

Southern Amadeus Basin Exploration

Southern Amadeus 2D Seismic Program

ENVIRONMENT MANAGEMENT PLAN

Proposed Revision

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Units of Measurement

Unit	Measurement
'	Foot (30 cm)
"	Inch (2.54 cm)
bbl	Barrel (159 litres)
°C	Degrees centigrade
g/m ²	Grams per square metre
cP	Centipoise
dB	Decibels
dB(A)	Decibels A-weighting
Hz	Hertz
kl	Kilolitre (1,000 litres)
km	Kilometre (1,000 metres)
km ²	Square kilometres
L	Litre (1,000 ml)
m	Metre (100 cm)
m ²	Square metre
m ³	Cubic metre
mg/L	Milligrams per litre
ml	Millilitre
mm	Millimetre
nm	Nautical mile (1.856 km)
ppb	Parts per billion
ppm	Parts per million
t	Tonne (1,000 kg)
µm	Micrometre (micron)

Abbreviations and Acronyms

Acronym	Description
2D	2 Dimension
AAPA	Aboriginal Areas Protection Authority
ALARP	As Low As Reasonably Practicable
APPEA	Australian Petroleum Production and Exploration Association
BoM	Bureau of Meteorology
CLC	Central Land Council
DPIR	Department of Primary Industry and Resources
EHS	Environment, Health and Safety
EMS	Environmental Management System
EMP	Environment Management Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan
ESD	Environmentally Sustainable Development
GIS	Geographical Information System
IMS	Incident Management System
MNES	Matter of National Environment Significance
MoC	Management of Change
NT	Northern Territory
SMS	Santos Management System
SSCC	Sacred Site Clearance Certificate

Executive Summary

Santos QNT Pty Ltd (Santos) has previously commenced a seismic survey in the Southern region of the Amadeus Basin, under two approved Environmental Management Plans (EMPs) in 2013 and 2016. Given these EMP's expire on 1 December 2017, this EMP combines the outstanding scope of both EMPs to enable the works to be undertaken under a consolidated approval. Specifically, this EMP covers:

- Re-visits and rehabilitation assessment (and works if required) of the 2013 seismic lines;
- Completion of the 2016 seismic scope, with the remaining acquisition confined to a smaller area within which the outstanding lines will be acquired.

Activity Location and Timing

The Project's seismic activities undertaken as part of the 2013 and 2016 surveys have been carried out over Exploration Permits 82, 105, 112, and 125. The permits are located east, south and south west of Alice Springs (The Project Area) (Figure ES-1). These Exploration Permits, situated on Aboriginal, Leasehold and Freehold land, cover a combined area of approximately 48,100km² of the Amadeus Basin.

Activity associated with this revised EMP is scheduled to re-commence in November 2017. Acquisition of the remaining lines is estimated to take approximately 2 months, subject to weather. Longer term rehabilitation revisits and photo monitoring will commence in 2017 (associated with the 2013 lines) and continue in subsequent years to meet requirements for the 2016 and 2017 lines.

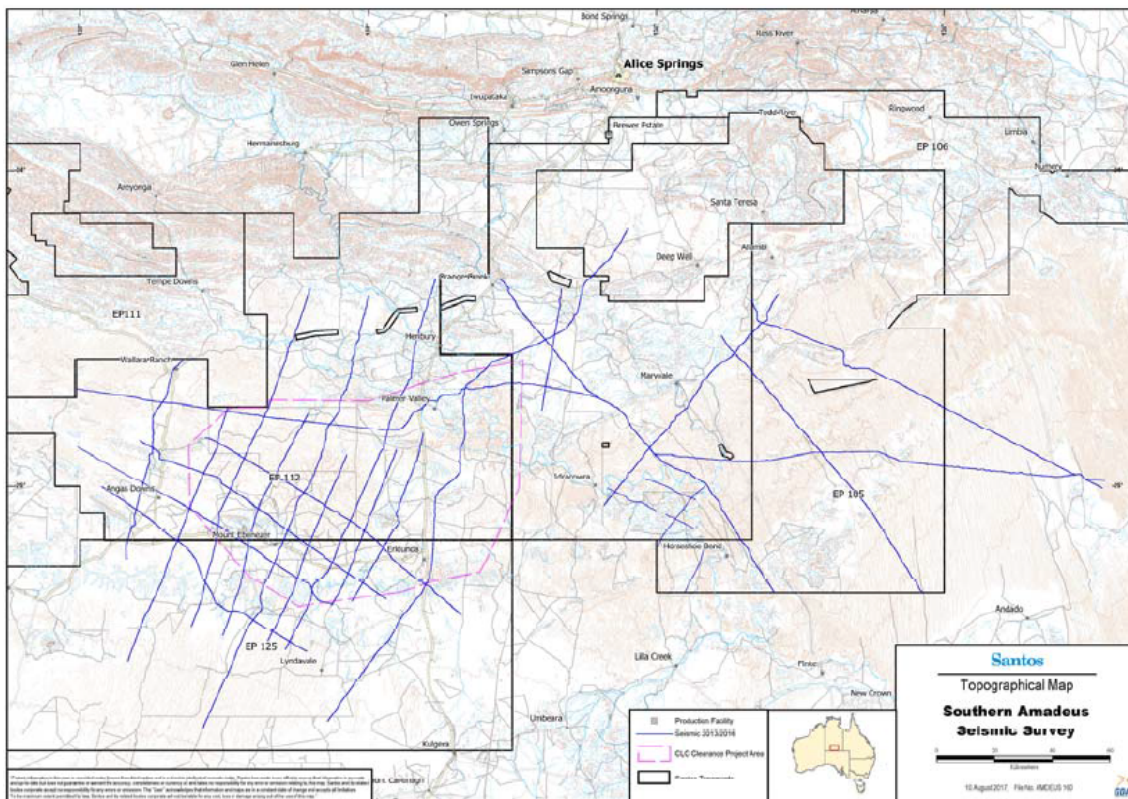


Figure ES-1 Location of Southern Amadeus Seismic Survey

Description of the Activity

The aim of the seismic survey is to produce detailed images of the various rock types and their location beneath the Earth's surface. This information is used to determine the location and size of oil and gas reservoirs. Line preparation is undertaken prior to acquisition to provide safe access and a defined line for the acquisition crew to follow. Surveying commences shortly after line preparation, with field surveyors using real-time kinematic GPS receivers to position receiver points for 2D surveys.

Recording normally commences two to three weeks after the start of line preparation. Work commences with the laying of cable and deployment of geophone bundles from light 4WD vehicles. Recording in 2D mode would normally commence when approximately 8km of cable and geophones have been laid. A preselected "live" section of the spread picks up the acoustic energy reflected from subsurface layers, converts it to electrical energy and transmits it to the instrument recording truck. The active spread is approximately 14km, which consists of 7km in front of the source point, and 7km behind.

The acoustic energy source is an array of either three or six truck mounted vibrator units, electronically synchronised to vibrate in phase with each other. They line up along the seismic line, a few metres apart, centred on midway between two receiver points. Simultaneously each unit, on command from the instrument truck, inputs one or more frequency sweeps into the ground at each source point.

There are generally two campsites in use at any one time: the line preparation/survey camp which moves weekly with the line preparation/survey team; and the main camp. The main camp is moved frequently during the activity to various proposed main campsites located on the sites previously used for the survey, all of which have received CLC clearance. Access routes to camp are clearly defined. Potable water is planned to be sourced from the Alice Springs water supply and trucked into camp. Wastewater from laundry, showers and kitchen is piped to an irrigation area outside of the camps; sewage management plans are in place. Solid waste will be transported to a suitable waste disposal facility. Fuel and chemicals will be stored using industry best practise procedures such as bunding, drip trays and safety cut-off valves.

Once the campsite or project area has been vacated, rehabilitation is undertaken including removal of rubbish and any man-made items. When necessary, and terrain permitting, the area is tyre ripped to remove compaction and wheel tracks. Photo points are established at each campsite to document pre-disturbance and post-restoration condition. Whilst most of the areas will naturally regenerate following restoration works, there is the possibility that specific areas (sensitive areas or areas subject to erosion) may need additional rehabilitation following the first wet-season. Areas identified in post-survey photo point monitoring, or by subsequent landholder liaison, as requiring additional rehabilitation works will be re-visited and rehabilitated accordingly.

Environment Description

The seismic survey is located within the arid zone of Central Australia that experiences low and variable rainfall and high diurnal and seasonal temperature fluctuations. The landscape of northern and central Australia is ancient and highly weathered and the soil types are susceptible to erosion given that the region experiences long dry periods followed by intense rainfall. All catchments within the Amadeus Basin region drain internally towards Lake Eyre (within South Australia). All surface water including rivers, streams and drainage lines are ephemeral and

subject to short flow duration and high turbidity. The salt lakes of Central Australia are also maintained by groundwater and support specialised flora and fauna.

The project area is covered by two bioregions, the Simpson Strzelecki Dunefields Bioregion in the east and Finke Bioregion in the west. Despite the lack of free-water the bioregions provide important habitat for a range of wildlife including a variety of small mammals, reptiles and birds. There are no Threatened Ecological Communities within the project area, however 37 species of flora and nine species of bird were listed on the EPBC Protected Matters database. The Fauna Atlas also identified 26 threatened fauna species previously observed within the vicinity of the project area, consisting of 19 species listed as Vulnerable, five listed as Endangered and two listed Critically Endangered.

There are no areas within the project area listed on the National Heritage Register or the NT Heritage Register. Areas of significance for indigenous cultural heritage are considered through the process of securing a sacred site clearance certificate from the Central Land Council (CLC).

The Amadeus Basin supplies gas within the Northern Territory and oil to South Australia. There is a range of current land uses throughout the area including conservation, tourism, oil and gas production and pastoral activities. The closest major community to the project area is Alice Springs, approximately 200 km north-east of the project area.

Major environmental risks and impacts

The planned and potential interactions between the activity, the aspects triggered and the environment represent a source of risk (or impact) which has potential to affect the environment. Planned / routine aspects include physical disturbance, noise, erosion, dust, waste, light emissions and resource consumption. Unplanned / non-routine aspects include contamination (from leaks and spills), vehicle collision with native fauna / livestock, disturbance to stakeholders, introduced pests / pathogens, and fire. For each aspect, receptors were identified and the risk or impact was assessed based on the likelihood of occurrence and the severity of potential consequences, and a pre-treatment risk ranking was identified to assist with the determination of the level of controls required to reduce the risk or impact. Control measures were identified in accordance with defined environmental performance outcomes, to eliminate, prevent, reduce or mitigate consequences associated with each of the identified environmental risks or impacts. A final residual risk ranking was undertaken to determine impact and risk acceptability and demonstrate the impact and risks have been reduced to as low as reasonable practicable (ALARP).

Environmental outcomes in relation to the activity

Through implementation of control measures, the residual risk ranking for most risks or impacts have been reduced to 2 (risk is acceptable provided ALARP has been achieved and demonstrated) or 1 (risk is acceptable and it is assumed that ALARP has been achieved).

Control measures have been identified using the Santos hierarchy of controls; a process which moves from risk elimination through to protection, in descending order of effectiveness, until a control measure(s) can be identified.

Performance outcomes, standards and measurement criteria are established in line with the control measure(s). Santos has defined ten performance outcomes, which are intended to guide the environmental performance standards for the activity. The performance outcomes are to:

1. Minimise the visual impact of seismic operations;
2. Minimise disturbance to and contamination of soil resources;
3. Minimise disturbance to native vegetation and native fauna;
4. Avoid disturbance to sites of cultural, sacred and heritage significance;
5. Minimise disturbance to livestock, pastoral infrastructure and landholders;
6. Avoid the introduction or spread of exotic species and implement control measures as necessary;
7. Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources;
8. Optimise (in order of most to least preferable) waste avoidance, reduction, reuse, recycling, treatment and disposal;
9. Remediate and rehabilitate operational areas as necessary; and
10. Generate no fires from the seismic operations.

Implementation Strategy

Santos manages the environmental impacts and risks of its activities through the implementation of the Santos Management System (SMS). The SMS provides a formal and consistent framework for all activities of Santos employees and contractors. Santos staff and contractors undertaking work in the field are required to undertake a two-stage induction process: a general Onshore EHS Induction focusing on hazard identification and Santos' expectations for Environment, Health and Safety management for workers at Santos' onshore operational sites; followed by an activity specific induction which covers the requirements of the EMP.

The SMS provides Delegation of Authority, Code of Conduct and Policies, Management Standards, and Processes, Procedures and Tools to support implementation of the Management Standard and Policy requirements.

Stakeholder consultation

Santos is committed to upholding its long-held reputation as a trusted Australian energy company. Santos seeks to establish and maintain enduring and mutually beneficial relationships with the communities of which it is a part; ensuring that Santos' activities generate positive economic and social benefits for and in partnership with these communities. The SMS details the requirements for appropriate communication and consultation mechanisms; including requirements to establish and maintain communication links with employees, contractors and external stakeholders, including local communities, government agencies and other organisations. In the preparation of the 2013 and 2016 seismic surveys, relevant stakeholders were identified and engaged such that they could be informed of the proposed activities, and have their specific issues considered and addressed. Stakeholders include:

- Community
- Landholders
- Traditional Owners and Aboriginal Peoples
- Representatives of Local Government

- Northern Territory Government departments

During both the planning and operational phase of the project, Santos will have a field based member of the Land Access team in the region. They will be the primary point of contact for all landholders and community members during these phases. During the operational phase of the project the Santos Field Representative will also manage day to day activities and communications with respect to the landholders to ensure they are consistently updated on the status of the project.

Contact details of the interest holder’s nominated liaison personnel

Table ES-1 provides details of the permit titleholder and titleholder nominated liaison person.

Table ES-1 Details of Titleholder and Nominated Liaison Person

Titleholder Details	Liaison Person Details
Name: Santos QNT Pty Ltd 60 Flinders Street, Adelaide, SA 5000 Telephone number: 08 8116 5000 ACN: 083 077 196	Mike Giles Manager, Geophysical Services Santos Ltd 60 Flinders Street, Adelaide Ph: 08 8116 7952 Email: michael.giles@santos.com

1.0 INTRODUCTION

1.1 Scope of this EMP

Santos Ltd (Santos) is the operator of exploration permits 82, 105, 112, and 125 which are located east, south and south west of Alice Springs in the Northern Territory (NT) (The Project Area) (Figure 3-1). These Exploration Permits cover a combined area of approximately 48,100km² of the Amadeus Basin.

Santos has previously commenced a seismic survey in the Southern region of the Amadeus Basin. The seismic program was carried out under two approved Environmental Management Plans (EMPs) titled '*Southern Amadeus Seismic Survey Environmental Plan, May 2013*' (2013 EMP) and '*2016 Southern Amadeus 2D Seismic Program*' (2016 EMP)

The scope of the 2013 survey has been completed, however the revisits associated with demonstrating long-term rehab success have not yet been undertaken. There is the possibility that additional restoration work could be required along the lines impacted by this survey and as such Santos may be required to have an approved revision to the EMP in place for the activity.

On 6 July 2016, the new NT *Petroleum (Environment) Regulations* came into effect. EMPs approved before this date are treated as current plans under the Regulations up until 1 December 2017. However, to continue to carry out a petroleum activity after 1 December 2017 Santos require approval of a proposed revision that meets the requirements on the new regulations.

As such, this EMP represents the proposed revision of the 2013 and 2016 EMPs. The scope of this EMP combines the outstanding scope of both EMPs to enable the works to be undertaken under a consolidated plan.

1.2 Titleholder details

Table 1-1 provides details of the permit titleholder and titleholder nominated liaison person.

As per Section 8.5, if there is a change in the titleholder, the titleholder's nominated liaison person or a change in the contact details for the titleholder or liaison person, Santos will notify DPIR and provide the updated details.

Table 1-1 Details of Titleholder and Nominated Liaison Person


Titleholder Details	Liaison Person Details
Name: Santos QNT Pty Ltd 60 Flinders Street, Adelaide, SA 5000 Telephone number: 08 8116 5000 ACN: 083 077 196	Mike Giles Manager, Geophysical Services Santos Ltd 60 Flinders Street, Adelaide Ph: 08 8116 7952 Email: michael.giles@santos.com

1.3 Corporate environment policy

The Santos Corporate Environmental Policy is provided in Figure 1-1. The policy is Santos’ public declaration to understanding and managing the environmental impacts and risks associated with its operations and complying with all relevant environmental laws. In the Northern Territory this incorporates the principles of ecologically sustainable development and demonstrating that environmental impacts and risks are managed to as low as reasonably practicable (ALARP) and acceptable levels.

The Santos Environmental Policy was signed by the Managing Director and Chief Executive Officer and approved by the Board. All personnel are responsible for the environmental performance of their activities and for complying with the general environmental duty as outlined in the Santos Environmental Policy.

Environment, Health and Safety



Policy

Our Commitment

Santos is committed to a workplace where we all go home without injury or illness and manage the impact of our operations on the environment.

Our Actions

We will:

1. implement a structured and systematic approach to environmental, health and safety management and monitor its effectiveness
2. include environmental, health and safety considerations in business planning and decision-making processes
3. understand and manage the impact of our operations on the environment
4. comply with all relevant environmental, health and safety laws
5. promote a strong and consistent safety culture across all aspects of business
6. work pro-actively and collaboratively with our stakeholders and the communities in which we operate
7. set, measure and review objectives and targets which drive continuous improvement
8. report publicly on our environmental, health and safety performance

Governance

The Environment Health Safety & Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This Policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher
Managing Director & CEO

Status: APPROVED

Document Owner:	Naomi James, Executive Vice President, EHS & Governance		
Approved by:	The Board	Version:	1

APPROVED 28 October 2016

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Figure 1-1: Santos Environment, Health and Safety Policy

2.0 ENVIRONMENT LEGISLATION AND OTHER REQUIREMENTS

The Petroleum (Environment) Regulations (the Regulations) is the governing environmental legislation for onshore petroleum activities in the NT. The objectives of the Regulations are to ensure that:

- onshore oil and gas activities are carried out in a manner consistent with the principles of ecologically sustainable development (ESD); and
- environmental impacts and risks associated with onshore oil and gas activities are reduced to a level that is as low as reasonably practicable (ALARP) and acceptable.

The Regulations achieve these objectives by requiring interest holders to have an approved EMP in place before a 'regulated activity' such as seismic surveys can be undertaken. An EMP will be approved when the Minister for Mines and Energy (the Minister) is satisfied that certain approval criteria have been met.

The EMP must be written to demonstrate that all environmental impacts and risks associated with the activity are reduced to a level that is ALARP and acceptable.

Other relevant legislation, agreement and codes of practice relevant are listed in the sections to follow.

2.1 Key Legislation Overview

Table 2-1: Key relevant territory and Commonwealth legislation

Act	Summary
Commonwealth	
Australian Heritage Council Act 2003	Establishes the Australian Heritage Council that is the principal adviser to the Australian Government on heritage matters. The Council's major role is to assess the heritage values of places nominated for the National Heritage List and the Commonwealth Heritage List, and to advise the Minister on promotion, research, education, policies, grants, conservation and other matters.
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity. It regulates a development or activity if it is likely to have a significant environmental impact on 'matters of national environmental significance' (MNES). This Act is administered by the Department of the Environment (DoE). It is considered that the proposed activities will not adversely impact MNES, and has not been referred for assessment and approval under the EPBC Act.
National Environment Protection Council Act 1994	Provides national standards for ambient air quality, movement of controlled wastes, and contaminated sites. This Act is administered by DoE.
National Greenhouse and Energy Reporting Act	While this Act is not directly relevant to this EMP, Titleholders are required to report annually in accordance with the NGER Act.

Act	Summary
Native Title Act 1993	This Act provides statutory recognition and protection for the concept of native title, including provisions for reaching Indigenous land use agreements.
Northern Territory	
Aboriginal Land Act 2013	Provides access to areas which are Aboriginal land, whether it is on land or sea.
Aboriginal Land Rights (Northern Territory) Act 1976	Provides for the preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginals in accordance with Aboriginal tradition.
Aboriginal and Torres Straights Heritage Protection Act 1984	Protects areas and objects in Australia that are of particular significance to Aboriginals in accordance with Aboriginal tradition. The ATSIHP Act allows the Environment Minister, on the application of an Aboriginal person or group of persons, to make a declaration to protect an area, object or class of objects from a threat of injury or desecration.
Biological Control Act 2011	Makes provision for the biological control of pests in the NT, and related purposes.
Bushfires Act 2014	Provides for the prevention and suppression of bushfires in the NT.
Control of Roads Act 2015	Provides for the administration and control of roads, including the maintenance of roads and opening and closing of roads.
Dangerous Goods (Road and Rail Transport) Act 2012	Makes provision for safety in the transport of dangerous goods by road as part of the system of nationally consistent road transport laws and makes provision for safety in the transport of dangerous goods by rail. Establishes common guidelines so that dangerous goods can be transported between states and territories.
Environmental Assessment Act 2013	<p>Establishes the framework for the assessment of potential or anticipated environmental impacts of development, and provides for protection of the environment. The NT Environmental Protection Authority (EPA) is responsible for administering the act.</p> <p>The EPA also determines the appropriate level of assessment for new developments or material changes to existing operations, based on the sensitivity of the local environment, the scale of the proposal and its potential impact upon the environment.</p> <p>Note: This Program is not subject to this Act and will be approved under the <i>Petroleum (Prospecting and Mining) Act 1980</i>.</p>
Environmental Offences and Penalties Act 2011	Establishes a penalty structure for environmental offences based around four offence levels. Penalties are defined in a variety of environmental statutes such as the <i>Waste Management and Pollution Control Act</i> and the <i>Water Act</i> .
Fire and Emergency Act 2015	Provides for the establishment of the Northern Territory Fire and Rescue Service, the operational and emergency response activities of the Service, the protection of life, property and the environment against fires and other emergencies and for related purposes.
Energy Pipelines Act 2015	Makes provision for the construction, operation, maintenance and cessation of use or abandonment of pipelines for the conveyance of energy-producing hydrocarbons, and for related purposes.

Act	Summary
Heritage Act 2015	Establishes the Heritage Council and the NT Heritage Register. It sets the process by which places become heritage places, allows for interim protection of places and sets out the process for getting permission to do work to heritage places and allows for fines and imprisonment for offences against the Act.
Northern Territory Aboriginal Sacred Sites Act 2013	Establishes the Aboriginal Areas Protection Authority (AAPA) as the body responsible for overseeing the protection of sacred sites in the Northern Territory. The AAPA provides a process for avoidance of sacred sites and entry onto sacred sites and the issue of Authority Certificates which indemnify the holder against prosecution under the Act for damage to sacred sites in the certificate area, provided works or use has occurred in accordance with the conditions of the Authority Certificate.
Plant Health Act 2015	Provides the framework to ensure appropriate actions can be taken for the control of pests; and facilitates the production and trading of plants and plant products that are free from pests.
Petroleum Act 2016	<p>Provides a legal framework to undertake exploration for petroleum and to develop petroleum production so that the optimum value of the resource is returned to the NT.</p> <p>The Petroleum Act is the principal legislation dealing with petroleum tenure, exploration and production activities onshore and inland waters of the Territory.</p> <p>Most current petroleum permits and licences are governed by the Petroleum Act (Act). In addition, the Act is supported by the Petroleum Regulations (Regulations) and the Schedule of Onshore Petroleum Exploration and Production Requirements 2012 (Requirements).</p> <p>The Act, Regulations and Requirements are administered by the Northern Territory Petroleum Registry (Registry) which forms part of the DPIR. The Minister for Mines and Energy (Minister) is the applicable Minister for the purposes of the Act.</p>
NT Petroleum (Environ) Regulations 2016	The Regulations aim to ensure that a) onshore oil and gas activities are carried out in a manner consistent with the principles of ecologically sustainable development (ESD); and b) environmental impacts and risks associated with onshore oil and gas activities are reduced to a level that is as low as reasonably practicable (ALARP) and acceptable. The Regulations achieve these objectives by requiring interest holders to have an approved EMP in place before a 'regulated activity' can be undertaken.
<i>Public and Environmental Health Act 2015 and Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations</i>	<p>Makes provision to protect and promote the health of individuals and communities in the Territory, and to monitor, assess and control environmental conditions, factors and agents, facilities and equipment and activities, services and products that impact on or may impact on public and environmental health.</p> <p>Relates to public health and is directed at preventing pollution of water-courses and water supplies in the Northern Territory. Wastewater treatment systems may be subject to requirements under the Public Health Act 1987 and Regulations. Sewerage Plants need to meet the NT Code of Practice for Small On-site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent.</p>
Schedule of Onshore Petroleum Exploration and Production Requirements 2016	Sets out detailed requirements, including approval for seismic activities and reporting of incidents.

Act	Summary
(under the Petroleum Act 2016)	
Soil Conservation and Land Utilisation Act 2013	Makes provisions for the prevention of soil erosion and soil conservation and reclamation. It makes provisions for restricting construction activities that may damage or further damage land that is not environmentally stable, such as areas suffering soil erosion or areas that have the potential to erode.
Territory Parks and Wildlife Conservation Act 2014	Makes provision for the establishment of Territory Parks and other Parks and Reserves and the study, protection, conservation and sustainable utilisation of wildlife. It sets aside areas of the NT as parks and conservation areas that may not be developed.
Waste Management and Pollution Control Act 2016	Aims to protect, and where practicable, restore and enhance the quality of the NT environment; encourage ecologically sustainable development; and facilitate the implementation of NEPMs established by the National Environment Protection Council. It is designed to prevent contamination of the surrounding environment, including soil, air, and water, and imposes a general duty on conducting an activity or action that causes or is likely to cause pollution resulting in environmental harm, or that generates or is likely to generate waste.
Water Act 2013	Provides for the investigation, allocation, control, protection, management and administration of water resources in the NT. The Act prohibits waste to come in contact with water or water to be polluted unless under authorisation.
Weeds Management Act 2013	Aims to prevent the spread of weeds throughout the NT, ensuring the management of weeds is an integral component of land management. It is designed to ensure there is community consultation in the creation of weed management plans and that the community takes responsibility in implementing weed management plans.
Work Health and Safety &S (National Uniform Legislation) Act 2016	The WHS Act is part of the nationally harmonised work health and safety laws, which aim to provide all workers in Australia with the same standard of health and safety protection regardless of the work they do or where they work.
International Agreements	
Migratory species: <ul style="list-style-type: none"> • Japan-Australia Migratory Bird Agreement • China-Australia Migratory Bird Agreement • Republic of Korea-Australia Migratory Bird Agreement Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Australia is party to many international agreements to protect and conserve migratory species and their habitat. Migratory species listed on the annexes to these Agreements are placed on the migratory species list under the EPBC Act.

Act	Summary
Ramsar Convention on Wetlands	The Ramsar Convention's broad aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. Ramsar wetlands within Australia are listed as a Matter of Environmental Significance and protected under the EPBC Act.

2.2 Relevant Agreements and Operating Consents

In addition to the legislative requirements listed above, there are a number of agreements and operating consents that are required prior to commencement of the activity. Santos will ensure that (Central Land Council) CLC Agreements and Landholder Access and Compensation Agreements have been identified, obtained and are in place prior to commencement of on ground activity.

Table 2-2 lists agreements and operating consents of the geophysical operations including a summary of the key items.

Table 2-2: Agreements and Operating Consents Overview

Document	Summary
Indigenous Land Use Agreement EMP Nos 82, 112, 118 and 125	Signed on 18 July 2007, this agreement between Central Land Council, Central Petroleum Ltd, Helium Australia Pty Ltd, Frontier Oil and Gas Pty Ltd, Ordiv Petroleum Pty Ltd refers to obligations under the Native Title (Cth) Act 1993. Details of this agreement are confidential and have been redacted.
Exploration Agreement EMP 105, 106 and 107	Dated 14 October 2013, this agreement between Central Land Council, Merlin Energy Pty Ltd and Santos QNT Pty Ltd. Details of this agreement are confidential and have been redacted.

In preparation for the next phase of activities a work program will be submitted to the CLC as per the terms of the agreement. The submission of a work program prescribes the nature, scope and objectives of the activity and ensures the relevant traditional owners are informed of the activity and sacred site clearances are undertaken with the consent and participation of the traditional owners. Following completion of site clearances, sacred site certifications are issued by the CLC and the conditions of the certificates such as exclusion or constraint zones are incorporated into project planning and execution to ensure avoidance and compliance. Where applicable Aboriginal Areas Protection Authority (AAPA) certification will also be obtained.

2.3 Codes of Practice and Relevant Guidelines

Contractors undertaking activities will be required to comply with the following environmental standards, guidelines and codes of practice:

- Santos Management System (SMS).
- Australian Petroleum Production and Exploration Association (APPEA) *Code of Environmental Practice* (2008).
- NT Petroleum (Environment) Regulations: Explanatory Guide.

3.0 OVERVIEW OF THE ENVIRONMENTAL RISK ASSESSMENT PROCESS

The Regulations operate around the concepts of environmental risks and environmental impacts. Environmental risk is defined as “*the chance of something happening that will have an environmental impact, measured in terms of the environmental consequences and the likelihood of those consequences occurring*”. Environmental impact is defined as “*any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity*”.

It is acknowledged that environmental risks are inherent in some onshore oil and gas activities, and without control, environmental impacts may arise. As such, the Regulations require detailed assessment, reduction and control of these environmental risks and impacts through the development and implementation of the EMP for the project. This section provides an overview of the environmental risk assessment process.

3.1 Process Overview

The planned and potential interactions between the described activity, the aspects triggered and the described environment represent a source of risk (or impact) which has potential to result in a change to the environment.

Environmental Risk Assessment (ERA) involves assessment of the likelihood and consequence of these impacts.

For the EMP to be accepted, it must be demonstrated that the environmental impacts and environmental risks will be reduced to a level that is:

1. as low as reasonably practicable (ALARP); and
2. acceptable.

ALARP essentially involves making a judgement about whether all reasonably practicable measures are in place to control a potential risk or impact considering the level of consequence and cost, time and resources involved to mitigate it.

To determine whether potential environmental risks and inputs are “acceptable” is a matter of judgement that depends on issues such as the nature and scale of impacts and the social or economic benefits. In determining acceptability, the Regulations require consideration of the principles of ESD. In particular, demonstration that the principles of inter-generational equity and the maintenance of biological diversity and ecological processes is required.

To meet the requirements for ERA under the regulations, the principles of the risk management process of *AS/NZS ISO 31000:2009 Risk management – principles and guidelines*, as well as *HB 203:2006 Environmental risk management - Principles and process* have been followed. The summary of this approach is as follows:

1. Identification of environmental aspects
2. Description of the environment that may be affected
3. Identification of the particular values and sensitivities
4. Identification and evaluation of potential environmental impacts
5. Determination of the pre-treatment risk ranking
6. Control measure identification and ALARP decision

7. Determine severity of consequence
8. Determine likelihood
9. Determine residual risk ranking
10. Determination of acceptability

Section 6 'Environmental Risk Assessment', details the outcomes of this process.

3.2 Identification of Environmental Aspects

Environmental aspects are identified as elements of the activity which can interact with the environment. Environmental aspects were identified for operations and emergency conditions (planned and unplanned aspects).

3.3 Identification of the environment that may be affected

Following the identification of environmental aspects, the likely extent of each aspect is considered and the environment which may be affected determined. This area is described within Section 4.0.

3.4 Identification of Particular Values and Sensitivities

Based on Santos' and publicly available information a review of the existing environment (Section 4.0) was undertaken to identify the environmental values and / or sensitivities with the potential to occur within the project area. Table 5-1 provides a summary of these values and sensitivities. These were used to inform the risk assessment as they provide the potential worst-case consequence.

3.5 Identification and Evaluation of Potential Environmental Impacts

Based on Santos' and publicly available information, the known and potential impacts to the identified receptors were identified. These were then evaluated and specifically considered:

- receptor sensitivity to identified aspect
- extent and duration of the potential impact.

3.6 Pre-treatment Risk Ranking

Risk is expressed in terms of a combination of the consequence of an impact and the likelihood of the impact occurring (see sections 0 – 3.10).

A pre-treatment risk ranking is identified to assist with the determination of the level of controls required to reduce the risk or impact.

3.7 Control Measure Identification and ALARP Decision

Based on the identified impacts, and the ranking of their pre-treatment risk, control measures were identified in accordance with the defined environmental performance outcomes, to eliminate, prevent, reduce or mitigate consequences associated with each of the identified environmental impacts. Control measures were identified through previous surveys, in workshops and through review of best practice techniques across the industry.

3.7.1 ALARP Decision Framework

When determining whether the risk or impact has been reduced to ALARP, it must be asked whether environmental risks can be lowered further without a grossly disproportionate increase in impost.

Santos' approach to this decision is based on the Oil and Gas UK's 'Guidance on Risk Related Decision Making' (Figure 3-1). This framework considers impact severity and several guiding factors to achieve ALARP risk demonstration:

- Activity type;
- Risk and uncertainty; and
- Stakeholder influence.

This framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the impact or risk (referred to as the Decision Type A, B or C). Decision types and methodologies to establish ALARP are outlined in Table 3-1.

Decision Context		A	B	C
Decision Context	Factor			
	Type of Activity	Nothing new or unusual Represents normal business Well-understood activity Good practice well-defined	New to the organisation or geographical area Infrequent or non-standard activity Good practice not well defined or met by more than one option	New and unproven invention, design, development or application Prototype or first use No established good practice for whole activity
	Risk and Uncertainty	Risks are well understood Uncertainty is minimal	Risks amenable to assessment using well-established data and methods Some uncertainty	Significant uncertainty in risk Data or assessment methodologies unproven No consensus amongst subject matter experts
Stakeholder Influence	No conflict with company values No partner interest No significant media interest	No conflict with company values Some partner interest Some persons may object May attract local media attention	Potential conflict with company values Significant partner interest Pressure groups likely to object Likelihood of adverse attention from national or international media	
Assessment Technique	Good Practice	✓	✓	✓
	Engineering Risk Assessment		✓	✓
	Precautionary Approach			✓

Figure 3-1: Impact and Risk 'Uncertainty' Decision Making Framework

Table 3-1: ALARP Decision Making based upon Level of Uncertainty

Decision Type	Description	Decision Making Tools
A	Risks classified as a Decision Type A are well-understood and established practice	<p>Good Practice Control Measures are considered to be:</p> <ul style="list-style-type: none"> • Legislation, codes and standards: Identifies the requirements of legislation, codes and standards that are to be complied with for the activity. • Good Industry Practice: Identifies further engineering control standards and guidelines that may be applied over and above that required to meet the legislation, codes and standards. <p>Professional Judgement: Uses relevant personnel with the knowledge and experience to identify alternative controls. When formulating control measures for each environmental impact or risk, the 'Hierarchy of Controls' philosophy, which is a system used in the industry to identify effective controls to minimise or eliminate exposure to impacts or risks, is applied.</p>
B	Risks classified as a Decision Type B are typically in areas of increased environmental sensitivity with some stakeholder concerns.	<p>Risk-based tools, such as cost based analysis or modelling: Assesses the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures identified during the risk assessment process.</p>
C	Risks classified as a Decision Type C will typically involve sufficient complexity, high potential impact, uncertainty or stakeholder interest	<p>Precautionary Approach: OGUK (2014) state that if the assessment, taking account of all available engineering and scientific evidence, is insufficient, inconclusive or uncertain, then a precautionary approach to hazard management is needed. A precautionary approach will mean that uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented.</p>

3.8 Determination of Severity of Consequence

The potential level of impact (consequence) was assessed and assigned, in line with potential hazards and receptors, using the 'Santos Environmental Consequence Classification' (Table 3-2) from the Santos Operational Risk Matrix. The consequence level for each hazard is documented in the risk assessment tables in Section 6.

Table 3-2 Santos Environmental Consequence Classification

Level	Environment
VI	<ul style="list-style-type: none"> • Regional and long-term impact on an area of significant environmental value. Destruction of an important population of plants and animals with recognised conservation value. • Complete remediation impossible.
V	<ul style="list-style-type: none"> • Destruction of an important population of plants or animals or of an area of significant environmental value. • Complete remediation not practical or possible.

Level	Environment
IV	<ul style="list-style-type: none"> Extensive and medium term or localised and long-term impact to an area, plants or animals of recognised environmental value. Remediation possible but may be difficult or expensive.
III	<ul style="list-style-type: none"> Localised and medium term or extensive and short-term impact to areas, plants or animals of significant environmental value. Remediation may be difficult or expensive.
II	<ul style="list-style-type: none"> Localised and short-term impact to an area, plants or animals of environmental value. Readily treated.
I	<ul style="list-style-type: none"> Localised and short term environmental or community impact – readily dealt with.

Definitions	
Duration of potential impact	Extent of impact
Short term: Days or weeks	Localised: Within the project area
Medium Term: Less than 12 months	Extensive: Within the permit area
Long Term: Greater than 12 months	Regional: Outside of the permit area

3.9 Determination of Likelihood

Likelihood relates to the potential for a consequence to occur. This includes the likelihood of an event occurring and the subsequent potential consequence. This is defined using the Santos Likelihood Descriptors (Table 3-3) from the Santos Operational Risk Matrix.

Table 3-3 Santos Likelihood Descriptors

Level	Criteria	
Almost Certain	f	Occurs in almost all circumstances or could occur within days to weeks
Likely	e	Occurs in most circumstances or could occur within weeks to months
Occasional	d	Has occurred before in Santos or could occur within months to years
Possible	c	Has occurred before in the industry or could occur within the next few years
Unlikely	b	Has occurred elsewhere or could occur within decades
Remote	a	Requires exceptional circumstances and is unlikely even in the long term or only occurs as a “100 year event”

3.10 Residual Risk Ranking

Risk is expressed in terms of a combination of the consequence of an impact and the likelihood of the impact occurring. Santos uses a Corporate Risk Matrix (Table 3-4) to plot the consequence and likelihood to determine the level of risk.

Once the level of risk is determined Santos uses a Risk Significance Rating (Table 3-5) to determine the magnitude of the risk and if further action is required to reduce the level of risk using the process described in Section 3.6.

Table 3-4 Santos Risk Matrix

	I	II	III	IV	V	VI
f	2	3	4	5	5	5
e	2	3	4	4	5	5
d	2	2	3	4	4	5
c	1	2	2	3	4	5
b	1	1	2	2	3	4
a	1	1	1	2	3	3

Table 3-5 Santos Risk Significance Rating

RISK LEVEL	MITIGATION / INVESTIGATION FOCUS (ADD ADDITIONAL BUSINESS UNIT SPECIFIC REQUIREMENTS WHERE REQUIRED)
5	<ul style="list-style-type: none"> - Intolerable risk level - Following verification of the residual risk at level 5, activity must stop - Activity cannot recommence until controls implemented to reduce residual risk to level 4 or lower - Dedicated multi-disciplinary incident investigation team - Management involvement in the investigation
4	<ul style="list-style-type: none"> - Assess risk to determine if ALARP - If ALARP, activities related to maintenance of controls/ barriers prioritised & managed - If not ALARP, improve existing controls and/or implement new control/s - Dedicated multi disciplinary incident investigation team
3	<ul style="list-style-type: none"> - Assess risk to determine if ALARP - If ALARP, activities related to maintenance of controls/ barriers prioritised & managed - If not ALARP, improve existing controls and/or implement new control/s - Full incident investigation
2	<ul style="list-style-type: none"> - Assess risk to determine if ALARP - If ALARP, activities related to maintenance of controls/ barriers prioritised & managed - If not ALARP, improve existing controls and/or implement new control/s - Incident investigations using simple tools
1	<ul style="list-style-type: none"> - Managed as stipulated by the related work processes - No incident investigation required

3.11 Determination of Impact and Risk Acceptability

The model Santos used for determining acceptance of residual risk is detailed in Figure 3-2 Santos Residual Risk Acceptance Model. In summary:

- A Level 5 residual risk is intolerable and must not be accepted or approved by Management.
- A Level 2 – 4 residual risk is acceptable provided that ALARP has been achieved and demonstrated.
- A level 1 residual risk is acceptable and it is assumed that ALARP has been achieved.

In addition to the requirements detailed above, for the purposes of petroleum activities, impacts and risk to the environment are considered broadly acceptable if:

- The residual risk is determined to be 1 (and ALARP Decision Type A selected and good practice control measures applied), or
- The residual risk is determined between 2 and 4 and ALARP can be demonstrated; and
- The following have been met:
 - Principles of ecologically sustainable development
 - Legal and other requirements
 - Santos policies and standards
 - Stakeholder expectations

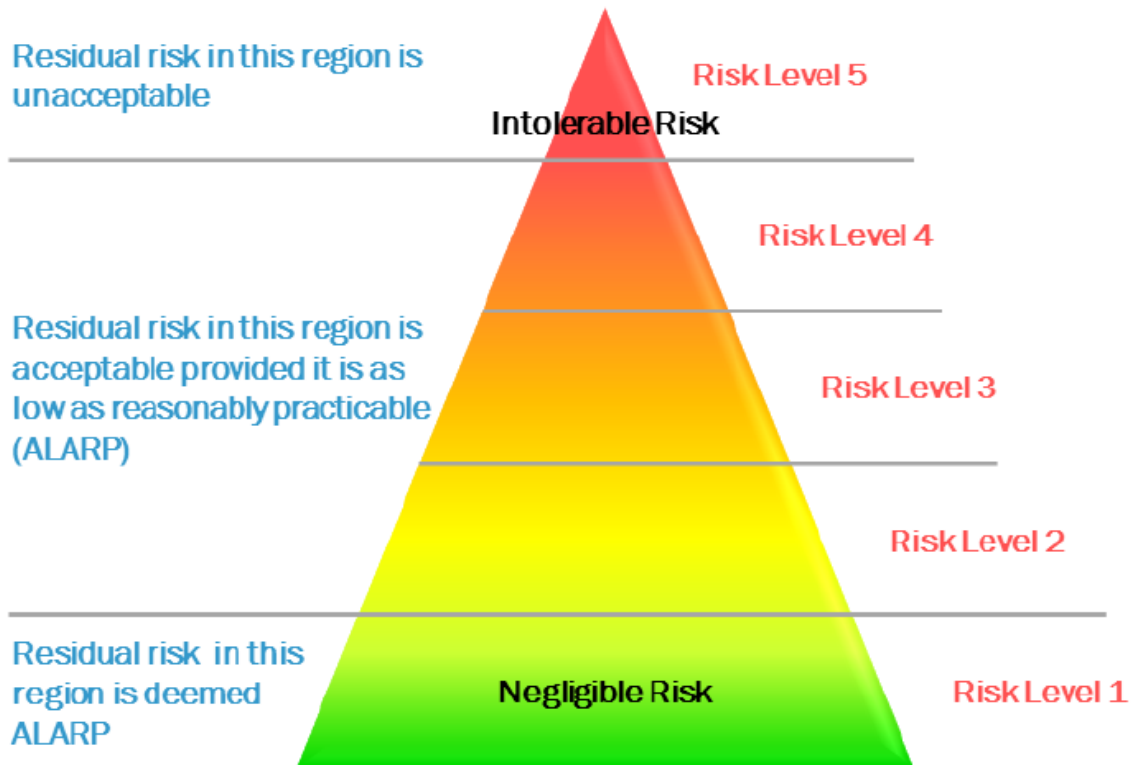


Figure 3-2 Santos Residual Risk Acceptance Model

4.0 DESCRIPTION OF THE ACTIVITY

4.1 Activity Overview

Santos has commenced a seismic survey in the Southern region of the Amadeus Basin. The seismic program to date has been carried out under two approved EMPs titled '*Southern Amadeus Seismic Survey Environmental Plan, May 2013*' (2013 EMP) and '*2016 Southern Amadeus 2D Seismic Program*' (2016 EMP). Given these EMP's expire on 1 December 2017, this EMP combines the outstanding scope of both EMPs to enable the works to be undertaken under a consolidated approval. Specifically, this EMP covers:

- Re-visits and rehabilitation assessment (and works if required) of the 2013 seismic lines; and
- Completion of the 2016 seismic scope, with the remaining acquisition confined to a smaller area within which the outstanding lines will be acquired.

The 2013 seismic survey and restoration is complete, with outstanding work limited to final re-visits to confirm long term rehabilitation success and close-out reporting to meet the *Environmental Closeout Procedures for Petroleum Activities* (DPIR 2016).

The acquisition associated with the 2016 seismic survey is currently about 80% complete but was suspended pending data analysis to optimise the location for the remaining acquisition. The activity to acquire the remaining lines (up to 400 km) is proposed to recommence late 2017 and may continue into 2018.

4.2 Location

The Project's seismic activities undertaken as part of the 2013 and 2016 surveys have been carried out over Exploration Permits 82, 105, 112, and 125. The permits are located east, south and south west of Alice Springs (The Project Area) (Figure 4-1).

These Exploration Permits, situated on Aboriginal, Leasehold and Freehold land, cover a combined area of approximately 48,100km² of the Amadeus Basin. The combined 2013 and 2016 lines acquired to date are shown in Figure 4-1.

The remaining lines, and scope of acquisition covered in this EMP, will be confined to the CLC clearance area (clearance pending) marked as a pink polygon in Figure 4-1. It is expected that up to 400 km of lines will be acquired within this area, which is consistent with the remaining quantity of line kilometres to be acquired under the 2016 EMP. The provision of a clearance area, rather than defining specific lines, provides greater operational flexibility and the ability to optimise line alignments based on data processing results, environmental considerations, landholder requests or other un-anticipated constraints.

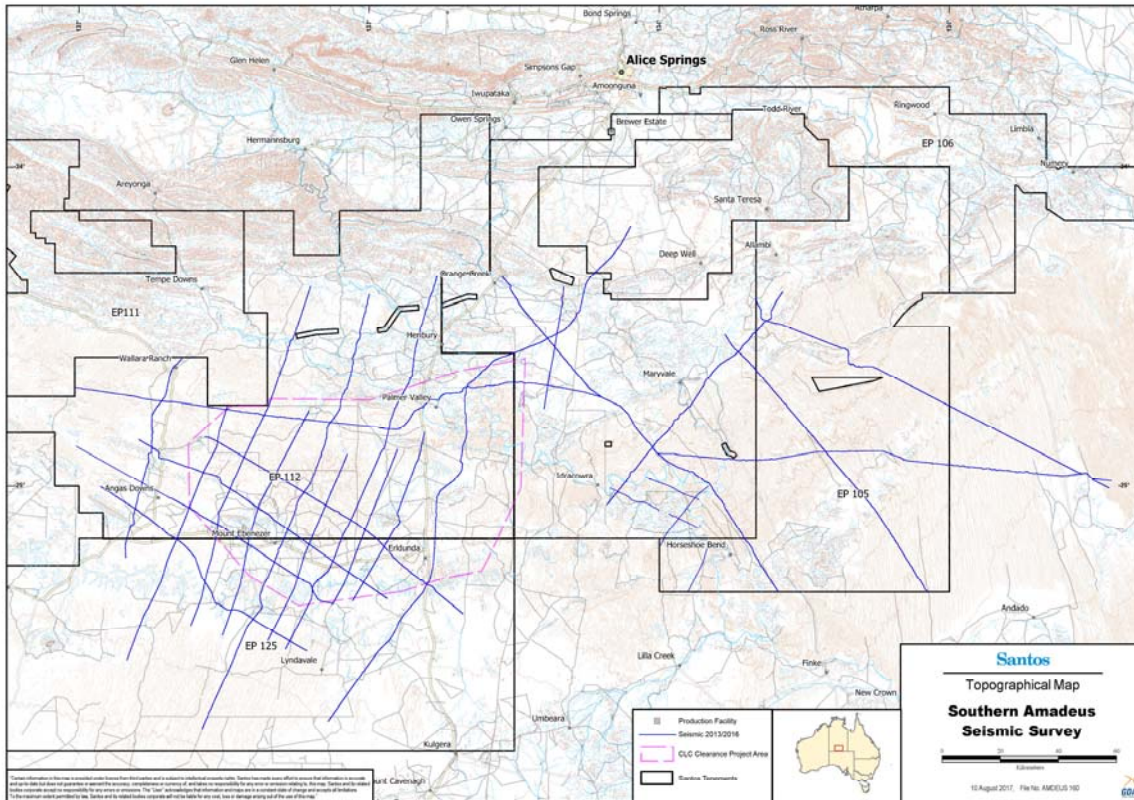


Figure 4-1 Location of Southern Amadeus Seismic Survey

4.3 Timing

The majority of the survey works associated with the Southern Amadeus 2D Seismic Program have been completed under previously accepted EMPs. Activity associated with this revised EMP is scheduled to re-commence in November 2017. Acquisition of the remaining lines is estimated to take approximately 2 months, subject to weather.

Longer term rehabilitation revisits and photo monitoring will commence in 2017 (associated with the 2013 lines) and continue in subsequent years to meet requirements for the 2016 and 2017 lines.

4.4 Seismic Activity

The aim of the seismic survey is to produce detailed images of the various rock types and their location beneath the Earth's surface. This information is used to determine the location and size of oil and gas reservoirs.

The seismic method uses vibrator trucks to produce sound waves. These sound waves are bounced off underground rock formations and the waves that reflect to the surface are captured by recording sensors. Analysing the time the waves take to return provides valuable information about rock types and possible gases or fluids in rock formations. The returning reflections are recorded in a digital format and sent to a seismic data processing centre to produce a 'cross-section' of the layers of the earth's crust.

4.5 Line and Access track preparation

Line preparation is undertaken prior to acquisition to provide safe access and a defined line for the acquisition crew to follow. Due to varying terrain, the line preparation is undertaken by a dozer and a light 4WD vehicle. The dozers will simply 'walk' with the blade up in easily traversable terrain, with the marks of the tracks being sufficient for the surveyors and recording crew to follow. The line position, plus tolerances for weaving the line around vegetation etc are pre-programmed into GPS units housed in the dozers. These GPS units are kinematic dual frequency units that allow the dozer operators to get real time position fixes. These are plotted on a pilot display that also indicates the weaving tolerances for the dozer operators.

Blade work is kept to a minimum and generally restricted to sand dunes and flood plain crabhole country where excessively rough terrain requires smoothing to allow access. Grader work is likewise kept to a minimum – graders are mainly used in flood plain crabhole country to smooth the tracks and knock down windrows in sand country.

In addition to line preparation, access routes may be required, although where possible these will be in areas previously disturbed.

4.6 Line surveying

Surveying commences shortly after line preparation.

The field surveyors use real time kinematic GPS receivers to position receiver points for 2D surveys. Surveyors insert metal pins with numbered plastic tags to indicate the points with selected points marked by a wooden stake. Markers are only temporary and protrude about 30cm above ground level. Line detours may also be marked with temporary biodegradable flagging.

Each survey team consists of one surveyor in a light 4WD vehicle, and generally makes only one pass over any given section of line. Back tracking may occur in areas where vehicle access routes have deviated from the true line position and markers must be inserted by personnel on foot.

4.7 2D seismic operations and recording

4.7.1 Recording

Recording normally commences two to three weeks after the start of line preparation. This operation is the largest part of the seismic operation in terms of personnel and vehicles. A recording crew would normally consist of up to 34 personnel and 16 vehicles. The size of the crew will vary depending on the recording technique used, terrain and season and recording is generally restricted to daylight hours.

4.7.2 Control Measure identification

Control measures were identified to eliminate each aspect or otherwise minimise the risks and impacts to ALARP. The process of identifying control measures involved:

- Identifying a risk control;
- Assessing the risk control;
- Deciding whether residual risk levels are tolerable;


- If not tolerable, identifying a new risk control; and
- Assessing the effectiveness of that control.

The Santos hierarchy of control is illustrated in Table 4-1. This process moves from risk elimination through to protection, in descending order of effectiveness, until a control measure(s) can be identified.

Performance outcomes, standards and measurement criteria are established in line with the control measure(s). Terms used for measuring the environmental performance for each hazard are defined as:

- *Control measure* – a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental impacts and risks.
- *Environmental outcome* – the outcomes that are identified by the interest holder to ensure environmental protection. These outcomes should relate to each risk and impact identified during the ERA process, and be consistent with commitments and targets presented in the Corporate Environment Policy.
- *Performance standard* – performance required of a control measure.
- *Measurement criteria* – defines how environmental performance will be measured and determine whether the outcomes and standards have been met.

Table 4-1 Santos Hierarchy of Control

Control	Effectiveness	Example
Eliminate		<i>Removal of the risk.</i> Refuelling of vehicles at the terminal eliminates the risks of an onsite refuelling.
Substitute		<i>Change the risk for a lower one.</i> The use of low-toxicity chemicals that perform the same task as a more toxic additive.
Engineering		<i>Engineer out the risk.</i> The use of oil traps and interceptor drains to reduce the contaminant discharged.
Isolation		<i>Isolate people or the environment from the risk.</i> The use of bunding for containment of bulk liquid materials.
Administrative		<i>Provide instructions or training to people to lower the risk.</i> The use of Job Hazard Analysis to assess and minimise the environmental risks of an activity.
Protective		<i>Use of protective equipment.</i> Containment and recovery of spilt hydrocarbons.

4.7.3 2D Seismic Operations

Work commences with the laying of cable and deployment of geophone bundles from light 4WD vehicles. Geophones are peg-shaped (approx. 20 cm long and 3cm diameter) so that they can be easily pushed into the ground. Geophone strings consist of 6 interconnected geophones and are dropped off at each receiver station. These strings are looped onto metal hangers for ease of handling. The geophones are then pulled off the hanger and planted in the ground by personnel on foot. Once planted, the string (10m in length to match the distance between receiver points) is connected to a “take out” on the recording cable.

Recording in 2D mode would normally commence when approximately 8km of cable and geophones have been laid. This layout is termed “the spread” and a preselected “live” section picks up the acoustic energy reflected from subsurface layers, converts it to electrical energy and transmits it to the instrument recording truck. The active spread is approximately 14km, which consists of 7km in front of the source point, and 7km behind.

The acoustic energy source is an array of either three or six truck mounted vibrator units, electronically synchronised to vibrate in phase with each other. They line up along the seismic line, a few metres apart, centred on midway between two receiver points. Simultaneously each unit, on command from the instrument truck, inputs one or more frequency sweeps into the ground at each source point. Each sweep lasts for only a few seconds. Generally, four seconds of reflected data is recorded. On completion of one source point the set of vibrators are moved to the next source point.

The “live” section of the spread is the only part of the spread where signal is recorded for any given source position. The live spread is moved (controlled by the recording truck operator) as the vibrators move up. As spread becomes redundant behind the vibrators (back end of line) it is picked up and transported to the front end of the line. This cycle continues until the line is completed. The recording truck may move once or twice during the day to keep pace with the spread.

Along any single line, the following vehicle passes can be expected to occur during normal operations:

- Vibrators - 1 pass for each truck
- Instrument truck - 1 pass
- Light vehicles - 15-20 passes in total
- Vibrator service truck - 1 pass.

4.8 Camp sites

There are generally two campsites in use at any one time, the line preparation/survey camp and main camp.

The line preparation/survey team operates from a small, short term central campsite independent of the main camp. This camp site will most likely be moved weekly. The camp, on average, accommodates 13 personnel using trailer mounted units for ease of mobility. Campsites are set up, where possible, on sites previously used, or in areas naturally devoid of vegetation and always adjacent to any existing tracks to minimise impact on the terrain between the camp and tracks.

The main camp houses up to 40 personnel and contains approximately 20 trailers and 36 vehicles. This includes personnel and equipment for the recording crew, crew management team and the recording and mechanical back up teams.

The camp is moved frequently during the activity to various proposed main campsites located on the sites previously used for surveys. These locations have received CLC clearance and have been chosen based on the following factors:

- Preference for pre-disturbed area wherever possible.
- Avoidance of clay pans or salt lakes.
- Located as near as practical to existing tracks or roads to avoid the need for clearance of native vegetation and subsequent disturbance fauna habitats.

The access routes from camp are clearly defined to restrict wheel track impact which results from vehicles transit to and from camp to the adjacent road at least once per day. Vehicles are restricted to the perimeter of the camp and parking areas are also defined.

Potable water is planned to be sourced from the Alice Springs water supply and trucked into camp. Santos estimates water usage to be approximately 160 litres per person per day. Based on this assumption water use for the line preparation crew would be approximately 2,240 litres per day, and recording crew usage of approximately 5,120 litres per day.

Wastewater from laundry, showers and kitchen is piped to an irrigation area outside of the camps. Sewage management practices at all camps consist of the use of port-a-loos and grey water capture and disposal to a ground pit with the aim to minimise any risks to human health or the environment.

Wastepaper, cardboard and food scraps are disposed of into sealed bins set up adjacent to the camp area. The sealed bins are transported regularly for waste disposal at the Alice Springs Town Council Waste Depot, with contaminated waste (including oil etc) being disposed via Cleanaway, also in Alice Springs. Recyclable materials, including tyres, are segregated on camp and regularly transported to the licensed waste depot in Alice Springs.

Appropriate chemical and fuel storage will be in place at camps. Fuel drums are stored within portable bunding and bulk fuel is stored within tankers equipped with safety features such as double-skins (or temporary bunding), safety cut-off valves, top accessing etc. Spill leak and drip trays will be used to address minor drips and spills resulting from re-fuelling operations.

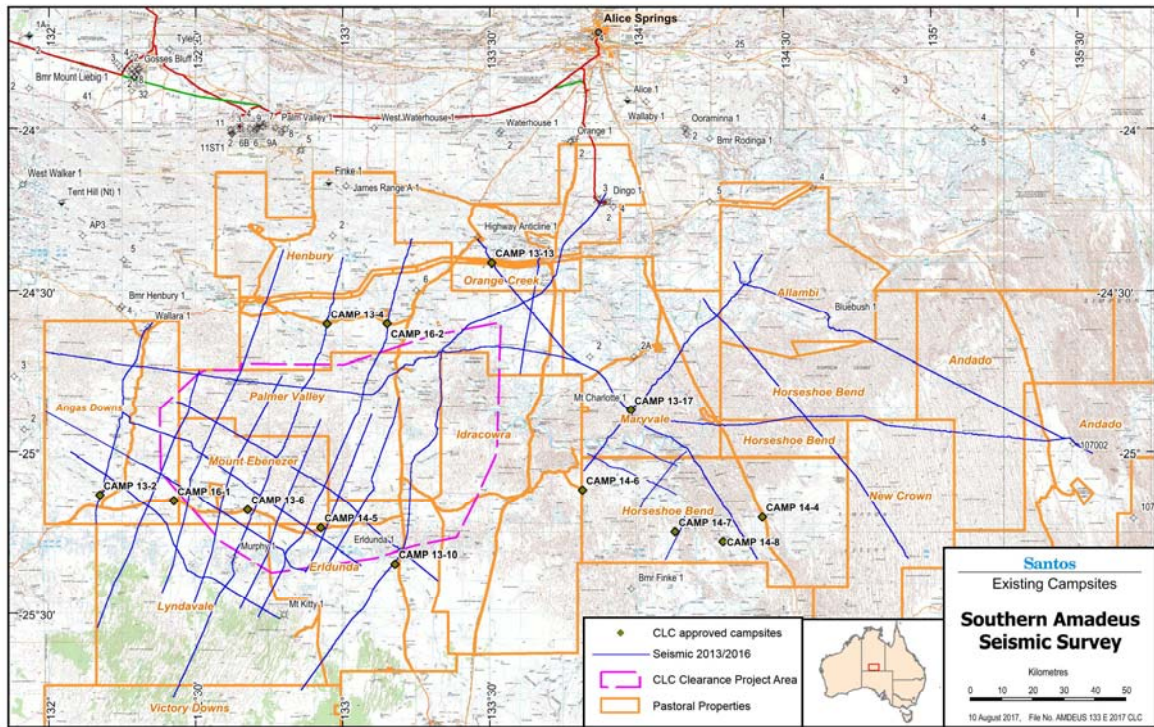


Table 4-2 CLC Cleared Camp Locations

4.9 Rehabilitation

4.9.1 Line/Access Track and Campsite Restoration

Once the campsite or project area has been vacated, rehabilitation is undertaken including removal of rubbish and any man-made items. When necessary, and terrain permitting, the area is tyre ripped to remove compaction and wheel tracks. The majority of seismic lines and access tracks and camp sites do not require restoration work, as one of the main objectives is to prepare and utilise them in a way that will facilitate rapid natural recovery. However, instances that can require restoration are:

- Wheel ruts caused after wet periods;
- Windrows not fully removed by grader;
- Windrows that have been created at intersection of lines and public tracks;
- Compaction of top soil at camp sites;
- Compaction of shoulders on public access tracks;
- Heavily trafficked routes between camp sites and nearest public track; and/or
- Access tracks that have turned to bulldust due to extensive seismic traffic.

Normally a single dozer or grader or one of each is all that is required to carry out the restoration work. Methods used for rehabilitation include:

- Ripping of compacted areas with bulldozer rear tyres;
- Windrow material pushed onto line and smoothed;
- Public road shoulders reinstated;
- Wheel rut material used to infill affected areas; and/or
- Affected watercourse channels and creek banks reinstated.

4.9.2 Post Survey Monitoring and Auditing

Photo points are established at each campsite to document pre-disturbance and post-restoration condition. In addition, and prior to the commencement of any survey, photo points are established at nominally 5 km intervals. By establishing many photo points, it provides a balanced representation of the various landform and vegetation types encountered and enables rehabilitation success to be effectively monitored.

Photo points are GPS coordinated prior to the start of line preparation and photographs are taken at each location along the proposed line direction to give a view of the terrain prior to line-preparation. All photographs are digital for consistent comparison. The process is repeated after line preparation and again after recording. The revisit intervals are generally one year, two years and four years although the return period is determined by weather/road conditions and current activity in the region. Revisits may also be targeted, with emphasis on sensitive areas and areas potentially subject to erosion such that environmental impact of re-accessing remote locations is minimised.

4.9.3 Long-term Rehabilitation

Whilst most of the areas will naturally regenerate following restoration works, there is the possibility that specific areas (sensitive areas or areas subject to erosion) may need additional

rehabilitation following the first wet-season. Areas identified in post-survey photo point monitoring, or by subsequent landholder liaison, as requiring additional rehabilitation works will be re-visited and rehabilitated accordingly.

Following completion of the final photo point revisit and any required additional rehabilitation, Santos will submit the final Environmental Line Reports to DPIR along with the application to release the long-term Rehabilitation Security. In accordance with the *Environmental Closeout Procedures for Petroleum Activities* (DPIR 2016) the final rehabilitation assessment and endorsement will be conducted by an appropriately qualified third party. Reporting requirements are discussed in Section 8.

4.9.4 Indicative Rehabilitation Schedule

An indicative rehabilitation schedule is shown in Table 4-3. It is noted that the long term rehabilitation assessment timing is dependent on a number of factors such as weather (i.e. waiting for a reasonable rainy season) and availability of resources in the region. If the long term rehabilitation assessment identifies further work is required, the work would be undertaken in accordance with the management measures contained within this EMP.

Table 4-3 Indicative Rehabilitation Schedule

2013 activity	Complete	2017/18
2016 activity	Partially Complete – finalise 2017/18	2019-2022
2017/18 activity	2017/18 post-acquisition	2019-2022

5.0 DESCRIPTION OF EXISTING ENVIRONMENT

This section describes the physical, biological, cultural and socio-economic environment and identifies any relevant values and sensitivities of the environment that may be affected by the activity (referred as the 'project area'). The project area is shown in Figure 4-1.

The information has been sourced using Santos' and publicly available information and the results from the Protected Matters Search. The identified environmental values and / or sensitivities with the potential to occur within the project area are summarised in Table 5-1.

Table 5-1 Environmental values and/or sensitivities with the potential to occur within the project area

Environment Receptor	Summary
Groundwater/ water courses	The salt lakes of Central Australia support specialised flora and fauna and are a significant landform in the southern region of the Northern Territory covering an area of some 2800 square kilometres. Within the project area, salt pans, defined by the waterlogged saline clays and fringing dunes, represent a small percentage of the total area (approximately 4%).
Native fauna	Despite the lack of free-water the bioregions provide important habitat for a range of wildlife including a variety of small mammals, reptiles and birds. There are a number of listed species of birds, mammals, reptiles and insects with the potential to be found in the project area, however there is no area of particular sensitivity in the region.
Native flora / habitat	The project area is covered by the bioregions of the Simpson Strzelecki Dunefields Bioregion in the east and Finke Bioregion in the west. The project area is considered to be representative of the broader region and while there are no TECs identified, there is the potential for some listed plant species including species of acacia.
Environmentally sensitive sites	A list of protected or conservation areas within the vicinity (however not within the project area) include: <ul style="list-style-type: none"> • Mac Clark (Acacia peuce) Conservation Reserve • Henbury meteorites conservation reserve • Rainbow valley conservation reserve • Illamurta springs conservation reserve • Ewaninga rock carvings conservation reserve • Owen spings reserve
Culturally sensitive sites	The project area and surrounds has the potential for Aboriginal sites with cultural value. However, sacred sites clearance will be obtained prior to any activity.
Landholders	There are a number of pastoral properties with livestock and infrastructure in the vicinity.

5.1 Natural environment

5.1.1 Climate

The Southern Amadeus seismic survey is located within the arid zone of Central Australia that experiences low and variable rainfall and high diurnal and seasonal temperature fluctuations.

Table 5-2 shows a summary of climate records for Alice Springs Airport (Station 015590), which is located approximately 140 kilometres (km) north of the Program area (Bureau of Meteorology [BoM] 2014).

The mean annual rainfalls for Alice Springs and Mereenie are 284 mm and 300 mm respectively, with most of rainfall in summer. Temperatures vary from very hot in summer to below freezing in winter, and frosts occur regularly during the winter months.

Average evaporation exceeds average rainfall for each month of the year and by some 1000% over an average year. The mean annual evaporation rate at Alice Springs is 3066 mm. The dominant wind directions are southeast to northeast with little seasonal variation.

Table 5-2 Temperature and rainfall records for BoM Station #015590

Month	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Temperature													
Mean Daily Max (°C)	36.4	35.1	32.6	28.2	23.0	19.8	19.7	22.6	27.3	30.9	33.6	35.4	28.7
Mean Daily Min (°C)	21.5	20.7	17.5	12.6	8.2	5.0	4.0	6.0	10.3	14.8	17.9	20.2	13.2
Rainfall													
Mean monthly (mm)	38.5	43.9	31.8	17.3	18.7	13.6	15.4	9.0	8.4	21.1	28.7	36.8	284.0

5.1.2 Geology

The Southern Amadeus seismic survey is located within the eastern, central and southern Amadeus Basin, an east-west trending structural depression extending across the southern part of the Northern Territory and into Western Australia. This basin covers an area of approximately 207,000 km² and contains up to 9100 m of late Proterozoic and Palaeozoic sediments. It is bound in the north by the Arunta complex and in the south by the Musgrave-Mann complex, both containing granite, gneiss and schists, with amphibolite and quartzite.

Geologically, rocks consist of sandstones that form resistant strike ridges and less resistant siltstones, commonly covered by superficial soils. Hydrocarbons occur in sandstones at depths ranging between 1200 and 1500 m.

5.1.3 Soils

The landscape of northern and central Australia is ancient and highly weathered. Soil types are susceptible to erosion given that the region experiences long dry periods followed by intense rainfall. In this environment, the soils become disturbed and once disturbed can be easily eroded.

The project area soils are dominated by tenosols soils, kandosols and rudosols associated with rugged rock terrain (DLRM 2013a). Smaller pockets of calcarosols and sodosols soils are present in the project area but will be avoided by the proposed activities.

- Tenosols are weakly developed or sandy soils, commonly shallow (slightly more developed than Rudosols), although they can include the deep sand dunes of beach

ridges, granitic soils and sand dunes of deserts. Tenosol soils show some degree of soil profile organisation (minor colour or soil texture changes in subsoil).

- Rudosols are very shallow soils or those with minimal soil development and includes very shallow rocky and gravelly soils across rugged terrain.
- Kandosols are massive and earthy soils (formerly red, yellow and brown earths) that are widespread across the Sturt plateau regions.
- Calcarosols soils with calcium carbonate often formed on limestone are restricted to small pockets in Central Australia.
- Sodosols soils are generally high in sodium with an abrupt increase in clay content from the top soil to subsoil. They are dispersive and restricted to small occurrences in the southern region of the NT.

The following land systems and their total area and percentage within the project area are detailed in Table 5-3, and shown in Figure 5-2.

Table 5-3 Percentage of land systems and total area within the project area

Land Systems	General Terrain Description	Area (km ²) within project area	% of Total
Desert dunefields	Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes; red sands	4330.69	59.2
Desert sandplains	Level to undulating sandplains with red sands	317.75	4.3
Sandstone plains and rises	Plateaux, plains and rises on sandstone, claystone, shale and limestone; outcrop with shallow stony soils	1483.93	20.3
Sandstone hills	Stony plateaux, tablelands and hills on sandstone, quartzite, siltstone and conglomerate (deeply weathered in places); outcrop with shallow stony soils	626.33	8.6
Limestone plains and rises	Plains, rises and plateaux on dolomite, limestone, chalcedony, shale and sandstone; red clayey sands, calcareous earths and outcrop with shallow, stony soils	58.20	0.8
Salt pans	Salt pans with waterlogged saline clays and fringing dunes	293.55	4.0
Sandstone ranges	Rugged ranges on quartzite, sandstone and conglomerate; outcrop with shallow, stony sandy soils	81.52	1.1
Alluvial floodplains	River plains, swamps and alluvial fans formed on Quaternary alluvium	118.40	1.6
Totals		7310	100%

5.2 Baseline water conditions

5.2.1 Hydrology

All catchments within the Amadeus Basin region drain internally towards Lake Eyre (within South Australia) (Figure 5-1). All surface water including rivers, streams and drainage lines are

ephemeral and subject to short flow duration and high turbidity. The dominant basin is associated with the Finke River system and its associated tributaries and feeder rivers.

5.2.2 Salt Lakes

The salt lakes of Central Australia are also maintained by groundwater and support specialised flora and fauna. Salt lakes are generally formed as a result of saline ground water discharging to the surface. Such salt lakes drain groundwater from both bedrock aquifers and aquifers made up of the river sands deposited on the valley floor. The water table is generally about 300 millimetres below the lake floor, shallow enough for the water to be evaporated resulting in salt pans. Salt lakes occasionally fill when heavy rains occur but they are usually dry. Ground water does not generally accumulate in the salt lakes as free-standing water but is all lost to evaporation. The salts in the ground water are left behind and gradually accumulate forming deposits of common salt and gypsum.

Salt lakes are a significant landform in the southern part of the Northern Territory, covering an area of some 2800 square kilometres. Within the project area, salt pans, defined by the waterlogged saline clays and fringing dunes, represent a small percentage of the total area (approximately 4%), and will be avoided by the proposed activities.

5.3 Flora & fauna

5.3.1 Bioregions

The Arid Lands region covers 49% of the land area of the Northern Territory (658,000 sq km). It includes all the MacDonnell Ranges and Burt Plain bioregions, the Territory sections of the Great Sandy Desert, Simpson Strzelecki Dunefields, Finke, Central Ranges, Channel Country and Stony Plains bioregions, most of the Territory section of the Tanami bioregion and parts of Sturt Plateau, Mitchell Grass Downs and Davenport Murchison Ranges bioregions.

The project area is covered by two bioregions, the Simpson Strzelecki Dunefields Bioregion in the east and Finke Bioregion in the west (Figure 5-3).

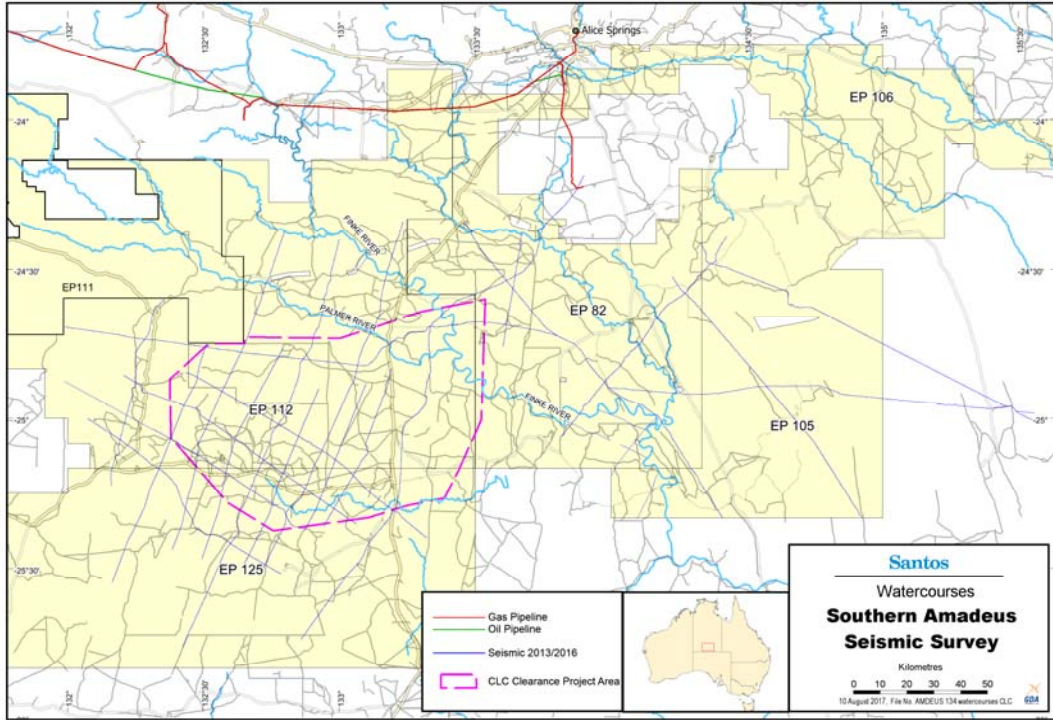


Figure 5-1 Watercourses

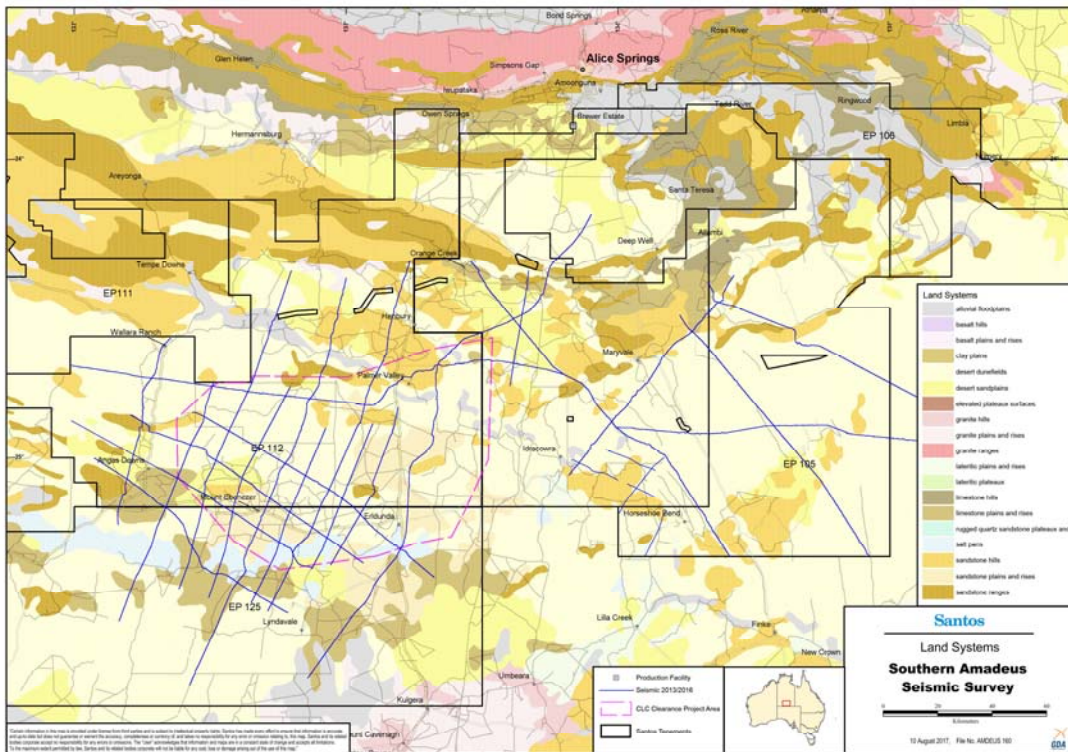


Figure 5-2 Land Systems

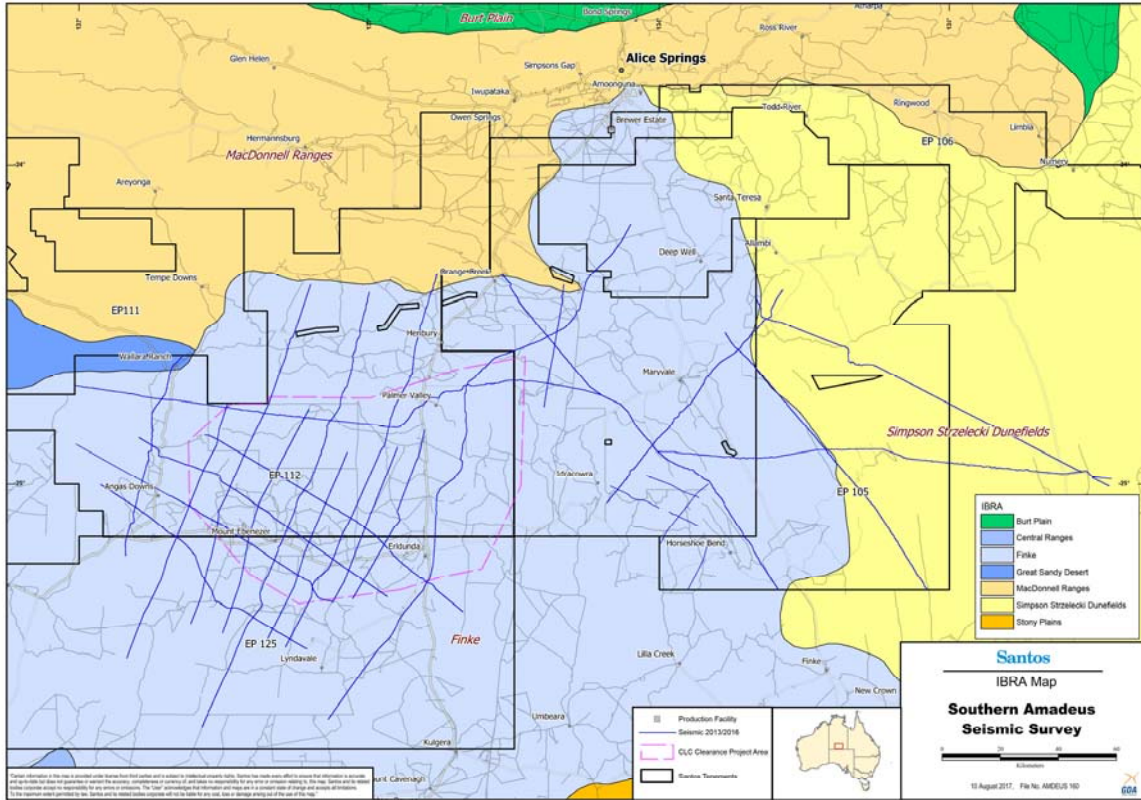


Figure 5-3 Bioregions

Simpson Strzelecki Dunefields Bioregion

The Simpson-Strzelecki Dunefields Bioregion covers an area of 297,227 km², and extends from the southeast of the NT, through the northeast of SA, with small areas in both Qld and NSW. The bioregion is part of the Australian continental dunefields, which consist of a huge anti-clockwise whorl of linear dunes in central Australia and thus dominated by high linear dunes of red sand.

Woodland communities are dominated by *Acacia ligulata*, mulga, needlewood (*Hakea leucoptera*), whitewood (*Atalaya hemiglauca*) and beefwood (*Grevillea striata*) with an understorey shrubland consisting of species of *Cassia*, *Eremophila* and *Dodonaea*. Mitchell Grass occurs on the dunes while temporary canegrass (*Glyceria ramigera*) - lignum (*Muehlenbeckia cunninghamia*) swamp communities occurring between them.

The sand dunes and sandplains communities support sandhill wattle (*Acacia ligulata*), turpentine (*Eremophila sturtii*), scattered mulga (*Acacia anuera*), rosewood (*Heterodendrum oleifolium*), whitewood (*Atalaya hemiglauca*), canegrass (*Eragrostis australasica*), the occasional white pine (*Callitris glaucophylla*) and various cassia and eremophila species.

Lignum (*Muehlenbeckia cunninghamia*), black box (*Eucalyptus largiflorens*) and river red gum (*Eucalyptus camaldulensis*) grow along the creeks and on the margins of freshwater claypans. Many of the same species are found in the more saline clays of the Cobham land system along with prickly wattle (*Acacia victoriae*) and chenopods. Bladder saltbush (*Atriplex vesicaria*), black bluebush (*Maireana pyramidata*), Mitchell grass (*Astrelba* sp.) and scattered mulga (*Acacia anuera*) are found on the tablelands and stony downs. Bimble box (*Eucalyptus populnea*), western bloodwood (*Eucalyptus terminalis*) and ironwood (*Acacia excelsa*) are present with denser mulga on the sands.

Finke Bioregion

The Finke Bioregion covers an area 73,800 km². The main land types are arid sand plains with dissected uplands and valleys, including some major rivers (Finke, Hugh and Palmer rivers).

The bioregion is dominated mulga taking different forms on different soil types. The mulga is made up of various Senna, Eremophila and Acacia species (*S. nemophila*, *S. desolate*, *E. freeelingii*, *E. gilesii*, *A. kempeana*, *A. tetragonphylla*).

The bioregion includes eucalypt low woodland with tussock and hummock grass understorey, acacia woodland, hummock grassland, and chenopod shrubland, associated with salt plains and floodouts on sand plains. The dominant chenopods are bluebush (*Maireana astroricha*) and bladder saltbush (*Atriplex vesicaria*).

5.3.2 Flora Species

A search of the NT Flora Atlas was completed to determine the flora species within the permit area.

The search of the NT Flora Atlas revealed a total of 18,612 native flora records within the search area. The records consist of 810 native flora species representing 314 genera and 80 non-native or introduced flora species. Of these species the Flora Atlas identified eight threatened flora species previously observed within the vicinity of the proposed development. These records consisted of six species listed as Vulnerable and two listed as Endangered.

A search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters database (DoE 2017) was undertaken to identify nationally listed threatened flora or fauna that may occur or are likely to occur within the area (Appendix 1). With respect to flora this search identified 2 threatened species of plants, including the 'endangered' *Frankenia plicata* and the 'vulnerable' Latz's Wattle (*Acacia latzii*).

5.3.3 Fauna Species

Despite the lack of free-water the bioregions provide important habitat for a range of wildlife including a variety of small mammals, reptiles and birds.

The Northern Territory (NT) fauna atlas currently includes all known terrestrial vertebrate records for the NT. A search of the NT Fauna Atlas was completed to determine the fauna species within the vicinity of the permit area.

The search of the NT Fauna Atlas revealed a total of 29,301 native fauna records within the search area. The records consist of 376 native fauna species and 12 non-native or introduced fauna species. Of these species, the Fauna Atlas identified 26 threatened fauna species previously observed within the vicinity of the proposed development. These records consisted of 19 species listed as Vulnerable, five listed as Endangered and two listed Critically Endangered.

A search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters database (DoE 2017) was undertaken to identify nationally listed threatened flora or fauna that may occur or are likely to occur (Appendix 1). With respect to fauna, this search identified 6 species of birds including the 'critically endangered' Curlew Sandpiper (*Calidris ferruginea*), as well as the Night Parrot (*Pezoporus occidentalis*) and the Australian Painted Snipe (*Rostratula australis*) which are listed as 'endangered'. The Thick-billed Grasswren (*Amytornis modestus*), Red Goshawk (*Erythrotriorchis radiatus*) and the Princess Parrot (*Polytelis alexandrae*) listed as 'vulnerable'. The search also identified 10 migratory species of birds, 1 of which is listed above as 'critically endangered', Curlew Sandpiper (*Calidris ferruginea*) which is a wetland species. The Curlew Sandpiper is also listed as a marine species along with the 'endangered' Painted Snipe (*Rostratula benghalensis*).

Listed insects included the 'endangered' Desert Sand-skipper (*Croitana aestivalis*).

Listed threatened mammals include the 'endangered' Central Rock-rat (*Zyzomys pedunculatus*) and the 'vulnerable' Crest-tailed Mulgara (*Dasyercus cristicauda*), Greater Bilyby (*Macrotis lagotis*) and the Black-footed Rock-wallaby (*Petrogale lateralis*).

Listed reptiles include the 'endangered' Slater's Skink (*Liopholis slatero slateri*) and the 'vulnerable' Great Desert Skink (*Liopholis kintorei*).

Animals of this arid region are likely to be mobile across the extensive area of habitat.

5.4 Cultural environment

5.4.1 Cultural Heritage

An assessment of cultural heritage values for the permit area was undertaken as preparation for the 2013 and 2016 surveys. It was confirmed that there are no areas within the permit area listed on the National Heritage Register (National Heritage List (DSEWPaC 2014a) or NT Heritage Register (DLPE 2014).

In addition, a search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters database (DoE 2017) showed no matters of national environmental significance including World Heritage Properties and National Heritage Places.

5.4.2 Sacred Site Protection

Areas of significance for indigenous cultural heritage is considered through the process of securing a sacred site clearance certificate from the Central Land Council (CLC). This process aims to prevent damage to, and interference with Aboriginal sacred sites, by setting out the conditions in relation to entering and working on the land.

The specific details of the sacred sites are held with the CLC, and through the process of obtaining a sacred site clearance certificate, it can be assumed for the purposes of the project activity that there are no sacred sites within the area for which the consent applies.

5.5 Socioeconomic environment

The Amadeus Basin supplies gas within the Northern Territory and oil to South Australia. There is a range of current land uses throughout the area including conservation, tourism, oil and gas production and pastoral activities. While the regional population has decreased with time, tourist numbers are consistent with tourism centres such as Alice Springs and Yulara continuing to be the key destinations of interest.

About 55% of the Arid Lands subregion is Aboriginal freehold and about 36% pastoral leases, on which cattle are grazed. Though accounting for a small total area, horticulture is an important land use in the Arid Lands subregion.

The region remains generally undeveloped in terms of infrastructure and roads.

5.5.1 Settlements

The closest major community to the project area is Alice Springs, approximately 200 km north-east of the project area (Figure 4-1).

Pastoral properties in the project area are shown in Figure 5-4.

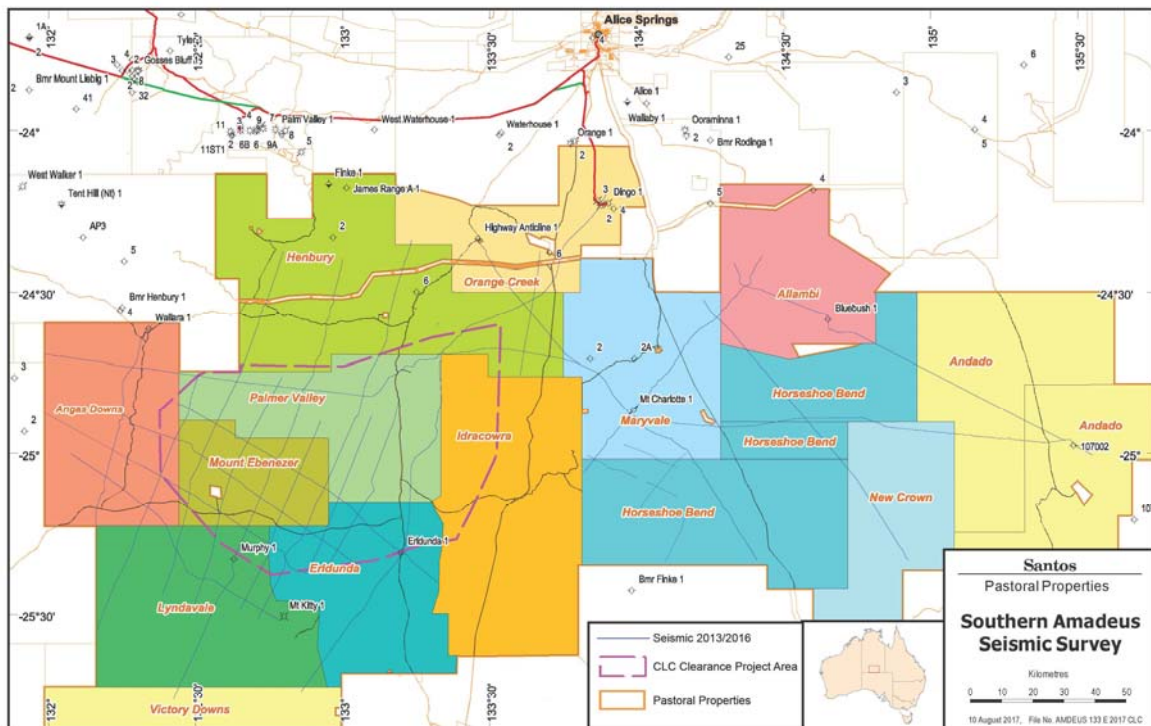


Figure 5-4 Stations in proximity to the project area

5.6 Values & sensitivities

5.6.1 Protected or Conservation Areas

Current and proposed protected areas make up 36% of the Arid Lands subregion; the majority of this is as proposed Indigenous Protected Areas.

There are protected or conservation areas within the permit area (DLRM 2014a and Figure 5-5). These include:

- Chamber's pillar historical reserve
- Mac Clark (Acacia peuce) Conservation Reserve
- Henbury meteorites conservation reserve
- Rainbow valley conservation reserve
- Illamurta springs conservation reserve
- Ewaninga rock carvings conservation reserve
- Owen springs reserve

All protected areas however are outside of the proposed project area.

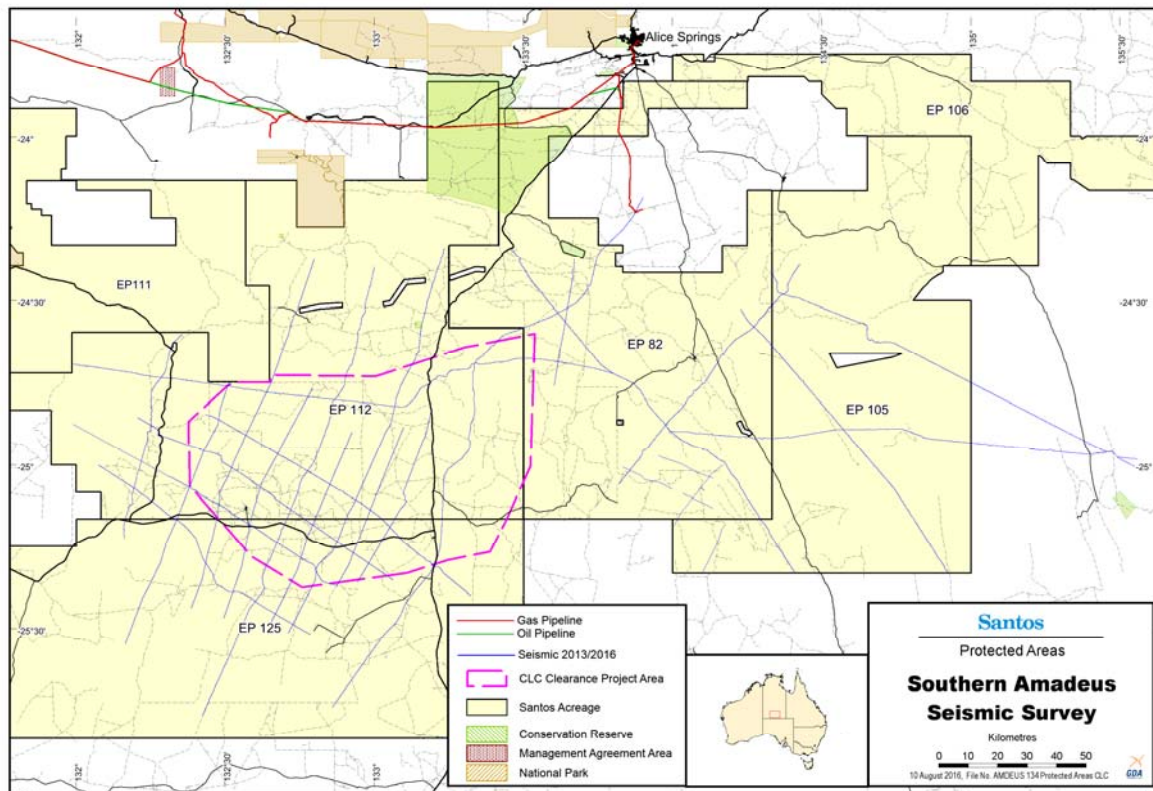


Figure 5-5 Protected and Conservation Areas

5.6.2 Protected species

Interrogation of databases and a review of published material indicate that a number of threatened species have been recorded within the region. A search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters database (DoE 2017) was undertaken to identify nationally listed threatened flora or fauna that may occur or are likely to occur. These searches identified six birds, one insect, four mammals, 2 reptiles, as well as two species of plant and a number of migratory species (all birds) that may or are likely to occur within the project area (Search results provided in Appendix A). The search did not identify any Threatened Ecological Communities in the area.

5.6.3 Significant Habitat

The EPBC Act matters search identified two nationally important wetlands being the Karinga Creek Palaeodrainage System and the Finke River Headwater Gorges System. These wetlands provide unique habitats and high degrees of species endemism.

In the NT there have been 67 sites identified as the most important sites for biodiversity conservation that need further protecting. Within the vicinity of the proposed development there are six of these as shown in Table 5-4.

Table 5-4 Sites of Conservation Significance

Sites of Conservation Significance	Significance rating
Greesater MacDonnell Rang	International
Karinga Creek paleodrainage system	International
Rodinga Range and adjacent ranges	National
Mount Conner and surrounds	National
George Gill Range and surrounds	International
Waterhouse Range	National

None of these sites of conservation significance however occur within the project area.

No other significant habitat has been identified within the project area (DLRM 2014a). The habitat of the project area is widespread and representative of each bioregion.

5.6.4 Fire Regime

Aboriginal people have traditionally used fire as a tool during hunting and gathering. These fires have shaped vegetation and faunal patterns across central Australia. The advent of pastoralism brought new approaches regarding fire use resulting in fewer but larger fires initiated during the warmer seasons.

Fire management or controlled burns within the Alice Springs fire management region are a common occurrence. Controlled burns are undertaken to reduce the possibility of uncontrolled fires and to assist in land management. Fire management in the region considers the various land uses including pastoral use, tourism and other industry including oil and gas activities.

Advice from Bushfires NT is that there are currently no planned burns in the area for the remainder of 2017.

5.6.5 Pest Plant and Animal Control

Pest plant and animal control is a significant land management issue in the Northern Territory.

While the Amadeus Basin region is relatively free of pest plant species, the *Alice Springs Regional Weed Management Plan 2013-2018* (DLRM 2013) identifies Priority Weeds that have been determined using expert local knowledge of the Alice Springs Regional Weed Reference Group. Priority weed species for the region are:

- Athel Pine (*Tamaris aphylla*)
- Cacti (*Opuntia* and *Cylindropuntia* spp.)
- Parkinsonia (*Parkinsonia aculeate*)
- Rubber Bush (*Calotropis procera*)

The plan also identifies species that are a 'Significant Threat' (i.e. buffel grass) and 'Alert Weeds' that are not yet naturalised in the region, but have the potential to have a high level of impact should they become established. Alert Weed species for the region are:

- Mesquite (*Prosopis* spp.)
- Prickly acacia (*Acacia nilotica*)
- Fountain grass (*Cenchrus setaceus*)

Weed distribution is more often related to environmental disturbances caused by the construction of roads and tracks, cattle grazing and feral animals. Weeds are most prevalent on land under pastoral lease with infestations generally concentrated around infrastructure such as water points, fence lines and tracks, and along the banks of watercourses where cattle and feral animals tend to congregate.

Thirteen introduced feral animal species are also identified as a problem in the region. Pest animals identified in the region include rabbits, feral cats, pigs, donkey and camels.

6.0 ENVIRONMENTAL RISK ASSESSMENT

6.1 Section overview

The planned and potential interactions between the described activity, the aspects triggered and the described environment represent a source of risk (or impact) which has potential to affect the described environment.

Table 6-1 identifies the aspects, both planned and unplanned, identified for each of the key activities proposed to be undertaken as a part of this project.

Table 6-1 Summary Table Activities and Aspects

Activity	Aspect											
	Physical disturbance	Noise	Erosion	Dust	Waste	Light emissions	Resource Consumption	Contamination (Leaks and Spills)	Vehicle collision with fauna / livestock	Disturbance to stakeholders	Introduced pests/pathogens	Fire
Line/Access Track and Campsite Preparation	X	X	X	X	X	X	X	X	X	X	X	X
Line surveying	X			X	X	X	X		X	X	X	X
Recording	X	X	X	X	X	X	X	X	X	X	X	X
Campsites and associated supply logistics	X	X	X	X	X	X	X	X	X	X	X	X
Rehabilitation	X	X		X		X	X		X	X	X	X

To identify and assess the impacts of the activities, the potential for an aspect to impact the receptors present has been undertaken, and a summary of this provided in Table 6-2.

Table 6-2 Summary Table Aspects and Receptors

Aspect	Receptor	Potential impacts or risk
Planned / Routine		
Physical disturbance	Soil	Damage to soil (compaction)
	Baseline water conditions	Disturbance to natural drainage patterns
	Native fauna	Disturbance to native fauna Loss of vegetation and habitat
	Native flora	Loss of vegetation and habitat

Aspect	Receptor	Potential impacts or risk
	Culturally sensitive sites	Disturbance to culturally sensitive site
	Livestock, pastoral infrastructure and landholders	Disturbance to livestock, pastoral infrastructure and landholders
Noise	Native fauna	Disturbance to native fauna
	Livestock, pastoral infrastructure and landholders	Disturbance to livestock Loss of amenity
Erosion	Soil	Soil erosion due to ground disturbance
	Baseline water conditions	Increased runoff and erosion Increased sediment loads Disturbance to natural drainage patterns
	Native flora	Direct loss of vegetation
	Culturally sensitive sites	Disturbance to culturally sensitive sites
	Livestock, pastoral infrastructure and landholders	Disturbance to landholders
Dust	Native flora	Smothering of undisturbed vegetation
	Livestock, pastoral infrastructure and landholders	Landholders (Loss of amenity) Landholders (health)
Waste	Native fauna	Disturbance, injury or death native fauna.
	Native flora	Direct loss of vegetation
	Soil	Degradation of soil quality
	Water courses	Contamination of groundwater and / or watercourses.
	Environmentally sensitive sites	Contamination of soil
	Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock. Loss of organic beef or cattle care certification
Light Emissions	Native Fauna	Disturbance to native fauna
	Livestock, pastoral infrastructure and landholders	Disturbance to livestock Loss of amenity (Landowners)
Resource	Native fauna	Disturbance, injury or death to native fauna
	Baseline water conditions	Depletion of groundwater and / or watercourses.

Aspect	Receptor	Potential impacts or risk
	Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock
Unplanned / Non-Routine		
Contamination (spills and leaks)	Soil	Degradation of soil quality
	Baseline water conditions	Changes to water quality
	Livestock, pastoral infrastructure and landholders	Loss of organic certification
Vehicle Collision with fauna / livestock	Native fauna	Disturbance, injury or death to native fauna
	Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock
Disturbance to stakeholders	Livestock, pastoral infrastructure and landholders	Unplanned interaction with or disturbance to other land users
	Petroleum / infrastructure	Unplanned interaction with or disturbance to other land users
Introduced pests/pathogens	Native flora	Introduction and or spread of weeds, pest plants, animals and pathogens.
	Native fauna	Introduction and or spread of weeds, pest plants, animals and pathogens.
	Livestock, pastoral infrastructure and landholders	Disturbance to Livestock Loss of organic beef or cattle care certification.
Fire	Native fauna	Disturbance, injury or death to native fauna
	Native flora	Loss of vegetation
	Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock Damage / loss to dwellings, infrastructure

6.2 Planned/routine

6.2.1 Physical disturbance

Physical disturbance will occur from the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics
- Rehabilitation

The area that may be affected by physical disturbance will be anywhere vehicles or personnel are required to access as a part of the activity. For this EMP, this will be limited to the project area described in Section 4.2, along with areas of existing infrastructure, or areas previously disturbed as a part of 2013 and 2016 survey activities where re-visits may be required.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Based upon the receptors identified in Section 5, those known to be impacted by physical disturbance are shown in Table 6-3.

Table 6-3 Physical Disturbance Receptor risks and impacts

Receptor	Potential Impact
Soil	Damage to soil (compaction)
Baseline water conditions	Disturbance to natural drainage patterns
Native flora	Disturbance to native flora Loss of vegetation and habitat
Native fauna	Disturbance to native fauna
Culturally sensitive sites	Disturbance to culturally sensitive sites
Livestock, pastoral infrastructure and landholders	Disturbance to livestock, pastoral infrastructure and landholders

Evaluation of Environmental Impacts

The proposed seismic survey and associated activities are expected to last for approximately two months. Physical disturbance is expected to occur as vehicles or personnel move across the permit area along the seismic lines. However, the entire area will not be disturbed for the period. Rather, the potential for impact will be linear and move with the project activities.

Soil

Project activities have the potential to result in localised soil compaction through heavy vehicle movements, stockpiling of soils and storage of equipment. Compaction of soil has the potential to negatively affect plant root growth, soil moisture potential, soil quality, vegetation establishment, surface and subsurface drainage, runoff and soil erosion.

Many factors will affect the potential for soil to compact including the soil type and characteristics. Soil types within the project area are mostly sandy, and will potentially compact particularly if wet at the time of compaction.

The restriction of vehicle movements, however, to defined locations and the general low level of plant and traffic will reduce the potential for impact.

Baseline Water Conditions

The clearance of vegetation has the potential to alter the hydrogeological conditions by increasing the rate and volume of recharge water entering the water table. Given that the area already has a low level of vegetation coverage and the area of actual disturbance within the project area is relatively small this effect will be negligible.

Project activities may potentially result in the alteration of surface waters through the placement of roads, camps etc. All surface waters near the project area including rivers, streams and

drainage lines are ephemeral and subject to short flow duration and high turbidity. Given the small area of disturbance and the lack of permanent surface waters, impacts to surface water flow is not likely to be significant.

Native Flora

The clearance of vegetation during access track preparation cannot be entirely avoided. During the preparation of seismic survey lines and access tracks, care is taken to ensure that minimal vegetation is cleared in heavily vegetated areas, and sensitive areas such as salt pans are avoided.

At under 2 km², the proposed area of linear disturbance within the project areas is relatively small, and will occur in a location with vegetation and habitat that is well represented in the broader region.

While there will be localised disturbance along the lines, the short term nature of the activity and the re-spreading of windrowed material will aid natural recovery. The small and linear nature of survey lines and the rate of recovery of most vegetation types and surface morphology, will result in an insignificant impact on wildlife habitat and minimal impact on vegetation.

Native Fauna

The project activities are likely to cause direct disturbance to some fauna species. Native fauna in this region are typical of dessert / exposed environments, and are likely to include small, fast moving species of mammal and reptiles.

The level of disturbance is relatively small, linear and temporary in nature, as such it is unlikely to result in significant impacts to fauna species, including species of conservation significance.

Culturally sensitive sites

Project activities have the potential to disturb culturally sensitive sites. The project area is required to be cleared for works prior to the commencement of activities by the CLC. This is intended to ensure that there is no impact to known sites of significance.

Livestock, Pastoral Infrastructure and Landholders

There are a number of pastoral properties within the vicinity of the project area. Activities have the potential to disturb the activities and amenity of landholders in the area. Landholder consent and consultation is required prior to activities to ensure that impacts are managed to acceptable levels.

Table 6-4 provides a summary assessment of the potential risk ranking to environmental receptors due to physical disturbance.

Table 6-4 Physical Disturbance Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Soil	Damage to soil (compaction)	Occasional	II	2	NT Government Landholders

Baseline water conditions	Disturbance to natural drainage patterns	Possible	III	2	NT Government
Native fauna	Disturbance to native fauna Loss of vegetation and habitat	Occasional	II	2	NT Government
Native flora	Loss of vegetation and habitat	Occasional	II	2	NT Government
Culturally sensitive sites	Disturbance to culturally sensitive site	Possible	IV	3	Aboriginal groups
Livestock, pastoral infrastructure and landholders	Disturbance to livestock, pastoral infrastructure and landholders	Occasional	II	2	Landholders

Control Measures

To manage physical disturbance and mitigate potential risks and impacts, the control measures outlined in Table 6-5 will be implemented.

A key control for physical disturbance is in place to prevent the potential for impacts to sites of cultural significance.

The CLC has issued Santos with a CLC SSCC detailing Subject Land, Exclusion Zones, Restricted Work Areas and all conditions. The Santos Cultural Heritage team will implement all details of the SSCC, including providing a Cultural Heritage / Sacred Site assessment to Project Managers, issuing compliance actions to Project Managers, updating GIS with details of Sacred Sites, including conditions and will deliver Cultural Heritage and Sacred Site inductions to relevant personnel.

All machinery operators are required to observe for cultural heritage. Any sites discovered, must be avoided and reported to the Santos Representative onsite who will notify the Santos Cultural Heritage Team.

Table 6-5 Controls to reduce risk and impacts of Physical Disturbance

Activity	Control
Line/Access Track and Campsite Preparation	Disturbance is restricted to areas for which CLC consent has been provided.
	Where possible, existing tracks, roads or seismic lines will be used for access.
	Blade work is kept to a minimum (i.e. operated blade-up) and generally restricted to sand dunes and flood plain crabhole country where excessively rough terrain requires smoothing to allow access.
	Where blade work is required the blade will be kept shallow so as to only disturb minimal topsoil / root-stock and only single blade width will be cleared.
	Grader work is kept to a minimum, graders are mainly used in flood plain crabhole country to smooth the tracks and knock down windrows in sand country.
	Vegetation is removed only when necessary - avoided by weaving lines through vegetated areas.

Activity	Control
	Creek bank vegetation is left intact and detours located if dense.
	Root stock, topsoil and seeds are left on line during line preparation.
	Avoidance of vehicle access on clay pans or salt lakes.
	All personnel are given environmental and cultural heritage inductions prior to commencing work. Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.
	All line preparation machinery operators are required to observe for cultural heritage sites that may have been missed during the Site Clearance process.
	Known sites of sacred or cultural significance are identified, avoided and reported to a Cultural Heritage team member to ensure discoveries are managed in line with the relevant agreement and legislative requirements.
	Any new sites identified during the activity will be reported to the Santos Cultural Heritage Team and avoided.
	Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.
	Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions.
	All gates are left in the condition in which they were found (i.e. open / closed).
	Relevant third party tenement holders shall be notified of activity including preparation of camp sites, preparation of survey lines and undertaking of operations.
	System is in place for logging landholder complaints to ensure that issues are addressed as appropriate.
	Damage to station tracks is avoided.
Line surveying Recording	Unauthorised offline driving is prohibited for all project personnel.
Campsites and associated supply logistics	Campsites are set up, where possible, on sites previously used, or in areas naturally devoid of vegetation and always adjacent to any existing tracks to minimise impact on the terrain between the camp and tracks.
	The number of campsites will be minimised.
	Unauthorised offline driving is prohibited for all project personnel.
Rehabilitation	Any remediation work should be undertaken upon completion of all activities.
	When necessary, all fences are restored to satisfaction of landowner / managers.
	Rehabilitation will consider landholder needs i.e. firebreaks, access tracks etc

Post treatment risk

Given the location of the project and the relatively small and linear nature of disturbance, together with the proposed controls, the potential for physical disturbance is reduced to an acceptable level. With the application of controls described in Table 6-5, the likelihood of potential impacts

is reduced to 'unlikely' and the consequence ranking assigned a 'level 2', resulting in an overall risk ranking of 2 (Table 6-6).

ALARP Discussion

The impacts and risks associated with physical disturbance is considered a decision 'Type A', meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of physical disturbance have been reduced to ALARP.

Statement of acceptability

The residual risk for physical disturbance is 2. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-6 Physical Disturbance Residual Risk Ranking

Receptor	Risk or Impact	Pre-treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Soil	Damage to soil (compaction)	2	Minimise disturbance to and contamination of soil resources	Possible	II	2	Type A	Demonstrated	Y
Baseline water conditions	Disturbance to natural drainage patterns	2	Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources	Unlikely	III	2	Type A	Demonstrated	Y
Native fauna	Disturbance to native fauna Loss of vegetation and habitat	2	Minimise disturbance to native vegetation and native fauna	Possible	II	2	Type A	Demonstrated	Y
Native flora	Loss of vegetation and habitat	2	Minimise disturbance to native vegetation and native fauna	Possible	II	2	Type A	Demonstrated	Y
Culturally sensitive sites	Disturbance to culturally sensitive site	3	Avoid disturbance to sites of cultural, sacred and heritage significance	Unlikely	IV	2	Type A	Demonstrated	Y
livestock, pastoral infrastructure and landholders	Disturbance to livestock, pastoral infrastructure and landholders	2	Minimise disturbance to livestock, pastoral infrastructure and landholders	Possible	II	2	Type A	Demonstrated	Y

6.2.2 Noise

Noise emissions will largely occur from vehicles and vibrator operations during recording. Lower levels of noise will also be generated during the following activities:

- Line/Access Track and Campsite Preparation
- Recording
- Camp sites and associated supply logistics; and
- Rehabilitation

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Noise generating activities will occur within the project area with some equipment including vehicles and camp infrastructure possibly being operated 24 hours a day.

Based upon the receptors identified in Section 5, those known to be impacted by noise are shown in Table 6-7.

Table 6-7 Noise Receptor risks and impacts

Receptor	Potential Impact
Native Fauna	Disturbance to native fauna
Livestock, pastoral infrastructure and landholders	Disturbance to livestock Loss of amenity (Landowners)

Evaluation of Environmental Impacts

The proposed seismic survey and associated activities are expected to last for approximately two months.

Native Fauna

The project activities will generate noise that is likely to cause some level of fauna disturbance.

Native fauna in this region are typical of desert / exposed environments, and are likely to include small, fast moving species of mammal and reptiles. Fauna are likely to be most active during dawn and dusk, when temperatures are lower, with many species adapted to a nocturnal lifestyle. Therefore, potential impacts from noise during the day are not expected to be significant.

Noise from the activities are likely to cause temporary localised terrestrial fauna behaviour changes adjacent to activities and the camp sites. Initially terrestrial fauna may move away from the area but then as they become more accustomed to the low-level noises will likely relocate back to the area. This however will be a localised and short-term impact in any given location as the seismic operation moves along the seismic line.

Livestock

Livestock animals are grazers; larger and slower than native animals and more likely to be motile during the day. It is likely, however, that livestock will be found within the project area, mostly gathered in herds, allowing them to move away from noise disturbance. Any impacts are likely to be localised and behavioural only, and short term as the seismic operation moves along the seismic line.

Settlements

The project area is in a remote location in the vicinity of a number of stations. Santos will have agreements in place with landholders and maintain ongoing communications during operations. Based on previous operational experience in the area, impacts to landowners (reduced amenity) due to noise are unlikely as any noise emissions are localised and short term in nature and are generally remote from any settlements.

In general, the impacts from noise will not be significant. The region has experienced previous noise disturbance for exploration and pastoral activities, and the project area is relatively small and the activities temporary. While this does not present a significant risk or impact, there remains a potential for noise impacts and as such measures are to be taken to prevent and mitigate impacts. The pre-treatment risk ranking is provided in Table 6-8.

Table 6-8 Noise Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native Fauna	Disturbance to fauna	Likely	I	2	NT Government
Livestock, pastoral infrastructure and landholders	Disturbance landholders (loss amenity)	Likely	I	2	Landholders
Livestock, pastoral infrastructure and landholders	Disturbance to livestock	Likely	I	2	Landholders

Control Measures

To manage and mitigate the potential risks and impacts associated with noise emissions, the control measures outlined in Table 6-9 will be implemented.

Table 6-9 Controls to reduce risk and impacts of Noise Emissions

Activity	Control
Line/Access Track and Campsite Preparation	Personnel are given environmental and cultural heritage inductions prior to commencing work.
Line surveying Recording	Relevant landholders and occupiers are consulted with respect to camp and line locations and lines can be moved if landholders raise concerns. Landholders are provided updates on progress throughout the seismic survey.

Post treatment risk

Given the location of the project and the relatively small and linear nature of operations, together with the proposed controls the potential for noise is reduced to an acceptable level.

With the application of controls described in Table 6-9, the likelihood of potential impacts is reduced to 'unlikely' and the consequence ranking assigned a 'level 1', resulting in an overall risk ranking of 1 (Table 6-10).

ALARP Discussion

The impacts and risks associated with noise is considered a decision 'Type A', meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of noise have been reduced to ALARP.

Statement of acceptability

The residual risk for noise is 1. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-10 Noise Residual Risk Ranking

Receptor	Risk or Impact	Pre-treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Fauna	Disturbance to fauna	2	Minimise disturbance to native vegetation and fauna	Possible	I	1	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance landholders (loss amenity)	2	Minimise disturbance to landholders	Possible	I	1	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance landholders (livestock)	2	Minimise disturbance to livestock	Possible	I	1	Type A	Demonstrated	Y

6.2.3 Erosion

Erosion may occur following disturbance to soil associated with the following activities:

- Line/Access Track and Campsite Preparation
- Recording
- Camp sites and associated supply logistics

While the area of potential erosion is difficult to predict, the area of disturbance is shown on Figure 4-1.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

The landscape of northern and central Australia is ancient and highly weathered and the soil types are prone to severe erosion. Soil erosion can not only disrupt the progress of the activity and add maintenance costs, but can remove fertile surface soils impacting on flora and crops, and cause damage to pastoral infrastructure and environmentally and culturally sensitive sites.

Based upon the receptors identified in Section 5, those known to be impacted by erosion are shown in Table 6-11.

Table 6-11 Erosion Receptor risks and impacts

Receptor	Potential Impact
Soils	Soil erosion due to ground disturbance
Baseline water conditions	Increased runoff Increased sediment loads Disturbance to natural drainage patterns
Native flora	Direct loss of vegetation
Culturally sensitive sites	Disturbance to culturally sensitive sites
Livestock, pastoral infrastructure and landholders	Disturbance to landholders

Evaluation of Environmental Impacts

Soils

The soils of central Australia are susceptible to erosion given that the region experiences long dry periods followed by intense rains. In this environment, the soils become disturbed and once disturbed can be easily eroded.

The soil systems in the project area vary, however the majority of the region is described as desert dunefields which are made up predominately of red sands. When disturbed, even a small amount of water can cause erosion, with substantial volumes of soil potentially being lost. This can result in increasing sediment loads and in a localised loss of vegetation and habitat, as well as a potential for disturbance to culturally sensitive sites and landholders should such areas be within the area impacted by the potential erosion.

Baseline water conditions

Ground disturbance associated with the project has the potential to result in increased runoff, increased sediment loads and the disturbance of natural drainage patterns.

All surface waters near the project area including rivers, streams and drainage lines are ephemeral and subject to short flow duration and high turbidity. Given the lack of permanent surface waters and turbid nature of surface waters during times of flood, impacts to surface waters as a result of erosion is not likely to be significant, however the surface water flows may promote increased erosion, adding to the sediment load of already turbid waters.

Native Flora

Erosion has the potential to result in the loss of important top soils, and direct loss of vegetation and habitat. The area of disturbance is however relatively small, and the project area will avoid areas close to sensitive vegetation and habitat. Impacts are therefore not likely to be significant.

Culturally sensitive sites

Culturally sensitive sites will be avoided by the survey. However, impacts from erosion can result offsite of the project area if unmanaged and there is therefore a potential for impacts to culturally sensitive sites in adjacent areas. Given however that the disturbance is over a relatively small area and the activity will be managed to reduce erosion risk, this is a very unlikely scenario.

Livestock, pastoral infrastructure and landholders As with the cultural sites, there is the potential that impacts of erosion could occur offsite of the project area if unmanaged. Landholders roads and other infrastructure (e.g. fencing) could be at risk from erosion due to project activities. Given however that the disturbance is over a relatively small area and the activity will be managed to reduce erosion risk, it is unlikely to result in significant impact.

The region has experienced previous disturbance from exploration and pastoral activities. The maximum area of linear disturbance for this activity has been estimated as 2 km², the extent of disturbance being relatively small and within an area for which CLC clearance will have been obtained. While this does not present a significant risk or impact, there remains a potential for erosion and as such measures are to be taken to prevent and mitigate impacts. The pre-treatment risk ranking is provided in Table 6-12

Table 6-12 Erosion pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Soil	Soil erosion due to ground disturbance	Occasional	III	3	NT Government Landholders
Baseline water conditions	Increased runoff and erosion	Occasional	III	3	NT Government
	Increased sediment loads	Possible	III	2	NT Government
	Disturbance to natural drainage patterns	Unlikely	III	2	Landholders
Native flora	Direct loss of vegetation	Occasional	III	3	NT Government

Cultural heritage	Disturbance to culturally sensitive sites	Unlikely	III	2	Aboriginal groups
Livestock, pastoral infrastructure and landholders	Disturbance to landholders	Possible	III	2	Landholders

Control Measures

To prevent soil erosion and mitigate the potential risks and impacts the control measures outlined in Table 6-13 will be implemented.

As a key control, an erosion and sediment control plan (ESCP) will be developed. This plan will consider the applicable types of erosion observed. This may include:

- rill
- sheet
- gully
- stream bank and bed erosion
- tunnel and wind erosion.

Each type of erosion may require differing management methods (DLRM 2017). An effective erosion control program requires planning and controlled implementation for the types of erosion predicted and observed as a result of the activity. The use of ESCPs is recommended to set out erosion and sediment control methods, strategies and works appropriate to specific land use and developments.

An ESCP will be developed to support the project activity during the pre-execution planning of activity at the time the disturbance is identified, and then updated to reflect the actual outcomes during implementation. The ESCP will include details of proposed earthworks, structures, methods and treatments for the activity. It will follow guidance material provided by the Department of Land Resource Management. Content will include:

- **Timing and staging** - To limit the extent and duration of soil exposure, development is staged so that land disturbance is confined to areas of manageable size.
- **Vegetation management** - Project will be planned for minimum disturbance to retain or preserve as much of the existing vegetation as possible, especially adjacent to drainage lines.
- **Surface water drainage control** – works will be undertaken to control the potential volume and velocity of surface water flows, and to limit the formation of concentrated flows.
- **Sediment control** – works will be planned to intercept and/or retain sediment to prevent it spreading into waterways, wetlands or neighbouring properties.
- **Revegetation and rehabilitation** – details of the rehabilitation for the disturbed sites will be provided.

The ESCP will be developed to be usable in the field as an instruction manual for personnel, providing clear directions and quick reference to methodology or standard drawings of erosion and sediment control structures.

Table 6-13 Controls to reduce risk and impacts of Erosion

Activity	Control
Line/Access Track and Campsite Preparation	Disturbance is restricted to areas for which CLC consent has been provided.
	Where possible, existing tracks, roads or seismic lines will be used for access.
	Blade work is kept to a minimum and generally restricted to sand dunes and flood plain crabhole country where excessively rough terrain requires smoothing to allow access.
	Grader work is kept to a minimum, graders are mainly used in flood plain crabhole country to smooth the tracks and knock down windrows in sand country.
	Due to the instability and erosion potential when disturbed, the steeper slopes and escarpments of tableland land systems are avoided.
	Creek bank vegetation is left intact and detours sought if too dense to pass through.
	All windrows are removed either during or on completion of work.
	Unavoidable compaction in areas other than those susceptible to erosion, will be ripped on completion of work.
	Any remediation work should be undertaken upon completion of all activities.
Recording	Unauthorised offline driving is prohibited for all project personnel.
	Operations are shut down during wet weather or flooding and only restarted once potential for extensive damage has passed.
	Following shut down due to flooding or inundation the risk assessment will be revisited to ensure controls are still appropriate to manage risk to ALARP.
Campsites and associated supply logistics	Campsites are set up, where possible, on sites previously used, or in areas naturally devoid of vegetation and always adjacent to any existing tracks to minimise impact on the terrain between the camp and tracks.
	The number of campsites will be minimised.
	Camp sites are ripped on completion of activity.

Post treatment risk

Given the relatively small area of disturbance, and with the application of controls described in Table 6-13 (including rehabilitation), the likelihood level of potential impacts is reduced to 'unlikely' and the consequence ranking assigned a 'level 2', resulting in an overall risk ranking of 2.

ALARP Discussion

The impacts and risks associated with erosion is considered a decision 'Type A', meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of erosion have been reduced to ALARP.

Statement of acceptability

The residual risk for erosion is 2. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-14 Erosion Residual Risk Ranking

Receptor	Risk or Impact	Pre-treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native flora	Smothering of undisturbed vegetation	3	Minimise disturbance to native vegetation and fauna	Possible	II	2	Type A	Demonstrated	Y
Baseline water conditions	Increased runoff	3	Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources	Unlikely	II	2	Type A	Demonstrated	Y
	Increased sediment loads	2		Unlikely	II	2	Type A	Demonstrated	Y
	Disturbance to natural drainage patterns	2		Unlikely	II	2	Type A	Demonstrated	Y
Native Flora	Direct loss of vegetation	3	Minimise disturbance to native vegetation and native fauna	Possible	II	2	Type A	Demonstrated	Y
Cultural heritage	Disturbance to culturally sensitive sites	2	Avoid disturbance to sites of cultural, sacred and heritage significance	Unlikely	III	2	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance to landholders	2	Minimise disturbance to livestock, pastoral infrastructure and landholders	Unlikely	II	2	Type A	Demonstrated	Y

6.2.4 Dust

Dust will largely occur from vehicles and vibrator operations, but also associated with the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics; and
- Rehabilitation

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Dust generation may occur within the project area and be most notable in drier periods. Based upon the receptors identified in **Section 5**, those known to be sensitive to dust are identified in Table 6-15.

Table 6-15 Dust Receptor risks and impacts

Receptor	Potential Impact
Native Flora	Smothering of undisturbed vegetation
Livestock, pastoral infrastructure and landholders	Landholders (Loss of amenity) Landholders (health)

Evaluation of Environmental Impacts

Native Flora

Dust generated by vehicle movements will initially be airborne; however, particles will quickly settle where they have the potential to decrease vegetation growth by smothering leaves and blocking stomata.

The composition of dust particles is dependent on the nature of the source material. Surface sediments and top soil is fairly homogenous within the project area; therefore, negligible variation is expected in the dust generated between different parts of the site.

Dust generation, and settling, will be temporary in any given location as the seismic operation moves along the seismic line. Any dust generated is expected to quickly disperse. Sensitivity to temporarily elevated dust levels is expected to be low given the limited timeframe and extent of exposure which would be less than would occur in a dust storm under dry, windy conditions, or adjacent a dirt road with regular vehicular traffic. .

Landholders

Landholders may be impacted by dust generation in several ways:

- Health impacts
- Amenity reduced

Dust is generated naturally throughout the region, due to the low levels of rainfall and the fine sediment particle size. It is expected, therefore, that sensitivity to dust from landholders would

be low. In addition, the area is remote, and the likelihood for dust to cause a nuisance to landholders is low.

In general the impacts from dust will not be significant. The region has experienced previous dust generation for exploration and pastoral activities, the project area is remote and the activities temporary. While dust does not present a significant risk or impact, there remains a potential for impacts and as such measures are to be taken to prevent and mitigate impacts. The pre-treatment risk ranking is provided in Table 6-16.

Table 6-16 Dust Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native Flora	Smothering of undisturbed vegetation	Likely	II	3	NT Government
Livestock, pastoral infrastructure and landholders	Loss of amenity	Possible	II	2	Landholders
	Landholders (health) / Health impacts to livestock	Possible	III	3	Landholders

Control Measures

To prevent soil erosion and mitigate the potential risks and impacts, the following control measures will be implemented:

Table 6-17 Controls to reduce risk and impacts of Erosion

Activity	Control
Line/Access Track and Campsite Preparation	Blade work is banned on naturally smooth surfaces or flat easy terrain. Minimal blade work is permitted elsewhere for access
	Where possible, existing tracks, roads or seismic lines will be used for access.
Line surveying Recording	Off line driving for the main crew is prohibited – no bush bashing or short cuts are permitted.
Campsites and associated supply logistics	Camp sites are positioned close to existing roads where possible and are ripped, if necessary, on completion of work.
	Off line driving for the main crew is prohibited – no bush bashing or short cuts are permitted.
	Speeds on unsealed roads will be limited – max 80 km/hr on unsealed roads, 40 km/hr on seismic lines.
Rehabilitation	Any remediation work should be undertaken upon completion of all activities.

Post treatment risk

Given the relatively small area of operations at any given period of time and with the application of controls described in Table 6-17, the likelihood level of potential impacts from dust is reduced to ‘possible’ and the consequence ranking assigned a ‘level 3’, resulting in an overall risk ranking of 2.

ALARP Discussion

The impacts and risks associated with dust is considered a decision 'Type A', meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of dust have been reduced to ALARP.

Statement of acceptability

The residual risk for dust is 2. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-18 Residual Risk Ranking

Receptor	Risk or Impact	Pre-treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native flora	Smothering of undisturbed vegetation	3	Minimise disturbance to native vegetation and fauna	Possible	II	2	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Landholders (Loss of amenity)	2	Minimise the visual impact of seismic operations	Possible	II	2	Type A	Demonstrated	Y
	Landholders (health) / Health impacts to livestock	3	Minimise disturbance to livestock, pastoral infrastructure and landholders	Unlikely	III	2	Type A	Demonstrated	Y

6.2.5 Waste

Waste will be generated largely from camp sites and associated supply logistics, but also from the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying; and
- Camp sites and associated supply logistics

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Wastewater from laundry, showers and kitchen is piped to an irrigation area outside the camp. Sewage management practices at all camps consist of the use of port-a-loos and grey water capture and disposal to a ground pit with the aim to minimise any risks to human health or the environment.

Wastepaper, cardboard and food scraps are disposed of into sealed bins set up adjacent to the camp area. The sealed bins are transported regularly for waste disposal at a licensed landfill. Recyclable materials, including tyres, are segregated on camp and regularly transported to a licensed waste depot in Alice Springs.

Based upon the receptors identified in Section 5, those known to be sensitive to waste, and the potential impacts to consider are detailed in Table 6-19.

Table 6-19 Waste Receptor risks and impacts

Receptor	Potential Impact
Native fauna	Disturbance, injury or death native fauna.
Native flora	Loss of vegetation and habitat
Soil	Degradation of soil quality
Water courses	Contamination of groundwater and / or watercourses.
Environmentally sensitive sites	Contamination of soil
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock. Loss of organic beef or cattle care certification

Evaluation of Environmental Impacts

The majority of waste management is centred around camp sites where it can be effectively managed on a day to day basis in accordance with land access agreements. While waste does not present a significant risk or impact, there remains a potential for impacts and as such measures are to be taken to prevent and mitigate impacts. The pre-treatment risk ranking is provided in Table 6-20.

Table 6-20 Waste Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native fauna	Disturbance, injury or death native fauna.	Occasional	III	2	NT Government
Native flora	Loss of vegetation and habitat	Occasional	III	3	Landholders NT Government
Soil	Degradation of soil quality	Occasional	III	3	Landholders NT Government
Water courses	Contamination of groundwater and / or watercourses.	Occasional	III	3	Landholders NT Government
Environmentally sensitive sites	Contamination of soil	Possible	II	2	NT Government
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock. Loss of organic beef or cattle care certification	Possible	IV	3	Landholders

Control Measures

To manage waste generation and handling, and mitigate the potential risks and impacts, the following control measures will be implemented:

Table 6-21 Controls to reduce risk and impacts of Erosion

Activity	Control
Line/Access Track and Campsite Preparation	Personnel are given environmental and cultural heritage inductions prior to commencing work.
Line surveying Recording	All empty drums will be stored on impervious areas with their closures in place, or transported immediately off-site.
	All generated waste (including consumable rubbish such as lunch wrappers) shall be returned to the camp and placed in the appropriately waste receptacle.
	All loads of rubbish are covered during transport.
Campsites and associated supply logistics	Covered bins are provided for the collection and storage of wastes.
	No incineration or open burning of waste materials shall occur on-site.
	No liquid wastes will be released accidentally or routinely discharged to surface waters.
	Wastes shall be removed from camp and disposed of at an approved facility.
	Wastewater from laundry, showers and kitchen is piped to an irrigation area outside the camp.

Activity	Control
	Wastepaper, cardboard and food scraps are disposed of into sealed bins set up adjacent to the camp area. The sealed bins are transported regularly for waste disposal at a licensed landfill. Recyclable materials are segregated on camp and regularly transported to a licensed waste depot in Alice Springs.
	Unusable tyres are returned to Alice Springs for recycling.

Post treatment risk

Given the relatively limited amount of waste material likely to be generated, and with the application of controls described in Table 6-21, the likelihood level of potential impacts from waste is reduced to ‘unlikely’ and the consequence ranking assigned a ‘level 2’, resulting in an overall risk ranking of 2.

ALARP Discussion

The impacts and risks associated with waste is considered a decision ‘Type A’, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of waste have been reduced to ALARP.

Statement of acceptability

The residual risk for waste is 2. Using Santos’ model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated

Table 6-22 Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native fauna	Disturbance, injury or death native fauna.	2	Minimise disturbance to native vegetation and fauna	Unlikely	II	1	Type A	Demonstrated	Y
Native flora	Loss of vegetation and habitat	3	Minimise disturbance to native vegetation and fauna	Unlikely	III	2	Type A	Demonstrated	Y
Soil	Degradation of soil quality	3	Minimise negative impacts to soil quality	Unlikely	III	2	Type A	Demonstrated	Y
Water courses	Contamination of groundwater and / or watercourses.	3	Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources	Unlikely	III	2	Type A	Demonstrated	Y
Environmentally sensitive sites	Contamination of soil	2	Minimise disturbance to environmentally sensitive sites	Unlikely	III	2	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock. Loss of organic beef or cattle care certification	3	Minimise disturbance to livestock, pastoral infrastructure and landholders	Unlikely	IV	2	Type A	Demonstrated	Y

6.2.6 Light emissions

Light emissions of all campsites, as well as the use of headlights during driving, are required for security and safe working. Lighting for both camping and on vehicle routes will be required for the entire duration.

Light emissions will be generated largely from camp sites and associated supply logistics, but also from the following activities:

- Line/Access Track and Campsite Preparation Line surveying
- Recording
- Camp sites and associated supply logistics; and
- Rehabilitation

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Light emissions may potentially result in impacts within the project area.

Based upon the receptors identified in Section 5, those known to be sensitive to light emissions, and the potential impacts to consider are detailed in Table 6-23.

Table 6-23 Receptor risks and impacts

Receptor	Potential Impact
Native Fauna	Disturbance to native fauna
Livestock, pastoral infrastructure and landholders	Disturbance to livestock Loss of amenity

Evaluation of Environmental Impacts

Fauna

The behaviour and movement of terrestrial fauna may be affected by anthropogenic light emissions from the project.

Light emissions will attract insects and terrestrial fauna that feed on insects and may temporarily alter feeding habits. Increased concentrations of terrestrial fauna around the project area may also have secondary impacts such as increased incidence of road-kill. Refer to Section 6.3 for further details on unplanned events such as collisions between vehicles and fauna.

Livestock

Similarly to native fauna, livestock are sensitive to light emissions. Sensitivity is reduced, however, as livestock species are likely to be cattle or similar, which are less affected by the effects of light such as through increased predation.

In general the impacts from light emissions will not be significant. The region has experienced previous light emissions from exploration and pastoral activities, the project area is relatively small and the activities temporary. While light does not present a significant risk or impact, there remains a potential for impacts and as such measures are to be taken to prevent and mitigate impacts. The pre-treatment risk ranking is provided in Table 6-24.

Table 6-24 Light Emissions Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native Fauna	Disturbance to native fauna	Likely	I	2	NT Government
Livestock, pastoral infrastructure and landholders	Disturbance to livestock Loss of amenity (Landowners)	Occasional	I	1	Landholders

Control Measures

To manage potential impacts and risks associated with light emissions, the control measures in Table 6-25 will be implemented.

Table 6-25 Controls to reduce risk and impacts of light emissions

Activity	Control
Line/Access Track and Campsite Preparation	Lights to be directed towards the ground
Line surveying Recording	As above
Campsites and associated supply logistics	Relevant landowners and occupiers are consulted with respect to camp and line locations and camps can be moved if landholders raise concerns. All boundary lighting will be positioned to face inwards to provide adequate lighting for safe operations, without excessive overspill.

Post treatment risk

Given the location of the project and the relatively small area of disturbance, together with the proposed controls the potential for light impacts is reduced to an acceptable level.

With the application of controls described in Table 6-25, the likelihood level of potential impacts remains 'possible' and the consequence ranking assigned a 'level 1', resulting in an overall risk ranking of 1.

ALARP Discussion

The impacts and risks associated with light emissions is considered a decision 'Type A', meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of light emissions have been reduced to ALARP.

Statement of acceptability

The residual risk for light emissions is 1. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-26 Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native Fauna	Disturbance to native fauna	2	Minimise disturbance to native vegetation and fauna	Possible	I	1	Type A	Demonstrated	Y
Settlements - Pastoral properties	Disturbance to livestock Loss of amenity (Landowners)	1	Minimise disturbance to livestock, pastoral infrastructure and landholders	Possible	I	1	Type A	Demonstrated	Y

6.2.7 Resource Consumption

Resources will be consumed largely at the Camp sites and associated supply logistics, but also during;

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics; and
- Rehabilitation

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Most resource consumption will be related to energy needs and domestic needs including waste processing. Potable water is planned to be sourced from Alice Springs. If suitable existing ground water can be located closer to the crew locations (with the appropriate agreements in place), some of the usage may be sourced locally. The area that might be affected is dependent on this outcome.

Based upon the receptors identified in Section 5, those known to be sensitive to resource consumption, and the potential impacts to consider are detailed in Table 6-27.

Table 6-27 Receptor risks and impacts

Receptor	Potential Impact
Native fauna	Disturbance, injury or death to native fauna
Natural water resources	Depletion of groundwater and / or watercourses.
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock

Evaluation of Environmental Impacts

Santos plans to source water from Alice Springs, where abundant water supply is located. If local water resources are identified, these may be used to supplement the water from Alice Springs, within the bounds of appropriate agreements with landholders / local pastoralists. If this eventuates bore numbers and approximate extraction volumes will be provided to DPIR.

Santos estimates water usage for the line preparation crew would be approximately 2,240 litres per day, and recording crew usage of approximately 5,120 litres per day. As the quantities required are small, and the period over which extraction will occur is short term, receptors are unlikely to experience any changes to their existing water supply.

While resource consumption does not present a significant risk or impact, there remains a potential for impacts and as such measures are to be taken to prevent and mitigate impacts. The pre-treatment risk ranking is provided in Table 6-28.

Table 6-28 Resource Consumption Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native fauna	Disturbance, injury or death to native fauna	Occasional	II	2	NT Government
Baseline water resources	Depletion of groundwater and / or watercourses.	Occasional	II	2	NT Government
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock	Possible	II	2	Landholders

Control Measures

To prevent the potential risks and impacts from resource consumption, the following control measures will be implemented:

Table 6-29 Controls to reduce risk and impacts of resource consumption

Activity	Control
Line/Access Track and Campsite Preparation	Personnel are given environmental inductions prior to commencing work.
Line surveying Recording	Appropriate agreements will be in place with landowners / pastoralists for local water sources If local water resources are to be used, bore numbers and estimated extraction volumes will be provided to DPIR.

Post treatment risk

With the proposed controls the potential for impacts from resource consumption remains at an acceptable level.

With the application of controls described in Table 6-29, the likelihood level of potential impacts remains ‘unlikely’ and the consequence ranking assigned a ‘level 2’, resulting in an overall risk ranking of 1 (Table 6-30 Residual Risk Ranking).

ALARP Discussion

The impacts and risks associated with resource consumption is considered a decision ‘Type A’, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of resource consumption have been reduced to ALARP.

Statement of acceptability

The residual risk for resource consumption is 1. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-30 Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native fauna	Disturbance, injury or death to native fauna	2	Minimise disturbance to native vegetation and fauna	Unlikely	II	1	Type A	Demonstrated	Y
Baseline water resources	Depletion of groundwater and / or watercourses.	2	Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources	Unlikely	II	1	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock	2	Minimise disturbance to livestock, pastoral infrastructure and landholders	Unlikely	II	1	Type A	Demonstrated	Y

6.3 Unplanned

6.3.1 Contamination (spills and leaks)

Small spills and / or leaks leading to contamination may occur from the following activities:

- Line/Access Track and Campsite Preparation
- Recording
- Camp sites and associated supply logistics
- Rehabilitation

The area that may be affected by contamination (spills and leaks) would be anywhere where spills and leaks may occur, although such events are more likely in campsites and where vehicles are in use. For this EMP, this will be limited to the project area described in Section 4.2.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Based upon the receptors identified in Section 5, those known to be sensitive to contamination (spills and leaks) are summarised in Table 6-31.

Table 6-31 Contamination (Spills and Leaks) Receptor risks and impacts

Receptor	Potential Impact
Soil	Degradation of soil quality
Baseline water conditions	Changes to water quality
Native fauna	Disturbance, injury or death native fauna.
Native flora	Loss of vegetation and habitat
Livestock, pastoral infrastructure and landholders	Loss of organic certification

Evaluation of Environmental Impacts

The proposed seismic survey and associated activities are expected to last for approximately two months. During this time, there is the potential for leaks and spills of stored materials including hydrocarbons and wastes within the project area. Spills or leaks outside of bunded areas would likely be lost to ground, especially on highly permeable sand, although a component of high volatility fuels such as diesel will effectively evaporate at the prevailing temperatures.

The risk of spills is present at camp sites and where vehicles are operating. The scale of a potential spill is limited by the quantity of fuel and other material stored and used as part of the activity. Other than bulk fuel storage within a road tanker, other potential sources of spills are limited to smaller storage vessels such as drums or IBCs, or from mechanical failures such as oil leaks or blown hydraulic hoses.

Leaks and spills could potentially result in a loss of soil and water quality, and subsequent risk to livestock, flora and fauna habitat, and public health.

Soil

Soil types within the project area are mostly sandy, with high levels of permeability. For smaller spills and leaks contamination is likely to be contained within the surface soils and would be readily removed or remediated. If a larger spill were to occur, such as that from a bulk tanker, there is the potential that product could infiltrate soils to depth and potentially reach groundwater.

Baseline water conditions

Water resources in the area can be characterised as either surface waters or ground water. Spills to surface waters such as ephemeral water courses and creeks have the potential to degrade water quality and potentially impact native fauna or stock that access the water. Small spills to surface waters would rapidly dilute, however larger spills have the potential to spread with the flow of water and cause impacts further from the source.

Large spills to land have the potential to reach the water table and cause groundwater contamination. Groundwater contamination may impact on the beneficial uses of the groundwater resource which could include stock watering or human consumption.

Table 6-32 provides a summary assessment of the potential risk ranking to environmental receptors due to contamination (spills and leaks).

Table 6-32 Contamination Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Soil	Degradation of soil quality	Occasional	II	2	NT Government Landholders
Baseline water conditions	Changes to water quality	Possible	IV	3	Landholders Aboriginal groups
Native fauna	Disturbance, injury or death native fauna.	Occasional	III	2	NT Government
Native flora	Loss of vegetation and habitat	Occasional	III	3	Landholders NT Government
Livestock, pastoral infrastructure and landholders	Loss of organic certification	Unlikely	IV	2	Landholders

Control Measures

To prevent contamination (spills and leaks) and mitigate the potential risks and impacts, the control measures outlined in Table 6-33 will be implemented.

Table 6-33 Controls to reduce risk and impacts of Contamination (spills and leaks)

Activity	Control
Campsites and associated supply logistics	Fuel storage is in accordance with dangerous goods regulations.
	Spill kits available to treat spills in situ
	All fuel stored and used should be under the control of qualified or trained personnel.
	Minimise fuel transfer where possible
	Use of road tanker for bulk fuel storage
	Use of drip trays for transfers.
	Any spills contained and retrieved.
	Any spills will be remediated to the satisfaction of the landholder, fenced, soil removed to appropriate facility and signed off by land holder in accordance with the access
	Fuel and other lubricants will be appropriately stored and managed, in accordance with AS1940.

Post treatment risk

Given the limited quantities of fuels and chemicals being used, the controlled location of their use and together with the proposed controls, the potential for contamination (spills and leaks) to occur is reduced to an acceptable level. With the application of controls described in Table 6-33, the likelihood level of potential impacts is reduced to ‘unlikely’ and the consequence ranking assigned a ‘level 3’, resulting in an overall risk ranking of 2.

ALARP discussion

The impacts and risks associated with contamination (spills and leaks) are considered to be a decision Type A, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of contamination (spills and leaks) have been reduced to ALARP.

Statement of acceptability

The residual risk for contamination resulting from contamination (spills and leaks) is 2. Using Santos’ model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-34 Contamination Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Soil	Degradation of soil quality	2	Minimise negative impacts to soil quality	Unlikely	II	1	Type A	Demonstrated	Y
Baseline water conditions	Changes to water quality	3	Minimise changes to groundwater quality	Unlikely	III	2	Type A	Demonstrated	Y
Native fauna	Disturbance, injury or death native fauna.	2	Minimise disturbance to native vegetation and fauna	Unlikely	II	1	Type A	Demonstrated	Y
Native flora	Loss of vegetation and habitat	3	Minimise disturbance to native vegetation and fauna	Unlikely	III	2	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Loss of organic certification	2	Minimise disturbance to livestock, pastoral infrastructure and landholders	Unlikely	III	2	Type A	Demonstrated	Y

6.3.2 Vehicle Collision with Fauna / Livestock

Vehicle collision with fauna / livestock may occur from the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics
- Rehabilitation

The area where vehicle collision may occur could be anywhere vehicles are required to access as a part of the activity. For this EMP, this will be limited to the project area described in Section 4.2.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Based upon the receptors identified in **Section 5**, those known to be potentially impacted by vehicle collision with native fauna / livestock are detailed in Table 6-35.

Table 6-35 Vehicle Collision with Fauna/Livestock Receptor risks and impacts

Receptor	Potential Impact
Native fauna	Disturbance, injury or death to native fauna
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock

Evaluation of Environmental Impacts

The proposed seismic survey and associated activities are expected to last for approximately two months. Vehicle collision with fauna / livestock could occur as vehicles move across the project area. However, the entire area will not be vulnerable for the period. Rather, the potential for impact will move with the project activities. As with any vehicle / animal interaction there is the risk of injury or death to native fauna and livestock on an individual (i.e. not population) scale.

Native Fauna

Native fauna is typical of desert / exposed environments, and likely to include small, fast moving species of mammal and reptile. Fauna are likely to be most active during dawn and dusk, when temperatures are lower, with many species adapted to a nocturnal lifestyle; therefore, will not be sensitive to the potential impacts associated with increased vehicle traffic mostly during daylight hours.

Livestock

In comparison to native fauna, livestock are more sensitive to vehicle collision. Livestock animals are likely to be grazers; larger and slower than native animals and more likely to be motile during the day. It is likely, however, that livestock will be found in prescribed areas of the project area, mostly gathered in herds, allowing drivers to be fully aware of their presence long before potential for a collision is realised. Vehicles will also be restricted to defined routes / locations, and generally low levels of traffic are expected.

Table 6-36 provides a summary assessment of the potential risk ranking to environmental receptors due to Vehicle collision with fauna / livestock.

Table 6-36 Vehicle Collision with Fauna/Livestock Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native fauna	Disturbance, injury or death to native fauna	Occasional	II	2	NT Government
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock	Likely	II	3	Landholders Aboriginal groups

Control Measures

To prevent vehicle collision with native fauna or livestock and mitigate the potential risks and impacts the control measures outlined in Table 6-37 will be implemented.

Table 6-37 Controls to reduce risk and impacts of Vehicle Collision with Fauna / Livestock

Activity	Control
ALL	Off line driving is banned – no bush bashing or short cuts are permitted.
	Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.
	All gates are left in the condition in which they were found (i.e. open / closed).
	When necessary, all fences are restored to satisfaction of landowner / managers.
	Speed will be limited along lines to 40km/hr and 80km/hr on other unsealed roads.
	All vehicle routes have speed limits set which must be adhered to.

Post treatment risk

Given the generally slow-moving nature of the operations, together with the proposed controls, the potential for vehicle collision with native fauna / livestock is reduced to an acceptable level. With the application of controls described in Table 6-37, the likelihood level of potential impacts is reduced to ‘unlikely’ and the consequence ranking assigned a ‘level 1’, resulting in an overall risk ranking of 1.

ALARP discussion

The impacts and risks associated with vehicle collision with native fauna / livestock are considered to be a decision Type A, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts from vehicle collision with native fauna / livestock have been reduced to ALARP.

Statement of acceptability

The residual risk for vehicle collision with native fauna / livestock is 1. Using Santos' model for acceptance, this is considered to be acceptable and it is assumed that ALARP has been achieved.

Table 6-38 Vehicle Collision with Fauna/Livestock Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native fauna	Disturbance, injury or death to native fauna	2	Minimise disturbance to native fauna	Unlikely	I	1	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock	3	Minimise disturbance to livestock, pastoral infrastructure and landholders	Unlikely	I	1	Type A	Demonstrated	Y

6.3.3 Disturbance to stakeholders

Disturbance to stakeholders may occur from the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics
- Rehabilitation

The area where disturbance to stakeholders may occur could be anywhere vehicles are required to access as a part of the activity. For this EMP, this will be limited to the project area described in Section 4.2.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Based upon the receptors identified in **Section 5**, those known to be potentially impacted by disturbance to stakeholders are summarised in Table 6-39.

Table 6-39 Receptor risks and impacts

Receptor	Potential Impact
Livestock, pastoral infrastructure and landholders	Unplanned interaction with or disturbance to other land users
Petroleum / infrastructure	Unplanned interaction with or disturbance to other land users

Evaluation of Environmental Impacts

The proposed seismic survey and associated activities are expected to last for approximately two months. There is potential for unplanned interactions to result in disturbance to stakeholders, including landowners and petroleum operators. The most likely scenario will involve unplanned vehicle movements, therefore although there is potential for impacts across the whole project area, the potential for impact will likely move with the project activities underway at the time.

Landholder / infrastructure

Unplanned interactions with / disturbance to landholders or landholders' infrastructure could occur during vehicle movement within the project area, such as disturbance to a road/track, damage to signage, damage to fencing or other infrastructure. The presence of the project activity in the area could also result in unplanned disturbance such as temporary exclusion from land areas or increases in vehicle traffic. Any disturbance / interaction would be temporary and short-lived.

All planned impacts, such as those involving physical presence of the operations, and discussed in Section 6.2.1

Petroleum / infrastructure

As with landholder / infrastructure described above, the same scenarios are possible with other petroleum operators / infrastructure. Any disturbance / interaction would be temporary and short-lived.

Table 6-40 provides a summary assessment of the potential risk ranking to environmental receptors due to disturbance to stakeholders.

Table 6-40 Disturbance to Stakeholders Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Livestock, pastoral infrastructure and landholders (including Power and Water Corp)	Unplanned interaction with or disturbance to other land users	Likely	II	3	Landholders
Petroleum / infrastructure	Unplanned interaction with or disturbance to other land users	Occasional	II	2	Petroleum Operators

Control Measures

To prevent disturbance to stakeholders and mitigate the potential risks and impacts the control measures outlined in Table 6-41 will be implemented.

Table 6-41 Controls to reduce risk and impacts of Disturbance to stakeholders

Activity	Control
Line and access track preparation	Dozers are walked with blade up wherever possible.
	Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.
	Relevant mineral and geothermal tenement holders shall be notified of activity including preparation of camp sites, preparation of survey lines and undertaking of operations.
	Damage to station tracks is avoided.
	All vehicle routes have speed limits set which must be adhered to.
	Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.
Line surveying	All litter is to be managed and disposed of correctly.
	Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions.
	System is in place for logging landholder complaints to ensure that issues are addressed as appropriate
	All gates are left in the condition in which they were found (i.e. open / closed).
	When necessary, all fences are restored to satisfaction of landowner / managers.
Recording	Seismic sources are not to operate within the distance defined by Santos standards, of any pipeline, utility, installation or building.
Campsites	No camps to be established less than 1km from PWC groundwater bores.

Post treatment risk

Given the location of the project and the relatively small area of disturbance, together with the proposed controls, the potential for disturbance to stakeholders is reduced to an acceptable level. With the application of controls described in Table 6-41, the likelihood level of potential impacts is reduced to 'unlikely' and the consequence ranking assigned a 'level 2', resulting in an overall risk ranking of 1 (Table 6-42).

ALARP discussion

The impacts and risks associated with disturbance to stakeholders are considered to be a decision Type A, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of disturbance to stakeholders have been reduced to ALARP.

Statement of acceptability

The residual risk for disturbance to stakeholders is 1. Using Santos' model for acceptance, this is considered to be acceptable and it is assumed that ALARP has been achieved.

Table 6-42 Disturbance to Stakeholders Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Livestock, pastoral infrastructure and landholders	Unplanned interaction with or disturbance to other land users	3	No unplanned interactions or disturbance to landholders	Unlikely	II	1	Type A	Demonstrated	Y
Petroleum / infrastructure	Unplanned interaction with or disturbance to other land users	2	No unplanned interactions or disturbance to petroleum operators	Unlikely	II	1	Type A	Demonstrated	Y

6.3.4 Introduced Pest and Pathogens

Pests and pathogens may be introduced from the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics
- Rehabilitation

The area where introduced pest and pathogens may occur could be anywhere within the project area where vehicles are required to access as a part of the activity. The key risk sits with the line preparation crew who are the first vehicles to traverse the line and select the most appropriate alignment. Once the lines have been prepared, the following vehicles associated with the recording and restoration will simply follow the line, so the risk is lower because stands of weeds would have been avoided, or management measures put in place to washdown.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Based upon the receptors identified in **Section 5**, those known to be potentially impacted by introduced pest and pathogens are summarised in Table 6-43.

Table 6-43 Introduced Pest and Pathogens Receptor risks and impacts

Receptor	Potential Impact
Native flora	Introduction and or spread of weeds, pest plants, animals and pathogens.
Native fauna	Introduction and or spread of weeds, pest plants, animals and pathogens.
Soil	Introduction or spread of pathogens.
Livestock, pastoral infrastructure and landholders	Disturbance to Livestock Loss of organic beef or cattle care certification

Evaluation of Environmental Impacts

Weeds are an increasing threat to the region's natural, cultural and economic assets (DLRM 2013). Pests and pathogens can be transported to site via vehicles, equipment, personnel, and any other materials brought on site such as soils and gravel. Locally established weeds can also be spread as a result of increased vehicle traffic, and vehicles moving from one site to another. The proposed seismic survey and associated activities are short term, expected to last for approximately two months. During this time there is the risk that pest species could be introduced or spread within the project area.

Native Flora and soils

Weeds threaten the survival of native vegetation if they outcompete flora for nutrients, habitat and sunlight. Once established, weed species often produce large quantities of seeds, allowing them to spread quickly and efficiently. Once established, weeds can be difficult to manage and

therefore preventing initial introduction and spread of certain species is the most effective form of weed management.

Pathogen introduction in vegetation or within soils can cause disease in native flora, and is quick to spread.

Pest animals can have a detrimental impact to native flora as a result of over grazing, alterations in the food chain and degradation of land through uprooting of plants and burrowing.

Fauna and Livestock

Pest animals can have a detrimental effect on native fauna and livestock through competition for food and habitat, as well as direct predation of native species. Some pests cause changes to natural habitats through selective grazing of favoured plant species, or degradation of land by uprooting plants and burrowing.

Pathogen introduction can cause disease in native fauna and livestock, as well as affect viability of food and habitats.

Table 6-44 provides a summary assessment of the potential risk ranking to environmental receptors due to introduced pest and pathogens.

Table 6-44 Introduced Pest and Pathogens Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native flora	Introduction and or spread of weeds, pest plants, animals and pathogens.	Likely	III	4	NT Government
Native fauna	Introduction and or spread of weeds, pest plants, animals and pathogens.	Occasional	III	3	NT Government
Soil	Introduction or spread of pathogens.	Possible	III	2	Landholders Government
Livestock, pastoral infrastructure and landholders	Disturbance to Livestock Loss of organic beef or cattle care certification	Possible	III	2	Landholders

Control Measures

To prevent introduced pests and pathogens and mitigate the potential risks and impacts the control measures outlined in Table 6-45 will be implemented.

Table 6-45 Controls to reduce risk and impacts of Introduced pests and pathogens

Activity	Control
All	All vehicles, plant and equipment shall be cleaned and inspected prior to arrival at the project area.
	A register of vehicle / equipment / machinery cleaning is kept.
	Notices of Priority Weed species to keep an eye out for displayed on mess room notice board and included in induction, as well as being made available to line clearance crew.
	Areas of priority weeds identified will be marked.
	If infestations of priority weed species are identified during line prep, they will be avoided via a detour around the infestation if within line tolerance.
	Wash down required if vehicle has passed through designated area(s), which was not able to be avoided.
	Records of detection, monitoring or eradication of exotic weed or other pest or noxious species introduced by activities are maintained.
	No soil or earth to be brought on site

Post treatment risk

Given the location of the project and the relatively small area of disturbance, together with the proposed controls, the potential for introduced pests and pathogens is reduced to an acceptable level. With the application of controls described in Table 6-26, the likelihood level of potential impacts is reduced to 'unlikely' and the consequence ranking assigned a 'level 3', resulting in an overall risk ranking of 2 (Table 6-46).

ALARP discussion

The impacts and risks associated with introduced pests and pathogens are considered to be a decision Type A, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of introduced pests and pathogens have been reduced to ALARP.

Statement of acceptability

The residual risk for contamination resulting from introduction of pests and pathogens is 2. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-46 Introduced Pest and Pathogens Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native flora	Introduction and or spread of weeds, pest plants, animals and pathogens.	4	Minimise disturbance to native fauna	Unlikely	III	2	Type A	Demonstrated	Y
Native fauna	Introduction and or spread of weeds, pest plants, animals and pathogens.	3	Minimise disturbance to native flora	Unlikely	III	2	Type A	Demonstrated	Y
Soil	Introduction or spread of pathogens.	2	Minimise negative impacts to soil quality	Unlikely	III	2	Type A	Demonstrated	Y
Livestock, pastoral infrastructure and landholders	Disturbance to Livestock Loss of organic beef or cattle care certification	2	Minimise disturbance to livestock	Unlikely	III	2	Type A	Demonstrated	Y

6.3.5 Fire

Fire may occur from the following activities:

- Line/Access Track and Campsite Preparation
- Line surveying
- Recording
- Camp sites and associated supply logistics
- Rehabilitation

The area where fire may occur will be anywhere within the project area described in Section 4.2.

Sensitive Environmental Receptors with the Potential to Occur within the Project Area

Based upon the receptors identified in **Section 5**, those known to be potentially impacted by fire are summarised in Table 6-47.

Table 6-47 Fire Receptor risks and impacts

Receptor	Potential Impact
Native flora	Loss of vegetation
Native fauna	Disturbance, injury or death
Livestock, pastoral infrastructure and landholders	Disturbance, injury or death to livestock Damage/loss to dwellings, infrastructure

Evaluation of Environmental Impacts

Fires can start due to various factors such as heat from vehicle exhausts, sparks from machinery or careless disposal of cigarettes. The proposed seismic survey and associated activities are expected to last for approximately two months. A fire caused by the activity could start anywhere that operations occur, although it would mostly likely be located close to vehicle movement or camp facilities.

The project activity will be undertaken in accordance with the recommendations of the Fire and Emergency Act 2015 and the Bushfire Act 2009.

Native Flora

Bushfires are a natural occurrence in areas of bush and scrubland and are an essential part of the life cycle for many native flora, promoting reproduction and growth in the long term. Uncontrolled man-made fires, however, can be devastating to large areas of vegetation, resulting in mid-term impacts to flora.

Most native flora in bush/ scrub habitats implement survival strategies to protect tissue from heat which would otherwise destroy them. Fire resistance and tolerance is exhibited through: bark thickness, other vegetative insulation, above-ground re-sprouting, underground roots and stems.

Following a fire event, change in conditions such as increased light availability and changes to nutrient levels can result in a temporary / semi-permanent change to floral assemblage in the area. This is not necessarily a negative impact, as post-fire plant responses include increased

productivity and flowering, fire stimulated seed release and dispersal, and improved seedling germination.

Overall, negative impacts associated with fire on native floral could be widespread, however populations are likely to recover over time.

Native Fauna

As with native flora, most native fauna species in fire-risk areas are adapted to tolerate or respond to fire in a way that aids survival. Survival responses include moving away from the area, burrowing to escape heat, and active use of the fire and burnt areas for feeding opportunities (such as birds of prey targeting rodents flushed from undergrowth by heat). Mortality resulting from fire is generally low, as most animals are able to move away from the affected area, however higher levels of mortality can be seen in flightless invertebrates and insects in vulnerable stages of development.

Dispersal from an area has ongoing impacts to the post-fire habitat, as animals will return at different rates resulting in a constantly evolving food chain. Changes to vegetation will also impact on fauna, changing food sources for herbivores and omnivores.

Any impacts would be temporary, with fauna quickly returning to an area post-fire.

Livestock

Although livestock are motile and able to move away from bushfire, they are often limited in their reach by the boundaries of landowners' land. Fences / ditches can hinder movement of livestock, effectively trapping them within the fire path.

Livestock are considerably more vulnerable to bushfire than native fauna, as their escape is limited and they are less-likely to be adapted to the environment.

Landholders

Landowners are impacted by any impacts on livestock as this will affect the viability of the operations. Similarly a loss of infrastructure such as fencing and buildings would have a significant impact on the livelihood of landowners.

During a bushfire any building / physical structures built with flammable materials such as wood are at risk. Burning of building can result in loss of assets and potentially impact livelihood. In extreme cases it could result in loss of life.

Table 6-48 provides a summary assessment of the potential risk ranking to environmental receptors due to fire.

Table 6-48 Fire Pre-treatment risk ranking

Receptor	Risk or Impact	Likelihood	Consequence	Risk Ranking	Relevant Stakeholders
Native flora	Loss of vegetation	Occasional	III	3	NT Government
Native fauna	Disturbance, injury or death	Occasional	III	3	NT Government
	Disturbance, injury or death to Livestock	Occasional	IV	4	Landholders

Damage/loss to dwellings, infrastructure					Aboriginal groups
	Damage/loss to dwellings, infrastructure	Unlikely	V	3	Landholders

Control Measures

To prevent fire and mitigate the potential risks and impacts the control measures outlined in Table 6-49 will be implemented.

Table 6-49 Controls to reduce risk and impacts of Fire

Activity	Control
Recording	Include fire season education as part of the induction.
	Appropriate fire prevention procedures in place.
	Appropriate firefighting gear available to the crew.
	All vehicles will be equipped with portable fire extinguishers.
	Machinery and vehicles should be parked in areas of low fire risk and be free of any combustible material, for example in the case of dry grass build up.
	Open fires, including open barbecues, billy fires, and brush burning, are banned on the project, in accordance with permission / restricted to a drum in accordance CLC agreement only in the campsite.
	Any petrol motor vehicles or petrol powered pumps will be fitted with spark arresters.
	All seismic vehicles will be equipped with fully operational VHF and / or UHF radio transceivers. The Contractor’s recording truck will maintain ‘fire watch’ on the appropriate UHF channel during working hours.
	Smoking will only be permitted in areas clear of vegetation, and there will be no disposal of butts.
	All personnel will receive information prior to the commencement of the activity relating to: <ul style="list-style-type: none"> Provisions of the Emergency Response Plan including procedures during a fire emergency The operation of fire fighting equipment and communications Restricted smoking requirements
Toolbox meetings will be conducted to: <ul style="list-style-type: none"> Alert the workforce of the fire risk level for the day Discuss any fire risk management breaches and remedial actions 	

Post treatment risk

Given the proposed controls, the potential for fire is reduced to an acceptable level. With the application of controls described in Table 6-49, the likelihood level of potential impact remains ‘possible’ and the consequence ranking assigned a ‘level 3’, resulting in an overall risk ranking of 2 (Table 6-50).

ALARP discussion

The impacts and risks associated with fire are considered to be a decision Type A, meaning that they are well-understood and that there are established practices in place to manage these risks.

With implementation of the control measures, it is considered that the risks and impacts of fire have been reduced to ALARP.

Statement of acceptability

The residual risk for fire is 2. Using Santos' model for acceptance, this is considered to be acceptable providing that ALARP has been achieved and is demonstrated.

Table 6-50 Fire Residual Risk Ranking

Receptor	Risk or Impact	Pre-Treatment Risk Ranking	Outcome	Likelihood	Consequence	Risk Ranking	ALARP	Acceptability	Accept Y/N
Native flora	Loss of vegetation	3	Minimise disturbance to native fauna	Possible	III	2	Type A	Demonstrated	Y
Native fauna	Disturbance, injury or death	3	Minimise disturbance to native flora	Possible	III	2	Type A	Demonstrated	Y
Damage/loss to dwellings, infrastructure	Disturbance, injury or death to Livestock	4	Minimise disturbance to livestock	Unlikely	III	2	Type A	Demonstrated	Y
	Damage/loss to dwellings, infrastructure	3	Minimise disturbance to landowners	Remote	IV	2	Type A	Demonstrated	Y

6.4 Principles of Environmentally Sustainable Development

As a factor to the determination of whether a risk or impact is acceptable, consideration has been made of the principles of environmentally sustainable development (ESD). The principles and how they have been considered in this EMP are described below:

A. *Decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations.*

This principle is inherently met through the EMP assessment process via the consideration of potential impacts and risks and stakeholder input. Longer term considerations are followed through via the restoration process and long term revisits to confirm rehabilitation success.

B. *If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*

The Environmental Risk Assessment within this EMP demonstrates that threats of serious or irreversible damage are highly unlikely. The proposed activity and receiving environment are well understood and Santos' ALARP decision framework considers 'risk and uncertainty' as part of the decision making context. In this framework, a risk that involves significant uncertainty would require a precautionary approach to hazard management and analysis would be replaced by conservative assumptions such that additional controls are more likely to be implemented.

C. *The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.*

Where the potential impacts and risk are determined to be serious or irreversible the precautionary principle is implemented to ensure the environment is maintained for the benefit of future generations. The Environmental Risk Assessment within this EMP demonstrates that potential impacts and risks will be reduced to ALARP and acceptable levels.

D. *The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.*

The potential to impact biological diversity and ecological integrity is inherent within the EMP assessment process. The Environmental Risk Assessment within this EMP demonstrates that potential impacts and risks will be reduced to ALARP and acceptable levels.

E. *Improved valuation, pricing and incentive mechanisms should be promoted.*

Not relevant to this EMP.

7.0 ENVIRONMENTAL OUTCOMES, PERFORMANCE STANDARDS, MEASUREMENT CRITERIA

Santos has defined ten (10) performance outcomes for the activity. These outcomes are intended to guide the environmental performance standards for this activity. The performance outcomes are to:

1. Minimise the visual impact of seismic operations;
2. Minimise disturbance to and contamination of soil resources;
3. Minimise disturbance to native vegetation and native fauna;
4. Avoid disturbance to sites of cultural, sacred and heritage significance;
5. Minimise disturbance to livestock, pastoral infrastructure and landholders;
6. Avoid the introduction or spread of exotic species and implement control measures as necessary;
7. Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources;
8. Optimise (in order of most to least preferable) waste avoidance, reduction, reuse, recycling, treatment and disposal;
9. Remediate and rehabilitate operational areas as necessary; and
10. Generate no fires from the Seismic operations.

The environmental controls proposed to be undertaken as a part of this activity are described in Table 7-1, along with the respective performance outcomes, standards and measurement criteria.

Table 7-1 Environmental controls, performance outcomes, standards and measurement criteria

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
Physical disturbance	Minimise disturbance to and contamination of soil resources.	Blade work is kept to a (i.e. operated blade-up) minimum and generally restricted to sand dunes and flood plain crabhole country where excessively rough terrain requires smoothing to allow access.	Inductions to inform operators that blade work only undertaken where excessively rough terrain occurs.	Induction package	Santos Environment Lead
		Where blade work is required the blade will be kept shallow so as to only disturb minimal topsoil / root-stock and only single blade width will be cleared.	Inductions to inform operators that blade work shall be kept shallow so as to only disturb minimal topsoil / root-stock and only single blade width will be cleared.	Induction package	Santos Environment Lead
		Root stock, topsoil and seeds are left on line during line preparation.	Inductions to inform operators that root stock, topsoil and seeds are left on line during line preparation.	Induction package	Santos Environment Lead
	Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources.	Avoidance of vehicle access on clay pans or salt lakes.	No vehicle access, roads or seismic lines to occur on clay pans or salt lakes.	Survey data (GIS mapping) & IVMS Data	Santos Field Representative
	Minimise disturbance to native vegetation and native fauna.	Where possible, existing tracks, roads or seismic lines will be used for access.	All activities will comply with the land access agreements regarding access track arrangements.	Permitted access plotted in IVMS weekly exception reports	Santos Field Representative
		Vegetation is removed only when necessary - avoided by weaving lines through vegetated areas.	Inductions to inform operators that vegetation is removed only when necessary.	Induction package	Santos Environment Lead

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		Creek bank vegetation is left intact and detours located if dense.	No removal of creek bank vegetation. - will be covered in CLC approvals	Survey data (GIS mapping)	Santos Field Representative
		Unauthorised offline driving is prohibited for all project personnel.	No unauthorised offline driving.	IVMS weekly reports	Santos Field Representative
		Campsites are set up, where possible, on sites previously used, or in areas naturally devoid of vegetation and always adjacent to any existing tracks to minimise impact on the terrain between the camp and tracks.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
		Any remediation work should be undertaken upon completion of all activities.	Procedures will be in place to require restoration stage to follow recording activities.	Daily report	Santos Field Representative
		The number of campsites will be minimised.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
	Avoid disturbance to sites of cultural, sacred and heritage significance.	Disturbance is restricted to areas for which CLC consent has been provided.	No disturbance to areas outside of the area permitted under the SSCC.	Survey Data & IVMS weekly reports	Santos Field Representative
		All personnel are given environmental and cultural heritage inductions prior to commencing work.	All personnel are given environmental and cultural heritage inductions prior to commencing work.	Induction package	Santos Environment Lead
		All line preparation machinery operators are required to observe for cultural heritage sites that may have been missed during the Site Clearance process.	Suspected artefacts are avoided and documented.	Documentation	Santos Field Representative
		Known sites of sacred or cultural significance are identified, avoided and reported to a	Suspected artefacts are avoided and documented.	Documentation	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		Cultural Heritage team member to ensure discoveries are managed in line with the relevant agreement and legislative requirements.			
		Any new sites identified during the activity will be reported to the Santos Cultural Heritage Team and avoided.	Suspected artefacts are avoided and documented.	Documentation	Santos Field Representative
	Minimise disturbance to livestock, pastoral infrastructure and landholders.	Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.	Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.	Induction package	Santos Environment Lead
		Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.	Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.	Consultation records	Santos Field Representative
		Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions.	Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions.	Incident management systems	Santos Field Representative
		All gates are left in the condition in which they were found (i.e. open / closed).	All gates are left in the condition in which they were found (i.e. open / closed).	Incident management systems	Santos Field Representative
		Relevant third party tenement holders shall be notified of activity including preparation of camp sites, preparation of survey lines and undertaking of operations.	Relevant third party tenement holders shall be notified of activity including preparation of camp sites, preparation of survey lines and undertaking of operations.	Consultation records	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		System is in place for logging landholder complaints to ensure that issues are addressed as appropriate.	System is in place for logging landholder complaints to ensure that issues are addressed as appropriate.	Complaints register	Santos Environment Lead
		Damage to station tracks is avoided.	Inductions to inform operators that damage to station tracks to be avoided.	Induction package	Santos Environment Lead
		When necessary, all fences are restored to satisfaction of landowner / managers.	Damaged fencing will be restored to the satisfaction of the landowner / manager.	Incident management systems	Santos Field Representative
		Rehabilitation will consider landholder needs i.e. firebreaks, access tracks etc	All activities will comply with the land access agreements regarding access track arrangements.	Stakeholder records regarding rehabilitation (or otherwise) of lines.	Santos Field Representative
Noise	Minimise disturbance to native vegetation and fauna	Personnel are given environmental and cultural heritage inductions prior to commencing work.	All personnel are given environmental and cultural heritage inductions prior to commencing work.	Induction package	Santos Environment Lead
	Minimise disturbance to landholders	Relevant landholders and occupiers are consulted with respect to camp and line locations and lines can be moved if landholders raise concerns. Landholders are provided updates on progress throughout the seismic survey.	Relevant landowners and occupiers are notified prior to activity including preparation of camp sites, preparation of survey lines and undertaking of operations.	Consultation records	Santos Field Representative
		Seismic sources are not to operate within the distance defined by Santos standards, of any pipeline, utility, installation or building.	Seismic sources are not to operate within the distance defined by Santos standards, of any pipeline, utility, installation or building.	Survey data (GIS mapping)	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
Erosion	Minimise disturbance to and contamination of soil resources	Blade work is kept to a minimum and generally restricted to sand dunes and flood plain crabhole country where excessively rough terrain requires smoothing to allow access.	Inductions to inform operators that blade work only undertaken where excessively rough terrain occurs.	Induction package	Santos Environment Lead
		Unavoidable compaction in areas other than those susceptible to erosion, will be ripped on completion of work.	Procedures will be in place to require restoration stage to follow recording activities.	Daily report	Santos Field Representative
		Any remediation work should be undertaken upon completion of all activities.	Procedures will be in place to require restoration stage to follow recording activities.	Daily report	Santos Field Representative
		An Erosion and Sediment Control Plan specific for the activity will be developed and implemented.	An Erosion and Sediment Control Plan specific for the activity will be developed and implemented.	ESCP	Santos Environment Lead
	Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources	Operations are shut down during wet weather or flooding and only restarted once potential for extensive damage has passed.	Operations are shut down during wet weather or flooding and only restarted once potential for extensive damage has passed.	Daily report	Santos Field Representative
		Following shut down due to flooding or inundation the risk assessment will be revisited to ensure controls are still appropriate to manage risk to ALARP.	Following shut down due to flooding or inundation the risk assessment will be revisited to ensure controls are still appropriate to manage risk to ALARP.	Documentation	Santos Field Representative
	Minimise disturbance to native vegetation and native fauna	Where possible, existing tracks, roads or seismic lines will be used for access.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
		Due to the instability and erosion potential when disturbed, the steeper slopes and	Inductions to inform operators that disturbance to steeper slopes and	Induction package	Santos Environment Lead

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		escarpments of tableland land systems are avoided where ever possible.	escarpments of tableland land systems are to be avoided when possible.		
		Creek bank vegetation is left intact and detours sought if too dense to pass through.	No removal of creek bank vegetation.	Survey data (GIS mapping)	Santos Field Representative
		All windrows are removed either during or on completion of work.	All windrows are removed either during or on completion of work.	ESCP	Santos Environment Lead
		Any remediation work should be undertaken immediately upon completion of all activities.	Procedures will be in place to require restoration stage to follow recording activities.	Daily report	Santos Field Representative
		Unauthorised offline driving is prohibited for all project personnel.	No unauthorised offline driving.	IVMS weekly reports	Santos Field Representative
		Campsites are set up, where possible, on sites previously used, or in areas naturally devoid of vegetation and always adjacent to any existing tracks to minimise impact on the terrain between the camp and tracks.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
		Camp sites are ripped on completion of activity.	Camp sites are ripped on completion of activity.	Photopoint Report	Santos Field Representative
		The number of campsites will be minimised.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
	Avoid disturbance to sites of cultural, sacred and heritage significance	Disturbance is restricted to areas for which CLC consent has been provided.	No disturbance to areas outside of the area permitted under the SSCC.	IVMS weekly reports	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
	Minimise disturbance to native vegetation and fauna	Camp sites are positioned close to existing roads where possible and are ripped, if necessary, on completion of work.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
Dust	Minimise the visual impact of seismic operations	Blade work is banned on naturally smooth surfaces or flat easy terrain. Minimal blade work is permitted elsewhere for access	Inductions to inform operators that blade work only undertaken where excessively rough terrain occurs.	Induction package	Santos Environment Lead
		Where possible, existing tracks, roads or seismic lines will be used for access.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
	Minimise disturbance to livestock, pastoral infrastructure and landholders	Where possible, existing tracks, roads or seismic lines will be used for access.	All activities will comply with the land access agreements.	Survey data (GIS mapping)	Santos Field Representative
	Minimise disturbance to native vegetation and fauna	Personnel are given environmental and cultural heritage inductions prior to commencing work.	All personnel are given environmental and cultural heritage inductions prior to commencing work.	Induction package	Santos Environment Lead
		All generated waste (including consumable rubbish such as lunch wrappers) shall be returned to the camp and placed in the appropriately waste receptacle.	All generated waste (including consumable rubbish such as lunch wrappers) shall be returned to the camp and placed in the appropriately waste receptacle.	Contractor Waste Management Procedure	Santos Field Representative
		All loads of rubbish are covered during transport.	All loads of rubbish are covered during transport.	Contractor Waste Management Procedure	Santos Field Representative
Covered bins are provided for the collection and storage of wastes.		Covered bins are provided for the collection and storage of wastes.	Contractor Waste Management Procedure	Santos Field Representative	

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		All empty drums will be stored on impervious areas with their closures in place, or transported immediately off-site.	All empty drums will be stored on impervious areas with their closures in place, or transported immediately off-site.	Contractor Waste Management Procedure	Santos Field Representative
		All loads of rubbish are covered during transport.	All loads of rubbish are covered during transport.	Contractor Waste Management Procedure	Santos Field Representative
		No incineration or open burning of waste materials shall occur on-site.	No incineration or open burning of waste materials shall occur on-site.	Incident management systems	Santos Field Representative
Waste	Minimise disturbance to native vegetation and fauna	No liquid wastes will be released accidentally or routinely discharged to surface waters.	No liquid wastes will be released accidentally or routinely discharged to surface waters.	Incident management systems	Santos Field Representative
		Wastes shall be removed from camp and disposed of at an approved facility.	Waste shall be removed from the camp by an appropriately licensed contractor and disposed at an approved facility. Records shall be kept of disposal of waste oils and fluids and hazardous wastes.	Waste records	Santos Field Representative
		Wastewater from laundry, showers and kitchen is piped to an irrigation area outside of the camp.	Wastewater from laundry, showers and kitchen is piped to an irrigation area outside of the camp.	Camp layout	Santos Field Representative
		Wastepaper, cardboard and food scraps are disposed of into sealed bins set up adjacent to the camp area. The sealed bins are transported regularly for waste disposal at a licensed landfill. Recyclable materials are segregated on camp and regularly transported to a licensed waste depot in Alice Springs.	Wastepaper, cardboard and food scraps are disposed of into sealed bins set up adjacent to the camp area. The sealed bins are transported regularly for waste disposal at a licensed landfill. Recyclable materials are segregated on camp and regularly transported to a licensed waste depot in Alice Springs.	Waste records	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		Unusable tyres are returned to Alice Springs for recycling.	Unusable tyres are returned to Alice Springs for recycling.	Waste records	Santos Field Representative
Artificial light	Minimise disturbance to livestock, pastoral infrastructure and landholders	All boundary lighting will be positioned to face inwards to provide adequate lighting for safe operations, without excessive overspill.	All boundary lighting will be positioned to face inwards to provide adequate lighting for safe operations, without excessive overspill.	Camp layout	Santos Field Representative
		Relevant landowners and occupiers are consulted with respect to camp and line locations and camps can be moved if landholders raise concerns.	All activities will comply with the land access agreements regarding access track arrangements.	Consultation Records Permitted access plotted in IVMS IVMS weekly exception reports	Santos Field Representative
Resource Consumption	Minimise disturbance, injury or death to native fauna	Personnel are given environmental inductions prior to commencing work.	All personnel are given environmental and cultural heritage inductions prior to commencing work.	Induction package Attendance records	Santos Environment Lead
	Minimise disturbance to livestock, pastoral infrastructure and landholders	Appropriate agreements will be in place with landowners / pastoralists for local water sources	Appropriate agreements will be in place with landowners / pastoralists for local water sources	Consultation records	Santos Field Representative
	Minimise impact to groundwater and / or watercourses	If local water resources are to be used, bore numbers and estimated extraction volumes will be provided to DPIR.	If local water resources are to be used, bore numbers and estimated extraction volumes will be provided to DPIR.	Water consumption records	Santos Field Representative
Contamination (Spills and Leaks)	Minimise negative impacts to soil quality	Fuel storage is in accordance with dangerous goods regulations.	Fuel storage is in accordance with dangerous goods regulations.	Audit Incident management systems	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
	Minimise changes to groundwater quality	Spill kits available to treat spills in situ	Spill kits available to treat spills in situ	Audit Incident management systems	Santos Field Representative
		All fuel stored and used should be under the control of qualified or trained personnel.	All fuel stored and used should be under the control of qualified or trained personnel.	Audit Incident management systems	Santos Field Representative
		Minimise fuel transfer where possible	Minimise fuel transfer where possible	Audit Incident management systems	Santos Field Representative
		Use of road tanker for bulk fuel storage	Use of road tanker for bulk fuel storage.	Audit Incident management systems	Santos Field Representative
		Use of drip trays for transfers.	Use of drip trays for transfers.	Audit Incident management systems	Santos Field Representative
		Any spills contained and retrieved.	Any spills contained and retrieved.	Incident management systems	Santos Field Representative
		Any spills will be remediated to the satisfaction of the landholder, fenced, soil removed to appropriate facility and signed off by land holder in accordance with the access	Any spills will be remediated to the satisfaction of the landholder, fenced, soil removed to appropriate facility and signed off by land hold in accordance with the access	Incident management systems	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		Fuel and other lubricants will be appropriately stored and managed, in accordance with AS1940.	Fuel and other lubricants will be appropriately stored and managed, in accordance with AS1940.	Audit Incident management systems	Santos Field Representative
Vehicle Collision with Fauna / Livestock	Minimise disturbance to native fauna	Off line driving is banned – no bush bashing or short cuts are permitted.	No unauthorised offline driving.	IVMS weekly reports	Santos Field Representative
		Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.	Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.	Consultation records	Santos Field Representative
	Minimise disturbance to livestock	All gates are left in the condition in which they were found (i.e. open / closed).	All gates are left in the condition in which they were found (i.e. open / closed).	Incident management systems	Santos Field Representative
Disturbance to stakeholders	No unplanned interactions or disturbance to landholders	When necessary, all fences are restored to satisfaction of landowner / managers.	Damaged fencing will be restored to the satisfaction of the landowner / manager.	Incident management systems	Santos Field Representative
		Speed will be limited along lines to 40km/hr and 80km/hr on other unsealed roads.	Speed will be limited along lines to 40km/hr and 80km/hr on other unsealed roads.	IVMS weekly reports	Santos Field Representative
		All vehicle routes have speed limits set which must be adhered to.	Speed limits will be adhered to.	IVMS weekly reports	Santos Field Representative
		Dozers are walked with blade up wherever possible.	Inductions to inform operators that blade work only undertaken where excessively rough terrain occurs.	Induction package	Santos Environment Lead

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.	Relevant landowners and occupiers are notified prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations.	Consultation records	Santos Field Representative
		Relevant mineral and geothermal tenement holders shall be notified of activity including preparation of camp sites, preparation of survey lines and undertaking of operations.	Relevant mineral and geothermal tenement holders shall be notified of activity including preparation of camp sites, preparation of survey lines and undertaking of operations.	Consultation records	Santos Field Representative
		Damage to station tracks is avoided.	Inductions to inform operators that damage to station tracks to be avoided.	Induction package	Santos Environment Lead
		Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.	Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.	Induction package	Santos Environment Lead
		All litter is to be managed and disposed of correctly.	All litter is to be managed and disposed of correctly.	Incident management systems	Santos Field Representative
		Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions.	Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions.	Incident management systems	Santos Field Representative
		System is in place for logging landholder complaints to ensure that issues are addressed as appropriate	System is in place for logging landholder complaints to ensure that issues are addressed as appropriate.	Complaints register	Santos Environment Lead

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		All gates are left in the condition in which they were found (i.e. open / closed).	All gates are left in the condition in which they were found (i.e. open / closed).	Incident management systems	Santos Field Representative
		When necessary, all fences are restored to satisfaction of landowner / managers.	Damaged fencing will be restored to the satisfaction of the landowner / manager.	Incident management systems	Santos Field Representative
		Seismic sources are not to operate within the distance defined by Santos standards, of any pipeline, utility, installation or building.	Seismic sources are not to operate within the distance defined by Santos standards, of any pipeline, utility, installation or building.	Incident management systems	Santos Field Representative
		No camps to be established less than 1km from PWC groundwater bores.	No camps to be established less than 1km from PWC groundwater bores.	Camp layout	Santos Field Representative
Introduced Pest and Pathogens	Minimise disturbance to native fauna/flora	All vehicles, plant and equipment shall be cleaned and inspected prior to arrival at the project area.	A register of vehicle / equipment / machinery cleaning is kept.	Register	Santos Field Representative
	Minimise disturbance to livestock	All vehicles, plant and equipment shall be cleaned and inspected prior to arrival at the project area.	A register of vehicle / equipment / machinery cleaning is kept.	Register	Santos Field Representative
		A register of vehicle / equipment / machinery cleaning is kept.	A register of vehicle / equipment / machinery cleaning is kept.	Register	Santos Field Representative
		Notices of weeds to keep an eye out for displayed on mess room notice board and included in induction	Notices of weeds to keep an eye out for displayed on mess room notice board and included in induction	Notice Board Induction Package	Santos Environment Lead
		If infestations of priority weed species are identified during line prep, they will be	If infestations of priority weed species are identified during line prep, they will be	IVMS weekly reports	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		avoided via a detour around the infestation if within line tolerance.	avoided via a detour around the infestation if within line tolerance.		
		Wash down required if vehicle has passed through designated area(s).	A wash down of vehicles is required if they have passed through designated area(s).	Incident management systems	Santos Field Representative
		Records of detection, monitoring or eradication of exotic weed or other pest or noxious species introduced by activities are maintained.	Records of detection, monitoring or eradication of exotic weed or other pest or noxious species introduced by activities are maintained.	Incident management systems	Santos Field Representative
		No soil or earth to be brought on site	No soil or earth to be brought on site	Incident management systems	Santos Field Representative
		Vehicle cleaning facilities	Vehicle cleaning facilities will be provided at camp sites	Camp layout	Santos Field Representative
Fire	Minimise disturbance to native flora / livestock	Include fire season education as part of the induction.	Inductions for all employees and contractors cover fire season education.	Induction package	Santos Environment Lead
	Minimise disturbance to landholders	Appropriate fire prevention procedures in place.	Appropriate fire prevention procedures in place.	Emergency Response Plan	Seismic Contractor HSE Coordinator
		Appropriate firefighting gear available to the crew.	Appropriate firefighting gear available to the crew.	Emergency Response Plan	Seismic Contractor HSE Coordinator
		All vehicles will be equipped with portable fire extinguishers.	All vehicles will be equipped with portable fire extinguishers.	Emergency Response Plan	Seismic Contractor HSE Coordinator
		Machinery and vehicles should be parked in areas of low fire risk and be free of any	Machinery and vehicles will be parked in appropriate locations.	IVMS weekly reports	Santos Field Representative

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		combustible material, for example in the case of dry grass build up.			
		Open fires, including open barbecues, billy fires, and brush burning, are banned on the project, in accordance with permission / restricted to a drum in accordance CLC agreement only in the campsite.	Open fires, including open barbecues, billy fires, and brush burning, are banned on the project, in accordance with permission / restricted to a drum in accordance CLC agreement only in the campsite.	Incident management systems	Santos Field Representative
		Any petrol motor vehicles or petrol powered pumps will be fitted with spark arresters.	Any petrol motor vehicles or petrol powered pumps will be fitted with spark arresters.	Compliance Checklists	Santos Field Representative
		All seismic vehicles will be equipped with fully operational VHF and / or UHF radio transceivers. The Contractor's recording truck will maintain 'fire watch' on the appropriate UHF channel during working hours.	All seismic vehicles will be equipped with fully operational VHF and / or UHF radio transceivers. The Contractor's recording truck will maintain 'fire watch' on the appropriate UHF channel during working hours.	Compliance Checklists	Santos Field Representative
		Smoking will only be permitted in areas clear of vegetation, and there will be no disposal of butts.	Smoking will only be permitted in areas clear of vegetation, and there will be no disposal of butts.	Incident management systems	Santos Field Representative
		All personnel will receive information prior to the commencement of the activity relating to <ul style="list-style-type: none"> Provisions of the Emergency Response Plan including procedures during a fire emergency The operation of firefighting equipment and communications Restricted smoking requirements 	All personnel will receive information prior to the commencement of the activity relating to <ul style="list-style-type: none"> Provisions of the Emergency Response Plan including procedures during a fire emergency The operation of firefighting equipment and communications Restricted smoking requirements 	Induction package	Santos Environment Lead

Aspect	Outcome	Controls	Performance standards	Measurement criteria	Responsible person
		Toolbox meetings will be conducted to <ul style="list-style-type: none"> • Alert the workforce of the fire risk level for the day • Discuss any fire risk management breaches and remedial actions 	Toolbox meetings will be conducted to <ul style="list-style-type: none"> • Alert the workforce of the fire risk level for the day • Discuss any fire risk management breaches and remedial actions 	Daily report will indicate when there is a high fire risk in place.	Santos Field Representative

8.0 IMPLEMENTATION STRATEGY

The Implementation Strategy described in this section is a summary of the Santos systems, practices and procedures in place to manage the environmental risk of the Southern Amadeus 2D Seismic Program. The strategy aims to ensure that the control measures, environmental performance outcomes and standards, detailed in Section 7, are implemented and monitored to ensure environmental impacts and risks are continually identified and reduced to a level that is ALARP and acceptable.

8.1 Santos EHS Management System

Santos manages the environmental impacts and risks of its activities through the implementation of the Santos Management System (SMS). The SMS provides a formal and consistent framework for all activities of Santos employees and contractors. The Santos SMS Framework is provided in Figure 8-1.

The framework for the SMS includes:

- Constitution, Board Charters, Delegation of Authority - define the purpose and authorities of the Santos Limited Board, Board Committees and senior staff.
- Code of Conduct and Policies – outline the key requirements and behaviours expected of anyone who works for Santos. The Policies are set and approved by the Board.
- Management Standards - prescribe the minimum performance requirements and expectations in relation to the way we work at Santos (the ‘What’).
- Processes, procedures and tools - support implementation of the Management Standards and Policy requirements by providing detail of ‘How’ to achieve performance requirements.

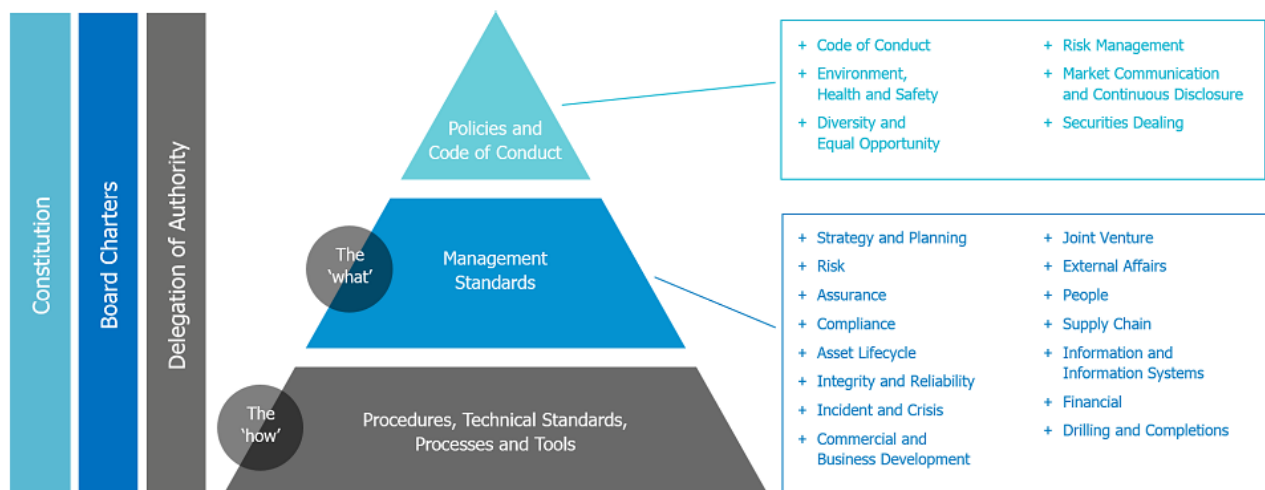


Figure 8-1 Santos Management System Framework

8.2 Roles and Responsibilities

The organisation structure for the Southern Amadeus 2D seismic survey is detailed in Figure 8-2. Key roles and environmental responsibilities for the activity are detailed in Table 8-1 and will be communicated to these positions prior to the activity commencing and when any changes are made to these positions.

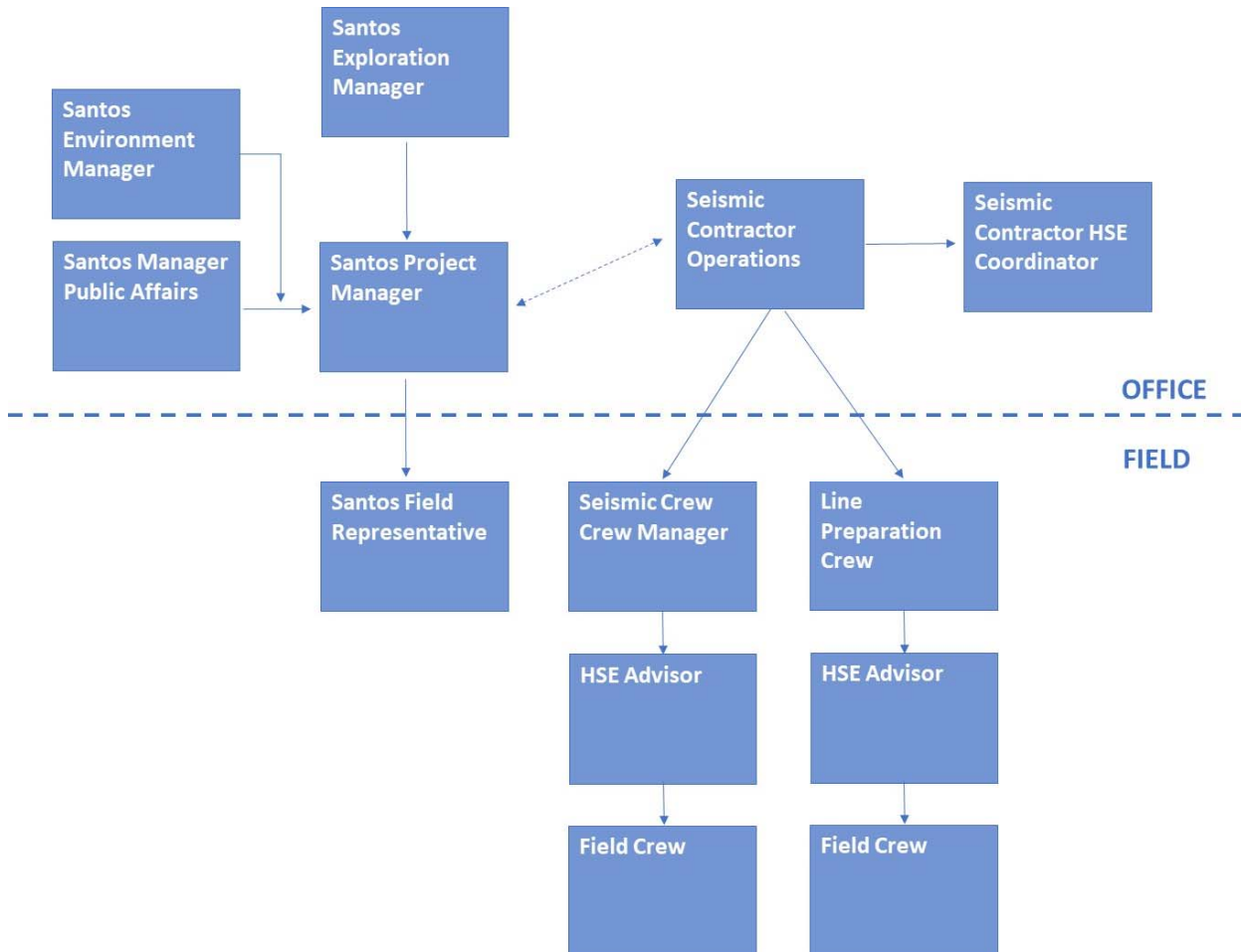


Figure 8-2 Seismic Activity Organisation Structure

Table 8-1 Seismic Activity Key Personnel Roles and Environmental Responsibilities

Role	Responsibilities
Santos Exploration Manager	<p>Ensure adequate resources are in place to meet the requirements within the EMP.</p> <p>Ensure incidents and non-conformances are managed as per Section 8.7 and 8.8.4, respectively.</p> <p>Notify DPIR of a change in titleholder, a change in the titleholder’s nominated liaison person or a change in the contact details for either (Section 8.4).</p>
Santos Geophysical Services Manager	<p>Ensure compliance with SMS including the EHS Policy.</p> <p>Ensure overall compliance with the EMP.</p> <p>Ensure relevant environmental legislative requirements, performance outcomes, control measures, performance standards, measurement criteria and requirements in the implementation strategy in this EMP are:</p> <ul style="list-style-type: none"> ● Communicated to the activity key personnel as detailed in Figure 8-2. ● Audited to inform the EMP Performance Report. <p>Ensure contractors are competent for the role they are employed for (Section 8.3).</p> <p>Report environmental incidents to the Exploration Manager and ensure reporting (Table 8-3) and investigations undertaken.</p> <p>Ensure records and documents are managed so they are available and retrievable (Section 8.8.2).</p> <p>Ensure non-conformances identified are communicated, raised in EHS Toolbox and corrective actions completed (Section 8.8.4).</p> <p>Review daily Santos Incident Summary Report and communicate relevant incidents and learnings to the Santos Representative (Section 8.8.4).</p> <p>Ensure the EMP Performance Report is prepared and submitted to DPIR (Section 8.8.5).</p>
Santos Field Representative	<p>Ensure field operations are implemented in accordance with the EMP.</p> <p>Maintain operational field records and documentation to demonstrate compliance with relevant Environmental Outcomes and Standards.</p> <p>Undertake on ground scouting and consultation with landholders.</p> <p>Ensure incident response measures are implemented.</p> <p>Report environmental incidents to the Geophysical Services Manager.</p> <p>Prepare daily Santos Incident Summary Report.</p> <p>Undertake routine inspections of camps and field crews to monitor compliance and general housekeeping.</p> <p>Provide information on EHS performance, incidents, near misses and opportunities for improvement at daily tool box meetings</p>
Santos Land Access Field Supervisor	<p>Undertake consultation with relevant persons throughout project planning and implementation.</p> <p>Document consultation with relevant persons.</p> <p>Ensure any commitments to relevant persons are undertaken.</p>
Santos Environment Lead	<p>Identify and communicate relevant environmental legislative requirements, performance outcomes, control measures, performance standards, measurement criteria and requirements in the implementation strategy in this EMP to the Exploration Manager, Geophysical Services Manager and Field Representative.</p> <p>Develop the environmental component of the activity induction (Section 8.3).</p> <p>Assess any environmentally relevant changes (Section 8.4).</p> <p>Review any non-conformances relevant to environment performance to ensure corrective actions are appropriate to prevent recurrence (Section 8.8.4).</p> <p>Review information received from external sources in regards to lessons learnt and non-conformances, relevant to the activity, with the project team to identify if there are actions relevant to the survey. If actions are relevant implement as per Section 8.8.4.</p> <p>Prepare and submit the EMP Performance Report to DPIR within 3 months of the activity finishing (Section 8.8.5).</p>
Seismic contractor operations Manager	<p>Responsible for ensuring training and competency of the line preparations crew. This includes ensuring that the crew is appropriately trained and briefed in environmental considerations contained within this EMP including:</p> <ul style="list-style-type: none"> ● Minimal disturbance via blade up as a preference ● Identification and avoidance / management of areas of weed infestation

Role	Responsibilities
	<ul style="list-style-type: none"> ● Root stock, topsoil and seed management ● Avoidance of highly sensitive areas such as clay pans and salt lakes ● ESC management ● Vegetation management.

8.3 Training and Competencies

Santos staff and contractors undertaking work in the field are required to undertake a two stage induction process. The general Onshore EHS Induction focuses on hazard identification and sets Santos' expectations for Environment, Health and Safety management for workers at Santos' onshore operational sites.

The general Onshore EHS Induction is supported by an activity specific induction. All field personnel will be required to complete the activity specific induction that will cover the requirements in this EMP. At a minimum, the induction will cover:

- Activity description
- Key receptors in the area
- Environmental impacts and risks, and associated controls to be implemented
- Management of change process
- Roles and responsibilities
- Incident and non-conformance reporting and management

Key roles for the activity, as detailed in Section 8.2, will be specifically briefed on their roles and responsibilities for this project in addition to the inductions.

Competency of contractors is assessed as part of the contracting qualification and via the prestart audit.

8.4 Emergency Response Plan

The Emergency Response Plan for the activity was prepared by the Seismic Contractor and provided as part of the original application (*Terrex Group Emergency Response Plan Amadeus 2D Seismic Survey June 2016*). Prior to re-commencement of the activity the Emergency Response Plan will be reviewed for currency and updated if required. If the Emergency Response Plan is updated, a revised version will be provided to DPIR.

The emergency response arrangements within the Emergency Response Plan will be exercised early in the campaign to ensure that personnel are familiar with the plan and the type of emergencies to which it applies and that there will be a rapid and effective response in the event of a real emergency occurring. Following the exercise, lessons will be captured and the plan updated if required.

Other triggers for revising or updating the Emergency Response Plan may include:

- New information becomes available following an incident, near miss or hazard
- Learnings from an exercise or drill
- Change in contractor undertaking the work
- Organisational changes
- Changes to government agency contact details or portfolios

8.5 Management of Change

The SMS establishes the processes required to ensure that when changes are made to a project, control systems, an organisational structure or to personnel, the EHS risks and other impacts of such changes are identified and appropriately managed.

The SMS requires that all environmentally relevant changes must obtain environmental approval (internal i.e. within Santos and/or external i.e. regulatory) prior to undertaking any activity.

Environmentally relevant changes include:

a) new activities, assets, equipment, processes or procedures proposed to be undertaken or implemented that have potential to impact on the environment and have not been:

- assessed for environmental impact previously, in accordance with the requirements of the standard; and
- authorised in the existing management plans, procedures, work instructions, or maintenance plans.

b) proposed changes to activities, assets, equipment, processes or procedures that have potential to impact the environment or interface with an environmental receptor.

c) changes to requirements of an existing external approval (e.g. changes to conditions of environmental licence).

d) new information or changes of information from research, stakeholders, legal and other requirements, and any other sources used to inform the EMP.

Where an environmentally relevant change is identified, the MoC is assessed by an Environmental Adviser and if required appropriate technical and/or legal advice is sought. The MoC assessment is made against the in-force EMP and is undertaken to ensure that impacts and risks from the change can be managed to ALARP and acceptable levels.

In the event that the proposed change is a significant modification or new stage of activity, introduces a significant new environmental impact or risk, results in a significant increase to an existing environmental impact or risk, or, as a cumulative effect results in an increase in environmental impact or risk, this EMP will be revised and submitted for re-assessment and acceptance by the regulator.

Section 1.2 details the permit titleholder, activity nominated liaison person and contact details for both. A change in any of these details are required to be notified to DPIR.

8.6 Incident Reporting

Incidents that impact on the environment or have the potential to impact on the environment (near-miss) are to be reported and entered into the EHS Toolbox Incident Management System (IMS).

Table 8-2 details the external incident notification, reporting requirements and timeframes for environmental incidents associated with the activity.

Table 8-2 Incident Reporting Requirements

Requirements	How and By When
Recordable Incident Reporting	
<p>A recordable incident is a breach of an environmental performance outcome or environmental performance standard, in the Environment Management Plan that applies to the activity; and is not a reportable incident.</p>	<p>Submit written report to DPIR (petroleum.operations@nt.gov.au) within 15 days after the end of each quarter, including on or before:</p> <ul style="list-style-type: none"> • 14 March • 14 June • 14 September • 14 December
<p>The recordable incident report must contain:</p> <p>(i) a record of all recordable incidents that occurred during the reporting period; and</p> <p>(ii) all material facts and circumstances concerning the recordable incidents that the operator knows or is able, by reasonable search or enquiry, to find out; and</p> <p>(iii) any action taken to avoid or mitigate any adverse environment impacts of the recordable incidents; and</p> <p>(iv) the corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents</p>	
Reportable Incident Reporting	
<p>A reportable incident is an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage. Based on the Santos Risk Matrix this is an incident that has an actual or potential consequence \geq III. Incidents should also be reported to NT DPIR if it has been reported to another government department or agency or there is the potential for media or stakeholder interest.</p>	
<p>The initial verbal report will include as much preliminary information as is available about the incident (e.g. interest holder, location, type of incident, affected stakeholders, initial assessment of environmental harm, initial response).</p>	<p>The initial verbal report will be made as soon as possible to the DME Operations Team Emergency Number (1 300 935 250)</p>
<p>The initial written report will include:</p> <p>(i) The results of any assessment or investigation of the conditions or circumstances that caused or contributed to the occurrence of the reportable incident, including an assessment of the effectiveness of the designs, equipment, procedures and management systems that were in place to prevent the occurrence of an incident of that nature;</p> <p>(ii) the nature and extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause;</p> <p>(iii) any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident;</p> <p>(iv) any actions taken, or proposed to be taken, to prevent a recurrence of an incident of a similar nature.</p>	<p>The initial written report will be provided) as soon as practicable but not later than 3 days after the reportable incident first occurs.</p> <p>Interim reports to be provided as agreed or at least every 90 days after the initial report.</p>
<p>The final reportable incident report will include a root cause analysis of the reportable incident.</p>	<p>The final report to be provided to DPIR (petroleum.operations@nt.gov.au) as soon as practicable but no later than 30 days after the clean up or rehabilitation of the area affected by the reportable incident is completed.</p>

8.7 Environmental Performance Monitoring and Reporting

8.7.1 Record Management

Key records for management relating to the activity include:

- Weed washdown records
- Induction records
- Photopoint records
- Records related to audits / inspections
- Records relating to investigation of incidents and noncompliance's.

SMS Information and Information Systems detail the requirements to ensure that information is kept current and accurate, stored in a manner to facilitate retrieval, and is accessible to personnel who need it.

Document control and record keeping requirements including record retention periods are specified in the SMS. Where no record retention requirement is specified, the default for physical records is 10 years and 'life of plant' for electronic records.

8.7.2 Audit

To ensure that the EMP requirements have been effectively implemented and that the performance outcomes and standards in the EMP have been met the following audits/reviews will be undertaken:

- Pre-start readiness review – to ensure the EMP requirements can be implemented by the contractor.
- During the activity – to ensure EMP requirements have been implemented.

Audit / review findings including actions are communicated to the Santos and Contractor Project Managers and Santos Field Representative. Actions are agreed with all parties and assigned an actioner and required completion date. The audit and actions are recorded in the Santos EHS Toolbox Audit & Compliance Manager which notifies the actioner and their manager when actions are due. If actions are not closed within the due date the system has a hierarchy notification system based on the number of days an action is overdue as to the level of manager who receive notification of the overdue action.

8.7.3 Management of Non-Conformances

For the activity, a non-conformance is classed as:

- A breach of an environmental performance outcome or environmental performance standard (Section 7). This triggers the requirement to report as a "recordable incident" as per Section 8.6.
- Failure to implement a requirement in the implementation strategy.

Non-conformances are identified via:

- Audits and inspections

- Incident reporting and investigations
- Preparation of the Performance Report

Where a non-conformance is identified, actions are implemented to correct the non-conformance and prevent reoccurrence.

To ensure that non-conformances lead to learning and improvements for the activity and on a company-wide basis, non-conformance are:

- Communicated to the Geophysical Services Manager and Santos Field Supervisor via Santos EHS Toolbox (see below), daily and weekly meetings and the appropriate reports (i.e. audit, performance, incident investigation) to ensure personnel are made aware of non-conformances and corrective actions to help prevent recurrence of similar incidents.
- Communicated to operational personnel at daily pre-start meetings via the Santos Field Supervisor to ensure personnel are made aware of non-conformances and corrective actions to help prevent recurrence of similar incidents.
- Communicated internally within Santos as per the Santos Internal Incident Notification Guide and where there are lessons learnt that are applicable to other areas of the business a Flash Notification is issued.
- Recorded in Santos EHS Toolbox and actions tracked to completion.
- Reviewed by the actioner's manager prior to being closed to ensure actions are completed and implemented.
- Reported externally as per the requirements as detailed in Section 8.6.

8.7.4 Routine reporting

To provide DPIR with sufficient information to enable the regulator to determine whether the environmental performance outcomes and standards in the EMP have been met, Santos will submit the following reports.

EMP Performance Report

Timing: Within three months of completion of the seismic activity and full de-mobilisation of Plant and Equipment.

Content: Summary of performance against the environmental performance outcomes and standards in the EMP.

Environmental Line Report

Timing: Within three months of undertaking post-restoration photopoint monitoring.

Content: Photopoint monitoring incorporating pre-line prep, post-line prep, post-recording and post-restoration photopoint monitoring.

Final Rehabilitation Report

Timing: Following a minimum of one wet season post-restoration.

Content: Final rehabilitation assessment and endorsement in accordance with the *Environmental Closeout Procedures for Petroleum Activities* (DPIR 2016).

8.7.5 Annual Performance Report

Given the activity is planned to be undertaken over a period of two months Santos does not propose to submit Annual Performance Reports. Instead, the EMP Performance Report discussed above will capture the activity's performance in meeting the outcomes and standards in the EMP and the Final Rehabilitation Report will capture the final outcomes of the longer-term rehabilitation success.

9.0 STAKEHOLDER ENGAGEMENT

Santos is committed to upholding its long-held reputation as a trusted Australian energy company. Santos seeks to establish and maintain enduring and mutually beneficial relationships with the communities of which it is a part; ensuring that Santos' activities generate positive economic and social benefits for and in partnership with these communities.

The Santos Management System (SMS) details the requirements for appropriate communication and consultation mechanisms. The standard includes requirements to establish and maintain communication links with employees, contractors and external stakeholders, including local communities, government agencies and other organisations. Reporting and notification of EHS incidents to the appropriate government agency occurs if and as required.

In the preparation of the 2013 and 2016 seismic surveys, relevant stakeholders were identified and engaged such that they could be informed of the proposed activities, and have their specific issues considered and addressed.

This consultation has continued in the preparation of the 2017 survey activities, and is ongoing for the duration of the activity and subsequent restoration activities.

The principal objectives of consultation undertaken for the activity is:

- To identify relevant stakeholders.
- Initiate and maintain open communications between relevant stakeholders and Santos.
- Identify, establish and implement stakeholder engagement tools for initial and on-going communications.
- Establish an open and transparent process for input.
- Proactively seek agreement with relevant stakeholders on recommended strategies to minimise negative impacts and maximise positive impacts of the activity.
- Provide a means for recording initiatives in which communication and/or consultation is undertaken, issues raised and responses recorded.

9.1 Stakeholder identification

Stakeholder identification was conducted prior to commencing the previous seismic surveys. The key relevant stakeholder groups included:

- Community
- Landholders
- Traditional Owners and Aboriginal Peoples
- Northern Territory Government departments

A full list of the stakeholders consulted is provided in the Appendix 2, with contact details for landholders also provided in this Appendix.

9.2 Stakeholder relevance

Key impacts and risks of the activities were mapped to stakeholder groups in the impact assessment scoping described in Section 6. These are summarised in Table 9-1. This was used as a basis for the nature and content of engagement undertaken.

Table 9-1 Stakeholder relevance to impacts and risks

Stakeholder group	Aspects	Receptor of interest	Potential risk or impact
Northern Territory Government departments	Physical disturbance	Soil	Damage to soil (compaction)
		Water courses	Disturbance to natural drainage patterns
		Native fauna	Disturbance to native fauna Loss of vegetation and habitat
		Native flora	Loss of vegetation and habitat
	Noise	Native fauna	Disturbance to native fauna
	Erosion	Soil	Soil erosion due to ground disturbance
		Surface water	Increased runoff and erosion Increased mobility of sediments Increased sediment loads
		Native flora	Direct loss of vegetation
	Dust	Native flora	Smothering of undisturbed vegetation
	Waste	Native fauna	Disturbance, injury or death native fauna.
		Water courses	Contamination of groundwater and / or watercourses.
		Environmentally sensitive sites	Contamination of soil
	Light Emissions	Native Fauna	Disturbance to native fauna
	Fire	Native fauna	Disturbance, injury or death to native fauna
		Natural water resources	Depletion of groundwater and / or watercourses.
	Resource Consumption	Natural water resources	Depletion of groundwater and / or watercourses.
Contamination (spills and leaks)	Soil	Degradation of soil quality	
	Groundwater / water courses		
	Groundwater	Changes to groundwater quality	
Surface water	Changes to surface water quality		
Death or injury to fauna / livestock	Native fauna	Disturbance, injury or death	

Stakeholder group	Aspects	Receptor of interest	Potential risk or impact
	Introduced pests/pathogens	Native flora	Introduction and or spread of weeds, pest plants, animals and pathogens.
		Native fauna	Introduction and or spread of weeds, pest plants, animals and pathogens.
Landholders	Physical disturbance	Soil	Damage to soil (compaction)
		livestock, pastoral infrastructure and landholders	Disturbance to livestock, pastoral infrastructure and landholders
	Noise	Livestock	Disturbance to livestock
		Landholder	Loss of amenity
	Erosion	Surface water	Increased runoff and erosion Increased mobility of sediments Increased sediment loads
		Settlements - Pastoral properties	Disturbance to landholders
	Dust	Landholder	Loss of amenity
	Waste	Water courses	Contamination of groundwater and / or watercourses.
		Settlements - Pastoral properties	Disturbance, injury or death to livestock. Loss of organic beef or cattle care certification
	Light emissions	Settlements - Pastoral properties	Disturbance to livestock Loss of amenity (Landowners)
	Fire	Natural water resources	Depletion of groundwater and / or watercourses.
		Landholders	Disturbance, injury or death to livestock
	Resource consumption	Natural water resources	Depletion of groundwater and / or watercourses.
		Landholders	Disturbance, injury or death to livestock
Contamination	Soil Groundwater / water courses	Degradation of soil quality	
	Groundwater	Changes to groundwater quality	

Stakeholder group	Aspects	Receptor of interest	Potential risk or impact
		Surface water	Changes to surface water quality
	Death / injury to livestock	Livestock	Disturbance, injury or death
	Disturbance to stakeholders	Landholder / infrastructure	Unplanned interaction with or disturbance to other land users
	Weeds and pest	Livestock	Disturbance Loss of organic beef or cattle care certification.
Traditional owners and Aboriginal Peoples	Physical disturbance	Culturally sensitive sites	Disturbance to culturally sensitive site
	Erosion	Culturally sensitive sites	Disturbance to culturally sensitive sites

9.3 Stakeholder consultation

Santos has undertaken (and continues to undertake) consultation to ensure that relevant stakeholders are appropriately informed of any impacts and risks of the activity, which may be relevant to the activities, functions and interests of the stakeholder. The purpose of the consultation has been to:

- Educate and inform key stakeholders of the elements of the Southern Amadeus Basin Exploration Program and possible future production
- Build and maintain stakeholder confidence through key relationships
- Gain trust and acceptance in the local communities as a responsible member of society
- Listen to and address concerns or queries
- Work with stakeholders to build understanding as to why and how Santos operates.

The key component of the engagement program has been face-to-face briefing sessions with key individuals and groups with timely feedback on issues and concerns.

Santos has also participated in a number of events to update a broader range of stakeholders on its activities in the Southern Amadeus including:

- The Alice Springs Show
- The Northern Territory Cattleman’s Association conference
- Chamber of Commerce NT open day.

Previous consultation with stakeholders is provided in the 2016 Southern Amadeus 2D Seismic Program Environment Plan. Records of this consultation along with consultation which has taken place since the cessation of this activity is summarised in Appendix 2. This table includes details of all notable consultation events, including details of the stakeholders consulted, the date of consultation, a summary of the stakeholder response and the status and actions by Santos.

Government Consultation

As part of the 2016 EMP approval application, this activity was submitted to the NT EPA. As part of the Notice of Intent (NoI) process, the NoI was provided to various government departments for review and comment. Comments were received from the following departments:

- NT Environment Protection Authority
- Department of Business
- Parks and Wildlife Commission of the Northern Territory
- Power and Water Corporation
- Primary Industries and Fisheries
- Tourism NT
- Department of Land Resource Management

This process has provided Santos with a good understanding of the interests and concerns of the different government departments and enabled follow up liaison to meet government expectations. A summary of the key themes and matters raised through this process and generally through the stakeholder consultation are presented in Table 9-2.

Table 9-2 Key themes and matters raised in consultation

Theme	Matters Raised	Santos Response
<i>Sacred site protection</i>	Requirement to minimise the environmental impact and disturbance to Aboriginal sacred sites.	Santos Ltd, in accordance with the Indigenous Land Use Agreement / Exploration Permit numbers EP 112 and EP 125, is required to submit an Application and Work Program to undertake project work activities for the 2017 Southern Amadeus Seismic Survey. The process for the sacred sites clearance starts with the submission of a work program, followed by face to face consultation sessions with the community facilitated by the CLC. These sessions help identify constraints and scope the areas / level of detail required for surveys. All matters are resolved via the process of securing CLC clearance. This is addressed in Section 6.2.1
<i>Landholder disturbance</i>	Requirement to minimise disturbance of activities on landholder.	Land Access Compensations Agreements (LACA) are negotiated and executed before any work is undertaken a property. Relevant landowners and occupiers are notified in accordance with the LACA prior to activity of preparation of camp sites, preparation of survey lines and undertaking of operations. Various procedures in place to minimise impacts as outlined in Section 6.2.1, and 6.3.3.
<i>Weed management</i>	Proponent to liaise closely with landholders affected by the seismic program to determine the most appropriate management actions for declared weeds in the Project area. Recommendations from EPA: <ul style="list-style-type: none"> • ensure that any vehicles and machinery used in the surveys are free of weeds, weed seeds, 	Santos has incorporated weed management measures in Section 6.3.4 of the EMP. This includes various operational controls to avoid the introduction or spread of exotic species. Santos' recent consultation with DLRM has indicated that preventing the spread of priority weeds is a current focus area. Specific controls to identify, mark,

Theme	Matters Raised	Santos Response
	<p>soil and vegetative material containing weeds and weed seeds prior to entering or exiting the site. Vehicles and machinery exhibiting such material will need to be thoroughly washed down before entering/leaving.</p> <ul style="list-style-type: none"> • ensure that operators and contractors are aware of existing locations of declared weeds, are capable of identifying declared weeds known to occur in the region and avoid these areas where possible. 	<p>avoid and/or implement washdowns have been included to specifically manage the risk of weed spread if such infestations are encountered.</p>
<p>Erosion and sediment control</p>	<p>It is recommended that the Proponent prepare an Erosion and Sediment Control Plan (ESCP). Subsequent ESCP implementation should be sufficient to avoid or minimise dust, soil erosion and sediment runoff during the seismic program.</p>	<p>Santos has incorporated erosion and sediment control measures in Section 6.2.3, which are aimed at avoiding or minimising dust, soil erosion and sediment runoff during operations. An ESCP will be developed to support the project activity during the pre-execution planning of activity at the time the disturbance is identified.</p>
<p>Risk of contamination from leaks and spills</p>	<p>It is recommended that the Proponent avoid damaging any of Power and Water Corporation's water and sewer assets. In addition, the Proponent should avoid undertaking any seismic operations (including line clearance) within the stand wellhead protection zones around Power and Water Corporation's bores (200m radius zone for rate of flow of Imanpa production bores). The establishment of worker's camps should be kept >1km from the production bores to mitigate potential groundwater contamination risks associated with the disposal of grey and black water from the worker's camp.</p>	<p>As detailed in Section 6.3.1, the seismic operations will avoid damaging Power and Water Corporation's water and sewer assets. Seismic lines can be weaved to place a minimum 200m exclusion zone around any bore. Camp sites have been located on pre-disturbed ground and will be >1km from any PWC production bores.</p>
<p>Employment opportunities</p>	<p>Community seeking information on employment opportunities arising from exploration activity.</p>	<p>This matter, while outside the scope of the EMP, is being addressed through ongoing engagement with CLC and local industry groups.</p>

9.4 Ongoing Consultation

During both the planning and operational phase of the project, Santos will have a field based member of the Land Access team in the region. They will be the primary point of contact for all landholders and community members during these phases. During the operational phase of the project the Santos Field Representative will also manage day to day activities and communications with respect to the landholders to ensure they are consistently updated on the status of the project.

Prior to any land access, the Land Access Field Supervisor and / or the Santos Field Representative will carry out on ground scouting and consultation to ensure that any impact or interruption to landholders is minimised.

Santos will not access any person's land without prior consent in the form of a written agreement and in accordance with the DPIR policies and guidelines.

Where stakeholders have requested or Santos believes it would be beneficial to engage with stakeholders on an ongoing basis during the activity, communications will continue until the activity has concluded.

10.0 REFERENCES

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Appendix 1: EPBC Act Protected Matters Search Project Area



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: 25/07/17 11:46:46

[Summary](#)

[Details](#)

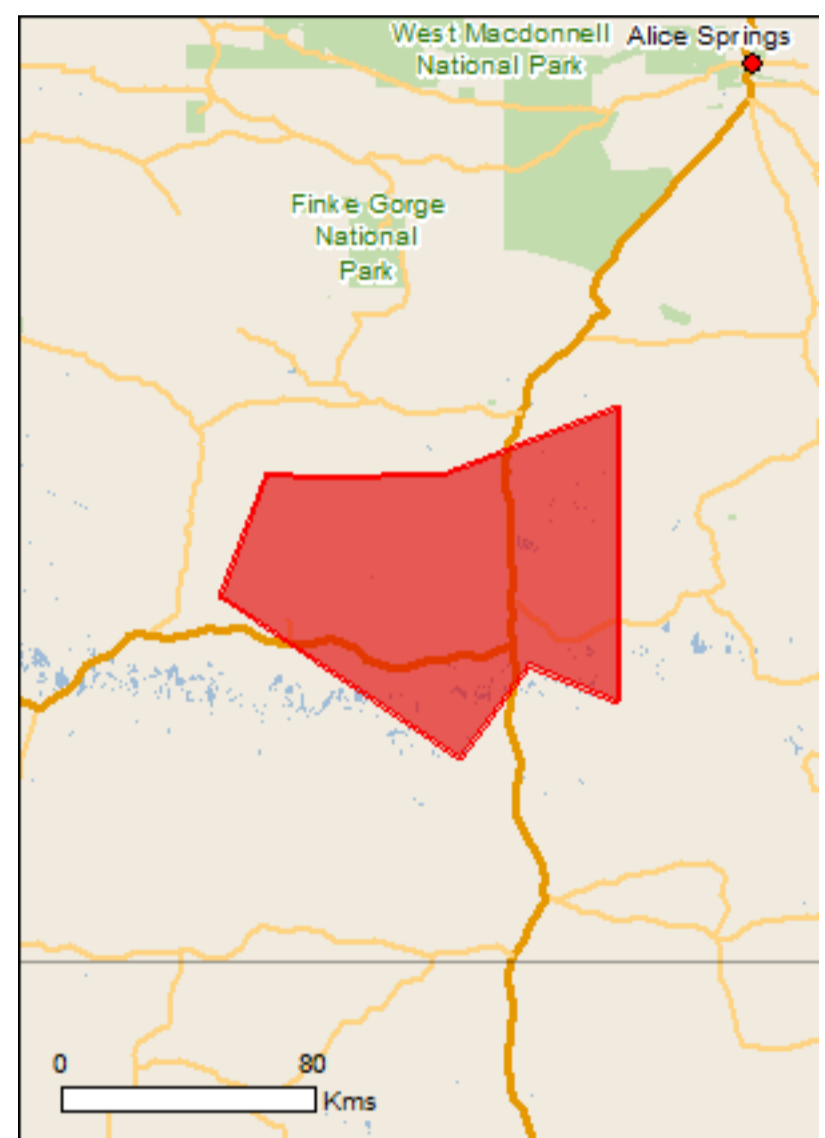
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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

[Coordinates](#)

[Buffer: 1.0Km](#)



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 Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	15
Listed Migratory Species:	10

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. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

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:	13
Whales and Other Cetaceans:	None
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.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	14
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Amytornis modestus Thick-billed Grasswren [84121]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Insects		
Croitana aestiva Desert Sand-skipper, Aestiva Skipper [26238]	Endangered	Species or species habitat may occur within area
Mammals		
Dasycercus cristicauda Crest-tailed Mulgara [328]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat may occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Endangered	Species or species habitat may occur within area
Plants		
Acacia latzii Latz's Wattle [14275]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Frankenia plicata [4225]	Endangered	Species or species habitat may occur within area
Reptiles		
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area
Liopholis slateri slateri Slater's Skink, Floodplain Skink [83163]	Endangered	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
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		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		
Actitis hypoleucos Common Sandpiper [59309]		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
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Angas Downs	NT

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 Resources Audit, 2001.

Name	Status	Type of Presence
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Birds

Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
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Mammals

Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
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Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
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Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
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Equus caballus Horse [5]		Species or species habitat likely to occur within area
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Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
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Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
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Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
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Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
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Plants

Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
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Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
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Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
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Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
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Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk,		Species or species
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Name	Status	Type of Presence
Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		habitat likely to occur within area
Nationally Important Wetlands		[Resource Information]
Name	State	
Karinga Creek Palaeodrainage System	NT	

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 and National Heritage properties, Wetlands of International and National 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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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.

Coordinates

-24.75854 132.50748,-24.76352 132.65011,-24.75829 133.00531,-24.58486 133.49588,-25.33014 133.49692,-25.23912 133.24559,-25.47855 133.05378,-25.06387 132.38154,-24.75854 132.50748

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian 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, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix 2: Southern Amadeus 2D Seismic Program Stakeholder Engagement Records

Table A2 -1 Stakeholder Engagement Records – Recent consultation to support 2017 activities

Stakeholder records contained within Table A2-1 is confidential to the stakeholders and has been redacted.

Table A2 -2 Stakeholder Engagement Records – Previous consultation to support 2013 and 2016 activities

Stakeholder records contained within Table A2-2 is confidential to the stakeholders and has been redacted.

Table A2 -3 Stakeholder Engagement Records – Landholder Contact Details

Stakeholder records contained within Table A2-3 is confidential to the stakeholders and has been redacted.