# Environmental Management Plan

# Amadeus Basin: Jacko Bore 1DW1 Drill and Test Program

# EP 125

# Santos QNT Pty Ltd

## Document Control

Prepared for: **Santos QNT Pty Ltd**

| Date | Rev | Description | Authors | Third Parties Engaged | Reviewed |
|---|---|---|---|---|---|
| **14/02/2023** | 1 | Issued for Submission | KR, TS, AS, VC, NF | EcOz Pty Ltd.<br>GHD Pty Ltd.<br>Heritage Consulting Australian Pty Ltd.<br>RDM Hydro Pty Ltd. | JG, LD, JH, RM, RA, DG, JL, SR |
| **16/06/2023** | 2 | Issued for Submission | KR, TS, AS, VC, NF, PS, VF | EcOz Pty Ltd.<br>GHD Pty Ltd.<br>Heritage Consulting Australian Pty Ltd.<br>RDM Hydro Pty Ltd.<br>Fyfe Pty Ltd.<br>Cirqa Pty Ltd. | AS, RA, JH, LD, SR, RM, MG, AR |
| **15/12/2023** | 3 | Issued for Submission | NF, PS, VC, VF, TS | EcOz Pty Ltd. | LD, JH, KAWS |
| **03/05/2024** | 4 | Issued for Submission | NF, TS | EcOz Pty Ltd. | KAWS, TW |
| **28/06/2024** | 5 | Approved for use for STO5-5 | NF, TS | EcOz Pty Ltd. | KAWS, TW |

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| Date | Rev | Name | Position |
|---|---|---|---|
| 28/06/2024 | 5 | David Gornall | Manager Environment EA PNG |

## Executive Summary

Santos QNT Pty Ltd (the Interest Holder) proposes to drill, complete, and test one helium appraisal well (Jacko Bore 1DW1) on an existing well pad in EP 125. The regulated Activity and its ancillary works (the Activity) is anticipated to commence in 2023.

This Environmental Management Plan (EMP) has been prepared in line with the *Petroleum (Environment) Regulations 2016* (NT) (PER) and the *Code of Practice: Petroleum Activities in the Northern Territory* (*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) [DENR et al., 2019].

The regulated Activity and its ancillary works (the Activity) to be carried out under this EMP are described in **Table. i**

## a. Description of the Activity

**Table. i Description of the Activity**

| The Activity | Description | Units | Unit of Measure | ha Cleared |
|---|---|---|---|---|
| **Well Pad**<br>(Expansion) | • Expansion of the existing Jacko Bore 1 well pad. Hectares (ha) cleared includes the following:<br>o New clearing for the expansion of the well pad.<br>o Laydown yard and overburden spoil stockpile.<br>o Construction of tank pad/s, fire breaks, and effluent irrigation area (no extra clearing).<br>o Buffer area to account for any deviations identified during ground-truthing. | 1 | each | 5.3 |
| **Campsite** (Including helicopter landing zone)<br>(Re-establishment) | • The re-establishment of a previously utilised campsite.<br>• The area cleared is N/A, as the campsite is pre-existing. | 1 | each | N/A |
| **Access Track**<br>(Use of existing tracks, re-establishment, and new tracks) | • Use and maintenance of the public road and existing access track to the well pad.<br>• The area cleared is listed as N/A, as these tracks are pre-existing. | 17,353 | m | N/A |
| | • Establish new access tracks to the well pad and campsite and bores.<br>• The area cleared for the construction of new tracks. | 1,000 | m | 2.0 |
| **Gravel/Borrow Pit/s**<br>(Use and maintenance) | • Use and maintenance of pre-existing pits along the access track to the well pad.<br>• The area cleared is listed as N/A, as the gravel pits are pre-existing. | 4 | each | N/A |
| **Water Bore/s (Construction)** | • The construction of production water bore pads where a producing water bore cannot be established on the well pad.<br>• The area cleared includes three cleared bore locations for up to two water bores. | Up to 2 bores<br>Up to 3 locations | maximum | 1.5 |
| **Well – Drilling**<br>(One horizontal well drilled and evaluated) | • The drilling, evaluation, and testing of a helium appraisal well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Well – Completions** | • The completion works required on the well.<br>• The cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Well – Monitoring and Maintenance** | • The workover, intervention, monitoring, and maintenance for the life of the well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1* | each | N/A |
| **Well – Suspension and Decommissioning** | • The well suspension and decommissioning works that may be required on the well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Well - Extended Production Testing** | • The Extended Production Testing (EPT) of the well for up to 365 days over a period of 12-18 months.<br>• The area cleared is listed as N/A, as clearing is calculated in the Well Pad expansion. | 1 | each | N/A |
| **Rehabilitation**<br>(Well Pad, Campsite, Access Tracks, Gravel/Borrow Pit/s) | • Rehabilitation of area utilised for the Activity and previously disturbed areas associated with the Interest Holder's exploration and appraisal activities. | 1 | each | N/A |

* The well may be re-completed or worked over more than once.

**Summary of the Activity:**

The Activity includes:

- The re-establishment of the previously cleared well pad area, access track and campsite.
- The expansion of the well pad and the clearing of new access tracks.
- Drilling, Completion and Extended Production Testing (EPT) of a horizontal well.

Construction of water bore/s, use of existing gravel/borrow pit/s, and maintenance and monitoring of the access track, well pad and well up to, and including suspension, decommissioning, and rehabilitation. Rehabilitation will be of area cleared for the Activity and previously disturbed areas associated with the Interest Holder's exploration and appraisal activities, but not infrastructure put in place by the landowner that may be utilised during the Activity.

Note: the Activity does not include hydraulic fracturing, nor is there the intention to hydraulically fracture the well.

**Project Area:**

The Activity will be conducted within the Project Area outlined in **Figure. i**. The Project Area was chosen to focus the environmental assessment on the area where the Activity will occur within the EP.

The Project Area is approximately 190km south of Alice Springs, 175km east of Yulara, and west of the Stuart Highway and the Alice Springs Tarcoola Railway in the Northern Territory (NT). It includes the public road that will be utilised from the Stuart Highway to the access track for the well pad (**Figure. ii**).

The coordinates of the Project area are shown below in **Table. ii**.

**Table. ii Project Area Coordinates**

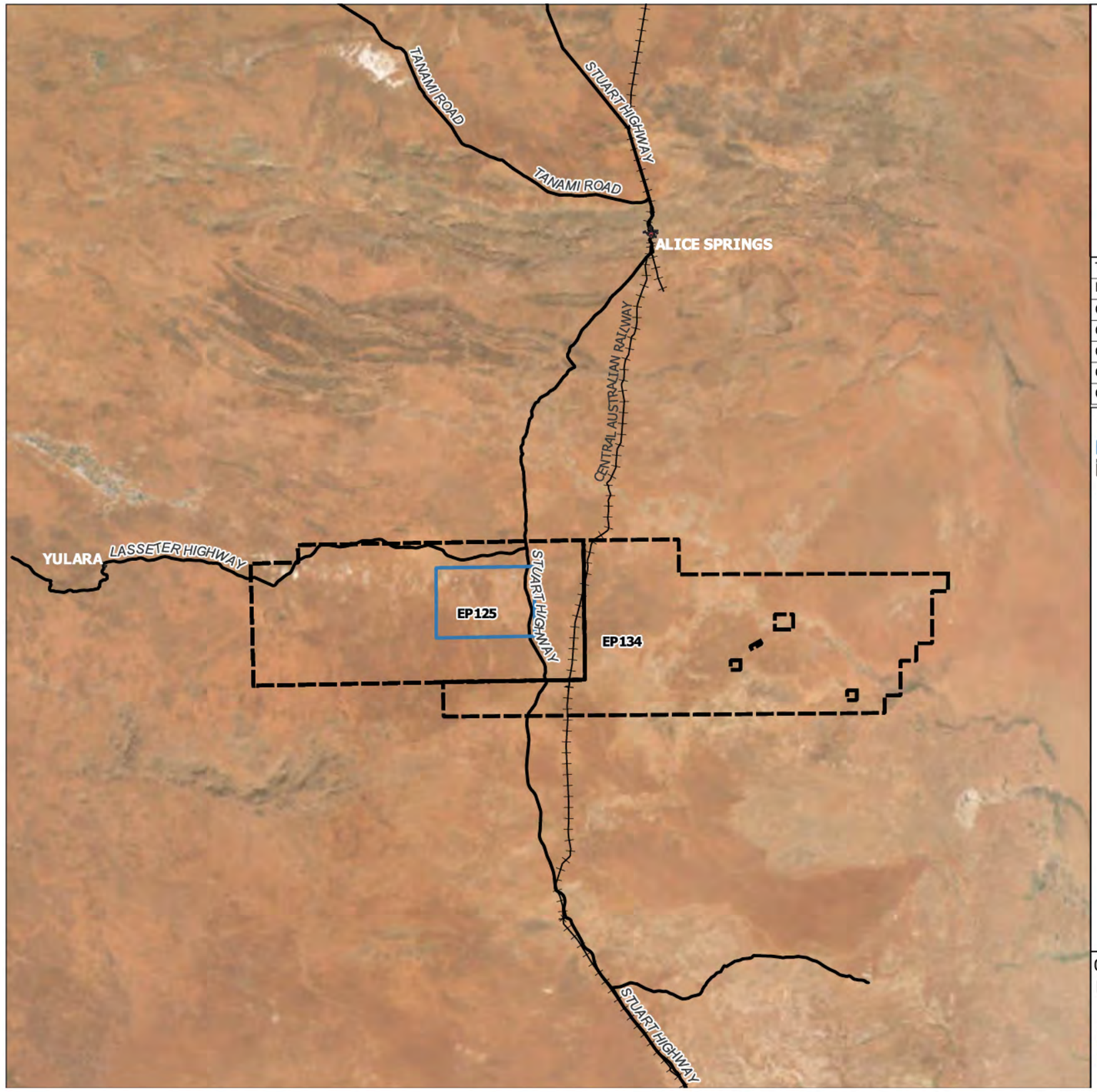
| Longitude | Latitude |
|---|---|
| 271045.1567 | 7164172.84 |
| 270950.6033 | 7201284.63 |
| 322803.5123 | 7202047.12 |
| 323289.6605 | 7165123.895 |

**Project Existing Environment:**

The Project Area lies within the Amadeus Depression of the Southern Desert Basins, which is dominated by limestone plains, pans, and tributary slopes. Karinga Creek runs through Erldunda Station to the north of EP 125, flowing in an east-west direction and draining into a chain of salt lakes/clay pans and eventually into the Finke River [SANTOS, 2013].

The Project Area contains the Karinga Creek Paleo-drainage System (KCPS) Site of Conservation Significance (SOCS) and Site of Botanical Significance (SOBS). To access the well pad, campsite and gravel/borrow pit/s, the pre-existing access tracks will be utilised as per **Figure. ii**. There will be no new construction within SOCS or SOBS in EP 125 as shown in **Figure. iii**.

A summary of the existing environment is presented in **Table. iii.**







| | |
|---|---|
| Title: | Project Area Location |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-01 |

Legend:

- Project Area
- EP Boundary
- NT Major Towns
- Principal Road
- Railways

0 30 60 90 120 150 km

Santos INGAUGE

**Figure. i Project Area**

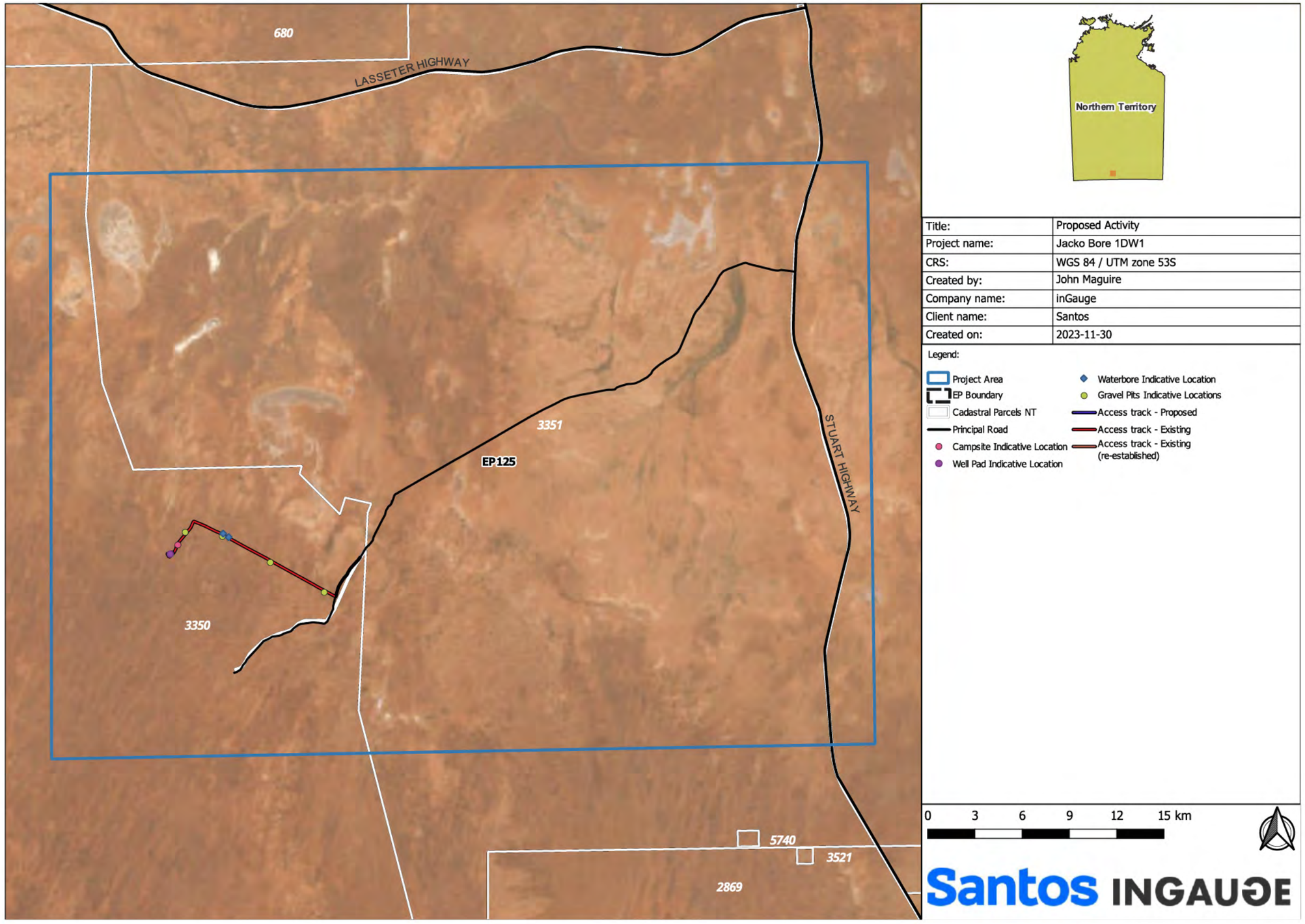



**Figure. ii Proposed Regulated Activity**

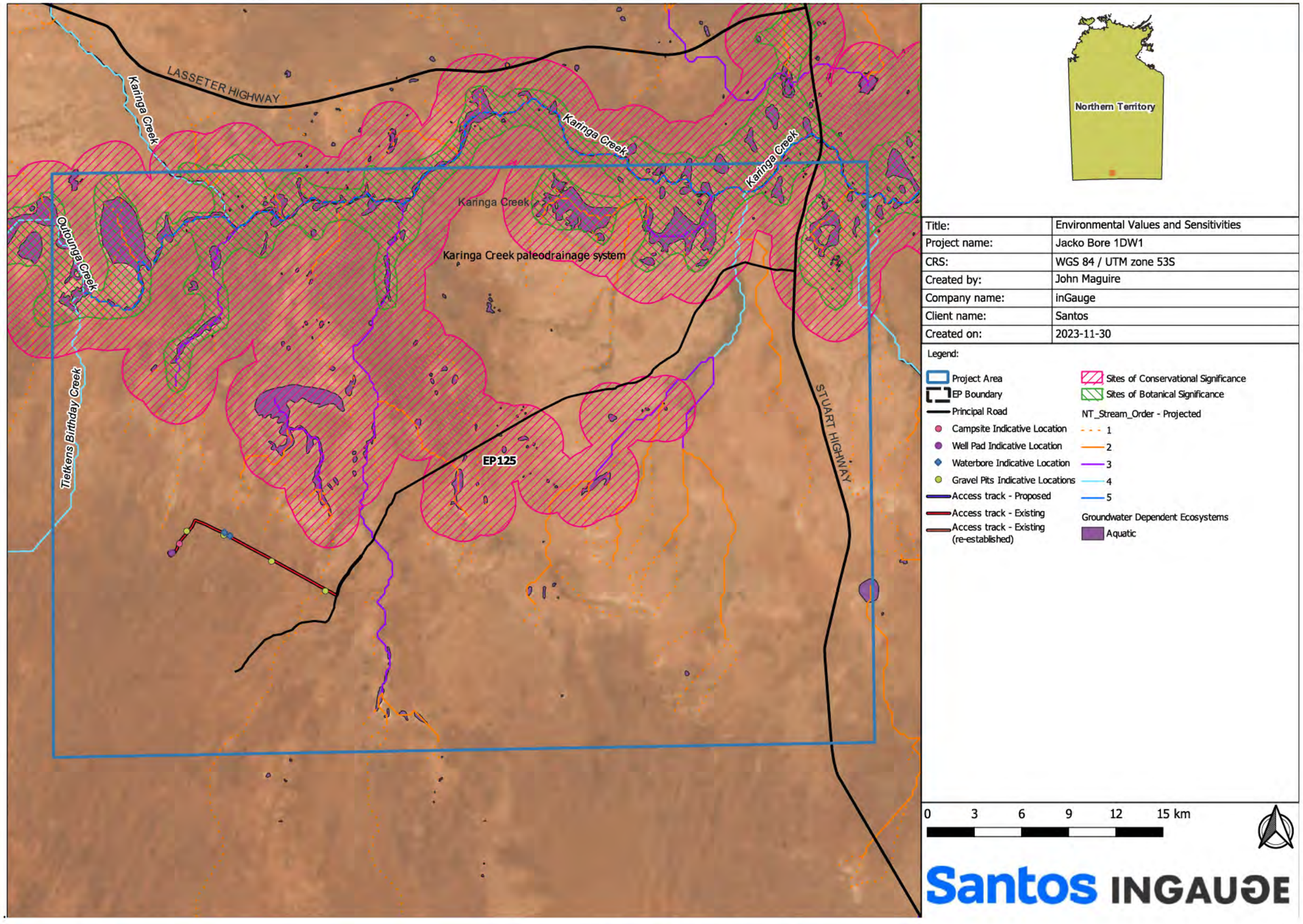



**Figure. iii Environmental Values and Sensitivities (Protected Areas)**

**Table. iii Summary of the Existing Environment**

| Area/Issue | Environmental Factors | Environmental Values and Sensitivities | Summary |
|---|---|---|---|
| **Air** | • Air Quality and Atmospheric Processes | Air quality is conducive to the life, health and well-being of humans and ecosystems | • A Methane Emissions Management Plan is available in **Appendix 10**. Leak detection tests will be undertaken at the well pad as per Part D (5) of *the Code*. |
| **People & Community** | • Community & Economy<br>• Culture & Heritage<br>• Human Health | Cultural heritage and Sacred sites | • The Interest Holder has obtained an AAPA Certificate (C2023/054 variation to C2023/018).<br>• An additional survey was conducted in November 2022 by an approved NT archaeological consultant (**Appendix 02**). |
| | | People and communities | • There are pastoral properties with livestock and infrastructure near the tenement. The Project Area spans a total of two pastoral properties. |
| **Water** | • Inland Water<br>• Environmental Quality | Groundwater | • The Project Area lies within the Amadeus basin, which hosts fractured and sandstone rock aquifers. These aquifers are primarily local scale, with low productivity. Project Area is not within a water control district. |
| | | Surface water | • The main watercourse near the Project Area is Karinga Creek. |
| | | Supply and quantity of water | • The Project Area encompasses sandstone and fractured rock aquifers, which are low-yielding. The groundwater is brackish to saline, with most groundwater quality being unsuitable for potable drinking water supply. |
| **Land** | • Terrestrial Ecosystems<br>• Landforms<br>• Terrestrial Environmental Quality | Sensitive or significant vegetation | • The Project Area overlies the Karinga Creek Paleodrainage System (KCPS) Site of Conservation Significance (SOCS) and Site of Botanical Significance (SOBS), but the well pad, water bore, and new access tracks will not be constructed within it, and the gravel/borrow pit/s being utilised are outside of this area. Access to the infrastructure will only be via existing pastoral tracks that traverse sections of the KCPS. |
| | | Groundwater Dependent Ecosystems (GDE) | • A search of the National Groundwater Dependent Ecosystems (GDEs) Atlas conducted in June 2022 identified a low potential of aquatic or subterranean GDEs occurring within the Project Area. There are mapped potential terrestrial GDEs identified in the Project Area, mainly in KCPS [BOM, 2022b]. The mapped potential GDEs are of unclassified potential from national scale assessment. |
| | | Threatened fauna species and their habitats | • The Protected Matters Search Tool (PMST) and a desktop data search identified the potential for threatened fauna species to be within the Project Area. The Interest Holder has identified mitigative measures to prevent habitat loss and minimise disturbance. |
| | | Listed migratory species | • The PMST indicates that migratory species are likely to or may occur in EP 125. These migratory species will most likely use the KCPS for stop-over ground. |
| | | Listed threatened flora species and ecological communities | • No Threatened Ecological Communities (TECs) are listed under the EPBC Act and/or TPWC Act within EP 125 or buffer zone. |
| | | Soils | • The Activity is located in an area that predominantly comprises clay soils in clay pans and red sands. These clays are scalded red-brown and heavy-brown clay, respectively. |

No declared pest species were observed during the field surveys [GHD, 2022].

## b. Environmental Impacts and Risks

The key risks of the Activity on the environment and community (Environmental Factors) extracted from the Risk Assessment (**Appendix 04**) are summarised in **Table iv**.

**Table iv Summary of Environmental Factors, Works, and Key Risks**

| Environmental Factors | The Activity | Impacts and Risks |
|---|---|---|
| **Air Quality and Atmospheric Processes** | • Establishing/constructing the well pad, new access tracks and campsite.<br>• Drilling, completions, and Extended Product Testing (EPT) mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Increased greenhouse gas emissions from land clearing, vehicle use and flaring. |
| **Community and Economy** | • Establishing/constructing the well pad expansion, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Damage to public and private roads.<br>• Nuisance (noise, light, and dust).<br>• Spread of biosecurity risk material.<br>• Completion of the Activity without input/involvement of local businesses or people.<br>• Bushfire. |
| **Culture and Heritage** | • Expansion of the well pad and the construction of new access tracks. | • Disturbance or damage to artefacts and/or cultural heritage sites. |
| **Human Health** | • Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Nuisance (dust, noise). |
| **Inland Water Environmental Quality** | • Establishing/constructing the well pad, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Sediment release from cleared infrastructure.<br>• Constructed infrastructure impedes natural surface water flow.<br>• Loss of well circulation while drilling.<br>• Loss of well control.<br>• Overflow of drilling by-products storage pits.<br>• Leak in drilling pit liner designed to store drilling by-products storage pit liner.<br>• Spills of drill fluids, chemicals, or fuels during operations.<br>• Spills of chemical or wastewater during transport, e.g., within KCPS SOCS/SOBS buffers. |
| **Landforms** | • Establishing/constructing the well pad and new access tracks. | • Change to previous landscape and visual amenity/aesthetics. |
| **Terrestrial Ecosystems** | • Establishing/constructing the well pad, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Impact on fauna movements from new infrastructure, noise, or light.<br>• Entrapment of fauna or stock in drilling by-product storage pit. |
| **Terrestrial Environmental Quality** | • Establishing/constructing the well pad, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Change or degradation of habitat features.<br>• Sediment release.<br>• Spread of biosecurity risk material.<br>• Pooling of runoff of greywater and treated sewage effluent from irrigation areas.<br>• Spills of drill fluids, chemicals, or fuels during operations.<br>• Spill of chemical or wastewater during transport.<br>• Bushfire.<br>• Rehabilitating site to previous land use standards or an acceptable level for continued landowner use. |

The complete list of risks and the associated risk management controls to prevent, detect and mitigate potential impacts are presented in the Risk Assessment (**Appendix 04**).

## c. Environmental Outcomes

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*, 2021 [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.

The objective of this EMP is to demonstrate that the environmental impacts and environmental risks associated with the Activity will be reduced to ALARP and acceptable. In order 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 will be implemented as described in the Environmental Risk Assessment Framework (**Appendix 03**).

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 sought to be achieved in the carrying out of the Activity and as described in this EMP, refer to **Section 7.7**.

## d. Stakeholder Engagement

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

Stakeholder engagement processes during the preparation of this EMP comprised of providing 'information, consultation, involvement, collaboration and empowerment' to achieve the best outcome for both parties' [IAP2, 2018].

The PER defines '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.

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

- Host Pastoralist Lyndavale Station.
- Traditional Owners (via Central Land Council (CLC) facilitation, pursuant to the Indigenous Land Use Agreement (ILUA) entered into under the Native Title Act 1993 (Cth), which covers the land area corresponding with Exploration Permit numbers 82, 112, 118 and 125).
- Overlapping Minerals Title Holder, Core Uranium Limited (Core).

The *Native Title Act 1993* (Cth) identifies Native Title Holders who hold rights and interests in an area according to their traditional laws and custom. In compliance with the Native Title Act 1993 (Cth), the Interest Holder has a registered ILUA, signed on 18 July 2007, which covers the land area corresponding with Exploration Permit numbers 82, 112, 118 and 125. In accordance with the ILUA, the CLC represents the Native Title Holder's rights and interests in the land to which the ILUA relates, including the land directly impacted by the Activity.

As the Native Title Holder's representative, CLC was responsible for organising and facilitating the Interest Holder's engagements with Traditional Owners directly affected by the environmental risks and environmental impacts of the Activity. This included an on-country meeting with the Imanpa community, who are the Traditional Owners and the Native Title Holders for the Jacko Bore Project Area.

During engagement with the CLC and the on-country meeting with the Imanpa community, no other Traditional Owners whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Activity were identified. To the best of the Interest Holder's knowledge, there are no additional Traditional Owners who are 'stakeholders' for the purposes of the Activity within the meaning of the PER. All Traditional Owner stakeholder engagements were carried out in

compliance with the *Stakeholder Engagement and Consultation Guideline* [NT EPA, 2021], the NT EPA guidance documents, and the EP Act [DEPWS, 2019].

Following a notice issued under Regulation 10 of the PER dated 13 April 2023, the Interest Holder reviewed whether Core, the registered title holder of Minerals Exploration Licence (EL) 32974 and application for Minerals EL 32971, according to Spatial Territory Resource Information Kit for Exploration (STRIKE), was a Stakeholder as defined under the PER. EL 32974 overlaps with the access track proposed to be used for the purposes of the proposed Activity and the application for EL 32971 overlaps with the proposed well pad and associated infrastructure. Although it is not anticipated that the environmental impact or risk of the proposed Activity will affect Core in exercising its rights or activities under the overlapping tenures, Core was notified of the proposed Activity out of an abundance of caution on 9 June 2023.

The engagement process involved:

- Educating 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.

**Table. v** is a list of stakeholders with whom the Interest Holder has carried out stakeholder engagement. Further information and evidence of the Interest Holder's stakeholder engagement is presented in **Section 8** of this **EMP**, and a complete log of stakeholder engagement is attached as **Appendix 11**.

Future engagement with pastoralists will occur throughout the duration of the proposed Activity.

**Table. v Contact Details of Stakeholders Directly Impacted by the Proposed Activity**

| Stakeholder | Role / Position | Phone Number | Email / Other Contact |
|---|---|---|---|
| **Pastoralists/Managers** | | | |
| [redacted] | Owners/Station Managers – Lyndavale Pty Ltd – Lyndavale Station<br>Represented by Emanate Legal (Nicholas Taylor) | [redacted] | [redacted] |
| [redacted] | Owners/Station Managers – Lyndavale Pty Ltd – Lyndavale Station<br>Represented by Emanate Legal (Nicholas Taylor) | [redacted] | [redacted] |
| **Central Land Council (on behalf of the Imanpa Community's Traditional Owners)** | | | |
| [redacted] | Manager Minerals and Energy | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Employment Facilitator | [redacted] | [redacted] |
| [redacted] | Manager - Minerals and Energy | [redacted] | [redacted] |
| [redacted] | Anthropologist - South Central Region | [redacted] | [redacted] |
| **Minerals Title Holder: Core Uranium** | | | |
| [redacted] | Director<br>Core Uranium Pty Ltd | [redacted] | [redacted] |
| **Minerals Title Holder: Terralith Metals Pty Ltd (Terralith)** | | | |
| [redacted] | Principal Consultant<br>M & M Walter Consulting (MMWC) | [redacted] | [redacted] |
| [redacted] | Managing Director Terralith Metals Pty Ltd | [redacted] | [redacted] |

**Table. vi Contact Details of Further Parties Informed of the Proposed Activity**

| Further Party | Role / Position | Phone Number | Email / Other Contact |
|---|---|---|---|
| **Landholders/Managers** | | | |
| [redacted] | Owners/Station Managers – Erldunda Land Trust<br>Erldunda Station | [redacted] | [redacted] |
| [redacted] | Accommodation Provider | [redacted] | [redacted] |

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

**Table. vii Summary of Engagement with Stakeholders**

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| **Station Owners / Managers** | | | |
| 2022.01.08 – 2022.01.26 | Emails / phone | [redacted] | Discussion of the Interest Holder's proposed drilling program. |
| 2022.02.07 | Email | [redacted] | Notice of Entry. |
| 2022.02.10 &2022.02.22 | Phone call | [redacted] | Upcoming survey plans. |
| 2022.02.26 | In person | [redacted] | Discussion of proposed activity. |
| 2023.04.21 | Email | [redacted] | Arrangements for in person visit and maps provided. |
| 2022.04.26 | In person | [redacted] | Discussion of proposed activity and water bore locations. |
| 2022.09.14 | Email | [redacted] | Proposal of face-to-face discussion. |
| 2022.09.27 | In person / via Skype | [redacted] | Update on status of the Activity and provided pastoralist engagement pack. |
| 2022.09.28 | Email | [redacted] | Notice of Entry. |
| 2022.10.05 | Email | [redacted] | Notice of Entry. |
| 2022.10.18 | Email | [redacted] | Notice of Entry. |

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| 2022.11.15 | Email | [redacted] | Notice of Entry & bushfires on Mt. Ebenezer Station. |
| 2022.11.19 | Email | [redacted] | Pastoral Engagement Packs. |
| 2023.01.17 | Email | [redacted] | Notice if Entry for leak detection visits. |
| 2023.02.28 | Email | [redacted] | Form 15 and draft LAA. |
| 2023.03.01 | Email & phone | [redacted] | Form 15 and draft LAA. |
| 2023.03.14 | Email | [redacted] | Form 15 and draft LAA. Acknowledgement that they would be acting on behalf of the Stanes. |
| 2023.04.11 | Email | [redacted] | Confirmation of meeting attendees and meeting link organisation. |
| 2023.04.12 | Phone hook-up | [redacted] | Phone hook-up to discuss the Mt Kitty 2 LAA with Stanes legal representative, Stanes, and Santos' representatives. |
| 2023.04.24 | Email | [redacted] | Organisation of meet-up for access track upgrades (Mt. Kitty 2) |
| 2023.04.25 | Phone | [redacted] | Access track inspection. |
| 2023.05.15 | Email | [redacted] | Initial response to Santos' draft Mt. Kitty 2 LAA. |
| **Central Land Council** | | | |
| 2021.12.13 | Video conferencing call | [redacted] | Requesting basic program information. |
| 2022.01.11 | Email | [redacted] | Preliminary high-level forward work program provided to CLC. |
| 2022.01.31 | Email | [redacted] | CLC request form. |
| 2022.03.15 | Email | [redacted] | Planning/scheduling query. |
| 2022.03.25 | Email | [redacted] | Planning/scheduling query. |
| 2022.04.01 | Email | [redacted] | Planning/scheduling query. |
| 2022.04.12 | Phone | [redacted] | Re CLC schedule. |
| 2022.05.10 | Email | [redacted] | Clarity on Exploration program. |
| 2022.05.19 | Video conferencing call | [redacted] | Proposed Regulated Activities and their locations. On Country meeting outcomes. |
| 2022.07.08 | Email | [redacted] | Interest Holder revised work programs. |
| 2022.07.12 | Email | [redacted] | Interest Holder proposed follow-up discussion regarding work program. |

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| 2022.07.25-26 | Email | [redacted] | Clarity on Exploration program. |
| 2022.07.29 | Video conferencing call | [redacted] | Techniques to be used at Dukas location in proposed and future work programs. |
| 2022.08.03 | Email | [redacted] | Confirming video conference points. |
| 2022.08.04 | Email | [redacted] | Prevision of digital data pertinent to revised work programs. |
| 2022.08.12 | Email | [redacted] | Clarification on previous queries. |
| 2022.08.22 | Email | [redacted] | Engagement of CSIRO for On Country meeting. |
| 2022.08.24 | Email | [redacted] | Cost estimate for On Country meeting & Sacred Site Clearance Survey |
| 2022.08.25 | Email | [redacted] | Seeking details regarding work programs. |
| 2022.08.29 | Email | [redacted] | Mt. Kitty 1 access tracks. |
| 2022.09.01 | Email | [redacted] | Chopper usage. |
| 2022.09.19 | Email | [redacted] | On-Country meeting confirmation. |
| 2022.09.21 | Email | [redacted] | Cost estimates for On Country meeting. |
| 2022.09.27 | Meeting | [redacted] | CLC and TO Meeting on country. |
| 2022.10.05 | Email | [redacted] | On Country meeting feedback. |
| 2022.10.19 | Email | [redacted] | Lodged work programs. |
| 2022.10.31 | Email | [redacted] | Employment opportunities. |
| 2022.11.02 | Email | [redacted] | Status of SSCC process and outcomes. |
| 2022.11.09 | Email | [redacted] | SSCC report timelines. |
| 2022.12.06 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2022.12.14 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2022.12.15 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2023.01.24 | Phone / Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| 2023.02.07 | Phone | [redacted] | Discussion regarding employment opportunities, identification, and existing business databases. |
| 2023.03.14 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2023.05.03 | Email | [redacted] | SSCC for our project areas in the Southern Amadeus. |
| **Core Uranium Pty Ltd** | | | |
| 2023.06.09 | Email | [redacted] | Notification of proposed activities & Engagement Pack |
| 2023.06.13 | Email | [redacted] | Acknowledgement and approval of proposed activities. |
| **Terralith Metals Pty Ltd (Terralith) via MMWC** | | | |
| 2023.12.01 | Email, Cover Letter, Map & Engagement Pack | [redacted] | Notification that Terralith had been identified as a stakeholder to the Interest Holder's proposed Activity in the Amadeus Basin. |
| 2023.12.01 | Email | [redacted] | Confirmation of receipt. |

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

During stakeholder engagement, the key concern raised by the Imanpa community's Traditional Owners was the name of the proposed appraisal well, Mt Kitty 2. To better reflect the cultural connection to the location, the original name of this Activity, Mt Kitty 2 has been changed to Jacko Bore 1DW1. The existing and previously named Mt Kitty 1, the discovery well of the Mt Kitty/Jacko Bore accumulation, is now called Jacko Bore 1, the discovery well of the Mt Kitty/Jacko Bore accumulation.

In order to effect this change, the Interest Holder consulted the Department for Industry, Tourism and Trade (DITT) and requested that the existing Mt Kitty 1 wellbore be re-named to Jacko Bore 1 and that the Activity proposed under this EMP to also refer to Jacko bore. That request was accepted. Therefore, the Activity proposed under this EMP is named Jacko Bore 1DW1. (It should be noted that any reference to this Activity in documentation previous to this decision may be referred to as Mt Kitty.)

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## Appendices

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**Appendix 03** - Environmental Risk Assessment Framework

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**Appendix 05** - Erosion and Sediment Control Plan

**Appendix 06** - Waste and Wastewater Management Plan

**Appendix 07** - Spill Management Plan

**Appendix 08** - Fire Management Plan

**Appendix 09** - Weed Management Plan

**Appendix 10** - Methane Emissions Management Plan

**Appendix 11** - Stakeholder Engagement Log

**Appendix 12** - Rehabilitation Management Plan

**Appendix 13** - Emergency Response Plan

**Appendix 14** - Traffic Impact Assessment

# Definitions

This section provides a guide for pertinent terms used throughout this EMP and its appendices.

**Table. viii Definitions**

| Terminology | Definition |
|---|---|
| **The Activity** | The regulated works covered by this EMP:<br>• The re-establishment of a previously cleared well pad, access tracks, and a campsite.<br>• Use of existing gravel pits.<br>• Expansion of the well pad and clearing of new access tracks.<br>• Drilling, completing, and testing a horizontal well.<br>• Drilling water bores.<br>• Ongoing maintenance during the life of the assets and the rehabilitation of land associated with the Activity. |
| **Above-ground tank** | An above-ground tank is used to store and manage produced fluid. This term may refer to a mobile tank, or a panelled tank. |
| **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. |
| **Borrow Pit** | Location of suitable fill material for construction purposes (e.g., gravel or clay). Also referred to throughout the EMP and its appendices as a 'gravel pit'. |
| **Camp Wastewater** | Treated sewage effluent and greywater from campsite/s and offices (e.g., laundry, showers and sink wastes). |
| **Drilling by-products** | Residual drilling fluids, cuttings, **and** cement returns. Also referred to as drilling waste. |
| **Drilling Fluids** | The mixture of water and additives for drilling purposes (e.g., lubricating the drill bit and removing cuttings). |
| **Completions Fluids** | Fluid use to control a well during the activity of well completion. |
| **Environmental Impact** | Has the meaning given in the PER being:<br>*'Any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity.'* |
| **The EP** | Exploration Permit 125. The location of the regulated Activity. See **Figure 1—1**. |
| **Extended Production Testing** | Up to 365 days of flow testing over a period of 12-18 months. |
| **Gravel Pit** | Location of suitable fill material for construction purposes (e.g., gravel or clay). Also referred to throughout the EMP and its appendices as a 'borrow pit'. |
| **The Interest Holder** | Santos QNT Pty Ltd. The title holder of the Exploration Permit 125. |
| **Implementation Strategy** | Has the meaning given in the PER 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* [of *the Code*]'. |
| **Minister** | Minister of Environment, Climate Change and Water Security. |
| **Non-operational** | Any time when there is no crewed activity occurring on the site.<br>A non-operational site may have the following:<br>• Storage of drill cuttings and drilling fluids.<br>• Storage of wastewater.<br>• Passive monitoring. |
| **Open-top (Treatment) Tank** | An above-ground tank used to evaporate (treat) stored water or wastewater. |
| **Operations** | Any time when there is crewed activity occurring on the site. A short visit to the site for inspection/monitoring does not constitute site activity. |
| **Pastoralist** | Leases the land. |
| **Produced Fluid** | Naturally occurring water extracted from the geological formation during EPT testing. |
| **Project** | The Activity to be conducted under this EMP. |
| **Project Area** | Location of the Activity within the EP. |
| **Recordable Incident** | Has the meaning given in the PER being:<br>*'An incident arising from a regulated activity:*<br>*That:*<br>*Has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or*<br>*Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or*<br>*Is inconsistent with an environmental outcome specified in the current plan for the activity; and*<br>*is not a reportable incident.'* |
| **Reportable Incident** | Has the meaning given in the PER being:<br>*'An incident, arising from a regulated activity, that has caused or has the potential to cause material environmental harm or serious environmental harm.'* |
| **Significant Rain Event** | 150mm over a 4-day period based on an Annual Exceedance Probability of approximately 5% (1 in 20-year Average Recurrence Interval) utilising rainfall data from the nearest weather station, Kulgera (station #015603) |
| **Traditional Owner** | Has the meaning given in the *Aboriginal Land Rights (Northern Territory) Act 1976* being:<br>traditional Aboriginal owners, in relation to land, means a local descent group of Aboriginals who:<br>(a) 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<br>(b) are entitled by Aboriginal tradition to forage as of right over that land. |

| Terminology | Definition |
|---|---|
| ***the Code*** | *Code of Practice: Petroleum Activities in the Northern Territory 2019* [DENR et al., 2019]. |
| **Wastewater** | Includes drilling fluids or drilling by-products, completions fluids, produced fluids and greywater |
| **Well Pad** | Location of the well and associated infrastructure. |

# Abbreviations and Units

**Table. ix Abbreviations and Units**

| Acronym / Abbreviations | Description |
|---|---|
| **AAPA** | Aboriginal Areas Protection Authority |
| **ALARP** | As Low as Reasonably Practicable |
| **ARI** | Average Recurrence Interval |
| **BoM** | Bureau of Meteorology |
| **CH&AE** | Cultural Heritage and Aboriginal Engagement |
| **CHAR** | Cultural Heritage Assessment Request |
| **CLC** | Central Land Council |
| **CPESC** | Certified Professional in Erosion and Sediment Control |
| **DAWE** | Dept of Agriculture, Water, and the Environment |
| **DEPWS** | Department of Environment, Parks, and Water Security |
| **DIDO** | Worker who primarily drives into work |
| **DITT** | Department of Industry, Tourism and Trade |
| **DLRM** | Department of Land Resource Management |
| **DoH** | Department of Health |
| **EMP** | Environment Management Plan |
| **EP Act** | Environment Protection Act 2019 |
| **EP Regulations** | Environment Protection Regulations 2020 |
| **EPA** | Environment Protection Authority (NT) |
| **EPBC Act** | Environment Protection and Biodiversity Conservation Act 1999 |
| **EPT** | Extended Production Testing |
| **ERP** | Emergency Response Plan or Contingency Plan |
| **EVNT** | Endangered, Vulnerable or Near Threatened |
| **FIFO** | Worker who primarily flies into work |
| **GDE** | Groundwater Dependent Ecosystems |
| **ha** | Hectares |
| **kg** | Kilograms |
| **kL** | Kilolitres |
| **km** | Kilometre |
| **L** | Litres |
| **LFA** | Landscape Function Analysis |
| **m** | Metres |

| Acronym / Abbreviations | Description |
|---|---|
| **ML** | Megalitres (1,000,000 litres) |
| **mm** | Millimetres |
| **MNES** | Matters of National Environment Significance |
| **MoC** | Management of Change |
| **NEPM** | National Environment Protection Measure |
| **NGERS** | National Greenhouse Energy Reporting Scheme |
| **NORM** | Naturally Occurring Radioactive Material |
| **NT** | Northern Territory |
| **NT EPA** | Northern Territory Environment Protection Authority |
| **OEM** | Original Equipment interest hold |
| **PER** | Petroleum (Environment) Regulations 2016 |
| **PMST** | Environment Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool |
| **PPE** | Personal Protection Equipment |
| **SMP** | Spill Management Plan |
| **SMS** | Santos Management System |
| **SOBS** | Site of Botanical Significance |
| **SOCS** | Site of Conservational Significance |
| **TD** | Total Depth |
| **TEC** | Threatened Ecological Communities |
| ***the Code*** | *Code of Practice: Petroleum Activities in the Northern Territory* 2019 |
| **the EP** | Exploration Permit 125 |
| **TO** | Traditional Owners |
| **TPWC Act** | Territory Parks and Wildlife Conservation Act 2014 |
| **VPD** | Vehicles Per Day |
| **WEL** | Water Extraction License |
| **WMP** | Weed Management Plan |
| **WOMP** | Well Operations Management Plan |
| **WoNS** | Weed of National Significance |
| **WWMP** | Wastewater Management Plan |

# 1 Introduction

## 1.1 Background and Purpose

The Interest Holder operates Exploration Permit 125 (the EP), located approximately 190km south of Alice Springs in the Northern Territory, as shown in **Figure 1—1**.

The Interest Holder has operated EP125 since 2013 and has conducted the following works: seismic survey, drilling of the Jacko Bore 1 exploration well, and the associated civil construction works.

The Interest Holder proposes to expand the existing well pad to drill, complete and test a helium appraisal well. The works required to do this are:

- The re-establishment of the previously cleared well pad and campsite.
- Expansion of the well pad and construction of new access tracks.
- Drilling, completion, and Extended Production Testing (EPT) of a horizontal/deviated well.
- Monitoring, testing and maintenance for the life of the well.
- Construction of a water bore/s, operation/use of existing gravel pit/s, maintenance, and monitoring of the tracks and well, up to and including decommissioning and rehabilitation.
- This Activity includes the regulated Activity and ancillary works as defined in *Regulation 5* of the *PER*.

Before carrying out the Activity, the Interest Holder must submit an Environmental Management Plan (EMP) relating to the Activity to the Minister for approval. Accordingly, this EMP has been prepared to meet the approval criteria in *Regulation 9* of the *PER*, including the requirements in *Schedule 1*, specifically:

- A description of the Activity to be undertaken in the EP.
- A description of the existing environment that may be affected by the Activity.
- An assessment of the anticipated environmental risks and environmental impacts associated with the Activity.
- The environmental outcomes and environmental performance standards of the Activity.
- An implementation strategy.
- Details of stakeholder engagement carried out by the Interest Holder.
- Details of the legislative requirements applicable to the Activity.
- Arrangements for recording, monitoring, and reporting information about the Activity.
- Arrangements for notifying the commencement of construction or drilling.

- The Interest Holder will seek approval before undertaking any regulated activity not included in this EMP.

In addition, this EMP has as its overriding objective and sets out measures to reduce the environmental risks and environmental impacts of the Activity to a level that is As Low As Reasonably Practicable (ALARP).

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) of the EP.

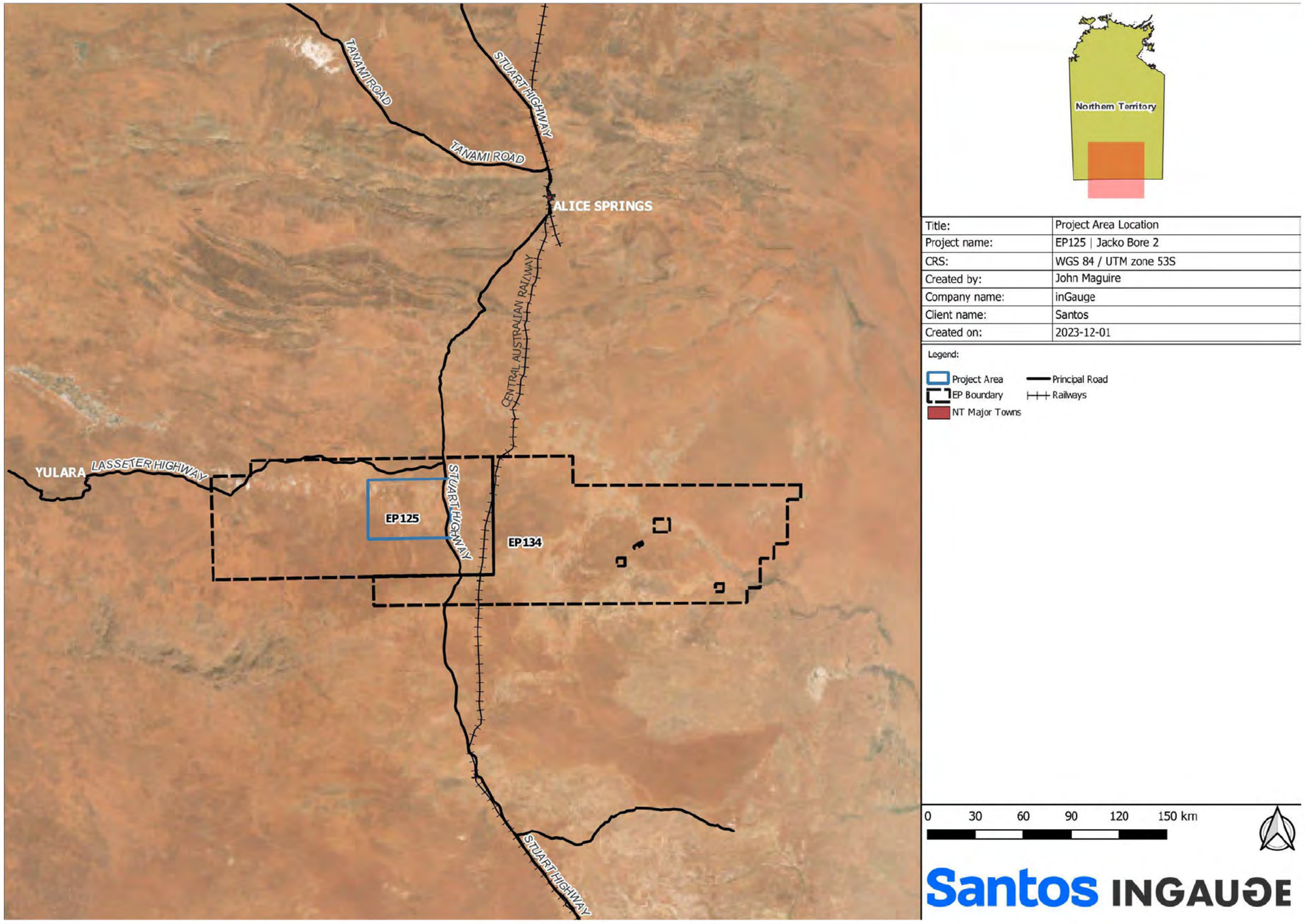



**Figure 1—1 Location of the Project Area**

### 1.2 Interest Holder Details

**Table 1—1** provides details of the Interest Holder and the Interest Holder's nominated liaison person.

**Table 1—2** provides details of joint venture partners.

The Interest Holder will notify and provide updated details to the Department of Industry, Tourism and Trade (DITT) and the Department of Environment, Parks, and Water Security (DEPWS) if there is a change in the contact details for the Interest Holder or liaison person.

**Table 1—1 Details of Interest Holder and Nominated Liaison Person**

| Interest Holder Details | Liaison Contact Person |
|---|---|
| **Name:** Santos 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 |
| **ABN:** 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—2 Joint Venture Partners**

| Joint Venture Partners | Percentage Interest (%) |
|---|---|
| **Santos QNT Pty Ltd (Operator)** | 20 |
| **Peak Helium (Amadeus Basin) Pty Ltd** | 56 |
| **Ordiv Petroleum Pty Ltd** | 24 |

# 2 Environmental Legislation and Other Requirements

### 2.1 Legislation Requirements

A summary of legislation and approval requirements and the Interest Holder's actions and intent for each are provided in the table below (**Table 2—1**).

**Table 2—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 prospect for hydrocarbons, including when found in connection with helium. | • Exploration permit EP125 has been obtained and applies to the Project Area and Activity. | Department of Industry, Tourism and Trade (DITT) |
| | • Compensation to be paid to native title holders and owners/occupiers of land where petroleum activity is proposed (Section 81 and 82). | • Exploration Agreements have been obtained with Traditional Owners affected by the Activity (ILUA, Native Title Act 1993 (Cth), regarding Exploration Permit numbers 82, 112, 118 and 125).<br>• An ILUA has been obtained with Traditional Owners affected by the Activity.<br>• Compensation will be made for the drilling of a well or improvements of work on the land as well as rights for access. | |
| | • The NT Schedule of Onshore Petroleum Exploration and Production Requirements covers key regulatory requirements for the operational management of well works in conjunction with *the Code*. | • Requirements will be addressed in the Well Operations Management Plan (WOMP). | |
| **Petroleum Regulations 2020 (NT)** | • Requiring a land access agreement before conducting regulated petroleum operations. | • Land access agreements will be in place before operations are undertaken. | DITT |
| **Petroleum (Environment) Regulations 2016 (NT)** | • Ensuring the regulated Activity and its ancillary works have an approved EMP. | • This EMP has been developed to satisfy this requirement. | Department of Environment, Parks, and Water Security (DEPWS) |
| | • Detailed requirements of the PER are set out throughout this EMP. In addition, the Interest Holder notes:<br>• *Reg. 18* revisions are required before the end of each five-year period of an EMP.<br>• *Reg. 17* revisions are required for increased or new environmental impact or risk | • EMP is revised every five years.<br>• 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. | |
| | • *Reg. 7* Stakeholder Engagement is undertaken for the Activity is undertaken during the preparation of an EMP. | • The Interest Holder has undertaken engagement in accordance with the PER. | |
| | • *Reg. 10(2)* legislative requirements include the requirement to comply with *the Code*.<br>• *Reg. 4A the Code* is the *Code of Practice: Onshore Petroleum Activity in the Northern Territory*. | • The EMP has been developed following *the Code*, including all mandatory requirements applicable to the Activity.<br>• Specific cross-references to the clauses in *the Code* are included in the EMP as relevant. | |
| **Code of Practice: Onshore Petroleum Activities in the Northern Territory** | • *The Code* applies to all conventional and unconventional oil and gas exploration, appraisal, development and production and ancillary works in the Northern Territory. | • This EMP, including its Appendices, has been prepared in accordance with *the Code*. | DEPWS |

| Legislation | Requirements | How the Interest Holder Meets the Requirements | Administrator |
|---|---|---|---|
| **Bushfires Management Act 2016 (NT)** | • Requirements for 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 Bushfire Management Plan (**Appendix 08**), including bushfire preventative and response measures. The Interest Holder utilised the *NT Government's Bushfire Management Planning Guide: Onshore Petroleum Projects (2020)* [DENR, 2020A].<br>• Annual fire mapping to monitor changes in fire frequency as required by *the Code*.<br>• Flaring works associated with Extended Production Testing will occur within a 25m vegetation exclusion zone. | 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 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)<br><br>DEPWS |
| **Territory Parks and Wildlife Conservation Act 1976 (NT)** | • Sets aside areas that cannot be developed and provisions to for threatened flora and fauna and protected wildlife. | • The Project Area does not overlap with any areas protected under the TPWC. | DEPWS |
| **Waste Management and Pollution Control Act 1998 (NT)** | • Requirements covering:<br>  ○ General environmental duty.<br>  ○ Waste management (including waste management hierarchy).<br>  ○ Waste transportation and waste disposal requirements. | • **Appendix 04** (Risk Assessment).<br>• **Appendix 06** (Waste and Wastewater Management Plan).<br>• **Appendix 07** (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. | • **Appendix 04** (Risk Assessment).<br>• **Appendix 06** (Waste and Wastewater Management Plan).<br>• **Appendix 07** (Spill Management Plan).<br>• **Appendix 12** (Rehabilitation 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 7.6** of this EMP. | |
| **Food Act 2004 (NT)** | • Health requirements for mining and construction camps. | • Camp kitchens will be registered as food businesses if offering food for sale or if they are under contract.<br>• Potable water supplied to camps will be routinely analysed to make sure it is safe, and where a camp kitchen is a registered food business, demonstration will be made to the *Department of Health* that they have a potable water supply. | Department of Health Environmental Health Branch |

| Legislation | Requirements | How the Interest Holder Meets the Requirements | Administrator |
|---|---|---|---|
| **Weed Management Act 2001 (NT)** | • Requires the occupier of the land (the Interest Holder) to:<br>o Take all reasonable measures to prevent the land from being infested with a declared weed.<br>o Take all reasonable measures to prevent a declared weed or potential weed on the land from spreading to other lands.<br>o Notify the weeds officer of the presence of the declared weed.<br>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 09**). | Weed Management Branch, DEPWS |
| **Water Act and Water Regulations 1992 (NT)** | • *The Act* requires a licence to take groundwater. | • The Interest Holder will apply for a Water Extraction Licence (WEL) to cover the estimated water usage required to complete the Activity. | Water Resources Division, DEPWS |
| | • The construction of water bores is regulated under the Act. | • The Interest Holder will only conduct bore work under an appropriate bore work permit. | |
| | • *The Act* requires permit to interfere with a waterway. | • 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 1km of a designated bore. | • No hydraulic fracturing is proposed in this EMP. | |
| | • The take of surface water for petroleum works is prohibited. | • 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. | |
| **NT Planning Scheme Land Clearing Guidelines** | The *NT Planning Scheme Land Clearing Guidelines* identify the following recommendations:<br>• Buffers are recommended as follows:<br>o *Section 4.3.3* Property boundary buffers:<br>i) 25m for <8ha.<br>ii) 50m for 8 to 20ha.<br>iii) 100m for 20 to 100ha.<br>iv) 200m for >100ha.<br>o Section 4.3.5.1 Road buffers:<br>i) Where land proposed for clearing is adjacent to a public road reserve, retain a minimum 50 m wide native vegetation buffer.<br>ii) The clearing and future use of the land shall not prevent or impede the drainage of the public road.<br>o *Section 4.4.6* Sensitive or significant vegetation value types retain:<br>i) Low – 50m.<br>ii) Medium – 100m.<br>iii) High – 250m. | • It is not anticipated that the Activity will cause any significant or long-term impact on the recommended vegetation buffers.<br>• An ecologist will complete an assessment of infrastructure placement before any ground disturbance to verify riparian zones, the buffers for drainage depressions, stream orders 1 to 4, the location (and density) of hollow-bearing trees and large trees to avoid where present by re-aligning infrastructure within the construction buffer.<br>• Where sensitive areas or habitat features are identified in areas where clearing is proposed, realignment of infrastructure within the construction buffer will be prioritised.<br>• Further information is available in **Section 5.6** and **Appendix 12** (Rehabilitation Management Plan).<br>• **Appendix 05** (Erosion and Sediment Control Plan) includes the erosion risk associated with clearing works based on slope gradient. | DEPWS |

| Legislation | Requirements | How the Interest Holder Meets the Requirements | Administrator |
|---|---|---|---|
| | ○ *Section 4.4.7* Riparian areas related to the stream order classification of the waterway:<br>i) Drainage depression – 25m.<br>ii) 1st Order – 25m.<br>iii) 2nd Order – 50m.<br>iv) 3rd and 4th Order – 100m.<br>v) ≥5th Order – 250m.<br>Acceptability of erosion risk associated with clearing works is based on the slope gradient. | | |
| • **Work Health and Safety (National Uniform Legislation) *Act 2011* (NT) (WHS Act)**<br>• **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.<br>• Duties imposed under the WHS Act require the elimination or minimisation of health and safety risks as far as is reasonably practicable (*s 17*). | • 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.<br>• The Interest Holder will notify NT Worksafe if required under the legislation.<br>• **Appendix 13** (Emergency Response Plan). | 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.<br>• 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*). | • Any dangerous goods transported and stored for the Activity will comply with these requirements.<br>• **Appendix 04** (Risk Assessment).<br>• **Appendix 07** (Spill Management Plan). | NT Worksafe, Department of the Attorney General and Justice |
| • **Heritage Act 2011 (NT)**<br>• **Heritage Regulations 2012 (NT)** | • Requires the avoidance of impacts on heritage places and objects.<br>• Work approval is required to carry out works on a heritage place or object (*s 72*). | • The Interest Holder has completed a desktop study and field scout, which confirmed the risk of unidentified archaeological features and/or relics during construction is low [Allan Lance, 2022a].<br>• Prior to and during construction, the Santos Management System (SMS) 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure' will be implemented.<br>• **Section 5.14** | Heritage Branch, Department of Tourism and Culture |
| **Radiation Protection Act 2004 (NT)** | • Manage radiation for the protection of people and the environment. | • Analysis of drilling by-products and produced fluids prior to on-site or off-site disposal in accordance with the Monitoring Program **Table 7—2**.<br>• Assessment of the potential accumulation of NORM in well equipment at the time of well suspension or decommissioning in accordance with the Monitoring Program **Table 8—2**.<br>• If analysis of well drilling equipment, by-products and produced fluids detects NORM levels that exceed the 'National standard for limiting occupational exposure to ionizing radiation [NOHSC:1013(1995)]' Schedule 1 levels, a Radiation Protection Plan will be developed and | Department of Health (DoH) |

| Legislation | Requirements | How the Interest Holder Meets the Requirements | Administrator |
|---|---|---|---|
| | | implemented and a licence under this Act will be applied for with the Department of Health [DoH, 2004]. | |
| **Northern Territory Aboriginal Sacred Sites Act 1989** | • For the Interest Holder to attain an AAPA Certificate. | • The Interest Holder has applied for and received an AAPA Certificate (C2023/054 variation to C2023/018). See **Section 3.5.1** for the conditions within.<br>• Prior to and during construction, the Santos Management System (SMS) 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure' will be implemented.<br>• **Section 5.14.2** | Aboriginal Areas Protection Authority (AAPA) |
| **Public and Environmental Health Act 2011 (NT)** | • Wastewater (sewerage and greywater) treatment systems are subject to the requirements of *the Act*. | • The Interest Holder aligns its operations to ensure that the Wastewater treatment systems meet the requirements of the Act and that the sewerage plants meet the *NT Code of Practice for Small Onsite Sewage and Sullage Treatment Systems and the Disposal or Re-use of Sewage Effluent*. | 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 course of the Activity to ensure the safe handling of dangerous goods. | NT Worksafe, Department of the Attorney General and Justice |
| **Commonwealth** | | | |
| **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. See **Section 2.5**. | Commonwealth Department of Climate Change, Energy, the Environment and Water |
| **National Greenhouse and Energy Reporting Act 2007** | • An Act that 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 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)** | • NEPM provides a nationally consistent approach to assessing site contamination to ensure sound environmental management practices to protect human health and the environment. | • The Interest Holder will test drilling and produced fluids in accordance with *the Code*. | 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. | • Exploration agreement with Traditional Owners. Central Petroleum and others and the Central Land Council:<br>  ○ ILUA re: Exploration Permits 82, 112, 118 and 125 Registered on 13 June 2008 by the Nation Native Title Tribunal with file no. DI2007/ 007. | Prime Minister and Cabinet |

## 2.2 Agreements and Approvals

The Interest Holder will ensure that all necessary consents and approvals are in place before the commencement of any activity proposed under this EMP (**Table 2—2**). All works will be undertaken according to the terms and conditions stipulated in relevant approval agreements.

**Table 2—2 Agreements and Approvals**

| Agreement/Approval | Overview/Status |
|---|---|
| **Exploration Agreement** | The Interest Holder has an ILUA in place. |
| **Land Access and Compensation Agreement** | The Interest Holder is currently in the negotiation of land access agreements with the affected parties. |
| **Water Extraction License** | The Interest Holder will submit an application for water use that will be submitted to DEPWS. |
| **WOMP** | The Interest Holder will submit a WOMP to the DITT for approval. |
| **AAPA Certificate** | The Interest Holder applied for and received an AAPA certificate that covers the Activity within the Project Area in the EP. The details of the AAPA Certificate are as follows:<br>• Document Number: 202305831<br>• C2023/054 variation to C2023/018 |

## 2.3 Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 and Relevant Guidelines

The *Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019* (*the Code*) applies to all activities involved in conventional and unconventional oil and gas exploration, appraisal, development, 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 [DENR et al., 2019].

In addition to compliance with *the Code*, contractors undertaking the Activity and its ancillary works will be 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].

## *2.4* Ecologically Sustainable Development

'Ecologically Sustainable Development' 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 18-24 of the EP Act. In determining whether to approve an EMP, the Minister must consider and apply those principles.

In the preparation of the EMP, the below points were considered in regard to the principles of ESD:

- The Activity will occur over a short time period using an existing well pad and access track that aids in limiting new clearing and minimising cumulative impacts (relevant to the principles set out in ss 19 and 21 of the EP Act).
- Of the 36 environmental risks identified, 31 were assessed as low to very low and 5 were assessed as medium if the Activity is conducted in accordance with the controls described in the EMP and 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).
- Third-party, suitably qualified consultants were engaged to complete on-ground ecological and cultural surveys to inform a detailed description of the environment and site-specific risk controls (relevant to the principles set out in ss 20, 23 and 26 of the EP Act).
- Third-party, suitably qualified consultants were also engaged to create site-specific erosion and sediment control, weed management and groundwater use plans (relevant to the principles set out in ss 19, 22, 23 and 26 of the EP Act).
- Site-specific plans (waste management, spill management, methane emissions, and fire management) have been created, all of which are underpinned by a contingency (emergency response) plan to prevent and mitigate foreseeable risks and respond to an unwanted event if one was to occur (relevant to the principles set out in ss 19, 21, 25, 26 and 27 of the EP Act).

- Stakeholders (inc. 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 achieve their local spend policy that includes engaging local businesses, facilities, suppliers, and the employment of local/regional people (relevant to the principle set out at ss 21 of the EP Act).
- The area utilised will be rehabilitated at the cessation of all approved Activity along with areas previously used for the Interest Holder's exploration activity in the Project Area at the cost of the Interest Holder (relevant to the principles set out at ss 18,19, 21 and 23 of the EP Act).

## 2.5 Referral under NT and Commonwealth Legislation

### 2.5.1 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* (2021). This self-assessment took into consideration:

- There is no anticipated impact on the variety and integrity of distinctive physical landforms, e.g., sand dunes, given the primary access track to the well pad is pre-existing and the area used for the Activity will be rehabilitated to its pre-disturbance condition.
- Land and soil will be protected through the implementation of site-specific erosion and sediment control, weed management, spill, waste, rehabilitation, and contingency (emergency) management plans.
- Terrestrial habitats will be protected by first identifying them during on-ground assessments by an ecologist and then by avoiding them by use of construction clearing buffers or re-scheduling works (in the case of the Grey Falcon and the Greater Bilby) during the limited requirement for new clearing to maintain environmental values.
- The water required for the Activity will be sourced from up to 2 new registered water bores that will be placed at least 1km from the nearest potential supply bore. There are no mapped streams or waterbodies within 1km of the potential water extraction bores, and the nearest Groundwater Dependent Ecosystem is >5km. The Interest Holder will help to maintain the hydrological regimes of groundwater and surface water for ecological health, land uses and the welfare and amenity of people.
- That protection of groundwater quality can be achieved by only using water-based drilling fluids and only non-ecologically toxic additives when drilling through freshwater aquifers and isolating aquifers behind casing and cement barriers before drilling of target formations.

- Drilling pits and above-ground open-topped treatment tanks will have freeboard levels maintained and monitored to prevent overtopping.
- Above-ground tanks will have secondary containment compliant with A.3.8 of *the Code* and telemetry to allow for remote monitoring.
- The Activity will be of a limited duration, with vehicles and equipment being maintained in accordance with the original equipment manufacturer's procedures, diesel use and flaring estimated, recorded and reported. Flaring will be utilised where practicable instead of venting to protect air quality and minimise emissions and their impact to contribute to the goal of achieving net zero greenhouse gas emissions by 2050.
- The workforce required for the Activity will be primarily interstate given the specialised nature of the Activity, e.g., drilling; 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 affected parties, and the EMP will be submitted for public comment and input.
- An AAPA Certificate has been granted, and this EMP includes measurement criteria (**Table 7—7**) to ensure compliance with the resulting conditions. A cultural heritage survey has been conducted that concluded that it is unlikely for significant early historical sites to be present near the access roads and tracks or the Jacko Bore 1DW1 well lease area.
- The Activity will be conducted approximately 8.5km away from the nearest sensitive receptor, limiting exposure to dust and noise from the Activity.
- During the Activity, the health and safety of personnel will be protected by implementing of 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.

### 2.5.2 EPBC Act Self-Assessment

*The Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a national scheme of environment and heritage protection and biodiversity conservation. 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 Department of Climate Change, Energy, the Environment and Water is required if the proposed action will have or is likely to have a significant impact on a matter of national environmental significance or the environment of Commonwealth land.

GHD was engaged to conduct an ecological assessment (**Appendix 01**) with the purpose of determining the potential adverse impacts of the Activity on threatened species and communities within and adjacent to the Project Area and to inform mitigation measures to avoid and reduce the risk of impacts.

The methods used for this assessment included a literature review, desktop searches of government databases relating to flora and fauna distributions (including the Protected Matters Search Tool (PMST), a field assessment and an assessment of the significance of impacts to threatened species and communities using the *Significant Impact Guidelines 1.1* [DoE, 2013].

The assessment is summarised below:

- There were no threatened ecological communities identified in the PMST search area, which comprised the Project Area and a buffer zone of 20km. A Site of Botanical Significance, the Karinga Creek Paleodrainage System, was identified 10km north of the Jacko Bore 1DW1 Study Area. This site has botanical significance within the Finke Bioregion and is within the Karinga Creek Paleodrainage System, which is recorded as an international site of conservation significance. The location of the well pad extension, gravel pits and campsite will not intersect with the KCPS; however, the existing access track (public road) does traverse the area in two areas spanning 12.3km in total and controls will be put in place to reduce the potential impact of a spill on the access track (Item 24 of **Appendix 04** (Risk Assessment).
- No Sites of Botanical Significance or Conservation Significance are located within the Study Area.
- One threatened flora species was identified as occurring or potentially occurring within the desktop search extent; however, none were identified within the Project Area during the field study.
- Of the seven introduced fauna species identified as occurring or potentially occurring within the desktop search extent, the only one observed during the field study within the Project Area was cattle. None of the 12 introduced flora records identified within the desktop search extent are listed under the NT *Weeds Management Act 2001* or the *Weeds of National Significance*-as requiring management. During the in-field weed survey, two introduced flora species were observed, Buffel grass and Bitter Paddy Mellon, which again do not require management under the *Weeds Management Act 2001*.

- The Project Area falls within the NT Athel Pine Statutory Weed Management Plan Class A zone, to be eradicated. There are a number of Athel Pine recordings along Karinga Creek to the north of the Project Area; however, the access road to Jacko Bore 1DW1 crosses some creek lines flowing to Karinga Creek. Any new Athel Pine incursions into the Project Area or access road will be reported to the NT Weed Management Branch by the Project's dedicated weed officer.
- The result of the field assessment was that none of the threatened fauna species were identified within the Project Area; however, there is potentially suitable habitat for two EPBC-listed threatened species, the Grey Falcon and Greater Bilby, for which detailed assessments of significant impacts was prepared based on the potential for it to be adversely impacted by the Activity.

Given the potential for the occurrence of the Grey Falcon and Greater Bilby, GHD completed a detailed assessment of significant impacts on Matters of National Environmental Significance (MNES) based on the Significant Impact Guidelines for the Grey Falcon and Greater Bilby that are listed as vulnerable and considered present or possible to occur within the Project Area as per historical records [DoE, 2013].

While the Grey Falcon was not observed during the ground survey, the survey did identify suitable foraging habitat but no potentially suitable breeding habitat in the Project Area (particularly tall trees along watercourses). The detailed assessment of significant impacts for the Grey Falcon and Greater Bilby concluded that impact on these species is considered unlikely (see **Section 5.2.3** of **Appendix 01**). This is based on the use of previously cleared land and the limited new clearing associated with the Activity, implementation of the Fire Management Plan (**Appendix 08**), and the implementation of management actions for invasive species under this EMP.

The Greater Bilby was not observed in the ground survey. The Greater Bilby previously occurred widely across arid and semi-arid regions of Australia; however, it is now restricted to the western deserts of the NT and WA. Within the NT, its distribution is highly fragmented. Records of the species in the Tanami region date from around the early 2000s. The most recent records are in regional SA and NSW (dated 2020 – 2021).

The Greater Bilby occurs primarily in open tussock grasslands, Mulga (*Acacia aneura*) woodlands and shrublands (including mixed associations with Witchetty Bush (*A. kempeana*), and hummock grasslands). These habitats occur on a variety of landforms, including uplands, rises, sand plains, dunes, drainage systems and other alluvial areas. Potentially suitable habitat is located within the Project Area. However, this habitat is in very poor condition, and it is considered unlikely the species would persist within the Project Area (Appendix B of **Appendix 01**).

Mitigation measures are in place to prevent or minimise any impact on the Grey Falcon and Greater Bilby and its foraging habitat. Therefore, it is unlikely that the Activity will directly impact this species' habitat or significantly impact this species. As such, the Activity does not require referral under the EPBC Act for a decision on whether the Activity is a controlled action.

# 3 Description of the Activity

## 3.1 Overview of Proposed Activity

The proposed Activity is to be undertaken to utilise much of the existing infrastructure developed for previous activities in the area. Re-utilising this existing infrastructure instead of clearing new areas for the Activity will significantly reduce the impact of the Jacko Bore 1DW1 project compared with that of a greenfield project. Past activities in EP 125 by the Interest Holder are a 2D seismic program in 2016 and the drilling of the previous Jacko Bore 1 in 2013. The Activity includes clearing of areas previously used and in a state of rehabilitation.

The Activity to be undertaken for this EMP comprises three phases, as follows:

1. **Civil Construction:**
    - The re-establishment of the previously cleared well pad, access tracks and campsite.
    - Expansion of the existing well pad and clearing of new access tracks.
    - Drilling of water bore/s.
    - Maintenance of established infrastructure and rehabilitation.
2. **Drilling and Completions:**
    - Drilling of a horizontal/highly deviated helium appraisal well.
    - The completion, workover, intervention, suspension, monitoring, testing and maintenance for the life of the well, and decommissioning work required on the well.
3. **Extended Production Testing:**
    - Production testing of the well for up to 365 days over a period of 12-18 months.

Further details on the above activities are provided below. The planned Project Schedule for the Activity is shown in **Figure 3—1**.

### 3.1.1 Impact of the Activity

**Table 3—1** below describes the components of the Activity to be carried out under this EMP and the associated additional clearing required (if applicable). As evidenced in **Table 3—1**, the total new area to be cleared is estimated to be 8.8 ha. **Table 3—1** describes in more detail the key components of the Activity to be carried out under this EMP.

The Activity described below has been included in the cumulative impact assessment for this EMP, which is discussed in **Section 3.1.2**.

**Table 3—1 Description of the Activity Under this EMP**

| The Activity | Description | Units | Unit of Measure | ha Cleared |
|---|---|---|---|---|
| **Well Pad**<br>(Expansion) | • Expansion of the previous Jacko Bore 1 well pad. The area cleared includes the following:<br>o New clearing for the expansion of the well pad<br>o Laydown yard and overburden spoil stockpile<br>o Construction of tank pad/s, fire breaks, and effluent irrigation area (no extra clearing).<br>o Buffer area to account for any deviations identified during ground-truthing | 1 | each | 5.3 |
| **Campsite (including helicopter landing zone)**<br>(Re-establishment) | • The re-establishment of a previously utilised campsite.<br>• The area cleared is N/A, as the campsite is pre-existing. | 1 | each | N/A |
| **Access Track**<br>(Use of existing tracks, re-establishment, and new tracks) | • Use and maintenance of the public road and existing access track to the well pad.<br>• The area cleared is listed as N/A, as these tracks are pre-existing. | 17,353 | m | N/A |
| | • Establish new access tracks to the well pad, campsite, and bores.<br>• The area to be cleared for the construction of new tracks | 1,000 | m | 2.0 |
| **Gravel/Borrow Pit/s**<br>(Use and maintenance) | • Use and maintenance of pre-existing pits along the access track to the well pad.<br>• The area cleared is listed as N/A, as the gravel pits are pre-existing. | 4 | each | N/A |
| **Water Bore/s (Construction)** | • The construction of production water bore pads where a producing water bore cannot be established on the well pad.<br>• The area cleared includes three cleared bore locations for up to two water bores. | Up to 2 bores<br>Up to 3 locations | maximum | 1.5 |
| **Well – Drilling**<br>(One horizontal well drilled and evaluated) | • The drilling, evaluation, and testing of a helium appraisal well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Well – Completions** | • The completion works required on the well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Well – Monitoring and Maintenance** | • The workover, intervention, monitoring, and maintenance for the life of the well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1* | each | N/A |
| **Well – Suspension and Decommissioning** | • The well suspension and decommissioning works that may be required on the well.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Well - Extended Production Testing** | • The Extended Production Testing (EPT) of the well for up to 365 days over a period of 12-18 months.<br>• The area cleared is listed as N/A, as clearing is calculated in the well pad expansion. | 1 | each | N/A |
| **Rehabilitation**<br>(Well Pad, Campsite, Access Tracks, Gravel/Borrow Pit/s) | • Rehabilitation of area utilised for the Activity and previously disturbed areas associated with the Interest Holder's exploration and appraisal activities. | 1 | each | N/A |

*** The well may be re-completed or worked over more than once.**

**Table 3—2 Key Components of the Activity Covered by this EMP**

| Overview | Units | Unit of Measure |
|---|---|---|
| Exploration Permit: | EP125 | |
| Total Area of EP: | 12761 | km² |
| Total Area of Project Area: | 1927 | km² |
| Total area of new disturbance under this EMP: | 8.8 | ha |
| Total area of historic disturbance absorbed under this EMP: | 53.5 | ha |
| Total number of new wells under this EMP: | 1 | Each |
| **Groundwater** | | |
| Extraction Licence #: | The Interest Holder intends to apply for a WEL post-EMP submission. Timing is expected to be Q2 or Q3 of 2023. | |
| Extraction licence volume per year: | 75 | ML |
| Number of bores for extraction: | 2 | Bores |
| Estimated total groundwater usage (20% contingency included): | 73.2 | ML |
| Estimated total area of potential disturbance: | 1.5 | ha |
| **Potable Water** | | |
| Source of potable water: | Groundwater or off-site source TBA | |
| Estimated usage at the campsite: | 1.3 | ML |
| **Schedule** | | |
| Activity Duration: | 500* | Days |
| Civil construction duration (cumulative): | 56 | Days |
| Drilling operations duration (cumulative): | 42 | Days |
| Completion operations duration (cumulative): | 15 | Days |
| Extended Production Testing duration (cumulative): | Up to 365 | Days |
| **Personnel** | | |
| Civil construction workforce (Primarily DIDO) | 10-20 | People |
| Drilling operations workforce (Primarily FIFO): | 50-80 | People |
| Completions (Primarily FIFO): | 50-80 | People |
| Extended Production Testing workforce (Primarily FIFO): | 5-10 | People |
| **Traffic Movement** | Light Vehicles | Heavy Vehicles |
| Peak movements for the Activity (Per Week): | ~113 | ~150 |
| Average movements per week for the duration of the Project: | ~30 | ~15 |
| **Produced Fluid** | | |

| Overview | Units | | Unit of Measure |
|---|---|---|---|
| Maximum produced fluid storage | Up to | 1 | ML |
| **Drilling** | | | |
| By-products: | 800 | | $m^3$ |
| **Emissions** | | | |
| Greenhouse Gas Emissions: | 5.1 | | $ktCO_2$-e |

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

### 3.1.2 Incremental and Cumulative Impacts

Cumulative impacts have been calculated for EP 125 and surrounding EPs (EP 112, 134, and 82), hereafter referred to as the Cumulative Study Area. Projects that commenced prior to 2013 have been excluded based on the assumption that the land has been fully rehabilitated and no additional monitoring is required.

A non-exhaustive list of previous works excluded from the assessment can be found in **Table 3—3**.

As of 2013, the Interest Holder has conducted 2D seismic programs (2013 – 2018) and drilled two exploration wells, Jacko Bore 1 in 2013/2014 and Dukas 1 in 2019. **Table 3—4** presents a summary of the impact due to petroleum activities within the Cumulative Study Area. Due to changes in regulatory frameworks, several values for previous works have been estimated.

Where values were not presented in the EMP provided at the time, estimates have been calculated based on similar projects, and the following assumptions have been made:

- All seismic lines are 5m wide.
- All seismic lines have been cleared unless explicitly stated (i.e., as in Peak Helium's Seismic Survey – 2021).
- Where details of clearing have been stated, it is assumed that both a campsite and gravel pit require 1ha of clearing and a well pad, 7ha.
- The Cumulative Study Area is 9419734.968 ha.

**Table 3—3 Non-exhaustive List of Previous Works Excluded from the Assessment**

| Interest Holder | Est. Dates | Location | Activities |
|---|---|---|---|
| **Exoil (NT)** | 1962 – 1963 | EP 125 | Seismic Survey |
| **Exoil (NSW)** | 1965 | EP 125 | Seismic Survey<br>Drilling: Erldunda 1 |
| **Magellan Petroleum** | 1965 | EP 82 | Drilling: Highway Anticline 1 |
| **Finke Oil** | 1965 | EP 82 | Drilling: Mt. Charlotte 1 |
| **Magellan Petroleum** | 1967 | EP 82 | Drilling: Orange 1 |
| **Magellan Petroleum** | 1970 | EP 82 | Drilling: Waterhouse 1 |
| **Magellan Petroleum** | 1984 | EP 82 | Drilling: Orange 2 |
| **Magellan Petroleum** | 1985 | EP 82 | Drilling: Waterhouse 2 |
| **Pacific Oil & Gas** | 1989 | EP125, 112 | Seismic Survey |
| **Indigo Oil** | 1990 | EP 112 | Drilling: Wallara 1 |
| **Pacific Oil & Gas** | 1991 | EP 125 | Drilling: Murphy 1 |
| **Pacific Oil & Gas** | 1992 | EP 82 | Drilling: Magee 1 |

The total vegetation clearing for this EMP is 8.8 ha, representing 0.000093% of the Cumulative Study Area (combined area of EP 82, 112, 125 and 134) and 0.0007% of EP 125. This is a conservative clearing estimate reflecting a worst-case scenario. **Section 4.1** details the cumulative impacts of groundwater extraction and outlines the proposed Activity duration and associated volumes that are expected to have a negligible impact on the target aquifer.

The Interest holder is aware that a mining exploration licence (EL28205), in the North-western section of EP125, has been awarded to Verdant Minerals JV and Parkway Minerals (ASX: PWN) to target water-soluble potassium-bearing mineral salt, referred to as POTASH. This project, the Karinga Lakes Project, is currently in the feasibility stage. In addition, the southern boundary of EP 125 intersects two mining exploration licences (EL 32970 / EL 32969) held by TIVAN. As minimal public information is available, these projects have been excluded from this assessment.

**Table 3—5** outlines expected cumulative impacts associated with future works in the Cumulative Study Area. Estimates have been provided where exact values are yet to be determined.

To reduce clearing impacts, existing infrastructure will be re-used. **Table 3—6** presents a summary of the incremental impacts of regulated activities for the Project Area. See **Section 3.5.1** for further details.

**Table 3—4 Estimated Cumulative Impacts for Previously Approved Petroleum Activities (Cumulative Study Area)**

| | | Santos – 2023-2024 Jacko Bore 1DW1 (STO5-2) | Peak Helium – 2021 Seismic Survey (PKH1-6) | Santos – 2019 Dukas 1 Drilling (STO-3) | Santos – 2016 / 2018 Seismic Survey | Tri-Star Energy – 2014 New Crown 1 Drilling | Santos – 2013 / 2014 Jacko Bore 1 (Mt Kitty 1) Drilling | Santos – 2013 Seismic Survey | Total |
|---|---|---|---|---|---|---|---|---|---|
| | **Approved** | TBA | 2021 | 2019 | 2016 | 2014 | 2013 | 2013 | **2013 – 2025** |
| | **Completed** | Testing 2025, Monitoring 2028 | 2022 (~7 weeks) | 2022 | 2018 (~24 weeks) | 2014 | 2014 | 2013 (~20 weeks) | |
| | **EP** | EP 125 | EP 134 | EP 112, 125 | EP 82, 105, 107, 112, 125 | EP 134 | EP 125 | EP 82, 105, 112, 125 | |
| Groundwater | **Estimated Total Water Use (ML)** | 73.2 | 0.1 | 27.5 | ~0.9* | ~73.2† | ~73.2† | ~0.75* | **248.85** |
| Land | **Clearing Area (ha)** | 8.8 | 8 | 87 | ~672.5 | ~14.5† | ~14.5† | ~743* | **1,548** |
| | **% Disturbance of Cumulative Study Area** | 0.000093 | 0.000085 | 0.000924 | 0.007139 | 0.000154 | 0.000154 | 0.007888 | **0.016437** |
| GHG | **Estimated Total Greenhouse Gas (GHG) Emissions ($ktCO_2$-e)** | 5.1 | 0.200 | 5.1† | 2.2* | 5.1† | 5.1† | 2.7* | **26** |
| Traffic | **Average / Peak Vehicle Movements (per week)** | Light Vehicles: ~30 / ~113<br>Heavy Vehicles: ~15 / ~150<br>See **Section 3.3** of the **EMP**. | Project has ceased.<br>Additional traffic due to monitoring considered minor. | Project has ceased.<br>Additional traffic due to monitoring considered minor. | Project has ceased.<br>Additional traffic due to monitoring considered minor. | Project has ceased,<br>No additional traffic assumed. | Project has ceased.<br>No additional traffic assumed. | Project has ceased.<br>No additional traffic assumed. | **Light Vehicles: ~30 / ~113**<br>**Heavy Vehicles: ~15 / ~150** |
| Social | **Peak Personnel Number on site** | ~80<br>See **Table 3—2**, **Table 3—3**, & **Figure 3—2** of the **EMP**. | Active phase of the project has ceased. | Active phase of the project has ceased. | Project has ceased. | Project has ceased. | Project has ceased. | Project has ceased. | **TBA** |
| Rehabilitation | **Rehabilitation Stage** | See **Section 6.3** of the **EMP**, and **Appendix 12** for the rehabilitation plan. | Currently being rehabilitated. Estimated rehabilitation stage is either 'preliminary assessment' or 'early rehabilitation'. | Not rehabbed, site is still in use. | Currently being rehabilitated. [Tom Ewers-Reilly, 2022]. | Currently being rehabilitated. | Well head fenced and left to naturally rehabilitate.<br>Well pad and access tracks currently being rehabilitated. | Currently being rehabilitated [Tom Ewers-Reilly, 2022]. | **Undergoing rehabilitation.** |

* Based on values provided in Peak Helium's 2021 Seismic EMP (PKH1-6) [Narelle Harvey, 2021]. † Based on calculations for Jacko Bore 1DW1.

**Table 3—5 Estimated Cumulative Impacts for Future Petroleum Activities (Cumulative Study Area)**

| | | Peak Helium – 2023 Ramsay AA, AB, AC (PKH2-3) | Santos – 2023-2024 Jacko Bore 1DW1 (STO5-2) – this EMP | Santos – Mahler 1 | Santos – Dukas 2 | Total |
|---|---|---|---|---|---|---|
| | **Est. Dates** | 2023 – 2027 | 2023 – 2025 | 2023 – 2028 | 2023 – 2028 | **2023 – 2028** |
| | **Location** | EP 134 | EP 125 | EP 82 | EP 112 | **EP 82, 112, 125, 135** |
| **Groundwater** | **Estimated Total Water Use (ML)** | 13.4 | 73.2 | 78.6 | 76 | **241.2** |
| **Land** | **Clearing Area (ha)** | 38.08 | 8.8 | 152 | TBA | **366** |
| | **% Disturbance of Cumulative Study Area** | 0.000404 | 0.000093 | 0.001614 | 0.001773 | **0.003884** |
| **GHG** | **Estimated Total Greenhouse Gas (GHG) Emissions ($ktCO_2$-e)** | 221 | 5.1 | TBA | TBA | **TBA** |
| **Traffic** | **Average / Peak Vehicle Movements (per week)** | Light Vehicles: ~15 / ~59<br>Heavy Vehicles: ~2 / ~25 | Light Vehicles: ~30 / ~113<br>Heavy Vehicles: ~15 / ~150<br>See **Section 3.3** of the **EMP**. | Light Vehicles: ~29 / 35<br>Heavy Vehicles: ~ 25 / 53 | Light Vehicles: ~29 / 35⁞<br>Heavy Vehicles: ~ 25 / 53⁞ | **Light Vehicles: ~103 / 242**<br>**Heavy Vehicles: ~ 67 / 281** |
| **Social** | **Peak Personnel Number on Site** | ~40<br>Campsites are anticipated to be constructed. | ~80<br>See **Table 3—2**, Table **3—3**, & **Figure 3—2** of the **EMP**. | ~105<br>Campsites are anticipated to be constructed. | ~100<br>Campsite/s are anticipated to be constructed. | **Total: ~325** |
| **Rehabilitation** | **Rehabilitation Stage** | Project yet to commence. | See **Section 6.3** of the **EMP**, and **Appendix 12** for rehabilitation plan. | Project yet to commence. | Project yet to commence. | **Projects yet to commence.** |

⁞ Estimation based on Mahler 1 project.

**Table 3—6 Incremental Impacts in the Project Area**

| Activity/Aspect | Jacko Bore 1 (Drilling Previous Activity)* | Jacko Bore 1DW1 (this EMP) | Total |
|---|---|---|---|
| **Vegetation Clearing** | • Cleared 53.5 ha of land across access tracks, well pad, camp pad, borrow pits and sand dune crossings. | • Clear areas for the proposed Activity 8.8 ha (**Table 3—10**), including well pad expansion, new access tracks. | 62.3 ha |
| **Campsite/s** | • Location near well pad was cleared for a temporary campsite. | • Temporary campsite/s will be located at same location as the one cleared for the Jacko Bore 1 well pad.<br>• Estimated 60 people at the campsite.<br>  ○ Campsite water will be brought in from outside of site as groundwater is expected to be non-potable. 1.28 ML for the Activity. | 1 campsite. |
| **Produced Fluid** | - | • Estimated to result in 80 kL of produced fluid with a contingency to account for up to 1 ML. Produced fluid to be stored in above-ground tanks (refer **Section 3.11.1**). | Estimated 80 kL.<br>(1 ML contingency) |
| **Gravel/Borrow Pits** | • Four gravel pits. | • Gravel from 1-4 existing pits to be utilised for approximately 5,000 $m^3$ of gravel/fill. | Up to 4 pits. |

* Jacko Bore 1 completed under previous regulatory framework.

## 3.2 Timing and Personnel Requirements of the Activity

**Table 3—7** summarises the indicative timing of the Activity.

**Figure 3—1** shows the estimated start dates and durations of works under the Activity, assuming a start in August 2024.

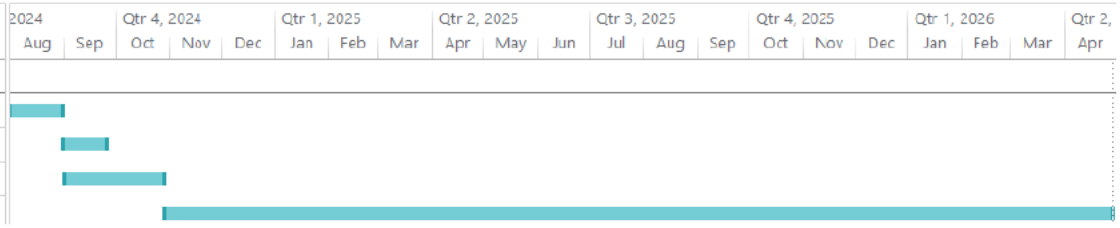
**Figure 3—2** shows the estimated personnel numbers for the Activity under this EMP.

**Table 3—7 Indicative Timing of the Activity***

| Regulated Activity | Estimated Duration | Estimated Timing |
|---|---|---|
| **Civil Construction** | 56 days | August – September 2024 |
| **Drilling and Completion** | 57 days | September – October 2024 |
| **Extended Production Test** | Up to 365 days over a period of 12-18 months | October 2024 – November 2025 |

**Based on current schedule at the time of writing.*

| Task Name | Duration | Start | Finish |
|---|---|---|---|
| **Jacko Bore** | | | |
| Drill Supply Waterbores | 22 days | Thu 1/08/24 | Fri 30/08/24 |
| Civil Construction | 19 days | Sat 31/08/24 | Wed 25/09/24 |
| Drilling and Completion | 42 days | Sun 1/09/24 | Sun 27/10/24 |
| Extended Production Test | 392 days | Mon 28/10/24 | Tue 28/04/26 |




* Note EPT is up to 365 days over a period of 12-18 months.

**Figure 3—1 Indicative Project Schedule for the Activity Under this EMP**

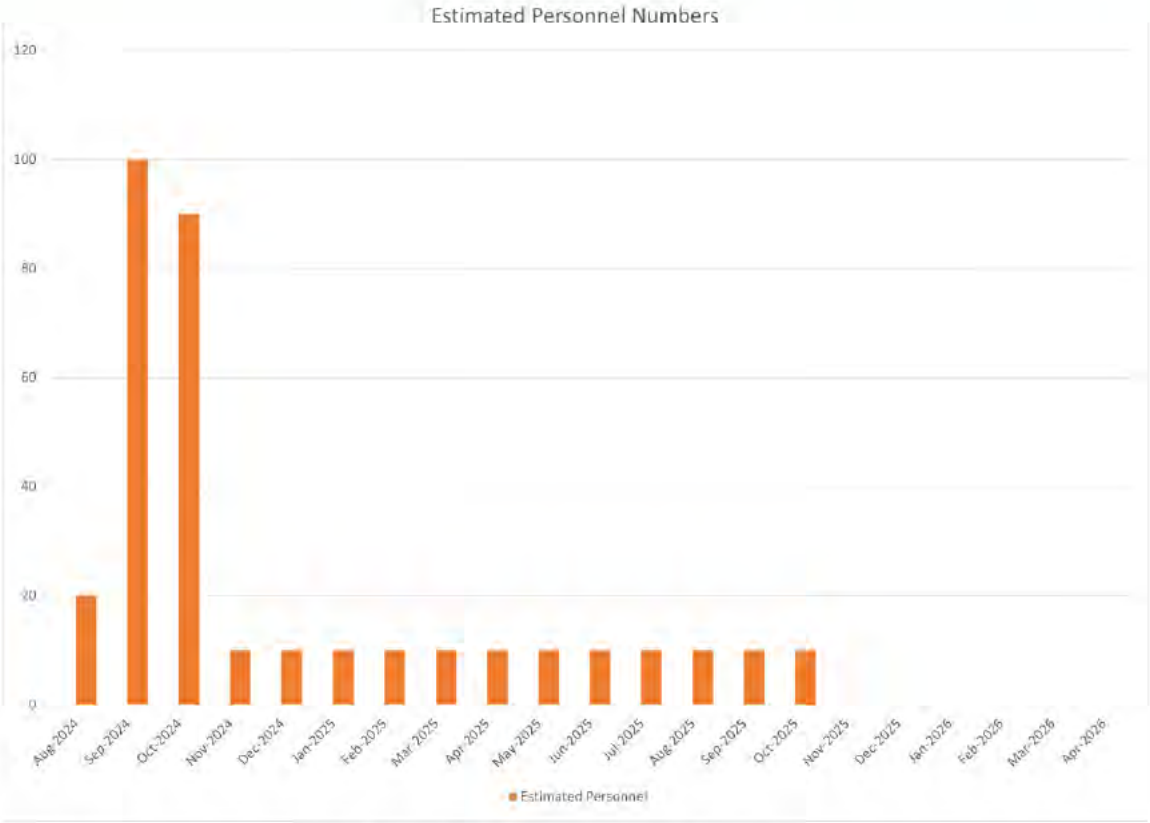



**Figure 3—2 Estimated Personnel Numbers**

## 3.3 Vehicle Movements and Traffic

The Activity will require the mobilisation of light and heavy vehicles for the duration of the Activity. The predicted vehicle movements for the three phases of the Activity are given below.

**Civil and Water Bore Construction:**

- Heavy Vehicles: There will be approximately 58 heavy vehicle movements for civil works, and water bore construction, including mobilisation, operations, and de-mobilisation.
    - Average 7 per week for approximately 8 weeks.
- Light Vehicles: There will be approximately 177 light vehicles for civil works and 56 for water bore construction, including mobilisation, operations, and de-mobilisation.
    - Average 28 per week for approximately 8 weeks.

**Drilling and Completions:**

- Heavy vehicles (mobilisation and de-mobilisation): There will be approximately 360 heavy vehicle movements to mobilise and de-mobilise the rig, fluid additives, casing, cement, fuel, etc. These heavy vehicle movements consist primarily of road trains arriving at the start of the drilling and completions operations, and again at the end of operations.
    - Average 53 per week for approximately 6-7 weeks.
- Heavy vehicles (operations): There will be approximately 183 heavy vehicle movements during drilling and completion works.
    - Average 21 per week for approximately 8-9 weeks.
- Light vehicles (mobilisation and de-mobilisation): There will be approximately 210 light vehicle movements associated with the mobilisation and de-mobilisation of the rig.
    - Average 35 per week for approximately 6-7 weeks).
- Light vehicles (operations): There will be approximately 197 light vehicle movements during drilling and completion works.
    - Average 28 per week for approximately 8-9 weeks

**Extended Production Testing and Monitoring:**

- Heavy vehicles (mobilisation and de-mobilisation): There will be approximately 60 heavy vehicle movements during the EPT.
    - Average 30 per week for approximately 2 weeks.
- Heavy vehicle movements (EPT and monitoring): There will be approximately 448 heavy vehicle movements associated with the EPT and well monitoring.
    - Average approximately 4 per week for approximately 129 weeks.

- Light vehicle (mobilisation and de-mobilisation): There will be approximately 70 light vehicle movements associated with mobilisation and de-mobilisation of the EPT and well monitoring.
    - Average 35 per week for approximately 2 weeks.
- Light vehicle movements (EPT and monitoring): There will be approximately 1564 light vehicle movements associated with the EPT and well monitoring.
    - Average about 13 per week for approximately 129 weeks.

From the above information, the highest potential vehicle weekly movements during the main phases of the Activity are as follows:

- During civil works and drilling mobilisation and de-mobilisation (assuming the worst case that these works overlap) – 6-8 weeks – heavy vehicles, 7 + 53 = 60 per week, and light vehicles 28 + 35 = 63 per week.
- During drilling operations – 8-9 weeks - heavy vehicles, 21 per week, and light vehicles 25 per week.
- During EPT mobilisation and de-mobilisation – 2 weeks – heavy vehicles, 30 per week, and light vehicles 35 per week.
- During EPT and monitoring – approximately 129 weeks – heavy vehicles, 4 per week, and light vehicles 13 per week.

The highest potential vehicle movements are during civil construction and drilling mobilisation and de-mobilisation works (assuming worst case that these activities may overlap), estimated at 60 heavy vehicles a week and 63 light vehicles a week, respectively, or on average about 18 vehicles per day. Therefore, daily traffic volumes forecasted throughout the duration of the exploration program are expected to remain well below the 150 vehicles per day 'limit' associated with low-volume rural roads as identified in the relevant Austroads' Guide [AUSTROADS, 2020].

An Operational Traffic Management Plan is required to be submitted to the Transport Civil Services Division, Department of Infrastructure, Planning and Logistics prior to commencement of operations if the below are deemed applicable:

- Where the Interest Holder proposes to utilise an existing but un-formalised and/or unapproved access to a Northern Territory Government (NTG) road, the access will be upgraded to meet current standards in accordance with the Austroads *Guide to Traffic Management*, *Guide to Road Design*, relevant Australian Standards, and the requirements of the TCSD. The access must be designed and constructed to accommodate the maximum size of vehicle expected to utilise the access.
- Any new/upgraded intersections are subject to Road Safety Audits in accordance with the Department's policy 'Road Safety Audits'.
- A "Permit to Work within the NTG Road Reserve" must be obtained by the interest holder prior to commencement of any works within the Stuart Highway Road reserve.

In addition, the Interest Holder is to ensure that all reasonable measures are taken to prevent the dropping or tracking of materials onto the sealed road network (e.g., the loads of all trucks

entering and leaving the site of works are to be constrained). This includes ensuring that all wheels, tracks, and body surfaces are free of mud and other contaminants before entering onto the sealed road network. The use of shaker screens/rubble pads to remove loose material from trucks prior to entering the road network is a requirement. Tracked material on the road pavement is a potential safety issue. Should this occur, the proponent will be obliged to sweep and clean material off the road.

## 3.4 Equipment and Service Mobilisation

The potential light vehicle and heavy vehicle movements of the Activity carried out under this EMP are anticipated to have a low level of impact given the limited number of vehicles required to complete the Activity (**Section 3.3**).

Traffic associated with the Activity will peak during the mobilisation of equipment but is of short, well-defined duration. The access to the Project Area is via the Stuart Highway, approximately 16km south of the Stuart and Lasseter highway intersection. Most of the specialised equipment and materials required for the Activity carried out under this EMP will be mobilised to the site from Queensland or South Australia if not currently in the NT at the time of the Activity. All equipment and materials will travel via the Stuart Highway, which is a sealed two-way road, and Project Area access tracks.

As discussed in **Section 3.3**, the peak weekly traffic generation will occur during civil works and drilling mobilisation, assuming in the worst case that these activities may overlap. The peak traffic movement is estimated to comprise 60 heavy vehicles a week and 63 light vehicles a week, respectively, or, on average, about 18 vehicles per day. The civil works would be undertaken over a period of approximately 8 weeks, and the drilling mobilisation approximately 6-7 weeks.

A traffic impact assessment by CIRQA in June 2023 concluded that formalised separate turn lanes on the Stuart Highway are not needed and that additional traffic movements associated with the Activity will be accommodated by the turn off and on the adjacent road network. See **Appendix 14** for Traffic Impact Assessment [CIRQA, 2023].

In the event that the Interest Holder proposes to utilise an existing but un-formalised and/or unapproved access to a Northern Territory Government (NTG) road, the access will be upgraded to meet current relevant standards, as outlined in Austroads's *Guide to Traffic Management*, 'Guide to Road Design' , plus the requirements of the Transport and Civil Service Division (TSCD). Where new/upgraded intersections are required, they will be subject to Road Safety Audits; a 'Permit to Work within the NTG Road Reserve' will be obtained by the Interest Holder prior to any works within the Stuart Highway Road reserve.

Finally, the Interest Holder will ensure that all reasonable measures are taken to prevent the dropping or tracking of materials onto the sealed road network. This includes ensuring that all wheels, tracks, and body surfaces are free of mud and other contaminants before entering onto the sealed road network. Prior to trucks entering the road network, shaker screens/rubber pads will be used to remove loose material. The Interest Holder will remove any tracked material on the road pavement.

## 3.5 Site Selection

### 3.5.1 Re-use of Existing Infrastructure

The location of the Jacko Bore 1DW1 well, covered by this EMP, will be on an existing well pad (referred to as Jacko Bore 1 in **Appendix 01**) that will be accessed using a pre-existing access track from an existing public road. The access and environmental sensitivities are shown in **Figure 5—10**. An alternative location for the Jacko Bore 1DW1 was assessed previously by AAPA and CLC/TO, but that alternative location is not covered by this EMP. The planning, design, and location selection of infrastructure to be re-established or newly constructed under this EMP have been carried out in line with *Land Clearing Guidelines* as published on the Department of Environment Parks and Water Security (DEPWS) website [DEPWS, 2020, 2021]. There will be no new watercourse crossings as part of the Activity.

The well pad, campsite, and gravel pits, along with the majority of access being proposed for use in the Project Area, are pre-existing. Overall, the utilisation of the pre-existing infrastructure limits the amount of new clearing required. The clearing associated with previous works is 53.5 ha which will only increase by 16.5% to 62.3 ha. The existing infrastructure (well pad, gravel pits, camp area, and some access tracks) is showing signs of re-growth, but they have not been rehabilitated. Therefore, they require maintenance clearing, but this is not considered new clearing. The 8.8 ha of new clearing, quantified in **Section 3.6.2**, is new disturbance and does not include the re-establishment of previously cleared areas.

The well pad expansion is required to accommodate additional facilities such as a water bore, an area to facilitate the setup of a compacted tank pad and any necessary secondary containment. Similarly, an expansion allows flexibility in rig size as the rig is likely to be bigger than the rig used previously and also provides sufficient space for a flare with a minimum ~25m vegetation exclusion zone radius. In addition, this pad is larger than the previous pad to accommodate a potential second well. The original well pad pegged area is ~0.8ha, which is insufficient for these additional facilities. The new clearing calculation also includes a fire break, soil stockpiles, and a buffer area. This is considered a high-side estimate of what may be required. The buffer area has been included to account for any deviations that may be necessary due to items identified during ground-truthing. It is not expected that this buffer area will be required to be cleared, but it is included as a contingency.

In addition to the well pad expansion, there are new access tracks connecting the well pad to the pre-existing access track. These access tracks aid in the flexibility of getting heavy vehicles on and off the site and help to facilitate ease in rig setup.

Two water bores have been included in the clearing calculations, but they are contingency water bores, and clearing will only be conducted if the water bore being drilled on the well pad is unsuccessful.

The Interest Holder has carried out an Ecological Assessment (**Appendix 01**) of the proposed new clearing locations, and this assessment has guided the site selection.

The Interest Holder has carried out flood modelling to show the impacts of a 1 in 100-year flood event on non-linear infrastructure, including the well pad expansion. This is discussed in **Section 5.6.3** and the modelling results are shown in **Figure 5—12**. Worst-case modelling indicates that the southern part of the well pad may experience isolated and minor flooding during a 1 in 100-year event. The well

pad expansion and upgrades will be designed and constructed to reduce this potential flood risk with site-specific erosion and sediment controls. All erosion and sediment controls will be approved by a Certified Professional in Erosion Sediment Control (CPESC) (**Appendix 05**).

Route selection for site access prioritised the utilisation of existing tracks which require minimal upgrade, maintenance, and repair. The construction of new access tracks will be generally limited to accessing the well pad expansion and campsite from the existing public road. This is shown in **Figure 5—9.** There are some ephemeral stream crossings along the existing public road access that lead to the Jacko Bore 1DW1 well pad site turnoff. The access track from the public road turnoff has one ephemeral stream crossing and avoids as many crossings as possible over dunes (refer **Section 5.6.1** and **Figure 5—11**).

Due to the above site selection and maintenance of existing infrastructure, both environmental and erosion and sediment impacts will be minimised. In addition, due to the re-use of existing infrastructure and its isolation, the impact on wildlife movement will be minimal.

The Activity will be conducted within the AAPA Certificate Land Type approved for the Activity, as per **Section 3.5.2**. A corridor has been assessed by ecological and archaeological consultants for the planned work to enable adjustment of the well pad expansion and access tracks to avoid environmental and areas of cultural significance encountered during construction works. As per **Appendix 02**, there were no cultural areas of significance encountered that will be disturbed by the Activity.

The AAPA Certificate includes the following conditions:

"Within the area marked Restricted Works Area 1 (RWA1) on Annexure 'A', associated with

sacred sites 5447-9 and 5447-11:

b) a) No works shall occur that could impede surface water flows in natural creek channels groundwater extraction will not impact the salt lakes."

In general, site and layout selection has been carried out to reduce impacts on existing landscape amenity to a level that is ALARP and acceptable by:

- Prioritising re-use of existing infrastructure.
- Preferencing the clearance of semi-rehabilitated areas, as opposed to disturbing mature native vegetation.
- Ensure potential environmental nuisance has been avoided and minimised.
- Minimising the surface footprint of all aspects of development.

### 3.5.2 Site Selection – Land Types and Working Corridors

The expansion of the existing Jacko Bore 1 well pad, the clearing of new access tracks, and the re-establishment of existing tracks, will be within the areas described below and as set out in the AAPA Certificate:

- **Land Type A**: The buffer is to account for construction, upgrade/use of new/existing access, including waterway crossings and required ground disturbance and vegetation removal. Construction, use and maintenance of water bores with treatment and storage facilities for monitoring and extraction. Construction/ maintenance of work camp facilities, extraction from gravel/borrow pits. Rehabilitation of disturbed areas at the completion of exploration and production works.
- **Land Type B:** The buffer is to account for construction, upgrade/ use of new/existing access, required ground disturbance/vegetation removal. Construction, use and maintenance of well pad, including:
    - Drilling.
    - Evaluation.
    - Flow test and monitoring (including helium, hydrogen, hydrocarbons, and other gasses).
    - The production, storage, and treatment of water/ wastes.
    - Water bores for monitoring/extraction.
    - Drilling sumps/pits.
    - Water treatment and storage facilities.
    - Work camp facilities and helipad.
    - Gravel extraction.
    - All works regarding the plugging, decommissioning and remediation of wells; their rehabilitation after completed testing, monitoring, and production.
- **Land Type C:** Subsurface deviated/horizontal well and ongoing maintenance of any infrastructure and or services.

The following figures show more detail of the construction buffer zones:

- **Figure 3—3 to Figure 3—7** show the outlines of the above land types as set out in the AAPA Certificate.
- **Figure 3—8 to Figure 3—11** show the well pad, campsite, gravel pit/s and access tracks within the indicatory construction buffer.

The environmental sensitivities of the Project Area in relation to the well pad, campsite, gravel pit/s, access tracks, the Karinga Creek Paleochannel Drainage System, stream orders and Groundwater Dependent Ecosystems are shown in **Figure 5—10** and discussed in **Section 5.4 – Section 5.11**.

The topography of the Project Area is discussed in **Section 5.4.1**, and the contours of the access road from the public road turnoff to the well pad are shown in **Figure 5—3.** More details on the contours in the vicinity of the well pad and campsite are discussed below and shown in **Figure 3—12** to **Figure 3—15.** The 1 in 100-year flood levels in the Activity area are discussed in **Section 5.6.3,** and the modelling results from the public road turnoff to the well pad are shown in **Figure 5—12.** More details on the flood contours in the vicinity of the well pad and campsite are discussed below and shown in **Figure 3—16**.

Shapefiles of the proposed Activity and relevant buffers are provided to DEPWS as part of this EMP.

### 3.5.3 Well Pad Site Selection

The well pad has been selected as it is a previously cleared area with an existing well. The drilling of Jacko Bore 1DW1 on this well pad requires significantly less land clearing than establishing a new well pad and new access tracks. The existing site is in an area that can experience isolated and minor flooding in a 1 in 100-year event. The contours and predicted 1 in 100-year event flood levels in the vicinity of the well pad and campsite are shown in **Figure 3—12** and **Figure 3—16**.

In terms of distance to the nearest sensitive receptor, the well pad and campsite are approximately 8.5 km from the closest settlement, Lyndavale homestead.

The use of the existing well pad, campsite and access tracks reflects a minimal disturbance approach and reduces the potential impacts on existing landscape amenity to a level that is ALARP and acceptable. The hierarchy of controls for the well pad site is shown in **Table 3—8**, and the selection criteria used is shown in **Table 3—9**.

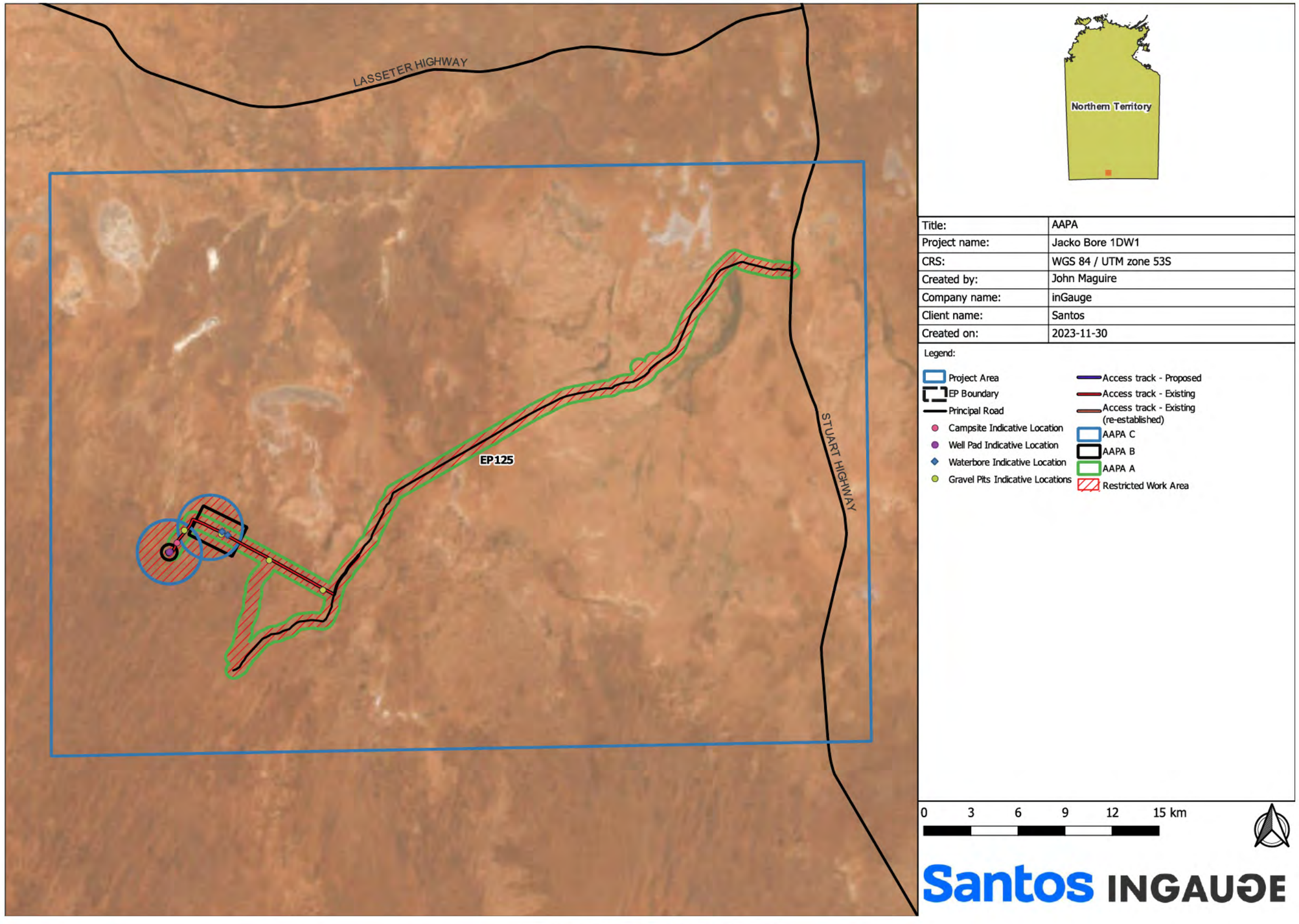



**Figure 3—3 AAPA Land Type A, B, C for the Activity**

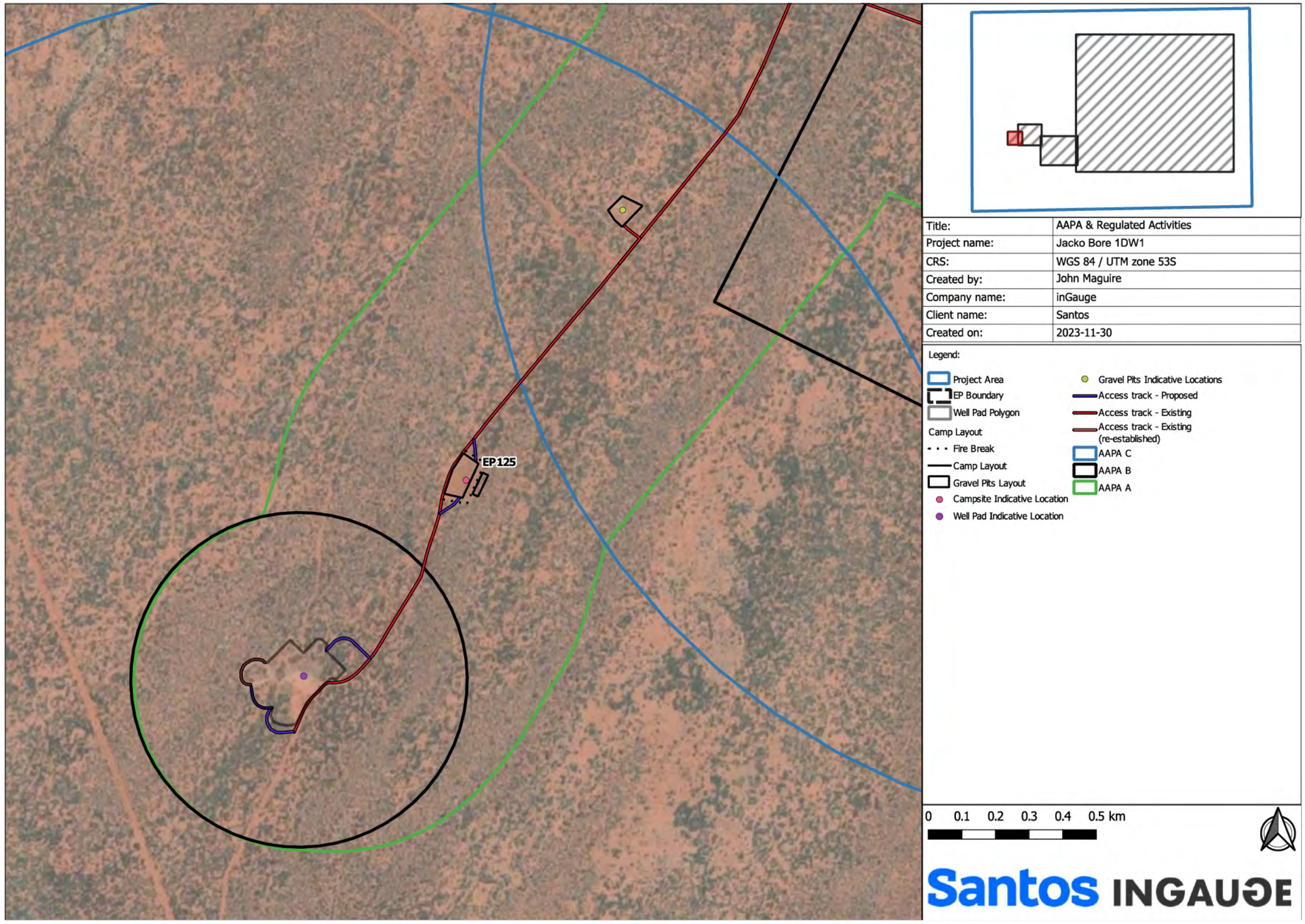
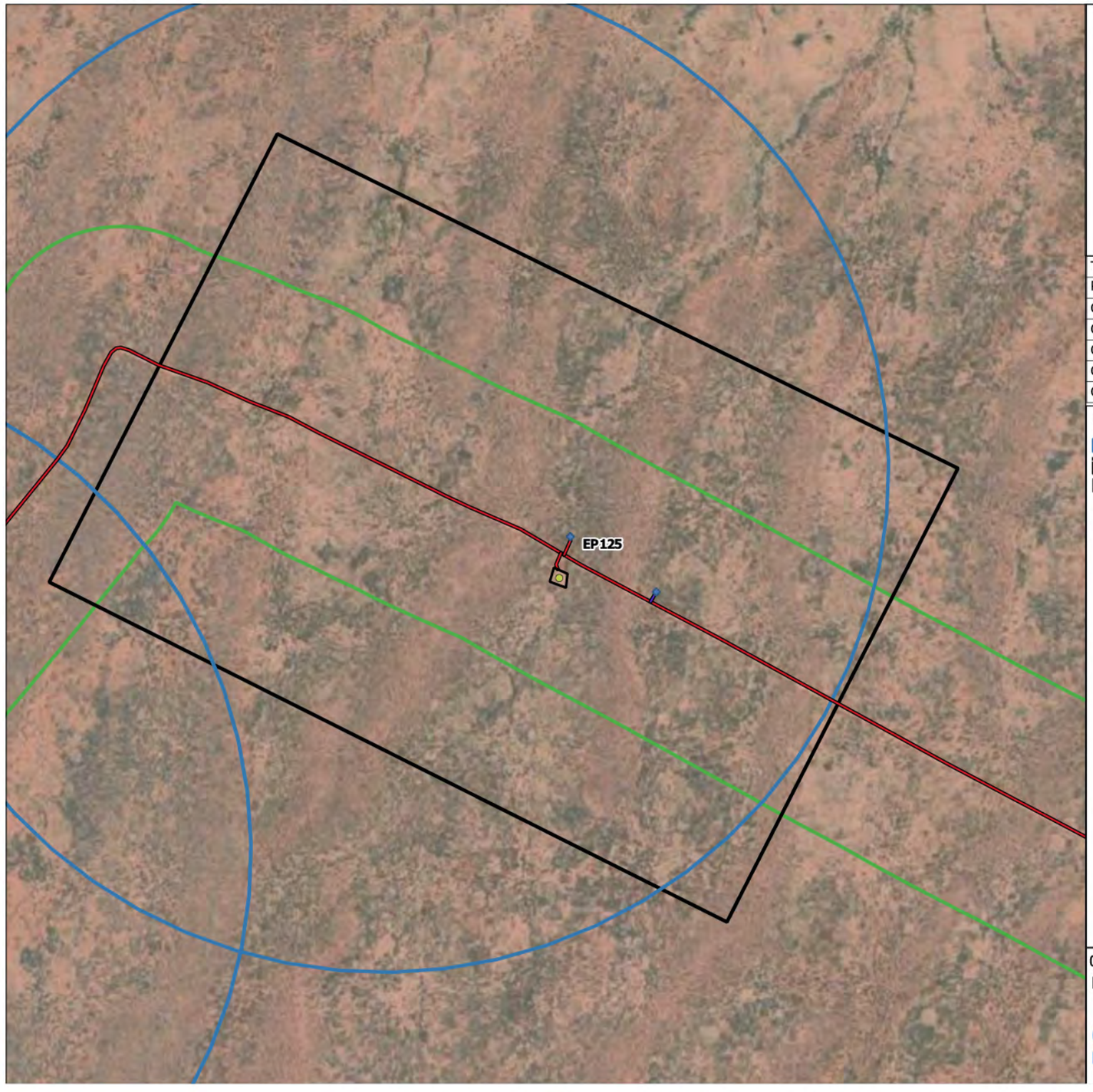



**Figure 3—4 AAPA Land Type A, B, C (Area 1 - Well Pad & Camp)**



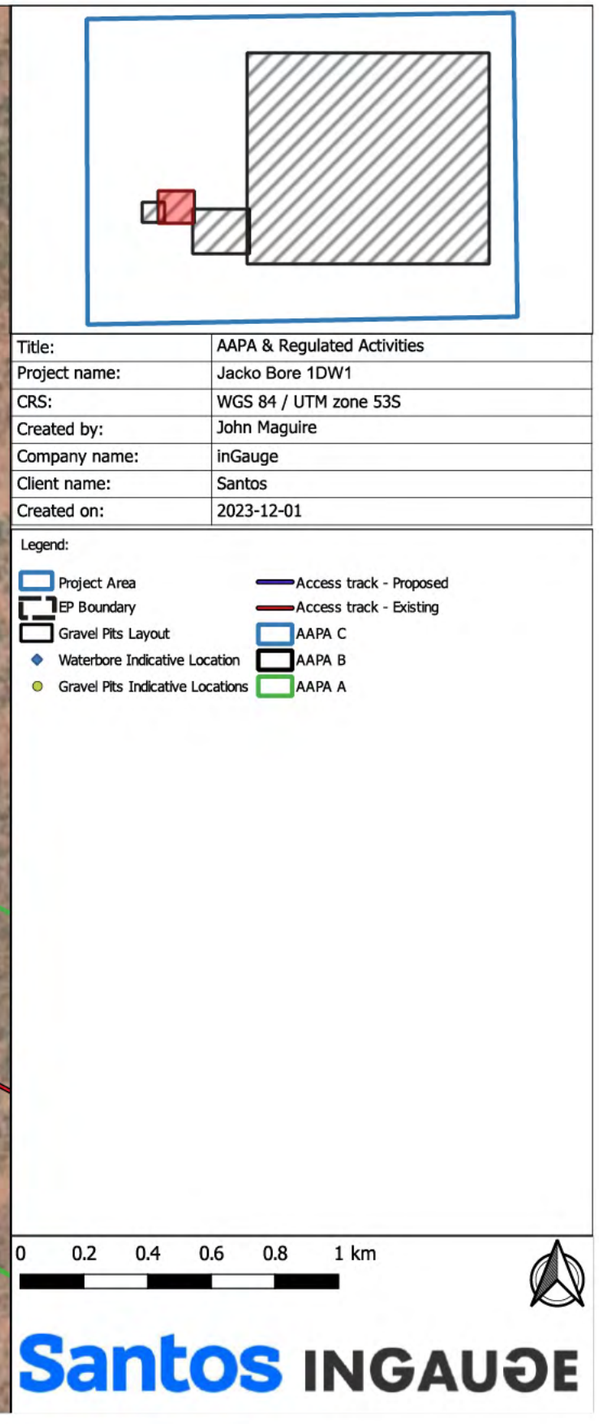
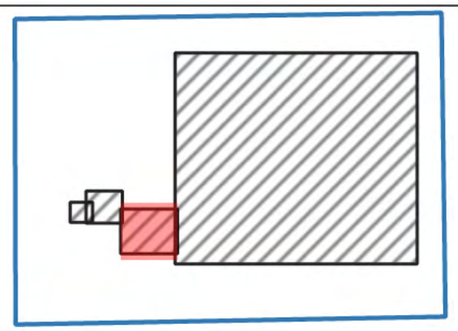




**Figure 3—5 AAPA Land Type A, B, C (Area 2 – Linear Infrastructure, Gravel Pits, & Water Bores)**



| | |
|---|---|
| Title: | AAPA & Regulated Activities |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-01 |

Legend:

- Project Area
- EP Boundary
- Gravel Pits Layout
- Gravel Pits Indicative Locations
- Access track - Existing
- AAPA A

0 0.4 0.8 1.2 1.6 2 km

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**Figure 3—6 AAPA Land Type A, B, C (Area 3 – Linear Infrastructure & Gravel Pits)**

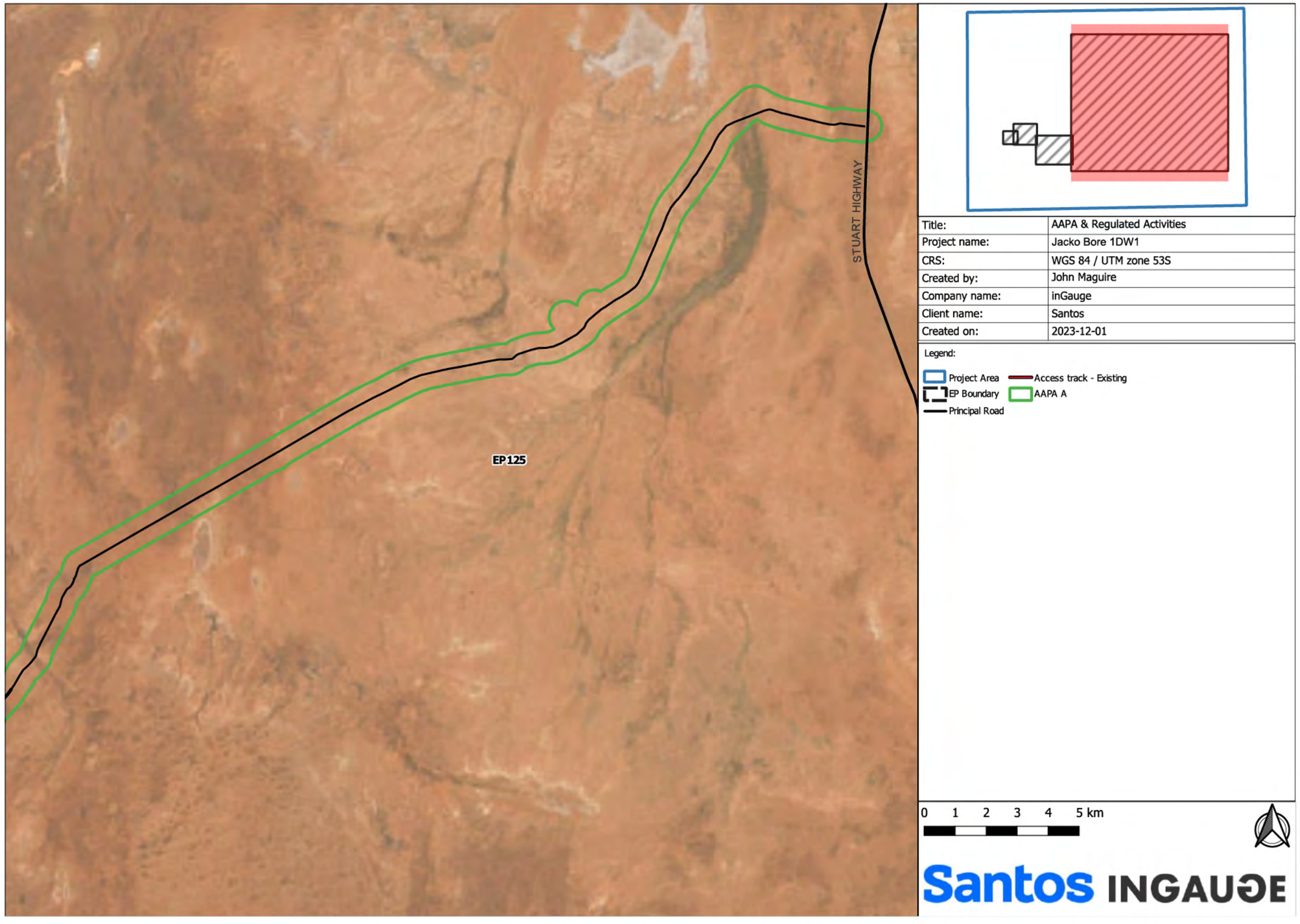



**Figure 3—7 AAPA Land Type A, B, C (Area 4 – Linear Infrastructure)**

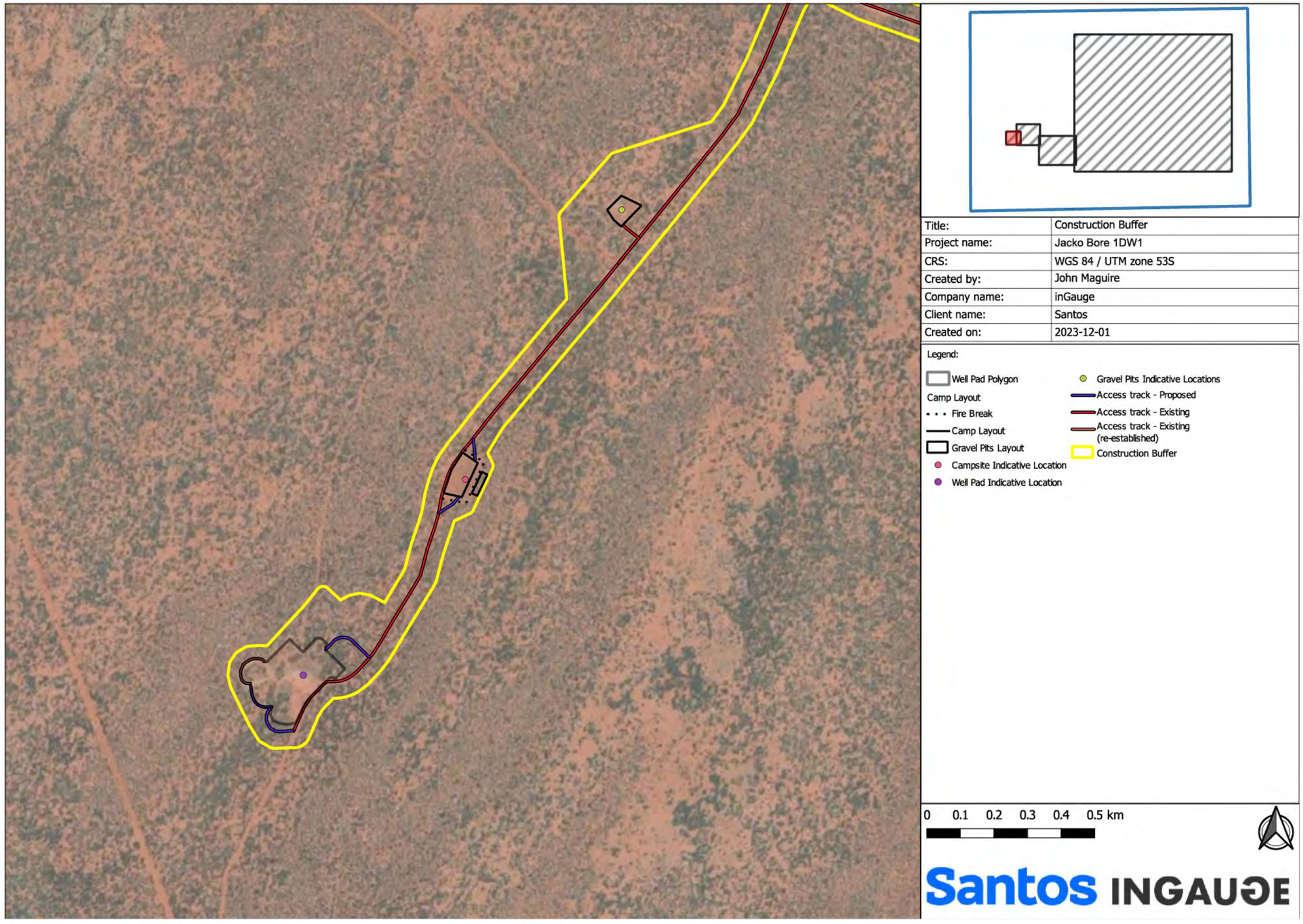



**Figure 3—8 Construction Buffer (Area 1 – Well Pad & Camp)**

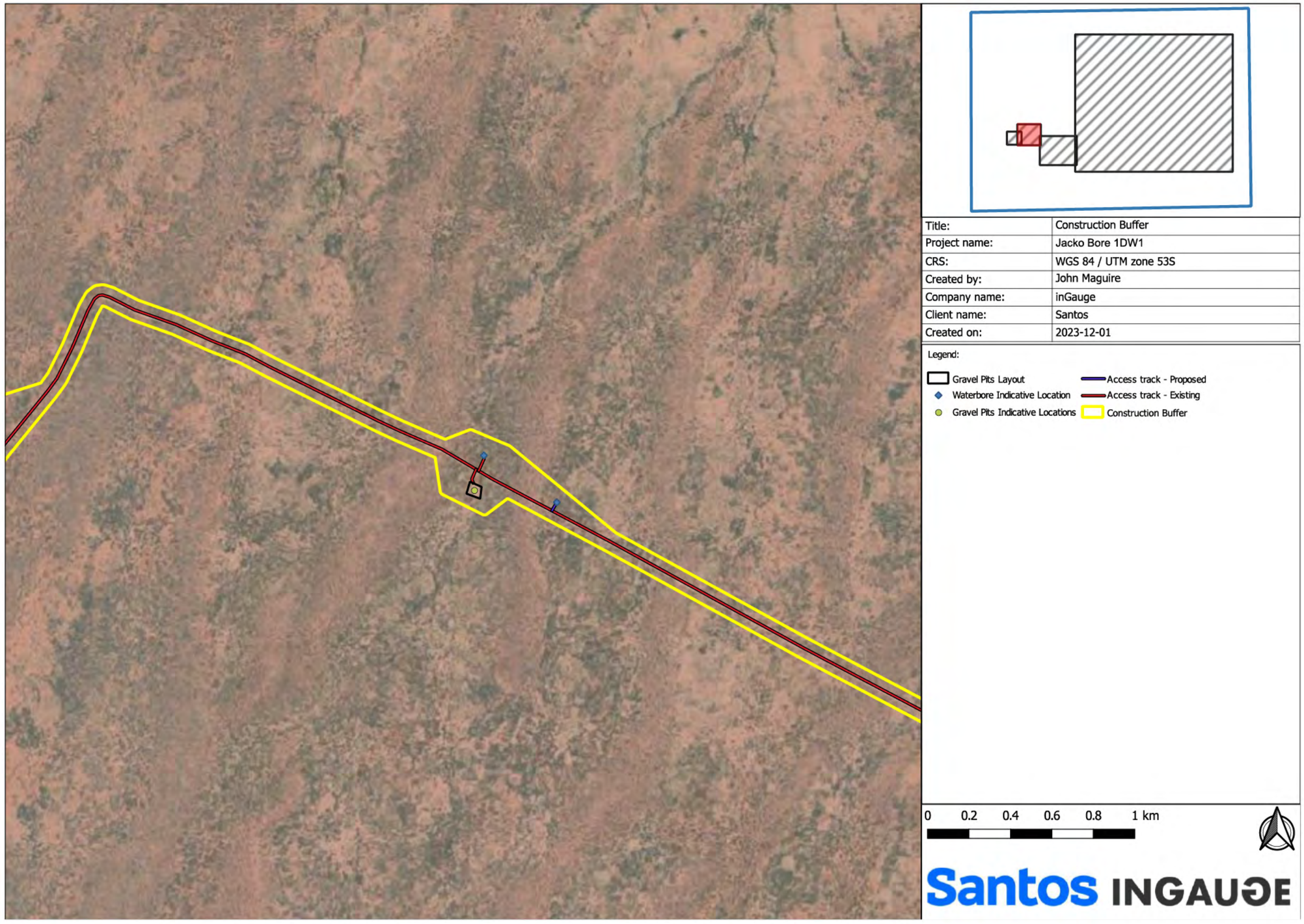



**Figure 3—9 Construction Buffer (Area 2 – Linear Infrastructure, Gravel Pits, and Water Bores)**

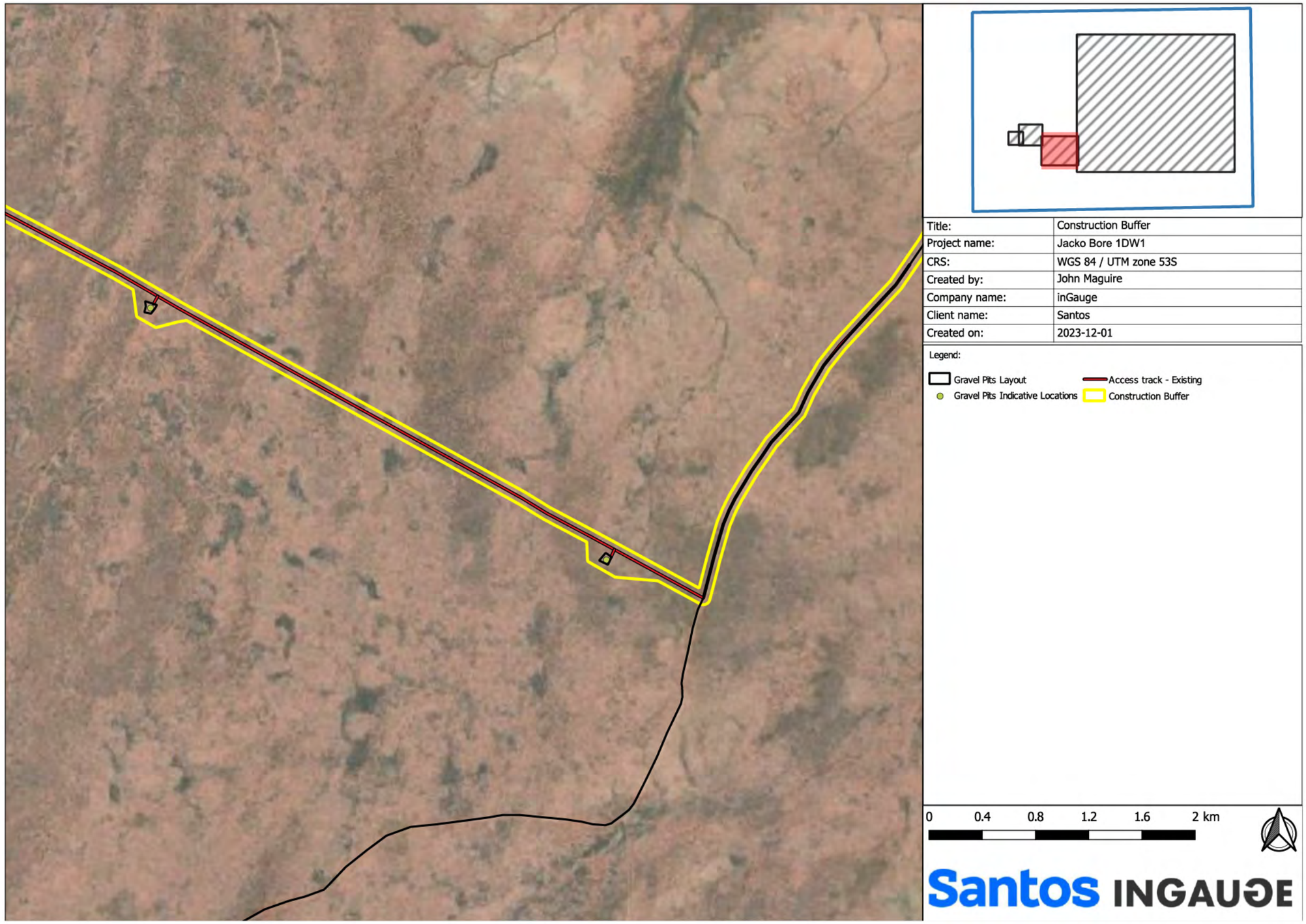



**Figure 3—10 Construction Buffer (Area 3 – Linear Infrastructure & Gravel Pits)**

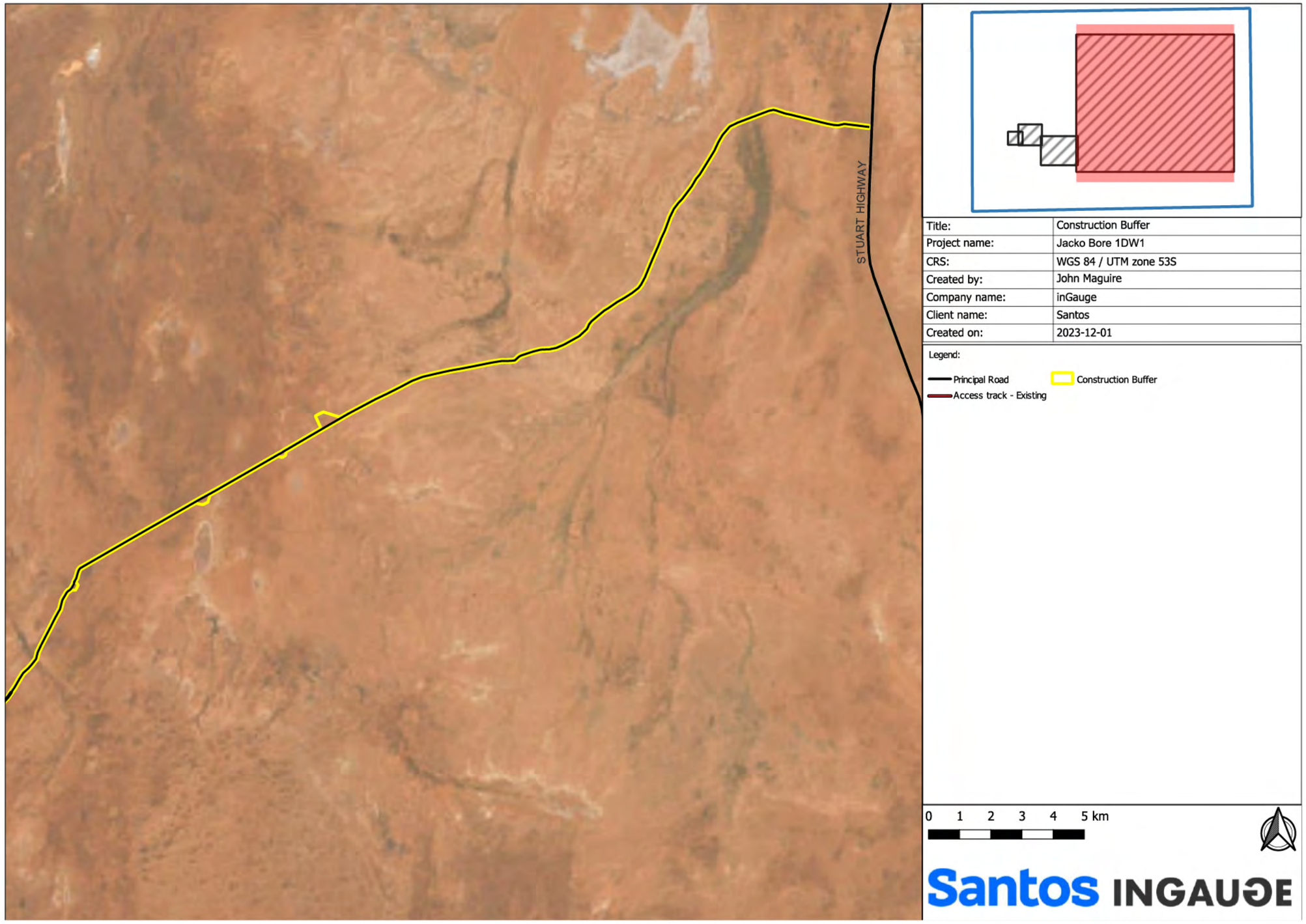



**Figure 3—11 Construction Buffer (Area 4 – Linear Infrastructure)**

**Table 3—8 Well Pad Site Selection Hierarchy of Controls**

| Controls and Demonstration of ALARP and Acceptability for Well Pad Site Selection | | |
|---|---|---|
| **Hierarchy of Control** | **Used?** | **Preventative Controls** |
| **Elimination** | No | The Activity requires the expansion of the existing well pad. |
| **Substitution** | Yes | Use of the existing well pad minimises the level of clearing required. |
| **Engineering/Design** | Yes | A baseline ecological assessment has been carried out for the proposed well pad expansion area.<br>A construction buffer has been included in the ecological survey to aid in the adjustment of the clearing to minimise impact on the environment, e.g., habitat features, surface water run-on/run-off.<br><br>The location of well pad expansion has been selected to avoid large trees that may provide habitat wherever possible.<br>The well pad expansion area has been designed to be as small as practicable whilst allowing for safe and efficient operation. |
| **Administration** | Yes | The Interest Holder has applied for and received an AAPA Certificate:<br>• Document Number: 202305831<br>• C2023/054 variation to C2023/018 |
| **Protective Equipment** | No | N/A |

**Table 3—9 Selection Criteria Used for Jacko Bore 1DW1**

| Well Pad | < 1 in 100 Year Flood Level | Slope (%) | Distance to Closest Bore (m) | Visible from Public Roads | Closest Stream Order | Distance to Closest Stream (m) | Distance to Closest Dwelling (m) |
|---|---|---|---|---|---|---|---|
| **Existing/Expansion** | No | < 1% | 3,200 | No | 2 | 1,600 | > 8,500 |

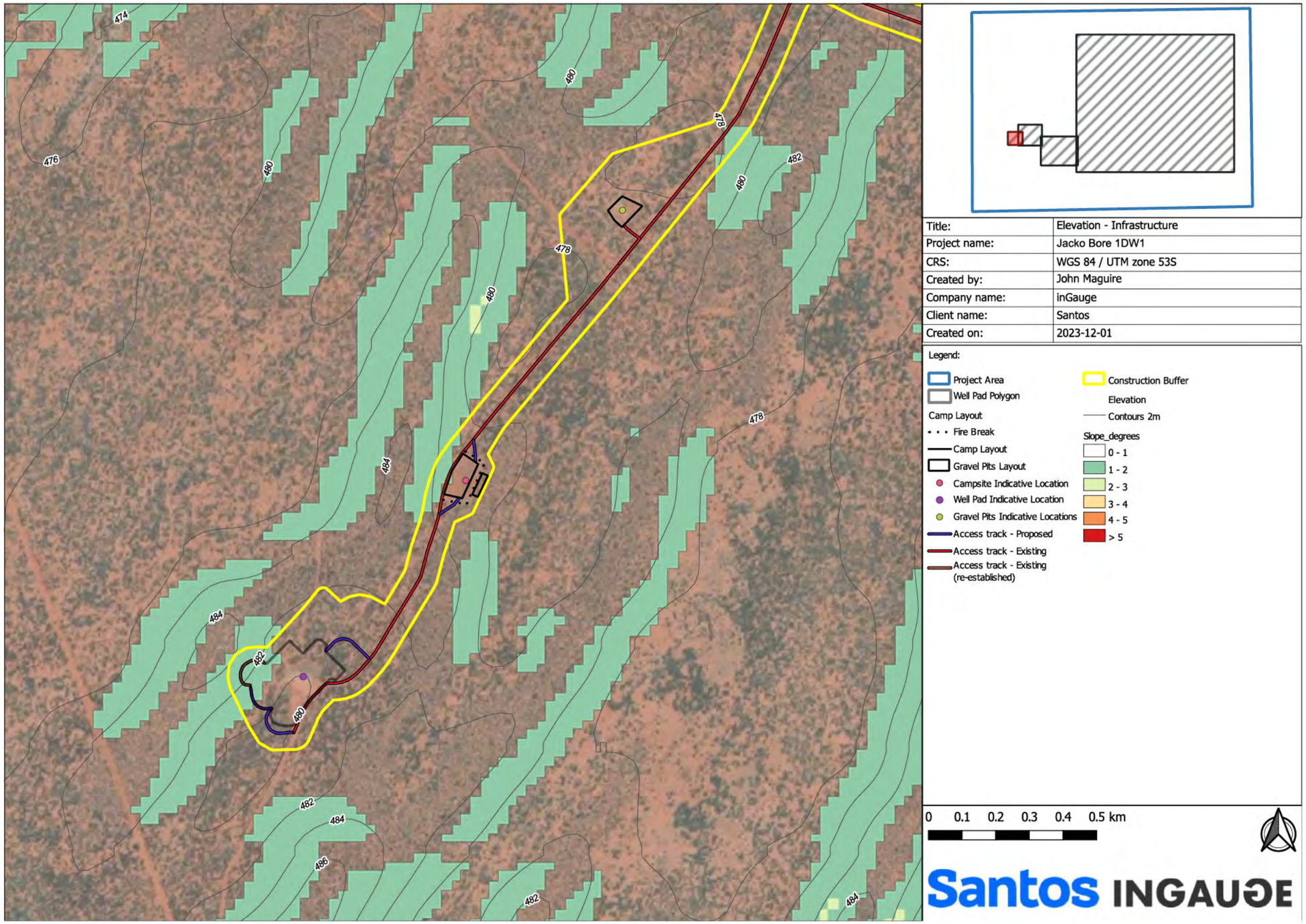
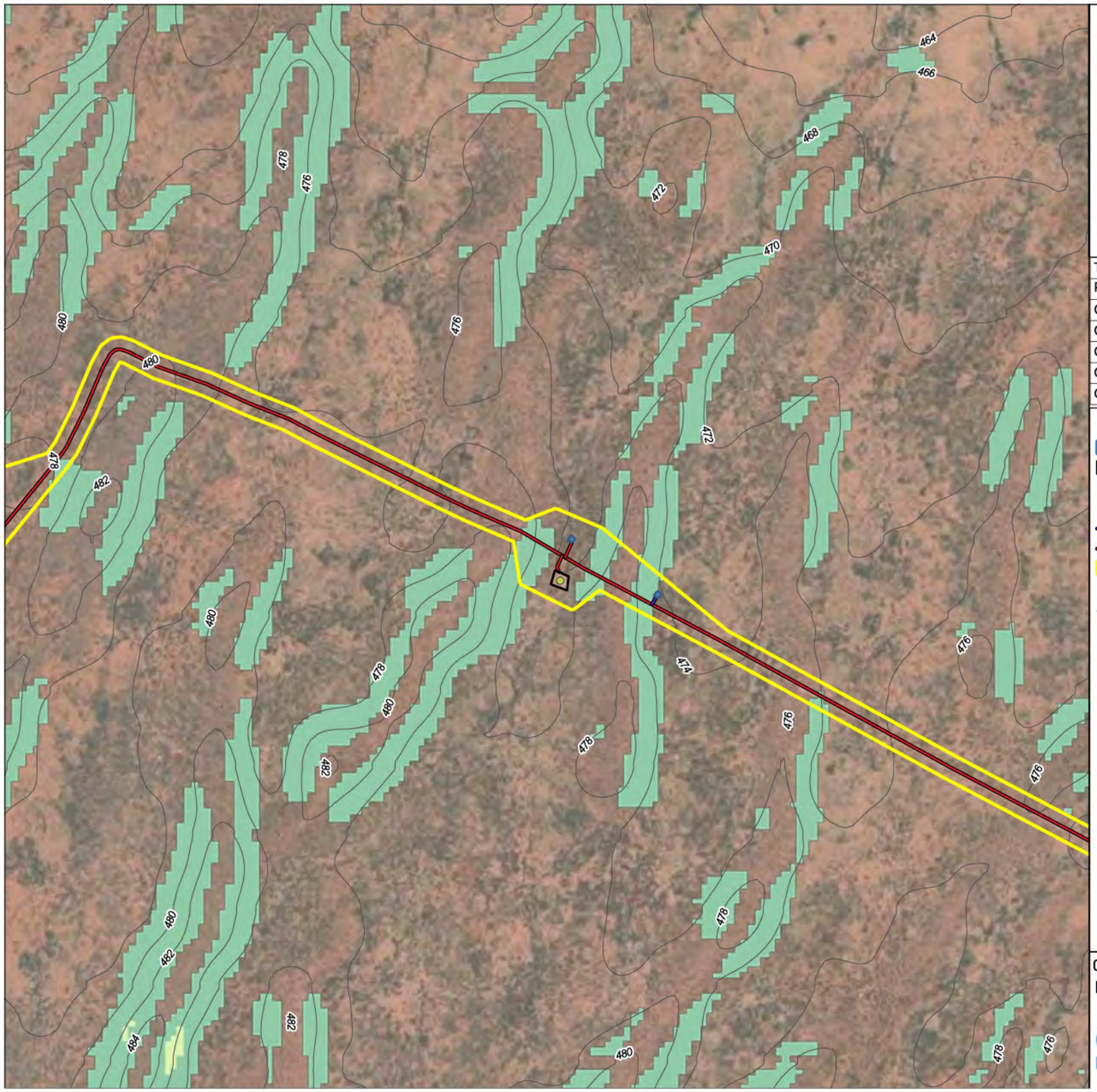
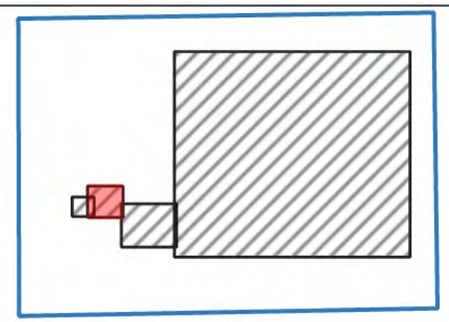



**Figure 3—12 Elevation (Area 1 – Well Pad and Camp)**



| | |
|---|---|
| Title: | Elevation - Infrastructure |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-01 |

Legend:

- Project Area
- Gravel Pits Layout
- Waterbore Indicative Location
- Gravel Pits Indicative Locations
- Access track - Proposed
- Access track - Existing
- Construction Buffer

Elevation

- Contours 2m

Slope_degrees

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- > 5

0 0.2 0.4 0.6 0.8 1 km

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**Figure 3—13 Elevation (Area 2– Regulated Activity)**

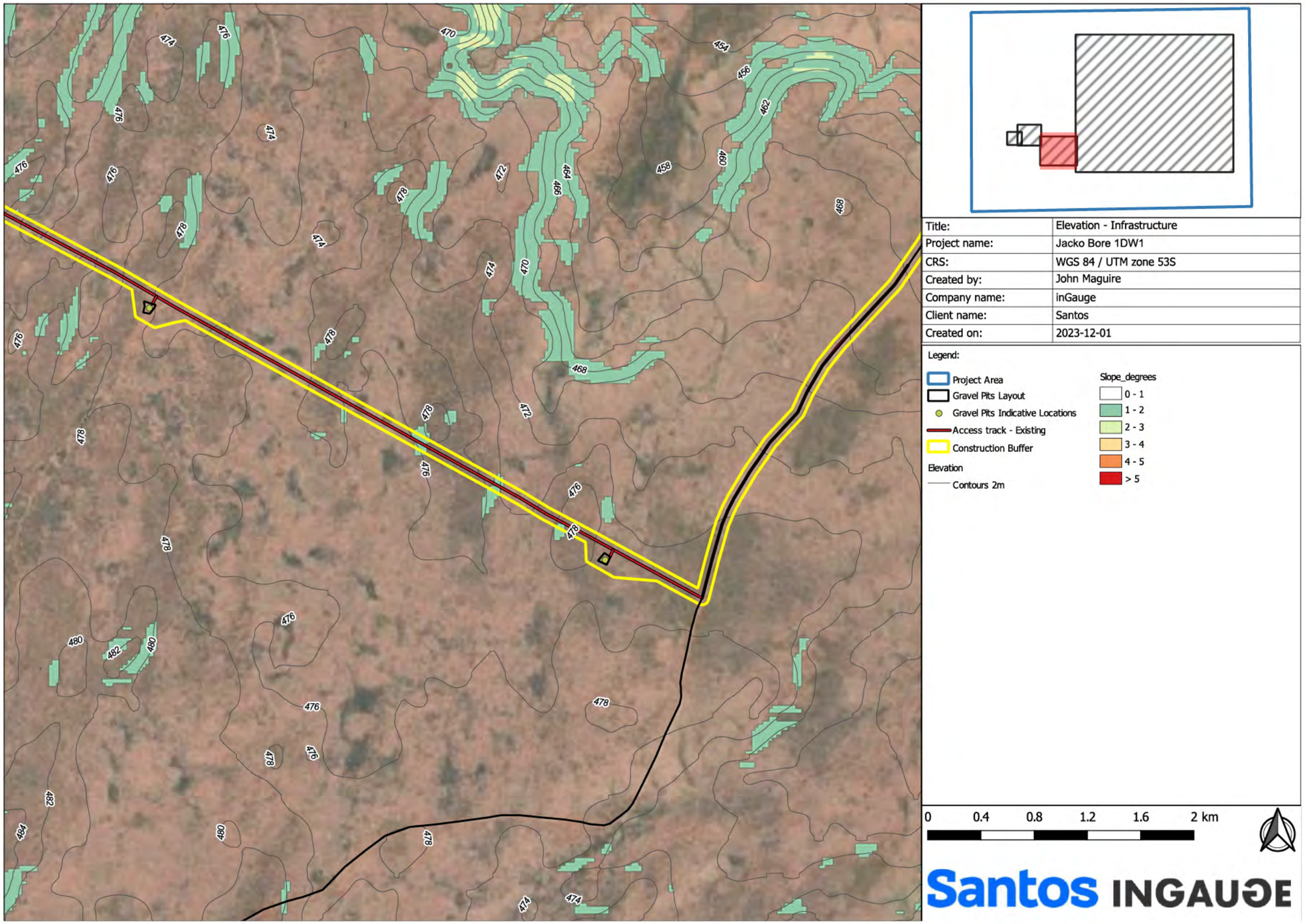



**Figure 3—14 Elevation (Area 3 – Regulated Activity)**

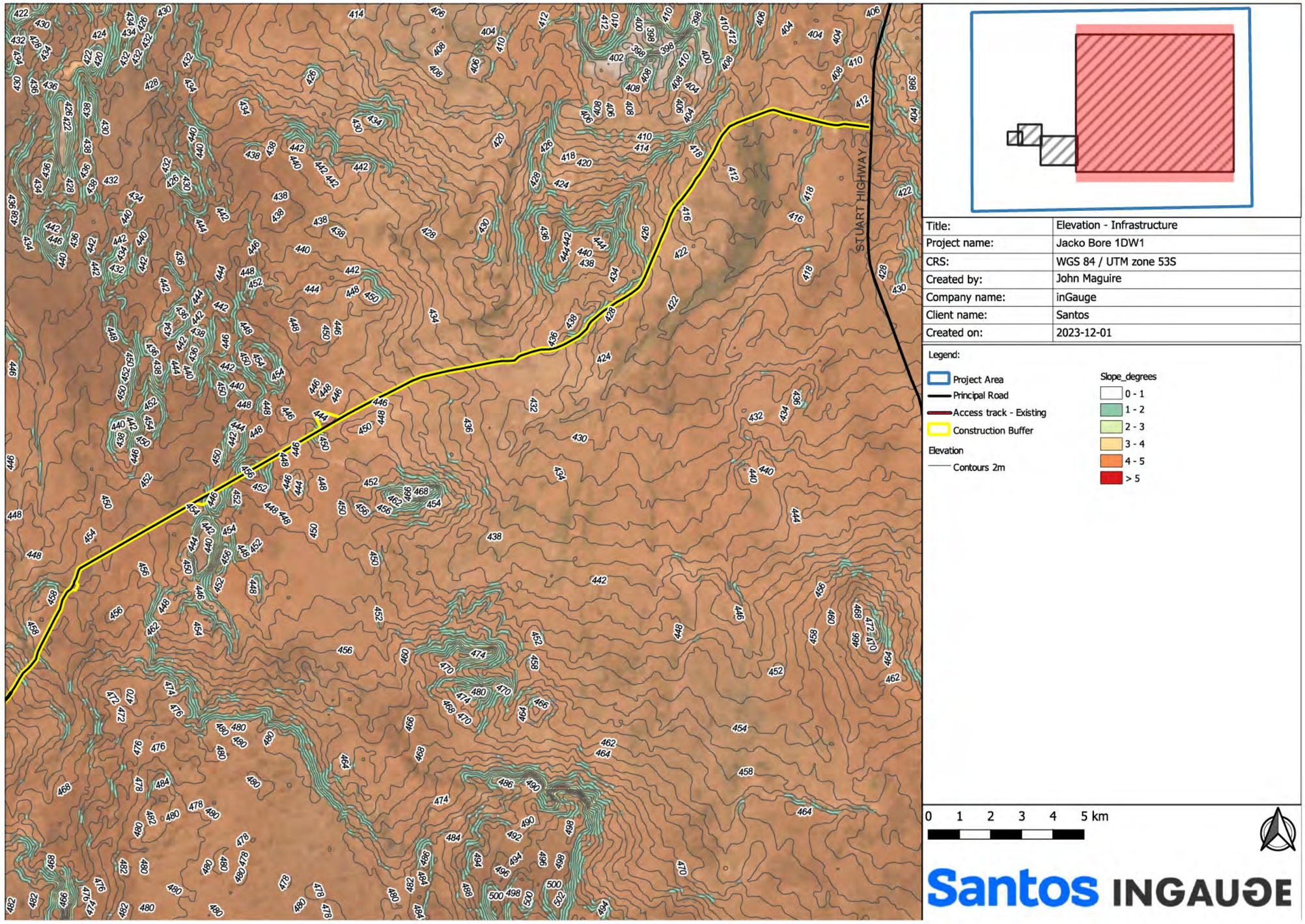



**Figure 3—15 Elevation (Area 4 – Linear Infrastructure)**

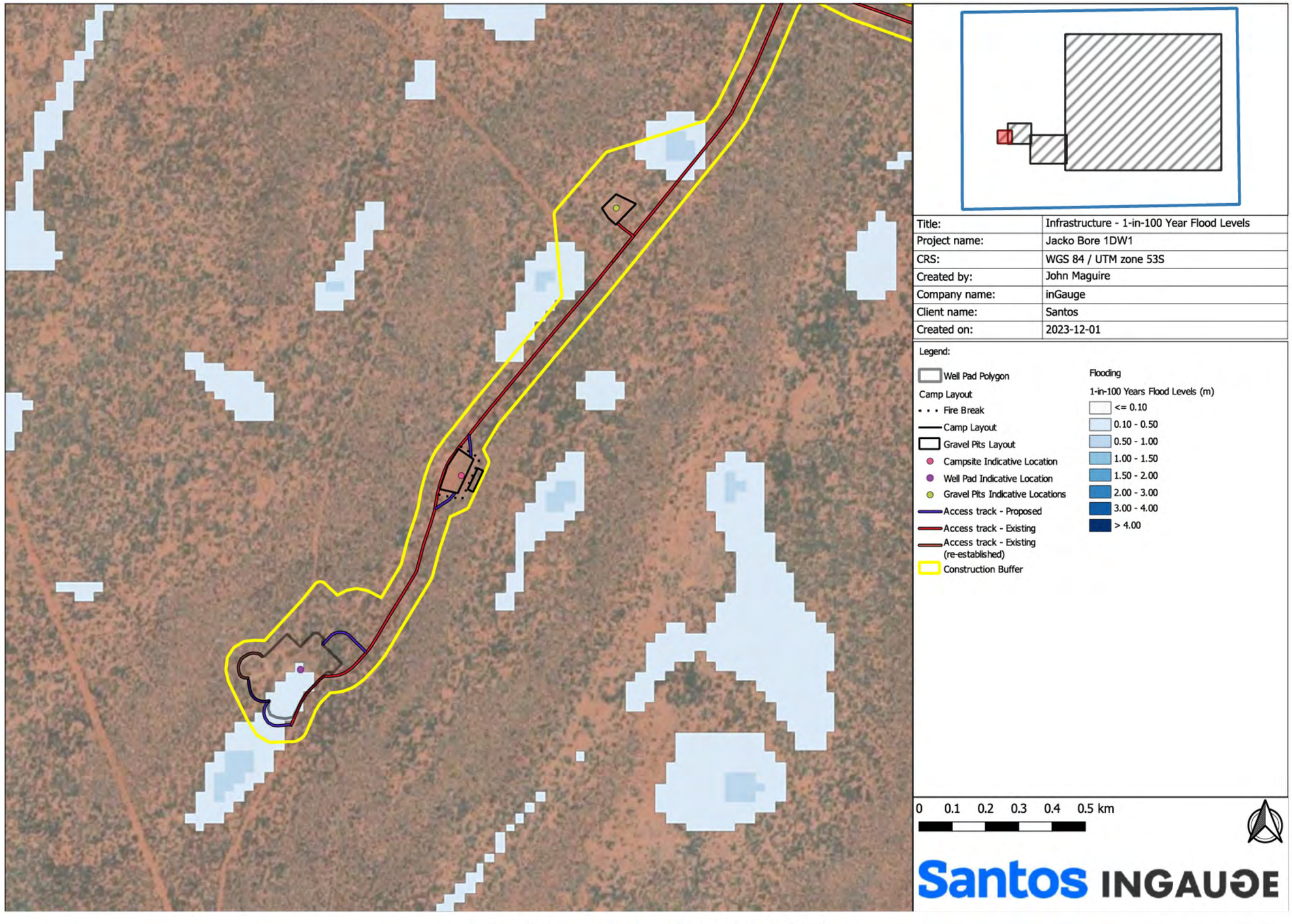



**Figure 3—16 1 in 100-year Flood Levels (Area 1 – Well Pad & Camp)**

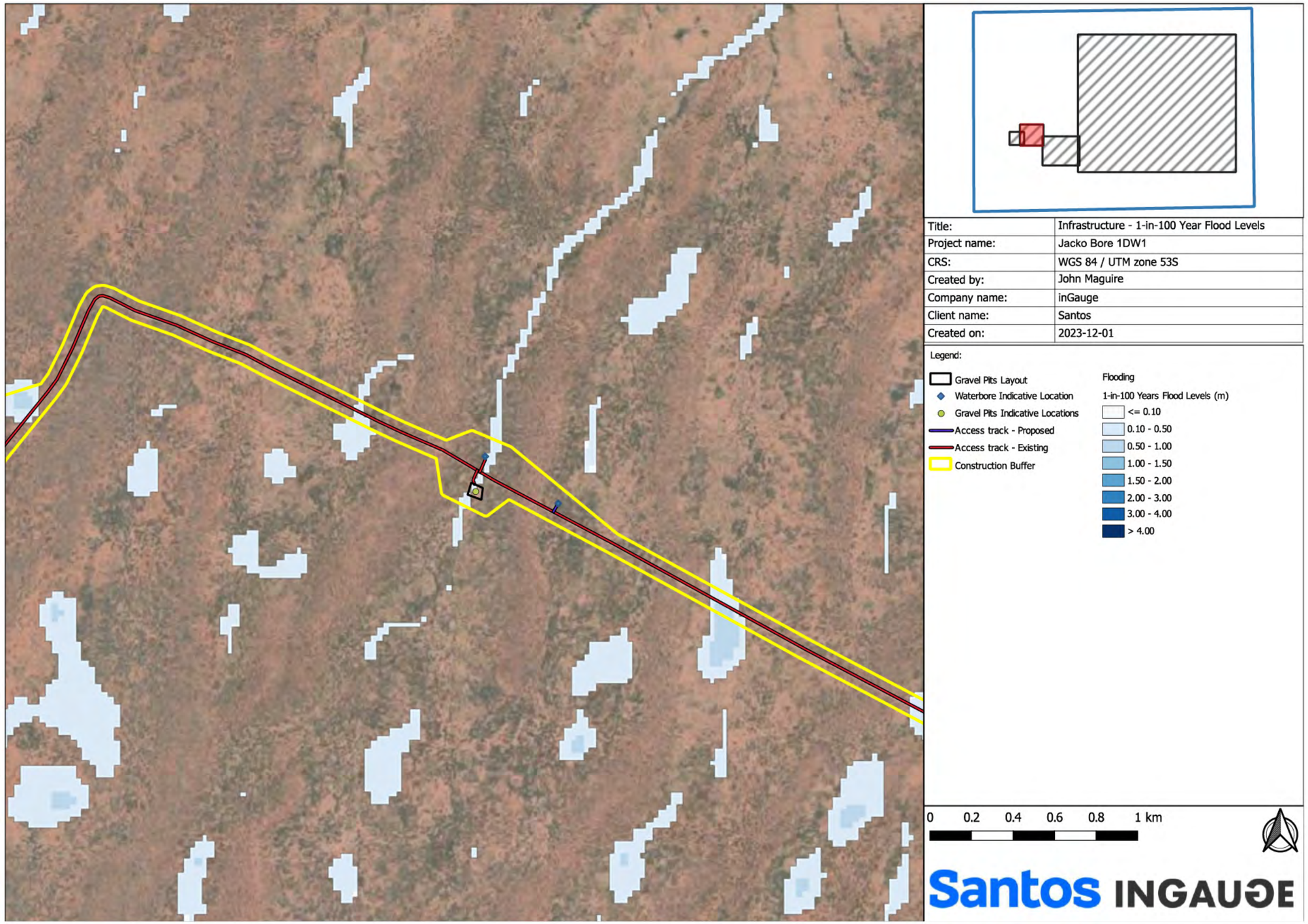



**Figure 3—17 1 in 100-year Flood Levels (Area 2 – Infrastructure)**

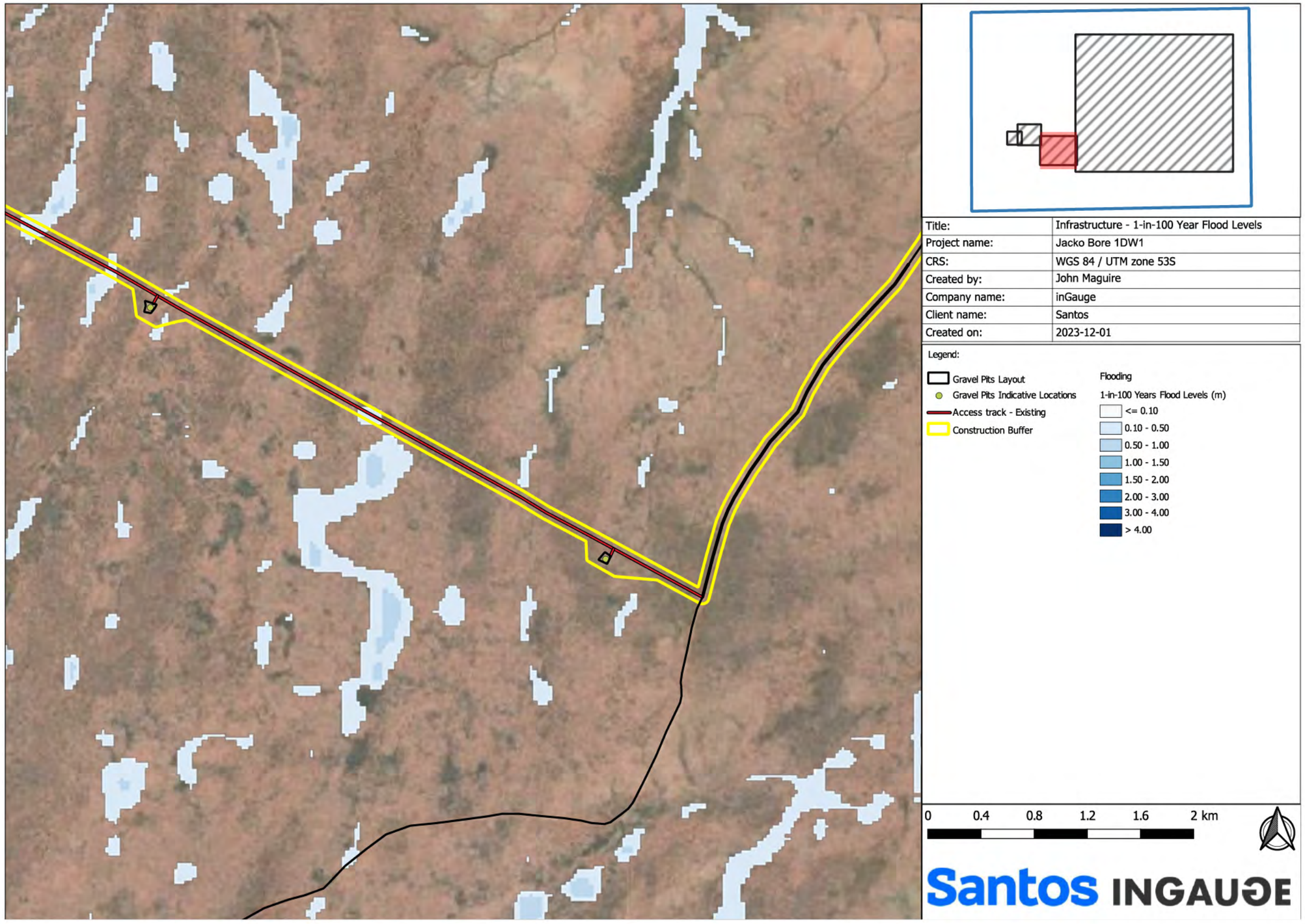



**Figure 3—18 1 in 100-year Flood Levels (Area 3 –Infrastructure)**

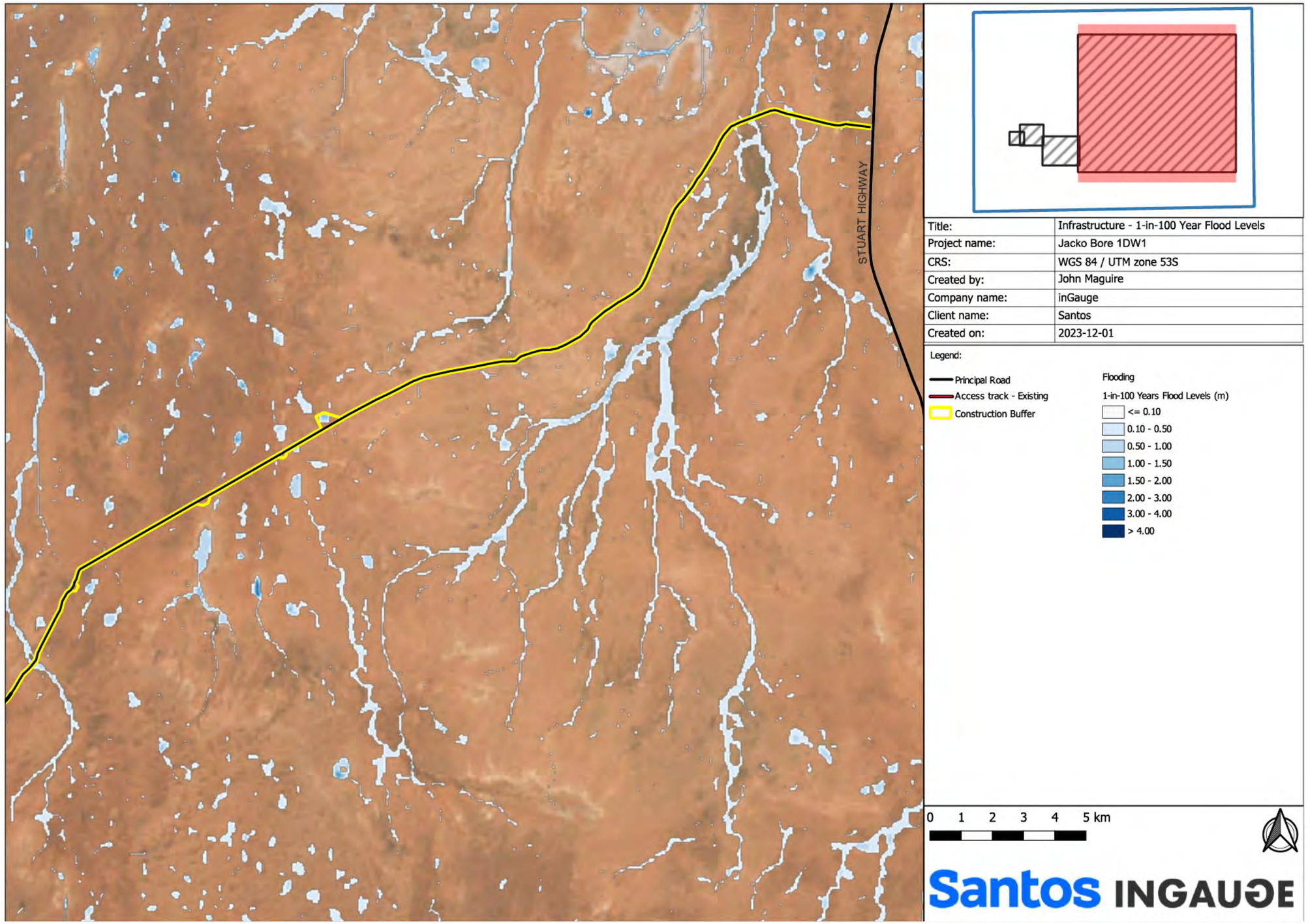



**Figure 3—19 1 in 100-year Flood Levels (Area 4 – Linear Infrastructure)**

## 3.6 Civil Construction

### 3.6.1 Overview

The civil construction works to be carried out under the EMP are:

- The re-establishment of the previously cleared well pad, access track, campsite, and gravel pit/s.
- Expansion of the existing well pad and clearing of new access tracks.
- Drilling of water bore/s.
- Maintenance of established infrastructure and rehabilitation.

The Activity under this EMP will be carried out by clearing the least area practicable and minimising the disturbance by:

- Drilling the Jacko Bore 1DW1 well on an existing well pad, which only requires expansion rather than the construction of a new disturbance area.
- Limiting new access track construction by utilising existing tracks to access the well pad, campsite, water bore/s and gravel pit/s. New access tracks will only be constructed where necessary to facilitate vehicle access to the well pad and/or campsite.
- Preferentially locating the water bore on the well pad.
- Running freshwater lines along the surface on or adjacent to access tracks where practicable. No ground disturbance would be required for the laying of freshwater lines.
- Use of the existing cleared area for the campsite and use of existing gravel pit/s.
- There will be no construction activity or use of pre-existing gravel pits within the KCPS SOCS or SOBS area or buffer.

The well pad design and site selection criteria aid in the prevention of spills of potentially harmful chemicals or those that may cause environmental harm to the ground or surface water, or their release from site by:

- Topsoil stripped from the well pad and pit areas and windrowed above the cut batter and fire break upslope, including overland flow diversion bunding on fill areas as required to prevent erosion.
- Clean water diversion - diversion berms on the upslope side of the pad and pits to divert runoff around the pad or to dissipate runoff prior to it entering the pad.

- Dirty water diversion – pad runoff is to be dissipated using mitigation measures such as coir logs or mulch berms.
- Lined pits to prevent seepage to ground from storage of drilling fluids and by-products.
- Overland flow diversion bund for pits to prevent surface water from inundating the pit.

### 3.6.2 Disturbance Areas

A breakdown of the area required for the Activity and how much of it is new disturbance is shown in **Table 3—10.**

**Table 3—10 Disturbance Areas of the Activity under this EMP**

| Description | Total Amount of Required Land (incl. Buffer), ha | Total Amount of Already Cleared Land (incl. Buffer), ha | New Clearing Required (incl. Buffer), ha |
|---|---|---|---|
| **Well Pad Expansion Area** | 5.3 | 0.8* | 4.5 |
| **Access Tracks** | 36.7 | 34.7 | 2.0 |
| **Sand Dune Crossings** | 6.8 | 6.8 | 0.0 |
| **Gravel Pit/s** | 9.9 | 9.9 | 0.0 |
| **Campsite** (Including helicopter pad) | 1.3 | 1.3 | 0.0 |
| **Groundwater Bores** | 1.5 | 0.00 | 1.5 |
| **Well Pad Buffer Area**** | 0.8 | 0.0 | 0.8 |
| **Total** | 62.3 | 53.5 | 8.8 |

*0.8 ha is the cleared area remaining of the original well pad.

** 0.8 ha is included as a contingency buffer to account for any necessary deviations that may be identified during ground-truthing.

### 3.6.3 Access Track Construction

#### *3.6.3.1 Access Works*

Access to the Jacko Bore 1D1W well pad will be primarily along an existing public road within EP125 and pre-existing access tracks. The access and proximity to environmental sensitivities are shown in **Figure 5—9.** As a priority, these tracks will be used for the Activity to reduce the amount of land clearing required.

As shown in **Table 3—10**, approximately 85% of the required access tracks for the Activity are existing, and these tracks will be maintained and upgraded where necessary. All new access tracks for the Activity are required to be 10m wide, but a buffer of 10 m (20 m width in total) has been accounted for in the clearing calculations. Where grading is required, turn-outs would be provided within the 20 m access track buffer zone to minimise erosion and sediment runoff to protect natural waterways.

There will be no new access construction in areas with Sites of Conservation Significance (SOCS) or Sites of Botanical Significance (SOBS) (**Section 5.10**).

#### 3.6.3.2 *Methodology*

Vegetation will be cleared from new access tracks and stockpiled or mulched for rehabilitation purposes. To avoid further clearing, cleared vegetation will be stockpiled in a naturally clear area where one is available in the immediate vicinity. New access tracks will be formed and compacted using on-site materials sourced from existing gravel pit/s.

The impact of access track construction on trees of significance or environmentally sensitive flora or fauna will be minimised as much as practicable; the clearing of large trees will be avoided wherever possible. The decision flow chart for tree clearing of linear infrastructure is shown in **Figure 3—20.**

As noted above, no clearing will occur within SOCS or SOBS. Any sensitive areas, nests, or potential habitats for listed threatened species will be avoided, and clearing and construction works will be situated to avoid these locations.

All erosion and sediment control measures will be constructed and maintained following **Appendix 05** (Erosion and Sediment Control Plan).

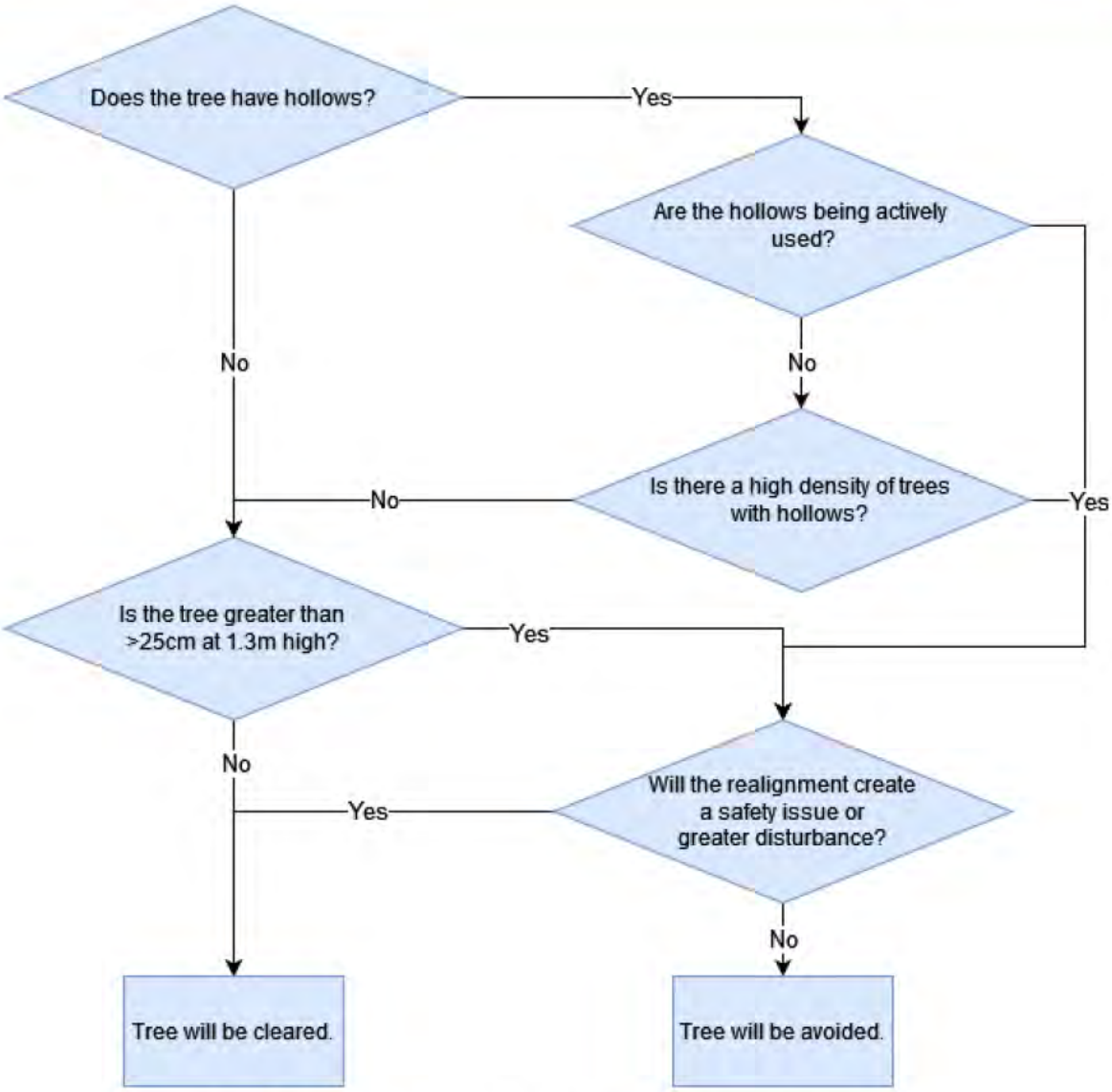



**Figure 3—20 Clearing Decision Tree for Linear Infrastructure Construction**

### 3.6.4 Well Pad Expansion

#### 3.6.4.1 *Overview*

The existing Jacko Bore 1 well pad will be expanded to support the drilling of a helium appraisal well. The use and expansion of the existing well pad will reduce the amount of clearing required compared with constructing an additional well pad in EP125. The indicative well pad layout is shown in **Figure 3—21**, including a draft placement of the well, tank pad, erosion and sediment controls, and fire protection.

An ecological assessment (**Appendix 01)** was conducted to ground-truth, in advance of any ground disturbance, the presence of the following environmental factors so they could be managed and/or avoided:

- Riparian zones.
- Buffers for drainage depressions and ordered streams.
- The location of significant flora and evidence of significant fauna (including potential habitat).
- The density of hollow-bearing trees.

The existing well pad will be expanded and upgraded as required to provide a safe and efficient workplace for drilling and other well pad-regulated works. The expansion and upgrade of the existing well pad will include the following:

- Clearing the well pad.
- Use of gravel/fill material for well pad expansion/capping and hardstand
- Constructing lined pits for the storage of freshwater and drilling by-products. Pits will be raised approximately 50cm above ground level to prevent inundation due to well pad run-off or flooding.
- Construction of a tank pad with a compacted base and overland flow diversion bund. The overland flow diversion bund may be constructed to a secondary containment standard. Refer **Appendix 06** for above-ground tank secondary containment specifications.
- Constructing a water production bore.
- Installing a drilling cellar (a pit below the rig to allow for valves etc) and conductor (outer bore casing) as required.
- Fencing the perimeter to prevent livestock and personnel entry.
- Clearing vegetation for firebreaks.
- Installing erosion and sediment control devices and diversion bunds/berms.

An additional buffer area has been included to account for any deviations that may be necessary due to items identified during ground-truthing. It is not expected that this buffer area will be required to be cleared but is included as a contingency.

#### *3.6.4.2 Methodology*

The well pad expansion area will be cleared and compacted using on-site materials as far as practicable, and gravel/fill will be used where required for well pad expansion/capping and/or hardstand. Pits will be constructed using bulldozers and excavators, with overland flow diversion bund/berms consolidated with watering and compaction.

In line with bore work permit conditions, water production bores will be drilled by a licenced driller.

Fire breaks will be constructed and maintained in line with **Appendix 08** (Fire Management Plan).

Erosion and sediment controls will be constructed as per **Appendix 05** (Erosion and Sediment Control Plan).

The well pad will be fenced to exclude livestock; barbed wire will be used in line with local pastoral practices.

#### 3.6.4.3 *Vegetation Stockpiling and Dirty Water Filtration*

Vegetation will be stripped from the well pad and windrowed along the downslope section of the well pad and fire access track. This vegetation stockpiling can filter any runoff from the well pad during construction and from the well pad fill batters post-construction.

#### 3.6.4.4 *Topsoil and Clean Water Diversion*

Soil from the well pad would be stripped and windrowed on the upslope extent of the well pad or where there is the possibility of significant run-on, up to 1.5m high to create a diversion bund (as shown in **Figure 3—21**) and in **Appendix 05** (Erosion and Sediment Control Plan). Care will be taken to ensure that water intercepted by a diversion bund/berm does not impact topsoil stockpiles.

The soil stockpile/clean water diversion bund/berm will protect the well pad from erosion and prevent significant water run-on.

#### 3.6.4.5 *Well Pad Drainage and Sediment Control*

The well pad will be designed with a minimum slope of 1% (except the well hardstand, which is designed to be flat) so rainfall collected on the well pad will runoff from the compacted area in a controlled manner. Rainwater on the well pad will drain toward Type 3 sediment controls constructed in accordance with the

Erosion and Sediment Control Plan (**Appendix 05**). If required, spoon drains with rock check dams/coir logs will be installed at appropriate spacing to capture on-site sheet flow (if any). As recommended by IECA unprotected slope lengths will not exceed 80m unless drainage or natural features reduce this length [IECA, 2008].

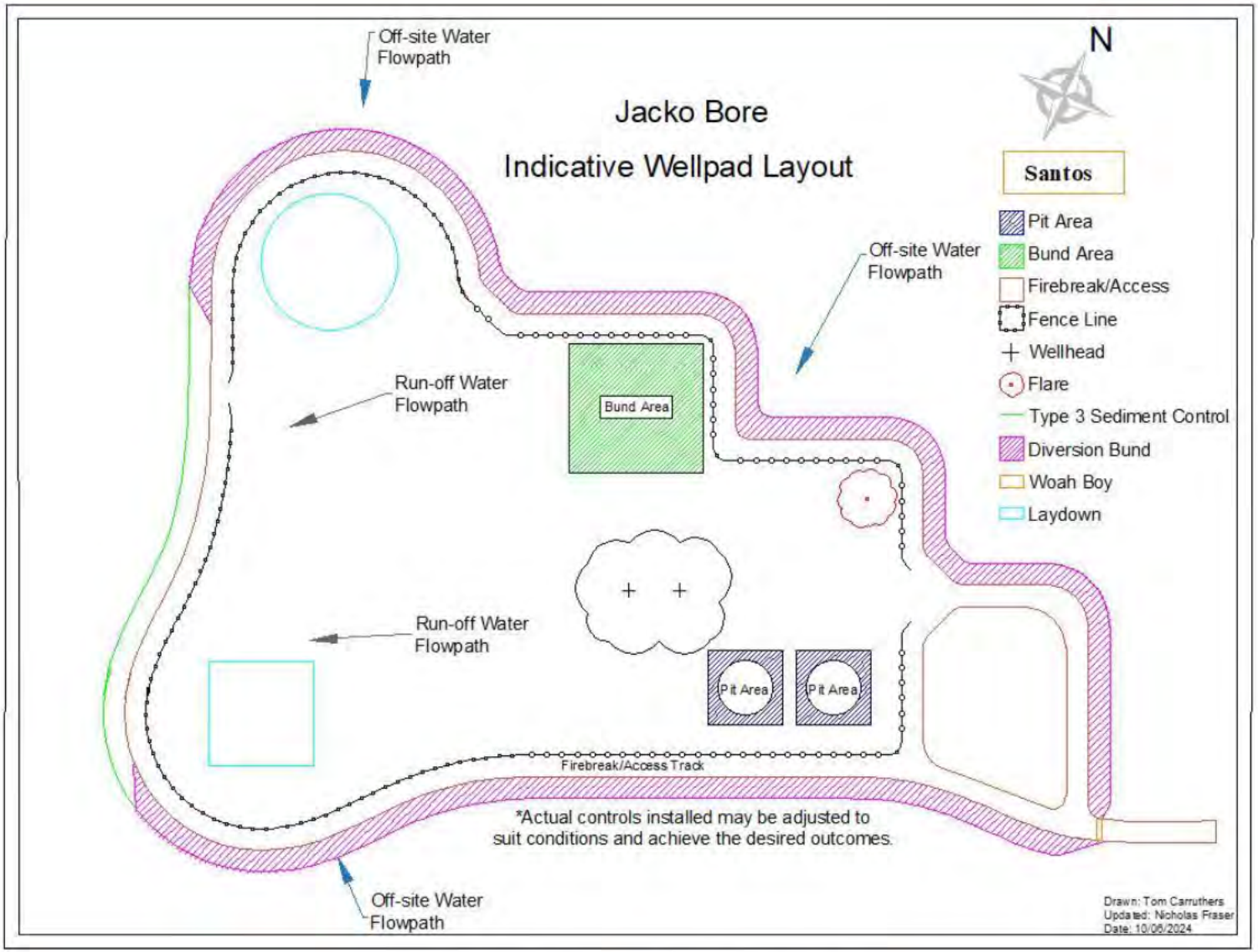



**Figure 3—21 Indicative Well Pad Footprint and Layout**

### 3.6.5 Groundwater Bores

It is anticipated that one groundwater bore will be required to meet the anticipated water demand. However, as a contingency, two bores are planned due to the variability in the supply potential of the aquifers. The primary groundwater bore is proposed to be positioned within or directly adjacent to the well pad site to minimise environmental disturbance. Water supply is discussed further in **Section 4.1**.

The other groundwater bore/s, if required, will be placed in a naturally clear area adjacent to an access track within the established working corridors. An overestimate of approximately 1.5 ha (including buffer) for up to three cleared areas has been accounted for in the total disturbance area of the Activity.

The chosen location will not be within 5km of a GDE. The closest GDE is over 9 km to the northeast of the well pad, as shown in **Figure 5—10**. It is mapped as an aquatic GDE of low potential, identified through a national scale assessment. A review of aerial photography identifies this GDE to be associated with a salt lake.

No impacts to the potential GDE are anticipated as the target aquifer depth for the water bore at the well site is 200m to 300m below ground, and therefore there is a significant thickness between the target zone and the water table that would provide a source of water to the GDE.

### 3.6.6 Groundwater Monitoring Program

On-going monitoring of the water extraction will comprise monthly flow meter readings from each extraction bore during operations or otherwise as required by the water extraction licence.

### 3.6.7 Freshwater Lines

If required, freshwater lines from water bores to water storage areas would be run along the surface in a similar manner to that used by pastoralists. Freshwater lines would be used if more efficient than trucking.

To eliminate the need for clearing, freshwater lines will be run on or immediately adjacent to access tracks where practicable. The length of freshwater lines and the extent of clearing, if any, cannot be determined until operational parameters are encountered. Depending on operational circumstances, no lines may be installed.

Leaks from any installed freshwater lines will be detected during Water Extraction License (WEL) water volume recording bore inspections. Leaks will be repaired as soon as practical after detection, with leaks that are causing access track and/or soil washouts given precedence.

Ground disturbance associated with freshwater lines is not approved under AAPA Certificate C2023/054 variation to C2023/018. If ground disturbance is required for freshwater lines, the Interest Holder will apply for a variation to AAPA Certificate C2023/054 variation to C2023/018. It is not anticipated that ground disturbance would be required to lay freshwater lines.

### 3.6.8 Highway Intersections

The Activity under this EMP does not require the construction of any highway intersections. The Interest Holder will utilise existing intersections off the Stuart Highway; these intersections have been constructed for road train access for livestock transport and are therefore suitable for the heavy vehicles required for the Activity covered by the EMP. See **Appendix 14** – Traffic Impact Assessment.

### 3.6.9 Campsite

There is an existing campsite location within the Project Area; however, it will need to be re-established (re-growth cleared) given the re-growth of vegetation since it was last utilised.

The location of the campsite is shown in **Figure 3—4**.

### 3.6.10 Gravel/Borrow Pit/s

The Interest Holder has identified active gravel pit/s along the existing access tracks in immediate proximity to the well pad, which are proposed for use during the construction of the well pad expansion for the Jacko Bore 1DW1 well.

Gravel/fill is only anticipated to be required at the well pad and will be primarily sourced from the gravel pit closest to the well pad. The total volume estimated for use is 5,000 $m^3$.

The re-use and maintenance of the pit/s may require:

- The removal of re-growth. If so, it will be stockpiled around the perimeter of the cleared area for rehabilitation.
- Establishment of 'whoa boys' on the access track to ensure water does not flow from the access track into the pit.
- Re-contouring of the batters/walls so that they are not left steeper than 1:1 to allow safe passage for animals and people.

An indicative layout for a gravel/borrow pit is shown in **Figure 3—22**.

The locations and details of the four gravel pits are provided in the following figures:

- Gravel Pits 01 - 04 - Elevations are shown in **Figure 3—23, Figure 3—24 & Figure 3—25**.
- Gravel Pits 01 - 04 - 1 in 100-year Flood Levels are shown in **Figure 3—26, Figure 3—27 & Figure 3—28:**
    - Flood levels and water bores.
    - Note: no water bores were identified in proximity to the gravel/borrow pits.
- Gravel pits 01 - 04 – proximity to environmental sensitivities is shown in **Figure 4—2:**

- Stream orders in proximity to the gravel pits.
- Note: no GDEs are identified within 5km.

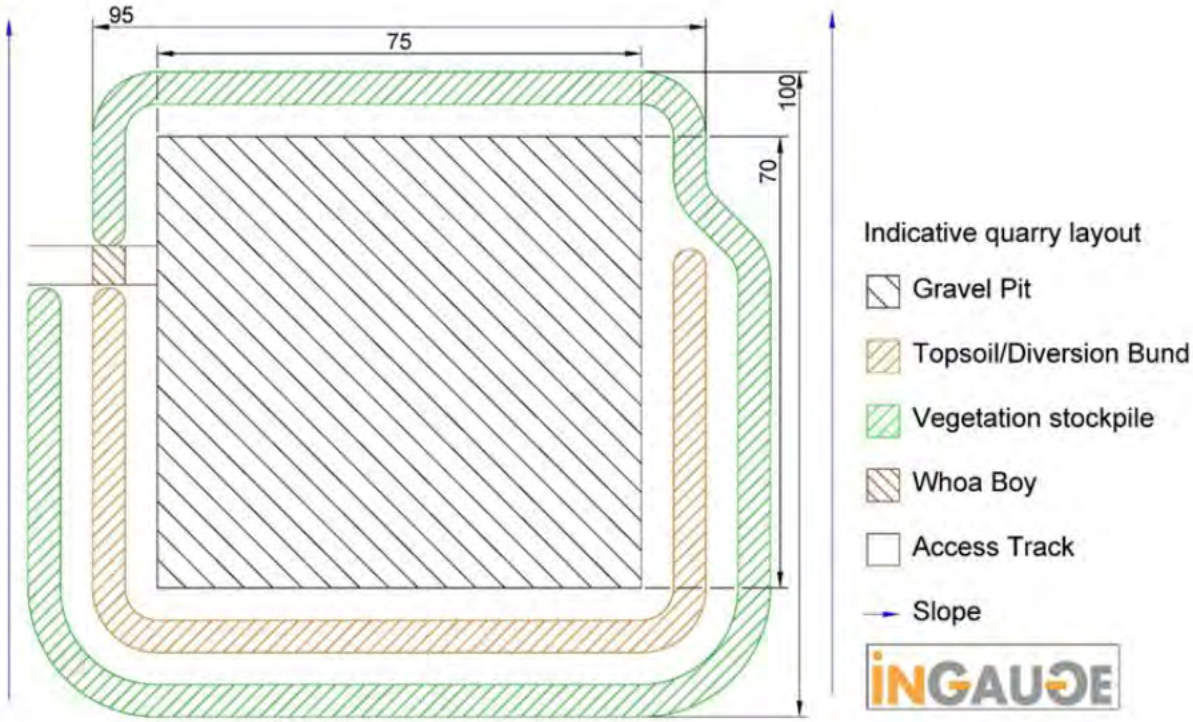



**Figure 3—22 Indicative Gravel Pit Layout**

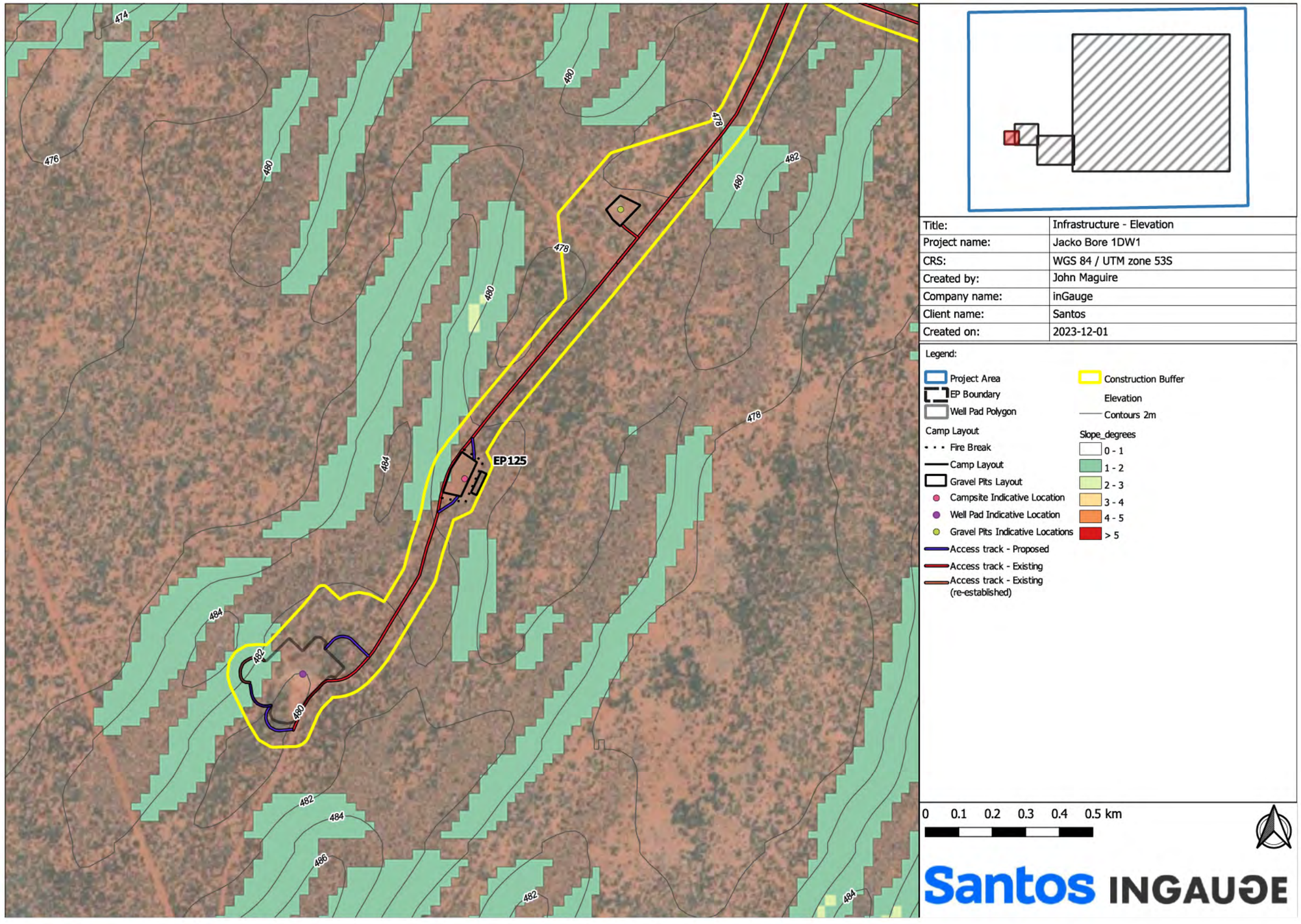



**Figure 3—23 Elevation – Gravel Pits 01 (Area 1)**

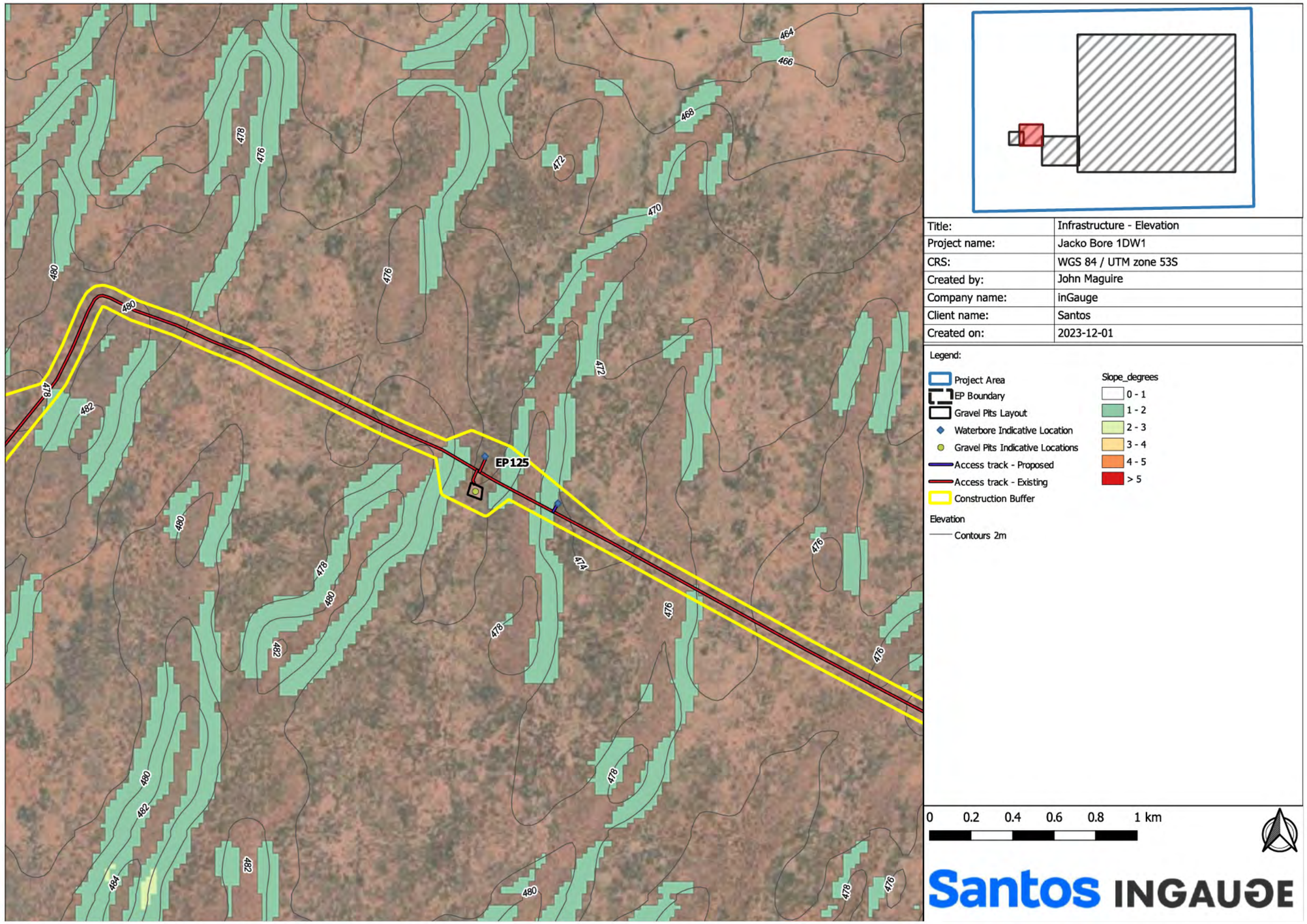



**Figure 3—24 Elevation – Gravel Pits 02 (Area 2)**

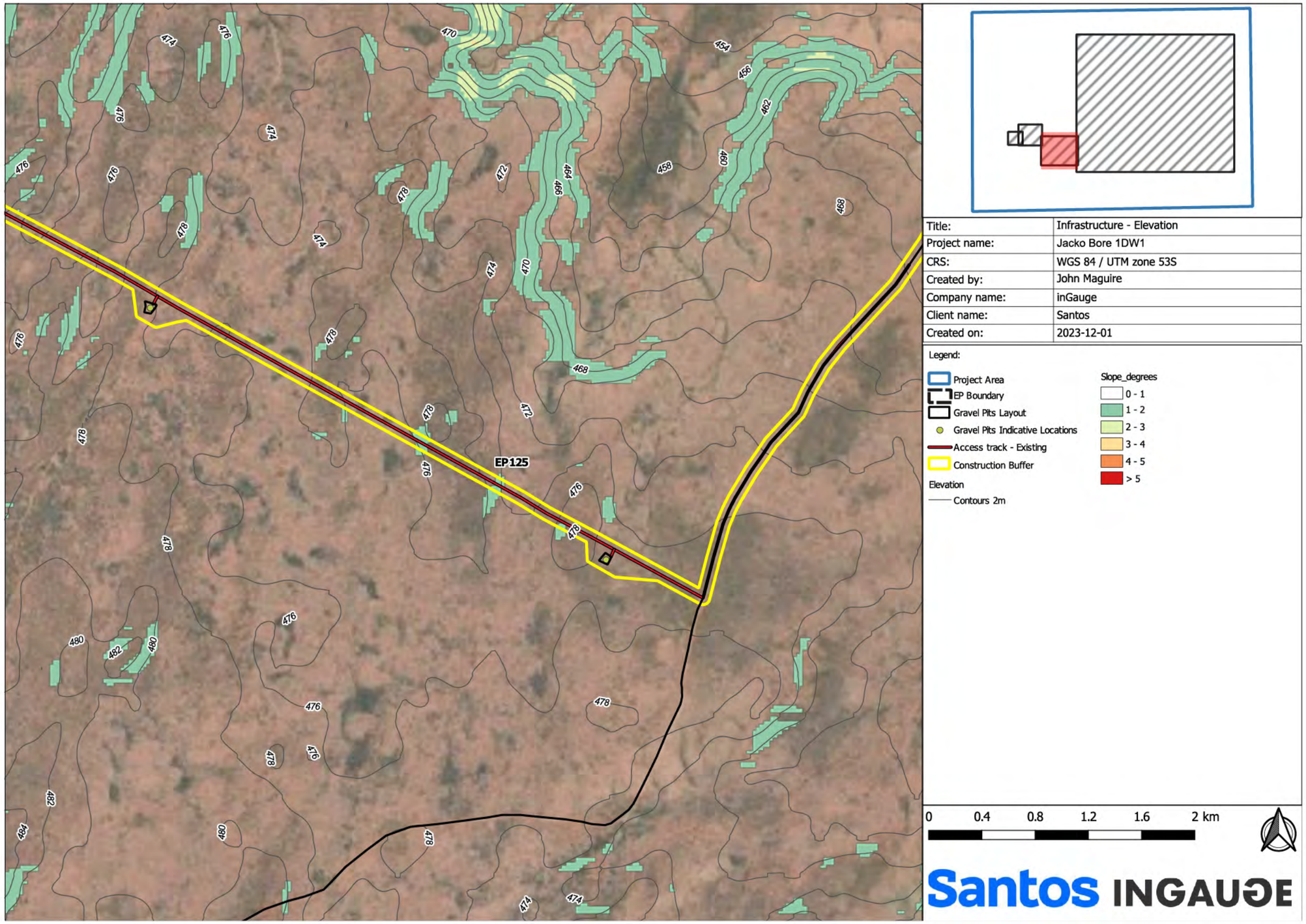



**Figure 3—25 Elevation – Gravel Pits 03 – 04 (Area 3)**

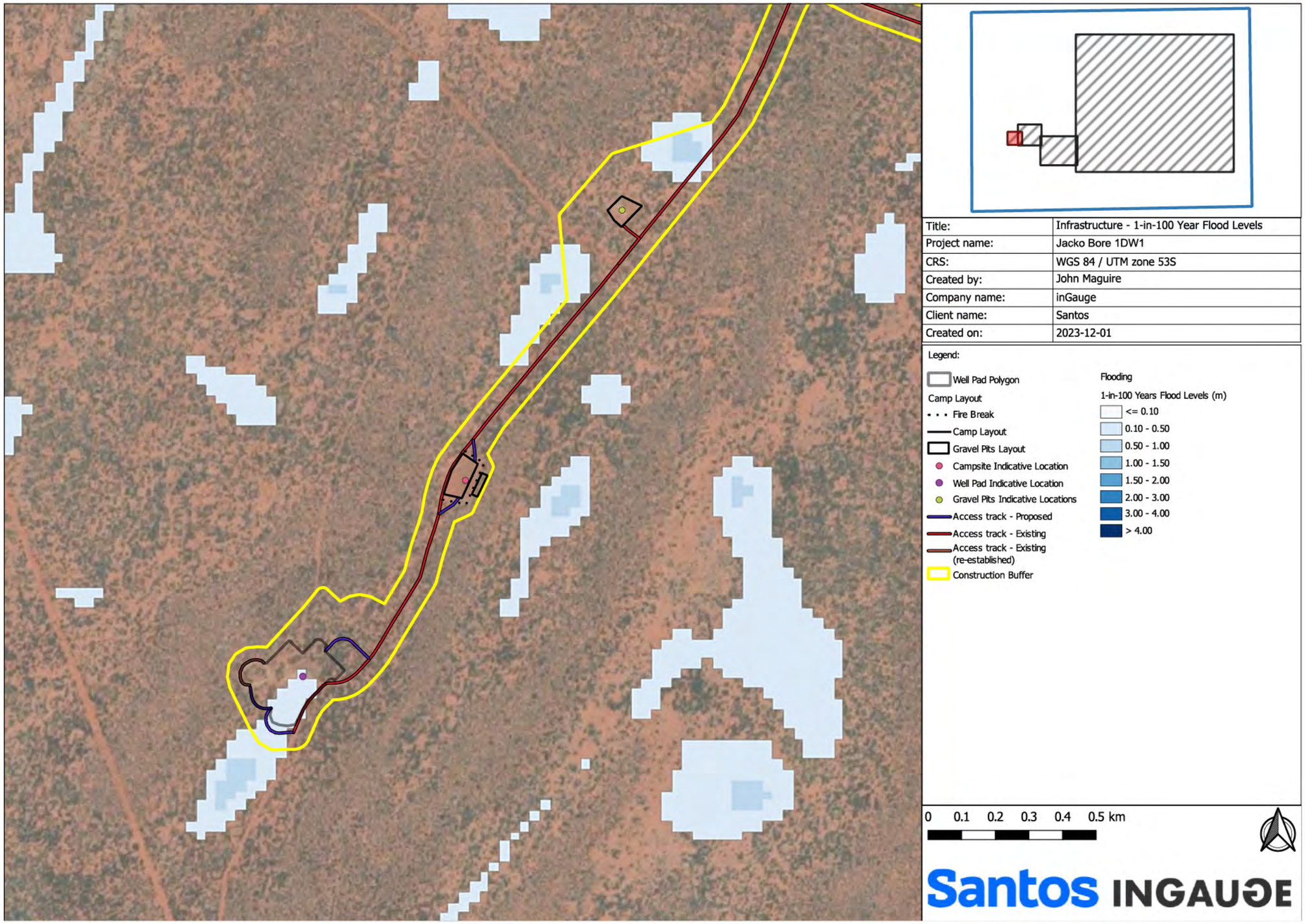
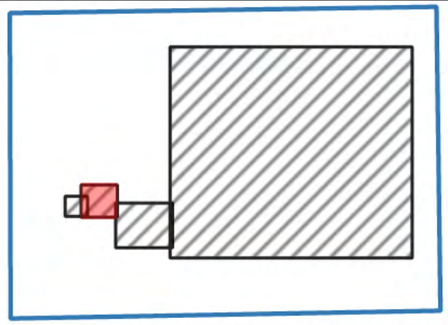



**Figure 3—26 1 in 100-year Flood Levels – Gravel Pits 01 (Area 1)**





| | |
|---|---|
| Title: | Infrastructure - 1-in-100 Year Flood Levels |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-01 |

Legend:

- Gravel Pits Layout
- Waterbore Indicative Location
- Gravel Pits Indicative Locations
- Access track - Proposed
- Access track - Existing
- Construction Buffer

Flooding

1-in-100 Years Flood Levels (m)

- <= 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- 2.00 - 3.00
- 3.00 - 4.00
- > 4.00

0 0.2 0.4 0.6 0.8 1 km

Santos INGAUGE

**Figure 3—27 1 in 100-year Flood Levels – Gravel Pits 02 (Area 2)**

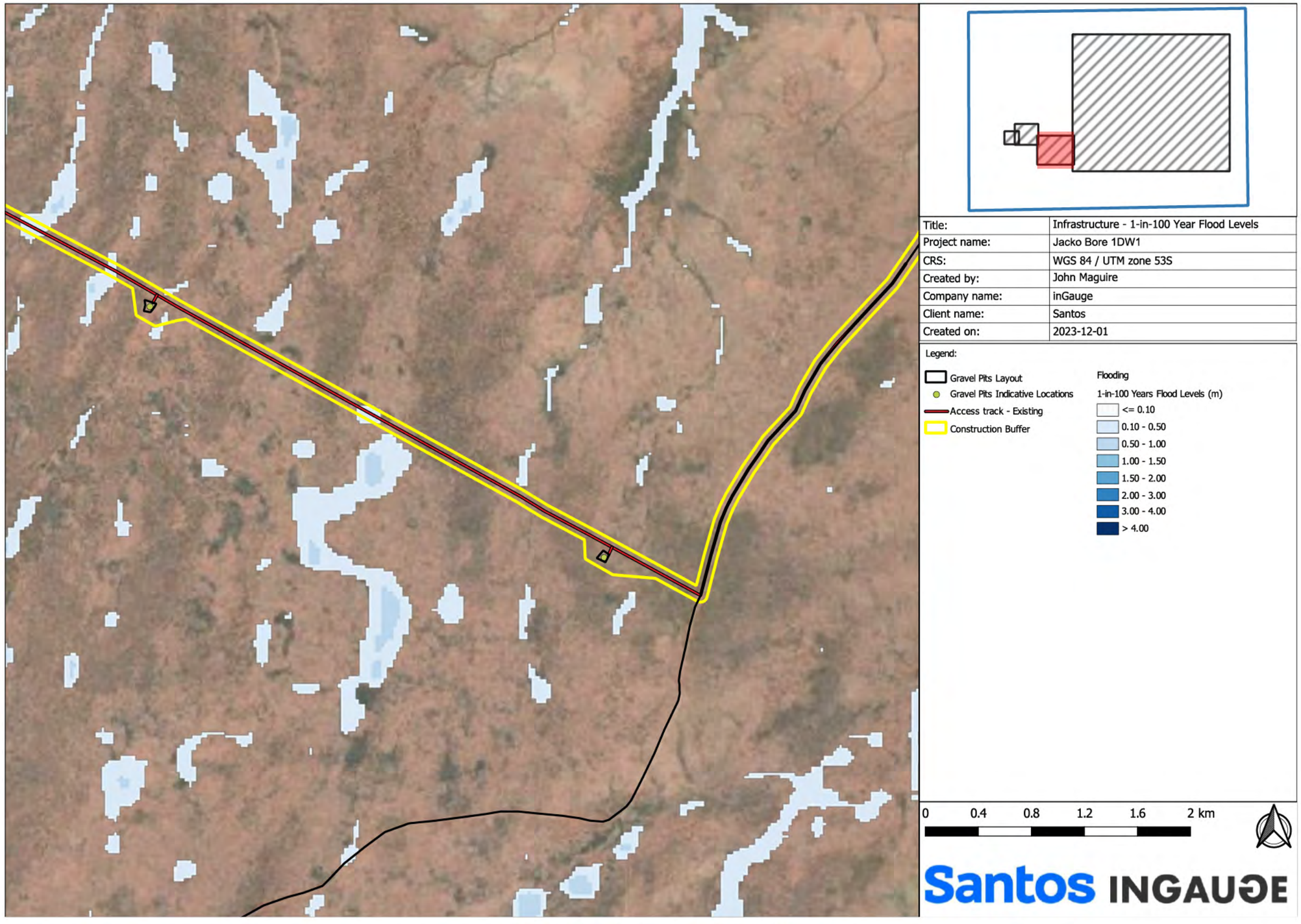



**Figure 3—28 1 in 100-year Flood Levels – Gravel Pits 03 – 04 (Area 3)**

## 3.7 Drilling and Well Operations

### 3.7.1 Overview

One horizontal/highly deviated cased well is proposed to be drilled on the well pad (Jacko Bore 1DW1). This will be drilled utilising the Jacko Bore 1 surface hole. If the Jacko Bore 1 casing fails, this well will be plugged and abandoned, the rig will be moved approximately 20 m on the same pad, and a horizontal/highly deviated well will be drilled from this location (Jacko Bore 1A).

### 3.7.2 Well Information

The well to be drilled under this EMP is a helium appraisal well on the existing/expanded Jacko Bore 1 well pad in the Amadeus Basin.

- **Table 3—11** presents the general well information for the proposed well.
- **Figure 3—29** illustrates the proposed well's indicative stratigraphy and casing depths. The proposed well design will have aquifers isolated utilising cemented casing, as shown in **Figure 3—29**.

**Table 3—11 General Well Information**

| General Well Information | | | |
|---|---|---|---|
| **Permit Area:** | EP125 | | |
| **Basin:** | Amadeus Basin | | |
| **Well Name:** | Jacko Bore 1DW1 | | |
| **Well Type:** | Appraisal | | |
| **Primary Target:** | Basement | | |
| **Appraisal Target:** | Helium | | |
| **Exploration Well Pad Location** | | | |

To facilitate flexibility whilst achieving ALARP, the Interest Holder has included a construction buffer around the indicative well pad expansion. This buffer allows fine-tuning of the well pad expansion clearing area to reduce ground impacts.

| **Jacko Bore 1DW1 Indicative Location** | **Property** | | **Lyndavale** |
|---|---|---|---|
| | Well Centre | Long | 132.796748 |
| | | Lat | -25.506235 |

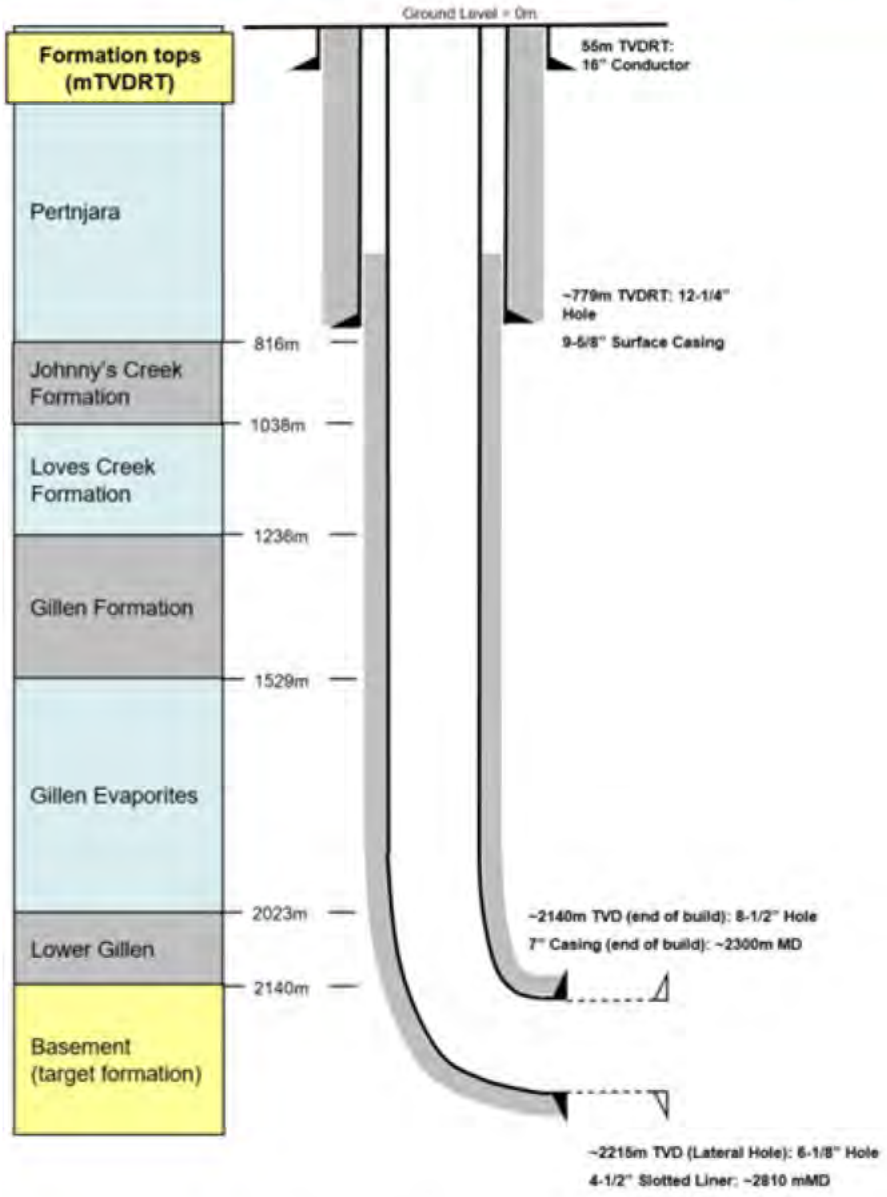



**Figure 3—29 Indicative Stratigraphy, Casing Depths**

### 3.7.3 Well Sections

The indicative well sections are shown in **Figure 3—27** and are discussed further below.

***Surface Hole Section***

The surface hole section will be drilled from a well cellar (a pit below the rig to allow for valves, etc) and conductor (outer bore casing) to a depth that isolates any shallow aquifer/s.

The surface casing will be installed into the surface hole and cemented (with specifically engineered cement) to seal off any aquifer from the rest of the wellbore to prevent fluid crossflow between formations. During cementing operations, cement may also be lost to the formation, resulting in cement slumping or 'patchy' cement sections.

If cementing of the surface casing for a well is unsuccessful (i.e., the cement does not return to the surface or slumping is observed), a top-up cement job/s will be undertaken. This process involves spotting cement from the surface into the annulus between the surface casing and formation.

***Intermediate Hole Section***

The surface casing shoe will be drilled out. Drilling will then progress by deviating the well, gradually increasing the angle of the hole until it reaches the end of the build section. When the well reaches its target depth, the intermediate casing is installed and cemented.

A Formation Integrity Test (FIT) or Leak-off Test (LOT) will be carried out at the intermediate casing shoe to prove integrity before drilling ahead.

***Horizontal Production Hole Section***

A horizontal/highly deviated wellbore will then be drilled from the end of the build section.

Where a horizontal wellbore is being drilled from the intermediate section, the following will apply:

- The production section will be directionally drilled horizontally within the target formations; the horizontal section length within the target formation is described in the WOMP.
- When drilling horizontal wellbores or, for that matter, any directional well, standard directional drilling techniques and equipment are employed to enable accurate wellbore direction to be recorded and maintained.
- The horizontal section will be completed using the drilling rig with a liner, as described in the WOMP.

### 3.7.4 Well Operation Management Plan (WOMP)

In parallel to the EMP, the Interest Holder is compiling a WOMP to cover the requirements of section B of *the Code* for the drilling, completions, and EPT works to be carried out under this EMP. The WOMP will be accepted by DITT before those works are carried out.

This EMP addresses separation distances between aquifers on-site and the target formation and monitoring to be carried out for aquifer protection. Other Section B requirements of *the Code* will be covered under the WOMP and not included in the EMP. The Interest Holder will provide DEPWS notification when DITT accepts the WOMP. The WOMP includes details on the following:

- Well-integrity management requirements.
- Casing setting depth will be selected to protect resources, including aquifers, according to section B.4.3.2 of *the Code.*
- Aquifers encountered during drilling operations will be isolated from each other, the surface, and any hydrocarbon-bearing zones by appropriate well barriers. This will be done following section B.4.3 of *the Code.*
- Primary cementing design and validation will be carried out following the WOMP and B.4.7 *of the Code.*
- Monitoring of barriers and casing conditions will be carried out as per the WOMP and B.4.1 of *the Code.*
- If an aquifer is discovered during drilling that was not identified before the commencement of the Activity, the Interest Holder will notify the Minister in compliance with regulation 23 of the PER. This notification will determine whether or not the aquifer's environmental values have been adequately addressed under the EMP and whether or not the EMP requires revision under regulation 17 of the PER.

### 3.7.5 Well Design and Well Barrier Requirements

- Casing and tubing requirements will be covered in the WOMP.
- Primary Cementing requirements will be covered in the WOMP.
- Wellhead requirements will be covered in the WOMP. Well Control requirements are covered in the WOMP.
- Drilling fluids will be selected and used in accordance with their designed function, the manufacturer's recommendations, and relevant SDS. Drilling fluid requirements are covered in the WOMP.
- A list of potential drilling, completions and cementing chemical additives functional groups, and their potential to be hazardous has been included in the Spill Management Plan. The actual drilling fluid additives (name, volume, and quantity) will be recorded during the drilling works in the daily well reports as per *the Code.*

- The management of residual drilling fluids under this EMP is covered in the Wastewater Management Plan and the Spill Management Plan (**Appendices 06** and **07**, respectively).
- Water-based drilling fluids will be utilised. The Benzene, Toluene, Ethylbenzene and Xylene (BTEX) of all drilling fluids and muds will not increase the BTEX content of the overall fluid above the BTEX content specified in *Table 8* of *the Code*.
- Note: Precautions are in place for pressure management whilst drilling Jacko Bore 1DW1 (i.e., mud drilling with the capability to increase mud weight to above maximum interpreted pore pressure).

### 3.7.6 Evaluation

Evaluation of the wellbore will be conducted using LWD (logging whilst drilling), where logging tools form part of the drill string and are located behind the drill bit.

## 3.8 Completion, Workover, Intervention

This section covers the completion, workover, maintenance, intervention, suspension monitoring and maintenance for the life of the well, and/or decommissioning works required on the well.

### 3.8.1 Well Suspension and Decommissioning

A well may be suspended or decommissioned under this EMP. If a well is decommissioned, it will undergo the following:

- Two permanent barriers to ground level from any:
    - Hydrocarbon bearing zone, or
    - Over-pressured permeable zone.
- One permanent barrier to ground level from any:
    - Normally pressured non-hydrocarbon bearing, permeable zone drilled after blow-out preventers (BOPs) are installed.
- One permanent barrier will be provided between discrete permeable zones with different pressure regimes.
- All aquifers will be isolated:
    - From each other and the surface by a minimum of one well barrier; and
    - From any permeable hydrocarbon-bearing ones by a minimum of two well barriers.

Well suspension and decommissioning requirements are covered in the WOMP. The WOMP will be compiled by the Interest Holder and reviewed and approved by DITT before the regulated Activity under this EMP is carried out. The Interest Holder will provide DEPWS notification when DITT approves the WOMP.

## 3.9 Extended Production Testing (EPT)

EPT is carried out to validate and quantify the well production rates and generate an indication of field reserves/resources. A three-phase separator is connected to the wellhead's outlet, which separates the well fluids into gas, condensate, and water using gravity level controllers.

Depending on the composition, the gas is directed to flare, water to fluid storage and treatment tanks, and condensate to storage tanks. All gas, water, and condensate flow volumes are measured and recorded.

A separator package splits the comingled flow from the wellbore into gas, water, and condensate. All gas, water, and condensate flow volumes are recorded.

Temporary wastewater and/or condensate storage/treatment tanks (as required) will be used on-site in the EPT process. More detail is provided in **Appendix 06** (Wastewater Management Plan).

Gas produced during the EPT will be sent to a flare system to allow a controlled release and gas burning. It will be equipped with an autoignition system. This is discussed further below.

The Interest Holder will carry out an EPT with a cumulative flow for a period of up to 365 days over a period of 12-18 months. The recommended test interval of 365 days has been selected in order to maximise the opportunity to test the well. Subsurface results, particularly in the case of exploration wells, are inherently uncertain. The extended test period enables technical professionals to develop a test schedule that maximises the opportunity to advance their understanding of the reservoir.

An indicative layout of an EPT package is shown in **Figure 3—30**.

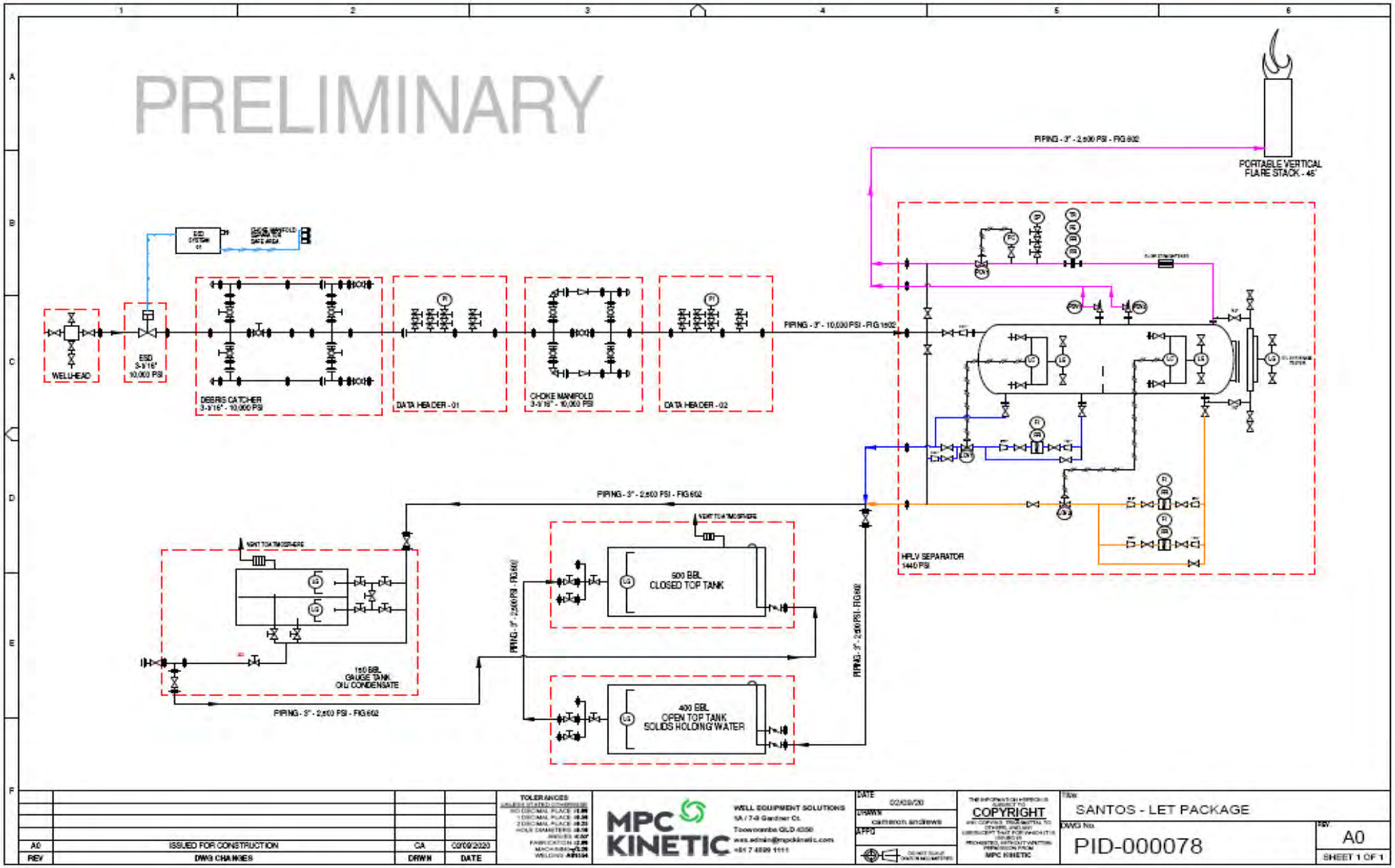



**Figure 3—30 Indicative Layout of EPT**

## 3.10 Venting and Flaring

### 3.10.1 Venting Management

All test production will flow to a separator package fitted with flow measurement devices. In accordance with Clause B.4.13.2(k) of *the Code,* gas will be flared in the first instance unless there is insufficient flammable gas flow or there is a safety hazard.

Gas volumes emitted during drilling, completions, and EPT will be measured using industry-standard measurement methodology.

During system upsets or accidental releases, emissions will be estimated using methods consistent with the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

### 3.10.2 Flare Design and Efficiency

Flaring works associated with Extended Production Testing (EPT) will occur within a vegetation-free safety zone. The flare will have a minimum vegetation exclusion zone radius of ~25m.

Gas produced during EPT will be sent to a vertical flare system to allow a controlled release and gas burning. It will be equipped with an autoignition system that provides electrical impulses to generate a spark to ensure that the flare is always operational. Where necessary the flare stack will be designed in accordance with:

- AS1170.0 Structures Design Actions Part 0 General Principles
- AS1170.2 Wind Actions
- AS4100 Steel Structures

A diagram of the proposed vertical flare (subject to change) design is shown in **Figure 3—31** below.

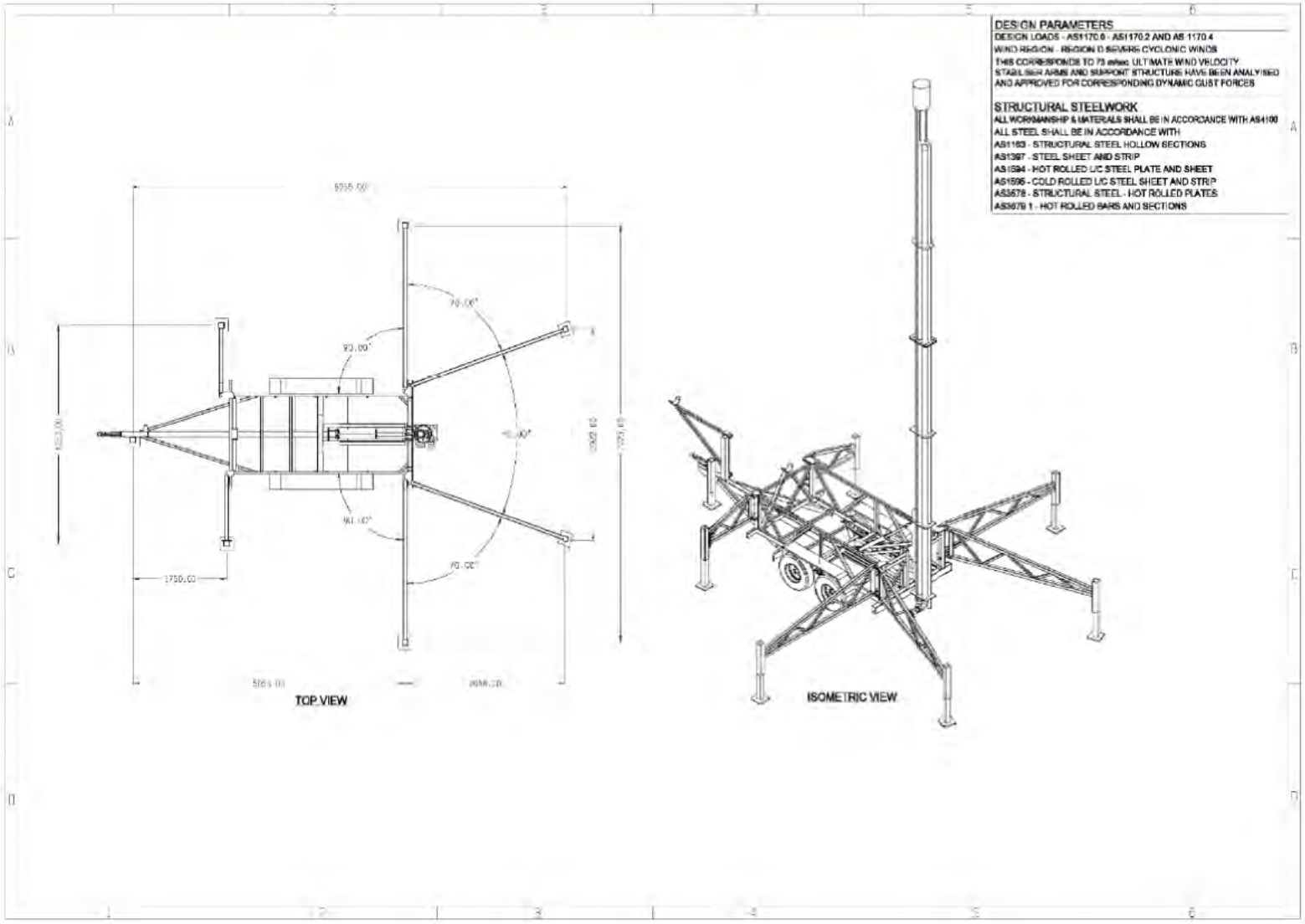



**Figure 3—31 Vertical Flare Stack**

## 3.11 Wastewater Management

### 3.11.1 Wastewater Storage and Treatment

The works that will generate waste and wastewater, including waste proposed to be handled, stored, or transported away from the Project Area, are detailed in **Appendix 06**.

The wastewater that will be generated per well and the estimated volume for the Activity are summarised in **Table 3—12**.

Drilling by-products will be stored in an engineered and lined cutting pit.

Produced fluid will be stored in above-ground tanks, which will be either a mobile tank or panelled tank. Due to the nature of the target formation, there is a degree of uncertainty in estimating the volume of the produced fluid that may be received. As such, a large contingency of up to 1 ML, reflecting a worst-case scenario, has been accounted for. However, the anticipated volume of produced fluid to be received is 80kL (refer to **Table 3—12**). Therefore, the Interest Holder has considered two different types of above-ground tanks: a panel tank, or mobile tank, with each mobile tank typically having a capacity of ~80kL, to account for varying volumes.

Prior to receiving produced fluid, a minimum of two mobile tanks will be available on-site, providing approximately 160 kL of total storage capacity (double the anticipated amount). Once the rate of fluid receival has stabilised (approximately 12 hours after the start of fluid receival), the Interest Holder will be able to predict the amount of produced fluid with an increased degree of certainty. At this point, a decision can be made regarding whether to install a panel tank (if a large volume is expected) or to continue using mobile tanks (if a smaller volume is expected). With two mobile tanks initially available on-site, the Interest Holder will have ample opportunity to make an informed decision on whether extra mobile tanks or a pond will be necessary.

The Interest Holder can choke back and reduce the receival rate from the well or shut in the well if required at any point in the event further storage is required beyond what is presently available at the site while maintaining any freeboard requirements.

To minimise the volume of fluid to be transported off-site as per Clause C.4.2.3 of *the Code*, the above-ground tanks will have removable lids to maximise evaporation. When the lid is removed from the above-ground tanks they are referred to as above-ground open-top treatment tanks. Details regarding removable lids are discussed further in **Appendix 06**.

The above-ground tanks must meet the secondary containment requirements set out in Clause A.3.8 of *the Code*. Details of secondary containment are discussed further in **Appendix 06**. A summary of all potential above-ground tank and secondary containment scenarios is presented in **Table 3—12** below.

**Table 3—12 All Potential Above-ground Tank Setup Scenarios**

| Tank Type | Lid Type | Containment Type |
|---|---|---|
| **Panelled** | Enclosed Tank (removable lid) | Double-lined/walled |
| | Enclosed Tank (removable lid) | Bunded to 110% capacity |
| | Open-topped | Double-lined/walled |
| | Open-topped | Bunded to 110% capacity |
| **Mobile** | Enclosed Tank (removable lid) | Double-lined/walled |
| | Enclosed Tank (removable lid) | Bunded to 110% capacity |
| | Enclosed Tank (fixed lid) | Double-lined/walled |
| | Enclosed Tank (fixed lid) | Bunded to 110% capacity |
| | Open-topped | Double-lined/walled |
| | Open-topped | Bunded to 110% capacity |

**Table 3—13 Wastewater Volumes and Characteristics**

| Waste Type | Volume Anticipated | Total Estimated Off-site Disposal Volume | Characteristics |
|---|---|---|---|
| **Residual Drilling & Completions Fluids** | ~2.5 ML | ~0.13 ML<br>• Note: 95% anticipated to be evaporated. | • Hazardous chemical additives* possible, e.g., to treat bacteria and control pH.<br>• Note: chemical additives are mixed with a high percentage of water >90%. |
| **Produced Fluids** | ~ 80 kL<br>• Contingency plan for up to 1 ML. | ~80 kL<br>• If a greater volume is encountered it is estimated that 95% of the volume will be evaporated and therefore ~5% will be disposed of off-site. | • Potentially hazardous formation water. |

*Hazardous chemical assessment is covered in the Spill Management Plan (**Appendix 07**).

The Interest Holder will follow its Waste and Wastewater Management Plan (WWMP) (**Appendix 06**) to manage (handle, store, reduce, reuse, recycle, dispose, track, and monitor) waste to minimise the risk of solid or liquid waste discharge into the surrounding environment.

The environmental impacts and risk associated with the proposed treatment, handling and re-use are deemed to be reduced to ALARP and acceptable based on multiple controls detailed in **Appendix 04** (Risk Assessment), including, but not limited to, the below.

### 3.11.2 Reduce, Re-use, Recycling, Treat, and Disposal of Waste

Wastewater fluids generated from the Activity will be assessed and either be removed from the Project Area for disposal, reduced by evaporation, or re-used (note: only drilling fluids are anticipated to be re-used). Further details are provided in **Appendix 06**.

Remaining drilling by-products will be assessed by a suitably qualified third party for on-site burial suitability.

The main opportunity for re-use of fluid is during drilling. Given the limited volume of make-up water required to drill and complete a well, the volume of water estimated to be re-used is less than 25% of what is required to drill a well. To enable re-use, centrifuges may be used on the drill rig to remove solids, and/or the solids will be settled out in the drill pits and re-used. Fluids unsuitable for re-use will be stored in the drilling pits for evaporation or transport for off-site disposal.

The primary method to reduce drilling and completions fluids generated during the Activity is evaporation. The estimated volume of fluid that will evaporate prior to pit closure is approximately 95%.

Above-ground tanks will have removable floating lids so that they can function as an open-top treatment tanks or as an enclosed tank. If a floating lid is removed it will be stored on-site, and the volume of produced fluids reduced by evaporation by approximately 95% before disposal off-site. This lid will be redeployed prior to a significant rain event.

To evaporate 95% of 1 ML of produced fluid it would take approximately 402 days based on the following assumptions:

- Average evaporation rate for Kulgera (refer **Section 5.1**)
- A 7-panel open-topped pond (~1.4ML storage capacity), which has a diameter of 22.4m

### 3.11.3 Waste Monitoring/Tracking

- The Interest Holder will monitor/track total waste volumes generated (a complete list is provided in the Waste Tracking section of **Appendix 06**) and removed from site.
- Tracking will include volumes of water and wastewater removed from site and its destination, as well as fluids evaporated. For transport, records will include the license number of any licensed waste transporters utilised.

### 3.11.4 Transport of Wastewater

Wastewater consists of drilling and completion fluids, drilling by-products and produced fluid. Wastewater sources are detailed in **Table 3—14**.

**Table 3—14 Wastewater Types**

| Waste Source | Waste Type |
|---|---|
| **Domestic Facilities** | • Greywater |
| **Drilling and Completions** | • Residual drilling and completions fluids.<br>• Drilling by-products. |
| **Extended Production Testing** | • Produced fluid.<br>• Drilling and completions fluids produced back from formations. |

- Licensed transport providers under the *Waste Management and Pollution Control Act 1998* will be utilised.
- The Interest Holder will use wastewater storage and treatment facilities licensed per the NT Government regulations.
- Wastewater will be transported interstate to a licensed storage and treatment facility.
- When wastewater is required to be transported interstate, a Consignment Authorisation as per the *National Environmental Protection (Movement of Controlled Waste Between States and Territories) Measure* 1998 (NEPM) will be obtained [SEWPAC, 1998].
- An application for an interstate Waste Transfer Certificate as per the *Movement Of Controlled (Listed) Waste Guide to using the NT Online Waste Tracking System 2021* before interstate transportation occurs is required [DEPWS, 2021B].
- Where applicable, disposal of wastewater containing radioactive material will be tracked and documented as per the requirements of the *Radiation Protection Act* 2004 [DoH, 2004].
- If drilling by-products, completion and drilling fluids are required to be removed from site they will be classified in accordance with the *Waste Management and Pollution Control (Administration)Regulations 1998 (NT)* and be assessed for NORMS.

*The Code* requires that during the wet season (1st October to 30th April), the transport of chemicals and wastewater on unsealed roads must only be undertaken if the risk of spills is demonstrated to be ALARP and acceptable.

The risk of a chemical 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 the risks of a chemical or wastewater spill are reduced to ALARP and acceptable in these circumstances, the following key controls are to be put in place (as reflected in **Appendix 04**):

- During the wet season, chemicals or wastewater is not to be transported during a significant rain event (>150mm over 4 days forecast).
- During the wet season, if chemicals or wastewater is to be transported, a Santos Road Status Report will be completed for unsealed roads within the Project Area. This report details which roads are open or closed and the hazards and controls based on site-specific conditions as assessed by the site supervisor / representative.
- Transport of chemicals and wastewater will not occur if water crossings have >30cm of flowing water at the time of proposed transport.
- In the event of a chemical or wastewater transport vehicle becoming bogged, the contingency plan for bogged vehicles (Section 7.2 of the Spill Management Plan) is to be followed so extraction works are conducted safely and prevent loss of contents and the Emergency Response Plan (Section 8 – communication) in case of a release of chemicals.

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

A more detailed explanation of the waste streams and their management is covered in **Appendix 06** (Waste and Wastewater Management Plan) and **Appendix 07** (Spill Management Plan).

Section 7 of **Appendix 07** details the measurement criteria of critical controls to help demonstrate the associated risks are being reduced to a level that is ALARP and acceptable.

# 4 Ancillary Works

## 4.1 Water Use

The Interest Holder will apply for a water extraction license and will work with the DEPWS Water Resources Division in obtaining a bore works permit to ensure that the appropriate methodology for sourcing water is undertaken. The exploration site is not within declared Water Control Districts or a Water Allocation Plan area (declared, draft or in progress).

The water supply target is a fractured rock aquifer of the Pertnjara Group of the Amadeus Basin. The target depth is 200 m to 300 m below ground level. The sustainable bore pumping rate is estimated as 3 L/s, based on the surrounding water bores' production rates.

It is noted that actual water usage rates are highly dependent on weather conditions and the nature of road materials (e.g., rocky, or sandy), and the antecedent moisture conditions. Given the uncertainties, a 20% contingency has been added to the total estimated volume.

The water required for the Activity, a breakdown of the water usage and volumes, is provided in **Table 4—1**.

**Table 4—1 Forecast Water Use for the Activity under this EMP**

| Use | Estimated Total Use (ML) |
|---|---|

| | |
|---|---|
| **Access Track Construction (Civil Construction)** | 1 |
| **Access Track Maintenance (Operations)** | 4 |
| **Well Pad Construction (Civil Construction)** | 1.7 |
| **Dust Suppression (Operations)** | 20 |
| **Drilling** | 1 |
| **Potable Water (May not be sourced from Groundwater)** | 1.3 |
| **Extended Production Testing** | 8 |
| **Monitoring, Maintenance and Rehabilitation*** | 24 |
| **Sum of Groundwater Extraction** | 61 |
| **Total Water Usage (Including 20% Contingency)** | 73.2 |

* Monitoring, Maintenance and Rehabilitation accounts for all water usage that may be required (including potable water) until the Project Area is successfully rehabilitated.

**Table 4—2** outlines the expected water usage by year until the end of the Activity covered by this EMP.

**Table 4—2 Estimated Groundwater Use for the Regulated Activity under this EMP by Financial Year (Including 20% Contingency)**

| Year | Use | Total Use (ML) |
|---|---|---|
| **2023/24** | Access Track, Well Pad, Dust Suppression, Drilling, Potable water. | 30.3 |
| **2024/25** | Extended Production Testing, potable water | 8.7 |
| **2025/26** | Monitoring, Maintenance and Rehabilitation | 8 |
| **2026/27** | Monitoring, Maintenance and Rehabilitation | 8 |
| **2027/28** | Monitoring, Maintenance and Rehabilitation | 6 |
| **Sum of Groundwater Extraction** | | 61 |
| Total Water Usage (Including 20% Contingency) | | 73.2 |

The cumulative impact of groundwater extraction has been assessed in conjunction with the *NT Water Allocation Planning Framework*. The framework states that for the Arid Zone of the NT, the total extraction over a period of at least 100 years must not exceed 80% of the total aquifer storage at the start of extraction [DENR, 2020B]. Therefore, calculations have been conducted to determine the percentage reduction in volume of storage by the Activity, with the following assumptions:

- Calculated for the area of NT Portion 3350 on which the Jacko Bore 1DW1 well site and access tracks are located.
- An aquifer thickness of 100 m at a porosity of 5%. Todd and Mays [D. K. TODD et al., 2005] indicates a range of 33% to 37% porosity for siltstones and sandstones; therefore, using 5% provides a highly conservative estimate.
- Continuous pumping for 100 years from all current production bores on NT Portion 3350 at their maximum yield identified in the NR Maps database plus 100 years of 34.8 ML of extraction by the Interest Holder (100 times the maximum annual volume).

Based on these assumptions, the total reduction in the total aquifer storage has been calculated as 0.6%, significantly below the *NT Water Allocation Planning Framework* 80% threshold. Therefore, even as a worst-case estimate, the cumulative impacts to groundwater from extraction will be minimal. Furthermore, extraction will comply with the water extraction licence conditions, which as per *Section 90(1)* of the *Water Act*, will be imposed with regard to the existing and likely future demand for the water source.

Based on the data acquired during the drilling of the previous Jacko Bore 1, the Pacoota Sandstone and Mereenie Sandstone aquifers are not present at the existing well pad.

The Hermannsburg Sandstone is the likely target for the water supply; however, the well pad where the supply bore will be located is within the fractured rock domain of the Amadeus Basin, and the fractures that may supply the groundwater are not necessarily associated with any specific formation.

As previously identified, monitoring associated with groundwater extraction will be undertaken in accordance with the conditions of the Water Extraction Licence and may include:

- Undertaking pumping test(s) to determine aquifer and bore performance and to assess the extent of drawdown associated with the proposed extraction rates and volumes.
- Measurement and recording of actual extraction volumes.
- Collection of water quality sample(s).

If required, freshwater lines may be run along the surface in a similar manner to pastoralists running freshwater lines if deemed more efficient than trucking. These freshwater lines will be run on or adjacent to access tracks where practicable. No ground disturbance would be required for the laying of freshwater lines.

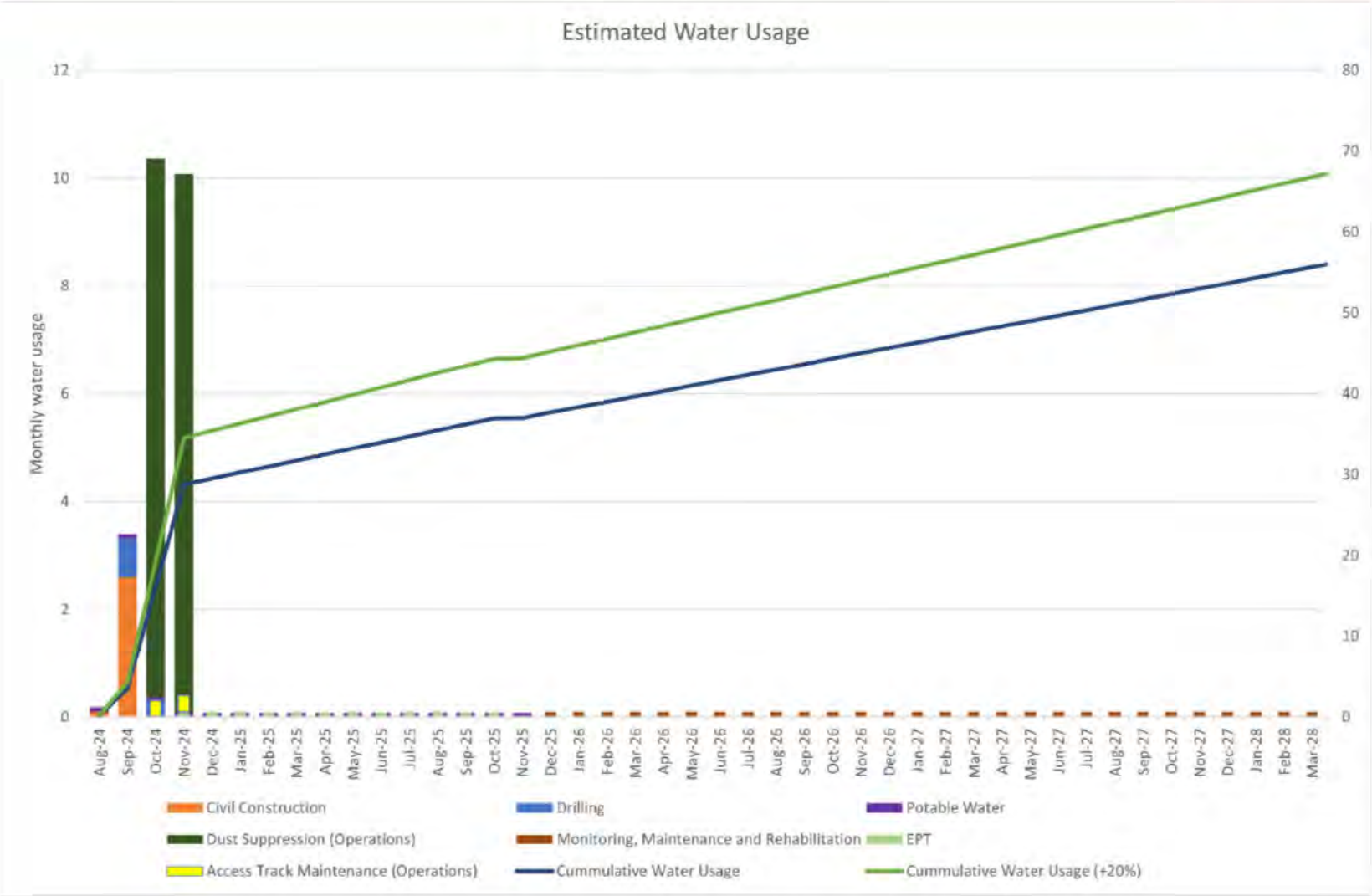



**Figure 4—1 Estimated Water Usage for the Activity by Month**

## 4.2 Greenhouse Gas Emissions

The *National Greenhouse and Energy Reporting (Measurement) Determination* (2008) made under subsection 10(3) of the *National Greenhouse and Energy Reporting Act* 2007 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 – *2021-22 from the National Greenhouse and Energy Reporting (Measurement) Determination 2008* (NGER Determination).

To calculate the Jacko Bore 1DW1 Extended Production Test (EPT) emissions, a compositional input sample from Mt Kitty 1 (now Jacko Bore 1), taken on the 5th of May 2014, has been used. This is noted in **Figure 4—2** below.

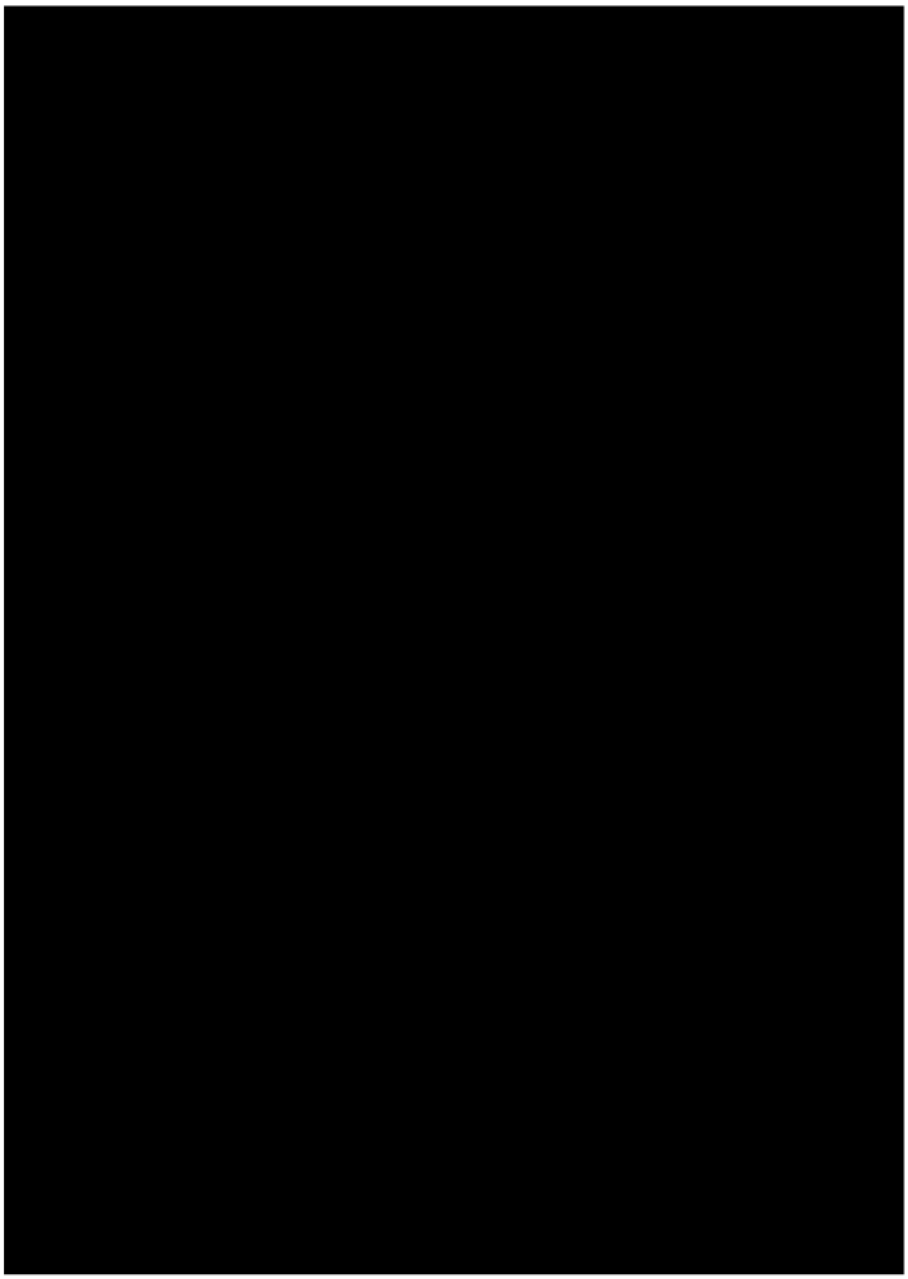


**Figure 4—2 Mt Kitty 1 Compositional Analysis 5/5/2014**

Assumptions for this calculation include air density, molecular weight, and component density. These are outlined in **Figure 4—3** below. Reference locations for these assumptions are also included in the figure.



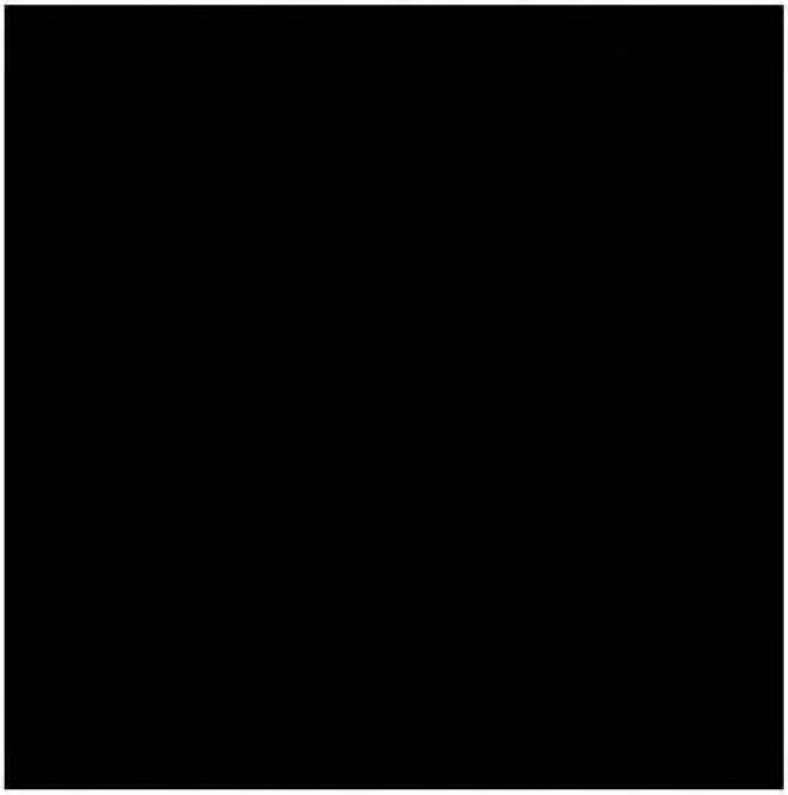
**Figure 4—3 GHG Calculation Assumptions**

Note: **Figure 4—3** is to be redacted prior to publication.

In order to generate the volume of emissions, a forecast was generated for the anticipated production during the EPT period. The volume per month of estimated production is outlined in **Figure 4—4** below. In **Figure 4—5** this has been converted to tonnes.



**Figure 4—4 Forecast Volume per month.**



Using the formulae (**Equation 1**) below from the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* [DCCEEW, 2022], the emissions factor was calculated.

**Equation 1**

*Formula 2.22.1*

$$EF_{i,CO2,ox,kg} = \Sigma_y \left[ \left( \frac{mol_y\% \times \left(\frac{mw_y}{V}\right) \times 100}{d_{y,total}} \right) \times \left( \frac{44.010 \times f_y \times OF_g}{(mw_y \times 100)} \right) \right]$$

*Formula 2.22.2*

$$d_{y,total} = \Sigma_y\, mol_y\% \times \left(\frac{mw_y}{V}\right)$$

Assumptions for this calculation include air density, molecular weight, and component density. These are outlined in **Figure 4—6** below. Reference locations for these assumptions are also included in the figure [THE ENGINEERING TOOLBOX, 2023].



**Figure 4—6 Conversion Assumptions – Emission Factor**

The above information was then used to calculate the emissions of each component and summed in **Figure 4—7**, below.

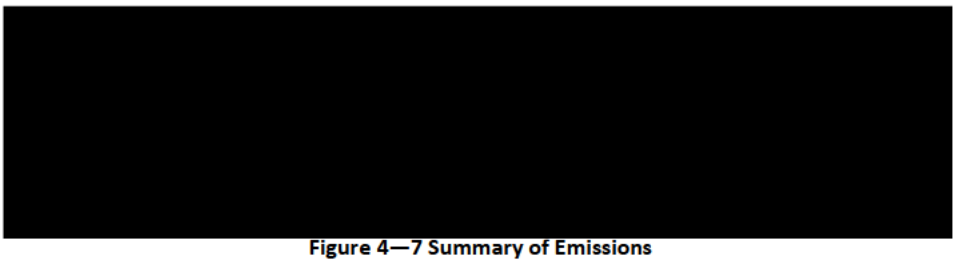


**Figure 4—7 Summary of Emissions**

The resulting total emissions from the proposed Jacko Bore 1DW1 EPT are estimated to be in the order of 3.6 kt$CO_2$-e.

As noted above, this total volume of $CO_2$-e is dependent upon the volume forecast during the testing period. If the produced volume of gas is different to the forecast, the level of $CO_2$-e emissions will also vary from the estimate above.

The recommended test interval of 365 days has been selected in order to maximise the opportunity to test the well. Subsurface results, particularly in the case of exploration/appraisal wells, are inherently uncertain. The extended test period enables technical professionals to develop a test schedule that maximises the opportunity to advance their understanding of the reservoir, thereby reducing subsurface uncertainty and risk and improving the potential to generate informed decisions regarding further investment.

GHG emissions generation will be mitigated by adopting *the Code*. The Interest Holder will use a Reduced Emissions Completion (REC) and undertake routine monitoring for leaks. RECs involve the capture and combustion of hydrocarbons in a flare. The combustion of gasses produced will reduce the emissions generated compared to venting. The wells will be tested for leaks as per D.5.2 of *the Code*.

The GHG estimates for the regulated Activity carried out under the EMP over three years are provided in **Table 4—4**.

**Table 4—5** below presents the produced greenhouse gas emissions by financial year for the EMP and the respective interest holder percentage, as well as how these figures were determined. **Figure 4—8** illustrates the EMP emissions by financial year.

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* identifies the Government's minimum requirements for how greenhouse gas emissions are to be managed for new or expanding industrial and land use development projects. The emissions threshold (100,000 tonnes $CO_2$-e) applies to all of an interest holder's onshore petroleum activities in a given year within the Northern Territory.

The Interest Holder has cumulatively accounted for the scope one emissions from all its onshore Northern Territory activities occurring within a financial year and requiring approval under the PER.

**Table 4—3** outlines these emissions.

**Table 4—3 Total Emissions in Interest Holder EPs**

| Exploration Project | FY 22/23 | FY 23/24 | FY 24/25 | Total (kt $CO_2$-e) | Interest Holder Percentage (%) | Interest Holder kt $CO_2$-e |
|---|---|---|---|---|---|---|
| **EP125 (Jacko Bore)** | 0.0 | 3.6 | 1.5 | 5.1 | 20 | 1.0 |
| **EP82 (Mahler*)** | TBA | TBA | TBA | TBA | 20 | TBA |
| **EP112 (Dukas*)** | TBA | TBA | TBA | TBA | 30 | TBA |
| **EP161 (Tanumbirini)** | 0.0 | 0.0 | 0.0 | 0.0 | 75 | 0.0 |
| **Total** | **0.0** | **3.6** | **1.5** | **5.1** | **-** | **1.0** |

* Mahler 1 and Dukas 2 will be the subject of future EMPs where their estimated emissions will be outlined with further detail.

Therefore, the Interest Holder's estimated scope one emissions of 1,000 $CO_2$-e are significantly below the Large Emitters Policy 100,000 tonnes $CO_2$-e threshold.

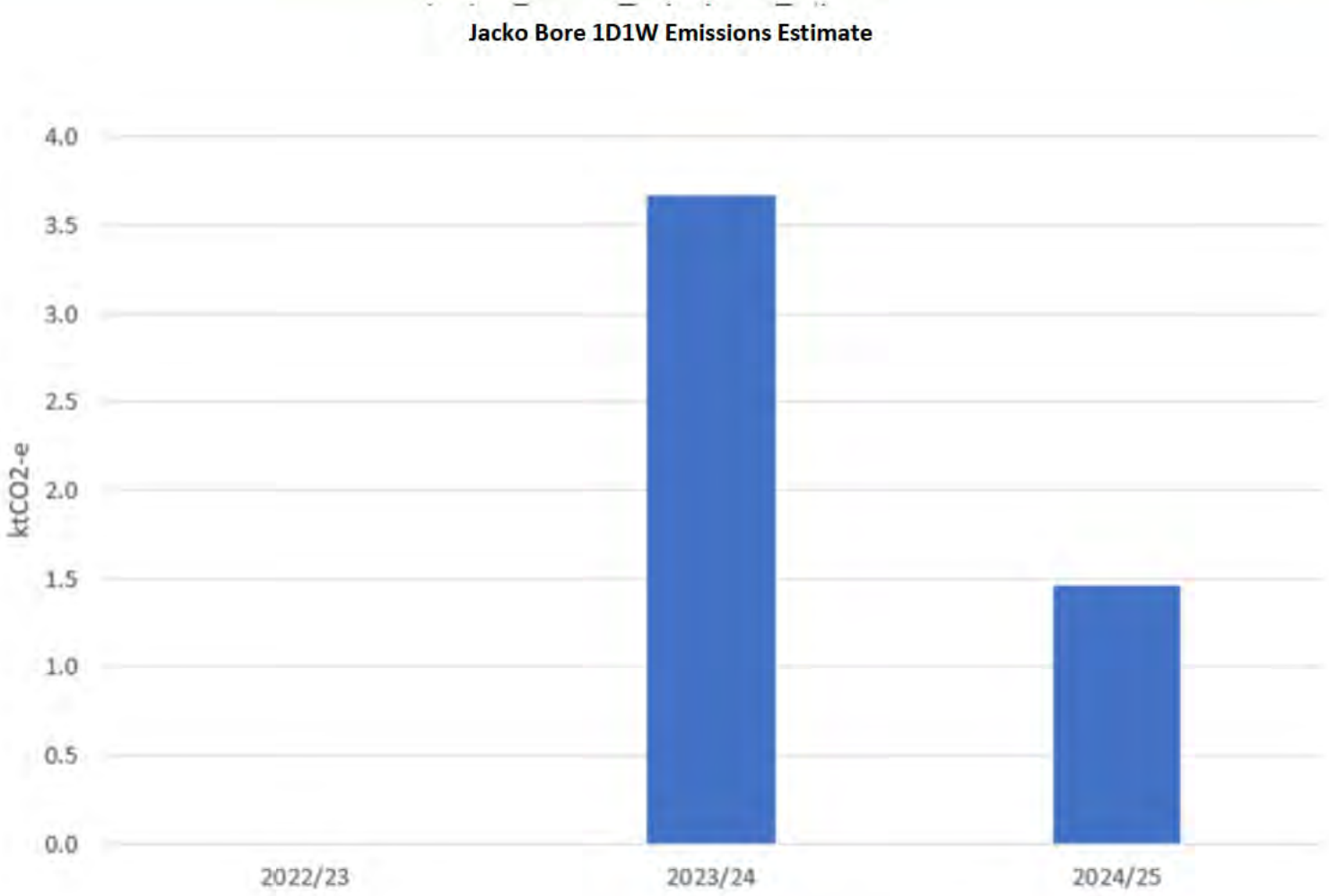



**Figure 4—8 Estimated Greenhouse Gas Emission Estimates for the Regulated Activity for this EMP**

**Table 4—4 Estimated Greenhouse Emissions Estimates for the Activity for this EMP ($tCO_2e$) per FY**

| Emissions Source | Inputs | Assumptions | 2022/23 | 2023/24 | 2024/25 | Total ($tCO_2e$) |
|---|---|---|---|---|---|---|
| **Vegetation Clearing** | 8.8 ha | • Based on the FullCAM model. | 0 | 87 | 0 | 87 |
| **Diesel Fuel Combustion** | Civils, Water bores, Drilling and EPT works as per schedule | • Estimate based on the Emissions and Energy Threshold Calculator – 2021-22*: Drilling rig fuel consumption of 8000L/Day | 0 | 1,367 | 0 | 1,367 |
| **Fugitive Emissions** | Completion works as per schedule | • Based on *Australian National Greenhouse Accounts National Inventory Report 2011 Vol 1* Emissions Factor for gas well completions of 25.9 tonnes/completion day. | 0 | 78 | 0 | 78 |
| **Flaring (EPT)**** | Extended Production Testing as per schedule | • Based on the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* Emissions factor of $CO_2$-e/tonnes flared, and a tip efficiency on flare (>98%). | 0 | 2,116 | 1,458 | 3,574 |
| | | **Total** | 0 | 3,648 | 1,458 | 5,106 |

* Emissions and Energy Threshold Calculator 2021-22 [CLEAN ENERGY REGULATOR, 2022].

**Flaring is the combustion of fuels for non-productive (non-commercial) reasons. Method 2/2A has been used to estimate emissions from flaring.

**Table 4—5 Summary of Estimated Emission Calculations by FY**

| Emissions Source | Project Activity | Assumptions/Source | Total Units | Total | 2022/23 | 2023/24 | 2024/25 |
|---|---|---|---|---|---|---|---|
| **Vegetation Clearing** | **Vegetation Clearing** | Project Schedule | ha | 8.8 | 0 | 8.8 | 0 |
| | | 9.85 $tCO_2$-e / ha | $tCO_2$-e | **87** | **0** | **87** | **0** |
| **Diesel Fuel Combustion** | **Drilling and Completions** | Project Schedule | Days | 48 | 0 | 48 | 0 |
| | | 8,000 litres per day | Litres | 384,000 | 0 | 384,000 | 0 |
| | | 0.00271* $tCO_2$-e / litres burnt | $tCO_2$-e | 1,041 | 0 | 1,041 | 0 |
| | **Water Bores** | Project Schedule | Days | 30 | 0 | 30 | 0 |
| | | 2,000 litres per day | Litres | 60,000 | 0 | 60,000 | 0 |
| | | 0.00272** $tCO_2$-e / litres burnt | $tCO_2$-e | 163 | 0 | 163 | 0 |
| | **Civils** | Project Schedule | Days | 30 | 0 | 30 | 0 |
| | | 2,000 litres per day | Litres | 60,000 | 0 | 60,000 | 0 |
| | | 0.00272** $tCO_2$-e / litres burnt | $tCO_2$-e | 163 | 0 | 163 | 0 |
| | **EPT** | Project Schedule | Days | 365 | 0 | 365 | 0 |
| | | 100 litres per day | Litres | 36,500 | 0 | 36,500 | 0 |
| | | 0.00272** $tCO_2$-e / litres burnt | $tCO_2$-e | 99 | 0 | 99 | 0 |
| | | Total | $tCO_2$-e | **1,367** | **0** | **1,367** | **0** |
| **Fugitive Emissions** | **Completions** | Project Schedule | Days | 3 | 0 | 3 | 0 |
| | | 25.9 tonnes per day | $tCO_2$-e | **78** | **0** | **78** | **0** |
| **EPT Flaring*** ** | | Total | $tCO_2$-e | **3,574** | **0** | **2,116** | **1,458** |
| | | **Total Estimated Emissions** | **$ktCO_2$-e** | **5.1** | **0** | **3.6** | 1.5 |

** 0.00271 Utilised for the drill rig as non-transport combustion of diesel oil* [CLEAN ENERGY REGULATOR, 2022].

*** 0.00272 Utilised for the transport combustion of diesel oil* [CLEAN ENERGY REGULATOR, 2022].

**** Emissions from flaring calculated utilising Method 2/2A which utilises a production forecast and full composition of the gas stream.*

## 4.3 Erosion and Sediment Control

*The Code* requires an Erosion and Sediment Control Plan (ESCP) (being the Primary ESCP) for the Activity to be developed by a suitably qualified person in accordance with relevant guidelines, including specific environmental outcomes and environmental performance standards included in the Implementation Strategy in the EMP. Where the Primary ESCP requires it, a further ESCP (being the Secondary ESCP) must be developed by a suitably qualified person in relation to the relevant matters and implemented by the Interest Holder.

A primary ESCP has been developed by a Third Party (EcOz) certified professional in Erosion and Sediment Control (CPESC) in accordance with the guideline *Best Practice Erosion and Sediment Control* and in consultation with DENR [IECA, 2019]. In addition, this ESCP includes consideration of the requirements of the *Land Clearing Guidelines* as published on the DENR website [DEPWS, 2020, 2021].

The Primary ESCP is provided in **Appendix 05**. This Primary ESCP will guide the development of the site-specific Secondary ESCP which will be approved by a CPESC before implementation.

## 4.4 Containment of Contaminants

Works that involve wastewater or chemical storage will be carried out according to:

- The Waste and Wastewater Management Plan (WWMP) (**Appendix 06**).
- The Spill Management Plan (**Appendix 07**).

Use, storage, and handling of materials on a site of petroleum activity:

- Which are or contain hazardous chemicals will comply with WHS legislation and appropriate standards for the type of chemicals.
- Will be used, stored, and handled in accordance with their approved SDS.

An assessment was carried out on whether the materials (solids or liquids) expected to be used or produced during the Activity are, could be considered to be, or could contain, hazardous chemicals and could potentially cause environmental harm as per *the Code*. The assessment and outcomes are detailed in **Appendix 07** (Spill Management Plan).

Liquid chemicals that may cause environmental harm will be stored in double-lined/walled tanks or bunded areas as per Clause A.3.8 of the Code. Containment bunds will have sufficient capacity to hold 100% of the largest container volume stored in the area, plus 10%, unless the container is equipped with individual secondary containment.

Materials that escape from primary containment or are otherwise spilled onto secondary containment will be removed as soon as possible (inc. accumulation of rainwater), with the aid of a spill kit or vacuum truck for disposal to a licensed facility.

Inspection reports and maintenance records of secondary containment will be kept.

Liquid hydrocarbons will be stored in above-ground tanks, whether separated or mixed with other fluids at a concentration greater than 1% by volume.

If condensate is produced during EPT operations in significant volumes, it will be stored on-site for management at a registered facility. All transport of condensate will be conducted by transport contractors licensed for that work.

If condensate is stored or separated on-site, it will be done in designated double-lined/walled storage tanks as per AS1940. These tanks will be monitored and have controls to prevent vapours from exceeding the Lower Explosive Limit (LEL) of the condensate outside the tank.

In addition to the above controls to prevent spills of potentially harmful chemicals or those that may cause environmental harm to the ground surface of their release from the site are detailed in **Section 3.6** Civil Construction.

## 4.5 Generation of Noise and/or Light

The works in the Activity that will produce noise and light under this EMP are shown in **Table 4—6** below.

**Table 4—6 Light and Noise Sources from the Activity under this EMP**

| Operation | Produced Noise | Night Operations | Produced Light |
|---|---|---|---|
| **Civil Construction** | Yes | No | No |
| **Drilling and Completions** | Yes | Yes | Yes (Work Lighting) |
| **Extended Production Test** | Yes | Yes | Yes (Work Lighting and Flare) |
| **Campsite** | No | Yes | Yes (Work Lighting) |

The nearest sensitive receptor is located approximately 8.5 km from the location of the Activity. Noise levels from drilling activities are typically 60-65 dBA at 500 feet (152.5 m) [NOISE MONITORING SERVICES, 2020]. The noise level at 8.5 km, accounting for distance attenuation, is estimated to be <30 dbA [DEPARTMENT OF ENVIRONMENT AND SCIENCE, 2020], which corresponds to background quiet rural levels. This does not include further attenuation due to the intervening sandy ground and dunes.

This demonstrates that the Activity will not generate noise above the minimum project intrusiveness noise levels as defined in Table 3.4 of the *Northern Territory Noise Management Framework Guideline* (for rural residential receptors). The sensitive/residential receptor category (rural residential) is defined in Table 3.6 of the *Northern Territory Noise Management Framework Guideline Version 0.1* [NT EPA, 2018].

# 5 Existing Environment

## 5.1 Climate

The Project Area (shown in **Figure 1—1**) is located approximately 63km northwest of Kulgera in the NT within EP125. The Interest Holder has used Bureau of Meteorology (BOM) data from the Kulgera weather station 015603 in its climate analysis [BOM, 2022c]. The Kulgera BOM station has been operational since 1968.

Using BOM's seasonal rainfall climate classification map, the Project Area and the Kulgera weather station are both located within the arid climate zone and have an annual rainfall between 200-300mm and are characterised by hot, dry summers and cold winters [BOM, 2021, 2022a; National Construction Code, 2015]. However, the rainfall is higher in the summer months (October to March).

Rainfall events can cause local rivers to run and create localised short-term flooding, determined by the rainfall volume, duration, and spatial distribution. It is these flooding events that are likely to provide the recharge to the aquifers. In contrast, the dry season between April and November experiences little rain.

The average annual evaporation for Kulgera is approximately 1801.4mm, which exceeds the annual rainfall even in the wettest years.

Details on the average monthly temperature, rainfall and evaporation is provided in **Table 5—1**, **Table 5—2**, and **Table 5—3**.

Table 5—1 Kulgera Average Monthly Temperatures

| Temperature (°C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average Max** | 37.0 | 35.7 | 32.4 | 28.3 | 22.9 | 18.9 | 19.2 | 22.1 | 27.1 | 30.8 | 33.6 | 35.1 | 28.6 |
| **Average Min** | 22.1 | 21.3 | 18.0 | 13.9 | 9.0 | 5.2 | 4.8 | 6.6 | 11.3 | 15.3 | 18.4 | 20.3 | 13.9 |

Table 5—2 Kulgera Average Monthly Evaporation

| Evaporation (mm) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P10** | 200.5 | 165.3 | 152.3 | 109.8 | 73.3 | 56.7 | 67.6 | 94.7 | 124.9 | 162.0 | 183.0 | 197.4 | 1587.5 |
| **P50** | 225.9 | 190.3 | 176.1 | 124.4 | 87.7 | 65.8 | 76.5 | 106.8 | 143.1 | 186.9 | 199.1 | 218.8 | 1801.4 |
| **P90** | 242.7 | 206.5 | 186.2 | 133.0 | 94.6 | 71.2 | 84.0 | 115.1 | 153.5 | 196.3 | 211.7 | 237.1 | 1931.8 |

Table 5—3 Kulgera Average Monthly Rainfall

| Rainfall (mm) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average Rain (mm)** | 28.9 | 32.5 | 29.1 | 13.3 | 12.3 | 15.8 | 11.6 | 8.5 | 14.8 | 19.4 | 25.2 | 32.8 | 249.9 |
| **Median Rain (mm)** | 14.4 | 9.0 | 10.7 | 2.6 | 3.8 | 4.4 | 4.6 | 1.2 | 4.4 | 5.0 | 16.7 | 22.6 | 219.3 |
| **Average Rain Days** | 2.5 | 2.4 | 2.0 | 1.7 | 1.6 | 1.7 | 1.6 | 1.2 | 1.7 | 2.1 | 3.1 | 3.2 | 24.8 |

## 5.2 Rainfall Events

An analysis of rainfall events was undertaken to provide information on the required freeboard for open pits and unattended open-topped treatment tanks to minimise the risk of overflowing.

The average daily rainfall records for Kulgera show that both the expected amount of rainfall and uncertainty range are highest from November through April, inclusive. The average rainfall and uncertainty range for May through October is low, with averages below 0.1mm per day. In December, the rainfall is still low, with an average of <0.2mm a day.

### 5.2.1 1:1,000 ARI Analysis - Design Purposes

While the NT regulatory wet season runs between October and April, there is minimal fluctuation in the local average rainfall. For calculation purposes, the local wet season has been determined to occur between December and February, the three months with the largest average rainfall.

Consistent with industry-accepted methodology associated with practices such as dam risk assessments (which calculate the wet season based on geographical location), three months was determined to be an appropriate period to model 1:1,000 ARI (1 in 1,000-year average recurrence interval) rainfall events as a basis for determining a design freeboard level for open pits and unattended open-topped treatment tanks.

The highest three-month rainfall period for Kulgera was used, and a Log Pearson III distribution technique was fitted to these data (**Figure 5—1**). This analysis allowed the Interest Holder to extrapolate the 1:1,000 ARI three-month wet season. Based on this methodology, the largest median predicted 1:1,000 ARI three-month rainfall period for Kulgera is 525 mm, raising to 577 mm when applying a 10% upper uncertainty bound. These calculations do not allow for any evaporation.

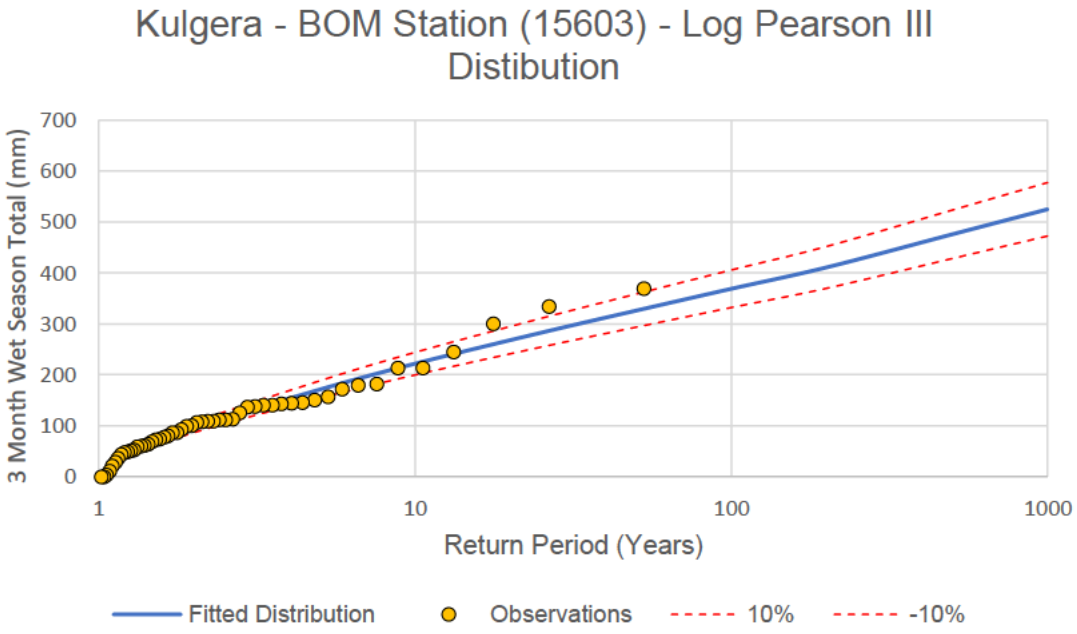



**Figure 5—1 Determination of 1:1,000 ARI Rainfall Events (Wet Season)**

To calculate the minimum amount of reserved space required to handle a 1 in 1,000 ARI rainfall event, a conservative P10 evaporation value of 450mm was used (approximately 80% of the P10 evaporation figure of 563.2 mm for the highest three-month rainfall months of December to February - **Table 5—2**). This 450 mm evaporation figure was incorporated into the 1:1,000 ARI 90-day extreme rain event calculations.

Using these conservative assumptions, theoretically, the minimum amount of reserved space required to handle a 1 in 1,000 ARI rainfall event would be 127 mm (577 mm minus 450 mm). However, maintaining only 127 mm of reserved space poses risks of overtopping and spills during extreme wind events. To mitigate these risks, a minimum operational freeboard of 300 mm (safety factor of 2) has been adopted. Additionally, a target freeboard level of 400 mm has also been adopted (safety factor of 3). If the target freeboard is breached, it will prompt a risk assessment concerning available space, as further detailed in **Section 2.4** of **Appendix 06** (Waste and Wastewater Management Plan).

### 5.2.2 Significant Rainfall Events - Operational Purposes

It is noted that in addition to the above determination of rainfall events for the design of open pits and tanks, for the purposes of day-to-day monitoring and wastewater management, a significant rainfall event (SRE) approach is used. This approach is suitable for the management of the Activity when SREs arising from monsoonal troughs, tropical lows, or cyclones are forecast.

The Interest Holder has defined an SRE as an event where greater than 150 mm total rainfall occurs over four days (refer **Section 3.1** of **Appendix 06**). This type of rain is consistent with rainfall from monsoonal troughs, tropical lows, or cyclones.

Historical SREs from the Kulgera BOM station are shown in **Figure 5—2**. Alice Springs Airport data is included in the figure for comparison purposes.

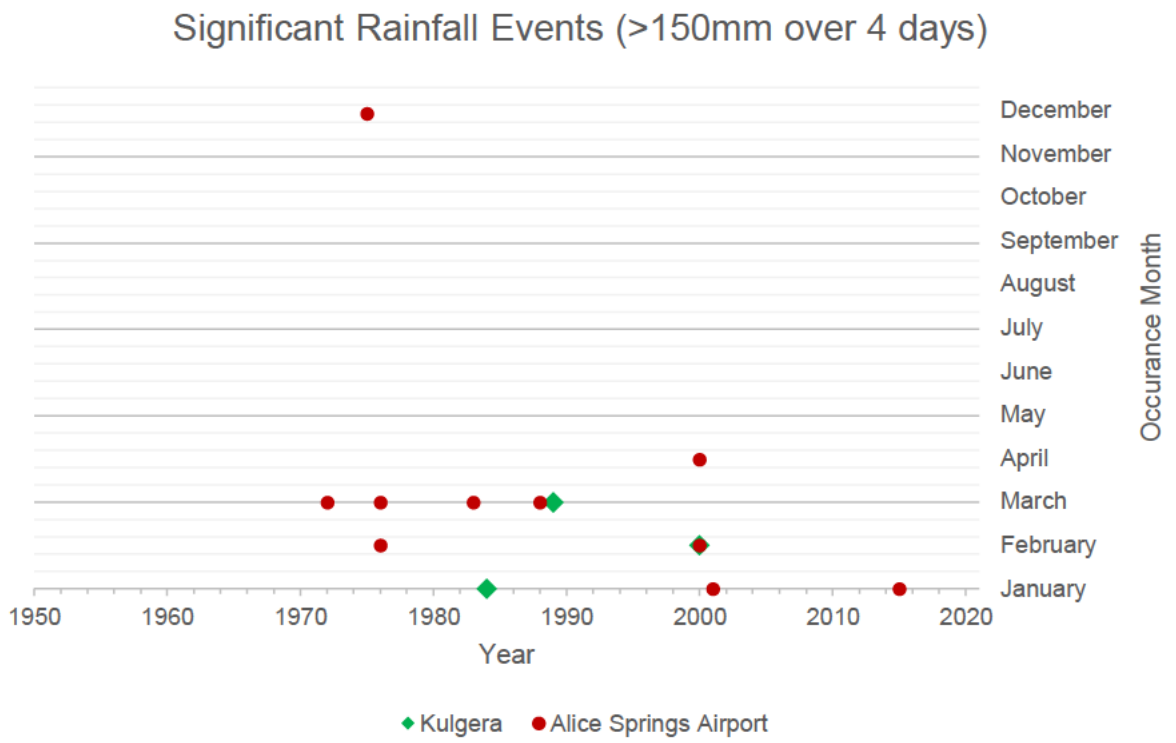



**Figure 5—2 Significant Rainfall Events**

## 5.3 Geology

The Amadeus Basin is an intracratonic basin that occupies a large portion of the southern Northern Territory and extends about 150 km into Western Australia and just into South Australia, covering about 170,000 km$^2$.

It is generally agreed that the Amadeus Basin was formed as a result of multiple different basin-forming mechanisms, where the basin contains up to 14 km of clastic, carbonate and evaporitic sedimentary rocks, which were deposited in shallow marine to continental environments during periods of extension and thermal subsidence during the late Proterozoic–early Paleozoic and Late Devonian. Stratigraphic groups deposited during this period include the Heavitree Quartzite, Dean Quartzite, Bitter Springs Formation, and Pinyinna Beds.

Recent technical studies performed by the Interest Holder, using vintage and new seismic reflection data along with well data, have allowed the construction of a new structural and depositional model for the south-eastern region of the Amadeus Basin, where the Interest Holder's current interests are located [S. MENPES et al., 2018].

Jacko Bore 1DW1 is located within the central portion of the Amadeus Basin. The geology within the Project Area comprises Paleozoic conglomerate, sandstones, siltstone, and rare limestone of the Pertnjara Group [DITT, 2021]. The Jacko Bore 1DW1 well prognosis is shown in **Table 5—4**, and details on the site lithology is provided in **Figure 5—3**.

**Table 5—4 Jacko Bore 1DW1's Well Prognosis**

| Formation | Depth (mTVD BGL) | Depth (mTVDSS) | Uncertainty (m) |
|---|---|---|---|
| **Surficial Deposits** | 0 | +482 | N/A |
| **Pertnjara Group** | 5 | +477 | +/- 1 |
| **Petermann Unconformity** | 816 | -331 | +/- 1 |
| **Johnnys Creek Formation** | 816 | -331 | +/- 1 |
| **Loves Creek Formation** | 1,038 | -555 | +/- 1 |
| **Gillen Formation** | 1,236 | -752 | +/- 2 |
| **Gillen Evaporites** | 1,529 | -1,044 | +/- 3 |
| **Lower Gillen Member** | 2,032 | -1,550 | +/- 20 |
| **Basement** | 2,162 | -1,680 | +/- 50 |

TVD BGL – True Vertical Depth Below Ground Level; TVDSS – True Vertical Depth Sub Sea (mean sea level).

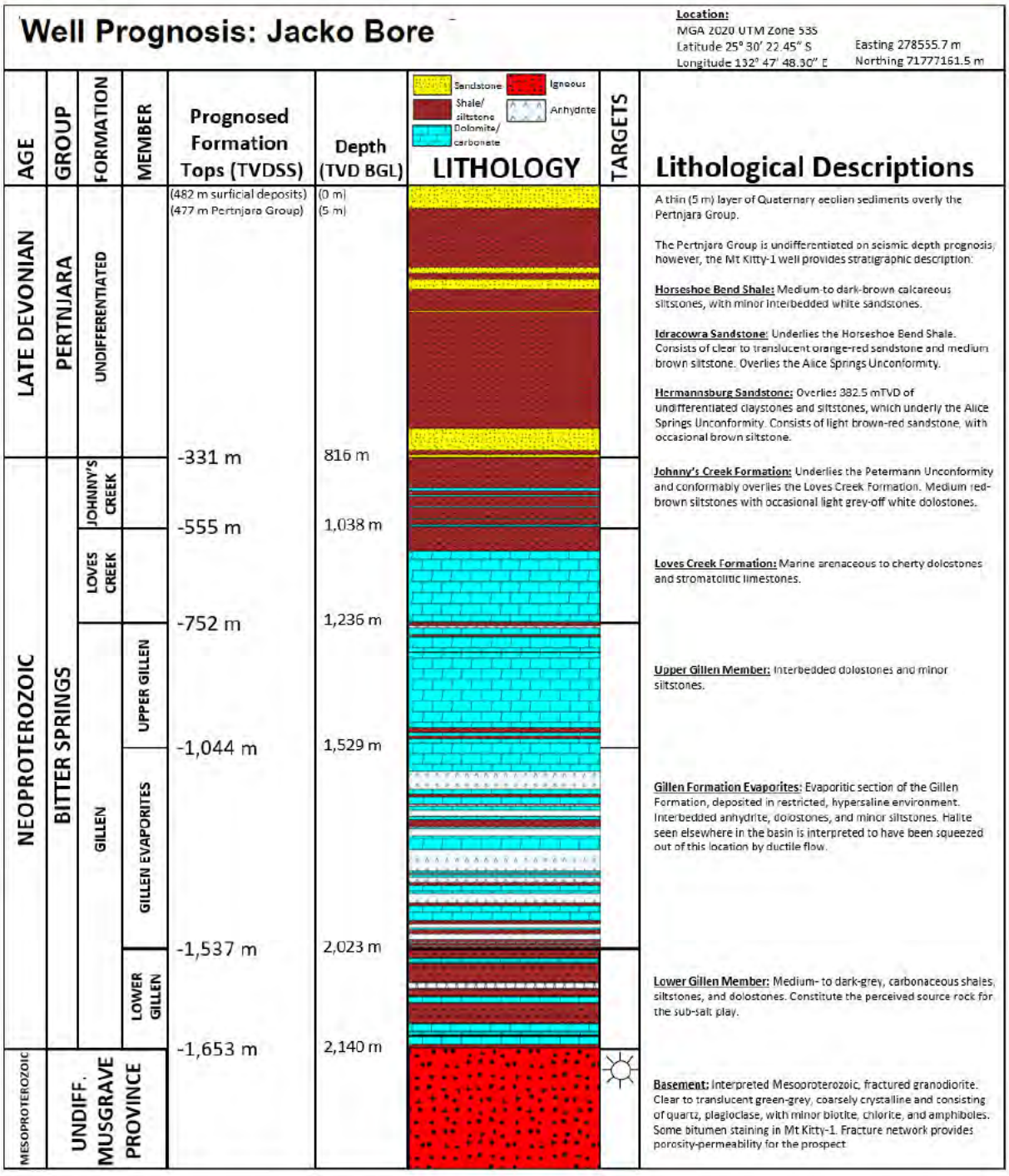



**Figure 5—3 Well Prognosis: Jacko Bore 1DW1**

## 5.4 Topography, Soils and Land Systems

### 5.4.1 Topography

The Project Area is in the Amadeus Basin, which is described as flat to gently undulating plains with slope gradients and lengths of less than 5% and 100m, respectively [GHD, 2022]. The immediate area of Jacko Bore 1DW1 comprises dunes and swales trending approximately southwest to northeast (**Figure 5—4**). This figure shows 2m contour lines and percentage slope in the immediate area of the Jacko Bore 1 well pad and approach track. The approach track to Jacko Bore 1DW1 avoids as much as possible crossings over the dunes.

### 5.4.2 Soils

The Project Area is mainly comprised of red clayey sands, with some sandy calcareous earths/stone mantles texture contrast soils. These clays are scalded red-brown and heavy-brown clay, respectively. There is a high volume of red sand to sandy red earth sands in the sandplains and soft red aeolian sands in the dunes.

In total, seven soil types are present in the well pad area and along the access tracks to Jacko Bore 1. Detail on the soil types in the Jacko Bore 1 well pad area and access road is shown in **Figure 5—5**. The Jacko Bore 1 well pad itself is located in an area with minor areas of mobile sands and irregular sand dunes.

### 5.4.3 Land Systems

Land systems are based on the concept of ecosystems, in which several local land feature sequences are repetitive and integrated, e.g., climate, geological material, landform, soil and native vegetation. In total, seven land system types, analogous to the seven soil types, are present in the well pad area and the access to Jacko Bore 1DW1. Detail on the land systems in the Jacko Bore 1 well pad area and access are shown in **Figure 5—5** and described in detail, including landform, soil description, and vegetation description in **Table 5—5**.

The Jacko Bore 1 well pad area is within the Simpson land system, comprising dune fields with parallel linear dunes, reticulate dunes, and irregular or aligned short dunes. The soils are red sands, and the vegetation description is, typically, Desert Cane Grass (*Zygochloa paradoxa)* on dune crests and mobile slopes, whilst stable slopes and sandy interdune corridors are populated with *Triodia basedowii* (a tussock-forming grass). Interdune corridors with less sands support numerous species of acacia (e.g., *Acacia georginae* and *aneura*) as well as open shrublands of Eucalyptus microtheca [Rosemary Purdie, 1984].

Information on the other land systems on the access to Jacko Bore 1DW1 is provided in **Table 5—5.**

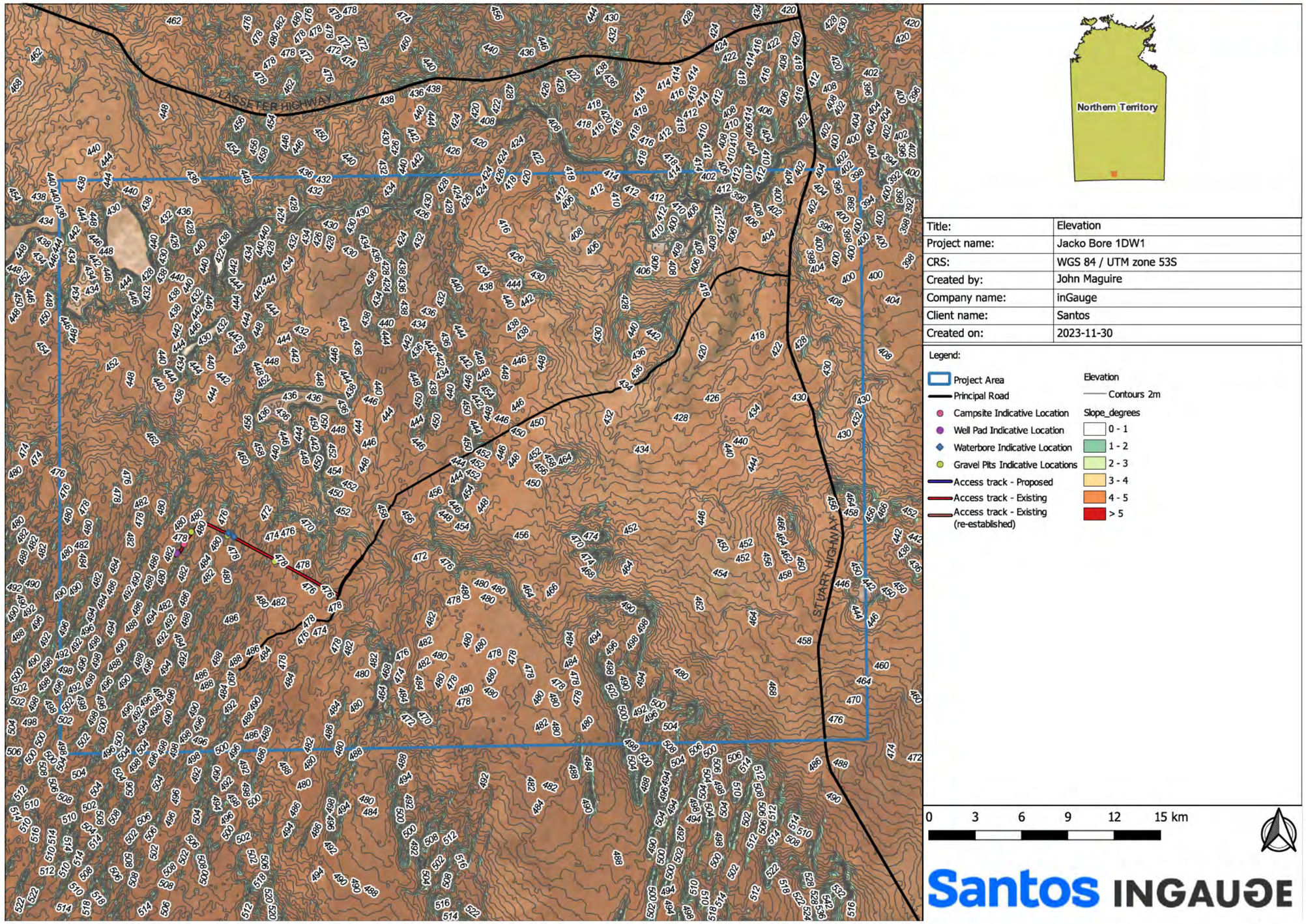



**Figure 5—4 Slope (%) and Contours (2m) of the Project Area**

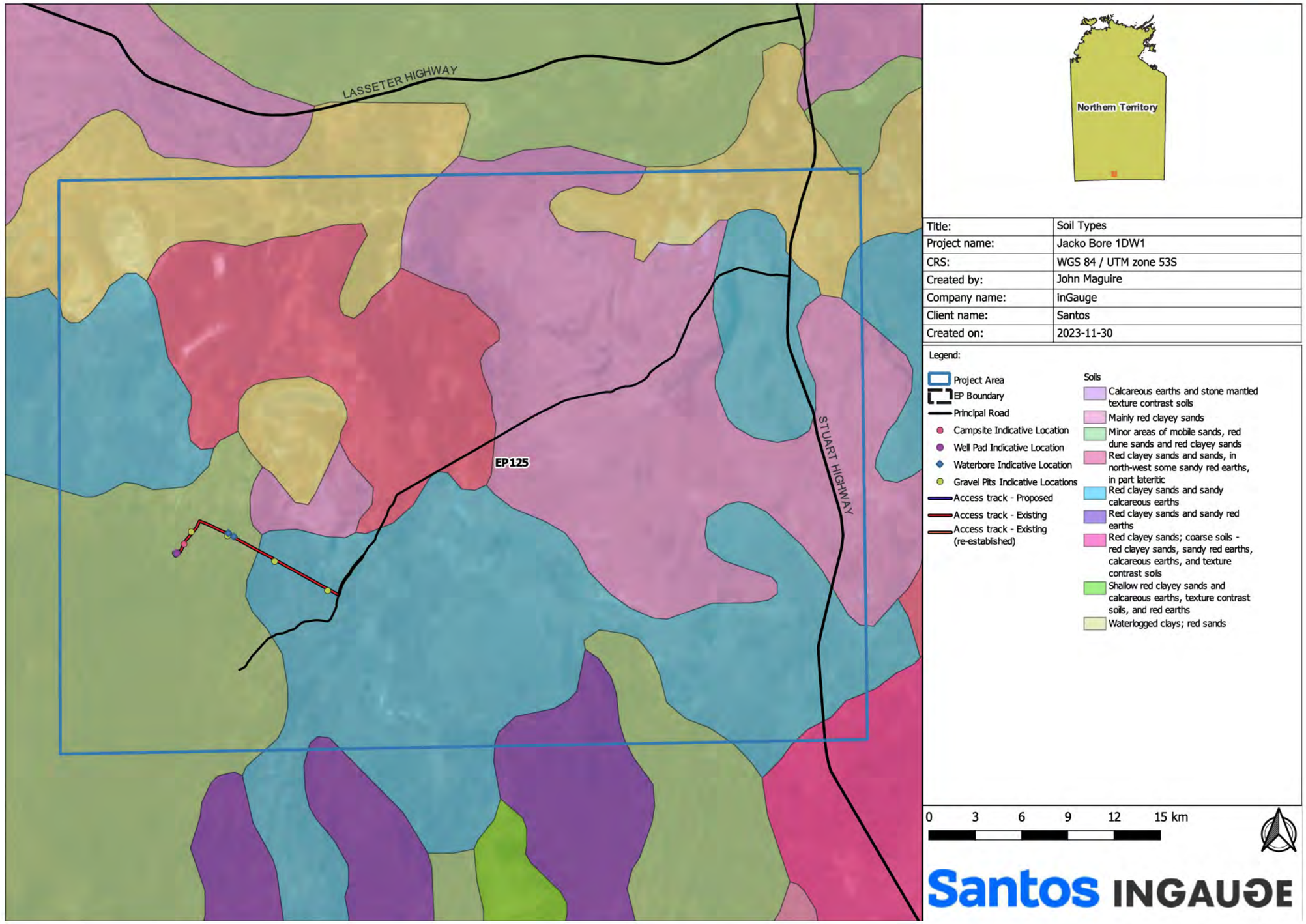



**Figure 5—5 Soil Types of the Project Area**

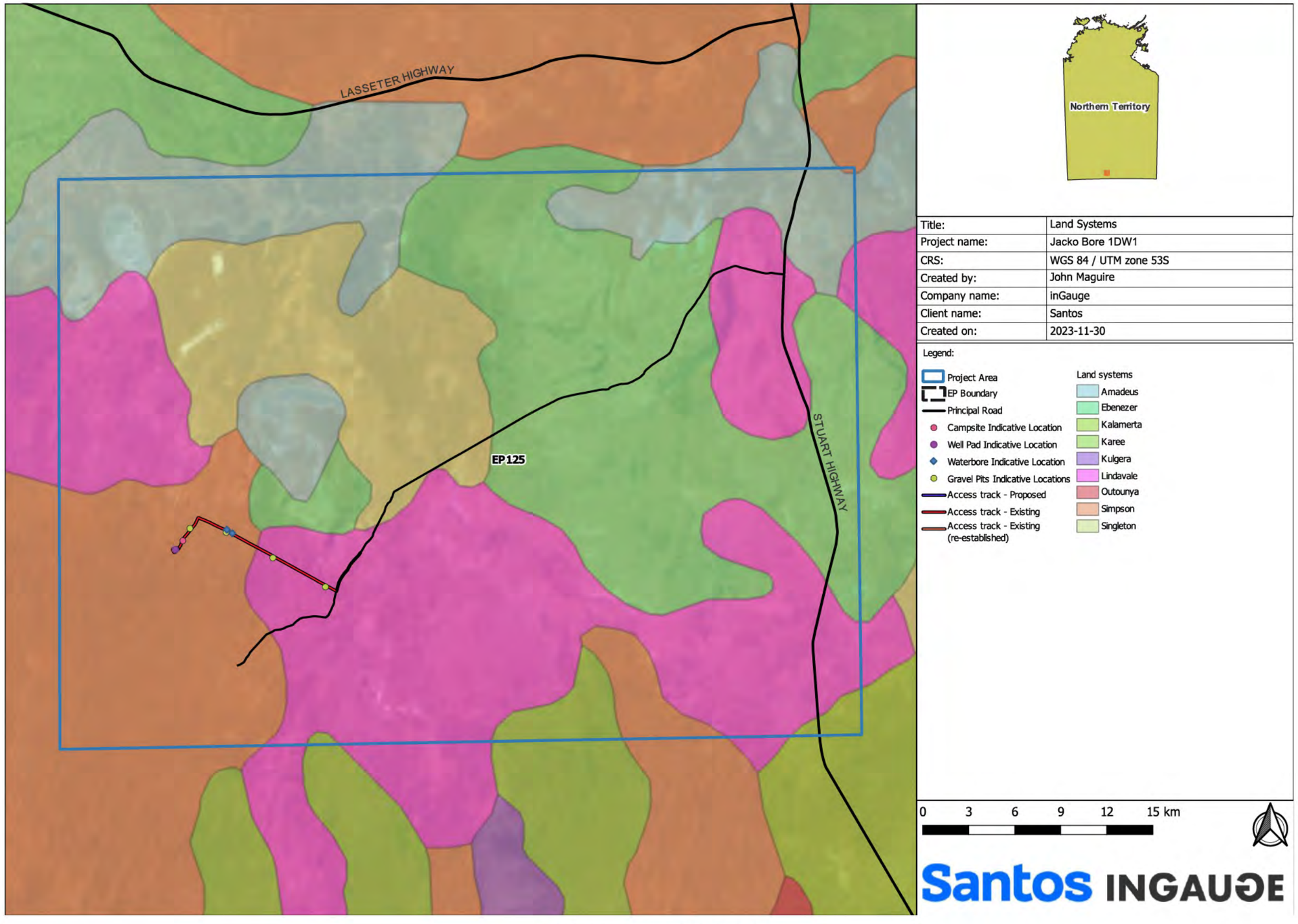



**Figure 5—6 Land Systems of the Project Area**

**Table 5—5 Land Systems of the Project Area**

| Land System | Landscape Class | Landform | Soil Description | Description | Approx. % of Area |
|---|---|---|---|---|---|
| **Simpson** | Desert dune fields. | Dune fields with parallel linear dunes, reticulate dunes, and irregular or aligned short dunes. | Red sands | Typically, Desert Cane Grass (*Zygochloa paradoxa*) is present on dune crests and mobile slopes, whilst stable slopes and sandy interdune corridors are populated with *Triodia basedowii* (a tussock-forming grass). Interdune corridors with less sands have a wider variety of soil types, supporting numerous species of acacia (e.g., *Acacia georginae* and *aneura*) as well as open shrublands of *Eucalyptus microtheca* [Rosemary Purdie, 1984]. | 13.79 |
| **Lindavale** | Limestone plains and rises. | Plains, rises and plateaux on weathered and un-weathered Cambrian limestone, dolomite, chalcedony, shale, sandstone, and siltstone with associated sand sheets. | Red clayey sands | Mulga, sparse shrubs and low trees, witchetty bush, bluebush and short grasses, and forbs [R. A. Perry et al., 1962]. | 31.98 |
| **Ebenezer** | 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. | Absent or sparse shrubs and low trees, witchetty bush, myall, bluebush, short grasses, and forbs, cottonbush, and samphire with some small bare areas. | 26.59 |
| **Amadeus** | Salt pans | Salt pans with fringing dunes | Waterlogged saline clays | Sparse, with a majority of bare ground in the pans and vegetation in the other areas, including tea-tree, samphire, saltbush, bluebush, witchetty bush, desert oak and spinifex. | 12.98 |
| **Kalamerta** | Peneplain | Sandy plains and claystone. Undulating to low hills. | Red clayey sand | Scattered vegetation characterised by bladder saltbush (*Atriplex vesicaria*) and bluebush foliage with areas of mulga, short grasses, and forbs present in some seasons. | 0.4 |
| **Karee** | Sand plain | Sloping plains and sandy loam soils. | Red clayey sands | Sparse shrubs (clumped or scattered) and low trees covering woolybutt grass (*Eragrostis eriopoda*) [W. A. Low et al., 2012]. | 1.34 |
| **Singleton** | Sand plain | Flat or gently undulating sand plains and swales. | Red clayey sands | Sparse shrubs with low trees or minor Desert Oak overhanging tussock forming grasses (*Triodia basedowii*) [R. A. Perry et al., 1962]. | 12.92 |

## 5.5 Groundwater

The Project Area is located within the Neoproteroic – Palaeozoic Amadeus basin, which has a 7-8 km sedimentary thickness in some areas. Two hydrogeological environments have been identified within the basin: relatively flat-lying sandstone aquifers in the north-central part of the basin and elsewhere, fractured rock aquifers [DEPWS, 2022B; J. W. LLOYD et al., 1987]. **Figure 5—7** presents the principal aquifers in the Amadeus Basin [G. A. YOUNG et al., 1987].

The fractured rock aquifers of the Pertnjara Group of the Amadeus Basin are located in EP125 and will be a target source of water for the Activity (**Figure 5—7**). The area has a moderate to high level of groundwater salinity, which coincides with the presence of the Karinga Creek Paleodrainage System (KCPS), a series of more than 100 saline lakes on the northern side of EP125 [L. HARRISON et al., 2009; G. A. YOUNG et al., 1987].

EP125 is not located within a water allocation plan area. Any guidelines published by the Northern Territory Government relating to groundwater monitoring parameters, methodologies, frequencies, reporting, and data submission for petroleum operations will be followed.

The area has a long history of groundwater utilisation. There are twelve known existing bores within 15km of the Jacko Bore 1 well pad site. Current water bores and the major aquifers for the Project Area can be seen in **Figure 5—8.** The closest bores are RN2256 and RN13258, which have a drilled depth of 27.4 m and 11.5 m, respectively. As discussed in **Section 4.1**, the target aquifer depth for the water bore at the well site is 200 m to 300 m below ground level.

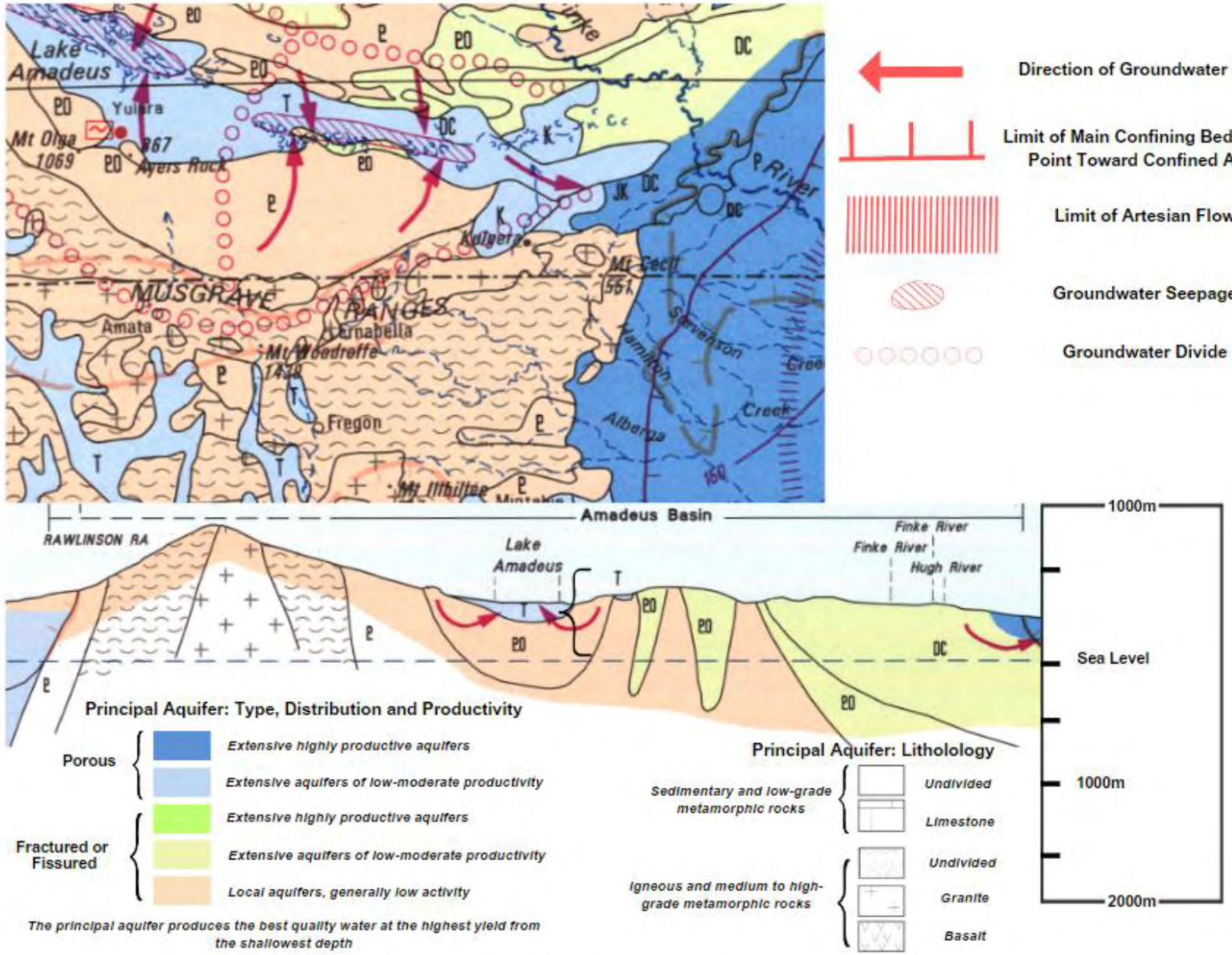
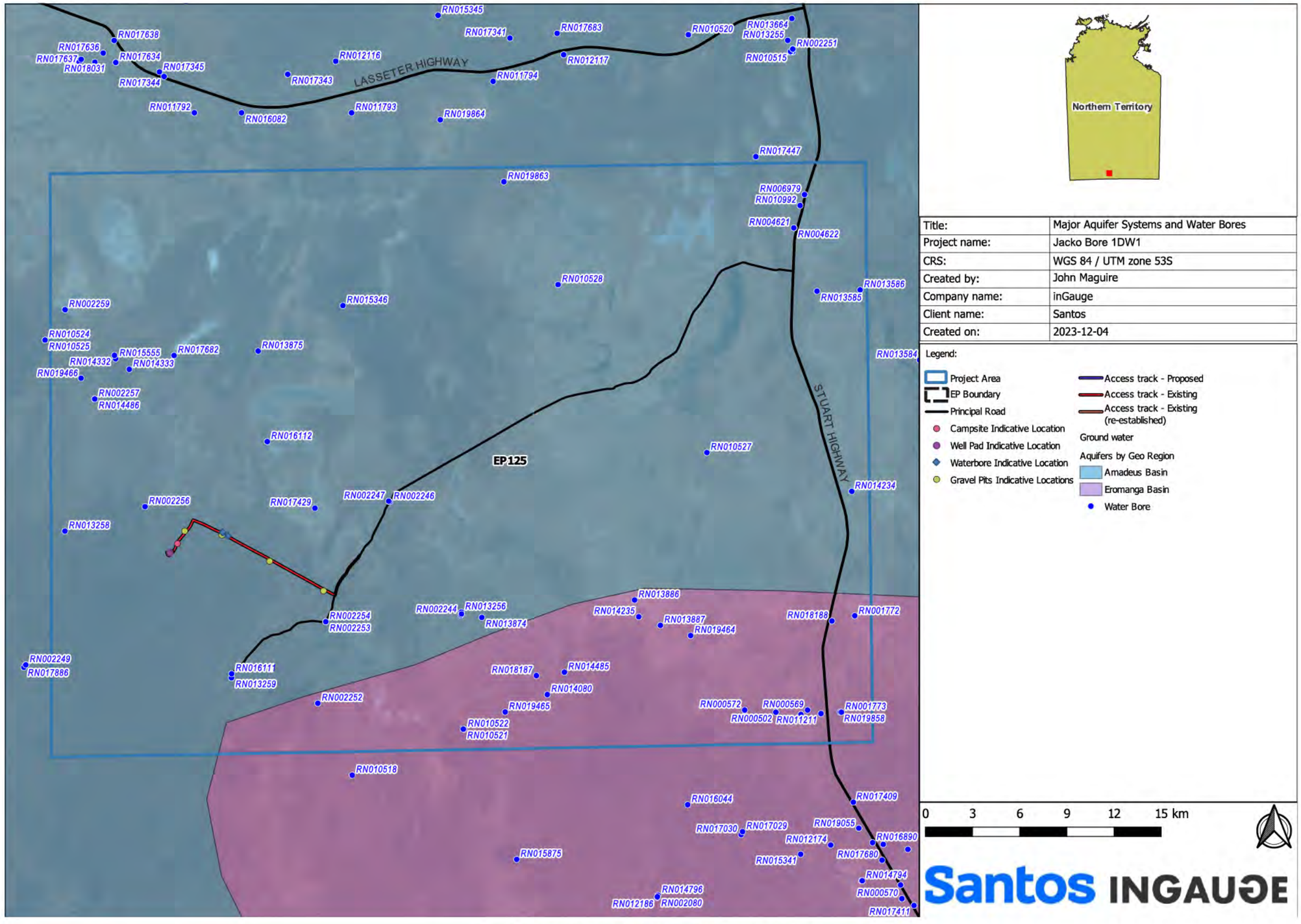



**Figure 5—7 Summary of the Principal Aquifers in the Amadeus Basin [G. A. YOUNG et al., 1987]**




| | |
|---|---|
| Title: | Major Aquifer Systems and Water Bores |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-04 |

**Figure 5—8 Major Aquifer Systems and Water Bores of the Region**

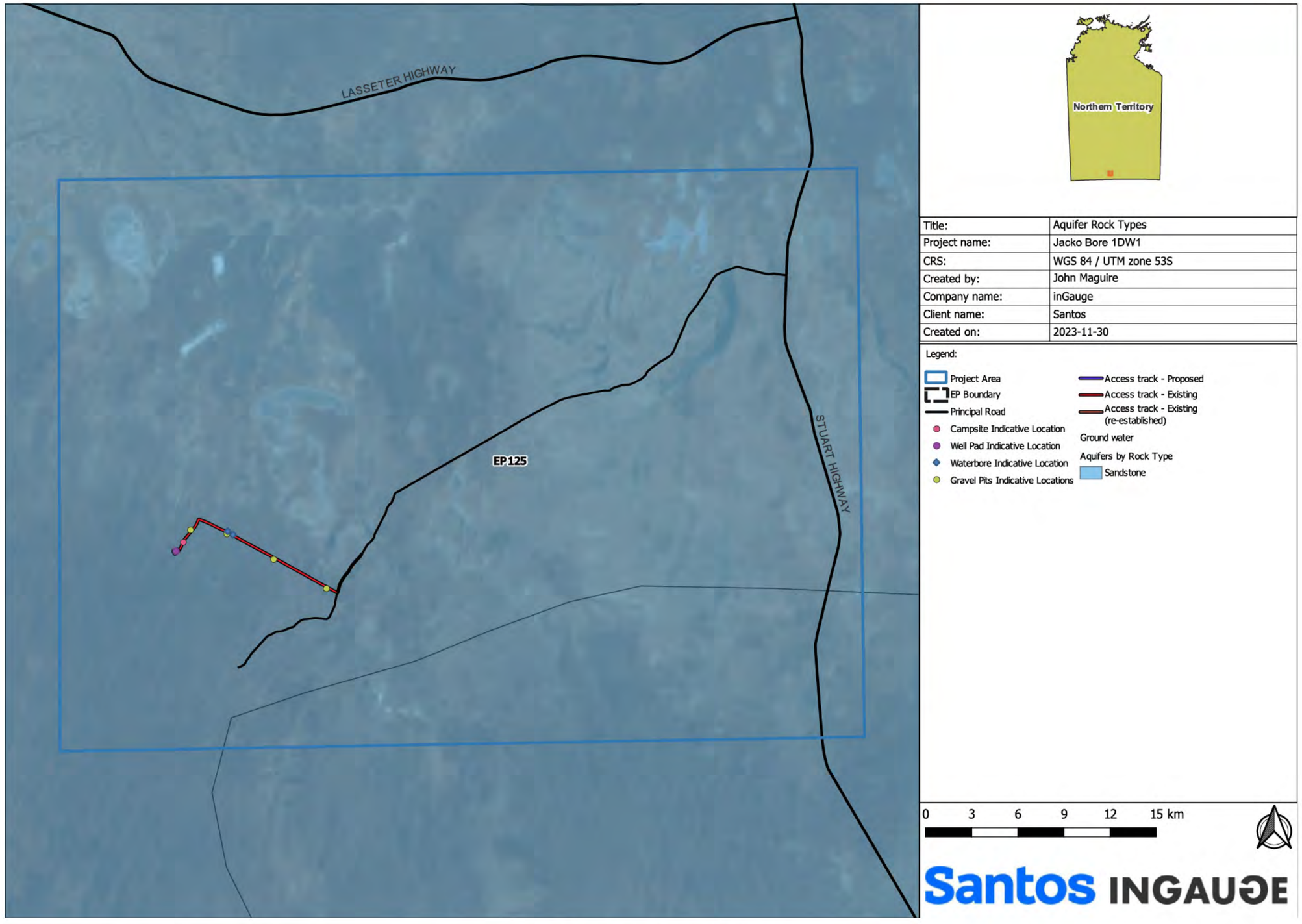



**Figure 5—9 Aquifer Rock Types of the Project Area**

## 5.6 Surface Water

### 5.6.1 Watercourses

There are several watercourses throughout the Project Area, including small drainages, tributaries, and drainage gullies. Most of the watercourses follow the EP topography and occur to the north of the Project Area. The watercourses, including stream orders, and riparian zones, are shown in **Figure 5—11.**

The main watercourse near the Project Area is Karinga Creek. Karinga Creek flows from west to east, draining into the Finke River, and is located approximately 20km north of the Jacko Bore 1 well pad site. There are some ephemeral stream crossings along the existing public road access that lead to the well pad site turnoff. These ephemeral streams ultimately flow to Karinga Creek. There is one existing crossing from the turnoff on the existing public road to the well pad site (**Figure 5—11**). No new crossings are planned.

The Karinga Creek Paleodrainage System (KCPS) consists of a chain of more than 100 saline lakes and is part of a larger chain of saline lakes that extend 500 km from Lake Hopkins in Western Australia to the Finke River. Karinga Creek flows after substantial rainfall, and the extensive lakes, claypans and saltpans are temporarily filled and provide important habitat for birdlife. The KCPS is both a Site of Conservation Significance and a Site of Botanical Significance, and this is discussed further in **Section 5.10** [L. HARRISON et al., 2009].

Observation of the spring's spatial layer of the Natural Resource Maps indicates that there are springs within the Project Area but that they are isolated, approximately 9km from the well pad in the KCPS Sites of Conservation Significance (SOC) area to the northeast [DEPWS, 2022B].

### 5.6.2 Groundwater Dependent Ecosystems (GDEs)

GDEs are complex dynamic natural ecosystems that require groundwater access to meet all or some of their water requirements on a permanent or intermittent basis to maintain their communities of plants and animals, ecosystem processes and ecosystem services [S. Richardson et al., 2011]. These diverse ecosystems are primarily driven by temporal groundwater flow variability contingent on climate, geology, and land use [C. Alfaro et al., 1994; G. Bertrand et al., 2012; T. M. Doody et al., 2017; B. Kløve et al., 2014].

A search of the National Groundwater Dependent Ecosystems (GDEs) Atlas conducted in October 2022 identified a low potential of aquatic or subterranean GDEs occurring within the Project Area. There are terrestrial GDEs present to the north of the well pad site, mainly within the Karinga Creek Paleodrainage System [BOM, 2022B]. **Figure 5—10** shows GDEs in relation to the Project Area.

There is a small area of mapped aquatic GDE of unclassified potential that is intersected by the existing access track to the well site. Review of aerial photography indicates that the area includes a cattle yard and is already heavily disturbed by pastoral activities. Other areas of mapped aquatic GDEs, also of unclassified potential, relate to salt pans. They are, however, outside the disturbance footprint and will therefore not be affected by the Activity.

The Jacko Bore 1 well site is within the fractured rock domain of the Amadeus Basin. Fractured rock aquifers are typically very localised with limited vertical and horizontal hydraulic connectivity. The target for the water supply bore proposed at the well pad is 200 – 300 m below ground level. This target depth was selected following an extensive review of water bore records and drilling logs from Jacko Bore 1. The greater than 200m of rock between the water supply target and the ground surface negates the potential for impact from the groundwater extraction activity.

Apart from some existing ephemeral stream crossings along the public road access and one after the Jacko Bore 1 well pad site turnoff, the Activity under this EMP does not encroach on the Karinga Creek Paleodrainage system; therefore, no specific further actions are required to avoid impacts on GDEs (**Figure 5—10**).

### 5.6.3 Flood Modelling

The main watercourse near the Project Area is Karinga Creek. Several watercourses throughout the Project Area include small drainages, tributaries, and drainage gullies. Water channels and tributaries only flow after heavy rainfall, which is rare in this arid region.

To estimate peak flood depths and flow rates, a Log Pearson III distribution was used to calculate the Annual Exceedance Probability (AEP) of a 1 in 100-year event flood event occurring in any year. A steady-state rainfall simulation was then developed over the catchment area using the TUFLOW hydraulic modelling suite and Shuttle Radar Topography Mission (SRTM) data to calculate peak flood depths and flow rates using the rainfall values from this event. The results are shown in **Figure 5—12**.

As illustrated in the figure, the modelling indicates the potential for some minor and isolated flooding near the well pad and in patches along the swales in the local area during a 1 in 100-year flood event. These isolated flood patterns arise from localised increases in water levels, likely due to saturated soils, causing a ponding of water, rather than from surface flows or the expansion of a surface water body. Therefore, the flooding does not pose a significant risk to the overall integrity of the well pad or infrastructure within. The flood modelling indicates that, during a 1 in 100-year flood event, some portions of the well pad may experience a slight encroachment of between 12 to 32 cm in height. Infrastructure particularly vulnerable to inundation due to flooding or runoff from heavy rain events, such as pits, will be equipped with overland flow diversion bunds to ensure protection. Topsoil diversion berms placed upslope will redirect runoff away from the site and reduce the risk of run-on. The site will additionally be designed with at least a nominal slope 1% (refer to **Section 3.6.4.5**), which will facilitate the removal of rainwater from the well pad.

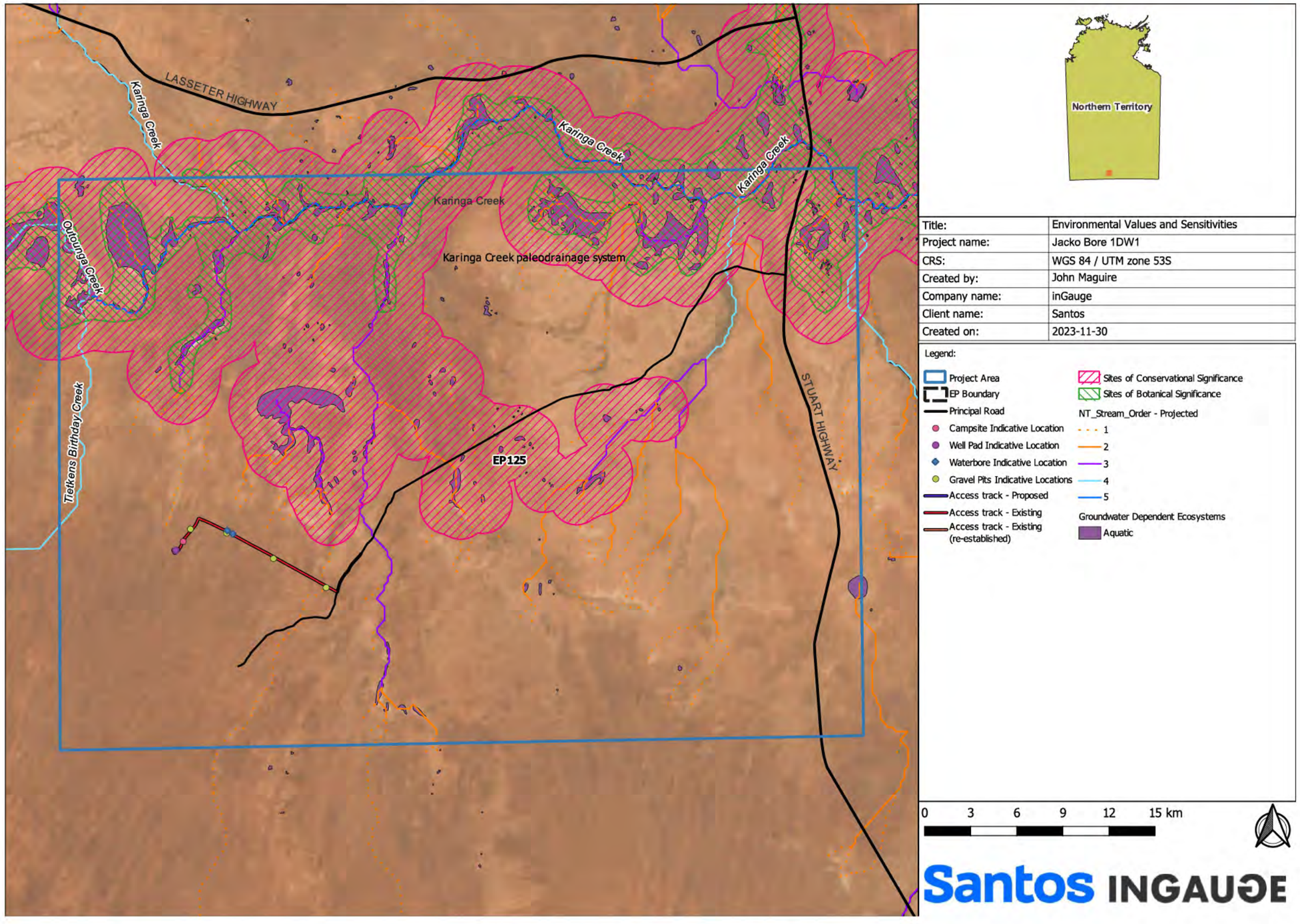
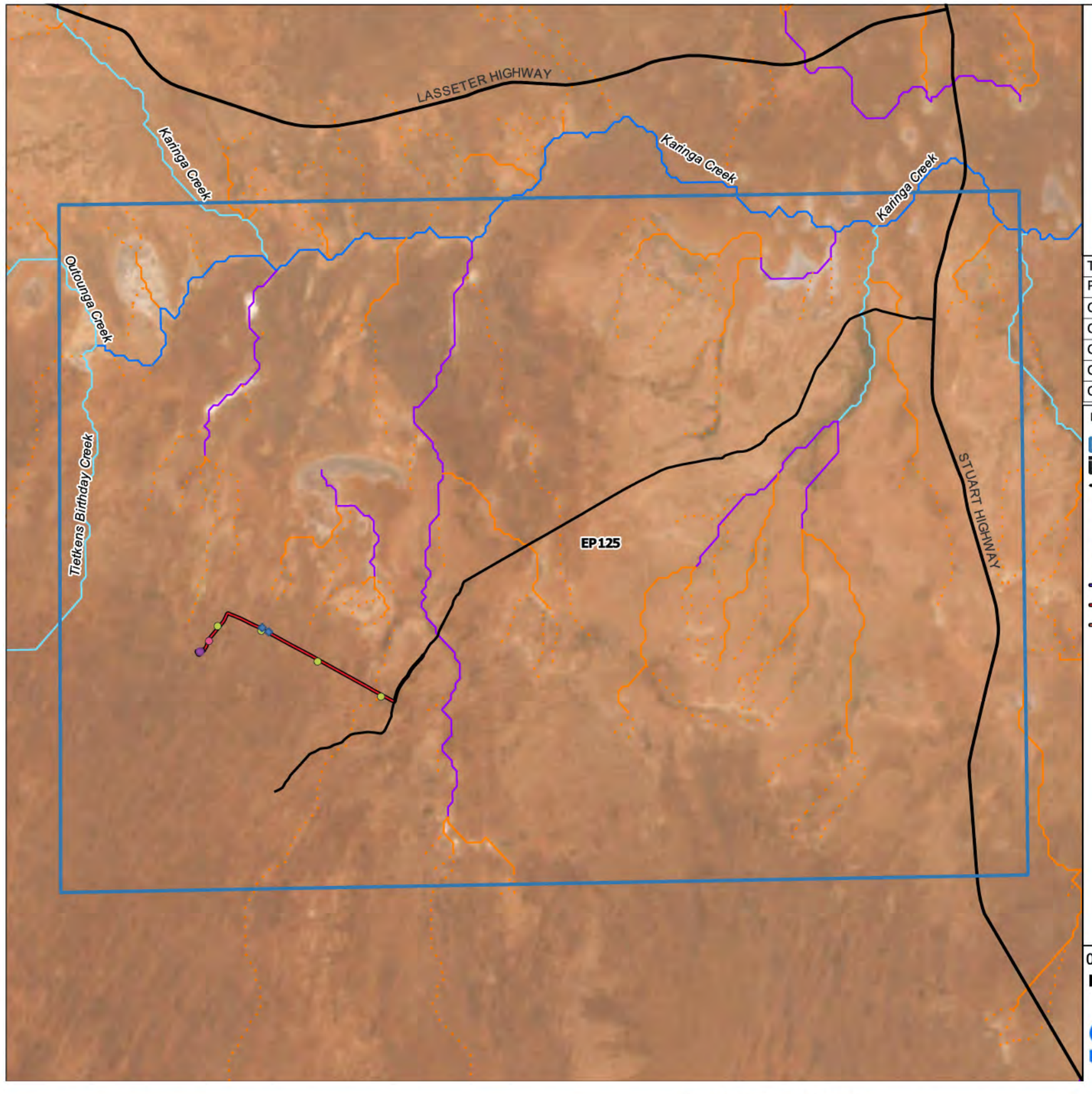



**Figure 5—10 Project Area Environmental Values and Sensitivities**







| | |
|---|---|
| Title: | Surface Streams |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-01 |

Legend:

- Project Area
- EP Boundary
- Principal Road
- Campsite Indicative Location
- Well Pad Indicative Location
- Waterbore Indicative Location
- Gravel Pits Indicative Locations
- Access track - Proposed
- Access track - Existing
- Access track - Existing (re-established)

NT_Stream_Order - Projected

- 1
- 2
- 3
- 4
- 5

0 3 6 9 12 15 km

Santos INGAUGE

**Figure 5—11 Surface Streams**

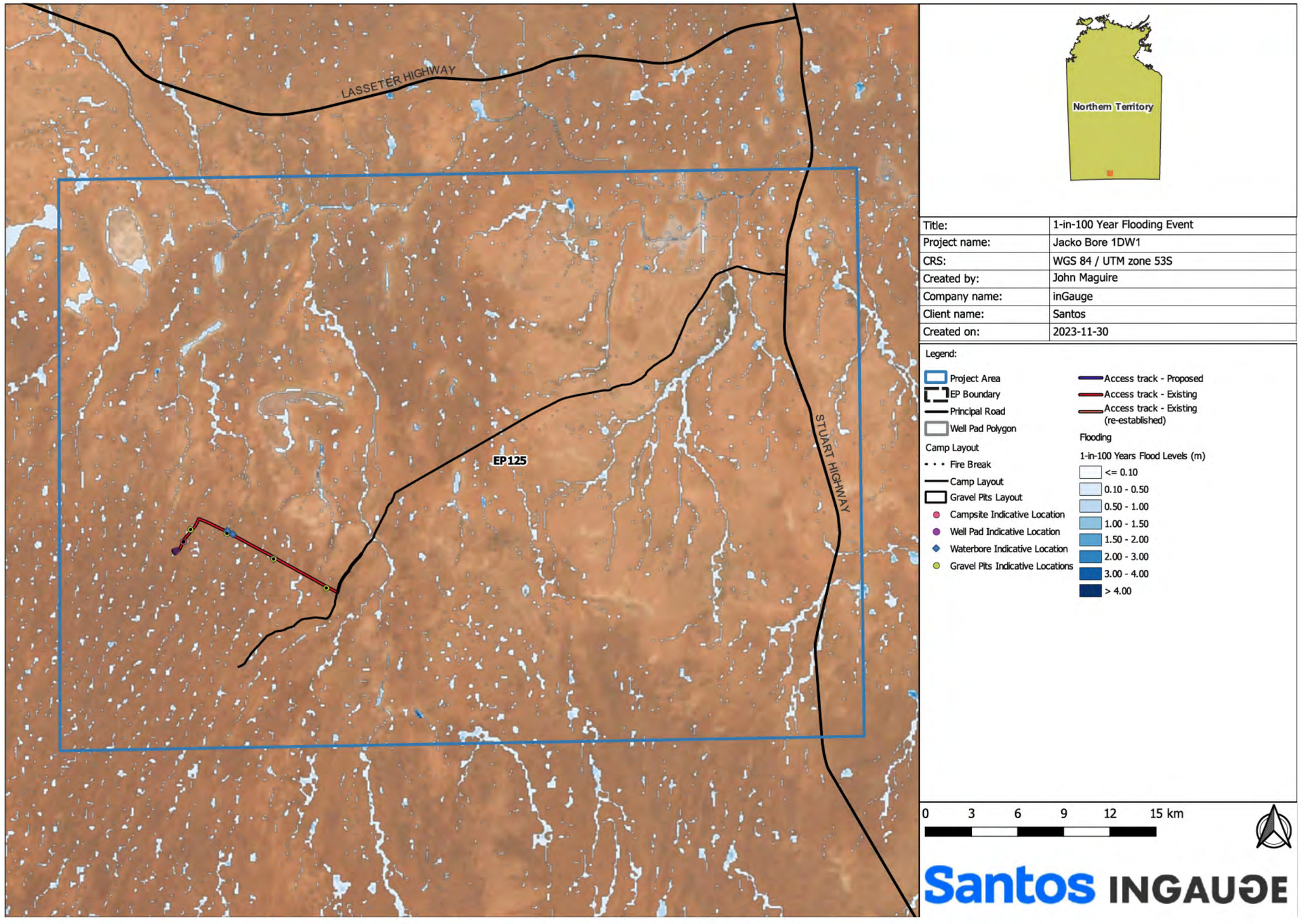



**Figure 5—12 Flooding Event (1 in 100-year) Over the Project Area**

## 5.7 Air Quality – Methane Emissions

*The Code* sets out the mandatory requirements for management plans for methane emission monitoring, leak management, detection, and reporting. *The Code* states that an EMP for a petroleum activity must include a Methane Emissions Management Plan (MEMP).

The MMEP is available in **Appendix 10**, and an overview of the MMEP is provided **Table 6—6**. The MEMP covers the works, risks, controls, monitoring, and reporting of methane emissions associated with the Activity. The Interest Holder is committed to monitoring their emissions in accordance with *the Code*.

## 5.8 Bioregions

Bioregions provide a consistent and robust framework for biodiversity assessment and planning and are based on typical climate, geology, landform, native vegetation, and species information. **Figure 5—13** shows the bioregions for the Project Area. This figure has been created using data from Land Systems of the Southern part of the Northern Territory database and indicates that the Project Area comprises three bioregions: Tanami, Great Sandy Desert, and Finke [C. S. CHRISTIAN et al., 1954; DEPWS, 2011].

EP125 occurs within the Finke interim biogeographical region – specifically the Tieyon subregion. The Finke IBRA comprises arid sand plains, with some dissected uplands and valleys and several major rivers (Finke, Hugh, and Palmer) [DAWE, 2008]. The Finke region is characterised by low sandstone ranges, weathered tablelands, and rounded metamorphic hills [B. BAKER et al., 2005]. Soils are a mix of predominantly shallow and deep sands, massive earths, and red duplex saline-affected soils. The most extensive vegetation is hummock grasslands and acacia shrublands dominated by mulga, senna, and saltbush/bluebush open shrublands.

The Project Area is dominated by both the Tanami and Finke Bioregions. The Tanami landscapes are mainly featureless sand plains with small areas of alluvial plains, low ridges and stony rises. Vegetation is predominantly spinifex hummock grassland with a tall-sparse shrub overstorey [DCEEW, 2008]).

A small part of the access track traverses the Great Sandy Desert bioregion. The Great Sandy bioregion comprises tree steppe, grading to shrub-steppe. Vegetation of the sub-bioregion is dominated by spinifex, shrubs (e.g., *Acacia* spp, *Grevillea wickhamii,* and *G. refracta*) and scattered trees (e.g., Bloodwoods and *Owenia reticulata*). Red sand dune fields overlying Jurassic and Cretaceous sandstone support vegetation [G. GRAHAM, 2001].

## 5.9 Vegetation

As noted in **Section 5.8**, the Project Area is primarily located within the Finke and Tanami bioregions and overlaps the Great Sandy Desert bioregion. The Project Area comprises open or sparse shrubs with Bassia spp or southern bluebush as well as spinifex and mulga over short grass.

In a recent ecological assessment study conducted by GHD, it was determined that vegetation within the Project Area is dominated by Mulga (*Acacia aneura*) over low woodland over Mulga tall shrubland, over Bunched kerosene grass (*Aristida contorta*), Erect Kerosene Grass (*Aristida holathera*), mid-high open tussock grassland. The Mulga low woodland was found to be in poor health, with nearly all the dominant Mulga trees found to be dead.

A second minor vegetation community was found in the study area characterised by 'Sandhill Wattle (*Acacia ligulata*), Rattle Pod Grevillea (*Grevillea stenobotrya*), Desert Heath Myrtle (*Aluta maisonneuvei*) tall open shrubland, over Bunched Kerosene Grass, Erect Kerosene Grass, mid-high open tussock grassland' [GHD, 2022]. The well pad was found to be populated with sparse Mulga regrowth. **Figure 5—13** presents the vegetation communities over the Project Area.

Further details are provided in **Appendix 01** (Ecological Assessment) [GHD, 2022].

## 5.10 Sites of Conservation and Botanical Significance

There are two Sites of Conservation Significance (SOCS) and three Sites of Botanical Significance (SOBS) within or intersecting the EP boundaries. The Karinga Creek Paleodrainage System (KCPS) is located 200km south of Alice Springs. It comprises both a Site of Conservation Significance and a Site of Botanical Significance. The KCPS is rated as internationally significant.

The KCPS is part of a larger chain of saline lakes that extend from Lake Hopkins in Western Australia to the Finke River in the Northern Territory. After substantial rainfall, the lakes, claypans and saltpans that comprise the KCPS fill and provide important habitat for more than 10,000 shorebirds and internationally significant numbers of the Banded Stilt, the Red-capped Plover, and the Sharp-tailed Sandpiper [L. HARRISON et al., 2009].

**Figure 5—15** shows the protected areas in the region. The locations of the well pad extension, gravel pits and campsite will not intersect with the KCPS; however, the existing public road access does traverse the fringes of the KCPS in two areas, spanning 12.3 km in total.

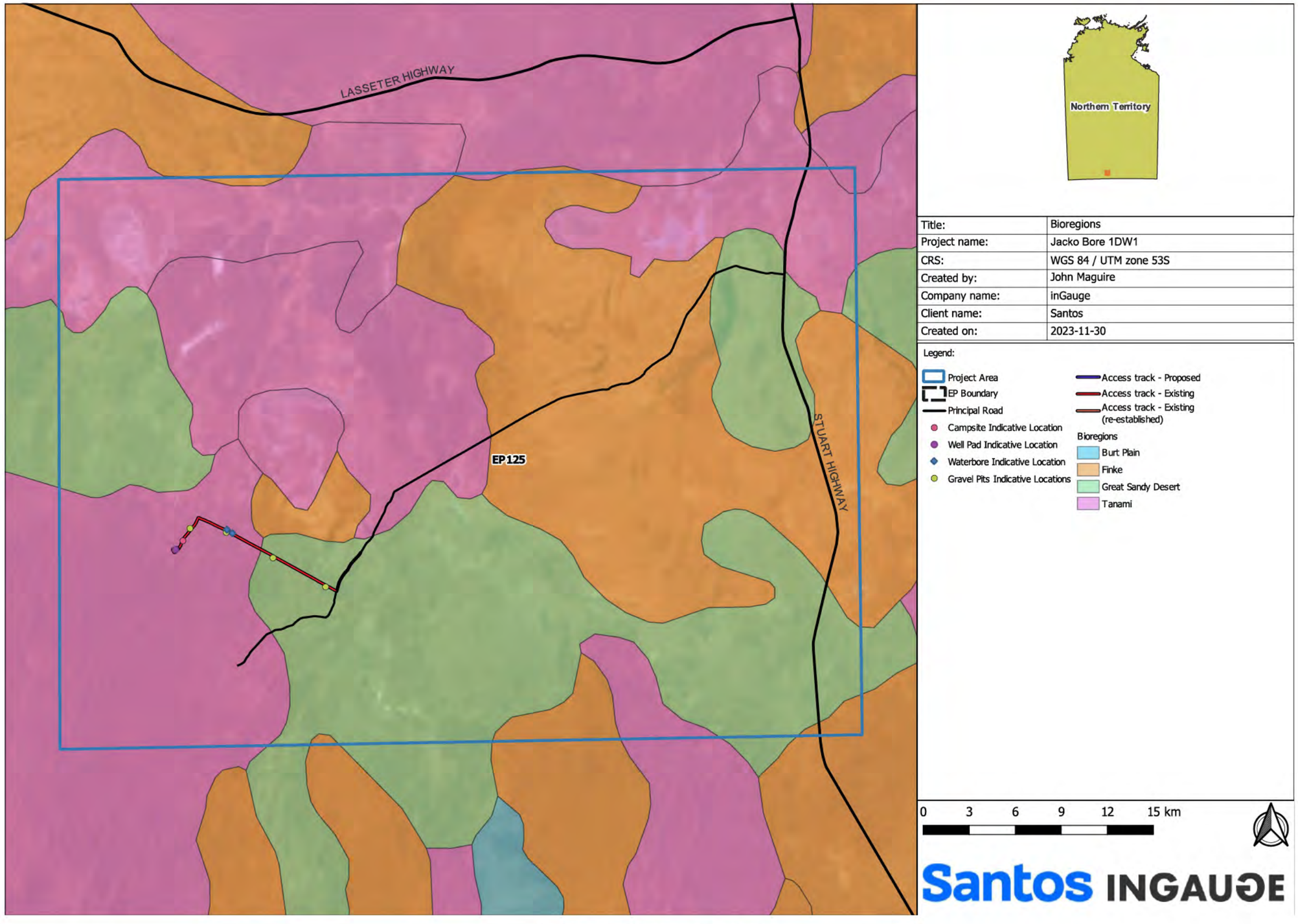



**Figure 5—13 Bioregions of the Project Area**

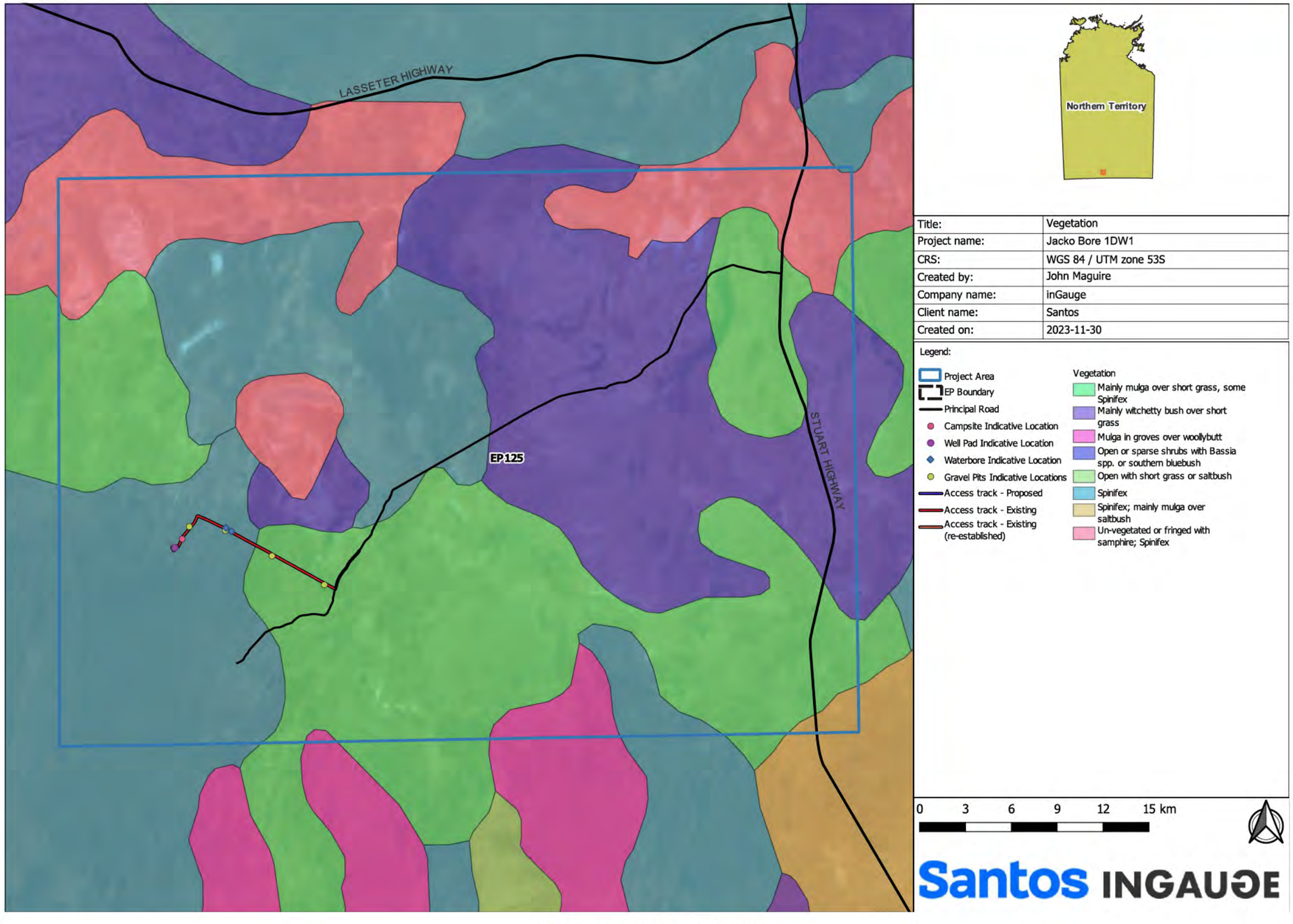



**Figure 5—14 Vegetation of the Project Area**

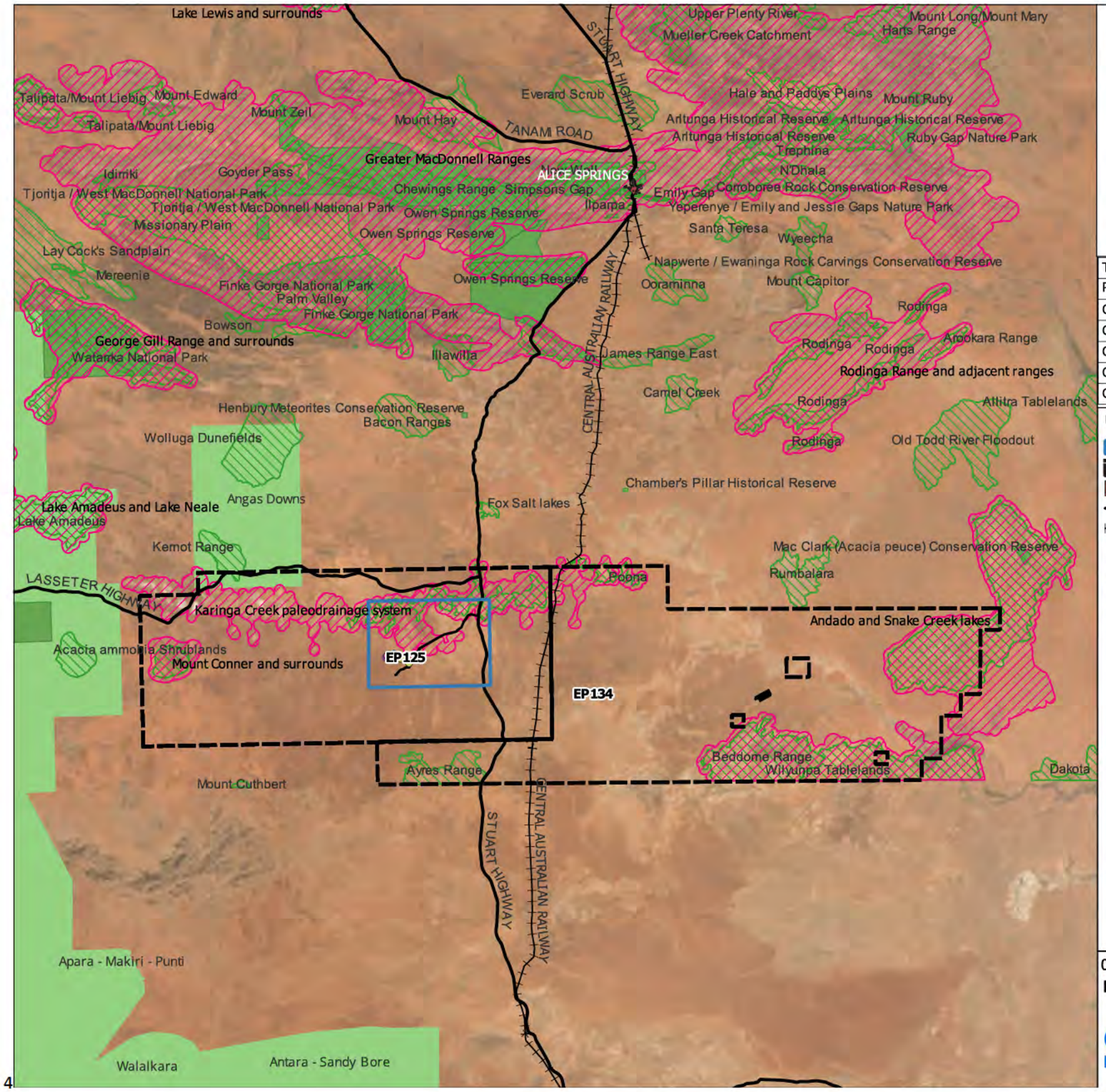



**Figure 5—15 Region Protected Areas**

## 5.11 Listed Threatened Species

In a recent ecological assessment study of the Project Area, GHD assessed the potential adverse impacts of the Activity on threatened species and communities within and adjacent to the Project Area and determined mitigation measures to avoid and reduce the risk of impacts.

To assess which threatened species are likely to occur in the Project Area, GHD performed a search of data from the NT Flora and Fauna Atlas in 2022, paired with findings from the Commonwealth Department of the Environment (DoE) Protected Matters Search Tool (PMST) [EPBC, 2021]. This data set was then assessed in relation to available habitats within the EP to determine the likelihood of species occurrence.

A rapid habitat assessment and vegetation and flora assessment was then undertaken, comprising two fauna ecologists and one flora ecologist, in October 2022. Daytime temperatures provided good conditions for bird, mammal, and reptile activity.

A comprehensive analysis of listed threatened species and their likelihood of occurrence in the Project Area is presented in **Appendix 01** (Ecological Assessment) [GHD, 2022]. The findings were used in the self-assessment process for the *EPBC Act*, discussed in **Section 2.5.2**. The findings of this process are summarised below:

- There were no threatened ecological communities identified in the PMST search area, which comprised the Project Area and a buffer zone of 20km. A Site of Botanical Significance, Karinga Creek, was identified 10km north of the Jacko Bore Study Area. This site has botanical significance within the Finke Bioregion and is within the Karinga Creek Paleodrainage System, which is recorded as an international site of conservation significance.
- The locations of the well pad extension, gravel pits and campsite do not intersect with the KCPS; however, the existing public road access to the Jacko 2 Bore well pad does traverse the area in two areas spanning 12.3 km in total. Controls to reduce the impact of spills on the access track are detailed in **Item 20** of **Appendix 04** (Risk Assessment).
- No Sites of Botanical Significance or Conservation Significance are located within the Study Area.
- One threatened flora species (*Frankenia plicata*) was identified as occurring or potentially occurring within the desktop search extent; however, no examples were identified within the Project Area. Frankenia plicata is listed as Endangered under the EPBC Act. No NT Flora Atlas records of this species occur within the NT. Habitat for the species occurs in South Australia on small hillside channels and on loamy sands to clay swales (DCCEEW, 2008). This habitat was not located during the survey and the species is unlikely to occur.
- The field assessment did not identify any threatened fauna species within the Project Area; however, there is potentially suitable habitat for two EPBC-listed threatened species, the Grey Falcon and Greater Bilby, for which detailed assessments of significant impacts were prepared based on the potential for these species to be adversely impacted by the Activity.
- Given the potential for the occurrence of the Grey Falcon and Greater Bilby, GHD completed a detailed assessment of significant impacts on Matters of National Environmental

Significance (MNES) under the EPBC Act for these species., which are listed as vulnerable and considered present or possible to occur within the Project Area as per historical records[DoE, 2013].

While the Grey Falcon was not observed during the ground survey, the survey did identify suitable foraging habitat but no potentially suitable breeding habitat in the Project Area (particularly tall trees along watercourses).

The Greater Bilby was also not observed in the ground survey. The Greater Bilby previously occurred widely across arid and semi-arid regions of Australia; however, within these areas, it is now restricted to the western deserts of the NT and WA. Within the NT, its distribution is highly fragmented. Records of the species in the Tanami region date from around the early 2000's. The most recent records are in regional SA and NSW (dated 2020 – 2021). Potentially suitable habitat is located within the Project Area; however, this habitat is in very poor condition, and it is considered unlikely the species would persist within the Project Area.

The detailed assessment of significant impacts for the Grey Falcon and Greater Bilby concluded that impact on these species is considered unlikely. This information is presented in **Appendix 01** (Ecological Assessment) [GHD, 2022]. This is based on the use of previously cleared land and the limited new clearing associated with the Activity, the implementation of the Fire Management Plan (**Appendix 08**),and the implementation of management actions for invasive species under this EMP.

## 5.12 Weeds and Introduced Fauna

### 5.12.1 Weeds

A weed survey for the Project Area was undertaken by GHD in October 2022, as part of an ecological assessment study. The report is available in **Appendix 01** (Ecological Assessment) [GHD, 2022].

Two weed species were recorded in the Project Area in very low densities during the field study – Buffel Grass (*Cenchrus ciliaris*) and Bitter Paddy Melon (*Citrullus colocynthis*). Neither are declared weeds under the *NT Weed Management Act* [DEPWS, 2001]; however, Buffel Grass is considered a Category 2 priority species in *The Alice Springs Regional Weeds Strategy 2021-2026* [DENR, 2018].

As noted in **Section 2.5.2**, the Project Area falls within the Athel Pine Statutory Weed Management Plan Class A zone, to be eradicated. This Plan states that athel pine can grow deep, woody root systems capable of penetrating up to 50m underground, enabling establishment in semi-arid and arid rangelands. It is also tolerant of saline and alkaline soils.

Athel pine tends to flourish in and around ephemeral river systems and wetlands. Since its introduction, athel pine has demonstrated highly invasive tendencies, establishing across large areas of inland Australia, where it has been implicated in lowering water tables, draining waterholes, and depriving native species of water and habitat. Athel Pine can also change river flow patterns and cause overland flooding and bank erosion.

The NT Statutory Plan shows locations where Athel Pine was recorded in 2021, and notes that it is well established throughout the Finke River Catchment Area. In particular, there were a number of

recordings along Karinga Creek, to the north of the Project Area, however, the public road access to the Jacko Bore 1 turnoff crosses some watercourse flowing to Karinga Creek.

Any new athel pine incursions near the well pad, campsite, gravel pit, water bores or access tracks will be reported to the NT Weed Management Branch by the Project's dedicated weed officer. Initial notification will be verbal, followed by written notification and location within seven working days.

Mitigation measures, monitoring and recording protocols, and responsible personnel are described in **Appendix 09** (Weed Management Plan).

**Table 5—6** shows the relevant introduced flora species (weeds) to the Project Area.

**Table 5—6 Relevant Weeds to the Project Area**

| Scientific Name | Common Name | NT Class | WoNS† | Weed Risk Status in Alice Springs Strategy 2012 – 2026 |
|---|---|---|---|---|
| ***Cylindropuntia spp.* including *C. imbracata, C. fulgida*** | Rope Cactus | A | - | Category 1, Very high |
| ***Opuntia spp.* including *Opuntia stricta*** | Prickly Pears | A | - | Category 1, Very high |
| ***Tamarix aphylla*** | Athel Pine | A/B | Yes | Category 2, Very High |
| ***Parkinsonia aculeata*** | Parkinsonia | B | Yes | Category 2, Very High |
| ***Cenchrus ciliaris*** | Buffel Grass | Not declared | - | Category 2, Very High |
| ***Eragrostis spp.* including *E. cilianensis, E. barrelieri, E. cylindriflora, E. minor*** | African Lovegrass* (several species) | Not declared | No | Class 3, *Medium |
| ***Argemone ochroleuca*** | Mexican Poppy | B | No | Class 3, Medium |
| ***Aerva javanica*** | Kapok | Not declared | No | Class 3, N/A |
| ***Acetosa vesicaria*** | Ruby Dock | Not declared | No | Class 3, Low |
| ***Cathamus lanatus*** | Saffron Thistle | B | No | Class 3, Medium |
| ***Cenchrus echinatus*** | Mossman River Grass | B | No | Category 4, Medium |
| ***#Tribulus terrestris*** | # Caltrop | B | - | Category 4, Low |

* Only *Eragrostis cylindriflora* has been assessed for weed risk.

# It is uncertain whether Caltrop (*Tribulus terrestris)* is considered native or introduced to the Northern Territory. It is a weed to be controlled around tracks, parks, and other infrastructure because their spiny fruit can cause nuisance.

† Weeds of National Significance.

The weed risk and mitigation measures are provided in **Table 5—7**.

**Table 5—7 Weed Risk and Mitigation Measures**

| Weed Risk | Mitigation Measures | Measurement Criteria | Responsible Person |
|---|---|---|---|
| **Introduction of new weed species** | • All vehicles/machinery/equipment entering the EP to be cleaned and free of soil and vegetative matter and have a valid weed hygiene declaration prior to entering. | • A register of vehicle/equipment/machinery inspection will be kept and maintained. | Dedicated Weed Officer |
| | • Site environmental inductions for all personnel and contractors to include vehicle weed hygiene requirements. | • All project staff undertake an environmental induction, recorded in the Training Register. | Dedicated Weed Officer |
| | • Spot checks on vehicle / equipment / machinery to ensure inspections are completed correctly. | • Recorded in register of vehicle/equipment/machinery inspection. | Dedicated Weed Officer |
| **Weed spread resulting from vehicles/plant traversing existing weed infestations** | • All personnel and contractors made aware of existing infestation locations and educated in the identification of priority weeds in the region. No vegetation clearing or vehicle movement in creek channels. | • All project staff undertake an environmental induction, to be recorded in the Training Register (as described in this EMP) Weed maps (of known occurrences/infestations) and factsheets included as part of environmental inductions. | Dedicated Weed Officer |
| | • Key operational staff to attend weed identification training delivered by the NT Weed Management Branch. | • To be recorded in the Training Register (as described in this **EMP**. | Dedicated Weed Officer |
| | • All vehicles, machinery, and equipment to stay on formed access tracks, except for those involved in clearing. | • Importance of staying on tracks covered in site induction. | Dedicated Weed Officer |

| Weed Risk | Mitigation Measures | Measurement Criteria | Responsible Person |
|---|---|---|---|
| | • Pre-clearance weed survey of areas to be cleared. | • Map all infestation so plan can be made to avoid spread. | Dedicated Weed Officer |
| | • All infestations of priority weeds will be demarcated and avoided, where possible. | • Maintain demarcation during operations and inspect (and rectify if needed) daily. | Field Representative |
| | • If infestations cannot be avoided, treat prior to traversing using methods set out in Section 6 of the Weed Management Plan (Appendix 09); or carry out washdown protocols at allocated area. | • Work plan to reflect additional tasks required. | Dedicated Weed Officer |
| | • Vehicles/plant to be cleaned and free of soil and vegetative matter prior to moving beyond all weed infestations/occurrences. | • Spot checks on vehicle/equipment/machinery to ensure inspections are completed correctly | Field Representative / Dedicated Weed Officer |

See **Appendix 09** for the complete **Weed Management Plan.**

### 5.12.2 Introduced Fauna

A search of the NT Fauna Atlas (DEPWS, 2022d) identified seven potential introduced fauna species in the study area, all mammals. These species are listed below:

- Cat (*Felis catus*)
- Camel (*Camelus dromedarius*)
- Cattle (*Bos taurus*)
- Fox (*Vulpes vulpes*)
- Horse (*Equus caballus*)
- House Mouse (*Mus musculus*)
- Rabbit (*Oryctolagus cuniculus*).

Predation by the Feral Cat is considered a high risk to the Grey Falcon, which will roost on the bare ground, making them vulnerable to Feral Cat predation [J SCHOENJAHN, 2018]. It is possible that clearing new tracks could make it easier for feral predators to move through areas of land that were previously unoccupied. However, in this respect, the Activity involves a small scale of vegetation clearance within widespread areas of potentially suitable habitat.

Uncontrolled waste (food) and inappropriate fire regimes also have the potential to increase introduced species. Food waste around construction areas and infrastructure would be properly managed to prevent predator numbers from increasing as a result of the Activity. Fire management is discussed in **Section 5.13** and **Appendix 08** (Fire Management Plan).

There is evidence that the Feral Cat and other invasive predators are already established within the Project Area.

[DEPWS, 2022A]. However, during the October 2022 field survey (**Appendix 01)**, of the seven introduced fauna species listed above, the only one observed within the study area was Cattle.

## 5.13 Fire Management

The Project Area is within the Finke bioregion, specifically within the Tieyon and Finke sub-regions. This area is characterised as open grassland savannah comprised of low sandstone ranges, weathered tablelands, and rounded metamorphic hills and dunes.

The Project Area has been primarily pastoral land, with infrequent fires within the region. According to fire scar data from the Northern Australia Fire Information website, a small part of the Project Area was burnt in 2022, and all other fires were prior to 2019 (**Figure 5—16**). There has not been a large-scale burn in the area for ten years; thus, it could be concluded that the Project Area has re-established fuel loads.

The Project Area exists within the Alice Springs Fire Management Zone in the Northern Territory. The Interest Holder's Fire Management Plan (**Appendix 08**) has been created in line with the Alice Springs Bushfires Management Plan [DENR, 2018]. Fire breaks will be constructed around the well pad and campsite during civil construction works and maintained during operations as required.

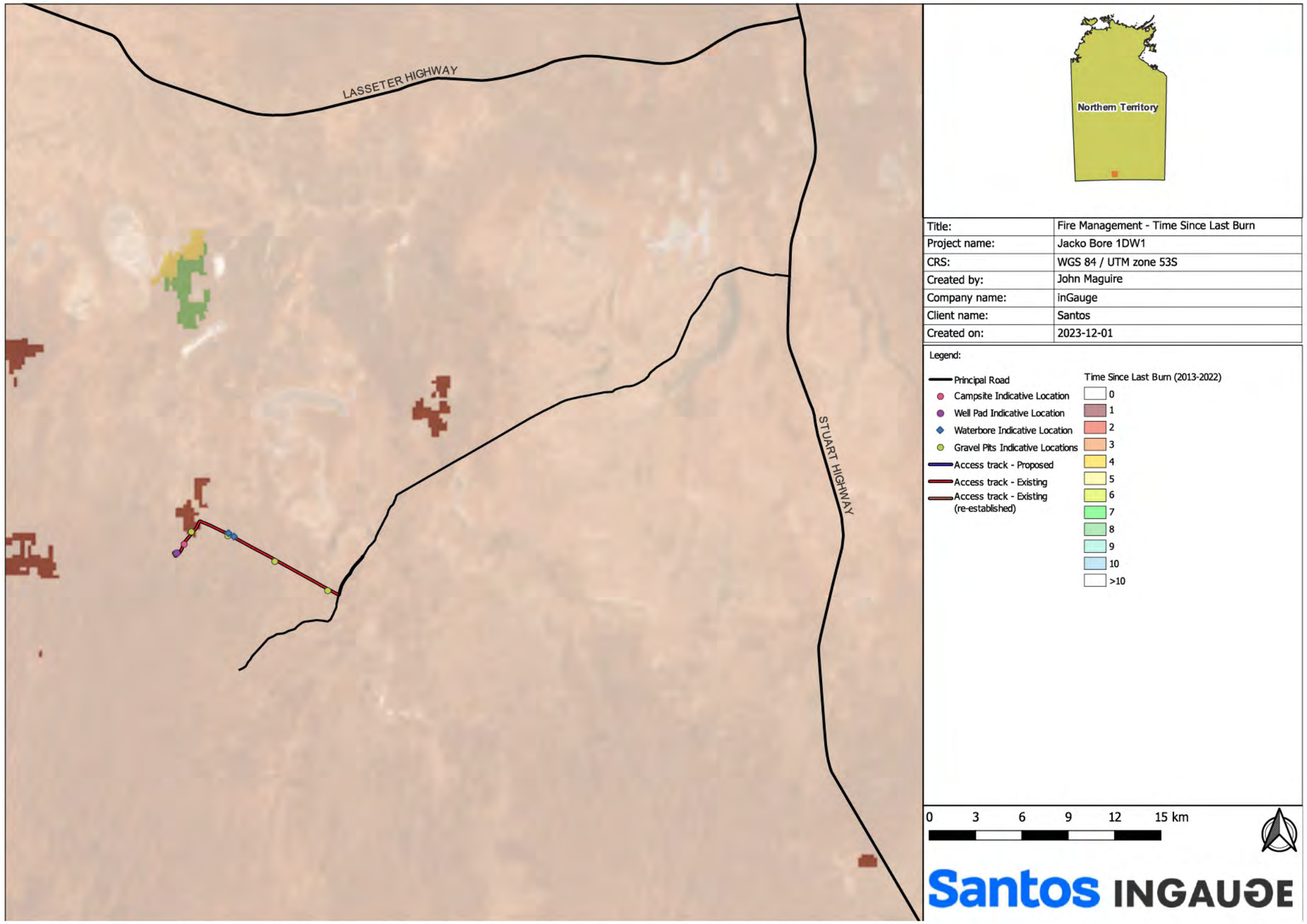



**Figure 5—16 Time Since Last Burnt**

## 5.14 Cultural Environment

### 5.14.1 Historical Heritage

A historical heritage assessment of the proposed Activity location was conducted in November 2022. The assessment included an archaeological field survey across the areas subject to works for the Jacko Bore 1DW1 construction, access roads and track upgrades from the Stuart Highway to the well pad site. The archaeological survey was undertaken by archaeologist Allan Lance of Heritage Consulting Australia, assisted in the field by Land Access Consultant Peter Rogers. The report is attached as **Appendix 02.**

Archaeological places or objects from early exploration and works in the region following European settlement occur outside of the Project Area. According to the survey's report, it is unlikely for significant places or objects to be present near the access roads and tracks or the Activity.

No sites of Territory or National significance have been recorded within 80km of the Project Area. Searches undertaken of the Commonwealth Register of National Estate and the NT Heritage Register support this. Only historical heritage items of local historical interest were identified in the Project Area and surrounding area and were of 'no special archaeological significance'. These items are not at risk from the Activity [ALLAN LANCE, 2022B].

The report recommends that no further archaeological survey is needed unless historical heritage items are discovered during the Activity. If archaeological places or objects are discovered, they will be reported to the NT Heritage Office.

The Interest Holder has applied for and received an Aboriginal Areas Protection Authority (AAPA) certificate. Details of the application and AAPA certificate are summarised below.

### 5.14.2 Sacred Sites and Aboriginal or Macassan Archaeological Places and Objects

#### 5.14.2.1 ***AAPA Certificate***

The original AAPA certificate application was formally accepted on 17 August 2022. The AAPA quote to commence the certification process and engage with Traditional Owners was approved on 31 August 2022. A subsequent application was accepted on 22 May 2023 and a variation to certificate C2023/018 was received on 30 May 2023. The reference to the varied certificate is given below.

The AAPA application contained a description of the Activity and details for consideration against known sacred sites. The conditions in the AAPA Certificate are detailed in Section **3.5.2** Site Selection – Land Types and Working Corridors. Should a sacred site be identified during the AAPA certification process that may be impacted by the planned Activity, solutions will be developed to protect the sacred site, in accordance with the conditions of the AAPA certificate.

The varied AAPA Certificate details are as follows:

- Document Number: 202305831
- C2023/054 variation to C2023/018

A stakeholder communications log is attached as **Appendix 11.**

#### *5.14.2.2 Sacred Site Clearance Certificate*

The Interest Holder received an approved Sacred Site Clearance (SSCC) certificate (#C2022-019) from the Central Land Council (CLC) dated the 6th of May 2023. There are two special conditions of the SSC certificate:

- There are two restricted work areas (RWA1-2) imposed identified by green border, green hatching and GPS coordinates located on the map on Annexure A. Entry into these restricted areas is subject to these conditions:
    - **RWA-1**: No new gravel pits or bores are permitted to be established, and no horizontal drilling is permitted (see **Figure 5—17**).
    - **RWA-2**: The existing disturbed track may be widened in this area if necessary. No other works are permitted (see **Figure 5—17**).
- One Alternative Subject Land (ASL) is established. Access is permitted into the ASL only for the purpose of:
    - The drilling program as outlined for Jacko Bore 1DW1 or a re-drill at the Jacko Bore 1 location.
    - All operational infrastructure (including campsite, laydown, storage areas, drill pads, flare pits, gravel pits, sumps, bores, turkey nest and storage tanks).

The Interest Holder is committed to complying with the conditions in the SSC certificate. Furthermore, the Interest Holder will uphold the requests made by Traditional Owners for the following:

- Traditional Owners have requested to visit the drill sites during the drilling program.
- The Interest Holder will have a meeting with Traditional Owners following the completion of the exploration program to explain the results and provide an update.
- The name be changed from Mt Kitty to Jacko Bore (this request has been complied with).
- As per the ILUA Agreement (Article four), Traditional Owners have asked to be included in employment opportunities related to the works.

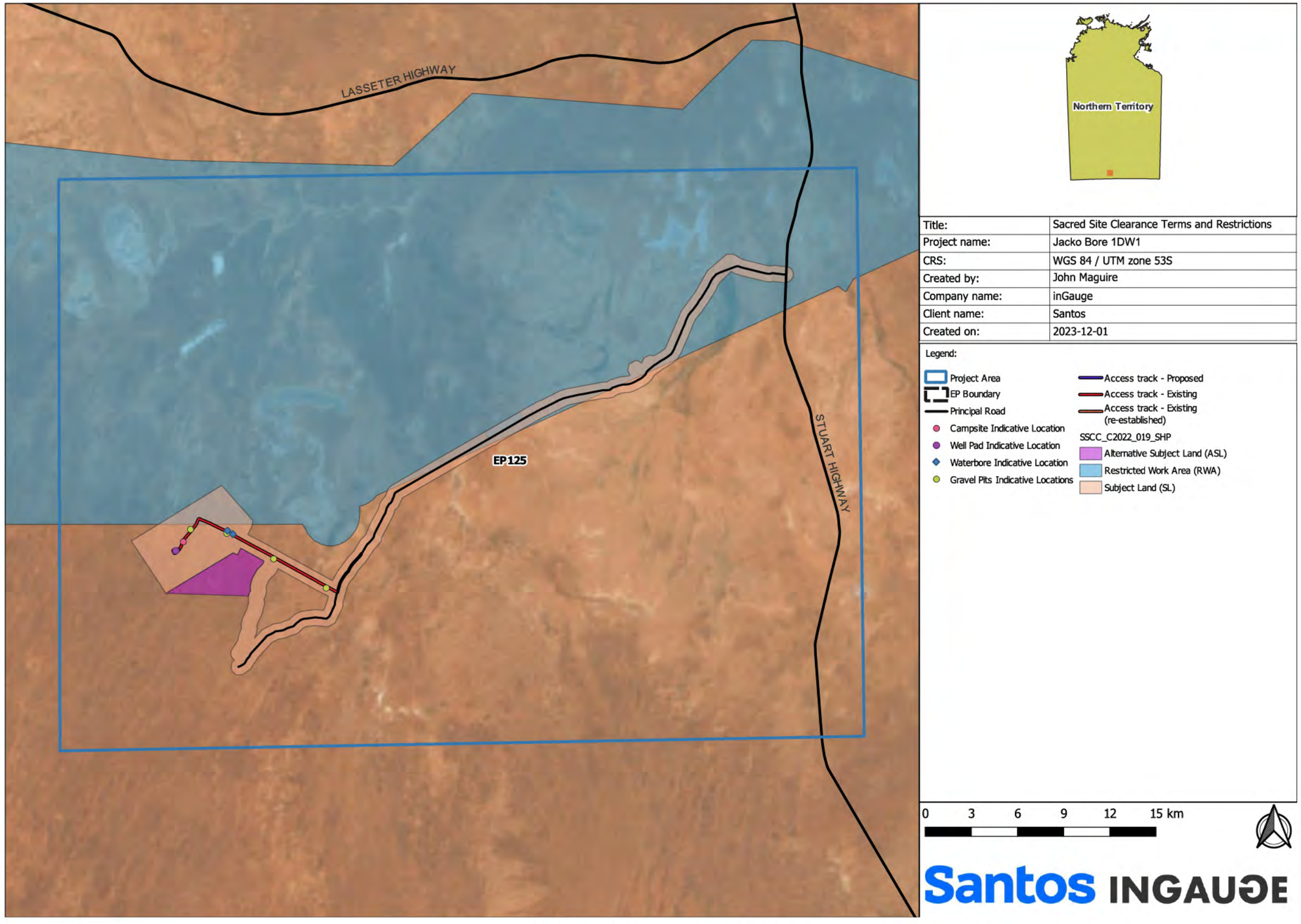



**Figure 5—17 Sacred Site Clearance Terms and Restrictions**

#### 5.14.2.3 ***Heritage Discoveries***

Any unexpected heritage discoveries will be managed in line with the agreed processes described in the ILUA and the Interest Holder's Santos Management System (SMS) 'SMS-EXA-OS02-PD02 – Cultural Heritage Procedure and policies if a suspected find of Aboriginal or non-Aboriginal cultural heritage is made during civil construction works under this EMP.

If suspected previously unrecorded sacred sites or Aboriginal or Macassan archaeological places or objects are uncovered during the Activity:

1. All work within a 50 m radius of the cultural material must stop immediately.
2. This area must be flagged appropriately as a temporary exclusion zone to ensure that no further work activities can be undertaken within it.
3. Work within the temporary exclusion zone must not commence again until instructed by the Cultural Heritage and Aboriginal Engagement (CH&AE) Team.
4. Report the discovery immediately to the responsible manager.
5. The responsible manager must contact the applicable CH&AE Team member immediately to report the discovery.
6. The CH&AE Team member must instigate the new discovery process as per the applicable cultural heritage agreement.
7. Following the completion of the new discovery process, the CH&AE Team must implement any required site management actions and advise the responsible manager that work can recommence.

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:

1. All work within a 50 m radius of the potential human skeletal material must stop immediately.
2. This area must be flagged appropriately as a temporary exclusion zone to ensure that no further work can be undertaken within it.
3. Work within this Temporary Exclusion Zone must not commence again until instructed by the CH&AE Team.
4. Report the discovery immediately to the responsible manager.
5. The responsible manager must contact the applicable CH&AE Team member immediately to report the discovery.
6. The CH&AE Team must engage a suitable expert to determine if the skeletal material is human.
7. If the expert determines that the material is human or likely to be human, the CH&AE Team must notify the applicable Coroner's department of the discovery. - .

8. The CH&AE Team must attach a copy of this procedure to each approved Cultural Heritage Assessment Request (CHAR).
9. The responsible manager must communicate the requirements of this procedure to workers.

## 5.15 Socio-economic Environment

### 5.15.1 Regional Economy

The dominant economy in the region is pastoralism and grazing, as directed under the *NT Pastoral Land Act* [DIPL et al., 1992].

Alongside pastoralism, the local economy is boosted by tourism. Current regional tourism focuses on Uluru, Kata Tjuta, the Mac Clark (*Acacia peuce*) Conservation Reserve, the Henbury Meteorite Craters, the Illamurta Springs Conservation Reserve, the 4WD Binns and Finke tracks, and those wanting to visit some of Australia's pastoral history (e.g., Charlotte Waters Telegraph Station and Old Andado Station). [DTFHC, 2022].

All of these tourist destinations are outside of EP125, and the Activity will not impact these regional tourism focuses.

### 5.15.2 Settlements

The region immediately surrounding the Project Area mainly comprises pastoral properties and is sparsely populated. The Lyndavale homestead, 8.5 km southeast of the well pad, is the only settlement within the Project Area (**Figure 5—18**). Erldunda homestead is the next closest to the Project Area, located approximately 10km north, about 3km south of the intersection of the Stuart Highway and the Lasseter Highway.

Ghan, located at the intersection of the Stuart and Lasseter Highways, is the nearest township community to the Project Area. The Erldunda Desert Oaks Resort tourist stop is located here.

### 5.15.3 Indigenous Protected Areas

Indigenous Protected Areas (IPAs) are 'areas of land and sea country managed by Indigenous groups in accordance with Traditional Owners' objectives. The Angas Downs IPA is an Aboriginal-owned 320,500-hectare pastoral lease 300 km southwest of Alice Springs and 135 km east of Uluru-Kata Tjuta National Park. The property was formally declared an IPA in 2009 and forms part of Australia's National Reserve System.

Before 2009, Angas Downs had been damaged by land management practices, and many native species had disappeared. Through IPA programs and government initiatives, Anangu Rangers and the Imanpa community are restoring the land and its cultural sites. As the IPA is located approximately 50 km from the Jacko Bore 1DW1 well pad site, with access off the Lasseter Highway, it is not anticipated that there will be any impacts on the IPA.

### 5.15.4 Petroleum Reserve Block Policy

The NT Government has a Petroleum Reserved Block Policy, which sets out Petroleum Reserved Block areas where petroleum exploration is not permitted.

The Project Area does not lie within a Reserved block or contain any Proposed Reserved Block as identified in the *NT Government's Petroleum Reserved Block Policy*, July 2019 [NT Government, 2019].

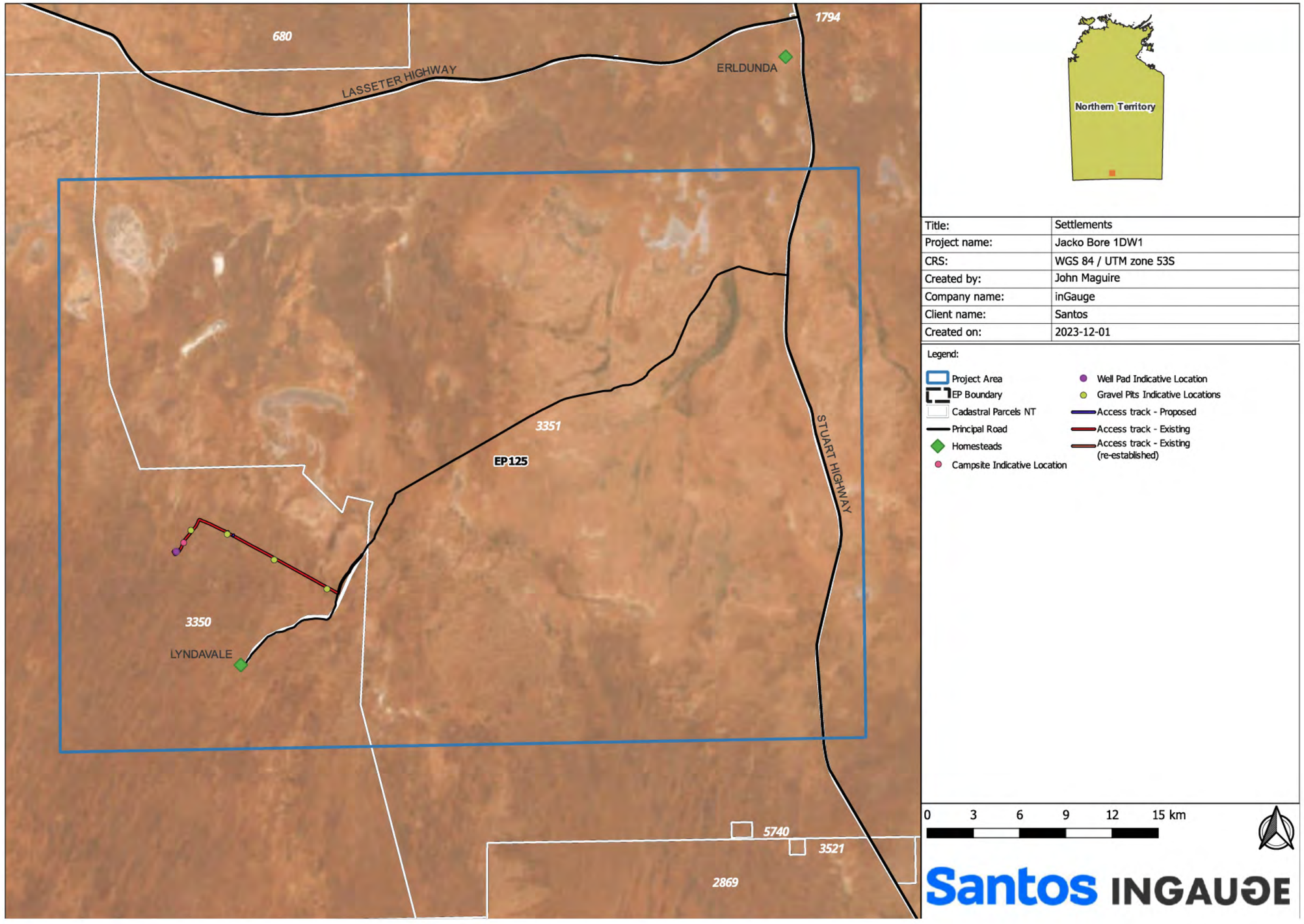



**Figure 5—18 Project Area – Settlements**

### 5.15.5 Environmental Risk Assessment Methodology

An environmental risk assessment has been undertaken for the proposed exploration Activity using the methodology outlined in **Appendix 03** (Environmental Risk Assessment Framework).

This risk assessment has been collaboratively conducted by suitably qualified, multidisciplinary personnel. Their details are presented in **Table 5—8**.

**Table 5—8 Risk Assessors**

| Risk Assessors | | |
|---|---|---|
| **Name** | **Title** | **Years of Experience** |
| **Trent Smith (inGauge)** | HSE & Compliance Manager | 20 |
| **Nicholas Fraser (inGauge)** | Environmental Engineer | 9 |
| **Ron Anderson (Santos)** | Lead EHS Compliance Adviser | 35 |
| **Joshua Gilroy (Santos)** | Lead Environmental Approvals Adviser | 30 |
| **Steve Roberts (Santos)** | Lead Drilling & Completions Project Engineer | 18 |
| **Mark Gilmour (Santos)** | Senior Staff Drilling Engineer | 15 |
| **Jonathon Hyde (Santos)** | Lead Amadeus Basin | 15 |
| **Lisa Dallow (Santos)** | Project Lead | 25 |

### 5.15.6 Risk Assessment

The Interest Holder has identified the risk in context of the consequence and likelihood of an environmental impact associated with the proposed Activity with the assistance of multi-disciplinary personnel.

All potential risks to the environment within the Project Area that are associated with the Activity are to be reduced to ALARP. ALARP is achieved when all the requirements of *the Code* have been met, and all reasonably practicable risk management controls have been identified and implemented as described in **Appendix 03** (Environmental Risk Assessment Framework).

The complete list of risks and the associated risk management controls to prevent, detect and mitigate potential impacts are presented in **Appendix 04** (Environmental Risk Assessment).

By identifying risks and implementing controls to reduce these risks to ALARP, this EMP aims to achieve the following environmental outcomes, which are adapted from the Northern Territory Environment Protection Authority's *Environmental Impact Assessment General Technical Guidance*, 2021 [NT EPA, 2019]:

- 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.

Measurement criteria are provided in **Section 7.7**. A summary of the environmental factors and key risks is presented in **Table 5—9**.

**Table 5—9 Summary of Key Environmental Risks**

| Environmental Factors | The Activity | Key Risks |
|---|---|---|
| **Air Quality and Atmospheric Processes** | • Establishing/constructing the well pad expansion, new access tracks and campsite.<br>• Drilling, completions, and Extended Product Testing (EPT) mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Greenhouse gas emissions from land clearing, vehicle use and flaring.<br>• Generation of dust. |
| **Community and Economy** | • Establishing/constructing the well pad expansion, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Damage to public and private roads.<br>• Nuisance (noise, light and dust).<br>• Spread of biosecurity risk material.<br>• Completion of the Activity without input/involvement of local businesses or people.<br>• Bushfire. |
| **Culture and Heritage** | • Expansion of the well pad and the construction of new access tracks. | • Disturbance or damage to artefacts and/or cultural heritage sites. |
| **Human Health** | • Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity | • Nuisance (dust, noise). |
| **Inland Water Environmental Quality** | • Establishing/constructing the well pad expansion, new access tracks and campsite.<br>• Drilling, completing, and testing a new well on the existing pad.<br>• Movement of heavy and light vehicles to complete the Activity. | • Sediment release from cleared infrastructure.<br>• Constructed infrastructure impedes natural surface water flow.<br>• Loss of drilling fluid to groundwater while drilling.<br>• Loss of well control.<br>• Overflow of drilling by-products storage pits.<br>• Leak in drilling by-product storage pit liner.<br>• Spills of fluid additive, chemical or fuel storage and handling points.<br>• Spills of chemical or wastewater during transport, e.g., within KCPS SOCS/SOBS buffer. |
| **Landforms** | • Establishing/constructing the well pad expansion and new access tracks. | • Change to previous landscape and visual amenity/aesthetics. |
| **Terrestrial Ecosystems** | • Establishing/constructing the well pad expansion, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Impact on fauna movements from new infrastructure, noise, or light.<br>• Entrapment of fauna or stock in drilling by-product storage pit. |
| **Terrestrial Environmental Quality** | • Establishing/constructing the well pad expansion, new access tracks and campsite.<br>• Drilling, completions and EPT mobilisation, operation, and de-mobilisation.<br>• Movement of heavy and light vehicles to complete the Activity. | • Change or degradation of habitat features.<br>• Sediment release from cleared infrastructure.<br>• Spread of biosecurity risk material.<br>• Pooling of runoff of greywater and treated sewage effluent from irrigation areas.<br>• Spills at fluid additive, chemical or fuel storage and handling points.<br>• Spill of chemical or wastewater during transport.<br>• Bushfire.<br>• Rehabilitating site to previous land use standards or an acceptable level for continued landowner use. |

### 5.15.7 Assessment of Risk Against Land Clearing Guidelines

*The Land Clearing Guidelines* (LCG) determine that riparian zones should not be cleared; however, where clearing is required, it must be demonstrated that the impact is not significant in a regional context [DEPWS, 2020, 2021]. The LCG provides processes for determining the risk to threatened species and regional biodiversity due to clearing. The following summarises how the EMP addresses the LCG requirements.

The clearing footprint has been assessed against the requirements of the *Land Clearing Guidelines* to determine whether the proposed Activity will significantly impact threatened species and regional biodiversity.

The proposed Activity under this EMP will not result in land clearing in riparian zones and buffers as defined in the *Land Clearing Guidelines.*

In summary, the Interest Holder will undertake clearing for the following:

- Expansion of the well pad and the creation of new access tracks:
    - All well pads, campsites, gravel pit/s and new access tracks are proposed to be located outside of riparian zones and associated buffer areas.
- There is no proposed clearing of high-value vegetation, riparian zones or their buffers, or areas of high density of hollow-bearing trees.
- The Interest Holder will avoid clearing undisturbed native vegetation where practicable, as it may provide suitable foraging habitat for the Grey Falcon.
- Construction methodology for all clearing is discussed in further detail in **Appendix 02**.

### 5.15.8 Clearing Footprint Assessment

The information that has been considered at the clearing footprint scale in line with the LCG and the Interest Holder's findings regarding the land clearing for the Activity under this EMP is:

- The area (location and extent) of native vegetation proposed to be cleared (i.e., the proposed clearing footprint).
- The proposed clearing footprint is shown in **Figure 3—3.**
- The type and general condition (e.g., 'intact', 'previously cleared', 'disturbed' or 'cleared') of the native vegetation) proposed to be cleared.
- Access tracks are on previously cleared land (e.g., seismic tracks and existing pastoral tracks).
- The flora and/or fauna species and their habitat that are likely to occur within the proposed clearing footprint.

The Interest Holder believes, given the area of clearing proposed and the large area of potential habitat within the region, that the proposal does not pose a significant risk to regional populations of these species.

### 5.15.9 Regional Level Assessment

The regional context assessment considered the area surrounding the disturbance footprint. The Interest Holder has defined the area surrounding the disturbance footprint as the Project Area, which is a smaller area than the catchment or bioregion recommended in the LCG. Using the smaller Project Area gives the disturbance a higher impact percentage than if benchmarked against the catchment or bioregion recommended in the LCG. The extent of the Project Area used for benchmarking is shown in **Figure. i.**

The information that has been considered regarding the land clearing for the Activity under this EMP is as follows:

- The composition and extent of remnant vegetation (i.e., intact/uncleared native vegetation).
- All of the Project Area, and the majority of the Amadeus Basin, is used for pastoral purposes and, therefore, are impacted by grazing, as observed during baseline surveys of the Project Area. Further details are presented in **Appendix 01.01**.
- Connectivity between areas of remnant vegetation.
- Fragmentation is not considered significant because the width of the clearing is either isolated, not sufficient to impede fauna movement or both.
- The relative importance of the affected vegetation as habitat for threatened or significant species.
- There are no new watercourse crossings under this EMP.

### 5.15.10 Surrounding Land Uses

The surrounding land is utilised for grazing stock; as such, the clearing for the Activity under this EMP will have a negligible impact due to the limited clearing and its isolation.

### 5.15.11 Biodiversity

The Interest Holder has assessed the overall risk to biodiversity on the likelihood of occurrence of biodiversity values in line with Table 17 of the *LCG*, the potential impact of the clearing on those values, and any measures proposed to reduce potential impact with a focus on the conservation of significant biodiversity values.

Based on the information gathered from the Ecological Assessment by GHD (**Appendix 01**) and a desktop review of the Project Area with a 20 km buffer:

- One threatened fauna species was predicted to occur within the desktop search area.
- An Assessment of Significance was conducted.
- No threatened fauna species of communities were observed during the ground survey.
- No listed threatened flora species or TECs were identified to occur.

Based on this information, the Interest Holder referred to the LCG and assessed the risk to biodiversity as a low for the Activity under this EMP. Furthermore, given the mitigation measures listed throughout this EMP and Appendices, there is unlikely to be an impact reducing the risk to ALARP and acceptable.

# 6 Management Plans Overview

## 6.1 Weed Management Plan

An Activity-specific weed management plan has been developed as part of this EMP. This management plan is summarised in the table below. Refer to **Appendix 09** for the complete plan.

**Table 6—1 Weed Management Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| 1 | **Introduction** | • Scope and objectives. The key objective is to set out the weed management measures to be implemented to prevent the introduction and spread of weeds during the works associated with the Activity in compliance with applicable legislation, regulations, conditions, and regional weed management plans.<br>• The appointment of a Dedicated Weeds Officer with the relevant skills, experience, and availability to successfully manage weed-related issues for the Activity.<br>• The role of the SMS. |
| 2 | **Project Area** | • This provides an overview of the Project Area and activities, which is detailed in **Section 3** of this EMP. |
| 3 | **Legislation** | • This section sets out the relevant legislation, statutory obligations, guidelines, and regional weed strategies regarding weed management for the proposed Activity. |
| 4 | **Weed Data** | • This section provides a desktop review of the NT Weed Branch dataset and the results of a baseline weed survey. **Table 5—6** shows the relevant introduced flora species (weeds) to the Project Area.<br>• As discussed above in **Section 5.12.1**. |
| 5 | **Weed Risk Mitigation Measures** | • This section provides the mitigation measures and measurement criteria to prevent the introduction of new weed species and to prevent weed spread. These measures are also provided in **Table 5—7** of this EMP. |
| 6 | **Annual Action Plan** | • Details the survey and control measures for weeds recorded in the Project Area. Weed monitoring will be undertaken post-disturbance (after suitable rainfall to allow germination/growth) to detect and map the extent of any infestations so that controls can be applied. |
| 7 | **Weed Monitoring** | • This sets out requirements for weed monitoring within the Project Area (known weed infestations, access tracks, infrastructure, campsite and gravel pits). |

| # | Section Title | Summary |
|---|---|---|
| | | • Weed recording, reporting and notification in accordance with the NT Weed Data Collection Guidelines.<br>• Any Athel Pine incursions near the well pad, gravel pits, campsite, water bores or access tracks will be reported to the NT Weed Management Branch by the Project's dedicated weed officer. Initial notification will be verbal, followed by written notification, including location within seven working days. |
| **App. A** | **Weed Hygiene Declaration** | • This Appendix provides a Weed Hygiene Declaration for all vehicles and equipment undertaking activity on the Project. |
| **App. B** | **Weed Control Recording Template** | • This Appendix sets out a Weed Control Recording Template to be used to record, report, and notify weeds recorded in the Project Area. |

## 6.2 Fire Management Plan

An Activity-specific fire management plan has been developed as part of this EMP. This management plan is summarised in the table below. Refer to **Appendix 08** for the complete plan.

**Table 6—2 Fire Management Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| **1** | **Introduction** | • The key objectives of the development and implementation of the Fire Management Plan are listed.<br>• The arrangements for the mitigation, management, and suppression of bushfires in the region are set out. |
| **2** | **Analysis of Baseline Information** | • Baseline fire information was sourced from The North Australia and Rangelands Fire Information website.<br>• Information was obtained on fire frequency and last burns in the region in the last 10 years.<br>• The information obtained shows that the recorded burns are confined to a small area in the northwest of the Project Area. The closest part of this area is about 13 km from the proposed Jacko Bore 1DW1 well pad site. Most of this small area had one fire 8 years ago, with a small part of the area, about 18 km from the proposed well pad site, having 2 fires, the most recent 4 years ago. |

| # | Section Title | Summary |
|---|---|---|
| 3 | **Impacts of the Proposed Activity on Existing Fire Management** | • This section provides an overview of the objectives of the Bushfires Management Act to support community-wide fire management within the Alice Springs Fire Management Zone, as set out in the Department of Environment and Natural Resource's *Alice Springs Bushfires Management Plan* (ASPBMP) [DEPWS, 2016, 2018; NT GOVERNMENT, 2018].<br>• The Project Area is located within the Lyndavale pastoral lease (PMB 66209), with access to the location of the proposed Activity via a public road that traverses the Erldunda pastoral lease (PMB 122). The Interest Holder will undertake the Activity with minimal impact on these primary users, in accordance with the ASPBMP objectives [DEPWS, 2018]. |
| 4 | **Coordination with Landholders and other Land Users** | • The Interest Holder has ensured that the Activity will not affect the pastoralists' fire management obligations and strategies and will comply with the ASPBMP objectives.<br>• The Interest Holder will actively monitor seasonal conditions and the fuel load in the cleared areas during the Activity [NAFI, 2021]<br>• Existing fire access trails and fire breaks will be reinstated or constructed around the re-established campsite and the well pad.<br>• There is currently no requirement for controlled burns for the works under this EMP, and no controlled burns will be carried out by the Interest Holder in the cleared footprint.<br>• Fire danger periods and alerts will be provided by BOM.<br>• Fire control measures. The Interest Holder will have fire response equipment on-site when the site is manned and will establish and maintain fire breaks.<br>• Annual Fire mapping to monitor any changes to fire frequency in the Project Area will be conducted. 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. |
| 5 | **Infrastructure Design, Construction, and Operation** | • The campsite and well pad expansion infrastructure will be designed/constructed with a ring-fire access trail/fire break ~10m from the fence line. The area between the fire access trail and the fence line will have vegetation removed to create a reduced fuel load to minimise the risk of causing a fire in the surrounding environment. |

| # | Section Title | Summary |
|---|---|---|
| | | • Flaring works associated with EPT will occur within a 25m vegetation exclusion zone radius.<br>• All plant and equipment will be maintained as per the Original Manufacturer's requirements.<br>• Firefighting and protective equipment will be kept on hand when the site is manned. |
| | **Emergency Contacts** | • This section lists relevant emergency contact details. |

## 6.3 Rehabilitation Plan

An Activity-specific rehabilitation management plan (RMP) has been developed as part of this EMP. Refer to **Appendix 12** for the complete plan.

**Table 6—3 Rehabilitation Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| **1** | **Introduction** | • The RMP outlines the rehabilitation of sites no longer required for ongoing or future works. The RMP has been developed using the *Rehabilitation Plan Guide for Surface Disturbance: Onshore Petroleum Disturbance* [DEPWS, 2020].<br>• The RMP applies to the land disturbance associated with access tracks, the proposed well pad (Jacko Bore 1DW1), and the re-establishment of gravel/borrow pit/s and campsite required for the Activity. |
| **2** | **Environmental Descriptions and Risks** | • This section provides an overview of the environmental aspects of the Project area. The key aspects are the management of removed topsoil; the presence of weeds of concern (e.g., Athel Pine); cattle grazing. topsoil compaction. and erosion risk management. The proposed controls to manage these aspects are summarised. |
| **3** | **Strategy for Final Land Use** | • Confirmation of the Interest Holder's commitment to returning the land to as close to possible to its pre-disturbed condition.<br>• Analogue sites will be chosen to reflect the landforms being disturbed by the Activity to assess the rehabilitation measures' success. |

| # | Section Title | Summary |
|---|---|---|
| 4 | **Rehabilitation Success Criteria** | • This section defines the objectives for rehabilitation success, including returning the landform to close to the pre-disturbance level, requiring little or no ongoing management.<br>• Measurement criteria are presented to assess the rehabilitation success against the objectives. |
| 5 | **Rehabilitation Works** | • This section presents the pre-planning and design for the rehabilitation works. This includes utilising existing tracks where possible.<br>• Positioning new infrastructure on locations with <2% slope (where practicable); and considering a 1 in 100-year return period flood event.<br>• Site stabilisation and maintenance measures are described.<br>• Annual monitoring at the end of the wet season will continue until the Minister is satisfied with the restoration of the disturbed areas. |
| 6 | **Monitoring and Maintenance Program** | • A monitoring and measurement program is presented to assess the rehabilitation success of areas being progressively rehabilitated. The program sets out the survey methods, measurable attributes, corrective actions, and ongoing maintenance and reporting for each of the Activity phases. |
| 7 | **Rehabilitation Plan on a Page** | • A tailored one-page rehabilitation plan will be developed, giving an overview of the plan, including relevant contacts, location figures, rehabilitation risks, pre-disturbance land condition summary, and rehabilitation management zones and objectives. |

## 6.4 Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan (ESCP) has been prepared for this EMP. The ESCP is attached as **Appendix 05**.

**Table 6—4 Erosion and Sediment Control Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| 1 | **Introduction** | • The ESCP has been prepared to provide a best-practice framework for the implementation of effective erosion and sediment control throughout the well construction works.<br>• The ESCP applies to all aspects of the Activity, including the land disturbance associated with access tracks the proposed well pad (Jacko Bore 1DW1), and the re-establishment of gravel/borrow pit/s and campsite required for the Activity. |
| 2 | **Site Characteristics** | • This section provides an overview of site characteristics relevant to erosion and sediment control, including climate and rainfall; landform class and description; soil type and description; and a figure showing 1m contours for the main Activity area. |
| 3 | **Erosion Hazard and Risk** | • This section describes the inputs and equations used to assess erosion hazard and risk for the Activity.<br>• Erosion hazard within individual project sub-catchments was assessed using the Revised Universal Soil Loss Equation – RUSLE (IECA 2008). This is commonly used to predict the long-term, average, and annual soil loss from sheet and rill erosion under specified management conditions.<br>• The inputs to RUSLE are rainfall erosivity (R–factor), erodibility (K-factor), slope (LS–factor), cover and management factor (C–factor), and erosion control practice factor (P–factor).<br>• The estimated soil loss using RUSLE was 25t/ha/yr (maximum), representing a very low erosion hazard for the construction of the road access and the associated well pad. |
| 4 | **Erosion and Sediment Control Measures** | • This section details the ESC measures for the ground-disturbing works, for the individual area of the drill pad, site access roads, borrow pits and ancillary areas.<br>• The drill pad will be constructed by blading and/or slashing of vegetation within the approved boundary, avoiding surface ground cover and soil disturbance as far as practicable. The rehabilitation of the well pad area will be in a staged manner as site activities are completed. |

| # | Section Title | Summary |
|---|---|---|
| | | • For access roads, route selection will aim to minimise disturbance to soil and vegetation, minimise the number of watercourse and drainage line crossings, reduce catchment areas above the road or track, and avoid sensitive areas. As necessary, cross banks will be used, and sediment control measures applied. Details are provided in **Appendix 05**.<br>• For borrow pits, locations will be chosen to minimise disturbance to soil and vegetation, and measures such as perimeter bunds and minimal side slopes employed. Topsoil with suitable seed bank will be stockpiled. Rehabilitation will be undertaken progressively as roads are constructed. Details are provided in **Appendix 05**.<br>• The erosion and sediment control strategies discussed above will also be used for ancillary areas such as site compounds, turn-around points, lay-down areas, etc. |
| **5** | **Management and Implementation** | • This section outlines responsibilities, training, installation of ESC measures, and implementation of updates and variations.<br>• The installation and maintenance of all ESC measures would be overseen by a suitably qualified person. Installation would be consistent with the ESC Plan. |

## 6.5 Spill Management Plan

An Activity-specific Spill Management Plan has been developed as part of this EMP. Refer to **Appendix 07** for the complete plan.

**Table 6—5 Spill Management Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| 1 | **Purpose** | • The Spill Management Plan has been developed to support the Activity covered in this EMP in accordance with *the Code*. |
| 2 | **Key Legislation** | • This section lists the key relevant legislation used to develop the Spill Management Plan. |
| 3 | **Potential Spill Materials** | • This section lists the estimated volumes of chemicals and wastewater associated with the Activity - fuels; general equipment maintenance chemicals; drilling, completions, and cementing additives; drilling and completions by-products; produced fluid; condensate and oil; and greywater and treated sewage.<br>• The storage, containment, and management for each of these materials is described (**Table 3—1** of **Appendix 07),** and subsequent text). |
| 4 | **Potential Spill Scenarios** | • Potential leak worse-case spill scenarios have been determined, including spill mechanism, estimated quantities, materials spills, location, and key management controls (**Table 4—1 of Appendix 07).** |
| 5 | **Potential Receptors** | • The potential receptors that could be affected by a spill (groundwater, surface water, soil) are discussed. |
| 6 | **Risk Assessment** | • An assessment of the risks associated with potential spills is provided in **Appendix 04.** |
| 7 | **Control Measures** | • The key management control measures in place to prevent and/or minimise the risk of spills is described.<br>• These measures include storage and containment (including secondary containment) in accordance with relevant codes; drilling pits designed and operated to manage a 1:1,000 ARI rainfall event; monitoring; transport of chemicals and wastewater; inspection records; spill-specific contingency/emergency response drills; and rapid clean up should spills occur. |
| 8 | **Spill Response and Management** | • This section provides an overview of spill response and management for spills during the Activity. Note that where the spill results from an |

| # | Section Title | Summary |
|---|---|---|
| | | emergency, the Contingency/Emergency Response Plan (**Appendix 13**) takes precedence.<br>• When a spill occurs, the Site Supervisor will conduct the initial assessment of the spill to identify the potential hazards, type, location, and required assistance. The spill response priorities will also be assessed (**Table 8—1 Appendix 04**) and regulators notified. Neighbours will also be notified if required.<br>• Spill response actions are listed to guide spill containment and response. These include the use of spill kits and segregated waste bins for small spills, and more comprehensive actions for larger spills, including reference to the Contingency/Emergency Response Plan (**Appendix 13**). For a reportable spill, an incident investigation would be completed.<br>• Off-site contaminated waste disposal would be undertaken in accordance with NT requirements, and all listed waste transportation would be undertaken by licensed contractors and be tracked and disposed of at approved waste management facilities. |
| **9** | **Monitoring and Inspections** | • Monitoring measures to manage spill risk during the Activity will include daily, weekly and monthly monitoring as appropriate. The minimum volumes of leaks that would be identified are also listed. |
| **10** | **Roles and Responsibilities** | • The relevant roles and responsibilities of individual personnel are listed. |
| **11** | **Implementation** | • All personnel, including contractors engaged to perform project works, must comply with the Spill Management Plan and *the Code*. |
| **12** | **Spill Reporting** | • Incident and reporting requirements are provided in **Table 7—3** of this EMP. |
| **13** | **Incident Reporting** | • Incident reporting requirements are set out in **Table 7—3** of this EMP.<br>• Reportable and recordable incidents are defined. |

## 6.6 Methane Emissions Management Plan

An Activity-specific Methane Emissions Management Plan has been developed as part of this EMP. Refer to **Appendix 10** for the complete plan.

**Table 6—6 Methane Emissions Management Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| 1 | **Background** | • *The Code* sets out the mandatory requirements for management plans for methane emission monitoring, leak management, detection, and reporting. *The Code* states that an EMP for a petroleum activity must include a Methane Emissions Management Plan (MEMP). |
| 2 | **Scope** | • This MEMP covers the works, risks, controls, monitoring, and reporting of methane emissions associated with drilling, completions, well testing and ongoing operations associated with the EMP and its revisions. |
| 3 | **Purpose** | • Outlines the design of the MEMP to manage methane emissions risks and reduce emissions to ALARP. |
| 4 | **Principles** | • The aim of the MEMP is to reduce emissions to ALARP via active monitoring and management. |
| 5 | **Activity Description** | • All associated works, including drilling, well testing, and the ongoing operation of the appraisal well, will be conducted as per the requirements of *the Code.*<br>• A description of the operations (drilling and completions; EPT; ongoing well operations and suspension), and potential emissions and controls associated with these operations, is described in **Table 5—1** of **Appendix 10**.<br>• It is noted that the Activity under this EMP does not include any production, compression, or transportation of hydrocarbons by flowline. |
| 6 | **Risk Assessment** | • **Appendix 04** presents the environmental risks associated with the Activity. As demonstrated, with the risk assessment controls and adherence to the standards listed in **Table 7—2**, emissions will be reduced to ALARP and acceptable. |
| 7 | **Equipment Selection** | • This section provides an overview of equipment to be used to monitor methane and the relevant ISO/API standards for material selection.<br>• Leak detection equipment will be consistent with *the Code*. |

| # | Section Title | Summary |
|---|---|---|
| 8 | **Monitoring Methodology** | • Mandatory inspections will be completed on all surface infrastructure (vents, flanges, valves, connections, drains, pressure relief vents, etc.) of the appraisal well in accordance with *the Code*.<br>• The monitoring method, inspection and monitoring frequency, leak classification, repair, and notification, and remediation work and leak response, are described. |
| 9 | **Reporting** | • A written closeout Leaking Report will be submitted in accordance with *the Code*.<br>• Greenhouse gas emissions will be estimated and reported consistent with national guidelines. If emissions are below the Commonwealth's reporting threshold, emissions will still be reported to the NT government under *the Code*.<br>• An annual report will be provided to the NT Government, including results of leak detection surveys, the extent of compliance with the leak management plan, a summary of monitoring undertaken during the period, a summary of minor and significant leaks; and actions taken. |

## 6.7 Waste and Wastewater Management Plan

An Activity-specific WWMP has been developed as part of this EMP. Refer to **Appendix 06** for the complete plan.

**Table 6—7 Waste and Wastewater Management Plan Overview**

| # | Section Title | Summary |
|---|---|---|
| 1 | **Introduction** | • The objectives of the WWMP are to describe the relevant works, environmental risks and impacts involved in managing waste and wastewater; to define the management methods and approaches, estimate quantities; and monitor, manage and report waste and wastewater volumes.<br>• The Waste Management Hierarchy (avoid, reduce, re-use, recycle, treat, and dispose), as outlined in the *National Waste Policy* will be used to achieve optimal environmental outcomes [AUSTRALIAN GOVERNMENT, 2018].<br>• Wastewater types are categorised into three key categories: domestic, drilling and completions, and extended production testing.<br>• The waste characteristics and volumes for each waste category are detailed. Please refer to **Appendix 06** for this detail. |
| 2 | **Freeboard Management** | • This section analyses rainfall and evaporation data to determine freeboard requirements for open pits and open-top treatment tanks to minimise the risk of overtopping.<br>• A 1:1,000 ARI rainfall event was used to assist in the assessment to determine the minimum freeboard.<br>• The minimum freeboard to be maintained is proposed to be 300 mm, and 400 mm is the target freeboard level to ensure the minimum freeboard of 300 mm is not exceeded. Should the levels in pits or open-top tanks (if needed) reach this level, an assessment will be undertaken to determine if the removal of fluid is required. |
| 3 | **Wastewater Risk Assessment** | • The environmental impacts and risks associated with the management (treatment, handling, and re-use) of wastewater are deemed to be reduced to As Low As Reasonably Practicable (ALARP), and acceptable. This conclusion is based on the identification and implementation of multiple controls detailed in **Appendix 04** (Risk Assessment), **Appendix 07** (Spill Management Plan), and the environmental performance standards (**Section 7.7** of this EMP). |

| # | Section Title | Summary |
|---|---|---|
| 4 | **Groundwater Investigation** | • This section provides an overview of the principal aquifers in the region. EP 125 is not within a water allocation plan area [DEPWS, 2021]. All water extraction will be conducted according to the Groundwater Extraction Licence for the Activity. |
| 5 | **Wastewater Management** | • This section details the waste storage and treatment for the waste categories described above. Please refer to **Appendix 06** for detail on the design and precautions for the storage and treatment method for each of these types of waste.<br>• The procedure for a significant rainfall event response to ensure the minimum operational freeboard of 300 mm is maintained is described. |
| 6 | **Waste Management** | • This section provides a table (**Table 3—1**, **Appendix 06**) listing the Interest Holder's methods to avoid, re-use, recycle, treat, and dispose of each type of waste from the Activity.<br>• The protocols for transport of waste are described. The Interest Holder will use NT licensed transport providers and wastewater storage and treatment facilities and transport wastewater interstate to a licensed storage and treatment facility. Waste tracking will be carried out and documented as per NT requirements using a chain of custody system. |
| 7 | **Wildlife, Stock and Human Interaction** | • Management and control methods will be implemented to minimise the risk of wildlife, stock and human receptors interacting with stored waste.<br>• Measures will include fencing of the well pad; installation of signage at the main well pad access gate; covered containment bins as necessary; above-ground tanks with no clear fauna (non-avian) access points; and installation of fauna ladders in open pits. |
| 8 | **Measurement Criteria** | • This section describes how the Interest Holder will meet the Environmental Performance Standards described in **Section 7.7** of this EMP.<br>• These measures include the type and quantity of drilling fluid additives; use of hazardous materials register; use of impermeable drilling pit liners; maintaining a minimum operational freeboard in storage pits; greywater irrigation; active re-use, recycling, and on-site disposal as per approval conditions; and sampling of drilling by-product pits. |
| 9 | **Monitoring** | • Waste monitoring will be implemented as per **Table 7—2** Monitoring Program of this EMP. |

| # | Section Title | Summary |
|---|---|---|
| | | • Monitoring would be undertaken in accordance with NT requirements, with methodology in accordance with Australian Standards and Guidelines.<br>• Sample analysis will be undertaken by a National Association of Testing Authorities (NATA) laboratory approved for that analysis, and where a NATA-accredited analysis is unavailable, QA/QC protocols (such as trip blanks) and samples will be sent to duplicate laboratories. |
| **10** | **Indicative Well Pad Layout and Pit Profiles** | • Diagrams of indicative well pad layouts and a pit profile are provided. |

## 6.8 Emergency Response Plan

An Emergency Response Plan (ERP) has been included as part of this EMP; refer to **Appendix 13.**

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.

**Table 6—8 Emergency Response Plan Summary**

| # | Section Title | Summary |
|---|---|---|
| 1-3 | **Contents, Document Control, and Definitions** | • **Section 1** to **Section 3** are the Table of Contents, the Document Control history, and the Definitions used in the ERP. |
| 4 | **Introduction** | • The purpose of the ERP is to set out the emergency response arrangements and requirements to ensure an effective and timely response and recovery to emergency and well-related events.<br>• The emergency response priorities and the cycle of response (recover, learn and prevent) are set out.<br>• An overview of related documents is provided, and a list of who uses this plan. |
| 5 | **Accountabilities** | • This is a comprehensive list of the personnel and their relevant accountabilities under the ERP. |
| 6 | **Assessment and Activation** | • This section presents five diagrams of the ERP arrangements. These diagrams are briefly described below.<br>• A one-page guide sets out the ER Team's Activation Assessment Matrix. There are three levels of response management teams – crisis, incident, and field; severities listed as 1 to 6; and examples of incidents for each of the severities for the categories of Health and Safety; Well Related, Environment; and Reputation and Regulatory.<br>• A one-page Emergency Activation Flowchart sets out the arrangements for the management teams for each of the three levels (crisis, incident, and field).<br>• A one-page Well Control Assessment and Activation flowchart sets out the arrangements for the management teams for well control events.<br>• A one-page Well Control Severity Assessment and Response Flowchart sets out the responsibilities and actions for each of the three levels (crisis, incident, and field).<br>• A one-page Medical Response Flowchart Overview provides guidance on the response for minor, moderate and severe injuries. |

| # | Section Title | Summary |
|---|---|---|
| 7 | **Emergency Response Organisation** | This section sets out an overview of the roles and responsibilities of:<br>• The site Field Response Team.<br>• The Incident Management Team (Adelaide).<br>• The Crisis Management Team (Adelaide). |
| 8 | **Emergency Communications** | This section sets out:<br>• A general guidance to emergency response.<br>• Wellsite emergency response numbers.<br>• The incident notification process.<br>• Stakeholder communications and business functions<br>• Personal response log - individuals who have responsibilities under this Plan are required to maintain a personal emergency response log during the emergency. |
| 9 | **Duty Cards – Field Response Team (FRT) (Site)** | • This sets out the Duty Cards detailing the roles and responsibilities of the FRT On-Scene Commander, FRT Contractor Supervisor, FRT Technical officer and FRT Muster Controller. |
| 10 | **Duty Cards – Incident Management Team (IMT) (Adelaide)** | • This sets out the Duty Cards detailing the roles and responsibilities of the IMT Incident Management Team Leader, IMT Operations Officer, IMT Technical Officer, IMT Logistics officer and IMT Log Keeper. |
| 11 | **Emergency Conclusion** | • This section sets out the processes to be implemented at the conclusion of the emergency, including post-emergency debriefing to discuss any problems and necessary improvements to the ERP. |
| 12 | **Supporting Information** | This section sets out:<br>• Emergency Situation Checklists for possible emergency situations.<br>• Spill response – small spills, typically managed on-site; and large spills, typically beyond the capability of the site to complete the response.<br>• Project-specific Journey Management Plans (JMPs) will be used. For example, all vehicles leaving the site will be equipped with water, a first aid kit and appropriate communication apparatus (e.g., mobile phone, satellite phone). Overdue arrivals or failure to make contact at agreed points/estimated times will invoke emergency response arrangements |

# 7 Implementation Strategy

## 7.1 Santos Management System

The Santos Management System (SMS) is the central system that contains the policies and procedures that the Interest Holder will utilise to manage and minimise the impact of its Activity.

The SMS covers:

- Accountabilities
- Planning and objectives
- Training and competency
- Communication
- Legal obligations
- Hazard identification and risk management
    - Including completion of monitoring, inspections, audits
- Contractor management
- Contingency Plans
    - Emergency Response Plan (**Appendix 13**) of this EMP is the contingency plan that specifies arrangements for the response to emergencies or potential emergencies (e.g., surface spills of chemicals, wastewater, fuels, oils, etc.) to ensure environmental impacts are minimised in the event of an incident.
    - Incident management plan (Emergency and Well Control Response Plan for Amadeus Basin DR-DC776-PLN-0608-0) includes trigger points and protocols to escalate incidents to be managed as emergencies.
- Performance reporting
- Interface management
    - Including stakeholder engagement and complaints management

Environmental outcomes will be achieved through the implementation of the SMS, monitoring, inspections, and audits.

## 7.2 Roles and Responsibilities

The project management hierarchy of key roles and responsibilities for the Activity under this EMP are:

- **Project Manager/Lead:**
    - Oversees all planning and the execution of the Activity and is responsible for compliance with the EMP and the SMS.
- **Construction Site Supervisor/Representative:**
    - Responsible for ensuring all areas of Civil Construction are carried out as per the EMP and the Interest Holder's SMS.
    - Acts as the point of contact for all Civil Construction contractors.
    - Acts as the designated point of contact for any civil-related complaints and incidents following the pre-determined strategies in this EMP or relevant ERP.
    - Undertakes monitoring, inspections, and compiles records of compliance
- **Drilling and Completions Manager/Lead:**
    - Responsible for ensuring the drilling, completions, and EPT are designed and implemented per the NT legislation and *the Code*.
    - Responsible for selecting and designing equipment and practices to manage environmental risk.
    - Responsible for selecting and engaging drilling, completion, and EPT contractors.
    - Responsible for ensuring all contractors comply with the contract terms, including compliance with the EMP requirements.
    - Ensures all contractors comply with the contract terms, including compliance with the EMP requirements.
    - Undertakes monitoring, inspections, and compiles records of compliance.
- **Operating Company Representative/Site Supervisor:**
    - Responsible for ensuring that all areas of drilling, completion, and EPT are carried out in accordance with the WOMP, EMP and the Interest Holder's SMS.
    - Responsible for the planning and executing of the drilling, completion, and EPT works on-site, including understanding and communicating the environmental requirements of this plan.
    - Facilitate inductions and review training of all workers (including contractors).
    - Ensures all reporting requirements are met.

- Act as the designated point of contact for drilling, completion, and EPT environmental incidents and emergencies following the pre-determined strategies in this EMP and relevant ERP.
- Undertakes monitoring, inspections,
- Undertakes monitoring, inspections and compiles records of compliance.
- Acts as the point of contact for all drilling, completion, and EPT contractors.

- **Environmental Team Representative**
  - Overall compliance with the EMP.
  - Verification that monitoring and inspections are occurring and records available.
  - Completion of audits and regulatory reporting.
- **Contractor Site Supervisor / Representative:**
  - Civil construction drilling, completion, and EPT 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.
- **Field Personnel:**
  - All staff and contractors working in the exploration permit areas are responsible for complying with this plan and associated procedures.

## 7.3 Training

The Interest Holder's SMS outlines their policies and procedures, including training and competency.

Specialist contractors will conduct most of the work conducted under this EMP. Contractors must demonstrate they have appropriate systems, procedures, and training in place before the commencement of the Activity.

All staff and contractors entering the site will be required to attend a site-specific induction. The induction covers the following aspects:

- Regulatory requirements for the area, including specific conditions of the EP and agreements.
- The importance of reporting environmental incidents, e.g., spills and sediment releases.
- Environmental considerations and procedures for environmental protection, e.g., weed and spill management.

- Safety procedures that cover remote area operations.
- Emergency response.
- Landowner sensitivities, including Aboriginal communities and their specific cultural requirements.
- Procedures for handling any culturally or archaeologically sensitive materials that may be discovered.

## 7.4 Review and Update

Implementation will be continually monitored and revised following *Regulation 22* (as required), based on inspections, audit results, incident learning, complaints, employee and stakeholder feedback, and changes in the Activity.

This EMP must be reviewed and proposed revisions submitted to the Minister for approval every five years as required by Regulation 18 of the PER.

## 7.5 Governance

### 7.5.1 Management and Non-Conformances

For the Activity, a non-conformance is defined as:

- A breach of an environmental outcome or environmental performance standard (see **Section** 7.7). A recordable incident resulting in an actual consequence above low.

Non-conformances are identified via:

- Audits and inspections.
- Incident reports and investigations.
- For identified non-conformances, corrective actions are to be taken and logged.

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 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.

### 7.5.2 Inspection and Audits

Desktop and/or field-based inspections and audits will be conducted by the Interest Holder during operations to verify that controls are in place to meet Environmental Outcomes and Environmental Performance Standards (see **Section 7.7**). The inspection and audit schedule are presented in **Table 7—1**. The results will be included in the annual environmental report.

**Table 7—1 EMP Inspection and Audit Schedule**

| Inspection / Audit | Scope | Frequency | Responsibility | Audit Type |
|---|---|---|---|---|
| **Inspection** | Measurement criteria for Environmental Outcomes and Environmental Performance Standards (**Section 7.7**). | Quarterly | Interest Holder Representative | Control verification |
| **Audit** | Compliance with Environmental Outcomes and Environmental Performance Standards, monitoring, recording, and reporting requirements. | Annually | Interest Holder Representative | Control verification |

### 7.5.3 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 a change represents a modification to a regulated activity in a manner that does not require a revision of the EMP:

- Before the regulated Activity is modified, the Interest Holder will provide a Reg 22 notice to the Minister that includes the details of the proposed modification.

Where there is an identified and verified change to the existing environment (as described in the EMP and **Appendix 01**) that will not require a revision of the plan:

- Within 30 days of verifying the change has occurred, the Interest Holder will notify the Minister as per *Reg 23* of the *PER*.

### 7.5.4 Monitoring

The purpose of monitoring in an Implementation Strategy is to collect data for interpretation to identify the potential for environmental impact prior to a negative outcome so that management measures can be put in place.

Monitoring will be conducted daily, weekly, monthly, or yearly based on the item being monitored.

For items identified to be outside of the listed parameters, actions to rectify are to be taken and documented.

The monitoring program is presented in **Table 7—2**.

**Table 7—2 Monitoring Program**

| # | Item | Location | Purpose | Monitoring Frequency and Method |
|---|---|---|---|---|
| 1 | **Drilling By-products** | Well pad - Drilling pit/s. | • Assess the potential impacts posed by the drilling by-products, and the available disposal options and collect data for Third Party on-site disposal assessments/approvals.<br>• Assess the hazard associated with the drilling by-products including the potential for Naturally Occurring Radioactive Material (NORMs) and leachability. | • Post-drilling activity prior to pit re-instatement or off-site management.<br>• NORMS as per C.5.2 of *the Code*.<br>• Leachability testing of drill cuttings in accordance with the Australian Standard Leaching Procedures as described in section C.4.1.2 of *the Code*.<br>• Other analytes as per Table 9 of *the Code*. |
| 2 | **Freeboard of Pit/s and open-topped tanks (if applicable)** | Well pad – Drilling pit/s and tanks | • Ensure adequate space for freeboard. | • Drilling by-product pit and open-topped treatment tank levels monitored daily.<br>• Minimum freeboard in the drilling pits of 300 mm is maintained by setting a target freeboard of 400 mm.<br>• Where the target 400 mm freeboard is exceeded, an assessment will be conducted to ensure the risk of overtopping or breaching the minimum freeboard requirement does not occur.<br>• Monitoring of pits and open-topped tanks completed by online telemetry, or photography until closure. All telemetry equipment will be maintained and calibrated in accordance with the manufacturer's specifications. |
| 3 | **Groundwater Extraction** | Production water bores. | • Ensure that the volume of water utilised is less than the authorised licenced volume.<br>• As per the NT Water Act. | • Extracted water volumes from each bore used to supply water for the Activity will be recorded in accordance with the conditions of the WEL. |
| 4 | **Waste** | Construction, Drilling, Completions and EPT operations. | • Total volume of waste removed from the site and its destination (inc. license number of the transporter).<br>• Total volume of water and wastewater re-used during drilling works or for other purposes.<br>• Characterisation of waste.<br>• Effectiveness of measures to mitigate stock, wildlife, and human interaction. | • Wastewater volume and destination recorded at the time of transport by on-site personnel.<br>• Wastewater quantity and quality monitoring with 6 monthly wastewater samples analysed at a NATA-accredited laboratory for the analytes listed in *the Code*.<br>• Ongoing monitoring of incident reports for stock, wildlife and human interaction with wastewater and recording of results.<br>• At the time of well suspension an assessment of the potential accumulation of NORM in well equipment will be assessed and measures put in place to reduce risks to HSE as per B.4.15.5(b) of *the Code*.<br>• See 'drilling by-products' for monitoring requirements (inc. NORMS)<br>• NORMS as per *the Code*. |
| 5 | **Bushfire** | Bureau of Meteorology (BOM) | • Hot spot alerts and fire danger is known. | • Daily checks of BOM fire and weather forecasts during operations.<br>• Visual inspections of cleared areas (inc. Fire access trails and breaks) for weeds/bushfire risk material post-wet season/prior to October (typically the start of the high bushfire risk period) in conjunction with weed surveys.<br>• Annual fire mapping. |
| 6 | **Methane Emissions** | Drilling, completions EPT (inc. flaring), and ongoing well operations. | • No leaks undetected.<br>• Volume of emissions. | • Leak detection tests - in accordance with *the Code*<br>• Emissions measured in accordance with **Section 10.9.2** of **Appendix 10**. |
| 7 | **Spills** | Chemical, fluid, fuel, and additive storage areas. | • Sites free of spill-related contamination. | • Secondary containment, when in use, to be visually inspected weekly during the dry season and daily during the wet season for damage, spills, or water for management. As per A.3.8.i of *the Code*.<br>• Note: if secondary containment is found to be damaged, it must be repaired as soon as practicable. |

| # | Item | Location | Purpose | Monitoring Frequency and Method |
|---|---|---|---|---|
| 8 | **Erosion and Sediment Control** | Access tracks, well pad and campsite and gravel pit/s. | • ESC measures in place as per ESC plan. | • Inspection of ESC measures post >10 mm of rain in 24 hours to check that devices are not impacted (if site access available) during operations. Until deemed unnecessary by an (Certified Professional in Erosion and Sediment Controls) CPESC or until commencement of site rehabilitation.<br>• Annually, after the end of the wet season, until rehabilitation success criteria are met, deemed unnecessary by a CPESC or at the completion of rehabilitation. Noting that the responsibility for disturbed areas will continue until the Minister is satisfied that all environmental outcomes and obligations under the EMP are met. |
| 9 | **Weeds** | Access tracks, well pad and campsite and gravel pit/s. | • Weeds identified and treated. | • Annual survey / visual inspections for maintenance / weed control post-wet season. |
| 10 | **Rehabilitation** | Access tracks, well pad, water bore/s, and campsite and gravel pit/s. | • Land disturbance is successfully rehabilitated. | • Annually, starting 12 months after it is determined the disturbed land is no longer required for the Activity or future activities after the end of the local wet season until the Minister is satisfied the environmental outcomes and obligations under the EMP have been met. |
| 11 | **Significant Rainfall** | Well pad. | • Significant rainfall event forecast. | • Weather forecast monitored weekly during the wet season while wastewater present in open-topped treatment tanks, pits are open, or chemical/wastewater is planned to be transported. |

## 7.6 Reporting

### 7.6.1 Incident Reporting

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

All personnel must report and record all incidents and near-misses and identify potential hazards for continuous improvement and to determine if the regulator is to be notified.

**Table 7—3** covers regulatory Incident and Reporting Requirements.

**Table 7—3 Incident and Reporting Requirements**

| Requirements | How and By When |
|---|---|
| **Petroleum (Environment) Regulations** | |
| **Recordable Incident Reporting:**<br>A recordable incident is a breach of an Environmental Objective or Environmental Performance Standard in the EMP that applies to the activity and is not reportable. | |
| The recordable incident report must contain:<br>• A record of all recordable incidents that occurred during the reporting period.<br>• All material facts and circumstances concerning the recordable incidents that the operator knows or is able, by reasonable search or enquiry, to find out.<br>• Any action taken to avoid or mitigate any adverse environmental impacts of recordable incidents.<br>• The corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents. | • Notify DEPWS in writing no later than 15 days after the reporting period. |
| **Reportable Incident Reporting:**<br>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 Petroleum Act. | |
| The initial written report will include:<br>• 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.<br>• The nature and extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause.<br>• Any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident.<br>• Any actions taken or proposed to be taken to prevent a recurrence of an incident of a similar nature. | • Notify DEPWS orally or in writing as soon as practical but not later than 2 hours after the incident occurred or the Interest Holder becomes aware of the incident.<br>• 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 DEPWS no later than three days after the incident occurs.<br>• Notify the AAPA orally 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** | |
| 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 may threaten to cause pollution resulting in material environmental harm or serious environmental harm. A notification is required to specify:<br>• The incident causing or threatening to cause pollution.<br>• The place where the incident occurred.<br>• The date and time of the incident.<br>• How the pollution has occurred, is occurring or may occur.<br>• 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 after (and in any case within 24 hours) first becoming aware of the incident or the time they should reasonably be expected to become aware of it. |
| **Heritage Act** | |

| Requirements | How and By When |
|---|---|
| When a proponent discovers a place or object that is known to be an Aboriginal or Macassan archaeological place or object, they must provide:<br>• A description of the place or object.<br>• Its location.<br>• The person's name and address.<br>• If known by the person –the name and address of the owner or occupier of the place or where the object is located. | • The proponent must advise the director of the Heritage Branch (08 8999 5039) of the discovery and its location.<br>• Also report to the Central Land Council (CLC) as soon as practicable but within seven days of the discovery. |
| **Work Health and Safety (National Uniform Legislation) Act and Regulations** | |
| 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:<br>• The death of a person.<br>• A serious injury or illness of a person.<br>• A dangerous incident.<br>• 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. |
| **Transport of Dangerous Goods by Road and Rail (National Uniform Legislation)** | |
| • 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. |

### 7.6.2 Routine Reporting

**Table 7—4** presents the routine reporting details required under this EMP.

**Table 7—4 Reporting Details**

| Frequency | Report Detail | Recipient |
|---|---|---|
| **Before the Commencement of the Activity** | • The commencement of a regulated activity. | • The Minister for Environment.<br>• The occupier of the land in which the activity is carried out.<br>• The owner of the land in which the activity is to be carried out. |
| **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:<br>• A summary of the works completed under the EMP during the reporting period.<br>• A summary of performance against measurement criteria.<br>• A summary of all the recording, monitoring, and reporting information about the regulated activity to which this EMP relates in a manner that will enable the Minister to determine whether the environmental outcomes and environmental performance standards in the plan are being met. | • DEPWS |

| Frequency | Report Detail | Recipient |
|---|---|---|
| **When Clearing Completed** | • Records of the nature, location, and extent of disturbance of flora and fauna including geospatial information depicting areas cleared. | • DEPWS & Minister |
| **Emissions Report** | • Emissions reporting must be in accordance with Section D.5.6 of *the Code*.<br>• The natural gas industry must estimate and report all greenhouse gas emissions to the Australian Government's Clean Energy Regulator annually in accordance with the NGERS framework.<br>• Hence emissions associated with venting and flaring, as described in Section D.5.9, must be consistent with the reporting requirements of the Clean Energy Regulator but must be provided separately to the Northern Territory Government in accordance with *the Code*. | • Department of Industry, Science, Energy and Resources<br>• DEPWS |

### 7.6.3 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 (5) years following the period during which the petroleum interest is in force or 15 years after the record comes into existence:

- Records linked to measurement criteria, commitments, and statutory reporting requirements.
- Induction records.
- Waste records.
- Hazardous goods manifest.
- Fuel usage.
- Chemicals stored and transported.
- Drilling fluid additives utilised (name, type, and quantity)
- Weed monitoring.
- Non-compliances and corrective action records.
- Internal audits and inspection records.
- Management of change records.

The records will be kept in accordance with Regulation 36 and made available in accordance with Regulation 37 of the *PER*.

## 7.7 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:** Those that will be achieved if the environmental impacts and environmental risks of a regulated activity are reduced to a level that is ALARP and acceptable.
- **Environmental Performance Standards:** Those that relate to managing environmental impacts and environmental risks of a regulated activity; and apply to persons, systems, equipment, or procedures involved in the Activity.

- **Measurement Criteria:** The criteria used to determine if an environmental outcome or environmental performance standard has been met.
- **Responsibility:** Refers to the person who owns the critical controls required to achieve the desired environmental outcome.

The objective of this EMP is to demonstrate that the environmental impacts and environmental risks associated with the Activity will be reduced to As Low As Reasonably Practicable (ALARP) and acceptable. In order 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 will be implemented as described in the Environmental Risk Assessment Framework (**Appendix 03**).

By implementing the controls outlined in this EMP and its associated 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 the carrying out of the Activity and as described in this EMP are outlined in the below tables.

The following section provides the risk management controls that the Interest Holder will implement during the Activity for each environmental factor:

- Air quality and atmospheric processes
- Community and economy
- Groundwater quality
- Landforms
- Terrestrial ecosystems
- Soil and surface water quality

**Table 7—5 to Table 7—10** detail the measurement criteria of critical controls (those controls that, if absent, would increase the risk of an environmental impact) of the risks identified in **Appendix 04** (Risk Assessment).

**Table 7—5 Environmental Outcomes, Performance Standards & Measurement Criteria – Air Quality & Atmospheric Processes**

| Environmental Outcome | Environmental Performance Standard | Measurement Criteria |
|---|---|---|
| **No unnecessary greenhouse gas emissions generated from the Activity.** | • Venting of gas during production testing occurs only when flaring is not possible due to for fire, safety, or operational reasons. | • Management of change records demonstrate the rationale for venting if flaring is not possible. |
| | • No uncontrolled leaks from the well head. | • Records of well head inspections every six months until the well is decommissioned to demonstrate that there are no leaks and/or identified leaks are managed. |

**Table 7—6 Environmental Outcomes, Performance Standards & Measurement Criteria – Community and Economy**

| Environmental Outcome | Environmental Performance Standard | Measurement Criteria |
|---|---|---|
| **No significant negative impact on community.** | • Spills during operations do not result in serious environmental harm. | • Records of Santos Road Status Reports conducted prior to the transport of chemicals or wastewater on unsealed roads in the Project Area in the wet season demonstrate that the risk of spills during transport has been reduced to ALARP.<br>• Quarterly inspection checklists, completed during operations, show spill kits are available.<br>• Quarterly inspection checklists demonstrate that the Contingency Plan (Emergency Response) Plan **Appendix 13** and Spill Management Plan **Appendix 07** are available for an immediate coordinated response to a bogged vehicle or spill scenario during operations. |
| | • Site access and speed limits are clear for visitors and workers. | • Site induction records show that speed limits and approved access points are covered for visitors and workers travelling to site. |
| | • No unresolved complaints related to noise or light pollution during operations. | • Records of complaints received demonstrate follow-up on the complaint has occurred or is ongoing. |
| | • No unmanaged biosecurity risk from declared and priority weeds within cleared footprint. | • A register of biosecurity/weed hygiene inspections demonstrates vehicles have weed certificates before entering the well pad.<br>• Records of annual weed surveys demonstrate that the work area is free of weeds, or that identified weeds are being managed/controlled. |
| | • No bushfires from conduct of the Activity on the well pad. | • Fire break inspection and maintenance records demonstrate that fire breaks are checked and cleared of fire-risk material until progressive rehabilitation commences. |

**Table 7—7 Environmental Outcomes, Performance Standards & Measurement Criteria – Cultural Heritage**

| Environmental Outcome | Environmental Performance Standard | Measurement criteria |
|---|---|---|
| **No significant impact on indigenous and non-indigenous artefacts, sacred or heritage sites.** | • No unauthorised disturbance to Aboriginal or Macassan archaeological places or objects, sacred sites, cultural heritage sites or non-indigenous cultural heritage sites by the Activity. | • Induction records, or toolbox talks, show that civils construction personnel have received training on where the limits of civils earthworks can occur within the construction buffer, demonstrating that works will not breach an AAPA Authority Certificate approved work area.<br>• The Incident register shows that Aboriginal or Macassan archaeological places or objects or cultural heritage sites, if discovered during construction, are recorded and reported to the CEO of the Northern Territory Heritage Office - as soon as practical after discovery.<br>• The Historical Heritage Assessment report demonstrates that the proposed work area of Activity has been scouted for areas of cultural heritage and that any areas identified can be avoided. |

**Table 7—8 Environmental Outcomes, Performance Standards and Measurement Criteria – Soil and Surface Water Quality**

| Environmental Outcome | Environmental Performance Standard | Measurement criteria |
|---|---|---|
| **No significant long-term impact on soil stability, quality, or surface water.** | • No uncontrolled or unremediated sediment releases from constructed tracks and well pad during operations. | • Monitoring records of ESC measures demonstrate the ESC measures are operating as per the ESCP (**Appendix 05**) and that maintenance work is occurring where required. |
| | • No over-topping of produced fluids from above-ground tanks. | • Monitoring records demonstrate that the minimum operational freeboard is being maintained.<br>• Spill register demonstrates that no spills occurred from overtopping events. |
| | • No leaks of produced fluids that cause serious environmental harm to the sub-soil. | • Inspection records of tanks, when containing fluids, include integrity checks demonstrating that tanks are in a suitable condition when in use.<br>• The incident register shows that any fluid identified between liners is recorded, investigated, and actioned, demonstrating active management and monitoring to prevent leaks to ground. |
| | • No over-topping of drilling by-products from storage pit/s. | • Monitoring records show that the minimum operational freeboard is being maintained.<br>• Spill register demonstrates no spills occurred from overtopping events. |
| | • No leaks of drilling by-products that cause significant environmental harm to sub-soils from storage pit/s. | • Monitoring records demonstrate that fluid level changes are consistent with operational Activity, and no wet patches are observed near the pit.<br>• The incident register shows that identified leaks are remedied as soon as possible. |
| | • No fluid additive, chemical, or fuel spills escape storage and handling areas during operations. | • Inspection records of secondary containment, when in use, demonstrate that the integrity of containment/storage is maintained and repaired if found damaged. |
| | • Spills do not result in serious environmental harm. | • Records of Santos Road Status Reports being conducted prior to the transport of chemicals or wastewater on unsealed roads in the Project Area demonstrate that the risk of spills during transport has been reduced to ALARP.<br>• Quarterly inspection checklists, completed during operations, show spill kits are available.<br>• Quarterly inspection checklists demonstrate that the Contingency Plan (Emergency Response) Plan **Appendix 13** and Spill Management Plan **Appendix 07** are available for an immediate coordinated response to a bogged vehicle or spill scenario during operations. |
| | • No runoff of grey water and treated sewage effluent out of designated irrigation area. | • Quarterly inspection checklists demonstrate irrigation is by use of dispersion hoses and/or sprinklers to prevent pooling within a fenced, vegetated area on a slope <5%. |
| | • Progressive rehabilitation of significantly disturbed areas commenced within 12 months of cessation of the Activity. | • Rehabilitation records show that progressive rehabilitation of significantly disturbed areas commenced as soon as practicable and no later than 12 months after the cessation of the Activity. |

**Table 7—9 Environmental Outcomes, Performance Standards and Measurement Criteria – Groundwater Environmental Quality**

| Environmental Outcome | Environmental Performance Standard | Measurement Criteria |
|---|---|---|
| **No significant impact on groundwater quality or quantity.** | • No significant environmental harm to groundwater from the loss of circulation while drilling. | • Drilling reports include details of all additives utilized when drilling through freshwater aquifers and demonstrate that they were not considered ecologically toxic. |
| | • No significant environmental harm to groundwater from the loss of well control while drilling. | • Training records demonstrate that well control training was carried out by those in control of drilling. |
| | • No leaks of drilling by-products that cause significant environmental harm to sub-soils from storage pit/s. | • Monitoring records demonstrate that fluid level changes are consistent with operational Activity, and no wet patches are observed near the pit.<br>• The incident register shows that identified leaks are remedied as soon as possible. |
| | • No leaks of produced fluids that cause serious environmental harm to the sub-soil. | • Inspection records of above-ground tanks, when containing fluids, include integrity checks demonstrating that tanks are in a suitable condition when in use.<br>• The incident register shows that any fluid identified between liners is recorded, investigated, and actioned, demonstrating active management, and monitoring to prevent leaks to ground. |
| | • Groundwater extraction limited to licenced volume. | • Water extraction records available that demonstrate the volume extracted is less than the maximum permitted for the Activity. |

**Table 7—10 Environmental Outcomes, Performance Standards & Measurement Criteria – Terrestrial Environmental Quality**

| Environmental Outcome | Environmental Performance Standard | Measurement Criteria |
|---|---|---|
| **No significant impact on threatened flora and fauna.** | • New disturbance assessed by an ecologist and sensitive areas avoided where practicable. | • Field assessments and/or GPS logs demonstrate that on-ground scouting by an ecologist prior to any new clearing has occurred. |
| | • No unmanaged biosecurity risk from declared and priority weeds within cleared footprint. | • A register of biosecurity/weed hygiene inspections demonstrates vehicles have weed certificates before entering the well pad.<br>• Records of annual weed surveys demonstrate work area free of weeds, or that identified weeds are being managed/controlled. |
| | • No bushfires from the conduct of the Activity on the well pad. | • Fire break inspection and maintenance records demonstrate that fire breaks are checked and cleared of fire-risk material until progressive rehabilitation commences. |

# 8 Stakeholder Engagement

## 8.1 Overview

The Interest Holder's approach to stakeholder engagement proactively focuses on building respectful relationships with stakeholders. The Interest Holder seeks to ensure 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 11**.

## 8.2 Identification of Stakeholders

The PER defines '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:

- Landholders, Landowners and Land Occupiers (Host Pastoralists).
- Traditional Owners (via Central Land Council facilitation, pursuant to the ILUA, *Native Title Act 1993* (Cth), regarding Exploration Permit numbers 82, 112, 118 and 125).
- Overlapping Minerals Title Holder(s).

The Interest Holder has undertaken actions to initiate stakeholder engagement and consult with pastoralists, Traditional Owners, and the overlapping Minerals Title Holder whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Activity.

### 8.2.1 Traditional Owners

The Interest Holder regularly engages with the Traditional Owners across EP 125. Further details on the Interest Holder's engagement with Traditional Owners regarding the Activity proposed in this EMP are available in **Section 8.5**, **Section 8.7**, and **Appendix 11** (Stakeholder Engagement Log).

The Native Title Act 1993 (Cth) identifies Native Title Holders who hold rights and interests in an area according to their traditional laws and custom. Through the agreement-making mechanisms in the Native Title Act 1993 (Cth), the Interest Holder entered into a registered ILUA, signed on 18 July 2007, which covers the land area corresponding with Exploration Permit numbers 82, 112, 118 and 125. In accordance with the ILUA, the Central Land Council (CLC) represents the Native Title Holder's rights and interests in the land to which the ILUA relates, including the land directly impacted by the Activity.

As the Native Title Holder's representative, the CLC was responsible for organising and facilitating the Interest Holder's engagements with Traditional Owners directly affected by the environmental risks and environmental impacts of the Activity. This included an on country meeting with the Imanpa community, who are the Traditional Owners and the Native Title Holders for the Jacko Bore Project Area. The Interest Holder determined through engagement with the CLC and its prior understanding of the area covered by EP 125 that those Imanpa community members engaged through the CLC have the cultural authority to:

- Consider and identify the cultural heritage values in the Jacko Bore Project Area,
- Speak to the Interest Holder on their considerations, and
- Provide guidance as to any potential issues with works being undertaken in the location of the work program.

During the engagement with the CLC, and the on country meeting with the Imanpa community, no other Traditional Owners whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Activity were identified. To the best of the Interest Holder's knowledge, there are no additional Traditional Owners who are 'stakeholders' for the purposes of the Activity within the meaning of the PER.

### 8.2.2 Pastoralists

The Interest Holder respects the established relationships with pastoralists across the Southern Amadeus Basin, including within EP 125, which have been built through undertaking regulated activities in the area since 2013.

The proposed Activity is located on pastoral leasehold land in a remote location, and the area directly affected is relatively small. The Interest Holder has identified that the proposed Activity will directly impact one pastoral station within the EP 125 area, the Lyndavale Station (PMB 66209); all environmental impacts or environmental risks associated with the proposed Activity sufficient to potentially affect the rights or activities of a pastoralist are wholly contained within the Lyndavale Station.

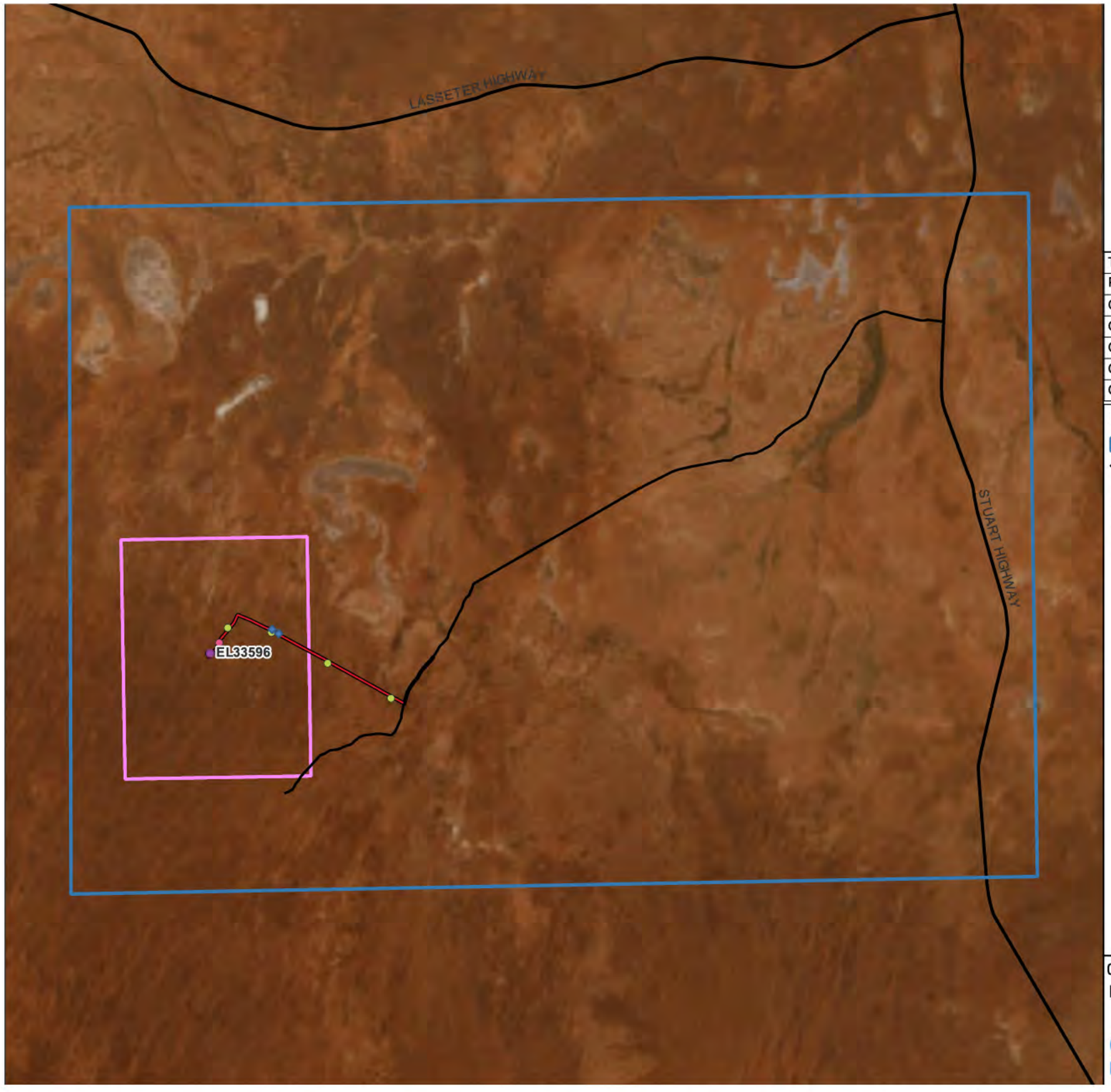
The Interest Holder has identified that access to the location of the proposed Activity will be via a public road, which traverses the Erldunda pastoral lease (PMB 122). As a matter of courtesy, the Interest Holder has informed the Erldunda pastoralist of the proposed Activity during structured engagement, which resulted from the respected relationship between the pastoralist and the Interest Holder.

Further details on the Interest Holder's engagement with pastoralists regarding the Activity proposed in this EMP are available in **Section 8.6**, **Section 8.7**, and **Appendix 11** (Stakeholder Engagement Log).

### 8.2.3 Other Titles

The Interest Holder engaged Core Uranium, previously a stakeholder as defined under the PER, due to their status as the registered title holder of Minerals EL 32974 and the applicant for Minerals EL 32971, as per STRIKE records. Although EL 32974 and EL 32971 initially overlapped with the Activity area, these licenses were subsequently removed during the EMP application process. As a result, despite Core Uranium's engagement on June 9 2023, they no longer qualify as a Stakeholder under the PER definition. Nonetheless, Stakeholder Engagement with Core Uranium has been retained in the Stakeholder Engagement Log for completeness.

Following a further notice issued under Regulation 10 of the PER dated 11 July 2023, the Interest Holder identified an application by Terralith Metals Pty Ltd, on 8th August 2023, for EL 33596. EL 33596 intersects the Jacko Bore well pad and is considered a Stakeholder (**Figure 8—1).**







| | |
|---|---|
| Title: | Mineral Titles |
| Project name: | Jacko Bore 1DW1 |
| CRS: | WGS 84 / UTM zone 53S |
| Created by: | John Maguire |
| Company name: | inGauge |
| Client name: | Santos |
| Created on: | 2023-12-01 |

Legend:

- Project Area
- Principal Road
- Campsite Indicative Location
- Well Pad Indicative Location
- Waterbore Indicative Location
- Gravel Pits Indicative Locations
- Access track - Proposed
- Access track - Existing
- Access track - Existing (re-established)
- Mineral Title - Exploration (Appln)

0 3 6 9 12 15 km

Santos INGAUGE

**Figure 8—1 Minerals Titles Overlapping Footprint of Proposed Activity (Exploration Licence (EL) 33596 - Terralith Metals Pty Ltd)**

## 8.3 Stakeholder Engagement Activity

The Interest Holder has consulted and communicated directly with Traditional Owners in the Imanpa community via a face-to-face on country meeting facilitated by the CLC. The Interest Holder also has structured engagement with pastoralists as a result of prior works. The Interest Holder also initiated engagement with the overlapping Minerals Title Holder. Dedicated consultation regarding the Activity proposed under this EMP has been undertaken with stakeholders (**Table 8—1**) as reflected in **Section 8.5, Section 8.6**, and **Appendix 11**.

Stakeholder engagement has been undertaken through face-to-face meetings and direct communication methods, including emails and phone calls (summarised in **Section 8.7** and documented in **Appendix 11**). The Interest Holder views its commitment to stakeholder engagement as ongoing as the Activity in this EMP is completed.

Briefing sessions with key individuals and groups will continue to be carried out with timely feedback on the Activity's issues and concerns. The purpose of the consultation is to give each stakeholder information about:

- The regulated Activity that the Interest Holder proposes to carry out.
- The location/s where the Interest Holder proposes to carry out the Activity.
- The anticipated environmental impacts and environmental risks of the Activity.
- The proposed environmental outcomes concerning the Activity.
- The possible consequences of carrying out the Activity to the stakeholder's rights or activities.

By providing honest and direct stakeholder engagement and allowing a reasonable period for the stakeholder to respond to the information, the Interest Holder aims to achieve the following in regard to any issues or concerns that are raised:

- Informed stakeholder feedback on analysis and alternatives on decisions.
- Working directly with the stakeholders throughout the process to ensure their concerns and aspirations are consistently understood and considered.
- Partnering with the stakeholder in each aspect of the decision-making process, including the development of alternatives and the identification of the preferred solutions.
- Building and maintaining stakeholder confidence through regular consultation.
- Gaining the trust and acceptance of the local community and groups through appropriate stakeholder engagement.
- Working with stakeholders to understand why and how the company operates.

A log of communications with stakeholders in relation to the Interest Holder's proposed Activity in EP 125 is summarised in **Section 8.7** and attached in **Appendix 11**.

The Interest Holder acknowledges the Aboriginal Areas Protection Authority (AAPA) as being the independent statutory authority responsible for overseeing the protection of Aboriginal Sacred Sites

in the Northern Territory. AAPA are not a stakeholder according to the PER, however, communication with AAPA surrounding the provision of AAPA Clearance Certificates for the proposed Activity, which commenced on 12 January 2022. The Interest Holder originally applied for an AAPA Certificate for the proposed Activity on 17 August 2022 and received certificate C2023/18. A variation to AAPA certificate C2023/018 was applied for on 22 May 2023 and Certificate C2023/054 was issued on 30 May 2023.

The Interest Holder received an approved Sacred Site Clearance Certificate (#C2022-019) dated 6th May 2023. An overview of the certificate, the special conditions therein, and the requests from the Traditional Owners are presented in **Section 5.14.2.2.**

## 8.4 Stakeholder Contact Details

**Table 8—1 Contact Details of Stakeholders Directly Impacted by the Proposed Activity**

| Stakeholder | Role / Position | Phone Number | Email / Other Contact |
|---|---|---|---|
| **Pastoralists/Managers** | | | |
| [redacted] | Owners/Station Managers – Lyndavale Pty Ltd – Lyndavale Station<br>Represented by Emanate Legal (Nicholas Taylor) | [redacted] | [redacted] |
| [redacted] | Owners/Station Managers – Lyndavale Pty Ltd – Lyndavale Station<br>Represented by Emanate Legal (Nicholas Taylor) | [redacted] | [redacted] |
| **Central Land Council (on behalf of the Imanpa community's Traditional Owners)** | | | |
| [redacted] | Manager Minerals and Energy | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Minerals and Energy Officer | [redacted] | [redacted] |
| [redacted] | Employment Facilitator | [redacted] | [redacted] |

| Stakeholder | Role / Position | Phone Number | Email / Other Contact |
|---|---|---|---|
| [redacted] | Manager - Minerals and Energy | [redacted] | [redacted] |
| [redacted] | Anthropologist - South Central Region | [redacted] | [redacted] |
| **Minerals Title Holder** | | | |
| [redacted] | Director<br>Core Uranium Pty Ltd | [redacted] | [redacted] |
| [redacted] | Principal Consultant<br>M & M Walter Consulting | [redacted] | [redacted] |
| [redacted] | Managing Director<br>Terralith Metals Pty Ltd | [redacted] | [redacted] |

**Table 8—2 Contact Details of Further Parties Informed of the Proposed Activity**

| Further Party | Role / Position | Phone Number | Email / Other Contact |
|---|---|---|---|
| **Landholders/Managers** | | | |
| [redacted] | Owners/Station Managers – Erldunda Land Trust<br>Erldunda Station | [redacted] | [redacted] |
| [redacted] | Accommodation Provider | [redacted] | [redacted] |

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

## 8.5 Traditional Owner Engagement

The Interest Holder has held an on-country meeting with Traditional Owners in the Imanpa community at the facilitation of the Central Land Council (CLC) regarding the regulated Activity under this EMP and its intended works. This meeting was held on Tuesday, 27 September 2022, in the large function room at the aged care facility in Imanpa.

CLC, as the corporate body representing the Imanpa community per the ILUA in place, was supplied the work program for the proposed Jacko Bore 1DW1 appraisal well on 11 January 2022. An updated version of the work program was supplied on 1 April 2022 (copy provided in **Appendix 11**). This allowed the CLC to engage with the Traditional Owners and conduct an inspection based on the detail provided in the work program. It also provided an opportunity for CLC to explain to the Traditional

Owners details of the works associated with the Activity proposed by the Interest Holder and the location/s where the Interest Holder proposes to carry out the Activity.

The on-country meeting with the Interest Holder, facilitated and chaired by the CLC, was held specifically to address the works associated with the supplied work program and to answer and/or capture any outstanding queries relating to the Activity's works, location or any of the potential environmental impacts, risks, controls, and environmental outcomes. A copy of the material presented, which formed the basis of discussion between the Traditional Owners in the Imanpa community and the Interest Holder, along with a copy of correspondence from CLC thanking the Interest Holder for the presentation and discussion, are provided in **Appendix 11**. The considerations raised in the on-country meeting, as confirmed with the CLC (**Appendix 11**), were:

- Possible renaming of the proposed well to reflect the cultural connection to the location.
- Plan site visits for Traditional Owners during drilling works.
- Any employment/commercial opportunities in line with the ILUA provisions.
- Return to the community should the current work program Activity change.

The Interest Holder acknowledges and agrees with the merits of the considerations raised. In addressing these considerations, the Interest Holder has begun identifying key opportunities to achieve desired outcomes and is committed to informing the Traditional Owners in the Imanpa community, via the CLC, of resolutions.

The on-country meeting was followed by a presentation by representatives of the CSIRO to the Traditional Owners in the Imanpa community under the Aboriginal Information Program regarding Hydraulic Fracturing in the Northern Territory. The Interest Holder was not invited to participate in this presentation. The Interest Holder emphasised in the on-country meeting that the use of hydraulic fracturing is not planned for this work program and agreed to return to further engage, including meeting on-country with the Traditional Owners in the Imanpa community, should hydraulic fracturing be planned in the future.

The Interest Holder will continue to build a respectful and collaborative relationship with the Traditional Owners of the Imanpa community. The registered ILUA provides future opportunities for the Interest Holder and its contractors to work with the Imanpa community regarding employment, training, and contracts. This will be discussed with CLC further as the Activity's works are further defined.

A record of the consultation related to the Activity under this EMP is summarised in **Section 8.7** and is attached in **Appendix 11**; this consultation is ongoing and will continue for the duration of the Activity.

## 8.6 Pastoral Stakeholder Engagement

The Interest Holder recognises the requirement to engage with pastoralists affected by the Activity as stakeholders under the PER. The Interest Holder will also negotiate a Land Access Agreement (LAA) with the impacted pastoralist in order to comply with the requirements of the *Petroleum Regulations 2020 (NT).*

A title search was completed to confirm that the [redacted] are the pastoral leaseholders of Lyndavale Station. The [redacted] family are also the pastoral leaseholders of the adjacent Mount Ebenezer Station; however, this property is not directly impacted by the Activity. Three LAAs have previously been executed between the pastoral leaseholder and the Interest Holder for regulated activities on these properties.

The Interest Holder has worked with the pastoral leaseholders for regulated activities since 2013, when 2D seismic operations were undertaken across the Southern Amadeus Basin, including on Lyndavale Station, where the Activity proposed under this EMP is located. This was followed by the construction and drilling of the Jacko Bore 1 well (2013-14) and associated infrastructure, on Lyndavale Station, and the construction and drilling of the Dukas 1/ST1 well (2019), and associated infrastructure on Mount Ebenezer Station.

The pastoral leaseholders have a good understanding of the construction and drilling operations proposed to be undertaken within the Activity based on previous engagement and interactions with the Interest Holder.

Initial engagement regarding the proposed Activity commenced with the pastoral leaseholder on 8 January 2022. During a face-to-face meeting with the [redacted] family on 27 September 2022 at Lyndavale Station, a Pastoral Engagement Pack that was developed for provision to the pastoral leaseholder was reviewed. The Pastoral Engagement Pack is specific to the proposed Activity and its associated works. The pack includes details of the works associated with the proposed Activity and the location/s where the Interest Holder proposes to carry out the Activity, and details of potential environmental impacts, risks, controls, and environmental outcomes. Hard and electronic copies of the Pastoral Engagement Pack were provided to the pastoral leaseholder for ongoing reference. A copy of the Pastoral Engagement Pack is provided in **Appendix 11**. No objections were raised during engagement with the pastoral leaseholder; however, general matters discussed during the engagement were noted for further consideration by the Interest Holder as required.

The Interest Holder and the pastoral leaseholder maintain an open and honest line of communication. If the pastoral leaseholder has any questions/concerns, at any time, the Interest Holder is committed to discussing and resolving these questions and concerns.

A record of the consultation related to the proposed Activity under this EMP is summarised in **Section 8.7** and is attached in **Appendix 11**; this consultation is ongoing and will continue for the duration of the Activity.

## 8.7 Stakeholder Engagement Summary

**Table 8—3 Summary of Engagement with Stakeholders**

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| **Station Owners / Managers** | | | |
| 2022.01.08 – 2022.01.26 | Emails / phone | [redacted] | Discussion of the Interest Holder's proposed drilling program. |
| 2022.02.07 | Email | [redacted] | Notice of Entry. |
| 2022.02.10 &2022.02.22 | Phone call | [redacted] | Upcoming survey plans. |
| 2022.02.26 | In person | [redacted] | Discussion of proposed activity. |
| 2023.04.21 | Email | [redacted] | Arrangements for in person visit and maps provided. |
| 2022.04.26 | In person | [redacted] | Discussion of proposed activity and water bore locations. |
| 2022.09.14 | Email | [redacted] | Proposal of face-to-face discussion. |
| 2022.09.27 | In person / via Skype | [redacted] | Update on status of the Activity and provided pastoralist engagement pack. |
| 2022.09.28 | Email | [redacted] | Notice of Entry. |
| 2022.10.05 | Email | [redacted] | Notice of Entry. |
| 2022.10.18 | Email | [redacted] | Notice of Entry. |
| 2022.11.15 | Email | [redacted] | Notice of Entry & bushfires on Mt. Ebenezer Station. |
| 2022.11.19 | Email | [redacted] | Pastoral Engagement Packs. |
| 2023.01.17 | Email | [redacted] | Notice if Entry for leak detection visits. |
| 2023.02.28 | Email | [redacted] | Form 15 and draft LAA. |
| 2023.03.01 | Email & phone | [redacted] | Form 15 and draft LAA. |
| 2023.03.14 | Email | [redacted] | Form 15 and draft LAA. Acknowledgement that they would be acting on behalf of the Stanes. |
| 2023.04.11 | Email | [redacted] | Confirmation of meeting attendees and meeting link organisation. |
| 2023.04.12 | Phone hook-up | [redacted] | Phone hook-up to discuss the Mt Kitty 2 LAA with Stanes legal representative, Stanes, and Santos' representatives. |

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| 2023.04.24 | Email | [redacted] | Organisation of meet-up for access track upgrades (Mt. Kitty 2) |
| 2023.04.25 | Phone | [redacted] | Access track inspection. |
| 2023.05.15 | Email | [redacted] | Initial response to Santos' draft Mt. Kitty 2 LAA. |
| **Central Land Council** | | | |
| 2021.12.13 | Video conferencing call | [redacted] | Requesting basic program information. |
| 2022.01.11 | Email | [redacted] | Preliminary high-level forward work program provided to CLC. |
| 2022.01.31 | Email | [redacted] | CLC request form. |
| 2022.03.15 | Email | [redacted] | Planning/scheduling query. |
| 2022.03.25 | Email | [redacted] | Planning/scheduling query. |
| 2022.04.01 | Email | [redacted] | Planning/scheduling query. |
| 2022.04.12 | Phone | [redacted] | Re CLC schedule. |
| 2022.05.10 | Email | [redacted] | Clarity on Exploration program. |
| 2022.05.19 | Video conferencing call | [redacted] | Proposed Regulated Activities and their locations. On Country meeting outcomes. |
| 2022.07.08 | Email | [redacted] | Interest Holder revised work programs. |
| 2022.07.12 | Email | [redacted] | Interest Holder proposed follow-up discussion regarding work program. |
| 2022.07.25-26 | Email | [redacted] | Clarity on Exploration program. |
| 2022.07.29 | Video conferencing call | [redacted] | Techniques to be used at Dukas location in proposed and future work programs. |
| 2022.08.03 | Email | [redacted] | Confirming video conference points. |
| 2022.08.04 | Email | [redacted] | Prevision of digital data pertinent to revised work programs. |
| 2022.08.12 | Email | [redacted] | Clarification on previous queries. |
| 2022.08.22 | Email | [redacted] | Engagement of CSIRO for On Country meeting. |
| 2022.08.24 | Email | [redacted] | Cost estimate for On Country meeting & Sacred Site Clearance Survey |

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| 2022.08.25 | Email | [redacted] | Seeking details regarding work programs. |
| 2022.08.29 | Email | [redacted] | Mt. Kitty 1 access tracks. |
| 2022.09.01 | Email | [redacted] | Chopper usage. |
| 2022.09.19 | Email | [redacted] | On-Country meeting confirmation. |
| 2022.09.21 | Email | [redacted] | Cost estimates for On Country meeting. |
| 2022.09.27 | Meeting | [redacted] | CLC and TO Meeting on country. |
| 2022.10.05 | Email | [redacted] | On Country meeting feedback. |
| 2022.10.19 | Email | [redacted] | Lodged work programs. |
| 2022.10.31 | Email | [redacted] | Employment opportunities. |
| 2022.11.02 | Email | [redacted] | Status of SSCC process and outcomes. |
| 2022.11.09 | Email | [redacted] | SSCC report timelines. |
| 2022.12.06 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2022.12.14 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2022.12.15 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2023.01.24 | Phone / Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2023.02.07 | Phone | [redacted] | Discussion regarding employment opportunities, identification, and existing business databases. |
| 2023.03.14 | Email | [redacted] | Seeking an update on SSCC for our project areas in the Southern Amadeus. |
| 2023.05.03 | Email | [redacted] | SSCC for our project areas in the Southern Amadeus. |
| **Core Uranium Pty Ltd** | | | |

| Date | Communication Form | Stakeholder | Summary of Communication |
|---|---|---|---|
| 2023.06.09 | Email | [redacted] | Notification of proposed activities & Engagement Pack |
| 2023.06.13 | Email | [redacted] | Acknowledgement and approval of proposed activities. |
| **Terralith Metals Pty Ltd (Terralith)** | | | |
| 2023.12.01 | Email, Cover Letter, Map & Engagement Pack | [redacted] | Notification that Terralith had been identified as a stakeholder to Santos' proposed Activities in the Amadeus Basin. |
| 2023.12.01 | Email | [redacted] | Confirmation of receipt. |

## 8.8 Workforce

Although not stakeholders, the Interest Holder is committed to building relationships with local businesses.

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 a preferential weighting applied to local and indigenous content in the contract award decision.

Ideally, the Interest Holder will engage local suppliers for the delivery of works and procure them from local and Indigenous businesses where these sources are available, accessible, within reasonable driving distance, and cost effective. Works may include:

- Civil construction.
- Drilling contractors for water bores.
- Supply, installation, and maintenance of water bore pumps.
- Well pad monitoring.
- Fencing construction and maintenance.
- Weed control.
- Traffic control.
- Accommodation.
- Catering supplies.
- Vehicle hire.
- General logistics services.

The workforce for specialized 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 located next to the well pad for activities such as drilling and extended production testing. For civils, accommodation will likely occur at Erldunda Roadhouse. Note: some local hire may be located in Alice Springs.

## 8.9 Future Engagement/Ongoing Consultation

Before any land access or the Activity commences, the Interest Holder will notify all owners and occupiers of land:

- Of the intention to carry out the Activity, including preliminary works related to the Activity, in accordance with regulation 52 of the *Petroleum Regulations 2020*; and
- Of the intention to commence construction or drilling as part of the Activity. The Minister will also be notified of this intention in accordance with regulation 12 of Schedule 1 of the PER.

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.

## 8.10 Assessment of Merit of Objections and Claims

The Interest Holder will continue to assess the merit of any feedback, objections, or complaints made and respond accordingly. Objections and complaints related to the Activity carried out under this EMP will be recorded in a register and acknowledged in writing. Feedback, objections, or complaints will be handled in accordance with the Interest Holder's SMS 'SMS-ESG-OS01-PD03 Community and Landholder Complaints' and/or 'SMS-GXA-OS01-PD02 – External Stakeholder Consultation Procedure for Environment Approvals' procedures. The Interest Holder's website publicly provides contact options via email (enquiriesNT@santos.com) or phone (1800 267 600).

**Table 8—4 Summary of Feedback, Issues Raised, and Responses**

| Summary of Feedback and Issues Raised by Stakeholders | | |
|---|---|---|
| **Landholders** | | |
| **Issue** | **Description** | **Response** |
| N/A | | N/A |
| **Traditional Owners** | | |
| **Issue** | **Description** | **Response** |
| **Proposed name of appraisal well ('Mt Kitty 2')** | • Possible renaming of the proposed well to reflect the cultural connection to the location. | • The Department of Industry, Tourism and Trade (DITT) accepted the Interest Holder's request to re-name the existing Mt Kitty 1 well as Jacko Bore 1 and also to refer to the proposed Activity as Jacko Bore. Interest Holder has updated this naming convention internally. |
| **Site Attendance** | • Plan site visits for Traditional Owners during drilling Activity. | • Consistent with Interest Holder's Operations in the Northern Territory, CLC will be engaged at an appropriate time to facilitate site visits during the proposed Activity. |
| **Employment/Commercial** | • Employment/commercial opportunities. | • Interest Holder has promoted Indigenous participation in works associated with the proposed Activity, in line with provisions of the ILUA, including within the contracts and procurement strategy. |
| **Work Program Activity** | • Return to the community should the current work program Activity change. | • Interest Holder is committed to informing the CLC if proposed Activity changes and is committed to engaging with Traditional Owners in face-to-face meetings where required. |

# 9 References


AAPE. (2008). *Code of Environmental Practice*. **https://appea.com.au/wp-content/uploads/2020/04/Code_of_Environmental_Practice.pdf**

C. Alfaro, & M. Wallace. (1994). *Origin and Classification of Springs and Historical Review with Current Applications*. *Environmental Geology*, *24*(2), 112-124. **https://doi.org/10.1007/bf00767884**

Austroads. (2020). *Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments* (978-1-925854-86-2). **https://austroads.com.au/publications/traffic-management/agtm12**

B. Baker, O. Price, J. Woinarski, S. Gold, G. Connors, A. Fisher, & C. Hempel. (2005). *Northern Territory Bioregions - Assessment of Key Biodiversity Values and Threats* (Northern Territory Parks & Conservation Masterplan, Issue. **https://www.researchgate.net/publication/301679851**

G. Bertrand, N. Goldscheider, J. M. Gobat, & D. Hunkeler. (2012). *From multi-scale conceptualization to a classification system for inland groundwater-dependent ecosystems*. *Hydrogeology Journal*, *20*(1), 5-25.

BOM. (2021). *Climate Statistics for Australian locations - Summary Statistics Larrimah*. Australian Government, Bureau of Meteorology. **http://www.bom.gov.au/products/IDD60801/IDD60801.94237.shtml**

BOM. (2022a, Thu 02 Jun 2022 02:28:09 AM EST). *Climate Statistics for Australian Locations. Summary Statistics KULGERA.* . Retrieved 07/06/2022 from **http://www.bom.gov.au/climate/averages/tables/cw_015603.shtml**

BOM. (2022b). *Groundwater Dependent Ecosystems Atlas* **http://www.bom.gov.au/water/groundwater/gde/map.shtml**

BOM. (2022c). *National Groundwater Dependent Ecosystems Atlas* **http://www.bom.gov.au/water/groundwater/gde/**

C. S. Christian, L. C. Noakes, R. A. Perry, R. O. Slatyer, G. A. Stewart, & D. M. Traves. (1954). *Survey of the Barkly Region, Northern Territory and Queensland, 1947-48*.

CIRQA. (2023). *Jacko Bore 1DW1 (EP 125) Lyndavale Access (Stuart Highway), Ghan, Northern Territory: Traffic Impact Assessment*.

National Construction Code. (2015). *Australia. Climate Zone Map* Retrieved from **https://www.abcb.gov.au/sites/default/files/resources/2022/Climate-zone-map-AUST.pdf**, **https://www.yourhome.gov.au/getting-started/australian-climate-zones**

DAWE. (2008). *Finke Bioregion*. Retrieved from **https://www.awe.gov.au/agriculture-land/land/publications/acris-rangelands-2008-taking-pulse**

DCCEEW. (2022). *National Greenhouse and Energy Reporting (Measurement) Determination*

DCEEW. (2008). *Tanami Bioregion*. **https://www.dcceew.gov.au/sites/default/files/env/resources/a8015c25-4aa2-4833-ad9c-e98d09e2ab52/files/bioregion-tanami.pdf**

DENR. (2018). *Alice Springs Bushfire Management Plan*. Retrieved from **https://depws.nt.gov.au/__data/assets/pdf_file/0009/575577/Alice-Springs-Regional-Bushfire-Management-Plan-2018.pdf**

DENR. (2020a). *Bushfire Management Planning Guide: Onshore Petroleum Projects*. Retrieved from **https://depws.nt.gov.au/__data/assets/pdf_file/0006/787488/bushfire-management-planning-guide.pdf**

DENR. (2020b). *Northern Territory Water Allocation Planning Framework* Retrieved from **https://depws.nt.gov.au/__data/assets/pdf_file/0011/476669/nt-water-allocation-planning-framework.pdf**

DENR, & DPIR. (2019). *Code of Practice: Onshore Petroleum Activities in the Northern Territory*. Retrieved from **https://depws.nt.gov.au/__data/assets/pdf_file/0011/705890/code-of-practice-onshore-petroleum-activity-nt.pdf**

DEPWS. (2001). *Weeds Management Act* (WEEDS MANAGEMENT REGULATIONS 2006, Trans.). In 2013 (Ed.), *In Force*. REPW017: Department of Environment, Parks and Water Security.

DEPWS. (2011). *Land Systems of the Southern part of the Northern Territory* (ANZLIC Identifier: A80055845E20EFA5E040CD9B21441034) **http://www.ntlis.nt.gov.au/metadata/export_data?type=html&metadata_id=A80055845E20EFA5E040CD9B21441034**

DEPWS. (2019). *Environmental Protection Act*. Northern Territory Legislation: NT Government. Retrieved from **https://legislation.nt.gov.au/en/Legislation/ENVIRONMENT-PROTECTION-ACT-2019**

DEPWS. (2020, 2021). *Land Clearing Guidelines - Northern Territory Planning Scheme*. NT Government Retrieved from **https://nt.gov.au/__data/assets/pdf_file/0007/236815/land-clearing-guidelines.pdf**

DEPWS. (2021a). *Greenhouse Gas Emissions Management for New and Expanding Large Emitters*. NT Government Retrieved from **https://depws.nt.gov.au/__data/assets/pdf_file/0008/1041938/ntg-large-and-expanding-emitters-policy-2021-version-1.0.pdf**

DEPWS. (2021b). *Movement Of Controlled (Listed) Waste: Guide to using the NT Online Waste Tracking System 2021* Retrieved from **https://ntepa.nt.gov.au/__data/assets/pdf_file/0016/1009141/guidelines-movement-of-controlled-waste.pdf**

DEPWS. (2022a). *Natural Resource (NR) Maps NT*.

DEPWS. (2022b). *Natural Resources Maps (NR Maps)*. Department of Environment and Natural Resources.Retrieved June 2022 from **https://nrmaps.nt.gov.au/nrmaps.html**

DIPL, & DEPWS. (1992). *Pastoral Land Act 1992*, Regulation. **https://legislation.nt.gov.au/en/Legislation/PASTORAL-LAND-ACT-1992**

DITT. (2021). *West Amadeus Basin, Northern Territory 1:500 000 Interpreted Geological Map Explanatory Notes*. **https://resourcingtheterritory.nt.gov.au/news-and-events/news/2021/new-interpreted-geology-map-in-the-western-amadeus-basin,-northern-territory**

DLRM. *Clearing Methodology Technical Note No. 18 Erosion and Sediment Control Guidelines*. Retrieved from **https://nt.gov.au/__data/assets/pdf_file/0013/212260/clearing-methodology.pdf**

DLRM. *Vegetation Retention Technical Note No. 12 - Erosion and Sediment Control Guidelines*. NT Government. Retrieved from **https://nt.gov.au/__data/assets/pdf_file/0018/212256/vegetation-retention.pdf**

DoE. (2013). *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*. Retrieved from **https://www.dcceew.gov.au/sites/default/files/documents/nes-guidelines_1.pdf**

DoH. (2004). *Radiation Protection Act 2004*. Department of Health. Retrieved from **https://legislation.nt.gov.au/en/Legislation/RADIATION-PROTECTION-ACT-2004**

T. M. Doody, O. V. Barron, K. Dowsley, I. Emelyanova, J. Fawcett, I. C. Overton, J. L. Pritchard, A. I. L. M. Van Dijk, & G. Warren. (2017). *Continental Mapping of Groundwater Dependent Ecosystems: A Methodological Framework to Integrate Diverse Data and Expert Opinion*. *Journal of Hydrology: Regional Studies, 10*, 61-81. **https://doi.org/10.1016/j.ejrh.2017.01.003**

DTFHC. (2022). *NT Heritage Register* **https://nt.gov.au/property/land/heritage-listings/heritage-register-search-for-places-or-objects**

NT EPA. (2018). *Northern Territory Noise Management Framework Guideline*. Retrieved from **https://ntepa.nt.gov.au/__data/assets/pdf_file/0004/566356/noise_management_framework_guideline.pdf**

NT EPA. (2019). *NT EPA Environmental Factors and Objectives - Environmental Impact Assessment General Technical Guidance*. (NTEPA2019/0141-010). Retrieved from **https://ntepa.nt.gov.au/__data/assets/pdf_file/0020/804602/guide-ntepa-environmental-factors-objectives.pdf**

NT EPA. (2021). *Stakeholder Engagement and Consultation* (NTEPA2019/0141-018). Retrieved from **https://ntepa.nt.gov.au/__data/assets/pdf_file/0005/884696/guidance-proponents-stakeholder-engagement-and-consultation.pdf**

NT EPA. (2022). *NT EPA Environmental Factors and Objectives* Retrieved from **https://ntepa.nt.gov.au/__data/assets/pdf_file/0020/804602/guide-ntepa-environmental-factors-objectives.pdf**

EPBC. (2021). *Protected Matters Search Tool* **https://www.awe.gov.au/environment/epbc/protected-matters-search-tool**

Tom Ewers-Reilly. (2022). *Rehabilitation Assessment 2021/22 Southern Amadeus Basin 2D Seismic Exploration Program. Santos* (Rehabilitation Inspection 2021/22: Southern Amadeus Basin Seismic Exploration Program (2013 – 2018), Issue.

GHD. (2022). *Ecological Assessment Mount Kitty 2 EP 125*.

Australian Government. (2018). *National Waste Policy*. Australian Government. Retrieved from **https://www.environment.gov.au/system/files/resources/d523f4e9-d958-466b-9fd1-3b7d6283f006/files/national-waste-policy-2018.pdf**

NT Government. (2019). *Petroleum Reserved Block Policy*. **https://nt.gov.au/__data/assets/pdf_file/0005/715631/petroleum-reserved-block-policy.pdf**

G. Graham. (2001). *Great Sandy Desert 1 (GSD1 - McLarty Subregion)*. Retrieved from **https://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/great_sandy_desert01_p326-331.pdf**

L. Harrison, L. McGuire, S. Ward, A. Fisher, C. Pavey, M. Fegan, B. Lynch, Natural Heritage Trust (Australia), & (2009). *Karinga Creek Paleodrainage System*. Retrieved from **https://hdl.handle.net/10070/532039**

Narelle Harvey. (2021). *Onshore Petroleum Projects Environmental Management Plan. EP 134. Peak Helium* (PKH(1-6)). EcOz.

IAP2. (2018). *IAP2 Spectrum of Public Participation*. In.

IECA. (2008). *Best Practice Erosion and Sediment Control* **https://www.austieca.com.au/documents/item/1021**

IECA. (2019). *Best Practice Erosion and Sediment Control (BPESC) document*. International Erosion Control Association. Retrieved from **https://www.austieca.com.au/publications/free-downloads**

B. Kløve, P. Ala-Aho, G. Bertrand, J. J. Gurdak, H. Kupfersberger, J. Kværner, T. Muotka, H. Mykrä, E. Preda, P. Rossi, C. B. Uvo, E. Velasco, & M. Pulido-Velazquez. (2014). *Climate change impacts on groundwater and dependent ecosystems*. *Journal of Hydrology*, *518*, 250-266. **https://doi.org/10.1016/j.jhydrol.2013.06.037**

Allan Lance. (2022a). *An Historical Heritage Assessment of the Proposed Mount Kitty 2 Lease and Access Roads*.

Allan Lance. (2022b). *An Historical Heritage Assessment of the Proposed Mount Kitty 2 Lease and Access Roads, Northern Territory*.

J. W. Lloyd, & G. Jacobson. (1987). *The Hydrogeology of the Amadeus Basin, Central Australia*. *Journal of Hydrology*, *93*(1-2), 1-24. **https://doi.org/10.1016/0022-1694(87)90191-0**

W. A. Low, A. McNally, B. K. Davies, & Penelope Greenslade. (2012). *Changes in vegetation over nine years after rehabilitating a linear feature in Australia's arid zone*. *The Rangeland Journal*, *34*(4). **https://doi.org/10.1071/rj12033**

S. Menpes, P. Walshe, F. Bache, J. Gustenhuber, & M. Sheridan. (2018, 20-21 March). *Exploring the southern Amadeus Basin with 2D Seismic* AGES 2018, Alice Springs, Northern Territory. **https://geoscience.nt.gov.au/gemis/ntgsjspui/handle/1/87080**
**https://geoscience.nt.gov.au/gemis/ntgsjspui/handle/1/87080**

R. A. Perry, & et al. (1962). *Lands of the Alice Springs Area, Northern Territory, 1956-7*. **https://www.publish.csiro.au/cr/pdf/LRS06**

Rosemary Purdie. (1984). *Land Systems of the Simpson Desert Region* [CSIRO Division of Water and Land Resources]. *Niatural Resources Series*, *2*. **https://publications.csiro.au/rpr/download?pid=procite:e0e8af78-7dfa-450b-b393-2af5b9eadde6&dsid=DS1**

Clean Energy Regulator. (2022). *NGER Emissions and Energy Threshold Calculator 2020-21*. Australian Government. **https://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/NGER-Emissions-and-Energy-Threshold-Calculator-2020-21.aspx**

S. Richardson, E. Irvin, R. Froend, P. Boon, S. Barber, & B. Bonneville. (2011). *Australian Groundwater-Dependent Ecosystem Toolbox Part 1: Assessment Framework*. (Waterlines Report Series No. 69). Canberra, Australia: National Water Commission. Retrieved from **http://www.bom.gov.au/water/groundwater/gde/GDEToolbox_PartOne_Assessment-Framework.pdf**
**http://www.bom.gov.au/water/groundwater/gde/GDEToolbox_PartTwo_Assessment-Tools.pdf**

Santos. (2013). *Environment Plan Summary Mt Kitty Exploration Well*. **https://depws.nt.gov.au/__data/assets/pdf_file/0009/258678/SantosEnvironmentPlanMtKitty.pdf**

J Schoenjahn. (2018). *Adaptations of the rare endemic Grey Falcon Falco hypoleucos that enable its permanent residence in the arid zone of Australia*

Department of Environment and Science. (2020). *Noise Measurement Manual*. (ESR/2016/2195). Retrieved from **https://environment.des.qld.gov.au/__data/assets/pdf_file/0027/88560/eis-tm-noise-measurement-manual.pdf**

Noise Monitoring Services. (2020). *Drilling Rig Noise Contro*. **https://www.noisemonitoringservices.com/drilling-rig-noise-control/**

SEWPAC. (1998). *National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998*. Department of Sustainability, Environment, Water, Population and Communities. Retrieved from **https://www.legislation.gov.au/Details/F2012C00858**

D. K. Todd, & L. W. Mays. (2005). *Groundwater Hydrology* (3 ed.). Wiley.

The Engineering ToolBox. (2023). *Air - Density, Specific Weight and Thermal Expansion Coefficient vs. Temperature and Pressure*. **https://www.engineeringtoolbox.com/air-density-specific-weight-d_600.html**

G. A. Young, R. A. Swoboda, & J. N. Mason. (1987). *Hydrogeology of Australia*. Bureau of Mineral Resources, Geology and Geophysics.