STATE COMMISSION ASSESSMENT PANEL
A COMMITTEE OF THE STATE PLANNING COMMISSION

APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Applicant:	Altura Group Pty Ltd
Development Number:	010/V083/17
Nature of Development:	Goat Hill Pumped Storage Hydro Project: a 230-270MW capacity pumped storage hydro facility comprising an upper and lower reservoir, penstock, powerhouse and ancillary infrastructure including transmission lines, access roads, water supply line and temporary construction facilities
Type of development:	Public Infrastructure
Zone / Policy Area:	Primary Industry Zone and Pastoral Zone
Subject Land:	Eyre Highway, Lincoln Gap
Contact Officer:	Laura Kerber
Phone Number:	7109 7073
Start Date:	Wednesday 17 January 2018
Close Date:	Thursday 8 February 2018

During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders Street, Adelaide during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered, faxed or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this pdf document.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapadmin@sa.gov.au
Fax Number: (08) 8303 0753

Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

SECTION 49 – PUBLIC INFRASTRUCTURE

Notice is hereby given that an application has been made by **Altura Group Pty Ltd** for consent to construct the **Goat Hill Pumped Storage Hydro Project: a 230-270MW capacity pumped storage hydro facility comprising an upper and lower reservoir, penstock, powerhouse and ancillary infrastructure including transmission lines, access roads, water supply line and temporary construction facilities** (Development Number: **010/V083/17**).

The land is situated approximately **12km west of Port Augusta at the Eyre Highway, Lincoln Gap** being Certificates of Title: 6138/388, 6138/334, 6138/331, 6138/347, 6138/348, 6138/332, 5983/539, 5983/540, 5983/541, and Crown Leases 6200/236, 6200/133, 6165/482 (various land parcels).

The subject land is located within the **Primary Industry Zone** of the **Port Augusta (City) Development Plan Consolidated 7 July 2016** and the **Pastoral Zone** of the **Land Not Within a Council Area (Flinders) Development Plan Consolidated 29 November 2012.**

The application may be examined during normal office hours at the office of the State Commission Assessment Panel, Level 5, 50 Flinders Street and at the office of the Port Augusta City Council (4 Mackay Street, Port Augusta). Application documentation may also be viewed on the State Commission Assessment Panel (SCAP) website: www.saplanningcommission.sa.gov.au/scap.

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide 5001 **NOT LATER THAN Close of Business Thursday 8 February 2018.**

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the SCAP to further explain the representation.

Submissions may be made available for public inspection. Please indicate in writing if you object to your submission being made available in this way.

Should you wish to discuss the application and the public notification procedure please contact **Laura Kerber** on **7109 7073.**

Alison Gill
SECRETARY
STATE COMMISSION ASSESSMENT PANEL
www.saplanningcommission.sa.gov.au/asap

PN2402

PN2402
21x2 (63mm)
Adelaide Advertiser, Transcontinental
17 January 2018

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	Altura Group Pty Ltd
Development Number:	010/V083/17
Nature of Development:	Goat Hill Pumped Storage Hydro Project: a 230-270MW capacity pumped storage hydro facility comprising an upper and lower reservoir, penstock, powerhouse and ancillary infrastructure including transmission lines, access roads, water supply line and temporary construction facilities
Zone / Policy Area:	Primary Industry Zone and Pastoral Zone
Subject Land:	Eyre Highway, Lincoln Gap
Contact Officer:	Laura Kerber
Phone Number:	7109 7073
Close Date:	Thursday 8 February 2018

My name:____

My phone number: ____

PRIMARY METHOD(s) OF CONTACT: Email address: ______________________________

Postal address:______________________________

________________________Postcode____________

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are:
[ ] owner of local property
[ ] occupier of local property
[ ] a representative of a company/other organisation affected by the proposal
[ ] a private citizen

The address of the property affected is ....Postcode.................................

The specific aspects of the application to which I make comment on are: ....

....

....

....

....

....

....

....

I [ ] wish to be heard in support of my submission
[ ] do not wish to be heard in support of my submission
(Please tick one)

by [ ] appearing personally
[ ] being represented by the following person : ....
(Cross out whichever does not apply)

Date: .... Signature: ....

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 or **scapadmin@sa.gov.au**

SECTION 49 & 49A – CROWN DEVELOPMENT
DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: Land Not Within a Council Area and Port Augusta City Council.

APPLICANT: Altura Group Pty Ltd

ADDRESS: PO Box 146 Ferny Hills QLD 4055

CROWN AGENCY: Department of the Premier and Cabinet

FOR OFFICE USE

DEVELOPMENT No: ____________________

PREVIOUS DEVELOPMENT No: ____________________

DATE RECEIVED: / /

CONTACT PERSON FOR FURTHER INFORMATION

Name: Rosahlena Robinson

Telephone: 0429 567 037 [work] ____________ [Ah]

Fax: ____________ [work] ____________ [Ah]

Email: rosahlena@alturagroup.com.au

☐ Complying ☐ Merit ☐ Public Notification ☐ Referrals	Decision: ____________ Type: ____________ Finalised: / /

NOTE TO APPLICANTS:

(1) All sections of this form must be completed. The site of the development must be accurately identified and the nature of the proposal adequately described. If the expected development cost of this Section 49 or Section 49A application exceeds $100,000 (excl. fit-out) or the development involves the division of land (with the creation of additional allotments) it will be subject to those fees as outlined in Item 1 of Schedule 6 of the *Development Regulations 2008.* Proposals over $4 million (excl. fit-out) will be subject to an advertising fee. (2) Three copies of the application should also be provided.

	Decision required	Fees	Receipt No	Date
Planning:				
Land Division:				
Additional:				
Minister's Approval				

EXISTING USE: Grazing Land

DESCRIPTION OF PROPOSED DEVELOPMENT: Pumped Storage Hydro Project of nominal 230-270 MW capacity comprising an Upper and Lower Reservoir, Penstock, Powerhouse and ancillary infrastructure, including transmission lines, access roads and water supply line.

LOCATION OF PROPOSED DEVELOPMENT: Approx. 12km west of Port Augusta, South Australia, CT6138/334

House No: ______ Lot No: ______ Street: Eyre Highway Town/Suburb: Lincoln Gap

Section No [full/part] ______ Hundred: ______ Volume: 6138 Folio: 334

Section No [full/part] ______ Hundred: ______ Volume: ______ Folio: ______

LAND DIVISION:

Site Area [m^2] 2,200,000 (approx) Reserve Area [m^2] - No of existing allotments ______

Number of additional allotments [excluding road and reserve]: ______ Lease: **YES** ☐ **NO** ☐

DEVELOPMENT COST [do not include any fit-out costs]: $ 350,000,000

POWERLINE SETBACKS: Pursuant to Schedule 5 (2a)(1) of the *Development Regulations 2008,* if this application is for a building it will be forwarded to the Office of the Technical Regulator for comment unless the applicant provides a declaration to confirm that the building meets the required setback distances from existing powerlines. The declaration form and further information on electricity infrastructure and clearance distances can be downloaded from sa.gov.au.

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the *Development Act 1993* and meet the requirements for lodgement under s.49 of the Development Act 1993.

SIGNATURE: RRobinson Dated: 14 / 12 / 2017

ALTURA GROUP

Goat Hill Pumped Storage Hydro Project

Volume 1: Executive Summary

Submitted 14 December 2017

Version: 1.0

Document Number: GHL-ENV-APL-0008

Preface

This Development Application has been prepared by Altura Group Pty Ltd (Altura) in support of an application for statutory consents for the construction and operation of Goat Hill Pumped Storage Hydro Project (the Project), approximately 12 km west of Port Augusta, South Australia.

The Project has been sponsored (18 September 2017) by the Department of the Premier and Cabinet as a development of public infrastructure as required by section 49 of the *Development Act 1993* (South Australia) (the Act). This Development Application has been submitted to the Department of the Premier and Cabinet for lodgement to the State Commission Assessment Panel.

The Development Application has been prepared in three volumes:

Volume 1: Executive Summary

Volume 2: Development Application Report

Volume 3: Technical Appendices.

The Development Application can be viewed during the statutory consultation period at the following locations:

Department of Planning, Transport and Infrastructure (DPTI) 77 Grenfell Street Adelaide SA 5001	Port Augusta City Council 4 Mackay Street (PO Box 1704) Port Augusta SA 5700

This Application for the Goat Hill Pumped Storage Hydro Project has been prepared by Altura with inputs from external consultants. Whilst all reasonable care and effort has been made to ensure the accuracy of the material published in the associated documents, Altura is not liable for any inaccuracies and deficiencies.

Notwithstanding the above, permission is herewith granted to the regulators to evaluate this Development Application in accordance with statutory procedures, which may necessitate the reproduction of this response to provide additional copies strictly for internal use. This document remains the property of Altura.

Registered office:

Altura Group Pty Ltd

Level 2, 340 Adelaide Street, Brisbane QLD 4000

Introduction

Altura Group Pty Ltd (Altura) is proposing to develop a Pumped Storage Hydro (PSH) Facility approximately 12 km west of Port Augusta, South Australia. The Project responds to the need for new and flexible forms of generation to support South Australia's power system through provision of a fast response plant, principally providing bulk energy storage. PSH is an efficient and reliable form of bulk energy storage at around 80% energy cycle efficiency and can be made available to the market within minutes.

The Project is to be situated predominately within privately-owned grazing land, accessed via the Eyre Highway. To enable access, transmission and water supply to the Project, linear infrastructure will cross a small number of land titles both privately owned and Crown Land.

Applicant

This Development Application Report (DAR) has been prepared on behalf of Pumped Hydro (SA) Pty Ltd, a wholly-owned subsidiary of Altura.

Altura was formed in 2016 to meet the growing need for experienced renewable energy project development expertise in Australia. Altura is a developer of renewable energy projects and advisory group in the energy and infrastructure markets. Altura has extensive experience in developing energy and infrastructure projects in Australian, African and Latin American markets.

Altura has developed a strategic partnership with Sunset Power International Pty Ltd (trading as Delta Electricity; 'Delta') to develop the Project through the planning, approvals and design phases through to Financial Close. Delta is funding the development and holds exclusive rights to build, operate and market output of the Project.

Approval pathway

This Development Application Report (DAR) has been prepared for submission to the State Commission Assessment Panel (SCAP) and relevant referral bodies, pursuant to Section 49(1)(a) of the Development Act 1999 (Development Act). In accordance with the Development Act, the Project, considered Public Infrastructure, has been granted Crown Sponsorship through the Department of Premier and Cabinet (DPC).

The Project is located primarily within 'Land Not Within a Council Area (Flinders) Development Plan' (consolidated 29 November 2012) and to a lesser degree within the 'Port Augusta (City) Development Plan' (consolidated 7 July 2016).

Project description

Pumped-storage hydroelectricity stores energy in the form of gravitational potential energy of water, which is pumped from a lower elevation (Lower Reservoir) to a higher elevation (Upper Reservoir). A typical PSH system is shown in Figure 1. During periods of high electrical demand, the stored water in the Upper Reservoir is released through turbines to produce electric power and the released water is stored in the Lower Reservoir. Lower cost off-peak power is then used to run the pumps to return the water to the Upper Reservoir.

The PSH Facility consists of a number of permanent features including an Upper Reservoir and intake, a Penstock, a Powerhouse containing the pumps and turbines (nominal capacity of between 230 – 270 MW), as well as a tailrace that connects to the Lower Reservoir and intake.

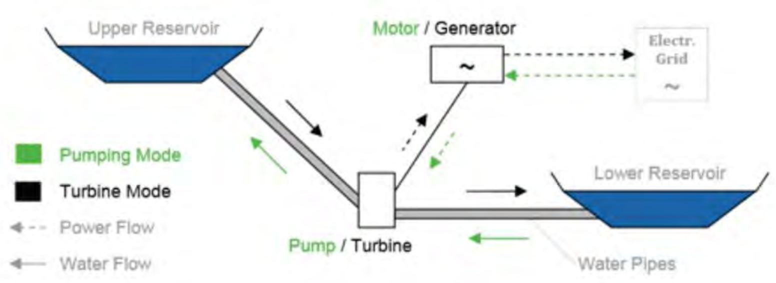

Figure 1: Typical PSH system

The Upper and Lower Reservoirs will be engineered from earthen embankment dams with a nominal storage volume capacity in the range of 4.0 to 4.5 Mm^3. The reservoir volumes will be similar and designed to meet approximately 8 hours of storage. The surface area of the reservoirs will be approximately 35 ha each, with the water surface area about 25 ha. Evaporation covers will be placed over the reservoirs.

The Project also requires permanent linear infrastructure such as 275 kV overhead transmission lines (approximately 18.5 km), a medium voltage overhead transmission line (approximately 6.5 km) and a water supply pipeline (approximately 9 km).

Internal access roads will be constructed from the access point off Eyre Highway to the Upper and Lower Reservoirs.

Support infrastructure that will also be required include a switchyard and substation (which connects the project to the SA electricity network), security fence, signage and a carpark area.

The main components of the Project are shown on Figure 2 below. The design concept of the PSH Facility has been overlaid on drone footage to provide visualisation of the Project in Figure 3.

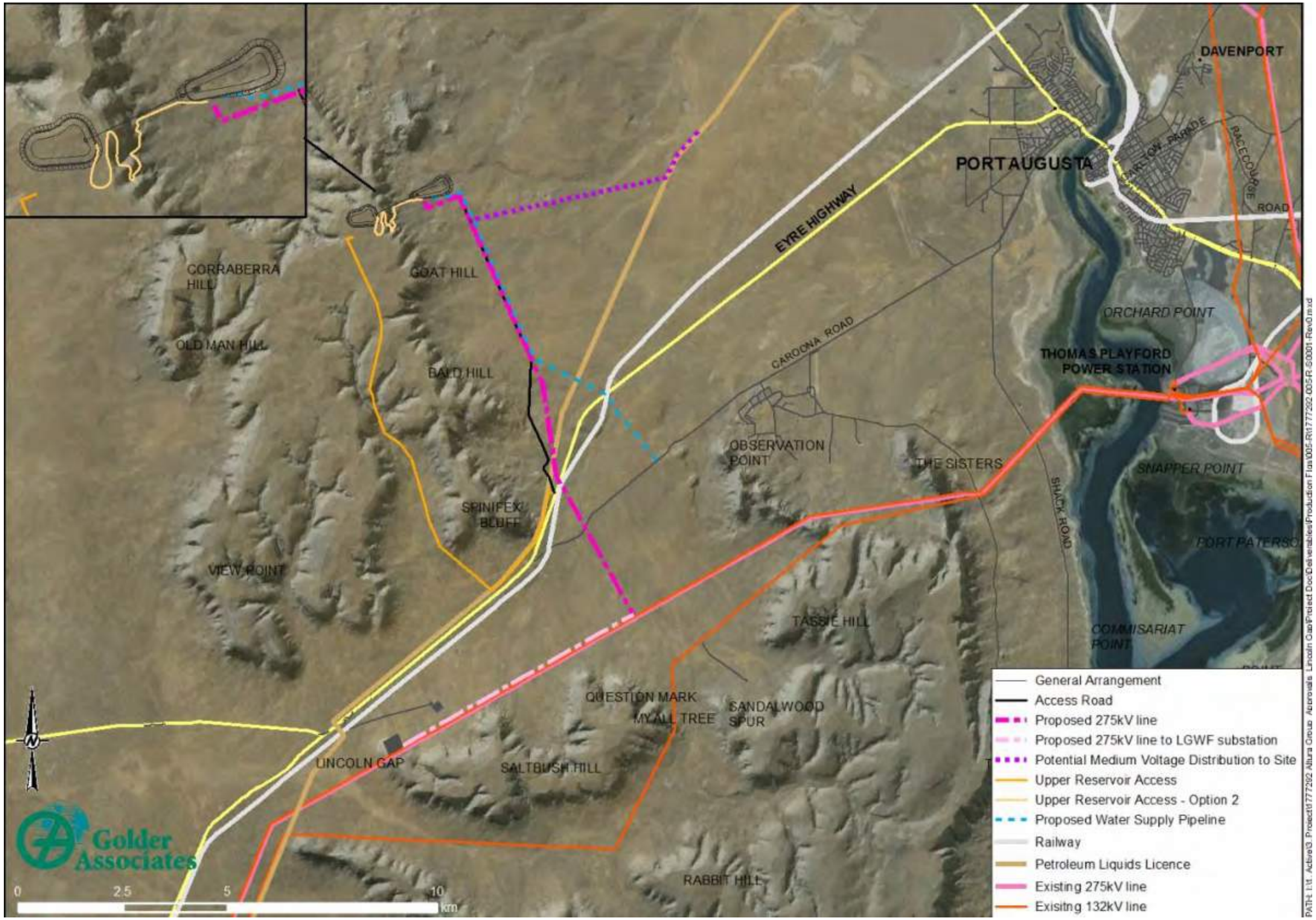

Figure 2: General project layout

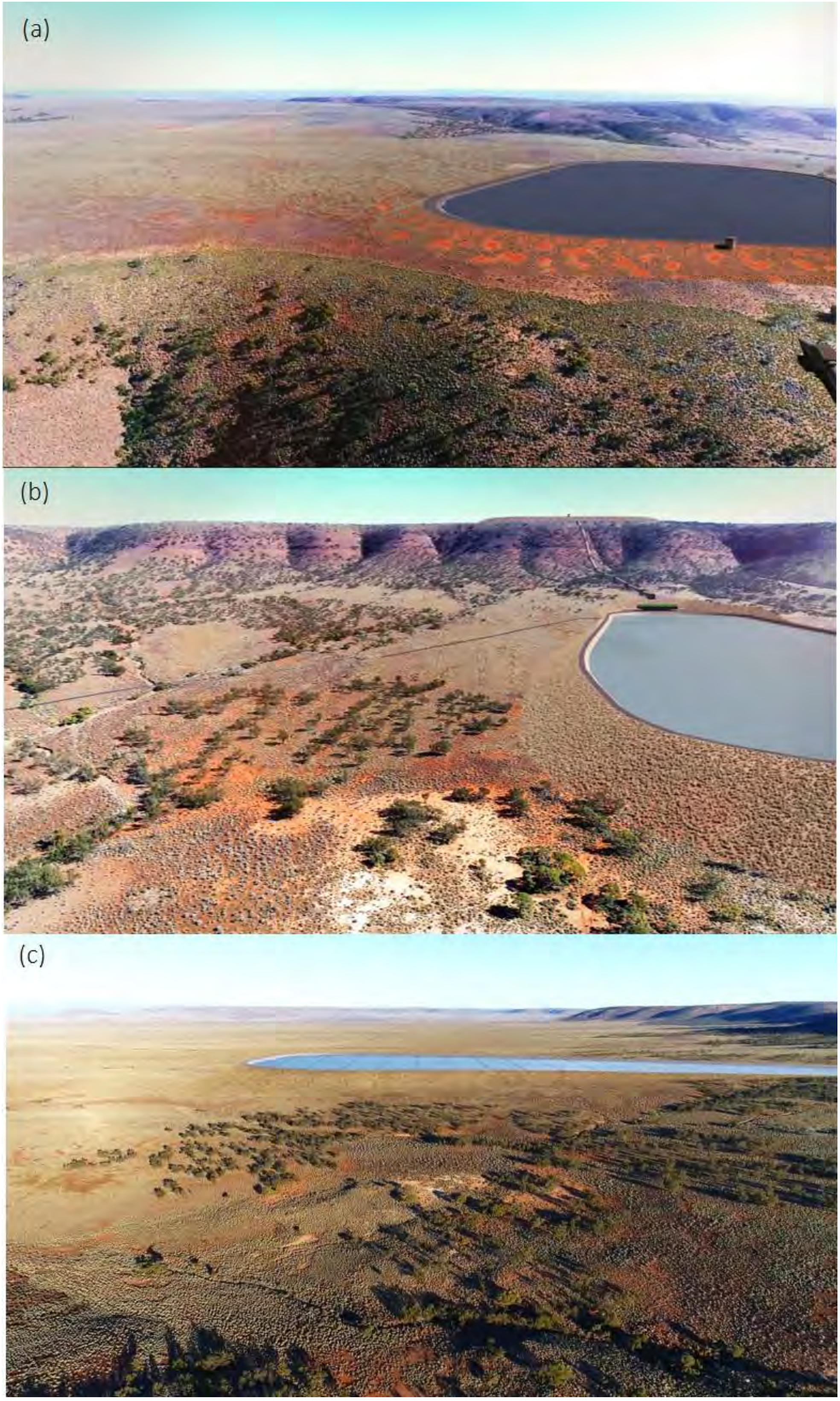

Figure 3: Visualisation of (a) Upper Reservoir and (b) Lower Reservoir with the Penstock leading to the Upper Reservoir and (c) Lower Reservoir looking south towards the Eyre Highway, some 7 km away.

Project benefits

The Project will provide reliable, economic energy storage and flexible generation and is consistent with both State and Commonwealth strategic priorities. The development of a PSH Facility will help provide energy security to facilitate the growth of renewable energy in South Australia and reduce South Australia's reliance on energy imports from Victoria.

Direct and indirect benefits will be delivered to South Australia through development of the Project:

- Provides reliable, economic energy storage and flexible generation
- Supports a high penetration of renewable resources and reduces reliance on energy imports from Victoria
- Enables South Australia to increase use of wind and solar, reducing market energy volatility
- Provides enough energy storage to power 135,000 homes annually (based on Clean Energy Council average house figures)
- Represents significant investment to the South Australia economy through the provision of local and regional jobs during construction
- Provides indirect economic benefits for local businesses during construction and operation, leveraging the strength of the South Australian civil contracting industry.

Consultation

A number of State agencies have been consulted in the development of this Project and preparation of this Development Application and supporting studies, as follows:

- Department of the Premier and Cabinet (DPC; sponsoring agency)
- Department of State Development (DSD; case manager)
- Department of Planning, Transport and Infrastructure (DPTI)
- Department of Environment, Water and Natural Resources (DEWNR)
- Environment Protection Authority (EPA).

A number of other key stakeholders have been engaged throughout the Project inception and development phases through one-on-one meetings and subsequent follow-up communication, as required. An Open-Door-Day was also held in Port Augusta to share information about the Project, and provide an opportunity for the community to ask questions. Overall, feedback has been positive, and stakeholders have been supportive of the Project.

Looking forward, Altura will continue to keep the regional community informed about the Project. Should Development Approval be granted, community and stakeholder consultation will continue throughout the future stages of pre-construction, construction, operation and decommissioning.

Existing environment and potential impacts

Topography, geology and soils

The general topography at the Project site ranges from a steep-sided plateau to undulating plains. The elevation difference of approximately 200 m is needed to enable the gravitational flow of water from a higher water body to a lower one, efficiently producing electrical energy.

The Project design and siting of the reservoirs has responded to known geological conditions that have been derived from desktop and preliminary geotechnical assessment of the Project site. Additional investigations are expected to be undertaken by the Construction Contractor which will allow for refinement of the concept design.

Hydrogeology and Hydrology

The closest drill hole to the site is approximately 3 km north west, with only two other exploration holes within 5 km. Based on the geological logs available for these three drill holes, the primary aquifer is likely to be within a sandstone or quartzite fractured rock aquifer.

Groundwater wells in the area suggest groundwater levels ranging from less than 5 m below ground level (mbgl) on the north side of the plateau to greater than 20 mbgl on the south side of the plateau.

Groundwater flows through fractures, joints and bedding planes and yields are expected to be low (exploration hole yields were between <1 and 3 L/s). Higher yields are often encountered in areas of faulting, which can present key pathways for groundwater flow. However, based on the SARIG website, no major faults have been mapped in this area.

Groundwater salinity, expressed as Total Dissolved Solids (TDS), is indicated to range from 7,000 ppm to 14,000 ppm (brackish) in the southwest region of the Project site to 14,000 ppm to 35,000 ppm (saline) in the northeast region of the Project site. Most of the groundwater in the region is indicated to be either saline or brackish.

Altura has drilled at the Powerhouse to 25 mbgl without encountering groundwater. However, groundwater may be intercepted at greater depths. If the groundwater is of sufficient quality, it will be used in such activities as filling the reservoirs, dust suppression, construction, and/or stock watering. If it is not of suitable quality, an appropriately sized and lined evaporation pond(s) will be constructed close to the location of the dewatering activities.

There is no permanent surface water however numerous creeks traverse the Project site which flow ephemerally in response to seasonal rain. 'Stream orders' have been assigned to the creeks, which measure their relative size. For example, the smallest tributaries are referred to as a 'first order stream' and tributaries go up in size until they are considered rivers ('seventh order streams' and above).

There are two ephemeral creeks intercepted by the PSH Facility (Figure 4):

- The surface Penstock crosses one watercourse, approximately half way down the escarpment This watercourse is a small tributary that drains to another stream;
- A road access option between the Lower and Upper Reservoirs, which crosses four first order streams, one being the same tributary that is crossed by the Penstock;
- The Lower Reservoir location incorporates a first order stream.

The catchment reporting to the Penstock crossing is reduced from baseline by 5 ha due to the footprint of the Upper Reservoir within this catchment. This relates to a peak flow reduction in the channel (estimated using the Rational Method for a 1:10 Annual Exceedance Probability) of 0.5 m^3/s from the baseline peak flow of 1.3 m^3/s and correspond to a minimal change in depth of water (0.07 m).

The Lower Reservoir is located at the head of the catchment of another watercourse. As a result of the Reservoir being located at the head of the catchment, no diversion of the watercourse is required in this location. The construction of the Lower Reservoir will reduce the catchment size further downstream by 5% (Location C, Figure 4). This results in an estimated reduction in peak flow downstream from a baseline flow of 21 m^3/s to a post construction peak flow of 19.9 m^3/s, or, a small change of 1.1 m^3/s. There were no downstream water users (i.e. farm dams) identified in this catchment.

The changes to surface water volumes anticipated by the Project have been assessed. Overall, no changes to the surface water volumes are anticipated except for the small reduction associated with the Lower Reservoir.

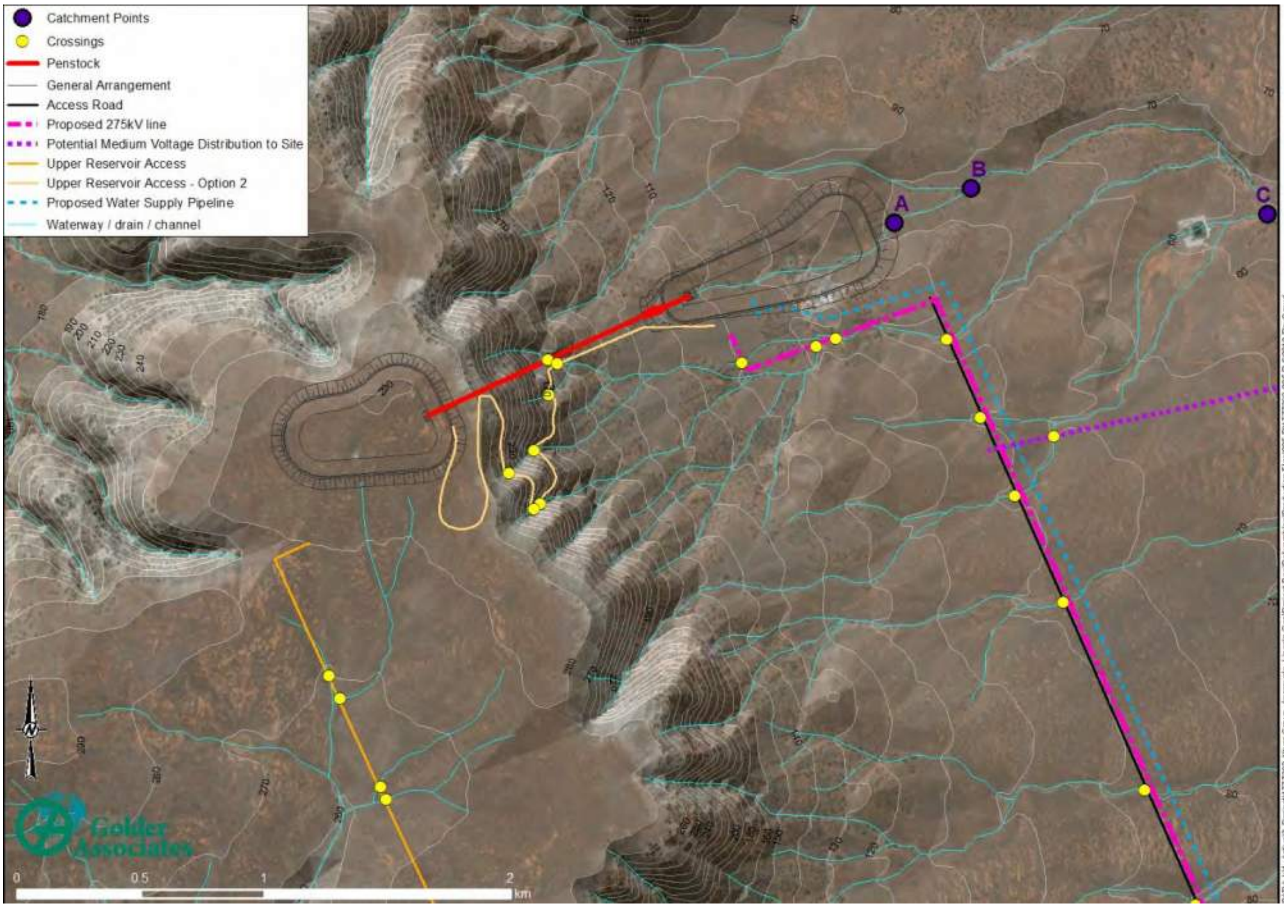

Figure 4: PSH Facility interaction with surface water drainage

Ecology

A comprehensive field survey was undertaken on the Project site during spring 2017 to characterise vegetation communities and identify any species of significance (flora and fauna).

There were 12 vegetation communities recorded at the site, dominated by low chenopod shrublands (saltbush and bluebush), mallee and remnant stands of native pine and she-oak low open woodlands. Saltbush and bluebush represent the majority of understory throughout the area (Figure 4).

With the Project site being historically and actively grazed by sheep and goats, most of the vegetation showed signs of long-term grazing impacts, resulting in a low habitat quality for fauna within the Project area.

Although 109 flora species were recorded and 52 fauna species (excluding livestock), no species were identified that were listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Sandalwood (*Santalum spicatum*), which is listed as a vulnerable plant under the State *National Parks and Wildlife Act 1972* was recorded at the Project site, as well as NPW Act-listed Slender-billed Thornbill (Western).

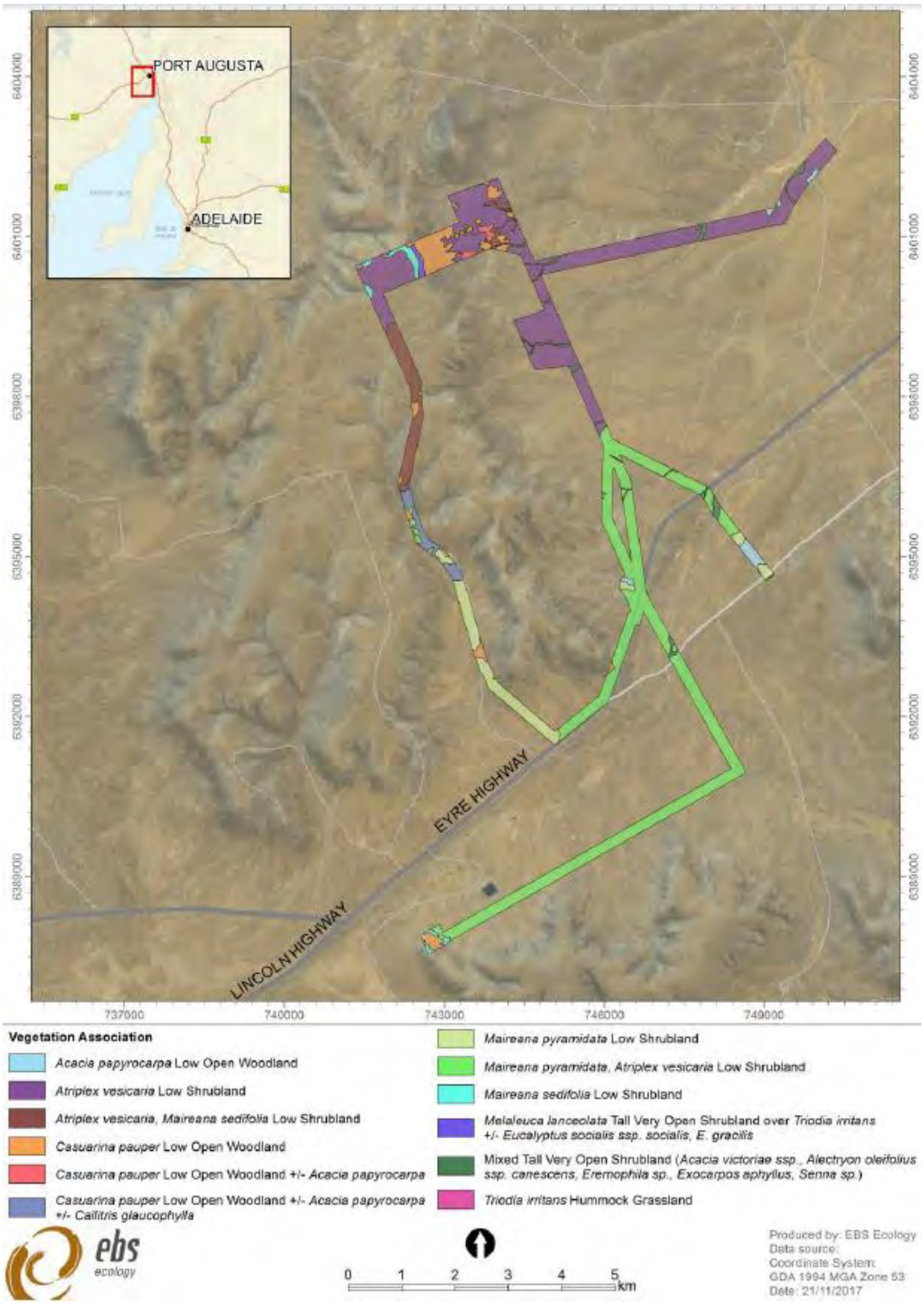

Figure 4: Vegetation associations

The potential impact of the Project on the Slender-billed Thornbill (Western) population identified on site is considered negligible given the species has a stable population, is widespread and has extensive areas of suitable habitat in the surrounding area.

The Project will require the removal of vegetation to allow for the construction and operation of the PSH permanent and ancillary infrastructure. The Project design will be optimised (e.g. co-located linear infrastructure) where practicable to minimise the impact on vegetation communities, and avoid the removal of Sandalwood trees where possible. The final design footprint will also be assessed to enable Significant Environmental Benefit calculations to be completed.

Seventeen weed species were identified during the survey, three of these were declared weeds under the Natural Resources Management Act, including African Boxthorn, Horehound and Bathurst Burr.

Cultural heritage

A search of the Department of State Development Aboriginal Affairs and Reconciliation (DSD-AAR) register was undertaken and identified five recorded/registered indigenous sites in the vicinity of the Project, and a single large ethnographic site within the infrastructure footprint. These registered sites are a mixture of archaeological (artefact scatters and ceremonial sites) and cultural (ethnographic) sites.

Altura is collaborating with the Barngarla Determination Aboriginal Corporation to finalise a Cultural Heritage Agreement. Once the agreement has been finalised, a detailed cultural heritage survey will be undertaken to further inform the Project design and the necessary management requirements. The survey is expected to occur during early 2018.

Amenity

The Project is remote from human settlement and is within a rural landscape, predominantly used for stock grazing. The closest town to the Project is Port Augusta approximately 12 km to the east, and the closest publicly utilised road is the Eyre Highway, approximately, some 7 km south of the site. The closest resident to the site is approximately 11 km to the south east.

While the Project will be situated on a plateau which rises approximately 200 m above the surrounding plains and may be slightly visible from the Eyre Highway, the visual impact of the Project is considered low. The visual impact is limited by the Project’s distance to Port Augusta and the Eyre Highway.

Lighting of the Powerhouse facility (the PSH component to contain exterior and security lighting) may present a distant new light source on the night-time landscape. However, the low position of the Powerhouse in the landscape (i.e. located within an excavated area), the distance from both Port Augusta and the nearest sensitive receivers (> 10km), together with transitory nature of passing motorists on the Eyre Highway some 6km away, the visual impact is considered low.

Overhead transmission lines and water supply pipeline will traverse the Eyre Highway. The visual impact of this infrastructure is considered negligible, based on the existing infrastructure present and transitory nature of passing motorists.

It is highly unlikely that construction noise levels will exceed the EP (Noise) Policy through construction activities so as to cause an adverse impact on the closest noise sensitive receptor (resident), more than 11 km from the Project. Operational noise impacts are also considered negligible, based on the below-ground operation of the Powerhouse and distance from sensitive receivers.

Offsite impacts due to dust generation are expected to be negligible based on the amount of dust expected, distance to the closest resident, distance to the closest publicly used road (Eyre Highway, >6 km) and lack of sensitive receptors. Operation of the Project will have a negligible impact on air quality.

Traffic

The proposed access point for the Project is located on the Eyre Highway, at the site of an existing access point to Augusta Quarries. This access point meets the requirements for minimum gap site distance as well as critical gap time to ensure safe ingress and egress to the site. There are also existing tracks suitable for access/maintenance to the proposed transmission lines and water supply pipeline.

Traffic will be generated to enable construction and operation of the Project. In context of the existing traffic, construction and operation of the Project is expected to have a short term but negligible impact on traffic volumes on DPTI roads. Although the traffic volumes and percentage of heavy vehicles may slightly increase on the road network servicing the Project, each of these roads is an existing gazetted freight route with minimal residences and generally have good pavement conditions (Figure 5).

Figure 5: Gazetted freight routes providing access to the Project.

Bushfire

The main bushfire risks associated with the Project will be during construction when hot-works are required. While these activities will increase the bushfire risk, the risk of fire initiation is reduced by appropriate hot-works procedures. Further, risk of a widespread fire is reduced by the surrounding environment and vegetation.

While operational activities are not expected to increase the risk of bushfire, the infrastructure added to the landscape (i.e. substation and transmission lines) have the potential to start or influence the spread of fire. These risks, however, are not expected to substantially increase above those associated with the current agricultural activities and existing infrastructure.

Management

Based on the information presented in this DAR and the supporting technical studies, the potential risks identified can be effectively managed through detailed design and/or management strategies to be included in an Environmental Management Plan.

Through the development of a Construction Environmental Management Plan by the Construction Contractor, the Project will incorporate appropriate measures to oversee the construction phase in an environmentally efficient manner and ensure the ongoing operations are similarly managed to avoid degradation of the landscape and promote safe and efficient procedures.

Site suitability - summary

Renewable energy infrastructure is a specifically envisaged form of development within the relevant Development Plan Zones, being the 'Pastoral' and 'Primary Industry' Zones. The primary desired land uses of grazing and associated farming activities within these zones are not compromised by the occupation of the PSH Facility on the land which can function compatibly in this rural environment.

The PSH Facility is appropriately sited in a location with topographic characteristics which enable the gravitational flow of water from a higher water body to a lower, efficiently producing electrical energy. The Project is suitably sited away from townships, sensitive land use and high quality/vulnerable environmental areas.

This form of infrastructure is by design, relatively low impact, with the appearance of the reservoirs being an extension of the natural land form and the supporting infrastructure being of modest scale and similar to existing rural structures and linear infrastructure already present in the landscape.

The proposal has sought to understand and address potential impacts, particularly those associated with visual impacts, the protection of flora and fauna, watercourses and erosion, traffic movements and Aboriginal heritage. Based on the environmental risk assessment, no potential impacts have been identified that would preclude development of the PSH Facility.

Through the development of a Construction Environmental Management Plan by the Construction Contractor, the Project will incorporate appropriate measures to manage the construction phase in an environmentally sensitive manner and ensure the ongoing operations are similarly managed to avoid degradation of the landscape and promote a high level of environmental integrity.

ALTURA GROUP

Goat Hill Pumped Storage Hydro Project

Volume 2: Development Application Report

Submitted 14 December 2017

Version: 1.0

Document Number: GHL-ENV-APL-0008

Preface

This Development Application Report has been prepared by Altura Group Pty Ltd (Altura) in support of an application for statutory consents for the construction and operation of Goat Hill Pumped Storage Hydro Project (the Project), approximately 12 km west of Port Augusta, South Australia.

The Project has been sponsored (18 September 2017) by the Department of the Premier and Cabinet as a development of public infrastructure as required by section 49 of the *Development Act 1993* (South Australia) (the Act). This Development Application has been submitted to the Department of the Premier and Cabinet for lodgement to the State Commission Assessment Panel.

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Registered office:

Altura Group Pty Ltd

Level 2 340 Adelaide Street, Brisbane QLD 4000

Acronyms

AADT	Annual average daily traffic
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AHD	Australian height datum
ALA	Atlas of Living Australia
BDBSA	Biological Databases of South Australia
bgl	Below ground level
CEMP	Construction Environmental Management Plan
CFS	Country Fire Service
DA	Development Application
DAR	Development Application Report
dB	Decibels
DEWNR	Department of Environment, Water and Natural Resources (SA)
DMP	Dewatering Management Plan
DOEE	Department of the Environment and Energy (Commonwealth)
DPC	Department of the Premier and Cabinet
DPTI	Department of Planning Transport and Infrastructure (SA)
DSD	Department of State Development
ELA	Exploration license application
EML	Extractive mining lease
EMP	Environmental Management Plan
EP	Environment Protection
EPA	Environment Protection Authority (SA)
FCAS	Frequency control ancillary services
GWh	Gigawatt hours
Ha	Hectare
HV	High voltage
Km	Kilometer
Km/hr	Kilometer per hour

Kv	Kilovolts
masl	Meters above sea level
MGSD	Minimum gap site distance
mm	Millimetre
Mm^3	Million cubic meters
MW	Megawatts
NCAS	Control ancillary services
NEM	National Electricity Market
NPW	National Parks and Wildlife
NRM	Natural Resources Management
OTR	Office of the Technical Regulator (SA)
PELA	Petroleum Exploration Licence Application
PSH	Pumped Storage Hydro
PV	photovoltaic
RET	Renewable Energy Target
SA	South Australia
SAPN	South Australian Power Network
SCAP	State Commission Assessment Panel
SEB	Significant Environmental Benefits
SEDMP	Soil Erosion and Drainage Management Plan
SIPSA	Strategic Infrastructure Plan South Australia
TDS	Total Dissolved Solids
TMP	Traffic Management Plan
VMS	Variable message sign
WAAP	Water affecting activity permit

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1.0 General Information

Altura Group Pty Ltd (Altura) is proposing to develop a Pumped Storage Hydro (PSH) facility approximately 12 km west of Port Augusta, South Australia.

Pumped storage hydroelectricity works by pumping water uphill from a Lower Reservoir to an Upper Reservoir when power is plentiful, and then releasing the water downhill to convert its gravitational potential energy when power demand is high. The technology is not new, with PSH systems first installed in Europe in the late 1800's that continue to provide significant energy storage and generation output.

The proposed Goat Hill PSH Project (the Project) will provide reliable, economic energy storage and flexible generation to support high penetration of renewable resources and reduce South Australia's reliance on energy imports from Victoria.

1.1 The proponent

This Development Application Report (DAR) has been prepared on behalf of the Applicant, Pumped Hydro (SA) Pty Ltd, which is a wholly-owned subsidiary of Altura.

Altura was formed in 2016 to meet the growing need for experienced renewable energy project development expertise in Australia. Altura is a developer of renewable energy projects and advisory group in the energy and infrastructure markets. Altura has extensive experience in developing energy and infrastructure projects in Australian, African and Latin American markets.

1.2 Project overview

The Project responds to the need for new and flexible forms of generation plant to support South Australia's power system through provision of fast response plant, principally providing bulk energy management. PSH is an efficient and reliable form of bulk energy storage at around 80% energy cycle efficiency and can be made available to the market within minutes.

The Project will install two bodies of fresh water that are located at different elevations and connected with a Penstock. When energy is available, the PSH Facility uses electricity to pump water from the Lower Reservoir to the Upper Reservoir. When required, energy is produced by releasing the water from the Upper Reservoir to the Lower Reservoir passing through the Penstock to the turbines.

The PSH Facility consists of an Upper Reservoir formed by engineered earthen embankments, an upper intake, a surface steel Penstock, vertical pressure shaft, below ground Powerhouse, tailrace tunnel and Lower Reservoir, also formed by engineered earthen embankments. A switchyard will connect the Project to the SA electricity network. Ancillary infrastructure required includes overhead medium and high voltage transmission lines, water supply pipeline and access roads.

Figure 1 shows the main components of the Project.

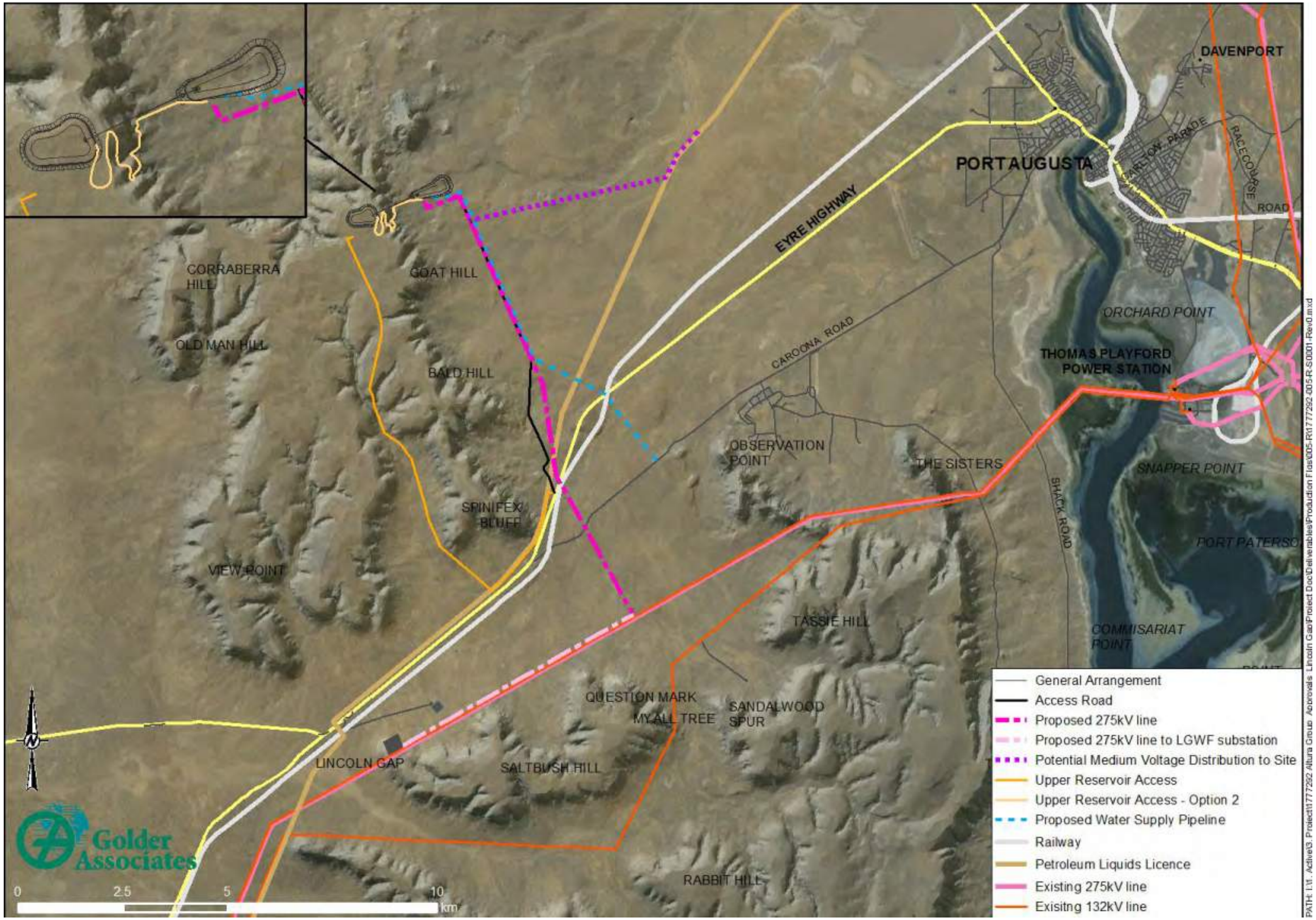


Figure 1: General Project layout

1.3 Approvals pathway

Pursuant to Section 49(1)(a) of the *Development Act 1993* (Development Act), the Project is classified as Public Infrastructure, in that it is infrastructure, equipment, structures, works and other facilities used in or in connection with the supply of electricity. Section 7(d) applies to works that exceed $4 M.

The Project was granted Crown Sponsorship under Section 49 of the Development Act through the Department of the Premier and Cabinet (DPC) on 18 September 2017 (Appendix B).

This DAR will be lodged with the South Australian Government through the State Commission Assessment Panel (SCAP) and referred to other government entities for review and comment as required.

In accordance with Section 49 (7d) of the Development Act, the development application will be publicly exhibited for at least 15 business days. This includes provision of the DA for public access at key local and State Government offices.

A report will be prepared by the SCAP, encompassing feedback from the referral agencies, and will be provided to the Minister for Planning for a final decision.

1.4 Consultation

This development and supporting information has been undertaken in consultation with the following State agencies:

- Department of the Premier and Cabinet (DPC; sponsoring agency and Office of the Technical Regulator)
- Department of State Development (DSD; case manager)
- Department of Planning, Transport and Infrastructure (DPTI)
- Department of Environment, Water and Natural Resources (DEWNR)
- Environment Protection Authority (EPA).

A number of other important stakeholders have been engaged throughout the Project inception and development phases, as detailed in Section 4.0 of this report.

1.5 Project timing

It is anticipated that construction works will begin in the second half of 2018. This projection is dependent on the timing of acquiring development approval and assumes this occurs early 2018. Construction is expected to occur over a period of 30 months.

1.6 Structure and content of this report

This DAR has been prepared to support the Development Application (DA) and assessment process. The DAR includes a range of supporting information and technical studies which can be found in Volume 3:

- Appendix A: Certificates of title and Crown leases
- Appendix B: Letters of support
- Appendix C: Planning Assessment
- Appendix D: Surface Water Assessment
- Appendix E: Flora and Fauna Assessment
- Appendix F: Traffic and Transport Route Assessment
- Appendix G: Project Risk Assessment
- Appendix H: Scope Environmental Management Plan.

The DAR summarises the strategic context including project rationale and benefits; site selection; and details of the community and stakeholder engagement undertaken to date. The DAR then summarises the physical, cultural and biological environments and how the Project interacts with those elements, and provides appropriate management strategies where required. A planning assessment against the relevant Development Plan(s) draws upon these studies to demonstrate that the locality of the Project is appropriate (Appendix C).

2.0 Strategic context

2.1 Project rationale

South Australia has become a leader in renewable energy, transitioning away from dispatchable fossil-fuel electricity generation and on track to achieve the Premier of South Australia's goal to provide 50% of electricity generated in the State from renewable energy sources by 2025. To facilitate the integration of renewable energy technologies into SA's electricity supply market, large capacity storage is critical to maintain energy security and affordability.

The development of a PSH Facility is consistent with both State and Commonwealth strategic priorities, as outlined in the following sections, and will help provide energy security to facilitate the growth of renewable energy in South Australia.

2.2 Relevant legislation and permits

2.2.1 Department of Environment, Water and Natural Resources

The Department of Environment, Water and Natural Resources is responsible for delivery of a range of state acts, most relevant to the Project including:

- Crown lands generally (*Crown Lands Management Act 2009*)
- Management of conservation and pastoral areas (*Pastoral Land Management and Conservation Act 1989*)
- Conservation, protection of vegetation and wildlife (*National Parks and Wildlife Act 1972* – 'NPW Act'; *Native Vegetation Act 1991*)
- Conservation, protection or management of natural assets including water (*Natural Resources Management Act 2004* 'NRM Act').

2.2.2 Native Vegetation Council

On the understanding that the application will result in the removal of some native vegetation, the application is likely to be referred to the Native Vegetation Council pursuant to Schedule 8 – Part 2(26). Once further detail of the extent of vegetation clearance is known, recognising that micro-siting is proposed to minimise the removal of native vegetation where possible, a calculation of the Significant Environmental Benefit (SEB) payment will be calculated in accordance with the Native Vegetation Act and supporting regulations.

2.2.3 Natural Resources SA Arid Lands

The administration of Water Affecting Activities is guided by the Water Affecting Activities policy, an addendum to the SA Arid Lands NRM Board's Regional NRM Plan and a regulatory requirement under the NRM Act to ensure the Board meets its role in the responsible management of water resources. Preliminary discussions with Natural Resources SA Arid Lands have commenced. A water affecting activity permit will be sought by the Contractor for the construction of the reservoirs, culverts and any draining or discharge of water.

2.2.4 Environmental Protection Agency

The EPA is also required to be referred the application pursuant to Schedule 8 – Part 2(11) of the Regulations as the proposed temporary concrete batching plants and crushing, grinding or milling associated with the processing of material extracted from the PSH Facility construction, constitute an activity of major environmental significance listed in Schedule 22 of the Regulations.

Concrete Batching Works: the conduct of works for the production of concrete or concrete products that are manufactured or are capable of being manufactured by the mixing of cement, sand, rock, aggregate or other similar materials, being works with a total capacity for production of such products exceeding 0.5 cubic metres per production cycle.

Crushing, Grinding or Milling: processing (by crushing, grinding, milling or separating into different sizes by sieving, air elutriation or in any other manner) of rock at a rate in excess of 1 000 tonnes per year.

2.2.5 Commissioner of Highways

The Project 'site' of the development adjoins an arterial road (National Eyre Highway) and accordingly the planning authority is required to refer the application to the Commissioner of Highways (DPTI), in accordance with Schedule 8 - Part 2(3) of the Regulations 2008.

Pursuant to Schedule 8 – Part 2(9B) of the Regulations, a referral may be required to the Office of the Technical Regulator. The proposed development incorporates electricity infrastructure that would be developed adjacent to existing infrastructure. However, this application is accompanied by a Certificate issued by the Technical Regulator (dated 2 August 2017 – refer to Section 2.3.6 below) regarding the compliance of this infrastructure in relation to the security and stability of the State's power system. Accordingly, we understand that this agency referral will not be required.

2.2.6 Office of the Technical Regulator

Regulation 70 of the *Development Regulations 2008* prescribes if the proposed development is for the purposes of the provision of electricity generating plant with a generating capacity of more than 5 MW that is to be connected to the State's power system, a certificate from the Technical Regulator is required, certifying that the proposed development complies with the requirements of the Technical Regulator in relation to the security and stability of the State's power system. This Certificate was achieved for the Goat Hill Project on the 2 August 2017 (Appendix B).

2.3 State Government strategic context

2.3.1 South Australia's Strategic Plan

South Australia's Strategic Plan (2011) identifies the State's strategic goals and targets. The Project will assist in achieving a number of these targets, specifically:

- Target 38: Business investment – helping exceed Australia's ratio of business investment as a percentage of the economy by 2014 and maintain thereafter
- Target 59: Greenhouse gas emissions reduction – helping achieve the Kyoto target by limiting the State's greenhouse gas emissions to 108% of 1990 levels during 2008-2012
- Target 64: Renewable energy - increasing and supporting renewable energy so that it comprises 33% of the State's electricity production
- Target 66: Emissions intensity – helping to limit the carbon intensity of total South Australian electricity generation to 0.5 tonnes of CO_2/MWh by 2020.

The contribution of the Project to these targets is provided in Table 1.

South Australia's Strategic Plan called for the infrastructure priorities to focus government and business investment. As a result, the Strategic Infrastructure Plan South Australia (SIPSA) was developed.

2.3.2 Strategic Infrastructure Plan South Australia

The SIPSA provided an overarching State framework for the planning and delivery of infrastructure by all government and private infrastructure providers. The SIPSA presented strategies for 14 infrastructure sectors, including energy. A summary of how the Project is aligned to the SIPSA strategic priorities for energy are outlined in Table 2.

The energy targets of the SIPSA have arguably been superseded by South Australia's Energy Plan (2017).

2.3.3 South Australia's Energy Plan

South Australia's energy plan includes six goals to ensure South Australia will become more self-reliant for its power; and transform the energy network to provide reliable 21st century clean energy. The Energy Plan vision includes:

- Providing South Australia with large scale storage for renewable energy so power is available when it is needed, beginning the transformation to next-generation renewable technology
- Creating new investment in cleaner energy to increase competition, put downward pressure on prices and provide more energy system stability.

The Project will help deliver the Energy Plan through providing a large scale energy storage solution to facilitate the provision of dispatchable renewable energy and, in turn, providing energy security to the energy system. The Project intends to trade on certificates created through the Energy Security Target should it be enacted.

Table 1: How the Project contributes to the South Australian Strategic Plan

Vision	Goal	Target	Alignment of the Project
A strong sustainable economy that builds on our strengths	South Australia has a resilient, innovative economy	Target 38: Business investment Exceed Australia's ratio of business investment as a percentage of the economy by 2014 and maintain thereafter (baseline: 2002-03)	- Provides reliable and economic energy storage, firm energy and flexible generation to support a high penetration of renewable resource development in South Australia and reduce reliance on energy imports from Victoria - Enables South Australia to increase use of its renewable resources (wind and solar) by responding to the peak 5-minute increase/decrease in wind generation capacity and therefore reducing energy market volatility - Helps to stabilise the energy supply to provide a more attractive investment scenario for businesses and industry looking to invest in South Australia - Increases power flows into Victoria, given South Australia has Australia's best renewable resources in proximity to South Eastern Australia, capitalising on an energy surplus from stable, predictable base load energy - Significant investment to the South Australia economy. - Provides indirect economic benefits for local businesses during construction and operation, leveraging the strength of the South Australian civil contracting industry

Vision	Goal	Target	Alignment of the Project
South Australians think globally, act locally and are international leaders in addressing climate change	We reduce our greenhouse gas emissions	Target 59: Greenhouse gas emissions reduction Achieve the Kyoto target by limiting the state's greenhouse gas emissions to 108% of 1990 levels during 2008-2012, as a first step towards reducing emissions by 60% (to 40% of 1990 levels) by 2050 (baseline: 1990)	- Facilitate the storage and deployment of variable renewable energy, providing an alternative to and avoid reliance on fossil fuels - Allow higher penetration of renewable energy and provide the necessary energy security for a reliable energy grid, including fulfilling the requirements under the Draft Electricity (General) (Electricity Security Target) Variation Regulation 2017.
	South Australia has reliable and sustainable energy sources, where renewable energy powers our homes, transport and workplace	Target 64: Renewable energy Support the development of renewable energy so that it comprises 33% of the State's electricity production by 2020	
		Target 66: Emissions intensity Limit the carbon intensity of total South Australian electricity generation to 0.5 tonnes of CO_2/MWh by 2020 (baseline: 2011)	

Table 2: How the Project contributes to the SIPSA

Strategic Priority	Alignment of the Project
Ensure the market operates in the public interest by providing reliable and affordable sources of energy	- Provides a reliable and economic energy storage to ensure a reliable energy grid - Provides a firm and flexible energy generation solution to support a high penetration of renewable resource development in South Australia and reduce reliance on energy imports from Victoria

Encourage and align private investment with business and community demands	- Helps stabilise the energy supply to:
	  - Provide reliable energy supply to the community, and
	  - Provide a more attractive investment scenario for businesses and industry looking to invest in South Australia

Promote the development of market and regulatory arrangements that encourage energy industry developments that minimise growth in greenhouse gas emissions	- Facilitate the storage and deployment of variable renewable energy, providing an alternative to and avoid reliance on fossil fuels - Allow higher penetration of renewable energy and provide the necessary energy security for a reliable energy grid.

2.3.4 South Australia's Seven Strategic Priorities

The State Government has developed seven priorities for South Australia's future. The Project contributes to the fulfilment of two of these priorities, as shown in Table 3.

Table 3: How the Project contributes to South Australia's seven strategic priorities

Strategic Priority	Relevant objective	Alignment of the Project
An affordable place to live	Industries supplying housing, food and utilities are efficient and supply at competitive prices.	The Project will contribute to secure a resilient and reliable energy supply in South Australia, reducing price pressure on consumers levied through electricity bills.
Premium food and wine from our clean environment	South Australia is renowned as a producer of premium food and wine from its clean water, clean air and clean soil.	The provision of electricity by PSH is viewed as a renewable energy supply, with no emissions to air, water and environment as a result of its operation. This, together with the Project providing network security for solar and wind renewable energy will further promote South Australia's green credentials.

2.3.5 South Australia's 10 Economic Priorities

The South Australian Government economic development strategy includes 10 economic priorities. The Project contributes to the fulfilment of three of these priorities, as shown in Table 4.

Table 4: How the Project contributes to South Australia's 10 economic priorities

Economic Priority	Relevant objective	Alignment of the Project
The knowledge state	Build a reputation as a state of knowledge creation and innovation	The Project is innovative for South Australia and Australia, in that **off**-river water is used to generate hydro-electricity. It is expected this Project will be a showcase for other states and internationally.
Unlocking our resources	Balance development with protection of the environment, making efficient use of water and energy, as well as providing access land via a shared approach	The Project unlocks previously un-tapped hydro resources by utilising existing topography in a semi-arid environment and efficiently utilising water resources to generate electricity. The off-river approach also avoids the environmental impacts associated with 'in-river' hydro developments. The Project can be "fueled" by the state's abundant wind and solar resources.
Growing through innovation	Create an environment of innovation	The development model of Altura seeks to foster innovation and adopt new methods for applying existing and new technologies solving today's challenges. The Project demonstrates South Australia's ability to apply sound hydro technology in a unique setting.

2.3.6 Electricity (General) (Electricity Security Target) Variation Regulation 2017

The Project will be able to provide 'real inertia' (i.e. spinning turbines) as opposed to 'synthetic inertia' (i.e. fast frequency response provided by battery storage). This will provide a new renewable energy form of inertia that will help in the stability of the South Australia's electricity network. Further, PSH can be paired with solar and wind, providing additional grid stability benefits, particularly frequency and voltage stability. The technical requirements of the Regulation will be assessed during the design definition and development of technical schedules as the Project advances.

2.3.7 Far North Region Plan (2010)

The Project aligns with many aims of the Far North Region Plan's vision, including:

- Introduce sustainable and innovative approaches to securing water and energy supplies
- Manage the region's population and industry growth, with a focus on Port Augusta, Roxby Downs and Coober Pedy.

2.4 Commonwealth Government direction

2.4.1 Targets for emissions and renewable energy

As part of the international Paris Agreement, the Australian Government has agreed to an emission reduction target of 26-28% below 2005 levels by 2030.

The Renewable Energy Target (RET) is an Australian Government scheme to reduce emissions of greenhouse gases in the electricity sector and encourage generation of electricity from sustainable and renewable resources. The RET for large-scale generation is 33,000 GWh by 2020. To achieve this target, approximately 23.5% of Australia's electricity generation in 2020 will be from renewable sources.

The Project will contribute toward achieving these targets by allowing higher penetration of renewable energy and therefore a reduction in greenhouse gas emissions, while ensuring energy security is maintained through a reliable energy grid.

2.4.2 Policy direction

The Department of the Environment and Energy has developed a plan, "Powering forward: a better energy future for Australia (2017)" which sets out the Government's priorities in providing an affordable and reliable energy system that will help meet international commitments. Three main issues are identified in the current energy market; affordability, reliability and emissions. In response to these issues, the Government will implement a National Energy Guarantee which is intended to provide investment certainty to deliver on its commitments.

The Project provides solutions to two of the issues identified; providing energy security through a reliable grid and facilitating deployment of variable renewable energy to reduce emissions.

2.5 Summary of Project benefits

The following benefits will be delivered to South Australia and wider Australia through development of the Project:

- Provides reliable, economic energy storage and flexible generation
- Supports a high penetration of renewable resources and reduces reliance on energy imports from Victoria
- Enables South Australia to increase use of wind & solar, reducing market energy volatility
- Provides enough energy storage to power 135,000 homes annually, based on Clean Energy Council average house figures
- Makes use of existing infrastructure (275 kV network near Davenport; and SA Water Morgan Whyalla Pipeline) to better utilise the State's assets
- Represents significant investment to the South Australia economy
- Provides indirect economic benefits for local businesses during construction and operation, leveraging the strength of the South Australian civil contracting industry.

2.6 Site selection

A number of parameters and criteria were considered when selecting the site for the PSH facility. These were developed based on technical requirements, but also to ensure the Project could be undertaken as sensitively as possible. The criteria were:

- Development plan zoning that facilitated renewable energy developments
- Suitable elevation profile and geotechnical conditions
- Supply of water
- Close proximity to required infrastructure
- Distant to sensitive receivers
- Minimal environmental and heritage sensitivities
- Good site accessibility
- Land access.

The outcomes of the site selection process, and reasoning for the site selected are shown in Table 5.

Table 5: Site criteria and parameters at Goat Hill

Aspect	Project site features
Land Not Within a Council Area (Flinders) and Port Augusta (City) Council	The zones encourage development of renewable energy facilities that benefit the environment, the community and the state. The land is, and has historically been, used for grazing.
Technically feasible	The site has an elevation change of about 200 m between the plains and plateau.
Proximity to required infrastructure and its capability	A 275 kV overhead transmission line will feed into the South Australian energy market via the selected connection point. Two realistic connection point options exist and will be subject to the final Connection Agreement with ElectraNet. The exact connection location depends on the result of ElectraNet' s option assessment and whether the Project will connect to the new Corraberra Substation proposed for the approved Lincoln Gap Wind Farm or a dedicated connection substation.
Water supply	Potable water to fill the reservoir will be supplied from the SA Water Morgan – Whyalla pipeline system which is located approx. 8km south of the PSH Facility.
Proximity to sensitive receptors	The closest residence is approximately 11 km to the south east of the site. The closest town is Port Augusta, approximately 12 km east of the site.
Environmental and heritage sensitives	Based on the environmental risk assessment, no potential impacts have been identified that would preclude development of the PSH Facility. The site has been degraded by historical and current grazing practices. Environmental impacts from construction activities can be effectively managed through implementation of a Construction Environmental Management Plan (CEMP). Altura has engaged with the Barngarla Determination Aboriginal Corporation and both parties are collaboratively establishing a Cultural Heritage Agreement.

Ease of access and road condition	The PSH Facility is situated approximately 7 km north of the Eyre Highway, with relatively simple access requirements. The Eyre Highway is a designated Freight Route in adequate condition for the required site traffic and plant. The existing (quarry) access point is suitable to allow required plant to enter the site without extensive moderations. The proposed transmission line and water supply pipeline crossings have existing tracks to provide access from public roads for maintenance requirements.
Land access	The landowners are supportive of the Project.

3.0 The Project

3.1 Site context and existing environment

The Project is located approximately 12 km west of Port Augusta, 55 km north east of Whyalla and 280 km north east of Adelaide.

The PSH Facility will be developed on about 80 ha of privately owned land which is currently used for sheep grazing, and has a large population of goats. A network of watering points, and farm vehicle and animal tracks are present across the land.

The site is characterised by a number of steep strike ranges that rise from the plain and comprises plateaus edged by steep escarpments (with deep gullies) and long footslopes. The plateau is a visually prominent landform which is visible from, and frames the western skyline of, the town of Port Augusta. The lower section of the Project area (near the proposed Powerhouse and Lower Reservoir) is at a surface elevation of around 90 m; while the Upper Reservoir will be located at a surface elevation of approximately 290 m.

The site is accessed via the Eyre Highway. The site can access services such a water supply pipeline and high voltage transmission line which traverses Lincoln Gap Station to the south of the plateau; approximately 10 km from the Project site.

3.1.1 Land tenure

The Project and most of the connecting infrastructure is located on freehold land owned by one landholder who has provided a letter of support to the Project (Appendix B).

To enable access, transmission and supply water to the Project, linear infrastructure will cross a small number of land titles that are generally owned by the Nutt Bros Nominees Pty Ltd (Figure 2).

The high voltage overhead transmission line may use a portion of Crown land. It crosses the Moomba-Port Bonython petroleum liquids pipeline, Eyre Highway, the Port Augusta – Whyalla rail line, Council' s Caroona Road, and Morgan-Whyalla water pipeline (Figure 2).

The water supply pipeline may use a portion of Crown land. It crosses the Moomba-Port Bonython petroleum liquids pipeline, Eyre Highway, the Port Augusta – Whyalla rail line, and Caroona Road (Figure 2).

Certificates of Title and Crown Leases have been provided in Appendix A.

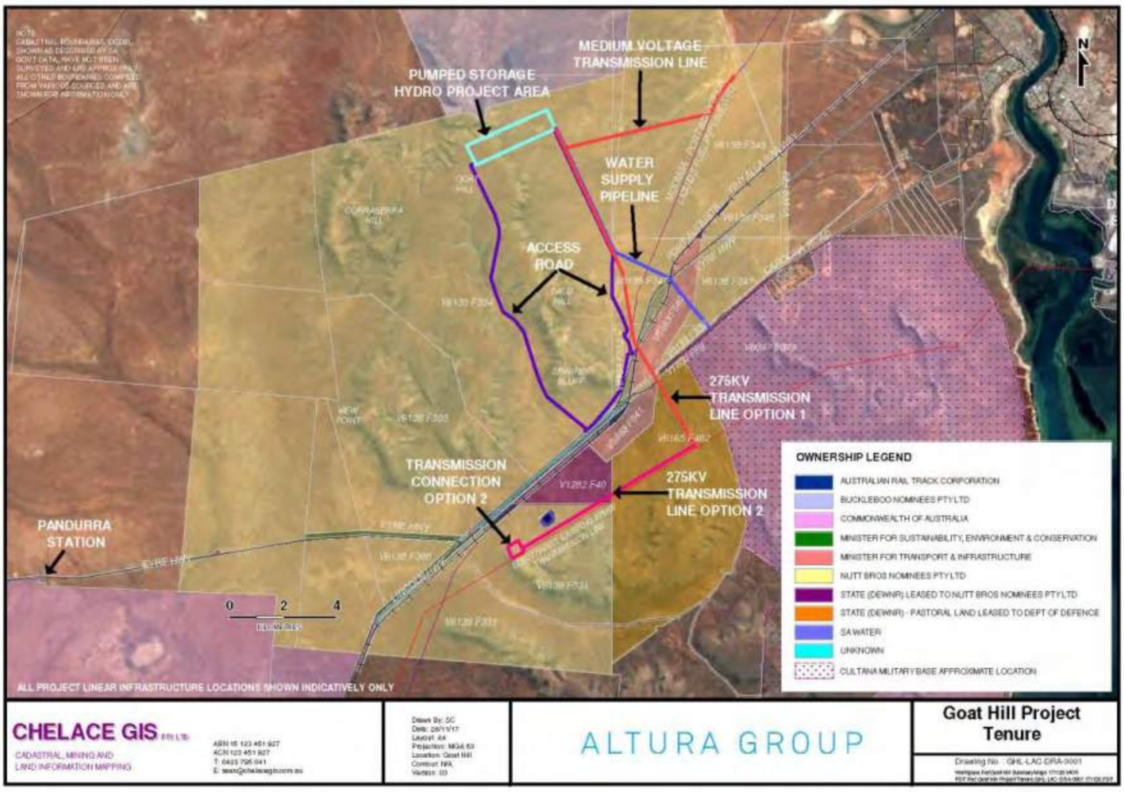


Figure 2: Project land tenure

3.1.2 Other interests on the Project site

An extractive mineral lease (EML 5851) is held by the Nutt Bros Nominees Pty Ltd for a 20 ha quarry (Figure 3 and Figure 4).

Under the *Mining Act 1971*, FMG Resources Pty Ltd successfully lodged an Exploration Licence Application (ELA) for the Illeroo area (2017/00173), with the ELA area covering portions of the Project site (Figure 3).

Under the *Petroleum, Geothermal and Energy Act 2000*, NAVGAS Pty Ltd lodged a Petroleum Exploration Licence Application (PELA 602). The Project site in its entirety is within the tenement (Figure 3).

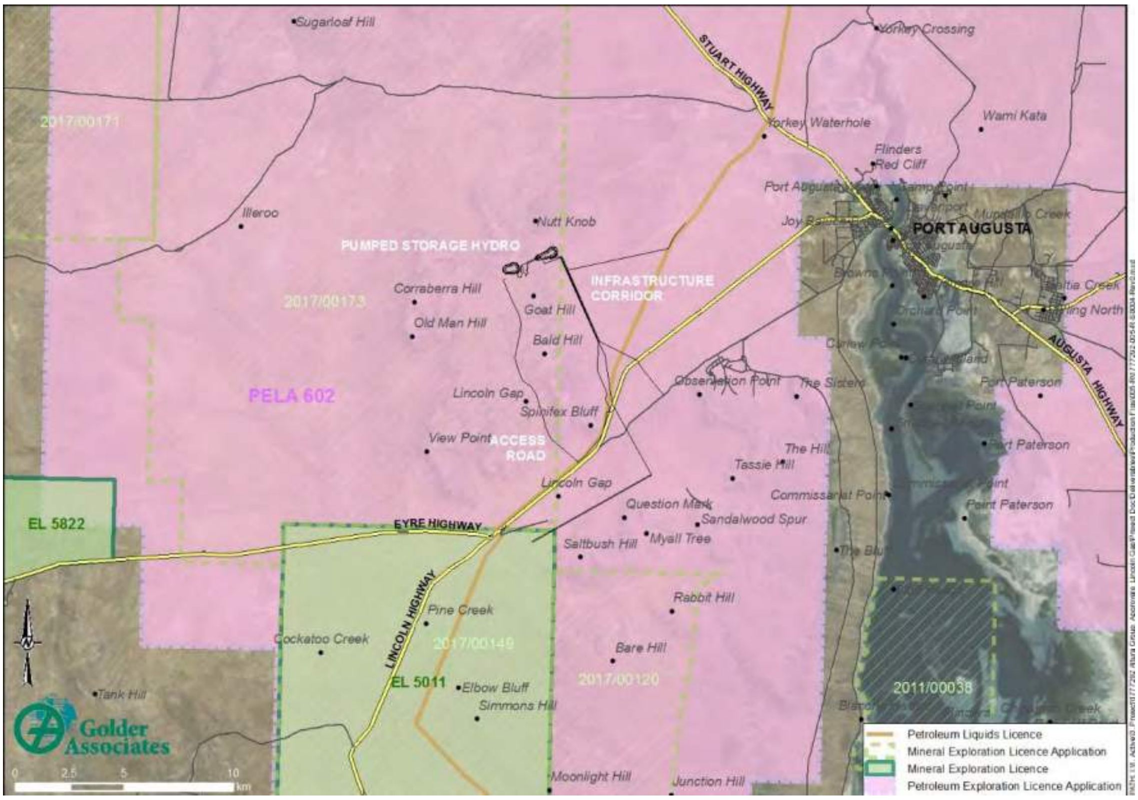


Figure 3: Petroleum and mining interests on or near the Project.

Figure 4: Extractive mineral lease (EML 5851).

3.1.3 Adjacent land uses

Preparation for construction of the Lincoln Gap Wind Farm has commenced next to the Project. The Nutt Bros Nominees Pty Ltd has leased land to Nexif Energy Australia Pty Ltd to enable a 59 wind turbine project and associated infrastructure. The nearest turbine will be approximately 480 m to the south of the Upper Reservoir. Lincoln Gap Wind Farm has a 25 year design life.

Australian Defence Force's largest training area in South Australia is located approximately 11 km the south of the PSH Facility. The lease over the land used by Cultana Training Area has provisions for mining access. It also has an Indigenous Land Use Agreement (ILUA) with the Barngarla people.

The Project is surrounded by large Pastoral Stations, including Cultana, Carriewerloo, Illeroo and Pandurra.

3.2 The development

Pumped storage hydroelectricity stores energy in the form of gravitational potential energy of water, which is pumped from a lower elevation (Lower Reservoir) to a higher elevation (Upper Reservoir). During periods of high electrical demand, the stored water in the Upper Reservoir is released through turbines to produce electric power and the released water is stored in the Lower Reservoir. Lower cost off-peak power is then used to run the pumps to return the water to the Upper Reservoir (Figure 5).

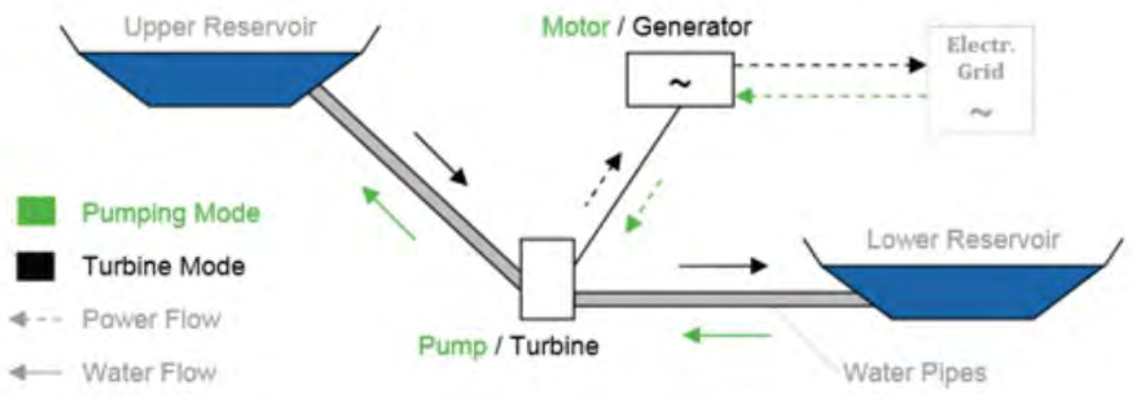


Figure 5: Typical PSH system

The PSH Facility includes a number of permanent features:

- Upper Reservoir and intake structure
- Steel surface Penstock
- Powerhouse structure containing hydro-mechanical and electrical infrastructure and associated facilities
- Tailrace, lower intake and Lower Reservoir.

The Project also includes permanent ancillary infrastructure:

- Linear infrastructure including:
  - approximately 18.5 km of 275 kV overhead transmission lines
  - approximately 6.5 km of medium voltage overhead transmission line
  - approximately 9 km of water supply pipeline
- Access roads including:
  - approximately 8 km of access road to the PSH Facility (connecting to Eyre Highway)
  - two Upper Reservoir Access Road alignment options, Option 1 approximately 10 km and Option 2 approximately 3 km
  - Internal PSH Facility access roads
- Support infrastructure:
  - a switchyard and substation (which connects the Project to the SA electricity network);
  - security fence
  - signage
  - carpark area.

3.2.1 PSH Infrastructure

Upper and Lower Reservoirs

The Upper and Lower Reservoirs will be engineered earthen embankment dams, each with a nominal storage capacity up to 4.5 Mm^3. The reservoir volumes have been designed to meet up to 8 hours of storage capacity.

The natural elevation where the Upper and Lower Reservoirs will be located is at an approximately 290 m and 90 m above sea level (masl) respectively. The upper intake, Penstock, Powerhouse and lower intake connect the two reservoirs. The preliminary design of the PSH Facility is shown in Figure 6.

The surface area of the reservoirs will be approximately 35 ha each, with the water surface area about 25 ha. The Upper Reservoir will have an estimated 20 m embankment height, and Lower Reservoir estimated at 20 to 35 m. The embankment crown width for the Upper and Lower Reservoirs will be approximately 6 m. The dimensions and volumes will be subject to final designs.

The reservoir base and sides will have an impermeable layer or liner to prevent water infiltration which will also include a leak detection system. Evaporation covers will also be installed on both reservoirs (see below).

Water quality within the reservoirs, which will be derived from the SA Water’s potable water supply (see below) is expected to remain good quality without the need of any treatment.

Reservoirs will be designed to include sufficient freeboard against overtopping. This together with the ability to move water between reservoirs, cater the reservoirs capacity to allow for maximum rainfall events.

The final reservoir designs will be optimised by the contractor and will be in accordance with the relevant Australian Standards (e.g. AS1170). Further, dam safety risk assessments will be undertaken during the detailed design phase in accordance with ANCOLD Guidelines.

The preliminary layout plans for the Upper and Lower Reservoirs is provided in Figure 7 and illustrative visualisation in Figure 8.

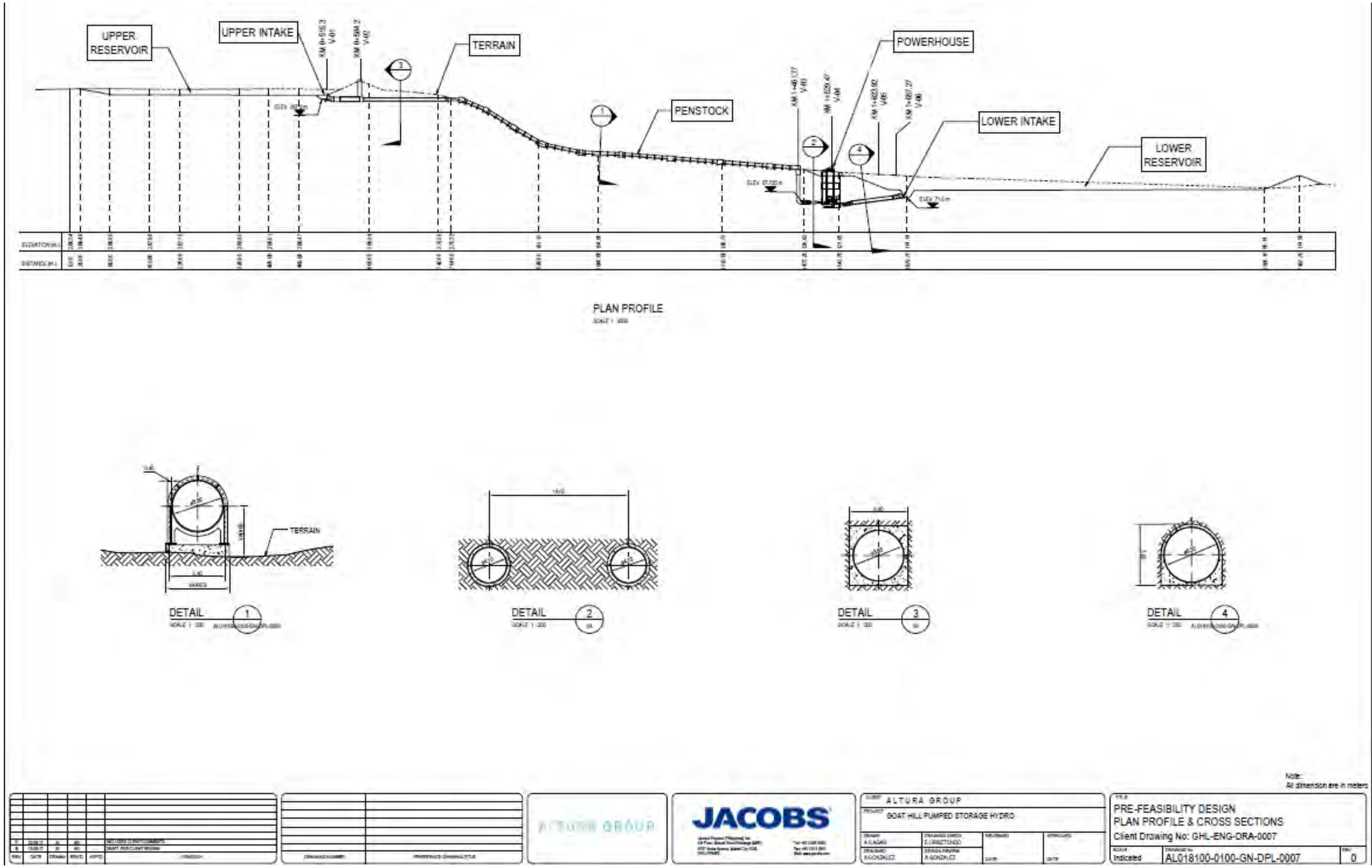


Figure 6: Goat Hill PSH Facility profile– indicative only (Upper Reservoir shown only partially in this profile)

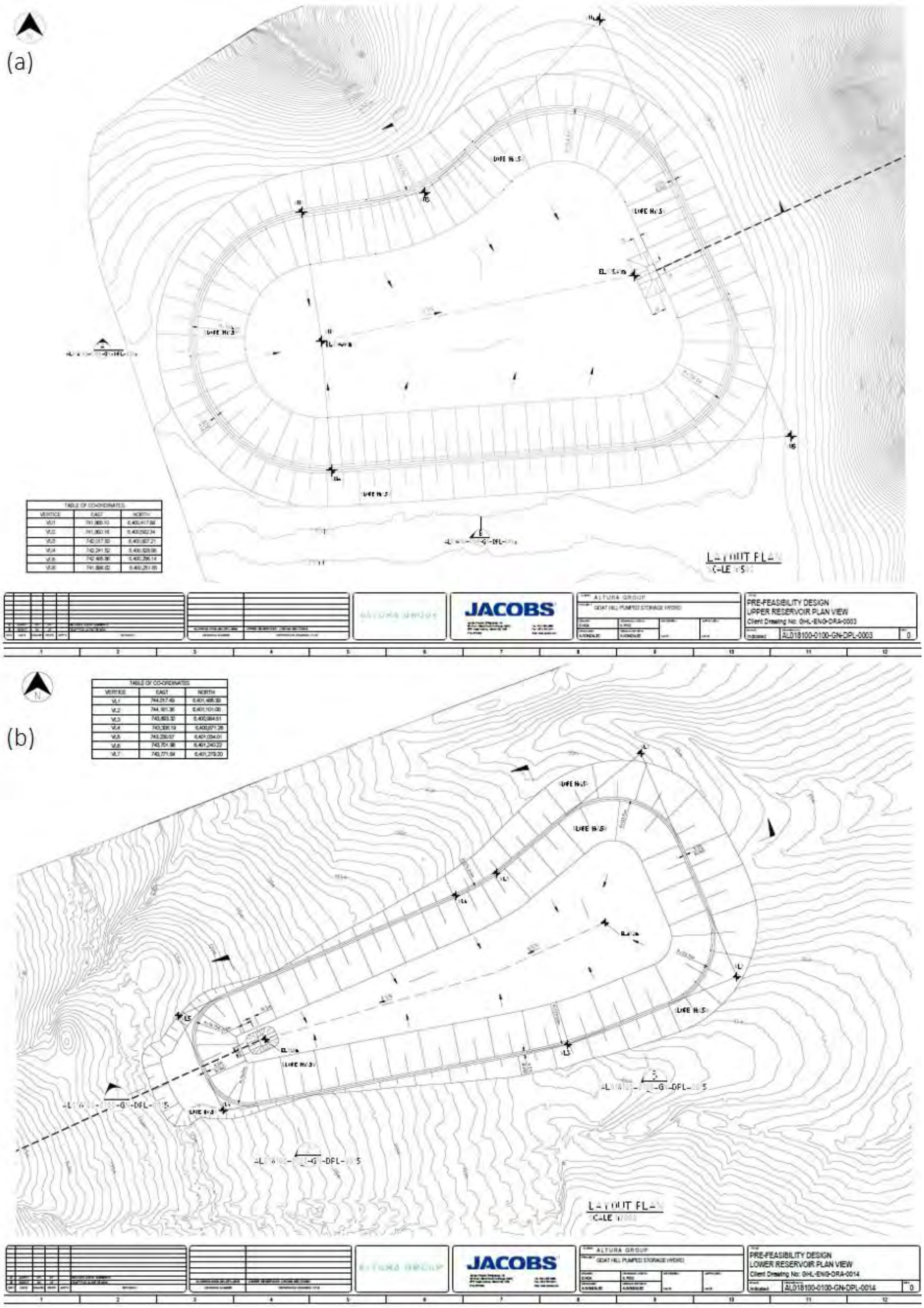


Figure 7: Indicative layout of the (a) Upper Reservoir and (b) Lower Reservoir

Figure 8: Visualisation of Upper and Lower Reservoirs including evaporation covers – illustrative only.

Evaporation covers

Given evaporation rates at the site are likely to exceed 2,300 mm per year, evaporation covers will be installed over the water surface of both reservoirs (Figure 8). Providing evaporation covers provides other advantages including they significantly reduce wind speed across the water surface, lower water temperature, prevent bird access, reduce light and therefore algae growth and assist in maintaining water quality.

Evaporation covers will either be located on a static framework above the water surface, or move in response to changes in water level, and be of a colour that is commensurate with the surrounds. The material used will most likely be an industrial strength, knitted, high density 'shade cloth' material, proven to reduce evaporation as much as 90%, with an ability to withstand site wind loading conditions and other weather extremes. Photos of similar cover types are provided in Figure 9.

The evaporation cover will allow heavy rainfall to infiltrate through, and/or be shed to the edges of the cover for incorporation into the reservoir.

It is likely the covers will need replacement after approximately 15 years.

Figure 9: Example of a static evaporation cover viewed from (a) above and (b) below.

Upper and lower intakes

Concrete intake structures will draw water from the Upper Reservoir into the Penstock and from the Lower Reservoir through to the turbines in the Powerhouse (Figure 10).

Upper and lower intakes may also include trash racks to prevent the entry of floating materials or debris that could damage the hydraulic works.

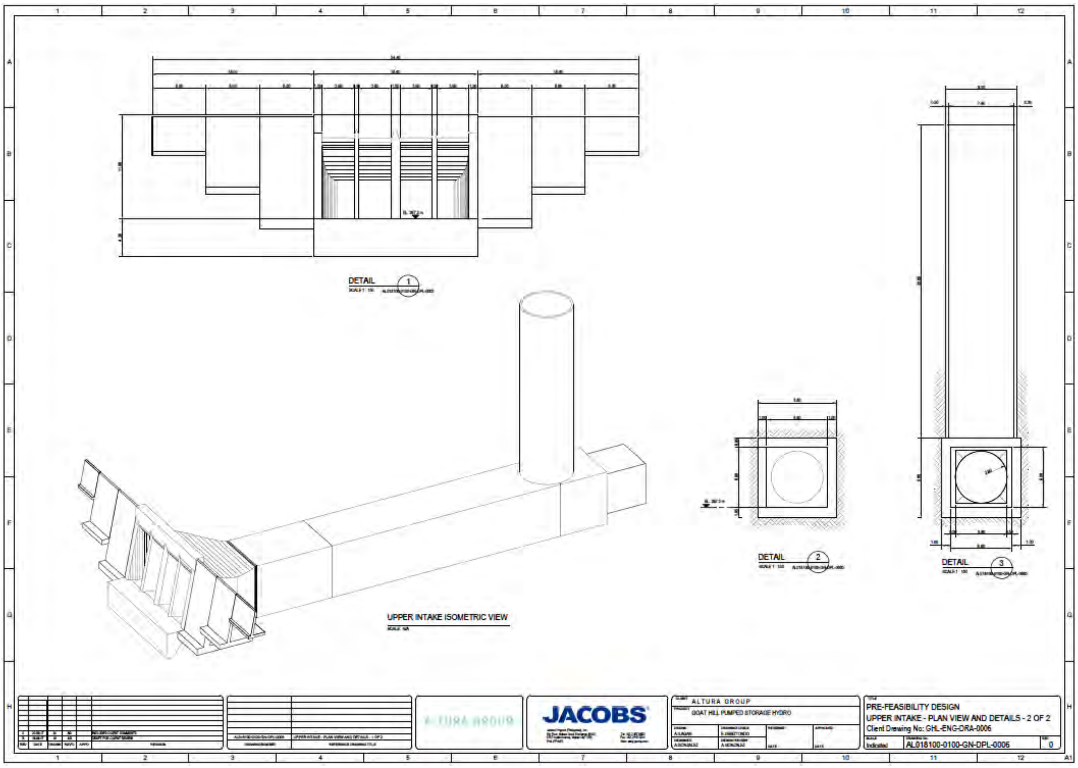


Figure 10 Upper Intake– indicative only.

Penstock

The water conveyance system from the Upper Reservoir to the Powerhouse will consist of a surface Penstock and vertical pressure shaft, with a combined length of approximately 1 km. The surface Penstock will be constructed of high strength steel with an approximate diameter of 6 m and will be applied with a protective coating to minimise corrosion.

The foundation system used for the Penstock will be subject to the Construction Contractor' s (Contractor) final design. The Penstock may be positioned on concrete anchor blocks (refer to Figure 6 and Figure 11), or supported using the terrain.

The Penstock will branch into two sections, either above or below ground, near the Powerhouse with individual pressure shafts entering the Powerhouse to the two pump-turbines.

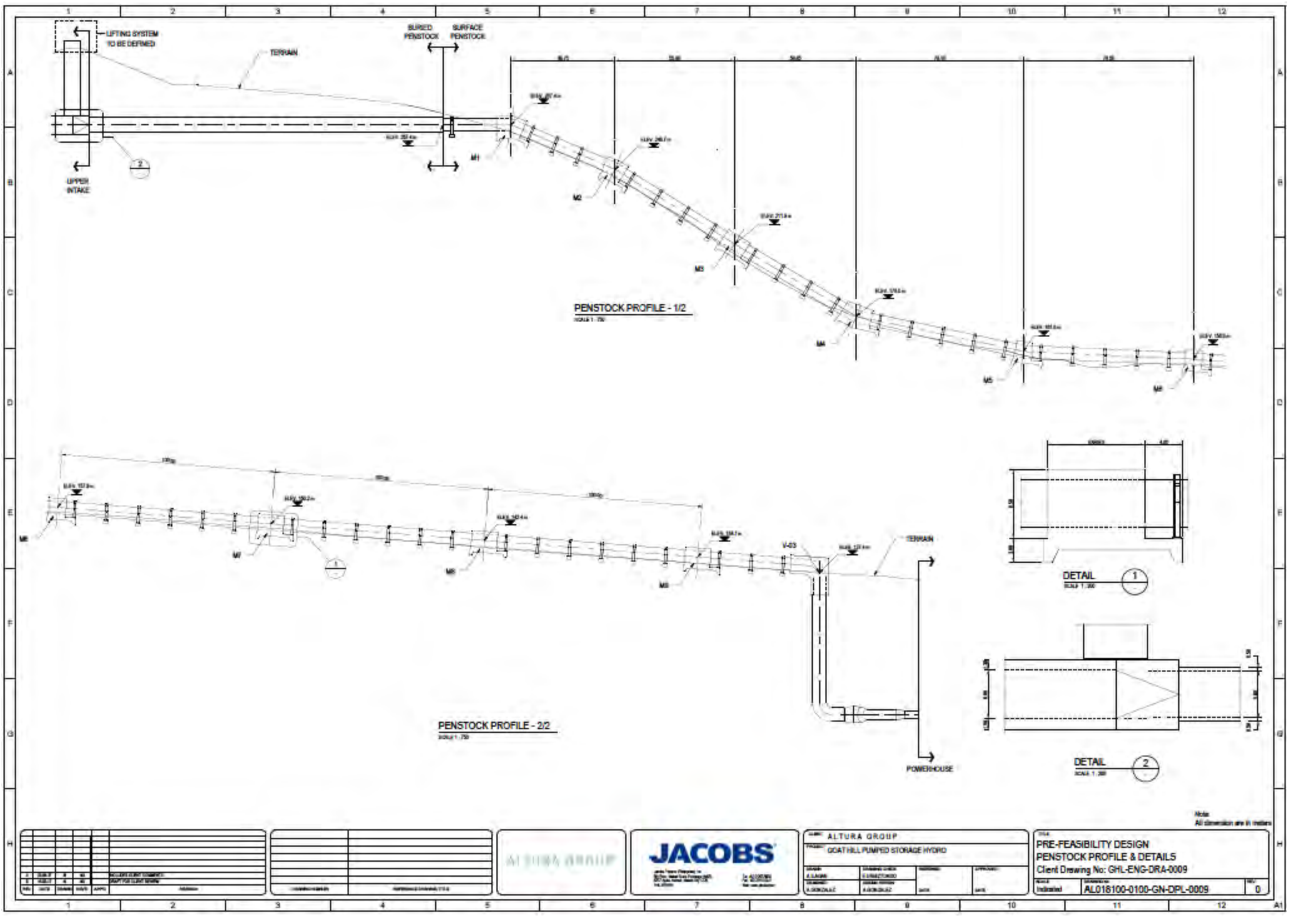


Figure 11 Profile of Penstock option with anchor blocks – indicative only.

Powerhouse

The Powerhouse will have above and below-ground components with a structure approximately three storeys tall. The current Powerhouse design includes a single shaft of approximately 30-40 m internal diameter to a depth of approximately 50 m below existing ground level, although the final dimensions will be subject to the Contractor’ s final design (Figure 12 and Figure 13).

The Powerhouse will be designed and constructed to complement the surrounding landscape (i.e. non-reflective, neutral colours).

The above ground component will comprise facilities associated with the assembly and crane hall, transformers, balance of plant, control room, offices and amenities, as well as an adjacent laydown area for construction and maintenance activities. In case of complete ancillary power loss, an emergency generator would be located adjacent to the Powerhouse (Figure 12 and Figure 13).

The below-ground component will include the two reversible Francis pump-turbines, a motor generator, valves and associated ancillary systems. The hydro pump-turbines will have a nominal generating capacity of between 110 MW and 135 MW each.

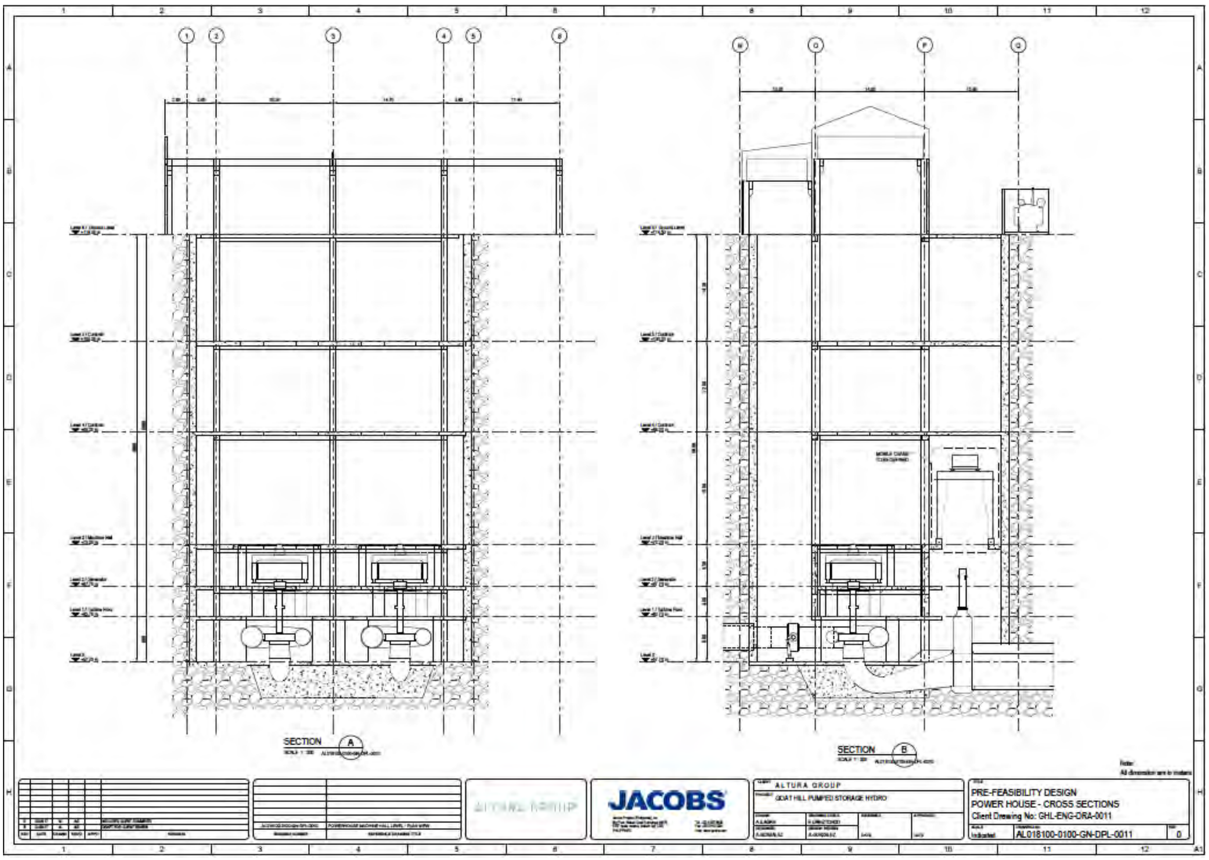


Figure 12 Profile of the Powerhouse above and below ground – indicative only

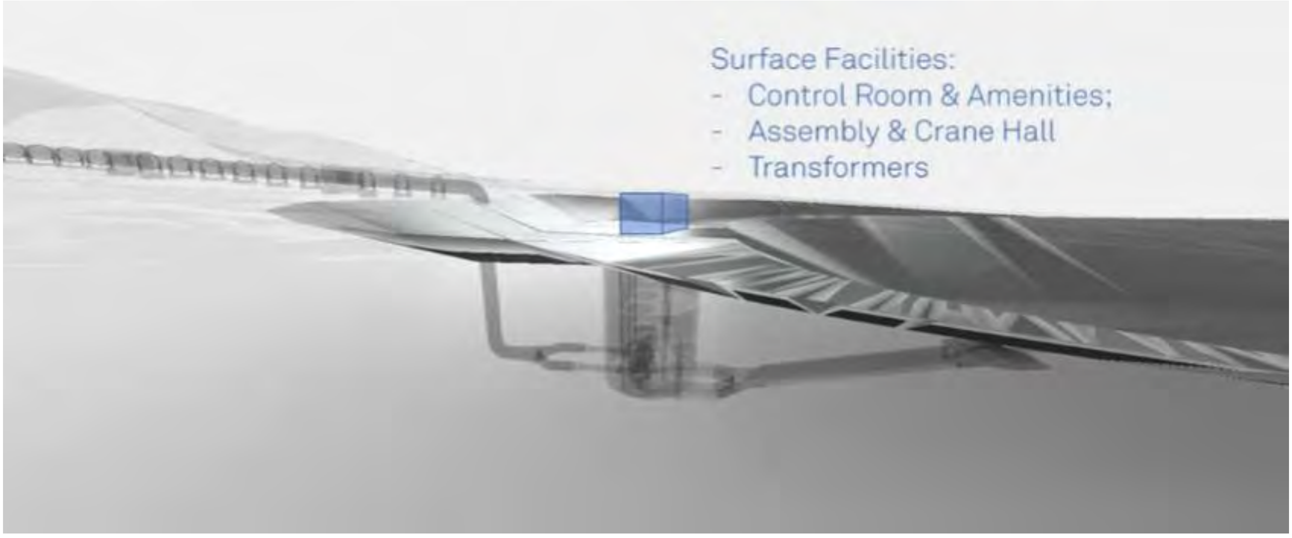


Figure 13 Three-dimensional model of the Powerhouse above and below ground-indicative only.

Tailrace

The tailrace is a hydraulic tunnel that connects the Powerhouse to the Lower Reservoir. The draft tubes from the pump-turbines may form a single tunnel with an approximate diameter of 6 to 7 m. The final design of the tailrace and Lower Reservoir transition will be determined during the detailed design phase.

3.2.2 Ancillary infrastructure

High voltage transmission line

A 275 kV overhead transmission line will feed into the South Australian energy market. Potential connection points include the ElectraNet's new Corraberra substation associated with the Lincoln Gap Wind Farm, or where the Project's 275 kV line meets ElectraNet's high voltage 275 kV network approximately 12 km to the south (Figure 1).

The transmission towers will be designed as per ElectraNet's design requirements and would likely be similar to existing electricity infrastructure found in the region (Figure 14).

The transmission line towers will likely have a height of 50 m, with towers spaced apart approximately 400 m with a minimum 50 m easement.

Transmission line tower construction and placement will be subject to the final electrical design and constraints that may be realised during construction (e.g. ground conditions, heritage).

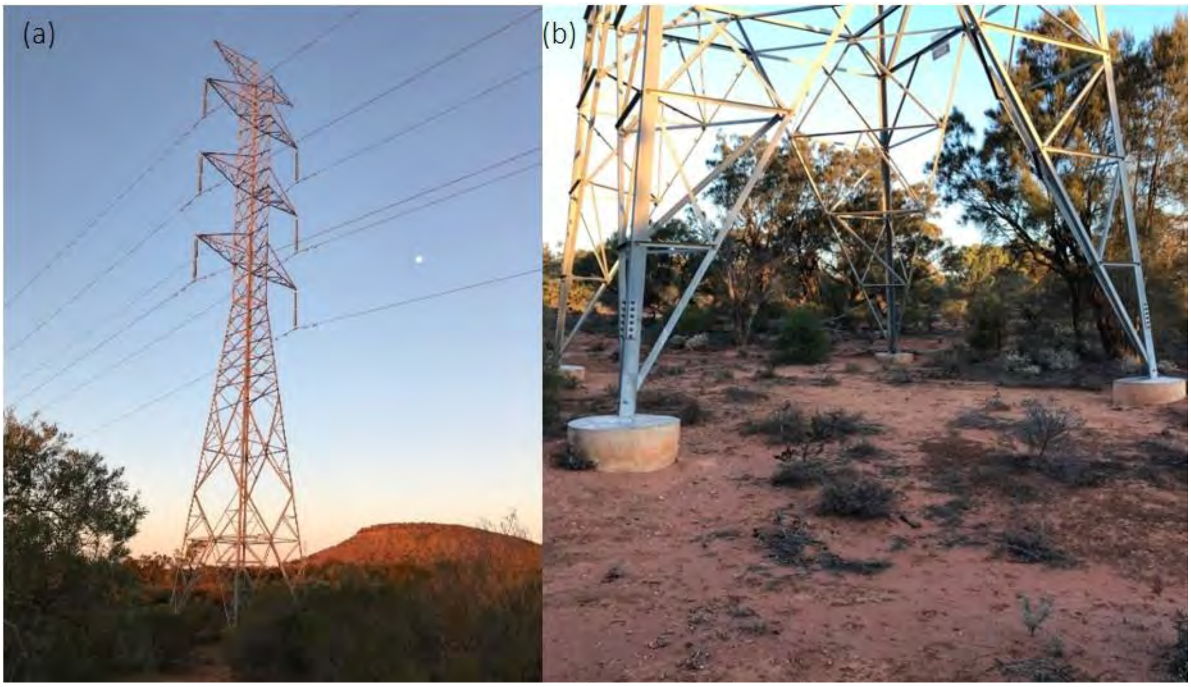


Figure 14 Example of (a) a 275 kV transmission line south of the Project and (b) the typical base construction.

Medium voltage transmission line

A medium voltage transmission line is proposed to connect the construction compound and surrounding area to a SAPN's power distribution line, approximately 6 km to the east of the Project.

Figure 15 Example of a medium voltage power transmission line within the region.

Pole design, subject to SAPN requirements, would likely be a stobie pole of approximately 15 m in height, pole placement of approximately 120 m, with an easement width of about 20 m (Figure 15).

The final connection point and pole design and placement will be determined in collaboration with SAPN.

Switchyard

An air-insulated switchyard may be constructed adjacent the Powerhouse, consisting of two independent unit bays with step-up transformers to 275 kV, switchgear and a single busbar.

Water supply and pipeline

Potable water for filling the reservoir will be drawn from SA Water’ s Morgan-Whyalla pipeline system some 8km south of the PSH Facility. Water from this pipeline will be used to fill the Lower Reservoir and for future any future make-up water which may be required. There is the potential to use groundwater which may be encountered during construction to contribute to filling the reservoir, although groundwater is likely to require treatment to reduce salinity. Assessment of groundwater sources will be made during detailed geotechnical investigations.

The fill volume is expected to be between 2.5-4.2 GL over approximately 12 months subject to SA Waters supply contract. During the operational phase, the maximum replenishment rate is based on the evaporation rates of 2.5 m per year, across both reservoirs, requiring a replenishment of around 2.5% of the total volume. Evaporation covers which may be up to 90% effective, together with rainfall, will significantly reduce the volume of replenishment water required.

A water supply pipeline will extend north from the SA Water main pipeline connection point, approximately 9 km to the Lower Reservoir. The current design includes a HDPE pipe laid on the surface or buried at approximately 1 m below ground level.

The easement width will be approximately 30 m and will be marked periodically with warning signs.

A support letter from SA Water is provided in Appendix B.

Access roads

The Main Access Road will be accessed from Eyre Highway via the existing crossing point (utilised by the local quarry) and provide vehicle access to the Powerhouse. This road will be unsealed and approximately 3 to 6 m wide subject to final design requirements. A sealed section of the road where it meets Eyre Highway will be constructed.

The Upper Reservoir Road will diverge from the Main Access Road to the Upper Reservoir in one of two locations (subject to Contractor requirement; Figure 1). The Upper Reservoir Road will also be an unsealed road approximately 3 to 6 m wide subject to final design requirements.

Additional internal unsealed roads will be used to access various construction and permanent infrastructure areas. Roads formed for the construction phase that are not required for operation of the facility will be rehabilitated.

Communications

A communications tower may be required for the PSH Facility and will be investigated further. If required, the location and design of the communications tower will be determined as part of the detailed design.

Car parking

Car parks associated with the Powerhouse will be designed and constructed to meet the local council requirements and Australian standards.

Site security

Security fencing, designed to comply with Australian standards, will be installed around the reservoirs, Powerhouse and associated infrastructure in order to ensure no unauthorized access as well as preventing wildlife and livestock from entering facilities. Video surveillance may also be used to monitor facility.

Site amenity

Landscaping around the Powerhouse will be undertaken using appropriate local native species where possible. Water supply and irrigation for landscaping will consider the use of rain water.

3.3 Construction activities

Given the minimum 10 km distance to a sensitive receptor, a 7-day, 24-hour construction schedule is proposed to allow maximum flexibility. Construction of the Project is expected to take 30 months and is generally expected to occur during daylight times however night works may be required.

The construction methodology and schedule will be developed fully by the appointed Construction Contractor (the ‘Contractor’). The Contractor will also be responsible for developing and implementing a CEMP.

3.3.1 Site preparation

Site preparation will include stripping vegetation and topsoil and levelling as required. Topsoil and vegetation removed will be appropriately stockpiled, managed and used in the rehabilitation of disturbed areas.

3.3.2 Reservoirs

The construction method for the reservoirs will depend on further geotechnical investigations, localised rock strata and the Contractor’s methodology. However, it is likely to include deep ripping, rock breaking, and localised drill and blast techniques.

The early design concept considers a balance of cut and fill to form the reservoir embankment. This is supported by preliminary geotechnical investigations which reveals good quality clays from shallow to deep depths at the Lower Reservoir. These clays would be used in reservoir embankment construction, together with forming an appropriate base for the reservoirs.

If material removed from the excavation cannot be used in reservoir construction, it will be temporarily stored and ultimately used for other civil works such as road fill, road base, and laydown and hardstand areas.

3.3.3 Reservoir filling

The reservoirs will be filled using potable water from SA Water's Morgan-Whyalla pipeline via the approximately 8 km long water supply pipeline.

Filing the reservoir is expected to take in the order of 12 months, subject to the seasonal demands placed on the SA Water supply from the local area.

3.3.4 Penstock

The steel Penstock will be delivered to site in partially pre-fabricated sections and assembled on site. Fabrication on site may include typical methods such as bending, rolling, welding, non-destructive testing and application of protective coatings.

3.3.5 Powerhouse

The Powerhouse construction methodology will be determined by the Contractor but is expected to be in the form of either an excavated, concrete lined shaft, or an open cut excavation with an internal concrete structure which may be partially backfilled.

Details of the Powerhouse construction will be confirmed during further geotechnical investigations and the detailed design phase.

3.3.6 Dewatering

Dewatering may be required as part of the Powerhouse construction activities, however if groundwater is intercepted, preliminary information indicates low yields are expected. Dewatering activities will be designed and implemented in accordance with the Environment Protection Act and Environment Protection (Water Quality) Policy.

The management of water extracted during dewatering will depend on the quality and quantity of water. Options for management of extracted water include, but are not limited to:

- Place in the reservoirs
- Use in construction activities such as the concrete batching plant and dust suppression activities
- Used for livestock watering.

If the extracted water is assessed as being not of a suitable quality to allow for these uses, an appropriately sized, lined evaporation pond will be constructed close to the location of the dewatering activities (within the assessed Project area).

The final management measures will be determined through the detailed design and further site investigations.

3.3.7 Water supply pipeline

The water supply pipeline will be constructed as per the Contractor's methodology and in accordance with industry standards.

Crossings of third party infrastructure will be in accordance with the requirements of the asset owners and will likely include horizontal directional drilling.

Where the pipeline is to be buried, topsoil and vegetation will initially be removed, and replaced after the pipeline and backfill material has been replaced. Minor ephemeral tributaries may be trenched through and reinstated with appropriate erosion protection.

3.3.8 Construction water supply

Water required for construction activities will be derived from water supplied initially from the SA Water pipeline.

Once the Project's water supply pipeline is installed, water pipes and/or water tanks may be strategically placed to provide access to the water for dust suppression and other construction activities.

3.3.9 Access roads

The access roads will be constructed as per the Contractor's methodology and in accordance with industry standards. Crossings of minor ephemeral tributaries will likely be constructed as causeways or culverts that will be installed with appropriate erosion protection.

3.3.10 Crushing and concrete batching plant

A temporary crushing and concrete batching plant may be established during the construction phase of the Project and is likely to include rock crushing facilities, rock stockpiles, crushed aggregate and sand stockpiles, access tracks, concrete mixing and delivery, control room, amenities, storage areas, parking areas, truck wash down and wastewater treatment facilities.

Details of the concrete batching plant, including the final location, will be determined by the Contractor and provided to the EPA for licensing requirements. The Project may also use existing concrete batching facilities in Port Augusta to supply pre-mix concrete.

3.3.11 Waste

A range of waste products will be generated during the construction. Waste will be managed and disposed in accordance with *Zero Waste SA Act 2004* and applicable South Australian regulations.

Waste water will be generated through construction including treated sewerage effluent, grey water from amenities, wash down water and potentially contaminated stormwater. Where feasible, waste water streams will be treated and reused on site (e.g. dust control) or directed to collection facilities for evaporation or removal from site for disposal by appropriately licensed contractors. Where appropriate, treated stormwater would likely be discharged to tributaries during or soon after the storm event(s). Discharge would be planned and implemented in accordance with the Environment Protection Act and Environment Protection (Water Quality) Policy.

3.3.12 Rehabilitation of temporary construction elements

The Project site will be progressively rehabilitated as soon as practicable after an area is no longer required for construction activities.

Roads and hardstand areas that are no longer required will be deep-ripped to ensure water infiltration and facilitate successful plant establishment.

Where practicable, topsoil and vegetation removed from the same or similar vegetation assemblages will be reapplied to that area.

Rehabilitation will be undertaken in accordance with good practice and applicable guidelines; including the use of local native species, protection from livestock grazing and actively managed against weeds.

3.3.13 Temporary construction facilities

The following construction facilities are anticipated and, for the most part, will be located in close proximity to the proposed PSH Facility (Figure 16):

- Workshops
- Warehouses (including chemical storage)
- Infrastructure, plant and material laydown areas
- Diesel generators and electrical connections
- Fueling areas
- Concrete batching plant(s) including rock crushing and screening and material and product stockpiles
- Waste storage areas
- Magazine area
- Vehicle clean-down facilities
- Site offices and amenities
- Construction water supply
- Sewerage treatment plant
- Parking.

It is noted that some of these temporary elements, in particular the concrete batching plants and rock processing (screening), may require EPA licensing.

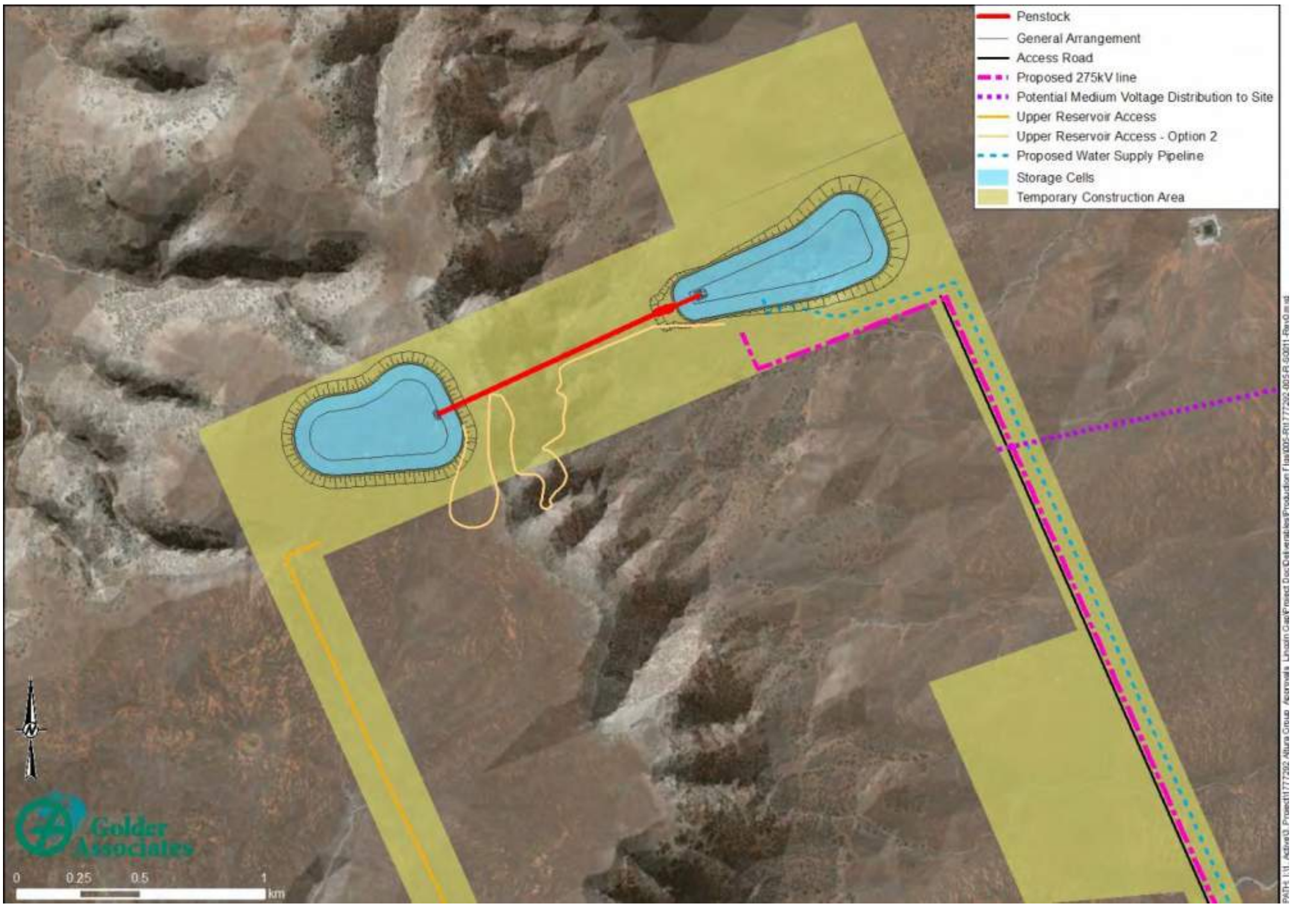


Figure 16: Potential construction facility locations (represented by yellow shading)

Workforce

The construction workforce is estimated to peak at approximately 150-250 personnel and is likely to fluctuate in accordance with the construction activities being undertaken and the requirements of the Contractor.

It is anticipated that members of the construction workforce will be accommodated at nearby towns including Port Augusta and Whyalla.

3.3.14 Commissioning

Following the completion of construction of the main PSH facilities and associated transmission line, the PSH Facility will undergo commissioning to confirm adherence to technical specifications and safety requirements.

3.4 Operations

The PSH Facility will operate according to market conditions 24 hours per day, seven days a week.

The pumping period will generally coincide with periods of high supply from intermittent renewable energy or periods of low demand which result in a surplus of system power generation capacity. Regular pumping cycles are expected to result from PV solar production on rooftop and utility scale schemes and during overnight periods caused with low demand and a surplus of base load capacity. Opportunistic pumping cycles will be initiated through periods of significant wind power generation which can be forecast on a day-ahead basis.

During periods of higher demand and low contribution from intermittent renewable generation the operating mode will be reversed, and the water stored in the Upper Reservoir will be returned through the turbines housed in the Powerhouse to generate electricity. Typically, this is expected to occur during the morning as demand increases until before solar contribution increases; and from the early evening coinciding with reduced contribution from solar and an increase in demand, through until the late evening.

Under normal conditions, the Powerhouse will receive auxiliary power via the transmission lines. When generating, the Powerhouse will provide its own auxiliary power. In the unlikely case of complete auxiliary power loss, an emergency generator would be located adjacent to the Powerhouse to enable black start conditions.

Minimal waste will be generated from the Powerhouse under normal operations, particularly if it is operated remotely. Any oils, oily water, sewerage, solid waste (etc.) will be collected and periodically disposed to appropriate licensed waste or recycling facilities.

Clean stormwater will be directed around the Powerhouse facility, whereas stormwater associated with hard stand areas for the Powerhouse will pass through first-flush systems before being discharged to either the reservoir or water courses via appropriately designed outlets.

The PSH Facility will likely operate remotely with routine attendance from the owner’s personnel to undertake inspections. The facility will also engage contractors where required for routine services such as waste removal, cleaning, security and general maintenance. During maintenance cycles, the workforce would temporarily expand to approximately 40 people.

3.5 Decommissioning

At the completion of the PSH operational life (expected to be > 50years), a detailed decommissioning plan will be developed which would consider reuse, recycling, disposal and potential preservation options (e.g. for tourism purposes). The final objectives at that time would need to consider relevant legislative requirements, plus the requirements of a number of stakeholders, including regulators, landowners, easement conditions, Council and the community.

The following description is an indicative outline for decommissioning the Facility.

- Powerhouse: All oils and hazardous materials would be removed and disposed of to licensed facilities. Salvageable equipment would be removed (for reuse, recycling or scrap). The above-ground Powerhouse building would be demolished and either disposed of to landfill or placed within the subsurface structure. The area would be made safe and the surrounds reprofiled and revegetated.
- Reservoirs: It is anticipated that the reservoirs (if not required for local or community water storage) would be emptied (likely re-injecting water back into the SA Water supply), and liners and evaporation structures removed. Sections of embankment wall would be breached to enable stormwater to flow from the reservoirs via reinstated channels. The remainder of the reservoir walls would be revegetated to blend with the surrounds.
- Penstocks: The Penstock would likely be cut-up for scrap metal and removed from site. If concrete anchor blocks were used, they would likely remain *in situ*.
- Water supply pipeline: If not required for continued use of the reservoirs, the pipeline (if buried) would be disconnected and left *in situ*. If located on the surface, it would be removed and recycled or disposed of.
- Transmission line: Towers and cabling would be removed and likely sold for scrap.
- Access roads: Roads no longer required would have all road furniture removed, windrows would be 'pulled-in' and the running surface deep ripped and revegetated.

4.0 Social environment, Stakeholders and Community Engagement

4.1 Social and economic environment

4.1.1 Population

The City of Port Augusta is the nearest population centre to the Project. The City is located at the junction of Australia' s east-west and north-south road and rail corridors. Port facilities in Port Augusta have been closed since 1974.

The Project is also close to Whyalla, the third most populous city in South Australia, after Adelaide and Mount Gambier. The City of Whyalla has an integrated steel works and shipbuilding heritage, and has port berthing facilities up to 10 m deep.

The general population statistics of Port Augusta and Whyalla are provided in Table 6.

Table 6: General population statistics of Port Augusta, Whyalla and South Australia

	Data (ABS)	Port Augusta	Whyalla	South Australia
Population	2015	14,522	22,759	1,698,660
Gender	2015	7,167 female 7,355 male	11,108 female 11,651 male	857,103 female 841,557 male
Anchor employment industry	2011	Health care and social assistance	Manufacturing	Health care and social assistance
Labour force, (participation rate %)		6,096 (54.7)	9,969 (56.5)	784,329 (59.9)
Unemployment (Unemployment rate %)	2011	353 (5.8)	812 (8.2)	44,470 (5.7)
Median age	2015	39.4	38.9	39.9
Median income ($)	2013	47,089	52,263	43,742

Based on former and existing employment industries from Port Augusta and Whyalla, skilled labour and workforces are locally available.

4.1.2 Socio-economic

The median weekly wage for people 15 years and over in Port Augusta was $604, which is close to the South Australian average ($600), though lower than the Australian average ($662). The median wage was $48,691 (Australian average $44,940).

The main employment (2011) in the LGA include Health Care & Social Assistance (15.4%), Public Administration & Safety (13.3%), Retail Trade (11.8%) and Accommodation and Food Services (9.2%). Electricity, gas, water & waste Services, and Construction make up approximately 4.5% and 7.4% respectively.

Based on former and existing employment industries from Port Augusta and Whyalla, skilled labour and workforces are locally available.

The Socio-Economic Index for Areas (SEIFA) is a suite of four summary measures that have been created from 2011 Census data to investigate different variables of socio-economic conditions by geographic areas. The four SEIFA indices are:

- Index of Relative Socio-economic Advantage and Disadvantage: is a continuum of advantage (high values) to disadvantage (low values), and is derived from Census variables related to both advantage and disadvantage.
- Index of Relative Socio-economic Disadvantage: focuses primarily on disadvantage, and is derived from Census variables such as low income, low educational attainment, unemployment, and dwellings without motor vehicles.
- Index of Economic Resources: focuses on financial aspects of advantage and disadvantage, using Census variables relating to residents' incomes, housing expenditure and assets.
- Index of Education and Occupation: includes census variables relating to the educational attainment, employment and vocational skills.

The Socio-Economic Indices for the Port Augusta LGA reveals that the LGA is relatively disadvantaged when compared to South Australia. In particular, it ranks 10th (out of 71) in the index of relative socio-economic disadvantage Table 7.

Table 7: Socio-Economic Indices for Port Augusta LGA (2011)

Index	Port Augusta LGA Score (Rank in State out of 71)	South Australia
Relative Socio-economic Advantage and Disadvantage	897 (8)	958
Relative Socio-economic Disadvantage	906 (10)	969
Economic Resources	917 (10)	971
Education and Occupation	917 (6)	971

4.1.3 Economic

It is anticipated this Project, together with other projects proposed in the Port Augusta region, will aid the recovery of the suppressed employment levels the town encountered with the closure of the Northern and Playford Coal-fired Power Stations. This benefit would be realised through both the construction and operational phases of the Project, including indirect economic benefits for local businesses through the Goat Hill Pumped Storage Hydro Project sourcing of local products, materials and services (such as construction supplies and materials, accommodation, food, and fuel).

4.2 Engagement approach

Altura has approached stakeholders with an objective of meaningful engagement, collaboration and transparency. One-on-one meetings have been undertaken with key stakeholders, and subsequent follow-up communication, as required. These meetings have provided an introduction to the Project, as well as an opportunity for stakeholders to voice any concerns and support for the Project. Generally, feedback has been positive, and stakeholders supportive of the Project. Table 8 summarises the general feedback from stakeholder engagement.

Table 8: Stakeholder engagement feedback and outcomes

Stakeholder group	Stakeholder	Feedback/outcomes
Government Departments/bodies	Department of Premier and Cabinet (DPC; sponsoring agency)	Supportive
	Department of State Development (DSD; case manager)	Supportive
	Department of Planning, Transport and Infrastructure (DPTI)	Identified the need to meet expectations with respect to submission, AustRoad standards and Crown Land easements. Communication with the Property section regarding forming an easement (or similar) on Crown Land. Preliminary investigations are supportive of forming an easement.
	Department of Environment, Water and Natural Resources (DEWNR)	Native Vegetation Unit was supportive, providing SEB are calculated and applied prior to vegetation removal. Communication with the Crown Lands section and Pastoral Unit regarding forming an easement (or similar) on Crown Land. Natural Resources SA Arid Lands supportive of Project.
	Department of Defence	Identified the requirement to seek endorsement to form an easement.
	Environment Protection Authority (EPA)	Identified need for a license for Concrete Batching Plant
	Port Augusta City Council (including Port Augusta Airport)	Supportive. Committed to ongoing liaison with Council about then Project, including accommodation requirements. No aviation matters of concern in relation to the Project.
	Port Augusta City Council Strategic Management Committee	Supportive

Stakeholder group	Stakeholder	Feedback/outcomes
	Whyalla City Council	Supportive
	Regional Development Australia Far North	Letter of support included in Appendix B
	Nature Foundation SA	Discussion of SEB options
	Country Fire Service (CFS)	Identified the requirement for Schedule 9 and 10 permits and Authorised Officers Requested an Emergency Response Plan to be developed in collaboration with the Country Fire Service (CFS) CFS to be inducted to the site during construction for an understanding of the activities, area and access
	Outback Communities Authority	Supportive
	Regional Development Australia Far North	Letter of support included in Appendix B.
	Upper Spencer Gulf Common Purpose Group	Supportive
Traditional Owners	Barngarla Determination Aboriginal Corporation	Supportive and formulating an Agreement with Altura
Community Groups/NGOs	Repower Port Augusta	Supportive
	Nature Foundation SA	Discussion of SEB options
	Energy Security for SA Party	Supportive
Political members	State Member for Giles	Supportive
	State Member for Stuart	Supportive
	Federal Member for Grey	Supportive

Additionally, Altura has liaised with ElectraNet, SAPN, SA Water, Australian Rail Track Corporation, Epic Energy and the OTR to ensure that the Project meets technical requirements associated with infrastructure crossings or connections.

4.3 Outcomes of community engagement

Altura held an Open-Door-Day in Port Augusta on 9 November 2017 between the hours of 10:30 and 16:00 at the Institute Theatre (Figure 17). The purpose of the event was to share information about the Project, and provide an opportunity for the community to ask questions. The Open-Door-Day was publicised using the following methods:

- Media release – reported by the Port Augusta Transcontinental and Flinders News
- Newspaper advertisement– in the Port Augusta Transcontinental and Whyalla News
- Targeted – emails to key stakeholders
- Social media – coordinated by Port Augusta City Council.

Figure 17: Open-Door-Day presentation

Approximately 120 people attended. Attendees were predominantly from Port Augusta, however a number of people travelled from Whyalla and Port Lincoln to learn about the Project.

Twenty-eight attendees provided written comment in support of the Project and expressed interest in potential business opportunities.

Overall feedback and conversations throughout the day were positive and community members showed particular interest in the following aspects of the Project:

- How the facility will work and the location
- The source and volume of water, including water conservation measures
- Construction timeline
- Job opportunities.

4.4 Engagement following submission of this report

Altura is committed to continued liaison with the community and stakeholders for the Project. This is expected to be in the form of:

- Continued and ongoing work with the Barngarla in accordance with the pending Cultural Heritage Agreement
- Continued work with DEWNR (Native Vegetation Unit) to ensure best value of the SEB offsets
- Ongoing liaison with DEWNR, DPTI and third-party asset owners regarding infrastructure crossings and easements
- Continued liaison with local Councils regarding the progress of the Project;
- Maintenance of the Altura website to communicate the Project schedule and milestones
- Provision of a dedicated email address to allow the community to provide project-related communication
- Issue of updates via email distribution lists to interested members of the public and stakeholders.

5.0 Physical, Cultural and Biological Environment

5.1 Overview

The Project environmental assessment has been prepared to assess the potential environmental impacts and proposed appropriate management and mitigation measures to ensure impacts are minimised to an acceptable level.

A number of technical studies were undertaken to ensure appropriate characterisation of the environment and potential impacts. Relevant technical reports are included in the following Appendices:

- Appendix C – Planning
- Appendix D – Surface water
- Appendix E – Flora and fauna
- Appendix F – Traffic and transport route assessment.

5.2 Risk assessment

The proposed location of the Project has been selected to take advantage of natural conditions, the proximity to existing infrastructure, and to ensure the Project can be developed to minimise impacts to the environment, known heritage, the community and comply with local planning requirements.

The potential environmental and social risks associated with the construction, operation and decommissioning of the Project were assessed in detail to ensure risks were appropriately characterised and effective management measures could be implemented to reduce or eliminate the risks.

The risk assessment involved mapping the potential source to receptor pathway and assigning an initial risk rating to each potential risk aspect. Where these was a clear and potentially substantive impact(s) from source to receptor, a detailed technical assessment was undertaken such that potential impacts could be better understood, and relevant mitigation measures could be proposed., technical studies were undertaken to provide an appropriate understanding of the risks and suitable mitigation measures. The initial risk assessment undertaken is included in Appendix G.

Based on the outcomes of the risk assessment, the following technical studies were undertaken to inform appropriate design modifications and management measures:

- Surface water: a Surface Water Quantity and Quality report was prepared to assess the impacts of the Project on surface water and management measures required (Appendix D)
- Ecology: a Flora and Fauna Assessment was undertaken to provide information on the existing ecosystem and potential impacts from the Project (Appendix E)
- Aboriginal heritage: an Aboriginal heritage agreement is being developed to ensure places of significance for Aboriginal heritage within the Project site are appropriately managed (Section 5.9)
- Visual amenity: drone footage was overlaid with concept design infrastructure to show the visual impact of the Project on the landscape (Section 5.11)
- Transport: a Traffic Impact and Route Assessment was undertaken to assess the possible routes to site; capability of the road network and access suitability; and the impact of the temporary increased traffic and heavy loads on surrounding roads (Appendix F).

The existing environment and potential interaction between the Project and the environment is described in the following sections.

5.3 Climate

Meteorological data have been collated from the Bureau of Meteorology (BOM). The solar exposure, precipitation and wind data from year 1990 were obtained from the weather station located at the Port Augusta Airport, which is approximately 10 km south east from the Project site.

Port Augusta is described as having a warm desert climate where summers are hot and dry, and winters mild and damp (Figure 18). To date, the highest recorded temperature has been 48.1^{0}C. Annual average rainfall is 219.7 mm, with an average of 34.4 days a year recording rainfall above 1 mm.

Generally, days are clear and sunny which contributes to high evaporation rates. At the adjacent Defence facility, annual evaporation has been approximately 2,300 mm, which is far greater than the average annual rainfall.

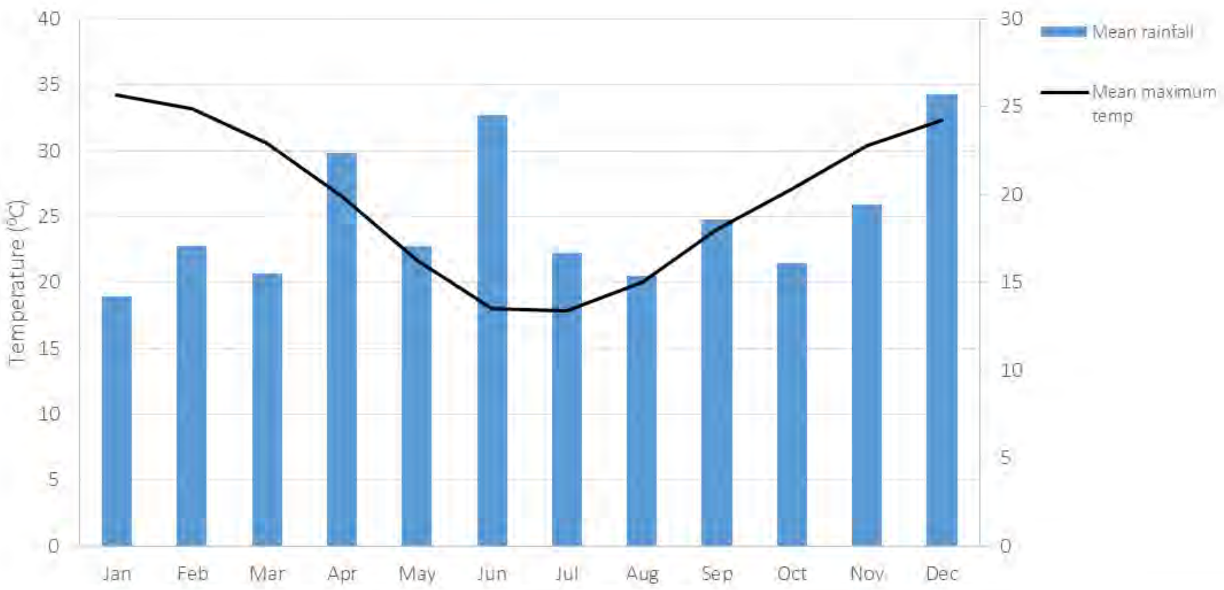


Figure 18: Average climate at Port Augusta Aero (station 018201) (data from 2001-2017)

5.4 Topography and landform

The Project site is on part of the Simmens Plateau, which results in the general topography ranging from a steep-sided plateau to undulating plains (Figure 19).

The plateau, on which the Upper Reservoir is to be located, is generally at 290 m Australian Height Datum (AHD) is relatively flat and sparsely vegetated. The eastern face, where the Penstock will be located, has steep escarpments with rocky outcrops, some vegetation and water drainage pathways. The escarpment slopes are generally evenly graded, formed from colluvial material from the plateau. The steep escarpment slope flattens off toward the east to undulating plains (approximately 90 m AHD) in the area where the Powerhouse and Lower Reservoir are to be located.

Drainage from the plateau is via several drainage pathways and incised gullies that drain down the escarpment towards the east.

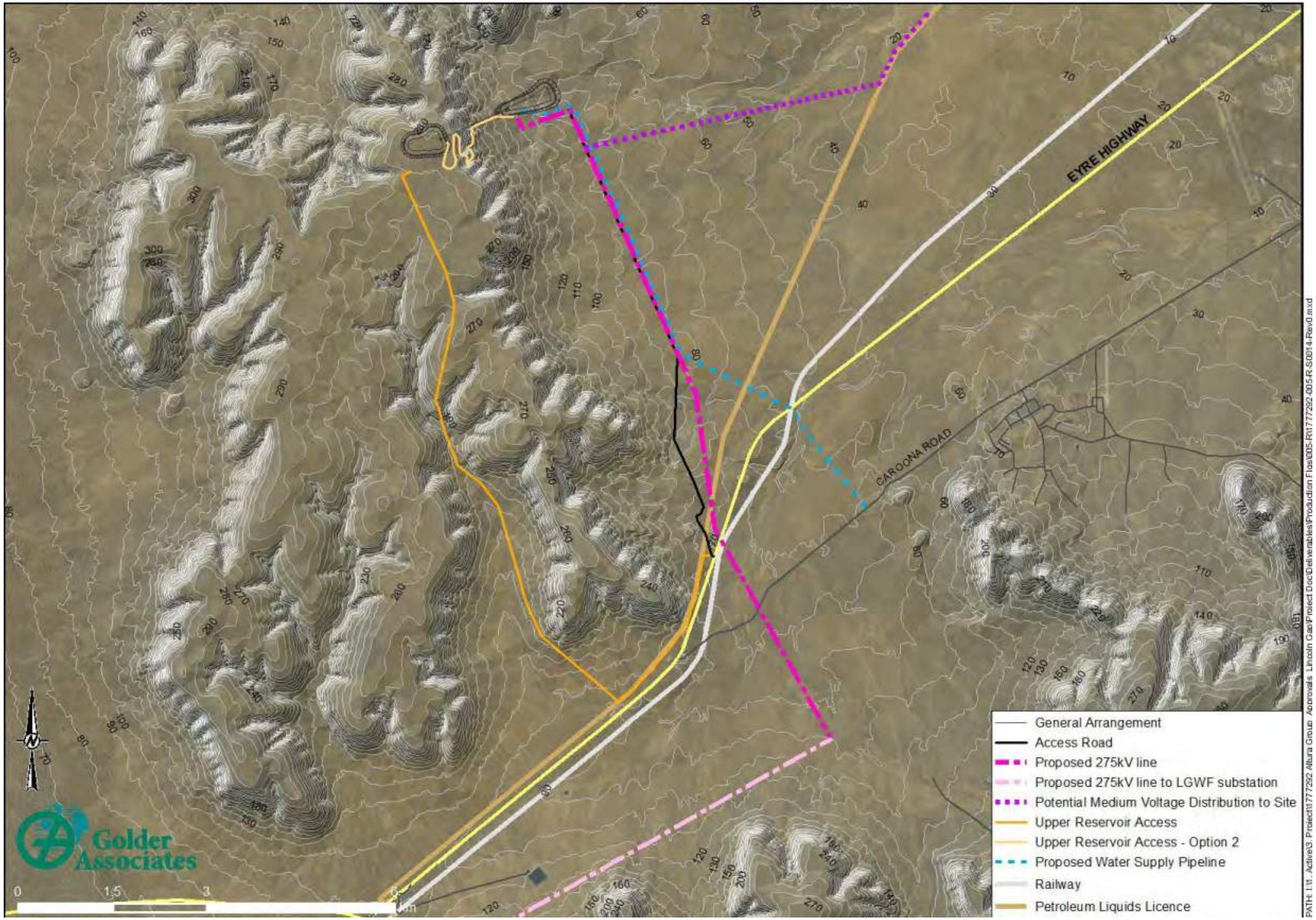


Figure 19: Site topography

5.5 Regional geological setting, soils and seismicity

5.5.1 Geology

Observations of surface conditions from satellite imagery and a review of the publicly available geological information suggest that the surface topography within the Project area is closely related to the site geology.

The underlying geology, as mapped by the Geological Survey of South Australia is shown on the 1:250,000 scale Port Augusta mapsheet (Geological Survey of South Australia 1968) and the 1:100,000 scale Augusta (Geological Survey of South Australia 2009a) and Cultana (Geological Survey of South Australia 2009b) mapsheets, and reproduced as Figure 20.

The map sheets indicate that the Project area is underlain by various geological units as follows:

- The materials forming the plateau are part of the Wilpena Group, Tent Hill Formation that makes up the Stuart Shelf. These are listed as follows:
  - Unconformity
    Tent Hill Formation, described as ‘equivalent of A.B.C. Range Quartzite and Brachina Formation’.
    - Simmens Quartzite Member (Nsts), described as ‘dense white quartzite’ and ‘equivalent of Arcoona Quartzite Member’.
    - Corraberra Sandstone Member (Nstc), described as ‘red-brown micaceous sandstone’.
    - Where erosion has occurred at the edges of the plateau, the near-surface materials are indicated to comprise the older Corraberra Sandstone Member (Nstc). However, for the most part this is overlain by the Simmens Quartzite Member of the Tent Hill Formation.
- The low-lying plains comprise soils of the Pooraka Formation (Qpap), described as ‘Gravels, sands and clayey sands with clay lenses. Overlies lower Pleistocene HINDMARSH CLAY in many places’.
- Further from the plateau, the soils in the areas of the drainage channels comprise quaternary soils (Qha1) described as ‘Fluviatile sands and gravels of the modern drainage channels’.

5.5.2 Geological Section at Simmens Hill, south of Goat Hill

Section A-B from the 1:250,000 scale Port Augusta mapsheet (Geological Survey of South Australia 1968), terminates at Simmens Hill. Simmens Hill forms part of the Simmens Plateau but is located south of Goat Hill, on the south side of Eyre Highway. The geology of Simmens Plateau is expected to be generally consistent across the gap with similar geological units shown on the mapsheet at the location of Simmens Hill and the northern plateau, in the area of the Upper Reservoir. A segment of this section is reproduced as Figure 21 below, showing the anticipated geological profile at the location of Simmens Hill and the upper members of the Tent Hill Formation described above. Figure 21 shows the proposed site area overlaid to the geology of the area with the approximate location of Section A-B that extends through Simmens Hill.

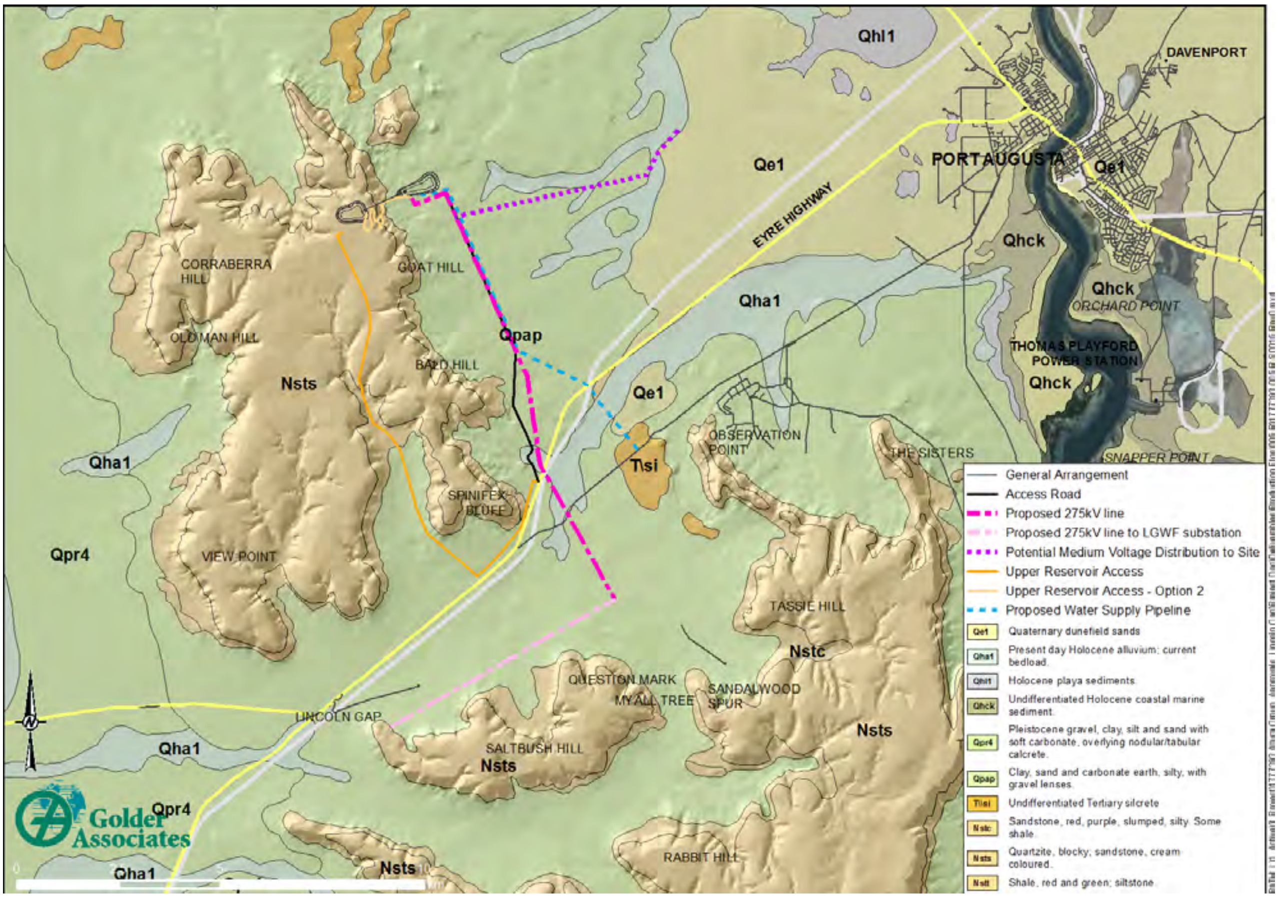


Figure 20: Regional geology

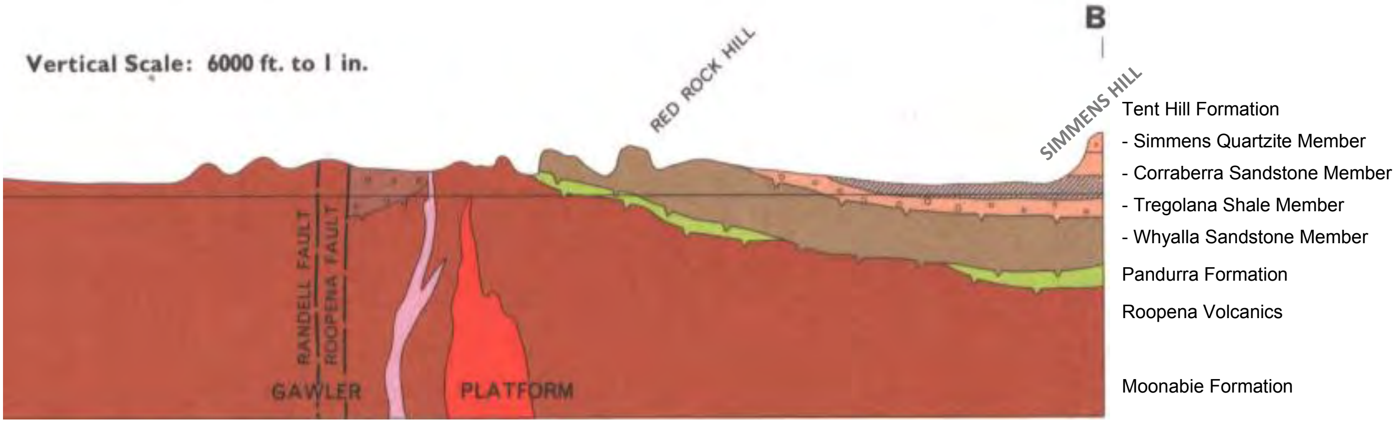


Figure 21: Segment of Geological Cross Section A-B from 1:250,000 scale Port Augusta geological mapsheet

5.5.3 Geological Units

The Cultana Explanatory Notes (McAveney et al. 2014), describes the geology of the Cultana 1:100,000 mapsheet in more detail, and includes descriptions of the geological units that make up the Simmens plateau and surrounding plains, as summarised below.

- Tent Hill Formation- At the location of the site, Simmens Plateau is made up of the Tent Hill formation, a coarsening upwards sequence of shale and sandstone consisting of:
  - Simmens Quartzite Member (Nsts)- blocky white quartzite and cream sandstone
  - Corraberra Sandstone Member (Nstc)- red, flaggy sandstone interbedded with shale and siltstone
  - Tregolana Shale Member (Nstt)- dark brown shale and siltstone with laminations of green shale and red, fine grained sandstone.
- Quaternary Deposits: The Simmens Plateau is flanked by Pleistocene-aged quaternary deposits that have formed high angle alluvial fans generally consisting of unconsolidated angular fragments derived from the Simmens Quartzite Member, grading to lower angle fans and then sheetwash fans and the undulating plains. On the plateau slopes, these sediments partly cover outcrops of the Tent Hill Formation (i.e. Simmens Quartzite, Corraberra Sandstone and Tregolana Shale Members) that form the plateau. These quaternary deposits typically comprise orange to red, poorly to moderately sorted, fine to coarse grained silty quartz sand with fine to coarse gravel and cobbles. The surface material is subject to erosional effects by wind and rain and nodular calcrete is present in some locations in the lower fan and plain deposits.

A site walkover was undertaken by a geotechnical engineer from Golder Associates on 11 April 2017. The ground conditions observed in surface exposures, open excavations and incised watercourses during the site visit were generally consistent with the published geology.

The following points summarise observations of the ground conditions made within the Project area during the site visit, described from the proposed location of the Upper Reservoir down to the Lower Reservoir:

- The plateau surface was relatively flat. Groundcover generally included sparse saltbush although some localised areas were observed where there was no vegetation and the surficial soils appeared to be disturbed resulting in a minor surface depression. At these locations, some surficial cracking and erosion was also observed. Clayey/silty sand soils were typically observed at the surface with some gravels and cobbles. No large outcrops of rock-strength materials were observed. Anecdotal evidence (discussions with the landowner), suggests that the thickness of the soil-strength overburden near the top of the plateau may be in the order of 1-2 m thick.
- Closer to the edge of the plateau, gravels and cobbles were interspersed with clayey/silty sand soils, considered to be colluvial deposits.
- The slope angle of the escarpment was estimated to be between 30 and 40 degrees. Some trees, and other low-lying vegetation was observed across the slope, interspersed with colluvial deposits and rock scree comprising clayey/silty sand, with gravel and cobbles. Some rock outcrops of sandstone and siltstone were observed.
- A low height cliff exposure was observed within the upper third of the escarpment, outcropping at some locations from the overlying scree. The rock exposed consisted of red, generally fine to medium grained, sandstone and siltstone.
- At the base of the escarpment, the slope of the ground surface flattens and extends into undulating plains. Groundcover consists of some trees and saltbush although the density of the trees decreases further from the plateau. The surficial soils were observed to comprise variable amounts of sand, silt/clay and gravel with some cobble and boulder sized fragments. Some localised exposures of rock-strength material, comprising red and grey-brown sandstone and siltstone were observed.
- Incised watercourses, dry at the time of the site visit, and typically a few metres (i.e. up to about 3 m) deep were observed extending from the eastern slope of the plateau. The soil profile exposed in the side walls of these were observed at some locations. Within the watercourses, the near-surface material exposed generally consisted of fine to coarse grained gravel and cobbles in a silty sand matrix, consistent with alluvial/colluvial deposits. The gravel and cobbles are generally fine to coarse grained and sub-angular to sub-rounded. At some locations, exposures of rock strength material were observed in the side walls and base of the watercourses. The exposures typically consisted of red sandstone, and grey brown shales, and the strength of the rock was inferred to range between very low and very high.

The thickness of soil-strength materials exposed in the incised watercourses, and the wall height, was observed to increase further from the base of the escarpment.

- Near the south eastern extent of the project area, a localised area of pale brown surficial soils, comprising sandy silty/clay, with some fine to coarse gravel and cobbles was observed. The soils at this location were generally more fine-grained than those predominantly observed at the site.
- Further from the base of the escarpment the frequency of outcropping rock and the number of trees was observed to decrease.

5.5.4 Soils

The geotechnical site walkover examined the soils at the Upper Reservoir, Penstock and Lower Reservoir locations. The soils were defined as:

- Upper Reservoir: orange brown clayey sand, sandy clay, and clay soils were typically observed near-surface with some gravels and cobbles
- Penstock: colluvial deposits and rock scree comprising orange brown clayey sand, sandy clay and clay, with gravel and cobbles
- Lower Reservoir: typically comprised fine to coarse grained gravel and cobbles in a silty sand matrix, consistent with alluvial/colluvial deposits. In the south eastern portion of the project area, finer grained materials comprising sandy silty/clay, with some fine to coarse gravel and cobbles were encountered.

Some erosion channels were observed near the base of the escarpment, with exposures of pale brown calcareous materials. Further from the base of the steep-angle slope, where the ground starts to flatten off, another excavation/erosion feature was observed. Sub-vertical faces, comprising silty/clayey sand, with some gravel were observed, about 1.5 to 2 m in height. At the base of the excavation, a small clay pan was observed, about 5 m in diameter. Some outcrops and loose rock fragments were also observed at the ground surface in this area, including blocks of pale brown/red brown, fine to coarse grained sandstone. Based on this, a simple test for the potential for soil dispersion was undertaken.

The Emerson class number test method divides soils into seven different classes based on their coherence in water, with one further class being distinguished by the presence of calcium-rich minerals. Classes 1 to 8 indicate a decreasing order of severity in reaction. Laboratory test results obtained from three samples of material encountered in the test pit investigations produced results of Class 4. These results indicate soils are non-dispersive, with no calcite or gypsum present.

5.5.5 Seismicity

Bulletin 54 of the Department of Mines and Energy (Geological Survey of South Australia 1995) mentions the Eyre Peninsula area as having regular earthquake activity. The earthquakes tend to occur as clustered, near surface, low magnitude events known as "swarms".

The SA Resources Information Gateway (SARIG) website (accessed April 2017) provided details of recorded earthquake activity in the region. The earthquakes typically occur in central and eastern Eyre Peninsula, mostly along northeast-southwest striking faults. Similarly oriented faults on the west of Eyre Peninsula are apparently less active with little neotectonic expression (e.g. scarps, alluvial fans) although this may reflect longer seismic cycles.

Several earthquake epicentres have been recorded in the vicinity of the site, with magnitudes of 0.9 to 1.3. One magnitude 3.5 earthquake was experienced in 1997 approximately 30 km southeast of the site (approximately 26 km south of Port Augusta on the west side of the Gulf).

5.5.6 Potential interaction

The Project will consider local geological and seismic conditions in the design.

Current information suggests that most material to be used in the construction of the Reservoir embankments could be sourced from Project construction activities therefore minimising (or avoiding altogether), the need to develop additional quarries on the site.

5.5.7 General management considerations

Current Project design and placement has responded to known geological conditions derived from preliminary geotechnical assessment of the Project site.

Altura has issued tenders to a range of Tier 1 contractors that include civil contractors experienced in civil operations pertinent to the Project. It is expected ground conditions at the site will be further investigated by the successful Contractor during detailed design.

Sediment and erosion mitigation measures are described in Section 5.7 (Hydrology).

5.6 Hydrogeology

The SARIG map database provides information on shallow groundwater levels and groundwater salinity in the vicinity of the site.

The closest drill hole to the site is approximately 3 km north west, with only two other exploration holes within 5 km. Based on the geological logs available for these three drill holes, the primary aquifer is likely to be within a sandstone or quartzite fractured rock aquifer.

Figure 22 shows indicative depths to groundwater in the vicinity of the Project site. Groundwater wells in the area of the site suggest groundwater levels range from less than 5 m below ground level (mbgl) on the north side of the plateau to greater than 20 mbgl on the south side of the plateau. Based on this information, the depth to groundwater at the Project site is expected to be greater than 20 mbgl. Preliminary geotechnical investigations to approx. 25 mbgl at the Project site in October 2017 did not encounter groundwater.

Groundwater flows through fractures, joints and bedding planes and yields are expected to be low (exploration hole yields were between <1 and 3 L/s). Higher yields are often encountered in areas of faulting, which can present key pathways for groundwater flow. However, based on the SARIG website, no major faults have been mapped in this area.

An extract from the SARIG groundwater salinity map is presented in Figure 23. Groundwater salinity, expressed as Total Dissolved Solids (TDS), is indicated to range from 7,000 ppm to 14,000 ppm (brackish) in the southwest region of the Project site to 14,000 ppm to 35,000 ppm (saline) in the northeast region of the Project site. Most of the groundwater in the region is indicated to be either saline or brackish.

There were no groundwater users identified within 5 km of the site.

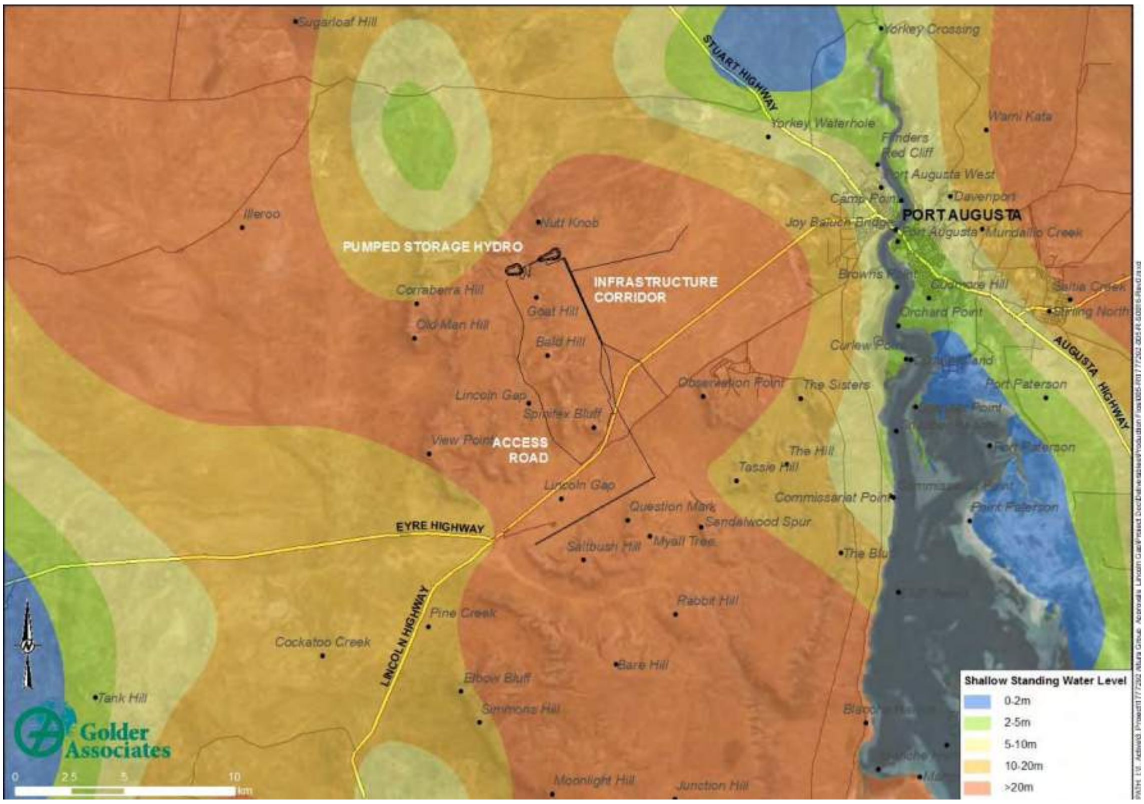


Figure 22: Indicative depth to groundwater (Source: SARIG map database)

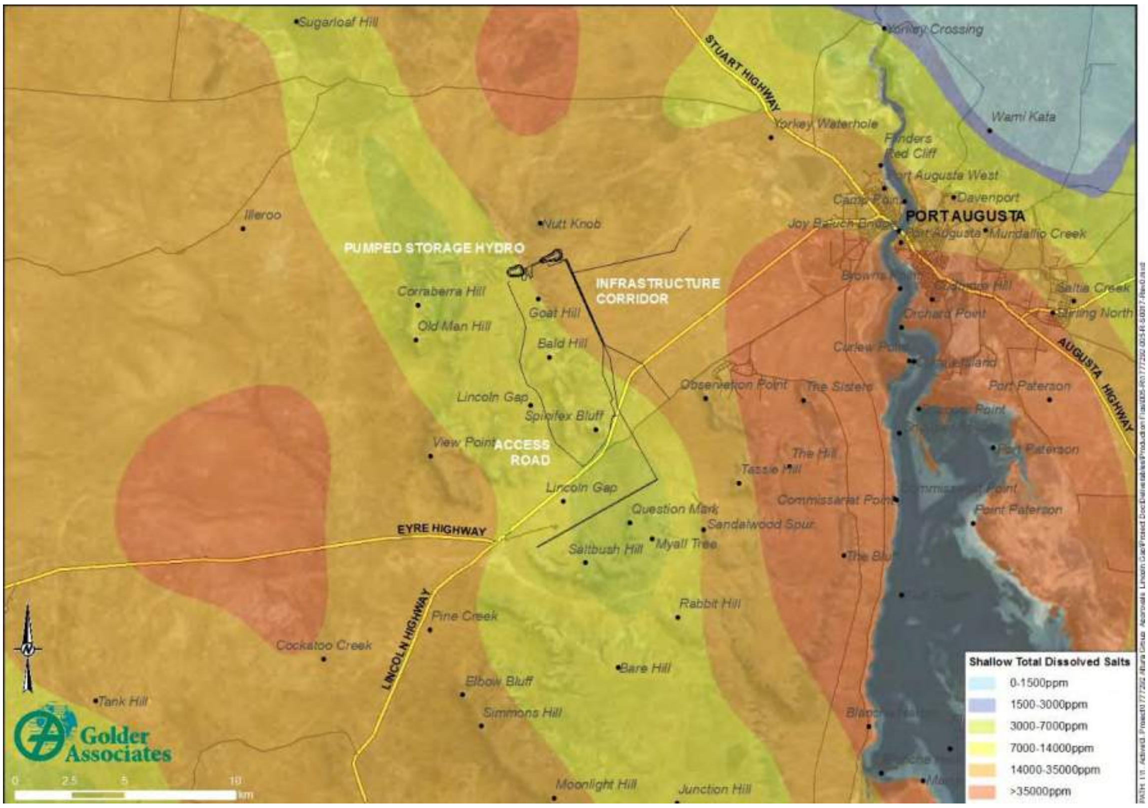


Figure 23: Indicative Total Dissolved Solids (Source: SARIG map database)

5.6.1 Potential interaction

Excavation for the construction of the Powerhouse has the potential to temporarily intersect groundwater, likely at depths greater than 25 mbgl. Based on the available information, if encountered, the aquifer is expected to be low yield with highly saline groundwater, and is unlikely to be used by anyone within 5 km of the site. Therefore, deep excavations associated with the Powerhouse and potential dewatering activities are considered a low risk to beneficial uses of the groundwater.

If groundwater is intersected during deep excavation, the extracted water will need to be reused/disposed of appropriately to ensure it does not pose a risk to the surrounding environment.

It is unlikely that groundwater will be encountered during other construction activities.

5.6.2 General management considerations

Current Project site selection and design has responded to known geological conditions derived from preliminary geotechnical assessment of the Project site.

Groundwater conditions at the site will be further investigated during detailed design to confirm the aquifer and groundwater characteristics and presence of beneficial uses.

A hierarchy of groundwater management will be implemented depending on groundwater characteristics. Assuming the water quality meets necessary criteria (i.e. the EP (Water Quality) Policy), preferable options include:

- Pumping extracted water into the reservoirs
- Use of extracted water for construction activities (e.g. dust suppression, concrete batching, Plant washdown)
- Pumped for use at nearby stock watering locations.

If extracted water is not of suitable quality to allow for these uses, an appropriately sized and lined evaporation pond will be constructed close to the location of the dewatering activities (within the construction area shown in Figure 16).

Appropriate permits and licenses will be obtained prior to undertaking dewatering and discharge of extracted water to watercourses (if required).

5.7 Hydrology

5.7.1 Existing environment

There is no permanent surface water at the Project site. A farm dam is present approximately 1.5 km east of the Lower Reservoir. Numerous creeks traverse the Project site which flow ephemerally in response to seasonal rain. Occasional intense storms can create high rates of runoff. Based on data collected by BOM (2010), there are an average of:

- 34.4 days a year in which rainfall is greater than 1 mm
- 5.7 days a year in which rainfall is greater than 10 mm.

A number of incised gullies (up to 3 m depth) have formed naturally at the base of the escarpment extending into the footslopes. Vegetation is sparse within these watercourses, giving rise to the erosion of fine sediments from the gully bed and bank profile.

As in all dryland channels, where the water table may be tens of meters below the surface, water is lost through channel beds and banks resulting in high transmission losses. As a result of the transmission losses, the Project site would experience:

- A downstream reduction in discharge, channel size and channel definition
- Slowing of flow velocities
- Termination of bedload (sediment) transfer.

During rare high flow events, surface water will continue out across the un-channeled ground surface resulting in shallow ponding of water on the plain, termed a 'flood out'.

5.7.2 Hydrological interactions and impact assessment

The interaction of the Project with drainage/watercourse and catchments using ArcGIS is presented in Appendix D.

'Stream orders' have been assigned to the creeks within the Project site, which measure their relative size. For example, the smallest tributaries are referred to as a 'first order stream' and tributaries go up in size until they are considered rivers ('seventh order streams' and above).

There are two creeks intercepted by the PSH Facility (Figure 24):

- The surface Penstock crosses one creek, approximately half way down the escarpment
  - This creek is a small tributary that drains to another stream (therefore is considered a stream order 1)
- A road access option between the Lower and Upper Reservoirs, which crosses four first order streams, one being the same creek that is crossed by the Penstock;
- The Lower Reservoir location fully incorporates a first order stream.

The catchment reporting to the Penstock crossing is expected to be reduced by 5 ha due to the footprint of the Upper Reservoir within this catchment. This relates to a peak flow reduction in the channel (estimated using the Rational Method for a 1:10 Annual Exceedance Probability) of 0.81 m^3/s from the baseline peak flow of 1.29 m^3/s. Assuming a triangular channel of 2 m top width this flow rate would correspond to a minimal change in depth of water (0.07 m).

The Lower Reservoir is located at the head of the catchment of another watercourse. As a result of the Reservoir being located at the head of the catchment, no diversion of the watercourse is required in this location. The construction of the Lower Reservoir will reduce the catchment size further downstream by 5% (Location C, Figure 24). This results in an estimated reduction in peak flow downstream from a baseline flow of 21 m^3/s to a post construction peak flow of 19.9 m^3/s, or, a small change of 1.1 m^3/s. There were no downstream water users (i.e. farm dams) identified in this catchment.

No water dependent ecosystems were identified during the flora and fauna survey (see Section 5.8).

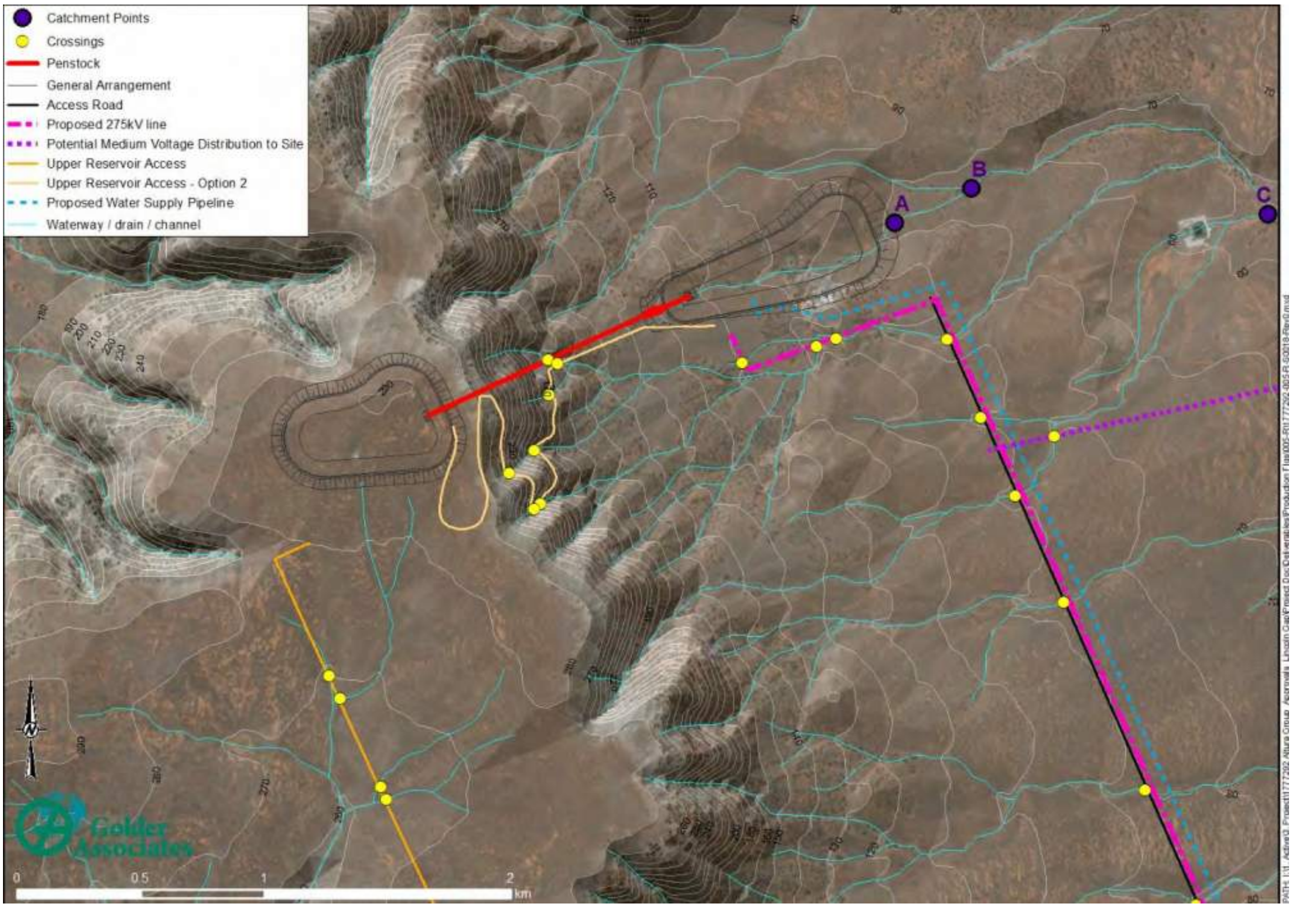


Figure 24: PSH Facility interaction with surface water drainage

A number of watercourses are crossed by the Main Access Road, transmission lines, water supply pipeline corridor and Upper Reservoir Road (options 1 and 2), as summarised in Table 9 and presented in Appendix D.

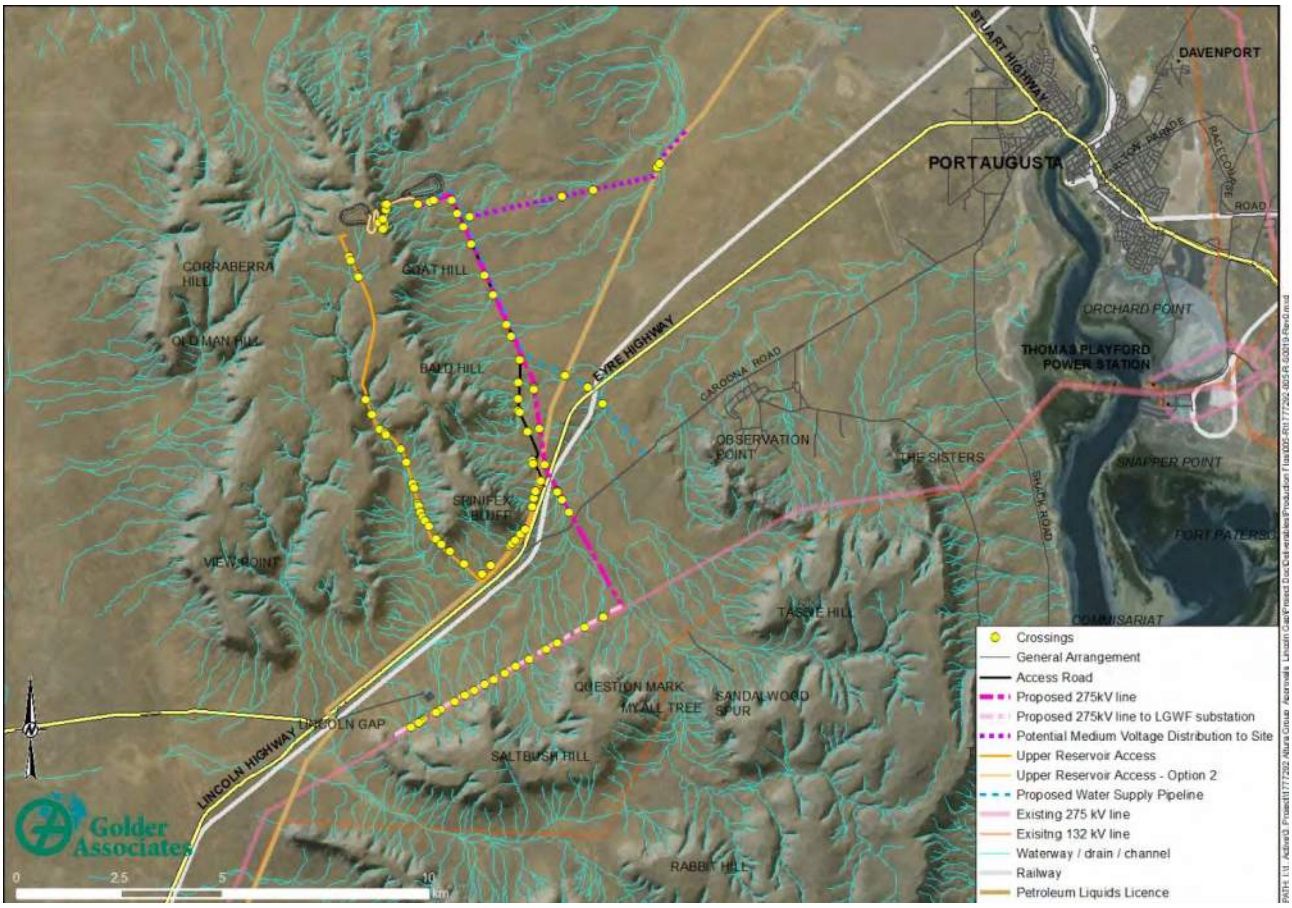


Figure 25. The stream order and size of the individual crossings are presented in Appendix D.

Table 9: Watercourse crossings

Index	Number of crossings	Catchment size range (ha)	Stream order (Stahler method)
Main Access Road	17	13 - 371	1 - 4
Upper Reservoir Road Option 1	33	4 - 988	1 - 4
Upper Reservoir Road Option 2	6	4 - 10	2
Transmission line Option 1 (275kV Connection to Davenport - Cultana)	19	13 – 5,400	1 - 4
Transmission line extension to substation	18	3 - 379	1 - 3
Medium voltage transmission line	4	152 - 1042	2 - 4
Water supply pipeline	11	13 – 13,400	1 - 5

Of the 93 identified crossings, only 23 catchments are greater than 100 ha.

Two major water crossings that have large contributing catchments have been identified on the east of Eyre Highway. These watercourses drain all of the eastern Simmens Plateau and have the largest contributing catchments; approximately 5,400 ha and 13,340 ha, respectively.

The changes to surface water volumes anticipated by the Project are summarised Table 10. Overall, no changes to the surface water volumes are anticipated except for the small reduction associated with the Lower Reservoir.

Table 10: Potential impact to identified watercourse crossings

Infrastructure	Potential impact
Lower Reservoir	The Lower Reservoir is proposed to be located at the head of the catchment of a small watercourse. The construction of the Lower Reservoir will result in a small reduction in the peak flow downstream.
Penstock	No change in watercourse volume - the Penstock is expected to be mounted on concrete saddle structures and supported by concrete anchor blocks. The concrete structures will be placed outside of the watercourse to allow water to flow freely beneath the pipe with no impact to streamflow in the existing watercourses. If the Penstock is placed directly on the ground, an appropriately sized culvert will be used to allow for uninterrupted flow of the existing watercourse (subject to final design).
Main Access Road	No change in watercourse volume - appropriately sized culverts or armored causeway crossings will be used to allow for uninterrupted flow of the existing watercourse pathways.
Upper Reservoir Road option 1	No change in watercourse volume - appropriately sized culverts or armored causeway crossings will be used to allow for uninterrupted flow of the existing watercourse pathways.
Upper Reservoir Road option 2	No change in watercourse volume - appropriately sized culverts or armored causeway crossings will be used to allow for uninterrupted flow of the existing watercourse pathways. Road batters are steep (approximately 30%) resulting in a high potential for erosion, scour and bank instability
Transmission lines	No change in watercourse volume - given the placement of the transmission line infrastructure is relatively flexible, the transmission connection corridor will have no impact to streamflow in the existing watercourses.
Water supply pipeline	Construction of the water supply pipeline will cause temporary disruption to the watercourses it crosses. If the pipeline is buried, there is also the potential for scouring around the buried pipeline over time. The impacted watercourses are generally minor, with the exception of one crossing south of the rail line which will require more detailed design and stringent management measures.

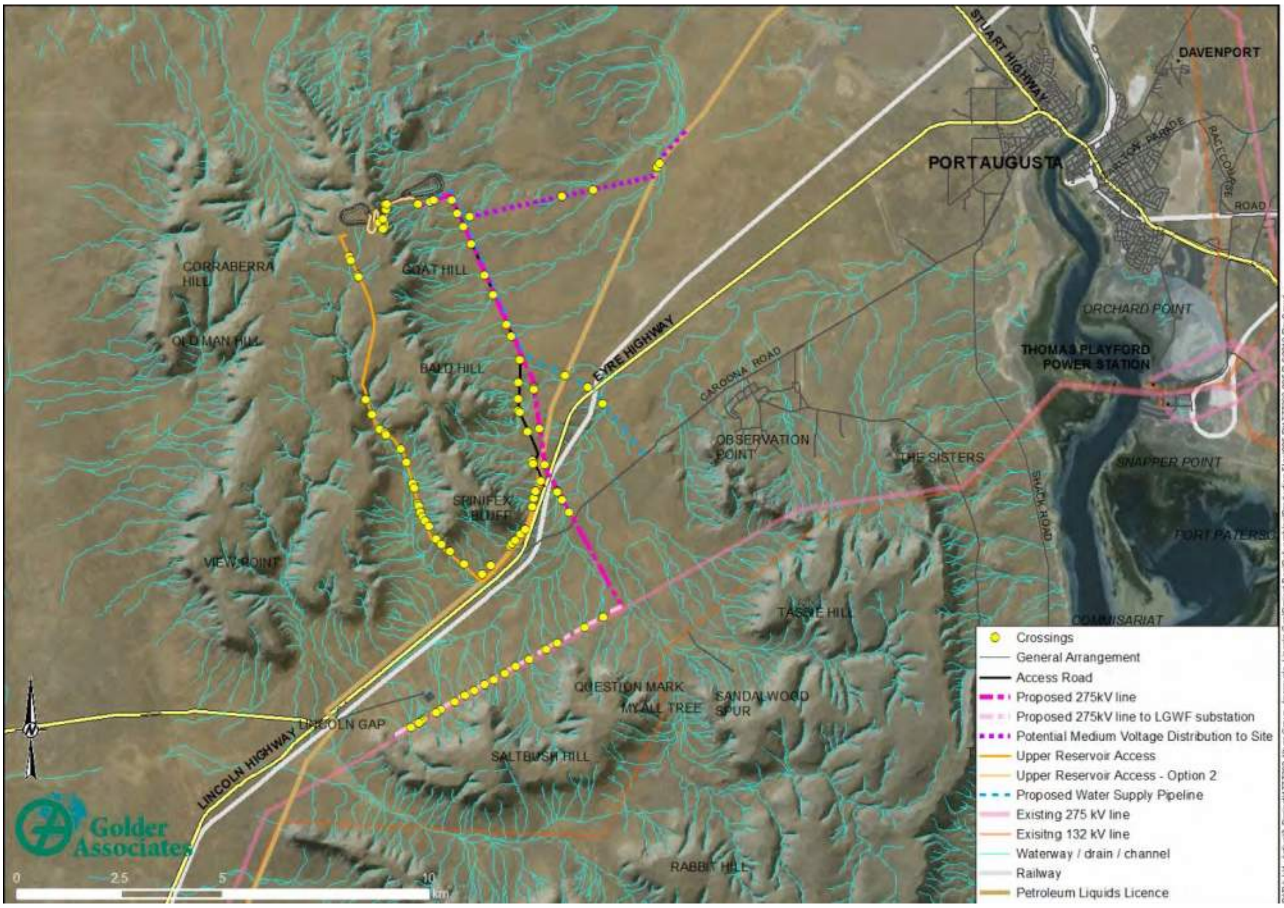


Figure 25: Interaction of the Project with drainage lines

5.7.3 General management

A number of general design and management considerations will ensure the impact on water quality is minor to negligible throughout the construction and operation, as discussed below.

Design

The transmission line tower locations will be designed to avoid placing infrastructure within the existing watercourses.

Depending on the final design of the Penstock, the concrete anchor blocks will be placed outside of the watercourse to allow water to flow freely beneath the pipe with no impact to streamflow in the existing watercourses.

If the Penstock is placed directly on the ground, an appropriately sized culvert will be used to allow for uninterrupted flow of the existing watercourse.

If the water supply pipeline is not buried, subject to the final design, it is proposed support structures will be designed to avoid placement in existing watercourses where required.

Roads and road crossings

Access roads and internal construction roads designs will align with relevant road guidelines, including where relevant the AustRoads Guide to Road Design.

Suitably sized culverts or armored causeway crossings will be used at road crossings to allow uninterrupted flow of watercourse pathways. An assessment of peak flow rate for impacted watercourses will be undertaken during detailed design to inform on the appropriate drainage infrastructure required.

The Upper Reservoir Road (option 2) will require design of erosion and scour protection to road batters and ongoing inspection and maintenance due to the steep gradient and high potential for erosion, scour and bank instability.

Water supply pipeline

If the pipeline is buried, scour protection will be applied to the water supply pipeline crossing locations. Suitable scour protection measures will likely involve the placement of stable rock rip-rap in the location of the pipeline crossing, the sizing of the stable rock will be calculated by standard hydraulic methods. Scour protection will not significantly change the flow characteristics of the watercourse channel.

Detailed design will be undertaken at water supply pipeline south of the rail line to provide a stable and erosion resistant crossing that can pass the design flow.

Water Affecting Activity Permits

A Water Affecting Activity Permit (WAAP) is required under the NRM Act, where an activity diverts water or alters flows from a natural watercourse within a region or potentially impacts on the landscape in a way that threatens the health.

Activities likely to require a WAAP include excavation of the Lower Reservoir and placement of drainage infrastructure within a watercourse (i.e. for road crossings, potential culvert associated with the Penstock, and water supply pipeline crossings). The drainage infrastructure and other water affecting activities proposed will be reviewed during detailed design and the relevant NRM Board (SA Arid Lands or Northern & Yorke) consulted regarding the activities that will required a permit.

Soil Erosion and Drainage Management Plan for construction

Construction activities will manage sediment erosion and drainage to ensure the temporary risks to water quality are appropriately controlled.

In accordance with the Code of Practice for the Building and Construction Industry, (Environment Protection Agency Government of South Australia, 1999), a Soil Erosion and Drainage Management Plan (SEDMP) will be prepared for the construction phase of the Project to specify erosion and sediment management controls.

Potential soil erosion and drainage management measures that will be considered in the CEMP are included in Appendix D.

5.8 Biological Environment

5.8.1 Existing environment

The Interim Biogeographical Regionalisation of Australia (IBRA) is used to classify the land surface across a range of environmental attributes which is then used to assess and plan for the protection of biodiversity (DEWNR 2011). The Project area is situated within the Arcoona Plateau and adjacent to Gawler Lakes subregion which have 99% and 62% remnant vegetation cover respectively.

The Project site is a typical example of the open, sparse vegetation of semi-arid regions. The variety of habitat types that are present at the site include plains of low open chenopod shrubland dominated by chenopod shrublands (saltbush and bluebush), mallee and remnant stands of native pines (*Callitris*) and Casuarina woodlands. Saltbush and bluebush represent the majority of understory throughout the area.

5.8.2 Desktop and field assessment

Species of conservation significance and their potential habitat were reviewed using publicly available databases prior to undertaking the fieldwork (Appendix E). Their presence or absence, as well as a comprehensive flora and fauna spring survey of the PSH Facility and surrounding infrastructure corridors was undertaken during September 2017 (Appendix E).

Vegetation

Twelve broad vegetation associations were identified within the Project survey area during the field survey (Table 11, Figure 26). The five most common Vegetation Associations included (Figure 27):

- *Atriplex vesicaria* Low Shrubland
- *Maireana pyramidata*, *Atriplex vesicaria* Low Shrubland
- *Maireana pyramidata* Low Shrubland
- *Casuarina pauper* Low Open Woodland
- *Atriplex vesicaria*, *Maireana sedifolia* Low Shrubland.

Most of the vegetation showed signs of long-term overgrazing with the structural and floristic diversity of the Vegetation Associations varying according to grazing intensity.

The regeneration of native perennial flora species was noted as being particularly low throughout all Vegetation Associations within the Project survey area. The majority of the vegetation within the areas assessed contained varying densities of the ground cover weed species Wards Weed (*Carrichtera annua)* and Burr Medic (*Medicago minima* var. *minima*).

Table 11: Vegetation Associations within the Project survey area.

Vegetation association description	Project Survey Area (ha) *	% of the Survey Area
Acacia papyrocarpa Low Open Woodland	18	1.4
Atriplex vesicaria Low Shrubland	487	38.5
Atriplex vesicaria, Maireana sedifolia Low Shrubland	73	5.8
Casuarina pauper Low Open Woodland	84	6.6
Casuarina pauper Low Open Woodland +/- *Acacia papyrocarpa*	9	0.7
Casuarina pauper Low Open Woodland +/- *Acacia papyrocarpa +/- Callitris glaucophylla*	28	2.2
Maireana pyramidata Low Shrubland	86	6.8
Maireana pyramidata, Atriplex vesicaria Low Shrubland	429	33.9
Maireana sedifolia Low Shrubland	19	1.5
Melaleuca lanceolata Tall Very Open Shrubland over *Triodia irritans +/- Eucalyptus socialis ssp. socialis, E. gracilis*	6	0.5
Mixed Tall Very Open Shrubland (*Acacia victoriae ssp., Alectryon oleifolius ssp. canescens, Eremophila sp., Exocarpos aphyllus, Senna sp.*)	26	2.1
Triodia irritans Hummock Grassland	1	0.1
Total	**1266***	

**note – The Project footprint is approximately 80 ha for the PSH Facility, 30 ha for the ancillary infrastructure and 90 ha for temporary related activities. i.e. total of ~ 16% of the survey area.*

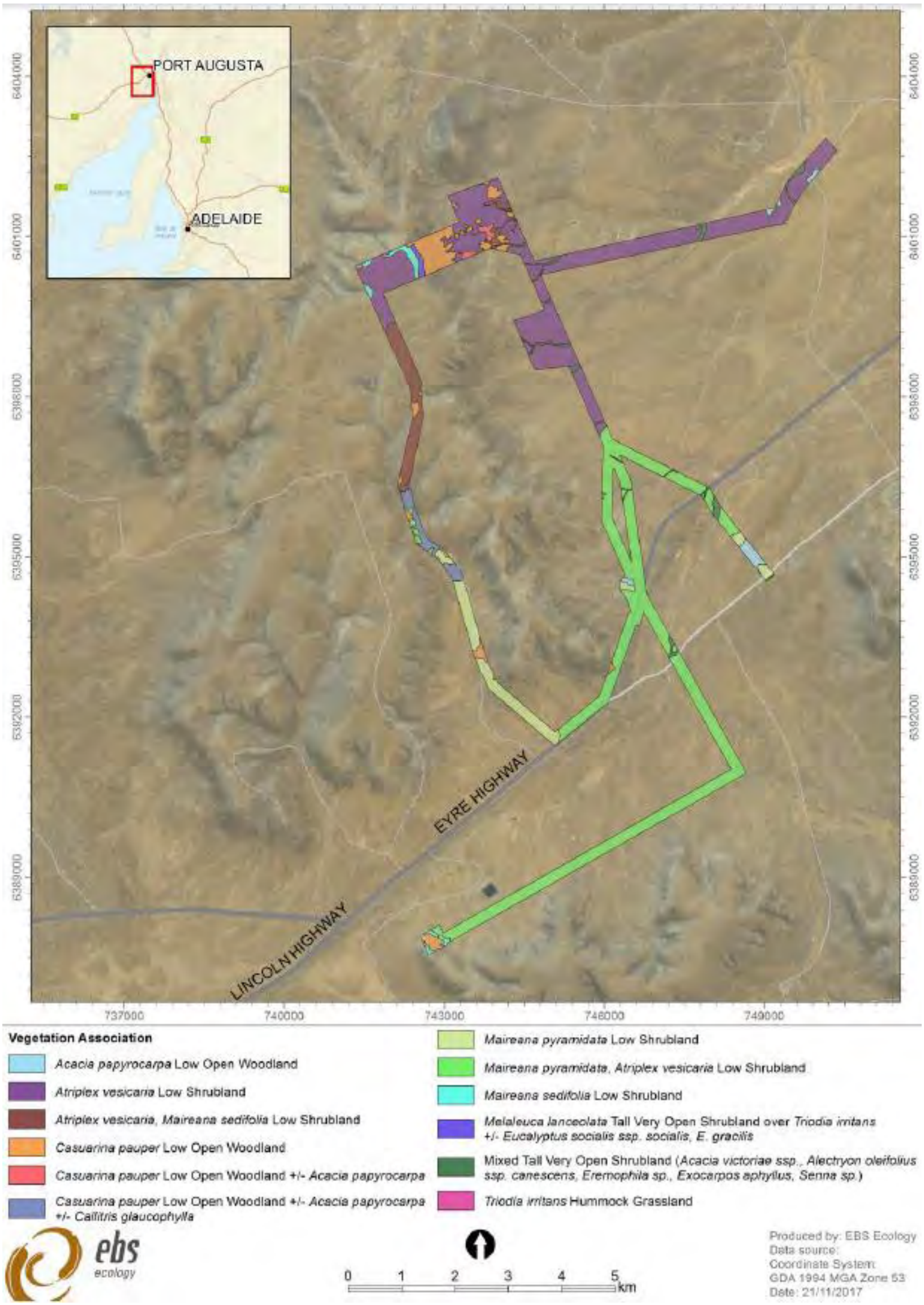


Figure 26: Vegetation associations at the Project site

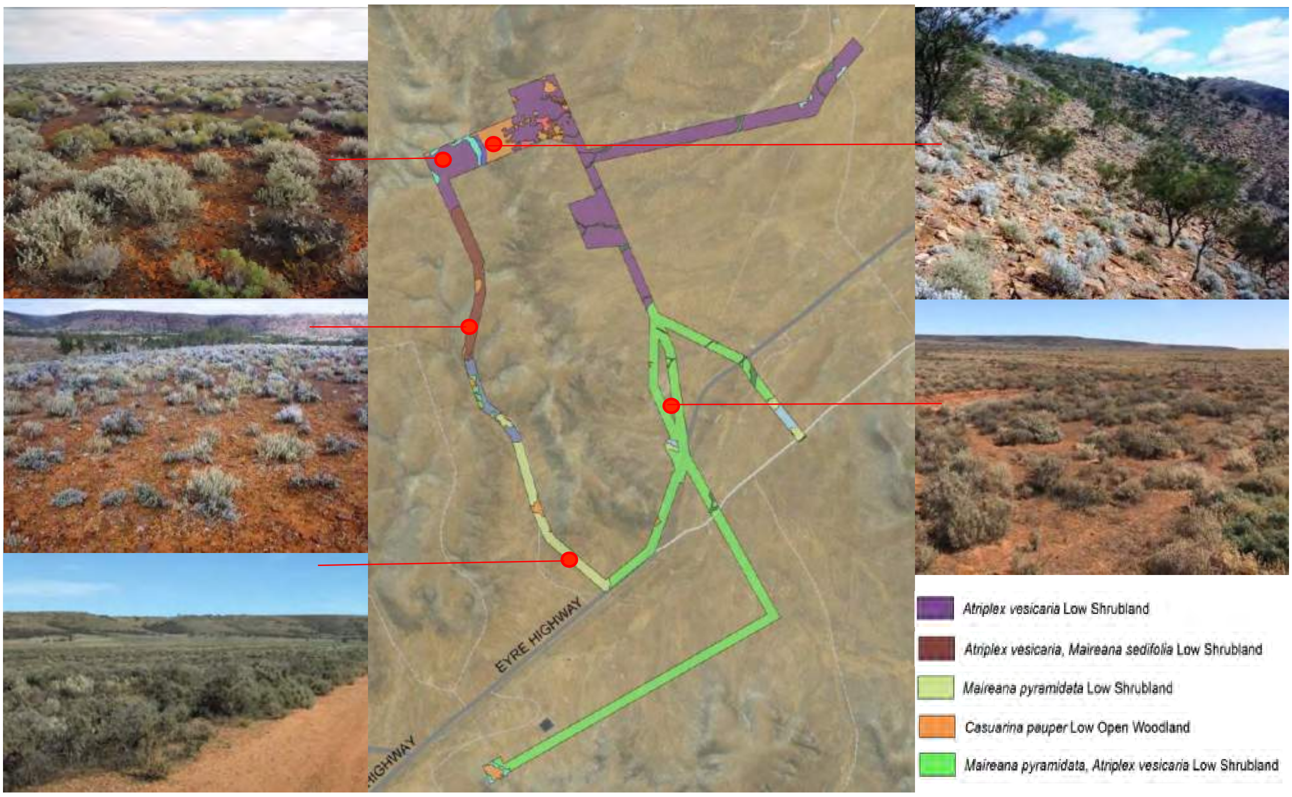


Figure 27: Common vegetation associations found within the Project site

Flora

One hundred and nine (109) flora species were recorded, including 92 native species and 17 weed species.

No *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed species were identified during the field survey.

Sandalwood (*Santalum spicatum*), which is listed as a vulnerable plant under the NPW Act was recorded within the proposed Lower Reservoir and Upper Reservoir Road corridor (Figure 28).

Three declared weeds under the NRM Act were also identified, including African Boxthorn (*Lycium ferocissimum*), Horehound (*Marrubium vulgare*) and Bathurst Burr (*Xanthium spinosum*).

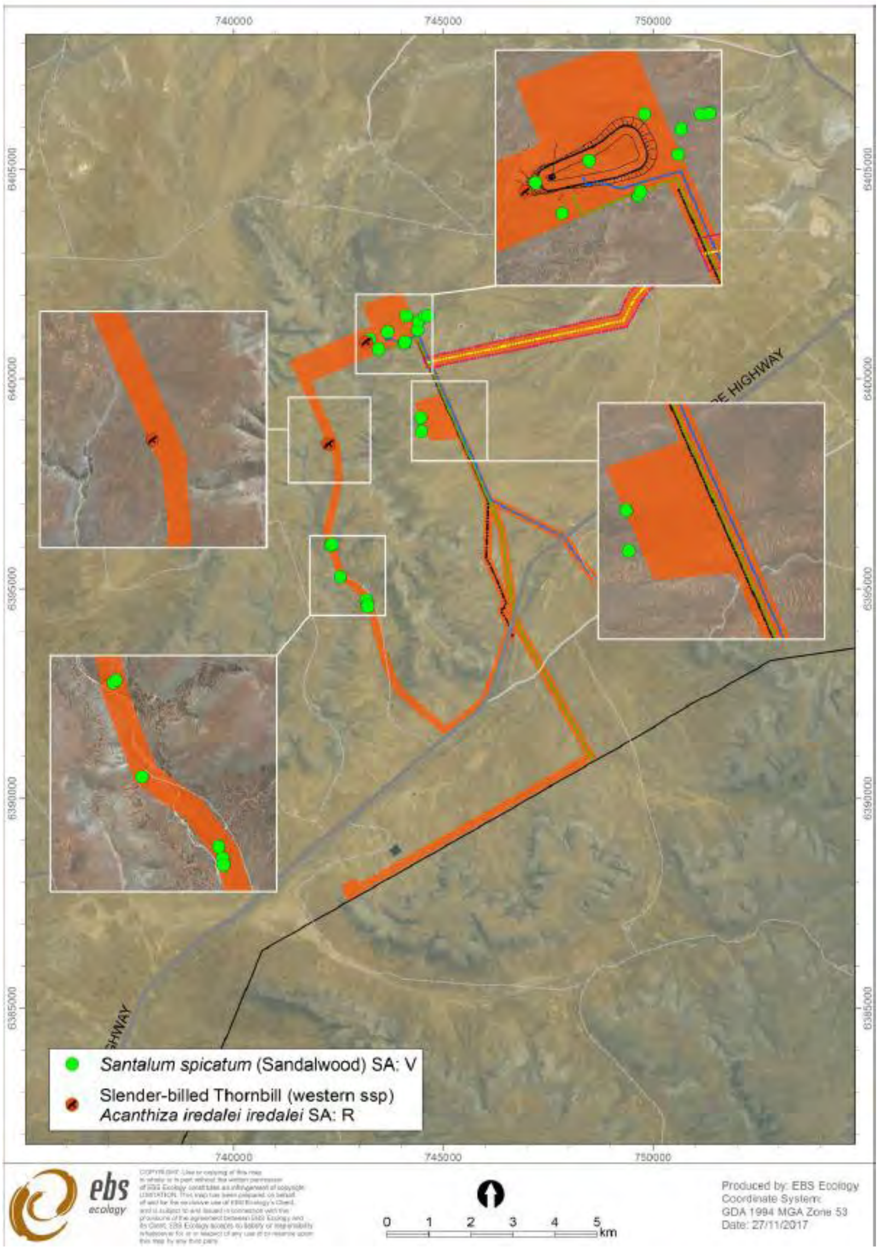
Fauna

The fauna survey recorded 44 bird species, four mammals (excluding livestock) and four reptile species.

The quality of habitat for fauna within the Project area was degraded by the historical and current grazing pressures.

There were no species observed during the field assessment that were listed under the EPBC Act.

The NPW Act-listed Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*) was observed within the Project area during the field survey (Figure 28) consisting of two groups of four and five individuals. The species was observed within Bladder Saltbush and Samphire shrubland, as well as in Belah (*Casuarina pauper*) and Bladder Saltbush shrubland. The habitat within Bladder Saltbush is considered to be their usual habitat, while it is uncommon for the species to inhabit *Casuarina* dominated habitats (EBS 2017).



(a) Sandalwood (*Santalum spicatum*)

(b) Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*)

Figure 28*:* Location of species listed under the National Parks and Wildlife Act (a) Sandalwood (*Santalum spicatum*), and (b) Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*).

5.8.3 Potential impact on flora and fauna

The Project will require the removal of vegetation to facilitate construction and operational activities.

Although a survey area of about 1, 265 ha was undertaken, this contains significant buffer areas and areas that are unlikely to be fully utilised for construction. Rather, the preliminary Project footprint is approximately, 80 ha for the PSH Facility, 30 ha for ancillary infrastructure and 90 ha for temporary construction related activities.

The PSH Facility will remove predominantly *Atriplex vesicaria* low shrubland and *Casuarina pauper* low open woodland. These are dominant in the area and typical of the Arcoona Plateau subregion (Interim Biogeographic Regionalisation of Australia). Of the 1,077,028 ha associated with the subregion, 99% is remnant vegetation. In that context, the Project interaction with flora is considered minor both within the landholder allotment and the subregion.

The potential impact of the Project on the Slender-billed Thornbill (Western) population identified on site is considered negligible given the species has a stable population, is widespread and has extensive areas of suitable habitat in the surrounding area.

5.8.4 General management considerations

The Project design will be optimised (e.g. co-locating linear infrastructure) where practicable to minimise the impact on vegetation communities, and avoid the removal of Sandalwood trees where possible (i.e. for linear infrastructure).

The final design footprint will be assessed to enable accurate SEB calculations and a native vegetation clearance report and application to be completed.

Management measures will be implemented during construction through the CEMP to ensure impacts to vegetation are minimised. These will include:

- Selective topsoil – vegetation salvage and re-spread (i.e. minimise mixing dissimilar assemblages)
- In consultation with the landowner, rehabilitation objective will aim to establish stable landforms and, re-establish the vegetation community / assemblage that was present before the disturbance took place
- Areas will be rehabilitated as soon as practicable after the area is no longer required, with areas temporarily fenced to reduce livestock grazing pressure
- Temporary roads, hardstand areas and the like deep-ripped to break compaction and ensure water infiltration and plant establishment

- Revegetated areas actively managed to prevent the spread of weed species
- Relocate impacted Sandalwood where feasible
- Include Sandalwood in the rehabilitation seed mix and any landscaping within Powerhouse compound (where grazing will be removed)
- Dirty vehicles / Plant potentially containing weed material to be cleaned-down prior to entering and leaving Project area
- Dust suppression to minimise dust settling on vegetation.

5.9 Cultural heritage

An Aboriginal Affairs and Reconciliation (DSD-AAR) register search was undertaken in July 2017 which revealed five recorded/registered indigenous sites in the vicinity of the Project, and a single large ethnographic site within the infrastructure footprint. These registered sites are a mixture of archaeological (artefact scatters and ceremonial sites) and cultural (ethnographic) sites. The details of the culturally sensitive site locations remain confidential.

Altura is collaborating with the Barngarla Determination Aboriginal Corporation to finalise a Cultural Heritage Agreement. Once an agreement has been reached, a detailed cultural heritage survey will be undertaken to further inform the Project design and the necessary management requirements.

5.10 Amenity Impact

5.10.1 Existing environment

The Project is sited remotely from human settlement and is within a rural landscape, predominantly used for stock grazing. The closest town to the Project is Port Augusta approximately 12km to the east, and the closest publicly utilised road is the Eyre Highway, approximately, some 7 km south of the site. The closest resident to the site is approximately 11 km to the south east (Figure 29).

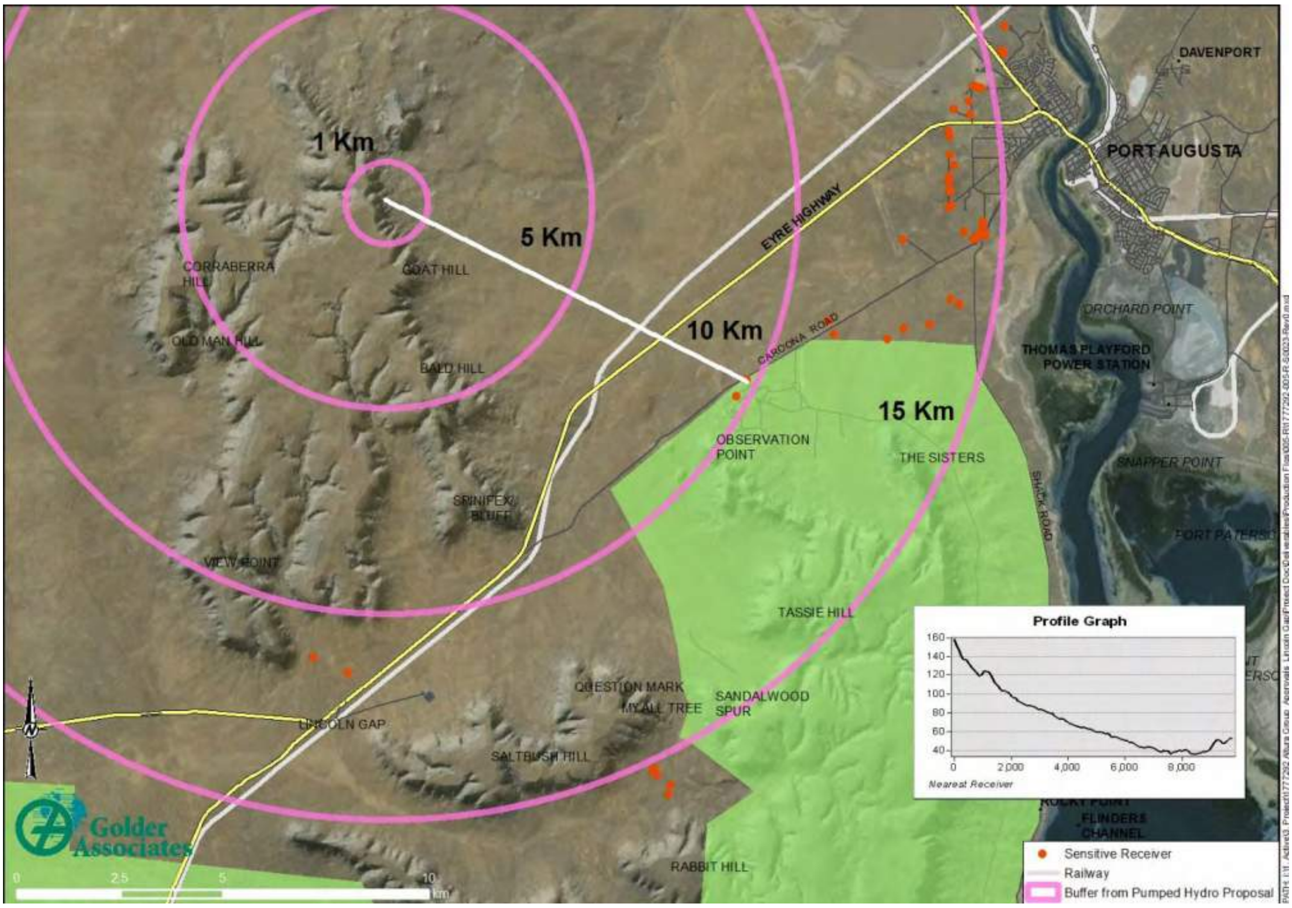


Figure 29: Sensitive receivers near the Project

Visual

The landscape is characterised by a number of plateaus rising above gently undulating plains. The Project will be situated on a plateau which rises approximately 200 m above the surrounding plains. The plateau is a visually dominant, but distant, landform which is visible from, and frames the western skyline of, Port Augusta.

Noise

Augusta Quarry operates approximately 7 km south east of the site and the Cultana Training Area, operated by the Commonwealth Department of Defence, is approximately 10 km south east.

The Augusta Quarry would likely produce a minor amount of construction noise and dust in certain conditions. The Cultana Training Area may also produce infrequent noise events, including through the use of explosives and ammunitions and aircraft and vehicle operations.

Other than the quarry and military training area, there are no other existing sources of noise, greater than those reasonably expected in a rural landscape traversed by a main highway.

Air quality

Based on the Project area being vegetated with low shrubland and grasses, with the exception of the quarry, the existing ambient dust levels are expected to be generally low. Dust may be generated from the landscape in exceptionally dry periods and in certain conditions (i.e. high winds).

5.10.2 Potential impact on amenity

Visual

The visual impact of the Project is limited by its distance to Port Augusta and the Eyre Highway, and position on the north eastern side of the plateau. The Penstock and embankments may be slightly visible from the Eyre Highway, but will not be dominant features of the landscape which is shown from the perspective of the Lower Reservoir in Figure 30. This visualisation has been prepared using the concept design to render the visual components of the PSH Facility over existing site features captured via drone.

While the embankments are of a notable scale, they will be constructed of excavated material from the reservoir location and then vegetated. After a time, once the vegetation matures, it is anticipated that these features will blend in relatively seamlessly into the landscape. A comparison can be made with the nearby above ground water storage operated by SA Water, located approx. 12 km south of the PSH Facility. Although approximately five times smaller than the proposed reservoirs, the embankment walls that have been revegetated minimise the intrusiveness of this element to the adjacent Eyre Highway. This existing water storage facility is located 1 km off the Eyre Highway whereas the Project's reservoirs are some 7 km from the highway (Figure 31).

From the closest public road (some 7 km away), the Penstock is considered insignificant. The proposed reservoirs and other components of the facility do not make any significant alterations to the existing plateau or steep strike ranges. While the embankments will increase the level of the land at these locations, it is not envisaged that the overall topography and appearance of the landscape will alter significantly (Figure 30 and Figure 32).

The overhead transmission line and water supply pipeline will traverse the Eyre Highway. This type of infrastructure is consistent with other infrastructure present along the Eyre Highway in the vicinity of the Project. The visual impact of this infrastructure is considered negligible, based on the existing infrastructure present and transitory nature of passing motorists.

Lighting of the Powerhouse facility (the PSH component to contain exterior and security lighting) may present a distant new light source on the night-time landscape.

However, the low position of the Powerhouse in the landscape (i.e. located within an excavated area), the distance from both Port Augusta and the nearest sensitive receivers (> 10km), together with transitory nature of passing motorists on the Eyre Highway some 7 km away, the visual impact is considered low.

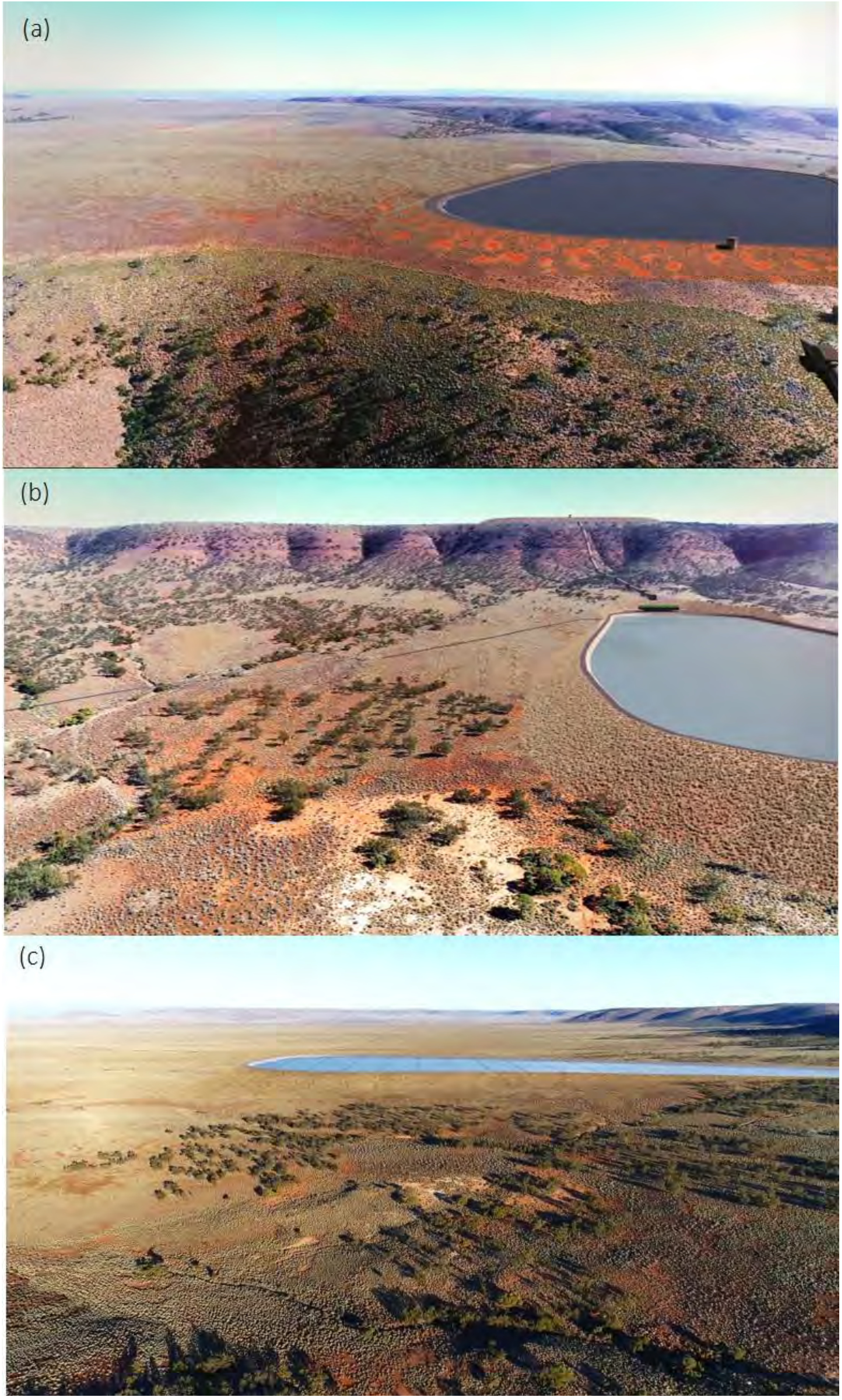


Figure 30: Visualisation of (a) Upper Reservoir and (b) Lower Reservoir with the Penstock leading to the Upper Reservoir and (c) Lower Reservoir looking south to the Eyre Highway, some 7 km away.

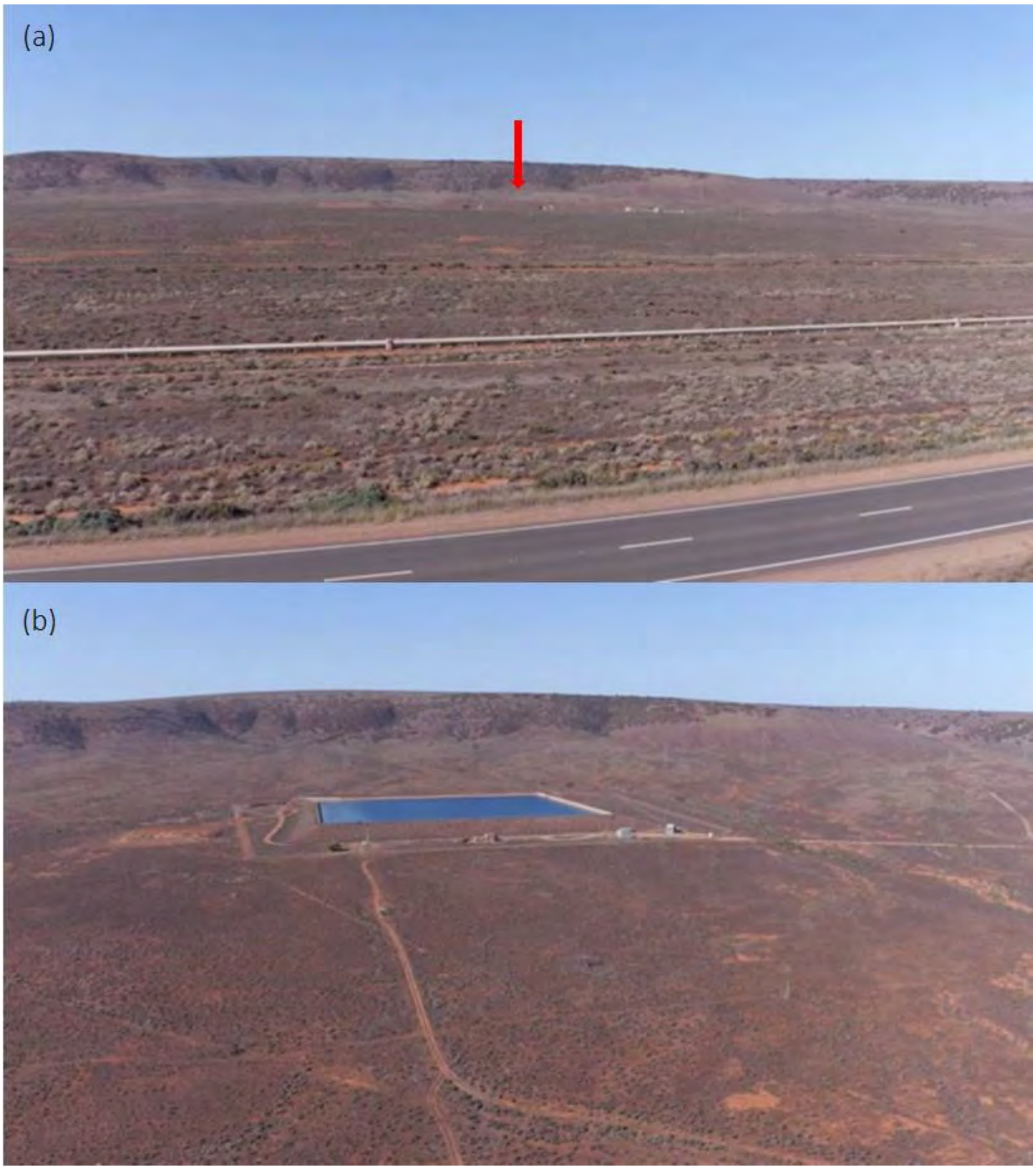


Figure 31: SA Water storage facility as visible (a) 1 km from Eyre Highway and (b) from elevated drone footage

Figure 32: Public access view from Eyre Highway to the Project some 12 km away.

Noise

Noise is expected to be generated through construction, including from the following sources:

- General plant and machinery
- Excavation and earthmoving
- Drilling
- Blasting (expected to occur periodically during the excavation of the Upper Reservoir)
- Crushing and concrete batching plant.

Construction activities will generally occur between daytime hours (7am-7pm), however some activities may occur outside of these times. It is highly unlikely that noise levels will exceed the EP (Noise) Policy through construction activities so as to cause an adverse impact on the closest noise sensitive receptor (resident), more than 11 km from the Project.

It is also noted that the construction of major elements of the PSH Facility will be below the natural ground surface, with the deepest, the Powerhouse, extending some 50m or so below the ground surface. These excavations in themselves are expected to provide shielding from construction noise sources occurring within.

Operational noise impacts are also considered negligible, based on the below-ground operation of the Powerhouse and distance from sensitive receivers.

Air quality

Local air quality may be temporarily impacted during construction, particularly through dust generation, via the following sources:

- Excavation
- Occasional blasting
- Crushing and concrete batching plant
- General site traffic on unsealed roads
- Laydown and stockpile areas.

Offsite air quality impacts are expected to be negligible based on the amount of dust expected, distance to the closest resident distance to the closest publicly used road (Eyre Highway, >7 km) and lack of sensitive receptors.

Operation of the Project will have a negligible impact on air quality.

5.10.3 General management considerations

Visual

Given the location away from public land, the nature of the structures to be built and the materiality and landscaping of the embankments, the PSH Facility is considered to be relatively unobtrusive and not inconsistent with the existing grazing landscape or scenic features of the subject site and surrounding locality.

Notwithstanding the relatively inconspicuous physical form of the facility, the Project nonetheless seeks to minimise its visual impact through the appropriate selection of materials, such as the use of excavated, battered site material where appropriate (rather than retaining walls), muted and natural colours to be used on external surface (i.e. Powerhouse and reservoir evaporation covers where possible), and revegetating of the reservoir embankments.

The position of the Powerhouse within an excavated area is expected to minimise lighting impacts to distant receivers. Nevertheless, lighting will be designed to minimise light spill to surrounding landowner's property, distant receivers and the township of Port Augusta. Lighting will consider solar options, auto-sensors, and auto turn-off facilities, and the placement of efficient, additional lighting (e.g. low-pressure sodium lights) for the use during maintenance activities (i.e. not normal operations).

Noise

Given the Project’ s distance to the nearest sensitive receivers (approximately 11 km), it is not considered that the construction of the PSH Facility will generate noise that would typically be heard at this distance.

Management measures to minimise any potential construction noise impacts will be implemented by the Contractor through a CEMP. These may include:

- Maintaining Plant and equipment
- Minimal use of horns and loudspeaker systems.

In addition to the above, a Blasting Management Plan will also be implemented by the Contractor which will include any potential noise impacts. If blasting activities are required outside of daytime hours, permission will be sought from the SA EPA.

There will be no requirements for management of noise during the operational phase of the Project.

Air quality

Management measures to minimise any potential impact to air quality from construction dust will be implemented by the Contractor through a CEMP. These will include:

- Use of water for dust suppression on access roads, laydown areas and other open areas
- Rehabilitating areas no longer required.

There will be no requirements for management of air quality during the operational phase of the Project.

5.11 Traffic impact and site access

5.11.1 Existing environment

Currently, direct access to the site can only be gained via the Eyre Highway. Eyre Highway forms part of the national highway route and is the only sealed road linking South Australia and Western Australia. The majority of the highway is two lane, single carriageway with a speed limit of 110 km/hour.

Lincoln Highway is a sealed 327 km road that links Whyalla and Port Lincoln through its connection to Eyre Highway. The majority of the highway is two lane, single carriageway with a speed limit of 110 km/hour.

Existing traffic volumes for Eyre Highway and Lincoln Highway are presented in Table 12 (data sourced from Location SA Map Viewer).

Both highways are gazetted freight routes and are capable of accommodating road trains (Figure 33).

Table 12: Existing traffic volumes

Road	Year of count	Annual average daily traffic volume (AADT)	% heavy vehicle (HV)
Eyre Highway	2014	2,700	20.5%
Lincoln Highway	2016	2,100	17%

5.11.2 Traffic assessment

Altura engaged independent traffic planners and engineers to examine the suitability of existing access points to the PSH Facility in relation to the existing road network, as well as the condition and capability of the network to accommodate the predicted vehicle movements (Appendix F).

The Project was inspected on 15 September 2017.

5.11.3 Traffic management and access

The majority of the construction components are expected to come from the Port Adelaide region. Further operational traffic will be generally from the Port Augusta region. On this basis, it was assumed that the majority of traffic will be travelling from north east (Port Augusta), and fewer traffic volumes will be generated from the south (Whyalla).

The proposed access point for the Project is located on the Eyre Highway, at the site of an existing access point to Augusta Quarries, as shown in Figure 33 and Figure 34. Given the road speed is 110km/hr, a minimum gap site distance (MGSD) of 153 m is required, as well as a critical gap time of five seconds to ensure safe ingress and egress to site. The existing access point meets these requirements. Further, the geometry of the access point generally meets the standard requirements. While not critical, the existing gate access into the site could be widened to achieve 8 m width to accommodate easier access by road trains. During construction, the gates will remain open at all times to allow for safe and efficient site ingress.

In addition to the main Eyre Highway access point, an assessment of where the proposed transmission lines and water supply pipeline cross the Eyre highway and Caroona Road was undertaken. It was determined that existing tracks were suitable for access/maintenance at each of these locations.

Further detail is provided in Appendix F.

Figure 33: Gazetted freight routes in the vicinity of the PSH Facility

Figure 34: Existing access point of Eyre Highway (c/- WGA)

5.11.4 Potential impacts to traffic

No new access points are proposed as a part of the Project.

Traffic will be generated to enable construction and operation of the Project. The project activities with the potential to generate traffic largely relate to the construction period are as follows:

- Construction of internal access tracks and laydown areas
- Delivery of site materials, temporary personnel facilities and compounds
- Delivery of equipment and materials for construction of reservoirs, Penstock, Powerhouse and tailrace
- Delivery of materials for the water supply pipeline and transmission infrastructure
- Dust suppression activities
- Access to the site by construction personnel.

Noting that the construction workforce may peak at 250 personnel, Altura is committed to minimising vehicular movements, with the Contractor expected to utilise buses and coaches as daily transport options for site workers.

On average, an additional 137 equivalent vehicle trips per day are expected during construction of the Project:

- 37 heavy vehicle trips
- 100 light vehicle trips.

During operations, assuming the PSH Facility is not remotely operated, additional vehicle trips per day are expected to be:

- <1 heavy vehicles
- 12 light vehicle trips.

In context of the existing traffic, construction and operation of the Project is expected to have a short term but negligible impact on traffic volumes on DPTI roads (Table 13). Although the traffic volumes and percentage of heavy vehicles may slightly increase on the road network servicing the Project, each of these roads is an existing gazetted freight route with minimal residences and generally have good pavement conditions.

Table 13: Network traffic impact - construction and operation

Road	Existing traffic (AADT)	AADT Construction			AADT Operation		
		Construction forecast	% increase	% HV increase	Operational forecast	% increase	% HV increase
Eyre Highway	2700	2837	5%	0%	2712	0%	0%
Lincoln Highway	2100	2234	7%	1%	2112	1%	0%

AADT = Average Annual Daily Traffic; HV = Heavy Vehicle

5.11.5 General management considerations

Management of traffic will be considered within a project-specific Traffic Management Plan (TMP). The TMP will be used to ensure the safety of all road users, and may include measures such as the use of Variable Message Signs (VMS) during peak periods of construction to improve safety for all road users and provide advanced warnings when required.

Appropriate approvals will be obtained from DPTI for oversize vehicles accessing the Project during construction.

Although traffic increases generated by the Project during construction are minimal, the use of buses to transport workers from nearby towns is expected to maintain the traffic impact to low levels.

Access

The access point from the Eyre Highway onto the Project's Main Access Road will be improved by at least the following management measures:

- Additional material over edge breaks
- Provide section of sealed wearing course (to minimise gravel and mud track)
- Install a grid at current gate location (=property fence)
- Increase width of gated access
- Monitor access entry condition and treat as required.

Access Road

Altura envisages placing warning signage on the Main Access Road to the PSH Facility to advise outgoing vehicles to give way to incoming vehicles. CEMP that will incorporate management measures to help reduce other traffic induced potential impacts, including wildlife and livestock strike, dust and noise.

5.12 Public Safety

5.12.1 Bushfire

The vegetation across the Project site is low, open shrubland dominated by chenopod shrubland. Vegetation associations mapped in the flora assessment were dominated by various fire-resistant plants species such as Bluebush and Saltbush. The Project site and surrounding area is not considered to be in a high bushfire risk area.

The main bushfire risks associated with the Project will be during construction when hot works are required. While these activities will increase the bushfire risk, the risk of fire initiation is reduced by appropriate hotworks procedures, and additional general fire management measures (e.g. removal of vegetation around construction buildings and storage areas, in addition to water cart facilities). Further, a widespread fire is reduced by the surrounding environment and vegetation.

While operational activities are not expected to increase the risk of bushfire, the infrastructure added to the landscape (i.e. substation and transmission lines) have the potential to start or influence the spread of fire. These risks, however, are not expected to substantially increase above those associated with the current agricultural activities and existing infrastructure.

The following design, construction and operational considerations will ensure the risk of bushfire as a result of the Project development is minimised:

- The final Project design will ensure ease of access to and around Project infrastructure. This access will be maintained throughout the operational phase of the Project
- All structures will be built with adequate building protection to meet the Building Code specifications. Building layout and selection will take account of the potential for trapping burning debris against the structures, or between the ground and building floor level in the case of transportable building
- A source of fire-fighting water will be maintained (i.e. reservoir water can be used as a source of fire-fighting water in the event of a bushfire if required)

- Appropriate permits (Schedule 9 and 10) will be acquired in accordance with the Fire and Emergency Services Act 2005 and the Fire and Emergency Services Regulations 2005
- An Emergency Response Plan will be developed in consultation with the CFS and local Fire Brigade, with both organisations invited to the Project site in the early stages of construction and before operations to gain an understanding of the site layout, emergency procedures and access.

5.12.2 Security

During construction, appropriate signage will also be placed near the beginning of the Main Access Road indicating that the road is private with strictly no public access permitted. During periods where no work is occurring on site, entrance to the Access Road will be prevented by a locked gate.

During operation, unauthorised access to the reservoirs and Powerhouse will be further restricted with security fencing, designed to comply with AS 1725.1. Video surveillance and other security features (e.g. sensor lighting) may also be installed for additional site security.

6.0 Residual risk and management

The sections above outline the risks identified and proposed strategies to avoid, mitigate or manage these risks. Based on the information presented in this DAR, and the supporting technical studies, the potential risks identified can be effectively managed through detailed design and/or management strategies.

A number of additional information inputs will occur throughout the detailed design phase including (but not limited to); detailed geotechnical; third-party infrastructure crossing requirements, groundwater quantity and quality review; heritage, and flora and fauna confirmation assessments.

This information will support the finalisation of the design to ensure the environmental impacts resulting from infrastructure placement can be further minimised. This will include such considerations as (where practicable):

- Avoiding placement of infrastructure in watercourses
- Micro siting construction to avoid removal of Sandalwood trees
- Avoiding disturbance of any identified heritage sites.

The Contractor will be required to prepare and implement a CEMP that meets regulatory requirements, including those set out in this DAR, guidelines and contractual obligations.

A scope EMP has been provided in Appendix H that summarises potential management and mitigation measures to effectively protect the environment.

7.0 Planning assessment

Following an assessment of the proposed development against the whole of the Land Not Within a Council Area (Flinders) and Port Augusta (City) Development Plan, it is considered that the Project is not significantly at variance with the Development Plan and warrants Development Approval.

The Planning Statement (Appendix C) assessed the Project in context of different planning issues. The planning use and general finding is provided in Table 14

Table 14: Planning Assessment overview

Planning aspect	Assessment outcome
Land use	The land use zone references construction of wind farms as a key objective. The Project will increase renewable energy opportunities within the region. Flinders Council Wide Objective 19 also seeks the development of renewable energy facilities.
Lincoln Highway	The Project supports efficient energy generation and supply of electricity that will benefit the environment, the community and the State.
Efficient energy generation	The reservoirs and other components of the facility do not make any significant alterations to the existing plateau or steep strike ranges. While the embankments will increase the level of the land at these locations, it is not envisaged that the overall topography and appearance of the landscape will alter significantly.
Visual impact and amenity	The extent of clearance appears modest in the context of the Project scale and broad site land holding. When native vegetation removal is unavoidable, Altura will prepare SEB contributions.
Flora, fauna and conservation	While the Project area is not recognised as a highly sensitive ecological area, the development is to be delivered in a manner which seeks to minimise erosion, avoid unstable embankments or cuttings and ensure watercourses are not significantly altered. In achieving this, the Project is considered to appropriately address the relevant erosion and stormwater provisions of both Development Plans
Soil erosion and stormwater management	Although further discussions with DPTI are required, the Project is expected to achieve the relevant provisions of the Development Plan.

Traffic and access	It considered that the Project will be able to be designed, sited and managed so as to appropriately conserve (through physical preservation, recording and/or salvage) any identified sites of archaeological and cultural significance.
Indigenous heritage	It considered that the Project will be able to be designed, sited and managed so as to appropriately conserve (through physical preservation, recording and/or salvage) any identified sites of archaeological and cultural significance.
Bushfire	Altura has undertaken consultation with the CFS in relation to the Project and an Emergency Response Plan is proposed as part of the operational procedures during the construction and operational phases of the Project.

8.0 Conclusion

Altura is seeking to establish 'Public Infrastructure' in the form of a Pumped Storage Hydro Facility to the west of Port Augusta, located primarily within 'Land Not Within a Council Area (Flinders) Development Plan' (consolidated 29 November 2012) and to a lesser degree within the 'Port Augusta (City) Development Plan' (consolidated 7 July 2016).

Renewable energy infrastructure is a specifically envisaged form of development within the relevant Development Plan Zones, being the 'Pastoral' and 'Primary Industry' Zones. The primary desired land uses of grazing and associated farming activities within these zones are not compromised by the occupation of the PSH facility on the land which can function compatibly in this rural environment.

The PSH Facility is appropriately sited in a location with topographic characteristics which enable the gravitational flow of water from a higher water body to a lower, efficiently producing electrical energy. The Project is suitably sited away from townships, sensitive land use and high quality/vulnerable environmental areas.

Once constructed, this form of infrastructure is by design, relatively low impact, with the appearance of the reservoirs being an extension of the natural land form and the supporting infrastructure being of modest scale and similar to existing rural structures and linear infrastructure already present in the landscape.

Based on the environmental risk assessment, no potential impacts have been identified that would preclude development of the PSH Facility.

The proposal has sought to understand and address potential impacts, particularly those associated with visual impacts, the protection of flora and fauna, watercourses and erosion, traffic movements and Aboriginal heritage.

Through the development of a Construction Environmental Management Plan by the Construction Contractor, the Project will incorporate appropriate measures to manage the construction phase in an environmentally sensitive manner and ensure the ongoing operations are similarly managed to avoid degradation of the landscape and promote a high level of environmental integrity.

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Signature Page

ALTURA GROUP

Goat Hill Pumped Storage Project Hydro-development Application

Volume 3: Report Appendices

APPENDIX A

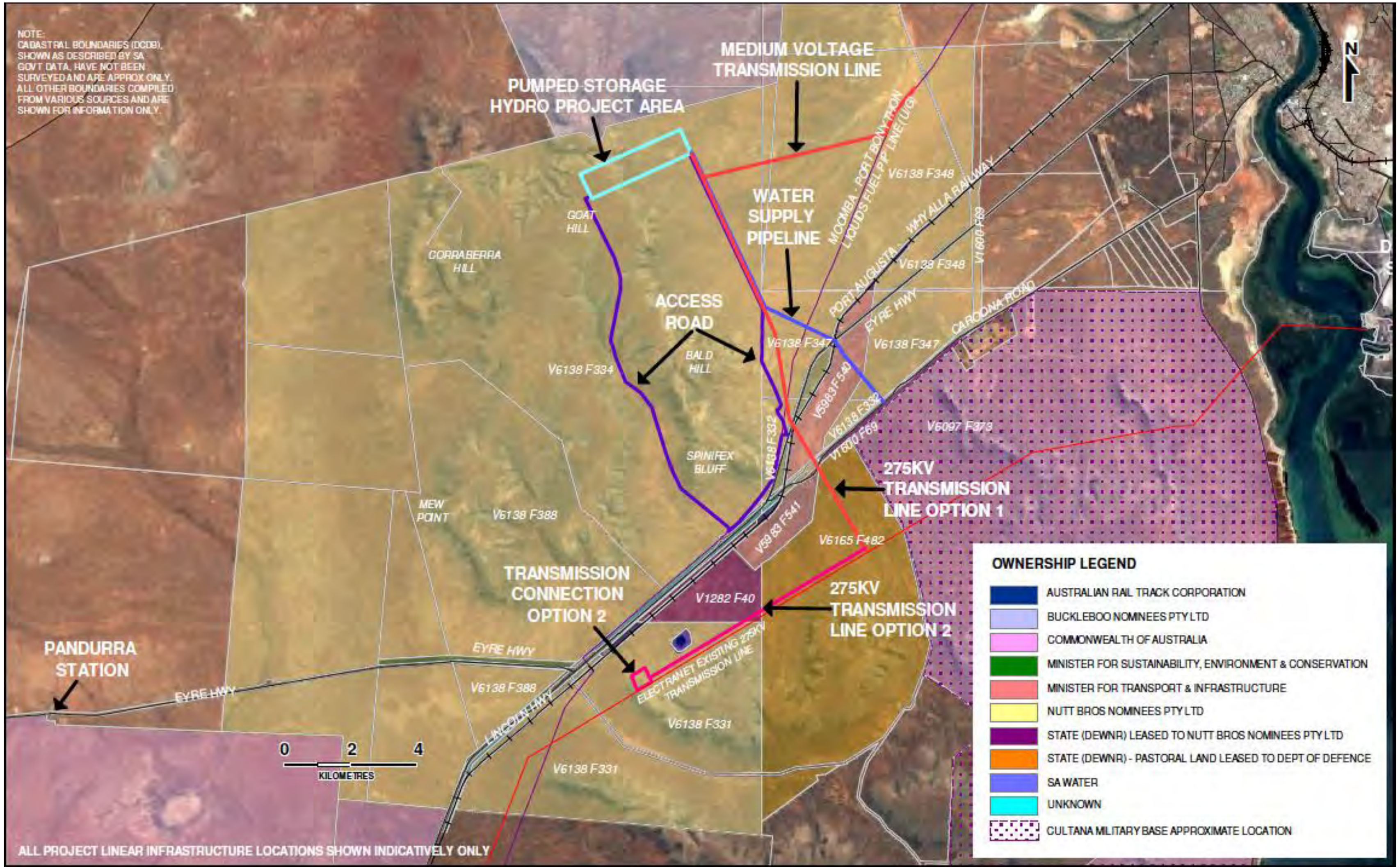
Certificate of Titles

Land Title Summary

Project Component									
Pump Storage Hydro Facility *	Water Supply Pipeline	275 kV Transmission Line	Medium Voltage Transmission Line	Main Access Road	Upper Reservoir Access Roads	Type	Volume	Folio	Owner
						CT	6138	388	Nutt Bros Nominees Pty Ltd
						CT	6138	334	Nutt Bros Nominees Pty Ltd
						CL	1282	40	State – DEWNR (Crown Lands)
						CT	6138	331	Nutt Bros Nominees Pty Ltd
						CT	6138	347	Nutt Bros Nominees Pty Ltd
						CL	1600	69	State – DEWNR (Crown Lands)
						CT	6138	348	Nutt Bros Nominees Pty Ltd
						CT	6138	332	Nutt Bros Nominees Pty Ltd
						CL	6165	482	State – DEWNR (Pastoral)
						CT	5983	541	Minister for Transport & Infrastructure
						CT	5983	540	Minister for Transport & Infrastructure
						CT	5983	539	Australian Rail Track Coorporation

* Reservoirs, Penstock, Powerhouse

Land Title Summary Map



CHELACE GIS PTY LTD CADASTRAL, MINING AND LAND INFORMATION MAPPING	ABN 15 123 451 927 ACN 123 451 927 T: 0423 795 041 E: sean@chelacegis.com.au	Drawn By: SC Date: 28/11/17 Layout: A4 Projection: MGA 53 Location: Goat Hill Contour: N/A Version: 03	ALTURA GROUP	Goat Hill Project Tenure Drawing No. : GHL-LAC-DRA-0001 Workspace Ref:Goat Hill Summary Maps 171128.WOR PDF Ref: Goat Hill Project Tenure GHL-LAC-DRA-0001 171128.PDF

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REAL PROPERTY ACT, 1886
South Australia

This Crown Lease Register Search is a true and correct extract of the Register of Crown Leases maintained by the Registrar-General.

Crown Leases are granted and administered pursuant to the Crown Land Management Act 2009 by the Department of Environment, Water and Natural Resources.

REGISTRAR - GENERAL SOUTH AUSTRALIA

Crown Lease - Volume 6200 Folio 236

Parent Title(s) CL 1282/40

Creating Dealing(s) RT 12780460

Title Issued 21/11/2017 **Edition** 1 **Edition Issued** 21/11/2017

Estate Type

CROWN LESSEE

Owner

THE CROWN

Crown Lessee

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF L 1 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

SECTION 10
HUNDRED OF HANDYSIDE
IN THE AREA NAMED LINCOLN GAP

TOTAL AREA: 354.2HA (CALCULATED)

DIAGRAM BOOK PAGES 2, 9, 12 AND 13

Lease Details

Lease Number OP019651

Lease Type PERPETUAL

Commencing On 01/07/1963

IN PERPETUITY

Conditions

CROWN LEASE CONDITIONS VIDE CL 1282/40

Easements

SUBJECT TO EASEMENT(S) WITH LIMITATIONS OVER THE LAND MARKED B ON F29704 TO TRANSMISSION LESSOR CORPORATION OF 1 UNDIVIDED 2ND PART (SUBJECT TO LEASE 9061500) AND ELECTRANET PTY. LTD. OF 1 UNDIVIDED 2ND PART EXPIRING ON 04/02/2090 (GU 7154789)

SUBJECT TO CERTAIN RIGHT(S) AND LIBERTIES OVER THE LAND MARKED EASEMENT ON PLAN ATTACHED TO SL 3168144 (SL 3168144)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.

Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

Additional Information

This additional information is provided by the Department of Environment, Water and Natural Resources and does not constitute part of the Crown Leases Register maintained by the Registrar-General. Contact the Department of Environment, Water and Natural Resources to verify the currency of this information and to obtain further details.

Annual Rent

Annual Rent:	$21
Rent Review:	Not subject to rental reviews

Product	Register Search (CL 6200/133)
Date/Time	04/12/2017 06:06PM
Customer Reference	CL 1600 69 - DEWNR
Order ID	20171204012587
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

This Crown Lease Register Search is a true and correct extract of the Register of Crown Leases maintained by the Registrar-General.

Crown Leases are granted and administered pursuant to the Crown Land Management Act 2009 by the Department of Environment, Water and Natural Resources.

REGISTRAR - GENERAL SOUTH AUSTRALIA

Crown Lease - Volume 6200 Folio 133

Parent Title(s)	CL 1600/69				
Creating Dealing(s)	RT 12780447				
Title Issued	17/11/2017	**Edition**	1	**Edition Issued**	17/11/2017

Estate Type

CROWN LESSEE

Owner

THE CROWN

Crown Lessee

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF L 1 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

SECTIONS 292 AND 293
HUNDRED OF COPLEY
IN THE AREAS NAMED LINCOLN GAP AND PORT AUGUSTA WEST

SECTION 255
HUNDRED OF GILLEN
IN THE AREAS NAMED LINCOLN GAP AND PORT AUGUSTA WEST

SECTIONS 256, 257, 258, 263 AND 264
HUNDRED OF GILLEN
IN THE AREA NAMED LINCOLN GAP

TOTAL AREA: 161HA (APPROXIMATE)

DIAGRAM BOOK PAGE 9 HUNDRED OF COPLEY
DIAGRAM BOOK PAGES 14, 15 AND 28 HUNDRED OF GILLEN

Lease Details

Lease Number	OM018374
Lease Type	TERM
Commencing On	01/12/2002
Expiring On	30/11/2020

Conditions

CROWN LEASE CONDITIONS VIDE CL 1600/69

Easements

SUBJECT TO CERTAIN RIGHT(S) AND LIBERTIES OVER PORTIONS OF SECTION 256 AND PORTION OF SECTION

264 BOUNDED BY BOLD BLACK LINES ON PLAN ATTACHED TO S 6311968 (S 6311968)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.

Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

Additional Information

This additional information is provided by the Department of Environment, Water and Natural Resources and does not constitute part of the Crown Leases Register maintained by the Registrar-General. Contact the Department of Environment, Water and Natural Resources to verify the currency of this information and to obtain further details.

Annual Rent

Annual Rent:	$167
Rent Review:	01/12/2017

Product	Register Search (CL 6165/482)
Date/Time	04/12/2017 05:21PM
Customer Reference	DEWNR - Pastoral
Order ID	20171204012337
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

This Crown Lease Register Search is a true and correct extract of the Register of Crown Leases maintained by the Registrar-General.

Pastoral Leases are granted and administered pursuant to the Pastoral Land Management and Conservation Act 1989 by the Department of Environment, Water and Natural Resources.

REGISTRAR - GENERAL SOUTH AUSTRALIA

Crown Lease - Volume 6165 Folio 482

Parent Title(s) CL 1306/19

Creating Dealing(s) RT 12401995

Title Issued 11/11/2015 **Edition** 3 **Edition Issued** 11/11/2015

Estate Type

CROWN LESSEE

Owner

THE CROWN

Crown Lessee

COMMONWEALTH OF AUSTRALIA
OF ADELAIDE SA 5000

Description of Land

SECTIONS 4 AND 8
HUNDRED OF GILLEN
IN THE AREA NAMED CULTANA

TOTAL AREA: 4510HA (APPROXIMATE)

Lease Details

Lease Number	PE002366
Lease Type	PASTORAL
Commencing On	07/03/1990
Expiring On	22/07/2054

Conditions

CROWN LEASE CONDITIONS VIDE CL 1306/19

Easements

NIL

Schedule of Dealings

Dealing Number	Description
11900518	LEASE COMMENCING ON 17/10/2012 AND EXPIRING ON 21/7/2054 TO TRANSMISSION LESSOR CORPORATION (SUBJECT TO LEASE 9061500) AND ELECTRANET PTY. LTD. AS TO THE SHARES SPECIFIED THEREIN OF AN EASEMENT OVER PORTION OF THE WITHIN LAND (B IN F29855)

Notations

Dealings Affecting Title NIL

Priority Notices NIL

Registrar-General's Notes

APPROVED FX55163

Administrative Interests NIL

Additional Information

This additional information is provided by the Department of Environment, Water and Natural Resources and does not constitute part of the Crown Leases Register maintained by the Registrar-General. Contact the Department of Environment, Water and Natural Resources to verify the currency of this information and to obtain further details.

Related Leases

Related Leases:

Maximum Stocking Rate: NIL stocking Rate Conservation Purposes

Annual Rent

Annual Rent: $370

Rent Review: Rent to be review no later than Unknown

Product	Register Search
Date/Time	24/02/2017 11:17AM
Customer Reference	LG03
Order ID	20170224004768
Cost	$27.75

Government of South Australia
Department of Planning, Transport and Infrastructure

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Registrar-General

Certificate of Title - Volume 6138 Folio 331

REAL PROPERTY ACT, 1886
South Australia

Parent Title(s)	CT 5179/927
Dealing(s) Creating Title	DDA 12113954
Title Issued	27/05/2014
Edition	1
Edition Issued	27/05/2014

Estate Type

FEE SIMPLE

Registered Proprietor

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF 1ST FLOOR 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

ALLOTMENT COMPRISING PIECES 1, 2, 3 AND 4 DEPOSITED PLAN 37168
IN THE AREA NAMED LINCOLN GAP
HUNDRED OF HANDYSIDE

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO HER MAJESTY THE QUEEN (AS 2861764)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED D AND E TO THE ELECTRICITY TRUST OF SOUTH AUSTRALIA (TG 7065720 AND RE 7609633 RESPECTIVELY)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED B AND C TO THE PIPELINES AUTHORITY OF SOUTH AUSTRALIA (TG 6328754 AND TG 6328755 RESPECTIVELY)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.
12534875	CAVEAT BY LINCOLN GAP WIND FARM PTY. LTD. (ACN: 133 372 595)

Notations

Dealings Affecting Title

NIL

Priority Notices

NIL

Notations on Plan

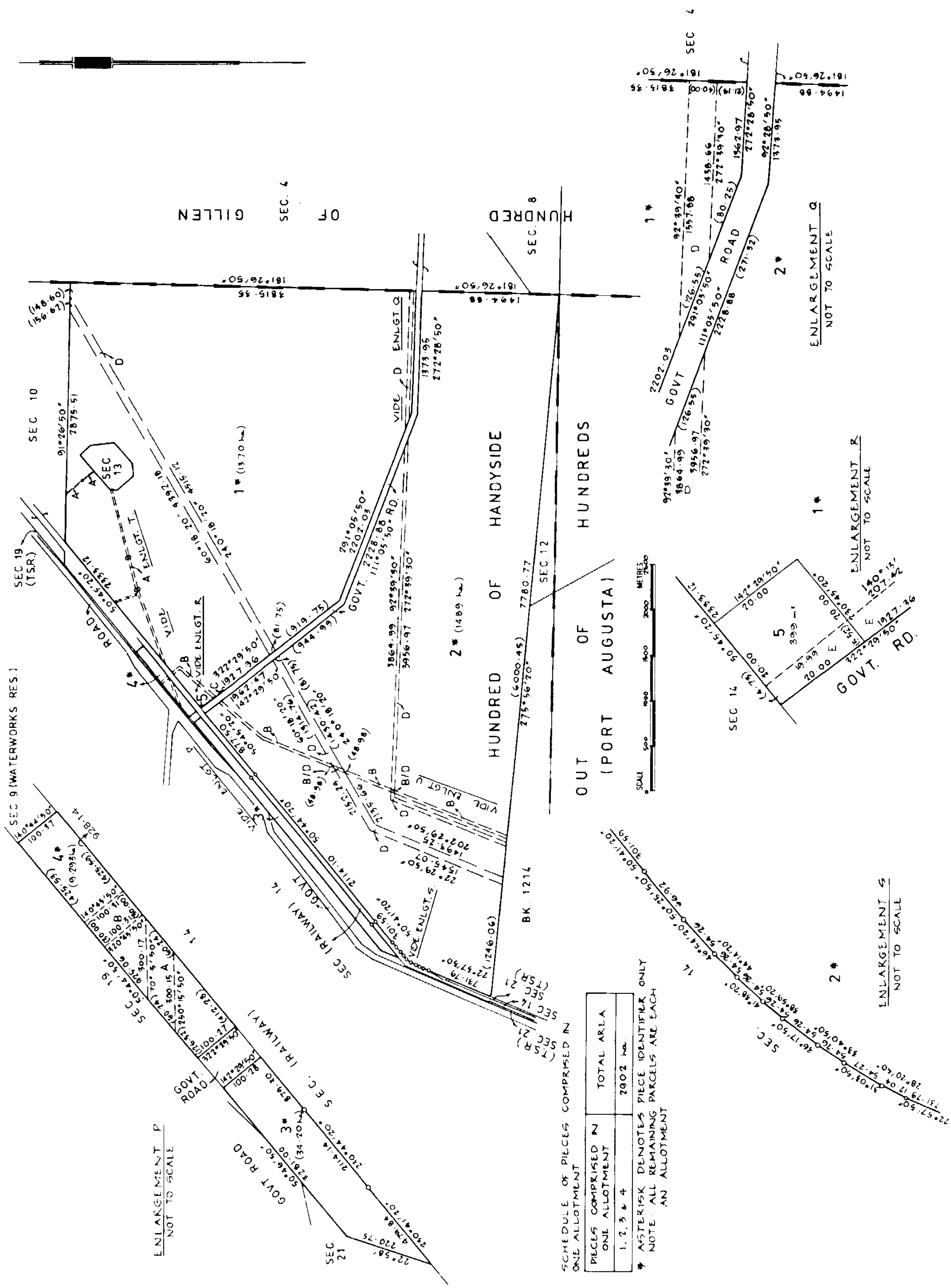
NIL

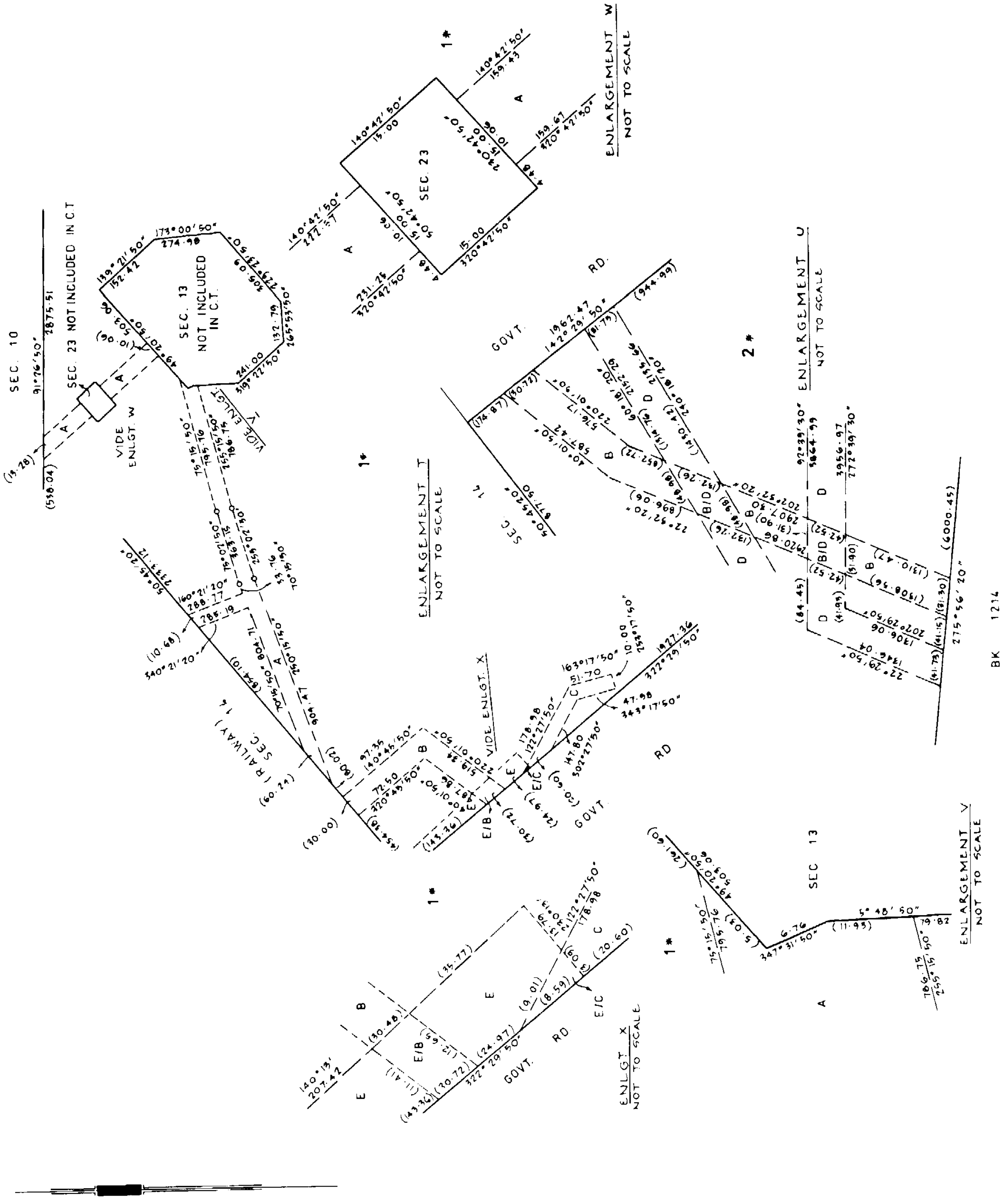
Registrar-General's Notes

NIL

Administrative Interests

NIL


HUNDRED OF HANDYSIDE
OUT OF HUNDREDS (PORT AUGUSTA)
ENLARGEMENT Q NOT TO SCALE
ENLARGEMENT R NOT TO SCALE
ENLARGEMENT S NOT TO SCALE
ENLARGEMENT P NOT TO SCALE
GOVT. ROAD
SEC 9 (WATERWORKS RES.)
SCHEDULE OF PIECES COMPRISED IN ONE ALLOTMENT
PIECES COMPRISED IN ONE ALLOTMENT
TOTAL AREA
1, 2, 3 & 4
2902 ha
* ASTERISK DENOTES PIECE IDENTIFIER ONLY
NOTE: ALL REMAINING PARCELS ARE EACH AN ALLOTMENT



Product	Register Search
Date/Time	24/02/2017 11:05AM
Customer Reference	LG02
Order ID	20170224004373
Cost	$27.75

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Registrar-General

Certificate of Title - Volume 6138 Folio 334

REAL PROPERTY ACT, 1886
South Australia

Parent Title(s)	CT 5270/320
Dealing(s) Creating Title	DDA 12113954
Title Issued	27/05/2014
Edition	1
Edition Issued	27/05/2014

Estate Type

FEE SIMPLE

Registered Proprietor

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF 1ST FLOOR 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

SECTION 313
HUNDRED OF COPLEY
IN THE AREA NAMED LINCOLN GAP

SECTION 4
HUNDRED OF HANDYSIDE
IN THE AREA NAMED LINCOLN GAP

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO THE PIPELINES AUTHORITY OF SOUTH AUSTRALIA (T 6328754)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.
12534875	CAVEAT BY LINCOLN GAP WIND FARM PTY. LTD. (ACN: 133 372 595)

Notations

Dealings Affecting Title

NIL

Priority Notices

NIL

Notations on Plan

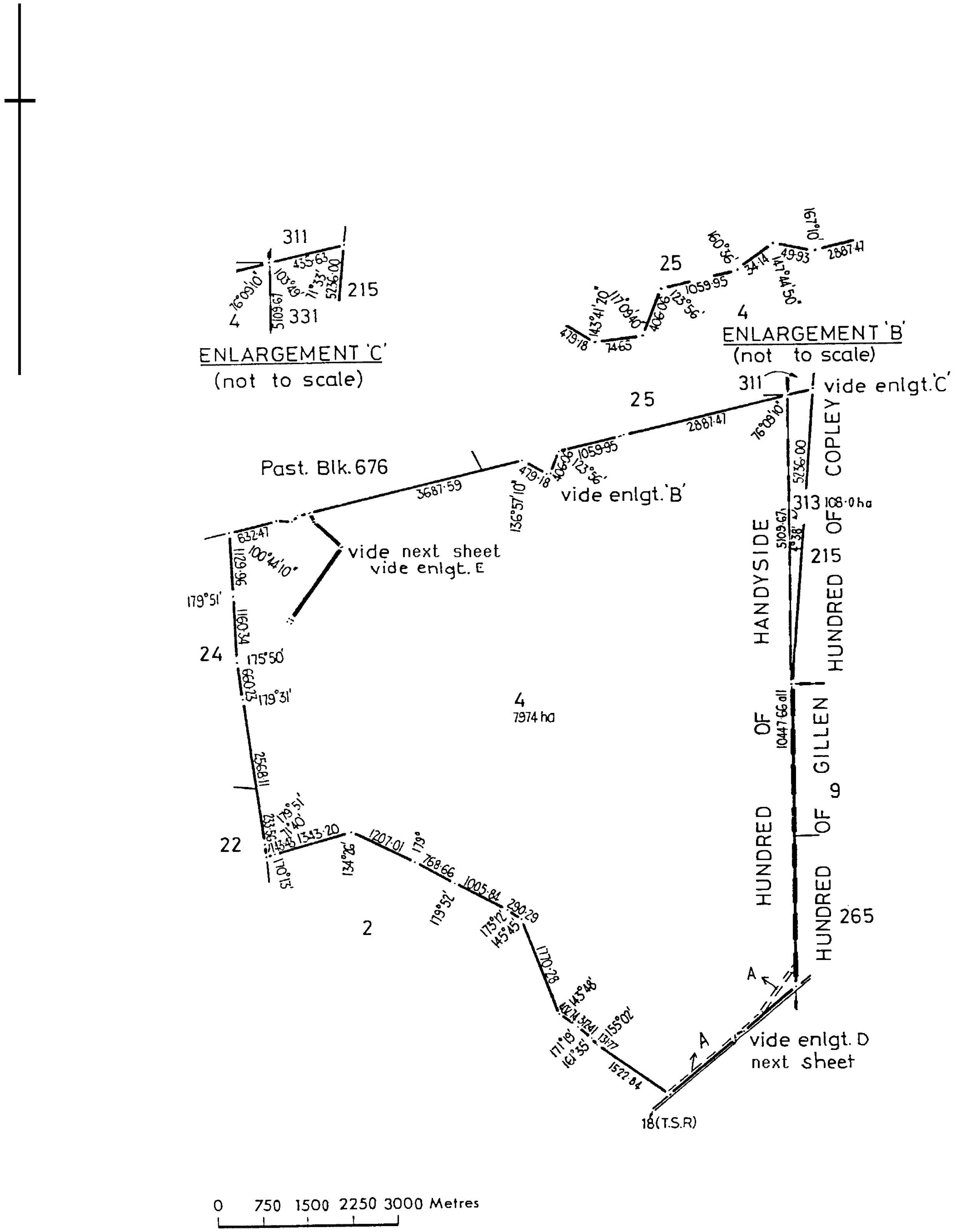
NIL

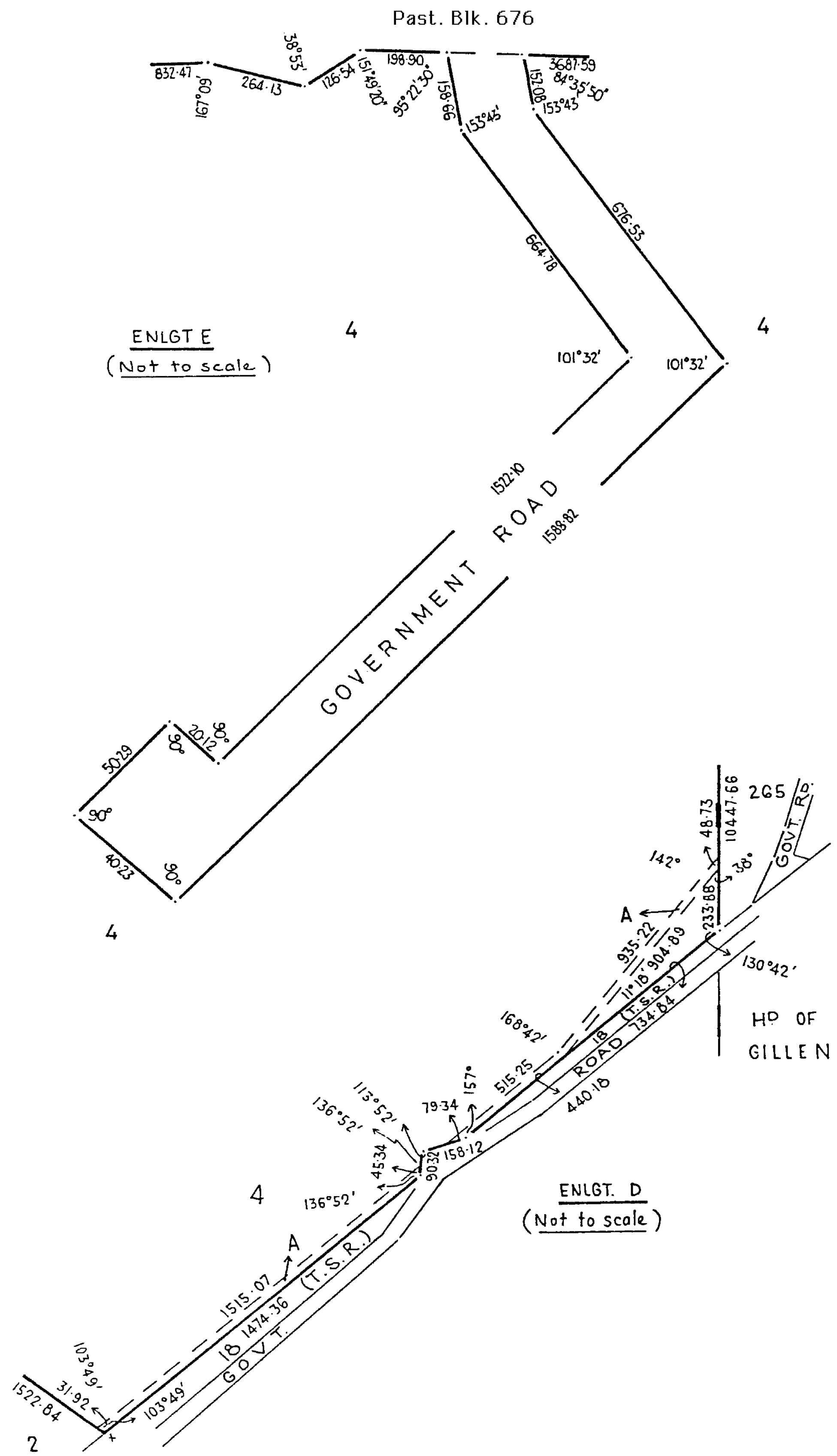
Registrar-General's Notes

NIL

Administrative Interests

NIL


ENLARGEMENT 'C'
(not to scale)
ENLARGEMENT 'B'
(not to scale)
Past. Blk. 676
vide next sheet
vide enlgt. E
vide enlgt. 'B'
vide enlgt. 'C'
vide enlgt. D
next sheet
HUNDRED OF COPLEY
HUNDRED OF HANDYSIDE
HUNDRED OF GILLEN
313 108·0 ha
4
7974 ha
18 (T.S.R)
0 750 1500 2250 3000 Metres


Past. Blk. 676
832·47
167°09'
264·13
38°53'
126·54
151°49'20"
198·90
95°22'30"
158·66
153°45'
3687·59
84°35'50"
157·08
153°43'
676·53
664·78
ENLGT E
(Not to scale)
4
101°32'
101°32'
4
1522·10
1588·82
GOVERNMENT ROAD
50·29
20·12
90°
90°
90°
40·23
90°
4
265
GOVT. RD.
10447·66
48·73
142°
38°
233·88
A
935·22
11°18' 904·89
(T.S.R.)
130°42'
HD OF GILLEN
168°42'
18 ROAD 734·84
515·25
440·18
157°
79·34
158·12
113°52'
136°52'
45·34
90·32
ENLGT. D
(Not to scale)
4
136°52'
A
1515·07
18 1474·36 (T.S.R.)
GOVT.
103°49'
103°49'
31·92
1522·84
2

REAL PROPERTY ACT, 1886

South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

REGISTRAR - GENERAL SOUTH AUSTRALIA

Certificate of Title - Volume 5983 Folio 539

Parent Title(s) CT 4388/653

Creating Dealing(s) RTC 10581428

Title Issued 27/03/2007 **Edition** 1 **Edition Issued** 27/03/2007

Estate Type

FEE SIMPLE

Registered Proprietor

AUSTRALIAN RAIL TRACK CORPORATION LTD. (ACN: 081 455 754)
OF OFF SIR DONALD BRADMAN DRIVE MILE END SA 5031

Description of Land

ALLOTMENT 22 DEPOSITED PLAN 67645
IN THE AREA NAMED LINCOLN GAP
HUNDREDS OF GILLEN AND HANDYSIDE

Easements

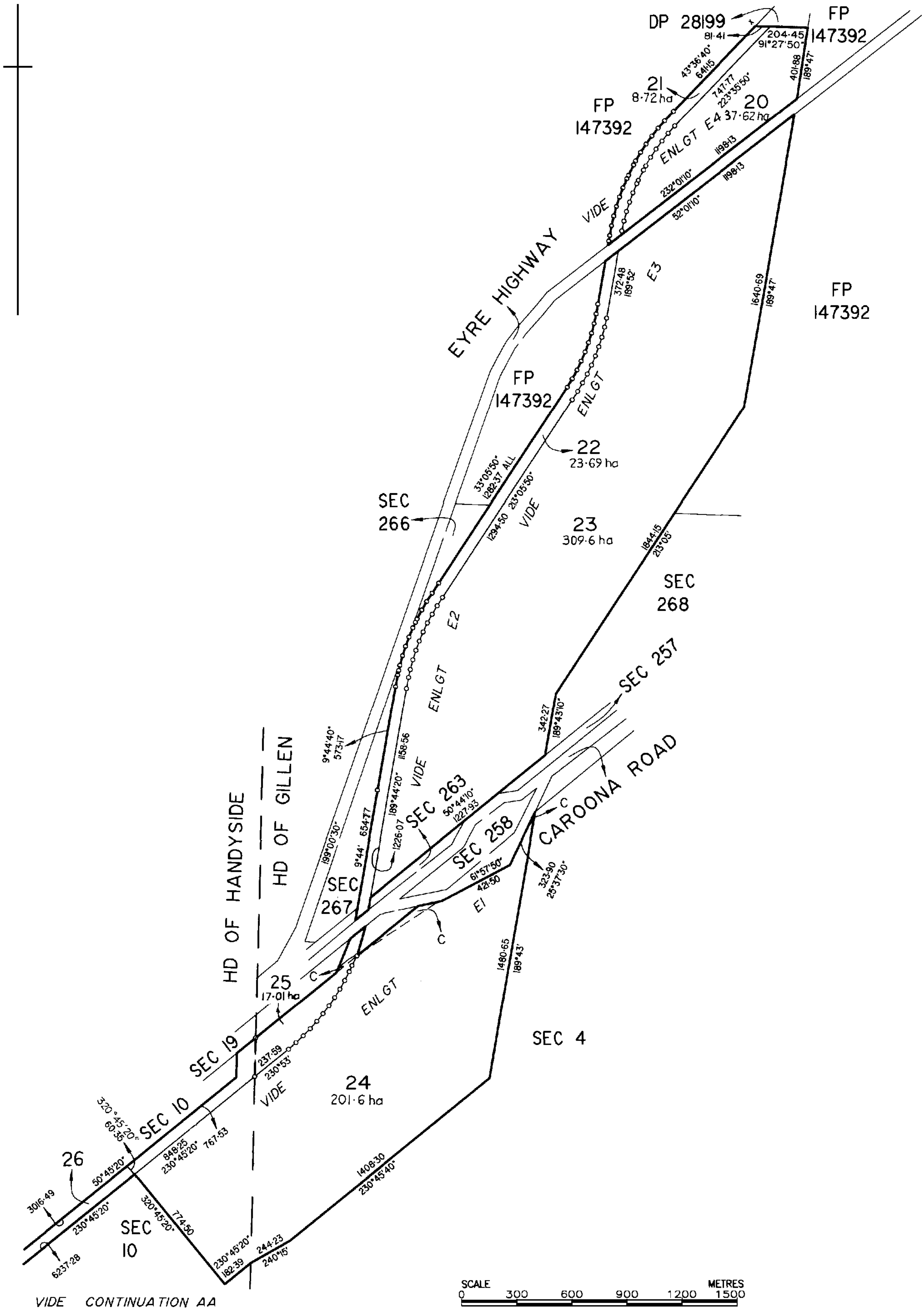
NIL

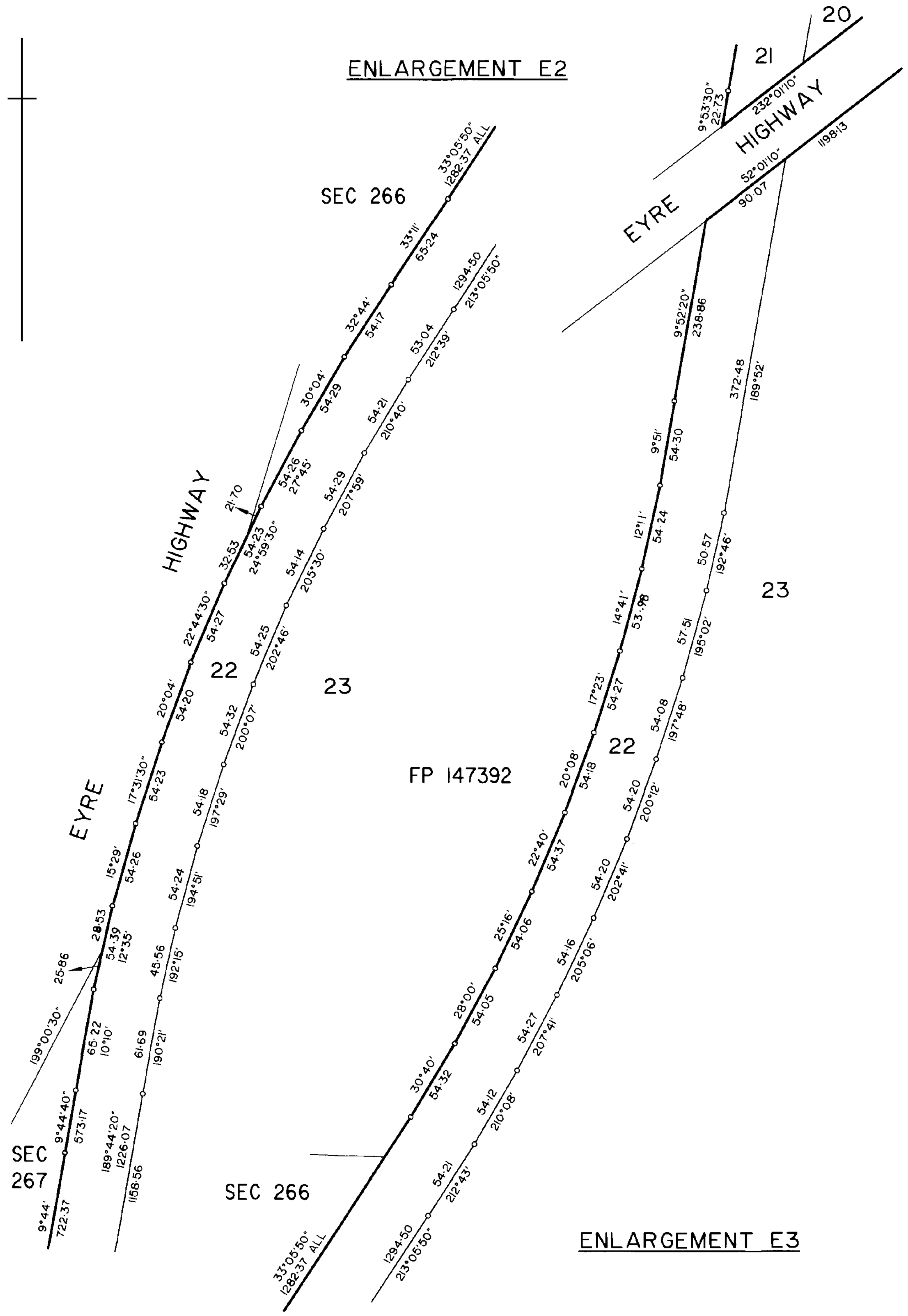
Schedule of Dealings

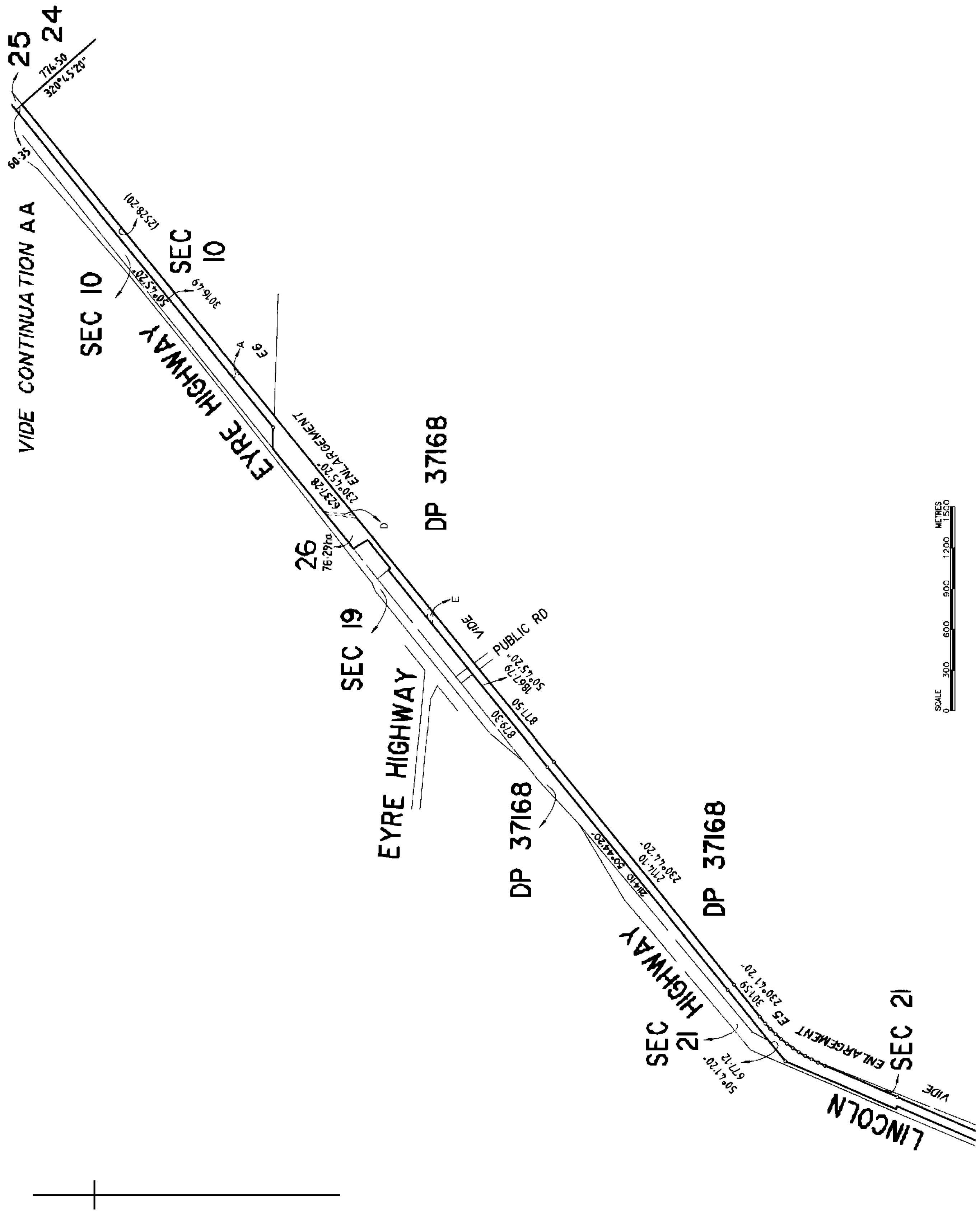
NIL

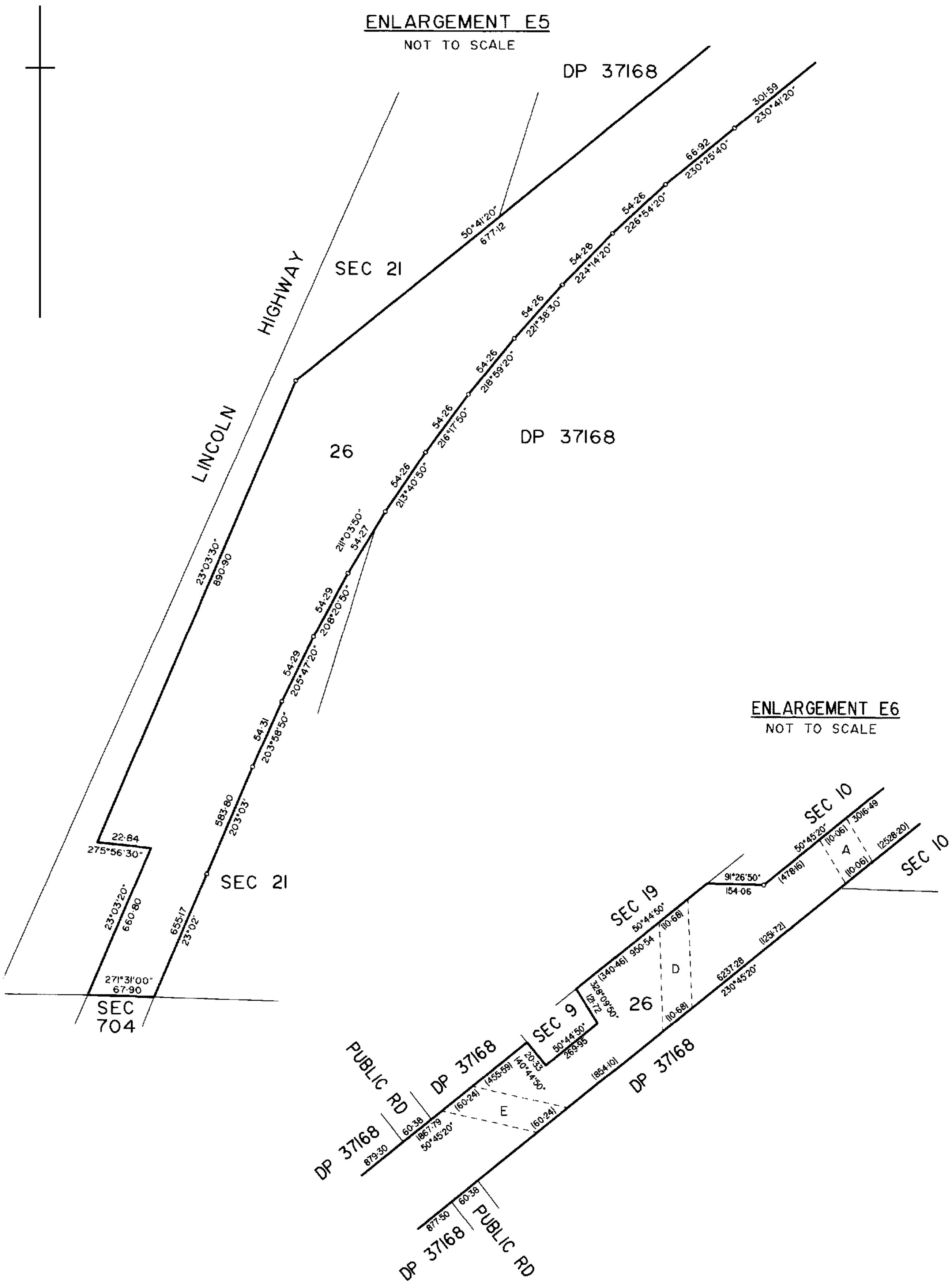
Notations

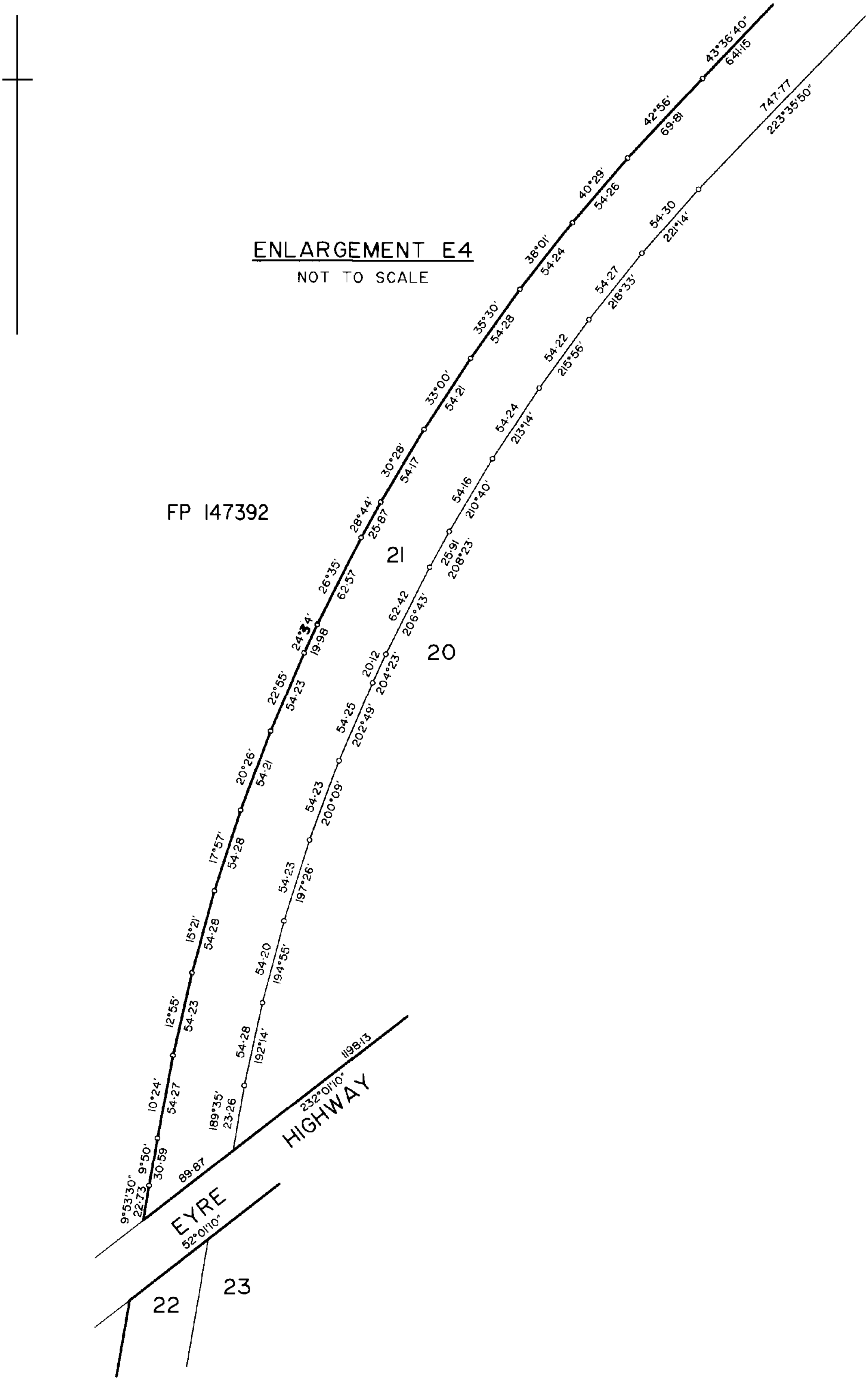
Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

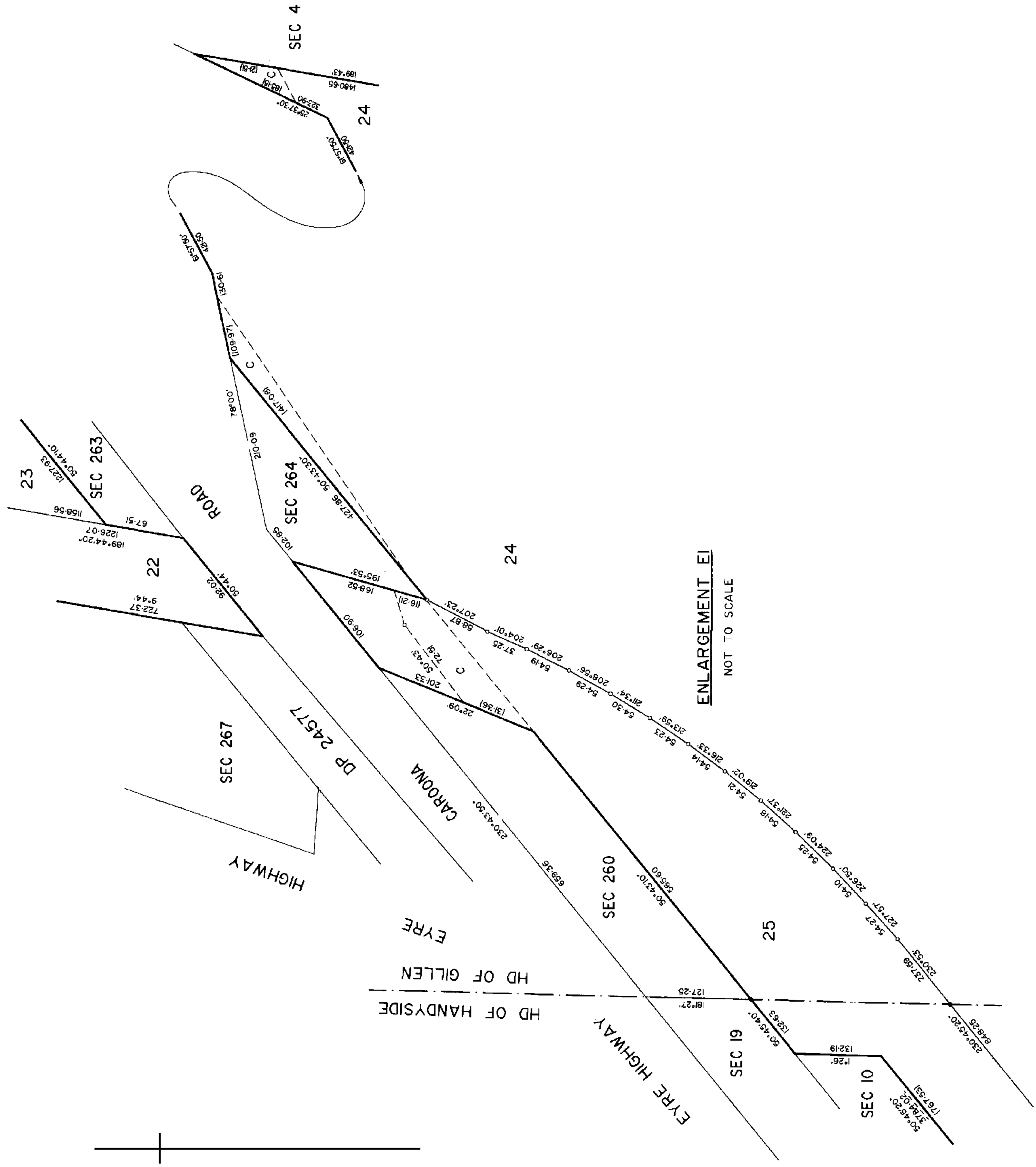

DP 28199
FP 147392
21
8·72 ha
20
37·62 ha
EYRE HIGHWAY
VIDE
ENLGT
E4
E3
E2
E1
22
23·69 ha
23
309·6 ha
SEC 266
SEC 268
SEC 257
SEC 263
SEC 258
SEC 267
CAROONA ROAD
HD OF HANDYSIDE
HD OF GILLEN
25
17·01 ha
SEC 19
SEC 10
26
24
201·6 ha
SEC 4
VIDE CONTINUATION AA
SCALE
METRES
0 300 600 900 1200 1500


ENLARGEMENT E2
SEC 266
EYRE
HIGHWAY
22
23
FP 147392
SEC 267
SEC 266
21
20
EYRE
HIGHWAY
23
22
ENLARGEMENT E3


25
24
774.50
320°45'20"
60.35
VIDE CONTINUATION A A
SEC 10
SEC 10
EYRE HIGHWAY
ENLARGEMENT
DP 37168
26
76.29ha
SEC 19
VIDE
PUBLIC RD
EYRE HIGHWAY
DP 37168
DP 37168
HIGHWAY
SEC 21
ENLARGEMENT
SEC 21
VIDE
LINCOLN
SCALE
METRES
0
300
600
900
1200
1500


ENLARGEMENT E5
NOT TO SCALE
DP 37168
SEC 21
LINCOLN HIGHWAY
26
DP 37168
SEC 21
SEC 704
50°41'20"
677·12
301·59
230°41'20"
66·92
230°25'40"
54·26
226°54'20"
54·28
224°14'20"
54·26
221°38'30"
54·26
218°59'20"
54·26
216°17'50"
54·26
213°40'50"
211°03'50"
54·27
23°03'30"
890·90
54·29
208°20'50"
54·29
205°47'20"
54·31
203°58'50"
583·80
203°03'
22·84
275°56'30"
23°03'20"
660·80
655·17
23°02'
271°31'00"
67·90
ENLARGEMENT E6
NOT TO SCALE
SEC 10
SEC 10
SEC 19
SEC 9
26
D
A
E
91°26'50"
154·06
50°45'20"
(478·16)
(10·06)
3016·49
(10·06)
(2528·20)
50°44'50"
950·54
(10·68)
(340·46)
328°09'50"
121·72
(10·68)
(1251·72)
6237·28
230°45'20"
50°44'50"
269·95
(854·10)
20·33
140°44'50"
(455·59)
(60·24)
(60·24)
1867·79
50°45'20"
60·38
879·30
DP 37168
DP 37168
DP 37168
DP 37168
PUBLIC RD
PUBLIC RD
877·50
60·38


ENLARGEMENT E4
NOT TO SCALE
FP 147392
21
20
22
23
EYRE
HIGHWAY
232°01'10"
1198·13
52°01'10"
89·87
747·77
223°35'50"
43°36'40"
64·15
42°56'
69·81
40°29'
54·26
38°01'
54·24
35°30'
54·28
33°00'
54·21
30°28'
54·17
28°44'
25·87
26°35'
62·57
24°34'
19·98
22°55'
54·23
20°26'
54·21
17°57'
54·28
15°21'
54·28
12°55'
54·23
10°24'
54·27
9°50'
30·59
9°53'30"
22·73
54·30
221°14'
54·27
218°33'
54·22
215°56'
54·24
213°14'
54·16
210°40'
25·91
208°23'
62·42
206°43'
20·12
204°23'
54·25
202°49'
54·23
200°09'
54·23
197°26'
54·20
194°55'
54·28
192°14'
189°35'
23·26



SEC 4
24
SEC 263
23
22
ROAD
SEC 264
SEC 267
DP 24577
CAROONA
HIGHWAY
EYRE
SEC 260
25
ENLARGEMENT E1
NOT TO SCALE
HD OF GILLEN
HD OF HANDYSIDE
EYRE HIGHWAY
SEC 19
SEC 10

Product	Register Search (CT 5983/540)
Date/Time	04/12/2017 05:53PM
Customer Reference	CT 5983 540 - DPTI
Order ID	20171204012542
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 5983 Folio 540

Parent Title(s)	CT 4388/653				
Creating Dealing(s)	RTC 10581428				
Title Issued	27/03/2007	**Edition**	2	**Edition Issued**	31/05/2012

Estate Type

FEE SIMPLE

Registered Proprietor

MINISTER FOR TRANSPORT AND INFRASTRUCTURE
OF ADELAIDE SA 5000

Description of Land

ALLOTMENT 23 DEPOSITED PLAN 67645
IN THE AREA NAMED LINCOLN GAP
HUNDREDS OF GILLEN AND HANDYSIDE

Easements

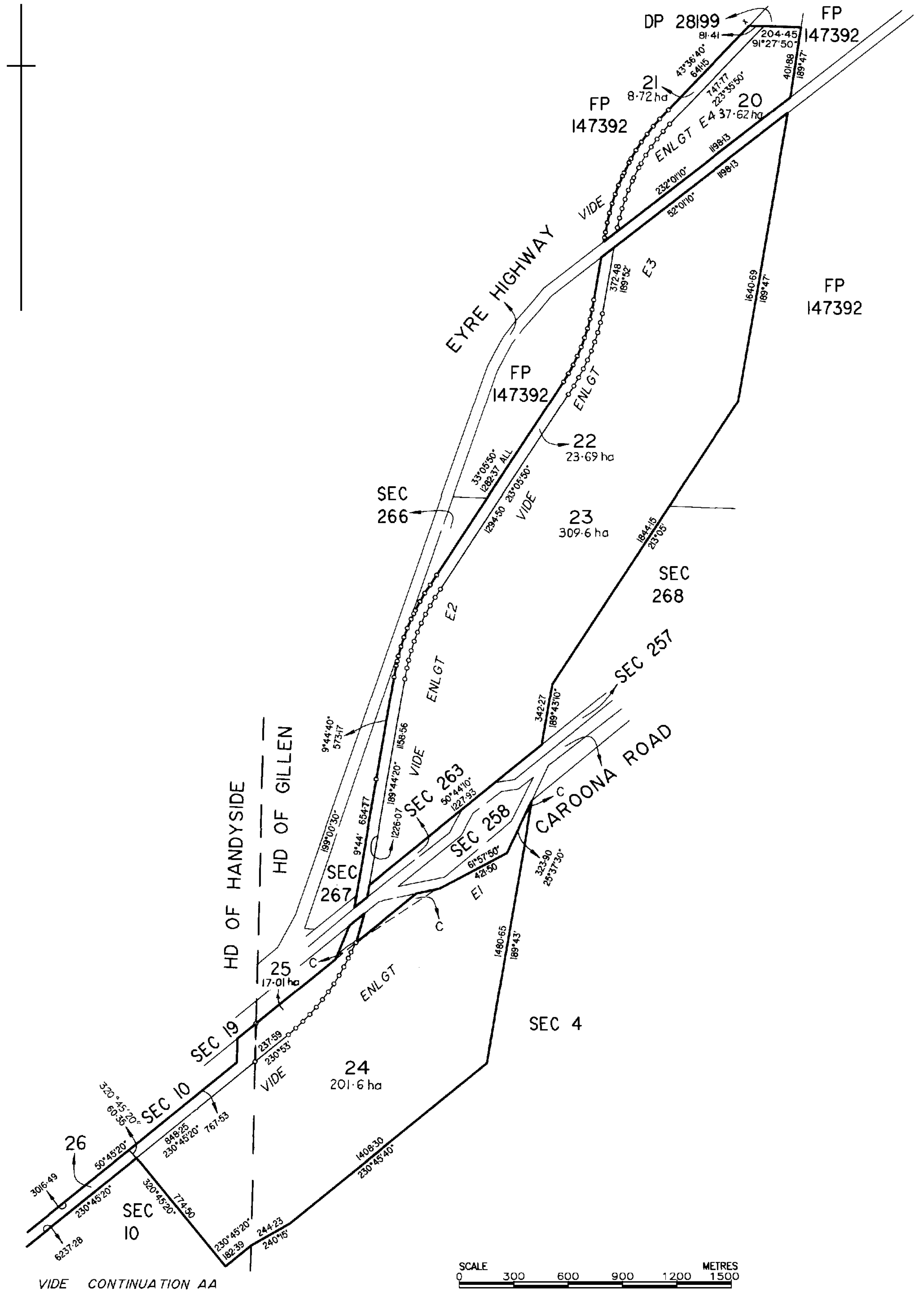
NIL

Schedule of Dealings

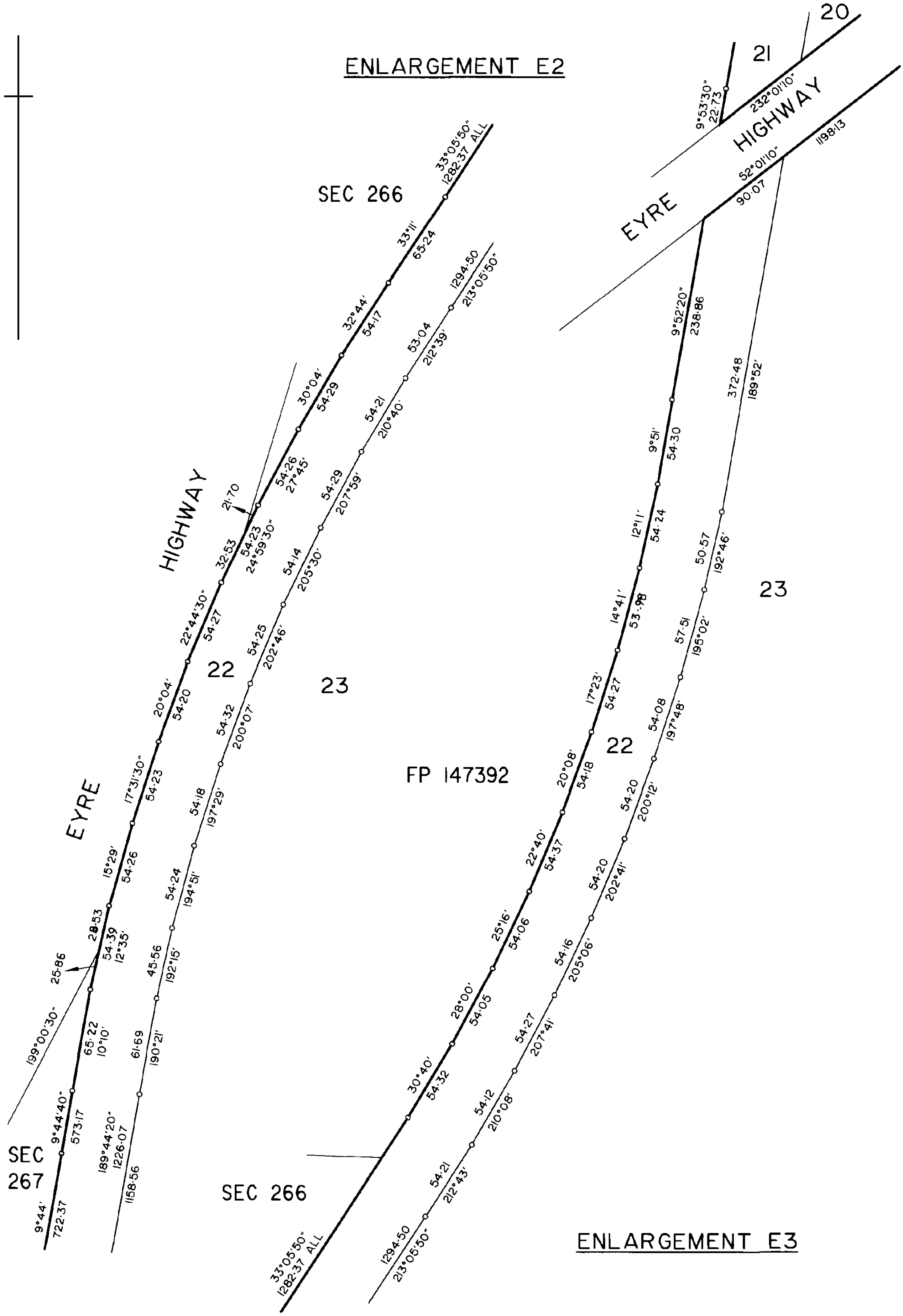
NIL

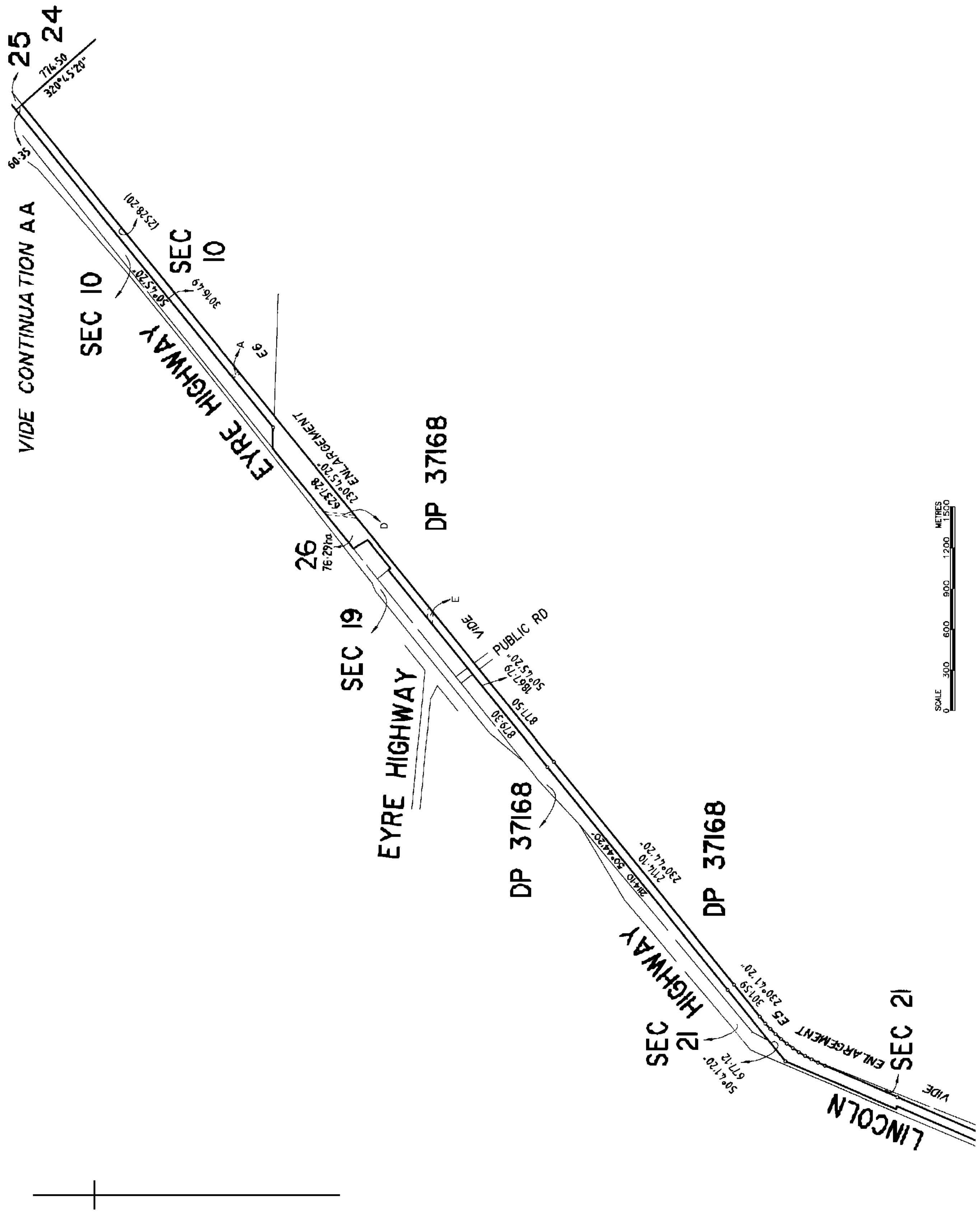
Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

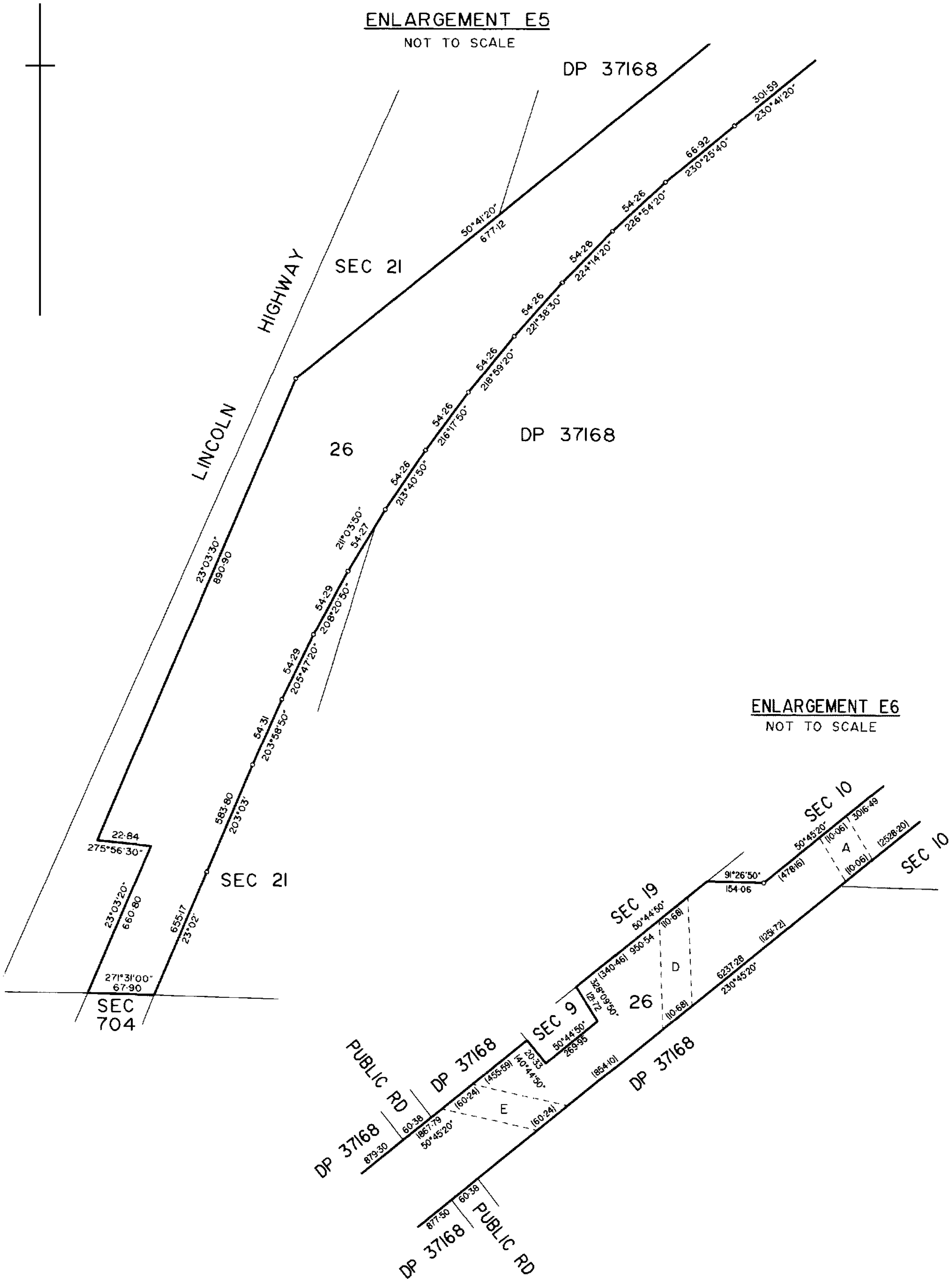

DP 28199
FP 147392
21
8·72 ha
20
37·62 ha
E4
ENLGT
VIDE
EYRE HIGHWAY
E3
FP 147392
ENLGT
22
23·69 ha
SEC 266
23
309·6 ha
SEC 268
E2
ENLGT
SEC 257
VIDE
SEC 263
CAROONA ROAD
SEC 258
HD OF HANDYSIDE
HD OF GILLEN
SEC 267
E1
25
17·01 ha
ENLGT
SEC 4
SEC 19
24
201·6 ha
VIDE
SEC 10
26
SEC 10
VIDE CONTINUATION AA
SCALE
METRES
0 300 600 900 1200 1500

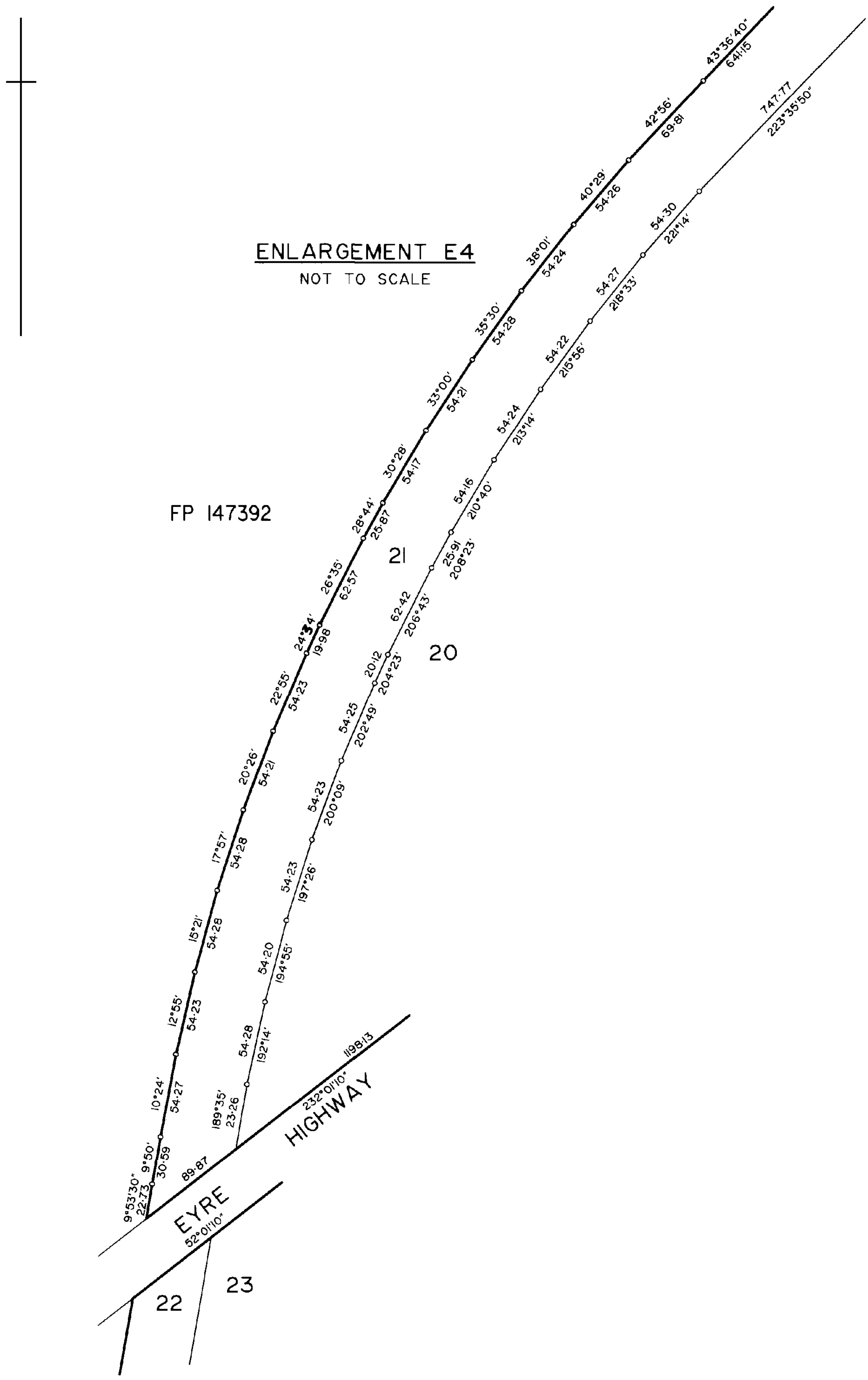
Product	Register Search (CT 5983/540)
Date/Time	04/12/2017 05:53PM
Customer Reference	CT 5983 540 - DPTI
Order ID	20171204012542
Cost	$28.25




25
24
774.50
320°45'20"
60.35
VIDE CONTINUATION A A
SEC 10
SEC 10
EYRE HIGHWAY
ENLARGEMENT
DP 37168
26
SEC 19
EYRE HIGHWAY
VIDE
PUBLIC RD
DP 37168
DP 37168
HIGHWAY
SEC 21
ENLARGEMENT
SEC 21
VIDE
LINCOLN

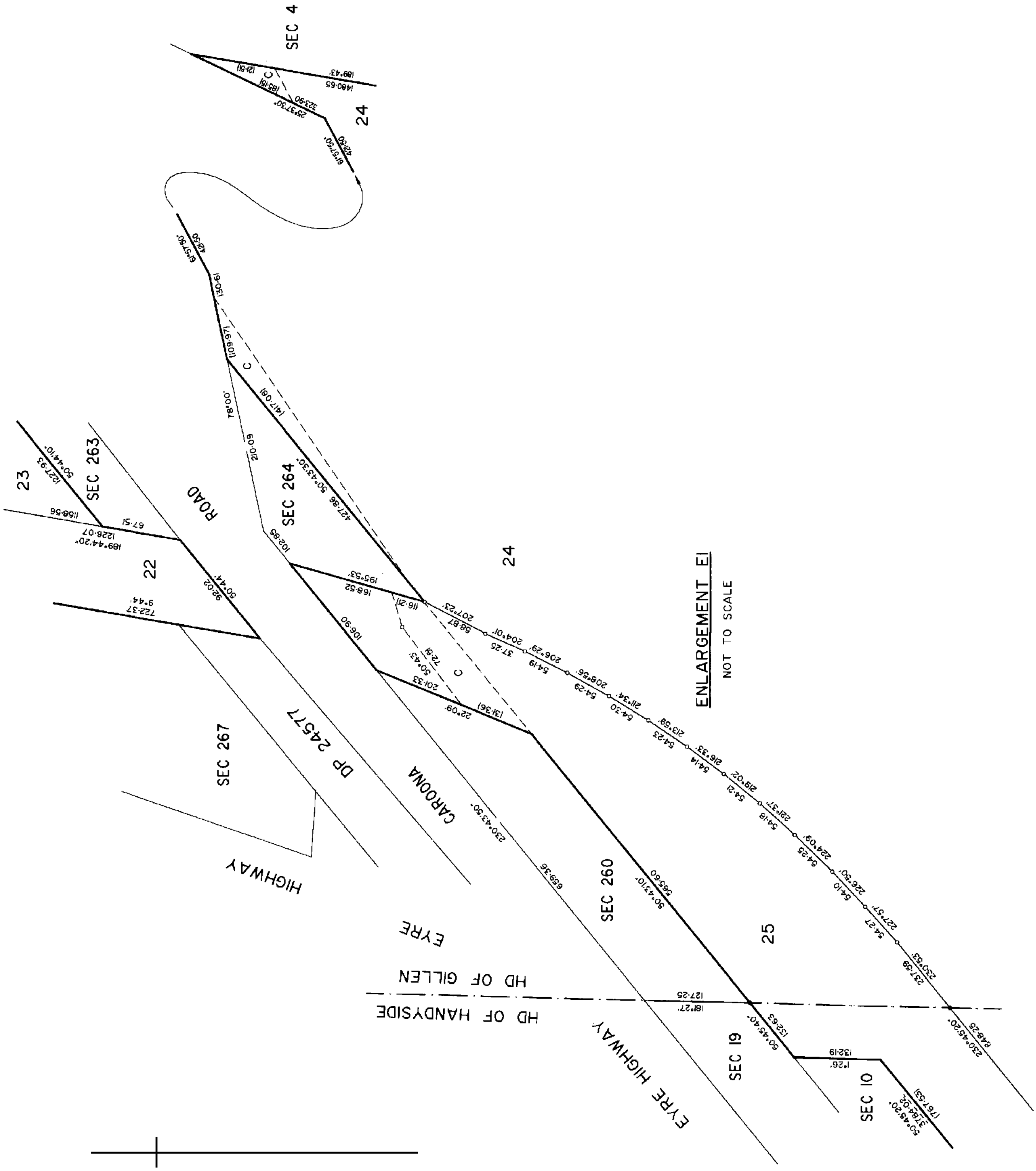
Product	Register Search (CT 5983/540)
Date/Time	04/12/2017 05:53PM
Customer Reference	CT 5983 540 - DPTI
Order ID	20171204012542
Cost	$28.25




ENLARGEMENT E4
NOT TO SCALE
FP 147392
21
20
22
23
EYRE HIGHWAY
43°36'40"
64·15
42°56'
69·81
40°29'
54·26
38°01'
54·24
35°30'
54·28
33°00'
54·21
30°28'
54·17
28°44'
25·87
26°35'
62·57
24°34'
19·98
22°55'
54·23
20°26'
54·21
17°57'
54·28
15°21'
54·28
12°55'
54·23
10°24'
54·27
9°50'
30·59
9°53'30"
22·73
89·87
747·77
223°35'50"
54·30
221°14'
54·27
218°33'
54·22
215°56'
54·24
213°14'
54·16
210°40'
25·91
208°23'
62·42
206°43'
20·12
204°23'
54·25
202°49'
54·23
200°09'
54·23
197°26'
54·20
194°55'
54·28
192°14'
189°35'
23·26
1198·13
232°01'10"
52°01'10"

Government of South Australia
Department of Planning, Transport and Infrastructure

Product	Register Search (CT 5983/540)
Date/Time	04/12/2017 05:53PM
Customer Reference	CT 5983 540 - DPTI
Order ID	20171204012542
Cost	$28.25



Product	Register Search (CL 6200/133)
Date/Time	04/12/2017 05:48PM
Customer Reference	CT 5983 541 - DPTI
Order ID	20171204012515
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

This Crown Lease Register Search is a true and correct extract of the Register of Crown Leases maintained by the Registrar-General.

Crown Leases are granted and administered pursuant to the Crown Land Management Act 2009 by the Department of Environment, Water and Natural Resources.

REGISTRAR - GENERAL SOUTH AUSTRALIA

Crown Lease - Volume 6200 Folio 133

Parent Title(s) CL 1600/69

Creating Dealing(s) RT 12780447

Title Issued 17/11/2017 **Edition** 1 **Edition Issued** 17/11/2017

Estate Type

CROWN LESSEE

Owner

THE CROWN

Crown Lessee

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF L 1 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

SECTIONS 292 AND 293
HUNDRED OF COPLEY
IN THE AREAS NAMED LINCOLN GAP AND PORT AUGUSTA WEST

SECTION 255
HUNDRED OF GILLEN
IN THE AREAS NAMED LINCOLN GAP AND PORT AUGUSTA WEST

SECTIONS 256, 257, 258, 263 AND 264
HUNDRED OF GILLEN
IN THE AREA NAMED LINCOLN GAP

TOTAL AREA: 161HA (APPROXIMATE)

DIAGRAM BOOK PAGE 9 HUNDRED OF COPLEY
DIAGRAM BOOK PAGES 14, 15 AND 28 HUNDRED OF GILLEN

Lease Details

Lease Number	OM018374
Lease Type	TERM
Commencing On	01/12/2002
Expiring On	30/11/2020

Conditions

CROWN LEASE CONDITIONS VIDE CL 1600/69

Easements

SUBJECT TO CERTAIN RIGHT(S) AND LIBERTIES OVER PORTIONS OF SECTION 256 AND PORTION OF SECTION

264 BOUNDED BY BOLD BLACK LINES ON PLAN ATTACHED TO S 6311968 (S 6311968)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.

Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

Additional Information

This additional information is provided by the Department of Environment, Water and Natural Resources and does not constitute part of the Crown Leases Register maintained by the Registrar-General. Contact the Department of Environment, Water and Natural Resources to verify the currency of this information and to obtain further details.

Annual Rent

Annual Rent:	$167
Rent Review:	01/12/2017

Product	Register Search (CT 6138/332)
Date/Time	04/12/2017 06:15PM
Customer Reference	CT 6138 332 - Nutts
Order ID	20171204012606
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 6138 Folio 332

Parent Title(s)	CT 5270/318				
Creating Dealing(s)	DDA 12113954				
Title Issued	27/05/2014	**Edition**	1	**Edition Issued**	27/05/2014

Estate Type

FEE SIMPLE

Registered Proprietor

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF 1ST FLOOR 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

SECTIONS 265, 266, 267 AND 268
HUNDRED OF GILLEN
IN THE AREA NAMED LINCOLN GAP

Easements

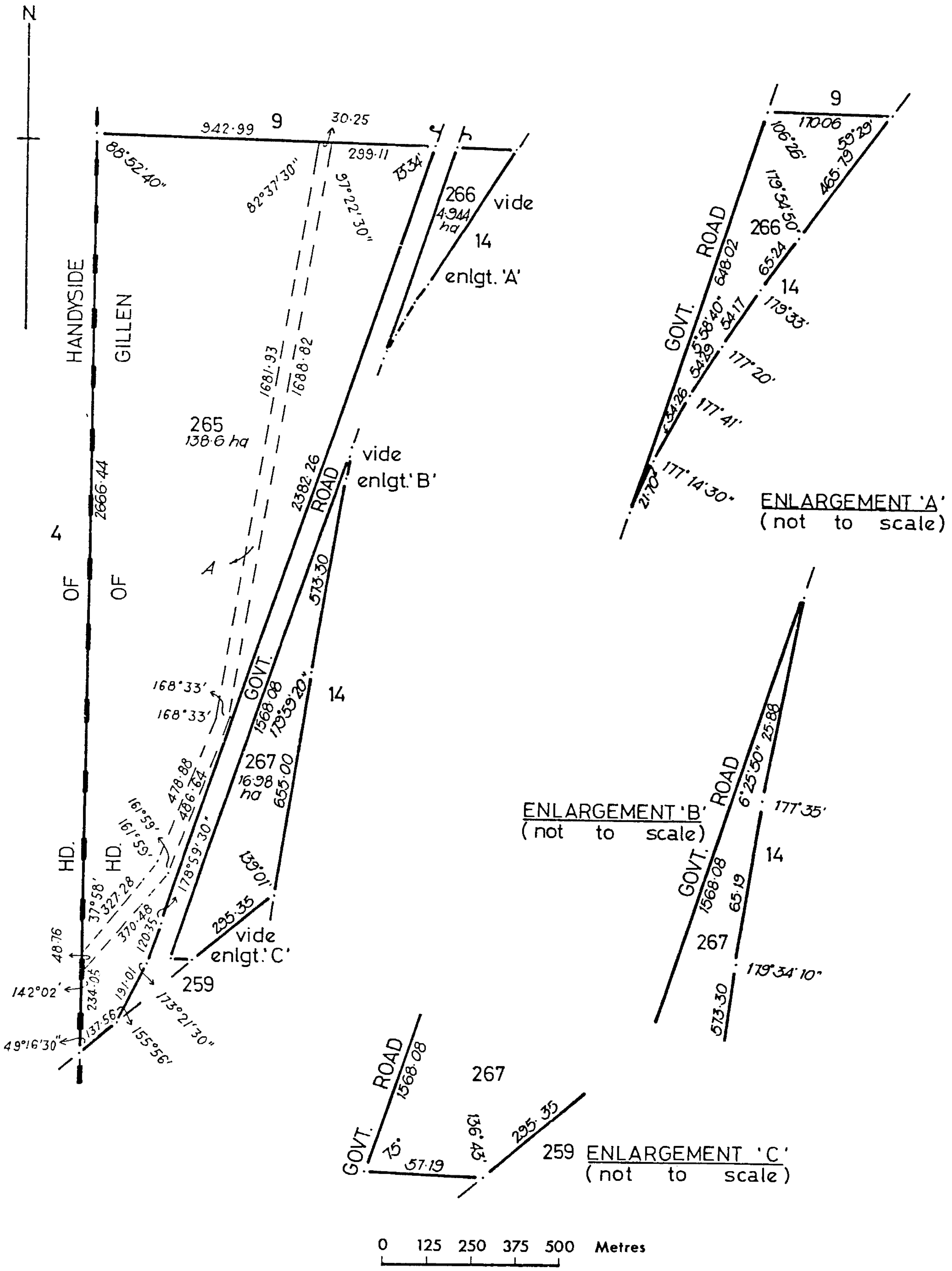
SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO THE PIPELINES AUTHORITY OF SOUTH AUSTRALIA (T 6328754)

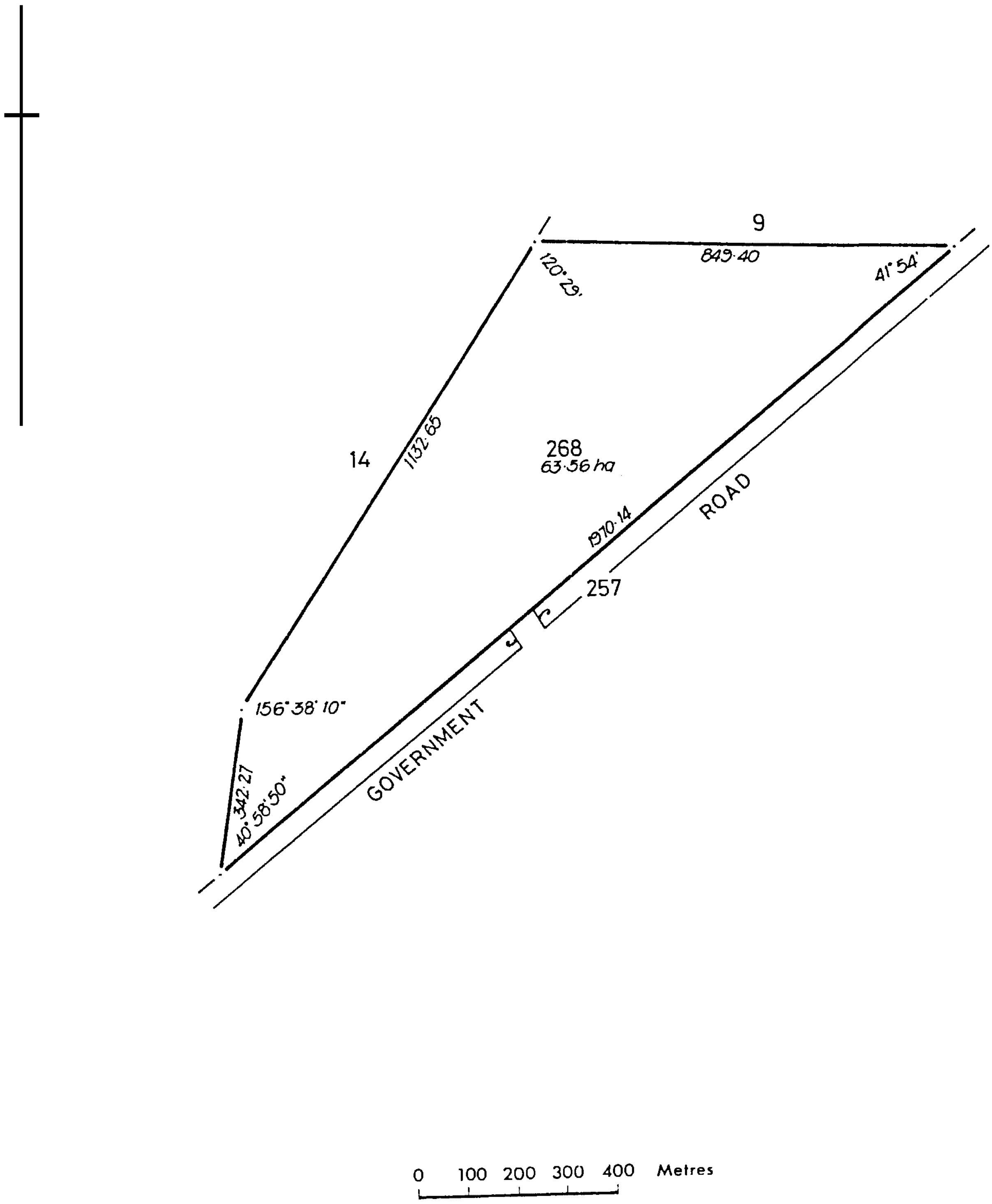
Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.

Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL


N
HANDYSIDE
GILLEN
4
OF
OF
HD.
HD.
9
942·99
30·25
299·11
88°52'40"
82°37'30"
97°22'30"
266
4·944 ha
vide
14
enlgt. 'A'
265
138·6 ha
1681·93
1688·82
2666·44
2382·26
ROAD
GOVT.
vide
enlgt.' B'
573·30
179°59'20"
14
1568·08
267
16·98 ha
655·00
168°33'
168°33'
478·88
486·64
161°55'
161°55'
178°59'30"
139°01'
295·35
vide
enlgt.' C'
259
48·76
142°02'
37°58'
327·28
370·48
120·35
234·05
191·01
137·56
49°16'30"
173°21'30"
155°56'
A
9
170·06
106°26'
59°29'
465·79
179°54'50"
ROAD
266
648·02
65·24
GOVT.
14
179°33'
5°58'40"
54·17
54·29
177°20'
177°41'
34·26
177°14'30"
21·70
ENLARGEMENT 'A'
(not to scale)
ROAD
6°25'50"
25·88
ENLARGEMENT 'B'
(not to scale)
177°35'
GOVT.
1568·08
65·19
14
267
179°34'10"
573·30
ROAD
1568·08
GOVT.
267
75°
57·19
136°43'
295·35
259
ENLARGEMENT 'C'
(not to scale)
0 125 250 375 500 Metres


9
849·40
120°29'
41°54'
14
1132·65
268
63·56 ha
1970·14
ROAD
257
GOVERNMENT
156°38'10"
342·27
40°58'50"
0 100 200 300 400 Metres

Product	Register Search (CT 6138/347)
Date/Time	04/12/2017 06:12PM
Customer Reference	CT 6138 347 - Nutt
Order ID	20171204012602
Cost	$28.25

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 6138 Folio 347

Parent Title(s) CT 5538/822

Creating Dealing(s) DDA 12113954

Title Issued 27/05/2014 **Edition** 1 **Edition Issued** 27/05/2014

Estate Type

FEE SIMPLE

Registered Proprietor

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF 1ST FLOOR 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

ALLOTMENT COMPRISING PIECES 3, 4 AND 5 FILED PLAN 147392
IN THE AREA NAMED LINCOLN GAP
HUNDREDS OF COPLEY AND GILLEN

ALLOTMENT COMPRISING PIECES 6, 7, 8 AND 9 FILED PLAN 147392
IN THE AREA NAMED LINCOLN GAP
HUNDREDS OF COPLEY AND GILLEN

PIECES 3.4 AND 5 FORM ONE ALLOTMENT
PIECES 6.7.8 AND 9 FORM ONE ALLOTMENT

Easements

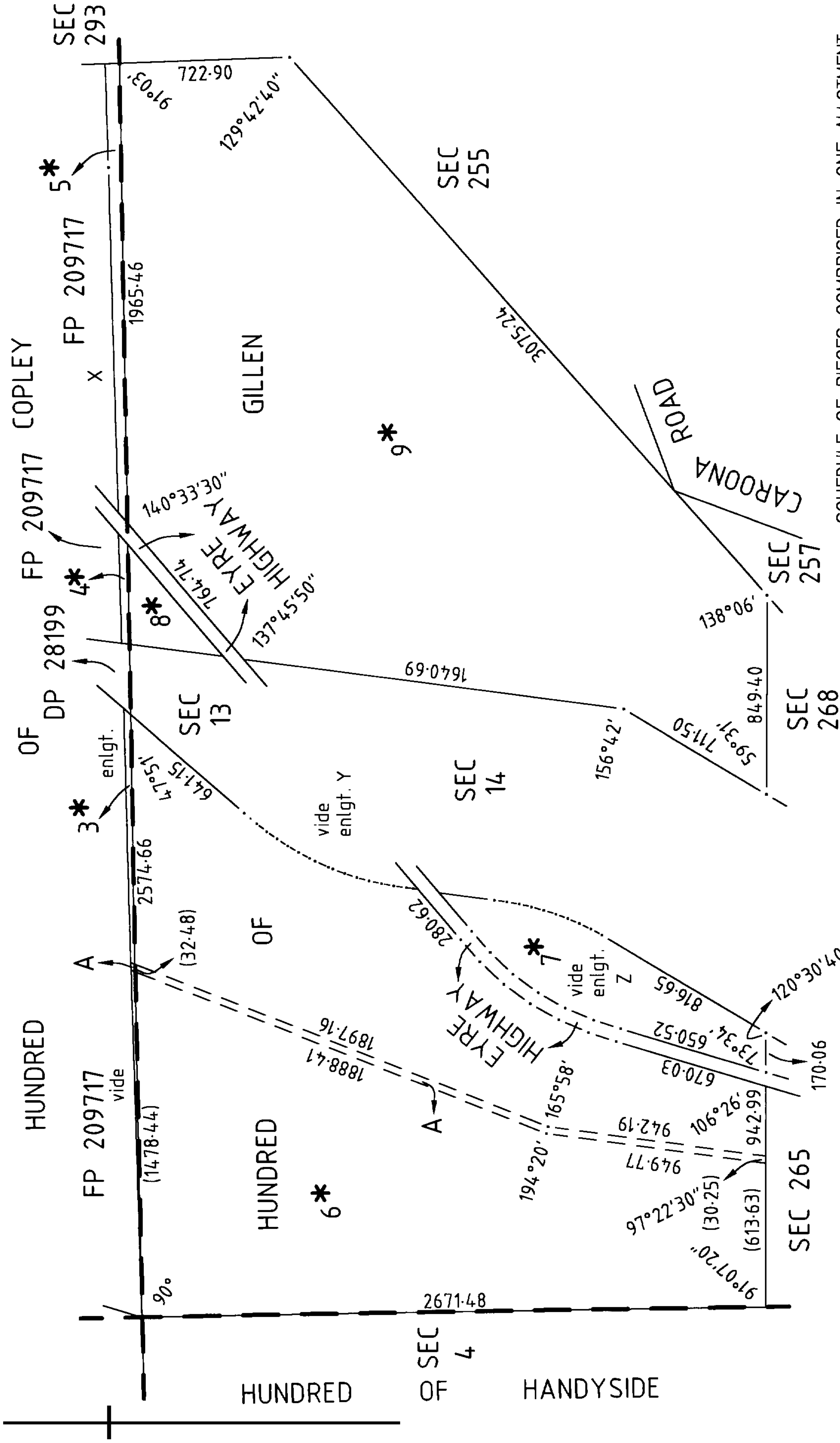
SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO THE PIPELINES AUTHORITY OF SOUTH AUSTRALIA (TG 6135622)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.

Notations

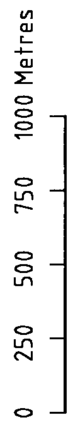
Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

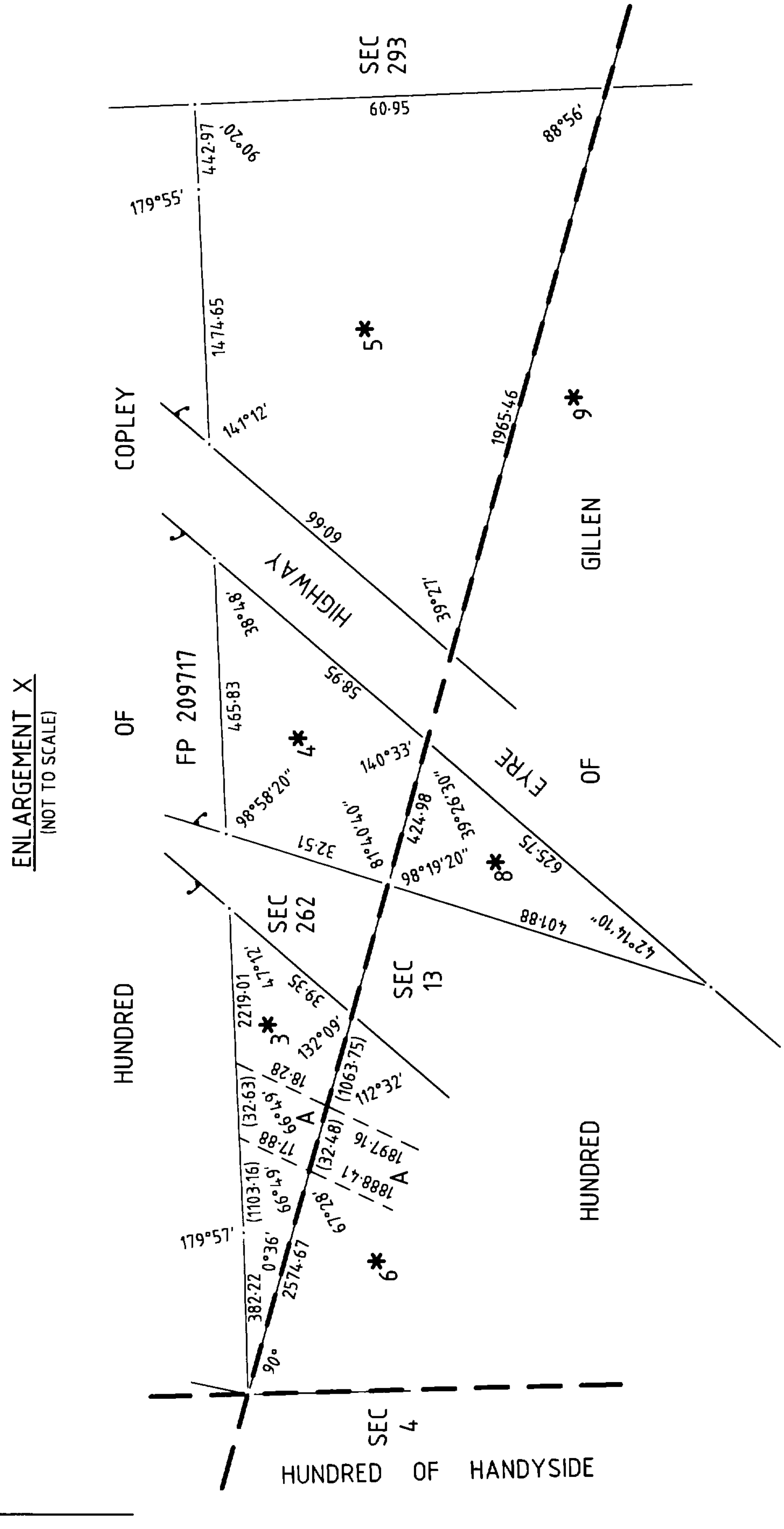


SCHEDULE OF PIECES COMPRISED IN ONE ALLOTMENT

PIECES COMPRISED IN ONE ALLOTMENT	TOTAL AREA
3,4,&5	14·84 ha
6,7,8,&9	982·3 ha

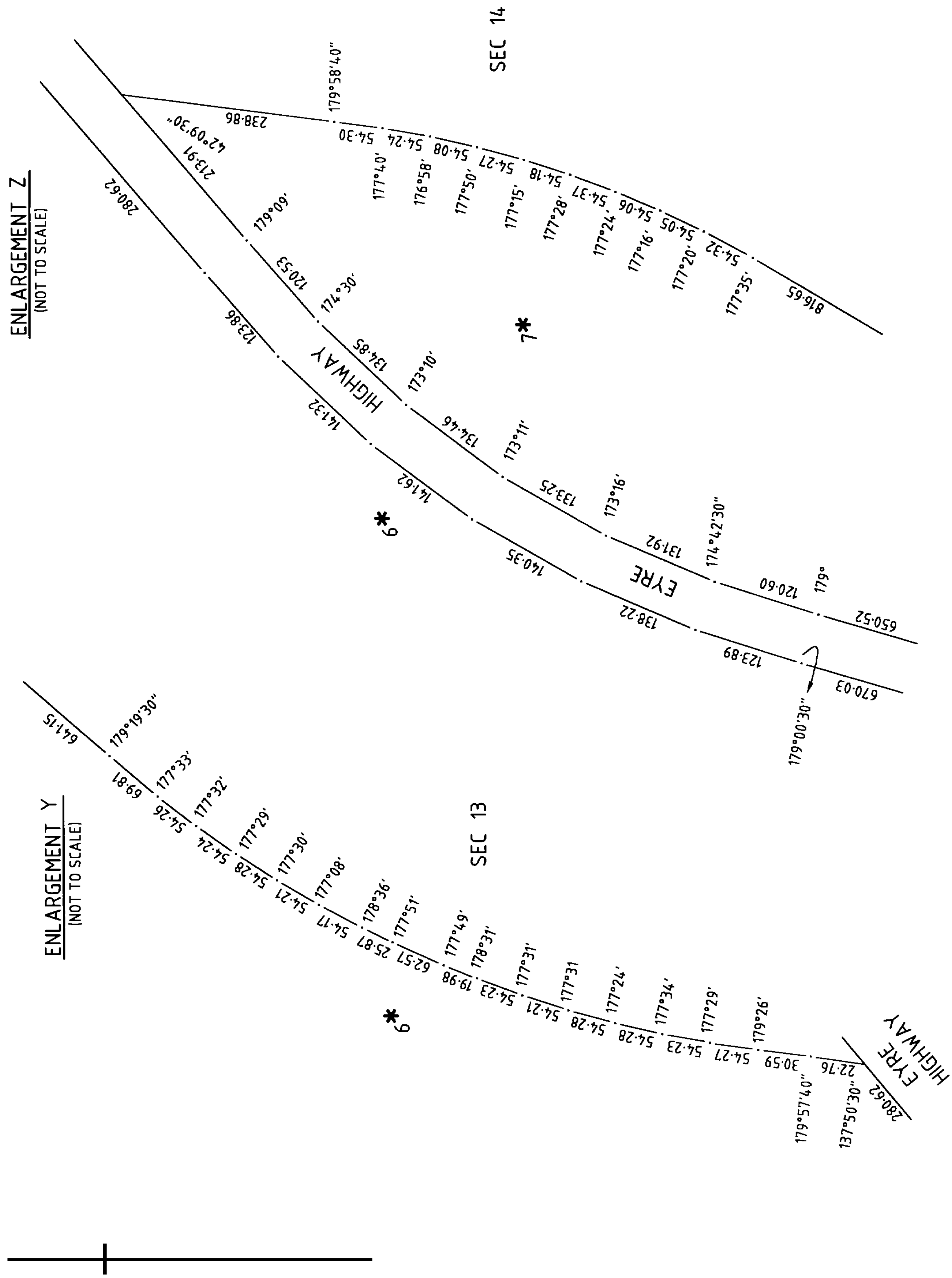
* Asterisk denotes PIECE identifier only.
NOTE: All remaining parcels are each an allotment.




ENLARGEMENT X
(NOT TO SCALE)
OF
FP 209717
SEC 293
60.95
88°56'
90°20'
442.97
179°55'
1474.65
5*
COPLEY
141°12'
1965.46
GILLEN
60.66
HIGHWAY
39°27'
38°48'
465.83
58.95
4*
140°33'
EYRE
OF
98°58'20"
424.98
39°26'30"
87°40'40"
32.51
98°19'20"
8*
625.75
401.88
42°14'10"
SEC 262
SEC 13
HUNDRED
2219.01
47°21'
39.35
3*
132°09'
18.28
(1063.75)
112°32'
(32.63)
96°49'
A
17.88
(32.48)
1897.16
1888.41
A
(1103.16)
64°49'
67°28'
179°57'
0°36'
2574.67
382.22
90°
HUNDRED
SEC 4
HUNDRED OF HANDYSIDE

Product	Register Search (CT 6138/347)
Date/Time	04/12/2017 06:12PM
Customer Reference	CT 6138 347 - Nutt
Order ID	20171204012602
Cost	$28.25

Government of South Australia
Department of Planning, Transport and Infrastructure



REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 6138 Folio 348

Parent Title(s)	CT 5538/823				
Creating Dealing(s)	DDA 12113954				
Title Issued	27/05/2014	**Edition**	1	**Edition Issued**	27/05/2014

Estate Type

FEE SIMPLE

Registered Proprietor

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF 1ST FLOOR 187 WAKEFIELD STREET ADELAIDE SA 5000

Description of Land

ALLOTMENT COMPRISING PIECES 91, 92 AND 93 FILED PLAN 209717
IN THE AREA NAMED LINCOLN GAP
HUNDRED OF COPLEY

ALLOTMENT COMPRISING PIECES 94 AND 95 FILED PLAN 209717
IN THE AREA NAMED LINCOLN GAP
HUNDRED OF COPLEY

PIECES 91.92 AND 93 FORM ONE ALLOTMENT
PIECES 94 AND 95 FORM ONE ALLOTMENT

Easements

NIL

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.

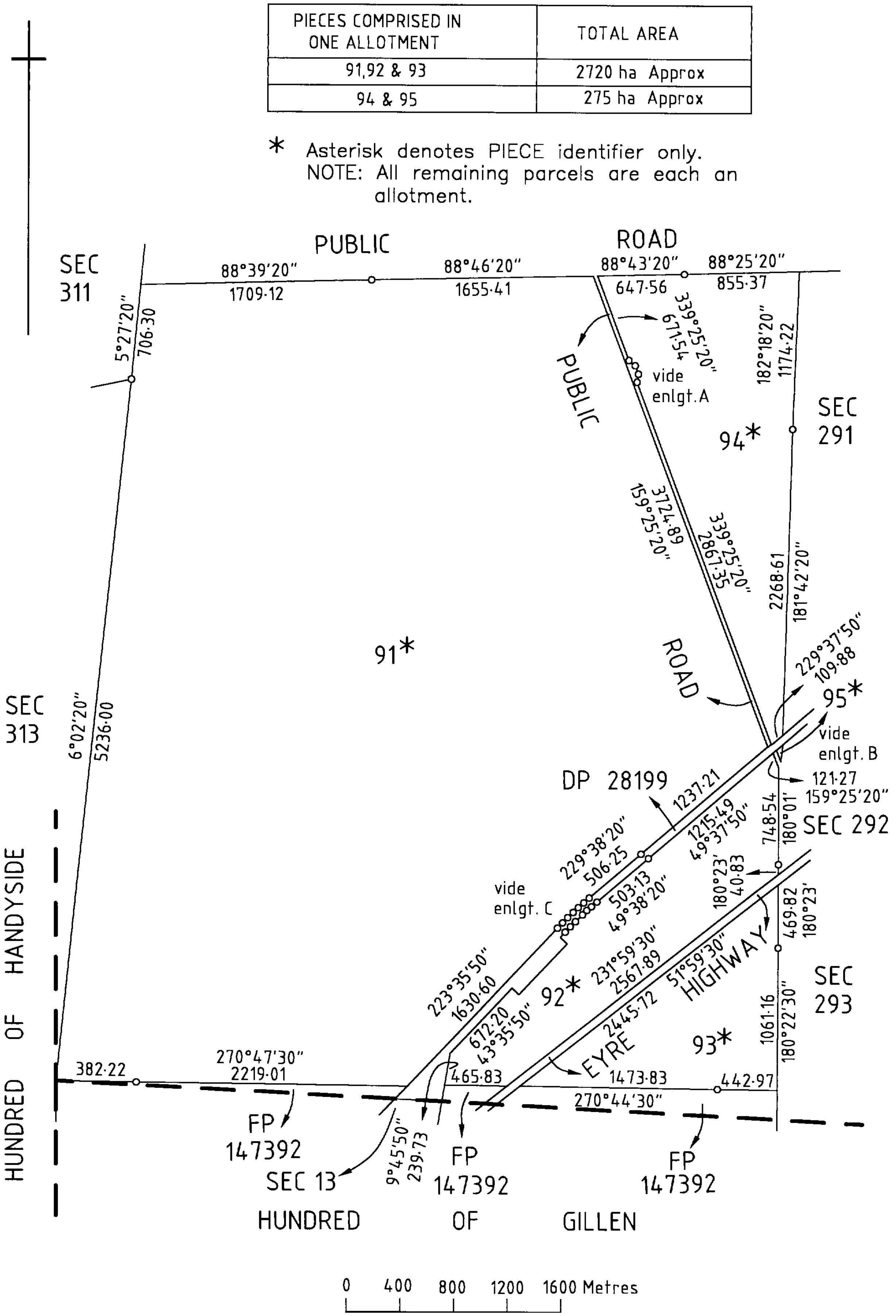
Notations

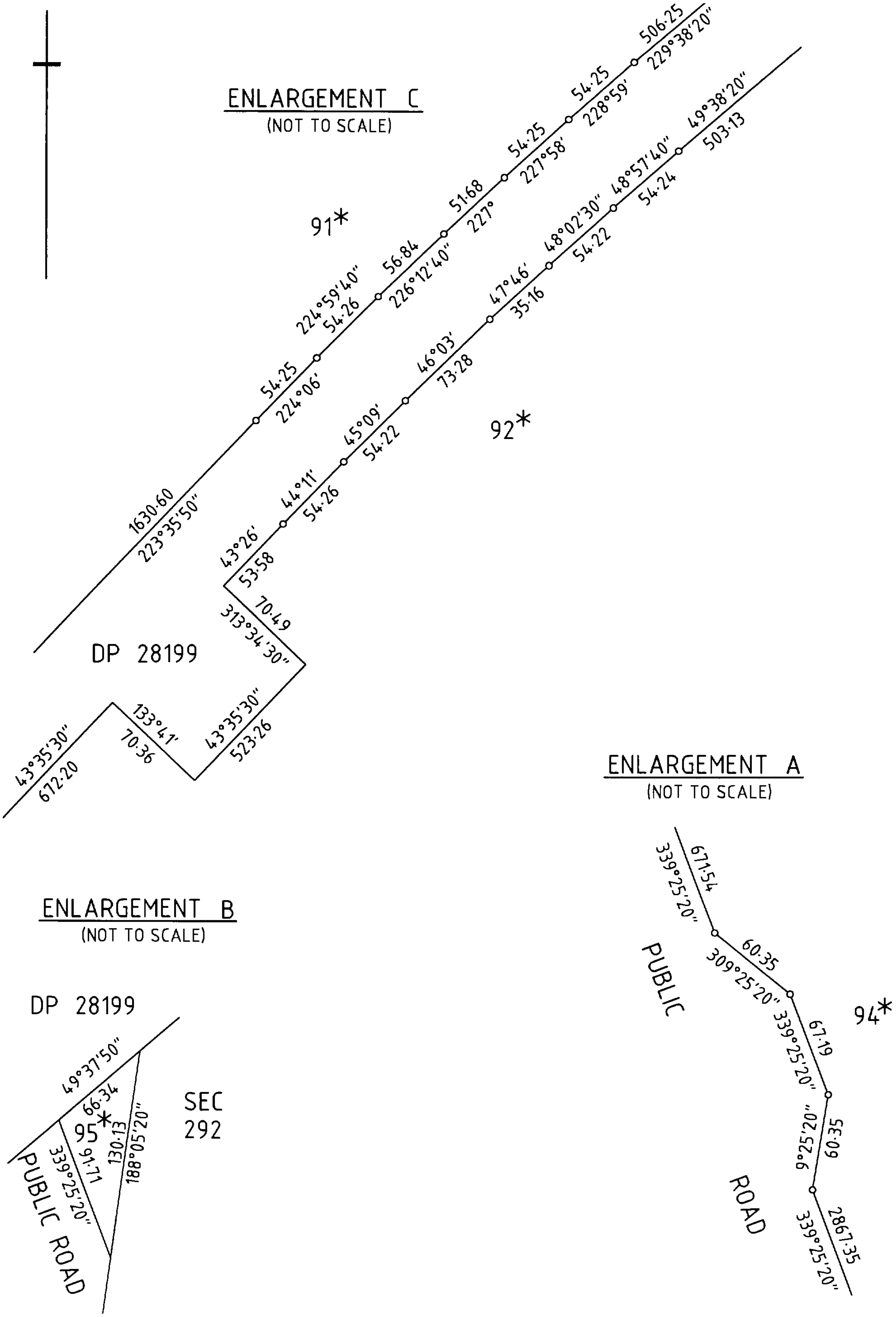
Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

SCHEDULE OF PIECES COMPRISED IN ONE ALLOTMENT

PIECES COMPRISED IN ONE ALLOTMENT	TOTAL AREA
91,92 & 93	2720 ha Approx
94 & 95	275 ha Approx

* Asterisk denotes PIECE identifier only.
NOTE: All remaining parcels are each an allotment.




ENLARGEMENT C
(NOT TO SCALE)
91*
92*
506·25
229°38'20"
54·25
228°59'
54·25
227°58'
51·68
227°
56·84
226°12'40"
224°59'40"
54·26
54·25
224°06'
1630·60
223°35'50"
49°38'20"
503·13
48°57'40"
54·24
48°02'30"
54·22
47°46'
35·16
46°03'
73·28
45°09'
54·22
44°11'
54·26
43°26'
53·58
70·49
313°34'30"
DP 28199
133°41'
70·36
43°35'30"
523·26
43°35'30"
672·20
ENLARGEMENT A
(NOT TO SCALE)
671·54
339°25'20"
60·35
309°25'20"
67·19
339°25'20"
94*
9°25'20"
60·35
PUBLIC
ROAD
2867·35
339°25'20"
ENLARGEMENT B
(NOT TO SCALE)
DP 28199
49°37'50"
66·34
95*
130·13
188°05'20"
91·71
339°25'20"
SEC
292
PUBLIC ROAD

Product	Register Search
Date/Time	24/02/2017 11:12AM
Customer Reference	LG01
Order ID	20170224004594
Cost	$27.75

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Registrar-General

Certificate of Title - Volume 6138 Folio 388

REAL PROPERTY ACT, 1886
South Australia

Parent Title(s)	CT 6066/920
Dealing(s) Creating Title	DDA 12113954
Title Issued	27/05/2014
Edition	1
Edition Issued	27/05/2014

Estate Type

FEE SIMPLE

Registered Proprietor

NUTT BROS NOMINEES PTY. LTD. (ACN: 079 738 659)
OF PMB 15 PORT AUGUSTA SA 5170

Description of Land

SECTIONS 2 AND 8
HUNDRED OF HANDYSIDE
IN THE AREA NAMED LINCOLN GAP

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO THE AUSTRALIAN NATIONAL RAILWAYS COMMISSION (SL 4743588)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED B TO THE NATURAL GAS AUTHORITY OF SOUTH AUSTRALIA (T 6328754)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED D FOR WATER SUPPLY PURPOSES TO THE SOUTH AUSTRALIAN WATER CORPORATION (TG 11439438)

SUBJECT TO RIGHT(S) OF WAY OVER THE LAND MARKED C TO THE AUSTRALIAN NATIONAL RAILWAYS COMMISSION (SL 4743588)

Schedule of Dealings

Dealing Number	Description
9404306	MORTGAGE TO RURAL BANK LTD.
12534875	CAVEAT BY LINCOLN GAP WIND FARM PTY. LTD. (ACN: 133 372 595)

Notations

Dealings Affecting Title

NIL

Priority Notices

NIL

Notations on Plan

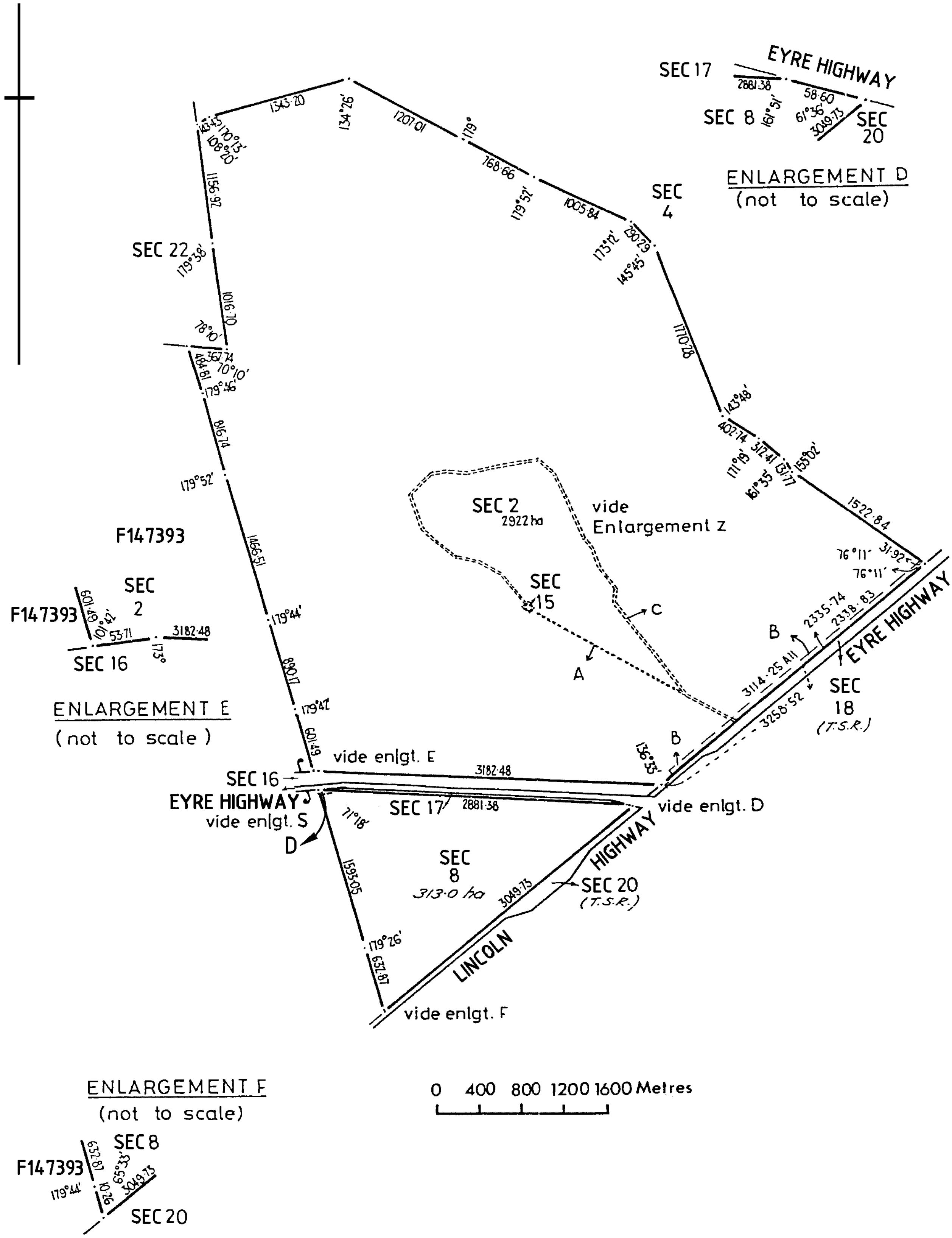
NIL

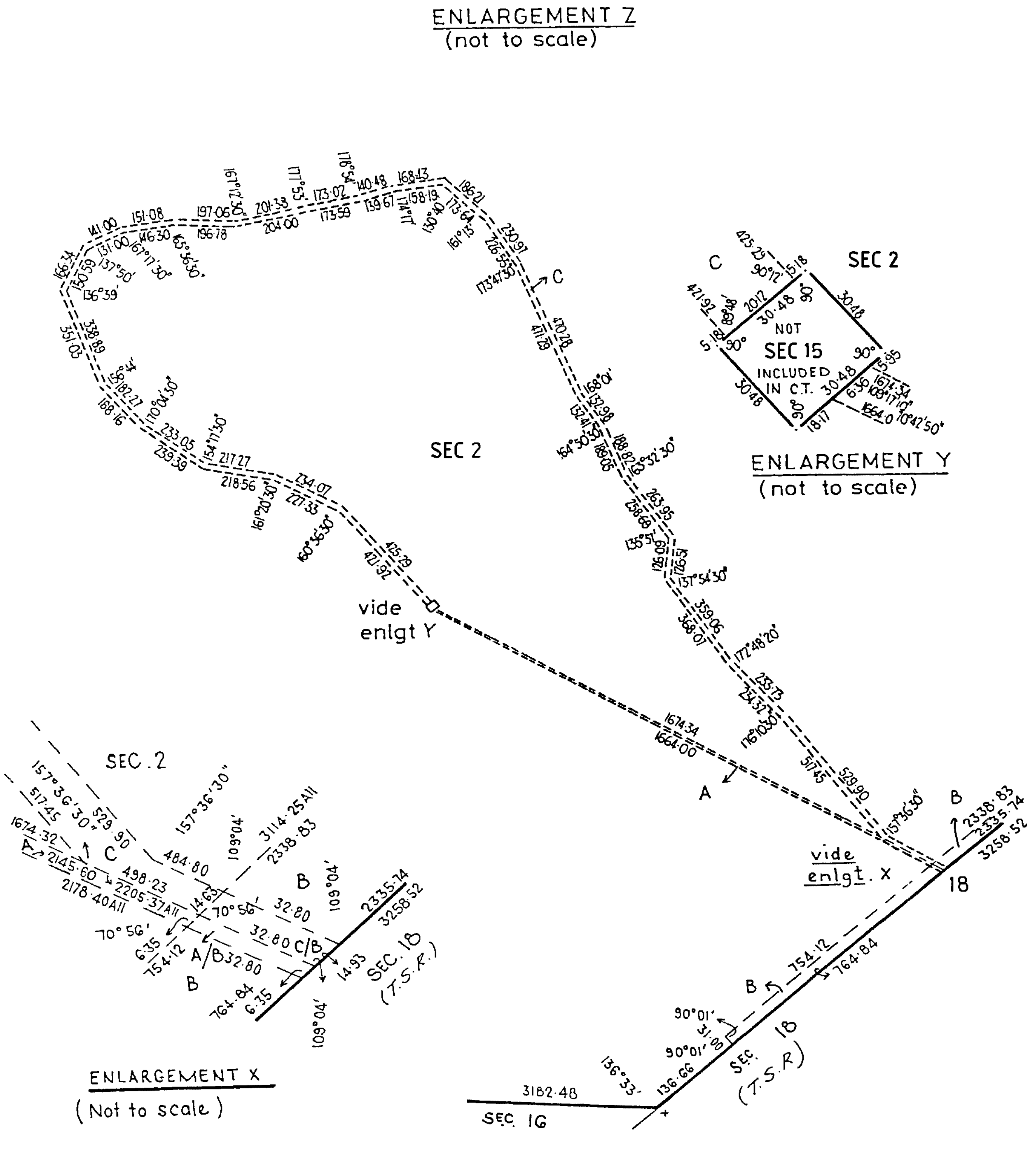
Registrar-General's Notes

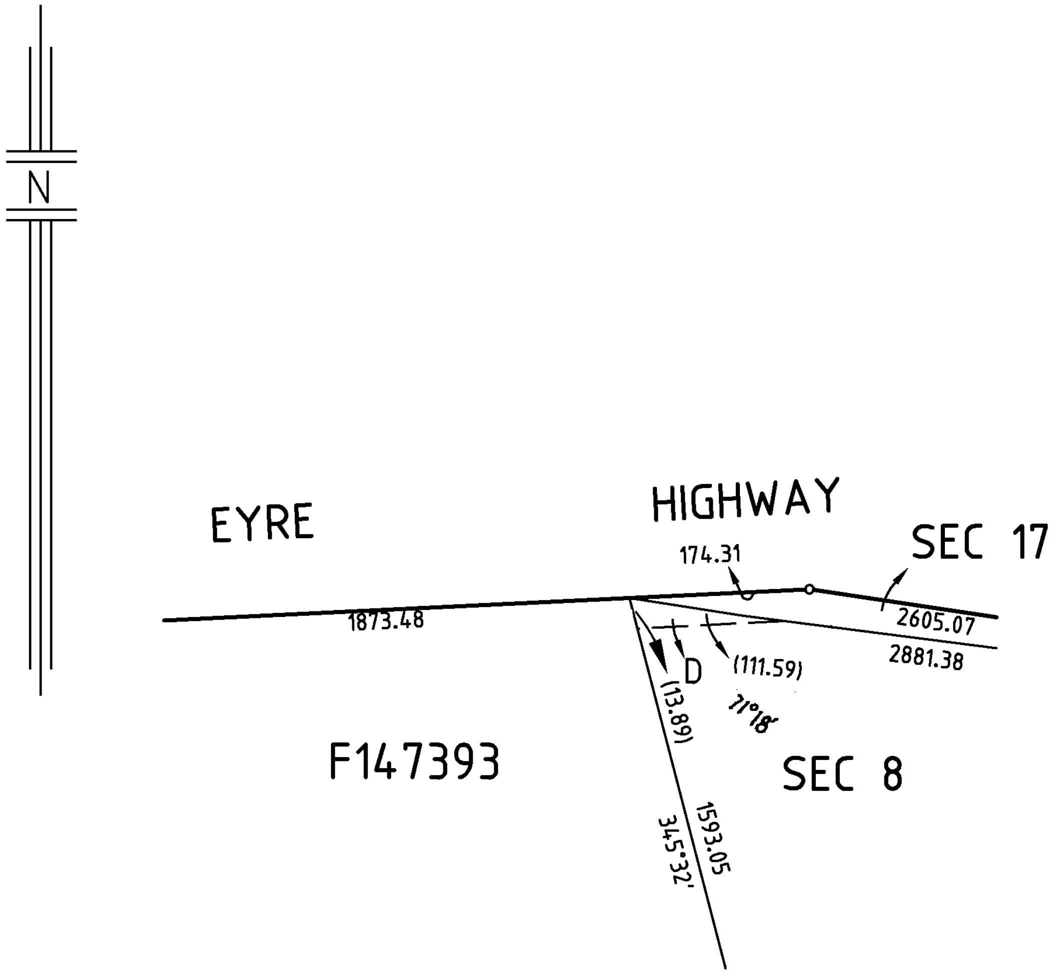
APPROVED FILED PLAN FOR LEASE PURPOSES FX48516

Administrative Interests

NIL


SEC 17
EYRE HIGHWAY
SEC 8
SEC 20
ENLARGEMENT D
(not to scale)
SEC 4
SEC 22
SEC 2
2922 ha
vide Enlargement Z
SEC 15
F147393
SEC 2
SEC 16
ENLARGEMENT E
(not to scale)
vide enlgt. E
EYRE HIGHWAY
vide enlgt. S
SEC 17
vide enlgt. D
SEC 18
(T.S.R.)
SEC 8
313·0 ha
SEC 20
(T.S.R.)
LINCOLN HIGHWAY
vide enlgt. F
ENLARGEMENT F
(not to scale)
SEC 8
F147393
SEC 20
0 400 800 1200 1600 Metres


ENLARGEMENT Z
(not to scale)
SEC 2
vide enlgt Y
1674.34
1664.00
A
C
B
vide enlgt. X
18
SEC 2
SEC 15 NOT INCLUDED IN C.T.
ENLARGEMENT Y
(not to scale)
SEC. 2
SEC. 18 (T.S.R.)
ENLARGEMENT X
(Not to scale)
754.12
764.84
3182.48
SEC. 16
SEC. 18 (T.S.R)



ENLARGEMENT S

NOT TO SCALE

APPENDIX B

Letters of support

Government of South Australia
Department of the Premier and Cabinet

Energy and Technical Regulation

Office of the Technical Regulator

Level 8, 11 Waymouth Street
Adelaide SA 5000

GPO Box 320
Adelaide SA 5001

Telephone: 08 8226 5500
Facsimile: 08 8226 5866

www.sa.gov.au/otr

Ref: 2017/01873.01 D17015113

2 August 2017

Christian Reilly
Altura Group
By email: Christian@alturagroup.com.au

Dear Christian,

RE: CERTIFICATE FOR DEVELOPMENT OF THE GOAT HILL PUMPED STORAGE PROJECT

The development of the Goat Hill Pumped Storage Project has been assessed by the Office of the Technical Regulator (OTR) under Section 37 of the Development Act 1993.

Regulation 70 of the *Development Regulations 2008* prescribes if the proposed development is for the purposes of the provision of electricity generating plant with a generating capacity of more than 5 MW that is to be connected to the State's power system – a certificate from the Technical Regulator is required, certifying that the proposed development complies with the requirements of the Technical Regulator in relation to the security and stability of the State's power system.

In making a decision on your application, our office has taken the following information into account:

- Your letter to the OTR 'Goat Hill Application to OTR.pdf' dated 28 July 2017, which was emailed to the OTR by Rosahlena Robinson on 28 July 2017.

After assessing the information provided, I advise that approval is granted for the proposed project.

Should you have any questions regarding this matter, please do not hesitate to call David Bosnakis on (08) 8226 5521.

Yours sincerely

Rob Faunt
TECHNICAL REGULATOR

cc: Rosahlena Robinson – Altura Group
Mark Jackson - DPC

14 July 2017

Altura Group Pty Ltd
P O Box 146
Ferny Hills Qld 4055

Attention: Altura Directors

Dear Altura Directors,

Goat Hill Pumped Storage Hydro Project – Letter of Support

Sunset Power International Pty Ltd trading as Delta Electricity ("**Delta"**) (ACN 162 696 335) is pleased to submit this letter of support to Altura Group Pty Ltd (ACN 615 855 724) for the development of their Goat Hill Pumped Storage Hydro Project (the "**Goat Hill Project**"). We understand that this letter may be included in Altura's Request for Proposals ("**RFP**") documentation and as part of engagement with regulatory approvals stakeholders.

This letter should remain confidential and must not be copied, reproduced, distributed or passed to others without the prior written consent of Delta (except for the purpose of issuing this letter as part of RFP or regulatory approval documentation).

The Goat Hill Project is strategically placed to meet demand for firm power in South Australia. The requirement for flexible firm capacity in South Australia is well understood, with several market signals pointing to the need for a pumped storage hydro plant including:

- high wind and rooftop PV penetration;
- 780MW coal retirement;
- market concentration & price volatility;
- high gas prices driven by LNG / export parity; and
- significant new utility PV projects coming online.

The preliminary evaluation of the Goat Hill Project nominates an installed generation capacity of 230MW and up to 8 hours of storage capacity. The concept design considers the use of two fixed-speed, reversible, Francis pump-turbines, each with a generating capacity of 115MW. The project has been sized considering an appropriate scale for the South Australian market and for a storage volume adequate to manage daily energy cycles.

Delta Electricity is the largest privately held generator in the NEM. Through the 1,320MW Vales Point Power Station in NSW;

- Delta Electricity is a growing strategic Independent Power Producer;
- energy production of 6-8,000GWh per year;
- Delta's Management Team is responsible for approximately 50% of new firm capacity generation in the NEM in the last growth phase (2005-2010) (Braemar 1 & 2, Uranquinty & Colongra OCGTs); and
- long term stable highly skilled workforce including energy trading, operations & asset management.

Following discussions with Altura, Delta is pleased to confirm our support for the project during the project development phase. Further, Delta enjoys the exclusive rights to market the Project and is the anticipated project owner as per our development agreement with you.

The Goat Hill Project is well positioned to be the first new pumped storage to reach FID in Australia and the Project forms an integral part of Delta's growth strategy into renewable energy.

This letter is being provided for information and discussion purposes only and must not be construed as creating any form of legal or other obligation on Delta.

Delta is delighted to have the opportunity to support such an important project for renewable energy in Australia and looks forward to working with the Altura during the next phases of the Project. We wish you every success with the progression of the project through the remaining phases of development.

Yours faithfully

Greg Everett
Managing Director

Nutt Bros Nominees Pty Ltd
PMBag 15
Port Augusta
SA 5701

31 July 2017

Altura Group Pty Ltd
PO Box 146
Ferny Hills Qld 4055

Attention: Altura Group Directors

Dear Altura Group Directors

Nutt Bros Nominees Pty Ltd, are pleased to support the Goat Hill Pumped Storage Hydro Project (Goat Hill Project), being developed by Altura Group Pty Ltd.

Nutt Bros Nominees own and operate the Lincoln Gap Station on which the Goat Hill Project is predominately located, and as landowners, we are supportive of the Project and consent to the Project being located on our property, subject to the finalisation of commercial terms.

We are delighted to have the opportunity to support such a unique and important project for renewable energy in the Port Augusta region and South Australia more broadly, and look forward to working with the Altura. We wish you every success with the progression of the project through the remaining phases of development.

We understand that this letter may be included in Altura's engagement with regulatory approval agencies and associated application documentation.

This letter is being provided for information and discussion purposes only and must not be construed as creating any form of legal or other obligation on Nutt Bros Nominees Pty Ltd.

Yours sincerely,

Bruce Nutt

Authorised Representative
Nutt Bros Nominees Pty Ltd ACN 079 738 659

E: brucenutt@bigpond.com

3 November 2017

ABN 94 561 061 743

2a Stirling Road
Port Augusta SA 5700

p: 08 8641 1444
f: 08 8642 6951
e: reception@rdafn.com.au
w: www.rdafn.com.au

All Postal
Correspondence
PO Box 1762
PORT AUGUSTA SA 5700

Mr Mark Endersby
Altura Group

To whom it may concern,

Re: Goat Hill Pumped Storage Hydro Project – Far North SA Region

Regional Development Australia Far North (RDAFN) is pleased to offer this letter supporting the development of renewable and alternative energy projects in our region.

The Far North SA region is in a prime location for renewable and alternative energy projects. The Altura Group Goat Hill Pumped Storage Hydro Project is an excellent example of these projects.

The project will create an estimated 250 jobs during construction with up to 15 proposed ongoing positions. The project is estimated to utilise up to 55% South Australia content for contract and construction work, therefore this is a great opportunity for our region and its businesses.

RDAFN acknowledges the importance of renewable and alternative energy production, and is a strong supporter of such projects that will assist with the improvement and reliability of power supply to our region, South Australia and beyond.

We wish the Altura Group well with their project and acknowledge their support and growth of the energy industry.

Yours sincerely

CWiseman.

Claire Wiseman
Chief Executive Officer

24 October 2017

Altura Group Pty Ltd
PO Box 146
Ferny Hills, QLD, 4055

Dear Christian,

GOAT HILL PUMPED HYDRO PROJECT

I refer to our previous discussions in regards to the proposed Goat Hill Pumped Hydro project located in Lincoln Gap in South Australia and to your intention to lodge a Development Application. I am pleased to confirm the following:

- SA Water is able to provide a potable water connection from the Morgan Whyalla pipeline to supply the Goat Hill Pumped Hydro project, subject to entering a water supply contract; and
- SA Water has no concerns or comments in relation to the development proposal.

Should you wish to discuss further, please feel free to contact me.

Yours sincerely,

Aaron Pearce
Business Development Manager

Phone: 0439 813 843
Email: Aaron.Pearce@sawater.com.au

APPENDIX C

Planning Assessment

GOAT HILL PUMPED STORAGE HYDRO PROJECT

Crown Development Planning Report

Prepared for: **Altura Group**

Date: **14.12.2017**

Proprietary Information Statement

The information contained in this document produced by Ekistics Planning and Design is solely for the use of the Client as identified on the cover sheet for the purpose for which it has been prepared and Ekistics Planning and Design undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

Document Control

Revision	Description	Author	Date
V1	Draft Planning Statement	RT	10/11/17
V2	Draft Planning Statement	RT	30/11/17
V3	Final Planning Statement	RT	12/12/17
V4	Revised Final Planning Statement	RT	13/12/17
V5	Revised Final Planning Statement	RT	14/12/17

Approved by: R.Thomas RThomas Senior Associate Date: 14/12/17 ekistics

Contents

Figures

Terminology and Abbreviations

Act	Development Act, 2003
CW	Council Wide
Flinders Plan	Land Not Within a Council Area (Flinders) Development Plan
OBJ	Development Plan Objectives
Port Augusta Plan	Port Augusta (City) Development Plan
PDC	Principles of Development Control
Regulations	Development Regulations, 2008
SCAP	State Commission Assessment Panel

ekistics

Executive Summary

Category	Details
PROJECT	Section 49 – Crown Sponsored Pumped Hydro Storage Project
ADDRESS OF SITE	Eyre Highway, Lincoln Gap, South Australia
CERTIFICATES OF TITLE	Volume 6138 Folio 388; Volume 6138 Folio 332; Volume 6138 Folio 334; Volume 5983 Folio 541; Volume 6138 Folio 331; Volume 5983 Folio 540; Volume 6138 Folio 347; Volume 5983 Folio 539; Volume 6138 Folio 348; Volume 5983 Folio 538
CROWN LEASE PARCELS	Crown Lease Volume 1282 Folio 40 Crown Lease Volume 1600 Folio 69
SITE AREA	Approx. 220 hectares
RELEVANT AUTHORITY	Minister for Planning following advice from the State Commission Assessment Panel (SCAP)
DEVELOPMENT PLAN	Land Not Within a Council Area (Flinders), consolidated 29 November 2012 Port Augusta (City) Development Plan, consolidated 7 July 2016
ZONING	Flinders – Pastoral Pt August – Primary Industry
EXISTING USE	Grazing Land
PROPOSAL DESCRIPTION	Pumped Storage Hydro Energy Project
AGENCY REFERRALS	Referrals: • Port Augusta Council • Department of Environment, Water and Natural Resources • Environmental Protection Agency • Commissioner of Highways
PUBLIC NOTIFICATION	15 business days pursuant to Section 49(7d) of the *Development Act, 1993*
APPLICANT	Department of the Premier and Cabinet C/- Pumped Hydro (SA), a fully owned subsidiary of Altura Group

1. Introduction

1.1 Background

This report has been prepared on behalf of Pumped Hydro (SA), a fully owned subsidiary of Altura Group, which is seeking to develop the Goat Hill Pumped Storage Hydro Project (the Project) at Goat Hill, west of Port Augusta, South Australia. The proposal has gained South Australian State Government Crown Sponsorship as a public infrastructure project which will deliver renewable electrical energy from a Pumped Storage Hydro Facility (PSH Facility) operated through a turbine system between two bodies of reservoir water.

This Planning Statement seeks to provide relevant information about the subject land and locality, describes the nature of the proposed development and provides an assessment of the development application against the relevant provisions of the relevant Development Plans (Land Not Within a Council Area [Flinders] and Port Augusta (City) Development Plan.

In preparing this report, we have reviewed the following documents:

- Plans including:
  - Goat Hill PSH Facility profile– indicative only GHL-ENG-DRA-0007 Rev 0;
  - Indicative layout of the (a) Upper Reservoir and (b) Lower Reservoir GHL-ENG-DRA-0014 Rev 0;
  - Upper Intake– indicative only. GHL-ENG-DRA-0006 Rev 0;
  - Profile of penstock option with anchor blocks – indicative only. GHL-ENG-DRA-0009 Rev 0;
  - Profile of the Powerhouse above and below ground – indicative only GHL-ENG-DRA-0011 Rev 0
- Flora and Fauna Assessment – EBS ecology – 27 November 2017
- Surface Water Quantity and Quality Technical Report – Golder Associates – 6 Decemeber 2017;
- Traffic Impact and Access Point Assessment – WGA - 6 November 2017;
- Scope Environmental Management Plan – Golder – 13 December 2017
- 3D imagery produced by Convergen

We have also liaised with the Senior Archaeologist, Guadalupe Cincunegui from Independent Heritage Consultants in relation to indigenous heritage matters.

Further we have:

- Reviewed relevant legislations, including the *Development Act*, 2003 (*Act*), *Development Regulations*, 2008 (*Regulations*);
- Undertaken a site and locality inspection;
- Reviewed the provisions of the following Development Plans:
  - Land Not Within a Council Area (Flinders), consolidated 29 November 2012 (*Flinders*);

- Port Augusta (City) Development Plan, consolidated 7 July 2016 (*Port Augusta*);

This Planning Statement has been prepared to assist the State Commission Assessment Panel (SCAP) in its assessment and determination of the development application.

2. Procedural Matters

2.1 Nature of Development

The construction of a pumped storage hydro facility constitutes Crown 'development' pursuant to Section 49 (1) of the *Development Act, 1993* (*the Act*). Pursuant to Act, 'Public Infrastructure' means (our emphasis):

> *(a) the <u>infrastructure, equipment, structures, works and other facilities used in or in connection with the supply of</u> water or <u>electricity</u>, gas or other forms of energy, or the drainage or treatment of waste water or sewage;*
>
> *(b) roads and their supporting structures and works;*
>
> *(c) ports, wharfs, jetties, railways, tramways and busways;*
>
> *(d) schools, hospitals and prisons;*
>
> *(e) all other facilities that have traditionally been provided by the State (but not necessarily only by the State) as community or public facilities;*

As mentioned, the Altura Group has received State Government sponsorship via the Department of Premier and Cabinet to deliver this public energy infrastructure pursuant to Section 49(2)(c) whereby when,

> *(c) a person proposes to undertake development initiated or supported by a State agency for the purposes of the provision of public infrastructure and specifically endorsed by the State agency for the purposes of this section…*

the State agency must lodge an application for approval containing prescribed particulars with the SCAP, formerly, the Development Assessment Commission.

Pursuant to Section 49(2)(c) of the Act, the SCAP is the relevant planning authority for this application, in so far as the preparation of advice to Minister for Planning pursuant to Section 49(7e) as the Department of Premier and Cabinet, who is a State Government Agency, is the Applicant.

2.2 Public Notification

Pursuant to Section 49(7d) of the Act, the application, which involves works that will exceed $4M (when all stages are complete) SCAP must publicly notify the application for a period of 15 days and allow persons who made written submissions the opportunity to be heard in support of their submission at a meeting of SCAP. SCAP must give due consideration to submissions in its assessment of the application.

2.3 Referrals

Pursuant to Section 49(4a) & (7a) and Schedule 8 of the Regulations, the application is required to be referred to the following authorities:

2.3.1 Port Augusta Council

Notwithstanding the majority of the development site area is not within the Port Augusta Council area (refer to further details below), components of the associated supporting infrastructure are located within this Council region and accordingly, pursuant to Section 49 (4a) and 49(6) of the Act, the SCAP must:

- Give the Council notice the application details and particulars within three (3) business days of lodgement; and
- Allow the Council two (2) months from this notification in which to provide a comment/report on the proposal, should it elect to do so.

2.3.2 Department of Environment, Water and Natural Resources

While the site area is not within a 'Prescribed Area' pursuant to Schedule 8 – Part 2(12A) for the purpose of Water Permit allocation, a referral to DEWNR is anticipated due to aspects of the Project including dewatering activities and Water Affecting Permits associated with waterway crossings.

2.3.3 Native Vegetation Council

On the understanding that the application will result in the removal of some native vegetation, the application is likely to be referred to the Native Vegetation Council pursuant to Schedule 8 – Part 2(26). Once further detail of the extent of vegetation clearance is known, recognising that micro-siting is proposed to minimise the removal of native vegetation where possible, a calculation of the Significant Environmental Benefit (SEB) payment will be calculated in accordance with the *Native Vegetation Act* 1992 and the *Native Vegetation Regulations* 2017.

2.3.4 Environmental Protection Agency

The EPA is also required to be referred the application pursuant to Schedule 8 – Part 2(11) of the Regulations due to :

- the proposed temporary **concrete batching plants** which are defined as the conduct of works for the production of concrete or concrete products that are manufactured or are capable of being manufactured by the mixing of cement, sand, rock, aggregate or other similar materials, being works with a total capacity for production of such products exceeding 0.5 cubic metres per production cycle; and
- the proposed **crushing and grinding of rock** material in excess of 1,000 tonnes per year associated with the excavation of the reservoirs.

These constitute activities of major environmental significance listed in Schedule 22 of the Regulations.

2.3.5 Commissioner of Highways

The subject 'site' of the development adjoins an arterial road (National Eyre Highway) and accordingly the planning authority is required to refer the application to the Commissioner of Highways (Department of Planning, Transport and Infrastructure - DPTI), in accordance with Schedule 8 - Part 2(3) of the Regulations 2008.

2.3.6 Office of Technical Regulator

Pursuant to Schedule 8 – Part 2(9B) of the Regulations, a referral may be required to the Office of the Technical Regulator. The proposed development incorporates electricity infrastructure that would be developed adjacent to existing infrastructure. However, we note that the application is accompanied by a Certificate issued by the Technical Regulator (dated 2 August 2017) regarding the compliance of this infrastructure in relation to the security and stability of the State's power system. Accordingly, we understand that this agency referral will not be required.

2.3.7 Other Referrals

We understand that the application may also be referred to the following non-statutory agencies for comment:

- The Outback Community Authority;
- SA Water Remote;
- Country Fire Service; and
- Department of State Development, Aboriginal Affairs and Reconciliation

2.4 Other Statutory Matters

The nature and scale of renewal energy projects requires a range of approvals, licences and permits under various State and Commonwealth legislation. Separate from the statutory provisions of the Act and Regulations, we understand that the proposed works may also be affected by the following legislation and Authorities whereby other approvals/permits/licences or agreements may be required in addition to a planning consent under the Development Act:

- Building Rules consent, Development Act, 1993;
- Environment Protection Act, 1993;
- Aboriginal Heritage Act 1988 and the Local Barngarla people;
- Natural Resources Management Act, 2004 and the SA Arid Lands, Northern and Yorke NRM Boards;
- Commonwealth Minister of Transport & Infrastructure; and
- Country Fire Service.

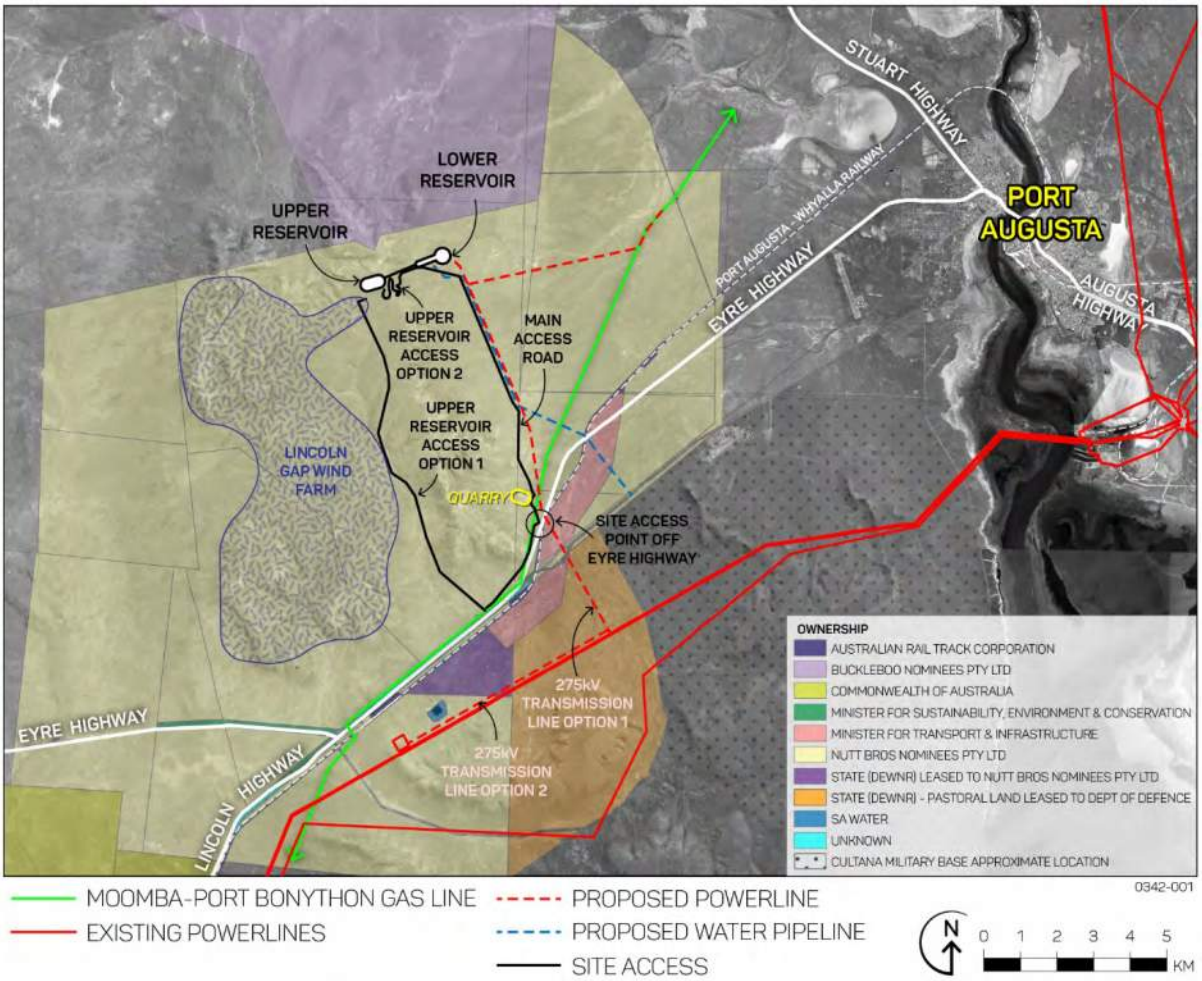
Where relevant, any required actions prompted by these Acts and/or Authorities are being undertaken separately but concurrently to the lodgement of this Development Application.

3. Subject Site and Locality

The subject site is located 12km west of Port Augusta and 55km north east of Whyalla. Central Adelaide is located approximately 280km to the south east. The PSH Facility and associated infrastructure covers an area of approximately 80 hectares located within a broader Project area covering approx. 220 hectares.

The Project siting, land ownership and key features in the locality are provided in the figure below.

Figure 3.1 *Subject site and Locality*



The Eyre Highway and a local Council road (Caroona Road), existing gas and water pipelines, railway line and several high voltage power lines traverse Lincoln Gap pastoral station to the south of the plateau.

The approved Lincoln Gap Wind Farm, which proposes 59 wind turbines, is to be located south-west of the site on the same plateau as the Upper Reservoir. This Project also includes a 275kV transmission line extending to the south of the Project which will connect into the existing ElectraNet 275kV transmission line via a newly constructed substation.

The Project intersects the Eyre Highway, a 110km/hour freight route. The intersection and initial length of the Main Access Road to the PSH Facility is currently available via an existing 4-metre-wide, unsealed road which is utilised by the local quarry (Augusta Quarries). This quarry operates on a portion of the land near the PSH facility, on Mineral Lease EML 5851 owned by the Nutt Bros Nominees Pty Ltd (the same entity that owns the land on-which the PSH Facility is to be located on). This quarry will not be impacted by the Project.

The Project area is currently used for sheep grazing. A network of farm tracks, some more discernible than others, criss-cross the land. Some remnant native vegetation is evident however it is visually evident that this has been greatly impacted by historical and ongoing grazing activities as well as a substantial feral goat population.

The general Project area is characterised by a number of steep strike ranges that rise from the plain and comprises plateaus edged by steep, rocky escarpments (with deep gullies). Drainage lines are ephemeral in nature.

The Upper Reservoir is to be constructed on a plateau, a visually dominant landform which is visible from, and frames the western skyline of, the town of Port Augusta. The elevation of the plateau is approximately 290 m AHD while the area where the Lower Reservoir is to be constructed, the elevation is approximately 90 m AHD.

An image of the site area with the plateau in the foreground is provided below.

Figure 3.2 *Subject site photo (looking south-west)*

The following land titles are affected in some capacity by the Project:

- Volume 6138 Folio 388
- Volume 6138 Folio 334
- Volume 6138 Folio 331
- Volume 6138 Folio 347
- Volume 6138 Folio 348
- Volume 6138 Folio 332
- Volume 5983 Folio 541
- Volume 5983 Folio 540
- Volume 5983 Folio 539
- Volume 5983 Folio 538
- Crown Lease Volume 1282 Folio 40
- Crown Lease Volume 1600 Folio 69

All of the land associated with the PSH Facility and the access roads, together with large sections of the high voltage transmission line and water supply pipeline, are located on land owned by Nutt Bros Nominees Pty Ltd. Altura will lease the land on which these assets are located with a lease agreement with Nutt Bros Nominees Pty Ltd.

It is noted that sections of the water supply pipeline and transmission lines traverse a number of third party infrastructure assets and Government-owned land from the Eyre Highway south, including:

- Eyre Highway;
- Caroona (Gap) Road;
- Port Augusta – Whyalla Rail Line;
- Moomba – Bonython liquid fuel pipeline;
- Land owned by the Australian Rail Track Corporation (ARTC);
- Land owned by the Minister of Transport & Infrastructure;
- Land owned by the Pastoral section of the State; and
- Land owned by the Commonwealth.

Arrangements for the necessary easements, access and occupation of this land is being negotiated with the relevant parties.

4. Description of the Proposal

4.1 Project Features

The following summarises the key features of the Project. Final details of the layout and building design will be determined following section of the Project contractor and subsequent detailed design phase.

4.1.1 Permanent Features

The application proposes construction of a PSH Facility consisting of a Powerhouse located between two bodies of reservoir water. In simple terms, the gravitational flow of water from the higher water body to the lower, produces electrical energy.

The Project seeks to make use of the natural topography of the land, with the water bodies located at different elevations – one Upper Reservoir on the plateau and the Lower Reservoir on the plain below.

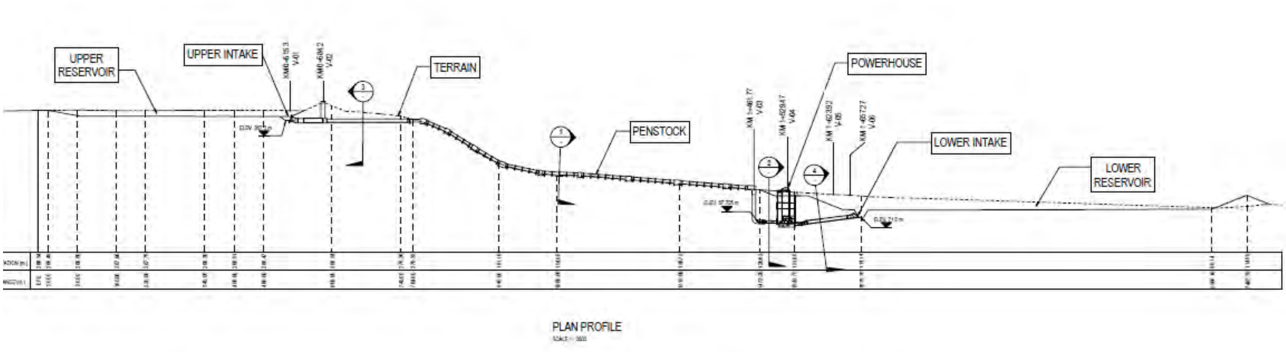
Key permanent features of the infrastructure Project include:

- An **Upper Reservoir** covering an area of approx. 34 hectares (water surface area of approx. 20-25 hectares) and holding capacity of approximately 4.5Mm³ of water;
- A **Lower Reservoir** covering an area of 36 hectares (with similar water surface area to upper) and holding capacity of approximately 4.5Mm³ of water;
- An **upper and lower intake** within each reservoir which consists of an emergency isolation gate and trash racks to prevent the entry of debris that could damage the hydraulic works;
- An above ground steel **Penstock** – an enclosed steel pipe running from the Upper to the Lower Reservoir (approx. 6m in diameter and 1,000m long);
- A **Powerhouse** building to house the turbines and pump equipment, the majority of which will be located approximately 50 metres below natural ground level adjacent the Lower Reservoir and measuring approx. 30-40 metre in diameter. The above ground components of this building will rise approximately 9m above ground level with the external appearance to be resolved during the detailed design phase; and
- A **Tailrace tunnel** connected to the Lower Reservoir.

As mentioned, the design characteristics of the above ground infrastructure will be finalised by the contractor and Altura during detailed design phase.

The key features of the PSH Facility are illustrated below. All these elements of the Project are located within the Pastoral Zone (Flinders).

Figure 4.1 *Pre-feasibility Design Profile (c/- Jacobs)*



A range of permanent ancillary infrastructure is also proposed as follows:

- Linear infrastructure including:
  - approx. 18.5 km of 275 kV overhead transmission lines;
  - approx. 6.5 km of medium voltage overhead transmission line; and
  - approx. 9 km of water supply pipeline;
- Access Roads, including:
  - approx. 8km of Main Access Road (connecting from the Eyre Highway to the Lower Reservoir); and
  - an Upper Reservoir Road (connecting from the Lower Reservoir to the Upper Reservoir) in the form of either a 3km (approx.) route or a 13km (approx.) route, subject to further design investigations (refer to Figure 3.1);
- Support infrastructure:
  - a switchyard and substation (which connects the Project to the SA electricity network);
  - carpark areas; and
  - ancillary fencing and signage.

The majority of the permanent ancillary infrastructure associated with the Project occupies land in the Pastoral Zone (Flinders), with a smaller component within the Primary Industry Zone (Port Augusta).

The 275 kV overhead transmission lines will connect to either the proposed substation associated with the Lincoln Gap Wind Farm or an alternative substation at Electranet's existing high voltage 275 kV network approximately 12km to the south, subject to the connection agreement with ElectraNet. Subject to final design requirements, the transmission lines are anticipated to be between 40m – 50m high lattice towers, with a double circuit and each circuit strung on either side of the tower by cross-arms.

A potential medium voltage transmission line (approx. 15-metre-high) may connect the construction facilities and Powerhouse to the SA Power Network's power distribution line, some 6 km to the east. Should this line be constructed, it will connect at a location where there is currently a single circuit use. This line would need to be upgraded by SAPN to a medium voltage line to enable electricity to be supplied by the Project.

The transmission line infrastructure locations (located within a defined transmission line corridor) will be subject to final electrical design and constraints that may be realised during construction (e.g. poor ground conditions, minimising vegetation clearance, avoidance of watercourses or heritage finds).

To complement the surrounding landscape, consideration will be given to exterior colours and finishes for the Powerhouse and other external buildings. (e.g. in non-reflective, neutral colours).

4.1.2 Temporary Works

The following temporary elements will also be required for the construction phase including but not limited to:

- Workshops/Outbuildings
- Warehouses (including chemical storage)
- Site offices and amenities
- Electrical connections/ diesel generators
- Concrete batching plant(s), including rock crushing and screening and material and product stockpiles
- Construction Water Supply
- Waste water treatment plant
- Infrastructure, plant & material laydown areas
- Waste storage areas
- Magazine area
- Parking areas
- Vehicle fueling areas
- Vehicle/plant clean-down facilities

Short term use of various internal unsealed roads will also be required in order to access the construction locations. Roads and temporary construction areas that are not required for the permeant operation of the facility will be rehabilitated.

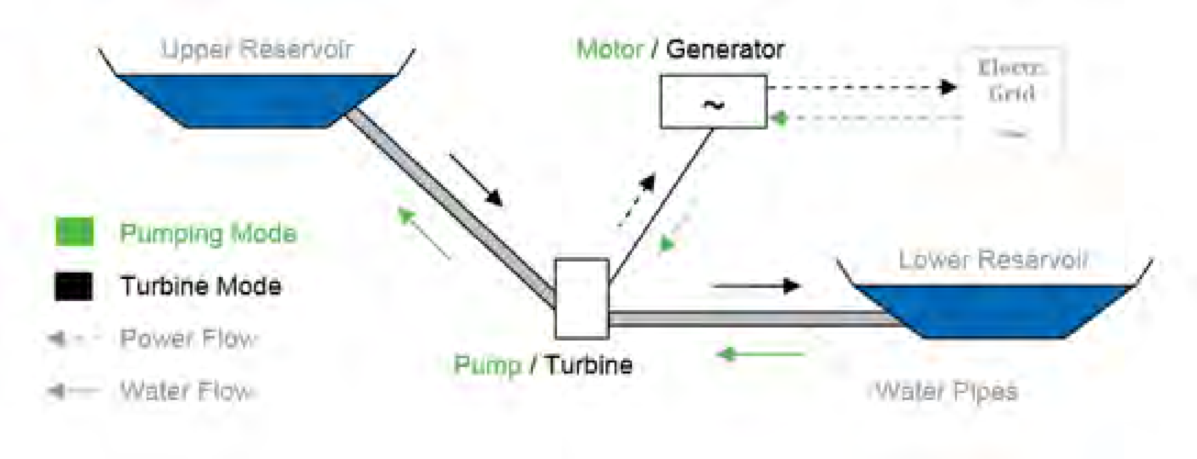
4.2 Operational Detail

The PSH Facility is a closed loop turbine system connected via two bodies of reservoir water located at different elevations – one higher, to be located on the plateau, and one lower, on the lower plains. The closed loop refers to the ability to re-use the water between the reservoirs on a repeated cycle.

During times of lesser energy demand, the PSH Facility pumps water from the Lower Reservoir to the using electricity. When energy is required in the grid, the water in the Upper Reservoir is released and flows back into the Lower Reservoir through a turbine which generates electricity. Subject to final design, the facility is proposed to deliver approximately 220MW to 270MW of pumped hydro storage capacity in a 4-8 hour generating cycle and will have the capability to operate 24 hours a day, 7 days week (subject to demand).

The following image illustrates the key steps in the cycle of a typical PSH Facility.

Figure 4.2 *Typical 'closed loop' PSH Facility (source Altura C/-EEG)*



Day to day operations are anticipated to be managed remotely and as such, the facility will only require a small operational workforce. The facility will also engage contractors for routine services such as waste removal, cleaning, security and general maintenance. During minor and major maintenance cycles, the workforce could temporarily expand to approximately 40 people.

4.3 Site Works

The reservoirs are to be constructed by ground excavation and blasting, combined with earth embankments.

The Upper Reservoir will be located at an approximate elevation of 290 AHD and will have a water surface area of approximately 20-25 hectares. The reservoir will be constructed using suitable, excavated material from the reservoir location to create an engineered earth embankment around the perimeter of approx. 20 metres high.

The Lower Reservoir will be located at an approximate elevation of approx. 90 AHD and will have a surface area of approximately 20-25 hectares. The Lower Reservoir will be constructed in a similar manner to the Upper Reservoir and will have an embankment height of approximately 15-20 metres.

The total height of the reservoir embankments will be determined based on final requirements of active storage and freeboard against overtopping from maximum rainfall events.

Reservoir lining will be installed across the entire reservoir floor area of both reservoirs to prevent water infiltration.

Evaporation covers will be constructed over both reservoirs to reduce evaporation (estimated to be over 2,000mm per year).

The Reservoirs, Powerhouse and associated infrastructure will be secured by security fencing and gates to prevent unlawful human and animal access to the water bodies and facilities. Video surveillance will be used to monitor the facility.

Water used to initially fill and then top-up the reservoirs as required (due to evaporation) will likely be supplied from SA Water's 600mm diameter mains water pipeline located adjacent to the Eyre Highway.

4.4 Access Arrangements

While various informal tracks are evident within the subject site, two defined access routes to service the PSH Facility are proposed.

The Main Access Road will be accessed from Eyre Highway via the existing crossing point (utilised by the local quarry) and provide vehicle access to the Powerhouse. This road is propsed to be an unsealed, all weather access road, approx. 3 to 6 metres wide. A sealed section of the road where it meets Eyre Highway is likely to be constructed.

The Upper Reservoir Road will essentially be an extension of the Main Access Road from the Lower Reservoir and provide vehicle access to the Upper Reservoir. This road will also be an unsealed track, approx.3- 6 metres wide.

As mentioned, various other internal unsealed roads will be used to access various construction and permanent areas. Where possible, existing tracks will be utilised.

Where roads meet watercourses within the site, culverts and/or causeway crossings will be constructed to minimise the impact on watercourse flow.

4.5 Construction Management

A draft scope Environment Management Plan (sEMP) has been prepared and is included in the application documents. The sEMP covers a range of management objectives in relation to construction including the need for regular reporting. While the broad intent of the sEMP is outlined, a final Construction EMP will not be produced until a construction contractor is appointed.

Construction activity will involve the temporary works previously listed and require the construction of workshops and warehousing, office and amenity buildings, in addition to transitory supporting infrastructure such as laydown areas, waste storage, waste water treatment, clean-down facilities and a series of concrete batching plants.

Construction activities will occur, for the most part, in close proximity to the proposed PSH Facility and within the Pastoral Zone (Flinders). Once finalised, the CEMP will document final location and setup arrangements. Indicative areas of construction activity are show in the images below, however it should be noted that these exceed the extent of area expected to be required for construction facilities. These areas will be surveyed for fauna, flora and heritage considerations.

Figure 4.3 *Potential construction areas (brown shaded areas)*

Some components of the facility are likely to be fabricated on site, for example the steel Penstocks, which would include typical assembly methods such as bending, rolling, welding, non-destructive testing and protective coating application. Other components will be delivered to site partially or completely pre-fabricated

Temporary crushing and concrete batching plant(s) will be established during construction and will include rock crushing facilities, rock stockpiles, crushed aggregate and sand stockpiles, access tracks, concrete mixing and delivery, control room, amenities, storage areas, parking areas, and truck washdown and wastewater treatment facilities.

It is noted that some of these temporary elements, in particular the concrete batching plants and rock processing, may require EPA licencing.

The construction workforce is estimated to peak around 150 - 250 personnel however numbers will fluctuate in accordance with the construction activities being undertaken and the final construction methodology selected by the construction contractor.

Notwithstanding the construction hours specified in the Environment Protection (Noise) Policy 2007, the flexibility to undertake construction 24 hours a day, 7 days a week is sought by Altura in order to deliver the

Project in a timely manner. Given the remoteness of the site, extended construction hours are not expected to cause inconvenience to any sensitive land uses.

The temporary construction facilities are anticipated to be required for 2.5 to 3 years subject to final selected Construction Contractor requirements.

4.6 Works Exempt from Approval

Pursuant to Schedule 14 (1) of the Regulations, we note the following works that are included with the scope of the PSH Facility may be excluded from the provisions of Section 49 of the Act and from requiring Development Approval:

- The reconstruction (including widening), alteration, repair or maintenance of a road and works associated with the construction of a road on land which is:
  - » adjacent to the road; and
  - » associated with the construction of the road;
- Works that would usually be 'complying' in nature, which in this instance includes (subject to these works being certified by a private certifier) such as tanks, aerials and antennae;
- Construction, reconstruction or alteration of any of the following items of infrastructure or works if only of a local nature, namely, a water treatment station, pressure regulating station, pumping station, waste water pumping station, water filtration plant, water storage tank, pump-out facility or sewerage works;
- The construction, reconstruction or alteration of any works or infrastructure that is ancillary to works or infrastructure referred to in the above point;
- The construction of a building or equipment used for or associated with the supply, conversion, transformation or control of electricity (other than an electricity generating station or an electricity substation);
- The construction, reconstruction or alteration of or addition to, a building which is to be located wholly underground;
- The construction of an outbuilding (i.e. workshop, warehouse, shed) not greater than 1 storey in height;
- The construction, reconstruction, alteration, repair or maintenance of any drain, pipe or underground cable;
- The construction, reconstruction or alteration of an electricity transmission line, other than a transmission line of 33,000 volts or more; and
- Advertising displays or signs associated with the crown development.

4.7 Operative Period and Staged Approval

Pursuant to Regulation 48(1) of the Regulations any consent or approval granted under Part 4 of the Act, will lapse at the expiration of 12 months from the operative date of the consent or approval. If the relevant development has been lawfully commenced within 12 months from the operative date of the approval, the approval will not lapse if it is substantially or fully completed within three years from the operative date of the approval. The period prescribed to commence or complete a development may be extended by the relevant authority either when the relevant consent or approval is given or at a later time (Regulation 48(2)).

Requests for extensions of time in which to commence and complete developments are reasonably common for large developments which have numerous and complex issues to resolve.

The Applicant seeks consent for staged approval and for a four (4) year operative period of consent in which to substantially complete the development.

In accordance with the Regulations, the request for an extended period of time in which to commence and complete the development can be determined by the relevant planning authority at the time the consent is given.

5. Development Plan Assessment

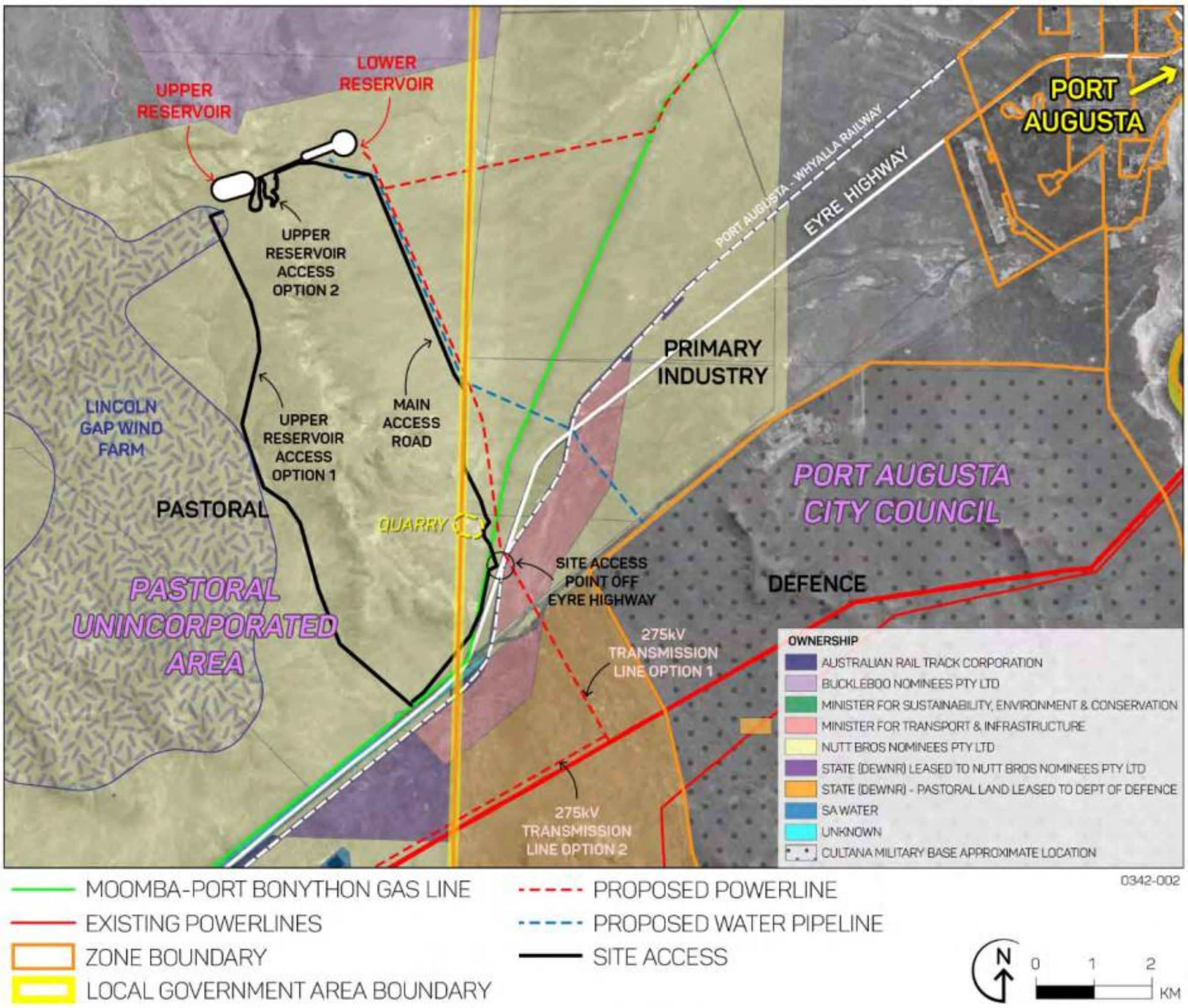
5.1 Overview

The subject site comprises land across two Development Plans:

- Land Not Within a Council Area (Flinders), consolidated 29 November 2012
- Port Augusta (City) Development Plan, consolidated 7 July 2016

Most of the infrastructure is located within the **Pastoral Zone** of the Flinders Development Plan (Flinders Plan), with sections of the transmission lines and water pipeline balance located within the **Primary Industry Zone** of the Port Augusta Development Plan (Port Augusta Plan). The following image illustrates the Council area and Zone boundaries.

Figure 5.1 *Development Plan Zoning*



The key planning issues relevant to the assessment of the application are considered to be as follows:

- Land Use;
- Efficient Energy Generation;
- Visual Impact and Amenity;
- Flora and Fauna;
- Soil Erosion and Stormwater Management;
- Traffic and Access;
- Indigenous Heritage; and
- Bushfire.

These matters are discussed and assessed below.

Due to the extensive nature of the provisions of the Development Plan relevant to the assessment of the Project, not all of them are quoted in this report. Particular emphasis has been placed on the provisions within the Flinders Development Plan given the PSH Facility is within this area. Where the identical objective or principle is found within both Development Plan's, the Flinders provision is listed.

5.2 Land Use

5.2.1 Land Not Within a Council Area (Flinders) Development Plan

Zone Objective 2

A zone in which the predominant activities are those which relate to the grazing of livestock.

Zone Objective 3

Accommodation of wind farms and ancillary development.

Zone Desired Character (extract)

Wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within the zone and constitute a component of the zone's desired character...

Zone PDC 2

Wind farms and ancillary development should be located in areas which provide opportunity for harvesting of wind and efficient generation of electricity and may therefore be sited:

(a) in visually prominent locations;

(b) closer to roads than envisaged by generic setback policy.

CW Objective 18

Development of renewable energy facilities that benefit the environment, the community and the state.

CW Objective 19

The development of renewable energy facilities, such as wind farms and ancillary development, in areas that provide opportunity to harvest natural resources for the efficient generation of electricity.

5.2.2 Port Augusta (City) Development Plan

CW Objective 1

Economically productive, efficient and environmentally sustainable primary production.

Objective 3

Protection of primary production from encroachment by incompatible land uses and protection of scenic qualities of rural landscapes.

Zone Desired Character (extract)

Development in the primary production areas will include a range of different types of farming activities, as well as appropriate value-adding uses.

5.2.3 Land Use Planning Assessment

The PSH Facility will be predominately located within a Pastoral Zone where the main activity is envisaged to be the grazing of livestock. While the Pastoral Zone does not specifically refer to 'hydro' renewable energy facilities as being suitable forms of land use, the zone does reference the construction of 'wind farms' as a key Objective. While specific in its wording, it is apparent that the construction of renewal energy facilities is envisaged within the Pastoral Zone.

In a location where wind farms are encouraged, it is reasonable to conclude that the development of infrastructure which seeks to achieve the same product deliverable as a wind farm, being renewable energy, is appropriate. This conclusion is reached having considered the nature of wind farms (and the author's previous assessment of same) which typically extend across a far greater area of land and are far more visually apparent that the proposed PSH Facility (the visual impacts are assessed later in this report).

In support of this view, the Flinders Council Wide Objective 19 seeks the development of renewable energy facilities, such as, but not necessarily restricted to, wind farms. It is reasonable to conclude that the Development Plan, as with most Development Plan's in South Australia, only currently references renewable energy infrastructure which is commonly known and constructed in the State (i.e. wind farms) while more broadly recognising that other types of renewable energy facilities may one day be proposed.

Pumped Storage Hydro is not new technology in the world or even in Australia (with 3 such hydro facilities established within other Australian States - 1 in Qld and 2 in NSW), however it is new in South Australia.

Planning policy within the Flinders plan relevant to the assessment of wind farms recognises that these forms of development also require extensive ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid). In addition to wind farms, these additional components which support the successful operation of renewal energy facilities are envisaged within both Council Zone's and constitute a component of both Zone's desired character.

We also note that the Primary Industry Zone (PDC 9) in Port Augusta's Plan envisages the establishment of major infrastructure Projects (the example given is a desalination plant) subject to appropriate management of visual and environmental impact and provision of local infrastructure to support such facilities.

Notwithstanding our view that both Development Plans support the establishment of renewable energy facilities, we acknowledge that the land on which the PSH Facility and its ancillary components is to be built is predominately to be for 'livestock grazing', a range of different types of' farming activities', as well as appropriate 'value-adding' uses. The PSH Facility could well be considered a 'value-adding' use in this context.

Importantly, the construction of the PSH Facility will not, in our view, compromise the continued use of the land around the facility for grazing or farm related activities. Given size of the associated pastoral land holding (the majority of the land in the ownership of the Nutt family), viable grazing will be able to continue effectively unaltered with only a marginal reduction in available land. While access to the land on which the reservoirs and Powerhouse are to be constructed will be removed as grazing land (and fenced to prohibit access), the bulk of the linear infrastructure (transmission lines and roads / tracks) will not be fenced and therefore stock grazing can continue on and under this infrastructure with minimal impact on stock movement. Furthermore, we note that the Penstock (the main pipe connecting the two reservoirs) traverses predominantly steep terrain for approximately half its length and this topography is unlikely to be attractive to livestock. We understand that the agreement with the land owner, allows for grazing activity around the PSH Facility (other than areas fenced off as mentioned).

During construction, a greater area of land will be occupied for temporary laydown and construction facilities. However, these components will be removed and where required, rehabilitated and therefore be again available for agricultural purposes following construction.

In summary, both the Pastoral and Primary Industry Zones envisage the building of renewal energy facilities (albeit predominately in the form of wind farms) where they will not unreasonably affect sustainable primary production or result in adverse environmental (this issue is covered later in the report). The proposed PSH Facility is considered to achieve the intent of the relevant land use provisions of both Development Plans.

5.3 Efficient Energy Generation

Land Not Within a Council Area (Flinders) Development Plan

CW PDC 89

Renewable energy facilities, including wind farms and ancillary development, should be:

(a) located in areas that maximize efficient generation and supply of electricity; and

(b) designed and sited so as not to impact on the safety of water or air transport and the operation of ports, airfields and designated landing strips.

Port Augusta (City) Development Plans

CW Objective 120

The development of renewable energy facilities, such as wind farms and ancillary development, in areas that provide opportunity to harvest natural resources for the efficient generation of electricity.

5.3.1 *Efficient Energy Generation Assessment*

These provisions relate to ensuring that renewal energy facilities are appropriately located to enable efficient energy generation. In the case of a pumped hydro facility, significant topographic variation between the elevation of the two reservoirs is essential as the energy is produced through the movement of water from the highest point to the lowest. The natural elevation of the plateau above the lower plains is highly suited to the proposed infrastructure.

Further, the ability to connect the facility to the proposed Lincoln Gap Wind Farm substation or new substation, both located on the existing ElectraNet high voltage 275 kV network located approximately 12km south also contributes to the suitability of the proposed 'Goat Hill' location.

The PSH Facility is also in relative close proximity (<10km) to the existing SA Water Morgan-Whyalla Water Pipeline, the source of water for the Project.

While more relevant to wind farms, we note that the PSH Facility is located well inland away from coastal land and activities (approx. 15km to the north-west) and also a considerable distance from the local Port Augusta Airport (approx. 12 km west). We understand consultation with the Port Augusta Airport Manager has confirmed that there are no air control concerns with the Project. Accordingly, the Project will not impact on the safety of water or air transport or the operation of ports, airfields and designated landing strips.

The Project supports efficient energy generation and supply of electricity that will benefit the environment, the community and the state.

5.4 Visual Impact and Amenity

5.4.1 *Land Not Within a Council Area (Flinders) Development Plan*

Zone PDC 1

Development should not impair the natural or scenic features of the Pastoral Zone.

CW Objective 25

The amenity of localities not impaired by the appearance of land, buildings and objects.

In areas of high scenic value, electric supply and telecommunications structures should be so sited and designed to preserve the attractiveness of such areas.

CW PDC 17

> *Buildings associated with the supply and maintenance of public utilities should be sited unobtrusively and landscaped.*

Zone Desired Character (extract)

> *Wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within the zone and constitute a component of the zone's desired character. These facilities will need to be located in areas where they can take advantage of the natural resource upon which they rely and, as a consequence, components (particularly turbines) may need to be:*
>
> *(a) located in visually prominent locations such as ridgelines;*
>
> *(b) visible from scenic routes and valuable scenic and environmental areas;*
>
> *(c) located closer to roads than envisaged by generic setback policy.*
>
> *This, coupled with the large scale of these facilities (in terms of both height and spread of components), renders it difficult to mitigate the visual impacts of wind farms to the degree expected of other types of development. Subject to implementation of management techniques set out by general / council wide policy regarding renewable energy facilities, these visual impacts are to be accepted in pursuit of benefits derived from increased generation of renewable energy.*

Zone PDC 2

> *Wind farms and ancillary development should be located in areas which provide opportunity for harvesting of wind and efficient generation of electricity and may therefore be sited:*
>
> *(a) in visually prominent locations;*
>
> *(b) closer to roads than envisaged by generic setback policy.*

5.4.2 Port Augusta (City) Development Plans

Zone Desired Character (extract)

> *Isolated new buildings, including large sheds, will be located and designed to blend with the existing landscape, with appropriate earthworks and building design to suit the natural landform. Other structures will be of a form that blends with, and does not detract from, the scenic qualities and function of the primary production area…*

Zone PDC 9

> *Development involving major infrastructure, such as a desalination plant, should be located, constructed and operated to ensure that:*
>
> *(a) the visual impact from arterial roads is minimised through a combination of separation distances, siting, design techniques and landscaping…*

CW Objective 97

> *The visual impact of infrastructure facilities minimised.*

CW PDC 326

> *Electricity infrastructure should be designed and located to minimise its visual and environmental impacts.*

5.4.3 *Visual Impact and Amenity Planning Assessment*

A clear intent of both Development Plans is to minimise the visual impact of infrastructure facilities on the landscape. In order to determine the visual impact, the applicant engaged Convergen to produce a 3D fly through and indicative perspective images of the PSH Facility as it will be viewed in the landscape from various vantage points. A drone was used to capture the landscape imagery and the engineering concept design of the facility has been overlayed. We understand the perspective images have been submitted with the application. A series of these images have been reproduced below.

Figure 5.2 *Perspective image – View from Upper Reservoir overlooking Lower Reservoir towards Port Augusta*

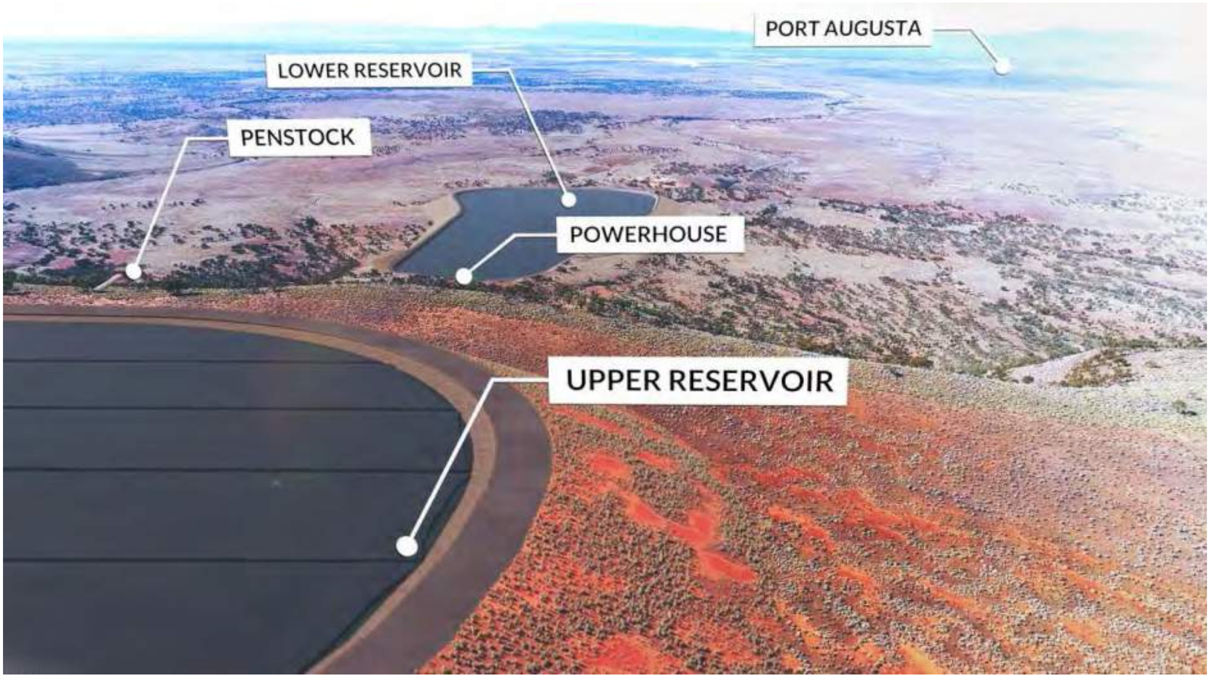


Figure 5.3 Perspective image – *View of Lower Reservoir looking up towards the Plateau*

Figure 5.4 *Perspective image – View over the Upper Reservoir looking south-west*

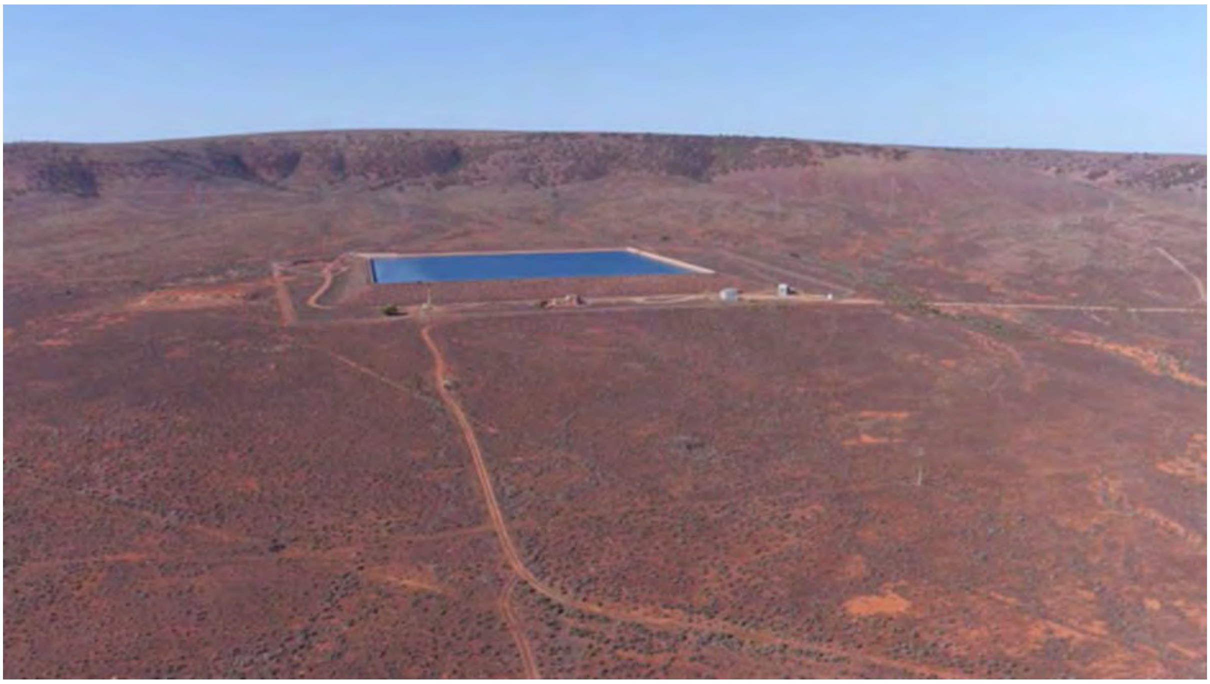
Figure 5.5 *Perspective image – View over Lower Reservoir looking south*

The scale of the reservoirs is substantial at between 34 to 26 hectares each in total area occupied (including the surrounding embankments), although we note that the facility covers a relatively small footprint for its energy capacity (i.e. ~ 80ha for 230 – 270 MW), compared to other renewable energy Projects such as the Aurora Solar Energy Project which occupies in the order of 800ha and generates 150MW.

The embankments are in fact the most substantial element rising between 20 to 25 metres above natural ground level in the form of a graded earth bank around each reservoir. While these are of a notable scale, they will be constructed of excavated material from the reservoir location and then vegetated. After a time, once the vegetation matures and the visual element of the embankment softens, it is anticipated that these features will blend relatively seamlessly into the landscape.

A comparison can be made with the nearby above ground water storage facility operated by SA Water, located approx. 12 km south of the PSH Facility. Although approx. five times smaller than the proposed reservoirs, the embankment walls that have been revegetated minimise the intrusiveness of this element to the adjacent Eyre Highway. This existing water storage facility is located 1km off the Eyre Highway whereas the proposed reservoirs are some 10km from the highway, noticeably reducing their visibility from this road and other publicly accessible land.

Figure 5.6 *SA Water Storage facility (drone images)*



Importantly the proposed reservoirs and other components of the facility do not make any significant alterations to the existing plateau or steep strike ranges. While the embankments will increase the level of the land at these locations, it is not envisaged that the overall topography and appearance of the landscape will alter significantly.

In the context of the wide, open landscape in which the facility sits, the above ground infrastructure, such as the Penstock, is considered insignificant in size and will also not dominate the appearance of the site particularly when viewed from public land.

The Powerhouse will not be dominant visual element as it will be:

- Distant from public view points (> 10km from the Eyre Highway);
- Located low in the landscape, being in an excavated area adjacent to the Lower Reservoir;
- Constructed of material that will be commensurate with the surrounds; and
- For the most part, will sited underground.

The proposed transmission lines will be visible from various locations, particularly as they get closer to and then cross roads. However, we note that there are several existing transmission lines (132kV, 275kV, 33kV, and single phase) within the landscape and while the poles and lattice components of the transmission lines will have a localised visual impact, the uniformity and repetitive pattern of this infrastructure will make it less evident in the landscape and the lines will be no more perceptible than the existing transmission towers, tanks, farm buildings and pipelines within the landscape. We also note the proximity of the Lincoln Gap Wind Farm (the closet turbine being approximately 480 metres away) which will be a far more dominant visual feature in the landscape and also crosses the Highway several km west of the Goat Hill Project.

In forming our view on the visual impacts, we note that views of the PSH Facility to the general public will be limited and only available from public roads, which at its closest point would be the Eyre Highway some 6 km away. Vehicles driving along this road may, at certain points gain glimpses of the facility however the ability to discern the infrastructure in any detail would be unlikely at this range.

The image below is taken from the western edge of the Port Augusta township, approximately 12km from the proposed PSH Facility (indicated by the arrow).

Figure 5.7 *View towards Project area from western edge of Port Augusta (approx. 12km)*

The Project is sited remotely from human settlement and urban areas with the closest residences being 10km to the south-west. The township of Port Augusta is 12 km west of the site and as such, it is unlikely that any part of the facility will be noticeably visible from this distance.

Given the location away from public land, the nature of the structures to be built and the materiality and landscaping of the embankments, the PSH Facility is considered to be relatively unobtrusive and consistent with the existing grazing landscape or scenic features of the subject site and surrounding locality.

Notwithstanding the relatively inconspicuous physical form of the facility, we note (as previously mentioned) that wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting transmission lines are envisaged within both Zones and that it is clearly recognised in the language within the Development Plans that infrastructure projects may be more visible than other forms of development and also may need to be located in visually prominent locations to facilitate efficient energy generation. This acceptance of the Development Plan that, in order to harness renewable energy, the facilities to be constructed may have some visual impact on the landscape is a relevant consideration in this application, despite it not being for a wind farm. In effect, the policy is saying that some visual impact from renewal energy developments is acceptable in pursuit of benefits derived from increased generation of renewable energy. The suitability of the Lincoln Gap Wind Farm proposed only a few km south-west of the subject site would have been assessed against these same provisions.

The proposed Project, nonetheless seeks to minimise its visual impact through the appropriate selection of materials, such as the use of excavated, battered site material where appropriate (rather than retaining walls), muted and natural colours to be used on external structures where possible, and revegetating the reservoir embankments.

Although the PSH Facility will be a new visual element in the landscape, the Project will not impair the existing grazing landscape to a degree that is contrary to that envisaged by the Development Plan, recognising that the benefits of renewal energy facilities need to be considered in context with the visual changes this infrastructure makes to the landscape.

In relation to other amenity considerations, construction is to occur over a 2.5 to 3 years period and during this period there may be some adverse impacts to the amenity of the locality. For example, during the construction phase there will be an increase in site activity on surrounding roads. This increase in traffic potentially may give rise to additional noise and dust, however these impacts are only temporary, will be localised and are distant from the nearest sensitive receiver. Adherence to the EPA legislation and the Construction Management Plan in relation to the management and minimisation of noise, vibration, dust and the like is a commitment of the Applicant. On this basis, the proposal is considered to meet the intent of both Development Plans in relation to amenity impacts.

5.5 Flora, Fauna and Conservation

5.5.1 Land Not Within a Council Area (Flinders) Development Plan

Zone Objective 1

The preservation of the natural environment and character of the zone.

CW Objective 17

The conservation of the quality of the environment within the Flinders Ranges. The greater portion of the Flinders Ranges has high scenic value and there are specific localities which are particularly outstanding. It is important that the natural character of these areas be conserved as part of Australia's heritage and all development and activities-whether tourist, recreational, mining or pastoral-should be subordinated to this aim.

CW Objective 18

The conservation, preservation and enhancement, of scenically attractive areas, including land adjoining water or scenic routes, landscape of the Flinders Ranges and the shores of Spencer Gulf are examples of areas of visual significance worthy of protection against unsightly development and mismanagement.

CW Objective 20

Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses.

CW PDC 18

The routes of electricity transmission lines and other public utilities should be designed to ensure minimal adverse environmental impact.

Flinders CW Objective 21

The retention of environmentally significant areas of native vegetation.

Flinders CW Objective 22

The retention of native vegetation where clearance is likely to lead to problems of soil erosion, soil slip and soil salinization, flooding, or a deterioration in the quality of surface waters.

Flinders CW PDC 28

Native vegetation should not be cleared if it:

(a) provides important habitat for wildlife;

(b) has a high plant species diversity or has rare or endangered plant species and plant associations;

(c) *has high amenity value;*

(d) *contributes to the landscape quality of an area;*

(e) *has high value as a remnant of vegetation associations characteristic of a district or region prior to extensive clearance for agriculture;*

(f) *is associated with sites of historical, scientific, archaeological or cultural significance; or*

(g) *is growing in, or is characteristically associated with, a wetland environment.*

Flinders CW PDC 29

Native vegetation should not be cleared if such clearance is likely to:

(a) *create or contribute to soil erosion;*

(b) *decrease soil stability and initiate soil slip;*

(c) *create, or contribute to, a local or regional soil salinity problem;*

(d) *lead to the deterioration in the quality of surface waters; or*

(e) *create or exacerbate the incidence or intensity of local or regional flooding.*

Flinders CW PDC 30

When clearance is proposed, consideration should be given to:

(a) *retention of native vegetation for, or as,*

  (i) *corridors or wildlife refuges;*

  (i) *amenity purposes;*

  (iii) *livestock shade and shelter; or*

  (iv) *protection from erosion along watercourses and the filtering of suspended solids and nutrients from run-off;*

(b) *the effects of retention on farm management; and*

(c) *the implications of retention or clearance on fire control.*

Flinders CW PDC 37

Development should, wherever practicable, incorporate the retention of existing trees and the planting of new trees, preferably native species endemic to the area.

5.5.2 Port Augusta (City) Development Plans

Zone PDC 9

Development involving major infrastructure, such as a desalination plant, should be located, constructed and operated to ensure that:

… (b) it has been demonstrated that all potential environmental impacts will be minimal…

CW Objective 38

Native flora, fauna and ecosystems protected, retained, conserved and restored.

CW PDC 77

Development design, construction and the use of land should take place in a manner which:

(a) provides buffer areas to protect habitats and physical features of nature conservation significance;

(b) minimises interference with biodiversity on the land and in surrounding localities;

(c) enhances the longer term protection and management of biodiversity;

(d) provides linkages and corridors between key areas of native vegetation;

(e) rehabilitates degraded areas that are an intrinsic component of the nature conservation network; and

(f) ensures that land to be dedicated for open space purposes by developers is acceptable for nature conservation or open space use, and is complementary to the open space system.

CW Objective 33

The ecologically sustainable use of natural resources including water resources, including marine waters, ground water, surface water and watercourses.

CW Objective 36

Development sited and designed to:

(a) protect natural ecological systems;

(b) achieve the sustainable use of water;

(c) protect water quality, including receiving waters;

(d) reduce runoff and peak flows and prevent the risk of downstream flooding;

(e) minimise demand on reticulated water supplies;

(f) maximise the harvest and use of stormwater;

(g) protect stormwater from pollution sources.

CW PDC 80

Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas.

CW PDC 83

Development should be appropriate to land capability and the protection and conservation of water resources and biodiversity.

CW PDC 84

Development should be designed to maximise conservation, minimise consumption and encourage re-use of water resources.

CW PDC 106

Development should be designed and sited to minimise the loss and disturbance of native flora and fauna, including marine animals and plants, and their breeding grounds and habitats.

CW PDC 110

Where native vegetation is to be removed, it should be replaced in a suitable location on the site with locally indigenous vegetation to ensure that there is not a net loss of native vegetation and biodiversity.

CW PDC 328

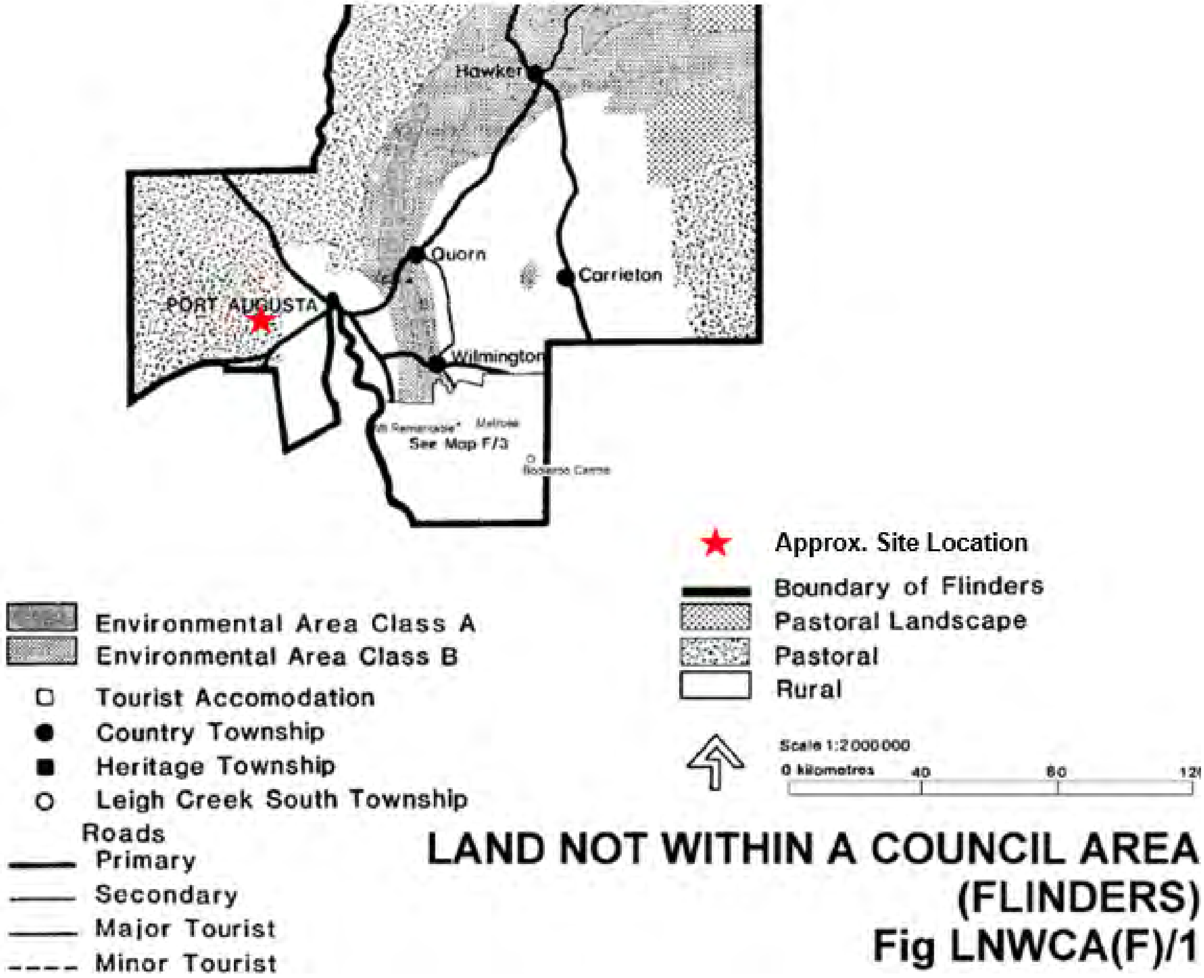
Utilities and services, including access roads and tracks, should be sited on areas already cleared of native vegetation. If this is not possible, their siting should cause minimal interference or disturbance to existing native vegetation and biodiversity.

5.5.3 Flora, Fauna and Conservation Planning Assessment

As mentioned, the Project area is currently used for sheep grazing and, although uncleared, this activity (together with goats and rabbits) has impacted on the remnant native vegetation. The presence of wild goats and rabbits has also disturbed the environmental quality of the area.

The following map (extract from the Flinders DP) illustrates that the subject land is classified ‘pastoral’ and ‘rural’ and is not within or adjoining either an Environmental Class A or B area as identified in the Development Plan. Further, the land in question does not form part of the recognised ‘Flinders Ranges’.

Figure 5.8 *Flinders Plan map extract*



While not identified as an area of outstanding conservation value, having been degraded by long term grazing, it is evident when visiting the Project area that native vegetation is present and that native fauna habitat may exist. Accordingly, the Project has been properly informed by specialised consultant input to ensure the natural environment, character and habitat of the area is appropriately preserved wherever possible.

EBS Ecology was engaged to conduct a baseline ecological assessment of the Project area to determine the potential presence of species listed as threatened or migratory under the Environment Protection and Biodiversity Conservation (EPBC) Act and the National Parks and Wildlife (NPW) Act.

EBS undertook detailed vegetation mapping, flora species inventories, targeted conservation rated species surveys as well as desktop assessments using existing databases and aerial photography. The methodology, survey and assessment results and recommendations are outlined within the comprehensive EBS Ecology Flora and Fauna Assessment report submitted with the development application.

Key findings from the EBS study are as follows:

- 109 flora species were recorded including 92 native species and 17 weed species;
- 44 bird species, 4 mammal and 4 reptile species were recorded;
- No flora or fauna species, or ecological communities with a conservation rating under the EPBC Act were recorded;
- One flora species (Sandalwood) listed as vulnerable under the NPW Act was recorded;
- One fauna species (Slender-billed Thornbill [western]) listed under the NPW Act was observed within the Project area; and
- 3 declared weed species were recorded (African Boxthorn, Horehound and Bathurst Burr) within the Project area.

In considering these findings, EBS make the following recommendations which we understand are accepted by Altura:

- Where possible, micro-site the Project footprint to avoid locations where Sandalwood is present and prevent its removal;
- Utilise existing vehicle tracks across the Project area where possible;
- Incorporate weed spread and management measures into the Environmental Management Plan; and
- Adoption of best practice environmental management measures during and following construction.

We note that in EBS's opinion, the presence of the Slender-billed Thornbill is not of concern as this species has a stable population, is widespread and has extensive areas of suitable habitat within the region.

While some native vegetation removal will occur, the extent of clearance appears modest in the context of the Project scale and broad site land holding. When native vegetation removal is unavoidable, the Applicant is aware that SEB payments will apply. The total permanent vegetation clearance is estimated to be approximately 100 hectares, which is a relatively small percentage 0.8 percent) of the assessed site (1,270 hectares) of the development.

Site Landscaping will be installed around the facility using appropriate local native species where possible. Landscaping water supply and subsequent irrigation will consider the use of rain water in appropriate locations.

As previously mentioned, the concept of micro-siting certain components of the infrastructure is agreeable to the Applicant and will be incorporated within the construction strategy with the method outlined in the final Environmental Management Plan. In addition to micro-siting, other measures incorporated into the Project which aim to preserve the natural environment include:

- Minimising the creation of new access roads and post-construction, rehabilitating any roads that are not required for permeant operation of the facility;
- Using earth battered, re-vegetated slopes rather than solid retaining walls;

- Containing temporary construction elements within designated locations;
- Minimising erosion and watercourse interference;
- Measures to manage soil stability and soil slip;
- Revegetated areas actively managed to prevent the spread of weed species; and
- Restricting access via security fencing only where essential (i.e. around the reservoirs) so as to allow for fauna movement and habitat in and around other infrastructure elements (i.e. below transmission lines).

The Applicant has confirmed that the rehabilitation objective will be to establish stable landforms and in agreement with the landowner, re-establish the vegetation community / assemblage that was present before the disturbance took place. Areas will be rehabilitated as soon as practicable after the area is no longer required, with temporary roads, hardstand areas and the like deep-ripped to break compaction and facilitate water infiltration and plant establishment.

During construction, wastewater sources may include treated sewerage effluent water, grey water from amenities, washdown water and potentially contaminated stormwater. Where feasible/appropriate, waste water streams will be treated and reused on site (e.g. dust control; landscaped area) or directed to collection facilities for evaporation or removal from site for appropriate disposal. Any hazardous liquid waste (e.g. oily water) will be will be captured and removed from site using a licensed waste contractor.

It is noted that a range of other general waste products will be generated during the construction and to a lesser extent the operational phase. As with waste water, hard waste will be managed and disposed of in accordance with best practice and South Australian regulations.

One of the key objectives in the Flinders Development Plan is for the location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment. In considering the finding of the EBS report and the measures that the Applicant has committed to adopting, construction of the PSH Facility will adequately achieve the Development Plan policy provisions related to conservation of the natural environment and the protection of flora and fauna. In particular, we note the intent to minimise removal of the Sandalwood species, listed as vulnerable under the NPW Act and that the Project is anticipated to have a negligible impact on the Slender-billed Thornbill.

5.6 Soil Erosion and Stormwater Management

5.6.1 Land Not Within a Council Area (Flinders) Development Plan

CW PDC 6

Development should not:

(a) cause or promote erosion;

(b) cause or promote the silting of watercourses;

(c) create any unstable embankment or cutting; or

(d) create a major alteration to surface or sub-surface hydrology.

CW PDC 10

All roads, tracks, pipelines and power supplies should, as integral parts of a development, conform to the same principles.

5.6.2 Port Augusta (City) Development Plans

CW PDC 116

Development should be designed and sited to prevent erosion.

CW PDC 117

Development should take place in a manner that will minimise alteration to the existing landform.

CW PDC 140

Development, including associated cut and fill activities, should not lead to an increased danger from land surface instability or to the potential of landslip occurring on the site or on surrounding land.

CW PDC 141

Development on steep slopes should promote the retention and replanting of vegetation as a means of stabilising and reducing the possibility of surface movement or disturbance.

5.6.3 Soil Erosion and Stormwater Management Planning Assessment

Golder has prepared a Surface Water Quantity and Quality Technical Report which considers how the Project manages potential erosion, treatment of watercourses and stormwater.

Two (2) existing watercourses are intersected by the PSH Facility, one on land across which the Penstock is to be located and the second within the area covered by the Lower Reservoir. In addition, there are a number of watercourse crossings along the access roads, water supply pipeline and transmission line corridor. The size of these watercourses vary (and are classified in the Golder report to assist with the interpretation of the stream hierarchy).

In a similar manner to the construction of other proposed infrastructure, the placement of the Penstock, is to be carefully sited so as to minimise the impact on the watercourse (and avoid entirely if possible). Should concrete saddles be constructed to support the Penstock and these are unable to be located outside the watercourse, then a more detailed erosion assessment would be undertaken to ensure the design accommodates potential rainfall events. The placement of transmission line footings will be similarly managed, noting that Golder confirm that proposed transmission corridor will have no impact on the flow of existing watercourses.

The second watercourse interception at the Lower Reservoir occurs at the head of the catchment of a watercourse. The Lower Reservoir will be sited on top of the commencement of this watercourse so it cannot be avoided. While this will result in a reduction in the catchment area for this watercourse, Golder confirm that this represents a small reduction in flow rate, calculated at less than 1% loss in catchment area, and therefore the changes to water quantity are considered to be insignificant.

Other watercourse interceptions will be managed through the construction of suitably sized road culverts or armoured causeway crossings and erosion protection such as rock rip rap so as to minimise impact on the flow characteristics of the watercourse channels. A micro-siting design solution will be tailored to appropriately mange the localised characteristics of each watercourse interception.

Beyond the impact on watercourses, a series of potential erosion and sediment control measures for the Project are outlined in the Golder report and it is noted that a Soil Erosion Drainage Management Plan is to be prepared as a part of the CEMP. Initial assessment recognises that at certain locations within the Project area, the potential for erosion is greater due to steeper topography and the resulting high velocity water flow during the infrequent rain events. The erosion control measures employed will be adjusted to take account of topography.

It is noted that there is no formal stormwater drainage infrastructure on the land or at the existing access point to Eyre Highway. For the most part, stormwater will run off the proposed infrastructure on the existing ground surface however stormwater collecting on the roofs of structures will be appropriately collected and managed so as to avoid erosion. Clean stormwater will be diverted to watercourses, used for dust control or to irrigate landscaped area and where possible be directed to top up the reservoirs. Any runoff with the potential to contain pollutants, including carparking areas and workshop areas, will be managed via a ‘first flush’ stormwater system. Excess runoff above the `first flush' volume will discharge directly into the stormwater outlet system.

Once finalised, the Soil Erosion Drainage Management Plan will outline the specific measures which will be used to avoid land degradation, minimise erosion and prevent sediment impacts on water quality.

While the Project area is not recognised as a highly sensitive ecological area, the development is to be delivered in a manner which seeks to minimise erosion, avoid unstable embankments or cuttings and ensure watercourses are not significantly altered where practible. In achieving this, the proposed PSH Facility is considered to appropriately address the relevant erosion and stormwater provisions of both Development Plans.

5.7 Traffic and Access

5.7.1 Land Not Within a Council Area (Flinders) Development Plan

CW Objective 15

The free flow of traffic on roads by minimising interference from adjoining development.

CW PDC 14

Development and associated points of access and egress should not create conditions that cause interference with the free flow of traffic on adjoining roads.

CW PDC 15

Development should include appropriate provision on the site to enable the parking, loading, unloading, turning and fuelling of vehicles.

5.7.2 Port Augusta (City) Development Plans

Zone PDC 9

Development involving major infrastructure, such as a desalination plant, should be located, constructed and operated to ensure that:

...

(c) local infrastructure such as roads have been upgraded to accommodate increased traffic movements.

5.7.3 Traffic and Access Planning Assessment

WGA was engaged by the applicant to undertake a traffic impact and access point assessment. The assessment examined the current conditions of the local road network and access points into the site, calculated the likely traffic volumes associated with construction of the project (noting the post construction traffic volumes will be nominal) and provides recommendation in relation to certain relatively minor civil works that should be undertaken to ensure safe and compliant traffic and access arrangements. The points at which the proposed linear infrastructure crosses existing roads has also been examined.

Of particular note is that during the construction phase, the site will be accessed by a notable increase in vehicle traffic, predominately light vehicles but also a regular number of heavy vehicles transporting materials and equipment to the site. WGA has estimated this increased volume at approx. 137 trips per day. Some oversize/overmass vehicles movements are anticipated to transport large pieces of equipment (i.e. transformers, concrete batching silos). A range of works on site will need to be undertaken prior to commencement of the PSH Facility construction to accommodate these vehicle movements, in particular, the Main Access Road and Upper Reservoir Road will need to be built. As the site access is off a 110km/hr highway which carries up to 36.5m road trains, certain works to the access point are also necessary to avoid entry and exit hazards. It is noted however that this access point already services a functioning quarry located within the subject site so heavy vehicles already utilise this access point as seen in the following image.

Figure 5.9 *Existing access point of Eyre Highway (c/- WGA)*

Key findings and recommendations from the WGA report include:

- There will be slight increase of traffic on the local road network, predominately the highways, during the construction phase however this is anticipated to have minimal impact given the functionality of these roads and their current condition;
- The increase on all roads during the operational period is considered negligible due to the small volume of traffic generated;
- The location of the access point on the straight stretch of Highway provides the required safe sight distances;
- The existing access point will require widening to between 6m to 8m to accommodate larger vehicles;
- The installation of warning signs advising outgoing vehicles to give way to incoming vehicles is suggested;
- Where the unsealed shoulder meets the sealed Highway, treatment should occur to smooth out the surface and resurfacing should occur if necessary;
- Appropriate access is available via existing informal tracks at locations where the linear infrastructure crosses existing roads however further analysis of the conditions on Caroona Road may need to be reviewed subject to the level of access require on this road; and
- Various matters were suggested for inclusion in the CEMP including:
  - » the use of water trucks to manage airborne dust form vehicles in dry weather;

- the use of advanced warning signage to alert road users to the increase of heavy vehicles during certain stages of the construction;
- measures to prevent the tracking of mud from the site onto the Highway in wet weather should be considered; and
- ongoing monitoring of surfaces near the access point during construction and resurfacing if/as required.

The applicant also advises that appropriate on-site traffic controls to ensure that vehicles use the designated site access tracks will be implemented.

We also note that the gate and security arrangements at the access point will require further consideration to ensure vehicles can enter efficiently.

We understand the Applicant is amenable to the resolution of these detailed matters following the advice of DPTI and during the next phase of design development.

Areas of on-site car parking and loading will be created to ensure safe vehicle parking and manoeuvring (turning, loading and unloading) during construction and after. Some of these carparking/service areas will only need to be temporary and will be rehabilitated post construction. The specific location of these areas will be resolved in conjunction with the arrangements of the temporary construction components (workshops, amenities, offices etc) once the contractor has been engaged and final designs are prepared.

Subject to resolution of the matters raised by WGA and the final advice of DPTI, the proposal will satisfactorily achieve the relevant Development Plan provisions relating to traffic and access.

5.8 Heritage

5.8.1 Land Not Within a Council Area (Flinders) Development Plan

CW Objective 33

> *Preserve sites of heritage, cultural, scientific, environmental, educational or landscape importance.*

5.8.2 Port Augusta (City) Development Plans

Objective 54

> *The conservation of land, buildings and structures and their settings, which are of aesthetic, architectural, historical, cultural, archaeological, geological, palaeontological, technological or scientific significance.*

CW PDC 143

> *Development should be designed and sited so as to conserve and enhance buildings, structures or sites of natural or man-made cultural heritage or of particular architectural merit.*

5.8.3 Heritage Planning Assessment

Both Development Plans contain numerous provisions relating to protection of places of heritage significance. While no State listed places are located within the vicinity of the project, Indigenous sites of value have been identified.

The Applicant has engaged Independent Heritage Consultants (IHC) to undertake an assessment, consult with the local Barngarla Indigenous Community and prepare a heritage agreement in relation to the proposed works.

IHC undertook a Department of State Development, Aboriginal Affairs and Reconciliation (DSD-AAR) search in July 2017 which revealed five recorded/registered indigenous sites in the vicinity of the Project and a single large ethnographic site within the infrastructure footprint. These registered sites are a mixture of archaeological (artefact scatters and ceremonial sites) and cultural (ethnographic) sites. The details of the culturally sensitive site locations have been requested to remain confidential.

All parties have agreed that recognition of the Indigenous heritage aspects of the Project will be most suitably managed through a Heritage Agreement. The Agreement, the details of which are currently being resolved, will be between the Altura and the Local Barngarla Indigenous Community. Once agreement is reached, a detailed cultural heritage survey will be undertaken to further inform the Project and any identified sites managed in accordance with this Agreement. It is understood that the emphasis will be on avoiding impacts (where practicable) and salvaging those sites that need further protection.

While survey work is still required, it is considered that the Project will be able to be designed, sited and managed so as to appropriately conserve (through physical preservation, recording and/or salvage) the identified sites of archaeological and cultural significance.

To date, the steps taken demonstrate a commitment by Altura to recognise, and where possible, preserve identified sites of heritage and cultural importance in accordance with the intent of the Development Plan provisions.

5.9 Bushfire

5.9.1 Land Not Within a Council Area (Flinders) Development Plan

CW PDC 30

When clearance is proposed, consideration should be given to:

…

(c) the implications of retention or clearance on fire control.

CW PDC 8

Buildings suitable for occupation, which are erected in areas subject to bushfires, should:

(a) be sited appropriately in relation to nearby trees and vegetation;

(b) be constructed of materials which have a good fire resistance;

(c) have adequate means of access and egress for fire-fighting vehicles, to and from the site; and

(d) have an adequate and readily accessible water supply available for fire-fighting at all times.

5.9.2 Port Augusta (City) Development Plans

CW Objective 48

Development located to minimise the threat and impact of bushfires on life and property.

CW PDC 109

Development that proposes the clearance of native vegetation should address or consider the implications that removing the native vegetation will have on the following:

…

(d) bushfire safety;

CW PDC 119

Development should be excluded from areas that are vulnerable to, and cannot be adequately and effectively be protected from, the risk of hazards.

CW PDC 128

Buildings and structures should be designed and configured to reduce the impact of bushfire through using designs that reduce the potential for trapping burning debris against the building or structure, or between the ground and building floor level in the case of transportable buildings.

5.9.3 Bushfire Planning Assessment

Neither Development Plan identifies the subject site as having a high bushfire risk however as the land is an open, grazing environment with consistent vegetation coverage, the potential for bushfire is recognised, particularly given the potential for the substations and powerlines to start or influence the spread of fire due to their electrical nature.

Given the presence of existing transmission lines and farm buildings, we note that this risk is already present in the environment.

The proposed structures associated with the PSH Facility are to be located on relatively flat land with reasonable accessibility via the upgraded Main Access Road. While access to fire fighting vehicles is understood to be provided to the Lower Reservoir area where the majority of the actual buildings and structures will be sited, given the non-habitable use of the land, there is an expectation that the CFS would make the necessary determinations at the time a fire was present, to assess whether access was safe and warranted.

All structures will be built with adequate building protection to meet the Building Code specifications. Building layout and selection will take account of the potential for trapping burning debris against the structures, or between the ground and building floor level in the case of transportable buildings. Appropriate separation buffers between building s and vegetation will also be incorporated.

The Applicant has undertaken consultation with the CFS in relation to the Project and an Emergency Response Plan as proposed part of the operational procedures during the construction and operational phases of the PSH facility.

6. Conclusion

The Altura Group is seeking to establish 'Public Infrastructure' in the form of a Pumped Storage Hydro Facility to the west of Port Augusta, located primarily within 'Land Not Within a Council Area (Flinders) Development Plan' (consolidated 29 November 2012) and to a lesser degree within the 'Port Augusta (City) Development Plan' (consolidated 7 July 2016).

Renewable energy infrastructure is a specifically envisaged form of development within the relevant Development Plan Zones, being the 'Pastoral' and 'Primary Industry' Zones. The primary desired land uses of grazing and associated farming activities within these zones are not compromised by the occupation of the PSH Facility on the land which can function compatibly in this rural environment.

The PSH Facility is to be appropriately sited in a location with topographic characteristics which enable the gravitational flow of water from a higher water body to a lower, efficiently producing electrical energy. The Project is suitably sited away from townships, sensitive land use and high quality/vulnerable environmental areas.

Once constructed, this form of infrastructure is by design, relatively low impact, with the appearance of the reservoirs being an extension of the natural land form and the supporting infrastructure being of modest scale and similar to existing rural structures and linear infrastructure already present in the landscape.

The proposal has sought to appropriately address potential impacts, particularly those associated with visual impacts, the protection of flora and fauna, watercourses and erosion, traffic movements and Aboriginal heritage.

Through the implementation of the CEMP, the Project will incorporate appropriate measures to oversee the construction phase in an environmentally efficient manner and ensure the ongoing operations are similarly managed to avoid degradation of the landscape and promote safe and efficient procedures.

Following an assessment of the proposed development against the whole of the Land Not Within a Council Area (Flinders) and Port Augusta (City) Development Plan, it is our considered view that the PSH Facility proposal is not significantly at variance with the Development Plan and warrants Development Approval.

APPENDIX D

Surface water

6 December 2017

SURFACE WATER QUANTITY AND QUALITY

Goat Hill Pump Storage Hydro Project

Submitted to:
Altura Group

REPORT

Report Number. 1777292-008-R-Rev1

Executive Summary

The Altura Group Pty Ltd is proposing to develop the Goat Hill Pumped Storage Hydro (PSH) Project (the Project), located approximately 12 km west of Port Augusta, to support South Australia's power network. This report describes the climate and hydrology of the Project location and identifies measures to manage/mitigate the potential Project impacts to surface water quantity and quality.

The climate of the Project location is described by the Bureau of Meteorology as a Desert (hot, persistently dry and non-seasonal). Rainfall is low and potential evaporation rates exceed average rainfall in all months. The Project utilises the elevation of the Simmens Plateau and steep slope of the adjacent escarpment for hydro-electric electricity production. Incised gullies occur naturally at the base of the escarpment and watercourse channels lose definition further away from the plateau where there is natural deposition of sediment. Watercourses in and around the Project location are ephemeral. Soils are mostly low dispersive clays with a mixture of coarser sands and gravel in the surface layers. Water quality data are not routinely collected at any of the Government of South Australia water monitoring sites within 50 km of the Project location.

The construction of project infrastructure has the potential to impact surface water quantity due to the reduction in catchment area and related watercourse flow during rainfall events at two locations. The overall potential change in peak flow at a nearby junction of the downstream watercourse has been identified to be a loss of <1% in catchment area and therefore the changes to water quantity are considered to be insignificant.

A total of 93 locations are identified where watercourses are intercepted by the Project or related infrastructure including the penstock, water supply pipeline, high voltage connection and two access roads. Road crossings will be managed by the design of suitably sized culvert or causeway crossings, without impact to watercourse flow. Where project infrastructure such as the penstock, above ground water supply pipeline or transmission lines cross watercourses, the crossings should be detailed where possible to avoid the placement of infrastructure within the watercourse.

If the water supply pipeline is buried, the crossing locations from the Eyre Highway to the Project location will require management to provide suitable scour protection. Suitable scour protection measures will likely involve the placement of stable rock rip-rap in the location of the pipeline crossing, the sizing of the stable rock to be calculated by standard hydraulic methods.

The Upper Reservoir Road – option 2 will require design of erosion and scour protection to road batters and ongoing inspection and maintenance due to the steep gradient of the road and road batters and high potential for erosion, scour and bank instability.

Erosion and sediment control planning and implementation during the construction and establishment stages of the Project will be addressed in a soil erosion drainage management plan. A selection of potential suitable erosion and sediment control measures are provided. Suitable controls are selected from controls identified in the International Erosion Control Association guideline, as those recommended for the climate, topography and soils encountered at the Project location.

Study Limitations

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in APPENDIX A of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

The Altura Group Pty Ltd (Altura) is proposing to develop the Goat Hill Pumped Storage Hydro (PSH) Project (the Project) located approximately 12 km west of Port Augusta. The Project responds to the requirement for new and flexible forms of generation plant to support South Australia's power system through provision of fast response plant providing bulk energy management.

This report describes the climate and hydrology of the Project location and identifies measures to manage/ mitigate the potential Project impacts to surface water quantity and water quality.

1.1 Project Overview

The PSH Facility will be installed using two bodies of water that are interconnected and located at different elevations. When energy is available, the PSH facility uses electricity to pump water from the Lower Reservoir to the Upper Reservoir. When required, energy is produced by releasing the water from the Upper Reservoir to the Lower Reservoir passing through the penstock to the turbines.

The Project consists of an Upper Reservoir formed by engineered earth embankments, an upper intake, a surface steel penstock, vertical pressure shaft, below ground powerhouse, tailrace tunnel to the Lower Reservoir also formed by engineered earth embankments. A switchyard will connect the Project to the SA electricity network. Ancillary infrastructure required includes an overhead high voltage transmission line, underground water supply pipeline and access roads. The Project location and infrastructure is shown in Figure 1.

The Project takes advantage of the natural conditions of the site where a number of steep strike ranges rise from the plain and comprise plateaus edged by steep escarpments and long foot slopes. A number of ephemeral watercourses are located on the lower escarpment and foot slopes in the vicinity of project and ancillary infrastructure.

2.0 SURFACE WATER BASELINE ASSESSMENT

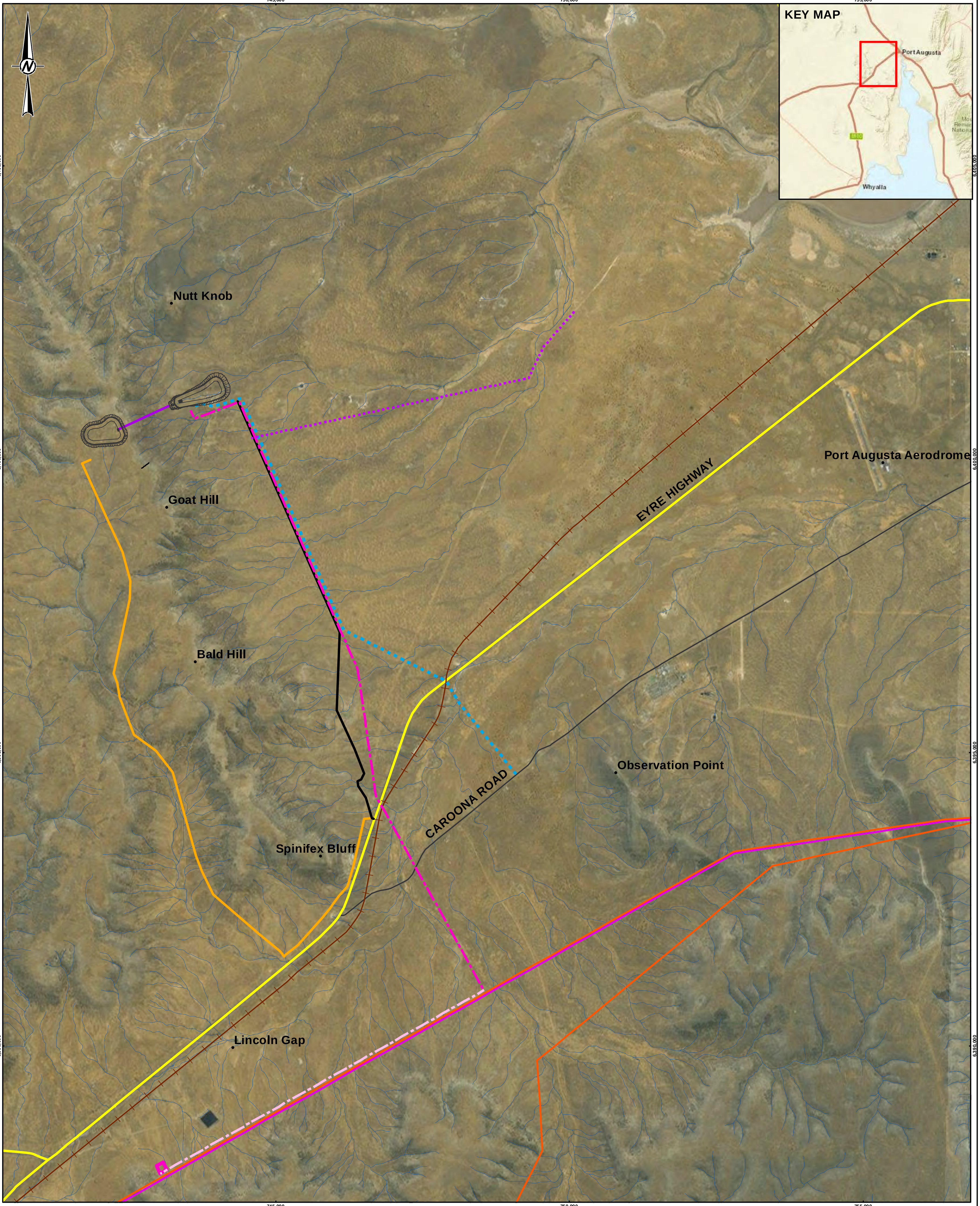
A baseline overview of parameters relevant to surface water quantity and quality is provided including climate, hydrology, surface water quantity and quality data availability and soils information.

2.1 Climate

2.1.1 Rainfall

The climate of the Project site is classified by the Bureau of Meteorology (BoM) as a Desert (hot and persistently dry – non seasonal) (BoM, 2017). The closest weather station to the site is the Port Augusta Aero Station (18201) opened in 2001 (32.51 S, 137.72 E). The mean annual rainfall for the period of record is 219.7 mm (range 100.4 – 346.4 mm). The maximum daily rainfall for the period of record is 74.4 mm. As indicated by the climate classification and as shown in Figure 2 there is no defined seasonal variability in rainfall.

PATH: J:\Hyd\2017\Adelaide Altura Group Approvals Lincoln Gap\GIS\1777292-008-R-RevB F001 Project Location and Infrastrucure.mxd PRINTED ON: 2017-12-05 AT: 12:16:57 PM



LEGEND

- Locations
- General Arrangement
- Access Road
- Proposed 275kV line
- Proposed 275kV line to LGWF substation
- Potential Medium Voltage Distribution to Site
- Upper Reservoir Access
- Upper Reservoir Access - Option 2
- Proposed Water Supply Pipeline
- Penstock

High Voltage Powerlines

- 275 kV Powerline
- 132 kV Powerline
- 66kV Powerline
- Highway
- Road
- Railway
- Watercourses
- Proposed Substation

Coordinate System: GDA 1994 MGA Zone 53
Projection: Transverse Mercator
Datum: GDA 1994

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NOTE(S)

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REFERENCE(S)

1. ROADS, RAILWAY, WATERCOURSES, LAKES, PLACE NAMES, HIGH VOLTAGE POWERLINES SOURCED FROM DATA SA, HTTPS://DATA.SA.GOV.AU/DATA
2. PROJECT GENERAL ARRANGEMENT, PROPOSED ACCESS ROAD, UPPER RESERVOIR ACCESS,HIGH VOLTAGE CONNECTION,MEDIUM VOLTAGE DISTRIBUTION, PROPOSED SUBSTATION AND WATER SUPPLY PIPELINE SUPPLIED BY ALTURA GROUP

CLIENT
ALTURA GROUP

CONSULTANT

Golder Associates

YYYY-MM-DD	5/12/2017
DESIGNED	DR
PREPARED	DR
REVIEWED	DP
APPROVED	RM

PROJECT
SURFACE WATER STUDY: GOAT HILL PUMPED STORAGE HYDRO PROJECT, EYRE HIGHWAY, SOUTH AUSTRALIA

TITLE
PROJECT LOCATION AND INFRASTRUCURE

PROJECT NO.	CONTROL	REV.	FIGURE
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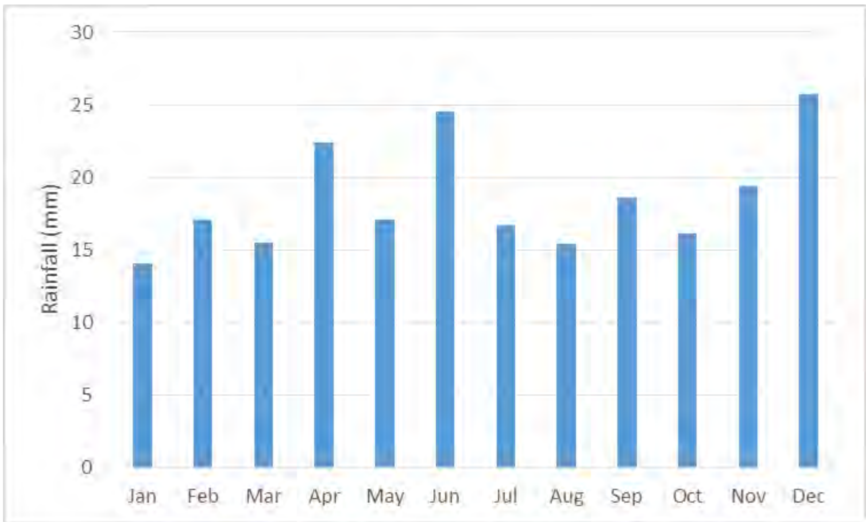


Figure 2: Mean monthly rainfall (Port Augusta Aero).

2.1.2 Evaporation

Evaporation records are not supplied by the BoM at Port Augusta climate stations. In the absence of evaporation records in close proximity to the Project location, a climate record was obtained from the Department of Science, Information Technology and Innovation's SILO Data Drill for the Project location. The Data Drill accesses grids of data interpolated from point observations by the BoM. The evaporation record represents Class A Evaporation, that is, the amount of water that evaporates from an open pan called a Class A Evaporation Pan. The monthly mean rainfall and evaporation was assessed for the period 1970 – 2017.

As shown in Figure 3, potential evaporation far exceeds rainfall. The average annual potential evaporation is 2380 mm (range 1920 – 2770 mm). Potential evaporation totals are highest in summer months.

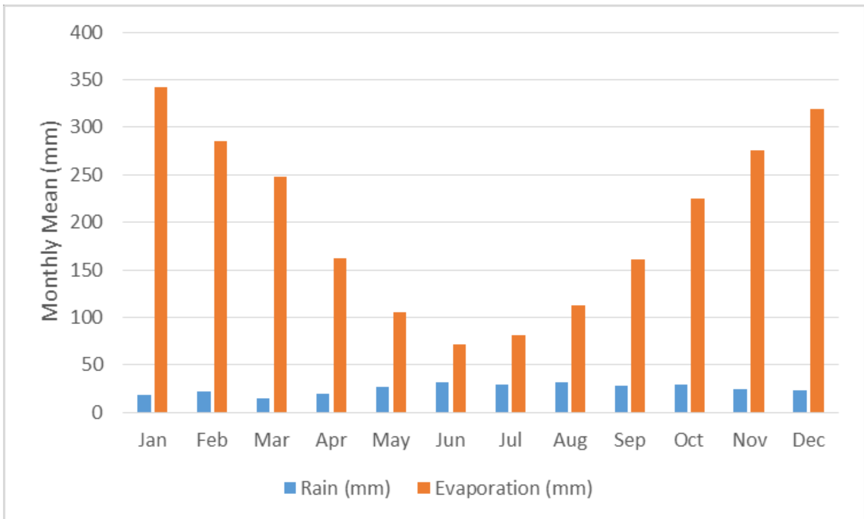


Figure 3: Monthly mean rainfall and evaporation (SILO data 1970 – 2017 location of Lincoln Gap).

2.1.3 Temperature

Mean maximum temperatures range between 17.8 to 27.1 ^{0}C in winter months to 30.4 to 30.6 ^{0}C in summer months. The highest recorded temperature during the period of record of 48.1 ^{0}C occurred during February.

2.1.4 Relative humidity

Average relative humidity is higher in winter months ranging from 35.5 – 93.9% than in summer when the range is 30.0 – 74.0%.

2.2 Hydrology

2.2.1 Landform

The proposed development is located within an area of grazing land near to the northern end and western side of the Spencer Gulf known as the Simmens Plateau. The Simmens Plateau is a prominent tableland separated by Lincoln Gap that extends across the Eyre Highway corridor.

The landform at the Goat Hill PSH consists of plateaus of approximately 290 m elevation edged by steep escarpments and long foot slopes at approximately 90 m elevation. The escarpment is shown in Figure 4.

Due to the steepness of the escarpment and the associated high erosion potential of runoff, incised gullies (up to about 3 m depth) have formed naturally at the base of the escarpment extending into the foot slopes. Vegetation is sparse within the existing watercourses, giving rise to the erosion of fine sediments from the gully bed and bank profile as shown in Figure 5.

Within the watercourses the near-surface material consists of fine to coarse grained gravel and cobbles in a silty sand matrix.

The gullies are close to the head of the catchments and are ephemeral in nature; as a result, the flow regime is variable. As in all dryland channels, where the water table may be several meters, or tens of meters below the surface, water is lost through the channel bed and banks resulting in high transmission losses. Away from the plateau high transmission losses, slowing of flow velocities and termination of bedload (sediment) transfer, all result in a downstream reduction in discharge and channel size and an apparent loss of definition of channels (as seen in Figure 4).

During rare high flow events flow will continue out across the un-channelled surface resulting in shallow ponding of water on the plain, termed a ‘floodout’.

Image 047: 11 April 2017 32 30 20.5800 S; 137 34 56.4699 E

Figure 4: From Simmens plateau looking east down the escarpment and to the lower foot slopes

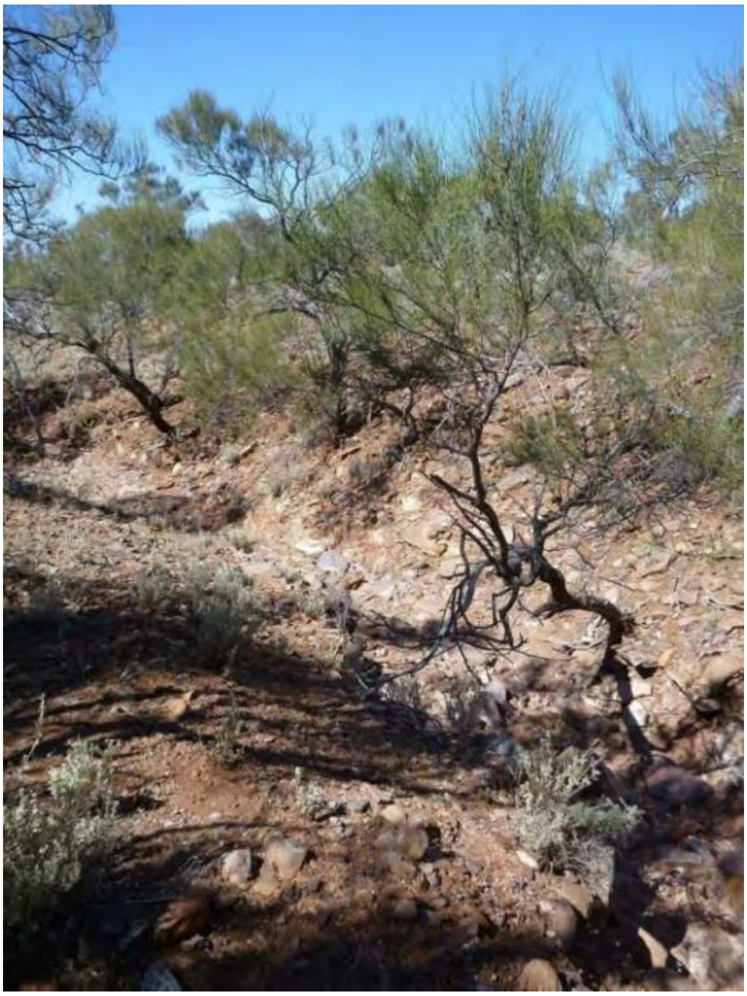


Image 033: 11 April 2017 32 30 15.1399 S; 137 35 5.2299 E

Figure 5: An ephemeral watercourse near to the alignment of the proposed surface penstock

2.2.2 Surface water data

The SA Government environmental data portal (SA Government, 2017) was accessed to identify the location and record of surface water monitoring in proximity to the Project site. Measured streamflow at a stream gauge on a similar sized catchment and watercourse within the region may provide a record of the specific flow rate (that is, flow rate per unit area) that can then be applied to a nearby ungauged watercourse.

There is a monitoring station at Saltia Creek (17 km to the east of Port Augusta) where the landform is similar to that at the project site, however, this monitoring station only recorded rainfall and flow depth (rather than flow rate) for a period of 15 years from 1979 and is now closed. Water quality is not monitored at Saltia Creek.

The only other stations within 50 km of the project site are to the east of the Spencer Gulf, where the landform and proximity to the Gulf results in different climate conditions to those experienced at the project site. Water quality monitoring at these sites is limited to measurement of Electrical Conductivity (salinity).

2.3 Soils

Test pit investigations were undertaken at the Project location during July 2017 as part of the Preliminary Geotechnical Study (Golder Associates, 2017). Relevant soil analysis results are provided in Table 1. Soils are predominantly CLAY with high percentages of particles passing the 0.075 mm sieve in all samples analysed. Emerson Class is a measure of soil dispersibility or soil structural stability. An Emerson Class Number of 4 is an indication of low to negligible dispersibility.

In the Upper Reservoir area rock strength materials (generally recovered as a mix of sandstone cobbles/boulders, and sandy gravel) were encountered in all test pits from depths ranging between 0.2 m and 1.55 m below ground level (bgl). Along the penstock alignment rock strength materials (generally recovered as a mix of sandstone cobbles/boulders, and sandy gravel) were encountered in all test pits from depths ranging between 0.25 m and 2.6 m bgl. In the Lower Reservoir area rock strength materials (recovered as a mix of soil and rock) were encountered in test pits excavated at the west end, from depths ranging between 0.35 m and 0.8 m bgl. Practical refusal was encountered within these rock strength materials at depths ranging between 1.5 m and 3.6 m bgl. Test pits excavated within the eastern portion of the Lower Reservoir area were terminated at around 4 m depth (target depth) within clayey soils.

Groundwater was not encountered in any of the test pits at the time of the investigation.

Table 1: Selected results of geotechnical laboratory testing.

Test Pit Location	Sample Depth (mbgl)	Soil Description	Particle Size Distribution (% passing)			Emerson Class Number
			19 mm	2.36 mm	0.075 mm	
Upper Reservoir	0.40 – 0.90	CLAY	100	100	79	4
Penstock	1.30 – 1.80	CLAY	99	87	55	4
Lower Reservoir	2.00 – 2.60	CLAY	100	85	76	4
Lower Reservoir	1.00 – 2.00	Sandy GRAVEL#	-	-	-	-

Notes: # based on visual and tactile assessment

3.0 SURFACE WATER QUANTITY IMPACTS

The potential interaction between Project infrastructure and surface watercourses is provided in this section along with measures to mitigate / manage potential surface water quantity impacts.

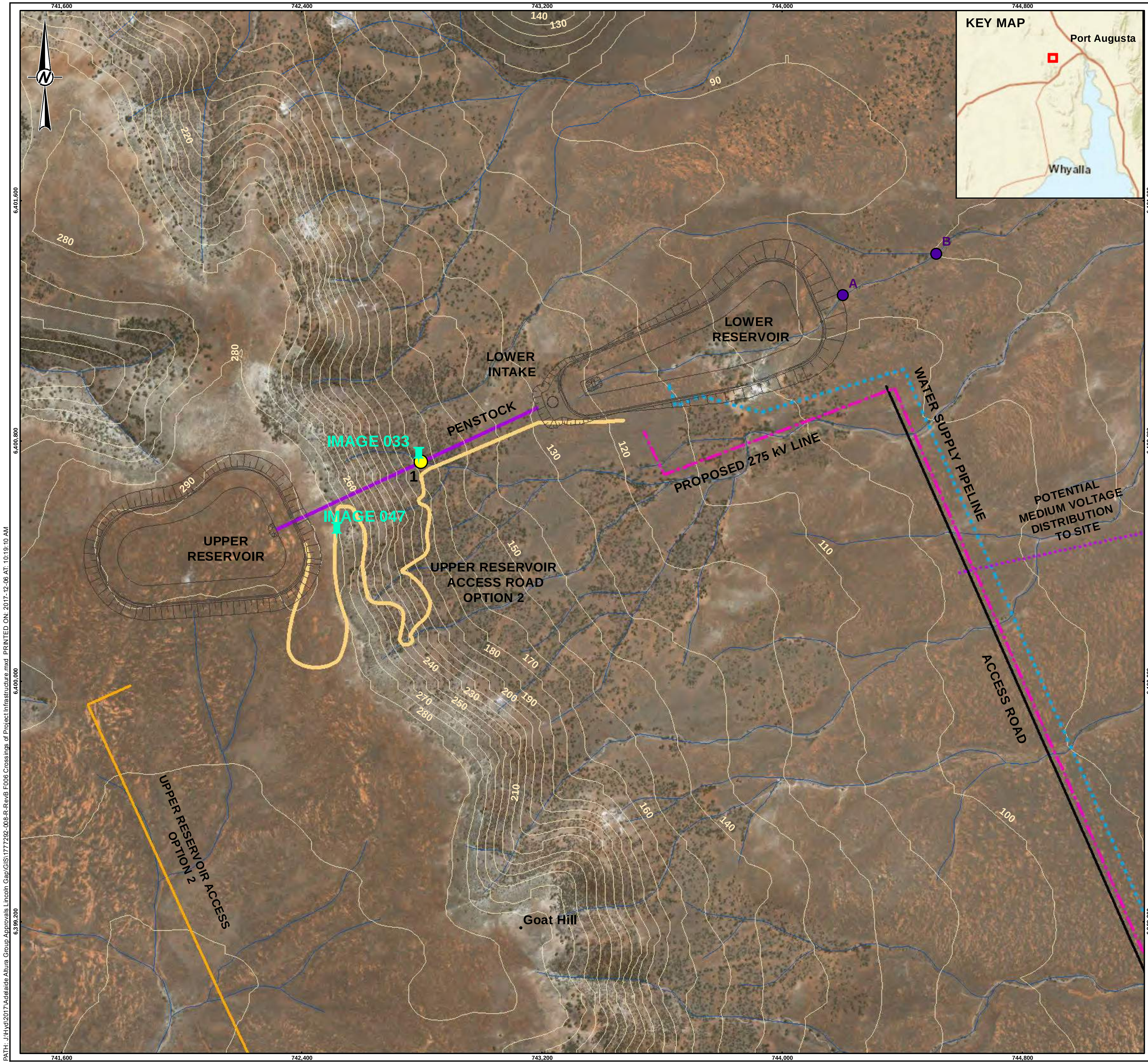
3.1 Interception / diversion of watercourse channels

An assessment of catchments reporting to the locations where watercourse lines interact with proposed Project infrastructure has been undertaken in ArcGIS. Local topography was obtained from a Digital Elevation Model sourced from Geoscience Australia.

There are two watercourses intercepted by the PSH Facility (shown in Figure 6). One crosses the surface penstock near to the location of Image 033 (shown in Figure 5) details provided in Table 2. The second watercourse crossing intercepted by the PSH Facility is fully contained within the Lower Reservoir.

Table 2: Watercourse crossing - PSH Facility.

Feature	Number of crossings	Catchment area (ha)	Stream order (Strahler method)
Watercourse crossing of penstock	1	7.5	1
Watercourse intercepted by the Lower Reservoir	1	25	1



LEGEND

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- Proposed 275kV line to LGWF substation
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- Upper Reservoir Access
- Upper Reservoir Access - Option 2
- Proposed Water Supply Pipeline
- Watercourses
- Contours (10m)

0 200 400 600 800 1,000

1:12,500 at A3 METRES

Coordinate System: GDA 1994 MGA Zone 53
Projection: Transverse Mercator
Datum: GDA 1994

NOTE(S)

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REFERENCE(S)

1. WATERCOURSES, PLACE NAMES SOURCED FROM DATA SA, HTTPS://DATA.SA.GOV.AU/DATA
2. PROJECT PLAN, PROPOSED ACCESS ROAD, HIGH VOLTAGE CONNECTION, WATER SUPPLY PIPELINE AND CONTOURS SUPPLIED BY ALTURA GROUP
3. CATCHMENTS BASED ON SUPPLIED CONTOURS AND DEM SOURCED FROM GEOSCIENCE AUSTRALIA (ELVIS, 2017)

CLIENT
ALTURA GROUP

PROJECT
SURFACE WATER STUDY: GOAT HILL PUMPED STORAGE HYDRO PROJECT, EYRE HIGHWAY, SOUTH AUSTRALIA

TITLE
PROJECT INFRASTRUCTURE

CONSULTANT
Golder Associates

YYYY-MM-DD	6/12/2017
DESIGNED	DR
PREPARED	DR
REVIEWED	DP
APPROVED	RM

PROJECT NO.	CONTROL	REV.	FIGURE
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There are eight watercourse crossings along the main access road, proposed water supply pipeline and proposed transmission line corridor. Additionally, there are a further nine watercourse crossings of the main access road, eleven crossings of the proposed transmission line, three crossings of the proposed water supply pipeline corridor, seventeen crossings of the proposed transmission line extension to the LGWF substation and four crossings of the potential transmission line (medium voltage). These crossings and their respective catchments are shown in Figure 7. There are 33 crossings of the Upper Reservoir access road – Option 1, and five watercourse crossings of the Upper Reservoir access road – Option 2, shown in Figure 8.

The stream order classification provides an indication of the size of the watercourse crossing. Of the 93 identified crossings only 23 catchments are greater than 100 hectares (ha) and seven of these are for the transmission lines where the footings can be placed to avoid the watercourses. The largest contributing catchment is 13 400 ha in a crossing of the water supply pipeline between the Eyre Highway and Caroona Road (indicated as Crossing 32 in Figure 7). Details of individual crossings are provided in APPENDIX C.

Table 3: Watercourses crossing - associated infrastructure.

	Number of crossings	Catchment size range (ha)	Stream order (Strahler)
Proposed water supply pipeline	11	13 – 13 400	1 – 5
Main access road	17	13 – 371	1 – 4
Proposed transmission line 1 (275kV Connection to Davenport - Cultana)	19	13 – 5400	1 – 4
Proposed transmission line extension to LGWF substation	17	3 – 379	1 – 3
Potential transmission line (Medium Voltage 33 kV Distribution to site)	4	152 – 1042	2 – 4
Upper Reservoir access road – Option 1	33	4 – 988	1 – 4
Upper Reservoir access road – Option 2	6	4 – 10	1

3.2 Mitigation measures to minimise impacts to water quantity

3.2.1 Major Project infrastructure

As indicated in Section 3.1, there are two watercourses intercepted by the PSH Facility. The first crosses the penstock surface pipeline. The catchment reporting to this crossing is reduced from baseline due to the footprint of the Upper Reservoir within this catchment by 5 ha or 40% of the baseline catchment size. Peak flow in the channel for the reduced catchment area has been estimated using the Rational Method for a 1:10 Annual Exceedance Probability (AEP) rainfall event to be 0.81 m^3/s a reduction from the baseline peak flow of 1.29 m^3/s. Assuming a triangular channel of 2 m width this flow rate corresponds to a minimal change in depth of water in the 1:10 AEP of 0.07 m.

The penstock will be constructed of high strength steel with an estimated diameter of 6 m. The penstock is expected to be mounted on concrete saddle structures and supported by concrete anchor blocks. The concrete saddle structures where possible should be detailed to avoid the placement of infrastructure within the watercourse. If it is not possible to place the saddle structures outside of the watercourse bed and banks then a suitable scour assessment would be undertaken for the design AEP rainfall event.

A second watercourse is intercepted by the Lower Reservoir. The Lower Reservoir is proposed to be located at the head of the catchment to this watercourse and the Reservoir embankment will intercept the watercourse at Point A (see Figure 6). As a result of the Reservoir being located at the head of the catchment, no diversion of the watercourse is required in this location. The construction of the Lower Reservoir will reduce the catchment to Point A by approximately 10 ha or 100%; Point B by approximately 25 ha or 25%; and the catchment to Point C, further downstream, by 5%. The estimated peak flow for the watercourse at Point C in the 1:10 AEP is 19.93 m^3/s. This represents a small reduction from the baseline peak flow of 1.05 m^3/s.

The estimated flow reduction to receiving watercourses from the construction of the two reservoirs is shown in Table 4. The estimate for crossing 32 is based on catchment size reduction as more detailed modelling is required to determine peak flows.

Table 4: Estimated flow reduction to receiving watercourses

Location	1:10 AEP baseline peak flow	1:10 AEP post-construction peak flow	1:10 AEP change in peak flow
Crossing 1	1.3 m^3/s	0.8 m^3/s	0.5 m^3/s
Point C	21.0 m^3/s	19.9 m^3/s	1.1 m^3/s
Crossing 32	NA	NA	< 1% (based on catchment size)

3.2.2 Associated infrastructure

3.2.2.1 Access Roads

Crossings of the Upper Reservoir Road – option 1 and Main Access Road will allow for uninterrupted flow of watercourse paths via suitably sized culverts or armoured causeway crossings. All of the catchments reporting to watercourse crossing of the Main Access Road are less than 500 ha in size allowing a simplified assessment of peak flow rate and sizing of road crossing infrastructure. Three crossings of the Upper Reservoir Road- option 1 have catchments greater than 500 ha and will require more detailed assessment of peak flow rate for sizing of road crossing infrastructure.

The Upper Reservoir Road - option 2 joins the main access road at the western end of the Lower Reservoir and traverses the escarpment in a series of switchbacks. This road section has small contributing catchments of less than 500 ha in size allowing a simplified assessment of peak flow rate and sizing of road crossing infrastructure. Road batters, however, are steep (approximately 30%) resulting in a high potential for erosion, scour and bank instability.

3.2.2.2 Water Supply Pipeline

If the water supply pipeline is above ground, support infrastructure should be detailed to avoid placement in watercourses.

If buried, the water supply pipeline crossing locations from the Eyre Highway to the Project location will require management to provide suitable scour protection. Suitable scour protection measures will likely involve the placement of stable rock rip-rap in the location of the pipeline crossing, the sizing of the stable rock to be calculated by standard hydraulic methods. Scour protection will not significantly change the flow characteristics of the watercourse channel. Crossing 32 (shown in Figure 7) has a large contributing catchment of 13,340 ha and will require detailed design of the supply pipeline crossing in this location to provide a stable and erosion resistant crossing that can pass the design flow.

3.2.2.3 Transmission Lines

The transmission connections, where possible, should be detailed to avoid the placement of infrastructure within the watercourse. Watercourse crossings of the transmission alignment have small contributing catchments and are not in a flood plain. The transmission connection corridor will have no impact to streamflow in the existing watercourses.

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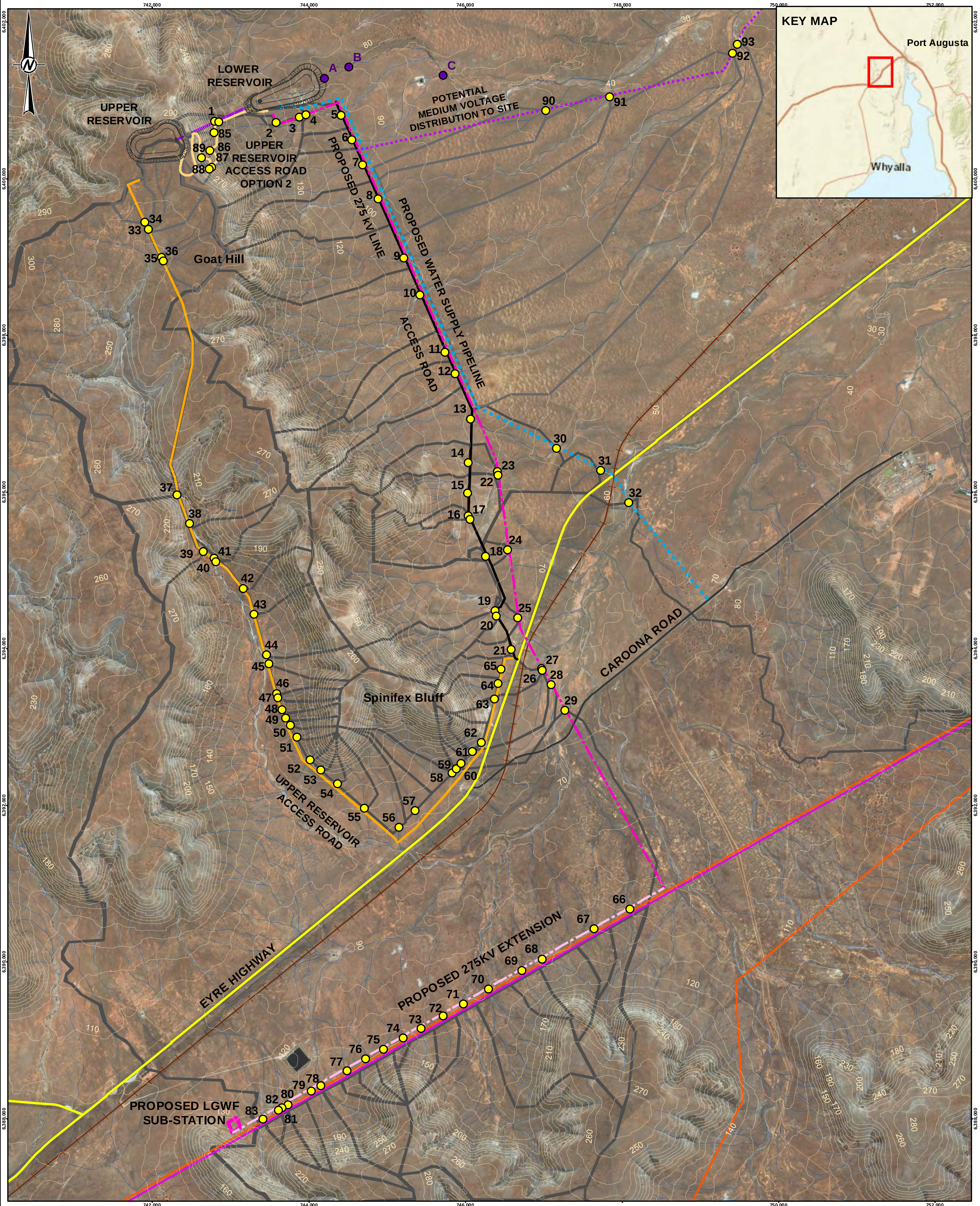


LEGEND

- Crossings
- Catchment Points
- General Arrangement
- Access Road
- Proposed 275kV line
- Proposed 275kV line to LGWF substation
- Potential Medium Voltage Distribution to Site
- Upper Reservoir Access
- Upper Reservoir Access - Option 2
- Proposed Water Supply Pipeline

High Voltage Powerlines

- 275 kV Powerline
- 132 kV Powerline
- 66kV Powerline
- Road
- Highway
- Railway
- Watercourses
- Contour (10m)
- Catchments
- Proposed LGWF Substation

Coordinate System: GDA 1994 MGA Zone 53
Projection: Transverse Mercator
Datum: GDA 1994

0 1,000 2,000
1:45,000 at A3 METRES

NOTE(S)
Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

REFERENCE(S)
1. Roads, Watercourses, Place Names, Powerlines sourced from Data SA, https://data.sa.gov.au/data
2. Project Centre Line, Proposed Access Road, High Voltage Connection, High Voltage extension, Proposed Substation and Water Supply Pipeline supplied by Altura Group
3. Catchments and Contours defined using topographic Digital Elevation Model sourced from Geoscience Australia, http://www.ga.gov.au/elvis

CLIENT
ALTURA GROUP

CONSULTANT
Golder Associates

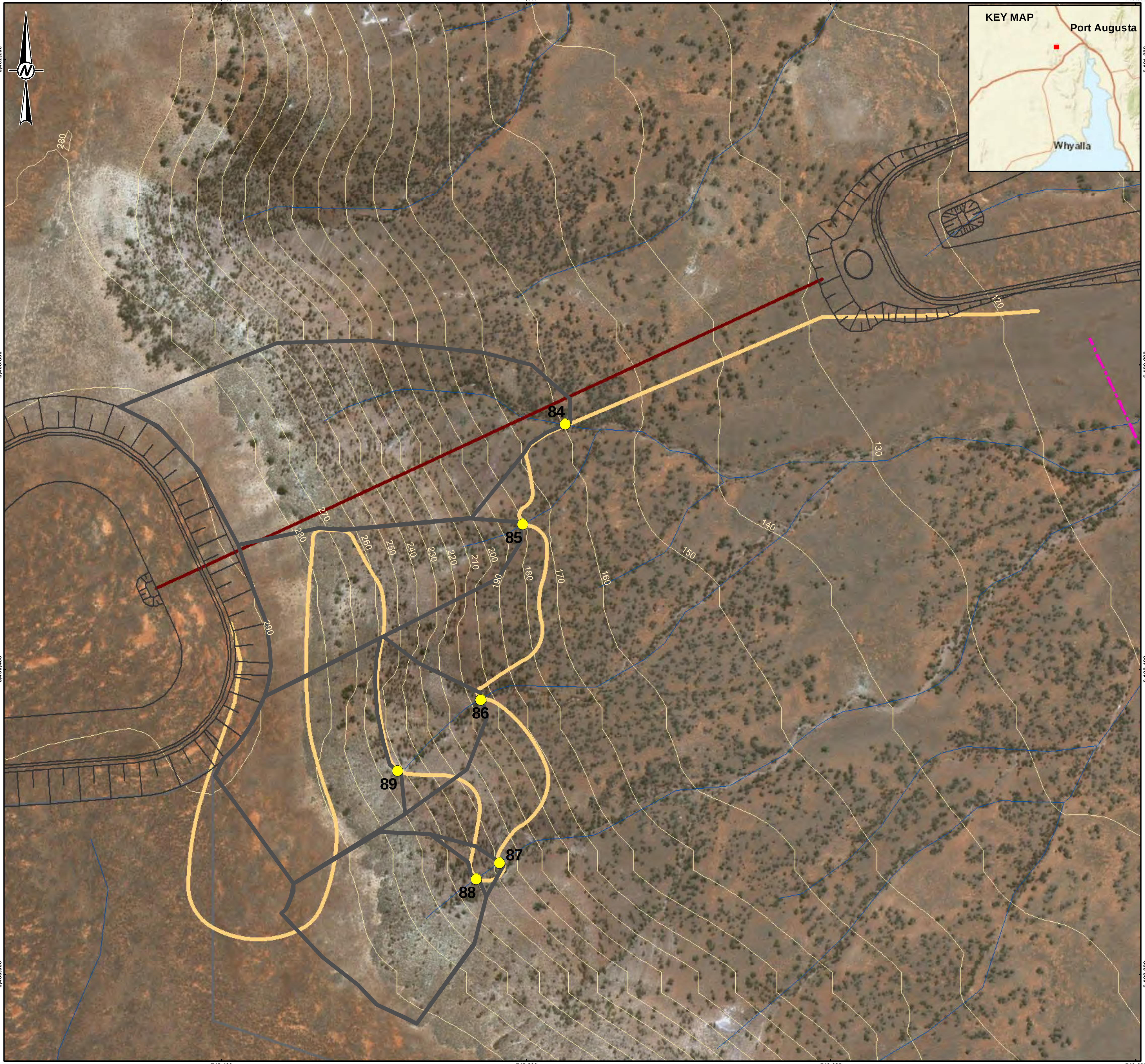
YYYY-MM-DD	6/12/2017
DESIGNED	DR
PREPARED	DR
REVIEWED	DP
APPROVED	RM

PROJECT
SURFACE WATER STUDY: GOAT HILL PUMPED STORAGE HYDRO PROJECT, EYRE HIGHWAY, SOUTH AUSTRALIA

TITLE
CROSSINGS OF ASSOCIATED INFRASTRUCTURE

PROJECT NO.	CONTROL	REV.	FIGURE
1777292	001	1	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3



LEGEND

- Crossings
- General Arrangement
- Proposed 275kV line
- Upper Reservoir Access - Option 2
- Penstock
- Watercourses
- Contours (10m)
- Catchments

0 100 200 300 400

1:5,000 at A3 METRES

Coordinate System: GDA 1994 MGA Zone 53
Projection: Transverse Mercator
Datum: GDA 1994

NOTE(S)
SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), MAPMYINDIA, NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

REFERENCE(S)
1. WATERCOURSES SOURCED FROM DATA SA, HTTPS://DATA.SA.GOV.AU/DATA
2. PROJECT PLAN, PROPOSED ACCESS ROADS, HIGH VOLTAGE CONNECTION, WATER SUPPLY PIPELINE AND CONTOURS SUPPLIED BY ALTURA GROUP
3. CATCHMENTS BASED ON SUPPLIED CONTOURS AND DEM SOURCED FROM GEOSCIENCE AUSTRALIA (ELVIS, 2017)

CLIENT
ALTURA GROUP

PROJECT
SURFACE WATER STUDY: GOAT HILL PUMPED STORAGE HYDRO PROJECT, EYRE HIGHWAY, SOUTH AUSTRALIA

TITLE
UPPER RESERVOIR ACCESS ROAD - OPTION 2

CONSULTANT		
Golder Associates	YYYY-MM-DD	6/12/2017
	DESIGNED	DR
	PREPARED	DR
	REVIEWED	DP
	APPROVED	MH

PROJECT NO.	CONTROL	REV.	FIGURE
1777292	001	1	8

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4.0 SURFACE WATER QUALITY IMPACTS

4.1 Erosion and sediment impacts

Soil erodibility for water erosion reflects the susceptibility of the soil to detachment and transport by water. Catchments in the Project location are relatively small, however, due to the steep topography, water flow within the channels naturally has a high velocity and therefore a high erodibility. Additionally, while Emerson Class analysis shows soils are non-dispersive, there is an abundance of fine soil particles (high clay percentage) that are easily transported by flowing water. Transported soil particles give rise to high Total Suspended Solids (TSS) in water, high turbidity and a reduction in water clarity. TSS and turbidity are the most visible indicators of water quality. Excessive suspended sediment can impair water quality.

The Environment Protection (Water Quality) Policy 2015 (Government of South Australia) specifies that a number of pollutants cannot be discharged to the stormwater system or onto land where they may enter stormwater including soil, clay, gravel or sand. The Code of Practice for the Building and Construction Industry (Environment Protection Agency Government of South Australia, 1999), requires that a soil erosion drainage management plan (SEDMP) be prepared where there is a high risk of sediment pollution to adjoining lands or receiving waters or where the total area to be disturbed or left disturbed at any one time exceeds 0.5 ha. A SEDMP will be prepared for the construction phase of the Project to specify erosion and sediment management controls (described in Section 4.1).

4.2 Mitigation measures to minimise impacts to water quality

Soil disturbing activities associated with construction such as clearing, grubbing and earthworks increase the soils exposure to wind, rain and concentrated sheet flow. The sediment generated in these processes has the potential to be introduced to receiving water environments.

Appropriate management of such activities minimises or prevents soil erosion and therefore sediment losses. Basic principles to enable good management for soil conservation include (International Erosion Control Association, 2008):

- Integrate erosion and sediment control issues into site and construction planning
- Develop effective and flexible Erosion and Sediment Control Plans (ESCPs) based on anticipated soil, weather, and construction conditions
- Control water movement through the site
- Minimise soil erosion
- Promptly stabilise disturbed areas
- Maximise sediment retention on the site
- Maintain all Erosion and Sediment Control (ESC) measures in proper working order at all times
- Monitor the site and adjust ESC practices to maintain the required performance standard.

The Upper Reservoir Road – option 2 will require design of erosion and scour protection to road batters and ongoing inspection and maintenance due to the steep gradient.

Examples of ESC measures that may be considered for use in the Project location are provided in Table 5.

Table 5: Erosion control measures for exposed soil slopes in arid environments.

Flat land (< 10% slope)	Slopes (10% - 25%)	Steep slopes (> 25%)
Gravelling	Bonded Fibre Matrix	Bonded Fibre Matrix
Mulching	Well anchored Mulching	Cellular Confinement Systems
Soil Binder	Rock Mulching	Erosion Control Matts and Mesh
Erosion Control Blankets	Erosion Control Matts and Mesh	Rock Armouring

Adapted from IECA, 2008.

Sediment controls can be grouped into three categories based on their ability to trap a specified grain size. The determination of the minimum sediment control standard (that is, Type 1, 2, or 3) primarily depends on the area of disturbance and the estimated soil loss rate. The soil loss rate depends on the rainfall erosivity, soil erodibility, slope length and grade and the effective soil cover.

In general, in areas with a monthly rainfall of less than 30 mm, as at the Project location, the simplest form of sediment control (Type 3) is suitable for catchment areas of less than 0.25 ha. A Type F/D Sediment Basin (wet basin) is the most effective sediment control technique for the removal of fine sediments for catchment areas of greater than 0.25 ha.

Table 6: Sediment control measures for fine sediments.

Type 1	Type 2	Type 3
Sheet flow treatment techniques		
Buffer zone capable of infiltrating 100% of runoff	Compost/mulch berm	Excavated drop inlet protection
Infiltration basin capable of infiltrating 100% of runoff	Mesh & aggregate drop inlet protection	Sediment fence
Concentrated flow treatment techniques		
F/D Sediment Basin	Rock filter dam	Fibre rolls
	Sediment weir	Check dam sediment traps

An erosion and sediment control toolbox providing concept-level typical erosion and sediment control techniques to be considered for use at the Project location is provided in APPENDIX C.

5.0 REFERENCES

ASRIS, 2017 Australian Soil Classification – Dominant Soil Order (250 m raster) online (Available) Accessed: October 2017 http://www.asris.csiro.au/

Bureau of Meteorology, 2017 Map of Climate Zones of Australia online (Available) Accessed: October 2017 http://www.bom.gov.au/climate/how/newproducts/images/zones.shtml

Environment Protection Agency Government of South Australia 1999 Code of Practice for the building and Construction Industry

Golder Associates, 2017 Geotechnical Assessment Report Golder document number 1777292-001-R-Rev0

International Erosion Control Association (IECA) 2008 Best Practice Erosion and Sediment Control.

South Australian Government, 2017 WaterConnect data portal online (Available) Accessed: October 2017 https://www.waterconnect.sa.gov.au/Systems/SWD/Pages/Default.aspx

Report Signature Page

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APPENDIX A

Important Information about this Report

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Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

APPENDIX B

Associated Infrastructure Crossings Catchment Area and Stream Order.

APPENDIX B
Associated infrastructure crossings catchment area and stream order

Crossing	Infrastructure	Catchment (ha)	Stream Order (Strahler Method)
1	Penstock	8	1
2	High Voltage	2	2
3	High Voltage	136	3
4	High Voltage	147	3
5	All	164	3
6	All	16	1
7	All	85	2
8	All	93	3
9	All	147	3
10	All	409	4
11	All	47	1
12	All	119	2
13	Main Access Road	100	2
14	Main Access Road	39	1
15	Main Access Road	56	3
16	Main Access Road	9	1
17	Main Access Road	73	3
18	Main Access Road	3	1
19	Main Access Road	249	3
20	Main Access Road	79	3
21	Main Access Road	10	1
22	High Voltage	49	1
23	High Voltage	165	4
24	High Voltage	9	1
25	High Voltage	343	4
26	High Voltage	65	3
27	High Voltage	69	2
28	High Voltage	46	2
29	High Voltage	5400	4
30	Water	297	4
31	Water	23	1
32	Water	13340	5

	Infrastructure	Catchment (ha)	Stream Order (Strahler Method)
33	Upper Reservoir Access Road	20	1
34	Upper Reservoir Access Road	45	2
35	Upper Reservoir Access Road	28	2
36	Upper Reservoir Access Road	34	2
37	Upper Reservoir Access Road	741	3
38	Upper Reservoir Access Road	957	4
39	Upper Reservoir Access Road	80	2
40	Upper Reservoir Access Road	82	2
41	Upper Reservoir Access Road	988	4
42	Upper Reservoir Access Road	72	2
43	Upper Reservoir Access Road	40	2
44	Upper Reservoir Access Road	69	2
45	Upper Reservoir Access Road	35	2
46	Upper Reservoir Access Road	16	1
47	Upper Reservoir Access Road	11	2
48	Upper Reservoir Access Road	8	1
49	Upper Reservoir Access Road	9	1
50	Upper Reservoir Access Road	7	1
51	Upper Reservoir Access Road	7	1
52	Upper Reservoir Access Road	8	1
53	Upper Reservoir Access Road	6	1
54	Upper Reservoir Access Road	6	1
55	Upper Reservoir Access Road	23	1
56	Upper Reservoir Access Road	43	1
57	Upper Reservoir Access Road	21	1
58	Upper Reservoir Access Road	27	1
59	Upper Reservoir Access Road	104	3
60	Upper Reservoir Access Road	4	1
61	Upper Reservoir Access Road	10	1
62	Upper Reservoir Access Road	14	1
63	Upper Reservoir Access Road	8	1
64	Upper Reservoir Access Road	26	1
65	Upper Reservoir Access Road	21	1

Crossing	Infrastructure	Catchment (ha)	Stream Order (Strahler Method)
66	High Voltage Extension	89	2
67	High Voltage Extension	20	1
68	High Voltage Extension	48	2
69	High Voltage Extension	22	1
70	High Voltage Extension	122	3
71	High Voltage Extension	379	3
72	High Voltage Extension	17	1
73	High Voltage Extension	28	3
74	High Voltage Extension	3	1
75	High Voltage Extension	11	1
76	High Voltage Extension	12	2
77	High Voltage Extension	7	1
78	High Voltage Extension	69	2
79	High Voltage Extension	46	2
80	High Voltage Extension	19	1
81	High Voltage Extension	13	1
82	High Voltage Extension	5	1
83	High Voltage Extension	122	2
84	Upper Reservoir Access Road Option 2	10	1
85	Upper Reservoir Access Road Option 2	5	1
86	Upper Reservoir Access Road Option 2	7	1
87	Upper Reservoir Access Road Option 2	4	1
88	Upper Reservoir Access Road Option 2	4	1
89	Upper Reservoir Access Road Option 2	5	1
90	Medium Voltage Distribution (33kV)	152	2
91	Medium Voltage Distribution (33kV)	279	3
92	Medium Voltage Distribution (33kV)	1042	4
93	Medium Voltage Distribution (33kV)	679	3

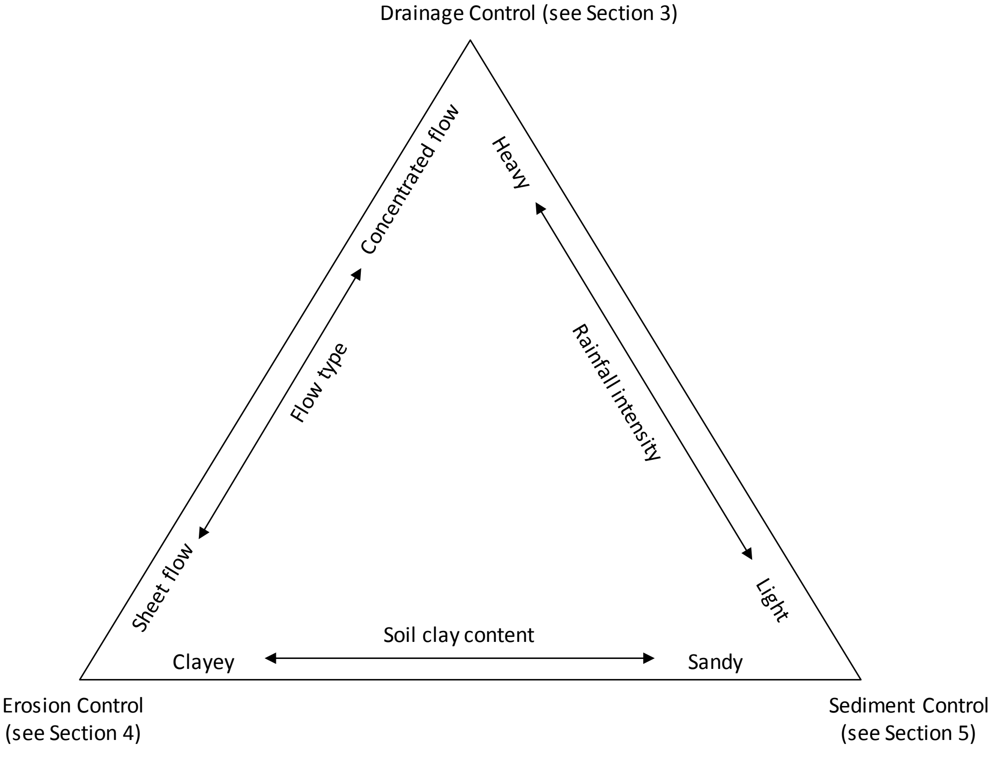
APPENDIX C

Erosion and Sediment Control Toolbox.

The Erosion & Sediment Control Toolbox is a supplementary document to the Goat Hill PSH project Surface Water Report. The toolbox contains the practical construction and maintenance guidance for erosion and sediment control (ESC) implementation on site.

Control Selection

There are several techniques that can be use to minimise erosion and sedimentation. Typically more than one technique will be required to effectively reduce erosion and sedimentation.



Design Standards

The sketches and designs included in this toolbox have been developed based on published guidelines for best practice management for erosion and sediment control and related drainage publications. Where drainage design guidance is provided in this toolbox, the design standards adopted are as per the table below unless otherwise noted.

Design Standards

	Anticipated Design Life		
Drainage Structure	**< 12 months**	**12-24 months**	**> 24 months**
Temporary drainage structures*	1 in 2 year	1 in 5 year	1 in 10 year
*if failure of structure risks occupied property adopt a 1 in 10 year design standard			

Golder Associates	CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox	
	DRAWN	DATE: 03.11.2017	TITLE: Control Selection	
	CHECKED	DATE: 03.11.2017		
	SCALE	SHEET SIZE: A4	PROJECT No: 1777292	REVISION: 1 / FIGURE No: Appendix C

Water Diversions

Application

Water diversions are typically used to divert clean water from small catchments around disturbed areas. Small water diversions can also be used to direct sediment laden water to sediment capture devices.

Design and Construction

- Diversion bunds for small catchments do not typically require design as they are a low risk structure.
- Diversion channels should not be excavated into dispersive soils unless the channel is to be lined with riprap. Alternatively, small bunds can be constructed on dispersive soils as indicated.
- Diversion bunds and channels should be constructed as close to the contour as practical. Longitudinal slope should not exceed approximately 1% unless the diversion is lined with riprap or other velocity controls implemented.

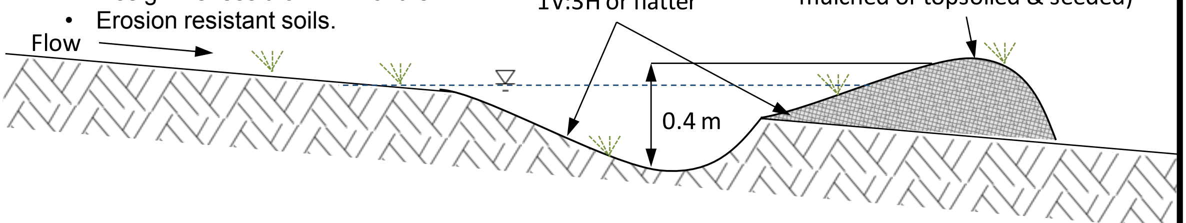
Maintenance

- Diversion bunds and channels should be inspected regularly for the following:
    - Build up of sediment within the flow path.
    - Failure of the bund.
    - Scour erosion within the flow path.

If these deficiencies are noted, repair works should commence as soon as practical, and prior to forecast rainfall events.

This diversion bund is suitable for:

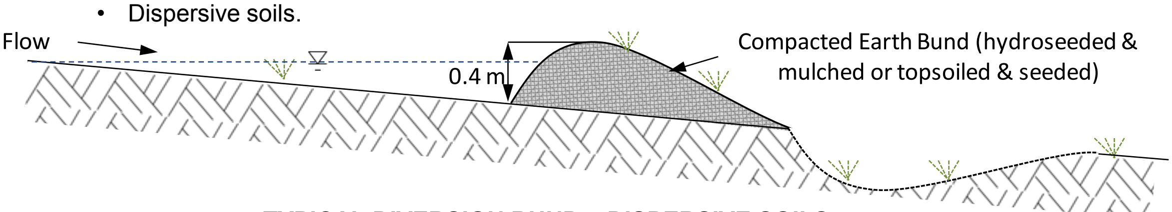
- Catchments less than 1 ha in area.
- Longitudinal slopes up to 2%.
- Design life less than 12 months.
- Erosion resistant soils.



TYPICAL DIVERSION BUND – EROSION RESISTANT SOILS

This diversion bund is suitable for:

- Catchments less than 1 ha in area.
- Longitudinal slopes up to 2%.
- Design life less than 12 months.
- Dispersive soils.

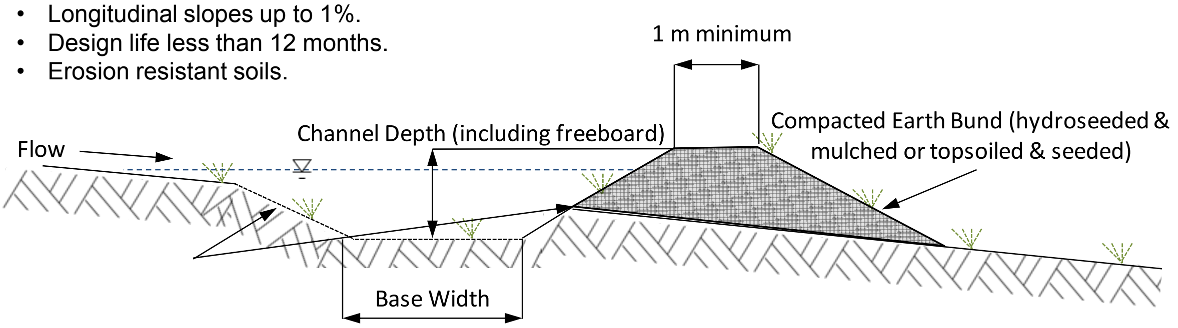


TYPICAL DIVERSION BUND – DISPERSIVE SOILS

Golder Associates	CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox	
	DRAWN	DATE: 03.11.2017	TITLE: Water Diversions 1	
	CHECKED	DATE: 03.11.2017		
	SCALE: Not to Scale	SHEET SIZE: A4	PROJECT No: 1777292	REVISION: 1 / FIGURE No: Appendix C

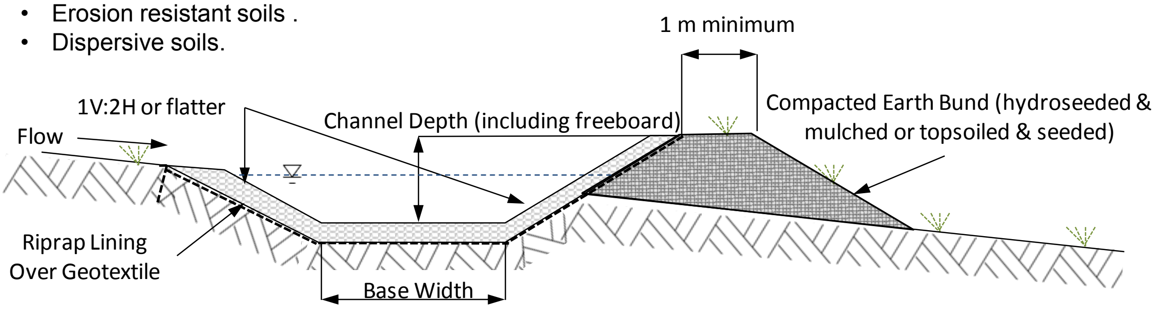
Water Diversions (cont)

This diversion channel is suitable for:
- Longitudinal slopes up to 1%.
- Design life less than 12 months.
- Erosion resistant soils.



TYPICAL UNLINED DIVERSION CHANNEL WITH BUND

This diversion channel is suitable for:
- Longitudinal slopes up to 5%.
- Design life greater than 24 months.
- Erosion resistant soils .
- Dispersive soils.



TYPICAL LINED DIVERSION CHANNEL WITH BUND

Unlined Diversion Channel Dimensions 1 in 2 Year ARI Event			
Catchment Area (ha)	Base Width (m)	Channel Depth (m)	Bed Velocity @ 1% Grade (m/s)**
1	2	0.3	0.50
2	2	0.4	0.60
3	2	0.4	0.70
5	3	0.5	0.75

Lined Diversion Channel Dimensions* 1 in 10 Year ARI Event				
Catchment Area (ha)	Base Width (m)	Channel Depth (m)	Bed Velocity @ 1% Grade (m/s)**	Bed Velocity @ 5% Grade (m/s)**
1	1	0.4	0.67	1.20
2	1	0.5	0.80	1.45
3	1.5	0.5	0.90	1.55
5	1.5	0.6	1.00	1.80

*For riprap liner specifications, including sizing, thickness and installation requirements, refer to technical specifications.

**Bed velocity is calculated as 0.7 x average flow velocity.

Golder Associates	CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox
	DRAWN	DATE: 03.11.2017	TITLE: Water Diversions 2
	CHECKED	DATE: 03.11.2017	
	SCALE: Not to Scale	SHEET SIZE: A4	PROJECT No: 1777292 · REVISION: 1 · FIGURE No: Appendix C

Open Channels

Application

Open channels convey concentrated flows, whether clean or sediment laden. They are often referred to as 'table drains' when used for roadside drainage applications.

Design and Construction

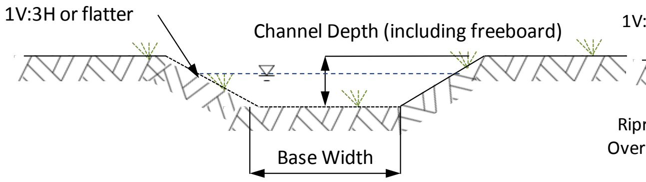
- Open channels that are incorporated as a component of other infrastructure (such as roads) will typically require specific design to ensure adequate performance.
- Open channels should not be excavated into dispersive soils unless the drain is to be lined with riprap or a non-dispersive cover material.
- Open channels should be constructed as close to the contour as practical. Longitudinal slope should not exceed approximately 1% unless the channel is lined with riprap or other velocity controls implemented.
- Channel side slopes should be constructed as flat as possible, with a maximum side slope 1V:3H for unlined channels, and 1V:2H for lined channels.
- Riprap is commonly used as a lining for open channels and can be an effective scour reduction measure for channel grades up to 10%.
- Riprap lined channels must be over-excavated during construction to allow the riprap lining to sit flush with the natural ground surface when placed to the required thickness.

Maintenance

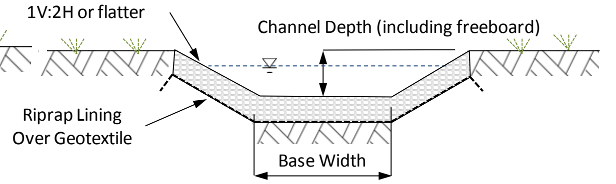
Open channels should be inspected regularly for the following:

- Build up of sediment within the flow path, or other debris.
- Scour erosion within the channel.
- Significant loss or movement of riprap.

If these deficiencies are noted, repair works should commence as soon as practical, and prior to forecast rainfall events. Excessive movement of riprap may indicate that the channel or riprap is undersized.



TYPICAL UNLINED OPEN CHANNEL



TYPICAL LINED OPEN CHANNEL

Unlined Channel Dimensions 1 in 2 Year ARI Event			
Catchment Area (ha)	Base Width (m)	Channel Depth (m)	Bed Velocity @ 1% Grade (m/s)**
1	2	0.3	0.50
2	2	0.4	0.60
3	2	0.4	0.70
5	3	0.5	0.75

Lined Channel Dimensions* 1 in 10 Year ARI Event				
Catchment Area (ha)	Base Width (m)	Channel Depth (m)	Bed Velocity @ 1% Grade (m/s)**	Bed Velocity @ 5% Grade (m/s)**
1	1	0.4	0.67	1.20
2	1	0.5	0.80	1.45
3	1.5	0.5	0.90	1.55
5	1.5	0.6	1.00	1.80

*For riprap liner specifications, including sizing, thickness and installation requirements, refer to the *Technical Specification for Construction of Drainage Structures and Erosion Protection (KM #6353769).*

**Bed velocity is calculated as 0.7 x average flow velocity.

Golder Associates	CLIENT Altura Group		PROJECT Erosion and Sediment Control Toolbox
	DRAWN	DATE 03.11.2017	TITLE Open Channels
	CHECKED	DATE 03.11.2017	
	SCALE Not to Scale	SHEET SIZE A4	PROJECT No 1777292 / REVISION 1 / FIGURE No Appendix C

Check Dams

Application

Check dams are typically used to reduce scour erosion in open channels by reducing flow velocity. They are also capable of capturing coarse sediments, however this is not their primary function. They can be installed in channel slopes up to 10%. Check dams should not be installed in major flow lines or streams.

Design and Construction

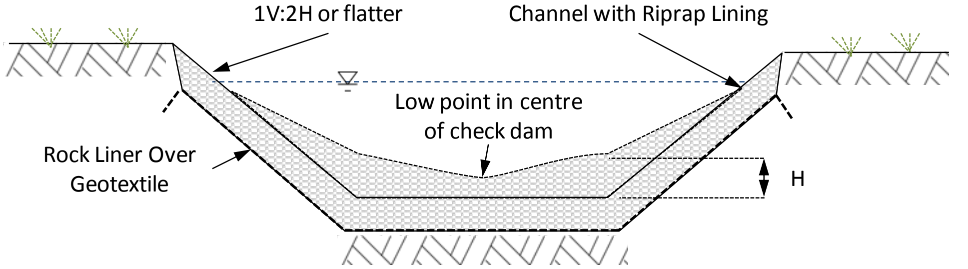
- Check dams for small catchments do not typically require design as they are a low risk structure.
- They can be constructed out of riprap for long term use, or from sandbags (or similar materials) for temporary use.
- Check dams should be constructed with a low point of the centre of the structure to prevent flows from scouring the side of the channel adjacent to the check dam.
- Check dams should not reduce the overall cross-sectional flow area of the open channel. It may be necessary to widen the channel in the vicinity of the check dams to maintain flow capacity.
- The height of the check dam (H) should be less than approximately half of the design flow depth. The height should not exceed 0.5m.
- A riprap or geotextile apron should be constructed downstream of the check structure equivalent to twice the height of the check structure.
- Check dams should be spaced such that the tail water from the downstream check structure extends to the apron of the upstream structure.

Maintenance

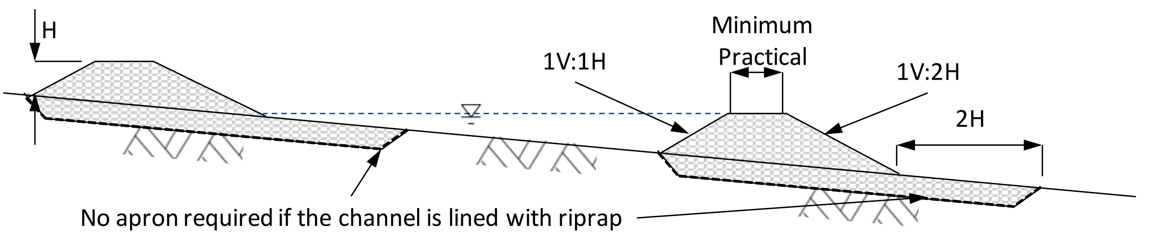
Check dams should be inspected regularly for the following:

- Build up of sediment within the flow path.
- Failure of the check dam.
- Scour erosion within the channel.
- Evidence of flows overtopping of the channel due to the check dam.

If these deficiencies are noted, repair works should commence as soon as practical, and prior to forecast rainfall events.



TYPICAL CHECK DAM CROSS-SECTION – ROCK



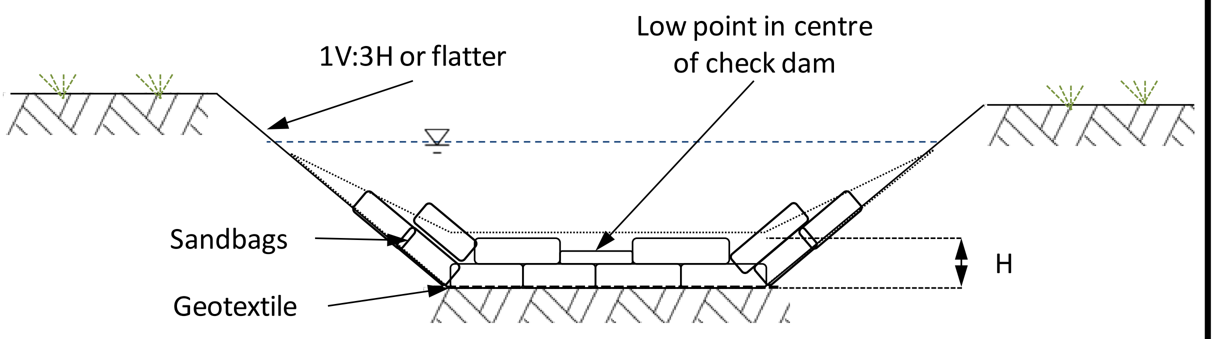
TYPICAL CHECK DAM LONG-SECTION – ROCK

CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox
DRAWN:	DATE: 03.11.2017	TITLE: Check Dams
CHECKED:	DATE: 03.11.2017	
SCALE: Not to Scale	SHEET SIZE: A4	PROJECT No: 1777292 · REVISION: 1 · FIGURE No: Appendix C

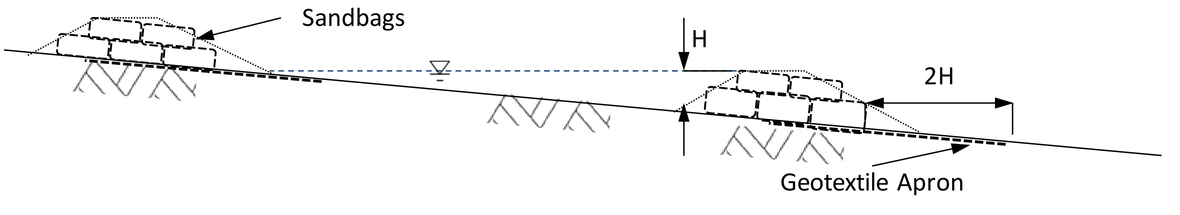
Golder Associates

Check Dams (Continued)

The sketches below indicate check dams constructed from sand bags as an alternative to rock. These would be suitable as a temporary velocity control measure.



TYPICAL CHECK DAM CROSS-SECTION – SAND BAG



TYPICAL CHECK DAM LONG-SECTION – SAND BAG

Golder Associates	CLIENT: Altura Group			PROJECT: Erosion and Sediment Control Toolbox		
	DRAWN:	DATE: 03.11.2017		TITLE: Check Dams (Continued)		
	CHECKED:	DATE: 03.11.2017				
	SCALE: Not to Scale		SHEET SIZE: A4	PROJECT No: 1777292	REVISION: 1	FIGURE No: Appendix C

Level Spreaders

Application

Level spreaders are typically used to return concentrated flow from small channels to sheet flow. Small clean water diversions should terminate with a level spreader unless directed into a stable waterway or drainage line.

Design and Construction

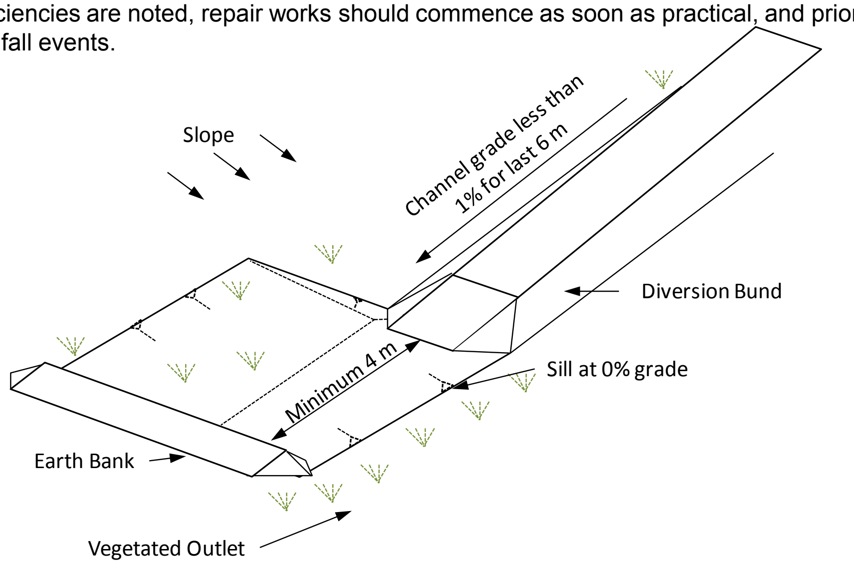
- Level spreaders are only to be used for small catchments (up to 1 ha).
- To limit scour erosion, level spreaders should only be constructed where >70% vegetation cover is present on the natural surface.
- The outlet sill should be protected from scour erosion with geotextile. The geotextile should be anchored in a 150 mm deep trench on the upstream and downstream side.
- The approach channel grade should be less than 1% for the last 6 m to reduce inflow velocity.

Maintenance

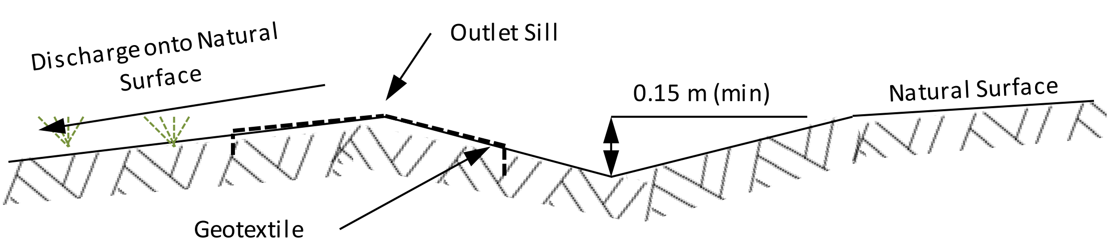
Level spreaders should be inspected regularly for the following:

- Establishment of vegetation on the sill and natural surface down grade of the sill.
- Build up of sediment behind the sill.
- Scour erosion on the sill or immediately down grade of the sill.

If these deficiencies are noted, repair works should commence as soon as practical, and prior to forecast rainfall events.



TYPICAL LEVEL SPREADER LAYOUT



TYPICAL LEVEL SPREADER OUTLET SILL SECTION

Golder Associates	CLIENT: Altura Group			PROJECT: Erosion and Sediment Control Toolbox		
	DRAWN	DATE: 03.11.2017		TITLE: Level Spreaders		
	CHECKED	DATE: 03.11.2017				
	SCALE: Not to Scale		SHEET SIZE: A4	PROJECT No: 1777292	REVISION: 1	FIGURE No: Appendix C

Sediment Fences

Application

Sediment fences are used to contain coarse sediments mobilised by sheet flow. They are temporary structures that work by creating a small pond behind the fence for the coarse sediments to settle out.

Design and Construction

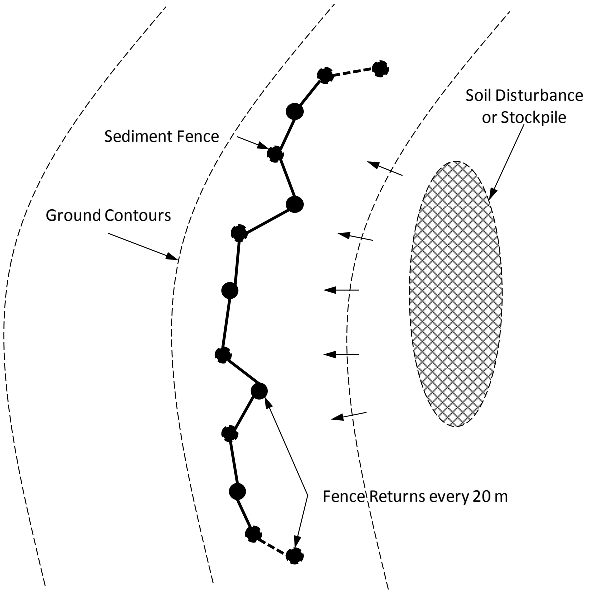
- Sediment fences are not to be used in areas of concentrated flow.
- Catchment area should not exceed 0.6 ha per 100 m of fence.
- Sediment fences should be installed along the contour with the ends turned up to allow for ponding behind the fence.
- Stakes to support the fabric should be placed at regular intervals (2 m maximum spacing).
- Long fences, or fences constructed across the contour, should have returns placed at regular intervals (20 m maximum spacing).
- The bottom edge of the fabric should be anchored in a 0.2 m deep compacted backfilled trench.
- Sediment fences should be placed no closer than 2 m from the base of fill batter slopes or stockpiles.

Maintenance

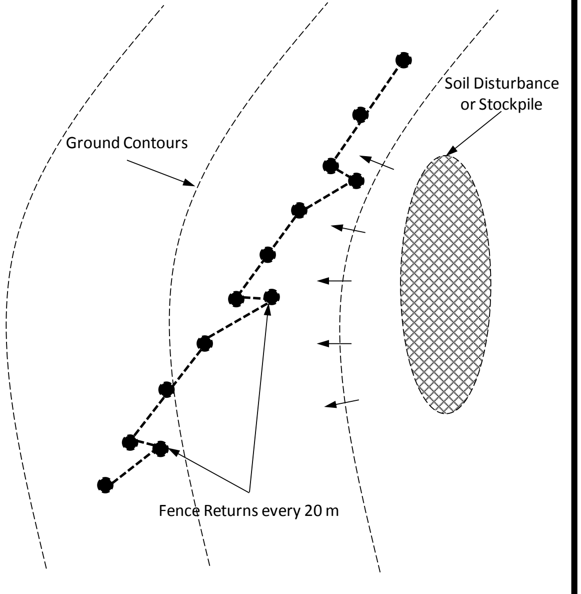
Sediment fences should be inspected regularly for the following:

- Rips, tears or other damage to the fabric and support stakes.
- Build up of sediment behind the fence.

If these deficiencies are noted, repair works should commence as soon as practical, and prior to forecast rainfall events. Sediment fences should be removed once no longer required and disposed of appropriately.



TYPICAL SEDIMENT FENCE LAYOUT (INSTALLED ON THE CONTOUR)



TYPICAL SEDIMENT FENCE LAYOUT (INSTALLED ACROSS THE CONTOUR)

Golder Associates	CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox	
	DRAWN	DATE: 03.11.2017	TITLE: Sediment Fences	
	CHECKED	DATE: 03.11.2017		
	SCALE: Not to Scale	SHEET SIZE: A4	PROJECT No: 1777292	REVISION: 1	FIGURE No: Appendix C

Sediment Basins

Application

Sediment basins should be considered the 'last line of defence' in the erosion and sediment control treatment process, and should be applied in conjunction with other measures. They are typically located at the downstream end of a disturbed catchment, and can be used to treat small to large catchments.

There are a number of sediment basin types for specific applications; which require detailed engineering design to ensure adequate sediment capture performance of the basin and reduce the risk of basin failure. The sediment basin design is suitable for capturing both coarse and fine sediment particles and is relatively simple to design, construct and operate if operated without flocculants.

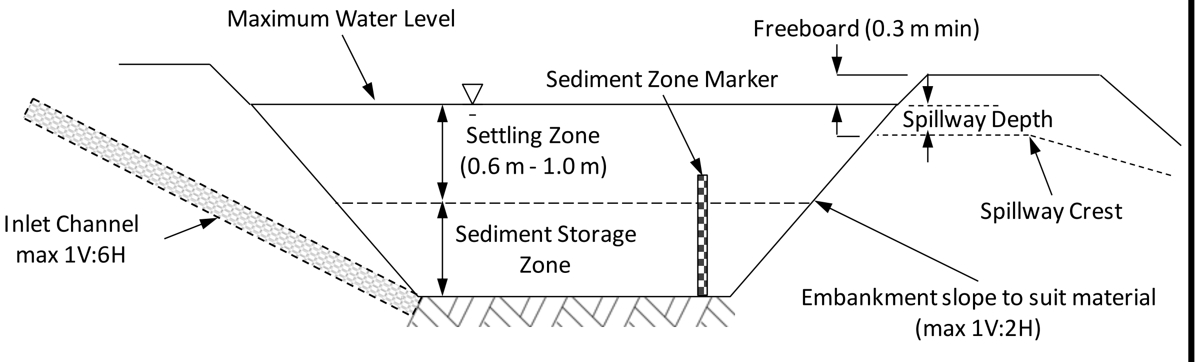
Design and Construction

- Sediment basins require detailed engineering design.
- Embankments and fill batters should be constructed to suit the soil material.
- The ideal length to width ratio of the basin is within the range of 3L:1W to 5L:1W.
- The maximum water level should not exceed 1.5 m in depth when measured from the bottom of the basin.
- A marker should be placed in the basin with the top of the sediment storage zone clearly marked.
- An emergency spillway is required to protect the basin embankment during large events. Specialist guidance is required to design and construct the spillway structure.

Maintenance

- When the sediment storage zone is full, the basin should be de-silted. Sediments should be placed where they will not be re-mobilised in subsequent rainfall events.
- Sediment basins should be inspected regularly for the following:
    - Build up of sediment.
    - Evidence of scour or other damage to the inlet channel, spillway or embankments.

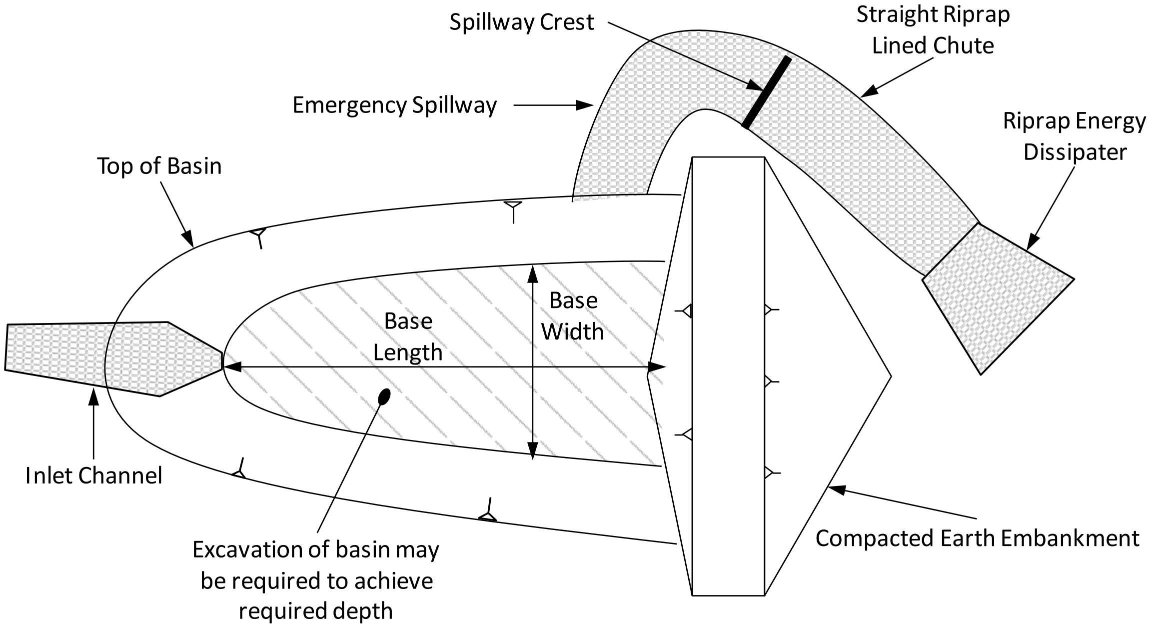
If these deficiencies are noted, repair works should commence as soon as practical, and prior to forecast rainfall events.



TYPICAL SEDIMENT BASIN SECTION

Golder Associates	CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox		
	DRAWN	DATE: 03.11.2017	TITLE: Sediment Basins		
	CHECKED	DATE: 03.11.2017			
	SCALE: Not to Scale	SHEET SIZE: A4	PROJECT No: 1777292	REVISION: 1	FIGURE No: Appendix C

Sediment Basin (layout)



TYPICAL TYPE F SEDIMENT BASIN LAYOUT

Golder Associates	CLIENT: Altura Group		PROJECT: Erosion and Sediment Control Toolbox
	DRAWN	DATE: 03.11.2017	TITLE: Sediment Basins
	CHECKED	DATE: 03.11.2017	
	SCALE: Not to Scale	SHEET SIZE: A4	PROJECT No: 1777292; REVISION: 1; FIGURE No: Appendix C

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APPENDIX E

Flora and Fauna Assessment

Goat Hill Pumped Storage Hydro Project

Flora and Fauna Assessment

Goat Hill Pumped Storage Hydro Project Flora and Fauna Assessment

27 November 2017

Version 4

Prepared by EBS Ecology for Golders

Document Control					
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3	23/11/2017	EBS		17/11/2017	Final
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3	23/11/2017	Electronic	Lissa Van Camp - Golders
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EBS Ecology Project Number: E70314

CITATION: EBS Ecology (2017) Goat Hill Pumped Storage Hydro Project Flora and Fauna Assessment. Report to Golders. EBS Ecology, Adelaide.

Cover photograph: View from the upper reservoir

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Torrensville, South Australia 5031
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GLOSSARY AND ABBREVIATION OF TERMS

BDBSA	Biological Database of South Australia (managed by DEWNR)
DEWNR	Department of Environment, Water and Natural Resources
DoE	Australian Government Department of the Environment
DotEE	Australian Government Department of the Environment and Energy (previously DoE)
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999*
NES	National Environmental Significance
NPW Act	*National Parks and Wildlife Act, 1972*
NRM Act	*Natural Resources Management Act 2004*
NVC	Native Vegetation Council
SEB	Significant Environmental Benefit
IBRA	Interim Biogeographical Regionalisation of Australia
Ha	Hectare
PMST	Protected Matters Search (under the EPBC Act)

EXECUTIVE SUMMARY

EBS Ecology (EBS) was engaged by Golder Associates on behalf of Altura Group Pty Ltd to conduct a baseline ecological assessment within an area of remnant vegetation located approximately 12 km to the south west of Port Augusta. The site has been selected for a proposed pumped storage hydro development. The field study was conducted from 4-8 September 2017, and included a vegetation and fauna survey. The vegetation survey included the Bushland Assessment method and Rangeland Assessment method devised by the Department of Environment, Water and Natural Resources (DEWNR 2017). The ecological assessment is intended to support project approval documents.

The desktop ecological assessment utilised data from the Protected Matters Search Tool, Biological Database of South Australia (BDBSA) and the Atlas of Living Australia (ALA) to determine the potential presence of species listed as threatened and or migratory under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act* and *National Parks and Wildlife* (NPW) *Act*. The likelihood of occurrence within the Project area for each EPBC Act and NPW Act listed species identified on the database was then assessed based on the species distribution, habitat availability, date of last record and the conspicuousness of the species. Prior to the field survey, the desktop assessment determined that the Western Grasswren (*Amytornis textilis myall*) and one flora species, *Senecio megaglossus* (Superb Groundsel), listed as threatened under the EPBC Act, had potential to occur. In addition to this, one migratory and one marine bird species listed under the EPBC Act were considered to potentially occur. These were the Fork-tailed Swift (*Apus pacificus*) (Migratory/marine) and Rainbow Bee-eater (*Merops ornatus*) (Marine). Furthermore, 16 flora and nine fauna species listed under the NPW Act were considered to potentially occur within the Project area.

The desktop assessment and field survey have built a solid characterisation of the dominant landforms and vegetation associations within the Project area. There were 12 broad vegetation associations and three major landform types recorded within the Project area. The landform types were: Plateau, escarpment and lower plains. One hundred and nine (109) flora species were recorded, which included 92 native species and 17 weed species. One species listed as vulnerable under the NPW Act, *Santalum spicatum* (Sandalwood), was recorded during the field survey within the Main Access Corridor and the Upper Access Road. EBS's first recommendation would be to micro site to avoid the individual locations of where they were recorded; if this is not possible then the SEB payment is likely to be more to factor in a state threatened flora species. No flora species or ecological communities with a conservation rating under the EPBC Act were recorded.

Three of the weed species recorded is listed as declared under the NRM Act; these were *Lycium ferocissimum* (African Boxthorn), *Marrubium vulgare* (Horehound) and *Xanthium spinosum* (Bathurst Burr). It is recommended that a Construction and Operational Environmental Management Plan (COEMP) be developed and implemented pre and post construction, and that within this plan a section on weed management, will recommend actions on best practice methods around controlling the spread of weeds.

The fauna assessment was conducted whereby all fauna taxa observed within the Project area was recorded; there was a particular focus on avifauna given the location of the Project area, the vegetation on site as well as the potential for avifauna to be transient across the Project area. The potential for threatened fauna species to occur was further assessed by examining the habitats available within the Project area.

The fauna survey recorded 44 bird species, four mammal and four reptile species. There were no species listed under the EPBC Act that were observed during the field survey. One species listed under the NPW Act, the Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*), was observed within the Project area during the field survey. This species was observed within the project footprint however the overall impact of the proposed development on the species will be negligible as the species has a stable population, is widespread, and has extensive areas of suitable habitat within the region.

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1 INTRODUCTION

EBS Ecology (EBS) was engaged by Golder Associates on behalf of Altura Group Pty Ltd to conduct a baseline ecological assessment within an area of remnant vegetation located approximately 12 km to the south west of Port Augusta. The site has been selected for a proposed hydro development. The ecological assessment ran from 4-8 September 2017 and comprised of a vegetation and fauna survey, which was intended to support project approval documents such as the Development Application.

1.1 Objectives

The overall objective of this assessment was to compile baseline information to characterise the existing flora and fauna values of the Project area, to inform planning and clearance requirements for the intersection at the Eyre Highway.

The specific objectives of the flora and fauna assessment were to:

- Conduct a review of biological databases to identify potential threatened species;
- Conduct background research of threatened species identified and determine if they are likely to occur within the Project area;
- Review relevant literature and existing spatial data;
- Map the native vegetation communities over the Project area;
- Assess the condition and importance of native vegetation present within the Project area using the Rangelands Assessment Manual and Bushland Assessment Manual devised by the Native Vegetation Council;
- Determine a Significant Environment Benefit (SEB) calculation for the project;
- Record all fauna observed over the Project area; and
- Assess potential habitat for any species of national or state conservation significance known or likely to occur within the Project area and determine possible impacts of the project on these species.

1.2 Project area

The Project area is situated in the mid-north region of South Australia, approximately 280 km north of Adelaide. The Project area is grazed by sheep and quarried (Figure 1). The proposed 275 kV transmission line runs alongside the Port Augusta to Whyalla railway line.

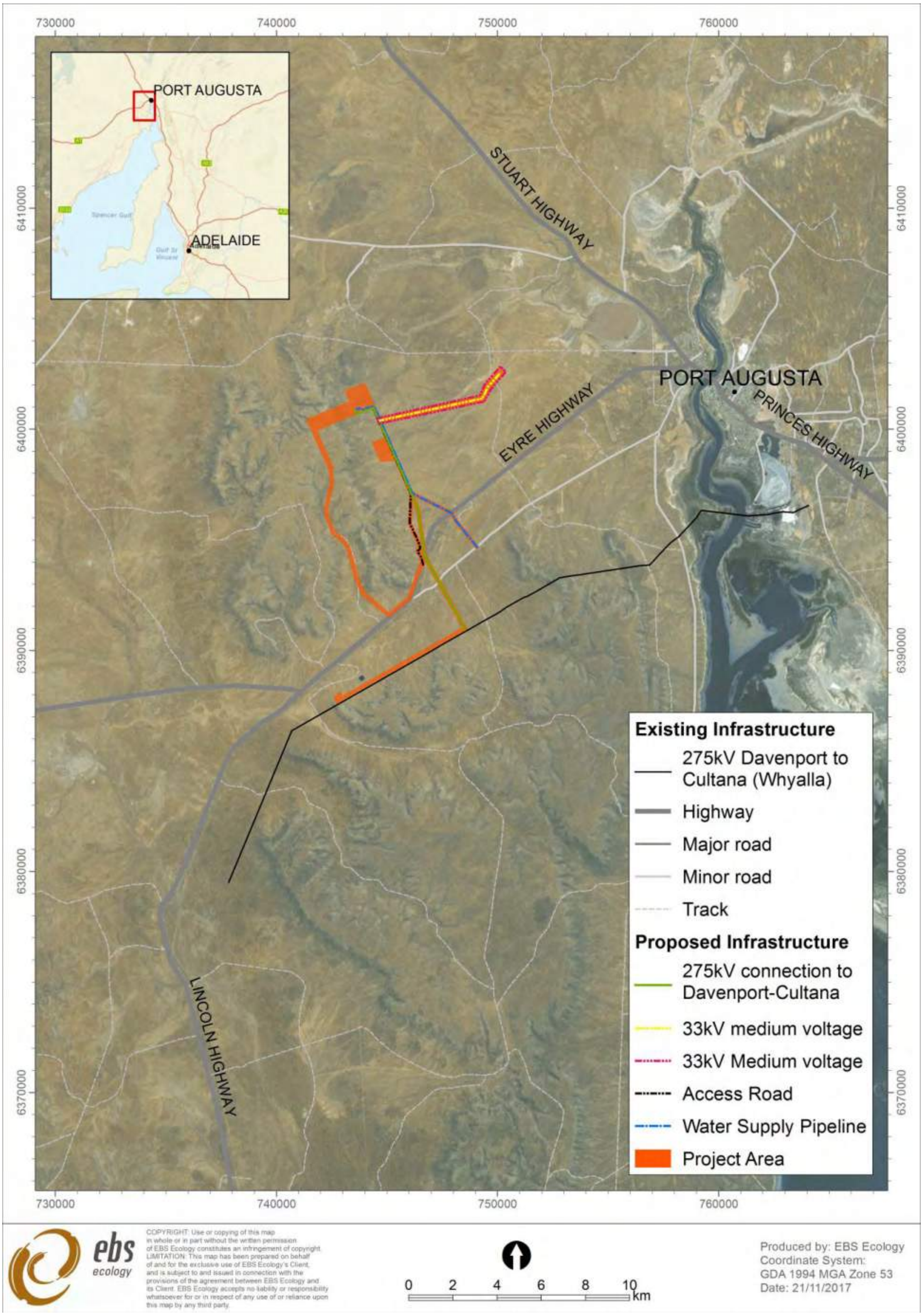


Figure 1. Location of the Project area.

2 COMPLIANCE AND LEGISLATIVE SUMMARY

2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as 'matters of national environmental significance'. The nine matters of national environmental significance protected under the Act are:

- World Heritage properties.
- National Heritage places.
- wetlands of international importance (listed under the Ramsar Convention).
- listed threatened species and ecological communities.
- migratory species protected under international agreements.
- Commonwealth marine areas.
- the Great Barrier Reef Marine Park.
- nuclear actions (including uranium mines).
- a water resource, in relation to coal seam gas development and large coal mining development.

Any action that has, will have, or is likely to have a significant impact on matters of national environmental significance requires referral under the EPBC Act.

This report includes an assessment of EPBC-listed threatened species, ecological communities and migratory species which are recognised as a matter of national environmental significance.

2.2 Native Vegetation Act 1991

In South Australia, under the *Native Vegetation Act 1991*, all clearance of native vegetation requires the approval of the NVC unless it is covered by a specific exemption contained within the *Native Vegetation Regulations 2017*.

Native vegetation refers to any naturally occurring local plant species that are indigenous to South Australia, from small ground covers and native grasses to large trees and water plants.

"Clearance", in relation to native vegetation, means:

- the killing or destruction of native vegetation;
- the removal of native vegetation;
- the severing of branches, limbs, stems or trunks of native vegetation;
- the burning of native vegetation;
- any other substantial damage to native vegetation, and includes the draining or flooding of land, or any other act or activity, that causes the killing or destruction of native vegetation, the severing of branches, limbs, stems or trunks of native vegetation or any other substantial damage to native vegetation.

Approval must be obtained before performing any activity that could cause substantial damage to native plants. This also applies to dead trees that may provide habitat for animals. These activities include but are not limited to:

- the cutting down, destruction or removal of whole plants
- the removal of branches, limbs, stems or trunks (including brush-cutting and wood-cutting)
- burning
- poisoning
- slashing of understorey
- drainage and reclamation of wetlands
- grazing by animals (in some circumstances).

This project is considered to comply with Division 1 of the Native Vegetation Regulations 2017 which allows for the clearance of native vegetation in relation to specific activities as set out in Schedule 1, Parts 4, 5 or 6.

2.3 National Parks and Wildlife Act 1972

Vascular plants and vertebrate animals (e.g. mammals, birds, reptiles and amphibians) are protected in South Australia under the threatened species schedules of the National Parks and Wildlife Act 1972 (NPW Act): Schedule 7 (endangered species), Schedule 8 (vulnerable species) and Schedule 9 (rare species). The criteria used to define threatened species in South Australia are generally based on categories and definitions from the IUCN Red List Categories and Criteria.

The current schedules do not include non-vascular plants, fish, insects, butterflies, spiders, scorpions and other invertebrates, fungi and other life forms which do not have a current legal conservation status in South Australia.

Under the NPW Act, persons must not:

- take a native plant on a reserve, wilderness protection area, wilderness protection zone, land reserved for public purposes, a forest reserve or any other Crown land
- take a native plant of a prescribed species on private land
- take a native plant on private land without the consent of the owner (such plants may also be covered by the Native Vegetation Act 1991)
- take a protected animal or the eggs of a protected animal without approval
- keep protected animals unless authorised to do so
- kill a protected animal without approval.

2.4 Natural Resources Management Act 2004

Under the *Natural Resources Management Act 2004* (NRM Act), landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

Key components under the Act include the establishment of regional Natural Resource Management (NRM) Boards and development of regional NRM Plans; the ability to control water use through prescription, allocations and restrictions; requirement to control pest plants and animals, and activities that might result in land degradation.

A ‘duty of care’ is a fundamental component of this Act, i.e. ensuring one’s environmental and civil obligation by taking reasonable steps to prevent land and water degradation. Persons can be prosecuted if they are considered negligent in meeting their obligations.

The Project area is predominately in SAAL and a small portion (linear infrastructure) in Northern and Yorke.

3 BACKGROUND INFORMATION

3.1 Environmental setting

3.1.1 IBRA

To classify landforms, the Interim Biogeographical Regionalisation of Australia (IBRA) is used. This is a landscape-based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity (DEWNR 2011). The Project area is situated within the Gawler IBRA bioregion and the Arcoona Plateau and adjacent to Gawler Lakes subregion (Table 1) (Figure 2). The Arcoona Plateau and Gawler Lakes subregion had 99% and 62% remnant vegetation cover, respectively.

Table 1. IBRA bioregion, subregion, and environmental association environmental landscape summary.

Gawler IBRA bioregion	
Semi-arid to arid, flat topped to broadly rounded hills of the Gawler Range Volcanics and Proterozoic sediments, low plateaux on sandstone and quartzite with an undulating surface of aeolian sand or gibbers and rocky quartzite hills with colluvial footslopes, erosional and depositional plains and salt encrusted lake beds, with black oak (belah) and myall low open woodlands, open mallee scrub, bluebush/saltbush open chenopod shrublands and tall mulga shrublands on shallow loams, calcareous earths and hard red duplex soils.	
Arcoona Plateau IBRA subregion	
A series of low plateaux on sandstone and quartzite with an undulating surface of aeolian sand or gibbers over red duplex soils, and rocky quartzite hills with colluvial footslopes. There is a cover of low chenopod shrubland, *Acacia victoriae* tall shrubland with a chenopod shrub understorey and fringing *Acacia papyrocarpa* woodland.	
Remnant vegetation	Approximately 99% (1077028 ha) of the subregion is mapped as remnant native vegetation, of which 0% (710ha) is formally conserved
Landform	Dissected sandstone plateau with bold eastern escarpment. Surface undulating to hilly and often gibber-covered, particularly in east
Geology	Sands, clays, silts; pallid zones and ferruginised breakaway scarps. Silcrete and silcrete skins; stony plains and plateau remnants. Colluvial fans, alluvial sands, silts, clays and gravels. Stony tablelands, gibber plains and stone circles (gilgai effects)
Soil	Crusty red duplex soils, Red calcareous loams
Vegetation	Chenopod shrublands
Conservation significance	34 species of threatened fauna, 14 species of threatened flora. 2 wetlands of national significance.
Gawler Lakes IBRA Subregion	
An undulating upland plain underlain by quartzite and sandstone, with shallow loamy soils. Encompasses the Woomera plateau, which is characterised by the absence of trees and tall shrubs, except on floodplains, where mulga (*Acacia aneura*), bullock bush (*Alectryon oleifolius ssp. canescens*), occasional red gums (*Eucalyptus camaldulensis*) and other species may be found. The gibber-covered areas are either bare or carry a scattered growth of samphire (*Halosarcia sp.*) and bindyi (*Sclerolaena sp.*). The depositional plains to the south and south-west of the plateau are covered with deep calcareous earths characteristically carrying an open myall (*Acacia papyrocarpa*) woodland with a bluebush (*Maireana sedifolia*) understorey, or red aeolian sand sheets and dunes with open mulga shrubland or a low woodland of Casuarina pauper or *Callitris glaucophylla*.	
Remnant	Approximately 62% (1271089 ha) of the subregion is mapped as remnant native vegetation, of

vegetation	which 2% (547873 ha) is formally conserved
Landform	Undulating plains overlain with sand sheets and dunes, with occasional silcrete capped rises
Geology	Alluvium, colluvium (sand silt clay & gravels). Silcrete cappings and Ti-rich skins. Dune sand and residual sand mantles. Evaporites (gypsum & halite). Bleached Cretaceous shales. Silicified rhizomorphs and nodular silcrete (Tertiary)
Soil	Brown calcareous earths, Crusty loamy soils with red clayey subsoils, Sand soils, brown and red, Shallow dense loams
Vegetation	Assumed native vegetation cover
Conservation significance	39 species of threatened fauna, 33 species of threatened flora. 2 wetlands of national significance.

3.1.2 Administrative boundaries

The Project area is predominately located in Lands Not Within A Council Area (Flinders). It is located within County of Manchester and the Hundreds of Copley, Gillen and Handyside. The Project area is in the Northern and Yorke and South Australian Arid Lands NRM Regions.

3.1.3 Climate

Comprehensive climate data were sourced from the Port Augusta Power Station, approximately 13 km west of the Project area. Rainfall and temperature are indicative of a warm desert climate, with cool wet winter months and hot dry summer months.

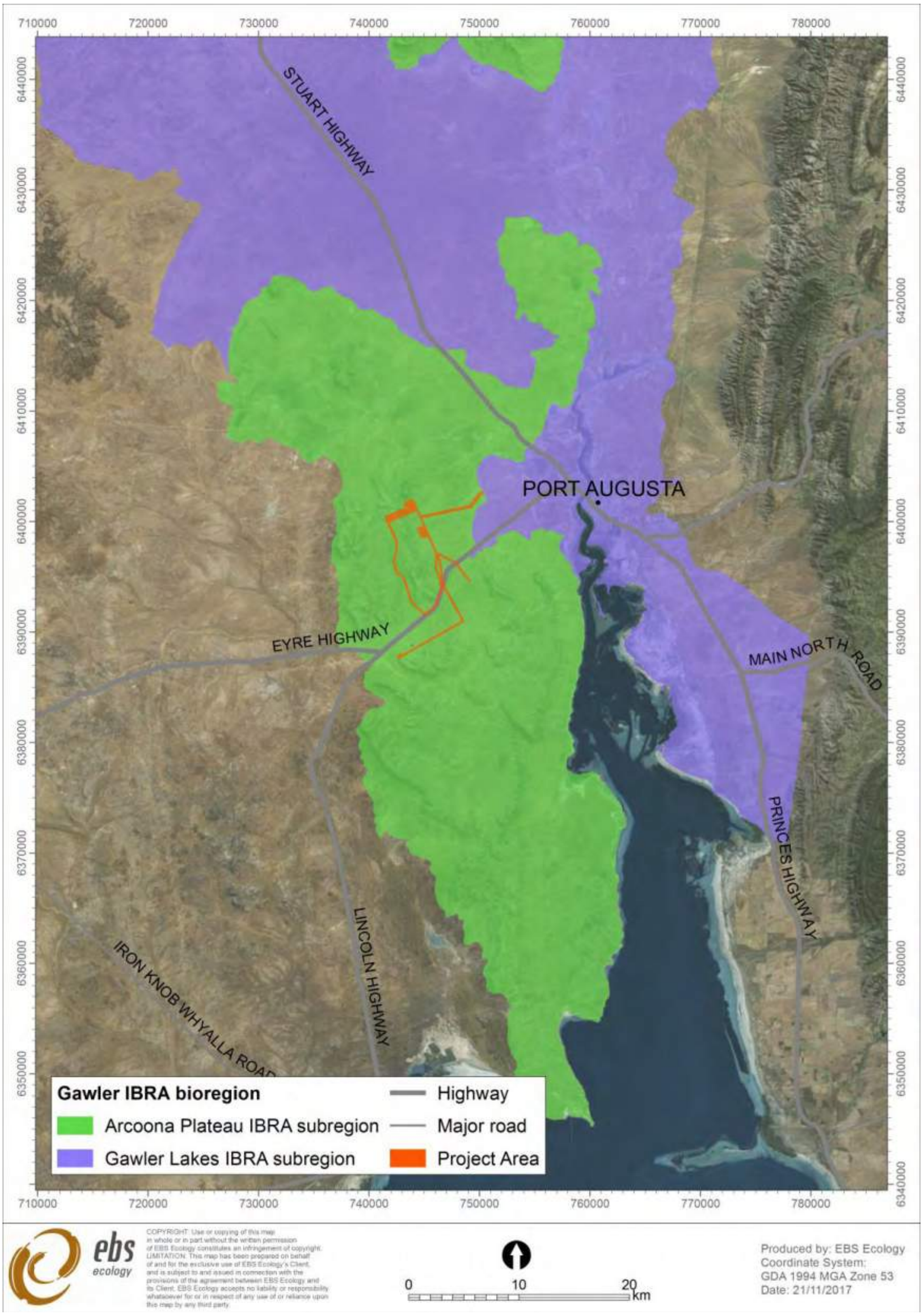


Figure 2. IBRA classification in relation to the Project area.

4 METHODS

4.1 Desktop survey

A Protected Matters Report was generated on 19 September 2017 to identify matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may occur or may have suitable habitat occurring within the Project area. The search radius used for the Protected Matters Search was 50 km, which is prescribed by the Rangelands Assessment Manual (DEWNR 2017a).

A Biological Database of South Australia (BDBSA) search was obtained from the Department of Environment, Water and Natural Resources (DEWNR) in September 2017, to identify flora and fauna species previously recorded within and around the Project area (DEWNR 2017b). A search radius of 50 km was used from the centre of the Project area, as prescribed by the Rangelands Assessment Manual (DEWNR 2017a). The BDBSA is comprised of an integrated collection of corporate databases which meet DEWNR standards for data quality, integrity and maintenance. In addition to DEWNR biological data, the BDBSA also includes data from partner organisations (Birds Australia, Birds SA, Australasian Wader Study Group, SA Museum, and other State Government Agencies). The data are included under agreement with the partner organisation for ease of distribution, but they remain owners of the data and should be contacted directly for further information.

The likelihood of occurrence for each EPBC Act and NPW Act species identified from the Protect Matters Report and BDBSA data extraction was then deliberated based on habitat availability in the Project area, date of last record and the conspicuousness of the species.

4.2 Field survey

4.2.1 Vegetation

The survey effort focused on permanent infrastructure sections of the Project area. Detailed vegetation association mapping, flora species inventories and targeted conservation rated species surveys were completed for the Upper Reservoir, Lower Reservoir, and Construction Expansion Area. The majority of these areas were traversed on foot. All location data were recorded using a hand held GPS.

The remaining areas including the Upper Reservoir Access Road, Main Access Road, Medium Voltage Corridor, 33kV Corridor and 275kV Corridor and water supply pipeline corridor were observed from a vehicle. Vegetation association mapping for these areas was compiled using aerial photography and occasional confirmation on-ground. Generally only the centre line of these routes was accessed (i.e. buffer areas were not surveyed).

Additional surveys will be required to prepare SEB calculations and NV clearance report and application.

The survey effort is summarised in Table 2.

Table 2. Summary of survey effort within the Project area (Figure 3 and Figure 6**).**

Location within Project area	Survey complete
Upper Reservoir	• Detailed vegetation association mapping. • Flora species inventory. • Conservation rated species (*Santalum spicatum*) survey.
Lower Reservoir	• Detailed vegetation association mapping. • Flora species inventory. • Conservation rated species (*Santalum spicatum*) survey.
Construction Expansion Area (adjacent Lower Reservoir)	• Detailed vegetation association mapping. • Flora species inventory. • Conservation rated species (*Santalum spicatum*) survey.
Water supply pipeline	• Preliminary vegetation association survey (Route driven and some sections walked).
Upper Reservoir Access Road	• Preliminary vegetation association survey (Route driven and some sections walked).
Main Access Road	• Preliminary vegetation association survey (Route driven and some sections walked).
33KV Corridor Medium	• Preliminary vegetation association survey (Route driven and some sections walked).
275KV Corridor	• Preliminary vegetation association survey (Route driven and some sections walked).

4.2.2 Fauna

A fauna assessment was used to determine if any native fauna/or fauna habitat may be impacted from the proposed works. This included the identification of any fauna of conservation significance at local, state and national levels, and habitat for any flora and fauna that may occur during other times of the year. The habitat assessment was used to determine whether any additional/targeted bird and bat surveys will be required within the Project area.

The fauna assessment was conducted whereby all fauna taxa observed within the Project area was recorded; there was a particular focus on avifauna given the location of the Project area, the vegetation on site as well as the potential for avifauna to be transient across the Project area (given its proximity to the coast).

Birds

Point Counts

Eleven point count locations were established over the Project area (Table 3; Figure 3). The point count sites aimed to represent the array of habitats on site however more sites were established within habitat types which were expected to support a greater diversity of bird species. Each of the 11 point count sites were surveyed for 20 minutes in the morning (<10:30 am) and 20 minutes in the afternoon (>1 pm). The observer recording all birds heard and observed within a 100 m radius of the centre of the site. If birds were heard or observed outside the 100 m search radius, they were recorded as ‘off-site’. Bird activity (e.g. flying overhead, flying over circling, resting or foraging on tree/shrub/ground), number of individuals observed, distance from observer, and any other notable observations were recorded.

Table 3. The landform and dominant vegetation species present at each of the point count sites distributed over the Project area.

Point Count ID	Easting	Northing	Landform	Vegetation
1	742055	6400288	Plain	*Atriplex vesicaria* (Bladder saltbush), *Tecticornia medullosa* (Samphire), *Sclerolaena sp.* Shrubland
2	742406	6400862	Crest of hill	*Casuarina pauper* (Belah), *Triodia irritans* (Porcupine Grass), *Maireana sedifolia* (Bluebush), *Maireana pyramidata* (Blackbush) Scrubland.
3	743856	6401203	Drainage line, washout and plain	*Casuarina pauper* (Belah), *Maireana sedifolia* (Bluebush), *Maireana pyramidata* (Blackbush) Scrubland.
4	743159	6400875	Slope	*Casuarina pauper* (Belah), *Atriplex vesicaria* (Bladder saltbush) Scrubland.
5	742345	6395969	Drainage line	*Casuarina pauper* (Belah), *Callitris glaucophylla* (Northern Cypress Pine), *Alectroyon oleifolius* (Rosewood) Woodland.
6	745045	6398995	Drainage line and plain	*Acacia victoriae* (Elegant Wattle), *Atriplex vesicaria* (Bladder saltbush), *Tecticornia medullosa* (Samphire), *Sclerolaena sp.* Shrubland
7	746075	6397049	Plain	*Atriplex vesicaria* (Bladder saltbush), *Tecticornia medullosa* (Samphire), *Sclerolaena sp.* Shrubland
8	743656	6393186	Plain	*Casuarina pauper* (Belah), *Maireana pyramidata* (Blackbush) Scrubland.
9	743206	6394676	Plain	Acacia papyrocarpa (Western Myall), *Alectroyon oleifolius* (Rosewood), *Maireana pyramidata* (Blackbush) Woodland.
10	745922	6392388	Drainage line and plain	Acacia papyrocarpa (Western Myall), *Maireana pyramidata* (Blackbush) Shrubland.
11	744621	6399197	Plain	*Atriplex vesicaria* (Bladder saltbush), *Tecticornia medullosa* (Samphire), *Sclerolaena sp.*

Opportunistic

In addition to point count records, all birds opportunistically observed were also recorded. For each observation, the following was recorded:

- Species;
- Number of individuals;
- GPS location;
- Method, i.e. sight or sound; and
- Habitat.

Other fauna

All non-avian fauna observed either opportunistically or during point counts were recorded.

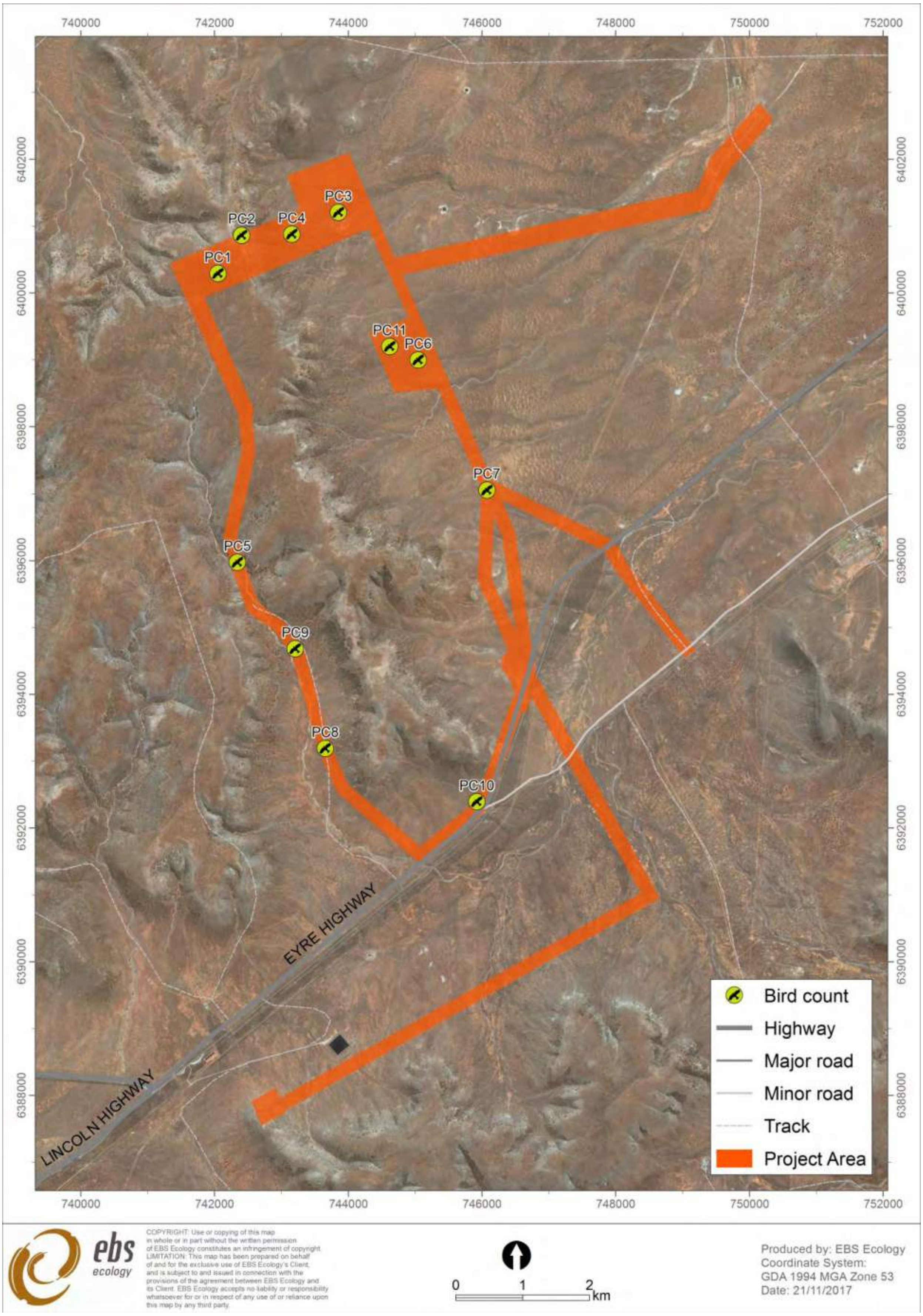


Figure 3. Locations of point count sites over the Project area.

4.3 Limitations

The findings and conclusions expressed by EBS are based solely upon information in existence at the time of the assessment. The combination of field data, database records and background research have provided a solid foundation for determining the flora and fauna that are likely to, or are known to, occur within the Project area.

The field survey was undertaken in spring which is considered an optimal time of the year for recording both flora and fauna species across the region. A number of flora species recorded however, could only be identified to genus level due to a lack of distinguishing identification features such as flowers or fruits. This included species such as *Austrostipa sp*. (Spear-grass), *Chrysocephalum sp.* (Everlasting), *Tecticornia sp.* (Samphire) and *Tetragonia sp*. (False Spinach). It should be noted though, that the number of species missing from the species inventory is expected to be low and data collected are considered adequate to make a reasonable assessment of potential impacts of the proposed works on flora.

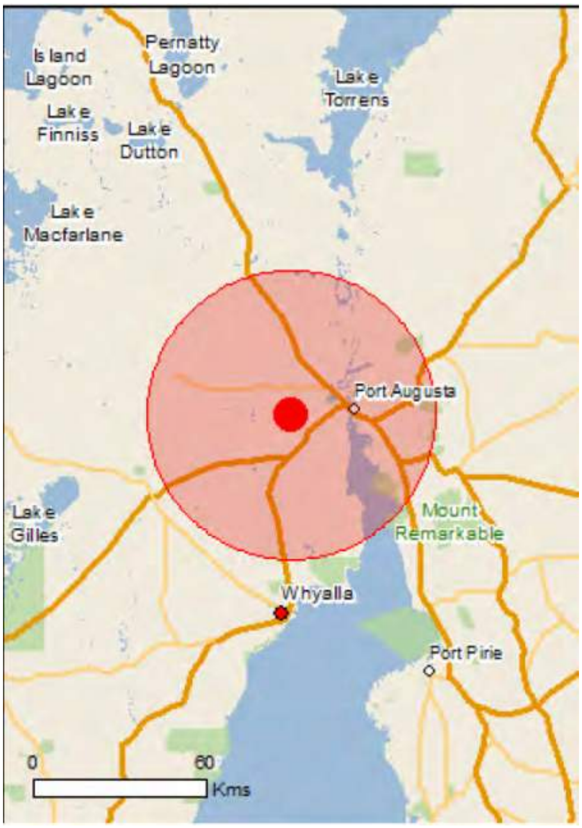
A targeted survey was carried out for avifauna. In addition to this, all fauna species observed were recorded. The compiled list of fauna observations however does not represent all species that could occur within the Project area; these survey results are considered adequate to make a reasonable assessment of potential impacts of the proposed works on fauna.

5 RESULTS

5.1 Matters of National Environmental Significance

The results of the EPBC Protected Matters Search Tool (PMST) report are summarised in Table 4 and the relevant matters of national environmental significance further discussed below.

Table 4. Summary of the EPBC Protected Matters Search.

Search area (50 km buffer)	Matters of National Environment Significance under the EPBC Act 1999	Identified within the search area
	World Heritage Properties	None
	National Heritage Properties	None
	Wetlands of International Importance	None
	Great Barrier Reef Marine Park	None
	Commonwealth Marine Area	None
	Threatened Ecological Communities	3
	Threatened Species	50
	Migratory Species	41
	Commonwealth Land	7
	Commonwealth Heritage Place	None
	Listed Marine Species	79
	Whales and other Cetaceans	8
	Critical Habitats	None
	Commonwealth Reserves Terrestrial	None
	Commonwealth Reserves Marine	None
	State and Territory Reserves	4
	Regional Forest Agreements	None
	Invasive Species	30
	Nationally Important Wetlands	1
	Key Ecological Features (Marine)	None

5.1.1 *Threatened Ecological Communities*

Three Threatened Ecological Communities (TECs) were identified by the Protected Matters Search as potentially occurring within the search area. From habitat assessment on site, none of the TECs were considered to potentially occur within the Project area (Table 5).

Table 5. Threatened Ecological Communities identified by the Protected Matters Search Tool as potentially occurring within the search area (50 km buffer).

Threatened Ecological Community	Status
Grey Box (*Eucalyptus macrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Unlikely
Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia	Unlikely
Subtropical and Temperate Coastal Saltmarsh	Unlikely

5.1.2 Threatened flora species

A total of 12 threatened flora species were identified as potentially occurring in the PMST search area (Table 6). One EPBC listed species, *Brachyscome muelleri* (Corunna Daisy) was identified from the BDBSA search results but was not included in the PMST. *B. muelleri* is unlikely to exist within the Project area due a lack of suitable habitat.

Senecio megaglossus (Superb Groundsel) was the only EPBC listed flora species considered to potentially occur within the Project area.

5.1.3 Threatened fauna species

A total of 38 threatened fauna species were identified as potentially occurring in the search area (Table 6). Nine species are aquatic marine species such as sea-turtles, cetaceans and sharks. The Western Grasswren (*Amytornis textilis myall*) was the only federally listed species considered to potentially occur within the Project area. The Curlew Sandpiper (*Calidris ferruginea*) however may occur at dams adjacent to the Project area.

5.1.4 Migratory and marine species

A total of 41 migratory species and 79 marine species were identified as potentially occurring in the search area (Table 7). Ten migratory species and 31 marine species are marine aquatic species, such as fish, cetaceans and sea-turtles. The Fork-tailed Swift (*Apus pacificus*) was the only migratory species that was considered to possibly occur within the Project area. However, a further five migratory species may possibly occur at dams adjacent to the Project area. Two marine bird species, the Fork-tailed Swift and Rainbow Bee-eater (*Merops ornatus*) were considered to possibly occur within the Project area, while a further six marine bird species may occur at dams adjacent to the Project area.

Table 6. Threatened flora and fauna species potentially occurring within the search area (50 km buffer).

Scientific name	Common name	Conservation status		Source	Date of last record	Likelihood of occurrence within Project area
		Aus	SA			
Flora						
Caladenia gladiolata	Bayonet Spider-orchid, Clubbed Spider-orchid	EN	E	1		Unlikely
Caladenia macroclavia	Large-club Spider-orchid	EN	E	1		Unlikely
Caladenia tensa	Greencomb Spider-orchid, Rigid Spider-orchid	EN		1, 2	1999	Unlikely
Caladenia woolcockiorum	Woolcock's Spider-orchid	VU	E	1		Unlikely
Caladenia xantholeuca	White Rabbits, Flinders Ranges White Caladenia	EN	E	1		Unlikely
Brachyscome muelleri	Corunna Daisy	EN	E	2	2005	Unlikely
Frankenia plicata	Braided Sea-heath	EN	V	1		Unlikely
Hibbertia cripsula	Ooldea Guinea-flower	VU	V	1		Unlikely
Olearia pannosa subsp. pannosa	Silver Daisy-bush, Silver-leaved Daisy, Velvet Daisy-bush	VU	V	1, 2	1996	Unlikely
Prasophyllum pallidum	Pale Leek-orchid	VU	R	1, 2	2009	Unlikely
Prasophyllum validum	Sturdy Leek-orchid	VU	V	1, 2	1994	Unlikely
Pterostylis xerophila	Desert Greenhood	VU	V	1		Unlikely
Senecio megaglossus	Superb Groundsel	VU	E	1	2005	Possible
Senecio megaglossus	Superb Groundsel	VU	E	1	2005	
Birds						
Amytornis merrotsyi merrostyi	Short-tailed Grasswren (Flinders Ranges)	VU		1, 2	2001	Unlikely
Amytornis textilis myall	Western Grasswren (Gawler Ranges)	VU		1, 2	2006	Possible
Calidris canutus	Red Knot	EN		1, 2	2000	Unlikely
Calidris ferruginea	Curlew Sandpiper	CE		1, 2	2000	Unlikely (possible adjacent dams)
Calidris tenuirostris	Great Knot	CE		1, 2	1983	Unlikely
Charadrius leschenaultii	Greater Sand Plover	VU	R	1, 2	1984	Unlikely

Scientific name	Common name	Conservation status		Source	Date of last record	Likelihood of occurrence within Project area
		Aus	SA			
Diomedea antipodensis	Antipodean Albatross	VU	V	1		Unlikely
Diomedea epomophora	Southern Royal Albatross	VU	V	1		Unlikely
Diomedea exulans	Wandering Albatross	VU	V	1		Unlikely
Diomedea sanfordi	Northern Royal Albatross	EN	E	1		Unlikely
Graniella picta	Painted Honeyeater	VU	V	1		Unlikely
Leipoa ocellata	Malleefowl	VU	V	1		Unlikely
Limosa lapponica baueri	Bar-tailed Godwit (baueri)	V	R	1, 2	1985	Unlikely
Limosa lapponica menzbieri	Bar-tailed Godwit (menzbieri)	V		1		Unlikely
Macronectes halli	Northern Giant Petrel	V		1		Unlikely
Macronectes giganteus	Southern Giant Petrel	EN	V	2	2000	Unlikely
Neophema chrysogaster	Orange-bellied Parrot	CE	E	1, 2	1992	Unlikely
Numenius madagascariensis	Far Eastern Curlew	CE	V	1, 2	2004	Unlikely
Pachyptila turtur subantarctica	Fairy Prion	VU		1		Unlikely
Pedionomus torqatus	Plains-wanderer	CE	E	1		Unlikely
Pezoporus occidentalis	Night Parrot	EN	E	1		Unlikely
Phoebetria fusca	Sooty Albatross	VU	E	1		Unlikely
Sternula nereis nereis	Australian Fairy Tern	VU	E	1, 2	2002	Unlikely
Thalassarche cauta cauta	Shy Albatross	VU	V	1		Unlikely
Thalassarche cauta steadi	White-capped Albatross	VU		1		Unlikely
Thalassarche impavida	Campbell Albatross	VU	V	1		Unlikely
Thalassarche melanophris	Black-browed Albatross	VU	V	1		Unlikely

Scientific name	Common name	Conservation status		Source	Date of last record	Likelihood of occurrence within Project area
		Aus	SA			
Mammal						
Petrogale xanthopus xanthopus	Yellow-footed Rock-wallaby (SA and NSW)	VU		1, 2	2008	Unlikely
Dasyurus viverrinus	Eastern Quoll	EN	E	2	1909	Unlikely
Bettongia lesueur	Burrowing Bettong	EX	E	2	1900	Impossible
Reptiles						
Aprasia pseudopulchella	Flinders Ranges Worm-lizard	VU		1, 2	2017	Unlikely
Notechis scutatus ater	Krefft's Tiger Snake (Flinders Ranges)	VU		1		Unlikely

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare.

Source of Information

1. **EPBC Act Protected Matters Report (DotEE 2017) – 50 km buffer applied to Project area.**
2. **Biological Database of South Australia data extract (DEWNR 2017b) - 50 km buffer applied to Project area.**

Table 7. Migratory and marine species potentially occurring within the Project area.

Scientific name	Common name	Conservation status		Source	Date of last record	Likelihood of occurrence within Project area
		Aus	SA			
Actitis hypoleucos	Common Sandpiper	Mig, Ma	R	1, 2	2004	Unlikely (possible adjacent dams)
Apus pacificus	Fork-tailed Swift	Mig, Ma		1, 2	2000	Possible
Ardea alba	Great Egret	Ma		1, 2	2005	Unlikely
Ardea ibis	Cattle Egret	Ma	R	1, 2	1994	Unlikely
Ardenna carneipes	Flesh-footed Shearwater	Mig, Ma	R	1		Unlikely
Arenaria interpres	Ruddy Turnstone	Mig, Ma	R	1, 2	1998	Unlikely
Calidris acuminata	Sharp-tailed Sandpiper	Mig, Ma		1, 2	2006	Unlikely (possible adjacent dams)
Calidris alba	Sanderling	Mig, Ma	R	1		Unlikely
Calidris canutus	Red Knot	Mig, Ma, E		1, 2	2000	Unlikely
Calidris ferruginea	Curlew Sandpiper	Mig, Ma, CE		1, 2	2000	Unlikely (possible adjacent dams)
Calidris melanotos	Pectoral Sandpiper	Mig, Ma	R	1		Unlikely
Calidris ruficollis	Red-necked Stint	Mig, Ma		1, 2	2006	Unlikely (possible adjacent dams)
Calidris tenuirostris	Great Knot	Mig, Ma, CE	R	1, 2	1983	Unlikely
Charadrius leschenaultia	Greater Sand Plover	Mig, Ma, VU	R	1, 2	1984	Unlikely
Charadrius veredus	Oriental Plover	Mig, Ma		1, 2	1996	Unlikely
Diomedea antipodensis	Antipodean Albatross	Ma, VU	V	1		Unlikely
Diomedea epomophora	Southern Royal Albatross	Mig, Ma VU	V	1		Unlikely
Diomedea exulans	Wandering Albatross	Mig, Ma, VU	V	1		Unlikely
Diomedea sanfordii	Northern Royal Albatross	Ma, EN	E	1		Unlikely
Gallinago hardwickii	Latham's Snipe	Mig, Ma	R	1		Unlikely
Gallinago stenura	Pin-tailed Snipe	Mig, Ma		1		Unlikely
Haliaeetus leucogaster	White-bellied Sea-eagle	Ma	E	1		Unlikely

Scientific name	Common name	Conservation status		Source	Date of last record	Likelihood of occurrence within Project area
		Aus	SA			
Himantopus himantopus	Black-winged Stilt	Ma		1		Unlikely
Limosa lapponica	Bar-tailed Godwit	Mig, Ma	R	1, 2	1985	Unlikely
Limosa limosa	Black-tailed Godwit	Mig, Ma	R	1, 2	1984	Unlikely
Macronectes giganteus	Southern Giant-Petrel	Mig, Ma EN	V	1, 2	2000	Unlikely
Macronectes halli	Northern Giant Petrel	Mig, Ma, VU		1		Unlikely
Merops ornatus	Rainbow Bee-eater	Ma		1, 2	2006	Likely
Motacilla cinerea	Grey Wagtail	Mig, Ma		1		Unlikely
Motacilla flava	Yellow Wagtail	Mig, Ma		1		Unlikely
Neophema chrysogaster	Orange-bellied Parrot	Ma, CE	E	1, 2	1992	Unlikely
Numenius madagascariensis	Far Eastern Curlew	Mig, Ma, CE	V	1, 2	2004	Unlikely
Pachyptila turtur	Fairy Prion	Ma		1		Unlikely
Pandion haliaetus	Osprey	Mig, Ma	E	1		Unlikely
Phalacrocorax fuscescens	Black-faced Cormorant	Ma		1		Unlikely
Philomachus pugnax	Ruff (Reeve)	Mig, Ma	R	1		Unlikely
Phoebetria fusca	Sooty Albatross	Mig, Ma, VU	E	1		Unlikely
Puffinus carneipes	Flesh-footed Shearwater	Ma	R	1		Unlikely
Recurvirostra novaehollandiae	Red-necked Avocet	Ma		1		Unlikely (possible adjacent dams)
Rostratula benghalensis (sensu lato)	Painted Snipe	Ma, EN	V	1		Unlikely
Sterna fuscata	Sooty Tern	Ma		1		Unlikely
Sterna nereis	Fairy Tern	Ma, VU	E	1, 2	2002	Unlikely
Thalassarche cauta	Tasmanian Shy Albatross	Mig, Ma, VU	V	1		Unlikely
Thalassarche impavida	Campbell Albatross	Ma, VU	V	1		Unlikely

Scientific name	Common name	Conservation status		Source	Date of last record	Likelihood of occurrence within Project area
		Aus	SA			
Thalassarche melanophris	Black-browed Albatross	Mig, Ma, VU	V	1		Unlikely
Thalassarche steadi	White-cappped Albatross	Ma, VU		1		Unlikely
Tringa nebularia	Common Greenshank	Mig, Ma		1, 2	2006	Unlikely (possible adjacent dams)
Tringa stagnalis	Marsh Sandpiper	Mig, Ma		1, 2	2006	Unlikely

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare.

Source of Information

1. **EPBC Act Protected Matters Report (DotEE 2017) – 50 km buffer applied to Project area.**
2. **Biological Database of South Australia data extract (DEWNR 2017b) - 50 km buffer applied to Project area.**

5.2 Matters of State Environmental Significance

5.2.1 Threatened flora species

A total of 73 species listed under the NPW Act have been recorded within a 50 km buffer of the Project area (Table 8). Fourteen (14) out of the 73 species were mapped within 20km of the Project area (Figure 4). One species listed as vulnerable under the NPW Act, *Santalum spicatum* (Sandalwood) was recorded during the field survey within the Main Access Road and the Upper Reservoir Access Road corridor. A further 16 species may possibly occur within the Project area.

Table 8. Threatened flora species potentially occurring within the Project area.

Scientific name	Common name	Conservation status		Last sighting (year)	Likelihood of occurrence within Project area
		Aus	SA		
Acacia gracilifolia	Graceful Wattle		R	1992	Unlikely
Acacia iteaphylla	Flinders Ranges Wattle		R	1975	Unlikely
Acacia quornensis	Quorn Wattle		R	2006	Unlikely
Anogramma leptophylla	Annual Fern		R	1999	Unlikely
Asperula syrticola	Southern Flinders Woodruff		R	1999	Unlikely
Austrostipa breviglumis	Cane Spear-grass		R	1999	Unlikely
Austrostipa echinata	Spiny Spear-grass		R	1990	Possible
Austrostipa gibbosa	Swollen Spear-grass		R	1992	Unlikely
Austrostipa petraea	Flinders Range Spear-grass		R	2005	Unlikely
Austrostipa pilata	Prickly Spear-grass		V	1996	Possible
Austrostipa tenuifolia			R	1994	Unlikely
Brachyscome ciliaris var. subintegrifolia			R	2005	Unlikely
Brachyscome muelleri	Corunna Daisy	EN	E	2005	Unlikely
Calandrinia sphaerophylla	Bead Purslane		R	1990	Possible
Calotis lappulacea	Yellow Burr-daisy		R	1999	Possible
Centrolepis cephaloformis ssp. cephaloformis	Cushion Centrolepis		R	1974	Possible
Ceratogyne obionoides	Wingwort		R	1990	Possible
Citrus glauca	Desert Lime		V	1993	Unlikely
Crassula exserta	Large-fruit Crassula		R	1974	Possible
Cryptandra campanulata	Long-flower Cryptandra		R	1999	Unlikely
Daviesia pectinata	Zig-zag Bitter-pea		R	1941	Unlikely
Deyeuxia densa	Heath Bent-grass		R	1994	Unlikely
Dianella longifolia var. grandis	Pale Flax-lily		R	1999	Unlikely
Drosera stricticaulis	Erect Sundew		V	1999	Unlikely
Echinopogon ovatus	Rough-beard Grass		R	1994	Unlikely
Elachanthus glaber	Shiny Elachanth		R	1995	Unlikely
Elatine gratioloides	Waterwort		R	1999	Unlikely
Eryngium ovinum	Blue Devil		V	1994	Unlikely

Scientific name	Common name	Conservation status		Last sighting (year)	Likelihood of occurrence within Project area
		Aus	SA		
Eucalyptus albens	White Box		R	1986	Unlikely
Eucalyptus behriana	Broad-leaf Box		R	1941	Unlikely
Eucalyptus cajuputea	Green Mallee		R*	2000	Unlikely
Eucalyptus percostata	Ribbed White Mallee		R	2006	Unlikely
Eucalyptus polybractea	Flinders Ranges Box		R	1999	Unlikely
Eucalyptus viridis ssp. viridis (NC)	Green Mallee		R	2009	Unlikely
Festuca benthamiana	Bentham's Fescue		R	2000	Unlikely
Frankenia cupularis			R	1993	Possible
Gratwickia monochaeta			R	2007	Possible
Haeckeria cassiniiformis	Dogwood Haeckeria		R	2006	Unlikely
Hovea purpurea	Tall Hovea		R	2001	Unlikely
Lepidium pseudotasmanicum	Shade Peppercress		V	1994	Unlikely
Leptorhynchos elongatus	Lanky Buttons		R	1994	Unlikely
Leptorhynchos scaber	Annual Buttons		R	1992	Unlikely
Logania saxatilis	Rock Logania		R	1996	Unlikely
Maireana excavata	Bottle Fissure-plant		V	1996	Unlikely
Malacocera gracilis	Slender Soft-horns		V	2010	Possible
Myoporum parvifolium	Creeping Boobialla		R	2009	Unlikely
Olearia pannosa ssp. cardiophylla	Velvet Daisy-bush		R	1999	Unlikely
Olearia pannosa ssp. pannosa	Silver Daisy-bush	VU	V	1996	Unlikely
Olearia picridifolia	Rasp Daisy-bush		R	1992	Unlikely
Orobanche cernua var. australiana	Australian Broomrape		R	1975	Unlikely
Osteocarpum acropterum var. deminutum	Wingless Bonefruit		R	1920	Unlikely
Osteocarpum pentapterum	Five-wing Bonefruit		E	1974	Unlikely
Ozothamnus scaber	Rough Bush-everlasting		V	1999	Unlikely
Phyllangium sulcatum			V	1992	Unlikely
Poa drummondiana	Knotted Poa		R	2000	Unlikely
Podolepis jaceoides	Showy Copper-wire Daisy		R	1924	Unlikely
Prasophyllum pallidum	Pale Leek-orchid	VU	R	2009	Unlikely
Prasophyllum validum	Mount Remarkable Leek-orchid	VU	V	1994	Unlikely
Pycnosorus globosus	Drumsticks		V	2001	Possible
Rumex dumosus	Wiry Dock		R	1992	Possible
Rumex dumosus var. (NC)	Wiry Dock		R	1994	Possible

Scientific name	Common name	Conservation status		Last sighting (year)	Likelihood of occurrence within Project area
		Aus	SA		
Rytidosperma laeve	Smooth Wallaby-grass		R	1992	Unlikely
Rytidosperma tenuius	Short-awn Wallaby-grass		R	1993	Unlikely
Santalum spicatum	Sandalwood		V	2010	Known
Sarcozona bicarinata	Ridged Noon-flower		V	2008	Possible
Senecio megaglossus	Large-flower Groundsel	VU	E	2005	Possible
Tecticornia lepidosperma			R	1998	Unlikely
Thelymitra grandiflora	Great Sun-orchid		R	1999	Unlikely
Thysanotus tenellus	Grassy Fringe-lily		R	1995	Unlikely
Velleia cycnopotamica			R	1900	Unlikely
Veronica decorosa	Showy Speedwell		R	1999	Unlikely
Wurmbea stellata	Star Nancy		R	2008	Possible
Zostera muelleri ssp. mucronata	Garweed		R	1974	Unlikely

Conservation status

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. ssp.: the conservation status applies at the sub-species level. An asterisk denotes ratings that need to be qualified for a variety of reasons, such as changes to taxonomy or nomenclature since listing or because a species assessed as 'presumed extinct' had to be listed under the Endangered category. Further details are available from the Vascular Plant Metadata document on the DEWNR website.

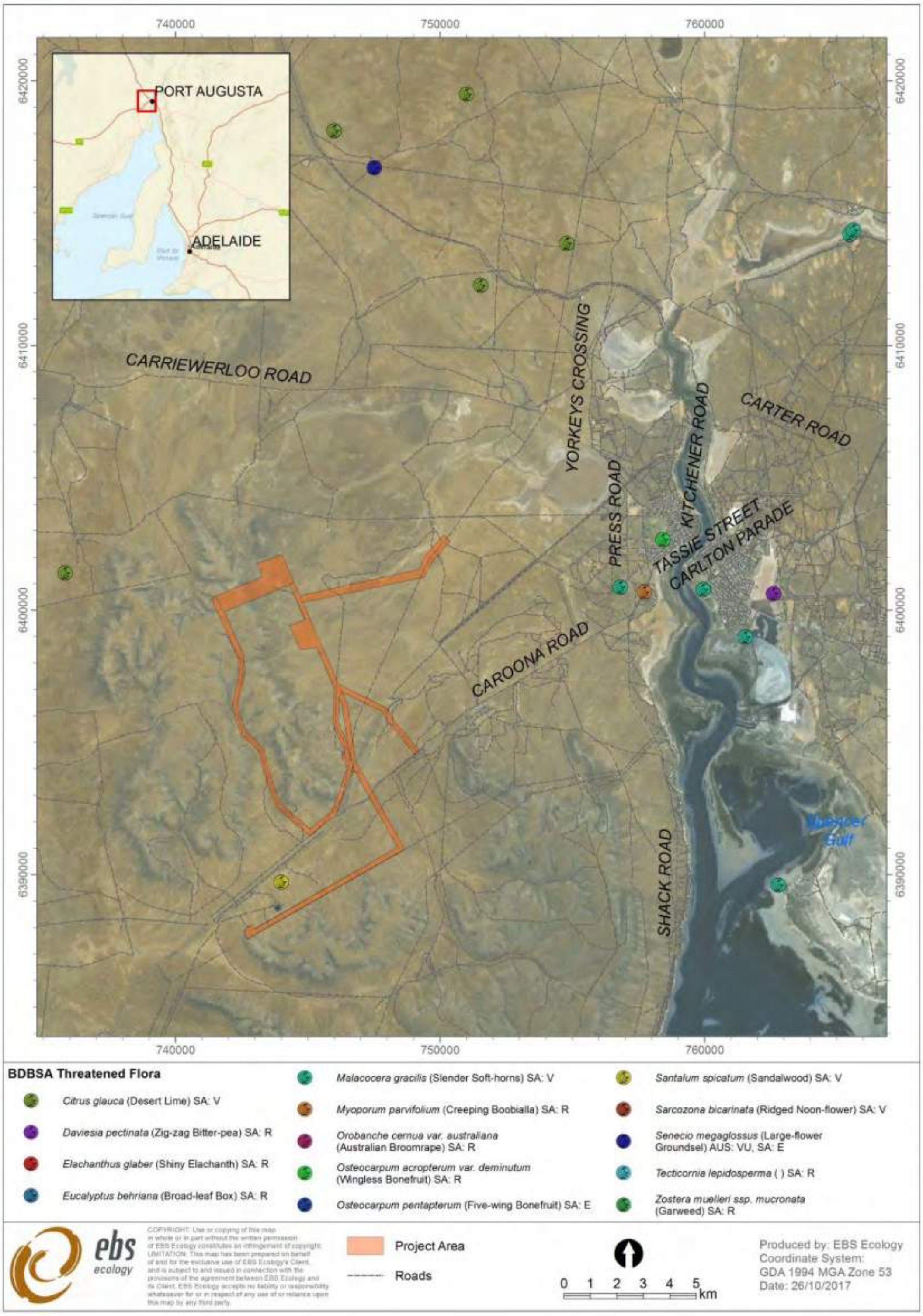


Figure 4. Threatened state flora species potentially occurring within the Project area (20 km buffer).

5.2.2 Threatened fauna species

A total of 50 species listed under the NPW Act have been recorded within a 50 km buffer of the Project area (Table 9). Thirty-four (34) out of the 50 species were mapped within 20km of the Project area (Figure 5). One species listed under the NPW Act, the Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*) was observed during the field survey. A further eight species may possibly occur within the Project area, while three species may occur at dams adjacent to the Project area.

Table 9. Threatened fauna species potentially occurring within the Project area (DEWNR 2017b).

Scientific name	Common name	Conservation status		Last sighting (year)	Likelihood of occurrence within Project area
		Aus	SA		
Acanthiza iredalei iredalei	Slender-billed Thornbill (western)		R	2006	Known
Actitis hypoleucos	Common Sandpiper		R	2004	Unlikely (possible at adjacent dams)
Ardea ibis	Cattle Egret		R	1994	Unlikely
Ardeotis australis	Australian Bustard		V	2006	Possible
Arenaria interpres	Ruddy Turnstone		R	1998	Unlikely
Balaenoptera edeni	Bryde's Whale		R	1989	Impossible
Bettongia lesueur	Burrowing Bettong	EX	E	1900	Impossible
Biziura lobata	Musk Duck		R	2006	Unlikely (possible at adjacent dams)
Calamanthus (Hylacola) pyrrhopygius	Chestnut-rumped Heathwren		V	1997	Unlikely
Calidris tenuirostris	Great Knot	CR	R	1983	Unlikely
Caretta caretta	Loggerhead Turtle	EN	E	1992	Impossible
Charadrius leschenaultii	Greater Sand Plover	VU	R	1984	Unlikely
Cinclosoma castanotum	Chestnut-backed Quail-thrush (Chestnut Quail-thrush)		R	2006	Unlikely
Cladorhynchus leucocephalus	Banded Stilt		V	2006	Unlikely
Climacteris affinis	White-browed Treecreeper		R	1965	Unlikely
Dasyurus viverrinus	Eastern Quoll	EN	E	1909	Unlikely
Egretta garzetta	Little Egret		R	2005	Unlikely
Emblema pictum	Painted Finch		R	1994	Unlikely
Falco hypoleucos	Grey Falcon		R	2006	Possible
Falco peregrinus	Peregrine Falcon		R	2005	Possible
Falcunculus frontatus	Eastern Shrike-tit		R	1999	Unlikely
Haematopus fuliginosus	Sooty Oystercatcher		R	2006	Unlikely
Haematopus longirostris	(Australian) Pied Oystercatcher		R	2004	Unlikely
Haliaeetus leucogaster	White-bellied Sea Eagle		E	1900	Unlikely
Hamirostra melanosternon	Black-breasted Buzzard		R	1991	Possible
Larus dominicanus	Kelp Gull		R	1982	Unlikely
Limosa lapponica	Bar-tailed Godwit	VU	R	1985	Unlikely
Limosa limosa	Black-tailed Godwit		R	1984	Unlikely

Scientific name	Common name	Conservation status		Last sighting (year)	Likelihood of occurrence within Project area
		Aus	SA		
Lophochroa leadbeateri	Major Mitchell's Cockatoo		R	2013	Possible
Macronectes giganteus	Southern Giant Petrel	EN	V	2000	Unlikely
Morelia spilota	Carpet Python		R	1988	Unlikely
Myiagra inquieta	Restless Flycatcher		R	2002	Unlikely
Neophema chrysogaster	Orange-bellied Parrot	CR	E	1992	Unlikely
Neophema chrysostoma	Blue-winged Parrot		V	2006	Possible
Neophema elegans	Elegant Parrot		R	2008	Possible
Neophema petrophila	Rock Parrot		R	1998	Unlikely
Neophema splendida	Scarlet-chested Parrot		R	1996	Possible
Ninox connivens	Barking Owl		R	1933	Unlikely
Numenius madagascariensis	Far Eastern Curlew	CR	V	2004	Unlikely
Oxyura australis	Blue-billed Duck		R	2001	Unlikely
Pachycephala inornata	Gilbert's Whistler		R	2001	Unlikely
Petroica boodang boodang	Scarlet Robin		R	2000	Unlikely
Phaps histrionica	Flock Bronzewing		R	2013	Unlikely
Podiceps cristatus	Great Crested Grebe		R	2002	Unlikely
Stagonopleura guttata	Diamond Firetail		V	2005	Unlikely
Sternula nereis	Fairy Tern	VU	E	2002	Unlikely
Stictonetta naevosa	Freckled Duck		V	2001	Unlikely (possible at adjacent dams)
Trichosurus vulpecula	Common Brushtail Possum		R	1973	Unlikely
Turnix varius	Painted Buttonquail		R	1999	Unlikely
Varanus varius	Lace Monitor		R	2017	Unlikely

Conservation status

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare.

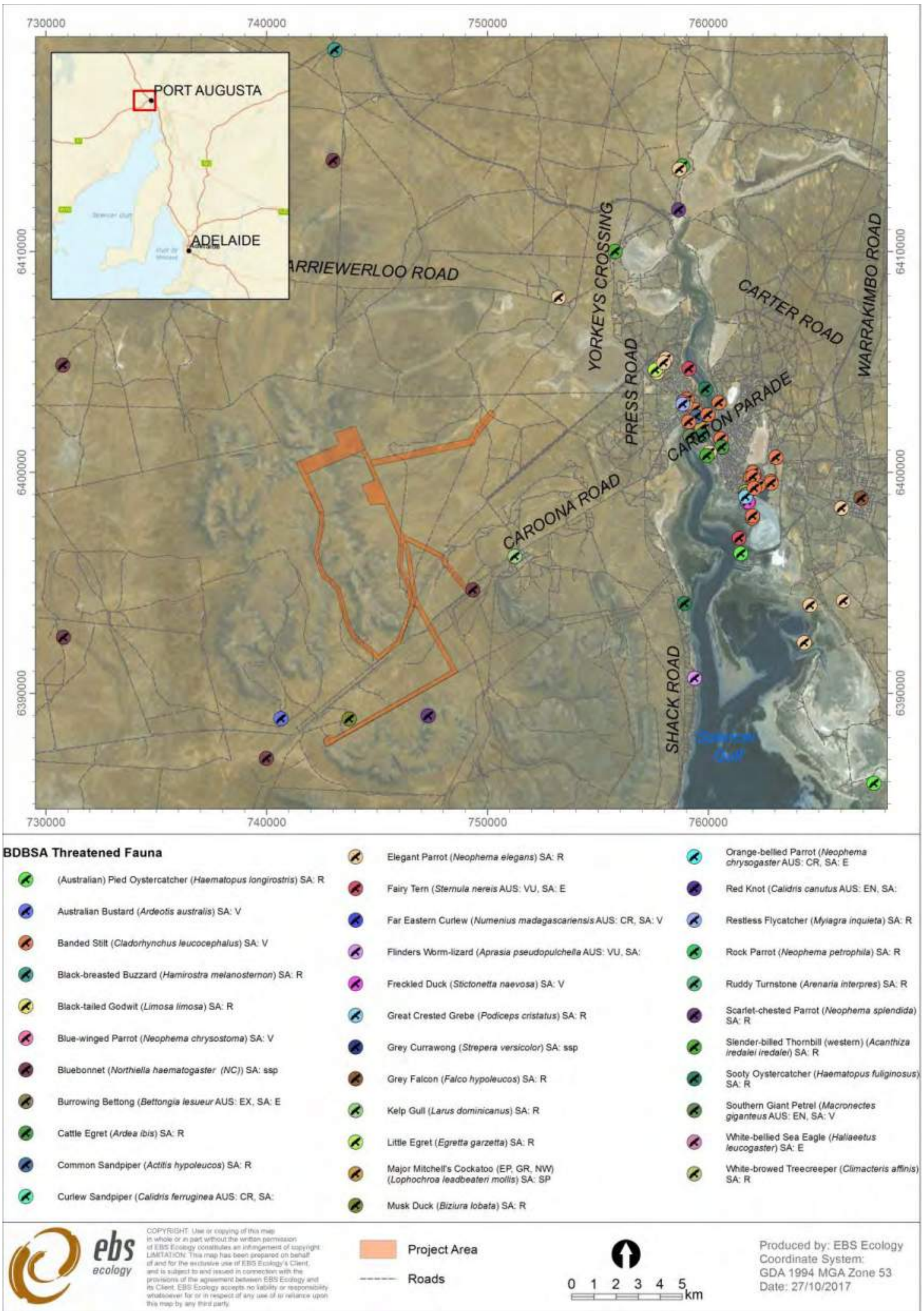


Figure 5. Threatened state fauna species potentially occurring within the Project area (20 km buffer).

5.3 Field survey

5.3.1 Vegetation

There were 12 broad vegetation associations and three major landform types recorded within the Project area (Figure 6 and Table 10). The landform types were:

- Plateau,
- escarpment and
- lower plains.

Each of the 12 vegetation associations are discussed further below and represented within Figure 10 to Figure 29).

One hundred and nine (109) flora species were recorded, which included 92 native species and 17 weed species (Appendix 1).

One species listed as vulnerable under the NPW Act, *Santalum spicatum* (Sandalwood) was recorded during the field survey within the Lower Reservoir Area and the Main Access Road corridor (Figure 7). Eighteen (18) *S. spicatum* trees were recorded, all occurring in drainage lines and hillslopes (Figure 8 and Figure 9).

No flora species or ecological communities with a conservation rating under the EPBC Act were recorded.

Three of the weed species recorded are listed as declared under the NRM Act, these were *Lycium ferocissimum* (African Boxthorn), *Marrubium vulgare* (Horehound) and *Xanthium spinosum* (Bathurst Burr).

Table 10. Vegetation association areas.

Vegetation association description	Area (ha)	% of the Project area
Acacia papyrocarpa Low Open Woodland	18	1.4
Atriplex vesicaria Low Shrubland	487	38.5
Atriplex vesicaria, *Maireana sedifolia* Low Shrubland	73	5.8
Casuarina pauper Low Open Woodland	84	6.6
Casuarina pauper Low Open Woodland +/- *Acacia papyrocarpa*	9	0.7
Casuarina pauper Low Open Woodland +/- *Acacia papyrocarpa +/- Callitris glaucophylla*	28	2.2
Maireana pyramidata Low Shrubland	86	6.8
Maireana pyramidata, *Atriplex vesicaria* Low Shrubland	429	33.9
Maireana sedifolia Low Shrubland	19	1.5
Melaleuca lanceolata Tall Very Open Shrubland over *Triodia irritans +/- Eucalyptus socialis ssp. socialis*, *E. gracilis*	6	0.5
Mixed Tall Very Open Shrubland (*Acacia victoriae ssp., Alectryon oleifolius ssp. canescens*, *Eremophila sp.*, *Exocarpos aphyllus*, *Senna sp.*)	26	2.1

Vegetation association description	Area (ha)	% of the Project area
Triodia irritans Hummock Grassland	1	0.1
Total	**1266***	

***note – The PSH permanent infrastructure and permanent ancillary infrastructure is anticipated to cover approximately 135 ha. An estimated 90 ha will be needed for temporary construction works.**

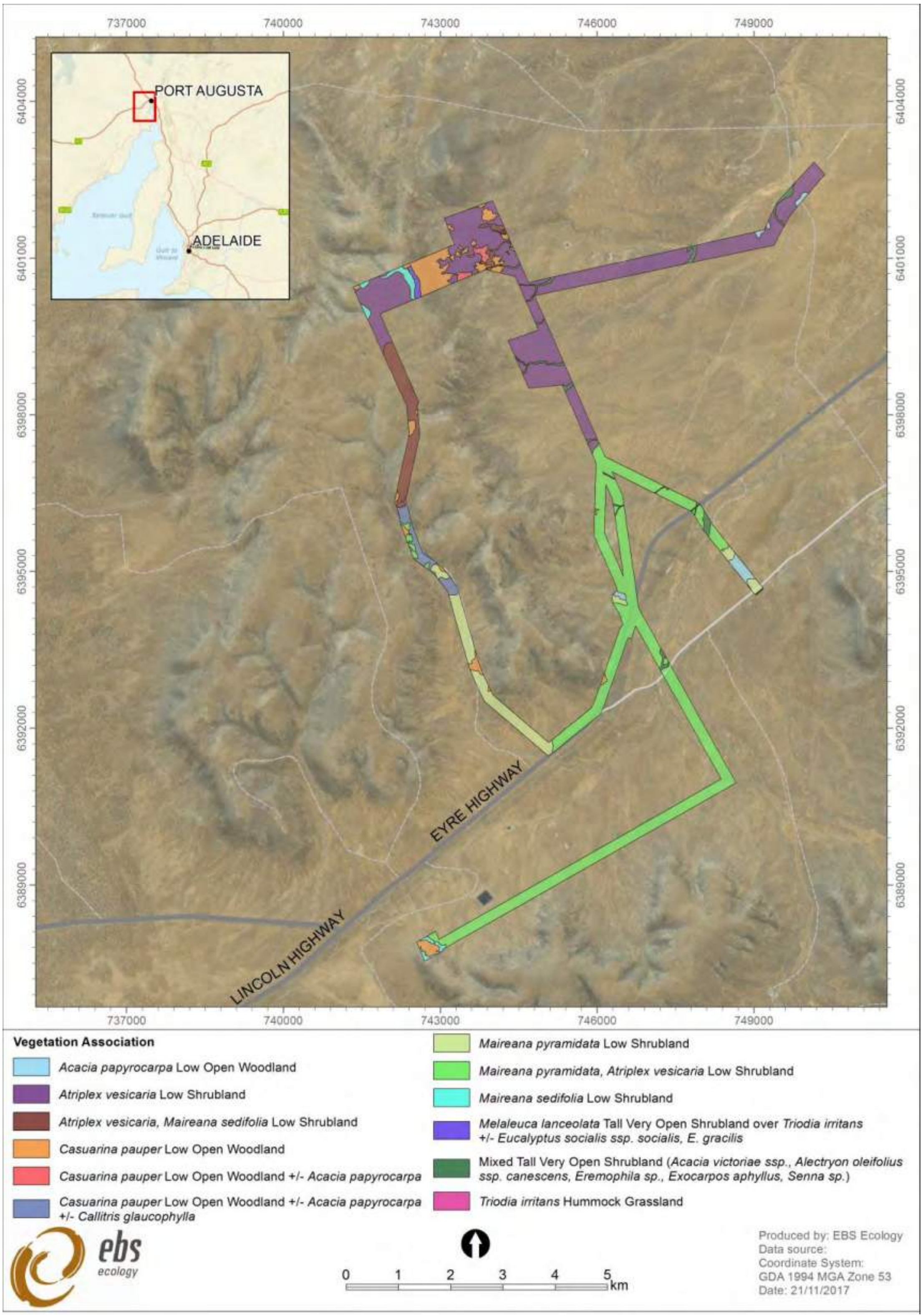


Figure 6. Vegetation associations mapped across the Project area.

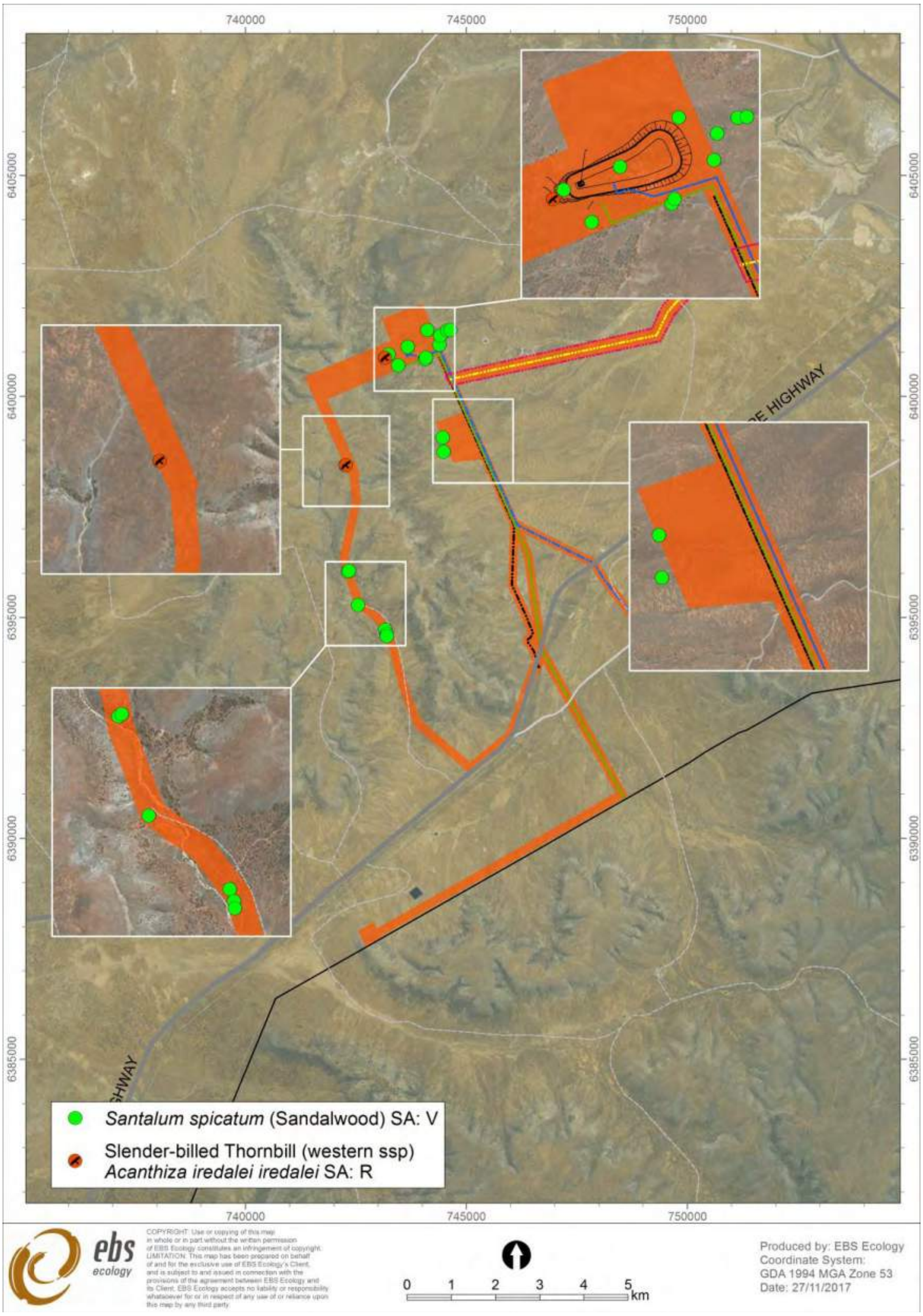


Figure 7. Threatened species, Sandalwood and the Slender-billed Thornbill, recorded in the Project area.

Figure 8. *Santalum spicatum* tree.

Figure 9. *Santalum spicatum* fruit.

Acacia papyrocarpa **Low Open Woodland**

This vegetation association occurs in five sections of the Project area, none of which were surveyed in detail. The *Acacia papyrocarpa* Low Open Woodland occurs on sand plains and low dunes. The understorey is dominated by either *Maireana pyramidata* (Black Bluebush) or *Maireana sedifolia* (Bluebush) dependent of soil type.

The areas highlighted as containing this vegetation association should be assessed during an additional survey to confirm boundaries, collect a flora species list and assess suitability for conservation rated species.

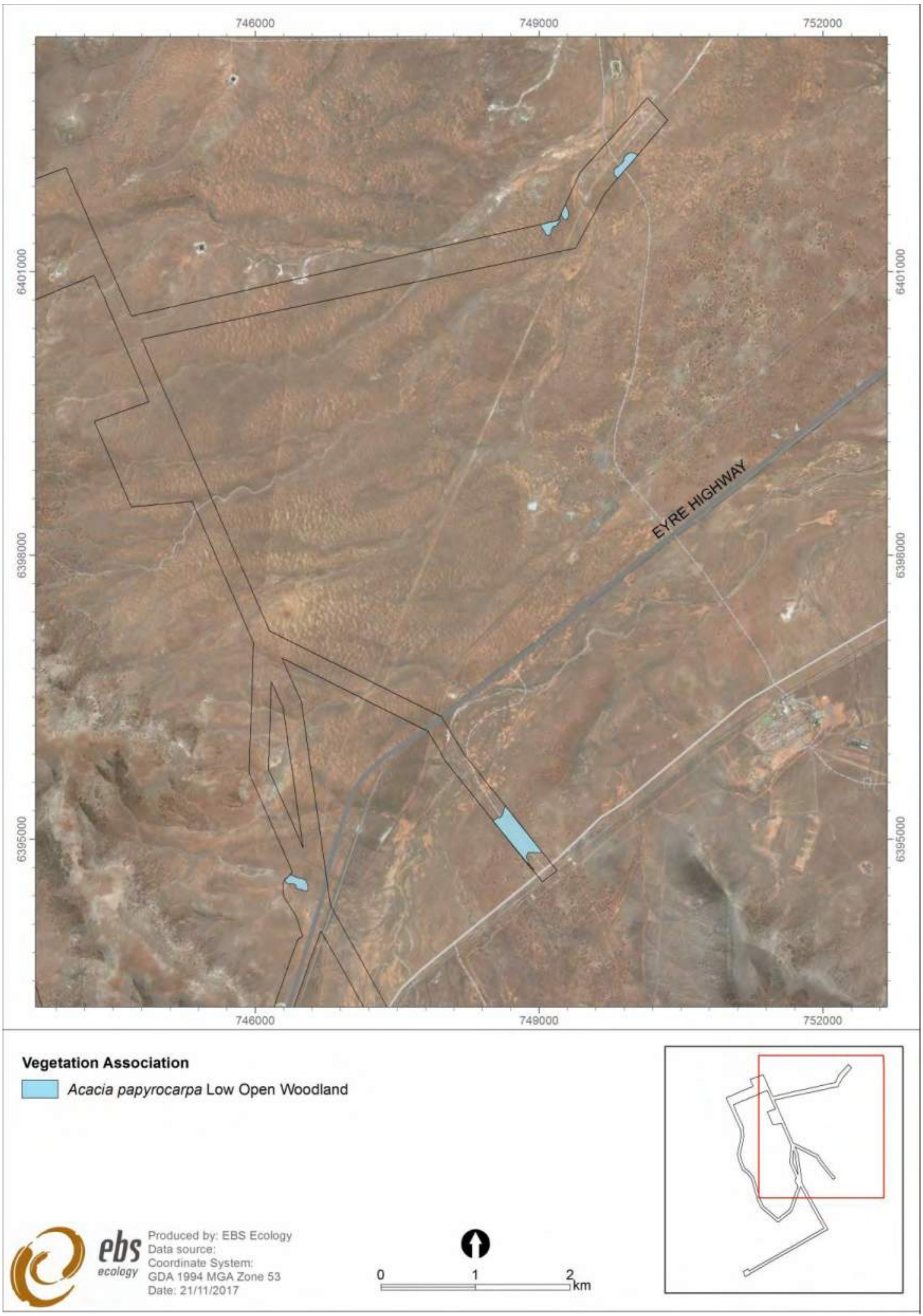


Figure 10. *Acacia papyrocarpa* Low Open Woodland within the Project area.

Atriplex vesicaria Low Shrubland

This vegetation association occurs on the central plateau, foot-slopes and lower plains (Figure 11 and Figure 12). The location of the Upper Reservoir is dominated by this vegetation association. Codominant shrubs varied within this vegetation association dependant on land form and soil types. Common codominant species include *Sclerolaena divaricata* (Tangled Bindyi), *Tecticornia sp.* (Samphire) and *Maireana pyramidata* (Black Bluebush).

Small herbs recorded within the Project area included *Atriplex spongiosa* (Pop Saltbush), *Rhodanthe corymbiflora* (Paper Everlasting) *Solanum ellipticum* (Velvet Potato-bush), *Pimelea simplex ssp.* (Desert Riceflower), and *Minuria cunninghamii* (Bush Minuria).

Much of the ground cover is dominated by the weed species *Carrichtera annua* (Ward's Weed) and *Medicago minima var. minima* (Little Medic). Other weed species include *Sisymbrium erysimoides* (Smooth Mustard), *Bromus rubens* (Red Brome), *Carthamus lanatus* (Saffron Thistle), *Hordeum vulgare* (Barley), *Rostraria pumila* (Tiny Bristle-grass) and *Medicago polymorpha var. polymorpha* (Burr-medic).

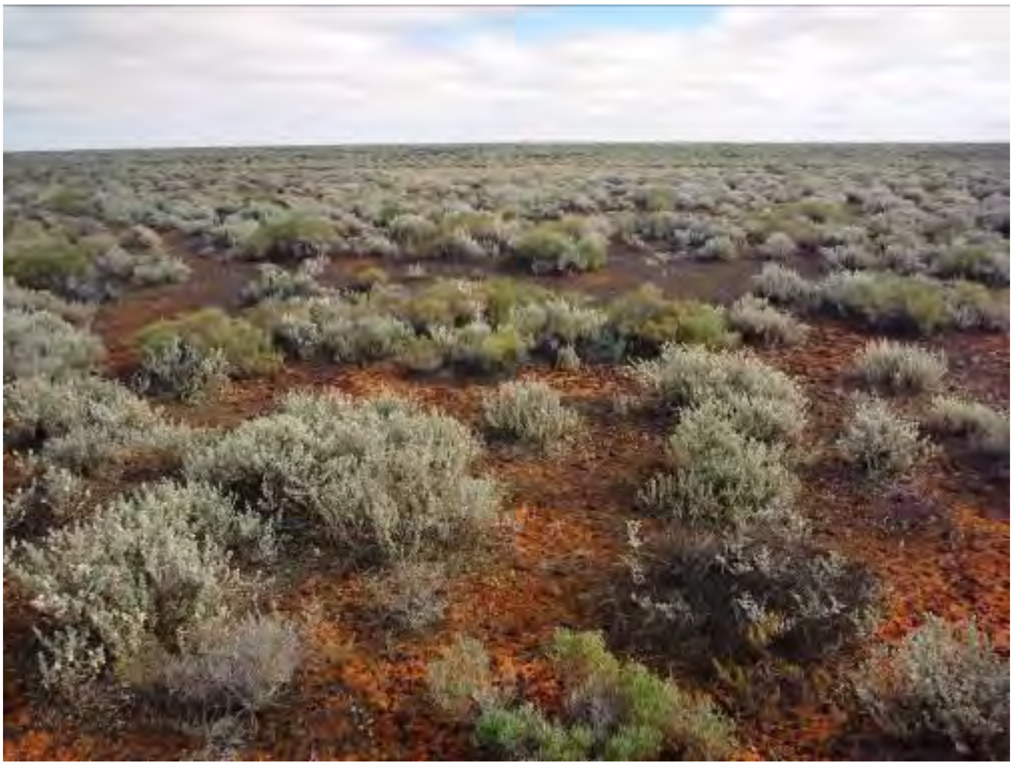


Figure 11. _Atriplex vesicaria_ Low Shrubland on the central plateau. Upper Reservoir Area.

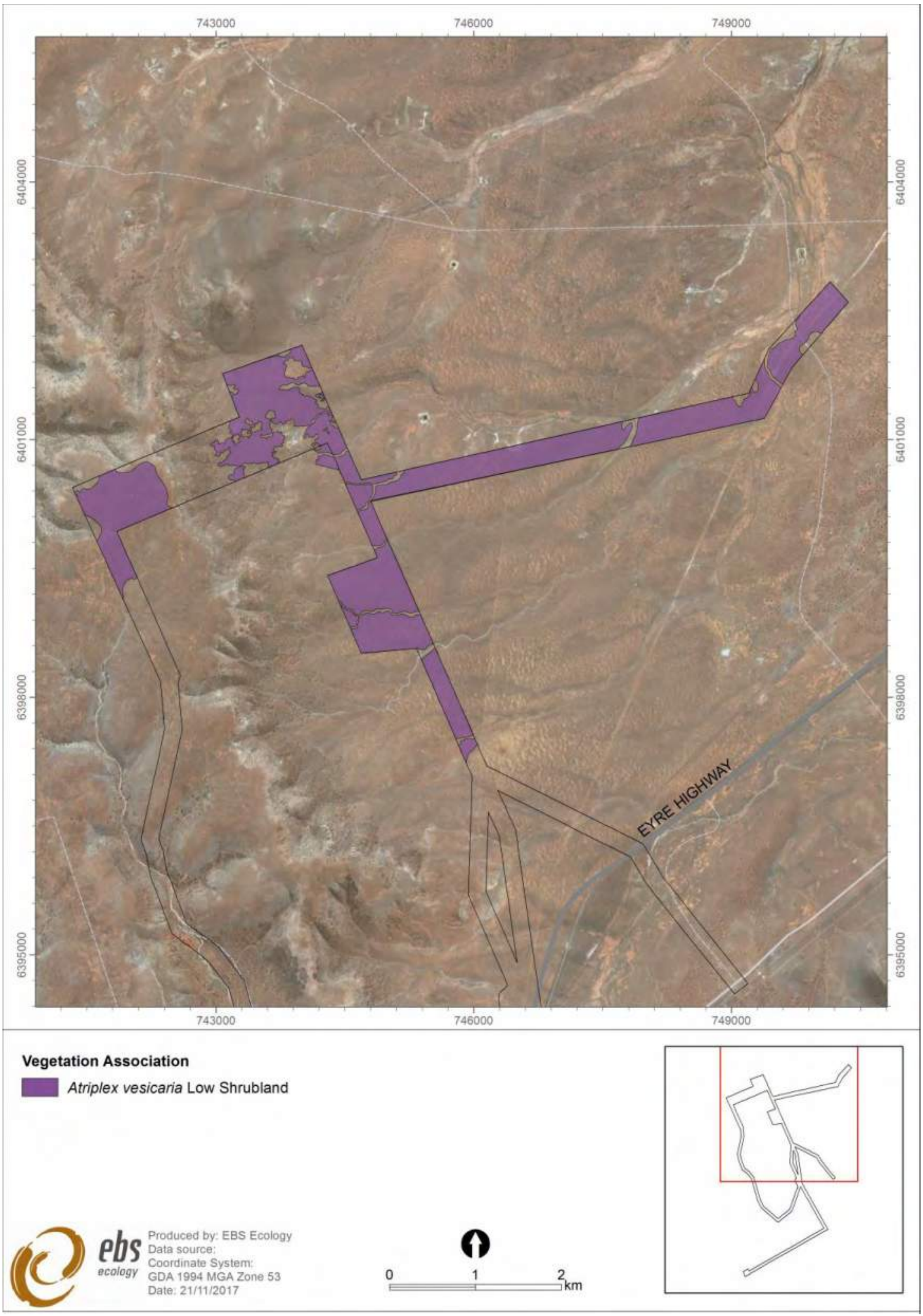


Figure 12. *Atriplex vesicaria* Low Shrubland within the Project area.

***Atriplex vesicaria, Maireana sedifolia* Low Shrubland**

The *Atriplex vesicaria*, *Maireana sedifolia* Low Shrubland occurs on Low hills and the edge of plateaus within the Project area (Figure 13 and Figure 14). This vegetation association contains a similar suite of species as the *Atriplex vesicaria* Low Shrubland but occurs in very shallow soils.

Much of the ground cover is dominated by the weed species *Carrichtera annua* (Ward's Weed) and *Medicago minima var. minima* (Little Medic).

Figure 13. *Atriplex vesicaria* and *Maireana sedifolia* Low Shrubland, located on the low hills of the Lower Reservoir Area.

Figure 14. ***Atriplex vesicaria*****,** ***Maireana sedifolia*** **Low Shrubland within the Project area.**

***Casuarina pauper* Low Open Woodland**

The *Casuarina pauper* Low Open Woodland dominates the escarpments, low hills, gullies and drainage lines within Project area (Figure 15 and Figure 16). The understorey layer of this vegetation association varies with landform and soil type. Common understorey layers were:

- *Atriplex vesicaria* (Bladder Saltbush) and *Tecticornia sp.* (Samphire);
- *Atriplex vesicaria* and *Maireana sedifolia* (Bluebush);
- *Maireana sedifolia*, *Atriplex vesicaria* and *Rhagodia ulicina* (Intricate Saltbush); and
- *Maireana sedifolia*, *Rhagodia ulicina* and *Triodia irritans* (Spinifex).

Groundcover species observed within this association included *Maireana trichoptera* (Hairy-fruit Bluebush), *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) and *Ptilotus obovatus* (Silvertails); weed species included *Carrichtera annua* (Ward's Weed) and *Medicago minima var. minima* (Little Medic).

Figure 15. *Casuarina pauper* Low Open Woodland located on the escarpment between the Upper and Lower Reservoirs.

Figure 16. ***Casuarina pauper*** **Low Open Woodland within the Project area.**

Casuarina pauper **Low Open Woodland +/-** ***Acacia papyrocarpa***

This vegetation association occurred on rocky gullies and drainage lines within the Lower Reservoir area (Figure 17 and Figure 18). *Acacia papyrocarpa* (Western Myall) have a scattered and sparse occurrence. The understorey is generally sparse with large areas containing a layer of creek rock. Tall to medium shrubs included *Alectryon oleifolius ssp. canescens* (Bullock Bush), *Senna artemisioides ssp. artemisioides x ssp. coriacea* (Desert Senna), *Eremophila longifolia* (Weeping Emubush), *Myoporum platycarpum ssp.* (False Sandalwood) and *Exocarpos aphyllus* (Leafless Cherry). The NPW Act listed *Santalum spicatum* (Sandalwood) was recorded within this vegetation association.

Smaller shrubs included *Atriplex vesicaria* (Bladder Saltbush), *Maireana pyramidata* (Black Bluebush) *Maireana sedifolia* (Bluebush), *Ptilotus obovatus* (Silvertails), (Rhagodia spinescens) and *Solanum petrophilum* (Rock Nightshade).

The weed species, *Carrichtera annua* (Ward's Weed) and *Medicago minima var. minima* (Little Medic) occurred in varying densities. Small sections of the drainage lines contained high levels of weed invasion including *Carthamus lanatus* (Saffron Thistle), *Sisymbrium erysimoides* (Smooth Mustard), *Hordeum vulga*re (Barley) and *Marrubium vulgare* (Horehound).

Figure 17. ***Casuarina pauper*** **Low Open Woodland +/-** ***Acacia papyrocarpa*** **on minor drainage lines of the Lower Reservoir Area.**

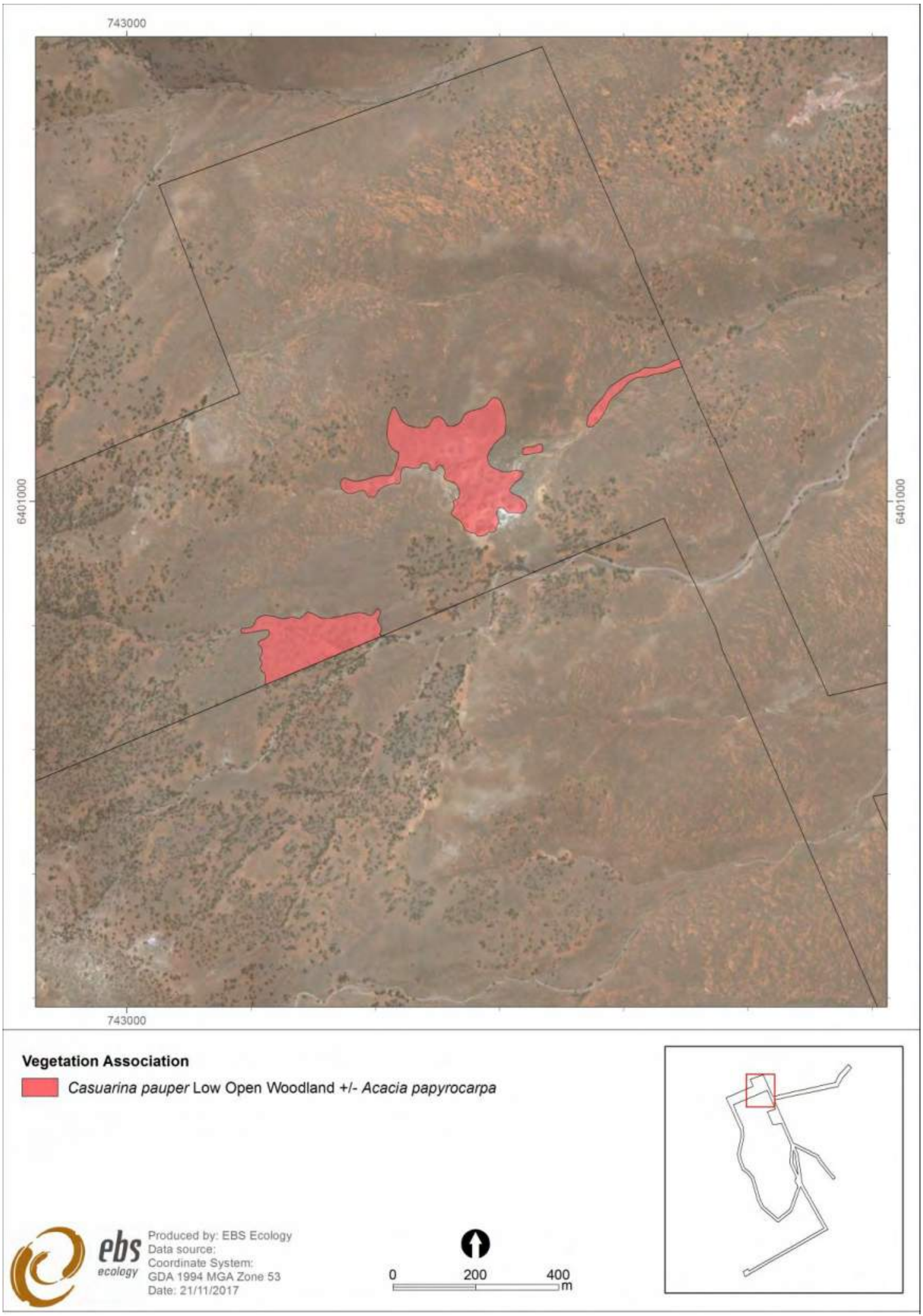


Figure 18. ***Casuarina pauper*** **Low Open Woodland +/-** ***Acacia papyrocarpa*** **within the Project area.**

Casuarina pauper* Low Open Woodland +/- *Acacia papyrocarpa* +/- *Callitris glaucophylla

This vegetation association is restricted to the escarpment, gullies and drainage lines which occur within the Upper Reservoir Access Road corridor (Figure 19). This vegetation was not surveyed in detail. *Acacia papyrocarpa* and *Callitris glaucophylla* have a scattered and sparse occurrence within the vegetation association.

The area highlighted as containing this vegetation association should be assessed during an additional survey to confirm boundaries, collect a flora species list and assess suitability for conservation rated species.

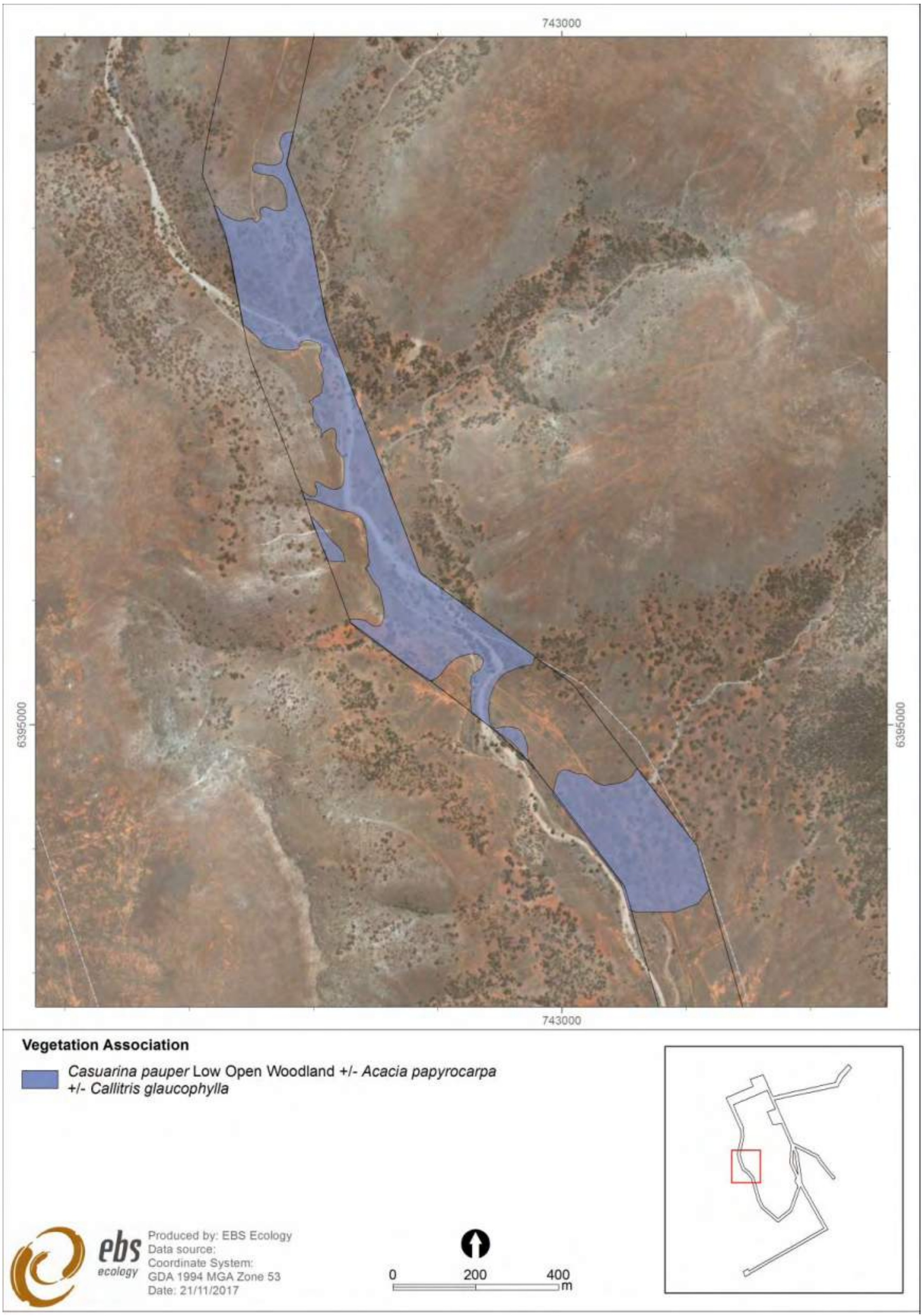


Figure 19. ***Casuarina pauper*** **Low Open Woodland +/-** ***Acacia papyrocarpa*** **+/-** ***Callitris glaucophylla*** **within the Project area.**

Maireana pyramidata Low Shrubland

The *Maireana pyramidata* Low Shrubland occurs on the foot-slopes and lower plains (Figure 20). This vegetation was not surveyed in detail. The areas highlighted as containing this vegetation association should be assessed during an additional survey to confirm boundaries, collect a flora species list and assess suitability for conservation rated species.

Figure 20. *Maireana pyramidata* Low Shrubland within the Project area.

Maireana pyramidata, Atriplex vesicaria **Low Shrubland**

This vegetation association occurs on the foot-slopes and lower plains (Figure 21). This vegetation was not surveyed in detail. The areas highlighted as containing this vegetation association should be assessed during an additional survey to confirm boundaries, collect a flora species list and assess suitability for conservation rated species.

Figure 21. *Maireana pyramidata*, Atriplex vesicaria Low Shrubland within the Project area.

***Maireana sedifolia* Low Shrubland**

The *Maireana sedifolia* Low Shrubland occurs on low hills and edges of the plateau in shallow soils (Figure 22 and Figure 23). These areas generally contained a low diversity of species. Common species included *Ptilotus obovatus* (Silvertails), *Atriplex vesicaria* (Bladder Saltbush), *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) *Rhodanthe corymbiflora* (Paper Everlasting), *Lawrencia squamata* (Thorny Lawrencia) and *Lycium australe* (Australian Boxthorn).

The weed species, *Carrichtera annua* (Ward's Weed) and *Medicago minima var. minima* (Little Medic) occurred in varying densities.

Figure 22. *Maireana sedifolia* Low Shrubland on the edge of the plateau. Upper Reservoir area.

Figure 23. ***Maireana sedifolia*** **Low Shrubland within the Project area.**

Melaleuca lanceolata Tall Very Open Shrubland over *Triodia irritans +/- Eucalyptus socialis ssp. socialis, E. gracilis*

This vegetation association occurs in a transitional zone on the upper edge of the escarpment (Figure 24 and Figure 25). *Triodia irritans* (Spinifex) along with sparsely located *Maireana sedifolia* (Bluebush) dominate the ground cover. All *Eucalyptus gracilis* (Yorrell) and *Eucalyptus socialis ssp. socialis* (Beaked Red Mallee) inspected within the vegetation association contained multiple hollows.

Weeds species were confined to the open areas under the *Eucalyptus* sp. and include *Carrichtera annua* (Ward's Weed), *Sisymbrium erysimoides* (Smooth Mustard) and *Hordeum vulga*re (Barley). Very few open areas between the *Triodia irritans* hummocks contained *Carrichtera annua*.

Figure 24. *Melaleuca lanceolata* Tall Very Open Shrubland over *Triodia irritans* +/- *Eucalyptus socialis ssp*. *socialis*, *E. gracilis* on the upper edge of the escarpment near the Upper Reservoir area.

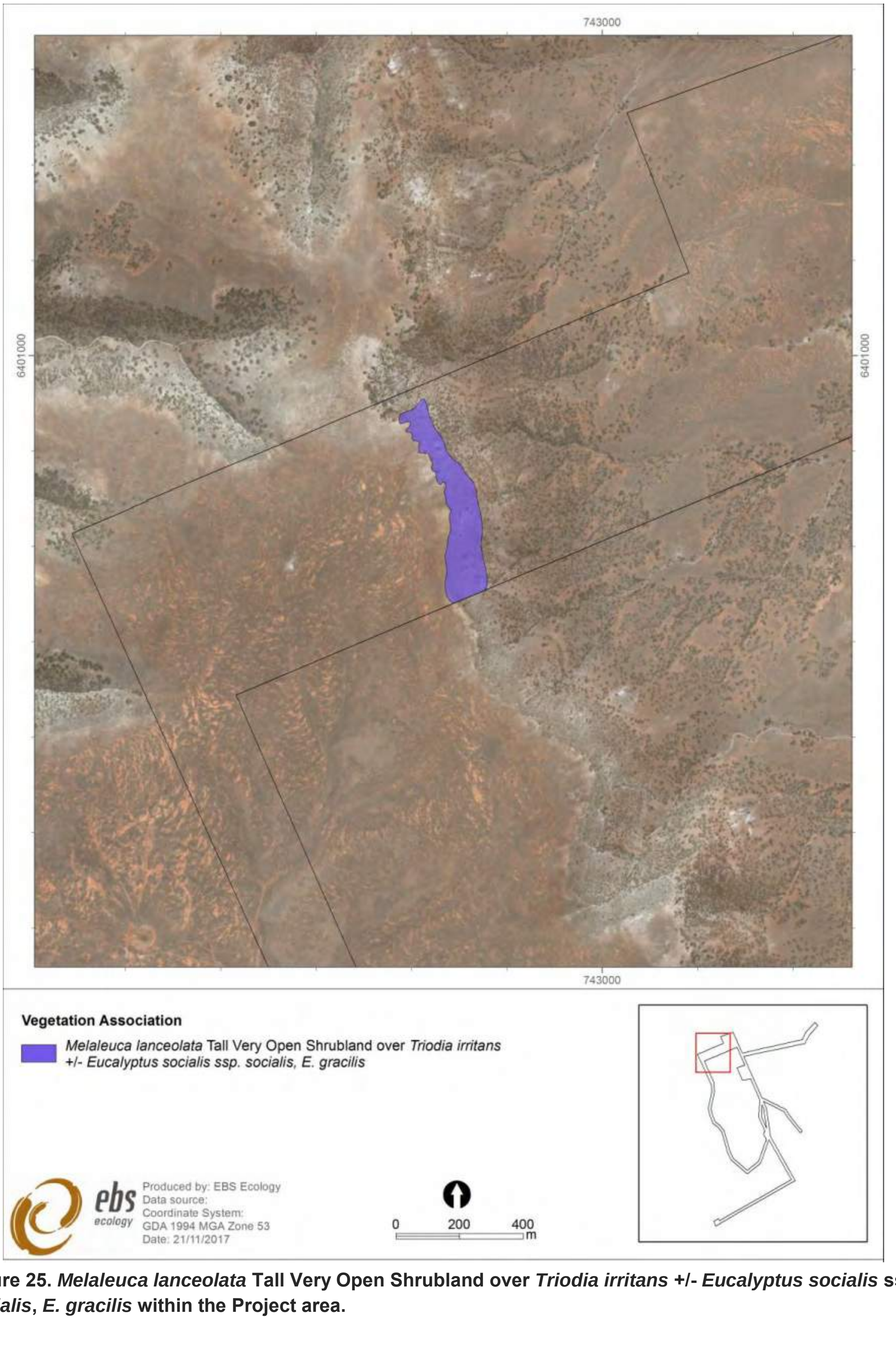


Figure 25. ***Melaleuca lanceolata*** **Tall Very Open Shrubland over** ***Triodia irritans*** **+/-** ***Eucalyptus socialis*** **ssp.** ***socialis*****,** ***E. gracilis*** **within the Project area.**

Mixed Tall* Very Open Shrubland *(Acacia victoriae ssp., Alectryon oleifolius ssp. canescens, Eremophila sp., Exocarpos aphyllus, and Senna sp.)

This vegetation association is restricted to minor drainage lines predominantly located on the lower plains within the Project area (Figure 26 and Figure 27). The minor drainage lines are widespread throughout the Project area, usually aligned in a south-west to north-east direction. The minor drainage lines contained the greatest diversity of flora within the Project area but also contained the most weed species.

The large shrub and small tree species varied throughout each drainage line but usually include *Acacia victoriae ssp*. (Elegant Wattle), *Alectryon oleifolius ssp. canescens* (Bullock Bush), *Exocarpos aphyllus* (Leafless Cherry), *Pittosporum angustifolium* (Native Apricot), *Eremophila longifolia* (Weeping Emubush), and *Eremophila alternifolia* (Narrow-leaf Emubush).

The NPW Act listed *Santalum spicatum* (Sandalwood) was recorded within this vegetation association.

Small sections of the drainage lines contained high levels of weed invasion including the declared species, *Xanthium spinosum* (Bathurst Burr) and *Marrubium vulgare* (Horehound).

Figure 26. Mixed Tall Very Open Shrubland on minor drainage lines of the plain.

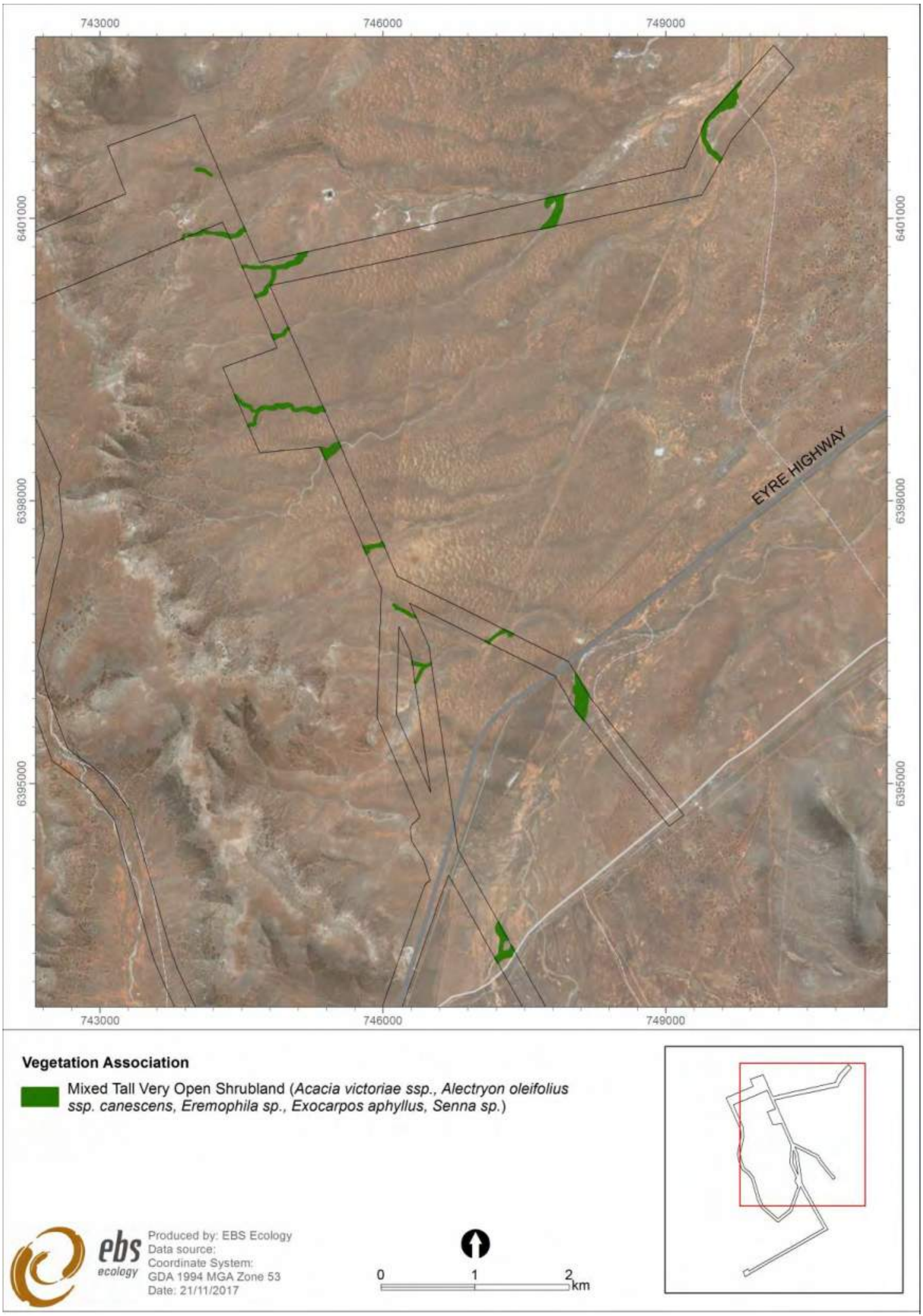


Figure 27. Mixed Tall Very Open Shrubland (*Acacia victoriae* ssp., *Alectryon oleifolius* ssp. *canescens*, *Eremophila* sp., *Exocarpos aphyllus*, and *Senna* sp.) within the Project area.

***Triodia irritans* Hummock Grassland**

The *Triodia irritans* Hummock Grassland is restricted to the upper edge of the escarpments within the Project area (Figure 28 and Figure 29). This vegetation association contained a similar suite of shrub and herb species to the *Melaleuca lanceolata* Tall Very Open Shrubland but lacked larger shrub and tree species.

Common shrubs include *Ptilotus obovatus* (Silvertails), Maireana sedifolia (Bluebush), *Rhagodia ulicina* (Intricate Saltbush), *Sclerolaena diacantha* (Grey Bindyi), *Olearia muelleri* (Mueller's Daisy-bush), *Scaevola spinescens* (Spiny Fanflower), *Westringia rigida* (Stiff Westringia) and *Sida petrophila* (Rock Sida).

Weeds species recorded were *Carrichtera annua* (Ward's Weed) and *Sisymbrium erysimoides* (Smooth Mustard). These were very sparsely located in small open areas between the *T. irritans* hummocks.

Figure 28. *Triodia irritans* Hummock Grassland on the upper edge of the escarpment near the Upper Reservoir area.

Figure 29. *Triodia irritans* Hummock Grassland within the Project area.

5.3.2 Fauna

Birds

A total of 378 birds from 44 species were recorded during point count surveys and opportunistically within the Project area (Appendix 2 and Appendix 3). The families of birds with the greatest representation were Acanthizidae (Australian Warblers) (six species), Meliphagidae (Honeyeaters) (four species), Artamidae (currawong, butcherbirds, magpies, woodswallows) (four species). Five of the species recorded were waterbirds, and therefore restricted to the dams adjacent to the Project area. One species of conservation significance was recorded: the (Western) Slender-billed Thornbill (*Acanthiza iredalei iredalei*). No introduced bird species were recorded during the field survey.

Point Count

The 11 point count sites recorded 29 bird species (Appendix 3). Overall, the most abundant species were the White-browed Babbler (*Pomatostomus superciliosus*) (22 individuals), Yellow-throated Miner (*Manorina flavigula*) (12 individuals), Southern Whiteface (*Aphelocephala leucopsis*) (10 individuals). The species recorded varied between habitat types. For example, Rufous Fieldwren (*Calamanthus campestris*) and White-winged Fairy-wren (*Malurus leucopterus*) were associated with chenopod plains, while the Chestnut-rumped Thornbill (*Acanthiza uropygialis*) and White-browed Babbler were associated with habitats which featured overstorey vegetation.

Mammals

A total of four mammal species were observed over the Project area (Appendix 2), which were comprised of three macropod species and the feral goat (*Capra hircus*). The Western Grey Kangaroo (*Macropus fuliginosus*) and Red Kangaroo (*Macropus rufus*) were both widespread and abundant over the Project area, while only a single observation of the Euro (*Macropus robustus*) was recorded. Feral goats were also widespread and abundant over the Project area. There were also opportunistic signs that rabbits and sheep occurred across the Project area.

Reptiles

Four reptile species were observed over the Project area (Appendix 2). The four species were the: Central Bearded Dragon (*Pogona vitticeps*), a species from the *Ctenophorus* genus, either the Painted Dragon (*Ctenophorus pictus*) or Peninsula Dragon (*Ctenophorus fionii*), Sleepy Lizard (*Tiliqua rugosa*) and the Western Brown Snake (*Pseudonaja nuchalis*). All of the reptile species observed are common and widespread over the semi-arid and arid zone.

6 DISCUSSION

6.1 Vegetation

The desktop assessment and field survey have built a solid characterisation of the dominant landforms and vegetation associations within the Project area.

The vegetation within the area containing the Upper and Lower Reservoir (and access tracks) and Expansion Area, showed signs of long-term overgrazing. The structural and floristic diversity varies according to grazing intensity. The regeneration of native perennial flora species was noted as being particularly low throughout all vegetation associations within these areas. These areas are currently grazed by Sheep, Goats, Rabbits and Kangaroos which were all recorded during the survey. Damage from browsing to palatable species such as *Enchylaena tomentosa* var. (Ruby Saltbush), *Casuarina pauper* and *Pimelea microcephala* ssp. *microcephala* (Shrubby Riceflower) was also common throughout these areas.

A species inventory was recorded for the Upper and Lower Reservoir and Expansion Area. These areas are likely to contain additional ephemeral and inconspicuous flora species which are only likely to be present for short periods following large rainfall events.

The majority of the vegetation within the areas assessed in detail contained varying densities of the ground cover weed species *Carrichtera annua* and *Medicago minima var. minima*. *Carrichtera annua* reacts rapidly to rainfall and is very common in degraded areas of the arid zone in South Australia. *Medicago minima var. minima* can become prolific in degraded areas after exceptional winter rains. This annual forb is recognized as a nutritious stock feed (Kutsche and Lay 2003).

The three declared weed species recorded during the survey, *Lycium ferocissimum* (African Boxthorn), *Marrubium vulgare* (Horehound) and *Xanthium spinosum* (Bathurst Burr) are relatively common in disturbed landscapes such as road and rail corridors and drainage lines within the Northern and Yorke and South Australian Arid Lands NRM Regions.

Another declared species, *Cenchrus ciliaris* (Buffel Grass) was observed within close proximity to the Project area on the batter of the Eyre Highway. Environmentally, *Cenchrus ciliaris* is considered one of Australia's worst weeds. The success of *Cenchrus ciliaris* as a pasture species and an environmental weed is due to its ease of establishment, rapid growth rate, fast maturation, prolonged flowering periods, prolific seed production and high seed dispersal ability, coupled with relatively long seed dormancy (Biosecurity SA 2012). This declared species is yet to be recorded in the Project area however the risk of it occurring is high given its presence on the Eyre Highway and surrounding the township of nearby Port Augusta (Pers obs.)

The current size of the Project area is 1263.6 ha and includes substantially sized buffer areas. The vegetation clearance is likely to be considerably less than this figure should the project proceed. Some specific recommendations are provided in Section 7.

The planning for the project is in the initial stages however a surface water report has already given consideration to some of the secondary impacts that may alter the natural hydrology surrounding the Upper and Lower Reservoir areas.

The surface water report (Golder 2017) identifies that the penstock will intersect one ephemeral creek (but may be avoided) and a second creek will be fully contained within the lower reservoir, but that this is at the head of the catchment; no diversion will be required. This results in less than 1% loss in catchment area, and therefore the changes to water quantity are considered to be insignificant.

An additional survey will allow for the collection of necessary data for the SEB calculations and NV clearance report and application. This will be scheduled for Autumn 2018.

6.2 Threatened species and ecological communities

A total of 13 threatened flora species with a rating under the EPBC Act were identified as potentially occurring in the PMST and BDBSA search area. *Senecio megaglossus* (Superb Groundsel) was the only EPBC listed flora species considered to potentially occur within the Project area. The other 12 species listed are unlikely to occur due to a lack of suitable habitat.

Senecio megaglossus is mostly confined to rocky creek banks and rocky gorge/valley slopes, though it has also been recorded in drainage lines, on the edge of an erosion gully, in sandhills and in arid hills (DotE 2017). *Senecio megaglossus* primarily has been recorded from a number of vegetation types including grasslands; tall open shrublands with *Pittosporum angustifolium* (Native Apricot), *Alectryon oleifolius* (Bullock Bush), and *Eremophila longifolia* (Emu Bush); in association with *Triodia irritans* (Spinifex); and in association with *Callitris columellaris* (White Cypress-pine) and *Eucalyptus camaldulensis* (River Red Gum) (TSSC 2008).

Senecio megaglossus is a long-lived perennial shrub, growing to 1 m high with bright yellow flower heads (TSSC 2008). Targeted surveys of drainage lines and gully's within the Project area from late July to November (flowers are borne) would be required to confirm the presence of *Senecio megaglossus.*

Three EPBC Act listed threatened ecological communities were identified in the PMST as potentially occurring within the search area. Based on the results of the desktop assessment and field survey it is considered that none of these EPBC Act listed threatened ecological communities are likely to occur within the Project area.

One species listed as vulnerable under the NPW Act, *Santalum spicatum* (Sandalwood) was recorded during the field survey within the Lower Reservoir Area and the Main Access Road corridor. Eighteen (18) *S. spicatum* trees were recorded, all occurring in drainage lines and hillslopes. Detailed surveys for this small tree species were only carried out within the Upper and Lower Reservoir and Expansion Area. It is likely that additional *Santalum spicatum* trees would exist within the Project area, particularly within drainage lines, low hills and foot slopes on the Upper Reservoir Road corridor. This will be further investigated during the surveys associated with the SEB and clearance application.

6.3 Fauna

6.3.1 Overview

The quality of habitat for fauna within the Project area was degraded by extensive grazing by macropods, sheep and feral goats. This was particularly evident within wooded areas, for example, *Casuarina pauper* (Belah) Woodland and *Acacia papyrocarpa* (Western Myall) Woodland, and around water points and dams, which were surrounded by chenopod shrubland.

6.3.2 EPBC Act Threatened species

Western Grasswren (Amytornis textilis myall) – EPBC Vulnerable

The Western Grasswren was considered to be potentially present within the Project area following the desktop assessment. However, following the field survey, it has been determined that the species would be unlikely to occur, due to the limited presence of suitable habitat. Western Grasswrens prefer dense, tall *Maireana pyramidata* (Blackbush) and *Lycium australe* (Australian Boxthorn) Shrubland and *Acacia papyrocarpa* (Western Myall) Woodland (Black *et al.* 2011). The majority of the Project area was dominated by non-preferred chenopod shrubland, such as *Atriplex vesicaria* (Bladder Saltbush), *Tecticornia medullosa* (Samphire) and *Maireana sedifolia*) (Low Bluebush) (Black *et al.* 2011). Where Blackbush was present, it occurred shrub height was low (<0.5 m) and the shrubland patches were small and isolated. Given the absence of this species from the Arcoona Tableland (Black *et al.* 2011), it is considered unlikely that the species would be present within the Project area.

An EPBC Referral is not required as none of the criteria in the Significant Impact Guidelines are triggered (DotEE 2013).

6.3.3 NPW Act Threatened species

The (Western) Slender-billed Thornbill was the only species listed under the NPW Act to be observed within the Project area during the field survey. The impact of the project on this species is discussed below.

Western Slender-billed Thornbill (Acanthiza iredalei iredalei)

Two groups of (Western) Slender-billed Thornbills, consisting of four and five individuals were observed within the Project area (Figure 7). The species was observed within *Atriplex vesicaria* (Bladder Saltbush), *Tecticornia medullosa* (Samphire), *Sclerolaena spp.* Shrubland, *Casuarina pauper* (Belah) and *Atriplex vesicaria* (Bladder Saltbush) Shrubland. The habitat within Bladder Saltbush is considered to be their usual habitat, while it is uncommon for the species to inhabit Casuarina dominated habitats (TSSC 2013). The upper reservoir was located within habitat preferred by the (Western) Slender-billed Thornbill. The project will have a negligible impact on the (Western) Slender-billed Thornbill as the species has a stable population, is widespread, and has extensive areas of suitable habitat within the region (DEWNR 2017c; TSSC 2013).

A further eight species listed under the NPW Act are considered to potentially occur within the Project area. The impact of the Project area on the species potentially occurring within the Project area will be negligible due to their uncommon to rare frequency of occurrence, widespread distribution and the availability of extensive areas of comparable habitat elsewhere in the region (Table 11).

Table 11. Fauna species which have potential to occur within the Project area.

Scientific name	Common name	Reasoning
Ardeotis australis	Australian Bustard	**Possible.** The Australian Bustard may be an irregular visitor to the Project area. Suitable habitat in *Atriplex vesicaria* (Bladder saltbush), *Tecticornia medullosa* (Samphire), *Sclerolaena sp.* Shrubland, is widespread over the Project area (Pers obs, Pizzey and Knight 2014). The species has been observed within 2 km of the Project area as recently as 2006 (ALA 2017).
Falco hypoleucos	Grey Falcon	**Possible.** The Grey Falcon may be a rare visitor to the Project area. The species inhabits lightly treed inland plains and has been observed within 40 km from the Project area in 2011 (ALA 2017).
Falco peregrinus	Peregrine Falcon	**Possible.** The Peregrine Falcon may be an uncommon visitor to the Project area. The species inhabits plains and open woodlands (Pizzey and Knight 2014). The species has been recorded within 50 km of the Project area in 2005 (DEWNR 2017b).
Hamirostra melanosternon	Black-breasted Buzzard	**Possible.** The Black-breasted Buzzard may be a rare visitor to the Project area. The Project area is at the southern limit of the range of the Black-breasted Buzzard; however, the species has been observed within 2 km of the Project area in 2006.
Lophochroa leadbeateri	Major Mitchell's Cockatoo	**Possible.** The Major Mitchell's Cockatoo may be a rare visitor to the Project area. The species inhabits chenopod plains and casuarina woodland, and therefore suitable habitat is present within the Project area (Pizzey and Knight 2014). Major Mitchell's Cockatoo were recorded within 7 km of the Project area in 2013 (ALA 2017).
Neophema chrysostoma	Blue-winged Parrot	**Possible.** The Blue-winged Parrot may be an uncommon visitor to the Project area. The species inhabits chenopod shrublands and has been observed within 20 km of the Project area in 2017 (Pers Obs; Pizzey and Knight 2014).
Neophema elegans	Elegant Parrot	**Possible.** The Elegant Parrot may be an uncommon visitor to the Project area, as the species inhabits chenopod shrublands (Pizzey and Knight 2014). The species has been observed within 10 km of the Project area as recently as 2006 (ALA 2017).
Neophema splendida	Scarlet-chested Parrot	**Possible.** The Scarlet-chested Parrot may be a rare visitor to the Project area, as it has historically been recorded within the region and inhabits chenopod shrublands and casuarina woodland (Pizzey and Knight 2014).

7 RECOMMENDATIONS

EBS recommends the following as part of its baseline ecological assessment for the Goat Hill project:

- Use existing network of established tracks where possible;
- Altura has agreed to micro-site the project footprint to ensure that Sandalwood individuals are not removed wherever possible; the reservoirs cannot be adjusted but other infrastructure will be micro sited to avoid impacts where practicable;
- Where micro siting cannot be achieved, the removal of individual Sandalwood trees will be factored in within the SEB calculations;
- Ensure that a Construction and Operational Environmental Management Plan (COEMP) has been developed prior to construction. This will provide specific, detailed methods to minimise environmental and ecological damage during the construction phase. This will also have a section on how best to manage the spread of weeds on site, both pre and post construction; and
- Best practice environmental management measures should be implemented during and following construction. Staff training and awareness of ecological issues, flora and fauna species, their values and threats is important for successfully minimising impacts during construction and operation.

To enable SEB calculations and a native vegetation clearance report and application to be completed, EBS will need to undertake a detailed vegetation assessment in some of the remaining areas; this is scheduled for Autumn 2018. In these areas, the methodology applied will relate to the:

- Rangelands Assessment methodology - in areas located within the SAAL NRM region; an estimated sample of eight sites would need to be undertaken; and
- A combination of both the Rangeland Assessment methodology (SAAL NRM region) and the Bushland Assessment methodology (Northern and Yorke NRM region).

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9 APPENDICES

Appendix 1. Flora species inventory for the Project area.

Family	Species name	Common name	Conservation status	
			Aus	SA
ADIANTACEAE	*Cheilanthes lasiophylla*	Woolly Cloak-fern		
AMARANTHACEAE	*Ptilotus nobilis ssp. nobilis*	Yellow-tails		
AMARANTHACEAE	*Ptilotus obovatus*			
AIZOACEAE	*Tetragonia sp.*	False Spinach		
BORAGINACEAE	*Heliotropium europaeum*	Common Heliotrope		
CAMPANULACEAE	*Wahlenbergia luteola*	Yellow-wash Bluebell		
CASUARINACEAE	*Casuarina pauper*	Black Oak		
CHENOPODIACEAE	*Atriplex nummularia ssp. nummularia*	Old-man Saltbush		
CHENOPODIACEAE	*Atriplex spongiosa*	Pop Saltbush		
CHENOPODIACEAE	*Atriplex vesicaria*	Bladder Saltbush		
CHENOPODIACEAE	**Chenopodium album*	Fat Hen		
CHENOPODIACEAE	*Chenopodium curvispicatum*	Cottony Goosefoot		
CHENOPODIACEAE	*Dissocarpus biflorus var. biflorus*	Two-horn Saltbush		
CHENOPODIACEAE	*Dissocarpus paradoxus*	Ball Bindyi		
CHENOPODIACEAE	*Enchylaena tomentosa var.*	Ruby Saltbush		
CHENOPODIACEAE	*Maireana aphylla*	Cotton-bush		
CHENOPODIACEAE	*Maireana appressa*	Pale-fruit Bluebush		
CHENOPODIACEAE	*Maireana astrotricha*	Low Bluebush		
CHENOPODIACEAE	*Maireana campanulata*	Bell-fruit Bluebush		
CHENOPODIACEAE	*Maireana eriantha*	Woolly Bluebush		
CHENOPODIACEAE	*Maireana pyramidata*	Black Bluebush		
CHENOPODIACEAE	*Maireana sedifolia*	Bluebush		
CHENOPODIACEAE	*Maireana spongiocarpa*	Spongy-fruit Bluebush		
CHENOPODIACEAE	*Maireana trichoptera*	Hairy-fruit Bluebush		
CHENOPODIACEAE	*Osteocarpum dipterocarpum*	Two-wing Bonefruit		
CHENOPODIACEAE	*Rhagodia parabolica*	Mealy Saltbush		
CHENOPODIACEAE	*Rhagodia spinescens*	Spiny Saltbush		
CHENOPODIACEAE	*Rhagodia ulicina*	Intricate Saltbush		
CHENOPODIACEAE	*Salsola australis*	Buckbush		
CHENOPODIACEAE	*Sclerolaena brachyptera*	Short-wing Bindyi		
CHENOPODIACEAE	*Sclerolaena cuneata*	Tangled Bindyi		
CHENOPODIACEAE	*Sclerolaena diacantha*	Grey Bindyi		
CHENOPODIACEAE	*Sclerolaena divaricata*	Tangled Bindyi		
CHENOPODIACEAE	*Sclerolaena eriacantha*	Silky Bindyi		
CHENOPODIACEAE	*Sclerolaena intricata*	Tangled Bindyi		
CHENOPODIACEAE	*Sclerolaena obliquicuspis*	Oblique-spined Bindyi		
CHENOPODIACEAE	*Sclerolaena patenticuspis*	Spear-fruit Bindyi		
CHENOPODIACEAE	*Sclerolaena ventricosa*	Salt Bindyi		
CHENOPODIACEAE	*Tecticornia sp.*	Samphire		

Family	Species name	Common name	Conservation status	
			Aus	SA
COMPOSITAE	*Calotis hispidula*	Hairy Burr-daisy		
COMPOSITAE	**Carthamus lanatus*	Saffron Thistle		
COMPOSITAE	*Chrysocephalum sp.*	Everlasting		
COMPOSITAE	**Dittrichia graveolens*	Stinkweed		
COMPOSITAE	**Leontodon rhagadioloides*	Cretan Weed		
COMPOSITAE	*Minuria cunninghamii*	Bush Minuria		
COMPOSITAE	*Olearia muelleri*	Mueller's Daisy-bush		
COMPOSITAE	*Pterocaulon sphacelatum*	Apple-bush		
COMPOSITAE	*Rhodanthe corymbiflora*	Paper Everlasting		
COMPOSITAE	*Vittadinia cuneata var. cuneata*	Fuzzy New Holland Daisy		
COMPOSITAE	**Xanthium spinosum*	Bathurst Burr		
CONVOLVULACEAE	*Convolvulus remotus*	Grassy Bindweed		
CRUCIFERAE	**Carrichtera annua*	Ward's Weed		
CRUCIFERAE	*Lepidium leptopetalum*	Shrubby Peppercress		
CRUCIFERAE	**Sisymbrium erysimoides*	Smooth Mustard		
CUCURBITACEAE	**Citrullus lanatus*	Bitter Melon		
CUPRESSACEAE	*Callitris glaucophylla*	White Cypress-pine		
EUPHORBIACEAE	*Euphorbia drummondii group*			
EUPHORBIACEAE	*Euphorbia tannensis ssp. eremophila*	Desert Spurge		
FRANKENIACEAE	*Frankenia serpyllifolia*	Thyme Sea-heath		
GOODENIACEAE	*Scaevola spinescens*	Spiny Fanflower		
GRAMINEAE	*Austrostipa scabra ssp.*	Rough Spear-grass		
GRAMINEAE	*Austrostipa sp.*	Spear-grass		
GRAMINEAE	**Bromus rubens*	Red Brome		
GRAMINEAE	*Cymbopogon ambiguus*	Lemon-grass		
GRAMINEAE	**Hordeum vulgare*	Barley		
GRAMINEAE	**Rostraria pumila*	Tiny Bristle-grass		
GRAMINEAE	*Rytidosperma setaceum*	Small-flower Wallaby-grass		
GRAMINEAE	*Triodia irritans*	Spinifex		
LABIATAE	**Marrubium vulgare*	Horehound		
LABIATAE	**Salvia verbenaca var. verbenaca*	Wild Sage		
LABIATAE	*Westringia rigida*	Stiff Westringia		
LEGUMINOSAE	*Acacia oswaldii*	Umbrella Wattle		
LEGUMINOSAE	*Acacia papyrocarpa*	Western Myall		
LEGUMINOSAE	*Acacia tetragonophylla*	Dead Finish		
LEGUMINOSAE	*Acacia victoriae ssp.*	Elegant Wattle		
LEGUMINOSAE	**Medicago minima var. minima*	Little Medic		
LEGUMINOSAE	**Medicago polymorpha var. polymorpha*	Burr-medic		
LEGUMINOSAE	*Senna artemisioides ssp. artemisioides x ssp. coriacea*	Desert Senna		
LORANTHACEAE	*Amyema quandang var. quandang*	Grey Mistletoe		
LORANTHACEAE	*Lysiana exocarpi ssp. exocarpi*	Harlequin Mistletoe		

Family	Species name	Common name	Conservation status	
			Aus	SA
MALVACEAE	*Abutilon halophilum*	Plains Lantern-bush		
MALVACEAE	*Lawrencia squamata*	Thorny Lawrencia		
MALVACEAE	*Sida corrugata var.*	Corrugated Sida		
MALVACEAE	*Sida intricata*	Twiggy Sida		
MALVACEAE	*Sida petrophila*	Rock Sida		
MYOPORACEAE	*Eremophila alternifolia*	Narrow-leaf Emubush		
MYOPORACEAE	*Eremophila longifolia*	Weeping Emubush		
MYOPORACEAE	*Eremophila scoparia*	Broom Emubush		
MYOPORACEAE	*Eremophila serrulata*	Green Emubush		
MYOPORACEAE	*Myoporum platycarpum ssp.*	False Sandalwood		
MYRTACEAE	*Eucalyptus gracilis*	Yorrell		
MYRTACEAE	*Eucalyptus socialis ssp. socialis*	Beaked Red Mallee		
MYRTACEAE	*Melaleuca lanceolata*	Dryland Tea-tree		
OXALIDACEAE	*Oxalis perennans*	Native Sorrel		
PITTOSPORACEAE	*Pittosporum angustifolium*	Native Apricot		
SANTALACEAE	*Exocarpos aphyllus*	Leafless Cherry		
SANTALACEAE	*Santalum spicatum*	Sandalwood		V
SAPINDACEAE	*Alectryon oleifolius ssp. canescens*	Bullock Bush		
SAPINDACEAE	*Dodonaea lobulata*	Lobed-leaf Hop-bush		
SOLANACEAE	*Lycium australe*	Australian Boxthorn		
SOLANACEAE	**Lycium ferocissimum*	African Boxthorn		
SOLANACEAE	*Solanum ellipticum*	Velvet Potato-bush		
SOLANACEAE	*Solanum petrophilum*	Rock Nightshade		
THYMELAEACEAE	*Pimelea microcephala ssp. microcephala*	Shrubby Riceflower		
THYMELAEACEAE	*Pimelea simplex ssp.*	Desert Riceflower		
ZYGOPHYLLACEAE	*Zygophyllum ammophilum*	Sand Twinleaf		
ZYGOPHYLLACEAE	*Zygophyllum ovatum*	Dwarf Twinleaf		
ZYGOPHYLLACEAE	*Zygophyllum prismatothecum*	Square-fruit Twinleaf		

Appendix 2. Opportunistic records of fauna within the Project area.

*	Class	Common name	Scientific name	Conservation status		Grand Total
				Aus	SA	
	AVES	Australasian Grebe	*Tachybaptus novaehollandiae*			1
		Australian Magpie	*Gymnorhina tibicen*			6
		Australian Pipit	*Anthus australis*			20
		Australian Raven	*Corvus coronoides*			1
		Australian Ringneck	*Barnardius zonarius*			3
		Black-faced Woodswallow	*Artamus cinereus*			20
		Black-fronted Dotterel	*Elseyornis melanops*			1
		Black-tailed Native-hen	*Tribonyx ventralis*			50
		Bluebonnet	*Northiella haematogaster*			4
		Brush Bronzewing	*Phaps elegans*			2
		Chestnut-rumped Thornbill	*Acanthiza uropygialis*			10
		Crested Pigeon	*Ocyphaps lophotes*			4
		Dusky Woodswallow	*Artamus cyanopterus*			2
		Emu	*Dromaius novaehollandiae*			1
		Galah	*Eolophus roseicapilla*			10
		Grey Butcherbird	*Cracticus torquatus*			1
		Grey Teal	*Anas gracilis*			5
		Little Raven	*Corvus mellori*			2
		Mulga Parrot	*Psephotus varius*			5
		Nankeen Kestrel	*Falco cenchroides*			3
		Pink-eared Duck	*Malacorhynchus membranaceus*			2
		Red-capped Robin	*Petroica goodenovii*			2
		Rufous Fieldwren	*Calamanthus (Calamanthus) campestris*			4
		Slender-billed Thornbill (western ssp)	*Acanthiza iredalei iredalei*		R	5
		Southern Whiteface	*Aphelocephala leucopsis*			22
		Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*			5
		Striated Pardalote	*Pardalotus striatus*			2
		Wedge-tailed Eagle	*Aquila audax*			1
		Weebill	*Smicrornis brevirostris*			1
		White-browed Babbler	*Pomatostomus superciliosus*			8
		White-fronted Chat	*Epthianura albifrons*			3
		White-winged Fairy-wren	*Malurus leucopterus*			19
		Willie Wagtail	*Rhipidura leucophrys*			2
		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*			2
		Yellow-throated Miner	*Manorina flavigula*			5
	MAMMALIA	Euro	*Macropus robustus*			1
*		Goat (Feral Goat)	*Capra hircus*			8
		Red Kangaroo	*Macropus rufus*			4
		Western Grey Kangaroo	*Macropus fuliginosus*			4
	REPTILIA	Central Bearded Dragon	*Pogona vitticeps*			1
		Dragon sp.	*Ctenophorus sp.*			1
		Sleepy Lizard	*Tiliqua rugosa*			1
		Western Brown Snake	*Pseudonaja nuchalis*			1

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. *: Introduced.

Appendix 3. The number of individuals from each bird species observed at Point Count sites over the Project area.

Common Name	Scientific Name	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	Grand Total
Australian Magpie	*Gymnorhina tibicen*			3									3
Australian Pipit	*Anthus australis*				5								5
Australian Raven	*Corvus coronoides*		2										2
Black-faced Woodswallow	*Artamus cinereus*				5				4				9
Bluebonnet	*Northiella haematogaster*				2				4				6
Brown Falcon	*Falco berigora*											1	1
Chestnut-rumped Thornbill	*Acanthiza uropygialis*		2		2						4		8
Collared Sparrowhawk	*Accipiter cirrocephalus*					2							2
Galah	*Eolophus roseicapilla*						2					2	4
Grey Butcherbird	*Cracticus torquatus*			1									1
Jacky Winter	*Microeca fascinans*									1			1
Mulga Parrot	*Psephotus varius*				2				4				6
Nankeen Kestrel	*Falco cenchroides*							1					1
Pallid Cuckoo	*Cacomantis pallidus*		1										1
Red-capped Robin	*Petroica goodenovii*									2	1		3
Rufous Fieldwren	*Calamanthus (Calamanthus) campestris*						1	1				1	3
Singing Honeyeater	*Gavicalis virescens*						2			4			6
Slender-billed Thornbill (western ssp)	*Acanthiza iredalei iredalei*				4								4
Southern Whiteface	*Aphelocephala leucopsis*									2		8	10
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		2		1	2			1				6
Stubble Quail	*Coturnix pectoralis*											3	3
Tree Martin	*Petrochelidon nigricans*									4			4
Welcome Swallow	*Hirundo neoxena*					3							3
White-browed Babbler	*Pomatostomus superciliosus*				5	3	6		4	4			22
White-winged Fairy-wren	*Malurus leucopterus*							3				2	5
White-winged Triller	*Lalage tricolor*									1			1
Willie Wagtail	*Rhipidura leucophrys*									1	1		2

Common Name	Scientific Name	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	Grand Total
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*				4						5		9
Yellow-throated Miner	*Manorina flavigula*			1		11							12
Grand Total		0	7	5	30	21	11	5	17	19	11	17	143

Appendix 4. Flora species recorded in the BDBSA within 50 km of the Project area (DEWNR 2017b).

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Abutilon fraseri ssp.				1994
	Abutilon fraseri ssp. diplotrichum	Dwarf Lantern-bush			2007
	Abutilon halophilum	Plains Lantern-bush			2007
	Abutilon leucopetalum	Desert Lantern-bush			1991
	Abutilon otocarpum	Desert Lantern-bush			1993
	Acacia acinacea	Wreath Wattle			1994
	Acacia anceps				1941
	Acacia aneura complex	Mulga			2007
	Acacia aneura var. (NC)	Mulga			1996
	Acacia aneura var. aneura	Mulga			1990
	Acacia aneura var. intermedia	Broad-leaf Mulga			2007
	Acacia argyrophylla	Silver Mulga-bush			1994
	Acacia ayersiana	Blue Mulga			1928
	Acacia beckleri (NC)	Beckler's Rock Wattle			1992
	Acacia brachystachya	Turpentine Mulga			2007
	Acacia burkittii	Pin-bush Wattle			2007
	Acacia calamifolia	Wallowa			2015
	Acacia calamifolia (NC)	Wallowa			2004
	Acacia continua	Thorn Wattle			2007
	Acacia cupularis	Cup Wattle			1994
	Acacia euthycarpa	Wallowa			2007
	Acacia gracilifolia	Graceful Wattle		R	1992
	Acacia hakeoides	Hakea Wattle			2009
	Acacia iteaphylla	Flinders Ranges Wattle		R	1975
	Acacia kempeana	Witchetty Bush			1992
	Acacia ligulata	Umbrella Bush			2008
	Acacia ligulata (NC)	Umbrella Bush			1986
	Acacia notabilis	Notable Wattle			2008
	Acacia oswaldii	Umbrella Wattle			2009
	Acacia papyrocarpa	Western Myall			2009
	Acacia paradoxa	Kangaroo Thorn			1975
	Acacia pravifolia	Coil-pod Wattle			1999
	Acacia pycnantha	Golden Wattle			2015
	Acacia quornensis	Quorn Wattle		R	2006
	Acacia ramulosa var. ramulosa	Horse Mulga			1941
	Acacia rigens	Nealie			1999
	Acacia rivalis	Silver Wattle			1964
	Acacia rupicola	Rock Wattle			1999
	Acacia salicina	Willow Wattle			2001
	Acacia sclerophylla var. sclerophylla	Hard-leaf Wattle			1995
	Acacia sibirica	Bastard Mulga			1992
	Acacia sp.	Wattle			1996
	Acacia spooneri				2006
	Acacia tarculensis	Steel Bush			1954
	Acacia tetragonophylla	Dead Finish			2007
	Acacia victoriae ssp.	Elegant Wattle			2015
	Acacia victoriae ssp. victoriae	Elegant Wattle			2009
	Acacia wilhelmiana	Dwarf Nealie			1996
	Acaena echinata	Sheep's Burr			1997
	Acaena novae-zelandiae	Biddy-biddy			2009

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Acaena sp.	Sheep's Burr			1994
	Acarospora smaragdula				1969
*	*Acetosa vesicaria*	Rosy Dock			1993
*	*Achillea millefolium*	Yarrow			1989
	Acrosorium ciliolatum				1973
	Actinobole uliginosum	Flannel Cudweed			1998
*	*Adonis microcarpa*	Pheasant's Eye			1969
	Agrostis avenacea var. perennis (NC)	Perennial Blown-grass			1994
*	*Aira caryophyllea*	Silvery Hair-grass			1999
*	*Aira cupaniana*	Small Hair-grass			1996
*	*Aira elegantissima*	Delicate Hair-grass			2009
*	*Aira praecox*				1997
*	*Aira sp.*	Hair-grass			2009
	Ajuga australis	Australian Bugle			2015
	Ajuga australis f. A (A.G.Spooner 9058)	Australian Bugle			2009
	Alectryon oleifolius ssp. canescens	Bullock Bush			2015
	Allocasuarina helmsii	Helm's Oak-bush			1950
	Allocasuarina muelleriana ssp.	Common Oak-bush			1994
	Allocasuarina muelleriana ssp. alticola	Flinders Ranges Oak-bush			1999
	Allocasuarina muelleriana ssp. muelleriana	Common Oak-bush			1987
	Allocasuarina verticillata	Drooping Sheoak			2003
	Aloina sullivaniana				1953
	Alternanthera denticulata	Lesser Joyweed			1993
	Alternanthera nana	Hairy Joyweed			1994
*	*Alternanthera pungens*	Khaki Weed			1986
	Alternanthera sp. A (prostrate)				1994
	Alyogyne hakeifolia	Hakea-leaf Hibiscus			1974
	Alyogyne huegelii	Native Hibiscus			1994
	Alyogyne huegelii (NC)	Native Hibiscus			1994
	Alyogyne sp. Great Victoria Desert (D.J.Edinger 6212)			1992	
*	*Alyssum linifolium*	Flax-leaf Alyssum			1996
	Alyxia buxifolia	Sea Box			1994
*	*Amaranthus caudatus*	Love-lies-bleeding			1989
*	*Amaranthus deflexus*	Spreading Amaranth			1997
	Amaranthus grandiflorus	Large-flower Amaranth			1997
	Amaranthus mitchellii	Boggabri Weed			1990
	Amaranthus sp.	Amaranth			1994
*	*Amaranthus viridis*	Green Amaranth			2003
	Amoenothamnion planktonicum				1975
	Amphibolis antarctica	Sea Nymph			1975
	Amphibromus nervosus	Veined Swamp Wallaby-grass			1997
	Amphipogon caricinus var. caricinus	Long Grey-beard Grass			1994
*	*Amsinckia lycopsoides*	Bugloss Fiddle-neck			1997
	Amyema linophylla ssp. orientalis	Casuarina Mistletoe			1990
	Amyema melaleucae	Tea-tree Mistletoe			1982
	Amyema miquelii	Box Mistletoe			2001
	Amyema miraculosa ssp. boormanii	Fleshy Mistletoe			1998

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Amyema preissii	Wire-leaf Mistletoe			1999
	Amyema quandang var. quandang	Grey Mistletoe			2007
	Amyema sp.	Mistletoe			1997
	Anacampseros australiana	Australian Anacampseros			1999
*	*Anagallis arvensis*	Pimpernel			2015
*	*Anchusa capensis*	Cape Forget-me-not			1994
	Angianthus glabratus	Smooth Angianthus			1998
	Angianthus tomentosus	Hairy Angianthus			1996
	Anogramma leptophylla	Annual Fern		R	1999
	Anotrichium elongatum				1978
	Anthocercis anisantha ssp. collina	Gawler Ranges Ray-flower			1990
	Anthosachne scabra	Native Wheat-grass			1996
	Antithamnion delicatulum				1978
	Antrocentrum nigrescens				1980
	Aphanes australiana	Australian Piert			1999
	Aphanes australiana (NC)	Australian Piert			1994
	Aphanes pumila	Australian Piert			1999
	Apodasmia brownii	Coarse Twine-rush			1941
	Arabidella filifolia	Thread-leaf Cress			2010
	Arabidella nasturtium	Yellow Cress			2008
	Arabidella procumbens	Creeping Cress			2008
	Arabidella trisecta	Shrubby Cress			2010
*	*Arctotheca calendula*	Cape Weed			2015
*	*Arctotheca sp.*				1994
	Areschougia congesta				1975
*	*Argemone ochroleuca ssp. ochroleuca*	Mexican Poppy			1946
	Argentipallium obtusifolium	Blunt Everlasting			1927
	Aristida anthoxanthoides	Yellow Three-awn			1921
	Aristida behriana	Brush Wire-grass			2009
	Aristida contorta	Curly Wire-grass			2007
	Aristida holathera var. holathera	Tall Kerosene Grass			2007
	Aristida nitidula	Brush Three-awn			1990
	Aristida personata	Purple Wire-grass			2000
	Aristida sp.	Three-awn/Wire-grass			1994
	Arthropodium minus	Small Vanilla-lily			2010
	Arthropodium sp.	Vanilla-lily			1994
	Arthropodium strictum	Common Vanilla-lily			2015
*	*Arundo donax*	Giant Reed			1987
*	*Asclepias curassavica*	Red-head Cotton-bush			1997
	Asparagopsis armata				1987
	Asparagopsis taxiformis				2007
	Asperococcus bullosus				2007
	Asperula conferta	Common Woodruff			2010
	Asperula syrticola	Southern Flinders Woodruff		R	1999
*	*Asphodelus fistulosus*	Onion Weed			2015
	Asplenium flabellifolium	Necklace Fern			1994
	Asteridea athrixioides	Wirewort			1973
	Asteridea athrixioides f. athrixioides (NC)	Wirewort			1994
*	*Asteriscus spinosus*	Golden Pallensis			1993
	Astrebla lappacea	Curly Mitchell-grass			2010

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Astroloma humifusum	Cranberry Heath			2001
	Atriplex acutibractea ssp.	Pointed Saltbush			1975
	Atriplex acutibractea ssp. acutibractea	Pointed Saltbush			1990
	Atriplex angulata	Fan Saltbush			2008
	Atriplex cinerea	Coast Saltbush			1995
	Atriplex eardleyae	Eardley's Saltbush			1997
	Atriplex fissivalvis	Gibber Saltbush			1990
	Atriplex holocarpa	Pop Saltbush			2008
	Atriplex limbata	Spreading Saltbush			1997
	Atriplex lindleyi ssp.	Baldoo			2008
	Atriplex lindleyi ssp. conduplicata	Baldoo			1997
	Atriplex lindleyi ssp. inflata	Corky Saltbush			1996
	Atriplex lindleyi ssp. lindleyi	Baldoo			1998
	Atriplex lindleyi ssp. quadripartita	Baldoo			1992
	Atriplex paludosa ssp. cordata	Marsh Saltbush			1998
	Atriplex paludosa ssp. paludosa	Marsh Saltbush			1996
	Atriplex pumilio	Mat Saltbush			1997
	Atriplex semibaccata	Berry Saltbush			1997
	Atriplex sp.	Saltbush			2009
	Atriplex spongiosa	Pop Saltbush			1997
	Atriplex stipitata	Bitter Saltbush			2009
	Atriplex suberecta	Lagoon Saltbush			1997
	Atriplex velutinella	Sandhill Saltbush			1920
	Atriplex vesicaria	Bladder Saltbush			2008
	Atriplex vesicaria ssp. (NC)	Bladder Saltbush			2009
	Audouinella daviesii				1975
*	*Austrocylindropuntia cylindrica*	Cane Cactus			2006
*	*Austrocylindropuntia subulata*	Eve's-pin Cactus			1985
	Austrodanthonia sp. (NC)				2009
	Austronereia australis				2007
	Austrostipa acrociliata	Graceful Spear-grass			2009
	Austrostipa blackii	Crested Spear-grass			1999
	Austrostipa breviglumis	Cane Spear-grass		R	1999
	Austrostipa curticoma	Short-crest Spear-grass			1996
	Austrostipa drummondii	Cottony Spear-grass			2015
	Austrostipa echinata	Spiny Spear-grass		R	1990
	Austrostipa elegantissima	Feather Spear-grass			2009
	Austrostipa eremophila	Rusty Spear-grass			2008
	Austrostipa exilis	Heath Spear-grass			1992
	Austrostipa flavescens	Coast Spear-grass			1992
	Austrostipa gibbosa	Swollen Spear-grass		R	1992
	Austrostipa nitida	Balcarra Spear-grass			2009
	Austrostipa nodosa	Tall Spear-grass			2015
	Austrostipa petraea	Flinders Range Spear-grass		R	2005
	Austrostipa pilata	Prickly Spear-grass		V	1996
	Austrostipa platychaeta	Flat-awn Spear-grass			2008
	Austrostipa puberula	Fine-hairy Spear-grass			1998
	Austrostipa scabra ssp.	Rough Spear-grass			1986
	Austrostipa scabra ssp. falcata	Slender Spear-grass			2001
	Austrostipa scabra ssp. scabra	Rough Spear-grass			2000
	Austrostipa setacea	Corkscrew Spear-grass			1996

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Austrostipa sp.	Spear-grass			2009
	Austrostipa stipoides	Coast Spear-grass			2009
	Austrostipa tenuifolia			R	1994
	Austrostipa trichophylla				2009
*	*Avellinia michelii*	Avellinia			1996
*	*Avena barbata*	Bearded Oat			2015
*	*Avena fatua*	Wild Oat			2009
*	*Avena sativa*	Cultivated Oat			1990
*	*Avena sp.*	Oat			2009
	Avicennia marina ssp. marina	Grey Mangrove			2001
	Baumea juncea	Bare Twig-rush			1960
	Bellotia eriophorum				1980
	Bergia trimera	Three-part Water-fire			2008
	Beyeria lechenaultii	Pale Turpentine Bush			1996
	Billardiera sp.	Apple-berry			1994
	Billardiera versicolor	Yellow-flower Apple-berry			1996
	Blennospora drummondii	Dwarf Button-flower			1974
	Boerhavia coccinea	Tar-vine			2007
	Boerhavia dominii	Tar-vine			1996
	Boerhavia dominii (NC)	Tar-vine			1996
	Boerhavia schomburgkiana	Schomburgk's Tar-vine			1992
	Boerhavia schomburgkiana (NC)	Schomburgk's Tar-vine			1999
	Bonnemaisonia australis				1987
	Boraginaceae sp.	Borage Family			1994
	Bothriochloa ewartiana	Desert Blue-grass			1973
	Botryocladia sonderi				1973
	Bovista cunninghamii				1999
	Brachycome leptocarpa (NC)	Small Hairy Daisy			1994
*	*Brachypodium distachyon*	False Brome			2015
	Brachyscome ciliaris var.	Variable Daisy			1994
	Brachyscome ciliaris var. brachyglossa	Rayless Variable-daisy			1992
	Brachyscome ciliaris var. ciliaris	Variable Daisy			2001
	Brachyscome ciliaris var. lanuginosa	Woolly Variable Daisy			2009
	Brachyscome ciliaris var. lyrifolia	Lyrate-leaf Daisy			2005
	Brachyscome ciliaris var. subintegrifolia			R	2005
	Brachyscome debilis	Weak Daisy			1996
	Brachyscome dichromosomatica var. dichromosomatica	Large Hard-head Daisy			2008
	Brachyscome exilis	Slender Daisy			1955
	Brachyscome gilesii	Giles Daisy			1994
	Brachyscome lineariloba	Hard-head Daisy			2008
	Brachyscome muelleri	Corunna Daisy	EN	E	2005
	Brachyscome perpusilla	Tiny Daisy			1994
	Brachyscome sp.	Native Daisy			1994
	Brachyscome trachycarpa	Smooth Daisy			1999
*	*Brassica rapa ssp. rapa*	Turnip Rape			1985
*	*Brassica tournefortii*	Wild Turnip			2009
*	*Briza maxima*	Large Quaking-grass			1992
	Bromus arenarius	Sand Brome			1999
*	*Bromus catharticus*	Prairie Grass			2009

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Bromus diandrus*	Great Brome			1997
*	*Bromus diandrus (NC)*	Great Brome			2009
*	*Bromus hordeaceus ssp. hordeaceus*	Soft Brome			1994
*	*Bromus madritensis*	Compact Brome			2009
*	*Bromus rubens*	Red Brome			2015
	Bromus sp.	Brome			2015
	Brongniartella australis				1975
	Bryopsis plumosa				1975
*	*Buglossoides arvensis*	Sheepweed			1994
	Bulbine alata	Winged Bulbine-lily			2009
	Bulbine bulbosa	Bulbine-lily			1999
	Bulbine semibarbata	Small Leek-lily			1999
*	*Bupleurum semicompositum*	Hare's Ear			1997
	Bursaria spinosa ssp.	Bursaria			2015
	Bursaria spinosa ssp. spinosa	Sweet Bursaria			2009
*	*Cactaceae sp.*				2009
	Caesia calliantha	Blue Grass-lily			1994
*	*Cakile maritima ssp. maritima*	Two-horned Sea Rocket			1998
	Caladenia capillata	Wispy Spider-orchid			1999
	Caladenia carnea complex	Pink Fingers Caladenia			1990
	Caladenia coactilis	Flinders Ranges Caladenia			1999
	Caladenia filamentosa complex	Daddy-long-legs Spider-orchid			1994
	Caladenia stricta	Upright Caladenia			2009
	Caladenia tensa	Inland Green-comb Spider-orchid	EN		1999
	Caladenia tentaculata	King Spider-orchid			1996
	Caladenia toxochila	Bow-lip Spider-orchid			1999
	Calandrinia calyptrata	Pink Purslane			2010
	Calandrinia disperma	Two-seed Purslane			1939
	Calandrinia eremaea	Dryland Purslane			2009
	Calandrinia remota	Round-leaf Parakeelya			1939
	Calandrinia sp.	Purslane/Parakeelya			1996
	Calandrinia sphaerophylla	Bead Purslane		R	1990
	Calandrinia volubilis	Twining Purslane			2008
*	*Calendula arvensis*	Field Marigold			2003
	Calliblepharis planicaulis				1978
	Callistemon teretifolius	Needle Bottlebrush			1999
	Callithamnion circinnatum				1974
*	*Callitriche stagnalis*	Common Water Starwort			1928
	Callitris glaucophylla	White Cypress-pine			2015
	Callitris gracilis	Southern Cypress Pine			2009
	Callitris verrucosa	Scrub Cypress Pine			1994
	Calocephalus citreus	Lemon Beauty-heads			1995
	Calostemma purpureum	Pink Garland-lily			1997
	Calotis cymbacantha	Showy Burr-daisy			1995
	Calotis erinacea	Tangled Burr-daisy			1997
	Calotis hispidula	Hairy Burr-daisy			2008
	Calotis lappulacea	Yellow Burr-daisy		R	1999
	Calotis latiuscula	Leafy Burr-daisy			1992
	Calotis multicaulis	Woolly-headed Burr-daisy			1958
	Calotis sp.	Burr-daisy			1994
	Calytrix tetragona	Common Fringe-myrtle			1999

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Capsella bursa-pastoris*	Shepherd's Purse			1994
*	*Carduus sp.*	Thistle			1994
*	*Carduus tenuiflorus*	Slender Thistle			2015
	Carex appressa	Tall Sedge			1994
	Carex bichenoviana	Notched Sedge			1997
	Carex breviculmis	Short-stem Sedge			1994
	Carex inversa var. major	Knob Sedge			1999
	Carex sp.	Sedge			1994
	Carex tereticaulis	Rush Sedge			1986
*	*Carpobrotus chilensis*	Angled Pigface			1975
	Carpobrotus rossii	Native Pigface			2008
	Carpobrotus rossii (NC)	Native Pigface			2004
	Carpobrotus sp.	Pigface			1996
*	*Carrichtera annua*	Ward's Weed			2015
*	*Carthamus lanatus*	Saffron Thistle			2015
*	*Carthamus sp.*				1994
	Cassinia arcuata	Drooping Cassinia			1990
	Cassinia complanata	Sticky Cassinia			1987
	Cassinia laevis	Curry Bush			2015
	Cassinia uncata				1999
	Cassinia uncata (NC)	Sticky Cassinia			1996
	Cassytha flindersii	Flinders Ranges Dodder-laurel			1994
	Cassytha melantha	Coarse Dodder-laurel			1975
	Cassytha peninsularis	Peninsula Dodder-laurel			1998
	Cassytha peninsularis var. (NC)	Peninsula Dodder-laurel			1994
	Casuarina pauper	Black Oak			2009
	Casuarinaceae sp.	Sheaok Family			2009
*	*Catapodium rigidum*	Rigid Fescue			1996
*	*Catharanthus roseus*				1993
	Caulerpa cactoides				1973
	Caulerpa flexilis var. muelleri				1978
	Caulocystis cephalornithos				1973
	Caulocystis uvifera				1974
*	*Cenchrus ciliaris*	Buffel Grass			2014
*	*Cenchrus ciliaris/pennisetiformis*	Buffel Grass			2010
*	*Cenchrus clandestinus*	Kikuyu			2002
*	*Cenchrus echinatus*				2014
*	*Cenchrus longispinus*	Spiny Burr-grass			2015
*	*Cenchrus setaceus*	Fountain Grass			2010
*	*Cenchrus spinifex*	Spiny Burr-grass			1993
*	*Centaurea calcitrapa*	Star Thistle			2002
*	*Centaurea melitensis*	Malta Thistle			1999
*	*Centaurea sp.*	Centaury			1994
*	*Centaurium erythraea*	Common Centaury			1994
*	*Centaurium tenuiflorum*	Branched Centaury			1997
	Centella cordifolia	Native Centella			1993
	Centipeda crateriformis ssp. compacta	Desert Sneezeweed			1912
	Centipeda crateriformis ssp. crateriformis	Common Sneezeweed			1999
	Centipeda cunninghamii	Common Sneezeweed			2007
	Centipeda cunninghamii (NC)	Common Sneezeweed			1999

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Centipeda thespidioides	Desert Sneezeweed			1983
	Centroceras clavulatum				1978
	Centrolepis cephaloformis ssp. cephaloformis	Cushion Centrolepis		R	1974
	Centrolepis eremica	Dryland Centrolepis			1989
	Centrolepis polygyna	Wiry Centrolepis			1974
	Centrolepis strigosa ssp. strigosa	Hairy Centrolepis			1994
	Ceramium cliftonianum				1978
	Ceramium macilentum				1975
	Ceramium puberulum				1975
	Ceramium shepherdii				1978
*	*Cerastium glomeratum*	Common Mouse-ear Chickweed			1996
*	*Cerastium sp.*	Chickweed			1994
	Ceratogyne obionoides	Wingwort		R	1990
	Chamaescilla corymbosa var. corymbosa	Blue Squill			1994
	Chamaesyce drummondii (NC)	Caustic Weed			1999
	Champia zostericola				1980
	Cheilanthes austrotenuifolia	Annual Rock-fern			2001
	Cheilanthes distans	Bristly Cloak-fern			2001
	Cheilanthes lasiophylla	Woolly Cloak-fern			2015
	Cheilanthes sieberi ssp.	Narrow Rock-fern			1994
	Cheilanthes sieberi ssp. sieberi	Narrow Rock-fern			2001
	Cheilanthes sp.	Rock-fern			1994
	Chenopodiaceae sp.	Goosefoot Family			1996
*	*Chenopodium album*	Fat Hen			2009
	Chenopodium curvispicatum	Cottony Goosefoot			2008
	Chenopodium desertorum ssp.	Desert Goosefoot			2008
	Chenopodium desertorum ssp. anidiophyllum	Mallee Goosefoot			2007
	Chenopodium desertorum ssp. desertorum	Frosted Goosefoot			2007
	Chenopodium desertorum ssp. microphyllum	Small-leaf Goosefoot			2007
	Chenopodium gaudichaudianum	Scrambling Goosefoot			1981
*	*Chenopodium glaucum*	Glaucous Goosefoot			1993
*	*Chenopodium murale*	Nettle-leaf Goosefoot			2010
	Chenopodium nitrariaceum	Nitre Goosefoot			1993
	Chiracanthia arborea				1973
*	*Chloris gayana*	Rhodes Grass			2010
	Chloris pectinata	Comb Windmill Grass			1994
	Chloris sp.	Windmill Grass/Chloris			1994
	Chloris truncata	Windmill Grass			1995
*	*Chloris virgata*	Feather-top Rhodes Grass			2014
	Chlorodesmis baculifera				1980
	Chondria harveyana				1980
	Chondria succulenta				2007
*	*Chondrilla juncea*	Skeleton Weed			1989
	Chondrophycus brandenii				1975
	Chondropsis semiviridis				1969
*	*Chrozophora tinctoria*	Dyer's Litmus Plant			1997
	Chrysocephalum apiculatum	Common Everlasting			1999
	Chrysocephalum apiculatum (NC)	Common Everlasting			2009

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Chrysocephalum pterochaetum	Shrub Everlasting			2007
	Chrysocephalum semipapposum	Clustered Everlasting			1999
	Chthonocephalus pseudevax	Ground-heads			1990
*	*Cicendia quadrangularis*	Square Cicendia			1994
*	*Cirsium vulgare*	Spear Thistle			1996
*	*Citrullus colocynthis*	Colocynth			2007
*	*Citrullus lanatus*	Bitter Melon			1995
*	*Citrullus sp.*	Wild Melon			2007
	Citrus glauca	Desert Lime		V	1993
	Citrus limon (NC)				1987
	Cladia aggregata				1969
	Cladophora bainesii				1981
	Cladophora laetevirens				1978
	Cladophora lehmanniana				1978
	Cladophora sericea				1975
	Cladophora vagabunda				1975
	Cladosiphon filum				1975
	Cladosiphon vermicularis				1975
	Cladostephus spongiosus				1978
	Clematis decipiens	Old Man's Beard			1981
	Clematis leptophylla				2001
	Clematis microphylla	Old Man's Beard			2015
	Clematis microphylla var. microphylla (NC)	Old Man's Beard			1996
	Cliftonaea pectinata				1973
	Codium harveyi				1973
	Codium nuytsianum				1974
	Codonocarpus cotinifolius	Desert Poplar			1990
	Coelarthrum opuntia				2007
	Compositae sp.	Daisy Family			1994
	Convolvulus angustissimus ssp. peninsularum	Narrow-leaf Bindweed			1996
	Convolvulus clementii				1992
	Convolvulus crispifolius	Silver Bindweed			1992
	Convolvulus erubescens (NC)	Australian Bindweed			1994
	Convolvulus erubescens complex				2015
	Convolvulus erubescens/remotus (NC)	Native Bindweed			1992
	Convolvulus microsepalus	Small-flower Bindweed			1998
	Convolvulus recurvatus ssp. nullarborensis				1983
	Convolvulus remotus	Grassy Bindweed			2015
	Convolvulus sp.	Bindweed			1992
*	*Conyza bonariensis*	Flax-leaf Fleabane			1997
	Correa glabra (NC)	Rock Correa			1994
	Cotula australis	Common Cotula			1999
	Craspedia glauca (NC)	Billy-buttons			1995
	Craspedia haplorrhiza	Billy-buttons			2001
	Craspedia variabilis	Billy-buttons			1999
	Craspedocarpus ramentaceus				1980
	Craspedocarpus tenuifolius				1973
	Crassula closiana	Stalked Crassula			1994
	Crassula colligata ssp. colligata				1992

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Crassula colligata ssp. lamprosperma				2009
	Crassula colorata var.	Dense Crassula			2008
	Crassula colorata var. acuminata	Dense Crassula			2009
	Crassula colorata var. colorata	Dense Crassula			1996
	Crassula decumbens var. decumbens	Spreading Crassula			1994
	Crassula exserta	Large-fruit Crassula		R	1974
	Crassula sieberiana complex	Australian Stonecrop			1994
	Crassula sieberiana ssp. tetramera (NC)	Australian Stonecrop			1998
	Crassula sp.	Crassula/Stonecrop			1996
	Crassula tetramera	Australian Stonecrop			1992
	Cratystylis conocephala	Bluebush Daisy			1997
*	*Crepis foetida ssp. foetida*	Stinking Hawksbeard			1997
	Crinum flaccidum	Murray Lily			2007
*	*Critesion murinum ssp. (NC)*	Barley-grass			1992
	Crouania robbii				1977
	Cruciferae sp.	Cress Family			1994
	Cryptandra amara var. (NC)	Cryptandra			1999
	Cryptandra campanulata	Long-flower Cryptandra		R	1999
	Cryptandra propinqua	Silky Cryptandra			1993
	Cryptandra sp. Floriferous (W.R.Barker 4131)	Pretty Cryptandra			1990
	Cryptandra tomentosa	Heath Cryptandra			1913
*	*Cucumis myriocarpus*	Paddy Melon			2004
	Cullen australasicum	Tall Scurf-pea			1994
	Cullen graveolens	Native Lucerne			2007
	Cullen tenax				1998
*	*Cylindropuntia fulgida var. mamillata*				2009
*	*Cylindropuntia imbricata*	Devil's Rope Pear			1996
	Cymbonotus preissianus	Austral Bear's-ear			1994
	Cymbopogon ambiguus	Lemon-grass			2015
	Cymbopogon obtectus	Silky-head Lemon-grass			1992
	Cymbopogon sp.	Lemon Grass			1994
	Cynanchum floribundum	Desert Cynanchum			1916
	Cynanchum viminale ssp. australe	Caustic Bush			1997
*	*Cynara cardunculus ssp. flavescens*	Artichoke Thistle			1994
*	*Cynodon dactylon (NC)*	Couch			2002
*	*Cynodon dactylon var. dactylon*	Couch			2010
	Cynoglossum australe	Australian Hound's-tongue			1990
	Cynoglossum suaveolens	Sweet Hound's-tongue			1994
*	*Cynosurus echinatus*	Rough Dog's-tail Grass			2009
	Cyperus alterniflorus	Umbrella Flat-sedge			1999
*	*Cyperus arenarius*	Sand Sedge			1962
	Cyperus bulbosus	Bulbous Flat-sedge			1997
	Cyperus gilesii	Giles' Flat-sedge			1939
	Cyperus gymnocaulos	Spiny Flat-sedge			1994
	Cyperus rigidellus	Dwarf Flat-sedge			1921
	Cyperus vaginatus	Stiff Flat-sedge			2001
	Cyrtostylis reniformis	Small Gnat-orchid			1999
	Cystophora expansa				1950

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Cystoseira trinodis				1974
	Dactyloctenium radulans	Button-grass			2016
	Damasonium minus	Star-fruit			1993
	Dampiera dysantha	Shrubby Dampiera			1994
	Dampiera rosmarinifolia	Rosemary Dampiera			1993
	Dampiera sp.	Dampiera			1994
	Danthonia sp. (NC)	Wallaby-grass			2002
	Dasya crescens				2007
	Dasya extensa				1981
	Dasya hookeri				2007
	Dasya quadrispora				1978
	Dasya villosa				2007
	Dasythamniella latissima				1986
	Dasythamniella superbiens				1975
*	*Datura ferox*	Long-spine Thorn-apple			2014
*	*Datura inoxia*	Downy Thorn-apple			1998
*	*Datura leichhardtii*	Leichhardt's Thorn-apple			2014
*	*Datura stramonium*	Common Thorn-apple			1975
	Daucus glochidiatus	Native Carrot			2015
	Daviesia arenaria	Sand Bitter-pea			1994
	Daviesia genistifolia	Broom Bitter-pea			1996
	Daviesia leptophylla	Narrow-leaf Bitter-pea			1994
	Daviesia pectinata	Zig-zag Bitter-pea		R	1941
	Daviesia ulicifolia (NC)	Gorse Bitter-pea			1993
	Deyeuxia densa	Heath Bent-grass		R	1994
	Deyeuxia quadriseta	Reed Bent-grass			1994
	Dianella brevicaulis	Short-stem Flax-lily			1996
	Dianella brevicaulis/revoluta var.	Black-anther Flax-lily			1996
	Dianella longifolia var. grandis	Pale Flax-lily		R	1999
	Dianella revoluta var.				2007
	Dianella revoluta var. divaricata	Broad-leaf Flax-lily			2007
	Dianella revoluta var. revoluta	Black-anther Flax-lily			2009
	Dichanthium sericeum ssp. sericeum	Silky Blue-grass			1998
	Dichelachne crinita	Long-hair Plume-grass			2000
	Dichondra repens	Kidney Weed			1994
	Dictyomenia harveyana				1976
	Dictyopteris australis				1980
	Dictyopteris muelleri				1973
	Dictyota dichotoma				1987
	Dictyota furcellata				1950
	Didymodon australasiae				1986
	Didymodon torquatus				1986
	Digitaria ammophila	Spider Grass			1994
	Digitaria brownii	Cotton Panic-grass			1998
*	*Digitaria sanguinalis*	Crab Grass			1920
	Dilophus gunnianus				1974
	Diploschistes ocellatus				1969
	Diploschistes scruposus				1969
*	*Diplotaxis muralis*	Wall Rocket			1994
*	*Diplotaxis tenuifolia*	Lincoln Weed			2002
	Dipterosiphonia dendritica				1978

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Disphyma crassifolium ssp. clavellatum	Round-leaf Pigface			2010
	Dissocarpus biflorus var.	Two-horn Saltbush			2008
	Dissocarpus biflorus var. biflorus	Two-horn Saltbush			1999
	Dissocarpus fontinalis				2007
	Dissocarpus paradoxus	Ball Bindyi			2009
	Distichlis distichophylla	Emu-grass			1975
	Distromium flabellatum				1978
*	*Dittrichia graveolens*	Stinkweed			2009
	Diuris palustris	Little Donkey-orchid			1994
	Dodonaea baueri	Crinkled Hop-bush			1996
	Dodonaea bursariifolia	Small Hop-bush			1960
	Dodonaea intricata	Gawler Ranges Hop-bush			1981
	Dodonaea lobulata	Lobed-leaf Hop-bush			2008
	Dodonaea microzyga var. microzyga	Brilliant Hop-bush			1990
	Dodonaea sp.	Hop-bush			2007
	Dodonaea stenozyga	Desert Hop-bush			1990
	Dodonaea viscosa ssp.	Sticky Hop-bush			2015
	Dodonaea viscosa ssp. angustissima	Narrow-leaf Hop-bush			2007
	Dodonaea viscosa ssp. spatulata	Sticky Hop-bush			1990
	Doxodasya bolbochaete				1975
	Drewiana nitella				1986
	Drosera auriculata	Tall Sundew			1996
	Drosera glanduligera	Scarlet Sundew			1994
	Drosera macrantha ssp. planchonii	Climbing Sundew			1994
	Drosera peltata (NC)	Pale Sundew			1994
	Drosera stricticaulis	Erect Sundew		V	1999
	Duboisia hopwoodii	Pituri			1903
	Dudresnaya australis				1973
	Duma florulenta	Lignum			2007
	Dysphania cristata	Crested Crumbweed			2007
	Dysphania melanocarpa f. melanocarpa (NC)	Black-fruit Goosefoot			1998
	Dysphania plantaginella	Plantain Crumbweed			1992
	Dysphania pumilio	Small Crumbweed			2007
	Dysphania rhadinostachya ssp. rhadinostachya	Green Crumbweed			1993
	Echinopogon ovatus	Rough-beard Grass		R	1994
*	*Echinopsis oxygona*				2005
*	*Echinopsis spachiana*				2005
*	*Echium plantagineum*	Salvation Jane			2015
*	*Echium sp.*	Bugloss			1994
*	*Ehrharta calycina*	Perennial Veldt Grass			1993
*	*Ehrharta longiflora*	Annual Veldt Grass			1996
	Einadia nutans ssp.	Climbing Saltbush			2015
	Einadia nutans ssp. nutans	Climbing Saltbush			2008
	Einadia nutans ssp. oxycarpa	Pointed-fruit Climbing Saltbush			1974
	Elachanthus glaber	Shiny Elachanth		R	1995
	Elachanthus pusillus	Elachanth			1999
	Elatine gratioloides	Waterwort		R	1999
	Eleocharis acuta	Common Spike-rush			1993

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Elymus scaber var. scaber (NC)	Native Wheat-grass			1994
	Embadium uncinatum	Gawler Ranges Slipper-plant			1989
*	*Emex australis*	Three-corner Jack			1996
*	*Emex spinosa*	Lesser Jack			2005
	Enchylaena tomentosa var.	Ruby Saltbush			2004
	Enchylaena tomentosa var. tomentosa	Ruby Saltbush			2009
	Enneapogon avenaceus	Common Bottle-washers			2016
	Enneapogon caerulescens	Blue Bottle-washers			1992
	Enneapogon cylindricus	Jointed Bottle-washers			1994
	Enneapogon nigricans	Black-head Grass			2014
	Enneapogon polyphyllus	Leafy Bottle-washers			2009
	Enteropogon acicularis	Umbrella Grass			2009
	Enteropogon ramosus	Umbrella Grass			1995
	Enteropogon sp.	Umbrella Grass			2009
	Epilobium billardierianum ssp. cinereum	Variable Willow-herb			1997
	Epilobium hirtigerum	Hairy Willow-herb			1969
	Eragrostis australasica	Cane-grass			2007
*	*Eragrostis barrelieri*	Pitted Love-grass			2014
*	*Eragrostis cilianensis*	Stink Grass			2004
*	*Eragrostis curvula*	African Love-grass			1997
	Eragrostis dielsii	Mulka			2007
	Eragrostis exigua	Delicate Love-grass			1997
	Eragrostis falcata	Sickle Love-grass			2003
	Eragrostis leptocarpa	Drooping Love-grass			1921
	Eragrostis setifolia	Bristly Love-grass			1992
*	*Eragrostis trichophora*	Hairyflower Lovegrass			2016
	Eremophila alternifolia	Narrow-leaf Emubush			2008
	Eremophila behriana	Rough Emubush			1981
	Eremophila crassifolia	Thick-leaf Emubush			1964
	Eremophila deserti	Turkey-bush			1998
	Eremophila duttonii	Harlequin Emubush			1990
	Eremophila glabra (NC)	Tar Bush			1992
	Eremophila glabra ssp.	Tar Bush			2008
	Eremophila glabra ssp. glabra	Tar Bush			2007
	Eremophila latrobei ssp. glabra	Crimson Emubush			2007
	Eremophila longifolia	Weeping Emubush			2009
	Eremophila oppositifolia ssp.	Opposite-leaved Emubush			2008
	Eremophila oppositifolia ssp. oppositifolia	Opposite-leaved Emubush			2001
	Eremophila santalina	Sandalwood Emubush			1994
	Eremophila scoparia	Broom Emubush			2008
	Eremophila serrulata	Green Emubush			1996
	Eriochiton sclerolaenoides	Woolly-fruit Bluebush			2008
	Eriochlamys behrii	Woolly Mantle			1996
	Eriochlamys behrii (NC)	Woolly Mantle			1996
	Eriochloa australiensis	Australian Cupgrass			1993
	Eriochloa pseudoacrotricha	Perennial Cupgrass			1992
	Erodiophyllum elderi	Koonamore Daisy			1990
*	*Erodium aureum*				1994
*	*Erodium botrys*	Long Heron's-bill			1996
	Erodium carolinianum	Clammy Heron's-bill			1974

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Erodium cicutarium*	Cut-leaf Heron's-bill			2007
	Erodium crinitum	Blue Heron's-bill			1996
	Erodium cygnorum	Blue Heron's-bill			1969
	Erodium cygnorum ssp. (NC)	Blue Heron's-bill			1975
	Erodium cygnorum ssp. glandulosum (NC)	Clammy Heron's-bill			1994
	Erodium janszii	Clammy Heron's-bill			1900
*	*Erodium moschatum*	Musky Herons-bill			1994
	Erodium sp.	Heron's-bill/Crowfoot			2007
*	*Eruca sativa*	Purple-vein Rocket			1986
	Eryngium ovinum	Blue Devil		V	1994
	Erythroclonium muelleri				1973
	Erythrotrichia carnea				1987
	Eucalyptus albens	White Box		R	1986
	Eucalyptus behriana	Broad-leaf Box		R	1941
	Eucalyptus brachycalyx	Gilja			2007
	Eucalyptus cajuputea	Green Mallee		R*	2000
	Eucalyptus calcareana	Nundroo Mallee			1977
	Eucalyptus camaldulensis ssp.	River Red Gum			2009
	Eucalyptus camaldulensis ssp. camaldulensis	River Red Gum			1996
	Eucalyptus camaldulensis ssp. minima	River Red Gum			2001
	Eucalyptus camaldulensis var. camaldulensis (NC)	River Red Gum			1994
	Eucalyptus cladocalyx (NC)	Sugar Gum			1998
	Eucalyptus cladocalyx ssp. petila	Sugar Gum			2003
	Eucalyptus concinna	Victoria Desert Mallee			1991
	Eucalyptus dumosa	White Mallee			1994
	Eucalyptus flindersii	Flinders Grey Mallee			1995
	Eucalyptus goniocalyx (NC)	Long-leaf Box			1994
	Eucalyptus goniocalyx ssp. goniocalyx	Long-leaf Box			1984
	Eucalyptus gracilis	Yorrell			2009
	Eucalyptus intertexta	Gum-barked Coolibah			2007
	Eucalyptus leptophylla (NC)	Narrow-leaf Red Mallee			1995
	Eucalyptus leucoxylon ssp.	South Australian Blue Gum			1998
	Eucalyptus leucoxylon ssp. leucoxylon	South Australian Blue Gum			1994
	Eucalyptus leucoxylon ssp. pruinosa	Inland South Australian Blue Gum			2001
	Eucalyptus microcarpa	Grey Box			2015
	Eucalyptus odorata	Peppermint Box			1998
	Eucalyptus odorata (NC)	Peppermint Box			2009
	Eucalyptus oleosa (NC)	Red Mallee			1998
	Eucalyptus oleosa ssp.				2008
	Eucalyptus oleosa ssp. ampliata	Red Mallee			1968
	Eucalyptus oleosa ssp. oleosa	Red Mallee			1954
	Eucalyptus percostata	Ribbed White Mallee		R	2006
	Eucalyptus polybractea	Flinders Ranges Box		R	1999
	Eucalyptus porosa	Mallee Box			2009
	Eucalyptus socialis (NC)	Beaked Red Mallee			2004
	Eucalyptus socialis ssp.	Beaked Red Mallee			2009
	Eucalyptus socialis ssp. socialis	Beaked Red Mallee			2007

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Eucalyptus socialis ssp. viridans	Beaked Red Mallee			1975
	Eucalyptus sp.				2009
	Eucalyptus viridis ssp. viridis (NC)	Green Mallee		R	2009
	Euchiton involucratus (NC)	Star Cudweed			1994
	Euchiton sphaericus	Annual Cudweed			1998
*	Euphorbia cyathophora				1986
	Euphorbia dallachyana	Caustic Weed			1999
*	Euphorbia dendroides	Tree Spurge			1997
	Euphorbia drummondii (NC)				2007
	Euphorbia flindersica				1916
	Euphorbia inappendiculata var. queenslandica				
	Euphorbia multifaria				1992
*	Euphorbia paralias	Sea Spurge			1975
*	Euphorbia peplus	Petty Spurge			1990
	Euphorbia stevenii	Bottletree Spurge			2007
	Euphorbia tannensis ssp. eremophila	Desert Spurge			2010
*	Euphorbia terracina	False Caper			2007
	Euphorbia thelephora var. australis				1993
	Euphorbia wheeleri	Wheeler's Spurge			1998
	Euphorbiaceae sp.	Spurge Family			2007
	Eutaxia diffusa	Large-leaf Eutaxia			1992
	Eutaxia microphylla	Common Eutaxia			1996
	Eutaxia sp.	Eutaxia			1994
	Exocarpos aphyllus	Leafless Cherry			2015
	Exocarpos cupressiformis	Native Cherry			2001
	Exocarpos syrticola	Coast Cherry			1996
	Feldmannia globifera				1975
	Festuca benthamiana	Bentham's Fescue		R	2000
*	Ficus carica	Edible Fig			2001
	Fissidens megalotis				1986
	Frankenia crispa	Hoary Sea-heath			1998
	Frankenia cupularis			R	1993
	Frankenia pauciflora var.	Southern Sea-heath			2008
	Frankenia pauciflora var. fruticulosa	Southern Sea-heath			1998
	Frankenia pauciflora var. gunnii	Southern Sea-heath			2004
	Frankenia serpyllifolia	Thyme Sea-heath			1996
	Frankenia sessilis	Small-leaf Sea-heath			1998
	Frankenia sp.	Sea-heath			1987
	Fulgensia bracteata				1969
*	Fumaria capreolata	White-flower Fumitory			1996
*	Fumaria densiflora	Dense Fumitory			1994
*	Fumaria muralis ssp.	Wall Fumitory			1994
*	Fungus sp.				2007
*	Galenia pubescens var. pubescens	Coastal Galenia			2007
*	Galenia secunda	Galenia			1998
	Galium binifolium (NC)	Reflexed Bedstraw			1994
	Galium gaudichaudii (NC)	Rough Bedstraw			1994
	Galium leptogonium	Reflexed Bedstraw			1974
	Galium microlobum	Rough Bedstraw			2008

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Galium migrans (NC)	Loose Bedstraw			1996
	Galium migrans ssp. inversum	Loose Bedstraw			1992
*	*Galium murale*	Small Bedstraw			1996
	Galium sp.	Bedstraw			1994
*	*Galium spurium*	Bedstraw			1999
*	*Gastridium phleoides*	Nit-grass			1997
	Gattya pinnella				1975
*	*Gazania linearis*	Gazania			1996
*	*Gazania sp.*	Gazania			2010
	Geastrum triplex				2000
	Geijera linearifolia	Sheep Bush			2008
	Gelinaria ulvoidea				1980
	Geococcus pusillus	Earth Cress			1994
*	*Geranium dissectum*	Cut-leaf Geranium			1987
*	*Geranium molle var. molle*	Soft Geranium			1986
	Geranium potentilloides var. potentilloides	Downy Geranium			1994
	Geranium retrorsum	Grassland Geranium			1999
	Geranium solanderi	Austral Geranium			1999
	Geranium sp.	Geranium			1994
	Giraudia robusta				1979
*	*Glaucium corniculatum*	Bristly Horned-poppy			2015
	Glinus lotoides	Hairy Carpet-weed			1993
	Glischrocaryon behrii	Golden Pennants			1992
	Glischrocaryon flavescens	Yellow Pennants			1992
	Gloiosaccion brownii				1980
	Glossocardia bidens	Native Cobbler's-pegs			1997
	Glycine canescens	Silky Glycine			1991
	Glycine clandestina var. (NC)	Twining Glycine			1999
	Glycine rubiginosa	Twining Glycine			2007
	Gnaphalium indutum ssp. indutum	Tiny Cudweed			1994
	Gnephosis arachnoidea	Spidery Button-flower			1998
	Gnephosis tenuissima	Dwarf Golden-tip			1996
	Gonocarpus elatus	Hill Raspwort			2015
	Gonocarpus mezianus	Broad-leaf Raspwort			1990
	Gonocarpus sp.	Raspwort			1994
	Gonocarpus tetragynus	Small-leaf Raspwort			1994
	Goodenia albiflora	White Goodenia			2015
	Goodenia amplexans	Clasping Goodenia			1996
	Goodenia berardiana	Split-end Goodenia			1994
	Goodenia calcarata	Streaked Goodenia			1992
	Goodenia cycloptera	Serrated Goodenia			1996
	Goodenia fascicularis	Silky Goodenia			2007
	Goodenia glabra	Smooth Goodenia			1992
	Goodenia havilandii	Hill Goodenia			1990
	Goodenia lunata	Stiff Goodenia			2007
	Goodenia ovata	Hop Goodenia			1999
	Goodenia pinnatifida	Cut-leaf Goodenia			2015
	Goodenia pusilliflora	Small-flower Goodenia			2010
	Goodenia robusta	Woolly Goodenia			1994
	Goodenia sp.	Goodenia			1995
	Goodenia willisiana	Silver Goodenia			1974

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Gossypium sturtianum var. sturtianum	Sturt's Desert Rose			1993
	Gracilaria cliftonii				1980
	Gramineae sp.	Grass Family			1997
	Gratwickia monochaeta			R	2007
	Grevillea huegelii	Comb Grevillea			2007
	Grevillea lavandulacea ssp. lavandulacea	Spider-flower			1994
	Grevillea lavandulacea var. sericea (NC)	Spider-flower			1994
	Grevillea nematophylla ssp. nematophylla	Water Bush			1991
	Griffithsia monilis var. monilis				1976
	Gunniopsis calva				1996
	Gunniopsis quadrifida	Sturt's Pigface			1992
*	*Gypsophila tubulosa*	Annual Chalkwort			1999
	Gyrostemon thesioides	Broom Wheel-fruit			1998
	Haeckeria cassiniiformis	Dogwood Haeckeria		R	2006
	Haeckeria punctulata	Sticky Haeckeria			2001
*	*Hainardia cylindrica*	Common Barb-grass			1997
	Hakea ednieana	Flinders Ranges Corkwood			1999
	Hakea francisiana	Bottlebrush Hakea			1966
	Hakea leucoptera ssp. leucoptera	Silver Needlewood			2009
	Hakea rostrata	Beaked Hakea			1914
	Halgania cyanea	Rough Blue-flower			1990
	Halophila australis	Paddle Weed			1973
	Haloplegma duperreyi				1980
	Halopteris platycena				1978
	Halopteris pseudospicata				1978
	Haloragis aspera	Rough Raspwort			1999
	Haloragis gossei	Gosse's Raspwort			1992
	Haloragis sp.	Raspwort			1994
	Halosarcia sp. (NC)	Samphire			2004
	Halydictyon arachnoideum				2007
	Hardenbergia violacea	Native Lilac			1994
	Harmsiodoxa brevipes var. brevipes	Short Cress			1941
*	*Helianthus annuus*	Sunflower			2004
	Helichrysum leucopsideum	Satin Everlasting			1915
*	*Heliotropium amplexicaule*	Blue Heliotrope			1996
	Heliotropium asperrimum	Rough Heliotrope			1990
*	*Heliotropium curassavicum*	Smooth Heliotrope			1998
	Heliotropium europaeum	Common Heliotrope			2014
*	*Heliotropium supinum*	Creeping Heliotrope			1998
	Hemichroa diandra	Mallee Hemichroa			2010
	Herb sp.				1992
*	*Herniaria cinerea*	Rupturewort			1998
	Herposiphonia rostrata				1974
	Herposiphonia versicolor				1987
	Heterosiphonia australis				1976
	Heterosiphonia gunniana				1973
	Heterosiphonia lawrenciana				1973
	Hibbertia exutiacies	Prickly Guinea-flower			1999

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Hibbertia riparia (NC)	Guinea-flower			1990
	Hibiscus krichauffianus	Velvet-leaf Hibiscus			1995
	Hibiscus sturtii var. grandiflorus	Sturt's Hibiscus			1993
	Hincksia sordida				2007
*	*Hirschfeldia incana*	Hoary Mustard			1999
	Hirsutithallia angustata				2007
*	*Hordeum glaucum*	Blue Barley-grass			1999
*	*Hordeum hystrix*	Mediterranean Barley-grass			1986
*	*Hordeum leporinum*	Wall Barley-grass			2009
*	*Hordeum marinum*	Sea Barley-grass			1994
*	*Hordeum sp.*	Barley-grass			2007
	Hormophysa cuneiformis				1950
	Hormosira banksii f. billardieri				1978
*	*Hornungia procumbens*	Oval Purse			1996
	Hovea purpurea	Tall Hovea		R	2001
	Hyalosperma demissum	Dwarf Sunray			1994
	Hyalosperma glutinosum ssp. glutinosum	Golden Sunray			1996
	Hyalosperma semisterile	Orange Sunray			1996
	Hyalosperma sp.	Sunray			1994
	Hybanthus floribundus ssp. floribundus	Shrub Violet			2015
	Hybanthus monopetalus	Slender Violet			1994
	Hydrocotyle callicarpa	Tiny Pennywort			1994
	Hydrocotyle laxiflora	Stinking Pennywort			1994
	Hydrocotyle pilifera var. glabrata	Buttercup Pennywort			1974
	Hydrocotyle trachycarpa	Wild Parsley			1994
*	*Hypericum perforatum*	St John's Wort			1998
*	*Hypochaeris glabra*	Smooth Cat's Ear			2015
*	*Hypochaeris radicata*	Rough Cat's Ear			1995
	Hypoxis sp.	Yellow Star-lily			1994
	Imperata cylindrica	Blady Grass			1997
	Indigofera australis ssp. australis	Austral Indigo			2015
	Indigofera australis ssp. hesperia	Austral Indigo			1994
	Indigofera australis var. australis (NC)	Austral Indigo			1994
	Indigofera leucotricha (NC)	Silver Indigo			1994
	Inocybe emergens				2000
*	*Ipomoea cairica*	Mile-a-minute			1975
	Isoetopsis graminifolia	Grass Cushion			1994
	Isolepis australiensis	Southern Club-rush			1999
	Isolepis cernua	Nodding Club-rush			1994
	Isolepis congrua	Slender Club-rush			1997
	Isolepis hookeriana	Grassy Club-rush			1994
	Isolepis inundata	Swamp Club-rush			1982
*	*Isolepis marginata*	Little Club-rush			1997
	Isotoma petraea	Rock Isotome			1998
	Ixiochlamys cuneifolia	Silverton Daisy			1992
	Ixiochlamys nana	Small Fuzzweed			1992
	Ixodia achillaeoides ssp. alata	Hills Daisy			1913
	Jasminum didymum ssp. lineare	Native Jasmine			1994
*	*Juncus acutus*	Sharp Rush			1997
	Juncus aridicola	Inland Rush			1999

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Juncus bufonius	Toad Rush			1999
	Juncus caespiticius	Grassy Rush			1994
	Juncus flavidus	Yellow Rush			1994
	Juncus subsecundus	Finger Rush			1999
*	*Kickxia elatine ssp. crinita*	Twining Toadflax			1994
	Kuckuckia spinosa				1976
	Lachnagrostis aemula (NC)	Blown-grass			1994
	Lachnagrostis filiformis	Common Blown-grass			1999
*	*Lactuca serriola (NC)*	Prickly Lettuce			1994
*	*Lactuca serriola f. serriola*	Prickly Lettuce			1992
*	*Lactuca sp.*	Lettuce			1975
	Lagenophora huegelii	Coarse Bottle-daisy			1999
*	*Lagunaria patersonii*	Pyramid Tree			1989
*	*Lamarckia aurea*	Toothbrush Grass			2015
*	*Lamium amplexicaule var. amplexicaule*	Deadnettle			1994
	Lasiopetalum discolor	Coast Velvet-bush			1992
	Laurencia forsteri				1976
	Laurencia majuscula				1974
	Lawrencella davenportii	Davenport Daisy			1915
	Lawrencia glomerata	Clustered Lawrencia			2016
	Lawrencia sp.	Lawrencia			1996
	Lawrencia squamata	Thorny Lawrencia			2007
	Leiocarpa leptolepis	Pale Plover-daisy			1985
	Leiocarpa semicalva ssp.	Hill Button-bush			1999
	Leiocarpa semicalva ssp. semicalva	Scented Button-bush			2010
	Leiocarpa sp.	Plover-daisy			1994
	Leiocarpa tomentosa	Woolly Plover-daisy			2009
	Leiocarpa websteri	Narrow Plover-daisy			2009
	Lemooria burkittii	Wires-and-wool			1990
*	*Leontodon rhagadioloides*	Cretan Weed			2015
*	*Lepidium africanum*	Common Peppercress			2012
	Lepidium fasciculatum	Bundled Peppercress			1992
	Lepidium leptopetalum	Shrubby Peppercress			1996
	Lepidium oxytrichum	Green Peppercress			1990
	Lepidium papillosum	Warty Peppercress			1999
	Lepidium phlebopetalum	Veined Peppercress			2008
	Lepidium pseudotasmanicum	Shade Peppercress		V	1994
	Lepidium rotundum	Veined Peppercress			1975
	Lepidosperma viscidum	Sticky Sword-sedge			2003
	Lepiota subcristata				2000
	Leptorhynchos elongatus	Lanky Buttons		R	1994
	Leptorhynchos scaber	Annual Buttons		R	1992
	Leptorhynchos sp.	Buttons			1992
	Leptorhynchos squamatus ssp. squamatus	Scaly Buttons			2015
	Leptorhynchos tetrachaetus	Little Buttons			1992
	Leptorhynchos waitzia	Button Immortelle			2009
	Leucochrysum molle	Hoary Sunray			2009
*	*Leucojum aestivum*	Snowflake			2004
	Levenhookia dubia	Hairy Stylewort			1999
	Lichen sp.				1997

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Liliaceae sp.	Lily Family			1994
*	*Limonium binervosum*	Dwarf Sea-lavender			1998
*	*Limonium companyonis*	Sea-lavender			2015
*	*Limonium diffusum*				1989
*	*Limonium lobatum*	Winged Sea-lavender			2015
*	*Limonium sinuatum*	Notch-leaf Sea-lavender			1987
*	*Limonium sp.*	Sea-lavender			1994
	Limosella australis	Australian Mudwort			1990
*	*Linaria incarnata*				1993
	Linum marginale	Native Flax			1999
*	*Linum trigynum*	French Flax			1994
	Lobelia gibbosa	Tall Lobelia			1999
	Lobelia gibbosa (NC)	Tall Lobelia			1992
	Lobophora variegata				1978
	Logania saxatilis	Rock Logania		R	1996
*	*Lolium loliaceum*	Stiff Ryegrass			1992
*	*Lolium perenne*	Perennial Ryegrass			1992
*	*Lolium rigidum*	Wimmera Ryegrass			2009
*	*Lolium sp.*	Ryegrass			1994
	Lomandra collina	Sand Mat-rush			2007
	Lomandra densiflora	Soft Tussock Mat-rush			1999
	Lomandra effusa	Scented Mat-rush			2007
	Lomandra leucocephala ssp. robusta	Woolly Mat-rush			1992
	Lomandra micrantha ssp.	Small-flower Mat-rush			1994
	Lomandra multiflora ssp. dura	Hard Mat-rush			2009
	Lomandra sp.	Mat-rush			1994
	Lomentaria australis				1976
	Lotus australis	Austral Trefoil			1997
	Lotus cruentus	Red-flower Lotus			2007
	Luzula meridionalis	Common Wood-rush			2001
	Lycium australe	Australian Boxthorn			2009
*	*Lycium ferocissimum*	African Boxthorn			2015
	Lysiana exocarpi ssp. exocarpi	Harlequin Mistletoe			1999
	Lythrum hyssopifolia	Lesser Loosestrife			1990
	Lythrum wilsonii	Wilson's Loosestrife			1993
	Macrothamnion secundum				1980
	Maireana aphylla	Cotton-bush			1994
	Maireana appressa	Pale-fruit Bluebush			2009
	Maireana astrotricha	Low Bluebush			2007
	Maireana brevifolia	Short-leaf Bluebush			2009
	Maireana cannonii	Cannon's Bluebush			1999
	Maireana carnosa	Cottony Bluebush			1960
	Maireana ciliata	Hairy Fissure-plant			1992
	Maireana enchylaenoides	Wingless Fissure-plant			1999
	Maireana eriantha	Woolly Bluebush			1990
	Maireana erioclada	Rosy Bluebush			2009
	Maireana excavata	Bottle Fissure-plant		V	1996
	Maireana georgei	Satiny Bluebush			2001
	Maireana integra	Entire-wing Bluebush			1994
	Maireana lobiflora	Lobed Bluebush			1992
	Maireana microcarpa	Swamp Bluebush			1992

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			Aus	SA	
	Maireana oppositifolia	Salt Bluebush			1998
	Maireana pentatropis	Erect Mallee Bluebush			2007
	Maireana planifolia	Flat-leaf Bluebush			1994
	Maireana pyramidata	Black Bluebush			2009
	Maireana radiata	Radiate Bluebush			1996
	Maireana schistocarpa	Split-fruit Bluebush			2001
	Maireana sedifolia	Bluebush			2009
	Maireana sp.	Bluebush/Fissure-plant			2009
	Maireana spongiocarpa	Spongy-fruit Bluebush			1992
	Maireana tomentosa ssp. urceolata (NC)				2007
	Maireana trichoptera	Hairy-fruit Bluebush			2008
	Maireana triptera	Three-wing Bluebush			2007
	Maireana turbinata	Top-fruit Bluebush			1998
	Malacocera gracilis	Slender Soft-horns		V	2010
	Malacocera tricornis	Goat-head Soft-horns			1996
*	*Malcolmia flexuosa*				1999
*	*Malva parviflora*	Small-flower Marshmallow			1996
	Malva preissiana	Australian Hollyhock			1992
*	*Marrubium vulgare*	Horehound			2015
	Marsdenia australis	Native Pear			2007
	Marsilea drummondii	Common Nardoo			1983
	Marsilea hirsuta	Short-fruit Nardoo			1993
*	*Medicago minima var. minima*	Little Medic			2015
*	*Medicago polymorpha var. polymorpha*	Burr-medic			2001
*	*Medicago praecox*	Small-leaf Burr-medic			1999
*	*Medicago scutellata*	Snail Medic			1994
*	*Medicago sp.*	Medic			2009
*	*Medicago truncatula*	Barrel Medic			1996
	Melaleuca interioris	Broombush			2007
	Melaleuca lanceolata	Dryland Tea-tree			2007
	Melaleuca lanceolata ssp. lanceolata (NC)	Dryland Tea-tree			2004
	Melaleuca uncinata	Broombush			2007
*	*Melia azedarach*	White Cedar			2001
	Melicytus angustifolius ssp. divaricatus	Tree Violet			2015
*	*Melilotus indicus*	King Island Melilot			1998
*	*Melinis repens*	Red Natal Grass			2002
	Menkea crassa	Fat Spectacles			1991
*	*Mesembryanthemum aitonis*	Angled Iceplant			2001
*	*Mesembryanthemum crystallinum*	Common Iceplant			2008
*	*Mesembryanthemum nodiflorum*	Slender Iceplant			2008
*	*Mesembryanthemum sp.*	Iceplant			1998
	Microbryum starckeanum				1953
	Microlaena stipoides var. stipoides	Weeping Rice-grass			1994
	Micropeuce feredayae				1980
	Microseris lanceolata	Yam Daisy			2015
	Microtis arenaria	Notched Onion-orchid			1999
	Microtis frutetorum				1999
	Microtis parviflora	Slender Onion-orchid			1996
	Microtis sp.	Onion-orchid			1994

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Microtis unifolia				1992
	Microtis unifolia complex	Onion-orchid			1992
	Millotia muelleri	Common Bow-flower			1994
	Millotia myosotidifolia	Broad-leaf Millotia			1999
	Millotia perpusilla	Tiny Bow-flower			1999
	Millotia sp.	Millotia/Bow-flower			1994
	Millotia tenuifolia var.	Soft Millotia			1994
	Millotia tenuifolia var. tenuifolia	Soft Millotia			1996
*	*Minuartia mediterranea*	Slender Sandwort			1974
	Minuria annua	Annual Minuria			1994
	Minuria cunninghamii	Bush Minuria			2016
	Minuria denticulata	Woolly Minuria			1992
	Minuria integerrima	Smooth Minuria			2008
	Minuria leptophylla	Minnie Daisy			1996
	Mitrasacme paradoxa (NC)	Wiry Mitrewort			1994
*	*Moenchia erecta*	Erect Chickweed			1994
	Mollugo cerviana	Wire-stem Chickweed			2007
	Monachather paradoxus	Bandicoot Grass			1992
*	*Monoculus monstrosus*	Tripteris			1996
*	*Moraea setifolia*	Thread Iris			1996
	Moss sp.				1996
	Mychodea carnosa				1973
	Myoporum insulare	Common Boobialla			2001
	Myoporum montanum	Native Myrtle			2009
	Myoporum parvifolium	Creeping Boobialla		R	2009
	Myoporum petiolatum	Sticky Boobialla			1994
	Myoporum platycarpum (NC)	False Sandalwood			1986
	Myoporum platycarpum ssp.	False Sandalwood			2004
	Myoporum platycarpum ssp. perbellum	Mallee Sandalwood			1992
	Myoporum platycarpum ssp. platycarpum	False Sandalwood			2009
	Myoporum viscosum (NC)	Sticky Boobialla			1994
	Myriophyllum verrucosum	Red Milfoil			1993
*	*Narcissus jonquilla*	Jonquill			2004
	Nemacystus novae-zelandiae				1973
*	*Nicotiana glauca*	Tree Tobacco			2004
	Nicotiana goodspeedii	Small-flower Tobacco			2008
	Nicotiana maritima	Coast Tobacco			2000
	Nicotiana occidentalis ssp. obliqua	Western Tobacco			1992
	Nicotiana simulans	Native Tobacco			1992
	Nicotiana sp.	Tobacco			2007
	Nicotiana sp. Corunna (D.E.Symon 17088)				2010
	Nicotiana velutina	Velvet Tobacco			2009
	Nitraria billardierei	Nitre-bush			2009
*	*Oenothera stricta ssp. stricta*	Common Evening Primrose			2002
*	*Olea europaea ssp.*	Olive			2015
*	*Olea europaea ssp. europaea*	Olive			1994
	Olearia axillaris	Coast Daisy-bush			1996
	Olearia calcarea	Crinkle-leaf Daisy-bush			2008
	Olearia decurrens	Winged Daisy-bush			2006
	Olearia exiguifolia	Lobed-leaf Daisy-bush			2007

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			Aus	SA	
	Olearia floribunda	Heath Daisy-bush			2008
	Olearia muelleri	Mueller's Daisy-bush			1996
	Olearia pannosa ssp.	Silver Daisy-bush			1994
	Olearia pannosa ssp. cardiophylla	Velvet Daisy-bush		R	1999
	Olearia pannosa ssp. pannosa	Silver Daisy-bush	VU	V	1996
	Olearia picridifolia	Rasp Daisy-bush		R	1992
	Olearia pimeleoides	Pimelea Daisy-bush			2015
	Olearia pimeleoides ssp. (NC)	Pimelea Daisy-bush			1996
	Olearia ramulosa	Twiggy Daisy-bush			1999
	Olearia sp.	Daisy-bush			1992
	Olearia tubuliflora	Rayless Daisy-bush			1994
*	*Oligocarpus calendulaceus*				1999
	Omphalolappula concava	Burr Stickseed			2001
*	*Onopordum acanthium*	Scotch Thistle			1986
*	*Onopordum acaulon*	Horse Thistle			1987
*	*Onopordum sp.*	Thistle			1994
	Opercularia turpis	Twiggy Stinkweed			1994
	Ophioglossum lusitanicum	Austral Adder's-tongue			1994
*	*Opuntia elata*	Riverina Pear			2005
*	*Opuntia elatior*				1985
*	*Opuntia engelmannii*				1983
*	*Opuntia ficus-indica*	Indian Fig			2005
*	*Opuntia linguiformis*				2006
*	*Opuntia microdasys*	Bunny-ears			2006
*	*Opuntia microdasys (NC)*	Bunny-ears			1992
*	*Opuntia monacantha*	Drooping Prickly Pear			1990
*	*Opuntia polyacantha var. erinacea*	Grizzly Bear Cactus			2004
*	*Opuntia puberula*				2005
*	*Opuntia robusta*	Wheel Pear			2005
*	*Opuntia sp. (NC)*	Prickly Pear			1996
*	*Opuntia stricta*	Erect Prickly Pear			2005
*	*Opuntia tomentosa*	Velvet Pear			1985
*	*Orbea variegata*	Carrion-flower			2007
	Orchidaceae sp.	Orchid Family			1987
	Orobanche cernua var. australiana	Australian Broomrape		R	1975
	Osteocarpum acropterum var. acropterum	Tuberculate Bonefruit			1996
	Osteocarpum acropterum var. deminutum	Wingless Bonefruit		R	1920
	Osteocarpum dipterocarpum	Two-wing Bonefruit			2009
	Osteocarpum pentapterum	Five-wing Bonefruit		E	1974
	Osteocarpum salsuginosum	Inland Bonefruit			2008
	Owenia acidula	Sour Plum			1991
*	*Oxalis bowiei*	Bowie Wood-sorrel			1992
	Oxalis perennans	Native Sorrel			2015
	Oxalis perennans (NC)	Native Sorrel			1999
*	*Oxalis pes-caprae*	Soursob			2001
	Oxalis radicosa	Downy Native Sorrel			1994
	Oxalis sp.	Sorrel			1994
	Ozothamnus retusus	Notched Bush-everlasting			2008
	Ozothamnus scaber	Rough Bush-everlasting		V	1999
	Pachydictyon polycladum				1978

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			Aus	SA	
	Pachymitus cardaminoides	Sand Cress			1991
*	*Panicum capillare var. brevifolium*	Witch-grass			1993
	Panicum decompositum var. decompositum	Native Millet			1998
	Panicum effusum var. effusum	Hairy Panic			2007
*	*Papaver aculeatum*	Bristle Poppy			1900
*	*Papaver hybridum*	Rough Poppy			1997
*	*Papaver sp.*	Poppy			1994
	Paractaenum novae-hollandiae ssp. reversum	Barbed-wire Grass			1937
	Paractaenum refractum	Bristle-brush Grass			1945
*	*Parapholis incurva*	Curly Ryegrass			1996
*	*Parentucellia latifolia*	Red Bartsia			1994
	Parietaria cardiostegia	Mallee Smooth-nettle			1996
	Parietaria debilis	Smooth-nettle			1994
	Parietaria debilis (NC)	Smooth-nettle			1996
*	*Parkinsonia aculeata*	Jerusalem Thorn			1985
*	*Paspalum vaginatum*	Salt-water Couch			1988
	Pauridia glabella var. glabella	Tiny Star			1994
	Pauridia vaginata var. vaginata	Yellow Star			1990
*	*Peganum harmala*	African Rue			2009
	Pelargonium sp.	Storks-bill			1994
*	*Pentameris airoides ssp. airoides*	False Hair-grass			1996
*	*Pentameris pallida*	Pussy Tail			1998
*	*Periballia minuta*	Small Hair-grass			1992
	Persicaria decipiens (NC)	Slender Knotweed			1994
	Persicaria prostrata	Creeping Knotweed			1999
	Petalostylis labicheoides	Butterfly Bush			1963
*	*Petrorhagia dubia*	Velvet Pink			1994
*	*Phalaris minor*	Lesser Canary-grass			1980
*	*Phalaris paradoxa*	Paradox Canary-grass			1992
*	*Phalaris sp.*	Canary Grass			1994
	Pheladenia deformis	Bluebeard Orchid			1994
	Philotheca linearis	Narrow-leaf Wax-flower			2008
	Phlegmatospermum cochlearinum	Downy Cress			2001
	Phragmites australis	Common Reed			1997
	Phyllangium sulcatum			V	1992
	Phyllanthus fuernrohrii	Sand Spurge			2007
	Phyllanthus lacunarius	Lagoon Spurge			2007
	Phyllanthus oblanceolatus	Sandhill Spurge			1992
	Phyllanthus saxosus	Rock Spurge			1997
*	*Picnomon acarna*	Soldier Thistle			2009
	Picris angustifolia ssp. angustifolia	Coast Picris			1999
	Picris angustifolia ssp. angustifolia (NC)	Coast Picris			1994
	Pimelea curviflora var.	Curved Riceflower			1994
	Pimelea glauca	Smooth Riceflower			1994
	Pimelea imbricata var. petraea	Rock Woolly Riceflower			1993
	Pimelea micrantha	Silky Riceflower			1999
	Pimelea microcephala ssp.	Shrubby Riceflower			2008
	Pimelea microcephala ssp. microcephala	Shrubby Riceflower			2009
	Pimelea simplex ssp.	Desert Riceflower			1975

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Pimelea simplex ssp. continua	Desert Riceflower			1992
	Pimelea simplex ssp. simplex	Desert Riceflower			1996
	Pimelea stricta	Erect Riceflower			2001
	Pimelea trichostachya	Spiked Riceflower			1990
*	*Piptatherum miliaceum*	Rice Millet			2010
	Pittosporum angustifolium	Native Apricot			2015
	Pittosporum sp.	Pittosporum			1994
	Plagiobothrys elachanthus	Hairy Forget-me-not			1994
	Plagiobothrys plurisepaleus	White Rochelia			1995
	Plantago cunninghamii	Clay Plantain			1984
	Plantago debilis	Shade Plantain			1999
	Plantago drummondii	Dark Plantain			2008
	Plantago gaudichaudii	Narrow-leaf Plantain			1994
	Plantago hispida	Hairy Plantain			1996
*	*Plantago lanceolata var.*	Ribwort			2009
	Plantago sp.	Plantain			2007
	Plantago sp. B (R.Bates 44765)	Little Plantain			1995
	Plantago turrifera	Crowned Plantain			1994
	Plantago varia complex	Native Plantain			1994
	Platysiphonia delicata				1976
	Platysiphonia mutabilis				1975
	Plectranthus intraterraneus	Inland Spur-flower			1987
	Pleurosorus rutifolius	Blanket Fern			2010
	Pleurosorus subglandulosus	Clubbed Blanket Fern			1974
*	*Poa annua (NC)*	Winter Grass			1994
*	*Poa bulbosa*	Bulbous Meadow-grass			1999
	Poa crassicaudex	Thick-stem Tussock-grass			2000
	Poa drummondiana	Knotted Poa		R	2000
	Poa fordeana	Forde's Poa			1900
*	*Poa infirma*	Winter Grass			1999
	Poa labillardieri var. labillardieri	Common Tussock-grass			1998
*	*Poa pratensis*	Kentucky Blue-grass			1994
	Poa sp.	Meadow-grass/Tussock-grass			1996
	Podolepis aristata ssp. affinis	Grey Copper-wire Daisy			1960
	Podolepis capillaris	Wiry Podolepis			2007
	Podolepis jaceoides	Showy Copper-wire Daisy		R	1924
	Podolepis tepperi	Delicate Copper-wire Daisy			1994
	Podotheca angustifolia	Sticky Long-heads			1996
	Pogonolepis muelleriana	Stiff Cup-flower			2001
	Pollexfenia pedicellata				1987
	Polycalymma stuartii	Poached-egg Daisy			1996
*	*Polycarpon tetraphyllum*	Four-leaf Allseed			1999
*	*Polygonum aviculare*	Wireweed			1980
*	*Polygonum aviculare (NC)*	Wireweed			1994
	Polygonum plebeium	Small Knotweed			1994
*	*Polypogon monspeliensis*	Annual Beard-grass			1997
*	*Polypogon viridis*	Water Bent			1994
	Polysiphonia amphibolis				1978
	Polysiphonia crassiuscula				1987
	Polysiphonia decipiens				1978
	Polysiphonia infestans				1978

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Polysiphonia teges				1982
	Pomaderris paniculosa ssp. paniculosa	Mallee Pomaderris			1999
	Pomaderris sp.	Pomaderris			1994
	Pomax umbellata	Pomax			1998
	Poranthera microphylla	Small Poranthera			1990
	Portulaca intraterranea	Buttercup Purslane			1997
	Portulaca oleracea	Common Purslane			2007
*	*Portulacaria afra*	Dwarf Jade Plant			2012
	Posidonia angustifolia	Narrow-leaf Tapeweed			1973
	Posidonia australis	Southern Tapeweed			1977
	Posidonia sinuosa	Narrow-leaf Tapeweed			1978
	Prasophyllum occidentale	Plains Leek-orchid			1999
	Prasophyllum odoratum	Scented Leek-orchid			1983
	Prasophyllum odoratum (NC)	Scented Leek-orchid			1994
	Prasophyllum pallidum	Pale Leek-orchid	VU	R	2009
	Prasophyllum patens (NC)	Broad-lip Leek-orchid			1992
	Prasophyllum validum	Mount Remarkable Leek-orchid	VU	V	1994
*	*Proboscidea louisianica*	Purple-flower Devil's Claw			1994
*	*Prosopis juliflora*	Mesquite			1989
	Prostanthera althoferi ssp. longifolia				1990
	Prostanthera behriana	Downy Mintbush			1994
	Prostanthera spinosa	Spiny Mintbush			1963
	Prostanthera striatiflora	Striated Mintbush			2006
	Protokuetzingia australasica				1978
*	*Prunus domestica ssp. domestica*	Plum			1987
*	*Prunus persica var. persica*	Peach			1990
*	*Prunus sp.*	Plum			1994
	Pseudognaphalium luteoalbum	Jersey Cudweed			1994
*	*Psilocaulon granulicaule*	Match-head Plant			1997
	Psoralea patens (NC)	Spreading Scurf-pea			1986
	Pterocaulon sphacelatum	Apple-bush			1990
	Pterostylis aff. excelsa (NC)	Dryland Greenhood			1994
	Pterostylis biseta	Two-bristle Greenhood			2015
	Pterostylis biseta (NC)	Two-bristle Greenhood			1998
	Pterostylis excelsa	Dryland Greenhood			1992
	Pterostylis mutica	Midget Greenhood			2000
	Pterostylis nana	Dwarf Greenhood			2000
	Pterostylis nutans	Nodding Greenhood			1994
	Pterostylis ovata	Gawler Ranges Greenhood			1990
	Pterostylis plumosa	Bearded Greenhood			1999
	Pterostylis pusilla	Small Rusty-hood			1994
	Pterostylis robusta	Large Shell-orchid			2003
	Pterostylis sanguinea	Blood Greenhood			1960
	Pterostylis sp.	Greenhood			1994
	Pterothamnion francisianum				1986
	Ptilocladia australis				1978
	Ptilotus decipiens				1990
	Ptilotus incanus/obovatus	Silver Mulla Mulla			1999
	Ptilotus nobilis ssp. angustifolius	Yellow-tails			1941
	Ptilotus nobilis ssp. nobilis	Yellow-tails			1995

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Ptilotus nobilis var. (NC)	Yellow-tails			1994
	Ptilotus nobilis var. nobilis (NC)	Yellow-tails			2009
	Ptilotus obovatus	Silver Mulla Mulla			2009
	Ptilotus obovatus (NC)	Silver Mulla Mulla			2007
	Ptilotus seminudus	Rabbit-tails			1936
	Ptilotus sp.	Mulla Mulla			1994
	Ptilotus spathulatus	Pussy-tails			2015
	Pultenaea graveolens	Scented Bush-pea			2008
	Pultenaea largiflorens	Twiggy Bush-pea			2005
	Pycnosorus globosus	Drumsticks		V	2001
	Pycnosorus pleiocephalus	Soft Billy-buttons			2001
*	*Pyracantha coccinea*				1997
	Pyrorchis nigricans	Black Fire-orchid			1926
	Radyera farragei	Desert Rose Mallow			1993
	Ramalina inflata ssp. australis				1995
	Ranunculus hamatosetosus	Hill Buttercup			1999
*	*Ranunculus muricatus*	Pricklefruit Buttercup			1999
	Ranunculus pachycarpus	Thick-fruit Buttercup			1994
	Ranunculus pentandrus var. platycarpus	Smooth Buttercup			1975
	Ranunculus pumilio var. pumilio	Ferny Buttercup			1992
	Ranunculus sessiliflorus var. sessiliflorus	Annual Buttercup			1994
	Ranunculus sp.	Buttercup			1994
*	*Raphanus raphanistrum*	Wild Radish			1989
*	*Rapistrum rugosum ssp. rugosum*	Turnip Weed			1998
*	*Reichardia tingitana*	False Sowthistle			1999
*	*Reseda luteola*	Wild Mignonette			2009
*	*Reseda odorata*	Sweet Mignonette			1991
	Rhabdonia coccinea				2007
	Rhabdonia verticillata				1974
	Rhagodia candolleana ssp.	Sea-berry Saltbush			2008
	Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			1982
	Rhagodia crassifolia	Fleshy Saltbush			1998
	Rhagodia parabolica	Mealy Saltbush			2015
	Rhagodia sp.	Saltbush			1990
	Rhagodia spinescens	Spiny Saltbush			2009
	Rhagodia ulicina	Intricate Saltbush			2008
	Rhodanthe corymbiflora	Paper Everlasting			2009
	Rhodanthe floribunda	White Everlasting			1996
	Rhodanthe laevis	Smooth Daisy			1989
	Rhodanthe microglossa	Clustered Everlasting			1996
	Rhodanthe moschata	Musk Daisy			2009
	Rhodanthe polygalifolia	Milkwort Everlasting			2010
	Rhodanthe pygmaea	Pigmy Daisy			1996
	Rhodanthe sp.	Everlasting			1994
	Rhodanthe stricta	Slender Everlasting			2008
	Rhodanthe stuartiana	Clay Everlasting			1996
	Rhodanthe troedelii	Small Paper-everlasting			1992
	Rhyncharrhena linearis	Bush Bean			2007
	Riccia cavernosa				1973
	Riccia crinita				1973

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Riccia crystallina				1973
	Riccia lamellosa				1973
	Riccia limbata				1987
	Riccia macrospora				1971
	Riccia nigrella				2003
	Riccia sorocarpa				1973
*	*Ricinus communis*	Castor Oil Plant			2014
*	*Romulea minutiflora*	Small-flower Onion-grass			1994
*	*Romulea rosea var. australis*	Common Onion-grass			1996
*	*Rorippa nasturtium-aquaticum*	Watercress			1928
	Rostellularia adscendens var. pogonanthera	Pink Tongues			1937
*	*Rostraria cristata*	Annual Cat's-tail			1996
*	*Rostraria pumila*	Tiny Bristle-grass			2001
*	*Rubus anglocandicans*				1997
	Rumex brownii	Slender Dock			2015
	Rumex brownii (NC)	Slender Dock			1994
*	*Rumex conglomeratus*	Clustered Dock			1994
*	*Rumex crispus*	Curled Dock			1992
	Rumex crystallinus	Glistening Dock			1990
	Rumex dumosus	Wiry Dock		R	1992
	Rumex dumosus var. (NC)	Wiry Dock		R	1994
*	*Rumex pulcher ssp. pulcher*	Fiddle Dock			2010
	Rumex sp.	Dock			2007
	Rumex tenax	Shiny Dock			2007
	Ruppia maritima	Sea Tassel			1990
	Ruppia sp.	Water-tassel			1975
	Ruppia tuberosa	Widgeon Grass			1982
	Rytidosperma auriculatum	Lobed Wallaby-grass			1995
	Rytidosperma caespitosum	Common Wallaby-grass			2015
	Rytidosperma erianthum	Hill Wallaby-grass			1995
	Rytidosperma fulvum	Leafy Wallaby-grass			1995
	Rytidosperma geniculatum	Kneed Wallaby-grass			1994
	Rytidosperma laeve	Smooth Wallaby-grass		R	1992
	Rytidosperma pilosum	Velvet Wallaby-grass			1992
	Rytidosperma racemosum var. racemosum	Slender Wallaby-grass			1994
	Rytidosperma setaceum	Small-flower Wallaby-grass			2009
	Rytidosperma sp.	Wallaby-grass			2007
	Rytidosperma tenuius	Short-awn Wallaby-grass		R	1993
*	*Sagina apetala*	Annual Pearlwort			1996
	Salsola australis	Buckbush			2009
*	*Salvia sp.*	Sage			1994
*	*Salvia verbenaca var.*	Wild Sage			2015
*	*Salvia verbenaca var. verbenaca*	Wild Sage			1997
	Santalum acuminatum	Quandong			2010
	Santalum lanceolatum	Plumbush			1991
	Santalum murrayanum	Bitter Quandong			1994
	Santalum spicatum	Sandalwood		V	2010
	Sarcocornia blackiana	Thick-head Samphire			2009
	Sarcocornia quinqueflora	Beaded Samphire			1998
	Sarcozona bicarinata	Ridged Noon-flower		V	2008

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Sarcozona praecox	Sarcozona			2008
	Sargassum decurrens				1973
	Sargassum paradoxum				1973
	Sargassum spinuligerum				1974
	Scaberia agardhii				1950
*	*Scabiosa atropurpurea*	Pincushion			1997
	Scaevola albida	Pale Fanflower			1990
	Scaevola collaris				1997
	Scaevola humilis	Inland Fanflower			2007
	Scaevola parvibarbata	Small-beard Fanflower			2009
	Scaevola sp.	Fanflower			1994
	Scaevola spinescens	Spiny Fanflower			2008
	Scambopus curvipes				2009
	Schenkia australis	Spike Centaury			1990
*	*Schinus molle*	Pepper-tree			2002
*	*Schismus barbatus*	Arabian Grass			2009
	Schoenia ramosissima	Dainty Everlasting			1991
	Schoenus apogon	Common Bog-rush			1997
	Schoenus nanus	Little Bog-rush			1998
	Scleranthus pungens	Prickly Knawel			1999
	Scleroblitum atriplicinum	Starry Goosefoot			1989
	Sclerolaena bicuspis	Two-spine Bindyi			1992
	Sclerolaena brachyptera	Short-wing Bindyi			2008
	Sclerolaena brevifolia	Small-leaf Bindyi			1967
	Sclerolaena constricta				1992
	Sclerolaena cuneata	Tangled Bindyi			2010
	Sclerolaena decurrens	Green Bindyi			2007
	Sclerolaena diacantha	Grey Bindyi			2007
	Sclerolaena divaricata	Tangled Bindyi			2009
	Sclerolaena eriacantha	Silky Bindyi			1993
	Sclerolaena holtiana	Holt's Bindyi			1992
	Sclerolaena intricata	Tangled Bindyi			1990
	Sclerolaena lanicuspis	Spinach Bindyi			1992
	Sclerolaena limbata	Pearl Bindyi			2008
	Sclerolaena longicuspis	Long-spine Bindyi			1987
	Sclerolaena obliquicuspis	Oblique-spined Bindyi			2009
	Sclerolaena parallelicuspis	Western Bindyi			2008
	Sclerolaena parviflora	Small-flower Bindyi			1991
	Sclerolaena patenticuspis	Spear-fruit Bindyi			2008
	Sclerolaena sp.	Bindyi			2009
	Sclerolaena uniflora	Small-spine Bindyi			1997
	Sclerolaena ventricosa	Salt Bindyi			2001
*	*Scorzonera laciniata (NC)*	Scorzonera			1994
	Sebaea ovata	Yellow Sebaea			1974
	Senecio anethifolius (NC)	Feathery Groundsel			1994
	Senecio anethifolius ssp. anethifolius	Feathery Groundsel			1916
	Senecio anethifolius ssp. brevibracteolatus	Feathery Groundsel			2009
	Senecio cunninghamii var. (NC)	Shrubby Groundsel			1994
	Senecio cunninghamii var. cunninghamii	Shrubby Groundsel			1909
	Senecio cunninghamii var.	Shrubby Groundsel			1979

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	flindersensis				
	Senecio dolichocephalus	Woodland Groundsel			1982
	Senecio gawlerensis	Gawler Ranges Groundsel			1994
	Senecio glossanthus	Annual Groundsel			2008
	Senecio glossanthus (NC)	Annual Groundsel			1998
	Senecio gregorii	Fleshy Groundsel			1996
	Senecio laceratus	Cut-leaf Groundsel			1994
	Senecio magnificus	Showy Groundsel			1986
	Senecio megaglossus	Large-flower Groundsel	VU	E	2005
	Senecio odoratus	Scented Groundsel			2001
	Senecio odoratus var. (NC)	Scented Groundsel			1994
	Senecio odoratus var. odoratus (NC)	Scented Groundsel			1994
	Senecio pinnatifolius (NC)	Variable Groundsel			1998
	Senecio quadridentatus	Cotton Groundsel			2015
	Senecio runcinifolius	Thistle-leaf Groundsel			1992
	Senecio spanomerus				1991
	Senecio tenuiflorus (NC)	Woodland Groundsel			1996
	Senna artemisioides nothossp. (NC)	Desert Senna			1980
	Senna artemisioides ssp.	Desert Senna			2015
	Senna artemisioides ssp. filifolia	Fine-leaf Desert Senna			2001
	Senna artemisioides ssp. petiolaris				2009
	Senna artemisioides ssp. petiolaris (NC)	Flat-stalk Senna			2004
	Senna artemisioides ssp. quadrifolia	Four-leaf Desert Senna			2007
	Senna artemisioides ssp. X artemisioides	Silver Senna			2008
	Senna artemisioides ssp. X coriacea	Broad-leaf Desert Senna			2009
	Senna artemisioides ssp. X sturtii	Grey Senna			2009
	Senna artemisioides ssp. zygophylla	Twin-leaf Desert Senna			1980
	Senna cardiosperma ssp. cardiosperma	Curved-leaf Senna			1983
	Senna cardiosperma ssp. gawlerensis	Gawler Ranges Senna			1998
	Senna planitiicola	Yellow Pea			1993
	Senna pleurocarpa var. pleurocarpa	Stripe-pod Senna			2007
	Senna sp.	Senna			2009
	Setaria basiclada				1997
	Setaria clementii	Clement's Paspalidium			1998
	Setaria constricta	Knotty-butt Paspalidium			2007
	Setaria dielsii	Diel's Pigeon-grass			1900
	Setaria jubiflora	Warrego Summer-grass			1998
*	*Setaria verticillata*	Whorled Pigeon-grass			1993
*	*Sherardia arvensis*	Field Madder			1994
	Sida ammophila	Sand Sida			2007
	Sida calyxhymenia	Tall Sida			1990
	Sida corrugata var.	Corrugated Sida			2015
	Sida corrugata var. angustifolia	Grassland Sida			1996
	Sida corrugata var. corrugata	Corrugated Sida			1994
	Sida fibulifera	Pin Sida			2007

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Sida filiformis	Fine Sida			1994
	Sida intricata	Twiggy Sida			2007
	Sida petrophila	Rock Sida			2001
	Sida phaeotricha	Hill Sida			1974
	Sida sp.	Sida			1994
	Sida spodochroma				2007
	Sida trichopoda	High Sida			2016
	Sigesbeckia orientalis	Oriental Sigesbeckia			1915
*	*Silene gallica var.*	French Catchfly			1995
*	*Silene gallica var. gallica*	French Catchfly			1992
*	*Silene nocturna*	Mediterranean Catchfly			2001
*	*Silene sp.*	Catchfly			1997
*	*Silene tridentata*				1996
	Siloxerus multiflorus	Small Wrinklewort			1994
*	*Silybum marianum*	Variegated Thistle			1994
*	*Sisymbrium erysimoides*	Smooth Mustard			2012
*	*Sisymbrium irio*	London Mustard			2001
*	*Sisymbrium orientale*	Indian Hedge Mustard			1996
*	*Sisymbrium sp.*	Wild Mustard			1994
	Solanum capsiciforme	Capsicum Kangaroo-apple			
	Solanum chenopodinum	Goosefoot Potato-bush			1954
*	*Solanum cinereum*	Narrawa Burr			1997
	Solanum cleistogamum	Shy Nightshade			1987
	Solanum coactiliferum	Tomato-bush			2001
*	*Solanum elaeagnifolium*	Silver-leaf Nightshade			1952
	Solanum ellipticum	Velvet Potato-bush			2015
	Solanum esuriale	Quena			1994
	Solanum lasiophyllum	Flannel Bush			1990
*	*Solanum nigrum*	Black Nightshade			1994
	Solanum petrophilum	Rock Nightshade			2010
	Solanum petrophilum (NC)	Rock Nightshade			2007
	Solanum quadriloculatum	Plains Nightshade			1982
	Solanum simile	Kangaroo Apple			1997
	Solanum sp.	Nightshade/Potato-bush			2004
*	*Solanum triflorum*	Three-flower Nightshade			1996
*	*Solidago canadensis*	Golden Rod			2003
	Solieria robusta				1980
*	*Sonchus asper ssp.*	Rough Sow-thistle			1992
*	*Sonchus asper ssp. asper*	Rough Sow-thistle			1997
*	*Sonchus oleraceus*	Common Sow-thistle			2009
	Sonchus sp.	Sow-thistle			1994
*	*Sonchus tenerrimus (NC)*	Clammy Sow-thistle			1992
*	*Spergularia bocconei*	Red Sand-spurrey			1990
	Spergularia brevifolia	Salt Sand-spurrey			1969
*	*Spergularia diandra*	Lesser Sand-spurrey			2008
*	*Spergularia diandra (NC)*	Lesser Sand-spurrey			1996
	Spergularia diandroides	Lesser Sand-spurrey			1966
	Spergularia marina	Salt Sand-spurrey			1974
*	*Spergularia media (NC)*	Coast Sand-spurrey			1975
*	*Spergularia rubra*	Red Sand-spurrey			1992
*	*Spergularia rubra (NC)*	Red Sand-spurrey			1995

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Spergularia sp.*	Sand-spurrey			1994
	Spermatochnus paradoxus				1986
	Sphacelaria biradiata				1978
	Sphacelaria cirrosa				1978
	Sphacelaria rigidula				1978
	Sphacelaria tribuloides				1975
	Spongoclonium australicum				1987
	Spongoclonium conspicuum				1987
	Spongoclonium fasciculatum				1975
	Sporobolus actinocladus	Ray Grass			2007
	Sporochnus comosus				1980
	Sporochnus moorei				1975
	Spyridia filamentosa				1978
	Spyridia tasmanica				1980
	Spyridium phlebophyllum	Inland Spyridium			2007
	Spyridium stenophyllum ssp. renovatum	Forked Spyridium			1918
	Spyridium subochreatum	Velvet Spyridium			1926
	Stackhousia monogyna	Creamy Candles			1999
	Stackhousia monogyna (NC)	Creamy Candles			1999
	Stackhousia sp.	Candles			1995
	Stackhousia spathulata	Coast Candles			2015
	Stackhousia subterranea	Creamy Candles			1993
	Stellaria filiformis	Thread Starwort			1974
*	*Stellaria media*	Chickweed			1996
*	*Stellaria pallida*	Lesser Starwort			1994
	Stellaria palustris var. (NC)	Swamp Starwort			1994
	Stemodia florulenta	Bluerod			1990
	Stenogramme leptophylla				1980
	Stenopetalum lineare	Narrow Thread-petal			2008
	Stenopetalum lineare (NC)	Narrow Thread-petal			1996
	Stenopetalum sphaerocarpum	Round-fruit Thread-petal			1990
	Stilophora rhizodes				1973
	Stuartina hamata	Prickly Cudweed			1974
	Stuartina muelleri	Spoon Cudweed			1996
	Stylidium calcaratum	Spurred Trigger-plant			1996
	Stylidium despectum	Hundreds And Thousands			1996
*	*Suaeda aegyptiaca*				2005
	Suaeda australis	Austral Seablite			2008
	Swainsona adenophylla	Violet Swainson-pea			2007
	Swainsona canescens	Grey Swainson-pea			1990
	Swainsona fissimontana	Broken Hill Pea			1987
	Swainsona formosa	Sturt Pea			1992
	Swainsona oroboides complex	Variable Swainson-pea			1987
	Swainsona phacoides	Dwarf Swainson-pea			2008
	Swainsona sp.	Swainson-pea			2007
	Swainsona stipularis	Orange Swainson-pea			1995
	Swainsona stipularis (NC)	Orange Darling Pea			1992
	Swainsona tephrotricha	Ashy-haired Swainson-pea			1999
	Synaptantha tillaeacea var. tillaeacea				1992
*	*Tagetes erecta*				1993

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Tagetes minuta*	Stinking Roger			1982
*	*Tamarix ramosissima*				1994
*	*Taraxacum khatoonae*	Dandelion			2008
	Tecticornia arbuscula	Shrubby Samphire			1998
	Tecticornia disarticulata				2007
	Tecticornia halocnemoides ssp.	Grey Samphire			1996
	Tecticornia halocnemoides ssp. halocnemoides	Grey Samphire			2010
	Tecticornia halocnemoides ssp. longispicata	Grey Samphire			1995
	Tecticornia indica ssp.	Brown-head Samphire			2004
	Tecticornia indica ssp. bidens	Brown-head Samphire			2009
	Tecticornia indica ssp. leiostachya	Brown-head Samphire			2010
	Tecticornia lepidosperma			R	1998
	Tecticornia medullosa				1990
	Tecticornia pergranulata ssp. divaricata	Black-seed Samphire			1990
	Tecticornia pergranulata ssp. pergranulata	Black-seed Samphire			1997
	Tecticornia pruinosa	Bluish Samphire			2001
	Tecticornia sp.	Samphire			2008
	Tecticornia tenuis	Slender Samphire			2001
	Templetonia aculeata	Spiny Mallee-pea			2006
	Templetonia egena	Broombush Templetonia			2001
	Templetonia egena (NC)	Broombush Templetonia			2009
	Templetonia retusa	Cockies Tongue			1994
	Tetragonia eremaea	Desert Spinach			2007
	Tetragonia implexicoma	Bower Spinach			2008
	Tetragonia moorei	New Zealand Spinach			2001
	Tetragonia sp.	False Spinach			2007
	Tetragonia tetragonioides (NC)	New Zealand Spinach			1986
	Tetragonia tetragonoides	New Zealand Spinach			1983
	Tetrapterum cylindricum				1986
	Tetrathamnion lineatum				1978
	Teucrium corymbosum	Rock Germander			1994
	Teucrium corymbosum (NC)	Rock Germander			1994
	Teucrium racemosum	Grey Germander			1997
	Teucrium sp.	Germander			1994
	Thelymitra alcockiae	Scented Sun-orchid			1994
	Thelymitra grandiflora	Great Sun-orchid		R	1999
	Thelymitra luteocilium	Yellow-tuft Sun Orchid			2005
	Thelymitra megcalyptra	Scented Sun-orchid			2004
	Thelymitra nuda				1996
	Thelymitra nuda (NC)	Scented Sun-orchid			1996
	Thelymitra pauciflora	Slender Sun-orchid			2005
	Thelymitra pauciflora (NC)	Slender Sun-orchid			1994
	Thelymitra rubra	Salmon Sun-orchid			1994
	Thelymitra sp.	Sun-orchid			1994
	Themeda triandra	Kangaroo Grass			2007
*	*Thinopyrum elongatum*	Tall Wheat-grass			1987
	Threlkeldia diffusa	Coast Bonefruit			2008
	Thryptomene elliottii				1960
	Thryptomene micrantha	Ribbed Thryptomene			1968

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Thyridolepis mitchelliana	Window Mulga-grass			1999
	Thysanotus baueri	Mallee Fringe-lily			2008
	Thysanotus exfimbriatus				1991
	Thysanotus patersonii	Twining Fringe-lily			1996
	Thysanotus tenellus	Grassy Fringe-lily		R	1995
	Tiparraria aurata				1978
	Toninia caeruleonigricans				1967
	Tortula atrovirens				1986
	Trachymene cyanopetala	Purple Trachymene			1990
	Trachymene glaucifolia	Blue Parsnip			1901
	Trachymene ornata	Cotton-ball Trachymene			1990
	Tragus australianus	Small Burr-grass			2007
	Tremella mesenterica				1995
	Trianthema triquetra	Red Spinach			1992
	Tribulus eichlerianus	Eichler's Caltrop			2007
	Tribulus minutus				2007
*	*Tribulus terrestris*	Caltrop			2014
	Trichanthodium skirrophorum	Woolly Yellow-heads			1991
*	*Trifolium angustifolium*	Narrow-leaf Clover			2015
*	*Trifolium arvense var. arvense*	Hare's-foot Clover			1999
*	*Trifolium campestre*	Hop Clover			1999
*	*Trifolium fragiferum var. fragiferum*	Strawberry Clover			1995
*	*Trifolium glomeratum*	Cluster Clover			1999
*	*Trifolium sp.*	Clover			2015
*	*Trifolium subterraneum*	Subterranean Clover			1992
*	*Trifolium tomentosum*	Woolly Clover			1996
	Triglochin calcitrapum (NC)	Spurred Arrowgrass			1975
	Triglochin centrocarpum (NC)	Dwarf Arrowgrass			1975
	Triglochin isingiana	Spurred Arrowgrass			1991
	Trigonella suavissima	Sweet Fenugreek			1992
	Triodia bunicola (NC)	Flinders Ranges Spinifex			2009
	Triodia irritans	Spinifex			2007
	Triodia irritans complex	Spinifex			1990
	Triodia irritans var. (NC)				1986
	Triodia scariosa	Spinifex			2015
	Triodia scariosa ssp. (NC)	Spinifex			1998
	Triodia sp.	Spinifex			2007
	Triodia sp. (NC)	Spinifex			1994
	Tripogon loliiformis	Five-minute Grass			2007
	Triptilodiscus pygmaeus	Small Yellow-heads			1999
	Triraphis mollis	Purple Plume Grass			2007
	Trymalium wayi	Grey Trymalium			1992
	Tulostoma berteroanum				2002
	Typha domingensis	Narrow-leaf Bulrush			2001
	Unidentified sp.				1995
*	*Urochloa panicoides var. panicoides*				2012
*	*Urospermum picroides*	False Hawkbit			1999
*	*Vachellia farnesiana*	Sweet Acacia			2011
	Velleia arguta	Toothed Velleia			2010
	Velleia cycnopotamica			R	1900
	Velleia paradoxa	Spur Velleia			1994

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
*	*Verbascum thapsus ssp. thapsus*	Great Mullein			1997
*	*Verbena aristigera*	Mayne's Pest			1997
*	*Verbena supina (NC)*	Trailing Verbena			1999
*	*Verbena supina var. erecta*	Trailing Verbena			1997
*	*Verbena supina var. supina*	Trailing Verbena			2007
	Veronica decorosa	Showy Speedwell		R	1999
	Veronica plebeia	Trailing Speedwell			1994
*	*Vicia monantha*	Spurred Vetch			1996
*	*Vicia monantha ssp. monantha*	One-flower Vetch			1960
*	*Vicia monantha ssp. triflora*				1994
*	*Vicia sp.*	Vetch			1998
	Vittadinia australasica var.	Sticky New Holland Daisy			1996
	Vittadinia australasica var. australasica	Sticky New Holland Daisy			1999
	Vittadinia blackii	Narrow-leaf New Holland Daisy			1994
	Vittadinia cervicularis var. cervicularis	Waisted New Holland Daisy			2015
	Vittadinia condyloides	Club-hair New Holland Daisy			1999
	Vittadinia cuneata var.	Fuzzy New Holland Daisy			2009
	Vittadinia cuneata var. cuneata	Fuzzy New Holland Daisy			2001
	Vittadinia cuneata var. morrisii	New Holland Daisy			1996
	Vittadinia dissecta var. hirta	Dissected New Holland Daisy			1990
	Vittadinia eremaea	Desert New Holland Daisy			1994
	Vittadinia gracilis	Woolly New Holland Daisy			1999
	Vittadinia megacephala	Giant New Holland Daisy			1994
	Vittadinia nullarborensis	Nullarbor New Holland Daisy			1997
	Vittadinia pterochaeta	Rough New Holland Daisy			1999
	Vittadinia sp.	New Holland Daisy			2009
	Vittadinia sulcata	Furrowed New Holland Daisy			1999
*	*Vulpia bromoides*	Squirrel-tail Fescue			1992
	Vulpia bromoides/myuros				1992
*	*Vulpia muralis*	Wall Fescue			1997
*	*Vulpia myuros f.*	Fescue			2009
*	*Vulpia myuros f. megalura*	Fox-tail Fescue			1996
*	*Vulpia myuros f. myuros*	Rat's-tail Fescue			1996
*	*Vulpia sp.*	Fescue			2015
	Wahlenbergia communis	Tufted Bluebell			2007
	Wahlenbergia gracilenta	Annual Bluebell			2010
	Wahlenbergia luteola	Yellow-wash Bluebell			2015
	Wahlenbergia preissii				1998
	Wahlenbergia sp.	Native Bluebell			1994
	Wahlenbergia stricta ssp. stricta	Tall Bluebell			2015
	Wahlenbergia tumidifructa	Swollen-fruit Bluebell			1989
	Waitzia acuminata var. acuminata	Orange Immortelle			1990
	Walwhalleya proluta (NC)	Rigid Panic			2009
	Warrenia comosa				2007
*	*Watsonia marginata*	Bordered Watsonia			1999
	Webervanbossea tasmanensis				1978
	Westringia rigida	Stiff Westringia			2008
	Wilsonia humilis	Silky Wilsonia			1998
	Wurmbea australis	Inland Nancy			2015
	Wurmbea biglandulosa ssp. flindersica	Flinders Ranges Nancy			2000

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Wurmbea centralis (NC)	Inland Nancy			1994
	Wurmbea citrina	Green-flower Nancy			1966
	Wurmbea dioica ssp. brevifolia	Early Nancy			2001
	Wurmbea dioica ssp. dioica	Early Nancy			2015
	Wurmbea dioica ssp. dioica (NC)	Early Nancy			1990
	Wurmbea sp.	Nancy			1995
	Wurmbea stellata	Star Nancy		R	2008
*	*Xanthium spinosum*	Bathurst Burr			2007
	Xanthoparmelia convoluta				1966
	Xanthoparmelia tasmanica				1994
	Xanthorrhoea quadrangulata	Rock Grass-tree			2003
	Xerochrysum bracteatum	Golden Everlasting			1994
*	*Zinnia elegans*				1993
	Zostera muelleri ssp. mucronata	Garweed		R	1974
	Zostera sp.	Grass-wrack			1975
	Zygochloa paradoxa	Sandhill Cane-grass			2009
	Zygophyllum ammophilum	Sand Twinleaf			1997
	Zygophyllum ammophilum (NC)	Sand Twinleaf			1996
	Zygophyllum ammophilum complex				1996
	Zygophyllum angustifolium	Scrambling Twinleaf			2007
	Zygophyllum apiculatum	Pointed Twinleaf			2008
	Zygophyllum aurantiacum (NC)	Shrubby Twinleaf			1996
	Zygophyllum aurantiacum ssp.	Shrubby Twinleaf			2009
	Zygophyllum aurantiacum ssp. aurantiacum	Shrubby Twinleaf			1997
	Zygophyllum aurantiacum ssp. aurantiacum (NC)	Shrubby Twinleaf			1998
	Zygophyllum aurantiacum ssp. cuneatum	Shrubby Twinleaf			1943
	Zygophyllum billardierei	Coast Twinleaf			2008
	Zygophyllum billardierei (NC)	Coast Twinleaf			1992
	Zygophyllum compressum	Rabbit-ears Twinleaf			1993
	Zygophyllum confluens	Forked Twinleaf			2001
	Zygophyllum crenatum	Notched Twinleaf			2001
	Zygophyllum eremaeum				1996
	Zygophyllum eremaeum (NC)	Pale-flower Twinleaf			1998
	Zygophyllum glaucum	Pale Twinleaf			2004
	Zygophyllum iodocarpum	Violet Twinleaf			2007
	Zygophyllum iodocarpum (NC)	Violet Twinleaf			1996
	Zygophyllum kochii	Koch's Twinleaf			1997
	Zygophyllum ovatum	Dwarf Twinleaf			2007
	Zygophyllum prismatothecum	Square-fruit Twinleaf			1990
	Zygophyllum reticulatum	Shrubby Twinleaf			2009
	Zygophyllum simile	White Twinleaf			1996
	Zygophyllum sp.	Twinleaf			2007

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. *: Introduced.

Appendix 5. Fauna species recorded in the BDBSA within 50 km of the Project area (DEWNR 2017b).

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater			19-10-08
	Acanthiza apicalis	Inland Thornbill			18-10-08
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill			13-04-06
	Acanthiza iredalei iredalei	Slender-billed Thornbill (western)		R	30-08-06
	Acanthiza nana	Yellow Thornbill			13-04-06
	Acanthiza sp.	thornbills			08-03-97
	Acanthiza uropygialis	Chestnut-rumped Thornbill			12-09-07
	Acanthophis antarcticus	Common Death Adder			01-01-89
	Acanthorhynchus tenuirostris halmaturinus	Eastern Spinebill (Ki, MLR, southern FR)			27-01-00
	Accipiter cirrocephalus	Collared Sparrowhawk			04-01-07
	Accipiter fasciatus	Brown Goshawk			13-04-06
	Actitis hypoleucos	Common Sandpiper		R	28-04-04
	Aegotheles cristatus	Australian Owlet-nightjar			11-09-07
	Alauda arvensis	Eurasian Skylark			13-09-07
	Amytornis merrotsyi merrotsyi	Flinders Ranges Short-tailed Grasswren	VU		19-04-01
	Amytornis textilis myall	Western Grasswren	VU		01-09-06
	Anas castanea	Chestnut Teal			18-06-01
	Anas gracilis	Grey Teal			12-09-07
	Anas superciliosa	Pacific Black Duck			02-04-06
	Anilios bicolor	Southern Blind Snake			01-01-50
	Anilios bituberculatus	Rough-nosed Blind Snake			21-10-08
	Anthochaera carunculata	Red Wattlebird			13-04-06
	Anthochaera carunculata woodwardi	Red Wattlebird (MLR, AP, YP, EP, far west, Yellabinna)			13-09-07
	Anthus australis	Australian Pipit			20-10-08
	Aphelocephala leucopsis	Southern Whiteface			20-10-08
	Aprasia inaurita	Red-tailed Worm-lizard			01-09-70
	Aprasia pseudopulchella	Flinders Worm-lizard	VU		21-03-17
	Apus pacificus	Pacific Swift (Fork-tailed Swift)			04-02-00
	Aquila audax	Wedge-tailed Eagle			11-07-14
	Arctocephalus forsteri	Long-nosed Fur Seal (New Zealand Fur Seal)			29-11-05
	Ardea alba	Great Egret			04-09-05
	Ardea ibis	Cattle Egret		R	23-05-94
	Ardea pacifica	White-necked Heron			12-09-07
	Ardeotis australis	Australian Bustard		V	31-12-06
	Arenaria interpres	Ruddy Turnstone		R	25-04-98
	Artamus cinereus	Black-faced Woodswallow			13-09-07
	Artamus cyanopterus	Dusky Woodswallow			10-09-07
	Artamus leucorynchus	White-breasted Woodswallow			23-11-99
	Artamus minor	Little Woodswallow			09-01-94
	Artamus personatus	Masked Woodswallow			26-03-07
	Artamus superciliosus	White-browed Woodswallow			12-11-00
	Austronomus australis	White-striped Free-tailed Bat			09-03-97

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Aythya australis	Hardhead			30-08-06
	Balaenoptera edeni	Bryde's Whale		R	21-04-89
	Barnardius zonarius	Australian Ringneck			14-09-07
	Bettongia lesueur	Burrowing Bettong	EX	E	00-01-00
	Biziura lobata	Musk Duck		R	28-03-06
	Brachyurophis semifasciatus	Half-girdled Snake			09-07-83
	Cacatua galerita	Sulphur-crested Cockatoo			12-07-01
	Cacatua sanguinea	Little Corella			01-09-06
	Cacomantis flabelliformis	Fan-tailed Cuckoo			13-04-06
	Cacomantis pallidus	Pallid Cuckoo			01-09-06
	Calamanthus (Calamanthus) campestris	Rufous Fieldwren			31-08-06
	Calamanthus (Hylacola) pyrrhopygius	Chestnut-rumped Heathwren	ssp	ssp	17-02-97
	Calidris acuminata	Sharp-tailed Sandpiper			30-08-06
	Calidris canutus	Red Knot	EN		24-09-00
	Calidris ferruginea	Curlew Sandpiper	CR		25-01-00
	Calidris ruficollis	Red-necked Stint			20-05-06
	Calidris tenuirostris	Great Knot	CR	R	13-02-83
	Caligavis chrysops	Yellow-faced Honeyeater			11-10-80
	Caligavis chrysops samueli	Yellow-faced Honeyeater (MLR, southern FR)			25-09-04
*	*Camelus dromedarius*	One-humped Camel (Dromedary, Arabian Camel)			07-07-11
	Canis lupus dingo	Dingo			01-01-89
*	*Capra hircus*	Goat (Feral Goat)			26-08-15
*	*Carduelis carduelis*	European Goldfinch			29-11-96
	Caretta caretta	Loggerhead Turtle	EN	E	01-08-92
	Certhionyx variegatus	Pied Honeyeater			26-03-07
	Chalcites basalis	Horsfield's Bronze Cuckoo			11-09-07
	Chalcites lucidus	Shining Bronze Cuckoo			01-10-98
	Chalcites osculans	Black-eared Cuckoo			26-03-07
	Chalinolobus gouldii	Gould's Wattled Bat			25-11-99
	Charadrius leschenaultii	Greater Sand Plover	VU	R	04-02-84
	Charadrius ruficapillus	Red-capped Plover			30-08-06
	Charadrius veredus	Oriental Plover			01-03-96
	Chenonetta jubata	Maned Duck			30-08-06
	Cheramoeca leucosterna	White-backed Swallow			11-09-07
	Chlidonias hybrida	Whiskered Tern			26-01-04
	Christinus marmoratus	Marbled Gecko			23-11-99
	Chroicocephalus novaehollandiae	Silver Gull			13-04-06
	Cincloramphus cruralis	Brown Songlark			11-09-07
	Cincloramphus mathewsi	Rufous Songlark			12-02-05
	Cinclosoma castanotum	Chestnut-backed Quailthrush (Chestnut Quailthrush)		ssp	31-07-06
	Cinclosoma cinnamomeum	Cinnamon Quailthrush			12-12-06
	Circus assimilis	Spotted Harrier			25-09-04
	Cladorhynchus leucocephalus	Banded Stilt		V	28-03-06
	Climacteris affinis	White-browed Treecreeper		R	25-05-65

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Climacteris picumnus	Brown Treecreeper			08-09-02
	Climacteris rufus	Rufous Treecreeper			12-09-25
	Colluricincla harmonica	Grey Shrikethrush			19-10-08
*	*Columba livia*	Feral Pigeon			30-10-05
	Coracina maxima	Ground Cuckooshrike			23-11-09
	Coracina novaehollandiae	Black-faced Cuckooshrike			19-10-08
	Corvus bennetti	Little Crow			12-09-07
	Corvus coronoides	Australian Raven			17-10-08
	Corvus mellori	Little Raven			20-10-08
	Corvus sp.	crows			17-10-08
	Coturnix pectoralis	Stubble Quail			29-08-06
	Cracticus torquatus	Grey Butcherbird			17-10-08
	Crinia flindersensis	Northern Flinders Ranges Froglet			19-07-03
	Crinia riparia	Southern Flinders Ranges Froglet			11-08-09
	Crinia signifera	Common Froglet			03-10-04
	Crinia sp.	Froglets			23-10-95
	Cryptoblepharus australis	Desert Wall skink			20-10-08
	Cryptoblepharus cf plagiocephalus (NC)	Desert Wall skink			25-11-99
	Ctenophorus chapmani	Prickly Dragon			14-09-07
	Ctenophorus cristatus	Crested Dragon			14-09-07
	Ctenophorus decresii	Tawny Dragon			24-11-99
	Ctenophorus fionni	Peninsula Dragon			11-09-07
	Ctenophorus fordi	Mallee Dragon			25-09-02
	Ctenophorus isolepis	Military Dragon			16-11-92
	Ctenophorus nuchalis	Central Netted Dragon			11-09-07
	Ctenophorus pictus	Painted Dragon			20-10-08
	Ctenotus inornatus	Brown Ctenotus			01-01-50
	Ctenotus leae	Centralian Coppertail			24-11-91
	Ctenotus olympicus	Saltbush Ctenotus			11-09-07
	Ctenotus orientalis	Spotted Ctenotus			01-04-00
	Ctenotus pantherinus	Leopard Skink			11-04-82
	Ctenotus regius	Eastern Desert Ctenotus			20-10-08
	Ctenotus schomburgkii	Sandplain Ctenotus			10-04-95
	Ctenotus spaldingi	Eastern Striped Skink			17-10-08
	Ctenotus taeniatus	Eyrean Ctenotus			11-02-91
	Ctenotus uber (NC)	Spotted Ctenotus			29-11-91
	Cyclodomorphus melanops	Spinifex Slender Bluetongue			25-06-82
	Cygnus atratus	Black Swan			10-09-07
	Dacelo novaeguineae	Laughing Kookaburra			13-04-06
	Daphoenositta chrysoptera	Varied Sittella			13-04-06
	Dasyurus viverrinus	Eastern Quoll	EN	E	29-06-09
	Delma australis	Barred Snake-lizard			23-11-99
	Delma butleri	Spinifex Snake-lizard			25-11-99
	Delma molleri	Adelaide Snake-lizard			23-11-99
	Delphinus delphis	Short-beaked Common Dolphin			04-06-05

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Demansia psammophis	Yellow-faced Whipsnake			24-11-99
	Demansia reticulata	Desert Whipsnake			11-04-95
	Dicaeum hirundinaceum	Mistletoebird			11-09-07
	Diplodactylus furcosus	Ranges Stone Gecko			20-10-08
	Diplodactylus tessellatus	Tessellated Gecko			13-09-07
	Diplodactylus vittatus complex (NC)	Stone Geckos			22-10-95
	Diporiphora winneckei (NC)	Canegrass Dragon			25-11-91
	Dromaius novaehollandiae	Emu			26-08-15
	Drymodes brunneopygia	Southern Scrub Robin			23-11-99
	Egernia stokesii	Gidgee Skink			09-10-15
	Egernia striolata	Eastern Tree Skink			23-11-99
	Egretta garzetta	Little Egret		R	22-12-05
	Egretta novaehollandiae	White-faced Heron			28-03-06
	Elanus axillaris	Black-shouldered Kite			03-10-02
	Elseyornis melanops	Black-fronted Dotterel			30-08-06
	Emblema pictum	Painted Finch		R	09-01-94
	Eolophus roseicapilla	Galah			19-10-08
	Eopsaltria griseogularis	Western Yellow Robin			14-09-25
	Epthianura albifrons	White-fronted Chat			14-09-07
	Epthianura aurifrons	Orange Chat			13-09-07
	Epthianura tricolor	Crimson Chat			14-09-07
*	*Equus caballus*	Horse (Brumby)			13-07-09
	Eremiascincus richardsonii	Broad-banded Sandswimmer			10-12-03
	Erythrogonys cinctus	Red-kneed Dotterel			24-09-04
	Eurostopodus argus	Spotted Nightjar			11-02-96
	Falco berigora	Brown Falcon			10-09-07
	Falco cenchroides	Nankeen Kestrel			20-10-08
	Falco hypoleucos	Grey Falcon		R	13-04-06
	Falco longipennis	Australian Hobby			27-07-05
	Falco peregrinus	Peregrine Falcon		R	10-10-05
	Falco subniger	Black Falcon			07-12-06
	Falcunculus frontatus frontatus	Eastern Shriketit		R	12-07-99
*	*Felis catus*	Domestic Cat (Feral Cat)			13-09-07
	Fulica atra	Eurasian Coot			28-03-06
	Furina diadema	Red-naped Snake			22-11-99
	Gallirallus philippensis	Buff-banded Rail			25-09-40
	Gavicalis virescens	Singing Honeyeater			19-10-08
	Gehyra lazelli	Southern Rock Dtella			25-11-99
	Gehyra sp.				20-10-08
	Gehyra variegata (NC)	Tree Dtella			20-10-08
	Gehyra variegata complex				22-04-92
	Geopelia cuneata	Diamond Dove			26-09-00
	Geopelia placida	Peaceful Dove			10-10-05
	Gliciphila melanops	Tawny-crowned Honeyeater			10-10-05
	Grallina cyanoleuca	Magpielark			20-10-08

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Gymnorhina tibicen	Australian Magpie			19-10-08
	Haematopus fuliginosus	Sooty Oystercatcher		R	28-03-06
	Haematopus longirostris	(Australian) Pied Oystercatcher		R	24-09-04
	Haliaeetus leucogaster	White-bellied Sea Eagle		E	01-01-00
	Haliastur sphenurus	Whistling Kite			13-04-06
	Hamirostra melanosternon	Black-breasted Buzzard		R	06-09-91
	Hemiergis decresiensis	Three-toed Earless Skink			12-03-97
	Hemiergis millewae	Rusty Earless Skink			05-12-82
	Heteronotia binoei	Bynoe's Gecko			20-10-08
	Hieraaetus morphnoides	Little Eagle			09-05-02
	Himantopus leucocephalus	White-headed Stilt			30-08-06
	Hirundo neoxena	Welcome Swallow			20-10-08
	Hydroprogne caspia	Caspian Tern			22-12-05
	Lalage tricolor	White-winged Triller			11-09-07
	Lampropholis guichenoti	Garden Skink			22-11-99
	Larus dominicanus	Kelp Gull		R	21-05-82
	Larus pacificus	Pacific Gull			22-01-05
	Leporillus sp.	stick-nest rats			01-01-84
	Lerista bougainvillii	Bougainville's Skink			12-03-97
	Lerista edwardsae	Myall Slider			20-10-08
	Lerista labialis	Eastern Two-toed Slider			18-10-08
	Lerista muelleri	Dwarf Three-toed Slider			20-10-08
	Lerista terdigitata	Southern Three-toed Slider			29-11-91
	Lerista timida	Dwarf Three-toed Slider			14-09-07
	Lialis burtonis	Burton's Legless Lizard			18-10-08
	Limnodynastes tasmaniensis	Spotted Marsh Frog			14-09-05
	Limosa lapponica	Bar-tailed Godwit	ssp	R	07-02-85
	Limosa limosa	Black-tailed Godwit		R	04-02-84
	Liopholis inornata	Desert Skink			05-05-81
	Liopholis margaretae	Masked Rock Skink			23-11-99
	Litoria ewingii	Brown Tree Frog			14-09-05
	Lophochroa leadbeateri	Major Mitchell's Cockatoo		R	20-09-56
	Lophochroa leadbeateri mollis	Major Mitchell's Cockatoo (EP, GR, NW)		SP	12-08-13
	Lucasium damaeum	Beaded Gecko			14-09-07
	Macronectes giganteus	Southern Giant Petrel	EN	V	30-01-00
	Macropus fuliginosus	Western Grey Kangaroo			26-08-15
	Macropus robustus	Euro			26-08-15
	Macropus rufus	Red Kangaroo			26-08-15
	Macropus sp.	(blank)			19-10-08
	Malacorhynchus membranaceus	Pink-eared Duck			30-08-06
	Malurus lamberti	Variegated Fairywren			19-10-08
	Malurus leucopterus	White-winged Fairywren			19-10-08
	Malurus pulcherrimus	Blue-breasted Fairywren			28-03-91
	Malurus splendens	Splendid Fairywren			27-06-96
	Malurus splendens callainus	Turquoise Fairywren			11-09-07

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Manorina flavigula	Yellow-throated Miner			17-10-08
	Megalurus gramineus	Little Grassbird			09-09-02
	Melanodryas cucullata	Hooded Robin		ssp	27-07-05
	Melanodryas cucullata westralensis	Hooded Robin (EP, GR, NW)			12-09-07
	Melithreptus brevirostris	Brown-headed Honeyeater			13-04-06
	Melopsittacus undulatus	Budgerigar			10-10-05
	Menetia greyii	Dwarf Skink			20-10-08
	Merops ornatus	Rainbow Bee-eater			04-03-06
	Microcarbo melanoleucos	Little Pied Cormorant			28-03-06
	Microeca fascinans	Jacky Winter		ssp	14-09-07
	Milvus migrans	Black Kite			31-08-06
	Mirafra javanica	Horsfield's Bush Lark			22-12-05
	Morelia spilota	Carpet Python		R	21-02-88
	Morethia adelaidensis	Adelaide Snake-eye			20-10-08
	Morethia boulengeri	Common Snake-eye			20-10-08
	Morethia obscura	Mallee Snake-eye			24-11-99
	Morethia sp.				17-10-08
	Mormopterus petersi	Inland Free-tailed Bat			14-01-86
	Mormopterus planiceps	Southern Free-tailed Bat			11-03-97
	Mormopterus spp. (species complex) (NC)	Southern Freetail-bats			11-03-97
*	*Mus musculus*	House Mouse			14-09-07
	Myiagra inquieta	Restless Flycatcher		R	18-01-02
	Neobatrachus pictus	Burrowing Frog			17-02-97
	Neobatrachus sudellae	Sudell's Frog			03-10-99
	Neophema chrysogaster	Orange-bellied Parrot	CR	E	18-08-92
	Neophema chrysostoma	Blue-winged Parrot		V	13-04-06
	Neophema elegans	Elegant Parrot		R	19-10-08
	Neophema petrophila	Rock Parrot		R	30-08-98
	Neophema sp.	Neophema parrots			17-10-08
	Neophema splendida	Scarlet-chested Parrot		R	24-06-96
	Neopsephotus bourkii	Bourke's Parrot			10-09-07
	Nephrurus levis	Smooth Knob-tailed Gecko			17-11-92
	Nesoptilotis leucotis	White-eared Honeyeater			24-09-00
	Ninox boobook	Southern Boobook			11-09-07
	Ninox connivens	Barking Owl		R	18-10-33
	Northiella haematogaster (NC)	Bluebonnet			10-09-07
	Northiella haematogaster haematogaster (NC)	Yellow-vented Bluebonnet			06-09-96
	Notomys alexis	Spinifex Hopping-mouse			01-01-12
	Numenius madagascariensis	Far Eastern Curlew	CR	V	26-01-04
	Nyctophilus geoffroyi	Lesser Long-eared Bat			21-10-08
	Nymphicus hollandicus	Cockatiel			24-09-04
	Ocyphaps lophotes	Crested Pigeon			20-10-08
	Oreoica gutturalis	Crested Bellbird			13-09-07
*	*Oryctolagus cuniculus*	Rabbit (European Rabbit)			20-10-08
*	*Ovis aries*	Sheep (Feral Sheep)			23-07-15

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Oxyura australis	Blue-billed Duck		R	30-07-01
	Pachycephala inornata	Gilbert's Whistler		R	12-08-01
	Pachycephala pectoralis	Golden Whistler			25-04-98
	Pachycephala rufiventris	Rufous Whistler			11-10-80
	Pachycephala rufiventris rufiventris	Rufous Whistler			10-09-07
	Parasuta spectabilis	Mallee Black-headed Snake			18-12-92
	Pardalotus punctatus	Spotted Pardalote			13-04-06
	Pardalotus striatus	Striated Pardalote			17-10-08
	Parvipsitta porphyrocephala	Purple-crowned Lorikeet			30-10-05
	Passer domesticus	House Sparrow			13-04-06
	Pelecanus conspicillatus	Australian Pelican			22-12-05
	Peltohyas australis	Inland Dotterel			25-09-00
	Petrochelidon ariel	Fairy Martin			04-09-05
	Petrochelidon nigricans	Tree Martin			01-09-06
	Petrogale xanthopus xanthopus	Yellow-footed Rock-wallaby	VU		20-06-08
	Petroica boodang boodang	Scarlet Robin		R	23-04-00
	Petroica goodenovii	Red-capped Robin			17-10-08
	Phalacrocorax carbo	Great Cormorant			09-09-02
	Phalacrocorax sulcirostris	Little Black Cormorant			28-03-06
	Phalacrocorax varius	Great Pied Cormorant			28-03-06
	Phaps chalcoptera	Common Bronzewing			17-10-08
	Phaps histrionica	Flock Bronzewing		R	07-09-13
	Phylidonyris novaehollandiae	New Holland Honeyeater			23-07-99
	Planigale tenuirostris	Narrow-nosed Planigale			22-11-99
	Platalea flavipes	Yellow-billed Spoonbill			29-10-01
	Platycercus elegans	Crimson Rosella			13-04-06
	Platycercus elegans fleurieuensis & elegans subadelaidae (NC)	Adelaide Rosellas			03-08-93
	Pluvialis squatarola	Grey Plover			12-12-99
	Podargus strigoides	Tawny Frogmouth			10-09-07
	Podiceps cristatus	Great Crested Grebe		R	21-09-02
	Pogona vitticeps	Central Bearded Dragon			20-10-08
	Poliocephalus poliocephalus	Hoary-headed Grebe			10-09-07
	Pomatostomus superciliosus	White-browed Babbler			20-10-08
	Porphyrio porphyrio	Purple Swamphen			07-10-99
	Porzana fluminea	Australian Crake (Australian Spotted Crake)			17-01-04
	Psephotellus varius	Mulga Parrot			10-09-07
	Psephotus haematonotus	Red-rumped Parrot			02-04-06
	Psephotus haematonotus haematonotus	Red-rumped Parrot (eastern SA except NE)			24-11-99
	Pseudechis australis	Mulga Snake			20-10-08
	Pseudomys bolami	Bolam's Mouse			22-10-08
	Pseudonaja aspidorhyncha	Patch-nosed Brown Snake			17-11-92
	Pseudonaja inframacula	Peninsula Brown Snake			01-01-50
	Pseudonaja mengdeni	Gwardar			10-07-83
	Pseudonaja modesta	Five-ringed Snake			08-04-82
	Pseudonaja nuchalis (NC)	Western Brown Snake			15-10-05

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Pseudonaja sp.	(blank)			11-03-97
	Pseudonaja textilis	Eastern Brown Snake			12-03-97
	Psophodes cristatus	Chirruping Wedgebill			01-09-06
	Ptilotula ornata	Yellow-plumed Honeyeater			14-09-07
	Ptilotula penicillata	White-plumed Honeyeater			13-04-06
	Ptilotula plumula	Grey-fronted Honeyeater			28-03-91
	Ptilotula plumula graingeri	Grey-fronted Honeyeater (FR, MN, LNE, MM)			13-04-06
	Purnella albifrons	White-fronted Honeyeater			11-09-07
	Pygopus nigriceps	Black-headed Scaly-foot			26-03-79
	Pyrrholaemus brunneus	Redthroat			18-10-08
	Rattus rattus	Black Rat (Ship Rat, Roof Rat)			25-11-99
	Recurvirostra novaehollandiae	Red-necked Avocet			30-08-06
	Rhipidura albiscapa	Grey Fantail			13-04-06
	Rhipidura leucophrys	Willie Wagtail			10-09-07
	Rhynchoedura ornata (NC)	Beaked Gecko			06-09-82
	Simoselaps bertholdi	Desert Banded Snake			18-10-08
	Smicrornis brevirostris	Weebill			18-10-08
	Sminthopsis crassicaudata	Fat-tailed Dunnart			20-10-08
	Sminthopsis dolichura	Little Long-tailed Dunnart			23-11-99
	Sminthopsis macroura	Stripe-faced Dunnart			14-09-07
	Spilopelia chinensis	Spotted Dove			22-01-01
	Stagonopleura guttata	Diamond Firetail		V	10-10-05
	Sternula nereis	Fairy Tern	VU	E	09-11-02
	Stictonetta naevosa	Freckled Duck		V	29-10-01
	Stiltia isabella	Australian Pratincole			02-12-00
	Strepera versicolor	Grey Currawong		ssp	13-04-06
	Strepera versicolor intermedia	Brown Currawong			12-09-07
	Strophurus elderi	Jewelled Gecko			25-11-99
	Strophurus intermedius	Southern Spiny-tailed Gecko			14-09-07
	Struthidea cinerea	Apostlebird			02-04-06
*	*Struthio camelus*	Common Ostrich			26-09-00
	Sturnus vulgaris	Common Starling			11-09-07
	Sugomel niger	Black Honeyeater			29-10-01
	Suta suta	Curl Snake			12-09-07
	Tachybaptus novaehollandiae	Australasian Grebe			13-04-06
	Tachyglossus aculeatus	Short-beaked Echidna	ssp		11-03-97
	Tadorna tadornoides	Australian Shelduck			14-04-01
	Taeniopygia guttata	Zebra Finch			10-09-07
	Thalasseus bergii	Greater Crested Tern			28-03-06
	Tiliqua occipitalis	Western Bluetongue			22-04-92
	Tiliqua rugosa	Sleepy Lizard			20-10-08
	Tiliqua scincoides	Eastern Bluetongue			22-04-92
	Todiramphus pyrrhopygius	Red-backed Kingfisher			01-09-06
	Todiramphus sanctus	Sacred Kingfisher			17-10-08
	Tribonyx ventralis	Black-tailed Nativehen			24-09-04

*	Scientific name	Common name	Conservation status		Last sighting (year)
			Aus	SA	
	Trichoglossus haematodus	Rainbow Lorikeet			07-10-01
	Trichosurus vulpecula	Common Brushtail Possum		R	01-01-73
	Tringa nebularia	Common Greenshank			30-08-06
	Tringa stagnatilis	Marsh Sandpiper			27-03-06
	Turdus merula	Common Blackbird			04-09-05
	Turnix varius	Painted Buttonquail		R	28-04-99
	Turnix velox	Little Buttonquail			13-09-07
	Tursiops aduncus	Indo-Pacific Bottlenose Dolphin			02-11-06
	Tympanocryptis lineata	Five-lined Earless Dragon			21-04-84
	Tympanocryptis tetraporophora	Eyrean Earless Dragon			20-11-91
	Tyto delicatula	Eastern Barn Owl			30-10-05
	Underwoodisaurus milii	Common Barking Gecko			22-10-95
	Vanellus miles	Masked Lapwing			30-08-06
	Vanellus tricolor	Banded Lapwing			30-08-06
	Varanus gilleni	Pygmy Mulga Goanna			01-10-84
	Varanus gouldii	Sand Goanna			01-01-15
	Varanus varius	Lace Monitor		R	12-01-17
	Vespadelus baverstocki	Inland Forest Bat			18-10-08
*	*Vulpes vulpes*	Fox (Red Fox)			23-07-15
	Zosterops lateralis	Silvereye			06-10-06

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. *: Introduced.

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APPENDIX F

Traffic and Route Assessment

WALLBRIDGE GILBERT AZTEC

Altura Group

Goat Hill Pumped Storage Hydro Project

TRAFFIC IMPACT & ACCESS POINT ASSESSMENT

Job No. ADL170460/ C
06 November 2017

Revision History

Rev	Date	Issue	Originator	Checker	Approver
A	03 October 17	Draft for Comment	SSS/HL	JZ	JZ
B	20 October 17	Final	SSS/HL	JZ	JZ
C	06 November 17	Final	SSS	JZ	JZ

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

Wallbridge Gilbert Aztec (WGA) has been engaged by Altura Group Pty Ltd (Altura) to undertake a traffic impact and access point assessment for a proposed Pumped Storage Hydro (PSH) facility to be located near Port Augusta, South Australia. The purpose of the assessment is to examine the suitability of proposed access points in relation to the existing road network, the condition of the existing road network and its suitability to accommodate heavy vehicle movements and the proposed traffic demand to assist with the Development Application with the State Commission Assessment Planning.

1.2 PROJECT DESCRIPTION

1.2.1 General

The Goat Hill PSH Project (the Project) is located 12km west of Port Augusta and 55km NNE of Whyalla, as shown in Figure 1. Central Adelaide is located approx. 280km to the SSE.

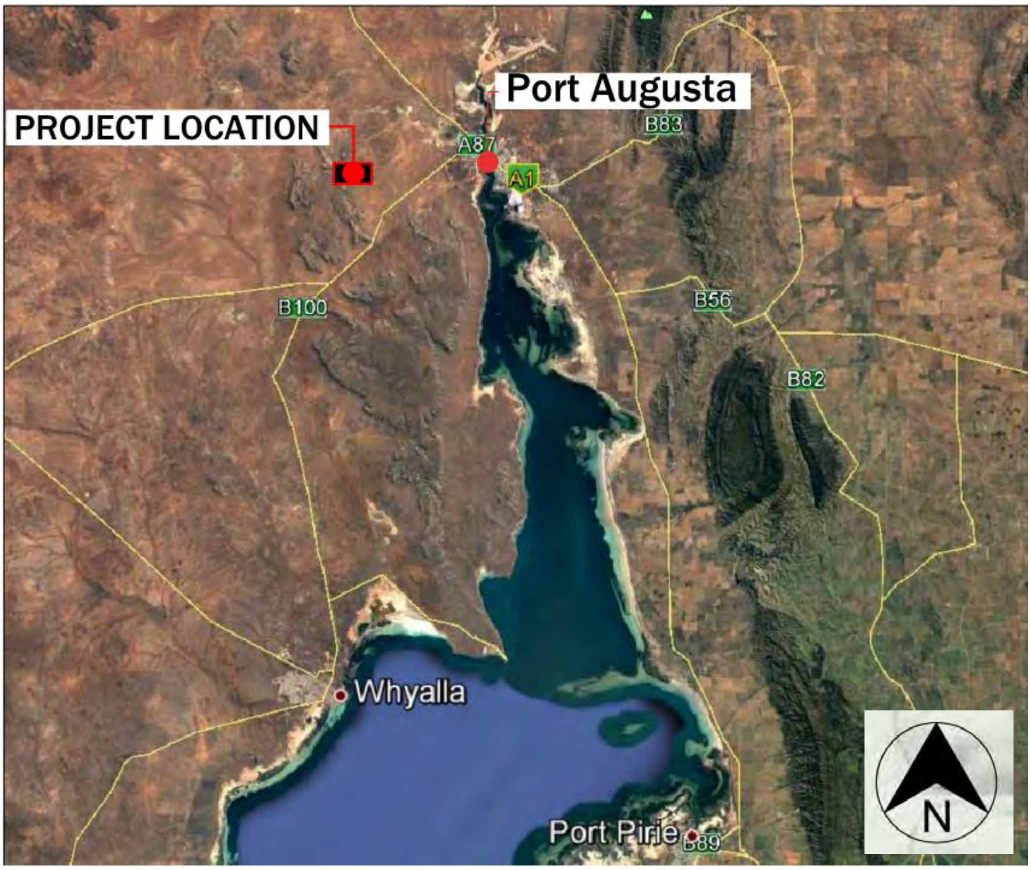


Figure 1 Proposed location of PSH facility (Source: Altura Group Pre-Feasibility Design General Layout)

The site is used for sheep grazing and, although uncleared, this activity (together with rabbits and goats) has impacted on the remnant native vegetation. A network of farm tracks resulting from previous and current grazing activities exist on the land.

1.2.2 Facility

The Project consists of an upper reservoir formed by engineered earth embankments, an upper intake, a surface steel penstock (pipeline), vertical pressure shaft, below ground powerhouse, tailrace tunnel and open cut channel to the lower reservoir also formed by engineered earth embankments. A switchyard connects the Project to the SA electricity network. The PSH will be accessed via a proposed access road, accessed from the Eyre Highway, as shown in Figure 2 below.

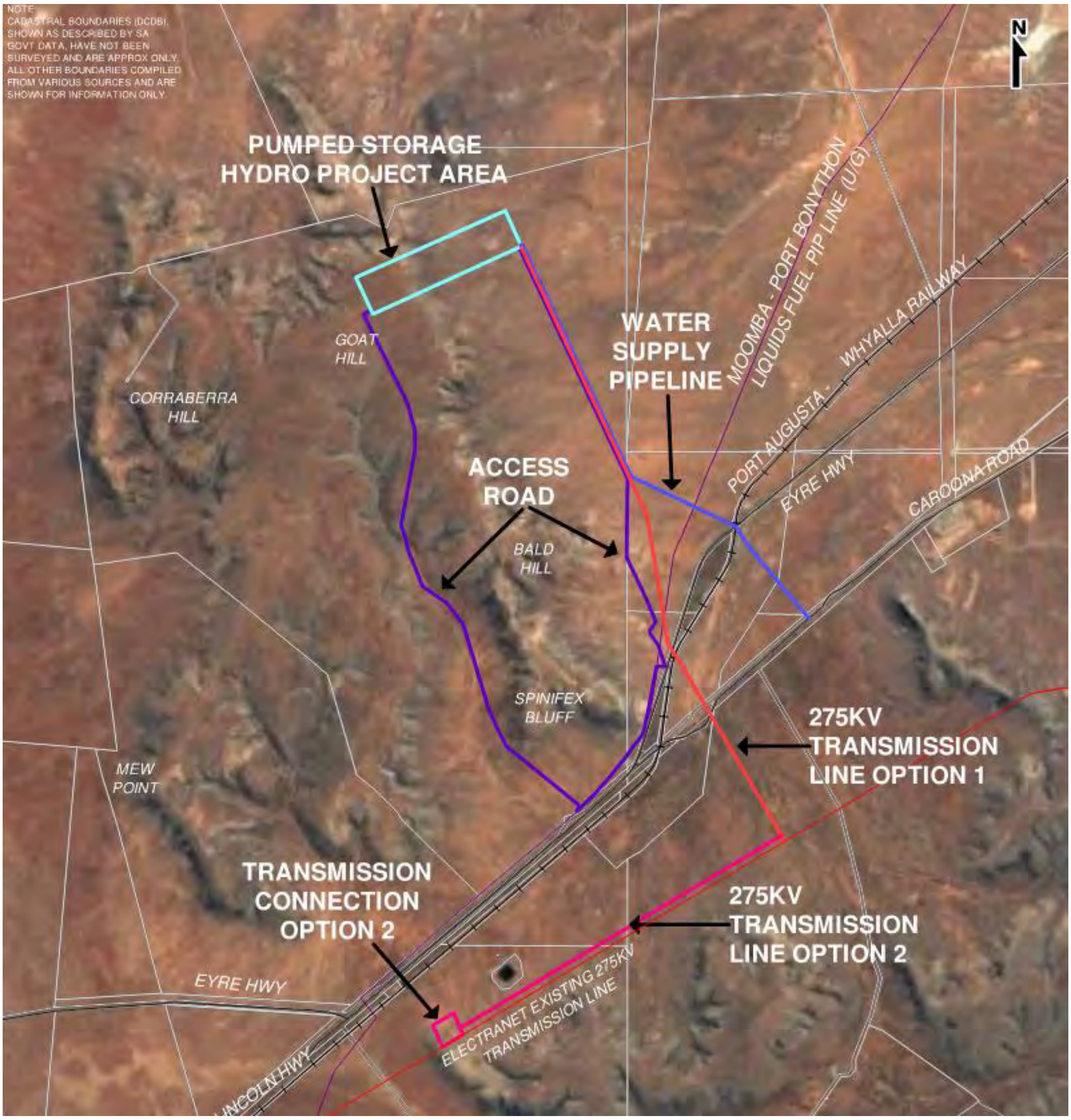


Figure 2 Proposed site layout (Source: Goat Hill Project Overview, GHL-LAC-DRA-0003)

1.3 SCOPE OF THE ASSESSMENT

The transportation of materials for the PSH will lead to a temporary increase in the number of heavy vehicles on surrounding roads and Altura is seeking to ensure that the network and the proposed access points are in a suitable condition to accommodate the anticipated volumes and the potential impact to amenity on the surrounding road network is minimised.

The assessment incorporates the following elements:

- Identification of proposed site access points
- Calculation of vehicle volumes likely to be generated by the proposed PSH facility
- Assessment of the current condition of the identified access points, identifying hazards and impediments to heavy vehicle movements and recommending treatments where required

1.4 INFORMATION SOURCES

A site assessment was undertaken on 15 September 2017 by WGA, and incorporated reviewing the proposed access points. Information on projected vehicle volumes during the construction and operation periods has been provided by Altura.

2 ACCESS POINTS

2.1 GENERAL

It has been assumed that all vehicle movements will access the site from the Eyre Highway, with the majority travelling from the north-east (from Port Augusta). This is based on the assumption that the majority of construction components will be sourced from the Port Adelaide region and movements produced during the operational period of the PSH will generally be from the Port Augusta region.

In addition to the site access point on the Eyre Highway, WGA have also undertaken a high level assessment of where the proposed transmission lines and water pipeline cross the Eyre Highway and Caroona Road, in order to determine the suitability for provision of an access/maintenance track at these locations.

The locations assessed are illustrated in Figure 3 below.

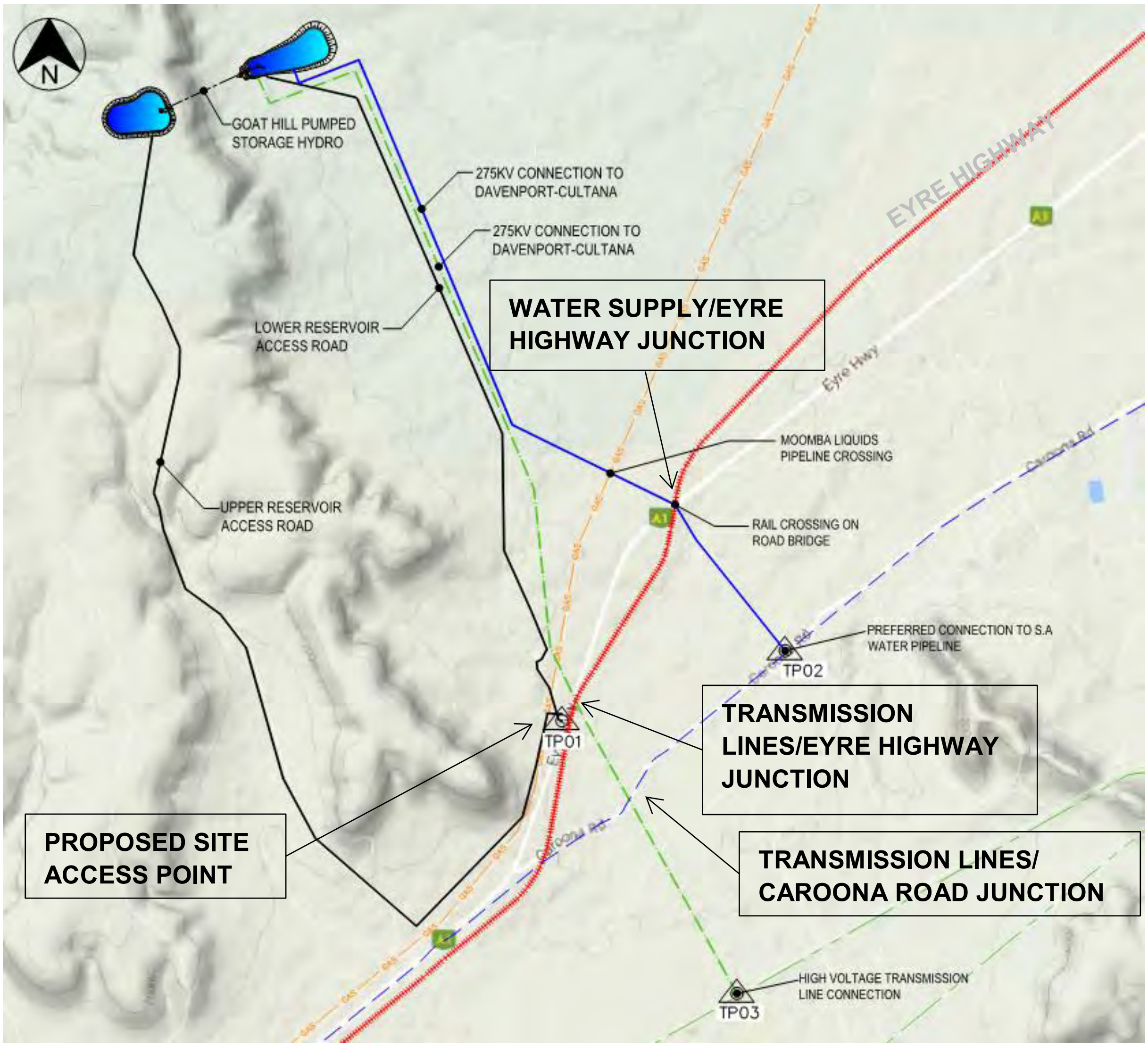


Figure 3 Site access points and junctions

2.2 GAZETTED FREIGHT ROUTES

The gazetted freight routes in the vicinity of the Project have been obtained from Department of Planning, Transport and Infrastructure's (DPTI's) RavNet website and are illustrated in Figure 4 below.

It can be seen that the Eyre Highway and a number of surrounding roads are gazetted 36.5 m road train routes. It has been assumed that all freight will access the Eyre Highway from one of these gazetted routes before accessing the site.

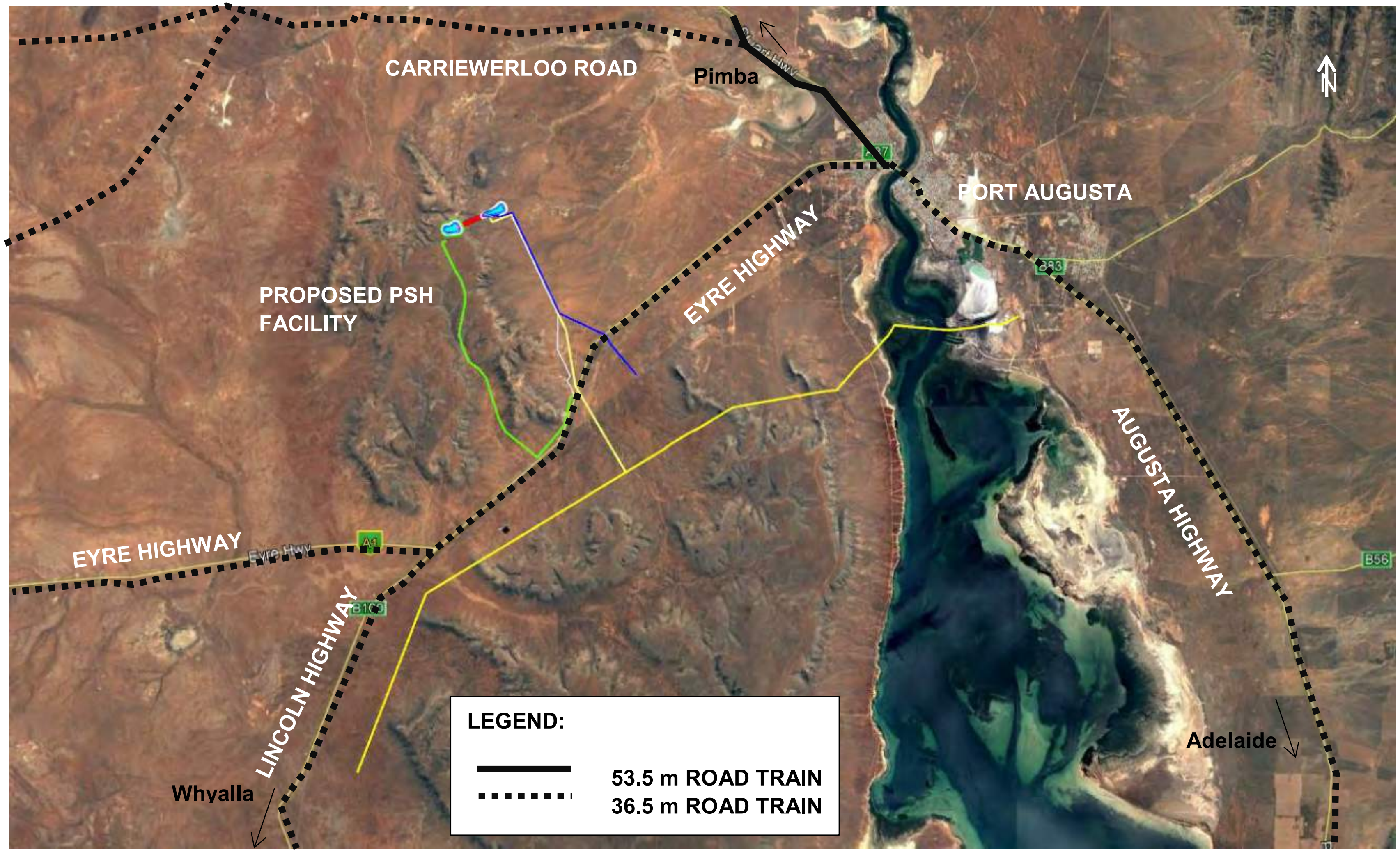


Figure 4 Gazetted freight routes in the vicinity of the Project

3 VEHICLE VOLUMES

3.1 EXISTING TRAFFIC

Traffic volumes on surrounding DPTI operated roads have been obtained from the SAViewer Website and are summarised in Table 3.1 below, including the annual average daily traffic volumes (AADTs) and the percentage of heavy vehicles (%HV) on each road. Although traffic information has been provided for Caroona Road by Council, the information provided is for the section of Caroona Road located within the township of Port Augusta (approximately 13km from the site) and the traffic volumes provided are not considered to be an accurate representation of actual traffic volumes at the site location. As Caroona Road is not a gazetted freight route (within the vicinity of the proposed site) and is unlikely to be utilised to access the site, it has not been assessed as part of this study.

Table 3.1 Existing traffic volumes

Road	Year of Count	Annual Average Daily Traffic (AADT)	Percentage of heavy vehicles (%HV)	Source
Eyre Highway	2014	2700	20.5%	SAViewer Website
Lincoln Highway	2016	2100	17.0%	SAViewer Website
Augusta Highway	2015	10800	12.0%	SAViewer Website

3.2 GENERATED TRAFFIC

3.2.1 General

Information on the amount and type of traffic expected to be generated by the construction and operation of the PSH facility has been provided by Altura. The majority of vehicle movements generated will be within the (approximate) thirty month construction period, with minimal traffic expected to be generated by the site once operational.

3.2.2 Construction

A summary of estimated construction period volumes provided by Altura is shown in Table 3.2 below, including an estimate of the average daily volume of vehicle trips based on a thirty month construction period (and an average of 30.5 days per month). The use of the term ‘Trip’ represents a one-way vehicular movement from one point to another. Therefore, a vehicle entering and leaving the PSH facility will correspond to two trips.

Table 3.2 Construction period traffic volumes

Vehicle	Vehicle trips (Total)	Equivalent Trips (Veh/Day)
Heavy Vehicles	33,722	37
Light Vehicles	90,000	100
Total	**123,722**	**137**
% HV	-	27.3 %

It can be seen from information contained in Table 3.2 above that the majority of movements to the site during the construction period are expected to be by light vehicles, followed by small-medium delivery trucks and semi-trailers. A moderate number of buses and coaches are also assumed to access the site during the construction period.

It should be noted that Altura have also indicated that a number of components may require transport via an oversize/overmass vehicle to the site:

- 2 motor-generators, in the order of 230 tonnes each ;
- 2 runners, in the order of 120 tonnes;
- Overhead crane beams, in the order of 10 tonnes and approximately 15m long;
- 2 transformers, in the order of 200 tonnes each; and
- Concrete Batching Plant Silo – likely oversize.

It has been assumed that these vehicles will travel to the site via the Eyre Highway and permits will need to be obtained from DPTI prior to travel.

3.2.3 Operations

Altura have advised that the PSH facility will possibly be operated remotely and consequently vehicle traffic to site during the operational period will be minimal.

In the event that the PSH facility requires onsite operation, it is expected that there will be two people present at the site over an eight-hour operational period, with three operational periods a day. Therefore, an average of six light vehicle movements per day for seven days a week is estimated based on the assumption that these staff will travel to site in separate light vehicles and the PSH facility operates all week. In addition to these movements, on average there will be two delivery truck movements and one waste truck movement a month to allow for periodic cleaning and maintenance. These volumes are summarised in Table 3.3 below.

Table 3.3 Operational period traffic volumes

Vehicle Type	Vehicle Trips - Average Per Week	Vehicle Trips - Average Per Day
Trucks	1.5	<1
Light Vehicles	84	12
Total	**84**	**12**

3.3 NETWORK TRAFFIC IMPACT

Table 3.4 and Table 3.5 below show the estimated impact on the surrounding road network resulting from the traffic to be generated by the development during the operational and construction phases. These volumes and percentages have been calculated on the assumption that the forecast traffic will be the sum of the existing traffic volume and 100% of the traffic trips generated by the PSH facility (that is, all generated traffic will access the site via the same route). Although this high traffic loading is not expected on the Lincoln Highway, it has been assumed as a sensitivity analysis.

Table 3.4 Network traffic impact- construction

Road	AADT			% HV		
	Existing	Forecast	% Increase	Existing	Forecast	% Increase
Eyre Highway	2700	2837	5.1%	20.5%	20.8%	0.3%
Lincoln Highway	2100	2237	6.5%	17.0%	17.6%	0.6%
Augusta Highway	10800	10937	1.3%	12.0%	12.2%	0.2%

Table 3.5 Network traffic impact- operational

Road	AADT			% HV		
	Existing	Forecast	% Increase	Existing	Forecast	% Increase
Eyre Highway	2700	2712	0.4%	20.5%	20.4%	-0.1%
Lincoln Highway	2100	2112	0.6%	17.0%	16.9%	-0.1%
Augusta Highway	10800	10812	0.1%	12.0%	12.0%	0.0%

It can be seen from Table 3.4 and Table 3.5 above that the traffic generated by the proposed PSH facility will have almost no impact on percentage of heavy vehicles on the subject roads, with the maximum change in percentage of heavy vehicle equivalent to 1% (Lincoln Highway).

During the construction period, Lincoln Highway would be most affected by the increase in traffic volumes due to the PSH facility construction, resulting in a 7% growth in AADT, followed by Eyre Highway (5%). There would be almost no influence on the traffic condition of Augusta Highway (1% increase).

During the operational period, there would be no impact on traffic volumes or heavy vehicle percentages, with the exception of the Lincoln Highway (which would have a 1% increase in AADT).

3.4 SUMMARY

Although the traffic volumes and percentage of heavy vehicles may increase slightly on the surrounding roads during construction, each of these roads is already a gazetted freight route (with minimal residences and generally good pavement condition) and as such the slight increase in traffic will have minimal impact.

It is noted that if all construction and operational traffic was to utilise the Lincoln Highway to access the Project, it would result in the highest increase in traffic volumes (6.5%) and percentage of heavy vehicles (0.6%) when compared to other routes. However, it is likely that only a small amount of construction traffic and potentially some operational traffic may access the Project from Whyalla via the Lincoln Highway, resulting in a greatly decreased impact than the calculated volumes.

The increase on all roads during the operational period is considered negligible due to the small volume of traffic generated.

4 ACCESS POINT ASSESSMENT

4.1 GENERAL

As discussed in Section 2.1, it is understood that the Project will be accessed primarily from an access point located off the Eyre Highway. On 15 September 2017, WGA undertook a site assessment of the proposed access point, assessing:

- Typical road geometry;
- Pavement condition;
- Stormwater drainage; and
- Sight Distance.

In addition to the main Eyre Highway access point, an assessment of where the proposed transmission lines and water pipeline cross the Eyre Highway and Caroona Road were also undertaken to determine the suitability for provision of an access/maintenance track at these locations.

4.2 SITE ACCESS POINT - EYRE HIGHWAY

4.2.1 General

The proposed Project access point is located on the Eyre Highway, at the site of an existing access point to a local quarry (Augusta Quarries), as shown in Figure 5 below. The dominant movements likely to be produced by the proposed PSH facility are also illustrated in Figure 5 below, and consist of right turns from the Eyre Highway to the proposed access road and left turn from the proposed access road to Eyre Highway. There is no warning or information signage associated with the existing access point (or quarry) located on either of the Eyre Highway approaches of the intersection, with the current quarry advertised via a small white sign located adjacent the access gate.

Approximately 30 m to the north of the proposed access point, an access point on the eastern side of the Eyre Highway provides access to the adjacent rail corridor (which runs parallel to the Eyre Highway at this location).

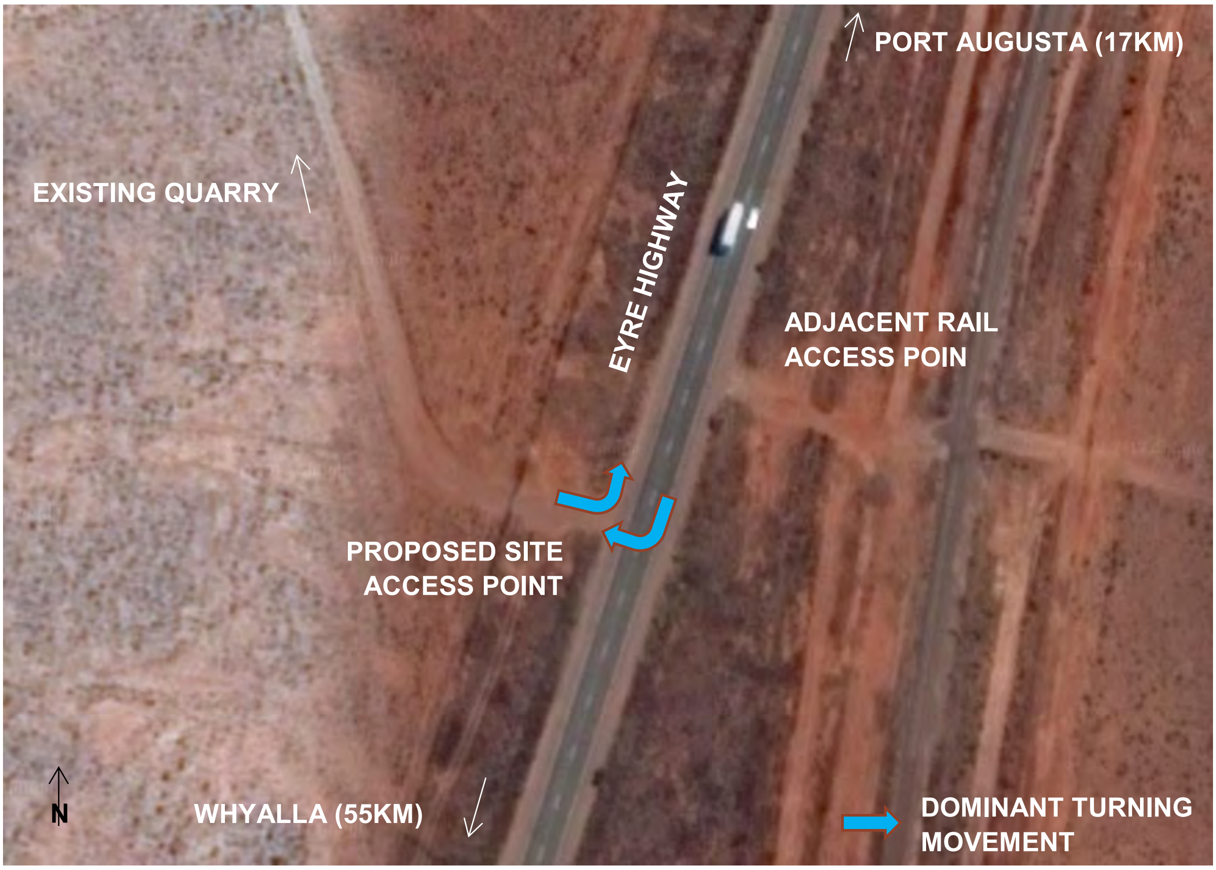


Figure 5 Proposed access point on Eyre Highway

4.2.2 Geometry

Adjacent the access point, the Eyre Highway comprises an approximately 7.6 m wide sealed carriageway with unsealed shoulders (varying in width from 2.2 m to 4m) and a two-way crossfall. Slightly wider unsealed shoulders (approximately 4m) are provided adjacent the access gate on the eastern side of the Eyre Highway (noting that this may be provided to assist turning heavy vehicles). Eyre Highway is straight on approach to the access point, with the closest horizontal curves located 1.6 km to the south and 1.8 km to the north, with a slight gradient increase to the south.

The existing access point has an approximate width of 15 m where it meets the Eyre Highway, tapering to a 4 m width single span access gate, located approximately 28 m from the edge of seal of the Eyre Highway, as shown in Figure 6. The access point location meets the Eyre Highway at an approximate angle of 90 degrees, and vehicles can access the gate via a gentle batter from the Eyre Highway.

Figure 6 Current configuration of site access point

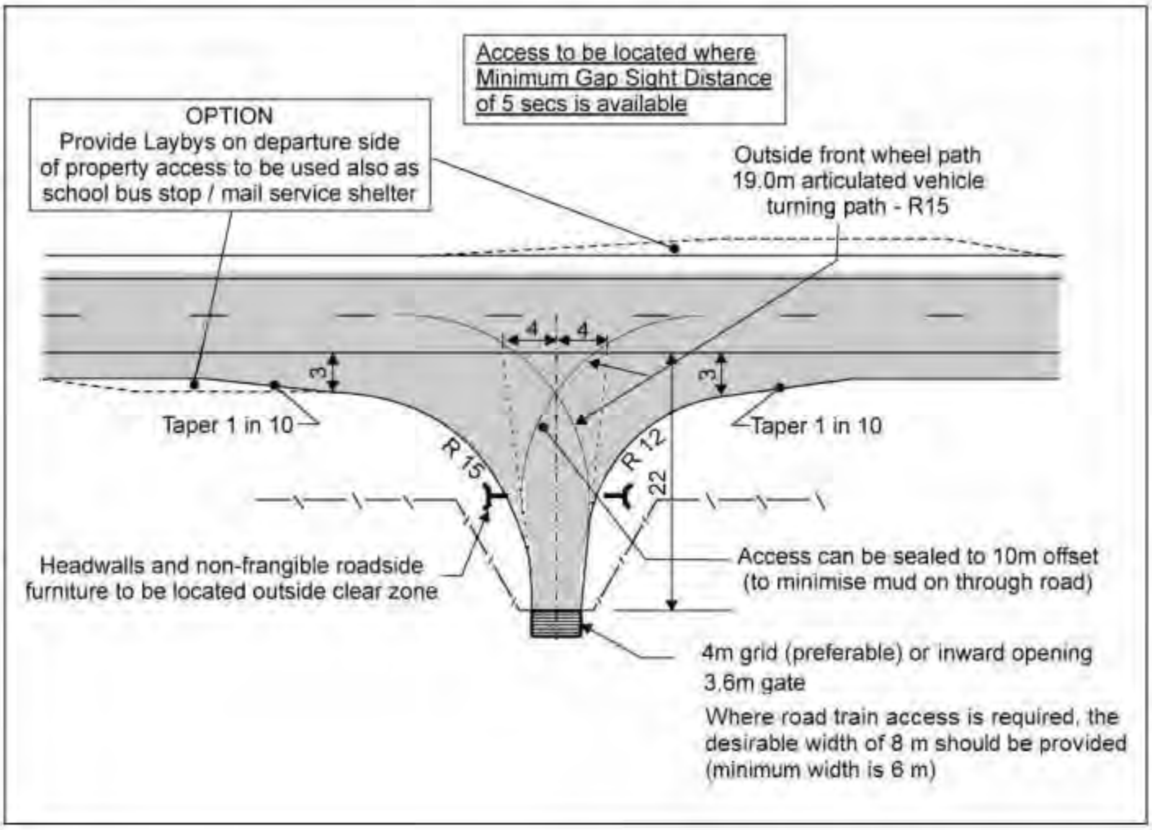
During the site investigation, a semi-trailer was observed to travel southbound along the Eyre Highway before turning right at the existing access point, as shown in Figure 7. The semi-trailer comfortably completed the turning manoeuvre, turning wide and slowing to a speed of approximately 30 km/hr to pass through the gate. An A-double was also observed to enter the site during the site investigation, with no apparent issues.

Figure 7 Semi-trailer observed utilising access point

The geometry of the access point has been assessed against guidance contained within the Austroads Guide to Road Design Part 4: Intersections and Crossings (AGRD4), which is a general guide providing road designers and other practitioners with information that is common to the geometric design of all at-grade intersections.

The existing geometry of the access point generally meets the requirements of AGRD4 (shown in Figure 8 below). However, the existing access gate width of approximately 4 m does not meet the desirable width of 8 m (minimum width of 6 m) for road train access. Although minimal road trains are to access the site, widening of the gate should be considered to accommodate these.

Due to the increased traffic volumes during construction (approximately 137 trips per day – refer to Section 3.2) consideration should also be given to installing warning signage to advise outgoing vehicles to give way to incoming vehicles if required. Although this signage will be located on private property, it is recommended that such signage should meet the requirements of AS1742.



Note: Minimum requirement for a single carriageway with design AADT <2000 or minimum requirement for dual carriageway left-in – left-out access for single unit truck. Where AADT >1000 and access is required for a semi-trailer then use the layout.

Source: Based on Austroads (2005).

Figure 8 Example of a rural property access for articulated vehicles on a two-lane two-way road (Source: AGRD4 Figure 7.4)

4.2.3 Pavement Condition

Adjacent the proposed access point, the Eyre Highway was observed to be surfaced with a spray seal (placed over thin asphalt layers). The seal was observed to be in average condition, with flushing visible in the wheelpaths and minor edge break visible at some locations along the junction with the existing access point. Where this had occurred, there was also visible erosion to the unsealed surface of the existing access point, likely exacerbated by the transfer of weight of heavy vehicles, as shown in Figure 9 below. The unsealed shoulder was observed to be generally in good condition with no sign of major erosion.

Figure 9 Minor edgebreak at proposed site access point

The unsealed access point was observed to be generally in good condition, with no major defects or deformations observed during the site assessment. Some minor rutting was visible where vehicles had tracked outside of the areas with wearing course, such as shown in Figure 10.

Figure 10 Minor rutting at proposed site access point

Due to the generally good condition of the existing pavement, there should be minimal works required during construction or operation of the site, outside of general maintenance requirements. It is however recommended that additional material be placed at locations of edge break, to provide a flush surface for vehicles tracking the joint. The pavement should be monitored during construction and operations, and consideration could be given to placing an asphalt surface or applying a resheet if it is found that the pavement is not withstanding the increased traffic loadings adequately.

Consideration could also be given to placing additional gravel wearing course adjacent the access gate to protect the pavement from wide turning vehicles and to providing a sealed wearing course adjacent the Eyre Highway to prevent mud from being tracked onto the Eyre Highway during wet weather.

4.2.4 Stormwater Drainage

No formal stormwater drainage infrastructure was observed at the existing access point during the site assessment. The two-way crossfall on the Eyre Highway drains water away from the pavement and shoulders to shallow informal table drains and vegetation located adjacent to the Eyre Highway. No visible erosion or scour was present within the site with some minor areas observed that could potentially pool water during a major stormwater event, such as the area shown below in Figure 11.

Figure 11 Low area at proposed access point

Given the high level of traffic already utilising the access point and the minimal amount of damage observed, these areas are not considered to be of high concern. However, they should be monitored for damage during construction and operations and maintenance applied where required.

4.2.5 Sight Distance

AGRD 4A states that for property accesses, sight distances at accesses should desirably comply with the sight distance requirements for intersections i.e. that approach sight distance (ASD), safe intersection sight distance (SISD) and minimum gap sight distance (MGSD) are achieved.

Approach Sight Distance (ASD)

ASD is the minimum level of sight distance which must be available on the minor road approaches to all intersections to ensure that drivers are aware of the presence of an intersection.

For a design speed of 40 km/hr and a reaction time of 2.0 seconds, the ASD required is 40 m (Table 3.1, AGRD 4A). This is assumed to have been achieved at the current site access point (not assessed during the site investigation as inside private property).

Safe Intersection Sight Distance (SISD)

SISD provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road approach moving into a collision situation and to decelerate to a stop before reaching the collision point.

For a design speed of 120 km/hr and a reaction time of 2.0 seconds, the ASD required is 324 m (Table 3.2, AGRD 4A). This is achieved at the current site access point.

Minimum Gap Sight Distance (MGSD)

MGSD is based on distances corresponding to the critical acceptance gap that drivers are prepared to accept when undertaking a crossing or turning manoeuvre at intersections.

For an approach speed of 110 km/hr (the maximum approach speed provided) and a critical gap acceptance time of 5 seconds, the required MGSD is 153 m (Table 3.5, AGRD 4A). This is achieved at the current site access point.

4.3 WATER SUPPLY PIPELINE/EYRE HIGHWAY JUNCTION

4.3.1 General

WGA have also undertaken a high level assessment of the site where the proposed water supply pipeline will cross the Eyre Highway in order to assess suitability for provision of an access point to a maintenance track to be provided adjacent the pipeline (if required). The location of the junction is shown in Figure 12 below.

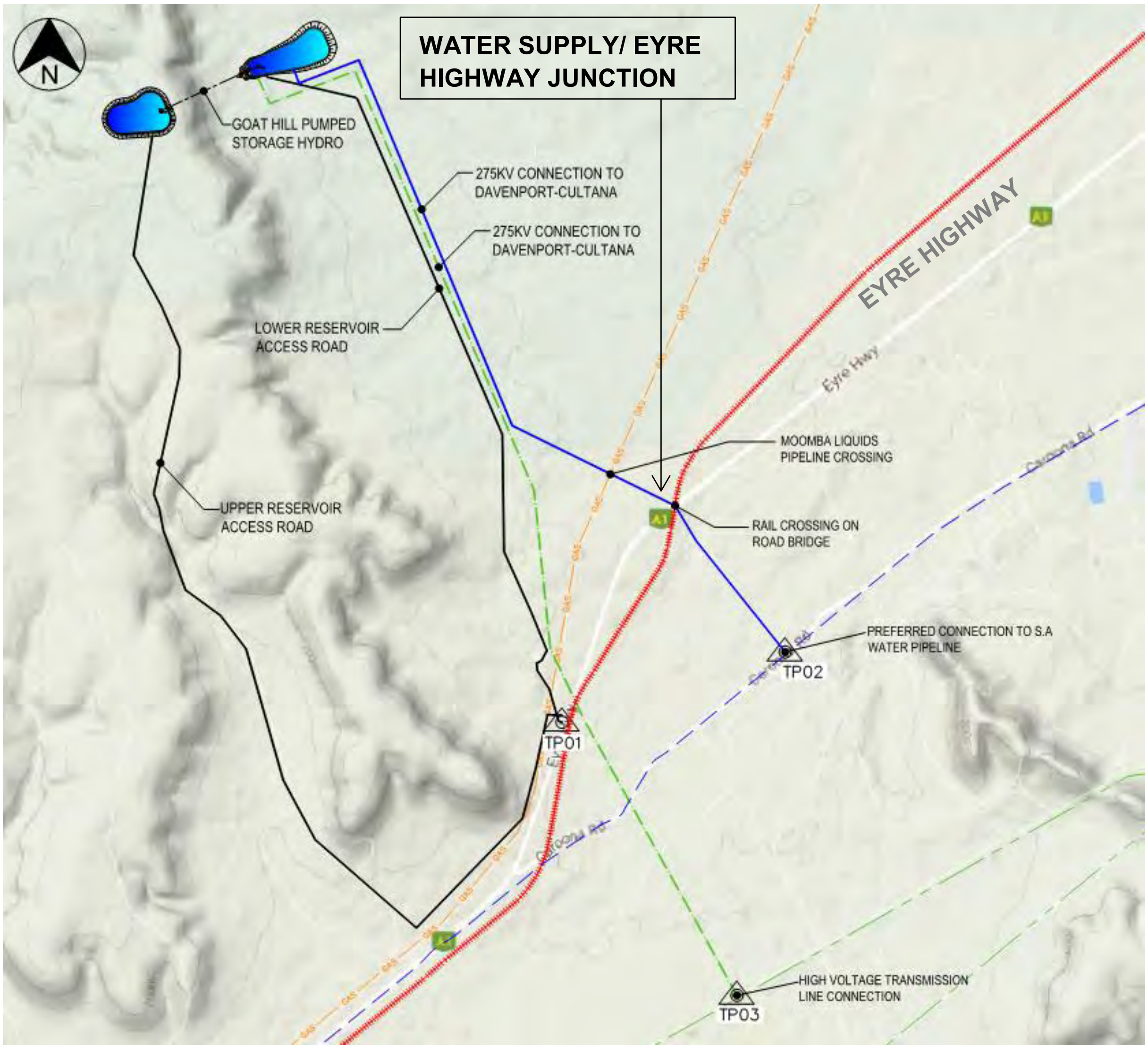


Figure 12 Location of Water Supply Pipeline/Eyre Highway junction

The water supply pipeline appears to be proposed to be located adjacent the existing rail line, which crosses the Eyre Highway at an underpass. An existing access track exists adjacent the existing rail (on both sides of the Eyre Highway) as shown in Figure 13 below, which appears to be accessed via private property.

Figure 13 Existing access track adjacent rail (and proposed water supply pipeline)

It has therefore been assumed that the water supply pipeline will be accessed via this existing access track, and no further assessment has been undertaken on accessing the water supply pipeline (and potential associated maintenance access track) from public roads.

4.4 TRANSMISSION LINE/EYRE HIGHWAY JUNCTION

4.4.1 General

WGA have also undertaken a high level assessment of the site where the proposed transmission line will cross the Eyre Highway in order to assess suitability for provision of an access point to a maintenance track to be provided adjacent the transmission line (if required). The location of the junction is shown in Figure 14 below, and is located approximately 300 m to the north of the proposed site access point. The junction is located on a section of the Eyre Highway raised approximately 1.5 m above the surrounding area, with batter slopes of approximately 1:6 in each verge.

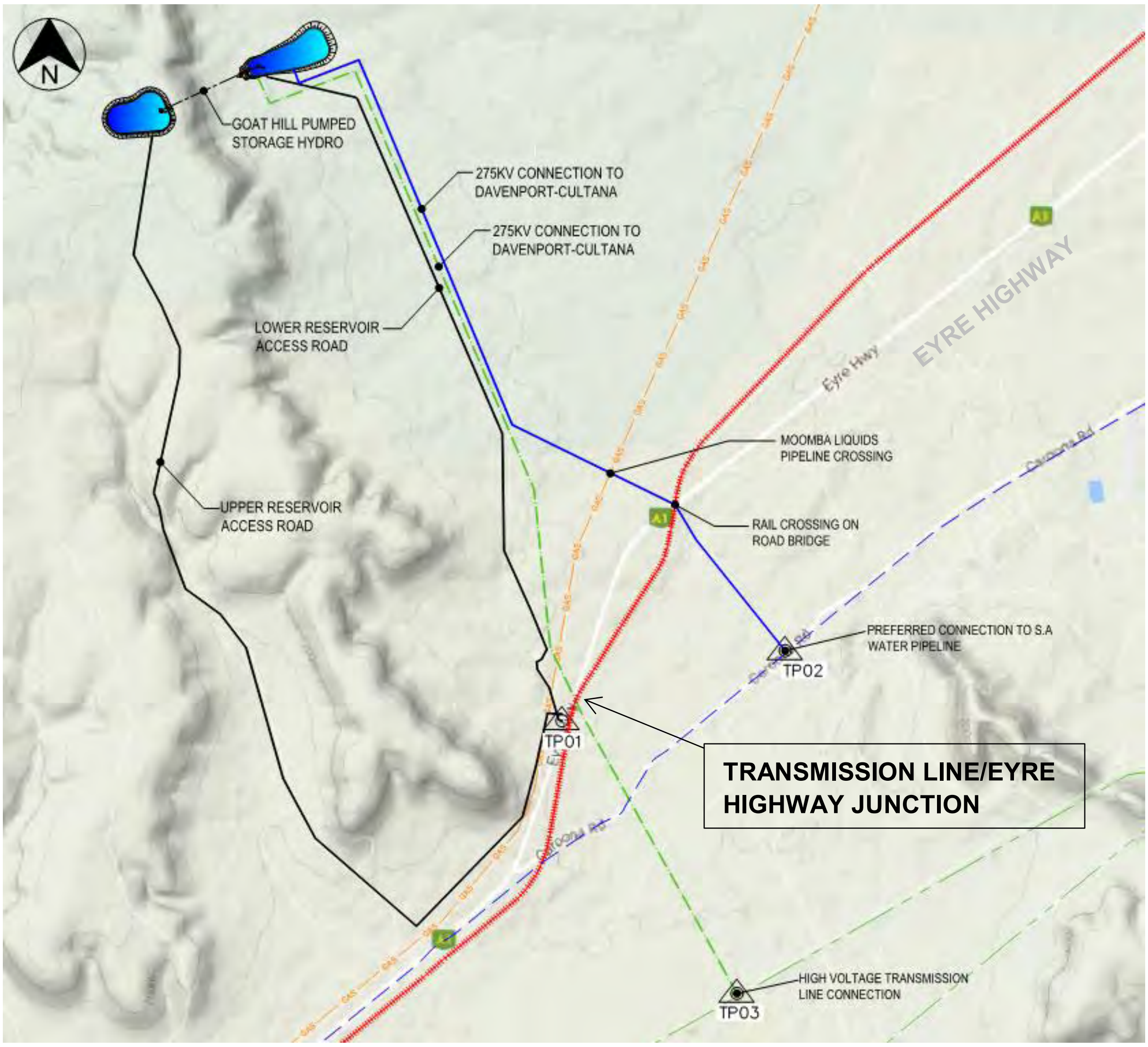


Figure 14 Location of Transmission Line/Eyre Highway junction

On the western side of the Eyre Highway, an existing access track was observed to exist inside of the private property boundary, as shown in Figure 15 below. The access track appears to branch off of the access track accessed from the proposed site access point. On the eastern side of the Eyre Highway, an existing access track exists adjacent the existing rail, as shown in Figure 16 below.

Figure 15 Existing access track, western side of Eyre Highway

Figure 16 Existing access track, eastern side of Eyre Highway

It has therefore been assumed that the transmission line will be accessed via this existing access tracks, and no further assessment has been undertaken on accessing the transmission lines (and potential associated maintenance access track) from public roads.

4.5 TRANSMISSION LINE/CAROONA ROAD JUNCTION

4.5.1 General

WGA have also undertaken a high level assessment of the site where the proposed transmission lines will cross Caroona Road in order to assess suitability for provision of an access point to a maintenance track to be provided adjacent the transmission lines (if required). The location of the junction is shown in Figure 17 below. The junction is located on relatively flat ground, and a water supply pipeline runs along the southern side of Caroona Road at this location.

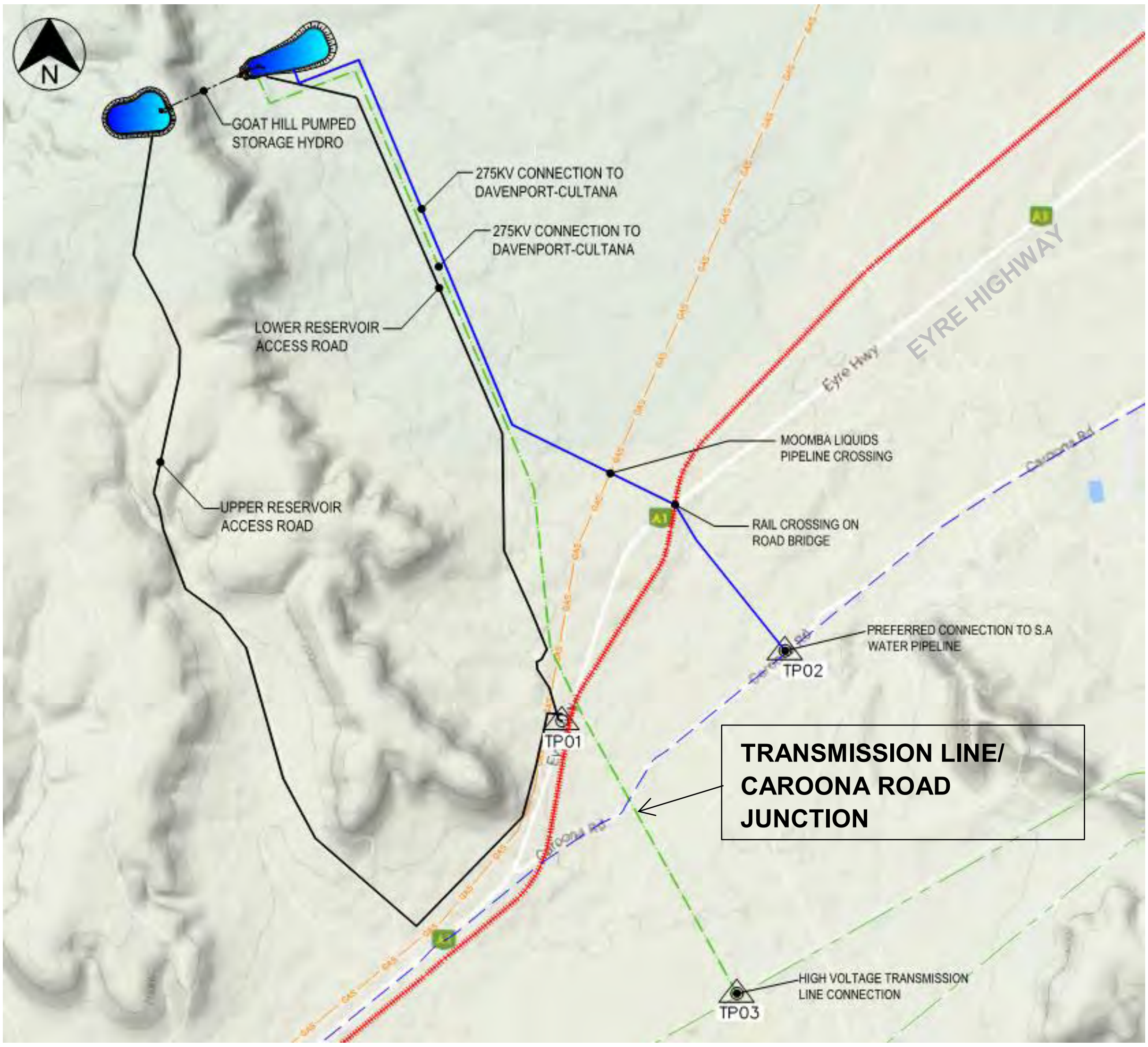


Figure 17 Location of Transmission Line/Caroona Road junction

As there is a water pipeline running along Caroona Road at this location, it has been assumed that no access will be required on the southern side of Caroona Road (as the pipeline would be required to be lowered to allow access), and that the transmission lines on the southern side of Caroona Road will be accessed via an alternative route.

On the northern side of Caroona Road, it has been assumed that access to the transmission lines will be via the Eyre Highway (an access point to the property was found to exist opposite the proposed site access point). If access was also to be provided from Caroona Road, consideration will need to be given to further assessing the pavement condition of Caroona Road, which was observed to be in poor condition during the site visit with severe longitudinal cracking and stripping in the wheelpaths (as shown in Figure 18). The impact on native vegetation should also be assessed.

Figure 18 Longitudinal cracking on Caroona Road

4.6 GENERAL NETWORK ISSUES

4.6.1 General

In addition to the specific issues discussed above, the following issues should be considered with regard to construction haulage:

- During dry periods, airborne dust may be generated by heavy vehicles using unsealed roads, creating an environmental hazard. During dry periods, it is recommended that a water truck is employed on haulage routes to dampen the surface and reduce the creation of airborne dust and it is recommended that an environmental procedure is developed for haulage operations. The policy should outline measures to be implemented to minimise the environmental impact of haulage operations.
- During the construction period, heavy vehicle volumes on the access roads will be increased (minimally). During periods of heavily increased traffic, it is recommended that advance warning methods are implemented to alert the public to the presence of heavy vehicles. It is considered that a portable variable message sign (VMS) would be suitable for providing advance warning of additional heavy vehicles around the access gate. In addition to the VMS, temporary signage could be placed at the proposed site access point during the construction period. It is considered that the use of VMS and signage at the access points will assist in improving safety for all road users during

the construction period. If adopted, advance warning methods should be in accordance with DPTI signage requirements and AS1742.

4.6.2 Oversize Vehicles

Altura have identified that oversize and overmass vehicles will need to access the site during the construction period (refer to Section 3.2.2). During the site inspection undertaken by WGA, two oversize/overmass vehicles were observed to travel along the Eyre Highway past the proposed access point in the space of approximately one hour (one of the vehicles is shown in Figure 19 below). Although permits will need to be obtained during the construction period from DPTI for each specific vehicle prior to travel, the presence of other oversize/overmass vehicles on the Eyre Highway indicates that approval has been granted by DPTI before for travel by this route.

Figure 19 Oversize vehicle tracking the Eyre Highway past proposed site access point

5 SUMMARY

5.1 GENERAL

WGA has been engaged by Altura to undertake a traffic impact and access point assessment for a proposed PSH facility to be located near Port Augusta, South Australia. The purpose of the assessment is to examine the suitability of proposed access points in relation to the existing road network, the condition of the existing road network and its suitability to accommodate heavy vehicle movements and the proposed traffic demand to assist with the Development Application with the State Commission Assessment Planning.

5.2 IMPACT ON TRAFFIC

Based on estimated traffic volumes provided by Altura, traffic generated by the PSH facility will have a minimal impact on traffic volumes on DPTI operated roads (Eyre Highway, Lincoln Highway, Augusta Highway) with the maximum increase in AADT equivalent to 7% (Lincoln Highway during construction). It is noted that it is highly unlikely that all construction vehicles would utilise Lincoln Highway to access the Project, with the majority of vehicles more likely to utilise the Eyre Highway. In the case that all construction vehicles utilise the Eyre Highway to access the site, the Eyre Highway would experience a 5% increase in AADT during the construction period.

The increase on all roads during the operational period is also considered negligible due to the small volume of traffic generated.

The presence of oversize/overmass vehicles on the Eyre Highway during the site inspection indicates that approval has been granted by DPTI before for travel on the Eyre Highway in the vicinity of the Project, noting that Altura will still need to obtain permits during the construction period from DPTI for each specific vehicle prior to travel.

5.3 SITE ACCESS ASSESSMENT

The proposed site access point was assessed for suitability, with the following items assessed:

- Typical road geometry;
- Pavement condition;
- Stormwater drainage; and
- Sight Distance.

The assessment identified that the existing access point is considered suitable for the proposed site access point, with the following to be taken into consideration:

- The existing geometry of the access point generally meets the requirements of AGRD4. However, the existing access gate width of approximately 4 m does not meet the desirable width of 8 m (minimum width of 6 m) for road train access. Although minimal road trains are to access the site, widening of the gate should be considered to accommodate these.

- Due to the increased traffic volumes during construction (approximately 137 trips per day – refer to Section 3.2) consideration should be given to installing warning signage to advise outgoing vehicles to give way to incoming vehicles if required.
- Due to the generally good condition of the existing pavement, there should be minimal works required during construction or operation of the site, outside of general maintenance requirements. It is however recommended:
  - That a section of sealed wearing course is provided adjacent the Eyre Highway to prevent mud from being tracked onto the Eyre Highway during wet weather;
  - That additional material is placed at locations of edge break, to provide a flush surface for vehicles tracking the joint;
  - The pavement is monitored during construction and operations, and consideration is given to placing an asphalt surface or applying a resheet on the apron if it is found that the pavement is not withstanding the increased traffic loadings adequately; and
  - That consideration is given to placing additional gravel wearing course adjacent the access gate to protect the pavement from wide turning vehicles.
- Low lying and poor draining areas should be monitored for damage during the construction and operation periods and maintenance applied where required.
- The existing access meets the sight distance requirements for intersections i.e. that approach sight distance (ASD), safe intersection sight distance (SISD) and minimum gap sight distance (MGSD) are achieved. However, to increase safety to the public, during periods of heavily increased traffic, it is recommended that advance warning methods are implemented to alert drivers to the presence of heavy vehicles. If adopted, advance warning methods should be in accordance with DPTI signage requirements and AS1742.
- During dry periods, airborne dust may be generated by heavy vehicles using unsealed roads, creating an environmental hazard. During dry periods, it is recommended that a water truck is employed on haulage routes to dampen the surface and reduce the creation of airborne dust and it is recommended that an environmental procedure is developed for haulage operations. The policy should outline measures to be implemented to minimise the environmental impact of haulage operations.

In addition to the main Eyre Highway access point, an assessment of where the proposed transmission lines and water pipeline cross the Eyre Highway and Caroona Road were also undertaken to determine the suitability for provision of an access/maintenance track at these locations. Existing accesses were observed to be available at each of these locations, and as such no further assessment was undertaken on providing access from public roads.

6 REFERENCES

- **Austroads, 2009.** Guide to Road Design, Part 3: Geometric Design
- **Austroads, 2009.** Guide to Road Design, Part 4: Intersections and Crossings - General
- **Austroads, 2009.** Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections
- **ARRB Group, 2009.** Unsealed Roads Manual, Guidelines to Good Practice 3rd Edition
- **Standards Australia, 2009.** Australian Standard 1742 Manual of Uniform Traffic Control Devices, Part 2: Traffic Control Devices for General Use

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APPENDIX G

Environmental Management Plan

13 December 2017

GOAT HILL PUMPED STORAGE HYDRO PROJECT

Scope Environmental Management Plan

Submitted to:
Altura Group Pty Ltd

SCOPE EMP

Golder Report Number. 1777292-007-R-Rev0

Distribution:
1 E-copy - Altura Group Pty Ltd
1 E-copy - Golder Associates Pty Ltd

Record of Issue

Company	Client Contact	Version	Date Issued	Method of Delivery
Altura Group	Mark Endersby	Rev A	October 2017	Electronic
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Altura Group	Mark Endersby	Rev 0	December 2017	Electronic

Table of Contents

1.0 INTRODUCTION

1.1 Purpose

Altura Group Pty Ltd (Altura) is proposing to develop a Pumped Storage Hydro (PSH) facility approximately 12 km west of Port Augusta, South Australia.

Pumped storage hydroelectricity works by pumping water uphill from a Lower Reservoir to an Upper Reservoir when power is plentiful, and then releasing the water downhill to convert its gravitational potential energy when power demand is high. The technology is not new, with PSH systems first installed in Europe in the late 1800’s that continue to provide significant energy storage and generation output.

Altura is currently assessing tenders from contractors experienced in building PSH facilities. The successful Contractor will be required to protect the community and environment during construction, such that all legislative requirements are complied with and the reputation of Altura as a responsible developer is maintained.

The purpose of this scope Environmental Management Plan (EMP) is to:

- Provide a framework to demonstrate how the successful Contractor will implement measures to reduce potential environmental impacts of the Goat Hill Pumped Storage Hydro Project (the Project) during construction.
- Define objectives and measurable targets associated with the significant environmental aspects of the Project.
- Identify the policies, processes and procedures that the Contractor will adopt to identify, manage and control the environmental aspects and impacts (using a risk management approach); legislative requirements; approval conditions; and other environmental obligations that relate to the construction phase of the project.
- Allocate responsibilities for ensuring the effective implementation of these policies, processes and procedures.
- Describe how the Contractor will monitor and review the environmental management performance of the Project to drive continuous improvement.

The EMP will be used by the Contractor to develop the Contractor’s Environmental Management Plan (CEMP) for the construction phase of the project and will ensure appropriate management of relevant environmental issues.

2.0 REGULATORY AND LEGAL COMPLIANCE

Table 1: Project environmental approval requirements

Relevant legislation	Approval authority	Type of approval/legislative considerations	Approval/consideration notes
Environment Protection Act 1993 (SA) (EP Act)	South Australia Environment Protection Authority	Responsibilities and procedures for site management to protect the environment. These relate to air quality, noise, contamination, water quality Licenses are required for the prescribed activities listed in Schedule 1 and Schedule 22 of the EP Act.	All activities onsite must comply with the EP Act. In accordance with Schedule 1 of the EP Act, a license for the Concrete Batching Plant will be required. In accordance with Schedule 22 of the EP Act, a license for the crushing, grinding or milling if material is being extracted for processing may be required. An Earthworks Drainage License may also be required.
Native Vegetation Act 1991 (SA) (Native Vegetation Act)	Minister for Environment and Heritage Department of Environment, Water and Natural Resources	Native Vegetation Clearance formal approval	Clearance of native vegetation (including major pruning) is prohibited unless approved by the Native Vegetation Council (NVC) (or delegate) under a Standard Operating Procedure or an approved Management Plan according to the level of impact.
Natural Resource Management Act 1994 (SA) (NRM Act)	Department of Environment, Water and Natural Resources South Australian Arid Lands (SAAL) and Northern & Yorke (N&Y) Natural Resource Management (NRM) Board and Natural Resources SAAL and N&Y	Permit to undertake a Section 147 – Water affecting activity Groundwater extraction license	Water Affecting Activities may be required for activities, depending on the level of diversion and impact on the water course. Placement of culverts within a watercourse is a Water Affecting Activity and will require permitting. The Project site is not within a prescribed wells area and therefore, no license for extraction is required. Well construction permits will be required where wells are installed for investigation or dewatering purposes.
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)	Minister for the Environment (Cth) Department of the Environment and Energy	Determination on the proposals status if designated a 'controlled action', approval for actions that may impact on matter of national environmental significance is required.	Based on the Flora and Fauna Assessment, a referral and subsequent approval is not considered necessary.
Fire and Emergency Services Act 2005	Minister for Emergency Services	Provision for the prevention, control and suppression of fires and for the handling of certain emergency situations; and for other purposes	Permits will be required for hot-works during construction

Relevant legislation	Approval authority	Type of approval/legislative considerations	Approval/consideration notes
Roads (Opening and Closing) Act 1991 (SA)	Commissioner of Highways DPTI	Approval for the closure of public roads and travel of oversize vehicles on public roads.	Closure of public roads is not expected to be necessary for this Project. Travel of oversize vehicles on public roads will be required.
Road Traffic Act 1961 (SA)	Minister for Transport DPTI	Road diversions, closures and traffic control will need to be undertaken in accordance with the provisions of this Act.	Where necessary, approval for diversion and traffic control will be obtained from DPTI.
Climate Change and Greenhouse Emissions Reduction Act 2007 (SA)	Not applicable	This legislation identifies greenhouse gas emission reduction targets.	The Project will involve the use of non-renewable materials and energy consumption during construction.

2.1 Management Responsibilities and General Duties

The Project will be undertaken in a manner that addresses the requirements of the *Environment Protection Act (1993)* general environmental duty, specifically:

'A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.'

Table 2 identifies the key stakeholders for the project, their representative(s) and the respective roles and responsibilities.

Table 2: Project responsibilities

Stakeholder	Role	Responsibilities	Contact details
Principal	Principal Project Owner	▪ Overarching responsibility for the project ▪ Site inspections and auditing of site works against the CEMP and approval conditions to ensure appropriate measures are implemented ▪ Management of stakeholder engagement	TBC
Construction Contractor	Project Manager	▪ Delivery of the construction of the Project ▪ Engaging contractors to implement the works ▪ Control of site operations ▪ Manager for the purpose of ensuring overall works compliance with the CEMP and relevant approval conditions	TBC
	Environmental Manager	▪ Ensuring compliance to requirements of this EMP and creating a CEMP ▪ Undertaking the required monitoring and reporting ▪ Responding where mitigating measures are not adequate or where the EMP requires amendments.	TBC

2.2 Training and Awareness

2.2.1 Inductions

Prior to commencement on site, all project personnel will undergo a Site Induction covering awareness of quality, safety, site rules and administration; and environmental issues and measures specific to this Project. Part of the induction will relate to the CEMP and may include, but not be limited to:

- Purpose, objective and key issues of the CEMP
- Conditions of environmental licences, permits and approvals
- Emergency response procedures and reporting processes for environmental incidents
- Site-specific issues such as location of refuse bins, refuelling and maintenance of vehicles, plant and equipment
- Declared Plant identification and practices to minimise the spread of weeds
- Aboriginal heritage issues, including identification of heritage sites and procedures for discovery of heritage sites
- Management of dust from construction activities
- Management of construction noise and vibrations, particularly during night works
- Contamination management procedure
- Protection of specific flora and/or fauna including management requirement
- Soil erosion and drainage management measures.

Induction records will be kept confirming that all relevant personnel have been appropriately inducted. Inductions will be updated as required, i.e. when significant changes occur on site or within the environmental management framework of the project.

2.2.2 Pre-Starts and Toolbox Talks

In addition to the site inductions, pre-start talks will be undertaken at the beginning of each day (before work commences). Environmental issues will be raised and discussed at these meetings, as required.

Records of Toolbox talks and the issues discussed will be retained.

2.3 Emergency Contacts

Organisation		Contact Details
Emergency- Police, Ambulance, Fire Services		000
Altura Group		TBC
Construction Contractor		TBC
CFS – Port Augusta		(08) 8642 2399
Police – Port Augusta		(08) 8648 5020
Port Augusta Hospital		(08) 8668 7500
Natural Resource Centre - Port Augusta		(08) 8648 5300
Wildlife hotline		(08) 8289 0896
Environment Protection Authority		(08) 8204 2004
Underground/ Services	AAPT/Power Tel	1800 786 306
	APA SA	1800 427 532
	NBN Co SA/NT	1800 626 762
	Nextgen NCC-SA	1800 032 532
	Optus and/or Uecomm SA	1800 505 777
	PIPE Networks SA	1800 201 100
	SA Power Networks	131 366
	SA Water	(08) 7424 1117
	Epic Energy (Moomba Port Bonython Pipeline operator)	(08) 8343 8100
	Santos (Moomba Port Bonython Pipeline owner)	(08) 8116 5000
	Telstra SANT	Submit Form via DB4YD website
	Vocus Communications	1800 262 663

3.0 ENVIRONMENTAL MANAGEMENT

3.1 Key Environmental Aspects

The potential environmental risks associated with the construction and operational activities of the Project were mapped in detail to ensure risks were appropriately characterised and effective management measures could be implemented to reduce or eliminate the risks.

This EMP provides strategies for the management of potential impacts identified associated with the construction and operational phases of the Project. The EMP strategies address the following environmental aspects:

- Flora and fauna, including weed and pest management (Section 3.2.1)
- Water quality including soil erosion and drainage management (Section 3.2.2)
- Air quality, noise and vibration (Section 3.2.3)
- Contamination (Section 3.2.4)
- Heritage (Section 3.2.5)
- Waste management (Section 3.2.6).

In addition to the aspects listed above, additional management measures will be detailed in separate management plans for specific risks in the construction and operational phases, as listed below and described in Section 3.3:

- Project health and safety
- Traffic management
- Blasting management
- Dewatering management.

3.2 Management Strategies

The environmental objectives, potential impacts and mitigation measures in the following tables are generally applicable to the construction and operational phases of the Project.

3.2.1 Flora and fauna

Table 3: Native vegetation management

Aspect	Clarification
Environmental Objectives	Minimise adverse impacts to existing native vegetation Comply with the *Native Vegetation Act 1991* relating to vegetation management
Potential Impacts	Destruction and disturbance of existing native vegetation from construction activities
Possible mitigation measures	■ selective topsoil – vegetation salvage and re-spread (i.e. minimise mixing dissimilar assemblages) ■ in consultation with the landowner, rehabilitation objective will aim to establish stable landforms and, re-establish the vegetation community / assemblage that was present before the disturbance took place ■ areas will be rehabilitated as soon as practicable after the area is no longer required, with areas temporarily fenced to reduce livestock grazing pressure

Aspect	Clarification
	■ temporary roads, hardstand areas and the like deep-ripped to break compaction and ensure water infiltration and plant establishment ■ revegetated areas actively managed to prevent the spread of weed species ■ relocate impacted Sandalwood where feasible ■ include Sandalwood in the rehabilitation seed mix and any landscaping within Powerhouse compound (where grazing will be removed) ■ dirty vehicles / Plant potentially containing weed material to be cleaned-down prior to entering and leaving Project area ■ dust suppression to minimise dust settling on vegetation.

Table 4: Fauna management

Aspect	Clarification
Environmental Objectives	Minimise adverse impacts to fauna and habitats
Potential Impacts	▪ Destruction and disturbance of fauna habitats ▪ Increased potential for collision with vehicles due to increased traffic in the site area
Possible mitigation measures	▪ Induct all site personnel to provide an understanding of the fauna potentially present including important fauna habitat, and measures to minimise adverse impacts on fauna ▪ Minimise vehicle movement and machinery disturbance within and around retained vegetation ▪ Rehabilitate disturbed areas as soon as practicable after the area is no longer required using local native flora species ▪ Dedicate vehicle movements to defined tracks ▪ Open trenches to include fauna egress controls, and/or to be inspected for trapped fauna. ▪ Contact the relevant authority in the event of encountering injured fauna

Table 5: Weed and pest management

Aspect	Clarification
Environmental Objectives	Prevent the spread of pest plants and animals Comply with the NRM Act relating to vegetation management.
Potential Impacts	Spread of weeds through Project activities including excavation and traffic movement Site-based waste attracting pest animals

Aspect	Clarification
Possible mitigation measures	▪ Induct all site personnel to provide an understanding of the declared plants present onsite and requirements of the NRM Act ▪ Movement, control and destruction of declared plants to be in accordance with the NRM Act. This includes obtaining appropriate approvals prior to transporting declared plants on public roads ▪ Dirty vehicles / Plant potentially containing weed material to be cleaned-down prior to entering and leaving Project area ▪ Cleared areas rehabilitated as soon as practicable after the area is no longer required ▪ Areas rehabilitated will be done so with soil stripped from areas with similar vegetation communities ▪ Rehabilitated areas actively managed against weeds ▪ Restrict vehicle access to defined tracks and access/egress points ▪ Ensure waste is appropriately stored to discourage pest animals. This includes covering putrescible and organic storages associated with crib rooms and offices. ▪ No waste is to be disposed on site.

3.2.2 Soil erosion and drainage management

Table 6: Soil erosion and drainage management

Aspect	Clarification
Environmental Objectives	Minimise erosion of soils and protect surface water drainage pathways.
Potential Impacts	Increased erosion due to soil cover disturbance and changes to surface water flow patterns.
Possible mitigation measures	▪ A suitable Soil Erosion and Drainage Management Plan should be developed. Potential measures are identified in Appendix D. ▪ Induct all site personnel to provide an understanding of the issues associated with erosion and drainage and the management strategies in place ▪ Progressive clearance of vegetation so that there is a minimal exposed earth across the site at any one time, where practicable ▪ Progressive stabilisation of soil and areas disturbed by earthworks using vegetation (e.g. hydro seeding), matting and various other techniques ▪ Soil to be stockpiled at least 40 m away from drainage pathways ▪ Topsoil stockpiles that are not being actively used or stored for extended periods, stabilised using hydromulch (or equivalent) ▪ Avoid placement of infrastructure within watercourses where practical to do so ▪ Suitably sized culverts or armored causeway crossings to be used at road crossings to allow uninterrupted flow of watercourse pathways; include suitable scour protection where required ▪ Treatment measures such as sediment fences, silt socks and temporary swales and basins placed and utilised to manage erosion and drainage. These should be used in sequence where sediment loads are expected to be high ▪ Control the entry and exit of stormwater runoff from work areas including to divert clean stormwater away from and around materials storage areas

3.2.3 Air quality, noise and vibration

Table 7: Air quality management

Aspect	Clarification
Environmental Objectives	Minimise impacts to air quality such as dust, vehicle emissions and odours. Comply with the National Environment Protection (Ambient Air Quality) Measure 1998 and SA EPA guidance.
Potential Impacts	Increased levels of dust generated during Project activities. Increased level of vehicle emission and particles by plant machinery.
Possible mitigation measures	▪ Induct all site personnel to provide an understanding of the issues associated with air quality management and the mitigating strategies in place

Aspect	Clarification
	▪ Maintain all plant machinery and equipment for efficient operation and minimise engine idle times and queuing ▪ Designated vehicle access routes and protocols to be determined and communicated to all contractors ▪ Covering or wetting-down soil and construction material stockpiles to minimise dust mobilisation ▪ Stockpile heights to be minimised where practicable to ensure nuisance dust is not generated as a result ▪ Stop work in areas where construction activities are generating unacceptable levels of dust until appropriate controls can be installed ▪ Where cutting and grinding are used, employ equipment and techniques such as dust extractors and surface wetting to minimise dust. Consider use of specific plant such as wet cutting saws, vacuum extraction or block/slab splitters ▪ Regularly water exposed surfaces, including exposed stockpiles and unsealed roadways, where dust generation is occurring ▪ Truck loads that have the potential to generate dust to be covered prior to leaving site ▪ Maintain communication lines for community members to contact the Construction Manager (or delegate).

Table 8: Noise and vibration management

Aspect	Clarification
Environmental Objectives	Comply with the *Environment Protection (Noise) Policy 2007,* SA EPA guidance for the construction industry and general environmental duty of care regarding construction noise. Comply with legislative and regulated construction vibration levels.
Potential Impacts	Increase in noise and vibration causing nuisance
Possible mitigation measures	▪ Induct all site personnel to provide an understanding of the issues associated with noise and vibration management and the mitigating strategies in place ▪ Maintain Plant and equipment in good working order ▪ Machinery to operate in accordance with relevant sections of the SA *Environment Protection (Noise) Policy 2007 (* S23 (b)) and the SA EPA Noise Information Sheet (2014), such as shutting or throttling equipment down whenever not in actual use; and ensuring noise reduction devises are fitted (applicable only where noise is impacting amenity) ▪ Truck movements to be limited to the designated route ▪ All vehicles and equipment will be appropriately serviced and maintained ▪ A Blasting Management Plan will be used to manage blasting on site (expected at the Upper Reservoir)

3.2.4 Contamination management procedures

Table 9: Contamination management

Aspect	Clarification
Environmental Objectives	Comply with *Environment Protection Act 1993* and relevant SA EPA Guidelines. Minimise adverse impacts to soil as a result of contamination.
Potential Impacts	Accidental spills causing contamination of soils and/or groundwater Contaminated soil mixing with 'clean' soil, further contaminating the site. Illegal disposal of contaminated material. Stockpiled contaminated soil becoming airborne. Contaminated material entering surface water drainage pathways.
Possible mitigation measures	▪ Induct all site personnel to provide an understanding of the spill mitigation strategies and Incident Plan ▪ Stop work and follow the Incident Plan in the event of a significant accidental spill ▪ Spill kits including containment and treatment equipment will be provided at the site ▪ Contaminated material to be separated ▪ No waste disposal is to occur on site ▪ Any material removed from the site to landfill, or for reuse at another site, will be done so in accordance with SA EPA regulatory requirements such as a waste soil assessment on surplus soils ▪ Any soil or other material spilled onto public roadways having originated from vehicles to be removed ▪ Erosion and sedimentation controls to be put in place, as described in Section 3.2.2 ▪ Air quality controls to be put in place, as described in Section 3.2.3.

3.2.5 Aboriginal heritage

Table 10: Aboriginal heritage management

Aspect	Clarification
Environmental Objectives	Avoid impacts to Aboriginal sites. Comply with the South Australian Aboriginal Heritage Act 1988.
Potential Impacts	Disturbance of Aboriginal sites or objects within the Project site.
Possible mitigation measures	▪ Induct all site personnel to provide an understanding of the issues associated with cultural heritage, including examples of indications of potential cultural significance ▪ Develop a Chance Finds procedure to ensure potential cultural heritage is managed appropriately ▪ Aboriginal heritage will be managed in accordance with the Agreement formed with the Bungarla

3.2.6 Waste management

Table 11: Waste management

Aspect	Clarification
Environmental Objectives	Prevent negative environmental impacts associated with construction waste. Prevent waste from impacting on land and surface water. Comply with *Environment Protection Act 1993* and relevant SA EPA Guidelines.
Potential Impacts	Inappropriate storage and disposal of waste impacting on land and surface water. Accumulation of pest animals.
Possible mitigation measures	▪ Site personnel inductions to include appropriate storage (including separation) and disposal/recycling of waste ▪ Work areas maintained in a neat and orderly manner ▪ Waste disposed of regularly by the persons/organisation undertaking the activities, with appropriate signage and separation of reusable / recyclable material ▪ Off-site waste disposal in accordance with SA EPA and Zero Waste SA guidelines/requirements

3.3 Separate management plans

The following aspects will be detailed in separate management plans developed by the contractor and its subcontractors, as required.

3.3.1 Health and safety

Health and safety documentation for public safety will be developed by the Contractor including an Emergency Response Plan (ERP). The ERP will be developed in collaboration with the Country Fire Service and will include details such as:

- Health and safety inductions for site staff, contractors and visitors
- Roles and responsibilities
- Muster point locations
- Bushfire emergency procedures including access and watering points
- Locations of, and access to fire extinguishers, spill kits and other necessary emergency equipment
- Incident reporting requirements.

3.3.2 Traffic management

A Traffic Management Plan is to be prepared by the Contractor and its subcontractors and will include details such as:

- Roles and responsibilities
- Public notification and procedures for heavy and oversize vehicles
- Parking facilities and site capacity
- Speed zones and give-way requirements
- Vehicle access restrictions
- Emergency and incident reporting procedures for vehicle accidents.

3.3.3 Blasting management

A Blasting Management Plan (BMP) is to be prepared by the Contractor and their blasting subcontractor and will include details such as:

- Inductions for site staff, contractors and visitors prior to blasting activities
- Roles and responsibilities
- Security and exclusion zones
- Blasting procedure
- Requirements for permits in accordance with *Fire and Emergency Services Act 2005*
- Time restrictions (i.e. in daylight hours only)
- Notification requirements to neighbours, community and authorities (if required for blasting outside of daylight hours)
- Emergency and incident reporting procedures.

3.3.4 Dewatering management

A Dewatering Management Plan is to be prepared by specialist Hydrogeologists based on information collected during the detailed design phase and will include details such as:

- Roles and responsibilities
- Expected quality and quantity of extracted water
- Options for reuse/disposal of extracted water
- Water quality monitoring requirements and trigger levels
- Dewatering schedule
- Contingency plan and incident reporting.

4.0 INCIDENT PLAN

A contingency plan is provided to guide site personnel in the event that environmental concern is raised during Project activities.

Examples of events that warrant concern could include (but is not limited to):

- Chemical spills
- Encountering potential Aboriginal artefacts
- Community complaints
- Encountering trapped or injured fauna

The following contingency plan will be followed:

1) **Stop Work:** where required, works will cease in the area of the environmental issue, or entire site (depending on severity of the event)
2) **Secure the Area:** the area will be made safe. This could include the following:
   - Containment of chemicals
   - Containment of contaminated water to prevent runoff going offsite.
   - Flagging off of areas
3) **Communicate:** the incident will be communicated as soon as practicable to the Principal and any relevant authorities
4) **Resolve:** the offending activity will not continue until the issue/concern has been resolved, corrective actions have been put in place, and the Principal has given approval to proceed.

5.0 REPORTING, INSPECTIONS AND AUDITING

Reporting requirements, site inspections and any audits of compliance with the EMP will be in accordance with Altura Group's requirements.

6.0 SUMMARY OF DOCUMENTS AND APPROVALS

Table 12 outlines the external approvals and permits required to facilitate the construction activities.

Table 12: External approvals and permits

Approval	Applicable
Native Vegetation	Yes
Development Approval	Yes
Water Affecting Activities Permit	Yes
EPA Licences, e.g. concrete batching plant	Yes
Local Government Consulted	Yes
EPBC Referral	No
Aboriginal Heritage	Yes
Local, State or National Heritage Approval	No
Consultation with NRM Board (if transporting plants declared under Part 175 of NRM Act)	TBC
DPTI permit for oversize vehicle on public road	Yes
Advanced notice of roadworks to motorists	Yes

Report Signature Page

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APPENDIX H

Risk Assessment

Source	Pathway	Receptor	Potential Impact	Current Risk Rating			Additional Control Strategy	Risk Rating After Additional Control		
				Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
Construction	Permanent removal causing disruption of vegetation communities	Vegetation protected by EPBC	No EPBC listed species therefore no impact							
		Vegetation protected by the Native Vegetation Act (State)	Yes	Almost certain	Minor	High	Appropriate approvals will be sought and SEB offets calculated. Design will consider any areas of sensitive/significant vegetation. Potential impacts to vegetation will be minimised through controls outlined in the CEMP.	Almost certain	Insignificant	Medium
		Other vegetatation	Yes	Almost certain	Minor	High		Almost certain	Insignificant	Medium
	Disturbance of vegetation causing temporary disruption of vegetation communities	Vegetation protected by EPBC	No EPBC listed species therefore no impact							
		Vegetation protected by the Native Vegetation Act (State)	Yes	Almost certain	Insignificant	Medium	Appropriate approvals will be sought and SEB offets calculated. Design will consider any areas of sensitive/significant vegetation. Potential impacts to vegetation will be minimised through controls outlined in the CEMP.	Almost certain	Insignificant	Medium
		Other vegetatation	Yes	Almost certain	Insignificant	Medium		Almost certain	Insignificant	Medium
	Disruption of habitats (including physical, noise, light, vibration) causing temporary or permanent displacement	Fauna protected by the EPBC Act	No EPBC listed species therefore no impact							
		Other fauna	Yes	Almost certain	Minor	High	Potential impacts to fauna will be minimised through controls outlined in the CEMP.	Almost certain	Insignificant	Medium
	Vehicle collision causing injury or death	Livestock	Yes	Possible	Moderate	Medium	Speed limits to be implemented on internal access tracks. Livestock to be restricted from construction areas.	Unlikely	Minor	Medium
		Native fauna	Yes	Possible	Moderate	Medium	Speed limits to be implemented on internal access tracks.	Possible	Minor	Medium
	Vehicle accessing the site causing introduction and spread of weeds	Existing ecosystem	Yes	Possible	Moderate	Medium	CEMP will be implemented to ensure vehicles accessing sites are cleaned and other measures to prevent importing of weeds to site is minimised.	Unlikely	Minor	Medium
	Soil disturbance causing introduction and spread of weeds	Existing ecosystem	Yes	Possible	Minor	Medium	Areas of disturbance to be remediated as soon as practicable. CEMP will be implemented to minimise the spread of weeds.	Possible	Insignificant	Low
	Disturbing Aboriginal artefacts during construction of the PSH facility causing animosity	Barngarla	Yes	Possible	Major	High	Survey to be undertaken to determine likelihood for encountering artefacts/sites- Barngarla engagement for artefact salvage. Aboriginal heritage induction for all site personnel. Chance finds procedure to be included in the CEMP to minimise impact on Aboriginal artefacts if encountered. Agreement with Barngarla to be reached before construction	Unlikely	Insignificant	Low
	Disturbing Aboriginal artefacts during construction of the PSH facility causing litigation	Barngarla	Yes	Possible	Major	High	Survey to be undertaken to determine likelihood for encountering artefacts/sites- Bangarla engagement for artefact salvage. Aboriginal heritage induction for all site personnel. Chance finds procedure to be included in the CEMP to minimise impact on Aboriginal artefacts if encountered. Agreement with Barngarla to be reached before construction.	Unlikely	Insignificant	Low
	Disturbing area of Aboriginal spiritual significance during construction of the PSH facility causing reputational damage	Barngarla	Yes	Possible	Major	High	Survey to be undertaken to understand potential impacts and any requirements for inductions. Agreement with Barngarla to be reached before construction	Unlikely	Insignificant	Low
	Disturbing Aboriginal artefacts during access track and ancillary infrastructure construction causing causing reputational damage	Barngarla	Yes	Unlikely	Major	High	Survey to be undertaken to determine likelihood for encountering artefacts/sitess. Design and alignment to avoid areas of high risk of encountering artefacts. Aboriginal heritage induction for all site personnel. Chance finds procedure to be included in the CEMP to minimise impact on Aboriginal artefacts if encountered. Agreement with Barngarla to be reached before construction	Unlikely	Insignificant	Low
	Disturbing Aboriginal artefacts during access track and ancillary infrastructure construction causing litigation	Barngarla	Yes	Unlikely	Major	High	Survey to be undertaken to determine likelihood for encountering artefacts/sites. Design and alignment to avoid areas of high risk of encountering artefacts. Aboriginal heritage induction for all site personnel. Chance finds procedure to be included in the CEMP to minimise impact on Aboriginal artefacts if encountered. Agreement with Barngarla to be reached before construction.	Unlikely	Insignificant	Low
	Disturbing area of Aboriginal spiritual significance during access track and ancillary infrastructure construction causing causing reputational damage	Barngarla	Yes	Unlikely	Major	High	Survey to be undertaken to understand potential impacts. Alignment and design to avoid areas of significance. Aboriginal heritage induction for all site personnel. Agreement with Barngarla to be reached before construction	Unlikely	Insignificant	Low
	Disturbing European heritage areas causing litigation or causing causing reputational damage	Locally, State, Nationally listed heritage areas	No heritage areas in close proximity therefore no impact.							
	Accidental spills causing pollution	Groundwater	Yes	Rare	Major	Medium	Pollution control procedures included in the CEMP and Emergency Response Plan to be implemented during construciton.	Rare	Minor	Low
		Surface water	Yes	Possible	Moderate	Medium	Pollution control procedures included in the CEMP and Emergency Response Plan to be implemented during construciton.	Unlikely	Minor	Medium
		Soil	Yes	Possible	Moderate	Medium	Pollution control procedures included in the CEMP and Emergency Response Plan to be implemented during construciton.	Unlikely	Minor	Medium
	Excavation for construction of the PSH facility causing decrease in water quality (through disruption of aquifers)	Groundwater aquifers	Yes	Likely	Moderate	High	Disruption of aquifers to be considered in design phase and appropriate control measures to ensure low impact construction method. Geotechnical assessment to inform likelihood for disruption. Appropriate dewatering management strategy to be put in place.	Likely	Minor	Medium
	Excavation for construction of the PSH facility causing decreased water security (through disruption of aquifers)	Local community- pastoralists	Yes	Possible	Major	High		Unlikely	Minor	Medium
	Change in surface water drainage pathways causing sedimentation	Surface water drainage pathways	Yes	Likely	Minor	Medium	SEDM to be included in the CEMP and implemented during construction	Likely	Insignificant	Medium
	Change in surface water drainage pathways causing erosion	Soil	Yes	Possible	Moderate	Medium	Soil erosion and drainage management to be included in the CEMP and implemented during construction	Unlikely	Minor	Medium
	Stockpiling of soils for PSH facility construction causing sedimentation	Surface water	Yes	Likely	Minor	Medium	Stockpiling locations and SEDM controls to be considered in design. CEMP to be implemented including stockpile management.	Likely	Insignificant	Medium
	Stockpiling of soils for construction of ancillary infrastructure causing sedimentation	Surface water	Yes	Unlikely	Minor	Medium	Stockpiling locations and SEDM controls to be considered in design. CEMP to be implemented including stockpile management.	Likely	Insignificant	Medium
	Concrete batching plant causing pollution	Surface water and soil	Yes	Possible	Moderate	Medium	Concrete batching plant to be self contained with no discharge to the environment. Any water proposed for discharge to the environment to be verified for appropriate water quality prior to discharge. CEMP to be implemented during concrete batching activities.	Rare	Insignificant	Low
	Construction, quarry dust and batching plant causing decrease in air quality	Sensitive receptors or residents	No sensitive receptors or residents in close proximity therefore no impacts							
		Flora	Yes	Possible	Moderate	Medium	Air quality management to be included in the CEMP.	Rare	Insignificant	Low
	Construction noise and vibration causing nuisance or damage	Sensitive receptors or residents	No sensitive receptors or residents in close proximity therefore no impacts							
	Blasting activities causing nuisance or damage	Sensitive receptors or residents	No sensitive receptors or residents in close proximity therefore no impacts							
		Site personnel (including landowner and visitors)	Yes	Possible	Major	High	Blasting Management Plan to be developed and implemented by contractor including restricted access at high risk times, appropriate signage to be displayed, advance notice of blasting activities to all site personnel and those potentially visiting the site.	Rare	Major	Medium
		Livestock	Yes	Possible	Moderate	Medium	Livestock restricted from construction activities and blast zones. Advance notice of blasting activities to ensure appropraite buffers between livestock and blasting activities.	Rare	Minor	Low
	Plant and machinery causing increased greenhouse gas emmissions	Community	Yes	Almost certain	Insignificant	Medium	Measures to reduce greenhouse gas emissions as much as practicable will be included in the CEMP.	Almost certain	Insignificant	Medium
	Visual impact of PSH facility causing nuisance	Highway users	Yes	Unlikely	Insignificant	Low		Unlikely	Insignificant	Low
		Residents	No residents within distance realistically able to see PSH facility							
	Visual impact of ancillary infrastructure causing nuisance	Highway users	Yes	Unlikely	Minor	Medium	Design of ancillary infrastructure to be designed to ensure minimal amenity impact for highway users.	Unlikely	Insignificant	Low
		Residents	No residents within distance realistically able to see ancillary infrastructure							
	Lighting of PSH facility causing nuisance	Highway users	Yes	Unlikely	Insignificant	Low		Unlikely	Insignificant	Low
		Residents	No residents within distance realistically able to see lighting from facility							
	Increased traffic and heavy loads causing degredation of public infrastructure (roads)	Road users and Council/DPTI	Yes	Rare	Minor	Low	Road condition to be monitored and maintained.	Rare	Insignificant	Low
	Increased traffic and heavy loads causing nuisance	Road users	Yes	Unlikely	Minor	Low	Advance warning of construction activities and changes to road conditions	Unlikely	Insignificant	Low
	Works in the vicinity of roads (ancillary infrastructure) casuing nuisance	Road users	Yes	Possible	Minor	Medium	Advance warning of construction activities and changes to road conditions	Unlikely	Insignificant	Low
	Construction activities causing increase in generation of waste	Community and existing environment	Yes	Almost certain	Insignificant	Medium	Measures to reduce waste generation as much as practicable will be included in the CEMP.	Almost certain	Insignificant	Medium
	Construction activities causing increase in water use	Community and existing environment	Yes	Almost certain	Insignificant	Medium	Reticulated water will be used in construction. Measures to minimise water use as much as practicable will be included in the CEMP.	Almost certain	Insignificant	Medium
	Contamination due to excavation of contaminated soil	Soils	No sources of contaminated soil (unless introduced during construction)							
	Unauthorised access causing increased risk to public safety	Community	Yes	Rare	Major	Medium	Appropriate access restrictions (fencing, alarms, security) will be put in place to ensure no unauthorised personnel access the site.	Rare	Minor	Low
	Construction activities causing an increased uncontrolled bushfire risk	Community and existing environment	Yes	Possible	Major	High	CFS will be consulted prior to construction to ensure access to the site is maintained, a water source is available and appropriate controls are in place. Site procedures implemented (i.e. hot works) Emergency Response Plan to be developed in consultation with CFS and other emergency providers; and implemented during construction. Diesel machinery only to be used on site.	Rare	Major	Medium

Source	Pathway	Receptor	Impact	Current Risk Rating			Additional Control Strategy	Risk Rating After Additional Control		
				Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
Operation	Disturbance of vegetation causing temporary disruption of vegetation communities	Vegetation protected by EPBC	No EPBC listed species therefore no impact							
		Vegetation protected by the Native Vegetation Act (State)	Yes	Possible	Minor	Medium	Access restricted to established tracks and cleared areas only. Existing vegetation to be maintained.	Unlikely	Insignificant	Low
		Other vegetatation	Yes	Possible	Minor	Medium		Unlikely	Insignificant	Low
	Disruption of habitats (including physical, noise, light, vibration) causing temporary or permanent displacement	Fauna protected by the EPBC Act	No EPBC listed species therefore no impact							
		Other fauna	No further impact expected to fauna							
	Vehicle Collision causing injury or death	Native fauna	Yes	Unlikely	Insignificant	Low	Speed restrictions to be in place and vehicle access on tracks only.	Unlikely	Insignificant	Low
	Built infrastructure (i.e. fences, reservoir) causing entrapment	Native fauna	Yes	Unlikely	Moderate	Medium	Maintenance of infrastructure including reservoir cover. Monitoring of fence lines for trapped animals.	Unlikely	Minor	Medium
	Vehicles accessing the site causing introduction and spread of weeds	Existing ecosystem	Yes	Unlikely	Minor	Medium	Access restricted to established tracks and cleared areas only. Weed control to be undertaken as part of maintenance activities. Car parking facilities for site visitors/maintenance vehicles.	Unlikely	Insignificant	Low
	Soil disturbance causing spread of weeds	Existing ecosystem	Yes	Unlikely	Minor	Medium		Unlikely	Insignificant	Low
	Disturbing Aboriginal artefacts causing reputational damage or litigation	Barngarla	No further impact expected							
	Disturbing area of Aboriginal spiritual significance during operation causing reputational damage	Barngarla	No further impact expected							
	Disturbing European heritage areas causing reputational damage or litigation	Locally, State, Nationally listed heritage areas	No heritage areas in close proximity therefore no impact.							
	Accidental spills causing pollution	Groundwater	Yes	Unlikely	Major	Medium	Fuel tanks to be above ground and within appropriate bunding	Rare	Minor	Low
		Surface water	Yes	Unlikely	Major	Medium		Rare	Minor	Low
		Soil	Yes	Unlikely	Moderate	Medium		Unlikely	Minor	Medium
	Excavation causing vertical disruption of aquifers	Groundwater aquifers	No further excavation							
	Built infrastructure causing change in surface water drainage pathways and sedimentation	Surface water drainage pathways	Yes	Possible	Minor	Medium	Design to consider surface water drainage and possible erosion and install appropriate permanent soil erosion and drainage management measures.	Unlikely	Minor	Medium
	Built infrastructure causing change in surface water drainage pathways and erosion	Soil	Yes	Possible	Moderate	Medium	Design to consider surface water drainage and possible erosion and install appropriate permanent soil erosion and drainage management measures.	Unlikely	Minor	Medium
	Failure of the penstock causing flood	Fauna (inlcuding livestock) and flora	Yes	Rare	Major	Medium	Appropriate design controls in place including early failure detection.	Rare	Moderate	Medium
		Site personnel	Yes	Rare	Extreme	High		Rare	Moderate	Medium
		Infrastructure	Yes	Rare	Major	Medium		Rare	Moderate	Medium
	Failure of the embankment walls causing mudslide	Fauna (inlcuding livestock) and flora	Yes	Rare	Major	Medium	Appropriate design controls in place including early failure detection	Rare	Moderate	Medium
		Site personnel	Yes	Rare	Extreme	High		Rare	Moderate	Medium
		Infrastructure	Yes	Rare	Major	Medium		Rare	Moderate	Medium
	Operational noise and vibration causing nuisance	Sensitive receptors or residents	No operational impact on noise and vibration. No sensitive receptors or residents in close proximity.							
	Decrease in air quality causing nuisance	Sensitive receptors or residents	No operational impact on air quality. No sensitive receptors or residents in close proximity.							
	Lighting of PSH facility causing nuisance	Highway users	Yes	Rare	Insignificant	Low		Rare	Insignificant	Low
		Sensitive receptors or residents	No sensitive receptors or residents in close proximity.							
	Plant and machinery causing increased greenhouse gas emmissions	Community and existing environment	No significant increase in greenhouse gas emissions due to operation							
	Increased traffic and heavy loads causing degredation of public infrastructure (roads)	Road users and Council/DPTI	Yes	Unlikely	Minor	Medium	Monitor quality of road to ensure no degredation. Undertake maintenance/repairs on areas of degredation if present.	Unlikely	Insignificant	Low
	Increased traffic and heavy loads causing nuisance	Road users	Yes	Rare	Insignificant	Low	Appropriate advance warning to road users in the event of road restrictions.	Rare	Insignificant	Low
	Operation causing increase in generation of waste	Community and existing environment	No significant increase in waste generation as a result of operation							
	Decommisioning causing increase in water use	Community and existing environment	Yes	Possible	Insignificant	Low		Possible	Insignificant	Low
	Unauthorised access causing increased risk to public safety	Community	Yes	Possible	Major	High	Appropriate access restrictions (i.e. permanent fencing) will be put in place to ensure no unauthorised personnel access the site.	Rare	Minor	Low
	Operation causing increased bushfire risk	Community and existing environment	Yes	Rare	Major	Medium	CFS will be consulted to ensure access to the site is maintained, a water source is available and appropriate controls are in place. Site procedures implemented (i.e. hot works) for maintenance work. Emergency Response Plan to be developed in consultation with CFS and other emergency providers; and implemented during operation. Diesel machinery only to be used on site.	Rare	Moderate	Medium

Source	Potential Consequences	Aspect	Impact	Current Risk Rating			Additional Control Strategy	Risk Rating After Additional Control			Comment
				Likelihood	Consequence	Rating		Likelihood	Consequence	Rating	
Decommissioning	Permanent removal causing disruption of vegetation communities	Vegetation protected by the EPBC Act (Commonwealth)	No EPBC listed species								
		Vegetation protected by the Native Vegetation Act (State)	No premanent removal expected								
		Other vegetation	No premanent removal expected								
	Disturbance of vegetation causing temporary disruption of vegetation communities	Vegetation protected by the EPBC Act (Commonwealth)	No EPBC listed species								
		Vegetation protected by the Native Vegetation Act (State)	Yes	Possible	Insignificant	Low	Limit access to established tracks and cleared areas only.	Almost certain	Insignificant	Medium	
		Other vegetation	Yes	Possible	Insignificant	Low		Almost certain	Insignificant	Medium	
	Disruption of habitats (including physical, noise, light, vibration) causing temporary or permanent displacement	Fauna protected by the EPBC Act (Commonwealth)	No EPBC listed species								
		Other fauna	Yes	Possible	Insignificant	Low	Limit access to established tracks and cleared areas only.	Almost certain	Insignificant	Medium	
	Vehicle collision causing injury or death	Livestock	Yes	Unlikely	Insignificant	Low	Limit access to established tracks and cleared areas only. Speed restrictions to be implemented	Rare	Insignificant	Low	
		Fauna	Yes	Unlikely	Insignificant	Low		Rare	Insignificant	Low	
	Foreign vehicles accessing the site causing introduction and spread of wee ds	Existing ecosystem	Yes	Possible	Moderate	Medium	EMP to be implemented where appropriate. Vehicles will be clean prior to accessing site	Unlikely	Minor	Medium	
	Soil disturbance the site causing the spread of wee ds	Existing ecosystem	Yes	Possible	Moderate	Medium	Site to be rehabilitated with appropriate vegetation as soon as practicable where infrastructure is removed	Unlikely	Minor	Medium	
	Disturbing Aboriginal artefacts causing reputational damage or litigation	Barngarla	No further impact expected								
	Distrubing area of Aboriginal spiritual significance causing reputational damage or litigation	Barngarla	No further impact expected								
	Disturbing European heritage areas causing reputational damage or litigation	Locally, State, Nationally listed heritage areas	No heritage areas in close proximity therefore no impact.								
	Accidental spills causing pollution	Groundwater	Yes	Unlikely	Major	Medium	Fuel tanks to remain in bunding until all fuel has been removed and ensure they are appropriately contained during transport.	Rare	Minor	Low	
		Surface water	Yes	Unlikely	Major	Medium		Rare	Minor	Low	
		Soil	Yes	Unlikely	Moderate	Medium		Unlikely	Minor	Medium	
	Excavation causing vertical disruption of aquifers	Groundwater aquifers	No further excavation								
	Change in surface water drainage pathways causing sedimentation	Surface water	No change to drainage pathways expected								
	Change in surface water drainage pathways causing erosion	Soil	No change to drainage pathways expected								
	Operational noise and vibration causing nuisance	Sensitive receptors or residents	No sensitive receptors or residents in close proximity								
	Impact on air quality causing nuisance	Sensitive receptors or residents	No impact expected on air quality. No sensitive receptors or residents in close proximity								
	Use of plant and machinery causing increased greenhouse gas emmissions (i.e. fossil fuel use and electricity)	Community	Yes	Almost certain	Insignificant	Medium		Almost certain	Insignificant	Medium	
	Increased traffic and heavy loads causing degredation of public infrastructure (roads)	Road users and Council/DPTI	Yes	Possible	Minor	Medium	Monitor quality of road to ensure no degredation, including dilapidation surveys before and after construction. Undertake maintenance/repairs on areas of degredation if present.	Unlikely	Insignificant	Low	
	Increased traffic and heavy loads causing nuisance to road users due	Road users	Yes	Rare	Insignificant	Low	Advance notice to road users of road restrictions.	Rare	Insignificant	Low	
	Decommissioning causing increase in generation of waste	Community and existing environment	Yes	Almost certain	Insignificant	Medium	Appropraite waste management in place via the EMP.	Almost certain	Insignificant	Medium	
	Decommissioning causing increase in water use	Community and existing environment	Yes	Possible	Insignificant	Low	Limit water use for dust suppression as much as practical. Limit works on high wind days.	Unlikely	Insignificant	Low	
	Unauthorised access causing increased risk to public sa fety	Community	No increase change in risk or management measures								
	Decommissioning causing increased bushfire risk	Community and existing environment	Yes	Possible	Major	High	CFS will be consulted prior to decommissioning to ensure access to the site is appropriate, a water source is available and appropriate controls are in place. Site procedures implemented (i.e. hot works) Emergency Response Plan to be developed in consultation with CFS and other emergency providers; and implemented during decommissioning. Diesel machinery only to be used on site.	Rare	Major	Medium	

Environment Risk Assessment

Acronyms

CEMP	Contractor's Environmental Management Plan
CFS	Country Fire Service
EMP	Environmental Management Plan
EPBC	Environment Protection and Biodiversity Conservation
PSH	Pumped Storage Hydro
SEB	Significant Environmental Benefit
SEDM	Soil Erosion and Drainage Management

Definitions

Likelihood	
Almost certain	The event is expected to occur
Likely	The event will probably occur
Possible	The event may occur occasionally; occurance would not be unusual
Unlikely	The event is unlikely to occur
Rare	The event may only occur in exceptional circumstances
Consequence	
Severe	Long term, significant damage or impact on environmental systems and local community
Major	Significant damage or impact on environmental systems and local community
Moderate	Measureable adverse environmental or social impact; will result in temporary annoyance or nuisance to community
Minor	Short term, minor adverse social or environmental impact
Insignificant	The presence of the hazard will not result in adverse social or environmental impact

Risk Assessment Matrix

Likelihood	**Consequence**				
	Insignificant	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

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