Jemena Northern Gas Pipeline Pty Ltd

Northern Gas Pipeline

Draft Environmental Impact Statement

CHAPTER 2 – PROJECT DESCRIPTION

Public

August 2016

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2. PROJECT DESCRIPTION

This chapter describes the layout and location of all infrastructure and facilities to be constructed and operated as part of the Northern Gas Pipeline (NGP) Project (the Project), including temporary construction-phase facilities which will be progressively removed after construction is complete and final rehabilitation has occurred. Details of the land areas within the Project footprint are provided and requirements for negotiation of land access agreements, easements and leases are discussed. The Project schedule is presented along with descriptions of activities that will occur during the construction, operation and decommissioning phases. The purpose of this chapter is to describe the key Project activities in sufficient detail to allow for adequate identification and assessment of environmental risks.

2.1 OVERVIEW

The Project will involve the construction of a new, underground, natural gas pipeline, approximately 622 kilometres (km) in length, and associated facilities. The pipeline will connect the existing Amadeus Gas Pipeline (AGP) at the Warrego Compressor Station in the Northern Territory (NT) to the existing Carpentaria Gas Pipeline (CGP) at Mount Isa in Queensland (Qld).

The following infrastructure and facilities will be constructed, described in order from west (Northern Territory) to east (Queensland):

- a 12-inch (323.9 mm) buried gas pipeline; approximately 457 km of which will traverse land in the Northern Territory with 165 km in Queensland
- a start of line receipt/compressor station at Warrego, located 45 km north-west of Tennant Creek in the Northern Territory. Referred to as the Phillip Creek Compressor Station (PCCS), the site will cover an area of 9 hectares (ha) (300 m by 300 m).
- three main line valve (MLV) facilities at locations along the pipeline, two covering an area of approximately 0.12 ha (30m x 40m) each and one covering an area of approximately 0.24 ha (30m x 80m).
- an end of line delivery station located to the south-west of the Mica Creek Meter Station in Queensland. Referred to as the Mount Isa Compressor Station (MICS), the site will cover an area of approximately 9 ha (300 m by 300 m).
- five cathodic protection (CP) stations, spaced between PCCS, MICS and the MLV sites, each covering an area of approximately 0.04 ha (20 m by 20 m). The CP sites will comprise buried anode beds, located some distance from the pipeline (generally less than 500 m). The beds are connected to the pipeline by buried cables.

Construction is currently scheduled to commence in early 2017 with the pipeline system planned to be operational in 2018. The exact timing is dependent on a number of factors including the timeliness of the required approvals, access agreements with relevant stakeholders and weather conditions. Construction of the PCCS and MICS is planned to extend through to early 2018, as access to these locations is less dependent on dry weather conditions. Commissioning of the pipeline, PCCS and MICS will occur after the construction period.

The construction schedule is driven by the Project objective to achieve commencement of gas transportation services (commercial operation) in 2018.

The construction footprint will comprise a 30 m wide pipeline construction Right of Way (ROW), and extra work space for temporary facilities required to support construction. Extra work space and temporary facilities will include:

- accommodation camps for work personnel
- access tracks (upgrade of existing and construction of new)
- additional works areas (turn-around points, additional work space for crossings and, if required, temporary storage areas)
- water supply bores and dams for storing water required for dust suppression and hydrostatic testing (pressure testing) of the pipeline.

The construction ROW and all temporary facilities, temporary access tracks and extra work areas will be progressively decommissioned and reinstated on completion of the construction phase[1]; the only components to be retained long term are access tracks to the permanent above-ground facilities (i.e. compressor stations, MLV and CP stations) and any access tracks or dams requested by landholders.

Following construction of the pipeline, landholders will be able to resume use of the land. Excavating or erecting permanent structures or buildings over the buried pipeline will be prohibited in accordance with the requirements under the relevant legislation and pursuant to agreements with landholders. Pipeline markers will be provided at fences, road crossings and other locations as required by *Australian Standard 2885 Pipelines – Gas and Liquid Petroleum (AS 2885)*.

Day-to-day operation and maintenance of the compressor stations and above-ground facilities will be performed by field staff based primarily at the PCCS and MICS. The field operations bases will be supported by Jemena's standard maintenance scheduling processes and procedures, in place on other pipeline assets. Easement and facility access will be via a combination of existing and Project-created access tracks, with use of helicopter where wet weather prevents access. Jemena's existing engineering resources will manage the new assets to align with current processes and offer support to field operations when coordinating key maintenance activities.

Control room staff will remotely perform a range of management and monitoring functions and manage pipeline throughput, customer billing, daily gas accounting and planning for scheduled outages.

The pipeline has a design life of 30 years, but with ongoing integrity management, and subject to appropriate commercial drivers, the operational life is expected to be longer. If, and when, the pipeline is no longer required, it will be suspended and, if a decision is made to abandon the pipeline, all above-ground infrastructure will be disposed of appropriately in accordance with the legislative requirements applicable at the time.

2.2 LOCATION

The proposed NGP route traverses approximately 622 km from Warrego in the Northern Territory to Mount Isa in Queensland. The pipeline runs south of the Barkly Highway, mostly through remote and sparsely populated cattle stations and Aboriginal land. The preferred pipeline route was initially selected using a multi-criteria analysis to compare four route options on the basis of risk profiling and capital expenditure.

[1] Final rehabilitation of the ROW and selected access tracks will take place progressively over an extended period (possibly a number of years) to allow Jemena to ensure the ROW is reinstated. Some access tracks, bores and dams may remain subject to landholder agreement.

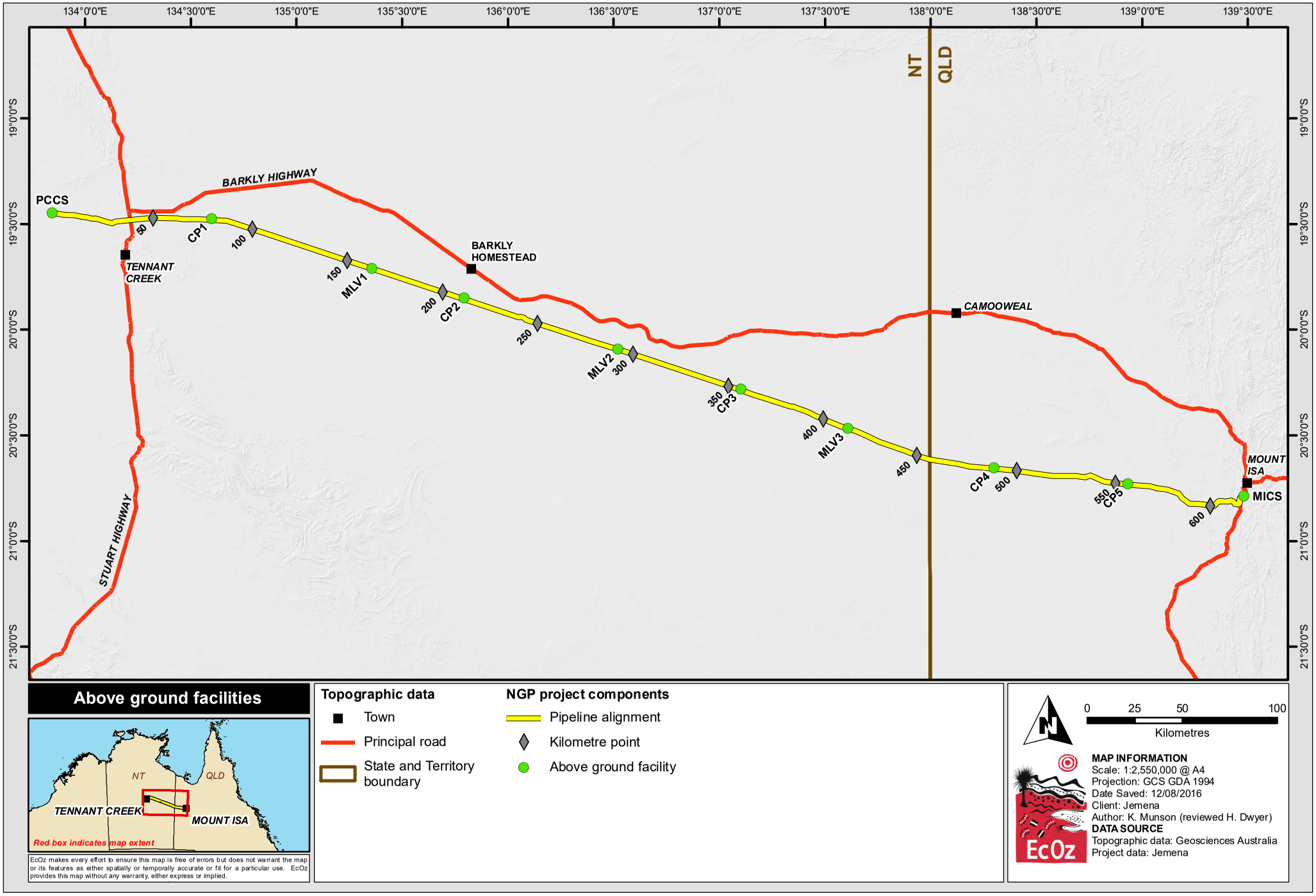
Jemena initially identified a ‘planning corridor,’ within which a preferred 1 km wide ‘alignment corridor’ was selected. The key aspects considered in defining the planning and alignment corridor were:

- ease of construction
- geotechnical factors
- approvals and regulatory issues associated with land access and tenure
- avoidance and/or minimisation of impacts to environment, sacred sites and heritage.

Within the 1 km wide ‘alignment corridor’, the pipeline route and proposed locations for above-ground facilities have been progressively refined through consultation with landholders, land councils, Native Title parties and other parties that possess an interest in land (refer Chapter 4 Stakeholder Engagement).

Desktop and ground-based environmental and heritage studies were also used to inform the route refinement process. The Project has adopted the principle of impact avoidance throughout the design phase wherever possible, consistent with the industry standard *Australian Pipeline and Gas Association (APGA) Code of Environmental Practice (2013)*.

The proposed NGP route and above-ground facility locations are shown in Figure 2-1 and described in the sections below. Temporary construction facility locations are addressed in Section 2.9.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-2. Map of NGP pipeline route and above-ground facilities locations.mxd

Figure 2-1. Map of NGP route and above-ground facilities locations

2.2.1 PIPELINE ROUTE

The NGP route is a predominantly 'straight-line' alignment with deviations around rocky hills which occur to the east of Warrego and south-west of Mount Isa. The key rationale for this route is to provide the shortest distance option, whilst avoiding major construction impediments such as environmental, sacred site, archaeological and landholder impacts and their associated costs.

The 30 m wide construction ROW will be within the 1 km wide 'alignment corridor,' which will allow for minor modifications to the route based on the findings of more detailed on-ground heritage, environmental and geo-technical surveys progressively underway through 2016. All surveys and alignment adjustments will be completed prior to the commencement of construction; there is not expected to be any major modifications to the alignment presented and assessed in this EIS.

The pipeline route is shown in Figure 2-1.

2.2.2 LOCATION OF FACILITIES

The operation of the NGP requires the installation of compression and other facilities at the start of line and end of line, and intermediate facilities along the length of the pipeline route. The approximate locations of above-ground facilities are shown in Figure 2-1 and detailed in Table 2-1.

Table 2-1. Location of above-ground facilities

Facility	Location	Jurisdiction	Latitude	Longitude
Phillip Creek Compressor Station (PCCS)	KP0	Northern Territory	-19.449443	133.854195
Cathodic Protection (CP 1)	KP79	Northern Territory	-19.478398	134.601091
Main Line Valve 1 (MLV 1)	KP163	Northern Territory	-19.710734	135.357274
Cathodic Protection (CP 2)	KP211	Northern Territory	-19.852858	135.792762
Main Line Valve 2 (MLV 2) Intermediate scraper station	KP292	Northern Territory	-20.092958	136.521878
Cathodic Protection (CP 3)	KP356	Northern Territory	-20.282932	137.101982
Main Line Valve 3 (MLV 3)	KP413	Northern Territory	-20.467512	137.609651
Cathodic Protection (CP 4)	KP489	Queensland	-20.655537	138.299971
Cathodic Protection (CP 5)	KP556	Queensland	-20.73109	138.931878
Mount Isa Compressor Station (MICS)	KP622	Queensland	-20.787959	139.480194

2.3 LAND INFORMATION

To build, own and operate the NGP, Jemena must gain access to the land and acquire interests in the land to establish the footprint upon which the pipeline and facilities will be built. This section provides information on the land and associated interests within the Project footprint. Jemena's proposed approach to land access is described in Section 2.4.

2.3.1 LOCAL GOVERNMENT

The Project covers two Local Government Areas (LGAs): the Barkly Regional Council, in the Northern Territory, and the Mount Isa City Council, in Queensland. Both councils were engaged by Jemena early

during the planning phase in order to identify risks and opportunities associated with the Project (refer Chapter 4 Stakeholder Engagement).

The Barkly Regional Council is the second largest LGA in Australia covering approximately 325,000 km^2 of land in the eastern portion of the Northern Territory. The area has 8,137 residents. The LGA includes Tennant Creek, which is the most populous town in the Barkly region, with a population of approximately 3,500 people. A number of smaller towns, communities and outstations are also scattered throughout the region. The major industries in the Barkly region are beef production and mining.

Mount Isa City Council covers an area of 43,310 km^2 and has an approximate population of 22,000 people. The City Council area includes the city of Mount Isa and the town of Camooweal, and extends from the Northern Territory border to just east of Mount Isa. Similar to the Barkly region, the major industries in this area are beef production and mining.

2.3.2 LAND TENURE

The majority of land tenure within and surrounding the Project footprint is comprised of perpetual pastoral leases, Aboriginal land with some freehold, vacant Crown land, Crown leases and reserves throughout (Figure 2-2 and Figure 2-3). In Queensland there are also parcels of State land and a timber reserve, located near Mount Isa.

The PCCS facility is located on a perpetual pastoral lease.

The MICS facility is located on a mining lease. The tenure of the MICS site is unallocated state land and is held by the State of Queensland (represented by the Department of Natural Resource and Mines).

The preferred land access strategy and tenure for the Project varies according to the underlying land tenure (refer Section 2.4).

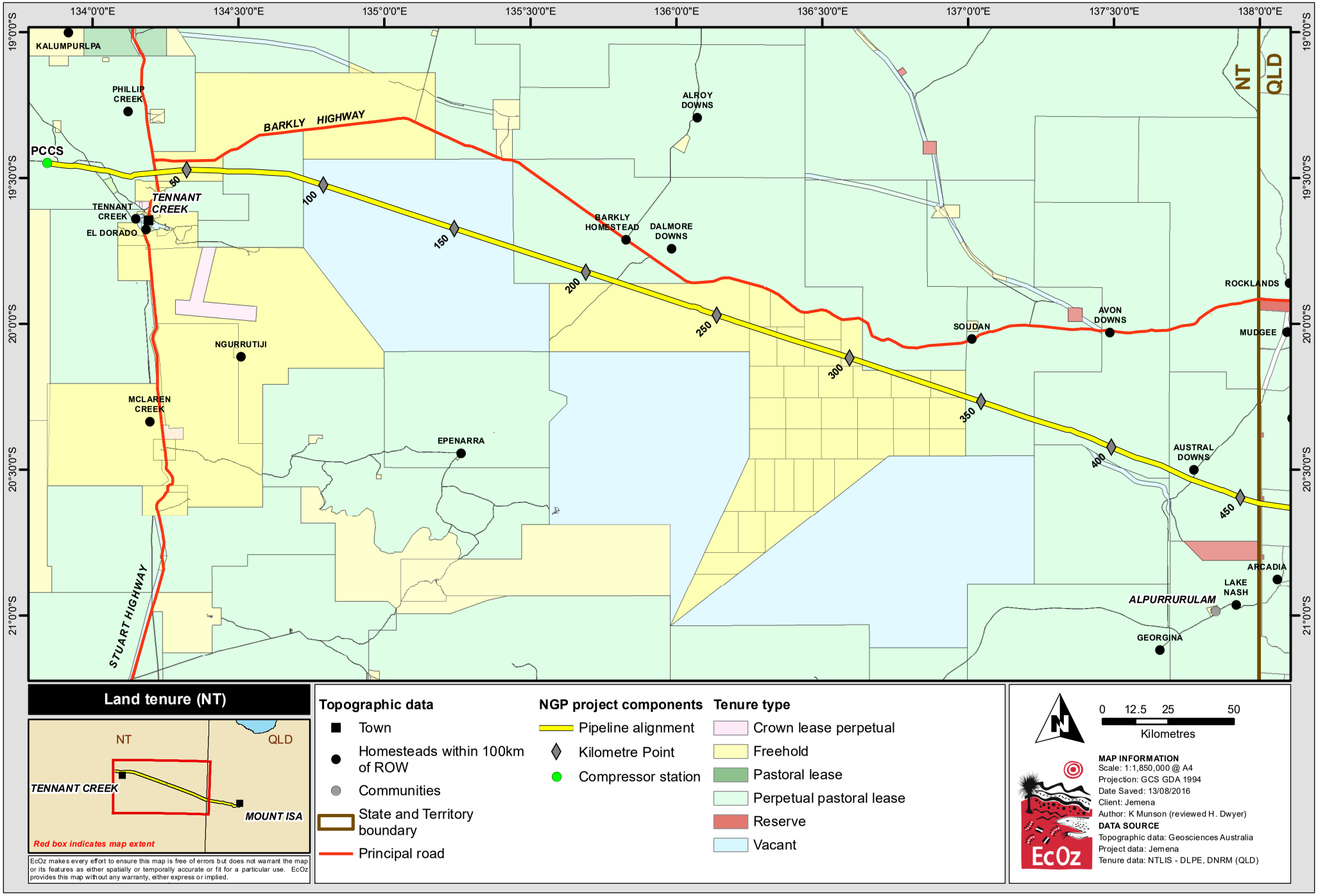
2.3.3 LANDHOLDERS AND NATIVE TITLE CLAIMS

Jemena is engaging with a range of landholders including land councils, Native Title parties and their representative bodies, road and railway authorities, leaseholders and State, Territory and Commonwealth Government departments and agencies.

The Project footprint covers 20 land parcels within the Northern Territory (Figure 2-2); seven of these are perpetual pastoral leases, nine are freehold, two are freehold under the Aboriginal Land Rights (Northern Territory) Act (*Cth*), one is a Crown lease and one is vacant Crown land.

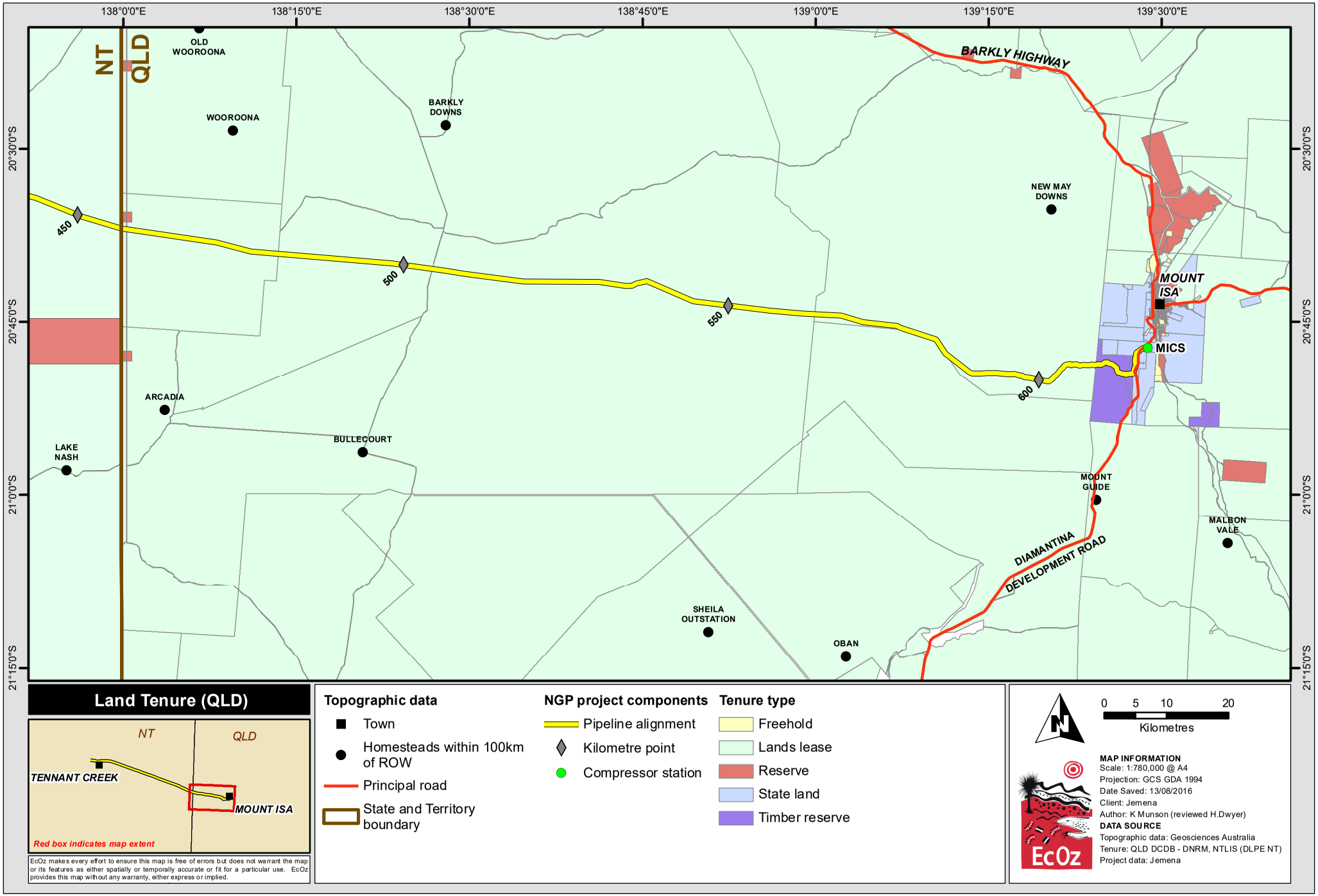
Within Queensland, the Project footprint covers 13 land parcels (Figure 2-3): five are rolling term leases for pastoral properties, one is freehold and two are no term leases (currently held by a pastoral company). Four parcels are owned by the State of Queensland and one is owned by the Mount Isa City Council; these parcels are estates in state land, timber reserves or road reserves.

The Project footprint also encompasses land in which there are a number of Native Title claims (including areas in which Native Title has been determined to exist). The location of Native Title claims, determinations and land with Aboriginal interests is shown in Figure 2-4.



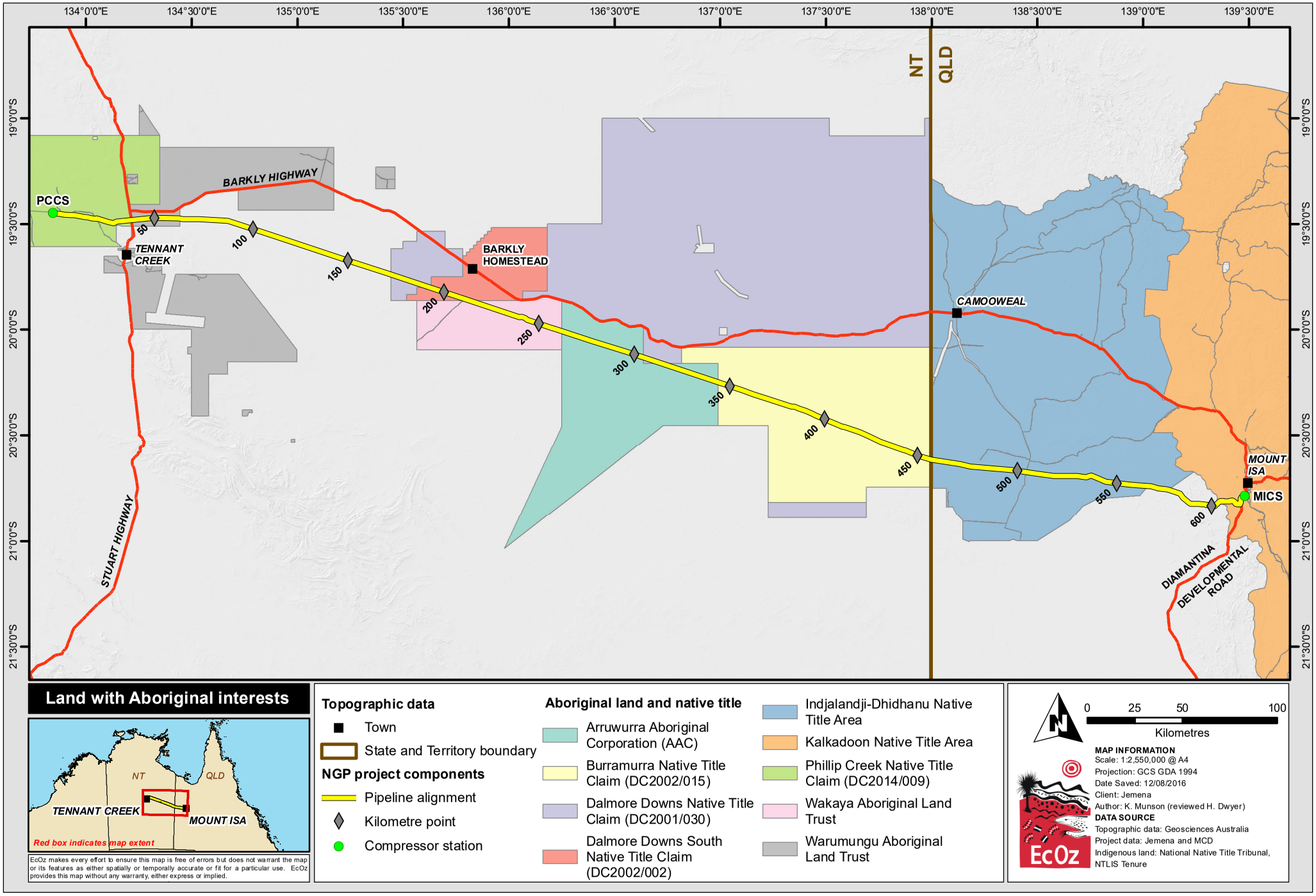
Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-3. Map of land tenure and parcels within and surrounding the project footprint - NT.mxd

Figure 2-2. Map of land tenure and parcels - Northern Territory



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-4. Map of land tenure and parcels within and surrounding the project footprint - Qld.mxd

Figure 2-3. Map of land tenure and parcels - Queensland



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-5. Map of land with Aboriginal interests.mxd

Figure 2-4. Map of land with Aboriginal interests

2.3.4 CURRENT LAND USE AND INFRASTRUCTURE

The majority of land traversed by the Project footprint is sparsely populated and used mainly for beef production. The region is characterised by a low level of industrial development, except for the areas around Mount Isa. Figure 2-5 shows the location of existing infrastructure (pipelines, roads and rail) and populated places in relation to the Project footprint. Further details of the current land use and infrastructure in the region are provided below.

The PCCS is located on Warrego Road, adjacent to an existing gas compressor station and the AGP. The land is part of a pastoral station (held under a perpetual pastoral lease), which is subject to a Registered Native Title Claim. Access for construction of the PCCS is currently being negotiated and will include any requirements for avoiding or minimising impacts on current land use in the area.

The MICS is located on the south west side of Mount Isa, near to the location of other infrastructure facilities held under sub-lease by a mining company. Jemena is in consultation with the leaseholder to ensure Project activities are acceptable and do not unduly impact on current or future land operations. Native Title has also been determined over the area.

The pipeline route crosses the Stuart Highway, which is the main highway linking Darwin and Adelaide. To the west of the highway, the pipeline route crosses the Adelaide to Darwin Railway line. The pipeline alignment runs south of the Barkly Highway, which is the main highway linking the Northern Territory to Queensland. Towards the eastern end of the pipeline, near Mount Isa, the route crosses the Diamantina Developmental Road, which is a rural road linking Mount Isa with Charleville, in south west Queensland.

The main towns and populated places in the region are Tennant Creek, Threeways Roadhouse, Barkly Homestead Roadhouse, Camooweal and Mount Isa. The closest city to the NGP is Mount Isa, which is approximately 7 km north east of the MICS. The town of Tennant Creek is 16.5 km to the south of the pipeline route and 41.5 km south east of the PCCS. There are also a number of small Aboriginal family outstations and pastoral homesteads in the areas traversed by the pipeline route.

The location of residential areas in relation to the pipeline route and facilities locations is presented in Table 2-2. The potential impacts of the Project on these locations are considered in the relevant chapters of this EIS.

Table 2-2. Populated places within 20 km of NGP

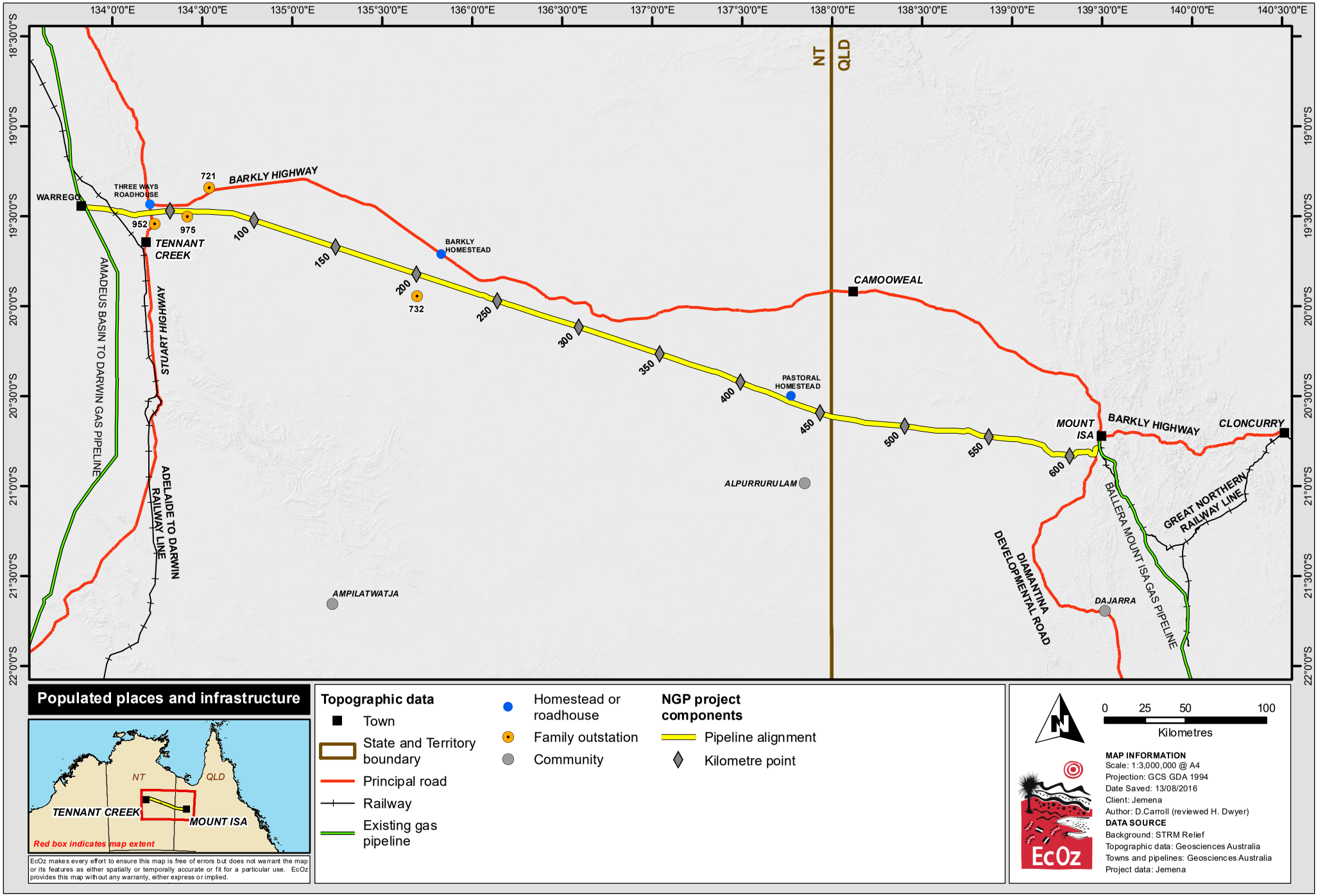
Place	Distance from Pipeline Route	Distance from Nearest NGP Facility	Population / No. of Dwellings
Tennant Creek	16.5km south	41.5km south-east of PCCS 121km west of MLV 1	3,634
Family Outstation 952	6.8km south	41.8km south-east of PCCS 121km west of MLV 1	3 houses
Family Outstation 975	3.4km south	60km east of PCCS 101 km north-west of MLV 1	2 houses
Family Outstation 721	14.8km north	73km east of PCCS 95 km north-west of MLV 1	8 houses
Family Outstation 732	12.4km south	44km south-east of MLV 1	4 houses
Pastoral Homestead	3.5km north	17.4km east of MLV 3	3 houses and a school
Homestead south of Mount Isa	1km east	2.5km south of MICS 2.0km north-east of MLV 4	Single house

Place	Distance from Pipeline Route	Distance from Nearest NGP Facility	Population / No. of Dwellings
Diamantina and Leichardt power stations residences (Powerhouse Road)	1.2km north-east	1.2km north-east of the MICS	9 houses
Mount Isa	1.8km north-east	1.8km north-east of MICS	City

2.3.5 RESOURCE TENEMENTS

There are a number of resource tenements within the Project footprint, which are granted for different stages of development including exploration, retention, extraction and production. There are 14 resource tenements intersected by the Project footprint in the Northern Territory and 11 in Queensland. Two mining leases are within the Project footprint, whilst the majority of tenements are exploration leases or permits with minimal to no current activity.

The application for pipeline permits and licences in the Northern Territory and Queensland requires a notification to affected parties (requirements are different for the Northern Territory and Queensland). Jemena has provided notification to all tenement holders as part of the application process for both pipeline licences. The notification of Application for a Pipeline Licence, together with the ongoing consultation throughout the survey period, paves the way for a consultative approach to be adopted whereby threats to the Project are mitigated and impacts to mineral and petroleum tenements are reduced to as low as reasonably practicable.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-6. Map of existing infrastructure and populated locations.mxd

Figure 2-5. Map of existing infrastructure and populated places

2.4 LAND ACQUISITIONS

Jemena is required to secure land tenure for the pipeline, above-ground facilities and compressor stations. Agreements will be secured through negotiation with landholders and other parties which possess an interest in land. Since 2015 Jemena has engaged with landholders, occupiers, Native Title Parties, Land Councils, other people having interests in the land, and a wide range of other stakeholders (refer Chapter 4 Stakeholder Engagement). Engagement is ongoing.

Jemena's land acquisition program comprises three distinct phases as follows:

- access for survey purposes
- access for construction purposes
- securing land tenure.

2.5 GEOTECHNICAL, ECOLOGICAL AND PRE-CLEARING SURVEYS

Preliminary geotechnical surveys were undertaken to inform route selection and construction requirements. Prior to construction, further detailed surveys will be undertaken to provide information for detailed engineering designs and construction methods. Information from the detailed geotechnical surveys will also inform the development of more detailed environmental management plans, in particular the progressive Erosion and Sediment Control Plans (ESCP) required for areas of high erosion risk, and the Rehabilitation Management Plan for the construction footprint.

To date, ecological surveys of the Project footprint have entailed aerial survey for the purpose of general characterisation of the environment and identification of potentially significant and/or sensitive habitat areas which require further ground-based assessment. Targeted threatened species surveys were conducted in April and May 2016 to inform the biodiversity risk assessment and Biodiversity Management Plan.

Baseline noise monitoring was undertaken in May 2016 through deployment of noise loggers at potentially sensitive receptor locations.

Sacred site and archaeological surveys of the construction footprint have largely been completed (the survey approach and methods are detailed in Chapter 8 of this EIS). Once complete, the survey results will inform the development of a detailed Project Cultural Heritage Management Plan

Prior to commencement of construction, further ground-based ecological surveys will be undertaken as follows:

- the major watercourse crossings to be intersected by the pipeline alignment will be assessed, with a particular focus on identifying and locating permanent pools in proximity to the construction footprint and characterising bed and band profiles for input to progressive ESCPs.
- mapping of the construction footprint, including proposed roads and access tracks, to plot the location and extent of existing weed species and define weed management zones.
- in the Queensland section of the construction footprint, regional ecosystem mapping in accordance with the conditions of the Environment Authority issued by the Department of Environment and Heritage Protection (DEHP).

Construction ROW pre-clearance environmental surveys will be conducted in order to flag the proposed clearing footprint and identify any specific controls required as per management plans and commitments outlined in this EIS.

2.6 PROJECT FOOTPRINT

The construction of the pipeline, compressor stations and above-ground facilities will require land clearing totalling approximately 2,470 hectares; of which 1,753 hectares will be in the Northern Territory and 717 hectares in Queensland. The main components of the Project construction and operational footprints are provided in Table 2-3 and Table 2-4.

The majority of land disturbance will be temporary (refer Table 2-3) – only approximately 102 hectares will remain cleared for operational purposes (refer Table 2-4). The construction ROW and all temporary facilities, access tracks and works areas will be progressively decommissioned and rehabilitated over an extended period[2] on completion of the construction phase. The only components to be retained in the long term are the compressor stations and above-ground facilities, access tracks to the facilities and any access tracks, bores or dams agreed with the landholder (refer Table 2-4).

Table 2-3. Components of the temporary Project construction footprint

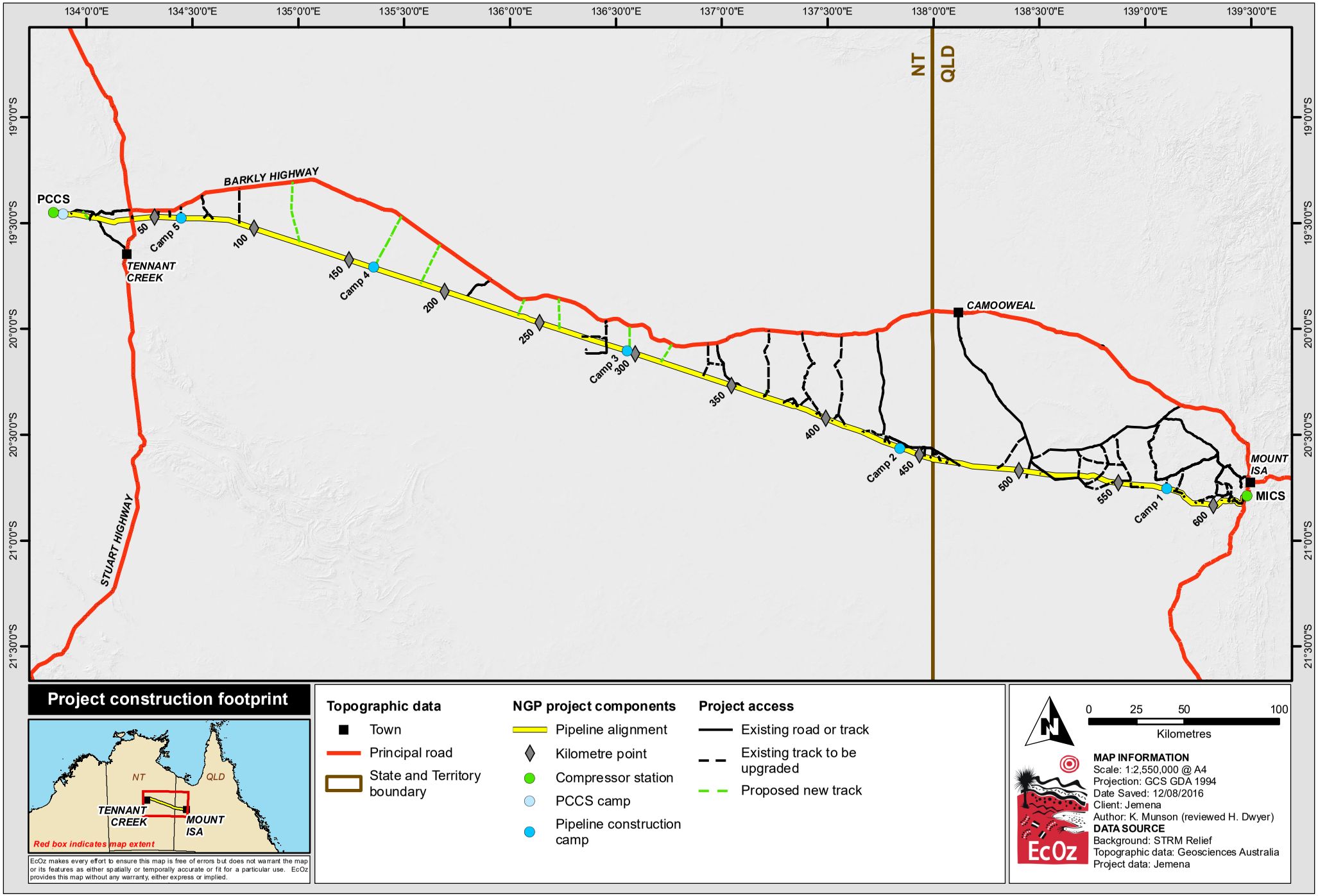
Project component	Size/scale	Northern Territory		Queensland	
		Number/ Length	Total	Number/ Length	Total
Construction ROW	30m wide	457km	1,371ha	165km	495ha
Temporary construction camps	12 ha each	5	60ha	1	12ha
Access tracks (disturbance area)	Varying	-	243ha	-	127ha
Temporary work spaces	Varying	18	50.6ha	33	68.3ha
Vehicle turnarounds	0.35ha each	8	2.8ha	-	-
Low consequence water storage dams for construction and hydrostatic pressure testing (12ML)	2.5ha each	6	15.0ha	2	5.0ha
Total area		**-**	**1,742.4ha**	**-**	**707.3ha**

[2] Final rehabilitation of the ROW and selected access tracks will take place progressively over an extended period (possibly a number of years) to allow Jemena to ensure the ROW is reinstated. Some access tracks, bores and dams may remain subject to landholder agreement.

Table 2-4. Components of the Project operational footprint

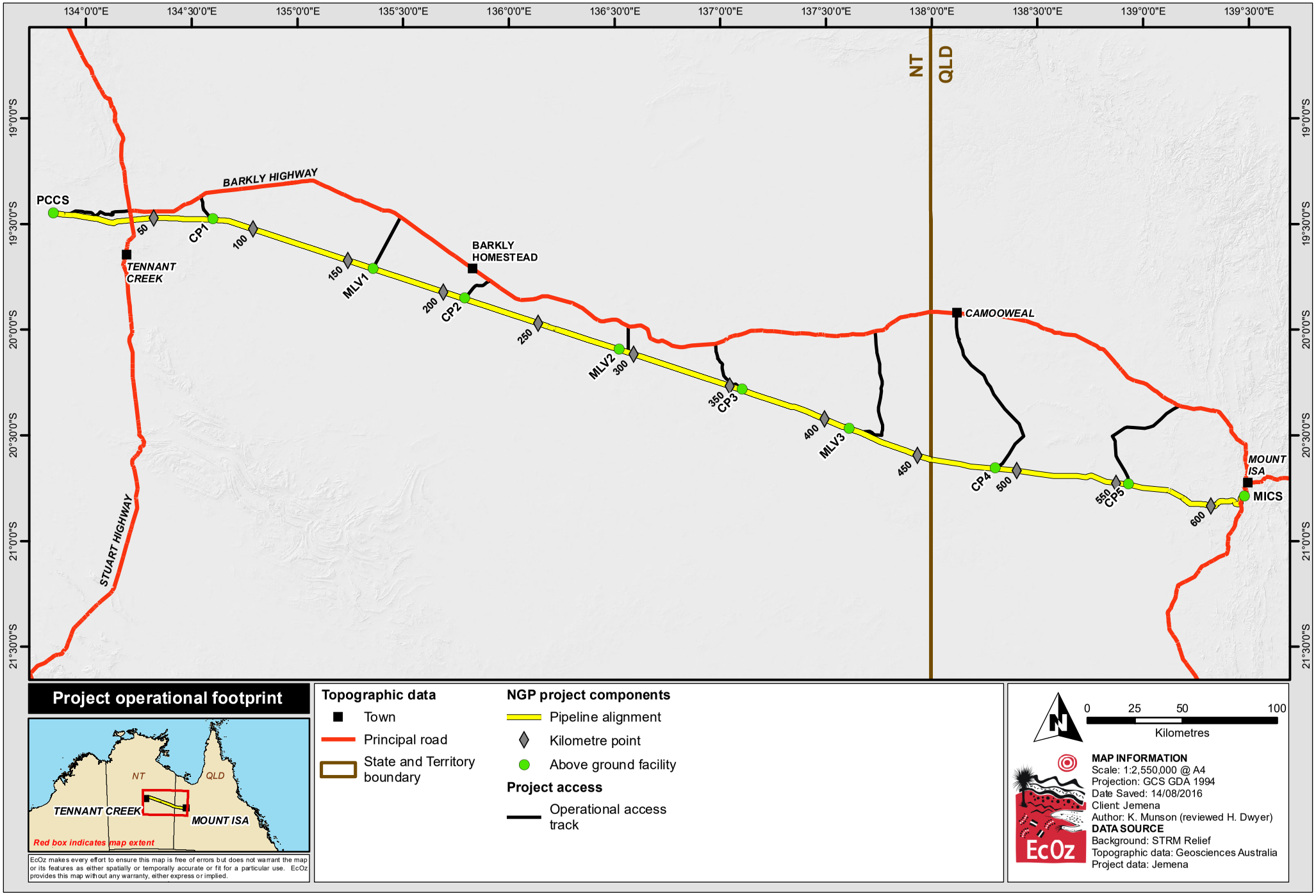
Project component	Size / scale	Northern Territory		Queensland	
		Number/ Length	Total	Number/ Length	Total
Phillip Creek Compressor Station	300m x 300m	1	9ha	-	-
Mount Isa Compressor Station	300m x 300m	-	-	1	9ha
Main Line Valve 1 and 3	30m x 40m	2	0.24ha	-	-
Main Line Valve 2 incl. scraper station	30m x 80m	1	0.24ha	-	-
Remote cathodic protection stations	20m x 20m	3	0.12ha	2	0.08ha
Access tracks (permanent)	Varying	-	57ha	-	25ha
Anode beds	40m x 10m Plus 3m tracks (up to 500m long)	6	1.14ha	2	0.38ha
Total area			**67.7ha**		**34.5ha**

Each of the Project components is further described in Section 2.7 Project Description, Section 2.8 Compressor Stations and Section 2.9 Construction Phase (Temporary) Facilities.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-7. Map of NGP construction footprint.mxd

Figure 2-6. Project construction footprint



Path: D:\Users\keith.munson\Desktop\Operational footprint play Helen.mxd

Figure 2-7. Project operational footprint

2.7 PIPELINE INFRASTRUCTURE

The NGP will be a buried, steel, gas transmission pipeline 12-inch in nominal diameter. The pipeline will be designed, constructed, tested, operated and maintained in accordance with AS 2885 and other applicable standards and regulations or industry codes of practice (including the *Australian Pipeline Industry Association (APIA) Code of Environmental Practice – Onshore Pipelines*). The pipeline system designed to AS 2885 Part 1 (AS 2885.1) includes the following infrastructure:

- tie-in facilities to connect to the existing AGP and CGP
- main line pipeline (from pig launcher to pig receiver inclusive)
- scraper assemblies (start of line, end of line and intermediate assembly at MLV2)
- main line valve assemblies including cold vents
- cathodic protection system.

The pipeline route and above-ground facilities locations are documented earlier in Section 2.2.1 and 2.2.2.

2.7.1 PIPELINE DESIGN CRITERIA

The information contained in this section is taken from the pipeline Design Basis Manual (DBM), prepared by Jemena to describe the principles, philosophies and specific design criteria to be applied for the detailed design of the NGP in accordance with AS 2885.1. The design criteria are informed by a broad variety of inputs, including the overall Project objectives, as well as various technical inputs such as the initial Pipeline Safety Management Study (SMS), which was carried out in accordance with AS 2885.1, as well as environmental conditions (seismic, geotechnical, temperature) and the physical location of the pipeline. These overall design requirements are used to determine the location-specific design elements, and the required wall thickness, additional protection requirements, depth of cover and marking requirements for different location classes.

2.7.1.1 Pipeline diameter and thickness

The NGP pipeline diameter size is 12-inches. The majority of the pipeline will be constructed from 6.4 mm thick steel pipe, with heavy wall pipe being utilised in selected locations to provide additional resistance to penetration, for increased safety and buoyancy control. The maximum allowable operating pressure (MAOP) of the pipeline is 15,320 kPa.

The pipeline will be buried for its entire length, and will be deep enough so that current land use activities can continue following installation. The associated facilities will be above ground.

2.7.1.2 Location classes

Jemena assessed the pipeline as primary location class R1 (Rural Area) and it will be designed to class R1 standards as prescribed by AS 2885.1. There are several areas along the route subject to periodic inundation which have been nominated as secondary location class W (Submerged). In these areas the pipeline will be designed to the AS 2885.1 requirements relevant to class W land, which include deeper burial. A detailed design SMS will be conducted to validate the findings of the preliminary SMS.

2.7.1.3 Pipe protection

The pipeline shall be designed with the intent that activities by third parties either in close proximity or directly in contact with the pipeline will not cause injury to the public or pipeline personnel. Pipeline protection measures are defined by AS 2885.1. These include:

- physical protection through separation and wall thickness
- procedural controls through pipeline awareness, route patrol and signage and external interference detection.

The level of protection measures provided in the design will be confirmed by the final SMS and will be based on the location class.

2.7.1.4 Depth of cover

The pipeline will be buried at a depth ranging between 750 mm to 3,000 mm, depending on location. The depth of cover over the pipeline shall comply with the minimum requirements of each location class as per AS 2885.1. At locations where the pipeline is potentially exposed to erosional forces, i.e. watercourse crossings and black soil plains, additional protection is provided by increasing the depth of cover. The pipeline is also buried deeper beneath highway, road and rail crossings, and within a specified distance of dwellings and other infrastructure.

2.7.1.5 Seismic loading

Seven extinct fault crossings were identified along the pipeline alignment. An assessment of earthquake hazards was conducted as part of the Desktop Geotechnical Report, the results of which confirmed the faults are inactive and the chance of an earthquake of sufficient size to damage the pipeline reoccurring is negligible. The report also concluded there were no meaningful design provisions which could be made to make a pipeline traversing the area less prone to earthquake damage.

A previous earthquake event north of Tennant Creek, which caused damage to but not failure of the AGP, is noted. The Project route does not traverse the area where this event occurred. The risk of pipeline failure from seismic activity is considered to fall into the definition of As Low as Reasonably Practicable (ALARP) as defined in AS 2885. This conclusion will be validated in the detailed design SMS.

2.7.1.6 Pipeline marking

Pipeline marker signs will be installed along the length of the pipeline in accordance with AS 2885.1, and will indicate the location of the pipeline, its description and the name and contact details of the operator. Additional signs will be installed at:

- either side of public roads and watercourse crossings
- one side of vehicle tracks and minor watercourse crossings
- all fence lines
- all direction change points
- utility crossings
- facility points
- property boundaries
- other locations as determined, noting that signs shall not be installed in the middle of fenced paddocks where such installation would interfere with the landholder's use of the land.

Aerial marker signs shall be installed at 10 km intervals to allow identification from aerial patrol.

High stretch marker tape shall be buried along the pipe route at the following locations:

- railway/road and track crossings (except where installed by trenchless method)
- other areas as identified via the SMS process

Marker tape shall be installed at a minimum of 300 mm above the pipeline and 450 mm below the surface.

2.7.2 TIE-IN

Tie-in to existing pipeline infrastructure will connect the NGP to the AGP at the Warrego Compressor Station and to the CGP via hot tap connection near to the Mica Creek Meter Station.

2.7.3 CATHODIC PROTECTION SYSTEM

The pipeline will be protected against corrosion to ensure its continued safe operation. To achieve primary protection, the pipe is coated externally along its length with dual layer Fusion Bonded Epoxy (FBE) anti-corrosion coating. As a secondary protection from degradation due to corrosion, an impressed current cathodic protection (CP) system will be installed. The Project's CP system will comprise a total of 10 CP stations, installed at intervals along the pipeline. Three of the installations are at MLV sites, five are dedicated CP stations and two are at PCCS and MICS (refer Figure 2-1).

Each CP station will comprise an array of anodes buried in the ground and connected to an above-ground solar powered transformer rectifier, located in a cabinet. The transformer rectifier is connected to the pipeline using buried cabling. The choice of ground bed type and size depends on the location and soil resistivity. Test points for potential corrosion measurement will be installed approximately every 5 km along the length of the pipeline, subject to accessibility of locations.

2.7.4 MAIN LINE VALVES

Main line valves (MLVs) are provided as a means to isolate the pipeline in segments for maintenance, operation, repair and for the minimisation of gas loss in the event that pipeline integrity is lost. Once isolated, the gas from the relevant section may be vented prior to incident investigation and/or maintenance taking place. Three MLVs will be located along the pipeline; proposed locations per Table 2-1 and shown in Figure 2-1.

A typical MLV site is shown in Figure 2-8. Each MLV site (with the exception of MLV2) will comprise the following components located within a 30 m by 40 m fenced compound (or 30 m by 80 m for MLV2, which incorporates scraper facilities):

- above-ground pipework and automated mainline isolation valve with gas over oil actuator
- pipeline blowdown vent
- remote terminal unit
- self-contained solar power supply and satellite communications
- cathodic protection unit, ground bed and test points
- off takes to allow for future compression and pipeline looping.

MLV 2 will also include a pipeline scraper receiver and launcher and will be used to launch and retrieve devices, typically called 'pigs', that perform a range of maintenance functions, including but not limited to inspection and cleaning. Figure 2-9 shows a typical MLV and pipeline scraper receiver and launcher site.

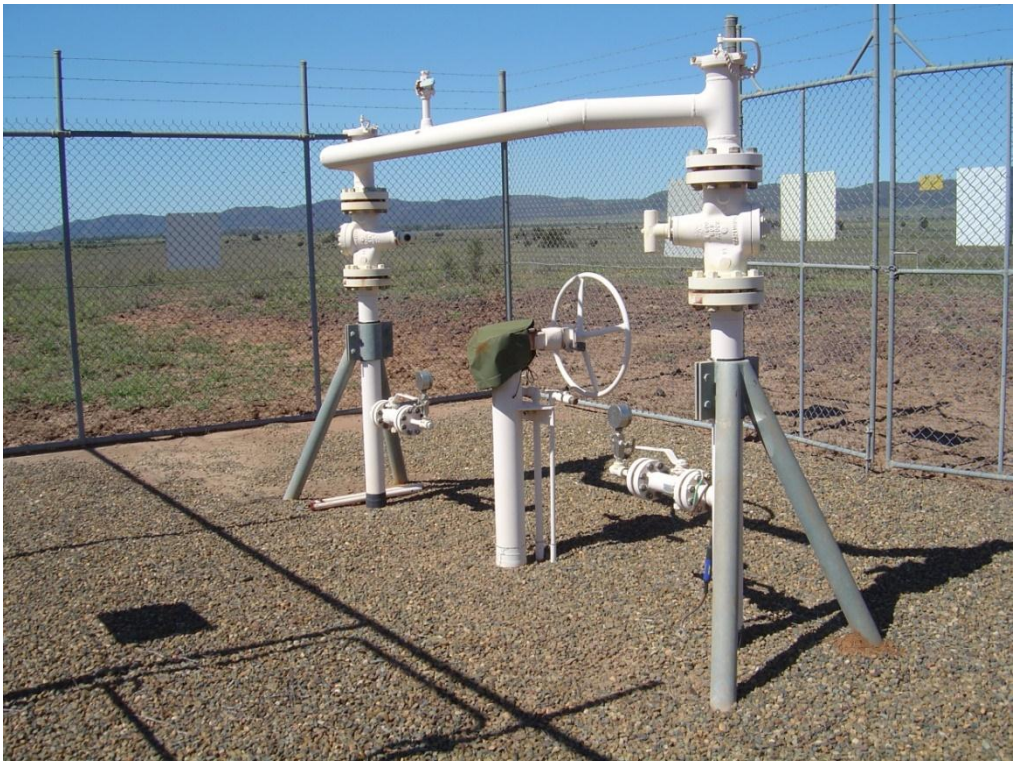


Figure 2-8. Photo of typical main line valve - Arcadia MLV on Jemena's Queensland Gas Pipeline

Figure 2-9. Photo of typical main line valve and scraper station - Oallen MLV and Scraper Facility on Jemena's Eastern Gas Pipeline

2.8 COMPRESSOR STATIONS

A compressor station will be constructed at either end of the pipeline; one at Phillip Creek, near Warrego (PCCS), and one at Mount Isa (MICS). The PCCS is referred to as the start of line or receipt compressor station and takes gas from the AGP via a single connection point. The MICS is referred to as the end of line or delivery compressor station; it delivers gas to the CGP. The sections below provide further details of the facility components and operations.

2.8.1 PHILLIP CREEK COMPRESSOR STATION

The PCCS will be located adjacent to the existing APA Group Warrego Compressor Station located on the AGP 45 km north-west of Tennant Creek, and will cover a fenced area of approximately 300 m by 300 m (9 hectares). A photo of the proposed site is shown in Figure 2-10.

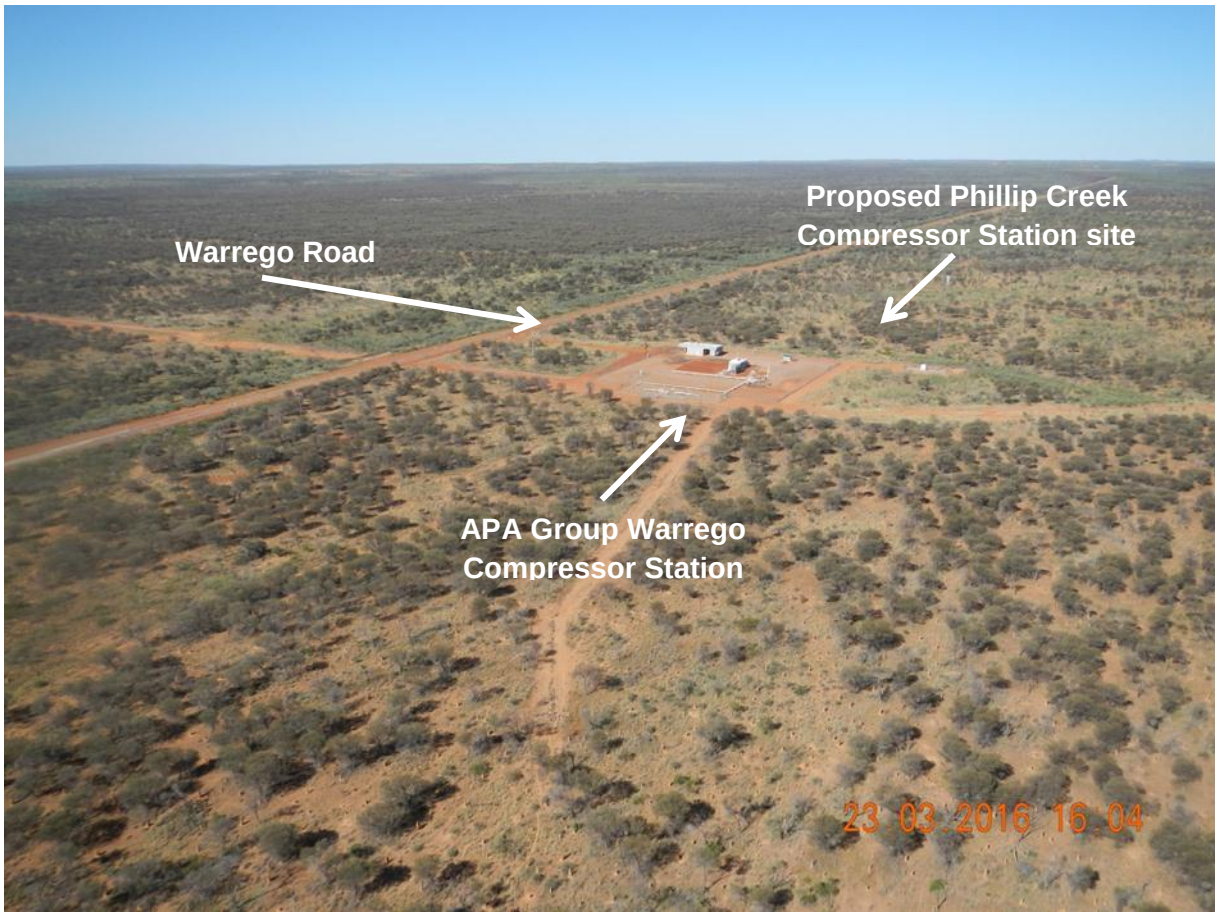


Figure 2-10. Photo of site for proposed Phillip Creek Compressor Station

2.8.1.1 Components and layout

The PCCS will consist of gas compression infrastructure to pressurise gas for transportation through the NGP to the Mount Isa end of line facility (the MICS). The PCCS will also comprise various filtration and separation equipment used to remove liquids and impurities to ensure gas meets the specifications for delivery into the CGP.

The infrastructure at PCCS will be of varying heights. Most infrastructure will be less than 15 m in height. The height of the flare stack is expected to be up to 40 m.

The flare system will operate with a permanent pilot flame. The flare and pipeline vent systems will be designed for release of gas during commissioning, periodic testing, variations in incoming gas and in emergency situations. Other supporting infrastructure includes an office, workshop, accommodation room and car park.

The main components and layout of the PCCS are shown in Figure 2-11.

2.8.1.2 Power supply

The PCCS site will be powered by duty/standby Gas Engine Alternators (GEAs), fuelled by pipeline gas. There will be a connection to the local electricity; however, this is not intended to be the primary power supply for the site.

2.8.1.3 Water and sewage

Water requirements for daily operation of the PCCS include demineralised service water, potable water for site amenities and drinking water. The PCCS will require approximately 4,800 litres/day (200 litres/hr), with the majority used as make-up (diluting) water in the nitrogen reduction system. Service water will need to be treated prior to use, which will occur through an on-site treatment system.

Service water will be taken from a borehole to be drilled near the PCCS site before being piped to tanks on site and pumped around the compressor station. Potable water will be trucked by road to the site as needed from existing commercial sources. On-site management of wastewater from amenities will be in the form of standard septic system. Operational potable water and amenities wastewater volumes will be low due to the small number of field operations staff based at the facility.

2.8.1.4 Air and noise emissions

Operation of the PCCS will produce air and noise emissions. Air emissions will include combusted fuel gas (N_2, O_2, CO_2, H_2O, trace NOX/SOX), removed nitrogen and acid gases (CO_2, water, H_2S, HC). These will be released to the atmosphere via the gas turbine exhaust, gas engine alternator exhaust, NRU vent, Acid Gas Removal Unit vent or the flare system. Noise emissions will be generated from the equipment (including aftercoolers), however a silencer will be installed on the compressor exhaust systems to minimise emissions. Noise emissions will also occur in association with flaring and venting activities.

Jemena has characterised and assessed the potential impacts of emissions on the environment and community (sensitive receptors). The reports concluded that due to the remoteness of the PCCS site, emissions are unlikely to affect any sensitive receptors. Air and noise risks are discussed in Chapter 11 of this EIS.

2.8.1.5 Fuel and chemical storage and use

Small volumes of diesel, petrol, kerosene and other fuels are expected to be stored on site for operational purposes such as fuel for vehicles, pumps, burners and other equipment. All dangerous goods storage facilities will be designed in accordance with the requirements of the *Australian Dangerous Goods Code* and *Australian Standard (AS) 1940 Storage and handling of flammable and combustible liquids*. Storage and handling of dangerous goods will comply with the requirements of the *National Standard NOHSC: 1015 (2001) Storage and Handling of Workplace Dangerous Goods*.

2.8.1.6 Produced water

Up to approximately 200 litres of water per hour will be produced at the PCCS as part of the nitrogen reduction facility. Produced water will be filtered through an on-site waste water treatment system to

remove minerals and trace chemicals such as amine and hydrocarbons. The treated water will then be directed to an on-site evaporation pond for disposal by evaporation.

2.8.1.7 Other wastes

Waste amine, mercury bed adsorbent material, spent mole sieves bed material, waste hot oil and gas filter drained waste (such as hydrocarbons, glycol, oil and pipeline dust) will be stored on site in allocated tanks, drums or storage facilities prior to removal off site by a licenced waste contractor. Small amounts of domestic waste will also be produced, which will be disposed of at an approved disposal facility. Further detail in relation to the operational waste streams and associated management controls is provided in Chapter 13 Environmental Management Plan.

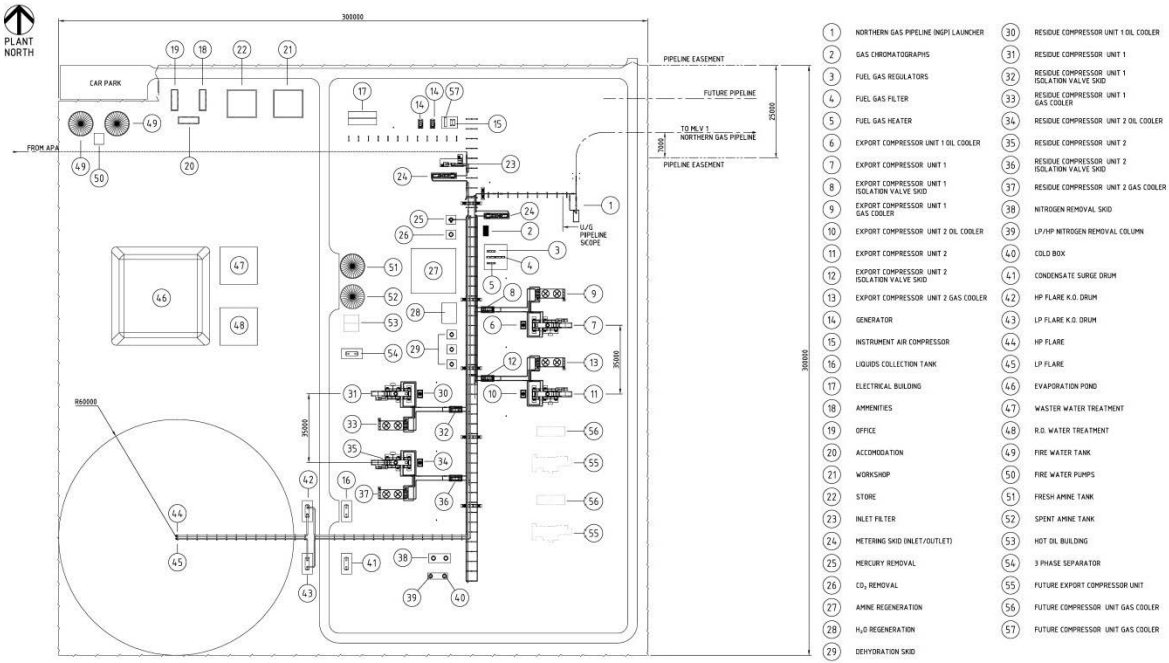


Figure 2 11. Phillip Creek Compressor Station site layout

NOT FOR CONSTRUCTION

2.8.2 MOUNT ISA COMPRESSOR STATION

The MICS facility will be located just south of the existing APA Group Mica Creek Meter Station, near Mount Isa, and will cover an area of approximately 300 m by 300 m (9 hectares). The site is located adjacent to an existing power station. An aerial view of the proposed site is shown in Figure 2-12.

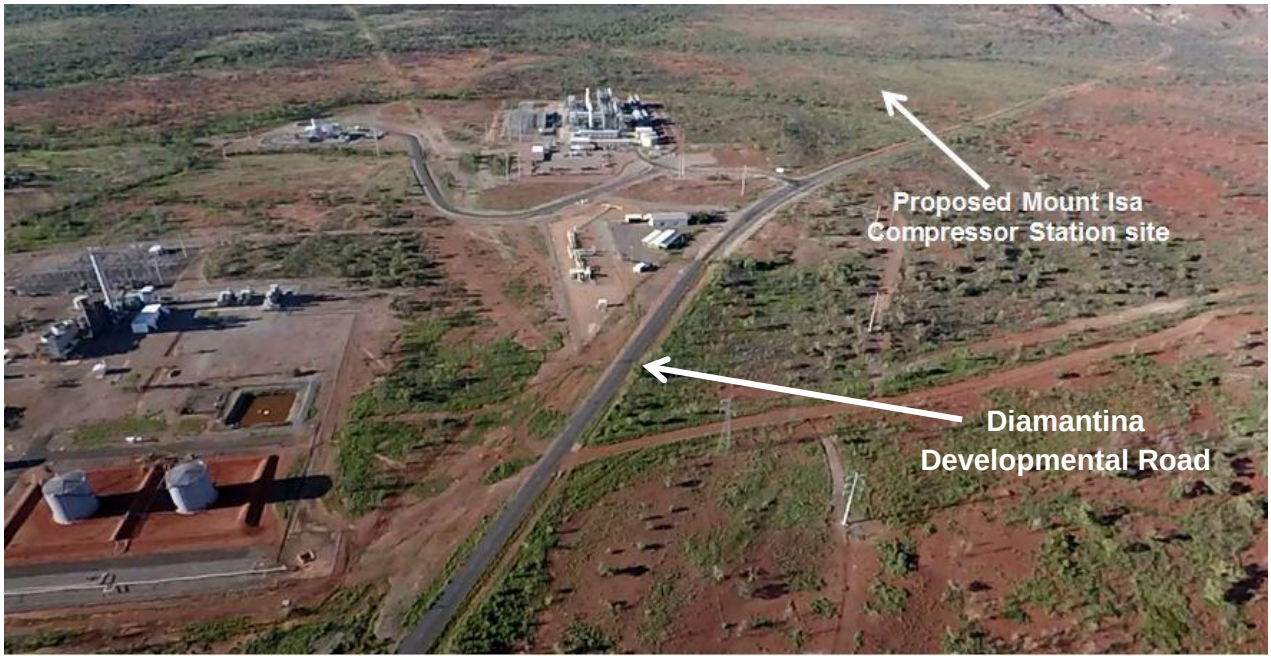


Figure 2-12. Photo of proposed Mount Isa Compressor Station site

2.8.2.1 Components and layout

The MICS will receive gas from the NGP and compress for delivery to the CGP. The facility is configured with two compressor units which can be operated alone or in parallel, depending on the gas load; the facility will comprise similar compressor components to the PCCS described above. Unlike the PCCS, it will not have any nitrogen reduction facilities, and therefore will not require flares, a hot oil system or evaporation ponds for produced water, and will not produce the various waste products associated with this activity.

A pipeline vent will be constructed, which will be used for venting gas during commissioning, periodic testing and in emergency situations. Other supporting infrastructure includes an office, workshop, accommodation room and car park.

The main components and layout of the MICS are shown in Figure 2-13.

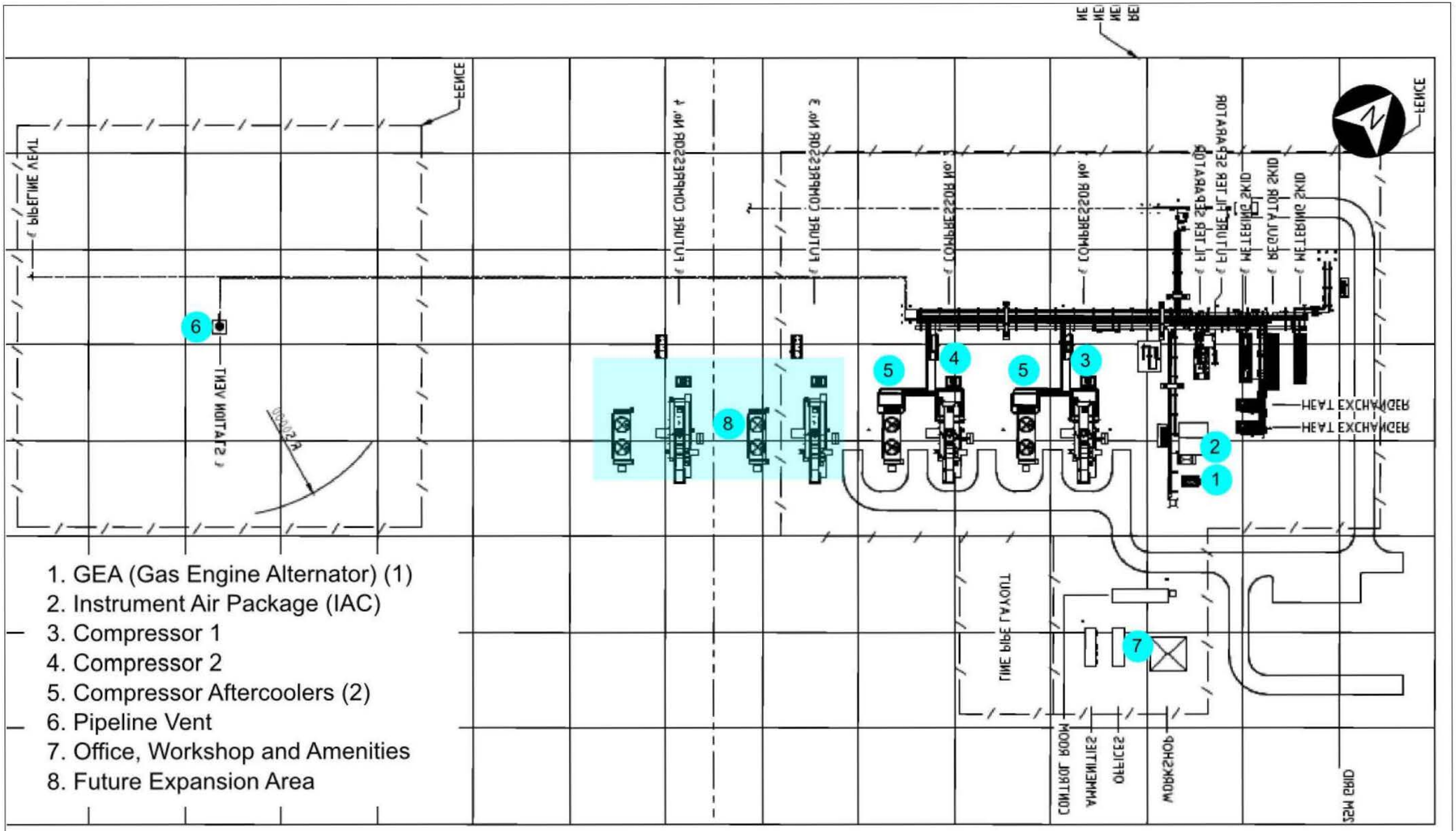


Figure 2 13. Mount Isa Compressor Station site layout

2.8.2.2 Power supply

The MICS will be powered by mains electricity. An on-site gas engine alternator will be provided, however this will only be used for standby purposes. The on-site gas engine alternator will be powered by pipeline gas.

2.8.2.3 Water and sewage

The MICS has no requirement for water other than amenities. Potable water will be sourced from existing commercial sources, trucked to the site as needed and stored in tanks.

On-site management of wastewater from amenities will be in the form of a standard septic system. Operational potable water and amenities wastewater volumes will be low due to the small number of field operations staff based at the facility.

2.8.2.4 Fuel and chemical storage

Small volumes of diesel, petrol, kerosene and other fuels will be stored on site for operational purposes such as fuel for vehicles, fire pumps, burners and other maintenance tasks. All dangerous goods storage facilities will be designed in accordance with the requirements of the *Australian Dangerous Goods Code* and *Australian Standard (AS) 1940 Storage and handling of flammable and combustible liquids*. Storage and handling of dangerous goods will comply with the requirements of the *National Standard NOHSC: 1015 (2001) Storage and Handling of Workplace Dangerous Goods*.

2.8.2.5 Air and noise emissions

Operation of the MICS will produce air and noise emissions. Air emissions will include combusted fuel gas, mainly CO and NOx; these will be released to the atmosphere via the gas turbine and gas engine alternator exhaust systems. Noise will be generated from the equipment (including aftercoolers), however a silencer will be installed on the compressor exhaust systems to minimise noise emissions. Noise emissions will also occur in association with compressor changeover and venting.

Jemena has characterised and assessed the potential impacts of emissions on the environment and community (sensitive receptors). Air and noise risks are discussed in Chapter 11 of this EIS.

2.8.2.6 Other wastes

The main waste products from the MICS will be gas filter drained waste (such as hydrocarbons, glycol, oil and pipeline dust). These wastes will be stored on site in allocated tanks, drums or storage facilities prior to removal off site by a licenced waste contractor. Small amounts of domestic waste will also be produced and disposed of at approved landfill sites in Mount Isa. Further detail on operational waste streams and associated management controls is provided in Chapter 13 Environmental Management Plan.

2.9 CONSTRUCTION PHASE (TEMPORARY) FACILITIES

During the Project construction phase, there will be a range of temporary facilities and structures put in place to support the construction program. This section describes these facilities, which include worker accommodation camps, access tracks (existing and new), additional works areas (turn-around points and storage areas), water supply bores and dams for storing water required for dust suppression and hydrostatic testing (pressure testing).

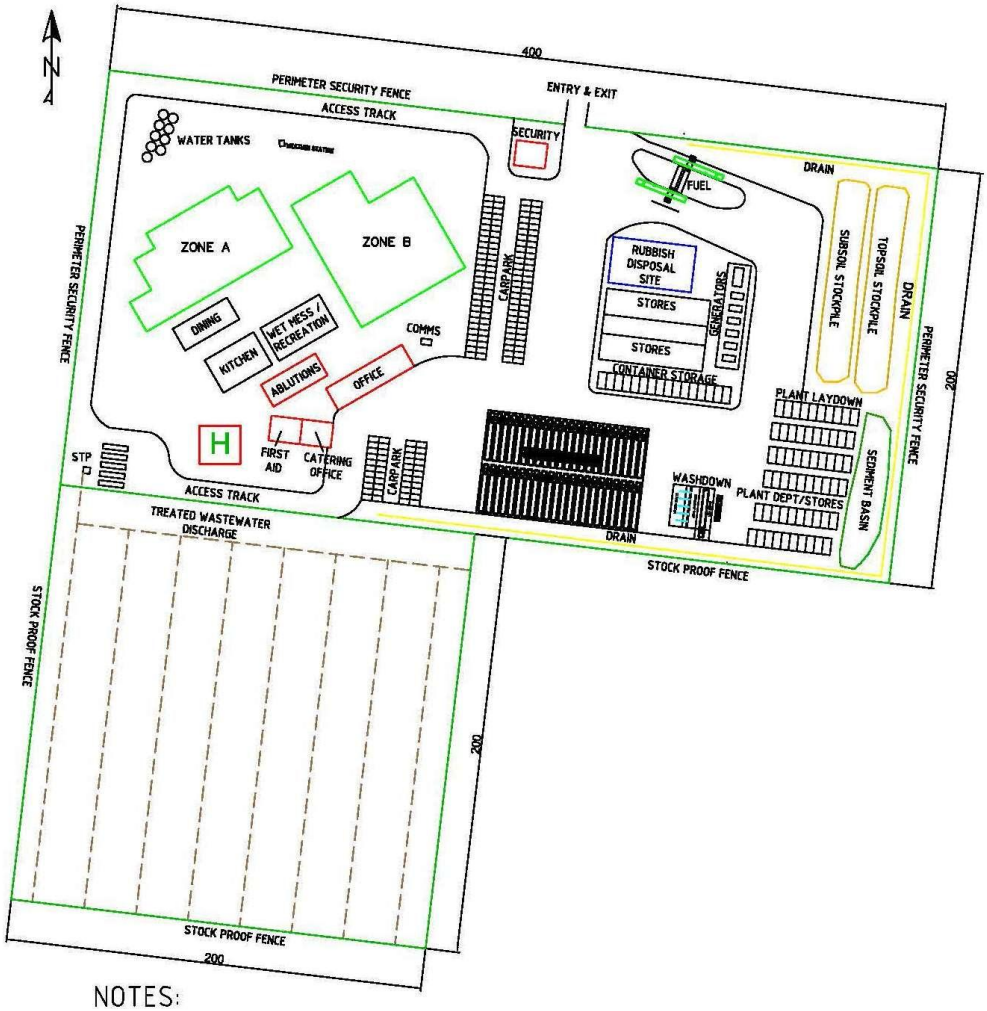
2.9.1 CONSTRUCTION CAMPS

Five temporary construction camps will be located along the ROW to accommodate construction workers. Camps will be commissioned and decommissioned progressively with multiple camps in operation at any one time. The majority of camp infrastructure will be pre-fabricated to minimise construction requirements and aid mobilisation and demobilisation efforts.

In addition to the pipeline construction camps, a construction camp will be located adjacent to the PCCS site to accommodate PCCS construction workers. This camp would be established early in the construction sequence (immediately following initial clearing activities) and will remain in operation until the completion of commissioning – anticipated in the third quarter of 2018.

Each construction camp will cover an area of 12 ha. A diagram of a typical camp layout is provided in Figure 2-14. Each camp will have capacity for up to 300 personnel and will include the following components:

- accommodation units
- kitchen and messing facilities
- ablution facilities
- recreational facilities
- workshop facilities
- equipment and vehicle parking, and laydown
- temporary communications and data systems
- potable water stored in aboveground temporary tanks
- wastewater treatment plant and irrigation field
- generators for camp power supply
- diesel fuel storage in self-bunded above-ground tanks (refer Section 2.9.4)
- storage of construction consumables and camp consumables
- washdown facilities
- chemical storage in self-bunded and vented containers
- waste collection facilities.



NOTES:
1 - GENERIC SITE LAYOUT FOR 300 PERSON ACCOMMODATION CAMP
2 - SITE AREA APPROXIMATELY12 HECTARES
3 - ALL CAMP LOCATIONS TO BE ABOVE Q100 FLOOD LEVEL + 1 METRE
4 - LAYOUT WILL VARY ACCORDING TO SITE SPECIFIC CONSTRAINT AT EACH LOCATION

Figure 2-14. Diagram of standard construction camp layout

Camp infrastructure will be transported via road train along the Barkly Highway and into the camp location via unsealed access tracks. Once a camp is no longer required the infrastructure will be removed and the site reinstated and rehabilitated. Camp movements generally occur during work cycle breaks (when workers are on break), but may happen progressively subject to Project requirements. Camp mobilisation and demobilisation will involve approximately 150 trailer movements.

Camp locations were selected to minimise travel times to the ROW and meet the requirements of accessibility and landholder agreements. The proposed locations are summarised in Table 2-5 and shown in Figure 2-6.

Table 2-5. Proposed construction camp locations

Camp	Approximate Location	Area (Ha)*	Land Parcel	Latitude	Longitude
Camp 1	KP572	12	Pastoral Station	-20.7851	139.083
Camp 2	KP440	12	Pastoral Station	-20.5633	137.842
Camp 3	KP296	12	Freehold land	-20.1044	136.563
Camp 4	KP169	12	Vacant Crown Land	-19.7304	135.410
Camp 5	KP63	12	Pastoral Station	-19.4769	134.449
PCCS Camp	KP0	12	Pastoral Station	-19.4488	133.8551

**Area includes treated wastewater irrigation field*

Each camp will have an area for the storage and distribution of consumables and materials. Disposable materials and consumables, particularly for camp catering, will be sourced locally where possible in order to maximise local content and participation and reduce transport costs. All bulk waste will be stored in allocated areas at camp for removal off site; no on-site landfill will occur.

Potable water for camps will be sourced from existing sources at Mount Isa and Tennant Creek (refer to Section 2.10). On-site wastewater management will be undertaken to achieve secondary treatment of wastewater and allow for disposal to land via surface irrigation. The wastewater treatment and irrigation system will be installed to Northern Territory Department of Health and Queensland DEHP standards; the irrigation area will be vegetated with grass, to aid in nutrient uptake and water filtration.

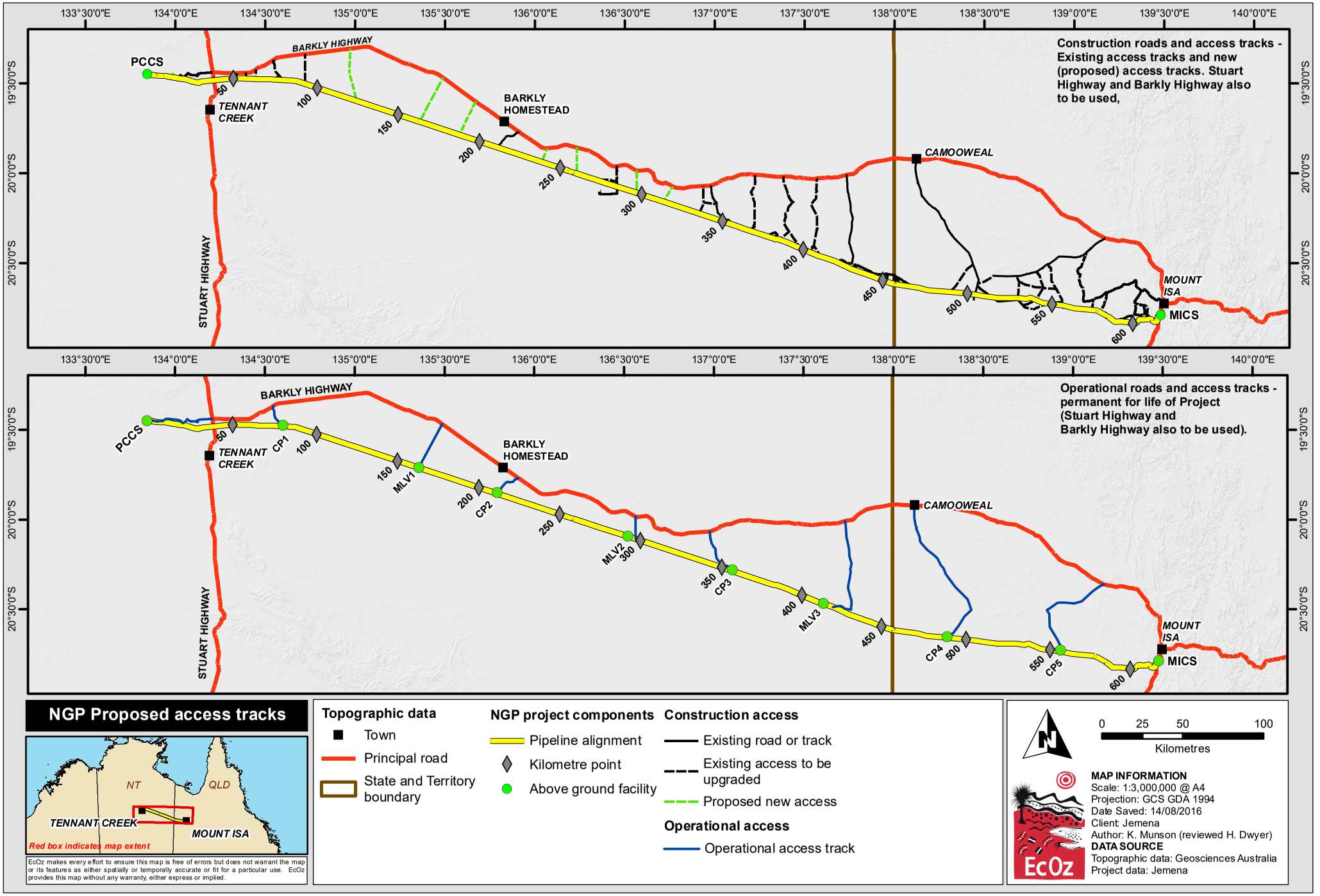
In addition to the six main camps, a number of mobile fly camps are also required to support construction activities, and provide accommodation and facilities for crews working outside the main construction area. These fly camps will allow crews better flexibility, reduced travel times and will reduce demand on the main construction camps. Fly camps will be moved as required, to support construction. The camps will be self-sufficient with built-in catering, water and wastewater facilities.

Existing commercial accommodation at Mount Isa and Tennant Creek will also be used during the planning and construction phases (refer to Section 2.10).

2.9.2 ACCESS TRACKS AND TURNAROUNDS

Access tracks will be required to link the existing roads and the construction ROW. Existing access tracks will be used wherever possible, and widened where required; this may require a disturbance width of up to 10 m. Where no appropriate existing tracks are available, and in agreement with landholders, a number of new access tracks will be constructed. Widening of existing access tracks and construction of new tracks will involve disturbance of approximately 243 ha of land in the Northern Territory and 127 ha of land in Queensland. Vehicle turnarounds will be required at a number of locations, which will temporarily disturb a further 2.8 ha of land.

Access tracks will be progressively rehabilitated following pipeline construction and final ROW rehabilitation unless they are required for permanent access to infrastructure, or requested by the landholder. The proposed location of access tracks is shown in Figure 2-15.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch2\Figure 2-16. Map of proposed access tracksKM.mxd

Figure 2-15. Map of proposed access tracks

Temporary turnaround areas will be removed and reinstated when no longer required, unless they are to be left under agreement with landholders or the road authority. Generally, hauling of pipe to the ROW will be designed such that truck movement is one way and there is continuity between entry and exit points along the ROW. Where this cannot be achieved, turn-around bays will be constructed.

2.9.3 ADDITIONAL WORKSPACES

Temporary work spaces will be required along the construction ROW for laydown of materials; these are identified as part of the overall Project construction footprint in Section 2.6. The workspaces will be located adjacent to the construction ROW and will require a total of approximately 50.6 ha of land in the Northern Territory and 68.3 ha of land in Queensland. The sites will be reinstated following completion of construction.

2.9.4 FUEL STORAGE FACILITIES

During the Project construction phase, bulk diesel fuel will be used to run camp generators and construction plant, equipment and vehicles. Diesel will be supplied in bulk by a contractor and stored at each camp location in self-bunded tanks in accordance with relevant Australian standards (AS1940-2004 and AS1692-2006).

Fuel will be distributed by fuel trucks with consumption logged against each item of equipment so as to track usage and identify potential spills or leaks. Equipment will generally be serviced and refuelled in-situ on the pipeline construction ROW at the end of each shift.

Refuelling of mobile equipment such as light vehicles, mini-buses and trucks will occur at the camp in designated bunded areas.

Spill kits will be located at refuelling areas and will be carried in service trucks and machinery. No refuelling of machinery on the construction ROW will occur within 100 m of a watercourse. Appropriate site personnel will be trained in spill response to ensure any spill is contained onsite and cleaned up appropriately.

2.9.5 DANGEROUS GOODS AND HAZARDOUS MATERIALS STORAGE

Various dangerous goods and hazardous materials will be used during the construction phase of the Project. The materials of which will be stored in the largest quantities are diesel fuel, fusion bond epoxy coating for the welded joints, explosives, brake, hydraulic fluids and oils, and primers, paints and thinners.

Hazardous materials will be stored in ventilated, self-bunded and secured containers co-located with the construction camps. Specialist contractor materials, such as blasting materials, will be stored in separate, contractor-managed, secured storage areas.

All dangerous goods storage facilities will be designed in accordance with the requirements of the *Australian Dangerous Goods Code* and *Australian Standard (AS) 1940 Storage and handling of flammable and combustible liquids*. Storage and handling will comply with the requirements of the *National Standard NOHSC: 1015 (2001) Storage and Handling of Workplace Dangerous Goods*. A Dangerous Goods and Hazardous Materials Register will be maintained, and all Safety Data Sheets (SDSs) will be stored in the chemical storage facilities. Spill kits and firefighting equipment will be kept with chemicals as required by legislation.

2.9.6 WEED HYGIENE FACILITIES

Weed wash-down bays will be constructed at each temporary camp and additional locations as required for jurisdictional boundaries and individual landholders. Washdowns will be undertaken in bunded, allocated bays and all weed seeds will be captured in sumps for disposal off site at approved facilities.

The location of additional weed washdown facilities is to be determined following completion of weed surveys prior to commencement of construction activities. Weed hygiene will be in accordance with the Weed Management Plan and supporting procedures; further detail in relation to weed risks and management measures are provided in Chapter 6 of this EIS.

2.9.7 WASTE MANAGEMENT

Waste will be stored in designated areas at each construction camp. The ROW will be kept clear of rubbish at all times, and all waste will be brought back to camps at the end of each shift. Waste streams will be separated and managed in accordance with a Waste Management Procedure (refer Chapter 13 of this EIS). Waste will be transported by a licensed waste contractor to an approved licensed facility or recycling centre as required.

2.9.8 COMMUNICATIONS

Project communications will be provided as follows:

- radio communications will be used in all construction areas, along the construction ROW, and all vehicles and machinery will be fitted with radios. The Project network will be installed by a specialised communications contractor and will be the primary construction and emergency response medium
- mobile phone coverage is limited throughout the Project area and appropriate personnel will be provided with satellite phones
- camps, compressor stations and associated offices will have telephone and internet coverage provided by microwave or satellite link at each location.

2.10 PERSONNEL & ACCOMMODATION

This section provides information in relation to the predicted personnel and accommodation requirements for construction and operation of the Project.

2.10.1 CONSTRUCTION

The highest levels of activity for the Project will occur during the construction and commissioning phases. Accordingly, the greatest employment opportunities will occur during this time, for general services and the installation and construction of the pipeline and compressor stations. It is anticipated that peak construction will require approximately 725 personnel. The Construction Contractor will engage a team of skilled pipeline and facilities construction personnel, who, due to the skills and experience required, will largely be sourced from outside the region. In addition to the core (skilled) construction team, the peak construction personnel will comprise semi-skilled personnel and labourers, who will be employed from the Project region, subject to availability.

A breakdown of the construction personnel is provided in Table 2-6. All personnel and subcontractors will receive training in general Project requirements, quality, safety, environment and specific work activities prior to commencement of works.

Table 2-6. Construction personnel requirements (estimate)

Personnel Type	Peak Number	Likely Source
Construction team	125	National/State/Regional/Local
Drivers and plant operators	236	State/Regional/Local
Trades: welders, fitters, electricians etc.	90	National/State/Regional/Local
Traffic control, trades assistants, security, stores	90	State/Regional/Local
Camp management and catering	44	National/State/Regional/Local
Labourers	140	National/State/Regional/Local
Total expected peak work force	**725**	**-**

Appropriately resourced, qualified environmental staff including fauna handlers will be required during the construction phase of the Project. These personnel will be responsible for ensuring construction is undertaken in accordance with the environmental management system, regulatory requirements and industry best practice.

Where possible, Project activities will be phased such that whilst individual workers or crews are on work breaks, other activities (or in some instances crews) will be utilised and work on site will continue. This will occur throughout the construction period. Work hours will generally be from 6am to 6pm. Additional crews, with different operating hours (such as night shift), may also operate for critical construction activities or as required in periods of extreme temperature.

Most construction personnel will be accommodated at the temporary construction camps detailed in Section 2.2.2. The Project intends to source and utilise local commercial accommodation providers in Tennant Creek and Mount Isa where it is available and feasible to do so. It is envisaged that relatively minor numbers (<50) of personnel will require commercial accommodation in these locations between January and March 2017, and December 2017 and May 2018 respectively.

2.10.2 OPERATION

Operation and maintenance of the pipeline and above-ground facilities will require a team of field staff (refer Table 2-7); some staff will be based in Tennant Creek to service the PCCS, others will be based in Mount Isa to service the MICS. Field staff will travel between PCCS and MICS as required to support operations and maintenance activities. Field staff will be responsible for day-to-day pipeline operations and maintenance activities, to respond to unplanned faults and outages, to communicate with local stakeholders and for facilitation of third party access. In the event of an emergency, Jemena will follow a pre-existing Emergency Response Plan consistent with its current operating pipelines.

Control room staff will remotely manage day-to-day project and maintenance operations, monitoring, management and scheduling of the throughput of the pipeline; there will be no extra control room staff required as a result of Project activities.

Ongoing maintenance activities will require the engagement of local and out-of-area technical expert contractors.

Table 2-7. Operational field staff requirements (anticipated)

Discipline	Quantity	Location	Position description
Field Manager	1	Tennant Creek	Manages and oversees the overall physical operations and maintenance activities of the NGP.
Technician/operator	3	Tennant Creek	Performs day to day maintenance of the above-ground facilities and routine maintenance of the pipeline ROW. Technicians will be specialised and have a background in either an electrical or mechanical trade.
Technician/operators	3	Mount Isa	As above
Apprentice	2	Tennant Creek Mount Isa	The apprentice's primary role is to provide assistance to the field technicians. They will work directly under the supervision of the field technicians in order to develop the skills to become proficient in the field of either electrical or mechanical trade.
Office Administration	1	Tennant Creek	Provides office support to the Field Manager in the day to day operations of the asset.

2.10.2.1 Operations field team

The operations field team will be specifically established for the Project; Jemena intends to source field staff from the local and regional labour market wherever possible. Existing Jemena operations field staff, who are proficient and well versed in working in the Jemena environment, will support the new team, particularly during compressor station maintenance activities.

Jemena plans to source private accommodation in both Tennant Creek and Mount Isa for support resources as required. Accommodation for additional personnel during periods of heavy maintenance will be at local commercial facilities (hotel/motel). The decision to lease accommodation in lieu of providing on-site accommodation facilities at the PCCS and MICS is due to the proximity of the stations to well-established communities.

2.10.2.2 Contractors

Additional resources will be required to support the NGP during operation. Contractors will be managed by either the field staff team or by Jemena's established engineering operations team for activities typically associated with maintaining the integrity of the assets, including:

- servicing compressor packages and utilities
- aerial surveys
- cathodic protection surveys
- weed management and biosecurity
- inspecting pressure vessels and hazardous areas

2.11 WATER USE

This section provides information in relation to the predicted water use for construction and operation of the Project.

2.11.1 CONSTRUCTION

For the construction phase of the Project, water is categorised as potable, construction and hydrostatic test water.

Approximately 20 ML of potable water will be sourced from the existing water supplies at Tennant Creek and Mount Isa, under agreements with authorised suppliers.

Approximately 69 ML of construction water will also be required, mostly for dust suppression in construction areas. This will be sourced from existing and/or new groundwater bores within or near the construction footprint. Potential water sources will be determined through engagement with landholders and sustainability of extraction will be assessed prior to use; further detail on water risks is provided in Chapter 7 of this EIS. The Construction Contractor will be responsible for obtaining licences for extraction of water where they are required.

Approximately 22 ML of water will be required to undertake hydrostatic testing (refer to Section 2.14 for further detail). This will be extracted from Mount Isa, and will be reused along the length of the pipeline.

Potable and construction water will be transported from water sources to camps and the construction ROW in allocated water trucks. Potable water will be stored in allocated water tanks at each camp.

Construction and hydrostatic test water will be stored in temporary 12 ML low consequence dams constructed along the ROW. Dams will be designed and constructed in accordance with accepted engineering standards, and will be monitored for structural and hydraulic integrity.

2.11.2 OPERATION

Water requirements for daily operation of the PCCS and MICS are discussed in Section 2.8.1 and 2.8.2.

2.12 ROADS & TRANSPORT

2.12.1 CONSTRUCTION

The Adelaide to Darwin Railway line will be used to transport pipe from the Darwin Port to the Tennant Creek rail siding. Depending on volumes, some materials may also be transported in this way. State, Territory and local roads will be utilised to transport materials, equipment and personnel to various logistics centres and the construction ROW.

The Warrego Road, Stuart Highway and Barkly Highway will provide the main arterial routes for accessing the construction ROW. The PCCS site will be accessed via the Stuart Highway and Warrego Road. The MICS site will be accessed via the Diamantina Developmental Road.

Various dangerous goods and hazardous materials will be transported on public roads. Those in large quantities will include diesel fuel, fusion bond epoxy coating for the welded joints, explosives, brake, hydraulic fluids and oils, and primers, paints and thinners. Transportation of these materials will be in accordance with the requirements of the Dangerous Goods Act and Regulations (*NT*), which adopts the

Australian Dangerous Goods Code written to help Australia's transport and logistics industry to operate safely when carrying dangerous goods.

2.12.1.1 Personnel transport

Personnel not from the Northern Territory will be mobilised to site by air to ether the Mount Isa, Tennant Creek or Alice Springs airports. A combination of scheduled and charter flights will be arranged (air charter operation company yet to be selected).

Project personnel will be transported from the nearest airport to the construction camps by bus or light vehicle. Local personnel will be transported to the construction camps by bus from nominated pick-up points to minimise the requirement for parking private vehicles at camps. Administration staff will coordinate the travel of all personnel between the work site and their place of residence during work cycle breaks. The main transport routes for personnel to and from the construction camps will be the Warrego Road, Stuart Highway and Barkly Highway.

From construction camps, personnel will be transported to the construction ROW via light vehicles or small buses. Peak travel times for travel to and from the construction ROW will be 5am-7am and 5pm-7pm daily. Camps will be located close to the ROW to minimise travel time, impacts to other road users and impacts on access track and road infrastructure. Overall road transport of personnel is managed through the Journey Management Plan and all permanent and long-term Project vehicles will require In Vehicle Monitoring Systems (IVMS) to manage personnel movement, ensure safe driving and compliance with traffic management.

2.12.1.2 Materials and equipment transport

The Construction Contractor is responsible for ensuring the safe and orderly passage of vehicle and pedestrian traffic on all public roads, access tracks and within the construction work areas. A Traffic Management Plan (Appendix E) has been developed for the construction phase of the Project, and will be refined through the detailed Project planning and design phase.

The Barkly Highway provides the main arterial route for accessing the construction ROW, and access to the ROW will be via existing and/or new tracks. Road use will be in accordance with the relevant road authorities – the Northern Territory Department of Transport and Barkly Shire Council and the Queensland Department of Main Roads and Mount Isa City Council. Road use will be discussed with all road authorities and appropriate approvals obtained for transport of oversize/overmass loads, works or activities within road corridors, road crossing approvals, road maintenance and Traffic Guidance Schemes (TGSs).

The Traffic Management Plan and all TGSs will be in accordance with the requirements of the appropriate regulations and regulatory bodies. Roads and intersections will be assessed prior to use to ensure they are fit for purpose, and any required works on roads (including closures or traffic diversions) will be discussed with the relevant road authority.

The volume of trucks, machinery and plant movements will fluctuate depending on the activities taking place on site at any given time. This will be determined through the detailed planning phase; however, it is anticipated there will be an average of:

- 10 single pipe trailers per day delivering pipe to the ROW, with peak requirement at approximately 15 single pipe trailers per day
- approximately 12 trailers per day to provide fuel, general consumables and potable water. This may be 12 metre trailers in a road train configuration.
- two trailers per day for the construction of compressor stations with a peak of 10 trailers per day

- 12 buses (10-17 seats) per day used to transport personnel to and from camps to the ROW. Buses will also be used to transport personnel to and from airports/their home at the end and start of cycle break.
- 120 light vehicles per day at peak to transport personnel around site.

Traffic along the ROW will be controlled with speed limits, designated radio channels, access gates, boundary fences and access tracks. Each access track will have information signs displaying access numbers, radio channels and any other relevant information.

2.12.2 OPERATION

Day-to-day operational traffic will involve personnel movements between Tennant Creek and the PCCS, and Mount Isa and the MICS. All above-ground facilities along the pipeline will have permanent unsealed access tracks from the Barkly Highway; access to these facilities will be infrequent for routine inspection and maintenance and in response to operational requirements.

2.13 CONSTRUCTION PROCESS

Project construction will occur in a manner similar to that of other linear infrastructure projects. Construction activities will be completed in a rolling fashion; clearing and grading will occur ahead of construction, which will be followed by reinstatement. Construction will be in accordance with AS 2885 and the *Code of Environmental Practice – Onshore Pipelines (APIA 2013)*.

The construction process is briefly summarised below and detailed further in the following sections.

Pre-construction activities will be as follows:

- construction of access roads/tracks from public roads/existing tracks to construction ROW
- establish laydown areas; setup and earth works
- drilling water bores and construction of dams for construction water.

The main line construction sequence will generally be as follows:

- survey and set out, potholing, fencing and temporary gates
- clear and grade
- drill and blasting will commence at the same time as the clear and grade, where it is required.
- pipe will be strung (laid out) along the ROW, followed by bending as required
- typically trenching activities will follow except in areas where rock is anticipated, where trenching occurs ahead of pipe stringing
- the pipe is welded into long strings (up to 1.5 km in length)
- welds are then subject to non-destructive testing (NDT) prior to field joint coating
- the trench is prepared with a suitable bedding material (generally sourced from screened trench spoil) if required to protect the coating
- the pipe strings are welded together, welds are tested before the pipe is lowered into the trench

- the pipe is then “padded” and the trench back filled and compacted
- bulk earthworks where required to restore to original ground contours
- once a significant section of the pipeline has been completed, the pipe will be cleaned and hydrostatically tested before it is dried and capped ahead of commissioning
- the entire construction ROW will be progressively rehabilitated upon completion of the construction phase.

2.13.1 CONSTRUCTION EQUIPMENT

The anticipated equipment requirements for the construction phase of the Project include light and heavy vehicles and equipment. Quantities will be defined once the Construction Contractor has finalised their Construction Plan. Key anticipated equipment for use during construction is listed below:

- trucks
- backhoes
- bending machines
- bucket wheel and rock saw trenchers
- tractors
- cranes
- dozers
- excavators
- fire trucks
- forklifts
- buses
- graders
- trailers
- air compressors
- welding annex/covered areas
- site office containers
- site stores
- hydro test pumps
- hydro test spades, blinds
- concrete pumps

2.13.2 ACCESS TRACKS, LAYDOWNS AND TRUCK TURNAROUNDS

Existing access tracks will be utilised to access the construction ROW wherever possible. They will be upgraded as required to ensure they are at least 5 m wide, however tracks may require a disturbance width of up to 10 m in some areas. Where needed, and where none exist, new access tracks will be constructed.

Approved access tracks and transport routes will be mapped and provided to construction personnel, whose movements will be restricted to these routes. Access tracks will be signposted to clearly identify approved tracks.

Temporary access track construction will involve clearing vegetation and stockpiling it in windrows along the track length for re-spreading during rehabilitation; the track will be graded and shaped as required. Removed topsoil will also be stockpiled alongside the track for re-spreading during rehabilitation. Drainage and erosion and sediment control requirements for access tracks are provided in the Progressive ESCP, which is discussed in Chapter 7 of this EIS.

Where access tracks will be permanent, topsoil will be used in track formation (e.g. for construction of drainage). Cleared vegetation will be pushed to the side of the track and left in-situ. Significant volumes of vegetative material are not expected as the majority of the construction footprint is sparsely vegetated with grasses, shrubs and low trees.

The proposed access track locations are shown in Figure 2-6. Cultural heritage and environmental surveys will be conducted along proposed new access tracks to ensure they are appropriately located to avoid and/or minimise impacts to heritage and environmental aspects.

Access tracks will be formed using existing in-situ material where available and passing bays will be provided where required. Where available, and as required, gravel may be sourced from local borrow pits. Newly formed access tracks will either remain for landholder use as agreed with the landholder, or be reinstated and rehabilitated where they are no longer required.

Traffic along the ROW will be managed to allow flow through (i.e. entry points and exit points avoid turnaround requirements). Where this is not possible, turnarounds will be required for trucks. Laydowns will also be required at certain points along the ROW. Turnarounds and laydowns will be temporary and constructed in the same manner as temporary access tracks; vegetation and topsoil will be pushed up and stockpiled along the side, to be re-spread over the area during rehabilitation.

2.13.3 PIPELINE RIGHT OF WAY

Pipeline construction activities will occur within a 30 m wide construction ROW; see Figure 2-16 for a typical layout.

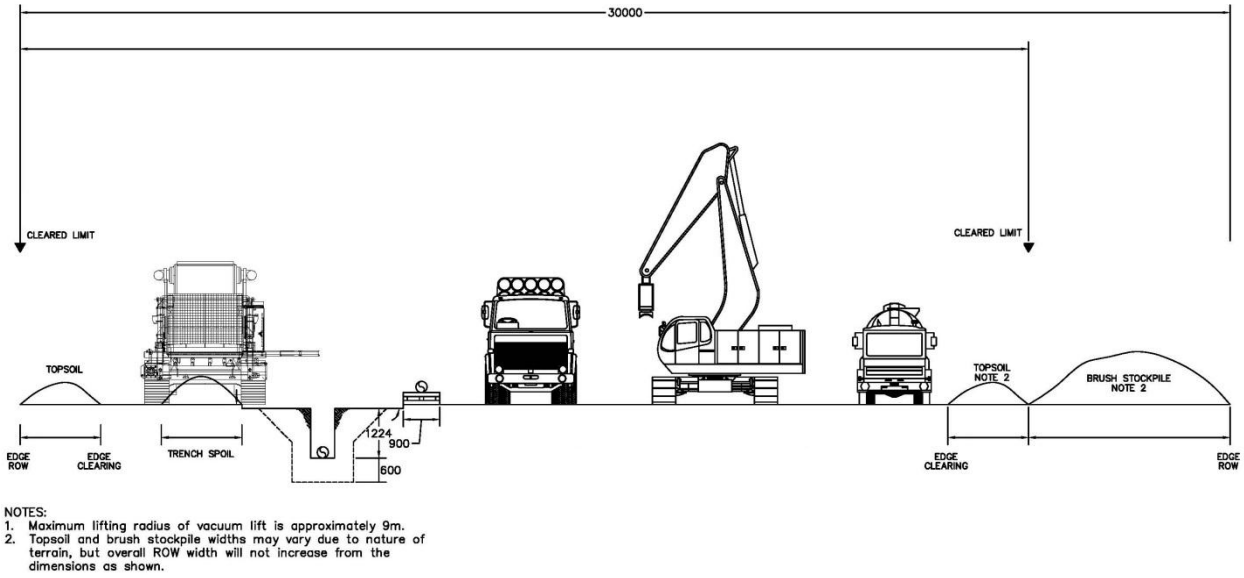


Figure 2-16. Typical construction ROW layout to be used for the Project construction phase

Activities within the ROW occur progressively in the following order: clearing and grading, trenching, spoil placement, stringing and welding the pipeline, lowering-in and then backfilling the trench. The construction process is detailed below.

2.13.3.1 Clear and grade

The construction ROW will be cleared and graded to create a safe area for vehicular movement, trenching, pipeline construction and other construction activities, and will be completed along the entire construction ROW. Figure 2-17 shows a photo of clear and grade activities on a typical pipeline construction ROW.

The ROW will be surveyed and marked with stakes to guide clearing and ensure it remains within the approved boundaries. Environmental inspections will be undertaken along the ROW prior to clearing and a ‘Green tag’ system will be established. The inspections will include identification of weeds and environmentally sensitive areas, which will be avoided or cleared under specific management actions.

The width of the ROW will generally be 30 m, within which all pipeline construction activities will occur, although the width may vary in some areas such as sensitive environments and/or watercourses. Vegetation will be cleared and stockpiled at the edge of the ROW with breaks as required to allow access to tracks and other facilities. Once the vegetation is cleared, topsoil will be stripped and stockpiled in windrows along the ROW. After topsoil stripping a level work surface will be graded with any surplus subsoil stockpiled in windrows separately to topsoil. Soil will be stockpiled such that backfilling and re-spreading will occur in order (i.e. subsoils replaced back trench and topsoil spread on surface).

A small crew will operate at the front end of the construction spread (‘front-end crew’) to undertake survey work, fencing and gates, clearing and grading and drill and blast works to prepare the ROW for the main construction crew. This work will commence once Consent to Construct is received in both Northern Territory and Queensland, with the crew progressing along the pipeline alignment ahead of the main construction crews. This allows sufficient time to prepare the ROW ahead of the construction and ensures there is sufficient buffer to avoid construction delays. The trenching, stringing and bending crew will follow the clearing crew; see below.

Crossing crews will also be with the front-end crew to prepare rail, road and watercourse crossings ahead of time and install any required erosion and sediment controls and other infrastructure. Clearing and

disturbance of major watercourses will not be undertaken until immediately prior to trenching and pipe installation to minimise the duration of watercourse disturbance.

Figure 2-17. Photo of a cleared pipeline construction ROW

2.13.3.2 Trenching

Trenching along the ROW will be undertaken using bucket wheel trenchers, rocksaws and excavators. Figure 2-18 shows a photo of trenching activities on a typical pipeline construction ROW.

The trenching, stringing and bending crew will progress along the ROW behind the front-end crew, and will be ahead of the welding crew. Trenching shall be to depths that ensure the minimum depth of cover is achieved for respective locations along the pipeline, as per the requirements of AS 2885. The pipeline is buried at depths between 750 mm and 3,000 mm with the average trench depth 1,250 mm. The minimum trench width is 625 mm. The trench spoil (e.g. soil and rock) will be stockpiled separately from topsoil within the ROW (Figure 2-16). It is anticipated that an average of 834m3 of trench spoil will be produced per kilometre. The trench generally follows the contours of the land (maintaining a constant depth from the surface), resulting in the pipe also following these contours.

Earthen trench breakers or similar will be left in the excavated trench line where fauna, vehicle or personnel movement is required or where steep slopes require the control of water runoff and trench flooding. Importantly, in sloping terrain, and where required for long term stabilisation of the trench, trench breakers will be installed prior to backfilling to prevent water washing down the porous trench material and compromising the stability of the pipeline, causing subsidence or wash-out of the soils within the trench. Breakers are typically formed by stacking a number of hessian sandbags containing trench spoil or stabilised sand to create a barrier across the trench line. The trench breakers are keyed into the wall and the floor of the trench for stability. Trench breakers will remain permanently in the trench in areas where scouring is a risk. Additional trench breakers will be installed either side of all major watercourse crossings.

Ramps will be required at intervals along the open trench to allow for fauna egress, minimising entrapment. Additionally, fauna handlers will be used to remove animals from the trench on a daily basis.

Figure 2-18. Photo of trenching activities along a typical pipeline construction ROW

2.13.3.3 Blasting

In ground where the use of conventional excavation machinery is not feasible due the profile of the substrate, it may be necessary to undertake blasting. Blasting will be conducted in accordance with the prepared Blasting Operations Management Plan (BOMP), and be undertaken by a specialised subcontractor. The BOMP details the safety precautions, drill pattern, charges, explosives, detonation methods, debris control and climatic conditions.

The pipeline alignment has been selected to avoid most rocky areas, however some areas near Mount Isa and elsewhere will require blasting. Exact locations will be identified during the geotechnical test program which form part of the Project survey program.

2.13.3.4 Stringing and bending

Stringing involves the laying out of pipe sections along the ROW in preparation for welding. Figure 2-19 shows a photo of pipe stringing activities on a typical pipeline construction ROW.

Following the clear and grade of a section of the construction ROW, pipe lengths will be transported from laydowns. Prime movers with trailers configured to carry 25 lengths of 18.5m long pipe will deliver pipe to the ROW. The pipe will be laid out adjacent to the trench on saw dust filled bags (or equivalent) to keep pipe sections off the ground and protect the coating.

Figure 2-19. Photo of pipe stringing on a typical pipeline construction ROW

2.13.3.5 Welding testing and coating

Following stringing, pipe sections will be joined by shielded metal arc welding (SMAW) butt-welding using internal and or external clamps, as required. End caps will be placed on the end of the pipe strings each night to prevent foreign objects or animals entering, and breaks in the pipe strings will allow for the movement of landholders, stock and construction vehicles as required.

2.13.3.6 Lowering in and backfill

Once the pipe is joined and coated, it will be lowered into the prepared trench. Figure 2-20 shows a photo of lowering in using a boom on a typical pipeline construction ROW.

Trench preparation generally entails ensuring the trench dimensions are sufficient, and the trench is free of debris and/or protrusions which may damage the pipe. Where the trench spoil will not damage the pipe, it will be used as bedding and padding. Where trench spoil is not of suitable quality padding machines will be used to break down the spoil, producing finer soil particle sizes. Imported quarry material will be sourced where padding machines cannot produce sufficient quality bedding or padding (free of injurious materials such as rock, clods of soil, clay or debris) (see Section 2.13.8).

The coated and welded pipe strings will be lowered-in such that the pipe is not unduly stressed and pipe coating is not damaged. The excavated trench spoil will be returned to the trench using bulldozers and/or graders. The material is progressively compacted during backfilling by tyre and track rolling or by using other compaction equipment. The backfilled trench may be mounded to allow for subsidence and settling in some areas.

As the pipe occupies space in the trench, there will be a volume of trench spoil that cannot be used as backfill. This spoil will be spread over the construction ROW during the bulk reinstatement, prior to the spreading of topsoil.

Figure 2-20. Photo of lowering in using booms on a typical pipeline construction ROW

2.13.4 ROAD AND RAIL CROSSINGS

Bored, uncased road and railway crossings will be required for the Warrego Road, Stuart Highway and Diamantina Development Road, plus the Adelaide to Darwin Railway line crossing (see Table 2-8). Buried services within the roadway easement would be located, and exposed if necessary, to prove their depth of cover and location in the crossing profile. Buried crossings will allow the pipeline construction to progress without impeding access along the main roads and railway line.

Open cut road crossings will be used to cross minor earthen roads (mostly tracks). All landholders will be notified with no work on roads to commence until required approvals are obtained and traffic control is in place. Fill, pavement and surfacing materials used in restoration of open-cut road crossings shall be supplied, placed, compacted and finished to the approval of the regulatory authority, or other relevant specifications, codes or standards.

Table 2-8. Road and rail crossing locations

Crossing	Location (KP)	Latitude	Longitude
Warrego Road	21	-19.4748	134.0484
Stuart Highway	39	-19.4818	134.2151
Diamantina Developmental Road	621	-20.7881	139.4729
Adelaide to Darwin Railway line	16	-19.4679	134.0009

2.13.5 WATERCOURSE CROSSINGS

Watercourse crossings will be undertaken in a manner that minimises impacts to the bed and bank profile and minimises the duration and extent of disturbance. Prior to commencement of works, detailed bed and bank profiles will be recorded to allow for post-construction reinstatement with appropriate drainage, erosion and sediment controls in place.

A number of major watercourse crossings will be required, as well as numerous minor watercourse crossings. It is envisaged that watercourse crossings will be dry at the time of crossing; open-cut trenches will be used, allowing construction to progress quickly and so reinstatement can occur prior to the onset of the wet season. The advanced clearing of watercourse crossings will be reduced to the minimum practicable and crossings will be backfilled and reinstated immediately following pipe installation.

2.13.6 PIPELINE FACILITIES

Facility construction will occur concurrently with construction of the pipeline. The construction sequence for the various facility points are described below.

2.13.6.1 Main line valves

Construction will commence with civil and structural works to clear and grub the site, the area will be fenced and foundations prepared. Unsuitable material (rock and soil) will be excavated from the site and replaced with engineered fill to establish a finished site level (see Section 2.13.8).

Once the site is suitably established, piping and mechanical works will be undertaken to install all process gas piping, pipeline vents, valves and fittings. A pig scraper receiver and launcher will also be installed at MLV 2. Electrical and instrumentation works will follow, for power generation, power distribution, cabling, earthing and cathodic protection. Power generation at each MLV will be via solar panels, which will charge batteries at the site.

The site instrumentation and control system works include station controllers, communications and all instrumentation for the safe and reliable operation of the plant. Communication will be via a satellite dish and communications systems.

2.13.6.2 Cathodic protection

The pipeline cathodic protection (CP) system will include a temporary CP system to ensure adequate corrosion protection during the construction period, and a permanent CP system which will be commissioned at the completion of construction. Subject to confirmation during detailed design, the Project intends to utilise vertical anode beds which are installed in the following manner:

- at anode bed locations, clear necessary vegetation, if required
- if required, clear vegetation for cable trench line
- drill vertical anode bed bores (typically 10 m deep) – notionally six of at 5 m spacing – install and backfill
- install test post and trench cables from anodes to test post located at the anode bed site.
- trench to ~ 600 mm depth and install cable from anode bed test point to facility (MLV or CP site) – may require some clearing of vegetation.
- backfill and restore the trench and anode bed site.
- install warning signs at anode bed and along cable route.

On completion of the CP construction works, the entire pipeline will be tested to ensure it has the required level of protection

2.13.7 COMPRESSOR STATIONS

The compressor stations will be constructed independently from the pipeline by an allocated crew which will be accommodated in a camp near to the Phillip Creek Compressor Station and at Mount Isa in commercial accommodation (refer to Section 2.10). The construction process of the stations is outlined below.

2.13.7.1 Civil works

A survey crew will mark out the site and allocated infrastructure locations such as access tracks, compressor station pad, drainage systems, underground services and existing services. Bulk earthworks (clearing and grubbing, excavation and stockpiling of unsuitable material on the site and backfill with selected granular fill for plant areas) will follow, along with placement of engineered fill to establish the finished site level (see Section 2.13.8).

Temporary and/or permanent storm water drainage will be installed based on the requirements of ESCPs and engineered designs. Security fencing will be installed around the site prior to installation of services and foundations.

Installation of underground services will follow, including services trenches (conduits), services pits and buried piping. All services will be installed based on engineered designs and standard requirements such that there is sufficient depth of cover over cables and future installations are accommodated.

The foundations for major equipment, utilities, pads and site buildings will then be prepared, followed by the necessary footings, steel reinforcing and other required infrastructure indicated on drawings.

2.13.7.2 Structural works

The structural works include fabrication and installation of all skids, pipe racks, pipe and instrument supports, access platforms and walkways, and prefabricated buildings. The majority of structural infrastructure will be prefabricated and galvanised off site and then delivered to site as required for installation.

Any required supports for process piping will be installed immediately after placement of the mechanical equipment or support foundations.

2.13.7.3 Mechanical works

The mechanical works includes the installation of all vendor equipment, including the compressor packages and nitrogen removal package. It will involve installing process vessels, compressor inlets and exhausts, fuel gas systems, air systems, gas engine alternators, water tanks, pumps and vent stacks.

Transport of all equipment will be undertaken by transport companies assigned to deliver each mechanical item. The type of delivery truck and trailer required will be determined by the mass and bulk of the mechanical equipment, and suitable traffic management will be employed to ensure safe transport of equipment to the site.

2.13.7.4 Piping works

The piping works includes all process, utility and maintenance pipework, including installation of all in line piping equipment, valves, fittings and instrumentation. Piping works will allow the pipeline to connect with the compressor station and will also be essential for distributing gas and water around the compressor station.

2.13.7.5 Electrical works

The site electrical works include electrical generation and infrastructure to power the site. The compressor stations will be connected to grid power from a utility supplier. Power generation will also be installed to provide power to the site; for PCCS, site generated power will be the primary supply, for MICS, grid power will be the primary supply. Cabling, earthing, lighting and cathodic protection will also be installed during this phase.

2.13.7.6 Instrumentation and control system

The site instrumentation and control system works include:

- communications links between the pipeline and network control room
- station controller for all controls including fire and safety
- safety systems
- cabling to field instrumentation
- fire and gas detection systems and a man-down system for safety purposes.

The fire and gas detection systems will be designed to be fail-safe and continuously monitor all detection circuits. Firefighting will be through isolation to limit fuel supply (i.e. as opposed to extinguishing by personnel or facility suppression measures). Dry chemical portable fire extinguishers will be provided in strategic locations as required by the local fire authority.

2.13.7.7 Office and amenities

The amenities building will contain an office, lunch room and ablutions and will be prefabricated offsite. The workshop and stores building will be in lockable sheds which will be constructed onsite. On-site wastewater management will be required at each station (as per Section 2.11).

2.13.8 QUARRY MATERIALS

Material may be required for bedding or padding within the trench, access track maintenance, temporary hardstand areas at camps and for hardstand areas within facilities. Requirements will depend on ground conditions, and will be determined following completion of further geotechnical investigations, which were in progress at the time of EIS submission.

Base materials required for permanent facility foundations will be obtained from approved quarries to meet specification requirements. Should new borrow pits be required for padding material or track maintenance, establishment will be discussed with the applicable landholder (and owner of the relevant material where that person is not the landholder) and regulators on a case-by-case basis, with approval from the regulatory authorities to be secured prior to the establishment of any new pit.

2.13.9 REINSTATEMENT AND REHABILITATION

Initial reinstatement of the ROW will be undertaken progressively by a ‘reinstatement crew’ as each pipe installation segment is complete. All temporary access tracks and construction camps will be progressively rehabilitated as soon as they are no longer required. The reinstated areas will be monitored following completion of construction activities, and it is anticipated that minor rehabilitation works and weed control activities will likely be required along the reinstated easement and other areas during the first few years of operation.

Reinstatement will be undertaken in accordance with the Construction Contractor’s Rehabilitation Management Procedure and will involve replacing all sub-soils where excavated, re-spreading all top soils, re-contouring of the disturbed area to match the surrounding landscape, installation of flow diversion banks as required by the Primary ESCP and re-spreading cleared vegetation over the reinstated soils. The topsoil will contain seed stock which will aid in natural revegetation of the area.

Specific reinstatement requirements for major watercourse crossings will be determined in Progressive ESCPs, but will include as a minimum:

- immediate re-contouring of beds and banks following pipe installation
- installation of flow diversion banks on watercourse approaches
- seeding or otherwise stabilising (with ground cover) the banks and approaches.

If initial reinstatement activities do not facilitate regrowth and/or adequate stabilisation in some areas, then active revegetation (e.g. hand seeding) will be undertaken, as required. This is most likely to occur in watercourse crossings (approaches and banks). Seeding will also be considered for areas where erosion risk is high; grass seed will be spread to establish a ground cover in those areas.

Rehabilitation monitoring requirements and acceptance criteria will be prescribed in a Rehabilitation Management Plan (refer Chapter 13 EMP).

2.14 TESTING AND COMMISSIONING

The pipeline will be subject to a strength test and leak test in accordance with AS 2885.1 and AS2885 Part 5 (AS 2885.5). This testing is referred to as hydrostatic pressure testing.

Hydrostatic pressure testing involves filling a section of the pipeline with water and monitoring its pressure to detect for leaks. The testing procedure will be developed by the hydrostatic pressure testing contractor and based on the pipeline design engineer's plan.

Prior to filling a test section with water, the pipeline will be pre-cleaned with cleaning pigs and checked to ensure it is free of dents, buckles or other obstructions.

Ten test sections will be required along the length of the pipeline, although this will be confirmed during the detailed design phase of the Project. Testing will be carried out in accordance with the time period nominated in AS2885; pressure and temperature in the pipeline will be monitored over this time.

Approximately 22 ML of water will be used in total for hydrostatic pressure testing. Water will be re-used in subsequent test sections, where practicable. As aforementioned, hydrostatic test water will be sourced from the existing supplies at Mount Isa, and supplemented, if required, with water from Tennant Creek (see Section 2.11).

Prior to use in hydrostatic pressure testing, water will be sampled; biocides or oxygen scavengers may be added depending on the source water quality. A small amount of water (approximately 1 ML) will initially be pushed through the pipeline test section to flush out any debris or particles; this flush water will be filtered and tested prior to land application at a designated location at the end of each test section. The hydrostatic test water will then be pumped into the pipeline and the pressure testing undertaken.

Upon completion of the hydrostatic pressure test in each test section, the water will be removed and transported via water truck to a storage dam in preparation for use in the next test section. The pipe will be cleaned and dried with allocated pigs driven by compressed air, and the process will be repeated as necessary to ensure no water, debris or particles are left in the pipe.

After the final test section, the hydrostatic test water will be sampled and analysed for water quality. If required water will be treated to ensure compliance with guideline values before being released by land application to an approved location near Tennant Creek under a Waste Discharge Licence. Monitoring and land application will be managed in accordance with the Water Management Plan (Construction); refer Chapter 7 of this EIS.

Pipeline commissioning is scheduled to occur in the first half of 2018.

2.15 OPERATION

The NGP facilities and pipeline will be designed and sufficiently automated for safe and reliable local and remote operation. The operation and proactive maintenance of the plant will be to a level consistent with Jemena's practice in existing facilities. Each facility will be monitored and controlled from the remote Jemena control room 24 hours per day.

There will be sufficient remote and local manual isolation to maintain security of supply during normal and abnormal operations, during maintenance activities and to enable the safe shutdown, bypass and reduction in pressure during an emergency. Emergency shutdown systems will be capable of being trip function tested without curtailing or limiting pipeline flows of gas. The facility will be provided with services and auxiliaries (and their remote control) necessary for the satisfactory performance, availability and reliability of the station and for ongoing operations and maintenance, including power, communications, water,

drainage and security. All proprietary equipment will have maintenance schedules in accordance with the supplier's recommendations.

All maintenance and servicing requirements will be outlined in the Operations and Maintenance Manual. Spare parts will be provided to ensure the reliability and availability requirements of the station are met.

2.16 DECOMMISSIONING AND REHABILITATION

The NGP has a design life of 30 years; however it could operate for longer if the pipeline integrity is maintained. In the event that the pipeline is no longer required, it will be decommissioned in accordance with AS 2885. The following options will be considered:

- suspension – this would involve depressurising the pipeline, capping and filling with an inert gas such as nitrogen or water with corrosion inhibiting chemicals. The cathodic protection would be maintained to prevent the pipe corroding\
- abandonment – this would involve disconnecting it from all sources of hydrocarbons, processing plants, meter stations and control lines, and purging the pipe of natural gas with a non-flammable liquid. The pipe may then be filled with water and left to corrode in-situ, filled with cementitious mud, or removed (generally only in built up areas).

While both decommissioning options have potential for small scale localised and temporary environmental impacts, recovering the buried pipe would result in significant and unnecessary environmental impacts. A detailed decommissioning or abandonment plan and rehabilitation program would be developed and implemented in consultation with landholders and the regulator at the time of abandonment. When the above-ground equipment and facilities have been removed, the sites (including access tracks) would be returned to their pre-use state, i.e. open grassed grazing land.

A detailed decommissioning or abandonment plan and rehabilitation program would be developed and implemented in consultation with landholders and the regulator at the time of abandonment. When the above-ground equipment and facilities have been removed, the sites (including access tracks) would be returned to their pre-use state, i.e. open grassed grazing land.

2.17 INDICATIVE CONSTRUCTION SCHEDULE

Construction is currently scheduled to commence in early 2017 and the pipeline system is planned to be operational in 2018. The exact timing is dependent on a number of factors including the timeliness of the required approvals, access agreements with relevant stakeholders and weather conditions

Construction of the PCCS and MICS is planned to extend through to early 2018, as access to these locations is less dependent on dry weather conditions. Commissioning of the pipeline, PCCS and MICS will follow the construction period. The construction schedule is driven by the Project objective to achieve commencement of gas transportation services (commercial operation) in 2018.

An overview of the construction schedule is provided in Table 2-9.

Table 2-9. Indicative Project construction schedule

2.18 PROJECT ALTERNATIVES

The Northern Territory Government led a competitive, three-stage tender process to appoint a private-sector developer for the NGP Project. The Project's feasibility was assessed by Jemena during the bid process and the NGP was sized to match the Northern Territory's current gas production and Mount Isa's current demand requirements. The alternative of 'not proceeding' with the Project was considered through Jemena's feasibility assessments; the NGP was deemed feasible with the Northern Territory's current gas production, and there is significant potential for future expansion. Given the Project's feasibility, not proceeding would result in lost economic and social opportunities for the Northern Territory and northern Australia, and for the broader economy through lost opportunity for enhanced competition and security of Australian gas supply. The economic impact of the Project is further set out in Chapter 9 and the associated appendices.

2.18.1 ALTERNATIVE ROUTE AND FACILITIES OPTIONS

Through the bid process, Jemena considered a number of alternative pipeline route and facilities options. A Multi-Criteria Analysis was used as a decision-aiding tool to provide a structured and transparent way of analysing complex issues and selecting between competing route and facilities options.

Initially a desk top assessment study was performed to select a preferred route corridor from a selection of four routes proposed by the Northern Territory Government which covered a range of possible inlet and outlet connections along the Amadeus and Carpentaria Gas pipelines. The pipeline options considered would either terminate at Mount Isa or Moomba. The Tennant Creek to Mount Isa alignment was chosen as the preferred route by Jemena as it was the shortest route distance to connect Northern Territory gas reserves to the Eastern Gas Market, and a tariff price could be determined at a significantly lower cost than a southern option.

A 20 km wide 'planning corridor' was defined within which the pipeline route would be refined through further desktop and ground-based assessment. Following a site visit in April 2015, which involved aerial

surveillance and on-ground inspection utilising public road accesses, four main route variations were identified within the 'planning corridor' for further assessment.

To select an alignment from the four route variations, an assessment was performed to rank the routes based on a number of criteria. The assessment criteria were arranged into two main areas for analysis: risk profiling and capital expenditure, as a means to provide consideration of the non-monetary issues (issues that may not directly impact the project costing but may impact the Project reputation or affect areas outside the Project) against the cost evaluation of each route.

A risk profiling exercise was undertaken to differentiate the key risk areas that apply to each route. The risk profiling method was based on the following set of categories that would establish a rationale for risk evaluation:

- lands, health, safety and environment
- operation and maintenance, and future growth
- design and constructability
- budget and schedule.

Comparative costs for each route option were estimated using available route data in relation to the following aspects which affect the unit costs of construction items:

- pipeline length
- soil type
- terrain slope
- crossing types
- area of inundation
- vegetation type.

The chosen pipeline route is the preferred route corridor due to the relatively low risk profile low and low capital expenditure. The route represents a compromise between maintaining regular access to the route via the Barkly Highway and avoidance of black soil areas. The western half of the route maintains access via the Barkly Highway through the portion of the route where there are little to no public access tracks. Along the eastern half the route deviates significantly from the Barkly but this area has a number of good condition access tracks predominantly used by the local cattle graziers. Access to water is generally available along the preferred route.

Over the course of 2016, the preferred locations for the pipeline corridor, above-ground facilities and access tracks were further refined to address the requirements of landholders and other stakeholders, and to avoid impacts to significant cultural heritage sites. Environmental surveys undertaken in May and June 2016 did not identify any areas of sensitivity which would require re-routing of the pipeline.

2.18.2 ALTERNATIVE CONSTRUCTION METHODS

Alternative construction methods for the pipeline trench and crossing locations (roads, rail and watercourses) are considered using findings from geotechnical assessments, environmental and heritage surveys and stakeholder consultations. Pipeline construction has a number of standard techniques available for constructing through different ground conditions and for minimising impacts at pipeline crossing locations and other areas of sensitivity.

The majority of the NGP will be constructed using standard 'open trench' construction techniques. This construction technique is preferred in terms of minimising the time it takes to construct a pipeline, which reduces costs and also provides for reinstatement and rehabilitation to occur within a shorter timeframe. In the absence of constraints that require ground disturbance to be avoided, the *Code of Environmental Practice – Onshore Pipelines (2013)* accepts open trenching as the standard technique used in pipeline construction. The NGP alignment has been refined over the planning phase to generally avoid areas of sensitivity that would necessitate the use of trenchless techniques.

In ground where the use of conventional excavation machinery is not feasible due the profile of the substrate, it may be necessary to undertake controlled blasting. The NGP alignment has been selected to avoid most rocky areas, however some areas near Mount Isa and elsewhere will require blasting. Exact locations will be identified during the geotechnical test program.

Boring or horizontal directional drilling are alternative construction methods to 'open trenching' which can be used as required where the pipeline crosses sensitive areas, major watercourses or significant built infrastructure. These techniques are substantially more expensive, take longer and have increased risks associated with the use of chemicals, waste production, noise and a larger construction footprint due to the use of more equipment. Accordingly, these methods are generally only considered as alternatives when ground conditions or other requirements preclude the use of open trenching.

Work undertaken during the Project planning phase has indicated that open cut road crossings will be suitable to cross minor earthen roads (mostly tracks). Bored, uncased road and railway crossings will be required for the Warrego Road, Stuart Highway and Diamantina Development Road, plus the Adelaide to Darwin Railway line crossing. These requirements are dictated by AS2885.

A number of major watercourse crossings will be required along the NGP, as well as numerous minor watercourse crossings. The watercourses crossed by the NGP typically have a narrow zone of riparian vegetation and relatively low banks, and it is envisaged that most watercourse crossings will be dry or at very low flow conditions at the time of crossing. Open-cut trench crossing are deemed appropriate for watercourses with these conditions. The *Code of Environmental Practice – Onshore Pipelines (2013)* states that the main advantage of open cut crossings is they allow construction to progress quickly and so reinstatement can occur within a shorter timeframe; also there is less noise and waste associated with this technique.

2.18.3 ALTERNATIVE SOURCES OF SERVICES

Due to the remote location of the Project, servicing options are limited. At the PCCS site the Project will establish its own generator power supply with the potential for a backup mains power connection from Tennant Creek. Jemena consider this to be the most suitable approach to supplying a stable power source to PCCS.

Water will be sourced through establishment of a groundwater bore at the PCCS site. The PCCS will not be connected to Tennant Creek water services, however, potable (drinking) water for construction camps and PCCS operational personnel will be sourced from the Tennant Creek mains water supply and trucked to the Project area. Wastewater (sewage) from ablutions at construction camps, and the operational PCCS, will be managed using approved on-site treatment systems during both the construction and operational phases, as the operational wastewater amounts are small and the Project area is too distant from the mains sewer system for connection to be viable.

The MICS will be serviced by mains power. An on-site GEA will be provided for stand-by purposes. During the planning phase, powering the MICS site using only GEAs was considered as an alternative to mains power; the alternative energy sources considered by the Project are discussed further below. The MICS will not be connected to Mount Isa mains water or sewer as the operational water demand and wastewater production will be low. Potable (drinking) water for construction camps and MICS operational personnel will be sourced from the Mount Isa mains water supply and trucked to the Project area.

2.18.4 ALTERNATIVE ENERGY SOURCES

Jemena have considered alternate energy sources. The combination of GEA and mains power supply has been used in Jemena's existing compressor station facilities and is considered to be the most appropriate option for the Project. This is due to the high power demand and requirement for generation load control to closely follow the changing facility demand.

2.18.5 EMERGENCY AND INCIDENT RESPONSE

Options for emergency and incident response during the Project construction and operational phases are being considered by Jemena and the Construction Contractor in consultation with Northern Territory Department of Health, Northern Territory Police, Fire and Emergency Services and local health and emergency service providers. The risk of the Project potentially impacting on the availability of existing emergency and health services to the local population is identified as a Project risk (refer Chapter 5), and so the capacity of the local services and alternatives available to meet the forecast Project demand are being investigated by Jemena.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