Xanadu-1 Conventional Well Construction

Section 38 referral supporting documentation

Prepared for
Norwest Energy NL
by Strategen

March 2017

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ENVIRONMENTAL

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Client: Norwest Energy NL

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	Client review	S Nind / E Congear	-	-
Draft Report	B	Client review	L Taylor	Electronic	22-Dec-16
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Final Report	0	Agency submission	D White; L Taylor	Electronic	01-Mar-17
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1. Introduction

1.1 Purpose and scope

This document has been prepared to provide supporting information for the referral of a proposed conventional oil well, as part of the Xanadu-1 work program, on the coast south of Dongara (the Proposal), under Section 38 of the *Environmental Protection Act 1986* (EP Act).

This referral supporting document has been prepared generally in accordance with Environmental Protection Authority (EPA) Instructions on how to prepare an Environmental Review Document (EPA 2016a). In accordance with s. 2.3.1 of the Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016, this document aims to provide sufficient information for the EPA to assess the Proposal at the referral stage.

The completed Section 38 referral form is presented in Appendix 1.

1.2 Proponent

The Proponent for the Proposal is Norwest Energy NL (Norwest), on behalf of Westranch Holdings Pty Ltd (Westranch). Norwest is an Australian-based, ASX listed (ASX:NWE) exploration and production company with assets in Australia and overseas. In Western Australia, the Company's operational focus is on the northern Perth Basin where it has operating and non-operating stakes in a number of northern Perth Basin permits, both onshore and offshore. Norwest has a head office in Perth.

Westranch Holdings Pty Ltd is the operator of exploration activities within Exploration Permit No. TP/15. Westranch Holdings Pty Ltd is a wholly owned subsidiary of Norwest Energy NL. Norwest Energy NL is the operator of Permit EP413 on which the drilling pad and surface location of the well will be located.

Information on the Proponent is detailed in Table 1.

Table 1: Details of the proponent

Proponent information	
Name of the proponent	Norwest Energy NL
Australian Company Number(s)	078 301 505
Postal Address	PO Box 1264 WEST PERTH WA 6872
Key proponent contact for the Proposal	Shelley Robertson Chief Executive Officer Norwest Energy NL Level 2, 6 Thelma Street WEST PERTH. WA 6005 Ph: 9227 3240 Email: info@norwestenergy.com.au
Consultant for the Proposal	Strategen Environmental Level 1, 50 Subiaco Square Road SUBIACO WA 6008 Ph: 9380 3100

1.3 Regulatory considerations

Implementation of the Proposal would require compliance with Australian legislation and regulations. Further to these statutory requirements, a range of other guidelines, standards and policies are also relevant to the Proposal. These are discussed below.

1.3.1 Applicable legislation

The key environmental legislation applying to the Proposal includes, but is not limited to:

- *Environmental Protection Act 1986* (EP Act) (WA)
- *Conservation and Land Management Act 1984* (CALM Act) (WA)
- *Wildlife Conservation Act 1950* (WC Act) (WA)
- *Aboriginal Heritage Act 1972* (AH Act) (WA)
- *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) (WA)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth).

1.3.2 Western Australian environmental impact assessment process

The EP Act is the primary legislation that governs environmental impact assessment and protection in Western Australia. The Proposal is being referred to the EPA under s 38(1) of the EP Act.

Standards, policies and guidelines

Assessment of the environmental impacts of the Proposal is based on various Position Statements and Guidance Statements. Standards, guidelines and policies related to specific environmental factors or individual aspects of the Proposal are listed in the individual sections relevant to the environmental factor being addressed. The generic documents considered relevant to assessment by the EPA and considered in the referral of this Proposal include:

- Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2016 (EPA 2016a)
- Statement of Environmental Principles, Factors and Objectives (EPA 2016b).

Environmental Protection (Clearing of Native Vegetation) Regulations 2004

The Department of Environment Regulation (DER) has delegated powers, under the Clearing Regulations, to the DMP for clearing activities within mining and related tenements and under exploration permits. These regulations set out certain clearing exemptions, which apply across the State except in environmentally sensitive areas.

The clearing requirements associated with the proposed exploration well are considered exempt from requiring a clearing permit, under Section 51 (C) of the EP Act - Regulation 5 (1), item 24, of the Clearing Regulations. This exemption is provided for low impact petroleum activities and prevents the need for clearing approvals, so long as the clearing does not occur within Environmentally Sensitive Areas (ESAs) or encroach on declared rare flora (DRF) (now referred to as Threatened flora) (EPA 2004a).

1.3.3 Other environmental approvals

Petroleum and Geothermal Energy Resources Act 1967

Onshore petroleum exploration and development activity is subject to the *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act), administered by the Western Australian Government through DMP. Vacant acreage is periodically released by DMP for applications to implement a work program undertaking a full assessment of the petroleum energy potential of the area. Norwest Energy will undertake this Proposal in accordance with an approved permit work program.

The DMP regulates all petroleum and geothermal activities under the following environmental regulations:

- Petroleum and Geothermal Energy Resources Regulations 2012 (PGERR)
- Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 (PGER(E)R)
- Petroleum (Submerged Lands) (Environmental) Regulations 2012
- Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015 (PGER(RMA)R).

The purpose of these regulations is to ensure that any petroleum or geothermal activity is carried out in a manner consistent with the principles of ecologically sustainable development and in accordance with an Environment Plan that:

- demonstrates the environmental impacts and risks of the activity will be reduced to As Low As Reasonably Practicable (ALARP)
- has appropriate environmental performance objectives and environmental performance standards
- has appropriate measurement criteria for determining whether objectives and standards have been met
- provides a risk-based management scheme for the exploration for, and production of, petroleum and, for the onshore regulations, geothermal energy resources.

Under the PGER Act, an accepted EP is required to be prepared and implemented for applicable activities. EPs are reviewed and approved by DMP. The Proponent has prepared and submitted an EP with DMP for assessment.

The Proponent has also given consideration to relevant industry guidance and Australian standards, including:

- The Australian Petroleum Production and Exploration Association (APPEA) Code of Environmental Practice (APPEA 2008) - provides an outline of environmental objectives which represent guidance on key aspects of good environmental practice in the petroleum industry
- National Code of Practice for the Preparation of Material Safety Data Sheets
- National Code of Practice for Labelling of Workplace Substances.

Australian Government environmental impact assessment process

While the states and territories have responsibility for environmental matters at a state and local level, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to focus the Australian Government interests on protecting Matters of National Environmental Significance (MNES).

The EPBC Act requires an assessment as to whether a proposed action is likely to have a significant effect on MNES.

The most relevant MNES is that which aims to protect threatened species and ecological communities. The EPBC Act lists flora and fauna species that are either extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Ecological communities are listed that are critically endangered, endangered or vulnerable. An assessment requires determining the presence (either confirmed or likely) of listed threatened species and communities in the Development Envelope and the likelihood of significant impacts that may be posed by the proposed action.

The Proposal is not anticipated to result in any significant impacts to matters of national environmental significance; consequently, referral to the Australian Government Department of Environment and Energy under the EPBC Act is not required.

2. The Proposal

2.1 Proposal overview

Norwest Energy NL (Norwest) on behalf of Westranch Holdings Pty Ltd (Westranch), proposes to construct a conventional oil well, as part of the Xanadu-1 work program, on the coast south of Dongara (the Proposal). The purpose of the Proposal is to explore offshore oil reserves within the TP/15 Exploration Permit Area, although the onshore Development Envelope falls within the area of Exploration Permit No. 413 (Figure 1).

The Proposal will involve clearing of vegetation for the well pad and access track within a defined Development Envelope (Figure 2), and the installation and testing of the well. There will be no disturbance to the marine environment as a result of the Proposal.

The Proposal is currently planned to commence in June 2017 and drilling and testing activities will have a duration of approximately 45 - 65 days including site civil works and demobilisation.

2.2 Proposal location

While the target of the well is to explore offshore oil reserves within the TP/15 Exploration Permit Area, the well will be drilled from a location that falls within the area of Exploration Permit No EP413.

The Development Envelope is within the locality of Arrowsmith, in the Shire of Irwin, located 42 km south of Dongara and 312 km north of Perth (Figure 1) and is zoned as 'Special Category Land (File Notation Area)' (Landgate 2015). Lot details are outlined in Table 2.

An Access Authority and Request for Consent of the Minister will be lodged with the DMP in accordance with the *Petroleum and Geothermal Energy Resources Act 1967*.

Table 2 Lot details

Lot No.	Deposited Plan	Reserve	Tenure
11982	243167	43078	Crown land

2.3 Justification

The Proposal initially involved a 2D marine seismic survey. Norwest now propose to modify the program to include a conventional onshore oil exploration well, within EP 413 onshore and within the TP/15 Exploration Permit Area offshore (known as the Xanadu–1 Work program).

Installation of a conventional oil well is necessary to assist with planning subsurface petroleum exploration activities, as existing 2D data is of insufficient quality to define the extent of the resource. The primary objective of this Proposal is to assist with designing future drilling programs and further refining the structural detail of the Xanadu-1 deposit.

2.4 Description

The Proposal involves construction of a conventional oil well within Exploration Permit 413 (EP413) to support exploration activities offshore within the TP/15 Exploration Permit Area (Figure 2). The Proposal will require the disturbance of up to 4.5 ha within a Development Envelope of approximately 10.3 ha. TP/15 is a conventional oil play; the focus of the exploration activities will be the Xanadu target, located at the southern end of the Permit Area.

The Proposal will involve the following key phases:

1. Site preparation operations in readiness for equipment mobilisation.
2. Mobilise the drilling package and ancillary equipment to the well location.
3. Drill, wireline log, and plug and abandon the well as per the approved Well Management Plan.
4. Demobilisation of the drilling package and ancillary equipment from the location.
5. Rehabilitation of well location following completion.

The conceptual layout of the Proposal is shown in Figure 3.

A summary of the key Proposal characteristics is provided in Table 3.

Table 3: Key Proposal characteristics

Summary of the Proposal		
Proposal Title	Xanadu-1 conventional onshore oil well.	
Proponent Name	Norwest Energy NL.	
Life of Proposal	5 years (including rehabilitation).	
Short Description	The Proposal involves construction of a conventional oil well for the purpose of exploration activities within the offshore TP/15 Exploration Permit Area. Disturbance associated with the Proposal will be undertaken onshore, approximately 42 km south of Dongara and 312 km north of Perth, within the Midwest region of Western Australia. The Proposal comprises the following components: • drill pad • cleared areas for supporting facilities including sump, well testing and installation areas • access track from Indian Ocean Drive • demobilizing, rehabilitating and closing vehicular access to drill pad and monitoring.	
Physical elements		
Element	Proposed Location	Proposed maximum extent
Total vegetation clearing	Development Envelope is shown in (Figure 2).	No more than 4.5 ha within a total Development Envelope of 10.3 ha.

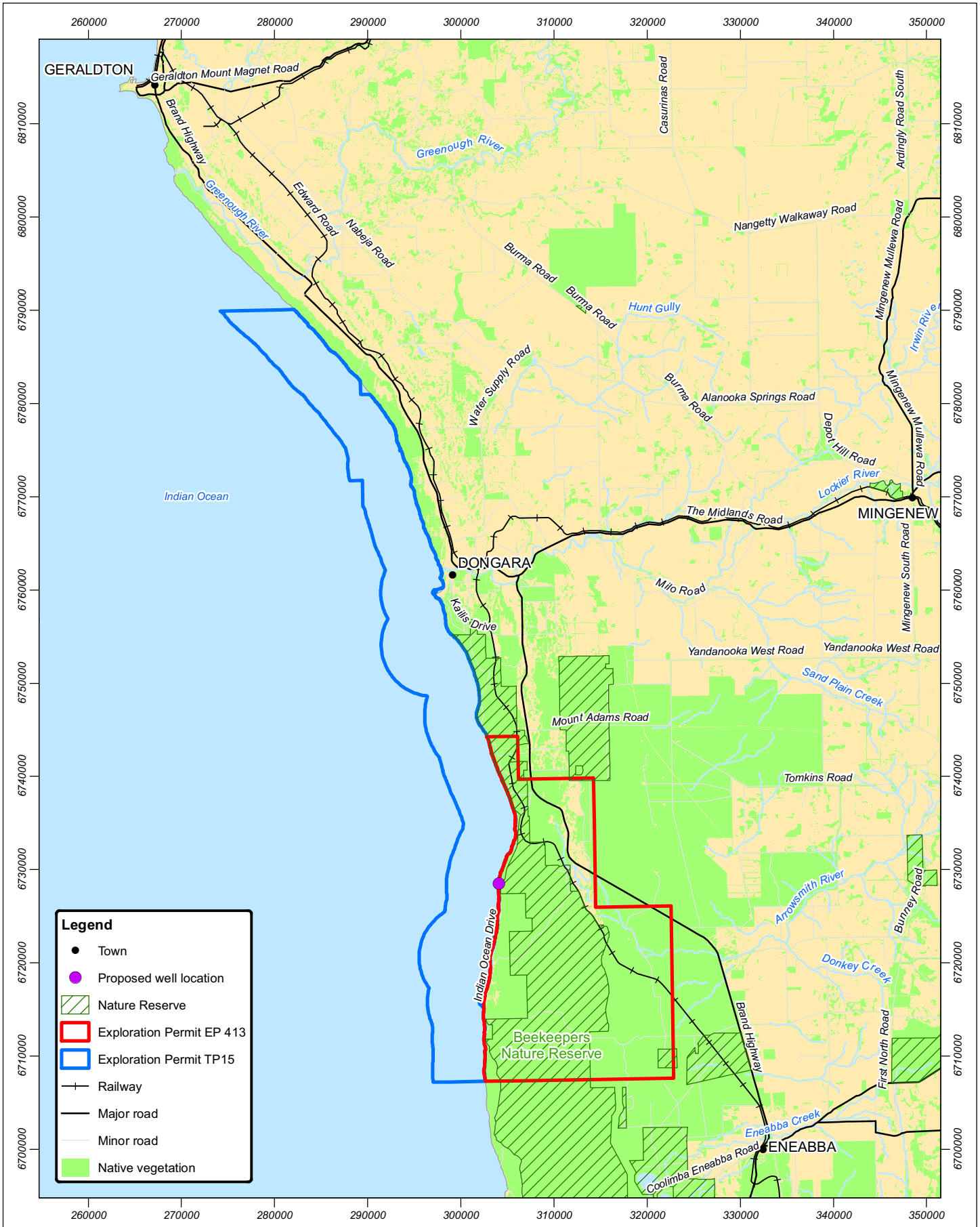

Figure 1 Regional location

Scale 1:550,000 at A4

0 3 6 9 12 15 km

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 28/02/2017

Author: DWhite

Source: Topography: Geoscience Australia 2012.
EP 413: DMP 2012; Native vegetation: DAFWA 2016.

Path: Q:\Consult\2016\NEE\NEE16193_01\ArcMap_documents\R002\NEE16193_01_R002_RevA_F001.mxd

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Figure 2 Development envelope

Scale 1:3,250 at A4

0 20 40 60 m

N

Legend

Development Envelope

Indicative disturbance footprint

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 22/03/2017

Author: DWhite

Source: Aerial image: ESRI online 2010.

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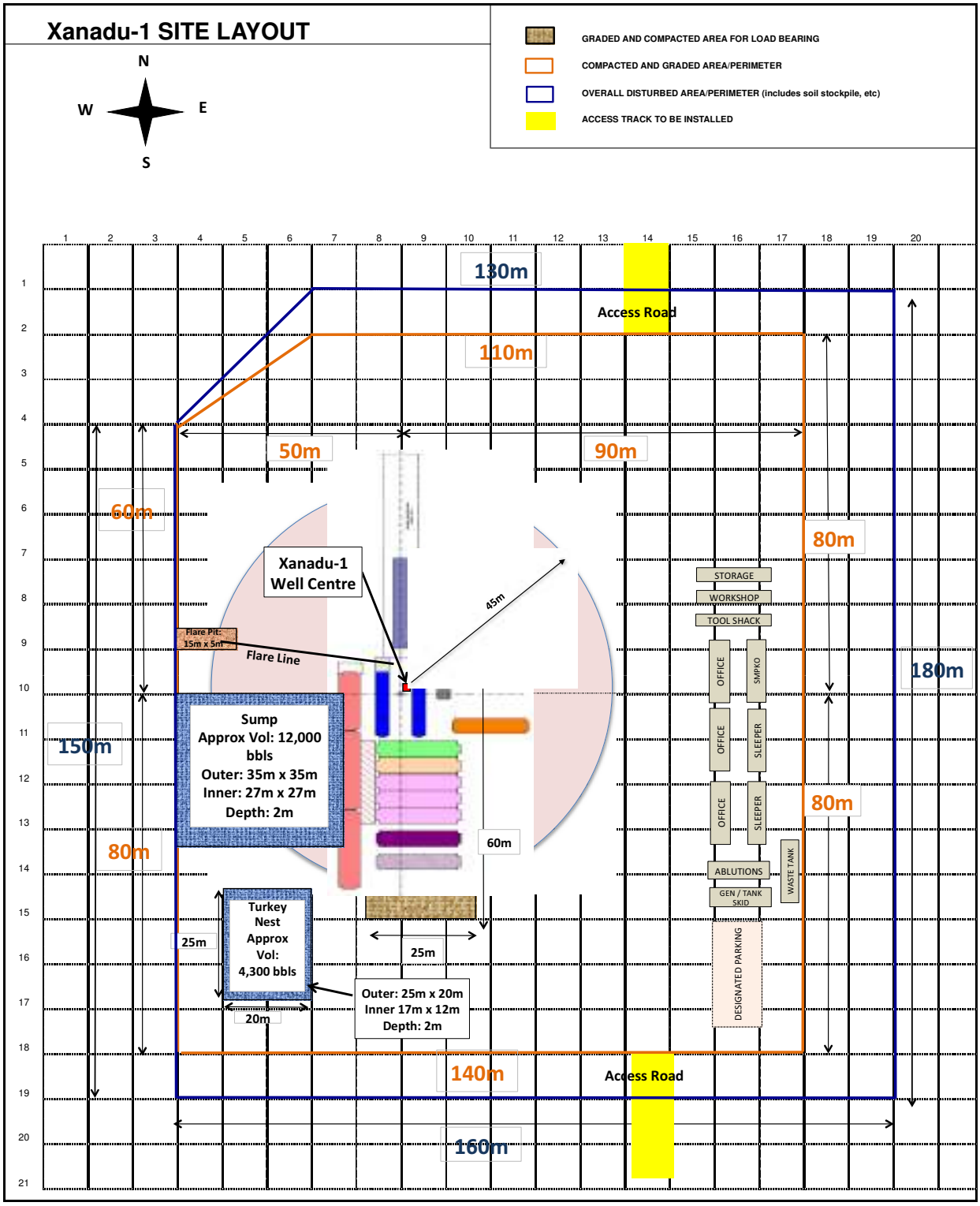

Figure 3: Conceptual site layout

2.5 Site Preparation

2.5.1 Access Roads

Access will be provided from Indian Ocean Drive through creation of a new track. An existing cleared track is present running north up towards the proposed Xanadu-1 well site. This existing track will be used to the extent possible to minimise the amount of vegetation clearing. Sections of new track will be constructed, including an "in" and "out" access to the well site itself.

All equipment and materials will be mobilised via this access track to the well location.

Sheeting material will be sourced from an established limestone borrow pit approximately 10km south of the location. The material will be certified as dieback free.

2.5.2 Preparation of well pad

The well site will include the following elements:

- cellar for drilling rig
- flare pit
- residual drilling fluid and cuttings storage pond (sump)
- water holding pond (turkey nest)
- workshop area and office space
- smoko shack
- gen set and pump skid unit
- toilet block and sewage holding tank
- parking for light vehicles, trucks and trailers
- bunded fuel and chemical storage areas.

The overall well pad area is a 180m x 160m rectangle with a shaped diagonal corner. This includes the well site (140m x 160m rectangle with a shaped diagonal corner) that will be compacted along with an external area to cater for soil stockpiling and a fire break around the perimeter. The well pad occupies an area of about 2.8 ha.

2.5.3 Disturbance methods

A maximum of 4.5 ha of native vegetation will be cleared as a result of the Proposal. Vegetation clearing will be minimised as far as practicable.

Native vegetation will be cleared and stock piled to the side of the location. The topsoil will subsequently be scraped from the cleared area and stockpiled in low profile mounds away from natural drainage and the location levelled off as required by the Drilling Contractor. The stockpiled topsoil and vegetation will be reused during rehabilitation of the well location on completion of operations.

2.5.4 Water requirements

Seawater will be used for drilling mud and cement along with some fresh water trucked to site. The turkey nest / water storage pond will be used to hold a stock of water during drilling operations for mixing of mud in the rig mud tanks.

2.5.5 Proposal schedule and life

The drilling and testing is currently planned to commence in June 2017 and will have a duration of approximately 45 to 65 days including site civil works and demobilisation.

A summary of the proposed schedule is provided in Table 4 below.

Table 4: Indicative Proposal schedule

Activities	Approximate duration	Indicative timing
Civil works	15 - 20 days	Q3 2017
Mobilisation of crew and equipment	10 - 15 days	Q3 2017
Drilling, logging and P&A	20 – 30 days	Q3 / Q4 2017

The timeframe and schedules for subsequent phases of the Proposal (decommissioning, care and maintenance and rehabilitation) will be determined as required at a later stage.

3. Stakeholder engagement

Norwest has commenced consultation with key stakeholders in relation to its exploration activities in the local area. The stakeholder groups identified to date include:

- State government agencies, including DMP (Environmental and Petroleum Divisions), Department of Parks and Wildlife (Parks and Wildlife) as the manager of coastal reserves, and Department of Water (DoW)
- the Department of Environment and Energy (DoEE)
- local government authority (Shire of Irwin)
- community stakeholders
- landowners.

Table 5 summarises the key consultation events, topics raised and the response to matters raised.

Norwest is preparing a Stakeholder Consultation Plan and will maintain a stakeholder consultation program throughout the life of the Proposal as part of normal business practice, providing updates to relevant stakeholders as required. The list of stakeholders will continue to be developed and revised as required.

Table 5: Stakeholder consultation

Key stakeholder	Issues raised	Response
Government		
DMP	Discussions on submission of EP to support work program. Update on status of EP Act referral.	EP prepared and lodged with DMP. DMP updated on status of s38 referral (this document).
Parks and Wildlife	Parks and Wildlife discussed the importance of fire management during exploration activities.	Fire will be included as a key factor to be managed as part of exploration activities.
Office of the Environmental Protection Authority (OEPA)	Introduction to Proposal.	Preparation of s 38 referral (this document).
Shire of Irwin	Provided with general Proposal updates on a regular basis. No issues raised.	Ongoing consultation will continue.
Department of Environment and Energy	Briefing on the proposal and discussion on relevant matters of National Environmental Significance.	Referral under the EPBC Act is not considered necessary.

4. Proposal site characteristics

4.1 Existing environment

4.1.1 Climate

Coastal Mid West areas experience a mild Mediterranean climate with warm, dry summers and mild, wet winters, which transitions inland to arid with very hot, dry summers and cold, dry winters. Rainfall decreases to the north and east. Coastal areas receive an average 400–500 mm/yr while inland areas can expect less than 250 mm. Rainfall in inland areas tends to be more erratic and unreliable (MWDC 2012).

Annual rainfall has decreased in the Mid West over recent decades. Evidence suggests that both natural variability and the enhanced greenhouse effect have most likely contributed to this decrease.

February is the warmest month across the Mid West region with average temperatures of about 30ºC in coastal areas. Prevailing winds dictate the temperature at this time of year with sea breezes as well as hot dry north easterly winds regular features on the coast. Winters are mild with the July average maximum temperature being the lowest of any month at just under 20°C. August is the coldest month with the average minimum temperature just over 10°C near the coast (MWDC 2012).

Inland temperatures are more extreme. January is the hottest month with average temperatures in the high 30s, with maximum temperatures exceeding 40ºC. Inland winters are mild with the July average maximum and minimum temperatures at Meekatharra being 18.8ºC and 7.4ºC respectively. Overnight temperatures fall below 5ºC about once a week in a typical winter. Such temperatures occur on clear nights following a day of cool southerly winds (MWDC 2012).

The nearest BoM climatic station (temperature) to the Development Envelope is at Eneabba (approximately 39.8 km to the southeast). Mean monthly maximum temperatures at Eneabba range from 36.4°C in February to 19.7°C in July and mean monthly minimum temperatures range from 18.7°C in February to 8.9°C in July (BoM 2015).

4.1.2 Vegetation

The Development Envelope lies within Beard vegetation associations 255 and 1026 (Beard 1990), both within the Cliff Head System. The Cliff Head System occupies the coastal strip of dunes and, to the south, salt lakes. The vegetation varies from a low Acacia / Melaleuca heath on limestone platforms to dense thickets of Acacias, Eucalyptus and Melaleucas on and ridges. The Beard vegetation associations are described as follows:

- Vegetation Association 255: Shrublands; mallee scrub, *Eucalyptus dongarraensis* (now *Eucalyptus obtusiflora* subsp. *dongarraensis*)
- Vegetation Association 1026: Mosaic: Shrublands; Acacia *rostellifera*, A. cyclops (in the south) and *Melaleuca cardiophylla* (in the north) thicket / Shrublands; Acacia *lasiocarpa* and *Melaleuca acerosa* heath.

4.1.3 Geology, landform and soils

Geology

Geological surveying covering the Development Envelope (Dongara – Hill River 1:250,000) indicates a surface geology of two broad geologies including Safety Bay Sands, which is calcareous aeolian and beach sand, in places weakly lithified, and coastal limestone, which is aeolian and residual limestone (GSoWA 1973).

The *WA Atlas* indicates that regolith of the Development Envelope is composed of exposed rock, saprolite and saprock (Landgate 2015).

The marine geology or oceanography of the TP/15 area is characterised by Permo-Triassic sands with fault-dependent lateral sealing and ultimate top seal at the Kockatea Shale.

Landform

Landforms across the Development Envelope can be described as flat to gently undulating sand plains, with occasional limestone ridges (Landgate 2015). The *WA Atlas* indicates that the Development Envelope has an elevation of less than 10 m above sea level (Landgate 2015).

Soils

Soils in the Development Envelope reflect the long geological history of the region. The soil landscapes are mostly derived from sedimentary rocks of the Yilgarn Craton and have been subjected to weathering over a long period of time. The result is soils with deeply weathered profiles that are inherently low in nutrients and have an accumulation of salt deep in the profile.

4.1.4 Hydrology

The Development Envelope is located within the Coastal rivers catchment (Landgate 2015). Rainfall which is deposited within this area typically drains to the ocean via sheet drainage across the relatively flat landscape.

Groundwater is contained within superficial formations on the coastal plain and the Yarragadee Formation. Groundwater quality in superficial aquifers is increasingly saline towards the coast and near the Irwin and Arrowsmith Rivers due to saltwater intrusion and infiltration of saline runoff (Shire of Irwin 2007). The Development Envelope falls within the Dongara groundwater sub-area, which is part of the Arrowsmith groundwater area (AGA). AGA is a proclaimed groundwater area, but is not a protected groundwater area (Landgate 2015).

The Yarragadee Formation comprises sand, shale and siltstone and extends 1000 m deep. The water table may lie 130 metres below ground level (mbgl), with only the uppermost 100 m considered fresh. Salinity increases with depth towards the coast and is associated with saltwater intrusion. Groundwater underlying the Yarragadee Formation is saline (Shire of Irwin 2007).

An ephemeral wetland was identified on the southern boundary of the existing access track during the flora and fauna survey (Strategen 2014). The wetland is located outside of the Development Envelope. The wetland is small, likely to be ephemeral and highly modified due to the presence of a turn-around point in the track. There are no Ramsar listed wetlands or Nationally Important (Directory) listed wetlands within the Development Envelope (DotE 2014a).

A search of the DoW database, 'Water Information Reporting', identified no groundwater bores within a 1 km radius of the site. The nearest groundwater bores are located 1.6 km to the south, 2 km to the east and 2.2 km to the north-east.

4.2 Social environment

Land use in the mid-west of Western Australia has centred on farming (cropping, pastoral and animal husbandry) since the 1860s. Other primary industries in the area include rock lobster fishing, mineral sands mining, aquaculture, olive farming and olive oil production. Onshore exploration for oil and gas production prospects is increasing in prominence in the region.

The Development Envelope is located within a sparsely-populated region with minimal settlement, transport and communications infrastructure. The township of Dongara, approximately 42 km to the north, is the largest population centre in the vicinity of the Development Envelope. Land use within the surrounding area is pastoral, primarily wheat, sheep and cattle farming. Various tracts of bushland within the region support honey production (on a seasonal basis) and commercial wildflower harvesting. The Beekeepers Nature Reserve is located west of Indian Ocean Drive (Figure 1).

Cultural heritage

A search of the Aboriginal Heritage Enquiry System found that there are no registered cultural sites within the Development Envelope. The Development Envelope is located within the Amangu People Native Title Claim area. A search of the Aboriginal Heritage Enquiry System on 14 January 2015 found that there are no registered cultural sites within the Development Envelope. A large area approximately 1.68 km north of the Proposal site has been surveyed previously for Aboriginal sites and none were identified within this area. There is a 'lodged' site at the proposed location of the well (Cliff Head, Site ID 5574) as well as a site across a much wider area referred to as 'Eneabba West' (Site ID 15297).

An Aboriginal Heritage survey will be carried out at the drill pad location prior to ground disturbance, and management protocols in the event of identification of artefacts during construction activities will be included in inductions for all personnel.

A search of the WA Atlas also indicated no areas of European heritage within or in proximity to the Proposal site (Landgate 2015).

5. Environmental principles and factors

5.1 Environmental principles

In 2003, the EP Act was amended to include a core set of principles that are applied by the EPA in assessing proposals. These environmental protection principles listed in s 4A of the EP Act are:

- precautionary principle
- principle of intergenerational equity
- principle of the conservation of biological diversity and ecological integrity
- principle relating to improved valuation, pricing and incentive mechanisms
- principle of waste minimisation.

Norwest has considered these principles in its design and will continue to do so during implementation of the Proposal (Table 6).

Table 6: Principles of environmental protection

Principle	Consideration
1. Precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: - Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment - An assessment of the risk-weighted consequences of various options.	Biological studies have been undertaken to ensure that the potential effects of the Proposal have been appropriately identified and assessed. The results of these studies will be used in Proposal planning to ensure that appropriate management measures have been adopted to avoid, where practicable, and/or minimise potential effects. The current understanding of potential impacts and proposed management has been outlined in this supporting document. Precautionary principles have been applied to environmental impacts related to the Proposal with the intention of identifying issues early in the process to enable planning to avoid, prevent or manage effects. The Proposal has been designed to minimise potential effects to flora, vegetation and fauna.
2. Intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Proposal has been designed to minimise potential effects to flora, vegetation and fauna and will ensure that the health, diversity and productivity of the environment is maintained and/or enhanced for the benefit of future generations. Disturbance associated with the drilling program will be rehabilitated on completion of activities.
3. Conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Conservation of biological diversity and ecological integrity underpins Norwest's approach to environmental management and is a major environmental consideration for the Proposal. Biological investigations will be undertaken to identify values of environmental conservation significance required to be protected from disturbance. The Proposal has been designed to minimise potential impacts to the key environmental values of the surrounding environment. Vegetation disturbance will be kept to a minimum through the use of previously cleared areas and the use of existing infrastructure. Norwest is committed to restoring disturbed environments.

Principle	Consideration
4. Improved valuation, pricing and incentives mechanisms Environmental factors should be included in the valuation of assets and services. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentives structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	Norwest acknowledges the need for valuation, pricing and incentive mechanisms and endeavours to pursue these principles when and wherever possible.
5. Waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Waste management will be consistent with the hierarchy of waste minimisation, that is: 1. Avoid and reduce at source. 2. Reuse and recycle. 3. Treat and/or dispose.

5.2 Environmental factors

A preliminary assessment of relevant environmental factors associated with the Proposal is summarised in Table 7.

Table 7: Preliminary assessment of environmental factors

Factor	Summary of issues	Environmental considerations
Flora and vegetation	Clearing of native vegetation to support drill pad and access road. Potential indirect impacts from dust weeds, dieback.	Conservation significant flora or vegetation communities - studies/investigations required.
Terrestrial fauna	Clearing of fauna habitat. Potential indirect impacts from contamination, waste, vehicle strikes.	Conservation significant fauna species - studies/investigations required.
Terrestrial environmental quality	Minimal storage of hazardous materials, chemicals on site to support construction and drilling operations.	Contamination of soil. Risks minimised through implementation of management measures. No further studies/investigations required (Other Factor).
Inland Waters Environmental Quality	Minimal storage of hazardous materials, chemicals on site to support construction and drilling operations.	Contamination of groundwater. Risks minimised through implementation of management measures. No further studies/investigations required (Other Factor).

Factor	Summary of issues	Environmental considerations
Air Quality	Dust generation during construction and vehicle movement during operation.	Risks minimised through implementation of management measures. No further studies/investigations required (Other Factor).

These factors have been identified based on pre-referral consultation and guidance from regulatory agencies such as OEPA, Department of Parks and Wildlife, DMP and DoEE, the results of relevant regional studies, as well the experience and advice of Norwest personnel and environmental consultants engaged to undertake environmental assessments and investigations of the Proposal. The preliminary environmental factors include:

- vegetation and flora
- terrestrial fauna.

Other factors that are recognised as requiring management are discussed in Section 8.

6. Environmental Factor - flora and vegetation

6.1.1 EPA objective

The EPA's objective for flora and vegetation is:

> *To protect flora and vegetation so that biological diversity and ecological integrity are maintained.*

6.1.2 Policy and guidance

The following EPA guidance and position statements set the framework for identification and assessment of impacts to flora and vegetation:

- Environmental Factor Guideline, Flora and Vegetation (EPA 2016b)
- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016f)
- Guidance Statement 51 - *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004)[1]

6.1.3 Baseline studies and investigations

A Level 1 flora survey was undertaken by Strategen in October 2014 to capture spring flowering species within an earlier indicative disturbance footprint. Since the 2014 survey, changes to the Proposal have altered the extent of the Development Envelope. Therefore a supplementary Level 1 flora and vegetation assessment was undertaken in November 2016 over previously un-surveyed areas. The original area surveyed in spring 2014 was briefly traversed during the 2016 survey to ensure that no changes to recorded vegetation types have occurred (i.e. the 2016 survey area includes the original 2014 survey area). The Survey Area is shown in Figure 4.

The surveys were conducted in accordance with EPA Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004) and EPA Position Statement No. 2 Environmental Protection of Native Vegetation in Western Australia (EPA 2000). It should be noted that the most recent EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016f) was published subsequent to the surveys; however, the survey methodology has been reviewed against the requirements for a Reconnaissance Survey (formerly Level 1 survey) as defined in the technical guidance and meets the updated requirements. The survey reports are provided as Appendix 2.

6.1.4 Description of factor

Flora species

A total of 42 plant taxa were recorded in the Survey Area, as presented in Table 8.

[1] Note: the flora and vegetation and fauna surveys were undertaken prior to the release of the new EPA technical guidance in December 2016.

Table 8: Native plant taxa recorded in the Survey Area

Family	Species
Aizoaceae	*Carpobrotus virescens*
Arecaceae	**Phoenix canariensis*
Asparagaceae	*Acanthocarpus preissii*
Asteraceae	*Olearia axillaris*
Campanulaceae	*Lobelia heterophylla*
Chenopodiaceae	*Atriplex cinerea*
	Rhagodia baccata subsp. *dioica*
	Rhagodia preissii subsp. *obovata*
	Threlkeldia diffusa
Cyperaceae	*Baumea juncea*
	Lepidosperma calcicola
Fabaceae	*Acacia lasiocarpa* var. *lasiocarpa*
	Acacia rostellifera
	Acacia sp.
Goodeniaceae	*Goodenia berardiana*
	Scaevola crassifolia
	Scaevola globulifera
	Scaevola thesioides
Gyrostemonaceae	*Gyrostemon ramulosus*
Haemodoraceae	*Conostylis candicans* subsp. *calcicola*
Lamiaceae	*Hemiandra linearis*
	Hemiandra pungens
Lauraceae	*Cassytha aurea* var. *aurea*
Malvaceae	*Alyogyne huegelii*
Myrtaceae	*Eucalyptus erythrocorys*
	Melaleuca huegelii
	Melaleuca lanceolata
	Melaleuca systena
Orchidaceae	*Orchidaceae* sp.
Poaceae	*Austrostipa elegantissima*
	**Avena barbata*
	**Bromus diandrus*
	Ehrharta longiflora
	Parapholis incurva
	Spinifex longifolius
Portulacaceae	*Calandrinia liniflora*
Ranunculaceae	*Clematis linearifolia*
Rhamnaceae	*Spyridium globulosum*
Rubiaceae	*Opercularia vaginata*
	Opercularia spermacocea
Scrophulariaceae	*Myoporum insulare*
Solanaceae	*Anthocercis littorea*

Vegetation associations

The Development Envelope lies within Beard vegetation associations 255 and 1026 (Beard 1990), both within the Cliff Head System. The Cliff Head System occupies the coastal strip of dunes and, to the south, salt lakes. The vegetation varies from a low *Acacia / Melaleuca* heath on limestone platforms to dense thickets of *Acacias, Eucalyptus* and *Melaleucas* on and ridges. The Beard vegetation associations are described as follows:

- **Vegetation Association 255**: Shrublands; mallee scrub, *Eucalyptus dongarraensis* (now *Eucalyptus obtusiflora* subsp. *dongarraensis*)
- **Vegetation Association 1026**: Mosaic: Shrublands; *Acacia rostellifera*, *A. cyclops* (in the south) and *Melaleuca cardiophylla* (in the north) thicket / Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath.

Figure 4 Survey area

Scale 1:3,250 at A4

0 20 40 60 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 22/03/2017
Author: DWhite
Source: Aerial image: ESRI online 2010.

Legend

- Development Envelope
- Survey area
- Indicative disturbance footprint

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Vegetation types

Four vegetation types were identified within the Survey Area, three of which are located within the Development Envelope (Table 9, Figure 5). Most of the Development Envelope comprises the VT02 coastal shrubland vegetation, with VT03 along the fore-dune and VT04 on the dune tops. Approximately 0.38 ha of the Development Envelope comprises cleared tracks and bare sand, while the remaining area is vegetated (Table 9, Figure 5).

Table 9: Vegetation types recorded within the Development Envelope

Vegetation type	Description	Area within Development Envelope	Proportion of Development Envelope (%)
VT01	*Melaleuca* spp. dense shrubland over sedges associated with winter-wet areas.	0.00 ha	0.00
VT02	*Acacia rostellifera* shrublands with occasional *Gyrostemon ramulosus* and *Anthocercis littorea* over *Scaevola* spp. and mixed Chenopods over *Acanthocarpus preissii* and weedy grasses.	8.94 ha	86.6
VT03	Acacia rostellifera and *Myoporum insulare* open shrublands over Scaevola crassifolia and Spinifex longifolius over *Tetragonia decumbens, Carpobrotus virescens, Threlkeldia diffusa and weedy grasses.	0.18 ha	1.74
VT04	Low open heath of *Melaleuca lanceolata, Acacia lasiocarpa* var. *lasiocarpa* and *Acanthocarpus preissii* over weedy grasses.	0.82	7.95
Cleared or bare sand	Cleared areas and bare sand of the beach	0.38 ha	3.68
	Total	10.32 ha	100.00

Vegetation condition

Vegetation condition within the Development Envelope ranged from Completely Degraded in cleared areas, to Excellent in remnant vegetation further from the track (Table 10, Figure 6). The main sources of disturbance are clearing associated with an existing track, and weed encroachment by the track margins and along the fore-dune.

Table 10: Vegetation condition of Development Envelope by size

Vegetation condition rating	Development Envelope (ha)	Proportion of Development Envelope (%)
Excellent	9.38 ha	90.9
Very Good	0.56 ha	5.5
Completely Degraded	0.38 ha	3.7
Total	10.32 ha	100.00

Conservation areas

There are no conservation areas located within the boundaries of the Development Envelope. Beekeepers Nature Reserve is located 360 m to the east of the proposed well location. Beekeeper's Nature Reserve is a major regional nature reserve that was vested with the Conservation Commission of Western Australia as a "C" Class Nature Reserve for the Protection of Flora in 1992. Beekeeper's Nature Reserve is listed as a nature reserve under the *Conservation and Land Management Act 1984*.

The well site and access is separated from Beekeepers NR by Indian Ocean Drive, a major regional road. Therefore while the activity is within 500m of the Beekeepers NR, there will be no direct or adverse impact to the nature Reserve.

Threatened and Priority Ecological Communities

None of the vegetation types recorded during the flora and vegetation survey resemble listed Threatened or Priority ecological communities known within the region.

Conservation significant flora

Database searches indicated that a total of 24 conservation significant flora taxa may occur within the Development Envelope, comprising two species listed as Endangered under the EPBC Act, and an additional six Priority 1 taxa, four Priority 2 taxa, seven Priority 3 taxa and five Priority 4 taxa. The likelihood of these taxa occurring within the Development Envelope was assessed based on known populations and preferred habitat (Table 11). None of the Threatened or Priority flora are considered likely to occur based on the listed habitat preferences and known features of the site, a coastal sand dune system. Twelve Priority listed species may possibly occur, and the remainder were assessed as unlikely to occur at the site.

No conservation significant flora species were recorded during the flora and vegetation survey.

Table 11: Likelihood of occurrence of Threatened and Priority flora within the Development Envelope

Species	Status	Source	Likelihood of occurrence
Centrolepis caespitosa	P4, E	Protected Matters Search Tool	**Unlikely:** Occurs in winter-wet clay pans dominated by low shrubs and sedges. Development Envelope does not contain suitable habitat.
Paracaleana dixonii	T, E	Threatened Flora Database	**Unlikely:** Occurs in deep sand in open areas beneath dense tall shrubland with scattered emergent banksias, or in shallow sand over laterite in heathland. Development Envelope does not contain suitable habitat.
Caladenia denticulata subsp. Arrowsmith (G Brockman GBB 2441)	P1	Threatened Flora Database	**Unlikely:** Occurs in laterite, clay, loam and deep sand of winter-wet flats, river banks and creeklines. Development Envelope does not contain suitable habitat.
Diuris eburnea	P1	Threatened Flora Database	**Unlikely:** Occurs on river banks. Development Envelope does not contain suitable habitat.
Scholtzia sp. Dongara (R Hart 8401)	P1	Threatened Flora Database	**Unlikely:** Occurs in white sand on flats over limestone. Development Envelope does not contain suitable habitat.
Synaphea oulopha	P1	Threatened Flora Database	**Unlikely**: Occurs in grey sand, gravelly loam and clay on lateritic breakaways and rises. Development Envelope does not contain suitable habitat.
Verticordia dasystylis subsp. *oestopoia*	P1	Threatened Flora Database	**Unlikely**: Occurs in gritty soils over granite and on outcrops. Development Envelope does not contain suitable habitat.
Verticordia luteola var. *rosea*	P1	Threatened Flora Database	**Possible:** Occurs in white sand on flats.
Acacia vittata	P2	Threatened Flora Database	**Possible:** Occurs in grey sand and sandy clay on the margins of seasonal lakes.
Dampiera tephrea	P2	Threatened Flora Database, NatureMap	**Possible:** Occurs in sand and gravelly loam.
Guichenotia quasicalva	P2	Threatened Flora Database	**Unlikely**: Occurs in sandy clay over laterite along drainage lines. Development Envelope does not contain suitable habitat.
Homalocalyx chapmanii	P2	Threatened Flora Database	**Unlikely:** Occurs in yellow or grey/brown sand on undulating plains over weathered granite. Development Envelope does not contain suitable habitat.
Anthocercis intricata	P3	NatureMap	**Possible:** Occurs in sand or loam over limestone and in consolidated sand dunes.
Haloragis foliosa	P3	Threatened Flora Database, NatureMap	**Possible:** Occurs in white/grey sand over limestone.
Hemigenia saligna	P3	Threatened Flora Database, NatureMap	**Possible:** Occurs in lateritic and sandy soils.
Hopkinsia anoectocolea	P3	Threatened Flora Database	**Possible:** Occurs in white or grey sand, often saline, winter wet depressions, floodplains and salt lakes.
Stylidium torticarpum	P3	Threatened Flora Database	**Unlikely:** Occurs in sandy clay and clay loam over laterite, adjacent to creeklines, depressions and beneath breakaways in heath or mallee shrubland. Development Envelope does not contain suitable habitat.
Triglochin protuberans	P3	Threatened Flora Database	**Unlikely**: Occurs in red loam or grey mud over clay in winter-wet sites, claypans, near salt lakes and on the margins of pools. Development Envelope does not contain suitable habitat.

Verticordia luteola var. *luteola*	P3	Threatened Flora Database	**Unlikely:** Occurs in grey sand over gravel in flats. Development Envelope does not contain suitable habitat.
Thryptomene sp. Lancelin (ME Trudgen 14000)	P3	Threatened Flora Database, NatureMap	**Possible:** Occurs in calcareous sand.
Banksia elegans	P4	Threatened Flora Database	**Possible:** Occurs in yellow, white or red sand on sandplains and low consolidated dunes.
Calytrix eneabbensis	P4	Threatened Flora Database	**Possible:** Occurs in white, grey or yellow sand over laterite on sandplains.
Eucalyptus zopherophloia	P4	Threatened Flora Database, NatureMap	**Possible:** Occurs in grey or white sand with limestone rubble in coastal areas.
Stawellia dimorphantha	P4	Threatened Flora Database	**Possible:** Occurs in white, grey or yellow sand.
Verticordia penicillaris	P4	Threatened Flora Database	**Unlikely:** Occurs in shallow gritty soils on granite outcrops. Development Envelope does not contain suitable habitat

T – listed as Threatened under WC Act
E – listed as Endangered under EPBC Act
P – Priority species as listed by Parks and Wildlife

Sources: Brown et al 1998; Hoffman and Brown 2011; Parks and Wildlife 2014a, 2014b, 2014e; DotE 2014a, 2014b.

Introduced flora and weed species

Five introduced flora species (weeds) were recorded (Table 12) (Strategen 2014). One species is listed as High priority under the Environmental Weed Strategy for Western Australia (CALM 1999; DEC 2009a). None of the introduced flora species are Weeds of National Significance (AWC 2014), and none are listed as a Declared Pest under the *Biosecurity and Agricultural Management Act 2007*(DAF 2014).

Table 12: Introduced flora species recorded during the site visits

Species	Common name	Declared Plant management status	Environmental Weed Strategy rating
Lysimachia arvensis	Pimpernel	-	Not listed
Avena barbata	Wild Oats	-	Moderate
Bromus diandrus	Brome Grass	-	High
Tetragonia decumbens	Sea Spinach	-	Low
Sonchus asper	Rough Sowthistle	-	Low

6.1.5 Rehabilitation and closure

Following the drilling activities the well will be plugged and abandoned and all equipment removed from site. A decision will be made on the intended future use of the well site that has been established. A number of scenarios may be possible depending on the outcome of the operational phase, including:

- near-term site rehabilitation
- site is kept on a care and maintenance basis pending a decision on potential further use of the site.

Further detail will be provided in relation to rehabilitation within the EP for the Proposal under the PGER Act. The objectives of the Rehabilitation will be to:

1. Return the drilling site and access tracks to a safe, stable landform that blends with the surrounding landscape.
2. Re-establish vegetation that is similar to the surrounding area. Rehabilitation will be undertaken active replanting with local indigenous species.

The following management measures will be implemented to maximise rehabilitation success:

- storing vegetation matter in windrows
- replacing vegetative matter upon completion
- establishing rehabilitation completion criteria
- controlling weeds
- managing unauthorised access.

Rehabilitation success with be monitored against established criteria addressing:

1. Species composition.
2. Percentage cover.
3. Presence of weeds.
4. Erosion.

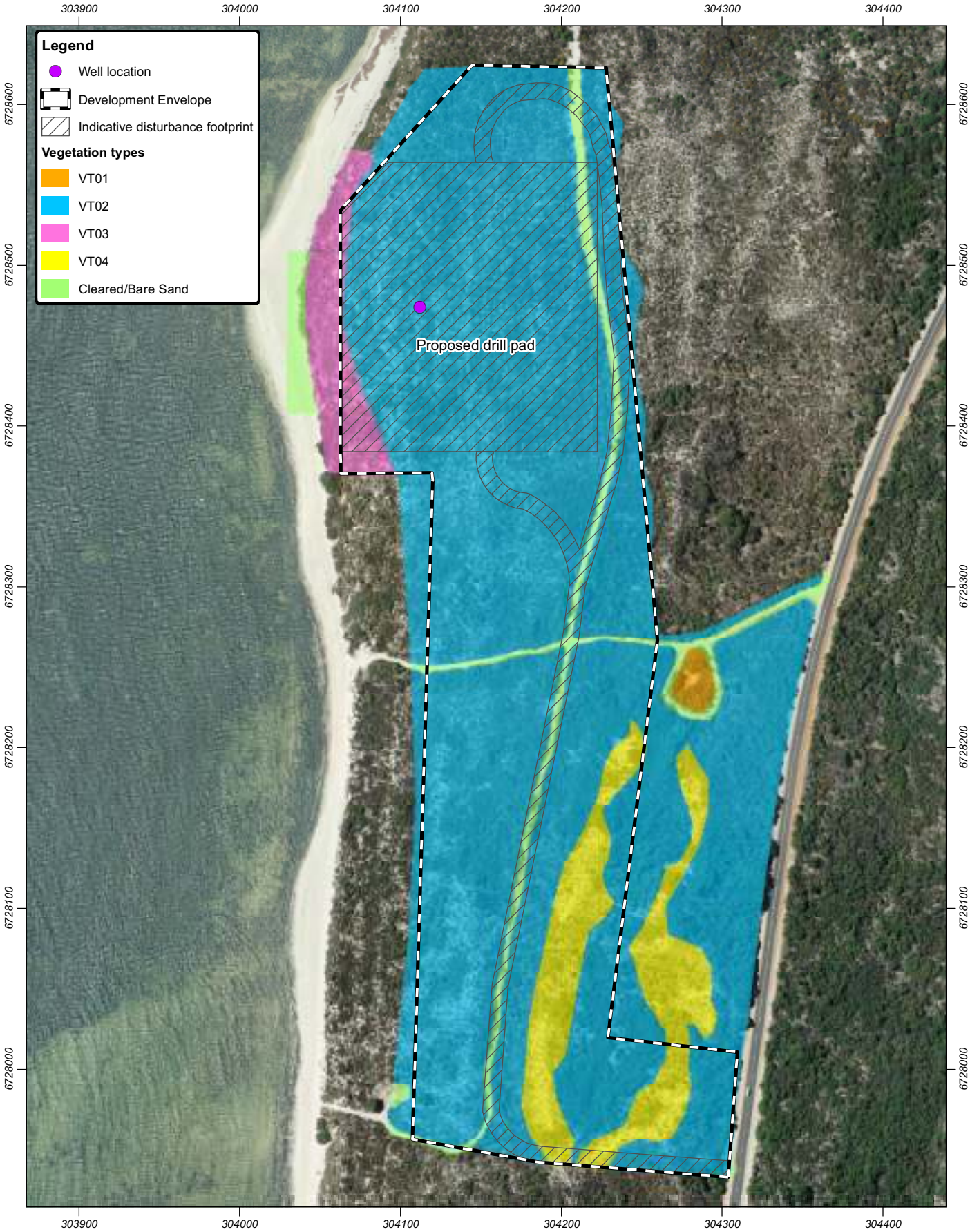

Figure 5 Vegetation types

Scale 1:3,250 at A4

0 20 40 60 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 22/03/2017
Author: DWhite
Source: Aerial image: ESRI online 2010.

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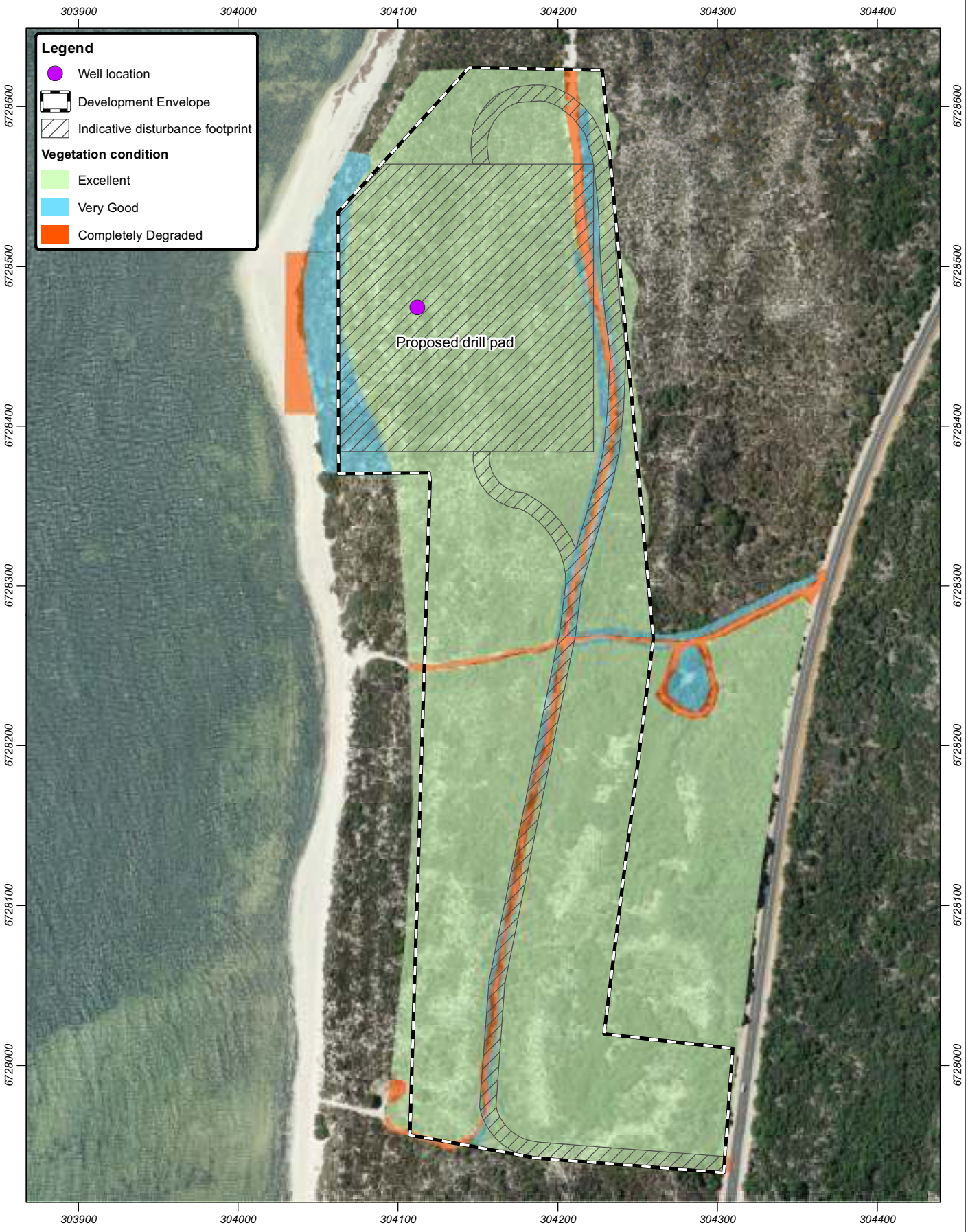

Figure 6 Vegetation Condition

Scale 1:3,250 at A4

0 20 40 60 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 22/03/2017
Author: DWhite
Source: Aerial image: ESRI online 2010.

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6.2 Assessment of likely direct and indirect impacts

An assessment of potential impacts flora and vegetation are outlined in Table 13.

Table 13: Flora and vegetation

EPA objective	Existing environment	Assessment of potential impact	Management	Predicted outcome and regulatory control
To protect flora and vegetation so that biological diversity and ecological integrity are maintained	The Development Envelope consists of 9.94 ha of remnant native vegetation within the Lesueur Sandplains subregion of the Geraldton Sandplains bioregion and 0.38 ha of previously cleared tracks. The Development Envelope hosts two vegetation associations, made up of three vegetation types. Database searches indicated that 24 conservation significant flora taxa may occur within the Survey Area, comprising two species listed as endangered under the EPBC Act, six Priority 1 taxa, four Priority 2 taxa, seven Priority 3 taxa and five Priority 4 taxa. No conservation significant species were identified within the Development Envelope.	The Proposal requires minimal clearing of vegetation (4.5 ha). Based on the outcomes of a Level 1 flora survey, no conservation significant flora occur within the Development Envelope. Indirect impacts to flora and vegetation may arise as a result of activities but can be effectively managed through implementation of a range of management measures.	The following key management measures will be implemented to minimise impacts on flora and vegetation: • induction of site personnel • use of existing tracks where possible and reduction of clearing areas where possible • use of GPS during clearing and mulching of drill pad to adhere to clearing boundaries and avoid vehicle access through excluded areas • implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with the Environment Plan developed as part of the DMP approvals process.	Taking into consideration: • the small size of the clearing area • absence of conservation-significant flora or vegetation communities • the proposed management measures to minimise impacts. The Proposal is not expected to represent a significant impact to flora and vegetation and meets the EPA objective. The key regulatory controls that will be applied to ensure appropriate management of the Proposal include: • management measures to address all potential environmental impacts outlined in the Environment Plan submitted to DMP under the PGER Act and associated regulations.

7. Environmental Factor - terrestrial fauna

7.1.1 EPA objectives

The EPA applies the following objective in its assessment of proposals that may affect terrestrial fauna:

> *To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*

7.1.2 Policy and guidance

The following EPA guidance and position statements set the framework for identification and assessment of impacts to flora and vegetation:

- Environmental Factor Guideline, Terrestrial Fauna (EPA 2016c)
- Guidance for the assessment of environmental factors (in accordance with the Environmental Protection Act 1986) No. 56 – *Terrestrial fauna surveys for environmental impact assessment in Western Australia.* (EPA 2004b).

7.1.3 Baseline studies and investigations

Prior to visiting the Development Envelope, searches were undertaken of the following databases to establish whether any conservation significant fauna species may potentially occur in the site:

- NatureMap (Parks and Wildlife 2014a) (search area encompassed a 5 km radius from an approximately central point of the site)
- EPBC Act Protected Matters Search Tool (DotE 2014a) (search area encompassed a 1 km radius from an approximately central point of the site)
- database requests for the Parks and Wildlife databases:
  - Threatened and Priority Fauna (Parks and Wildlife 2014c)
  - Threatened and Priority Ecological Communities database (Parks and Wildlife 2014d).

Threatened or Priority listed fauna species that were identified as 'possible' or 'likely to occur' within the Development Envelope were further considered following the results of the flora and vegetation survey. Key habitat requirements of each species were assessed against the vegetation types recorded to determine whether the Development Envelope was likely to represent key habitat for any conservation significant fauna species.

7.1.4 Description of factor

Conservation significant fauna

A search of the Protected Matters database undertaken on 23 October 2014 using a 1 km buffer around the site found 46 fauna species listed as MNES for the area, including 28 listed threatened fauna species and an additional 19 migratory species (Table 14). Another two species are listed as Priority fauna by Parks and Wildlife (Table 14).

Level 1 flora and vegetation surveys were undertaken within the Development Envelope (Strategen 2014; Strategen 2017). The survey reports is provided as Appendix 2.

A number of exclusively marine species were returned in the search results. These 35 species (identified as 'not present' in Table 14) have been excluded from further analysis.

Five of the species listed in Table 14 may possibly occur within the Development Envelope, based on an assessment of preferred habitat. None were considered highly likely to occur.

Table 14: Likelihood of occurrence of conservation significant fauna within the Development Envelope

Species	Status	Source	Likelihood of occurrence
Birds			
Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*	T, E	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This species may be present in the Development Envelope as a fly-over, but is unlikely to utilise the area as it is unlikely to contain suitable habitat (i.e. high quality foraging habitat, trees large enough for breeding and/or roosting).
Northern Royal Albatross, *Diomedea epomophora sanfordi*	T, E, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Southern Giant Petrel, *Macronectes giganteus*	T, E, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Amsterdam Albatross, *Diomedea exulans amsterdamensis*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Tristan Albatross, *Diomedea exulans exulans*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Australian Lesser Noddy, *Anous tenuirostris melanops*	T, V	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Southern Royal Albatross, *Diomedea epomophora epomophora*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Wandering Albatross, *Diomedea exulans (sensu lato)*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Malleefowl, *Leipoa ocellata*	T, V	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This species prefers shrublands and low woodlands dominated by mallee vegetation, although it also occurs in acacia shrublands and coastal heathlands.
Northern Giant-Petrel, *Macronectes halli*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Shy Albatross, *Thalassarche cauta cauta*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
White-capped Albatross, *Thalassarche cauta steadi*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Black-browed Albatross, *Thalassarche melanophris*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Campbell Albatross, *Thalassarche melanophris impavida*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Common Sandpiper, *Actitis hypoleucos*	IA, M	Threatened Fauna Database	**Unlikely:** Occurs in wetland habitats. Development Envelope does not contain suitable habitat.
Cattle Egret, *Ardea ibis*	IA, M	Protected Matters Search Tool	**Unlikely:** Occurs in wetland habitats. Development Envelope does not contain suitable habitat.
Fork-tailed Swift, *Apus pacificus*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Eastern Great Egret, *Ardea modesta*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Unlikely:** Occurs in wetland habitats. Development Envelope does not contain suitable habitat.
Ruddy Turnstone, *Arenaria interpres*	IA, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Development Envelope.
Red-necked Stint, *Calidris ruficollis*	IA, M	Threatened Fauna Database	**Unlikely:** Occurs in coastal and wetland habitats. Development Envelope does not contain suitable habitat.
Eastern Reef Egret, *Egretta sacra*	IA, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Development Envelope.

White-bellied Sea-Eagle, *Haliaeetus leucogaster*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This species is found in coastal habitats and around terrestrial wetlands. They prefer habitats that include large areas of open water and breed in tall open forest or woodland.
Bar-tailed Godwit, *Limosa lapponica*	IA, M	Threatened Fauna Database	**Unlikely:** Occurs in coastal and wetland habitats. Development Envelope does not contain suitable habitat.
Rainbow Bee-eater, *Merops ornatus*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This widely-distributed species is found in a range of habitats across Australia, including coastal dune systems.
Grey Plover, *Pluvialis squatarola*	IA, M	Threatened Fauna Database	**Unlikely:** This species occurs almost entirely in coastal areas, preferring sheltered bays, estuaries and lagoons, reef flats as well as terrestrial wetlands and salt lakes. Development Envelope does not contain suitable habitat.
Fleshy-footed Shearwater, *Puffinus carneipes*	IA, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Caspian Tern, *Sterna caspia*	IA, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Roseate Tern, *Sterna dougallii*	IA, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Reptiles			
Loggerhead Turtle, *Caretta caretta*	T, E, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Development Envelope.
Leatherback Turtle, *Dermochelys coriacea*	T, E, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Development Envelope.
Western Spiny-tailed Skink / Houtman Abrolhos Spiny-tailed Skink,, *Egernia stokesii badia / Egernia stokesii aethiops*	T, E	Protected Matters Search Tool	**Unlikely:** Occurs in woodland habitat and in rocky outcrops. Development Envelope does not contain suitable habitat.
Green Turtle, *Chelonia mydas*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Flatback Turtle, *Natator depressus*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Mammals			
Blue Whale, *Balaenoptera musculus*	T, E, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Southern Right Whale, *Eubalaena australis*	T, E, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Western Quoll, *Dasyurus geoffroii*	T, V	Protected Matters Search Tool	**Unlikely:** This species prefers wooded or forested habitats. Development Envelope does not contain suitable habitat.
Humpback Whale, *Megaptera novaeangliae*	T, V, M	Protected Matters Search Tool	**Not present**: This is an exclusively marine species that would not use the Development Envelope.
Australian Sea-lion, *Neophoca cinerea*	T, V	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Development Envelope.
Bryde's Whale, *Balaenoptera edeni*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Dusky Dolphin, *Lagenorhynchus obscurus*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Killer Whale, *Orcinus orca*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.

Western Brush Wallaby, *Macropus irma*	P4	Threatened Fauna Database	**Possible:** This species prefers tall open forests, but is also found in mallee and heathland habitats.
Sperm Whale, *Physeter macrocephalus*	P4	Threatened Fauna Database	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Sharks			
Grey Nurse Shark, *Carcharias taurus* (west coast population)	T, V	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Great White Shark, *Carcharodon carcharias*	T, V, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Whale Shark, *Rhincodon typus*	T, V, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Mackerel Shark, *Lamna nasus*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.
Giant Mana Ray, *Manta birostris*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Development Envelope.

T – listed as Threatened under WC Act
IA – listed migratory birds protected under international agreements and listed under WC Act
E – listed as Endangered under EPBC Act
V – listed as Vulnerable under EPBC Act
M – listed as Migratory under the EPBC Act
P – Priority species as listed by Parks and Wildlife
Sources: Parks and Wildlife 2014d; DotE 2014a, 2014b.

The habitat requirements of five conservation significant fauna species that may possibly occur in the Development Envelope were assessed against the vegetation types described. The results of this assessment are summarised in Table 15.

Table 15: Habitat for conservation significant fauna

Species	Habitat requirements	Vegetation in Development Envelope	Key habitat suitability
Carnaby's Black Cockatoo	Uncleared or remnant native eucalypt woodlands and shrubland dominated by Proteaceae species (*Banksia, Hakea* and *Grevillea*) (DotE 2014b). The preferred breeding habitat includes large tall living or dead eucalypts with suitable hollows (DotE 2014b).	Area devoid of large trees and no Proteaceae species were recorded.	Highly unlikely that the Development Envelope will represent key habitat for this species.
Malleefowl	Semi-arid regions of southern Australia. Prefer shrublands and low woodlands dominated by mallee vegetation, coastal heathlands and acacia shrublands (DotE 2014b).	Vegetation in the Development Envelope is consistent with the habitat requirements of the Malleefowl. No breeding mounds of the Malleefowl were observed within the Development Envelope, which suggest that they may only pass through the area.	Likely that the Development Envelope contains suitable habitat.
White-bellied Sea Eagle	Coastal habitats and around terrestrial wetlands, particularly in areas characterised by the presence of large areas of open water (DotE 2014b). Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas (DotE 2014b). Breeding usually occurs in tall open forest or woodland (DotE 2014b).	Vegetation in the Development Envelope does not contain features typical of breeding.	Development Envelope is unlikely to represent key habitat for this species. Although, the species may fly over the Development Envelope.
Rainbow Bee-eater	Widely distributed throughout Australia and utilises a variety of different habitats (DotE 2014b). Occurs in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (DotE 2014b).	Vegetation in the Development Envelope is consistent with the habitat requirements of the Rainbow Bee-eater.	The wide distribution and varied habitat preferences indicate that the Development Envelope is unlikely to represent key habitat for this species.
Western Brush Wallaby	Open forest or woodland, particularly with open, seasonally wet flats with low grasses and open, scrubby thickets (Strahan 1995). It is also found in some areas of mallee and heathland (Strahan 1995).	Coastal acacia shrublands.	Development Envelope is unlikely to represent key habitat for this species.

7.1.5 Assessment of likely direct and indirect impacts

An assessment of potential impacts to fauna are in outlined in Table 16.

Table 16: Fauna

EPA objective	Existing environment	Assessment of potential impact	Management	Predicted outcome and regulatory control
To protect terrestrial fauna so that biological diversity and ecological integrity are maintained	A total of 48 conservation significant fauna species, including 28 listed threatened fauna species, 19 migratory species and two Priority fauna species were identified as potentially occurring in the Development Envelope. Five of the species were identified as possibly occurring within the Development Envelope, based on an assessment of preferred habitat.	The Development Envelope does not represent key habitat for conservation significant species deemed 'possible' or 'likely' to occur, identified as part of the fauna assessment undertaken in October 2014. Given the small area of maximum clearing required (4.5ha) it is likely that impacts on fauna will be minimal. Indirect impacts to fauna may arise as a result of Proposal activities but can be effectively managed through implementation of a range of management measures.	The following key management measures will be implemented to minimise impacts on fauna: • adhering to clearing boundaries • induction of site personnel • use of existing tracks • responsible storage and management of waste • use of GPS during clearing and mulching of drill pad to avoid vehicle access through excluded areas • implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with the Environment Plan developed as part of the DMP approvals process • reducing vehicle speeds.	Taking into consideration: • the small area of vegetation disturbance • absence of key habitat for conservation significant species • the proposed management measures to minimise impacts. The Proposal is not expected to represent a significant impact to fauna and meets the EPA objective. The key regulatory controls that will be applied to ensure appropriate management of the Proposal include: • management measures to address all potential environmental impacts outlined in the Environment Plan, submitted with DMP under the PGER Act and associated regulations.

8. Other environmental factors and issues

Table 17 outlines potential impacts and activities, and their management, associated with other environmental factors or issues relevant to the Proposal.

Table 17: Other environmental factors and issues

Factor	EPA Objective	Description	Statute	Responsible agency	Proposed management
Air quality	To maintain air quality and minimise emissions so that environmental values are protected.	Dust may be generated as a result of the Proposal primarily through vegetation disturbance activities and light traffic movements on unsealed roads. Gaseous emissions from heavy machinery and infrastructure associate with the exploration activities.	EP Act PGER Act	DER DMP	Management measures to minimise dust will include: 1. The application of water (or appropriate suppressants) to access roads, working surfaces and stockpiles (as required). 2. Implementing and enforcing appropriate vehicle speed limits on site access roads. Management and monitoring actions for air quality will be detailed in an Environment Plan which will require approval from DMP.
Terrestrial environmental quality Inland waters environmental quality	To maintain the quality of land and soils so that environmental values are protected. To maintain the quality of groundwater and surface water so that environmental values are protected.	The Proposal may involve the use of hazardous materials such as fuels and lubricants in small quantities for refuelling and maintenance of vehicles. Inappropriate handling, transport and/or storage of hazardous materials have the potential to result in discharges to the environment.	*Dangerous Goods Safety Act 2004*	DMP, Resources Safety Branch	The proposed well location will be surfaced with a limestone hardstand. All hazardous material or dangerous goods storage facilities will comply with the *Dangerous Goods Safety Act 2004* and associated Dangerous Goods Safety Regulations 2007, at a minimum. Handling and transport of dangerous goods listed in Australian Dangerous Goods Code (currently ADG7) will be carried out as described in the MSDS for each identified material. Management and monitoring actions for hazardous materials will be further detailed in an Environment Plan which will require approval from DMP.
		The Proposal will result in the generation of wastes. Waste may impact the quality of the terrestrial environment if not managed appropriately.	*Waste Avoidance and Resource Recovery (WARR) Act 2007*	DER	The proposed well location will be surfaced with a limestone hardstand. Management of waste will be undertaken in accordance with the WARR Act. Measures will include covering of all waste prior to disposal at an appropriately licensed facility. More detailed management and monitoring measures will be detailed in the Environment Plan which will require approval from DMP.

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9. Overview of environmental impact and management

Table 18: Preliminary summary of environmental factors, impact, management

Environmental factor	EPA objective(s)	Existing environment	Potential impacts	Proposed management	Predicted outcome	Proposed regulatory framework
Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The Development Envelope consists of 9.94 ha of remnant native vegetation within the Lesueur Sandplains subregion of the Geraldton Sandplains bioregion and 0.38 ha of previously cleared tracks. The Development Envelope hosts two vegetation associations, made up of three vegetation types. Database searches indicated that 24 conservation significant flora taxa may occur within the Survey Area, comprising two species listed as endangered under the EPBC Act, six Priority 1 taxa, four Priority 2 taxa, seven Priority 3 taxa and five Priority 4 taxa. No conservation significant species were identified.	The Proposal requires minimal clearing of vegetation (4.5 ha). Based on the outcomes of a Level 1 flora survey, no conservation significant flora occur within the Development Envelope. Indirect impacts to flora and vegetation may arise as a result of activities but can be effectively managed through implementation of a range of management measures.	The following key management measures will be implemented to minimise impacts on flora and vegetation: • induction of site personnel • use of existing tracks where possible and reduction of clearing areas where possible • use of GPS during clearing and mulching of drill pad to adhere to clearing boundaries and avoid vehicle access through excluded areas • implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with the Environment Plan developed as part of the DMP approvals process.	Taking into consideration: • the small size of the clearing area • absence of conservation-significant flora or vegetation communities • the proposed management measures to minimise impacts. The Proposal is not expected to represent a significant impact to flora and vegetation and meets the EPA objective.	Environment Plan under the PGER Act and associated regulations.
Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	A total of 48 conservation significant fauna species, including 28 listed threatened fauna species, 19 migratory species and two Priority fauna species were identified as potentially occurring in the Development Envelope. Five of the species were identified as possibly occurring within the Development Envelope, based on an assessment of preferred habitat.	The Development Envelope does not represent key habitat for conservation significant species deemed 'possible' or 'likely' to occur, identified as part of the fauna assessment undertaken in October 2014. Given the small area of maximum clearing required (4.5ha) it is likely that impacts on fauna will be minimal. Indirect impacts to fauna may arise as a result of Proposal activities but can be effectively managed through implementation of a range of management measures.	The following key management measures will be implemented to minimise impacts on fauna: • adhering to clearing boundaries • induction of site personnel • use of existing tracks • responsible storage and management of waste • use of GPS during clearing and mulching of drill pad to avoid vehicle access through excluded areas • implementation of erosion, weed, fire, hazardous materials, waste, fauna and dieback management measures in accordance with the Environment Plan developed as part of the DMP approvals process • reducing vehicle speeds.	Taking into consideration: • the small area of clearing (maximum 4.5ha) • absence of key habitat for conservation significant species • the proposed management measures to minimise impacts. The Proposal is not expected to represent a significant impact to fauna and meets the EPA objective.	Environment Plan under the PGER Act and associated regulations.

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10. Significance test

The EPA may have regard to various factors in reaching a decision as to whether a proposal is likely to have a significant effect on the environment, whether it is likely to meet its objectives for environmental factors and consequently, whether a referred Proposal should be assessed. Those factors include:

- values, sensitivity and quality of the environment which is likely to be affected
- extent (intensity, duration, magnitude and geographic footprint) of the likely impacts
- consequence of the likely impacts (or change)
- resilience of the environment to cope with the impacts or changes
- cumulative impact with other projects
- level of confidence in the prediction of impacts and the success of proposed mitigation
- objects of the Act, policies, guidelines, procedures and standards against which a Proposal can be assessed
- presence of strategic planning framework
- presence of other statutory decision-making processes which regulate the mitigation of the potential effects on the environment to meet the EPA objectives and principles for EIA
- public concern about the likely effect of the Proposal, if implemented, on the environment
- a significance test for the Proposal has been undertaken against each of these criteria.

A significance test has been conducted to determine whether the Proposal is likely to:

- have a significant effect on the environment
- meet its objectives for environmental factors
- require formal assessment.

The outcomes of the significant test are outlined in Table 19.

Table 19: Significance test

Criteria	Assessment
Values, sensitivity and quality of the environment which is likely to be impacted	The Proposal is located within the Mid West region of Western Australia. The Proposal will not affect nearby Beekeeper's NR, and does not affect any significant areas or land features. The majority of the vegetation is in Very Good to Excellent condition. No TECs, PECs, Threatened or Priority flora have been recorded within the Development Envelope. Five conservation significant fauna species may occur in the Development Envelope; however, the Development Envelope is unlikely to represent key habitat for any of these species. None of the terrestrial fauna habitats present are restricted to the Development Envelope. Potential impacts to fauna values are considered to be minor, given the widespread, common habitats.
Extent (intensity, duration, magnitude and geographic footprint) of the likely impacts. Consequence of the likely impacts (or change). Resilience of the environment to cope with the impacts or changes	A maximum of 4.5 ha will be cleared as a result of the Proposal. The Proposal is within the Lesueur subregion of the Geraldton Sandplains bioregion, and contains Beard vegetation associations 1026 and 255. Approximately 92.36% of the pre-European extent of Vegetation Association 255 and approximately 92.84% of the pre-European extent of Vegetation Association 1026 remains. Based on the above disturbance area, impacts associated with the Proposal are considered to be minimal. The overall effects of the Proposal are not expected to be significant at a local or regional level.

Criteria	Assessment
Cumulative impact with other projects	A maximum of 4.5 ha will be cleared as a result of the Proposal. Much of the Midwest region retains extensive areas of native vegetation, such as that within the nearby Beekeepers NR. Given the very small area of vegetation likely to be affected by the Proposal, the overall cumulative impacts to preliminary key environmental factors are considered to be low. Rehabilitation of cleared areas will be undertaken following completion of the program.
Level of confidence in the prediction of impacts and the success of proposed mitigation	The environmental impacts of this Proposal will be addressed through the management measures identified in an EP that has been submitted to DMP, providing a high level of confidence in the anticipated impacts of the Proposal. The EP addresses a number of factors, including (but not limited to): flora and vegetation, fauna, and rehabilitation and closure.
Objects of the act, policies, guidelines, procedures and standards against which a Proposal can be assessed	Legislation, policies, guidelines, procedures and standards have been considered as discussed below. Norwest has considered relevant legislation and the principles of environmental protection in the design of the Proposal and will continue to do so during implementation. Relevant guidance has been considered in undertaking baseline surveys.
Presence of strategic planning framework	Not applicable.
Presence of other statutory decision making processes which regulate the mitigation of the potential effects on the environment to meet the EPA objectives and principles for EIA	The key regulatory control required for the Proposal to ensure appropriate management is an approved Environment Plan under the requirements under the PGER Act.
Public concern about the likely effect of the proposal, if implemented, on the environment	Norwest has commenced consultation with key stakeholders in relation to its exploration activities in the local area, including State government agencies (including Department for Mines and Petroleum (DMP) (Environmental and Petroleum Divisions), and Department of Parks and Wildlife (Parks and Wildlife) as the manager coastal reserves) and community stakeholders. Norwest will continue to consult with relevant stakeholders throughout the life of the Proposal as part of normal business practice, providing updates to relevant stakeholders as required. The list of stakeholders will continue to be developed and revised as required.

The Proposal is being referred to the EPA for a decision on whether or not formal environmental assessment is required. The outcome of the significance test suggests that the Proposal meets the EPA objectives and is unlikely to warrant formal environmental assessment.

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Appendix 1
Section 38 referral form

Environmental Protection Authority

EPA Referral Form

Form for the referral of a proposal to the Environmental Protection Authority under Section 38 of the *Environmental Protection Act 1986*

Referrer information

Who is referring this proposal?		X Proponent ☐ Decision-making authority ☐ Community member/third party	
Name (print) Shelley Robertson		**Signature** 	
Position	CEO	Organisation	Norwest Energy NL
Email	info@norwestenergy.com.au		
Address	Level 2, 6	Thelma Street	
Suburb	WEST PERTH	WA	6005
Date	1 March 2017		
Does the referrer request that the EPA treat any part of the proposal information in the referral as confidential? *Provide confidential information in a separate attachment.*		☐ Yes X No	

Referral declaration for organisations, proponents and decision-making authorities:

I, …**Shelley Robertson** , *(full name)* declare that I am authorised to refer this proposal on behalf of…**Norwest Energy NL**. and further declare that the information contained in this form is true and not misleading.

Part A: Proponent and proposal description

Proponent information

Name of the proponent/s (including Trading Name if relevant)	Norwest Energy NL
Australian Company Number(s) ☐ **OR** Australian Business Number(s) ☐	ACN 078 301 505
Contact for the proposal (if different from the referrer) *Please include: name; physical address; phone; and email.*	Shelley Robertson Chief Executive Officer Norwest Energy NL Ph: 9227 3240
Does the proponent have the legal access required for the implementation of all aspects of the proposal? *If yes, provide details of legal access authorisations /*	X Yes ☐ No

agreements / tenure. *If no, what authorisations / agreements / tenure is required and from whom?*	Refer to Section 2.2 of Supporting Document
Proposal type	
What type of proposal is being referred? For a change to an approved proposal please state the Ministerial Statement number/s (MS No./s) of the approved proposal For a derived proposal please state the Ministerial Statement number (MS No.) of the associated strategic proposal	X significant **– new proposal** ☐ significant – change to approved proposal (MS No./s: _____) ☐ proposal under an assessed planning scheme ☐ strategic ☐ derived (Strategic MS No.: _____)
For a significant proposal: • Why do you consider the proposal may have a significant effect on the environment and warrant referral to the EPA?	Proposal is not expected to result in a significant effect on the environment. The Proposal is being referred to ensure certainty in approvals.
For a proposal under an assessed planning scheme, provide the following details: • Scheme name and number For the Responsible Authority: • What new environmental issues are raised by the proposal that were not assessed during the assessment of the planning scheme? • How does the proposal not comply with the assessed scheme and/or the environmental conditions in the assessed planning scheme?	
Proposal description	
Title of the proposal	Xanadu-1 conventional onshore oil well
Name of the Local Government Authority in which the proposal is located.	Shire of Irwin
Location: a) street address, lot number, suburb, and nearest road intersection; or b) if remote the nearest town and distance and direction from that town to the proposal site.	The Development Envelope is within the locality of Arrowsmith, in the Shire of Irwin, located 42 km south of Dongara and 312 km north of Perth.
Proposal description – including the key characteristics of the proposal *Provide as an attachment to the form*	Refer to Section 2 of the Supporting Documentation.
Have you provided electronic spatial data, maps and figure in the appropriate format? *Refer to instructions at the front of the form*	X Yes ☐ No
What is the current land use on the property, and the extent (area in hectares) of the property?	Vegetated Crown Land. The Development Envelope is 10.38 hectares.

Have you had pre-referral discussions with the OEPA? If so, quote the reference number and/or the OEPA contact.	Anthony Sutton Director, Assessment and Compliance Division

Part B: Environmental impacts

Environmental factors

What are the likely significant environmental factors for this proposal?	☐ Benthic Communities and Habitat ☐ Coastal Processes ☐ Marine Environmental Quality ☐ Marine Fauna X Flora and Vegetation ☐ Landforms ☐ Subterranean Fauna ☐ Terrestrial Environmental Quality X Terrestrial Fauna ☐ Hydrological Processes ☐ Inland Waters Environmental Quality ☐ Air Quality ☐ Social Surroundings ☐ Human Health

*For the environmental factors identified above, complete the following table, or provide the information in a **supplementary report**. Please be sure to complete a separate table per factor identified above.*

Potential environmental impacts

1	***EPA Factor***	Refer to Sections 6, 7, and 8 of the Supporting Document.
2	***EPA policy and guidance*** - What have you considered and how have you applied them in relation to this factor?	
3	***Consultation*** – Outline the outcomes of consultation in relation to the potential environmental impacts	
4	***Receiving environment -*** Describe the current condition of the receiving environment in relation to this factor.	

5	***Proposal activities*** – Describe the proposal activities that have the potential to impact the environment	
6	***Mitigation -*** Describe the measures proposed to manage and mitigate the potential environmental impacts.	
7	***Impacts*** - Assess the impacts of the proposal and review the residual impacts against the EPA objective.	
8	***Assumptions*** - Describe any assumptions critical to your assessment *e.g. particular mitigation measures or regulatory conditions.*	

Part C: Other approvals and regulation

State and Local Government approvals

Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	☐ Yes X No
If this proposal has been referred by a decision-making authority, what approval(s) are required from you?	N/A

Proposal activities	Land tenure/access	Type of approval	Legislation regulating the activity
e.g. clearing, dewatering, mining, processing, dredging,	e.g. Crown land – LA Act, Min Act, CALM Act specify type	e.g. Native Vegetation Clearing Permit, licence, mining proposal,	e.g. *EP Act 1986* – Part V, *RiWI Act 1914*, *Mining Act 1979*
Site access	Crown land	Access Authority Consent of the Minister	Petroleum and Geothermal Energy Resources Act 1967 (PGER Act)
Clearing		Environment Plan	PGER Act
Drilling exploration		Environment Plan	PGER Act

Commonwealth Government approvals

Does the proposal involve an action that may be or is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)?	☐ Yes X No
Has the proposed action been referred? If yes, when was it referred and what is the reference number (EPBC No.)?	☐ Yes X No Date: _____ EPBC No.: _____
If referred, has a decision been made on whether the proposed action is a controlled action? If 'yes', check the appropriate box and provide the decision in an attachment.	☐ Yes ☐ No ☐ Decision – controlled action ☐ Decision – not a controlled action
Do you request that this proposal be assessed under the bilateral agreement or as an accredited assessment?	☐ Yes - Bilateral ☐ No ☐ Yes - Accredited
Is approval required from other Commonwealth Government/s for any part of the proposal? *If yes, describe.*	☐ Yes X No Approval:

Appendix 2
Environmental studies

Level 1, 50 Subiaco Square Road Subiaco WA 6008 PO Box 243 Subiaco WA 6904
Phone (08) 9380 3100 Fax (08) 9380 4606
177 Spencer Street Bunbury WA 6230 PO Box 287 Bunbury WA 6231
Phone (08) 9792 4797 Fax (08) 9792 4708

To: Shelley Robertson

Date: 23 March 2017

Company: Westranch Holdings Pty Ltd

Project No: NEE16193.01

Fax/email: shelley.robertson@norwestenergy.com.au

Inquiries: C Courtauld / L Taylor

Xanadu-1 Well Construction
Flora and vegetation assessment

Background

Westranch propose to undertake onshore exploration drilling TP/15 Exploration Permit Area as part of the Xanadu-1 work program (the Proposal). The primary objective of this Proposal is to assist with designing future drilling programs and further refining the structural detail of the Xanadu-1 deposit.

The Proposal involves construction of a conventional oil well for the purpose of exploration activities within the offshore TP/15 Exploration Permit Area. Disturbance associated with the Proposal will be undertaken onshore, approximately 42 km south of Dongara and 312 km north of Perth, within the Midwest region of Western Australia.

The Proposal will involve clearing of vegetation for the drilling area and access track, and the installation and testing of the well, including associated ground disturbance activities.

Strategen was previously engaged to commence works to support the Xanadu-1 work program, including (but not limited to):

1. Undertaking a Level 1 flora, vegetation and fauna habitat survey.
2. Referral of the project to the EPA under s 38 of the *Environment Protection Act 1986* (EP Act).

As part of this previous engagement, the Level 1 flora, vegetation and fauna habitat survey was undertaken in spring 2014 and a report on the outcomes was completed (Strategen 2016).

Since the 2014 survey, changes have been made to the Proposal footprint and access track alignment. Therefore a supplementary Level 1 flora and vegetation assessment was undertaken in November 2016 over previously un-surveyed areas to provide detail regarding the flora and vegetation values contained within the revised footprint area.

Objective

The objective of this report is to document the flora and vegetation values within the revised footprint area (the survey area) to determine:

1. Vegetation types and conditions within the revised footprint area.
2. Whether there are any conservation significant flora and vegetation and fauna values associated with the revised footprint area.
3. Whether the project will impact on Matters of National Environmental Significance (MNES) and consequently require consideration under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Methodology

Desktop assessment

Prior to visiting the survey area, revised desktop searches were undertaken of the following databases to establish whether any conservation significant fauna species could potentially occur within the survey area:

- NatureMap (Parks and Wildlife 2007-) (search area encompassed a 5 km radius from an approximately central point of the site)
- EPBC Act Protected Matters Search Tool (DEE 2016) (search area encompassed a 1 km radius from an approximately central point of the site).

The updated desktop assessments were used to inform the site investigation.

Flora and vegetation survey

A Level 1 flora and vegetation survey of the survey area (Figure 1) was undertaken in accordance with Guidance Statement 51 (EPA 2004) on 23 November 2016 by two ecologists. It should be noted that the most recent *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) was published subsequent to this survey (December 2016); however, the survey methodology was reviewed against the requirements for a Reconnaissance Survey (formerly Level 1 survey) as defined in this document and meets the updated requirements.

Table 1 identifies staff involved in the field surveys, their role and qualifications.

Table 1: Personnel

Name	Role
Ms. R. Chesney Strategen (Senior Ecologist)	Planning, fieldwork, plant identification, data interpretation and report preparation
Ms. C. Courtauld Strategen (Ecologist)	Planning, fieldwork, plant identification, data interpretation and report preparation

The survey area was traversed on foot to record changes in vegetation structure. A quadrat was established and sampled when a different, previously unrecorded vegetation type was observed and the original area surveyed in spring 2014 was briefly traversed during the 2016 survey to ensure that no changes to recorded vegetation types have occurred (i.e. the 2016 survey area includes the original 2014 survey area). A total of four 10 m x 10 m vegetation quadrats were established across the survey area (in addition to five sampled during the 2016 survey [Strategen 2014]). Between quadrats, notes were recorded regarding vegetation type and structure, with opportunistic sampling of flora undertaken when previously unrecorded species were observed. At each quadrat, the following parameters were recorded:

- GPS location
- soil and landform characteristics
- vascular plant taxa present
- foliage cover (%)
- photograph
- overall condition of the vegetation.

Vegetation condition was measured using the condition rating scale of Keighery (1994):

1. Pristine: pristine or nearly so, no obvious signs of disturbance.
2. Excellent: vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3. Very Good: vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

4. Good: vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5. Degraded: basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
6. Completely Degraded: the structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

All plant specimens collected during the survey were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Florabase (Western Australian Herbarium 1998-).

Weed species recorded in the site assessment were evaluated as per the previous survey, using weed prioritising lists including the Weeds of National Significance (WoNS; AWC 2014) list and species declared under the BAM Act (DAFWA 2016), with additional reference to the *Midwest Region Environmental Weed Rankings Summary* (Parks and Wildlife 2013) and *Western Weeds* (Hussey et al. 2007).

Vegetation types defined in the current survey were aligned to those defined in the 2014 flora and vegetation survey (Strategen 2014). Mapping for both areas was consolidated for presentation in this survey report.

Constraints and limitations

Potential constraints and limitations that may have had an impact on the outcomes of the flora and vegetation assessment have been considered (Table 2).

Table 2: Potential constraints or limitations on the survey

Potential constraint or limitation	Impact on survey	Comment
Sources and availability of contextual information	Not a constraint	The Geraldton Sandplains are reasonably well-surveyed, including surveys within the neighbouring Beekeepers NR, and several sources of contextual information exist.
Proportion of flora collected and identified	Not a constraint	A total of 23 native species were recorded during the survey. Of these, all were able to be confirmed to at least species level. Four 10 x 10 m quadrats were sampled across the approximately 13 ha 2016 Survey Area (in addition to five quadrats in the 2014 Survey Area). The remainder of the Survey Area was traversed on foot to determine whether any additional vegetation types were present. Additional species not previously recorded within quadrats were recorded on an overall species list while traversing the site. As such, it is likely that the majority of native species present were recorded during the survey.
Survey timing	Not a constraint	The results presented in this report are the product of a spring (November) survey. Spring is considered the optimal survey time for the Southwest.
Survey completeness and intensity	Not a constraint	The survey was conducted at the intensity appropriate for a complete Level 1 survey as described by EPA Guidance Statement 51, in the appropriate season for the Geraldton Sandplains bioregion i.e., during the optimum flowering time for the majority of southwest WA flora species. Upon review of the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, the survey also met the requirements for a Reconnaissance Survey (formerly Level 1 survey).

Potential constraint or limitation	Impact on survey	Comment
Effects of disturbance	Not a constraint	The effects of disturbance (including the presence of weeds and planted revegetation areas) were not a constraint for this vegetation assessment. Remnant vegetation was in sufficiently good condition to enable determination of a vegetation type and, as such, conduct a comparison with known Threatened or Priority Ecological Communities in the area.
Access and resources	Not a constraint	The Survey Area was readily accessible by vehicle or by foot. Adequate resources were available to complete the survey as planned.
Experience levels	Not a constraint	The field survey and reporting were conducted by two ecologists, with six and two years field experience respectively.

Results

Desktop assessment

The 2016 database searches did not identify any additional conservation significant flora taxa potentially occurring within the when compared to results from the 2015 assessment.

Regional setting

The survey area lies within Beard vegetation associations 1026 and 255 (refer to Attachment 1), both within the Cliff Head System. The Cliff Head System occupies the coastal strip of dunes and, to the south, salt lakes. The vegetation varies from a low Acacia/Melaleuca heath on limestone platforms to dense thickets of *Acacias, Eucalyptus* and *Melaleucas* on sand ridges. The Beard vegetation associations are described as follows:

- Vegetation Association 255: Shrublands; mallee scrub, *Eucalyptus dongarraensis* (now *Eucalyptus obtusiflora* subsp. *dongarraensis*)
- Vegetation Association 1026: Mosaic: Shrublands; *Acacia rostellifera*, *A. cyclops* (in the south) and *Melaleuca cardiophylla* (in the north) thicket / Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath.

Flora and vegetation survey

Four vegetation types were identified within the survey area, three of which were identified in the previous vegetation survey undertaken in 2014 (Strategen 2016) (Table 3, Figure 1; Figure 2). VT01 and VT02 identified in the 2016 supplementary survey aligned with the floristic composition of VT01 and VT02 defined in the previous survey (Strategen 2016). Most of the survey area was comprised of VT02 (i.e. coastal shrubland vegetation), which graded into VT03 (located along the dune top) and VT01 (associated with a wet depression in the eastern portion of the survey area) (Table 3, Figure 1; Figure 2).

A total of 13.7 ha was survey across the 2014 and 2016 vegetation assessments (refer to Figure 1). Of the 13.7 ha survey area, 13 ha is vegetated, while the remaining 0.7 ha comprises cleared tracks.

Table 3: Vegetation types recorded during surveys

Vegetation type	Description	Area (ha)	Proportion of Total Survey Area (%)
VT01	*Melaleuca lanceolata, Rhagodia preissii* subsp. *obovata* and *Acacia rostellifera* dense shrubland over sedges associated with winter-wet areas.	0.1	0.5
VT02	*Acacia rostellifera* low mid shrubland with occasional *Gyrostemon ramulosus, Melaleuca lanceolata and Anthocercis littorea* over *Rhagodia baccata, Scaevola* spp. and mixed Chenopods over *Acanthocarpus preissii, Conostylis candicans* and weedy grasses.	11.2	81.8
VT03	*Acacia rostellifera* and *Myoporum insulare* open shrublands over *Scaevola crassifolia* and *Spinifex longifolius* over **Tetragonia decumbens*, *Carpobrotus virescens, Threlkeldia diffusa* and weedy grasses.	0.5	3.8
VT04	Low open heath of *Melaleuca lanceolata, Acacia lasiocarpa* var. *lasiocarpa* and *Acanthocarpus preissii* over weedy grasses.	1.2	8.8
Cleared or bare sand	Cleared areas and bare sand on the beach.	0.7	5.0
Total		13.7	100

Vegetation condition ranged from Completely Degraded in cleared areas associated with the existing track, to Excellent in remnant vegetation further from the track (Table 4, Figure 1; Figure 2). The main sources of disturbance were clearing associated with the track, and weed encroachment by the track margins.

Table 4: Vegetation condition of the total survey area by size

Vegetation condition rating	Surveyed area (ha)	Proportion of survey area (%)
Excellent	12.0	87.4
Very Good	1.0	7.6
Completely Degraded	0.7	5.0
Total	13.7	100

Conservation significant vegetation

None of the vegetation types recorded during the flora and vegetation survey resemble listed Threatened or Priority ecological communities known within the region.

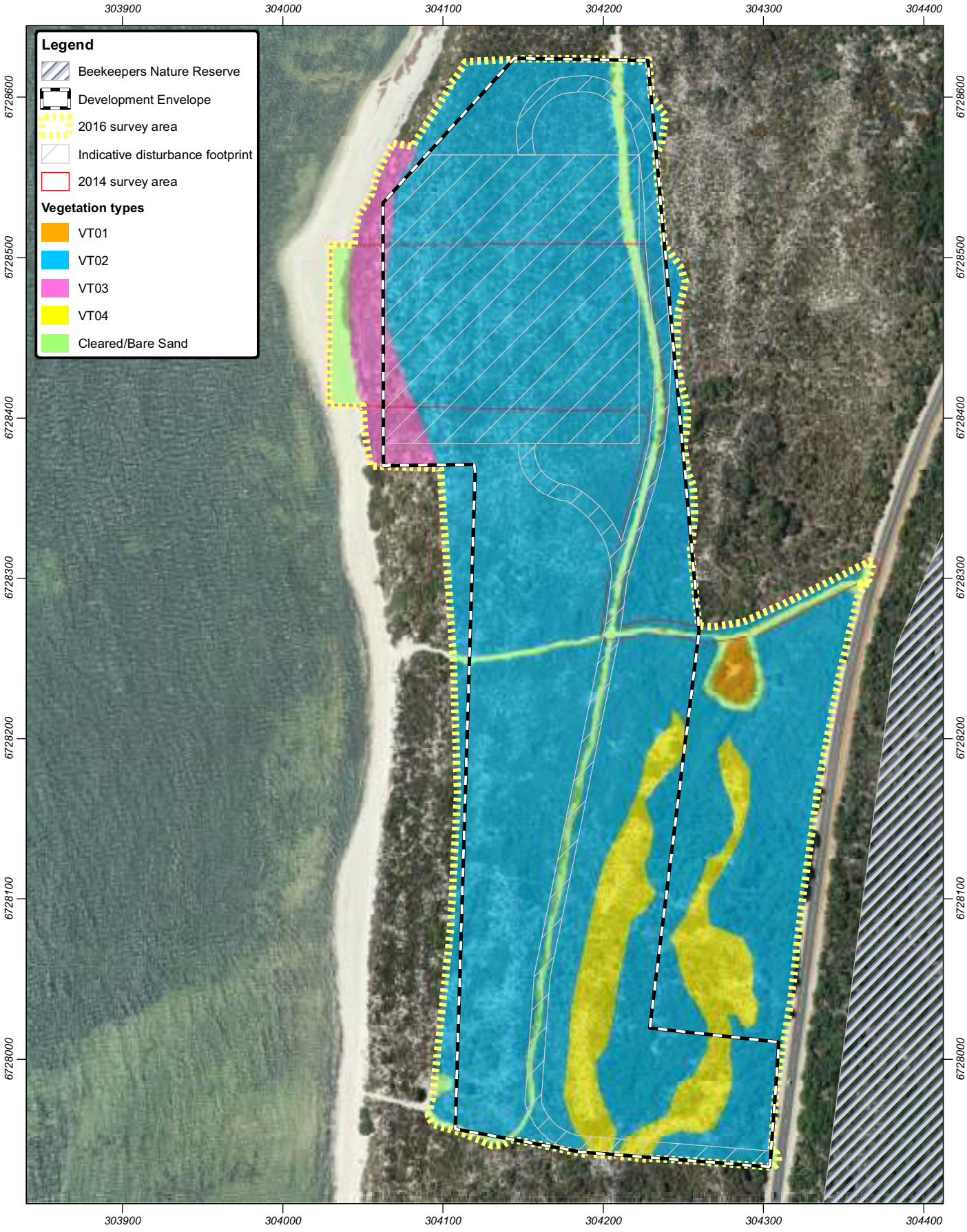

Figure 1 Vegetation Type

Scale 1:3,250 at A4

0 20 40 60 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 22/03/2017
Author: DWhite
Source: Aerial image: ESRI online 2010.

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Path: Q:\Consult\2016\NEE\NEE16193_01\ArcMap_documents\M002\NEE16193_01_M002_RevB_F001.mxd

Figure 2 Vegetation Condition

Scale 1:3,250 at A4

0 20 40 60 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 22/03/2017
Author: DWhite
Source: Aerial image: ESRI online 2010.

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Flora

A total of 22 native plant taxa were recorded in the survey area during the 2016 supplementary survey (Table 5).

Table 5: Native plant taxa recorded in the survey area

Family	Species
Aizoaceae	*Carpobrotus virescens*
Arecaceae	**Phoenix canariensis*
Asparagaceae	*Acanthocarpus preissii*
Campanulaceae	*Lobelia heterophylla*
Chenopodiaceae	*Rhagodia baccata*
	Rhagodia preissii subsp. *obovata*
	Threlkeldia diffusa
Cyperaceae	*Lepidosperma calcicola*
Fabaceae	*Acacia lasiocarpa* var. *lasiocarpa*
	Acacia rostellifera
	Acacia sp.
Goodeniaceae	*Scaevola thesioides*
Haemodoraceae	*Conostylis candicans*
Lamiaceae	*Hemiandra pungens*
Lauraceae	*Cassytha aurea*
Myrtaceae	*Eucalyptus erythrocorys*
	Melaleuca huegelii
	Melaleuca lanceolata
Orchidaceae	*Orchidaceae* sp.
Poaceae	*Austrostipa elegantissima*
	**Avena barbata*
	**Bromus diandrus*
Ranunculaceae	*Clematis linearifolia*
Rubiaceae	*Opercularia spermacocea*

Conservation significant flora

No conservation significant flora species were recorded during the flora and vegetation survey.

Introduced flora

Three introduced flora species were recorded during the flora and vegetation survey, one species (**Phoenix canariensis;* Canary Islands Date Palm) was likely planted (Table 6). One species is listed as High priority under the Environmental Weed Strategy for Western Australia (CALM 1999; Parks and Wildlife 2013). None of the introduced flora species are Weeds of National Significance (AWC 2014), and none are listed as a Declared Pest under the BAM Act (DAFWA 2016).

Table 6: Introduced flora species recorded during the site visits

Species	Common name	Declared Plant management status	Environmental Weed Strategy rating
**Avena barbata*	Wild Oats	-	Moderate
**Bromus diandrus*	Brome Grass	-	High
**Phoenix canariensis*	Canary Island Date Palm	-	-

Discussion

Flora species and vegetation types recorded within the supplementary survey area are consistent with those recorded in the 2014 survey area.

The vegetation within the survey area is typical of the coastal region, mainly consisting of *Acacia rostellifera* shrublands over a range of low shrubs and grasses, transitioning to lower densities of shrubs on the dune top. The survey area contained high densities of introduced grasses along the edges of tracks. The majority of the survey area was in Very Good to Excellent condition, whilst the cleared areas and areas of weed incursion near the tracks were Completely Degraded.

None of the vegetation types recorded during the flora and vegetation survey resemble listed Threatened or Priority ecological communities known within the region.

The flora within the survey area resembled the previous survey results (Strategen 2016) with many of the same taxa recorded. There were less exotic species recorded compared to the previous survey, likely due to annual species senescing prior to the survey period (end of spring). No Declared weeds under the BAM Act were recorded during the survey.

No conservation significant taxa were recorded during the survey and are not likely to occur within the survey area based on the listed habitat preferences and known features of the site.

Conclusion

The results of the flora and vegetation assessment did not find any major environmental constraints that may affect the proposed clearing within the survey area. No conservation significant flora taxa or ecological communities have been recorded within the survey area, and none are thought likely to occur based on results of the assessment.

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Xanadu-1 Well Construction

Flora, vegetation and fauna habitat assessment

Prepared for
Westranch Holdings Pty Ltd
by Strategen

May 2016

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ENVIRONMENTAL

Xanadu-1 Well Construction

Flora, vegetation and fauna habitat assessment

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Strategen Environmental Consultants Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ACN: 056 190 419

May 2016

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consulting Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

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In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Westranch Holdings Pty Ltd

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	A	Client review	T Stehbens / E Congear / D Goundrey	Electronic	9 January 2015
Final Report	**0**	**Agency submission**	**T Stehbens / E Congear / D Goundrey**	**Electronic / hard copy**	**25 May 2016**

Filename: NEE14297_01 R001 Rev 0 - 25 May 2016

Executive Summary

Strategen was commissioned by Norwest Energy NL on behalf of Westranch Holdings Pty Ltd, to undertake a flora, vegetation and fauna habitat assessment of the Xanadu-1 proposed drill site location and associated access track (Survey Area) in October 2014. This assessment was undertaken as a baseline environmental investigation to support environmental impact assessment of the proposed Xanadu-1 work program within the TP/15 Exploration Permit Area.

The Survey Area is located on a narrow strip of land between Indian Ocean Drive and the coastline in the Shire of Irwin, approximately 42 km south of Dongara and 312 km north of Perth. The Survey Area comprises an area of 2.39 ha, encompassing the proposed drill pad location, and a 10 m wide corridor surrounding the existing access track to Indian Ocean Drive, located adjacent to Beekeepers Nature Reserve (Beekeepers NR). The assessment comprised a desktop analysis of conservation significant flora, ecological communities and fauna, followed by a flora and vegetation field survey.

Vegetation of the Survey Area is typical of the coastal region, mainly consisting of *Acacia rostellifera shrublands* over a range of Chenopods and *Scaevola* spp., transitioning to higher densities of *Spinifex longifolius* on the fore-dune. Much of the Survey Area was affected by weeds, particularly introduced grasses, with higher densities recorded along the edges of tracks and along the fore-dune. Cleared areas (mainly tracks and the bare sand of the beach front) accounted for 0.34 ha, while the remaining 2.05 ha of the Survey Area were vegetated.

None of the vegetation types recorded during the flora and vegetation survey resemble listed Threatened or Priority ecological communities known within the region, and no conservation significant flora taxa were recorded on site. Five weed species were recorded during the survey, including **Bromus diandrus*, listed as a High priority for control under the Environmental Weed Strategy for Western Australia (CALM 1999; DEC 2009a). This species should be a priority for management during any rehabilitation works undertaken on the site.

Five conservation significant fauna may occur in the Survey Area based on the desktop assessment: Carnaby's Black Cockatoo, Malleefowl, White-bellied Sea-Eagle, Rainbow Bee-eater and the Western Brush Wallaby; however, the Survey Area is unlikely to represent key habitat for any of these species. Given the large area of relatively undisturbed vegetation surrounding the Survey Area, particularly within nearby Beekeepers Nature Reserve, it is unlikely that clearing within the Survey Area would significantly affect populations of any fauna species.

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1. Introduction

1.1 Background

Norwest Energy NL (Norwest), on behalf of Westranch Holdings Pty Ltd (Westranch), proposes to construct the Xanadu-1 onshore oil well for the purpose of exploratory works within the TP/15 Exploration Permit Area, located off the coast of Dongara (the Proposal).

The onshore component of the Proposal is located 42 km south of Dongara and 312 km north of Perth within the Shire of Irwin. The Proposal will involve conventional drilling into onshore and offshore oil reserves for the purpose of exploration.

Key elements of the program which may result in impacts to the environment include the following:

- clearing of 2.05 ha including a 60 m by 60 m drilling area and access track
- well installation and testing, including associated ground disturbance activities.

Norwest engaged Strategen to undertake a flora, vegetation and fauna habitat assessment of the Xanadu - 1 proposed drill site location and associated access track (Survey Area). This assessment has been undertaken as a baseline environmental investigation to support environmental impact assessment of the Proposal within the TP/15 Exploration Permit Area.

1.2 Scope and objectives

This report has been produced to support the environmental impact assessment and approvals processes for any future works that may occur within the Survey Area. The specific objectives of the vegetation survey were to undertake a flora, vegetation and fauna habitat assessment including:

- establish vegetation quadrats representing the vegetation units
- record the species present and foliage cover
- assess condition of native vegetation
- note any additional species of interest present in the Survey Area
- assess the potential for vegetation to provide habitat to conservation significant fauna
- provide the results in a technical report.

This survey has been undertaken to meet the requirements of a Level 1 survey in accordance with the Environmental Protection Authority (EPA) Guidance Statement 51 on terrestrial flora and vegetation surveys (EPA 2004a).

1.3 Location

The Survey Area is located on a narrow strip of land between Indian Ocean Drive and the coastline in the Shire of Irwin, approximately 42 km south of Dongara and 312 km north of Perth (Figure 1). The Survey Area comprises approximately 200 m by 400 m area encompassing the proposed drill pad location, and a 10 m wide corridor surrounding the existing access track to Indian Ocean Drive, to allow for track widening if required (Figure 2). The Survey Area is adjacent to Beekeepers Nature Reserve (Beekeepers NR).

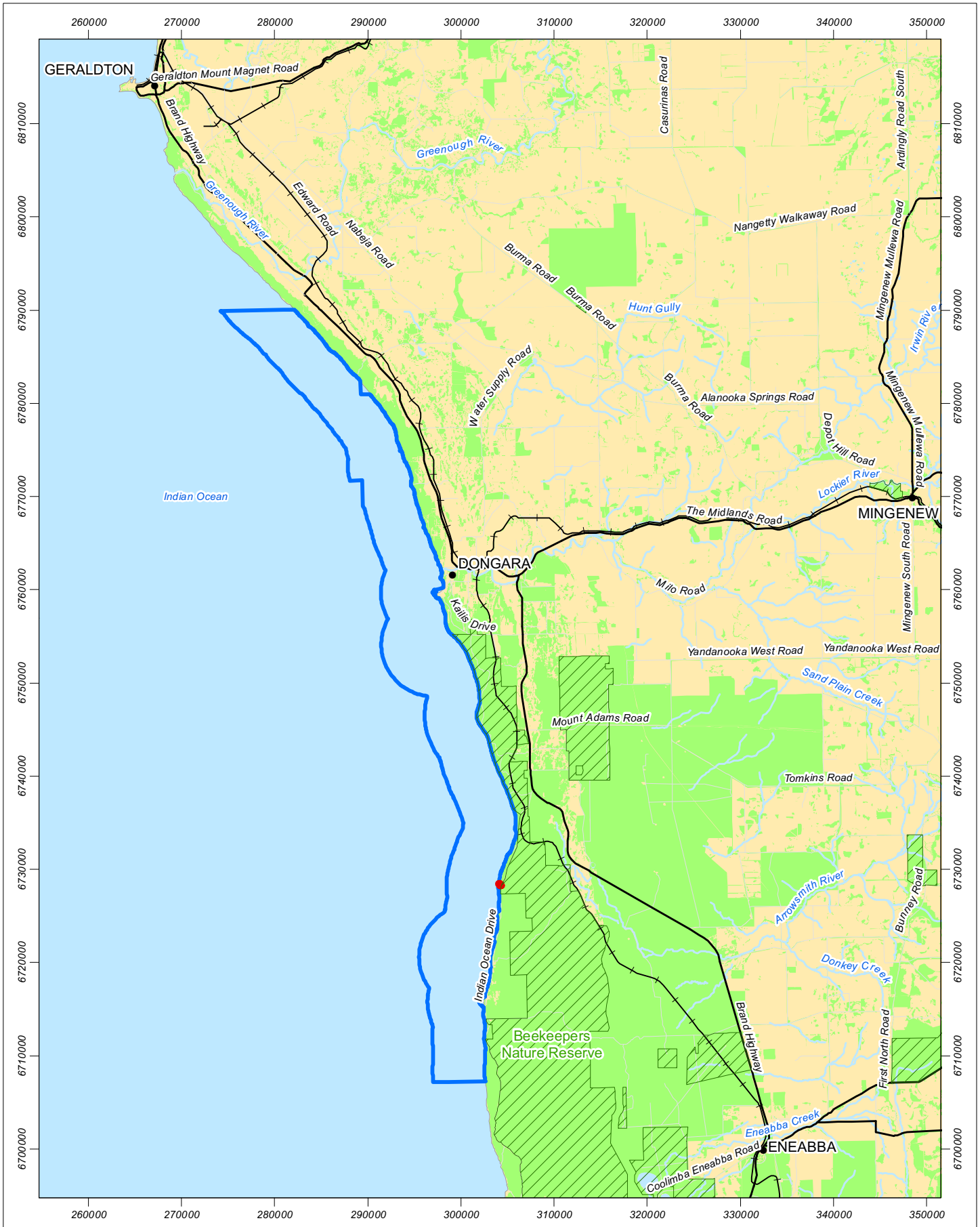

Figure 1 Regional location

Scale 1:550,000 at A4

0 3 6 9 12 15 km

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 3/12/2014

Author: JCrute

Source: Topography: Geoscience Australia 2012.
EP 413: DMP 2012.

Path: Q:\Consult\2014\NEE\NEE14297\ArcMap_documents\R001\RevA\NEE14297_01_R001_RevA_F001.mxd

Legend

- Town
- Railway
- Major road
- Minor road
- Native vegetation
- Nature Reserve
- Survey area
- Exploration Permit TP15

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Figure 2: Survey Area

Scale 1:2,500 at A4

0 20 40 60 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 3/12/2014
Author: JCrute
Source: Vegetation Beard: DAFWA 2012.

Legend

- Road
- Survey area
- Beekeepers Nature Reserve

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1.4 Legislative context

This assessment has been conducted with reference to the following Australian and Western Australian legislation:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Wildlife Conservation Act 1950* (WC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State.

1.4.1 Conservation significant flora and ecological communities

Threatened species are listed under the EPBC Act at the Australian Government level and under the WC Act at the State level (Appendix 1). Flora, fauna and ecological communities protected under the EPBC Act are referred to as Matters of National Environmental Significance (MNES) and include rare or threatened species and communities, as well as migratory species protected under international agreements. Priority species are listed by the Department of Parks and Wildlife (Parks and Wildlife) and include species of 'significant conservation value' (Appendix 1).

Threatened ecological communities (TECs) are listed under both the EPBC Act and EP Act (Appendix 1). Priority ecological communities (PECs) are listed by Parks and Wildlife and include species of significant conservation value (Appendix 1).

1.4.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the EP Act, and include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed threatened species
- TECs.

1.4.3 Protection of native vegetation

Native vegetation is defined under the EP Act as "*indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation*".

This definition "*does not include vegetation that was intentionally sown, planted or propagated unless a) that vegetation was sown, planted or propagated as required under this Act or another written law; or b) that vegetation is of a class declared by regulation to be included in this definition*".

Native vegetation can only be cleared with a clearing permit unless for some circumstances where exemptions apply pursuant to the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations). Clearing permits issued pursuant to the Regulations may be issued as area permits or purpose permits. Exemptions for clearing under Regulation 5 of the Regulations do not apply within ESAs.

1.4.4 Introduced species

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as declared pests under the BAM Act are classified under three categories:

1. **C1 Exclusion**: Pests assigned under this category are not established in Western Australia, and control measures are to be taken to prevent them entering and establishing in the State.
2. **C2 Eradication**: Pests assigned under this category are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
3. **C3 Management**: Pests assigned under this category are established in Western Australia, but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area that is currently free of that pest.

Under the BAM Act, land managers are required to manage populations of declared pests as outlined under the relevant category.

1.4.5 Regulatory guidance

This flora vegetation and fauna habitat assessment has been designed to address the recommendations of the EPA as described in the following guidance:

- EPA Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000)
- EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)
- EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004a)
- EPA Guidance Statement No 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b).

2. Methodology

2.1 Desktop assessment

Information used to identify the regional vegetation context was gathered from the following sources:

- Interim Biogeographic Regionalisation of Australia (IBRA): regions and subregions (Desmond and Chant 2001; DotE 2014a)
- Beard (1976): pre-European mapping of the Murchison region.

Prior to visiting the Survey Area, searches were undertaken of the following databases to establish whether any conservation significant fauna species could potentially occur in the site:

- NatureMap (Parks and Wildlife 2014a) (search area encompassed a 5 km radius from an approximately central point of the site)
- EPBC Act Protected Matters Search Tool (DotE 2014b) (search area encompassed a 1 km radius from an approximately central point of the site)
- database requests for the Parks and Wildlife databases:
  - Threatened and Priority Flora database (Parks and Wildlife 2014b)
  - Threatened and Priority Fauna (Parks and Wildlife 2014c)
  - Threatened and Priority Ecological Communities database (Parks and Wildlife 2014d).

The desktop review was used to inform the site investigation.

2.2 Flora and vegetation survey

2.2.1 Vegetation

A flora and vegetation survey of the Survey Area was undertaken on 27 and 28 October 2014. A total of five 10 m x 10 m vegetation quadrats were established across the Survey Area. At each site, the following parameters were recorded:

- GPS location
- soil and landform characteristics
- vascular plant taxa present
- foliage cover (%)
- photograph of each site
- overall condition of the vegetation.

Vegetation condition was measured using the condition rating scale of Keighery (1994):

1. Pristine: pristine or nearly so, no obvious signs of disturbance.
2. Excellent: vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3. Very Good: vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4. Good: vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

5. Degraded: basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
6. Completely Degraded: the structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

2.2.2 Flora

Vascular taxa were identified on-site with reference to Florabase (Parks and Wildlife 2014e) where necessary. Where identifications could not be made on-site, a specimen was collected and sent to the Western Australian Herbarium. Nomenclature of the species recorded is in accordance with Florabase (Parks and Wildlife 2014e). All botanists held valid collection licences to collect flora for scientific purposes, issued under the WC Act (Table 1).

Table 1: Flora collection licence details

Name	Flora licence number
Daniel Panickar	SL010993
Tegan Stehbens	SL011156

A targeted survey was conducted to search for any Threatened or Priority Flora species identified as potentially occurring during the desktop survey.

Introduced species

Weed species recorded in the site assessment were evaluated using weed prioritising lists including the Weeds of National Significance (WoNS; AWC 2014) list and species declared under the BAM Act (DAF 2014), with additional reference to the *Midwest Region Environmental Weed Rankings Summary* (Parks and Wildlife 2013) and *Western Weeds* (Hussey et al. 2007).

The Environmental Weed Strategy for Western Australia rates weeds as high, moderate, mild or low according to the following criteria (CALM 1999):

- ability to invade bushland in good to excellent condition or ability to invade waterways
- wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world
- ability to change the structure, composition and function of ecosystems; in particular, an ability to form a monoculture in a vegetation community.

The rating for each weed was determined by the following system, with reference to the above three criteria (CALM 1999):

- High – species scores yes for all three criteria
- Moderate – species scores yes for two criteria
- Mild – species scores yes for one criterion
- Low – species does not score yes for any of the criteria.

A weed species rated as High indicates this species should be prioritised for control, funding and/or research. Species rated as moderate should be monitored and should receive control/funding if resources are available. A Mild rating indicates monitoring and control should be undertaken where appropriate and a Low rating indicates the species requires a low level of monitoring (CALM 1999).

2.3 Fauna habitat assessment

Threatened or Priority listed fauna species that were identified as 'possible' or 'likely to occur' within the Survey Area were further considered following the results of the flora and vegetation survey. Key habitat requirements of each species were assessed against the vegetation types recorded in the Survey Area to determine whether the Survey Area was likely to represent key habitat for any conservation significant fauna species.

2.4 Survey constraints and limitations

Potential constraints and limitations that may have had an impact on the outcomes of the flora and vegetation assessment have been considered (Table 2).

Table 2: Potential constraints or limitations on the survey

Potential constraint or limitation	Impact on survey	Comment
Sources and availability of contextual information	Not a constraint	The Geraldton Sandplains are reasonably well-surveyed, including surveys within the neighbouring Beekeepers NR, and several sources of contextual information exist.
Proportion of flora collected and identified	Not a constraint	A total of 31 native species were recorded during the survey. Of these, all were able to be confirmed to at least species level. Five 10 x 10 m quadrats were sampled across the approximately 2.39 ha Survey Area. Additional species not previously recorded within quadrats were recorded on an overall species list while traversing the site. As such, it is likely that the majority of native species present were recorded during the survey.
Survey timing	Not a constraint	The results presented in this report are the product of a spring (October) survey. Spring is considered the optimal survey time for the Southwest.
Survey completeness and intensity	Not a constraint	The survey was conducted at the intensity appropriate for a complete Level 1 survey as described by EPA Guidance Statement 51, in the appropriate season for the Geraldton Sandplains bioregion i.e., during the optimum flowering time for the majority of southwest WA flora species.
Effects of disturbance	Not a constraint	The effects of disturbance (including the presence of weeds and planted revegetation areas) were not a constraint for this vegetation assessment. Remnant vegetation was in sufficiently good condition to enable determination of a vegetation type and, as such, conduct a comparison with known Threatened or Priority Ecological Communities in the area.
Access and resources	Not a constraint	The Survey Area was readily accessible by vehicle or by foot. Adequate resources were available to complete the survey as planned.
Experience levels	Not a constraint	The field survey and reporting were conducted by two botanists, each with more than four years experience in the field. Plant identification was undertaken by Cate Tauss.

3. Results

3.1 Desktop assessment

3.1.1 Climate

The climate of the Survey Area is described as dry warm Mediterranean, with winter precipitation of 300 to 500 mm and seven to eight dry months per year (Beard 1990). The nearest monitored weather station is located at Dongara; average climate data for Dongara is displayed in Figure 3.

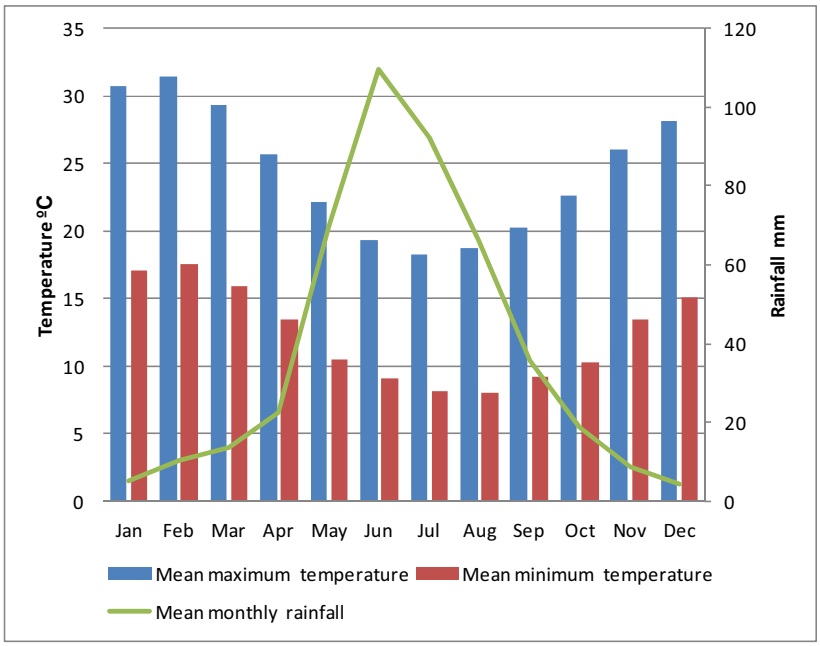

Figure 3: Average climate data for Dongara

3.1.2 Regional setting

IBRA classifies Australia's landscapes into 89 distinct regions based on commonalities in climate, geology, landform patters and flora and fauna communities (DotE 2014a). These bioregions are further divided into 419 subregions based on localised units within each bioregion (DotE 2014a). The Survey Area is located within the Lesueur Sandplains subregion of the Geraldton region.

The Geraldton Sandplains bioregion is composed mainly of proteaceous shrub-heaths, rich in endemics, on extensive, undulating, lateritic sandplains. The Lesueur Sandplains subregion comprises coastal Aeolian and limestone formations and alluvial drainage systems with extensive yellow sandplains in the southeastern portion. The vegetation comprises shrub-heaths rich in endemics on a mosaic of lateritic mesas, sandplains, coastal sands and limestone.

Beard (1981) undertook a comprehensive surveying and mapping exercise for the vegetation of Western Australia, describing vegetation in broad categories known as vegetation associations. The Survey Area is located within the Irwin Botanical District of the Northern Sandplains Region (Beard 1990). Flora composition of this district is described as predominantly consisting of scrub heath on sandplains near the coast, with *Acacia-Casuarina* thickets further inland (Beard 1990).

The Survey Area lies within Beard vegetation associations 1026 and 255 (Figure 4), both within the Cliff Head System. The Cliff Head System occupies the coastal strip of dunes and, to the south, salt lakes. The vegetation varies from a low Acacia Melaleuca heath on limestone platforms to dense thickets of *Acacias, Eucalyptus* and *Melaleucas* on sand ridges. The Beard vegetation associations are described as follows:

> Vegetation Association 255: Shrublands; mallee scrub, *Eucalyptus dongarraensis* (now *Eucalyptus obtusiflora* subsp. *dongarraensis*)
> Vegetation Association 1026: Mosaic: Shrublands; *Acacia rostellifera*, *A. cyclops* (in the south) and *Melaleuca cardiophylla* (in the north) thicket / Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath.

Parks and Wildlife, formerly the Department of Environment and Conservation (DEC), undertake GIS-based estimates of the percentage remaining for each of the Beard vegetation associations on a regular basis. At the time of the most recent estimate (October 2012), approximately 92.36% of the pre-European extent of Vegetation Association 255 and approximately 92.84% of the pre-European extent of Vegetation Association 1026 remained (Table 3; Government of Western Australia 2013).

Table 3: Pre-European and current extent of vegetation associations occurring within the Survey Area

Vegetation association	Pre-European extent (ha)	Current extent (ha)	% remaining	Percentage of current extent in Parks and Wildlife managed land (%)	Current extent within Lesueur Sandplains remaining (%)
255	3176.54	2933.92	92.36	51.46	95.74
1026	70 700.48	65 641.37	92.84	54.41	93.21

3.1.3 Conservation significant vegetation communities

A database search of the Parks and Wildlife Threatened Ecological Communities Database was undertaken to determine whether any Threatened or Priority flora species are known from within a 5 km radius of the Survey Area (Parks and Wildlife 2014c). Additionally, a search of the project area using the Protected Matters Search Tool was undertaken (DotE 2014b).

No TECs or PECs have been previously recorded within the Survey Area (DotE 2014b, Parks and Wildlife 2014c).

3.1.4 Conservation significant flora

Database searches of NatureMap and the Parks and Wildlife Threatened Flora Database were undertaken to determine whether any Threatened or Priority flora species are known from within a 5 km radius of the Survey Area (Parks and Wildlife 2014a; Parks and Wildlife 2014b). Additionally, a search of the project area using the Protected Matters Search Tool was undertaken (DotE 2014b). Results of the database searches are presented in Table 4.

Database searches indicated that a total of 24 conservation significant flora taxa may occur within the Survey Area, comprising two species listed as Endangered under the EPBC Act, and an additional six Priority 1 taxa, four Priority 2 taxa, seven Priority 3 taxa and five Priority 4 taxa (Table 4). The likelihood of these taxa occurring within the Survey Area was assessed based on known populations and preferred habitat. None of the Threatened or Priority flora are considered likely to occur (Table 4) based on the listed habitat preferences and known features of the site, a coastal sand dune system (Table 4). Twelve Priority listed species may possibly occur, and the remainder were assessed as unlikely to occur at the site (Table 4).

Table 4: Likelihood of occurrence of Threatened and Priority flora within the Survey Area

Species	Status	Source	Likelihood of occurrence
Centrolepis caespitosa	P4, E	Protected Matters Search Tool	**Unlikely:** Occurs in winter-wet clay pans dominated by low shrubs and sedges. Survey Area does not contain suitable habitat.
Paracaleana dixonii	T, E	Threatened Flora Database	**Unlikely:** Occurs in deep sand in open areas beneath dense tall shrubland with scattered emergent banksias, or in shallow sand over laterite in heathland. Survey Area does not contain suitable habitat.
Caladenia denticulata subsp. Arrowsmith (G Brockman GBB 2441)	P1	Threatened Flora Database	**Unlikely:** Occurs in laterite, clay, loam and deep sand of winter-wet flats, river banks and creeklines. Survey Area does not contain suitable habitat.
Diuris eburnea	P1	Threatened Flora Database	**Unlikely:** Occurs on river banks. Survey Area does not contain suitable habitat.
Scholtzia sp. Dongara (R Hart 8401)	P1	Threatened Flora Database	**Unlikely:** Occurs in white sand on flats over limestone. Survey Area does not contain suitable habitat.
Synaphea oulopha	P1	Threatened Flora Database	**Unlikely**: Occurs in grey sand, gravelly loam and clay on lateritic breakaways and rises. Survey Area does not contain suitable habitat.
Verticordia dasystylis subsp. *oestopoia*	P1	Threatened Flora Database	**Unlikely**: Occurs in gritty soils over granite and on outcrops. Survey Area does not contain suitable habitat.
Verticordia luteola var. *rosea*	P1	Threatened Flora Database	**Possible:** Occurs in white sand on flats.
Acacia vittata	P2	Threatened Flora Database	**Possible:** Occurs in grey sand and sandy clay on the margins of seasonal lakes.
Dampiera tephrea	P2	Threatened Flora Database, NatureMap	**Possible:** Occurs in sand and gravelly loam.
Guichenotia quasicalva	P2	Threatened Flora Database	**Unlikely**: Occurs in sandy clay over laterite along drainage lines. Survey Area does not contain suitable habitat.
Homalocalyx chapmanii	P2	Threatened Flora Database	**Unlikely:** Occurs in yellow or grey/brown sand on undulating plains over weathered granite. Survey Area does not contain suitable habitat.
Anthocercis intricata	P3	NatureMap	**Possible:** Occurs in sand or loam over limestone and in consolidated sand dunes.
Haloragis foliosa	P3	Threatened Flora Database, NatureMap	**Possible:** Occurs in white/grey sand over limestone.
Hemigenia saligna	P3	Threatened Flora Database, NatureMap	**Possible:** Occurs in lateritic and sandy soils.
Hopkinsia anoectocolea	P3	Threatened Flora Database	**Possible:** Occurs in white or grey sand, often saline, winter wet depressions, floodplains and salt lakes.
Stylidium torticarpum	P3	Threatened Flora Database	**Unlikely:** Occurs in sandy clay and clay loam over laterite, adjacent to creeklines, depressions and beneath breakaways in heath or mallee shrubland. Survey Area does not contain suitable habitat.
Triglochin protuberans	P3	Threatened Flora Database	**Unlikely**: Occurs in red loam or grey mud over clay in winter-wet sites, claypans, near salt lakes and on the margins of pools. Survey Area does not contain suitable habitat.
Verticordia luteola var. *luteola*	P3	Threatened Flora Database	**Unlikely:** Occurs in grey sand over gravel in flats. Survey Area does not contain suitable habitat.
Thryptomene sp. Lancelin (ME Trudgen 14000)	P3	Threatened Flora Database, NatureMap	**Possible:** Occurs in calcareous sand.

Banksia elegans	P4	Threatened Flora Database	**Possible:** Occurs in yellow, white or red sand on sandplains and low consolidated dunes.
Calytrix eneabbensis	P4	Threatened Flora Database	**Possible:** Occurs in white, grey or yellow sand over laterite on sandplains.
Eucalyptus zopherophloia	P4	Threatened Flora Database, NatureMap	**Possible:** Occurs in grey or white sand with limestone rubble in coastal areas.
Stawellia dimorphantha	P4	Threatened Flora Database	**Possible:** Occurs in white, grey or yellow sand.
Verticordia penicillaris	P4	Threatened Flora Database	**Unlikely:** Occurs in shallow gritty soils on granite outcrops. Survey Area does not contain suitable habitat.

T – listed as Threatened under WC Act.
E – listed as Endangered under EPBC Act.
P – Priority species as listed by Parks and Wildlife (refer to Appendix 1 for definitions).
Sources: Brown et al 1998; Hoffman and Brown 2011; Parks and Wildlife 2014a, 2014b, 2014e; DotE 2014b, 2014c.

3.1.5 Conservation significant fauna

A search of the Protected Matters database undertaken on 23 October 2014 using a 1 km buffer around the site found 46 fauna species listed as MNES for the area, including 28 listed threatened fauna species and an additional 19 migratory species (Table 5). Another two species are listed as Priority fauna by Parks and Wildlife (Table 5).

A number of exclusively marine species were returned in the search results. These 35 species (identified as 'not present' in Table 5) have been excluded from further analysis.

Five of the species listed in Table 5 may possibly occur within the survey area, based on an assessment of preferred habitat. None were considered highly likely to occur.

Table 5: Likelihood of occurrence of conservation significant fauna within the Survey Area

Species	Status	Source	Likelihood of occurrence
Birds			
Carnaby's Black Cockatoo, *Calyptorhynchus latirostris*	T, E	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This species may be present in the Survey Area as a fly-over, but is unlikely to utilise the area as it is unlikely to contain suitable habitat (i.e. high quality foraging habitat, trees large enough for breeding and/or roosting).
Northern Royal Albatross, *Diomedea epomophora sanfordi*	T, E, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Southern Giant Petrel, *Macronectes giganteus*	T, E, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Amsterdam Albatross, *Diomedea exulans amsterdamensis*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Tristan Albatross, *Diomedea exulans exulans*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Australian Lesser Noddy, *Anous tenuirostris melanops*	T, V	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Southern Royal Albatross, *Diomedea epomophora epomophora*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Wandering Albatross, *Diomedea exulans (sensu lato)*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Malleefowl, *Leipoa ocellata*	T, V	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This species prefers shrublands and low woodlands dominated by mallee vegetation, although it also occurs in acacia shrublands and coastal heathlands.
Northern Giant-Petrel, *Macronectes halli*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Shy Albatross, *Thalassarche cauta cauta*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
White-capped Albatross, *Thalassarche cauta steadi*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Black-browed Albatross, *Thalassarche melanophris*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Campbell Albatross, *Thalassarche melanophris impavida*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Common Sandpiper, *Actitis hypoleucos*	IA, M	Threatened Fauna Database	**Unlikely:** Occurs in wetland habitats. Survey Area does not contain suitable habitat.
Cattle Egret, *Ardea ibis*	IA, M	Protected Matters Search Tool	**Unlikely:** Occurs in wetland habitats. Survey Area does not contain suitable habitat.
Fork-tailed Swift, *Apus pacificus*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Eastern Great Egret, *Ardea modesta*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Unlikely:** Occurs in wetland habitats. Survey Area does not contain suitable habitat.
Ruddy Turnstone, *Arenaria interpres*	IA, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Survey Area.
Red-necked Stint, *Calidris ruficollis*	IA, M	Threatened Fauna Database	**Unlikely:** Occurs in coastal and wetland habitats. Survey Area does not contain suitable habitat.
Eastern Reef Egret, *Egretta sacra*	IA, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Survey Area.
White-bellied Sea-Eagle, *Haliaeetus leucogaster*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This species is found in coastal habitats and around terrestrial wetlands. They prefer habitats that include large areas of open water and breed in tall open forest or woodland.

Bar-tailed Godwit, *Limosa lapponica*	IA, M	Threatened Fauna Database	**Unlikely:** Occurs in coastal and wetland habitats. Survey Area does not contain suitable habitat.
Rainbow Bee-eater, *Merops ornatus*	IA, M	Threatened Fauna Database, Protected Matters Search Tool	**Possible:** This widely-distributed species is found in a range of habitats across Australia, including coastal dune systems.
Grey Plover, *Pluvialis squatarola*	IA, M	Threatened Fauna Database	**Unlikely:** This species occurs almost entirely in coastal areas, preferring sheltered bays, estuaries and lagoons, reef flats as well as terrestrial wetlands and salt lakes. Survey Area does not contain suitable habitat.
Fleshy-footed Shearwater, *Puffinus carneipes*	IA, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Caspian Tern, *Sterna caspia*	IA, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Roseate Tern, *Sterna dougallii*	IA, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Reptiles			
Loggerhead Turtle, *Caretta caretta*	T, E, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Survey Area.
Leatherback Turtle, *Dermochelys coriacea*	T, E, M	Threatened Fauna Database	**Not present:** This is a marine species that would not use the Survey Area.
Western Spiny-tailed Skink / Houtman Abrolhos Spiny-tailed Skink,, *Egernia stokesii badia / Egernia stokesii aethiops*	T, E	Protected Matters Search Tool	**Unlikely:** Occurs in woodland habitat and in rocky outcrops. Survey Area does not contain suitable habitat.
Green Turtle, *Chelonia mydas*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Flatback Turtle, *Natator depressus*	T, V, M	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Mammals			
Blue Whale, *Balaenoptera musculus*	T, E, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Southern Right Whale, *Eubalaena australis*	T, E, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Western Quoll, *Dasyurus geoffroii*	T, V	Protected Matters Search Tool	**Unlikely:** This species prefers wooded or forested habitats. Survey Area does not contain suitable habitat.
Humpback Whale, *Megaptera novaeangliae*	T, V, M	Protected Matters Search Tool	**Not present**: This is an exclusively marine species that would not use the Survey Area.
Australian Sea-lion, *Neophoca cinerea*	T, V	Protected Matters Search Tool	**Not present:** This is a marine species that would not use the Survey Area.
Bryde's Whale, *Balaenoptera edeni*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Dusky Dolphin, *Lagenorhynchus obscurus*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Killer Whale, *Orcinus orca*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Western Brush Wallaby, *Macropus irma*	P4	Threatened Fauna Database	**Possible:** This species prefers tall open forests, but is also found in mallee and heathland habitats.

Sperm Whale, *Physeter macrocephalus*	P4	Threatened Fauna Database	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Sharks			
Grey Nurse Shark, *Carcharias taurus* (west coast population)	T, V	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Great White Shark, *Carcharodon carcharias*	T, V, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Whale Shark, *Rhincodon typus*	T, V, M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Mackerel Shark, *Lamna nasus*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.
Giant Mana Ray, *Manta birostris*	M	Protected Matters Search Tool	**Not present:** This is an exclusively marine species that would not use the Survey Area.

T – listed as Threatened under WC Act.
IA – listed migratory birds protected under international agreements and listed under WC Act.
E – listed as Endangered under EPBC Act.
V – listed as Vulnerable under EPBC Act.
M – listed as Migratory under the EPBC Act.
P – Priority species as listed by Parks and Wildlife (refer to Appendix 1 for definitions).
Sources: Parks and Wildlife 2014d; DotE 2014b, 2014c.

3.2 Flora and vegetation survey

3.2.1 Vegetation

Three vegetation types were identified within the Survey Area (Table 6, Figure 6). Most of the Survey Area was the VT02 coastal shrubland vegetation, with VT03 along the fore-dune and a very small area VT01 associated with a wet depression (Table 6, Figure 6). A total of 2.05 ha of the 2.39 ha Survey Area is vegetated, while the remaining 0.34 ha comprises cleared tracks and bare sand of the beach.

Table 6: Vegetation types recorded during site visit

Vegetation type	Description	Area	Proportion of Survey Area (%)
VT01	*Melaleuca* spp. dense shrubland over sedges associated with winter-wet areas.	<0.01 ha	14.40
VT02	*Acacia rostellifera* shrublands with occasional *Gyrostemon ramulosus* and *Anthocercis littorea* over *Scaevola* spp. and mixed Chenopods over *Acanthocarpus preissii* and weedy grasses.	1.73 ha	0.07
VT03	Acacia rostellifera and Myoporum insulare open shrublands over Scaevola crassifolia and Spinifex longifolius over *Tetragonia decumbens, Carpobrotus virescens, Threlkeldia diffusa and weedy grasses.	0.32 ha	72.22
Cleared or bare sand	Cleared areas and bare sand of the beach.	0.34 ha	13.31
Total		2.39 ha	100.00

Vegetation condition ranged from Completely Degraded in cleared areas associated with the existing track, to Excellent in remnant vegetation further from the track (Table 7, Figure 7). The main sources of disturbance were clearing associated with the track, and weed encroachment by the track margins and along the fore-dune.

Table 7: Vegetation condition of the Survey Area by size

Vegetation condition rating	Surveyed area (ha)	Proportion of survey area (%)
Excellent	1.82 ha	75.97
Very Good	0.23 ha	9.63
Completely Degraded	0.34 ha	14.40
Total	2.39 ha	100.00

Conservation significant vegetation

None of the vegetation types recorded during the flora and vegetation survey resemble listed Threatened or Priority ecological communities known within the region.

3.2.2 Flora

A total of 31 native plant taxa were recorded in the Survey Area (Table 8).

Table 8: Native plant taxa recorded in the Survey Area

Family	Species
Aizoaceae	*Carpobrotus virescens*
Asparagaceae	*Acanthocarpus preissii*
Asteraceae	*Olearia axillaris*
Chenopodiaceae	*Atriplex cinerea*
	Rhagodia baccata subsp. *dioica*
	Rhagodia preissii subsp. *obovata*
	Threlkeldia diffusa
Cyperaceae	*Baumea juncea*
	Lepidosperma calcicola
Fabaceae	*Acacia lasiocarpa* var. *lasiocarpa*
	Acacia rostellifera
Goodeniaceae	*Goodenia berardiana*
	Scaevola crassifolia
	Scaevola globulifera
Gyrostemonaceae	*Gyrostemon ramulosus*
Haemodoraceae	*Conostylis candicans* subsp. *calcicola*
Lamiaceae	*Hemiandra linearis*
Lauraceae	*Cassytha aurea* var. *aurea*
Malvaceae	*Alyogyne huegelii*
Myrtaceae	*Melaleuca huegelii*
	Melaleuca lanceolata
	Melaleuca systena
Poaceae	*Ehrharta longiflora*
	Parapholis incurva
	Spinifex longifolius
Portulacaceae	*Calandrinia liniflora*
Ranunculaceae	*Clematis linearifolia*
Rhamnaceae	*Spyridium globulosum*
Rubiaceae	*Opercularia vaginata*
Scrophulariaceae	*Myoporum insulare*
Solanaceae	*Anthocercis littorea*

Conservation significant flora

No conservation significant flora species were recorded during the flora and vegetation survey.

Introduced flora

Five introduced flora species (weeds) were recorded during the flora and vegetation survey (Table 9). One species is listed as High priority under the Environmental Weed Strategy for Western Australia (CALM 1999; Parks and Wildlife 2013). None of the introduced flora species are Weeds of National Significance (AWC 2014), and none are listed as a Declared Pest under the BAM Act (DAF 2014).

Table 9: Introduced flora species recorded during the site visits

Species	Common name	Declared Plant management status	Environmental Weed Strategy rating
Lysimachia arvensis	Pimpernel	-	Not listed
Avena barbata	Wild Oats	-	Moderate
Bromus diandrus	Brome Grass	-	High
Tetragonia decumbens	Sea Spinach	-	Low
Sonchus asper	Rough Sowthistle	-	Low

3.3 Fauna habitat assessment

The habitat requirements of five conservation significant fauna species that may possibly occur in the Survey Area were assessed against the vegetation types described for the Survey Area.

Carnaby's Black Cockatoo

Carnaby's Black Cockatoo occurs in uncleared or remnant native eucalypt woodlands and shrubland dominated by Proteaceae species (*Banksia, Hakea* and *Grevillea*) (DotE 2014c). The preferred breeding habitat includes large tall living or dead eucalypts with suitable hollows (DotE 2014c). Given that the Survey Area was completely devoid of large trees, and no Proteaceae species were recorded, it is highly unlikely that this area would represent key habitat for this species. However, the species may occasionally fly over the Survey Area.

Malleefowl

Malleefowl are widespread in semi-arid regions of southern Australia and prefer shrublands and low woodlands dominated by mallee vegetation (DotE 2014c). However, it also occurs in other habitat types including coastal heathlands and acacia shrublands such as those of the Survey Area (DotE 2014c). The breeding mounds of the Malleefowl are distinctive, and none were recorded within the Survey Area. Given this, it is likely that while Malleefowl may occasionally pass through the Survey Area, it is unlikely that this area would represent key habitat for this species.

White-bellied Sea-Eagle

The White-bellied Sea-Eagle occurs in coastal habitats and around terrestrial wetlands, particularly in areas characterised by the presence of large areas of open water (DotE 2014c). Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas (DotE 2014c). Breeding usually occurs in tall open forest or woodland (DotE 2014c). While the White-bellied Sea-Eagle may fly over the Survey Area, it is unlikely to provide key habitat for this species as it does not contain features typical of breeding or feeding habitat.

Rainbow Bee-eater

The Rainbow Bee-eater is widely distributed throughout Australia and utilises a variety of different habitats (DotE 2014c). This species occurs in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (DotE 2014c). The Rainbow Bee-eater feeds mainly on insects and nests in burrows between August and January. Although this species may occur in the Survey Area, the wide distribution and varied habitat preferences indicate that the Survey Area is unlikely to represent key habitat for this species.

Western Brush Wallaby

The Western Brush Wallaby favours open forest or woodland, particularly with open, seasonally wet flats with low grasses and open, scrubby thickets (Strahan 1995). It is also found in some areas of mallee and heathland (Strahan 1995). The coastal Acacia shrublands of the Survey Area are unlikely to represent key habitat for this species; however, it may occasionally pass through the area.

Figure 4: Vegetation associations

Scale 1:20,000 at A4

0 200 400 600 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 2/12/2014
Author: JCrute
Source: Vegetation Beard: DAFWA 2012.

Legend

- Proposed well location
- Road
- Survey area

Vegetation associations

- CLIFF HEAD_1026
- CLIFF HEAD_255
- ILLYARRIE_377

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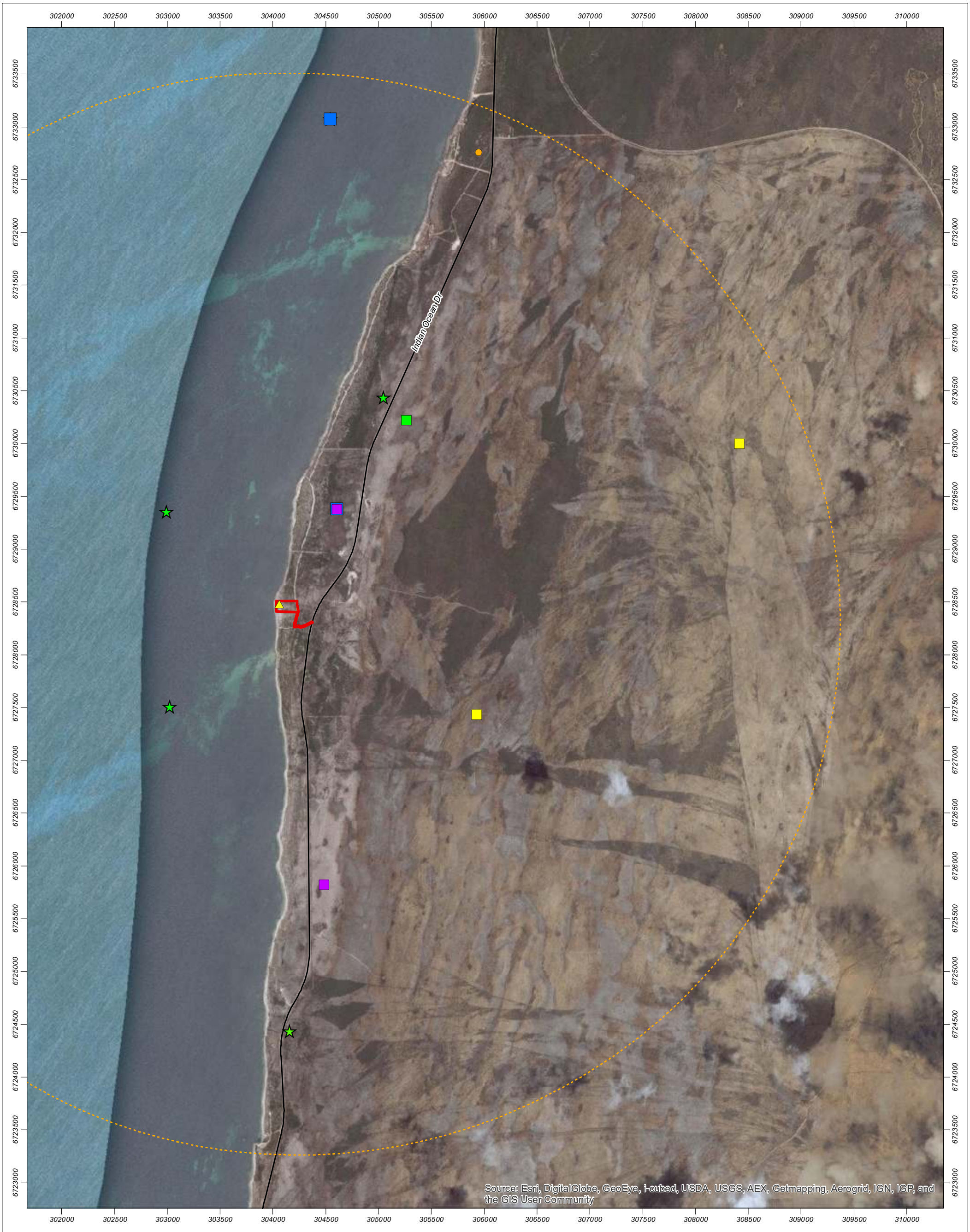

Figure 5: Threatened and Priority flora

Scale 1:33,000 at A3

0 200 400 600 800 1,000 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 2/12/2014
Author: JCrute
Source: Aerial image: ESRI online. Flora: DPaW 2014.

Legend

Species

- *Dampiera tephrea* (P2)
- *Anthocercis intricata* (P3)
- *Hemigenia saligna* (P3)
- *Thryptomene* sp. Lancelin (M.E. Trudgen 14000) (P3)
- *Haloragis foliosa* (P3)
- *Eucalyptus zopherophloia* (P4)
- Proposed well location
- Survey area
- 5km wide buffer

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Figure 6: Vegetation types

Scale 1:2,500 at A4

0 20 40 60 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 3/12/2014
Author: JCrute
Source: Aerial image: ESRI online 2010.

Legend

- Proposed well location
- Road
- Survey area

Vegetation type

- VT01
- VT02
- VT03
- Cleared/bare sand

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Figure 7: Vegetation condition

Scale 1:2,500 at A4

0 20 40 60 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 3/12/2014
Author: JCrute
Source: Aerial image: ESRI online 2010.

Legend

- Proposed well location
- Road
- Proposed survey area

Vegetation condition

- Excellent
- Very Good
- Completely Degraded

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4. Discussion

4.1 Vegetation

Vegetation of the Survey Area is typical of the coastal region, mainly consisting of *Acacia rostellifera* shrublands over a range of Chenopods and *Scaevola* spp., transitioning to higher densities of *Spinifex longifolius* on the fore-dune. Much of the Survey Area was affected by weeds, particularly introduced grasses, with higher densities recorded along the edges of tracks and along the fore-dune. The Very Good to Excellent condition of the vegetation was mainly a reflection of this weed incursion. Cleared areas (mainly tracks and the bare sand of the beach front) accounted for 0.34 ha, while the remaining 2.05 ha of the 2.39 ha Survey Area is vegetated.

None of the vegetation types recorded during the flora and vegetation survey resemble listed Threatened or Priority ecological communities known within the region.

4.2 Flora

The desktop assessment listed 24 conservation significant flora taxa that may occur within the Survey Area, twelve of which were assessed as possibly occurring in the Survey Area based on based on the listed habitat preferences and known features of the site. However, as none of these species were recorded during the survey, the likelihood of any conservation significant flora taxa occurring within the Survey Area is very low.

Five introduced flora species (weeds) were recorded during the survey, one of which (**Bromus diandrus*) is listed as High priority under the Environmental Weed Strategy for Western Australia (CALM 1999; D Parks and Wildlife 2013). This species should be a priority for management during any rehabilitation works undertaken on the site.

4.3 Fauna

Five conservation significant fauna may occur in the Survey Area based on the desktop assessment: Carnaby's Black Cockatoo, Malleefowl, White-bellied Sea-Eagle, Rainbow Bee-eater and the Western Brush Wallaby.

An assessment of the fauna habitat based on the vegetation survey results and known habitat requirements of conservation significant fauna indicates that the Survey Area is unlikely to represent key habitat for any of the listed fauna species; however, all may pass through the area from time to time. Given the large area of relatively undisturbed vegetation surrounding the Survey Area, particularly within nearby Beekeepers Nature Reserve, it is unlikely that clearing of 2.05 ha within the Survey Area would significantly affect populations of any fauna species.

5. Conclusion

The results of the flora, vegetation and fauna habitat assessment did not find any major environmental constraints that may affect the 2.05 ha of proposed clearing within the Survey Area. No conservation significant flora taxa or ecological communities have been recorded within the Survey Area, and none are thought likely to occur based on results of the assessment. The 2.39 ha Survey Area is unlikely to represent key habitat for any conservation significant fauna species, and given the relatively undisturbed nature of the surrounding area, clearing within the Survey Area is unlikely to significantly affect populations of any fauna species.

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Appendix 1
Threatened and Priority definitions

Table A1 Definition of threatened flora and fauna taxa under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Conservation code	Category
Ex	Extinct Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Adapted from section 179 of the EPBC Act.

Table A2 Definition of threatened flora and fauna taxa under the Western Australian *Wildlife Conservation Act 1950* (WC Act)

Conservation code	Category
Schedule 1: T	Threatened Flora (Declared Rare Flora – Extant) Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the WC Act).
	Threatened Fauna (Specially Protected Fauna – Extant) Fauna that is rare or likely to become extinct are declared to be fauna that is in need of special protection (Schedule 1 under the WC Act).
Schedule 2: X	Presumed Extinct Flora and Fauna (Declared Rare Flora – Extinct; Specially Protected Fauna – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the WC Act).
Schedule 3: IA	Migratory birds protected under an international agreement (Specially Protected Fauna – Migratory) Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), relating to the protection of migratory birds.
Threatened flora and fauna (Schedule 1) are further ranked by the Department of Parks and Wildlife according to their level of threat using IUCN Red List criteria:	
T - CR	Critically Endangered – considered to be facing an extremely high risk of extinction in the wild.
T - EN	Endangered – considered to be facing a very high risk of extinction in the wild.
T - VU	Vulnerable – considered to be facing a high risk of extinction in the wild.

Department of Parks and Wildlife (Parks and Wildlife) 2013, Florabase, [Online].

Table A3 Definition of priority flora and fauna species as listed by the Department of Parks and Wildlife

Conservation code	Category
P1	Priority One – Poorly Known Species Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	Priority Two – Poorly Known Species Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	Priority Three – Poorly Known Species Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	Priority Four – Rare Threatened and other species in need of monitoring a. Rare - Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. b. Near Threatened - Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	Priority Five – Conservation Dependent Species Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Department of Parks and Wildlife (Parks and Wildlife) 2013, Florabase, [Online], Government of Western Australia.

Table A3 Definition of threatened ecological communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Conservation code	Category
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Adapted from section 182 of the EPBC Act

Table A4 Definition of threatened ecological communities under the Western Australian *Wildlife Conservation Act 1950* (WC Act)

Conservation code	Category
PTD	Presumed Totally Destroyed An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: (i) records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; (ii) all occurrences recorded within the last 50 years have since been destroyed.
CE	Critically Endangered An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; (ii) The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	Endangered An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; (ii) The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	Vulnerable An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: (i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; (ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; (iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Department of Environment and Conservation (DEC) 2010 Definitions, Categories and Criteria for Threatened and Priority Ecological Communities.

Table A5 Definition of priority ecological communities as listed by the Department of Parks and Wildlife

Conservation code	Category
P1	Poorly-known ecological communities Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	Poorly-known ecological communities Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	Poorly known ecological communities (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Department of Environment and Conservation (DEC) 2010 Definitions, Categories and Criteria for Threatened and Priority Ecological Communities.

Appendix 2
Naturemap search results

NatureMap
Mapping Western Australia's biodiversity

NEE14297.01 Naturemap_5km

Created By Daniel Panickar on 24/10/2014

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 114°58' 39" E,29°33' 29" S
Buffer 5km
Group By Family

Family	Species	Records
Acrotylaceae	1	2
Aizoaceae	1	1
Amaranthaceae	1	2
Araliaceae	1	1
Asphodelaceae	1	1
Asteraceae	5	7
Byblidaceae	1	1
Caulerpaceae	1	1
Ceramiaceae	3	6
Codiaceae	1	2
Cymodoceaceae	2	2
Cyperaceae	2	2
Dilleniaceae	3	3
Droseraceae	1	1
Ericaceae	2	2
Euphorbiaceae	2	2
Fabaceae	3	3
Goodeniaceae	3	4
Haemodoraceae	2	2
Haloragaceae	1	2
Lamiaceae	3	5
Lauraceae	1	1
Loganiaceae	1	1
Loranthaceae	1	1
Malvaceae	2	2
Myrtaceae	16	30
Orchidaceae	5	6
Phyllanthaceae	2	2
Polygalaceae	1	1
Posidoniaceae	1	2
Proteaceae	3	3
Ranunculaceae	1	1
Rhamnaceae	1	2
Rhodomelaceae	12	21
Rutaceae	3	3
Sapindaceae	1	2
Scrophulariaceae	3	4
Solanaceae	2	2
Stylidiaceae	1	1
Thymelaeaceae	4	5
Udoteaceae	1	2
Urticaceae	1	1
Zygophyllaceae	1	2
TOTAL	**104**	**147**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acrotylaceae					
1.	26915	*Hennedya crispa*			
Aizoaceae					
2.	2798	*Carpobrotus virescens (Coastal Pigface, Kolboko)*			
Amaranthaceae					
3.	2717	*Ptilotus divaricatus (Climbing Mulla Mulla)*			
Araliaceae					
4.	19042	*Trachymene coerulea subsp. leucopetala*			
Asphodelaceae					
5.	1368	*Trachyandra divaricata*	Y		
Asteraceae					
6.	7832	*Angianthus milnei (Cone-spike Angianthus)*			
7.	7836	*Angianthus tomentosus (Camel-grass)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
8.	7928	*Chrysanthemum coronarium*	Y		
9.	8149	*Olearia rudis (Rough Daisybush)*			
10.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
Byblidaceae					
11.	20230	*Byblis lamellata*			
Caulerpaceae					
12.	26556	*Caulerpa cactoides*			
Ceramiaceae					
13.	26753	*Dasyphila preissii*			
14.	27310	*Spyridia filamentosa*			
15.	27364	*Wollastoniella myriophylloides*			
Codiaceae					
16.	26679	*Codium perriniae*			
Cymodoceaceae					
17.	126	*Amphibolis antarctica (Sea Nymph)*			
18.	127	*Amphibolis griffithii*			
Cyperaceae					
19.	43205	*Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)*			
20.	16254	*Schoenus sp. G Broad Sheath (K.L. Wilson 2633)*			
Dilleniaceae					
21.	5134	*Hibbertia huegelii*			
22.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
23.	5153	*Hibbertia pachyrrhiza*			
Droseraceae					
24.	14298	*Drosera macrantha subsp. macrantha*			
Ericaceae					
25.	6405	*Leucopogon insularis*			
26.	29053	*Leucopogon sp. South Eneabba (E.A. Griffin 8027)*			
Euphorbiaceae					
27.	4594	*Beyeria cinerea*			
28.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
Fabaceae					
29.	3419	*Acacia ligulata (Umbrella Bush, Watarka)*			
30.	3525	*Acacia rostellifera (Summer-scented Wattle)*			
31.	3604	*Acacia xanthina (White-stemmed Wattle)*			
Goodeniaceae					
32.	7481	*Dampiera tephrea*		P2	
33.	7580	*Lechenaultia linarioides (Yellow Leschenaultia)*			
34.	7666	*Verreauxia reinwardtii (Common Verreauxia)*			
Haemodoraceae					
35.	12027	*Conostylis candicans subsp. calcicola*			
36.	1448	*Conostylis resinosa*			
Haloragaceae					
37.	6173	*Haloragis foliosa*		P3	
Lamiaceae					
38.	16934	*Hemiandra glabra subsp. glabra*			
39.	6839	*Hemiandra pungens (Snakebush)*			
40.	6869	*Hemigenia saligna*		P3	
Lauraceae					
41.	11351	*Cassytha aurea var. hirta*			
Loganiaceae					
42.	6512	*Logania spermacocea*			
Loranthaceae					
43.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
Malvaceae					
44.	9099	*Lasiopetalum angustifolium (Narrow Leaved Lasiopetalum)*			
45.	17322	*Thomasia rulingioides*			
Myrtaceae					
46.	17761	*Beaufortia aestiva*			
47.	5382	*Beaufortia elegans*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
48.	5518	*Darwinia neildiana (Fringed Bell)*			
49.	14100	*Eremaea beaufortioides var. microphylla*			
50.	15494	*Eucalyptus diminuta*			
51.	5722	*Eucalyptus obtusiflora (Dongara Mallee)*			
52.	5730	*Eucalyptus oraria (Ooragmandee)*			
53.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
54.	13544	*Eucalyptus zopherophloia (Blackbutt Mallee)*		P4	
55.	13271	*Melaleuca huegelii subsp. huegelii*			
56.	5922	*Melaleuca lanceolata (Rottnest Teatree, Moonah)*			
57.	5936	*Melaleuca megacephala*			
58.	9183	*Melaleuca nematophylla (Wiry Honey-myrtle)*			
59.	6034	*Scholtzia laxiflora*			
60.	17266	*Thryptomene sp. Lancelin (M.E. Trudgen 14000)*		P3	
61.	6109	*Verticordia picta (Painted Featherflower)*			
Orchidaceae					
62.	18036	*Caladenia bicalliata subsp. cleistogama*			
63.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
64.	15425	*Prasophyllum calcicola*			
65.	41982	*Pterostylis microglossa*			
66.	1702	*Thelymitra campanulata (Shirt Orchid)*			
Phyllanthaceae					
67.	4675	*Phyllanthus calycinus (False Boronia)*			
68.	4685	*Phyllanthus scaber*			
Polygalaceae					
69.	4555	*Comesperma integerrimum*			
Posidoniaceae					
70.	125	*Posidonia sinuosa*			
Proteaceae					
71.	1956	*Grevillea argyrophylla (Silvery-leaved Grevillea)*			
72.	2143	*Hakea conchifolia (Shell-leaved Hakea)*			
73.	2146	*Hakea costata (Ribbed Hakea)*			
Ranunculaceae					
74.	10804	*Clematis linearifolia*			
Rhamnaceae					
75.	4828	*Spyridium globulosum (Basket Bush)*			
Rhodomelaceae					
76.	26520	*Brongniartella australis*			
77.	29619	*Chondrophycus brandenii*			
78.	26663	*Cladurus elatus*			
79.	26688	*Coeloclonium tasmanicum*			
80.	26795	*Doxodasya bolbochaete*			
81.	26803	*Echinothamnion hystrix*			
82.	26925	*Heterocladia caudata*			
83.	26999	*Laurencia clavata*			
84.	27001	*Laurencia filiformis*			
85.	27168	*Polysiphonia amphibolis*			
86.	27173	*Polysiphonia decipiens*			
87.	27190	*Protokuetzingia australasica*			
Rutaceae					
88.	4413	*Boronia crenulata (Aniseed Boronia)*			
89.	4414	*Boronia cymosa (Granite Boronia)*			
90.	15273	*Diplolaena leemaniana*			
Sapindaceae					
91.	4754	*Dodonaea aptera (Coast Hop-bush)*			
Scrophulariaceae					
92.	7215	*Eremophila glabra (Tar Bush)*			
93.	17175	*Eremophila glabra subsp. albicans*			
94.	14191	*Eremophila glabra subsp. tomentosa*			
Solanaceae					
95.	6948	*Anthocercis intricata*		P3	
96.	6949	*Anthocercis littorea (Yellow Tailflower)*			
Stylidiaceae					
97.	25801	*Stylidium hesperium*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Thymelaeaceae					
98.	5232	*Pimelea argentea (Silvery Leaved Pimelea)*			
99.	5243	*Pimelea ferruginea*			
100.	5246	*Pimelea gilgiana*			
101.	11402	*Pimelea imbricata var. piligera*			
Udoteaceae					
102.	27121	*Penicillus nodulosus*			
Urticaceae					
103.	12670	*Parietaria cardiostegia*			
Zygophyllaceae					
104.	4390	*Zygophyllum fruticulosum (Shrubby Twinleaf)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 3
Protected Matters search results

Australian Government
Department of the Environment

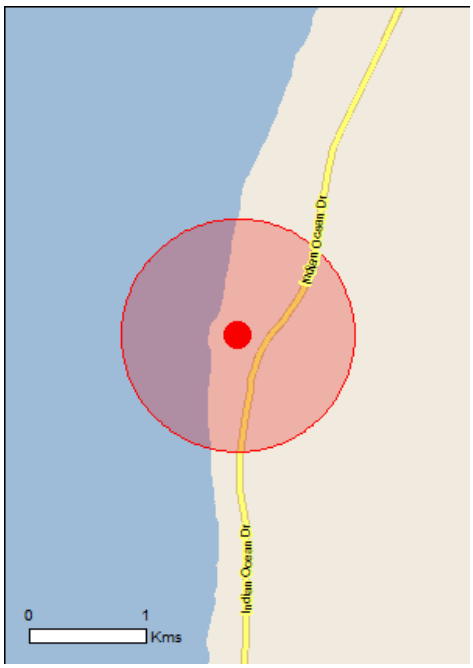
EPBC Act Protected Matters Report

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

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

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

Report created: 23/10/14 19:37:52



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
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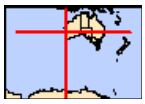

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	29
Listed Migratory Species:	33

Other Matters Protected by the EPBC Act

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

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	52
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	1
State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora epomophora Southern Royal Albatross [25996]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora sanfordi Northern Royal Albatross [82331]	Endangered	Species or species habitat may occur within area
Diomedea exulans amsterdamensis Amsterdam Albatross [82330]	Endangered	Species or species habitat may occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea Australian Sea-lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
Centrolepis caespitosa [6393]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii aethiops Houtman Abrolhos Spiny-tailed Skink [26192]	Vulnerable	Species or species habitat may occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		

Name	Status	Type of Presence
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered*	Species or species habitat may occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Sterna caspia		
Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Reptiles		
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Moore River to Murchison River Area	WA	Indicative Place

State and Territory Reserves

[Resource Information]

Name	State
Beekeepers	WA

Invasive Species

[Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Plants		
[Asparagus asparagoides](#) Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
[Cenchrus ciliaris](#) Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
[Tamarix aphylla](#) Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Coordinates

-29.55744 114.97943

Caveat

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

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-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
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-Other groups and individuals

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

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