

Terrestrial Environment

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7. TERRESTRIAL ENVIRONMENT

7.1. Introduction

The following Chapter describes the key terrestrial biological features of the Project area. It aims to:

- » Provide a clear description of the existing terrestrial environment in the study area with consideration of the regional context
- » Identify any key environmental values, including listed threatened species and habitats
- » Identify processes involved with the construction and operation of the Project that may have an impact on the terrestrial environment
- » Assess the level of risk associated with any impacting processes and consider mitigation measures which will reduce the level of risk to an acceptable level.

7.2. Methodology

The study approach has been to collate the considerable amount of available information for the general study region, particularly from major investigations undertaken for other existing and proposed projects, government databases and management plans. In addition, surveys were specifically undertaken to provide additional information with particular reference to relevant legislative requirements, as detailed in **Section 7.2.4**.

7.2.1. Sources of Information

For the terrestrial biological environment, the major sources of information are indicated below. Any other sources used, for example, specific research papers, are referenced in the text and included in the references. Some of the major sources of information relate to previous environmental studies undertaken for industrial projects between Point Lowly and the Port Lincoln Highway and use of land by the Department of Defence to the north. The areas covered by these major Projects are indicated in **Figure 7.2a**. The information sources include:

- » Cultana Training Area Expansion Public Environment Report (AECOM, 2012)
- » Olympic Dam Expansion Environmental Impact Statement; Draft Main Report Volume One and Two (BHP Billiton (BHPB), 2009), Supplement (BHPB, 2011a) and Assessment Report (Minister for Mineral Resources Development and Minister for Urban Development, Planning and the City of Adelaide 2011)

- » Titanium Dioxide Manufacturing Plant, Whyalla - Draft Environmental Impact Statement (Dames and Moore, Pty. Ltd. 1991)
- » Whyalla Investment Park Declaration of Environmental Factors (A.G.Consulting Group Pty Ltd 1989)
- » Southern Cross Refinery Environmental Impact Statement; Draft (Maunsell and Partners and Australian Groundwater Consultants 1987a), Supplement (Maunsell and Partners and Australian Groundwater Consultants 1987b) and Assessment Report (Department of Environment and Planning 1987)
- » Environmental Impact Statement for Port and Terminal Facilities at Stony Point - South Australia; Draft (Social and Ecological Assessment Pty Ltd. 1981), Supplement (Social and Ecological Assessment Pty Ltd. 1981) and Assessment (Department of Environment and Planning 1981).

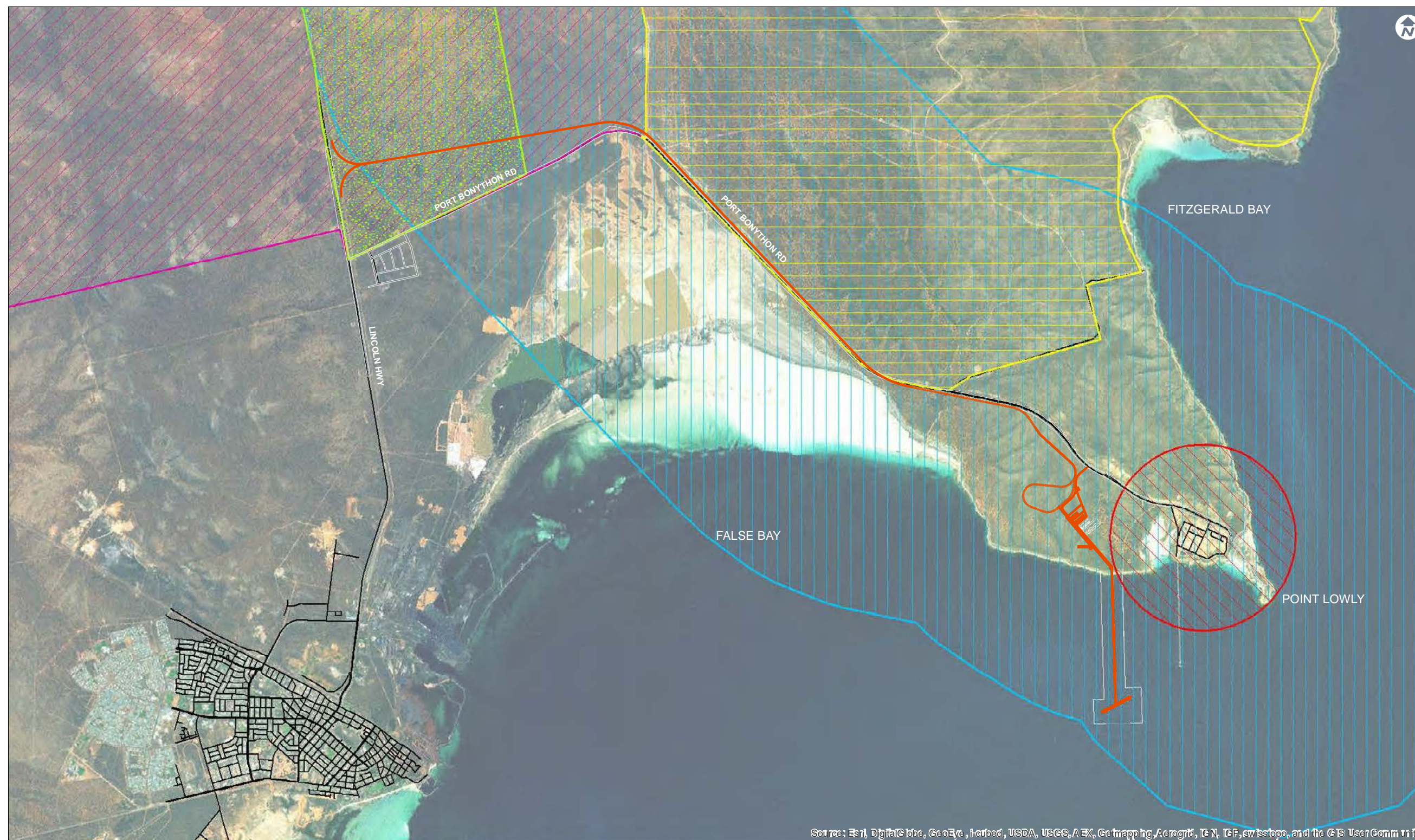
Other important publications dealing with the terrestrial biological environment include:

- » *Whyalla Conservation Park Management Plan; North-East Eyre Peninsula South Australia* (Department of Environment, Heritage and Aboriginal Affairs 1998)
- » *Eyre Peninsula Coastal Action Plan and Conservation Priority Study*, Volume One and Two (Caton et al, 2011)
- » 'The Status, Distribution and Habitat of the Slender-billed Thornbill *Acanthiza iredalei* in South Australia' (Matthew, 1994)
- » South Australia Wader Surveys, January and February 2000 (Wilson, J.R. 2000).

Databases examined include:

- » Biological Database of South Australia (through the 'NatureMaps' interface and direct requests through DEWNR)
- » Protected matters search tool (database of species, habitats and places protected under the EPBC Act)
- » Atlas of living Australia (database of biodiversity knowledge aggregated from a range of providers including museums, herbaria, community groups, government departments, universities and individuals).

Figure 7.2a: Extent of previous environmental assessments



Source: Esri, DigitalGlobe, GeoEye, Helio, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 7.2a -
Previous Environmental Reports

Legend

Previous environmental studies:

-  Cultana Expansion Area
-  Olympic Dam Expansion
-  Santos Refinery
-  Cultana Training Area
-  Titanium Dioxide Manufacturing Plant

 Roads

Note: Areas are indicative only



1:75,000 (at A3)
0 1 2 4
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

7.2.2. Surveys

7.2.2.1. Vegetation Surveys

Two vegetation surveys were undertaken. The first was in October/November, 2011, with a focus on defining broad vegetation associations and habitat types in the area. The second, a more targeted survey, was conducted in August 2012, which involved defining individual species abundance at specified survey sites. The timing of the surveys over the spring period gave the best chance of identifying plants down to species level.

Additionally, in the five months preceding the field survey in late October, 2011, there had been seven significant rain events (between 6.8mm and 17mm), representing a period of high winter rainfall. The subsequent survey period in August, 2012, was preceded by below average early winter rainfall with the exception of one significant rainfall event (35mm) on 10 July 2012. Given this, these species counts are considered to represent moderate to high plant species diversity for all plant associations. A review of existing data from previous surveys conducted in the area from 1981-2012 provided an indication of expected species presence and seasonal variation. The methodology for the vegetation survey was based on the survey methods described in the South Australian Government published Guide to a Vegetation Survey (Heard & Channon 1997), using a modified Braun-Blanquet system for estimating cover/abundance for each plant species at a survey site.

A total of 39 survey sites were chosen to sample the range of vegetation communities and the variation within the major vegetation associations (Figure 7.2b). These sites were divided into two categories:

- » 12 primary sites were surveyed in detail to assess vegetation cover and abundance
- » 27 secondary sites were surveyed to provide some additional detail related to species variability; (species were recorded only as presence/absence).

At primary survey sites, vegetation species lists were compiled over a homogeneous area of approximately 2500 m² including cover and abundance scores for each species noted. These sites are considered a reasonable representation of a typical example of this vegetation association. Density ratings were given for each species recorded at the primary survey sites using a modified Braun-Blanquet system (refer to Table 7.2a).

Table 7.2a: Modified Braun-Blanquet system for estimating cover/abundance

Code	Description
N	Not many (one to ten individuals).
T	Sparse (cover <5%). These may be spreading shrubs that individually cover a relatively large area, but are sparsely present
1	Plentiful (cover <5%). These may be grasses or small herbs with small leaves or vertical growth habit, that may be numerous, but still only have a small Projected foliage cover
2	Any number of individuals covering 5 – 25% of the area
3	Any number of individuals covering 25 – 50% of the area
4	Any number of individuals 50 – 75% of the area
5	Covering >75% of the area

At the other secondary survey sites, species lists were compiled over an area of up to 5000 m² to capture some of the variability within the primary vegetation groupings.

7.2.2.2. Fauna surveys

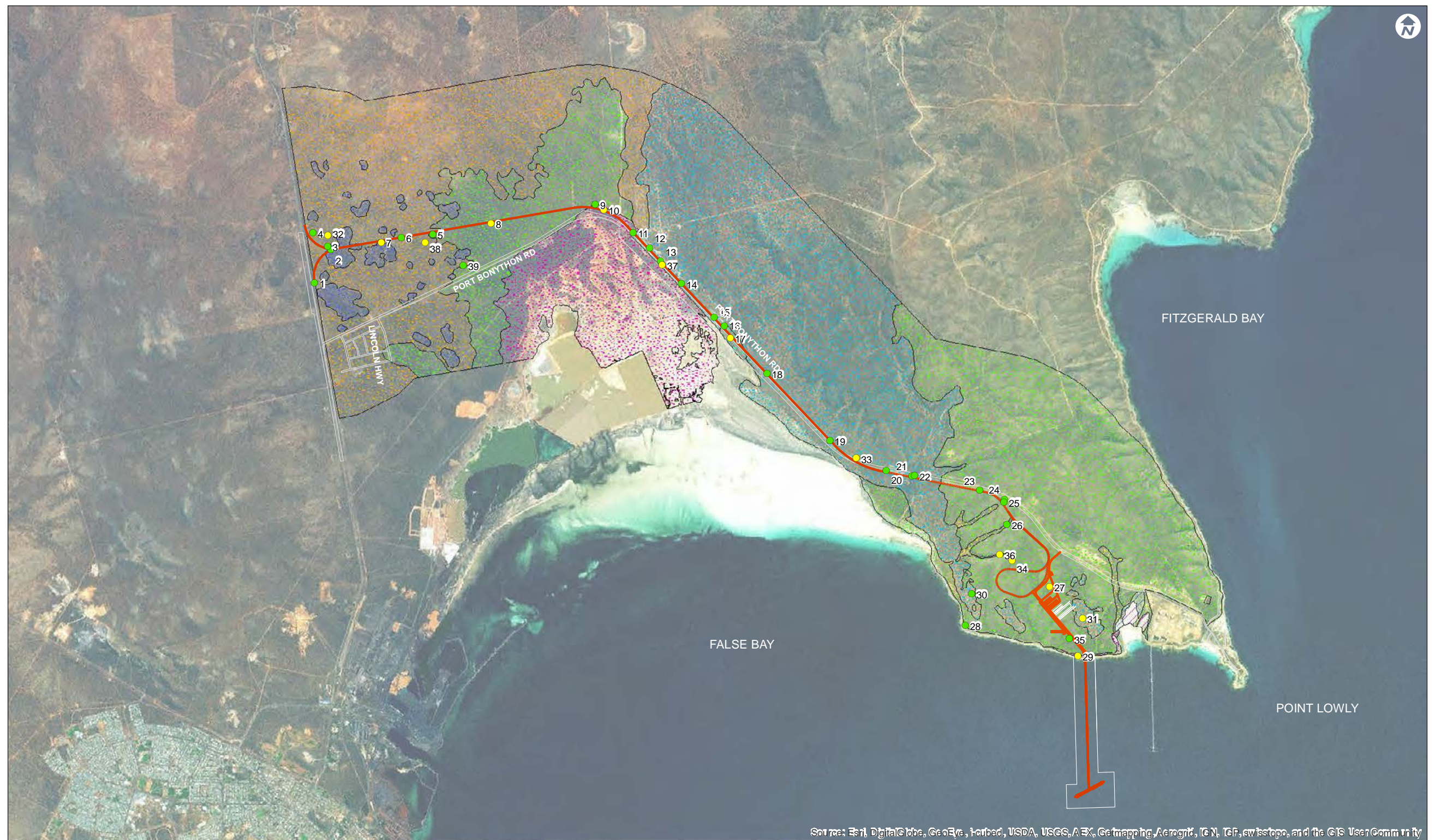
A fauna survey was conducted concurrently to the August 2012 vegetation survey with a focus on birds, particularly threatened species. Full details of the survey are included in Appendix G.1.

At each of the primary vegetation survey sites a bird survey was carried out (Figure 7.2c). Due to the cryptic nature of the targeted threatened species, particularly the Slender-billed Thornbill (*Acanthiza iredalei iredalei*), an area survey was deemed to be the most appropriate survey method, as consistent with the Survey Guidelines for Australia’s Threatened Birds (Department of the Environment, Water, Heritage and the Arts, 2010). Surveys at each site were carried out over a one hour period and averaged 1.5km walked in a circular loop around the targeted habitat. During the survey birds were identified either by visual observation or call recognition.

Birds and other fauna recorded outside of the survey periods were recorded as opportunistic sightings. Specific surveys for other groups of fauna, such as mammals and reptiles, were not undertaken as these groups were not represented in searches of threatened species in the study area (refer Section 7.4.4) and it was deemed that sufficient data was available from previous studies in the area (over a 30 year period) as reported in Section 7.4.4.

Figure 7.2b: Vegetation Survey

Figure 7.2b: Vegetation Survey



Source: Esri, DigitalGlobe, GeoEye, iSat, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 7.2b -
Vegetation Survey

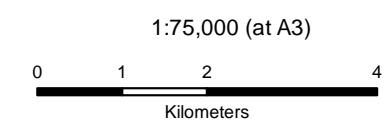
Legend

Vegetation associations:

	Association 1 - Myall sparse woodland		Association 6 - Emubush shrubland
	Association 2 - Blackoak woodland		Association 7 - Hopbush shrubland
	Association 3 - Mallee woodland		Association 8 - Boobialla sparse shrubland
	Association 4 - Chenopod shrubland		Santos Association 1 - Myoporum sparse woodland
	Association 5 - Sampshire shrubland		Santos Association 2 - Dune field

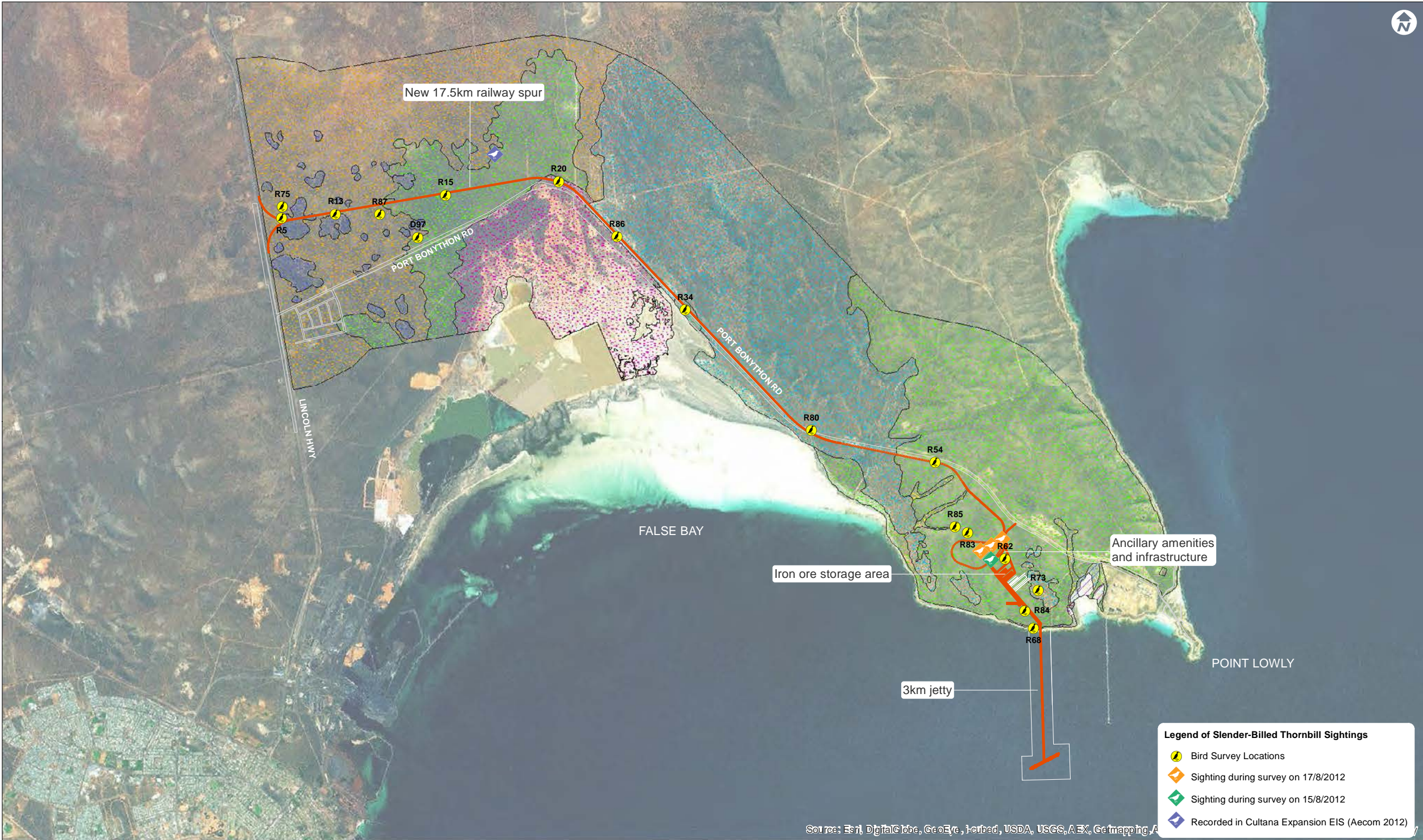
Survey point locations:

- Primary
- Secondary



Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

Figure 7.2c: Bird Survey Locations and Slender-Billed Thornbill Sightings



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Figure 7.2c -
Bird Survey Locations and
Slender-Billed Thornbill Sightings

Legend			
Vegetation associations:			
	Association 1 - Myall sparse woodland		Association 6 - Emubush shrubland
	Association 2 - Blackoak woodland		Association 7 - Hopbush shrubland
	Association 3 - Mallee woodland		Association 8 - Boobialla sparse shrubland
	Association 4 - Chenopod shrubland		Santos Association 1 - Myoporum sparse woodland
	Association 5 - Samphire shrubland		Santos Association 2 - Dune field

7.2.3. Impact Significance Criteria

For the purpose of assessing the environmental effects of the Project on the terrestrial biological environment, impact significance criteria are defined and are included in **Table 7.2b**. The impact assessment approach has utilised aspects of both Federal and State legislation and guidelines.

In summary, the impact assessment considered whether the Project will:

- » Cause direct or indirect death of a fauna species
- » Cause loss of an important habitat for a species or community
- » Fragment habitat or create a barrier to movement
- » Risk the introduction distribution of a pest species or disease.

Based on the risk assessment methodology outlined in **Chapter 1, Project Introduction**, the primary impacting processes during construction and operation are assessed

based on the potential impact of the process, the likelihood that this impact will occur, and resultant level of risk. **Table 7.2b** below aligns with the general significance criteria but is specific to impacts on terrestrial flora and fauna.

7.2.4. Terminology

To assist in describing the existing environment in relation to the Project the following terminology has been adopted:

- » Project footprint area: the area likely to be directly impacted by construction and operation activities (i.e. impacted by machinery, vegetation clearance, etc.)
- » Study area: an arbitrary 1km buffer around the Project footprint area where most indirect impacts are likely to occur. Defines the extent of detailed vegetation mapping (refer to **Chapter 1, Project Introduction**)
- » Region: general local area outside the study area. Applied where context is required in descriptions of the existing environment (ie extent of Chenopod shrubland).

Table 7.2b: Impact significance categories for terrestrial flora and fauna

Impact Significance	Description For Non-Threatened Species	Description For Threatened Species
Very high	Regional permanent (in excess of 50 years) decrease in numerous species resulting in severe change in regional community structure and reduction in biodiversity. Dominance of only a few species. Reduction in regional viability of the numerous species	Permanent (in excess of 50 years) decrease in an important population or subpopulation of a threatened species or community resulting in significant reduction in viability of the species or community Adversely effects habitat critical to the survival of the species by fragmenting, modifying, destroying, removing or isolating or decreasing the availability or quality of habitat to the extent that the species or community is likely to decline
High	Regional long-term (from five to 50 years) decrease in a number of species resulting in significant change in regional community structure and reduction in biodiversity. Reduction in regional viability of some species	Long-term (from five to 50 years) decrease in an important population or subpopulation of a threatened species or community resulting in a possible reduction in viability of the species or community Adversely effects habitat critical to the survival of the species by fragmenting, modifying, destroying, removing or isolating or decreasing the availability or quality of habitat to the extent that the species or community may possibly decline
Moderate	Regional medium-term (one to five years) decrease in a number of species resulting in change in regional community structure and reduction in biodiversity. Possible reduction in regional viability of some species	Medium-term (one to five) decrease in an important population or subpopulation of a threatened species or community, however, impact only expected to be temporary with no long term reduction in viability of the species or community Moderate loss of suitable habitat but not of the extent that it affects the viability of the species or community
Minor	Local short-term (up to one year) decrease in some species resulting in a change in local community structure and reduction in local biodiversity, however, impact only expected to be temporary with no long term reduction in viability of the species or community	Short-term (up to one year) decrease in a population or subpopulation of a threatened species or community with no effect on the viability of the species or community Minor loss of suitable habitat but with replacement of habitat from offsets
Negligible	Minimal change to existing species populations and communities, possibly a temporary effect within the bounds of natural variability	Minimal change to existing population, possibly a temporary effect within the bounds of natural variability

7.3. Relevant Legislation and Policy

7.3.1. Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act is the primary federal legislation protecting biodiversity in Australia. This legislation was used to:

- » Identify nationally threatened flora and fauna species and communities
- » An EPBC protected matters search uses a database to determine the likelihood of protected species, habitats or places occurring in a defined area. A protected matters search has been conducted for an area including a 2km buffer around the Project footprint
- » Determine whether the Project was likely to have a significant impact on the threatened species/communities identified in the Protected Matter search using the EPBC significance criteria
- » If there was an identified risk of a significant impact, determine the need for an environmental offset as required under the Act.

7.3.2. National Parks and Wildlife Act 1972 (NPW Act)

In South Australia, the *National Parks and Wildlife Act 1972* (NPW Act) protects biodiversity, it lists threatened species on a state level in Schedules; seven (endangered), eight (vulnerable) and nine (rare). Presence of protected species under the NPW Act in the area was searched via the Biological Database of South Australia as well as through checks against survey observations from the study area.

7.3.3. Native Vegetation Act 1991 (NV Act)

Under the NV Act, any clearance of native vegetation, other than vegetation covered under exemptions, requires specific, written approval from the Native Vegetation Council (NVC). The Act does not permit clearing of a “substantially intact stratum” of native vegetation, except under specific circumstances and where a Significant Environmental Benefit (SEB) is available and agreed. The Regulations to the Act detail the circumstances under which areas of vegetation may be cleared following approval by NVC.

7.3.4. National Resource Management Act 2004 (NRM Act)

This Act promotes sustainable and integrated management of the State’s natural resources and makes provision for their protection. It includes a requirement for landholders to control weeds declared under the NRM Act on their properties

The Project is located within the Eyre Peninsula Natural Resource Management Region.

7.3.5. CAMBA, JAMBA and ROKAMBA

The Australian Government has entered into three bilateral migratory bird agreements. These are:

- » Japan-Australia Migratory Bird Agreement (JAMBA)
- » China-Australia Migratory Bird Agreement (JAMBA)
- » Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

The JAMBA and CAMBA agreements list terrestrial, water and shorebird species which migrate between Australia and the respective countries. In both cases the majority of listed species are shorebirds.

Both agreements require the parties to protect migratory birds by:

- » Limiting the circumstances under which migratory birds are taken or traded
- » Protecting and conserving important habitats
- » Exchanging information
- » Building cooperative relationships.

The JAMBA agreement also includes provisions for cooperation on the conservation of threatened birds.

Australian government and non-government representatives meet every two years with Japanese and Chinese counterparts to review progress in implementing the agreements and to explore new initiatives to conserve migratory birds.

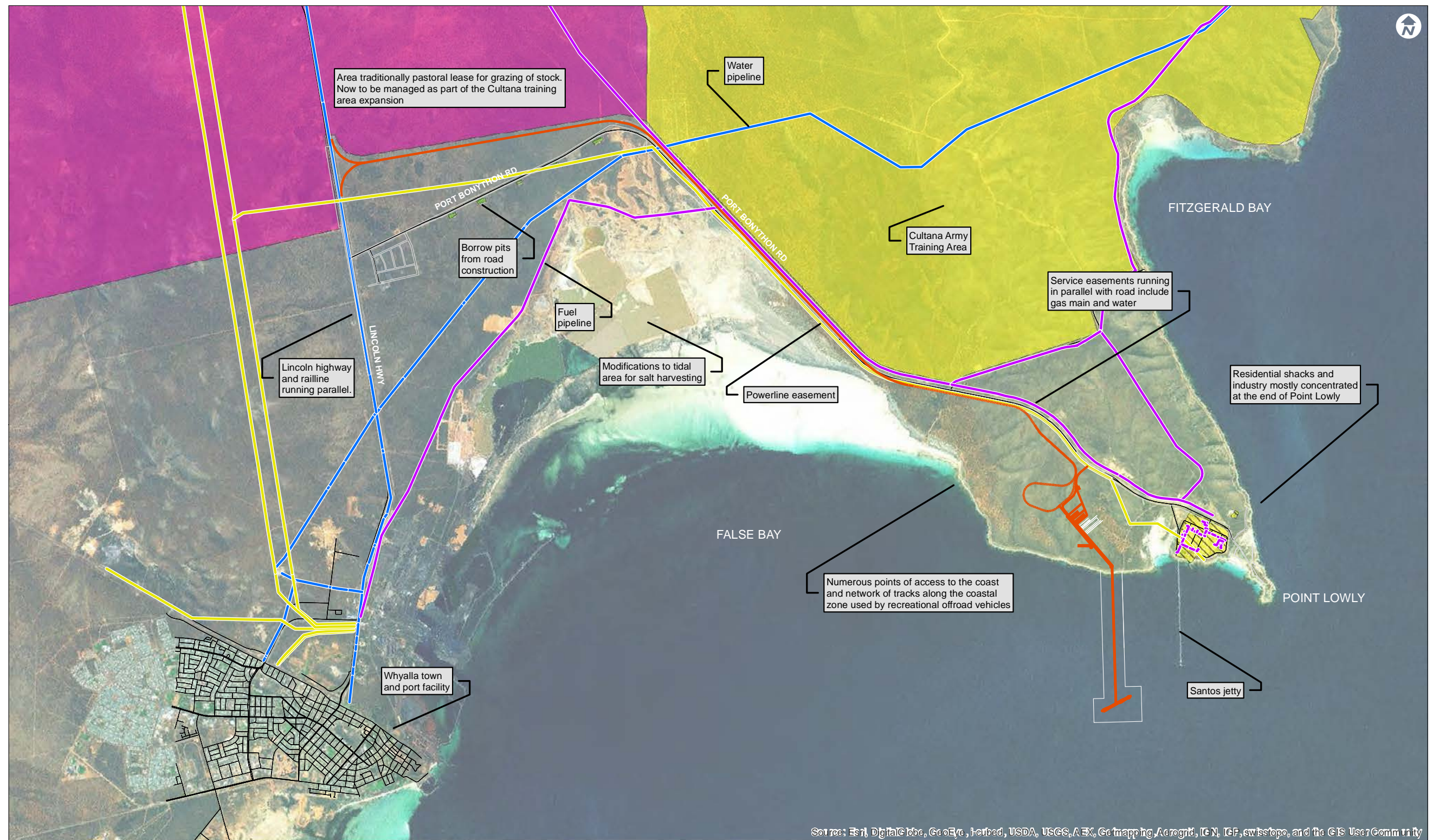
These agreements have been used to identify shorebirds or migratory birds that many require protection within the study area.

7.4. Existing Terrestrial Environment

7.4.1. Effects of Past and Existing Activities

The impacts of past and present activities in the study area affect the condition of the existing terrestrial environment. These impacts are summarised below and illustrated in **Figure 7.4a**.

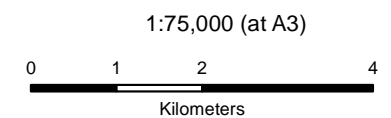
Figure 7.4a: Past and existing activities



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Legend	
— Roads	
— Water Pipelines	
— Power Lines	
— Fuel Pipelines	
Impact summary:	
■ Borrow pits	■ CEA
■ CUTA	■ Industrial

Figure 7.4a - Impact Summary



Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

7.4.1.1. Pastoralism

Grazing by sheep and cattle is a traditional activity, with grazing still currently occurring on the Tregalana Pastoral Lease. Particularly in some Myall and Blackoak Vegetation Associations (Associations one and two), the cryptogammic crust (surface crust of lichen and other biological materials important for soil stabilisation, fixation of nitrogen and moisture retention) has not yet regenerated in areas impacted by sheep tracks (Figure 7.4b). However, stocking rates appear to be conservative with the vegetation generally being in good condition.

Figure 7.4b: Stock tracks through Vegetation Association One in the west of the study area. Note lack of cryptogamic crust in areas where stock have been walking



7.4.1.2. Roads and Tracks

Formal roads have cleared linear tracts of vegetation to provide access to Point Lowly and other areas of interest. Numerous borrow pits from construction of roads are evident in aerial photographs. There is also a network of informal tracks and high level of offroad vehicle use (Caton et al, 2011), particularly around the coast, coastal home areas and the Project area. Impacts from this use include soil compaction, vegetation damage, soil erosion, dune instability and weed introduction. There is also the risk of potential increased damage to the stranded shingle beach which is an important geological feature of the area. Similarly, these tracks provide opportunity for informal camping around the coast also with soil compaction, vegetation damage, fauna disturbance, soil erosion, dune instability, increased fire risk and weed introduction (Caton et al, 2011).

7.4.1.3. Coastal Home Areas

These include small settlements that occur around Point Lowly, False Bay and Fitzgerald Bay, with the loss of some vegetation/habitat, track development and garden escapes.

7.4.1.4. Feral Animals

Feral animals, including cats, dogs, mice, rabbits, goats and foxes, have all been recorded in the Project area (refer Section 7.4.4).

7.4.1.5. Commercial Use

The construction of the Santos facility resulted in the loss of approximately 100Ha of Chenopod (Saltbush/Bluebush) shrubland and the loss of fauna habitat within the region. However, there is now improved management of vegetation remaining on the Santos property particularly around Weeroona Bay as public access has been limited. Previously, there were coastal homes and access was allowed to these areas. The restrictions on access and removal of coastal homes has reduced physical damage to vegetation and protected fauna species such as Common Dunnart (*Sminthopsis murina*) on the western side of Weeroona Bay. The habitat diversity of this area was seen as an important attribute because of regional impacts on fauna since European settlement. Fortunately, when the Santos facility was developed the important terrestrial habitat areas, ie the less common vegetation associations, were largely left intact. A conclusion of environmental monitoring studies undertaken for the Project was that the construction phase of the development had little, if any, direct effect on the natural mammal and reptile populations (Santos Ltd, 1985).

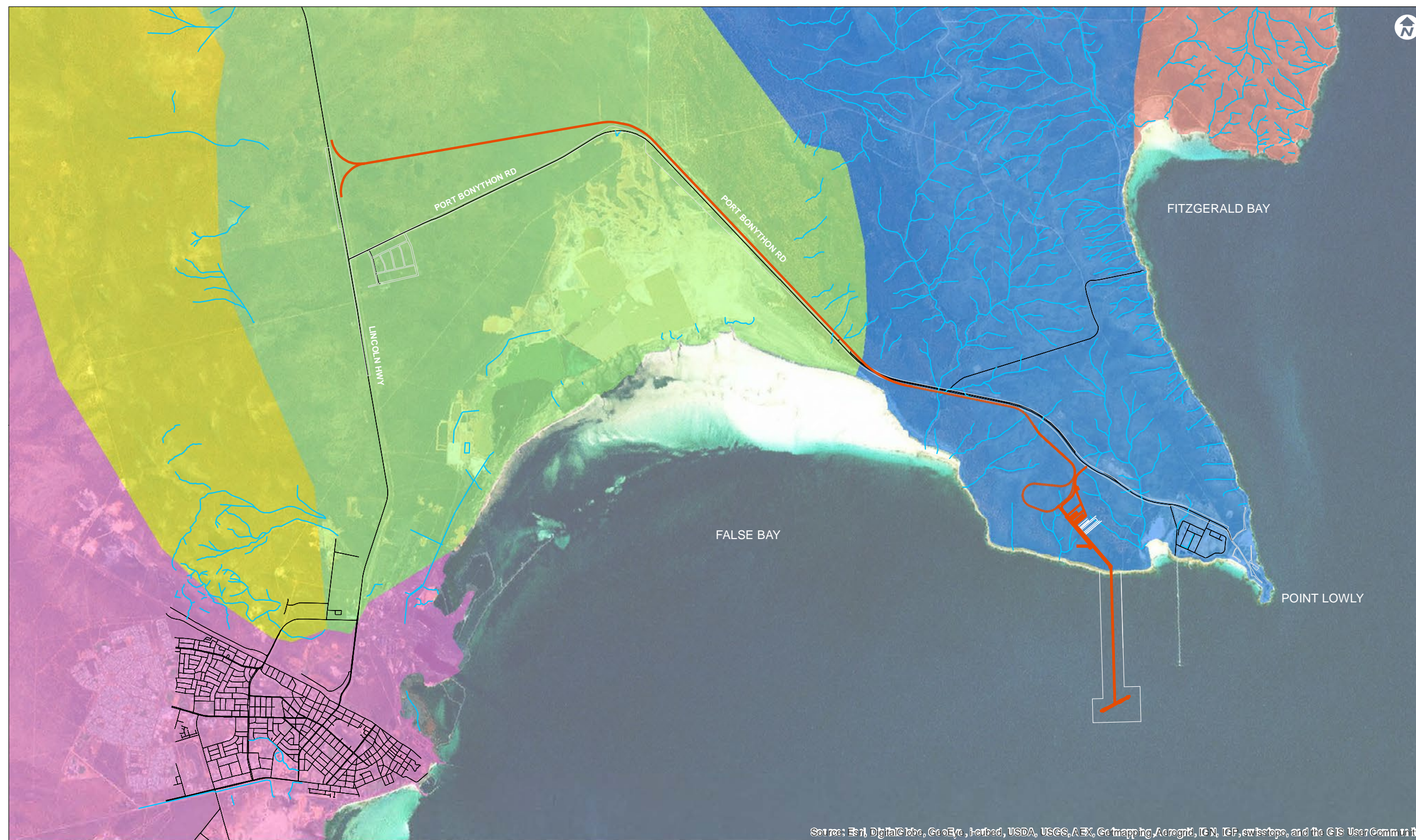
7.4.1.6. Services

The construction of the water main, power transmission line, underground gas and hydrocarbon pipelines along Port Bonython Road have resulted in clearance along their easements, with access to these facilities being maintained along their length.

7.4.2. Bioregion Classification

The Interim Biogeographic Regionalisation of Australia (IBRA) is a national and regional planning framework endorsed by all levels of government as a key tool for identifying land for conservation under *Australia's Strategy for the National Reserve System* (NRMMC, 2009). The latest version, IBRA7, classifies Australia's landscape into 89 distinct bioregions based on common climate, geology, landform, native vegetation and species information. These 89 bioregions are then further refined into 419 subregions which are more localised and homogenous geomorphological units in each bioregion. Subregions are further delineated into IBRA Associations, initially derived from the Environmental Associations of South Australia created by the CSIRO in 1977. The study area falls within the Gawler IBRA Bioregion, and is split between the Arcoona Plateau and Myall Plains Subregions. On a finer scale it is split between Tregalana and Simmens IBRA Associations. These associations are shown on Figure 7.4c.

Figure 7.4c: IBRA Associations around Whyalla and Point Lowly



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- Legend**
- Roads
 - Water courses
- IBRA Associations:**
- Douglas
 - Red Rock
 - Simmens
 - Tregolana
 - Whyalla

Figure 7.4c - IBRA Associations



1:75,000 (at A3)

0 1 2 4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

The Tregalana IBRA Association has an area of approximately 506km² and encompasses the western area of the site, down to a point on Port Bonython Road approximately 13.5km east of the intersection with the Lincoln Highway. This Association is generally characterised in the Department of Environment and Natural Resources Database (accessed through NatureMaps, 24/08/2011) as an erosional, undulating plain, with occasional low sand dunes and pans with some samphire and mangrove flats. Soils consist of red calcareous earths, reddish sands, crusty red duplex soils and grey calcareous loams. Vegetation is low woodland of Myall and Blackoak, Chenopod shrubland of saltbush and bluebush, Chenopod scrubland of samphire and low woodland of mangroves. Climate is semi-arid with low rainfall and high evaporation. Soil moisture tends to be greatest in winter.

The Simmens IBRA Association has an area of approximately 1560km² and includes the eastern area of the study site from the border of the Tregalana IBRA Association. Point Lowly, at the southern extent of this association, is generally characterised as a plateau with steep escarpments and long footslopes mantled by aeolian sand. Soils include powdery red calcareous loams, crusty red duplex soils, reddish sands, white calcareous sands and grey calcareous sands. Vegetation consists of Chenopod shrubland of Saltbush and Plover Daisy, low woodland of Blackoak and False Sandalwood, low open woodland of Myall with Blackoak or Bluebush, open scrub of Beaked Red Mallee, grassland of rolling Spinifex and low woodland of Mangroves. Climate is semi-arid, similar to the Tregalana Association.

7.4.3. Flora

7.4.3.1. Regional Vegetation Context

The South Australian Government has mapped statewide native vegetation data that it holds based on the National Vegetation Information System (NVIS) framework. It provides detail on a regional scale, defining vegetation types which also define faunal habitat, shown on **Figure 7.4d**, and discussed further in **Section 7.4.4** below. Although useful on a regional scale, this mapping has some limitations on a local scale due to the vegetation mosaic being composed using a combination of on-ground surveys and aerial mapping. To provide clarity and define vegetation associations at a local scale, such as in the study area, additional survey effort was required.

7.4.3.2. Description of Vegetation Associations

Within the Tregalana and Simmens IBRA Associations, using the information from previous studies and the vegetation surveys undertaken in October 2011 and August 2012, ten vegetation associations are defined in the study area. These include seven major vegetation associations that are well represented in the study area, with an additional three minor associations of limited extent (refer **Figures 7.4e** and **7.4f**). Within some of the seven major vegetation associations, variants are also described. The ten associations described below provide additional detail and allow for mapping on a finer scale.

Within the land held by Santos in the fenced area adjacent to the Project area, particularly around Weroona Bay, there are other associations which are now protected and managed by Santos. They are minor associations relating to the locally uncommon landform that occurs in that area (e.g. drainage line through sandy beach and dune area). These vegetation associations, described in the Santos Environmental Impact Statement (EIS) (SEA, 1981), include:

- » *Melaleuca lanceolata/Olearia axillaris* inlet (from drainage line to Weeroona Bay)
- » *Myoporum platycarpum* low open woodland
- » Dune field.

The vegetation associations surveyed for the proposed bulk commodities export facility (BCEF) are summarized in **Table 7.4a** and **Table 7.4b**. A full list of plant species for each vegetation association is provided in **Appendix G.2**. The description of these vegetation associations includes their condition, as well as species composition. None of these vegetation associations are recognised as threatened under State or Federal legislation, however, some have significance as habitat for threatened fauna as discussed further in **Section 7.4.4**.

In **Table 7.4a** and **Table 7.4b** the following formatting applies:

- » **Primary sites (bold figure)** where basic description of vegetation and habitat derived
- » Secondary sites (not bold) where additional species variation within a vegetation type were described.

Detailed descriptions of each Vegetation Association are provided in **Appendix G.2**.

Figure 7.4d: Regional Distribution of Vegetation Associations

Figure 7.4d: Regional Distribution of Vegetation Associations

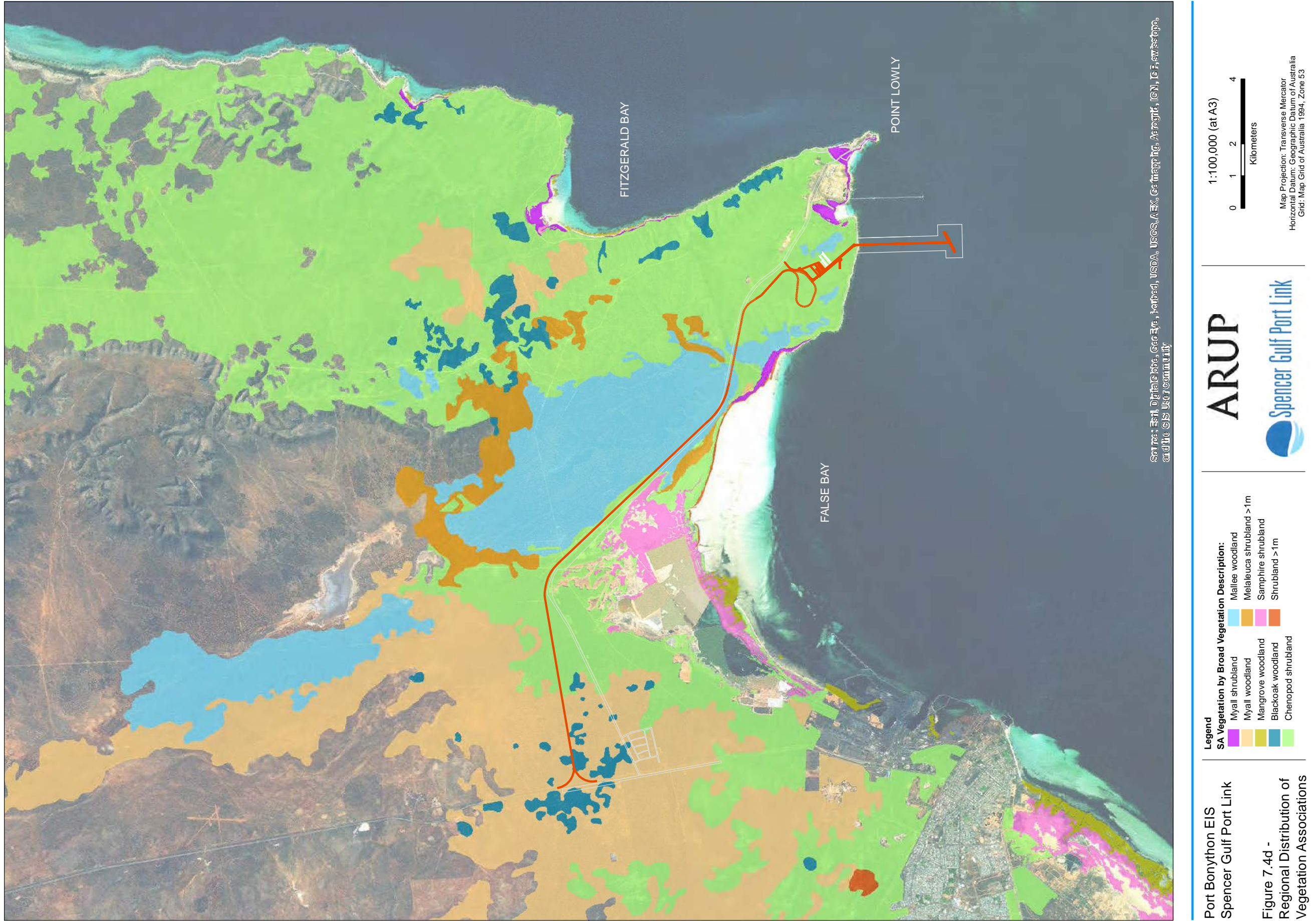
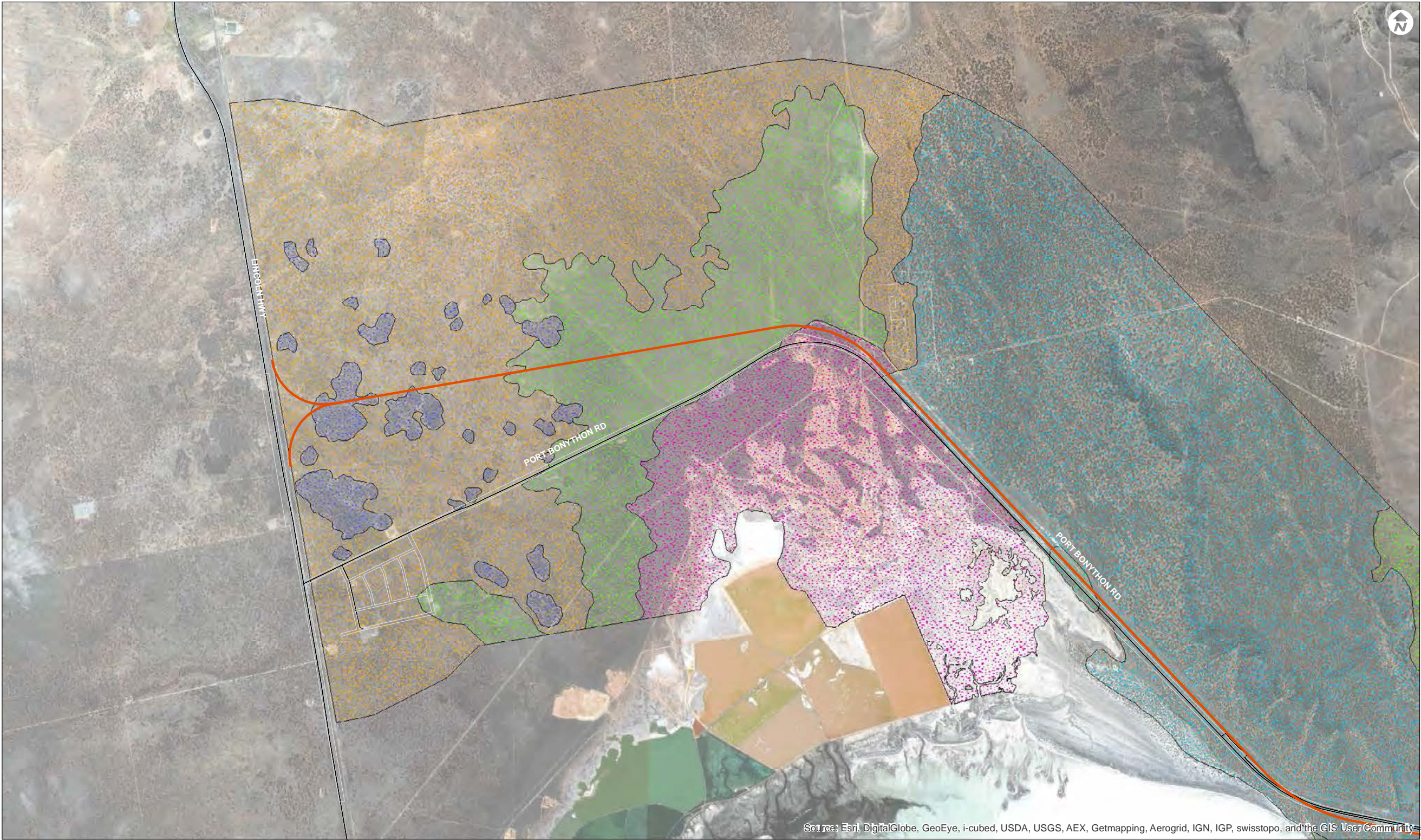


Figure 7.4e: Major Vegetation Associations of Study Area (Eastern)

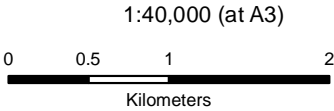


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figure 7.4e - Vegetation Associations

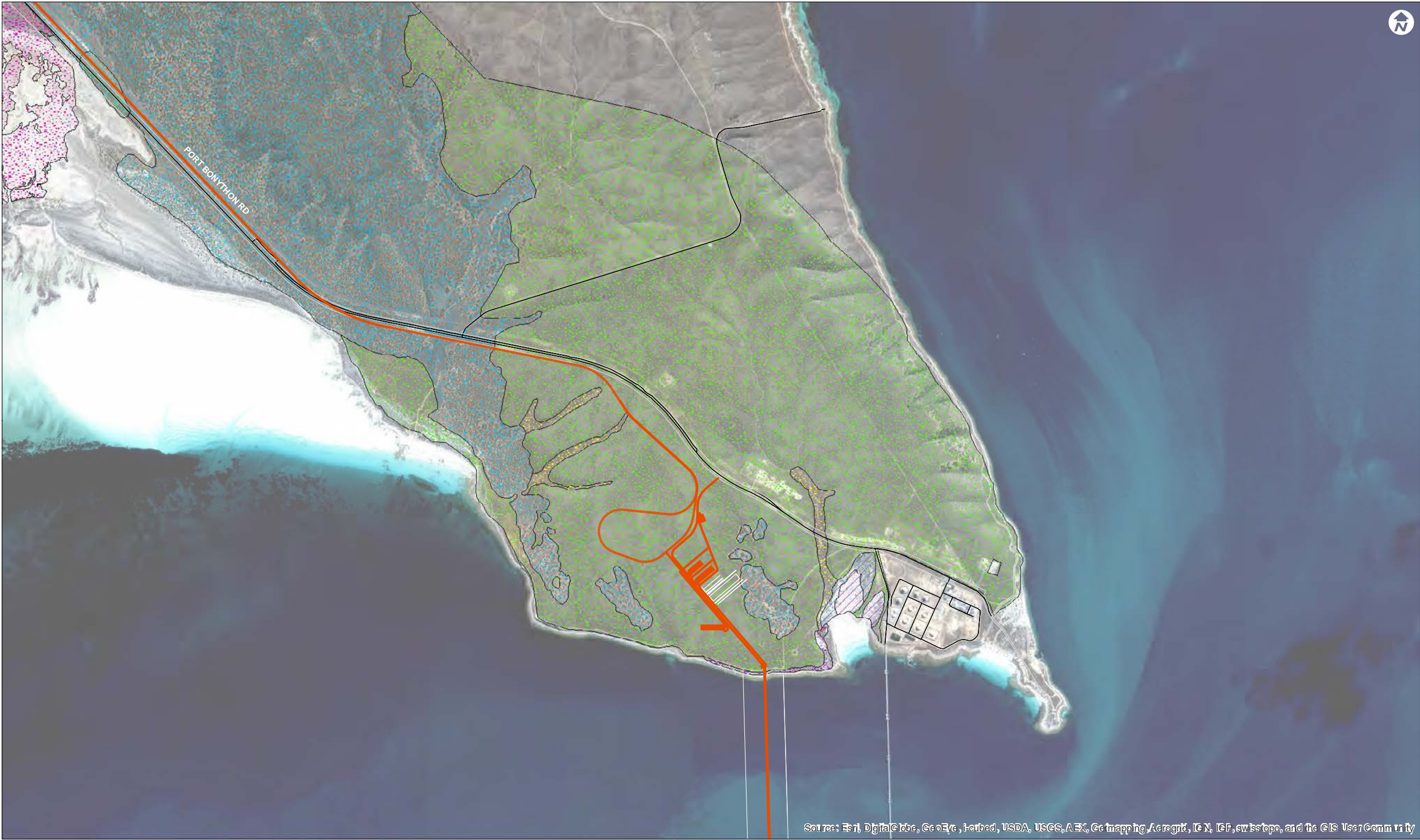
Legend			
Vegetation associations:			
	Association 1 - Myall sparse woodland		Association 6 - Emubush shrubland
	Association 2 - Blackoak woodland		Association 7 - Hopbush shrubland
	Association 3 - Mallee woodland		Association 8 - Boobialla sparse shrubland
	Association 4 - Chenopod shrubland		Santos Association 1 - Myoporum sparse woodland
	Association 5 - Samphire shrubland		Santos Association 2 - Dune field

— Roads



Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

Figure 7.4f: Major Vegetation Associations of Study Area (Western)

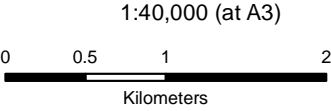


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Figure 7.4f - Vegetation Associations

Legend			
Vegetation associations:			
	Association 1 - Myall sparse woodland		Association 6 - Emubush shrubland
	Association 2 - Blackoak woodland		Association 7 - Hopbush shrubland
	Association 3 - Mallee woodland		Association 8 - Boobialla sparse shrubland
	Association 4 - Chenopod shrubland		Santos Association 1 - Myoporum sparse woodland
	Association 5 - Samphire shrubland		Santos Association 2 - Dune field

— Roads



Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

Table 7.4a: Major Vegetation Associations

Major Vegetation Association	Vegetation Association Variant(s)	Primary Site, Secondary Site	Comments	Habitat Type
1 Western Myall (<i>Acacia papyrocarpa</i>) open low woodland over Pearl Bluebush (<i>Maireana sedifolia</i>), Bladder Saltbush (<i>Atriplex vesicaria</i>), Black Bluebush (<i>Maireana pyramidata</i>), herbs and grasses	1A Western Myall (<i>Acacia papyrocarpa</i>) ± <i>Myoporum platycarpum</i> over Pearl Bluebush (<i>Maireana sedifolia</i>)	32, 6	Variable density of tall shrub/ tree layer. Extensive in region. Generally in good condition with respect to species richness and cryptogamic crust due to low sheep stocking rates.	Western Myall / Black Oak open woodlands over Chenopod shrubs and grasses on sandy clay loam
	1B Pearl Bluebush (<i>Maireana sedifolia</i>) with sparse Western Myall (<i>Acacia papyrocarpa</i>) ± <i>Myoporum platycarpum</i>	38, 1, 3	Variable density of tall shrub/ tree layer. Extensive in region. Generally in good condition with respect to species richness and cryptogamic crust due to low sheep stocking rates.	Bluebush, Saltbush low Chenopod shrublands on sandy clay loam
2 Black Oak (<i>Casuarina pauper</i>) low woodland over Pearl Bluebush (<i>Maireana sedifolia</i>) ± Silver Mulla Mulla (<i>Ptilotus obovatus</i>) ± Bladder Saltbush (<i>Atriplex vesicaria</i>) and Ward's Weed (<i>Carrichtera annua</i>)	2 Black Oak (<i>Casuarina pauper</i>) low woodland over Sheep Bush (<i>Geijera linearifolia</i>), Spiny Fanflower (<i>Scaevola spinescens</i>) tall shrubs over Ruby Saltbush (<i>Enchylaena tomentosa</i>), Balcarra Spear-grass (<i>Austrostipa nitida</i>), ± Silver Mulla Mulla (<i>Ptilotus obovatus</i>) ± Pearl Bluebush (<i>Maireana sedifolia</i>), ± Bladder Saltbush (<i>Atriplex vesicaria</i>) low shrubs over Ward's Weed (<i>Carrichtera annua</i>)	7, 2, 4	Variable density of tall shrub/ tree layer. Extensive in region. Generally in good condition with respect to species richness and cryptogamic crust due to low sheep stocking rates.	Western Myall / Black Oak open woodlands over Chenopod shrubs and grasses on sandy clay loam
3 Beaked Red Mallee (<i>Eucalyptus socialis</i>), Red Mallee (<i>Eucalyptus oleosa ssp. ampliata</i>) open mallee over Sheep Bush (<i>Geijera linearifolia</i>), Dryland Teatree (<i>Melaleuca lanceolata</i>) shrubs over Ward's Weed (<i>Carrichtera annua</i>), Mealy Saltbush (<i>Rhagodia parabolica</i>), Ruby Saltbush (<i>Enchylaena tomentosa</i>), Grey Bindyi (<i>Sclerolaena diacantha</i>) shrubs	3A Beaked red mallee (<i>Eucalyptus socialis</i>) ± red mallee (<i>Eucalyptus oleosa ssp. ampliata</i>) over Mueller's daisy bush (<i>Olearia muelleri</i>) and stiff westringia (<i>Westringia rigida</i>)	33, 14, 18, 19	Established remnants (3B) much more biodiverse than younger regenerating areas (3A,3C).	Mallee on shallow calcareous stony sands
	3B Beaked red mallee (<i>Eucalyptus socialis</i>) ± <i>Myoporum platycarpum</i> over Mueller's daisy bush (<i>Olearia muelleri</i>) and stiff westringia (<i>Westringia rigida</i>).	31, 20, 30	Established remnants (3B) much more biodiverse than younger regenerating areas (3A,3C). Extensive areas in adjacent Cultana Army Training Area.	Mature mallee on shallow calcareous stony sands
	3C Western Myall (<i>Acacia papyrocarpa</i>), Beaked Red mallee (<i>Eucalyptus socialis</i>), bladder saltbush (<i>Atriplex vesicaria</i>).	37, 11, 12, 13	Established remnants (3B) much more biodiverse than younger regenerating areas (3A,3C).	Mallee on shallow calcareous stony sands

Major Vegetation Association	Vegetation Association Variant(s)	Primary Site, Secondary Site	Comments	Habitat Type
4 Pearl Bluebush (<i>Maireana sedifolia</i>), Bladder Saltbush (<i>Atriplex vesicaria</i>) open low Chenopod shrubland over Ruby Saltbush (<i>Enchylaena tomentosa</i>), Spiny Saltbush (<i>Rhagodia spinescens</i>), Spear grass (<i>Austrostipa</i> sp.) shrubs and grasses	4A Pearl Bluebush (<i>Maireana sedifolia</i>) ± Bladder Saltbush (<i>Atriplex vesicaria</i>) ± Black Bluebush (<i>Maireana pyramidata</i>)	34, 35, 28	Slender-billed Thornbill preferred habitat. Extensive in region. Generally in good condition with respect to species richness and cryptogamic crust due to low sheep stocking rates.	Bluebush, Saltbush low Chenopod shrublands on sandy clay loam
	4B Pearl Bluebush (<i>Maireana sedifolia</i>), Tall Sida (<i>Sida petrophila</i>) ± Bladder Saltbush (<i>Atriplex vesicaria</i>) ± Black Bluebush (<i>Maireana pyramidata</i>)	27, 23, 39	Slender-billed Thornbill preferred habitat. Extensive in region. Generally in good condition with respect to species richness and cryptogamic crust due to low sheep stocking rates.	Bluebush, Saltbush low Chenopod shrublands on sandy clay loam
	4C Bladder Saltbush (<i>Atriplex vesicaria</i>) ± Pearl Bluebush (<i>Maireana sedifolia</i>) ± Black Bluebush (<i>Maireana pyramidata</i>)	8, 5	Less biodiverse than 4A and 4B. Poor Slender-billed Thornbill habitat. Extensive in region. Generally in good condition with respect to species richness and cryptogamic crust due to low sheep stocking rates.	Saltbush low Chenopod shrublands on sandy clay loam
5 Brown-headed Samphire (<i>Tecticornia indica</i> ssp. <i>leiostachya</i>), Round-leaved Pigface (<i>Disphyma crassifolium</i>) low shrubland	5 Brown-headed Samphire (<i>Tecticornia indica</i> ssp. <i>leiostachya</i>), Round-leaved Pigface (<i>Disphyma crassifolium</i>), Sea Heath (<i>Frankenia pauciflora</i> ssp. <i>gunnii</i>) low shrubland	10, 9, 15	Low biodiversity. Highly saline. Subject to inundation and poorly drained.	Samphire on saline flats
6 Narrow-leaf Emubush (<i>Eremophila alternifolia</i>), Pearl Bluebush (<i>Maireana sedifolia</i>), Tall Sida (<i>Sida petrophila</i>) over Ruby Saltbush (<i>Enchylaena tomentosa</i>), Grey Bindyi (<i>Sclerolaena diacantha</i>) low shrubs and Ward's Weed (<i>Carrichtera annua</i>)	6 Narrow-leaf Emubush (<i>Eremophila alternifolia</i>), Pearl Bluebush (<i>Maireana sedifolia</i>), Tall Sida (<i>Sida petrophila</i>) over Ruby Saltbush (<i>Enchylaena tomentosa</i>), Grey Bindyi (<i>Sclerolaena diacantha</i>) low shrubs and Ward's Weed (<i>Carrichtera annua</i>)	36, 26	Very minor in extent. Outside impact area. Narrow gullies that will channel, but not hold water during significant rainfall events. Plant diversity and variability relatively high locally, compared with the more homogeneous Bluebush, Tall Sida shrublands (4A, 4B) that surround them.	Fuchsia Bush, Bluebush, Tall Sida in rocky gullies
7 Narrow-leaf Hop-bush (<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>), Sandhill Wattle (<i>Acacia ligulata</i>) open tall shrubland	7 Narrow-leaf Hop-bush (<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>), Sandhill Wattle (<i>Acacia ligulata</i>) ± Senna (<i>Senna artemisioides</i> ssp.) open tall shrubland	17, 16	Very minor in extent. Small area of dunes surrounded by regenerating mallee (3A). Lower habitat value than surrounding mallee.	Wattle, Hopbush shrubland on low sand dunes

Table 7.4b: Minor Vegetation Associations

Minor Vegetation Association	Primary Site, Secondary Site*	Comments	Habitat Type
8 Boobialla (<i>Myoporum insulare</i>) ± Nitre Bush (<i>Nitraria billardierei</i>) open shrubland over Black Bluebush (<i>Maireana pyramidata</i>) and exotic herbs	29, -	Very minor in extent. Very low biodiversity in the unprotected stony area at the base of the low cliffs along the coastline. Will sustain high wind and wave action during storms. Only hardy, salt tolerant species are able to survive.	Very sparsely vegetated stony beach
9 Beaked Red Mallee (<i>Eucalyptus socialis</i>) ± Flase Sandalwood (<i>Myoporum platycarpum</i>), Angled Iceplant (<i>Mesembryanthemum aitonis</i>), Black Bluebush (<i>Maireana pyramidata</i>) shrubland over Onion Weed (<i>Asphodelus fistulosus</i>)	21, 22	Very minor in extent. Dominated by exotic species and ephemeral species. A typical vegetation and habitat due to ephemeral drainage line providing more moisture seasonally and favouring exotic species.	Mallee and ephemeral shrubs and grasses in narrow sandy drainage line
10 Bullock Bush (<i>Alectryon oleifolius</i>), False Sandalwood (<i>Myoporum platycarpum</i>) tall open shrubland over Pearl Bluebush (<i>Maireana sedifolia</i>) and Ward's Weed (<i>Carrichtera annua</i>)	24, 25	Outside impact area. Very minor in extent. Provides roosting and nesting sites for some birds.	Bullock Bush, False Sandalwood groves over Bluebush on shallow sandy clay loam

7.4.3.3. Listed Rare, Vulnerable or Endangered Flora

The EPBC Act is the primary federal legislation protecting biodiversity. In South Australia, the NPW Act protects biodiversity at a state level. A review of the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) EPBC database indicated two species as being potentially present in the region as shown in **Table 7.4c**. One species, listed as Vulnerable in South Australia (NPW Act Schedule eight) is also described.

Red

Table 7.4c: Threatened flora species potentially present on site

Species	Conservation Status*		Observed? Yes/No	Comments
	NPW Act 1972	EPBC Act 1999		
Nodding Rufous-hood (<i>Pterostylis mirabilis</i> - previously <i>Pterostylis</i> sp. Eyre Peninsula (R. Bates, 1974))	V	V	N	<i>Pterostylis mirabilis</i> occurs on Eyre Peninsula in South Australia, where it is known from about 12 localities. Populations occur within an estimated area of 190km ² , and are thought to comprise about 220 plants. This species occurs in coastal areas to areas about 100km inland, in the high country (75–200m above sea level) between Cleve and Kimba, in the 300mm rainfall zone (SEWPaC, 2008b) growing in association with broombush (<i>Melaleuca uncinata</i>), native pine (<i>Callitris</i> sp.) and mallee (<i>Eucalyptus</i> sp.) (DEH, 2007b). There are no records near Port Bonython and habitat where it has been observed does not exist at the proposed development site.
Bead Samphire (<i>Tecticornia flabelliformis</i>)	V	V	N	Bead Samphire grows in Western Australia, South Australia and Victoria. In South Australia, there are isolated sub-populations in the south-east, Northern Lofty and Eyre Peninsula regions. On Eyre Peninsula, Bead Samphire has an extent of occurrence in excess of 22,000km ² and grows between Fowlers Bay in the west, and Koppio, Tod Reservoir in the east. There is also one offshore sub-population on Flinders Island. (DEH 2007). There are no records near Port Bonython and its presence in the impact area of the proposed development is extremely unlikely.
Sandalwood (<i>Santalum spicatum</i>)	V		N	<i>Santalum spicatum</i> is found from the west Australian coast, wheatbelt and Nullarbor Plain into South Australia. It occurs across the northern part of the Eyre Peninsula and in the Flinders Ranges. Whilst being generally uncommon and sparsely distributed, <i>Santalum spicatum</i> occurs extensively throughout the myall and mulga plains of northern Eyre Peninsula and throughout the Flinders and Gawler Ranges. The extent of occurrence of Sandalwood across northern Eyre Peninsula is approximately 27,000km ² , occurring from near Andamooka in the north to Darke Peak in the south (Pobke 2007). <i>Santalum spicatum</i> is a root parasite that occurs on hillslopes of calcrete, consolidated dunes with sand to loam, ridges, hillcrests and plains with loam to clay loam and relies on host species, including Acacia, Allocasuarina, Melaleuca and herbaceous species (Pobke, 2007). The Project area is on southern extremity of current distribution (SA Herbarium records). <i>Santalum spicatum</i> was recorded at nine locations in Mallee, Mulga and Myall Woodland and Bluebush Uplands within the Cultana Expansion Area (AECOM 2011), north and west of the current Project area, the closest observation being approximately 15km north of the proposed railway corridor. The ongoing threats that include high grazing pressure, habitat fragmentation and illegal harvesting all lead to a lack of recruitment and establishment and keep this species in the Vulnerable category at State level, though there is a suggestion that it may be appropriate to be reclassified as Rare (Pobke 2007). There is a possibility that <i>S. spicatum</i> exists in the myall woodland vegetation type at the western end of the proposed railway corridor, however, it was not recorded in recent field surveys.

*SA = South Australian National Parks and Wildlife Act 1972; EPBC = Federal Environmental Protection & Biodiversity Conservation Act, 1999

U = Uncommon; R = Rare; V = Vulnerable; E = Endangered; X = Extinct

7.4.3.4. Weeds

Weeds recorded in the Project area include those that are declared under the *Natural Resources Management Act 2004* (NRM Act), as well as those considered aggressive environmental weeds. The main declared and environmental weeds that were observed during vegetation surveys undertaken for the Project are presented in Table 7.4d. A further list of environmental weeds that could possibly occur in the study area is provided in **Appendix G.3**.

Table 7.4d: Weeds of concern in the study area

Rating	Species	Common Name	Comments
+	<i>Asphodelus fistulosus</i>	Onion Weed	Common, though not dominant except in highly disturbed areas
*	<i>Bromus rubens</i>	Red Brome	Common, though not dominant
*	<i>Carrichtera annua</i>	Ward's Weed	Common and dominant understorey in all vegetation types throughout most of the surveyed area
*	<i>Carthamus lanatus</i>	Saffron Thistle	Occasional in wetter parts
*	<i>Centaurea melitensis</i>	Malta Thistle	Occasional individuals
+	<i>Echium plantagineum</i>	Salvation Jane	Occasional in wetter parts
*	<i>Emex australis</i>	Three-corner Jack	Minor infestation in drainage area 4km west of Port Bonython
*	<i>Eragrostis minor</i>	Small Stink-grass	Occasional patches in disturbed areas
*	<i>Limonium lobatum</i>	Winged Sea-lavender	Occasional individuals in disturbed areas
+	<i>Lycium ferocissimum</i>	African Boxthorn	Occasional individuals
+	<i>Marrubium vulgare</i>	Horehound	Minor infestation in drainage area 4km west of Port Bonython
*	<i>Medicago polymorpha</i>	Burr-medic	Common throughout the Chenopod shrubland and myall low woodland areas (previously grazed)
*	<i>Mesembryanthemum aitonis</i>	Angled Iceplant	Common in regenerating mallee areas and disturbed saline areas
*	<i>Reichardia tingitana</i>	False Sowthistle	Occasional in sandier part in the mallee close to the coast
*	<i>Salvia verbenaca</i>	Wild Sage	Occasional in disturbed areas immediately adjacent to road
*	<i>Schismus barbatus</i>	Arabian Grass	Occasional in open areas between mallee in disturbed areas
*	<i>Sisymbrium erysimoides</i>	Smooth Mustard	Occasional patches under mallee
*	<i>Solanum nigrum</i>	Black Nightshade	Occasional individuals
*	<i>Sonchus oleraceus</i>	Common Sow Thistle	Occasional in disturbed areas immediately adjacent to road
+ Plants that are declared species under the Natural Resources Management Act 2004			
* Plants that are not declared but considered aggressive environmental weeds (Environmental Weeds, refer Appendix G.3)			

Landholders have an obligation under the NRM Act to control declared weeds. Therefore, the control of weeds declared under the NRM Act during construction and operation, such as preventing the spread of Onion Weed, African Boxthorn and Horehound, will be an important objective of the environmental management plan (refer **Chapter 19, Environmental Management Plan**).

7.4.4. Terrestrial Fauna

7.4.4.1. Terrestrial Fauna Habitat

The fauna habitats, both coastal and those more typical of arid inland environments, were described in **Section 7.4.3**. These are summarised below along with several minor habitats of limited extent in, or adjacent to, the study area:

- » Myall and Black oak open woodlands (Vegetation Associations one and two)
- » Mallee woodlands (Vegetation Association three)
- » Low Chenopod shrublands (Vegetation Association four)
- » Samphire shrublands (Vegetation Association five)
- » Narrow-leaf Emubush shrublands in rocky gullies (Vegetation Association six)
- » Sandhill Wattle open shrubland on low sand dunes (Vegetation Association seven)
- » Boobialla open shrubland on rocky beach (Vegetation Association eight)
- » Sandy beach and dunes (occurs in Weroona Bay on Santos land to the east of the Project area (Santos Association two))
- » Mangrove flats and tidal areas (small groups of mangroves occur along the coast in the area near the False Bay coastal homes).

Many of these habitats are regionally common and extensive as shown on **Figure 7.4d**. Low Chenopod shrublands are the most widespread habitat in the region, and is also important for a protected bird species (refer **Section 7.4.4.2**). Myall and Blackoak open woodlands are the next most represented habitat in the region and also comprise important habitat for the aforementioned protected bird species.

The distribution of vegetation cover across the region is relatively consistent, with no significant disturbances that fragments habitats or creates barriers for movement of fauna.

The occurrence and distribution of the main fauna groups; birds, mammals, amphibians and reptiles is discussed in the following sections. **Appendix G.4** contains a collation of species records from some of the major studies in the area. This list documents species recorded over a 30 year period and a range of seasons and helps to identify the variability of species in the area that can not be captured by a single survey.

7.4.4.2. Birds

A total of 168 bird species (including shorebirds and migratory species) are recorded for the general Point Lowly region and the full list is included in **Appendix G.4**. This includes Slender-billed Thornbill – western subspecies (*Acanthiza iredalei iredalei*) which is listed as Vulnerable under the EPBC Act as shown in the EPBC Protected Matters search, **Appendix G.4**. As required, to satisfy the requirements of the EPBC Act, as outlined earlier in **Section 7.3.1**, additional field surveys were undertaken in August 2012, to determine the occurrence of the species in the study area. In the August 2012 survey, a total of 60 bird species were recorded from the 17 survey sites (**Figure 7.2c**) or opportunistically within the Study Area. This confirmed the presence of the Slender-billed Thornbill within the immediate Project footprint and more generally in the study area. One species, Scarlet-chested Parrot (*Neophema splendida*), was a new record for this area, but is likely a vagrant, and is listed as Rare under the NPW Act. Twenty-one bird species were observed opportunistically, six of which were not recorded in survey sites. The complete report on the bird survey is included in **Appendix G.1**.

An average of 9.5 bird species were recorded at each survey site with the lowest number being three species and the highest being 15 species. Species diversity recorded for each site is presented in **Table 7.4e**.

The Vegetation Associations which tend to have low floristic diversity are usually structurally less diverse. Generally these are also found to have lower bird species diversity. Vegetation associations in the study area that clearly show this are the samphire (Vegetation Association five) and saltbush sites (Vegetation Association 4C), both having very low species diversity (three species and four species respectively). Also showing below average species diversity were both of the Pearl Bluebush sites (Vegetation Association 4A and 4B) (8.5 and 6.5 species respectively). These habitat types are not suitable for foliage feeders and perch hunting species but are more suitable for smaller insectivorous species that prefer to feed on or low to the ground. Species include the Stubble Quail (*Coturnix pectoralis*), Australian Pipit (*Anthus novaeseelandiae*), White-winged Wren (*Malurus leucopterus*), Rufous Fieldwren (*Calamanthus campestris*), Brown Songlark (*Cincloramphus cruralis*), White-fronted Chat (*Epthianura albifrons*) and Slender-billed Thornbill (*Acanthiza iredalei*).

The Narrow-leaf Hop-bush site (Vegetation Association seven) and the Myall/Mallee regeneration site (Vegetation Association 3C), both of which showed a high level of disturbance through road works and off road traffic, also showed a lower than average species diversity. Although floristic diversity was not particularly low the amount of disturbance in these two sites may contribute to the slightly below average species diversity of nine species.

The scattered Myall over Bluebush site (Vegetation Association 1B) shows a gradual increase in average species diversity (ten) with the introduction of species more reliant on habitat types with perching opportunities. The Yellow-rumped Thornbill found at this site is typical of an “edge” inhabiting species which prefers to live where scrub and grassland meet (Schodde & Tidemann, 1990).

The Vegetation Associations with the highest species diversity were the Western Myall (Vegetation Association 1A) and Blackoak sites (Vegetation Association Two) which had a total of 14 and 15 species respectively. The presence of trees and shrubs, such as Blackoak and Myall, provides a middle and/or upper storey that can accommodate foliage feeders and perch hunters. Frequently recorded perch hunters in these sites included White-browed Babbler (*Pomatostomus superciliosus*), Grey Fantail (*Rhipidura albiscapa*), Jacky Winter (*Microeca fascians*) and Red-capped Robin (*Petroica goodenovii*). Frequently recorded foliage-feeders included Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*) and Singing Honeyeater (*Lichenostomus virescens*).

Both Mallee sites (Vegetation Association 3A and 3B) were also high in species diversity (13 and 11 species) and included species more often associated with this habitat type such as Weebill (*Smicronis brevirostris*) and Turquoise Wren (*Malurus splendens musgravi*).

The Emubush rocky gully site (Vegetation Association six) also had a high floristic and structural diversity which will contribute to its relatively high bird species diversity (14).

Few spring visitors were recorded in the area possibly being too early in the season, although one White-winged Triller (*Lalage sueurii*) was recorded opportunistically. Other species which may be expected to occur later in the season as evidenced by previous surveys in the area (**Appendix G.4**) will include Cockatiel (*Nymphicus hollandicus*), Budgerigar (*Melopsittacus undulates*), Orange Chat (*Epthianura aurifrons*), Rainbow Bee-eater (*Merops ornatus*), Rufous Songlark (*Cincloramphus mathewsi*), White-browed Woodswallow (*Artamus superciliosus*) and Masked Woodswallow (*Artamus personatus*). (Robinson et al, 2000).

Also expected to occur are nocturnal species such as Owlet Nightjar (*Aegotheles cristatus*), Tawny Frogmouth (*Podargus strigoides*), Southern Boobook (*Ninox novaeseelandiae*) and Spotted Nightjar (*Eurostopodus argus*) (Robinson et al, 2000).

Table 7.4e: Species diversity recorded for each site

Vegetation Association		Number of One Hour Surveys	No. of Species per Site (Average Where >1 Survey)
1A	Western myall (<i>Acacia papyrocarpa</i>) ± Myoporum (<i>Myoporum platycarpum</i>) over pearl bluebush (<i>Maireana sedifolia</i>)	1	14
1B	Pearl bluebush (<i>Maireana sedifolia</i>) with sparse western myall (<i>Acacia papyrocarpa</i>) ± Myoporum (<i>Myoporum platycarpum</i>)	3*	10
2	Black oak (<i>Casuarina pauper</i>) ± Myoporum (<i>Myoporum platycarpum</i>) ± <i>Acacia papyrocarpa</i> low woodland over <i>Geijera linearifolia</i> , <i>Scaevola spinescens</i> tall shrubs over <i>Enchylaena tomentosa</i> , <i>Austrostipa nitida</i> , ± <i>Ptilotus obovatus</i> ± <i>Maireana sedifolia</i> , ± <i>Atriplex vesicaria</i> low shrubs over <i>Carrichtera annua</i> .	1	15
3A	Beaked red mallee (<i>Eucalyptus socialis</i>) ± red mallee (<i>Eucalyptus oleosa</i> ssp. <i>ampliata</i>) over Mueller's daisy bush (<i>Olearia muelleri</i>) and stiff westringia (<i>Westringia rigida</i>)	1	13
3B	Beaked red mallee (<i>Eucalyptus socialis</i>) ± Myoporum (<i>Myoporum platycarpum</i>) over Mueller's daisy bush (<i>Olearia muelleri</i>) and stiff westringia (<i>Westringia rigida</i>)	1	11
3C	Western Myall (<i>Acacia papyrocarpa</i>), beaked red mallee (<i>Eucalyptus socialis</i>), bladder saltbush (<i>Atriplex vesicaria</i>)	1	8
4A	Pearl bluebush (<i>Maireana sedifolia</i>) ± bladder saltbush (<i>Atriplex vesicaria</i>) ± blackbush (<i>Maireana pyramidata</i>)	2*	8.5
4B	Pearl bluebush (<i>Maireana sedifolia</i>), tall sida (<i>Sida petrophila</i>) ± bladder saltbush (<i>Atriplex vesicaria</i>) ± blackbush (<i>Maireana pyramidata</i>)	2*	6.5
4C	Bladder saltbush (<i>Atriplex vesicaria</i>) ± pearl bluebush (<i>Maireana sedifolia</i>) ± blackbush (<i>Maireana pyramidata</i>)	1	5
5	Brown headed samphire (<i>Tecticornia indica</i> ssp. <i>Leiostachya</i>), round leaved pigface (<i>Disphyma crassifolium</i>), sea heath (<i>Frankenia pauciflora</i> ssp. <i>Gunnii</i>) low shrubland	1	3
6	Narrow leaf emubush (<i>Eremophila alternifolia</i>), pearl bluebush (<i>Maireana sedifolia</i>), tall sida (<i>Sida petrophila</i>) shrubland over <i>Carrichtera annua</i> , <i>Enchylaena tomentosa</i> , <i>Sclerolaena diacantha</i> low shrubs.	1	14
7	Narrow leaf hop bush (<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>), sandhill wattle (<i>Acacia ligulata</i>) open tall shrubland	1	9
8	<i>Myoporum insulare</i> ± <i>Nitraria billardiarei</i> open shrubland over <i>Maireana pyramidata</i> and exotic herbs.	1**	1**

* Additional survey effort for presence of Slender-billed Thornbill (western), protected under EPBC Act and presence likely in these habitat types

**Vegetation Association eight was a minor association of limited area, as such, it is not comparable with other survey locations.

Species of conservation significance, including the Slender-billed Thornbill (western) and Scarlet-chested Parrot observed in the survey, are discussed in more detail below.

Slender-billed Thornbill – western subspecies (*Acanthiza iredalei iredalei*)

(Listed as Vulnerable under the EPBC Act 1999 and Rare under the NPW Act 1972)

The Slender-billed Thornbill (western) is one of three subspecies that occur in disjunct populations throughout the saltbush and samphire country of southern and western Australia (Frith 1982). The extent of occurrence is estimated at 1,400,000km², based on published maps, and is considered of medium reliability (Garnett & Crowley, 2000).

Arid zone habitats include mid-dense shrublands dominated by Bluebush (*Maireana* spp) and Saltbush (*Atriplex* spp.) often with few or no trees (Marchant & Higgins 1993, Pizzey & Knight 1997, Garnett & Crowley 2000). It has been noted that they may have a particular preference for areas dominated by Pearl Bluebush (*Maireana sedifolia*) but will occur less frequently in shrublands dominated by Bladder Saltbush (*Atriplex vesicaria*) if *M. sedifolia* is present as a component of the plant community (Matthew 1994, G. Carpenter pers. comm.).

It is estimated that the home range of one nesting pair covers a 10Ha area based on observations by Recher and Davis (2000) and Matthew (2012, pers. comm.). It is also thought that the home range may be larger for groups in the non-breeding season (Matthew 2012, pers. comm.). Garnett and Crowley (2000) give an estimation of 100,000 breeding birds over their area of occupancy (400,000km²) but with a low level of reliability. While Matthew suggests a density of about 0.08 birds/Ha in the Gawler Ranges and a density of approximately 0.12 birds/Ha near Whyalla (Matthew 2012, pers. comm.). The differences in these figures may be due to various factors such as variable observation conditions, seasonal influences, differences in habitat etc.

Very little is known about the breeding biology of this bird and it is possible that they have a cooperative breeding system based on studies of other species of thornbills (Recher and Davis 2000). Current populations of this subspecies are thought to be stable and have now been deemed as a species of least concern in “The Action Plan for Australian Birds 2010” (Garnett et al, 2011).

A group of several Slender-billed Thornbills (western) were observed during the current surveys near the proposed 6.1km rail loop. A group of birds was also observed in a similar location during a survey undertaken in 2001 (pers. comm. M. DeJong 2011). Numerous records of the species have been made in both the Cultana training area and the Cultana expansion area north of the proposed development (Aecom 2011).

The Slender-billed Thornbill’s (western) at the Project site are part of the Gawler Ranges/Upper Eyre Peninsula subpopulation (Figure 7.4g), the largest subpopulation of the subspecies, estimated at a minimum of 15, 000 birds (SEWPaC, 2012d).

The survey for the Project detected a group of at least five birds in Vegetation Association 4B on the 15 August, 2012. These birds were first detected by call during the transect. This area was revisited on the 17 August 2012 and was extensively searched for a period of two hours covering about 7km. (refer Table 7.4f). Two birds were first identified 95m from the sighting on 15 August 2012. About 20 minutes later three or four birds were seen 100m away from the first sighting and 30 minutes later two birds were seen 140m from the second sighting which was a total of 250m away from the sighting on the 15 August 2012. It is unknown whether the groups of Slender-billed Thornbills identified in the study area in Vegetation Association 4B were the same birds or different groups. This is impossible to determine without colour banded individuals. It is noted that a group of several Slender-billed Thornbills were also observed at the site of the proposed BCEF in 2001. (Playfair et al 2001).

Table 7.4f: Additional search for Slender-billed Thornbill (western)

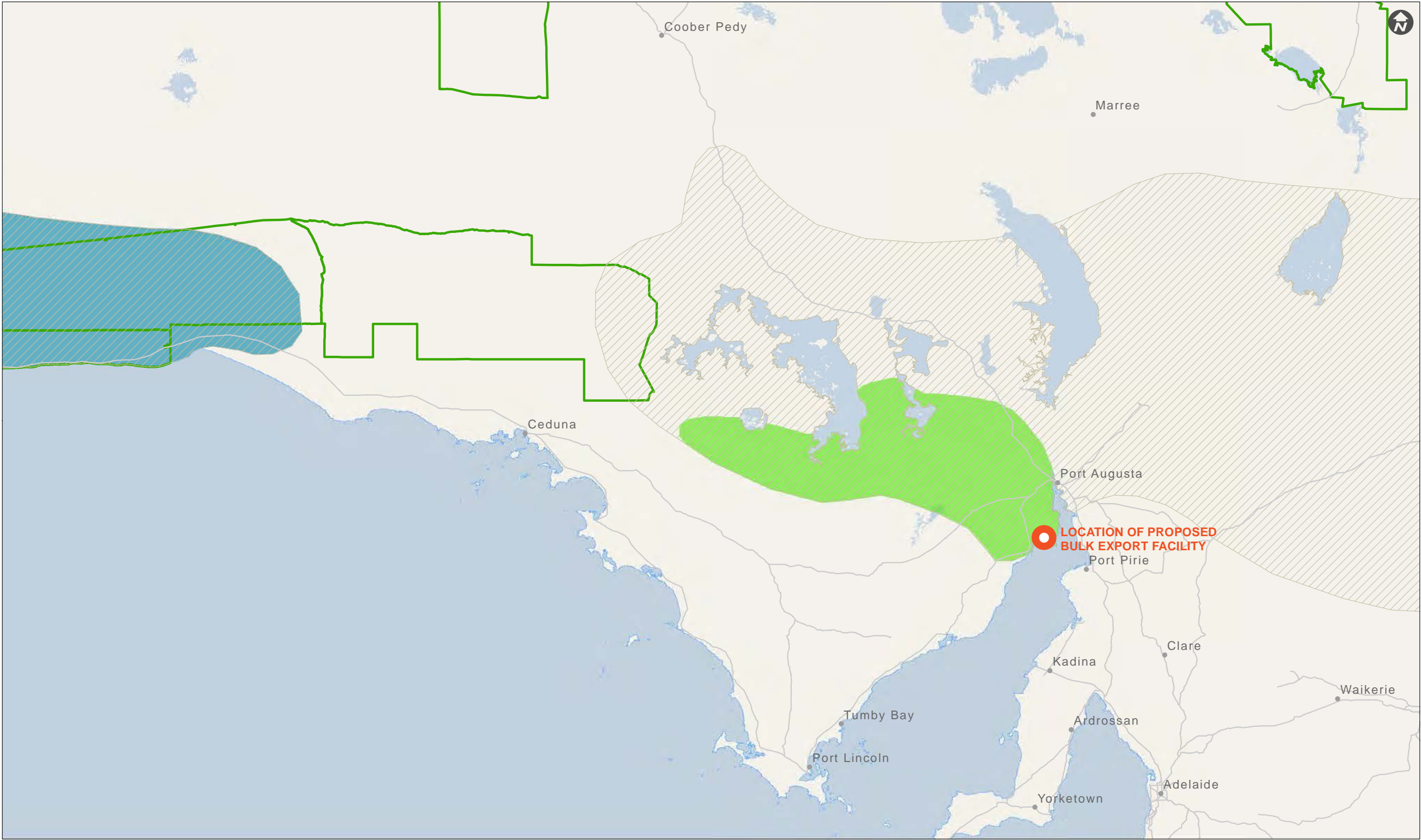
Sighting	Time	Number of Birds	Notes	Distance from Other Sightings
1	0854	2	In Bluebush, Saltbush, Sida with White-winged Wrens	240m from three 95m from sighting on 15/8
2	0912	3 or 4	In Bluebush, Saltbush, Sida with White-winged Wrens	100m from one 110m from sighting on 15/8
3	1015	2	In Bluebush, Saltbush, Sida with White-winged Wrens	144m from two 250m from sighting on 15/8

Scarlet-chested Parrot (*Neophema splendida*)

(Listed as rare under the NPW Act)

The range of this species fluctuates substantially in response to climatic conditions (Garnett & Crowley, 2000). Its distribution is not continuous but extends throughout the southern interior of Australia. One bird, a female and possibly immature (based on the dullness of the blue on the face) was sited in the patch of isolated Mallee in Vegetation Association 3B. The study site is on the extreme edge of its range and this nomadic species is unlikely to breed within the study area, but is likely to be an occasional visitor. For these reasons, this species is unlikely to be affected by any development at the study site.

Figure 7.4g: Estimated extent of occurrence of sub-populations of Slender-billed Thornbill



Port Bonython EIS
Spencer Gulf Port Link

Figure 7.4g -
Estimated extent of occurrence
of sub-populations of
Slender-billed Thornbill

- Legend**
- Gawler Ranges Subpopulation
 - Nullabor Subpopulation
 - National park
 - Preferred habitat



1:3,000,000 (at A3)

0 50 100 200
Kilometers

Map Projection: Geographic Lat / Long
Horizontal Datum: World Geodetic System 1984
Grid: Geographic Lat / Long

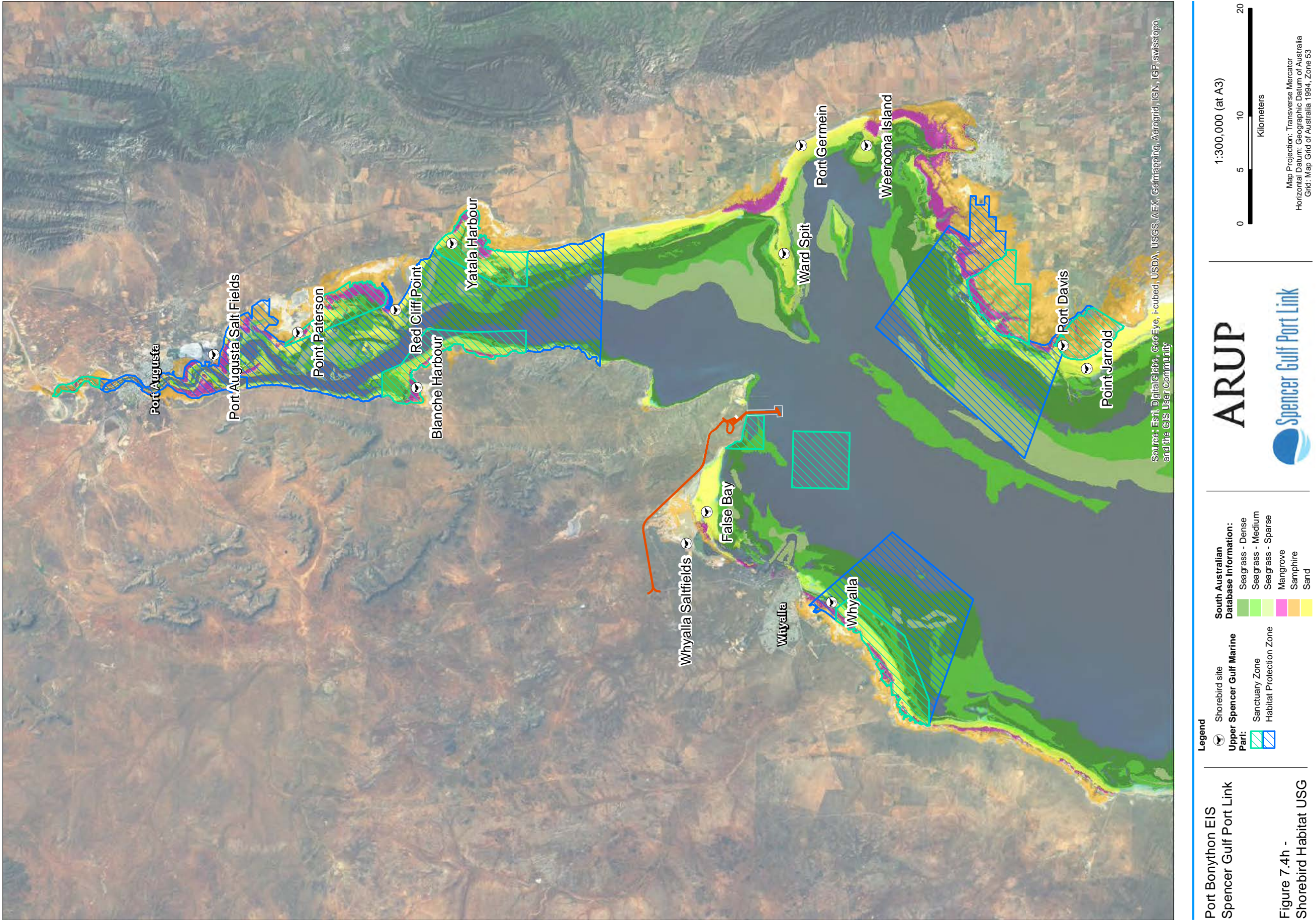
7.4.4.3. Shorebirds

An important bird group to consider are the shorebirds, because of the coastal wetlands of the Upper Spencer Gulf being renowned as an important shore bird habitat. The Upper Spencer Gulf is defined for the purposes of this Chapter as the area north of an east-west line from Point Jarrod across to Cowleds Landing, as consistent with the zoning for the Upper Spencer Gulf Marine Park (DEWNR, 2012b; discussed in **Chapter 14, Marine Ecology**). This encompasses the areas around Whyalla, Port Pirie and Port Augusta and includes the coastal regions of the study area. False Bay and the Whyalla salt fields are recognised areas for shore birds to the south of the study area as illustrated in **Figure 7.4h**.

Shorebirds (*Charadriiformes*) which include sandpipers, plovers, avocets, stilts, snipe, oystercatchers, pratincoles, jacanas, stone curlew and the plains-wanderer are also known as waders, and feed on coastal mudflats, estuaries, beaches and edges of inland wetlands. These habitats do not occur within the coastal footprint of the Project, i.e. in the vicinity of the proposed jetty. They occur within False and Fitzgerald Bay, which are well removed from the Project impact area. Some of the major coastal wetlands in Upper Spencer Gulf and wader sites are shown on **Figure 7.4h**.

This group contains a number of migratory species that are protected under the EPBC Act (refer **Section 7.3.1**) and migratory bird agreements with Japan, China and the Republic of Korea.

Figure 7.4h: Shorebird Habitat USG



7.4.4.4. Mammals

A list of mammal species likely to occur in the study area was compiled using data from previous studies in the region spanning a 30 year period and current species databases with a particular focus on similar habitats present in the study area. The full list of species is included in **Appendix G.4**. This list indicated that no species protected under State or Federal legislation are expected to occur in the study area. Due to the information already available on mammals from the area, and the lack of threatened species, it was determined for this Project that resources be focused on survey effort for threatened bird species. A summary of the key findings from previous studies on mammals is provided.

Surveys were carried out in September 2007 on Tregalana Station (the boundary of which encompasses the western extent of the current development) as part of the Olympic Dam Expansion studies (BHPB, 2009). With respect to the habitats present in the study area:

- » Multiple captures of the Stripe-faced Dunnart (*Sminthopsis macroura*) and the introduced House Mouse (*Mus musculus*) from *Maireana sedifolia*/*Atriplex vesicaria* woodland (comparable to Vegetation Association one and four and regionally common)
- » One Stripe-faced Dunnart from *Acacia papyrocarpa*/*Myoporum platycarpum* woodland (comparable to Vegetation Association one)
- » Group of Western Grey Kangaroos (*Macropus fuliginosus*) in *Casuarina pauper* woodland (comparable to Vegetation Association 2).

The most recent surveys in the region were undertaken for the Cultana Expansion Public Environmental Report (Department of Defence, 2011) on land to the north and west of the current EIS study area. While these surveys did not target mammals specifically, they did record opportunistic sightings of Western Grey Kangaroos (*Macropus fuliginosus*) and Red Kangaroos (*Macropus rufus*).

A survey of mammals was conducted at the Santos facility adjacent to the proposed development in May 1981 (Santos, 1981). While the survey is dated it provides a baseline understanding on the variety of mammal species present in habitat within the Project area. The Santos survey provided the following observations:

- » The mammal fauna of the region is patchy and depauperate, containing a large exotic component. It comprised an estimated ten native species and six introduced species (excluding vagrant sheep)
- » The House Mouse (*Mus musculus*) was by far the most abundant mammal in the area and the presence of juveniles and pregnant or lactating females indicated that the population is breeding (E. Yeatman 1981, reported in Santos 1981). Mice were trapped in all habitats and abounded in the creeklines

- » Of the native mammals, the presence of Common Dunnart (*Sminthopsis murina*), was identified in mallee behind and to the west of Weeroona Bay. This small carnivorous marsupial is widely but patchily distributed over the State and on known distributional records was not expected to occur near the site. The area where this species was recorded is now protected and managed by Santos within its fenced boundary
- » Bats were sighted in all habitats. Four species may be expected to occur, although only one, Lesser Long-eared Bat (*Nyctophilus geoffroyi*) was actually recorded – in *Myoporum platycarpum* woodland behind Weeroona Bay
- » Both Grey Kangaroos (*Macropus fuliginosus*) and Euros (*Macropus robustus*) were observed, reflecting the local availability of their respectively preferred plains and highland habitat. The Red Kangaroo (*Macropus rufus*) was expected to occasionally visit the area (Yeatman 1981, reported in Santos 1981).

The studies (Santos, 1981 and BHPB, 2009) note that the population of native mammals in the study area has decreased since European settlement, primarily through habitat clearance and the introduction of domestic and feral animals, refer **Section 7.4.4.7** below.

7.4.4.5. Reptiles and Amphibians

A number of detailed studies conducted within, and the region adjacent to, the study area have occurred across the last 32 years which included surveys of reptiles and amphibians associated with:

- » Santos EIS and operation (1981 to unknown)
- » Cultana Training Area and Expansion Area Public Environment Report (PER) (2005-2010)
- » Olympic Dam Expansion EIS; including infrastructure corridor connecting desalination plant at Point Lowly (2007).

Review of these studies, along with searches of South Australian and Federal databases, resulted in only one recorded threatened species; a single record in 1950 of a Carpet Python (*Morelia spilota*) near the tip of Point Lowly (discussed in **Section 7.4.3.3**). A summary of results from previous studies is presented below.

Two species of frogs are known to occur in the study area, the Spotted Grass Frog (*Limnodynastes tasmaniensis*) and the Trilling Frog (*Neobatrachus centralis*), but are unlikely to be present on or near the 6.1km railway loop or bulk storage facilities, or along most of the 17.5km rail line in the absence of surface water or swamps, except near the floodway to False Bay. Both are common, widely distributed and may inhabit the swamps behind False Bay.

Seven species of lizards and snakes were recorded during two brief surveys undertaken for the Santos EIS in December 1980 (Santos, 1981). In addition to this, it was stated that based on known distributions, the reptilian fauna of the site and near vicinity could include a further 41 species, giving a total of 48. This comprises six Dragon lizards (*Family Agamidae*) eight Geckoes (*Gekkonidae*), five Legless Lizards (*Pygopodidae*), one Goanna (*Varanidae*), 15 Skinks (*Scincidae*), one Blind Snake (*Typhlopidae*), 11 Front-fanged Snakes (*Elapidae*), and one Python (*Boidae*) (Mirtschin, 1981).

Surveys in 2007 on Tregalana Station also included reptile and amphibian surveys. While no amphibians were recorded, the following results were reported for reptiles:

- » Highest species diversity (five species) was associated with *Acacia papyrocarpa*/*Myporum platycarpum* woodland (comparable to Vegetation Association one)
 - Crested Dragon (*Ctenophorus cristatus*)
 - Beaded Gecko (*Diplodactylus damaeus*)
 - Tree Dtella (*Gehyra variegata*)
 - Sleepy Lizard (*Tiliqua rugosa*)
 - Rough-nosed Blind Snake (*Ramphotyphlops bituberculatus*)
- » Four species were recorded in the *Maireana sedifolia*/*Atriplex vesicaria* shrubland (comparable to Vegetation Association four)
 - Eyrean Earless Dragon (*Tympanocryptis tetraporophora*)
 - Tessellated Gecko (*Diplodactylus tessellates*)
 - Dwarf Three-toed Slider (*Lerista muelleri*)
 - Desert Banded Snake (*Simoselaps bertholdi*)
- » Two species were recorded in the *Casuarina pauper* woodland (comparable to Vegetation Association 2)
 - Dwarf Three-toed Slider (*Lerista muelleri*)
 - Sleepy Lizard (*Tiliqua rugosa*).

The most recent surveys in the region were undertaken for the Cultana Expansion Public Environmental Report (AECOM, 2011) on land to the north and west of the current EIS study area. While these surveys did not target reptiles specifically, they did record opportunistic sightings of Central Bearded Dragon (*Pogona vitticeps*), Peninsula Dragon (*Ctenophorus fionni*), Shingleback (*Tiliqua rugosa*), Common Blue-tongue (*Tiliqua scincoides*) and the Bearded Gecko (*Lucasium damaeum*).

The recently released Eyre Peninsula Coastal Action Plan and Conservation Priority Study (Caton et al, 2011) identifies six reptile species as being recorded in the Port Bonython area; Western Bluetongue (*Tiliqua occipitalis*), Mallee Black-headed Snake (*Parasuta spectabilis*), Adelaide Snake-eye (*Morethia adalaidensis*), Dwarf Skink (*Menetia greyii*), Spiny-tailed Skink (*Egernia stokesii*), Carpet Python (*Morelia spilota*). No amphibians were recorded in the plan.

A list of species recorded or expected to occur in the study area is provided in **Appendix G.4**. There are certain species in this list which have specific habitat requirements, such as coastal dune shrubland, which is uncommon in the region, or are at the edge of their known distribution and so will be uncommon. These reptile species include Southern Spiny-tailed Gecko (*Strophurus intermedius*), Red-tailed Worm-lizard (*Aprasia inaurita*), Prong-snouted Blind Snake (*Ramphotyphlops bituberculata*), Desert Banded Snake (*Simoselaps bertholdi*) and Carpet Python (*Morelia spilota*).

7.4.4.6. Listed Rare, Vulnerable or Endangered Fauna

Thirty nine species listed under the EPBC and/or the NPW Act have been noted in searches of relevant databases and presented in **Table 7.4g**. For each of these species, notes on habitat requirements are provided, along with the likelihood of occurrence in the Project area. Definitions for likelihood of occurrence are as follows:

- » Unlikely: habitat not present in the study area
- » Possible: habitat present but species not recently recorded in study area
- » Likely: habitat present and species recorded locally outside the study area
- » Confirmed: presence confirmed by recent surveys in the study area.

In **Table 7.4g** the following abbreviations are used:

E	endangered
V	vulnerable
R	rare
Mi	listed as migratory under EPBC Act
CJR	listed under migratory bird agreements with China, Japan and Republic of Korea

With the exception of the Slender-billed Thornbill, Rainbow Bee-eater and the Neophema sp. parrots, which have terrestrial habitat requirements, the rest of the birds listed below in **Table 7.4g** are aerial species or shorebirds and waterbirds that generally inhabit tidal mudflats, estuaries, sandy and rocky beaches, saltfields, samphire swamps, sewage ponds and mangroves, though some species have preferential habitat types (Pizzey & Knight 1997, Marchant & Higgins 1993). Suitable habitat for these waders and deep water feeders exists in coastal areas surrounding Port Bonython but are generally not found within the direct footprint of the Project, or within close proximity.

Table 7.4g: Threatened Terrestrial Fauna Species

Species	EPBC Status	NPWSA Status	Comments	Likelihood of Occurrence in the Project Area
Bush Birds				
Slender-billed Thornbill (Western) (<i>Acanthiza iredalei iredalei</i>)	V	R	<p>The Slender-billed Thornbill (Western) is one of three subspecies that occur in disjunct populations throughout the saltbush and samphire country of southern and western Australia (Frith, 1982). A group of several Slender-billed Thornbills (western) were observed during the current surveys in Vegetation Association 4B near the site of the rail loop. A group of birds was also observed in a similar location during a survey undertaken in 2001 (pers. comm. M. DeJong 2011). Numerous records of the species have been made in both the Cultana training area and the Cultana expansion area north of the proposed development (Aecom, 2011).</p> <p>The presence of the species has been confirmed in one area of the Project site and it is likely to be present in other areas of the site with suitable habitat.</p>	Confirmed
Blue-winged Parrot (<i>Neophema chrysostomus</i>)	-	V	Potential winter visitor from southern states and has been recorded in the dunes at Point Lowly (Cox, 1974). Preferred habitat of coastal dune vegetation and samphire not present in impact area of Project. Not observed during site surveys.	Unlikely
Elegant Parrot (<i>Neophema elegans</i>)	-	R	Potential seasonal visitor to the area. Prefers samphire habitat which occurs adjacent to, but not within, the Project impact area. Not observed during site surveys.	Possible
Scarlet-chested Parrot (<i>Neophema splendida</i>)		R	One bird, a female and possibly immature (based on the dullness of the blue on the face) was sighted in the patch of isolated mallee Vegetation Association 3B during surveys for the current Project. The range of this species fluctuates substantially in response to climatic conditions (Garnett & Crowley, 2000). Its distribution is not continuous but extends throughout the southern interior of Australia. The study site is on the extreme edge of its range and this nomadic species is unlikely to breed within the study area, but is likely to be an occasional visitor.	Confirmed, but vagrant sighting
Shorebirds/Marine/Migratory Birds				
<i>Actitis hypoleucos</i> Common Sandpiper	Mi, CJR	R	Widespread, scattered populations: quite common on north and west Australian coasts, uncommon in South East and interior (Morcombe, 2012) Found in variety of habitat including coastal and inland wetlands, both saline and fresh. Spring-summer non-breeding migrant. Two records exist in the Biological Database of South Australia from the Whyalla Saltfields (one individual) and False Bay (two individuals)	Confirmed in False Bay
Fork-tailed Swift (<i>Apus pacificus</i>)	Mi, CJR	-	In South Australia the Fork-tailed Swift is widespread from the Victorian border west to the Spencer Gulf. It is also common in coastal parts of Eyre Peninsula as far west as Franklin Island, off Streaky Bay and north to 32°S (Higgins, 1999). Occurs periodically over study area, with large flocks occur occasionally over the Port Augusta area (100,000s). Almost exclusively aerial species, summer visitor (October-April). Species has large foraging range.	Unlikely
Great Egret, White Egret (<i>Ardea modesta</i>)	Mi, CJR	-	No breeding sites known to occur in vicinity of study area. May forage in coastal areas of study site and adjacent tidal flats and salt fields, however, no records could be found.	Unlikely
Cattle Egret (<i>Ardea ibis</i>)	Mi, CJR	R	Occurs as a vagrant to the Port Augusta area. Habitat at study site not preferred by species and unlikely to occur.	Unlikely
Ruddy Turnstone (<i>Arenaria interpres</i>)	Mi, CJR	R	Breeding in northern Siberia and Alaska and found in a wide variety of habitats, generally mudflats or rocky coastline, rarely inland waters (DEH, 2005a). 11 Australian sites of international importance have been identified, none in northern Spencer Gulf (Bamford et al 2008). Species recorded in general area (Whyalla saltfields, Ward Spit) but not in the study area. Species has large foraging range.	Possible

Species	EPBC Status	NPWSA Status	Comments	Likelihood of Occurrence in the Project Area
Shorebirds/Marine/Migratory Birds				
Musk Duck (<i>Biziura lobata</i>)		R	Endemic to Australia. Ranges from north-west Western Australia, through the south and east to southern Queensland. Prefers deep water lagoons with dense reed beds. This sort of habitat is not found in the EIS study area.	Unlikely
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	Mi, CJR	-	Breeding in northeast Siberia, prefers muddy edges of shallow fresh or brackish water. Common both on intertidal and inland waters. 38 Australian sites of international importance have been identified, none on Spencer Gulf (DEH, 2005a). Large numbers have been recorded in False Bay, though this site is not considered of international importance. Species has large foraging range.	Confirmed in False Bay
Sanderling (<i>Calidris alba</i>)	Mi, CJR	R	Breeding in high arctic regions -Alaska, Greenland, Russia and found mostly on open sandy beaches as a summer visitor to South Australian shores (DEH, 2005a). 12 Australian sites of international importance have been identified, none in northern Spencer Gulf (Bamford et al 2008). No records from study area. Species has large foraging range.	Unlikely
Red Knot, Knot (<i>Calidris canutus</i>)	Mi, CJR	-	Breeding in northern Siberia and Alaska and found mostly on intertidal mudflats, sandflats, estuaries, sandy beaches of sheltered coasts. Seven Australian sites of international importance have been identified, one being the Port Pirie coast in northern Spencer Gulf (Bamford et al 2008). Recorded in Whyalla Saltfields (Atlas of Living Australia, viewed 15/05/2013). Species has large foraging range.	Possible
Curlew Sandpiper (<i>Calidris ferruginea</i>)	Mi, CJR	-	Breeding in the arctic tundra and found on intertidal mudflats of sheltered coastal areas, coastal lakes, estuaries, bays, occasionally inland wetlands in southern Australia (DEH 2005a). 22 Australian sites of international importance have been identified, none in Spencer Gulf (Bamford et al 2008). Species has been recorded in False Bay (Atlas of Living Australia, viewed 15/05/2013). It has a large foraging range.	Confirmed in False Bay
Red-necked Stint (<i>Calidris ruficollis</i>)	Mi, CJR	-	Distributed along most of the Australian coastline. Breeds in Siberia and parts of Alaska. Recorded in False Bay and the Whyalla saltfields.	Confirmed in False Bay
Great Knot (<i>Calidris tenuirostris</i>)	Mi, CJR	R	Breeding in northern Siberia and found in coastal habitats including intertidal mudflats, estuaries, lagoons and sandflats in southern Australia. Nine Australian sites of international importance have been identified (DEH 2005a), none near the development area. A recorded observation of approximately 1000 individuals is reported from the Whyalla Saltfields (BDSA, 2011) and numbers have been recorded at Ward Spit on the eastern side of Spencer Gulf. It has a large foraging range.	Possible
Greater Sand Plover, Large Sand Plover (<i>Charadrius leschenaultia</i>)	Mi, CJR	R	Small numbers of individuals have been recorded from the Whyalla saltfields south of the development site (BDSA, 2011). Generally prefers marine coastal habitats.	Possible
Oriental Plover, Oriental Dotterel (<i>Charadrius veredus</i>)	Mi, CJR	-	The Oriental Plover is a non-breeding visitor to Australia, where it occurs in both coastal and inland areas, mostly in northern Australia. It is seldom seen in southern Australia. No records from study area and unlikely to be found.	Unlikely
Banded Stilt (<i>Cladorhynchus leucocephalus</i>)	-	V	Australian resident and recorded in upper Spencer Gulf including False Bay and the Whyalla Saltfields. Occurs in large flocks sometimes consisting of tens of thousands of birds. Breeds on islands in inland salt lakes during inland flooding events.	Confirmed in False Bay
Gibson's Albatross (<i>Diomedea exulans gibsoni</i>)	V, Mi	V	Breeds in New Zealand. Gibson's Albatross feeds pelagically, using the wind to travel great distances (Weimerskirch, 1997). No known reports in Spencer Gulf, but may pass over marine area of development site while foraging. Has large foraging range.	Unlikely

Species	EPBC Status	NPWSA Status	Comments	Likelihood of Occurrence in the Project Area
Shorebirds/Marine/Migratory Birds				
Eastern Reef Egret (<i>Egretta sacra</i>)	-	R	Australian resident common along the northern Australian coastline. Less common along southern coastline and mainly absent from Victorian and Tasmanian coasts. Forages along coastline including estuarine mudflats and inshore reefs. Possibly occasional visitor to coastline around study area. One observation was reported towards the tip of Point Lowly in 2002 (BDSA, 2011).	Possible
Latham's Snipe, Japanese Snipe (<i>Gallinago hardwickii</i>)	Mi, CJR	R	Breeding in Japan and adjacent parts of Siberia this species forages in freshwater wetlands on inland, upland and coastal plains, preferring soft moist ground or shallow flooded areas. No Australian sites have been identified as internationally important (DEH, 2005a). Very unlikely to occur in the development area.	Unlikely
White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>)	Mi, C	E	Species may be an irregular visitor to the area, however, nearest known breeding populations occur on islands to the south and west of the Eyre Peninsula. Nests are usually near water, in tall live or dead trees or on remote coastal cliffs (Dennis & Lashmar, 1996). Species has large foraging range.	Possible
Pied Oystercatcher (<i>Haematopus longirostris</i>)		R	Australian resident occurring around whole Australian coast. Common but vulnerable to disturbance and becoming uncommon in some parts of SE Australia. Coastal species that forages along beaches and mudflats, less often along rocky coasts and headlands. A number of observations are recorded from the Whyalla Saltfields (BDSA, 2011). Less likely to occur in coastal impact area of Project and not recorded in previous surveys of the area.	Possible
White-throated Needletail (<i>Hirundapus caudacutus</i>)	Mi	-	A visitor to South Australia from South-east Asia, mostly from October to April. It is almost exclusively aerial when present in SA, however, no records have been found for Upper Spencer Gulf.	Unlikely
Bar-tailed Godwit (<i>Limosa lapponica</i>)	Mi, CJR	R	Breeding in northern Russia, Scandinavia, and Alaska, this species forages in mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats. Nine Australian sites of international importance have been identified, none in South Australia (Bamford et al, 2008). Species has been recorded in False Bay and Whyalla saltfields.	Confirmed in False Bay
Southern Giant-Petrel (<i>Macronectes giganteus</i>)	E, Mi	V	Southern giant petrels range widely throughout the southern oceans. In summer they occur predominantly in subantarctic to Antarctic waters, usually below 60oS in the South Pacific and south-east Indian Oceans, or 53oS in the Heard Island and Macquarie Island regions. In winter they are rare in the southern waters of the Indian Ocean, and more common off South America, South Africa, Australia and New Zealand (SEWPaC, 2011b). No records from Upper Spencer Gulf but may be occasional winter visitor attracted to fishing activity (known to follow fishing boats). Species has large foraging range.	Unlikely
Northern Giant-Petrel (<i>Macronectes halli</i>)	V, Mi	-	In summer they occur predominantly in subantarctic to Antarctic waters, usually between 40-64oS in open oceans. Their range extends into subtropical waters (to 28oS) in the winter and early spring (SEWPaC, 2011b). No records from Upper Spencer Gulf but may be occasional winter visitor attracted to fishing activity (known to follow fishing boats). Species has large foraging range.	Unlikely
Eastern Curlew (<i>Numenius madagascariensis</i>)	Mi, CJR	V	Breeding in Russia and northeast China, this species prefers intertidal coastal mudflats, coastal lagoons, sandy spits. 19 Australian sites of international importance have been identified, although none are in South Australia (DEH, 2005a). Small numbers of individuals have been recorded in False Bay and Whyalla saltfields. Species has large foraging range.	Confirmed in False Bay

Species	EPBC Status	NPWSA Status	Comments	Likelihood of Occurrence in the Project Area
Shorebirds/Marine/Migratory Birds				
Rainbow Bee-eater (<i>Merops ornatus</i>)	Mi	-	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches (Higgins, 1999). Southern populations spend non-breeding, winter season in the north of Australia. The Rainbow Bee-eater is currently considered to be a low priority for management. The population size and population trends have not been quantified, but the population size is assumed to be reasonably large, and there is little documented evidence of population declines (SEWPaC, 2011a). Species has large foraging range.	Unlikely
Ruff (Reeve) (<i>Philomachus pugnax</i>)	Mi, CJR	R	Breeding in northern Europe and Russia and preferring terrestrial wetlands with exposed mudflats at edges. Rare, but regular summer visitor to Australia, mainly seen singly, pairs or small groups, associated with other small waders. No Australian sites identified as internationally important (DEH, 2005a). No records from study area. Species has large foraging range.	Unlikely
Fairy Tern (<i>Sternula nereis nereis</i>)	-	E	Species is a rare visitor to the study area. Fairy Terns nest in small colonies on coral shingle on continental islands or coral cays, on sandy islands and beaches inside estuaries, and on open sandy beaches (Hill et al., 1988; Higgins & Davies, 1996). No nesting or feeding habitat available in development area.	Unlikely
Buller's Albatross (<i>Thalassarche bulleri</i>)	V, Mi	V	Generally, adults forage between 40 and 50°S east of Tasmania, while juveniles and non breeding adults disperse across the South Pacific Ocean to the coast of South America (BirdLife International 2004b). Seasonal visitor, that does not breed in Australia. Species may pass over marine area of study site while foraging, however, has large foraging range and unlikely to be affected by development. No known reports from Upper Spencer Gulf.	Unlikely
Shy Albatross (<i>Thalassarche cauta cauta</i>)	V, Mi	-	Shy albatrosses are usually found over the continental shelf, and regularly venture close to shore along the coasts of Tasmania and southern Australia, even entering bays and harbours (Brothers et al. 1998, Hedd et al. 2001, Reid et al. 2002). Species may pass over marine area of development site while foraging. Regularly recorded off South Australia, however, it has a large foraging range.	Unlikely
Campbell Albatross (<i>Thalassarche melanophris impavida</i>)	V, Mi	-	Campbell albatrosses occur in Antarctic and subantarctic waters and in the subtropical South Pacific Ocean. They breed only on subantarctic Campbell Island, south of New Zealand. Their post-breeding dispersal is restricted to the temperate shelf waters of New Zealand, Australia and the South Pacific Ocean (Marchant and Higgins 1990). Species may pass over marine area of study site while foraging, however, it has an extremely large foraging range.	Unlikely
Marsh Sandpiper, Little Greenshank (<i>Tringa stagnatilis</i>)	Mi, CJR	-	Breeds from eastern Europe to central Asia and spends the non-breeding period from Africa to Australia. This species occur in inland wetlands and salt marshes. Four Australian sites of international importance have been identified, all in tropical northern Australia (Bamford et al, 2008). Small numbers recorded in False Bay.	Confirmed in False Bay
Reptiles				
Carpet Python (<i>Morelia spilota imbricate</i>)		R	Found on Eyre Peninsula between Port Augusta and Ceduna and some offshore islands. They inhabit complex mallee that receives runoff from nearby rocky hills (Ehmann, 2005). Single historical record from 1950 at site near the proposed desalination plant (BHPB, 2009). Could inhabit the mallee adjacent to the north of the Project impact area, however, no recent records exist and not ideal habitat for the species.	Unlikely

7.4.4.7. Non-Indigenous Fauna

Surveys of native fauna in the region have generally commented on the abundance of feral species encountered (SEA, 1981; AECOM, 2012). Grazing by introduced herbivores and predation and competition by other introduced species has resulted in significant extinctions of small to medium sized mammals within the Gawler bioregion (Neagle, 2002).

A number of introduced mammal species have been recorded in the Cultana Training Area to the north of the study area including Feral Cats (*Felis catus*), Feral Goats (*Capra hircus*), European Rabbits (*Oryctolagus cuniculus*), Red Foxes (*Vulpes vulpes*) and introduced rats (Parsons Brinkerhoff, 2002 and others; reported in Aecom, 2012). A number of introduced bird species have also been recorded including the Common Starling (*Stumus vulgaris*), House Sparrow (*Passer domesticus*) and Rock Dove (*Columba livia*).

Appendix G.4 shows records of introduced bird and mammal species recorded in surveys from the area. The recording of species such as the House Sparrow, Common Starling, House Mouse and European Fox across a number of separate surveys indicates a relative abundance. In particular, surveys conducted for the Santos EIS adjacent to the Project site noted the presence of House Mice in all habitats with particular abundance in creeklines (SEA, 1981). It is noted, however, that mice populations are particularly dynamic with regards to seasonality and food abundance.

As discussed in **Section 7.4.1** much of the Project area has previously been used for grazing, predominantly by sheep. Feral species that have been identified in the area or are likely to occur can be summarised as:

- » Feral Goats (*Capra hircus*)
- » European Rabbits (*Oryctolagus cuniculus*)
- » Red Foxes (*Vulpes vulpes*)
- » Feral Cats (*Felis catus*)
- » House mouse (*Mus musculus*)
- » House Sparrow (*Passer domesticus*)
- » Common Starling (*Stumus vulgaris*)
- » Cabbage White (*Pieris rapae rapae*) (possible)
- » Feral Sheep (*Ovis aries*) (possible)
- » Eurasian Blackbird (*Turdus merula*) (possible)
- » Rock Dove (*Columba livia*) (possible).

Other species that could occur in the study area include the Eurasian Blackbird (*Turdus merula*) and Rock Dove (*Columba livia*) (Biological Database of South Australia).

7.5. Potential Impacts

The assessment of environmental impacts is provided in the following sections, with regards to the construction phase (three years) and the longer term operational phase for the Project. Proposed mitigation measures are also described to minimise risk or reduce it to an acceptable level, in order to protect the key environmental (ecological) values.

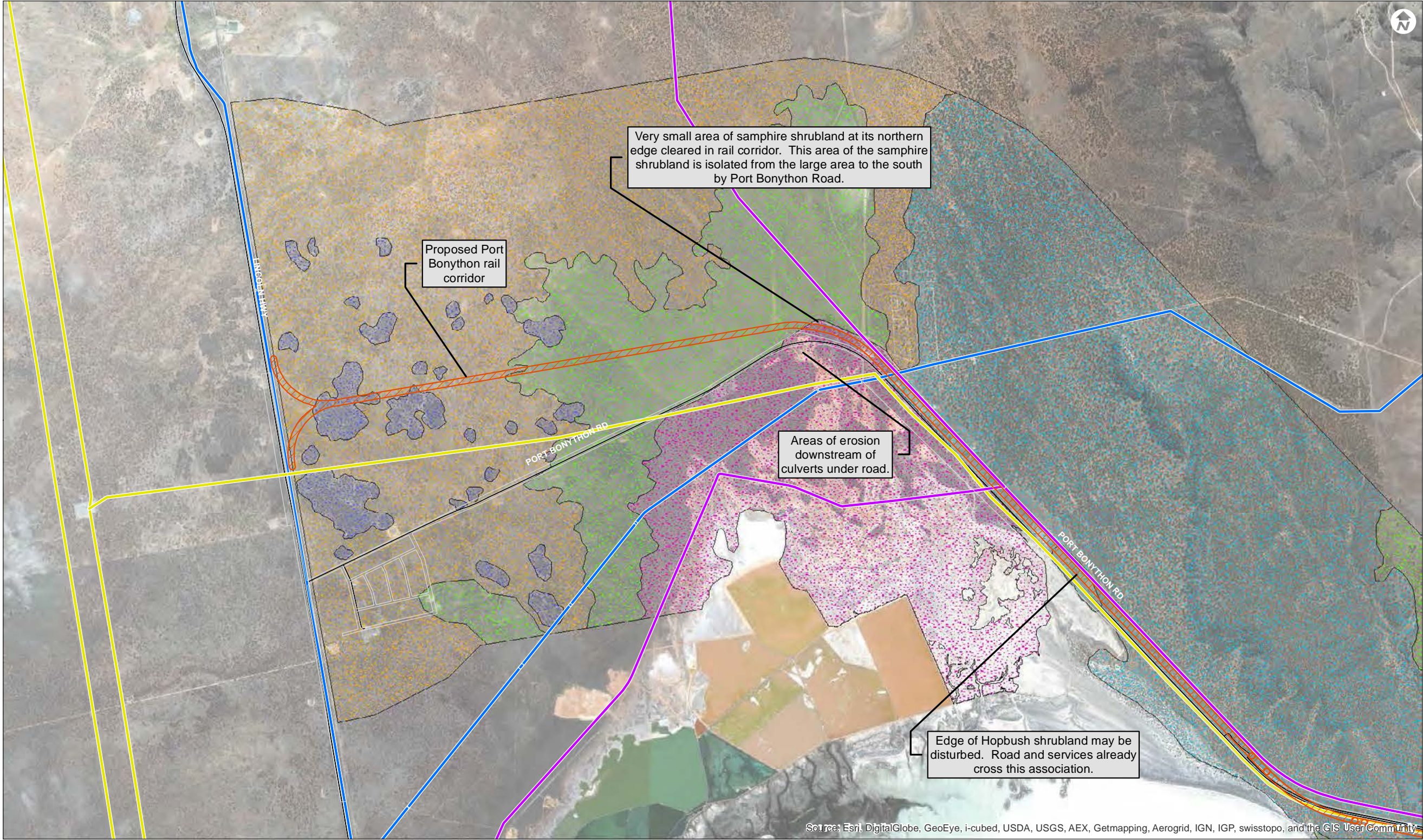
The flora, fauna and general biodiversity of the terrestrial environment has been described in **Section 7.4**. From this baseline assessment the main environmental values can be described as:

- » Areas of intact native vegetation which provides a high habitat value and supports biodiversity
- » The presence of listed fauna, particularly the Slender-billed Thornbill (western) (associated predominantly with Chenopod habitat).

7.5.1. Construction

The construction area, along the new rail spur and bulk storage and loading facilities is shown on **Figure 7.5a** and **7.5b**. This defines a work area for construction and not necessarily the total area disturbed or cleared. It is recognised that with a smaller disturbed area there is less post-construction site remediation required. It is intended that a post-construction survey be undertaken to determine the actual extent of the area disturbed or vegetation cleared. However, for the purposes of assessment a conservative approach is taken, by assuming that the construction area is the actual area affected. The impacts and mitigation measures are described in the following sections.

Figure 7.5a: Project Footprint (West)

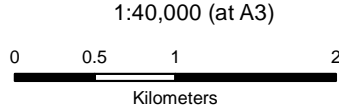


Port Bonython EIS
Spencer Gulf Port Link

Legend

Vegetation associations:

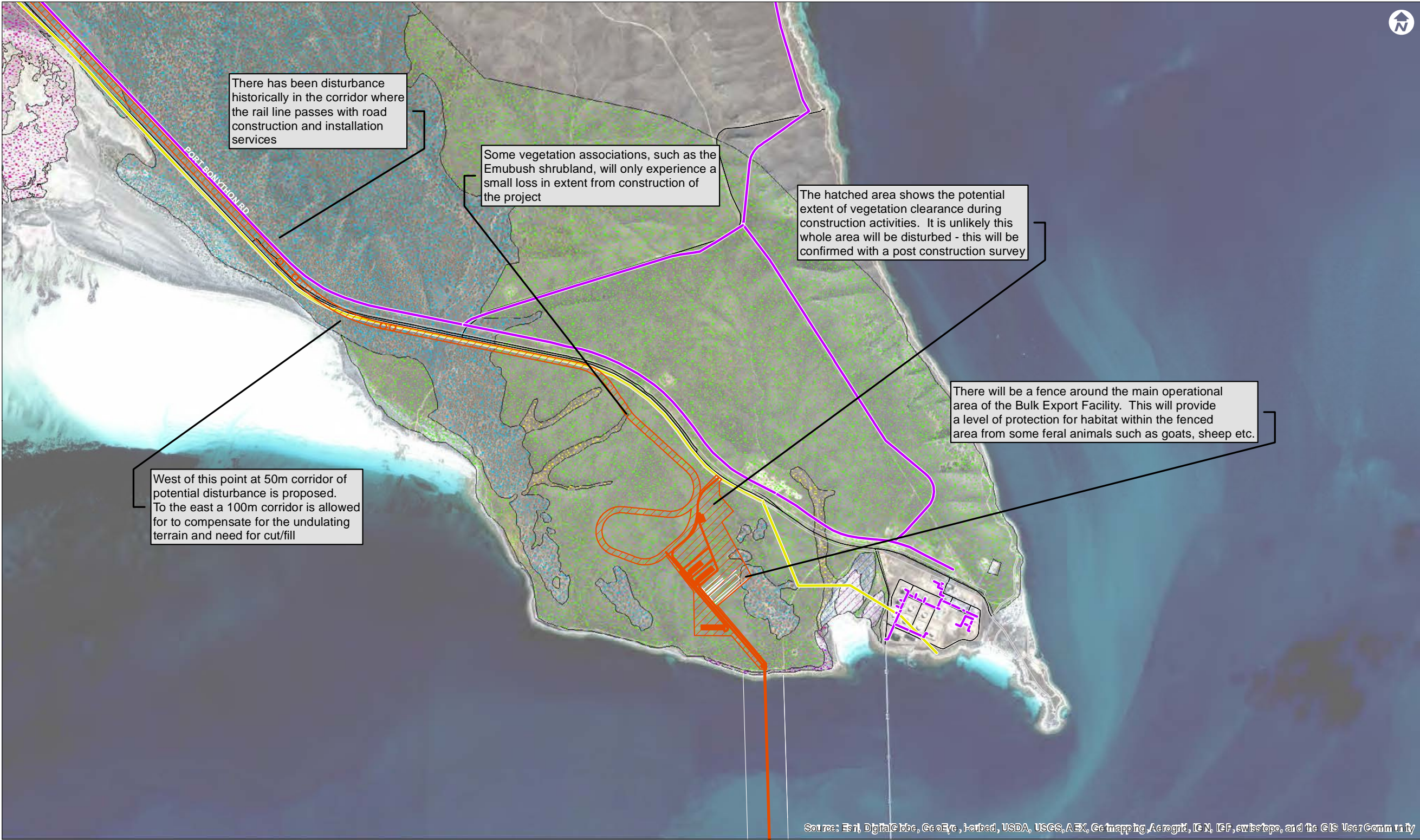
- | | | |
|---------------------------------------|---|-----------------|
| Association 1 - Myall sparse woodland | Association 6 - Emubush shrubland | Roads |
| Association 2 - Blackoak woodland | Association 7 - Hopbush shrubland | Fuel pipelines |
| Association 3 - Mallee woodland | Association 8 - Boobialla sparse shrubland | Power lines |
| Association 4 - Chenopod shrubland | Santos Association 1 - Myoporum sparse woodland | Water pipelines |
| Association 5 - Samphire shrubland | Santos Association 2 - Dune field | |



Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

Figure 7.5a - Project Footprint (West)

Figure 7.5b: Project Footprint (East)



Port Bonython EIS
Spencer Gulf Port Link

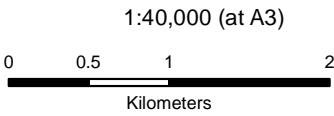
Figure 7.5b - Project Footprint (East)

Legend

Vegetation associations:

	Association 1 - Myall sparse woodland		Association 6 - Emubush shrubland
	Association 2 - Blackoak woodland		Association 7 - Hopbush shrubland
	Association 3 - Mallee woodland		Association 8 - Boobialla sparse shrubland
	Association 4 - Chenopod shrubland		Santos Association 1 - Myoporum sparse woodland
	Association 5 - Samphire shrubland		Santos Association 2 - Dune field

	Roads
	Fuel Pipelines
	Power Lines
	Water Pipelines



Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

7.5.1.1. Construction Impacts

Terrestrial Vegetation clearance/Habitat Loss

The total area in the terrestrial construction footprint shown on Figure 7.5a and 7.5b is approximately 230Ha, consisting of:

- » Approximately 135Ha in the 50-100m wide corridor for the new rail spur to Port Bonython from the Lincoln Highway line. The 50m corridor allows for the construction of the railway line and an access track along its length. For 4.7km before the rail loop, the clearance area widens to approximately 100m to allow for a haul road and any cut/fill required to maintain rail line gradients. It is unlikely, however, that all of the corridor will be disturbed and every effort will be made to minimise the area of disturbance. For the 50m corridor less than half will probably be disturbed (refer to Figure 7.5c for indicative appearance and Appendix E.1 for cross-sections)

Figure 7.5c: The existing Whyalla-Port Augusta rail line, indicative of the appearance of the BCEF rail spur once constructed and rehabilitated.



- » An area of approximately 95Ha for the construction of the iron ore storage sheds, loading infrastructure, amenity buildings, access roads and jetty onshore construction platform.

The Project will affect all vegetation associations at some point with the majority of vegetation clearance occurring across Vegetation Associations three (Mallee woodland) and four (Bluebush and Saltbush shrubland), refer Table 7.5a.

Table 7.5a: Areas of vegetation potentially disturbed during construction

Vegetation Association	Area Possibly Disturbed/Cleared (Ha)
1: Myall low open woodland	14.2
2: Blackoak low woodland	4.4
3: Mallee woodland	53.7
4: Bluebush and Saltbush shrubland	150.2
5: Samphire shrubland	5.9
6: Emubush shrubland	0.1
7: Hop-bush shrubland	0.7
TOTAL	228.7

The main areas of vegetation disturbance are discussed below:

- » As discussed previously in Section 7.4.3, there are no endangered habitats in the Project area that are listed under the EPBC Act (1999)
- » Outside of the direct construction footprint area, the main associations affected (the Myall woodland, Mallee woodland and Chenopod shrubland) are regionally extensive, as shown on Figure 7.4d
- » The Emubush shrubland occurs in gullies and drainage lines within the Chenopod shrubland. There is only likely to be a very small loss (0.1Ha) of this habitat in one section of the rail easement where the Emubush shrubland extends into the 100m wide rail construction corridor, refer Figure 7.5b
- » The Hopbush shrubland occurs in a small sandy area behind False Bay. The rail corridor may impact a small area (0.7ha) along the edge of this habitat if all of the easement was cleared, refer Figure 7.5a. The hopbush occurs in an area that has already been disturbed through construction of the Port Bonython road and installation of services to Port Bonython/Point Lowly. While the vegetation has regenerated, periodic maintenance of these facilities is likely to disturb this area again in the future
- » A small area (5.9Ha) Samphire shrubland found in the saline, low lying areas where the Myall Creek drains to False Bay will be impacted at its northern limit by the rail corridor. This habitat is also regionally extensive, refer Figure 7.5a. The area disturbed is now isolated from the main Samphire shrubland to the south by the Port Bonython road
- » Approximately 4.4Ha of the Blackoak woodland occurs within the 50m railway corridor. Some of this will be cleared. It occurs regularly as patches within the Myall open woodland, refer Figure 7.5a.

As discussed in **Section 7.3.3**, under the NV Act, any clearance of native vegetation, other than vegetation covered under exemptions, requires specific, written approval from the NVC.

Clearance is proposed under NV Act Regulation 5(1)(c) - Development subject to Section 48 – *Development Act 1993*. This regulation applies where a proposed development is considered to be of such social, economic or environmental importance that an environmental impact statement is declared by the relevant Minister to be necessary.

Where this is the case, NVC approval is not required for the clearance of any native vegetation. Instead, the Council is provided the opportunity to make comment on the proposed development, which is then taken into account by the Minister administering the DA.

Where such a development has been approved, and it involves the clearance of native vegetation, a Significant Environmental Benefit (SEB) must be achieved to compensate for the cleared vegetation. A SEB may include the management or restoration of existing native vegetation on the applicant's property or at another area approved by the NVC.

The following SEB offset area estimates in **Table 7.5b** are based on the guidelines for the Mining Industry (DWLBC 2005).

The condition ratings used in **Table 7.5** are defined as:

- » "Good condition" is mostly intact overstorey and understorey vegetation; weed infestation is moderate to low, but the original vegetation is still dominant; clearance is assessed by the Native Vegetation Council to be at variance with the "Principles of Clearance" and should be compensated at a SEB ratio of 8:1
- » "Moderate condition" is of mostly intact overstorey, moderate but not severe weed infestation amongst the understorey and is assessed not to be at variance with the "Principles of Clearance". This classification should be compensated at a SEB ratio of 6:1
- » "Poor condition" is of mostly intact overstorey, but there is still considerable weed infestation amongst the understorey. An appropriate remediation plan must be developed to address this SEB requirement. This classification should be compensated at a SEB ratio of 4:1.

The actual vegetation clearance required will not be accurately known until after construction, and it is expected that these figures provided here will prove to be significant overestimates.

Table 7.5b: SEB offset estimates

Vegetation Assoc	Condition Rating	Area To Be Cleared (Ha)	Seb Offset Area (Ha)
1: Myall low open woodland	Good	14.2	113.6
2: Blackoak low woodland	Good	4.4	25.2
3: Mallee woodland	Moderate	53.7	322.2
4: Bluebush and Saltbush shrubland	Good	150.2	1201.6
5: Samphire shrubland	Good	5.9	47.2
6: Emubush shrubland	Poor	0.1	0.4
7: Hop-bush shrubland	Good	0.7	5.6

Options for SEB offset are currently being discussed with the NVC and will likely be finalised as part of EIS approval conditions.

- » Examining **Figures 7.4d** and **7.5a** and **7.5b**, it is apparent that the Project will not result in habitat fragmentation and will not result in the isolation of any habitat area essential for any fauna species, since the areas of vegetation to be cleared are relatively small in a regional context
- » The development shall not cause a barrier to fauna movement. The main facilities at Stony Point, including the rail loop will be fenced. Situated adjacent to the coast with access all around it shall not impede any fauna movement from one habitat to another. The rail line will not be fenced, although it is possible that the rail corridor may provide some difficulties in movement for small-bodied mammals and reptiles when navigating the track due to lack of vegetation in which to hide and the elevation.
- » The eastern end of the rail corridor where a 100m construction corridor is proposed experiences more undulating terrain and it will be necessary in parts for cut and fill to maintain rail line gradients. Although allowed a 100m corridor for safety reasons, it is not anticipated that all this area will be disturbed. Additionally, areas disturbed as part of cut and fill for the rail line will be rehabilitated with native species appropriate for the surrounding vegetation association. This will ensure that any potential habitat fragmentation as a result of the rail corridor is only temporary.

Overall with regard to the Significance Criteria, the significance of effects are minor and the risk rating medium.

Effects on Listed Flora and Fauna

Flora

As discussed in **Section 7.4.3**, no species listed under the EPBC Act or in Schedules seven (endangered), eight (vulnerable) and nine (rare) of the NPW Act have been noted in surveys conducted in the construction corridor or in the 1km area on either side of the corridor, examined in recent surveys undertaken for the Project.

Two species are listed in the EPBC protected matters search as potentially occurring in this region and which are listed as vulnerable are Nodding Rufous-hood (*Pterostylis mirabilis*) and Bead Samphire (*Tecticornia flabelliformis*). These two species and the Sandalwood (*Santalum spicatum*) are also listed as vulnerable in South Australia NPW Act (1972), refer **Table 7.4c**. As described in **Section 7.4.3.3**, the habitats suitable for the Nodding Rufous-hood and Bead Samphire do not occur in the study area and their occurrence is very unlikely. Consequently, with reference to the above significance criteria there is a negligible impact with a low risk to these species.

The Sandlewood has been recorded in the Cultana Army Training Area to the north of the Project area. Despite suitable habitat occurring in the construction area, none were found in vegetation surveys. There is still a possibility that a Sandalwood tree may occur within the construction corridor, but considering the probability is low, and the extensive occurrence of this species throughout the myall and mulga plains of northern Eyre Peninsula and throughout the Flinders and Gawler Ranges, the impact on this species is also negligible with a low risk.

Fauna

As discussed in **Section 7.4.4.6** there are 39 species listed under the EPBC (1991) and/or the NPW Act (1972) which have been noted in searches of relevant databases and presented in **Table 7.4g**. For each of these species, notes on habitat requirements are provided, along with the likelihood of occurrence in the Project area.

Two species of bush birds listed under State or Federal legislation were identified during surveys of the study area. One of these, a juvenile Scarlet-chested Parrot (*Neophema splendida*), was considered an occasional visitor and at the extreme edge of its range. This species is unlikely to be affected by the development since the development area is not considered as core habitat for the Scarlet-chested Parrot.

The other species, the Slender-billed Thornbill (*Acanthiza iredalei iredalei*), is a resident of the area, primarily within the Chenopod shrubland habitat (Vegetation Association four). This type of habitat is extensive in the region (refer to **Figure 7.4d**) and the removal of vegetation associated with the Project is not expected to pose any risk of habitat fragmentation or viability of the population in the area. The population of Slender-billed Thornbill in the EIS study area is part of the Gawler Ranges sub-population, estimated to be the largest sub-population of

the species at approximately 15,000 birds (SEWPac, 2012d). This sub-population inhabits an extensive area of similar habitat extending northwest from the Project site (**Figure 7.4g**).

Historically, one of the main threats to the Slender-billed Thornbill has been the loss of habitat, primarily through grazing. It is likely that habitat in the region is improving for the species, with the elimination of grazing in most parts and management of land by the Department of Defence as part of the Cultana Training Area Expansion.

Any birds displaced by removal of habitat due to the construction of the Project are likely to move to adjacent, good quality habitat, including that managed as part of the Cultana Army Training Area.

The Native Vegetation Act SEB requirements and Construction Environmental Management Plan (CEMP) implementation, discussed in **Section 7.6**, will also reduce the impacts of construction on the Slender-billed Thornbill.

Migratory shorebirds listed under the EPBC Act utilise False Bay to the southwest of the Project impact area. The rail corridor is separated from the tidal habitat of False Bay by the Port Bonython Road and vegetated sand dunes. It is considered that the activities associated with construction of the Project will not affect, or pose any credible risk, to shorebirds in this area.

Overall, the impact to the threatened species, particularly as a result of the potential threat of weeds and vegetation clearance, is minor with a medium risk rating.

Effects of Noise

Noise from the construction of the rail spur, bulk ore storage facilities, conveyers and jetty etc. is likely to locally affect fauna, particularly in the immediate vicinity. The affect will vary depending on the species. The ways noise can affect the habitat value of an area for native fauna due to individual species sensitivities, is poorly understood, but it is known that some species are more tolerant to noise than others, BHPB (2009). It is also known that many fauna, including bird species, will become accustomed to increases in background noise (D.Paton, pers comm).

Key points to note from the effects of noise are:

- » Temporary and generally transitory (particularly the rail line). There is an abundance of good quality adjacent habitat in the area for temporally displaced sensitive species
- » During construction noise will be largely limited to 6:00am-6:00pm to conform to EPA requirements, minimising affects on nocturnal species in adjacent areas.

Overall, with regard to the significance criteria, the impact is expected to be minor with a low risk rating.

Effects of Light Spill

Artificial light used during construction can result in light spill into surrounding areas. This has the potential to affect fauna, particularly nocturnal species, through affecting feeding, reproductive behaviour, predator/prey relationships and social behaviour.

The attraction of flying insects, such as moths, to artificial lighting at night is well known although the spectrum of the light influences the degree of attraction (Longcore and Rich, 2004). This attraction can work up the food chain as insectivorous species, such as bats, are attracted to the increase in invertebrates and higher predatory species, such as owls, are attracted to the increased concentrations of bats. Conversely, some species can show light avoidance behaviour and may move away from an area where artificial light is introduced.

With regard to the proposed construction activities, points to note are:

- » The effects of light during construction will be transitory, being limited to the construction period
- » The use of artificial light during construction is expected to be low with activities mainly occurring during daylight hours, between 6:00am-6:00pm, in line with EPA requirements.

Overall, with regard to the significance criteria, the impact is expected to be minor with a low risk rating.

Weeds

As outlined in **Section 7.4.3.4**, many weeds have been recorded in the EIS study area, including declared and environmental weeds. The distribution of these weeds favours the disturbed areas along the roads, tracks and service areas. As with any construction Project, there is the risk of further weed introduction by:

- » The increased vehicle movements into the area
- » The establishment of weeds in disturbed areas.

Landholders are required under the NRM Act to control declared weeds on their properties. In addition to this requirement, the proponent will actively control other environmental weeds as identified in **Section 7.2.4** within land under their control as a component of a comprehensive CEMP.

The area disturbed by construction is large and without mitigation measures this could increase the spread of weeds and vehicles could introduce new species to the area. However, with regard to the significance criteria the impact is moderate with a medium risk.

Bushfires

Although bushfires are a natural occurrence, the risk of ignition through anthropogenic causes is potentially increased with increased activity in the area as a result of construction activities. An increased incidence of bushfires could affect community composition and the occurrence and distribution of vegetation associations, increase the potential for soil erosion and exacerbate climate change effects. The likelihood of increased bushfire risk from the Project is detailed further in **Chapter 17, Hazard and Risk**.

With regard to the significance criteria, the impacts are moderate and the risk rating medium.

7.5.2. Operation

During the life of the Project, the long-term operational phase, the main ecological issues are:

- » The prevention of the spread of weeds and the introduction of new weed species
- » Development area edge effects with some fauna affected by light, noise, dust etc., including along the railway corridor
- » Feral animal management
- » The potential for increased bushfire occurrence
- » Maintenance activities, requiring access to infrastructure, including the rail line, and protection of post-construction rehabilitated areas and undisturbed areas.

There should be no further vegetation clearance after construction. Post-construction rehabilitation of disturbed areas and revegetation may continue for some years, which is addressed in the EMP, refer to **Chapter 19, Environmental Management Plan**.

7.5.2.1. Operation Impacts

Weeds

As outlined in **Section 7.4.3.4**, there are numerous weeds that have been recorded in the EIS study area, including declared and environmental weeds. The risk of weed invasion as a result of the Project operation occurs through:

- » Increased vehicle movements associated with the Project, possibly bringing new weeds
- » The establishment of weeds in disturbed areas, particularly following any maintenance activities.

It is intended that the CEMP will ensure a low incidence of weeds on the site at the completion of the construction phase. However, in the long-term, without adequate management and monitoring the weed spread could occur, and with regard to the significance criteria, the effects are likely to be minor with a medium risk rating.

Edge Effects

Usually around urban or industrial developments, even though there may be little direct physical disturbance into adjacent habitats, there is a degree of disturbance from light spill, noise, dust, etc. These may be in addition other factors such as weeds and feral animals, which are dealt with elsewhere. The degree of disturbance will depend on the nature of the development and activities. In this case it is anticipated that there will be some effects from light spill and noise, which are addressed below. Also considered is the potential for impairment of air quality and any affect on fauna and flora.

(A) Noise

Background noise levels at Point Lowly are in the order of 40 dBL and in False Bay are in the order of 25 dBL, (refer **Chapter 5, Noise and Vibration**). Examples of the results of modelling noise levels during the operational phase for the railway corridor and the conveyer system are shown in **Figures 5.7a to 5.7g in Chapter 5, Noise and Vibration**. These indicate:

- » For the rail corridor:
 - There will be an increase in noise levels over the False Bay with levels 60-65dB (L_{max}), for 200-500 metres each side of the rail line. However, the effects will be transitory and fall rapidly to background levels beyond 500m from the rail line. Typical of most rail lines throughout the country, there will be a gradual build up of noise to the peak as the train approaches, and a gradual decrease as it passes; there will be no sudden loud impact noise.
 - Beyond 200-500 meters along the corridor, noise levels drop to background levels and there is no impact on False Bay, except for a small area on the north-east boundary. There is no impact on the tidal flats used by migratory species
- » For the conveyer system:
 - There will be an increase over the background for approximately 400-700 metres in neutral weather conditions without mitigation, but can increase in unstable conditions. Noise levels above 50dB(A) will largely occur within the fenced compound.

Noise can affect the habitat value of an area for native fauna due to disruptions in behaviour, particularly breeding and predator/prey interactions. Data relating to individual species sensitivities to noise is poor but it is known that some species are more tolerant to noise than others. Some information on the significance of noise levels on fauna comes from studies of the effects of highway noise, particularly for birds. It was found that there was reduced density of birds in close proximity to the sound, with the affected area dependent on the traffic volume (Reijnen & Foppen 1995). Generally the effects are more significant above 50dB(A). In this instance, in view of the short transit time, noise profile and extent of effect, with regard to the significance criteria, the effects along the railway line are minor with a low risk rating.

For the noise of the conveyers with or without mitigation, it is expected that there will be some affects on some fauna. There is very little difference in the area of effect surrounding the development between non-mitigation and mitigated scenarios (refer **Chapter 5, Noise and Vibration**). However, as it will be a more constant noise without sudden impact noises, many fauna may become accustomed the increased background noise. Any species that are more sensitive will be displaced into the surrounding unaffected habitat areas. In view of the extent of available habitat, and with regard to the significance criteria, there is a minor impact with a low risk rating.

(B) Light Spill

During operation, the use of artificial light will be minimised where possible in line with objectives to minimise energy use and carbon emissions where possible. It is the intention that unless loading activities are occurring, only low level security lighting will be used on the site. The effects of artificial light from the operation of the current Project also need to be considered in the context of the adjacent Santos facility which is a significant source of artificial light.

Although expected to be minimal, it is possible that an additional source of artificial light will reduce the habitat value for some species in the immediate area. With regards to the significance criteria the effects are expected to be minor with a low risk rating.

(C) Air Quality

For this Project there are no air emissions from any industrial process. The only potential impact is from dust disturbance. This is dealt with extensively in **Chapter 6, Air Quality**, where it was determined to be a low risk with proposed mitigation measures.

Feral Animals

The current Project is not expected to contribute to numbers of introduced species in the area, but local problems could occur, through:

- » The sheds and other structures providing roosting places for feral species such as the feral pigeon, which could then compete with endemic species for available food
- » Inadequate disposal of any rubbish, organic waste etc., encouraging rats and mice
- » 'Stowaways' on visiting ships, although less likely on ore ships compared to other cargoes such as grains or livestock
- » Cats or dogs kept as pets by personnel, which may become feral.

Overall, considering the feral animal population already known to occur, as discussed in **Section 7.4.4**, the effects are likely to be minor with a low risk rating.

Bushfires

As discussed above for construction, the risk of ignition through anthropogenic causes is potentially increased with increased activity in the area, and this also remains the case as a result of operational activities. An Emergency Response Plan will be prepared which to protect personnel and property and will also reduce the risk of fire breakout, refer **Chapter 17, Risk and Hazard**, which also addresses the risk to the adjacent Santos facility. While fires can occur at any time during the fire danger season, the greatest risk of bushfire spread is when there are hot northerly winds. Being on the coast, this reduces the risk from the new port. With regard to the Significance Criteria, the risk rating is considered to be medium.

7.6. Mitigation Measures

7.6.1. Construction Impact Mitigation

As required a Construction Environmental Management Plan (CEMP) will be prepared by the Contractor which will outline the measures that will be taken to mitigate potential adverse impacts, together with monitoring and reporting requirements. With regard to the above issues, these are indicated below and the full range of measures outlined in the Environmental Management Plan (EMP) in **Chapter 19, Environmental Management Plan**.

7.6.1.1. Terrestrial Vegetation Clearance

The CEMP to be prepared by the construction Contractor includes:

- » Measures to minimise site disturbance and land clearance as much as practical. In addition to reducing environmental impacts, it is recognized that there is a benefit to the proponent in minimising site remediation costs and NV Act SEB requirements
- » Strategies for minimising soil erosion (also post-construction), particularly cut and fill around gullies, where erosion may lead to sedimentation in the gullies and downstream bank erosion. Areas disturbed during construction will be at risk of erosion unless stabilized. Erosion may occur via two means; wind and runoff.

Although the Project is in an arid area with low annual rainfall, rainfall events can be intense and these intense events are the most likely to cause significant erosion. Erosion can have a number of impacts including:

- » Direct loss of habitat and potential for long recovery times due to loss of topsoil
- » Increased turbidity in receiving waterways (including the marine environment).

Soil and sediment management will be conducted in line with statutory obligations including EPA Codes of Practice and documented in the CEMP. This will include mitigation measures such as:

- » Temporary stabilisation of disturbed areas
- » Onsite containment of stormwater flows
- » Revegetation/rehabilitation of disturbed areas as soon as is practicable after construction.

Wind erosion through dust mobilisation is exacerbated if soils exposed by construction disturbance become dry and experience regular vehicle traffic. In particular for the Project area, much of the soil is characterised by a cryptogamic crust which provides some protection against erosion. Once the crust is disturbed soils become more susceptible to erosion. Mitigation measures to reduce wind erosion will include:

- » Wetting down of disturbed areas via water trucks
- » Revegetation/rehabilitation of disturbed areas as soon as is practicable after construction
- » Drainage management to maintain flow patterns in watercourses.

Overall, with the above mitigation measures, the impact with respect to the clearance of vegetation reducing habitat for threatened species and non-threatened species will be a minor impact with the risk rating being low.

7.6.1.2. Noise

The CEMP (**Chapter 19, Environmental Management Plan**) defines the measures to ensure compliance with the EPA regulations (*Environment Protection (Noise) Policy 2007*), which will ensure that noise levels are controlled as much as is practicable. In protecting human receptors, through compliance with EPA guidelines some protection is given to native fauna, in that noise levels will not be excessive.

7.6.1.3. Light Spill

A Light Management Plan will be prepared by the Contractor. The use of lighting at night will be minimised where safe to do so in line with objectives of the Project to minimise energy use and carbon emissions where possible. Shielded lights may also be used to minimise spill. It is the intention that unless construction activities are occurring, at night only low level security lighting will be used on the site. With these measures, the residual impact will be negligible with a low risk rating.

7.6.1.4. Weeds

Measures to mitigate the spread or introduction of weeds include:

- » Liaising with the EPNRMB to prioritise weed control strategies and identify emerging issues
- » Ensuring thorough and appropriate cleaning of plant and machinery entering the development site
- » Minimising the area disturbed by construction and machinery wherever possible
- » Rehabilitating disturbed areas as soon as is practicable
- » Ensuring that vehicles remain on designated tracks to minimise the area of disturbance and avoid the potential spread of weeds
- » Undertaking targeted surveys and control activities for declared and environmental weeds within the Project area.

Overall, with the implementation of weed management strategies in the CEMP, the residual impact shall be negligible with a low risk rating.

7.6.1.5. Bushfire

Measures to the impact of bushfire on the ecology of the study area include:

- » Restricting high risk activities during days declared as Total Fire Ban for the region (e.g. welding, grinding, etc.)
- » Where possible, conducting high risk activities in a suitable location with low fire risk (i.e. cleared, hard stand area)
- » Having 'spotters' present during high risk activities with fire control equipment.

Risk to personnel is addressed in **Chapter 17, Hazard and Risk**.

Overall with the above safeguards, the residual risk is minor and the risk rating low

7.6.2. Operation Impact Mitigation

For the issues described above, the effects are considered to be minor and the risk rating low. However, it is necessary that there is a management regime to ensure that this remains the case. An Operation Environmental Management Plan (OEMP) will be prepared by the Site Operator, which will include the necessary measures for long-term performance. Key measures to be addressed are outlined below and further addressed in **Chapter 19, Environmental Management Plan**.

7.6.2.1. Weeds

Measures to mitigate the spread or introduction of weeds during the operation of the Project will include:

- » Liaising with the EPNRMB to prioritise weed control strategies and identify emerging issues
- » Ensuring thorough and appropriate cleaning of plant and machinery entering the BCEF
- » Minimising the area disturbed by operational plant and vehicles wherever possible, including ensuring that vehicles remain on designated roads networks to minimise the area of disturbance and avoid the potential spread of weeds
- » Any maintenance that results in soil disturbance or damage to vegetation should be followed by appropriate rehabilitation works, as for post-construction activities
- » Undertaking periodic surveys and control activities for declared and environmental weeds within the Project area, including along the rail line.

7.6.2.2. Light

The OEMP will include a Light Management Plan. Shielded lights will be used to minimise spill. Only low level security lighting will be used on the site. With these measures, the residual impact will be negligible with a low risk rating.

7.6.2.3. Noise

The OEMP will include measures to ensure continuing compliance with EPA guidelines, including any maintenance of infrastructure. Practical measures to mitigate any effects have been described in **Chapter 5, Noise and Vibration**. As described above, it is expected that there will be increased noise levels, around the conveyers, for approximately 500-750 metres, up to 50dB (A). Some behavioural response may occur with more sensitive species, and these may be displaced into the available suitable habitat which is regionally extensive.

7.6.2.4. Feral Animals

An OEMP for the site will include monitoring and control of feral animals on land controlled by the proponent. The risk is expected to be low.

7.6.2.5. Bushfire

The OEMP will aim to reduce fire risk in the first instance by adopting such measures as:

- » Liaising with the local CFS.
- » Restricting high risk activities during days declared as Total Fire Ban for the region (e.g. welding, grinding etc.)
- » Where possible, conducting high risk activities in a suitable location with low fire risk (i.e. cleared, hard stand area)
- » Having adequate fire control equipment and trained personnel.

These measures will ensure the risk rating remains low.

7.7. Monitoring

Monitoring during the construction and operational phases will be required to ensure that high standards of environmental protection and management are achieved and maintained. These are outlined in detail in **Chapter 19, Environmental Management Plan**, but key monitoring activities will include the activities outlined in the following sections.

7.7.1. Construction

- » Following construction, a survey will be undertaken to determine the actual area cleared. This will be required for ongoing consultation with the Native Vegetation Council
- » Periodic monitoring and reporting (three-six months) for weeds, followed by control actions as required
- » Monitoring of post construction rehabilitation/revegetation measures and reporting with remediation measures taken as required.

It is important to note that post construction rehabilitation will likely continue for some years after construction activities are completed.

7.7.2. Operation

- » Periodic (probably annually) monitoring and reporting of weeds, particularly after any infrastructure maintenance which may result in some vegetation disturbance
- » Monitoring and reporting on the implementation and success of the vegetation management plan prepared as part of the SEB requirements determined in consultation with the Native Vegetation Council
- » Regular inspection and reporting on the use of infrastructure (e.g. sheds) by feral species, followed by control measures as required
- » Continued monitoring and reporting of post-construction rehabilitation/revegetation works.

Other aspects, such as noise levels, are addressed in **Chapter 19, Environmental Management Plan**.

7.8. Risk Assessment Summary

Based on the risk assessment methodology outlined in **Section 7.2**, the primary impacting processes during construction and operation, significance of impact and likelihood of impact occurring and the residual risk rating after mitigation measures are implemented, are summarised in **Table 7.8a**.

Table 7.8a: Risk assessment summary

Initial Assessment with Standard Mitigation (i.e. Statutory Requirements)					Residual Assessment with Additional Mitigation in Place			
Primary Impacting Processes	Statutory Mitigation Measures Required	Significance of Impact	Likelihood of Impact	Risk Rating	Additional Mitigation Measures Proposed	Significance of Impact	Likelihood of Impact	Risk Rating
Construction								
Vegetation clearance reducing habitat for threatened and non-threatened species	SEB offset through NVM Act	Minor	Possible	Medium	CEMP implementation, which includes minimising land disturbance as much as practical, post construction remediation.	Minor	Unlikely	Low
Habitat fragmentation as a result of vegetation clearance		Minor	Unlikely	Low	Rehabilitation of areas disturbed during construction and not required for operation of the BCEF	Minor	Unlikely	Low
Noise pollution from construction of rail line, storage facility and ship loading infrastructure	EPA regulations (<i>Environment Protection (Noise) Policy 2007</i>) for amenity benefit also benefit native fauna	Minor	Unlikely	Low	None required, risk already low			
Light pollution from construction affecting a species (particularly migratory species)	None identified	Minor	Unlikely	Low	Minimise non-essential lighting through a Light Management Plan	Minor	Unlikely	Low
Proliferation of weeds as a result of construction activities affecting threatened and non-threatened species	Control of declared weeds (NRM Act)	Moderate	Possible	Medium	Ongoing monitoring and control of environmental weeds within land controlled by SGPL as part of CEMP	Negligible	Unlikely	Low
Increased occurrence of bushfires as a result of construction activities		Moderate	Possible	Medium	Mitigation measures as outlined in CEMP	Minor	Unlikely	Low

Initial Assessment with Standard Mitigation (i.e. Statutory Requirements)					Residual Assessment with Additional Mitigation in Place			
Primary Impacting Processes	Statutory Mitigation Measures Required	Significance of Impact	Likelihood of Impact	Risk Rating	Additional Mitigation Measures Proposed	Significance of Impact	Likelihood of Impact	Risk Rating
Operation								
Edge effects as a result of vegetation clearance		Minor	Possible	Medium	Rehabilitation of areas disturbed during construction and not required for operation	Minor	Unlikely	Low
Noise pollution from operation of the Project (e.g. rail and ship loading activities)	EPA regulations (<i>Environment Protection (Noise) Policy 2007</i>) for amenity benefit also benefit native fauna	Minor	Unlikely	Low	None required, risk already low			
Light pollution from operation affecting a species (particularly migratory species)		Minor	Unlikely	Low	Light Management Plan to minimise the use of lighting while still maintaining a safe working environment	Minor	Unlikely	Low
Proliferation of weeds as a result of poor management and/or vehicle movements affecting threatened and non-threatened species	Control of declared weeds (NRM Act)	Moderate	Possible	Medium	Ongoing monitoring and control of environmental weeds within land controlled by SGPL to be included in an Operation Environmental Management Plan (OEMP)	Negligible	Unlikely	Low
Proliferation of feral animals as a result of the Project	Control of declared pest animals (NRM Act)	Minor	Possible	Low	Fencing to exclude pest animals from land managed by SGPL.	Negligible	Unlikely	Low
Increased occurrence of bushfires as a result of construction activities		Moderate	Possible	Medium	Mitigation measures as outlined in OEMP	Minor	Unlikely	Low