

**Salinity Reduction Scheme
Younghusband Peninsula
South Australia**

Native Vegetation Assessment
Regulation 5(1)(zi)

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Environmental Design & Management
Rural Solutions SA
February 2010



RURAL SOLUTIONS SA



**Government
of South Australia**



This report is advisory only and the final decision rests with the Native Vegetation Council, SA (DWLBC).

Final February 2010.

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1 PREFACE

DATE: Friday, February 12, 2010

TO:

Mike Hodder, Leader, Native Vegetation Assessments
Biodiversity Assessment Services
Native Vegetation Program
Land and Biodiversity Services
Department of Water, Land and Biodiversity Conservation

FROM:

Rural Solutions SA, Emma Kinnane *on behalf of* Damien Pearce, Department for Environment and Heritage (DEH).

SUBJECT:

Native Vegetation Clearance for the establishment of a pipeline to pump hyper-saline water from the Coorong over Youngusband Peninsula into the ocean, in the South East Region SA

HP 410500 Sections 5 and 6 in the Hundred of Santo
HP 410200 Section 17 in the Hundred of Glyde

Dear Mike,

Please find attached a data report for site inspection relating to clearance for a pipeline to pump hyper-saline water from the Coorong (south lagoon) to the ocean. The Coorong has historically been naturally fed by the River Murray and the ocean, but with the reduction in flows from the river over the barrages, subsequent inflows over the past few years have been restricted to salty ocean water. Recent salt levels in the Coorong have increased five to six times the salinity of ocean water, rather than the usual three times and are having a detrimental effect on the ecosystem. Current indicators showing a decline in the health of the Coorong ecology directly attributed to the effects of salinity include dieback in vegetation, the disappearance of invertebrates, and notable changes to the movement and migration of birds (Paton et al. 2009a and 2009b), (EPBC referral DEH 2009).

The exact location of the pipeline is currently unconfirmed, but a likely position is indicated in this proposal and amendments will be made when plans are finalised. Descriptions of how potential sites were surveyed are explained in the Methodology section. Native vegetation has been assessed in accordance with *Regulation 5(1)(zi) Clearance for Preserving, Enhancing Ecological processes*, under the Native Vegetation Act 1991, South Australia (refer Appendix 1). This regulation does not require a Significant Environmental Benefit (SEB).

The proposed salinity reduction scheme does not align entirely with Regulation 5(1)(zi) given that the primary ecological improvements are aquatic and monitoring of success is related to the aquatic Coorong and marine environments. However, secondary improvements may be observed in vertebrate and invertebrate fauna increases, and plant health. As discussed with you prior the field assessment in January 2010, the Native Vegetation Group has advised that a management plan to monitor the effects of the clearance as stated in Part A of the Regulation is not required for the Native Vegetation Application. However, aquatic monitoring will occur as part of the overall project, executed by South Australian Research and Development Institute (SARDI). Additionally, operating procedures and a rehabilitation plan will be submitted when the exact location of the pipeline is established.



The assessment involved a field inspection on the 20th and 21st of January 2010 by accredited Rural Solutions SA Environmental Consultant, Emma Kinnane and accompanied by DEH Ranger Clare Manning, South Australian Murray-Darling Basin Natural Resources Management Board (SAMDB NRM) Officer Glynn Rickets and Flinders University volunteer Josh Oster.

Please find attached consultant data report for review and consideration.

2 SIGNATURE PAGE

Locality:

The proposed native vegetation clearance is on Younghusband Peninsula in the Coorong National Park 10–15km north west of Salt Creek and 45-50 km SE of Meningie, within the South East Region, South Australia.

The application area covers the following parcels:
HP 410500 Sections 5 and 6 in the Hundred of Santo
HP 410200 Section 17 in the Hundred of Glyde

Applicant:



Department for Environment and Heritage (DEH), Damien Pearce, Manager, Operational delivery Coorong, Lower Lakes and Murray Mouth Program

Clearance area:

Estimated two hectares of native vegetation.
Refer to Advisory Plan 1 for more detail.

The proponent has read and understood the consultant data report.

Mr Damien Pearce, on behalf of DEH

Signed  Date 11/2/2010




CONSULTANTS DATA REPORT

3 BACKGROUND INFORMATION TO THE PROPOSAL

Sections 3.1 and 3.2 are derived mainly from the draft Environment Protection and Biodiversity Conservation (EPBC) Act referral for the salinity reduction scheme (DEH, 2009), a document in final preparation. Content has been edited for the purpose of the consultants data report and references are available from the EPBC referral.

3.1 SALINITY REDUCTION SCHEME - RATIONAL

The salinity reduction scheme is an urgent response to achieve biodiversity conservation by mitigating the adverse impacts of hypersalinity in the Coorong South Lagoon, part of an internationally significant RAMSAR wetland and critical habitat for nationally listed bird species. The continued degradation is a result of the build-up of excessive salinity levels in the lagoon due to low or no fresh water inputs to the Coorong from the Murray over the barrages. This more recent impact follows a longer period of slow decline in environmental conditions and ecological character of the Coorong.

The proposed salinity reduction scheme to be implemented by DEH is an important, urgent management response to restore critical habitat for a number of EPBC-listed bird species (up to nine species), including listed migratory bird species protected under international agreements, and to restore the ecological character of the Ramsar listed wetland of the Coorong South Lagoon.

- The South Lagoon is now five to six times more saline than seawater (Lester et al. 2009), whereas it was historically two to three times the salinity level of seawater (e.g. in Geddes and Hall 1990). The diversity of bird and fish life in this lagoon has decreased dramatically in the past seven years and the ecosystem is on the verge of irreversible collapse. For example, there have been large (30%) to very large (99.9%) decreases in the populations of 23 out of 27 of the most common species of Coorong waterbirds during the period 1985 – 2007 (Paton et al. 2009b).
- Several Keystone Speceis are now missing from the South Lagoon
 - Aquatic plant *Ruppia tuberosa* (grows well in water at 100 ppt, plus needs adequate water levels, which are decreasing).
 - Chironomids (midges) (tolerate up to 120 ppt).
 - Small-mouthed hardyhead fish (tolerate up to 120 ppt).
 - *Note that all of these are food for birds, including those species listed under the CAMBA, JAMBA and RoKAMBA international migratory bird agreements.*
- Threatened species are in decline – a prime example is the Fairy Tern, *Sternula nereis*, which is listed under the EPBC Act, largely due to reduced breeding in the Coorong South Lagoon.
- If there are no freshwater flows over the barrages, or even under minimal to low flow regimes (304 - 579 GL / yr), the situation in the Coorong South Lagoon will remain unsuitable for the recovery of keystone species (CLLAMM ecology 2008) in the absence of intervention.

3.2 SALINITY REDUCTION SCHEME - PROPOSAL

The objective is to achieve the habitat restoration by decreasing the salinity of the South Lagoon to target salinity levels, through:

- Pumping of hypersaline water from the Coorong South Lagoon to the Southern Ocean.



- Natural flow of less saline water from the Coorong North Lagoon to the South Lagoon, which will lead to reduced salt concentrations in the South Lagoon via dilution.

The Department for Environment and Heritage, on behalf of the South Australian (SA) Government proposes to:

- 1) Construct a pipeline from the Coorong South Lagoon across the Coorong National Park (Younghusband Peninsula) to the Southern Ocean;
- 2) Pump hypersaline water from the Coorong South Lagoon to the Southern Ocean, for approx. three years over a nominal five year ultimate project life depending on conditions, to reach target salinity levels in the Lagoon, coupled with dilution of the South Lagoon due to natural water flow from the less saline North Lagoon;
- 3) Closely monitor salinity levels and water quality at key locations in the Coorong Lagoons and around the Southern Ocean outfall, and adaptively manage the pumping regime.

3.3 LEGISLATION AND NATIVE VEGETATION CLEARANCE PROPOSAL

The salinity reduction scheme proposal requires a number of approvals through various State and Federal Government agencies. A referral has been developed for submission under the Environment Protection and Biodiversity Conservation Act (EPBC Act) due to the presence of nationally (EPBC listed) birds and the Coorong's status as an internationally significant RAMSAR wetland. The proposal also triggers the South Australian Native Vegetation Act 1991 due to the clearance required for installation of the pipeline and associated infrastructure. Given that the clearance should benefit the natural ecosystem processes it falls under Native Vegetation Regulation 5(1)(zi) *Clearance for preserving, Enhancing Ecological Processes* (see Appendix 1) which does not require an SEB to offset clearance, but usually requires a management plan that provides for monitoring the effects of the clearance. Given that measurable effects will initially be aquatic and a proposed monitoring plan is to be executed by SARDI, the Native Vegetation Council (NVC) is unlikely to require a separate management plan. It is noted that a site rehabilitation plan and standard operating procedures for construction within the vegetation clearance area will be provided when the final position for the pipeline is established.

The proposal requires clearance of approximately two hectares of native vegetation via narrow strip across the Younghusband peninsula and in a small patch on the mainland.. The field assessment associated with this report, address legislative requirements related to the native vegetation clearance component of the overall salinity reduction scheme. Engineering requirements were considered broadly whilst in the field, but the primary purpose of this component is to determine the type of vegetation present within the possible infrastructure area.

Methodologies used to assess native vegetation are provided in the Methodology section.



4 LANDSCAPE CONTEXT

4.1 PROPOSED LOCATION OF INFRASTRUCTURE

The assessment area is located between Policemans Point and Woods Well along the Coorong (mainland and Younghusband Peninsula) with the exact location dependent on a number of variables.

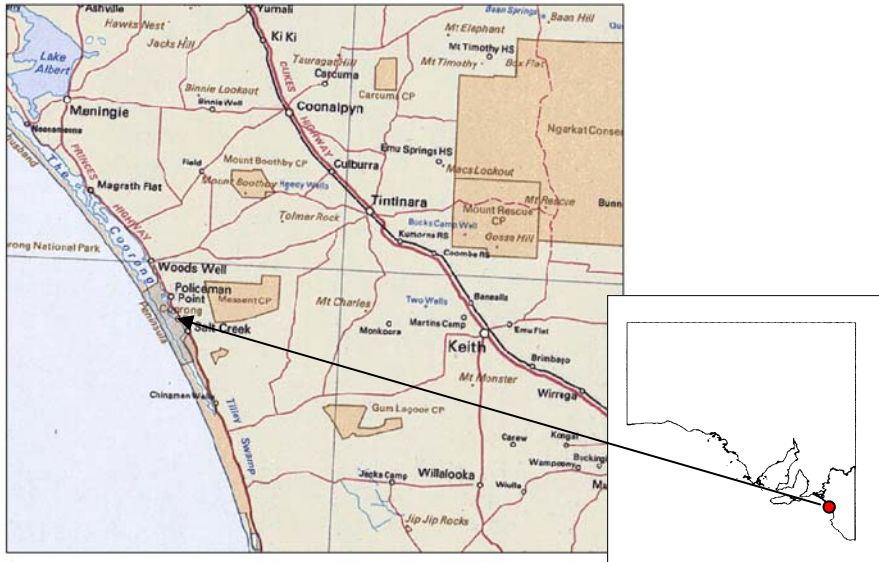


Figure 1 - Site Location

A possible infrastructure zone is allocated based on the suitable range to pump hyper-saline water out of the Coorong South Lagoon. The zone is between Woods Well and Policemans Point along the Coorong as shown on Advisory Plan 1. The works zone is approximately 16km north of Tea Tree Crossing along the beach near Salt Creek in the South East region of South Australia. The work zone is bound by the following co-ordinates:

The works shall be at 5 locations within the area bounded by the following coordinates as shown in Appendix A, Figure A:						
NE 35° 5' 50" S / 139° 24' 09"E						
NW 35° 54' 00" S / 139° 22' 56"E						
SW 36° 04' 11" S / 139° 32' 23"E						
SE 36° 02' 33" S / 139° 35' 23"E						
	Latitude			Longitude		
location point	degrees	minutes	seconds	degrees	minutes	seconds
Generator	-35	59	55	139	32	13
South Lagoon pump location	-36	00	23	139	31	27
Pipeline from South Lagoon to Ocean (approx. mid point)	-36	01	03	139	30	32
Pipeline ocean outfall	-36	01	23	139	30	38
Parnka Point track widening	-35	54	22	139	23	37

Table 1 - Site Co-ordinates



At the time of the field assessment, a final impact site had not been selected but a likely scenario is proposed. The location proposed is a naturally low lying channel through the vegetation of the Younghusband Peninsula as shown on Advisory Plan 1. Several swales of sand exist along the channel but otherwise it represents the flattest terrain. Additionally, this area is opposite an existing boat ramp and access point on the mainland side of the Coorong which would minimise impact. Other nearby locations within the same vegetation associations have not been ruled out and surveying is continuing along the possible range.

4.2 LAND USE

The 50,000 ha Coorong National Park was declared in 1966 to conserve the distinctive landscape, coastal dune system, lagoons, wetlands and coastal vegetation and the great variety of birds, animals and fish that live in or visit the area (DEH Website). The Coorong National Park is a designated RAMSAR wetland of international importance in recognition of the diverse range of wetland ecosystems, habitats, birds, fish and plant species. It is regarded as a significant area for biodiversity in southern Australia. The Coorong is also an archaeological site of national importance with middens and burial sites throughout the park giving evidence of Aboriginal occupation over many thousands of years. The park is visited for recreation activities including camping, four wheel driving, fishing, sight seeing and bird watching.

Taken together, these factors account for the Coorong National Park's significance in regional nature conservation and recreation and for its special importance as an area of national and international biological and heritage significance.

5 INFRASTRUCTURE COMPONENTS AND OPERATION

5.1 INFRASTRUCTURE COMPONENTS

The following is based on engineering feasibility assessments done by Tonkin Consulting (2009). Infrastructure will include a number of components with the location of various structures dependent on environmental and engineering variables. The main structural components of the project include;

1. A generator located on the mainland side of the Coorong (east) to power the pump.
2. An underwater cable to carry electricity from the generator to the pump.
3. A pump located in the Coorong channel, near the western shore.
4. Pipeline(s) from the pump over the sand dunes of the Younghusband Peninsula into the ocean.

1. A generator located on the mainland side of the Coorong (east) to power the pump.

It is likely the generator will be fuelled by diesel given the lack of mains power in the vicinity, requiring up to two semi trailers of diesel per week. Greener fuelling systems are being explored but at this stage nothing produces the required power source. A hybrid system may be a possibility.

Placement will be on the mainland, preferably near existing tracks, but will depend largely on other components of the infrastructure with investigations to commence into locating generators on cleared pasture paddocks as an option. Vegetation near possible clearance areas was not assessed by Rural Solutions SA but observation and plant collections were made by Damien Pearce on Thursday February 4th. Data was supplied to Emma Kinnane for identification and inclusion in this report but includes major features only. An accurate assessment will be made when the exact location is finalised.



2. An underwater cable to carry electricity from the generator to the pump

The pipe will run along the substrate of the Coorong channel, likely to be two to three km in length. Its position will be dependent on other infrastructure and it should have minimal impact on native vegetation.

3. A pump located in the Coorong channel, near the western shore.

The pump will float on a barge close to the western shore of the Coorong and pump large volumes of water through the adjacent pipeline. It is predicted that one pump will be sufficient and will require a water depth of several metres to work effectively. A channel of water of reasonable depth is required to transport the barge and pump to its site, but this does not need to replicate the cable transect.

4. Pipeline(s) from the pump over the sand dunes of the Young Husband Peninsula into the ocean.

This component is the main driver of the position of the final infrastructure given the economic, environmental and engineering impacts. The ideal location is a naturally low lying area, as straight as possible in both dimensions, of short distance and with minimal vegetation clearance or habitat disturbance. The large expense associated with changes in the vertical plane particularly (elevation), plus the horizontal plane (corners) establishes these as the main drivers of the pipe position. However, where environmental impact will be significantly greater or of national significance, such as near bird breeding habitat or fresh water soaks, these factors may drive the pipe position (Personal discussion with DEH). There is a degree of flexibility in the design that will allow avoidance of key sites.

Water will be pumped from the pump over the sand dunes into the ocean through either one large pipe or two smaller pipes depending on costs. The hydraulic head (height) and hydraulic length (corners) increase frictional loss which may affect the size of the pump, the number of pumps, the energy consumption and therefore the cost and carbon footprint. Terrain surveys are being conducted using a LIDAR terrain model within the possible pipeline zone between Woods Well and Policeman Point. The unconfirmed site proposed in this data report is in a natural valley and is the flattest found thus far.

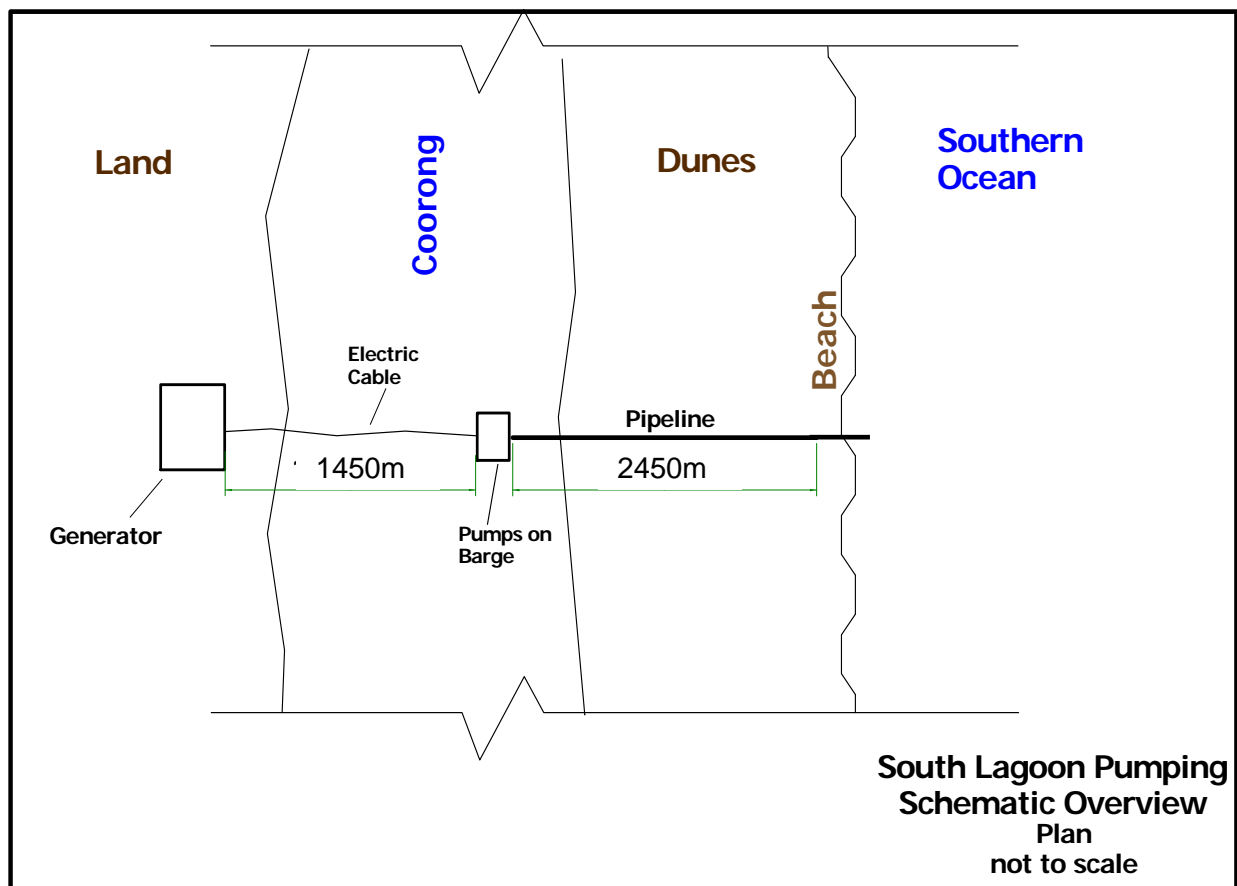
It is unconfirmed yet whether the pipe will be partially or fully buried, but is likely to sit on the surface where possible to save excavation impacts. Where there are saddles in the terrain, the pipe may be buried. The direct impact of the pipe is 10m including works, but a footprint of 20m is being used to cover higher impact areas and the final location will guide length but it is estimated at 1km. Given there is no SEB required, an approximation of clearance area should be sufficient.

Two alternative ocean beach outfalls have been considered. These are (1) at the top of the beach and (2) in the surf zone. It has been determined that the preferred option is the outfall in the surf zone. This conclusion was reached after considering minimal impacts, modelled scenarios, engineering aspects such as durability and physical impact at the outfall. Neither option has an additional impact on vegetation clearance.

Further details of these elements of the proposed construction are contained in a report from Tonkin Consulting Engineers (Appendix C). The fundamental elements are confirmed; however exact final piping route within the proposed corridor will be determined to account for least impact together with acceptable water transfer efficiency.

A diagram of the proposed infrastructure is provided below:





South Lagoon Pumping Schematic Overview (SA DWLBC).

5.2 INFRASTRUCTURE OPERATIONAL PHASE

Pumping of hyper-saline water from the South Lagoon to the Southern Ocean will involve:

- 1) Pumping rates are yet to be finalised, however it is anticipated that in the order of 270 – 300 GL shall be pumped over the life of the project to meet the salinity outcome targets. The final actual volume of water to be transferred will depend on a number of future factors including (a) commencement date against salinity concentrations, (b) potential inward flows, (c) seasonal conditions and evaporation regimes, (d) progress against salinity targets and (e) the adaptive management of the pumping regime as determined by ongoing monitoring and modelling inputs. Early modelled scenarios (Lester et al., 2009 Appendix E2; Aurecon 2009a, Appendix D) used pumping rates of 150 ML to 450 ML per day (approximately 54 GL to 160 GL per year) with additional modelling based on the likely 250 ML per day scenario.
- 2) The length of the operational component of the project is anticipated to be three years, however, depending on the adaptive management pumping regime this may occur over an approximate five year window, or may be accelerated if favourable conditions are met and progress against salinity targets is exceeded. Under the modelled scenarios, target salinity levels in the South Lagoon should be achieved in this timeframe, subject to variations caused by potential inflows, seasonal conditions and salinity variations. The project is planned to be completed via pumping scenarios that target late summer water transfer for maximum efficiency, but constrained by ultimate project duration considerations.



- 3) Monitoring of the environment- salinity, water level and water quality in South Lagoon and around ocean outfall, and biological / ecological parameters.
- 4) Adaptive management of the pumping regime using data from the monitoring program to influence timing of pumping, duration and rate. Pumping will be able to be managed to address any seasonal influences or specific impacts or opportunities.

Decommissioning

Infrastructure may be decommissioned after the completion of the project in three years. Despite associated costs with removal of infrastructure, amenity and Aboriginal Cultural preferences may drive its removal. Should the disturbance impacts be too great, and removal unjustified the infrastructure may remain in place. Given the unknown outcome of infrastructure removal, the restoration plan proposed will address both scenarios to ensure the removal or retention of infrastructure is not likely to impact on the long-term ecology and aesthetic value of the Park. The restoration plan will address issues including weed and pest management, erosion, revegetation and site clean up. It is important that an open community consultation process be established to guide the final site rehabilitation outcome.

6 NATIVE VEGETATION CLEARANCE

It is estimated clearance of two hectares of native vegetation will be required for the pipeline, including a small patch for the generator and possible access tracks (depending on existing tracks at the final location).

Two Advisory Plans are included below. Advisory plan 1 includes an overview of the location and all five transects assessed. Advisory Plan two shows the Proposed Transect 1 in more detail. Components of each transect are shown including the pipeline, pump, electrical cable and generator. The pipeline component (clearance 20m width) was that walked during the assessment and points of interest recorded using a GPS. Other component locations are approximate.

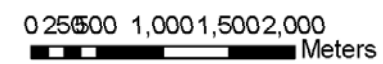


Advisory Plan 1: Transects 1-5



Legend

- Transect 1 - Proposed transect
- Transect 2 - Woods Well
- Transect 3 - Cattle Island
- Transect 4 - Cattle Point
- Transect 5 - Jacks Point
- Pump (approximate)
- Electric Cable (approximate)
- OceanOutlet
- Generator (approximate)
- Princes Soak



1:45,000

Map created by Environmental Management
 Rural solutions SA
www.ruralsolutions.sa.gov.au
 8226 9997
 Design:
 Cartography: Jan 2010, Emma Kinnane
 Cadastre & Road data sourced from PIRSA South Australia
 Photography sourced from ImageMap SA 2008,
 Datum: Geocentric Datum of Australia, 1994
 Projection: UTM, Zone 54

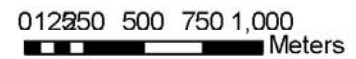


Advisory Plan 2: Proposed Transect 1



Legend

- Transect 1 - Proposed transect (Pipeline)
- Pump (approximate)
- Electric Cable (approximate)
- Generator (approximate)
- PrincesSoak



1:25,000

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 Cartography: Jan 2010, Emma Kinnane
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 Photography sourced from ImageMap SA, 2008.
 Datum: Geocentric Datum of Australia, 1994
 Projection: UTM, Zone 54



7 FIELD ASSESSMENT METHODOLOGY

The objective of the native vegetation assessment component was to initially assess a transect within the most likely project impact site in detail, recording all flora and environmental features. Following the initial assessment then compare other potential impacts sites along the Young Husband Peninsula to determine if the vegetation and site condition was fairly uniform or varied dramatically.

Five transects plus Princes Soak were assessed as shown on Advisory Plan 1.

Four transects were assessed through from the ocean to the Coorong and one, just a few hundred metres from the ocean. The most likely transect was assessed in detail using the patch assessment method described below. The focus for other transect possibilities was noting changes in species composition, condition of sites and significant species or site features. Additionally, a fresh water soak (Princes Soak) was briefly assessed to determine changes compared with the rest of the vegetation., but previous monitoring reports (Winter, S., Squire, E. DWLBC/DEH 2003) provide more comprehensive information on this area.

The Native Vegetation Council accredited patch assessment methodology was used to collect data. For this location, the entire transect was walked recording required attributes for an area of 20m in width, but not excluding species outside this area. The method includes the following components:

- Complete flora species list of species observed
- Describe vegetation association (noting dominant, co-dominant overstorey, understorey and emergent species).
- Cover abundance (CA) using the Braun/Blanquet scale such that an estimate is provided of both cover and abundance using a seven point scale.
- Life stages relevant to greater than 10% of the population at that time such as flowering, fruiting, regeneration etc.

Patch data sheets are provided in Appendix 2 and a full flora species list with attributes and locations is provided in Appendix 3. Identification is unconfirmed for several species which will be taken to the South Australian Herbarium for identification, with results amended once available.

Additional, site attributes were recorded included:

- Disturbance impacts (i.e.. evidence of feral or native fauna, weeds, erosion, grazing, tracks, rubbish etc.
- Photographs of vegetation and natural features.
- Identification of observed threatened species or ecosystems.
- Landscape features /terrain

Limitations

The time of year and dry conditions present when the site visit was conducted present a limitation to the vegetation assessment. Annual species which *may* have been dormant during the inspection and *may* not have been observed.

8 VEGETATION AND SITE DESCRIPTIONS

Vegetation was of a typical coastal dune association, with changes noted along a transect away from the foredune toward the Coorong side where an increase in salinity was observed, influencing vegetation type. The vegetation was found to be quite uniform along the north/south



transect of the Youngusband Peninsula with changes generally minor such as variability between dominant species, some species present, or density of vegetation. Variations appeared largely dependent on local terrain where lower lying valleys supported slightly denser vegetation and a variation in species composition including more low tussock species such as *Lepidosperma gladiatum* (Coast Sword-sedge). A total of 47 species were recorded (not including a full species list from the soak), of which seven were weeds. None of the 12 state or nationally threatened flora species known from the Coorong area (DEH flora list) were noted along any of the transects, but three species had a rating for the South East region. *Atriplex paludosa* ssp. *paludosa* (Marsh Saltbush) is rated Q (Not yet assessed but flagged as being of possible significance); and *Ozothamnus turbinatus* (Coast Bush-everlasting) and *Lasiopetalum discolor* (Coast Velvet-bush) are both rated Uncommon for the South East. *Lasiopetalum discolor* was noted at transects opposite Cattle Point and Jacks Point neither of which are recommended for works. One specimen of *Ozothamnus turbinatus* was observed on the incipient dune at the Proposed transect 1. *Atriplex paludosa* ssp. *paludosa* was observed near the salt pans at Woods Well. Additionally, one *Senecio* sp. was collected at Princes Soak and will be taken to the herbarium for accurate identification as it may be *Senecio biserratus* (Jagged Groundsel) rated Uncommon for the South east region. The pipeline should not impact on the fresh water soak area.

Given the survey was conducted in summer, annual or seasonal species *may* have been in a dormant phase. These include:

- *Caladenia valida* (Robust Spider-orchid), SA Rare
- *Drosera whittakeri* ssp. *aberrans* (Drosera) SA Rare
- *Picris squarrosa* (Squat picris) SA Rare
- *Pterostylis arenicola* (Sandhill Greenhood) AUS Vulnerable, SA Vulnerable
- *Scaevola calendulacea* (Dune Fanflower) SA Vulnerable
- *Thelymitra epipactoides* AUS Endangered, SA Endangered
- *Wurmbea latifolia* ssp. *venessae* (Broad leaf nancy) SA Rare

To accurately determine the presence of these species, timing of the survey needs to align with emergent and preferably flowering phases such as spring and/or following significant rains.

From a native vegetation perspective, the impact of clearance in Transect 1 is not significantly greater than other transects. Vegetation is quite thick in the bottom of the gully in places but not as thick as noted in Transects 3, 4 and 5 (Cattle Island, Cattle Point and Jacks Point). Vegetation composition is largely uniform along the peninsula, excluding where noted otherwise. The occurrences of threatened species at Transect 1 were isolated, and unlikely to be specific to that transect with regard to its habitat and land form. The area most suitable from a native vegetation clearance perspective is Transect 4 (Cattle Point) given it is largely devoid of vegetation and involves a short clearance area. However, with a maximum height of 28m above sea level at the Coorongs edge, it would incur an extreme cost to develop this site (as advised through discussions with DEH).

8.1 PROPOSED TRANSECT (1)

The area surveyed was approximately 900m in length as shown on Advisory Plan 2. Vegetation is divided into four main vegetation associations, but there was significant overlap between each along the gradient away from the coast and the categories are fairly arbitrary. The main vegetation association and features are shown for each category. This landform in transect one was determined to be the more consistent with only minor undulation therefore making this site likely to be most suitable from an engineering perspective. Plant species densities were higher than other transects given the natural gully collecting additional fresh water, and *Lepidosperma gladiata* was noted throughout the gully. However, no threatened species or communities were observed except one specimen of *Ozothamnus turbinatus*. This transect supports good quality native vegetation but does not have unique attributes, threatened species or distinct features that support its unsuitability for clearance.



Primary Fore-dune/Incipient dune (proposed transect 1)

Applying to the first 50m of the dune off the shoreline.

Vegetation association

Olearia axillaris (Coast daisy-bush)/*Rhagodia candolleana* ssp. *candolleana* (Sea-berry Saltbush)/*Ficinia nodosa* (Knobby Club-rush)/**Euphorbia paralias* (Sea Spurge) low open shrubland over *Pimelea serpyllifolia* ssp. *serpyllifolia* (Thyme Riceflower)/**Thinopyrum junceiforme* (Coast Sea-wheat)/*Lotus australis* (Australian Trefoil)/*Carpobrotus rossii* (Native Pigface) ± *Spinifex sericeus* (Rolling Spinifex) ± *Threlkeldia diffusa* (Coast bone-fruit).

Other species occasionally noted include:

Leucophyta brownii (Coast cushion-bush)

Atriplex cinerea (Coast Saltbush)

Ozothamnus turbinatus (Coast Bush-everlasting).

Description

Fore-dune is in fair to good condition except right on shoreline where weeds Coast Sea-wheat and Sea Spurge are replacing native Rolling Spinifex. Plants appear healthy but dwarfed due to persistent on-shore winds. Parts of dune are naturally mobile but the area is fairly stable and well vegetated.

Disturbances

- Some tracking due to access by fishermen and leisure activities.
- Rubbish, mostly fishing related or washed up plastic and random items.
- Weeds are an issue but are assisting stabilisation of the dune system so any control works should be well planned. The sheer abundance of Sea Spurge and Coast Sea-wheat make it virtually impossible to control.



Figure 2 - Healthy incipient dune



Figure 3 - Weed invaded incipient dune

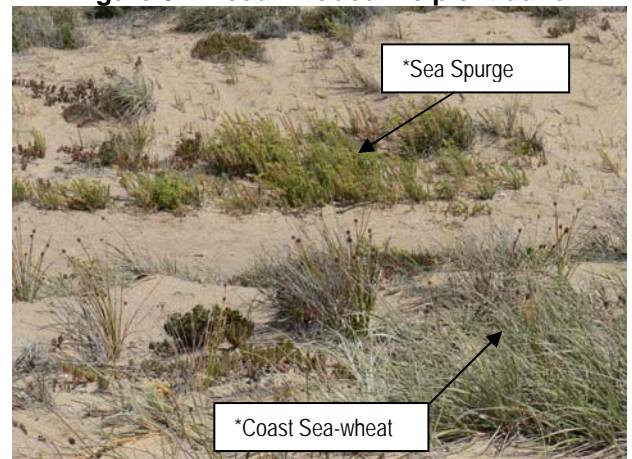


Figure 4 - *Coast Sea-wheat (foreground), *Sea Spurge (Rear)



Secondary foredune (proposed transect 1)

Similar to the mid/hind dunes but with characteristics of the foredune.

Vegetation association

Myoporum insulare (Common Boobiaaalla)/*Olearia axillaris* (Coast Daisy-bush)/*Scaevola crassifolia* (Cushion Fan-flower) shrubland over *Rhagodia candolleana* ssp. *candolleana* (Sea-berry saltbush)/*Ficinia nodosa* (Knobby Club-rush)/*Carpobrotus rossii* (Native Pigface)/*Threlkeldia diffusa* (Coast bone-fruit)/*Pimelea serpyllifolia* ssp. *serpyllifolia* (Thyme Riceflower) ± **Lagurus ovatus* (Hare's Tail Grass)

Other species occasionally noted include:

Leucophyta brownii (Coast cushion-bush)
Exocarpus syrticola (Coast cherry)
Lycium ferocissium (African Boxthorn)

Description

Dunes stable and healthy with excellent vegetation cover and leaf litter, a diverse range of plants, few weeds and excellent lichen and macrophitic cover and crust.

Disturbance

- *Hare's Tail-grass is abundant and widespread but its control is likely to prove impossible and it does not appear to be competing severely with other species.
- Occasional African Boxthorn.
- Rabbit diggings and a dead fox observed.



Figure 5 - *Cushion Fan-flower and excellent vegetation cover



Figure 6 - Common Boobiaaalla



Figure 7 - *Hare's Tail Grass is invading dunes



Hind Dunes (proposed transect 1)

Species composition changes slightly and plants are larger and denser.

Vegetation association

Myoporum insulare (Common Boobialla)/*Acacia longifolia* ssp. *sophorae* (Coastal Wattle)/*Olearia axillaris* (Coast Daisy-bush)/*Leucopogon parviflorus* (Coast Beard-heath) tall closed shrubland over *Rhagodia candolleana* ssp. *candolleana* (Sea-berry saltbush)/*Lepidosperma gladiata* (Coast Sword-sedge)/*Threlkeldia diffusa* (Coast bone-fruit)/*Pimelea serpyllifolia* ssp. *serpyllifolia* ± *Lagurus ovatas* (Hare's Tail-grass) ± *Spinifex sericeus* (Rolling Spinifex).

Description

Dunes are extremely stable and healthy with diverse range of plants, few weeds and excellent cryptogamic cover and crust. Dense bushes are likely to provide habitat for birds, reptiles and mammals. Transect 1 is in a deep valley and vegetation is thick in places where fresh water under the dune profile is likely to occur, compared to higher areas where vegetation was observed as more open and sparse.

Disturbance

- Hairs Tail Grass is naturalised throughout. Control is likely to prove difficult and given its low competitive nature other species are more likely to be prioritised in future weed management programs. Disturbance can aid the spread of this species.
- African Boxthorn is beginning to establish in patches and should be controlled as priority.
- Rabbit diggings noted.



Figure 8 - Large healthy bushes, leaf litter and fallen timber



Figure 9 - Coast Sword Sedge is common in Proposed Transect 1



Figure 10 - Excellent cryptogam cover



Coorong Saltpan/Samphire (proposed transect 1)

Significant change in species composition to more salt tolerant species.

Vegetation association

Sarcocornia quiniflora (Beaded samphire)/*Halocarcia* sp. (Samphire)/*Olearia axillaris* (Coast daisy Bush) low shrubland over *Suaeda australis* (Austral Seablite)/*Samolus repens* (Creeping Brookweed) ± *Atriplex paludosa* ssp. *paludosa* (Marsh saltbush) ± *Juncus kraussii* (Sea Rush) ± *Lecopogon parviflorus* (Coast Beard-heath).

Description

Samphire species appear healthy but other plants such as Sea Rush and Common Boobialla on Coorong edges are suffering leaf drop and appear stressed (likely due to the increased salinity).

Disturbance

- **Ammophila arenaria* (Marrum grass) was growing on sand dunes near Coorong, competing with native Spinifex.
- Salinity is affecting plants on Coorong shore.



Figure 11 - Coorong saltpan/samphire overview



Figure 12 - Good cover of Beaded Samphire



Figure 13 - Flowering Rolling Spinifex on dunes adjacent Coorong



8.2 ADDITIONAL TRANSECTS ASSESSED

Four additional transects were assessed to determine if vegetation was uniform along the Youngusband Peninsula and to investigate other more suitable locations for the pipeline scheme (see Advisory Plan 1).

8.2.1 Transect 2 – Woods Well

Transect 2 – Woods Well

Although there is a natural ‘crater’ or low lying area, the surrounding dunes are much higher than Transect 1, which may be inappropriate from an engineering perspective. Native vegetation is fairly uniform with transect 1 except slightly sparser and slight changes in cover abundance of species rather than different species all together. There was an increase in *Leucophyta brownii* (Coast Cushion-bush), *Acacia longifolia* ssp. *sophorae* (Coastal wattle), *Atriplex cinerea* (Coast Saltbush) and *Exocarpis syrticola* (Coast Cherry) and *Scaevola crassifolia* (Cushion Fan-flower). There was less *lepidosperma gladiata* and *Pimelea serpyllifolia* (Thyme Riceflower). Sea spurge is regenerating on dune slopes.

Toward the Coorong there is a depression in the landscape where dense *Lepidosperma gladiata* (Coast sword-sedge)/*Juncus kraussii* (Sea Rush) sedgeland occurred. This plant associations is not threatened, but is unusual within the scope of the study area and is likely to provide good habitat for small vertebrate and invertebrate animals.

This area is less preferred for clearance given the density of vegetation with dense matted understorey.



Figure 14 - Incipient dune with Coast Saltbush



Figure 15 - Natural crater with tall sand dunes either side



Figure 16 - Natural depression /sedgeland (photo Clare Manning)



8.2.2 Transect 3 – Opposite Cattle Island

Transect 3 – Opposite Cattle Island

This area was assessed due to what appeared to be a natural depression between the sand dunes.

However, the channel was extremely narrow with very tall dunes either side (20m+) and comprising extremely dense vegetation, particularly at the Coorong end. Bird calls indicated dense, occasionally impenetrable vegetation is likely to provide valuable fauna habitat.

The vegetation was fairly uniform and compared to transect 2 (Woods Well) except this site was extremely dense. In addition, given the narrow width of the channel, excavation may de-stabilise the dune system increasing erosion risk.

This area is less preferred for clearance from a native vegetation perspective due to extremely dense vegetation providing habitat for fauna and supporting a high number of plant specimens.



Figure 17 - Dense tall samphire (photo Clare Manning)



Figure 18 - Dense vegetation providing fauna habitat (photo Clare Manning)



Figure 19 - Impenetrable vegetation in natural depression



8.2.3 Transect 4 – Opposite Cattle Point

Transect 4 – Opposite Cattle Point

This area was assessed based on the short distance across the Youngusband Peninsula (only 680m) and the lack of vegetation evident on aerial photography.

This transect was largely devoid of native vegetation except for the first few hundred metres of the foredune which was fairly uniform with other transects. However, sand has accumulated on a dune blow out to a substantial height of 28m above sea level at the Coorong edge. Given the short distance across the peninsula, there is a bay that may be too shallow for the pump therefore the total length of the pipe would be almost as large as other transects anyway.

Vegetation on the foredune was similar except for the presence of *Lasiopetalum discolor* (Coast Velvet-bush) as a dominant species, rather than *Myoporum insulare* (Common Boobialla). Coast Velvet-bush is rated Uncommon for the South East region and its clearance should be avoided. In addition the height of the dunes may class this transect as unsuitable from an engineering perspective (as indicated by discussions with DEH).



Figure 20 - Natural clearing increases in height toward the Coorong



Figure 21 - Coast Velvet-bush (threatened)



Figure 22 - Sand blow out 28m above sea level (Coorong side)



8.2.4 Transect 5 – Jacks Point

Transect 5 – Jacks Point

This area was assessed as a possible point for the generator on the mainland

The assessment was only undertaken for half the distance, Vegetation was generally uniform with other transects, but with *Lasiopetalum discolor* (Coast Velvet-bush) again dominant in the secondary foredune.

The transect is considered unlikely for the pipeline given its long length (1.7km), the high density of vegetation in the hind dunes and samphire flats, the presence of threatened Coast Velvet-bush and the position being opposite Jacks Point, an important bird breeding habitat. Additionally, the dune system is variable in height up to about 20 m.



Figure 23 - Dense healthy vegetation on primary and secondary foredunes



Figure 24 - Sand dunes are mixed terrain



8.3 PRINCES SOAK

A fresh water soak was visited to determine its difference from other vegetation along the Youngusband Peninsula within the possible works zone.

Princes Soak

The assessment did not involve a detailed flora survey, but did record condition and dominant vegetation.

Vegetation association

Juncus kraussii (Sea Rush) sedgeland with *Sarcocornia quiniflora* (Beaded Samphire) over *Acaena novae-zelandiae*/*Apium prostratum* ssp. *prostratum* ± *Myoporum insulare* (Common Boobialla).

Other species noted were **Cakile maritima* ssp. *maritima* (Two-horned sea Rocket), *Lepidosperma gladiata* (Coast sword-sedge).

Description

The freshwater soak was dry at the time of assessment and although sedges and more herbaceous species remained present, The soak appeared under stress, as Sea Rush and Common Boobialla plants showed signs of leaf drop and death consistent with symptoms associated with salinity and drought.

Disturbance

- Salinity affected.
- The lack of inundation may be affecting frog populations and herbaceous/semi-aquatic plant species.
- Two-horned Sea Rocket is a weed but is known to be an important food source for the nationally endangered Orange-bellied parrot, therefore its removal is not recommended.

This area is unsuitable for clearance given the unique range of species not found in other areas and the presence of threatened flora and fauna species.



Figure 25 - Edge of Princes Soak with Samphire ssp. and Sea Rush



Figure 26 - Stressed salinity affected area on Coorong edge (Common Boobialla)



Figure 27 - Dead or dying Sea Rush



8.4 GENERATOR INFRASTRUCTURE AREA

The mainland was not assessed during the field survey but was visited on Thursday February 4th by Damien Pearce (DEH) and a selection of plants collected. Photographs are unavailable therefore it is difficult to ascertain the vegetation association. From the species collected (see Appendix 3) it appears there were two main associations:

1. *Melaleuca lanceolatum* ssp. *lanceolatum* (Dryland Tea-tree)/*Acacia longifolia* ssp. *sophorae* (Coastal Wattle)/*Myoporum insulare* (Common Boobialla) shrubland(?) over *Dianella brevicaulis* (Black-anther Flax-lily) and *Rhagodia candolleana* ssp. *candolleana* (Sea-berry Saltbush)
2. *Suaeda australis* (Austral Seabite)/*Sarcocornia quiniflora* (Beaded samphire)/*Tetacornia* sp. (Samphire) open shrubland (?) ± *Atriplex paludosa* ssp. *paludosa* (Marsh saltbush).

When the final position of the infrastructure is confirmed a more accurate assessment will be undertaken. Consideration is being given to siting infrastructure on private land on previously cleared introduced pasture paddocks for ease of operations, subject to agreements being reached and other logistical considerations.

8.5 WEEDS AND FERAL ANIMALS

The abundance and composition of weed species did not differ greatly between transects. Coast Sea-wheat and Sea Spurge have largely replaced naturally growing Sea Spinifex on the incipient dune on the beach shoreline along the whole coast. Sea spurge was also occasionally recruiting on bare sand blowouts away from the shoreline, usually where the sand crust had been disturbed opposite Woods Well and Cattle Point. Hare's Tail Grass was widespread through all transects. Patches of African Boxthorn were isolated but have the potential to spread once the area is disturbance and left unmanaged during operations. Marram Grass was only observed near Princes Soak at the first transect, on a bare dune face near the Coorong.

Rabbit diggings were evident throughout the dunes in all transects, sometimes older and devoid of dung or tracks. Deer dung was observed at transect 1. Kangaroo dung was noted at all transects and occasional animals observed, but little grazing was noted. A dead fox was found at transect 1, and some tracking observed in most transects that resembled a cat or fox track but was older and indistinguishable.

Weeds and feral animals



Figure 28 - **Euphorbia paralias* (Sand Spurge) recruiting in open disturbed areas



Figure 29 - **Thinopyrum junceiforme* (Coast Sea-wheat)





Figure 30 - *Thinopyrum junceiforme* (Coast Sea Wheat) and Sea Spurge along shoreline



Figure 31 - *Ammophila arenaria* (Marrum Grass)



Figure 32 - *Lagurus ovatus* (Hare's Tail grass)



Figure 33 - *Lycium ferrocissium* (African Boxthorn)



Figure 34 - Rabbit diggings and droppings



Figure 35 - Dead Fox

8.5.1 Weed management

The NVC have advised there is currently no requirement for a management or rehabilitation plan. However, following the field assessment and given the nature of the project, a rehabilitation plan is recommended particularly to prevent the spread of weeds. DEH will develop and implement a site management plan incorporating weed management. Sea Spurge and Sea Wheat Grass are currently mainly restricted to the beach shoreline, whilst native Sea Spinifex grass persists away



from the coast. There is some concern that these weeds may spread along the pipeline corridor and into the dune system should the project be undertaken without a remediation plan.

9 FAUNA

A fauna survey was not conducted during the assessment, except for observational records. During the assessment, officers observed

- *Dromaius novaehollandiae* (Emu)
- *Macropus fuliginosus* (Western Grey Kangaroo)
- *Tiliqua rugosa* (Sleepy Lizard)
- Feral Deer (dung)
- *Oryctolagus cuniculus* (Rabbit) dung and tracks
- *Vulpes vulpes* (Fox) dead

Fauna of conservation significance local to the region was determined using existing data bases, reports and Native Vegetation Group ornithologist (Graham Carpenter). The Coorong is an internationally significant bird breeding and nesting habitat and birds comprise the majority of species of conservation significance. It is hoped that the salinity reduction project will provide benefits for native wildlife, increasing invertebrate populations and plant health to provide for threatened bird feeding and habitat requirements. The project may be detrimental for fauna species utilising native vegetation as habitat but given the small clearance area, it is anticipated they can move to adjacent vegetation. However, where habitat is particularly valuable such as very dense areas or fresh water soaks, clearance should be avoided or minimised.

Table 2 - Birds of conservation significance in native vegetation in this area follow.

Scientific Name	Common name	AUS	SA	SE	Habitat Use
<i>Cisticola exilis</i>	Golden-headed Cisticola		U	U	Confined to wetland vegetation around soaks
<i>Coturnix australis</i>	Brown Quail		V	V	resident in grassy/Juncus/Baumea flats
<i>Dasyornis broadbenti</i>	Rufous Bristlebird		R	R	Widespread in dense dune vegetation
<i>Emblema bellum</i>	Beautiful Firetail		R	R	Widespread in dense dune vegetation
<i>Lichenostomus cratitius</i>	Purple-gaped Honey Eater		R	R	Widespread in Melaleuca halmaturorum and dense dune vegetation
<i>Neophema elegans</i>	Elegant parrot		R	K	mostly winter visitor, habitat as above
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	E	E	E	Winter visitor to this area, one of few wintering sites in SA. Feeds mainly in samphire and nearby areas
<i>Neophema chrysostoma</i>	Blue-winged Parrot		V	V	mostly winter visitor, habitat as above
<i>Phaps elegans</i>	Brush Bronzewing		U	U	Widespread in Melaleuca halmaturorum and dense dune vegetation
<i>Sericornis (Clamanthus) fuliginosus</i>	Striated Fieldwren		U	U	In Juncus, Baumea and samphire low shrublands
<i>Stipiturus</i>	Southern emu-wren		U	U	Mainly around soaks (eg Princess



<i>malachurus</i>					Soak), also Melaleuca lanceolata shrubland on mainland side
<i>Strepera versicolor</i>	Grey Currawong		U	U	Widespread in mallee, Melaleuca halmaturorum and dense dune vegetation

Waterbirds of conservation significance that could be affected in this area follow. The Coorong also Coorong has islands that support significant breeding colonies of more common waterbirds including Australian Pelican, Crested Tern and Caspian Tern. The objective is that most effects on waterbirds are positive, due to the proposed pipeline improving the conservation status of these species, which have been impacted by rising salt levels. However, small negative impacts may occur if native vegetation clearance is not planned accordingly (such as avoiding fresh water soaks).

Table 3 - Water birds of conservation significance using local water habitats

Scientific Name	Common name	AUS	SA	SE	Habitat Use
<i>Biziura lobata</i>	Musk Duck		R	R	open water of lagoons
<i>Calidris alba</i>	Sanderling		R	R	Ocean beach
<i>Cladorhynchus leucocephalus</i>	Banded Stilt		V	V	Area regularly supports a high proportion of the total population
<i>Gallinago hardwickii</i>	Latham's Snipe		R	R	Around freshwater soaks
<i>Graham</i>	Hooded Plover		V	V	Breeds on ocean beach and foredune, also feeds Coorong lagoon margins
<i>Haematopus longirostris</i>	Pied Oystercatcher		R	R	nests on ocean beach, plus sometimes on Coorong shore
<i>Oxyura australis</i>	Blue-billed Duck		R	R	open water of lagoons
<i>Pluvialis fulva</i>	Pacific Golden Plover		R	R	Margin of Coorong lagoons
<i>Podiceps cristatus</i>	Great Crested Grebe		R	R	open water of lagoons
<i>Sterna nereis</i>	Fairy tern		E	E	Nest on many of the smaller islands in Coorong here

AUS=Australia SA=South Australia SE= South East region

E=Endangered: rare and in danger of disappearing from the wild in the short term

V=Vulnerable: rare and in danger of disappearing from the wild in the long term

R=Rare: occurring infrequently, either locally abundant in a limited area or sparsely distributed over a wide area

K=status uncertain, but considered likely to be either rare, vulnerable or endangered

U=Uncommon: declining and inadequately conserved, but not yet rare or vulnerable

C=Common: not of particular importance¹

AUS=Australia E=Endangered (Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act))

10 PROJECT IMPACT

10.1 ADOPTING A CODE OF PRACTICE SALINITY REDUCTION SCHEME

A management plan and operational code of practice will ensure that all works in this sensitive environment are undertaken in a manner that reduces the spread of weeds and dune instability and involves some revegetation of easy to propagate plants to prevent weed spread.

During discussions, the client advised that when final position of the pipeline is established, a management plan will be written to accompany the final development proposal. This is likely to occur when the engineering component of the project goes to tender and may be written by Rural Solutions SA in partnership with the engineering company.

¹ Definitions based on regional ratings obtained from Carpenter, G & Reid, J (2000) *The Status of Native Birds in South Australia's Agricultural Regions. Unpublished Database, 2000.* Department for Environment & Heritage, South Australia.



A specific Environmental Code of Practice for the project is a key requirement to allow successful planning and implementation of the salinity reduction scheme. Its adoption by DEH and organisations operating on their behalf will ensure that best practice standards and guidelines are implemented to protect the environment from harm during the construction and rehabilitation processes. Given that the project is in preliminary phases, planning will rely on determination of exact infrastructure position and surrounding features. A code of practice with standard operating procedures and a rehabilitation plan should be submitted prior to commencement of works.

Good planning will markedly decrease the level of environmental impact on the Younghusband Peninsula and Coorong ecosystem whilst aiming to improve the quality of work completed, minimise maintenance requirements and reduce the time and cost of rehabilitation.

10.2 ACKNOWLEDGEMENT OF ENVIRONMENTAL IMPACT ISSUES

There are several categories of impact including clearance of native vegetation, manipulation and disturbance of aquatic (Coorong and ocean) ecosystem and infrastructure works and operations.

The specific environmental impact factors in the table below apply more specifically to minimising environmental impact when clearing, utilising access roads and for basic engineering and works procedures. Detailed construction guidelines will be a requirement of the engineering tender process and a rehabilitation and impact mitigation plan will be submitted simultaneously (once the final infrastructure position is finalised).

Impacts associated with the aquatic environment are being determined separately and will be monitored by SARDI. This assessment should include water quality and reduction in Coorong salinity, changes in invertebrate populations, changes in bird numbers and use of the southern lagoon as breeding habitat. The condition of vegetation at the Coorong edges should also be monitored for improvements given the current salinity affected state of some species.

Modelling regarding the ocean outlet predicts a 'dead zone' of 200m from the outlet, then two kilometres of reduced impact decreasing away from the outlet. Modelling is based on a worse case scenario (with no tidal movement), therefore with tidal movements and currents impact should be reduced. Monitoring of impacts on the ocean environment will be conducted by SARDI.



Potential Impacting Activity	Environmental Risk	Likely Occurance
Community Consultation	Failure to consult the community on environmental and social impacts can lead to project delays and implications. DEH are currently going through a consultation process.	Moderate
	The Coorong is a public use site. The area is regularly used for recreation activities including camping, four wheel driving, fishing, swimming, boating, site seeing, nature study and bird watching. Vehicles, machinery, dust and noise associated with the project has the potential to have negative impact on community needs and expectations when visiting the area.	Low
	The ocean outlet is proposed for the surf zone, therefore the pipeline will need to run along the beach which will affect public access and amenity unless completely buried. DEH have advised that access along the beach will remain available.	Low
Native vegetation clearance for tracks, generator and pipeline	The project will disturb or remove native vegetation and native fauna habitat through clearance/modification for access tracks, turn around areas, machinery storage areas, generator and pipeline(s) installation creating and upgrading access tracks, parking and turn around areas, machinery and equipment storage and pipeline infrastructure. Removal of flora is inevitable, but should be minimised and accurately recorded to ensure appropriate species are replaced, particularly if threatened. Fauna may be able to relocate given the small width of clearance but consideration in planning could minimise impact (such as avoiding breeding habitat).	Moderate
	Native vegetation clearance may cause de-stabilisation of fragile dune systems and increase erosion potential.	Moderate
Tracks, Vehicle Access and Infrastructure works	Sites of cultural significance could exist within the infrastructure zone. Precautions are being undertaken to minimise impact through avoidance.	Moderate
	The movement of vehicles within the site has the potential to spread weeds and soil pathogens.	Moderate
	Flooding, increased water levels or a heavy rain event may impact on road condition, on the Coorong side. Inappropriate use of indiscriminate tracks or driving on tracks that are wet and slippery may increase risk of soil erosion and degradation.	Low
	The storage or transport of hazardous substances or the use or generation of chemicals, which may build up residues in the environment (i.e. diesel fuel, greases and lubes), have the ability to cause environmental harm to soil, vegetation, fauna and water bodies. The engineering tender will require a comprehensive environmental impact mitigation plan with operations being regularly audited.	Low
	Waste generated from staff and operational activities have the ability to cause environmental harm to soil, vegetation, fauna and water bodies. The management plan will reduce the risk of impact	Low

Low - Minor risk of occurring

Moderate – Possible risk of occurring (greater than 50% chance) High –

Likely risk of occurring



11 APPENDIX 1 FLORA SPECIES LIST

Scientific name	Common Name	Unconfirmed Identification	Transect	Veg Zone	AD	CA	LS	Rating SE
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle		All	IF HD	O	2		
<i>Acaena novae-zelandiae</i>	Biddy-biddy		Soak	SK				
<i>Alyxia buxifolia</i>	Sea Box		Proposed transect 1	2FD		N	FM	
* <i>Ammophila arenaria</i>	Marram Grass		Proposed transect 1	SP		1	F	
<i>Atriplex cinerea</i>	Coast Saltbush		Woods Well, Jacks Point	ID		N	F	
<i>Atriplex paludosa</i> ssp. <i>paludosa</i>	Marsh Saltbush		Proposed transect 1, Cattle Island	SP		N		Q
<i>Billardiera cymosa</i>	Sweet Apple-berry		Proposed transect 1	2FD		N	M	
* <i>Cakile maritima</i> ssp. <i>maritima</i>	Two-horned Sea Rocket		Soak	SK		N		
<i>Carpobrotus rossii</i>	Native Pigface		All	All	U	T	M	
<i>Clematis microphylla</i>	Old Man's Beard		All	HD		T		
<i>Dianella brevicaulis</i> var.	Black-anther Flax-lily		Mainland	M		?		
<i>Dianella revoluta</i> var.	Flax Lily		Hind dune	All		N		
* <i>Euphorbia paralias</i>	Sea Spurge		All	ID,2FD, HD	U	1		
<i>Exocarpos syrticola</i>	Coast Cherry		All	ID,2FD,HD	T			
<i>Ficinia nodosa</i>	Knobby Club-rush		All	ID, 2FD	U	T	F	
<i>Frankenia pauciflora</i> var.	Southern Sea-heath		Cattle Island	SP		N		
<i>Halosarcia</i> sp.	Samphire	?	All	SP, M		2		
<i>Helichrysum</i> sp.	Everlasting	?	All	2FD, HD		T	F	
<i>Juncus kraussii</i>	Sea Rush		Soak, All	SP		2	F	
* <i>Lagurus ovatus</i>	Hare's Tail Grass		All	All		1	F	
<i>Lasiopetalum discolor</i>	Coast Velvet-bush		Cattle point, Jacks Point	2FD		2	F	U
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge		All	HD,SP,M	U	2	F	
<i>Leucophyta brownii</i>	Coast Cushion Bush		All	ID,2FD,HD		T	F	
<i>Leucopogon parviflorus</i>	Coast Beard-heath		All	HD,SP	U	T		
* <i>Limonium sinuatum</i>	Notch-leaf Sea-lavender	?	Proposed transect 1, woods Well	SP		N	F	

<i>Lotus australis</i>	Austral Trefoil		All	ID	U	1	FM	
* <i>Lycium ferocissimum</i>	African Boxthorn		All	All		T-2	F	
<i>Melaleuca lanceolata</i> ssp. <i>lanceolata</i>	Dryland Tea-tree		Mainland	M	M		M	
<i>Muehlenbeckia gunnii</i>	Coastal Climbing Lignum		All	All		T		
<i>Myoporum insulare</i>	Common Boobialla		All	All	O	3	FM	
<i>Olearia axillaris</i>	Coast Daisy-bush		All	All	O/U	2		
<i>Ozothamnus turbinatus</i>	Coast Bush-everlasting		Proposed transect 1	ID		N	F	U
<i>Pelargonium australe</i>	Australian Pelargonium	?	All	All		1	FM	
<i>Pimelea serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme Riceflower		All	ID,2FD,HD	2	F		
<i>Pomaderris obcordata</i>	Wedge-leaf Pomaderris	?	All	ID		N		
<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	Sea-berry Saltbush		All	All	U	2	F	
<i>Samolus repens</i>	Creeping Brookweed		All	SP	U	3	F	
<i>Sarcocornia quinqueflora</i>	Beaded Samphire		All	SP,M				
<i>Scaevola crassifolia</i>	Cushion Fanflower		Woods Well, Cattle Point, Cattle Island, Jacks Point	2HD			F	
<i>Senecio</i> sp.	Groundsel	?	Soak	S		N	F	
<i>Spinifex sericeus</i>	Rolling Spinifex		All	HD		T	F	
<i>Suaeda australis</i>	Austral Seablite		All	SP,M	T			
<i>Tetacornia</i> sp.	Samphire	?	All	SP				
<i>Tetragonia implexicoma</i>	Bower Spinach		All	2FD,HD		T		
<i>Thinopyrum junceiforme</i>	Coast Sea Wheat		All	ID,2FD	U	1		
<i>Threlkeldia diffusa</i>	Coast Bonefruit		All	2FD,HD,S P	U	2		
* <i>Vulpia</i> sp.	Fescue		Jacks Point	HD		N		

SE – South Australia's South east region

U – Uncommon for South East region

Q - Not yet assessed but flagged as being of possible significance

Vegetation Association Description (AD): Flag the dominant/codominant overstorey, understorey and emergent species in column (AD) on the plant list for - up to 3 overstorey species (O), up to 3 emergent species (E), up to 5 understorey species (U).

NOTE: Dominant/codominant overstorey species are defined as species that dominate the tallest layer that has a canopy cover of >5%. If there are no layers that have a canopy cover >5% then the dominant/codominant overstorey species are defined as species that dominate the tallest layer which has the maximum recorded cover/abundance (check plant list). An emergent species is defined as a species that emerges above the overstorey and occupies a stratum that has a canopy cover of less than 5%.

Cover Abundance (CA) using the modified Braun/Blanquet scale: For each species present, an estimate is required of both cover and abundance measured on this modified seven point scale

N - Not many, 1 - 10 individuals*

T - Sparsely or very sparsely present, cover very small (less than 5%)

1 - Plentiful but of small cover (less than 5%)

2 - Any number of individuals covering 25 - 50% of the area

3 - Covering more than 75% of the area

4 - Any number of individuals covering 50 - 75% of the area

5 - Any number of individuals covering 5 - 25% of the area

*NOTE: Where large trees or shrubs are involved, choose a category to reflect the cover rather than the number of individuals.

Life Stage (LS): Enter each respective code where it is relevant to greater than 10% of individuals of the population at that particular site. However, this does not apply to seedlings. Enter seedlings whenever they are present. For record when any number of seedlings observed

plants have buds formed in varying stages of development for flowering reproductive stages (budding or fruiting) only note if more than 10% of the reproductive organs are at that stage

NOTE: A species can have more than one life stage code entered.

plants are in flower

S – seedling - record when any number of seedlings observed

B – budding - plants have buds formed in varying stages of development for flowering

F – flowering – plants are in flower

I - immature fruits not shedding seed

M – mature fruit - fruits ripe and/or shedding seed

D - dead/dormant - indicates above ground material only is dead; includes plant species with dormant organs

X – recently shed - plants are in a non-reproductive phase which show signs of having shed seed or fruits recently shed within the last 12 months

Vegetation Zones

ID - Incipient/foredune – first 50-100m from shoreline where shrubs are wind beaten and small in size

2FD – Secondary foredune – behind incipient dune but showing slightly different veg associations and structure

HD – Hind dunes – Main dune system away from shore, can be variable in species composition and structure

SP – Samphire/saltpan end of dunes, near the Coorong Lakes. Vegetation becomes more salt tolerant and changes composition.

SK – Fresh water soak (note this is not a full species list).

M – Mainland side of Coorong

12 APPENDIX 2 – NATIVE VEGETATION REGULATION²

Regulation 5(1) (zi) Clearance for Preserving, Enhancing Ecological Processes

Pursuant to Section 27(1)(b) of the Act, native vegetation may, subject to any other Act or law to the contrary, be cleared –

if the purposes of the clearance is to preserve or enhance ecological processes and—
(i) —

- (A) the owner of the land has prepared a management plan that provides for monitoring the effects of the clearance; and
 - (B) the owner of the land has satisfied the Council that the management plan complies with guidelines that have been prepared by the Council in accordance with section 25 of the Act; and
 - (C) the Council has given its approval to the management plan; and
 - (D) the clearance is undertaken in accordance with the management plan; or
 - (ii) the clearance is undertaken in accordance with guidelines that apply to the clearance that have been prepared by the Council in accordance with section 25 of the Act
- (and the operation of this paragraph extends to vegetation on land that is subject to a heritage agreement)

This regulation covers situations where management of native vegetation to preserve or enhance biological diversity involves clearance. Examples include burning to regenerate old stands of vegetation or maintain habitat for threatened species.

This regulation allows landowners to establish and work in accordance with management plans that describe actions involving clearance and programs to monitor the effects of clearance as a means of enhancing or preserving biological diversity.

The person/s responsible for the clearing of the vegetation must do so under the guidelines of the management plan approved by the Native Vegetation Council.

This regulation applies to land covered under a Heritage Agreement.

² DWLBC: Guide to the *Native Vegetation Regulations 2003* as in force from 10 September 2009



13 APPENDIX 4 PATCH DATA SHEETS

PATCH DATA SHEET						APPLICATION NO. 2 ___/___/___			CL /SA /HA		
<p>Note: Indicate by circling in the top right-hand corner if a clearance (CL), set aside (SA) or heritage agreement (HA) area is being assessed. Do not enter both CL and SA data on the same sheet. However, to save paper, multiple CL or SA area lists from the same application may be entered consecutively on the same sheet(s).</p>											
<p>Vegetation Association Description (AD): Flag the dominant/codominant overstorey, understorey and emergent species in column (AD) on the plant list for - up to 3 overstorey species (O), up to 3 emergent species (E), up to 5 understorey species (U).</p> <p>NOTE: Dominant/codominant overstorey species are defined as species that dominate the tallest layer that has a canopy cover of >5%. If there are no layers that have a canopy cover >5% then the dominant/codominant overstorey species are defined as species that dominate the tallest layer which has the maximum recorded cover/abundance (check plant list). An emergent species is defined as a species that emerges above the overstorey and occupies a stratum that has a canopy cover of less than 5%.</p>											
<p>Cover Abundance (CA) using the modified Braun/Blanquet scale: For each species present, an estimate is required of both cover and abundance measured on this modified seven point scale.</p> <p style="margin-left: 40px;"> N Not many, 1 - 10 individuals* T Sparsely or very sparsely present, cover very small (less than 5%) 1 Plentiful but of small cover (less than 5%) 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 covering 50 - 75% of the area 5 Covering more than 75% of the area </p> <p>*NOTE: Where large trees or shrubs are involved, choose a category to reflect the cover rather than the number of individuals.</p>											
<p>Life Stage (LS): Enter each respective code where it is relevant to greater than 10% of individuals of the population at that particular site. However, this does not apply to seedlings. Enter seedlings whenever they are present. For reproductive stages (budding or fruiting) only note if more than 10% of the reproductive organs are at that stage.</p> <p>NOTE: A species can have more than one life stage code entered.</p>											
<p>S seedling record when any number of seedlings observed</p>											
<p>B budding plants have buds formed in varying stages of development for flowering</p>											
<p>F flowering plants are in flower</p>											
<p>I immature fruit immature fruits not shedding seed</p>											
<p>M mature fruit fruits ripe and/or shedding seed</p>											
<p>D dead/dormant indicates above ground material only is dead; includes plant species with dormant organs.</p>											
<p>X recently shed plants are in a non-reproductive phase which show signs of having shed seed or fruits within the last 12 months</p>											
AREA + WP		SPECIES					Voucher #	AD	CA	LS	
E.g. A2, WP 7		NOTE: final corrected species will be written in the shaded area.									
	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										

