Environmental Impact Assessment

Melville Island Road Upgrades

Department of Infrastructure Planning and Logistics

21 February 2022

→ **The Power of Commitment**

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			Name	Signature	Name	Signature	Date
S4	0	H. North	C. Sylianteng		C. Sylianteng		16/03/2022

Acknowledgment of Country

We acknowledge Tiwi people as the Traditional Owners of the land from which the Project area is situated on, and Larrakia people from the land on which we do business, and we pay our respects to their Elders, past, present and emerging.

Executive summary

This Environmental Impact Assessment (EIA) has been prepared by GHD Pty Ltd (GHD) on behalf of the proponent, the Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) as formal notification of a proposal to undertake construction works to upgrade the Pirlangimpi Road and Pickertaramoor Road on Melville Island, Northern Territory.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.5 and the assumptions and qualifications contained throughout the report.

Overview of the proposal

The Tiwi Islands Regional Council (TIRC) and Northern Territory Government (NTG) are implementing an upgrade strategy for the roads on the Tiwi Islands. This Environmental Impact Assessment identifies, describes and assesses significance of the risks associated with the upgrading of Pirlangimpi Road and Pickertaramoor Road.

Roadworks are anticipated to commence on Pirlangimpi and Pickertaramoor Roads in 2024 for approximately three to five years every dry season (April to October), with approximately 15-20 km of road constructed each year.

The core objectives for the road upgrades are to:

- Improve freight efficiency, connectivity, and travel time.
- Improve safety and driver comfort.
- Support regional and local economic development.
- Support Indigenous employment.
- Respect culture and improve local socio-economic outcomes.

The works include pavement lifts, re-gravelling, sealing to a two-lane standard, formation widening, realigning, installation of transverse drainage structures and overall improvements to the flood immunity and rideability of the roads.

The construction phase of the project will also include:

- Importing vehicles, plant and machinery from the mainland to Melville Island
- Development of gravel pit areas at several locations located along Pirlangimpi Road, Pickertaramoor Road and Milikapiti Road to source gravel, including vegetation clearing, gravel extraction and progressive rehabilitation
- Sourcing water from existing bores, and potentially new bores where there are distances of >16 km between water sources, or where existing water sources are not adequate.
- A site office and camp for each road length constructed. The site office and laydown area are likely to be within one of the designated gravel pit areas.

Project area

The project area is located on the central western part of Melville Island, the largest of the Tiwi Islands, 80 km north of Darwin in the Northern Territory. Melville Island is Aboriginal freehold land held by the Tiwi Aboriginal Land Trust. The existing access roads on Melville Island are unsealed roads managed and maintained by the Tiwi Island Regional Council.

Pirlangimpi and Pickertaramoor Roads are important links between various Indigenous communities on Melville Island. Both roads meet at one location (three ways) connecting the larger communities of Wurrumiyanga (Nguiu), Pirlangimpi, Milikapiti, Wurankuwu and Pickertaramoor and access to existing timber plantations on Melville Island. These roads also provide access to Paru Road, which is a vital link for the barge to Bathurst Island, which connects services and facilities between both islands.

The total project area consists of the following components:

- The two access roads with a linear footprint of approximately 73 km (Pirlangimpi Road, 48 km and Pickertaramoor Road, 26 km)
- Road realignment areas (approximately 23 ha in total)
- 23 proposed gravel pit areas. Only 1 ha is proposed to be cleared in any proposed gravel pit area at any one time. Each 1 ha extraction area will be rehabilitated immediately following extraction. The assessed area for gravel pits (which the 1 ha extraction area will be located within) is approximately 234 ha.
- Water points and access tracks (approximately 34 ha)

Existing conditions

Governance

The Tiwi Islands (Tiwi: Ratuati Irara meaning "two islands") comprise Bathurst Island, Melville Island and nine smaller islands. The Tiwi Islands have been inhabited by Tiwi people for over 40,000 years. Control of the Tiwi Islands was transferred back to Tiwi people through the Tiwi Aboriginal Land Trust and Tiwi Land Council in 1978.

The Tiwi Islands local government area was established in 2001, when the previous community government councils in the three main communities of Wurrumiyanga (located on Bathurst Island), Pirlangimpi and Milikapiti (both located on Melville Island) were amalgamated with the Wurankuwu Aboriginal Corporation to form a single local government (Tiwi Island Local Government, 2002).

The Tiwi Islands Local Government was replaced in 2008 by the Tiwi Islands Regional Council as part of a Northern Territory-wide restructuring of local government.

Socio-economic conditions

In 2016 the population of Tiwi Islands was 2,453 people. Wurrumiyanga is the largest community on the Tiwi Islands and in 2016, had a population of approximately 1,500 people.

Key demographic indicators for the Tiwi Islands shows that in 2016 the population of Tiwi Islands compared to other remote areas in NT was characterised by:

- A higher population of Aboriginal or Torres Strait Islander people.
- A lower proportion of the population who spoke English at home.
- A lower median weekly household income.
- A lower proportion of people who travelled by, or owned, a car.

The areas of Pirlangimpi, Wurrumiyanga and Milikapiti can be characterised compared to the other remote areas of the NT by:

- A higher median age in Pirlangimpi.
- A higher rate of year 12 completion in Wurrumiyanga.
- A higher rate of households renting their dwelling in Wurrumiyanga and Milikapiti.
- A lower unemployment rate in Pirlangimpi and Milikapiti compared to Wurrumiyanga and Tiwi Islands overall.
- A lower rate of mobility in Pirlangimpi and Wurrumiyanga.

Economic conditions

Commercial forestry and fishing tourism remain key contributors to the Tiwi Islands' regional economy, making up 17.3% of the total economic output (NIEIR, 2021). Once cleared, land is used for monoculture plantations, which is an important source of local jobs for residents.

The largest proportions of the labour force in Tiwi Islands are employed in the Education and Training (24%), and Public Administration and Safety (17.7%) industries. Only 2% of the labour force in Tiwi Islands are employed in Agriculture, Forestry and Fishing industry.

Biodiversity

Melville Island is classified as an international site of conservation significance (SOCS) where the bioregion comprises extensive relatively unmodified area, supporting intact biota. The isolation of most of this bioregion has allowed many species to remain unaffected by threatening processes that have led to widespread population declines on mainland Australia.

Desktop studies in addition to detailed and targeted threatened species survey identified several listed threatened species as being present or possibly present within the Project area. These include five mammals, three birds and two reptiles that are listed under the EPBC Act and/or the TPWC Act. Most notably, three detections of Brush-tailed Rabbit-rat and 4 detections of Brush-tailed Phascogale, both EPBC Act 'endangered' species in four different locations throughout the Project area.

There are a total of 17 vegetation communities mapped throughout the Project area, with the majority classified as tall *Eucalyptus spp*. open forest/woodland with very small areas of grasslands, seasonally saturated or inundated (Melaleuca) areas, and Corymbia-dominated seasonally saturated communities. Eight of the 17 mapped communities are significant and/or sensitive, though are only found within small patches of the Project area.

Matters of National Environmental Significance

A search of the EPBC Act PMST identified no World Heritage Properties, National Heritage Properties, Commonwealth Heritage Places Wetlands of International Significance and Threatened Ecological Communities within 10 km of the Project area. The only MNES identified were 42 threatened species, 46 migratory species and 78 marine species. Marine habitats are not found within the Project area. Of the migratory species, seven are found in terrestrial habitats, but are extremely uncommon migrants.

Contamination potential

A review of the historical aerial imagery, NT EPA contaminated land audit register and available Project area specific reports, identified no significant sources of land contamination or unexploded ordinances within the Project area. It is noted however, that a municipal waste transfer facility and a water treatment facility including evaporation ponds are located within a few hundred metres of the Pirlangimpi and Pickertaramoor Roads. These land uses have the potential to cause contamination if managed improperly.

Impact Assessment

This Environmental Impact Assessment has been undertaken using the Northern Territory Environmental Protection Authority's (NT EPA) Guidelines for Environmental Assessments. The NT EPA list environmental factors and objectives under the themes of Land, Water, Sea, Air and People. These categories have been adopted for this assessment, with the exception of Sea, as no potential impacts were identified in this category.

A total of 52 potential impacts were identified through this assessment. The full risk assessment matrix is provided at Appendix A of this report.

An initial assessment of the potential impacts was undertaken which assessed the likelihood and severity of consequence of each potential impact. Most potential impacts achieved a Low or Medium risk rating using the methodology of risk analysis outlined at Section 6 of this report. None of the identified potential impacts are classified as being of a severe risk consequence.

A summary of the potential impacts that were identified as high risk at the initial assessment, along with a summary of the proposed mitigation measures and the residual risk after mitigation is provided at Table E.1.

Table E.1 Summary of Potential High-Risk Impacts

	Potential high-risk impacts	Proposed mitigation and management measures	Residual risk after mitigation and management
Land	Pest species are introduced and established	A Weeds and Pest Management Plan will be developed and implemented during construction by the contractor. The plan will detail procedures that need to be adhered to, to ensure that no declared weeds are spread or introduced within the site for the duration of the works.	Medium
People	Unknown indigenous cultural heritage sites are disturbed or damaged during road construction, operation and/or decommissioning.	Should any item be encountered, which might be an artefact of heritage value or any relic, artefact or material which might be of Aboriginal or Torres Strait Islander origin, all construction work that might affect the item will cease and the contractor will protect the item from damage or disturbance.	Medium

Project response to key principles of environment protection and management

DIPL and its Contractors are committed to planning and conducting the Project in accordance with the environment protection and management principals provided in this referral. The key aspects of these principles for the Project include:

– Much of the disturbance footprint is located along the existing roads or cleared areas for existing gravel pits or plantation.
– A careful and considered approach to micrositing gravel pit areas to avoid and minimise and reduce potential impacts to the unique biodiversity values found on Melville Island
– A careful and considered approach to micrositing gravel pit areas to avoid and minimise and reduce potential impacts to erosion of cleared areas on slopes.
– The progressive rehabilitation of each 1 ha gravel extraction area throughout the construction phase of the Project and beyond to restore pre-existing vegetation as quickly as possible upon completion of the works

Based on this, there is no residual significant environmental impact associated with the proposed works.

Contents

Table index

Figure index

Appendices

List of terms/abbreviations

Term/abbreviation	Definition
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
AAPA	Aboriginal Areas Protection Authority
ASS	Acid Sulfate soils
BoM	Bureau of Meteorology
CEMP	Contractor's Environmental Management Plan
CoP	Code of Practice
DAWE	Department of Agriculture, Water and the Environment
DEPWS	Department of Environment, Parks and Water Security
DoD	Department of Defence
DoH	Department of Health
DIPL	Department of Infrastructure, Planning and Logistics
DITT	Department of Industry Tourism and Trade
DTFHC	Department of Territory Families, Housing and Communities
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP Act NT	*Environment Protection Act 2019*
EIA	Environmental Impact Assessment
ESC	erosion and sediment control
IPP	Indigenous Participation Plan
MNES	Matters of National Environmental Significance
NIAA	National Indigenous Australians Agency
NR Maps	Natural Resource Maps
NT EPA	Northern Territory Environmental Protection Authority
NTG	Northern Territory Government
PMC	Department of the Prime Minister and the Cabinet
PMST	Protected Matters Search Tool
PWC	Power and Water Corporation
RWA	Restricted Work Area
SOCS	international site of conservation significance
TGS	Territory Groundwater Services
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976*
TIRC	Tiwi Islands Regional Council
TLC	Tiwi Land Council
UXO	Unexploded Ordnance
WoNS	Weeds of National Significance

1. Introduction

1.1 Purpose of this report

This referral has been prepared by GHD Pty Ltd (GHD) on behalf of the Department of Infrastructure Planning and Logistics (DIPL) to identify environmental risks associated with the construction and upgrade of the Pirlangimpi Road and the Pickertaramoor Road on Melville Island (the Project).

This document identifies and characterises the potential environmental impacts associated with the Project and determines whether these impacts have the potential to be significant or require further assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, Commonwealth) and the *Environment Protection Act 2019* (NT EPA).

This report contains:

– Site Details (Section 2)
– Details of the proposed action and need for the proposed action (Section 3)
– Regulatory framework (Section 4)
– Relevant aspects of the existing environment (Section 5)
– Matters of National Environmental Significance (Section 5.9)
– Environmental risk assessment (Section 6)
– Potential impacts and mitigation measures (Section 7)
– Rehabilitation and closure of key project elements (Section 8)
– Conclusions (Section 9)

1.2 Proponent Details

Project proponent details are presented in Table 2.

Table 2 Project Proponent

Proponent	Department of Infrastructure Planning and Logistics – Transport and Civil Delivery Department
Contact person	Josefa Tchong
Mailing Address	PO Box 61, Palmerston, NT 0831
Street Address	Floor 2, Highway House, Palmerston Circuit, Palmerston
Telephone	+618 8999 4512
Email	josefa.tchong@nt.gov.au

1.3 Environmental Consultant

This referral was prepared by GHD and supported by Connect Environmental for the biodiversity studies component. Details are provided in Table 3 and Table 4.

Table 3 Environmental Consultant Details

Company	GHD Pty Ltd
Key contact person	Natalie Fries
Mailing Address	Level 7 24 Mitchell Street Darwin NT 0801 Australia
Street Address	Level 7 24 Mitchell Street Darwin NT 0801 Australia
Telephone	+61 8 8982 0102

Company	GHD Pty Ltd
Email	Natalie.Fries@ghd.com

Table 4 Subconsultant (Biodiversity Assessment)

Company	Connect Environmental
Key contact person	Mihkel Proos
Telephone	+61 411 019 569
Email	mproos@connectenvironmental.com.au

1.4 Scope of referral

This report assesses only one component of the Tiwi Islands Road upgrades, which consists of the upgrade of Pirlangimpi Road (47 km) and Pickertaramoor Road (26 km) on Melville Island. The Paru Road (13 km) is currently being assessed under a different proposal (AECOM, 2021) and the Milikapiti Road (27 km) will be assessed in a future and separate proposal.

1.5 Limitations

This report has been prepared by GHD for the Department of Infrastructure Planning and Logistics and may only be used and relied on by the Department of Infrastructure Planning and Logistics for the purpose agreed between GHD and the Department of Infrastructure Planning and Logistics as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than the Department of Infrastructure Planning and Logistics arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has prepared this report on the basis of information provided by the Department of Infrastructure Planning and Logistics and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Site description

The Project area referred to throughout this report, can be defined as:

– The road corridor on both the Pirlangimpi and Pickertaramoor Roads, including sections for realignment and widening
– Potential gravel pit areas: The larger area assessed within desktop assessments and surveys
– Proposed gravel pit areas: smaller areas that were reduced and microsited within the potential gravel pit areas to avoid biodiversity values (only this area has been assessed for potential impacts, rather than the whole potential gravel pit area)
– Water points including their access roads. Existing bores with access permissions will be used as a first preference. Natural water sources will be assessed for suitability should they be required.

The Project area is shown in Figure 1 and Figure 2 and is quantified in Table 5 below. Description of the need for the project and relevant components of the works are discussed in Section 3.

Table 5 Project area components

Road	Potential gravel pit area^ (ha)	Proposed gravel pit areas~ (ha)	Road realignment and widening (ha)	Water point# (ha)
Pirlangimpi Road	674.03	157.42	21.96	24.8
Pickertaramoor Road	463.61	67.53	6.27	9.3
Milikapiti Road*	32.02	9.07	N/A	N/A
Total	**1169.66**	**234.02**	**28.23**	**34.1**

* Map 14 gravel pit area and adjacent water source only.
^ Area surveyed for biodiversity and described in this report
~ Reduce area for inclusion in impact assessment
# Includes existing bores only

2.1.1 Pirlangimpi Road

The Pirlangimpi Road runs through Pirlangimpi township which has a population of approximately 350 people. Pirlangimpi Road is 48 km in length and generally runs in a northwest to south east diagonal direction from the Pirlangimpi community boundary and Port gate (Figure 2) (via separate access road to approximately 1.93 km) to the Pirlangimpi/Paru/Milikapiti intersection (known as Threeways; Figure 2).

The road is generally a two-way undivided road, is unsealed, made of poor-quality pavement materials and includes a shoulder on each side with inadequate drainage. The current posted speed limit is 80 km/hr.

2.1.2 Pickertaramoor Road

Pickertaramoor Road is 26 km in length (6.1 km sealed) and generally runs in a northwest to southeast diagonal direction from Threeways intersection to Pickertaramoor (Figure 2).

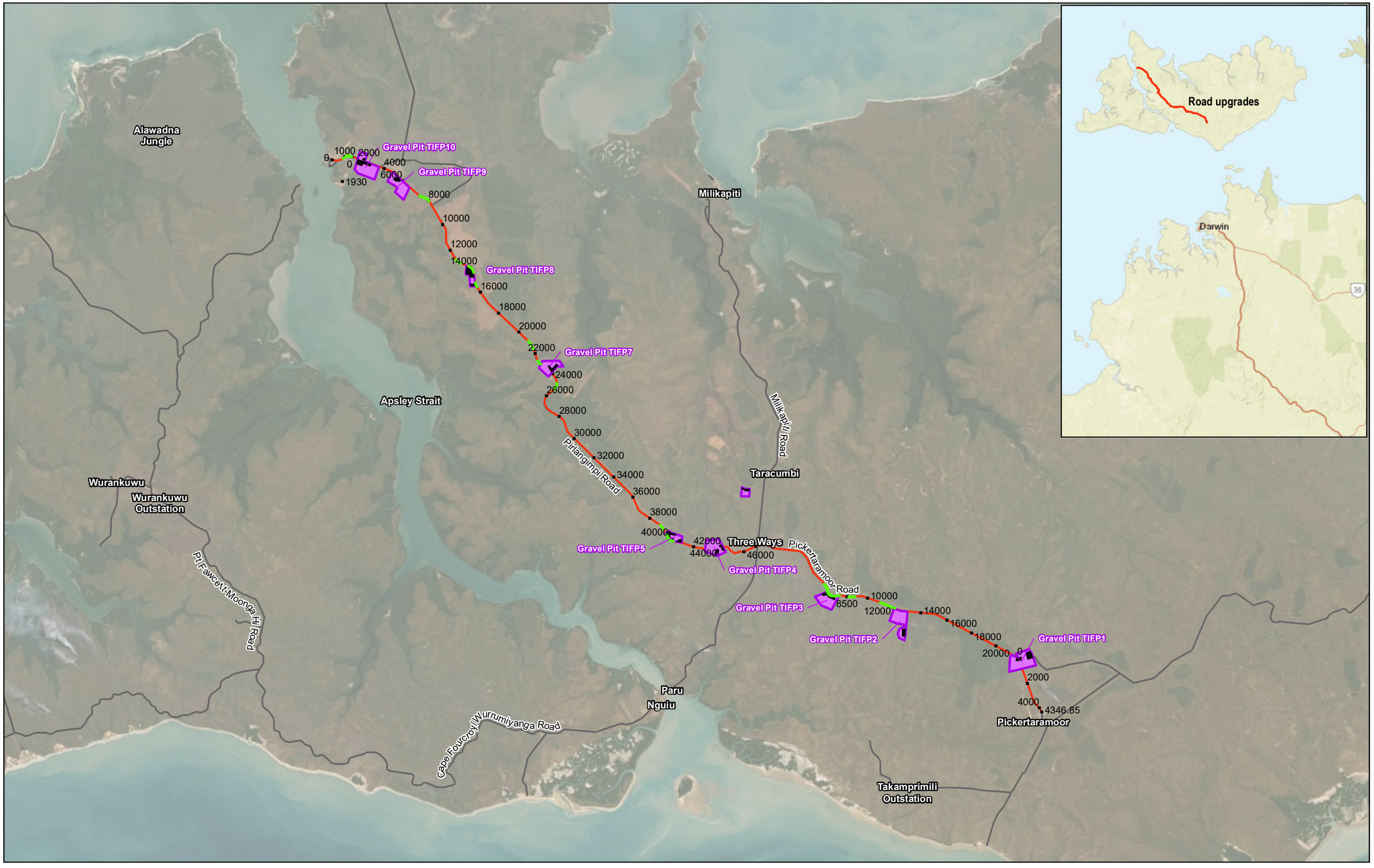
The road is generally a two-way undivided road, that is predominantly unsealed, though a small section of the road is sealed near the Threeways intersection. The road is made of poor-quality pavement materials and includes a shoulder on each side with inadequate drainage.

2.1.3 Milikapiti Road

Only the proposed gravel pit area on the southern end of Milikapiti Road will be assessed within this referral.

2.1.4 Land tenure

The whole of Melville Island is Parcel 1644 and is Aboriginal freehold land (scheduled under ALRA). The access roads on Melville Island are unsealed roads managed and maintained by the Tiwi Island Regional Council (TIRC). The Pirlangimpi and Pickertaramoor Roads will remain as private roads on completion of the upgrades.



Legend

- Road realignments
- Proposed gravel pit areas
- Potential gravel pit areas
- Road upgrades

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0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

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Terrestrial biodiversity surveys for
Melville Island roads

Project Area, Melville Island, NT

Project No. **12543964**
Revision No. **0**
Date **2/11/2022**

FIGURE 1

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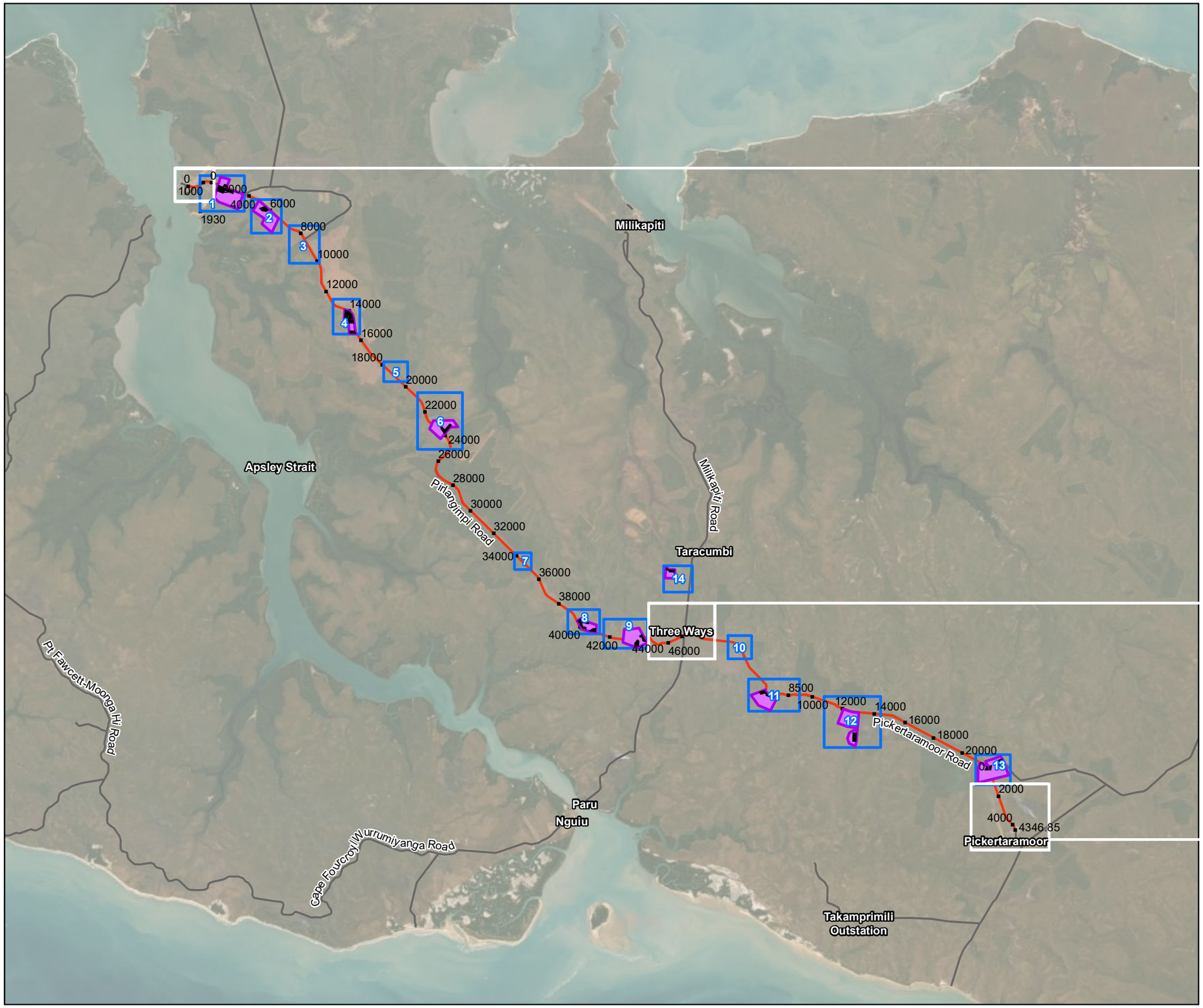

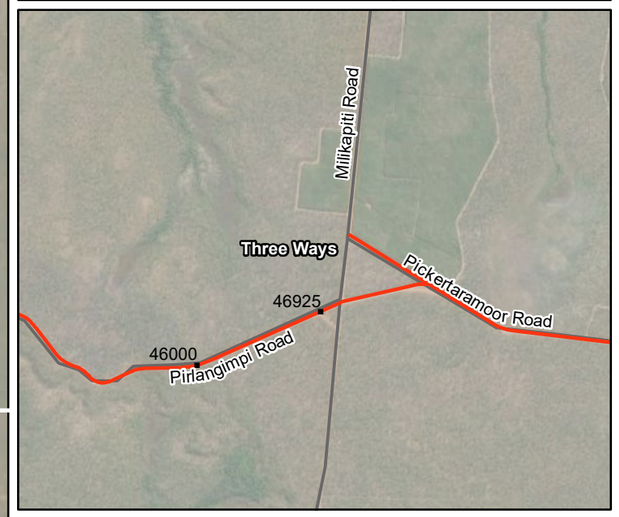

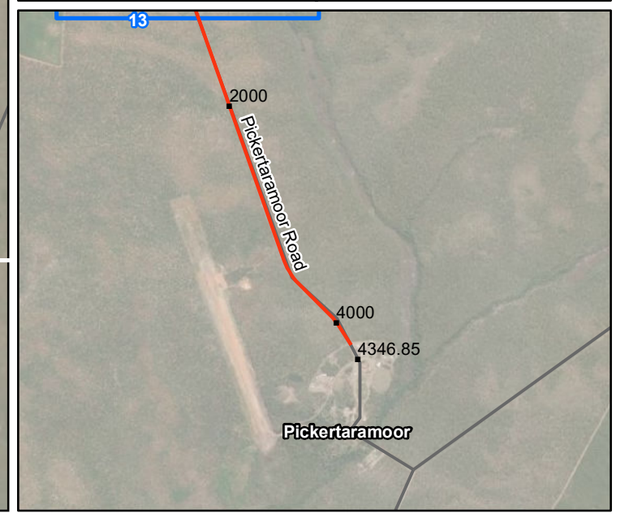

Legend

- Proposed gravel pit areas
- Potential gravel pit areas
- Map areas
- Road upgrades

1:250,000 @ A3

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

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Terrestrial biodiversity surveys for
Melville Island roads

Road upgrades

Project No. **12543964**
Revision No. **0**
Date **2/11/2022**

FIGURE 2

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3. Project description

The Australian Government is committed to the upgrade of roads on Melville Island, announcing an investment of $60 million in its 2019 Budget. A 20% co-contribution of $15 million from the Northern Territory Government has increased the total funding available to $75 million.

All roads on the Tiwi Islands are under the control of the Tiwi Islands Regional Council (TIRC). TIRC is responsible for the management of approximately 925 kilometres of listed roads and tracks on a land mass of approximately 8,320 square kilometres.

In recent years, road usage, particularly on Melville Island, has grown with the operations of the timber plantation and population growth. This has affected the existing gravel road and its drainage features that are generally in poor condition and are subject to deterioration and inundation during the wet season.

During the wet season, major weather events cause sections of the roads to become impassable or subject to prolonged restrictions due to flooding and saturated road pavements. An upgrade to priority sections of the road will improve flood immunity and reduce the duration of restrictions and road closures during major weather events. Significant, targeted road maintenance and upgrade work is required for overall community safety and for local industry to meet their on-going development targets.

3.1 Project objectives and benefits

The Project will assist to unlock the economic potential of the region and open a range of new long-term economic and social opportunities for people across the island community. Economic opportunities include tourism, forestry, mining and energy developments and employment opportunities in those industries. It will contribute to the 'Closing the Gap' initiative through improving access to health and educational services, facilitate social and cultural connections and reduce barriers to development, including operating costs for business (PMC, 2021).

More specifically, the key objectives of the project include improvements to motorist safety, reduction in travel times, and provide driver amenities through the following:

– Improve freight efficiency, connectivity and travel time:
    - Improve access between the major communities that provide essential services such as medical, educational, police, food stores and Tiwi College at Pickertaramoor.
    - Reduce mass restriction frequency and duration for heavy vehicles.
    - Improve flood immunity along the corridor.
    - Improve travel times and reduce closures and restrictions along the corridor for both private and commercial users including forestry.
    - Reduced vehicle operating costs
– Increase safety:
    - Provide safer overtaking opportunities.
    - Improve road surface condition for vehicle trafficability.
    - Reduce crash frequencies and severity.
– Support regional and local economic development:
    - Improve inter-community connections on Melville Island.
    - Support the growth of rural populations and the forestry, aquaculture, tourism, mining, energy and diversified industries.
    - Support existing businesses and industries.
    - Continued development with new and existing plantation areas requiring access for fertilising, spraying, environmental care and the prevention and fighting of fires.
– Support Indigenous employment:

- Provide opportunities for Indigenous employment and training during the construction period of the project.
- Maximise opportunities for Indigenous Business Enterprise involvement, participation, growth and development during the construction period of the project.
- Provide a possible sustainable source of future employment out of the ongoing maintenance of the assets.

– Culture:
  - Respect culture and country.
  - Improve the socio-economic environment for the community.
– Reduced road maintenance cost

3.2 Land use

The Pirlangimpi and Pickertaramoor Roads traverse the central western part of Melville Island (Figure 1), the largest island of the Tiwi Islands, 80 km north of Darwin in the Northern Territory. Melville Island is comprised entirely of Aboriginal freehold land owned by the Tiwi Aboriginal Land Trust.

The Pirlangimpi and Pickertaramoor Roads are important links between various Indigenous communities on Melville Island (Figure 1). All three roads meet at one location (Threeways), which connects the larger communities of Wurrumiyanga (Nguiu; Bathurst), Pirlangimpi, Milikapiti, Wurankuwu and Pickertaramoor and access to existing timber plantations throughout Melville Island.

Melville Island primarily supports Indigenous land uses; however, the plantation forestry industry is also prevalent. Melville Island is classified as an international site of conservation significance (SOCS) where the bioregion comprises extensive relatively unmodified area, supporting intact biota. The isolation of most of this bioregion has allowed many species to remain unaffected by threatening processes that have led to massive population declines on mainland Australia.

3.3 Description of works

3.3.1 Timing

Road works commenced on site on Paru Road in 2021 and are expected to continue for another two years with completion due at the end of 2023.

Roadworks associated with this referral are anticipated to commence on Pirlangimpi and Pickertaramoor Roads in 2024 and continue for approximately three to five years, with works being undertaken every dry season (April to October). It is anticipated that approximately 15-20 km of road will be constructed each year.

3.3.2 Roadworks

Roadworks are anticipated to commence on Pirlangimpi and Pickertaramoor Roads in 2024 for approximately 3-5 years every dry season (April to October). Road works will only be undertaken in the dry season of every year with approximately 15-20 km of road constructed each year.

For each road length constructed, a site office and vehicle depot will be set up to reduce travel times on local roads.

The upgrade works for both the Pirlangimpi Road (48 km) and Pickertaramoor Road (26 km) aim to improve the overall flood immunity and rideability of the road, by:

– Widening to two-laned sealed pavement and improve horizontal and vertical alignments
– Re-gravelling
– Lifting and widening the road formation
– Improving the horizontal and vertical alignments
– Installation of transverse drainage structures

– Sealing with two coat seal
– Line marking and installation of road signage
– Overall improving the flood immunity and rideability of the roads

To achieve the above, specific road works activities will include:

– Clearing and grubbing. Though it is noted that most of the road corridor is already cleared, the majority of the clearing will be undertaken for the re-alignment sections, which are mapped in Figure 3, Figure 4, Figure 5 and Figure 6.
– Earthworks in cut and fill
– Pavement works
– Drainage works including the construction of multiple transverse drainage structures along the road
– Sealing works
– Line marking works
– Gravel pit works

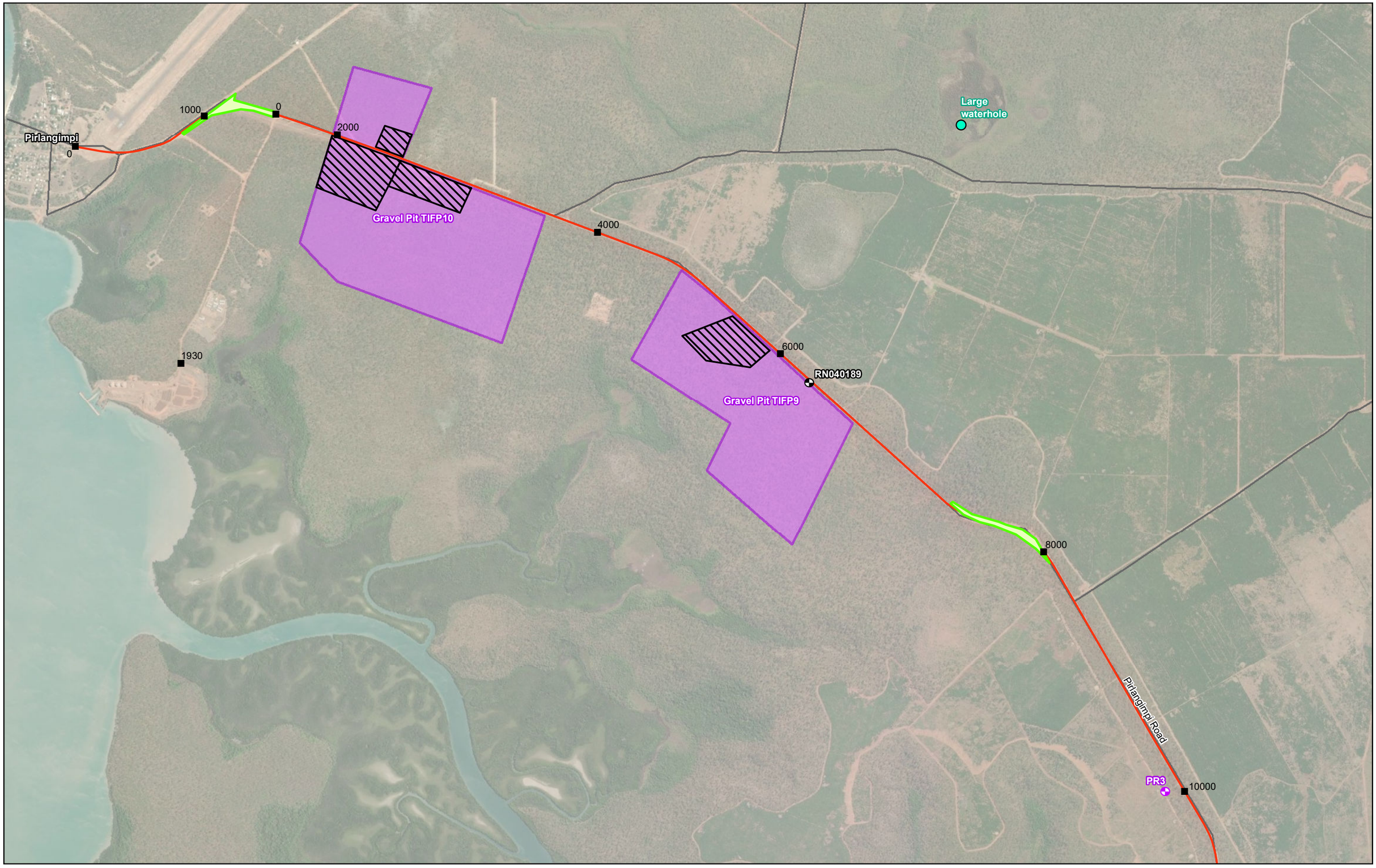
The road has been designed in accordance with relevant design standards. The works shall be carried out as per the contract specifications and designs specific to each contract. Detailed design information including specifications presented in a separate design report that can be provided by DIPL upon request.

3.3.3 Plant and equipment

Plant and equipment that may be used to carry out the roadworks will include:

– Backhoes
– Graders
– Excavators
– Water carts
– Rollers
– Dump trucks
– Road trains
– Bitumen spray truck

It is likely that plant and equipment will be transported to Melville Island at the start of each dry season for the construction period. Plant and equipment will be stored at the site office and laydown area closest to each section under construction.



Legend

- Existing bore
- Proposed bore
- Natural water body
- Road upgrades
- Road realignments
- Proposed gravel pit areas
- Potential gravel pit areas

1:25000 @ A3

0 0.25 0.5 0.75 1

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

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Terrestrial biodiversity surveys for
Melville Island roads

Gravel pit areas and road realignment

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 3

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Legend

- Proposed bore
- Natural water body
- Road upgrades
- Road realignments
- Proposed gravel pit areas
- Potential gravel pit areas

1:40000 @ A3

0 0.45 0.9 1.35 1.8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

N

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Department of Infrastructure, Planning and Logistics
Terrestrial biodiversity surveys for
Melville Island roads

Gravel pit areas and road realignment

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 4

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34000
PR4
36000
Rolla Plains water hole
Gravel Pit TIFP
Milikapiti Road
38000
Pirlangimpi Road
PR6
40000
Gravel Pit TIFP5
42000
PR1a
Gravel Pit TIFP4
44000
46000
Three Ways
46925
Pickertaramoor Road
RN008433 & RN008437

Legend

- Munupi Yellow Ochre Track
- Existing bore
- Proposed bore
- Natural water body
- Road upgrades
- Road realignments
- Proposed gravel pit areas
- Potential gravel pit areas

1:30000 @ A3

0 0.35 0.7 1.05 1.4

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

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Melville Island roads

Gravel pit areas and road realignment

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 5

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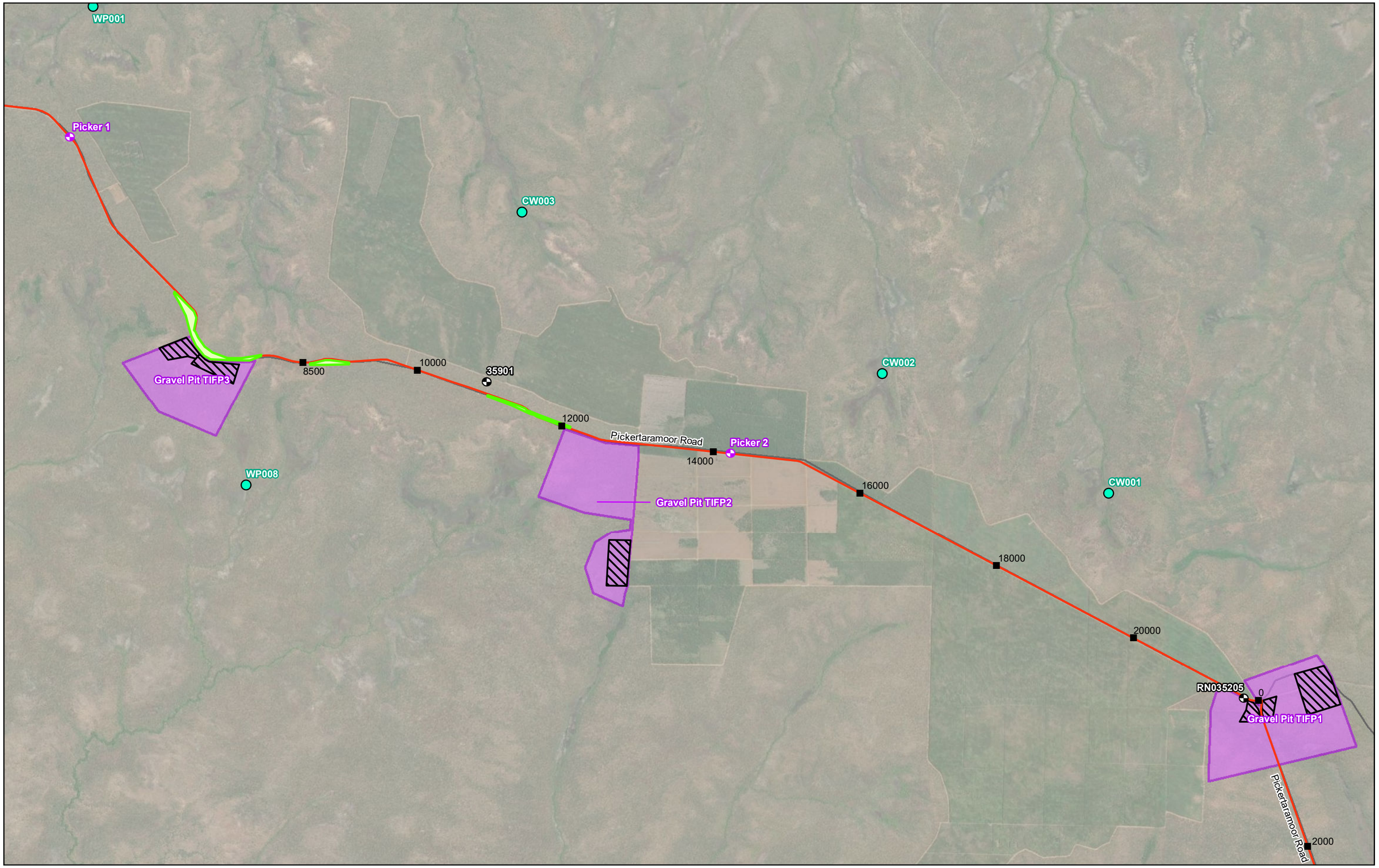

Legend

- Existing bore
- Proposed bore
- Natural water body
- Road upgrades
- Road realignments
- Proposed gravel pit areas
- Potential gravel pit areas

1:45000 @ A3

0 0.5 1 1.5 2

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

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Department of Infrastructure, Planning and Logistics
Terrestrial biodiversity surveys for
Melville Island roads

Gravel pit areas and road realignment

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 6

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3.3.4 Gravel and fill resources

DIPL engaged HiQA Geotechnical to undertake preliminary gravel investigations (HiQA, 2016), to ascertain the suitability and quantities of the material along the 75 km road alignment and to determine potential gravel pit areas. Results of this investigation have resulted in a gravel extraction plan for the Project consisting of the following:

- Potential gravel pit areas (approximate total of 1,169.66 ha):
  - Pirlangimpi Road: 674.03 ha (map areas 1-10; Figure 3, Figure 4, Figure 5 and Figure 6)
  - Pickertaramoor Road: 463.61 ha (map areas 11-13, Figure 6)
  - Milikapiti Road: 32.02 (Map area 14; Figure 5).
- The potential gravel pit areas listed above were further reduced to avoid biodiversity values within, to include smaller 'proposed' gravel pit areas (approximate total of 234.02 ha) within (Figure 3 to Figure 6).
- Actual gravel extraction will only occur from 1 ha at a time within the proposed gravel pit areas. It should be noted that the impact assessment in this report focuses on the 'proposed' gravel pit areas (234.02 ha), though the area for clearing and its associated impacts are expected to be less
- The 'proposed' gravel pit areas have been determined for their suitability in gravel quality and strategically micro-sited to pose the least impact to threatened species, as well as suitability in terms of maintaining erosion and sediment control (ESC) (Preference given for areas with less than 2% slope where possible, however, depending on the availability and quality of gravel material, areas with up to 6% slope may be utilised with increased ESC measures). This was informed by HiQA surveys (HiQA, 2016), in addition to biodiversity and threatened species survey (Connect Environmental, 2021)
- Further geotechnical investigations are required to confirm material quality and quantity which will be undertaken in 2022 and will govern the final positioning of final 1 ha extraction areas within the pit survey boundaries.
- The biodiversity values within the proposed gravel pit areas are summarised in Section 5.8 detailed in full in Appendix B.
- Areas that are identified as suitable for gravel supply will be approved by the local landowners.
- All clearances, licenses and permits required will be provided before works begin.
- During construction phase of the Project, gravel pit plans will be submitted to Tiwi Land Council for review and approval with preparation for erosion and sediment control during the wet season. This will involve ideally only 1 ha cleared and rehabilitated at a time within each gravel pit location.

3.3.5 Water resources

Water will be required throughout each construction stage of the Project for earthworks, pavement works, construction of access roads, dust suppression, washing of vehicles and plant. Several studies have been undertaken in previous years across Melville Island into the reliability of groundwater and surface water supplies (Haig et al. 2003; Territory Groundwater Services (TGS), 2020). An existing bore network and several known surface water bodies are present near to the Project area and have the potential to supply construction water to the Project at the relevant stages of works. These water supply options are discussed in the following sections and a preliminary water supply strategy for construction is presented thereafter.

It should be noted that the Northern Territory Administrator has signed an exemption to Section 45 Licence to take or use water (surface water) and Section 60 *Grant of licence to take groundwater* of the *Water Act*. This effectively exempts DIPL and its contractors from the requirement to obtain a water licence when undertaking water extraction associated with road works on public roads. Although a licence under the *Water Act* to extract water for road works is not required, approvals to use or extract water from a waterway or bore from landowners is still required and must be obtained for the identified water resources to be used. DIPL have written approval from Tiwi Land Council to use the nominated water sources shown in Figure 7. The Contractor will be required to submit land user request forms to TLC to obtain access to the nominated areas when the contract is awarded. DIPL and its contractors will access and use water as per specifications set out the following documents:

- Section 22-24 of Standard specification for environmental management, version 2.0 (DIPL, 2019).

– NTG, Water Resources Branch: Guidelines for Water Extraction as they relate to Road Construction and Maintenance

3.3.5.1 Natural waterbodies

While the existing and proposed bores are the preferred source of water for the project, the need to source water from natural water bodies may arise as discussed in this section. Several naturally occurring, ephemeral and perennial surface water bodies exist on Melville Island near to the Project area (TGS, 2020; Figure 7). A small selection of these water bodies may hold water in sufficient quantities and of appropriate quality for construction. Details for the selection of these sites is as follows:

– Prior to commencing water extraction, existing waterholes, creeks and springs will be assessed for suitability following an assessment of potential associated environmental and social impacts, including condition of access tracks and their ability to accommodate water trucks, sensitive riparian vegetation and habitat for listed threatened species, and disturbance to culturally significant sites. AAPA certificates and heritage advice will be obtained by DIPL for the areas prior to extraction.
– Additionally, further investigation is required to understand whether dry season access to these natural waterbodies will be suitable for water extraction for the Project. It is noted that most sources will only be suitable during the wet season, when construction water demand is likely to be lower and water bodies are likely to be nearer to full capacity.
– Consideration will be given to the surface water-groundwater connectivity at these locations and the potential combined impacts of water extraction from surface water bodies and groundwater bores where these connections exist.

One confirmed natural water body will be utilised for water extraction, which is Taracumbi Outstation Creek (refer Figure 7), for which DIPL have appropriate access approvals and AAPA certificates.

3.3.5.2 Bores

– A comprehensive water resources investigation was undertaken by TGS which assessed the suitability of existing bores and sites for potential new bores (TGS, 2020). It is likely that most of the water required for the Project will be sourced from existing bores, several which have been used in the past for ad hoc roadworks. Where existing bores are utilised, notification and approval from local landowners and bore owners will be obtained prior to commencing extraction.
– Extraction from existing bores, proposed bores and surface water sources, except Taracumbi Falls and White Sands, which are located within a Restricted Work Area (RWA), have been approved by the TLC following community consultation with Traditional Owners. A third surface water extraction site, Bluewater Creek is unsuitable due to insufficient water during the dry season.
– It is known that the nominal required construction water supply per 10 km of double lane sealed road is 3 L/s, and must be located within a water carting distance of no more than 8 km. Therefore, bores may need to be constructed where there are gaps of >16 km between existing bores approved for access, or where water sources are inadequate.
– Existing bores, locations for potential new bore installations and surface water extraction points approved by TLC for Pirlangimpi and Pickertaramoor Roads are listed in and mapped in Figure 7. A full description of their suitability, constraints and permissions are provided within the TGS report in Appendix C.

Table 6 Existing and proposed bores and surface water extraction sites for Pirlangimpi and Pickertaramoor Roads.

Existing/ proposed water source	Water source		Chainage (km)/ Location, where relevant
	Bore name	Natural water body	
Pirlangimpi Road			
Existing	Plantation bores RN008433 & RN008437		0.7 km up Milikapiti Rd from Threeways
	PWC bore RN040189		42

		Rolla Plains water hole on Maxwell Creek	8.2 km turnoff. Then 2 km track north of road
		White water hole on maxwell creek	19.7 km turnoff. Then 5 km track north of road
		Waterhole on Maxwell Creek	23.8 km turnoff. Then 2 km track north of road.
		Large waterhole approx. 6km west of Pirlangimpi. Have been used for roadworks previously.	46 (a few kms north of road)
Proposed	New Bore Target PR1a		5.2
	New Bore Target PR6		8.2 km turnoff then 100m north of road at gravel pit
	New Bore Target PR4		13.2
	New Bore Target PR7		28.2
	New Bore Target PR1		29.4
	New Bore Target PR2		33.5
	New Bore Target PR3		38.0
Pickertaramoor Road			
Existing	Plantation bores RN008433 & RN008437		0.7 km up Milikapiti Rd
		Taracumbi outstation creek. Suitable early in dry season only	0.7 km on Milikapiti Rd
		Stewards Billabong	14 km east of road
	Plantation bore 35901		10.4
	Plantation/ Matilda Mineral Bore RN035205		20.8
		WP001	1.75
		WP008	7.2
		CW003	10.8
		CW002	17.1
		CW001	20.0
Proposed	New Bore Target Picker 1		3.6
	New Bore Target Picker 2		13.8

3.3.5.3 Water supply strategy

It is expected that approximately 200 kL / day of water will be required for the road works. It is estimated that the earthworks and pavement works will take approximately 6 months per year, which equates to approximately 36ML of water. When considering spillage and dust suppression, this volume will increase.

A hydrogeological assessment and roadworks water supply strategy was undertaken for the project (TGS, 2020). The following criteria were considered for the assessment by TGS in the development of their water supply strategy:

– The nominal water supply per 10 km of road is 3 L/S.
– This was recommended to minimise drawdown. Storage infrastructure (tanks or turkey nests) can be used to mitigate low flow rates.
– The feasible carting distance is no greater than 8 km.

– Water quality that is brackish saline was allowable for specific components of the roadworks i.e. earthworks only, and as such water quality was not a focus of the investigation. In saying this, all identified water sources for construction are low salinity.
– Bores within 2 km of existing community bore fields run by Power and Water Corporation (PWC) are strictly out of bounds unless special permission is obtained.
– Contractor shall only take water from sites which have been approved by the local landowners via Land User Request Form.

This water supply strategy determined the following principles should be considered for the appropriate management of water resources for the duration of the Project, including access and water extraction permissions:

– Every effort will be made to ensure that any water extraction will not compromise the supply utilised by the environment, local landowners, or communities, to the point where such users are adversely affected.
– All water extraction will be undertaken in accordance with the DIPL Standard Specification for Environmental Management.
– Use of existing bores requires the permission of the current owner and/or users which has been given for sources identified. The approvals should be provided to the Department with the Contractor's Environmental Management Plan (CEMP) that is required to be submitted by the construction contractor.
– No bore work permits are required to drill a new bore on Melville Island as it is not within a Water Control District.
– No water extraction licences are required for the Project as the water will be utilised for road construction and/or maintenance. However, any proposed extractions from bores and natural water bodies must comply with the relevant land use permit requirements such as land use proposals or sacred site clearances.
    - Use of existing bores requires permission of current owner and/or users. Approvals for use of all water sources are being sought from the landowners via the Tiwi Land Council and will be provided to the contractors for inclusion within the CEMP.
    - Any access tracks required during works will have gravel laid on the surface to prevent degradation.
– In summary, the Pirlangimpi and Pickertaramoor Road constructions may rely on water supply as follows:
    - Pirlangimpi Road: some surface water supply locations are available at the eastern end a few kilometres north of Pirlangimpi road, present as waterholes. A few bores will need to be drilled in reasonably prospective areas between CH 42 and Maxwell Creek camp. A Power and Water production bore at CH 42 is available if a pumping test is undertaken and requirements for extraction are followed, such as to preserve current water users including the environment and local communities.
    - Pickertaramoor Road: several waterholes have been identified and are generally 1-2 km from Pickertaramoor Road. There are two low flowing bores that are available, however there is no watercourse available at the Pickertaramoor community and there are no reliable prospects for drilling additional groundwater bores. Approval and development of suitable access tracks to these locations are required before use. Cartage of water is likely to be required for the southern end of Pickertaramoor Road where water supply options are limited in the local area.

3.3.6 Construction facilities

For each road length constructed, a site compound will need to be constructed. This will include a site office, vehicle depot and laydown area to reduce travel times on local roads. The Project will engage a Principal Contractor who will be responsible for organising and managing the accommodation for the project workforce. It is envisioned that the Principal Contractor will utilise gravel pit areas for the camp.

The site compound may require limited vegetation clearing, however, where possible, site compounds will be near the gravel pit areas to reduce the disturbance area. Large hollow bearing trees will be retained where possible. The compound will comprise transportable buildings, toilets and ablution facilities, a laydown area and minor infrastructure. Following use and closure, the compound site and site access will be rehabilitated as appropriate.

It is assumed that some of the construction workforce, primarily those who reside on Melville Island, will travel between accommodation in Pirlangimpi or Pickertaramoor community to site each workday by a bus or passenger

vehicles. For the remaining workers, temporary camps will be constructed along the stretches of road, located strategically to reduce travel times to and from the project site, as well as, to ensure that construction traffic is localised close to the works and require little to no extra vegetation clearing i.e. positioned within gravel pit areas and site compounds where possible. Camp locations will form part of TLC's Land Use Request Form application and will be approved prior to mobilisation.

All construction facilities will comply with NT and Commonwealth Acts and regulations, including but not limited to:

- *Dangerous Goods Act 1998*
- Work Health and Safety (National Uniform Legislation) Act 2011 and associated regulations
- *Waste Management and Pollution Control Act 1998*
- *Water Act 1992*
- Code of Practice for the small on-site sewage and sullage treatment systems and the disposal or reuse of sewage effluent (The Code)
- Code of Practice (CoP) for “Managing the work environment and Facilities”. Safe Work Australia – Approved CoP under s274 of the *Work Health and Safety (National Uniform Legislation) Act 2011*
- Health requirements for mining and construction camps, including registration of kitchens.
- Construction and operation of the site compound will be managed so that it:
    - Does not create a public health nuisance, in particular from dust or other particulate matter
    - Is located within the road reserve or on land with appropriate owner permissions
    - Meets the requirements of this EIA.
    - All site laydown is to occur in accordance with the relevant AAPA Certificate, TLC Clearance and TLC entry permit.
    - The gravel pit rehabilitation program will be largely governed by the principals detailed within DIPLs standard specification for environmental management, version 2.0 (DIPL, 2019).

3.3.7 Traffic management

A traffic management plan will be prepared by the contractor to outline the proposed traffic management strategy to safely and efficiently manage traffic around the construction of the road.

Road closures will not be required, and both the Pirlangimpi and Pickertaramoor Roads will remain open to all users. Temporary traffic management will consist of temporary lane closures, temporary speed limits, portable traffic signals and stop-and-slow methods. Vehicles will be detoured along the existing table drains, which will be prepared for this purpose through grading. Detour design will include intersections and carriage ways that are used by local communities and Plantation Forestry and are therefore designed to cater for triple road-trains (53.0 m) and minimum service vehicle (8.8 m). As part of the tender documentation, the Contractor will be responsible for traffic management to ensure this. The works shall be planned and managed to minimise obstruction and inconvenience to the public, and ensure public safety is accommodated at all work sites at all times.

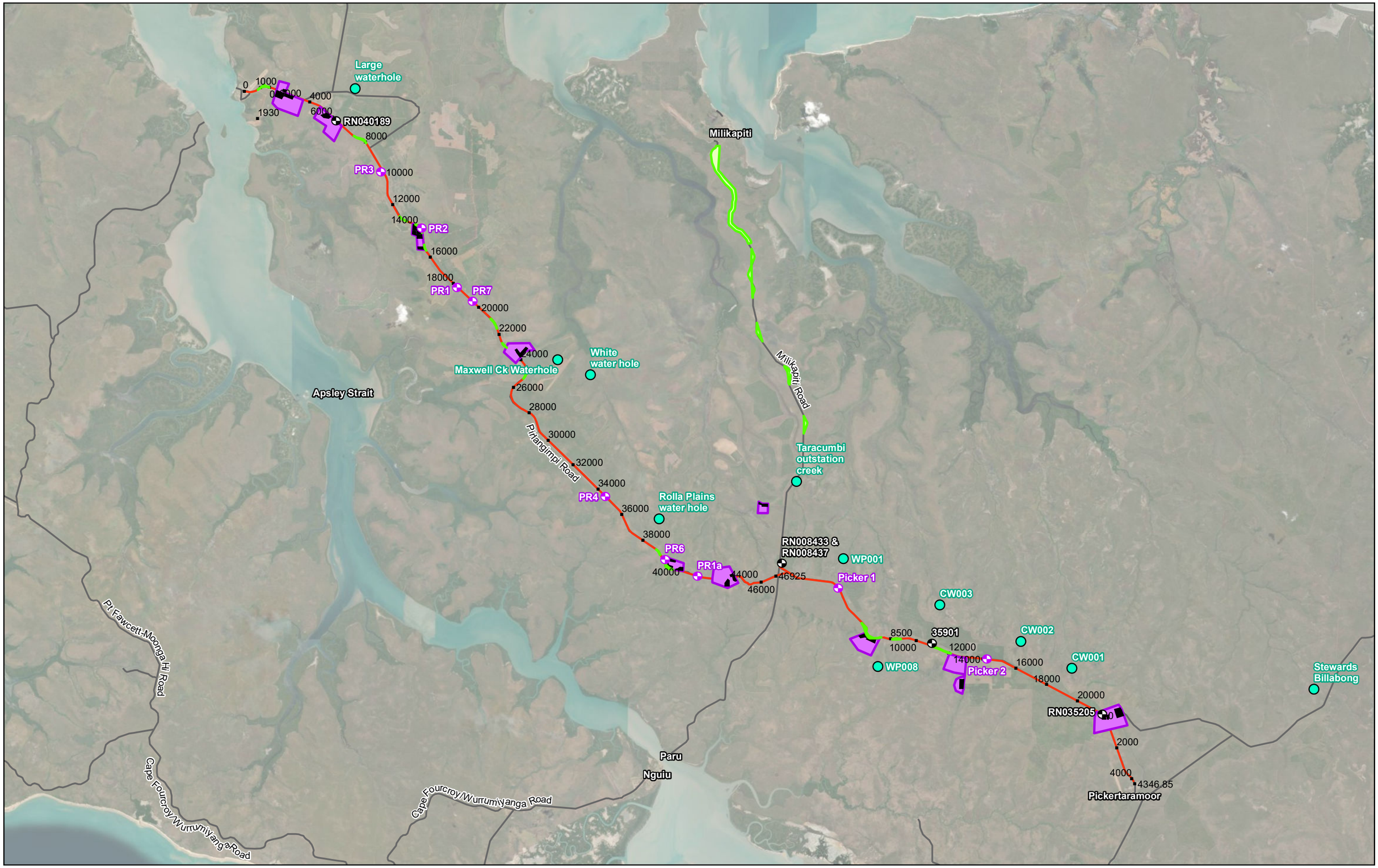
The existing road network has a forecasted overall daily traffic volume of 102 vehicles, inclusive of six heavy vehicles in 2024 when the construction commences. The construction traffic is estimated to be 36 daily trips (including 23 heavy vehicle trips). The traffic generated by the construction of the roads will result in a 35% increase in overall daily traffic and a 483% increase in the heavy vehicle daily traffic along Pirlangimpi Road and Pickertaramoor Road. It should however be noted that there is low baseline traffic on each of the roads which results in a significant percentage increase in traffic volumes. A full assessment of impacts for the construction phase of the Project was conducted by GHD, 2021 and is provided in Appendix D.

As part of the tender documentation, the Contractor shall assume responsibility for the safe conduct of traffic through, past or around the works, 24 hours a day, from possession of the site to completion of all works, defects liability period (if any) and handover.

3.4 Construction environmental management plan

A project specific construction environmental management plan (CEMP) will be prepared by the Contractor. The CEMP will be aligned with current version of the NT Government's Standard Specification for Environmental Management. The proposed CEMP outline is presented in Appendix E.

The CEMP will detail relevant environmental management and protection measures and the sequence of construction works. This document will include conditions of applicable environmental approvals and permits, and requirements detailed in this referral including environmental compliance and audit triggers. The CEMP is a hold point in the contract; therefore, no works can commence on site until it is approved for use by DIPL.



Legend

- Existing bore
- Proposed bore
- Natural water body
- Road realignments
- Proposed gravel pit areas
- Potential gravel pit areas
- Road upgrades

1:200,000 @ A3

0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

N

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Department of Infrastructure, Planning and Logistics
Terrestrial biodiversity surveys for
Melville Island roads

Water sources

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 7

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3.5 Alternatives

The NT and Federal Government are committed to developing regional and remote areas for the economic benefit of Territorians. Upgrading the Milikapiti Road, Pirlangimpi Road and Pickertaramoor Road on Melville Island will help unlock the economic potential of the region and open a range of new long-term economic and social opportunities for people across the island community. The road upgrade also aims to improve motorist safety, reduce travel times, and increase accessibility during the wet season.

3.5.1 'Do nothing' option

The 'Do nothing' option would have a considerable impact on the ability to achieve the aims discussed above. Therefore, the 'Do nothing' option is not considered to be a viable option regarding NTG and the Federal Government's intent to increase safety and unlock economic opportunities on Melville Island.

3.5.2 Timing

The duration and intensity of the construction phase of the Project was carefully considered to avoid and minimise adverse impacts to other road users and the receiving environment. In addition, seasonal limitations mean only a few months of the year are suitable for land clearing and earthworks in terms of erosion and sediment control and practicality of using plant and machinery. The construction works are aimed to be undertaken in the dry season (April to October). For any works outside of this period, the contractor will be required to develop and implement an approved Erosion and Sediment Control Plan.

Progressively upgrading and rehabilitating shorter, manageable sections of the roads at a time, and opening only 1 ha of gravel pit area at a time allows the receiving environment time to recover, and for ongoing weed management to be conducted.

3.5.3 Micrositing of gravel pit areas to reduce impacts

A phased approach to the micrositing of gravel pit extraction areas is being undertaken, to avoid and minimise the risks to listed threatened species and their habitat as well as the reduction of erosion and sediment control risks. This approach involves the following steps:

1. Large areas were nominated (potential gravel pit areas; Figure 2, Figure 3 - Figure 6) for their suitability and available quantity of material (HiQA, 2016)
2. Potential gravel pit areas (Figure 2, Figure 3 - Figure 6) were refined following listed threatened species surveys (Connect Environmental, 2021) in order to avoid biodiversity values within. This refinement results in the 'proposed' gravel pit areas assessed within this impact assessment
3. Within these proposed areas, actual gravel extraction will only occur from 1 ha at any one time. The micrositing of these actual gravel extraction areas will be determined by further geotechnical investigations to confirm material quality and quantity, which will be undertaken in 2022.

4. Regulatory Framework

A summary of the Commonwealth and the Northern Territory Government legislative requirements and associated approvals relevant to environmental management for the project are provided in Table 7 and Table 8, accompanied by the DIPL actions and intent for each Commonwealth Legislation.

Commonwealth legislation applicable to the proposed project includes, but is not limited, to those listed in Table 7.

Table 7 Commonwealth legislation relevant to the Project

Legislation	Administration	Proposed action
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (ATSIHP Act)	Department of Agriculture, Water and the Environment (DAWE)	The project will be on Aboriginal freehold land. There are no known declarations under the ATSIHP Act relevant to the proposed action.
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	DAWE	The project will be subject to assessment against the requirements of the EPBC Act. The relevant requirements have been considered in this EIA.

Northern Territory legislation applicable to the proposed project includes, but is not limited, to those listed in Table 8.

Table 8 Northern Territory Legislation

Legislation	Administration	Relevance to proposed action
Aboriginal Land Act 1978	Office of the Aboriginal Land Commissioner Prime Minister and Cabinet	Facilitates access to Aboriginal land and certain roads bordered by Aboriginal land.
Land Title Act 2000	Department of the Attorney-General and Justice	Registering title and facilitate dealings with land.
Biological Control Act 1986	Department of Industry Tourism and Trade (DITT)	Melville Island is Cane Toad free. Measures will be implemented to ensure biological control for the Project is adhered to.
Bushfires Management Act 2016	Bushfires NT, Department of Environment, Parks and Water Security (DEPWS)	Project works will be undertaken every dry season for approximately 3-5 years in savannah bushland where natural bushfires are highly prevalent where the protection of life, property, and the environment must be considered.
Control of Roads Act 1953	DIPL	The Project involves the diversion and obstruction of local roads, and the appropriate management of traffic will be required for the duration of the Project.
Dangerous Goods (Road and Rail Transport) Act 2012	NT WorkSafe	Dangerous goods will be handled and transported during construction and operation of the project to the requirements of the Act.
Environment Protection Act 2019 and Environment Protection Regulations 2020	NT EPA and DEPWS	Development of additional infrastructure and changes to the activities undertaken on each site which may have a significant effect on the environment is assessed
Heritage Act 2011	Department of Territory Families, Housing and Communities (DTFHC)	A search of the NT Heritage Register (NT Heritage Council 2019) has been obtained for the Project footprint to identify known places or objects of heritage significance in the NT.
Northern Territory Aboriginal Sacred Sites Act 1989	Aboriginal Areas Protection Authority (AAPA)	AAPA approvals have been granted for road and gravel pit areas.
Public and Environmental Health Act 2011	Department of Health (DoH)	Camp will require ablutions and kitchen facilities. Both these facilities must meet NT Dept Health requirements.

Legislation	Administration	Relevance to proposed action
Territory Parks and Wildlife Conservation Act 1976 (TPWC Act)	DEPWS	Disturbance of vegetation will occur during the Project, where Northern Territory threatened amphibians, birds, invertebrates, mammals and reptiles must be protected.
Fisheries Act 1988	DITT	The extraction of water from existing waterholes, creeks and springs will occur, where the regulation, conservation and management of fish and aquatic life must be achieved.
Planning Act 1999	DIPL	Planning permission is not required because roadworks are exempt from this Act. In the past DIPL have not obtained approval for vegetation clearing to access gravel for roadworks for this reason. Approvals on Aboriginal Land are obtained from the Tiwi Land Council consultation process.
Weeds Management Act 2001	DEPWS	The introduction of people, machinery and infrastructure to the Project location are required, where the prevention of introduction and spread of weeds is an integral component of land management.
Soil Conservation and Land Utilisation Act 1969	DEPWS	Earth works and clearing are required for this Project therefore soil erosion and soil conservation must be considered.
Water Act 1992	DEPWS	The Northern Territory Administrator has signed an exemption to Section 45 Licence to take or use water (surface water) and Section 60 Grant of licence to take groundwater of the *Water Act*. This effectively exempts DIPL and its contractors from the requirement to obtain a water licence when undertaking water extraction associated with road works on public roads. Although a licence under the *Water Act* to extract water for road works is not required, approvals to use or extract water from a waterway or bore may still be required.
Waste Management and Pollution Control Act 1998	DEPWS	The Project will result in waste generation and will need to be managed effectively to meet the objectives of waste minimisation and prevention of pollution.
Work Health and Safety (*National Uniform Legislation*) *Act 2011* and Regulations	Department of the Attorney-General and Justice	The construction and decommissioning phases of this Project may be hazardous in nature and the health and safety of people must be protected.

5. Existing Environment

Sections 5.1 to 5.12 below provide a detailed description of the environmental, cultural and socio-economic context in which the Project occurs.

5.1 Bioregional context

The Project lies within the Tiwi Cobourg bioregion, which is characterised by coastal vegetation comprising of some mangroves and saline flats. Most of the bioregion is covered by tall eucalypt open forests, typically dominated by *Eucalyptus miniata* (Darwin Woollybutt), *E. tetrodonta* (Darwin Stringybark) and *E. nesophila* (Melville Island bloodwood). The landscape is of low relief, with laterite and Cretaceous sandstone the dominant substrates (Baker et al. 2005). The Tiwi Cobourg bioregion is 10,005 km^2 comprising around 0.75% of the NT land mass.

Land tenure comprises of 98.8% aboriginal freehold land, whilst crown leases and other freehold tenure make up the remaining land mass. Approximately 20.58% of the bioregion comprises National Parks or other protected areas (Baker et al. 2005).

The survey area for the upgrades to the Pirlangimpi, Pickertaramoor and Milikapiti Roads cover a total area of 750 km^2. This comprises of both access roads (75 km) plus 10 km on either side of the roads. The Project area is located on aboriginal freehold land within the subregion, Tiwi Islands (Woinarski *et al.* 2002).

5.2 Climate

The climate of the Melville Island region is classified as dry monsoonal. It is characterised by seasonal shifting of the prevailing winds and two distinct seasons, the dry and wet season, with two subsidiary, transitional periods between them.

The wet season is short but intense and occurs from November to March characterised by north-westerly winds. The transition of the two seasons varies, with the dry season starting anytime between late March and late May characterised by south-easterly winds (TLC, 2020).

Melville Island experiences the highest rainfall in the Northern Territory, with 90% falling within the wet season. Mean annual averages range from 1,200 mm to 1,400 mm on the eastern Melville Island and up to 200 m in the north-western Melville Island (BOM, 2021). A high frequency of destructive cyclones is a feature of this bioregion. Cyclone events damage infrastructure and cause major alterations in the biodiversity and its management through alterations of vegetation structure.

Climate statistics from the Bureau of Meteorology (BoM) weather station in Pirlangimpi Airport (site number 014142), located approximately 0.9 km north east of the Pirlangimpi township and Point Fawcett (site location 200731), located on the eastern most point on Bathurst Island, approximately 58 km away from the northern point of Pickertaramoor Road are shown in Table 9 and Table 10 below (BOM, 2021).

Table 9 Average monthly rainfall for Pirlangimpi Airport and Point Fawcett, NT (BOM, 2021)

Station	Average monthly rainfall (mm)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Pirlangimpi Airport (from 1963 – 2021)	418.1	370.0	350.7	157.6	21.2	3.7	2.5	6.4	27.2	83.2	191.3	341.7
Point Fawcett (from 1995-2021)	336.9	271.3	243.2	132.9	33.0	6.1	0.3	0.5	8.8	63.9	121.9	290.4

Table 10 Climate statistics for Pirlangimpi Airport, Point Fawcett, NT (BOM, 2021)

Aspect	Pirlangimpi Airport (from 1979 to 2021)	Point Fawcett (from 1997 to 2021)
Mean maximum temperature	32.5°C	31.8°C
Mean minimum temperature (from 1979 to 2021)	22.3°C	22.7°C
Average annual rainfall	1,986.4 mm	1,573.1 mm
Highest monthly rainfall (from 1963 to 2021)	878.8 mm February 2008	1044.8 mm in February 2011

5.3 Geology

Melville Island is situated within the Money Shoal Basin consisting of gently dipping Mesozoic and Cenozoic sedimentary rocks which are up to 5 km thick (Ahmed and Munson, 2013), underlain by Lower Proterozoic sedimentary, metamorphic, and igneous rocks of the Pine Creek Geosyncline and Nimbuwah Complex (refer Figure 8).

The sequence of Mesozoic and Cenozoic sediments comprising Melville Island are as follows, in order of deposition:

– Mullaman Beds (Cretaceous): interbedded sandstones and shales.
– Wangarlu Mudstone Member (Cretaceous): mudstone.
– Moonkinu Member (Cretaceous): sandstone underlying the related Moonkinu Member claystone. (Formerly known as the Bathurst Island Group).
– Van Diemen Sandstone (Paleogene): friable, cross-bedded sandstone with minor siltstone lenses and conglomerate.
– The Van Diemen Sandstone, Moonkinu Member and quaternary coastal and alluvial sediments make up the surficial geology within the Project area (Ahmad et al*.,* 2013).

5.4 Hydrogeology

A hydrogeological assessment and roadworks water supply strategy was prepared by TGS (TGS, 2020; Appendix C) describes the groundwater characteristics within 10 km of the Project area. These findings are summarised below in the context of the suitability of groundwater resources for the Project's water requirements. There are two regional aquifer systems, which are detailed in the following sections.

5.4.1 The Van Diemen Sandstone aquifer

Local yield and groundwater storage depend on the thickness of the sandstone and local topography. This sandstone hosts very fresh water, with the thickest part of the sandstone being located just north of Threeways and at two locations along the Pirlangimpi Road. These areas have higher production potential and will be the preferred location for the installation of new bores, should they be required for the Project. Areas near the marine environment where saltwater intrusion may be a factor will be avoided. Additionally, this aquifer is likely to bear variable but significant connectivity to the overlying alluvium and laterites of Melville Island, as well as connectivity to the various surface water features discussed in Section 3.3.5.1.

5.4.2 The Moonkinu Member Sandstone aquifer

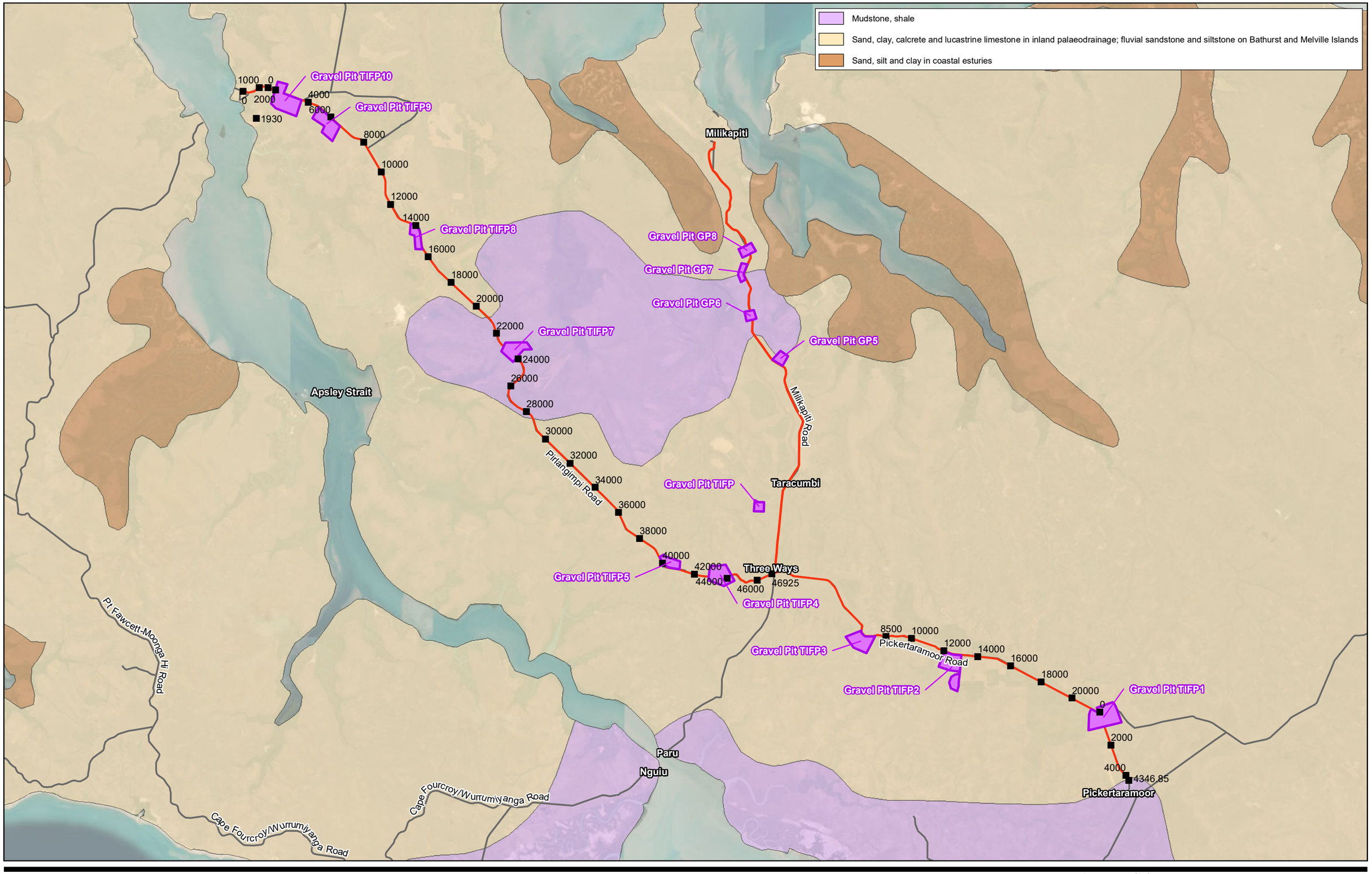
A 30-60m thick grey sandstone unit constrained between the relatively impermeable Moonkinu Member claystone above and the Wangarlu Mudstone below. This sandstone aquifer occurs north of Threeways and dips gently to the northwest. This aquifer has yet to be tested south of Milikapiti, but the results of two existing bores indicate it may produce a moderate yield.

5.5 Hydrology

The Project area is drained by four catchments directly into the Timor Sea (Figure 9). The catchments include the kilu-impini, Mirikau-yunga, Tijipripu and the Takamprimili. Both the Pickertaramoor and Pirlangimpi Roads tend to follow the top of a plateau which effectively form catchment divides. The Pickertaramoor Road divides the Tijipripu and the Takamprimili catchments (discharging to the north via Taracumbi Creek and southwest via Takamprimilli Creek respectively), and the Pirlangimpi Road divides the Takamprimili (draining to the west) and the Kilu-impini and the Mirikau-yunga catchments (draining to the northeast and northwest via Bluewater Creek respectively). This is reflected by the absence of any watercourse crossings on the two roads. Major surface water drainage features are shown in Figure 9.

The highest points of elevation on Melville Island include Threeways intersection, the Pickertaramoor Road and the northern section of the Pirlangimpi Road. From these elevated areas, there are land units prone to rapid runoff, discharging into the nearby ephemeral creeks and potentially entering permanent water bodies.

To date, no flood studies inclusive of the site have been completed.



Legend

- Road upgrades
- Gravel pit survey areas

1:200,000 @ A3

0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

N

GHD

Department of Infrastructure, Planning and Logistics
Terrestrial biodiversity surveys for Melville Island roads

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

Geology of project area

FIGURE 8

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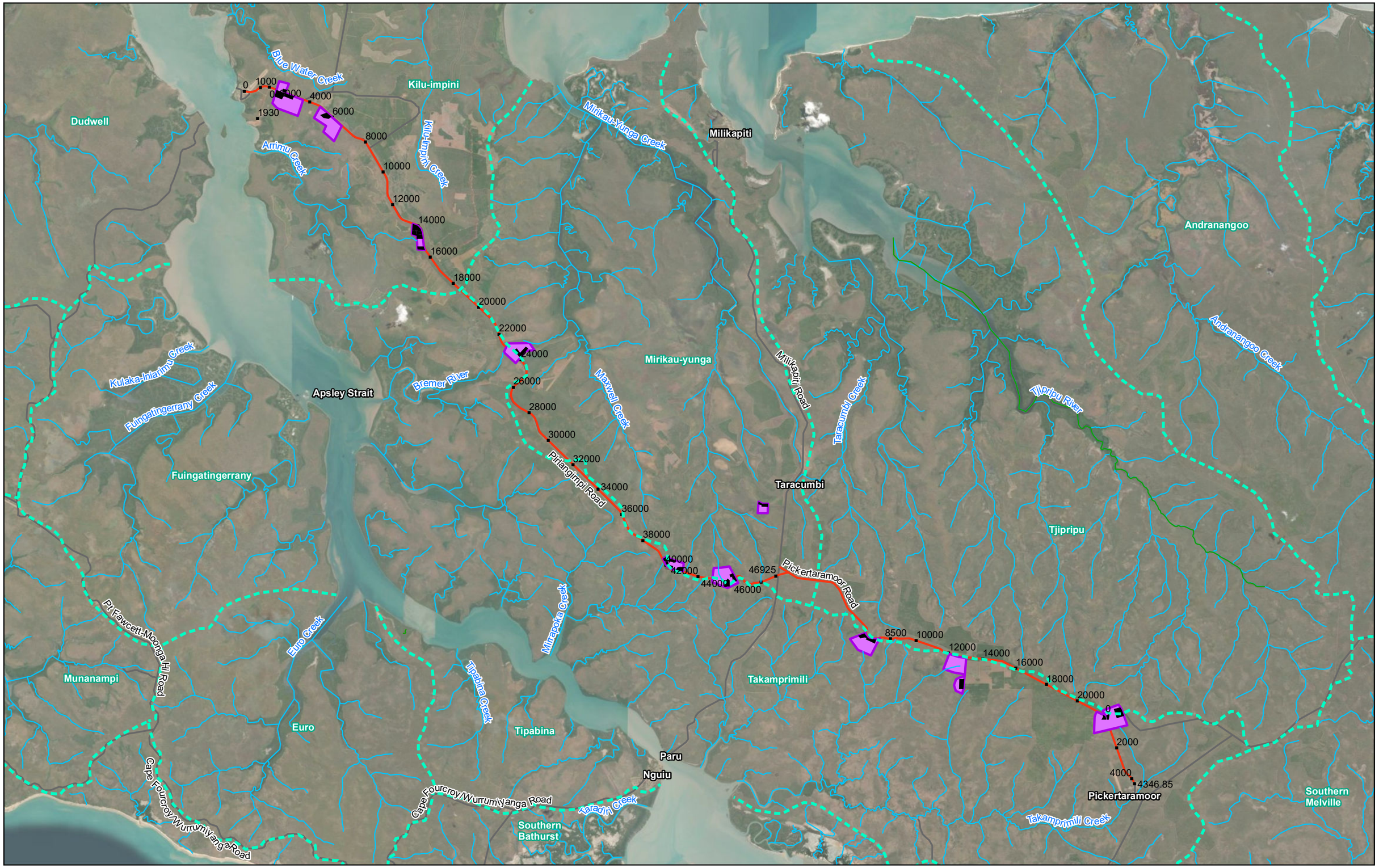
Data source: DIPL - Road upgrades, Gravel pits (2020) Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: omacgregor



Legend

- Indicative catchment boundaries
- Road upgrades
- Waterway
- Proposed gravel pit areas
- Potential gravel pit areas

1:200,000 @ A3

0 2.5 5 7.5 10

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

N

GHD

Department of Infrastructure, Planning and Logistics
Terrestrial biodiversity surveys for
Melville Island roads

Surface water hyrdrology

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 9

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5.6 Land Systems and soil types

The Pirlangimpi and Pickertaramoor Roads lie within the following land systems: Dundas, Moonkinu, Pickertaramoor, Rugged, Van Diemen, Melville and Tiwi (DEPWS 2021).

The land systems within the project area are described in Table 11 (DEPWS 2021) and land system mapping is provided in the Biodiversity Assessment Report (Appendix B).

Soil types associated with these land systems are predominantly well drained.

The closest 'high probability' acid sulfate soils (ASS) areas (mapped on NR MAPS: DEPWS, 2021) are a). approximately 400 m south of Pirlangimpi Road (one location associated with a first order intermittent stream draining to the Bremer River), and b). 250m either side of the barge landing road in Pirlangimpi community. Both sites are outside of the proposed works areas.

Table 11 Land System descriptions – Pirlangimpi and Pickertaramoor Roads (DEPWS, 2021)

Land System	Landscape Class	Class description	Landform	Soil description	Broad vegetation description	Comment
Van Diemen	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Broad, gently dissected plateau surface on strongly weathered Tertiary Van Diemen sandstone	Deep sandy and loamy red earths	Tall open forest of *E. miniata, E. tetrodonta, C. nesophila* over tropical tall grass (*Sroghum spp. Chrysopogon spp. Heteropogon spp*)	Both roads partially lie within the Van Diemen land system. Approximately 20% of Pirlangimpi road and 70% of Pickertaramoor Road lie within this land system. Overall, the Van Diemen land system covers a large proportion of the project area.
Dundas	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Gently undulating plains formed on deposits overlaying Van Diemen sandstone	Deep sandy and loamy red earths	Mid-high open forest of *E. miniata, E. tertadonda, C. nesopphila, C. confertiflora*	The northern end of Pirlangimpi Road transcends out of the Tiwi land system and into Dundas land system. The project area that lies with the Dundas land system is minimal in relation to the total project area.
Moonkinu	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Broad, flat to gently undulating plains and associated drainage lines	Sandy red earths	Low open shrubland of *Grevillea pteridifolia, Persoonia falcata* and *Acacia oncinocarpa* over *Eulafia mackinlayi, Eriachne avenacea* and *Eriachne*	The middle section of Pirlangimpi Road lies within the Mooniknu land system. The project footprint that covers that land area is minimal in relation to the overall project area.
Melville	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Broad, flat to gently undulating plains and associated drainage lines	Sandy red earths	Tall open forest of *E. miniata, E. tetrodonta, C. nesophila and C. conferifora* over *imperata cylindrica, Pseudoponantherum* and *Eriachne triseta*	The southern tip of Pickertaramoor Road lies in the Melville land system. The project area that lies within the land system is very minimal in relation to the project area.
Pickertaramoor	Sandstone plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Rolling low hills and rises on Van Diemen sandstone	Shallow skeletal soils	Tall open forest of *C. nesophila, E. tetrodonta*, E. miniata	Approximately 20% of the southern end of Pickertaramoor Road lies within the Pickertaramoor land system
Rugged	Sandstone plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Rugged terrain deeply dissected by many creeks and drainage channels	Very shallow soils	Tall open forest of *C. nesophila, E. tetrodonta, E. miniata*	Approximately 20% of the southern end of Pirlangimpi and a small section of Pickertaramoor Road lies within the Rugged land system.

Land System	Landscape Class	Class description	Landform	Soil description	Broad vegetation description	Comment
Tiwi	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Gently underlaying plains on deeply weathered Van Diemen	Deep sandy red earths	Tall open forest of *E. miniata, E. tetrodonta, C. nesophila and C. conferifora* over *imperata cylindrica, Pseudoponantherum* and *Eriachne triseta*	The northern most section and a small mid-section of Pirlangimpi Road lie within the Tiwi land system.

5.7 Land units

Two sets of land unit mapping exist within the Project area:

– Land units of areas adjacent to the Tuyu and Yapilika forestry plantations (1:16,000 scale; Wells & van-Cuylenburg, 1978)
– Land units of the Seventeen Mile Plain (1:50,000 scale; Van-Cuylenburg & Dunlop, 1973).

Land units and associated vegetation communities are listed with a description summary in Table 12. A full description of land units and their mapped locations within the Project area are provided within the Biodiversity Assessment Report (Appendix B)

5.8 Biodiversity

The Tiwi Islands are classified as an international site of conservation significance (DEPWS, 2009). Listed for its extensive relatively unmodified wilderness area, which supports a high level of endemism and range restricted species. The Tiwi Islands have allowed many listed threatened flora and fauna species to remain largely unaffected by threatening processes that have led to widespread population declines on mainland Australia (such as Cane Toads and some invasive exotic plants).

Species richness, as a measure of biodiversity, was generally highest at the western end of the Pirlangimpi Road in map areas 1 and 2 (Figure 2; Figure 3). This may be due to the higher rainfall experienced in this part of the Project area, in addition to containing a higher density of large hollow bearing trees.

Biodiversity within the Project area has been assessed in detail, including listed threatened species within the Biodiversity Assessment Report (Appendix B). A summary of the biodiversity characteristics is provided in section 5.8.1 to 5.8.4 below.

5.8.1 Flora

5.8.1.1 Vegetation types

Land type cover mapping acquired by Parks and Wildlife Commission of the NT and prepared for the TLC (1998) was used to identify broad vegetation types within the project area. This was further delineated through on-ground vegetation mapping whilst on site. In summary, most of the Project area is classified as tall *Eucalyptus* spp. open forest/woodland with very small areas of grasslands, seasonally saturated or inundated (Melaleuca) areas, and Corymbia-dominated seasonally saturated communities. A full description of vegetation communities throughout the Project footprint is provided in Table 12 below and described in detail and mapped in Section 6.2.1 and Appendix I of the Biodiversity Report (Appendix B).

Sensitive or significant vegetation

Parts of the Project area host vegetation communities considered as ‘sensitive’ or ‘significant’ under the NT Land Clearing Guidelines (DEPWS, 2021). In addition, the NT EPA also consider areas containing relatively high density of large hollow-bearing trees as significant vegetation. Areas within the Project area hosting such vegetation are listed in summary below and in Table 12 below (see shaded rows) and detailed in full and mapped in Section 6.2.2 and Appendix I of the Biodiversity Report Appendix B.

Table 12 Vegetation communities in the Project area (green shading indicates a sensitive or significant community)

Vegetation Community code	Short name	Landform and associated land units	Description	Comment / relevance to project area
E1	*Eucalyptus miniata (Darwin Woollybutt), E. tetrodonta* (Darwin Stringybark), *Corymbia nesophila* (Melville Island Bloodwood) tall open forest	– Plateau surface with slopes less than 2% – Land units 1a1, 1a2, 1b1, 1b2	*Eucalyptus miniata (Darwin Woollybutt), E. tetrodonta (Darwin Stringybark), Corymbia nesophila (Melville Island Bloodwood) tall open forest over Livistona humilis (Sand Palm), Grevillea heliosperma (Rock Grevillea), Terminalia ferdinandiana (Billygoat Plum), Planchonia careya (Cocky Apple) tall shrubland over Heteropogon triticeus, Sorghum intrans, Mnesithea rottboellioides tall open tussock grassland.*	Map 1-5,7,10, 12, 14 (Figure 2, Figure 3 - Figure 6) The most dominant vegetation type on Plateau.
E2	*Corymbia nesophila (Melville Island Bloodwood), Eucalyptus miniata* (Darwin Woollybutt) tall open forest	– Periphery of plateau surface with slopes from 2-10% – Land units 1c1, 1c2, 2a2 and 2a	*Corymbia nesophila* (Melville Island Bloodwood), *Eucalyptus miniata* (Darwin Woollybutt) tall open forest over *Livistona humilis* (Sand Palm), *Acacia* spp. and *Grevillea* spp. tall shrubland over tall tussock grassland.	Map 1, 4, 6, 9, 11, 12, 14 (Figure 2, Figure 3 - Figure 6) The second dominant vegetation type on plateau.
E3	*Eucalyptus tetrodonta* (Darwin Stringybark) and *E. miniata* (Darwin Woollybutt) mid sparse to open woodland	– Plateau escarpment edge with slopes 5-10%+ – Land units 2a3, 2a4	*Eucalyptus tetrodonta* (Darwin Stringybark) and *E. miniata* (Darwin Woollybutt) mid sparse to open woodland over *Acacia* spp., *Livistona humilis* (Sand Palm), *Calytrix exstipulata* (Turkey Bush), *Petalostigma pubescens* (Quinine Bush) tall shrubland over mixed species tall tussock grassland.	Map 9, 11, 12 (Figure 2, Figure 5 and Figure 6) Upper storey sometimes sparse with dense shrubland comprising 1-2 dominant species
E4	*Eucalyptus miniata* (Darwin Woollybutt), *E. tetrodonta* (Darwin Stringybark) tall open forest	– Plateau upper foot slopes with slopes of 5-10%	*Eucalyptus miniata* (Darwin Woollybutt), *E. tetrodonta* (Darwin Stringybark) tall open forest over *Livistona humilis, Acacia spp*. and *Grevillea* spp. tall shrubland over *Eulalia mackinlayi*, *Eriachne* spp. tall tussock grassland.	Map 9, 11, 12, 13 (Figure 2, Figure 5, Figure 6) Predominant community immediately below escarpment edge
E5	*Corymbia nesophila* (Melville Island Bloodwood), *Eucalyptus miniata* (Darwin Woollybutt) tall open forest	– Plateau lower foot slopes with slopes of 2-5%	*Corymbia nesophila* (Melville Island Bloodwood), *Eucalyptus miniata* (Darwin Woollybutt) tall open forest over *Acacia* spp. and *Livistona humilis* (Sand Palm) tall shrubland over *Eriachne* spp. and mixed species tall tussock grassland.	Map 11, 13 (Figure 2, Figure 6) Often found on lower foot slopes.
E6	*Eucalyptus miniata* (Darwin Woollybutt), *Corymbia nesophila* (Melville Island Bloodwood), *C. latifolia* mid open forest	– Often near head of drainage area in rugged terrain. – Land unit 1d, 3a	*Eucalyptus miniata* (Darwin Woollybutt), *Corymbia nesophila* (Melville Island Bloodwood), *C. latifolia* mid open forest over *Grevillea heJiosperma. Erythrophleum chlorostachys, Acacia* spp. tall open shrubland over *Eulalia mackinlayi*, *Eriachne* spp.	Map 1 (Figure 2, Figure 3) Only occasionally encountered on plateau surface (not elsewhere).
E7a	*Corymbia bleeseri*, *C. nesophila* mid woodland	– Gently sloping mid-landscape position.	*Corymbia bleeseri*, *C. nesophila* mid woodland over *Calytrix* spp., *Banksia dentata* mid open shrubland	Map 13 (Figure 2, Figure 6) Rapidly draining community only found in

Vegetation Community code	Short name	Landform and associated land units	Description	Comment / relevance to project area
W1a	*Pandanus spiralis* (Screw Palm) mid sparse shrubland	– Shallow, broad open depressions – gently undulating to level run-on plains.	*Grevillea pteridifolia* (Fern-leaved Grevillea) mid isolated trees over *Pandanus spiralis* (Screw Palm) mid sparse shrubland over *Eulalia mackinlayi*, *Eriachne burkittii* (Wanderrie Grass) and *Ectrosia* sp. tall open tussock grassland	Map 6, 12, 13 (Figure 2, Figure 4, Figure 6)
W2a	*Melaleuca viridiflora* and / or *M. nervosa* low open forest	– Shallow, broad open depressions and gently undulating to level run-on plains.	*Melaleuca viridiflora* and / or *M. nervosa* low open forest over *Pandanus spiralis, Grevillea pteridifolia* mid sparse shrubland over *Eriachne sp., Aristida sp.* mid tussock grassland.	Map 6 (Figure 2, Figure 4) A primarily Melaleuca-dominated woodland / woodland community where few other mid storey species exist. Inundated during wet season (February 2021)
W1b	*Grevillea pteridifolia low isolated tree over Sorghum spp. tall, closed tussock grassland*	– Low lying in the landscape, generally flat. –	*Grevillea pteridifolia low isolated trees over Pandanus spiralis tall, isolated shrubs over Sorghum spp. tall closed tussock grassland*	Sparsely wooded ('treeless') plain on eastern side of road in Map 6 (Figure 2, Figure 4)
W2b	*Lophostemon lactifluus*, *Melaleuca viridiflora*, *Buchanania obovata* low woodland	– Slightly sloping, low in the landscape – Land unit 6b, Land unit 4c	*Lophostemon lactifluus*, *Melaleuca viridiflora*, *Buchanania obovata* low woodland over *Pandanus spiralis*, *Livistona humilis*, *Grevillea pteridifolia* tall shrubland over *Eriachne burkitii*, *Eulalia mackinlayi* mid tussock grassland.	Map 6 (Figure 2, Figure 4) Often a transition community between *Melaleuca* and *Eucalyptus* woodlands
W2c	*Melaleuca viridiflora +/- M. nervosa*, *Grevillea pteridifolia* low open woodland	– Slightly sloping, low in the landscape – Land units 6a and 6c	*Melaleuca viridiflora +/- M. nervosa*, *Grevillea pteridifolia* low open woodland over *Livistona humilis, Pandanus spiralis* mid open to sparse shrubland over *Eriachne* sp., *Aristida* sp. mid tussock grassland.	Map 6 (Figure 2, Figure 4) A more open community than W2a and generally without *Lophostemon lactifluus*. It includes areas where the canopy and shrub layers are often only sparsely present.
W2d	*Grevillea pteridifolia, Grevillea heliosperma, Planchonia careya* low open woodland	– Flat to gently undulating terrain, moderately rapid drainage – Land unit 4a, 4b, 5b	*Grevillea pteridifolia, Grevillea heliosperma, Planchonia careya* low open woodland over *Livistona humilis* (Sand Palm) mid shrubland over *Sorghum plumosum, Eriachne* spp. mid tussock grassland.	Map 13 (Figure 2, Figure 6) Denser 'shrubland' with some eucalyptus / Corymbia species (mostly as juveniles). Moderately rapid drainage relative to adjacent *Melaleuca* communities
W3a	*Corymbia porrecta* (unconfirmed), *Melaleuca nervosa +/- M. viridiflora*, *Grevillea pteridifolia* low open woodland	– Slightly undulating terrain; generally low in the landscape – Land unit 4c	*Corymbia porrecta* (unconfirmed), *Melaleuca nervosa +/- M. viridiflora*, *Grevillea pteridifolia* low open woodland over *Livistona humilis, Acacia* spp. mid open shrubland over *Sorghum* spp. tall tussock grassland.	Map 6 (Figure 2, Figure 4) A variable community though is basically W2c with the addition of *Corymbia* species in the canopy

Vegetation Community code	Short name	Landform and associated land units	Description	Comment / relevance to project area
				and increased *Sorghum* in the grass layer. The *Corymbia* species and *Grevillea pteridifolia* may be isolated or in patches.
N/A	Hollow bearing trees	– Various	Large trees with hollows suitable for fauna – defined in the NT Land Clearing Guidelines (DENR, 2021) in *Eucalyptus miniata* and *E.tetrodonta* communities as a minimum of five or more stems greater than 50 cm diameter per hectare and/or 30 or more stems greater than 40cm diameter per hectare.	Map area 2, 8, 9, 11, 13 (Figure 2, Figure 3 - Figure 6)
C	Cleared	– Various native and weed species.	Cleared open space (including tracks) with no or little revegetation. Sometimes they contain grasses (such as *Sorghum plumosum)* or isolated shrubs (such as *Melaleuca viridifolia* or *Grevillea pteridifolia*). Importantly, these previously cleared areas may also rapidly revegetate (some already are) and may consist of dense forests within a relatively short amount of time (especially in wetter areas). Such areas comprise habitat for biodiversity.	
P	Plantation		Monoculture forestry	

5.8.1.2 Listed threatened flora

A desktop review identified 19 listed threatened flora species that are either known to occur or predicted to occur within 10 km of the Project area as documented within the Commonwealth Government Protected Matters Search Tool (PMST) and NR Maps databases (DENR, 2021). A full tabulated list of these species is provided in Appendix B.

A preliminary likelihood of occurrence assessment was conducted (Appendix B), and of these 19 species, only one confirmed as present and a further two as assessed as likely to occur within the Project area.

Targeted field survey for these three species was conducted within suitable habitat in the Project area in mid-February to early March 2021. The findings from this survey are summarised below.

Cycas Armstrongii

Cycas armstrongii appeared relatively widespread throughout the survey area, apart from the lower-lying seasonally saturated areas. The highest densities of *C. armstrongii* were found in map areas 5 and 13 (Figure 2; Figure 4 and Figure 6).

Typhonium jonesii and *T. mirabile.*

Approximately 542 ha was surveyed which encompassed the 'potential gravel pit areas. A total of 1,212 *T. jonesii* individuals and 772 *T. mirabile* individuals were detected within this area. The highest density patches for both species were found to occur within map area 8 (gravel pit area at the eastern end of Pirlangimpi Road and the another for *T. jonesii* in map area 13 (the gravel pit area at the eastern end of the Pickertaramoor Road).

Following the reduction in size from the 'potential' gravel pit areas to the 'proposed' gravel pit areas, there is a total of 296 *T. jonesii* individuals and 39 *T. mirabile* individuals detected (Table 13).

Individual records of both species are mapped, and coordinates are listed within Appendix B.

Table 13 Number of Typhonium sp. Individuals found within the survey area

Road name	Map area	Number of individuals detected	
		T. jonesii	*T. mirable*
Pirlangimpi Rd	1	0	0
	2	10	10
	3	0	0
	4	0	6
	5	1	2
	6	0	0
	7	0	0
	8	56	21
	9	7	0
Pickertaramoor Rd	10	1	0
	11	2	0
	12	25	0
	13	194	0
Milikapiti Rd	14	0	0
Total		**296**	**39**

5.8.1.3 Weeds

Declared weeds that are defined under the *Weeds Management Act* and/or identified as WoNS in the Project area are given in Table 14 (DAWE, 2021; DEPWS, 2021; DEPWSa, 2021).

Table 14 Weeds within the Project area

Common Name	Scientific Name	Source	Status - NT	Status - National	Last recorded
Gamba Grass	*Andropogon gayanus*	PMST	A C	WoNS	Unknown
Lantana	*Lantana camara*	PMST		WoNS	Unknown
Mimosa or Giant sensitive tree	*Mimosa pigra*	PMST	A B (Zoned)	WoNS	Unknown
Mission Grass (perennial)	*Cenchrus polystachios*	PMST NR Maps	B	WoNS	2014
Mossman River grass	*Cenchrus echinatus*	NR Maps	B		2012
Purple rubber vine	*Cryptostegia madagascariensis*	NR Maps	A		2012
Bellyache bush, black physicnut	*Jatropha gossypiifolia*	NR Maps	A B	WoNS	Unknown
Hyptis suaveolens	*Mesosphaerum suaveolens*	NR Maps	B		2014
Sicklepod	*Senna obtusifolia*	NR Maps	B		2014
Coffee Senna	*Senna occidentalis*	NR Maps	B		2014
Spiny-head Sida	*Sida acuta*	NR Maps	B		2014
Flannel Weed	*Sida cordifolia*	NR Maps	B		2014
Paddy`s Lucerne	*Sida rhombifolia*	NR Maps	B		2012
Branched Porterweed	*Stachytarpheta australis*	NR Maps	B		2007
Cayenne Snakeweed	*Stachytarpheta cayennensis*	NR Maps	B		2014

5.8.2 Fauna

There have been numerous previous desktop assessments and field surveys conducted within the Project area for terrestrial fauna (summarised in Appendix B, Section 2.9). These findings in addition to the NR Maps database (DENR, 2021) contain 618 individual records of threatened species (four invertebrates, six mammals, eight birds and two reptiles) from with 10 km of the project area. The PMST predicted that an additional six listed threatened species, or their habitat may occur within the study area (three birds, two mammals and one reptile).

There are also a number of migratory and marine species that were identified in the PMST Report as being potentially present in the project area. Species listed as Marine or Migratory Marine under the EPBC Act are not included in this assessment as there are no marine habitats present within the Project footprint.

Existing records of threatened fauna species occurring within 10 km Project areas are tabulated and mapped in Appendix E and Appendix B respectively, of the Biodiversity Assessment Report (Appendix B of this report). The likelihood of occurrence of these threatened species was assessed (Appendix B), resulting in 14 species as potentially occurring in the Project area, which include six mammals, two reptiles and three birds). These are detailed in Table 15 below.

Subsequently, these species were the focus of targeted field survey, conducted within suitable habitat in the Project area in mid-February to late April 2021. A description of survey effort and methodology, in addition to survey findings from this survey are provided in full in Appendix B and are summarised in Table 16 below.

Table 15 Likelihood of occurrence of listed threatened species within the Project area

Common Name	Scientific Name	TPWC Act	EPBC Act	No records on Melville*	Preliminary likelihood of occurrence within the Project area	Revised likelihood of assessment within the Project area (following field survey)
Mammals						
Fawn Antechinus	*Antechinus bellus*	Vulnerable	Vulnerable	3	**Unlikely** – paucity of records (most recent from 25 years ago (1996))	**Unlikely** - Not detected.
Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma	*Conilurus peninicillatus*	Endangered	Vulnerable	332	Possible – suitable habitat and nearby recent records.	**Present** - within map 1. Possible throughout most of the Project area except map 6.
Bare-rumped Sheath-tailed Bat	*Saccolaimus Saccolaimus*	-	Critically endangered	0	**Unlikely** – no records	**Unlikely** - Not detected.
Black-footed Tree-rat (Melville Island	*Mesembriomys gouldii melvillensis*	Vulnerable	Vulnerable	163	**Possible** – suitable habitat and numerous records.	**Present** - within map 1, 2, 4, 6, 8, 13 and 14. Possible throughout the rest of the Project area.
Northern Brush-tailed Phascogale	*Phascogale pirata*	Endangered	Vulnerable	6	**Possible** – suitable habitat, although there is a paucity of records (most recent from 2007)	**Present** - within map 9, 12 and 14. Possible throughout most of the Project area.
Pale Field-rat	*Rattus tunneyi*	Vulnerable	-	153	**Possible** - although most habitats do not appear suitable (study areas appear to be confined to *E. tetrodonta* / *E. miniata* woodlands, not near creeks).	**Present** - within map areas 2, 4, 6 and 9. **Possible** to occur in map areas 11, 12, and 13. And **Unlikely** to occur elsewhere within the Project footprint.
Butler's Dunnart	*Sminthopsis butleri*	Vulnerable	Vulnerable	108	**Possible** – suitable habitat and nearby records	**Possible** - throughout most of the Project area except map 6.
Common Brushtail Possum (north-western)	*Trichosurus vulpecula arnhemensis*	-	Vulnerable	6,353	**Likely** – suitable habitat and high number of records	Either **present** or **likely** to be present throughout the entire Project footprint.
Water Mouse, False Water Rat, Yirrkoo	*Xeromys myoides*	Data Deficient	Vulnerable	8	**Unlikely** – no suitable habitat	**Unlikely** – no suitable habitat
Birds						
Red Goshawk	*Erythrotriorchis radiates*	Vulnerable	Vulnerable	27	**Possible** – numerous records, potentially suitable habitat.	**Possible -** throughout most of the Project area except map 6.
Grey Falcon	*Falco hypoleucos*	Vulnerable	-	1	**Unlikely** – paucity of records	**Unlikely** – paucity of records

Common Name	Scientific Name	TPWC Act	EPBC Act	No records on Melville*	Preliminary likelihood of occurrence within the Project area	Revised likelihood of assessment within the Project area (following field survey)
Partridge Pigeon	*Geophaps smithii*	Vulnerable	Vulnerable	180	**Likely** – suitable habitat and numerous records.	**Present** - throughout the entire Project area.
Hooded Robin (Tiwi)	*Melanodryas cucullata melvillensis*	Critically endangered	Critically endangered	18	**Unlikely** – has not been recorded since 1992	**Unlikely** – has not been recorded since 1992
Horsfield's Bushlark (Tiwi)	*Mirafra javanica melvillensis*	Vulnerable	Vulnerable	13	**Unlikely** – lacck of suitable habitat (treeless plains with Acacia). Paucity of records.	**Unlikely** – lack of suitable habitat
Masked Owl (Tiwi)	*Tyto novaehollandiae melvillensis*	Vulnerable	Vulnerable	340	**Possible** – suitable habitat appears to exist and high number of records.	**Present** - within Map 8 & 10. Possible throughout rest of Project area.
Reptiles						
Plains Death Adder	*Acanthophis hawkei*	Vulnerable	Vulnerable	0	**Unlikely** - unsuitable habitat and location. Prefers black soil plains.	**Unlikely** - unsuitable habitat and location.
Mertens' Water Monitor	*Varanus mertensi*	Vulnerable	-	16	**Possible** – no obvious habitat (although it is noted that this species can move away from creek lines in search of temporary waters during the wet season)	**Present** – within map 6 **Possible** - in map 9, 11, 12 and 13. **Unlikely** - throughout rest of Project area.
Yellow-spotted Monitor	*Varanus panoptes*	Vulnerable	-	7	**Possible** – wide ranging species, several records.	**Possible** in map 6, 9, 12 and 13. **Unlikely** – throughout rest of Project area
Invertebrates						
Cognate land snail	*Amphidromus cognatus*	Vulnerable	Vulnerable	5	**Unlikely** – Collected at three sites on Melville Island in 1980	**Unlikely**
Atlas Moth	*Atacus wardi*	Vulnerable	-	14	**Unlikely** – no suitable habitat	**Unlikely** – no suitable habitat
Dodd's Azure	*Ogyris iphis doddi*	Endangered	-	1	**Unlikely** - One specimen, captured in June 1986.	**Unlikely**
Land Snail	*Trochomorpha melvillensis*	Vulnerable	-	12	**Unlikely** – no suitable habitat	**Unlikely** – no suitable habitat

*As per NR Maps, January 2021

Table 16 Summary of threatened species detected during targeted field survey, 2021

Common Name	Scientific name	No. of detections [1]	Locations		Vegetation community
			Road	Map area	
Red Goshawk	*Erythrotriorchis radiatus*	2	Milikapiti	19	E4
Partridge Pigeon	*Geophaps smithii smithii*	89[1]	Pirlangimpi	1, 2, 3, 4, 5, 6, 8, 9	E1, E2, E5, W2c, C
			Pickertaramoor	11, 12, 13	E2, E4, C
			Milikapiti	14	E1, E2, E3, E4, E6, W2a
Masked Owl	*Tyto novaehollandiae melvillensis*[2]	3	Pickertaramoor	10	C
			Pirlangimpi	9	C
Brush-tailed Rabbit-rat	*Conilurus penicillatus*	3	Pirlangimpi	1	E1
Black-footed Tree-rat	*Mesembriomys gouldii melvillensis*	24	Pirlangimpi	1, 2, 4, 6, 8	E1, E2, W2b, W3a
			Pickertaramoor	13	E4, E5
			Milikapiti	14	E1, E2, E4
Brush-tailed Phascogale	*Phascogale pirata*	4	Pirlangimpi	9	E5
			Pickertaramoor	12	E2
			Milikapiti	14	E1
Pale Field-rat	*Rattus tunneyi*	7	Pirlangimpi	2, 4, 6, 9	E1, E5, W1b, W2b, W3a
			Milikapiti		E5
Butler's Dunnart	*Sminthopsis butleri*	5			
Northern Brushtail Possum	*Trichosurus vulpecula arnhemensis*	72	Pirlangimpi	1, 2, 4, 8, 9	E1, E2, E3, E5
			Pickertaramoor	11, 12, 13	E2, E3, E4, E5
			Milikapiti	14	E1, E2, E3, E4, E5, E7b, W2c
Merten's Water Monitor	*Varanus mertensi*[2]	1	Pirlangimpi	6	C

[1] This includes detections from outside the survey area such as along roadsides and includes detections along the Milikapiti Rd
[2] Targeted surveys were not conducted for this species

5.8.3 Habitats

A total of 17 vegetation communities were mapped within the Project area, which included plantations and cleared areas (Appendix B). Threatened fauna species occurred most frequently within vegetation types E1 and E2, the most dominant and the second most dominant vegetation types within the Project area.

Threatened fauna species also occurred frequently within vegetation types E5, a partially significant vegetation community type. Threatened species occurred less frequently within the sensitive, significant or partially significant vegetation types W2c, W2a, W2b, W1b W3a and E7b, potentially due to the smaller proportion of the Project area that intersects these vegetation types.

Further detail for habitat types and their distribution throughout the Project area, in addition to discussion around their importance for listed threatened species, is provided within the Biodiversity Assessment Report (Appendix B).

5.8.4 Introduced fauna

There are 72 individual records of 10 introduced fauna species within 10 km of the Project area. The PMST report identified an additional two species that may occur or have suitable habitat within the area.

Table 17 Pest species potentially found within the Project area

Common Name	Scientific Name
Asian House Gecko	*Hemidactylus frenatus*
Cattle	*Bos taurus*
Cat	*Felis catus*
Cane Toad	*Rhinella marina*[1]
Dog	*Canis lupus*[2]
Eurasian Tree Sparrow	*Passer montanus*
Flower-pot Blind Snake	*Ramphotyphlops braminus*
Horse	*Equus caballus*
Pig	*Sus scrofa*
Swamp Buffalo	*Bubalus bubalis*
Rabbit	*Oryctolagus cuniculus*
Rock Dove	*Columba livia*

[1] - Indicates species have been since eradicated
[2] - Are predicted to occur by the PMST only

5.9 Matters of National Environmental Significance (MNES)

A search of the EPBC Act PMST (Appendix F), identified the MNES within a 10 km buffer on the project area. The search found no results for World Heritage Properties, National Heritage Properties, Commonwealth Heritage Places Wetlands of International Significance and Threatened Ecological Communities.

The MNES identified for the project area include the following:

– 42 threatened species (discussed in section 5.8 above)
– 78 listed marine species; 29 migratory marine species; 13 migratory wetland species - Marine and wetland habitats are not found in the vicinity of the Project area and are therefore these species are not assessed further for the purposes of this report.
– 4 migratory terrestrial species:
    - Red-rumped Swallow (*Cecropis daurica*)

- Barn swallow (*Hirundo rustica*)
- Rufous Fantail (*Rufous rufifrons*)
- Horsefield's cuckoo (*Cuculus optatus*)

Of these migratory terrestrial species, the Barn Swallow and Red-Rumped Swallow are considered to be extremely uncommon migrants (DOE 2015). The Project area is unlikely to support habitat that would be considered important for any of these species for foraging or breeding activity or support an ecologically significant proportion of a population. Therefore, it is highly unlikely that the Project poses any significant impact to migratory terrestrial species.

5.10 Potential contamination

The following information sources were reviewed for indicators of potential contamination along the Project area:

– Historical aerial imagery
– The Department of Defence (DoD) Unexploded Ordnance (UXO) Mapping Application
– The NT EPA contaminated land audit register
– Project area-specific registers and reports (currently available to GHD)

Each information source was reviewed, and the findings are discussed in the following sections.

5.10.1 Historical aerial imagery

A review of historical aerial imagery sourced from Google Earth was undertaken on 1 November 2021. The earliest available aerial imagery was taken in 1984 and was of insufficient resolution to distinguish features relating to potential contamination along on Pirlangimpi and Pickertaramoor Roads.

From 1984 to 2021, the landscapes adjacent the two roads appear to have undergone regular cycles of forestry activities.

Between 2003 and 2016, historical imagery shows that several smaller areas were cleared adjacent to Project area. These localised, cleared areas have been cleared directly adjacent to Pirlangimpi and Pickertaramoor Roads at regular spacings. These clearings are likely to represent gravel pits or clean fill sources utilised for the road construction and maintenance. Discernible activities are limited to land disturbance activities including gravel pit developments, deforestation and plantation developments.

In 2011, a series of three small ponds appear to have been constructed roughly 25 km south of Pirlangimpi community adjacent the Maxwell Creek landing ground along Pirlangimpi Road (approximately 400 m south of gravel pit TIFP7 shown in Figure 4). The ponds are likely to have been constructed and bear similarities to typical wastewater treatment evaporation ponds. The ponds are located relatively close to the landing ground, and presumably service the Maxwell Creek airport. Operation of wastewater treatment ponds and sewage storage activities can incur contamination risks associated with contaminated water storage, effluent management and potential impacts to groundwater from the evaporation ponds. Contamination from these sources may impact nearby groundwater and surface water users. The risks to local water users may vary from negligible to significant depending on the construction and operation of the wastewater treatment infrastructure and the connection pathway of potential contamination sources to the relevant receptors.

As Pickertaramoor Road verges south towards Pickertaramoor community, a waste transfer station access road extends approximately 400m west southwest towards a clearing (approximately 2.5 km south of gravel pit TIFP1 shown in Figure 1). It is understood that this clearing comprises a waste transfer station. This waste handling facility likely services the Pickertaramoor community area and represents a significant potential contamination source within 400 m of the Project area.

5.10.2 NT EPA contaminated land audit register

A search of publicly available information contained within the NT EPA's online contaminated land audit register was completed on 1 November 2021. This search yielded no results for environmental audit sites within or adjacent to the Project area.

5.10.3 Unexploded Ordinance

Unexploded Ordnance (UXO) can be found in most states and territories of Australia. The DoD has undertaken research to identify and define these locations throughout Australia. A search across the Project area within this database was conducted using the UXO Mapping Application provided by DoD. The search concluded that the Project area itself is free of known potential UXO-impacted sites. However, the coastal area at the southern point of Melville Island has “Substantial potential” for UXO occurrence. The area bears this classification as DoD have reported that this location was a former “RAAF Bombing and Gunnery Area” (DoD, 2021). However, it should be noted that this potential UXO-bearing site is not within or directly adjacent to the Project area and is therefore not considered a risk to this Project.

5.11 Socioeconomic environment

5.11.1 Social history and governance

The Tiwi Islands (Tiwi: Ratuati Irara meaning "two islands") comprise Bathurst Island, Melville Island and nine smaller islands. The Tiwi Islands have been inhabited by Tiwi people for over 40,000 years.

The Tiwi Islands were created by sea level rise at the end of the last ice age, which finished about 11,700 years ago, with the flooding occurring an estimated 8,200 to 9,650 years ago. The Tiwi People have occupied the Tiwi islands since at least the last ice age when the islands were separated from the mainland. The story of the flooding is told in Tiwi traditional stories and creation myths passed down orally from generation to generation ever since. After years of isolation, the Tiwi have a unique language and culture, including dance, song and art.

Tiwi islanders are believed to have had contact with Macassan traders (Squires 2006), and the first historical record of contact between Indigenous islanders and European explorers was with the Dutch, who took three ships into Shark Bay on Melville Island and landed on 30 April 1705 (Tiwi Land Council, 2008). There were other visits by explorers and navigators in the seventeenth, eighteenth and nineteenth centuries.

In February 1824 Captain Gordon Bremer took instruction from the British Colonial Office to take possession of Bathurst and Melville Islands, along with the Cobourg Peninsula (now part of Arnhem Land) on the mainland to the east, subject to the land being unoccupied by any people except "...the Natives of those or any of the other Eastern Islands" (Morris, 2001). Bremer established the first European settlement on the Islands, which was also the first British settlement in northern Australia, at Fort Dundas on Melville Island, near present-day Pirlangimpi in September 1824. However, owing in part to the hostility of the Indigenous population, it lasted only five years, being abandoned in 1829 (Forrest. 1995).

Control of the Tiwi Islands was transferred back to Tiwi people through the Tiwi Aboriginal Land Trust and Tiwi Land Council in 1978.

The Tiwi Islands local government area was established in 2001, when the previous community government councils in the three main communities of Wurrumiyanga (located on Bathurst Island), Pirlangimpi and Milikapiti (both located on Melville Island) were amalgamated with the Wurankuwu Aboriginal Corporation to form a single local government (Tiwi Island Local Government 2002).

The Tiwi Islands Local Government was replaced in 2008 by the Tiwi Islands Shire Council as part of a Northern Territory-wide restructuring of local government. Tiwi Islands Shire Council became Tiwi Islands Regional Council in 2014.

5.11.2 Demographic characteristics

According to the Australian Bureau of Statistics (ABS) Census, in 2016 the population of Tiwi Islands was 2,453 people. Wurrumiyanga, is the largest community on Tiwi Islands. In 2016, Wurrumiyanga had a population of about 1,500 people and is where several community facilities are located. This includes tourism facilities, business, and a ferry wharf providing connectivity to Darwin.

The communities of Pirlangimpi and Milikapiti are located on Melville Island. Each have a population of about 450 people (Tiwi Islands Regional Council). There are other smaller settlements on Tiwi Islands, including

Pickertaramoor to the south of Melville Island, where Tiwi College is located. Tiwi College is a secondary boarding school, which is owned and managed by Tiwi people.

Key demographic indicators for the Tiwi Islands compared to other very remote areas in the NT are provided in Figure 10, which shows that in 2016 the population of Tiwi Islands compared to other remote areas in NT was characterised by:

– A higher population of Aboriginal or Torres Strait Islander people.
– A lower proportion of the population who spoke English at home.
– A lower median weekly household income.
– A lower proportion of people who travelled by, or owned, a car.
– The areas of Pirlangimpi, Wurrumiyanga and Milikapiti can be characterised compared to the other areas by:
    - A higher median age in Pirlangimpi.
    - A higher rate of year 12 completion in Wurrumiyanga.
    - A higher rate of households renting their dwelling in Wurrumiyanga and Milikapiti.
    - A lower unemployment rate in Pirlangimpi and Milikapiti compared to Wurrumiyanga and Tiwi Islands overall.
    - A lower rate of mobility in Pirlangimpi and Wurrumiyanga.

Table 18 Key demographic indicators

Indicator	Pirlangimpi (ILOC)	Wurrumiyanga (ILOC)	Milikapiti (ILOC)	Tiwi Islands (Statistical Level 2)	Very Remote Australia (NT)
Population characteristics					
Population	371	1,563	401	2,453	44,819
Aboriginal or Torres Strait Islander	90%	90.3%	93.3%	89%	74.8%
Median age	34	29	28	30 years	27 years
Need for assistance	4%	5%	3%	4%	3%
Educational attainment					
Completed Year 12	18%	49%	19%	13%	10%
Completed post-school qualifications	46.7%	23.1%	27.4%	12.3%	19.2%
Dwelling tenure					
Owned	0%	0.02%	0%	2.2%	8.2%
Rented	80%	93%	96%	90.7%	82.9%
Linguistic diversity					
Spoke English at home	-	-	-	11%	24.2%
Employment and economy					
Unemployment rate	14.6%	28.3%	11.8%	23.8%	21.4%
Median weekly household income	-	-	-	$780	$1,333
Mobility					
Lived at same address 5 years ago	93%	90%	83%	86.2%	87%
Vehicle use					
People who travelled to work by car as a driver or passenger	-	-	-	28.1%	44.2%

Indicator	Pirlangimpi (ILOC)	Wurrumiyanga (ILOC)	Milikapiti (ILOC)	Tiwi Islands (Statistical Level 2)	Very Remote Australia (NT)
Dwellings with no registered vehicles	-	-	-	62.6%	37.1%

5.11.3 Economy and industry

Forest products are an important part of the Tiwi Islands economy. Forestry dates to 1898, with plantations being trialled from the 1950s and 1960s (Tiwi Land Council March 2009). Agricultural, Forestry and Fishing remains a key contributor to the Tiwi Islands regional economy, making up 17.3% of the areas total economic output (NIEIR, 2021). Once cleared, land is used for monoculture plantations, which is reportedly an important source of local jobs for residents.

As shown in Figure 10, the largest proportions of the labour force in Tiwi Islands are employed in the Education and Training (24%), and Public Administration and Safety (17.7%) industries. Only 2% of the labour force in Tiwi Islands are employed in Agriculture, Forestry and Fishing industry.

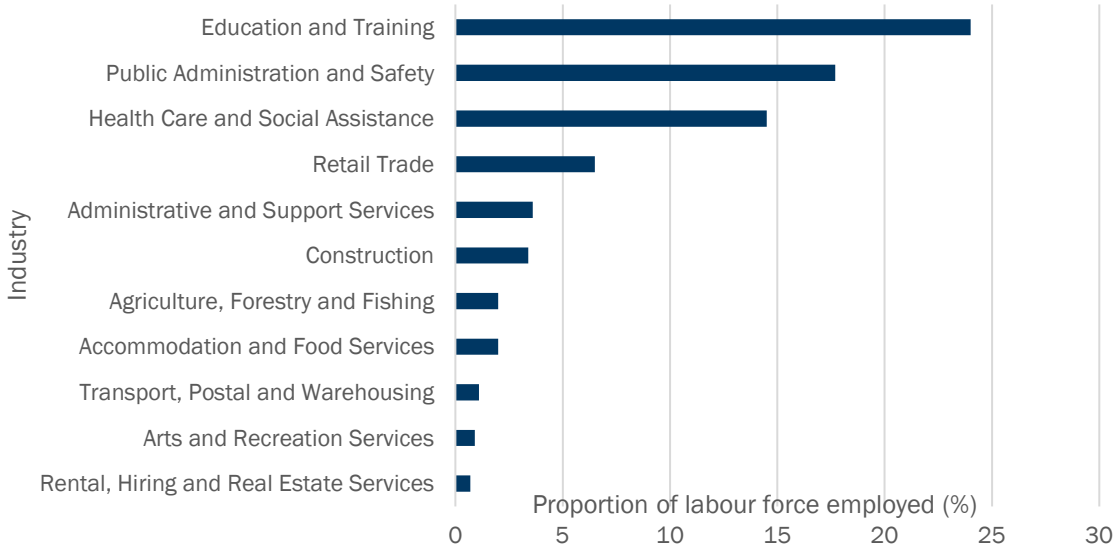


Figure 10 Industry profile, Tiwi Islands (2016)

Existing road upgrade projects provide local Indigneous residents and businesses with employment and procurement opportunities (identified and managed by the Tiwi Islands – Paru Road Indigenous Participation Plan, 2019). This provides up to 60 local employment opportunities during construction and ongoing opportunities for Indigenous suppliers in the local and regional area (DIPL, 2019). Paru Road provides vital access to the barge to Bathurst Island that produces a number of facilities and services to communities on Melville Island.

5.12 Cultural heritage and sacred sites

DIPL have sought advice from AAPA regarding the location of registered and recorded sacred sites within the Project area. The clearances cover works associated with major road works including all pre-construction, construction, re-construction, upgrading, and maintenance activities associated with roads, infrastructure and all earth disturbing works including road widening and reforming.

The proposed works are not in the vicinity of any of the identified restricted areas. AAPA certificates are provided in Appendix G and are summarized in Table 19 below. New AAPA certificates will be obtained in the event selected gravel pit areas fall outside the existing AAPA certificate boundaries.

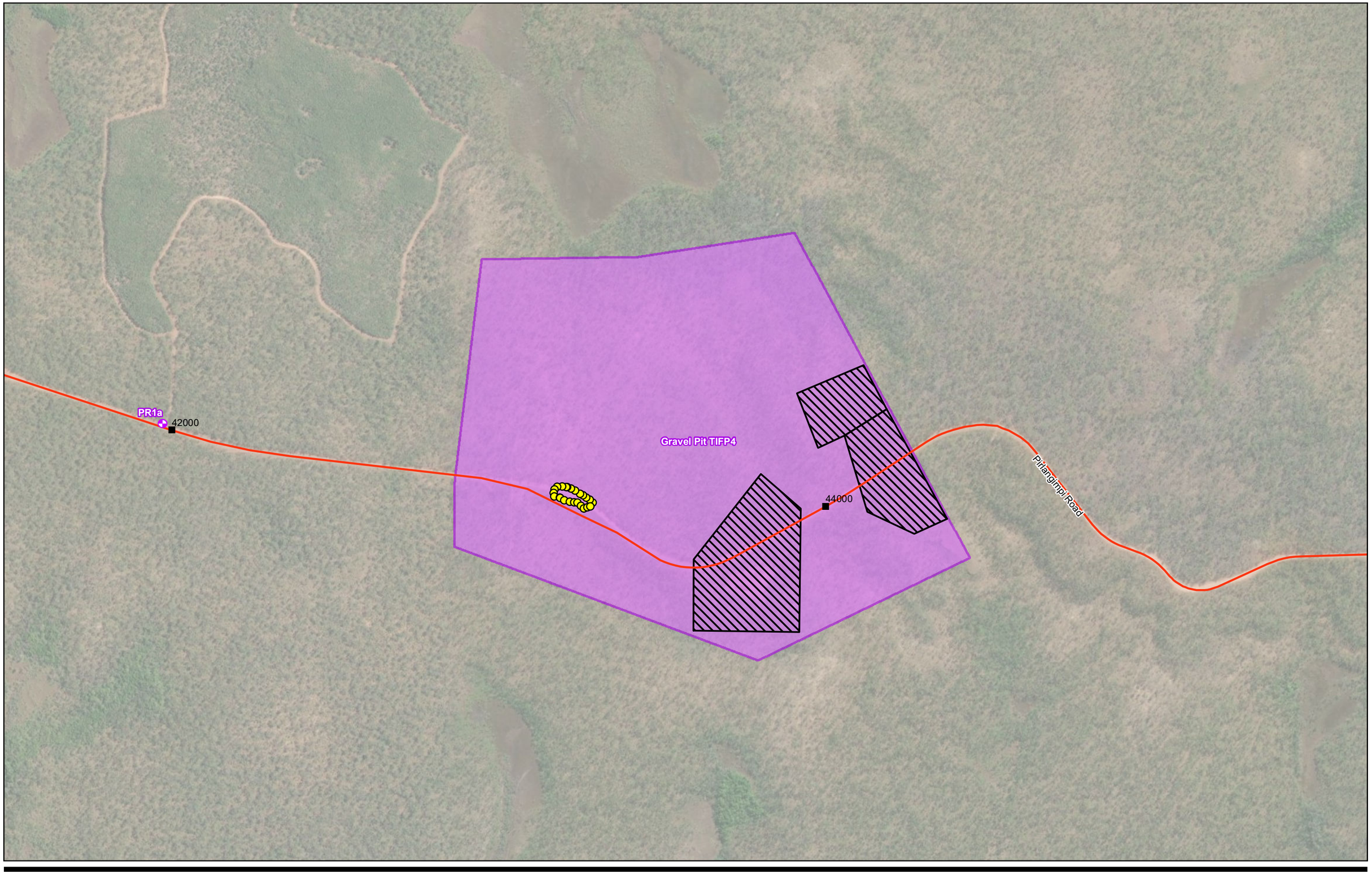
Table 19 Summary of AAPA certificates for the Project area

AAPA Certificate Reference	Project area component	Relevant conditions
2013/19 - C2013/103	Four extractive areas on Pirlangimpi, Pickertaramoor and Milikapiti Roads	N/A
2016/324 – C2016/124	– Undertake additional resource survey and extraction, and road alignments of the Pickertaramoor Road on Melville Island. – Subject land A is 200 m either side of the Pirlangimpi, Pickertaramoor road center line – Subject land B is 1 km either side of the Pirlangimpi, Pickertaramoor road center line	– No work shall take place or damage shall occur to RWA1 (scared site 5074-15). – No work shall take place or damage shall occur to RWA2 (scared site 5074-16)

The Heritage Branch has conducted a search of the NT Heritage Register and the NT Archaeological Sites Database. They confirm that there are no nominated, provisional or declared heritage places located within NT Portion 1644, nor any previously recorded Aboriginal archaeological sites. They have attached an aerial map extract of the Project area (refer to Appendix G).

In addition to advice received from both AAPA and the Heritage Branch, DIPL also sought advice from Tiwi Land Council (TLC) on any unregistered or unrecorded site, item, artefact, material or relic known to them. TLC advised of a newly identified site of cultural significance for yellow ochre collection, which is in the process of being registered through AAPA. This site is within the Pirlangimpi Road alignment adjacent to gravel pit TIFP4 in map area 9 (Figure 11; Figure 5).

An adjustment to the proposed road alignment has been developed (referred to as the ‘preferred road alignment’) to avoid disturbance to this site and take the shortest route, impacting the smallest area of potential threatened species habitat. Figure 11 shows the yellow ochre site and the Pirlangimpi Road preferred alignment in relation to the original alignment.



Legend

- Munupi Yellow Ochre Track
- Potential gravel pit areas
- Proposed bore
- Road upgrades
- Proposed gravel pit areas

1:10,000 @ A3

0 90 180 270 360

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 52

N

GHD

Department of Infrastructure, Planning and Logistics
Terrestrial biodiversity surveys for
Melville Island roads

Cultural Heritage

Project No. **12543964**
Revision No. **0**
Date **20/02/2022**

FIGURE 11

G:\43\12543964\GIS\Maps\12543964_012.mxd
Print date: 20 Feb 2022 - 14:11

Data source: DIPL - Road upgrades, road realignments (2020). GA - place names, roads (2015). CE - Map areas (2021). Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: cmacgregor

6. Environmental risk assessment

An environmental risk assessment was undertaken, including consultation with DIPL through risk workshops, to identify the potential environmental impacts from activities associated with the Project. GHD used the DIPL environmental risk analysis method which is based on the requirements of AS/NZS ISO 31000:2009 (Risk Management).

6.1.1 Methodology

The environmental risk analysis was undertaken to:

– Establish a risk framework that defined boundaries of risk likelihoods and consequences.
– Identify the type of risks associated with the project.
– Analyse the identified risks.
– Evaluate the risks by rating them according to the likelihood of the risk and its consequence.
– Outline management measures to mitigate risks to an acceptable level.
– Determine the residual level of risk after application of management measures.

The first step involves the identification of the consequence levels should a particular risk result in a negative impact. These are summarised in Table 20.

The second step involves defining the risk categories. This considered the frequency of activities that may cause the impact and likelihood (probability) of the impact occurring during the activity. The level of likelihood that a risk would occur is summarised in Table 21.

The risk rating category of each potential impact was then determined by combining the likelihood with the consequence of the risk according to the matrix shown in Table 22. The risk rating categories that were adopted for this project are outlined in Table 23. As indicated in Table 20, risk rating scores were also attributed to each risk rating.

The impacts were initially rated with the existing control measures already in place and confirmed to be functioning, known as the initial risk rating. The risk rating was then revised to consider the effectiveness of additional control measures that would be implemented, known as the residual risk rating. Where no additional control measures were identified, or administrative controls only were identified, there was no risk reduction.

The impacts were categorised into themes and factors, as per the NT EPA Environmental Impact Assessment Guidelines[1]. The themes categorised in this assessment include land, water, air and people.

[1] NT EPA 2020, NT EPA Environmental factors and objectives, Environmental impact assessment guidance, version 1.0, dated 26 June 2020.

Table 20 Risk consequence definitions

Risk	Negligible - 1	Minor - 2	Moderate - 3	Major - 4	Severe - 5
Environment and Heritage	No measurable impact.	Minor Impacts on flora / fauna and habitat but no negative impacts to ecosystem function.	Policy or contractual breach.	Legislative, regulatory or policy breach.	Major legislative. Regulatory or policy breach.
	Limited / minimal damage to areas of low significance.	Minor impacts with no permanent or lasting detrimental effects to the environment or cultural or social values.	Significant localised impacts without long term detrimental environmental or social impacts.	Significant widespread environmental effects with long term detrimental environmental or social impacts.	Significant extensive environmental effects with long term detrimental environmental or social impacts.
			Short term or repairable adverse effects to ecosystem function or endangered / beneficial species, habitat or cultural & heritage values.	Localised eradication or significant impact to ecosystem function, endangered / beneficial species, habitat or cultural and heritage values.	Widespread, permanent and persistent damage to ecosystem function or area of significance including cultural heritage values.
					Eradication of endangered/beneficial species or habitat.

Table 21 Risk likelihood definitions

Level	Descriptor	Likelihood of Occurrence
1	Rare	May occur in exceptional circumstances.
2	Unlikely	Could occur at some time
3	Possible	Might occur at some time
4	Likely	Will probably occur in some circumstances
5	Almost Certain	Expected to occur in most circumstances

Table 22 Risk Rating Matrix

Likelihood Rating	Consequence Rating				
	Negligible 1	Minor 2	Moderate 3	Major 4	Severe 5
Rare 1	Low 1	Low 2	Low 3	Low 4	Low 5
Unlikely 2	Low 2	Low 4	Medium 6	Medium 8	Medium 10
Possible 3	Low 3	Medium 6	Medium 9	High 12	High 15
Likely 4	Low 4	Medium 8	High 12	High 16	Extreme 20
Almost Certain 5	Low 5	Medium 10	High 15	Extreme 20	Extreme 25

Table 23 Risk rating categories

Risk category	General description
Low	Potential impacts either require no specific management measures or can be directly managed through design measures, general mitigation measures and safety controls.
Medium	Management responsibility required. Potential impacts can be mitigated through the application of relatively standard environmental management measures.
High	Management attention needed. Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts associated with the risk.
Extreme	Immediate action required. Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts associated with the risk.

Risk rating scores were attributed to each risk rating. These scores ranged between one and twenty-five. Risks were initially allocated assuming that no management measures were in place. The risk rating was then revised to take into account the effectiveness of mitigation measures that would be implemented, known as the residual risk rating.

6.2 Results of environmental risk analysis

The full environmental risk register is provided in Appendix A which presents the outcome of the risk assessment process. The inherent risk assessment results are based on the proposed construction activities and the timescale over which they will be undertaken. A summary of the environmental risks is provided in Table 24 below.

Table 24 Environmental risk analysis summary

Activity	Number of risks				Total
	Low	Medium	High	Extreme	
Number of risks for project prior to mitigation measures (initial risks)	21	28	3	0	52
Number of risks for project including mitigation measures (residual risks)	39	13	0	0	52

7. Potential impacts and management

This section summarises potential medium to high impacts identified for the duration of the project and their proposed mitigation as detailed in the risk assessment register (Appendix A). These have been grouped based on the relevant environmental factors.

Table 25 provides a summary description of the environmental factors potentially impacted along with the initial risk rating from existing controls and the residual risk rating with additional control measures.

Table 25 Summary of environmental factors and potential impacts

Theme	Factor	Potential impacts	Initial risk	Residual risk
Land	Landforms	Yes	Medium	Low
	Terrestrial Environmental Quality	Yes	Medium	Medium
	Terrestrial ecosystems	Yes	High	Medium
Water	Hydrological processes	Yes	Low	Low
	Inland water quality	Yes	Low	Low
	Aquatic ecosystems	No	N/A	N/A
Sea	Coastal processes	No	N/A	N/A
	Marine Environmental quality	No	N/A	N/A
	Marine ecosystems	No	N/A	N/A
Air	Air quality	Yes	Medium	Low
	Atmospheric processes	Yes	Low	Low
People	Communities and economy	Yes	Medium	Low
	Culture and heritage	Yes	Medium	Medium
	Human health	Yes	Medium	Medium

7.1 Land

7.1.1 Landforms

The potential impacts associated with the landform types present in the project area are primarily related to erosion and sedimentation of cleared areas associated with gravel pits. The initial risk of these impacts is medium due to the majority of soil types having good drainage characteristics preferable selection of slopes of less than 2% (areas with up to 6% slope may be utilised with increased ESC measures) and the construction method of 1 ha of clearance proposed in any one location (as per the Standard specification for environmental management, version 2.0 (DIPL, 2019).

Further mitigation measures including management during construction and rehabilitation measures reduce the risk to low. It will be a contract requirement to have each section of road constructed each year sealed to protect the pavement, provide a safe driving surface and prevent erosion. That is, it will not be left incomplete prior to wet season and contractors demobilising from the site.

The Contractor will be required to submit a Gravel Pit Management Plan to DIPL for assessment and endorsement. The purpose of the Gravel Pit Management Plan is to document all necessary steps and tasks required in establishing the nominated gravel pits to enable construction of the Project and primarily to ensure the following is achieved:

– The timely, efficient, and comprehensive management of all pit-related activities
– The smooth handover of the nominated gravel pits back to TIRC and TLC.

The sections of the roads that are ‘relocated’ will be scarified and rehabilitated to prevent access and encourage vegetation growth. Topsoil from the new alignments will be stockpiled at the laydown area or pits and be utilised in spreading across the decommissioned sections of road to increase the potential for native species seed bank germination and recruitment.

The road has been designed to incorporate culverts and other drainage means to avoid changing the upstream and downstream flood levels as much as practical. The culverts have been strategically designed to reduce upstream ponding and to ensure connectivity of watercourses.

Most of the road follows the existing alignment. With the upgrade works, the road will be lifted with cross fall to ensure drainage of the road surface, and table drains and offlet drains to ensure that runoff water is directed away from the road and into the natural environment. There are a number of transverse drainage structures (culverts) to be constructed along the road.

The construction works are aimed to be undertaken in the Dry season (April to October). With any works outside of this period, the Contractor will be required to develop and implement an approved Erosion and Sediment Control Plan.

7.1.2 Terrestrial ecosystems and environmental quality

The listed threatened species that are confirmed to occur, or have the potential to occur, within the Project area face several existing threats on the Tiwi Islands. These threats, including inappropriate fire regimes, extensive and intense fires, feral cats and large-scale loss of critical or important habitat, are likely to be implicated in the apparent decline of these species on the Tiwi Islands (Connect Environmental, 2021). By comparison, the anticipated impacts from this Project, are unlikely to significantly impact the distribution or abundance of these species on the Tiwi Islands, although localised and small-scale impacts will be experienced by animals occupying those areas.

While an approximate maximum of 262.25 ha of vegetation may be impacted within the Project area (proposed gravel pit areas combined with road widening and realignment areas), the composition of this area is important to recognise, as this affects the nature and scale of impacts:

– The total clearance area within the ‘potential’ gravel pit areas mapped for gravel extraction is unlikely to be used to its maximum extent, as is comprised of multiple smaller areas nominated for proposed gravel pits (23, 1 ha areas).
– In the ‘proposed’ gravel pit areas (which comprise approximately 78% of the ‘potential’ area), only 1 ha of clearance is proposed in any one location (as per the Standard specification for environmental management, version 2.0 (DIPL, 2019). Therefore, the extent of disturbance is likely to be much smaller than the numbers provided in the impact assessment.
– Much of the disturbance footprint is located along the existing roads or cleared areas for existing gravel pits or plantation. Such areas are likely to have reduced values for biodiversity associated with ‘edge’ effects – that is, the alteration of habitat characteristics resulting from increased levels of light, dust and noise and consequential changes to vegetation composition.

7.1.3 Detailed impact assessment on Matters of National Environmental Significance (threatened species)

Evaluations of the significance of potential impacts are based on the *Commonwealth’s Matters of National Environmental Significance Significant Impacts Guidelines 1.1 the guidelines* as applied to Endangered and Vulnerable species.

Only species that were considered ‘present’, or ‘possible’ to occur within the Project area are considered in this significant impact assessment. Refer to Appendix B for the method regarding data inputs, justification for likelihood of occurrence and references. It should also be noted that the assessment of impacts has been made ‘pre-mitigation’ as per the guidelines. With the implementation of mitigation and management measures it will be possible to reduce risk considerably (as is discussed in the risk register and subsequent sections below).

In summary, impacts to all listed threatened flora and fauna species were assessed as ‘unlikely’ under all criteria, except for one: “*Result in invasive species that are harmful to a vulnerable species becoming established in the*

vulnerable species' habitat". The Project area is predominantly located adjacent to existing disturbed areas, is fragmented, and will generally not impact sensitive or significant habitat types. In this regard, the distribution and abundance of invasive fauna already present in the vicinity of the disturbance footprint are unlikely to be altered. However, the importation of plant and machinery onto the Tiwi Islands from the mainland, and subsequent earthworks, could introduce and/or spread grassy weeds (i.e., Gamba grass) and cane toads into potential habitat of listed threatened species. With these two invasive species being a key threatening process on the mainland, contributing to widespread decline of threatened species, this is considered a key risk of the Project.

However, appropriate controls will be able to be implemented to avoid the likelihood of this occurring and further ongoing management measures, will reduce the impact to the point where such invasive species do not adversely affect the species' habitat.

7.1.4 Proposed mitigation and management measures

In addition to the minimum standards for environmental management for DIPL's civil and building works which are described in the *Standard specification for environmental management* (version 2.0; DIPL, 2019), further measures will be implemented to reduce potential impacts on biodiversity values. The following table summarises the proposed mitigation and management measures in to reduce the primary source of risk and likelihood of resulting potential impacts related to the loss of individuals or habitats of threatened species.

Table 26 Summary of mitigation measures to reduce primary risks to listed threatened species

Species	Primary source of risk	Mitigation and management measures
Cycas armstrongii	– Two map areas were detected to contain high density patches. – Introduction and spread of invasive species	– High density patches of cycads will be avoided within proposed clearance areas, including those observed in map area 13 (Figure 6) and map area 5 (water point PR7; Figure 7). – Measures described in Appendix A and in section 7.1.4.2 below
Typhonium jonesii	– A total of 25 detected individuals occurs within the proposed project area as well as a patch of 16 within map area 12.	– Avoidance buffer of 20 m for vegetation clearance around water point to avoid all individuals. – Measures described in Appendix A and in section 7.1.4.2 below
Typhonium mirabile	– A total of two detected individuals occurs within the proposed disturbance footprint	
Red Goshawk	– A total of 246.9 ha of foraging habitat exists across the proposed project area. No nests were detected though potential nesting habitat may be present.	Conduct surveys for Red Goshawk nests immediately prior to construction and within the breeding season (April to October) within and surrounding (300 m buffer) proposed clearance areas. Where nests are located, no clearing should occur within 300 m of the nest for the remainder of that dry season.
Partridge Pigeon	– A total of 246.9 ha of breeding and foraging habitat exists across the proposed Project area.	Measures described in Appendix A
Masked Owl	– A total of 246.9 ha of foraging habitat exists across the proposed Project area. Potential nesting habitat may be present.	Conduct surveys for Masked Owl nests / nesting activity immediately prior to construction and within the breeding season (March to July). Within and surrounding (300 m buffer) of proposed clearance areas. Where nests are located, no clearing should occur within 300 m of the nest for the remainder of that dry season.
Brush-tailed Rabbit-rat	– Confirmed within one map area only (map area 1; Figure 3)	Measures described in section 7.1.4.2 below - i.e. 200 m avoidance buffer around all records.
Black-footed Tree-rat	– Confirmed in six map areas (map areas 1, 2, 4, 6, 8, 13; Figure 3, Figure 4, Figure 5 & Figure 6) and possible to occur throughout the rest of the Project area	Following further delineation of suitable gravel extraction points after the appropriate geotechnical investigations have been conducted, the intention will be to avoid areas with higher densities of large hollow bearing trees.

Species	Primary source of risk	Mitigation and management measures
Brush-tailed Phascogale	– Confirmed in three map areas (map areas 9, 12 and 14; Figure 5 & Figure 6)	– 200 m avoidance buffers recommended around all records (see 7.1.4.2 below). – Limit the number and extent of pits within map areas 9, 12 and 14 to the absolute minimum required. – Ensure any constructed pits are located adjacent to existing pits.
Pale Field-rat	– Confirmed in four map areas (map areas 2, 4, 6, 9; Figure 3, Figure 4 & Figure 5). Some suitable habitats may be removed.	– Avoidance measures of sensitive and/or significant vegetation communities will essentially mitigate most of the risk associated with removal of suitable habitat for this species (see 7.1.4.2 below) – Measures described in section 7.1.4.2
Butler's Dunnart	– Suspected of occurring in two map areas, though all (potential) detections occur a minimum 200 m from the Proposed Project area.	Measures described in Appendix A and in section 7.1.4.2
Northern Brushtail Possum	– Confirmed in eight map areas. A total of 246.9 ha of breeding and foraging habitat exists across the proposed Project area.	Following further delineation of suitable gravel extraction points after the appropriate geotechnical investigations have been conducted, the intention will be to avoid areas with higher densities of large hollow bearing trees.
Merten's Water Monitor	– Confirmed in one map area. A total of 17.9 ha of 'seasonal' habitat exists in the proposed Project area.	– Avoidance measures of sensitive and/or significant vegetation communities will essentially mitigate most of the risk associated with removal of suitable habitat for this species (see 7.1.4.2 below) – Measures described in Appendix A and in section 7.1.4.2

7.1.4.1 Biosecurity mitigation

Land managers, including the Department and its Contractors, are legally responsible for the prevention of spread and control of Declared Weeds in accordance with the *Weeds Management Act* regardless of the size of project.

During the construction works, the Contractor will be required to implement an approved Weed Management Plan in line with NTG Standard Specification for Environmental Management in order to reduce the risk of introduction and spread of invasive species. Items that will be included in the plan are summarised below, and included in the risk register (Appendix A) and within the CEMP framework (Appendix E):

– Provide a copy of a site specific and project specific Weed Management Plan (WMP) in accordance with Australian Government and Northern Territory Government guidelines. A detailed WMP is to be submitted with the CEMP.
– Consult with Local Council and the Department of Environment Parks and Water Security (DEPWS) Weed Management Branch about management procedures to be implemented by the Contractor
– Before entering the Tiwi Islands, all vehicles, plant and machinery will be steam or high-pressure water cleaned to remove all earth/soil to prevent the spread of weeds and pest animals.
– Vehicles, plant and machinery will complete a weed hygiene declaration and undergo biosecurity checks prior to entering the Tiwi Islands
– A Weeds and Pest Management Plan will be developed by the Contractor as part of the CEMP (Appendix E) and implemented during construction and decommissioning. This management plan will include the above mitigations in addition to the following:
    - Regular inspections (most importantly following soil disturbance and following rainfall) of the Project area and surrounds to identify, contain, and eradicate the emergence of weeds, as per NT Government Weed Management Handbook (DEPWS, 2018)

7.1.4.2 Avoidance buffers

Further micrositing for gravel pit extraction areas will be carefully considered to avoid biodiversity values (i.e., listed threatened species and/or their habitat, as well as significant or sensitive vegetation communities). These values are summarised in Section 5.8 and are discussed in detail and mapped in Appendix B. The framework for

biodiversity avoidance buffers has been designed to follow the NT Land clearing guidelines (DEPWS, 2021), and is summarised below.

Level 1 (highest priority):

1. Within 20 m of 'patches' of *Typhonium jonesii* and/or *T. mirabile*.
2. Within 100 m of the following sensitive and/or significant vegetation communities:
   a. W1a: Found within map area 6, 12, 13 (Figure 2, Figure 4, Figure 6)
   b. W2a: Map 6 (Figure 2, Figure 4)
3. Within 200 m of any threatened species classified as 'endangered' (i.e., Brush-tailed Phascogales and Brush-tailed Rabbit-rats).

Level 2 (low to medium priority):

1. Within 50 m preferred of 'patches' of *Typhonium jonesii* and/or *T. mirabile*.
2. Avoid clearance of vegetation communities associated with seasonally saturated or inundated soils (potentially significant vegetation communities):
   a. Vegetation community E5: Map area 11, 13 (Figure 2, Figure 6)
   b. Vegetation community W1b; W2b; W2c; and W3a: Map area 6 (Figure 2, Figure 4)

7.2 Air

Potential impacts are associated with air quality and visibility primarily relate to dust generation as a result of vegetation clearance and topsoil excavation. The initial risk of reduction of visibility and impacts on road safety for nearby communities or residential dwellings, road users and construction personnel is considered to be 'medium'. This risk is reduced to a 'low' rating through the employment of mitigation measures including limiting ground disturbance works through the construction method of 1 ha of clearance proposed in any one nominated gravel pit location, covering of loads and water spraying of earthworks formations, stockpiles and roads for dust suppression. Impacts to atmospheric processes were assessed as low.

7.3 People

The medium and high potential impacts under the theme of People relate to traffic and road closures, disruption to utility services and disturbance to indigenous cultural heritage. These are discussed in more detail below.

7.3.1 Traffic

The traffic impacts of the increase in overall traffic and heavy vehicles were assessed as per Austroads Guide to Traffic Management Part 12 to determine whether further analysis may be required at the next stages of planning.

The traffic generated by the construction of the roads will result in a 35% increase in overall daily traffic and a 483% increase in the heavy vehicle daily traffic along Pirlangimpi Access Road and Pickertaramoor Access Road. The Austroads Guide to Traffic Management Part 12 suggests that a significant increase in heavy vehicles and / or overall traffic.

It should be noted, however, that there is low baseline traffic on each of the roads which results in a significant percentage increase in traffic volumes.

While the overall traffic volumes are low, the preparation of a traffic management plan will be required by the appointed contractor. The purpose of the traffic management plan is to outline the proposed traffic management strategy to manage traffic safely and efficiently around the construction of the road.

With a traffic management plan implemented the residual risk rating for traffic related impacts are reduced to low except for, impeded access for emergency services as a result of temporary road closures which remains a medium risk. The section of the road constructed that year must be completed to a finished standard, so as to provide a safe driving surface and prevent erosion.

Construction work and construction traffic will be concentrated on specific sections of the roads. Although works are occurring on the road, access along the road will remain open to all users.

As part of the tender documentation, the Contractor will be responsible for traffic management to ensure this. The works shall be planned and managed to minimise obstruction and inconvenience to the public, and ensure public safety is accommodated at all work sites at all times.

As shall be part of the tender documentation, the Contractor shall assume responsibility for the safe conduct of traffic through, past or around the works, 24 hours a day, from possession of the site to completion of all works, defects liability period and handover.

Temporary traffic management will consist of temporary lane closures, temporary speed limits, portable traffic signals and stop-and-slow methods.

The Project will engage a Principal Contractor who will be responsible for organising and managing the accommodation for the project workforce. It is envisioned that the Principal Contractor will utilise gravel pits areas to minimise impact to the environment.

Refer to Appendix H for the Traffic study.

7.3.2 Accidental damage to utilities or services / Exposure to UXO

The consequence of accidental damage to utilities or services, or exposure to UXO has a rare likelihood of a major consequence that being human injury or fatality. Mitigation measures include ensuring service utilities locations are identified and communicated to contractors and protection measures are put in place to ensure services are not damaged.

In the event an item encountered is suspected to be a UXO, all construction work that might affect the item will cease. Measures will be implemented to protect the item from damage or disturbance. The Superintendent will be notified immediately, and appropriate actions will be taken.

With implementation of these mitigation measures the risk rating remains as a medium due to the major consequences.

7.3.3 Indigenous cultural heritage

DIPL have sought advice from AAPA, Heritage Branch and TLC in order to understand to location and nature of registered and recorded sacred sites (see details in Section 5.12), however, there remains the potential to disturb known and unknown indigenous cultural heritage sites. The risk rating for known sites being medium and the risk for unknown sites being high.

The risk to known sites is mitigated, and reduced to a ‘medium’ rating through the following:

– All conditions being adhered to within the issued AAPA Authority Certificate(s) and Heritage Branch Advice (provided in Appendix G)
– Preferred Pirlangimpi Road alignment to avoid a yellow ochre collection site (refer Figure 11).

For unknown sites, mitigation measures reduce the residual risk rating to ‘medium’. These mitigation measures are detailed below:

– Should any item be encountered, which might be an artefact of heritage value or any relic, artefact or material which might be of Aboriginal or Torres Strait Islander origin, all construction work that might affect the item will cease. The items will then be protected from damage or disturbance. This reduces the residual risk to medium
– The works on this site will adhere to the DIPL’s Standard for Environmental Management, in order to manage the risk of impacting the environment in the area. To avoid misunderstandings, this specification states the following definitions:
    - Heritage item – An object declared under section 18 of the *Heritage Act 2011* to be a heritage object.
    - Heritage site – A place in the Northern Territory (whether or not covered by water) declared under section 17 of the *Heritage Act 2011* to be a heritage place.

- Hold point – A mandatory verification point beyond which a work process cannot proceed without authorisation by the Superintendent.

– Should any item, artefact, material or relic be encountered which might be of heritage value or Aboriginal origin, cease all construction work that might affect the item, artefact, material or relic from damage or disturbance and notify the Superintendent immediately. The Superintendent will arrange for appropriate specialists and community representatives to inspect the site.
– In the event that any potential archaeological sites are encountered, works in the immediate area should cease and the Heritage Branch of Department of Tourism and Culture be contacted for advice. Advise the Superintendent that this has happened.

7.4 Socioeconomic

This section summarises potential social and economic benefits because of construction and operation of the proposal. Risks to people and communities are outlined in the Environmental Risk Analysis (see Appendix A).

7.4.1 Construction of the Project

Construction of the Project could provide employment opportunities for local residents. In order to meet Indigenous Participation requirements, construction may also benefit Indigenous workers across the region and NT. Some roles will require work experience, certification and licenses; however, it is expected that the majority of roles will be entry level. Local and Indigenous workers may benefit from upskilling and training opportunities provided through the construction period. Employment and training opportunities could provide long-term benefits for these workers. Indigenous participation in construction could be supported by the Indigenous Participation Plan prepared for the project. Consultation with stakeholder engagement results indicated that employment and training opportunities could provide long-term benefits, and skills could be transferrable to other Indigenous communities on Tiwi Islands (see section 7.5).

Minimum targets for Aboriginal employment and engagement of Indigenous businesses will be determined by an Indigenous Participation Plan (IPP) and, in conjunction with National Indigenous Australians Agency (NIAA), will be set in the contract documentation and monitored throughout the contract duration.

The tender documentation will contain clauses that outline project objectives for local development. These clauses will outline contract requirements such as:

– Indigenous Participation – To seek to ensure a more active indigenous participation in the Contractor's activities through maximising employment, development and training opportunities, including the engagement of the Tiwi people and Tiwi operated businesses, including the Tiwi Islands Regional Council.
– Maximising the involvement and enhancing the skills and capability of the Tiwi People.
– Maximising the involvement of local and regional industry.
– Enhancing the skills and capability of local and regional industry.

Following formal handover of the road assets, TIRC will continue undertaking their responsibility for the maintenance of the assets. Hence, it is critical for TIRC to participate in parts of the construction works in order to develop their knowledge and skills that will be required to maintain the assets.

Ongoing maintenance will be required for the new works. These include re-line marking, replacement of damaged or missing road signs and guideposts, re-sealing, pavement repairs, pothole repairs and shoulders repairs. DIPL will assist TIRC with developing a Maintenance Strategy.

Construction could provide procurement opportunities, which could also benefit local and Indigenous businesses in general road construction, gravel production, concrete supply, protection works, labour hire and training. Presence of construction workforce in the local area may increase expenditure at local businesses, or at accommodation facilities. This may be a small economic benefit for these businesses for the duration of the construction period.

The road works intended for the Tiwi Islands will consider indigenous participation through the Contractor for a number of activities for the Project. These activities may include:

- Earthworks such as hauling and dumping fill material, and laying, watering and compacting fill layers
- Pavement works such as grading, compacting and trimming
- Drainage work such as installation of reinforced concrete box culverts and concrete works
- Protection works such as the installation of Reno mattresses and dumped rock
- Borrow pit operations and material extractions
- Servicing and maintenance of construction plant and equipment
- Work Zone 2 and 3 traffic management positions to manage traffic flow through the work sites and to and from the material and water sources
- General labour work
- Camp operations such as cooking and cleaning
- Transport of workers to and from camp and job site
- Environmental monitoring.

Of equal importance is the opportunity for on-the-job skills development and for key civil operator roles that are in high demand across the NT.

Tiwi Rangers are proposed to be utilised in any land clearing operations to confirm approval of clearing area prior to clearing being undertaken.

Tiwi Rangers have also been involved in the survey works undertaken by consultants as part of the planning and development of the referral. This has provided invaluable training and experience in the undertaking of surveys to meet guidelines and standards for flora and fauna assessments. Tiwi Rangers have also been involved with other previous construction works on Melville Island.

DIPL will be implementing in the tender documentation the minimum requirement for engagement of indigenous persons and businesses. The % will be taken from an approved Indigenous Participation Plan governed by The Indigenous Employment and Supplier-Use Infrastructure Framework that aims to increase Indigenous employment and supplier-use in the delivery of land transport infrastructure projects funded or co-funded by the Australian Government.

7.4.2 Operation of the Project

In recent years, road usage on Melville Island has grown with the operations of the timber plantation and population growth. This has affected the existing gravel road and its drainage features that are generally in poor condition and are subject to deterioration and inundation during the wet season. During the wet season, major weather events cause sections of the roads to become impassable or subject to prolonged restrictions due to flooding and saturated road pavements. An upgrade to priority sections of the road will improve flood immunity and reduce the duration of restrictions and road closures for road users during major weather events.

The road upgrade may improve motorist safety, reduce travel times, and provide year-round access between destinations. Significant targeted road maintenance and upgrade work is required for overall community safety and for local industry to meet their on-going development targets.

Sealing the selected roads on Melville Island may help unlock the economic potential of the region and open a range of new long-term economic and social opportunities for people across the island community. Economic opportunities could include tourism, forestry, mining and energy developments, and employment opportunities in those industries. Stakeholder consultation (see section 7.5) also indicated that the development of existing and future industries, such as cattle, cropping and mining, would be supported by the proposal.

It could also contribute to the Closing the Gap initiative (PMC, 2021) through improving access to health and educational services, facilitate social and cultural connections and reduce barriers to development, including operating costs for business.

The Project will upgrade the prioritised sections of the key access roads on Tiwi Islands to deliver essential economic, educational, health and social benefits through improved safe year-round access on sealed roads to priority areas.

Below are key flow-on social and economic benefits of the Project:

– Provide all-weather access between the communities and businesses on Bathurst and Melville Islands
– Support economic growth opportunities, particularly those associated with the potential export of plantation timber
– Create more employment opportunities from the upskilling of local peoples engaged on the works
– Create local longer term employment opportunities
– Create local business improvement opportunities through their engagement on the Project.
– Support business and economic certainty required to facilitate the growth of existing Indigenous enterprises and potential establishment of new Indigenous enterprise on the Tiwi Islands.
– Provide all-weather access to Tiwi College on Melville Island
– Improve education opportunities and outcomes through year-round access to schools
– Enable year-round cultural tourism enterprise to be developed
– Provide safer and trafficable roads for users

7.5 Stakeholder engagement

7.5.1 Consultations completed to date

The prioritisation of the Project will be governed by a Corridor Investment Strategy. This Investment Strategy provides an evidence-based approach to road transport infrastructure along the Corridor for both the Australia Government and local government, from high level planning through to pre-delivery.

Stakeholder engagement and consultation was performed through meetings with major organisations and leaders on Tiwi Islands. A number of meetings were held through 2020 and 2021 in Darwin and on the Islands with Tiwi Land Council and Tiwi Islands Regional Council. A site visit was conducted in mid-2020 that enabled DIPL staff to inspect all of the roads proposed for upgrades and meet with local stakeholders including forestry industry representatives. These consultations formed the basis of this investment strategy, including identification and prioritisation of projects.

DIPL provides regular and ongoing Project updates to the key stakeholders. DIPL's Transport and Planning Division communicates regularly with TIRC and TLC.

In addition to ongoing updates, DIPL have also consulted with key stakeholders on the topic of local employment throughout construction phase of the Project. They have also prepared a Draft Indigenous Participation Plan. This plan highlights the importance of employment opportunities in maintaining the Tiwi Islands local economy.

DIPL delivered a presentation to the Tiwi Land Council in March 2021. The presentation provided an overall outlook and plan for the delivery of the Tiwi Islands $75 million program. The presentation was positively received. DIPL also provide status updates via email to TIRC and TLC regarding significant milestones and decisions required by TIRC and TLC.

GHD have consulted with key stakeholders on behalf of DIPL regarding road design, traffic and road corridor assessment issues. Outcomes of this engagement have been summarised below:

– All stakeholders consulted identified Paru Road, Pirlangimpi Road, Pickertaramoor Roads as the most important, with Milikapiti Road also identified as important by some stakeholders.
– All stakeholders recognised the importance of the upgrading roads program and were supportive and interested in support the construction activities (including employment, consultation, and accommodation).
– Improvements to the road network would benefit local residents and industries on Tiwi Islands.
– Stakeholders identified the following current and future industries that could benefit from the Project:
    - Forestry industry
    - Proposed expansion of the cattle (buffalo) industry
    - Potential development of the blowfly plant industry (currently being researched)
    - Sand mining of Ranku Road

- Stakeholders identified that employment and training opportunities provided through the project could benefit wider Indigenous communities, as skills would be transferrable
- There have been no controls around gravel extraction in the past, and stakeholders are concerned about existing gravel extraction management processes.

Tiwi Rangers are proposed to be utilised in any land clearing operations to confirm approval of clearing area prior to clearing being undertaken. A mineral extraction agreement with TLC has been established providing formal approval to clear and extract from the nominated gravel pit areas and includes reimbursement for extractives to the Council.

7.5.2 Consultation strategy during construction

DIPL and the Contractor will notify local residents and businesses, including Indigenous communities, about new or changed construction activities which will affect access to their properties or otherwise significantly disrupt residents or occupiers use of their premises. DIPL will also provide ongoing updates to TIRC and TLC throughout the Project duration.

Unless the work is of an urgent nature for safety reasons, notification of residents must be at least 5 working days before commencing the work and must advise of the following:

– The nature of the work.
– Why it is necessary.
– The expected duration.
– Changes to arrangements for traffic or property access.
– The name and 24-hour contact telephone number of the contractor's representative who can respond to resident concerns.

Within one working day of receiving a complaint about any environmental issue, including pollution, the Contractor will supply a written report to the DIPL Superintendent detailing the complaint and action taken to alleviate the problem. A register of all such complaints will be maintained, together with the following records:

– Date and time of complaint.
– The method by which the complaint was made (telephone, letter, meeting, etc).
– Name, address, contact telephone number of complainant (if no such details were provided, a note to that effect).
– Details of complaint.
– Action taken in response including follow up contact with the complainant.
– Any monitoring to confirm that the complaint has been satisfactorily resolved.
– If no action was taken, the reasons why no action was taken.

8. Rehabilitation and closure

DIPL and its Contractors are committed to the progressive rehabilitation of each 1 ha gravel extraction throughout the construction phase of the Project and beyond. This program is one of the key environment protection and management principals, developed with the existing environmental conditions and associated key risks of the Project in mind.

The gravel pit rehabilitation program is largely governed by the principles detailed within DIPLs standard specification for environmental management, version 2.0 (DIPL, 2019). Further and specific details will also be included in the CEMP and a gravel pit management plan (to be developed by the Contractor and for which a framework is provided in Appendix E). These principals will include, but not be limited to the following:

– Provide the conditions conducive to rehabilitation of pre-existing vegetation quickly upon completion of the works
– The extraction area “floor” is to be ripped using dozer or grader tyres to a depth of 100 mm to 200 mm to loosen the floor to encourage new plants to establish. Ripping is to be carried out along contour lines to reduce erosion.
– The previously stripped and stockpiled material including topsoil and overburden is to be pushed back over the excavation, detour or access track. The topsoil will contain a natural seedbank. The surface of the topsoil is to be scarified along the contours which will further enhance the ability of the material to trap mobile seeds, dust and moisture.
– Spreading of cleared and stockpiled vegetative matter over disturbed areas prior to demobilisation. This will provide micro-habitats to assist the re-colonisation of flora and fauna across the site as well as slow run-off.
– Progressively rehabilitate extraction areas i.e., rehabilitate one pit before moving to the next.
– On completion of the works remove all facilities, unless otherwise agreed in writing with the owner or lessee of the land and restore the site to a clean and tidy condition.
– Rehabilitate the site to its condition prior to conducting site works
– The contractor will assume all responsibility for any current and consequential damage caused to the site as a result of occupation and pay for all remedial action required.

Following formal handover of the road assets, TIRC will continue undertaking their responsibility for the maintenance of the assets. Hence, it is critical if TIRC is able to participate in parts of the construction works in order to develop their knowledge and skills that will be required to maintain the assets.

Ongoing maintenance will be required for the new works. These include re-line marking, replacement of damaged or missing road signs and guideposts, re-sealing, pavement repairs, pothole repairs and shoulders repairs. DIPL will assist TIRC with developing a Maintenance Strategy.

9. Conclusion

The proposal to upgrade the Pirlangimpi Road and Pickertaramoor Road on Melville Island involves roadworks anticipated to commence in 2024 for approximately three to five years every dry season (April to October), with approximately 15-20 km of road constructed each year. The completion of this project will assist to unlock the economic potential of the region and open-up a range of new long-term economic and social opportunities for people across the island community. More specifically, benefits will include improvements to motorist safety, reduction in travel times, and provide driver amenities.

DIPL and its Contractors are committed to planning and conducting the Project in accordance with the environmental protection and management principals provided in this referral. The key aspect of these principals is the careful and considered approach to micrositing gravel pit areas to avoid, minimise and reduce potential impacts to biodiversity values coupled with the progressive rehabilitation of each 1 ha gravel extraction area throughout the construction phase of the Project, and beyond, in order to restore pre-existing vegetation as quickly as possible upon completion of the works.

The environmental risk assessment identified potential environmental impacts from activities associated with the Project. Impacts assessed as having risk ratings of ‘medium’ or higher include those to terrestrial environmental quality and terrestrial ecosystems consisting of the introduction and spread of invasive species; and to communities and economy and culture and heritage consisting of the disturbance of unknown indigenous cultural heritage sites. Specific mitigation measures for these potential impacts have been detailed throughout this referral and associated CEMP template. Based on this, it has been assessed that there are no residual significant impacts to NT EPA factors and objectives or matters of national environmental significance associated with the proposed works.

10. References

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