Environmental Management Plan: EP 161 2D Seismic and Ground Gravity Survey Program

STO7-4

NT Exploration Permit 161

Santos QNT PTY Ltd

Prepared for: **Santos QNT Pty Ltd**

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Appendices

Appendix 01 - Ecological Assessment

Appendix 02 - Archaeological Assessment

Appendix 03 - Weed Management Plan

Appendix 04 - Stakeholder Engagement Log

Appendix 05 - Emergency Response Plan

Abbreviations and Units

Table. i Abbreviations and Units

Acronym/Abbreviations	Description
AAPA	Aboriginal Areas Protection Authority
ALARP	As Low as Reasonably Practicable
ARI	Average Recurrence Interval – the average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration. A one in 1,000-year ARI rainfall event is written as 1:1,000 ARI.
BoM	Bureau of Meteorology
cm	Centimetres
CPESC	Certified Professional in Erosion and Sediment Control
DAWE	Dept of Agriculture, Water, and the Environment
DBH	Diameter at Breast Height
DEPWS	Department of Environment, Parks, and Water Security
DIDO	Drive-In-Drive-Out – a worker who primarily drives into work
DITT	Department of Industry, Tourism and Trade
DLRM	Department of Land Resource Management
DoH	Department of Health
EHS	Environment Health and Safety
EMP	Environment Management Plan
EP	Exploration Permit
EP Act	*Environment Protection Act, 2019 (NT)*
EP Regulations	*Environment Protection Regulations, 2020 (NT)*
EPA	*Environment Protection Authority (NT)*
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999 (Cth)*
EPT	Extended Production Testing
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan or Contingency Plan
ESD	Ecologically Sustainable Development
EVNT	Endangered, Vulnerable or Near Threatened

Acronym/Abbreviations	Description
FIFO	Fly-In-Fly-Out – a worker who primarily flies into work
GHG	Greenhouse Gas
GDE	Groundwater Dependent Ecosystem
ha	Hectares
HF	Hydraulic Fracture(ing)
ILUA	Indigenous Land Use Agreement
IUCN	International Union for Conservation of Nature
kg	Kilograms
km	Kilometre
ktCO2-e	Kilotonnes of carbon dioxide equivalent
L	Litres
LAA	Land Access Agreement
LACA	Land Access Compensation Agreement
m	Metres
mg	Milligrams
ML	Megalitres (1,000,000 litres)
mm	Millimetres
MMP	Mine Management Plan
MNES	Matters of National Environment Significance
MoC	Management of Change
NEPM	National Environment Protection Measure
NGERS	National Greenhouse Energy Reporting Scheme
NLC	Northern Land Council
NRMaps	Natural Resources Maps, DEPWS
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
OEM	Original Equipment Manufacturer
PMST	Environment Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool
PPE	Personal Protection Equipment
SMP	Spill Management Plan

Acronym/Abbreviations	Description
SMS	Santos Management System
SQP	Suitably Qualified Person
SREBA	Strategic Regional Environmental and Baseline Assessment
TEC	Threatened Ecological Communities
the Code	*Code of Practice: Onshore Petroleum Activities in the Northern Territory, 2019 (NT)*
the PER	*Petroleum (Environment) Regulations, 2016 (NT)*
the EP	Exploration Permit 161
TO	Traditional Owners
TPWC Act	*Territory Parks and Wildlife Conservation Act, 2014 (NT)*
VPD	Vehicles Per Day
WHS	Work, Health, and Safety
WMP	Weed Management Plan
WoNS	Weed of National Significance
WWMP	Wastewater Management Plan
WWPC Act	*Waste Management and Pollution Control Act, 1998 (NT)*

Definitions

Table. ii Definitions

Terminology	Definition
Activity (may be referred to as "the Activity" in this EMP).	The regulated Activity and associated works covered by this EMP, including: • Mobilisation and establishment of a temporary camp, including an equipment parking and fuelling area, on the previously cleared Tanumbirini well pad. • Maintenance and monitoring of pre-existing access tracks. • Where necessary, line preparation of 5 m wide seismic lines, and any required connection lines between seismic lines, using a rotary machine. • Conduct a 2D seismic and ground gravity survey. • Demobilisation of temporary camp and monitoring of rehabilitation of seismic and connection lines prepared under this EMP, that are not along pre-existing tracks.
Camp Wastewater	Treated sewage effluent and greywater from campsite/s and offices (e.g., laundry, shower, and sink wastes).
Environmental Factors	Environmental factors are broad divisions of the environment that may be impacted by a proposed action. *NT EPA Environmental Factors and Objectives. Environmental Impact Assessment General Technical guidance 2022* groups Factors under 5 Themes; Land, Air, Water, Sea, and People [DEPWS, 2022B].
Environmental Objective	Environmental objectives provide an indicator of whether the environmental impact of a proposed action may be significant and whether a proposed action is likely to be acceptable [DEPWS, 2022B].
Environmental Impact	As defined in *the PER* Regulation 3 as being: *'Any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity'*
Environmental Values	Important components of an environmental factor, e.g., threatened species and water quality.
The EP	The Exploration Permit subject of this EMP. The location of the Activity. See **Figure. i**.
Fauna Spotter	A specialist in identification and management of flora and fauna.
Fire Tender	Fire suppression capacity during line preparation.
Interest Holder	The title holders of Exploration Permit 161 are Santos QNT Pty Ltd (75% interest) and Tamboran Resources Limited (25% interest). The Activity will be wholly undertaken by Santos QNT Pty Ltd (the Operator).
Implementation Strategy	Has the meaning given in *the PER* Regulation 3 being:

Terminology	Definition
	'The implementation strategy for a regulated activity that is included in the environmental management plan for the Activity, as required by Schedule 1, Part 2.'
Mature Tree	Trees with greater than 25 cm at 1.3 m height (diameter at breast height [DBH]).
Mulch / Mulcher	In this document, mulching refers to removal of above-ground vegetation (when necessary) using a mulcher that cuts, mulches, and spreads cut vegetation over a 5 m width, leaving root stock intact and minimal soil disturbance.
Pastoralist	Operates or holds the lease to the land.
Non-operational	Any time when there is no crewed works occurring on the site. A non-operational site may include field monitoring.
Operational	Any time when there is crewed works occurring on the site. A short visit to the site for inspection/monitoring does not constitute site works.
Project Area	Location of the Activity within Northern Territory.
Recordable Incident	Has the meaning given in Regulation 3 *PER* being: '*An incident arising from a regulated activity:* *(a) that:* *(i) has resulted in an environmental impact or environmental risk not specified in the current plan for* the activity; or *(ii) has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or* *(iii) is inconsistent with an environmental outcome specified in the current plan for the activity; and* *(b) is not a reportable incident.*
Reportable Incident	Has the meaning given in Regulation 3 *PER* being: *'An incident, arising from a regulated activity, that has caused or has the potential to cause material environmental harm or serious environmental harm.'*
No Mulching Area	The area in which mulchers are not used within the main braided area of Tanumbirini Creek and its tributaries.
Slasher / Slashing	In this document, slashing refers to "mowing" of grasses to enable safe passage for the seismic vehicle convoy and to provide sufficient ground contact for the vibro-source and geophones.
Suitably Qualified Person	A person who has professional qualifications, training or skills or experience relevant to the nominated subject matters or tasks and can give authoritative assessment, advice, and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature or conduct tasks in accordance with requirements.
Traditional Owner	Has the meaning given in the *Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)* being:

Terminology	Definition
	***Traditional Aboriginal Owners**, in relation to land, means a local descent group of Aboriginals who:* *have common spiritual affiliations to a site on the land, being affiliations that place the group under a primary spiritual responsibility for that site and for the land; and are entitled by Aboriginal tradition to forage as of right over that land.*
Wastewater	Defined in paragraph C.2.1 of *the Code*. Includes greywater but excludes sewage.
Well Pad	Location of a pre-existing well and associated infrastructure.

Executive Summary

Introduction and Scope

Santos QNT Pty Ltd (the Operator) proposes to conduct a two-dimensional (2D) seismic survey and a ground gravity survey on a western portion of Exploration Permit (EP) 161. The Activity is anticipated to commence between June and July of 2024.

This Environmental Management Plan (EMP) has been prepared to comply with the *Petroleum (Environment) Regulations 2016 (NT)* (*PER*) and the *Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 (NT)* (*the Code*) and outlines how the environmental impacts and environmental risks associated with the Activity will be reduced to a level that is As Low As Reasonably Practicable (ALARP) and acceptable.

The Operator has undertaken several activities in EP 161 since 2013, including 2D seismic surveys, drilling, and hydraulic fracture stimulation. The current list of Environmental Management Plans (EMPs) for EP 161 is shown in **Table. iii**.

Description of the Activity

The Activity under this EMP includes:

- Mobilisation and establishment of a temporary camp, including an equipment parking and fuelling area.
- Maintenance and monitoring of pre-existing access tracks.
- Where necessary, line preparation of 5 meter (m) wide seismic lines and any required connection lines between seismic lines with a rotary machine e.g. mulcher or slasher.
- Conducting a 2D seismic and ground gravity survey.
- Demobilisation of temporary camp and monitoring of rehabilitation of seismic and connection lines prepared under this EMP that are not along pre-existing tracks.

The Activity involves the preparation and acquisition of twelve 2D seismic lines in the western part of EP 161, of which five are approximately 7.5 – 8.5 kilometres (km) long, and seven are approximately 24 – 33 km long. Additionally, approximately 10 km of connector lines may be prepared for access between the seismic lines. Gates will be provided where seismic or connection lines cross fence lines. Much of the area to be surveyed is open woodland, and in these areas, minimal line preparation work will be required for access by vehicles. Where necessary, mulcher or slasher machines will be used for line preparation.

Mulchers cut vegetation above ground and mulch and spread the cut material with minimal impact and rapid rehabilitation. The vegetation rootstock is left intact, and soil disturbance is minimal. The mulcher prepares a 5 m width within the notional 50 m seismic line or connection line corridors, allowing for

deviation around potential obstacles and key environmental sensitivities (e.g., mature trees, trees with active hollows or nests) where practicable.

Infrastructure installed for previous exploration operations, or by the landowner, that may be utilised during the Activity, will not be rehabilitated under this EMP. Any ongoing rehabilitation in the area for previous operations is covered by other EMPs (listed in **Table. iii**), and is unaffected by this EMP.

Legislative Framework

The primary legislation governing environmental approvals for onshore petroleum activities is the *Petroleum Act, 1984 (NT)* and *the PER*.

The object of *the PER* is to ensure that regulated activities are carried out in a manner consistent with the principles of ecologically sustainable development and in a manner by which the environmental impacts and risks of the activity will be reduced to levels that are ALARP and acceptable.

Under *the PER*, it is an offence to carry out a regulated activity without a current (approved) EMP in place, and it is an offence to carry out a regulated activity in a manner that contravenes a current EMP. Regulated activity is defined in Reg 5(1) of *the PER* as being an activity or stage of an activity:

(a) carried out, or proposed to be carried out, in connection with a technical works programme for a petroleum interest; and

(b) that has, or will have, an environmental impact or environmental risk.

The PER Reg 5(2) states that *'without limiting subregulation (1), a regulated activity includes the following operations or works:* [1]

(a) land clearing;

(b) earthworks (cutting, filling, excavating or trenching);

(c) the construction, operation, modification, decommissioning, dismantling or removal of a well, pipeline or other facility;

(d) establishing seismic lines or drill pads;

(e) conducting seismic surveys;

(f) drilling;

(g) hydraulic fracturing;

(h) the release of a contaminant or waste, and

(i) the storage and transportation of petroleum and hazardous substances.

As the Activity involves conducting seismic surveys and establishing seismic lines for the purpose of those surveys, the Activity is a regulated activity under *the PER* and the Interest Holder is required to

[1] Text copied from the *Petroleum (Environment) Regulations 2016 (NT)* and includes operations and works that are not part of the Activity described within this EMP.

prepare this EMP for approval. **Section 2** of this EMP sets out the additional environmental legislative requirements relevant to the Activity and how they have (or are proposed to be) complied with under this EMP.

Table. iii List of Environmental Management Plans for EP 161

EP 161 Works Programs	Scope Definition	EMP Name	Approved	Completed
McArthur Basin Civil and Seismic Program	Tanumbirini area seismic 2D seismic survey – approximately 500 km of 5 m wide seismic lines.	ENV-EP 161 (DEPWS reference STO-0002)	August 2013	✓
	Expansion of the Tanumbirini lease pad and construction of the Inacumba lease pad.	Environment Management Plan: McArthur Basin Civil and Seismic Program – Revision 4	June 2019	✓*
	Civil engineering activity – upgrading and creation of new roads and access tracks, clearing of laydown areas, borrow pits, campsites, and tank pads.			✓*
	Acquisition of a 10 km 2D seismic line.			✓
	2D seismic survey (total approx. 240 km of seismic lines & 10 km of connection lines).	EP 161 2D Seismic and Ground Gravity Survey Program (STO 6-0)	**This EMP**	
McArthur Basin Drilling Program	Drilling of Tanumbirini-1.	ENV-EP 161 TAN 0003	June 2013	✓
	Marmbulligan – 1 stratigraphic Corehole Program.	EP-161 2016 Stratigraphic Corehole Program	August 2016	✓
	Drilling of water bores in Tanumbirini North.	MAB-PLN-005	November 2018	✓
	Drilling of water bores at Tanumbirini South and Inacumba North and South.	MAB-PLN-004	December 2018	✓
	Drilling of Inacumba-1 pilot well.	McArthur Basin 2019 Drilling Program Revised and added program in STO 2-7	July 2019	n/a
	Plug and decommission of the deepest section of the Inacumba-1 pilot well.			n/a
	DFIT of Tanumbirini-1.			✓
	Drilling of Tanumbirini-2H well.			✓
	Well integrity monitoring.			Ongoing
	Evaluation of Inacumba-1/1H and Tanumbirini-2H (including mudlogging, wireline/LWD, DFIT, coring).			✓/✕
	Suspension and/or plugging and decommissioning of Tanumbirini-2H and Inacumba-1/1H.			✓/✕
	Rehabilitation of the Tanumbirini-1, Tanumbirini-2H and Inacumba-1H wells.			Ongoing
	Drilling of Tanumbirini-3H well.	STO 2-7 (Inacumba program cancelled)	January 2021	✓
	Drilling of Inacumba-2H well.			✕
	Evaluation of Inacumba-2H and Tanumbirini-3H (including mudlogging, wireline/LWD, DFIT, and coring).			✓/✕
	Suspension and/or plugging and decommissioning of Inacumba-2H and Tanumbirini-3H.			✓/✕
	Rehabilitation of the Tanumbirini-3H and Inacumba-2H wells.			Ongoing
McArthur Basin Hydraulic Fracturing Program	Hydraulic fracture stimulation (including fracturing diagnostics) at Tanumbirini-1.	McArthur Basin 2019 – 2020 Hydraulic Fracturing Program (Inacumba program cancelled)	October 2019	✓
	Hydraulic fracture stimulation (including fracturing diagnostics) at Tanumbirini-2H.			✓
	Hydraulic fracture stimulation (including fracturing diagnostics) at Inacumba-1/1H.			n/a
	Flow-back and appraisal testing of Tanumbirini-1/2H and Inacumba-1/1H (extended production testing).			✓/✕
	Hydraulic fracture stimulation (including fracturing diagnostics) at Inacumba-2H and Tanumbirini-3H.	STO 3-8 (Inacumba program cancelled)	September 2021	✓/✕
	Flow-back and appraisal testing of Tanumbirini-3H and Inacumba-2H (extended production testing).			✓/✕

* Ongoing civil works are required to maintain infrastructure.

✓/✕ Has not yet begun.

Location of the Activity

The Activity will be conducted within EP 161, which is located approximately 130 km east of Daly Waters in the Northern Territory (NT) (**Figure. i**). EP 161 encompasses a 10,582 km^2 area; however, the Activity will be limited to a small portion in the west of this EP.

The Activity will take place wholly within Tanumbirini Station, an approximate 5,000 km^2 cattle grazing property within NT Portion 701 of Arnold. No Activity will occur on Beetaloo Station.

The Activity will take place within a work area approved by the Aboriginal Areas Protection Authority (AAPA). To focus discussions regarding the environment in this region, a Project Area has been defined. The Project Area references the immediate surroundings where the Activity will occur rather than the entirety of EP 161.

The boundaries of the Project Area are detailed in **Table. iv** and illustrated in **Figure. i**.

Figure. ii shows the AAPA-approved work area situated within the Project Area.

Table. iv Project Area Coordinates

Northing	Easting
8192645.062	453547.504
8192645.062	473470.939
8157466.286	473470.939
8157466.286	464585.0618
8166671.826	464569.7012
8166655.261	455679.8782
8175873.760	455660.7917
8175868.959	453547.504

Coordinate System: GD2020 MGA53

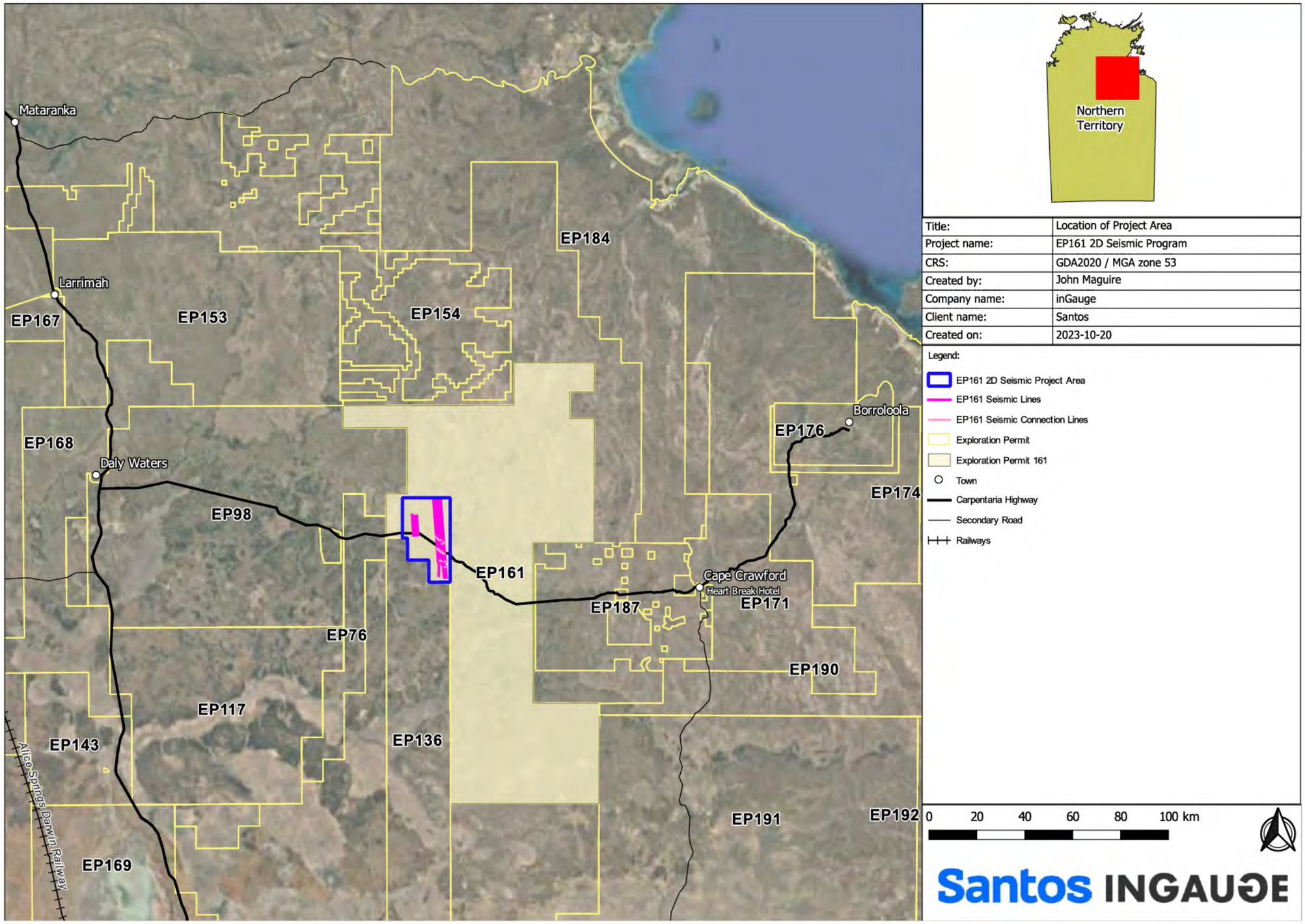


Figure. i Project Area Location

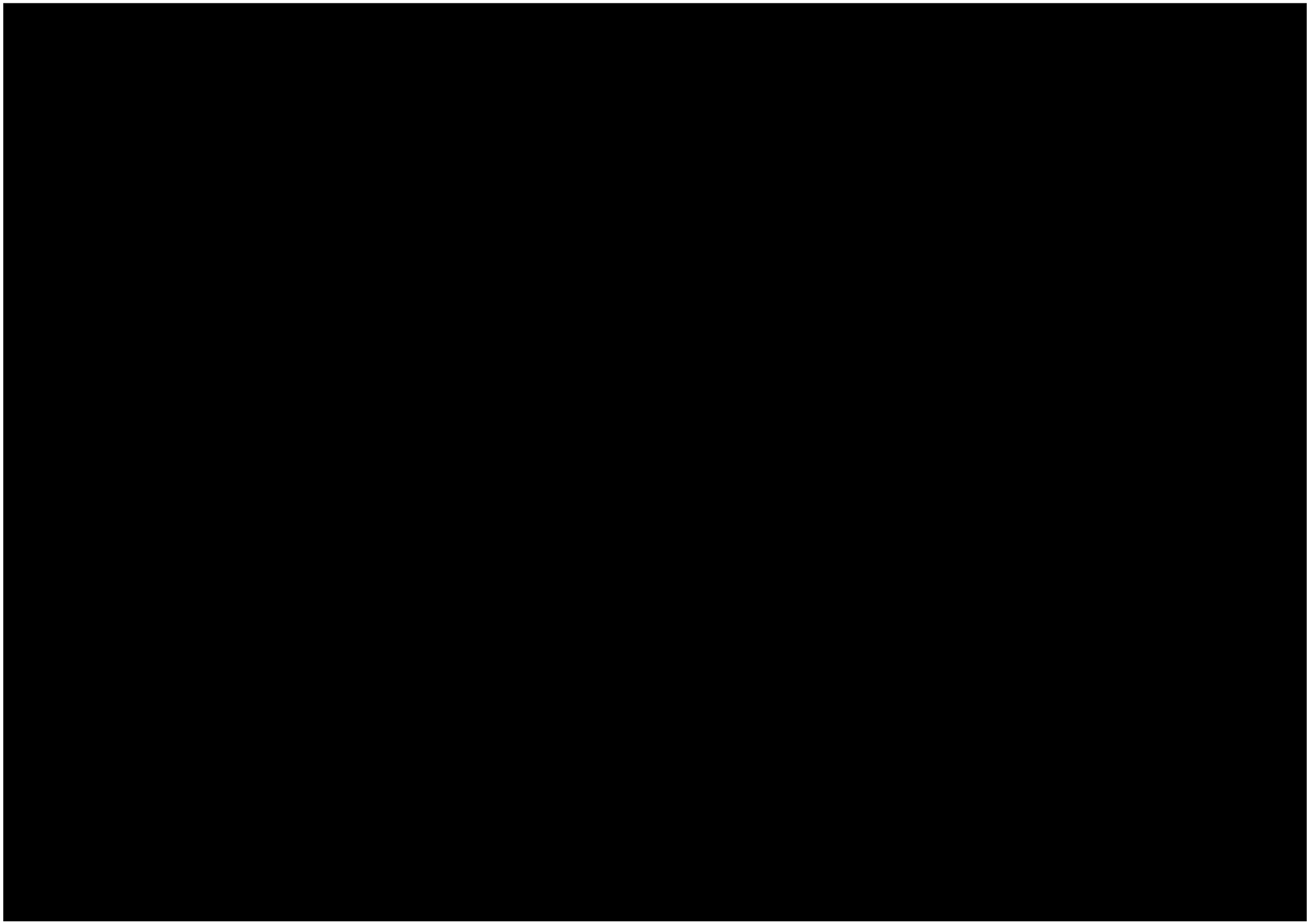


Figure. ii AAPA Area (Cropped to Project Area)

Existing Environment

The Activity is located within the Sturt Plateau and the Gulf Fall and Upland bioregions. Plateaus, sandstone outcrops and undulating plains outline the landscape. The vegetation is comprised of tussock grasslands, eucalypt and acacia forests and woodlands. The climate is semi-arid and subtropical and is influenced by monsoonal weather.

The soils in this area are comprised of kandosols and rudosols, with the major surface water features in the Project Area being the ephemeral Tanumbirini Creek to the north and Newcastle Creek to the south. The main regional groundwater resource is the Cambrian Limestone Aquifer (CLA), which provides groundwater for pastoral enterprises, domestic bores at homesteads and town water supplies at several small communities across the region. The CLA is subdivided into the Anthony Lagoon Beds (ALB) and the Gum Ridge Formation (GRF) [DEPWS, 2022A].

The Project Area straddles the intersection between the Limmen Bight – Roper River catchments, which drain towards the Gulf of Carpentaria, and the Victoria River – Wiso catchments, which drain towards the Timor Sea.

The Project Area is located at the junction of two bioregions. The western series of five seismic lines are entirely within the Sturt Plateau bioregion, and the eastern series of seven seismic lines cross over from the Sturt Plateau bioregion to the Gulf Fall and Upland bioregion.

A desktop assessment and targeted on-ground ecological surveys were undertaken in July 2023 with a specific focus on the location of the Interest Holder's proposed seismic lines. The scope of the study was to provide:

- Habitat and vegetation community descriptions.
- Locations and photos of communities and species present.
- Locations of fauna breeding places and other habitat features.
- Watercourse assessments.
- Baseline weed assessment.
- Likelihood of targeted, threatened species to occur within or adjacent to the proposed seismic Activity.
- Key ecological characteristics and potential constraints of the proposed seismic Activity.

The desktop assessment utilised the following datasets and databases:

- EPBC PMST.
- The Atlas of Living Australia (ALA) database.
- Australia's Virtual Herbarium (AVH).
- Online Zoological Collections of Australian Museums (OZCAM).

- BirdLife Australia's Birdata.
- Northern Territory Government Department of Environment, Parks and Water Security.
- (DEPWS) NR Maps.
- Strategic Regional Environmental and Baseline Assessment (SREBA) for the Beetaloo Subbasin.

The assessment focused on the Project Area with a 20 km buffer. This area is referred to as the Search Area.

No Threatened Ecological Communities (TEC), World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park, or Commonwealth Marine Areas occur within the Search Area.

The desktop assessment utilised the nationally recognised ecosystem classification system, the Interim Biogeographic Regionalisation for Australia (IBRA). Bioregions are large, geographically distinct ecosystems distinguished by broad physical and biological characteristics. The IBRA bioregions of the Beetaloo Sub-basin are described in the DEPWS report *Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin* [DEPWS, 2022c].

The EPBC PMST and SREBA data sets were analysed, and records of significant and threatened flora and fauna species found during targeted SREBA surveys were identified. No SREBA records were found for the Project Area; however, the SREBA surveys did identify species within the broader region.

Two significant species of flora previously recorded within the Project Area. *Acrachne racemosa* and *Sida sp. Excedentifolia*, are listed as Data Deficient under the *TPWC Act*.

Of the seven bird species identified as likely to occur within the Project Area, one had a high potential of occurrence – the Gouldian Finch – with a previous record within 20 km of the Project Area. Two others had a moderate chance of occurrence – the Grey Falcon and Crested Shrike-tit; however, there are no records of them within the Project Area. Two mammalian species – the Northern Quoll and Bare-rumped Sheath-tailed Bat – have a moderate potential to occur; however, there are no previous records of these species within 20 km of the Project Area. The Yellow-spotted monitor has a moderate potential to occur; however, there are no previous records of the species within 20 km of the Project Area.

Five significant bird species, one significant mammal and one significant reptile species have previously been recorded within the Project Area. The bird and mammal species were the Australian Bustard, Bush-stone curlew, Pictorella Mannikin, Rainbow bee-eater, Hooded Parrot, and Spectacled Hare-wallaby, which are all listed as Near Threatened under the *TPWC Act*. No threatened fauna species have previously been recorded in the Project Area apart from the Gouldian Finch record within 20 km of the Project Area.

One threatened reptile, Mertens' Water Monitor (*Varanus mertensi*) has been previously recorded within the search area. This record is south of the Carpentaria Highway and not associated with a mapped watercourse or water feature. This species is rarely far from water, which casts doubt on the validity of this record.

Recent surveys for the SREBA identified the Northern Blue Tongue Lizard at several sites across the Beetaloo Basin, including Beetaloo Station immediately south of Tanumbirini Station. Given the

vegetation communities present appear to be suitable for the species, it's likely that this species is also present within the Project Area.

No threatened fauna or flora species were observed during the on-ground surveys undertaken in July 2023. Two near-threatened fauna species were identified (Northern Nail-tail Wallaby and Australian Bustard). These species are highly mobile and are unlikely to be impacted by the proposed seismic Activity. Habitat exists for some conservation significant species in the area; however, given the narrow linear nature of the disturbance, species habitat requirements and the likelihood of occurrence, the risk of impacts from the proposed Activity is considered low.

Cultural Environment

A database search showed no prescribed archaeological places and objects listed on the National Heritage List, nor on the Commonwealth Heritage List along the proposed seismic line survey routes, nor are there any places under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)*. A search of the Archaeological Sites Register held by the NT Heritage Branch revealed no previously recorded archaeological sites in the survey area (**Appendix 02 Section 2.1.2**).

An archaeological study undertaken in July 2023 (**Appendix 02**) has identified four significant sites in the Project Area, including the Lagoon Creek site previously identified by Lance in 2019. Seismic lines have been adjusted so that all four sites are avoided. An exclusion zone of 10 m around other background scatter sites will also be used.

A previous report by Lance (2019) overlapped with some of the areas investigated in the archaeology report for this EMP. Lance reported 22 sites in and around the proposed seismic line area. Of primary interest to this report are the sites recorded at Lagoon Creek, in the northern area of the western survey block, representing the only high-density artefact scatter sites found in that survey.

The Interest Holder has obtained AAPA Authority Certificates C2013/142, C2018/105 variation to C2018/102, C2019/043 variation to C2014/053 and C2020/011. The Authority Certificates have identified Aboriginal Sacred Sites and detailed restricted work areas that the Interest Holder will observe.

Environmental Factors and Values that may be Impacted

An environmental risk assessment has been undertaken (**Sections 5** and **6**). A summary of the environmental factors, the risk sources and potential impacts is provided in **Table. v**.

Table. v Summary of Environmental Factors, Risk Sources, and Potential Impacts

Environmental Factor	Risk Source	Potential Impacts
Landforms	• Rotary machine, vehicle, and plant movements.	• Damage to landforms
Terrestrial Environmental Quality	• Seismic line preparation using a rotary machine. • Vehicle and plant movements. • Fuel, oil, chemical and hydraulic fluid spills, and leaks. • Camp. • Smoking. • Waste storage	• Soil quality • Disturbance to native vegetation • Dust • Noise and seismic vibration • Light • Fauna strikes. • Introduce and spread weeds. • Bushfire • Fauna interaction with camp
Terrestrial Ecosystems	• Seismic line preparation using a rotary machine. • Vehicle and plant movements. • Fuel, oil and hydraulic fluid spills and leaks. • Camp • Smoking	• Habitat loss • Introduce and spread weeds • Bushfire
Hydrological Processes	• Seismic line preparation	• Alteration of drainage lines • Extraction of groundwater
Inland Water Environmental Quality	• Storage and handling of chemicals, oil, and fuel. • Seismic line preparation.	• Water quality • Erosion
Air Quality	• Vehicles and plant exhaust	• Dust • Exhaust emissions
Atmospheric Processes	• Vehicles and plant exhaust	• Greenhouse gas emissions
Community and Economy	• Seismic line preparation • Vehicle and plant movements.	• Dust • Light • Noise • Seismic vibration • Vehicle impacts with stock and wildlife
Culture and Heritage	• Seismic line preparation • Vehicle and plant movements	• Exposing/damaging culturally sensitive site.
Human Health	• Seismic line preparation and survey.	• Dust • Light

Environmental Factor	Risk Source	Potential Impacts
	• Vehicle and plant movements	• Noise • Seismic vibration

Environmental Outcomes in Relation to the Activity

This EMP aims to achieve the following environmental outcomes in relation to the Activity, which have been adopted from the Northern Territory Environment Protection Authority's *Environmental Factors and Objectives: Environmental Impact Assessment General Technical Guidance* [NT EPA, 2022]:

- Protect air quality and minimise emissions and their impact so that environmental values are maintained.
- Enhance communities and the economy for the welfare, amenity, and benefit of current and future generations.
- Protect sacred sites, culture, and heritage.
- Protect threatened species and mitigate any disturbances or impacts the Activity may create.
- Protect the quality of groundwater and surface water so that environmental values, including ecological health, land uses, and the welfare and amenity of people, are maintained.
- Conserve the variety and integrity of distinctive physical landforms.
- Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- Protect terrestrial habitats to maintain environmental values, including biodiversity, ecological integrity, and ecological functioning.

The objective of this EMP is to demonstrate that the potential environmental impacts and risks associated with the Activity will be reduced to ALARP and acceptable. To achieve this objective, the Interest Holder will carry out the Activity such that all risks are identified, and risk management controls are implemented as described in the Environmental Risk Assessment so that all the requirements of *the Code* will be met (**Section 6**).

By implementing the controls outlined in the EMP and associated appendices, the risk of an impact from the Activity on the environment will be reduced to ALARP and be acceptable.

For performance standards and measurement criteria associated with the environmental outcomes to be achieved in the carrying out of the Activity and as described in this EMP, refer to **Section 8**.

Stakeholder Engagement

The Interest Holder has established and maintains mutually beneficial relationships with stakeholder groups and endeavours to generate positive economic and social benefits for and in partnership with communities.

Stakeholder identification was undertaken prior to commencing previous works in 2014 and has been ongoing since in relation to other works in the area. The relevant stakeholder groups were identified and engaged so that they could be informed of the proposed Activity and the associated risks, to build an understanding as to why and how the Interest Holder operates and have any objections or claims considered and addressed.

Stakeholder engagement is discussed in **Section 9**, and a full list of the relevant stakeholders is provided in **Appendix 04**. The Interest Holder has continued to engage with these key stakeholders about this Activity and development on an ongoing basis.

The proposed Activity is located within a private pastoral station in a remote location. The footprint of the Activity and its impact on the environment is small. The Interest Holder has identified the following groups as the relevant stakeholders whose rights or operations may be directly affected by the environmental impacts or environmental risks of the proposed Activity:

- Traditional Owners:
    - Facilitation via the Northern Land Council.
    - Nurrdalinji Native Title Aboriginal Corporation.
- Landholders, landowners, and land occupiers (host pastoralists):
    - Rallen Australia Pty Ltd (Tanumbirini Station).
- Other (Mining / Mineral) Title Holders:
    - Pennant Resources Pty Ltd.
- Services:
    - Power and Water Corporation (third-party pipeline).
    - Telstra (communications tower).
    - Department of Infrastructure, Planning and Logistics (DIPL) – roads including Carpentaria Highway.

Government and industry stakeholders are updated through regularly scheduled industry and governmental joint meetings and one-off conferences. Landholders have been consulted about the Activity on several occasions. Both a Land Access Agreement (LAA – number LAA0022) and an Indigenous Land Use Agreement (ILUA) covering the scope of this EMP are in place for landholders and TOs, respectively.

Stakeholder engagement records detailing who, when, type of engagement, method of delivery, and matters raised have been provided in **Appendix 04**, with a summary of stakeholder contact details provided in **Table. vi**, and a summary log of stakeholder engagement provided in **Table. vii**.

The engagement process has involved:

- Discussion with stakeholders on the proposed impacts of the Interest Holder's operations.
- Building relationships.
- Sharing information.
- Bringing stakeholder voices into decisions in the ongoing planning and development of the proposed Activity so that specific issues can be considered and addressed.
- Future engagement with pastoralists will occur throughout the proposed Activity.

Table. vi Stakeholder Contact Details

Stakeholder	Role / Position	Phone Number	Email / Other Contact
Landholder			
[redacted]	Landholder Tanumbirini Station (Rallen Australia)	[redacted]	
	Legal Representation		
Northern Land Council			
[redacted]	Senior Project Officer	[redacted]	
	Senior Project Officer		
	Petroleum Manager		
Nurrdalinji Native Title Aboriginal Corporation			
[redacted]	N/A	[redacted]	
Mineral / Mining Title Holders			
[redacted]	Managed by: Australian Mining & Exploration Title Services Pty Ltd	[redacted]	
Services			
[redacted]	[redacted] Graduate Mechanical Engineer	[redacted]	

Stakeholder	Role / Position	Phone Number	Email / Other Contact
[redacted]	[redacted]		
Additional Parties (Non-Stakeholder)			
[redacted]			

Table. vii Stakeholder Engagement Log - Summary

Date	Method	Stakeholder	Summary of Communication	Response Date	Response Summary
Landholder					
2022.05.21	Email	Landholder → Santos	Raises concerns over location of access track.	2022.05.23	Clarifies that the access track locations are indicative only. Would like to organise a discussion time.
2022.05.31	Email	Landholder → Santos	Raises concerns of the use of open topped pits. Wishes to organise a meeting.	2022.05.31	Responds to concerns, noting discussions with Operations Team to better understand.
2022.10.26	In person	Santos + Landholder	Onsite at Tanumbirini Station. Discussions of seismic acquisition and rehabilitation.	2022.10.26	The Interest Holder committed to mulching seismic lines and utilising existing tracks where possible.
2023.10.20	Email	Santos → Landholder	Email outlining the below attachments, and acknowledgement of query regarding renaming the well. Attached files: • EP 161 Seismic – Pastoralist Engagement Pack. • Letter Santos Confirmation of Registration Access Agreement. • A Deputy Chief Executive Signed – Notice of Approved Access Agreement.	-	-
Northern Land Council & Traditional Owners					
2022.09.26	Email	Santos → NLC	Work program and spatial files.		
2023.04.05	Email	Santos → NLC	• Shares information which is expected to be shared during the On-Country Meeting and agenda. Attached files: • Meeting Agenda 2023 Work Program Meeting Santos EP 161. • Mataranka presentation pack_NLC_EP 161 Meeting_12 April 2023.	-	-
2023.04.12	In Person	Santos + NLC + TO	• On-Country Meeting in Mataranka.	-	-
2023.04.14	Email	Santos → NLC	Forwarding AAPA certificates.	2023.04.14	NLC • Raises concerns around location of seismic lines in relation to sacred site/s. • Outlined that the TO's wished to share knowledge of country on country, and witness what the Interest Holder is doing.
2022.04.14	Email	Santos → NLC	• Highlights that the certificates have been issued by AAPA, each with conditions, guidance, and warnings. • Outlines that specific access to areas of country within EP 161 are determined by the pastoralist. • Santos is not in a position to approve access to country.	2023.04.14	• Insufficient clarity on the Interest Holder's position to approve access to country. • Requested additional management in future.
Nurrdalinji Native Title Aboriginal Corporation					

Date	Method	Stakeholder	Summary of Communication	Response Date	Response Summary
2023.08.17	Email	Santos → NNTAC	• Details on proposed 2024 Seismic program and potential future works.	2023.08.28	• NNTAC request for further information regarding EMP, consultation, fracking, along with other questions.
2023.08.31	Email	NNTAC → Santos	• Provides a list of questions regarding the work program.	2023.09.26	• Responses provided to question raised by NNTAC.
2023.09.21	Email	NNTAC → Santos	• Nurrdalinji Aboriginal Corporation invite Santos to a meeting.	2023.10.07	• Meeting focusing on consent and inclusion of NTTAC in future discussions.
Mineral/Mining Title Holders					
2023.10.10	Email	Santos → NT Australian Mining & Exploration Title Services (on behalf of Pennant Resources)	• Notification of intent to undertake regulated activities. • Attached files: maps of seismic line across Tanumbirini station.	-	-
Services					
Telstra					
2023.08.02	Email	Santos → Telstra	• Seeking relevant contact details in regard to Telstra Tower 3354.	-	-
2023.09.06	Phone	Santos → Telstra	• Discussed details and potential impacts of proposed 2024 Seismic Program and potential future works.	2023.09.06	• Summary and reiteration of the Interest Holder's plans in EP 161, the name and location of the tower. • A GIS map of the location and survey plan of the site.
2023.09.06	Email	Telstra → Santos	• Confirmation that Telstra has no issues with proposed Interest Holder Activity in the area. • Details of the Amplitel site.	2023.10.09	• Formal communication of work the Interest Holder will be conducting in EP 161 during 2024/2025. • Outlining the Activity.
Power & Water					
2023.10.03	Email	Santos → Power Water	• Details on proposed 2024 Seismic program, including rehabilitation and monitoring. • Maps of the proposed Activity.	2023.10.26	Phone: • Discussion of Activity in relation to pipeline. Email: • Requests previously sent documents with maps /attachments. Outlines policies with pipeline crossings with heavy >10T vehicles, pipeline buffers, and ground limit of peak particle velocity (PPV).
2023.10.31	Email	Santos → Verbrec	• Attaches copy of Stakeholder Engagement Pack. • Confirms Santos will clear the pipeline by 30 m during seismic acquisition and that PPV tests will be conducted to ensure the PPV is below 10mm/sec.	-	-
DIPL					
2023.10.03	3:06pm	Santos → DIPL	• Notification of intent to undertake regulated activities.	-	-

Note: confidential contact details are to be redacted prior to the EMP being published online.

1. Introduction

1.1 Background and Purpose

Santos QNT Pty Ltd (the Interest Holder) is the Interest Holder of Exploration Permit (EP) 161, which is located approximately 130 km east of Daly Waters in the NT (**Figure. i**). The Interest Holder has undertaken exploration activities in EP 161 since 2013, including two-dimensional (2D) seismic surveys, drilling, and hydraulic fracturing.

The Interest Holder is proposing to conduct a 2D seismic survey and ground gravity survey in the Western portion of EP 161. The Activity is scheduled to commence between June and July 2024. The Activity is focused within the eastern portion of the Beetaloo Sub-basin, shown in **Figure 1.1—1**. The purpose of the Activity is to increase understanding of the prospectivity potential of EP 161.

The Activity will take place within a work area approved by the AAPA. To focus discussions regarding the environment in this region, a Project Area has been defined (refer to **Table. iv** for the Project Area coordinates). This references the immediate surroundings where the Activity will occur rather than the entirety of EP 161 (refer to **Figure. ii**). The Activity will take place wholly within Tanumbirini Station, an approximate 5,000 km^2 cattle grazing property within NT Portion 701 of Arnold. No Activity will occur on Beetaloo Station.

The Activity under this EMP includes:

- Mobilisation and establishment of a temporary camp, including an equipment parking and fuelling area, on the previously cleared Tanumbirini well pad.
- Maintenance and monitoring of pre-existing access tracks.
- Where necessary, line preparation of 5 m wide seismic lines and any required connection lines between seismic lines with a rotary machine e.g. mulcher or slasher.
- Conducting a 2D seismic and ground gravity survey.
- Demobilisation of temporary camp and monitoring of rehabilitation of seismic and connection lines prepared under this EMP that are not along pre-existing tracks.

The Activity involves the preparation and acquisition of twelve 2D seismic lines in the western part of EP 161, five approximately 7.5 - 8.5 km long and seven approximately 24 - 33 km long. Additionally, approximately 10 km of connector lines may be prepared for access between seismic lines. Much of the area to be surveyed is open woodland, and in these areas minimal line preparation work will be required for vehicle access. Where necessary, a mulcher or slasher will be used for line preparation.

Mulchers cut vegetation above ground and mulch and spread the cut material for minimal impact and to promote rapid rehabilitation. The vegetation rootstock is left intact, and soil disturbance is minimal. The mulcher only prepares a 5 m width within the notional 50 m seismic line and connection line corridors, allowing for deviation around potential obstacles and key environmental sensitivities (e.g., mature trees, trees with active hollows or nests) where practicable.

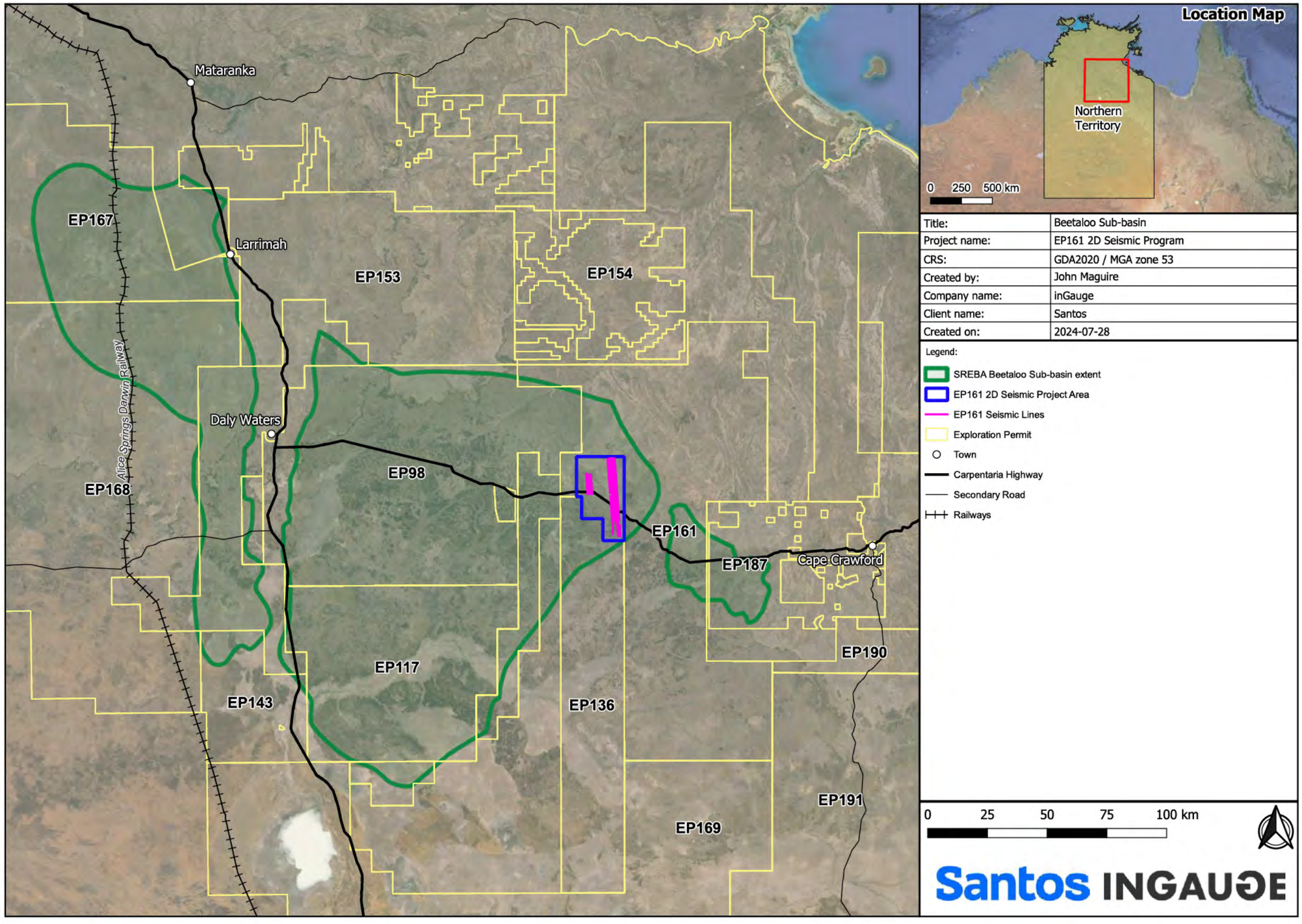


Figure 1.1—1 Location of the Beetaloo Sub-basin Relative to the Project Area

Infrastructure installed for previous exploration operations or by the landowner that may be utilised during the Activity will not be rehabilitated under this EMP. Any ongoing rehabilitation in the area for previous operations is covered by other EMPs (listed in **Table. iii**), and is unaffected by this EMP.

1.2 Scope of this EMP

Before carrying out the Activity, the Interest Holder must submit an EMP to the Minister for approval. This EMP has been prepared to meet the approval criteria in Regulation 9 of the *PER* and the content requirements in Schedule 1, including the following:

- A description of the Activity (including location of the Activity, general details of the construction and layout, and an outline of the proposed timetable).
- A description of the existing environment that may be affected by the Activity (including details of any values and sensitivities of the environment).
- An assessment of the environmental risks and associated environmental impacts (including a description of the process used to assess the impacts and risks).
- The environmental outcomes and environmental performance standards of the Activity.
- An implementation strategy (including details of systems, monitoring and testing, and personnel) and an emergency contingency plan, known as the Emergency Response Plan.
- Details of stakeholder engagement carried out by the Interest Holder.
- Details of the legislative requirements applicable to the Activity that are relevant to the protection of the environment.
- Arrangements for recording, monitoring, and reporting information about the Activity.
- Arrangements for notification of commencement of construction or seismic survey.
- The Interest Holder will seek approval before undertaking any regulated activity not included in this EMP.

The Interest Holder is committed to undertaking the Activity in a manner that minimises and controls the environmental impacts, including potential impacts on Pastoralists and Traditional Owners (TO).

In addition, this EMP sets out measures to reduce the environmental risks and potential environmental impacts of the Activity to an acceptable level that is ALARP and acceptable.

The Activity includes two sets of proposed seismic lines, each in an approximate north-south orientation. One set of five seismic lines, each approximately 7.5 - 8.5 km long, is west of the Tanumbirini Station homestead, and the other set of seven seismic lines each approximately 24 - 33 km long is east of the Tanumbirini Station homestead. Additionally, approximately 10 km of connector lines may be prepared for access between seismic lines. For further detail on these lines refer to **Section 3.5**.

Table 1.3—2 presents the details of the EP 161 Interest Holders. However, for the purpose of this EMP, Santos QNT Pty Ltd is the Operator as it will be wholly responsible for the undertaking of the Activity and implementation of the management measures set out in this EMP. Tamboran Resources Limited will not be involved in implementing the EMP. **Table 1.3—1** provides details of the Interest Holder and the Interest Holder's nominated liaison person.

1.3 Interest Holder Details

Table 1.3—2 presents the details of the EP 161 Interest Holders.

However, for the purpose of this EMP, Santos QNT Pty Ltd is the Operator as it will be wholly responsible for the undertaking of the Activity and implementation of the management measures set out in this EMP. Tamboran Resources Limited will not be involved in implementing the EMP.

Table 1.3—1 Details of Operator and Nominated Liaison Person

Operator Details	Liaison Contact Person
Name: Santos QNT Pty Ltd	**Name:** David Gornall
Address: 60 Flinders Street, Adelaide, SA 5000	**Position:** Manager Environment EA PNG
Telephone: 08 8116 5000	**Company:** Santos QNT Pty Ltd
ACN: 083 077 196	**Address:** Level 22, Santos Place, 32 Turbot Street, Brisbane, QLD, 4000
	Phone: 07 3838 3000
	Email: David.Gornall@santos.com

Table 1.3—2 Interest Holders

Interest Holders	Percentage Interest (%)
Santos QNT Pty Ltd (Operator)	75
Tamboran Resources Limited	25

2. Environmental Legislation and Other Requirements

2.1 Legislation Requirements

A regulated activity is defined in Reg 5(1) of the *Petroleum (Environment) Regulations 2016* (*the PER*) as *an activity or stage of an activity carried out, or proposed to be carried out, in connection with a technical work programme for a petroleum interest and that has, or will have, an environmental impact or environmental risk*.

The PER Reg 5(2) states *without limiting sub-regulation (1), a regulated activity includes the following operations or works* [2]:

(a) land clearing;

(b) earthworks (for example, cutting, filling, excavating or trenching);

(c) the construction, operation, modification, decommissioning, dismantling or removal of a well, pipeline or other facility;

(d) establishing seismic lines or drill pads;

(e) conducting seismic surveys;

(f) drilling;

(g) hydraulic fracturing;

(h) the release of a contaminant or waste;

(i) the storage and transportation of petroleum and hazardous substances.

The Activity involves conducting seismic surveys and establishing seismic lines for the purpose of those surveys and is, therefore a regulated activity under *the PER*. The Interest Holder is required to submit this EMP for approval before the Activity can be carried out.

A summary of the environmental legislation (Commonwealth and NT) and approval requirements and the Interest Holder's actions and intent for each is provided in **Table 2.1—1**.

[2] Text copied from the *Petroleum (Environment) Regulations 2016 (NT)* and includes operations and works that are not part of the Activity described within this EMP.

Table 2.1—1 Summary of Legislation Requirements

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
Northern Territory			
Petroleum Act 1984 (NT)	• A petroleum exploration permit is required to explore for hydrocarbons. • An exploration permit remains in force for five years commencing on the day it was granted or renewed (Section 22).	• Exploration permit EP 161 has been obtained and applies to the Project Area and Activity, and the Interest Holder is the title holder of EP 161.	Department of Industry, Tourism and Trade (DITT)
	• Compensation to be paid to native title holders and owners and occupiers of land with a registered interest in the land where petroleum Activity is proposed (Section 81 and 82).	• An ILUA is in place with Traditional Owners affected by the Activity. A Co-operation and Exploration Agreement - Exploration Permit Application EP(A)161 was signed 4 April 2012. • Compensation will be made for work on the land as well as rights for access.	
Petroleum Regulations 2020 (NT)	• Requiring a land access agreement before conducting regulated petroleum operations.	• A Land Access Agreement (LAA) is in place – number LAA0022*, approved 4 October 2023.	DITT
Petroleum (Environment) Regulations 2016 (NT)	• Ensuring the Activity has an approved EMP, which satisfies the approval criteria set out in Regulation 9. • The Activity is a regulated activity as defined in Regulation 5 of *the PER* that includes establishing seismic lines and conducting seismic surveys.	• This EMP has been developed to satisfy the approval criteria set out in Regulation 9, the EMP: *(a) includes all information required by Schedule 1;* *(b) is appropriate for the nature and scale of the regulated Activity to which the EMP relates;* *(c) demonstrates that the Activity will be carried out in a manner by which the environmental impacts and environmental risks of the Activity will be reduced to a level that is:* *(i) as low as reasonably practicable;* *(ii) and acceptable; and* *(d) includes an authority certificate in relation to the land on which the Activity will be carried out* (**Section 4.4.4**).	Department of Environment, Parks, and Water Security (DEPWS)
	• Reg. 5A decisions by the Minister are subject to the principles of ecologically sustainable development.	• This EMP considers the principles of ecologically sustainable development.	
	• The *PER* includes notification requirements for recordable and reportable incidents.	• This EMP identifies the incident and reporting requirements (**Section 8.6.1**) which are to be undertaken in accordance with the *PER*.	
	Clause 12 of Schedule 1: *A plan must specify arrangements for the interest holder to notify the following persons before the proposed date of commencement of construction, drilling, or seismic surveys:* *(a) the Minister;* *(b) the occupier of the land on which the activity is to be carried out;* *(c) the owner of the land on which the activity is to be carried out (unless the owner is also the occupier).*	• **Section 8**, **Table 8.6—2** (Reporting Details).	
	• Detailed requirements of *the PER* are set out throughout this EMP. In addition, the Interest Holder notes: ○ Reg. 18 revisions are required before the end of each five-year period of an EMP.	• A revised EMP will be submitted before the end of each five-year period of the EMP. • A proposed revision of this EMP will be submitted to the Minister for approval if there has been a new or increased environmental impact or risk that is not provided for in this EMP.	

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
	○ Reg. 17 revisions are required for increased or new environmental impact or risk.		
	• Reg. 7 stakeholder engagement is undertaken for the Activity is undertaken during the preparation of an EMP.	• The Interest Holder has undertaken stakeholder engagement in accordance with *the PER* (**Section 9**).	
	• Reg. 10(1) of Schedule 1 an EMP must *(a) specify any* **legislative requirements** applicable to the regulated activity described in the plan that are relevant to the protection of the environment; and *(b) demonstrate how those requirements will be met* • Reg. 10(2) ***legislative requirements*** *include the requirement to comply with an approved code of practice.*	• This EMP has been developed to comply with all mandatory requirements of *the Code*, applicable to the Activity. • Specific cross-references to the clauses in *the Code* are included in the EMP as relevant. • Relevant legislative requirements applicable to the Activity are detailed in this table. • A summary of how those requirements will be met is included in this table.	
Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 (NT)	• *The Code* applies to all conventional and unconventional oil and gas exploration, appraisal, development and production and ancillary works in the Northern Territory and provides the minimum standards that must be adhered to.	• This EMP, including its Appendices, has been prepared to comply with *the Code*. • The EMP includes an assessment of the Environmental Factors and Values that may be affected by the Activity (**Table 4.6—1**). • The mitigation and management of the environmental factors and objectives are presented in **Table 6.1—1** (Risk Assessment Table), following the description of the risk assessment process (**Section 5**). • **Table 6.1—1** includes references to the relevant sections of *the Code* for each risk source to ensure compliance with *the Code*.	DEPWS
Code of Practice for Wastewater Management NT 2020	• This *Code of Practice* provides technical requirements and guidance for the selection, design, installation, and management of wastewater management systems (WMS) in the Northern Territory. • This *Code of Practice* provides the best practice for effective wastewater management based upon current standards and guidelines, while safeguarding public health and minimising possible adverse environmental effects.	• Any Sewage Treatment System installed will comply with this *Code of Practice* (**Section 7.5**).	Chief Health Officer Department of Health – Public Health Directorate
Bushfires Management Act 2016 (NT)	• This Act requires owners and occupiers to take all reasonable steps to protect property from fire and prevent or inhibit fire from spreading to other lands (Section 90).	• Addressed through the Interest Holder's Fire Management Plan (**Section 7.3**), including bushfire preventative and response measures. The Interest Holder utilised the *NT Government's Bushfire Management Planning Guide: Onshore Petroleum Projects (2020)* [DENR, 2020] to prepare the Fire Management Plan. • Annual fire mapping to monitor changes in fire frequency as required by *the Code*.	Bushfires NT
Environment Protection Act 2019 (NT) and Environment Protection Regulations 2020 (NT)	• A proponent is required to refer a proposed action to the NT EPA that has the potential to have a significant impact on the environment or meets a referral trigger (Section 48). • A referral trigger means an action that the Minister considers is likely to have a significant impact on the environment, or a location-based trigger which involves an area that the Minister considers is of significance because of a feature of the natural or	• A self-assessment of the potential environmental impacts was completed using the pre-referral screening tool (**Section 2.5.1**). Based on this assessment, the Interest Holder has determined that the Activity will not significantly impact the environment. Moreover, no referral triggers have been declared by the Minister to date. As such, the Activity is not required to be referred to the *NT EPA*.	Northern Territory Environment Protection Authority (NT EPA) DEPWS

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
	cultural environment and likely to be subject to significant impact by actions.		
Territory Parks and Wildlife Conservation Act 1976 (NT)	• Sets aside areas that cannot be developed and provisions for threatened flora and fauna and protected wildlife.	• The Project Area does not overlap with any areas protected under the *TPWC Act* (**Section 4.3.1** and **Figure 4.3—1**).	DEPWS
Waste Management and Pollution Control Act 1998 (NT)	• Requirements covering: o General environmental duty. o Waste management (including waste management hierarchy). o Waste transportation and waste disposal requirements.	• **Section 5** and **Section 6** (Risk Assessment). • **Section 7.5** (Waste and Wastewater Management Plan). • **Section 7.7** (Spill Management Plan).	DEPWS
	• S12. General environmental duty applies to works outside of the lease area or if a spill or leak occurs that leaves the lease area or 1km from the centreline of a flowline.	• **Section 6** (Risk Assessment). • **Section 7.4** (Rehabilitation Management Plan). • **Section 7.5** (Waste and Wastewater Management Plan). • **Section 7.6** (Emergency Response Plan). • **Section 7.7** (Spill Management Plan).	
	• S14. Duty to notify of incidents causing or threatening to cause pollution: applies if an incident occurs outside of the lease area or if a spill or leak occurs that leaves the lease area or 1km from the centreline of a flowline, which causes or threatens to cause material or serious environmental harm.	• **Section 8.6.1** (Incident Reporting).	
Food Act 2004 (NT)	• Health requirements for mining and construction camps.	• Potable water supplied to camps will be routinely analysed to make sure it is safe, and a demonstration will be made to the *Department of Health* that the camp kitchen has a potable water supply by the camp contractor.	Department of Health Environmental Health Branch
Weeds Management Act 2001 (NT)	• Requires the occupier of the land (the Interest Holder) to: o Take all reasonable measures to prevent the land from being infested with a declared weed. o Take all reasonable measures to prevent a declared weed or potential weed on the land from spreading to other lands. o Notify the weeds officer of the presence of the declared weed. o Comply with any declared weed management plans.	• The Interest Holder will comply with the requirement of this Act through the implementation of weed prevention, detection, and eradication controls as detailed in the Weed Management Plan (**Appendix 03**).	Weed Management Branch, DEPWS
Water Act 1992 (NT) and Water Regulations 1992 (NT)	• The Act requires a licence to take groundwater (Section 60).	• Groundwater from existing water bores may be required for firefighting water, maintenance of the existing pastoral access road(s) and/or dust suppression. Water will be extracted only in accordance with, and if authorised by, groundwater extraction licence(s) held by the Interest Holder. Water Extraction Licence GRF10280 authorises the extraction of 193.5 ML/year from the Gum Ridge	Water Resources Division, DEPWS

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
		Formation. Water Extraction Licence GRF 10280 was reissued to the Interest Holder on 6 December 2023 for a period of 10 years that expires on 31 December 2033.	
	• The construction of water bores is regulated under the Act.	• No water bores will be constructed under this EMP. • If any bore work is required, the necessary authorisations will be obtained under section 57 of the *Water Act 1992*.	
	• The Act requires permit to interfere with a waterway (Section 41).	• A permit to construct or alter works is to be applied for if there is a change to a waterway's shape, volume, speed or direction of water flow, bed or bank stability which is not planned under this EMP.	
	• The Act limits the amount of groundwater for hydraulic fracturing within 1 km of a designated bore.	• No hydraulic fracturing is proposed in this EMP.	
	• The taking of surface water for petroleum works is prohibited (Section 45A).	• No surface water take is proposed under this Activity.	
	• Prohibits wastewater releases to surface water bodies or reinjection.	• No wastewater release to surface water is proposed. Sewage and greywater may be transported offsite by a waste management contractor or treated in a portable sewage treatment plant (STP). Treated effluent from the STP would be irrigated in a designated irrigation area 50 – 100 m away from the camp location and away from any place from which it is reasonably likely to enter any waters, and to minimise spray drift and ponding (**Section 7.5.3.2**). • No waste or wastewater will be disposed of underground.	
NT Planning Scheme Land Clearing Guidelines	The NT Planning Scheme 2020 states at clause 3.2(5) that the clearing of native vegetation is to: • avoid impacts on environmentally significant or sensitive vegetation; • be based on land capability and suitability for the intended use; • avoid impacts on drainage areas, wetlands, and waterways; • avoid habitat fragmentation and impacts on native wildlife corridors; and • avoid impacts on highly erodible soils. The *NT Planning Scheme Land Clearing Guidelines* (LCG [2021]) identify the following recommendations: • Buffers are recommended as follows: o *Section 4.3.3* Property boundary buffers for native vegetation: i) 25 m for < 8 ha. ii) 50 m for 8 to 20 ha. iii) 100 m for 20 to 100 ha. iv) 200 m for > 100 ha. o *Section 4.3.5.1* Road buffers:	• The seismic lines will be operated within a notional 50 m working corridor of 25 m on each side of the nominal seismic centre line. • Where necessary, a mulcher or slasher will be used for preparing the seismic lines for access by survey vehicles. Mulchers simultaneously cut vegetation and mulch and spread the mulch for minimal impact. The vegetation rootstock is left intact, allowing rapid rehabilitation. Only a 5m width within the notional 50 m seismic line corridor will be prepared. This enables avoiding as much as is practicable mature trees, trees with active hollows or nests, and obstacles such as termite mounds. • In easily traversable terrain such as open woodland, the slasher would be predominately used or the mulcher would be operated with the mulcher up, with the marks of the mulcher tracks being sufficient for the surveyors and recording crew to follow. • A riparian vegetation decision tree will be completed for all watercourses (refer to **Section 3.5.2**) to determine the most appropriate action for seismic vehicles. LCG and buffer areas associated with waterways and drainage lines were considered during planning for the Activity and are further discussed in **Section 4.1.7**. • The presence of any riparian vegetation in the final ground truthing along the seismic line routes would be recorded, and the final routes selected within the 50 m seismic line corridors avoiding these areas as much as practicable. Small portable nodal geophones may also be used in riparian areas for data acquisition (**Section 3.5.4**). • Vegetation slashing may be required for safe access by personnel. • Mature trees and trees with active hollows or nests selected for preservation will be flagged and recorded to ensure their protection.	DEPWS

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
	i) Where land proposed for clearing is adjacent to a public road reserve, retain a minimum 50 m wide native vegetation buffer. ii) The clearing and future use of the land shall not prevent or impede the drainage of the public road. ○ *Section 4.4.6* Sensitive or significant vegetation value types retain: i) Low – 50 m. ii) Medium – 100 m. iii) High – 250 m. ○ *Section 4.4.7* Riparian areas related to the stream order classification of the waterway measured from the outer edge of the riparian vegetation or levee (whichever is the greater). If braided channels are present, the edge of the outer most stream channel: i) Drainage depression – 25 m. ii) 1st Order – 25 m. iii) 2nd Order – 50 m. iv) 3rd and 4th Order – 100 m. v) ≥ 5th Order – 250 m.	• Further information is available in **Section 7.4**(Rehabilitation Management Plan). **Section 7.1** (Erosion and Sediment Control Plan) addresses the erosion risk associated with line preparation works based on slope gradient.	
Work Health and Safety (National Uniform Legislation) *Act 2011* (NT) (WHS Act) Work Health and Safety (National Uniform Legislation) *Regulations 2011* (NT)	• Requires workers and workplaces to implement the national health and safety framework. This includes hazardous chemical assessments, a hazardous chemical register, access to safety data sheets, labelling, and the use, handling, generation, and storage of hazardous chemicals at a workplace. • Duties imposed under the WHS Act require the elimination or minimisation of health and safety risks as far as is reasonably practicable (Section 17). • Requires notification of notifiable incidents and preservation of incident sites.	• The Santos Management System (SMS) includes the management of chemical storage dossiers, safety data sheets (SDS) and appropriate procedures and controls to prevent worker exposure to hazards. • The Interest Holder will notify NT WorkSafe if required under the legislation. • **Section 7.6** (Emergency Response Plan). • **Section 8.6.1** (Incident Reporting).	NT WorkSafe, Department of the Attorney-General and Justice
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2010 (NT) and Regulations 2011	• Requires implementing all required signage, spill management, reporting, and licencing requirements for chemical transportation during drilling activity. • Road vehicles must be licenced, and the drivers must hold a dangerous goods driver's licence to transport dangerous goods over a certain volume or weight (Regulations, Part 15). • Notification of incident resulting in dangerous situation required.	• Any dangerous goods transported and stored for the Activity will comply with these requirements. • **Section 6** (Risk Assessment). • **Section 7.7** (Spill Management Plan). • **Section 8.6.1** (Incident Reporting).	NT WorkSafe, Department of the Attorney General and Justice
Heritage Act 2011 (NT) **Heritage Regulations 2012 (NT)**	• Requires the avoidance of impacts on heritage places and objects. • Work approval is required to carry out works on a heritage place or object (Section 72).	• An archaeological study undertaken in July 2023 (**Appendix 02**) has identified four significant sites in the Project Area. Seismic lines have been adjusted so that all four sites are avoided. An exclusion zone of 10 m around other background scatter sites will also be used (**Section 4.4**).	Heritage Branch, Department of Tourism and Culture

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
	• Requires a written report where a place or object that is known to be an Aboriginal or Macassan archaeological place or object is discovered (Section 114).	• Any new sites or finds identified during the Activity will be reported to the CEO of the Heritage Council under the *Heritage Act 2011* (**Section 8.6.1**). • Prior to and during the Activity, the SMS, 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure' will be implemented. • Further information is provided in **Section 4.4** (Cultural Environment) and **Appendix 02**.	
Northern Territory Aboriginal Sacred Sites Act 1989 (NT)	• The Interest Holder must obtain an AAPA Authority Certificate.	• The Interest Holder has obtained AAPA Authority Certificates (**Section 4.4.4**). • See **Section 4.4.4** for the conditions in the Certificates. • Prior to and during the Activity, the SMS, 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure' will be implemented. • Further information is provided in **Section 4.4** (Cultural Environment).	AAPA
Public and Environmental Health Act 2011 (NT) **Public And Environmental Health Regulations 2014**	• Sewerage and greywater treatment systems are subject to the requirements of *this Act and Regulations*.	• The Interest Holder will ensure that if sewerage and greywater treatment systems are required, they will meet the requirements of the Act, Regulations and the *NT Code of Practice for Small Onsite Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent*. • If it is estimated that the system will treat more than 2,000 L/day, the Interest Holder will notify the CHO of the intention to install the wastewater management system or series of wastewater management systems at least 7 days before the start of the installation in the prescribed form.	Chief Health Officer (CHO) Department of Health (DoH)
Dangerous Good Acts 1998 (NT)	• Safe handling inc. storage and transport of dangerous goods.	• The SMS will be implemented during the Activity to ensure the safe handling of dangerous goods.	NT WorkSafe, Department of the Attorney General and Justice
Agricultural and Veterinary Chemicals (Control of Use) Act 2004	• Use of agricultural chemicals e.g., pesticides to manage land.	• **Section 6** (Risk Assessment) • **Section 7.7** (Spill Management Plan)	DITT
Commonwealth			
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	• Not carry out any conduct that contravenes a provision of a Ministerial declaration in relation to a significant Aboriginal area. • Not carry out any conduct that contravenes a provision of a Ministerial declaration in relation to a significant Aboriginal object or objects. • Must report anything reasonably suspected to be Aboriginal remains to the Minister.	• The Interest Holder has obtained AAPA Authority Certificates. See **Section 4.4.4** for certificate details.	Commonwealth Department of Climate Change, Energy, the Environment and Water
Aboriginal Land Rights (Northern Territory) Act 1976	• Exploration license will only be granted in respect to Aboriginal land when the relevant Land Council and Minister consent, the Governor General has declared granting the license is in the national interest and the Land Council and the applicant have entered into an agreement as to the terms and conditions of the license.	• EP 161 is issued. • EP 161 section 31D Cooperation and Exploration Agreement.	

Legislation	Requirements	How the Interest Holder Meets the Requirements	Administrator
Environment Protection and Biodiversity Conservation Act 1999	• Determine whether the Activity is likely to have a significant impact on a matter of national environmental significance or the environment of Commonwealth land.	• The Interest Holder has determined that the Activity is not likely to have a significant impact on a matter of national environmental significance (and is not being carried out on Commonwealth land) and, as such, does not need to be referred to the Commonwealth Minister for the Environment and Water for determination. • Further information is provided in **Section 2.5**.	Commonwealth Department of Climate Change, Energy, the Environment and Water
National Greenhouse and Energy Reporting Act 2007	• This Act requires operators who generate emissions over a threshold to report information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production of corporations.	• The parent company of the Interest Holder is obligated and registered to report all emissions under the *National Greenhouse and Energy Reporting Scheme* (NGERS).	Department of Industry, Science, Energy and Resources
National Environment Protection Council Act 1994 (National Environment Protection [Assessment of Site Contamination] Measure 1999) (NEPM)	• This Act provides a nationally consistent approach to assessing site contamination to ensure sound environmental management practices to protect human health and the environment.	• No drilling, flow-back or completion waste will be produced under this EMP. • Waste will be managed by a licensed contractor.	Department of Agriculture, Water and Environment
Native Title Act 1993	• The legislation provides ways in which future dealings affecting native title may proceed and the recognition and protection of native title, including ensuring that the right to negotiation with native title claimants and any expedited procedure for consultation are complied with.	• An ILUA is in place with Traditional Owners affected by the Activity. A Co-operation and Exploration Agreement - Exploration Permit Application EP(A)161 was signed 4 April 2012.	Prime Minister and Cabinet

* LAA0022 – between Santos QNT Pty Ltd (ABN 33 083 077 196), Tamboran Resources Limited (ABN 28 135 299 062), and Rallen Australia Pty Ltd (ABN 40 628 080 820).

2.2 Other Agreements and Approvals

The Interest Holder will ensure that all necessary agreements and approvals are in place (in addition to this EMP) before the commencement of any part of the Activity proposed under this EMP. These other agreements and approvals are listed in **Table 2.2—1**. All works will be undertaken according to the terms and conditions stipulated in relevant approvals and agreements.

Table 2.2—1 Agreements and Approvals

Agreement/Approval	Overview / Status
Exploration Agreement	The Interest Holder has an ILUA in place. The Co-operation and Exploration Agreement - Exploration Permit Application EP(A)161 was signed 4 April 2012.
Land Access Agreement	The Interest Holder has a LAA in place – number LAA0022*, approved 4 October 2023.
AAPA Authority Certificate	The Interest Holder has obtained AAPA Authority Certificates: • C2013/142 • C2018/105 variation to C2018/102 • C2019/043 variation to C2014/053 • C2020/011
Water Extraction Licences	• Water Extraction License GRF10280 authorises extraction of 193.5 ML/year from the Gum Ridge Formation. • Water Extraction Licence GRF 10280 was reissued to the Interest Holder on 6 December 2023 for a period of 10 years that expires on 31 December 2033.

* LAA0022 – between Santos QNT Pty Ltd (ABN 33 083 077 196), Tamboran Resources Limited (ABN 28 135 299 062), and Rallen Australia Pty Ltd (ABN 40 628 080 820)

2.3 Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 (NT)

The *Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019* (NT) (*the Code*) applies to all activities involved in conventional and unconventional oil and gas exploration, appraisal, development and production and ancillary activities in the Northern Territory. *The Code* covers all petroleum activities, including all petroleum well types, exploration, assessment, development, monitoring, injection, and production wells.

In addition to compliance with *the Code*, contractors undertaking the Activity and its ancillary works are required to comply with the following environmental standards, guidelines, and codes of practice:

- The SMS.
- *Australian Petroleum Production and Exploration Association's (APPEA) Code of Environmental Practice 2008* [AAPE, 2008].
- *NT EPA Environmental Factors and Objectives* [NT EPA, 2022].
- *Land Clearing Guidelines – Northern Territory Planning Scheme* [DEPWS, 2020, 2021].
- *Vegetation Retention Technical Note No. 12 Erosion and Sediment Control Guidelines* [DLRM].
- *Clearing Methodology Technical Note No. 18 Erosion and Sediment Control Guidelines* [DLRM].
- *Environment Management Plan Content Guideline Onshore Petroleum Regulated Activities* [NT EPA, 2022].

2.4 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is defined in the *EP Act* as 'development that improves the total quality of human life, both now and in the future in a way that:

- Maintains the ecological processes on which all life depends.
- Recognises the need for development to be equitable between current and future generations.'

The principles of ESD, as referenced in the *Petroleum Act 1984*, are set out in Sections 17 - 24 of the *EP Act*. In determining whether to approve an EMP, the Minister must consider and apply those principles.

In the preparation of this EMP, the following points were considered regarding the principles of ESD:

- The Activity will occur over a short time using an existing well pad for the temporary campsite and an existing access road and tracks that limit new preparation and minimises cumulative impacts (relevant to the principles set out in ss 19 and 21 of the *EP Act*).
- On-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland (up to 85%). Therefore, traversing without line preparation will be feasible for much of the seismic line length. The nominal 50 m seismic line corridors will allow deviation around potential obstacles and key environmental sensitivities (e.g., mature trees, trees with active hollows or nests) where practicable and cultural sites can be avoided. Mature trees, trees with active hollows or nests selected for preservation, would be recorded, and flagged to ensure their protection.
- In areas with high-density vegetation, a mulcher or slasher may need to be used to enable safe passage for the seismic vehicle convoy and to provide sufficient ground contact for the vibro-source and geophones.

- A mulcher cuts and mulches vegetation and spreads the mulch on the seismic line for minimal impact and rapid rehabilitation. For both a mulcher and slasher the soil is not disturbed, and the vegetation rootstock is not cleared.
- Where preparation is required, only a 5 m width within the notional 50 m seismic line corridor or connection line corridor will be prepared, allowing for deviation around potential obstacles and key environmental sensitivities (e.g., mature trees, trees with active hollows or nests) where practicable, and cultural sites can be avoided.
- In the final ground truthing along the seismic and connection line routes to identify significant trees, the presence of any riparian vegetation would also be recorded. Seismic vehicles may traverse these areas where the density of vegetation allows safe passage of vehicles with no line preparation. Vegetation slashing or mulching may be required for access but will follow the riparian vegetation decision tree shown in **Figure 3.5—13**. Where suitable, watercourse crossing points are not possible, existing access tracks will be used. Small portable nodal geophones may also be used in riparian areas for data acquisition.
- In easily traversable terrain, there will be no line preparation. Similarly, no line preparation will be required in areas where seismic lines intersect existing cleared areas, e.g., existing access tracks and the Carpentaria highway.
- An archaeological study undertaken in July 2023 (**Appendix 02**) has identified four significant sites in the Project Area. Seismic lines have been adjusted so that all four sites are avoided.
- No new groundwater bores are required. Water required to maintain existing tracks, dust suppression or firefighting water will be sourced from existing, licenced water bore(s).
- All the identified environmental risks identified were assessed as low or very low if the Activity is conducted in accordance with the controls described in the EMP and its Appendices (including those required for compliance with *the Code*). All identified risks have been assessed and reduced to a level considered ALARP and acceptable (relevant to the principles set out in ss 19 and 21 of the *EP Act*).
- Mitigation measures are in place to prevent or minimise any impact on threatened species; therefore, the Activity does not require referral under the *EPBC Act* for a decision on whether the Activity is a controlled action (relevant to the principles set out in ss 23).
- The Interest Holder engaged third-party, suitably qualified independent consultants to complete on-ground ecological and cultural heritage surveys to inform a detailed description of the environment and site-specific risk controls (relevant to the principles set out in ss 19, 20, 23 and 26 of the *EP Act*).
- Site-specific plans (Erosion and Sediment Control, Weed Management, Fire Management, Rehabilitation Management, Waste Management, Emergency Response, and Spill Management) have been created, all of which aim to prevent and mitigate foreseeable risks and respond to an unwanted event if one was to occur (relevant to the principles set out at ss 19, 21, 25, 26 and 27 of the *EP Act*).

- Stakeholders (including Traditional Owners and Pastoralists) that may be affected by the Activity have been identified and engaged (relevant to the principles set out at ss 18, 20, 21 and 22 of the *EP Act*).
- The Interest holder has strategies in place to engage local businesses, facilities, suppliers, and promote the employment of local/regional people (relevant to the principle set out in ss 21 of the *EP Act*).
- The area utilised for this EMP will be rehabilitated at the cessation of all approved Activity (relevant to the principles set out at ss 18,19, 21 and 23 of the *EP Act*) in accordance with the Rehabilitation Management Plan. Activity in areas previously used for the Interest Holder's exploration activity in the Project Area are covered by the respective EMPs for those operations.

2.5 Referrals Under NT and Commonwealth Legislation

2.5.1 EPBC Act Self-Assessment

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides a national environment and heritage protection and biodiversity conservation scheme. The EPBC Act's objectives are to protect the environment, especially matters of national environmental significance, conserve Australian biodiversity, and enhance the protection and management of significant natural and cultural places.

Referral of the Activity to the DCCEEW is required if the proposed action will have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or the environment of Commonwealth land.

Fox and Co were engaged to conduct an ecological assessment (**Appendix 01**) to determine the potential adverse impacts of the Activity on listed threatened species and habitat communities within the Project Area and to inform mitigation measures to avoid and reduce the risk of impacts. The assessment comprised a desktop review, followed by a field survey in July 2023.

Full detail of potentially occurring threatened and significant flora and fauna species in the Project Area is provided in **Table 7**, **Appendix B** of **Appendix 01** (Ecological Assessment), which includes an account of the species' likelihood of presence within the Search Area based on known records, species biology and ecology. A summary of the findings is provided in **Section 4.2** of this EMP.

No threatened fauna or flora species were observed within EP 161 during the July 2023 baseline survey. Two near threatened fauna species were identified (Northern Nail-tail Wallaby and Australian Bustard). These species are highly mobile and are unlikely to be impacted by the proposed seismic Activity. Habitat exists for some conservation significant species in the area; however, given the narrow, linear nature of disturbance, habitat requirements and the likelihood of occurrence, impacts from proposed seismic operations are considered to be low and referral under the *EPBC Act* is not required.

2.5.2 Referral Under the Environment Protection Act 2019 (EP Act)

Under the EP Act, proposed actions that may have a significant impact on the environment are required to be referred to the NT EPA for assessment.

The Interest Holder has assessed the Activity using the pre-referral screening tool in the NT EPA's *Referring a Proposal to the NT EPA: Environmental Impact Assessment Guidance for* Proponents [NT EPA, 2021]. This self-assessment took the following points into consideration:

- There is no anticipated impact on the variety and integrity of distinctive physical landforms, given that the primary access track to the campsite at the Tanumbirini well pad is pre-existing, and that the area used for the Activity will be rehabilitated to its pre-disturbance condition.
- The seismic lines will be operated within a notional 50 m working corridor 25 m on each side of the nominal seismic centre line. Much of the area to be surveyed is open woodland; in these areas minimal line preparation work will be required for access by survey vehicles. Mature trees, trees with active hollows or nests selected for preservation, would be recorded, and flagged to ensure their protection during final ground truthing prior to line preparation.
- Where necessary, a mulcher or slasher will be used for preparing the seismic lines for access by survey vehicles. A mulcher simultaneously cut vegetation, mulch, and spread the mulch for minimal impact. Both a mulcher and slasher leave the vegetation rootstock intact, allowing rapid rehabilitation. Only a 5 m width within the notional 50 m seismic line corridor will be prepared. This enables the preparation vehicles to avoid, as much as is practicable, mature trees, trees with active hollows or nests, and obstacles such as termite mounds.
- In easily traversable terrain such as open woodland, the mulcher would be operated with the mulcher up, with the marks of the mulcher tracks sufficient for the surveyors and recording crew to follow.
- In the final ground truthing along the seismic line routes to identify significant trees, any riparian vegetation would also be recorded. Seismic vehicles may traverse these areas where the density of vegetation allows safe passage of vehicles with no line preparation. Vegetation slashing or mulching may be required for access but will follow the riparian vegetation decision tree shown in **Figure 3.5—13**. Where suitable watercourse crossing points are not possible, existing access tracks will be used. Small portable nodal geophones may also be used in riparian areas for data acquisition.
- Land and soil will be protected through the implementation of site-specific management plans described in **Section 7** (see this section for Erosion and Sediment Control, Weed Management, Fire Management, Rehabilitation Management, Waste Management, Emergency Response, and Spill Management).
- Terrestrial habitats will be protected by first identifying them during on-ground assessments by an ecologist, and then by avoiding them within the 50 m seismic line corridors.
- No new groundwater bores are required. The water required to maintain existing tracks, to be used for dust suppression, or firefighting will be sourced from existing, registered water bore(s).

- The Activity will be of a limited duration, with vehicles and equipment being maintained per the original equipment manufacturer's procedures and diesel use will be recorded and reported.
- The workforce required for the Activity will be primarily interstate, given the specialised nature of the Activity; however, the Interest Holder has strategies and targets in place for local hire.
- Stakeholders have been engaged, and land access agreements will be in place with the affected parties.
- An archaeological study undertaken in July 2023 (**Appendix 02**), has identified four significant sites in the Project Area. Seismic lines have been adjusted so that all four sites are avoided.
- AAPA Authority Certificates have been granted, and the terms and conditions of the AAPA Authority Certificates are incorporated into project planning.
- During the Activity, the health and safety of personnel will be protected by implementing the contractor's safety protocols, which will be assessed to ensure conformance with the SMS. In addition, the environmental protection measures set out in this EMP will be implemented in accordance with the contractor's environment protection protocols, which will be assessed to ensure conformance with the SMS.

Based on the self-assessment, the Interest Holder has determined that the Activity is unlikely to have a significant impact on the environment, and therefore, it is not required to be referred to the NT EPA under *the EP Act*.

3. Project Description

3.1 Activity Summary

The Activity to be undertaken for this EMP is summarised in **Table 3.1—1**. **Table 3.1—2** provides key information on the Activity covered by this EMP.

Table 3.1—1 Summary of the Activity

Component	Details
Operating Hours	• Daylight restricted (12-hr day shifts where possible).
Civil Works	• Maintenance of the previously cleared Tanumbirini well pad and existing access tracks if necessary. • Establishment of a temporary camp site at the Tanumbirini well pad for use during the Activity and for vehicle parking and fuelling.
Seismic Acquisition Program	• 2D seismic and ground gravity survey • Line preparation of twelve seismic lines, one set of five, approximately 7.5 - 8.5 km long and another set of seven, approximately 24 – 33 km long. The total seismic line length is approximately 240 km. • Preparation of approximately 10 km of connection lines between the seismic lines for vehicle access.
Equipment and Machinery	• Light and heavy vehicles like mulchers, slashers, seismic vibroseis source and survey trucks, ground gravity survey vehicles.
Access	• Existing access is available to the Tanumbirini well pad. • Existing access to the seismic lines will be used wherever possible, with connection lines to be prepared between seismic lines where necessary. Refer to **Section 3.5.1.2** (Site Selection) for further details. LAA will be in place with the Tanumbirini Station pastoralist.
Diesel Use	• Campsite, generators, light, and heavy vehicle diesel usage.
Water Source	• Water required to maintain existing track(s) dust suppression and firefighting. Water will be trucked in from existing licenced bores. • Potable water for the campsite will be trucked in.
Rehabilitation Methods Proposed	• Mulchers cut vegetation above ground and mulch and spread the cut material for minimal impact and to promote rapid rehabilitation. • Mulchers and slasher do not disturb the soil, and vegetation rootstock is left intact. • Further rehabilitation of the seismic lines is discussed in **Section 7.4**.

Table 3.1—2 Key Information on the Activity Covered by this EMP

Overview	Units	Unit of Measure
Exploration Permit	EP 161	
AAPA Authority Certificates	C2020/011 C2019/043 variation to C2014/053 C2018/105 variation to C2018/102 C2013/142	
Total Area of EP	10,582	km²
Total Area of Project Area	580	km²
Total length of seismic lines	240	km
Total length of connection lines between seismic lines	10	km
Total length of seismic and connection lines	250	km
Estimated maximum new disturbance under this EMP	125***	ha
Water		
Groundwater Extraction Licence(s)*	GRF10280	
Source of potable water	Off-site Source TBA	
Estimated groundwater extraction	5	ML
Indicative Schedule**		
Activity duration	60	Days
Seismic line preparation	29	Days
Seismic and ground gravity survey	38	Days
Emissions		
Estimated greenhouse gas emissions	7.1	$ktCO_2$-e

** Current only.*

*** Days estimated from current project schedule (subject to change).*

**** This is a max disturbance estimate reflecting a worst-case scenario, as in practice it is estimated some 85% of the area of potential disturbance is low-density woodland, which will allow traversing with minimal line preparation.*

3.2 Timing and Personnel

The Activity is expected to take 9 to 10 weeks and is proposed to be commenced between June and July 2024.

Indicative Activity and personnel schedules are provided in **Table 3.2—1** and **Table 3.2—2**. The exact start date is tentative, as it is subject to approval and dependent on contractor availability. Once the Activity commences, the estimated weeks to complete the relevant Activity is presented in **Table 3.2—1**. Note there may be overlap in the preparation and surveys.

Table 3.2—1 Indicative Activity Schedule

Activity	Approximate Commencement and Completion*	Estimated Weeks to Complete Activity
Seismic Line Mobilisation	September - October	1 week
Seismic Line Preparation	October - November	4 weeks
Seismic and Ground Gravity Surveys	November	4 weeks
Survey Demobilisation	November	1 week

* Subject to approval and contractor availability.

Table 3.2—2 Indicative Personnel Estimates

Activity	Personnel Numbers
On-site Company Representative	2
Seismic Line Preparation	13
Seismic and Ground Gravity Surveys	31
Total:	**46**

3.3 Vehicle Movements

The Activity will require the mobilisation of company representatives, a line preparation crew, a seismic survey crew and a ground gravity survey crew. All personnel will be staging from a temporary camp on EP 161 in accordance with the indicative Activity schedule in **Table 3.2—1**. The mobilisation and demobilisation of the crews are anticipated to only occur once each. As the seismic lines will be prepared prior to the surveys (refer to **Section 3.5**), these crews will mobilise to site on different days. Estimated vehicle numbers for the Activity are presented in **Table 3.3—1**.

Therefore, daily traffic volumes throughout the Activity are expected to remain significantly below the 150 vehicles per day (vpd) 'limit' associated with low-volume rural roads, as identified in the relevant Austroads' Guide [AUSTROADS, 2020].

Table 3.3—1 Estimated Vehicle Mobilisation Numbers

Activity	Light Vehicle	Heavy Vehicle
On-site Company Representative (OCR)	2	0
Seismic Line Preparation	9	3
Seismic and Ground Gravity Surveys	16	14
Total:	**27**	**17**

Most vehicles mobilised to site are support vehicles which stay on existing access tracks and do not traverse seismic lines. The types of vehicles used for the Activity are described below and the number of vehicles that are used on seismic lines are shown in **Table 3.3—2**.

Heavy vehicles can be split into two categories:

- Operational support heavy vehicles (on seismic lines):
    - Trucks required to carry in equipment/vehicles e.g. temporary camps, mulchers, slashers, vibrator trucks etc.
    - Water and supply trucks.
- Seismic Heavy Vehicles (used on seismic lines):
    - Line preparation units e.g. mulchers and slashers.
    - Seismic vibrators and recorders.
    - Mechanic trucks (not used for seismic but is a support vehicle that may need to traverse working corridors).

Seismic heavy vehicles will typically only traverse a seismic line once, however approximately 5% of the seismic lines (~12 km) will require backtracking due to dead ends. Additional, backtracking short distances on seismic lines for access or due to unforeseen issues may occur.

Existing access tracks near the seismic lines are abundant (refer **Figure 3.5—3**) and show the availability of access and exit points that will reduce the requirement for multiple passes for majority of the Activity. Similarly, connection lines have been chosen to reduce the need for backtracking refer **Section 3.5.1.4**.

Light vehicles will include 4WD's or UTV/s for:

- Mobilising personnel to camp and seismic lines.
- Line surveying.
- Nodal geophones deployment / retrieval.
- Fire Tender / Fauna Spotter.
- Supervisors and seismic crew management.
- Rehabilitation.

Like heavy vehicles, many light vehicles will only make one pass of seismic lines per phase of the Activity with the nodal geophones deployment/retrieval personnel, crew management and the Santos site supervisor travelling between work fronts more frequently.

To limit crossings on unformed tracks, only 1 seismic line watercourse crossings of the 71 crossings where there is no existing crossing available will be traversed more than once due to a dead end resulting in backtracking, during each stage of the activity i.e. line preparation, surveys/acquisition, and post-survey closure. The remaining 70 new crossings on seismic lines will be crossed only once.

A breakdown of vehicles used on seismic lines compared with the amount that are mobilised to site (refer **Table 3.3—1**) is presented in **Table 3.3—2**.

Table 3.3—2 Estimated Vehicle Numbers Used on Seismic Lines

	Vehicles Used on Every Seismic Line		Occasionally Used on Seismic Line*	
Activity	**Number of Light Vehicles**	**Number of Heavy Vehicles**	**Number of Light Vehicles**	**Number of Heavy Vehicles**
Line Preparation and OCR	7	1	3	1
Seismic and Ground Gravity Survey and OCR	13	3	4	2

* Support vehicles that may occasionally traverse seismic lines short distances.

3.4 Civil Works

The existing Tanumbirini well pad is in the northern section of the eastern group of seismic lines, on the central seismic line of this group. The well pad is served by existing access tracks.

Civil works will be limited to ongoing maintenance of existing access tracks used to access seismic lines, the campsite, and maintenance required for the existing well pad where the temporary campsite, equipment parking and refuelling will be located (shown in **Figure 3.4—1** and **Figure 3.4—2**).

Within the Project Area, there is a vast network of existing access tracks; however, to maintain clarity and reduce visual clutter in the figures, only key tracks near the Activity have been included. This approach also demonstrates the Activity's capacity to both access the seismic lines without construction of tracks and to circumvent areas where line preparation is not feasible (for more details, refer to **Section 3.5**). It is crucial to highlight that the Activity is not exclusively limited to these depicted tracks.

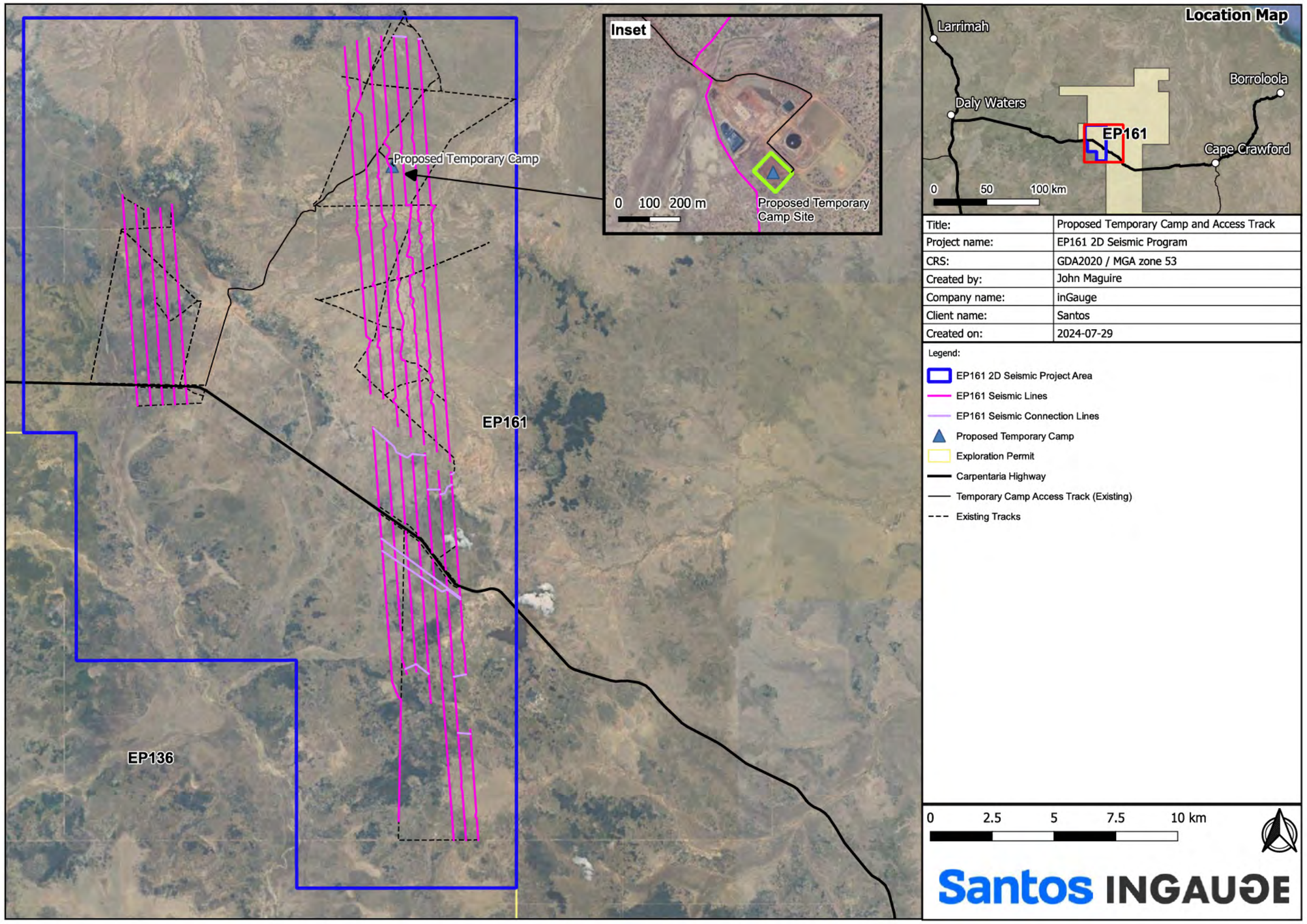


Figure 3.4—1 Location of Temporary Camp

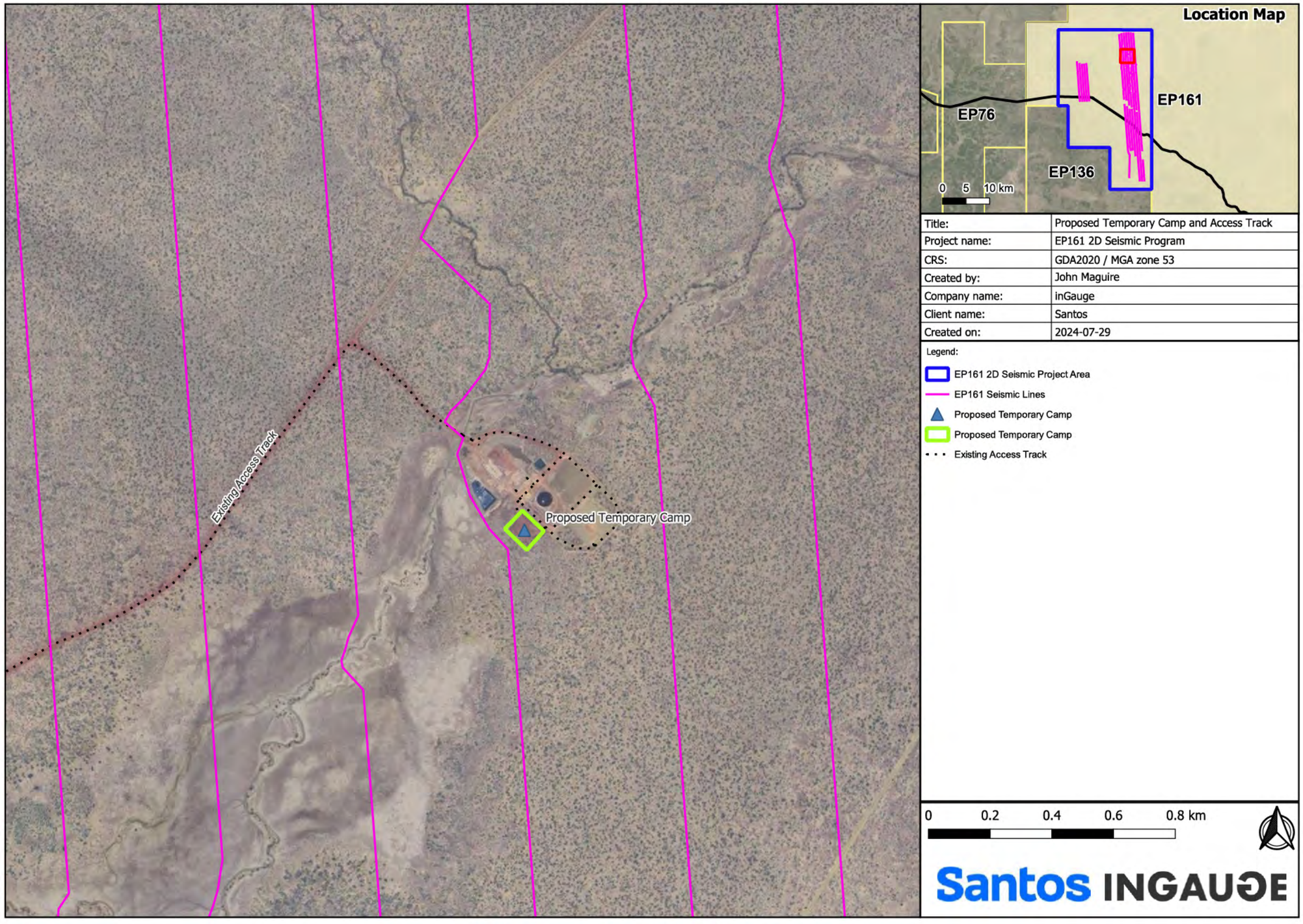


Figure 3.4—2 Indicative Location of Temporary Camp on Existing Tanumbirini Well Pad

3.5 Seismic and Ground Gravity Acquisition Program

3.5.1 Operational Background

3.5.1.1 Technology

Geophysical surveys are used to evaluate subsurface properties. The survey method of the Activity is 2D seismic and an ancillary ground gravity survey.

Seismic acquisition allows an image of the geological structures below the surface to be generated using a seismic energy source (discussed further in **Section 3.5.4**). The energy source generates acoustic energy, which travel into the Earth and are then reflected from subsurface geological structures. The returning reflections are recorded in a digital format and, upon completion of the survey, sent to a seismic data processing centre to produce a cross-section of the layers of the Earth's crust.

Seismic lines are strategically selected and placed near one another to capture this cross-sectional view of the subsurface structures, ensuring a clear 2D image of these structures. Connection lines provide access between the seismic lines and are not used for data collection.

The ground gravity survey method is a non-invasive geophysical approach that accurately measures the Earth's gravitational field at designated surface points using a gravity meter and is discussed further in **Section 3.5.5**.

3.5.1.2 Site Selection and Planning

The preliminary concept seismic line locations were based on borehole breakout data and fracture orientations from image logs. The preliminary selection process integrated data from the MCSAN 2013 Survey and possible future well locations. The location of the preliminary lines was refined during follow-up planning and design to address the controls and proactive measures outlined in this EMP. The development of controls in this EMP were informed by third-party desktop surveys and civil, ecological, and archaeological field surveys (refer to **Appendix 01**, **Appendix 02**, and **Section 4** Description of the Existing Environment). An example of how the preliminary lines have been adjusted to the proposed seismic lines is shown in **Figure 3.5—1**.

Clause A.3.1(a) of *the Code* requires that the planning, design, location, and construction of petroleum infrastructure must have regard to the considerations in the *LCG* and outlines items that specific considerations must be given. These specific considerations and how they are addressed is outlined in **Table 3.5—1**, noting there are no construction operations proposed with the Activity.

The proposed seismic and connection lines comply with AAPA Authority Certificates C2020/011 and C2019/043 (variation to C2014/053), by avoiding the Restricted Work Areas (RWA).

A working corridor of 50 m has been established for the seismic and connection lines (25 m either side of the line) to allow deviations to avoid, where possible:

- Mulching, as opposed to traversing.
- Areas of greater erosion concern (e.g., significant slope).

- Key environmental sensitivities (e.g., mature trees, trees with active hollows or nests).
- Obstacles (e.g., termite mounds).
- Cultural heritage sites (e.g., archaeological sites, AAPA restricted work areas).

Figure 3.5—2 illustrates an indicative example of how the seismic vehicles can deviate from the seismic centreline to a route that avoids these items. **Figure 3.5—3** provides an overview of the seismic and connection lines, including an inset illustrating the working corridor applied to all lines. In the event the seismic convey cannot find a safe and ALARP route within the 50 m working corridor, they will back track to a line connection and rejoin the original line past the obstruction. Detailed views of the seismic lines, associated connection lines, access tracks, and the campsite can be found in **Figure 3.5—4**, **Figure 3.5—5**, and **Figure 3.5—6**.

Figure 3.5—7 provides detailed views of the central area in the eastern group of seismic lines, highlighting all connection lines and presenting two options for connection lines near the McArthur River gas pipeline. Further descriptions of these options are available in **Section 3.5.1.4**. Details on the seismic and connection lines, including line lengths, coordinates, and disturbance areas, are provided in **Table 3.5—2**.

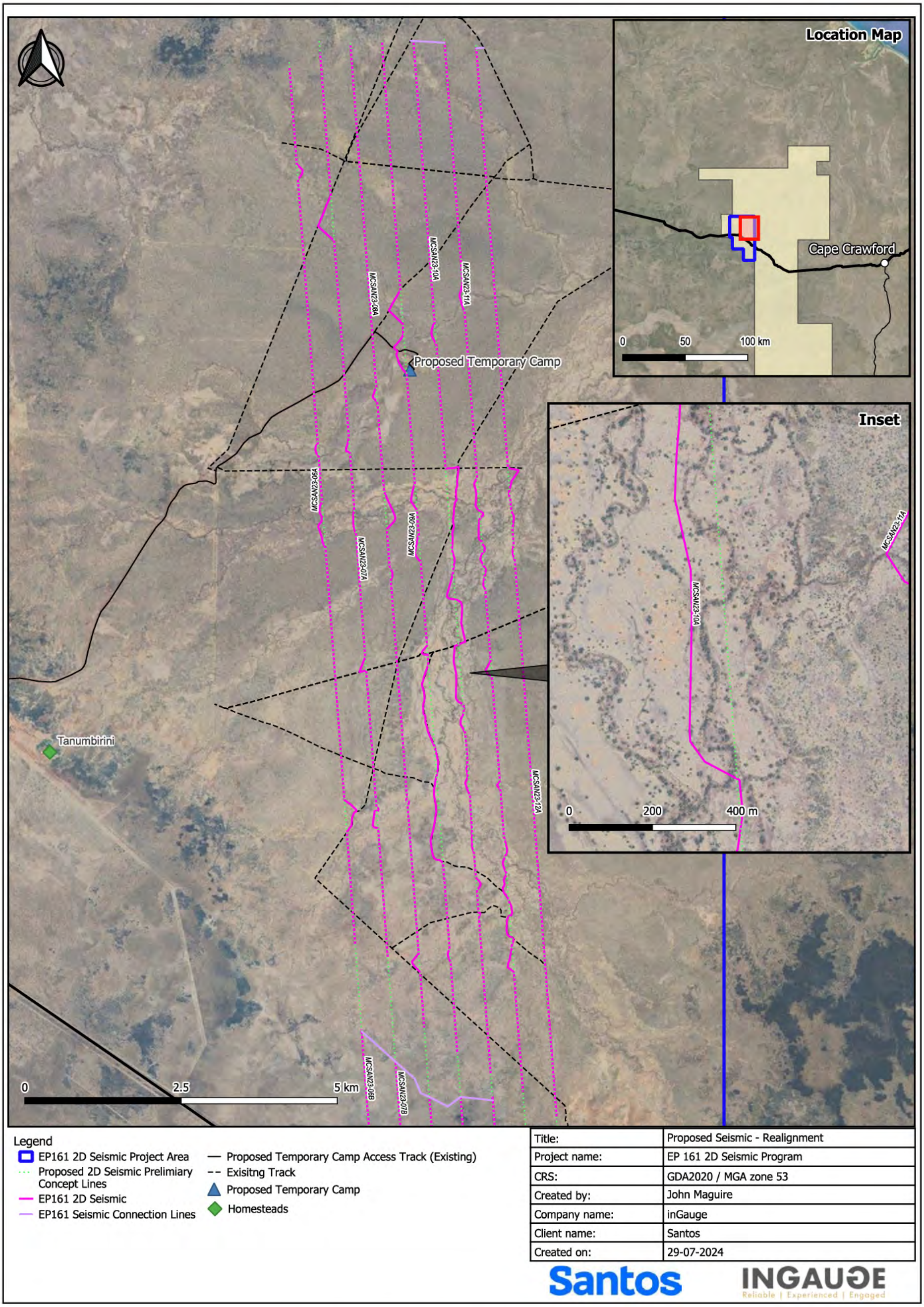


Figure 3.5—1 Realignment of Preliminary Seismic Lines

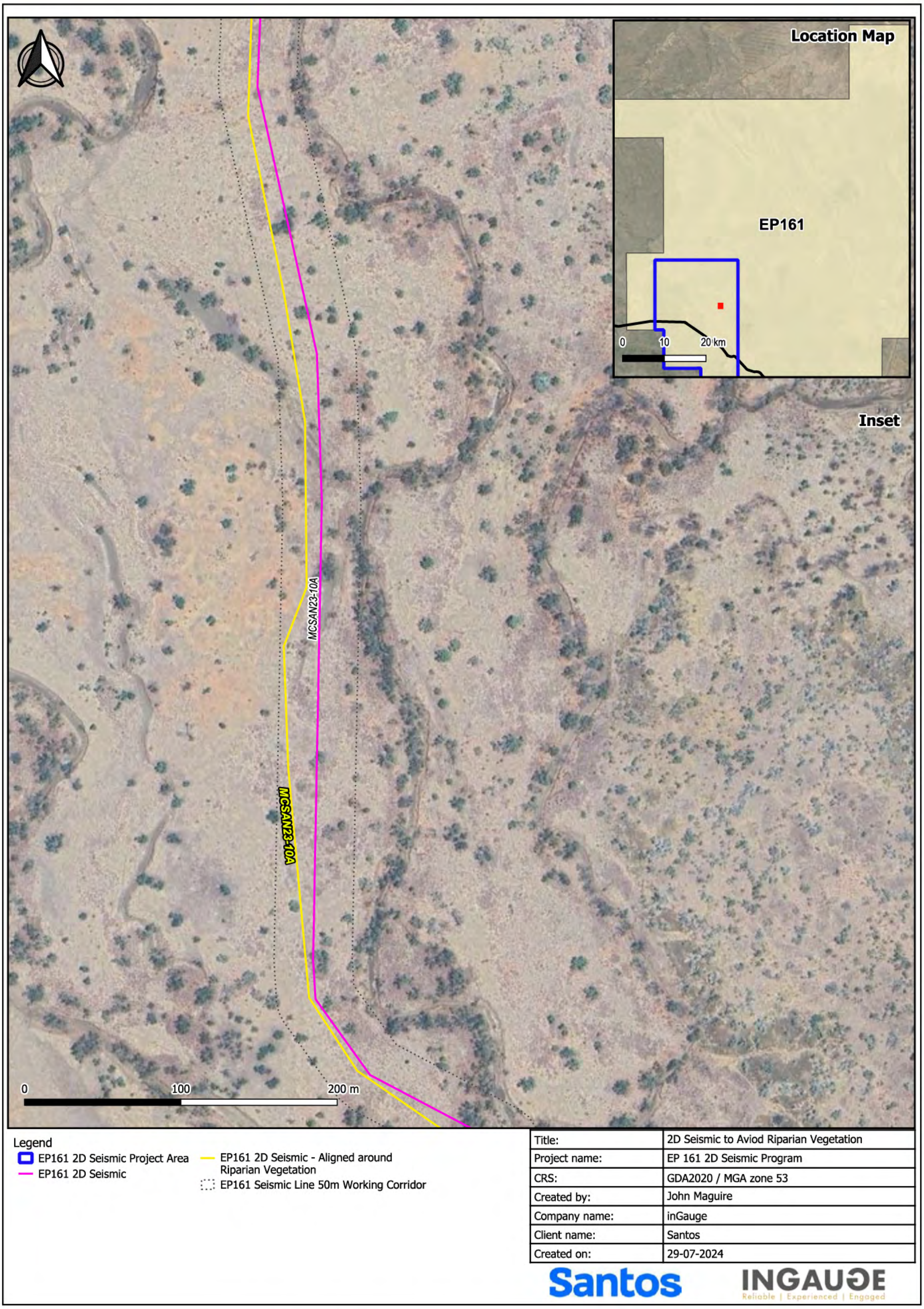


Figure 3.5—2 Indicative Example of Route Adjustment within Working Corridor

Table 3.5—1 Site Selection and Planning

Specific Criteria	Planning Considerations	Design Considerations	Location Considerations
Suitability of Site	• Preliminary seismic line locations based on previous borehole breakout data and reviewed fracture orientations from image logs. • Desktop surveys undertaken to refine preliminary seismic line locations based on environmental sensitivities. • Field surveys undertaken to further refine the location of preliminary seismic lines. • Fauna Spotter to ground-truth ahead of seismic line preparation crew to ground truth riparian area, assist in decision trees, stream crossing locating.	• Tree mulching and riparian area mulching decision trees created to ensure significant vegetation is avoided where possible. • Slasher used in combination with mulcher to provide alternative to mulching where possible. • The area of vegetation to be potentially mulched has been minimised through efficient design, co-location, and use of existing infrastructure. • Seismic connection lines chosen to avoid significant backtracking in an area known to be highly traversable without mulching.	• Preliminary concept seismic lines adjusted based on field surveys (civil, cultural, and ecological) to a ground-truthed route. • Creation of a 50 m working corridor to allow deviations around environmental sensitivities and reduce mulching requirements (refer **Figure 3.5—2**). • Campsite selected at a previously cleared location requiring no new clearing. • Use of existing access tracks to reach seismic lines. • Seismic connection lines ground-truthed and located in traversable areas.

Erosion and Sediment Controls	• A Mulcher and slasher have been selected for vegetation removal (where required) for the Activity. As detailed in **Section 3.5.2** these rotary machines do not disturb the soil and vegetation rootstock is left intact.	• Erosion and sediment control plan developed, **Section 7.1**.
		  ○ The Activity designed to ensure a very low erosion hazard.
		  ○ Controls specific to the Activity, wet weather and watercourses created.
			• Creation of a 50 m working corridor to allow selection of areas with favourable slope and soils where possible.
			• Ground-truthed seismic connection lines defined to reduce required

Specific Criteria	Planning Considerations	Design Considerations	Location Considerations
	• No new tracks or infrastructure being constructed. • The Activity to occur during a period of very low erosion risk. • Utilise existing clearing to support the Activity. • Maintenance and rehabilitation to ensure identified erosion is addressed (**Section 7.1.8**).	• The mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line which provides immediate protection of soil surface from both natural elements and mechanical damage (e.g., vibroseis trucks). • Slashers and mulchers leave rootstock intact.	passes of vehicles along seismic line **Section 3.5.1.4**. • All creek crossings to be undertaken at a 90° angle.
Sensitive Receptors	• Proximity of camp site to Tanumbirini Station. • Activity is short in duration and noise sources are not fixed and continue along seismic lines quickly. • Land Access Agreement.	• During program consultation with landholder, mulcher selected for the Activity instead of bulldozer (refer **Appendix 04**). • Design of program allows deviations to reduce mulching and, therefore, reduces noise. • One pass of heavy vehicles expected for seismic lines near sensitive receptor. • Dust suppression as necessary on existing access tracks.	• A setback distance of at least 2.7 km from seismic line working corridors. • Camp site on existing well pad approximately 8 km away from Tanumbirini Station.
Wildlife Movement	• A mulcher and slasher have been selected for the Activity. These rotary machines leave rootstock intact	• Creation of a 50 m working corridor to allow deviations and, therefore, reduce preparation requirements (refer **Figure 3.5—2**).	• Seismic lines situated in highly traversable areas based on field surveys, satellite imagery and SREBA vegetation datasets.

Specific Criteria	Planning Considerations	Design Considerations	Location Considerations
	promoting rapid rehabilitation of any prepared vegetation. • The mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line, providing soil fertility improvement for disturbed areas. • Fauna Spotter to be present during line preparation. • No construction proposed and, therefore, no permanent structures that could affect wildlife movement.	• Narrow preparation width required for access and infrequent mulching due to the highly traversable landforms within working corridor. • The Activity requires a short duration and passes through localised area quickly. • Vehicles for the Activity are slow-moving and frequently stopping, providing opportunity for wildlife to vacate the area. Continuous movement of the vehicles means no lasting impact on wildlife movement.	• Ecologist field survey conducted, and Activity location informed based on survey. • Ground-truthed seismic working corridors to ensure a traversable route is available.
Biodiversity Protection	• Fauna Spotter to be present during line preparation. • Desktop surveys to be undertaken prior to the Activity. • Baseline Ecological Assessment to allow the Interest Holder to undertake considerations specific to biodiversity protection. • Ground-truthing to ensure seismic lines are positioned to provide protection of aquatic systems.	• Tree mulching and riparian area mulching decision trees created to ensure no unnecessary mulching. • Slasher used in combination with mulcher to provide an alternative to mulching where possible. • The area of vegetation to be potentially mulched has been minimised through efficient design, co-location, and use of existing infrastructure. • Tree and riparian area decision trees to be used by Fauna Spotter to ensure mulching of significant vegetation (e.g.,	• Preliminary concept seismic lines adjusted based on field surveys (civil, cultural, and ecological) to a ground-truthed route. • Seismic connection lines ground-truthed and located in traversable areas.

Specific Criteria	Planning Considerations	Design Considerations	Location Considerations
	• Site selection to avoid vegetation clearing and mulching to maintain ground cover. • The presence of essential habitats and threatened wildlife documented and assessed using ecological surveys.	trees with hollows or nests) and riparian vegetation is appropriately considered and avoided as much as practical while still ensuring safe work conditions.	
Water	• The Activity will not interfere with or obstruct a waterway. • Preliminary concept lines to be scouted to ensure proposed seismic lines avoid critical and important habitats (completed during ground-truthing field surveys). • Limit groundwater extraction licensed volumes from existing bores installed under an approved EMP. • No construction of waterway crossings.	• Alluvial groundwater-dependant ecosystems are present in the area (further information is provided in **Section 4.3.3**). These areas will not be traversed, and vegetation will be avoided where possible. • Tree mulching and riparian vegetation decision trees consider impacts to watercourses, as well as critical and important habitats. • During survey demobilisation, areas where vehicles were used for the Activity will be inspected to identify and address potential erosion issues. • Mulching of large vegetation in riparian areas (although not anticipated) requires completion the riparian vegetation decision tree (as shown in **Figure 3.5—13**).	• Preliminary concept seismic lines adjusted based on field surveys (civil, cultural, and ecological) to a ground-truthed route. The Tanumbirini Creek area was completely traversed, and therefore, the route selected is traversable without mulching.

Specific Criteria	Planning Considerations	Design Considerations	Location Considerations
Weeds	• The Activity is unlikely to introduce or spread any declared weeds. • Baseline weed survey to be undertaken prior to the Activity. • Implementation of a site-specific weed management plan.	• Rehabilitation expected to commence following survey completion. • Rehabilitation plan includes weed control requirements. • Use of the mulcher and slasher does not disturb soil and does not allow weeds to establish easily.	• Known weed locations along seismic lines have been GPS logged and will be avoided. • Use of existing tracks for seismic surveys and access.
Cultural Heritage	• Archaeological survey to be undertaken prior to the Activity. • AAPA Restricted Work Areas to be GPS located.	• Line preparation vehicles to be GPS programmed to avoid cultural heritage locations.	• Cultural heritage areas avoided, and preliminary seismic lines adjusted based on survey and AAPA Restricted Work Areas.

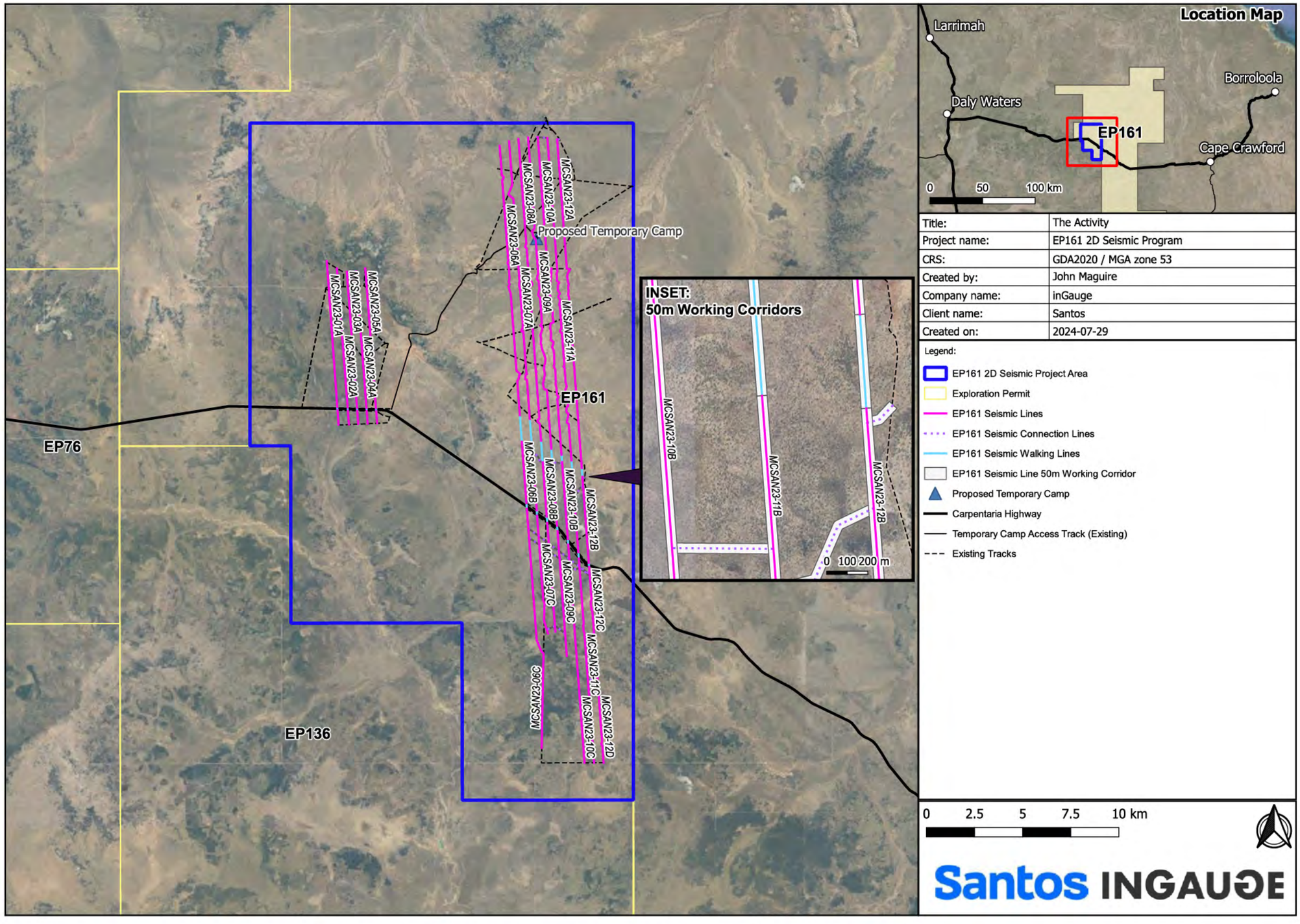


Figure 3.5—3 Overview of Seismic Lines and Connection Lines with Inset Showing Close-up of Working Corridors

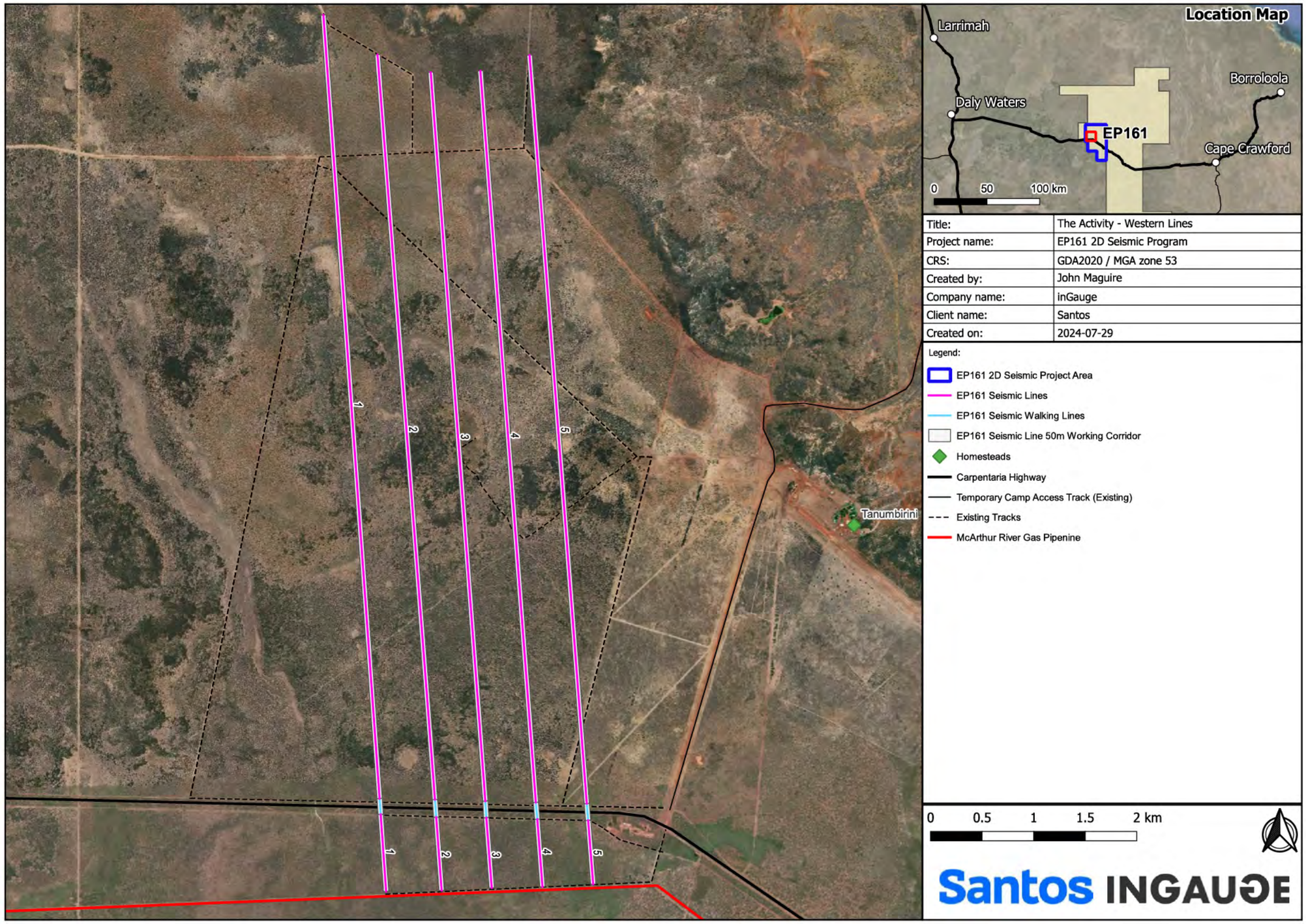


Figure 3.5—4 Western Seismic Lines

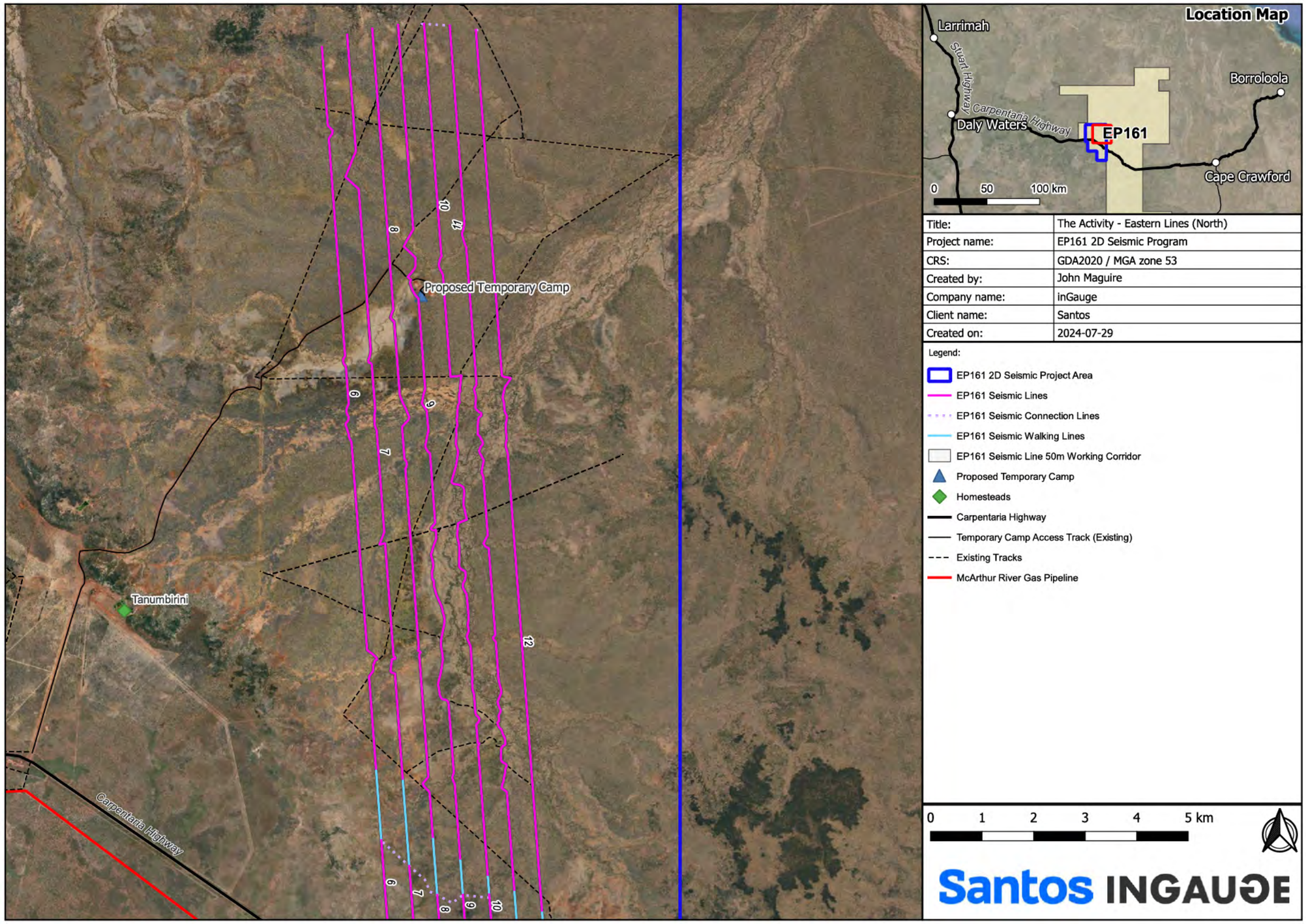
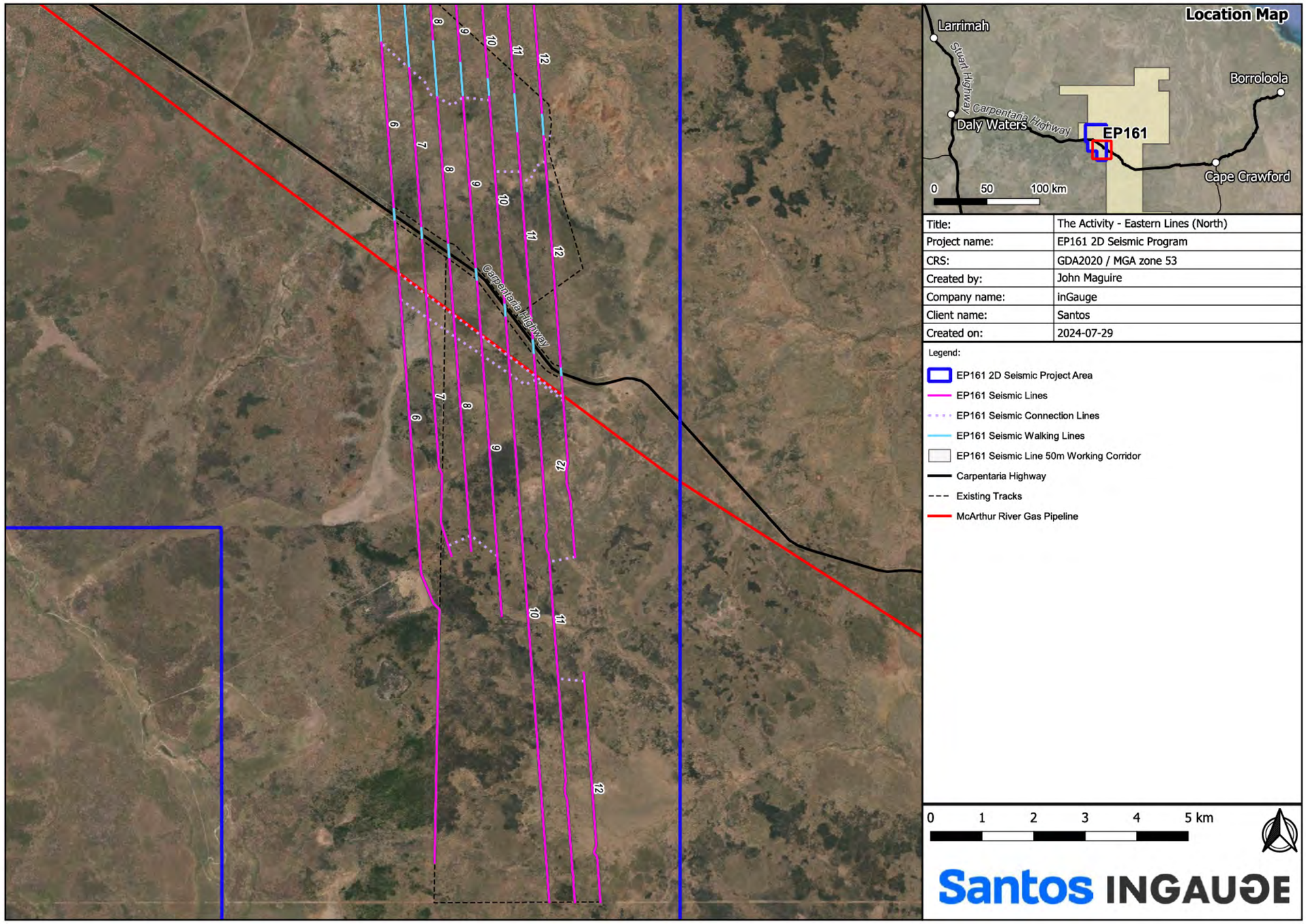


Figure 3.5—5 Eastern (North View) Seismic and Connection Lines



Title:	The Activity - Eastern Lines (North)
Project name:	EP161 2D Seismic Program
CRS:	GDA2020 / MGA zone 53
Created by:	John Maguire
Company name:	inGauge
Client name:	Santos
Created on:	2024-07-29

Legend:

- EP161 2D Seismic Project Area
- EP161 Seismic Lines
- EP161 Seismic Connection Lines
- EP161 Seismic Walking Lines
- EP161 Seismic Line 50m Working Corridor
- Carpentaria Highway
- Existing Tracks
- McArthur River Gas Pipeline

Santos INGAUGE

Figure 3.5—6 Eastern (South View) Seismic and Connection Lines

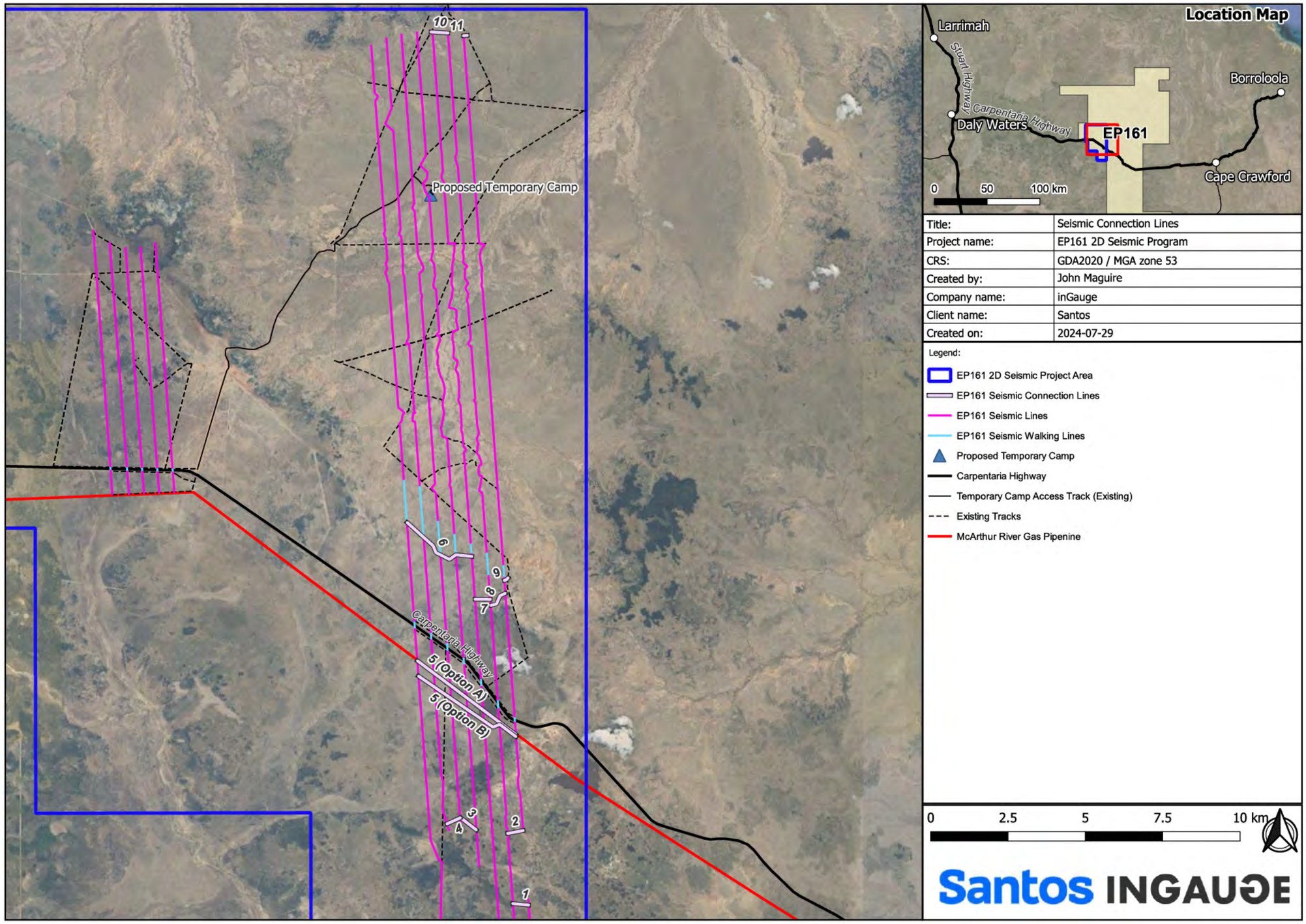


Figure 3.5—7 Seismic Connection Lines

Table 3.5—2 Disturbance Areas

Line Number	Name	Start / End Point		Length (m)		Prepared (ha)	
		MGA53 GDA2020	MGA53 GDA2020	Line	Total	Area	Total
Line 1	MCSAN23-01A	457541.1	8185474	7,620	8,368	4	4
	MCSAN23-01A	458086.4	8177876				
	MCSAN23-01B	458096.8	8177721	748		0	
	MCSAN23-01B	458149.6	8176975				
Line 2	MCSAN23-02A	458066.1	8185089	7,247	7,959	4	4
	MCSAN23-02A	458623.3	8177866				
	MCSAN23-02B	458635.5	8177694	712		0	
	MCSAN23-02B	458687.8	8176984				
Line 3	MCSAN23-03A	458582.1	8184919	7,090	7,772	4	4
	MCSAN23-03A	459111.8	8177852				
	MCSAN23-03B	459121.5	8177689	682		0	
	MCSAN23-03B	459174	8177009				
Line 4	MCSAN23-04A	459063.9	8184933	7,117	7,773	4	4
	MCSAN23-04A	459601.8	8177839				
	MCSAN23-04B	459616	8177674	656		0	
	MCSAN23-04B	459666	8177020				
Line 5	MCSAN23-05A	459540.8	8185084	7,281	7,901	4	4
	MCSAN23-05A	460095.7	8177827				
	MCSAN23-05B	460109.2	8177663	620		0	
	MCSAN23-05B	460158	8177045				
Line 6	MCSAN23-06A	466522.4	8191457	14,324	30,075	7	15
	MCSAN23-06A	467571.1	8177465				
	MCSAN23-06B	467674.1	8176074	3,198		2	
	MCSAN23-06B	467914.4	8172886				
	MCSAN23-06C	467934.8	8172601	12,553		6	
	MCSAN23-06C	468708.3	8160169				
Line 7	MCSAN23-07A	467012.1	8191697	14,964	24,209	7	12
	MCSAN23-07A	468089.2	8177267				
	MCSAN23-07B	468215.5	8175575	3,067		2	
	MCSAN23-07B	468448.9	8172518				
	MCSAN23-07C	468465.1	8172240	6,178		3	
	MCSAN23-07C	469035.8	8166120				
Line 8	MCSAN23-08A	467498.2	8191815	15,987	24,485	8	12
	MCSAN23-08A	468673.5	8176139				
	MCSAN23-08B	468758.7	8175012	2,828		1	

Line Number	Name	Start / End Point		Length (m)		Prepared (ha)	
		MGA53 GDA2020	MGA53 GDA2020	Line	Total	Area	Total
	MCSAN23-08B	468969.3	8172193				
	MCSAN23-08C	468994	8171870	5,670		3	
	MCSAN23-08C	469418.2	8166218				
Line 9	MCSAN23-09A	467999.4	8191886	16,861	26,668	8	13
	MCSAN23-09A	469204.3	8175718				
	MCSAN23-09B	469256.8	8175014	3,305		2	
	MCSAN23-09B	469503.2	8171720				
	MCSAN23-09C	469530.4	8171435	6,502		3	
	MCSAN23-09C	470010.3	8164953				
Line 10	MCSAN23-10A	468503.4	8191904	17,336	32,714	9	17
	MCSAN23-10A	469737.4	8175404				
	MCSAN23-10B	469767.3	8175022	4,005		2	
	MCSAN23-10B	470065.4	8171029				
	MCSAN23-10C	470086	8170738	11,373		6	
	MCSAN23-10C	470932.9	8159401				
Line 11	MCSAN23-11A	470253.8	8175113	17,356	32,023	9	16
	MCSAN23-11A	469001.6	8191874				
	MCSAN23-11B	470313.6	8174315	3,986		2	
	MCSAN23-11B	470610.5	8170342				
	MCSAN23-11C	470634.7	8170014	10,681		5	
	MCSAN23-11C	471430.8	8159401				
Line 12	MCSAN23-12A	469508.9	8191784	17,313	29,780	9	15
	MCSAN23-12A	470790.4	8174711				
	MCSAN23-12B	470821.7	8174254	4,475		2	
	MCSAN23-12B	471154.8	8169793				
	MCSAN23-12C	471169.1	8169580	3,505		2	
	MCSAN23-12C	471432	8166097				
	MCSAN23-12D	471925.8	8159402	4,487		2	
	MCSAN23-12D	471601.3	8163851				
			Total:	**240,727**	**240 km**	**120**	**120**
Connecting Lines (See **Figure 3.5—5**, **Figure 3.5—6**, and **Figure 3.5—7**)	1	471611.5	8163691	511		0.3	
		471102.6	8163738				
	2	471439.2	8166097	512		0.3	
		470935.1	8166007				
	3	469902.4	8166129	636		0.3	
		469414.5	8166495				

Line Number	Name	Start / End Point		Length (m)		Prepared (ha)	
		MGA53 GDA2020	MGA53 GDA2020	Line	Total	Area	Total
	4	469365.7	8166495	411		0.2	
		468991.7	8166324				
	5 (Option A [Preferred])	468012.3	8171588	3,982		0.00	
		471198.5	8169203				
	5 (Option B)	468047.2	8171093	3,824		1.9	
		471203.8	8169131				
	6	468047.2	8171093	665		0.3	
		471203.8	8169131				
	7	470859.8	8173770	2,642		1.3	
		470393.2	8173377				
	8	469775	8174958	484		0.2	
		467679.4	8176059				
	9	470367.4	8173571	161		0.1	
		469883.3	8173575				
	10			546		0.3	
	11			117		0.1	
					Total (Option A)	10,667	3
					Total (Option B)	10,509	5
					Total (Seismic and Connecting Line Option A)	**250 km**	**123**
					Total (Seismic and Connecting Line Option B)	**250 km**	**125**

3.5.1.3 Disturbance Areas

Maximum disturbance estimates have been calculated on the assumption that vegetation will be mulched or slashed (5 m width) rather than traversed for the total 250 km of proposed seismic (240 km) and connection lines (10 km), with 125 ha of maximum estimated disturbance (**Table 3.5—2**).

This is a maximum disturbance estimate reflecting a worst-case scenario, as in practice, it is estimated that 85% of the area of potential disturbance is made up of low-density woodland (74.6%), is already disturbed (4.4%) or is riparian (6.2%) (refer to **Table 4.2—3**), which would require minimal line preparation.

Moreover, a significant portion of seismic lines align with existing access tracks (e.g., Line 6 shown in **Figure 3.5—6**). While surveys are planned to utilise these tracks, eliminating the need for line preparation, the disturbance estimates still consider potential preparation in these areas should alternative routes within the working corridor become necessary. As a result, the actual disturbance area is expected to be considerably less than the estimated 125 ha.

3.5.1.4 Seismic Connection Lines and McArthur River Pipeline

Seismic connection lines determined to be easily traversable and not requiring significant mulching (if any) have been scouted. Connection lines enable crews to traverse between adjacent lines, reducing the impact of heavy vehicle traffic on seismic lines caused by repeated passes and fuel use.

In total, 10 km of connection lines are planned for utilisation to move between seismic lines. Along the route of the McArthur River pipeline, two potential seismic connection lines have been proposed: Option A and Option B (**Figure 3.5—7** and **Table 3.5—2**). Seismic vehicles will traverse the pipeline; however, no vibroseis energy source will be used within 30 m of the pipeline.

Communication with the owners of the McArthur River gas pipeline to use their pre-existing access track as a seismic connection line is ongoing. Option A assumes that the pre-existing access track can be used, and Option B assumes a new connection route will be required. Option A would follow a previously disturbed area.

3.5.2 Seismic Line Preparation

As noted in **Section 3.5.1.2**, on-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland, is already disturbed or is riparian (up to 85%). Therefore, traversing without line preparation will be feasible for much of the seismic and connection line length. Ground truthing will occur along the seismic and connection line routes to identify significant trees and riparian vegetation.

A slasher and a mulcher will be used for the Activity where necessary. Both are rotary machines however; slashers will only be used for the ‘mowing’ of grass. A mulcher will be utilised for mowing as well as any other preparation required (e.g. tree removal). They both will prepare a width of 5 m within a 50 m seismic line working corridor.

A slasher or mulcher will be necessary in some areas to provide safe access and enable sufficient ground contact for the seismic vibro-source and the geophone nodes. **Figure 3.5—8** shows an example of both rotary machines.



Figure 3.5—8 Indicative Skid Steer Slasher (front) and Mulcher (rear)

In particular the main confluence of Tanumbirini and Snake Creek (refer **Section 4.1.7**) was demonstrated to be highly traversable in desktop assessment (refer **Section 4.2.2**) and during ground-truthing. As such, a no-mulching boundary has been applied to the braided/confluence of Snake and Tanumbirini Creeks. Similarly, a 50 m buffer around creeks identified during field scouting located in the tributaries immediately surrounding the main braided/confluence of Snake and Tanumbirini Creeks. This boundary can be seen in **Figure 3.5—9**. Slashing may still be required within these boundaries for the safety of personnel and the convoy.

Where mulching is necessary, the mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line for minimal impact and rapid rehabilitation.

Both the mulcher and slasher preparation widths are 5 m, the soil is not disturbed, and vegetation rootstock is left intact. The mulcher will operate with the mulcher up within the working corridor when mulching is not required. GPS / navigation devices will notify personnel of vehicle exclusion zones like the working corridor boundaries or any other ‘no-go’ zones like the no-mulching area.

The nominal 50 m seismic line corridors allow deviation around potential obstacles and key environmental sensitivities (e.g., mature trees, trees with active hollows or nests) where practicable and cultural sites will be avoided. **Figure 3.5—10** shows an example of a weaving seismic line deviating around vegetation. Rotary vehicles like mulchers and slashers will often just be used to ‘mow’ grass (refer to **Figure 3.5—11**) as the working corridors are highly traversable (up to 85%). Areas like Tanumbirini Creek (refer to seismic lines MCSAN23-[06-12]A and **Figure 3.5—2**) will not require mulching and as such, only a slasher will be used in this area.

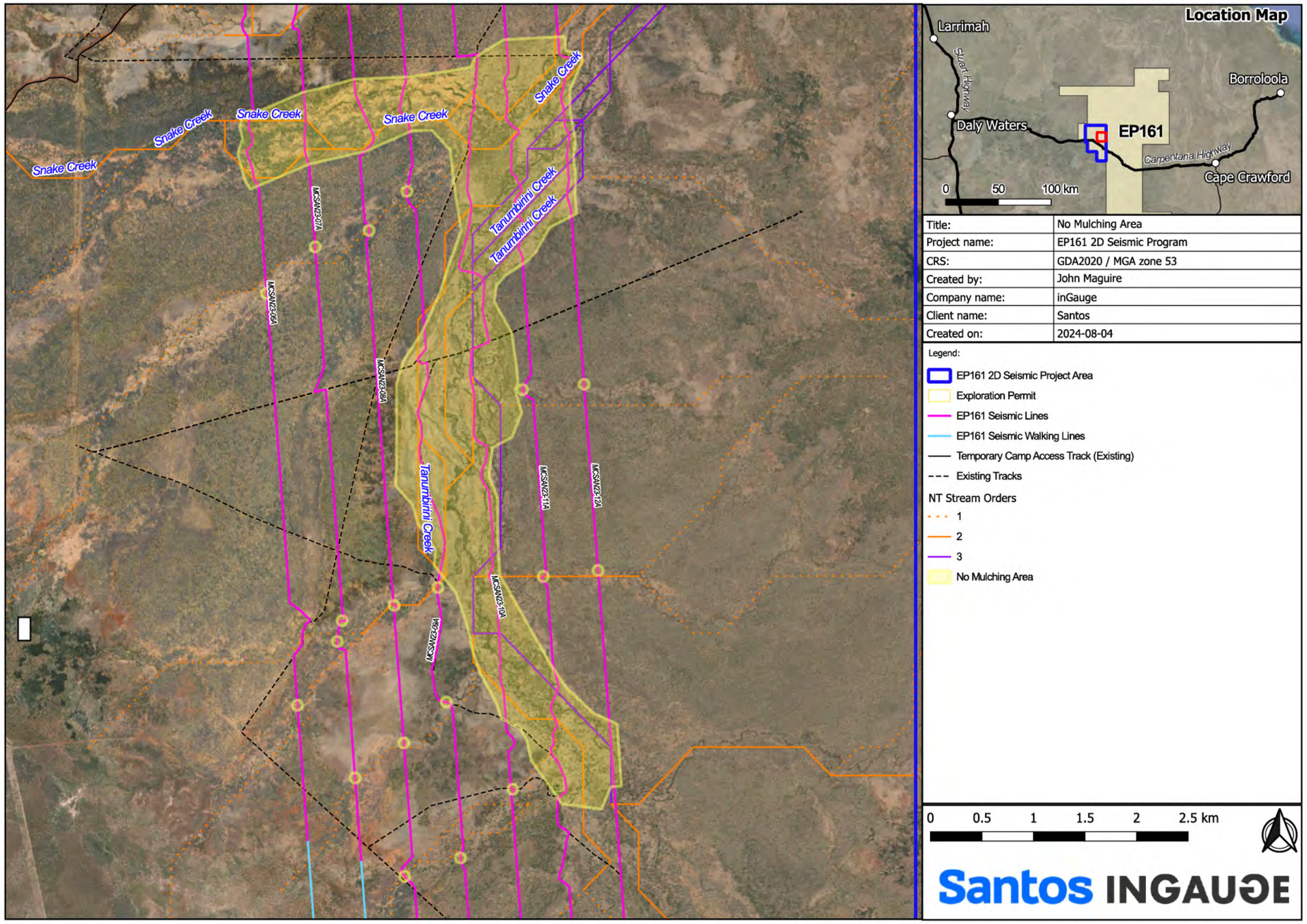


Figure 3.5—9 No Mulching Area



Figure 3.5—10 Example of a Weaving Seismic Line Deviating Around Vegetation



Figure 3.5—11 Example of Low Impact from Rotary Vehicles e.g. Mulcher / Slasher

The line preparation fauna spotter catcher will utilise the tree mulching decision tree shown in **Figure 3.5—12** to decide which mature trees, trees with active hollows or nests selected for preservation will be recorded and flagged for preservation. The decision tree shown in **Figure 3.5—12** will be used to aid the line preparation crew in avoiding mulching mature trees, when realignment is unavoidable what is acceptable to mulch and what is not.

During line preparation, in collaboration with the fauna spotter, the Site Supervisor will assess the potential realignment for safety issues using their experience in similar situations. Unsafe conditions would include hazardous landscapes such as cliffs, swampy areas, and flowing water.

Some grass slashing may be necessary during line preparation to assist in the safe passage of personnel and to reduce fire risk. Additionally, the Activity may necessitate travel through existing fence lines. In such cases, the fence lines may be temporarily removed, and subsequently, either a gate will be installed, or the fence will be reinstated.

In addition to the tree mulching decision tree, a riparian vegetation decision tree shown in **Figure 3.5**—13 will also be used to guide the Activity, as further discussed in **Section 4.1.7**. The Fauna Spotter will consult with the Site Supervisor about use of the riparian vegetation decision tree where the line crosses a waterway to ensure the crossings is safe.

Records of completed checklists will be kept (refer **Section 8.6.3**) and will include commentary for decisions made.

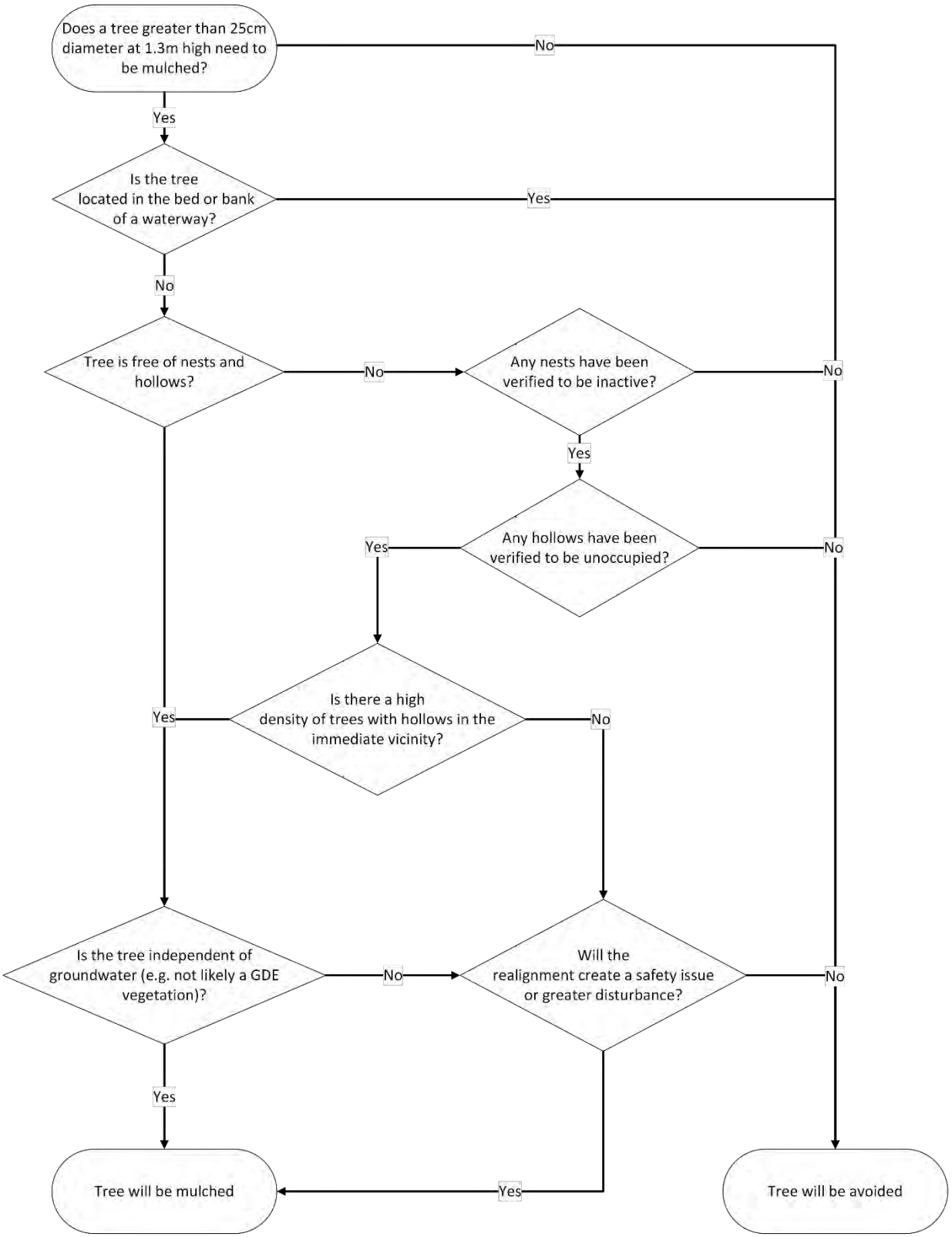


Figure 3.5—12 Tree Mulching Decision Tree

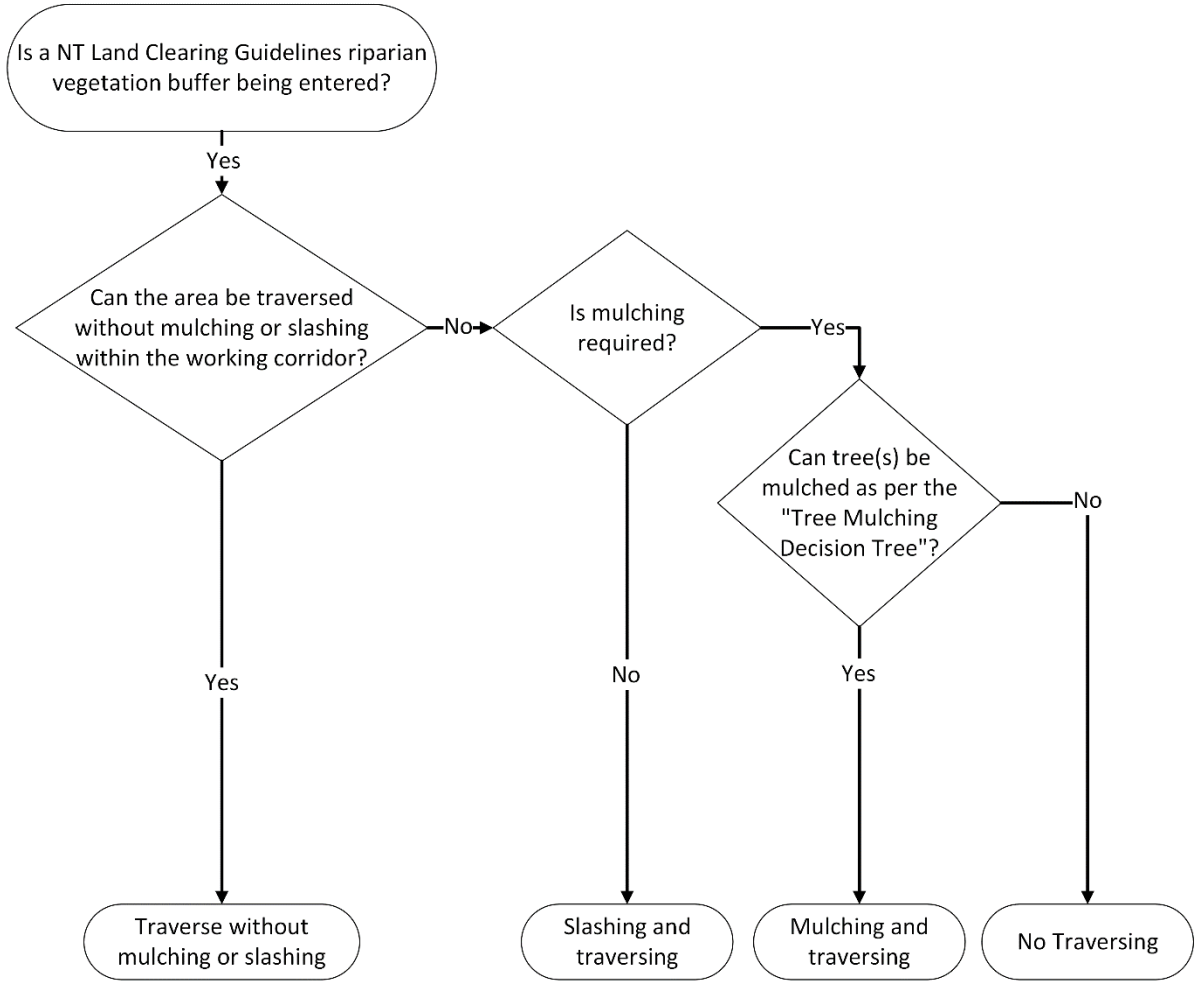


Figure 3.5—13 Riparian Vegetation Decision Tree

Where there are existing crossing points in the seismic working corridor, they will be used, to avoid preparation. Where there are no existing crossings in the seismic working corridor, the least sensitive crossing point will be identified and used. That is, the section of the bank with the lowest gradient or hardest surface and where preparation is not required.

After assessing a crossing to ensure risk of impact is reduced, the chosen crossing point is to be marked e.g. flagging, and all vehicles will use the selected crossing point.

In the final ground truthing and recording of significant trees along the seismic line routes, the presence of any riparian vegetation would also be recorded. The final routes selected within the 50 m seismic line working corridors would avoid these areas as much as practicable. Small portable nodal geophones may also be used in riparian areas for data acquisition (**Section 3.5.4**).

3.5.3 Seismic Survey

Seismic surveys commence after line preparation. The field surveyors use GPS receivers to position receiver points for the 2D surveys. Surveyors mark the ground with biodegradable paint, with selected points marked by wooden stakes. Line detours may also be marked with temporary biodegradable flagging.

The nodal geophones (node) (shown in **Figure 3.5—15**) are autonomous units (cable-less) containing the geophone, battery, and data storage. The units are approximately 10 x 10 x 10 cm with a spike on the underside that is pushed into the ground.

The use of cable-less nodal systems eliminates interconnecting cables between the geophones and the recording truck and the need for vehicles to carry, deploy and pick up the cables. It reduces the number of vehicle passes on the lines and fewer personnel are required. All these efficiencies result in reduced environmental impacts.

Each survey team includes a light 4WD vehicle and generally makes only one pass over any given section of line. Personnel lay nodes will be carried to the working corridors by 4WD vehicles. They walk along the line, placing the nodes every 5 - 10 metres. While line preparation and acquisition are limited to the working corridor, node placement is confined to the Project Area. Each node weighs approximately 1 kg, so they can be carried by hand from the vehicles that will remain within the working corridor. Nodes are positioned linearly, ensuring that even when placed outside the working corridors, they align with the general direction of the seismic lines. These walking corridors are shown in **Figure 3.5—14**. This allows for their placement in areas without preparation or vehicle access (e.g., between each line MCSAN23-[01-12][A-D]; for specific line names, refer to **Table 3.5—2**). Additionally, they can be deployed through sensitive areas, like archaeological background scatter sites, as recommended in **Appendix 02** and, if permitted, within relevant AAPA certificates, ensuring continuous data acquisition across the Project Area. GPS / navigation devices will notify personnel of vehicle exclusion zones like the working corridor boundaries, RWA or any other ‘no-go’ zones.

When sufficient nodes are deployed and activated, acquisition can commence.

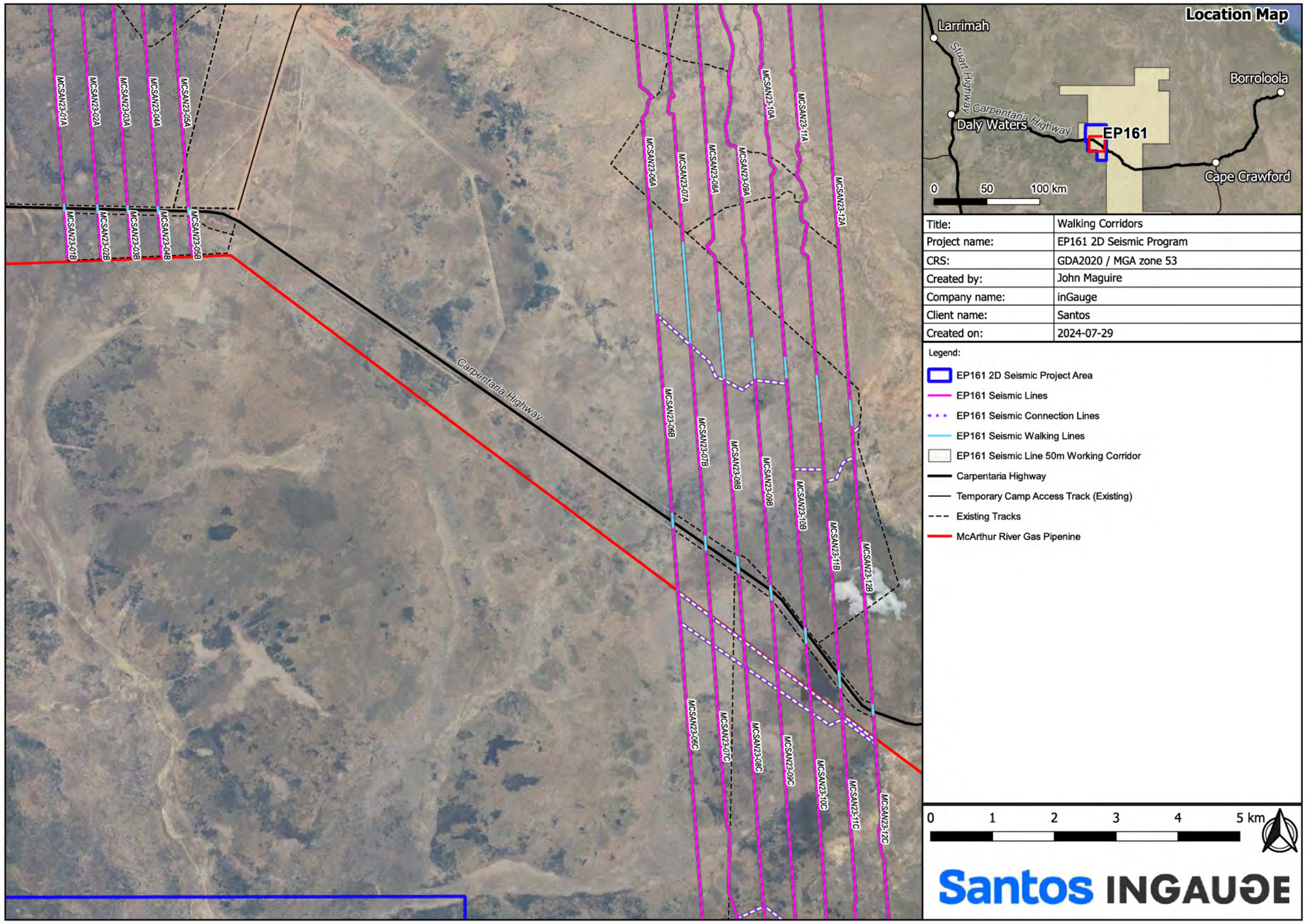


Figure 3.5—14 Walking Corridors



Figure 3.5—15 Activation of Recording Node

3.5.4 2D Seismic Acquisition Operations

Acoustic energy can be created using various means, such as seismic air guns, vibrators or falling weights (known as 'thumpers'). The layout of activated nodes is called 'the spread' and records the acoustic energy reflected from subsurface layers (refer to **Figure 3.5**—17), converts it to electrical energy and stores the data on the nodal unit until it is retrieved from the field and the data downloaded to the recording system.

The acoustic energy source used for this Activity will be an array of two or three truck-mounted vibrator units (refer to **Figure 3.5**—16) that are electronically synchronised. They line up as a 'fleet' along the seismic line, a few metres apart (source point). On command from the recording truck, the vibrators lower their base plate (pad) to input one or more frequency 'sweeps'. Generally, a sweep would last 8 - 12 seconds. Typically, the source points are 10 - 20 metres apart. As such, localised disturbance is short-lived as the vehicles continue along the seismic line quickly. Acquisition vehicles will typically only require one pass on a seismic line and, for best results, need to be nearby geophones.

The 'live' section of spread is typically about 6 km in length. The live spread moves forward with the vibrators so that they are always near the centre. As nodes become redundant behind the vibrator, they are redeployed in front. This continues until acquisition is completed for that line.



Figure 3.5—16 Indicative Example of a Vibrosis Source – Vibe Truck

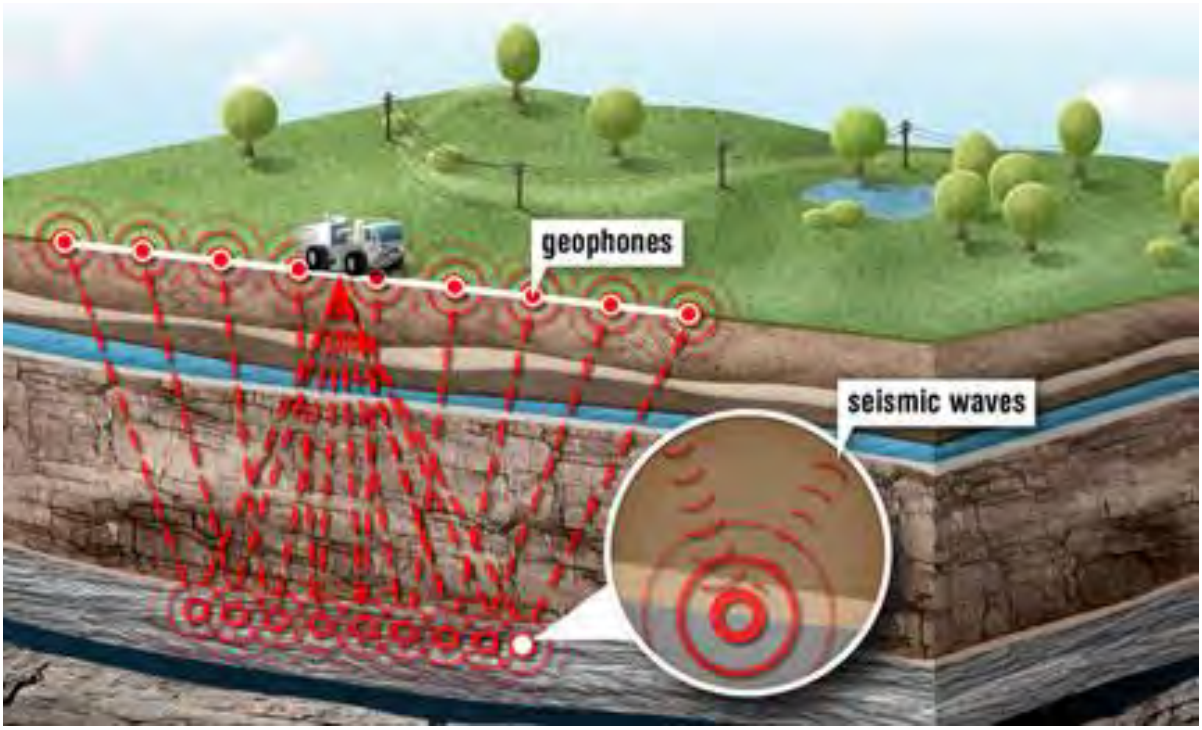


Figure 3.5—17 Example Illustration of Seismic Acquisition

3.5.5 Ground Gravity Survey

A ground gravity survey is proposed to be undertaken after line preparation. The survey would be undertaken at regular intervals along the prepared seismic lines.

The survey method is a non-invasive geophysical approach that accurately measures the Earth's gravitational field at designated surface points using a gravity meter. Like the geophones discussed in **Section 3.5.4**, the gravity meter can be hand-carried. Processing the gravity data allows for the detection of slight shifts in gravity caused by differences in the density beneath the surface.

The gravity survey would be carried out by one surveyor using a suitably equipped light vehicle; an example is shown in **Figure 3.5—18**.



Figure 3.5—18 Example of a 4WD Vehicle Conducting a Gravity Survey (Grey Box Gravity Meter)

3.5.6 Post-Survey Closure

On completion of the 2D seismic and ground gravity surveys, all pegs will be removed from the seismic lines. All temporary infrastructure at the campsite (the Tanumbirini well pad) will be removed. Traversed areas will be inspected for erosion issues, and any identified areas will be addressed in accordance with the Erosion and Sediment Control Plan **Section 7.1**.

3.6 Campsite

A temporary camp for the seismic crew will be placed within the previously cleared Tanumbirini well pad fenced area (**Figure 3.4—1** and **Figure 3.4—2**).

The campsite will have an area for parking equipment and vehicles. A diesel storage tank and refuelling point will also be provided, as well as a small storage area for lubricants, hydraulic fluids, and segregated wastes.

The campsite will include a kitchen, showers, and port-a-loo-type toilets. Sewage and greywater may be transported off-site by a waste management contractor or treated in a portable sewage treatment system (STS).

Treated effluent from the STS would either be removed from site for disposal at an approved location or be irrigated in a designated irrigation area 50 - 100 m away from the camp location, well away from any place from which it is reasonably likely to enter any waters, and to minimise spray drift and ponding. Fencing will be installed around the irrigation area. The STS would meet the NT's Code of Practice for Wastewater Management [CODE OF PRACTICE FOR WASTEWATER MANAGEMENT, 2020 (NT)]. Waste management is discussed further in **Section 7.5** (Waste and Wastewater Management Plan).

3.7 Water Use

Potable water at the campsite will be sourced off-site. It is anticipated that 200 L per person per day will be required. Groundwater may be extracted from existing bores with Water Extraction Licences held by the Interest Holder.

Water Extraction Licence GRF10280 authorises the extraction of 193.5 ML/year from the Gum Ridge Formation. Water Extraction Licence GRF 10280 was reissued to the Interest Holder on 6 December 2023 for a period of 10 years that expires on 31 December 2033.

It should be noted that a seismic and ground gravity program does not inherently demand water. Thus, any water required for the Activity primarily supports secondary operational needs. These secondary operational needs include:

- Access track maintenance and dust suppression.
- Firefighting.

On-ground conditions and prevailing weather patterns will influence the quantity of groundwater required. For example, during prolonged dry periods, there could be an increased need for water for dust suppression, whereas during wetter periods, the demand might decrease. Thus, the need for groundwater extraction is highly variable and circumstantial.

The forecast groundwater use for the Activity is 5 ML (**Table 3.7—1**).

Table 3.7—1 Forecast Groundwater Use

Use	Estimated Total Use (ML)
Operations - Access Track Maintenance, Dust Suppression, and Firefighting	5

Compared with other petroleum operations, the volume of groundwater required for this Activity is minor. Specifically, this extraction accounts for only 0.6% of the 852 ML/year allocated across all currently approved petroleum activities extracting from the Gum Ridge Formation. Additionally, it represents 2.6% of the 193.5 ML/year authorised for extraction from the Gum Ridge Formation. Given these percentages, no significant impact is anticipated on either aquifer when considering other users.

3.8 Noise Sensitive Receptors

Daily operations will be centred around the existing Tanumbirini well pad, which is the location of the temporary campsite. The noise sources from the Activity will be the campsite, line preparation equipment, and 2D seismic acquisition vehicles. The loudest noise sources for sensitive receptors will be line preparation, followed by vibrator equipment. The nearest receptor is the Tanumbirini homestead, located more than 8 km from the temporary campsite on the existing Tanumbirini well pad. The Activity will be conducted during daylight hours and will continuously move along seismic lines. The closest edge of a working corridor is approximately 2.7 km from Tanumbirini homestead, and the Activity is unlikely to cause a noise nuisance at this distance. Loud operations like the use of rotary machines are of brief duration, and the noise will quickly diminish as the vehicles move away from the homestead. Based on acquisition operations discussed in **Section 3.5.4**, vibrator trucks will have travelled anywhere between 750 - 2,250 m within a 15-minute period.

To ensure that noise levels from the Activity remain acceptable, a noise attenuation calculation has been performed. This calculation confirms that the minimum daytime Activity intrusiveness noise levels at the nearest sensitive receptor, potentially caused by preparation, are below the 40 dB(A) limit set by *Table 3.4* of the *Northern Territory Noise Management Framework Guideline* [EPA, 2018]. The calculation is based on a conservative estimate that reflects a worst-case scenario and assumes the following:

- During line preparation equipment will emit 113 dB (vibrators emit approximately 104 dB, approximately less than 3 times the sound pressure of a mulcher/slasher) measured at 2 m

from the source continuously for 1 minute (a significant overestimate) [UG Courses - Agricultural Engineering, 2014].

- Noise level for a tractor-mounted rotary machine is 95 dB at 1m from the source when not actively preparing [UG Courses - Agricultural Engineering, 2014].
- The 2.7 km distance between the Tanumbirini homestead and the edge of the working corridor is flat and has no vegetation or landforms in between.

Based on these assumptions, the minimum daytime intrusiveness at the homestead from the Activity will be 39.5 dB(A) for a duration of less than 15 minutes, which is in line with the guideline. In reality, the noise level is likely to be much lower.

3.9 Greenhouse Gas Emissions

The *National Greenhouse and Energy Reporting (Measurement) Determination (2008)* (NGER Determination) made under subsection 10(3) of the *National Greenhouse and Energy Reporting Act 2007 (Cth)* was utilised to estimate the greenhouse gas (GHG) emissions related to the Activity covered in this EMP.

The estimation was calculated using factors and formulas available in the *Emissions and Energy Threshold Calculator – 2022-23* from the *NGER Determination* [CLEAN ENERGY REGULATOR, 2023].

The NT Government has released its policy, *Greenhouse Gas Emissions Management for New and Expanding Large Emitters* (*the Large Emitters Policy*) [DEPWS, 2021A].

The *Large Emitters Policy* sets out the NT Government's minimum requirements and guidance for large emitters to manage greenhouse gas emissions for new or expanding industrial and land use development projects. The *Large Emitters Policy* applies to industrial projects whose emissions exceed the threshold of 100,000 tonnes of CO_2-e.

For onshore petroleum activities, an Interest Holder requiring project approval under *the PER* must estimate greenhouse gas emissions based on the cumulative total scope 1 emissions from all its activities over a financial year. In the following tables:

- **Table 3.9—1** presents the assumptions for the use of diesel.
- **Table 3.9—2** presents the estimated greenhouse gas emissions for this Activity.
- **Table 3.9—3** presents the forecast greenhouse gas emissions for the total scope one emissions under this EMP and the Interest Holder's projects that require an approval under the *PER*.

The resulting total emissions from this Activity are estimated to be 7.1 ktCO_2-e for financial year 2023/24 and 0 ktCO_2-e for 2024/25 (**Table 3.9—2**). The total scope one emissions for this Activity and all other onshore NT EPs in which the Interest Holder has an interest, for the three financial years, 2023/24, 2024/25 and 2025/26, are estimated to be 13.11 ktCO_2-e (**Table 3.9—3**). It is noted that when this figure is apportioned according to the Interest Holder's holdings in the EPs, the estimated emissions come to 7.24 ktCO_2-e (**Table 3.9—3**).

The Interest Holder's total, cumulative scope 1 emissions remain well below the 100 $ktCO_2$-e threshold for any given financial year, ensuring that the NT Large Emitters Policy is not applicable.

Table 3.9—1 Assumptions for Diesel Use

Use	Diesel (L / Vehicle / Day)	Estimated Total Usage (kL)
Light Vehicle (including ground gravity survey vehicle)	60	68
Heavy Vehicle	100	10
Advanced Heavy Vehicles (seismic source vehicle and line mulchers / slasher)	400	147
General Camp Use	300	20
	Total (kL)	**245**

Table 3.9—2 This Activity's EMP Greenhouse Gas Emissions

Emissions Source	Inputs	Assumptions	($ktCO_2$-e)†		
			2023 / 24	2024 / 25	Total
Preparation of Vegetation	125 ha	• Based on the FullCAM model. • Carbon mass / ha = 51.47 tCO2-e / ha	6.43	-	6.43
Diesel Fuel Combustion	245 kL	• Estimate based on the Emissions and Energy Threshold Calculator – 2022-23*: Fuel Consumption – Diesel Oil.	0.67	-	0.67
		Total ($ktCO_2$-e)	**7.1**	**-**	**7.1**

* [CLEAN ENERGY REGULATOR, 2023]. † Values have been rounded to 2 decimal places.

Table 3.9—3 Total Forecast Emissions in Interest Holder EPs ($ktCO_2$-e)

Exploration Project	FY 23/24	FY 24/25	FY 25/26	Total ($ktCO_2$-e)	Interest Holder %	Interest Holder †† (kt CO_2-e)
EP 125 (Jacko* Bore)	3.6	1.5	0.0	5.1	20	1.02
EP 112 (Dukas 1 Decommissioning)	0.31	0.0	0.0	0.31	30	0.093
EP 161 (2D Seismic and Gravity Survey Program)	6.89†	0.0	0.0	7.1	75	5.68
EP 161 (Other projects)	0.6	0	0	0.6	75	0.45
Total	**11.09†**	**1.5**	**0.0**	**13.11**	**-**	**7.24**

* Jacko Bore, Mahler 1 and Dukas 2 may be the subject of future EMPs where their estimated emissions will be outlined in further detail.
† Values have been rounded to 2 decimal places.
†† for the three financial years, 23/24, 24/25 and 25/26.

3.10 Cumulative and Incremental Impacts

3.10.1 Overview

In accordance with Schedule 1, Cause 3(b) of *the PER*, an EMP must include the cumulative effects of the environmental impacts and risks of the Activity when considered together and in conjunction with any other operations or events that occurred or may occur in or near the Project Area for the Activity.

Cumulative impacts are associated with land clearing, groundwater extraction, greenhouse gas emissions, traffic, social impacts, and rehabilitation.

Cumulative impacts have been estimated for EP 161 and surrounding EPs (EP 76, 98, 136, 154, 169, 187, 190, and 191), hereafter referred to as the Cumulative Study Area. Projects commenced before 2013 have been excluded. A non-exhaustive list of previous works excluded from the assessment of cumulative impacts is provided in **Table 3.10—1**.

As of 2023, the Interest Holder has conducted seismic survey exploration and drilled four exploration wells: Tanumbirini 1 (2014), Marmbulligan-1 (2016), Tanumbirini 2H (2021) and Tanumbirini 3H (2021) in EP 161.

Table 3.10—1 Non-exhaustive List of Previous Works Excluded from the Assessment

Date Estimate	Interest Holder	Location	Works
1984	Amoco Australia Petroleum Company	OP 191	Drilling – Broadmere 1
1984	Amoco Australia Petroleum Company	OP 191	Drilling – Broadmere 1 ST
1990	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Jamison 1
1991	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Mason 1
1992	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Balmain 1
1992	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Shortland 1
1993	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Chanin 1
1993	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Ronald 1
1993	Pacific Oil & Gas Pty Limited	EP 98	Drilling – Burdo 1
2007	Sweetpea Petroleum Pty Limited	EP 98	Drilling - Shenandoah 1
2009	Falcon Oil & Gas Australia Limited	EP 98	Drilling - Shenandoah 1A
2011	Falcon Oil & Gas Australia Limited	EP 98	Drilling - Shenandoah 1A (Re-Entry)
2012	Armour Energy Limited	EP 176	Drilling – Cow Lagoon 1

3.10.2 Mining and Mineral Tenements and Operations

3.10.2.1 Exploration Licences (Granted)

Several mineral and mining exploration licences overlap EP 161 (**Table 3.10—2**).

One tenement (EL 33128 - Green Critical Minerals Limited) has an active Mining Management Plan (MMP), which outlines that works at the time of preparation of this EMP were expected to commence between 1st July and the 30th October 2023, for a two-week period [GREEN CRITICAL MINERALS LTD, 2021]. Crew are expected to be accommodated in Heartbreak Hotel and helicoptered to site each day [GREEN CRITICAL MINERALS, 2023].

Table 3.10—2 Mineral and Mining Exploration Licences

Exploration Licence	Interest Holder	Overlap Project Area	MMP Submitted
EL 31981	Pennant Resources Pty Ltd	Yes	No
EL 32002		Yes	No
EL 32010		Yes	No
EL 32011		Yes	No
EL 32012		No	No
EL 32013		Yes	No
EL 32014		Yes	No
EL 32472	Transition Minerals Ltd	No	No
EL 32721	Baudin Resources Pty Ltd	No	No
EL 32889	Gempart (NT) Pty Ltd	No	No
EL 33028	Daly Tenements Pty Ltd	No	No
EL 33128	Green Critical Minerals Limited	No	**Yes**
EL 33130		No	No

3.10.2.1 Operating Mines

A search of STRIKE conducted in June 2023 found no operating mines, or mines either in the feasibility or care and maintenance phase, within EP 161. One mine was found within the Cumulative Study Area, Merlin mine (EP 190, EL 26944), which is currently closed and in the care and maintenance phase. The Merlin mine was acquired by Lucapa Diamonds (a wholly owned subsidiary of Australia Natural Diamonds Pty Ltd) in 2021 [DITT, 2019].

Three additional mines have been identified in the surrounding region: Bootu Creek mine (EL 30042), south of the southern boundary of EP 161, which is in the care and maintenance phase; Teena mine (EP 171), in the feasibility stage, and McArthur River Mine (EP 176) which is currently operating.

The 2012 Draft McArthur River Mine Environmental Impact Statement (EIS) [2012] predicts that traffic volumes associated with mining operations in 2024 would be an additional 10 vpd from the mine's access road to Tableland's Highway. This route includes the Carpentaria Highway; however, the Tablelands Highway intersection occurs in EP 187, indicating that no mine-related traffic is anticipated to cross through EP 161.

3.10.2.2 McArthur River Mine Pipeline

Completed in 1995, the McArthur River Mine Pipeline intersects EP 161, as shown in **Figure 3.5—3**. This 330 km long pipeline connects the APA Group's Amadeus Gas Pipeline at Daly Waters with the McArthur River Mine power station and mine [AEMC]. Owners and operators of the pipeline are shown in **Table 3.10—3**.

Table 3.10—3 McArthur River Mine Pipeline – Owners / Operators

Infrastructure	Owner	Operator
McArthur River Pipeline	Power and Water Corporation	OSD Asset Services
McArthur River Mine Power Station	EDL	EDL
McArthur River Mine	Glencore	Glencore
Amadeus Gas Pipeline	APA Group (APT Pipelines NT Pty Ltd)	APA Group (APT Pipelines NT Pty Ltd)

3.10.3 Cumulative Impacts – Petroleum EMPs

Table 3.10—4 presents a list of approved Petroleum EMPs included in the cumulative impact assessment, and **Table 3.10—5** presents a summary of the cumulative impacts owing to approved, ongoing petroleum works within the cumulative study area. As a result of changes in regulatory frameworks, several values for previous works have been estimated.

Where values were not presented in the respective EMP (or calculation assumptions outlined in alternate EMPs in a project series), estimates have been calculated based on similar projects. The following assumptions have been made:

- All new access tracks are 6 m wide, seismic lines are 5 m wide, and repurposing seismic lines for access tracks requires an additional 1 m of width.
- All seismic lines have been cleared unless explicitly stated.
- Where details of clearing haven't been stated, it is assumed that both the campsite and gravel pit would require clearing of 1 ha and 7 ha, respectively.
- The Cumulative Study Area is 7,917,423 ha, and the EP 161 area is 1,058,200 ha.
- 2.5 ML (on average) of groundwater is required to drill an exploration well.
- 0.5 ML (on average) of groundwater is required to drill a water bore.
- Values that have been estimated to one decimal place have been rounded up to the nearest integer.

- Where a range of values have been presented, the highest value has been used. E.g., where GHG emission values for both a 90-day and 180-day well test have been presented, the 180-day estimate has been used.
- Where a project has been split into numerous EMPs (for instance, separate EMPs for seismic and civils, drilling, and HF stimulation) and updated GHG, water, and clearing values have been presented, the most recent estimate has been used.
- Adjustments have been made if the Activity scope has been changed post EMP approval. i.e., project scope has been curtailed.
- The period for GHG emissions and water use extends over the entire length of the project. For instance, for a project approved in 2013, which has had several subsequent EMP approvals, the values presented below are the sum of potential GHG emissions and water use from 2013 until year that the area is rehabilitated.

The total maximum area estimates for line preparation for this EMP is 125 ha (**Table 3.5—2**), representing 0.00158 % of the Cumulative Study Area (combined area of EP 76, 98, 136, 154, 161, 169, 187, 190, 191), and 0.0118 % of EP 161. This is a conservative estimate.

Table 3.10—4 Approved EMPs Included in Assessment

Interest Holder	EP	Site	Approved EMPs
Santos **~2013 – 2023**	**EP 161**	**Tanumbirini & Inacumba**	• STO 3-8 • STO 2-7 • Hydraulic Fracturing Program Rev 4 • Civilis & Seismic Rev 4 • MAB-PLN-004 • MAB-PLN-005 • ENV-EP 161 TAN 0003 • ENV-EP 161-STO-0002
		Marmbulligan	• Stratigraphic Corehole Program
Sweetpea **~ 2020 – 2025**	**EP 98 / 136 / 161**	**Maverick**	• SWP 4-3 • SWP 2-3 • SWP 1-4
Tamboran B2 (Origin) **~ 2016 – 2027**	**EP 98**	**Amungee NW**	• ORI 11-3 • ORI 10-3 • ORI 7-2 • NT-2050-35-PH-0018 • NT-2050-15-MP-0014 • NT-2050-15-MP-0010

Interest Holder	EP	Site	Approved EMPs
		Kalala S	• ORI 9-2 • NT-2050-15-MP-0010
		Velkerri 98 N1	• NT-2050-15-MP-0014
	EP 76	**Velkerri 76 S2**	• ORI 10-3 • ORI 5-4 • ORI 4-1 • ORI 2-1
Imperial Oil & Gas **~ 2015 – 2025**	**EP 187**	**Carpentaria**	• IMP 4-3 • IMP 3-4 • IMP 2-6.1 • EP187-EMP-XPN-REP-007
Amour Energy **~ 2013 – 2014**	**EP 190 / 171**	**Glyde Sub-basin**	• EP171-190-ENV-GEN-PLN-003 • NT-ENV-GEN-REP-002
Minerals Australia & Jacaranda Minerals~2023	**EP 154**		• MIA 1-4

Table 3.10—5 Estimated Cumulative Impacts for Approved, and On-going Petroleum Works (Cumulative Study Area) [2013 to ~2027]

Interest Holder	Site / EMP Number	Land Cleared		Groundwater	Greenhouse Gas Emissions	Traffic	Social	Rehabilitation
		Clearing (ha)	% Disturbance*	~ Total (ML)	~ Total (tCO_2-e)	Peak Vehicle No. (per day)	Personnel No. (peak)	Rehabilitation Stage
Santos EP 161	Tanumbirini & Inacumba	297		~171	~146,726	~50	~100	Seismic lines rehabilitated. Drilling sites still active.
	Marmbulligan	22		~22	4,881	~50	~40	Currently rehabilitating.
	Total	**~ 319 ha**	**0.0040291%**	**~ 193 ML**	**~ 152 ktCO₂-e**			
Tamboran EP 98 / 136 / 161	SWP 4-3	2		578	728,399	44	100	Project still active.
	SWP 2-3	166 - 173		318	14,909	56	55	Project still active.
	SWP 1-4	279		1	5,377	30-40	50-60	Partial rehabilitation (~72ha).
	Total	**~ 454 ha**	**0.00005734%**	**~ 897 ML**	**~ 749 ktCO₂-e**			
Tamboran B2 (Origin) EP 76 & 98	Amungee NW & Kalala S	136		~ 614	739,389	44	78	Project still active.
	Velkerri 98 N-1	1		1	994	~10	~20	Current rehabilitating.
	Velkerri 76 S2	26		170	198,779	44	78	Project still active.
	Total	**~ 163 ha**	**0.002059%**	**~ 785 ML**	**~ 939 ktCO₂-e**			
Imperial Oil & Gas EP 187	IMP 4-3	166		435	250,893	50	40	Project still active.
	IMP 3-4	11		8	9,991	50	40	Project still active.
	IMP 2-6.1	14		5	4,158	50	30	Project still active.
	Seismic	70		0	6,638	30	27	Project still active.
	Total	**~ 261 ha**	**0.00330%**	**448 ML**	**~271 ktCO₂-e**			
Amour Energy EP 190	EP171-190-ENV-GEN-PLN-003	0		0	1	4	8	Rehabilitated.
	NT-ENV-GEN-REP-002	1		1	4,000	30-40	30	Rehabilitated.
	Total	**~ 1 ha**	**0.0000126%**	**1 ML**	**~4 ktCO₂-e**			
Minerals Australia / Jacaranda Minerals EP 154	MIA 1-4	16		1	1,050	~1	~30	Project still active.
	Total	**~ 16 ha**	**0.0000020%**	**1 ML**	**1.05 ktCO₂-e**			
	Total	**1,214 ha**	**0.00619%**	**~ 2,325 ML**	**~ 2,116 ktCO₂-e**			

4. Description of the Existing Environment

This section describes the physical, biological, cultural, and socio-economic factors and identifies environmental values that may be affected by the Activity. The existing environment has been assessed and described using the Environmental Factors and Objectives described in *NTEPA Environmental Factors and Objectives* [DEPWS, 2022B].

The Project Area has been defined to focus the ecological and archaeological surveys on the area that immediately encompasses the footprint of the Activity. The information in this section has been sourced using Fox and Co's Ecological Assessment (**Appendix 01**), NR Maps [DEPWS, 2006], and the EPBC PMST [DCCEEW, 2023].

A short synopsis of the existing environment for each line is presented in **Table 3.10—1** below.

Table 3.10—1 Brief Description of the Environment Intersected by Seismic Lines

Seismic Line	Description
Seismic Line 1	• Line 1 is ~8.4 km long and intersects large area of dense Bulwaddy (Macropteranthes kekwickii) shrubland, particularly south and north of the Carpentaria Highway. • The northern 1/3 of the line contains open eucalypt / corymbia woodland • There are no mapped waterways on drainage lines intersecting Line 1.
Seismic Line 2	• Line 2 is ~10 km long and intersects large area of dense Bulwaddy (Macropteranthes kekwickii) shrubland, particularly south and north of the Carpentaria Highway. • The northern 1/3 of the line contains open eucalypt / corymbia woodland. • There are no mapped waterways on drainage lines intersecting Line 2.
Seismic Line 3	• Line 3 is ~7.8 km long and intersects large area of dense Bulwaddy (Macropteranthes kekwickii) shrubland, particularly south and north of the Carpentaria Highway. • The northern 1/3 of the line contains open eucalypt / corymbia woodland. • There are no mapped waterways on drainage lines intersecting Line 3.
Seismic Line 4	• Line 4 is ~7.8 km long and intersects large area of dense Bulwaddy (Macropteranthes kekwickii) shrubland, particularly south and north of the Carpentaria Highway. • The northern 1/3 of the line contains open eucalypt / corymbia woodland. • There are no mapped waterways on drainage lines intersecting Line 4.
Seismic Line 5	• Line 5 is ~7.9 km long and intersects large area of dense Bulwaddy (Macropteranthes kekwickii) shrubland, particularly south and north of the Carpentaria Highway.

Seismic Line	Description
	• The northern 1/3 of the line contains open eucalypt / corymbia woodland. • There are no mapped waterways on drainage lines intersecting Line 5.
Seismic Line 6	• Line 6 is ~30 km long • The southern portion of Line 6 contains lancewood (Acacia shirleyi) thickets with some Bulwaddy (Macropteranthes kekwickii). • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, low open melaleuca dominated woodlands and corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3 km north of the Carpentaria Highway, Line 6 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines. • Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/corymbia woodland. • Line 6 crosses 5 Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 6 also crosses two (2) SO2 watercourses, including the upper reaches of Snake Creek which runs east – west across Lines 6 - 12. • SO2 watercourses have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). SO2 watercourses are typically 0.3 - 0.5 m deep and 3 – 6 m wide. All are impacted by cattle.
Seismic Line 7	• Line 7 is ~24.2 km long • The southern portion of Line 7 contains a mosaic of small pockets of eucalypt woodland and lancewood (Acacia shirleyi) / bulwaddy (Macropteranthes kekwickii) thickets. • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, low open melaleuca dominated woodlands and corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3 km north of the Carpentaria Highway, Line 7 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines. • Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/corymbia woodland.

Seismic Line	Description
	• Line 7 crosses five (5) Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 7 also crosses four (4) SO2 watercourses which are a series of narrow braided ephemeral watercourses, including the upper reaches of Snake Creek which runs east – west across Lines 6 - 12. • SO2 watercourses have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). SO2 watercourses are typically 0.3 - 0.5 m deep and 3 – 6 m wide. All are impacted by cattle.
Seismic Line 8	• Line 8 is ~24.5 km long • The southern portion of Line 8 contains a mosaic of small pockets of eucalypt woodland and lancewood (Acacia shirleyi) / bulwaddy (Macropteranthes kekwickii) thickets. • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, low open melaleuca dominated woodlands and corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3 km north of the Carpentaria Highway, Line 8 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines. • Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/ corymbia woodland. • Line 8 crosses four (4) Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 8 also crosses three (3) SO2 watercourses which are a series of narrow braided ephemeral watercourses, including the upper reaches of Snake Creek which runs east – west across Lines 6 - 12. • SO2 watercourses have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). SO2 watercourses are typically 0.3 - 0.5 m deep and 3 – 6 m wide. All are impacted by cattle.
Seismic Line 9	• Line 9 is ~26.7 km long • The southern portion of line 9 contains a mosaic of small pockets of eucalypt woodland and lancewood (Acacia shirleyi) / bulwaddy (Macropteranthes kekwickii) thickets. • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, low open melaleuca dominated woodlands and

Seismic Line	Description
	corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3 km north of the Carpentaria Highway, Line 9 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines. • Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/corymbia woodland. • Line 9 crosses eight (8) Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 9 also crosses three (3) SO2 watercourses which are a series of narrow braided ephemeral watercourses, including Snake Creek which runs east – west across Lines 6 – 12 and Tanumbirini Creek (SO2) which runs parallel (north-south) to Line 9 for approximately 4 km. Tanumbirini Creek is a series of shallow, ephemeral braided channels. • Snake Creek and Tanumbirini Creek have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). These SO2 watercourses are typically 0.3 - 0.5 m deep and 3 – 6 m wide. All are impacted by cattle.
Seismic Line 10	• Line 10 is ~32.7 km long • The southern portion of Line 10 contains a mosaic of small pockets of eucalypt woodland and lancewood (Acacia shirleyi) / bulwaddy (Macropteranthes kekwickii) thickets. • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, low open melaleuca dominated woodlands and corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3 km north of the Carpentaria Highway, Line 10 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines. • Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/ corymbia woodland. • Line 10 crosses seven (7) Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 10 also crosses Snake Creek (SO2) which runs east – west across Lines 6 – 12 and Tanumbirini Creek (SO2 and SO3) which runs parallel (north-south) to Line 10 for approximately 4 km. Tanumbirini Creek is a series of shallow, ephemeral braided channels.

Seismic Line	Description
	• Snake Creek and Tanumbirini Creek have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). These SO2 watercourses are typically 0.3 - 0.5 m deep and 3 – 6 m wide. All are impacted by cattle.
Seismic Line 11	• Line 11 is ~32 km long • The southern portion of Line 11 contains a mosaic of small pockets of eucalypt woodland and lancewood (Acacia shirleyi) / bulwaddy (Macropteranthes kekwickii) thickets. • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, snappy gum (E. leucophloia) low open woodland, low open melaleuca dominated woodlands and corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3 km north of the Carpentaria Highway, Line 11 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines. • Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/ corymbia woodland. • Line 11 crosses seven (7) Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 11 also crosses Snake Creek (SO2) which runs east – west across Lines 6 – 12 and Tanumbirini Creek (SO2 and SO3) which runs parallel (north-south) to Line 11. Tanumbirini Creek is a series of shallow, ephemeral braided channels. • Snake Creek and Tanumbirini Creek have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). These SO2/SO3 watercourses are typically 0.3 - 0.5 m deep and 3 - 8 m wide. All are impacted by cattle.
Seismic Line 12	• Line 12 is ~29.8 km long • The southern portion of Line 12 contains a mosaic of small pockets of eucalypt woodland and lancewood (Acacia shirleyi) / bulwaddy (Macropteranthes kekwickii) thickets. • Vegetation consists of a mosaic of communities including open silver box (Eucalyptus pruinosa) woodlands, snappy gum (E. leucophloia) low open woodland, low open melaleuca dominated woodlands and corymbia / eucalypt open woodlands with a turpentine (Acacia lysiphloia) shrub layer. • Heading north approximately 3km north of the Carpentaria Highway, Line 12 intersects the top of a scarp. Due to access and topography constraints only the potential deployment of geophones will occur in this gap between the lines.

Seismic Line	Description
	• Heading north from the base of the scarp, the landscape again is a mosaic of silver box dominated woodland (almost monoculture stands of silver box) and eucalypt/corymbia woodland. • Line 12 crosses five (5) Stream Order (SO) 1 watercourses which are narrow and highly ephemeral. They are generally shallow (less than 0.3 m deep) and narrow (less than 2 – 3 m wide) with little to no discernible riparian layer. • Line 12 also crosses Snake Creek (SO2) which runs east – west across Lines 6 – 12 and Tanumbirini Creek (SO3) which is a series of shallow, ephemeral braided channels. • Snake Creek and Tanumbirini Creek have a sparse riparian layer of Eucalyptus camaldulensis (river red gum). These SO2/SO3 watercourses are typically 0.3 - 0.5 m deep and 3 – 8 m wide. All are impacted by cattle.

4.1 Physical Environment

4.1.1 Climate

The Project Area is in a semi-arid, subtropical climatic region, which is impacted by the monsoonal climate to the north, where there is a distinctive wet and dry season. Most of the rainfall occurs during the short, hot summer months between November and March. Rainfall events are usually associated with intense thunderstorms or widespread monsoonal activity. The local area averages 50 days of rain per annum. Little rainfall occurs during the remainder of the year when the climate is characterised by mild days and cool nights [S. FULTON, & A. KNAPTON, 2015].

EP 161 is situated between the Daly Waters Airstrip weather station (#014626) and the McArthur River Mine Airport weather station (#014704). A weather station (#14628) at Tanumbirini Station has captured monthly rainfall data between 1970 and 2023; however, no other climate statistics have been recorded from the site.

Table 4.1—1 shows rainfall averages data for Daly Waters, McArthur River and Tanumbirini Station.

The most rain during the year falls in January and February. Tanumbirini Station's maximum rainfall occurs during January, with an average of 202.4 mm (January) recorded between 1970 and 2023. The least amount of rainfall occurs during July and August across all three weather stations; however, the McArthur River Mine receives more rain during March and April on average than Daly Waters or Tanumbirini Station (**Table 4.1—1**). The annual rainfall pattern varies between the three weather stations. The overall mean annual rainfall increases towards the coast.

The minimum and maximum daily temperatures in Daly Waters are slightly less than in McArthur River Mine throughout the year (**Table 4.1—2**). The highest temperatures for both areas occur in November, with temperatures of 38.2°C and 38.7°C, respectively. The lowest temperatures occur in July, with an average daily temperature between 11.8°C and 12.3°C at both stations. The average temperature increases closer to the coast [BUREAU OF METEOROLOGY, 2023A, 2023B, 2023C].

Table 4.1—1 Average Rainfall Statistics

Average Rainfall (mm)													
Site Name and Number	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Daly Waters Airstrip (14626)	161.7	186.2	105.5	20.8	6.2	2.9	2.6	0.4	1.8	21.7	51	118.5	680.3
McArthur River Mine Airport (14704)	215.3	179.9	144.4	31.3	6.7	1.6	2.5	0.3	4.5	20.5	59	125	795.9
Tanumbirini Station (014628)	202.4	177.9	118.2	23.6	2.3	4.8	3.2	1.2	5.4	22.3	50.2	122.2	733.7

Table 4.1—2 Average Temperature Statistics

Average Temperature (°C)														
Site Name and Number	**Statistic**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Daly Waters Airstrip (14626)	**Avg. Maximum**	35.8	35.0	34.9	34.1	31.4	29.0	29.2	31.3	35.0	37.5	38.2	37.4	34.1
	Avg. Minimum	24.1	23.4	22.5	19.6	15.9	13.1	11.8	12.6	16.8	21.1	23.6	24.2	19.1
McArthur River Mine Airport (14704)	**Avg. Maximum**	36.0	35.4	35.4	35.0	32.4	30.1	30.2	32.2	35.5	38.0	38.7	37.8	34.7
	Avg. Minimum	25.0	24.8	23.6	20.8	16.6	12.9	12.3	13.5	17.4	21.4	24.2	25.1	19.8

4.1.2 Topography

Tanumbirini Station is situated approximately 250 - 280 m above sea level along the Carpentaria Highway. The station is situated on a drainage divide that separates the inland drainage of the Sturt Plateau from the north-easterly flowing streams that lead into the Gulf of Carpentaria.

To the west and southwest are the gently undulating plain of the Sturt plateau, and to the north and east towards the Gulf of Carpentaria are laterite plains. Formed by laterite capping on Cretaceous aged sedimentary rocks, the undulating terrain is characterised by scattered low, steep hills and dissected plateaux on exposed Proterozoic and Palaeozoic sedimentary rocks [S. FULTON, & A. KNAPTON, 2015].

The Project Area features gentle undulations. Areas with a slope greater than 3% are highlighted due to increased erosion risk. A Revised Universal Soil Loss Equation which is a soil loss model that addresses sheet and rill erosion on short slopes (< 300 m) explores this risk further in **Section 7.1.4**. As shown in **Figure 4.1—1**, the eastern seismic lines have been separated to avoid areas of significant slope, while the remainder of the Activity is situated in areas with isolated slope variations.

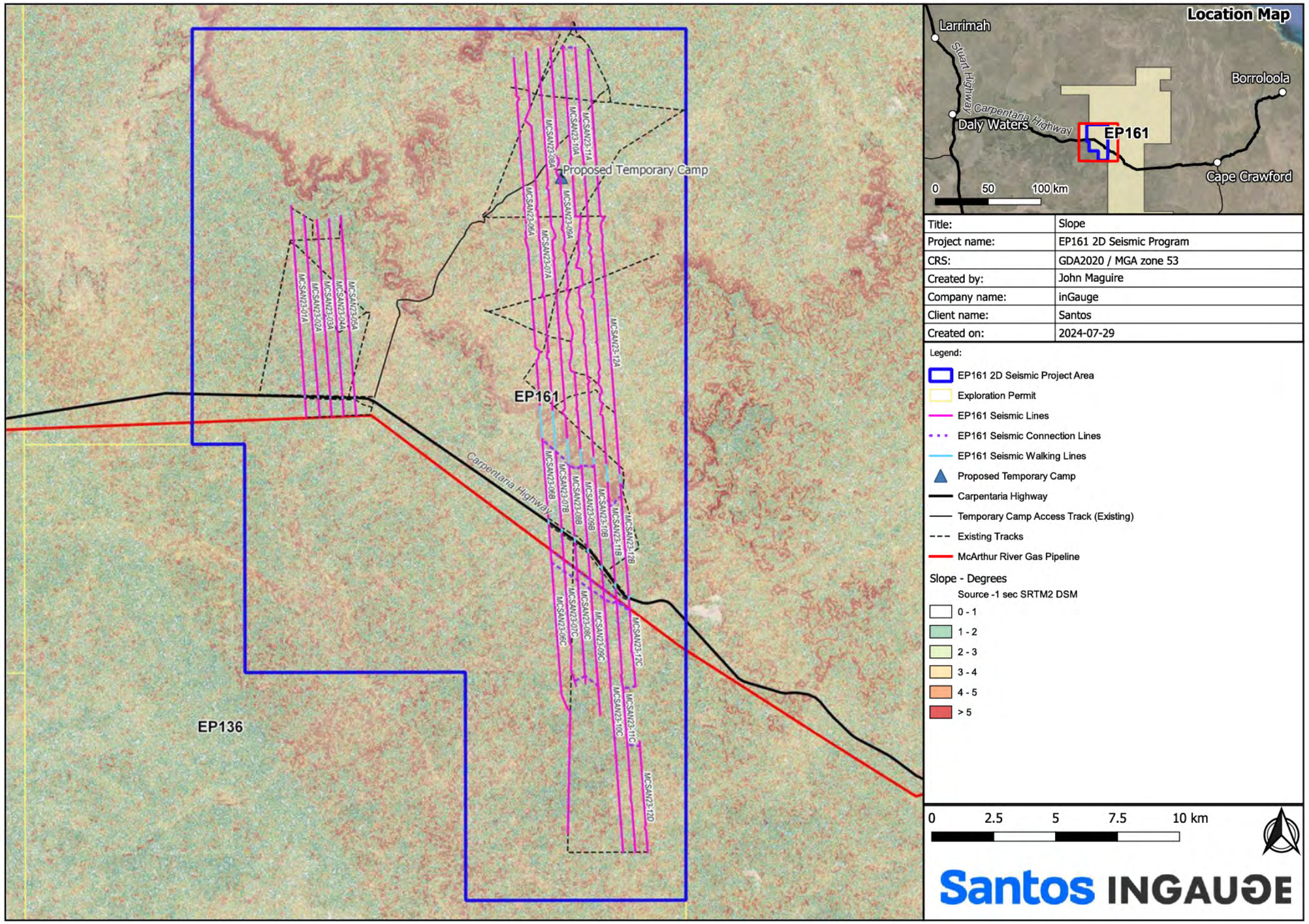


Figure 4.1—1 Slope of Project Area

4.1.3 Geology

Gas exploration on EP 161 targets shale sequences within the Beetaloo Sub-basin, which forms part of the greater McArthur Basin. **Figure 4.1—2** shows the location of Beetaloo Sub-basin relative to the Project Area. The Beetaloo Sub-basin comprises a thick sequence of flat-lying mudstone and sandstone formations (Roper Group), estimated to reach 5,000 m in thickness in the basin's centre.

The Beetaloo Sub-basin is an ancient Proterozoic sedimentary basin that has been relatively tectonically quiescent throughout its long history, evidenced by the lack of significant structural deformation.

The primary exploration target within the basin is the Velkerri Formation, which is thought to have been deposited ~1.4 billion years ago. This formation comprises intervals of high organic content fine-grained rocks ('shales') contained within clay-rich and organically lean layers. The Velkerri Formation is overlain by other formations of the Roper Group (Maiwok Sub-group), including the Moroak Sandstone and the Kyalla Formation.

The Roper Group sediments are unconformably overlain by Neoproterozoic basal sediments of the northern Georgina Basin, which constitute the Kiana Group, including the Bukalara Sandstone and Cox Formation at this location.

The Kiana Group is unconformably overlain by the Barkly Group, which includes the Gum Ridge Formation and the Anthony Lagoon Formation, which comprise the two hydrogeological sub-units of the Cambrian Limestone Aquifer (CLA). The Cambrian Barkly Group is unconformably overlain by undifferentiated Cretaceous to Quaternary sediments of the Carpentaria Basin.

4.1.4 Soils

The Project Area soils are dominated by kandosols and rudosols [NRMaps, 2023; CSIRO 2013]. Rudosols are very shallow soils or those with minimal soil development and include very shallow rocky and gravelly soils across rugged terrain. Kandosols are massive and gravelly soils (formerly red, yellow, and brown earths) that are widespread across the Sturt Plateau bioregion.

The soil types in the Project Area are shown in **Figure 4.1—3**. This figure illustrates that three soil classifications dominate the seismic line groups. Details of local soils from groundwater bores in the vicinity of the seismic line groups were retrieved from the "Know Your Bore" NT database and are consistent with [DEPWS, 2024].

The bore data indicates that the soils in the seismic groups contain:

- **Seismic Lines 1 - 5:** sandy gravel and clays of brown sand and red gravel.
    - Strata information investigated from RN025291, RN38179, RN40937, RN40938.
- **Seismic Lines 6A - 12A:** black soil, gravel. sandy clay.
    - Strata information investigated from RN40936, RN38580, RN7658.
- **Seismic Lines 6B - 12B and Connection lines:** Sandy topsoil and red clay.
    - Strata information investigated from RN40936, RN38580, RN7658.

The soil type greatly affects soil erodibility. Erosion hazard and risk for the Activity is discussed further in **Section 7.1**.

4.1.5 Land Systems

Land systems are defined by their distinct differences from the surrounding areas and by the recurring pattern of geology, topography, soils, and vegetation. Land system information for EP 161 and the Project Area is shown in **Figure 4.1—4** and described in **Table 4.1—3**.

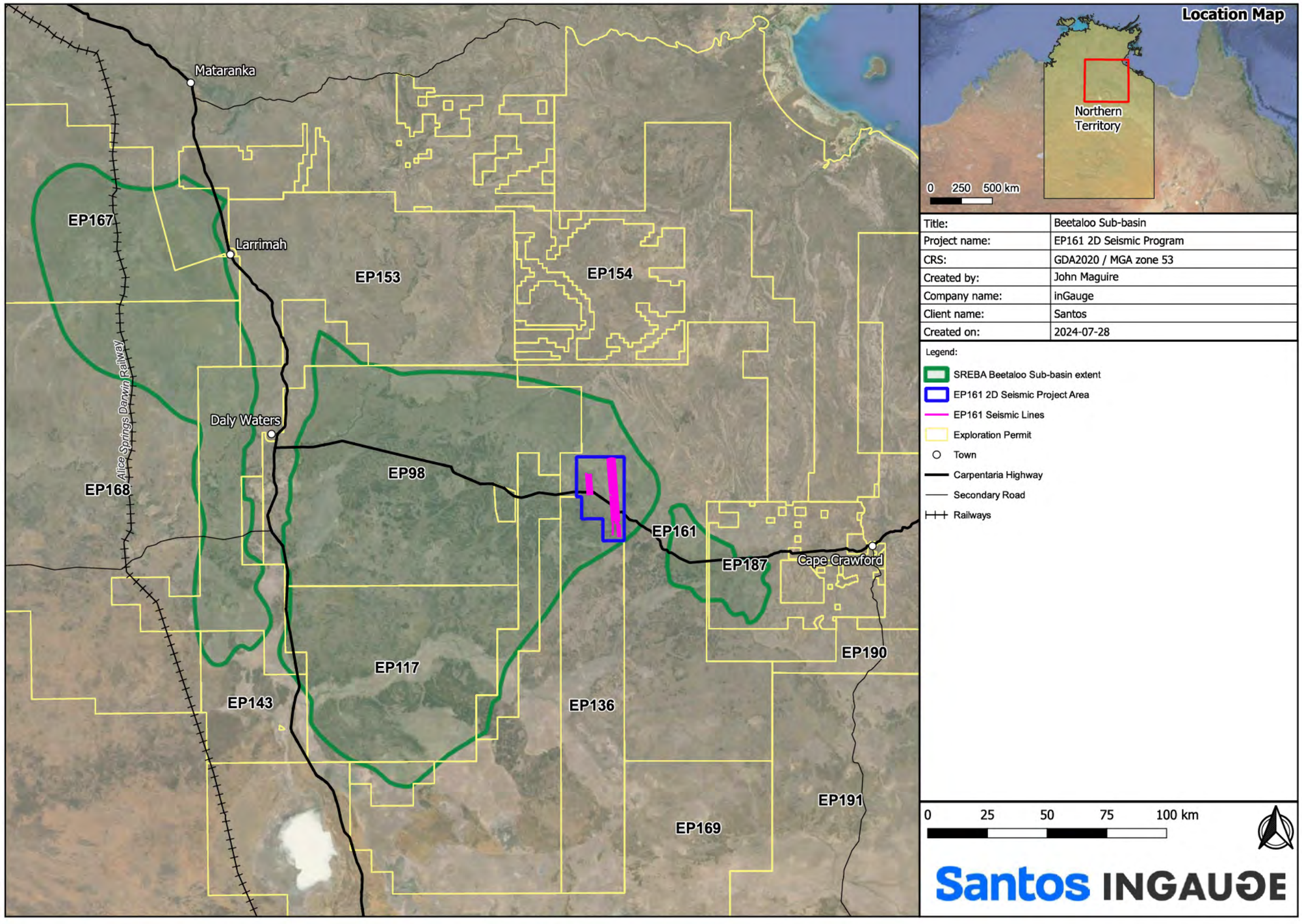


Figure 4.1—2 Beetaloo Sub-basin Extent

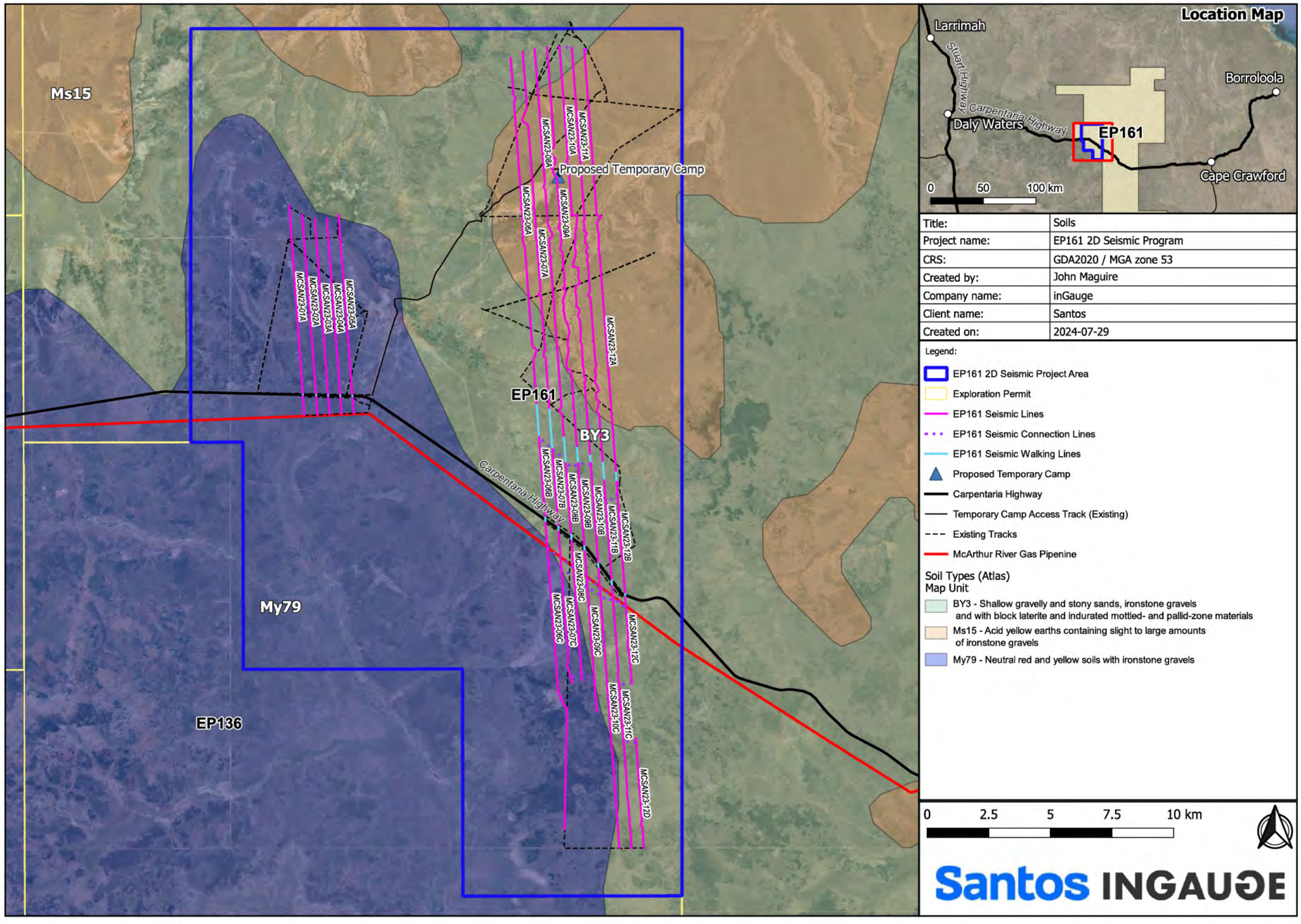


Figure 4.1—3 Soil Types in the Project Area

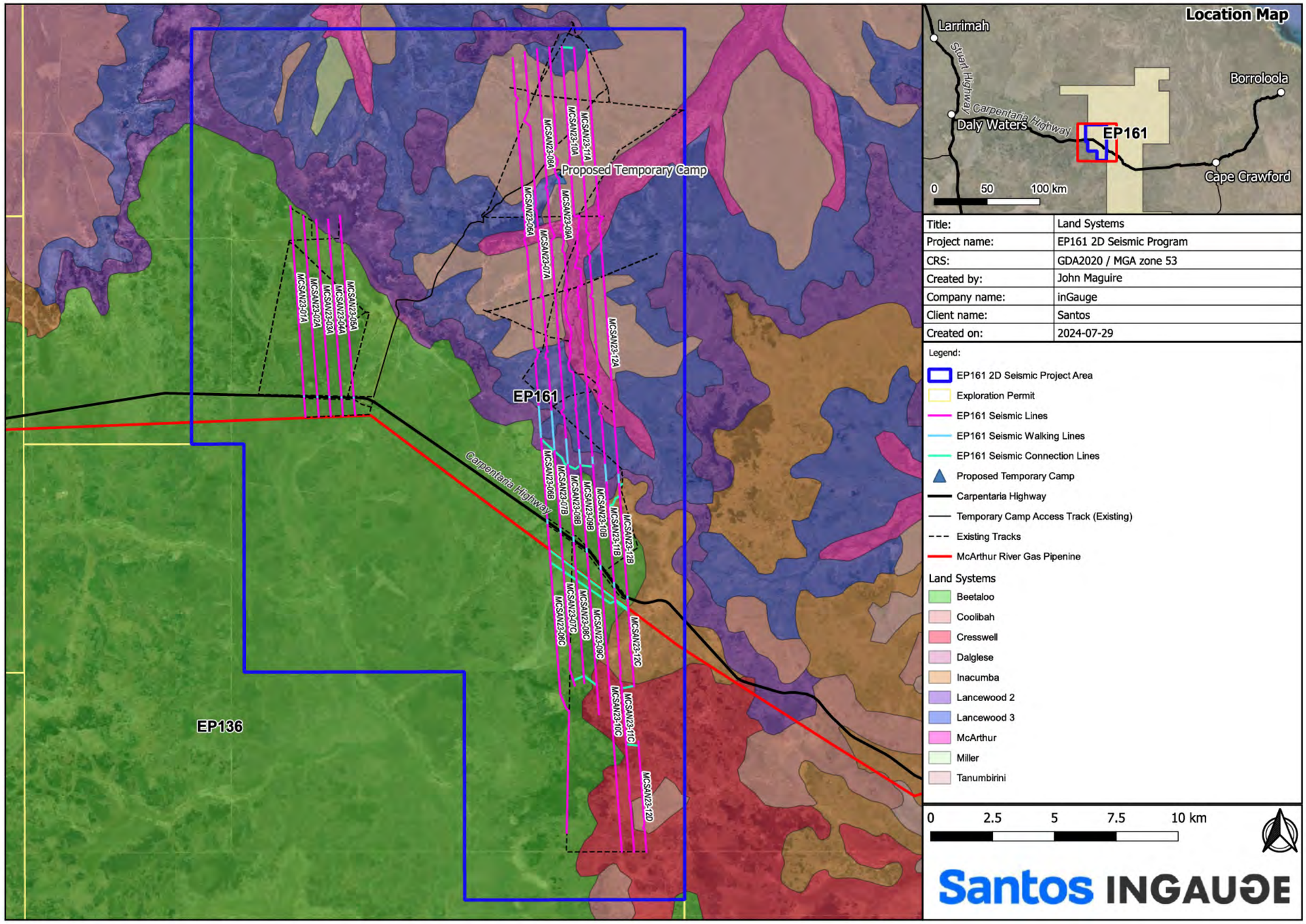


Figure 4.1—4 Land Systems Within the Project Area

Table 4.1—3 Percentage of Land Systems and Total Area Within the Project Area

Land System	Landscape Class	Class Description	Landform	Soil Descriptions	Vegetation Description	% of Total Area
Beetaloo	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite), including sand sheets and other depositional products; sandy and earth soils.	Information not available.	Information not available.	Information not available.	<1%
Coolibah	Alluvial floodplains	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium.	Level to gently undulating plains on unconsolidated transported materials, rarely sedentary.	Grey and brown clays, minor black earths.	Mid-high open woodland of *Eucalyptus microtheca, Excoecaria parvifolia* over *Chrysopogon fallax, Sorghum plumosum, Aristida spp.*	1%
Inacumba	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite), including sand sheets and other depositional products; sandy and earth soils.	Gently undulating rises and undulating plains to low hills on ferruginised Lower Cretaceous sediments (laterite) and weathered sandstones.	Lithosols	Mid-high open woodland of *Corymbia dichromophloia, Eucalyptus miniata, Eucalyptus tetrodonta, Corymbia ferruginea, Eucalyptus leucophloia* with isolated stands of *Acacia shirleyi* on steeper slopes over *Eriachne spp, Chrysopogon fallax, Plectrachne pungens.*	35%
Lancewood 2	Lateritic plateaux	Plateaux, scarps, and some rises on deeply weathered sediments; shallow soils with rock outcrop.	Plateau margins, escarpments and rugged low hills and plateaux.	Lateritic lithosols	Mid-high open forest of *Acacia shirleyi* over *Schizachyrium* fragile, *Chrysopogon fallax, Triodia bitextura.*	<1%
Lancewood 3	Sandstone plains and rises	Plains, rises and plateaux on mostly on sandstone, siltstone, claystone, shale, and some limestone, commonly shallow soils with surface stone and rock outcrop.	Gently undulating plains and drainage floors on claystone.	Grey and Brown clays	Tall open grassland of *Chrysopogon fallax, Eulalia aurea, Iseilema vaginiflorum.*	25%
McArthur	Alluvial floodplains	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium.	Broad or narrow fluvial corridors conduct regional drainage across various land systems towards the coast.	Grey and brown clays, red and yellow earths, and siliceous sands.	Mid-high open woodland of *Corymbia terminalis, Eucalyptus microtheca, Excoecaria parvifolia, Lysiphyllum cunninghami, Corymbia papuana* over *Chrysopogon spp, Eulalia fulva, Iseilema vaginiflorum.*	2%
Tanumbirini	Lateritic plains and rises	Plains, rises and plateaux on mostly on sandstone, siltstone, claystone, shale, and some limestone, commonly shallow soils with surface stone and rock outcrop.	Gently sloping pediplains below but isolated from lateritic escarpments.	Lateritic yellow earths and brown clays.	Mid-high open woodland of *Eucalyptus chlorophylla, Erythrophleum chlorostachys, Corymbia polycarpa, Eucalyptus tetrodonta, Terminalia grandifolia* over *Chrysopogon fallax, Eulalia fulva, Plectrachne pungens.*	36%

4.1.6 Groundwater

No groundwater bores will be drilled under this EMP. Water for maintenance of existing access tracks, dust suppression and firefighting water will be sourced from licenced bores. As noted in **Section 3.7**, Water Extraction Licence GRF10280 authorises the extraction of 193.5 ML/year from the Gum Ridge Formation Water Extraction Licence GRF 10280 was reissued to the Interest Holder on 6 December 2023 for a period of 10 years that expires on 31 December 2033.

Potable water will be trucked to the campsite. As noted in **Section 4.1.3**, the Gum Ridge Formation is recognised as a regional aquifer and is considered to be the deepest aquifer present in the Project Area.

There are several groundwater bores in the vicinity of the Project Area. The locations of these bores are shown in **Figure 4.1—5** utilising data from NR Maps NT [NRMaps, 2023]. Field surveys and scouting have identified that this dataset does have inaccuracies.

4.1.7 Surface Water

The Project Area straddles the intersection between the Limmen Bight - Roper River catchments, which drain towards the Gulf of Carpentaria, and the Victoria River – Wiso catchments, which drain towards the Timor Sea [BoM, 2012; ESRI BoM, 2022; NT Government, 2023]. Several non-perennial creeks run through the Project Area, with the major ones being Tanumbirini Creek to the north and Newcastle Creek to the south.

The surface water drainage system is shown in **Figure 4.1—6**.

As shown in the figure, there are several streams and drainage lines in the Project Area. The highest flows for the drainage lines occur during the wet season, predominantly due to cyclones and monsoonal rainfall. These drainage lines are largely ephemeral, subject to short flow duration and high turbidity.

During planning for the Activity, the *Land Clearing Guidelines* (*LCG* [DEPWS 2021]) were considered. The *LCG* recommend riparian area buffers around different stream orders. The recommended buffer distances are as follows:

- Drainage lines and 1st order streams – 25 m buffer from the outer edge of drainage depression or riparian vegetation/levee.
- 2nd order streams – 50 m buffer.
- 3rd order and 4th order creeks – 100 m buffer.
- Rivers – 250 m buffer.

The *LCG* states that stream orders can be determined using a topographic map of an appropriate scale and that alignment should be field verified. The Interest Holder has overlaid the stream order dataset over satellite imagery, and this has shown significant discrepancies within the braided area of Tanumbirini Creek in the northern portion of the eastern group of seismic lines **Figure 4.1—6**, which underscores the importance of the field verification. A description of the surface water crossings is provided in **Section 4.2.3**.

During the ecological survey, it was observed that drainage lines and waterways were affected by cattle. Additionally, the riparian vegetation in the Project Area is primarily sparse woodland, through which seismic vehicles can manoeuvre with no mulching. This was verified in the field during the July survey where seismic lines that traverse through riparian areas and waterways were scouted. As such, no mulching will be undertaken in the Tanumbirini Creek area, but slashing may occur for the safety of work crews (**Figure 4.1—6**).

To further aid in minimising the potential for preparation in other riparian areas that may be encountered, a decision tree has been developed to guide the Activity (see **Figure 3.5—13**). In **Figure 3.5—13** a reference to riparian area is deemed to include a Groundwater Dependant Ecosystem (GDE).

4.1.8 Flood Modelling

Flood modelling has not been undertaken for this EMP, as seismic work is to occur in dry conditions, with no long-term infrastructure proposed, in the unlikely event of unseasonal significant rainfall, the work would be postponed.

It is noted that flood modelling was undertaken for the Tanumbirini well pad (the site of the proposed temporary camp and vehicle parking and refuelling area) in the *Environment Management Plan: McArthur Basin Drilling Program - NT Exploration Permit (EP) 161* [SANTOS QNT PTY LTD, 2021].

This modelling indicated that the Tanumbirini well pad supporting infrastructure areas, including the camp, tank pads and laydown areas, would be unaffected by a 1 in 100 Annual Exceedance Probability (AEP) flood event.

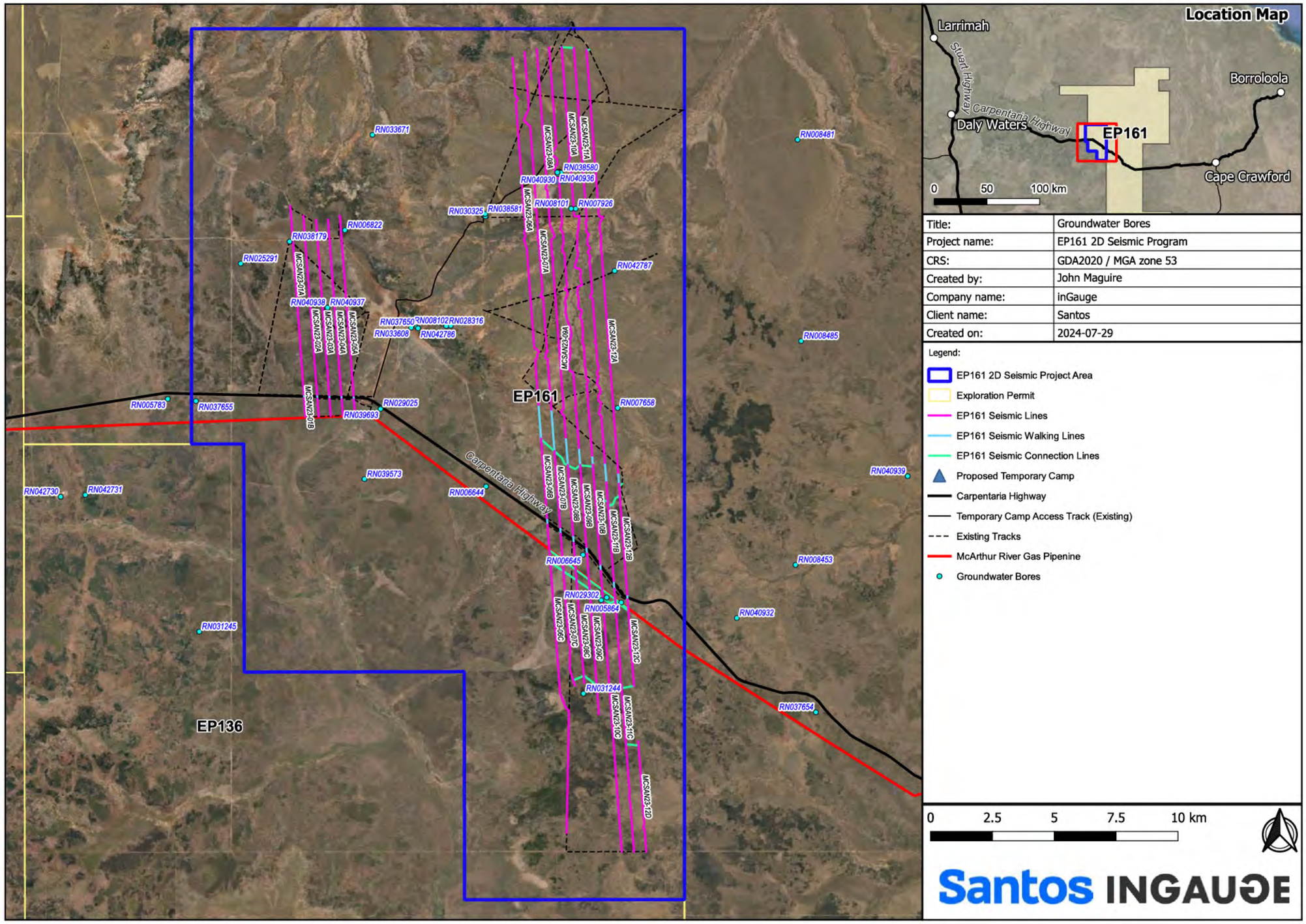


Figure 4.1—5 Groundwater Bores in Proximity to the Project Area

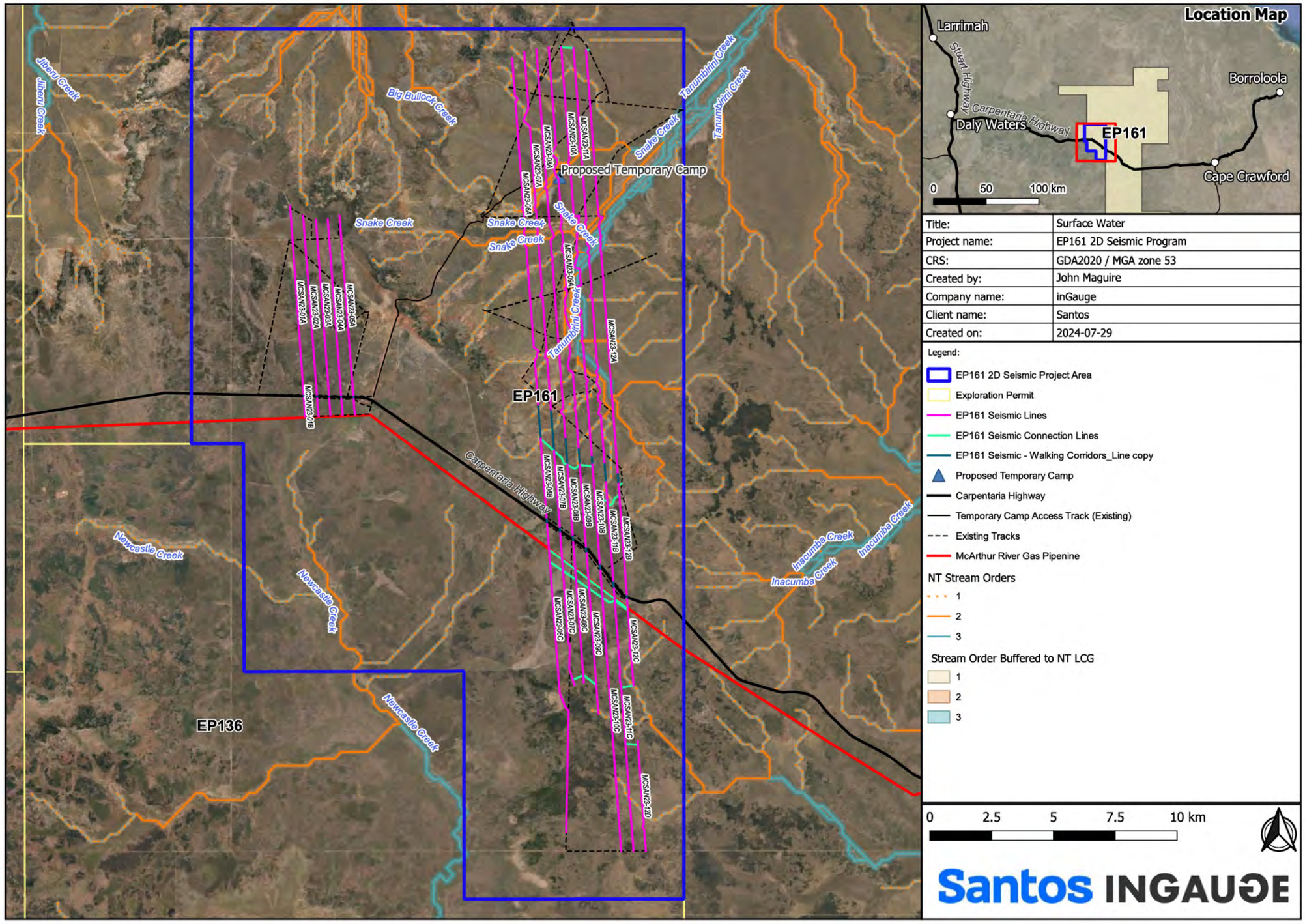


Figure 4.1—6 Surface Water Drainage and Stream Order

4.2 Natural Environment

A desktop assessment and targeted ecological surveys were undertaken in July 2023 with a specific focus on the Interest Holder's proposed seismic lines. The desktop assessments of available Northern Territory and Commonwealth databases were undertaken prior to the commencement of the field survey to identify records or potential occurrences of conservation-significant species and vegetation communities within the study area. The field survey obtained ecological information and opportunistic observations relevant to the seismic lines.

The desktop assessments included a review of previous investigations on EP 161, relevant literature, mapping, database searches and the SREBA for the Beetaloo Sub-basin. In particular, the desktop assessments, in addition to a review of previous EMPs on EP 161, included revised searches of the following databases:

- EPBC PMST (-16.804167, 135.174167).
- ALA database.
- AVH.
- OZCAM.
- BirdLife Australia's Birdata.
- DEPWS NR Maps.
- SREBA for the Beetaloo Sub-basin.

The findings of the desktop assessment and field surveys have informed the sections below.

4.2.1 Bioregional Context

The IBRA is a nationally recognised ecosystem classification system. Bioregions are large, geographically distinct ecosystems distinguished by broad physical and biological characteristics. These regions are used as the basis for regional comparisons and conservation of flora and floristic communities.

The IBRA bioregions of the Beetaloo Sub-basin are described in the DEPWS report SREBA, for the Beetaloo Sub-basin [DEPWS, 2022C]. The bioregions of the Beetaloo Sub-basin region, as shown in this report, are presented in **Figure 4.2—1**. The Beetaloo Sub-basin occurs mainly within the Sturt Plateau bioregion, extending into the Gulf Fall and Uplands bioregion in the north-east of the Sub-basin, with an incursion of the Mitchell Grass Downs bioregion from the south.

The Project Area is located at the junction of two biogeographic regions, as shown in **Figure 4.2—2**. The western series of 5 seismic lines is entirely within the Sturt Plateau bioregion, and the eastern

series of 7 seismic lines crosses over from the Sturt Plateau bioregion to the Gulf Fall and Upland bioregion. These bioregions are discussed below.

4.2.1.1 Gulf Fall and Upland Bioregion

The Gulf Fall and Upland Bioregion covers an area of 118,480 km^2 and includes gorges, water holes and dissected sandstone plateaus comprising Proterozoic sandstone outcrops. Vegetation is predominantly eucalypt woodlands over spinifex grasslands. Cattle grazing and mining are the main land uses. Other land uses include Aboriginal land and conservation reserves. The major population centres are Borroloola and Ngukurr.

Feral animals, weeds and a broad fire regime are eroding the bioregion; however, it is generally in good condition. The bioregion also provides refuge for threatened species, including the endangered Carpentaria rock-rat and the Gouldian finch.

The riparian zones of water courses are in reasonably good condition but experience degradation from uncontrolled livestock and feral animals. Other issues localised watercourses face are weed infestations, altered fire regimes and pollution related to mining.

The bioregion is generally in good condition but is being degraded by increasing feral animals (primarily pigs, buffalo, donkeys, and cattle), weeds, and broad-scale changes in fire regime [DoEE, 2008].

4.2.1.2 Sturt Plateau Bioregion

The Sturt Plateau Bioregion comprises a total area of approximately 98,575 km^2. The topography is characterised by low-lying, flat to gently undulating plains. The vegetation is mostly eucalypt open forests and woodlands dominated by bloodwoods. Open areas are dominated by perennial grasses and annual grasses. The main industry use in this region is cattle grazing. The major population centres include Larrimah and Daly Waters.

The climate in this bioregion is dry but influenced by monsoonal activity. Historically, water supply issues have affected this region, but the increase in groundwater information has led to improved success rates for drilling bores and, subsequently, better land development.

Approximately 77% of the Sturt Plateau bioregion is grazed by stock. Several weeds are known to occur in this bioregion, such as Hyptis sp, prickly acacia, sicklepod and mission grass. The Alice Springs to Darwin railway corridor has allowed new weeds to invade and spread in the region. Known invasive animals include pigs, dogs, camels, cats, and horses.

The strategic placement of water access points has increased infrastructure development, reduced the number and intensity of wildfires, and increased the area available for grazing [Bastin & ACRIS, 2008].

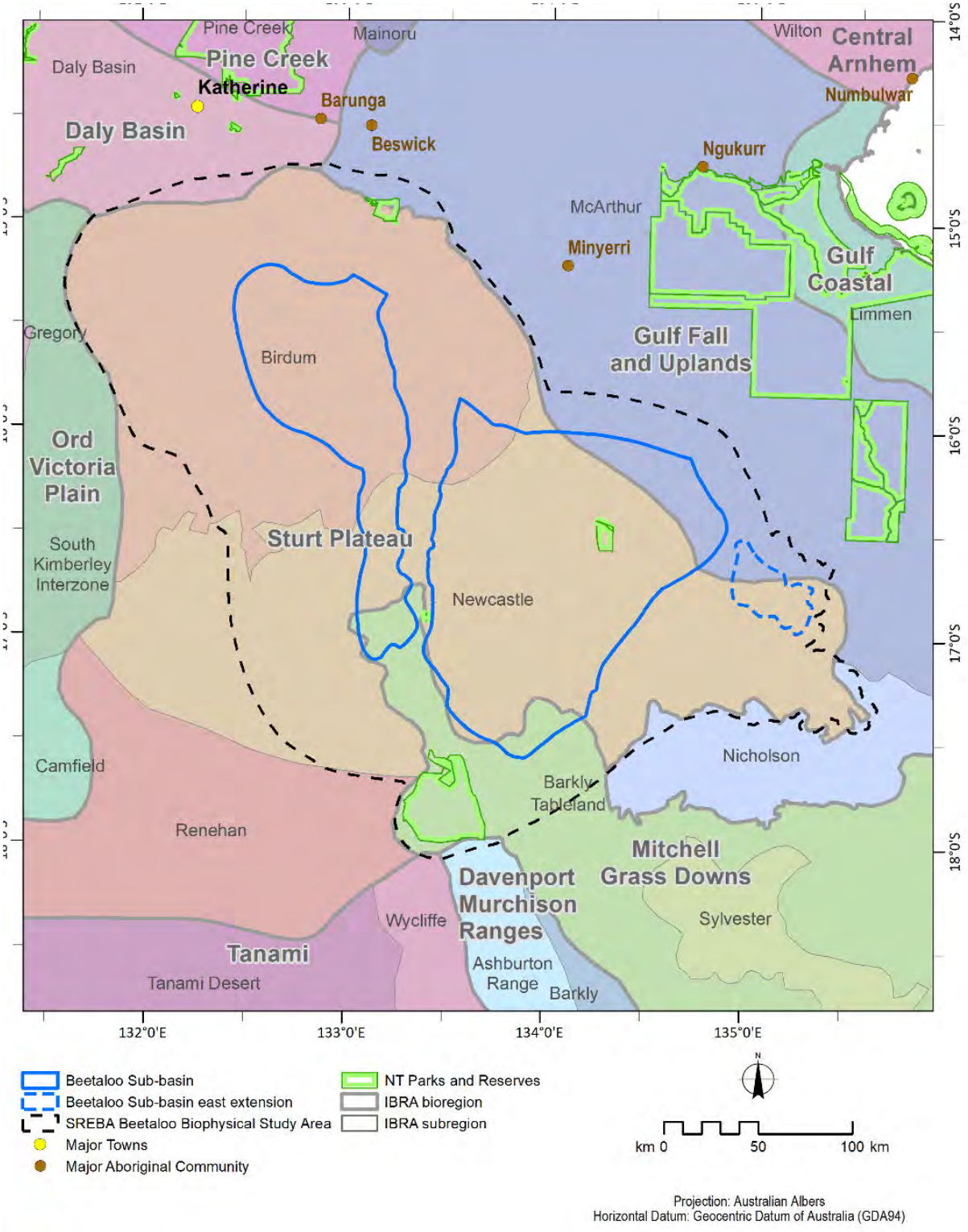


Figure 4.2—1 Beetaloo Sub-basin Bioregions [DEPWS, 2022C]

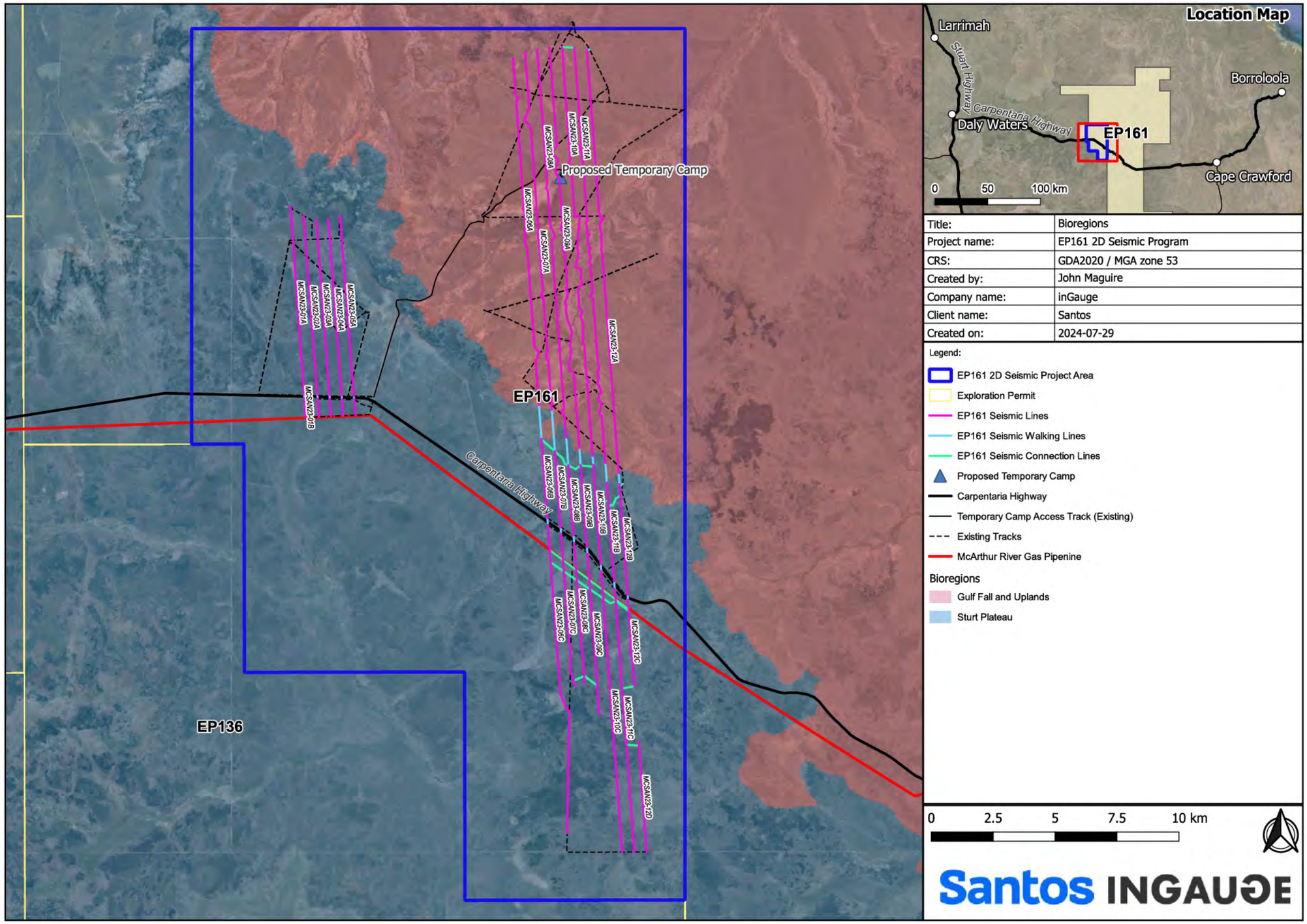


Figure 4.2—2 Bioregions Within the Project Area

4.2.2 Vegetation

As described above, desktop assessment and targeted ecological surveys were undertaken in July 2023 with a specific focus on the Interest Holder's proposed seismic lines **(Appendix 01**) [Fox and Co. Environmental 2023] (Fox Report). **Sections 4.2.5.1** to **4.2.5.5** include summaries from the Fox Report.

The scope of the study was to provide:

- Habitat and vegetation community descriptions.
- Locations and photos of communities and species present.
- Locations of fauna breeding places and other habitat features.
- Watercourse assessments.
- Baseline weed assessment.
- Likelihood of targeted, threatened species to occur within or adjacent to the Activity.

The vegetation includes bullwaddy/lancewood thickets, tussock grasslands, open eucalypt/acacia woodlands, and rocky scarps/plateaus. **Table 4.2—1** provides a summary description and typical photos of vegetation communities within the Project Area can be found in (**Appendix 01**) [Fox and Co. Environmental 2023].

Vegetation mapping to show the vegetation communities for the Project Area has been undertaken as shown in **Figure 4.2—3**, **Figure 4.2—4**, and **Figure 4.2—5**, using the SREBA vegetation dataset [YOUNG L ET AL; DEPWS, 2023].

Utilising the SREBA vegetation dataset, the vegetation groups within the 50 m seismic working corridor were extracted, and this is presented in **Table 4.2—2**. The total of each vegetation group is present in **Table 4.2—3**. These vegetation groups clearly represent that the working corridors incorporate primarily low-density vegetation.

In total, low-density open vegetation (74.6%), riparian vegetation (6.2%) and already disturbed areas (4.4%) make up approximately 85% of the vegetation found within the working corridors (refer to **Table 4.2—3**). Therefore, the Activity can be conducted with limited mulching/slashing.

Mulching will primarily be carried out in areas of high-density vegetation. In contrast, areas such as the seismic lines MCSAN23-06A to MCSAN23-12A, which traverse through Tanumbirini Creek, consist mostly of low-density vegetation (96%) and already disturbed areas (4%), will not be mulched. In these areas, vehicles can navigate the working corridor without the need for tree removal, as such preparation will be limited to only slashing in this area (**Figure 4.2—4**).

Two significant flora species have previously been recorded within the Fox & Co study area. Both species, *Acrachne racemosa* and Sida sp. *Excedentifolia*, are listed as DD (Data Deficient) under the *TPWC Act*.

No threatened flora species were observed by Fox during the July 2023 on-ground surveys.

Table 4.2—1 Vegetation Descriptions (excerpt from Appendix 01)

Vegetation Description	Typical Photo Description
Bullwaddy (*Macropteranthes kekwickii*) / Lancewood (*Acacia shirleyi)* forests. Bullwaddy and lancewood form dense thickets with little to no shrub layer and minimal grass-cover, whilst other areas contain open bullwaddy and lancewood with a grassy groundcover.	
Eucalypt and Corymbia woodland with acacia shrub layer. Dominant canopy species include variable-barked bloodwood (*Corymbia dichromophloia*) and snappy gum (*Eucalyptus leucophloia*). Often with dense shrub layer of turpentine (*Acacia lysiphloia*).	
Eucalypt woodland with native tussock grassland groundcover. Dominant canopy species include silver box (*Eucalyptus pruinosa*), snappy gum (*Eucalyptus leucophloia*) and coolabah (*Eucalyptus microtheca*). Some areas contain monoculture stands of silver box.	
Melaleuca and eucalypt floodplains. Canopy is low and open and often consists of coolabah (*Eucalyptus microtheca*) with broad-leaved paperbark (*Melaleuca viridiflora*) secondary layer/shrub layer.	
Low rocky hills with snappy gum (*Eucalyptus leucophloia*) and spinifex. Rocky ridges/scarps with snappy gum.	

Vegetation Description	Typical Photo Description
Riparian vegetation along ephemeral waterways. Larger waterways often contain sparsely scattered river red gum (*Eucalyptus camaldulensis*) along the banks.	
Tussock grassland	

Table 4.2—2 Vegetation within Working Corridors

Open Vegetation (High traversability without mulching)	Area of Vegetation Within Working Corridor (ha)	Percentage of Seismic Lines
Silver box low open woodland	313.05	26
Corymbia/Eucalyptus woodland (run-on areas and heavier soils)	101.57	8.5
Eucalyptus chlorophylla low open woodland	91.02	7.6
Tussock grassland	83.73	7.0
Corymbia/Eucalyptus open woodland on sandy loam	77.33	6.4
Melaleuca low open woodland on floodplains and drainage depressions	70.45	5.9
Snappy gum low open woodland	65.68	5.5
Corymbia/Eucalyptus woodland on sandstone	56.41	4.7
Bauhinia and Corymbia open woodland on sandy clay	18.10	1.5
Coolabah low open woodland on clay	8.31	0.7

Open Vegetation (High traversability without mulching)	Area of Vegetation Within Working Corridor (ha)	Percentage of Seismic Lines
Corymbia bella woodland on alluvial plains	4.93	0.4
Acacia shrubland and hummock grassland on sandplains	3.20	0.3
Melaleuca forests (springs, river channels)	0.81	0.1
Riparian Vegetation (High traversability without mulching)	**Area of Vegetation Within Working Corridor** (ha)	**Percentage of Seismic Lines**
Riparian woodland (ephemeral streams)	74.26	6.2
High-density Vegetation (Low traversability without mulching)	**Area of Vegetation Within Working Corridor** (ha)	**Percentage of Seismic Lines**
Lancewood forest	101.06	8.4
Bullwaddy shrubland and woodland	76.28	6.4
Already Disturbed (No line preparation required)	**Area of Vegetation within Working Corridor** (ha)	**Percentage of Seismic Lines**
Track	48.52	4.05
Production from Dryland Agriculture and Plantations (Airstrip)	3.35	0.28
Intensive Uses (vegetation near pipeline)	1.26	0.10

Table 4.2—3 Total Vegetation by Group

Vegetation Groups	Percentage of Vegetation within Working Corridors	Traversability without Mulching
Low-density Open Woodland	74.6%	High
High-density Woodland	14.8%	Low
Riparian Vegetation	6.2%	High
Already Disturbed	4.4%	High

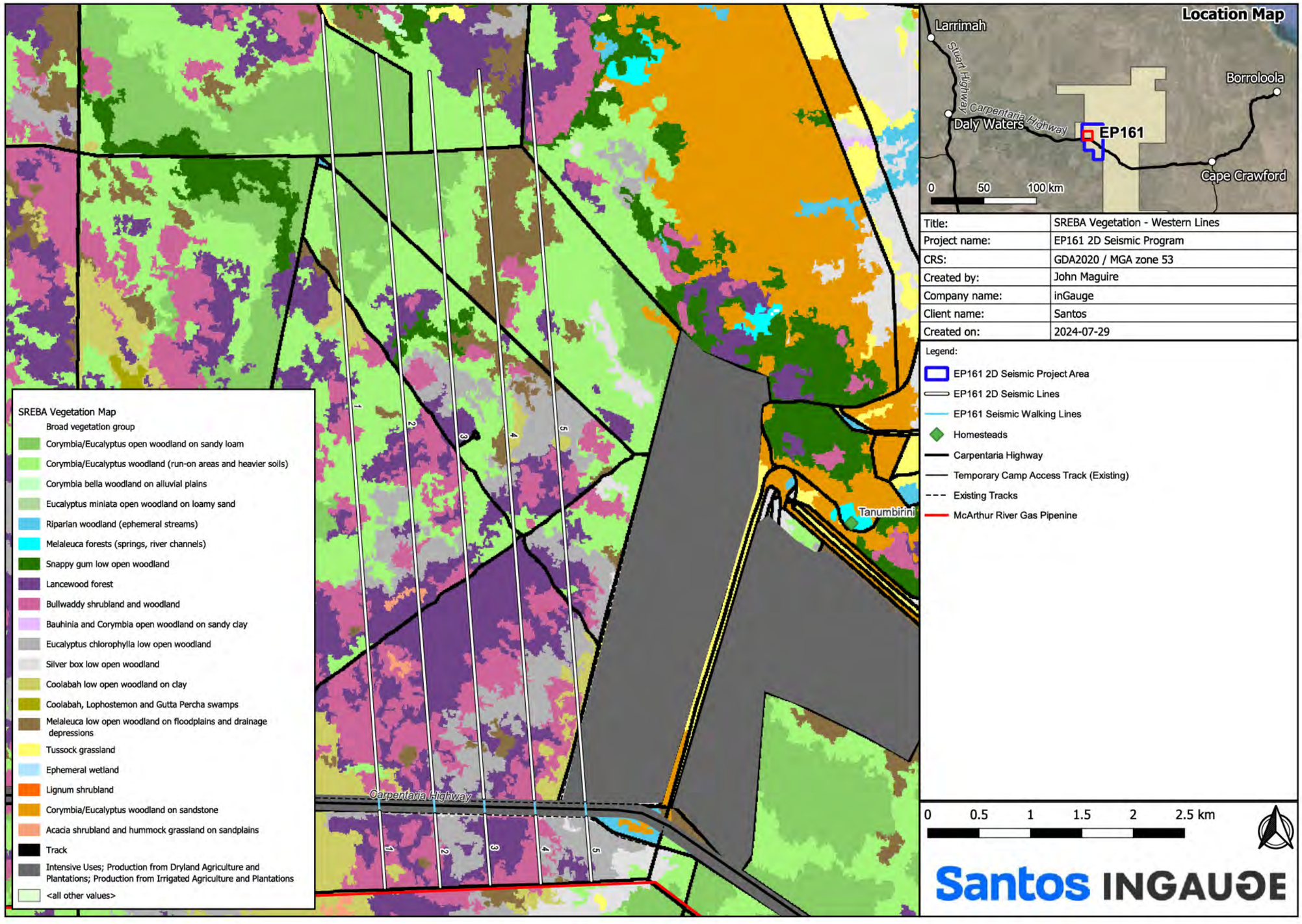


Figure 4.2—3 Vegetation Communities Lines 1 - 5

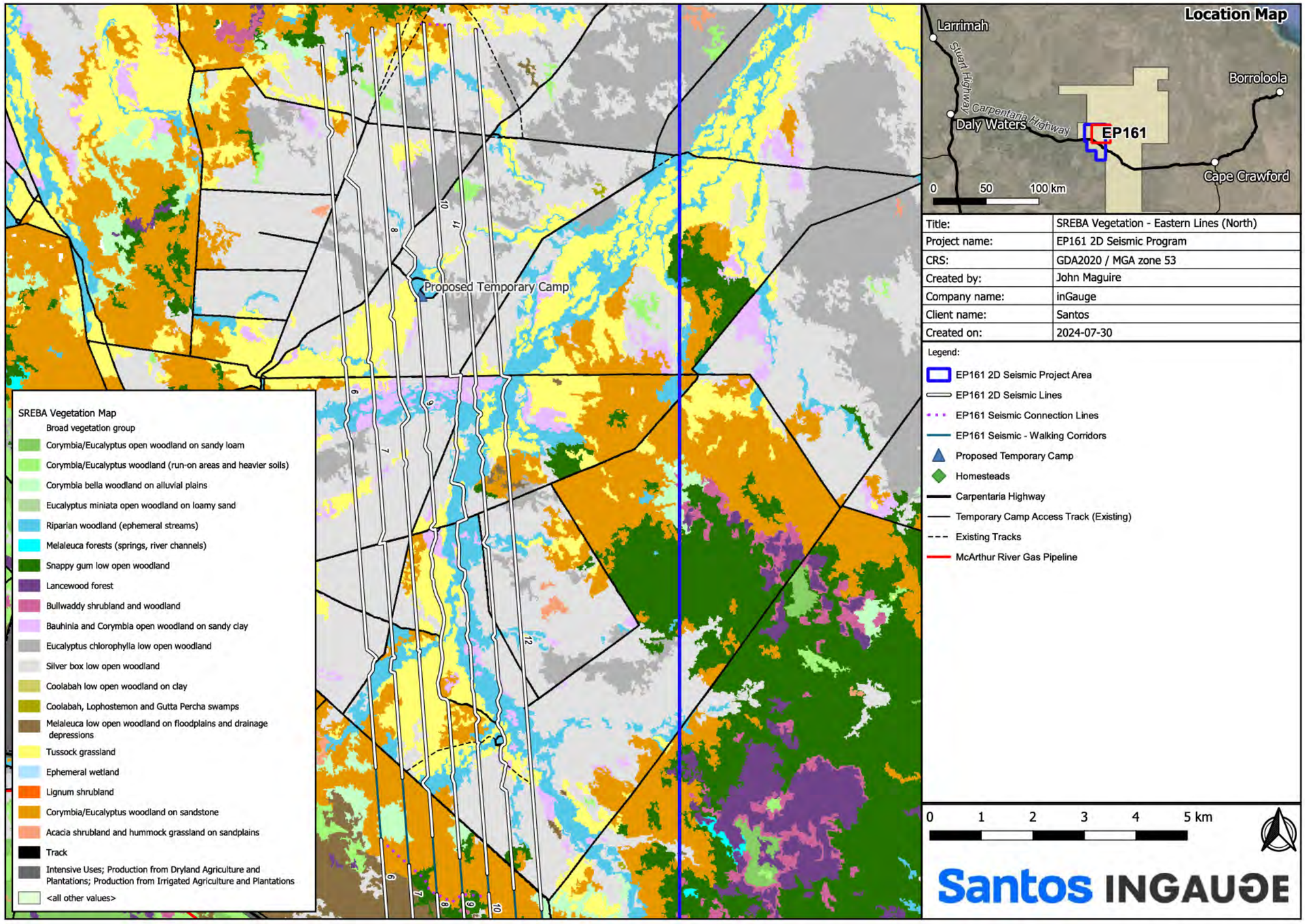


Figure 4.2—4 Vegetation Communities Lines 6 - 12 (North View)

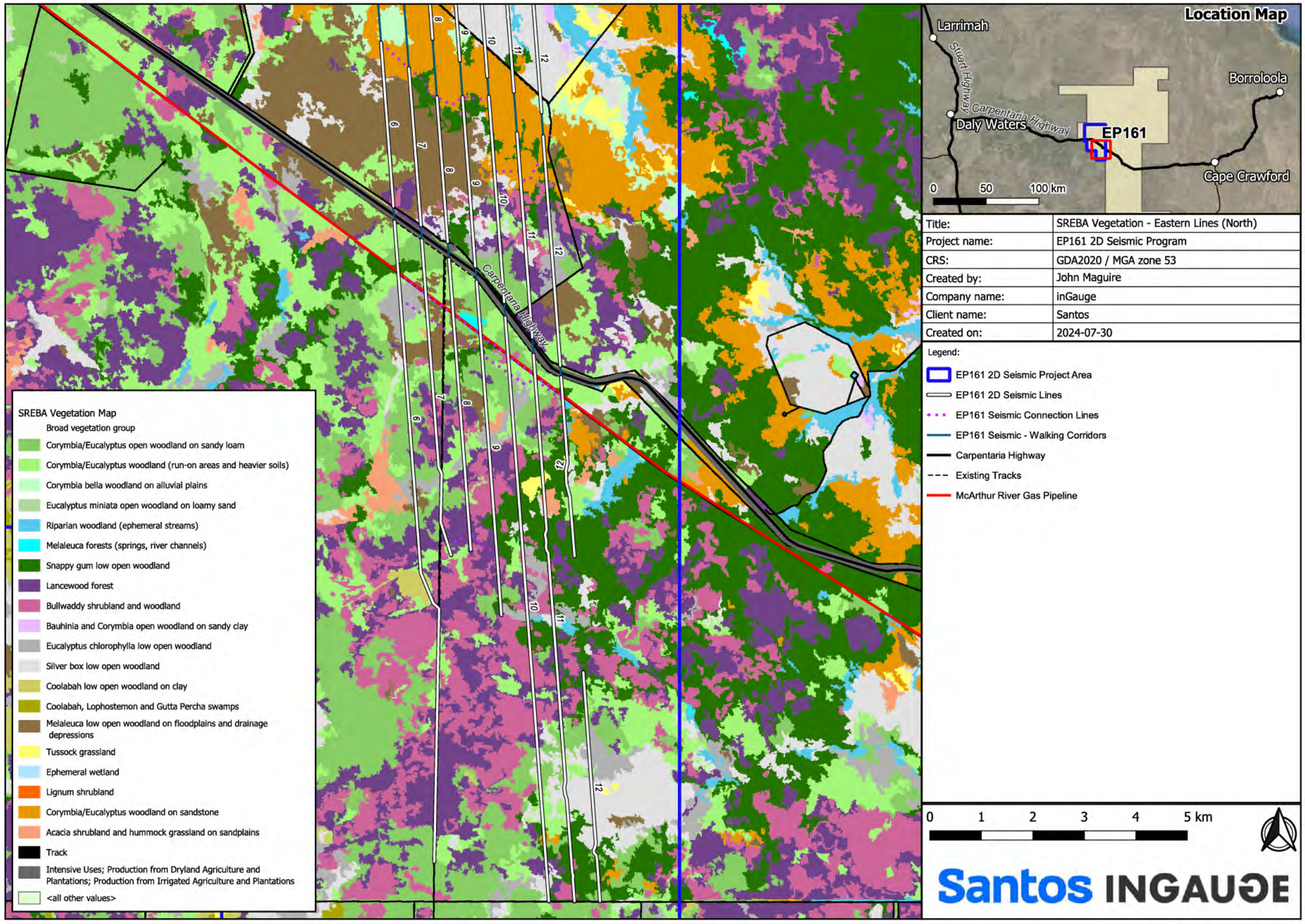


Figure 4.2—5 Vegetation Communities Lines 6 - 12 (South view)

4.2.3 Seismic Line Creeks – Elevation Range, Morphology, and Vegetation

In the Project Area, north of the Carpentaria Highway, there is a topographic high that has been formed from outcroppings of relict Cretaceous sandstones and quartzites and mapped as the Lancewood 2 land system (see **Figure 4.1—4**). The Lancewood 2 land system forms a catchment divide that separates the Gulf Falls and Upland bioregion from the Sturt Plateau bioregion to the south. The elevated topographic uniformity of the Sturt Plateau bioregion on EP 161, contrasts with topographic diversity of the Gulf Falls & Upland bioregion to the north and northeast, which includes steep hills, water holes and dissected drainage lines of the upper Limmen River catchment system. Riparian vegetation in the Project Area predominantly occurs along freshwater waterways (ephemeral or permanent) north of the Lancewood 2 land system in the Limmen River upper catchment. In contrast, the Project Area south of the Lancewood 2 land system is situated in the highlands of the Newcastle Creek and October Creek catchment on the Sturt Plateau (see **Figure 4.1—4**).

In total the seismic lines intersect creeks approximately 100 times which will require crossing **Table 4.2—4**. These creeks have been identified during field surveys and a representative sample is discussed in the below subsections (**4.2.3.1** and **4.2.3.2**). Some creeks have existing crossings which can be used for the Activity, the make-up of creeks is presented in the below table and their locations are discussed in **Section 4.2.4**.

Table 4.2—4 Approximate Number and Type of Creek Crossings

Summary (Approximate)	New	Existing
Number of Crossings	71	29
Total	100	

4.2.3.1 October Creek Catchment Crossings (Southern Lines)

The southern section of the seismic Survey Area has four of the seismic lines, 12B, 11B, 10B and 9B, which intercept stream order 1 (SO1) drainage lines, in the headwaters of the October Creek catchment. However, no drainage lines were detected on 10B and 9B during field surveys, despite streams being indicated in a stream order mapping spatial layer. This anomaly is not unexpected for low order stream order (SO1) as the mapping layer is not based on ground truthing (refer **Section 4.1.7**).

Georeferenced imagery from seismic line 12B and 11B intercepts for the three mapped SO1, labelled **OC-SO1-south**, **OC-SO1-central** and **OC-SO1-north** are shown in **Figure 4.2—6**. The terminus of seismic line 12B in this segment of the survey area is shown at the **OC-SO1-north** in Photo ID # 247. In terminating at this location, it will avoid significant riparian vegetation and surface water, identified during field surveys. The **OC-SO1-north** drainage network in this elevated portion of the October Creek catchment commences in the Inacumba land system geomorphically described as plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils consisting of Leptic Rudosols and shallow Ferric Brown Kandosols.

In contrast the **OC-SO1-south**, **OC-SO1-central** drainage network in this elevated portion of the October Creek catchment commences in the Creswell land system plains and rises and is associated with deeply weathered laterite, including sand sheets and other depositional products; sandy and earth soils erosionally stable, gently undulating plains and rises consisting of Leptic Rudosols, Leptic Tenosols, Red and Yellow Kandosols. Photographs were taken at each respective creek crossing (or nearby) for the southern seismic lines, the locations of these photo points are shown in **Figure 4.2—7**.

OC-SO1-South Drainage Line			
SL12B – Photo ID # 237	SL12B – Photo ID # 255	SL11B - Photo ID # 256	SL11A – Photo ID # 255(1)
			

OC-SO1-Central Drainage Line		OC-SO1-North Drainage Line	
SL11B - Photo ID # 258	SL11B - Photo ID # 254	SL12B – Photo ID # 246	SL12B – Photo ID # 246(1)
			

SL12B – Photo ID # 247(1) - Terminus in this Location	SL12B – Photo ID # 247 - Terminus in this Location
	

Figure 4.2—6 Imagery from October Creek Drainage Lines Intersected by Seismic Lines

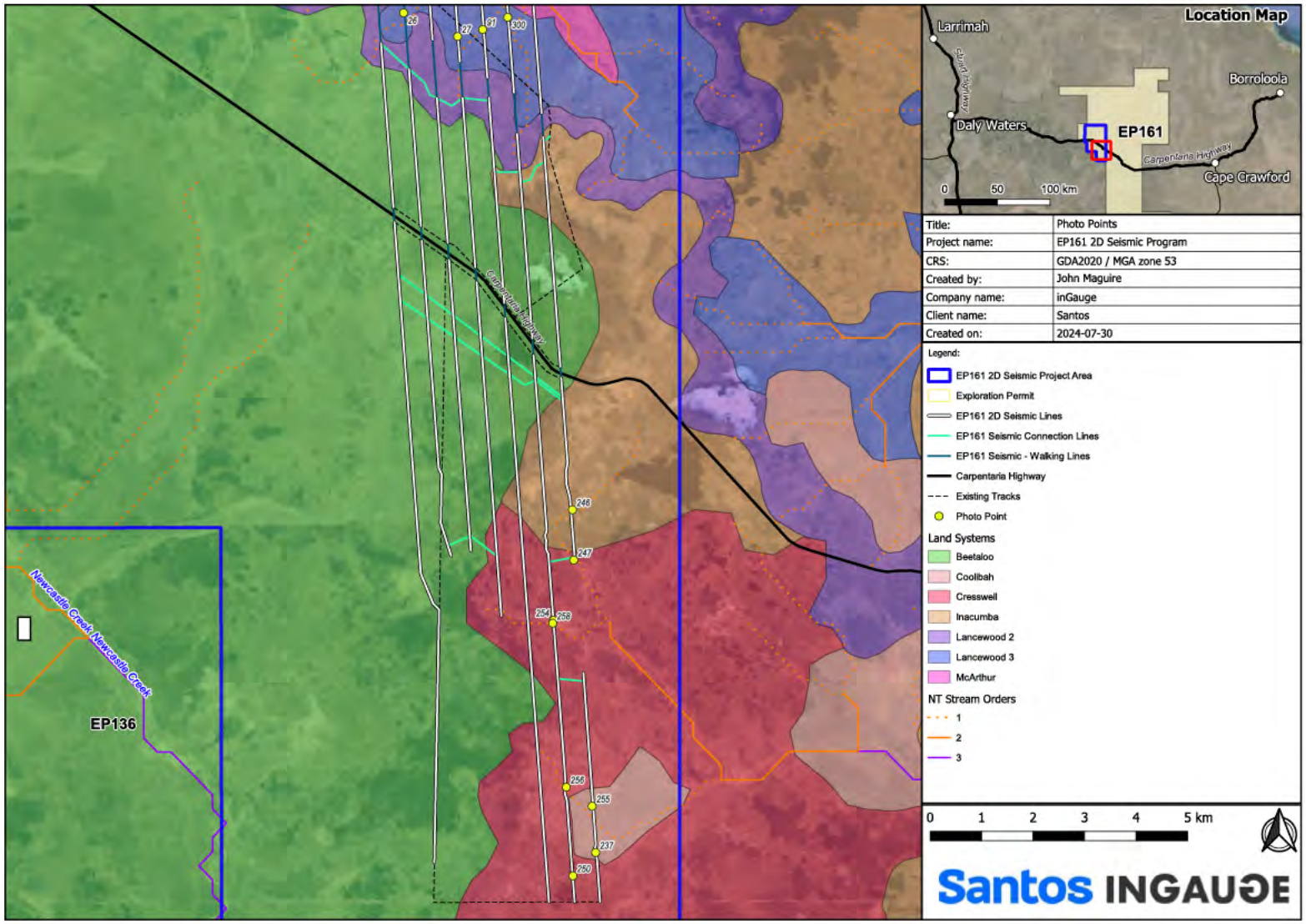


Figure 4.2—7 Photo Points and Stream Orders on the Southern Seismic Lines

4.2.3.2 Tanumbirini Creek Catchment Crossings (Northern Lines)

Three creek catchments occur with this northern portion of the seismic Survey Area. They are Tanumbirini Creek, Snake Creek and Big Bullock Creek. The latter two are sub-catchments of Tanumbirini Creek. The elevation range, stream orders and land systems associated with the seismic line corridors in this northern section of the Project Area are provided in **Table 4.2—5**. Each of the creek systems originate from a topographic high in the Lancewood 2 land system and converge into the Tanumbirini Creek to the northwest of the Project Area.

Field surveys to ground truth creek crossings intersected by the proposed seismic lines have taken place. All creek crossing that are mapped to intersect with the seismic lines were crossed and assessed during field surveys. Additionally, photographs were taken at each creek crossing intersected by the working corridors to inform the existing environment assessment. A subset of these images has been selected to provide indicative description of the vegetation and morphology in the vicinity of the creek crossings in this section of the Project Area. The selected images have been grouped on the three creek sub-catchment systems and stratified according to elevation and stream order to provide a suitable representative. The details of each of the georeferenced images including Photo ID, elevation, stream order, land system and vegetation description is provided in **Table 4.2—6**. A map of the representative Photo ID points relative to the seismic line corridor crossings and associated stream orders is provided in **Figure 4.2—8**.The images and associated details for Snake Creek are shown in **Figure 4.2—9**, Big Bullock Creek in **Figure 4.2—10**; and Tanumbirini Creek in **Figure 4.2—11**.

The creek systems in this northern region of the seismic Survey Area are primarily associated with the Lancewood 2 land system at higher elevations, which consists of plateaux, scarps and some rises on deeply weathered sediments; shallow soils with rock outcrop and Leptic Rudosol soils. At lower elevations in the catchment area, the Tanumbirini land system is intersected, consisting of plains and rises associated with deeply weathered laterite including sand sheets and other depositional products; sandy and earth soils and consist of Ferric Brown Kandosols and Brown Dermosols. The McArthur land system forms the main Tanumbirini Creek drainage network. This land system consists of alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium that encompass broad or narrow fluvial corridors conducting regional drainage across various land systems towards the coast Soils in the McArthur land system consist of Aquic Vertosols, Red and Yellow Kandosols and Orthic Tenosols.

Table 4.2—5 Creek Catchment Elevation Ranges and Associated Stream Orders on Seismic Line Corridors

Catchment	Max. Elevation (m)	Min. Elevation (m)	Stream Orders	Land Systems
Tanumbirini Creek	251	206	DL, SO1, SO2, SO3	LW2, TAN, MAC
Big Bullock Creek	230	208	SO1, SO2	LW2, TAN
Snake Creek	221	209	SO2	MAC

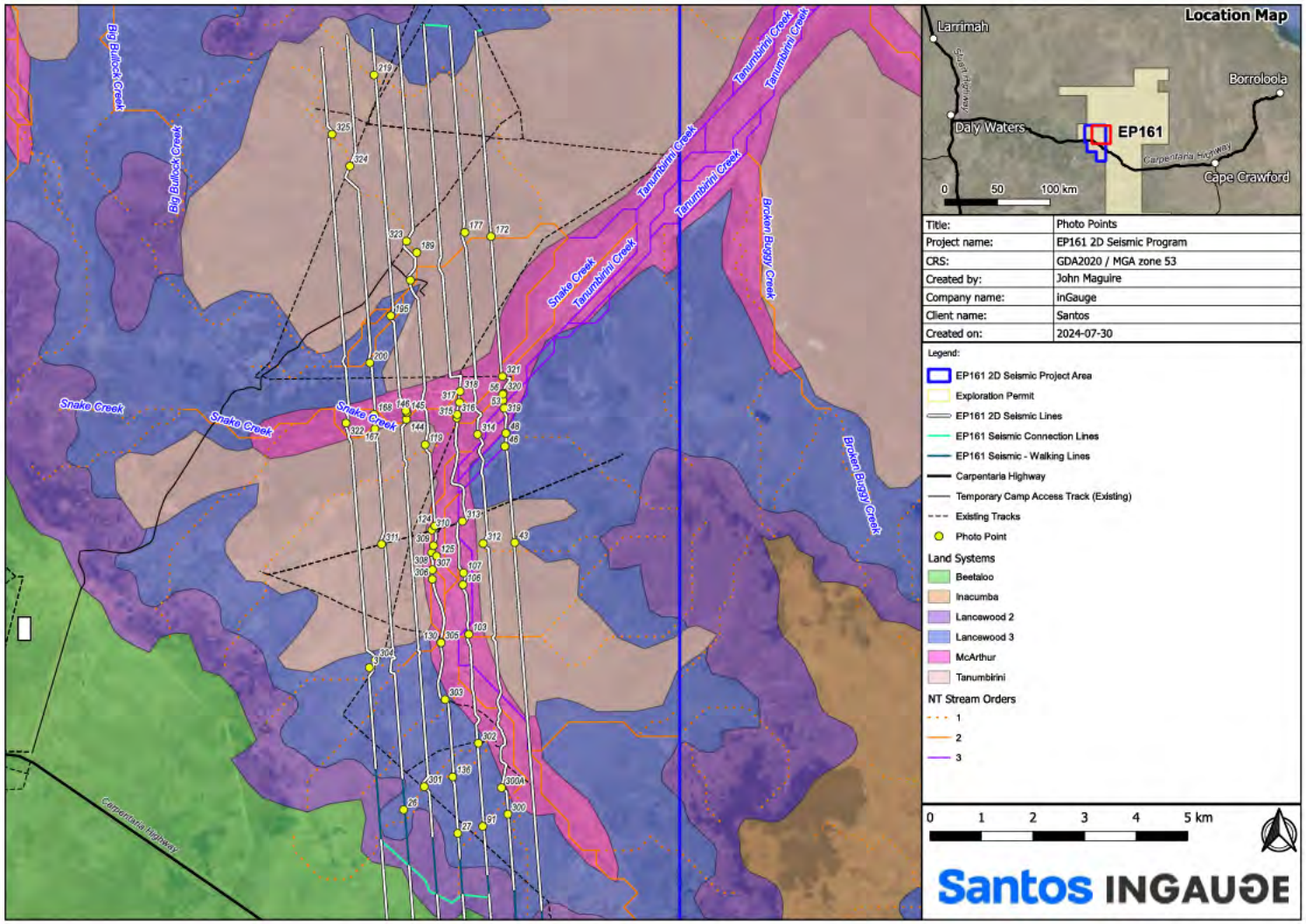


Figure 4.2—8 Photo Points and Stream Orders on the Northern Seismic Lines

Table 4.2—6 Description of Selected Imagery on SSL in the Three Creek Catchments

Catchment	Photo ID	Elevation	Stream Order	Land System	Northing	Easting	Vegetation
Snake Creek	**167**	220	SO2	McArthur	8184058	467553	Sparse riparian vegetation, grassy banks.
	168	218	SO2	McArthur	8184338	467538	Sparse riparian vegetation, grassy banks, gravel bed.
	146	210	SO2	McArthur	8184411	468155	Part of braided SO2 system (see photo 144).
	145	209	SO2	McArthur	8184373	468173	Sparse riparian vegetation, grassy banks, gravel bed.
Big Bullock Creek	**219**	230	SO1	Tanumbirini	8190931	467537	Very narrow 1 - 2 m wide with banks approximately 0.2 - 0.3 m high.
	189	216	SO1	Tanumbirini	8187482	468366	Eroded grassy banks. Sparse riparian vegetation.
	195	213	SO2	Lancewood2	8186254	467861	Low eroded grassy banks. Very sparse juvenile river red gum riparian vegetation.
	200	211	SO2	Lancewood2	8185340	467456	Low eroded grassy banks. Very sparse juvenile river red gum riparian vegetation.
	172	209	SO2	Tanumbirini	8187794	469807	Up to 8 m wide. River red gum riparian vegetation, some with hollows.
	177	208	SO2	Tanumbirini	8187874	469300	Sparse River red gum riparian vegetation, some with hollows, with grassy banks.
Tanumbirini Creek	**27**	246	DL	Lancewood2	8176205	469161	Drainage line in landscape of *Eucalyptus. Ppruninosa.*
	26	244	DL	Lancewood2	8176664	468113	Minimal riparian Veg. Sharp eroded banks. Surrounding *E. pruninosa* on alluvial with *Sesbania*.

Catchment	Photo ID	Elevation	Stream Order	Land System	Northing	Easting	Vegetation
	91	242	SO1	Lancewood 2	8176339	469647	Very sparse riparian vegetation. Grassy banks and gravelly bed with scrub.
	3	234	SO1	Lancewood 2	8179423	4674451	Fast flow erosion zone. Minimal riparian Veg. Adjacent veg *E. pruninosa* on alluvial.
	136	232	SO1	Lancewood 2	8177301	469065	Grassy banks, narrow channel, young redgum saplings.
	43	223	SO1	Tanumbirini	8181851	470269	Silver box with beefwood surround veg. Grassy banks. Sparse Coolabah.
	46	213	SO3	Lancewood 2	8183720	470077	Red gum riparian. Sparse. Creek up to 5 m wide. Sparse mature River Red Gums present.
	48	212	SO3	Lancewood 2	8183974	470097	Part of braided SO3 waterway. A series of narrow braided channels form part of the larger system. Likely floods out in the wet season. Grassy banks. Sparse riparian vegetation.
	144	212	SO2	McArthur	8184244	468165	Sparse riparian vegetation. Grassy small banks.
	119	210	SO1	Tanumbirini	8183752	468532	Narrow. Banks up to 0.3 - 0.5 m high. Erosion and *Hyptis* weed present.
	53	208	SO3	McArthur	8184460	470063	Part of braided SO3 waterway. A series of narrow braided channels form part of the larger system. Likely floods out in the wet season. Grassy banks. Sparse riparian vegetation.
	56	207	SO3	McArthur	8184731	470036	Main SO3 channel. 5 – 8 m wide. Sparse riparian vegetation. Grassy banks.

Catchment	Photo ID	Elevation	Stream Order	Land System	Northing	Easting	Vegetation
	130	219	SO2	McArthur	8179906	468837.8	Existing crossing. River Red Gum riparian vegetation width ~2 m. Creek up to 5 m wide from top of banks.
	103	219	SO2	McArthur	8180070	469376	SO2 watercourse at confluence of Tanumbirini Creek. Gravelly bed/substrate. Sparse riparian vegetation River Red Gum, some with hollows. Grassy banks ~ 0.3 - 0.5 m high
	106	220	SO3	McArthur	8179906	468837	Part of main braided Tanumbirini SO2/SO3 system. Tanumbirini Creek with pool of standing water during dry season conditions. Low banks sparse riparian vegetation.
	107	221	SO3	McArthur	8181263	469274	SO2 / SO3 watercourse which forms part of Tanumbirini Creek braided system. Clayey gravel substrate/bed. Grassy banks up to 1m high with low sparse riparian vegetation.
	125	218	SO2	Tanumbirini	8181589	468752	Drainage channel. Water present. Grass banks. Rare sapling River Red Gum in creek bed.
	124	217	SO2	Tanumbirini	8182175	468719	Drainage line feeding into larger braided SO2 system. Grass banks.

# 167 Snake Creek: SO2 – 220 m AHD	# 168 Snake Creek: SO2 – 218 m AHD	# 146 Snake Creek: SO2 – 210 m AHD	# 145 Snake Creek: SO2 – 209 m AHD
			

Figure 4.2—9 Snake Creek Seismic Line Corridors Area

# 219 Big Bullock Creek: SO1 – 230 m AHD	# 189 Big Bullock Creek: SO1 – 216 m AHD	# 195 Big Bullock Creek: SO2 – 213 m AHD
		

# 200 Big Bullock Creek: SO2 – 211 m AHD	# 172 Big Bullock Creek: SO2 – 209 m AHD	# 177 Big Bullock Creek: SO2 – 208 m AHD
		

Figure 4.2—10 Big Bullock Creek Seismic Line Corridors Area

# 27 Tanumbirini Creek: DL – 246 m AHD	# 26 Tanumbirini Creek: DL – 244 m AHD	# 91 Tanumbirini Creek: SO1 – 242 m AHD
		

# 3 Tanumbirini Creek: SO1 – 234 m AHD	# 136 Tanumbirini Creek: SO1 – 232 m AHD	# 43 Tanumbirini Creek: SO1 – 223 m AHD
		

# 46 Tanumbirini Creek: SO3 – 213 m AHD	# 48 Tanumbirini Creek: SO3 – 212 m AHD	# 144 Tanumbirini Creek: SO2 – 212 m AHD
		

#119 Tanumbirini Creek: SO1 – 210 m AHD	# 53 Tanumbirini Creek: SO3 –208 m AHD	# 56 Tanumbirini Creek: SO3 – 208 m AHD
		

# 130 Tanumbirini Creek: SO2 – 219 m AHD	# 103 Tanumbirini Creek: SO2 – 219 m AHD	# 106 Tanumbirini Creek: SO3 – 220 m AHD
		

# 107 Tanumbirini Creek: SO3 – 221 m AHD	# 125 Tanumbirini Creek: SO2 – 218 m AHD	# 124 Tanumbirini Creek: SO2 – 217 m AHD
		

Figure 4.2—11 Tanumbirini Creek Seismic Line Corridors Area

4.2.4 Seismic Line Creek Crossings

As discussed in **Section 4.2.3** georeferenced imagery was taken of creeks that would need to be crossed in the proposed seismic survey area. This identified the potential use of existing creek crossing tracks used by the pastoralist and cattle that will be used for traversing the creek systems on these seismic lines to further mitigate potential impact to the creeks. As seen in imagery of the creeks (refer **Figure 4.2—6**, **Figure 4.2—9**, **Figure 4.2—10**, **Figure 4.2—11**, and **Figure 4.2—14**), the creek systems have been heavily affected by cattle and in recent imagery, flooding. In early 2024, Tanumbirini Station (BOM 14628) recorded its highest 90-day rainfall of more than 1,200 mm since records commenced more than 50 years ago. This caused regional and local flooding and impacted creek lines, as evident in the imagery of existing station creek crossings, primarily in the drainage network in the McArthur land system. Previous 1 in 100 AEP flood extent modelling conducted for the Tanumbirini 2- H Civil and Seismic EMP -2019 area, predicted the flood extent exceeding the 218 m AHD contour in the McArthur Creek/Snake catchment at this location.

Survey lines has been made to utilise existing waterway crossings identified during ground-truthing for the purposes of the seismic survey. The identified new and existing waterway crossings in the northern area of the seismic lines are shown in **Figure 4.2—12** and the southern seismic line crossings are shown in **Figure 4.2—13**.

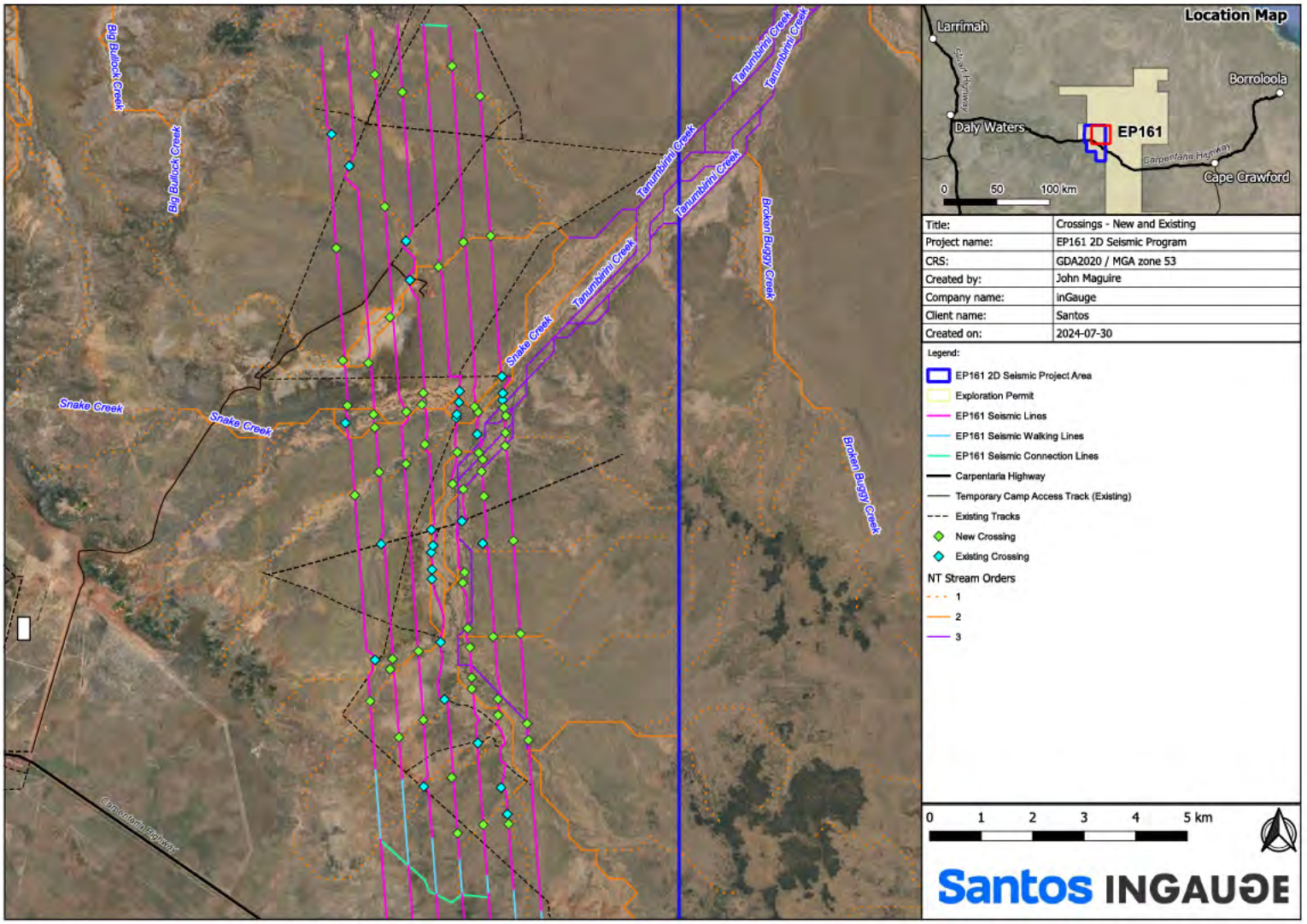


Figure 4.2—12 New and Existing Creek Crossings on the Northern Seismic Lines

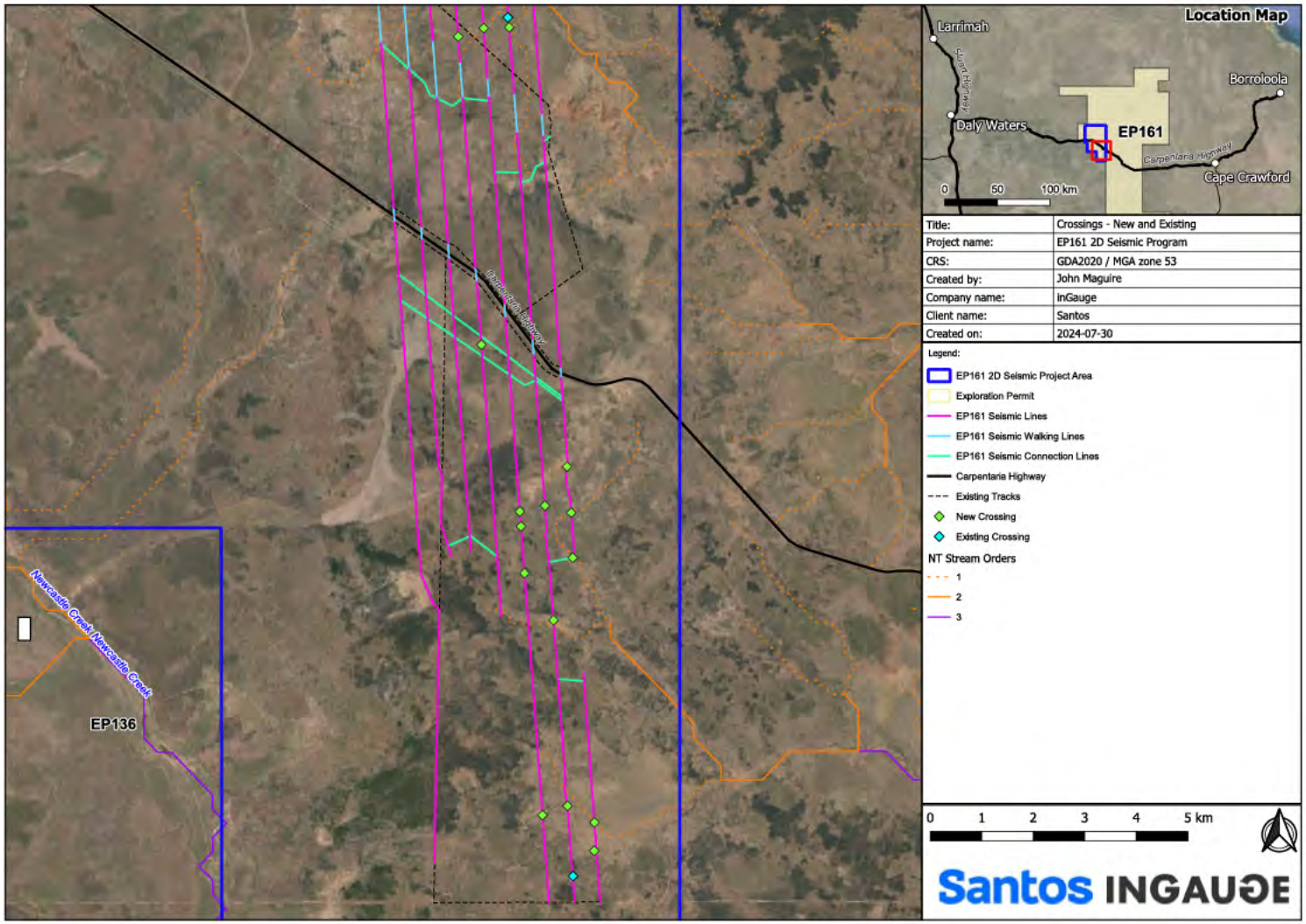


Figure 4.2—13 New and Existing Creek Crossings on the Southern Seismic Lines

SL12A - SS6A Creek Crossing Status

SL-12A # 319 Tanumbirini Creek: Crossing 215 m AHD	SL-12A # 320 Tanumbirini Creek: Downstream 214 m AHD	SL-12A # 321 Tanumbirini Creek: Crossing 214 m AHD
		
SL-12A # 321 **Tanumbirini Creek: Downstream 214 m AHD**	**SL-11A # 300** **Tanumbirini Creek: Crossing 240 m AHD**	**SL-11A # 300A** **Tanumbirini Creek: Crossing 234 m AHD**
		
SL-11A # 312 **Tanumbirini Creek: Crossing 221 m AHD**	**SL-11A # 314** **Tanumbirini Creek: Crossing 215 m AHD**	**SL-10A # 302** **Tanumbirini Creek: Crossing 230 m AHD**
		

SL12A - SS6A Creek Crossing Status

SL-10A # 302

Tanumbirini Creek: Downstream 230 m AHD



SL-10A # 313

Tanumbirini Creek: Crossing 219 m AHD



SL-10A # 315

Tanumbirini Creek: Crossing 214 m AHD



SL-10A # 315

Tanumbirini Creek: Crossing 214 m AHD



SL-10A # 316

Snake Creek: Crossing 216 m AHD



SL-10A # 316

Snake Creek: Crossing 216 m AHD



SL-10A # 317

Snake Creek: Crossing 215 m AHD



SL-10A # 317

Snake Creek: Crossing 215 m AHD



SL-10A # 318

Snake Creek: Crossing 215 m AHD



SL12A - SS6A Creek Crossing Status

SL-10A # 318 Snake Creek: Crossing 215 m AHD	SL-09A # 303 Tanumbirini Creek: Crossing 226 m AHD	SL-09A # 303 Tanumbirini Creek: Crossing 226 m AHD
		
SL-09A # 305 **Tanumbirini Creek: Crossing 226 m AHD**	**SL-09A # 305** **Tanumbirini Creek: Crossing 226 m AHD**	**SL-09A # 306** **Tanumbirini Creek: Crossing 220 m AHD**
		
SL-09A # 306 **Tanumbirini Creek: Crossing 220 m AHD**	**SL-09A # 307** **Tanumbirini Creek: Crossing 219 m AHD**	**SL-09A # 307** **Tanumbirini Creek: Crossing 219 m AHD**
		

SL12A - SS6A Creek Crossing Status

SL-09A # 308

Tanumbirini Creek: Crossing 219 m AHD



SL-09A # 308

Tanumbirini Creek: Crossing 219 m AHD



SL-09A # 309

Tanumbirini Creek: Crossing 219 m AHD



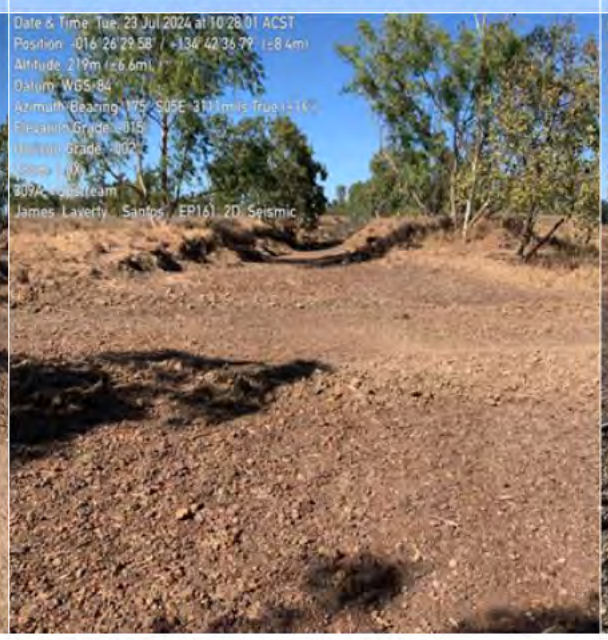
SL-09A # 309

Tanumbirini Creek: Crossing 219 m AHD



SL-09A # 310

Tanumbirini Creek: Crossing 215 m AHD



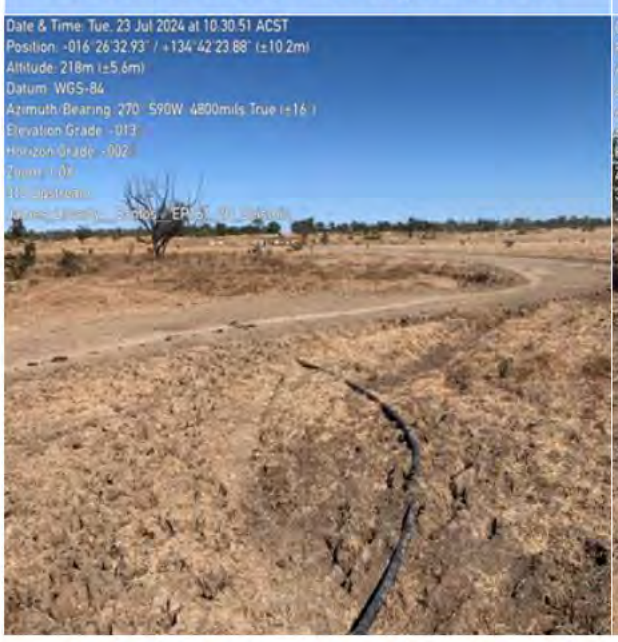
SL-09A # 310

Tanumbirini Creek: Crossing 215 m AHD



SL-09A # 310

Tanumbirini Creek: Crossing 215 m AHD



SL-09A # 323

Bullock Creek: Crossing 217 m AHD



SL-09A # 323

Bullock Creek: Crossing 217 m AHD



SL12A - SS6A Creek Crossing Status

SL-08A # 301

Tanumbirini Creek: Crossing 240 m AHD



SL-08A # 301

Tanumbirini Creek: Crossing 240 m AHD



SL-07A # 304

Tanumbirini Creek: Crossing 231 m AHD



SL-07A # 304

Tanumbirini Creek: Crossing 231 m AHD



SL-07A # 311

Tanumbirini Creek: Crossing 223 m AHD



SL-07A # 311

Tanumbirini Creek: Crossing 223 m AHD



SL-07A # 324

Tanumbirini Creek: Crossing 231 m AHD



SL-07A # 324

Tanumbirini Creek: Crossing 231 m AHD



SL-06A # 322

Snake Creek: Crossing 222 m AHD



SL12A - SS6A Creek Crossing Status		
SL-06A # 322 **Snake Creek: Crossing 222 m AHD**	**SL-06A # 325** **Bullock Creek: Crossing 228 m AHD**	**SL-06A # 325** **Bullock Creek: Crossing 228 m AHD**
		

Figure 4.2—14 SL12A - SL6A Creek Crossing Status

4.2.5 Summary of Key Findings in Appendix 01 – Ecological Assessment

4.2.5.1 Listed Species

A desktop review was undertaken to assess the likelihood of occurrence of threatened and significant fauna and flora species in the Project Area. This search encompassed the Project area with a buffer of 20 km. This area is referred to as the Search Area. The field survey further informed and verified this likelihood of occurrence assessment. The following criteria were used in the assessment to identify the likelihood of occurrence for threatened species:

- **Low potential to occur** – the species has not been recorded in the region (no records from desktop searches), and/or current known distribution does not include the Search Area, and/or suitable habitat is generally lacking from the Search Area.
- **Moderate potential to occur** – the species has been recorded in the region (desktop searches); however, suitable habitat is generally lacking from the Search Area or the species has not been recorded in the region (no records from desktop searches); however, potentially suitable habitat occurs in the Search Area.
- **High potential to occur** – the species has been recorded in the region (desktop searches), and suitable habitat is present in the Search Area.
- **Known to occur** – the species has been recorded on-site in the recent past (i.e., in the last 5-10 years), and the Search Area provides suitable habitat for it.

Full details on potentially occurring threatened and significant flora and fauna species in the Project Area is provided in **Appendix 01** (Ecological Assessment), with an account of the species likelihood of presence within the study area based on known EPBC PMST and SREBA records, species biology and ecology. The details include species *EPBC Act* Status, *TPWC Act* Status, IUCN Status, habitat preference and likelihood of occurrence.

No threatened fauna or flora species were observed within EP 161 during the July 2023 baseline survey. Two near-threatened fauna species were identified (Northern Nail-tail Wallaby and Australian Bustard). These species are highly mobile and are unlikely to be impacted by the proposed seismic Activity. Habitat exists for some conservation significant species in the area; however, given the narrow, linear nature of the disturbance, habitat requirements and the likelihood of occurrence, impacts from proposed seismic operations are considered low.

The habitats available within the Search Area are described with photographs in **Section 4.3** of **Appendix 01**. Not all the threatened and significant species indicated through desktop information are expected to occur within the study area due to the absence of suitable habitat for some species.

4.2.5.2 Desktop Assessment – SREBA

SREBA data sets were analysed, identifying records of significant and threatened flora and fauna species found during targeted SREBA surveys. No SREBA records were found within the study area; however, the SREBA surveys did identify species within the broader region.

Two significant flora species were previously recorded within the study area. Both species, *Acrachne racemosa* and *Sida sp. Excedentifolia*, are listed as Data Deficient under the *TPWC Act*. Five significant bird species, one significant mammal and one significant reptile species have previously been recorded within the study area. The bird and mammal species were the Australian Bustard, Bush-stone curlew, Pictorella Mannikin, Rainbow bee-eater, Hooded Parrot, and Spectacled Hare-wallaby, which are all listed as Near Threatened under the *TPWC Act*. No threatened fauna species have been recorded in the study area; however, there is a previous record of the Gouldian Finch 20 km from the Project Area.

One threatened reptile, the Mertens' Water Monitor (*Varanus mertensi*), has been previously recorded within the search area. This record is south of the Carpentaria Highway and not associated with a mapped watercourse or water feature. This species is rarely far from water, which casts doubt on the validity of this record. Another reptile, the Yellow-spotted Monitor (*Varanus panoptes*), has a moderate potential to occur, although there are no previous records in the Search Area.

Although not noted in **Appendix 01**, recent surveys for the SREBA identified the Northern Blue Tongue Lizard at several sites across the Beetaloo Basin, including Beetaloo Station immediately south of Tanumbirini Station. Surveys were not undertaken on Tanumbirini Station, but the vegetation communities present there appear to be suitable for the species and the Flora and Fauna Division of DEPWS expects that it is likely this species is also present within the Project Area.

Further detail is provided in **Appendix 01**. The records of threatened and significant fauna species within the Project Area and in the region are shown in **Figure 4.2—15** and **Figure 4.2—16**, respectively.

4.2.5.3 Threatened Species – EPBC and TPWC Act Listings

The listed threatened EPBC and TPWC listings are provided in **Table 7** of **Appendix 01**. The EPBC PMST identified the Search Area as having potential habitat for no nationally threatened flora species, 14 threatened terrestrial species and 14 migratory species. The *TWPC Act* listing included one additional reptile listed as vulnerable, making the total terrestrial threatened list 15.

One of the 15 terrestrial species is a specialist marine species and has therefore been excluded from the assessment (Freshwater Sawfish) as no suitable habitat exists within the Search Area. Two of the 14 migratory species are specialist marine species and have therefore been excluded from the assessment (including Saltwater crocodiles and Freshwater Sawfish [the latter listed as both terrestrial and migratory]) as no suitable habitat exists within the Search Area. Shorebirds have also been excluded from the assessment due to a lack of suitable habitat in the Search Area.

The 14 threatened terrestrial species identified as likely to occur within the Project Area include seven bird species – the Curlew Sandpiper, Red Goshawk, Gouldian Finch, Grey Falcon, Northern Shrike-tit, Australian Painted Snipe, and Masked Owl (northern); five mammal species – the Northern Quoll / Digul, Ghost Bat, Greater Bilby, Bare-rumped Sheath-tailed Bat, and Northern Brushtail

Possum; and two reptiles – the Gulf Snapping Turtle and the Yellow-spotted Monitor (the latter a TWPC Act listing).

Of the seven bird species, one had a high potential of occurrence – the Gouldian Finch – with a previous record within 20 km of the Project Area. Two others had a moderate chance of occurrence – the Grey Falcon and Crested Shrike-tit; however, there are no records within the Project Area. The Northern Quoll, Bare-rumped Sheath-tailed Bat and Yellow-spotted monitor have a moderate potential to occur; however, there are no records of these species in the Search Area.

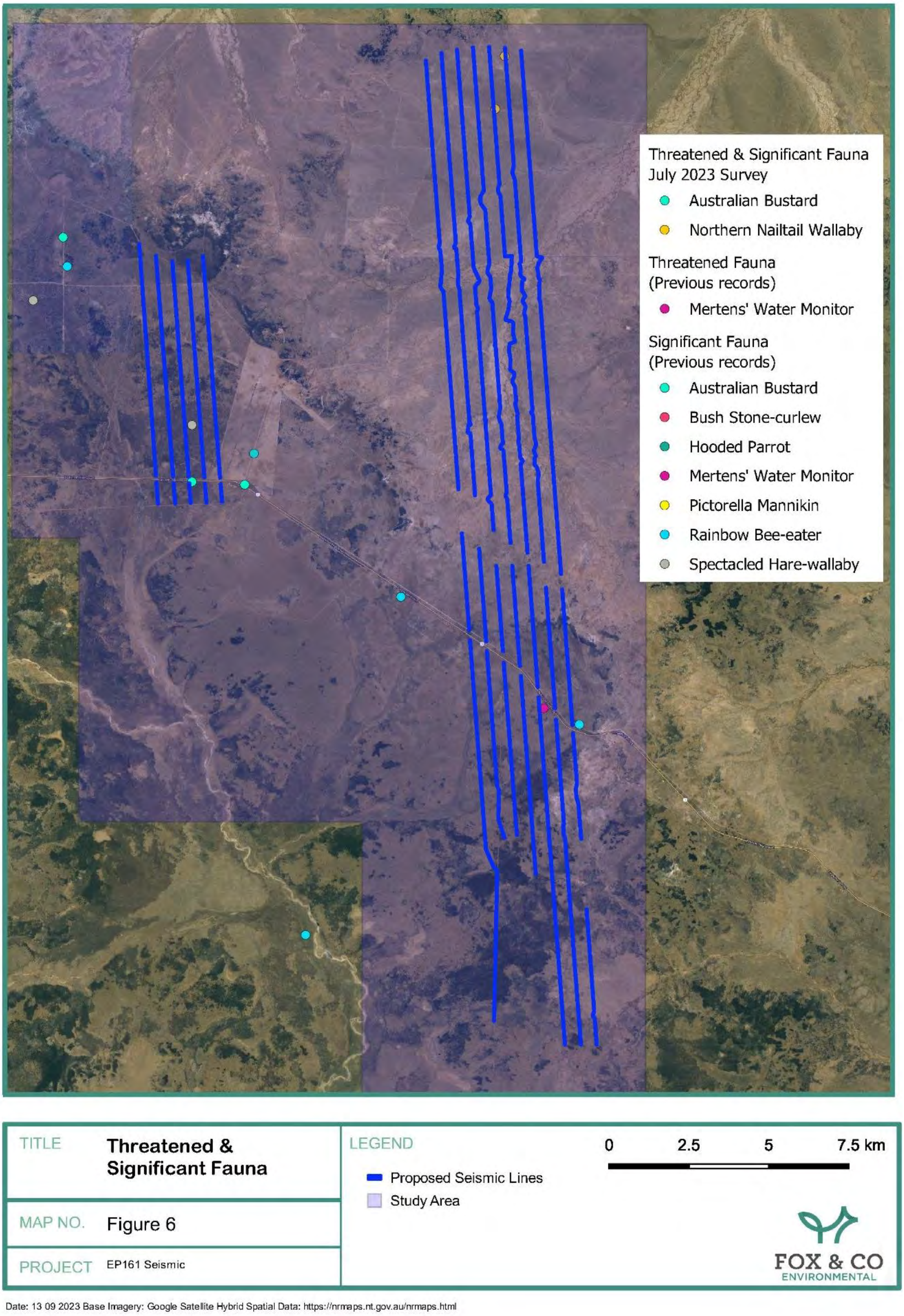


Figure 4.2—15 Threatened and Significant Fauna in the Project Area

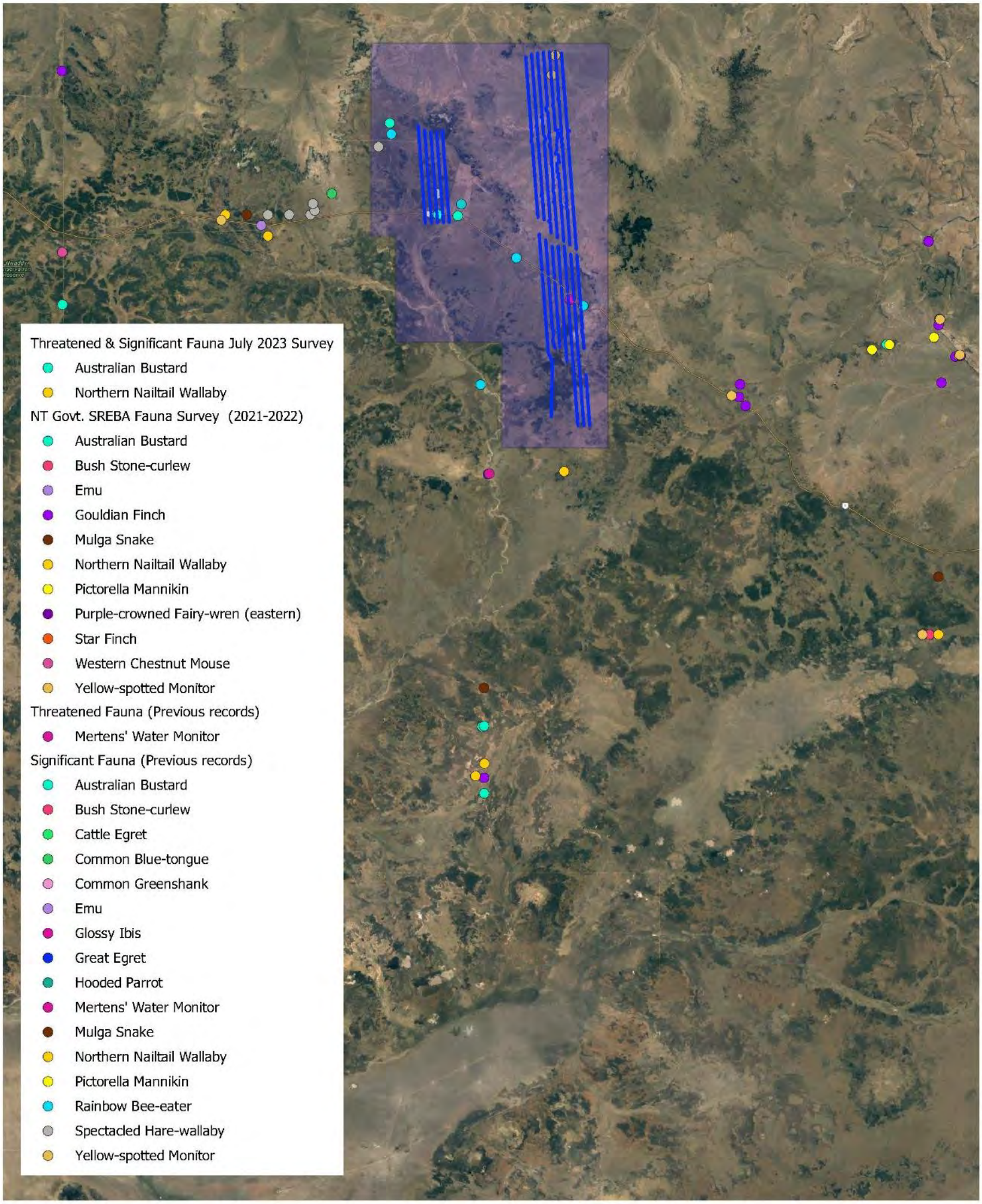


Figure 4.2—16 Threatened and Significant Fauna Regional Scale

The 12 threatened migratory species identified with likelihood of occurrence in the Search Area include one migratory marine bird species with moderate potential to occur but likely to fly over and not land – the Fork-tailed Swift; five migratory terrestrial bird species of which four have moderate potential to occur (although there are no previous records) – Red-rumped Swallow, Oriental Cuckoo/Horsfield's Cuckoo, Barn Swallow and Yellow Wagtail; and six migratory wetland bird species, all of which have low potential to occur and lack of suitable habitat and/or no previous records.

No TEC's, World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park, or Commonwealth Marine Areas occur within the Search Area.

4.2.5.4 Field Survey

As noted in **Section 4.2.2**, a targeted ecological field survey was undertaken in July 2023 with a specific focus on the Interest Holder's proposed seismic lines. No threatened fauna or flora species were observed during on-ground surveys.

Two near-threatened fauna species were identified (Northern Nail-tail Wallaby and Australian Bustard). These species are highly mobile and are unlikely to be impacted by the Activity. The observation locations in the Project Area are shown in **Figure 4.2—15**, and in the broader area in **Figure 4.2—16**. Habitat exists for some conservation significant species in the area; however, as noted above, given the narrow linear nature of the disturbance, species habitat requirements and the likelihood of occurrence, impacts from the proposed Activity are considered low.

4.2.5.5 Weeds and Animal Pest Species

The Weeds of National Significance (WoNS) list, compiled by the Commonwealth government, provides a national standard for ranking the impact of individual pest weed species. The *Weeds Management Act* 2001 (NT) is the relevant law in the NT that describes the procedures involved with weed control. Under the *Weeds Management Act* 2001 (NT), weeds can be declared as:

- **Class A** – To be eradicated.
- **Class B** – Growth and spread to be controlled.
- **Class C** – Not to be introduced into the NT (All declared weeds are automatically class C weeds).

As part of the 2023 field study, weed infestations were recorded and mapped. This informed the preparation of a project-specific Weed Management Plan (WMP) (**Appendix 03**) [FOX & CO ENVIRONMENTAL, 2023]. The two main weed species recorded were Hyptis (*Hyptis suaveolens* and Spinyhead Sida (*Sida acuta*). These weeds were associated with existing infrastructure (e.g., access tracks, fence lines), areas of high cattle disturbance such as water points and some drainage lines/waterways.

Table 4.2—7 lists the weeds reported in the study area during weed surveys undertaken in July 2023. The Carpentaria Highway and cattle operations represent the greatest threat to weed migration into the Project Area. The identified weed species were Class B; no Class A weeds were identified.

Table 4.2—7 Declared Weeds Identified in the Project Area, July 2023

Species	NT Declared Class	Weed of National Significance (WoNS)
Hyptis (*Hyptis suaveolens*)	B	No
Spinyhead sida (*Sida acuta*)	B	No
Rubber Bush (*Calotropis procera*)	B*	No

* Only declared Class B: South of 16°30' S latitude.

Two pest animals were identified in the field survey - Cane Toads (*Bufo marinus*) and Pigs (*Sus scrofa*).

4.3 Significant Areas

4.3.1 Protected Areas

There are no National Parks, conservation areas, or Sites of Conservation Significant near the Project Area (**Figure 4.3—1**).

The Bullwaddy Conservation Reserve is approximately 30 km west of the western series of seismic lines and in a different catchment. The reserve is a declared conservation area within the Sturt Plateau bioregion, conserving Acacia woodlands and the unique *Acacia shirleyi* (Lancewood)/*Macropteranthes kekwickii* (Bullwaddy) vegetation type.

The Limmen National Park is located approximately 80 km to the north-east of the Project Area. It is adjacent to the Limmen River and associated coastal floodplains, which is a Site of Conservation Significance. The site is dominated by huge coastal mudflats, which are some of the most extensive in the NT, and mangrove forests associated with the mouth of the Roper River and the large coastal delta system at the mouth of the Limmen River [L HARRISON et al., 2009].

The Activity will not have any impact on either the Bullwaddy Conservation Reserve or the Limmen National Park.

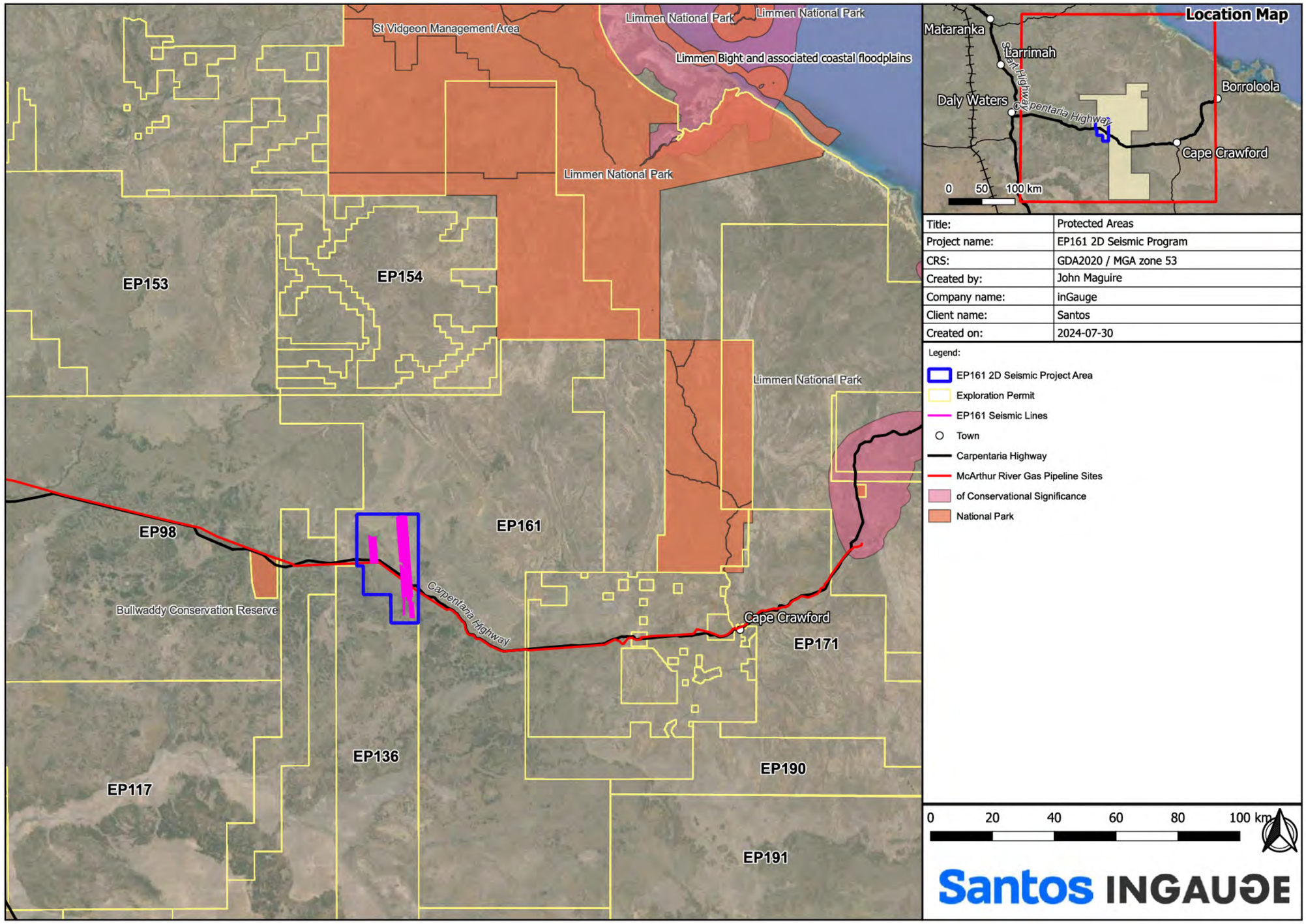


Figure 4.3—1 Protected Areas

4.3.2 Significant Vegetation Communities

Significant or sensitive vegetation communities are described in the *NT Land Clearing Guidelines (LCG)* [DEPWS, 2021B]. Significant vegetation communities are those that are distinct and limited in extent or support important ecological values. They include vine thicket, closed forest or riparian vegetation, mangroves, monsoon vines forest, sand-sheet heath and vegetation containing large trees with hollows. Sensitive vegetation is a term applied to ecosystems easily impacted by neighbouring or adjacent land uses or management.

Descriptions of habitats within the Search Area are presented in **Section 4.3** of **Appendix 01** (Environmental Assessment), including photographs of habitat types with accompanying text. Within the Project Area, riparian vegetation is the sensitive vegetation most likely to occur. This community is associated with ephemeral watercourses. Vegetation along a watercourse can be split into two categories:

- Riparian vegetation (considered sensitive under the *NT Clearing Guidelines*).
- Drainage line vegetation (not considered sensitive under the *NT Clearing Guidelines*) [DEPWS, 2021B].

Riparian areas often have significantly higher fauna diversity than surrounding areas. Whilst the riparian vegetation in the study area occurs in predominantly sparse woodland, the habitat values include:

- Provides water (in the wet season) and larger pools in the dry season. Supports flowering and seeding vegetation as well as prey (aquatic species, invertebrates, and small vertebrates) for small mammals, birds, and reptiles.
- Riparian vegetation provides refuge, sheltered movement corridors for fauna.
- Riparian vegetation includes sparse E. camaldulensis (river red gum), which have some hollows that are important for hollow-dependent animals (e.g. parrots, bats, finches).
- Potential habitat for Gouldian finch (Erythrura gouldiae) where eucalypt and paperbark woodlands, usually with a grassy understorey, occur in the vicinity.
- Riparian E. camaldulensis vegetation along waterways, is likely an alluvial GDE, which is typical in highly monsoonal environments with prolonged dry seasons.

The SREBA modelling identified a number of Broad Vegetation Groups considered to be 'Significant Vegetation' across the Beetaloo Basin [PATYKOWSKI J YOUNG L, LEIPER I, NANO C, FISHER A, GILLESPIE G, BARNETT G, BUCKLEY K, HANRAHAN N, MCDONALD P, MILLER A,, & RUYKYS L RIBOT R, STEWART A, ZIMNY A, 2022].

Four vegetation groups are spatially restricted, in total covering less than 1% of the SREBA study area: Riparian woodland (ephemeral streams) (504 km^2), Melaleuca forests (springs, river channels) (254 km^2), Ephemeral wetlands (27 km^2), and Lignum shrubland (17 km^2).

The SREBA report found that disturbance was prevalent across all broad vegetation groups, despite site selection being biased towards 'best on offer' condition. Cattle grazing was the predominant disturbance recorded, and was most extensive and intense within ephemeral wetland, and equally intense (but less extensive) in riparian woodland (ephemeral streams). The majority of ephemeral

wetland sites were impacted by cattle and, on average, 82% of their area was affected with 60% of this area being highly degraded (i.e. no vegetation cover due to grazing, trampling, and pugging). Melaleuca forests (springs, river channels) often displayed substantial impacts of disturbance from pig foraging and wallows and, where unfenced, also from cattle. During field surveys drainage lines and waterways within the working corridors were observed to be impacted by cattle (**Appendix 01**).

Modelling this SREBA dataset within the Project Area is shown in **Figure 4.3—2**. The 'high ecological value' communities that may be encountered within the seismic working corridors for the Activity are:

- Corymbia bella woodlands on alluvial plains – (GDE).
- Riparian Woodland (ephemeral streams) – (GDE).
- Melaleuca Forests (Springs, River Channels) – (GDE).

More details about these communities and how much of the working corridors they represent is shown in **Table 4.3—1**.

Table 4.3—1 High Ecological Value Vegetation

Broad Vegetation Group	GDE Nature	GDE Type*	GDE Attribution Confidence	Percentage of Working Corridor (%)
Riparian Woodland	Seasonal	2/3	Low-Moderate	6.22
Melaleuca Forests	Permanent	3	High	0.07
Corymbia bella Woodland on Alluvial Plains	Seasonal	2/3	Moderate	0.40

* Type 2 represents ecosystems dependent on the surface expression of groundwater and Type 3 represent ecosystems dependent on subsurface presence of groundwater. The Activity will not impact Type 3 GDEs as groundwater requirements are insignificant compared to aquifer capacity. The vehicles used in the Activity will not impact groundwater and any impacts to these communities will be reduced to ALARP (see controls in Section **3.5.2** and **4.3.3**).

The GPS tracklogs from field surveys indicate that 0.12% of the riparian area, classified as having low to moderate attribution confidence, within the working corridor might not have been verified on the ground. In contrast, the entire extent of the Melaleuca and Corymbia Bella woodland was ground-truthed. Additionally, almost all (99.9%) of the riparian vegetation, which constitutes 6.1% of the working corridor, was successfully verified through ground-truthing. While likely GDEs were observed during the survey (**Appendix 01**), field surveyors did not traverse any GDEs.

To avoid disturbing these vegetation types, during planning for the Activity, in consideration of the *LCG* recommendations, the seismic centreline was adjusted based on the field survey tracklogs where the field team identified a route that avoids GDEs. Additionally, while not anticipated, mulching of these

vegetation types will be avoided to the maximum extent practicable by applying controls including the following:

- Use of a mulcher/slasher instead of bulldozer for line preparation.
- Avoiding vegetation within 50 m working corridor.
- No mulching areas (e.g. only slashing permitted).
- Completing the tree mulching decision tree checklist **Figure 3.5—12**.
- Completing the riparian vegetation decision tree checklist **Figure 3.5—13**.

See **Section 3.5.2** for more details.

Any unavoidable impacts to these vegetation communities will be further reduced to ALARP and acceptable achieving the Rehabilitation Management Plan success criteria in **Section 7.4.6**.

4.3.3 Groundwater Dependent Ecosystems

A search of the DEPWS Groundwater, springs and dependent ecosystems water resources stories data and the Natural Resource Mapping Spring data indicates the presence of springs, including Beauty Creek Springs, located approximately 30 km to the north of the Project Area. Additionally, the National Groundwater Dependent Ecosystems Atlas states there is low to moderate potential for terrestrial and aquatic GDEs within the Project Area [BOM, 2022].

Within the Project Area, there are high ecological value vegetation groups e.g., riparian vegetation communities present along the watercourses, particularly those dominated by E. camaldulensis may rely on rainfall stored in alluvial sediments and, therefore, may be groundwater dependent. The SREBA dataset corroborates this, showing low to moderate potential for seasonal groundwater-dependent ecosystems along the riparian areas in the Project Area, as shown in **Figure 4.3—2** [YOUNG L ET AL; DEPWS, 2023].

Terrestrial vegetation that relies on the availability of shallow groundwater is considered to be GDE vegetation. These types of GDEs are very similar to riparian ecosystems and any conditions in this EMP that apply to riparian ecosystems also will apply to those GDEs.

As detailed in **Section 4.3.2** the Activity is unlikely to have an impact on these communities. Groundwater extraction from groundwater bores for the Activity and for firefighting purposes will not affect alluvial GDEs, and these volumes would be too small to have an impact on any other GDE that may occur in the Project Area.

The EP 161 Environmental Assessment Report (**Appendix 01**) notes that riparian *Eucalyptus. camaldulensis* vegetation observed along Stream Order 2 and 3 was likely a GDE (alluvial), which is typical in highly monsoonal environments with prolonged dry seasons. Mulching of these vegetation types will be avoided to the maximum extent practicable (see **Section 3.5.2**).

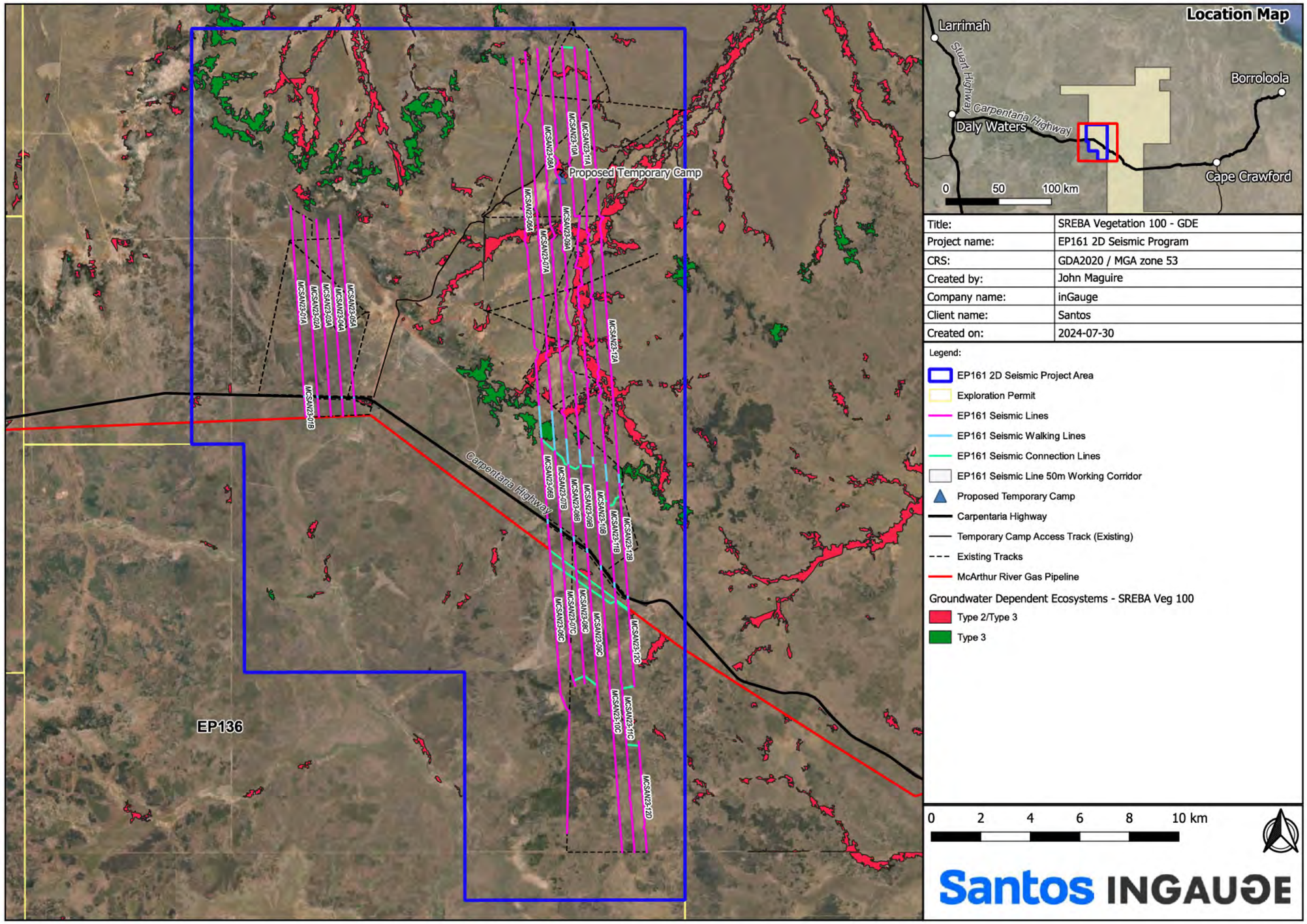


Figure 4.3—2 SREBA Potential GDE Locations

4.3.4 Fire

Aboriginal people have traditionally used fire as a tool during hunting and gathering. Patch burning shortly after the end of the rainy season has 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 later in the dry season.

Fire management or controlled burns within the region are a common occurrence. Controlled burns are undertaken early in the dry season to reduce the possibility of uncontrolled fires and to assist in land management.

The peak fire danger season for the region is during the late dry season. At this time, high fuel loads and dry, windy conditions fuel potentially very large bushfires. Periods of increased temperature, reduced rainfall, and humidity due to climatic cycles such as El Niño can exacerbate these conditions.

Bullwaddy vegetation communities are very sensitive to frequent and intensive fires (*PWCNT 2005*). Late-season fires also impact pastoralism because the heat of these large wildfires kills the understorey grass species that stock relies on during the lean times before the wet season rains.

Fire management is discussed in the Fire Management Plan provided in **Section 7.3**. The Plan shows the fire frequency within the Project Area (**Figure 7.3—1**) and the time since the last burn (**Figure 7.3**—2). The frequency in the immediate vicinity of the Project Area is very low at three or fewer between 2013 and 2022.

4.4 Cultural Environment

4.4.1 Historic and Natural Heritage

An independent archaeologist was contracted by the Interest Holder to undertake a survey of the proposed seismic line survey routes to determine the presence of archaeological artefacts or sites of significance within the Project Area. A seven-day survey was conducted from 18 to 24 July 2023.

Areas of significance for sacred sites, as defined by the *Aboriginal Sacred Sites Act 1989 (NT)*, are considered through the process of applying for an Authority Certificate from the AAPA. This process aims to prevent damage to and interference with sacred sites by identifying them in advance and setting out the conditions for entering and working on the land (discussed further in **Section 4.4.4**).

A database search of the area along the proposed seismic line survey routes showed there are no archaeological places and objects on the National Heritage List, nor on the Commonwealth Heritage List, nor are there any significant Aboriginal areas or objects to which a declaration has been made under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) (**Appendix 02**). A search of the Archaeological Sites Register held by the NT Heritage Branch revealed no previously recorded archaeological sites in the survey area.

A report by Lance [A LANCE, 2019] overlapped with some of the areas investigated in the archaeology report for this EMP (**Appendix 02**). In the Lance report, 22 sites were recorded in and around the Project Area. These are listed in full with descriptions of the found artefacts in **Table 2** of **Appendix 02**. The locations of the sites are shown in **Figure 4.4—1**.

Of primary interest to this report are the sites recorded by Lance at [redacted], which represent the only high-density artefact scatter sites found in that survey. The Lagoon Creek site was found to be much larger than previously recorded and essentially comprises home camps that people were continuously revisiting for millennia and is of high significance. The findings of the consultant report and its recommendations are discussed further in **Section 4.4.2**.

If further sites are found while carrying out the Activity, they will be reported to the NT Heritage Branch, as is required under *Section 114* of the *Heritage Act 2011 (NT)*.

4.4.2 Archaeological Study

Prior to and during the Activity, the SMS, 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure' will be implemented. Any new sites or finds identified during the Activity will be reported to the CEO of the Heritage Council under the *Heritage Act 2011 (NT)* (Section 8.6.1).

4.4.2.1 Overall Findings

The survey in areas south of the highway was constrained by bullwaddy and lancewood stands that were impenetrable to all-terrain vehicles and even to pedestrian access. The survey skirted around these impenetrable areas.

Four archaeological sites (TAS01 to TAS04) and four background scatters were recorded. Of these sites, TAS04 was of high significance. Only one isolith (site with isolated stone artefacts) was found south of the highway. The rest were found north of the highway. These site locations and sites previously identified (refer **Section 4.4.1**) are shown in **Figure 4.4—1**. More detailed maps of these four sites are provided in **Appendix 02**, as well as photographs of the local context and artefacts found.

The archaeology was characterised by isoliths and low-density artefact scatters on creek lines and at the edges of black soil plains. The main archaeological sites, or home camps, were the same as those recorded in an earlier survey [A LANCE, 2019], although their boundaries have been extended following further assessment of site TAS04.

Tanumbirini Creek is a braided creek system that was predicted to have higher archaeological potential, but field observations indicated that the opposite is true. The northern areas of the western survey block flood during the wet season, obliterating any archaeological sites. Furthermore, the escarpment country to the north of the highway consisted of shaley and conglomerate rock, unsuitable for rock art shelters.

Photographs of the isolated artefacts are shown in **Appendix 02,** along with survey transect recording. The main disturbance to the sites was caused by cattle. The raw material types were predominantly silcretes, quartz and quartzite. No fine-grained materials such as chert were seen. The tool types were points, scrapers, an adze, and grindstones, while flakes and flake pieces made up most finds. **Table 3** of **Appendix 02** lists the findings.



Figure 4.4—1 Cultural Heritage Sites

4.4.2.2 Tanumbirini Archaeological Site 4 (TAS04)

Site TAS04 is a high-density artefact scatter site with a range of stone tool types, particularly intact [redacted]s and [redacted]. Two previously recorded sites were recorded in the vicinity [A LANCE, 2019], and both represent high-density artefact scatters and are essentially home camps, or the main occupation sites found in the survey area.

The sites were inspected and found to be much larger than first recorded, particularly [redacted]. The site occurs on flat ground adjacent to a lancewood forest. There are patches of cleared ground along the creek, which may have been produced by erosion. Additional artefactual material was found at [redacted], suggesting that artefacts are quite likely to be all around the area. The location of site TAS04 and the other main archaeological sites are shown in detail in **Appendix 02**. [redacted] have been combined into TAS04. The occurrence of lancewood and bullwaddy on MCSAN23-03 and 04 prevented their surveys.

As noted in **Section 4.4.1**, the TAS04 site at [redacted] was found to be much larger than first recorded and represents a highly significant home camp that people have been continuously revisiting for millennia and is of high significance. The overall results of the July 2023 survey concur with the previous study that indicated no suitable stone for making stone tools occurs within the survey area and that raw material had been brought in for that purpose [A LANCE, 2019].

Photographs of site TAS04 and artefacts found at site TAS04 are provided in **Appendix 02**. Numerous [redacted] and [redacted] were found in the area, as well as [redacted]. [redacted] are typically made from quartzite and are unifacially retouched on both margins.

4.4.2.3 Archaeological Report Recommendations

The recommendations provided in the archaeological report are:

1. Recommendation 1: Archaeological sites:
    a) All archaeological sites are to be avoided. A radial site exclusion zone is suggested for archaeological sites as defined by their site centroids. These vary from 20 m for site TAS02 and TAS03, to a 50 m radii exclusion zone for TAS01. Stop points are provided for seismic lines MCSAN23-01 to MCSAN23-05 to avoid TAS04. Handheld equipment should only be used north of the stop points.
    b) Walking/hand-carrying of geophones through archaeological sites is permitted. No preparation or driving through sites is permitted.
    c) TAS01 is cleared by 100 m on either side (east to west) from the centre line as no other artefacts were seen outside of its exclusion zone. This will enable the seismic team to deviate around the 50 m radius exclusion zone around the site.
2. Recommendation 2: Background scatters and isoliths:
    a) All background scatters (isoliths) are to be avoided. An exclusion zone of 10 m from the site centroid is suggested for all isoliths.

In response to the recommendations in **Appendix 02**, the Interest Holder has revised the seismic lines so that all the above four sites are avoided.

4.4.3 Northern Land Council

The Interest Holder has executed an Exploration Agreement with the Northern Land Council (NLC), which has defined processes for community consultation, sacred site surveying, and reporting to the AAPA. Community consultations and sacred site avoidance surveys of EP 161 work program areas were completed by NLC and Traditional Owners in 2013, 2014, 2016, and 2019 for different proposed work programs (2D seismic surveying, exploration drilling, water bore drilling, and hydraulic fracturing).

These processes have identified any sacred sites or restricted work areas. Relevant information and conditions are then communicated to the Interest Holder as conditions on any granted Authority Certificate from AAPA. The Interest Holder and the NLC consulted the relevant Traditional Owners in relation to the proposed Activity in early 2023 (in addition to other relevant work program activity covered under other EMPs).

4.4.4 AAPA Authority Certificates

The Interest Holder holds various AAPA Authority Certificates for the EP. A summary of certificates is included below.

AAPA Authority Certificate C2013/142, Reference: 2013/783 was granted in 2013 for the construction and use of seismic lines and access tracks to allow for 2D seismic survey works and associated water sampling.

An AAPA Authority Certificate (Certificate C2018/105 – Variation to C2018/102, Reference: RA2018/108) was granted in 2018 to facilitate the development of the access track needed to construct the Inacumba North and Tanumbirini North water monitoring bores located within the Project Area of this EMP.

Works subject to AAPA Authority Certificate (Certificate C2018/105 – Variation to C2018/102, Reference: RA2018/108) included upgrading and maintenance of access tracks.

AAPA Authority Certificate C2019/043 variation to C2014/053, Reference: RA2019/8 was granted in 2019 for works, including civil engineering (such as upgrading and creating new access tracks, lease pads, water bore installation, water extraction, and camps); 2D seismic acquisition and evaluation as required and all works ancillary to the above-mentioned works including routine and ongoing maintenance of any infrastructure or other services. The areas covered by AAPA Authority Certificate C2019/043 include the Tanumbirini-1/2H and Inacumba-1/1H locations.

The Activity will occur within areas covered by the AAPA Authority Certificates detailed above that allow for seismic and other survey techniques.

The terms and conditions of the AAPA Authority Certificates are incorporated into planning for the Activity.

4.4.5 Heritage Discoveries

Any unexpected heritage discoveries will be managed in line with the agreed processes described in the ILUA and the Interest Holder's SMS policy 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure', in the event a suspected find of Aboriginal or non-Aboriginal cultural heritage is made during the Activity.

In summary, if suspected previously unrecorded sacred sites or Aboriginal or Macassan archaeological places or objects are uncovered during the Activity:

- All work to cease within the vicinity of the suspected find.
- The Traditional Owner's representative (the AAPA) will be contacted so that an assessment of the find and recommendations for any necessary management measures can be arranged.
- Work is not to recommence in the vicinity of the find until the Traditional Owner's representative provides direction.
- This direction may include flagging the discovery, realigning around the suspected find in the buffer area or relocating the work front to a new location removed from the suspected find.
- If the find is determined to be an Aboriginal or Macassan archaeological place, object, or sacred site, the Interest Holder will also notify the Heritage Branch of the Northern Territory Government.

If any suspected human remains are discovered during any activity, they must be initially assumed under the provisions of the relevant Coroners Act to be a crime scene and treated accordingly. The following procedure is to be applied:

- All works in the vicinity must cease, and the Interest Holder must be notified immediately.
- The Interest Holder must immediately notify the police of the discovery.
- The remains must be left in place and protected from harm or damage with a minimum of a 50 m buffer.
- It is essential to use best judgement and restrict all movement in the immediate vicinity around the discovery until directed otherwise by the police; any disturbance could contaminate a potential crime scene.
- Likewise, do not set up temporary fencing unless directed by the police.
- If the appointed expert investigating the find under the relevant Coroner's Act believes that there are reasonable grounds to believe the remains to be:
    - A crime scene: the police will provide direction on managing the discovery.
    - Aboriginal ancestral remains or historical remains: the relevant Director Heritage Branch, Department of Tourism and Culture, is to be contacted at (08) 8999 5039 (Darwin office) or (08) 8951 9247 (Alice Springs office) or email **heritage@nt.gov.au**.

4.4.6 Cultural Area Buffers

The AAPA Authority Certificates that cover the Activity (see **Section 4.4.4**) will be complied with by having GPS markers for the excluded areas programmed into line preparation and data acquisition vehicles.

The cultural area buffers required by the Archaeological Study (**Appendix 02** and discussed in **Section 4.4.2**) will be complied with, using GPS markers for the excluded areas programmed into line preparation and data acquisition vehicles.

Vehicle GPS logs will be available to confirm compliance with the cultural buffers described in this EMP.

4.5 Socioeconomic Environment

4.5.1 Land Use

There are a range of current land uses within the area, including conservation, tourism, oil and gas exploration and pastoral activities.

The EP 161 lease overlays two Local Government Areas: Barkly Regional Council to the south and Roper Gulf Regional Council to the north. The Barkly Regional Council covers an area of 323,514 km^2 and has a population of approximately 7,531. The Barkly Regional Council includes the Barkly Tablelands, numerous Aboriginal land trusts and pastoral properties.

The Roper Gulf Regional Council covers an area of 186,000 km^2 and has a population of approximately 6,121. The Roper Gulf Regional Council includes 16 towns and communities of varying sizes, major roadhouses, 22 outstations and 50 pastoral properties.

The local area remains generally undeveloped in terms of infrastructure and roads. Major infrastructure within EP 161 includes the Carpentaria Highway and the Daly Waters to McArthur River gas pipeline, which run approximately parallel with one another east-west through the southern half of the tenement. The McArthur River Mine is located approximately 100 km east of the Project Area.

The Carpentaria Highway is frequented as a tourist route in the dry season, both as a route to destinations around the Gulf of Carpentaria and as a link between the NT and Queensland.

4.5.2 Settlements

The closest towns to the Project Area are Daly Waters (approximately 130 km to the west) and Borroloola (approximately 180 km to the east). The nearest significant population centre is Katherine, located approximately 350 km to the north-west. Pastoral properties and towns near the Project Area are shown in **Figure 4.5—1**.

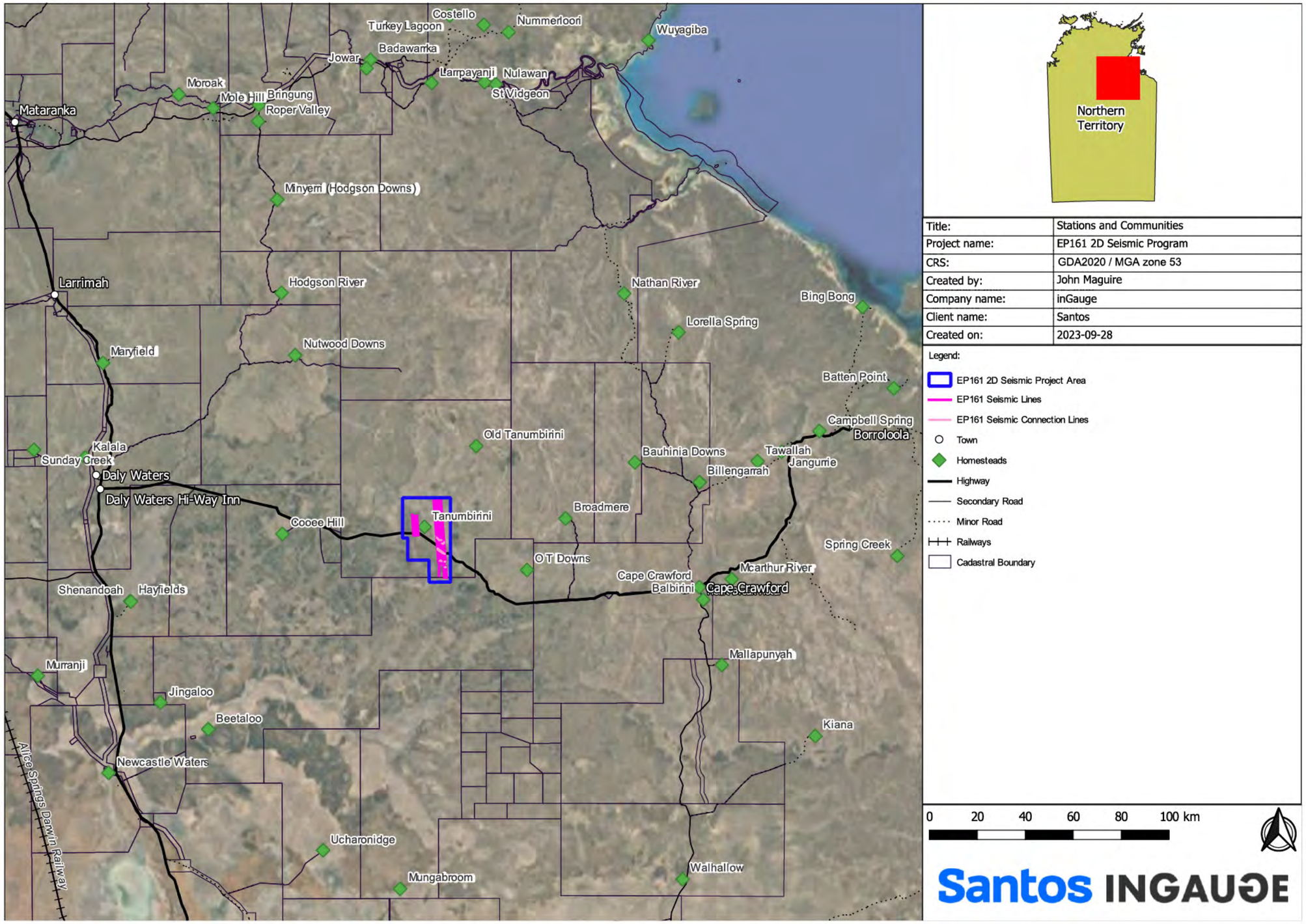


Figure 4.5—1 Stations and Settlements in Proximity to the Project Area

4.6 Environmental Factors, Objectives, and Values

The NT EPA has developed Environmental Factors and Objectives, as described in NT EPA *Environmental Factors and Objectives*, as a means of organising environmental information to allow the identification of values, the assessment of the significance of potential impacts to those values, and the setting of benchmarks to protect those values [DEPWS, 2022B].

The NT EPA's Environmental Factors are broad divisions of the environment (categorised under five themes of Land, Water, Sea, Air and People) that may be impacted by a proposed action.

The NT EPA's Environmental Factors and Objectives for this proposed Activity are described in **Table 4.6—1**.

The mitigation and management of the environmental factors and objectives are presented in **Table 6.1—1** (Risk Assessment Table), following the description of the risk assessment process (**Section 5**).

As noted in **Section 2.5.2**, the Interest Holder has determined that the proposed Activity will not significantly impact the environment and, therefore, is not required to be referred to the NT EPA for assessment. This conclusion was informed by the NT EPA's Environmental Factors and Objectives for this proposed Activity.

Table 4.6—1 Environmental Factors and Values that may be Affected by the Activity

Theme	Environmental Factors	Environmental Objectives	Environmental Values	Summary
Land	**Landforms** **Terrestrial Environmental Quality** **Terrestrial Ecosystems**	• Conserve the variety and integrity of distinctive physical landforms. • Protect terrestrial habitats to maintain environmental values, including biodiversity, ecological integrity, and ecological functioning. • Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Threatened fauna species and their habitat	• The *EPBC Act*, PMST, and *TEWPC Act* database searches identified 15 listed threatened species that have the potential to occur in the Search Area. Of these, only one had a high potential of occurrence – the Gouldian Finch - with a previous record within 20 km of the Project Area. Two other bird species had a moderate chance of occurrence – the Grey Falcon and Crested Shrike-tit; however, there are no records within the Search Area. Two mammalian species – the Northern Quoll and Bare-rumped Sheath-tailed Bat – and one reptile - the Yellow-spotted Monitor - have moderate potential to occur; however, there are no previous records of these species in the study area.
			Listed migratory species	• 12 threatened migratory species were identified with potential to occur in the study area, including one migratory marine bird species with moderate potential to occur but likely to fly over and not land - the Fork-tailed Swift. There are five migratory terrestrial bird species, of which four have moderate potential to occur, although there are no previous occurrence records – the Red-rumped Swallow, Oriental Cuckoo/Horsfield's Cuckoo, Barn Swallow and Yellow Wagtail. There are six migratory wetland bird species, all of which have low potential to occur, a lack of suitable habitat and/or no previous records.
			Listed threatened flora species and ecological communities	• There are no TECs or threatened flora listed under the *EPBC Act* and/or *TPWC Act* known to occur within the Search Area.
			Sensitive or significant vegetation	• Two significant flora species have previously been recorded within the Search Area. Both species, *Acrachne racemosa* and *Sida* sp. *Excedentifolia,* are listed as DD (Data Deficient) under the *TPWC Act*. • No threatened flora species were observed during the July 2023 on-ground surveys.
			Damage to distinctive physical landforms	• Ephemeral creeks within the Project Areas are in the headwaters of the Limmen Bight River catchment and feed into the Limmen Bight River during significant rainfall events.
			Soils	• The Project Area soils are dominated by kandosols and rudosols.
Water	**Hydrological Processes** **Aquatic Ecosystems** **Inland Water Environmental Quality**	• Protect the quality of groundwater and surface water so that environmental values, including ecological health, land uses, and the welfare and amenity of people are maintained. • Protect the hydrological regimes of groundwater and surface water so that environmental values, including ecological health, land uses, and the welfare and amenity of people, are maintained. • Protect aquatic habitats to maintain environmental values, including biodiversity, ecological integrity, and ecological functioning.	Groundwater	• The Cambrian Limestone Aquifer (the Gum Ridge Formation) is a regional-scale aquifer that provides groundwater resources for pastoral enterprises, domestic bores at homesteads and town water supplies at several small communities across the region.
			Surface water	• There are ephemeral creeks and drainage lines present in the Project Area. In significant rainfall events, these drain into larger rivers eventually into the Gulf of Carpentaria. Approximately 80 km to the east of the Project Area the rivers traverse the Limmen Bight National Park.
			Supply and quantity of water	• Ephemeral creeks adjacent to the Project Areas are in the headwaters of the Limmen Bight River catchment and feed into the Limmen Bight River during significant rainfall events.
			Groundwater dependent ecosystems	• There is low to moderate potential for terrestrial and aquatics GDEs within the Project Area.

Theme	Environmental Factors	Environmental Objectives	Environmental Values	Summary
People	**Community and Economy** **Culture and Heritage** **Human Health**	• Enhance communities and the economy for the welfare, amenity, and benefit of current and future generations of Northern Territorians. • Protect culture and heritage. • Protect the health of the Northern Territory population.	Cultural heritage, sacred sites	• A field survey conducted by an independent archaeologist in July 2023 (**Appendix 02**) and a historical report by Lance (2019) identified sites of significance within the Project Area.
			Human health	• Emissions from the Activity (noise, light, dust, and vehicle exhausts) may impact human health.
Air	**Air Quality** **Atmospheric Processes**	• Protect air quality and minimise emissions and their impact so that environmental values are maintained. • Minimise greenhouse gas emissions to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	Impacts on air quality Increased greenhouse gas emissions	• Emissions from the Activity (greenhouse gases and dust) may impact air quality and atmospheric processes.

5. Environmental Risk Assessment Process

5.1 Introduction

The central concepts in *the PER* are environmental risk and environmental impact.

> **Environmental risk** is defined in *the PER* 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 in *the PER* as '*any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity*.'

Environmental risks are inherent in onshore oil and gas activities, and without control, environmental impacts may arise. *The PER* requires detailed assessment, reduction and control of environmental risks and impacts through the development and implementation of the EMP for the Activity. This section provides an overview of the environmental risk assessment process used in this EMP.

5.2 Process Overview

The interactions between the Activity and the described environment are sources of risk that have the potential to result in a change to the environment (an impact).

An Environmental Risk Assessment (ERA) involves the assessment of the likelihood and consequence of these impacts. An EMP must demonstrate that the environmental impacts and environmental risks will be reduced to a level that is ALARP and acceptable.

ALARP involves determining if 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' depends on issues such as the nature and scale of impacts and the social or economic benefits.

To meet the requirements under *the PER,* the principles of the risk management process in AS/NZS ISO 31000:2018 *Risk Management – Principles and Guidelines* and *HB 203:2012 Environmental Risk Management - Principles and Process* have been followed. A summary of this approach comprises the following:

- Identification of environmental factors.
- Description of the environment that may be affected.
- Identification of the objectives.
- Identification and evaluation of potential environmental impacts.
- Determination of the pre-treatment risk ranking.
- Control measure identification and ALARP decision.

- Determine the severity of the consequence.
- Determine likelihood.
- Determine residual risk ranking.

Section 6 (Environmental Risk Assessment) details the outcomes of this process.

5.3 Environmental Factors, Risk Sources and Potential Impacts

Based on the Interest Holder's Ecological Assessment (**Appendix 01**) and desktop reviews of publicly available information (described in **Section 4**), a review of the existing environment was undertaken to identify the environmental factors with the potential to occur within the Project Area. The outcome of the desktop reviews and field studies is provided as **Section 4** of this EMP. The environmental factors that may be affected have been identified using the *NT EPA Environmental Factors and Objectives* [DEPWS, 2022B].

Following the identification of the environmental factors, the risk sources and potential impacts were identified and are summarised in **Table 5.3—1**.

Table 5.3—1 Summary of Environmental Factors, Risk Sources, and Potential Impacts

Environmental Factor	Risk Source	Potential Impacts
Landforms	• Rotary machine, vehicle, and plant movements.	• Damage to landforms.
Terrestrial Environmental Quality	• Seismic line preparation using a rotary machine. • Vehicle and plant movements. • Fuel, oil, chemical and hydraulic fluid spills, and leaks. • Camp. • Smoking. • Waste storage	• Soil quality. • Disturbance to native vegetation. • Dust. • Noise and seismic vibration. • Light. • Fauna strikes. • Introduce and spread weeds. • Bushfire. • Fauna interaction with camp.
Terrestrial Ecosystems	• Seismic line preparation using a rotary machine. • Vehicle and plant movements. • Fuel, oil and hydraulic fluid spills and leaks. • Camp. • Smoking.	• Habitat loss. • Introduce and spread weeds. • Bushfire.

Environmental Factor	Risk Source	Potential Impacts
Hydrological Processes	• Seismic line preparation.	• Alteration of drainage lines. • Extraction of groundwater.
Inland Water Environmental Quality	• Storage and handling of chemicals, oil, and fuel. • Seismic line preparation.	• Water quality. • Erosion.
Air Quality	• Vehicles and plant exhaust.	• Dust. • Exhaust emissions.
Atmospheric Processes	• Vehicles and plant exhaust.	• Greenhouse gas emissions.
Community and Economy	• Seismic line preparation. • Vehicle and plant movements.	• Dust. • Light. • Noise. • Seismic vibration. • Vehicle impacts with stock and wildlife.
Culture and Heritage	• Seismic line preparation. • Vehicle and plant movements.	• Exposing/damaging culturally sensitive site.
Human Health	• Seismic line preparation and survey. • Vehicle and plant movements.	• Dust. • Light. • Noise. • Seismic vibration.

5.4 Determination of Severity of Consequence

The potential severity of each impact (consequence) was assessed and assigned a ranking considering potential hazards and receptors, using the 'Environmental Consequence Ranking' (**Table 5.4—1**). The consequence ranking for each hazard is documented in the risk assessment table in **Section 6**.

Table 5.4—1 Environmental Consequences Ranking

Impact Level		Environment	Community and Reputation
Irreversible Impact	**VI**	• Irreversible impact on Land Environmental Factors (EF(s)).	• Sustained national community criticism** or widespread protest. • Industry reputation and approvals impacted.

Impact Level		Environment	Community and Reputation
			• Changes at executive/board level of long-term share price impact (> month).
Extensive Impact	**V**	• Extensive population or community scale impact on EF(s) of conservation significance.* • Extensive impact on other EF(s).	• National community criticism of large-scale protest. • Company reputation and approvals impacted. • Shareholder intervention or short-term share price impact (<month).
Severe Harm	**IV**	• Large-scale impact to EF(s) of conservation significance.* • Moderate-scale surface water impact. • Localised impact on groundwater with potential or known beneficial use.	• State-level community criticism or protest over multiple days/locations. • State-based company reputation impacted. • Very short-term share price impact (< week).
Moderate Harm	**III**	• Moderate-scale impact on EF(s) of conservation significance.* • Localised surface or groundwater impact.	• Local community criticism (> week) or one-day community protest. • Local company reputation impacted.
Minor Harm	**II**	• Small-scale impact to EF(s). • Potential surface of groundwater impact.	• Minor level local community criticism (< week). • No reputation impacts.
Negligible Harm	**I**	• No impact on Land EF(s).	• No actual or potential community criticism. • Details remain with the Interest Holder's sites and/or offices. • Incident reporting according to routine protocols.

* A Conservation Significant Value is subject to legal protection through regulation or has been identified as a priority by government in terms of special protection or management.

** Criticism includes criticism by one or more individuals in person, public forums, traditional media, or social media.

5.5 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. A ranking of likelihood has been assigned using the Interest Holder's Likelihood Descriptors (**Table 5.5—1**) from the Interest Holder's Operational Risk Matrix.

Table 5.5—1 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 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'.

5.6 Pre-treatment Risk Ranking

Risk is expressed in terms of a combination of the likelihood of an event occurring and the consequence of an impact. These factors are set out in the Risk Matrix in **Table 5.6—1**.

As part of the risk assessment process, a pre-treatment risk ranking has been determined to assist with the level of controls required to reduce the risk or impact. Pre-treatment risk is determined by the combination of likelihood and consequence classification using the Risk Matrix.

The assessment of environmental risk depends on the nature of the receiving environment. Therefore, not all elements under each category will be applicable. Areas or species of significant conservation value are most susceptible to potential changes to the environment and must be accorded special protection or management. A significant conservation value is one that is subject to legal protection through regulation or has been identified as a priority by the government or community.

Table 5.6—1 Risk Matrix

Consequence / Likelihood		Negligible	Minor Harm	Moderate Harm	Severe Harm	Extensive Impact	Irreversible Impact
		I	II	III	IV	V	VI
Almost Certain	F	Low 2	Medium 3	High 4	Very High 5	Very High 5	Very High 5
Likely	E	Low 2	Medium 3	High 4	High 4	Very High 5	Very High 5
Occasional	D	Low 2	Low 2	Medium 3	High 4	High 4	Very High 5
Possible	C	Very Low 1	Low 2	Low 2	Medium 3	High 4	Very High 5
Unlikely	B	Very Low 1	Very Low 1	Low 2	Low 2	Medium 3	High 4
Remote	A	Very Low 1	Very Low 1	Very Low 1	Low 2	Medium 3	Medium 3

5.7 Residual Risk Ranking

Risk is expressed in terms of a combination of the consequence of an impact and the likelihood of the impact occurring. The Interest Holder uses the Risk Matrix to plot the consequence and likelihood to determine the initial residual risk ranking.

Once the initial ranking of a residual risk is determined, the Interest Holder uses the Risk Significance Rating (**Table 5.7—1**) to determine if further controls are required to reduce the potential impacts of the risk using the process described in **Section 5.8**.

Table 5.7—1 Risk Significance Rating

Risk Level	Mitigation/Investigation Focus
5	• Intolerable risk level. • Following verification of the residual risk at level 5, activity must stop. • Activity cannot recommence until controls implemented to reduce the residual risk to level 4 or lower. • Detailed multi-disciplinary incident investigation team. • Management involvement in the investigation.
4	• Assess risk to determine ALARP.

Risk Level	Mitigation/Investigation Focus
	• If ALARP, Activity related to maintenance of controls/barriers prioritised and managed. • If not ALARP, improve existing controls and/or implement new controls. • Detailed multi-disciplinary incident investigation team.
3	• Assess risk to determine ALARP. • If ALARP, Activity related to maintenance of controls/barriers prioritised and managed. • If not ALARP, improve existing controls and/or implement new controls. • Full incident investigations.
2	• Assess risk to determine ALARP. • If ALARP, Activity related to maintenance of controls/barriers prioritised and managed. • If not ALARP, improve existing controls and/or implement new controls. • Incident investigations using simple tools.
1	• Managed as stipulated by the related work processes. • No incident investigation required.

5.8 Control Measure Identification; an ALARP Decision Framework

A risk is reduced to ALARP when all the requirements of *the Code* have been met, all reasonably practicable risk management controls have been identified and implemented, and the cost of further reducing the risk is disproportionate to the benefit. 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 surveys, workshops and through a review of best practice techniques across the industry. 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. The Interest Holder's approach to this decision-making process is based on the *Guidance on Risk Related Decision Making* [OGUK, 2014]. This framework (**Figure 5.8—1**) considers impact severity and several guiding factors in achieving ALARP risk demonstration:

- Activity type.

- Risk and uncertainty.
- 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 5.8—1**.

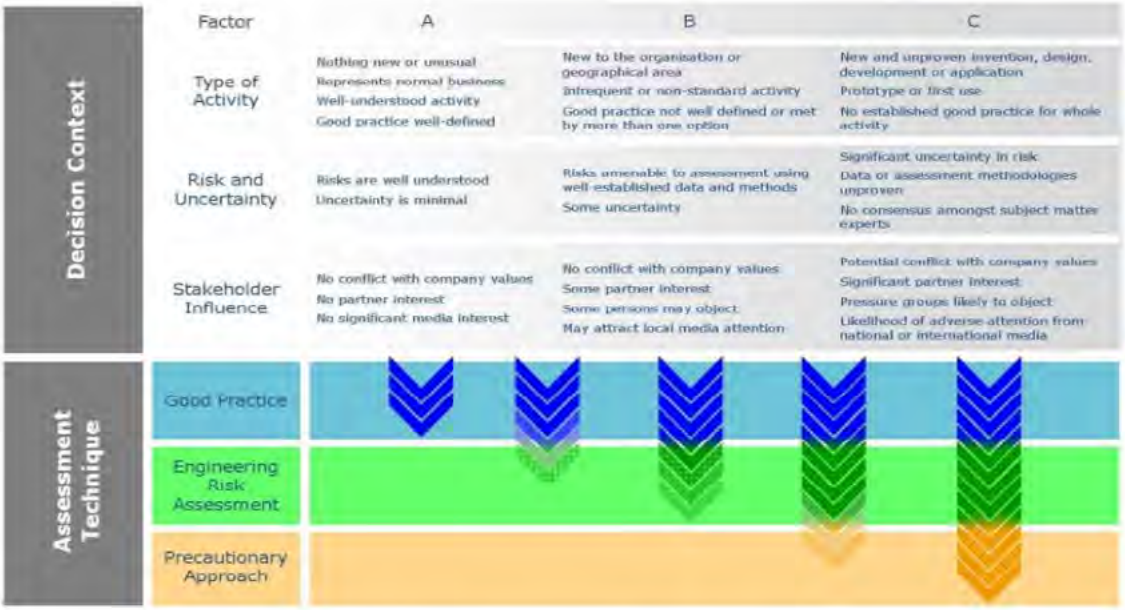


Figure 5.8—1 Impact and Risk 'Uncertainty" Decision-Making Framework

Table 5.8—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	Good Practice Control Measures are considered to be: 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. Professional Judgement: Uses relevant personnel with the knowledge and experience to identify alternative controls. When formulating control measures for each

Decision Type	Description	Decision-making Tools
		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.
B	Risks classified as a Decision Type B are typically in areas of increased environmental sensitivity with some stakeholder concerns.	Risk-based tools, such as cost-based analysis or modelling: this 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.
C	Risks classified as a Decision Type C will typically involve significant complexity, high potential impact, uncertainty, or stakeholder interest.	Precautionary Approach: states 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.

5.9 Determination of Impact and Risk Acceptability

The model The Interest Holder used for determining acceptance of residual risk is detailed in the Interest Holder's Residual Risk Acceptance Model in **Figure 5.9—1**. 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 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.

- The Interest Holder's policies and standards.
- Stakeholder expectations.

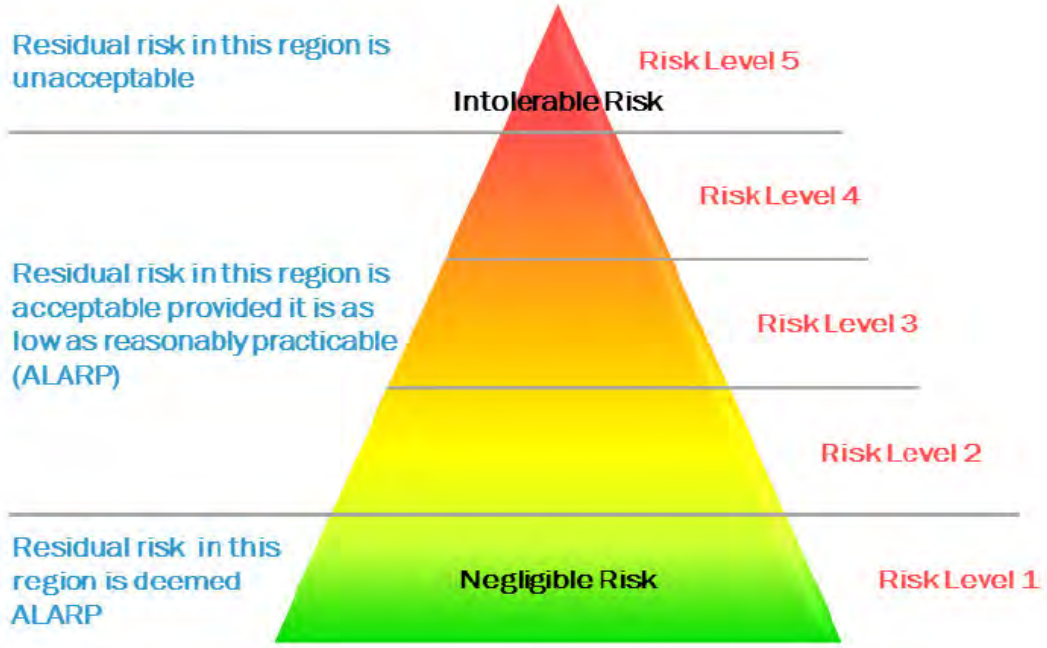


Figure 5.9—1 Residual Risk Acceptance Model

6. Environmental Risk Assessment

An environmental risk assessment was undertaken for the proposed Activity using the methodology outlined in **Section 5**. The results are reported in **Table 6.1—1**.

6.1 Risk Assessment Table

The risk ranking descriptors in **Table 6.1—1** are as follows:

- **L** = likelihood descriptor, as presented in **Table 5.5—1 Likelihood Descriptor**, with values ranging from A (remote) to F (almost certain).
- **C** = consequences ranking, as presented in **Table 5.4—1 Environmental Consequences Ranking**, with values ranging from 1 (negligible harm) to V1 (irreversible damage).
- **R** = risk ranking, as presented in **Table 5.7—1 Risk Significance Rating**, ranging from 1 (managed, no incident investigation required) to 5 (intolerable risk).

Table 6.1—1 Risk Assessment Table

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
Physical Disturbance	Disturbance to native vegetation	Terrestrial environmental quality	Mulching/ slashing and vehicle and plant movements	E	I	2	• The temporary campsite will be on a previously cleared area, the Tanumbirini well pad. • Existing access tracks and roads will be used for access. • Where possible, existing tracks and roads will be utilised for surveys to eliminate the need for additional line preparation. • Where necessary, line preparation will be conducted using a mulcher, which simultaneously cuts, mulches, and spreads the mulch on the seismic or connection line. • Slashing may be used in no mulch regions. • The slasher and mulcher leave rootstock intact to reduce erosion and facilitate rehabilitation. • The mulcher/slashing prepares a 5 m width within an indicative 50 m corridor so seismic vehicles can deviate around dense vegetation and landforms. • The mulcher will be used “mulcher up” to avoid disturbance when not required. • Mature trees, trees with active hollows or nests selected for preservation, are to be flagged to ensure their protection. • Tree mulching decision tree to be used to protect mature and nesting trees.	A.3.1 Site Selection and Planning A.3.9 Rehabilitation	C	I	1	Yes	A
Physical Disturbance	Damage to Landforms	Landforms	Mulching/slashing and vehicle and plant movements	E	I	2	• The temporary campsite will be on a previously cleared area, the Tanumbirini well pad. • Existing tracks and roads will be used for access. • Where possible, existing tracks and roads will be utilised for surveys to eliminate the need for additional line preparation • A 50 m buffer in place to aid in choosing the most traversable area to place seismic lines. • The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed. • Stream orders to be crossed at 90 degrees.	A.3.1 Site Selection and Planning	C	I	1	Yes	A
Physical Disturbance	Disruption of natural drainage lines	Hydrological processes.	Mulching and vehicle and	E	I	2	• Supervisor and Fauna Spotter to pre-scout and identify riparian areas. Riparian area start and stop points are to be input into GPS / a navigation system.	A.3.1 Site Selection and Planning A.3.9 Rehabilitation	C	I	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
			plant movements				• Riparian vegetation decision tree to be used before traversing riparian vegetation. • All-terrain vehicles used do not require formed watercourse crossings and do not cause major disturbance. • Where possible, the number of times a watercourse without a formed crossing is traversed on a seismic line will be limited to once per stage of the Activity, with minimal disturbance expected. The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed.						
Physical Disturbance	Adversely affect the breeding pattern of a Grey Falcon	Terrestrial ecosystems	Vehicle and plant movements (including mulching of vegetation)	E	II	4	• Seismic lines ground-truthed, and a 50 m working corridor implemented to maximise traversability without mulching. • Slashing will be used in no mulch regions. • Fauna Spotter to precede line preparation vehicles to identify the presence of Grey Falcon active nests within or visually adjacent to the 50 m working corridor. • Seismic line prep and data acquisition to maintain a 300 m vehicle free exclusion zone established for identified active Grey Falcon nests within, or visually adjacent to the 50 m working corridor (seismic nodes walked through area).	A.3.1 Site Selection and Planning	B	II	1	Yes	B
Physical Disturbance	Adversely affect habitat critical to the Gouldian Finch	Terrestrial ecosystems	Mulching vegetation	C	II	2	• Mulching of large hollow-bearing trees with a trunk diameter greater than 25 cm at 1.3 m above the ground avoided utilizing the tree mulching decision tree.	A.3.1 Site Selection and Planning	B	I	1	Yes	B
Physical Disturbance	Adversely affect habitat critical to the Brushtail Possum	Terrestrial ecosystems	Vehicle and plant movements (including mulching)	B	II	1	• Seismic lines ground-truthed, and a 50 m working corridor implemented to maximise traversability without mulching. • Mulching of trees with a trunk diameter greater than 25 cm at 1.3 m above the ground avoided, where possible, utilizing the tree mulching decision tree. • Riparian areas ground-truthed by Fauna Spotter to verify area where mulching is limited to mowing/slashing where practicable. • Slashing will be used in no mulch regions. • Water crossing conduced at 90 degrees. • Where possible, the number of times a watercourse without a formed crossing is traversed on a seismic line will be limited to once per stage of the Activity.	A.3.1 Site Selection and Planning	A	II	1	Yes	B

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
							• Fauna Spotter to precede line preparation vehicles.						
Physical Disturbance	Adversely affect habitat critical to the Yellow-spotted Monitor. Mertens' Water Monitor	Terrestrial ecosystems	Vehicle and plant movement (including mulching)	C	III	2	• Seismic lines ground-truthed, and 50 m working corridor implemented to maximize traversability without mulching. • Slashing will be used in no mulch regions. • Riparian areas ground-truthed by Fauna Spotter to verify area where mulching is limited to mowing/slashing where practicable. • Water crossing conducted at 90 degrees. • Where possible, the number of times a watercourse without a formed crossing is traversed on a seismic line will be limited to once per stage of the Activity. • Fauna Spotter to be present during line preparation.	A.3.1 Site Selection and Planning	C	II	2	Yes	B
Physical Disturbance	Adversely affect habitat critical to the Crested Shrike-tit	Terrestrial ecosystems	Mulching vegetation	A	II	1	• Seismic lines ground-truthed, and 50 m working corridor implemented to maximise traversability without mulching. • Mulching of trees with a trunk diameter greater than 25 cm at 1.3 m above the ground avoided utilising the tree mulching decision tree. • Fauna Spotter to be present during line preparation. • Slashing will be used in no mulch regions.	A.3.1 Site Selection and Planning	C	I	1	Yes	B
Physical Disturbance	Adversely affect habitat critical to the Bluetongue Lizard habitat	Terrestrial ecosystems	Mulching vegetation	B	II	1	• Seismic lines ground-truthed, and a 50 m working corridor implemented to maximize traversability without mulching. • Riparian areas ground-truthed by Fauna Spotter to verify areas where mulching is limited to mowing/slashing where practicable. • Fauna Spotter to be present during line preparation. • Slashing will be used in no mulch regions.	A.3.1 Site Selection and Planning	A	II	1	Yes	B
Physical Disturbance	Disturbance to soil Compaction of soils Erosion of soil due to loss of vegetative cover	Terrestrial environmental quality	Mulching and vehicle and plant movements	F	I	2	• The temporary campsite will be in a previously cleared area. • Existing access tracks and roads used for access. • Where possible, existing tracks and roads will be utilised for surveys to eliminate the need for additional line preparation. • Where necessary, line preparation will be conducted using a mulcher, which simultaneously cuts, mulches, and spreads the mulch on the seismic or connection line. • Slashing will be used in no mulch regions. • The slasher and mulcher leave rootstock intact to reduce erosion and facilitate rehabilitation.	A.3.1 Site Selection and Planning A.3.9 Rehabilitation	C	I	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
							• The mulcher/slasher prepares a 5 m width within an indicative 50 m corridor so seismic vehicles can deviate around dense vegetation and landforms. • The mulcher will be used "mulcher up" to avoid disturbance in easily traversable terrain. • Weather checked daily to determine if the Activity will commence. • Fauna Spotter to pre-scout and identify riparian areas to verify area where mulching limited to mowing/slashing where practicable. Riparian area start and stop points to be input into navigation system. • Riparian vegetation decision tree to be used before traversing riparian vegetation. • Immediately protect the soil surface after mulching with mulch to the greatest extent possible. • The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed.						
Physical Disturbance	Damage to culturally sensitive sites Indirect impacts on sensitive site	Culture and Heritage	Mulching and vehicle and plant movements	C	III	2	• Disturbance is restricted to subject land as set out within the AAPA Authority Certificates and will avoid the restricted work areas in the Certificates during line preparation. • Known sites of sacred or cultural significance have been identified and will be avoided. • Any new sites identified during the Activity will be reported to the NT Heritage Branch. • Maintain GIS database of Project Area and cultural heritage sites, including details of any works conditions. • Provide information to personnel and contractors of Sacred Site water hole that may be impacted by sediment release during watercourse crossing. • Site inductions include details of controls in the Spill Management Plan. • Spill kits available to treat spills in situ. • Erosion and sediment controls implemented in accordance with the ESCP (**Section 7.1**). • The Activity will not commence if there has been any rainfall in the previous 24 hours within the Project Area until ground conditions have been assessed.	A.3.1 Site Selection and Planning	A	III	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
							• Where possible, the number of times a watercourse without a formed crossing is traversed on a seismic line will be limited to once per stage of the Activity. • No crossing of watercourses on line 12 in wet conditions. • Seismic lines inspected for erosion during rehabilitation activity.						
Groundwater Extraction	Reduction in groundwater quantity	Hydrological processes	Use of groundwater for the Activity	B	III	2	• Groundwater for track maintenance and dust suppression, if required, will be extracted from existing licenced bores. • The water use for the Activity is small.	C.6.1 Water and wastewater tracking and reporting requirements	A	III	1	Yes	A
Groundwater Extraction	Reduction in groundwater available for other users	Community and Economy	Use of groundwater for the Activity	B	III	2	• Groundwater for track maintenance and dust suppression, if required, will be extracted from existing licenced bores. • The quantity of water required is not expected to have any significant impact on the aquifer.	C.6.1 Water and wastewater tracking and reporting requirements	A	III	1	Yes	A
Creation of Dust	Smothering of flora	Terrestrial environmental quality	Mulching and vehicle and plant movements	F	II	3	• Line preparation will be done using a mulcher/slasher. • Mulching/slashing of seismic lines will reduce their potential to create dust. • Driving will only be permitted on designated access roads and seismic lines. • Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines. • Activity to be completed within a short timeframe. • Water trucks used to suppress dust on access tracks if required.	No section directly applicable.	B	II	1	Yes	A
Creation of Dust	Loss of amenity	Community and economy Air quality	Mulching and vehicle and plant movements	F	II	3	• Line preparation will be done using a mulcher/slasher. • Mulching/slashing of seismic lines will reduce their potential to create dust. • Driving is only permitted on designated access roads and seismic lines. • Speeds on unsealed roads will be limited – a maximum 60 km/hr on unsealed roads and 40 km/hr on seismic lines. • Activity to be completed within a short timeframe. • Water trucks used to suppress dust on access tracks, if required.	No section directly applicable.	B	II	1	Yes	A
Creation of Dust	People inhaling dust	Human health Community and economy	Mulching and vehicle and plant movements	F	II	3	• Line preparation will be undertaken using a mulcher/slasher. • Mulching/slashing of seismic lines will reduce the potential to create dust.	A.3.1 Site Selection and Planning	B	II	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
		Air quality					• Driving is only permitted on designated access roads and seismic lines. • Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads and 40 km/hr on seismic lines. • Water trucks used to suppress dust on access tracks, if required.						
Creation of Vehicle and Plant Emissions	Reduction in air quality	Air quality Atmospheric processes	Vehicle and plant movements creating air emissions	C	II	2	• Vehicles and fixed plant maintained to OEM maintenance schedule. • Vehicles compliant with Northern Territory Motor Vehicle registration requirements and Work Health and Safety Regulations.	A.3.1 Site Selection and Planning	B	II	1	Yes	A
Noise and Vibration from the Activity	Disturbance to native fauna	Terrestrial environmental quality	Vehicle movements and seismic equipment generating noise and vibration	D	II	2	• Vehicles and fixed plant maintained to OEM maintenance schedule. • The Activity timeframe is short in duration.	A.3.1 Site Selection and Planning A.3.3 Noise	B	II	1	Yes	A
Noise and Vibration from the Activity	Disturbance to landholders	Community and economy	Vehicle movements and seismic equipment generating noise and vibration	D	II	2	• Vehicles and fixed plant maintained to OEM maintenance schedule. • The Activity will be restricted to daylight hours. • Land access agreement in place. • Seismic activity transient and short in duration relevant to noise impacts to a point source receptor (e.g., maximum noise level to be less than 15 minutes in duration).	A.3.1 Site Selection and Planning A.3.3 Noise	B	II	1	Yes	A
Light from the Activity	Disturbance to native fauna	Terrestrial environmental quality	Vehicles and seismic equipment operating at night Lighting from campsite	F	II	3	• The Activity will be restricted to daylight hours.	A.3.1 Site Selection and Planning	B	II	1	Yes	A
Light from the Activity	Disturbance to landholders	Community and economy	Vehicles and seismic equipment operating at night	F	II	3	• The Activity will be restricted to daylight hours.	A.3.1 Site Selection and Planning	B	II	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
			Lighting from camp										
Fauna Interaction with Mobile Plant and Vehicles	Disturbance, injury, or death to terrestrial fauna	Terrestrial environmental quality	Vehicles and seismic equipment	E	I	2	• Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads and 40 km/hr on seismic lines. • Driving is only permitted on designated access roads and seismic lines. • Fauna Spotter present during line preparation. • Driving at night is prohibited except in cases of emergency or unforeseen circumstances such as vehicle breakdown.	A.3.5 Biodiversity protection	C	I	1	Yes	A
Livestock Interaction with Mobile Plant and Vehicles	Disturbance, injury to, or death of livestock	Community and economy	Vehicles and seismic equipment	E	I	2	• Relevant landowners and occupiers notified prior to commencement of the Activity. • All gates are left in the condition they were found (i.e., open/closed). • All fences restored to the satisfaction of landowner/managers. • Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads and 40 km/hr on seismic lines. • Fauna Spotter present during line preparation.	A.3.5 Biodiversity Protection	C	I	1	Yes	A
Introduction and Spread of Weeds	Loss of native vegetation through competition for resources	Community and economy Terrestrial environmental quality Terrestrial Ecosystems	Plant and vehicles carrying weeds from outside the Project Area Spread of weeds in Project Area through mulching and vehicle movements	D	III	3	• Comply with the approved Weed Management Plan. • Dedicated Weed Officer. • Vehicle inspections and clearance certificates.	A.3.1 Site Selection and Planning A.3.6 Weed Management	B	III	2	Yes	A
Introduction and Spread of Weeds	Loss of pasture through competition for resources	Community and economy	Plant and vehicles carrying weeds from outside	D	III	3	• Comply with the approved Weed Management Plan. • Implement a Dedicated Weed Officer. • Vehicle inspections and clearance certificates.	A.3.1 Site Selection and Planning A.3.6 Weed Management	B	III	2	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
			the Project Area Spread of weeds in Project Area through mulching and vehicle movements										
Fire	Disturbance to or death of terrestrial fauna	Community and economy Terrestrial environmental quality Terrestrial Ecosystems	Ignition sources from plant and machinery Smoking	D	III	3	• All vehicles will be equipped with portable fire extinguishers. • Machinery and vehicles should be parked in areas of low fire risk. • Any petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters. • All vehicles will be equipped with operational VHF and/or UHF radio transceivers. • Smoking will only be permitted in designated areas; all butts will be disposed in specially designed receptacles. • Monitor North Australian Fire Management (NAFI) annual fire mapping. • Fauna Spotter during line preparation. • All personnel will receive an induction prior to the commencement of the Activity relating to the following: o The Emergency Response Plan. o The operation of portable fire extinguishers and communications equipment. o Smoking restrictions. o Compliance with the Fire Management Plan. • During operations, daily toolbox meetings will be conducted to: o Alert the workforce of the fire risk level for the day. o Discuss any fire incidents and near misses and remedial actions. o Reinforce compliance with the Fire Management Plan.	A.3.1 Site Selection and Planning A.3.7 Fire Management	B	III	2	Yes	A
Fire	Injury to or death of livestock, loss of pasture,	Community and economy	Ignition sources from plant and machinery	D	III	3	• All vehicles will be equipped with portable fire extinguishers. • Machinery and vehicles parked in low fire risk areas.	A.3.1 Site Selection and Planning	B	III	2	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
	dwellings, and infrastructure		Smoking				• All petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters. • All vehicles will be equipped with operational VHF and/or UHF radio transceivers. • Smoking will only be permitted in designated areas, all butts disposed in specially designed receptacles. • Monitor North Australian Fire Management (NAFI) annual fire mapping. • Fire Tender present during line preparation. • All personnel will receive an induction prior to the commencement of the Activity relating to: o The Emergency Response Plan. o The operation of portable fire extinguishers and communications equipment. o Smoking restrictions. o Compliance with the Fire Management Plan. • During operations daily toolbox meetings will be conducted to: o Alert the workforce of the fire risk level for the day. o Discuss any fire incidents and near misses and remedial actions. o Reinforce compliance with the Fire Management Plan.	A.3.7 Fire Management					
Disturbance to Landholder	Disturbance to landholders' operations	Community and economy	Vehicle and plant movements	D	II	2	• Relevant landowners and occupiers are notified before the commencement of the Activity. • Inductions for all employees and contractors cover pastoral, conservation, legislation, and infrastructure issues. • System is in place for logging public/landholder complaints to ensure that issues are addressed. • Any damage to station tracks and fences is reported and restored to the satisfaction of landowner/managers. • All gates are left in the condition they were found (i.e., open/closed). • Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads and 40 km/hr on seismic lines. • Seismic sources are not to operate within the distance defined by the Interest Holder's standards of any pipeline, utility, installation, or building.	A.3.1 Site Selection and Planning D.1 Overview	B	II	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
Chemical and Fuel Leaks and Spills	Impact to soil quality	Community and economy Terrestrial environmental quality	Inappropriate storage or handling of hazardous substances Poor refuelling or fuel transfer practices	D	III	3	• Spill kits available to treat spills in situ. • Minimise fuel transfer where possible. • Site inductions include details of controls in the Spill Management Plan. • No refuelling near riparian buffers. • Use of drip trays for transfers. • Any spills contained and remediated. • Fuel and lubricants will be stored and managed in accordance with AS1940. • Compliance with the Spill Management Plan. • All contaminated materials/waste stored at the temporary campsite is in appropriate containers or bunds to prevent off-site release. • Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment. • During operations daily inspections of chemical storage area and secondary containment (**Table 8.7—1 Environmental Monitoring Program**). • Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request. • Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (**Appendix 05**). • Comply with **Section 7.7.6.2** *Contingency Plan for Bogged Vehicles Transporting Chemicals* of the Spill Management Plan.	A.3.8 Containment of contaminants A.3.9 Rehabilitation B.4.16 Site material and fluids management C.7.2 Spill management plan	B	III	2	Yes	A
Chemical and Fuel Leaks and Spills	Reduction in surface water and groundwater quality	Inland water environmental quality Community and economy	Inappropriate storage or handling of hazardous substances Poor refuelling or fuel transfer practices	D	III	3	• Spill kits available to treat spills in-situ. • Minimise fuel transfer where possible. • Site inductions include details of controls in the Spill Management Plan. • No refuelling near waterways. • Use of drip trays for transfers. • Any spills contained and remediated. • Fuel and lubricants will be stored and managed in accordance with AS1940.	A.3.8 Containment of contaminants A.3.9 Rehabilitation B.4.16 Site material and fluids management	B	III	2	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
							• Compliance with the Spill Management Plan. • All contaminated materials/waste stored at the temporary campsite is in appropriate containers or bunds to prevent off-site release. • Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment. • During operations daily inspections of chemical storage area and secondary containment (**Table 8.7—1 Environmental Monitoring Program**). • Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request. • Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (**Appendix 05**). • Comply with **Section 7.7.6.2** *Contingency Plan for Bogged Vehicles Transporting Chemicals* of Spill Management Plan.	C.7.2 Spill management plan					
Irrigation of Treated Effluent (if needed)	Reduction in surface water quality	Inland water environmental quality	Irrigation of treated effluent in an area where it can enter waterways	D	III	3	• Treated effluent sprayed in an irrigation area 50-100 m away from the camp in a place where it is reasonably unlikely to enter any waterways. • Personnel will be advised to minimise water usage when using showers, in the kitchen, etc, to reduce volumes of greywater generated. • Irrigation will be done in a manner to minimise spray drift and ponding. • During operations daily inspections to confirm controls are complied with and records kept. • Fencing will be installed around the irrigation area. • The STP will be designed to comply with, and all wastewater will be disposed of, in accordance with the *Public and Environmental Health Regulation 2014* and the NT's *Code of Practice for Wastewater Management* [DoH, 2014].	A.3.8 Containment of contaminants A.3.9 Rehabilitation B.4.16 Site material and fluids management C.7.2 Spill management plan	B	III	2	Yes	A
Fauna Interaction	Fauna attracted to waste	Terrestrial environmental quality Community	Waste stored inappropriately	F	II	3	• Waste will be segregated and stored on-site, and all putrescible waste material will be held in fauna-proof containers. • Other than waste from approved wastewater systems and grey water, there will be no disposal of waste to the natural environment.	C.3.1 Waste management hierarchy	B	II	1	Yes	A

Risk Type	Potential Impact	Relevant Environmental Factor	Risk Source	Initial Risk Ranking			Mitigation and Management Measures		Residual Risk Ranking			Effective Controls	Uncertainty Ranking
				L	C	R	EMP Commitments	Relevant section of *the Code*	L	C	R		
		and economy					• A licenced waste contractor will be used for any off-site transfer or disposal. Tracking or other records to be kept. • Compliance with the Wastewater Management Plan. • During operations daily inspections of the designated waste disposal area and the effluent hoses and irrigation area to ensure no visible leaks or pooling. • Daily inspection reports will be created during operations and maintained.						

7. Management Plans

In addition to this EMP, the following management plans have been developed to reduce the impact of the Activity on the surrounding environment and community.

7.1 Erosion and Sediment Control Plan

7.1.1 About the Authors – Suitably Qualified Persons

This Erosion and Sediment Control Plan has been prepared by professionals using their skill and care acquired through education, training, and experience in the subject matters of environment, safety, risk management and petroleum development and operations.

Table 7.1—1 Suitably Qualified Authors

Name	Position	Qualifications	Years of Experience
Nicholas Fraser	Environmental Engineer	Bachelor of Environmental Engineering (Hons)	9
Peter Shaw	Environmental Specialist	Bachelor of Laws, Bachelor of Science (Hons)	44
Vic Farrington	Environmental Engineer and Scientist	BE(Chem), MAppSc, MBE, Cert. Env Assessment	44

7.1.2 Background

Erosion is an intrinsic element of the environmental cycle, instrumental in shaping landscapes, rejuvenating ecosystems, and facilitating the natural redistribution of soil and nutrients. However, unchecked human activities can expedite this process. Several factors influence the soil's vulnerability to erosion, including but not limited to its composition, terrain slope, the degree of land disturbance, and prevailing climatic conditions.

To that end, the selected seismic lines and acquisition methodologies are designed to minimize soil impact and, as a result, mitigate potential erosion from the Activity. The Activity adopts a flexible seismic acquisition path based on ground-truthing and desktop surveys.

On-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland (up to 85%). Therefore, traversing without line preparation will be feasible for much of the seismic line length. The nominal 50 m seismic line working corridors allow deviation around potential obstacles where practicable and cultural sites can be avoided. Mature trees, trees with active hollows or nests selected for preservation, would be recorded, and flagged to ensure their protection.

Line preparation may be needed to enable safe passage for the seismic vehicle convoy and to provide sufficient ground contact for the vibro-source and geophones. The slasher 'mows' grass and the mulcher cuts and mulches vegetation and spreads the mulch on the seismic line for minimal impact and rapid rehabilitation. During preparation the soil is not disturbed, and the vegetation rootstock is not cleared. The mulcher operates with the mulcher up when mulching is not required (refer to **Section 3.5.2**).

The working corridor permits the seismic team to avoid areas with significant slopes or other obstacles, opting for more favourable routes. The use of rotary machines significantly reduces land disturbance associated with the Activity. **Section 4** of this EMP reviews the characteristics of the Project Area's physical environment, elements that were fundamental in crafting this Erosion and Sediment Control Plan (ESCP).

7.1.3 Objectives and Implementation

This ESCP has been prepared to provide a best-practice framework for the implementation of effective erosion and sediment control measures, associated with the Interest Holder's Activity within the designated Project Area.

The objectives of the ESCP include:

- Implementing reasonable and practical measures to minimise the actual or potential environmental damage caused by soil or water displacement resulting from the Activity.
- Preserving, and where feasible, augmenting the land use capacities of disturbed areas, particularly in relation to the land's soil, water, and vegetation attributes.
- Preventing soil erosion from the site and its subsequent deposition off-site, while minimising associated risks to water and air quality.
- Demonstrating satisfactory stabilisation of the site upon the conclusion of the works.

ESC measures at the temporary camp located on the Tanumbirini well pad will be according to a previously implemented ESCP detailed in **Section 7.1.6**.

Seismic line preparation will be consistent with the *NT Land Clearing Guidelines (LCG)* [DEPWS, 2020, 2021] and avoid cultural heritage sites as further detailed in **Section 4.4.2.3**.

7.1.4 Erosion Hazard

Erosion hazard is assessed using the Revised Universal Soil Loss Equation – RUSLE [IECA, 2008]. This is commonly used to predict the long-term, average, annual soil loss from sheet and rill erosion under specified management conditions.

The RUSLE is represented by the following equation:

$$A = R * K * LS * P * C$$

where:

A = Annual soil loss due to erosion [t/ha/yr]

R = Rainfall erosivity factor

K = Soil erodibility factor

LS = Topographic factor derived from slope length and slope gradient

P = Erosion control practice factor

C = Cover and management factor

The RUSLE was used to calculate annual soil loss due to erosion [t/ha/yr] for Tanumbirini as part of the *McArthur Basin 2019 Civils and Seismic Program Environmental Management Plan* (historic ESCP*)* (Ref: NTEPA2019/0032-007~0005). Unlike the historic ESCP, the Activity covered by this EMP has a narrower Project Area and does not include soil disturbing clearing. Therefore, factors applied in that ESCP have been refined where necessary.

Rainfall Erosivity (R-factor)

The rainfall erosivity factor (R-factor) is a measure of the ability of rainfall to cause erosion. It is a product of two components: total energy (E) and maximum 30-minute intensity for each storm [Landcom, 2004]. The R-factor is an input component in measuring estimated soil loss using the RUSLE calculation. The adopted annual R-factor for the Project Area is 8,464 (Katherine); provided by the Darwin Harbour Advisory Committee Research Group.

Erodibility (K-factor)

The K-factor is a numerical representation of the ability of soils to resist the erosive energy of [IECA, 2008]. Soil samples were collected in EP 161 for the historic ESCP, and of these, Sample ID numbers ESCP 4 and ESCP 6 were taken from the Project Area covered by this EMP. These soil samples, along with the desktop soil analysis discussed in **Section 4.1.4**, indicate that the soil textures in the working corridor areas are representative of Sand and Clayey Sand. The default K-factors for these soil textures range from 0.015 to 0.025. A K-factor of 0.025 represents the highest observed erodibility for clayey sand soil based on texture, as per *IECA 2008* Table E4 [IECA, 2008]. Therefore, this value has been conservatively adopted for all calculations.

Slope (LS-factor)

The LS-factor describes the combined effect of slope length and slope gradient on soil loss. The slope as shown in **Figure 4.1—1** is variable but on average is below 2%. As discussed in **Section 4.1.2** seismic lines 6-12 intersect a drainage divide that separates the Gulf Falls and Upland bioregion of the northern lines from the Sturt Plateau bioregion to the south. As such, the seismic lines have been segmented and their corresponding slope profile are presented in **Table 7.1—2**. To present a

conservative estimate reflecting a worst-case scenario, the largest average slope for each seismic group slope profile is presented in **Table 7.1—3**.

Table 7.1—2 Seismic Line Slope Profile Split by Region

Seismic Lines	Average	Mode	Median
MCSAN23 01A to 01B	1.16%	0.10%	0.70%
MCSAN23 02A to 02B	1.18%	0.10%	0.70%
MCSAN23 03A to 03B	1.20%	0.10%	0.70%
MCSAN23 04A to 04B	1.21%	0.20%	0.70%
MCSAN23 05A to 05B	1.10%	0.20%	0.70%
MCSAN23 06A	1.09%	0.20%	0.60%
MCSAN23 06B to 06C	0.78%	0.10%	0.50%
MCSAN23 07A	1.10%	0.10%	0.60%
MCSAN23 07B to 07C	0.85%	0.10%	0.60%
MCSAN23 08A	0.95%	0.20%	0.60%
MCSAN23 08B to 08C	0.95%	0.10%	0.70%
MCSAN23 09A	1.13%	0.30%	0.50%
MCSAN23 09B to 09C	0.99%	0.10%	0.70%
MCSAN23 10A	1.14%	0.10%	0.50%
MCSAN23 10A to 10C	0.98%	0.40%	0.60%
MCSAN23 11A	0.99%	0.20%	0.50%
MCSAN23 11B to 11C	1.18%	0.20%	0.80%
MCSAN23 12A	0.99%	0.20%	0.60%
MCSAN23 12C to 12D	1.37%	0.10%	0.90%

Table 7.1—3 Seismic Line Group – Average Slope Profile

Seismic Lines Groups	Max Average Slope for Group (%)
Seismic Lines 1 - 5	1.21%
Seismic Lines 6A - 12A	1.14%
Seismic Lines 6B - 12B	1.37%

IECA LS-factors are in whole increments, so to ensure calculations are conservative, a 2% slope gradient will therefore be adopted for each line.

Slope length is the horizontal distance of surface flow to a channel or where the slope decreases, and accumulation begins. The slope length is conservatively estimated to be 20 m. This provides a 0.24 LS factor (as per IECA 2008 Table E3).

Cover and Management Factor (C-factor)

The cover and management factor (C-factor) is a measure of the level of soil surface protection provided by various groundcovers. Due to equipment selection, the soil is not disturbed, and the vegetation rootstock is not cleared; therefore, a C-factor of 0 is likely. Similarly, due to site selection, 85% of the area is highly traversable, further supporting a C-factor of 0.

However, to conservatively reflect a worst-case scenario, no canopy cover has been assumed and, although grass cover is substantial within the working corridors, a sparse ground cover has been selected. The cover at the surface, consisting of grass and grass-like plants, will be at least 50 mm deep. As per IECA 2008 Table E10 the C-factor for each seismic line group based on these conservative values is shown below **Table 7.1—4**.

Table 7.1—4 Seismic Lines C-factor

Seismic Lines Groups	Conservative Ground Cover (%)	C-factor (no appreciable cover)
Seismic Lines 1 - 5	60	0.01
Seismic Lines 6A - 12A	40	0.04
Seismic Lines 6B - 12B	60	0.01

P-Factor

The P-factor measures the combined effect of all support practices and management variables. It also represents structural methods for controlling erosion. The P-factor is reduced by practices that reduce both the velocity of runoff and the tendency of runoff to flow directly downhill. At construction sites, it reflects the roughening or smoothing of the soil surface by machinery [IECA, 2008]. Although no construction planned as part of the Activity a P-factor for compacted and smooth conditions of 1.3 will be adopted as per IECA Table E11 [IECA, 2008].

Soil Loss

Potential soil loss calculations and associated erosion hazard for seismic line groups are provided in **Table 7.1—5**.

Table 7.1—5 Seismic Lines – Soil Loss & Erosion Hazard

Seismic Line Groups	Seismic Lines 1-5	Seismic Lines 6A-12A	Seismic Lines 6B-12B & Connection Lines
Rainfall Erosivity	8464	8464	8464
Soil Erodibility (K)	0.025	0.025	0.025
Length / Gradient (LS)	0.24	0.24	0.24
Erosion Control Practice (P)	1.3	1.3	1.3
Ground Cover in Disturbed Catchment (C)	0.04	0.1	0.04
Soil Loss (t/ha/yr)	2.6	6.6	2.6
Soil Loss Class	1	1	1
Erosion Hazard	Very Low	Very Low	Very Low

7.1.5 Erosion Risk

The provisional Activity schedule, detailed in **Section 3.2**, is set to commence in Q3 of 2024. Merging regional rainfall data with the erosion risk assessment from the International Erosion Control Association (IECA) reveals that until November there is a very low - moderate erosion risk.as shown in **Table 7.1—6**. If unseasonal rainfall does occur the Activity's timing may be deferred to coincide with drier conditions, depending on the actual ground conditions.

Table 7.1—6 Project Area IECA Erosion Risk Rating by Month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tanumbirini Station	202.4	177.9	118.2	23.6	2.3	4.8	3.2	1.2	5.4	22.3	50.2	122.2
Erosion Risk	High			Very Low							Moderate	High

Notes: Very Low (less than 30 mm), Low (30-45 mm), Moderate (45-100 mm), High (100-225 mm)

7.1.6 Existing Erosion and Sediment Control Plans

As part of the *McArthur Basin 2019 Civils and Seismic Program Environmental Management Plan* (Ref: NTEPA2019/0032-007~0005), an ESCP was developed by a Certified Professional in Erosion and Sediment Control (CPESC) for EP 161 and approved by DEPWS on 6 June 2019. This ESCP includes the ESC controls for the Tanumbirini well pad where the temporary camp will be placed.

The ESC measures for the Tanumbirini well pad and any of the access tracks constructed by the Interest Holder under this previously approved ESCP will continue to be observed.

7.1.7 Erosion and Sediment Control

The primary strategy for mitigating the adverse impacts linked to sedimentation is the prevention of erosion. As such, the Activity will be completed in a manner that minimises soil exposure to erosive elements, such as water and wind, after disturbance. Line preparation for the Activity will be undertaken by mulchers and slashers, which do not disturb the soil, and vegetation rootstock is left intact. Additionally, a mulcher immediately spreads mulch allowing the protection of soil to minimise the chance of erosion and promote natural rehabilitation.

The Activity will prioritise the use of areas of existing disturbance, and in easily traversable terrain, there will be no preparation. If traversing creeks, the least sensitive crossing point will be identified within the seismic working corridor. That is, the section of the bank with the lowest gradient or hardest surface.

The measures to be utilised encompass a range of management techniques, equipment utilisation, and vegetation-based practices. As discussed in **Section 7.1.4**, based on these practices, the Activity will have estimated soil loss rate of less than 9.4 t/ha/yr. According to IECA Table 4.5.1 [IECA, 2008], best practice for this rate does not require sediment controls of Type 1 - 3 (refer **Table 7.1—5**). Nonetheless, to ensure the Activity is conducted in an ALARP manner, the proposed controls are outlined as follows:

- Seismic convoy is to operate within a 50 m working corridor, allowing seismic vehicles to deviate around erosion sensitive areas such as dense vegetation, drainage lines, creek channels and steep banks.
- Undertake ALARP and acceptable line preparation by:

- Utilising existing disturbance areas (landowner fence lines, access tracks, firebreaks, etc.).
- Slashing or travelling mulcher-up in areas where the Activity can occur safely without mulching.

- Riparian areas verified by a Fauna Spotter and riparian vegetation decision tree (**Figure 3.5—13**) completed when crossing watercourses.
- Immediate protection of soil surface using a mulcher.
- Repeated driving along seismic lines by heavy vehicles will be avoided where possible, noting approximately 5% of seismic lines will require backtracking.
- Seismic lines and connecting lines will be inspected to after surveys are completed to identify erosion zones. Areas of concern, such as those with vehicle wheel tracks deeper than 15 cm or where wheel ruts could concentrate water flow during rainfall events, leading to severe rilling and gullying, will be treated. These areas will be treated by ripping the site perpendicular to the flow direction, which reduces water flow concentration during rainfall and prevents severe rilling and/or gullying.

7.1.7.1 Watercourse Crossing Points

The following controls will be implemented for all stream, drainage line, and waterway crossings:

- The Riparian Vegetation Decision Tree (**Figure 3.5—13**) will be completed.
- Where there are existing crossing points in the seismic working corridor, they will be used.
- Where there are no existing crossings in the seismic working corridor, the least sensitive crossing point will be identified and used. That is, the section of the bank with the lowest gradient or hardest surface, and where mulching is not required (see **Section 3.5.2**, **Figure 3.5—13** Riparian Vegetation Decision Tree).
- Crossing points to be marked e.g. flagging, and all vehicles will use the selected crossing point.
- Where possible, the number of times a watercourse without a formed crossing is traversed on a seismic line will be limited to once per stage of the Activity, i.e. line preparation, surveys/acquisition, and post-survey closure. One watercourse crossings (~1.4% of the new crossings) will be traversed more than once due to a dead end resulting in backtracking, during each stage of the activity, The remaining 70 new crossings will be crossed only once per stage of the Activity.
- All creek crossings to be undertaken at a 90° angle.
- If soil is disturbed immediately upslope of a watercourse, a flow diversion bank will be installed to redirect water flow.
- Watercourses with standing water greater than 10 cm likely support Type 2 GDE vegetation (refer **Section 4.3.3**) standing water will not be traversed.

7.1.7.2 Wet Weather Control Measures

The Activity for a particular day will not commence if there has been any rainfall in the previous 24 hours within the Project Area until;

- Ground conditions have been assessed as suitable for the type of work proposed for that day and also determined to be safe. Unsuitable ground conditions would include:
    - Areas of standing water greater than 10 cm along the proposed seismic line that cannot be avoided within the working corridor.
    - Boggy areas that cannot be avoided within the working corridor.
- Creek conditions have been assessed as suitable and safe. Creek levels greater than 15 cm and flowing water would be considered unsuitable and unsafe conditions. If creek conditions are determined to be unsuitable and unsafe for the work proposed for that day, alternative jobs may be undertaken that do not require a creek crossing.

7.1.8 Rehabilitation and Maintenance

While the Activity is not expected to significantly disturb the soil surface, the seismic and connecting lines will be inspected after the survey is complete to identify any areas where the Activity has substantially exposed the soil surface or caused wheel ruts. This work will make part of the survey demobilisation (refer **Section 3.2**)

Wheel ruts will be treated with light ripping (refer **Section 7.1.7**) and exposed soil will be stabilised with mulch. Any areas of major concern will be inspected regularly as part of the rehabilitation management plan until they meet erosion rehabilitation objectives are outlined in **Section 7.4**.

Some maintenance to existing tracks or fence lines used during the Activity could be required. This will be limited to ensuring that the tracks or fence lines used are restored to pre-use condition or better in consultation with the landowner.

7.1.9 Responsibilities

This ESCP provides a framework for managing erosion and sediment during the Activity. Specific roles and responsibilities are detailed below.

Table 7.1—7 ESCP Roles and Responsibilities

Role	Responsibilities
Project (Area) Manager	• Implementation and compliance with the Erosion and Sediment Control Plan. • Address complaints, non-conformances, and incidents associated with this plan.

Role	Responsibilities
	• Provide resources to complete monitoring, inspections and required maintenance of erosion and sediment controls.
Site Supervisors/Field Team Leaders	• Implement the requirements specified in the Erosion and Sediment Control Plan. • Ensure all staff, including sub-contractors, are inducted before work begins. • Perform visual inspections of erosion and sediment control measures, especially during or immediately after unseasonably high rainfall. • Ensure any assessment of ground conditions after a rain event in the Project Area is conducted and recorded. • Maintain erosion and sediment control measures where required. • Inform the Project (Area) Manager about incidents or non-conformances.

7.2 Weed Management Plan

Clause A.3.6 of *the Code* requires that a project specific weed management plan must be developed as part of the EMP which meets the requirements of the *Weed Management Planning Guide: Onshore Petroleum Projects 2019* (NT) and it must provide at least for the following:

- Baseline weed assessments prior to the Activity commencing.
- Ongoing weed monitoring.
- Provision of a dedicated weed officer.
- Consistency with statutory requirements including any relevant threat abatement plans under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

The dedicated weed officer for this Activity is outlined in **Table 7.2—1**.

A project-specific Weed Management Plan has been developed as part of the EMP, which meets the requirements of the *Weed Management Planning Guide: Onshore Petroleum Projects 2019* (NT) [DENR, 2019] and Clause A.3.6 of *the Code*. The Weed Management Plan is provided in **Appendix 03**.

Table 7.2—1 Dedicated Weed Officer Details

Name	Position	Skills	Years of Experience	Contact
James Laverty	Site Supervisor - Civils	Santos Onshore Biosecurity Management Induction. Weed control. Landowner liaison.	19	Lavo.laverty@santos.com

7.3 Fire Management Plan

7.3.1 Baseline Fire Information

Baseline fire information has been sourced from The North Australia and Rangelands Fire Information (NAFI) website and assessed [NAFI, 2021]. NAFI is independently funded by the Commonwealth of Australia through the Department of Industry, Science, Energy and Resources, and is managed through the Darwin Centre for Bushfire Research as a branch of the Charles Darwin University's Research Institute for the Environment and Livelihoods.

The NAFI is the most reliable source of NT bushfire data. Data obtained through the NAFI website has been reviewed and analysed, and the results are presented below.

The fire frequency and last burns to occur within EP 161 in the last 10 years are shown in **Figure 7.3—1** and **Figure 7.3—2**, respectively. Approximately 74% of the Project Area has not been burned since 2013; however, portions of the seismic line area have been burned within the last 5 years.

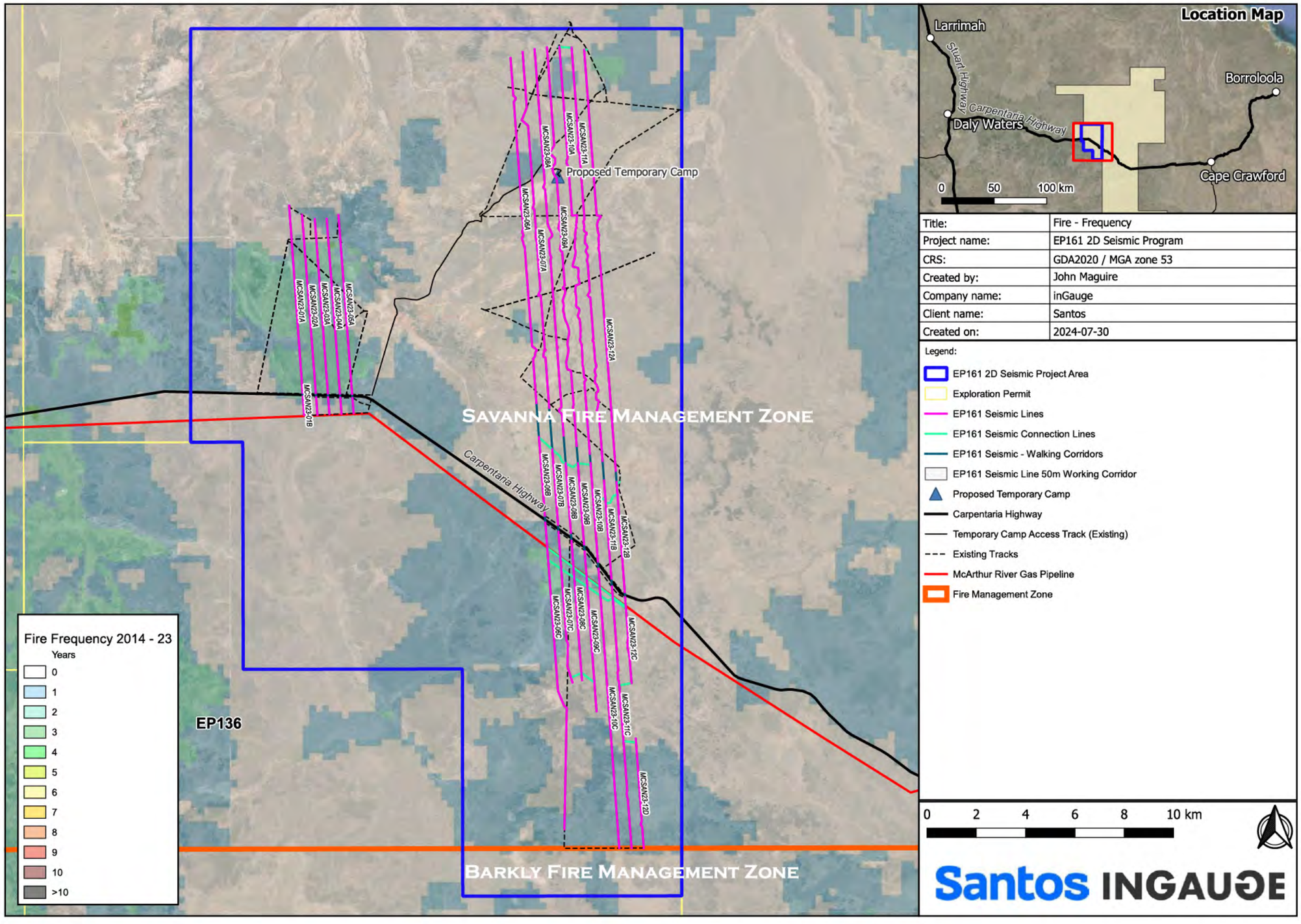


Figure 7.3—1 Fire Frequency within the Project Area

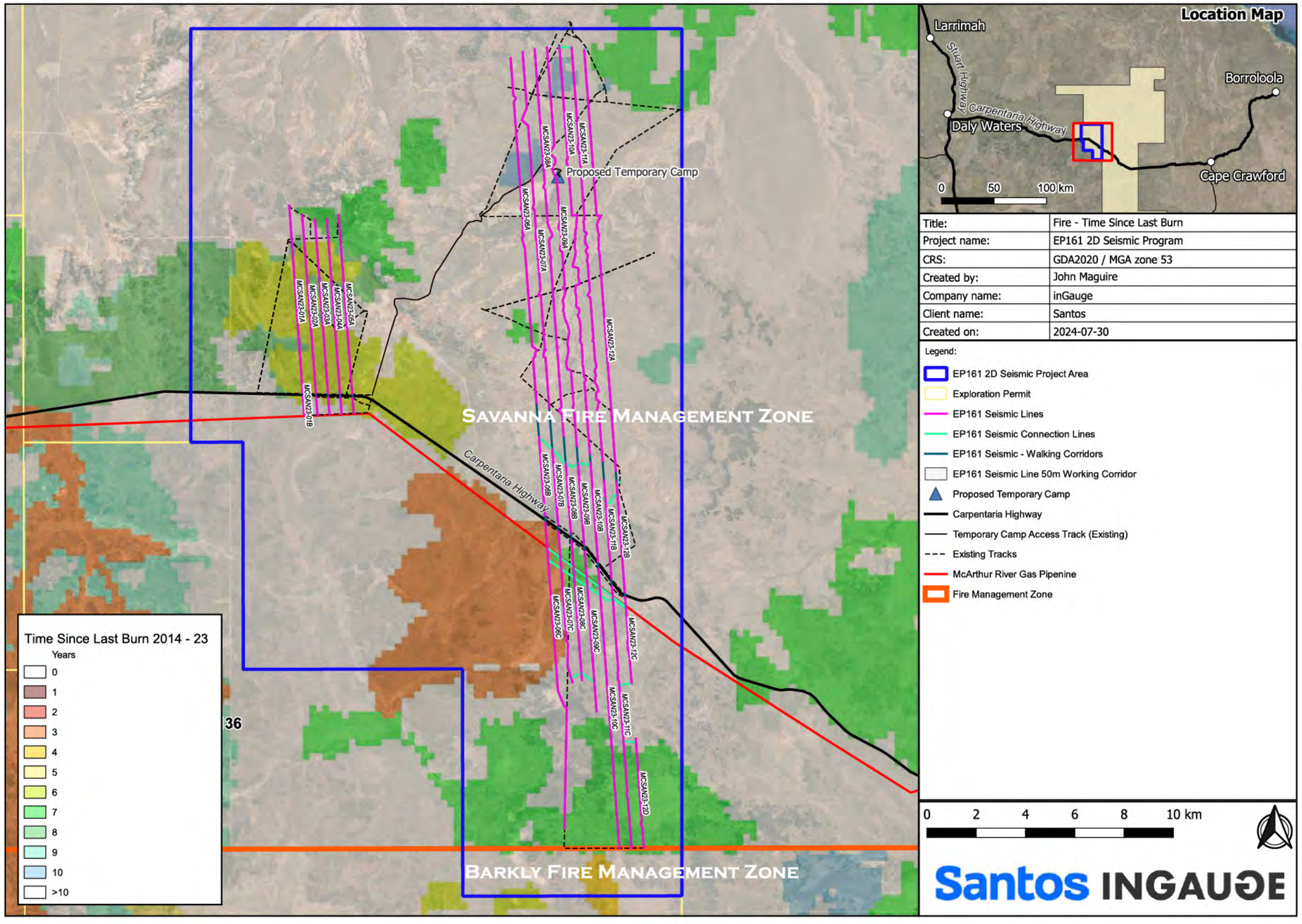


Figure 7.3—2 Time Since Last Burn

7.3.2 Fire Management

7.3.2.1 Coordination with Landholders and Other Land Users

The Activity will require a Land Access and Compensation Agreement with the landholder/s. Through this process, the Interest Holder will ensure that the Activity does not affect the landholder's fire management obligations and strategies.

The project lies within the Savanna Fire Management Zone in the Northern Territory. *The Savanna Regional Bushfires Management Plan 2022* has been developed to support community-wide fire management within the Savanna Fire Management Zone in line with the *Bushfires Management Act 2016 (NT)*.

The Activity does not include the use of fire and there will be no impact on fire management. This is consistent with the *Savanna Regional Bushfires Management Plan* and the Fire management objectives for petroleum exploration [DEPWS, 2018].

7.3.2.2 Fire Mitigation Measures

A temporary camp will be placed on the Tanumbirini well pad location. The Activity under this EMP includes a Fire Control Zone surrounding the Tanumbirini well pad location.

The objectives of a Fire Control Zone are:

- **Assets** - Protecting assets (resources, materials, and equipment) by removing fuel in their vicinity may be done using other means.
- **Safety** - Manage fire to maintain the safety of employees and visitors to site by removing vegetation and managing bushfire hazards that may arise from the use of machinery.
- **Neighbours** - Unplanned fires during exploration can quickly impact neighbouring properties where grass is a significant asset to their livelihoods.
- **Firebreaks** - Installation of a 10 m bare earth buffer around the campsite, and monitoring of fire access tracks for weeds, and spray, grade, or slash where appropriate.

The fire control zones are maintained under the McArthur Basin Hydraulic Fracturing 2019-20 Program Exploration Permit, EP 161 Revision 4, EMP, dated 14 October 2019. Communication of fire alerts will include:

- All personnel will receive information prior to the commencement of the Activity relating to:
    - Provisions of the Emergency Response Plan, including procedures during a fire emergency.
    - The operation of fire-fighting equipment and communications.
    - Restricted smoking requirements.
- Daily Toolbox meetings will be conducted to:

- Alert the workforce of the fire risk level for the day.
- Discuss any fire risk management breaches and remedial actions.

All project infrastructure will be designed and constructed to mitigate risks of ignition. Project-specific requirements to mitigate risks of ignition include:

- Fire-fighting equipment and competent fire-fighting personnel will be available.
- 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.
- Any petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters.
- All vehicles will be equipped with operational VHF and/or UHF radio transceivers.
- Smoking will only be permitted in designated areas, and butts will only be disposed of in specially designed receptacles.
- A Fire Tender present during line preparation.
- Fire-fighting water will be available at the temporary camp.

7.3.3 Annual Fire Mapping

Annual fire mapping to be completed during the annual survey of prepared areas to monitor changes to fire frequency in the Project Area will be conducted as per *Clause A.3.7.(a)(iii)* of *the Code*. The Interest Holder will use NAFI for the most up-to-date fire frequency.

In addition, if a fire occurs in the area immediately surrounding the Project Area during operations, the Interest Holder – in consultation with land managers – will map the extent of the fire's effects within the immediate area and provide DEPWS with the information.

7.3.4 Emergency Contacts

Emergency contacts are listed in **Table 7.3—1**.

Table 7.3—1 Emergency Contacts

Entity	Contact Details
Bushfire Northern Territory Head Office	(08) 8922 0840 – (08) 8922 0844 Bushfires.nt@nt.gov.au
National Response Centre	1800 076 251
Emergency	**000** or **112** (mobile)

Entity	Contact Details
NAFI Central	http://www.firenorth.org.au/nafi3/
Secure NT (Fire Bans)	https://securent.nt.gov.au/alerts
Fire Incident Map	https://pfes.nt.gov.au/incidentmap/

7.3.5 Fire Management Plan One-Pager

The Interest Holder has drafted a one-page, tailored Fire Management Plan to be completed by the seismic contractor, to be referenced in conjunction with the Emergency Response Plan (**Section 7.6**). The one-pager would be issued to personnel during site induction.

The draft Fire Management Plan one-pager is shown in **Table 7.3—2**.

7.3.6 Operational Fire Monitoring

The NT government has created a three-tier bushfire alert system. The three alerts are:

- **Advice** – Areas that have either a small fire that is controllable, planned fuel reduction burning, or an area likely to be affected by smoke.
- **Watch and Act** – An area that has a bushfire approaching a community that is changing with conditions or will threaten property or life if not controlled.
- **Emergency Warning** – An area that is in immediate danger from the bushfire, and you must act now to protect your life.

Other sources of information are the Northern Territory Government Secure NT website: **https://securent.nt.gov.au/alerts** and **Facebook (Bushfires NT)**.

Communication of these alerts will via the daily toolbox meetings. Where bushfire alert information becomes known after the toolbox meeting, the Onsite Company Representative (who is responsible for monitoring for bushfire alerts) will communicate to all site personnel.

Table 7.3—2 Draft Fire Management Plan 1-Pager

Santos

BUSHFIRE MANAGEMENT PLAN 2024 EP 161 SEISMIC SURVEY

STAKEHOLDER	CONTACT DETAILS	NAME
Santos Supervisor		
Site Supervisor		
EMERGENCY	000 or 112	
Katherine Fire Station	(08) 8973 8014	
Bushfires NT Katherine Office (Savanna)	(08) 8973 8876	
North Australian Fire Information Secure (NAFI)	www.firenorth.org.au/ https://securent.gov.au/alerts	
DEPWS	(08) 8999 5511	
Land Managers		Tanumbirini Station
Bushfire NT Head Office	(08) 8922 0844	
National Response Centre	1300 560 647	

FIRE MANAGEMENT

Property Land Used

→ Primary – cattle grazing
→ Secondary – gas exploration

Property Aim (Santos)

→ Undertake the Activity and its ancillary works with minimal impact on primary user/s.

Fire Management Objectives

→ Prevent human-induced bushfire ignitions that cause loss of life, damage to assets or environmental harm.
→ Be prepared in the event of a bushfire.
→ Protect the campsite and associated infrastructure and equipment.
→ Coordinate fire management actions with pastoralists.

Fire Management Risks

→ Ignitions (humans & lightning) on or off site resulting in harm to workers or loss of equipment.
→ Ignition during slashing or mulching.

PREPAREDNESS PLANNING

Site Supervisor to monitor fire danger ratings via the North Australia and Rangelands Fire Information (NAFI) website) daily during medium to high wildfire risk months.

Actions to be taken when based on the Australian Fire Danger Rating System:

Moderate: Plan and prepare

→ Discuss fire rating at pre-start meetings and emergency response protocols (if there is a fire.

High: Be ready to act

→ Be alert for fires in your area.
→ Discuss fire rating at pre-start meetings and emergency response protocols if there is a fire.
→ Decide what you will do if a fire starts. If a fire starts, your life and property may be at risk. Avoid bushfire risk areas.

Extreme: Act now to protect your life and property

→ Do not commence or continue work without assessing the risk of injury to personnel.
→ These are dangerous fire conditions.
→ Discuss emergency response protocols if there is a fire.
→ If a fire starts, take immediate action. If you and your property are not prepared to the highest level, go to a safer location well before the fire impacts.
→ Reconsider travel through bushfire risk areas.

Catastrophic: For your survival, leave bushfire risk areas

→ Cease work, turn off all plant and machinery and move to a fire safe area if safe to do so.
→ Evacuate the Project Area.
→ These are the most dangerous conditions for a fire. Your life may depend on the decisions you make, even before there is a fire.
→ Stay safe by going to a safer location early in the morning or the night before.
→ Infrastructure may not withstand fires in these conditions, you may not be able to leave, and help may not be available.

ANNUAL WORKS CALENDAR



FIRE MANAGEMENT ACTIONS AND MITIGATION MEASURES

Infrastructure Protection Buffer	→ Protect infrastructure and equipment by maintaining a ~10-metre bare earth buffer around the campsite.
Infrastructure Fire Exclusion	→ Ensure all vehicles are fitted with fire extinguishers and that all firefighting equipment and water supplies are checked regularly. → Ensure all machinery and vehicles will be parked in areas of low fire risk and be free of any combustible material. → Ensure staff/contractors are trained in the operation of firefighting equipment and are aware of this plan. → Site Supervisor is to monitor fire danger daily and liaise with the pastoralist if a fire threatens infrastructure. → Smoking will only be permitted in designated areas clear of vegetation and butts only disposed in specially designed receptacles. → An evacuation area/emergency muster point is established and clearly labelled in the event of an emergency.
Fire Access Trails	→ Co-locate fire access tracks with facility access tracks. → Monitor access tracks for weeds, and spray, grade, or slash where appropriate.

Wildfire/Bushfire Response

FIRE FIRST ACTIONS

Remove yourself and others from potentially dangerous situations.
Raise the alarm with the Interest Holder's Site Supervisor.
Identify the following:

→ Location
→ Immediate threats
→ Fire characteristics (what is burning, direction and travel speed)
→ Weather – wind strength and direction.

If possible, wait in a **safe** location for directions from the Site Supervisor or the Pastoralist and communicate this fact.

The Interest Holder's Site Supervisor will escalate the emergency as per the Site Emergency Response Plan (**Section 7.6**).

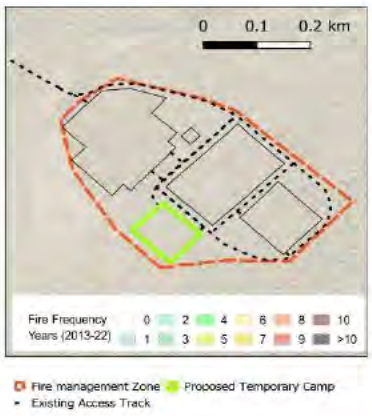
EP 161 FIRE MANAGEMENT ZONES AND FIRE FREQUENCY



Location of Project Area



Fire Management Zone



Fire Frequency

7.4 Rehabilitation Management Plan

7.4.1 About the Authors – Suitably Qualified Persons

This Rehabilitation Management Plan has been prepared by professionals using their skill and care acquired through education, training, and experience in the subject matters of environment, safety, risk management and petroleum development and operations.

Table 7.4—1 Rehabilitation Management Plan - Suitably Qualified Persons

Name	Position	Qualifications	Years of Experience
Nicholas Fraser	Environmental Engineer	Bachelor of Environmental Engineering (Hons)	9
Peter Shaw	Environmental Specialist	Bachelor of Laws, Bachelor of Science (Hons)	44
Vic Farrington	Environmental Engineer and Scientist	BE(Chem), MAppSc, MBE, Cert. Env Assessment	44

7.4.2 Aims

This Rehabilitation Management Plan (RMP) aims to outline the program for the rehabilitation of sites no longer required for ongoing or future works as per the requirements set out in the *Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019* (NT) (*the Code*). This RMP has been developed using the *Rehabilitation Plan Guide for Surface Disturbance: Onshore Petroleum Disturbance* [DEPWS, 2020].

7.4.3 Final Land Use and Rehabilitation Objectives

All significantly disturbed land put in place by the Interest Holder that is not required for ongoing or future petroleum works will be rehabilitated to as close as possible to its pre-disturbed condition, consistent with surrounding land uses and ecological values as compared to analogue sites.

For this project, rehabilitation will be undertaken on seismic and connection lines. Rehabilitation objectives are as follows:

- Stable and self-sustaining.
- Safe for the land users and wildlife.

- Returned to an agreed and close-to pre-disturbance level that requires little or no ongoing management.
- Re-instated to reflect the natural ecosystem/s or establish an alternative outcome that is commensurate with the surrounding land use.
- No declared weed infestations in the rehabilitated area that require management.

To verify rehabilitation is on track, analogue sites will be chosen to reflect the landforms being disturbed by the rotary machine. The analogue sites will be surveyed, assessed, and photographed before line preparation works commence to aid in the rehabilitation assessments.

7.4.4 Rehabilitation Approach

Rehabilitation site success is evaluated by comparing the disturbed sites to the pre-disturbance land condition assessment (analogue sites) and adjacent vegetation communities. To aid in the evaluation, the analogue sites (selected pre-works) will be surveyed to determine levels of species composition and richness.

The proposed rehabilitation approach is natural regeneration for the disturbed areas. Wherever practicable, vegetation will not be mulched, and vehicles will traverse (slashing may be required) over or around the vegetation instead.

It is estimated that 85% of the area of potential disturbance is made up of low-density woodland (74.6%), is already disturbed (4.4%) or is riparian (6.2%) (refer to **Table 4.2—3**). These areas will require minimal line preparation.

Where necessary, line preparation will be undertaken using a rotary machine. The mulcher or slasher simultaneously cuts, mulches vegetation, and spreads it on the seismic line so that the soil is not disturbed, and vegetation rootstock is left intact, allowing for rapid re-vegetation. This approach minimises ground disturbance and reduces the requirement for post-seismic rehabilitation works.

While most of the areas will naturally regenerate following the Activity, there is the possibility that specific areas (areas subject to erosion or where compacted) may require active rehabilitation works following the first wet season. Areas where additional rehabilitation works are identified during inspections will be managed in accordance with **Table 7.4—2** and **Table 7.4—3**.

7.4.4.1 Contamination Detected

If during the Activity or annual surveys, any contamination is detected the site supervisor will be notified who will take action as delineated within the SMS (refer **Section 8.2**). The Interest Holder will additionally notify the NT EPA as required by the *Waste Management and Pollution Control Act (WMPC Act) 1998* if:

- An incident occurs that may cause, spread or enhance contamination at a site (i.e. in accordance with section 14 of the *Waste Management and Pollution Control Act 1998*;
- If the level of the contaminant in, or on, soil is equal to or above a level of contamination set out in Schedule B1 of the *National Environment Protection (Assessment of Site Contamination)*

Measure 1999 (as amended 2013) (ASC NEPM) or other approved guideline value with respect to a current or approved use of the land, and people have been, or foreseeably will be, exposed to the contaminant; or

- The contaminant or a by-product has entered, or will foreseeably enter land, neighbouring land, the atmosphere, groundwater, or surface water, and is above, or will potentially be above, a level of contamination set out in Schedule B1 of the *ASC NEPM* or other approved guidelines and will foreseeably continue to remain equal to or above that level.

7.4.5 Commencement of Progressive Rehabilitation

The progressive rehabilitation of significantly disturbed land will be commenced as soon as practicable, but no longer than 12 months following cessation of activities on the land in accordance with Clause A.3.9(c) of *the Code*.

7.4.6 Rehabilitation Success Criteria

Rehabilitation success criteria are performance objectives against which rehabilitation success can be measured. Success criteria are used to assess rehabilitation trends and to determine if a site meets the desired outcomes.

Rehabilitation site success is identified through the information obtained in the pre-disturbance land condition assessment (baseline) and adjacent vegetation communities (analogue). To aid in the evaluation, the analogue sites (selected pre-works) will be surveyed to determine levels of species composition and richness.

After the Activity, the Interest Holder will work toward rehabilitation success based on the success measures set out in **Table 7.4—2**.

7.4.7 Monitoring and Maintenance Program

Rehabilitation monitoring will occur on an annual basis until rehabilitation areas have achieved the success criteria.

The Interest Holder will inspect and maintain areas being progressively rehabilitated in line with **Table 7.4—3**. All rehabilitation monitoring works are scheduled to occur before the defined wet season (or as recommended by an independent, suitably qualified person [SQP]); re-entry to the Project Area will be subject to weather/road conditions. Inspections and maintenance will occur during dry periods (outside of the wet season) where possible or as advised by SQP.

Following the guidance of the *Rehabilitation Plan Guide for Surface Disturbance: Petroleum Exploration*, a suitably qualified third party will conduct the final rehabilitation assessment and endorsement [DEPWS, 2020].

Table 7.4—2 Rehabilitation Success Measures

Objectives	Measurement Criteria
• Stable and self-sustaining landform with no erosion requiring ongoing maintenance.	• No severe/significant erosion to be present within the rehabilitation area. • No active erosion issues to be present on sensitive and/or erosion-prone land types identified during baseline surveys (i.e., drainage lines). • Less than 2% cover of minor erosion issues (i.e., stabilised, or likely to stabilise) across the rehabilitation area.
• Safe for land users and wildlife.	• No waste or rubbish associated with the Activity left in the Project Area.
• Returned to an agreed and close to the pre-disturbance level that requires little or no ongoing management. • Re-instated to reflect the natural ecosystem/s or establish an alternative outcome commiserate with the surrounding land use.	• Ground cover foliage is equivalent to 70% of the analogue site. This cover is likely to self-sustain over time, and rehabilitated areas will become ecologically integrated with surrounding areas (refer to **Table 7.4—3**). • Perennial species cover (i.e., woody species such as shrubs and small trees, and perennial grass/forb species if applicable) is equivalent to 70% of the analogue site. • The dominant flora species in the mid and ground layers (strata) is equivalent to 80% of the analogue site. • If canopy species are mulched, evidence that recruitment of dominant canopy species is occurring. ○ Areas where the dominant vegetation is Lancewood and Bullwaddy (slow-growing species) have established other pioneer species and have recruitment of the dominant species projected to reach 80% of the analogue site. • Rehabilitation area is equivalent to 50% of the organic litter and coarse woody debris of the analogue site. • There is evidence that native fauna is utilising habitat within the rehabilitation area, i.e. tracks, scats, burrows etc.
• No declared weed infestations in the rehabilitated area that require management.	• No establishment of weeds declared under the *Northern Territory Weeds Management Act 2001 (NT).*

Objectives	Measurement Criteria
	• Non-declared weed species (i.e., Buffel Grass) cover to be at similar levels (or less than) to baseline and/or surrounding areas.

7.4.8 Reporting

The Interest Holder will provide an annual rehabilitation survey report to DEPWS 90 days after the anniversary of the EMP approval date each year. The annual rehabilitation survey report will:

- Summarise progressive rehabilitation progress.
- Summarise the outcomes of annual rehabilitation monitoring of prepared areas against reference sites.
- Summarise maintenance works and corrective actions taken to improve rehabilitation outcomes.
- Include geospatial files for areas under rehabilitation.

7.4.9 Rehabilitation Management Plan One-Pager

The Interest Holder has drafted a one-page Rehabilitation Management Plan **Table 7.4—4** to provide a quick reference summary of the Plan.

Table 7.4—3 Inspection, Maintenance, and Reporting

Rehabilitation Phases	Rehabilitation Surveys	Methods	Measurable Attributes	Corrective Actions	Maintenance	Reporting
Planning and Design: No more than 12 months prior to seismic.	• Identify, establish, and survey analogue sites. • Survey vegetation and soil pre-disturbance.	• Ground truth geospatial data. • Survey, assess and document existing erosion issues.	• Ground cover (%). • The vegetation structure is recognisable as or is trending towards the dominant community. • Erosion (qualitative – photo evidence of scarring, rill/sheet erosion).	N/A	N/A	• Overview reports for analogue sites.
Stabilisation and Maintenance: During the Activity.	• Inspect and monitor.	• Visual inspection of seismic lines and mulching or slashing for potential ESC issues and weeds.	• No visible erosion. • No declared weeds.	• Erosion and Sediment measures implemented. • Weed management conducted.	• Repair and reinstate any ESC measures. • Remove weeds.	• Incident reports during operations, e.g., spills. • Inspection reports
Progressive Rehabilitation/Annual Inspection: Annually after completion of the Activity.	• Annually at the end of the defined wet season or as recommended by an SQP until success criteria are met.	• Inspect ESC measures and weed growth. • Inspect re-growth in comparison to analogue sites. • Weed inspections.	• Erosion - no visible scaring, drill/sheet erosion (photo evidence). • No declared weeds. • Comparable to analogue sites (e.g., Ground cover %, perennial cover %, community structure %, dominant species %, site stability, fire (frequency & intensity)).	• Dependent upon a third-party report or landowner feedback. • Erosion remediated if required. • Weed management conducted. • Additional seeding if required. • Soil amelioration if required.	• Repair and reinstate ESC measures. • Remove weeds.	• Annual inspection report.
Completion of Rehabilitation	• Final inspection by a suitably qualified person and landowner.	• Site inspection by a third-party SQP sign-off.	• As per rehabilitation success criteria outlined in **Section 7.4.6**.	• Dependent upon third-party report.	• Dependent upon third-party report.	• Handover report with the landowner. • Sign off on final Environmental Report.

Table 7.4—4 Draft One-Pager Rehabilitation Management Plan

Rehabilitation Management Plan (RP) EP 161				
Santos REHABILITATION PLAN 2024	**Project Area Details**		**Contact Details**	
	EP Number:	161	**Title of Responsible Person:**	NT Senior Supervisor Civil Works
	Project Activity:	2D Seismic Program	**Name:**	James Laverty
			Phone Number:	[redacted]
	Total Area of Surface Disturbance:	125 ha	**Email:**	[redacted]

Land Uses, Rehabilitation Objectives, and Risk

Land Uses:

- Cattle grazing, gas exploration.

Rehabilitation Objectives:

- Stable and self-sustaining (e.g., no visible erosion that requires maintenance).
- Safe for the land users and fauna.
- Returned to an agreed and close to the pre-disturbance level that requires little or no ongoing weed control measures.
- Re-instated to reflect the natural ecosystem/s or establish an alternative outcome commiserate with the surrounding land use.
- No declared weed infestations in the rehabilitated area that require management.

Rehabilitation Risks:

- Compaction by vehicles on seismic lines.
- Exposed land surface contributes to increased weed recruitment and increased fire intensity, decreasing revegetation success.
- Extreme weather events (e.g., flood, fire, cyclone, drought) that destroy immature vegetation/regeneration.
- Fauna grazing on seedlings reduces rehabilitation outcomes.

Rehabilitation Approach

- The line preparation crew operates within a 50m working corridor, which permits deviations to avoid key environmental sensitivities and enables the selection of areas with favourable natural conditions (e.g., minimal slope).
- To reduce the need for rotary machines and limit repeated travel on prepared lines, existing access tracks are prioritised.
- Rotary machines are used for line preparation so the soil is not disturbed, and the vegetation rootstock is not cleared.
- Decision trees utilised to assist in guiding line preparation.
- Mulched vegetation is immediately spread on the prepared line to reduce soil exposure and promote rapid rehabilitation.
- Annual inspections at the end of the wet season to inspect ESC measures and re-growth in comparison to analogue sites.

Project Area Vegetation Communities





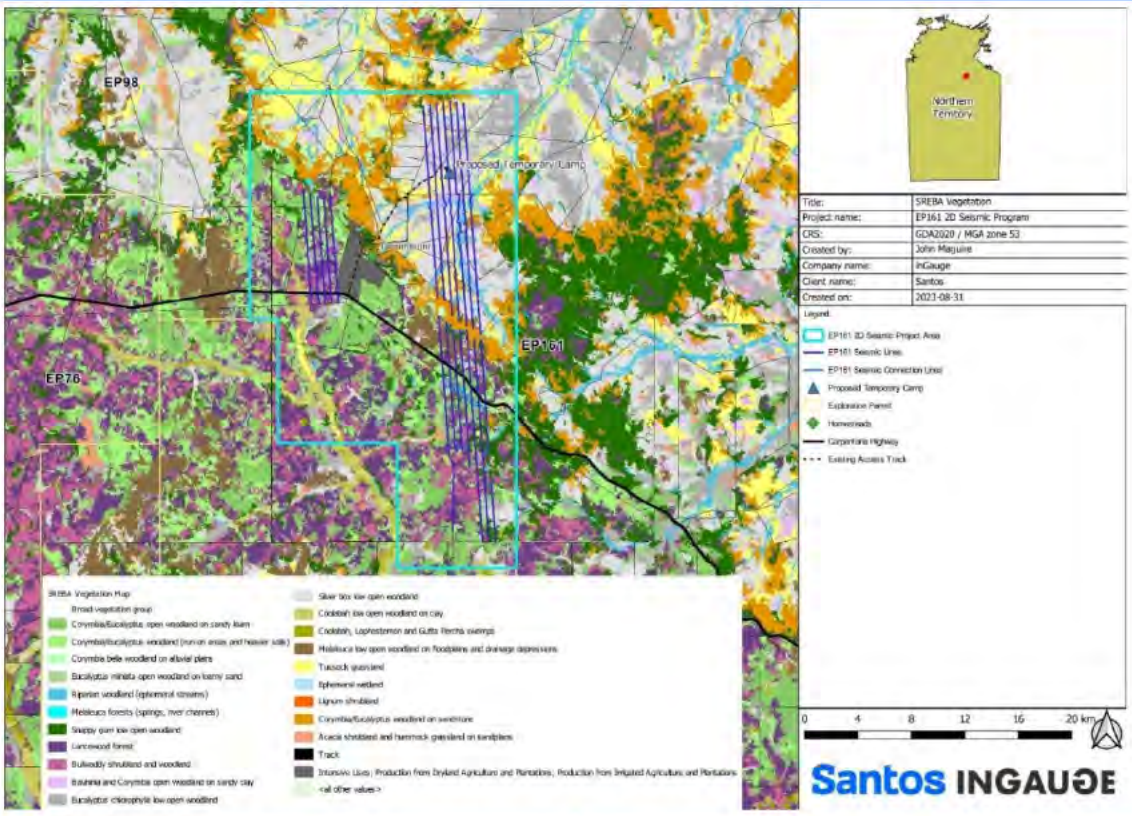


Community 1: Open woodlands – Silver box, Eucalypt, Corymbia and Melaleuca woodland with shrub layers or grassland groundcover



Community 2: Bullwaddy / Lancewood

Project Area Vegetation Map



Pre-Disturbance Land Condition Summary

The Project Area is within a pastoralist property, located near the junction of two biogeographic regions as well as the headwaters of several catchments. As a result, the landscapes reflect to some degree those of the southern Sturt Plateau and Gulf Fall and Upland (upper Roper River) Bioregions.

The Project Area soils are dominated by kandosols and rudosols. Rudosols are very shallow soils or those with minimal soil development and include very shallow rocky and gravelly soils across rugged terrain.

The dominant vegetation type in the Project Area is woodland. Vegetation communities within the Project Area are dominated by Eucalyptus and Corymbia species (in the plains and undulating hills), Acacia woodlands/forests, and Melaleuca communities (within drainages lowlands, and depressions), Lancewood (*Acacia shirleyi*) woodland/forests and Bullwaddy (*Macropteranthes kekwickii*) woodlands.

Rehabilitation Plan Prepared by:	Trent Smith	**Role:** HSE & Compliance Manager inGauge

7.5 Waste and Wastewater Management Plan

An EMP for a petroleum activity must include a Wastewater Management Plan (WWMP). This WWMP assesses all waste and wastewater management under the Activity, including:

- Wastewater meeting the definition of waste under the *Waste Management and Pollution Control Act* (greywater).
- Sewage effluent.
- Camp and vehicle waste.

7.5.1 Wastewater Management Framework

The Waste and Wastewater Management Framework seeks to:

- **Describe** the relevant works, environmental risks, and impacts involved in managing waste and wastewater.
- **Define** the methods and approaches used to store, treat, and reuse water and ultimately dispose of it either on-site or off-site.
- **Estimate** the quality and quantities of water and wastewater from the Activity and derived solids that will be removed from the site.
- **Monitor**, manage, and report waste and wastewater volumes.

7.5.2 Waste Management Hierarchy

The following hierarchy of principles outlined in the *National Waste Policy* will be used to achieve optimal environmental outcomes.

- Avoid, reduce, reuse, recycle, treat, and dispose.

The application of this hierarchy to the waste types generated during the Activity is outlined in **Table 7.5—1**.

The opportunities for the avoidance, reduction, reuse, and recycling of wastewater generated during the Activity are limited.

7.5.3 Management

7.5.3.1 Activity Description

Elements of the Activity that may generate waste are summarised in described in **Table 7.5—1**.

Table 7.5—1 Waste Generating Activity

Activity – Waste Source	Potential Waste Type
Domestic-type Activity (Camp)	Putrescible and municipal waste
	Recyclables (glass and cans)
	Greywater (laundry, showers, sink wastes, etc.)
	Toilet waste (port-a-loos)
Seismic Vehicle Activity	Vehicle tyres
	Batteries
	Oil drums
	Oily rags, filters, waste oil and hydraulic fluid etc.

7.5.3.2 Domestic Activity

Domestic-type liquid waste arising from the camp would comprise greywater from showers, sinks, laundry, etc., and sewage from toilet facilities.

The facilities at the camp may include port-a-loos and/or a fully self-contained portable STS. The STS, if needed, will be designed to comply with and all wastewater will be disposed of in accordance with the Public and Environmental Health Regulation 2014 and the NT's *Code of Practice for Wastewater Management* [DoH, 2014].

The STS will be equipped with an irrigation sprinkler system to manage treated effluent, which will be sprayed in a fenced irrigation area 50-100 m away from the camp to a location well away from any place from where it is unlikely to enter any waterways and to minimise spray drift and ponding.

If installed, all greywaters would be treated in the STS prior to irrigation. Sewage from port-a-loos may be transported offsite by a licenced waste management contractor or treated in the STS and irrigated as detailed above.

Solid waste will be disposed of in sealed bins set up adjacent to the campsite. The sealed bins will be transported for disposal of waste to a landfill. Recyclable materials will be managed on-site using segregated bins and transported to an approved local waste facility (**Section 7.5.4**).

7.5.3.3 Waste Quantities and Characteristics

This section characterises the anticipated wastewater streams that will be generated, including the chemical characteristics and volumes of each. **Table 7.5—2** provides a summary of the anticipated waste quantities and characteristics.

Table 7.5—2 Anticipated Waste Quantities and Characteristics

Waste	Estimated Volume	Chemical Characteristic
Domestic-type Solid Waste Putrescible, municipal, and recyclable	< 50 m^3	Non-hazardous
Domestic Wastewater Port-a-loo toilets and/or STS	< 20 m^3	Non-hazardous.
Vehicle Maintenance Solid Waste	< 50 m^3	Potentially hazardous

7.5.4 Waste Management Methods, Locations, and Strategies

This section contains a proposed method and location of water and wastewater storage, transportation, treatment disposal and re-use as part of the proposed activity, with reference to any requirements mandated by *the Code*.

7.5.4.1 Waste Generating Activities and Management Methods

Control measures will be implemented to minimise interactions of all stored waste with wildlife, stock, and human receptors. Control measures will comprise fencing, signage, and fauna-proof containment, as necessary.

Waste generating activities and management methods are described in **Table 7.5—1**.

7.5.4.2 Proposed Locations

A temporary campsite will be placed on the existing Tanumbirini well pad. Waste will be managed in a designated area on the well pad (refer **Figure 3.4—1** and **Figure 3.4—2**).

7.5.4.3 Waste Minimisation Strategies

Water will not be re-used for any purpose due to public health restrictions. Personnel will be advised to minimise water usage when utilising showers, in the kitchen, etc, to reduce volumes of greywater generated.

Table 7.5—3 Waste Generating Activities and Management Methods

Activity – Waste Source	Potential Waste Type	Avoid/Reduce/Reuse/Recycle/Treat/Dispose
Domestic-type Activity (Camp)	Putrescible and municipal waste Stored secured to prevent access by wildlife to minimise interactions with wildlife, stock, and human receptors	Will be managed at the camp using segregated fauna-proof bins and transported to an approved local waste facility.
	Recyclables (glass and cans)	Will be managed at the camp using segregated bins and transported to an approved local waste facility.
	Greywater (laundry, showers, sink wastes, etc.)	To be treated in the camp area in a fully self-contained STS and irrigation area (see **Section 7.5.3.2**).
	Toilet waste (port-a-loos)	May be transported offsite by a waste management contractor or treated in the STS and irrigated.
Seismic Vehicle Activities	Vehicle tyres	Will be stored in a segregated area at the camp for transport to an approved local waste facility.
	Batteries	Will be stored in a segregated area at the camp on bunded pallets for transport to an approved local waste facility.
	Oil drums	Will be stored in a segregated area at the camp on bunded pallets for transport to an approved local waste facility.
	Oily rags, filters, waste oil, hydraulic fluid, etc.	Will be managed in a segregated area at the camp using labelled hazardous waste bins on bunded pallets and transported to an approved hazardous waste facility.

7.5.4.4 Monitoring Plan

Refer to **Table 8.7—1** of the EMP for waste and wastewater monitoring frequency and methodology.

7.6 Emergency Contingency Plan (Emergency Response Plan)

An Emergency Response Plan (ERP) has been included as part of this EMP and is attached as **Appendix 05**.

The ERP outlines protocols for a timely and effective reaction to emergencies. It includes details of systems, monitoring and testing, emergency response arrangements, and personnel accountabilities, supplemented by various diagrams and guides for different response levels and scenarios. The plan details the roles of on-site and management teams, provides emergency contact information, and outlines communication strategies.

The ERP, in conjunction with the Interest Holder's *Incident Management Procedure,* is the contingency plan to be activated in the case of an environmental incident.

7.7 Spill Management Plan

An EMP for a petroleum activity must include a Spill Management Plan (SMP). This SMP assesses potential spills and management strategies for the Activity.

7.7.1 Key Legislation

Key legislation and documents that have been consulted in developing this plan are provided below:

- ***Petroleum (Environment) Regulations 2016 (NT)***: requires the Interest Holder to assess the environmental impacts and risks of the regulated Activity regarding any action proposed, including the prevention of a spill of the chemical or other substance.
- ***Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 (NT):*** covers the management of chemicals and wastewater on-site, including the use of secondary containment, lined tanks, and the Interest Holder's spill management plan.
- ***The Code of Practice of On-site Wastewater Management 2020 (Cth):*** provides standards and guidance to ensure the management of on-site wastewater.
- ***Transport Of Dangerous Goods by Road and Rail (National Uniform Legislation) Regulations 2010 (NT)*:** covers the transportation of goods by road in the NT and licence requirements for vehicles and drivers carrying dangerous goods.
- ***Workplace Health and Safety (National Uniform Legislation) Act 2011 (NT)*:** covers the storage and handling of chemicals on-site.
- ***Waste Management and Pollution Control Act 1998 (NT)***: covers the requirements for the transportation and disposal of waste within the Northern Territory, including the requirements for contractors, vehicles and facilities managing listed wastes to be licenced.

7.7.2 Potential Spill Materials

A list of chemicals, water and wastewater and the way that they will be stored, transported, and transferred as part of the Activity is provided in the following sections.

7.7.2.1 Grey Water and Sewage

Grey water and sewage from the temporary camp will be managed according to **Section 7.5.3.2** and will include port-a-loos and/or a fully self-contained portable STS. The estimated quantities, location and containment measures of these systems is provided in **Table 7.7—1**.

7.7.2.2 Fuel, Hydraulic Fluids, and Oils

The minor quantities of oils (including hydraulic fluid, oils, and other lubricants) to be kept on-site will be stored in a bunded area or on bunded pallets.

Bulk diesel fuel will be stored in tanks equipped with safety features such as double skins (or temporary bunding), safety cut-off valves, top accessing, etc. Spill, leak, and drip trays, as well as spill kits, will be used to address the risk of spills associated with re-fuelling and hydraulic leaks during operations. The estimated quantities, location and containment measures of fuels and oils are provided in **Table 7.7—1**.

Table 7.7—1 Estimated Volumes and Storage of Fuels and Oils

Description	Stored On-site (m^3)	Storage Location	Containment
Diesel Fuel	~ 50	Tanks (double-skinned).	Secondary containment.
Hydraulic Fluid, Oils / Lubricants	< 1	Storage tanks and drums.	Secondary containment (bunded pallet storage).
Greywater / Sewage	< 6	Portaloo or fully self-contained portable STS.	Secondary containment double skinned tank or bund.

7.7.3 Spill Scenarios

Fluids described in **Table 7.7—1** will be handled, stored, and transported during the Activity. The potential impact of a spill or leak is dependent on the type and volume of material released and the release location. Due to the remote location of the Activity, fuels will be transported by road and stored on-site prior to use. The potential spill sources during the Activity and design controls are shown in **Table 7.7—2**.

Table 7.7—2 Potential Spill Scenarios and Design Controls

Potential Spill Scenario	Minimum Spill Volume Detected	Quality of Spill	Design Controls
Loss of Containment at Storage Area	< 1 m^3	Hazardous fluids.	Secondary containment (bunded pallet storage), spill kits.
Poor Refuelling or Transfer Practices	< 1 m^3	Hazardous fluids.	Secondary containment, spill leak and drip trays, spill kits.
Hydraulic Oil or Fuel Leak During the Activity	< 1 m^3	Hazardous fluids.	Vehicle maintenance as per OEM specifications and spill kits available.

7.7.4 Risk Assessment Table

An assessment of environmental impacts and environmental risks posed by a spill event has been carried out, and this is presented in **Section 6** of this EMP.

7.7.5 Procedures and Process

The existing Tanumbirini well site layout and design have been approved in the Civils and Seismic EMP and has been designed to minimise the potential for harm to others and the environment with considerations of the *Land Clearing Guidelines* and Part A of *the Code*. Features of the well site include:

- It has been designed and operated to minimise the risk of causing a fire on the well site or in the surrounding environment.
- It is adequately secured to prevent access by wildlife.
- It is designed and operated to minimise the potential for releases of contaminants to the environment and the impacts of such a release.
- It is designed to ensure the use, storage and handling of materials is adequate and complies with *the Code*.

7.7.6 Control Measures

7.7.6.1 Key Activity Control Measures

The key control measures to manage spills associated with the Activity in the EMP are summarised in the list below. The key management controls include but are not limited to:

- All contaminated materials / waste stored at the temporary campsite will be in appropriate containers or bunds to prevent off-site release.
- Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment (Section A.3.8 (g)(i) of *the Code*).
- Monitoring to detect spills will be in accordance with **Table 8.7—1** of the EMP.
- Spill kits will be readily available at each worksite while operational and on all mobile service trucks or vehicles where hydrocarbons and chemicals are stored or used.
- Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request.
- Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (**Appendix 05**).
- Materials that escape from primary containment or are otherwise spilled onto secondary containment will be removed as soon as possible.
- Minimise fuel transfer where possible.
- No refuelling near waterways.
- Use of drip trays for transfers.
- Any spills to be contained and promptly remediated.
- Fuel and lubricants will be stored and managed in accordance with AS1940.

7.7.6.2 Contingency Plan for Bogged Vehicles Transporting Chemicals.

If a vehicle becomes bogged, extraction activities must be conducted safely and in a manner that prevents loss of contents. Vehicle extraction must be conducted as follows:

- If anyone requires medical attention or the incident cannot be rectified using existing resources, contact Emergency Services **000**.
- Notify the line manager of incident and ask for assistance. Never attempt extraction without assistance.
- Ensure rescue vehicles can safely reach the incident location. Stop traffic or divert away from the incident if required.

- Complete Job Hazard Analysis before attempting extraction. Take action to mitigate hazards identified.
- If safe, removal of chemicals from the bogged vehicle may be necessary before extraction.
- Chemicals may have escaped from containment on the bogged vehicle.
- If safe, use vehicle placarding and HAZCHEM code to identify chemical spill.
- Refer to SDS for safety and environmental risks that must be managed.
- Ensure all personnel are safe from fumes, smoke, and other chemical hazards.
- Use safety equipment, if required, to extract personnel from bogged vehicle.
- Be aware of the potential for fires. Keep ignition sources and personnel away if there is a risk of fire from flammable or combustible chemical spills.
- If safe, activate chemical containment action:
    - Wear appropriate PPE, consult the SDS.
    - If safe and possible, stop the spill at the source. Shut off valves.
    - If the spill is pooling, try to contain it with a spill kit, soil, or other bunds to prevent it from escaping to drainage and waterways.
- Clean up:
    - Retrieve as much as possible at source with absorbents.
    - Remove contaminated soil. Seal in labelled containers and transport via a licensed contractor to a licensed facility for disposal.

7.7.7 Minimising the Risk of a Spill

7.7.7.1 Santos SMS

The Interest Holder manages the environmental impacts and risks of its Activity through the implementation of the SMS. The SMS provides a formal and consistent framework for all activities of the Interest Holder's employees and contractors.

Relevant components of the SMS include:

- SMS-MS1 Risk – ST13 Environmental Hazard Controls Procedure.
- SMS-MS1 Incident and Crisis – ST2 Incident Reporting, Investigation and Learning Procedure.

In addition, the ERP (**Appendix 05**) and the Contractor's ERP provide additional processes and procedures.

7.7.7.2 Transport of Bulk Diesel on Unsealed Roads During the Wet Season

The Code requires that during the wet season (1st October to 30th April), the transport of chemicals and wastewater on unsealed roads must not be undertaken unless the risk of spills is demonstrated to be ALARP and acceptable.

The risk of a spill during the wet season may occur if a vehicle becomes bogged, tips over, or is damaged during extraction from a bogged position.

To demonstrate that the risks of a bulk diesel transport spill are reduced to ALARP and acceptable in these circumstances, the following key controls are to be put in place (as reflected in the Risk Assessment in **Section 6**):

- If there has been any rainfall in the previous 24 hours within the Project Area, ground conditions must be assessed to be suitable for the transport by the Site Supervisor.
- Transport of bulk diesel will not occur if water crossings have flowing water present at the time of proposed transport.
- In the event of a bulk diesel transport vehicle becoming bogged, the contingency plan for bogged vehicles (**Section 7.7.6.2**) is to be followed so extraction works are conducted safely and prevent loss of contents. **Section 8** (Communication) of **Appendix 05** - Emergency Response Plan must be implemented if the incident includes the release of chemicals.

With these controls in place, the transport of chemicals during the wet season is deemed to be reduced to ALARP and acceptable.

7.7.7.3 Chemical Handling

Vehicle maintenance fluids such as hydraulic fluid and lubricating oil will not be delivered in bulk. The original packages for these fluids will be unloaded from the delivery truck by forklift and stored in the bunded chemical storage area. Use of these chemicals will be limited to maintenance areas near the temporary camp. Spill kits will be available and drip trays used under the work area.

Deisel will be delivered in bulk with the delivery vehicle serving as storage container and refuelling point. Refuelling will be done as required with drip trays under the hose connections and with spill kits available.

Porta-loos will be delivered by truck and unloaded to the designated area and will be collected by the licensed Port-loo contractor.

Grey water disposed offsite will be collected by a licensed contractor with spill kits available.

Waste oil and hydraulic fluid will be stored in sealed, labelled containers in the bunded chemical storage area until collected by a licensed contractor.

7.7.8 Spill Detection

Table 8.7—1 Environmental Monitoring Program in the EMP details the monitoring frequency and method of spill detection for the designated storage area.

7.7.9 Spill Response Strategy

7.7.9.1 Response

Small spills will be managed locally at the site using dedicated spill kits, which will be readily available and appropriately stocked. For spills that are large and cannot be managed locally, the On-scene commander is to notify the Interest Holder's Incident Management Team Duty Manager as shown in the Detailed Emergency Response flowchart described in the ERP (**Appendix 05**) to provide incident details and initiate an appropriate response.

All spills will be managed in accordance with:

- The Santos Emergency Response Plan.
- The Contractor's Emergency Response Plan.
- SMS-MS1 Risk – ST13 Environmental Hazard Controls Procedure.
- Incident and Crisis ST2 - Incident Reporting, Investigation and Learning Procedure.
- The EMP.

7.7.9.2 Communication to Personnel

Spill prevention and monitoring strategies will be communicated to personnel via:

- This Plan.
- Site inductions.
- Safety meetings.
- Toolbox talks.
- Other scheduled meetings.

Communications regarding a spill will be undertaken in accordance with the Emergency Communications section of the ERP. This includes the following steps:

- The Incident Management Team Leader (IMTL) is informed of the incident and establishes contact with the affected site and is to be provided with details of the incident, an understanding of the severity and response resource requirements.
- Assessment of the emergency and its severity is made (based on information from the affected site), and an emergency/incident response level is determined.
- IMT activated to provide support to the affected site or facilities.
- IMTL maintains open communications with the affected site On-Scene Commander (OSC).
- Affected site OSC supervises the Field Response Team (FRT).

- Other personnel (roles) may be conscripted into the IMT as required.

7.7.10 Incident Reporting

Incidents may require reporting under the *Petroleum (Environment) Regulations 2016 (NT)* and the *Waste Management and Pollution Control Act 1998 (NT)* as set out in **Table 8.6—1** of this EMP.

8. Implementation Strategy

The Implementation Strategy described in this section summarises the Interest Holder's systems, practices, and procedures that will be implemented to manage the environmental impacts and risks of the Activity.

The aim of this strategy is to ensure that the control measures are implemented, and performance outcomes and standards are monitored, so that environmental impacts and risks are continually identified and reduced to a level that is ALARP and acceptable.

8.1 Environmental Outcomes, Performance Standards and Measurement Criteria

This EMP has been developed to protect the integrity of the existing and surrounding environment from risks associated with the Activity through the establishment and implementation of:

- **Environmental Outcomes:** That will be achieved if the environmental impacts and environmental risks of the Activity are reduced to a level that is ALARP and acceptable.
- **Environmental Performance Standards:** That relate to managing environmental impacts and environmental risks of the Activity, and apply to persons, systems, equipment, or procedures involved in the Activity.
- **Measurement Criteria:** The criteria/records used to determine if an environmental outcome or environmental performance standard has been met.

The objective of this EMP is to demonstrate that the environmental impacts and risks associated with the Activity will be reduced to ALARP and acceptable. To achieve this objective, the Activity will be carried out in such a manner so that all the requirements of *the Code* will be met, and all reasonably practicable risk management controls have been identified and implemented as described in the Environmental Risk Assessment Process in **Section 5** and **Risk Assessment Section 6**.

By implementing the controls outlined in the EMP and its appendices, the risk of an impact from the Activity on the environment will be reduced to ALARP and be acceptable. Performance standards and measurement criteria associated with the environmental outcomes sought to be achieved in undertaking the Activity as described in this EMP are outlined in **Table 8.1—1**.

Table 8.1—1 sets out the risk sources for each environmental factor, the key environmental outcomes to be achieved, the relevant environmental performance standards, and the measurement criteria.

Table 8.1—1 Environmental Outcomes, Environmental Performance Standards, and Measurement Criteria

Risk Sources	Environmental Outcome	Environmental Performance Standard	Measurement Criteria and Records
Environmental Factor: Terrestrial Ecosystems (Flora and Fauna, Native Vegetation)			
Waste stored inappropriately.	The Activity will not result in permanent degradation of native flora and fauna.	Introduced predators are not attracted to waste storage points.	During operations, a daily checklist shows designated waste areas are inspected and managed to prevent overflow.
Plant and vehicles distributing weeds from outside or within the Project Area.		No introduction of declared or priority weeds on lines prepared for seismic.	Vehicle hygiene certificates are available with all equipment on-site during the Activity, showing they are clear of biosecurity risk material. Annual post-wet season weed survey report submitted to DEPWS.
Ignition sources from plant, machinery or smoking causing fire.		No uncontrolled fire started because of the Activity.	Daily operational reports demonstrate preparation in case of an emergency, e.g., they cover the presence of fire firefighting capacity (in vehicle, campsite and/or Fire Tender).
			Daily operational reports show bushfire risk is considered prior to commencing the Activity.
Rehabilitation commitments not being adhered to.		Rehabilitation commitments adhered to.	Annual rehabilitation survey reports demonstrate progressive rehabilitation against analogue sites. Maintenance records demonstrate corrective actions taken to improve rehabilitation outcomes are occurring where required.
Adverse impacts to threatened fauna species.		No adverse impacts to threatened fauna species.	Fauna Spotter survey records, including commentary on how decisions were made, demonstrate that riparian areas are ground truthed, and large diameter trees are avoided using the decision tree checklist. Records of pre-line preparation survey demonstrate scouting conducted for active Grey Falcon nests. Spatial data files demonstrate that a vehicle free exclusion zone of 300 m was kept between the line preparation and acquisition activity and any identified active Grey Falcon nests within or adjacent to a seismic working corridor. Records of completed tree mulching decision tree checks, including commentary on how decisions to mulch were made, demonstrate consideration for avoidance over mulching every tree with a diameter greater than 25 cm at 1.3 m above the ground. Fauna Spotter wildlife interaction/relocation records demonstrate that species were protected (identified and relocated) prior to traversing riparian areas.
Unchecked camp wastewater irrigation pools attract fauna or livestock.		No uncontrolled release of treated effluents or greywater.	Inspection records show irrigation is completed by use of dispersion hoses and/or sprinklers within the fenced area on a slope of < 5%.
Riparian vegetation mulched, where it could have been avoided.		No line preparation in riparian zones prior to ground truthing.	Tracklogs show no mulcher used in Tanumbirini Creek restricted area presented in maps.

Risk Sources	Environmental Outcome	Environmental Performance Standard	Measurement Criteria and Records
			Fauna Spotter survey records, including commentary on how decisions were made, demonstrate that riparian areas are ground truthed and trees with a diameter greater than 25 cm at 1.3 m above the ground are avoided using the decision tree checklist.
Trees >25 cm diameter at breast height not mulched, where it could have been avoided.		No mulching of trees > 25 cm diameter at 1.3 m above the ground in the path of line preparation without assessment.	Records of completed tree mulching decision tree checklists, including commentary on how decisions to mulch were made, demonstrate consideration for avoidance over mulching every tree with a diameter greater than 25 cm diameter at 1.3 m above the ground.
Environmental Factor: Terrestrial Environmental and Inland Water Environmental Quality (Soils, Surface Water, Groundwater)			
Stored or transported chemicals are released to land or water.	No significant impact on surface water quality parameters or soil from spills or sediment during the conduct of the Activity.	Spills do not result in material or serious environmental harm.	During operations, daily checklists show chemicals, fuels, etc, that are hazardous or have the potential to cause environmental harm are stored within secondary containment in accordance with SDS.
			Daily inspection checklist shows spill kits available during the Activity are full and suited for the types of chemicals that may spill.
			The Contingency Plan (Emergency Response Plan **Appendix 05**) Spill Management Plan **Section 7.7**) is available on-site for an immediate coordinated response to a bogged vehicle or spill scenario.
Vehicle movements and line preparation impact soil and drainage lines.		Vehicle movements and line preparation does not cause erosion.	Records of inspection during survey demobilisation show areas where vehicles were used for the Activity were inspected to identify and address potential erosion issues. GPS track logs demonstrate that stream orders along seismic lines are crossed only once (where possible) per activity stage, at 90 degrees and/or existing crossing were used within the working corridor. Record of site inspections demonstrate that where there is visible soil disturbance upslope of a water course, a flow diversion bank was installed to re-direct water flow. Annual rehabilitation survey reports show that no active erosion is present in disturbed areas or that corrective actions are being taken to rectify.
Soil degradation due to delayed rehabilitation of prepared lines.		Erosion controls in place for seismic lines are in line with the ESC plan.	Annual rehabilitation survey reports completed that cover seismic and connection lines include assessment of erosion and sediment control success measures.
Project groundwater extraction results in a reduction in groundwater quantity.		Groundwater use is limited to licenced volume.	Groundwater extraction licence in place.
			Groundwater extraction volumes recorded in accordance with licence and less than the maximum permitted volume for the Activity.
Environmental Factor: Air Quality and Atmospheric Processes			

Risk Sources	Environmental Outcome	Environmental Performance Standard	Measurement Criteria and Records
Inefficient vehicle and plant movement results in unnecessary emissions.	Net zero emissions by 2050.	Vehicles used for the Activity are maintained to OEM specifications.	Records of maintenance are available for vehicles, plant, and equipment, showing they are up to date with the Activity's schedule as per OEM specifications.
			Records for fuel used for the Activity.
Environmental Factor: Community and Economy			
Noise from vehicle movements and the Activity results in noise disturbance to landholders.	Use of land meets the conditions of Land Access Agreements.	No recurring complaints received about noise.	Stakeholder engagement records demonstrate all reasonable noise complaints received were resolved, or if they are unable to be resolved, monitoring demonstrates noise emissions comply with the relevant legislation.
Activity disrupts landowner's regular use of land.		No disruption to pastoral activities based on a misunderstanding of conditions.	Site induction records show all personnel have completed site inductions that cover property access requirements.
Vehicles travelling in unapproved areas and upsets landowner.		No interruption to pastoralists from misdirection on property or speeding.	Site induction records show that clear directions to the campsite have been provided to all staff, contractors, and visitors.
			Records of inductions delivered demonstrate that those visiting site have been made aware of speed limits and approved access points.
Environmental Factor: Culture and Heritage			
Vehicle and plant movements throughout the Project Area results in disturbance to sacred sites.	Conditions to protect sacred sites, culture and heritage met during conduct of the Activity.	No disturbance to Aboriginal or Macassan archaeological places or objects, sacred sites, and cultural heritage sites during the Activity.	GIS shape files of seismic lines show that line preparation and acquisition activity occurred within the areas shown in AAPA Authority Certificates C2013/142, C2018/105 variation to C2018/102, C2019/043 variation to C2014/053 and C2020/011.
			Line preparation and seismic data acquisition GPS log show no vehicles encroached into an AAPA excluded areas.
			Line preparation and seismic data acquisition GPS log show no vehicles encroached on the cultural buffers detailed in **Appendix 02 –** Archaeological Assessment.
			Induction records show that civil and seismic personnel have received training on the appropriate actions to take upon discovering Aboriginal or Macassan archaeological places, objects, or sacred sites previously unidentified during their work.
			Incident records to include any sacred sites discovered during construction or seismic Activity and that they have been reported to the AAPA and the CEO of the Northern Territory Heritage Office as soon as practical.

Risk Sources	Environmental Outcome	Environmental Performance Standard	Measurement Criteria and Records
		No indirect impacts on identified sacred sites from and cultural heritage sites during the Activity.	Meeting records demonstrate that site personnel and contractors are aware of potential indirect impacts to the Sacred Site water hole from crossing streams on Line 12. Weather forecast records demonstrate that Line 12 stream crossed only in dry conditions.

8.2 Santos Management System

The SMS is the central system that contains the policies and procedures that the Interest Holder will utilise to manage and minimise the impact of the Activity.

The SMS covers:

- Accountabilities.
- Planning and objectives.
- Training and competency.
- Communication.
- Legal obligations.
- Hazard identification and risk management.
- Contractor management.
- Incident management.
- Performance reporting.
- Interface management.
- Contingency (Emergency Response) Plans.
    - The Santos Emergency Response Plan (**Appendix 05**) of this EMP is the contingency plan that specifies arrangements for the response to emergencies or potential emergencies (e.g., adverse weather, bushfire, environmental considerations, flooding, vehicle accidents, etc.) to ensure environmental impacts are minimised in the event of an incident during Seismic Activity.
    - Seismic Contractor's site-specific ERPs must meet the standard set by the Santos ERP.

8.3 Roles and Responsibilities

Key roles and environmental responsibilities for the activity are detailed in **Table 8.3—1** and will be communicated to these positions prior to the activity commencing and when any changes are made to these positions.

Table 8.3—1 Key Personnel Roles and Responsibilities

Role	Responsibilities
Project / Area Manager	• Oversees all planning and the execution of the Activity and is responsible for compliance with the EMP, associated plans (e.g. ESCP) and the SMS. • Fulfil the role of the Emergency Commander in the Emergency Response Plan.

Role	Responsibilities
Site Supervisor / Field Team Leaders	• Responsible for ensuring seismic activities are carried out as required by the EMP, associated plans (e.g. ESCP), and the SMS. • Acts as the point of contact for all seismic contractors. Acts as the designated point of contact for any seismic complaints and non-conformances/incidents. • Undertakes monitoring, inspections, and audits. • Aid in the decision-making process for water crossing as per this EMP. • Site Supervisor-Civils acts as the Weed Officer for the Activity. • Fulfil the role of the On Scene Commander in the Emergency Response Plan. • Ensure contractors and employees familiar with commitments in EMP and ERP. • Identify and manage any non-conformances. • Lead and participate in emergency response exercises.
Land Access Adviser	• Undertake consultation with relevant persons throughout project planning and implementation. • Document consultation with relevant persons. • Ensure any commitments to relevant persons are undertaken.
Environment Lead	• Assess any environmentally relevant changes (**Section 8.5** and **8.6**). • Review any complaints, non-conformances/or incidents that are relevant to Environmental Performance to ensure corrective actions are appropriate to prevent recurrence (**Section 8.7.3**). • Assist in compliance monitoring, control verification and reporting relevant to this EMP. • Prepare and submit (if required) environmental reports in accordance with Ministerial Conditions and this plan.
Fauna Spotter	• Assist Site Supervisor in ground truthing riparian areas, site selection to avoid mulching/slashing and completion of decision trees. • Complete daily report of wildlife interaction or relocations • Identify presence or absence of active Grey Falcon nests within or visually adjacent to seismic working corridors and establish vehicle movement free exclusion zones if present
Contractor Site Supervisor / Field Team Leaders	• Seismic service providers (contractors) that are responsible for delivering the commitments outlined in this plan. • Contractors to comply with the nominated contractual terms and work instructions issued under this EMP. • Contractors must ensure all staff are aware of their obligations, are appropriately trained, and that procedures and controls are fully implemented and complied with. • Provide Fire Tender capacity during line preparation. • Fulfil the role of the Contractor Field Response Leader in the Emergency Response Plan.

Role	Responsibilities
Contractors Involved in Field Work	• Hold all relevant licenses for and be trained in all work to be carried out. • Comply with work instructions and commitments in this plan. • Attend all relevant inductions, tool-box talks and work planning meetings. • Report all incidents as soon as possible to supervisor. • Complete relevant incident reports and checklists. • Understand emergency response principles and how to raise an alarm.
Employees Involved in Field Work	• Hold all relevant licenses for and be trained in all work to be carried out. • Comply with work instructions and commitments in this plan. • Attend all relevant inductions, tool-box talks and work planning meetings. • Report all incidents as soon as possible to the Site Supervisor. • Complete relevant incident reports and checklists. • Understand emergency response principles and how to raise an alarm.

8.4 Training and Competencies

The Interest Holder's staff and contractors undertaking work in the field are required to undertake a two-stage induction process. The general onshore Environment Health and Safety (EHS) induction focuses on hazard identification and sets the Interest Holder's expectations for EHS management for workers at the Interest Holder's 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.
- Environmental values in the Project Area.
- Environmental impacts and risks and associated controls to be implemented.
- Management of change.
- Roles and responsibilities.
- Incident and non-conformance reporting and management.

The competency of contractors is assessed as part of the contracting qualification and via the prestart audit. Competencies assessed during the contracting process include:

- Maturity of EHS systems.
- EHS Performance.
- Internal training and auditing processes.
- Existing procedures and training.

- Awareness of environmental values and cultural sensitivities.
- Weed identification and management.
- Identification of features to be avoided or protected.
- Refuelling procedures.
- Procedures for preparing seismic lines.
- Hazardous material and waste management procedures.
- Incident notification and management processes.

8.5 Management of Change

All changes or deviations to the Activity will be managed through the Interest Holder's or the contractor's Management of Change (MoC) procedures/standards. A MoC procedure outlines processes of change acceptance. When a new environmental impact or environmental risk arises from the change, the EMP will be revised.

Where there has been a new environmental impact or environmental risk not provided for in the EMP for the Activity or an increase in an existing environmental impact or risk not provided for in the EMP, the Interest Holder must submit to the Minister a revised EMP for approval in accordance with *Regulation 17* of *the PER*.

Where a change represents a modification to a regulated activity in a manner that does not require a revision or resubmission of the EMP:

- Before the Activity is modified, the Interest Holder will provide a notice in accordance with *Regulation 22* of the *PER* to the Minister that includes the details of the proposed modification. This applies where there is a change to the existing environment (as described in **Section 4**) that will not require a revision or resubmission of the plan.
- Within 30 days after the change has occurred, the Interest Holder will give the Minister a notice that specifies the details of that change in accordance with Regulation 23 of the *PER*.

8.6 Reporting

8.6.1 Incident Reporting

Incident reporting and investigation provide the mechanism to prevent a recurrence.

All personnel must report and record all incidents and near-misses for learning purposes and to determine if the regulator is to be notified.

Table 8.6—1 provides the regulatory Incident and Reporting Requirements.

Table 8.6—1 Incident and Reporting Requirements

Requirements	How and By When
Petroleum (Environment) Regulations, 2016 (NT)	
Recordable Incident Reporting: A recordable incident is an incident arising from the Activity that has resulted in an environmental impact or environmental risk (not specified in this EMP), has resulted in a contravention of an Environmental Performance Standard in the EMP, or is inconsistent with an environmental outcome determined in the EMP that applies to the Activity and is not reportable.	
The recordable incident report must contain the following: • A record of all recordable incidents that occurred during the reporting period. • All material facts and circumstances concerning the recordable incidents that the Interest Holder knows or is able, by reasonable search or enquiry, to find out. • Any action taken to avoid or mitigate any adverse environmental impacts of recordable incidents. • The corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents.	• Notify the Minister in writing no later than 15 days after the reporting period.
Reportable Incident Reporting: A reportable incident is an incident relating to the Activity that has caused or has the potential to cause material or serious environmental harm as defined under *the PER*.	
The initial written report will include: • 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 evaluation of the effectiveness of the designs, equipment, procedures, and management protocols that were in place to prevent the occurrence of an incident of that nature. • The nature and extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause. • Any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident. • Any actions taken or proposed to be taken to prevent a recurrence of an incident of a similar nature.	• Notify the Minister orally or in writing as soon as practical but not later than 2 hours after the incident first occurred, or the Interest Holder becomes aware of the reportable incident. • The notification must specify the contact details of the Interest Holder, all material facts and circumstances, information about any action taken to avoid or mitigate environmental harm and information about the corrective action that has been taken or proposed to be taken. • Any verbal report will be followed up by a written report within 24 hours of giving verbal notice. Then, an initial report will be provided to the Minister no later than three days after the incident occurs. • Notify the AAPA verbally or in writing as soon as practical if the reportable incident impacts a sacred site.
• The final reportable incident report must include a root cause analysis of the reportable incident.	• The final report is to be provided to the Minister 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.
Waste Management and Pollution Control Act, 1998 (NT)	
Duty to notify of incidents causing or threatening to cause pollution where an incident occurs in the conduct of an activity, and the incident causes or is threatening or may threaten to cause pollution resulting in material environmental harm or serious environmental harm. A notification is required to specify: • The incident causing or threatening to cause pollution. • The place where the incident occurred. • The date and time of the incident. • How the pollution has occurred, is occurring or may occur. • The attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and the identity of the person notifying.	• The proponent must notify the NT EPA as soon as practicable (and in any case within 24 hours) after first becoming aware of the incident or the time they should reasonably be expected to become aware of it.
Heritage Act, 2011 (NT)	
When a proponent discovers a place or object that is known to be an Aboriginal or Macassan archaeological place or object, they must provide a written report to the CEO of the Heritage Council, which includes: • A description of the place or object. • Its location. • The person's name and address.	• The proponent must advise the director of the Heritage Branch (08 8999 5039) of the discovery and its location.

Requirements	How and By When
• If known by the person –the name and address of the owner or occupier of the place or where the object is located.	
Work Health and Safety (National Uniform Legislation) Act, 2011 (NT) and Regulations, 2011 (NT)	
A person who conducts a business or undertaking must ensure that the regulator is notified immediately after becoming aware that a notifiable incident arising from the conduct of the business or undertaking has occurred. A notifiable incident means: • The death of a person. • A serious injury or illness of a person. • A dangerous incident. The person with management or control of a workspace (Interest Holder) has a duty to preserve incident sites at which a notifiable incident has occurred so far as reasonably practicable. Requirement to notify NT WorkSafe if the volumes of chemicals held on-site exceed requirements.	• The proponent must notify NT WorkSafe immediately after becoming aware that a notifiable incident has occurred. Notify by phone or in writing. • A person giving notice by telephone must give details of the incident and (if required) give written notice within 48 hours of being required to do so. • The Interest Holder will preserve any incident site so far as reasonably practicable.
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) (NT)	
If a driver of a road vehicle transporting dangerous goods and the vehicle is involved in an incident resulting in a dangerous situation, they must notify the prime contractor for the goods, the Competent Authority, and the police or fire service of the incident.	• As soon as practicable after the incident occurred.

8.6.2 Routine Reporting

Table 8.6—2 presents the routine reporting details required under this EMP.

Table 8.6—2 Reporting Details

Frequency	Report Detail	Recipient
Before the Commencement of the Activity	• The commencement date of construction or seismic surveys.	• The Minister for Industry, Tourism and Trade. • The Minister for Environment, Climate Change and Water Security. • The occupier of the land in which the activity is carried out. • The owner of the land in which the activity is to be carried out.
Before the Commencement of the Activity	• If the Sewage Treatment Plant will treat more than 2,000 L/day, notice of intention to install the wastewater management system or series of wastewater management systems at least 7 days before the start of the installation in the prescribed form.	• Chief Health Officer, Department of Health (DoH).
Quarterly	• Quarterly recordable incident report summarising recordable incidents during operational and non-operational works.	• DEPWS
Annually	• An annual environmental performance report will be prepared and submitted to the Minister, covering the following: o A summary of the works completed under the EMP during the reporting period. o A summary of performance against measurement criteria.	• DEPWS
When Mulching Completed	• Records of the nature, location, and extent of disturbance of flora and fauna, including geospatial information depicting areas mulched.	• DEPWS & Minister
Within 90 Days of Seismic Data Acquisition Being Completed	• Estimate of greenhouse gas emissions from the Activity in accordance with Section D.6.2 of *the Code*.	• NT Government
Annually	• Emissions by Interest Holders that exceed statutory limits must be reported to the Clean Energy Regulator (NGERS). • Reporting period 1 July to 30 June. • Reporting is through the Emissions and Energy Reporting System (EERS). • The deadline for reporting is 31 October of the relevant reporting year.	• Clean Energy Regulator

8.6.3 Record Keeping

The Interest Holder's SMS outlines the policies and procedures governing data management and prescribed records.

To the extent the following documents are prescribed records for the *PER*, they will be kept for the longer of five years following the period during which the petroleum interest is in force or 15 years after the record comes into existence:

- Records of measurement criteria, commitments, and statutory reporting requirements.
- Completed decision tree checklists which include commentary on how decisions were made.
- Induction records.
- Preparation/disturbance.
- Waste/wastewater transport records.
- Fuel usage.
- Rehabilitation and weed monitoring reports.
- Non-compliances and corrective action records.
- Internal audits.
- Regular inspection reports.
- Incident reports.
- Management of change records.

8.7 Environmental Performance Monitoring and Reporting

8.7.1 Monitoring

An environmental monitoring program will be implemented by the Interest Holder as part of this EMP. A summary of the key monitoring activities is provided in **Table 8.7—1**.

8.7.2 Inspections and Audit

To ensure that the EMP requirements have been effectively implemented and that the Environmental Outcomes and Environmental Performance Standards have been met. Daily inspections and checks detailed in **Table 8.7—1** will be completed on-site and recorded during the duration of the seismic acquisition activity.

One control verification audit of all the controls, including measurement criteria will be completed during the Activity.

Table 8.7—1 Environmental Monitoring Program

Item	Location	Purpose	Monitoring Frequency and Method
Waste and Wastewater	Seismic and camp operations.	• Ensure removal of all waste introduced or generated during the Activity. • Effectiveness of measures to mitigate stock, wildlife, and human interaction.	• Waste transported off-site recorded. • During operations, daily inspections of designated waste area for evidence of interaction of stock or wildlife. • During operations, daily inspection of designated effluent irrigation area for leaks or pooling.
Weather and Bushfire	Bureau of Meteorology (BOM)	• Hot spot alerts and fire danger is known.	• Daily checks of fire and weather forecasts during operations.
Spills	Fuel, STP, storage areas and effluent irrigation areas.	• Sites free of spill-related contamination.	• Secondary containment, when in use, to be visually inspected daily for damage, spills, or water for management. As per A.3.8.(i) of *the Code*. • During operations, daily inspections of fuel/oils storage area for leaks or evidence of spills. • During operations, daily inspections during operations show that spill kits are full and available.
Erosion & Sediment Control	Campsite	• ESC measures in place as per this EMP's ESC plan.	• During survey demobilisation seismic lines are inspected to pinpoint and address potential erosion zones in prepared/traversed areas. • Weather conditions are checked daily. The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed.
Weeds	Campsite and Seismic and connection lines	• Weeds identified and treated.	• Annual survey/visual inspections for maintenance/weed control post-wet season.
Rehabilitation	Seismic and connection lines	• Presence of a stable and self-sustaining landform re-instated as per the success criteria of the rehabilitation plan of this EMP.	• Annually at the end of the local wet season, starting 12 months after it is determined the prepared line is no longer required for the Activity or future activities until the Minister is satisfied the environmental outcomes and obligations under the EMP have been met.
Review of Implementation Strategy	This EMP	• Ensure this EMP achieves the environmental outcomes and to comply with *PER* Schedule 1, Item 6(1)(a). • NOTE; The duration of the Activity is very short. The only on-going monitoring will be for weeds and rehabilitation. Other risks such as wastewater, bushfire, and spills will not carry over after the seismic acquisition is completed.	• Annually after the weed and rehabilitation surveys.

8.7.3 Management of Non-conformances

For the Activity, a non-conformance is defined as:

- A breach of an environmental outcome or environmental performance standard (see **Section 8.1**).
- A recordable incident resulting in an actual consequence above low (refer **Table 8.6—1**).

Non-conformances are identified via:

- Audits and inspections.
- Incident reports and investigations.

Where a recordable incident is identified, measures will be taken to assess the cause of the incident, action/s taken to avoid or mitigate the incident and prevent similar recordable incidents.

To ensure that recordable incidents lead to learning and improvements for both the Activity and the company, non-conformance incidents and corrective actions will be communicated to:

- The Interest Holder's management and operational personnel.

Recordable incidents and corrective actions will be:

- Recorded as per the Interest Holder's Incident Management protocols (i.e., SMS-HSS-OS07 Incident Reporting and Investigation) and actions tracked to completion, where required.
- Reviewed by the action owner's supervisor before being closed to ensure actions are completed and implemented.
- Tracked and reported, ensuring the status of corrective actions are communicated in quarterly recordable incident reports.

9. Stakeholder Engagement

9.1 Overview

The Interest Holder's approach to stakeholder engagement proactively focuses on building respectful relationships with stakeholders. The Interest Holder seeks to ensure that stakeholders are fully informed of on-ground works through regular communication and consultation. The Interest Holder recognises that stakeholder engagement is integral to achieving its objectives.

The Interest Holder aims to establish and maintain enduring and mutually beneficial relationships with the communities it is a part of, ensuring that proposed activities generate positive economic and social benefits for, and in partnership with, these communities.

A stakeholder communications log documenting stakeholder engagement associated with the Activity proposed under this EMP is attached as **Appendix 04**.

Stakeholder engagement has been conducted as per *Regulation 7(2)* of *the PER*.

9.2 Stakeholder Identification

Regulation 7(3) of the *PER* defines a Stakeholder as:

- A person or body whose rights or activities may be directly affected by the environmental impacts or environmental risks of the regulated Activity proposed to be carried out, or
- An agent or representative or a person or body mentioned in the point above.

Using this stakeholder definition, the Interest Holder has identified the following as the relevant stakeholder groups for the proposed Activity:

- Traditional Owners:
  - Northern Land Council facilitation, pursuant to the registered ILUA dated 4 April 2012 under the *Native Title Act 1993* (Cth), which covers the land area corresponding with EP 161.
  - Nurrdalinji Native Title Aboriginal Corporation.
- Landholders, landowners, and land occupiers (host pastoralists):
  - Rallen Australia (Tanumbirini Station).
- Other (Mining / Mineral) Title Holders:
  - Pennant Resources Pty Ltd.
- Services:
  - Power and Water Corporation (third-party pipeline).
  - Telstra (communications tower).
  - Department of Infrastructure, Planning and Logistics (DIPL) - roads including Carpentaria Highway.

The Interest Holder has undertaken actions to initiate stakeholder engagement and consult with pastoralists, Traditional Owners, and other Title Holders whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Activity.

9.2.1 Traditional Owners

The Interest Holder regularly engages with the Traditional Owners across EP 161. Further details on the Interest Holder's engagement with Traditional Owners regarding the Activity are available in **Section 9.3**, **Table 9.4—1**, and **Appendix 04** (Stakeholder Engagement Log). The *Native Title Act, 1993* (Cth) recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and custom. The *Native Title Act, 1993* (Cth) allows for the making of ILUAs, which are voluntary agreements with Native Title Holders about the use and management of areas of land and/or waters.

9.2.1.1 Northern Land Council (NLC)

In compliance with the *Native Title Act, 1993* (Cth), the Interest Holder has a registered ILUA (2012.04.04), which covers the land area corresponding with EP 161. In accordance with the ILUA, the NLC represents the Native Title Holder's rights and interests, in the land to which the ILUA relates, including the land directly impacted by regulated activities within EP 161.

The NLC is responsible for organising and facilitating the Interest Holder's engagements with Traditional Owners directly affected by the environmental risks and environmental impacts of the regulated Activity. This includes an on-country meeting regarding regulated activities proposed under each EMP.

The Interest Holder determined through engagement with the NLC, and its prior understanding of the area covered by EP 161 that the Traditional Owner's engaged through the NLC have the cultural authority to:

- Consider and identify the cultural heritage values in the EP 161 Project Area.
- Speak to the Interest Holder on their considerations.
- Provide guidance as to any potential issues with works being undertaken in the location of the Activity.

The Interest Holder maintains consistent engagement with the Traditional Owners, ensuring that ongoing consultation – both present and future – is undertaken through the NLC, in accordance with the ILUA.

9.2.1.2 Nurrdalinji Native Title Aboriginal Corporation

If another Traditional Owner whose rights or activities may be directly affected by the environmental impacts or environmental risks of the regulated activity has been identified or self-identified, they are also a stakeholder in accordance with *Reg 7* of the *PER* and must be engaged by the Interest Holder regarding preparation of an EMP.

The Interest Holder considers Nurrdalinji Native Title Aboriginal Corporation (NNTAC) a stakeholder in accordance with *Reg 7* of the *PER,* and as such the Interest Holder has and will continue to engage with the NNTAC. Since 2021, the NNTAC have remained active in the area, regularly expressing an interest in petroleum onshore operations generally and specifically in relation to the Interest Holder's regulated activities on Tanumbirini Station, including observation of the Interest Holder's ongoing regulated activities on the pastoral station. Stakeholder engagement in accordance with *Reg 7* was commenced with the NNTAC on the 17th of August 2023. A record of the consultation with the NNTAC is available in **Appendix 04** (Stakeholder Engagement Log) and summarised in **Section 9.3**, and **Table 9.4—1**. The Interest Holder will maintain an open line of communication with the NNTAC for any ongoing consultation.

9.2.2 Pastoralists

The Interest Holder respects the established relationships with pastoralists across the Beetaloo Sub-basin, including within EP 161, which have been built through undertaking regulated activities in the area since 2013. The proposed Activity is located on Tanumbirini Station (Rallen Australia).

The Interest Holder has identified that the Activity will be accessed and completed using both public roads and private access tracks, for which the latter has a LAA in place. Further details on the Interest Holder's engagement with Tanumbirini Station regarding the proposed Activity, are available in **Section 9.3**, **Table 9.4—1**, and **Appendix 04** (Stakeholder Engagement Log).

9.2.3 Other Title Holders

A search of NR Maps and STRIKE databases [DITT, 2019] has established the presence of numerous overlapping mining and exploration licences across EP 161. A list of approved exploration licences can be found in **Table 3.10—2** and **Figure 9.2—1** outlines the six exploration licences that may be impacted by the Activity.

All six exploration licences are held by Pennant Resources Pty Ltd (Pennant). Based on publications on DITT's website [DITT, 2023], no Mine Management Plan (MMP) applications have been submitted for exploration licences that intersect the Project Area for the Activity for this EMP.

Although it is not anticipated that the environmental impact or risk of the proposed Activity under this EMP will affect Pennant in exercising its rights or activities under the overlapping tenures, Pennant will be notified of the commencement date of the proposed Activity.

As outlined in **Section 3.10.2**, the North Berkely Mining Project (EL33128) (**Figure 9.2—2**) conducted by Green Critical Minerals (GCM) is the only EL in the area with an MMP, but it shares no access roads or tracks, and their crew are accommodated in the Heartbreak Hotel at the intersection of the Carpentaria and Tablelands Highways [GREEN CRITICAL MINERALS, 2023]. Therefore, GCM is not considered a stakeholder under the *PER*.

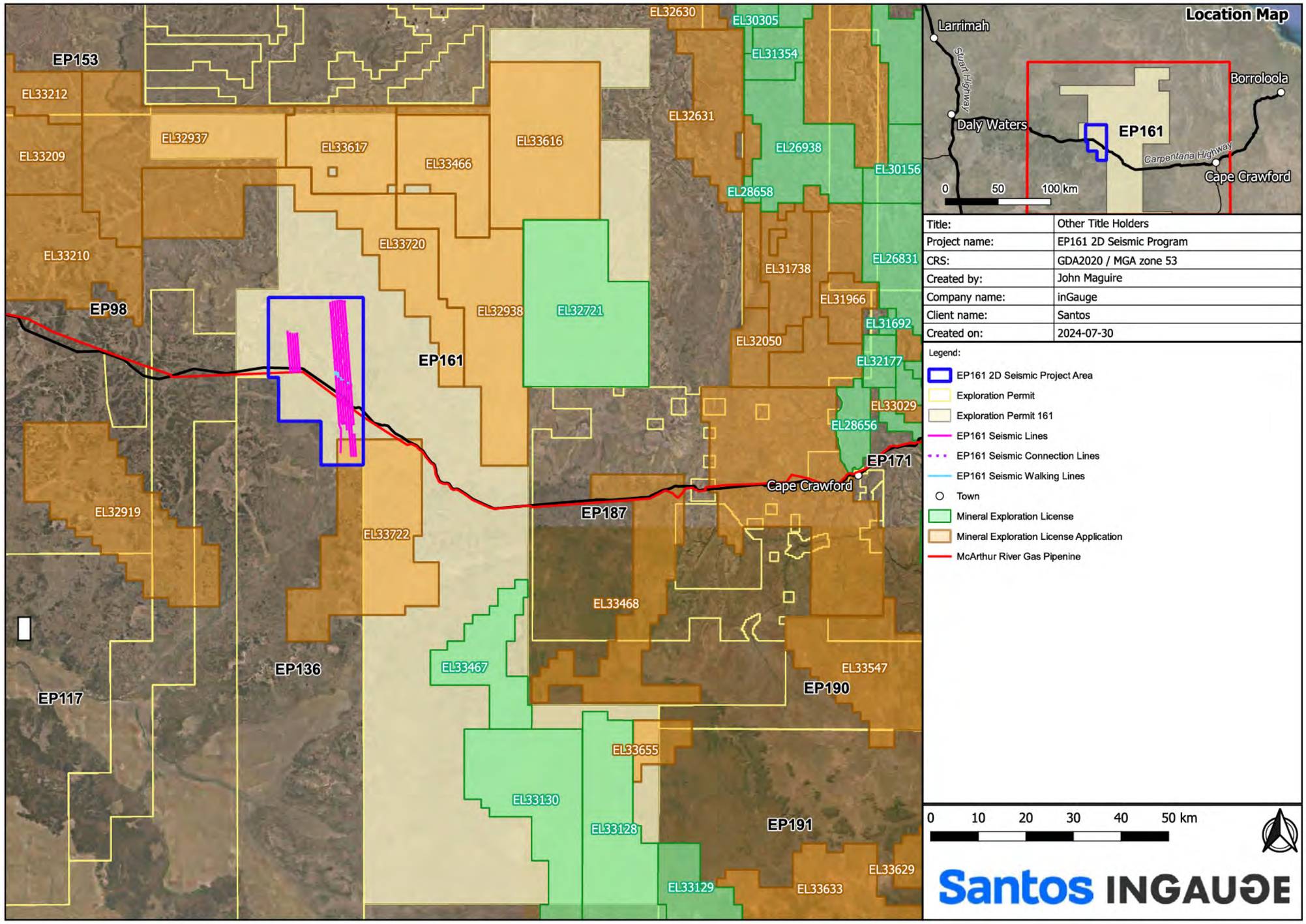


Figure 9.2—1 Exploration Licences Held by Pennant Resources Pty Ltd

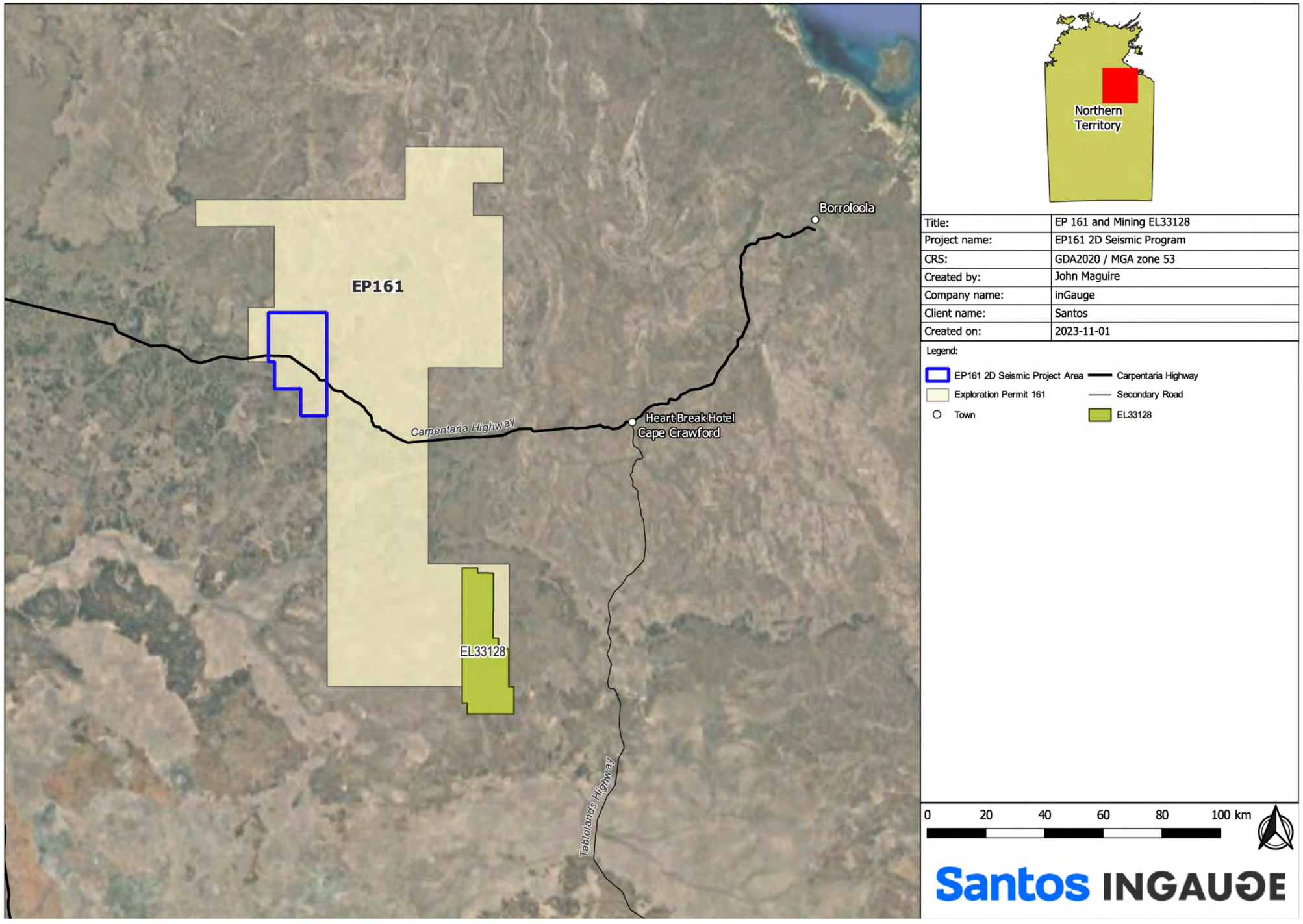


Figure 9.2—2 Green Critical Minerals (EL33128) North Berkely Mining Project

9.2.4 Services

9.2.4.1 Power and Water Corporation

The McArthur River Mine Pipeline intersects EP 161, and the gas pipeline and pipeline corridors will be traversed during the 2D seismic and ground gravity survey. It is considered that the Activity will not impact the pipeline. However, to avoid the Activity coinciding with pipeline maintenance windows and to maintain positive relations, Power and Water Corporation will be engaged as a stakeholder.

9.2.4.2 Telstra

A Telstra communications tower is in the vicinity of the Project Area; however, the Activity is not expected to impact or impinge on the facility's area. To avoid maintenance windows and maintain good relations with the facility owner, Telstra will be engaged as a stakeholder.

9.2.4.3 Department of Infrastructure, Planning and Logistics (DIPL)

The Carpentaria Highway will be used as an access and transport route to conduct the Activity. The function of the highway will not be impacted, however as upgrades are underway the DIPL will be engaged as a stakeholder to maintain good relations.

9.2.5 Notification of Seismic Surveys

See **Table 8.6—2** (Reporting Details) in **Section 8** of the EMP (Implementation Strategy).

9.2.6 Additional Parties

The following people and parties are not considered stakeholders under *Regulation 7* of *the PER*; however, they have been notified of the proposed Activity to maintain and strengthen relationships:

- Roper Gulf Regional Council
- Department of Environment, Parks, and Water Security
- Minister for Mining and Industry - Nicole Manison
- Barkly Council - Member for Barkly - Steven Edgington
- Beetaloo Station

Table 9.2—1 Stakeholder Contact Details

Stakeholder	Role / Position	Phone Number	Email / Other Contact
Landholder			
[redacted]	Landholder Tanumbirini Station (Rallen Australia)	[redacted]	
	Legal Representation		
Northern Land Council			
[redacted]	Senior Project Officer	[redacted]	
	Senior Project Officer		
	Petroleum Manager		
Nurrdalinji Native Title Aboriginal Corporation			
[redacted]			
Mineral / Mining Title Holders			
[redacted]	Managed by: Australian Mining & Exploration Title Services Pty Ltd	[redacted]	
Services			
Power and Water Corporation	[redacted]	[redacted]	[redacted]
Telstra	[redacted]	[redacted]	[redacted]
Department of Infrastructure, Planning and Logistics (DIPL)	[redacted]	[redacted]	[redacted]

Table 9.2—2 Additional Parties - Contact Details

Party Name	Role/Position	Phone Number	Email/Other Contact
Landholder			
[redacted]	Landholder Beetaloo Station	[redacted]	
Roper Gulf Regional Council			
[redacted]	Communication Manager	[redacted]	[redacted]
Department of Environment, Parks, and Water Security			
[redacted]	Director Communications	[redacted]	[redacted]
Minister for Mining and Industry - Nicole Manison			
[redacted]	Chief of Staff	[redacted]	[redacted]
Barkly Council - Member for Barkly - Steven Edgington			
[redacted]	Councillor	[redacted]	[redacted]

9.3 Stakeholder Engagement Activities

The Interest Holder has continued to engage each stakeholder on an ongoing basis since initial identification, specifically regarding the Activity and development in the Northern Territory generally. This includes providing information, presentations, and mapping. Traditional Owners, Landholder, and Industry stakeholders are updated through regularly scheduled industry and governmental joint meetings and one-off conferences. The Interest Holder's engagement includes the following:

- Landholder engagement:
    - 2022..05.21 – 2023.05.31: LAA negotiations
    - 2022.10.26: Onsite discussions surrounding seismic acquisition and rehabilitation.
    - 2023.10.20: Engagement pack provided.
- NLC Traditional Owner engagement:
    - 2022.09.26 - 2022.04.14: Work Program information.
    - 2023.04.12: On-Country Meeting (NLC and TO).
    - 2023.04.14: Discussions regarding AAPA.
- Nurrdalinji Native Title Aboriginal Corporation engagement:
    - 2023.08.17: Work Program submission.

- 2023.08.28 - 2023.09.26: Question and answers regarding Work Program.
- 2023.10.08: Zoom meeting.

- Mineral / Mining Titles:
  - 2023.10.10: Notification of proposed Activity.
- Services:
  - Telstra: 2023.08.02 – 2023.10.09
  - Power and Water: 2023.10.03 – 2023.10.31
  - DIPL: 2023.10.03

Ongoing engagement with landholders/managers is documented in **Appendix 04** and summarised in **Table 9.4—1**, which details the type of information provided to the stakeholders and dates of engagement.

9.4 Assessment of Merit of Objections and Claims

Objections and complaints related to the Activity carried out under this EMP will be recorded in a register and acknowledged in writing.

Complaints from community members and landholders will be investigated, including formal responses to remedy the complaint if relevant and appropriate.

The merits of objections made by stakeholders are addressed in **Table 3.1—1** *Assessment of Merits* in the Stakeholder Log (**Appendix 04**). The Interest Holder will continue to assess the merit of any feedback and will respond accordingly.

Table 9.4—1 Stakeholder Engagement Log - Summary

Date	Method	Stakeholder	Summary of Communication	Response Date	Response Summary
Landholder					
2022.05.21	Email	Landholder → Santos	Raises concerns over location of access track.	2022.05.23	Clarifies that the access track locations are indicative only. Would like to organise a discussion time.
2022.05.31	Email	Landholder → Santos	Raises concerns of the use of open topped pits. Wishes to organise a meeting.	2022.05.31	Responds to concerns, noting discussions with Operations Team to better understand.
2022.10.26	In person	Santos + Landholder	Onsite at Tanumbirini Station. Discussions of seismic acquisition and rehabilitation.	2022.10.26	The Interest Holder committed to mulching seismic lines and utilising existing tracks where possible.
2023.10.20	Email	Santos → Landholder	Email outlining the below attachments, and acknowledgement of query regarding renaming the well. Attached files: • EP 161 Seismic – Pastoralist Engagement Pack. • Letter Santos Confirmation of Registration Access Agreement. • A Deputy Chief Executive Signed – Notice of Approved Access Agreement.	-	-
Northern Land Council & Traditional Owners					
2022.09.26	Email	Santos → NLC	• Work program and spatial files.		
2023.04.05	Email	Santos → NLC	• Shares information which is expected to be shared during the On-Country Meeting and agenda. Attached files: • Meeting Agenda 2023 Work Program Meeting Santos EP 161. • Mataranka presentation pack_NLC_EP 161 Meeting_12 April 2023.	-	-
2023.04.12	In Person	Santos + NLC + TO	• On-Country Meeting in Mataranka.	-	-
2023.04.14	Email	Santos → NLC	Forwarding AAPA certificates.	2023.04.14	NLC • Raises concerns around location of seismic lines in relation to sacred site/s. • Outlined that the TO's wished to share knowledge of country on country, and witness what the Interest Holder is doing.
2022.04.14	Email	Santos → NLC	• Highlights that the certificates have been issued by AAPA, each with conditions, guidance, and warnings. • Outlines that specific access to areas of country within EP 161 are determined by the pastoralist. • Santos is not in a position to approve access to country.	2023.04.14	• Insufficient clarity on the Interest Holder's position to approve access to country. • Requested additional management in future.
Nurrdalinji Native Title Aboriginal Corporation					

Date	Method	Stakeholder	Summary of Communication	Response Date	Response Summary
2023.08.17	Email	Santos → NNTAC	• Details on proposed 2024 Seismic program and potential future works.	2023.08.28	• NNTAC request for further information regarding EMP, consultation, fracking, along with other questions.
2023.08.31	Email	NNTAC → Santos	• Provides a list of questions regarding the work program.	2023.09.26	• Responses provided to question raised by NNTAC.
2023.09.21	Email	NNTAC → Santos	• Nurrdalinji Aboriginal Corporation invite Santos to a meeting.	2023.10.07	• Meeting focusing on consent and inclusion of NTTAC in future discussions.
Mineral/Mining Title Holders					
2023.10.10	Email	Santos → NT Australian Mining & Exploration Title Services (on behalf of Pennant Resources)	• Notification of intent to undertake regulated activities. • Attached files: maps of seismic line across Tanumbirini station.	-	-
Services					
Telstra					
2023.08.02	Email	Santos → Telstra	• Seeking relevant contact details in regard to Telstra Tower 3354.		•
2023.09.06	Phone	Santos → Telstra	• Discussed details and potential impacts of proposed 2024 Seismic Program and potential future works.	2023.09.06	• Summary and reiteration of the Interest Holder's plans in EP 161, the name and location of the tower. • A GIS map of the location and survey plan of the site.
2023.09.06	Email	Telstra → Santos	• Confirmation that Telstra has no issues with proposed Interest Holder Activity in the area. • Details of the Amplitel site.	2023.10.09	• Formal communication of work the Interest Holder will be conducting in EP 161 during 2024/2025. • Outlining the Activity.
Power & Water					
2023.10.03	Email	Santos → Power Water	• Details on proposed 2024 Seismic program, including rehabilitation and monitoring. • Maps of the proposed Activity.	2023.10.26	Phone: • Discussion of Activity in relation to pipeline. Email: • Requests previously sent documents with maps /attachments. Outlines policies with pipeline crossings with heavy >10T vehicles, pipeline buffers, and ground limit of peak particle velocity (PPV).
2023.10.31	Email	Santos → Verbrec	• Attaches copy of Stakeholder Engagement Pack. • Confirms Santos will clear the pipeline by 30 m during seismic acquisition and that PPV tests will be conducted to ensure the PPV is below 10mm/sec.	-	-
DIPL					
2023.10.03		Santos → DIPL	• Notification of intent to undertake regulated activities.	-	-

9.5 Ongoing Consultation

Before any land access or the Activity commences, the Interest Holder will notify all owners and occupiers of land (refer **Section 9.2.5**).

The Interest Holder will also uphold and respect any specific requirements for notification and consultation under an executed agreement (e.g., ILUA and/or LAA).

During the Activity, the Interest Holder will have field representatives in the vicinity. Field-based representatives will be the primary point of contact for all landholders and community members during the work phases. Field representatives will manage the day-to-day Activity and communications concerning the landholders to ensure they are consistently updated on the Activity's status.

Stakeholders will have direct access to a company representative based in an office location who has existing relationships and is experienced in the agreements required to conduct the Activity under this EMP.

The Interest Holder takes a proactive engagement strategy in its Northern Territory operations to ensure that stakeholders are consistently engaged and informed. The Interest Holder's ongoing strategy for respectful engagement is to maintain availability to inform stakeholders of current operations, review past operations' status and findings, and communicate plans for any potential future operations.

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

9.6 Workforce

Although not a stakeholder, the Interest Holder is committed to building relationships with local businesses, facilities, and suppliers.

The Interest Holder upholds a preference to engage local businesses, facilities, suppliers, and the employment of local/regional people. To achieve this, Santos will fulfil the obligations of the ILUA and will implement a contract and procurement strategy that includes preferential weighting applied to local and indigenous content in the contract award decision.

The Interest Holder will engage with local and Indigenous businesses for the delivery of works and supplies where these sources are available in the area of the Activity.

Works may include:

- Weed control.
- Monitoring.
- Slashing.

The workforce for specialised works will be primarily conducted by principal contractors, whose workforce is comprised of FIFO workers. Where principal contractors require services, contract terms and conditions will promote local hire.

Workforce accommodation for the Activity will be primarily at the campsite.

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