [7] Brandle 2010, [8] Benschemesh 2005; [9]Department for Environment, Water, Heritage and the Arts (2010) *Survey guidelines for Australia's threatened birds;* [10] Shirihai 2007; [11] Caton, Detmar, Fotheringham, Laurence., Quinn, Royal, Rubbo, and Sandercock 2011

6.1.2 Species possibly present

Seventeen species have potential to occur in the study area. This is based on location of historic BDBSA records, habitat preferences, germination, feeding / shelter requirements or physical conditions found in the study area. These 17 species comprise three flora species and 14 bird species. Of the 14 bird species, three species were highlighted in the desktop study due to 'Listed Marine', hence conservation status does not apply to the terrestrial component of the port site (see Section 2.1). Justification for likelihood of occurrence and potential for impacts to each species is discussed below.

Significant flora possibly present

Jumping-jack Wattle *(Acacia enterocarpa)* – Endangered (EPBC and NPW)

The EPBC PMST lists the Jumping-Jack Wattle as likely to occur or with suitable habitat likely to occur in the area. There are BDBSA records for this species within 5 km of the proposed study area (from 2000, 2001) where the closest records are for a number of individuals near the Port Neil Lincoln Highway turnoff in roadside vegetation along the Highway (record from 1967, 970 m from study area). These records within 1 km were confirmed by the SKM ecology team when conducting a brief assessment of the proposed rail corridor (Jacobs 2014b). Jumping-Jack Wattle was not however observed during the Cape Hardy survey or during subsequent site visits to search for *Acacia dodonaeifolia* (Hop Bush Wattle, SA rating of rare). Given the degraded nature of the project site, and the small fragmented patches of native vegetation which were surveyed in detail, it is considered highly unlikely that a significant population of Jumping-Jack Wattle occurs at the port site.

Knotted Poa *(Poa drummondiana)* – Rare (NPW)
Knotted Poa is known to occur on sand, sandy loam, dunes and amongst shrubland, and is most commonly associated with *Melaleuca lanceolata*, *Gahnia lanigera* and *Atriplex paludosa* ssp. *cordata* (Jessop *et al*. 2006). There is one Knotted Poa record in the BDBSA (from 1996) within 5 km of the study area. This record is from sand scrub at Port Neil, just behind the sand dunes (DENR 2011). The other 15 records are 27 -128 km from the study area in locations such as Hincks WPA and Conservation Park, and a Heritage Agreement Area. *Melaleuca* and *Gahnia* (*G. deusta*) were represented in some vegetation patches within the study area on sandy loam soils, hence there is potential for this species to be present despite not being recorded by the survey team. This species is widespread throughout coastal areas in South Australia, with the major stronghold at the tip of the Yorke Peninsula (E Flora SA, DEWNR 2007). It is also noted that this species is not listed as a priority NPW species for the EP in Pobke 2007. It is not anticipated that the development will have a significant impact on the Knotted Poa if it does occur within the study area.

Myrtle Fanflower *(Scaevola myrtifolia)* – Rare (NPW)
Myrtle Fanflower is known to occur within mallee communities from the eastern coast of the Eyre Peninsula and the far west coast of South Australia (E Flora SA, DEWNR 2007). Mallee communities are common within the study area (e.g. site C4) but the species was not observed by the field team. There is one BDBSA record for this species within 5 km of the study area, located at Cape Burr, Port Neil (from 1991). The other 26 regional BDBSA records for this species are 12-28 km from the study area in locations from Lincoln Highway, Arno Bay and between Wharminda and Butler Tanks. There is potential that this species may occur within the study area, however there is limited suitable habitat within the study area. Given that impacts to mallee habitat at site C4 are likely to be avoided and this species was not observed at that site, it is unlikely that the development will have a significant impact on this species.

Significant fauna possibly present
Fourteen (14) bird species have the potential to occur within the study area. This is based on location of BDBSA records, habitat preferences, knowledge of available habitat within the study area and field survey results. Justification for likelihood of occurrence and potential for impacts to each species from the proposed development are discussed below.

Australian Fairy Tern *(Sternula nereis nereis)* – Vulnerable, Listed Marine (EPBC), Endangered (NPW)
There are three subspecies of Fairy Tern (they breed in Australia, New Zealand and New Caledonia), *Sterna nereis nereis* is the Australian subspecies. It is likely that BDBSA records for *Sterna nereis* (Fairy Tern) are actually *S. n. nereis (*Australian Fairy Tern).

The Fairy Tern is known to use coastal habitats, including estuaries and sheltered sandy beaches above the high tide line and below vegetation (Simpson and Day 2004, Caton *et al.* 2011, SPRAT 2013). This species is also known to congregate on coastal shores. Fairy Tern nesting occurs on sheltered sandy beaches, spits and banks above the high tide line and below vegetation and is also known to roost on beaches at night (Caton *et al.* 2011, SPRAT 2013, Golder Associates 2013). Breeding occurs from October to February and preferred habitat ranges from coral shingle to sandy islands or beaches or within estuaries. Key threats to the species include to disturbance of exposed nesting and roosting sites (e.g. storms, floods, high tides, strong winds) as well as predation of eggs and chicks from other birds (e.g. Silver Gulls, and White-bellied Sea Eagle) and mammals (foxes, domestic dogs and cats) (Caton *et al.* 2011, DENR 2012 cited in Goulder Associates 2013).

There are no BDBSA records for this species within the study area or within 1 km, however there is one BDBSA record 4-5 km from the study area. Records for this species exist within the region, from a recent South Australian Fairy Tern Census (DENR 2012 cited in Goulder Associates 2013). The recent Fairy Tern Census located the Fairy Tern at Munyaroo CP (over 100 km from study are), no sightings were made along the east coast of the EP from Louth Bay (50 km South of the study area) to Whyalla (over 250 km North of the study area), and no sightings were made on Lipson Island. Similarly, this species was not observed as part of the current survey.

Although this species was not observed during the SKM field survey, suitable habitat occurs within the study area and it is considered possible that this species may use habitat available in the area. The Fairy Tern is however, a highly mobile species and is not considered to be solely reliant on habitat present within the study area. It is not expected that the proposed development within the study area will significantly impact this species. Mitigation activities to avoid impacts to fauna species during construction and operation will be addressed as part of a construction EMP for the proposed development.

Australian Pied Oystercatcher *(Haematopus longirostris)* – Rare (NPW)
The Australian Pied Oystercatcher is a global shorebird known to use coastal habitats including beaches, mudflats, offshore islands, bays, inlets and rocky coasts and headlands around the entire Australian coast (Simpson and Day 2004, Geering *et al.* 2008, Caton *et al*. 2011). It is a habitat generalist with records scattered about much of the South Australian coast, but prefers sandy beaches and estuaries, particularly for nesting (Simpson and Day 2004, Geering *et al*. 2008, DENR 2011, Caton *et al*. 2011). There are 6 records for this species within 5 km (Port Neil from 1998-2001). In addition there are over 70 regional records (from 1981-2009), these observations range from 7-150 km from the study area and primarily from locations such as Elliston and Anxious Bay. A recent shorebird study suggested the population on the EP is approximately 1,500 birds, which is considered to be significant (Caton *et al*. 2011). This population is known to have a wide breeding distribution along 2,500 km of coastline and some offshore islands (Caton *et al.* 2011). Whilst the Australian Pied Oystercatcher may visit the study area it is not likely to be solely dependent on the coastal habitat specific to the study area, and being highly mobile, is not likely that the species will be significantly impacted by the proposed development.

Black-faced Cormorant *(Phalacrocorax fuscescens)* – Listed Marine (EPBC)
The Black-faced Cormorant is known to inhabit marine habitats, including offshore rock stacks and islets in the region (Simpson and Day 2004). Such habitat features are present within the study area and surrounding districts, including shorelines that feature large boulders sunk in shallow water. This is a highly mobile species, which is sedentary when not feeding.
There are seven BDBSA records for this species within 5 km of the study area (from 1998 to 2004). There are also 17 regional records (5- 174 km) from 1968 to 2009, where the location ranges from Waldegrave and Lipson Islands to Elliston. Although, this species is sedentary when not feeding, it is highly mobile and is not expected to be specifically reliant upon habitat features within the study area. Consequently, significant impacts to this species are not expected from the proposed development.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Cape Barren Goose *(Cereopsis novaehollandiae)* – Listed Marine (EPBC), Rare (NPW)
Cape Barren Geese are known to occupy tussocky grassland and scrub and pasture-based habitat (Simpson and Day 2004, SPRAT 2013, Caton *et al*. 2011). Known from the Eyre Peninsula, particularly near Port Lincoln (near North Shields and Little Swamp) (Brandle 2010). There are no BDBSA records within the study area or within 1 km, but there are two records within 5 km (Port Neil in 1998). The species has also been observed

opportunistically between Port Lincoln and Tumby Bay during field surveys 2011/2012 for the Infrastructure corridor.

Suitable habitat features exist within the study area and surrounding districts, therefore it is considered likely that this species may use habitat within the study area. The Cape Barren Goose is a large conspicuous bird that disperses easily. The species generally breeds on offshore islands rather than remaining on mainland. Therefore, it is not expected that the construction and operation of a port facility at Cape Hardy will significantly impact this species.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Cattle Egret *(Ardea ibis)* – Migratory Wetland, Listed Marine (EPBC), Rare (NPW)
The Cattle Egret is known to occupy pasture habitats, as well as floodwaters, wetlands and intertidal mudflats where it feeds on a variety of invertebrates, frogs and lizards (Simpson and Day 2004). Pasture habitats are known to be present within the study area and surrounding districts, although most are somewhat degraded due to weed invasion. It is possible that low-lying areas within the study area may hold water following heavy rain events however no permanent wetlands were observed within the study area. There are no BDBSA records for this species within 5 km or within 25km of the study area. The Cattle Egret is a highly mobile species. Consequently, it is not expected that this species is reliant upon habitat features present within the study area. Therefore, it is not expected that the construction and operation of a port facility at Cape Hardy will significantly impact this species.

Eastern Osprey *(Pandion cristatus)* – Listed Marine, Migratory Marine (EPBC), Endangered (NPW)
Previously, known as *Pandion haliaetus,* the taxonomy of this species is controversial (SPRAT 2013). The Eastern Osprey is known to use coastal habitats, including elevated coastal cliffs exposed sites, sea stacks and elevated habitats (Simpson and Day 2004, Brandle 2010). Coastal habitat is present within the study area and although elevated habitats are preferred, they will use sandy or rocky shore habitats where elevated habitat or trees are unavailable. Consequently, the Eastern Osprey is vulnerable to human disturbance, particularly if breeding on the ground, rather than using elevated habitat (DSEWPaC 2010). In particular, bio-accumulation of toxic substances through the consumption of affected prey as well as destruction of habitat, are considered major threats to the Eastern Osprey (DSEWPaC 2010).

There are no BDBSA records within 1 km of the study are, but there are records 2- 4 km from the study area (2009, 2001). There are 12 regional records (140-175 km away) from 1975 to 2003. Previously a population has occurred at Spencer Gulf (Brandle 2010). The species is known to have a sparse distribution within SA including an estimated 52 breeding pairs, primarily located on the west coast of the Eyre Peninsula (Dennis 2004, 2007, cited in Brandle 2010).

The Eastern Osprey is known to occur sympatrically with the White-bellied Sea-eagle (DSEWPaC 2010) and these species sometimes interact with one another. Although this species was not observed during the field survey, the White-bellied Sea-eagle was observed, which may indicate that suitable habitat features for the Eastern Osprey may be present within the wider study area. It is likely that any threats to the Eastern Osprey as a result of development of the Cape Hardy port site would also affect White-bellied Sea-eagles, where they occur sympatically. Prior to any construction activities a targeted survey for both species within the area would clarify the likelihood of risks associated with development.

The construction of a port facility at Cape Hardy may impact individual of this species, but given the high mobility and wide distribution of the Osprey, as well as CEMP mitigation activities that will be implemented it is

unlikely to be significantly impacted. Adoption of a standard Environmental Management Plan to address pollution, overall footprint, location of individual nesting pairs (if they occur) and ongoing ecological impacts will assist in managing risks for this species.

Fork-tailed Swi*ft (Apus pacificus)* – Migratory Marine, Listed Marine (EPBC)
The Fork-tailed Swift has global distribution, but is considered native to Australia where it is a non-breeding visitor to all states and territories of Australia (Higgins 1999 cited in SPRAT 2013). In South Australia this species occurs commonly in coastal areas of the Eyre Peninsula as far west as Streaky Bay and as far north as Wudinna (northern EP), however there have been records beyond this (SPRAT 2013). This species migrates to Australia between October and April and rarely occurs in Australia outside these times (SPRAT 2013). When in Australia, it is known to use many habitat types, including coastal, arid and urban areas (Simpson and Day 2004, SPRAT 2013). There are two BDBSA records within 5 km of the study area (from 1988 and 1998) and no other records in the wider region. Suitable habitat exists within the study area for this species.

The Fork-tailed Swift is highly mobile, does not breed in Australia and migrates to Australia between October and April. Threats to this species include habitat destruction and predation by feral animals, but given the wide range of this species potential impacts are thought to be negligible (SPRAT 2013). Based on the above information it is not expected that this species would be solely reliant upon habitat found within the study area. Therefore, it is not expected that construction and operation of a port facility at Cape Hardy would significantly impact this species.

Little Penguin *(Eudyptula minor)* – Listed Marine (EPBC)
The Little Penguin is known to occur frequently throughout southern Australia, from Western Australia to NSW (Simpson and Day 2004). This species feeds in coastal bays and open water, and is known to breed in rocky, cliff crevices, sandy and vegetated dunes, as well as in breakwater habitats (Simpson and Day 2004, SPRAT 2013). The Little Penguin usually occupies island-based colonies but some pairs do nest separately. There are no BDBSA records within 5 km of the study area, but one record from the Port Neil boat ramp (1999). There are also 10 other regional records 5-155km from the study area (from 1958-2003). They are also known to nest on Lipson Island (Edyvanne 1999, Madden Hallett *et al*. 2011). Whilst this species was not directly observed during the field survey, it is considered possible that this species may occur, based on the presence of favourable habitat, known range and nearby records.

Little Penguins are at risk from human activities, including alteration of habitat and disturbance of breeding grounds. Unmanaged rubbish can also impact these birds via entanglement, or inadvertent consumption (mistaking for prey) (Birds Australia date unknown A). The establishment of EMPs to avoid and/or mitigate threats like pollution, manage waste disposal and the overall disturbance footprint will be sufficient to mitigate any potential impact to this species should it occur within the study area.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Pacific Golden Plover *(Pluvialis fulva)* – Listed Marine, Migratory (EPBC), Rare (NPW)
The Pacific Golden Plover occurs globally, breeds in Siberia and migrates annually from Siberia to southern areas, including Australia (SPRAT 2013). In Australia the species is widespread in coastal regions such as beaches, mudflats and rocky shore habitats, but is also known to inhabit inland areas, including samphire and sometimes pasture (Geering *et al*. 2007, SPRAT 2013). These birds usually congregate in small flocks, are highly mobile (SPRAT 2013). There are a number of nationally important sites for this species, but none of these occur within South Australia. There are no BDBSA records for this species within 1 km of the study area, but one record 4-5 km (1999) and four other regional records 7-22km from the study area (1973-2009).

Suitable habitat exists for this species within the study area and surrounding districts and there are regional records of this species. However, it is not expected that the Pacific Golden Plover relies on specific habitat features within the area, due to its highly mobile and migratory nature. Consequently, should individuals visit the study area it is not expected that the construction and operation of a port facility at Cape Hardy would significantly impact the species.

Peregrine Falcon *(Falco peregrinus)* – Rare (NPW)
This raptor inhabits most land types but prefers cliffs and rocky outcrops, and rocky coastal islands throughout Australia (Simpson and Day 2004). In South Australia this species has sparse distribution in woodlands (preferably near water), in gorges and coastal cliffs (Brandle 2010). Although the breeding range for this species does not include the Eyre Peninsula (Simpson and Day 2004), coastal cliffs in the EP region have been used for breeding (Dennis 2004 cited in Brandle 2010), as well as grain silos further inland (Brandle 2010).

There are no BDBSA records within the study area for this species, but one record 4-5 km from the study area (2007). There are also 9 regional BDBSA records 9-167 km from the study area (1991-2003). The species was also recorded from two coastal sites during the EP Biological Survey (Brandle 2010).

Preferred habitat for this species does not occur within the study area, particularly breeding habitat, however it is possible they could occur as a visitor or pass through the area to preferred habitat. This species is highly mobile and it is unlikely that impacts to the species would occur and a result of the project.

Rainbow Bee-eater *(Merops ornatus)* – Listed Marine, Migratory Terrestrial (EPBC)
The Rainbow Bee-eater is a widely distributed migratory species known to use a range of habitat types, including woodlands, shrublands and various cleared and semi-cleared habitats (SPRAT 2013, Simpson and Day 2004). These habitat types include a wide variety of vegetation types that occur in terrestrial to coastal environments. This species occurs throughout Australia, eastern Indonesia, and Papua New Guinea. Breeding populations of the Rainbow Bee-eater that inhabit southern Australia are known to migrate north during the southern winter (SPRAT). The majority of global breeding populations occur on Rottnest Island and in the south west of Torres Strait. In SA, this species most frequently visits Dangalli Conservation Park (SPRAT). There are no BDBSA records within 5 km of the study are, but there are records near Darke Peak CP from 2003. This species was observed as part of a flora and fauna survey of the mine site study area (Jacobs 2014c). The Rainbow-bee-eater was observed at Site 2 located within remnant vegetation with a Heritage Agreement area of the mine site survey (Jacobs 2014c).

This species is considered to be highly mobile and wide ranging within Australia. Key threats to the species include predators (namely the Cane Toad, foxes, dingoes and other feral dogs). Although population sizes have not been quantified, it is considered the current population is large and this species is therefore given low priority for management (SPRAT). Given the mobile nature of this species, and its ability to use a wide range of habitat types over a large range, it is not expected that the construction and operation of a port facility at Cape Hardy will significantly impact this species.

Ruddy Turnstone *(Arenaria interpres)* – Listed Marine, Marine Migratory (EPBC), Rare (NPW)
The Ruddy Turnstone is a migratory shorebird that breeds in the high arctic tundra across the globe and migrates to a number of continents, including Australia (Geerling *et al.* 2008). The Subspecies that occurs in Australia breeds in eastern Siberia and Alaska (Geerling *et al.* 2008). This shorebird is known to use rocky shore habitats that feature washed up seaweed, as well as coral and sand islands and less commonly intertidal mudflats (Simpson and Day 2004, Geering *et al*. 2008). There are no BDBSA records for this species within the

study area or 1 km of the study area, however there are 8 regional records 4-5 km from the study area (1998-2009) and another 33 records within the region (1998-2008).

Suitable habitat for this species is present within the study area, particularly at Site C1 and C2, where sandy beaches are interspersed with large boulders, and seaweed is regularly washed up onto the shore. Given the number of previous records in the region, it is expected that the Ruddy Turnstone may occupy habitat features within or surrounding the study area. However, given the highly mobile, migratory nature of this species, it is not expected that habitat within the study area is critical for this species. Consequently, it is not expected that the development and operation of a port facility at Cape Hardy will significantly impact the species.

Sooty Oystercatcher *(Haematopus fuliginosus)* – Rare (NPW)
The Sooty Oystercatcher is endemic to Australia with widespread distribution along most coastal areas, preferring rocky coastlines and occasional estuaries (Simpson and Day 2004, Geering *et al*. 2008). There are two subspecies, *H.* fuliginosus is the southern subspecies. Their ranges overlap on the Queensland coast.

There are no BDBSA records within the study are or within 1 km, but there are 6 records within 4-5 km (Port Neil) of the study area (from 2001 -2008). There are also over 90 regional records for this species, primarily from Elliston, Waldegrave Island and Lipson Island (from 1968-2009). Based on this information the Sooty Oystercatcher is likely to occur in the study area, but is not likely to be solely dependent on habitat found within the study area, and being highly mobile, is not likely to be significantly impacted by the development.

Slender-billed Thornbill (western) *(Acanthiza iredalei iredalei)* –Rare (NPW)
The western subspecies of the Slender-billed Thornbill feeds primarily on insects and is found in arid and semi-arid regions of southern Western Australia and south-western South Australia (SPRAT 2012). A relatively sedentary bird, the Slender-billed Thornbill's core habitat is chenopod shrubland dominated by Samphire (*Sarcocornia* sp.), Bluebush (*Maireana* sp.) or Saltbush (*Atriplex* sp.), but it may also range into Mallee grassy woodlands and dense heathy shrublands (Pizzey and Knight 2006).

There is potential for a small area of suitable habitat closer to the coast within 1 km of the study area, however this area is between a major road and pastoral land. There are no BDBSA records for this species within 25 km of the study area. The species was recorded northeast of Munyaroo CP in 2002 as part of the Biological Survey of the EP (Brandle 2010). The northeast of the EP is at the southern margin of known distribution for this species (Brandle 2010). This species was observed as part of a flora and fauna survey of the mine site study area (Jacobs 2014c). This bird was recorded at sites 2 and 3 in the shrub layer below a Mallee canopy. Interestingly, it was not recorded at site 5 (dominanted by Samphire), which could be considered core habitat for this species, but in poor condition. Whilst it is possible, that this species occurs throughout the study area, it is more likely to be a visitor to the area, given the amount of good quality suitable habitat is low. The species is also highly mobile, therefore it is not considered that impacts to the species or individuals will occur as a result of construction or operation activities for the proposed project.

This species has been recently delisted (2014) from EPBC conservation status (Vulnerable), but still holds NPW status.

6.1.3 Significant flora and fauna identified during survey in study area

Fourteen species of conservation significance were observed on site, including 1 plant and 13 birds. Potential impacts to these species are discussed below.

Hop-bush Wattle *(Acacia dodonaeifolia)* – Rare (NPW)

The Hop-bush Wattle is endemic to South Australia with major populations on the southern Eyre Peninsula, and the Southern Lofty regions (Whibley and Symon 1992). Multiple BDBSA records exist for this species in the southern Eyre Peninsula region near the study area. This species also has key distribution in the Southern Lofty Ranges with minor populations in the south-east, on Kangaroo Island and on Yorke Peninsula. The Hop-bush Wattle was observed at Site C1a, within a low shrubland on a rocky, low hill and at other sites in subsequent surveys for the infrastructure corridor (approximately 80 plants within the study area that can be avoided and 20 plants outside the study area).

If vegetation clearance is required for construction, impact to individuals of this species may occur (depending on which sites are cleared). However, given that the majority of Hop-bush Wattle plants in the study area occur in degraded rocky habitat that has been avoided by surrounding agricultural use, impacts to individuals should be minimal. Impacts to individual plants can be mitigated as part of the CEMP and vegetation clearance applications. Given the population size on the wider EP, the development is not anticipated to have a significant impact on Hop-bush Wattle. This species may be useful in revegetation programs given that it persists in degraded rocky outcrops within Agricultural settings.

Australian Pelican *(Pelecanus conspicillatus)* – Listed Marine (EPBC)

The Australian Pelican occurs throughout Australia, Papua New Guinea and western Indonesia. The species occurs with widespread permanent and ephemeral water bodies (Australian Museum 2013). The Australian Pelican is known to use open water, fresh and saline, for habitat and feeding opportunities. This species was observed at Site C2, which is directly adjacent to coastline.

It is expected that any works within the study area may directly affect local individuals through altering available habitat. However, this species is large and very mobile. Consequently, it is not expected that construction and operation of a port will cause significant impact to this species. Potential impacts can be mitigated as part of the CEMP for the project.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Black-faced Cuckoo Shrike *(Coracina novaehollandiae)* – Listed Marine (EPBC)

The Black-faced Cuckoo Shrike is known to inhabit open woodland and forest habitats throughout Australia (Birds Australia 2008a, Simpson and Day 2004). This species is widespread throughout Australia and the Eyre Peninsula occurs within the breeding range (Simpson and Day 2004). This species was recorded at 40 sites in the EP Biological Survey (Brandle 2010). Although there are no BDBSA records for this species in the study area, there are four records within 5 km (2000-2001) and over 80 regional records (26-156 km away from 1969-2003). This species was observed at Site C4, in mallee scrub dominated by *Eucalyptus socialis, E. foecunda* (now *E. leptophylla*) and *E. brachycalyx*.

Local individuals may be affected by any works within the study area through possible removal of available habitat and feeding resources, if the moderate quality vegetation is cleared (e.g. site C3, C4). However given

that suitable habitat is limited and fragmented in the study area it is unlikely to be critical habitat for local individuals. In addition, this species is widespread and highly mobile, therefore, it is considered unlikely that works within the study area will constitute a significant impact to the species.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Caspian Tern *(Sterna caspia / Hydroprogne caspia)* – Listed Marine, Marine Migratory *(*EPBC*)*
The Caspian Tern has global distribution and occurs in North America, Europe, Africa, Asia, Australia and New Zealand. Within Australia this species is widespread and occurs in both coastal and inland habitats. In SA they occur along the coast (from Carpenter Rocks to Nuyts Archipelago and Ceduna) and inland along the Murray River. There are also breeding sites throughout Australia; in SA breeding has been recorded along the coast from the Coorong, northwest to Ceduna (Higgins and Davies 1996 cited in SPRAT 2013). They are known to occur commonly on the Eyre Peninsula along the coast, particularly on St Peter and Eyre Islands and a number of other key areas outside the study area for this project (see Caton *et al*. 2011, pp140).

Caspian Terns are known to use coastal habitats, as well as inland watercourses, saline brackish lakes and open wetlands (Simpson and Day 2004, SPRAT 2004). This species was observed at Site C1 during the survey of Cape Hardy. No signs of breeding or nesting were observed. Suitable food resources would exist in waters adjacent to the study area. It is however, considered unlikely that the Caspian Tern directly relies upon habitat within the study area, given that this is a highly mobile species with a wide distribution. If individuals of this species visit the study area during construction works, local individuals may be impacted directly or indirectly, however impacts to local populations are not expected to be significant. Standard CEMPs for the project should be sufficient to mitigate or reduce impacts to this species.

Common Sandpiper *(Actitis hypoleucos)* – Listed Marine, Marine Migratory (EPBC), Rare (NPW)
The Common Sandpiper has global distribution and regularly migrates to Africa, Australia, southern Asia, Papua New Guinea and less often New Zealand (Geering *et al*. 2008, SPRAT 2013). In Australia the species occurs along the coastline and in many inland areas, with areas of national importance primarily in the north of Australia in the Northern Territory, Western Australia and Queensland (SPRAT 2013). In Australia the Common Sandpiper is widespread, but usually occurs in small numbers due to the amount of available suitable habitat (SPRAT 2013). Breeding occurs throughout Eurasia in a variety of habitats (Geering *et al*. 2008).

This shorebird rarely uses intertidal mudflats, but prefers rocky creeks, channels, dams, mangrove-lined inlets and occasionally prefers piers and jetties (Geering *et al*. 2008). They are also known to roost on rocks and branches of vegetation, particularly mangroves and also posts, jetties and artificial structures (Higgins and Davies 1996 cited in SPRAT 2013).

The Common Sandpiper was observed at Site C1 during the field survey. No signs of nesting were observed. This species is highly mobile, has wide distribution and preferred habitats for feeding, which do not occur in the study area. It is therefore not expected to be directly reliant upon habitat within the study area. It is not considered likely that works within the study area will constitute a significant impact for the Common Sandpiper. Standard construction and operation EMPs for the project should be sufficient to mitigate or reduce impacts to this species.

Hooded Plover *(Thinornis rubricollis)* – Listed Marine (EPBC), Vulnerable (NPW)
The Hooded Plover is known to occupy coastal stretches in south-east Australia, as well as inland lakes in Western Australia (Simpson and Day 2004, Caton *et al.* 2011). This species breeds in summer and incubates

eggs directly on sandy oceans beaches (Caton *et al.* 2011). It is consequently very susceptible to disturbance (Birds Australia 2006c). This species has been recorded breeding at various sites along the EP coast; 42 breeding pairs have been found between Streaky Bay and the Lipson area, as well as Port Neil (Cooper 2010 in prep. cited in Caton *et al*. 2011). The EP region supports 50% of the state's population and is thus important for this species (Caton *et al*. 2011).

The Hooded Plover was observed at Site C1 throughout the field survey, predominantly occupying large boulders on the beach, illustrated in Plate 6-1. This species was easily disturbed and on several occasions flew directly away from field survey staff if their approach was too close, a common behaviour of this species (Geering *et al*. 2008). Despite being disturbed by the survey team, the Hooded Plover still returned to this location and was observed during all subsequent visits.

Significant impacts to the Hooded Plover as a species are not expected by this development, however there is potential for short-term impacts to the local population or breeding pairs during the construction phase of project components based on the shoreline (e.g. Modular Offloading Facility and Wharf Construction). During the construction phase, disturbance to an area of the beach and rocky outcrops (e.g. via large vehicle movements and deposition of building materials) will cause short-term impacts to the beach environment. Hooded Plovers are highly sensitive to disturbance during breeding. In addition, predation by domestic dogs, foxes and cats are also significant threats to breeding pairs.

Although, nesting sites were not observed during the survey, the presence of the Hooded Plover suggests that mitigation measures may be required to avoid or reduce direct and indirect impacts, particularly during construction. Mitigation measures could involve: targeted searches to locate breeding pairs and nesting sites, exclusion zones, signage, avoidance of disturbance activities during the summer breeding season. Further detail about this species is provided in the EP Coastal Action Plan (Caton *et al* 2008) and the SA Recovery Plan for the Hooded Plover (Baker-Gabb and Weston 2006). Impacts to Hooded Plovers are not expected during operation of the wharf, given the mobile nature of the species.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Plate 6-1 Hooded Plovers at Site C1

Little Raven *(Corvus mellori)* – Listed Marine (EPBC)
The Little Raven is known to occupy a wide range of habitat types, excluding closed forests and occurs throughout the EP across to the eastern margins of NSW and Victoria. Breeding occurs from inland areas to coastal areas throughout this distribution, but is patchy along the east coast of Australia (Simpson and Day 2004). There are no BSBSA records for this locally common species within the study area, however there are 4 records 4-5 km from the study area and over 170 regional records (5-168 km away, from 1979-2008).

This habitat generalist was observed in all fauna trapping locations during the field survey, using coastal, woodland and mallee scrub habitats within the study area.

It is unlikely that construction or operation activities within the study area will significantly impact the locally common Little Raven. This species is large, highly mobile and adept at using different habitat resources to thrive. This species has potential to increase in numbers as a result of human activities, hence standard CEMPs required for the project would likely focus this as detrimental impacts to species are not anticipated.

Note: this species does not have a conservation listing under the NPW Act and the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Nankeen Kestrel *(Falco cenchroides)* – Listed Marine *(*EPBC*)*
The Nankeen Kestrel is a cosmopolitan species that occupies many different habitat types, excluding dense forest, throughout Australia (Simpson and Day 2004). This common species was regularly observed in a number of habitats in the EP Biological Survey (Brandle 2010) and surveys for the EP Coastal Action Plan (Caton *et al*.

2011). Similar to other coastal raptors, threats to this species relate to clearance of habitat, bioaccumulation of pesticides, but there are also susceptible to impacts from poisoning programs during rodent plagues (Caton *et al*. 2011). There are no BSBSA records for this locally common species within the study area, however there are seven records 4-5 km from the study area and over 110 regional records (5-175 km away, from 1963-2003).

This raptor was frequently observed hovering over cropping land and along roadsides within the region, actively searching for prey. The Nankeen Kestrel was observed at Site C1, C2 and C4, using coastal and mallee scrub habitats within the study area.

It is not considered likely that works within the study area will significantly impact the Nankeen Kestrel. Local individuals may be affected through alterations to potential habitat and feeding localities, however given the size and mobility of this species, significant impacts to the local population are not expected. Standard CEMPs for the project should be sufficient to mitigate or reduce impacts to individuals of this species.

Note: this species does not have a conservation listing under the NPW Act and the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Nankeen (Rufous) Night Heron *(Nycticorax caledonicus)* – Listed Marine *(*EPBC*)*
The Nankeen Night Heron is known to occupy creek lines, intertidal flats, estuaries, swamps and other water bodies (Simpson and Day 2004). This species also roots in trees close to water and is known to roost under jetties and wharves (Simpson and Day 2004). The Nankeen Night Heron has a broad range across the eastern half of Australia and around some coastal areas along the west coast. The EP is included in the species' overwintering range, but breeding does not occur in South Australia (Simpson and Day 2004). There are no BDBSA records for this species within the region. This species was not recorded in the EP Biological Survey (Brandle 2010). It is likely that this species may be a rare and occasional visitor to the study area.

This species was observed west of Site C3, roosting in a large Eucalyptus tree next to a homestead. The roosting locale was reasonably close to coastline, and was adjacent to a small gully. Given the size and mobility of the Nankeen Night Heron, and paucity of records for this species in the region, it is not expected that works within the study area will constitute a significant impact to this species.

Note: this species does not have a conservation listing under the NPW Act and the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Pacific Gull *(Larus pacificus)* – Listed Marine (EPBC)
The Pacific Gull is endemic to the coast of southern and south-western Australia. This species is known to use coastal habitats, reefs, boats (for roosting) and also known to scavenge within human-made waste, such as rubbish dumps and fishing scrap areas on the coast (Simpson and Day 2004, Birds Australia 2008c). Breeding areas are known for the west coast of the EP (Simpson and Day 2004). There are BDBSA records for this species within the study area, and 20 records within 5 km of the study area (1998-2009). There are also over 120 regional BDBSA records (5-175 km, from 1998-2010) for this species.

This Gull species was observed at Site C1 and C2, both coastal habitats (Plate 6-2). Signs of nesting were not observed at Site C1 and C2, however it is likely that adults breed either within the study area or nearby, given the suitable habitat conditions and the number of regional records.

The Pacific Gull is a large, highly mobile and locally common bird that is known to frequent coastal areas with human activity (e.g. coastal rubbish dumps, roosts on boat ramps) and therefore construction and operation

works within the study area are not expected to significantly impact individuals or the local population. This species has potential to increase in numbers as a result of human activities, hence standard CEMPs required for the project would likely focus on this, given detrimental impacts are not anticipated.

Note: this species does not have a conservation listing under the NPW Act and the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Plate 6-2 Pacific Gull at Site C2

Rock Parrot *(Neophema petrophila)* – Listed Marine (EPBC), Rare (NPW)

The Rock Parrot is an endemic species. There are two races, *Neophema petrophila petrophila* and *Neophema petrophila zietzi,* the latter of which occurs in SA (Simpson and Day 2004). The conservation ratings are for the species level. The Rock Parrot (race *zietzi)* is known to inhabit off-shore islands, coastal heath and saltmarsh/samphire habitats on the EP (Simpson and Day 2004, Birds Australia 2006e, Brandle 2010). Race *petrophila*, occurs on the southwest and southern coast lines of Western Australia. On the EP this species is known to breed on the off-shore islands and disperse to the mainland coastal habits from Summer to Autumn (Brandle 2010). Little is known about the ecology and the current population status of this species in South Australia (Brandle 2010).

There are no BDBSA records for this species in the study area, two BDBSA records 4-5 km from the study area (2000-2001) and 19 additional regional records (26-154 km from study area, 1968-2007). The EP Biological Survey recorded this species from six coastal sites (coastal heath and samphire) in (Brandle 2010). The Rock Parrot (race *zietzi)* was observed at Site C1 (coastal dune community) during the field survey.

Based on the information above this species is known to use habitat in the study area. It is unlikely that they are breeding within the study area, as they are known to use coastal islands, but information for the species is limited. Whilst there may be short-term impacts to individuals of this species if habitat is disturbed or removed as a result of the project, it is unlikely that the habitat within the study area is critical to the survival of the local population or the species. This species is highly mobile and would likely move from the study area during construction activities to suitable habitat along the coastline either side of the project area. It is not anticipated that the proposed development will have a significant impact on this species.

Note: the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Silver Gull *(Chroicocephalus novaehollandiae)* – Listed Marine (EPBC)
The Silver Gull is a common species known to occupy and feed in a wide range of coastal habitats and is frequently seen inland and in urban and farmland environments (Simpson and Day 2004, Birds Australia 2007). This species is known as a native species that occurs in high number on EP (Caton *et al*. 2011), hence is not a species of concern. This species is also known to threaten the survival of threatened migratory and shorebird species, particularly those that nest on the beach (Caton *et al*. 2011).

There are BDBSA records for this species within the study area, along with more than 200 regional records. This species was observed at Site C1 and C2 during the field survey, both coastal habitats.

It is considered unlikely that works within the study area will significantly impact the Silver Gull. This species is highly mobile, known as an abundant native species and is able to use a wide range of habitat resources. This species has potential to increase in numbers as a result of human activities, hence standard construction EMPs required for the project would likely focus this, given detrimental impacts to the species are not anticipated.

Note: this species does not have a conservation listing under the NPW Act and the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

Stubble Quail *(Coturnix pectoralis)* – Listed Marine (EPBC)
The Stubble Quail is known to occupy many habitats, including cropping land, natural grasslands, and low shrublands (Frith and Waterman 1977, Simpson and Day 2004). This species has wide distribution in Australia, with breeding areas primarily occurring along the southern and southeast margins, excluding the coastline of the great Australian bite from Esperance to Ceduna (Simpson and Day 2004). The whole EP is included in the breeding range for this species (Simpson and Day 2004).

There are no BDBSA records for this species within the study area, but there are 14 regional records 5-156 km from the study area (1968-2008). These records are primarily from regional Conservation Parks. This species was observed at Site C1 during the field survey as well as opportunistically in highly degraded areas during vegetation assessments for the infrastructure corridor.

It is not expected that works within the study area will significantly impact the Stubble Quail. Local individuals may be displaced however the species is mobile and unlikely to be solely reliant on habitat within the study area.

Note: this species does not have a conservation listing under the NPW Act and the EPBC rating of 'Listed Marine' is not applicable for the terrestrial port study area (as per Section 2.2).

White-bellied Sea-eagle *(Haliaeetus leucogaster)* – Listed Marine, Migratory (EPBC), Endangered (NPW)
The White-bellied Sea-eagle occurs throughout all Australian coastlines, as well as inland areas of the Northern Territory, Queensland, NSW and Victoria (Simpson and Day 2004, Birds Australia 2006f). This species is known to use many habitat types, particularly large rivers, fresh and saline lakes, reservoirs, coastal seas and islands (Simpson and Day 2004). This species has also been recorded in (or flying over) a variety of terrestrial habitats including those in semi-arid zones (Marchant & Higgins 1993). Significant populations of this species are known to occur on the Eyre Peninsula (Brandle 2010). Most of the known territories for this species occur on west coast of the EP (Dennis and Lashmar 1996 cited in Brandle 2010). The White-bellied Sea-eagle is known to often occur sympatrically with the Eastern Osprey, discussed in Section 6.1.2. Similar to the Osprey this raptor is known to have low reproductive rates and found in low population densities (Olsen 1998 cited in Caton *et al.* 2011). Also, similar to the Osprey this species is vulnerable to human disturbance, key threats include clearance of habitat, electrocution on poorly configured power poles, and entanglement with fishing gear (Caton *et al*. 2011). Both of these species are known to be particularly intolerant to disturbance (Dennis 2004 cited in Caton *et al.* 2011).

There are no BDBSA records for this species within the study area, but there are two records within 5 km (1998, 2001) and nine other regional records 5-160 km from the study area (1968-2009). This raptor was recorded at Venus Bay and Cowell during the previous EP Biological Survey (Brandle 2010). Surveys used for the more recent EP Coastal Action indicated 70-80 breeding pairs of this raptor occur on the EP (Dennis *et al.* 2011b, cited in Caton *et al*. 2011). Three subregions on the EP were highlighted during these surveys as providing significant habitat for both the White-bellied Sea-eagle and the Osprey. The key subregions are located on the upper-western EP and the southern EP and include adjacent off-shore islands (Caton *et al.* 2011).

This species was observed during the field survey for the current project at Site C1. However, signs of nesting were not observed during the field survey of the study area. It is likely that this species uses a large stretch of coastline throughout the study area, given its size and range requirements, however the habitat of the study area is not likely to provide critical habitat for individual pairs, as these occur elsewhere on the EP. It is not expected that proposed works within the study area would significantly impact the regional White-bellied Sea-eagle population.

7 Port site legislation and approvals

As a result of the findings from the field and desktop studies associated with the Cape Hardy proposed Port site, the following legislation is considered relevant to further approvals, licensing or special conditions prior to any developmental works.

7.1 Environment

7.1.1 EPBC Referral Determination

Thirteen (13) species listed under the EPBC Act were observed using habitat within the Cape Hardy Port study area. Of these thirteen, three species are Migratory and / or threatened birds (White-bellied Sea Eagle, Common Sandpiper and Caspian Tern) and 10 bird species have EPBC status of 'Listed Marine', therefore protection only relates to activities in the Commonwealth Marine Area (not the terrestrial port site). Two of the ten Listed Marine species have state conservation ratings (Hooded Plover and Rock Parrot). Significant impacts to these species are not expected, as discussed in Section 6. However, the field survey undertaken to produce this report did not constitute targeted searches for listed species and degree of presence was not quantified. Although site usage by these species is based upon limited data, further targeted surveys are unlikely to change the conclusion that significant impacts to all EPBC listed species are not expected. This is because the fragmented, isolated and degraded nature of remaining habitat on site is not expected to support core populations of these species, only potential transient visitors. There were no other matters of national environmental significance identified on site (i.e. wetlands of international importance, commonwealth lands or marine areas, threatened ecological communities).

It is understood that Iron Road intends to submit an EPBC referral for further assessment by the Commonwealth Government.

7.1.2 Native Vegetation Act and SEB

An application to clear native vegetation and thus permit development of the port site will be required under the Native Vegetation Act and Regulations if any of patches of native vegetation are to be disturbed. All applications are assessed by the Native Vegetation Council (NVC) against the principles of clearance (Schedule 1 of the Act), a set of criteria which dictate the circumstances clearance of native vegetation may be permitted. Clearance if permitted will undoubtedly be with a set of conditions and a requirement for significant environmental benefit (SEB) to be made to counter the loss of habitat.

The rationale for SEB is based upon the premise that further clearance of native vegetation (irrespective of size) will result in more loss of habitat, biodiversity and environmental values in a landscape that has already been substantially modified by European settlement. The intent of SEB is not only to replace the immediate environmental values lost through clearance, but also to achieve a net gain that contributes to improving the condition of the environment and biodiversity of the region. SEB may be made through on ground management and restoration of native habitats as guided by an approved vegetation management plan, or by direct monetary contribution into the Native Vegetation Fund (NVF).

The field survey associated with this report did not constitute a specific survey with regards to collecting data regarding potential offset values that may be required. As such, only summary information has been presented in Section 5.3.3, which may form the basis for further discussions into potential offset requirements for native vegetation within the study area.

7.1.3 Natural Resources Management Act

Several weed species observed throughout the study area are declared under the Natural Resources Management Act. Consequently, control is required for these species and is the responsibility of landholders. This will be addressed in a construction an Environmental Management Plan (EMP) for development and EMPs for operation of the site. Similar requirements apply for the appropriate management and control of pest fauna and abundant native species.

Additionally, any water-affecting activities may need prior approval and discussion in an EMP.

7.1.4 Environment Protection Act

The development of the proposed Cape Hardy site may require approval from the EPA under the Environment Protection Act, with regards to undertaking an ecologically sustainable development and minimising or preventing environmental harm. All proponents have a general environmental duty of care, by which harm to the environment must be avoided. Table 7-1 summarises certain environmental constraints that may be applicable to the development of a port site at Cape Hardy.

Table 7-1 Activities related to Port Construction and Operation that may trigger Environment Protection Act

Theme	Policy	Activities that may trigger policy
Air Quality	*Environment Protection (Air Quality) Policy 1994*	Emissions into the air eg iron ore dust.
Water Quality	*Environment Protection (Water Quality) Policy 2003*	Accidental release of compounds into marine environment at Port site.
Noise	*Environment Protection (Noise) Policy 2007*	Noise associated with construction and ongoing operation, eg loading of product onto ships.
Site Contamination	*Environment Protection Regulations 2009*	Accidental release of compounds into terrestrial environment, e.g. chemicals, iron ore dust.
Waste	*Environment Protection Regulations 2009*	Generation of waste following loading of product.

8 Summary and Conclusion

This report summarises results of a desktop study (2011, and updated in 2014) and field survey (undertaken during early November 2011) of the terrestrial ecological environment at the proposed Cape Hardy port site. The desktop study considered the South Australian (BDBSA) and Commonwealth (EPBC Act) databases as well as general distribution texts and published information from ecological studies and biodiversity planning in the region. Key outcomes are outlined below:

- The Eyre Hills subregion has the highest occurrence of endemism within the EYB bioregion. Nineteen endemic plant species and two endemic plant communities have been recorded within the area (DEH 2002). The Eyre Peninsula Blue Gum Woodland community has recently been listed under the EPBC Act, as endangered (August 2013). Areas where this community are known to occur and may occur have been mapped (SPRAT Profile August 2013). These key areas occur south of Ungarra and North of Cleve, outside the study area.
- Vegetation types surveyed across the proposed port site are common throughout inland and coastal Eyre Peninsula. The development of a port at Cape Hardy is unlikely to have a significant impact on the abundance, diversity, geographic distribution and productivity of flora at the species and community levels.
- In general the majority of habitats within the study area are degraded to some extent due to historic land clearance, weed infestation and vegetation patches are isolated, however several habitat types are present and these support a range of fauna.
- A total of 34 weeds were recorded during the field survey, including some species Declared under the *Natural Resources Management Act 2004* (NRM Act) and some listed as Weeds of National Significance (WoNS), including Boxthorn and Bridal Creeper. Onion weed (Declared for the EP region) was prevalent at the site.
- A total of 62 vertebrate species (including 8 introduced), and 106 plant species (including 34 introduced) were recorded from the four flora and fauna survey sites, three flora only sites and opportunistically within the study area.
- Thirteen bird species of national conservation significance were recorded in the study area, of which three are Migratory and threatened under the EPBC Act (White-bellied Sea-eagle, Caspian Tern and Common Sandpiper). The other 10 species are 'Listed Marine' of which two species area also listed under the state NPW Act (Hooded Plover and Rock Parrot). No EPBC Act listed flora species were recorded during the field survey.
- One flora species of state significance (NPW Act) was recorded in the study area; Hop-bush Wattle (*Acacia dodonaeifolia*). The proposed development is unlikely to have a significant impact on this species.
- In total, fifty-six species of conservation significance were discussed here; including species listed under the EPBC Act and the SA NPW Act identified during the desktop study. Twenty five of these species are considered unlikely to occur on site due to a lack of suitable habitat, or a known distribution that is distant from the study site. Seventeen species have potential to occur within the study area and surrounding region due to the presence of suitable habitat, associative species, regional BDBSA records or recent regional studies / biodiversity planning. This includes the Jumping Jack Wattle (EPBC Act). Fourteen of the 56 species of conservation significance discussed were recorded during the field survey, including one plant (NPW Act) and 13 birds. Of the 13 birds, three are Migratory / threatened under the EPBC Act, (White-bellied Sea-eagle, Caspian Tern, Common Sandpiper), 8 only have Listed Marine status that is not applicable to the study area and two have Listed Marine / NPW Act status (Hooded Plover, Rock Parrot).

- None of the 17 species of conservation significance with potential to occur in the study area are expected to be significantly impacted. If local individuals occur they may be displaced however all of the fauna species are highly mobile and unlikely to be solely reliant on habitat within the study area. Mitigation activities to avoid impacts to fauna species during construction and operation that will be addressed as part of a CEMP for the proposed development are considered sufficient to reduce impacts to these species.
- An application to clear native vegetation and develop the port site will be required under the state NV Act and Regulations if any patches of native vegetation are to be disturbed. Clearance if permitted, would involve a set of conditions and a requirement for SEB to be made to counter the loss of habitat.

9 References

Alldredge M, Pollock K H and Simons T R (2006) Estimating Detection Probabilities from Multiple Observer Point Counts, *The Auk*, 123(4): 1172-1182.

Australian & New Zealand Environment & Conservation Council (ANZECC) and Agriculture & Resource Management Council OF Australia & New Zealand (ARMCANZ) (1999) *National Principles and Guidelines for Rangeland Management*, Commonwealth of Australia, Canberra.

Australian Museum (2010) *Australian Pelican* (online), Available: http://australianmuseum.net.au/Australia-Pelican, Accessed 12/1/12.

Berkinshaw T (2009) *Mangroves to Mallee: The Complete Guide to the Vegetation of Temperate South Australia*, Greening Australia, Adelaide.

Birds Australia (2006a) *Caspian Tern* (online), Available http://birdsinbackyards.net/species/Sterna-caspia, Accessed 12/1/12.

Birds Australia (2006b) *Common Sandpiper* (online), Available: http://birdsinbackyards.net/species/Actitis-hypoleucos, Accessed 12/1/12.

Birds Australia (2006c) *Hooded Plover* (online), Available: http://birdsinbackyards.net/species/Thinornis-rubricollis, Accessed 12/1/12.

Birds Australia (2006d) *Nankeen Night Heron* (online), Available: http://birdsinbackyards.net/species/Nycticorax-caledonicus, Accessed 12/1/12.

Birds Australia (2006e) *Rock Parrot* (online), Available: http://birdsinbackyards.net/species/Neophema-petrophila, Accessed 12/1/12.

Birds Australia (2006f) *White-bellied Sea-eagle* (online), Available: http://birdsinbackyards.net/species/Haliaeetus-leucogaster, Accessed 12/1/12.

Birds Australia (2007) *Silver Gull* (online), Available: http://birdsinbackyards.net/species/Larus-novaehollandiae, Accessed 12/1/12.

Birds Australia (2008a) *Black-faced Cuckoo Shrike* (online), Available: http://birdsinbackyards.net/species/Coracina-novaehollandiae, Accessed 12/1/12.

Birds Australia (2008b) *Nankeen kestrel* (online), Available: http://birdsinbackyards.net/species/Falco-cenchroides, Accessed 12/1/12.

Birds Australia (2008c) *Pacific Gull* (online), Available: http://birdsinbackyards.net/species/Larus-pacificus, Accessed 12/1/12.

Birds Australia (date unknown A) *Little Penguin* (online), Available: http://birdsinbackyards.net/species/Eudyptula-minor, Accessed 23/1/12

Birds Australia (date unknown B) *Oriental Plover* (online), Available: http://birdsinbackyards.net/species/Charadrius-veredus, Accessed 23/1/12.

Black, JM (1986) *Flora of South Australia, Vol. I-IV revised.* Government printer: South Australia.

Brandle, R (2010) *A Biological Survey of the Eyre Peninsula, South Australia.* Department for Environment and Heritage, South Australia.

Brooker M I H and Kleinig D A (2001) *Field Guide to Eucalypts: Volume 2 South-western and Southern Australia.* Bloomings Books, Melbourne Australia.

Bureau of Meteorology (BOM) (2012). *South Australian Weather Observation Stations* (accessed online), http://www.bom.gov.au/sa/observations/map.shtml

Caton B, Detmar S, Fotheringham D, Laurence S, Quinn J, Royal M, Rubbo N and Sandercock R (2011), Eyre Peninsula Coastal Action Plan and Conservation Priority Study, Volume 1, Eyre Peninsula NRM Board and Department of Environment and Natural Resources, Adelaide.

Churchill S (2009) *Australia Bats*, Second Edition, Allen and Unwin, Australia.

Cogger H (2000) *Reptiles and Amphibians of Australia*. Reed, NSW.

Cunningham G, Mulham B, Milthorpe P and Leigh J (1993) *Plants of Western New South Wales*, Inkata Press, Sydney.

Department for Environment and Heritage (DEH) (2002) *Biodiversity Plan for Eyre Peninsula South Australia*, Department for Environment and Heritage, South Australia

Department for Environment and Heritage (DEH) (2007) No Species Loss: A Nature Conservation Strategy for South Australia 2007-2017, Department for Environment and Heritage, Adelaide.

Department for Environment, Water, Heritage and the Arts (DEWHA) (2010) *Survey guidelines for Australia's threatened birds – Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999.*

Department for Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2008) *Approved Conservation Advice for Frankenia plicata* (online), Available: http://environment.gov.au/biodiversity/threatened/species/pubs/4225-conservation-advice.pdf

Department for Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2010) *Pandion cristatus – Eastern Osprey*, (online), Available: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=952, Accessed 24/1/12, 2013.

Department for Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011) *Southern Giant-Petrel*, (online), Available: http://www.antarctica.gov.au/about-antarctica/fact-files/animals/flying-birds/southern-giant-petrel, Australian Antarctic Division, Accessed 23/1/12, 2013.

Department for Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012b) *Psophodes nigrogularis oberon – Western Whipbird (Western Mallee)*, (online), Available: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64686, Accessed 2/3/2012, 2013.

Department for Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012c) *Merops ornatus – Rainbow Bee-eater*, (online), Available: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=670, Accessed 2/3/12.

Department for Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012d) *Diomedea exulans (sensu lato) – Wandering Albatross*, (online), Available: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1073, Accessed 2/3/2012, 2013.

Department of Environment and Heritage (Commonwealth) (2005) *Australia's Biogeographical Regions*. Available online from: http://www.deh.gov.au/parks/nrs/ibra. Department of Environment and Heritage.

Department of Environment and Natural Resources (DENR) (2011). *Biological Database of South Australia (*extract of state wide*;* GIS dataset), DENR, Adelaide.

Department of Water, Land and Biodiversity Conservation (DWLBC) (2005) *Guidelines for a native vegetation significant environmental benefit policy for the clearance of native vegetation associated with the minerals and petroleum industry* (draft Sept 2005), DWLBC, Adelaide.

DEWNR (2013a) Statistics by Association (table) supplied by Native Vegetation and Management Unit (Tanya Milne), Department of Environment and Natural Resources, Adelaide.

DEWNR (2013b) *BushRAT manual for native vegetation*; Native Vegetation & Biodiversity Management Unit, DEWNR, Adelaide

Edyvane K (1999) Conserving Marine Biodiversity in South Australia, SARDI report number 39, PIRSA

Eflora SA (DEWNR 2007). Species Specific Fact Sheets. Accessed on line 2011-2013 at:http://www.flora.sa.gov.au/census.shtml

Frith, HJ and Waterman, MH (1977) Movements of Stubble Quail *Coturnix pectoralis*, from South Australian Grainfields, *Australian Wildlife Research*, Volume 4, pages 85-90.

Geering A, Agnew L and Harding S (eds.) (2007) *Shorebirds of Australia*. Melbourne: CSIRO Publishing.

Goulder Associates (2013) Preliminary Documentation (EPBC Ref: 2012/6590): Port Spencer Stage 1 and 2,Eyre Peninsula, SA. Report 127663016-029-R-Rev1 prepared for Centrex Metals Limited.

Heard L and Channon B (Eds) (1997) *Guide to a native vegetation survey (agricultural region) using the Biological Survey of South Australia Methodology.* Geographic Analysis and Research Unit, Information and Data Analysis Branch, Department of Housing and Urban Development.

Iron Road Limited (2011) *Application for Declaration of Environmental Factors to conduct exploration drilling work within a vegetation heritage agreement area (HA869) EL3699 Warramboo area, Eyre Peninsula, South Australia.* SKM and Iron Road Limited, Adelaide.

Jacobs (2014a) Marine Study (in prep)

Jacobs (2014b) Central Eyre Iron Project Infrastructure – Infrastructure Ecological Assessment (in prep), Jacobs, Adelaide

Jacobs (2014c) Warramboo Central Eyre Iron Project: Mine Site Ecological Survey. EF-34-0003. Jacobs, Adelaide

Jacobs (2014d) Offset Plan (in prep)

Jessop J, Dashorst GRM and James F (2006) *Grasses of South Australia*, Wakefield Press, South Australia.

Karfs R, Applegate R, Fisher R, Lynch D, Mullin D, Novelly P (2000) *Regional land condition and trend assessment in tropical savannas: National Land and Water Resources Audit rangeland monitoring implementation project, final report*, National Land and Water Resources Audit, Canberra, viewed 15 Sept 2013, http://nrmonline.nrm.gov.au/catalog/mql:38

Madden-Hallett DM, Hammer M, Gursanky W, Donato DB (2011) Lipson Island baseline flora and fauna report and assessment of risk. For Golder Associates, Donato Environmental Services Darwin.

Menkhorst P and Knight F (2004) *A Field Guide to the Mammals of Australia*. Oxford University Press, Melbourne.

Milne TI, Croft SJ and Pedler JA (2008) Bushland Condition Monitoring Manual: Eyre Peninsula Region. Volume 3, vegetation communities of the Eyre Peninsula Region. The Nature Conservation Society of South Australia Inc.

National Rangeland Management Working Group (NRMWG) (1996) *Draft national strategy for rangeland management*, Dept. of the Environment, Sport and Territories on behalf of ANZECC and ARMCANZ, Canberra.

Nicole D (2013) *Native Eucalypts of South Australia,* Lane Print and Post, Adelaide, South Australia.

Nicolle D (1997) *Eucalypts of South Australia,* Lane Print Group, South Australia.

NRMMC (2010) Australia's Biodiversity Conservation Strategy 2010-2030, National Biodiversity Strategy Review Task Group convened under the Natural Resource Management Ministerial Council (NRMMC)

Owens H (Ed) (2000) *Guidelines for vertebrate surveys in South Australia using the Biological Survey of South Australia*. Biological Survey and Research Section, National Parks and Wildlife SA, Department for Environment and Heritage, Adelaide.

Parks and Wildlife Service Tasmania (2011) *Cape Barren Goose, Cereopsis novaehollandiae* (online), Available: http://www.parks.tas.gov.au/index.aspx?base=5110, Accessed 24/1/12.

Parnaby H 1992. *An interim guide to identification of insectivorous bats of south-eastern Australia*. *Technical Reports of the Australian Museum No. 8*. Australian Museum, Sydney.

Pizzey G and Knight F (2006) *The Field Guide to the Birds of Australia (Seventh Edition)*.

Pobke K (2007) *Draft recovery plan for 23 threatened flora taxa on Eyre Peninsula, South Australia 2007-2012*, Department for Environment and Heritage, South Australia.

Richardson FJ, Richardson RG and Shepherd RCH (2011) *Weeds of the south-east: an identification guide for Australia*.

Robertson M (2005) *Stop Bushland Weeds: A Guide to Successful Weeding in South Australia's Bushland* (2nd edit), Nature Conservation Society of South Australia, Adelaide.

Shirihai H (2007) *A Complete Guide to Antarctic Wildlife: the Birds and Marine Mammals of the Antarctic Continent and the Southern Ocean* (2nd edit.) A & C Black, London.

Simpson K and Day N (1999) *Field Guide to the Birds of Australia* (6th Edition). Penguin Books Australia.
Simpson K and Day N (2004) *Field Guide to the Birds of Australia* (7th Edition). Penguin Books Australia.
Sinclair Knight Merz (SKM) (2010) *Port Options Briefing Document (V4 30 August 2010)*, SKM, Adelaide.
Strahan R (1995) *The Mammals of Australia.* Reed Books, NSW.
Thackway, R and Cresswell, ID (1995) *An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program, Version 4.0.* Australian Nature Conservation Agency, Canberra.
Todd J A (2000) *Recovery Plan for twelve threatened Spider-orchid Caladenia taxa (Orchidaceae: Caladeniinae) of Victoria and South Australia 2000 – 2004*. Department of Natural Resources and Environment, Melbourne.
Triggs B (1996) *Tracks, Scats and Other Traces: A Field Guide to Australian Mammals*. Oxford University Press.
Whibley D J E and Symon D E (1992) *Acacias of South Australia (2nd edit.)*, South Australian Government, Adelaide
Wilson S and Swan G (2008) *A Complete Guide to Reptiles of Australia* (2nd Edition). Reed New Holland, Sydney.

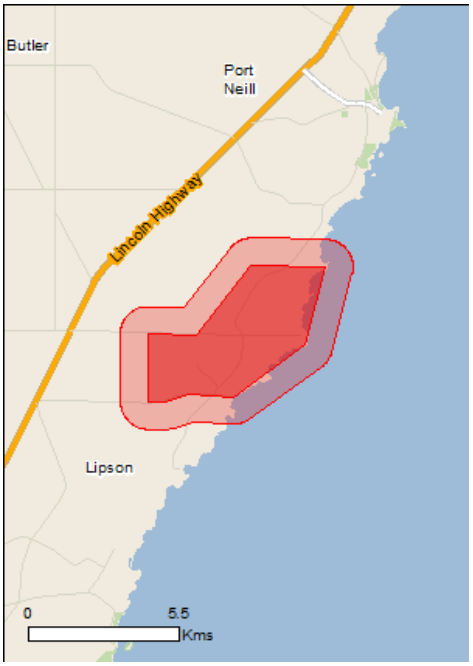
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

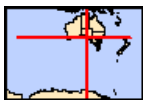
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 28/08/13 09:37:40



Coordinates
Buffer: 1.0Km



Appendix A EPBC Protected Matters Search Tool

Search results obtained from the EPBC Protected Matters Search Tool are presented below. All marine mammals and sub-tidal species have been excluded from this report, as they are covered in a related marine environment report (Jacobs 2014a).

Note: the Slender-billed Thornbill appears in the search results. This species was delisted from the EPBC Act 14/12/13.

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	26
Listed Migratory Species:	29

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	51
Whales and Other Cetaceans:	11
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	None
State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	17
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Acanthiza iredalei iredalei Slender-billed Thornbill (western) [25967]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Psophodes nigrogularis leucogaster Western Whipbird (eastern) [64448]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Mammals		
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Neophoca cinerea Australian Sea-lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
Acacia enterocarpa Jumping-jack Wattle [17615]	Endangered	Species or species habitat likely to occur within area
Acacia pinguifolia Fat-leaved Wattle [5319]	Endangered	Species or species habitat may occur within area
Caladenia tensa Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area
Frankenia plicata [4225]	Endangered	Species or species habitat likely to occur within area
Ptilotus beckerianus Ironstone Mulla Mulla [3787]	Vulnerable	Species or species habitat may occur within area
Pultenaea trichophylla Tufted Bush-pea [12715]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Foraging, feeding or related behaviour likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]		Species or species habitat likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Vanacampus vercoi Verco's Pipefish [66286]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area

Name	Status	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Tumby Bay To Dutton Bay	SA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Coordinates

-34.19585903 136.2999634,-34.19519305 136.2852016,-34.19731831 136.2775175,
-34.19730183 136.2717735,-34.1787514 136.27163,-34.17902122 136.2878141,-34.16005711
136.305788,-34.16048382 136.3303089,-34.18178637 136.3235294,-34.19585903
136.2999634

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix B Site Photos

Plate B-1 Site C1, facing north

Plate B-2 Site C1, facing east

Plate B-3 Site C1, facing south

Plate B-4 Site C1, facing west

Plate B-5 Site C2, facing north

Plate B-6 Site C2, facing east

Plate B-7 Site C2, facing south

Plate B-8 Site C2, facing west

Plate B-9 Site C3, facing north

Plate B-10 Site C3, facing east

Plate B-11 Site C3, facing south

Plate B-12 Site C3, facing west

Plate B-13 Site C4, facing north

Plate B-14 Site C4, facing east

Plate B-15 Site C4, facing south

Plate B-16 Site C4, facing west

Appendix C Flora and Fauna Search Results (BDBSA)

Flora Results (Biological Database of South Australia)

Species Name	Common Name	Introduced	EPBC Status	NPW Status
Acacia ancistrophylla var. lissophylla	Hook-leaf Wattle			
Acacia cupularis	Cup Wattle			
Acacia enterocarpa	Jumping-jack Wattle		EN	E
Acacia hakeoides	Hakea Wattle			
Acacia montana	Mallee Wattle			R
Acacia sclerophylla var. sclerophylla	Hard-leaf Wattle			
Acacia spinescens	Spiny Wattle			
Austrodanthonia caespitosa	Common Wallaby-grass			
Austrodanthonia setacea	Small-flower Wallaby-grass			
Austrostipa acrociliata	Graceful Spear-grass			
Austrostipa drummondii	Cottony Spear-grass			
Austrostipa elegantissima	Feather Spear-grass			
Austrostipa exilis	Heath Spear-grass			
Austrostipa hemipogon	Half-beard Spear-grass			
Austrostipa platychaeta	Flat-awn Spear-grass			
Austrostipa scabra ssp. falcata	Slender Spear-grass			
Boronia inornata ssp. leptophylla	Dryland Boronia			
Brachiaria notochthona	Hairy-edged Arm-grass			
Brachyscome ciliaris var. ciliaris	Variable Daisy			
Bulbine semibarbata	Small Leek-lily			
Calandrinia calyptrata	Pink Purslane			
Calandrinia eremaea	Dryland Purslane			
Cassinia complanata	Sticky Cassinia			
Cassytha melantha	Coarse Dodder-laurel			
Chenopodiaceae sp.	Goosefoot Family			
Chenopodium desertorum ssp. desertorum	Frosted Goosefoot			
Chenopodium desertorum ssp. microphyllum	Small-leaf Goosefoot			
Clematis microphylla var. microphylla (NC)	Old Man's Beard			
Comesperma volubile	Love Creeper			
Cotyledon orbiculata var. orbiculata	Pig's Ear			
Correa reflexa (NC)	Common Correa			
Crassula colorata var. colorata	Dense Crassula			
Crassula sieberiana ssp. tetramera (NC)	Australian Stonecrop			
Dampiera rosmarinifolia	Rosemary Dampiera			
Daucus glochidiatus	Native Carrot			
Dianella brevicaulis	Short-stem Flax-lily			
Dianella revoluta var. revoluta	Black-anther Flax-lily			

Species Name	Common Name	Introduced	EPBC Status	NPW Status
Disphyma crassifolium ssp. clavellatum	Round-leaf Pigface			
Dodonaea bursariifolia	Small Hop-bush			
Dodonaea hexandra	Horned Hop-bush			
Einadia nutans ssp. nutans	Climbing Saltbush			
Enchylaena tomentosa var. tomentosa	Ruby Saltbush			
Eremophila crassifolia	Thick-leaf Emubush			
Eucalyptus angulosa	Coast Ridge-fruited Mallee			
Eucalyptus calcareana	Nundroo Mallee			
Eucalyptus dumosa[1]	White Mallee			
Eucalyptus gracilis	Yorrell			
Eucalyptus incrassata	Ridge-fruited Mallee			
Eucalyptus peninsularis X Eucalyptus socialis ssp.	Merrit Intergrade			
Eucalyptus socialis (NC)	Beaked Red Mallee			
Eucalyptus yalatensis	Yalata Mallee			
Exocarpos aphyllus	Leafless Cherry			
Gahnia deusta	Limestone Saw-sedge			
Glycine rubiginosa	Twining Glycine			
Goodenia varia	Sticky Goodenia			
Goodenia willisiana	Silver Goodenia			
Hakea rugosa	Dwarf Hakea			
Helichrysum leucopsideum	Satin Everlasting			
Kennedia prostrata	Scarlet Runner			
Lasiopetalum behrii	Pink Velvet-bush			
Lepidium sp.	Peppercress			
Lichen sp.				
Logania linifolia	Flax-leaf Logania			
Logania ovata	Oval-leaf Logania			
Lomandra effusa	Scented Mat-rush			
Maireana brevifolia	Short-leaf Bluebush			
Maireana enchylaenoides	Wingless Fissure-plant			
Melaleuca acuminata ssp. acuminata	Mallee Honey-myrtle			
Melaleuca halmaturorum	Swamp Paper-bark			
Melaleuca lanceolata ssp. lanceolata (NC)	Dryland Tea-tree			
Melaleuca uncinata	Broombush			
Microcybe multiflora ssp. baccharoides	Scale-leaf Microcybe			
Myoporum brevipes	Warty Boobialla			
Nitraria billardierei	Nitre-bush			
Olearia axillaris	Coast Daisy-bush			
Olearia floribunda var. floribunda	Heath Daisy-bush			
Oxalis perennans	Native Sorrel			
Ozothamnus decurrens	Ridged Bush-everlasting			

Species Name	Common Name	Introduced	EPBC Status	NPW Status
Phebalium bullatum	Silvery Phebalium			
Philotheca pungens	Prickly Wax-flower			
Pimelea flava ssp. dichotoma	Diosma Riceflower			
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			
Pimelea stricta	Erect Riceflower			
Pittosporum angustifolium	Native Apricot			
Poa drummondiana	Knotted Poa			R
Podolepis tepperi	Delicate Copper-wire Daisy			
Prostanthera serpyllifolia ssp. microphylla	Small-leaf Mintbush			
Prostanthera serpyllifolia ssp. serpyllifolia	Thyme Mintbush			
Ptilotus spathulatus f. spathulatus (NC)	Pussy-tails			
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			
Rhagodia crassifolia	Fleshy Saltbush			
Rhagodia preissii ssp. preissii	Mallee Saltbush			
Rhodanthe pygmaea	Pigmy Daisy			
Salsola tragus	Buckbush			
Santalum acuminatum	Quandong			
Scaevola myrtifolia	Myrtle Fanflower			R
Sclerolaena diacantha	Grey Bindyi			
Senecio glossanthus	Annual Groundsel			
Senecio pinnatifolius (NC)	Variable Groundsel			
Senecio spanomerus				
Spyridium bifidum var. bifidum	Forked Spyridium			
Spyridium eriocephalum var. eriocephalum	Heath Spyridium			
Spyridium phylicoides	Narrow-leaf Spyridium			
Stenanthemum leucophractum	White Cryptandra			
Tecticornia sp.	Samphire			
Tetragonia implexicoma	Bower Spinach			
Threlkeldia diffusa	Coast Bonefruit			
Thryptomene micrantha	Ribbed Thryptomene			
Triodia scariosa	Spinifex			
Vittadinia australasica var. australasica	Sticky New Holland Daisy			
Vittadinia dissecta var. hirta	Dissected New Holland Daisy			
Vittadinia gracilis	Woolly New Holland Daisy			
Wahlenbergia preissii				
Wilsonia rotundifolia	Round-leaf Wilsonia			
Wurmbea dioica ssp. dioica (NC)	Early Star-lily			
Zygophyllum sp.	Twinleaf			
Aeonium haworthii		*		
Agave americana	Century Plant	*		

Species Name	Common Name	Introduced	EPBC Status	NPW Status
Aloe maculata	Broad-leaf Aloe	*		
Anagallis arvensis	Pimpernel	*		
Arctotheca calendula	Cape Weed	*		
Asparagus asparagoides f. asparagoides	Bridal Creeper	*		
Asphodelus fistulosus	Onion Weed	*		
Avellinia michelii	Avellinia	*		
Avena barbata	Bearded Oat	*		
Brassica tournefortii	Wild Turnip	*		
Bromus rubens	Red Brome	*		
Calendula arvensis	Field Marigold	*		
Carrichtera annua	Ward's Weed	*		
Diplotaxis tenuifolia	Lincoln Weed	*		
Ehrharta longiflora	Annual Veldt Grass	*		
Emex australis	Three-corner Jack	*		
Eragrostis minor	Small Stink-grass	*		
Euphorbia paralias	Sea Spurge	*		
Euphorbia terracina	False Caper	*		
Galenia pubescens var. pubescens	Coastal Galenia	*		
Gazania linearis	Gazania	*		
Gazania rigens	Gazania	*		
Hordeum glaucum	Blue Barley-grass	*		
Lepidium africanum	Common Peppercress	*		
Limonium hyblaeum		*		
Limonium sinuatum	Notch-leaf Sea-lavender	*		
Lolium rigidum	Wimmera Ryegrass	*		
Lycium ferocissimum	African Boxthorn	*		
Marrubium vulgare	Horehound	*		
Medicago minima var. minima	Little Medic	*		
Medicago polymorpha var. polymorpha	Burr-medic	*		
Medicago truncatula	Barrel Medic	*		
Mesembryanthemum crystallinum	Common Iceplant	*		
Mesembryanthemum nodiflorum	Slender Iceplant	*		
Panicum hillmanii	Witch-grass	*		
Paspalum dilatatum	Paspalum	*		
Pennisetum clandestinum	Kikuyu	*		
Pentaschistis airoides	False Hair-grass	*		
Reichardia tingitana	False Sowthistle	*		
Retama raetam	White Weeping Broom	*		
Rostraria cristata	Annual Cat's-tail	*		
Salvia verbenaca var. verbenaca	Wild Sage	*		
Scabiosa atropurpurea	Pincushion	*		

Species Name	Common Name	Introduced	EPBC Status	NPW Status
Schinus molle	Pepper-tree	*		
Schismus barbatus	Arabian Grass	*		
Silene nocturna	Mediterranean Catchfly	*		
Sisymbrium irio	London Mustard	*		
Solanum nigrum	Black Nightshade	*		
Sonchus oleraceus	Common Sow-thistle	*		

[1] Note: Nicolle now suggests historic records for *E. dumosa* on the Eyre Peninsula are now included with *E. calcareana* (Nundroo Mallee)

* = introduced species

Data source: BDBSA 2011(study area and 5 km buffer, grey highlight species not found within 1 km); 2013 (study area and 1 km buffer, non highlight species, 71 total species)

Fauna Results (Biological Database of South Australia)

Class	Species Name	Common Name	Introduced	EPBC Status	NPW Status
AVES	*Acanthiza apicalis*	Inland Thornbill			
AVES	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill			
AVES	*Accipiter cirrocephalus*	Collared Sparrowhawk			
AVES	*Actitis hypoleucos*	Common Sandpiper			R
AVES	*Alauda arvensis*	Eurasian Skylark	*		
AVES	*Anas castanea*	Chestnut Teal			
AVES	*Anas gracilis*	Grey Teal			
AVES	*Anthochaera carunculata*	Red Wattlebird			
AVES	*Anthus novaeseelandiae*	Australasian Pipit			
AVES	*Apus pacificus*	Fork-tailed Swift			
AVES	*Aquila audax*	Wedge-tailed Eagle			
AVES	*Ardea pacifica*	White-necked Heron			
AVES	*Ardeotis australis*	Australian Bustard			V
AVES	*Arenaria interpres*	Ruddy Turnstone			R
AVES	*Artamus cyanopterus*	Dusky Woodswallow			
AVES	*Artamus personatus*	Masked Woodswallow			
AVES	*Artamus superciliosus*	White-browed Woodswallow			
AVES	*Barnardius zonarius*	Australian Ringneck			
AVES	*Cacomantis flabelliformis*	Fan-tailed Cuckoo			
AVES	*Cacomantis pallidus*	Pallid Cuckoo			
AVES	*Calidris acuminata*	Sharp-tailed Sandpiper			
AVES	*Calidris ruficollis*	Red-necked Stint			
AVES	*Cereopsis novaehollandiae*	Cape Barren Goose			R
AVES	*Chalcites basalis*	Horsfield's Bronze-Cuckoo			
AVES	*Chalcites lucidus*	Shining Bronze-Cuckoo			
AVES	*Chalcites osculans*	Black-eared Cuckoo			
AVES	*Charadrius bicinctus*	Double-banded Plover			
AVES	*Charadrius ruficapillus*	Red-capped Plover			
AVES	*Charadrius veredus*	Oriental Plover			
AVES	*Chroicocephalus novaehollandiae*	Silver Gull			
AVES	*Cincloramphus cruralis*	Brown Songlark			
AVES	*Cincloramphus mathewsi*	Rufous Songlark			
AVES	*Circus assimilis*	Spotted Harrier			
AVES	*Colluricincla harmonica*	Grey Shrike-thrush			
AVES	*Columba livia*	Rock Dove	*		
AVES	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike			
AVES	*Corvus coronoides*	Australian Raven			
AVES	*Corvus mellori*	Little Raven			
AVES	*Coturnix ypsilophora*	Brown Quail			V
AVES	*Cracticus torquatus*	Grey Butcherbird			
AVES	*Egretta novaehollandiae*	White-faced Heron			
AVES	*Elanus axillaris*	Black-shouldered Kite			
AVES	*Eolophus roseicapilla*	Galah			
AVES	*Epthianura albifrons*	White-fronted Chat			
AVES	*Epthianura tricolor*	Crimson Chat			
AVES	*Falco berigora*	Brown Falcon			

Class	Species Name	Common Name	Introduced	EPBC Status	NPW Status
AVES	*Falco cenchroides*	Nankeen Kestrel			
AVES	*Falco peregrinus*	Peregrine Falcon			R
AVES	*Geopelia placida*	Peaceful Dove			
AVES	*Glossopsitta porphyrocephala*	Purple-crowned Lorikeet			
AVES	*Grallina cyanoleuca*	Magpie-lark			
AVES	*Gymnorhina tibicen*	Australian Magpie			
AVES	*Haematopus fuliginosus*	Sooty Oystercatcher			R
AVES	*Haematopus longirostris*	Australian Pied Oystercatcher			R
AVES	*Haliaeetus leucogaster*	White-bellied Sea-Eagle			E
AVES	*Hirundapus caudacutus*	White-throated Needletail			
AVES	*Hirundo neoxena*	Welcome Swallow			
AVES	*Hydroprogne caspia*	Caspian Tern			
AVES	*Lalage tricolor*	White-winged Triller			
AVES	*Larus pacificus*	Pacific Gull			
AVES	*Lichenostomus virescens*	Singing Honeyeater			
AVES	*Malurus leucopterus*	White-winged Fairy-wren			
AVES	*Manorina flavigula*	Yellow-throated Miner			
AVES	*Melopsittacus undulatus*	Budgerigar			
AVES	*Merops ornatus*	Rainbow Bee-eater			
AVES	*Microcarbo melanoleucos*	Little Pied Cormorant			
AVES	*Milvus migrans*	Black Kite			
AVES	*Morus serrator*	Australasian Gannet			
AVES	*Neophema petrophila*	Rock Parrot			R
AVES	*Nymphicus hollandicus*	Cockatiel			
AVES	*Ocyphaps lophotes*	Crested Pigeon			
AVES	*Pandion cristatus*	Eastern Osprey			E
AVES	*Pardalotus punctatus*	Spotted Pardalote			
AVES	*Passer domesticus*	House Sparrow	*		
AVES	*Pelecanus conspicillatus*	Australian Pelican			
AVES	*Phalacrocorax carbo*	Great Cormorant			
AVES	*Phalacrocorax fuscescens*	Black-faced Cormorant			
AVES	*Phalacrocorax sulcirostris*	Little Black Cormorant			
AVES	*Phalacrocorax varius*	Pied Cormorant			
AVES	*Phaps chalcoptera*	Common Bronzewing			
AVES	*Phylidonyris novaehollandiae*	New Holland Honeyeater			
AVES	*Platalea regia*	Royal Spoonbill			
AVES	*Pluvialis fulva*	Pacific Golden Plover			R
AVES	*Poliocephalus poliocephalus*	Hoary-headed Grebe			
AVES	*Pomatostomus superciliosus*	White-browed Babbler			
AVES	*Rhipidura leucophrys*	Willie Wagtail			
AVES	*Sternula nereis*	Fairy Tern		VU	E
AVES	*Stigmatopelia chinensis*	Spotted Dove	*		
AVES	*Sturnus vulgaris*	Common Starling	*		
AVES	*Sugomel nigrum*	Black Honeyeater			
AVES	*Thalassarche melanophris*	Black-browed Albatross		VU	V
AVES	*Thalasseus bergii*	Crested Tern			
AVES	*Thinornis rubricollis*	Hooded Plover			V
AVES	*Threskiornis spinicollis*	Straw-necked Ibis			
AVES	*Todiramphus sanctus*	Sacred Kingfisher			

Class	Species Name	Common Name	Introduced	EPBC Status	NPW Status
AVES	*Tribonyx ventralis*	Black-tailed Native-hen			
AVES	*Tringa brevipes*	Grey-tailed Tattler			R
AVES	*Tringa nebularia*	Common Greenshank			
AVES	*Turdus merula*	Common Blackbird	*		
AVES	*Vanellus miles*	Masked Lapwing			
MAMMALIA	*Lasiorhinus latifrons*	Southern Hairy-nosed Wombat			
MAMMALIA	*Macropus fuliginosus*	Western Grey Kangaroo			
REPTILIA	*Ctenophorus fionni*	Peninsula Dragon			
REPTILIA	*Hemiergis peronii*	Four-toed Earless Skink			
REPTILIA	*Lerista dorsalis*	Southern Four-toed Slider			
REPTILIA	*Lialis burtonis*	Burton's Legless Lizard			
REPTILIA	*Parasuta spectabilis*	Mallee Black-headed Snake			
REPTILIA	*Pogona barbata*	Eastern Bearded Dragon			
REPTILIA	*Pseudonaja inframacula*	Peninsula Brown Snake			
REPTILIA	*Tiliqua occipitalis*	Western Bluetongue			
REPTILIA	*Tiliqua rugosa*	Sleepy Lizard			

Data source: BDBSA 2011 (5 km from study area boundary), no new species identified in 2013 search (1 km buffer)

Appendix D Field study flora records by site

Native species	Common	Site C1	Site C2	Site C3	Site C4	Site Ca	Kiandra Road 1	Kiandra Road 2	NPW Act Status
Acacia dodonaeifolia	Hop-bush Wattle					X			R
Acacia longifolia ssp. sophorae	Coastal Wattle		X						
Acacia oswaldii	Umbrella Wattle	X		X			X		
Acacia sp.				X					
Acacia spinescens	Spiny Wattle				X				
Acrotriche patula	Prickly Ground-berry			X					
Allocasuarina verticillata	Drooping She-oak			X					
Atriplex cinerea	Coast Saltbush	X							
Atriplex nummularia	Old-man Saltbush		X						
Austrodanthonia caespitosa	Common Wallaby-grass					X	X		
Austrodanthonia (glaucous) sp.	Wallaby-grass			X					
Austrodanthonia sp.	Wallaby-grass			X	X				
Austrostipa (fine) sp.	Spear-grass		X						
Austrostipa elegantissima	Feathery Spear-grass			X	X				
Austrostipa elegantissima	Elegant Spear-grass			X					
Austrostipa scabra ssp. *scabra*	Rough Spear-grass				X	X			
Austrostipa sp.	Spear-grass			X			X	X	
Blennodia pterosperma	Native Stock	X	X				X		
Bursaria spinosa	Christmas Bush			X					
Calandrinia sp.	Purslane			X					
Cassytha sp.	Snotty-gobble				X	X		X	
Cheilanthes sp.	Rock Fern			X					
Convolvulus remotus	Native Bindweed			X					
Dianella revoluta	Flax-lily	X	X	X	X			X	
Dichondra repens	Kidney Weed			X					
Dodonaea viscosa ssp. *spatulata*	Sticky Hop-bush			X					
Einadia nutans	Climbing Saltbush			X	X				
Enchylaena tomentosa	Ruby Saltbush	X	X	X	X	X	X		
Eremophila longifolia	Weeping Emubush					X			
Erodium crinitum	Blue Heron's-bill					X			
Eucalyptus brachycalyx	Gilja				X				
Eucalyptus leptophylla	Narrow-leaved Red Mallee				X				
Eucalyptus socialis	Summer Red Mallee				X			X	

Native species	Common	Site C1	Site C2	Site C3	Site C4	Site Ca	Kiandra Road 1	Kiandra Road 2	NPW Act Status
Eutaxia microphylla ssp. *microphylla*	Common Eutaxia				X				
Exocarpos aphyllus	Leafless Cherry				X				
Ficinia nodosa	Knobby Club-rush	X	X						
Glycine rubiginosa	Twining Glycine					X			
Lepidosperma carphoides	Black Rapier-sedge			X	X	X			
Lepidosperma (fine)	Rapier-sedge				X				
Lepidosperma viscidum	Stick Sword-sedge			X					
Leucophyta brownii	Cushion-bush	X	X						
Lomandra effusa	Scented Mat-rush	X	X	X		X			
Maireana brevifolia	Short-leaf Bluebush	X	X				X	X	
Maireana radiata	Radiate Bluebush				X				
Melaleuca armillaris	Needle-leaf Honey-myrtle		X						
Melaleuca halmaturorum	Swamp Paper-bark		X						
Melaleuca lanceolata	Dryland Tea-tree				X			X	
Melaleuca uncinata	Broombush				X			X	
Myoporum brevipes	Warty Boobialla					X			
Nicotiana velutina	Velvet Tobacco			X					
Nitraria billardieri	Nitre Bush	X					X		
Olearia axillaris	Coast Daisy-bush	X	X						
Oxalis perennans	Native Sorrel			X		X			
Pimelea flava ssp. *dichotoma*	Diosma Riceflower				X				
Pimelea micrantha	Silky Riceflower			X					
Pimelea sp.	Riceflower	X							
Pittosporum angustifolium	Native Apricot			X	X	X		X	
Pomaderris paniculosa	Pomaderris			X					
Prostanthera serpyllifolia ssp. *microphylla*	Small-leaf Mintbush				X				
Rhagodia candolleana	Seaberry Saltbush	X	X		X	X			
Rhagodia crassifolia	Fleshy Saltbush				X				
Rhagodia preisii	Mallee Saltbush				X				
Salsola kali	Buckbush		X			X			
Sclerolaena uniflora	Small-spine Bindyi					X			
Senecio pinnatifolius	Variable Groundsel				X				
Suaeda australis	Austral Seablite						X	X	
Tetragonia implexicoma	Bower Spinach				X				
Teucrium sessiliflorum	Mallee Germander			X					
Threlkeldia diffusa	Coast Bonefruit	X	X						
Vittadinia cuneata var. *cuneata*	Fuzzy New Holland Daisy			X					

Native species	Common	Site C1	Site C2	Site C3	Site C4	Site Ca	Kiandra Road 1	Kiandra Road 2	NPW Act Status
Vittadinia sp.	New Holland Daisy						X	X	
Wahlenbergia sp.	Native Bluebell			X	X	X			
TOTAL	**72**	**14**	**16**	**29**	**27**	**17**	**9**	**10**	

Exotic Species	Common	Site C1	Site C2	Site C3	Site C4	Site Ca	Kiandra Road 1	Kiandra Road 2	Status
Ammophila arenaria	Marram Grass	X	X						
Anagallis arvensis	Pimpernel	X	X						
Arctotheca calendula	Cape Weed			X					
Asparagus asparagoides	Bridal Creeper			X				X	WONS
Asphodelus fistulosus	Onion Weed	X	X	X	X	X	X		Declared EP
Avena barbata	Bearded Oat		X	X			X	X	
Avena fatua	Wild Oat					X			
Brassica tournefortii	Wild Turnip		X		X		X		
Bromus arenacea	Brome	X	X					X	
Bromus rubens	Red Brome		X						
Carthamus lanatus	Saffron Thistle					X			
Centaurium tenuiflorum	Branched Centaury			X					
Ehrharta longiflora	Annual Veldt Grass			X				X	
Euphorbia paralias	Sea Spurge		X						
Euphorbia terracina	False Caper	X			X		X	X	Declared (all of SA)
Galenia pubescens	Coastal Galenia		X	X			X	X	
Hordeum leporinum	Wall Barley-grass					X		X	
Hypochaeris glabra	Smooth Cat's Ear			X	X	X			
Lepidium africanum	Common Peppercress							X	
Lepidium sp.	Peppercress			X					
Lolium sp.				X			X	X	
Lycium ferocissimum	African Boxthorn		X	X		X	X	X	Declared (all of SA)
Marrubium vulgare	Horehound		X				X		Declared (all of SA)
Mesembryanthemum crystallinum	Common Ice-plant	X				X		X	
Mesembryanthemum nodiflorum	Slender Iceplant	X	X						
Nicotiana glauca	Tree Tobacco				X		X		
Oenothera stricta	Common Evening Primrose	X							
Salvia verbenaca	Wild Sage							X	

Exotic Species	Common	Site C1	Site C2	Site C3	Site C4	Site Ca	Kiandra Road 1	Kiandra Road 2	Status
Solanum nigrum	Black Nightshade				X	X		X	
Sonchus oleraceus	Common Sow-thistle	X	X	X	X	X	X	X	
Tamarix aphylla	Athel Pine		X						WONS Declared (all of SA)
Taraxacum officinale	Common Dandelion		X		X				
Trifolium arvense	Hare's-foot Clover			X		X			
Vulpia sp.	Fescue	X	X						
TOTAL	34	10	16	13	9	10	10	14	