

REFERRAL UNDER THE ENVIRONMENTAL PROTECTION ACT

Holtze Development Area



December 2022

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EXECUTIVE SUMMARY

This Referral report was prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Department of Infrastructure Planning and Logistics (DIPL) to develop the Holtze Development Area ('the Proposal').

The Proposal is being referred to the NT EPA to determine whether formal assessment is required pursuant to the NT *Environmental Protection Act 2019* (EP Act).

The Proposal is located 1.8 km north of the Palmerston Central Business District (CBD) in the Litchfield Local Government Area. The Proposal area covers two vacant Crown land lots; Section 4231 and 4229 Hundred of Bagot and one freehold lot; Portion 2295.

The Proposal involves the clearing of approximately 116 ha for development of the Holtze Development Area, including:

- Holtze Land Release;
- Territory Reserve Parcel;
- The Palmerston Health Precinct; and
- Other residual future urban development areas west of Taylor Road.

Works include construction of enabling and subdivision infrastructure, comprising sewerage, water supply, power, communications, roads, drainage and social infrastructure.

Following initial enabling infrastructure works, the land will be subdivided and released for development of residential, commercial, public space and community purposes.

The NT EPA has developed a framework for the assessment of environmental impact. The framework uses 14 environmental factors to provide a systematic approach to organising environmental information and to establish environmental objectives against which proposals will be assessed. Pre-referral screening of the Proposal undertaken by EcOz Environmental Consultants determined that the Proposal has potential to impact six of the 14 environmental factors. A summary of the potential impacts and likelihood of the Proposal having residual significant environmental impacts on environmental values is provided below:

Summary of factors relevant to the Proposal and residual impacts

Factor	Reason for potential impact	Residual impact
Terrestrial environmental quality	Relatively large area of land and soil disturbance associated with the Proposal that could lead to erosion and sedimentation, and because the Preliminary Site Investigation identified some areas of contamination that would require addressing to ensure compatibility with the future residential land use.	Unlikely to be significant – mitigations available include Erosion and Sediment Control Plan and remediation of existing contamination.
Terrestrial ecosystems	The presence of threatened species and significant vegetation within the Proposal area.	Unlikely to be significant – impacts have either been avoided through design or can be mitigated through various standard mitigation measures.
Hydrological processes	Potential for alteration of overland flows and groundwater recharge as a result of the Proposal.	Unlikely to be significant – the Proposal has sought to minimise impacts through ensuring current hydrological flow paths are maintained, and modelling post-construction flows to ensure peak flows are reflective of pre-development

Factor	Reason for potential impact	Residual impact
		conditions using industry best practice mitigations (WSUD).
Inland water quality	Potential impacts to water quality from land clearing, construction activities and the urbanisation of the natural environment as a result of the Proposal.	Unlikely to be significant – the Proposal has sought to minimise impacts through a hierarchy of controls including avoidance (erosion control to eliminate sedimentation risk during construction) through to the adoption of industry best practice mitigations and proven treatment controls and devices (WSUD).
Community and economy	Potential impacts during construction, including to local amenity at nearby residential receptors and PRH due to noise and dust emissions, and exposure to biting insects potentially impacting human health.	Unlikely to be significant – the Proposal has sought to minimise impacts through extensive planning and consultation, basing design on relevant land capability and infrastructure needs assessments for the area. Although one impact is identified as being potentially significant, a biting insect management strategy has been prepared in consultation with Department of Health to demonstrate that this risk will be managed to an acceptable level.
Human health	Known biting insect risk in the area, and the potential impacts on human health.	Unlikely to be significant – DIPL has worked with Department of Health (Medical Entomology) to prepare a biting insect management plan outlining mosquito management measures including common mitigations to manage the risk to human health. In doing this, DIPL have worked to protect the health of the Northern Territory population, both during construction and operation, and have prepared a management plan that demonstrates risk to human health can be minimised to a level that is considered acceptable by Department of Health.

The environment protection and management measures outlined in this Referral indicate with appropriate avoidance, management and mitigation measures associated with the development, the Proposal is unlikely to result in material significant impacts to any of the six environmental factors assessed and therefore will meet the NT EPA's factor objectives.

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ACRONYMS

AAPA	Aboriginal Areas Protection Authority
ACM	Asbestos containing material
ASS	acid sulfate soils
BFV	Barmah Forest virus
BWQMP	Baseline Water Quality Management Plan
CBD	Central Business District
CEMP	Construction Environment Management Plan
CSMP	Conceptual Stormwater Management Plan
DENR	Department of Environment and Natural Resources (Northern Territory) – now DEWPS
DEPWS	Department of Environment, Parks and Water Security
DIPL	Department of Infrastructure Planning and Logistics
DLRM	Department of Land Resource Management (Northern Territory) – now DENR
DRLUP	Darwin Regional Land Use Plan
DRWCD	Darwin Rural Water Control District
DSI	Detailed Site Investigation
EP Act	<i>Environmental Protection Act 2019 (NT)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act (1999) (Commonwealth)</i>
ESCP	Erosion and Sediment Control Plan
GDE	Groundwater Dependent Ecosystem
GHAP	Greater Holtze Area Plan
GPT	Gross Pollutant Trap
HESLUP	Holtze to Elizabeth River Subregional Land Use Plan
ISLIP	Integrated Strategic Land Use and Planning
KUNV	Kunjin virus
LGA	Local Government Area
LSA	Land Suitability Assessment
MNES	Matters of National Environmental Significance
MREV	Murray Valley encephalitis virus
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 2013
NT	Northern Territory
NTEPA	Northern Territory Environment Protection Authority
NTPC	Northern Territory Planning Commission
NTPS	Northern Territory Planning Scheme
PCG	Project Control Group
PESLUP	Palmerston Environs Subregional Land Use Plan
PRH	Palmerston Regional Hospital
PSI	Preliminary Site Investigation
PWC	Power Water Corporation
RAP	Remediation Action Plan
RRV	Ross River virus
SAQP	Sampling Analysis and Quality Plan

SDG	Subdivision Development Guidelines
SPS	Sewer pump station
TERC	Territory Economic Recovery Commission
TPWC Act	<i>Territory Parks and Wildlife Conservation Act</i> (Northern Territory)
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
WSUD	Water Sensitive Urban Design
WWII	World War II

PUBLICATION STATEMENT

This Referral has been prepared by EcOz Environmental Consultants (EcOz) on behalf of the Department of Industry, Planning and Logistics. A listing of the key consultants, their qualifications and experience in the environmental field are provided below.

Key consultant	Qualifications	Experience
Glen Ewers <i>Managing Consultant – Ecology</i>	Bachelor of Science Bachelor of Law (Environment) Diploma of Arts (Environmental Studies) Graduate Certificate in Ornithology	15+ years
Emma Lewis <i>Managing Consultant – Water & Soil</i>	Bachelor of Science	11+ years
Alice Nicholl <i>Environmental Consultant</i>	Bachelor of Science Master of Science (BioScience)	2+ years

Inputs from relevant technical consultants have been provided throughout the development of this Referral. A listing of the key technical consultants, their qualifications and experience in the environmental field are provided below.

Key technical specialist	Specialist area	Qualifications	Experience
Steve Hart Current Environmental	Greenhouse Gas	Bachelor of Science PIEMA	18+ years
Dr Silvano Jung Ellengowan Enterprise	Archaeology and heritage	Doctor of Philosophy (Ph.D.) Master of Arts Master of Letters Bachelor of Arts	30+ years
Geoff MacKenzie Byrne Consultants	Stormwater and hydrology	Bachelor of Engineering Technology Graduate Diploma of Management TMIEAust, CEngT	20+ years
Sharmil Markar WRM Water & Environment	Flood modelling	Doctor of Philosophy (Ph.D.) Bachelor of Science (Engineering) (Hons) FIEAust, CPEng, RPEQ, NER IntPE(Aus), APEC Engineer	35+ years
Paul Graham Aurecon Group	Traffic	Bachelor of Engineering (Civil)	35+ years
Ken Body Fyfe	Social infrastructure	Bachelor of Applied Science	15+ years

1 INTRODUCTION

This Referral report was prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Department of Infrastructure Planning and Logistics (DIPL) to develop the Holtze Development Area (referred to in this document as 'the Proposal') (Figure 1-1).

The Proposal is being referred to the NT EPA to determine whether formal assessment is required pursuant to the NT *Environmental Protection Act 2019* (EP Act). This Referral also gives consideration as to whether the Proposal should be referred for assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1 About DIPL

The Northern Territory DIPL is a public sector agency created in September 2016 (NTG 2022). It was established under the administrative arrangements order issued by the Administrator of the Northern Territory (NT).

The department aims to drive the sustainable, economic and social advancement of the NT through:

- Land use and transport planning
- Infrastructure investment
- Effective logistics supply chains.

1.2 About the Holtze Development Area

DIPL undertakes its role in accordance with a draft Integrated Strategic Land Use and Planning (ISLIP) framework to coordinate a number of key functions including:

- Strategic Planning which includes the preparation of land use plans by the NT Planning Commission (NTPC) and includes extensive consultation with stakeholders and the community;
- Land Supply priorities, established for a 20 year period, and includes:
 - o a minimum of five years of Land Under Development;
 - o development prioritisation over 20 years based on estimated yields from Area Plans, and;
- Infrastructure delivery priorities over time for the construction of trunk infrastructure to support development potential in Area Plans.

DIPL has developed a draft land supply strategy to meet demand for new residential land as the population of Greater Darwin grows. The draft land supply strategy assessed areas for suitability for potential future urban development and will help ensure there is appropriate supply of new residential land as a key part in achieving the Government's economic and social objectives. Identifying suitable land for future development is key to ensuring there is land available for release to purchasers for development of new residential housing and community infrastructure.

Based on a high growth forecast, the next land release is required as early as 2023.

The Greater Holtze area (Figure 1-2) has been identified by Government as the next development front for the following reasons:

- Its vicinity to existing urban communities allowing for community interconnectivity.
- The requirement to ensure sustainability of the existing social infrastructure in Palmerston (currently under-utilised).
- The cost efficiencies associated with enabling infrastructure to support new development.
- It is the only viable location for development to occur that can meet the land supply strategy in a timely manner.

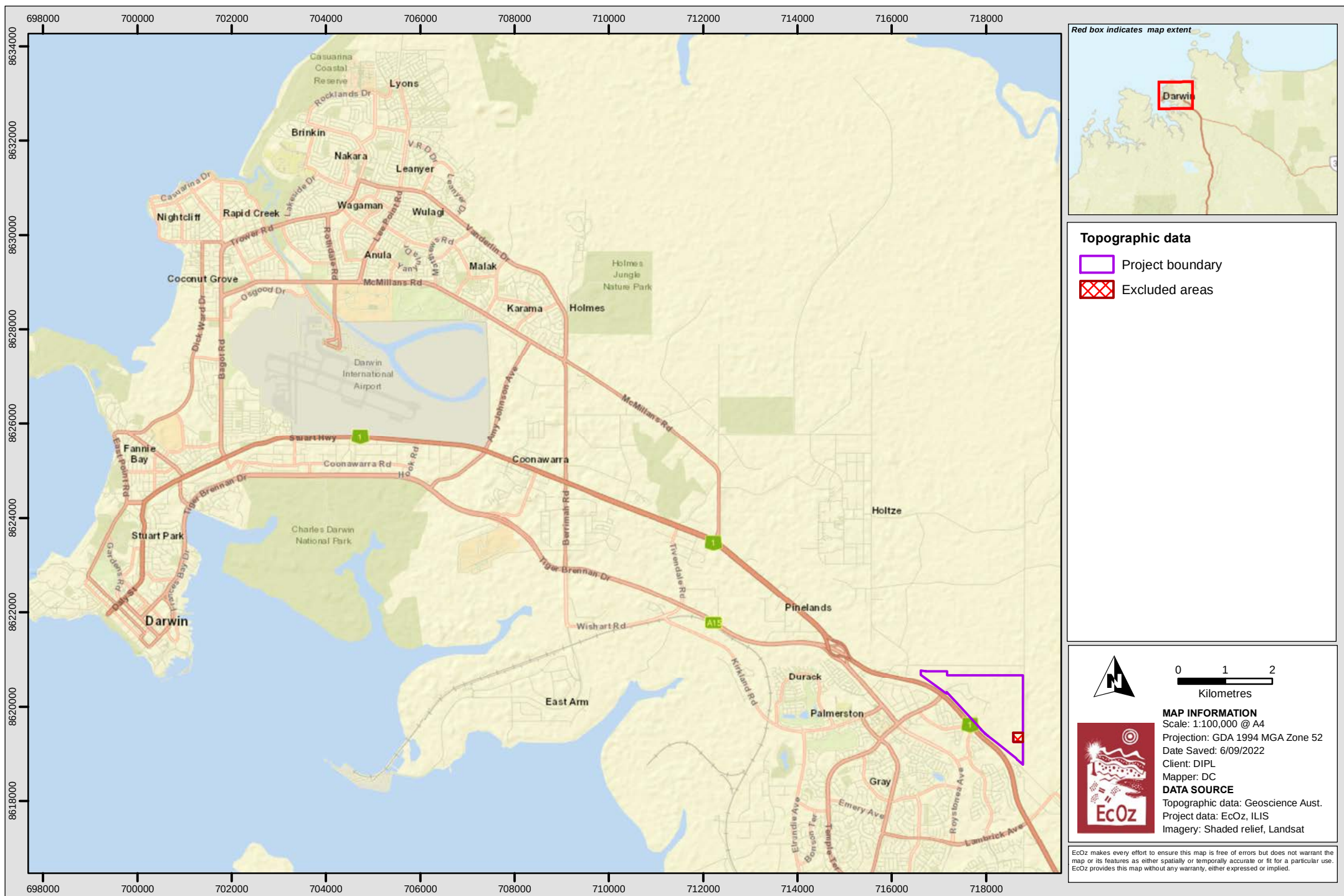
The Greater Holtze area is comprised of four potential development areas – referred within the Holtze to Elizabeth River Subregional Land Use Plan (HESLUP) as Holtze, Kowandi, Holtze North and Howard Springs North (Figure 1-2). This Referral describes potential impacts relating to the development of the Holtze area only – known as the Holtze Development Area (the Proposal).

The Proposal involves the clearing of approximately 116 ha for development of the Holtze Development Area, including:

- Holtze Land Release;
- Territory Reserve Parcel;
- The Palmerston Health Precinct; and
- Other residual future urban development areas west of Taylor Road.

Works include construction of enabling and subdivision infrastructure, comprising sewerage, water supply, power, communications, roads, drainage and social infrastructure.

Following initial enabling infrastructure works, the land will be subdivided and released for development of residential, commercial, public space and community purposes.



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Figure 1-1. Regional context of the Proposal

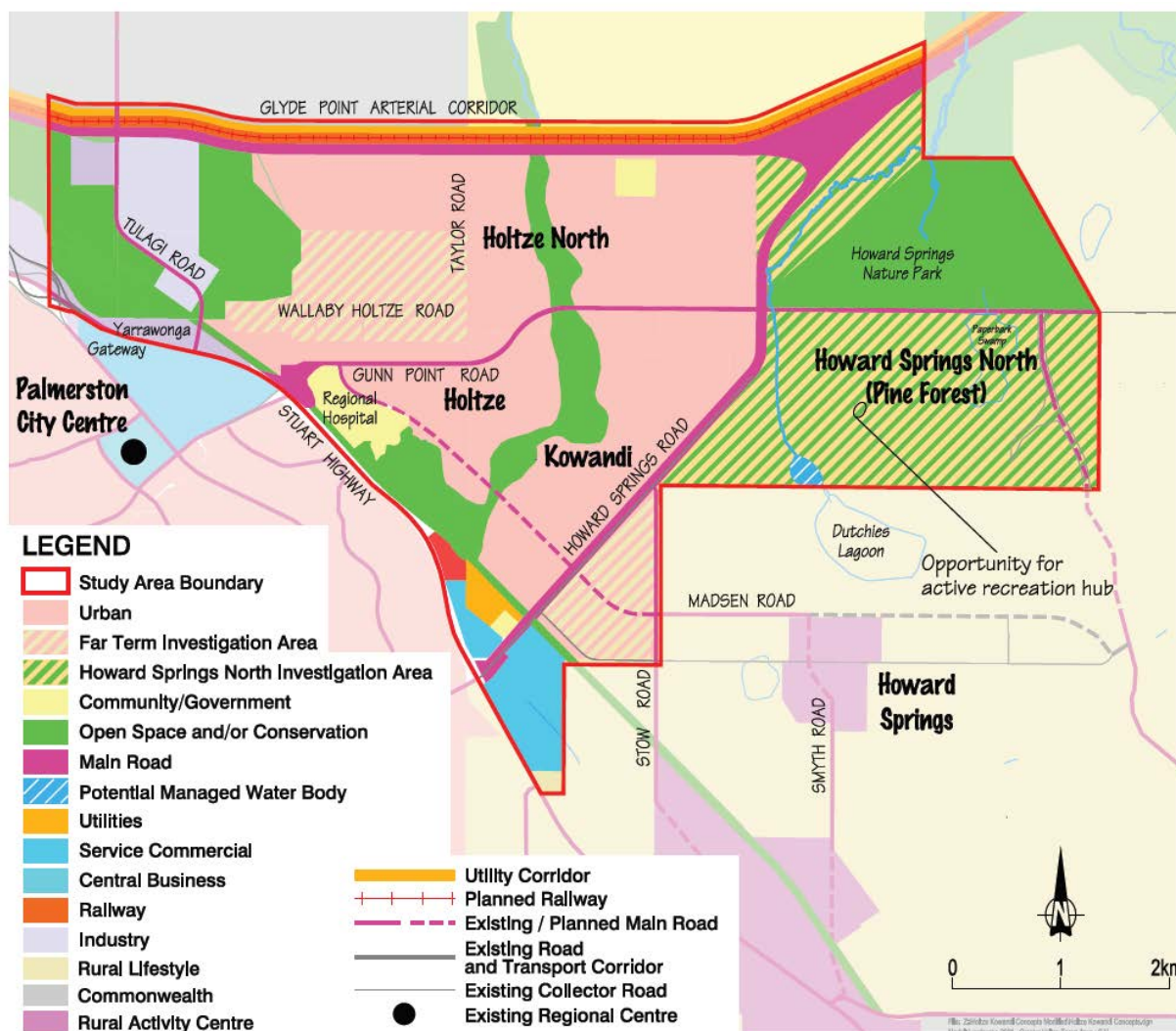


Figure 1-2. Map of the Greater Holtze focus area (HESLUP, 2022)

1.3 Regulatory context

The Proposal will adhere to all relevant NT and Commonwealth environment and heritage legislation and will be required to obtain all associated permits and approvals. The NT EPA will assess the information in this Referral to determine if the Proposal requires assessment under the EP Act. Relevant primary legislation is described in Table 1-1.

Table 1-1. Relevant legislation

Legislation	Relevance to Proposal	Agency
<i>Environment Protection and Conservation Act 1999</i> (Cth) (EPBC Act)	The EPBC Act is the Australian Government's key environmental legislation. Approval under the EPBC Act may be required for any proposed action likely to have a significant impact on a matter protected by that Act. The environment assessment and approvals process of the EPBC Act aims to protect Matters of National Environmental Significance (MNES), as well as the environment in general where actions proposed are on, or will affect Commonwealth land, and/or where Commonwealth agencies are proposing to take an action. The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water. The only MNES relevant to this Proposal are two listed threatened species; Black-footed Tree-rat and Northern Brushtail Possum. An assessment of the potential impacts on matters protected by the EPBC Act (MNES) has been undertaken for the Proposal and has determined that an EPBC Act Referral is not required (see Section 7.3 and Section 9).	Department of Climate Change, Energy, the Environment and Water
<i>Planning Act 1999</i> (NT)	Under the <i>Planning Act 1999</i> a Development Permit will be required for land clearing greater than 1 ha of vegetation for roads and enabling infrastructure. Development permits related to subdivision and development of the land will remain the responsibility of future developers.	Department of Infrastructure, Planning and Logistics
<i>Environment Protection Act 2019</i> (EP Act)	In October 2019 the <i>Environment Protection Act 2019</i> (NT) replaced the <i>Environment Assessment Act 1982</i> (NT). The EP Act and associated <i>Environment Protection Regulations 2020</i> sets out referral triggers, which require the proponent of a project to refer the project to the NT EPA for assessment. Pre-referral screening determined the Proposal has potential to impact six environmental factors and is being referred to the NT EPA to determine whether formal assessment is required pursuant to the NT EP Act.	Department of Environment, Parks and Water Security

1.4 Studies undertaken to inform this Referral

The following studies have been undertaken to inform this Referral:

- An Archaeological Survey of the Proposed Holtze Development Area undertaken by Ellengowan Enterprises in November 2014;
- A Preliminary Contaminated Site Investigation to assess potential contamination risk for the Holtze Development Area, undertaken by EcOz in 2014;
- Traffic Impact Assessment undertaken by Aurecon in 2015;
- A Land Suitability Assessment to assess the suitability of the land for development within the Holtze Development area undertaken by EcOz in 2015;
- Holtze-Kowandi North-Howard Springs Forestry Reserve Biting Insects Assessment November 2019 to October 2020 which included an assessment of the baseline and provided recommendations for future development, undertaken by Medical Entomology, NT Health in 2020;
- Holtze to Elizabeth River Regional Social Infrastructure Assessment to assess the regional social infrastructure needs to service future development of the Holtze to Elizabeth River area, undertaken by Fyfe Pty Ltd in 2021;
- Typhonium Conservation Strategy 2020/21 Field Season Summary Report undertaken by Department Environment Parks and Water Security (DEWPS) in 2021 ;

- An Ecological & Heritage Constraints Analysis for Holtze/Kowandi to identify the ecological and heritage values within the Greater Holtze area that may constrain future development and identify knowledge gaps for future approvals, undertaken by EcOz in 2021;
- An ecological values assessment for Holtze Residential Urban Development to inform the impact assessment for this Referral , undertaken by EcOz in 2021;
- Preliminary flood modelling for the Holtze-Kowandi area undertaken by WRM Water and Environment in 2021;
- Palmerston and Environs Strategic Planning Reports undertaken by Power and Water Corporation in 2021-22 to assess the options to provide water, sewer and power servicing of Greater Holtze; and
- A Detailed Site Investigation, including sampling and analysis, undertaken by EcOz in 2022.

2 ENVIRONMENTAL CONTEXT

2.1 Location and regional context

The Proposal is located 1.8 km north of the Palmerston Central Business District (CBD) in the Litchfield Local Government Area. The Proposal comprises:

- The Proposal area – Figure 2-1 and Table 2-1 – is the main site, bound by the Stuart Highway in the south, Taylor Road in the east and existing rural blocks along Wallaby Holtze Road to the north; and
- The enabling infrastructure – Figure 2-2 and Table 2-2 – are the combined areas of land adjacent to the Proposal area required for construction of enabling infrastructure.

These are discussed in more detail below.

2.1.1 The Proposal area

The Proposal area covers two vacant Crown land lots; Section 4231 and 4229 Hundred of Bagot and one freehold lot; Portion 2295 – (Figure 2-1). Immediately east of the Proposal area is Section 5623 (Kowandi) which is currently held by the Commonwealth Department of Finance. Section 7773 lies within the Proposal area and is the site of Palmerston Regional Hospital (PRH), accessed from Linco Road. Land information relating to the Proposal area – excluding enabling infrastructure – is included in Table 2-1 and shown in Figure 2-3.

There are two adjacent rural residential blocks along Taylor Road (Portion 2307 and 2277) that are privately owned are not included in the Proposal area. There is residual Crown land identified in the HESLUP for urban residential land uses, adjacent to these private blocks, that is included in this Proposal however has not been included in the Holtze Land Release for development in the near future.

Table 2-1. Summary of Proposal component locations

Latitude	-12.4751978
Longitude	131.0066316
Area	202 ha
Street address	213 & 265 Taylor Road and 102 Wallaby Holtze Road
Tenement details	Vacant Crown Land & Freehold
Lot/Section number	Section 4231, 4229 and 2295
Town/Hundred	Hundred of Bagot
Zoning	Rural Living (RL) (44 ha), Future Development (FD) (120 ha), Community Purpose (CP) (18 ha) and Proposed Main Road (PM) (20 ha).
Tenure	Vacant Land (and 2 current rural residences)
Ownership of land	Northern Territory Government
Surrounding land	To the north of the Proposal area are parcels of Freehold land zoned Rural Living (RL). A strip of land zoned Conservation (CN) is located between the southern Proposal area boundary and the Stuart Highway. To the east are undeveloped areas zoned Rural (R) and Rural Living (RL), and a large parcel of land zoned Commonwealth (Defence Establishment

Howard Springs). The Palmerston Indigenous Village zoned Community Living (CL) adjoins the south-eastern corner of the Proposal area. South of the Stuart Highway (and Proposal area) are the City of Palmerston suburbs of Johnston, Farrar and Yarrowonga (an industrial precinct).

2.1.2 Enabling infrastructure

Enabling infrastructure includes components such as sewer, water, and power mains that support and enable the use of land for residential and commercial development. Planning and assessment of the requirements for enabling infrastructure for the Holtze Development Area has considered potential future servicing requirements of the Greater Holtze area – not only the Holtze Development Area – to allow enabling infrastructure to be delivered in an efficient manner. This strategic planning process has been undertaken by the Proponent in conjunction with Power Water Corporation (PWC) in three phases:

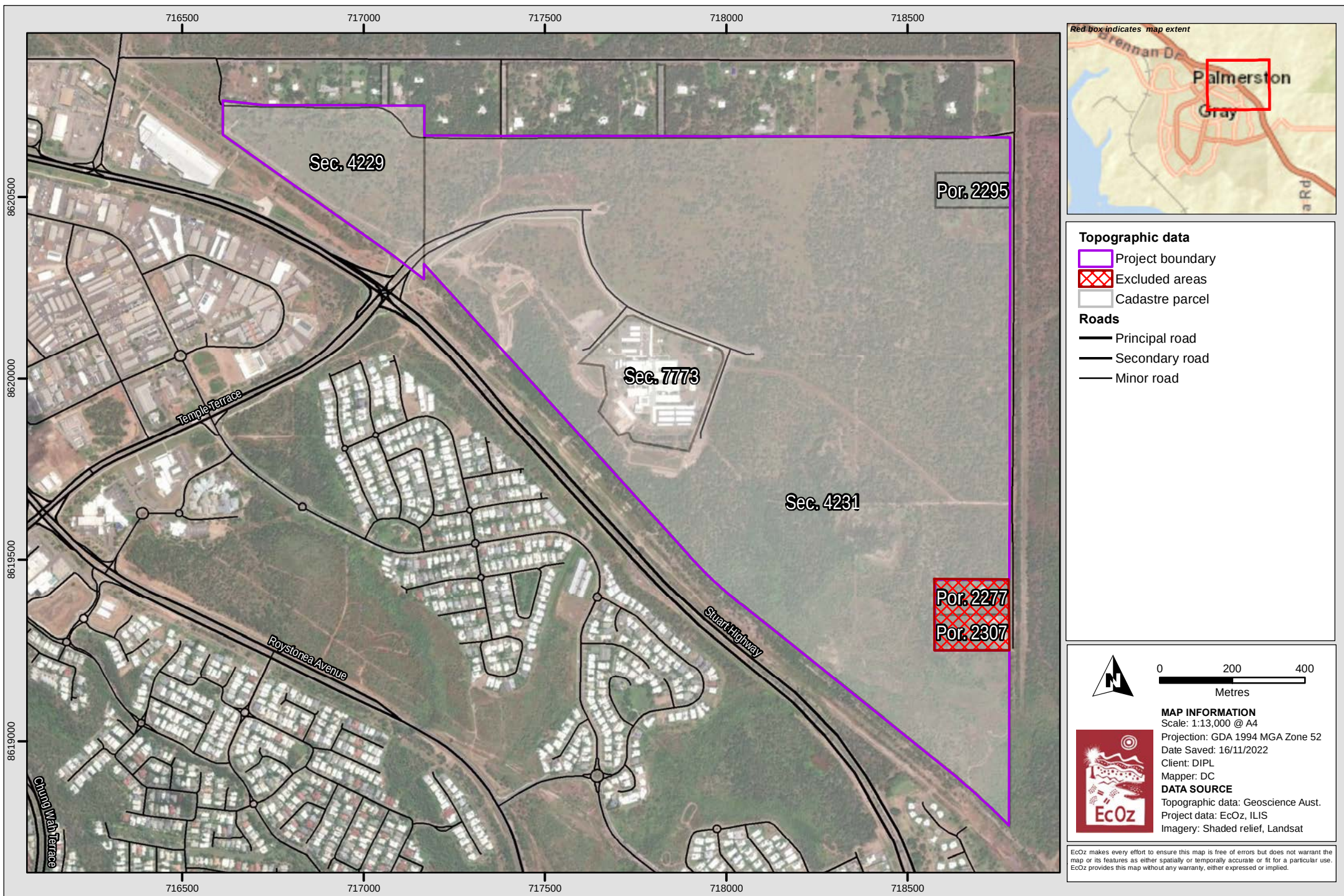
- Phase 1 – Assessment of existing network capacity and estimation of future demand from anticipated future development – including a low, medium and high growth scenario
- Phase 2 – Development of options to service the proposed future demand including identification of any potential land and/or easements required in the options.
- Phase 3 – Technical strategic report of a preferred option inclusive of staging timeline and high-level cost estimates

The Proponent and PWC have jointly developed a strategy for the enabling infrastructure in the Holtze Development Area that considers the broader regional requirements in addition to short term measures to support Holtze whilst the strategic planning for Greater Holtze is still underway.

The location of the enabling infrastructure identified to support the Holtze Development Area proposed for development as part of this Proposal is described in Table 2-2 and Section 3, and shown in Figure 2-2.

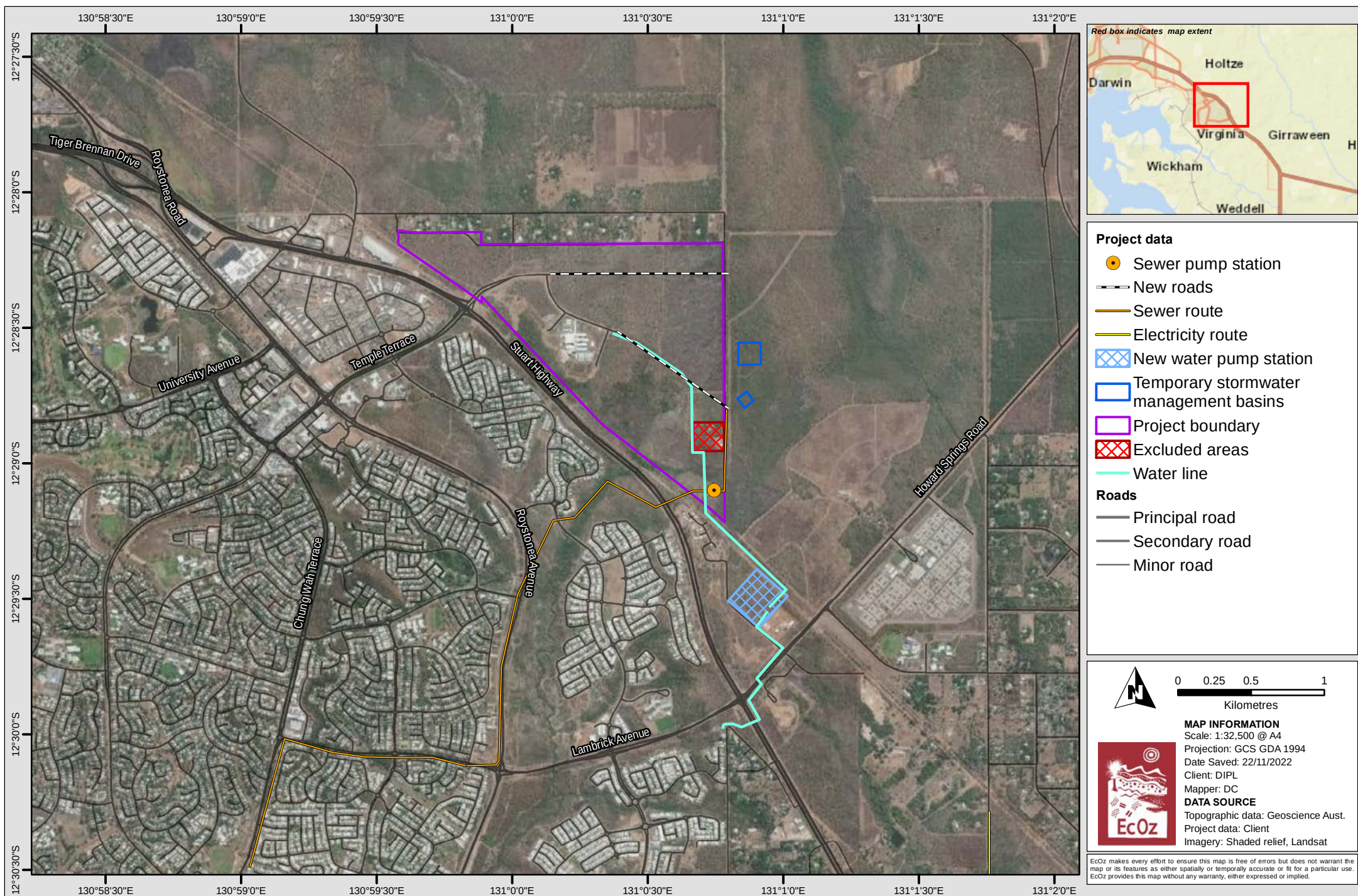
Table 2-2. Location of enabling infrastructure

Component	Location
Sewer main pipeline and access road	Hundred of Bagot • Section 4231 • Lot 4249 • Lot 4250 Stuart Highway Lambrick Avenue Chung Wah Terrace
Sewer pump station (SPS)	Hundred of Bagot - Section 4231
Water main pipeline	Hundred of Bagot • Section 4231 • Section 273 • Section 5623 Stuart Highway Lambrick Avenue Howard Springs Road
Water booster pump station and groundwater storage tank	Hundred of Bagot - Section 273
Mains power transmission line and access road	Hundred of Bagot - Section 3373
Temporary stormwater management basins (first land release)	Hundred of Bagot - Section 5623



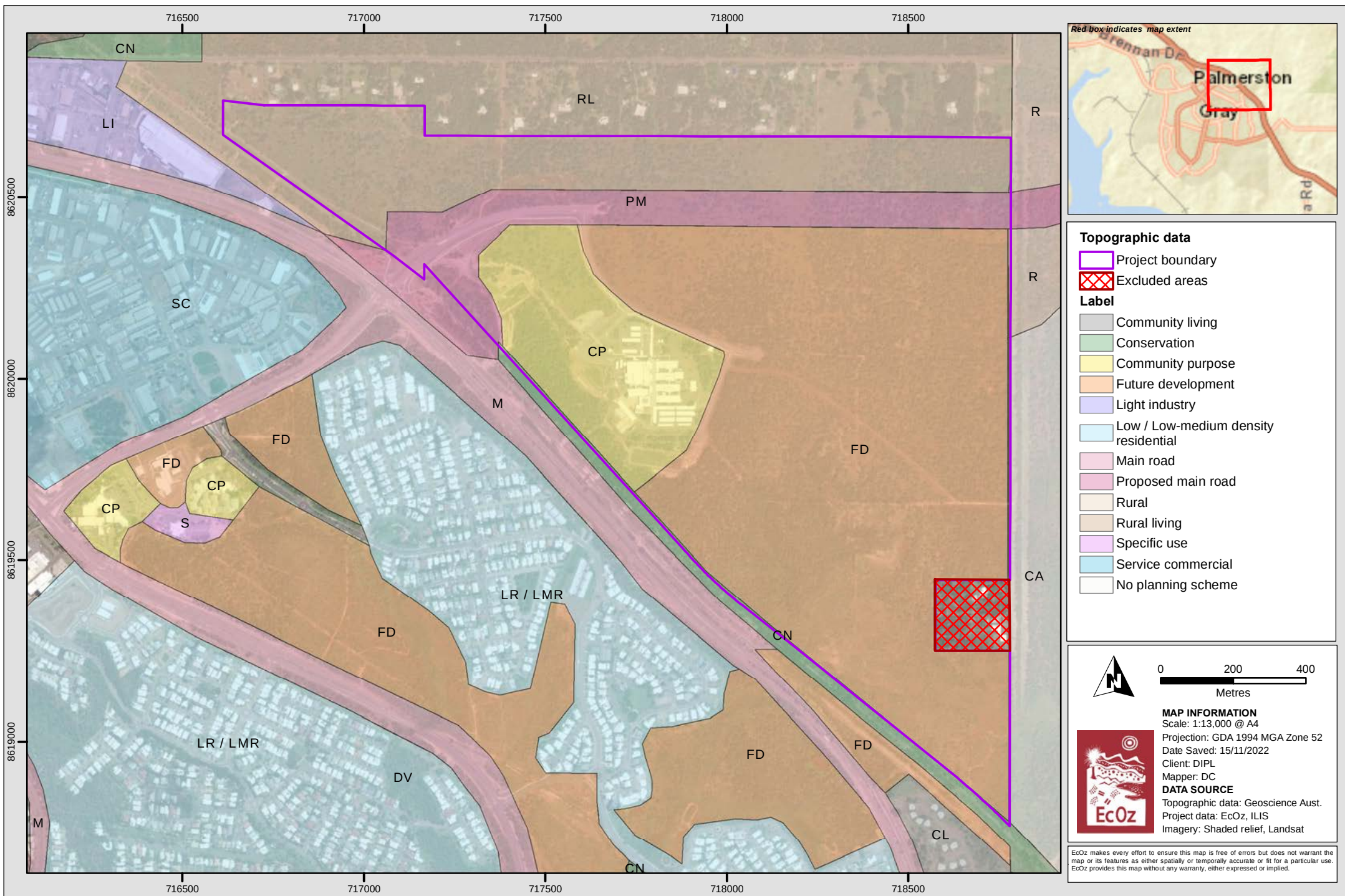
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Figure 2-1. Map of Proposal area



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Figure 2-2 Map showing Proposal area and enabling infrastructure



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Figure 2-3. Town planning zones in Proposal and surrounds

2.2 Description of the existing environment

The following section provides an overview of the existing environment. Where relevant to assessment of environmental factors, the receiving environment and sensitive receptors are discussed in Section 7.

2.2.1 Natural environment

Detailed descriptions of the soils, ecology and hydrology of the site are presented in Sections 7.2.2, 7.3.2 and 7.4.2, respectively. In general, the site consists of flat to gently undulating upland surfaces that slope steeply towards the Stuart Highway along the southern boundary of the site. The lowland drainage areas comprise the upper reaches of the Mitchell Creek catchment. The dominant vegetation is Eucalypt forest and woodland in the well-drained areas, and woodland/shrubland of *Grevillea* and *Pandanus* where the soils are seasonally-waterlogged.

Inspection of historical aerial imagery indicates that the northern portion of the Proposal area – approximately 90 ha – was cleared in the late 1960s and now comprises re-growth vegetation.

2.2.2 Significant sites or features

The Howard Springs Nature Park, an NT Government nature reserve, is situated approximately 4 km northeast of the Proposal area. The closest national park to the Proposal area is Charles Darwin National Park, approximately 11 km west.

No Aboriginal heritage sites or objects were identified within the Proposal area (Appendix A). A Register Inspection lodged with the Aboriginal Areas Protection Authority (AAPA) did not identify any known sacred sites in the Proposal area (Appendix B). An Authority Certificate covering the Proposal area has been issued (Appendix B).

There are no sites within the Proposal area listed on the Heritage Register. Five concrete slabs – four of which potentially were made during World War II (WWII) – were identified within the Proposal area, as well as a 'Sidney Williams Hut', a typical structure found in the Darwin area during WWII. Consultation with the NT Heritage Branch indicated that the slabs are unlikely to be of significance. There are many examples of WWII constructed slabs in the region and those of significance are formally protected as listed heritage sites. The Heritage Branch also indicated that the Sidney Williams Hut is very dilapidated and no longer holds historical value therefore no further assessment is required (Appendix C).

The Palmerston Indigenous Village is directly across the Stuart Highway, south-west of the Proposal area – approximately 200 m from the proposed Holtze Development Area open space and 900 m from proposed urban development. The Proposal area is adjacent to rural residential properties in the north and east.

2.3 Land use history

The site is not registered as a contaminated site under the *Waste Management and Pollution Control Act 1998* (WMPC Act).

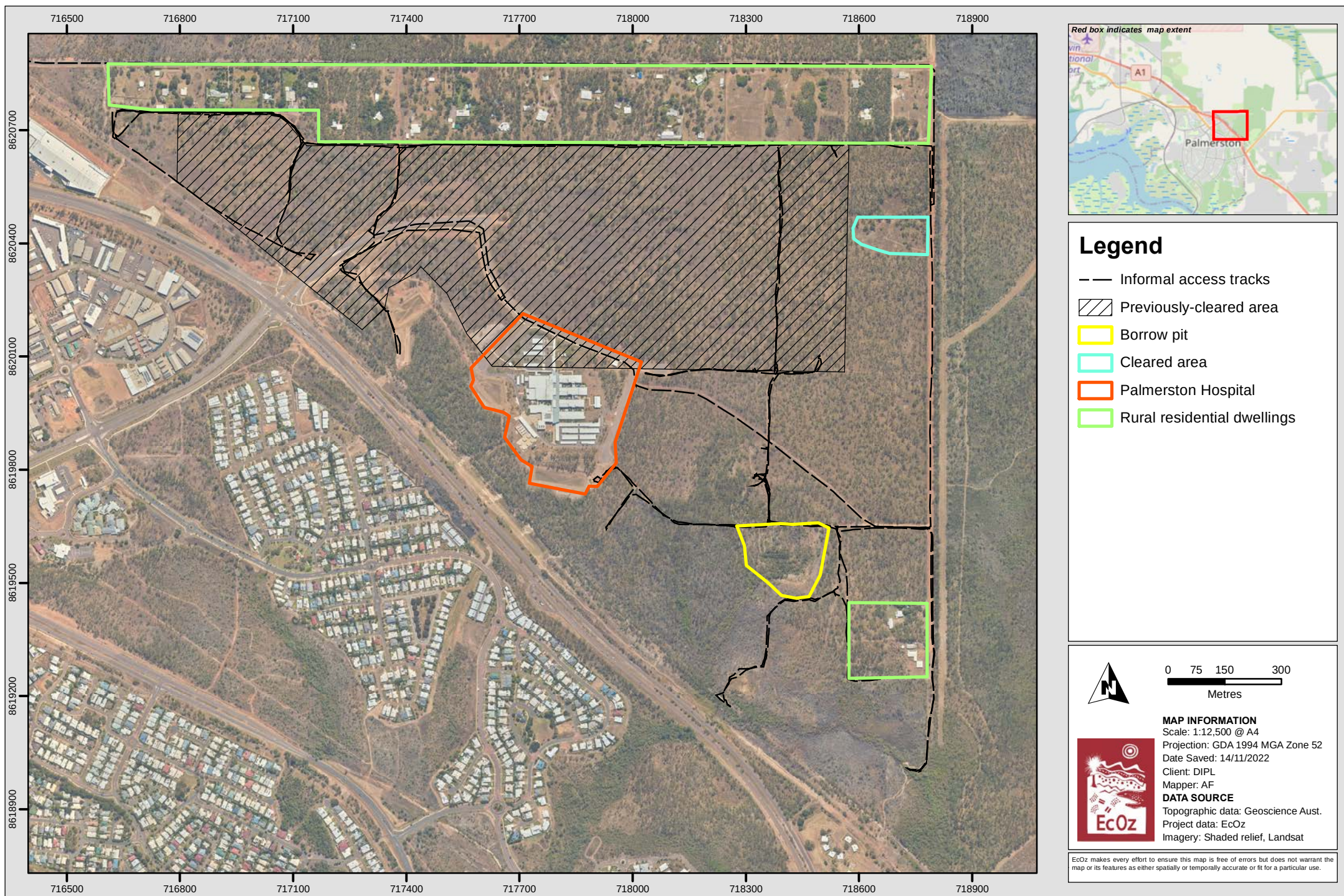
A Preliminary Site Investigation (PSI) of the Proposal area was undertaken in 2014 in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)*. The PSI included a desktop history review of the area as well as a site assessment to identify the potential for site contamination.

Available aerial photography was reviewed in order to determine the site history, with available images from 1969 to present. From the desktop review the following observations are made in relation to historical site land use:

- Vegetation in Section 4229 and northern part (approx. 40 %) of Section 4231 was entirely cleared in the late 1960's and has gradually re-grown without apparent further disturbance since that time.

- Rural blocks along Wallaby-Holtze Road were developed prior to 1969, with the number of constructed dwellings gradually increasing since that time.
- Informal access tracks are located throughout the Proposal area.
- A borrow pit in the south-eastern section was constructed between 1974 and 1993, which does not appear to have been utilised since that time.

The outcomes of the PSI are discussed further in Section 7.2, including further contamination investigations that are being undertaken with the engagement of an accredited contaminated lands auditor. A copy of the completed investigation will be provided with a Statement of Audit to the NT EPA once issued by the auditor.



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Figure 2-4. Proposal area land use history

3 PROPOSAL DESCRIPTION

The Proposal involves the clearing of approximately 116 ha for development of the Holtze Development Area, including:

- Holtze Land Release;
- Territory Reserve Parcel;
- The Palmerston Health Precinct; and
- Other residual future urban development areas west of Taylor Road.

Works include construction of enabling and subdivision infrastructure, comprising sewerage, water supply, power, communications, roads, drainage and social infrastructure.

Following initial enabling infrastructure works, the land will be subdivided and released for development of residential, commercial, public space and community purposes.

The Holtze Development Area will provide much needed residential land to support the growing population of Greater Darwin. The subdivision will result in residential dwellings, and a local commercial centre. Infrastructure constructed will also support the future expansion of ancillary health uses on the Palmerston Health Precinct.

To achieve this, the Proponent is seeking approval for the key activities outlined in Table 3-1.

Table 3-1. Key construction and operation activities

Proposal phase	Activity
Construction	• Site establishment, fencing, installation of temporary construction infrastructure (site offices, cribs sheds etc.) and installation of environmental controls (i.e., erosion and sediment controls) • Clearing and grubbing • Construction of new roads to service the area (earthworks, pavement installation, sealing works) • Stormwater drainage installation, including detention basins • Installation of services including water and sewer mains, electrical reticulation and street lighting, and telecommunication • Building construction works (foundations, structural work, internal services, fit-out, painting) • Landscaping
Operation	• Residential living • Community recreation • Public and private transport access • Asset management of services and roads • Irrigation of parks and verges

As the landowner and project managers of the Proposal area, the Proponent holds ultimate responsibility for the delivery of Holtze. However, the responsibility for the construction and physical development of Holtze is split across the Proponent as well as a future developer (yet to be assigned) and as such construction works will occur over stages. The Proponent is responsible for the delivery of enabling infrastructure whilst the developer will manage the works associated with the subdivision of the site into individual lots, including the construction of all associated infrastructure (i.e. internal roads, footpaths, connection of services etc). The responsibilities of each party are further detailed in Table 3-2.

This Referral relates to the development of the Holtze area only (not the Greater Holtze area) and enabling infrastructure required to support the development. The Proposal area is defined as the development within

the current Holtze lots – described in Section 2.1.1 – and the land required for enabling infrastructure in adjacent lots – described in Section 2.1.2. Environmental values outside of the Proposal area that have the potential to be impacted by the Proposal have been considered where relevant.

This Referral has been prepared acknowledging the various NT Government land use plans which allow for intensive development of Greater Holtze, including land immediately to the north and east of Proposal area. Environmental assessment of these surrounding areas will be undertaken following subsequent land use planning and development strategies related to the Greater Holtze area. Whilst not directly assessed in this Referral, this broader development context has been considered where relevant in the assessment of potential impacts of the Proposal. Land proposed for future development has not been relied upon to provide buffers or mitigations for impacts associated with the Holtze Development Area. This is particularly relevant to the Terrestrial Ecosystems factor, and so is discussed in more detail in Section 7.3.

Table 3-2. Responsibilities for Holtze delivery

Component	Proponent	Developer
Land clearing	Only where required for construction and installation of enabling infrastructure	Clearing to facilitate wider development (subdivided land and internal roads)
Earthworks	Minor earthworks to facilitate enabling infrastructure Earthworks to construct Linco and Gunn Point Road extensions	Earthworks to create a finished surface that complements the topography, the alignment of roads and the proposed stormwater drainage regime
Roads	Widening and extension of Linco Road Future extension of Gunn Point Road (formerly Glyde Point Road)	Construction access road within existing Gunn Point Road corridor All internal roads within the subdivision
Services	All enabling infrastructure leading to the Holtze Development area	All internal services and connections into individual lots
Stormwater	Construction of detention basins and outfalls to manage sitewide stormwater	Construction of internal stormwater network to service subdivision

3.1 Key components

The key components and features of the Proposal are presented in Table 3-3 and Table 3-4.

Table 3-3. Key Proposal components

	Component	Approximate footprint	Estimated clearing extent
Main development area			
Development infrastructure	Urban development area (residential, commercial and community uses)	76 ha	76 ha
	Sub-arterial/ Collector roads	7 ha	7 ha
	Open space and drainage	65 ha	6.5 ha
Other	Remaining area (north of the proposed Gunn Point Arterial)	45 ha	2 ha
Total development area		193 ha	91.5 ha
Existing development disturbance (hospital site)			9 ha
Total disturbance following development			100.5 ha
Ancillary works			
Enabling infrastructure	Sewer main pipeline	11.85 ha (5,925 m, 20 m corridor)	5 ha
	Water main pipeline	8 ha (4,000 m, 20 m corridor)	6.8 ha
	Water booster pump station and groundwater storage tank	9 ha	9 ha
	Mains power transmission line and access road	0.7 ha (680 m, 10 m corridor)	0.7 ha
	Temporary stormwater management basins	3 ha	3 ha
Ancillary areas disturbance			24.5 ha
Total Proposal area clearing required			116 ha
Total Proposal area disturbance footprint			125 ha

Table 3-4. Key Proposal features

Proposal element	Component	Details
Schedule	Construction	Q2 2023 – Q4 2025: construction of enabling infrastructure and early development works (i.e. land clearing) Q4 2024: first staged release of titled lots, construction works within subdivision
	Operation	Q4 2024 onwards – occupancy to follow construction of housing in first land release
Workforce	Construction	The residential development in the Holtze Land Release will support 577 direct jobs and 1,314 indirect jobs over the infrastructure, subdivision and residential construction period of the project. This is equivalent to approximately 38 direct jobs and 48 indirect jobs annually for 15 years and result in \$12.9 million in value added to the Territory economy.
	Operation	- The health precinct has potential for the development of over 10,000m² of floor space and house over 2,700 direct ongoing jobs at full development. These jobs are primarily in the industries of healthcare and social assistance, public administration and safety and professional and scientific services and result in \$433 million in value added to the Territory economy. - As the rest of the development area is residential, operational staff are not required. However, paid workers associated with maintenance of the residential area and open public space would be serviced by a combination of the Council, Crown Land and private industry.
Transport	Construction	- Construction materials will be transported to site via the existing road network. - A temporary access road may be required for construction of a new sewer pump station on Holtze via Taylor Road. - Construction workers would use existing transport options, including (but not limited to) public transport, pedestrian and cycle way, private vehicle.
	Operation	Local residents will use: - Public transport - There is an existing need to provide a frequent public transport service from surrounding areas to PRH. Development of the Proposal can support a relatively direct public transport corridor from Howard Springs to Palmerston via the hospital. The existing Palmerston Bus Interchange is ideally located near the neighbourhood and can support a frequent bus service to the hospital and neighbourhood centre as it grows. - Pedestrian and cycle way - The Proposal would provide an interconnected street network supporting access, route choice and designed with priority for convenient walking and cycling. The existing Darwin to Howard Springs Cycleway is of high quality offering a commuter and recreational facility for future workers and residents. - Private vehicle The Proposal also includes the extension of Linco Road and Gunn Point Road to support transport movement through the area. The extension of Linco Road to Howard Springs Road was identified within the Holtze Development Plan and has been retained in the HESLUP. The extension is intended to promote an interconnected local road and shared transport network. The extension of Gunn Point Road through the

Proposal element	Component	Details
		Holtze Development Area to the PRH intersection is also identified in the HESLUP as a sub-arterial road to support traffic movements to and from the future development areas of Greater Holtze.
Water source	Construction	- Water required predominantly for dust suppression and pipeline commissioning. - Sourced from existing PWC reticulated water mains.
	Operation	- A new transmission main is proposed from the Zuccoli elevated tank to supply water to Holtze Development Area. - A temporary booster pump will be required to provide the pressures required for the Holtze Development Area. The booster pump will be constructed on Section 273 (Crown Land), where PWC has planned for a water storage tank farm. - Further development of the Greater Holtze area will require the construction of additional ground level reservoirs on Section 273.
Energy source	Construction	Diesel-powered generators and machinery, or battery-operated equipment as required.
	Operation	- Connection to the existing feeder 22PA202 (Howard Springs) with network augmentations (new high voltage interconnections and cable replacements). - The existing feeder into Holtze from the Palmerston zone substation will be extended for adequate supply.
Emissions	Construction	- Noise, dust and greenhouse gas emissions through general machinery use and vehicle movements. - Appropriate mitigation measures are to be included in construction environmental management plans (CEMP) to minimise any impact. - An estimate of scope 1 and scope 2 GHG emissions associated with land clearing, construction, and utilities work for the Proposal was undertaken. No relevant scope 3 emissions were identified (see Appendix D). - The Proposal does not trigger the thresholds outlined in the NT EPA's draft <i>Environmental factor guidance: Atmospheric processes</i> and as such greenhouse gas emissions is not a significant factor to consider in the referral.
	Operation	- The purpose of the Proposal is to provide additional housing for a growing population, which in turn results in increased greenhouse gas emissions for the Darwin region through increased vehicle movements and power consumption. - However, as these emissions are directly related to population number, the per capita estimates are not expected to increase.
Waste	Construction	- Portable ablution blocks will be utilised for the construction workforce and will be serviced by a licenced waste contractor as per the <i>Waste Management and Pollution Control Act 1998</i> (NT). - Construction and putrescible waste generated through works will be stored in appropriate containers for disposal at a licenced waste management facility.

Proposal element	Component	Details
		Waste generation through construction is anticipated to be minimal due to the nature of the works (i.e. predominantly trenching earthworks, roadworks and installation of service networks).
	Operation	- Connection into the existing downstream DN1050 trunk sewer in Palmerston. - A new sewer pump station is required for the Holtze Development Area and it is preferred that this pump station is constructed on the low-lying land in the south-east corner of the Proposal area. The initial sewer rising main will be constructed for the Proposal area along a corridor adjacent to Roystonea Avenue, then west alongside Lambrick Avenue, then south down Chung Wah Terrace and connect into a new sewer trunk gravity main feeding into the existing trunk sewer (as shown in Figure 2-2). - General and recycling kerbside waste collection service provided to residents through the local Council authority. - Stormwater to be managed through a network designed to appropriate standards
Hazardous substances	Construction	- Diesel, oils, lubricants, paints, solvents and other substances relevant to general building construction. It is not expected that any bulk quantities of materials will be stored on-site, and refuelling will occur off-site at appropriate facilities. - Construction contractors will maintain a hazardous substance register for the site, including storage location, summary of hazardous/dangerous goods status and links to Safety Data Sheets (SDSs). - All hazardous substances, dangerous goods and other chemical products will be stored, used and managed in accordance with their SDSs (including appropriate bunding requirements).
	Operation	The proposed land use (residential, community and open space) will not result in quantifiable volumes of hazardous substance storages in the area.
Decommissioning and rehabilitation		- The final infrastructure will result in a paved and landscaped urban development. - All other areas of disturbance (such as service corridors) will be rehabilitated post construction to match pre-disturbance conditions.

3.2 Development precincts

The Proposal area has been divided into a number development precincts (Figure 3-1), including:

- Holtze Land Release;
- Territory Reserve Parcel;
- The Palmerston Health Precinct; and
- Other residual future urban development areas west of Taylor Road (private and Crown land).

An open space and drainage zone will remain on the southern half of the development footprint. Clearing of some vegetation will be required for construction of the drainage infrastructure. The drainage infrastructure design is currently conceptual, therefore the clearing extent has been estimated at up to 10% of the area (12.2 ha). The residual open space will remain as natural vegetation for community recreational use.

The area north of the proposed Gunn Point Road (bordering with the existing rural properties on Wallaby Holtze Road) is not proposed for development as part of the Proposal. This area is to remain as a buffer zone to the Rural Living area until future land use plans are adopted to allow for further development. The area may require minor disturbance along drainage easements in the short term for installation of stormwater infrastructure.

The residual urban development areas west of Taylor Road will remain as private and Crown Land until future development is planned. The area may require minor disturbance on Crown land in the short term for construction of water and sewer infrastructure.

3.3 Social and economic considerations

The Proposal allows for the release of land to meet the future demand for serviced land, particularly residential dwelling lots. Land release in this area provides housing choices in a location with good access to social infrastructure. Residential growth in the Holtze Development Area will generate demand for commercial land in local centres to support convenience retail, as well as service existing commercial land that will benefit from passing trade. The development will leverage significantly on Palmerston's existing commercial and social infrastructure however, it is likely that new infrastructure will be required. A regional social infrastructure assessment was undertaken as part of the HESLUP development to inform the future area plan.

The PRH has established demand for adjacent ancillary medical and support services – including accommodation for health workers.

Social infrastructure

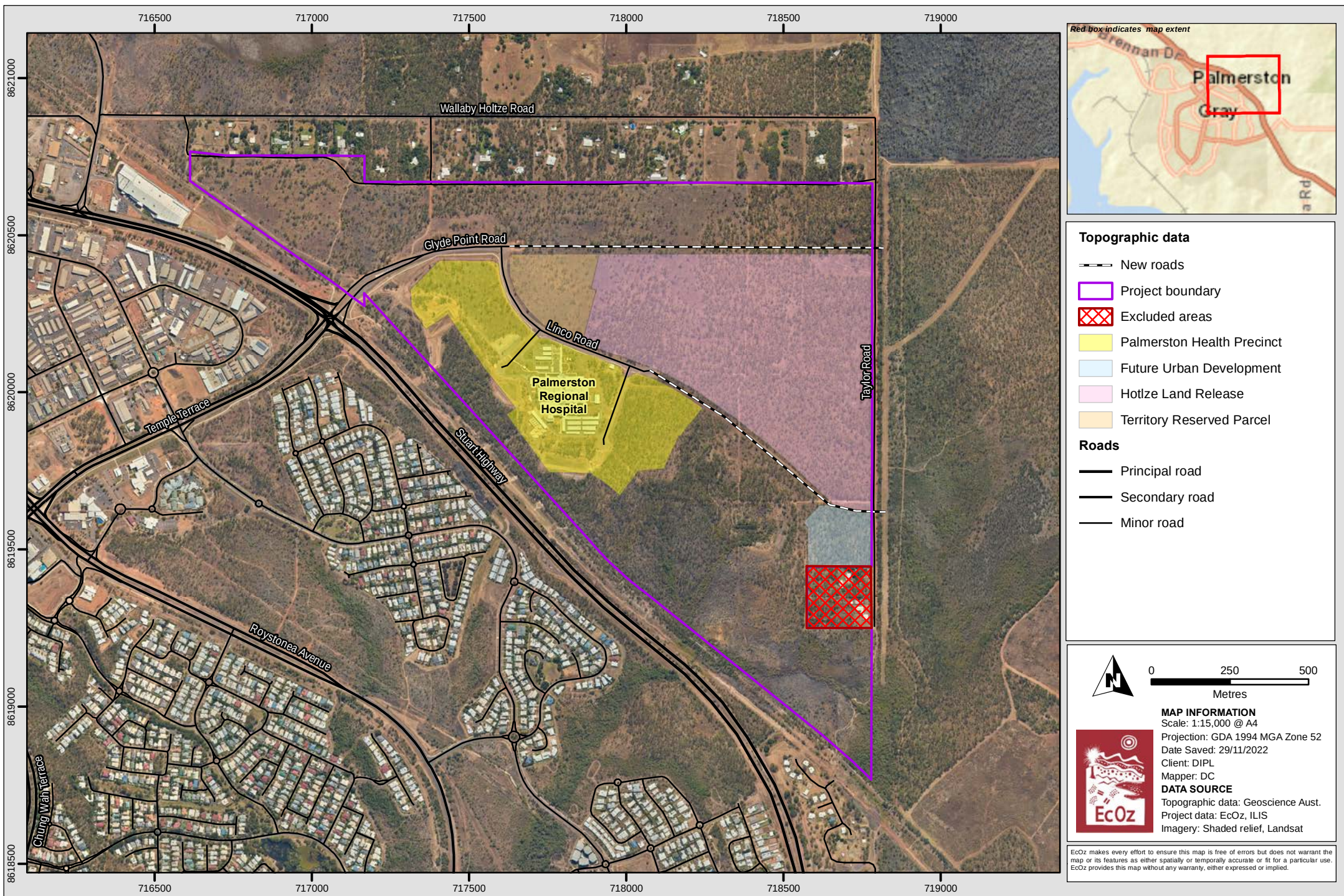
The regional social infrastructure assessment identified that there is currently capacity in existing schools in the surrounding areas to facilitate the Holtze Development Area population. However, it is likely that additional public and private schools may be required in the medium- to long-term and should be considered within the Greater Holtze area. Schools will be located such that there is easy access to the sub-arterial road network (to minimise 'rat-running' through suburbs) and facilitate safe walking/cycling to schools. Schools will be located such that ovals, sporting facilities (e.g., basketball/netball hoops) and playgrounds can be integrated with the open space networks for after-hours community use.

Emergency services – fire and ambulance services will be located on arterial/sub-arterial networks to allow for appropriate response times. It is likely the new Palmerston Police and Fire stations will also service Greater Holtze.

Commercial infrastructure

The Holtze Area Plan (2016) includes a small commercial/mixed use area for the purpose of convenience retail to support the neighbourhood, and in particular PRH and the Palmerston Health Precinct. Palmerston is

already serviced by several large shopping centres, and the large centres in Coolalinga are within easy driving distance. The new Holtze Development Area population will increase the commercial viability and vibrancy of the existing shopping centres in the Palmerston CBD, and further large-scale commercial competition will not be encouraged.



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Figure 3-1. Map of Proposal development precincts

4 SITE SELECTION AND ALTERNATIVES

The section examines the various alternative sites, layouts and approaches that were considered prior to deciding upon the Proposal presented in this Referral.

4.1 Development need

The NT Government has a vision of a sustainable and diverse \$40 billion economy by 2030. The Territory Economic Reconstruction Commission Report (TERC Report, TERC 2020) laid out a framework for achieving this vision, providing advice on the key strategies, approaches and actions that will increase private sector investment, leading to industry growth, business opportunities and sustained and sustainable jobs growth in the NT.

Many of the economic opportunities outlined in the TERC Report are linked in some way to further land development in the Greater Darwin region. This includes opportunities to develop industrial hubs and precincts; enabling infrastructure such as ports, powerlines and roads; and residential and commercial development to service an expanding population. Inability to source required land, or excessive delay or uncertainty in its provision, has been identified as a major potential barrier to the Territory's economic growth.

Recent experience in the Darwin housing market demonstrates the problems that occur when the supply of adequate and affordable serviced land for housing lags behind demand. Potential home or residential land buyers are disadvantaged by the acute supply shortage as house and land prices rise beyond the reach of many, particularly first home buyers.

4.2 Site selection

The Darwin Region Land Use Plan (DRLUP) was adopted in 2015 with the purpose of identifying the essential characteristics and needs that will shape future development across the region. The plan also provides a policy framework to guide future development whilst balancing protection and use of the natural environment. The DRLUP identifies strategies to ensure the sustainable supply of housing across the region, including infill development (building within unused or underutilised land within existing development areas) and greenfield development (previously undeveloped areas). Based on population projections, the DRLUP identifies that roughly 50% of housing demand can be achieved by infill and 50% by greenfield development.

Infill development is still progressing in areas such as Northcrest and The Heights Durack, however other potential infill areas under review are insufficient to provide the housing needs identified to achieve the NT growth targets, therefore more greenfield development is required. The Lee Point locality and the eastern suburbs of Palmerston are the final greenfield developments possible within existing urban boundaries, therefore new greenfield opportunities in the Litchfield Local Government Area (LGA) are being explored.

The importance of Litchfield LGA within the Greater Darwin context lays in its land and water resources, natural and cultural heritage, and regional urban and rural growth potential (DLPE, 2015). Litchfield's proximity to established urban concentrations and abundant land showcases that future urban development will be located within this subregion (DLPE, 2015).

Key development areas identified in the DRLUP include:

- Residential and associated development including urban, peri-urban and rural lifestyle areas within the Litchfield LGA:
 - o Holtze – includes a new hospital and surrounding urban development
 - o Weddell – includes a planned future city with associated development areas around Noonamah with provision of a range of urban, per-urban and rural residential and lifestyle lots

- o Murrumujuk – this area is associated with Glyde Point (strategic industrial development) north of Shoal Bay
- Cox Peninsula – urban area which requires major infrastructure investment and is dependent on resolution of the Kenbi land claim
- Industrial and associated development actions at Middle Arm and Glyde Point
- Proposed airport – Blackmore Peninsula.

4.2.1 Site development challenges

The key development areas identified in the DRLUP all face similar challenges for development including the potential impact to significant riparian vegetation and/or listed threatened species, such as:

- Black Footed Tree Rat;
- *Typhonium praetermissum*; and
- Darwin Cycad.

Potential environmental impacts associated with development of greenfield land to support population growth are well understood, and all potential future development areas are faced with similar environmental challenges. Social and economic factors should also be considered in selecting the most appropriate area for the first land release.

The Greater Holtze area has a number of opportunities that support its development for urban land uses, including:

- Existing and previous disturbance of the area through land clearing for rural land uses, extractive mining and Defence uses;
- It is close to existing social infrastructure in Palmerston and Howard Springs which support social inclusion of the residents in Greater Holtze; and
- It is more cost effective to develop in the short to medium term due to proximity to the Palmerston infrastructure network.

Other development areas identified in DRLUP, including Weddell, Cox Peninsula or Murrumujuk, would be subject to social exclusion, exponentially higher development costs and greater disturbance to native ecosystems if developed in the short to medium term.

4.2.2 Greater Holtze site benefits

The Greater Holtze area was identified as the most suitable development front for the following reasons:

- Its vicinity to existing urban communities allowing for community interconnectivity;
- The cost efficiencies associated with the ability to utilise existing social infrastructure in Palmerston;
- Proximity to current and future employment areas of Palmerston CBD, PRH and the future Palmerston health precinct resulting in reduced travel times and vehicle dependency;
- To support the existing Regional Centre in Palmerston;
- The cost efficiencies associated with enabling infrastructure to support new development; and
- Allows development to occur that can meet the demand for land identified in the land development strategy in the short to medium term.

The availability of former Commonwealth Defence establishment land (Kowandi) and Crown Land in the area creates the potential for approximately 5,000 dwellings in the near to mid-term. The Proposal area (Holtze) has been identified as the first suburb for development in Greater Holtze (with approximately 700 dwellings).

4.3 Site layout

The Holtze site layout has been designed based on area planning principles and a land suitability assessment for the area. These are discussed below.

4.3.1 Area planning

Under the NT Planning Scheme (NTPS), the strategic framework is made up of plans and policies which all form part of the NTPS. These plans and policies describe how the government expects land to develop now and, in the future, and when incorporated into the NTPS, include planning principles to guide best practice development. The Greater Holtze area – including the Holtze Development Area which is the subject of this Referral - has been the subject of multiple strategic planning assessments and plans since 2015, the most recent of which being the Greater Holtze Area Plan (the Area Plan). As the Area Plan is still undergoing development and consultation and is yet to be incorporated into the NTPS, the Holtze Development Area (this project) land release will progress in accordance with the Holtze Area Plan and Planning Principles 2016 (the *principles*). The *principles* were incorporated into the NTPS in March 2016, and it is not anticipated that there will be any significant changes to the NTPS resulting from the Area Plan.

These planning principles include the provision of lots across a broad range of densities to support a mix of housing types and provide housing choice in appropriate locations. The principles also include the development of a mixed use health precinct adjacent to the PRH. The gazetted area plan includes the following neighbourhoods and densities:

- Compact walkable neighbourhood – 20 to 40 dwellings per hectare.
- Compact walkable neighbourhood – 10 to 20 dwellings per hectare.
- Residential area outside the neighbourhood – 10 to 14 dwellings per hectare.

4.3.2 Land suitability

A land suitability assessment (LSA) for the Proposal area was undertaken in 2014 to understand any environmental constraints to development across the site (Appendix E).

The assessment identified three suitability classes in relation to proposed subdivision activities; unconstrained land, marginally suitable land and not suitable land (constrained). The findings of this assessment helped to inform the development areas and the constrained land has largely been avoided through design. The details of the LSA and the constraints identified are discussed further in Section 7 along with identified mitigation measures where appropriate.

5 PRINCIPLES OF ENVIRONMENTAL PROTECTION AND MANAGEMENT

The Proposal has applied the principles of environment protection and management (Part 2 of the EP Act), and section 43 general duty on proponents. Details of this are provided in Table 5-1.

Table 5-1. Checklist of the EP Act section 42 and 43 requirements

Section 43 General duty	Comment
<i>Have the following principles of ecologically sustainable development been taken into consideration in the design of the proposed action?</i>	
• Decision-making principle	Yes – the Proposal has considered both short- and long-term impacts and benefits – including impacts during construction and occupancy of the Proposal. There has also been extensive ongoing consultation regarding plans to develop the Holtze Development Area, as described in Section 6.
• Precautionary principle	Yes – this assessment is based on both existing information and studies undertaken specifically for the Proposal and undertaken by suitably-qualified professionals. As a precaution, studies were undertaken early in the planning process to provide the necessary confidence to make an assessment of potential risks and impacts.
• Principle of evidence-based decision-making	Yes - this assessment is based on both existing information and studies undertaken specifically for the Proposal and undertaken by suitably-qualified professionals.
• Principle of intergenerational and intergenerational equity	Yes – the Proposal aims to benefit and improve access to housing and services for current and future generations of Territorians, providing increased social and affordable housing availability in line with projected population growth. The Proposal will also enable high paying skilled jobs to be located locally. The Proposal has undertaken extensive environmental assessments to minimise impacts to the environment, designing land use zones based on suitable land capability assessments and retaining areas of open space to provide a green corridor for fauna movement and retention of habitat. Consultation with relevant stakeholders has guided plans for energy and water sources to minimise pressures on the existing environment resulting from population growth.
• Principle of sustainable use	Yes – Engagement with relevant stakeholders has confirmed there is sufficient capacity in the power and water network to support the Holtze Development Area.
• Principle of conservation of biological diversity and ecological integrity	Yes – ecological assessments have been undertaken for the Proposal to inform design and development. Open space areas in the future development area have been incorporated to retain and support habitat connectivity and riparian vegetation within the Proposal area. DIPL is working with DEPWS to identify occurrences of <i>Typhonium praetermissum</i> , and Black-footed Tree-rat and Northern Brushtail Possum habitat that can be conserved within the Greater Holtze region, planning mechanisms (and associated responsibilities) for doing so, and offset sites. Additionally, DIPL and DEPWS are preparing a draft regional conservation and offset plan for Greater Darwin.
• Principle of improved valuation, pricing and incentive mechanisms	Yes – Environmental outcomes are considered by DIPL when comparing design options for enabling infrastructure. Environmental performance is considered by DIPL when assessing tenderers undertaking construction works on DIPL's behalf.

	Environmental factors and desired environmental objectives for the development are outlined in the NT Planning Scheme (NTPS) and land use plans prepared by the NT Planning Commission (NTPC). Prospective developers will include in their proposals for development, an outline of how they propose to respond to these environmental objectives, which is a factor in the assessment process of selecting the successful Developer. There will be various parties generating waste during the various construction phases of the project including contractors delivering infrastructure on behalf of DIPL, the land developer and individual building companies. Each of these parties will be responsible for the cost of treating waste generated as part of their works, which is typically through the disposal of waste in a legal manner to landfill and or through recycling activities. Future residents of the development will also be responsible waste they generate, which is typically the collected by local council for landfill and or recycling, the cost of which is recovered through council rates. The ultimate users of the site are the future land owners, which will contribute to the full life cycle costs of treatment of waste through council rates and charges.
<i>Have the following management hierarchies been taken into consideration in the design of the proposed action?</i>	
• Environmental decision-making hierarchy	Yes – the Proposal has applied the environmental decision-making hierarchy through design of the Holtze Development Area to avoid impacts based on consultation and environmental assessments. Proposal infrastructure is being designed to minimise impacts where they cannot be avoided, as demonstrated throughout this referral.
• Waste management hierarchy	Yes - Construction and putrescible waste generated through works will be stored in appropriate containers for disposal at a licenced waste management facility. Waste generation through construction is anticipated to be minimal due to the nature of the works (i.e., predominantly trenching earthworks, roadworks and installation of service networks). Future residents will have access to general waste and recycling services for household generated waste products. Contractors and prospective developers are incentivised to make sustainability commitments, including recycling and waste management (in line with the waste hierarchy), as part of their respective submissions. Any commitments made by Contractors and the successful Developer will form part of their respective contracts, against which their performance will be assessed.
<i>Other section 43 considerations</i>	
• Have communities that may be affected by the proposed action been provided with information and opportunities for consultation?	Yes - the NTPC has undertaken significant consultation with the community and stakeholders as part of developing the HESLUP. This included two rounds of targeted consultation which ran for six weeks each, as well as a public exhibition period of the draft plan. Further consultation is occurring via the NTPC for its development of the Greater Holtze Area Plan (GHAP) throughout 2022 and into 2023. This includes two four-week rounds of consultation and a statutory public exhibition period. Development of these two plans has provided the wider Darwin community, people who live in the area, and key stakeholders with significant opportunities to engage and provide feedback. Consultation strategies have been developed to provide numerous avenues for engagement including online and in person, supported by a suite of written materials.

• Has consultation with affected communities, including Aboriginal communities' been undertaken in a culturally appropriate manner?	Yes - a variety of consultation opportunities and methods have been employed throughout HESLUP and GHAP consultations to date, including online, written, face-to face in public settings (pop-up info stalls) and opportunities for small group meetings with the project team. Direct contact with the NTPC was offered to the Northern Land Council, Larrakia Nation and Yili Reung. Consultation was undertaken onsite with residents of the Wallaby Holtze locality during HESLUP consultations.
• Has community knowledge and understanding (including scientific and traditional knowledge and understanding) of the natural and cultural values of areas that may be impacted by the proposed action been sought and documented?	Yes - stakeholders have been invited to review and contribute to land capability analysis throughout the engagement processes on HESLUP and GHAP. The NTPC has met with representatives of the Holtze Landcare Group to discuss wallaby populations and environmental considerations as well as receiving formal submissions from the group.
• Have Aboriginal values and the rights and interests of Aboriginal communities' been addressed in relation to areas that may be impacted by the proposed action?	Yes - Aboriginal values have been recognized through adherence and reinforcement of Aboriginal Areas Protection Authority (AAPA) certification processes and compliance with the <i>Aboriginal Sacred Sites Act 1989</i>. Direct contact with the NTPC was offered to the Northern Land Council, Larrakia Nation Aboriginal Corporation and Yili Reung. There is ongoing engagement with Larrakia Nation Aboriginal Corporation regarding Place Names for the Greater Holtze area, including naming of suburbs, structuring roads and themes for local road names.

6 CONSULTATION

The *Northern Territory Environment Protection Act (2019)* requires proponents to engage with stakeholders who may be affected by their Proposal and to support these communities and the public to understand the potential impacts and benefits of a proposed action. The NT EPA's Stakeholder Engagement and Consultation Guidance for Proponents (2021) recognises that stakeholder consultation is an important component of social, cultural and health impact assessments, over and above formal opportunities for feedback on documents placed on public exhibition.

Consultation relevant to the Proposal has been ongoing since 2015 and has been conducted throughout the land use framework planning process by the NTPC on behalf of NTG. The Proposal area has been included in three land use framework administrative processes under the *Planning Act* in recent years. These include the HESLUP that was incorporated into the NTPS in 2022 and the ongoing Greater Holtze Area Plan (GHAP). The GHAP commenced stage 2 consultation on 10 November 2022 with the presentation of a draft GHAP for stakeholder comment. An engagement strategy was prepared by the NTPC to guide the consultation process for HESLUP. Each stage of consultation has informed the proceeding stage of design and development, ultimately informing the Proposal as it is presented in this referral. Additionally, commitments to plan and develop the Proposal were included most recently in both the 2021-22 and 2022-23 NT Budget Papers.

The following subsections describe objectives, methods and outcomes of consultation to date, as well as commitments for ongoing consultation.

6.1 Objectives

Stakeholder consultation has been undertaken across multiple stages of engagement, including the Holtze Area Plan, HESLUP and GHAP. Key objectives that have been consistent throughout include:

- Encourage involvement from the community and stakeholders to better understand their perceptions and knowledge of the area at present, and aspirations for the area into the future;
- Ensure the engagement program allows community and stakeholders access to relevant information about the Proposal;
- Promote improved knowledge and understanding of the land use planning process and its role in the identification and delivery of land to accommodate growth in the near to far term;
- Build an understanding of stakeholder and community issues and sensitivities;
- Balance the needs of a growing population with the protection of the environment and preservation of the rural lifestyle;
- Provide opportunities and a variety of feedback mechanisms to encourage comment from all stakeholders;
- Foster ongoing close and productive working relationships through collaborating with the City of Palmerston and Litchfield Council;
- Seek feedback from the community and stakeholders on the draft Area Plans, Land Use Plans and Planning Principles that will inform and guide future development;
- Inform stakeholders and the community about works that will impact them and significant project milestones; and
- Communicate the scope of the project.

6.2 Stakeholders

Consultation on the broader strategic development plan commenced in 2015 and has been ongoing since this time, with consultation outcomes informing the proceeding design and development phase. This includes consultation regarding the Holtze Area Plan, which was incorporated into the NTPS in March 2016, the HESLUP which was incorporated into the NTPS in July 2022, and the GHAP which is subject to ongoing development currently.

Key stakeholders identified across multiple stages of consultation include:

- Project Control Group (PCG) - an advisory group with technical specialists representing government agencies, Power and Water Corporation and local Councils. The role of the PCG is to provide strategic direction and specialist advice on the Proposal.
- Government agencies and service authorities – multiple NT Government departments and agencies – including the NT Department of Health, Department of Industry Tourism and Trade, Land Development Corporation, NT Land Corporation, DEPWS - with varying known interests in the Proposal, and Commonwealth Departments of Finance and Defence.
- Local government – both City of Palmerston and Litchfield Council were involved in consultation.
- Political representatives – including Members of both the Northern Territory and Commonwealth Governments, at departmental officer level.
- Industry – various industry bodies, including Master Builders Association, Property Council NT, NT Chamber of Commerce, Planning Institute of Australia, Real Estate Institute NT, Urban Development Institute of Australia NT and Housing Industry Association.
- Members of the public – both local residents – including the residents of Wallaby Holtze Road and Taylors Road – and the general community.
- Aboriginal stakeholders – including AAPA and the Northern Land Council.
- Environmental groups and organisations such as Landcare NT, Environment Centre NT and the Environmental Defenders Office.
- Recreational organisations – various recreational organisations who use the land within/surrounding the area.

6.3 Engagement

Methods used to provide information and seek feedback have been relatively consistent since 2015 and varied depending on the stakeholder group – i.e. some stakeholder groups preferred engagement via email, whereas others requested face to face meetings. Through each stage of consultation, methods included:

- Discussion papers – summarising the context for the preparation of the Holtze Area Plan, the HESLUP (at that stage called PESLUP) and the GHAP. The discussion papers were available online and through a small number of print copies.
- Flyers / take-away materials – providing a summary of the HESLUP, suitable for use across most stakeholder groups.
- Direct email – certain stakeholders were contacted by email and directed to the NTPC website.
- Print and radio media.
- Face to face consultation – information stalls were held at local markets and shopping centres.
- Stakeholder meetings – meetings were held with certain stakeholders.

- Online engagement – including the Northern Territory Government's Have Your Say portal and the DIPL Facebook page.

6.4 Addressing stakeholder concerns

As described above, consultation relevant to the Proposal has been ongoing since 2015 and has been conducted throughout the land use framework planning process by the NTPC and DIPL on behalf of NTG. Appendix F reports on themes identified, and issues raised through the following consultation processes:

- Holtze Urban Area Plan – Stage 1 Community Consultation – 2015
- Holtze Urban Area Plan – Planning Scheme Amendment – 2015
- HESLUP – Stage 1 Community Consultation – 2021
- HESLUP – Stage 2 Community Consultation – 2021
- HESLUP – Planning Scheme Amendment – 2022
- GHAP – Stage 1 Consultation – 2022.

A summary of Appendix F is provided in Table 6-1 where relevant to the current Proposal. Information gathered during consultation was used to refine and progress the Area Plan and Planning Principles as part of the Holtze Area Plan, the HESLUP, and subsequently the GHAP. This feedback has been considered in detail, and has informed the design and development to date of the current Proposal.

Table 6-1. Consultation process timeline and summary

Key themes and consultation outcomes relevant to the Holtze Development Area	When raised	Response/outcomes
Proposed hospital and medical precinct - General support for a range of social infrastructure surrounding the proposed hospital and medical precinct. - Support higher residential density and transport nodes concentrated around the Palmerston Regional Hospital (PRH) and identified activity centres, with lot sizes increasing with distance from these centres.	Stage 1 Holtze Area Plan and Proposed Planning Principles - May 2015 Stage 1 GHAP - 2022	Urban development shown in proximity of the hospital and medical precinct retained in response to the majority support – no change.
Proposed commercial area: - General support for the location of the small commercial area proposed adjacent the hospital and medical precinct. - Minor opposition to commercial development in Holtze generally with concern it may compete with the Palmerston CBD.	Stage 1 Holtze Area Plan and Proposed Planning Principles - May 2015	Location of the commercial area remains as proposed.
Proposed service commercial area: - Generally strong opposition to the proposed Service Commercial area shown and belief that it is unwarranted and inappropriately located. - Small number support the Service Commercial area shown as an extension to the existing service commercial area of Yarrowonga	Stage 1 Holtze Area Plan and Proposed Planning Principles - May 2015	Service commercial area was removed from Holtze Area Plan in 2015 in response to this feedback and has not been reintroduced.
Impacts to the environment and existing residents: - General concerns for the natural environment, wildlife habitat, endangered species, sensitive environments, water resources such as groundwater, and stormwater runoff issues impacting Mitchell Creek - suggestions for the Area Plan to include conservation areas and wildlife corridors. - Concerns of development in absence of conservation strategy.	Stage 1 Holtze Area Plan and Proposed Planning Principles - 2015 Proposed NTPS Amendment – 2018 Stage 1 HESLUP - 2021 Stage 2 HESLUP – 2021 Stage 3 HESLUP - 2022 Stage 1 GHAP - 2022	- Open space has been provided within the Proposal area and over time has been increased and incorporated into a wildlife corridor with surrounding areas. - The Proponent engaged ecologists to undertake ecological assessments to inform design. - Open space coincides with areas of identified high ecological value. - DIPL is working closely with DEPWS in developing the Regional Conservation Strategy

Key themes and consultation outcomes relevant to the Holtze Development Area	When raised	Response/outcomes
- Support for project enabling development Regional Conservation Strategy. - Concerns urban development will impact rare and endangered flora and fauna species, including the Black-footed Tree-rat and Typhonium.		– as discussed elsewhere in this Referral report - that will identify key habitat areas to conserve and to constitute offsets for any unavoidable loss.
Impacts to existing residents: - Concerns impact on the rural amenity and lifestyle of existing residents including emotional, physical and financial impacts on residents. - Suggestion existing land use of properties on Wallaby Holtze Road remain unchanged with a natural buffer behind existing lots. - Support buffers from private lots on Wallaby-Holtze Road and Taylor Road to new urban development. - Resistance towards development landowners will maintain their lot as-is.	Stage 1 Holtze Area Plan and Proposed Planning Principles - 2015 Proposed NTPS Amendment – 2018 Stage 1 HESLUP - 2021 Stage 2 HESLUP – 2021 Stage 3 HESLUP - 2022	- Area plan was amended to provide a vegetation buffer from Wallaby-Holtze Road resident boundaries in 2015 in response to feedback. - Extent of the Area Plan was reduced to address concerns of Wallaby-Holtze Road residents in 2015. - Concerns of private landowners on Wallaby-Holtze Road and Taylor Road are acknowledged. There is no intent to develop private land against the owner's wishes. - Ongoing confirmation and communication that existing rural blocks will not be rezoned in response to ongoing concerns over this issue.
Roads: - Proposed local road connection between 60 and 70 Wallaby Holtze Road is not supported. - Concerns development associated with the Area Plan will negatively impact traffic flow of the Stuart Highway in the locality. - The re-alignment of the Glyde Arterial Corridor (now Gunn Point Road) was generally not supported. - Support the improvement of public transport to reduce environmental impact of travel and transport. - Concerns over the extension of Linco Road.	Stage 1 Holtze Area Plan and Proposed Planning Principles - May 2015 Stage 1 GHAP - 2022	- Deletion of local road connection between 60 and 70 Wallaby Holtze Road in response to concerns raised. - Glyde Arterial Road was realigned in 2015 to provide a buffer to the Wallaby-Holtze Road residents in response to concerns raised. - Comments and suggestions specific to the road network are considered by the Transport and Civil Services Division of the Department and have informed subsequent stages of development.
Water: Some concerns raised around groundwater usage as groundwater in the area is considered to be overused.	Stage 1 Holtze Area Plan and Proposed Planning Principles - 2015 Proposed NTPS Amendment – 2018 Stage 1 HESLUP - 2021	The Proponent has engaged in ongoing consultation with PWC to minimise water use impacts – Holtze will be connected to the Zuccoli elevated tank therefore will not impact

Key themes and consultation outcomes relevant to the Holtze Development Area	When raised	Response/outcomes
Risk to water quality from stormwater entering waterways, therefore stormwater management should be designed to maintain water quality.	Stage 2 HESLUP - 2021	groundwater. No groundwater dependent land uses are proposed. - Stormwater design has been informed by concerns raised through consultation. - The Proponent has engaged hydrological specialists to design adequate stormwater network and stormwater management plan – these will be best practice designs.
Human health: - Concerns over mosquito management. - A biting insect management plan will be required and consideration should be given to the handover requirements to ensure design and monitoring is implemented correctly.	Stage 1 Holtze Area Plan and Proposed Planning Principles - 2015 Proposed NTPS Amendment – 2018 Stage 1 HESLUP - 2021 Stage 2 HESLUP - 2021	- DIPL has been in ongoing consultation with Medical Entomology regarding mitigations for mosquitoes and biting insects generally. - Preparation of a biting insect management plan in consultation with Department of Health.
Social infrastructure: - Ongoing coordination with Local Government recommended, in particular when it comes to Social Infrastructure. - Litchfield Council noted the strategic work being undertaken in preparation of the first draft Subregional Land Use Plan and expressed appreciation that the Planning Commission was able to respond and address feedback raised during Stage One.	Stage 2 HESLUP - 2021	Ongoing work undertaken in consultation with Local Government, of subregional and area social infrastructure assessments.

6.5 Future engagement

DIPL recognise the importance of ongoing communication and engagement throughout all Proposal stages. Key objectives of ongoing consultation will be to keep the public and relevant stakeholders informed and aware of Proposal progress, works that may affect them, and provide clear communication channels for people to use to direct any queries or concerns. DIPL is developing a detailed strategy to guide the next phase of engagement, however the key methods and approach are summarised below.

6.5.1 Referral consultation

- Key stakeholders will be contacted directly by DIPL and advised this Referral is available for public consultation in accordance with EP Regulation 52. DIPL is open to receiving any questions or feedback during this time and encourages submission to the NT EPA's consultation hub.
- The Proposal will be advertised on the NT Government [Have Your Say](#) page. This will include a summary of the Proposal, describe that a referral has been submitted to the NT EPA and is available for public comment, and links to assist people to access the Referral documents on the NT EPA's website.

6.5.2 Ongoing project development and construction

A communication and media strategy has been developed by the Proponent in 2022 to support the delivery of Holtze land releases in the Greater Darwin region. Given the nature, size and length of this project, the strategy will serve as a guide and will be a living document, updated as operational and communication needs change.

Strategy goals and objectives

The goal of this strategy is to inform nearby residents, stakeholder groups and the general public about the delivery of the Proposal.

The aim and goal will be achieved through the following objectives:

- Inform stakeholders and the community about works that will impact them.
- Inform stakeholders and the community about significant project milestones.
- Provide regular project updates to stakeholders and the community.
- Communicate the scope of the project.
- Differentiate the work the NTPC is doing with the department's delivery.
- Provide clear communication channels that direct stakeholders and the community to the correct project team depending on their query.

The Proponent project team will consult with some necessary stakeholders at an operational level outside of the scope of the communication and media strategy. This is likely to happen at the Project Control Group level and individual stakeholder meetings to ensure the relevant authorities are involved in the process and leads to good planning and integration within the wider infrastructure and planning context.

A separate strategy will be developed to support construction works for the Proposal. The Proponent is committed to keeping the community informed about things that impact them. Where construction work impacts a stakeholder's amenity, all reasonable effort is taken to work with stakeholders to find appropriate mitigation solutions to reduce impacts.

Stakeholders

The strategy includes a detailed analysis of stakeholders who will be communicated with. It may expand as the project progresses. It details each stakeholder along with their interest and involvement in the project and dedicated communication approach. A range of people and organisations are included from the following stakeholder groups:

- Ministerial stakeholders;
- Australian Government;
- Northern Territory Government;
- Local government;
- Aboriginal stakeholder groups;
- Peak bodies;
- Industry groups;
- Community and environmental groups;
- Nearby owners and residents;
- General public; and
- Media.

Ongoing engagement methods

A variety of methods will be used across many stakeholders and stakeholder groups. The key objectives of engagement will be to keep stakeholders informed of the Proposal progress, particularly when there is potential for impacts – i.e. notifying local residents when construction will be occurring nearby. Likely engagement materials and methods include:

- Fact sheets and stakeholder notices;
- Maps and graphics;
- Project webpage, including question and answer, and frequently asked questions resources;
- Media briefs and releases;
- Videos;
- Briefings;
- Letterbox drops;
- Mail outs;
- Phone and email; and
- Social media.

7 ENVIRONMENTAL FACTORS

7.1 Overview

The NT EPA has developed a framework for the assessment of environmental impact. The framework uses 14 environmental factors to provide a systematic approach to organising environmental information and to establish environmental objectives against which proposals will be assessed. Pre-referral screening of the Proposal undertaken by EcOz Environmental Consultants determined that the Proposal has potential to impact six of the 14 environmental factors:

- Terrestrial environmental quality;
- Terrestrial ecosystems;
- Hydrological processes;
- Inland water quality;
- Community and economy; and
- Human health.

A summary of the pre-referral screening outcomes is presented in Appendix G.

For each of the six factors, the following approach was taken to identify and assess environmental impacts from the Proposal:

- **Identification and characterisation of environmental values:** A combination of desktop and field assessments were undertaken to identify and characterise the existing environment that occurs within the development footprint and surrounding areas. Valued components of the environment were then selected for further assessment on the basis that they are ecologically, socially, culturally and/or economically important, and are either likely to be impacted by the Proposal, or people are highly concerned that they could be impacted.
- **Identification of potential impacts:** Consideration was given to how the activities associated with implementing the Proposal (described in Section 3) could impact each of the valued components. Potential direct and indirect impacts were identified.
- **Avoidance and mitigation:** For each impact, measures that will be implemented to avoid and mitigate those impacts were identified.
- **Assessment of impacts:** The residual impact to each valued component was then assessed considering the context and intensity of the impact, and the scale, duration and magnitude (degree of change) of the impact.

The outcomes of the impact assessment process are summarised in Table 7-1 and discussed further in subsequent sections of this Referral Report.

Table 7-1. Summary of potential impacts and avoidance/mitigation measures

Factor	Environmental value	Potential impacts and benefits	Avoidance and mitigation	Residual impact
LAND				
Terrestrial environmental quality Section 7.2	- Land and soil integrity - Land and soil quality	Construction: - Erosion caused by soil disturbance. - Spread or disturbance of existing contamination caused by soil disturbance. - Contamination of soils caused by hazardous chemicals spills/leaks.	- Development footprint avoid high risk erosion areas. - Remediation of existing contamination prior to construction. - Land rehabilitation post-construction. - Erosion and Sediment Control Plan (ESCP) - Remediation Action Plan - CEMP	The environment protection and management measures outlined in this Referral indicate with appropriate management of land quality, the Proposal is unlikely to result in material significant terrestrial environmental quality impacts.
Terrestrial ecosystems Section 7.3	- Vegetation and habitats - Significant vegetation - seasonal wetlands and riparian vegetation - Threatened fauna - Threatened flora	Construction - Loss of habitat for threatened species – both flora and fauna - caused by land clearing. - Loss of significant vegetation caused by land clearing. - Direct mortality of threatened species – both flora and fauna - caused by land clearing. - Reduced quality of threatened species habitat – both flora and fauna - caused by weed species introduction/spread. - Fragmentation of threatened fauna habitat due to land clearing. Residential land use: - Reduced habitat quality for threatened flora and fauna within the public passive open space caused by increased human presence. - Loss of significant vegetation caused by handstand and stormwater drainage. - Reduced threatened flora and fauna habitat quality within the public passive open space caused by handstand and stormwater drainage.	- Area to be cleared minimised through design - Impact avoided through design of public open space - Weed management plan - Fauna spotter-catcher to minimise direct mortality of threatened species during land clearing - Open space maintenance to support habitat quality for threatened species - Regional Typhonium population strategy	The assessments undertaken for this environmental factor conclude that the residual impact to general terrestrial ecosystem values will be minor. The activities associated with this Proposal are unlikely to have a significant impact on any threatened species however, cumulative impacts associated with developing the Greater Holtze area have the potential to significantly impact Black-footed Tree-rat, Northern Brushtail Possum and <i>Typhonium praetermissum</i> (these will be need to be addressed if/when Greater Holtze is being developed).
WATER				
Hydrological processes Section 7.4	- Surface water flow regimes - Groundwater levels and recharge	Construction: - Alteration of surface water hydrology due to land clearing and ground levelling Residential land use: - Alteration of surface water hydrology due to increased impervious surfaces and constructed drainage network - Reduction in groundwater recharge due to increased impervious surfaces	- Non-reliance on groundwater for water use during residential land use - Conceptual stormwater management plan (CSMP) - Water-sensitive urban design	The environment protection and management measures outlined in this Referral indicate with appropriate management of hydrological flows, the Proposal is unlikely to result in material significant hydrological impacts.
Inland water environmental quality Section 7.5	- Surface water quality - Groundwater quality	Construction: - Increased turbidity caused by erosion from soil disturbance. - Contamination of surface and/or groundwater from chemical spills or leaks. Residential land use: - Decreased surface water quality from contaminated stormwater drainage.	- ESCP - CEMP - CSMP	The environment protection and management measures outlined in this Referral indicate with appropriate management of water quality, the Proposal is unlikely to result in material significant water quality impacts.
PEOPLE & COMMUNITIES				
Community & economy Section 7.6	- Way of life - Community - Access - Culture - Health and wellbeing - Surroundings - Livelihoods - Decision-making systems	Construction: - Economic benefits and employment due to construction activities. - Loss of amenity due to noise and dust emissions. - Disturbance of Aboriginal sacred sites due to land clearing. - Disturbance of non-Aboriginal archaeology due to land clearing. - Human health and nuisance impacts due to exposure to biting insects. - Access restrictions / delays due to construction related traffic. - Stress / anxiety about water resources due to water use for construction. Residential land use: - Improved way of life due to residential land use and housing availability.	- A vegetation buffer has been retained between the Proposal and existing residential properties along Wallaby Holtze Road - Biting insect management plan - Stakeholder engagement plan - CEMP	The screening level assessment presented in this Referral indicates with appropriate management of impacts related to biting insects, the Proposal is unlikely to result in material significant social impacts.

Factor	Environmental value	Potential impacts and benefits	Avoidance and mitigation	Residual impact
		• Improved sense of place for new residents due to housing availability. • Improved access to PRH due to development of community land uses and nearby residential land uses. • Improved access to community services and facilities due to development of community land uses and roads. • Improved access for pedestrians/cyclists due to development of roads and shared use paths. • Employment during operation • Loss of sense of place for existing residents due to more people inhabiting the area. • Impacts to access of emergency services due to more people inhabiting the area. • Loss of amenity due to residential noise and traffic • Human health and nuisance impacts due to exposure to biting insects. • Visual impacts due to residential land use. • Lack of access to recreational activities due to more people inhabiting the area. • Lack of access to public transport and social infrastructure due to more people inhabiting the area. • Increased pressure on local council and services provided due to more people inhabiting the area. • Stress / anxiety about water resources due to water use for residential land use. • Traffic impacts due to new roads and traffic	• CSMP	
Human health Section 7.7	• Protection from diseases	Construction and residential land use: • Disease and nuisance due to exposure to biting insect habitat. • Disease and nuisance due to creation of biting insect habitat.	• Biting insect management plan	DIPL has prepared a biting insect management strategy- Appendix K - that demonstrates that the risk to human health can be managed to a level that is considered acceptable by Department of Health, and the Proposal is unlikely to result in material significant human health impacts.

7.2 Terrestrial environmental quality

The Terrestrial Environmental Quality factor was identified for further consideration in this Referral due to the relatively large area of land and soil disturbance associated with the Proposal that could lead to erosion and sedimentation, and because the PSI identified some areas of contamination that would require addressing to ensure compatibility with the future residential land use.

The environment protection and management measures outlined in this Referral indicate with appropriate management of land quality, the Proposal is unlikely to result in material significant terrestrial environmental quality impacts and will meet the NT EPA's objective.

7.2.1 Factor objective

Protect the quality and integrity of land and soils so that environmental values are supported and maintained.

7.2.2 Presence of environmental values

The environmental values identified for assessment under the Terrestrial Environmental Quality factor are:

- **Land and soil integrity** – intact land and soils are valued due to their role in supporting future land uses (i.e. green spaces and gardens) and preventing offsite impacts to water quality associated with erosion and sedimentation.
- **Land and soil quality** – clean (uncontaminated) land and soils are valued due to their role in supporting the future residential land use, protecting human health, and preventing offsite impacts to water quality associated with mobilisation of contaminants when soils are disturbed.

Land and soil integrity

A Land Suitability Assessment (LSA) for the Proposal was conducted in 2014 which included ground truthing of land units (EcOz 2014). Seven land units occur within the Proposal area (Table 7-2 and Figure 7-1). In general, the site consists of flat to gently undulating upland surfaces (land units 3a, 3b and 3c) that are well drained, where the site is proposed for residential development. Areas proposed as passive public open space are generally more constrained, with the southern boundary of the area sloping steeply towards the Stuart Highway (land unit 1c), with slopes of greater than 5 %, with a higher risk of erosion. The lowland drainage areas (land units 2b2 and 5b1) comprise the upper reaches of the Mitchell Creek catchment. These areas receive rainfall runoff from the upper slopes and subsequently contain hydrosolic soils that are seasonally or permanently saturated. This section of the Proposal area also contains a creek line that may periodically flood during the monsoon season.

The LSA identified instances of rill and gully erosion in several locations within the Proposal area. Erosion was most common adjacent to dirt tracks in the south-east section of the Proposal area, where slopes of 2-4 % occur. Slopes of greater than 5 % in some sections increase the erosion potential of the area.

The Proposal area is outside areas of moderate and high risk of acid sulfate soils (ASS), does not occur within the primary or secondary storm surge zone, and is not at risk of flooding due to rising rivers.

Table 7-2. Land units within Proposal area

No.	Landform	Soil	Slope	Drainage
1c	Rises and short steep slopes	Organosols	5 - 15%	Nil to low level of seasonal soil waterlogging
2b2	Side slopes	Hydrosols	2 - 5%	Moderate level of seasonal soil waterlogging

No.	Landform	Soil	Slope	Drainage
3a	Flat to gently undulating upland surfaces	Kandosols	0 - 2%	Nil to low level of seasonal soil waterlogging
3b			0.5 - 2.5%	
3c			0 - 2%	
5b1	Drainage lines with upland terrains	Hydrosols	1-4 %	Very slow. High level of seasonal soil waterlogging

Land and soil quality

The site is not registered as a contaminated site under the WMPC Act.

A PSI of the Proposal area was undertaken in 2014 in accordance with the NEPM, providing a good indication of existing land and soil quality. A site inspection observed a number of concrete slabs that are assumed to have been from WWII as well as sporadic, illegally dumped rubbish, car bodies, fill, building materials, an old quarry site and a network of mountain bike tracks were identified across the Proposal area. Asbestos containing materials (ACM) was also identified and confirmed through laboratory analysis, within stockpiles of dumped materials and around areas where concrete slabs were observed.

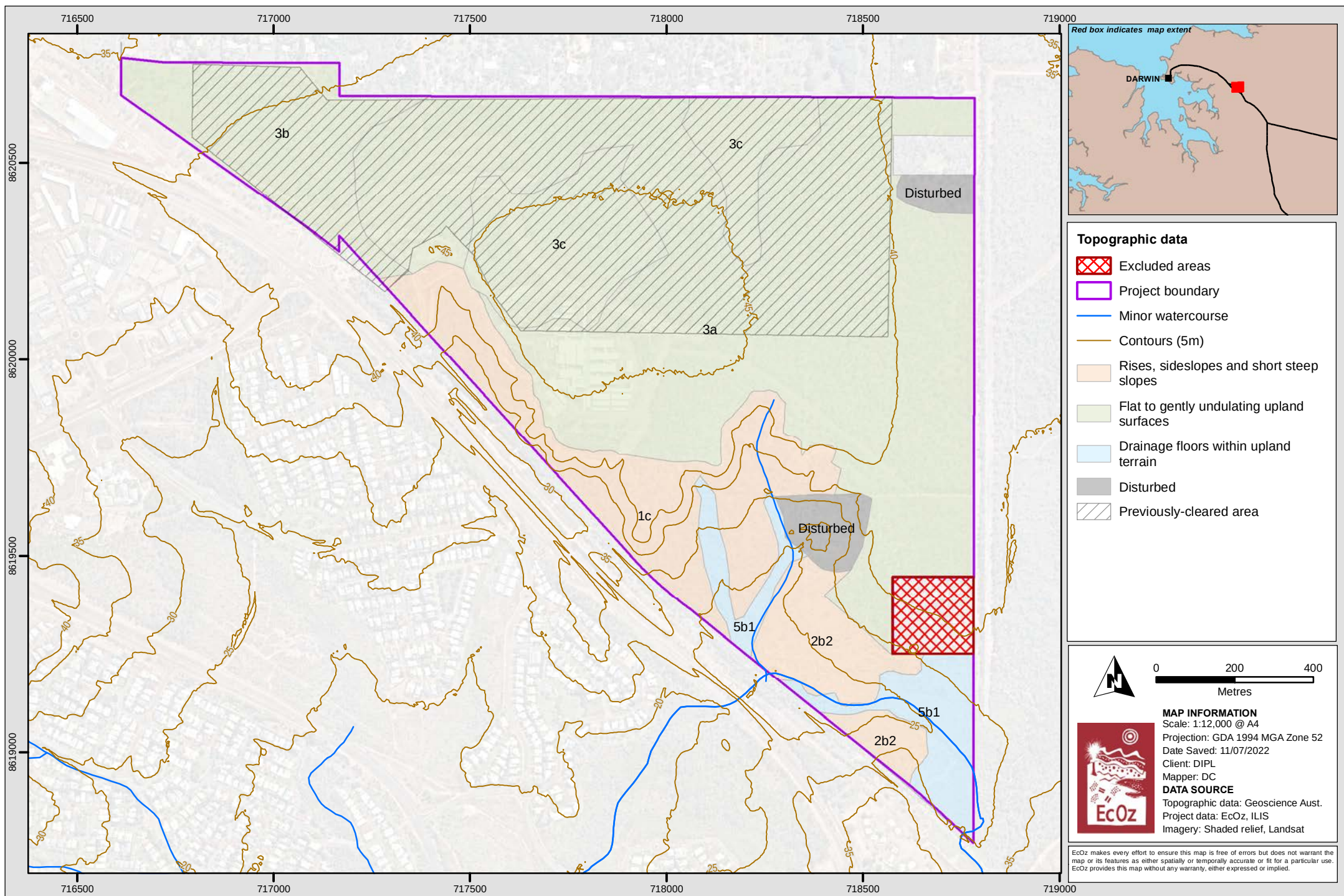
Following the PSI, a Detailed Site Investigation (DSI) was commissioned in 2022 which included a sampling program to investigate the potential contamination.

The Sampling Analysis and Quality Plan was implemented in September 2022 and the sampling objectives were met. The sampling found the following:

- The presence of asbestos was common across the project area where there had been illegally dumped waste, car bodies or surrounding the historical slabs. Apart from areas where there was known waste dumped or historical activity, there was neither visual nor laboratory evidence to suggest that asbestos had spread elsewhere on site, therefore remaining localised.
- A small number of sites where illegally dumped waste or car bodies were present, had exceedances in lead.
- Detections and exceedances at some sites for hydrocarbons, where there was either illegally dumped rubbish, car bodies, or the site had been used for historical quarrying.
- The results of all groundwater and surface water samples presented no concern due to their adherence to the NEPM guidelines and consistency.
- High levels of both aluminium and iron were observed in all soil and samples collected but were determined to likely be of natural origin.

Apart from the abovementioned contaminants identified, there were no further visual indicators of contamination present at surface level or at depth across the site. It is therefore considered that any contamination present is localised to areas of dumping and it is unlikely that the extent of contamination present within the project area, has been spread since its placement or activity.

An accredited contaminated lands auditor has been engaged to oversee the investigation and concluded that the SAQP was of a satisfactory level to identify and delineate impacts across the Project area. The auditor is currently reviewing the DSI and upon completion of the investigation will provide a statement of audit to be included on the NT EPA's contaminated land register (along with the associated investigation reports).



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ20050 - Holtze NOI\Project files\Figure 2-1. Map of land units within Holtze.mxd

Figure 7-1. Map showing land units and disturbed areas in Proposal area

7.2.3 Potential impacts

The impact assessment process identified the following potential impacts to land and soils from the Proposal activities described in Section 3:

Table 7-3. Potential impacts to terrestrial environmental quality

Construction	Residential land use
• Erosion caused by soil disturbance. • Spread or disturbance of existing contamination caused by soil disturbance. • Contamination of soils caused by hazardous chemicals spills/leaks.	No potential impacts identified.

7.2.4 Impact avoidance

The Proposal has been designed so that areas of land to be developed for residential and mixed community uses avoids constrained areas of steep slopes and waterlogging where there is an increased erosion risk - Figure 7-1.

7.2.5 Mitigation

The following measures will be implemented to mitigate impacts to land and soils.

Construction management plans

A Primary Erosion and Sediment Control Plan (ESCP) has been developed to establish the minimum requirements and detail the guiding principles for the site-specific ESCPs required as the development progresses (Appendix H).

As is standard for any development involving clearing of land this size, a site-specific ESCP aligning with the *International Erosion and Sediment Control Guidelines 2008* will be developed by a Certified Professional in Erosion and Sediment Control or suitably qualified person prior to clearing, and implemented during clearing and construction. An ESCP will not be required after construction as stormwater drainage management will be implemented into the design and landscape plans.

A CEMP will be prepared for all stages of works, and will include provisions for protection of land such as:

- Spill containment and response procedures.
- Hazardous goods storage requirements in line with relevant Australian Standards.
- Waste management practices.
- Temporary ablution block design and approval, and appropriate wastewater removal processes.

The CEMP will also include an unexpected finds procedure for potential contaminants that may be encountered during excavation works.

Existing contamination management / rehabilitation of current site contamination

Given the PSI was conducted in 2014, the Proponent has engaged a registered Contaminated Sites Auditor to review the existing documentation and provide ongoing advice. EcOz have been engaged to undertake a Detailed Site Investigation to determine the current extent of potential contamination across the site. Based on the outcomes of the PSI (EcOz 2014), the presence and extent of contamination is expected to be limited to isolated patches of surface contamination due to dumped waste, and easily managed through a Remediation Action Plan (RAP). The RAP would be endorsed, implemented and validated through an audited

process to ensure the land is fit for its intended use as per the *Waste Management and Pollution Control Act 1998*, NEPM and NT Contaminated Land guideline.

Land rehabilitation

Following construction works, development areas will be progressively rehabilitated in line with their intended land use i.e. parklands, verges, residential garden areas. The site-specific ESCP will include allowance for temporary cover or rehabilitation until such time as permanent rehabilitation works are undertaken.

7.2.6 Assessment of residual impact

Considering implementation of the abovementioned mitigation measures, there are no significant residual impacts expected to land and soil integrity or quality.

Land and soil integrity

Clearing areas for infrastructure creates the potential for erosion through wind or water assisted processes. Soil loss calculations undertaken on the proposed development areas indicate the erosion hazard is rated from very low to moderate, based on the soil types present during construction conditions. When considering the rainfall erosivity for the Darwin region in the wet season, the erosion risk is considered high in October, November and April and extreme in December to March. The high risk of erosion during the wet season will be managed by implementing an ESCP, which is standard across projects in the Darwin region and would be prepared in line with the *International Erosion and Sediment Control Guidelines 2008*.

Land and soil quality

The RAP will manage known contamination risks, with existing contamination to be remediated prior to commencement of construction. Additionally, an unexpected finds procedure in the CEMP will manage risks of unknown contamination across the site. Post-construction, the land will be remediated to a level acceptable for residential living and community uses. No significant residual impacts are predicted.

The storage and use of chemicals and fuels on-site during construction works have the potential to result in spills or leaks, leading to contamination of land, surface and/or groundwater. The installation and use of temporary ablution facilities during construction also have the potential to result in spills or leaks. Standard management measures will be implemented to mitigate this risk, including preparation of a CEMP including provisions for protection of land such as:

- Spill containment and response procedures.
- Hazardous goods storage requirements in line with relevant Australian Standards.
- Waste management practices.
- Temporary ablution block design and approval, and appropriate wastewater removal processes

With implementation of these mitigations no significant residual impacts are expected.

7.2.7 Conclusion

The NT EPA's objective for the Terrestrial Environmental Quality factor is to: *Protect the quality and integrity of land and soils so that environmental values are supported and maintained.*

The Proposal has avoided potential impacts to terrestrial environmental quality through Proposal design, avoiding construction of residential and community land uses in highly constrained areas with high risk of erosion and waterlogging. Additionally, impacts will be minimised through the adoption of industry best practice mitigations and proven, standard construction environmental management protocols. The Proposal will remediate areas of existing contamination on the site and improve on existing land quality. The environment protection and management measures outlined in this Referral indicate with appropriate management of land quality, the Proposal is unlikely to result in material significant terrestrial environmental quality impacts and will meet the NT EPA's objective.

7.3 Terrestrial ecosystems

The Terrestrial Ecosystems factor was identified for further consideration in this Referral due to the presence of threatened species and significant vegetation within the Proposal area. The assessments undertaken for this environmental factor conclude that the residual impact to general terrestrial ecosystem values will be minor. Moreover, because of commitments made by DIPL regarding the footprint of the Greater Holtze region, the activities associated with this Proposal are unlikely to have a significant impact on any threatened species.

7.3.1 Factor objective

Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The information for this section is primarily based on the *Ecological Values Assessment for Holtze Residential Urban Development Report* in Appendix I. That report was compiled using desktop spatial databases maintained by the NT Government, data from previous surveys in the region (undertaken by other entities), and the results of ecological studies of the Proposal area and surrounds in 2014-15, which were supplemented by targeted studies in 2020.

All surveys for this Proposal were undertaken in accordance with the NT guidelines, including:

- *Northern Territory Threatened Plant Survey Guidelines – Supplement 1: Typhonium Field Surveys (Bickerton et al. 2020)*
- *Weed Data Collection – A Field Guide for Collecting Weed Data for the NT (WMB 2015)*
- *Camera Trapping SOP for the Top End Long-term Monitoring Program (DENR 2017)*
- *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping (Brocklehurst et al. 2007).*

Please note, this Referral Report contains new information regarding *Typhonium praetermissum* and the Northern Brushtail Possum – which has only recently been listed as threatened – that supersedes any similar information in Appendix I.

7.3.2 Presence of environmental values

The environmental values identified for assessment under the Terrestrial Ecosystems factor are:

- **Native vegetation and biodiversity** which provide a range of benefits – including providing habitat for native wildlife, forming and protecting soils, providing for tourism and recreation, and other important functions relevant to ecosystem services that sustain human life.
- **Sensitive vegetation types** which are valued due to their unique and/or inherently high biodiversity values, and are considered significant under the *Land Clearing Guidelines* (DEPWS 2021).
- **Threatened species (flora and fauna)** which are vulnerable to extinction in the near future and are important due to the role they play in a health and functioning ecosystem, as well as having high social value. Species in the NT can be listed as threatened under the *NT Territory Parks and Wildlife Act* (TPWC Act) or the Commonwealth EPBC Act and are afforded legislative protection under these Acts.

Vegetation and habitats

Seven land units occur within the Proposal area (see Table 7-4 and Figure 7-2). The lowland drainage areas (land unit 5b1) comprise the upper reaches of the Mitchell Creek catchment. The dominant vegetation is Eucalypt forest and woodland in the well-drained areas, and woodland/shrubland of *Grevillea* and *Pandanus* where the soils are seasonally-waterlogged. In general, the site contains intact native vegetation, however

there is evidence of disturbance throughout the site. Inspection of historical aerial imagery indicates that the northern portion of the Proposal area – approximately 90 ha – was cleared in the late 1960s and now comprises re-growth vegetation. Patches of the two most commonly-recorded weed species, Gamba Grass (*Andropogon gayanus*) and Mission Grass (*Cenchrus polystachios*), were mainly located along the northern boundary and access tracks to the south of the Proposal area located at the base of the rocky ridge. The remaining surveyed weed populations were mainly focused on the northern boundary and within the northern access corridors adjoining Wallaby-Holtze Road.

Table 7-4. Land units and vegetation within Proposal area

No.	Landform	Vegetation
1c	Rises and short steep slopes	Woodland of <i>E. tetradonta</i> , <i>E. miniata</i> , over <i>S. intrans</i> and <i>H. triticeus</i>
2b2	Side slopes	Low woodland of <i>C. latifolia</i> , <i>E. tectifera</i> and <i>Grevillea pteridifolia</i> over <i>H. triticeus</i>
3a	Flat to gently undulating upland surfaces	Open forest of <i>E. tetradonta</i> , <i>E. miniata</i> +/- <i>Erythrophleum chlorostachys</i> over <i>S. intrans</i> and <i>H. triticeus</i>
3b		Open woodland of <i>E. tetradonta</i> , <i>E. miniata</i> +/- <i>C. bleeseri</i> , over <i>S. intrans</i> and <i>H. triticeus</i>
3c		Low open woodland of <i>C. latifolia</i> and <i>E. tectifera</i> over <i>S. intrans</i> and <i>H. triticeus</i>
5b1	Drainage lines with upland terrains	Open woodland/shrubland of <i>Grevillea pteridifolia</i> and <i>Pandanus spiralis</i> over mixed grasses

C. = *Corymbia*, *E.* = *Eucalyptus*, *H.* = *Heteropogon*, *S.* = *Sorghum*

The existing environment which the enabling infrastructure will be placed – described in Section 2.1.2 – is summarised below:

- **Electricity route** – remnant woodland (some of which is immediately adjacent to a road);
- **Water lines** – disturbed woodland adjacent to roads and powerlines;
- **Water pump station** – remnant woodland and disturbed land adjacent to buildings, powerlines and a road;
- **Sewer route** – Palmerston suburbs and Mitchell Creek corridor leading into the south-east corner of the Proposal area; and
- **Temporary stormwater infrastructure** – remnant woodland (some of which is adjacent to a road).

Significant vegetation

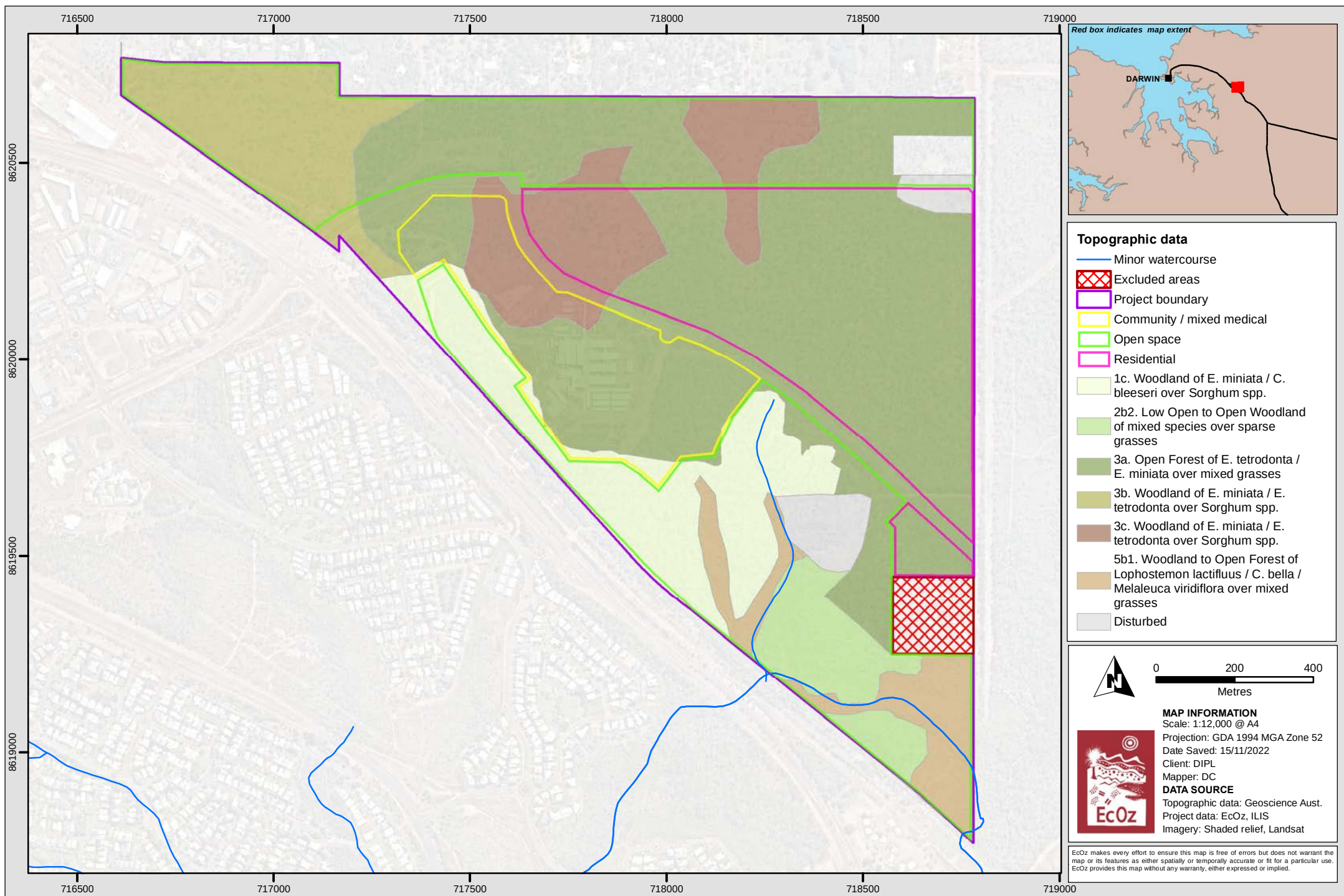
The only significant vegetation type confirmed within the Proposal area is riparian vegetation associated with headwaters of Mitchell Creek. This is located entirely within the proposed passive public open space. Tree hollows provide valuable habitat for fauna. There may be some large *Eucalyptus miniata* and *Eucalyptus tetradonta* that are hollow-bearing within the site; however, not at the densities mentioned in the Land Clearing Guidelines (DEPWS 2021) that make it a significant vegetation type.

Threatened species

Results of desktop assessments supplemented by targeted surveys identified five threatened flora and fauna species with a reasonable likelihood of occurring within the Proposal area – see Table 7-5.

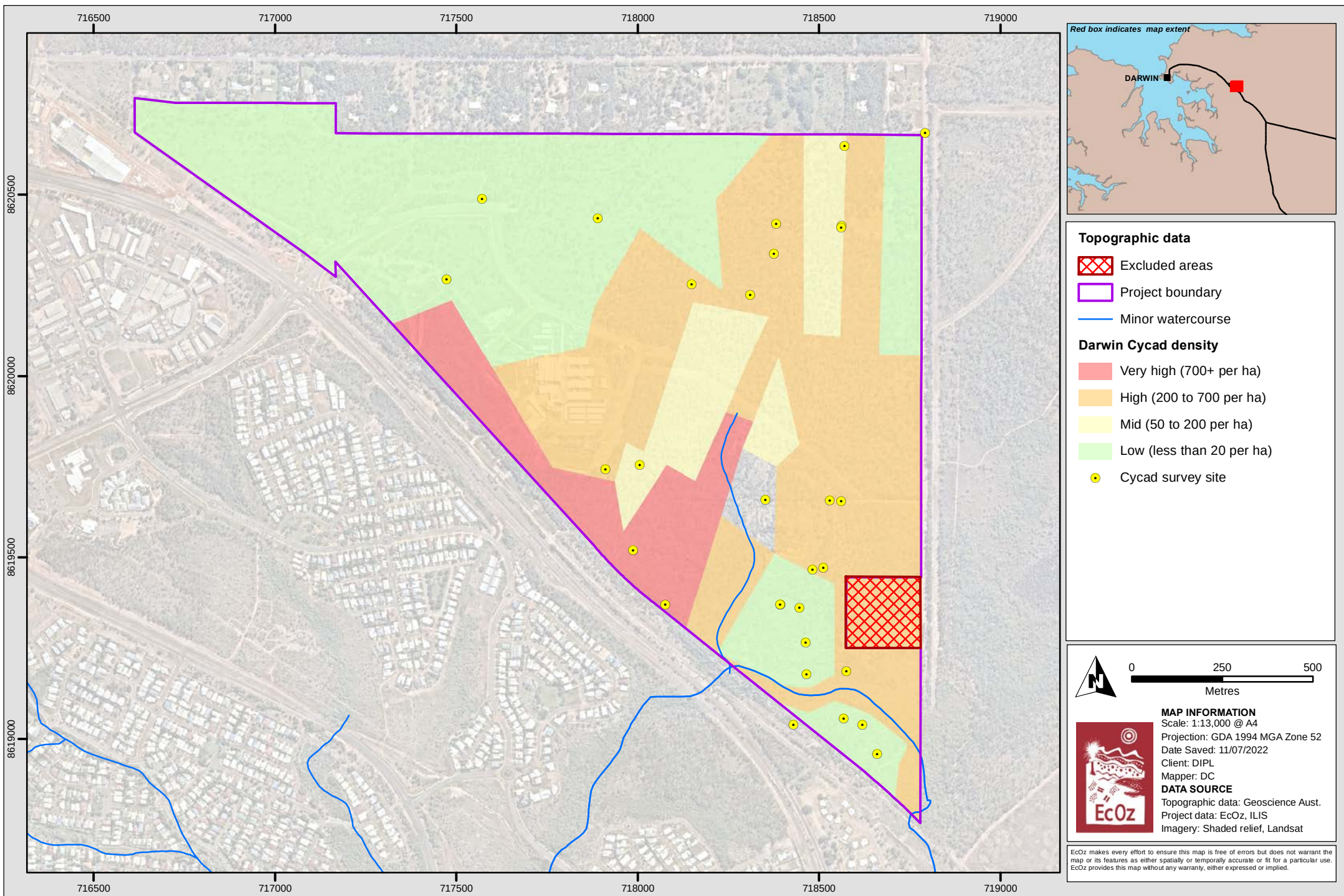
Table 7-5. Threatened species with a reasonable likelihood of occurrence within the Proposal area

Species	TPWC Act	EPBC Act	Occurrence within Proposal area
Darwin Cycad <i>Cycas armstrongii</i>	Vulnerable	-	Present in varying densities throughout the woodland habitats; the highest (700+ per ha) occurring on the rocky ridge areas in the passive public open space. Figure 7-3 depicts the density distribution across the Proposal area.
<i>Typhonium praetermissum</i>	Vulnerable	-	Recorded within the Proposal area and surrounds from numerous surveys in the past decade (see Figure 7-4) and are considered part of the Greater Holtze sub-population (as per Cuff and Green 2019). The majority of plants in the Proposal area are located in two patches – north-east of the hospital and in the western section of the Holtze site. There is an area modelled as high likelihood habitat for this species in the water pump station footprint which has not been surveyed.
Mertens' Water Monitor <i>Varanus mertensii</i>	Vulnerable	Nominated for listing as Endangered	Not recorded onsite, but recorded downstream. Suitable habitat is restricted to ephemeral first-order drainage lines in the south of the Proposal area (described as land unit 5b1 in Figure 7-2). As this species does not forage far from water, it is likely that – if present – it only occurs within the Proposal area during the wet season when the creeks contain water, using off-site downstream areas during the dry season (i.e. Mitchell Creek) and migrating upstream in the wet season in search of food resources and breeding opportunities.
Black-footed Tree-rat <i>Mesembriomys gouldii gouldii</i>	Vulnerable	Endangered	Despite recent camera trapping across the Proposal area, this species was recorded only once, in the south of the Proposal area (see Figure 7-5, which also shows the location of other recent records). The species appears to be confined to the denser, less disturbed woodland on the steeper sloped areas (i.e. within the passive public open space).
Northern Brushtail Possum <i>Trichosurus vulpecula arnhemensis</i>	-	Vulnerable	Recorded recently only once, at the same site as the Black-footed Tree-rat (see Figure 7-5, which also shows the location of other recent records). This species has similar habitat requirements for the Black-footed Tree-rat, with a more generalist diet.



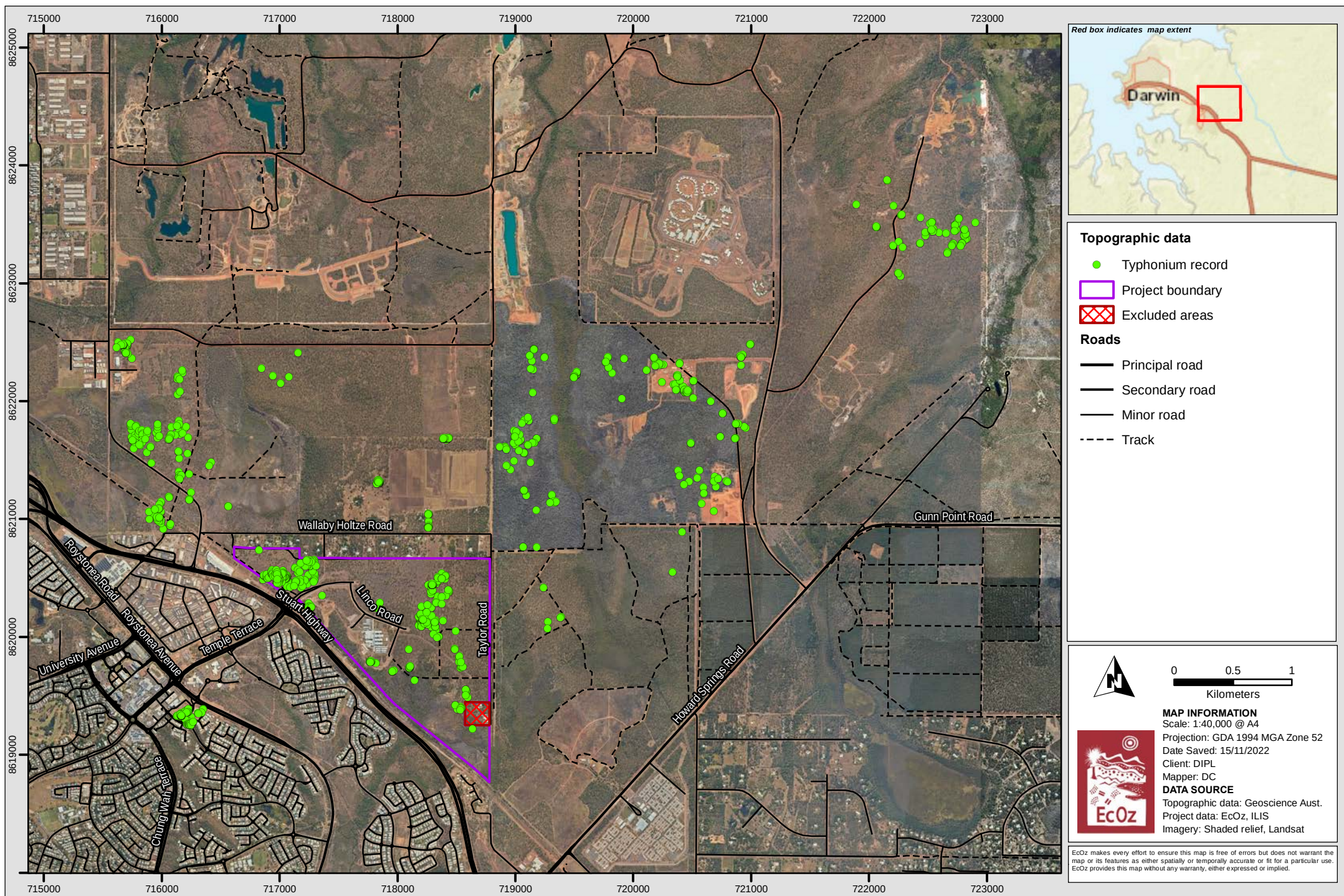
Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ20050 - Holtze NOI\Project files\Figure 7-2. Map showing vegetation types in Proposal area.mxd

Figure 7-2. Map of vegetation types (by land unit) within the Proposal area



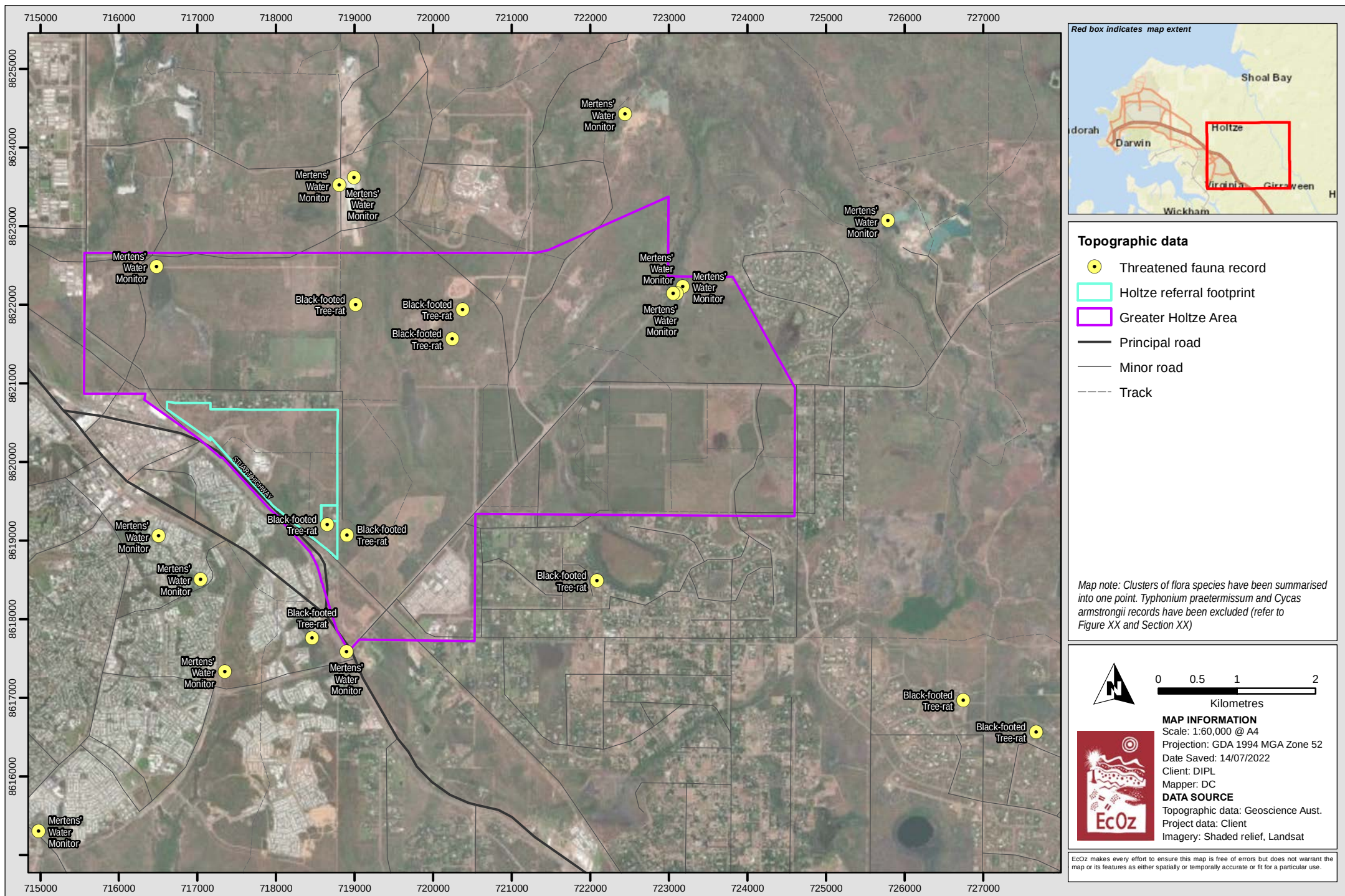
Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ20050 - Holtze NOI\Project files\Figure 5-1. Map of cycad survey sites within the Holtze site.mxd

Figure 7-3. Map of Darwin Cycad density within the Proposal footprint



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Figure 7-4. Map of *Typhonium praetermissum* records within the Greater Holtze sub-population



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ20070 - Constraints analysis - HoltzeKowand\01 Project Files\Report maps\Figure X-X. Map of threatened flora and fauna records within and around the study area.mxd

Figure 7-5. Map of threatened species records relevant to the Proposal

7.3.3 Potential impacts

The impact assessment process identified the following potential impacts to terrestrial ecosystems from the Proposal activities described in Section 3:

Table 7-6. Potential impacts to terrestrial ecosystems

Construction	Residential land use
• Loss of habitat for threatened species – both flora and fauna – caused by land clearing. • Loss of significant vegetation caused by land clearing. • Direct mortality of threatened species – both flora and fauna – caused by land clearing. • Reduced quality of threatened species habitat – both flora and fauna – caused by weed/invasive species introduction/spread. • Fragmentation of threatened fauna habitat due to land clearing.	• Reduced threatened flora and fauna habitat quality within the public passive open space caused by increased human presence. • Loss of significant vegetation caused by impervious surfaces and drainage resulting in changes to hydrological flow • Reduced threatened flora and fauna habitat quality within the public passive open space impervious surfaces and drainage resulting in changes to hydrological flow

7.3.4 Impact avoidance

The Proposal has been designed to minimise land clearing and maintain habitat connectivity and threatened species habitat through design of the passive public open space. Additionally, direct impacts to riparian vegetation have been avoided through design of the passive public open space.

In September 2022, DIPL and DEPWS convened a workshop that used the results of the studies to identify the relative importance of the various occurrences of *T. praetermissum* within both the Proposal area and the greater Holtze region. As shown in Figure 7-6, there are two main patches of *T. praetermissum* plants within the Proposal area – these are closely-related and so together constitute a single occurrence. DIPL and DEPWS ran an analysis on the two patches of *T. praetermissum* in the vicinity of the Proposal area, removing sections to see what the outcome would be for the connectivity with the rest of the sub-populations. As a consequence, the north-western patch will not be disturbed by Proposal activities, the eastern patch is within the residential development footprint and so will likely be cleared or removed – see Figure 7-6. No other occurrences of *T. praetermissum* are within the Proposal's area of influence. DIPL is confident that the avoidance strategy will have the lowest possible impact on *T.praetermissum*.

A broader outcome of the workshop was identification of important patches of the species within the Holtze sub-population (across Greater Holtze) that DIPL will buffer, conserve and facilitate management. This is helped by the fact that most of the occurrences are on Crown Land that is under the responsibility of DIPL. Doing so will maintain an adequate level of genetic flow and variation within the sub-population that minimises the likelihood that the development will have a significant impact on the species. By making this commitment, the workshop identified that loss of *T. praetermissum* plants within the cleared portions of the Proposal area would not have a significant impact on the species, and so is acceptable.

To meet this commitment to conserve important occurrences of *T. praetermissum* within the HESLUP area, DIPL will:

- Develop and implement mechanisms that enable conservation, offset and management of the important occurrences;
- Prepare an ongoing program to manage the important occurrences on Crown land.
- Invest in translocation trials and studies, including the viability of developing an offsite nursery for salvaged plants, to implement re-location from cleared areas to protected areas.

It is acknowledged that these are significant undertakings which will require input and buy-in from stakeholders such as the NT EPA, DEPWS, local council, residents, adjacent land holders and managers.

7.3.5 Mitigation

The following measures will be implemented to mitigate impacts to terrestrial ecosystems.

Pre-clearance surveys and use of a fauna spotter-catcher

A pre-clearance survey will be conducted by a qualified ecologist prior to clearing and development, to identify any important habitat features for wildlife. During clearing activities, a qualified ecologist will be present to relocate or provide aid to any wildlife found or affected by clearing activities within the site. Each morning after clearing, trenches / pits / excavations will be checked for trapped wildlife, and any found will be relocated.

Weed management

During construction, the introduction and/or spread of weeds will be managed through a Weed Management Plan within the CEMP, prepared in accordance with relevant guidance documents. This plan will include hygiene and quarantine measures to prevent the introduction of new species to the site, prevent the spread of weeds within the site, and will detail control measures for existing weed infestations. Weed management will be in line with the *Weeds Management Act 2001*.

Ongoing maintenance of the habitat values of the passive public open space will be critical to minimising the impact of the Proposal on all the threatened species considered likely to be present. This will include weed and fire management and discouraging access outside of any walking and cycling trails. Responsibility for this management has not yet been assigned and may depend on the planning scheme mechanisms utilised to protect the area. DIPL will develop a management regime based on standard management practices, in consultation with DEPWS, local council, Larrakia Rangers, and Parks and Wildlife.

Design of public open space as wildlife corridor

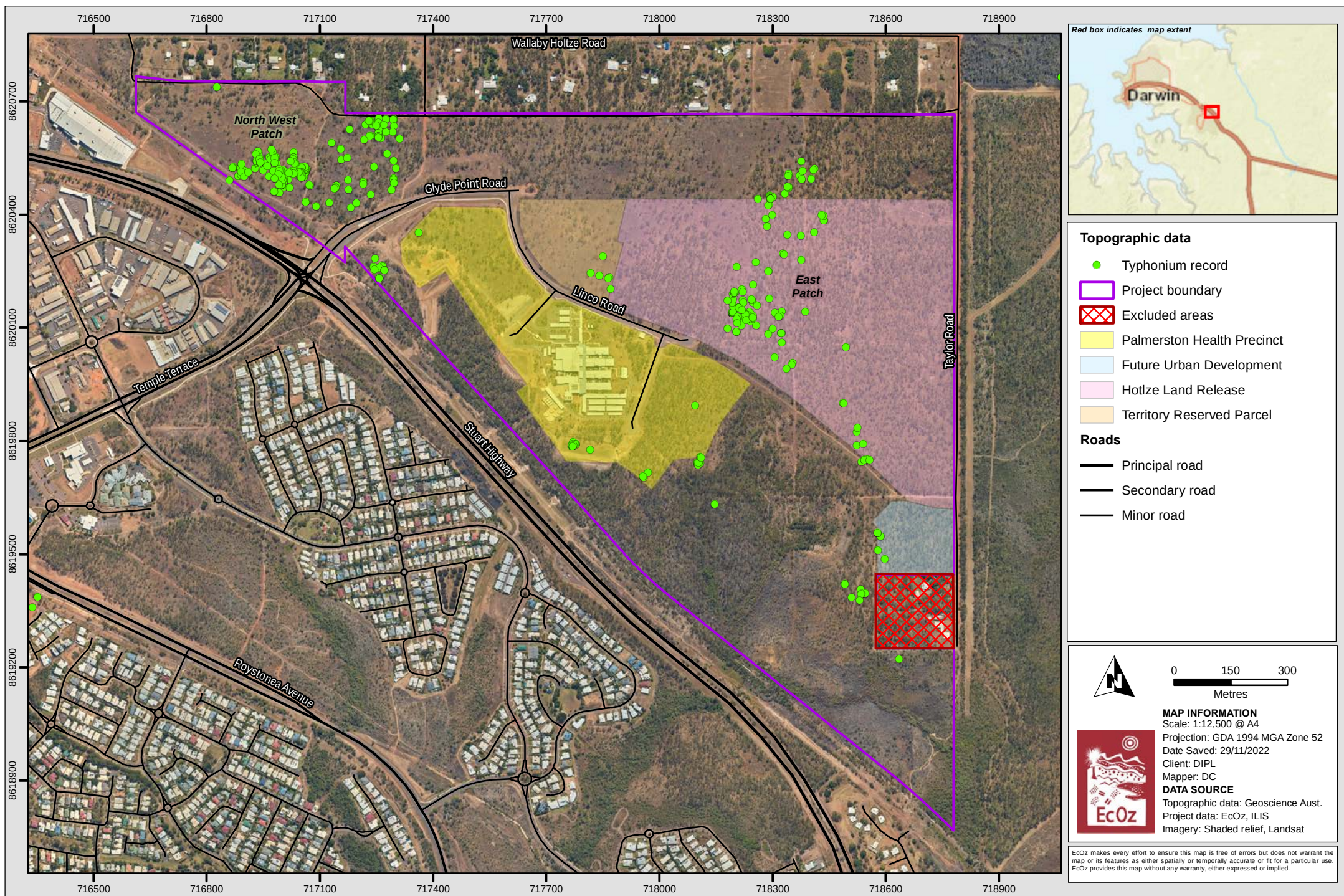
Retention of vegetation as passive public open space minimises the impacts of habitat fragmentation due to land clearing. Managed appropriately to minimise weeds and fire (under relevant Council and/or Crown Land procedures) this public open space can act as a wildlife corridor, providing for fauna movement through the area and into adjacent Kowandi.

Darwin Regional Conservation Strategy

DIPL is working with DEPWS to develop a Darwin Regional Conservation and Offset Strategy to ensure future development is undertaken in a way that supports the persistence across the region of the threatened species potentially impacted by the Proposal.

Hydrology mitigations

The Proposal has sought to minimise impacts through ensuring current hydrological flow paths are maintained, and modelling post-construction flows to ensure peak flows are reflective of pre-development conditions using industry best practice mitigations (water-sensitive urban design). The environment protection and management measures outlined in Section 7.4 indicate with appropriate management of hydrological flows, the Proposal is unlikely to result in material significant hydrological impacts. These management measures include an erosion and sediment control plan, and stormwater management plans.



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Figure 7-6. Map of *Typhonium praetermissum* records relevant to the Proposal footprint

7.3.6 Residual impact (vegetation)

Vegetation and habitats

The majority of the Proposal clearance footprint is savanna woodland and forest – the dominant habitat in the Top End. Additionally, most of the Proposal footprint to be cleared is regrowth vegetation that already has reduced ecosystem integrity because of past clearance, dumping, weeds and adjacent development.

The amount of vegetation clearance for this Proposal has been minimised through design. The clearing of approximately 75 hectares of savanna woodland will not result in a significant impact to vegetation and habitats of non-threatened species.

Significant vegetation

Areas of riparian vegetation will be retained through design of the passive public open space area. Additionally, the abovementioned hydrological mitigations will minimise the potential risk of changes in hydrology impacting riparian vegetation persistence in the area. Through these avoidance and mitigation measures, there are no significant impacts to riparian vegetation expected. There will be some loss of hollow-bearing trees; however, as discussed in Section 7.3.2, the density of hollow-bearing trees at the site does not qualify as significant vegetation.

7.3.7 Residual impact (threatened species)

Mertens' Water Monitor

The riparian habitat that supports Mertens' Water Monitor (Vulnerable under the TPWC Act) will be buffered by the passive public open space from land clearing. Critical to avoiding a significant impact to this species will be minimising changes to flows and/or water quality in the habitat that could lead to a deterioration in its quality. As described in Section 7.4, changes to hydrological flows can be managed through water-sensitive urban design and implementation of a stormwater management plan.

Black-footed Tree-rat and Northern Brushtail Possum

Due to their similar ecological and habitat requirements, the impact to the Black-footed Tree-rat (Endangered under the EPBC Act, Vulnerable under the TPWC Act) and Northern Brushtail Possum (Vulnerable under the EPBC Act) is considered together. Using adequate survey effort across the Proposal footprint, both species were only recorded in the denser woodland associated with the drainage line in the passive public open space. The vegetation that dominates the northern section of the footprint is mostly regrowth, and it lacks both the large trees with hollows that provide roosting and nesting habitat, and a diverse mid-storey that is preferred as foraging habitat – particularly for the Black-footed Tree-rat. Consequently, whilst marginally-suitable habitat for these species will be cleared for the residential development of the north of the site, retaining the passive public open space (~54 ha) should support the persistence of these species in the south of the Proposal footprint.

The Greater Darwin region is a stronghold for these two mammal species. A Darwin Regional Conservation and Offset Strategy is being prepared to ensure future development is undertaken in a way that supports the persistence of these species in the region. It is acknowledged the HESLUP proposes development across much of Greater Holtze, which coincides with many large areas in which these species have been recorded or are likely to occur. By focussing initial development on a small portion of the Greater Holtze region, this Referral seeks to ensure the release of land needed for residential development at this time without compromising the outcomes of the regional assessment for these species. Concurrent with preparing this Referral, DIPL is working with DEPWS to identify Black-footed Tree-rat and Northern Brushtail Possum habitat that can be conserved within the Greater Darwin region, establishing operational mechanisms (and associated responsibilities) for doing so. A key design consideration is maintenance of adequate vegetation and habitat to provide a wildlife corridor that maintains connectivity of the occurrence of these species within the Proposal area with known occurrences to the north-east.

The *EPBC Significant Impact Guidelines 1.1* produced by the Commonwealth Government (DEWHA 2013) describe the process for determining the significance of impacts to threatened species listed under the EPBC Act. Because they are Commonwealth-listed species which could be significantly impacted by the Proposal, an assessment against the *EPBC Significant Impact Guidelines 1.1* is provided in Table 7-7.

The main threat to Black-footed Tree-rat and Northern Brushtail Possum from this Proposal is direct loss of individuals through land clearing. Assuming that Greater Holtze is designed and developed with the connectivity objectives mentioned above, the impact to Black-footed Tree-rat and Northern Brushtail Possum from the Proposal does not meet the significant impact criteria because construction is unlikely to lead to the mortality of any individuals, critical habitat in the passive public open space will be retained, and its maintenance will ensure connectivity to adjacent habitat to the east.

Table 7-7. Significant impact assessment table for Black-footed Tree-rat and Northern Brushtail Possum

(using the criteria for Endangered species)

Criterion	Summary of impacts
Lead to a long-term decrease in the size of the population	These species were not detected at any of the survey sites within the Eucalypt woodland habitats that comprise the residential precinct and – as explained in Section 7.3.2 – that likely reflects the lack of mid-storey diversity and tree hollows in that habitat. Consequently, land clearing should not cause direct mortality of any individuals. As a precaution, all land clearing activities will include pre-clearance surveys and use of a fauna spotter-catcher.
Reduce the area of occupancy	Determining a species Area of Occupancy (AOO) is based on the IUCN 2 x 2 km grid cell method. For the Black-footed Tree-rat, the AOO is 604 km ² (TSSC 2015); for the Northern Brushtail Possum, it is 1,392 km ² (TSSC 2021). Because that habitat that will be cleared has low suitability for these species and is relatively small compared with the amount of available habitat in surrounding areas, it is unlikely that this Proposal will result in a reduction in the area of occupancy for these species.
Fragment the existing population into two or more populations	Clearing land for the residential precinct will restrict any current north-south movement of these species from the passive public open space area. However, such movement is likely to be minimal due to the low quality habitat within the area to be cleared. Moreover, the passive public open space will remain connected to similar habitat to the east in Kowandi.
Disrupt the breeding cycle of a population	The land that will be cleared for this Proposal is unlikely to contain breeding roosts due to the paucity of tree hollows and Pandanus, and is therefore unlikely to be important for the breeding cycle of these species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent the species is likely to decline	For the reasons given in this table, it is unlikely that the loss of, or decrease in quality of, habitat because of Proposal activities will cause a decline in the species.
Adversely affect critical habitat	Critical habitat for these species is not formally defined. Given that these species were only recorded in the denser, less disturbed woodland on the steeper sloped areas of the Proposal area (which are entirely contained within the passive public open space), it is assumed that this is the critical habitat for these species. Disturbance to that habitat will be minimal.
Result in invasive species, that are harmful to the species, becoming established in the species' habitat	Surveys indicate that Feral Cats are already present within the Proposal site. Predation by Feral Cats is suspected to be a threat to these species (TSSC 2015 & 2021); however, the greater Darwin region – including rural and suburban areas – is a stronghold for the Black-footed Tree-rat and Northern Brushtail Possum, despite the high density of Feral Cats in the area. The inherent risk of a significant increase in this species because of

Criterion	Summary of impacts
	Proposal activities is minimal. As such, no specific mitigation measures are proposed for this development Weeds are also considered a threat to these species (TSSC 2015 & 2021). Invasive grasses – especially dense stands of Gamba Grass – change the ability of this species to forage effectively on the ground, and result in fires that are far more intense and destructive of Black-footed Tree-rat and Northern Brushtail Possum habitat. Consequently, management of weeds in the passive public open space will need to be thorough and ongoing to ensure that this does not occur.
Introduce disease that may cause the species to decline	Disease is not considered to be a threatening process for the Black-footed Tree-rat; but spread of diseases from Black Rats is considered a potential risk to the Northern Brushtail Possum (TSSC 2021). The fact that Northern Brushtail Possums and Black Rats co-exist in the Darwin suburbs suggests that this risk has not manifested in the greater Darwin region. Camera trapping shows that Black Rats are already present in the Proposal area. Development of the residential precinct will likely increase Black Rats because the species has a strong association with human settlements, but Black Rats will likely concentrate that increase within the precinct because of the prevalence of feeding and roosting opportunities within an urban environment. Black-footed Tree-rats frequent larger rural blocks and Northern Brushtail Possums occur in the more vegetated suburbs of Darwin, but the high density of residences within the precinct reduces the likelihood that these species will be present. Nevertheless, there will be some interaction between Black Rats in the precinct, and Black-footed Tree-rats and Northern Brushtail Possums in the passive public open space.
Interfere with the recovery of a species	The Conservation Advice reports (DoE 2021 & 2015) provided to support these species' nominations for federal listing as threatened species are considered to provide sufficient direction to implement priority actions and mitigate against key threats. Those documents contain a large number of conservation and management actions, none of which will be substantially interfered with by this Proposal. In fact, if the passive public open space can be managed for fire and weeds, then this may benefit the individuals present.

Darwin Cycad

Darwin Cycads (Vulnerable under the TPWC Act) are endemic to the Top End, occurring in abundance throughout the greater Darwin region, sometimes forming dense stands (Kerrigan et al. 2006). Nevertheless, their long-term conservation has to be considered because they are long-lived, have a slow reproductive rate and localised distribution that is poorly represented in conservation reserves (Liddle 2009). Within the favoured habitat and when conditions are favourable, the Darwin Cycad can occur at densities ranging from several to more than 1,000 individuals per hectare (Watkinson and Powell 1997; Liddle 2004). Areas with very high density (i.e. greater than 700 individuals per hectare) and high density (i.e. greater than 400 individuals per hectare) stands are important for maintaining the species' diversity and function (Hill 2020). The passive public open space supports the highest density of Darwin Cycads – see Figure 7-3. Because land clearing within that area will be minimal, it is unlikely that there will be a significant impact to this species.

Typhonium praetermissum

DIPL is aware of the presence of *T. praetermissum* in both the Proposal area and the Greater Holtze region, in the past few years, and has invested in field and genetic studies of the species across its range to gain a better understanding of how sub-populations of the species are related, and therefore which occurrences are critical to the continuity of the species and should be of conservation priority. These studies have been led by the Flora and Fauna Division of DEPWS. The outcome will be a *Typhonium Praetermissum* Conservation Strategy, due in December 2022. Key to this will be retaining important occurrences of each sub-population.

The studies show that the *T. praetermissum* plants within the Proposal area are members of an occurrence within the Holtze sub-population of the species. That sub-population occurs across the Greater Holtze region as identified in HESLUP, predominantly on Crown Land. As shown in Figure 7-6, there are two main patches of *T. praetermissum* plants within the Proposal area – these are closely-related and so together constitute a single occurrence. The north-western patch will not be disturbed by Proposal activities, the eastern patch is within the residential development footprint and so will likely be cleared or removed. No other occurrences of *T. praetermissum* are within the Proposal's area of influence.

The commitments DIPL are making regarding regional conservation of *T. praetermissum* detailed in Section 7.3.4 will ensure the persistence of the Holtze sub-population of the species. More specifically, for this Proposal it has been determined that the loss of some plants within the Proposal area will not constitute a significant impact to *T. praetermissum*.

7.3.8 Conclusion

The NT EPA's objective for the Terrestrial Ecosystems factor is to: *Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.*

The assessments undertaken for this environmental factor conclude that the residual impact to general terrestrial ecosystem values will be minor. Moreover, because of commitments made by DIPL regarding the footprint of the Greater Holtze region, the activities associated with this Proposal are unlikely to have a significant impact on any threatened species.

7.4 Hydrological processes

The Hydrological Processes factor was identified for further consideration in this Referral due to the potential impacts to alteration of overland flows and groundwater recharge as a result of the Proposal. The environment protection and management measures outlined in this Referral indicate with appropriate management of hydrological flows, the Proposal is unlikely to result in material significant hydrological impacts and will meet the NT EPA's objective.

7.4.1 Factor objective

Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

7.4.2 Presence of environmental values

The environmental values identified for assessment under the Hydrological Processes factor are:

- **Surface water flow regimes** – the flow regime of surface water is the volume, duration and seasonal pattern of flows through a watercourse. The flow regime is an important factor in maintaining local ecosystems which have adapted to the conditions, including habitat formation and species migration. Flow regimes are also key in regulating the geomorphic processes that shape the flow paths and channels.
- **Groundwater levels and recharge** – groundwater is an important resource to support a number of factors including ecosystems, cultural values, public water supply and agriculture. Groundwater recharge occurs as a result of the downward movement of surface water to groundwater and is an important process in maintaining groundwater levels.

The Proposal area lies within the Darwin Harbour Region and several beneficial uses for water resources within this district have been declared under the NT *Water Act*, namely:

- Environment – provide water to keep the health of aquatic ecosystems.

- Cultural – provide water to meet aesthetic, recreational and cultural needs.
- Rural stock and domestic – provide rights and ownership rights to take water for domestic and/or stock purposes.
- Aquaculture – water for commercial production of aquatic animals, including related research.
- Agriculture - irrigation water for primary production, including related research.

Surface water flow regimes

The Proposal area lies across the catchments of the Howard River and the Elizabeth River. Catchment boundaries and surface water drainage lines are shown in Figure 7-7. There are no perennial drainage lines within the Proposal footprint, and there is only one ephemeral drainage line, in the south-east of the Proposal footprint. There are no other surface water features (e.g. swamps or wetlands) within the Proposal footprint.

A Flood Assessment (WRM 2021) undertaken for the Proposal indicates that the northern half of the Proposal area drains to the north and east into unnamed ephemeral drainage lines which then flow into tributaries of King Creek. The southern half of the Proposal area drains south into Mitchell Creek, which discharges into the Elizabeth River, and then into Darwin Harbour, approximately 7.5 km south of the Proposal area. The flood modelling does not show any potential flood impacts to the Proposal area due to its distance from the closest concentrated flow paths.

The headwaters of Mitchell Creek, a minor stream, are situated at the south-eastern corner of the Proposal area. Flows within the creek typically occur between December and June, with periods of little to no flow in the mid to late Dry season, and prior to Wet season rainfall. The Mitchell Creek Natural Resource Management Plan (EcOz 2012) notes the catchment provides an important corridor linking upland drier areas with more permanently wet areas lower in the catchment. Mitchell Creek is the only creek in Palmerston with a defined channel. Land use within the Mitchell Creek catchment is predominantly urban and community purpose, future development, and conservation.

Surface water from the development footprint that flows north drains towards a historic sandmining swamp north of Wallaby Holtze Road (approximately 500 m from the Proposal). The surface water that flows east drains towards the Kowandi North paperbark swamp approximately 1 km east of the Proposal (Figure 7-7). Both of these swamps drain towards the north into ephemeral tributaries of King Creek. Aerial imagery indicates that riparian vegetation is associated with these ephemeral streamlines and the stream flow is typical of similar ephemeral streams in the area, generally flowing from December to June. The streams drain into the perennial section of King Creek, 10 km north of the Proposal and King Creek drains into Shoal Bay approximately 12.5 km north-east of the Proposal area.

Groundwater levels and recharge

The Proposal area is within the Darwin Rural Water Control District (DRWCD) and is underlain by the Mount Partridge aquifer. This aquifer system is of local scale, low yielding and has moderate to low storage capacity (DENR 2019). The aquifer is comprised of fractured and weathered rocks, and groundwater flow paths would likely follow the land contours although localised flow could be impacted by drawdown from the nearby residential users. The Mount Partridge aquifer has further been divided into groundwater resource zones in relation to water availability. There are two aquifer management zones underlying the Proposal area; Kings Creek and Mitchell Creek (NTG 2020) as shown in Figure 7-8. Details of recharge and use within each zone are listed in Table 7-8.

Table 7-8. DRWCD aquifer management zones in Proposal area

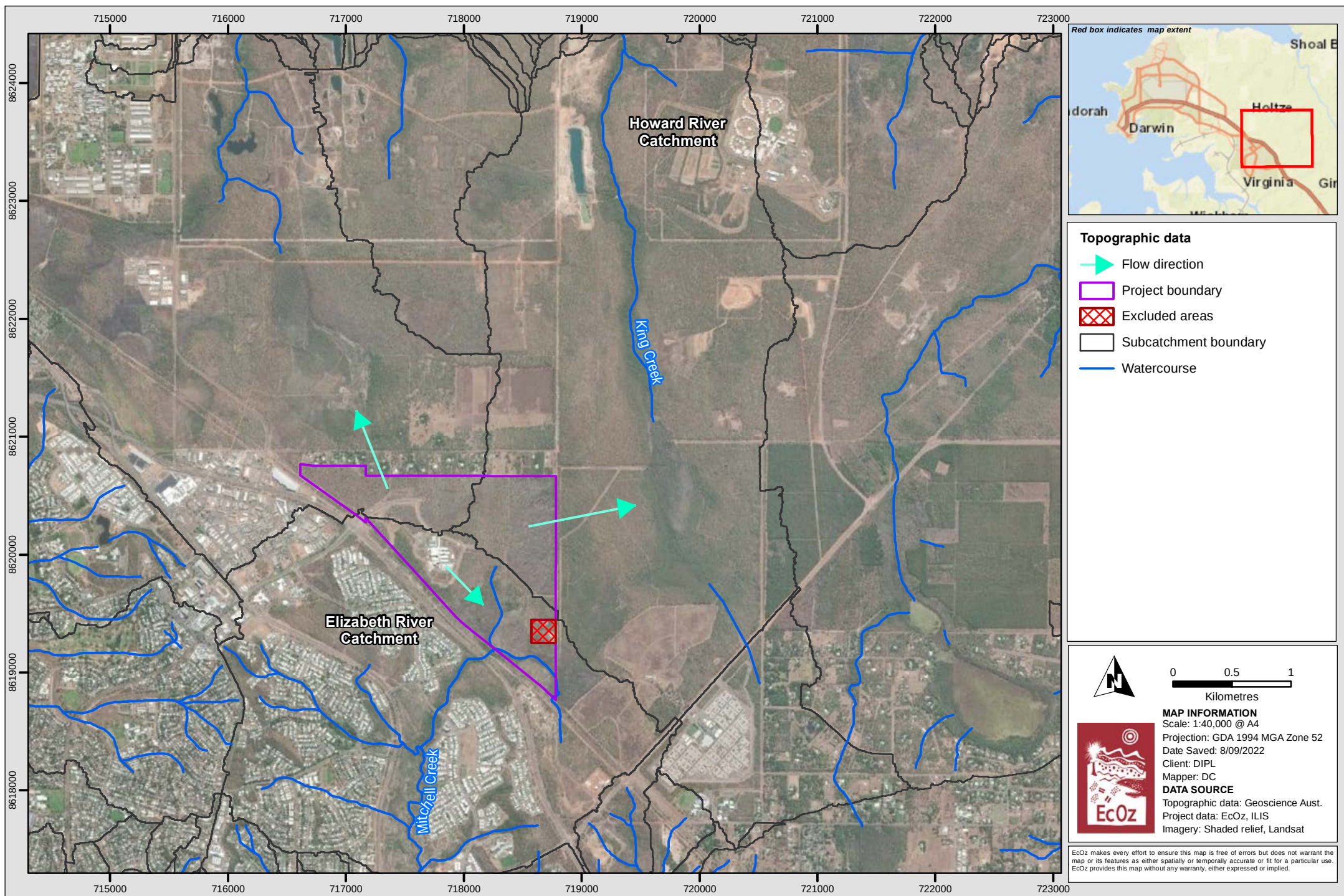
Zone #	Management Zone	Area (ha)	Total recharge (ML)	Consumptive Pool (ML)	Stock and Domestic (ML)	Licensed Use (ML)	Use Category
74	Kings Creek	8,988	17,976	3,595	434	42	Low
75	Mitchell Creek	1,642	3,283	657	823	28	Over-used

The water use categories assigned to the management zones determine the capacity for future groundwater dependent development within each zone. The two water use categories listed in the table above are defined below:

- Over-used (>100% use) – Any development that results in an increase in the number of land titles and therefore an increase in the number of statutory rights to access groundwater will not be supported
- Low (<50% use) – Applications to use this resource are currently being accepted

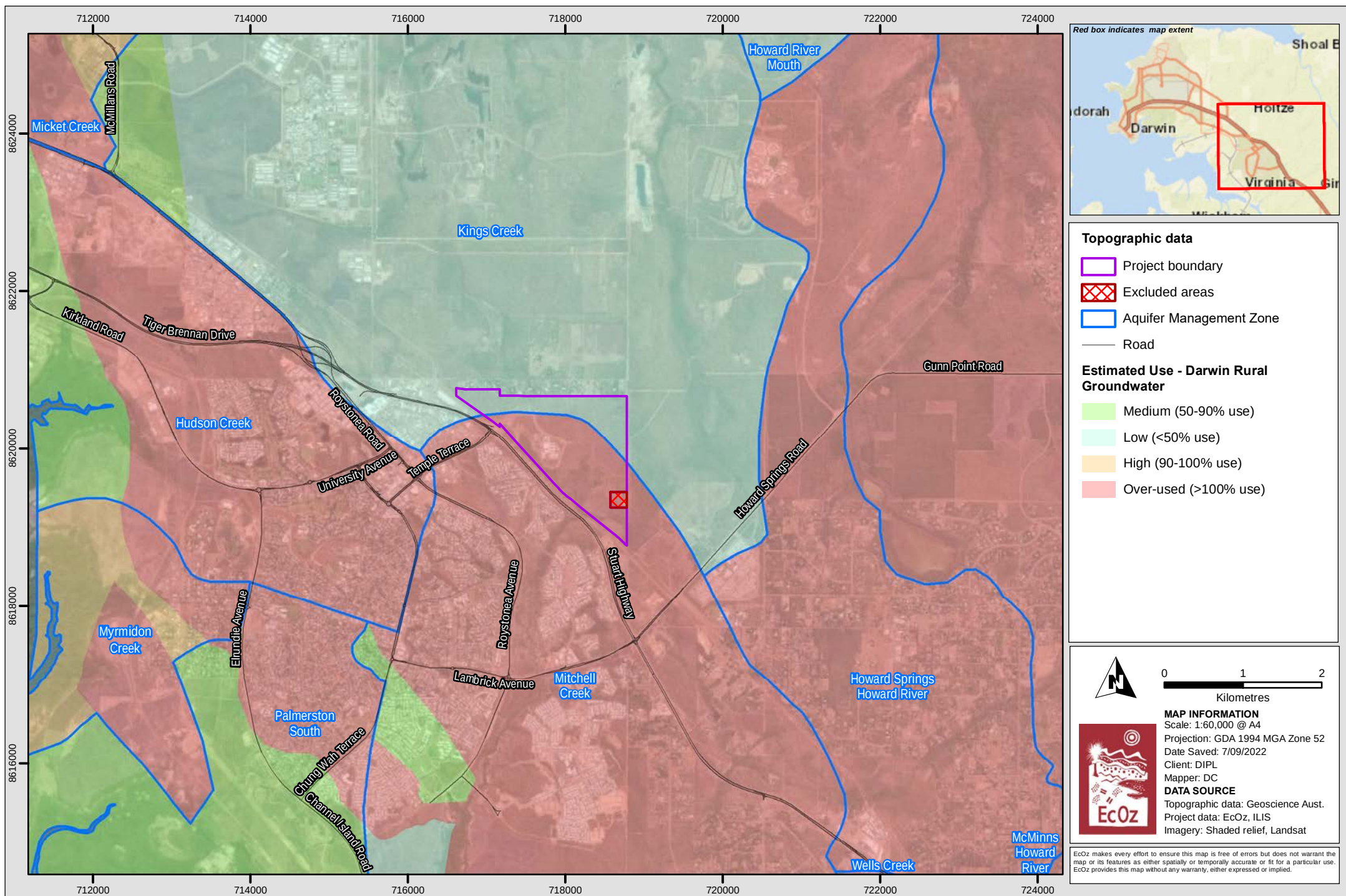
There are numerous groundwater supply bores located on existing rural properties immediately north and east of the Proposal area (Figure 7-9). There are bores mapped within the Proposal area, however these bores were unable to be located and are expected to have been decommissioned or incorrectly mapped and not actually constructed within the Proposal area. Groundwater levels in bores surrounding the area generally range between 5m to 20m with seasonal variances between the wet and dry seasons. This development does not rely on groundwater as a water supply and therefore will not impact on levels from this activity.

No groundwater dependent ecosystems were identified within the Proposal area. The Koolypinah Dolostone aquifer (fractured and karstic rocks) (approximately 3 km at the nearest point) to the east of the Proposal area feeds the Howard Springs and other groundwater dependant ecosystems (GDE) in the region including Melacca Creek, Howard River and numerous streams and small springs around the periphery of Black Jungle Swamp. These GDEs are located on the western side of the Howard Groundwater system which currently has a water allocation plan in development. The extraction of bore water from the aquifer has significantly changed the natural water balance and the system flow dynamics (NRETAS n.d.). The aquifer is at or beyond sustainable levels of extraction.



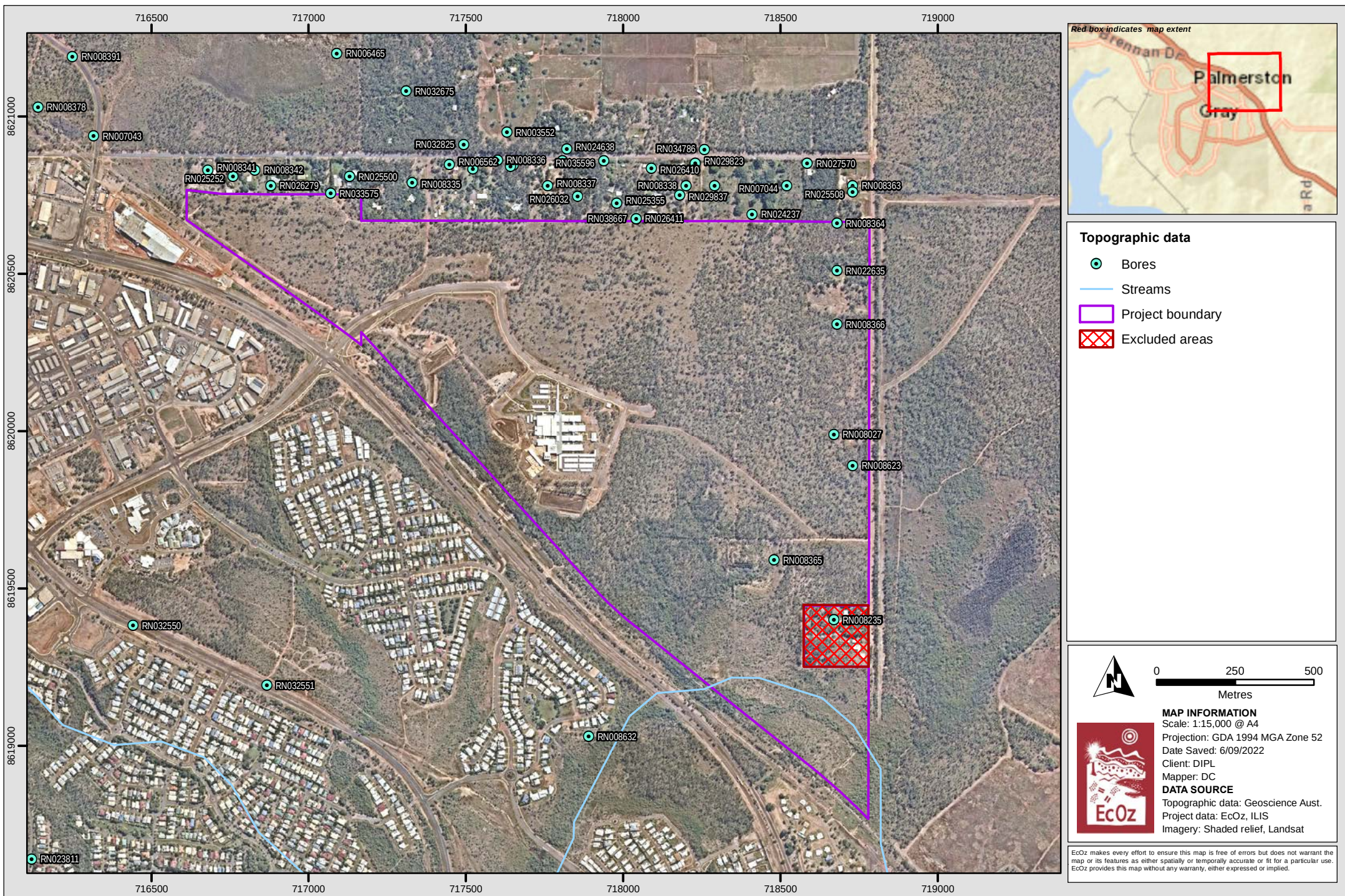
Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ22063 - Holtze residential\01 Project Files\Report Maps\Map of rivers and catchments.mxd

Figure 7-7. Catchment boundaries and surface water drainage lines



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Figure 7-8. Aquifer management zones and regional estimated usage



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ22063 - Holtze residential\01 Project Files\Report Maps\Bores in and around the project area.mxd

Figure 7-9. Groundwater bores in the vicinity of the Proposal area

7.4.3 Potential impacts

The impact assessment process identified the following potential hydrological impacts from the Proposal activities described in Section 3:

Table 7-9. Potential impacts to hydrological processes

Construction	Residential land use
Alteration of surface water hydrology as a result of land clearing and ground levelling	- Alteration of surface water hydrology as a result of increased impervious surfaces and constructed drainage networks - Reduction in groundwater recharge due to an increase in impervious surfaces

7.4.4 Impact avoidance

Impacts to hydrological processes as described in Table 7-9 cannot be avoided without impacting the overall objectives of the Proposal, and the benefits the Proposal would bring. Therefore, impacts will be mitigated as described below.

7.4.5 Mitigation

The following measures will be implemented to mitigate impacts to hydrological processes:

Primary ESCP

The Primary ESCP (and subsequent construction ESCPs) includes consideration of surface water flows and drainage controls. The Primary ESCP details typical drainage controls to appropriately manage sheet flows and channelised flows to reduce peak velocities and flow rates. Outfall controls will be located in natural low points from the site and will be designed to mitigate peak flows from the site and maintain flows to downstream receivers.

Conceptual Stormwater Management Plan

A CSMP - Appendix J - has been developed for the Proposal which indicates that development in the southern sub-catchment (south of Linco Road) will increase the total volume of stormwater runoff discharging to Mitchell Creek. Similarly, development in the northern sub-catchment (north of Linco Road) will result in increased stormwater volumes discharging into the northern drainage systems (through Kowandi and Holtze North towards King Creek). Whilst development will result in an increase in total runoff, peak discharges will be mitigated and the locations of outfalls are reflective of predevelopment conditions to minimise any downstream impacts. The CSMP maintains current catchment boundaries and will promote localised recharge within each catchment

Existing drainage infrastructure to control stormwater volumes has been constructed as part of the Palmerston Regional Hospital and will also support the proposed new health precinct. This infrastructure includes three detention basins at outfall points.

The new stormwater drainage system will comprise a network of sealed roads, roadside kerb and channel, entry pits and piped drainage supplemented by a system of overland flow paths located in a public open spaces and drainage reserves. Design of the stormwater drainage system and structures will be in accordance with the requirements of Australian Rainfall and Runoff (IEAUST), Guidelines for Preventing Biting Insect Problems for Urban Residential Developments or Subdivisions in the Top End of the NT and relevant Council Development Guidelines and will be approved through the Development Application process.

Northern sub-catchment – the residential development precinct will feature an underground stormwater drainage system discharging east towards Kowandi and north towards Wallaby Holtze Road to maintain the current sub-catchment flow regimes. The CSMP indicates that there will be up to 3 points of discharge that will include temporary outfalls, detention structures and treatment devices. The final stormwater drainage devices may change as the Greater Holtze development progresses in order to integrate with the wider stormwater system.

Southern sub-catchment – the community/health precinct and any other flows captured south of Linco Road will be directed to potentially another detention structure prior to discharge into Mitchell Creek (similar to the existing PRH stormwater system).

Indicative locations of the detention structures are shown on Figure 7-10.

The detention structures will be designed to attenuate peak flows to reflect pre-development conditions and mitigate downstream impacts. The relatively small development footprint, in relation to the total catchment area is not predicted to increase flood impacts downstream.

Water-sensitive Urban Design (WSUD)

Water-sensitive Urban Design (WSUD) is an approach to urban planning and design philosophy, which aims to overcome some of the stormwater management deficiencies associated with conventional developments. WSUD promotes an approach to urban development that responds to the site's natural features, protects natural ecosystems on site and downstream and optimises the use of water as a precious resource.

This Proposal is committed to implementing the principles of WSUD in accordance with the NT Subdivision Development Guidelines (SDG) throughout all stages of development to ensure best-practice outcomes for the Proposal.

The NT SDG sets out the range of WSUD approaches that can be practically implemented across the Northern Territory, including:

- Lakes;
- Bioremediation (at stormwater source only);
- Wet/dry wetlands; and
- Ephemeral wetlands.

7.4.6 Residual impact

Considering implementation of the abovementioned mitigation measures, there are no significant residual impacts expected to hydrological processes.

Surface water flow regimes

During construction and land clearing, surface water flows from the Proposal area are also expected to increase due to the removal of vegetation and installation of channelised drainage lines. Urbanisation of stormwater catchments can increase the rate of surface water flows discharging into the downstream receiving environment through altering land use and increasing impervious areas, thereby reducing stormwater infiltration and concentration time. The channelising of water through an engineered stormwater network can also result in increased flow velocities. Altering outfall locations from developments can not only concentrate flows in these locations but also result in reduced flows to other areas that may have been receiving pre-development flows.

The use of WSUD features and implementation of the CSMP will ensure the peak velocities are maintained and outfalls are located to match pre-development conditions and minimise impacts to the downstream receiving environments.

Groundwater levels and recharge

Urbanisation and the increase in impervious areas through developing the land will reduce the surface area available for infiltration and groundwater recharge. The approximate area for urban development within the Proposal area (including housing, commercial areas and road infrastructure) is 82 ha. Assuming this area is replaced with impervious surfaces, it represents less than 50 % of the total Proposal area. In considering vegetated backyards, verges and suburban parks, the actual impacted area is expected to be less than this. Therefore, a large proportion of the site (greater than 50 %) will remain as open spaces and/or vegetated to promote surface water infiltration and subsequent groundwater recharge.

Maintaining large areas of undeveloped, open space within the Proposal area combined with the principles of WSUD still allows for surface water infiltration leading to diffuse groundwater recharge over a large proportion of the site. As the Proposal does not require groundwater extraction for future use, the Proposal is not expected to have a significant impact on groundwater levels.

7.4.7 Conclusion

The NT EPA's objective for the Hydrological Processes factor is to: *Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

The Proposal has sought to minimise impacts through ensuring current hydrological flow paths are maintained, and modelling post-construction flows to ensure peak flows are reflective of pre-development conditions using industry best practice mitigations (WSUD). The environment protection and management measures outlined in this Referral indicate with appropriate management of hydrological flows, the Proposal is unlikely to result in material significant hydrological impacts and will meet the NT EPA's objective.

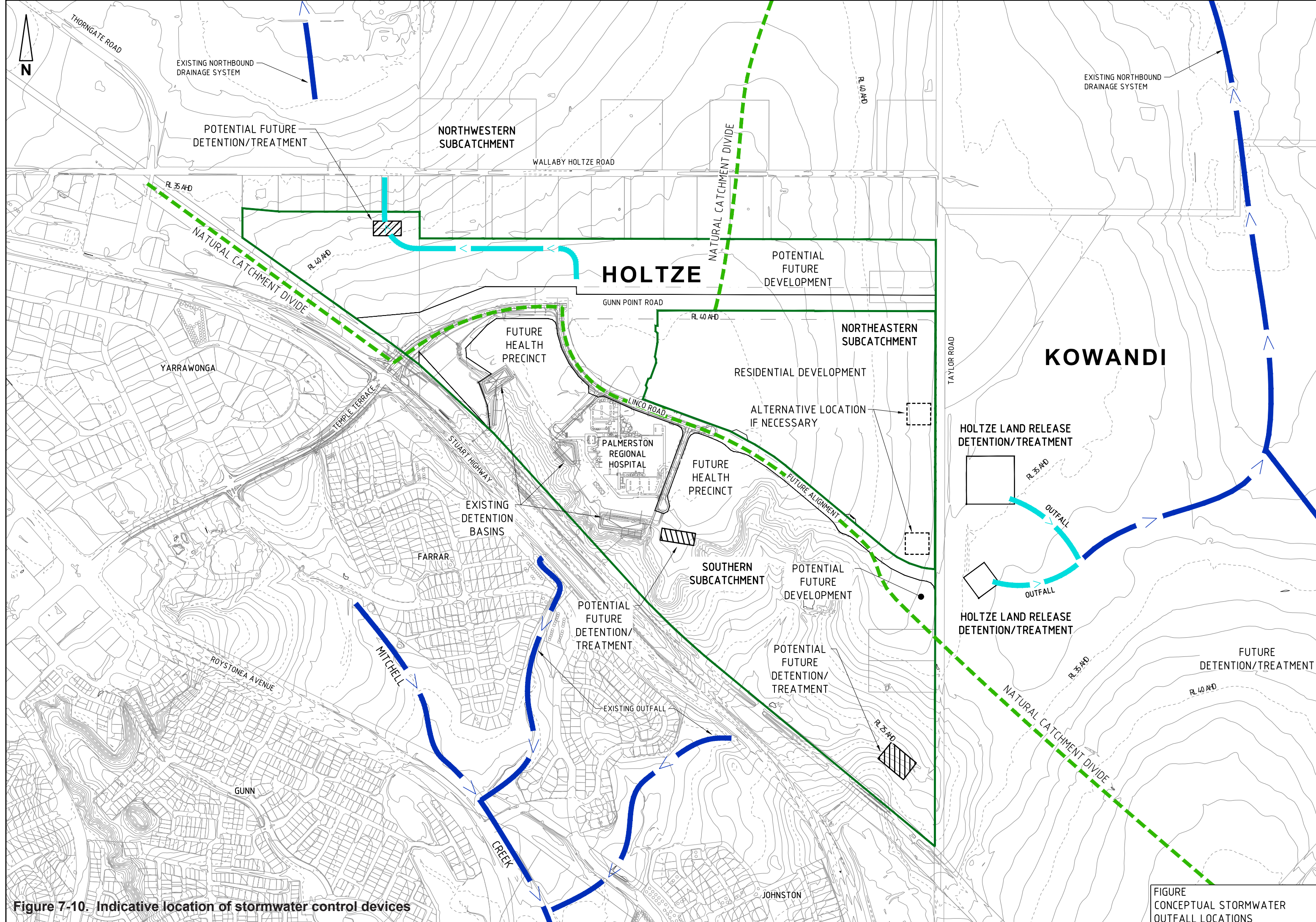


Figure 7-10. Indicative location of stormwater control devices

FIGURE
CONCEPTUAL STORMWATER
OUTFALL LOCATIONS

7.5 Inland water environmental quality

The Inland Water Environmental Quality factor was identified for further consideration in this Referral due to the potential impacts to water quality from land clearing, construction activities and the urbanisation of the natural environment as a result of the Proposal. The environment protection and management measures outlined in this Referral indicate with appropriate management of water quality, the Proposal is unlikely to result in material significant water quality impacts and will meet the NT EPA's objective.

7.5.1 Factor objective

Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

7.5.2 Presence of environmental values

The environmental values identified for assessment under the inland water environmental quality factor are:

- **Surface water quality** – surface water quality is important in maintaining ecosystem health and supporting biodiversity within the catchment.
- **Groundwater quality** – ground water quality is important in managing human health impacts from direct consumption or contact with irrigation or stock water.

Surface water quality

Mitchell Creek

The headwaters of Mitchell Creek, a minor stream, are situated at the south-eastern corner of the Proposal area. Flows within the creek typically occur between December and June, with periods of little to no flow in the mid to late Dry season, and prior to Wet season rainfall. Mitchell Creek flows in a southerly direction through built-up areas in Palmerston, discharging into Elizabeth River. The Mitchell Creek catchment is approximately 1,573 ha and land use within the catchment is predominantly urban and community purpose, future development, and conservation.

There is limited water quality data available for Mitchell Creek, however the catchment has undergone significant degradation due to urbanisation over the last 20 years or more. The catchment is under threat from the increasing urbanisation in Palmerston as well as weed and pest invasion, uncontrolled vehicle access and illegal dumping of rubbish and garden waste (EcOz, 2012).

Mitchell Creek discharges into Elizabeth River which is included in a water quality monitoring program for the whole of Darwin Harbour. The last report card published in 2020, indicates that the water quality in Elizabeth River was rated as very good. The median recorded concentrations of turbidity, dissolved oxygen, Chlorophyll-a and nutrients were all compliant with the Darwin Harbour Water Quality Objectives.

King Creek

Surface water from the urban development area of the Proposal drains into an ephemeral stream 1 km north of the boundary. The stream drains into King Creek, 10 km north of the Proposal area. The King Creek catchment has an area of 64 km² and land use within the catchment is predominantly rural, Commonwealth (defence) land and extractive industry. The extractive industry is mainly for the extraction of gravel and stone within Crown Land. A water quality monitoring program undertaken in the early 1980's detected high levels of turbidity and suspended solids, and periods of high total hardness and chloride which was potentially influenced by the extractive industries (Field, 1983).

King Creek discharges into Shoal Bay which is included in a water quality monitoring program for the whole of Darwin Harbour. The last report card published in 2020, indicates that the water quality in Shoal Bay was rated

as very good. The median recorded concentrations of turbidity, dissolved oxygen, Chlorophyll-a and nutrients were all compliant with the Darwin Harbour Water Quality Objectives.

Land adjacent to the Proposal area contains seasonal swamps, namely, a historic sandmining swamp – to the north (500 m) – and Kowandi North paperbark swamp – to the east (1 km). No water quality data is available for these swamp areas, however water quality within swamps can be seasonally variable as they don't experience the same flow regimes as defined waterways (Aquatic Health Unit 2006).

Groundwater quality

Bore logs downloaded from the NT Governments 'NR Maps' online database indicate that groundwater quality is very good, with circum-neutral pH and low concentrations of dissolved ions. Groundwater generally occurs at a depth of 60 – 80 m below ground level, with standing water levels ranging from 6 – 12 m below ground level.

7.5.3 Potential impacts

The impact assessment process identified the following potential impacts to surface and groundwater quality from the Proposal activities described in Section 3:

Table 7-10. Potential impacts to inland water environmental quality

Construction	Residential land use
- Increased turbidity caused by erosion from soil disturbance. - Contamination of surface and/or groundwater from chemical spills or leaks.	Decreased surface water quality from contaminated stormwater drainage.

7.5.4 Impact avoidance

Impacts to inland water environmental quality as described in Table 7-10 cannot be avoided without impacting the overall objectives of the Proposal, and the benefits the Proposal would bring. Therefore, impacts will be mitigated as described below.

7.5.5 Mitigation

The following measures will be implemented to mitigate impacts to inland water environmental quality:

Construction management plans

ESCPs will include appropriate controls for minimising erosion and treating sediment laden water in accordance with guidelines to ensure discharges from site are clean and protect downstream receptors.

CEMPs will include provisions for protection of water quality including:

- Spill containment and response procedures;
- Hazardous goods storage requirements in line with relevant Australian Standards (e.g. bunding);
- Waste management in accordance with regulations and best practice guidelines; and
- Temporary ablution block design and approval, and appropriate wastewater removal processes.

Appropriate construction management measures within the CEMP, as detailed above and in Sections 7.2.4 and 7.2.5, will minimise the risk of contamination of both surface water and groundwater as a result of construction works. Additionally, the underlying aquifer is very deep - 60 – 80 m below ground level, with standing water levels ranging from 6 – 12 m below ground level - so any spills or leaks to surface are also unlikely to infiltrate into groundwater.

Conceptual Stormwater Management Plan

The protection of the receiving ecosystems and the enhancement of water conservation within this development will be achieved by implementing Water Quality Management in line with the Darwin Harbour Strategy (Darwin Harbour Advisory Committee, 2010). The Darwin Harbour Strategy includes the following relevant objectives:

- *1.4 - Water quality and ecological health of the marine, freshwater and terrestrial catchment environments in the region are to be maintained or, if quality and health have been negatively affected through human activity, improved where possible; and*
- *1.10 - Stormwater collection systems are to be designed and managed to minimise pollution of receiving waters, protect the structure of waterways, optimise the protections of property, and where and when possible, provide grey water for reuse and ensure public health and safety.*

This Proposal has adopted the NT SDG water quality performance targets (which are based on the Darwin Harbour Strategy Objectives) for stormwater from developed areas, which are as follows:

- 80% reduction in the mean annual load of total suspended solids (TSS)
- 35% reduction in the mean annual load of Total Phosphorus (TP)
- 45% reduction in the mean annual load of Total Nitrogen (TN)
- 90% reduction in the mean annual load of Gross Pollutants.

To achieve these performance targets, the CSMP has considered a number of treatment options available to the Proposal as detailed below:

- **Gross Pollutant Traps (GPT)** is a sediment trap incorporating a litter or trash rack and is designed to remove litter and coarse sediments greater than 5 mm before it enters waterways. GPTs will be considered at the point of discharge from piped systems and detention basins where they will be most effective.
- **Grassed swales** as opposed to concrete alternatives, provide flow paths for stormwater whilst also promoting infiltration, treatment of nutrients and removal of TSS.
- **Detention basins** either wet or dry, can provide effective removal of coarse sediments, pollutants and nutrients due to retention time.

To establish the effectiveness of stormwater treatment options, the adopted systems will be modelled using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). This model uses inputs relevant to the development area (such as soil types, device configurations, pollutant loads etc) to then predict pollutant load reductions to be verified against the Proposal's water quality objectives.

Water-sensitive urban design (WSUD)

This Proposal is committed to implementing the principles of WSUD included in the NT SDG throughout all stages of development to ensure best-practice outcomes for the Proposal. Natural stormwater quality controls such as grassed swales and natural detention basins meet the objectives of WSUD, and these options will be considered in preference to other mechanical or chemical treatment devices.

7.5.6 Residual impact

Considering implementation of the abovementioned mitigation measures, there are no significant residual impacts expected to inland water environmental quality.

Surface water quality

Erosion from soil disturbance during construction, and potential spills and leaks of hazardous chemicals, have the potential to impact surface water quality by increasing turbidity and introducing contamination to waterways. Additionally, the stormwater drainage system and increased human presence in the area has potential to impact surface water quality by directing contaminated stormwater from roads and residential areas

into waterways. Controls such as ESCP's and chemical and hazardous substance storages in accordance with Australian Standards are standard, and proven effective, in mitigating impacts to water quality associated with construction activities. The adoption of WSUD principles and implementation of stormwater treatment devices will manage the urban runoff water quality and protect the downstream receptors.

Groundwater quality

As with surface water quality, the nominated construction management controls are standard and effective in mitigating impacts to groundwater quality associated with construction activities.

The Proposal has potential future benefits for groundwater quality in the region as the urbanisation of the area will result in the connection of the suburb into mains water and the urban sewage system. This will ultimately reduce the reliance on groundwater extraction in the region and reduce the number of septic systems that have the potential to impact on groundwater quality. The sewage system for the Proposal will be designed to meet current National Standards and Power and Water Corporation requirements to minimise the risk of failures resulting in spills or leaks.

7.5.7 Conclusion

The NT EPA's objective for the Inland Water Environment Quality factor is to: *Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.*

The Proposal has sought to minimise impacts through a hierarchy of controls including avoidance (erosion control to eliminate sedimentation risk during construction) through to the adoption of industry best practice mitigations and proven treatment controls and devices (WSUD) in accordance with the NT SDG. The environment protection and management measures outlined in this Referral indicate with appropriate management of water quality, the Proposal is unlikely to result in material significant water quality impacts and will meet the NT EPA's objective.

7.6 Community and economy

The Community and Economy factor was identified for further consideration in this Referral due to the potential impacts during construction, including to local amenity at nearby residential receptors and PRH due to noise and dust emissions, and exposure to biting insects impacting human health. Additionally, the Proposal has potential social benefits during both construction, and through provision of housing required to meet the demand of forecast population growth. The screening level assessment presented in this Referral indicates there are appropriate measures available to manage impacts related to biting insects, and the Proposal is unlikely to result in material significant social impacts.

7.6.1 Factor objective

Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.

The assessment of this factor has been based on a combination of desktop research, consultation, technical assessments and local knowledge. Guidelines used to inform the assessment include:

- *Environment Protection Act 2019*
- IAP2 Quality Assurance Standard for Community and Stakeholder Engagement
- NT EPA Guidance for Proponents – Stakeholder Engagement (2019)
- New South Wales Social Impact Assessment Guideline for State Significant Projects (2021).

7.6.2 Presence of environmental values

The environmental values identified for assessment under the community and economy factor are:

- **Way of life** - how people live, how they get around, how they work, how they play, and how they interact on a daily basis;
- **Community** - composition, character, cohesion, function, and sense of place;
- **Access** - how people access and use infrastructure, services and facilities, whether provided by local, state, or federal governments, or by for-profit or not-for-profit organisations or groups;
- **Culture** - both Aboriginal and non-Aboriginal culture, including shared beliefs, customs, values, and stories, and connections to country, land, waterways, places, and buildings;
- **Health and wellbeing** - physical and mental health, especially for those who are highly vulnerable to social exclusion or substantial change, plus wellbeing of individuals and communities;
- **Surroundings** - access to, and use of, services that ecosystems provide, public safety and security, access to and use of the natural and built environment, and its aesthetic value and amenity;
- **Livelihoods** - people's capacity to sustain themselves, whether they experience personal breach or disadvantage, and the distributive equity of impacts and benefits; and
- **Decision-making systems** - whether people experience procedural fairness; can make informed decisions; have power to influence decisions; and can access complaint, remedy and grievance mechanisms.

Social context and surrounding land use

The Proposal area is largely undeveloped land, with minor areas of disturbance from illegal dumping. The PRH, which opened in 2018, is within the Proposal area boundary. Directly north of the Proposal area there are 21 residential lots along Wallaby Holtze Road. East of Taylor Road is undeveloped Commonwealth freehold land, identified in the HESLUP for future residential development. There are two adjacent rural residential blocks along Taylor Road (Portion 2307 and 2277) that are privately owned and while included in the Proposal area, are not identified for development in the near future. The site is bordered to the south-west by the Stuart Highway, across which is the suburb of Farrar and the 15 Mile Community, Palmerston.

Other land uses within 5 km include large scale commercial properties, including Bunnings and Boating Camping Fishing (BCF), Robertson Barracks, Darwin Correctional Centre, Howard Springs rural activity centre and Howard Springs Nature Park. However, the immediate surrounding area is largely undeveloped with a mix of land use zoning.

The area of Holtze is incorporated in the Litchfield LGA. The Litchfield LGA incorporates land around Ironstone and Knuckey Lagoon on the urban fringe of Darwin, Robertson Army Barracks, activity centres around Howard Springs, Coolalinga, Humpty Doo, Berry Springs and Mandorah, and dispersed rural residential, rural living and agricultural land holdings. The existing socio-economic character of the Litchfield LGA is distinctly rural, with many people choosing to live in the area as a rural lifestyle alternative to urban living in the adjacent Palmerston and Darwin. By contrast, the Palmerston region consists of urban areas with medium to high-density residential development.

The population of the Litchfield LGA is generally older, with a median age of 40 years compared to a median age of 31 years in Palmerston (ABS 2020a). Children aged 0 - 14 years make up a lower portion of the population in the Litchfield LGA (16% compared to 25% in Palmerston), whilst people aged 65 years and over make up a higher portion of the population (10.9% compared to 5.3% in Palmerston) (ABS 2020a & ABS 2020b).

The most common occupations in Litchfield (M) include technicians and trades workers (24.3%), clerical and administrative workers (14.1%), professionals (11.9%), managers (12.3%), and machinery operators and drivers (8.7%) (ABS 2016). These employment statistics are indicative of a larger proportion of the population being employed in rural agricultural activities and Defence than is the case in the broader Palmerston and Darwin area. Unemployment is low at 3.9% compared to the NT (7.0%) and Australian (6.9%) statistics (ABS 2016).

In recent years, the Palmerston and Litchfield parts of the Darwin statistical division have recorded the highest growth in population of any Northern Territory Local Government Area. At the 2020 census the population of Litchfield was 25,566 whilst Palmerston was 39,032 (ABS 2020a & ABS 2020b).

7.6.3 Potential impacts

A screening level assessment of potential social impacts (positive and negative) was undertaken using the screening tool and guidance provided in the New South Wales Social Impact Assessment Guideline for State Significant Projects (2021). The purpose of the screening assessment is to identify those impacts that are potentially significant, and therefore will require further assessment to be undertaken to ensure they are avoided and mitigated to an acceptable level, or in the case of positive impacts, work is undertaken to ensure the benefits are realised by the local community.

The following assumptions apply to this assessment:

- The Proposal will be constructed and operate in accordance with all relevant regulatory guidelines, including those for the management of noise, dust, and safety;
- Stakeholders have honestly communicated any concerns based on information presented to them during consultation;
- Mitigations identified will be implemented and effective; and
- The Proposal has been developed in accordance with the HESLUP Land Capability and Needs Assessment (NTPC, 2021) therefore community services and supporting infrastructure has been incorporated in the Proposal design such that residents will have sufficient access to required services.

The impact assessment process identified the following potential impacts to community and economy from the Proposal activities described in 153. The potential impacts were identified considering the issues raised during consultation, and professional judgement of the assessors informed by knowledge and experience of the social impacts that have occurred with other similar projects in the NT:

Table 7-11. Potential impacts and benefits to community and economy

Construction	Residential land use
• Economic benefits and employment due to construction activities. • Loss of amenity due to noise and dust emissions. • Disturbance of Aboriginal sacred sites due to land clearing. • Disturbance of non-Aboriginal archaeology due to land clearing. • Human health and nuisance impacts due to exposure to biting insects. • Access restrictions / delays due to construction related traffic. • Stress / anxiety about water resources due to water use for construction.	• Improved way of life due to residential land use and housing availability. • Improved sense of place for new residents due to housing availability. • Improved access to PRH due to development of community land uses and nearby residential land uses. • Improved access to community services and facilities due to development of community land uses and roads. • Improved access for pedestrians/cyclists due to development of roads and shared use paths. • Increased local employment opportunities and business generation to local business. • Loss of sense of place for existing residents due to more people inhabiting the area. • Impacts to access of emergency services due to more people inhabiting the area.

Construction	Residential land use
	• Loss of amenity due to residential noise and traffic • Human health and nuisance impacts due to exposure to biting insects. • Visual impacts due to residential land use. • Lack of access to recreational activities due to more people inhabiting the area. • Lack of access to public transport and social infrastructure due to more people inhabiting the area. • Increased pressure on local council and services provided due to more people inhabiting the area. • Stress / anxiety about water resources due to water use for residential land use. • Traffic impacts due to new roads and traffic

7.6.4 Impact avoidance

The works associated with this Proposal has been designed to minimise amenity impacts to existing residents by maintaining a vegetation buffer between existing residential properties and the area proposed for residential development. This has occurred directly in response to feedback from the local community to avoid visual and operational noise impacts and minimise any impacts on sense of place currently held by existing residents.

Additionally, the passive public open space has been incorporated to minimise impacts on biodiversity that are valued by the community. The Proposal is in line with the land capability and social infrastructure needs assessment undertaken, to avoid impacts related to increased pressure on social infrastructure and lack of access to social infrastructure.

A traffic impact assessment has been prepared to inform Proposal design, to avoid traffic related impacts during the residential living phase of the Proposal. The updated road network has been designed by suitably qualified specialists to ensure they are fit for purpose, avoiding impacts associated with insufficient capacity of the road network.

7.6.5 Mitigation

A range of mitigation and enhancement measures are available for the impacts – both positive and negative – identified in Appendix L.

Construction environment management plan

A CEMP will be prepared to mitigate potential construction-related impacts. This management plan will include provision for the following:

- Construction noise level monitoring to ensure construction activities occur in accordance with NT EPA Noise Management Framework Guideline 2018.
- Dust suppression.
- Unexpected finds procedure for heritage (Aboriginal and non-Aboriginal).
- AAPA authority certificate to manage and avoid impacts to Aboriginal sacred sites.
- Biting insect management plan to manage impacts of biting insects during construction.
- Traffic management plan to manage construction traffic.

Stakeholder engagement plan

A stakeholder engagement plan is being prepared for the Proposal to guide engagement and consultation through future stages. The plan will include guidance and structure regarding engagement with all stakeholders, including local residents, Government departments and authorities, and relevant private corporations – as discussed in Section 6.

Biting insect management plan

DIPL has together with Department of Health (Medical Entomology), prepared a biting insect management plan – see Section 7.7 and Appendix K – to manage the human health risk and nuisance impacts of biting insects. Mitigations include both active management and engineering strategies, for potential impacts during both the construction and operations phase, to manage existing biting insect habitat and ensure new habitat is not created as a result of the Proposal.

Conceptual stormwater management plan

As discussed in Section 7.4, a CSMP has been prepared to inform management of stormwater and design of stormwater drainage infrastructure. In addition to mitigating impacts relating to hydrological processes and inland water environmental quality, this will reduce the likelihood of inadvertently creating new biting insect habitat through mismanagement of water flows and drainage.

7.6.6 Residual impact

The social impact screening assessment – Appendix L– identified one negative impact as being potentially significant in terms of its impact on the health and well-being of local residents. Appropriate mitigations have been identified to manage this potential impact to an acceptable level, which is discussed below.

The other impacts were not identified as being potentially significant and can be managed through standard mitigation measures. A full list of potential impacts and associated mitigations is provided in Appendix L.

Considering implementation of the abovementioned mitigation measures, there are no significant residual impacts expected to community and economy.

Health and wellbeing – biting insects

Biting insects are known to be a nuisance, and carry potentially life-threatening disease. Establishment of new residential area may lead to health risks and nuisance impacts of biting insects for residents of the Holtze Development Area. As is discussed further in Section 7.7, there is known biting insect habitat both within and nearby the Holtze Development Area.

The Holtze Development Area is likely to become home to a range of residents, including children and other people who are vulnerable to biting insect nuisance and disease. The impacts of biting insects may vary for different land uses across the Proposal area.

While biting insects are managed in other residential development projects across the Top End, there is a risk the Proposal could inadvertently create new biting insect habitat, further exacerbating the problem.

DIPL has consulted with Department of Health and prepared a biting insect management plan – see Section 7.7 and Appendix K – to manage the risk to a level that is acceptable by Department of Health. Mitigations include both active management and engineering strategies, for potential impacts during both the construction and operations phase, to manage existing biting insect habitat and ensure new habitat is not created as a result of the Proposal. The CSMP will also support this.

Other – negative

The full list of potential impacts and associated mitigations is provided in Appendix L. None of the other impacts were identified as being potentially significant, and have been avoided through planning and design, or will be managed using standard management measures in future. Long-term planning, extensive community

consultation and ongoing stakeholder engagement, and preparation of a land capability and social infrastructure needs assessment will avoid impacts associated with undersupply of infrastructure and poor planning. Other impacts, such as construction related amenity impacts and disturbance of heritage, can be managed through standard procedures included in a CEMP. Impacts to existing residents' sense of place through changed zoning and land use have been mitigated through ongoing consultation and retention of a vegetation buffer for this stage of the development. This will be further mitigated by ensuring new developments comply with design and layout requirements of the NTPS, and further engagement with existing residents to reaffirm their existing land use rights are not being altered.

Other – positive

The Proposal will provide benefits during both the construction and operation phase. These include employment opportunities, increased housing availability, new community services and improved local amenity and community cohesion for future residents. These benefits can be maximised through the development of a local procurement plan and implementation of the area planning principles.

7.6.7 Conclusion

The NT EPA's objective for the Community and Economy factor is to: *Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians*. The Proposal will provide housing and supporting infrastructure in line with forecast demands of the growing population in the Palmerston region, benefiting current and future generations of Territorians. The Proposal has sought to minimise impacts through extensive planning and consultation, basing design on relevant land capability and infrastructure needs assessments for the area. Although one impact is identified as being potentially significant, a biting insect management plan has been prepared in consultation with Department of Health to demonstrate how this risk will be mitigated to an acceptable level. The screening level assessment presented in this Referral indicates with appropriate management of impacts related to biting insects, the Proposal is unlikely to result in material significant social impacts.

7.7 Human health

The Human Health factor was identified for further consideration in this Referral due to the known biting insect risk in the area, and the potential impacts on human health. DIPL have prepared a management plan that demonstrates risk to human health can be managed to a level that is considered acceptable by Department of Health, as is outlined in this Referral.

7.7.1 Factor objective

Protect the health of the Northern Territory population.

This assessment has been based on a Medical Entomology biting insect assessment (2020) for the Holtze, Kowandi North, Howard Springs Forestry Reserve area, and review of relevant assessments and mitigations employed on similar residential development projects across the Top End. Guidelines and legislation used to inform this assessment include:

- Guidelines for Preventing Biting Insect Problems for Urban Residential Developments or Subdivisions in the Top End of the NT 2009
- Northern Territory Subdivision Development Guidelines 2020
- Work Health and Safety (National Uniform Legislation) Act 2011
- NT Public and Environmental Health Act 2011.

7.7.2 Presence of environmental values

The environmental value identified for assessment under the human health factor is:

- **Protection from disease** – protection from disease is important in maintaining human health at the population level, preventing harm and suffering, and supporting a healthy and balanced economy.

The Proposal is proximal to coastal mangroves, estuarine creeks and swamps that provide suitable habitat for a variety of biting insects such as midges and mosquitoes. Biting insects can pose potential health risks, both as pest insects and as vectors of diseases such as Ross River virus, Barmah Forest virus, Murray Valley encephalitis virus and Kunjin virus. Previous biting insect investigations undertaken by Department of Health across 2019 and 2020 at and near the site provide an indication of biting insects that occur within close proximity of the Proposal. Biting insects recorded during this investigation include:

- *Aedes vigilax* - vector of Ross River virus (RRV) and Barmah Forest virus (BFV).
- *Culex annulirostris* - vector of RRV, BFV, Murray Valley encephalitis virus (MREV) and Kunjin virus (KUNV).
- *Coquillettidia xanthogaster*.
- *Anopheles sp.* – vector of malaria.

There are multiple breeding sites in and around the Proposal area, including seasonally flooded wetlands and large freshwater wetlands, both natural and man-made.

Within the Proposal area

Two areas of borrow pits were identified adjacent to Mitchell Creek, north of the Stuart Highway within the section of Proposal area identified for open space, forming potential mosquito breeding sites particularly during the wet season. Mitchell Creek upstream of the Stuart Highway appears unlikely to produce appreciable mosquito numbers, due to the limited potential area of residual ponding compared to the large swamps. However, the creek might occasionally produce localised dry season populations of *Cx. annulirostris* and *Anopheles sp.* There is the potential that future urban stormwater low flows could result in changed dry season flow conditions and increased nutrient levels, which could increase mosquito breeding productivity. Moderate density *Cx. annulirostris* breeding has been found in a small arm of Mitchell Creek in Zuccoli during the late dry season, suggesting urban discharge in Holtze could also increase mosquito breeding in upper Mitchell Creek. The potential future colonisation of this part of Mitchell Creek with semi-aquatic weeds, such as olive hymenachne and paragrass, could further exacerbate any current mosquito breeding.

Adjacent to the Proposal area

There are multiple mosquito breeding sites in the broader Greater Holtze area, however there are two within the urban buffer recommended by Medical Entomology (NT Health 2020), based on the current residential development boundaries.

A large paperbark swamp (approximately 21 ha) on the Kowandi site is 900 m east of the planned residential boundary along Taylor Road. This site is a very large paperbark swamp with shallow ponding and thick coverage of aquatic and emergent vegetation; however, it dries out by end of June. The site has been identified to provide habitat for mosquito species *Anopheles sp.*, potential *Cx. annulirostris*, *Cq. xanthogaster* and *Ma. uniformis*. It is a very high importance site due to the large swamp size and high mosquito trap catches. The swamp also has almost complete coverage of aquatic and emergent vegetation, which increases the available habitat for mosquito larvae. The normal recommended 1.6 km residential exclusion buffer around this site will not be possible based on current development plans, therefore active management actions must be identified.

The smaller paperbark swamp (approximately 9 ha) on the Kowandi site is 250 m east of the planned residential boundary along Taylor Road. This site is a smaller paperbark swamp, south-west of Kowandi North large paperbark swamp, and has been identified to provide potential habitat for mosquito species *Cq. xanthogaster*, *Cx. annulirostris* and *Anopheles sp.*

Additionally, the site is within flight range of important mosquito species that are breeding in the Shoal Bay coastal swamps to the north and northeast.

Holtze and Kowandi experience seasonally high to very high salt marsh mosquito (*Aedes vigilax*) numbers during the build-up and early wet season months. Holtze and Kowandi experience seasonally high to very high *Cq. xanthogaster* abundance during the early dry season. This species predominantly bites at night, although can bite during the day in shaded areas near their breeding sites.

7.7.3 Potential impacts

The impact assessment process identified the following potential impacts to surface and groundwater quality from the Proposal activities described in Section 3:

Table 7-12. Potential impacts to human health

Construction	Residential land use
• Disease and nuisance due to exposure to biting insect habitat. • Disease and nuisance due to creation of biting insect habitat.	• Disease and nuisance due to exposure to biting insect habitat. • Disease and nuisance due to creation of biting insect habitat.

7.7.4 Impact avoidance

Impacts to human health as described in Table 7-12 cannot be avoided without impacting the overall objectives of the Proposal, and the benefits the Proposal would bring. Therefore, impacts will be managed as described below.

7.7.5 Mitigation

The following measures will be implemented to manage the impacts to human health:

Biting insect management plan

A biting insect management plan has been prepared in consultation with Department of Health to manage the risks of biting insects to human health during all stages of the Proposal – see Appendix K.

Through the development of the Greater Holtze area, nearby key mosquito habitats will be modified as part of the future development of the broader area, however habitat modification involves further consideration through stormwater and hydrological design of these areas that are not yet completed, therefore this is not considered part of this Proposal. Until such a time that high risk habitats proximal to the Proposal area can be modified, the Proposal will manage the risk to public health from biting insects in a manner consistent with existing mosquito management programs, including:

- 1) Aerial treatment and barrier (residual surface insecticide) treatments as required, as an interim measure before habitat modification can occur. This may include treatment of:
 - Noogoo and Milners Swamp and associated upper tidal channel of Kings Creek;
 - The southern half of the Howard River coastal swamplands and associated upper mangrove channel of the Howard River;
 - Section 65 paperbark swamp and adjacent large sandmining area; and
 - The Yarrawonga swamplands to the north-west of the Proposal area.
- 2) Continued consideration of engineering controls to guide future management of biting insect habitat through development of the broader Greater Holtze area. While further investigation is required, successful engineering controls are the preferred treatment of this habitat.

- 3) Work with Department of Health to determine appropriate ongoing management actions to manage the risk to human health.

In addition to these key commitments, there are a range of mitigation and management actions available to the Proposal through the design and planning, construction, and occupation/operation phases, including:

- Conduct inductions and training regarding personal protection;
- Minimise work at dusk and night when mosquitoes will be most prevalent;
- Make available personal protective clothing and insect repellent adequate to protect against bites to all site personnel;
- Undertaking ongoing monitoring to inform timing of spraying;
- Any personnel suspected of suffering from mosquito borne diseases must remain off-site until medically declared clear to prevent the spread of the disease;
- Managing mosquito numbers locally through the use of residual surface insecticides during peak times;
- Design stockpile / laydown / site compound area to reduce likelihood of pooling / creation of temporary habitat;
- Vegetation growth within structures that pool water should be removed to reduce breeding site potential;
- Assess construction sites for pooled water after rain, removing any pooled water if identified;
- Residence time for standing water should be less than 5 days;
- Treat unavoidable shallow ponding with a residual mosquito larvicide (e.g. methoprene 30 day pellets) until the shallow ponding has been rectified/developed;
- Vehicle ruts, man-made or natural depressions occurring through construction activities will be rectified to avoid pooling of water following heavy rainfall; and
- Sediment basins should be maintained, with sediment periodically removed, to ensure capacity is retained in the structures.

7.7.6 Residual impact

Due to the proximity of existing biting insect breeding habitat, and the potential for the Proposal to create new biting insect habitat, there are some potential impacts to human health. Considering implementation of the abovementioned mitigation measures, there are no significant residual impacts expected to human health. Advice from Department of Health is that while mosquito levels are generally comparable to parts of Darwin that have similar constraints (e.g. Leanyer), mosquito numbers can be reduced to achieve similar results to the lesser mosquito prone suburbs in urban Darwin and Palmerston through implementation of the measures outlined in the biting insect management strategy.

7.7.7 Conclusion

The NT EPA's objective for the Human Health factor is to: *Protect the health of the Northern Territory population.* A biting insect management plan has been prepared in consultation with Department of Health to demonstrate how this risk will be mitigated to an acceptable level. The assessment presented in this Referral indicates with appropriate management of impacts related to biting insects, the Proposal is unlikely to result in material significant impacts to human health.

In doing this, DIPL has worked to protect the health of the Northern Territory population, both during construction and operation, and have prepared a management plan that demonstrates that the risk to human health can be managed to a level that is considered acceptable by Department of Health.

8 CUMULATIVE IMPACTS

Cumulative impacts are impacts that can accumulate as a result of additive or interactive processes and actions, interactions among multiple management measures (past, present and future), a combination of multiple minor impacts over time, and activities conducted over a wider area than the proposed action, such as the activities of multiple proposals operating in a region.

8.1 Relevant projects

Existing or planned projects that DIPL is aware of, and that could contribute to cumulative impacts, are discussed below.

8.1.1 Greater Holtze development

The Greater Holtze Focus Area, as identified in the HESLUP, is a potential development area that is close to community facilities. The Greater Holtze Focus Area surrounds the Holtze Development Area directly east towards Howard Springs Road (Kowandi), to the north extending towards the proposed Glyde Point Arterial and northeast across Thorngate Road (Holtze North). The HESLUP identifies a potential large area for urban/per-urban development, community/Government, industrial and open space/conservation areas.

The availability of Holtze-Kowandi for development creates the potential for approximately 5000 dwellings to be developed in the near to mid-term through staged land releases. The development would include the construction of social infrastructure and services to support the local region as well as transport infrastructure to provide connectivity to the Greater Darwin region.

The intention is to maintain a green corridor through the development area that may support ecological and recreational values. DIPL is working with a range of consultants and other government agencies to incorporate environmental design into the planning stages, including but not limited to:

- Biting insect management; Department of Health;
- Flood modelling; engineering consultant;
- Green corridor options assessment; engineering consultant, hydrogeologists, DEPWS, environmental consultant.

The future land use of the Howard Springs North area is subject to further investigation, however there is community support for continued open space and recreation or regional active-recreation and/or sporting hub. Future development in this area will consider the potential of retained natural areas.

Planning for Greater Holtze is well underway with an area plan expected to be adopted in 2023. Under a high-growth scenario, land releases in Kowandi would be required in 2025/2026 and Holtze North by 2030 (pending project approvals).

8.2 Cumulative impacts

Greenhouse gas emissions

The Holtze Development Area does not trigger assessment of atmospheric processes as the calculated emissions from the Proposal are below the thresholds outlined in the NT EPA guideline document. The development of Greater Holtze will result in greater greenhouse gas emissions through further land clearing and construction of urban environments. With the timeline of Greater Holtze development spanning over the next ten years or so, this will also start to encroach on the NTG's target of net zero emissions by 2050 as detailed in *The Northern Territory Government's Climate Change Response: Towards 2050*. In consideration of this, it is recommended that DIPL undertake a greenhouse gas assessment to determine potential emissions and if necessary prepare a Greenhouse Gas Abatement Plan for Greater Holtze. This plan would not only

adequately address the emissions that will be generated by the development, but also demonstrate leadership in the industry and the importance of mitigating emissions in produced by the construction and land development industry.

Hydrogeology

The development of Greater Holtze requires land clearing and an increase in impervious surfaces in a greenfield area which has the potential to impact on hydrogeology and aquifer recharge. The development will also encroach on some low-lying swamps and sandsheet heaths along the proposed green corridor that may have some hydrogeological significance. These low-lying areas currently pose a biting insect risk to development, and therefore they will most likely require alteration to sustain development. In order to better understand the current hydrogeology of the area and the importance of these swamps to the system, DIPL have engaged a hydrogeologist – Innovative Groundwater Solutions – to undertake a study to assess the potential impacts of development on hydrogeology of the region. The outcomes of the study will be used to inform ongoing planning and development conditions.

Hydrology and water quality

As discussed in Section 7, the impacts to hydrology and inland water quality from urban development are understood. Whilst these impacts can be mitigated through stormwater management planning and industry best practice control, development can still put increased pressure on urban catchments. Currently the King Creek catchment is predominantly comprised of rural and extractive land uses with limited urban development pressures. The Mitchell Creek catchment however is surrounded by urban development within the Palmerston municipality. In order to better understand the current condition of both catchments as well as the potential impacts from urban development DIPL has prepared a draft Baseline Water Quality Monitoring Plan (BWQMP) for Greater Holtze.

The BWQMP aims to determine pre-development water quality in the Greater Holtze area catchment (namely King Creek). The plan also aims to understand, through routine monitoring, the urban runoff characteristics and quality from similar existing urban development areas surrounding the Mitchell Creek catchment. Objectives of the BWQMP include:

- Establishment of routine surface water monitoring sites representative of the Greater Holtze (Kings Creek) catchment, Palmerston (Mitchell Creek) catchment and low-flow drains in Palmerston;
- Selection of water quality parameters relevant to the detection of impacts from the project area;
- Collection of baseline (pre-development) surface water quality data at the routine monitoring sites to enable differentiation of impacts caused by the development from pre-existing conditions and to determine appropriate assessment criteria (trigger values);
- Regular sampling of routine monitoring sites during operations to assess the results against baseline conditions and detect any impacts;
- Maintenance of all surface water quality results in a central database; and
- Analysis and interpretation of long-term surface water quality trend using the database.

The plan is being developed in consultation with DEPWS and City of Palmerston in order to collate existing historical data and monitoring locations into the plan. Baseline data collected through implementation of this plan can be used in assessing the appropriateness of water quality treatment devices in the stormwater system in line with the NT SDG and monitoring their success to inform the Greater Holtze development and contingency planning and appropriately address any potential cumulative impacts posed.

DIPL is also exploring opportunities with Charles Darwin University to research WSUD in the tropics and what WSUD measures are most appropriate to this environment with the outcomes to inform future urban planning and developments.

Threatened species

Full development of the Greater Holtze area as it is currently planned in the HESLUP will likely have a significant impact upon threatened species due to the loss of a substantial area of habitat for *Typhonium*

praetermissum, Black-footed Tree-rat and Northern Brushtail Possum, and the mortality of significant number of *Typhonium praetermissum* plants. To minimise this impact, DIPL is working closely with DEPWS in developing a Regional Conservation Plan that will identify key habitat areas to conserve and to constitute offsets for any unavoidable loss. The intention is for that strategy to be completed before approval is sought for any further development of the Greater Holtze area.

Whilst the extent and significance of ecological values within Greater Holtze is broadly understood, a number of other studies identified to inform Greater Holtze planning and approvals include:

- Ground-truth land units within areas not yet surveyed, with a particular focus on areas likely to support significant vegetation such as riparian vegetation, wetlands or sandsheet heath
- Survey remaining areas of suitable habitat for the following threatened species:
 - o Howard Springs Toadlet
 - o Black-footed Tree-rat
 - o *Atalaya brevialata*
 - o *Cleome insolata*
 - o *Typhonium praetermissum*
 - o *Typhonium taylori*
 - o *Stylidium ensatum*
 - o *Utricularia dunstaniae*
 - o *Utricularia singeriana*
- Engage with DEWPS regarding the significance of the known presence of the Black-footed Tree-rat, Howard Springs Toadlet and the Darwin Cycad.

9 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

There are nine Matters of National Environmental Significance (MNES) protected under the *EPBC Act*:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth Marine Areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- A water resource, in relation to coal seam gas development and large coal mining development.

The only MNES relevant to this Proposal is listed threatened species. The potential for impacts to threatened species has been considered in Section 7.3 of this report. The conclusion was that no listed threatened species are likely to be significantly impacted upon by this development.

10 REFERENCES

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APPENDIX A ARCHAEOLOGICAL SURVEY REPORT

APPENDIX B AAPA DOCUMENTS

APPENDIX C HERITAGE BRANCH CORRESPONDENCE

APPENDIX D GREENHOUSE GAS EMISSIONS CALCULATION

APPENDIX E LAND SUITABILITY ASSESSMENT

APPENDIX F COMMUNITY CONSULTATION REPORTS

APPENDIX G PRE-SCREENING TOOL

APPENDIX H PRIMARY EROSION AND SEDIMENT CONTROL PLAN

APPENDIX I ECOLOGY REPORT

APPENDIX J CONCEPTUAL STORMWATER MANAGEMENT PLAN

APPENDIX K BITING INSECT MANAGEMENT PLAN

APPENDIX L SOCIAL IMPACT SCREENING ASSESSMENT

Potential community and economy impacts

Proposal activity	Description of potential impact	Category	Positive or negative	Potentially significant impact as defined by NT EP Act 2019	Mitigation/enhancement measures
Pre-construction					
Proposal planning	Existing rural residents with properties along Wallaby Holtze Road have raised concerns about change of land use from rural residential to higher density residential. Concern may also extend to residents of Palmerston Indigenous Village, although no specific issues have been raised by NLC when engaged.	Decision-making systems	Negative	No	- Communicate clear expectations to public around community engagement and level of influence. - Where appropriate, provide explanations regarding design decisions, especially if these conflict with public opinion.
	Concerns about loss of biodiversity values associated with land clearing and development, and degradation of Mitchell Creek.	Surroundings	Negative	No	- Biodiversity impact mitigation measures being developed to minimise impacts and maximise open space. - Appropriate ongoing maintenance of residual open space.
Construction					
Construction workforce	Employment and economic benefits for local trades	Livelihoods	Positive	No	Preparation of a local procurement strategy to maximise local benefits.
Construction of Proposal components, including land clearing, site establishments, installation of	Loss of amenity due to noise and dust emissions from construction activities - existing residents.	Surroundings	Negative	No	- Dust suppression methods. - Construction noise level monitoring, construction activities occurring in accordance with NT EPA Noise Management Framework Guideline 2018. - Vegetation buffer being retained along Wallaby Holtze Road.

Proposal activity	Description of potential impact	Category	Positive or negative	Potentially significant impact as defined by NT EP Act 2019	Mitigation/enhancement measures
services, residential building construction and landscaping					Inform residents of periods of high construction activity.
	Disturbance or destruction of Aboriginal sacred sites, and other culturally significant areas.	Culture	Negative	No	- Unexpected finds 'stop work' procedure. - Continue consultation Indigenous stakeholders. - Application for AAPA Authority Certificate. - Cultural heritage field assessment has been undertaken with archaeologist.
	Disturbance of non-Aboriginal archaeology and heritage.	Culture	Negative	No	- Unexpected finds 'stop work' procedure. - Heritage/archaeological field assessment has been undertaken with archaeologist. - Consultation has been undertaken with NT Heritage Branch.
	High numbers of biting insects in the Proposal area could impact health of construction workers.	Health and wellbeing	Negative	No	Biting Insect Management Plan, including both site-wide management and personal protective equipment.
Traffic on local roads, including transportation of construction materials to site	Concern regarding access and traffic flows to adjacent areas are restricted and/or delayed during construction. Disruption to daily activities of local residents, landowners and users by construction related traffic and road upgrade works	Way of life	Negative	No	- Traffic management plans to minimise impacts during construction - Informing community when and where works are planned - Utilisation of dedicated construction phase access roads that separate construction traffic from public roads where possible.
Water usage for construction	People are concerned about use of water resources. Water for construction will be sourced from PWC reticulated water mains that were installed in the Proposal area during the construction of PRH and therefore will not impact water availability for surrounding community.	Surroundings	Negative	No	- Continue engagement with PWC in relation to capacity of existing supplies to service construction phase requirements - Project will ensure there is adequate water supply for construction without any impact on existing users.

Proposal activity	Description of potential impact	Category	Positive or negative	Potentially significant impact as defined by NT EP Act 2019	Mitigation/enhancement measures
Operation					
Increased local population	Increased local employment opportunities and business generation to local business.	Livelihoods	Positive	No	• Provide good transport route options to existing commercial shopping precincts. • Encourage development in line with social infrastructure needs assessment for the region to minimise risk of oversupply of certain industry types, maximising benefits to local business.
Establishment of new residential area, residential living, increased local population, increased waste production etc	Increased housing availability.	Way of life	Positive	No	• Proposal housing estimates have been based on available land. • Developer to adhere to plans to meet predicted housing capacity. • Develop Proposal schedule and adhere to it to ensure housing delivered on time, when it is needed most in line with population growth.
	Amenity and community cohesion for new residents.	Community	Positive	No	• Design guidelines and restrictions in planning scheme to encourage neighbourhood design that provides a community environment for residents.
	Improved access to Palmerston Hospital, including nearby residential options for workers, potential accommodation options for users of hospital facilities, and enabling potential residential aged care needs to meet the existing demands.	Access	Positive	No	• Provide mix of lot sizes to support a range of dwelling types. • Provide a range of transport options between residential area and the hospital, including public transport, active transport networks, and efficient local road network for private vehicle transport. • Provide entry-level housing to support a range of people in securing housing in the area.
	New community services and facilities, including public transport and road networks.	Access	Positive	No	• Develop social infrastructure in line with the requirements identified in the

Proposal activity	Description of potential impact	Category	Positive or negative	Potentially significant impact as defined by NT EP Act 2019	Mitigation/enhancement measures
					HESLUP Regional Social Infrastructure Assessment. Monitor future demands as regional development occurs to ensure long-term access is fulfilled.
	Vehicle, pedestrian and cyclist ease of movement and access, both within the development, and between the development and surrounding areas.	Access	Positive	No	- Road network design has been informed by traffic impact assessment and needs assessment - Road configuration and upgrades managed by the Transport and Civil Services Division of the Department - Develop transport network to encourage active transport.
	Changed zoning and land use may impact sense of place for existing residents in the nearby vicinity.	Community	Negative	No	- Residents have participated in stakeholder engagement practices to date. - Consider opportunities for the transition of land uses and densities between new and existing areas. - Ensure appropriate compliance with design and layout requirements of NTPS. - Communicating to residents the development does not alter existing use rights and land can continue to be used in accordance with the current land use zone.
	Pressure on emergency services due to needing to service a new population centre.	Access	Negative	No	- Work with emergency services providers to allow proper planning for increased demand. - All roads to meet standards to allow for emergency services to access development.

Proposal activity	Description of potential impact	Category	Positive or negative	Potentially significant impact as defined by NT EP Act 2019	Mitigation/enhancement measures
	Operational noise impacts to existing residents on Wallaby-Holtze Road, including residential noise, road traffic and other community facilities.	Surroundings	Negative	No	- Consider opportunities for the transition of land uses and densities between new and existing areas. - Ensure appropriate compliance with design and layout requirements of NTPS. - The Proposal will operate in accordance with road design standards including noise buffer requirements if necessary, ensuring noise levels are within required thresholds.
	High numbers of biting insects in the Proposal area/inadvertent creation of new biting insect habitat could impact health of residents.	Health and wellbeing	Negative	Yes	- Stormwater drainage design to be developed in consultation with Medical Entomology Branch to ensure no creation of new biting insect breeding habitat and to identify requirements for ongoing mosquito control program. Biting Insect Management Plan - including mosquito spraying and control measures, and educating new residents on measures to be implemented at home to manage biting insects. - Transparency about any residual biting insect risks/impacts to future residents.
	Visual impacts due to changed land use.	Surroundings	Negative	No	A vegetation buffer will be maintained during this phase of the development between the residents along Wallaby Holtze Road and the new Gunn Point Road and residential properties to the south.
	Access to recreational areas, such as parks and other facilities.	Surroundings	Negative	No	- Manage open space so it is appropriate for recreation. - Provide adequate public transport and access networks to recreation facilities in adjacent areas.

Proposal activity	Description of potential impact	Category	Positive or negative	Potentially significant impact as defined by NT EP Act 2019	Mitigation/enhancement measures
	Access to public transport and other social infrastructure and services, such as schools.	Access	Negative	No	- Develop social infrastructure in line with the requirements identified in the HESLUP Regional Social Infrastructure Assessment. - Monitor future demands as regional development occurs to ensure long-term access is fulfilled.
	Increased pressure on local council for waste collection and management services and associated increase in rates for the Litchfield LGA.	Access	Negative	No	- Continue consultation with Litchfield Council to ensure adequate servicing of residential population. - Stage development to gradually increase service requirements.
Water and power supply for operation	Concern about increased demand on water and power and capacity of system service increased population.	Surroundings	Negative	No	Continue to work with Power and Water Corporation to confirm if any additional augmentations are required to the network.
Operation of new road network, including extension of Gunn Point Road and extension of Linco Road and increased traffic (private and public transport) on Stuart Highway and other local roads	Increased population resulting in increased traffic on existing roads increase traffic congestion and or risk of accidents.	Way of life	Negative	No	- Traffic management impact assessment - Design roads to required safety standards and to be interconnected, allowing for direct access to neighbourhoods reducing the need for local traffic on higher order roads