PHOENIX
ENVIRONMENTAL SCIENCES

Environmental desktop review for the Napier Downs Irrigation Project

Prepared for Australian Capital Equity Pty Ltd

June 2019

Final Report

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Final Report

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EXECUTIVE SUMMARY

Australian Capital Equity (ACE) is investigating the feasibility of developing an irrigated agriculture project on Napier Downs Station, located in the Shire of Derby-West Kimberley, Western. The proposed project will entail the development of approximately six centre irrigation pivots which will be used to produce fodder crops for cattle stocked on Napier Downs and nearby stations.

Two potential sites have been identified:

• Option 1 (preferred option) – study area is approximately 670 ha and located in Naradong Paddock at Lennard River crossing, on Gibb River Road

• Option 2: Hawkstone Paddock – study area is approximately 1500 ha and located 40km from Napier Downs Station (NDS) Homestead on Gibb River Road.

Option 1 is preferred because it is accessible during the wet season, with feasible logistics (close to road and infrastructure; 10 km from NDS Homestead) and will permit six Rhodes grass cuts per year.

Option 2 does not have access from NDS Homestead in the wet season, therefore access is limited to the dry season (6 to 8 months) and will allow 4 cuts of Rhodes grass per year.

Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned to provide a desktop review to collate existing biological information that may inform the decision over which option to choose.

ACE has asked for a desktop review based on two different study areas:

1. Desktop study of Option 1 only

2. Desktop study of Option 1 and 2, presenting results for each option in a single desktop report.

From the desktop review 17 significant flora species were identified as occurring within 40 km of each of the study Options, although none were recorded from either area itself. These 17 species are not identical for each Option. Option 1 recorded eight Priority 1, three Priority 2 and six Priority 3 species nearby, of which 11 are likely or possible to occur in the study area while 6 are unlikely to. Option 2 recorded seven Priority 1, three Priority 2 and seven Priority 3 species of which 12 species are likely or possible to occur in the study area while 5 are unlikely to. No Priority 4 species were recorded. There is therefore a high likelihood the either or both Options will contain conservation significant flora.

Eight Priority Ecological Communities (PEC) were identified in proximity to the two Options, with the southern boundary of Option 2 only 2 km from the boundary of the buffer zone of the Kimberley Vegetation Association 759 PEC, which intersects between the two Options. Neither Option is impacted by any PEC, although both are separated by them.

A total of 35 weed species were recorded from the combined Option 1 and 2 desktop study area. Two species, **Parkinsonia aculeata* and **Jatropha gossypiifolia* are WoNS and these plus a third, **Calotropis procera* are Declared Pests.

The results of the desktop review show that the known flora and vegetation values do not discriminate between the two Options, and it is likely that the choice will be made considering other factors

1 INTRODUCTION AND SCOPE

Australian Capital Equity (ACE) is investigating the feasibility of developing the Napier Downs Project (the Project), an irrigated agriculture project located on Napier Downs Station (NDS) in the Shire of Derby-West Kimberley, Western Australia (WA) (Figure 1-1). The Project will entail the development of approximately six centre irrigation pivots which will be used to produce fodder crops for cattle stocked on Napier Downs and nearby stations, with water to be sourced from the Grant Aquifer.

Two potential sites have been identified (Figure 1-1):

- Option 1 (preferred option) – located in Naradong Paddock at Lennard River crossing on Gibb River Road, ~96 km east of Derby, measuring ~3 km by 2 km (600.0 ha)
- Option 2: Hawkstone Paddock – located 40 km from NDS Homestead on Gibb River Road, ~120 km east of Derby, measuring ~3 km by 5 km (1,573.2 ha).

Together, the two options form the study area for this review, which measures approximately 2,173.19 ha in total.

Option 1 is preferred due to its accessibility during the wet season, with feasible logistics (close to road and infrastructure; 10 km from NDS Homestead) and will permit six Rhodes grass cuts per year. Option 2 does not have access from NDS Homestead in the wet season, therefore access is limited to the dry season (6 to 8 months) and will allow four cuts of Rhodes grass per year.

Both sites have been identified as having capacity to access the Grant Aquifer and establish six pivots based on a 6 GL annual abstraction. Both sites have also previously been identified as having favourable Pindan soils, no currently known Native Title claims and no known protected or Threatened species (based on previous preliminary desktop information provided by J. McMahon of ACE).

In March 2019, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by ACE to undertake a desktop study of several environmental factors to inform the Project's pre-feasibility study, with the aim to identify the key environmental values of the study area and surrounds, identify any fatal flaws and determine the need of any further biological investigations required to support environmental approvals for the Project.

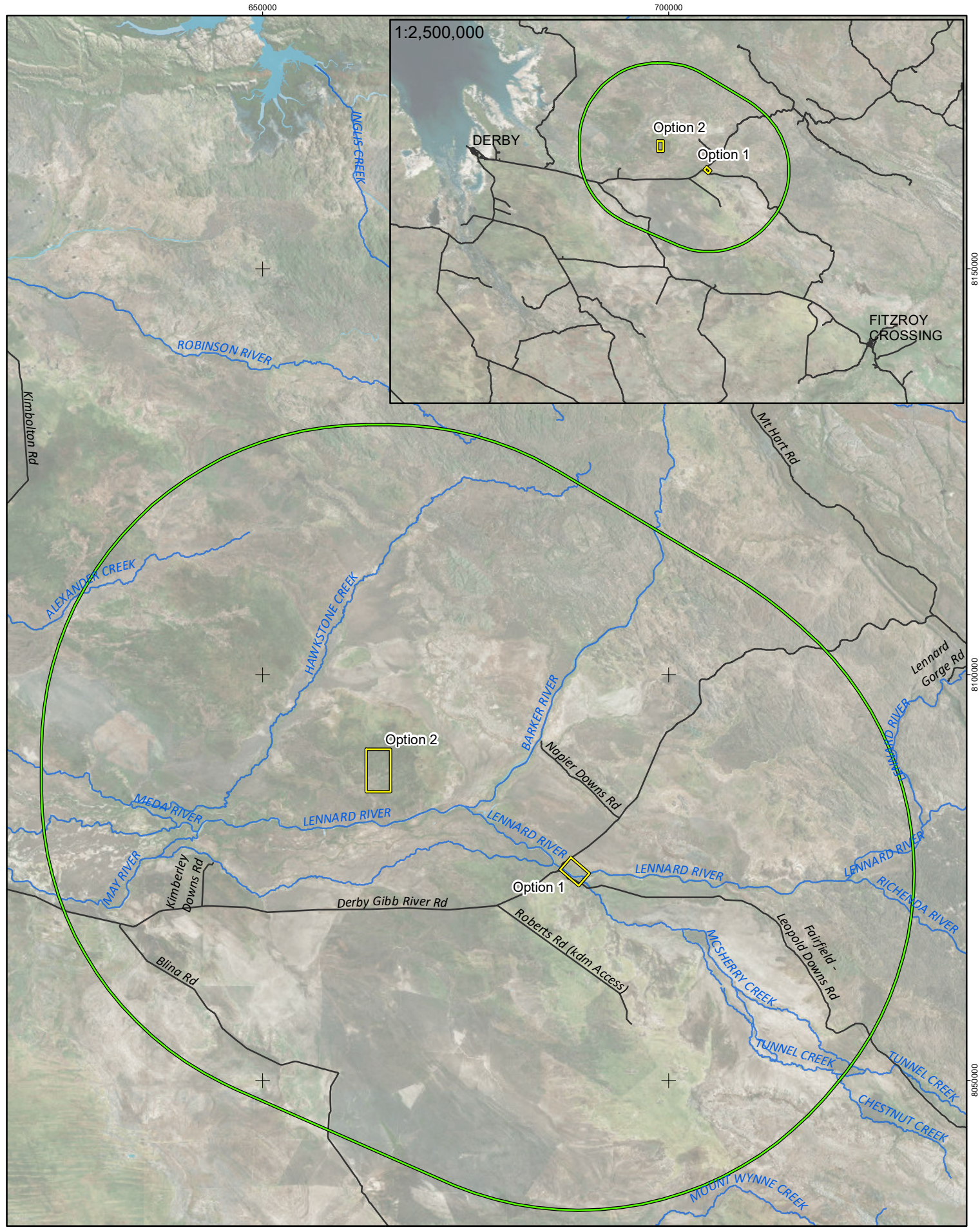
1.1 SCOPE OF WORK

A biological desktop review for several environmental factors was completed for the Project, including:

- terrestrial flora and vegetation in accordance with relevant Environmental Protection Authority (EPA) guidance (Department of Mines and Petroleum 2016; EPA 2016f)
- terrestrial fauna including vertebrates and short-range endemic (SRE) invertebrate fauna in accordance with relevant EPA guidance (Department of Mines and Petroleum 2016; EPA 2016c, g)
- subterranean fauna in accordance with relevant EPA guidance (EPA 2016b, e, f).

The objective of the desktop review was to identify the following:

- potential conservation significant flora, vegetation and fauna values that may be present in the study area
- any potential values that may represent significant constraints for the Project
- proposed scope of field survey requirements for the Project.



Australian Capital Equity Pty Ltd - Environmental desktop review for the Napier Downs Irrigation Project

Project No	1248
Date	16-Apr-19
Drawn by	IH
Map author	MH

0 5 10 20
Kilometres

1:600,000 (at A4) GDA 1994 MGA Zone 51

Study area
Desktop study area

Figure 1–1

Project location and study areas

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2 LEGISLATIVE CONTEXT

The protection of flora and fauna in WA is principally governed by three acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State *Environmental Protection Act 1986* (EP Act).

2.1 COMMONWEALTH

The EPBC Act is administered by the Federal DoEE. Under the EPBC Act, actions that have, or are likely to have, a significant impact on a Matter of National Environmental Significance (MNES), require approval from the Australian Government Minister for the Environment through a formal referral process. The EPBC Act provides for the listing of Threatened native flora, fauna and TECs as matters of MNES. National heritage places and world heritage places are also listed as matters of MNES. The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation (DoEE 2019a).

Conservation categories applicable to Threatened flora and Threatened fauna under the EPBC Act are as follows:

- Extinct (EX)[1] – there is no reasonable doubt that the last individual has died
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)[1] – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely Threatened.

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English & Blyth 1997). There are three categories under which ecological communities can be listed as TECs under the EPBC Act: Critically Endangered, Endangered and Vulnerable.

The EPBC Act is also the enabling legislation for protection of Migratory species under a number of international agreements (also listed as matters of NES):

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn)
- Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).

[1] Species listed as Extinct and Conservation Dependent are not Matters of NES and therefore do not trigger the EPBC Act.

2.2 STATE

2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened flora and fauna species in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future[2]
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future[2]
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium-term future[2].

Species may also be listed as specially protected under the BC Act in the one or more of the following categories:

- species of special conservation interest – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range
- migratory species
- cetaceans
- species subject to international agreement
- the category of species otherwise in need of special protection.

The DBCA administers the BC Act and also maintains a non-statutory list of Priority flora and fauna. Priority species are still considered to be of conservation significance – that is they may be rare or Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority flora and fauna lists are assigned to one of four Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a Threatened Ecological Community and its listing is otherwise in accordance with the ministerial guidelines.

2.2.3 Threatened and Priority Ecological Communities

The BC Act provides for the listing of TECs in the following categories:

- Critically Endangered – facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future[2]
- Endangered – facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future[2]

[2] As determined in accordance with criteria set out in the ministerial guidelines.

- Vulnerable – facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future[2].

An ecological community may be listed as a collapsed ecological community under the BC Act if there is no reasonable doubt that the last occurrence of the ecological community has collapsed or the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure.

The DBCA also maintains a non-statutory list of PECs, which may become TECs in the future, however, do not currently meet survey criteria or that are not adequately defined. PECs are assigned to one of five categories depending on their priority for survey or definition, with Priority 1 of highest concern and Priority 5 of lowest concern.

2.2.4 EPA environmental factors

2.2.4.1 Flora and vegetation

For the purposes of Environmental Impact Assessment (EIA), the EPA defines flora as native vascular plants and vegetation is defined as groupings of different flora patterned across the landscape that occur in response to environmental conditions (EPA 2016f). The EPA's objective for the factor flora and vegetation is: to protect flora and vegetation so that biological diversity and ecological integrity are maintained (EPA 2016a, f).

Under EPA guidance (EPA 2016a), flora may be significant for:

- being identified as a Threatened or Priority species
- local endemism or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- representing new species or anomalous features that indicate a potential new species
- representing the range of a species (particularly, at the extremes of range recently discovered range extensions, or isolated outliers of the main range)
- being unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- having relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Vegetation may be significant for (EPA 2016a):

- being identified as a TEC or PEC
- having restricted distribution
- subject to a degree of historical impact from threatening processes
- having a role as a refuge
- providing an important function required to maintain ecological integrity of a significant ecosystem.

2.2.4.2 Terrestrial fauna

EPA defines terrestrial fauna as *animals living on land or using land (including aquatic systems) for all or part of their lives* and includes *vertebrate (birds, mammals including bats, reptiles, amphibians, and freshwater fish) and invertebrate (arachnids, crustaceans, insects, molluscs and worms) groups* (EPA

2016c). Fauna habitat is defined as *the natural environment of an animal or assemblage of animals, including biotic and abiotic elements, that provides a suitable place for them to breed, forage, roost or seek refuge* (EPA 2016c). The EPA's objective for the factor terrestrial fauna is: *to protect terrestrial fauna so that biological diversity and ecological integrity are maintained* (EPA 2016c).

EPA (2016c) identifies the following attributes that constitute significant fauna:

- being identified as a Threatened or Priority species
- species with restricted distribution, including short range endemic (SRE) invertebrates (see section 2.2.4.3)
- species subject to a degree of historical impact from threatening processes
- providing an important function required to maintain the ecological integrity of a significant ecosystem.

Fauna habitats may be significant if they provide habitat important to the life history of a significant species, i.e. breeding, feeding and roosting or aggregation areas, or where they are unique or isolated habitats, for example wetlands, in the landscape or region (EPA 2016c).

2.2.4.3 Short range endemic invertebrates

Short range endemic (SRE) fauna are defined as animals that display restricted geographic distributions, nominally less than 10,000 km^2, that may also be disjunct and highly localised (Harvey 2002; Ponder & Colgan 2002). Short range endemism in terrestrial invertebrates is believed to have evolved through two primary processes (Harvey 2002), relictual short range endemism – where drying climate has forced range contraction into small pockets with remaining moist conditions (e.g. south-facing rock faces or slopes of mountains or gullies) – and habitat specialist SREs that may have settled in particular isolated habitat types (e.g. rocky outcrops) by means of dispersal and evolved in isolation into distinct species. However, SRE invertebrates have also been reported in more widespread habitats such as spinifex plains or woodlands, mainly in groups with low dispersal capabilities, for example mygalomorph spiders and millipedes.

There can be uncertainty in categorising a specimen as SRE due to several factors including poor regional survey density, lack of taxonomic research and problems of identification, i.e. specimens that may represent SREs cannot be identified to species level based on the life stage at hand. For example, in contrast to mature males, juvenile and female millipedes, mygalomorph spiders and scorpions cannot be identified to species level. Molecular techniques such as 'barcoding' (Hebert *et al.* 2003a; Hebert *et al.* 2003b) are routinely employed to overcome taxonomic or identification problems.

The WA Museum applies three categories which were adopted in this assessment: confirmed, potential and not SRE. Confirmed SREs are taxa for which the distribution is known to be less than 10,000 km^2, the taxonomy is well known and the group is well represented in collections and/ or via comprehensive sampling (WAM 2013). Potential SREs include those taxa for which there is incomplete knowledge of the geographic distribution of the group and its taxonomy, and the group is not well represented in collections.

The EPA's environmental factor guideline for Terrestrial Fauna (EPA 2016c) identifies species with restricted distributions as being significant fauna in the context of EIA. Short-range endemic fauna need to be considered in environmental impact assessments (EIA) as localised, small populations of species that are generally at greater risk of changes in conservation status due to environmental change than other, more widely distributed taxa. The likelihood of SRE occurrence therefore needs to be considered early in the environmental scoping stage of any proposal (Department of Mines and Petroleum 2016).

2.2.4.4 Subterranean fauna

For the purposes of EIA, the EPA (EPA 2016b) defines subterranean fauna as: *fauna which live their entire lives (obligate) below the surface of the earth*. They include stygofauna (aquatic and living in ground water) and troglofauna (air-breathing and living in caves and voids). The EPA's objective with respect to subterranean fauna is *its protection so that biological diversity and ecological integrity are maintained*.

The obligate underground existence with of subterranean fauna greatly increases the likelihood of short-range endemism and the possibility that a species' conservation status may be impacted as a result of the implementation of a Proposal. Subterranean fauna species may therefore be considered to be significant due to being identified as Threatened or Priority species, locally endemic, potentially new species, occupying restricted habitats and/or forming part of a TEC or PEC (EPA 2016b).

Troglofauna and stygofauna have been recorded in a range of porous near-surface regolith materials and geological formations in WA (Lawrance 2009). EPA (2016f) identifies the following habitat types that have a high likelihood of supporting subterranean fauna:

- troglofauna – geology with cavities, voids and caves, e.g.
    - karstic limestone
    - channel iron deposits, particularly pisolite in inverted landscape geomorphology
    - groundwater calcrete formations above water table
    - alluvium/colluvium habitats in valley-fill settings
    - banded ironstone formations, especially where hydrated zones occur or there is a lot of jointing or fracturing
    - sandstone, where weathered and/or fractured
- stygofauna – groundwater and voids present, e.g.
    - karst limestone
    - calcretes
    - alluvial formations (particularly when associated with palaeochannel aquifers)
    - fractured rock.

A number of factors contribute to the likelihood of subterranean fauna to occur in an area, including, sediment texture, hydraulic conductivity (controlling food and oxygen supply), depth from surface, water regime (timing, frequency, duration, extent and depth, and variability), energy (food) flow (in the form of dissolved organic matter (DOM), salinity (accepted upper tolerance approximately 70,000 mg/L TDS), dissolved oxygen (DO) and redox status of the groundwater (Subterranean Ecology 2010). Independent of all other factors, salinity appears to be the main limiting factor for the occurrence of stygofauna. The majority of non-marine stygofauna are intolerant to salinity. Most are found in freshwater (<3,000 mg/L TDS) but some will tolerate water with salinities above this level. Stygofauna have been collected in saline waters (3,000-70,000 mg/L TDS) in calcrete formations in the Yilgarn and Nullarbor regions of WA (Cooper *et al.* 2008; Humphreys *et al.* 2004).

2.2.5 Environmentally Sensitive Areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas of the State to be Environmentally Sensitive Areas (ESAs). ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (DMP 2008).

ESAs are areas where the vegetation has high conservation value. Several types of areas are declared ESAs including:

- a declared World Heritage property
- an area that is included on the Register of the National Estate, because of its natural heritage value
- the area covered by vegetation within 50 m of Threatened Flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened Flora is located
- the area covered by a TEC
- a defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland.

2.2.6 Clearing of native vegetation

The clearing of native vegetation in WA is not generally permitted where the biodiversity values, land conservation and water protection roles of native vegetation would be significantly affected. Any clearing of native vegetation in WA requires a permit under Part V Division 2 of the EP Act, except where an exemption applies under the Act, or is prescribed by the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (the Regulations), and the vegetation is not in an ESA. Permit applications to clear native vegetation require assessment against the '10 Clearing Principles', as outlined in the regulations.

2.2.7 Introduced Flora

Introduced flora pose threats to biodiversity and natural values by successfully out-competing native species for available nutrients, water, space and sunlight; reducing the natural structural and biological diversity by smothering native plants or preventing them from growing back after clearing, fire or other disturbance; replacing the native plants that animals use for shelter, food and nesting; and altering fire regimes, often making fires hotter and more destructive (AWC 2007).

Management of some weed species is required under Commonwealth or State frameworks. Key classifications for significant introduced flora that are relevant to this report are:

- declared pest – the *Biosecurity and Agriculture Management Act 2007* (BAM Act), Section 22 makes provision for a plant taxon to be listed as a Declared Pest organism in parts of, or the entire State. Under the *Biosecurity and Agriculture Management Regulations 2013* Declared Pests are assigned to one of three control categories that dictate level of management required (DAFWA 2016).
- WoNS – high impact, established introduced flora causing major economic, environmental, social and/or cultural impacts in a number of states/territories, and which have strong potential for further spread (Australian Weeds Committee 2012). Management is required in accordance with Department of Primary Industries and Regional Development (DPIRD) guidelines for particular WoNS.

Throughout this report, introduced flora species are indicated with an asterisk (*).

3 METHODS

3.1 GENERAL ENVIRONMENTAL VALUES

While little survey data and biological information exists in the vicinity of the study area, survey and sampling data is available more broadly in the region, which provides some contextual information for the desktop review that is relevant to the Project.

Review of base environmental datasets was undertaken to define surface water, groundwater, geology, soils, land systems and biogeographical units in the study area. Proximity of conservation reserves to the study area was also reviewed. The following datasets were interrogated:

- Interim Biogeographical Regionalisation of Australia (IBRA) regions (DSEWPaC 2012)
- Land system mapping by (DAFWA 2011)
- Clearing Regulations - Environmentally Sensitive Areas (DER 2016)
- DBCA Managed Lands and Waters
- National heritage places
- Surface geology
- Directory of important wetlands
- Regolith
- Basins
- Aquifers
- Hydrogeology
- *Surface geology of Australia 1:1,000,000 scale, Western Australia [Digital Dataset]* (Stewart *et al.* 2008)
- DWER groundwater areas
- Public Water Drinking Source Areas
- Rivers and river basins.

3.2 FLORA AND VEGETATION

Database searches and a literature review were undertaken to identify and prepare a list of significant flora and vegetation that may occur within the survey area, including:

- Threatened flora and TECs listed as MNES under the EPBC Act
- Threatened flora and TEC listed under the BC Act
- Priority flora and PECs listed by DBCA
- Groundwater dependent ecosystems.

The following database searches were undertaken for the study area:

- EPBC Act Protected Matters Search Tool (DoEE 2019b)
- DBCA/WA Museum (WAM) NatureMap database (DBCA 2019b)

- DBCA and WA Herbarium Threatened and Priority Flora database (DBCA 2019c)
- DBCA Threatened and Priority Ecological Communities database (DBCA 2019c)
- Groundwater dependent ecosystem atlas (BoM 2019b).

The search extent for the database searches was a centre point for both Option 1 and Option 2 areas with a 40 km buffer.

Given the remoteness of the study areas, Florabase (DBCA 2019a) was interrogated to determine whether any Threatened flora were recorded for the Fitzroy Trough IBRA subregion subsequently extending the desktop survey area for Threatened and Priority flora.

A preliminary assessment of the likelihood of occurrence of each species was undertaken for the significant flora identified in the desktop assessment. Assessment was conducted for each of the two options. Based on habitats apparently present in the study areas, flowering periods, disturbance within the study areas and/or proximity of the closest records, taxa were assigned a rank reflecting their likelihood of occurring within the study areas.

A review of land systems, soils and vegetation associations was undertaken to define potential vegetation units in the study area. The potential for occurrence in the study area of the significant flora and vegetation identified in the database searches was then assessed. The assessment was based on reviewed information relating to habitat preference (soils, landforms, elevation and vegetation associations) and locality records from the database searches. The flora assessments assigned each taxon to one of four ratings:

- recorded – desktop record of species within study area
- likely – study area within known range of species; suitable habitat likely to be present within the study area and/or records within 5 km of survey area
- possible – study area within known range of species; potential habitat may be present within the study area, no records within 5 km of survey area
- unlikely – study area outside known range of species, no records within 5 km and suitable habitat unlikely to be present in study area.

3.3 TERRESTRIAL FAUNA

Database searches and a literature review were undertaken to identify and prepare a list of significant terrestrial fauna that may occur within the survey area, including:

- Threatened fauna listed as MNES under the EPBC Act
- Threatened fauna and critical habitat listed under the BC Act
- Priority fauna listed by DBCA
- species listed as Migratory under international agreements and recognised under the EPBC Act and/or BC Act, particularly migratory shorebirds
- SRE invertebrate fauna.

The following database searches were undertaken for the study area:

- EPBC Act Protected Matters Search Tool (DoEE 2019b)
- DBCA/WAM NatureMap database (DBCA 2019b)
- DBCA Threatened and Priority Fauna database (DBCA 2019c)

- WAM Arachnology/Myriapodology, Crustacea and Mollusca databases for SREs (WAM 2019).

The search extent for the Protected Matters, NatureMap and Threatened and Priority fauna database searches was a centre point for both Option 1 and Option 2 areas with a 40 km buffer. The WAM invertebrate database searches where conducted for a 100 km^2 area encompassing both Options, consistent with the nominal range of SRE species (Harvey 2002).

In addition, the following datasets were reviewed:

- Important Bird Areas (REF)
- Key Biodiversity Areas for Birdlife (REF)

A preliminary assessment of the likelihood of occurrence for species of conservation significance identified in the desktop review was undertaken based on the known distribution, habitat preferences and ecology of the species, presence of records in the proximity of the study area and occurrence of potential fauna habitats within the study area based on desktop vegetation assessment and aerial imagery.

3.4 SUBTERRANEAN FAUNA

The WAM Arachnology/Myriapodology, Crustacea and Mollusca databases (WAM 2019) were interrogated for subterranean fauna records within a 100 km^2 search extent encompassing the study area. The Protected Matters, NatureMap, Threatened and Priority Fauna database and Threatened and Priority Ecological Communities database results were also reviewed for any records of subterranean fauna or communities.

Relevant geological and hydrogeological data was reviewed to characterise the potential subterranean environment within the study area and assess suitability as habitat for subterranean fauna.

4 RESULTS

4.1 EXISTING ENVIRONMENT

4.1.1 National heritage places, conservation reserves and Environmentally Sensitive Areas

The study area is situated within the West Kimberley National Heritage Place, which is listed on the National Heritage List and therefore a matter of NES (Figure 4-1). The listing is vast in extent, covering 1,917 km^2 of the Kimberley region, and is recognised as nationally significant under several criteria (DoEE 2019a), with many specific significant features identified, including (but not limited to):

- the King Leopold orogen, Kimberley ria coast, Lennard Shelf – for geological significance
- the Devonian Reefs, Gogo fossil sites, Dampier Coast – for evolutionary/fossil record
- northern Kimberley coast and islands, the Kimberley Plateau and the west Kimberley Devonian reefs – for their rich biodiversity
- vine thickets – for endemic invertebrates
- river systems (the Drysdale, Prince Regent, Roe, Moran, Carson, Isdell, Mitchell and King Edward Rivers) – as refuges for freshwater fish species
- Roebuck Bay – for Migratory shorebird habitat
- Kimberley coast from the Buccaneer Archipelago to King George River, Mitchell River National Park, King George Falls, King George River, Geiki Gorge Conservation Park, Geikie Gorge National Park, Windjana Gorge National Park, King Leopold Ranges and the Kimberley coast from the Buccaneer Archipelago to King George River – for aesthetic landscape values
- numerous indigenous heritage sites of national significance.

The study area is situated over the King Leopold Orogen geological province; it does not intersect any of the other specific features described in the West Kimberley National Heritage Place; Windjana Gorge National Park is the closest, located approximately 16.5 km east of Option 1.

The study area is not situated within any conservation reserves or ESAs (Figure 4-1). The nearest conservation reserve managed by the DBCA is Windjana Airstrip, located approximately 14.5 km east of the Option 1 area, followed by Windjana Gorge National Park and King Leopold Ranges Conservation Park approximately 32.5 km northeast (Figure 4-1). There are no conservation reserves within 40 km of the Option 2 area (Figure 4-1).

The nearest ESA is located approximately 16.5 km east of the Option 1 area at Windjana Gorge National Park (same boundary as the park) and approximately 28 km north of the Option 2 area (Figure 4-1). It is not known what criteria these sites meet as an ESA.

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Kilometres

1:600,000 (at A4) GDA 1994 MGA Zone 51

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- Desktop study area
- Study area
- National Heritage places
- Conservation Reserves
- Environmentally Senistive Areas

Figure 4–1

National Heritage places, Conservation Reserves and Environmentally Sensitive Areas

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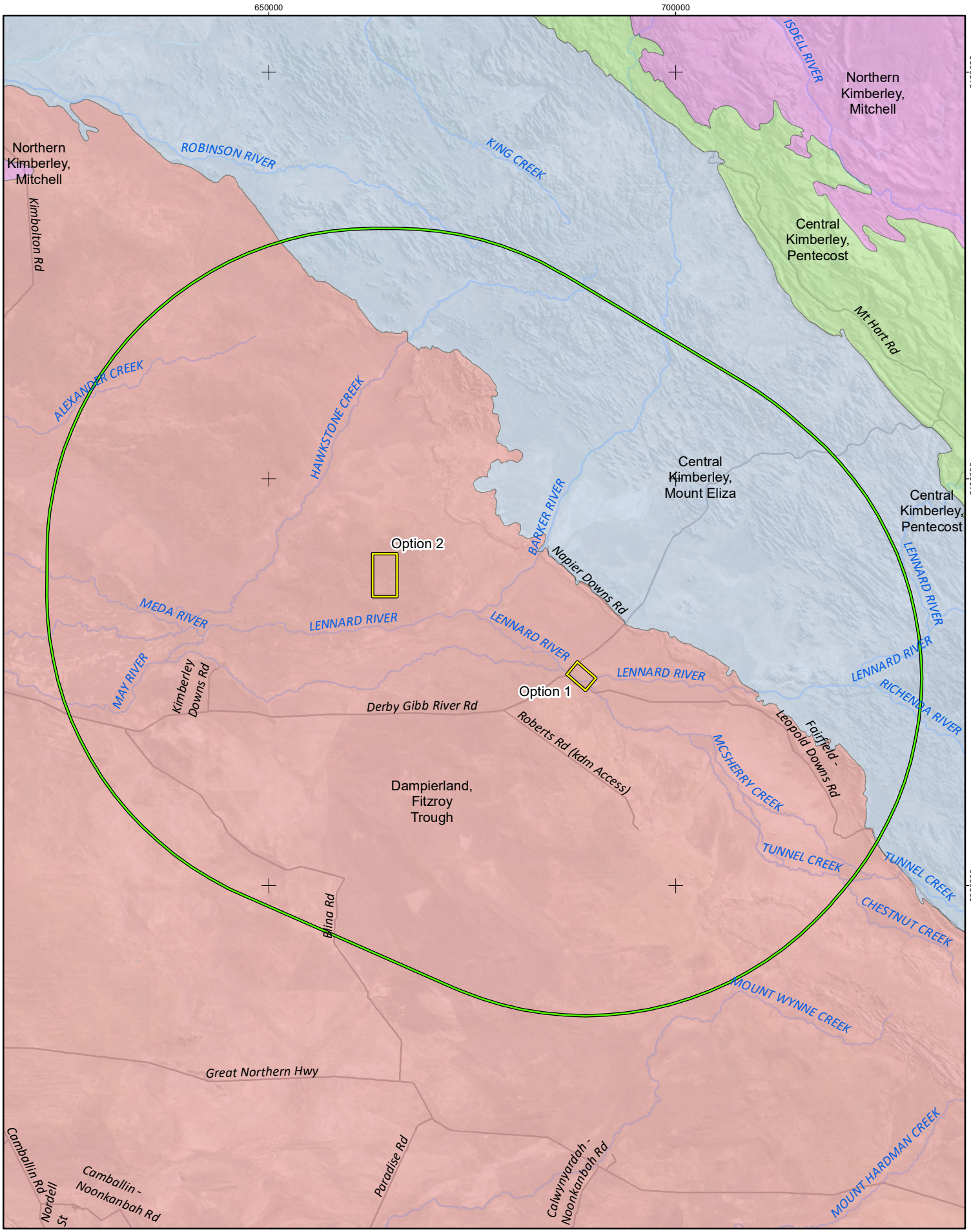
4.1.2 Interim Biogeographical Regionalisation of Australia (IBRA)

The study area is located entirely within Fitzroy Trough (DL1) subregion of the Dampierland bioregion (Figure 4-2). The Fitzroy Trough subregion comprised of four basic components, described as (Graham 2001):

- Quaternary sandplain overlying Jurassic and Mesozoic sandstones with Pindan, with hummock grasslands on hills.
- Quaternary marine deposits on coastal plains, with mangal, samphire – *Sporobolus* spp. Grasslands, *Melaleuca alsophila* low forests, and *Spinifex* spp. – *Crotalaria* spp., strand communities.
- Quaternary alluvial plains associated with the Permian and Mesozoic sediments of Fitzroy Trough support tree savannahs of ribbon grass (*Chrysopogon* spp.), bluegrass (*Dichanthium* spp.) and Mitchell grass (*Astrebla* spp.) scattered coolabah (*Eucalyptus microtheca*) – *Bauhinia cunninghamii*, with riparian forests of river red gum (*Eucalyptus camaldulensis*) and Cadjeput (*Melaleuca* spp.) fringe drainages.
- Devonian reef limestones in the north and east supporting sparse tree steppe over lobed spinifex (*Triodia intermedia*) and limestone spinifex (*T. wiseana*) hummock grasses.

The subregion experiences a dry hot tropical and semi-arid climate with summer rainfall, with average rainfall between 500–800 mm, often, often influenced by cyclonic activity in the northwest of WA.



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Desktop study area
Study area
IBRA Region, subregion
Central Kimberley, Mount Eliza
Central Kimberley, Pentecost
Dampierland, Fitzroy Trough
Northern Kimberley, Mitchell

Figure 4–2

IBRA regions of the study area

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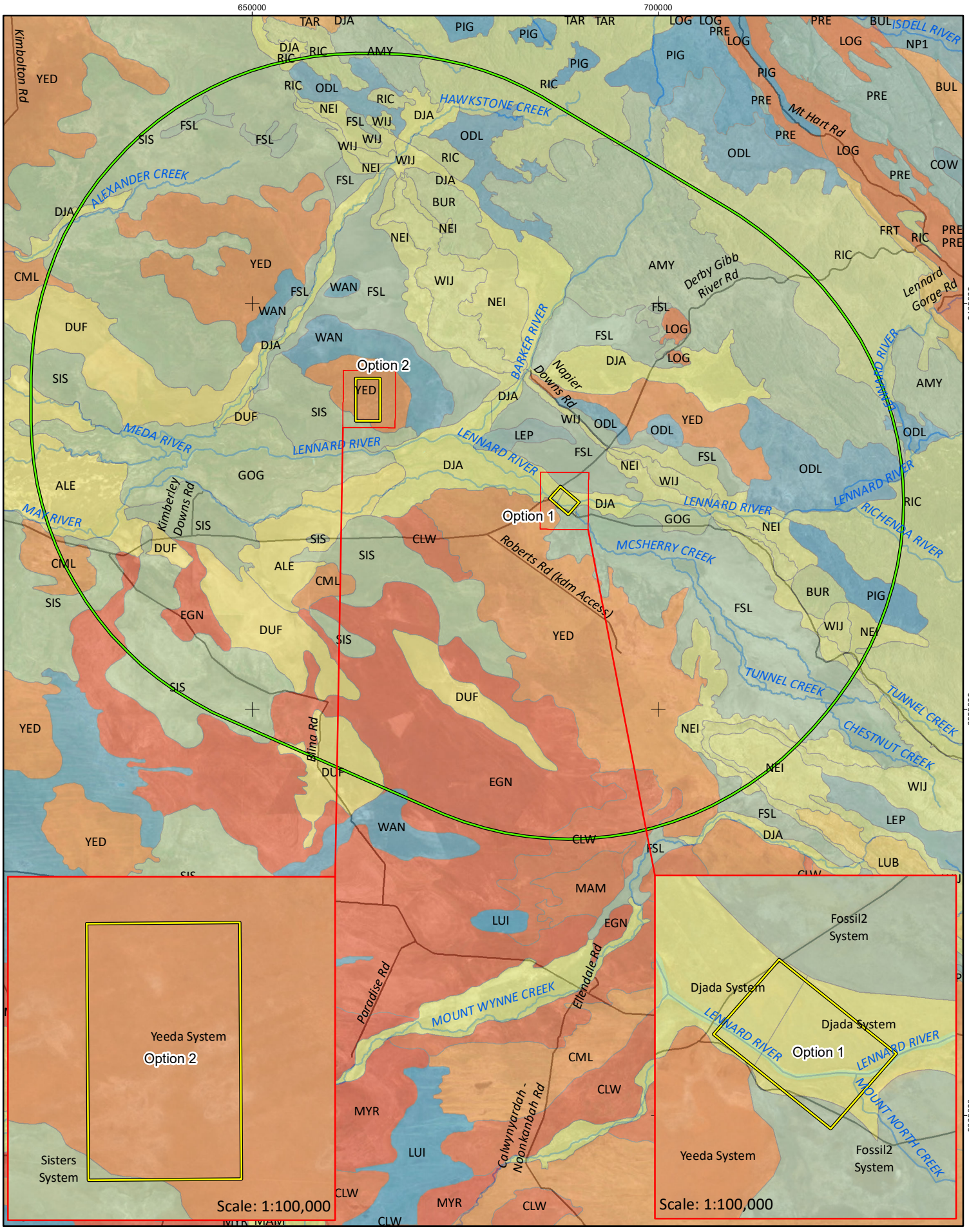
4.1.3 Land systems

The study area intersects four land systems, as mapped by the Department of Agriculture and Food Western Australia (Figure 4-3; Table 4-1). Both Options lie primarily within one land system, with a small proportion overlapping a second. The Option 1 area occurs within the Djada and Fossil2 systems, while Option 2 area intersects two different land systems, the Yeeda and Sisters systems. Table 4-2 below shows the areas and percentages of each land system per Option study area.

Table 4-1 Description of land systems intersecting the study area

Land system	Land system description	Option 1		Option 2	
		Area (ha)	% of Option 1 area	Area (ha)	% of Option 2 area
Yeeda	Red sandplains supporting pindan vegetation with dense acacia shrubs, scattered bloodwood and grey box trees and curly spinifex and ribbon grass.			1,555.5	98.9
Sisters	Low sandy plateaux and sandplain with thorough-going drainage, deep red sands and yellow loamy soils, pindan and tall woodlands.			17.68	1.1
Djada	Active flood-plains with levees and levee back slopes supporting ghost gum open woodlands with frontage grasses, and cracking clay back plains supporting ribbon grass-blue grass and Mitchell grass grasslands.	567.3	94.6		
Fossil2	Cracking clay plains supporting Mitchell grass and ribbon grass-blue grass grasslands with sparse trees and shrubs, and minor limestone outcrop slopes with patches of hard spinifex.	32.7	5.4		
Total		**600.0**	**100**	**1,573.2**	**100**



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Map author	MH

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Desktop study area
Study area

Figure 4-3

Land systems of the study area

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4.1.4 Surface and groundwater values

The study area falls within the Lennard River drainage basin of the Timor Sea Division (Figure 4-4). The Lennard River runs east to west through the Option 1 area (Figure 4-4). The Lennard River originates in the King Leopold Ranges roughly 70 km east of the Option 1 area. It flows westward and divides into the Meda and May Rivers approximately 47 km west of the Option 1 area; these discharge into King Sound roughly another 50 km WNW.

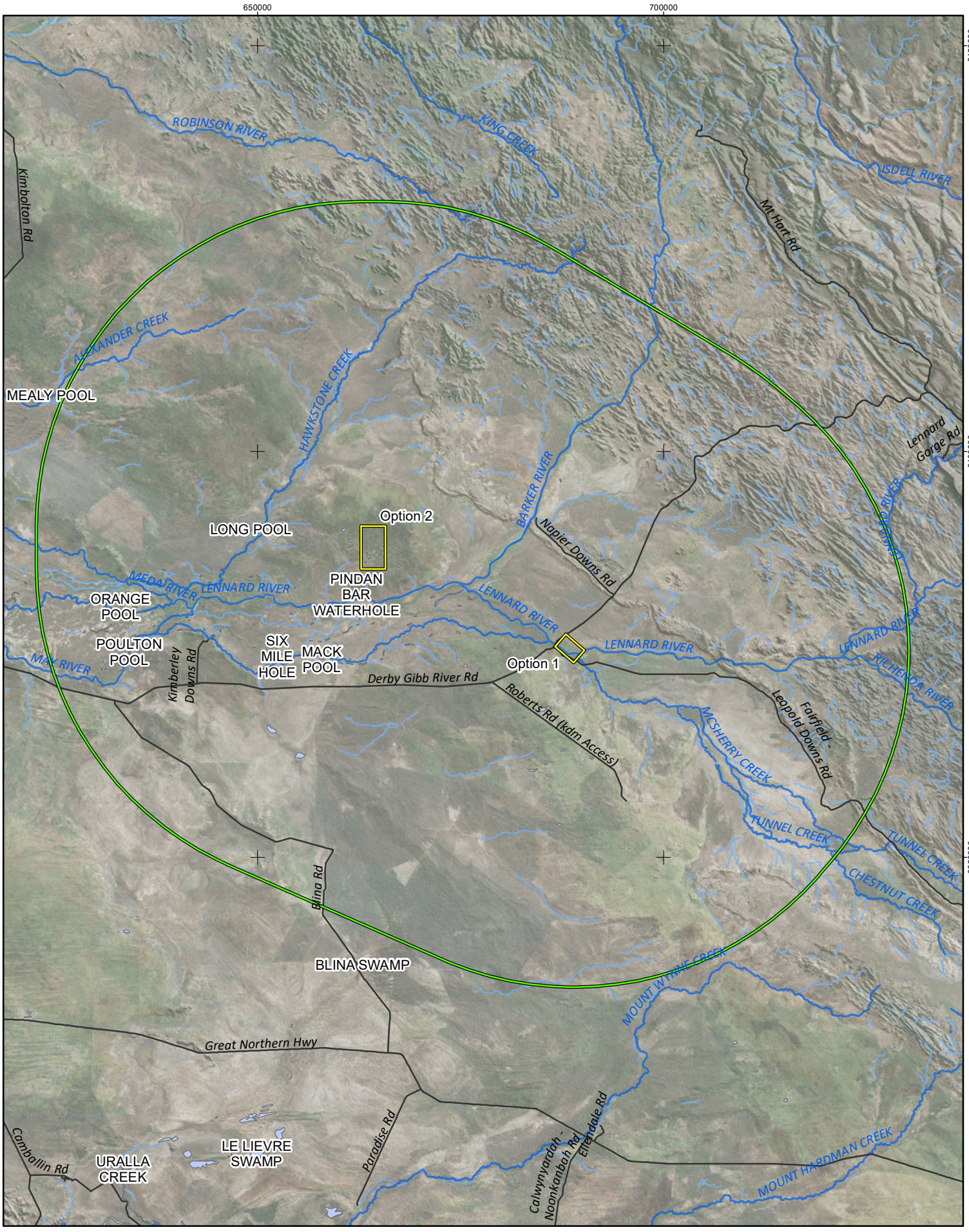
No rivers or mapped drainage lines intersect the Option 2 area but there are some minor drainage lines just south of the Option 2 area into the Lennard River (Figure 4-4).

There are no Ramsar or other significant wetlands in the study area or the wider desktop search extent. Some very small minor non-perennial wetlands are mapped in the option 2 area according to the Geoscience Australia Lakes dataset (Figure 4-4). None are present in the Option 1 area.

The study area is located in the Canning-Kimberley groundwater subarea of the Canning-Kimberley groundwater area as proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). There are no public water drinking source areas in proximity to the study area.

The target aquifer for the Project is the Grant Group (Figure 4-5; see section 4.1.5).

Several groundwater springs are present outside the study area within the desktop search extent. The closest to the Option 1 study area is Baralama Spring located 12 km to the east and the closest to the Option 2 area is Ngooderoodyne Spring located 30 km to the west (Figure 4-5).



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Map author	MH

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Kilometres

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Desktop study area
Study area
River
Minor watercourse
Wetland

Figure 4–4

Surface water values

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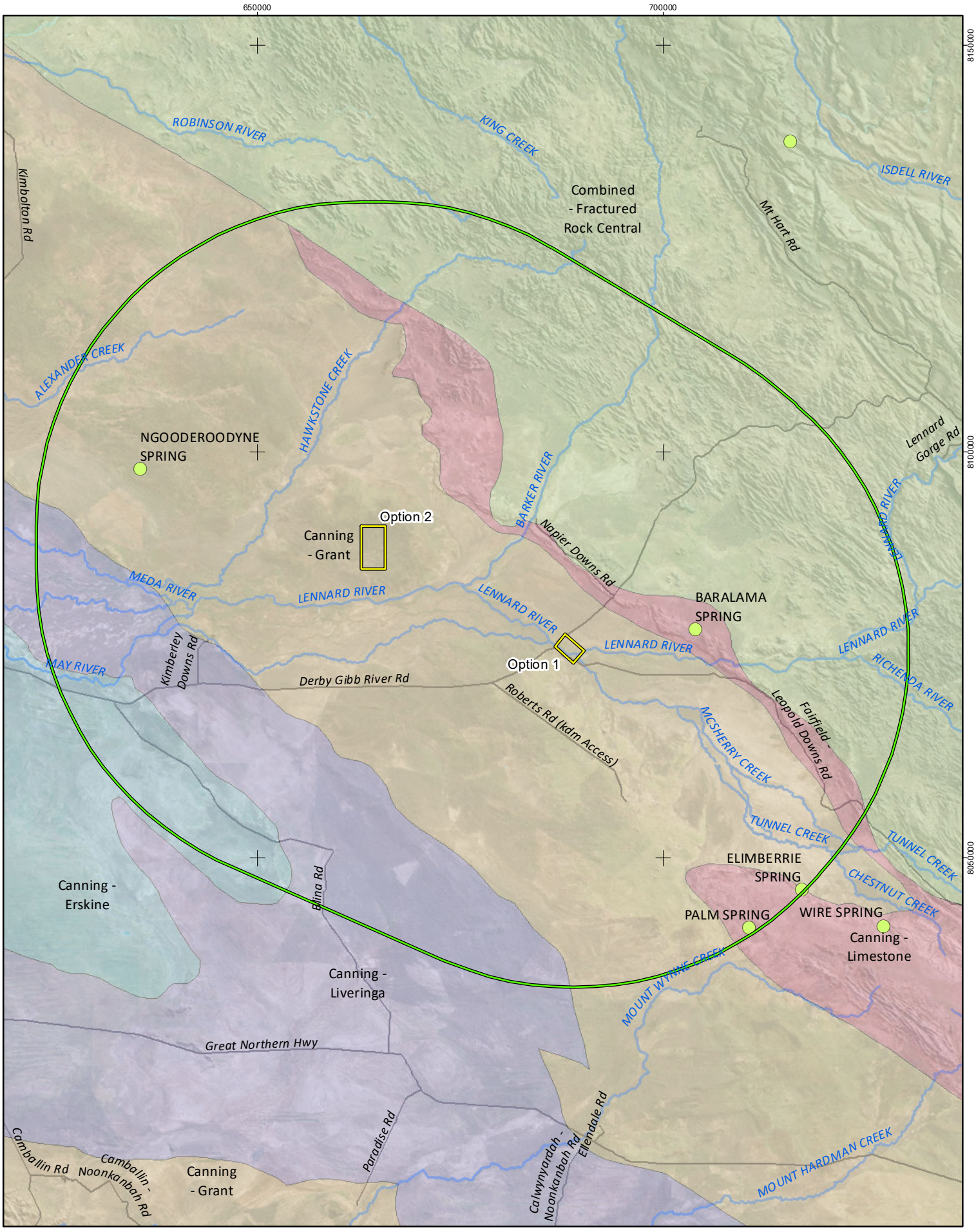

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Kilometres

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Desktop study area
Study area
Spring
River

WRIMS aquifer
Canning - Erskine
Canning - Grant
Canning - Limestone
Canning - Liveringa
Combined - Fractured Rock Central

Figure 4–5

Ground water values

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4.1.5 Geology and hydrogeology

According to the Lennard River map sheet (GSWA 1992), the study area overlies an area dominated by shallow- dipping rocks of the Phanerozoic Canning Basin succession. It falls within the King Leopold Orogen geological province which includes the Palaeoproterozoic metasedimentary and igneous rocks of the Hooper Complex and the deformed margins of the Speewah and Kimberley Basins (Stewart *et al.* 2016). The southwestern margin of the Hooper Complex ends northeast of the study area, beyond the narrow Napier Range located approximately 7 km north of the study area. Napier Range is comprised of exhumed Devonian limestone reef complex.

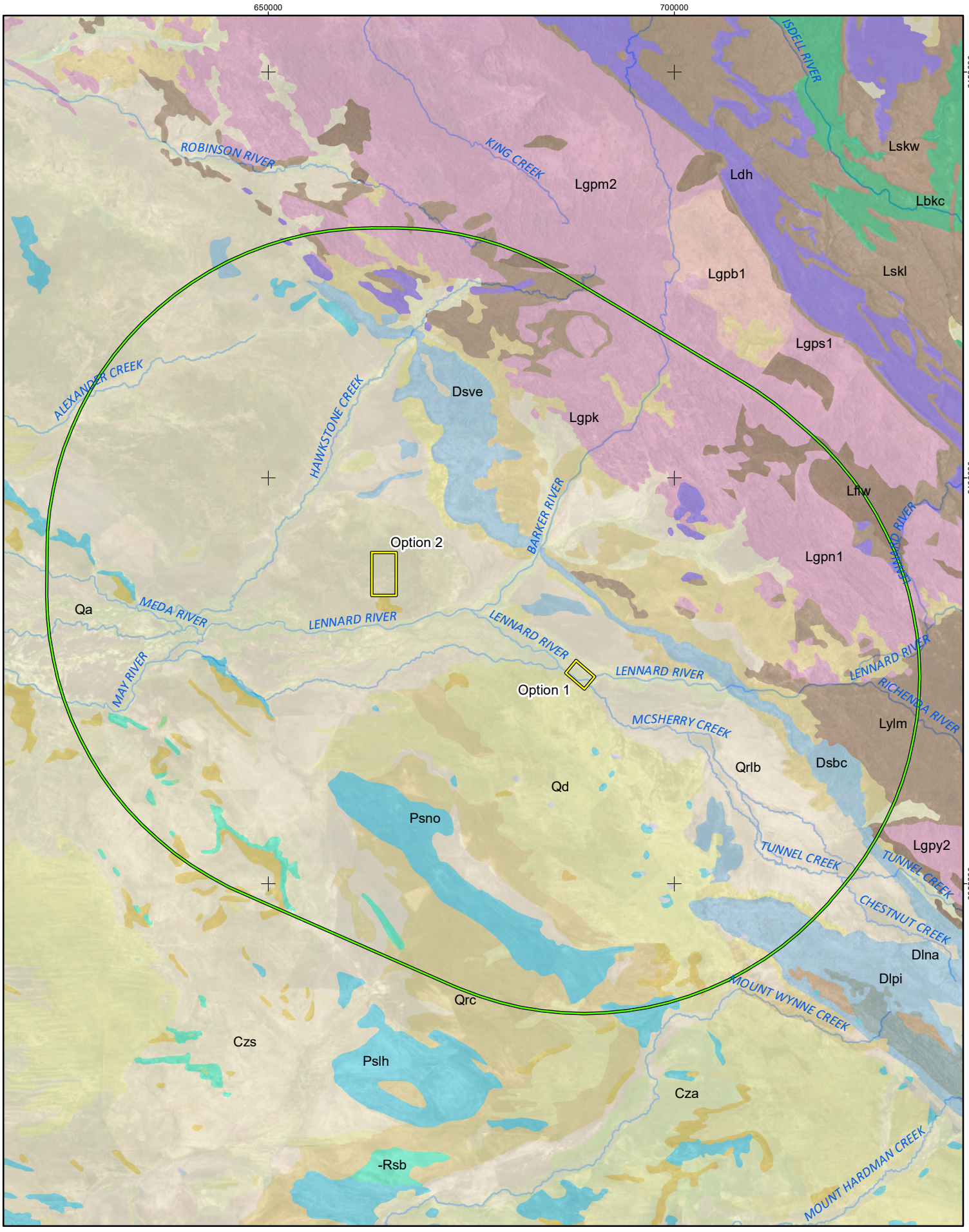
The Grant Group aquifer area occurs at the northern extremity of the expansive Canning Basin, which consists predominantly of Palaeozoic sedimentary rocks with a thin Mesozoic and Tertiary cover (Paul *et al.* 2013). Most of the underlying geology of the Canning Basin is covered by Cainozoic colluvium and alluvium.

The Grant Group aquifer is a thick sedimentary sequence consisting mainly of Carboniferous and Permian sandstones, with minor Devonian sandstone on the northeast margin included with the aquifer (DWER). The sandstones often contain fine-grained facies in the middle (Harrington & Harrington 2015). Grant Group rocks mainly outcrop in the anticlinal structures and form some of the ranges, such as the Grant Range near Liveringa, and the St George Ranges southeast of Noonkanbah middle (Harrington & Harrington 2015).

Surface geology within the Option 1 study area comprises alluvial and inland eolian deposits; generally quartzose (Czc/Plg; Figure 4-6). The Option 2 study area is mapped as a combination of Czc/Plg and marine and continental siltstone, shale, sandstone, and limestone, glacially influenced (Plg; Figure 4-6).

Regolith mapping for the area shows the Option 1 area occurs mainly over alluvium, with the description ‘alluvium in drainage channels, floodplains, and deltas’ (Figure 4-7). The Option 2 area is located over sandplain described as ‘mainly eolian, including some residual deposits’ (Figure 4-7).

The Grant Group aquifer is expansive and, according to the DWER WRIMS Aquifer dataset (DWER), is mostly unconfined. Salinity is assumed to be fresh given the aquifer is a target water resource.



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Map author	MH

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Desktop study area
Study area

Figure 4-6

Surface geology

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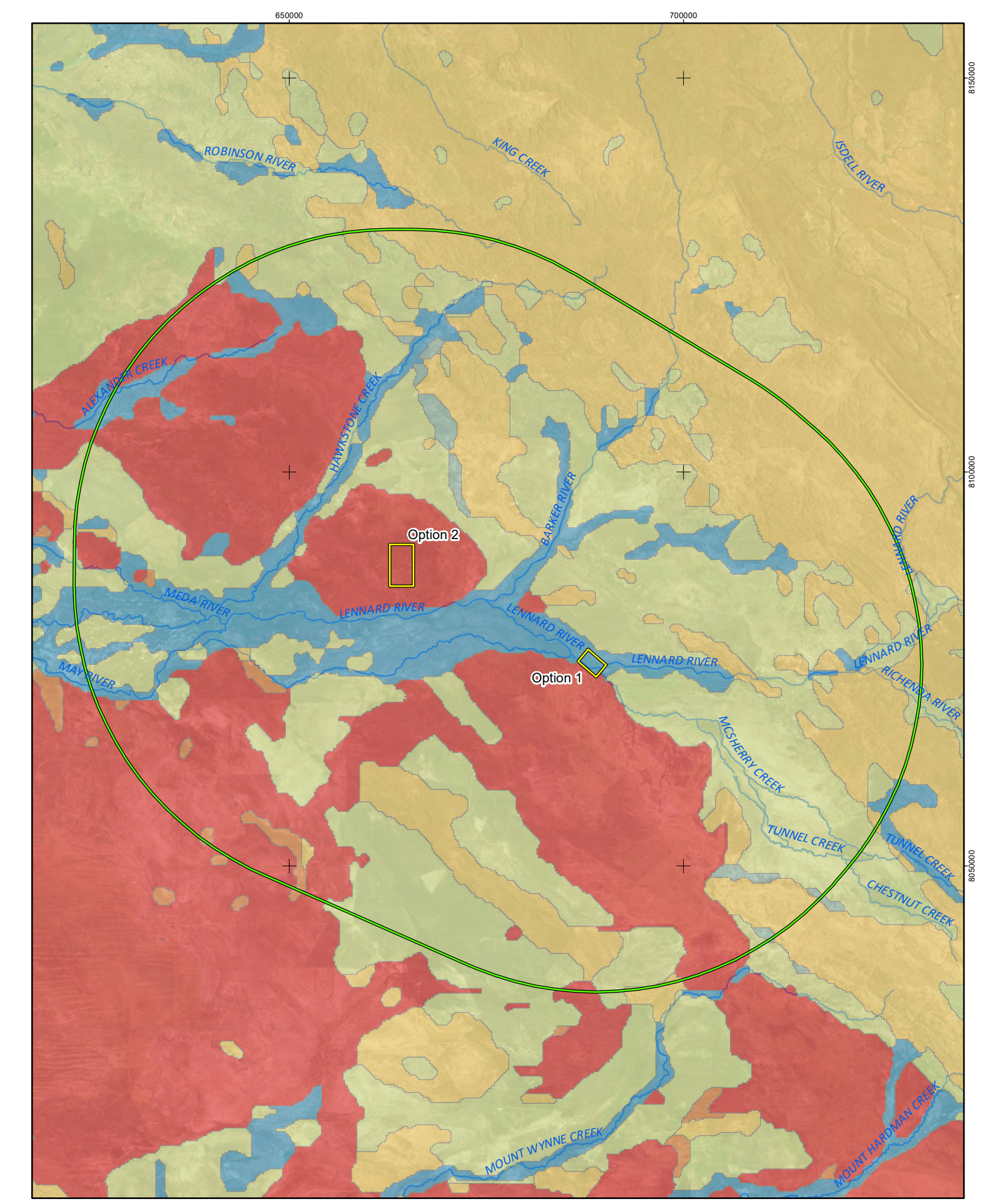

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Map author	MH

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Desktop study area
Study area

Regolith type
- Alluvium
- Calcrete
- Colluvium
- Exposed
- Residual
- Sandplain

Figure 4-7

Regolith

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4.2 FLORA AND VEGETATION DESKTOP ASSESSMENT

4.2.1 Vegetation

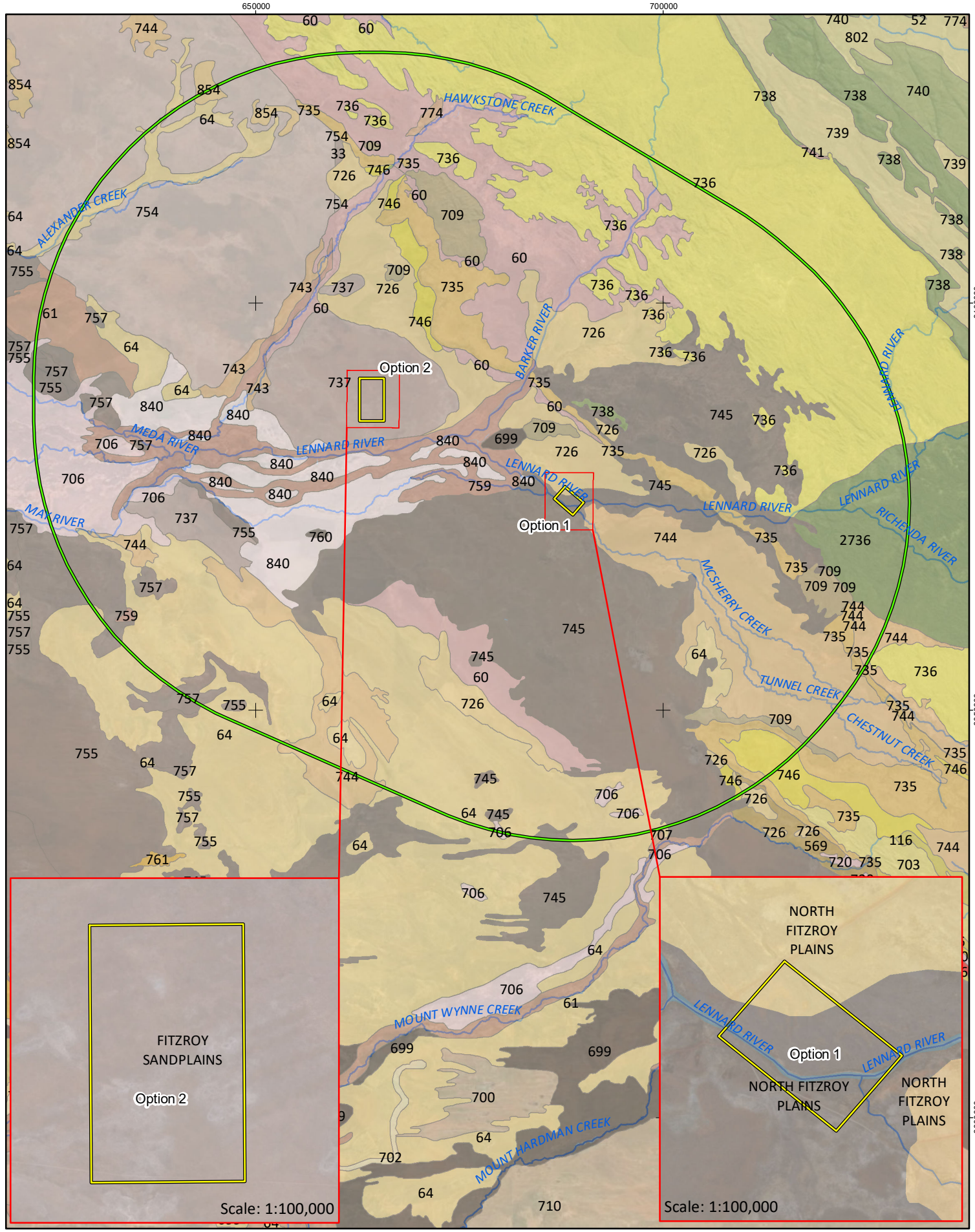
4.2.1.1 Native vegetation extent and status

Regional scale vegetation mapping by Shepherd *et al.* (2002) mapped three vegetation associations in the desktop study area (Figure 4-8). Two of these associations, 726 and 745, cover the Option 1 study area and the third, 737, comprises 100% of the Option 2 study area. Associations 726 (grasslands) and 745 (shrublands) comprise 14.59% and 82.41% respectively of the Option 1 study area.

Each of the three associations have 100% or nearly so of their pre-European extents remaining and are classified as of Least Concern (Table 4-2). None of the vegetation associations are well represented in DBCA managed lands.

Table 4-2 Extent and conservation status of the Shepherd *et al.* (2002) vegetation associations intersecting the study area (DBCA 2018)

Assoc.	Description	State IBRA	State IBRA	State IBRA	Current DBCA Managed Lands (ha)	Status	Area (ha)	% of study area
		Pre-European extent (ha)	Current extent (ha)	% remaining				
726	Grasslands, tall bunch grass savanna low tree; baobabs, bauhinia & beefwood over mitchell & ribbon/blue grass on black soil	76,491.30 35,414.02	76,446.44 35,414.02	99.94 100.00	148.6 (0.19%)	Least concern	105.6	17.59% of Option 1 study area
745	Shrublands, pindan; acacia shrubland with scattered low trees over spinifex	230,257.94 192,624.80	229,300.03 191,695.67	99.58 99.52	1,141.0 (0.5%)	Least concern	494.5	82.41% of Option 1 study area
737	Shrublands, pindan; *Acacia tumida* shrubland with scattered low bloodwood & *Eucalyptus setosa* over curly spinifex	36,229.88 36,229.88	36,217.35 36,217.35	99.97 99.97		Least concern	1573.2	100% of Option 2 study area
Total						**600 ha Option 1** **1573.2 ha Option 2**		**100%**



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Map author	MH

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Desktop study area
Study area

Figure 4-8

Vegetation associations of the study area (Sheperd *et al*. 2002)

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4.2.1.1 Threatened and priority ecological communities

A number of Priority Ecological Communities occur in the vicinity of the Option 1 and Option 2 areas (Figure 4-9; Table 4-3). In total, eight PECs occur close to the study areas, with the closest buffer zone, of the Kimberley Vegetation Association 759 PEC, approximately 2 km to the south of Option 2 study area and intersecting the area between the two study areas. Neither study area intercepts the buffer zones of the PECs.

Table 4-3 Threatened and Priority Ecological Communities within 40 km of the study areas

Community ID	Community name	Cons. status	Buffer (km)	Proximity to study area
Boab dominated assemblages (MVT limestone ranges)	Boab dominated assemblages of Devonian limestone reef complex (previously 'Monsoon vine thickets of limestone ranges')	Priority 3	0.5	16.4 km east of Option 1 study area
Gogo Land System	Gogo Land System	Priority 3	0.5	11.8 km east of Option 1 study area and 17.5 km south-west of Option 2 study area
Leopold Land System	Leopold Land System	Priority 3	0.5	5.4 km north of Option 1 study area and 12.0 km east of Option 2 study area
Napier Range Cave	Invertebrate community of Napier Range Cave	Priority 1	0.5	9.7 km east of Option 2 study area and 19.4 km north-west of Option 1 study area
Napier Range	Monsoon vine thickets and Camaenid land snails of limestone ranges (Napier Range)	Priority 1	0.5	6.6 km north of Option 1 study area and 7.3 km north of Option 2 study area
Vegetation Association 33	Kimberley Vegetation Association 33 As defined by John Beard's vegetation mapping for the Kimberley (Beard 1979). Shrublands, pindan; acacia shrubland with eucalypt medium woodland over curly spinifex	Priority 1	0.5	25.9 km north of Option 2 study area
Vegetation Association 759	Kimberley Vegetation Association 759 As defined by John Beard's vegetation mapping for the Kimberley (Beard 1979). Grasslands, tall bunch grass savanna woodland, coolabah over ribbon/blue grass (Botriochloa spp.)	Priority 3	0.5	2.0 km south of Option 2 study area and 4.2 km west of Option 1 study area
Vegetation Association 760	Kimberley Vegetation Association 760 As defined by John Beard's vegetation mapping for the Kimberley (Beard 1979). Shrublands, pindan; *Acacia tumida* shrubland with scattered low bloodwood & *Eucalyptus setosa* (not current name) over ribbon & curly spinifex.	Priority 1	0.5	13.7 km south-west of Option 2 study area and 27.8 km west of Option 1 study area

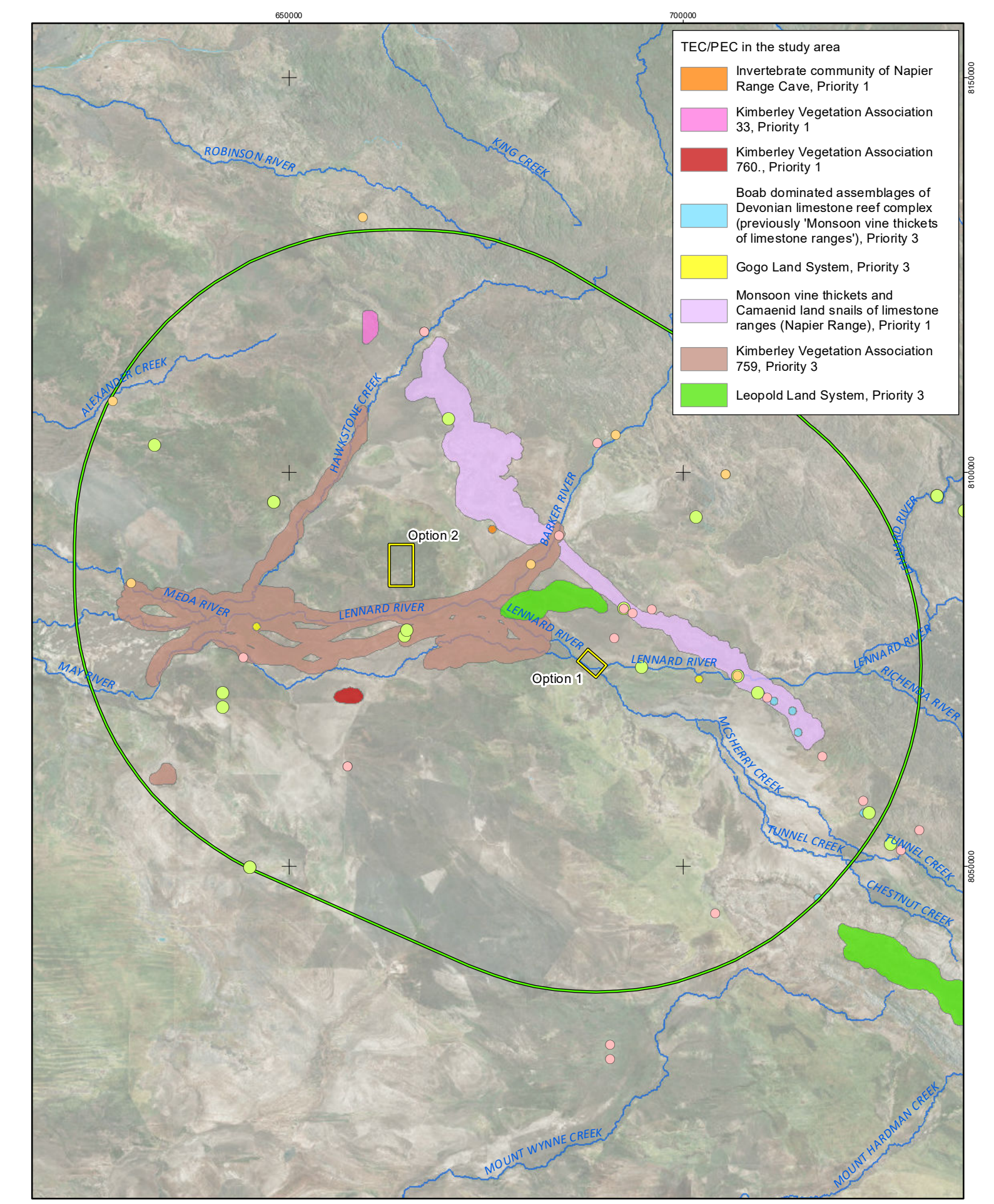

Figure 4-9

Desktop records of significant flora and ecological communities

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4.2.1.2 Groundwater dependent ecosystems

Interrogation of the groundwater dependent ecosystems atlas (BoM 2019a) determined that major creek/river systems in the vicinity of the study areas, including Lennard River, have been ranked as having moderate potential as groundwater dependent ecosystems.

4.2.2 Flora

A search of the DBCA database *Naturemap* (DBCA 2019) showed a difference in flora composition between the Option 1 and Option 2 sites, although the majority of species recorded in the database search were found in both. While the records show similar numbers of species within the major Families, the species recorded will differ to some extent.

Option 1

A total of 598 species were recorded in the vicinity of Option 1, from 250 genera and 86 Families. The most prolific Families were the Poaceae (grasses) and Fabaceae (legumes) with 76 and 83 species respectively. Other well represented Families are the Malvaceae (40), Myrtaceae (28) and Asteraceae (24).

Option 2

A total of 658 species were recorded in the vicinity of Option 2, from 272 genera and 88 Families. Fabaceae (94) and Poaceae (80) were the most prolific Families, with Malvaceae (41), Myrtaceae (30) and Asteraceae (23).

4.2.2.1 Significant Flora

A search of Florabase (DBCA 2019a) determined that there were no Threatened flora recorded for the Fitzroy Trough IBRA subregion.

Option 1

A total of 17 conservation significant flora species were identified in the desktop review from within 40 km of the study area (Figure 4-9; Table 4-4). No species were listed under the EPBC Act or BC Act as either Endangered, Vulnerable or Critical. Seventeen Priority species were recorded, comprising eight Priority 1, three Priority 2, and six Priority 3 species. No Priority 4 species were recorded. No records of significant flora were returned within the Option 1 area.

Within the Option 1 study area, nine species were assessed as likely to occur, two as possibly occurring and six as unlikely to occur (Table 4-4).

Option 2

A total of 17 conservation significant flora species were identified in the desktop review from within 40 km of the study area (Figure 4-9; Table 4-5). No species were listed under the EPBC Act or BC Act as either Endangered, Vulnerable or Critical. Seventeen Priority species were recorded, comprising seven Priority 1, three Priority 2, and seven Priority 3 species. No Priority 4 species were recorded. No records of significant flora were returned within the Option 2 area.

Within the Option 2 survey area, 11 species were assessed as Likely to occur, one as possibly occurring and five as unlikely to occur (Table 4-5).

Table 4-4 Conservation significant flora records from the Option 1 study area of the desktop review and likelihood of occurrence

Species	Cons. status	Nearest record to study area	Description and habitat (DBCA 2019a)	Likelihood of occurrence	Criteria
Alysicarpus major	P3	6.3 km NE of the study area	Prostrate perennial herb. Plains, floodplains, valleys, scree slopes, loam over basalt, laterite.	Likely	Closest record 6.3 km NE of the study area. Habitat is suitable
Blumea pungens	P2	13 km NW of the study area	Erect herb 0.6-1.5 m. Riverine, hillslopes, gorges. Sand over sandstone.	Unlikely	Closest record 13 km NW of the study area. Habitat appears unsuitable
Corymbia pedimontana	P1	20.8 km E of the study area	Tree to 10m, brown-red bark. Plains at base of hills. Red sandy soils or loam over limestone.	Unlikely	Closest record 20.8 km E of the study area. Habitat appears to be specific, not represented here
Cucumis sp. Bastion Range (A.A. Mitchell et al. AAM 10710) PN	P1	7 km NE of the study area	Annual vine. Limestone, sandstone scree, watercourses.	Unlikely	Closest record 7 km NE of the study area. Habitat appears unsuitable
Decaisnina biangulata	P3	34.3 km NW of the study area	Hemiparasitic aerial shrub on *Lophostemon*, *Syzygium*, *Tristania*, *Terminalia*.	Likely	Closest record 34.3 km NW of the study area. Habitat suitable for hosts
Fimbristylis dictyocolea	P1	33.7 km SE of the study area	Short grass or sedge-like perennial. Edges of swamps or in water.	Possible	Closest record 33.7 km SE of the study area. Some suitable habitat in area
Gomphrena cucullata	P3	22.2 km WNW of the study area	Spreading or erect annual herb to 0.25 m. Open floodplains. Red sandy loam, clayey sand.	Likely	Closest record 22.2 km WNW of the study area. Habitat suitable
Heliotropium aenigmatum	P1	6.85 km NE of study area	Ascending or spreading herb 0.15-0.6 m. Variety of habitats.	Likely	Closest record 6.85 km NE of study area. Habitat suitable
Heliotropium calvariavis	P1	26.3 km N of study area	Ascending to spreading-ascending annual, herb, to 0.15 m high. Sandy soils.	Likely	Closest record 26.3 km N of study area. Habitat suitable
Heliotropium parviantrum	P1	32 km ENE of study area	Erect annual, herb, to 0.15 m high. Flats, plains, rocky slopes. Sandy soils.	Likely	Closest record 32 km ENE of study area. Habitat suitable
Polymeria distigma	P3	40 km ENE of the study area	Prostrate trailing herb. Sandy soils	Likely	Closest record 40 km ENE of the study area. Habitat suitable
Pterocaulon globuliflorum	P2	16.8 km E of study area	Erect, much-branched perennial, herb or shrub, 0.4-0.6 m. Sandstone cliffs and scree slopes.	Unlikely	Closest record 16.8 km E of study area. No suitable habitat

Species	Cons. status	Nearest record to study area	Description and habitat (DBCA 2019a)	Likelihood of occurrence	Criteria
Schoenoplectiella humillima	P2	27.5 km N of the study area	Sedge to 5 cm. Seepages, pools, red-brown clay.	Likely	Closest record 27.5 km N of the study area. Some suitable habitat in area
Tephrosia rosea var. Napier Range (C.R. Dunlop 7760 & B.K. Simon)	P3	4.5 km E of study area	Silver leafed perennial herb to 0.5 m. Valley floors, skeletal soils.	Unlikely	Closest record 4.5 km E of study area. Habitat unlikely to be suitable
Tephrosia sp. Mistake Creek (A.C. Beauglehole 54424)	P3	16.8 km E of study area	Erect open shrub to 2 m. Flats/banks, drainage.	Likely	Closest record 16.8 km E of study area. Habitat suitable
Trachymene oleracea subsp. *sedimenta*	P1	3 km NE of study area	Annual herb to 0.6 m. Limestone or sandstone on inland ranges.	Unlikely	Closest record 3 km NE of study area. Habitat unlikely to be suitable
Triodia pascoeana	P1	33.8 km S if study area	Tussock-forming grass 1-3 m high. Limestone ranges & gorges, floodplains	Possible	Closest record 33.8 km S of study area. Habitat may be suitable

Table 4-5 Conservation significant flora records from the Option 2 study area of the desktop review and likelihood of occurrence

Species	Cons. status	Distance from study area	Description and habitat (DBCA 2019a)	Likelihood of occurrence	Criteria
Acacia monticola x *tumida* var. *kulparn*	P3	25 km SE of study area	Shrub to 2m, grey bark fissured to reveal reddish stems. Coastal cliffs.	Unlikely	Closest record 25 km SE of study area. Habitat not suitable
Alysicarpus major	P3	27 km E of study area	Prostrate perennial herb. Plains, floodplains, valleys, scree slopes, loam over basalt, laterite.	Likely	Closest record 27 km E of study area. Habitat suitable
Alysicarpus suffructicosus	P2	39.4 km N of study area	Erect compact shrub to 0.3 m. Sandy clay.	Likely	Closest record 39.4 km N of study area. Habitat appears suitable
Blumea pungens	P2	15 km E of study area	Erect herb 0.6-1.5m. Riverine, hillslopes, gorges. Sand over sandstone.	Likely	Closest records 15 km E of study area. Habitat appears suitable
Clerodendrum inerme	P1	20.6 km SW of study area	Erect dense tree or multi-stemmed shrub to 4m. Coastal swales, sandstone.	Unlikely	Closest record 20.6 km SW of study area. Habitat unsuitable
Cucumis sp. Bastion Range (A.A. Mitchell et al. AAM 10710) PN	P1	28 km E of study area	Annual vine. Limestone, sandstone scree, watercourses.	Unlikely	Closest record 28 km E of study area. Habitat appears unsuitable
Decaisnina biangulata	P3	16.7 km ENE of study area	Hemiparasitic aerial shrub on *Lophostemon*, *Syzygium*, *Tristania*, *Terminalia*.	Likely	Closest record 16.7 km ENNE of study area. Habitat suitable for hosts
Gomphrena cucullata	P3	63.4 km S of study area	Spreading or erect annual herb to 0.25m. Open floodplains. Red sandy loam, clayey sand.	Likely	Closest record 6.34 km S of study area. Habitat appears suitable
Heliotropium aenigmatum	P1	18.5 km E of study area	Ascending or spreading herb 0.15-0.6m. Variety of habitats.	Likely	Closest record 18.5 km E of Option 2 study area. Habitat appears suitable
Heliotropium calvariavis	P1	26.8 km NE of study area	Ascending to spreading-ascending annual, herb, to 0.15 m high. Sandy soils.	Likely	Closest record 26.8 km NE of study area. Habitat appears suitable
Heliotropium parviantrum	P1	23.5 km S of study area	Erect annual, herb, to 0.15 m high. Flats, plains, rocky slopes. Sandy soils.	Likely	Closest record 23.5 km S of study area. Habitat appears suitable

Species	Cons. status	Distance from study area	Description and habitat (DBCA 2019a)	Likelihood of occurrence	Criteria
Ipomoea johnsoniana	P1	27 km N of study area	Dense shrub to 1m, twining stems. Sandy flats over limestone, sandstone.	Possible	Closest record 27 km from study area. Habitat may be suitable
Polymeria distigma	P3	12.75 W of study area	Prostrate trailing herb. Sandy soils	Likely	Closest record 12.75 W of study area. Habitat suitable
Schoenoplectiella humillima	P2	30 km NE of study area	Sedge to 5cm. Seepages, pools, red-brown clay.	Likely	Closest record 30 km NE of study area. Habitat suitable
Stylidium pindanicum	P3	15.6 km NW of study area	Annual herb to 30cm, leaves basally rosetted. Damp, sandy soils, clay flats.	Likely	Closest record 15.6 km NW of study area. Habitat suitable
Tephrosia rosea var. Napier Range (C.R. Dunlop 7760 & B.K. Simon)	P3	30.8 SE of study area	Silver leafed perennial herb to 0.5m. Valley floors, skeletal soils.	Unlikely	Closest record 30.8 SE of study area. Habitat unsuitable
Trachymene oleracea subsp. *sedimenta*	P1	26.3 km SE of study area	Annual herb to 0.6m. Limestone or sandstone on inland ranges.	Unlikely	Closest record 26.3 km SE of study area. Habitat unsuitable

4.2.2.2 Introduced species

Option 1

A total of 33 weed species have been recorded from the Option 1 study area, from 16 families and 29 genera (Table 4-6). Two species, **Parkinsonia aculeata* and **Jatropha gossypiifolia* are WoNS and these plus a third, **Calotropis procera* are Declared Pests.

Option 2

A total of 35 weed species have been recorded from the Option 2 study area, from 16 families and 31 genera (Table 4-7). Two species, **Parkinsonia aculeata* and **Jatropha gossypiifolia* are WoNS and these plus a third, **Calotropis procera* are Declared Pests.

The similarity in the weed species between the two sites is to be expected considering their proximity to each other and habitat similarity.

Table 4-6 Weed species recorded by the desktop assessment near the Option 1 study area

Family	Species	WoNS	Declared Pests
Asteraceae	**Acanthospermum hispidum*		
Amaranthaceae	**Aerva javanica*		
Asteraceae	**Bidens pilosa* var. *pilosa*		
Apocynaceae	**Calotropis procera*		s22(2) Exempt
Poaceae	**Cenchrus ciliaris*		
Poaceae	**Cenchrus echinatus*		
Poaceae	**Chloris virgata*		
Cucurbitaceae	**Citrullus amarus*		
Malvaceae	**Corchorus olitorius*		
Poaceae	**Digitaria ciliaris*		
Poaceae	**Echinochloa colona*		
Poaceae	**Eragrostis minor*		
Euphorbiaceae	**Euphorbia hirta*		
Euphorbiaceae	**Jatropha gossypiifolia*	Y	s22(2) C3
Fabaceae	**Leucaena leucocephala*		
Malvaceae	**Malvastrum americanum*		
Malvaceae	**Malvastrum coromandelianum*		
Malvaceae	**Melochia pyramidata*		
Lamiaceae	**Mesosphaerum suaveolens*		
Poaceae	**Panicum coloratum*		
Fabaceae	**Parkinsonia aculeata*	Y	s22(2) Exempt
Passifloraceae	**Passiflora foetida*		
Passifloraceae	**Passiflora foetida* var. *hispida*		
Solanaceae	**Physalis angulata*		
Portulacaceae	**Portulaca pilosa*		

Family	Species	WoNS	Declared Pests
Malvaceae	**Sida acuta*		
Malvaceae	**Sida acuta* subsp. *acuta*		
Aizoaceae	**Trianthema portulacastrum*		
Zygophyllaceae	**Tribulus terrestris*		
Asteraceae	**Tridax procumbens*		
Poaceae	**Urochloa mosambicensis*		
Fabaceae	**Vachellia farnesiana*		
Lamiaceae	**Vitex trifolia*		

Table 4-7 Weed species recorded by the desktop assessment near the Option 2 study area

Family	Species	WoNS	Declared pests
Asteraceae	**Acanthospermum hispidum*		
Amaranthaceae	**Aerva javanica*		
Asteraceae	**Bidens pilosa* var. *pilosa*		
Apocynaceae	**Calotropis procera*		s22(2) Exempt
Poaceae	**Cenchrus ciliaris*		
Poaceae	**Cenchrus echinatus*		
Poaceae	**Chloris virgata*		
Cucurbitaceae	**Citrullus amarus*		
Malvaceae	**Corchorus olitorius*		
Poaceae	**Cynodon dactylon*		
Poaceae	**Digitaria ciliaris*		
Poaceae	**Echinochloa colona*		
Poaceae	**Eragrostis minor*		
Euphorbiaceae	**Euphorbia hirta*		
Euphorbiaceae	**Jatropha gossypiifolia*	Y	s22(2) C3
Fabaceae	**Leucaena leucocephala*		
Malvaceae	**Malvastrum americanum*		
Malvaceae	**Malvastrum coromandelianum*		
Malvaceae	**Melochia pyramidata*		
Lamiaceae	**Mesosphaerum suaveolens*		
Lamiaceae	**Ocimum americanum*		
Poaceae	**Panicum coloratum*		
Fabaceae	**Parkinsonia aculeata*	Y	s22(2) Exempt
Passifloraceae	**Passiflora foetida*		
Passifloraceae	**Passiflora foetida* var. *hispida*		
Solanaceae	**Physalis angulata*		

Family	Species	WoNS	Declared pests
Portulacaceae	**Portulaca pilosa*		
Malvaceae	**Sida acuta*		
Malvaceae	**Sida acuta* subsp. *acuta*		
Aizoaceae	**Trianthema portulacastrum*		
Zygophyllaceae	**Tribulus terrestris*		
Asteraceae	**Tridax procumbens*		
Poaceae	**Urochloa mosambicensis*		
Fabaceae	**Vachellia farnesiana*		
Lamiaceae	**Vitex trifolia*		

4.3 TERRESTRIAL FAUNA

4.3.1 Vertebrate fauna

Records for 341 terrestrial vertebrate fauna species and subspecies were identified as potentially occurring within the study area in the desktop review. This comprised 19 frogs (including one naturalised species), 68 reptiles (including one naturalised species), 205 birds (including two naturalised species) and 49 mammals (including seven naturalised species (Appendix 2).

A total of 42 species of conservation significance were identified in the desktop review, comprising 20 species listed under the EPBC Act and/or BC Act as Threatened (CR, EN, VU) or Specially Protected (OS) (Table 4-8; Figure 4-10). A further 18 species are listed as Migratory under the EPBC Act and BC Act and nine species are listed as Priority species by the DBCA (Table 4-8).

No conservation significant species have previously been recorded within the study area; however, one species has previously been recorded approximately 900 m northwest of the Option 2 area, Gouldian Finch (EN – EPBC Act; P4 DBCA). A further five significant species have previously been recorded within 10 km of the study area, Common Greenshank (Mig – EPBC/BC Acts), Ghost Bat (VU – EPBC/BC Acts), Northern Short-tailed Mouse (P4 – DBCA), Peregrine Falcon (OS – BC Act) and Rock Ringtail Possum (P3 – DBCA). Likelihood of occurrence for each species is summarised in Table 4-8

A preliminary assessment of the likelihood of occurrence for species of conservation significance identified in the desktop review was undertaken based on the known distribution, habitat preferences and ecology of the species, presence of records in the proximity of the study area and occurrence of potential fauna habitats within the study area based on desktop vegetation assessment and aerial imagery (Table 4-8).

The occurrence of Freshwater Crocodile (OS) within the study area is only considered to apply to Option 1 as no suitable habitat appears to be present within the Option 2 area. Within Option 1, the species occurrence is dependent on the presence and persistence of water in the Lennard River that dissects the study area. If this contains water permanently or for long periods following rainfall events, and/or is connected to sections of permanently fed pools, the species may occur as either a resident, if permanent, or transient individual/visitor if only seasonally flowing following rainfall events.

Although the study area occurs outside of mapped priority area for Night Parrot (EN/CR), and records of the species are extremely sparse and sporadic, the species may potentially occur within the study area. Based on vegetation identified in the desktop review, no vegetation types containing old growth

spinifex (*Triodia* spp.) or Samphire (*Tecticornia* spp.) which the species has previously been recorded in occur within the study area; however, due to the limited knowledge of the species habitat preferences and ecology, it cannot be ruled out as potentially occurring within the study area.

Due to their large foraging ranges, conservation significant raptor species such as Red Goshawk (VU), Grey Falcon (VU) and Peregrine Falcon (OS) may occasionally occur within the study area to forage; however, the potential for nesting needs to be determined in a site assessment.

Based on the previous record of Gouldian Finch (EN/P4) approximately 900 m from the Option 1 area and the continuation of habitat bordering the drainage line through the area, the species is considered likely to occur within the Option 1 area. Based on the vegetation identified in the desktop review, the species may also occur within the Option 1 area if suitable foraging grasses are present.

The Kimberley subspecies of Marked Owl (VU/P1) may occasionally occur within the study area to forage; however, the likelihood of the species nesting within the study area is dependent on the presence of suitable nesting hollows. Vegetation types identified in the desktop review include *Eucalyptus* species which may provide suitable nesting options for the species.

The desktop review identified a number of migratory shorebird and waterbird species which have been recorded in the vicinity of the study area; these records are largely clustered around the Lennard River and its tributaries/apparent low-lying areas which appear prone to flowing, particularly south of Option 1. Potential for occurrence of several migratory bird species is therefore possible along the Lennard River and low lying areas in the Option 1 study area, particularly during the wet season. The value of the intermittent small wetlands in the Option 2 area is probably limited but requires site investigation to confirm.

Fork-tailed Swift (Mig) inhabit a broad range of habitats and may occur only occasionally to forage in the study area; however, nesting is unlikely to occur due as the species is almost entirely aerial.

Despite historic decline of the distribution of Golden Bandicoot, the species still occupies small areas in the western Kimberley. The species is known to occur in a wide range of habitats, including those identified in the desktop review as occurring within the study area and may occur in both options of the study area as a resident.

Although the study area occurs just outside the current known range for Bilby (VU), the desktop review indicated suitable vegetation types (including grassland and shrubland habitats) and substrates permitting burrow construction which may support the species occurrence within the study area. The nearest record of the species identified in the desktop review is located approximately 24 km south-southeast of the study area; however, the species is known to traverse large distances and habitat between the record and study area appears to be largely continuous based on aerial imagery.

The absence of any rocky habitat suitable for Northern Quoll (EN) suggests the species is unlikely to occur as a resident within the study area; however, riparian or woodland habitat bordering the drainage line in the Option 1 area may act as a suitable movement or dispersal corridor for the species between other areas of suitable habitat outside of the study area.

Of the four conservation significant bat species, all may occasionally occur within the study area to forage; however, only one has the potential to roost, Bare-rumped Sheath-tailed Bat (P3) which is known to roost in hollow trunks and branches in woodland habitats. The other three bat species, Northern Leaf-nosed Bat (P2), Orange Leaf-nosed Bat (VU/P4) and Yellow-lipped Cave Bat (P2) all frequently use caves for roosting. No cave supporting geology was identified within the study area, but all three species have been recorded from the Napier Range just to the north which is likely to provide roosting habitat. Foraging habitat includes woodlands and forests, therefore they may occur within the study area to forage.

Woodland occurring species such as the Kimberley Brush-tailed Phascogale (VU) and Northern Brushtail Possum (VU) may occur within the study area if suitable vegetation types and structures are present, including the presence of hollow bearing trees in which the species may use to roost.

The Northern Short-tailed Mouse (P4) has been recorded multiple times within the vicinity of the study area, including in habitats that appear continuous from aerial imagery. The species occurs within a range of habitats, including those associated with the vegetation and soil types identified in the desktop review, and is likely to occur throughout the study area.

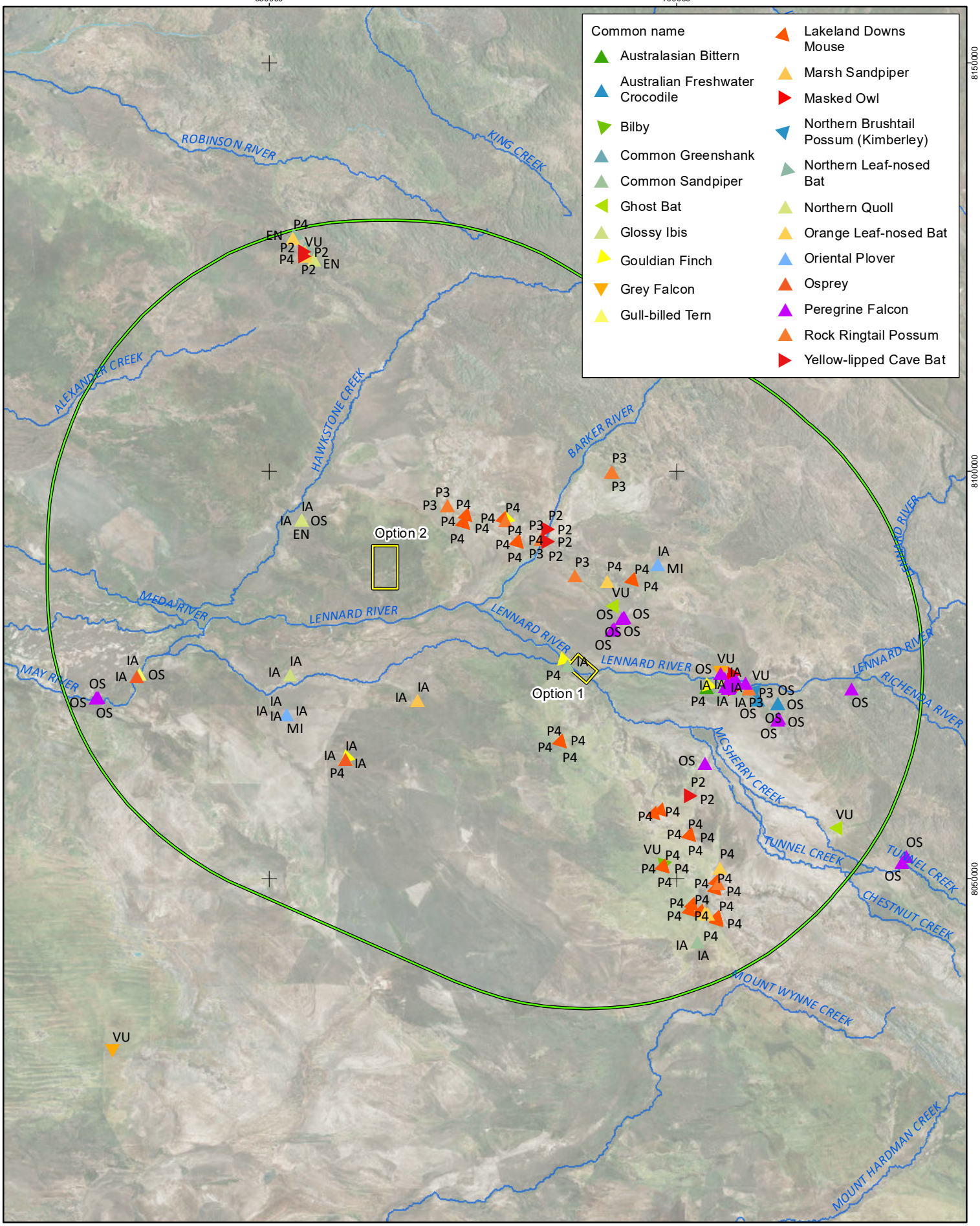
A number of conservation significant mammal species identified in the desktop review are considered unlikely to occur due to the absence of any clear suitable habitat in which the species commonly occurs, i.e. rocky ranges West Kimberley Black-footed Rock-wallaby (VU/EN) and Rock Ringtail Possum (P3).

Table 4-8 Conservation significant fauna species identified in the desktop review

Species	Common name	Conservation status[1]			Likelihood of occurrence	
		EPBC Act	BC Act	DBCA	Option 1	Option 2
Reptiles						
Crocodylus johnstoni	Freshwater Crocodile		OS		Likely	Unlikely
Crocodylus porosus	Salt-water Crocodile		OS		Unlikely	Unlikely
Birds						
Actitis hypoleucos	Common Sandpiper	Mig	Mig		Possible	Unlikely
Apus pacificus	Fork-tailed Swift	Mig	Mig		Possible	Possible
Botaurus poiciloptilus	Australasian Bittern	EN	EN		Possible	Unlikely
Calidris acuminata	Sharp-tailed Sandpiper	Mig	Mig		Possible	Unlikely
Calidris ferruginea	Curlew Sandpiper	CR/Mig	VU/Mig		Possible	Unlikely
Calidris melanotos	Pectoral Sandpiper	Mig	Mig		Possible	Unlikely
Cecropis daurica	Red-rumped Swallow	Mig	Mig		Unlikely	Unlikely
Charadrius veredus	Oriental Plover	Mig	Mig		Possible	Unlikely
Erythrotriorchis radiatus	Red Goshawk	VU	VU		Possible	Possible
Erythrura gouldiae	Gouldian Finch	EN		P4	Likely	Possible
Falco hypoleucos	Grey Falcon		VU		Possible	Possible
Falco peregrinus	Peregrine Falcon		OS		Possible	Possible
Gelochelidon nilotica	Gull-billed Tern	Mig	Mig		Possible	Unlikely
Glareola maldivarum	Oriental Pratincole	Mig	Mig		Possible	Possible
Hirundo rustica	Barn Swallow	Mig	Mig		Possible	Possible
Motacilla cinerea	Grey Wagtail	Mig	Mig		Possible	Possible
Motacilla flava	Yellow Wagtail	Mig	Mig		Possible	Possible
Numenius madagascariensis	Eastern Curlew	CR/Mig	VU/Mig		Possible	Unlikely
Pandion cristatus	Osprey	Mig	Mig		Possible	Unlikely
Pezoporus occidentalis	Night Parrot	EN	CR		Possible	Possible

Species	Common name	Conservation status[1]			Likelihood of occurrence	
		EPBC Act	BC Act	DBCA	Option 1	Option 2
Plegadis falcinellus	Glossy Ibis	Mig	Mig		Possible	Possible
Polytelis alexandrae	Princess Parrot	VU		P4	Possible	Possible
Rostratula australis	Australian Painted Snipe	EN	EN		Possible	Unlikely
Tringa glareola	Wood Sandpiper	Mig	Mig		Possible	Unlikely
Tringa nebularia	Common Greenshank	Mig	Mig		Possible	Unlikely
Tringa stagnatilis	Marsh Sandpiper	Mig	Mig		Possible	Unlikely
Tyto novaehollandiae kimberli	Masked Owl	VU		P1	Possible	Possible
Mammals						
Dasyurus hallucatus	Northern Quoll	EN	EN		Possible	Unlikely
Hipposideros stenotis	Northern Leaf-nosed Bat			P2	Possible	Unlikely
Isoodon auratus auratus	Golden Bandicoot	VU	VU		Possible	Possible
Leggadina lakedownensis	Northern Short-tailed Mouse			P4	Likely	Likely
Macroderma gigas	Ghost Bat	VU	VU		Possible	Unlikely
Macrotis lagotis	Bilby	VU	VU		Possible	Possible
Petrogale lateralis subsp. (West Kimberley)	West Kimberley Black-footed Rock-wallaby	VU	EN		Unlikely	Unlikely
Petropseudes dahli	Rock Ringtail Possum			P3	Unlikely	Unlikely
Phascogale tapoatafa kimberleyensis	Kimberley Brush-tailed Phascogale	VU	VU		Possible	Possible
Rhinonicteris aurantia	Orange Leaf-nosed Bat	VU		P4	Possible	Unlikely
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheath-tailed Bat			P3	Possible	Possible
Trichosurus vulpecula arnhemensis	Northern Brushtail Possum		VU		Possible	Possible
Vespadelus douglasorum	Yellow-lipped Cave Bat			P2	Possible	Unlikely

[1] CR – Critically Endangered; EN – Endangered; VU – Vulnerable; OS – Specially Protected; Mig – Migratory; P1–4 – Priority 1–4.



Australian Capital Equity Pty Ltd - Environmental desktop review for the Napier Downs Irrigation Project

Project No	1248
Date	16-Apr-19
Drawn by	IH
Map author	MH

0 5 10 20
Kilometres

1:600,000 (at A4) GDA 1994 MGA Zone 51

Desktop study area
Study area

Figure 4-10
Desktop records of significant vertebrate fauna

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4.3.2 Short-range endemic invertebrates

Four terrestrial invertebrates listed as Threatened under the BC Act and three species listed as Priority fauna by DBCA were identified in the desktop review within the 100 km radius of the study area (Table 4-9). All of the listed species are molluscs (land snails) in the family Camaenidae and are potential SREs; the records are mainly associated with the Napier Range (Figure 4-11).

Two of the PECs identified in the desktop review (section 4.2.1.1) are associated with the SRE invertebrates: Invertebrate community of Napier Range Cave and Monsoon vine thickets and Camaenid land snails of limestone ranges (Napier Range) (Figure 4-11).

Records of a further 51 potential terrestrial SRE species were identified through the WA Museum database searches (Table 4-9; Figure 4-11). No records of SRE invertebrates were returned within the study area.

Habitat descriptions for the desktop records include:

- rocky outcrops, limestone outcrops
- rock piles, boulders, rubble, rock crevices
- under stones in creek beds
- caves/cave entrances
- bases of escarpments and cliffs
- rock/scree slopes
- rocky gullies
- cliff bases,
- embayments
- vine thickets
- in soil and leaf litter
- on roots, trunk and/or branches of trees, in particular Boabs
- on plains under spinifex.

Camaenid land snails of the genus *Amplirhagada* are endemic to the Kimberley, where they have radiated extensively (Köhler 2010). Many species are restricted to single localities, such as rainforest patches or more open woodlands (Solem 1991). These patches are usually surrounded by habitats that are uninhabitable for the snails and most land snails have limited dispersal capabilities, as is the case for most SRE taxa. The rich diversity of camaenid land snails is associated with the Devonian reef complex (Humphreys 1995).

Table 4-9 Terrestrial SRE invertebrates identified in desktop review

Higher taxon, Family	Species	Conservation status	SRE status
Malacostraca - Isopoda (isopods)			
Armadillidae	*Kimberleydillo waldockae*		Potential
Gastropoda - Pulmonata (land snails)			
Camaenidae	*Amplirhagada carinata*		Potential
Camaenidae	*Amplirhagada napierana*		Potential
Camaenidae	*Amplirhagada percita*		Potential
Camaenidae	*Amplirhagada percita ignora*		Potential
Camaenidae	*Kendrickia ignivenatus*		Potential
Camaenidae	*Kimboraga mccorryi*		Potential
Camaenidae	*Kimboraga micromphala*	P2 (DBCA)	Potential
Camaenidae	*Kimboraga yammerana*	P1 (DBCA)	Potential
Camaenidae	*Mouldingia occidentalis*	CR (BC Act)	Potential
Camaenidae	*Parrhagada commoda*		Potential
Camaenidae	*Parrhagada detecta*		Potential
Camaenidae	*Parrhagada ferrosa*		Potential
Camaenidae	*Rhagada basedowana*		Potential
Camaenidae	*Rhagada* cf. *construa*		Potential
Camaenidae	*Rhagada* cf. *gatta*		Potential
Camaenidae	*Rhagada construa*		Potential
Camaenidae	*Rhagada gibbensis*	P1 (DBCA)	Potential
Camaenidae	*Rhagada mimika*		Potential
Camaenidae	*Rhagada sutra*		Potential
Camaenidae	*Tenuigada ignara*		Potential
Camaenidae	*Tenuigada percita*		Potential
Camaenidae	*Torresitrachia crawfordi*		Potential
Camaenidae	*Trachia frogatti*		Potential
Camaenidae	*Trachia orthocheila*		Potential
Camaenidae	*Westraltrachia alterna*	VU (BC Act)	Potential
Camaenidae	*Westraltrachia commoda*		Potential
Camaenidae	*Westraltrachia complanata*		Potential
Camaenidae	*Westraltrachia cunicula*		Potential
Camaenidae	*Westraltrachia derbyi*		Potential
Camaenidae	*Westraltrachia froggatti complanata*		Potential
Camaenidae	*Westraltrachia froggatti froggatti*		Potential

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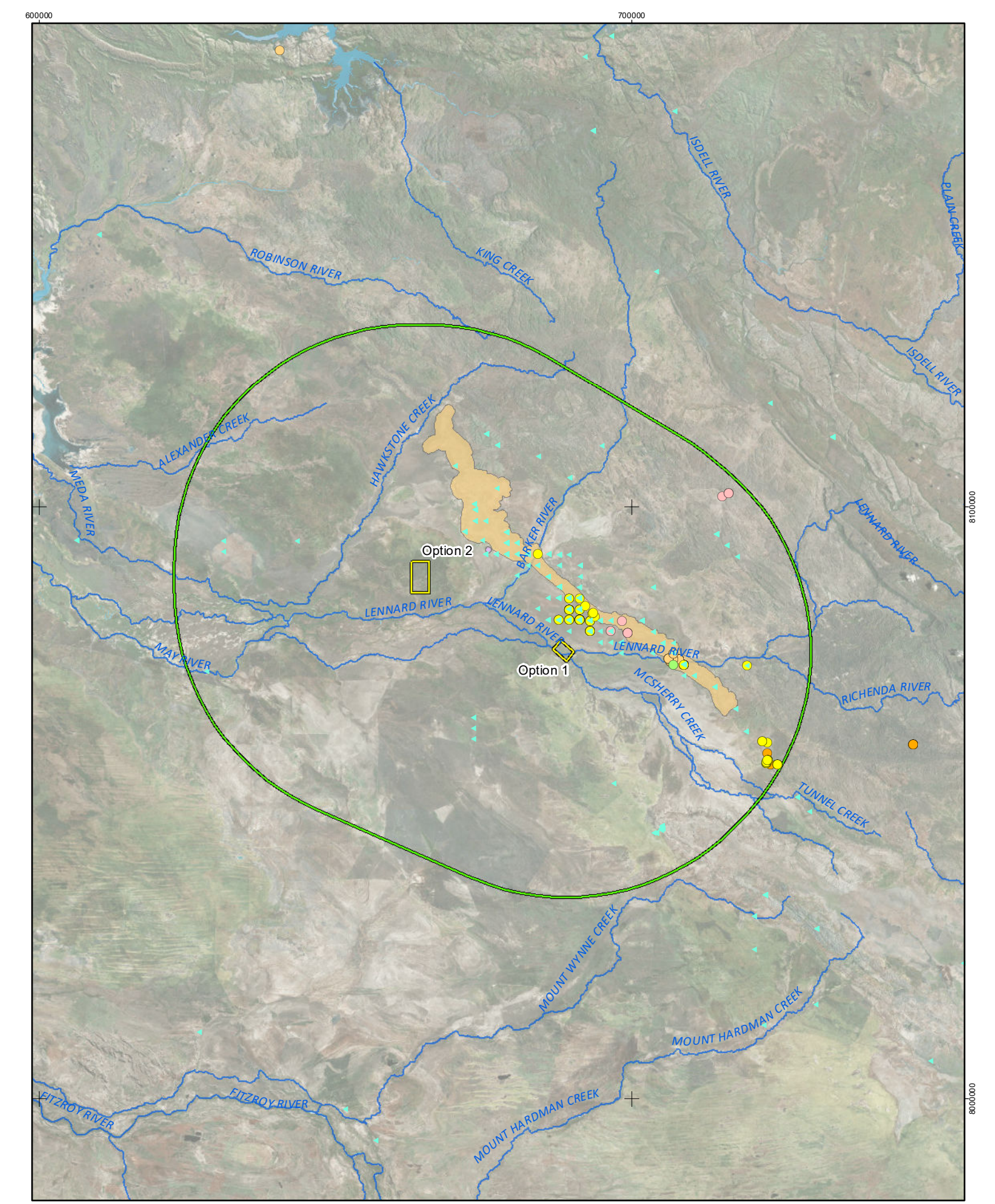
Higher taxon, Family	Species	Conservation status	SRE status
Camaenidae	*Westraltrachia froggatti*		Potential
Camaenidae	*Westraltrachia froggatti complanata*		Potential
Camaenidae	*Westraltrachia increta*		Potential
Camaenidae	*Westraltrachia inopinata*	VU (BC Act)	Potential
Camaenidae	*Westraltrachia instita*		Potential
Camaenidae	*Westraltrachia lievreana*		Potential
Camaenidae	*Westraltrachia limbana*		Potential
Camaenidae	*Westraltrachia rotunda*		Potential
Camaenidae	*Westraltrachia* sp.1		Potential
Camaenidae	*Westraltrachia* sp.2		Potential
Camaenidae	*Westraltrachia subtila*		Potential
Camaenidae	*Westraltrachia tropida*		Potential
Camaenidae	*Westraltrachia turbinata*	VU (BC Act)	Potential
Camaenidae	*Westraltrachia woodwardi*		Potential
Viviparidae	*Viviparidae cf. Notopala sp.*		Potential
Viviparidae	*Viviparidae* cf. *Larina* sp.		Potential
Arachnida - Mygalomorphae (trapdoor spiders)			
Euagridae	*Cethegus* `sp. nov.`		Potential
Halonoproctidae	*Conothele* `MYG542`		Potential
Halonoproctidae	*Conothele* sp.		Potential
Idiopidae	*Idiosoma `occidentalis* sp. group`		Potential
Arachnida - Araneomophae (modern spiders)			
Selenopidae	*Karaops jenniferae*		Potential
Sparassidae	*Heteropoda cavernicola*		Potential
Arachnida - Opiliones (harvestmen)			
Assamiidae	*Dampetrus* sp.		Potential
Assamiidae	*Assamiidae* sp.		Potential
Arachnida - Pseudoscorpiones (pseudoscorpions)			
Chthoniidae	*Austrochthonius `minutissimus`*		Potential
Diplopoda (millipedes)			
Paradoxosomatidae	*Helicopodosoma* `Mt Hart`		Potential



Australian Capital Equity Pty Ltd - Environmental desktop review for the Napier Downs Irrigation Project

Project No	1248
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0 5 10 20
Kilometres

1:800,000 (at A4) GDA 1994 MGA Zone 51

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Desktop study area
Study area

TEC/PEC in the study area
- Invertebrate community of Napier Range Cave, Priority 1
- Monsoon vine thickets and Camaenid land snails of limestone ranges (Napier Range), Priority 1

SRE status, Conservation Significant Status
- Potential
- Potential, P1
- Potential, P2
- Potential, CR
- Potential, VU
- Uncertain

Figure 4-11

Desktop records of short-range endemic invertebrates

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4.4 SUBTERRANEAN FAUNA

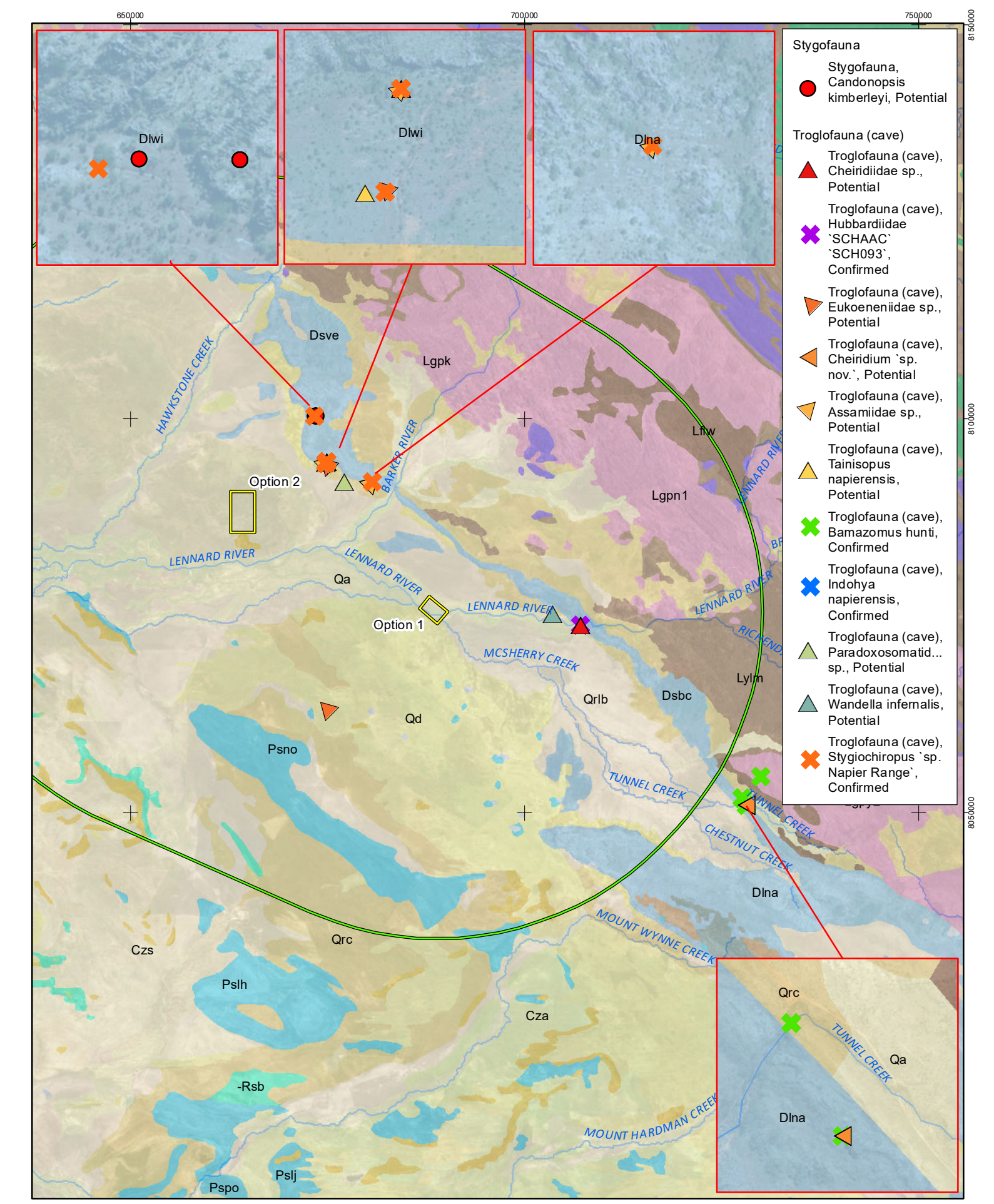
Records of 12 troglofauna and a single stygofauna species were returned in the database searches (Table 4-10; Figure 4-12). No subterranean species listed as Threatened or Priority were returned in the database searches.

All of the troglofauna are associated with caves of Napier Range, and several are known from only a single cave (e.g. Harvey 2001; Harvey & Volschenk 2007). However, stygofauna have also been collected from wells, bores, cave pools and springs in the west Kimberley (Humphreys 1995; Karanovic 2005).

Lack of records for troglofauna other than the restricted cave fauna and the very limited records for stygofauna are likely to be a consequence of very limited sampling in the region. The main geologies suitable for subterranean fauna in the Kimberley are karst / limestone, sandstone and alluvium (EPA 2016e; Humphreys 1995). Based on geology and hydrology (section 4.1.5), the Grant Group aquifer provides the conditions for both troglofauna and stygofauna to occur in the vicinity of the Project.

Table 4-10 Subterranean fauna identified in desktop review

Higher taxon, Family	Species	SRE status	Troglofauna/stygofauna
Arachnida - Araneomophae (modern spiders)			
Filistatidae	*Wandella infernalis*	Potential	Troglofauna (cave)
Arachnida - Opiliones (harvestmen)			
Assamiidae	*Assamiidae* sp.	Potential	Troglofauna (cave)
Arachnida - Palpigradi (microwhip scorpions)			
Eukoeneniidae	*Eukoeneniidae* sp.	Potential	Troglofauna (cave)
Arachnida - Pseudoscorpiones (pseudoscorpions)			
Cheiridiidae	*Cheiridium* `sp. nov.`	Potential	Troglofauna (cave)
Cheiridiidae	*Cheiridiidae* sp.	Potential	Troglofauna (cave)
Hyidae	*Indohya napierensis*	Confirmed	Troglofauna (cave)
Arachnida - Schizomida (short-tailed whipscorpions)			
Hubbardiidae	*Hubbardiidae* `SCHAAC` `SCH093`	Confirmed	Troglofauna (cave)
Hubbardiidae	*Apozomus eberhardi*	Confirmed	Troglofauna (cave)
Hubbardiidae	*Bamazomus hunti*	Confirmed	Troglofauna (cave)
Diplopoda (millipedes)			
Paradoxosomatidae	*Stygiochiropus* `sp. Napier Range`	Confirmed	Troglofauna (cave)
Paradoxosomatidae	*Paradoxosomatidae* sp.	Potential	Troglofauna (cave)
Malacostraca - Isopoda (isopods)			
Tainisopidae	*Tainisopus napierensis*	Potential	Troglofauna (cave)
Ostracoda - Podocopida (ostracods)			
Candonidae	*Candonopsis kimberleyi*	Potential	Stygofauna



Australian Capital Equity Pty Ltd - Environmental desktop review for the Napier Downs Irrigation Project

Project No	1248
Date	16-Apr-19
Drawn by	IH
Map author	MH

0 5 10 20
Kilometres

1:600,000 (at A4) GDA 1994 MGA Zone 51

Desktop study area
Study area

Figure 4-12

Desktop records of subterranean fauna and surface geology

PHOENIX ENVIRONMENTAL SCIENCES

5 DISCUSSION AND RECOMMENDATIONS

5.1 FLORA AND VEGETATION

A number of significant flora species have been recorded in proximity to the study areas, however none have been recorded within them. Seventeen species of significant flora were recorded in database searches for each Option, although not all of them occur near both. How many occur within the study areas is dependent on the habitat found there, however an assessment of the Likelihood of Occurrence based on assumed habitat and other factors shows that in Option 1, 11 are likely or possible to occur while six are unlikely. In Option 2 ,12 species are likely or possible to occur while five are unlikely. This gives a high likelihood of conservation significant flora being present in either of the Options.

While several PECs are recorded from the vicinity of the study areas, both Options are outside existing buffer zones. It is therefore unlikely that examples of these PECs will be found in the study areas, although they should be surveyed for the possibility, as DBCA mapping of the PECs may not have been groundtruthed in the field.

The desktop assessment has determined a moderate potential for the occurrence of groundwater dependent ecosystems. Subsequently detailed survey of riparian vegetation types is recommended to identify whether groundwater dependent vegetation is present in the study area.

From the flora and vegetation perspective there appears little to differentiate the two Options, and consideration of flora and vegetation values does not appear to place constraints on either Option. Based on the desktop review, consideration of other selection criteria may have more bearing on the final decision.

The region that the study areas occur in is to a certain extent unknown in terms of flora and vegetation values, and there is very little of the existing vegetation associations that are protected in DBCA managed lands such as nature reserves or National Parks. A detailed survey incorporating quadrat sampling should be conducted on the preferred study area, either Option 1 or 2. This will allow for a detailed description of the vegetation and flora occurring in the study area and an assessment of its conservation values or otherwise.

A detailed survey is necessary for proposals where the desktop review finds that the area supports a high diversity of flora or vegetation. Also, if the area contains restricted landforms or vegetation units, or has only received minimal survey effort in the past then a detailed survey will be necessary to address the EPA's objective for flora and vegetation (EPA 2016d). As the Option 1 and 2 study areas are expected to contain species of significant flora, and restricted vegetation units (PECs) have been recorded locally, a detailed survey would appear necessary to support this Project.

5.2 TERRESTRIAL FAUNA

Several conservation significant fauna species are considered to have the potential to occur in either Option, but a greater number may occur in the Option 1 area due to its intersection with the Lennard River. Likelihood of occurrence for several fauna species in Option 1 is linked to the river and associated riparian habitat. On this basis the Option 1 area appears to have potential for higher fauna value.

Potential value of the study areas to SREs, particularly land snails requires field assessment. The Kimberley is poorly surveyed for SREs and given the proximity of several SRE records from the area of the desktop review, it is possible that SRE taxa are present in the study areas.

Proximity of development to the Lennard River and associated riparian habitat may present a constraint if development is proposed within these areas, or in close proximity. Usually, application of an exclusion buffer along rivers, along with other management measures can mitigate this constraint.

Field verification of habitats is required to confirm suitability and importance for the species identified in the desktop review.

A targeted Level 2 is recommended and should include:

- detailed habitat assessment and mapping
- targeted survey for Bilby, including plot sampling within and adjacent to the survey area
- acoustic recordings for the significant bat species and Night Parrot
- camera trapping for Threatened mammal species
- avifauna surveys
- targeted survey for SRE invertebrates, including characterisation and mapping of SRE habitats.

5.3 SUBTERRANEAN FAUNA

There is potential for stygofauna and troglofauna to be present in the subterranean habitats underlying the study area. In accordance with EPA guidance (EPA 2016f), a survey for subterranean fauna is typically required where a desktop identifies potential for subterranean fauna to be present. However, requirement for survey is likely to depend on potential for impacts, in particular whether there is potential for confined geologies to be present that may harbour range restricted species.

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Appendix 1 Flora species records from desktop review

FAMILY	SPECIES	COMMON NAME	CONS CODE
Acanthaceae	*Dicliptera armata*		
	Hygrophila angustifolia		
	Hypoestes floribunda	Bunu	
	Hypoestes floribunda var. *angustifolia*		
	Hypoestes floribunda var. *varia*		
	Nelsonia campestris		
	Rostellularia adscendens var. *clementii*		
Aizoaceae	*Trianthema oxycalyptrum* var. *oxycalyptrum*		
	Trianthema pilosum		
	**Trianthema portulacastrum*	Giant Pigweed	
	Trianthema triquetrum	Red Spinach	
Alismataceae	*Albidella oligococca*		
Amaranthaceae	*Achyranthes aspera*	Chaff Flower	
	**Aerva javanica*	Kapok Bush	
	Alternanthera denticulata	Lesser Joyweed	
	Alternanthera nana	Hairy Joyweed	
	Amaranthus undulatus		
	Gomphrena brachystylis		
	Gomphrena brachystylis subsp. *pindanensis*		
	Gomphrena breviflora		
	Gomphrena canescens	Batchelors Buttons	
	Gomphrena canescens subsp. *canescens*		
	Gomphrena cucullata		P3 (DBCA list)
	Gomphrena cunninghamii		
	Gomphrena flaccida	Gomphrena Weed	
	Gomphrena leptoclada		
	Gomphrena leptoclada subsp. *leptoclada*		
	Gomphrena occulta		
	Gomphrena tenella		
	Ptilotus capitatus		
	Ptilotus conicus		
	Ptilotus corymbosus		
	Ptilotus exaltatus	Tall Mulla Mulla	
	Ptilotus fusiformis		
	Ptilotus spicatus		
Anacardiaceae	*Buchanania oblongifolia*		
Apocynaceae	*Alstonia actinophylla*	White Cheeswood	
	Alstonia spectabilis		
	**Calotropis procera*	Calotrope	
	Carissa lanceolata	Conkerberry	

	Cynanchum brevipedicellatum		
	Cynanchum floribundum	Dumara Bush	
	Cynanchum pedunculatum		
	Cynanchum puberulum		
	Cynanchum viminale subsp. *australe*	Caustic Bush	
	Gymnanthera oblonga		
	Marsdenia angustata		
	Marsdenia pleiadenia		
	Marsdenia viridiflora		
	Marsdenia viridiflora subsp. *tropica*		
	Tabernaemontana orientalis		
	Wrightia saligna		
Aquifoliaceae	*Ilex arnhemensis*		
Araceae	*Typhonium liliifolium*	Alamard	
Araliaceae	*Trachymene oleracea* subsp. *sedimenta*		P1 (DBCA list)
Asclepiadaceae	*Oxystelma esculentum*		
Asteraceae	**Acanthospermum hispidum*	Starburr	
	Apowollastonia cylindrica	Yellow Daisy	
	**Bidens bipinnata*	Bipinnate Beggartick	
	**Bidens pilosa*	Cobbler's Pegs	
	**Bidens pilosa* var. *pilosa*		
	Blumea axillaris		
	Blumea integrifolia		
	Blumea pungens		P2 (DBCA list)
	Blumea saxatilis		
	Blumea tenella		
	Calotis breviseta		
	Cyanthillium cinereum		
	Pentalepis ecliptoides subsp. *ecliptoides*		
	Pentalepis trichodesmoides		
	Pentalepis trichodesmoides subsp. *trichodesmoides*		
	Pterocaulon globuliflorum		P2 (DBCA list)
	Pterocaulon intermedium		
	Pterocaulon niveum		
	Pterocaulon serrulatum		
	Pterocaulon serrulatum var. *velutinum*		
	Pterocaulon sphacelatum	Apple Bush	
	Pterocaulon tricholobum		
	Sphaeranthus indicus		

	Streptoglossa bubakii		
	**Tridax procumbens*	Tridax	
Bignoniaceae	*Dolichandrone occidentalis*		
Bixaceae	*Cochlospermum fraseri*	Kapok Bush	
Boraginaceae	*Coldenia procumbens*		
	Ehretia saligna	False Cedar	
	Ehretia saligna var. *saligna*		
	Heliotropium aenigmatum		P1 (DBCA list)
	Heliotropium brachythrix		
	Heliotropium calvariavis		P1 (DBCA list)
	Heliotropium conocarpum		
	Heliotropium cunninghamii		
	Heliotropium dichotomum		
	Heliotropium diversifolium		
	Heliotropium foliatum		
	Heliotropium glabellum		
	Heliotropium ovalifolium		
	Heliotropium paniculatum		
	Heliotropium parviantrum		P1 (DBCA list)
	Heliotropium sp. Ord River (W. Fitzgerald 1611)		
	Heliotropium tanythrix		
	Heliotropium tenuifolium	Mamukata	
	Heliotropium viator		
	Trichodesma zeylanicum	Camel Bush	
	Trichodesma zeylanicum var. *zeylanicum*		
Byblidaceae	*Byblis filifolia*		
	Byblis liniflora	Northern Byblis	
Cannabaceae	*Celtis strychnoides*		
	Trema tomentosa var. *aspera*	Peach Leaf Poison Bush	
Capparaceae	*Capparis jacobsii*		
	Capparis lasiantha	Split Jack	
	Capparis sepiaria		
	Capparis spinosa		
	Capparis umbonata	Wild Orange	
Caryophyllaceae	*Polycarpaea breviflora*		
	Polycarpaea corymbosa		
	Polycarpaea holtzei		
	Polycarpaea longiflora		
	Polycarpaea violacea		
Cleomaceae	*Cleome oxalidea*		

	Cleome tetrandra		
	Cleome tetrandra var. *tetrandra*		
	Cleome viscosa	Tickweed	
Combretaceae	*Terminalia bursarina*	Bendee	
	Terminalia canescens	Joolal	
	Terminalia carpentariae	Wild Peach	
	Terminalia ferdinandiana	Mador	
	Terminalia hadleyana		
	Terminalia platyphylla	Wild Plum	
	Terminalia volucris	Rosewood	
Commelinaceae	*Cartonema spicatum* var. *spicatum*		
	Commelina ciliata		
	Commelina ensifolia	Wandering Jew	
	Cyanotis axillaris		
	Murdannia graminea	Baniyu	
Convolvulaceae	*Bonamia linearis*		
	Bonamia media		
	Bonamia pannosa		
	Evolvulus alsinoides var. *decumbens*		
	Ipomoea aquatica	Potato Vine	
	Ipomoea coptica		
	Ipomoea eriocarpa		
	Ipomoea johnsoniana	Johnson's Morning Glory	P1 (DBCA list)
	Ipomoea plebeia	Bellvine	
	Ipomoea polymorpha		
	Operculina aequisepala		
	Operculina brownii	Potato Vine	
	Polymeria ambigua	Morning Glory	
	Polymeria distigma		P3 (DBCA list)
	Xenostegia tridentata		
Cucurbitaceae	**Citrullus amarus*		
	Cucumis melo	Ulcardo Melon	
	Cucumis picrocarpus		
	Cucumis sp. Bastion Range (A.A. Mitchell et al. AAM 10710) PN		P1 (DBCA list)
	Diplocyclos palmatus	Native Bryony	
	Diplocyclos palmatus subsp. *affinis*		
	Luffa saccata		
	Trichosanthes cucumerina		
Cycadaceae	*Cycas pruinosa*	Argyle Cycad	
	Bulbostylis barbata		
	Crosslandia setifolia		

	Cyperus breviculmis		
	Cyperus carinatus		
	Cyperus castaneus		
	Cyperus conicus		
	Cyperus difformis	Rice Sedge	
	Cyperus iria		
	Cyperus javanicus		
	Cyperus macrostachyos		
	Cyperus microcephalus subsp. *microcephalus*		
	Cyperus nervulosus		
	Cyperus pygmaeus		
	Cyperus squarrosus		
	Cyperus tenuispica		
	Cyperus vaginatus	Stiffleaf Sedge	
	Cyperus viscidulus		
	Eleocharis atropurpurea		
	Eleocharis brassii		
	Eleocharis triquetra		
	Fimbristylis caespitosa		
	Fimbristylis cardiocarpa		
	Fimbristylis cephalophora		
	Fimbristylis dictyocolea		P1 (DBCA list)
	Fimbristylis littoralis		
	Fimbristylis microcarya		
	Fimbristylis neilsonii		
	Fimbristylis phaeoleuca	Sedge	
	Fimbristylis schultzii		
	Fimbristylis solidifolia		
	Fuirena ciliaris		
	Lipocarpha microcephala		
	Schoenoplectiella dissachantha		
	Schoenoplectiella humillima		P2 (DBCA list)
	Schoenoplectiella laevis		
	Schoenoplectiella lateriflora var. *lateriflora*		
	Schoenoplectiella praelongata		
	Scleria novae-hollandiae		
Dioscoreaceae	*Dioscorea bulbifera*	Ganmanggu	
Droseraceae	*Drosera burmanni*	Tropical Sundew	
	Drosera cucullata		
	Drosera derbyensis		
	Drosera fragrans		
	Drosera hartmeyerorum		

	Drosera serpens		
Ebenaceae	*Diospyros maritima*		
Elatinaceae	*Bergia pedicellaris*		
	Bergia trimera		
Eriocaulaceae	*Eriocaulon cinereum*		
Erpodiaceae	*Erpodium coronatum* var. *australiense*		P2 (DBCA list)
Euphorbiaceae	*Acalypha pubiflora* subsp. *australica*		
	Claoxylon hillii		
	Euphorbia australis	Namana	
	Euphorbia cinerea		
	Euphorbia coghlanii	Namana	
	Euphorbia drummondii	Caustic Weed	
	**Euphorbia hirta*	Asthma Plant	
	Euphorbia kimberleyensis		
	Euphorbia schultzii var. *schultzii*		
	Euphorbia trigonosperma		
	**Jatropha gossypiifolia*	Bellyache Bush	
	Mallotus nesophilus		
	Microstachys chamaelea		
Fabaceae	*Abrus precatorius*	Crabs Eyes	
	Abrus precatorius subsp. *precatorius*		
	Acacia ancistrocarpa	Fitzroy Wattle	
	Acacia bivenosa		
	Acacia colei var. *colei*		
	Acacia colei var. *ileocarpa*		
	Acacia eriopoda	Broome Pindan Wattle	
	Acacia hemignosta	Clubleaf Wattle	
	Acacia hemsleyi		
	Acacia monticola	Gawar	
	Acacia monticola x tumida var. *kulparn*		P3 (DBCA list)
	Acacia neurocarpa		
	Acacia platycarpa	Pindan Wattle	
	Acacia plectocarpa subsp. *plectocarpa*		
	Acacia pyrifolia var. *pyrifolia*		
	Acacia stigmatophylla	Djulurd	
	Acacia tumida var. *kulparn*		
	Acacia tumida var. *tumida*		
	Aeschynomene indica	Budda Pea	
	Albizia lebbeck		
	Alysicarpus major		P3 (DBCA list)

	Alysicarpus muelleri		
	Alysicarpus suffruticosus		P2 (DBCA list)
	Bauhinia cunninghamii		
	Cajanus acutifolius		
	Cajanus cinereus		
	Cajanus latisepalus		
	Cajanus marmoratus		
	Cajanus reticulatus		
	Cajanus reticulatus var. *grandifolius*		
	Cajanus viscidus		
	Canavalia papuana		
	Chamaecrista absus		
	Chamaecrista absus var. *absus*		
	Chamaecrista mimosoides		
	Crotalaria cunninghamii	Green Birdflower	
	Crotalaria dissitiflora	Grey Rattlepod	
	Crotalaria medicaginea var. *neglecta*		
	Crotalaria montana var. *angustifolia*		
	Crotalaria novae-hollandiae	New Holland Rattlepod	
	Crotalaria novae-hollandiae subsp. *crassipes*		
	Crotalaria novae-hollandiae subsp. *novae-hollandiae*		
	Crotalaria ramosissima		
	Crotalaria retusa	Wedgeleaf Rattlepod	
	Crotalaria verrucosa	Blueflower Rattlepod	
	Cullen badocanum		
	Cullen martinii		
	Desmodium brownii		
	Desmodium filiforme		
	Dichrostachys spicata	Pied Piper Bush	
	Glycine tomentella	Woolly Glycine	
	Indigofera colutea	Sticky Indigo	
	Indigofera hirsuta	Hairy Indigo	
	Indigofera linifolia		
	Indigofera linnaei	Birdsville Indigo	
	Indigofera trita		
	Indigofera trita subsp. *trita*		
	**Leucaena leucocephala*	Leucaena	
	Neptunia dimorphantha	Sensitive Plant	
	Neptunia gracilis	Native Sensitive Plant	

	Neptunia major		
	Neptunia monosperma		
	Nomismia rhomboidea		
	**Parkinsonia aculeata*	Parkinsonia	
	Petalostylis cassioides		
	Rhynchosia minima	Rhynchosia	
	Senna costata		
	Senna goniodes		
	Senna magnifolia		
	Senna notabilis		
	Senna planitiicola		
	Sesbania cannabina	Sesbania Pea	
	Sesbania erubescens		
	Sesbania formosa	White Dragon Tree	
	Sesbania simpliciuscula var. *fitzroyensis*		
	Swainsona campylantha		
	Tephrosia brachyodon var. *longifolia*		
	Tephrosia coriacea		
	Tephrosia flammea		
	Tephrosia lasiochlaena		
	Tephrosia leptoclada		
	Tephrosia remotiflora		
	Tephrosia rosea	Flinders River Poison	
	Tephrosia rosea var. Napier Range (C.R. Dunlop 7760 & B.K. Simon)		P3 (DBCA list)
	Tephrosia rosea var. *rosea*		
	Tephrosia simplicifolia		
	Tephrosia sp. B Kimberley Flora (C.A. Gardner 7300)		
	Tephrosia sp. Mistake Creek (A.C. Beauglehole 54424)		P3 (DBCA list)
	Tephrosia sp. Northern (K.F. Kenneally 11950)		
	Tephrosia sp. Pentecost River (I.D. Cowie 4168)		
	Tephrosia stipuligera		
	Uraria lagopodioides		
	**Vachellia farnesiana*	Mimosa Bush	
	Vachellia pachyphloia subsp. pachyphloia		
	Vachellia suberosa	Corkybark Wattle	
	Vigna lanceolata	Maloga Vigna	
	Vigna lanceolata var. lanceolata		
	Vigna radiata	Mung Bean	
	Zornia muelleriana subsp. congesta		
Gentianaceae	*Canscora diffusa*		

Goodeniaceae	*Goodenia armitiana*		
	Goodenia bicolor		
	Goodenia coronopifolia		
	Goodenia heppleana		
	Goodenia lamprosperma		
	Goodenia odonnellii		
	Goodenia scaevolina	Ngurubi	
	Goodenia sepalosa var. sepalosa		
	Velleia panduriformis	Cabbage Poison	
Haloragaceae	*Gonocarpus leptothecus*		
	Myriophyllum verrucosum	Red Water Milfoil	
Hemerocallidaceae	*Corynotheca micrantha var. gracilis*		
Hernandiaceae	*Gyrocarpus americanus*	Helicopter Tree	
	Gyrocarpus americanus subsp. pachyphyllus		
Hydrocharitaceae	*Najas tenuifolia*	Water Nymph	
	Ottelia ovalifolia	Swamp Lily	
	Ottelia ovalifolia subsp. chrysobasis		
	Vallisneria annua		
	Vallisneria nana		
	Vallisneria rubra		
Hypericaceae	*Hypericum gramineum*	Small St John's Wort	
Lamiaceae	*Anisomeles farinacea*		
	Basilicum polystachyon		
	Callicarpa candicans		
	Clerodendrum floribundum	Lollybush	
	Clerodendrum inerme		P1 (DBCA list)
	Clerodendrum tomentosum		
	Clerodendrum tomentosum var. lanceolatum		
	Clerodendrum tomentosum var. mollissima		
	Clerodendrum tomentosum var. tomentosum		
	**Mesosphaerum suaveolens*		
	**Ocimum americanum*		
	Plectranthus scutellarioides		
	Premna acuminata	Ngalinginkal	
	Vitex acuminata		
	Vitex glabrata	Vitex	
	**Vitex trifolia*		
Lauraceae	*Cassytha capillaris*		
	Cassytha filiformis	Love Vine	
Lecythidaceae	*Planchonia careya*	Mangaloo	
Linderniaceae	*Lindernia lobelioides*		

	Lindernia tectanthera		
Loganiaceae	*Mitrasacme galbina*		
	Mitrasacme hispida		
	Mitrasacme nudicaulis var. nudicaulis		
	Strychnos lucida	Strychnine Bush	
Loranthaceae	*Amyema benthamii*		
	Amyema dolichopoda		
	Amyema sanguinea var. pulchra		
	Amyema villiflora subsp. villiflora		
	Decaisnina biangulata		P3 (DBCA list)
	Dendrophthoe acacioides subsp. acacioides		
	Diplatia grandibractea		
	Lysiana spathulata subsp. spathulata		
Lythraceae	*Ammannia baccifera*		
	Ammannia fitzgeraldii		
	Ammannia multiflora		
	Rotala diandra		
	Rotala mexicana		
	Rotala occultiflora		
Malvaceae	*Abelmoschus ficulneus*		
	Abutilon hannii		
	Abutilon indicum	Indian Lantern Flower	
	Abutilon lepidum		
	Adansonia gregorii	Boab	
	Azanza thespesioides		
	Brachychiton diversifolius subsp. diversifolius		
	Brachychiton viscidulus		
	Corchorus aestuans		
	**Corchorus olitorius*	Jute	
	Corchorus pumilio		
	Corchorus sidoides	Flannel Weed	
	Corchorus sidoides subsp. sidoides		
	Corchorus sidoides subsp. vermicularis		
	Corchorus tridens		
	Gossypium australe	Native Cotton	
	Grewia breviflora		
	Grewia retusifolia	Dog's Balls	
	Hibiscus apodus		
	Hibiscus austrinus var. austrinus		
	Hibiscus austrinus var. occidentalis		
	Hibiscus geranioides		
	Hibiscus leptocladus		

	Hibiscus meraukensis	Merauke Hibiscus	
	Hibiscus sturtii	Sturt's Hibiscus	
	**Hibiscus tridactylites*	Bladder Ketmia	
	Hibiscus vitifolius		
	**Malvastrum americanum*	Spiked Malvastrum	
	**Malvastrum coromandelianum*		
	Melhania oblongifolia		
	Melochia corchorifolia		
	**Melochia pyramidata*		
	**Sida acuta*		
	**Sida acuta subsp. acuta*		
	Sida hackettiana		
	Sida rohlenae subsp. occidentalis		
	Sida rohlenae subsp. rohlenae		
	Sida spinosa	Spiny Sida	
	Triumfetta albida		
	Triumfetta breviaculeata		
	Triumfetta coronata		
	Triumfetta incana		
	Triumfetta simulans		
	Triumfetta triandra		
	Waltheria indica		
Marsileaceae	*Marsilea hirsuta*	Nardoo	
Melastomataceae	*Melastoma affine*		
Meliaceae	*Melia azedarach*	White Cedar	
Menispermaceae	*Tinospora smilacina*	Snakevine	
Menyanthaceae	*Nymphoides aurantiaca*	Marshwort	
	Nymphoides crenata	Wavy Marshwort	
	Nymphoides indica	Marshwort	
Molluginaceae	*Glinus lotoides*	Hairy Carpet Weed	
	Glinus oppositifolius		
Moraceae	*Ficus aculeata*		
	Ficus aculeata var. indecora	Ranji	
	Ficus atricha		
	Ficus brachypoda		
	Ficus cerasicarpa		
	Ficus coronulata	River Fig	
	Ficus platypoda	Native Fig	
	Ficus racemosa	Stem-fruit Fig	
	Ficus racemosa var. racemosa		
	Ficus tinctoria		
	Ficus tinctoria subsp. tinctoria		
	Ficus virens	Albayi	
	Ficus virens var. virens		

Myrtaceae	*Calytrix achaeta*		
	Calytrix brownii		
	Calytrix exstipulata	Kimberley Heather	
	Corymbia bella		
	Corymbia cadophora		
	Corymbia cadophora subsp. cadophora		
	Corymbia confertiflora		
	Corymbia dichromophloia		
	Corymbia flavescens		
	Corymbia greeniana		
	Corymbia opaca		
	Corymbia pedimontana		P1 (DBCA list)
	Corymbia polycarpa		
	Corymbia zygophylla		
	Eucalyptus bigalerita	Northern Salmon Gum	
	Eucalyptus camaldulensis subsp. obtusa	Blunt-budded River Red Gum	
	Eucalyptus confluens	Kimberley Gum	
	Eucalyptus coolabah	Coolibah	
	Eucalyptus houseana	Kimberley White Gum	
	Eucalyptus jensenii	Wandi Ironbark	
	Eucalyptus microtheca	Coolibah	
	Eucalyptus tectifica	Darwin Box	
	Lophostemon grandiflorus subsp. riparius		
	Melaleuca alsophila		
	Melaleuca bracteata	River Teatree	
	Melaleuca leucadendra		
	Melaleuca minutifolia	Tea Tree	
	Melaleuca nervosa	Fibrebark	
	Melaleuca viridiflora	Broadleaf Paperbark	
	Verticordia verticillata	Featherflower	
	Xanthostemon paradoxus	Xanthostemon	
Nyctaginaceae	*Boerhavia burbidgeana*		
	Boerhavia coccinea	Tar Vine	
	Boerhavia dominii		
	Boerhavia gardneri		
	Boerhavia paludosa		
	Boerhavia schomburgkiana		
Nymphaeaceae	*Nymphaea violacea*		
Oleaceae	*Jasminum didymum subsp. didymum*		

	Jasminum molle		
Onagraceae	*Ludwigia octovalvis*	Willow Primrose	
	Ludwigia perennis		
Ophioglossaceae	*Ophioglossum gramineum*		
Opiliaceae	*Opilia amentacea*		
Orchidaceae	*Cymbidium canaliculatum*		
Orobanchaceae	*Buchnera asperata*		
	Buchnera ramosissima	Blackrod	
	Buchnera urticifolia	Blackrod	
	Striga curviflora		
Passifloraceae	*Adenia heterophylla*		
	Adenia heterophylla subsp. australis		
	**Passiflora foetida*	Stinking Passion Flower	
	**Passiflora foetida var. hispida*		
Pedaliaceae	*Josephinia eugeniae*	Josephinia Burr	
	Josephinia papillosa		
	Josephinia sp. Northern (T.E.H. Aplin 6360)		
Phyllanthaceae	*Antidesma ghaesembilla*	Yangu	
	Bridelia tomentosa		
	Flueggea virosa		
	Flueggea virosa subsp. melanthesoides	Dogwood	
	Notoleptopus decaisnei		
	Phyllanthus baccatus		
	Phyllanthus maderaspatensis		
	**Phyllanthus tenellus*		
	Phyllanthus virgatus		
Picrodendraceae	*Petalostigma pubescens*		
Plantaginaceae	*Bacopa floribunda*		
	Stemodia flaccida		
	Stemodia grossa	Marsh Stemodia	
	Stemodia lythrifolia	Bunu Bunu	
	Stemodia viscosa	Pagurda	
Plumbaginaceae	*Plumbago zeylanica*	Native Plumbago	
Poaceae	*Aristida holathera var. holathera*		
	Aristida hygrometrica	Northern Kerosene Grass	
	Aristida inaequiglumis	Feathertop Threeawn	
	Aristida latifolia	Feathertop Wiregrass	
	Aristida polyclados		P1 (DBCA list)
	Arundinella nepalensis	Reedgrass	

	Bothriochloa bladhii	Forest Bluegrass	
	Bothriochloa bladhii subsp. bladhii		
	Cenchrus basedowii	Spotter's Grass	
	**Cenchrus ciliaris*	Buffel Grass	
	**Cenchrus echinatus*	Burrgrass	
	Cenchrus elymoides		
	Chloris pectinata	Comb Chloris	
	**Chloris virgata*	Feathertop Rhodes Grass	
	Chrysopogon latifolius	Broadleaf Ribbongrass	
	Chrysopogon pallidus	Ribbongrass	
	Cymbopogon ambiguus	Scentgrass	
	Cymbopogon bombycinus	Silky Oilgrass	
	Cymbopogon procerus	Lemon Grass	
	Cynodon convergens		
	**Cynodon dactylon*	Couch	
	Dactyloctenium radulans	Button Grass	
	Dichanthium fecundum	Curly Bluegrass	
	Dichanthium sericeum subsp. polystachyum		
	**Digitaria ciliaris*	Summer Grass	
	Dinebra neesii	Umbrella Canegrass	
	**Echinochloa colona*	Awnless Barnyard Grass	
	Echinochloa macrandra		
	Ectrosia scabrida	Hare's Foot Grass	
	Elytrophorus spicatus	Spikegrass	
	Enneapogon polyphyllus	Leafy Nineawn	
	Enneapogon purpurascens	Purple Nineawn	
	Eragrostis cumingii	Cuming's Love Grass	
	Eragrostis exigua		
	Eragrostis fallax		
	**Eragrostis minor*	Smaller Stinkgrass	
	Eragrostis tenellula	Delicate Lovegrass	
	Eriachne ciliata	Slender Wandarrie Grass	
	Eriachne festucacea	Plains Wandarrie Grass	
	Eriachne glauca var. barbinodis		
	Eriachne glauca var. glauca		
	Eriachne melicacea		

	Eriachne mucronata	Mountain Wanderrie Grass	
	Eriachne obtusa	Northern Wandarrie Grass	
	Eriachne sulcata		
	Eulalia aurea		
	Heteropogon contortus	Bunch Speargrass	
	Imperata cylindrica	Kunai Grass	
	Iseilema fragile		
	Iseilema macratherum	Bull Flinders Grass	
	Iseilema vaginiflorum	Red Flinders Grass	
	Mnesithea rottboellioides		
	Oryza australiensis	Australian Wild Rice	
	**Panicum coloratum*		
	Panicum decompositum	Native Millet	
	Panicum mindanaense		
	Panicum seminudum var. cairnsianum		
	Panicum seminudum var. seminudum		
	Paspalidium jubiflorum	Warrego Grass	
	Paspalum scrobiculatum	Scrobic	
	Perotis rara	Comet Grass	
	Pseudochaetochloa australiensis		
	Pseudoraphis spinescens	Spiny Mudgrass	
	Schizachyrium fragile	Senale Redgrass	
	Schizachyrium pseudeulalia		
	Sehima nervosum	Whitegrass	
	Sorghum intrans	Darwin Canegrass	
	Sorghum plumosum	Plume Canegrass	
	Sorghum stipoideum	Annual Sorghum	
	Sorghum timorense		
	Sporobolus australasicus	Fairy Grass	
	Themeda triandra		
	Triodia bitextura		
	Triodia caelestialis		
	Triodia pascoeana		P1 (DBCA list)
	Triodia wiseana	Limestone Spinifex	
	Urochloa holosericea		
	**Urochloa mosambicensis*	Sabi Grass	
	Urochloa praetervisa		
	Urochloa pubigera		
	Whiteochloa cymbiformis		
	Xerochloa barbata	Rice Grass	

	Xerochloa imberbis	Rice Grass	
	Yakirra australiensis		
Polygalaceae	*Polygala galeocephala*		
	Polygala kimberleyensis		
	Polygala pterocarpa		
	Polygala succulenta var. *congesta*		
	Polygala tepperi		
	Polygala wightiana		
	Persicaria attenuata subsp. *attenuata*		
Pontederiaceae	*Pontederia cyanea*		
Portulacaceae	*Calandrinia strophiolata*		
	Calandrinia tepperiana		
	Calandrinia uniflora		
	Portulaca digyna		
	Portulaca filifolia		
	Portulaca oleracea	Purslane	
	Portulaca pilosa	Djanggara	
Proteaceae	*Grevillea cunninghamii*		
	Grevillea mimosoides		
	Grevillea pyramidalis	Caustic Bush	
	Grevillea pyramidalis subsp. *leucadendron*		
	Grevillea refracta subsp. *refracta*		
	Grevillea striata	Beefwood	
	Grevillea wickhamii subsp. *aprica*		
	Grevillea wickhamii subsp. *macrodonta*		
	Hakea arborescens	Common Hakea	
	Hakea macrocarpa		
Pteridaceae	*Adiantum philippense*		
	Cheilanthes brownii		
	Cheilanthes caudata		
	Cheilanthes pumilio		
Rhamnaceae	*Ventilago viminalis*	Supplejack	
Rubiaceae	*Dentella minutissima*		
	Dentella misera		
	Dentella repens		
	Gardenia pyriformis subsp. *pyriformis*		
	Gardenia resinosa subsp. *kimberleyensis*		
	Nauclea orientalis	Leichardt Pine	
	Spermacoce constricta		
	Spermacoce dolichosperma		
	Spermacoce laevigata		
	Spermacoce occidentalis		
	Synaptantha scleranthoides		
Rutaceae	*Harrisonia brownii*		

Santalaceae	*Santalum lanceolatum*	Northern Sandalwood	
Sapindaceae	*Atalaya hemiglauca*	Whitewood	
	Atalaya variifolia	Wingleaf Whitewood	
	**Cardiospermum halicacabum*	Balloon Vine	
	Dodonaea hispidula var. *arida*		
	Dodonaea lanceolata var. *lanceolata*		
	Dodonaea physocarpa		
	Dodonaea polyzyga		
	Ganophyllum falcatum		
Sapotaceae	*Planchonella arnhemica*	Northern Yellow Boxwood	
Scrophulariaceae	*Myoporum montanum*	Native Myrtle	
Selaginellaceae	*Selaginella ciliaris*		
Simaroubaceae	*Brucea javanica*		
Solanaceae	*Nicotiana benthamiana*	Tjuntiwari	
	**Physalis angulata*		
	Solanum beaugleholei		
	Solanum dioicum	Gilu	
	Solanum leopoldense		P3 (DBCA list)
	Solanum lucani		
	Solanum quadriloculatum	Tomato Bush	
Stylidiaceae	*Stylidium cordifolium*		
	Stylidium fissilobum		
	Stylidium fluminense		
	Stylidium pindanicum	Pindan Triggerplant	P3 (DBCA list)
	Stylidium rotundifolium		
	Stylidium semipartitum		
Taccaceae	*Tacca leontopetaloides*	Gandungai	
Thymelaeaceae	*Pimelea punicea*		
Urticaceae	*Pouzolzia zeylanica*		
Violaceae	*Hybanthus aurantiacus*		
	Hybanthus enneaspermus		
	Hybanthus enneaspermus subsp. *enneaspermus*		
Vitaceae	*Ampelocissus acetosa*	Djabaru	
	Cissus adnata		
Xyridaceae	*Xyris complanata*		
	Xyris indica		
	Xyris oligantha		
Zygophyllaceae	*Tribulopis angustifolia*		
	Tribulopis bicolor		

	**Tribulus terrestris*	Caltrop	

Appendix 2 Terrestrial vertebrate fauna records from desktop review

FAMILY	SPECIES	COMMON NAME	CONS CODE
Acanthizidae	Gerygone chloronota	Green-backed Gerygone	
	Gerygone olivacea	White-throated Gerygone	
	Smicrornis brevirostris	Weebill	
Accipitridae	Accipiter cirrocephalus	Collared Sparrowhawk	
	Accipiter fasciatus	Brown Goshawk	
	Accipiter novaehollandiae	Grey Goshawk	
	Aquila audax	Wedge-tailed Eagle	
	Circus approximans	Swamp Harrier	
	Circus assimilis	Spotted Harrier	
	Elanus caeruleus	Black-shouldered Kite	
	Erythrotriorchis radiatus	Red Goshawk	VU (EPBC & WC Acts)
	Haliaeetus leucogaster	White-bellied Sea-Eagle	
	Haliastur sphenurus	Whistling Kite	
	Hamirostra isura	Square-tailed Kite	
	Hamirostra melanosternon	Black-breasted Buzzard	
	Hieraaetus morphnoides	Little Eagle	
	Milvus migrans	Black Kite	
	Pandion cristatus	Osprey	Mig. (EPBC & WC Acts)
Aegothelidae	Aegotheles cristatus	Australian Owlet-nightjar	
Agamidae	Amphibolurus gilberti	Ta-ta	
	Chlamydosaurus kingii	Frill-necked Lizard	
	Ctenophorus caudicinctus subsp. macropus	Ring-tailed Dragon	
	Ctenophorus isolepis subsp. isolepis	Crested Dragon	

	Ctenophorus nuchalis	Central Netted Dragon	
	Diporiphora arnhemica		
	Diporiphora bennettii		
	Diporiphora lalliae		
	Diporiphora magna		
	Diporiphora pindan		
	Pogona minor subsp. mitchelli	Dwarf Bearded Dragon	
	Tympanocryptis lineata subsp. macra		
Alaudidae	Mirafra javanica	Horsfield's Bushlark	
Alcedinidae	Ceyx azureus	Azure Kingfisher	
Anatidae	Anas gracilis	Grey Teal	
	Anas superciliosa	Pacific Black Duck	
	Aythya australis	Hardhead	
	Cygnus atratus	Black Swan	
	Dendrocygna eytoni	Plumed Whistling Duck	
	Malacorhynchus membranaceus	Pink-eared Duck	
	Nettapus pulchellus	Green Pygmy-goose	
Anhingidae	Anhinga novaehollandiae	Australasian Darter	
Anseranatidae	Anseranas semipalmata	Magpie Goose	
Apodidae	Apus pacificus	Fork-tailed Swift	Mig. (EPBC & WC Acts)
Ardeidae	Ardea garzetta	Little Egret	
	Ardea ibis	Cattle Egret	
	Ardea intermedia	Intermediate Egret	
	Ardea modesta	great egret	
	Ardea novaehollandiae	White-faced Heron	
	Ardea pacifica	White-necked Heron	
	Botaurus poiciloptilus	Australasian Bittern	EN (EPBC & WC Acts)
	Ixobrychus flavicollis	Black Bittern	

	Nycticorax caledonicus	Rufous Night Heron	
Artamidae	Artamus cinereus	Black-faced Woodswallow	
	Artamus cinereus subsp. melanops	Black-faced Woodswallow	
	Artamus leucorynchus	White-breasted Woodswallow	
	Artamus minor	Little Woodswallow	
	Artamus personatus	Masked Woodswallow	
Boidae	Aspidites melanocephalus	Black-headed Python	
Bovidae	*Bos taurus	European Cattle	
Bufonidae	Platyplectrum ornatum	Ornate Burrowing Frog	
	*Rhinella marina	Cane Toad	
Burhinidae	Burhinus grallarius	Bush Stone-curlew	
Camaenidae	Kimboraga micromphala		P2 (DBCA list)
	Kimboraga yammerana		P1 (DBCA list)
	Mouldingia occidentalis		CR (WC Act)
	Rhagada gibbensis		P1 (DBCA list)
	Westraltrachia alterna		VU (WC Act)
	Westraltrachia inopinata		VU (WC Act)
	Westraltrachia turbinata		VU (WC Act)
Campephagidae	Coracina maxima	Ground Cuckoo-shrike	
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	
	Coracina papuensis	White-bellied Cuckoo-shrike	
	Lalage leucomela	Varied Triller	
	Lalage tricolor	White-winged Triller	
Canidae	*Canis familiaris	Dog	
Caprimulgidae	Eurostopodus argus	Spotted Nightjar	
Carphodactylidae	Nephrurus sheai		
Centropodidae	Centropus phasianinus	Pheasant Coucal	

Charadriidae	Charadrius veredus	Oriental Plover	Mig. (EPBC & WC Acts)
	Elseyornis melanops	Black-fronted Dotterel	
	Erythrogonys cinctus	Red-kneed Dotterel	
	Vanellus miles	Masked Lapwing	
Cheluidae	Chelodina burrungandjii	Northern Long-necked Turtle	
Ciconiidae	Ephippiorhynchus asiaticus	Black-necked Stork	
Climacteridae	Climacteris melanurus	Black-tailed Treecreeper	
Colubridae	Boiga irregularis	Brown Tree Snake	
Columbidae	Chalcophaps indica	Emerald Dove	
	Geopelia cuneata	Diamond Dove	
	Geopelia humeralis	Bar-shouldered Dove	
	Geopelia striata	Zebra Dove	
	Geopelia striata subsp. placida	Peaceful Dove	
	Geophaps plumifera	Spinifex Pigeon	
	Ocyphaps lophotes	Crested Pigeon	
	Petrophassa albipennis	White-quilled Rock Pigeon	
	Phaps chalcoptera	Common Bronzewing	
Coraciidae	Eurystomus orientalis	Dollarbird	
Corvidae	Corvus bennetti	Little Crow	
	Corvus orru	Torresian Crow	
Cracticidae	Cracticus nigrogularis	Pied Butcherbird	
	Cracticus tibicen	Australian Magpie	
	Cracticus torquatus	Grey Butcherbird	
Crocodylidae	Crocodylus johnstoni		OS (WC Act)
	Crocodylus porosus	Salt-water Crocodile	OS (WC Act)
Cuculidae	Cacomantis pallidus	Pallid Cuckoo	
	Cacomantis variolosus	Brush Cuckoo	

	Chrysococcyx basalis	Horsfield's Bronze Cuckoo	
	Chrysococcyx osculans	Black-eared Cuckoo	
	Cuculus optatus	Oriental Cuckoo	
	Eudynamys orientalis	Pacific Koel	
	Eudynamys scolopacea	Common Koel	
	Scythrops novaehollandiae	Channel-billed Cuckoo	
Dasyuridae	Dasyurus hallucatus	Northern Quoll	EN (EPBC & WC Acts)
	Phascogale tapoatafa subsp. kimberleyensis	Kimberley Brush-tailed Phascogale	VU (EPBC & WC Acts)
	Planigale ingrami	Long-tailed Planigale	
	Pseudantechinus ningbing	Ningbing Pseudantechinus	
	Sminthopsis macroura	Stripe-faced Dunnart	
Dicaeidae	Dicaeum hirundinaceum	Mistletoebird	
Dicruridae	Grallina cyanoleuca	Magpie-lark	
	Myiagra inquieta	Restless Flycatcher	
	Myiagra rubecula	Leaden Flycatcher	
	Myiagra ruficollis	Broad-billed Flycatcher	
	Rhipidura albiscapa	Grey Fantail	
	Rhipidura leucophrys	Willie Wagtail	
	Rhipidura rufiventris	Northern Fantail	
Diplodactylidae	Amalosia rhombifer	Zigzag velvet gecko	
Diplodactylidae	Crenadactylus ocellatus subsp. rostralis	Clawless Gecko	
	Strophurus ciliaris		
	Strophurus taeniatus		
Elapidae	Furina ornata	Moon Snake	
	Pseudechis australis	Mulga Snake	
	Pseudonaja mengdeni	Western Brown Snake	
	Suta punctata	Spotted Snake	

Emballonuridae	Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat	
	Saccolaimus saccolaimus subsp. nudicluniatus	Bare-rumped Sheath-tailed Bat	P3 (DBCA list)
	Taphozous georgianus	Common Sheath-tailed Bat	
Equidae	*Equus asinus	Donkey	
	*Equus caballus	Horse	
Estrilidae	Emblema pictum	Painted Finch	
	Erythrura gouldiae	Gouldian Finch	EN (EPBC; P4 (DBCA list)
	Heteromunia pectoralis	Pictorella Mannikin	
	Neochmia phaeton	Crimson Finch	
	Neochmia ruficauda	Star Finch	
	Poephila acuticauda	Long-tailed Finch	
	Poephila personata	Masked Finch	
	Taeniopygia bichenovii	Double-barred Finch	
	Taeniopygia guttata	Zebra Finch	
Falconidae	Falco berigora	Brown Falcon	
	Falco cenchroides	Australian Kestrel	
	Falco hypoleucos	Grey Falcon	VU (WC Act)
	Falco longipennis	Australian Hobby	
	Falco peregrinus	Peregrine Falcon	OS (WC Act)
	Falco subniger	Black Falcon	
Felidae	*Felis catus	Cat	
Gekkonidae	Gehyra australis		
	Gehyra granulum	Kimberley granular-toed gecko	
	Gehyra occidentalis		
	Gehyra pilbara		
	Gehyra pseudopunctata	Southern Kimberley spotted gecko	
	Heteronotia binoei	Bynoe's Gecko	

	Heteronotia planiceps		
Glareolidae	Glareola maldivarum	Oriental Pratincole	Mig. (EPBC & WC Acts)
Gruidae	Grus rubicunda	Brolga	
Halcyonidae	Dacelo leachii	Blue-winged Kookaburra	
	Todiramphus pyrrhopygius	Red-backed Kingfisher	
	Todiramphus sanctus	Sacred Kingfisher	
Hipposideridae	Hipposideros ater subsp. gilberti	Dusky Leafnosed-bat	
	Hipposideros stenotis		P2 (DBCA list)
	Rhinonicteris aurantia		VU (EPBC; P4 (DBCA list)
Hirundinidae	Cecropis daurica	Red-rumped Swallow	Mig. (WC Act)
	Hirundo rustica	Barn Swallow	Mig. (EPBC & WC Acts)
	Petrochelidon ariel	Fairy Martin	
	Petrochelidon nigricans	Tree Martin	
Hylidae	Cyclorana australis	Giant Frog	
	Cyclorana cryptotis	Hidden-ear Frog	
	Cyclorana longipes	Long-footed Frog	
	Litoria caerulea	Green Tree Frog	
	Litoria coplandi	Rock Frog	
	Litoria inermis	Bumpy Rocket Frog	
	Litoria meiriana	Rockhole Frog	
	Litoria pallida	Pale Rocket Frog	
	Litoria rothii	Northern Laughing Tree Frog	
	Litoria rubella	Little Red Tree Frog	
	Litoria splendida	Splendid Tree Frog	
Jacanidae	Irediparra gallinacea	Comb-crested Jacana	
Laridae	Gelochelidon nilotica	Gull-billed Tern	Mig. (WC Act)
	Sterna hybrida	Whiskered Tern	

Limnodynastidae	Limnodynastes lignarius	Carpenter Frog	
	Notaden nichollsi	Desert Spadefoot	
Macropodidae	Macropus agilis	Agile Wallaby	
	Macropus antilopinus	Antilopine Wallaroo	
	Macropus robustus	Euro	
	Macropus rufus	Red Kangaroo	
	Onychogalea unguifera	Northern Nailtail Wallaby	
	Petrogale brachyotis	Short-eared Rock-wallaby	
	Petrogale lateralis subsp. (West Kimberley)	West Kimberley Black-footed Rock-wallaby	VU (EPBC Act); EN (WC Act)
Maluridae	Malurus lamberti	Variegated Fairy-wren	
	Malurus melanocephalus	Red-backed Fairy-wren	
Megadermatidae	Macroderma gigas	Ghost Bat	VU (EPBC & WC Acts)
Meliphagidae	Cissomela pectoralis	Banded Honeyeater	
	Conopophila rufogularis	Rufous-throated Honeyeater	
	Gavicalis virescens	Singing Honeyeater	
	Lichmera indistincta	Brown Honeyeater	
	Manorina flavigula	Yellow-throated Miner	
	Melithreptus albogularis	White-throated Honeyeater	
	Melithreptus cyanotis	Blue-faced Honeyeater	
	Melithreptus gularis	Black-chinned Honeyeater	
	Myzomela erythrocephala	Red-headed Honeyeater	
	Philemon argenticeps	Silver-crowned Friarbird	
	Philemon citreogularis	Little Friarbird	
	Ptilotula flavescens	Yellow-tinted Honeyeater	
	Ptilotula plumula	Grey-fronted Honeyeater	

	Ramsayornis fasciatus	Bar-breasted Honeyeater	
	Stomiopera unicolor	White-gaped Honeyeater	
Meropidae	Merops ornatus	Rainbow Bee-eater	
Molossidae	Chaerephon jobensis	Greater Northern Freetail-bat	
Motacillidae	Anthus australis	Australian Pipit	
	Motacilla cinerea	Grey Wagtail	Mig. (EPBC & WC Acts)
	Motacilla flava	Yellow Wagtail	Mig. (EPBC & WC Acts)
Muridae	Leggadina lakedownensis		P4 (DBCA list)
	*Mus musculus	House Mouse	
	Pseudomys delicatulus	Delicate Mouse	
	Pseudomys nanus	Western Chestnut Mouse	
	Rattus tunneyi	Pale Field-rat	
	Zyzomys argurus	Common Rock-rat	
Myobatrachidae	Uperoleia aspera	Derby Toadlet	
	Uperoleia lithomoda	Stonemason Toadlet	
	Uperoleia mjobergii	West Kimberley Toadlet	
	Uperoleia trachyderma	Blacksoil Toadlet	
Neosittidae	Daphoenositta chrysoptera	Varied Sittella	
Oriolidae	Oriolus sagittatus	Olive-backed Oriole	
	Sphecotheres vieilloti	Australasian Figbird	
	Ardeotis australis	Australian Bustard	
Pachycephalidae	Colluricincla harmonica	Grey Shrike-thrush	
	Colluricincla megarhyncha	Little Shrike-thrush	
	Colluricincla woodwardi	Sandstone Shrike-thrush	
	Pachycephala rufiventris	Rufous Whistler	
Pardalotidae	Pardalotus rubricatus	Red-browed Pardalote	

	Pardalotus striatus	Striated Pardalote	
Pelecanidae	Pelecanus conspicillatus	Australian Pelican	
Peramelidae	Isoodon auratus subsp. auratus		VU (EPBC & WC Acts)
Petroicidae	Melanodryas cucullata	Hooded Robin	
	Microeca fascinans	Jacky Winter	
	Microeca flavigaster	Lemon-breasted Flycatcher	
	Poecilodryas cerviniventris	Buff-sided Robin	
Phalacrocoracidae	Phalacrocorax carbo	Great Cormorant	
	Phalacrocorax melanoleucos	Little Pied Cormorant	
	Phalacrocorax sulcirostris	Little Black Cormorant	
	Phalacrocorax varius	Pied Cormorant	
Phalangeridae	Trichosurus vulpecula subsp. arnhemensis		VU (WC Act)
Phasianidae	Coturnix ypsilophora	Brown Quail	
Podargidae	Podargus strigoides	Tawny Frogmouth	
Podicipedidae	Poliocephalus poliocephalus	Hoary-headed Grebe	
	Tachybaptus novaehollandiae	Australasian Grebe	
Pomatostomidae	Pomatostomus temporalis	Grey-crowned Babbler	
Pseudocheiridae	Petropseudes dahli	Rock Ringtail Possum	P3 (DBCA list)
Psittacidae	Aprosmictus erythropterus	Red-winged Parrot	
Psittacidae	Cacatua galerita	Sulphur-crested Cockatoo	
	Cacatua roseicapilla	Galah	
	Cacatua sanguinea	Little Corella	
	Calyptorhynchus banksii	Red-tailed Black-Cockatoo	
	Melopsittacus undulatus	Budgerigar	

	Neophema bourkii	Bourke's Parrot	
	Nymphicus hollandicus	Cockatiel	
	Pezoporus occidentalis	Night Parrot	EN (EPBC Act); CR (WC Act)
	Platycercus venustus	Northern Rosella	
	Polytelis alexandrae	Princess Parrot	VU (EPBC; P4 (DBCA list)
	Trichoglossus haematodus subsp. rubritorquis	Red-collared Lorikeet	
	Trichoglossus versicolor	Varied Lorikeet	
Pteropodidae	Pteropus alecto	Black Flying-fox	
	Pteropus scapulatus	Little Red Flying-fox	
Ptilonorhynchidae	Ptilonorhynchus nuchalis	Great Bowerbird	
Pygopodidae	Delma borea		
Pygopodidae	Delma nasuta		
	Delma tincta		
	Lialis burtonis		
Rallidae	Amaurornis moluccana	Bush Hen	
	Fulica atra	Eurasian Coot	
	Gallirallus philippensis	Buff-banded Rail	
Recurvirostridae	Himantopus himantopus	Black-winged Stilt	
Rostratulidae	Rostratula australis	Australian Painted Snipe	EN (EPBC & WC Acts)
Scincidae	Carlia munda	Shaded-litter Rainbow Skink	
	Cryptoblepharus megastictus		
	Cryptoblepharus metallicus		
	Cryptoblepharus ruber		
	Cryptoblepharus tytthos		
	Ctenotus inornatus		
	Ctenotus militaris		

	Ctenotus pantherinus	Leopard Ctenotus	
	Ctenotus piankai		
	Ctenotus robustus		
	Ctenotus serventyi		
	Cyclodomorphus melanops subsp. melanops	Slender Blue-tongue	
	Eremiascincus isolepis		
	Lerista bipes		
	Lerista borealis		
	Lerista labialis		
	Menetia greyii		
	Menetia maini		
	Morethia ruficauda subsp. ruficauda		
	Notoscincus ornatus subsp. wotjulum		
	Proablepharus reginae		
	Proablepharus tenuis		
	Tiliqua multifasciata	Central Blue-tongue	
	Tiliqua scincoides subsp. intermedia		
Scolopacidae	Actitis hypoleucos	Common Sandpiper	Mig. (EPBC & WC Acts)
	Calidris acuminata	Sharp-tailed Sandpiper	Mig. (EPBC & WC Acts)
	Calidris ferruginea	Curlew Sandpiper	CR/Mig. (EPBC Act); VU/Mig. (WC Act)
	Calidris melanotos	Pectoral Sandpiper	Mig. (EPBC & WC Acts)
	Numenius madagascariensis	Eastern Curlew	CR/Mig. (EPBC Act); VU/Mig. (WC Act)
	Tringa glareola	Wood Sandpiper	Mig. (EPBC & WC Acts)

	Tringa nebularia	Common Greenshank	Mig. (EPBC & WC Acts)
	Tringa stagnatilis	Marsh Sandpiper	Mig. (EPBC & WC Acts)
Strigidae	Ninox boobook	Boobook Owl	
	Ninox connivens	Barking Owl	
	Ninox rufa subsp. rufa	Rufous Owl	
Suidae	*Sus scrofa	Pig	
Sylviidae	Cisticola exilis	Golden-headed Cisticola	
	Megalurus mathewsi	Rufous Songlark	
	Megalurus timoriensis	Tawny Grassbird	
Tachyglossidae	Tachyglossus aculeatus	Short-beaked Echidna	
Threskiornithidae	Platalea flavipes	Yellow-billed Spoonbill	
	Platalea regia	Royal Spoonbill	
	Plegadis falcinellus	Glossy Ibis	Mig. (EPBC & WC Acts)
	Threskiornis moluccus	Australian White Ibis	
	Threskiornis spinicollis	Straw-necked Ibis	
Thylacomyidae	Macrotis lagotis	Bilby	VU (EPBC & WC Acts)
Turnicidae	Turnix maculosus	Red-backed Button-quail	
	Turnix pyrrhothorax	Red-chested Button-quail	
	Turnix velox	Little Button-quail	
Typhlopidae	*Indotyphlops braminus		
Tytonidae	Tyto alba	Barn Owl	
	Tyto novaehollandiae subsp. kimberli		VU (EPBC; P1 (DBCA list)
Varanidae	Varanus acanthurus	Spiny-tailed Monitor	
	Varanus eremius	Pygmy Desert Monitor	
	Varanus gouldii	Bungarra or Sand Monitor	
	Varanus panoptes subsp. panoptes		

	Varanus scalaris	Spotted Tree Monitor	
	Varanus tristis	Racehorse Monitor	
Vespertilionidae	Chalinolobus gouldii	Gould's Wattled Bat	
	Chalinolobus nigrogriseus	Hoary Wattled Bat	
	Miniopterus schreibersii subsp. orianae		
	Nyctophilus arnhemensis	Arnhem Land Long-eared Bat	
	Nyctophilus geoffroyi	Lesser Long-eared Bat	
	Nyctophilus walkeri	Pygmy Long-eared Bat	
	Scotorepens greyii	Little Broad-nosed Bat	
	Vespadelus caurinus	Western Cave Bat	
	Vespadelus douglasorum	Yellow-lipped Cave Bat	P2 (DBCA list)
	Vespadelus finlaysoni	Finlayson's Cave Bat	

Appendix 3 SRE and subterranean fauna records from desktop review