14. Flora

14.1 Overview

The existing vegetation in the study area and surrounding region will be managed during the planning, design, construction and operational phases of the project.

14.2 Legislative and policy requirements

14.2.1 Commonwealth and state legislation

Table 14.1 summarises key legislation relevant to flora issues associated with the project.

Table 14.1 Commonwealth and state legislation

Legislation	Description	Relevance to project
Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)	The EPBC Act protects the environment in relation to impacts on matters of national environmental significance. It requires assessment and approval of actions that are likely to have a significant impact on a Matter of National Environmental Significance.	No flora species were identified through the EPBC Protected Matters Search Tool as potentially occurring within the project footprint.
Environment Protection Act 1993 (SA)	This Act is the overarching environmental legislation that deals with the protection of the environment and environmental offences. It is administered and enforced by the SA Environment Protection Authority. In relation to flora and fauna Part 4 Section 25 of the Act states: *A person must not undertake an activity which pollutes, or might pollute the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.*	Construction and operation of the proposed road network must comply with the Act. This includes the prevention of environmental harm as detailed in Part 4 Section 25 of the Act.
Natural Resources Management Act 2004 (SA)	This Act provides for the establishment of natural resources management boards in South Australia. The *Natural Resources Management Regulations 2005* establishes pest management actions on a state basis (which includes pest flora and fauna species).	The South Road Superway Project lies within the Adelaide and Mount Lofty Ranges Natural Resources Management (AMLR NRMB) region.

Legislation	Description	Relevance to project
Native Vegetation Act 1991 (SA)	The Act provides incentives and assistance to landowners for the preservation and enhancement of native vegetation, and controls the clearance of native vegetation. It also identifies flora species considered to be of conservation significance. The Act focuses on retaining areas of remnant native vegetation, in particular in order to prevent further: • reduction of biological diversity and degradation of the land and its soil • loss of quantity and quality of native vegetation • loss of critical habitat. Approval is required under the Act for the clearance of native vegetation.	If native vegetation is required to be cleared, approval under the Act will be obtained. One flora species of state conservation significance, *Acacia iteaphylla* (Flinders Range Wattle), was recorded as occurring within the study area (EBS 2009).
National Parks and Wildlife Act 1972 (SA)	This Act was developed to establish and manage reserves for public enjoyment. In addition, it provides for the protection of native flora and fauna, and identifies flora and fauna species considered to be of conservation significance for the state of South Australia.	Species listed as being of conservation significance by the Act should be protected. Potential impacts to these species should be avoided or minimised to ensure protection of these species into the future. 15 species of native flora listed under the NPW Act have been identified as occurring within 5.0 km of the project footprint.
Development Act 1993 (SA)	The Act provides for proper, orderly and efficient planning and development in South Australia.	Any trees meeting the 'significant tree' requirements under the Development Act, which will be removed or require major pruning will require an DAC application.

14.3 Assessment methodology

The flora assessment included:

- a literature review of previous investigations
- a search of flora database records from local, South Australian and Australian governments including the Biological Database of South Australia (BDBSA), which is maintained by the Department for Environment and Heritage (DEH) and a Protected Matters Search of the *Environment Protection and Biodiversity Act 1999* (EPBC Act)
- field surveys using the method outlined in the DTEI Vegetation Survey Guidelines
- consultation with South Australian Government groups and key stakeholders
- assessment of impacts to native flora based on the criteria outlined in the EPBC Act Significant Impact Guidelines.

14.4 Existing conditions

14.4.1 Flora communities prior to European settlement

Early maps of South Australia show extensive freshwater swamps and lagoons stretching from the Port River in the north to the Patawalonga Creek and Grovene in the south. The swamps were collectively referred to as the 'Reedbeds' due to the abundance of *Phragmites australis* (Common Reed) (Kraehenbuehl 1996). The project footprint south and east of the Barker Inlet Wetlands was described

as once 'being flat and free from scrub and bushes, the soil was rich and the swamps to the west (Barker Inlet) provided excellent feed for cattle' (Kraehenbuehl 1996).

The majority of the study site (area north of Wirriga Street) was originally characterised by samphire low shrublands including mixed *Halosarcia* spp. *Sclerostegia* spp. *Atriplex paludosa* and *Sarcocornia* spp. (Kraehenbuehl 1996). However, the area directly north of the Days Road intersection originally comprised *Melaleuca halmaturorum* low woodland (Kraehenbuehl 1996).

14.4.2 Flora communities within study area

Within the study area, the *Avicennia marina* (Mangrove) and *Melaleuca halmaturorum* (Tea Tree) low woodlands have been cleared, as have much of the samphire low shrublands. Within the northern portion of the study area, around Gillman, much of the samphire community is degraded and now dominated by exotic species (Kraehenbuehl 1996). The samphire low shrublands have been further degraded through the dumping of fill and wastes and drainage off the coastal fringe (Brown and Root 2001a). Flora in Barker Inlet Wetland is primarily *Juncus acutus* tall sedges (Brown and Root 2001a).

Remnant flora and fauna habitat in the Port Adelaide Enfield region has been progressively cleared since 1855 when Port Adelaide was first declared a Corporate Town. The study area therefore has virtually no remnant native vegetation. However, Barker Inlet Wetland system and planted native trees in Regency Park Golf Course and roadside verges do provide habitat for common native flora and fauna species (**Figure 14.1**).

A flora survey of the study area in August 2009 identified seven vegetation associations:

1. Barker Inlet Wetlands were planted with approximately 50 different terrestrial and aquatic species originating from the Adelaide Plains region. The upperstorey of Vegetation Association 1 is considered to be in good condition and comprises species including *Casuarina glauca* (Swamp Oak), *Myoporum insulare* (Common Boobialla), *Melaleuca halmaturorum* (Swamp Paper Bark) and *Allocasuarina verticillata* (Drooping Sheoak) (EBS 2009). The understorey is dominated by exotic species and is considered to be in poor condition (EBS 2009).
2. Vegetation Association 2, also in Barker Inlet Wetland, is dominated by *Tecticornia arbuscula* (Shrubby Glasswort). This association is located in areas subject to flooding from tidal flows and its salt tolerant species are dominated by samphire (EBS 2009). The understorey is dominated by native salt tolerant species including some exotic species (EBS 2009). This association is considered to be in good condition but has some degradation with pollution and rubbish present in the area (EBS 2009).
3. Vegetation Association 3 occurs in the Barker Inlet Wetland system and is dominated by Shrubby Glasswort, *Enchylaena tomentosa* (Ruby Saltbush) and exotic herbs (EBS 2009). The understorey is dominated by *Atriplex* spp (Saltbush) *Schoenoplectus pungens* (Spikey Club-rush) and exotic species (EBS 2009).
4. Vegetation Association 4, around the edges of the permanent waterbodies in the Barker Inlet Wetland system, is dominated by *Typha domingensis* (Narrow-leaf Bulrush) reedbeds (EBS 2009). Four indigenous and two weed species were recorded for this vegetation association (EBS 2009).
5. Vegetation Association 5 comprises grassland and herbland species (EBS 2009) and is entirely dominated by exotic species (EBS 2009).
6. Vegetation Association 6 includes a mixed *Eucalyptus* plantation over exotic grassland (EBS 2009). It is located within Regency Park Golf Course and TAFESA Regency Campus. The upper storey is dominated by *Eucalyptus* species, many of which are not locally indigenous and were planted for amenity reasons (EBS 2009). Other tree species included Drooping Sheoak, *Schinus molle* (Pepper Tree) and *Acacia* ssp. (wattle) (EBS 2009). Several trees are considered to be in good condition and provide habitat for fauna species (EBS 2009). The understorey in this association is highly modified and heavily degraded; it is primarily made up of weed species and is considered to be in poor condition (EBS 2009).

7. Vegetation Association 7 is located in built-up residential and industrial areas, which are heavily modified through past and current land use. The vegetation is primarily 'garden' variety and exotic species; plantations are also common (EBS 2009). Some areas support few native species planted over exotic grassland and/or herbland understories. The understorey is primarily exotic and considered to be in poor condition (EBS 2009).

Figure 14.1 shows the seven vegetation associations and their distribution within the study area.

14.4.3 Native flora species in the site and surrounding area

The flora survey of the project footprint in August 2009 identified the presence of 26 indigenous flora species.

These native species were primarily planted individuals, located in the golf course, roadside verges and Barker Inlet Wetland. Only one species of State conservation significance, *Acacia iteaphylla* (Flinders Range Wattle), was identified as occurring in the study area during this survey (EBS 2009). It was found in Vegetation Associations 6 and 7 (EBS 2009).

Six of the seven vegetation associations contain at least some native vegetation. Most of the native vegetation in the study area is not remnant but has been planted for rehabilitation in Barker Inlet Wetland or for amenity reasons such as in Regency Park Golf Course and built-up residential/industrial areas (EBS 2009).

In addition, the flora survey of the study area in August 2009 identified a number of significant trees, as defined by the *Development Act 1993* (EBS 2009). Removal of these trees will require approval of the Council.

14.4.4 Weed species occurring within the study area

The flora survey of the study area identified 11 species of weeds listed as declared plants under the *Natural Resources Management Act 2004* (NRM Act) (EBS 2009). The NRM Act details management conditions that apply to leaseholders and owners of sites on which declared plants occur. The 11 declared weed species are:

- *Asphodelus fistulosus* (Onion Weed)
- *Cynara cardunculus* ssp. *flavescens* (Artichoke Thistle)
- *Diplotaxis tenuifolia* (Lincoln Weed)
- *Echium plantagineum* (Salvation Jane)
- *Hirschfeldia incana* (Hoary Mustard)
- *Lantana camara* (Common Lantana)
- *Lycium ferocissimum* (African Boxthorn)
- *Moraea faccida* (One-leaf Cape Tulip)
- *Olea europaea* (Olive)
- *Oxalis pes-caprae* (Soursob)
- *Tamaris aphylla* (Athel Pine).

Two of these species, Athel Pine and Common Lantana, are also described as Weeds of National Significance (WoNS). As stated by John Burley, from the National Weeds Strategy Committee, "The WoNS program 'is a proactive attempt to strategically manage priority weeds that pose future threats to primary industries, land management, human or animal welfare, biodiversity and conservation values' (John Burley).

Reducing the likelihood of transmission of these weed species must be considered during construction of the road network. Proposed measures to reduce the likelihood of spreading weeds during the construction and operation of the project are included in Section 14.7.

14.5 Species of conservation significance

14.5.1 Likelihood of occurrence

A search of the National EPBC Act Protected Matters Search Tool was completed to identify if species of national conservation significance have the potential to occur within the study area.

The search results indicated that no flora species listed under the EPBC Act would occur in the study area; one ecological community was identified as potentially occurring within the study area. Analysis of data maintained by DEH in the BDBSA did not identify the presence of flora species, protected under the EPBC Act or National Parks and Wildlife Act, within 0.5 km of the site. However, the flora survey in August 2009 identified the presence of one species of state conservation significance. In addition, two species protected under the EPBC Act and eight species protected under the National Parks and Wildlife Act were identified as occurring within 5.0 km of the study area. The likelihood of occurrence of these species in the study area is discussed in **Table 14.2.**

The survey locations of these species are shown in **Figure 14.1.**

Table 14.2 Species and ecological communities of conservation significance in the project area

Species	Common name	EPBC Act 1999 rating	NPW Act 1972 rating	Likelihood of occurrence
Ecological community				
Eucalyptus odorata Grassy Woodland of South Australia	Peppermint Box Grassy Woodland of South Australia	CE		Low; the project footprint has been highly degraded from its pre-European state and this community was not identified as occurring within the project footprint during the 2009 flora survey (EBS 2009)
Flora species				
Prostanthera eurybioides	Monarto Mintbush	E	E	Very low; the site is degraded, the preferred habitat for this species, including mallee shrubland, does not occur within the project footprint (DEH 2008); the species is considered to no longer occur in the Southern Mount Lofty Botanical region (DEH 2008).
Tecticornia flabelliformis	Bead Samphire	V	V	Low; the preferred habitat for this species includes saltmarsh which historically occurred in the project area (DEH 2008); the altered nature of the habitat in the project footprint and the date of the last sighting of this species (1990) indicates that it is unlikely for this species to occur in the study area.
Juncus radula	Hoary Rush		V	Low; this species inhabits riparian and seasonally damp regions, thus there is potential for it to occur in Barker Inlet Wetland (DEH 2008) but the altered nature of the project footprint and date of its last sighting (1985), indicate a low likelihood that this species occurs in the project footprint.
Acacia dodonaeifolia	Hop-bush Wattle		R	Low; this species usually occurs in eucalypt and open wooded forest on sand or loam soils (CSIRO 2009); it has potential to occur in areas of native vegetation in roadside verges and golf course but the altered nature of the project footprint and date of the last sighting of this species (1981) indicate a low

Species	Common name	EPBC Act 1999 rating	NPW Act 1972 rating	Likelihood of occurrence
				likelihood that this species occurs in the project footprint.
Austrostipa multispiculis	Small-seed Spear-Grass		R	Low; this species is often found in eucalypt woodlands but is also along creeks and in grassy areas (Jessop et al. 2006); the altered nature of the project footprint and date of the last sighting of this species (1990) make the likelihood that this species occurs in the project footprint low.
Bothriochloa macra	Red-leg Grass		R	Low; this species is known to occur in disturbed areas and probably typically in fairly open grassland or grassy woodland communities (Jessop et al. 2006); the altered nature of the project footprint and date of the last sighting of this species (1973) make the likelihood that this species occurs in the project footprint low.
Leionema hillebrandii	Mount Lofty Phebalium		R	Low; this species is found in healthy woodland and forest areas (DEH 2008); in this degraded area, and with the last sighting of this species in 1979, it is unlikely that this species will occur .
Microtis rara	Sweet Onion-orchid		R	Low; this species occurs in small colonies around permanent swamp margins often in deeply shaded places. In the Adelaide region it is restricted to peaty swamps and creek-sides often hidden in dense tree thickets and reeds and only flowering after fire or other disturbance (DEH 2008). Due to the altered nature of the project footprint and date of its last sighting (1985), the species has a low likelihood of occurring in the project footprint.
Pteris tremula	Tender Brake		R	Low, this species occurs in wet, shaded gullies or gorges, sinkholes and caves and requires permanent water. Within the Adelaide region the preferred broad vegetation groups are Wetland and Riparian (DEH 2008). Due to the altered nature of the project footprint and the date of the last sighting of this species (1970), the likelihood that this species occurs within the project footprint is considered low.
Sclerolaena muricata var. *villosa*	Five-spine Bindyi		R	Low; this species is often found in overgrazed paddocks and in coastal regions (PlantNet 2009) the degraded nature of the site, inappropriate habitat in the project footprint and date of the last sighting of this species (1993), the potential for the species to be present is considered to be low.
Acacia iteaphylla	Flinders Range Wattle		R	High; this species was identified as occurring in Vegetation Associations 6 and 7 site during the August 2009 flora survey (EBS 2009).

The altered nature of the project footprint and the history of disturbance, including the removal of most remnant native vegetation, indicates that it would be unlikely for species of conservation significance to occur in the study area, with the exception of the Flinders Range Wattle which was identified in highly degraded Vegetation Associations 6 and 7 (EBS 2009). Most species listed in **Table 14.2** were identified as occurring in the wetland system to the northwest of the South Road Superway Project or in areas of remnant vegetation throughout the northern Adelaide metropolitan region (see **Figure 14.1**).

South Road Superway
Study Area
Acacia iteaphylla (Flinders Range Wattle) - NPW Act - rare
1 - Exotic grassland / herbland
2 - *Tecticornia arbuscula* closed shrubland
3 - *Typha domigensis* reedbed
4 - *Tecticornia arbuscula / Enchyleana tomentosa* + / - exotic herbs low open shrubland
5 - *Casuarina glauca / Myoporum insulare / Melaleuca halmaturorum* +/- *Allocasuarina verticillata revegetation*
6 - Mixed Eucalyptus plantation over exotic grassland
7 - Built-up (residential / industrial areas)

Vegetation Associations and Listed Flora In Study Area

(EBS 2009)

Figure 14.1

14.6 Effects of the project on existing flora

The EPBC Act Significant Impact Guidelines (DEWHA 2006) outline and define significant impact criteria for categories of threatened species. Broadly, the criteria define an action as 'significant' if it:

- leads to a long term decrease in the population
- reduces the area of occupancy of the species
- fragments an existing population
- adversely affects critical habitat
- disrupts breeding cycles
- detrimentally affects habitat quality
- leads to the introduction of invasive species
- introduces disease that may affect a species
- interferes with the recovery of the species.

For the purposes of this assessment, flora species are considered to be significantly impacted if the construction/operation of the South Road Superway Project is likely to meet one or more of the criteria listed above. Impacts to all native flora species have been considered using these criteria and the South Road Superway is not considered to have a significant impact.

The potential impacts to native vegetation as a result of the South Road Superway Project are considered to be negligible. The site has been highly degraded from its pre-European state through the development of industry and road networks in the region. Very little remnant vegetation remains in the region; most vegetation is amenity plantings in the golf course, road side verges and Barker Inlet South Wetland.

The following areas, which will likely be removed for this project, provide habitat for native and exotic vegetation:

- roadside verges along the length of South Road (including Regency Park Golf Course), as well as east of Rafferty Street and South Terrace
- undeveloped area north of Naweena Street to be developed for the Naween Street extension
- undeveloped area located within the Davis Street extension
- habitat in the immediate vicinity of proposed signalised junctions (Rafferty Street and Cormack Road, Naweena–Gallipoli Link, Grand Junction Road and Naweena Road, and Regency Road and Gallipoli Grove)
- habitat in Barker Inlet South Wetland between South Rd and Salisbury Highway.

Construction of an elevated roadway instead of a ground level road will mean less land acquisition and thus less vegetation required to be removed. Along with the altered nature of this vegetation, it is therefore unlikely that any native species including those of conservation significance will be significantly impacted by the construction and operation of the South Road Superway. Nevertheless, management measures are being developed to mitigate or minimise any effects of the construction of the road on native flora (see **Section 14.7**).

The August 2009 flora survey of the project area identified the presence of significant trees as defined by the *Development Act 1993*. Removal of these trees will require the approval of the local Council.

14.6.1 Limitations

- The flora survey was conducted during the winter and it is likely that not all flora species could be identified during the winter months (e.g. deciduous, grasses and herbs), thus species of conservation significance may occur in the study area but were not identified during this survey.
- Records of historic surveys maintained by DEH in the BDBSA may be inaccurate or incomplete. In addition these historic surveys have not necessarily been undertaken throughout all seasons or in the study area. The data indicate which species have been identified as occurring in the study area and surrounding region but cannot be used to determine which species do not occur there.
- This assessment has not considered the cumulative impacts of construction or operation of other road networks, industry or residential developments. This assessment only considers potential impacts associated with the construction and operation of the South Road Superway Project.

14.7 Mitigation measures to minimise effects

14.7.1 Principles and measures adopted to minimise effects

Table 14.3 Potential flora and fauna impacts and their management and mitigation

Project stage	Potential impact	Mitigation/management measures
Design	Flora and fauna	▪ Identification of species, or species habitat, of conservation significance within the project footprint ▪ Designing the road corridor to limit the removal of native vegetation and fauna habitat ▪ Designing the road corridor to ensure surface water quality is not decreased through construction and/or operation of the upgraded road network ▪ Development of a construction environmental management plan ▪ Development of an operational environmental management plan
Construction	Removal of native flora habitat Spread of weed species	▪ Implementation of a construction environmental management plan including measures such as: – confine vehicle access to existing roads where possible to reduce the spread of weeds – no dumping of materials/waste or diversion of drainage lines that will impact native vegetation during construction – place fencing around native vegetation which is located within construction premises and which is not being removed as a consequence of the proposed project – any pollution events that occur (i.e. spilling of hydrocarbons) will be cleaned up immediately with minimal impact to native vegetation – any imported fill should be clean and not include any exotic species or propagules of exotic species – clean all earthmoving machinery of soil and vegetation material prior to entering or exiting the site – induct all site personnel and ensure personnel are aware of mitigation measures to be implemented to reduce impacts to flora and fauna – adopt an adaptive management approach to identify impacts associated with the construction of the road network and develop or alter processes/procedures to eliminate or

Project stage	Potential impact	Mitigation/management measures
		minimise these impacts.
Operation	Degradation of flora habitat adjacent to the project footprint	▪ Maintain any rehabilitated areas including weeding, watering and replacement of dead plant stocks as necessary ▪ Adopt an adaptive management approach to identify impacts associated with the operation of the road network and develop or alter processes/procedures to eliminate or minimise these impacts.

14.8 Conclusion

The remnant flora habitat in the project footprint has been highly altered since expansion of the Adelaide metropolitan area from 1855. The project footprint now comprises only a few areas of planted vegetation habitat including those identified in Section 14.7.

Of these areas containing native planted vegetation habitat it is likely that small portions will need removal for construction of the South Road Superway. Only one species listed as having state or national conservation significance was identified as occurring in the study area during historic and current flora surveys (DEH 2009; EBS 2009). The Flinders Range Wattle, a species listed as being of conservation significance under the National Parks and Wildlife Act, was identified as occurring within Vegetation Associations 5 and 6. Both associations are both highly modified with native and exotic amenity plantings common. It is likely that the Flinders Range Wattle in these associations has been planted and is adaptable to inhabiting disturbed areas.

Due to the small amount of vegetation required to be removed as well as the altered nature of the vegetation present within the study area, it is unlikely that any native species, including those of conservation significance, will be significantly impacted by the construction and operation of the South Road Superway. Proposed management measures will mitigate or minimise the affects of construction and operation of the road on native flora.