

Preston
Consulting



NATIVE VEGETATION CLEARING PERMIT APPLICATION

LAKE ARGYLE ROAD SUPPORTING INFORMATION

22 MARCH 2017

**PREPARED FOR THE SHIRE OF WYNDHAM EAST KIMBERLEY
PREPARED BY PRESTON CONSULTING PTY LTD**

Contact details:

SHIRE OF WYNDHAM EAST KIMBERLEY

Contact Person: Mark Davidson
Email: Mark.Davidson@swek.wa.gov.au
Phone: (08) 9168 4100
Address: 20 Coolibah Drive, PO BOX 614 Kununurra WA 6743

Document developed by:

PRESTON CONSULTING PTY LTD

Email: pscott@prestonconsulting.com.au
Website: www.prestonconsulting.com.au
Phone: +61 8 9221 0011
Fax: +61 8 9221 4783
Street Address: Level 3, 201 Adelaide Terrace, East Perth, Western Australia, 6004
Postal Address: PO Box 3093, East Perth, Western Australia, 6892

Disclaimer

This Report has been prepared on behalf of and for the exclusive use of the Shire of Wyndham East Kimberley and is subject to and issued in accordance with the agreement between Preston Consulting Pty Ltd and the Shire of Wyndham East Kimberley.

Preston Consulting Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this Report by any third party.

Copying of any part of this Report without the express permission of Preston Consulting Pty Ltd and the Shire of Wyndham East Kimberley is not permitted.

TABLE OF CONTENTS

TABLE OF CONTENTS	3
LIST OF TABLES	4
LIST OF FIGURES	4
LIST OF APPENDICES	4
1 INTRODUCTION	5
1.1 <i>Project Background</i>	5
1.2 <i>Purpose</i>	5
2 STUDY AREA	7
2.1 <i>Boundary</i>	7
2.2 <i>Tenure and Land Access</i>	7
3 PROPOSED ACTIVITIES	8
3.1 <i>Description of Proposed Activities</i>	8
3.1.1 <i>Road Widening</i>	8
3.1.2 <i>Borrow Pits</i>	8
3.1.3 <i>Road Drainage</i>	9
3.2 <i>Estimated Vegetation Disturbance Requirements</i>	9
3.3 <i>Method of Vegetation Disturbance</i>	9
3.4 <i>Timelines</i>	10
4 RELEVANT ENVIRONMENTAL CHARACTERISTICS	11
4.1 <i>Land Systems and Soils</i>	11
4.2 <i>Biogeographic Regions</i>	13
4.3 <i>Flora and Vegetation</i>	13
4.3.1 <i>Conservation Significant Flora</i>	13
4.3.2 <i>Introduced Flora Species</i>	18
4.3.3 <i>Threatened and Priority Ecological Communities</i>	18
4.4 <i>Fauna</i>	20
4.5 <i>Surface Water Drainage</i>	28
4.6 <i>Current Land Use</i>	28
4.7 <i>Lake Argyle Ramsar Site</i>	28
5 STAKEHOLDER CONSULTATION	29
6 ASSESSMENT OF CLEARING AGAINST THE TEN CLEARING PRINCIPLES	30
7 SUMMARY AND CONCLUSIONS	36
8 REFERENCES	37
9 GLOSSARY	42



10	APPENDICES	43
	<i>Appendix A Shape Files for Study Area – On Attached CD</i>	<i>44</i>
	<i>Appendix B Letters of Authority</i>	<i>45</i>
	<i>Appendix C Phoenix (2017) Targeted Vegetation Survey Report</i>	<i>46</i>
	<i>Appendix D Desktop Fauna Search Reports.....</i>	<i>47</i>

LIST OF TABLES

Table 1: Summary of estimated vegetation disturbance requirements.....	9
Table 2: Potential Threatened Fauna species with a 1 km buffer of the Study Area	21
Table 3: Assessment of proposed vegetation disturbance against the ten clearing principles.....	31

LIST OF FIGURES

Figure 1: Representation of the existing Lake Argyle Road within the rocky outcrop area.....	5
Figure 2: Location of the Project and Study Area (Phoenix, 2017)	6
Figure 3: Land Systems of the Study Area (Phoenix, 2017)	12
Figure 4: Conservation Significant Flora Records from Database Searches (Phoenix, 2017)	14
Figure 5: Conservation Significant Flora Locations from the Targeted Flora Survey (Phoenix, 2017).....	16
Figure 6: <i>Utricularia tridactyla</i> Distribution within the Study Area (Phoenix, 2017).....	17
Figure 7: Conservation Significant Vegetation (Phoenix, 2017)	19

LIST OF APPENDICES

Appendix A: Shape Files of Study Area – On Attached CD
Appendix B: Letters of Authority
Appendix C: Phoenix Flora and Vegetation Survey Report
Appendix D: Desktop Fauna Search Reports



1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Shire of Wyndham East Kimberley (SWEK) is proposing to widen the Lake Argyle Road (LAR) which runs south from the Victoria Highway for about 34.5 km to Lake Argyle (the Project). The LAR is the sole bitumised access route to the Argyle Dam and Lake Argyle. A photograph representative of the existing LAR is shown in Figure 1 below. The LAR is south of the town of Kununurra in the Kimberley region of Western Australia (WA) (Figure 2).

The works include:

- Widening of the road surface to provide an additional 2 m of road running surface;
- Expansion of the road shoulder to accommodate the expanded running surface;
- Renovation of existing culverts and floodways to support the expanded running surface;
- Extraction of borrow material with four sources of borrow identified; and
- Ongoing maintenance of the road.

Alternative alignments or changes to alignment are not considered necessary and the current centreline will form the basis for the centreline of the upgraded road. Road diversions are not considered necessary for the scope of the works.

The works are expected to be implemented over approximately 10 years.

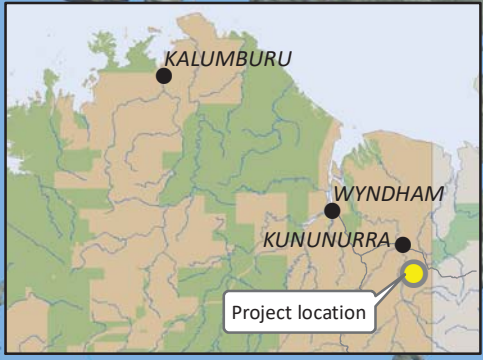


Figure 1: Representation of the existing Lake Argyle Road within the rocky outcrop area

1.2 PURPOSE


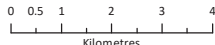
The purpose of this application for a Native Vegetation Clearing Permit (NVCP) is to allow the necessary clearing of native vegetation to enable the road upgrade works to be safely completed.





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Shire of Wyndham Lake Argyle Road	
Project No	1141
Date	07-Mar-17
Drawn by	KW
Map author	GW
	
	
1:150,000 (at A4) GDA 1994 MGA Zone 52	


 Study area

Figure 2: Location of the Project and Study Area (Phoenix, 2017)



2 STUDY AREA

2.1 BOUNDARY

The Study Area (SA) for the assessment comprised the LAR reserve, based on a 25 m buffer from the current road centreline, and four proposed borrow pits adjacent to LAR (Figure 2). The SA covered an area of native vegetation along the roadside of approximately 121 ha. Approximately 20 ha were surveyed for the four borrow pits.

The scope of the SA was based on:

- Widening the bitumised road surface by approximately 2 m with commensurate expansion of roadside drainage and culverts;
- Being able to complete the necessary drainage works within the defined limits of the road reserve; and
- The additional disturbance required at the existing borrow pits to provide sufficient borrow material for the works.

All vegetation disturbance detailed in this NVCP application is proposed to occur within the SA. This NVCP application proposes that the SA is to be used as the boundary for a purpose permit. Relevant shape files of the SA have been provided in Appendix A.

2.2 TENURE AND LAND ACCESS

The road reserve extends 50 m either side of the road centreline. Therefore all proposed vegetation disturbance addressed in this NVCP application will occur within:

- The road reserve;
- Freehold land (borrow pits 44 and 33); and
- Unallocated Crown Land (borrow pits 11 and 22).

The Letter of Authority from Yawoorroong Miriung Gajerrong Yirgeb Noong Dawang Aboriginal Corporation and email correspondence from the Department of Lands are attached as Appendix B.

The SA is entirely within the SWEK Local Government area.



3 PROPOSED ACTIVITIES

LAR was constructed more than 40 years ago to support the development of the Lake Argyle Dam. Whilst it has been maintained according to its original specifications it no longer meets current requirements for the amount and type of traffic. SWEK has successfully applied for funds to support road widening and upgrade of the LAR.

The intent of this NVCP application is to seek a purpose permit to allow the LAR upgrade works within the SA. These activities may include:

- Access to borrow materials and water supply for upgrade works;
- Construction of the road shoulder, bitumised surface, peripheral drainage;
- Upgrade to existing floodways and culverts; and
- Laydown and machinery storage as required.

3.1 DESCRIPTION OF PROPOSED ACTIVITIES

The LAR construction activities are scheduled to commence in Q2 2017 and may continue for up to ten years depending upon funding arrangements.

Standard road construction and surfacing equipment will be utilised and will be provided by the selected contractor.

3.1.1 ROAD WIDENING

The road running surface width will be increased by 1 - 4 m depending upon location. The widening will generally be equal on either side of the road centreline. The running surface currently ranges from 5 - 5.5 m with an estimated average of 5.2 m. It will be increased to an average of 7.2 m with the road shoulder widened commensurately to achieve a 10 m wide top surface enabling safe margins for vehicles along the road side. With allowance for variations in road level and topography, and a design batter angle of 1 in 4 for the inner slope and 1 in 3 for the outer slope, the footprint for the road upgrade varies along the length of the road.

3.1.2 BORROW PITS

Four borrow pits have been selected that are capable of providing the required construction materials. The four pits were used for the original road construction works. One or more of the borrow pits will be used over the course of the project. Note that any one of the borrow pits could potentially provide all of the required construction materials. Four have been nominated to provide SWEK with flexibility to manage costs and works. At least one of these pits will need to remain available for maintenance works as required.

Topsoil will be salvaged from clearing areas at borrow pits and either stored in already cleared areas or placed directly on to areas to be rehabilitated.



3.1.3 ROAD DRAINAGE

Two main drainage elements will be utilised – a roadside V-drain adjacent to the road shoulder will direct road runoff to culverts or roadside outlet drains. The roadside V-drain will need to be relocated further from the road centreline to accommodate the additional blacktop and road shoulder. Topsoil will be pushed to the outer edge of the V-drain.

The second element is roadside outlet drains. The purpose of the outlet drains is to remove runoff water from the V-drain and allow it to filter into native vegetation. Roadside outlet drains currently exist in some locations and are expected to be extended by several metres along their existing alignment to accommodate the runoff water resulting from the additional road width. In some areas new outlet drains may be constructed.

No topsoil will be salvaged from roadside outlet drains.

3.2 ESTIMATED VEGETATION DISTURBANCE REQUIREMENTS

Table 1 summarises the maximum potential vegetation disturbance requirements for each of the activities. The calculations assume that the roadside drains are already cleared of native vegetation, but the roadside outlet drains are either absent or can be considered uncleared. All clearing is to be completed within the SA.

Table 1: Summary of estimated vegetation disturbance requirements

Activity / Item	Description	Maximum Disturbance Expected (ha)
Road Widening	Average of 8 m width for 34,570 m	27.7
Borrow Material	Estimated 200 x 200 m at 4 locations	16.0
Road Drainage	Estimated roadside outlet drains every 100 m x 30 m long x 2 m wide x 2 sides. Includes culvert and floodway works.	10.8
TOTAL		54.4

3.3 METHOD OF VEGETATION DISTURBANCE

Vegetation will generally be cleared with bulldozers or graders along road verges and around borrow pits. Diggers and loaders may be used around drainage lines as required. Roadside verges may be mowed or sprayed to control growth prior to the commencement of clearing works. Areas with sparse vegetation may not require removal of cleared vegetation. Generally, however, vegetation will be cleared and pushed to the side of the disturbed area. Areas with thicker vegetation will need to have the vegetation pushed into piles, mulched and removed.



3.4 TIMELINES

SWEK proposes to commence the activities in Q2 2017. The works will be implemented in seasonal programmes (i.e. during the dry season) over a ten year period. It is not feasible to complete the works during the wet season.

Any rehabilitation works in borrow pits would be completed prior to the annual onset of the wet season. The LAR is expected to stay in use for the foreseeable future.



4 RELEVANT ENVIRONMENTAL CHARACTERISTICS

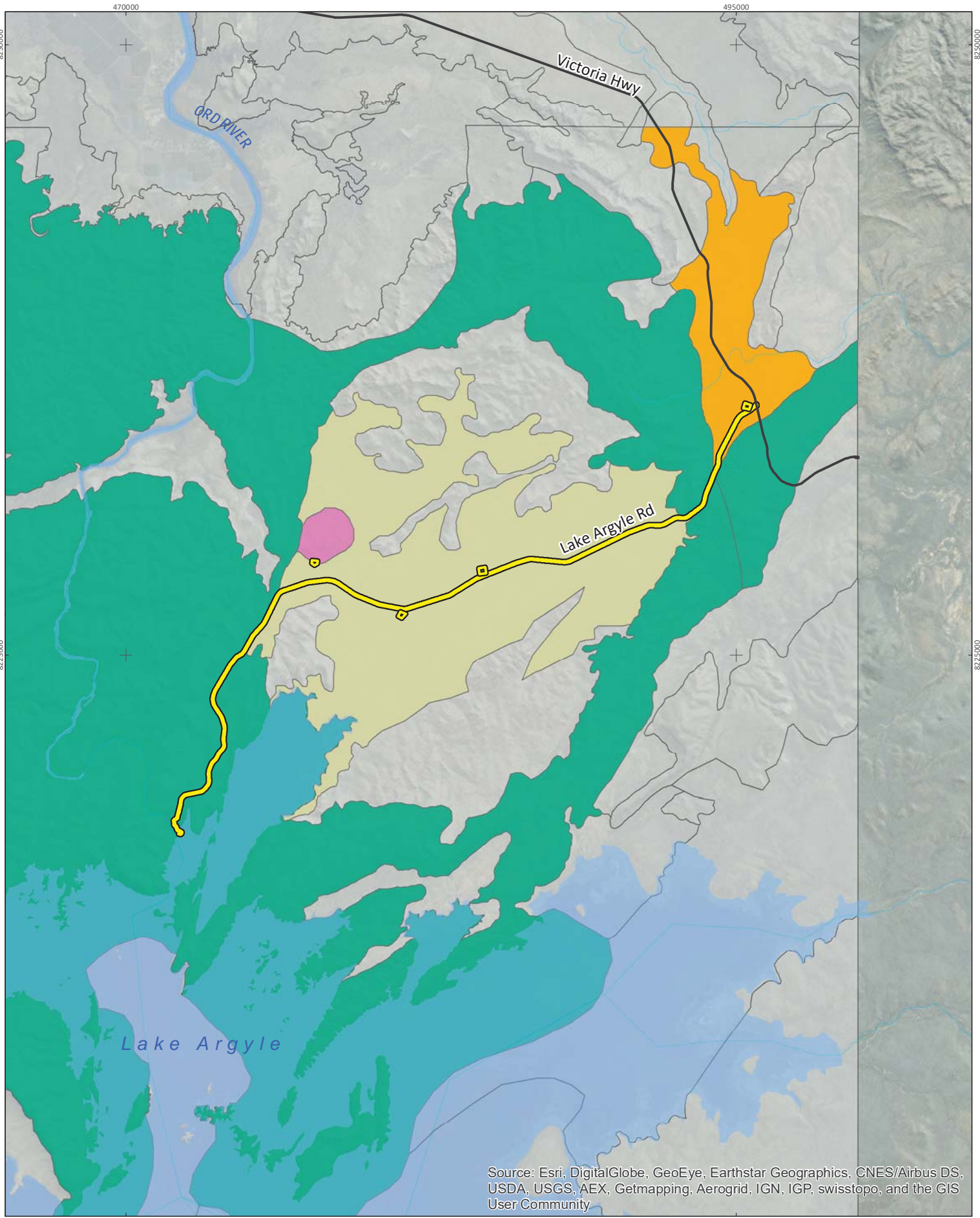
This section contains information about the environmental characteristics of the SA (within the context of the region) that may be relevant to this NVCP application.

4.1 LAND SYSTEMS AND SOILS

As part of the rangeland resource surveys, the then-Department of Agriculture comprehensively described and mapped the biophysical resources of the Kimberley, together with an evaluation of the condition of the soils and vegetation (from an agricultural perspective) (Payne and Schoknecht, 2011). As part of this process an inventory of land types, land systems and land units with particular use capabilities, habitats or conservation values were established to assist in land use planning. According to this mapping, the location of these land systems within the SA are shown in Figure 3.

The SA contains four land systems that are replicated widely outside of the SA. 0.1% or less of each land system is present within the SA, providing evidence that the landscape and soil units extend well outside of the SA.





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Shire of Wyndham
Lake Argyle Road

Project No 1141
Date 07-Mar-17
Drawn by KW
Map author GW



0 1 2 4 6 8
Kilometres

1:200,000 (at A4) GDA 1994 MGA Zone 52

Study area

Land systems within the study area

Cockatoo System

MacPhee System

Pinkerton System

Pompey System

All other land systems

Figure 3: Land Systems of the Study Area (Phoenix, 2017)



4.2 BIOGEOGRAPHIC REGIONS

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA). IBRA version 7.0 includes 89 biogeographic regions and 419 sub regions.

The SA is located entirely within the Victoria Bonaparte (VB1) biogeographic region. This region is described as having a protection level of 10-15% (DoEE, 2017a).

The VB1 sub-region covers 1,932,467 ha. Rare features of the VB1 subregion include:

- Ramsar listed wetlands of the Ord floodplain and Lake Kununurra;
- 'Wet' tropical river of the lower Ord River;
- Man-made wetlands of Lake Kununurra; and
- Alluvial plain systems of the Ord and Weaber plains.

4.3 FLORA AND VEGETATION

Following a desktop review, Phoenix Environmental Sciences Pty Ltd (Phoenix) completed a targeted flora and vegetation survey of the SA in February 2017. The information in this section has been sourced from Phoenix' targeted flora and vegetation survey memo report (Phoenix, 2017) which has been attached in Appendix C. The SA is shown in yellow on Figure 2.

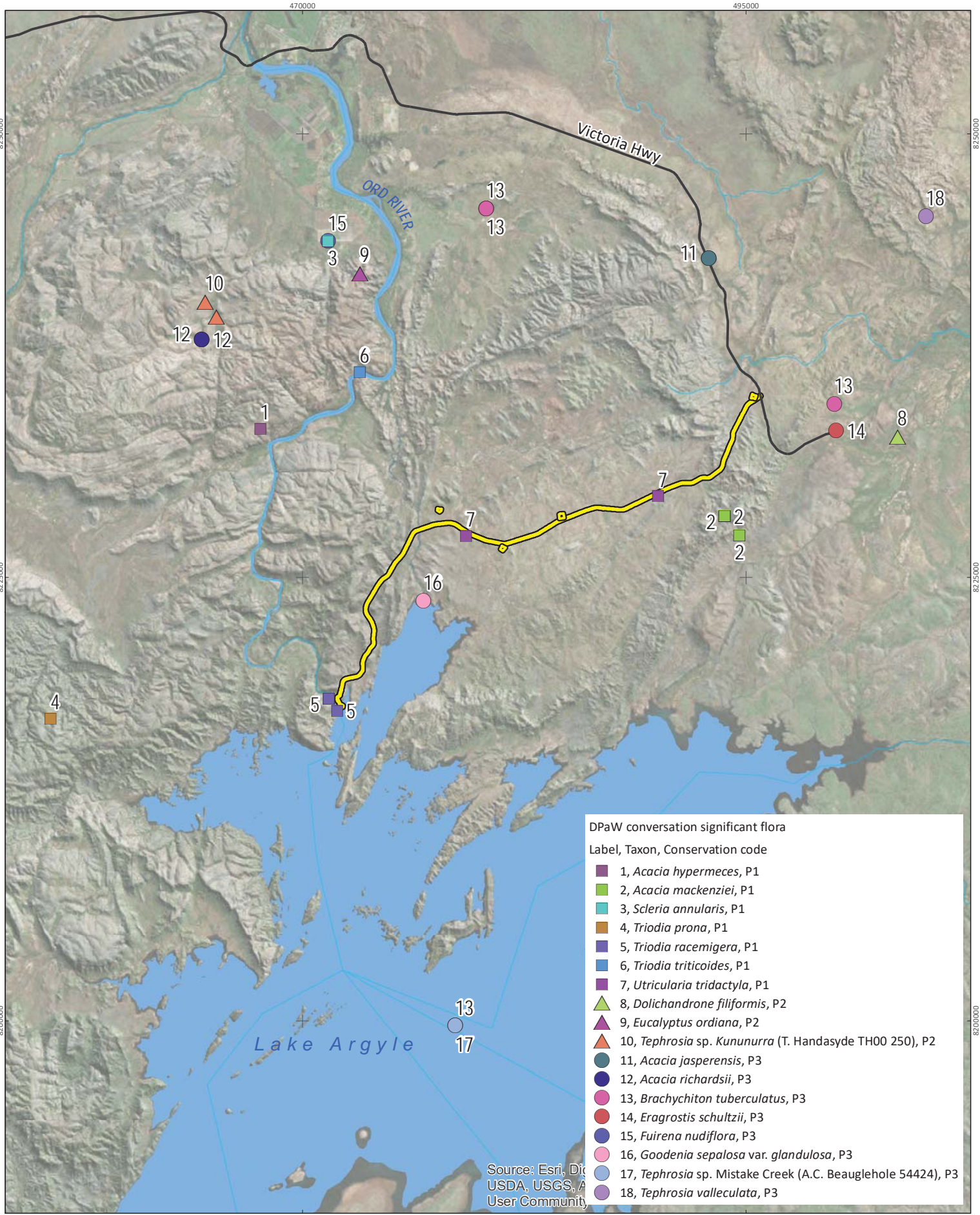
4.3.1 CONSERVATION SIGNIFICANT FLORA

A total of 43 conservation significant flora species were identified from the database searches as previously recorded within a 40 km radius of the SA including:

- 1 Threatened Flora species, listed under the *Wildlife Conservation Act 1950* (WC Act);
- 23 Priority 1 species;
- 6 Priority 2 species;
- 12 Priority 3 species; and
- 1 Priority 4 species.

The database searches revealed that of the species listed above, 18 conservation significant species were recorded within a 20 km buffer of the SA (Figure 4).





Shire of Wyndham
Lake Argyle Road

Project No	1141
Date	07-Mar-17
Drawn by	KW
Map author	GW

0 1.25 2.5 5 7.5 10
Kilometres

1:275,000 (at A4) GDA 1994 MGA Zone 52

Study area

Figure 4: Conservation Significant Flora Records from Database Searches (Phoenix, 2017)



The desktop review and consultation with DPaW prior to survey directed the effort to locate *Typhonium* on black soil areas. Most of the areas surveyed were noted to be red soils and the species was not located within the SA and is considered highly unlikely to be present. No prior records are in close proximity to the SA and very limited suitable habitat for the species was noted in the SA, all of which was searched (Phoenix, 2017).

Two database records (from 1985) for the Priority 1 species *Triodia racemigera* in the SA were revisited during the survey; however, despite a targeted search, no plants of this species were located.

Two Priority Flora species were recorded in the SA during the survey (Figure 5).

Utricularia tridactyla (P1) is known from eight recorded populations. It was observed in a single population within the SA. Searching around the locality revealed only a few plants within 25 m of the current road centreline with no individuals noted within 15 m of the road centreline (Figure 6). For display purposes, a 5 m buffer around the plants is shown in (Figure 6). Several areas of suitable habitat for the species were searched within the SA and it is considered highly likely that suitable habitat and additional populations would occur in the surrounding broader landscape (Phoenix, 2017).

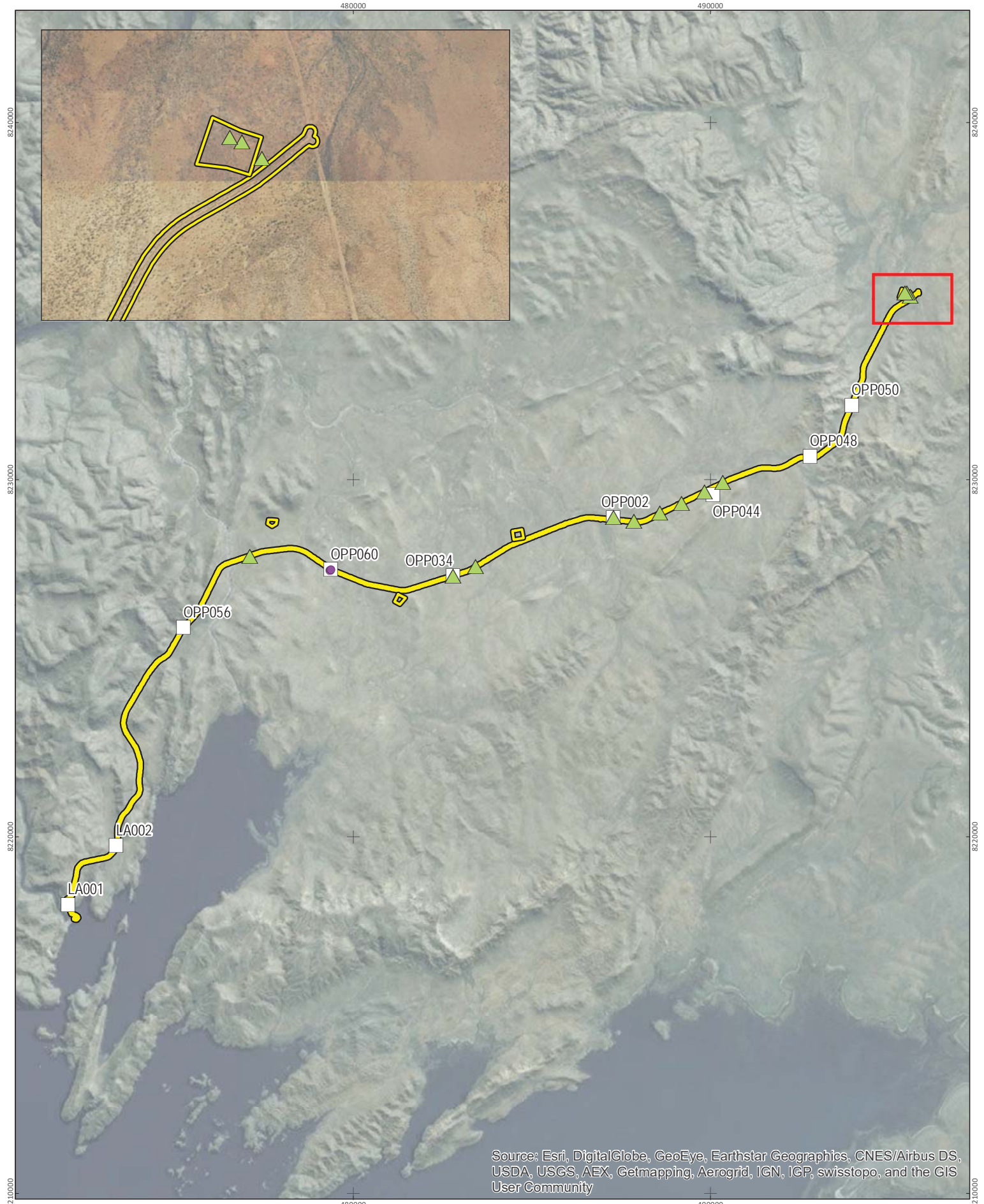
Dolichandrone filiformis (P2) was noted to be more locally common within the SA (Phoenix, 2017). The ten populations recorded during the survey increased the number of known locations for the species in WA from six (ALA, 2017) to 16, representing more than half of known locations for WA and approximately 10% of all known locations in Australia. This species has a wide distribution in the Northern Territory (NT) and the results of the survey indicated a wider distribution in WA than is currently documented. *Dolichandrone filiformis* was recorded in vegetation types that are likely to be well represented in the wider landscape surrounding the SA and it is therefore considered highly likely that additional populations occur in the broader vicinity.

The potential for seven additional Priority Flora to occur in the SA could not be completely ruled out as suitable habitat was present and, due to their small size, it is possible that plants were missed during the targeted searches. Suitable habitat is likely to be present for all of these species in the broader landscape beyond the proposed clearing areas (Phoenix, 2017).

All other conservation significant flora identified in the desktop study were considered unlikely to be present in the SA either due to a lack of suitable habitat or, for species for which there was suitable habitat present, it was considered that this habitat was satisfactorily searched to detect any plants of these species.

No Commonwealth or State listed Threatened Flora were recorded in the survey.





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

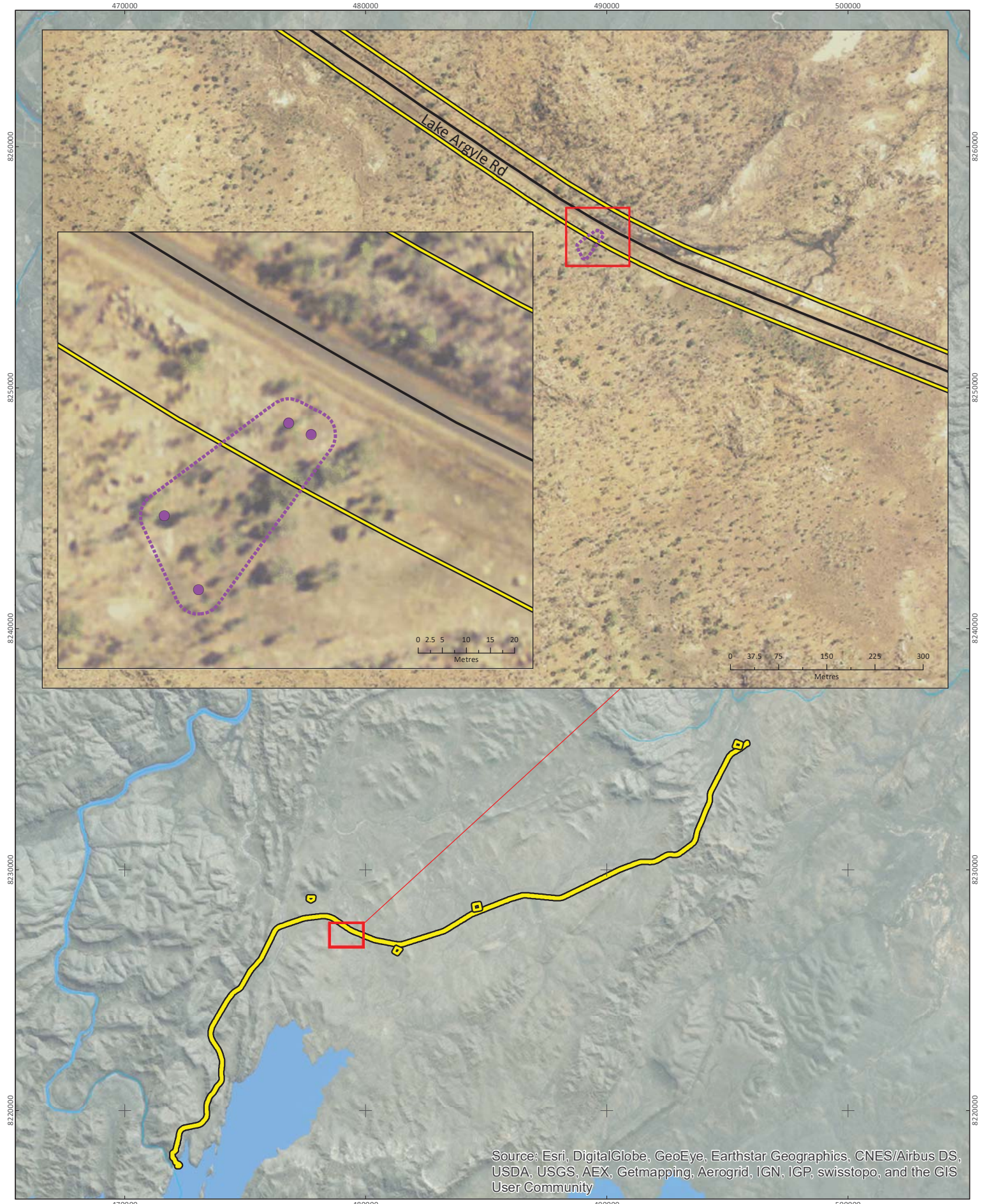


Shire of Wyndham Lake Argyle Road		
Project No	1141	
Date	07-Mar-17	
Drawn by	KW	
Map author	GW	
1:135,000 (at A4)		GDA 1994 MGA Zone 52

- Study area
- Relevé
- Priority flora records**
- Utricularia tridactyla*, P1
- Dolichandrone filiformis*, P2


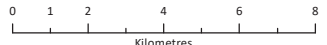
Figure 5: Conservation Significant Flora Locations from the Targeted Flora Survey (Phoenix, 2017)





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Shire of Wyndham Lake Argyle Road	
Project No	1141
Date	07-Mar-17
Drawn by	KW
Map author	GW
	
	
1:200,000 (at A4) GDA 1994 MGA Zone 52	






-  Study area
-  Road centreline
-  *Utricularia tridactyla* distribution
-  Priority flora records
-  *Utricularia tridactyla*, P1

Figure 6: *Utricularia tridactyla* Distribution within the Study Area (Phoenix, 2017)



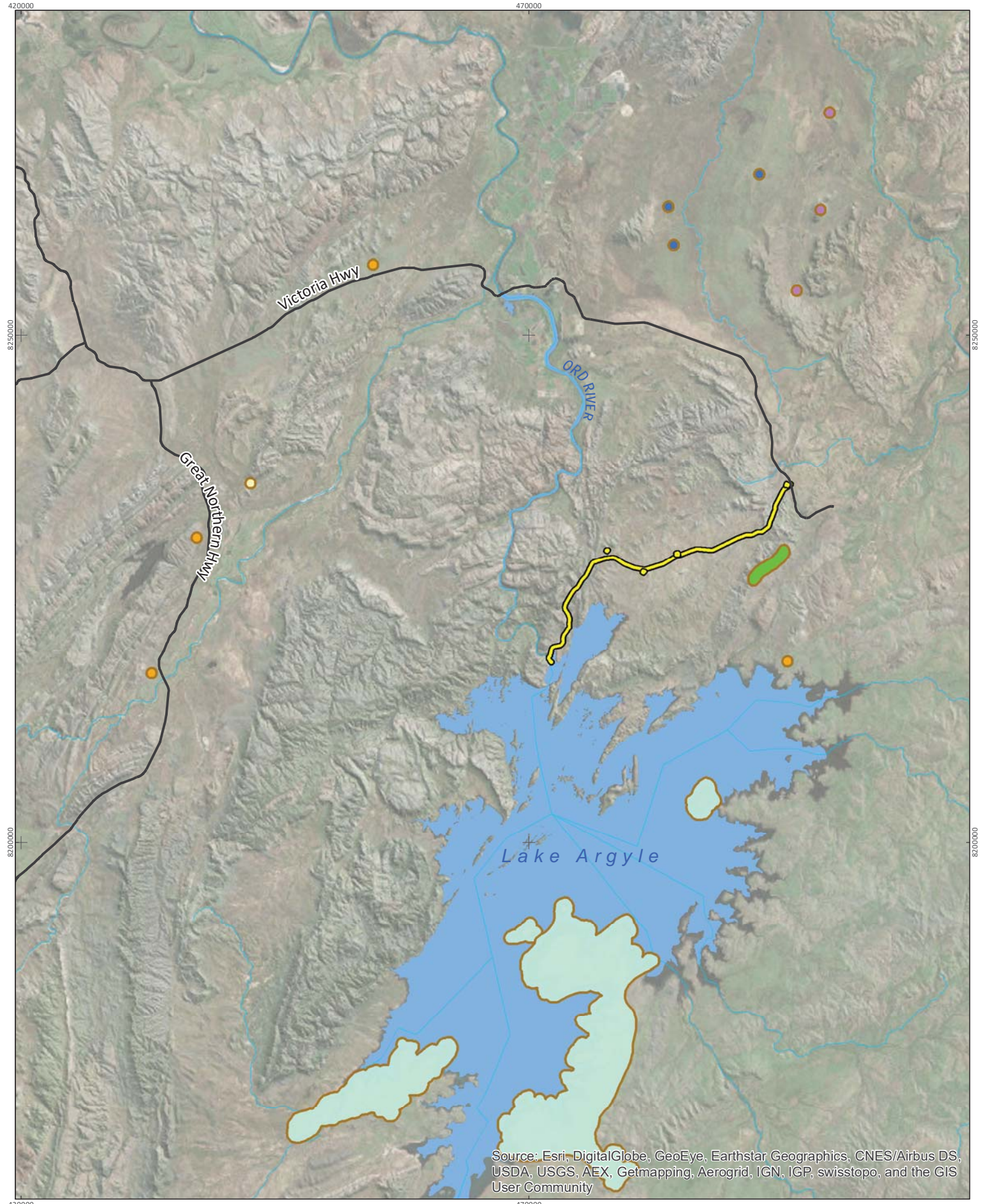
4.3.2 INTRODUCED FLORA SPECIES

A total of 15 declared pest flora species were identified from the database searches previously recorded within 40 km radius of the SA. No declared pest or Weeds of National Significance were recorded in the SA (Phoenix, 2017).

4.3.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

None of the vegetation in the SA was considered to represent a federal or state listed Threatened Ecological Community (TEC) or Priority Ecological Community (PEC) (Phoenix, 2017). The P1 PEC Plant assemblages on vertical sandstone surfaces in the east Kimberley is the closest known conservation significant ecological community to the SA (Figure 7) but no suitable habitat for this community is present within the SA. None of the vegetation types within the SA are floristically representative of this PEC (Phoenix, 2017).





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Shire of Wyndham
Lake Argyle Road

Project No	1141
Date	07-Mar-17
Drawn by	KW
Map author	GW

0 2 4 8 12 16
Kilometres

1:475,000 (at A4) GDA 1994 MGA Zone 52

- Study area
- TEC/PEC search results**
- Plant assemblages on vertical sandstone surfaces (P1)
- Argyle Land System of the Kimberley region (P3)
- Dinnabung Land System (P3)
- Ivanhoe Land System (P3)
- Tanmurra Land System (P3)
- Willeroo Land System (P3)

Figure 7: Conservation Significant Vegetation (Phoenix, 2017)



All information within this map is current as of 07-Mar-17. This product is subject to COPYRIGHT and is property of Phoenix Environmental Sciences (Phoenix). While Phoenix has taken care to ensure the accuracy of this product, Phoenix make no representations or warranties about its accuracy, completeness or suitability for any particular purpose.

4.4 FAUNA

Desktop database searches for the SA included a Federal *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search and a State NatureMap Species Report. The Protected Matters Search and NatureMap reports are provided in Appendix D.

Fifteen protected fauna (including nine birds, four mammals, one reptile and one shark) and/or habitat were identified in the EPBC Act Protected Matters Search as potentially occurring in the area.

The State's NatureMap search identified one additional species with the potential to occur in the area, the Freshwater Crocodile.

Thirteen (12 birds and the Estuarine Crocodile) additional listed Migratory species were also identified as potentially occurring in the area during the database searches:

- Migratory Marine Birds
 - Fork-tailed Swift (*Apus pacificus*);
- Migratory Terrestrial Species
 - Red-rumped Swallow (*Cecropis daurica*);
 - Oriental Cuckoo (*Cuculus optatus*);
 - Barn Swallow (*Hirundo rustica*);
 - Grey Wagtail (*Motacilla cinerea*);
 - Yellow Wagtail (*Motacilla flava*);
- Migratory Wetland Species
 - Curlew Sandpiper (*Calidris ferruginea*);
 - Oriental Plover (*Charadrius veredus*);
 - Oriental Pratincole (*Glareola maldivarum*);
 - Eastern Curlew (*Numenius madagascariensis*);
 - Osprey (*Pandion haliaetus*);
 - Common Greenshank (*Tringa nebularia*); and
- Migratory Marine Species
 - Estuarine Crocodile (*Crocodylus porosus*).

The proposed activities are to occur within a relatively narrow corridor (approximately 7.2 m – 10 m wide), and represent a small incremental expansion on an existing critical piece of road infrastructure. For 34.5 km, the LAR transits through several broad fauna habitats that will remain mostly undisturbed. The listed Migratory bird species above all have a wide range of suitable habitats and are unlikely to be impacted by the proposed activities, as significant habitat such as wetlands and permanent watercourses will not be disturbed.

Table 2 lists the species identified in the EPBC Act Protected Matters Search and the NatureMap Search as species and/or habitat potentially occurring in the area, their classification, distribution and habitat. The Estuarine Crocodile has been included in Table 2 however listed Migratory bird species have not been included due to the reasons outlined above.



Table 2: Potential Threatened Fauna species with a 1 km buffer of the Study Area

Species	Conservation category	Database	Distribution	Habitat
Birds				
Curlew Sandpiper (<i>Calidris ferruginea</i>)	Critically Endangered, Migratory	PMST	Widespread. In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers (DoEE, 2016). In the NT they mostly occur around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove Peninsula, Groote Eylandt and Sir Edward Pellew Island. They are recorded inland from Victoria River Downs and around Alice Springs (Higgins & Davies, 1996).	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins & Davies, 1996).
Red Goshawk (<i>Erythroriorchis radiatus</i>)	Vulnerable	PMST	Widespread. It is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia. It has probably always occurred in central Australia (Garnett & Crowley, 2000).	In the NT and the Kimberley, tall open forest and woodland, or tall fringing woodlands along rivers in grasslands, shrub-lands, and low open woodlands are preferred (Aumann & Baker-Gabb, 1991).
Gouldian Finch (<i>Erythrura gouldiae</i>)	Endangered	PMST	Formerly ranging from Cape York Peninsula in Queensland, through the northern half of the NT, to the Kimberley in WA. A DPaW NatureMap search found 380 sightings of the Gouldian Finch across the majority of the Kimberley region. Given the relatively high number of sightings, Gouldian Finch are not listed under the WC Act however they are listed by DPaW as a Priority (P) 4 species (relatively low level of concern).	Known breeding habitat for Gouldian Finches is characterised by rocky hills with hollow-bearing smooth-barked gums near to water sources, dry season feeding habitat is dominated by annual spear grasses or native sorghum (<i>Sarga species</i>), and in the wet season birds shift to feeding from scattered patches of cockatoo grass (<i>Alloteropsis semialata</i>), golden beard grass (<i>Chysopogon fallax</i>) or spinifex-dominated communities (<i>Triodia bitextura</i> ; <i>T. acutispicula</i> ; <i>T. bynoei</i> ; <i>T. schinzii</i>) (O'Malley, 2006).
Crested Shrike-tit (northern), Northern Shrike-tit (<i>Falcunculus frontatus whitei</i>)	Vulnerable	PMST	The northern subspecies of the Crested Shrike-tit is endemic to north-WA. It occurs in the Kimberley and in the north of NT (Higgins & Peter, 2002). Historically, it was distributed from Wotjulum Mission and Beverley Springs Station in the Kimberley, east in a narrow band to Borroloola in the NT (Robinson & Woinarski, 1992).	Crested Shrike-tits have been recorded in eight different woodland types in northern Australia, mainly those that are dominated by Darwin Woollybutt (<i>Eucalyptus miniata</i>), Darwin Stringybark (<i>E. tetradonta</i>) or Smooth-stemmed Bloodwood (<i>E. bleeseri</i>) (Robinson & Woinarski, 1992). In the NT and WA the species forages for invertebrates, mostly in foliage, branches, and the trunk and bark across a range of eucalypt and other tree species, individual populations are thought to occupy a large home range (Woinarski, 2004).
Purple-crowned Fairy-wren (western) (<i>Malurus coronatus</i>)	Endangered	PMST	The Purple-crowned Fairy-wren (western) occurs along waterways in the Kimberley, and east to the Victoria River Downs in the NT (Barrett et al., 2003; Blakers et al., 1984; Rowley, 1993; Schodde & Mason, 1999). The extent of	The Purple-crowned Fairy-wren (western) inhabits dense, riparian vegetation in the wet-dry tropics of WA and the NT. It is found near permanent rivers and springs (or associated billabongs and swamps) where it occupies dense thickets of <i>Pandanus aquaticus</i> or



Species	Conservation category	Database	Distribution	Habitat
<i>coronatus</i>)			occurrence is estimated to be 250 000 km ² (Garnett & Crowley, 2000).	canegrass and also occurs, less frequently, in rushes and shrubs (DoEE, 2017b).
Eastern Curlew, Far Eastern Curlew (<i>Numenius madagascariensis</i>)	Critically Endangered	PMST	Within in Australia, the eastern curlew has a primarily coastal distribution. They have a continuous distribution from Barrow Island and Dampier Archipelago, WA, through the Kimberley and along the NT, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere (DoEE, 2015).	During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (<i>Zosteraceae</i>). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh species and on mudflats fringed by mangroves, and sometimes within the mangroves (Marchant & Higgins, 1993).
Night Parrot (<i>Pezoporus occidentalis</i>)	Endangered	PMST	The current distribution of the night parrot is not known. Historic records and observations are scanty and anecdotal with few substantiated records since 1935. There are accepted historical records from remote arid and semi-arid inland regions of WA, NT, SA and Queensland (Higgins, 1999). It is possible that the night parrot may continue to occur throughout much of this range (Garnett et al., 1993; Blyth, 1996; Garnett & Crowley, 2000; Garnett et al., 2011).	Most habitat records are of Spinifex grasslands and/or chenopod shrublands in the arid and semi-arid zones, and <i>Astrebla spp.</i> (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, <i>Acacia aneura</i> (Mulga) woodland, treeless areas and bare gibber (Garnett et al., 2011; Higgins, 1999). Roosting and nesting sites are consistently reported as within clumps of dense vegetation, primarily old and large Spinifex clumps, but sometimes other vegetation types (Higgins, 1999, Murphy, 2015).
Australian Painted Snipe (<i>Rostratula australis</i>)	Endangered	PMST	Widespread. Has been recorded at wetlands in all states of Australia (Barrett et al., 2003; Blakers et al. 1984). It is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, NSW, Victoria and south-eastern SA. It has been recorded less frequently at a smaller number of more scattered locations farther west in SA, the NT and WA (Barrett et al., 2003; Blakers et al., 1984; Marchant & Higgins, 1993; Rogers et al., 2005). The extent of occurrence is estimated, with low reliability, to be 4,500,000 km ² (Garnett & Crowley, 2000).	Generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains (DoEE, 2016).
Masked Owl (northern) (<i>Tyto novaehollandiae kimberli</i>)	Vulnerable	PMST	The few records that are available show the Masked Owl (northern) to be present in the Kimberley region of WA, where it occurs from Yampi Sound north-east to Cambridge Gulf, including Windjana Gorge and Augustus Island (DoEE, 2017c).	In northern Australia, the Masked Owl has been recorded from riparian forest, rainforest, open forest, <i>Melaleuca</i> swamps and the edges of mangroves, as well as along the margins of sugar cane fields (DoEE, 2017c).



Species	Conservation category	Database	Distribution	Habitat
Mammals				
Northern Quoll (<i>Dasyurus hallucatus</i>)	Endangered	PMST	In the Kimberley, Northern Quoll records are scattered discontinuously from just south of Derby across to Wyndham. Declines are known from lowland areas and/or the semi-arid inland fringes of its range e.g. the south-west Kimberley (McKenzie, 1981) and Purnululu National Park in south-east Kimberley (Woinarski, 1992).	<p>The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Threatened Species Scientific Committee, 2005). Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Rocky habitats are usually of high relief, often rugged and dissected but can also include tor fields or caves in low lying areas such as in WA. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes.</p> <p>Dens are made in rock crevices, tree holes or occasionally termite mounds (Threatened Species Scientific Committee, 2005). Northern Quolls sometimes occur around human dwellings and campgrounds. Northern Quolls appear to be most abundant in habitats within 150 km of the coast (Braithwaite & Begg, 1995). Habitat in the Top End and Kimberley comprises rocky areas and tall open coastal eucalypt forests. Prime habitat in these northern regions is sandstone escarpment (Braithwaite & Griffiths, 1994). Rocky habitats support higher densities and/or longer lived individuals within the species range, due to more protection from predators, better nutrition and less exposure to agricultural practices (Burnett, 1997; Oakwood, 2000). Rocky habitats also supported a higher density of Northern Quoll dens (Oakwood, 1997 in Oakwood, 2000). Breeding success is higher in animals that have a den near a creek line (Braithwaite & Begg, 1995).</p>
Ghost Bat (<i>Macroderma gigas</i>)	Vulnerable	PMST	This species is endemic to Australia. Its current range is discontinuous with geographically disjunct colonies distributed across northern tropical and subtropical coastal and inland regions (J. Worthington-Wilmer pers. comm.). There are scattered historical records through arid WA, southern NT, northern South Australia, and western and south-western Queensland (McKenzie & Hall, 2008).	Although it occurs in rainforest areas, the Ghost Bat is mainly found in the arid zone near rock outcrops, and roosts in caves, mines, and rock clefts. The species also occurs throughout the tropical savanna, in savanna woodlands, and in mangroves (N. McKenzie pers. comm.). It generally forages within 1-2 km of the roost site. Most of the prey are large invertebrates such as beetles, but it is also known to take small vertebrates including other bats, birds, lizards, and snakes (Tidemann et al., 1985). Most prey is taken to a feeding perch in trees, rock overhangs, or cave entrances



Species	Conservation category	Database	Distribution	Habitat
				(Hutson et al., 2001). Ghost bats move between a number of caves seasonally or as dictated by weather conditions. They require a range of cave sites (Hutson et al., 2001). Most maternity sites appear to require multiple entranced caves (L. Hall pers. comm.).
Greater Bilby (<i>Macrotis lagotis</i>)	Vulnerable	PMST	The species occurs in two separate geographic areas; one extending from the western deserts region (Tanami, Great Sandy, Gibson) of the NT and WA north to the Pilbara and Kimberley regions, the second in south-western Queensland. The species occurs in the Gibson Desert and Great Sandy Desert bioregions as far south as Tjirrkali Community and west to about Newman. Populations exist in the Pilbara bioregion (including the Hamersley Range area, along the Fortescue River and north-east to Shay Gap), in the Dampierland bioregion (along 80 Mile Beach north to Beagle Bay) and in the Central Kimberley and Ord-Victoria Plains bioregions south of the Fitzroy and Margaret Rivers. The distribution is highly fragmented within this area (Pavey, 2006).	From a survey of sites in WA, Queensland and the NT, Southgate (1990b) found that a broad range of environments are still occupied by the greater bilby. Three major vegetation types were recognised: 1. Open tussock grassland (both grasses and forbs) growing on uplands and hills. 2. Mulga woodland/shrubland (both pure mulga and mixed stands of mulga/witchetty bush) growing on ridges and rises. 3. Hummock grassland growing on sand plains and dunes, drainage systems, salt lake systems and other alluvial areas.
Bare-rumped Sheath-tailed Bat (<i>Saccolaimus saccolaimus nudicluniatas</i>)	Vulnerable	PMST	The type locality for the Bare-rumped Sheath-tail Bat is Babinda Creek near Cardwell, North Queensland, with syntypes collected from Gowrie Creek near Cardwell (De Vis, 1905). Occasional individuals have been collected from a narrow coastal region (less than 40 km inland) between Ayr and Cooktown, North Queensland, with one isolated specimen from north of Coen on Cape York Peninsula (Coles et al., 1999; Ingram & Raven, 1991). Other observations include a road-killed individual on Magnetic Island off Townsville; a sighting of up to 15 individuals flushed from a roost tree in the Iron Range area, Cape York, Queensland (Murphy, 2002); and likely acoustic detection in an area to the west of Townsville (Balance Environmental, 2012). In the NT it was first recorded in 1979 in the Kapalga area of Kakadu National Park (McKean et al., 1981) and there have been less than five confirmed records since that time (Thomson, 1991; Woinarski & Milne, 2002).	The Bare-rumped Sheath-tail Bat occurs mostly in lowland areas, typically in a range of woodland, forest and open environments (Schulz & Thomson, 2007; Reardon et al., 2010; Dennis, 2012). The Bare-rumped Sheath-tail Bat has been suggested to forage over habitat edges such as the edge of rainforest and in forest clearings (Churchill, 1998). There is no information available on foraging habitat shifts between the dry and wet seasons. The small number of confirmed roosts located in Australia have all been in tree hollows (Churchill, 1998; Compton & Johnson, 1983). Overseas other subspecies (perhaps distinct species to the form(s) occurring in Australia) commonly roost in caves, overhangs and man-made structures (Churchill, 1998; Payne & Francis, 1998). However, in Australia no individuals have been found roosting in caves. For example, a survey conducted of about 1,000 coastal caves in the Wet Tropics region failed to locate this species (Clague et al. unpublished cited in Coles et al., 1999). Roosting habitat In Australia, all confirmed roosting records are from deep tree hollows in the Poplar Gum, Darwin Woollybutt (<i>Eucalyptus</i>



Species	Conservation category	Database	Distribution	Habitat
				<p>miniata) and Darwin Stringybark (Churchill, 1998; Compton & Johnson, 1983; McKean et al., 1981; Murphy, 2002). Hollows in these tree species have also been used as maternity roosts. Such roosts are susceptible to damage by termites and by fire (Churchill, 1998; Murphy, 2002).</p> <p>Foraging habitat The Bare-rumped Sheathtail Bat has been suggested to forage over habitat edges such as the edges of rainforest and forest clearings (Churchill, 1998).</p>
Reptiles				
Plains Death Adder (<i>Acanthophis hawkei</i>)	Vulnerable	PMST	<p>The plains death adder has a disjointed distribution. Based on the presence of suitable habitat, the potential geographic range of the plains death adder extends from Western Queensland, across the north of the NT to north-east WA (DoEE, 2011).</p> <p>It is known to occur on the cracking soils on floodplains of the Adelaide, Mary and Alligator Rivers as well as the cracking black soils of the Barkly Tableland on the NT /Queensland border and the Mitchell Grass Downs of western Queensland. It likely occurs on floodplains and cracking soil plains across mainland northern Australia Ward & Philips, 2012).</p> <p>The distribution of this species overlaps with the EPBC Act-listed threatened ecological community 'The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin' (DoEE, 2011).</p>	Suitable habitat for the plains death adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000).
Freshwater Crocodile (<i>Crocodylus johnstoni</i>)	Other specially protected fauna (S)	Nature Map (DPaW)	<p>The species occurs along all but the near coastal reaches of the rivers, streams and creeks that flow into the waters off northern Australia between King Sound in the south-western Kimberley, WA and the northern part of Cape York Peninsula, Queensland.</p> <p>They occasionally occur in near coastal areas where Saltwater Crocodiles are absent, but are much more common in inland areas (Australian Museum, 2017a).</p>	<p>Freshwater Crocodiles inhabit various freshwater environments, including rivers, creeks, pools, billabongs, lagoons, and swamps. During the wet season these habitats become inundated with flood waters which allow the crocodiles to move throughout the flood plains. As the water levels drop the crocodiles tend to congregate in the larger and deeper water bodies, where they prefer to inhabit the shallower waters at the pool edges. Despite the periodic flooding and drying of their habitat, Freshwater Crocodiles show a strong fidelity to their dry season water body.</p> <p>Freshwater Crocodiles may shelter in burrows among the roots of trees fringing the water bodies they inhabit.</p>



Species	Conservation category	Database	Distribution	Habitat
				Despite the common name, Freshwater Crocodiles may also occur in brackish waters up to 24% salinity (seawater is 35%) (Australian Museum, 2017a).
Estuarine Crocodile (<i>Crocodylus porosus</i>)	Migratory Marine	PMST	In Australia, Estuarine Crocodiles are found in northern coastal areas and drainages, from Broome in north-western WA to the Gladstone area in south eastern Queensland. They also occur on a number of islands off the NT and Queensland coasts which may be as far as 96 km from the nearest point on the mainland (Australian Museum, 2017b).	The species can be found in a wide range of habitats, including rivers, estuaries, creeks, swamps, lagoons and billabongs. They can tolerate salinities ranging from 0% (freshwater) to 35% in full strength sea water, and have even been recorded in water twice as saline (70%) as sea water. Estuarine Crocodiles seem to be limited in their upstream movement primarily by physical barriers such as escarpments and other types of rapidly rising ground (Australian Museum, 2017).
Sharks				
Freshwater Sawfish (<i>Pristis pristis</i>)	Vulnerable	PMST	The Freshwater Sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River, WA, to the western side of Cape York Peninsula, Queensland. It is mainly confined to the main channels of large rivers (Allen, 2000, pers. comm.). The species is known from several drainages of northern Australia including the Fitzroy River, Durack River and Ord River in WA; the Adelaide River, Victoria River and Daly River of the NT; and the Gilbert River, Mitchell River, Norman River and Leichhardt River of Queensland (Last & Stevens, 1994). The species is also recorded from the McArthur River, NT (Merrick & Schmida, 1984). In the Fitzroy River catchment it is probably confined to the main Fitzroy River; in the Durack River catchment it probably only occurs in the main Durack River; in the Ord River catchment it occurs only in the Main Ord Channel below Kununurra Dam and in the Pentecost River; and in the Victoria River catchment it is probably restricted to the main Victoria River and possibly Fitzmaurice River (Allen, 2000, pers. comm.).	The freshwater sawfish is a marine/estuarine species that spends its first three–four years in freshwater growing to about half its adult size (Allen, 2000 pers. comm.). Juveniles and sub-adult Freshwater Sawfish predominantly occur in rivers and estuaries, while large mature animals tend to occur more often in coastal and offshore waters up to 25 m depth (Giles et al., 2006; Stevens et al., 2005). In northern Australia, this species appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found as far as 400 km from the sea (Thorburn et al., 2007; Whitty et al., 2008). Freshwater Sawfish occur in fresh or weakly saline water (Last & Stevens, 1994). The species tends to move up rivers during flood periods (Allen, 2000 pers. comm.). Small specimens, mostly less than 150 cm, have been caught in remote ponds where they have been isolated for several years between floods (Last & Stevens, 1994). The preferred habitat of this species is mud bottoms of river embayments and estuaries, but they are also found well upstream (Allen, 1997). They are not found near riparian vegetation (Wilson, 1999). They are usually found in turbid channels of large rivers over soft mud bottoms (Allen, 1991) more than 1 m deep, but they will move into shallow waters when travelling upstream or while hunting prey (Wilson, 1999). Thorburn and colleagues (2003) found Freshwater Sawfish caught as part of their northern



Species	Conservation category	Database	Distribution	Habitat
				Australian distribution study were most often associated with deeper section of a river adjacent to a sand or silt shallow, such as a sandbar or shallow backwater.



4.5 SURFACE WATER DRAINAGE

The catchment area above the Ord River Dam is reported as being 46,100 km². The entire Ord River catchment is reported as being 47,200 km² at the Kununurra Diversion Dam (DoW, 2006).

The SA is almost entirely within the Kununurra Diversion Dam catchment area, with a small portion that would report to the same location, but via Lake Argyle.

4.6 CURRENT LAND USE

The SA passes through Unallocated Crown Land and with the exception of borrow pits is located entirely within a Road Reserve.

4.7 LAKE ARGYLE RAMSAR SITE

The Lakes Argyle and Kununurra Ramsar site covers approximately 117,000 ha and is based on the water stored behind the Kununurra Diversion Dam, located approximately 5 km east of Kununurra, and the Ord River Dam 55 km upstream.

The Lakes Argyle and Kununurra Ramsar site meets the following Ramsar criteria (Hale and Morgan, 2010):

- Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions;
- Regularly supports 20,000 or more waterbirds;
- Regularly supports one percent of the individuals in a population of one species or subspecies of waterbird;
- Supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity; and
- Regularly supports one percent of the individuals in a population of one species or subspecies of wetland dependent non-avian animal species.



5 STAKEHOLDER CONSULTATION

SWEK identified the following potential key stakeholders for the Project:

- Department of Transport;
- Main Roads WA;
- Department of Environment Regulation;
- Department of Water;
- Water Corporation;
- Department of Regional Development;
- Registered Native Title holders;
- Local tour operators; and
- Freehold property owners.

SWEK have consulted with key stakeholders during the planning and funding stages, and will continue during the implementation stages for the Project. Given the potential 10 year implementation time frame, ongoing consultation will be required. SWEK notifies key stakeholders of road work activities and road status via its website <http://www.swek.wa.gov.au/>.



6 ASSESSMENT OF CLEARING AGAINST THE TEN CLEARING PRINCIPLES

The proposed vegetation disturbance has been assessed against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014) under Part V Division 2 of the *Environmental Protection Act 1986*. The following sections of this document assess the Project against these ten clearing principles.

The results of the desktop and subsequent targeted flora and vegetation survey for the Project conducted by Phoenix (2017) described in Section 4 has been used in this assessment of the ten clearing principles.

The survey has more than doubled the known locations of the priority flora P1 *Utricularia tubulata* and P2 *Dolicondronia phyllofolia*.



Table 3: Assessment of proposed vegetation disturbance against the ten clearing principles

Relevant information	Assessment of potential impacts	Assessment of variance with principle
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity		
<p>Whilst the Kimberley region is recognised as a biodiversity hotspot, no systematic review of biodiversity has been completed for the region (Graham, 2001).</p> <p>Vegetation communities with high levels of biodiversity are relatively restricted. Graham (2001) documented the biodiversity values at a subregional level for the Victoria Bonaparte 1 (VB1) subregion. The SA does not include any of the “known special values in relation to landscape, ecosystem, species and genetic values”, centres of endemism, refugia or rainforest (noted for high biodiversity). Rainforests are not recorded for the land systems within the SA (Schoknecht and Payne, 2011).</p> <p>None of the vegetation recorded within the SA was considered by Phoenix (2017) to represent a TEC or PEC. The P1 PEC <i>Plant assemblages on vertical sandstone surfaces in the east Kimberley</i> is the closest known conservation significant ecological community, located approximately 3 km south of the SA (Figure 7). None of the vegetation types recorded within the SA are floristically representative of this P1 PEC (Phoenix, 2017).</p> <p>The implementation of the Project will not disturb any conservation significant vegetation within the boundaries of any known TECs or PECs.</p>	<p>The SA does not include any of the documented biodiversity values noted for the VB1 sub-region. The SA has been found not to include any areas of native vegetation that comprise a high level of biological diversity.</p> <p>The implementation of the Project will not disturb any conservation significant vegetation within the boundaries of any known TECs or PECs.</p> <p>The vegetation within the SA is broadly representative of vegetation from the surrounding area and is likely to occur in much larger areas outside of the SA.</p>	<p>The proposed vegetation disturbance is not expected to be at variance with this principle.</p>
(b) Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA		
<p>Database searches identified that nine birds, four mammals, three reptiles and one shark of conservation significance.</p> <p>The SA predominantly contains broad fauna habitats that remain mostly undisturbed, however two fauna habitats exist within the SA that are restricted:</p> <ul style="list-style-type: none"> • Numerous surface water drainage lines of various sizes, of which most or all are expected to be ephemeral; and • Rocky outcrop areas located at the eastern end of the SA. Figure 1 shows a small section of a rocky outcrop area along the Lake Argyle Road. <p>No wetlands were noted to occur within the SA.</p>	<p>The broad fauna habitat identified within the SA is not expected to be a significant fauna habitat as:</p> <ul style="list-style-type: none"> • These habitats extend well beyond the boundaries of the SA; and • These habitats remain relatively undisturbed. <p>Table 2 reviewed the distribution and habitat information for the conservation significant fauna highlighted from the desktop reviews. The proposed native vegetation disturbance within these broad fauna habitats is generally linear and narrow and therefore will contain only a small percentage of the broader habitat. Impacts on conservation significant fauna significant habitat are therefore not anticipated or will be negligible in extent.</p> <p>Drainage line habitat, while it is restricted, is relatively widespread throughout the area. Nevertheless, disturbance will be minimised as</p>	<p>The proposed vegetation disturbance is not expected to be at variance within this principle.</p>



Relevant information	Assessment of potential impacts	Assessment of variance with principle
	<p>habitat will only be disturbed for the widening of the existing road surface and the reinstatement of existing drainage features (i.e. culverts and erosion protection). Borrow pits and laydown areas will not be located within drainage line habitat.</p> <p>The rocky outcrop areas located at the eastern end of the SA may be considered to be a significant fauna habitat, particularly for the Northern Quoll (if present). An example of a small section of a rocky outcrop area is shown in Figure 1. These areas are not proposed to be disturbed.</p> <p>The Project may require disturbance of potential Northern Quoll foraging habitat (if present). In order to minimise the disturbance of potential foraging habitat the following management measures will be implemented:</p> <ul style="list-style-type: none"> • A 1 km buffer from rocky outcrop areas will be mapped, and vegetation clearing within this buffer will be restricted to the widening of the existing road surface and the reinstatement of existing drainage features (i.e. V-drains); and • All non-linear infrastructure (i.e. borrow pits and laydown areas) will be located outside of this 1 km buffer zone. <p>Once the above management measures have been implemented only a narrow (1 – 4 m) area of disturbance will be required through potential Northern Quoll foraging habitat. Given that this proposed area consists of less than 0.5% of Northern Quoll foraging range, and is adjacent to an existing road, this area is not expected to be significant habitat.</p> <p>Trees within the proposed clearing footprint will be checked on an opportunistic basis prior to clearing. If bird nesting activity is noted in any of the trees within the proposed clearing footprint then where practicable those trees will not be felled until after all fledglings have departed.</p>	
(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora		
<p>Suitable habitat was identified in the SA for nine Priority Flora species, of which two were recorded, <i>Utricularia tridactyla</i> (P1) and <i>Dolichandrone filiformis</i> (P2). Two database records for the P1 species <i>Triodia racemigera</i> in the SA were revisited during the survey, however no plants of this species were located (Phoenix, 2017).</p> <p>No Threatened Flora species were recorded within the SA.</p>	<p>The desktop study identified two populations of <i>Utricularia tridactyla</i> in close proximity to the SA. Targeted searches for the species at these locations identified one large population within and extending out of the SA (Figure 5 & Figure 6). The recorded population of <i>Utricularia tridactyla</i> comprised in excess of 130 individuals. The closest recorded plant of the species occurred approximately 10 m from the current road reserve.</p>	<p>The proposed vegetation disturbance is not expected to be at variance with this principle.</p>



Relevant information	Assessment of potential impacts	Assessment of variance with principle
	<p>Phoenix (2017) placed a 5 m buffer around the plants within the SA. The location of the plants has been noted by SWEK and none will be disturbed. To minimise indirect impacts, no road outlet drains or culvert works will be completed in this location or within the buffer. Therefore no impact is expected upon individuals or the known populations of this species.</p> <p>The survey found <i>Dolichandrone filiformis</i> (P2) to be locally common (ten populations) in small numbers. It was generally located away from the road. The locations have been noted by SWEK. It is easily recognisable and any road outlet drains being planned in the areas where this species has been found will be relocated to avoid direct and indirect disturbance to any individuals. One population was recorded in a borrow pit. Its location has also been noted by SWEK and it will be flagged in the field and its disturbance avoided.</p>	
(d) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a threatened ecological community		
<p>None of the vegetation recorded within the SA was considered by Phoenix (2017) to represent a TEC or PEC. The P1 PEC <i>Plant assemblages on vertical sandstone surfaces in the east Kimberley</i> is the closest known conservation significant ecological community to the SA, located approximately 3 km south of the SA (Figure 7). None of the vegetation types recorded within the SA are floristically representative of this P1 PEC (Phoenix, 2017).</p> <p>The implementation of the Project will not disturb any conservation significant vegetation within the boundaries of any known TECs or PECs.</p>	No impact on TECs.	The proposed vegetation disturbance is not at variance with this principle.
(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared		
<p>The SA is located in the Kimberley region, which has not been extensively cleared. The surrounding area is largely uncleared with disturbance limited to that caused by local access activity.</p>	<p>At a local scale, the proposed clearing represents only 25% of the total native vegetation within the SA (approximately 55 ha is proposed to be cleared of the 219 ha SA). At a catchment scale, the clearing represents less than 0.008% of the Ord River Catchment above the Kununurra Diversion Dam (which is almost entirely native vegetation).</p> <p>At a regional scale, 15-30% of the IBRA bioregion is reported to be protected in conservation estate (Cresswell and Murphy, 2017), and hence is native vegetation.</p>	The proposed vegetation disturbance is not at variance with this principle.
(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland		
<p>The majority of the SA is within the Ord River catchment area.</p> <p>The Project crosses several ephemeral creeks and un-named ephemeral creeks.</p>	Narrow areas of native vegetation will be required to be disturbed within watercourse boundaries. The proposed road widening activities	The proposed vegetation disturbance may be at variance



Relevant information	Assessment of potential impacts	Assessment of variance with principle
The Project runs parallel to the shore of Lake Argyle which is a Ramsar wetland.	within watercourse boundaries are limited to extension of existing culverts and hence are of low impact. As the works will be completed in the dry season and the creeks are ephemeral, there is very little risk of significant changes to water flow or quality during construction. Once completed, no changes to water flow, water quality or surrounding vegetation are expected. The works do not require clearing of fringing vegetation of Lake Argyle.	with this principle.
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation		
The surrounding area is largely uncleared with disturbance limited to that caused by local access activity.	The proposed footprint is linear in nature and will be completed in stages, limiting its potential to cause broad land degradation. As works can practically only be completed during the dry season, the risk of significant erosion events during construction is limited. The cleared area is to enable engineered works that are specifically designed to limit land degradation. Erosion risks will be limited by standard road drainage engineering techniques such as rock lining, gabons and revetment mattresses in appropriate locations. Sediment loads will be limited by rock armouring and grade management.	The vegetation disturbance is not expected to be at variance with this principle.
(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area		
The Project lies within approximately 400 m the shore of Lake Argyle at its closest point. Lake Argyle is a Ramsar wetland, the boundary of which coincides with the shoreline and is hence separated by approximately 400 m. No other conservation areas intersect or are located near the Project.	The centreline of the existing LAR passes within approximately 400 m of the shore of Lake Argyle at its closest point. All clearing and works will be completed within the SA (within 25 m of the centreline). Therefore the works do not require clearing of fringing vegetation of Lake Argyle and as the works have a small footprint and are routine in nature, no indirect impacts on the environmental values of Lake Argyle are expected.	The proposed native vegetation disturbance is not expected to be at variance with this principle.
(i) Native vegetation should not be cleared if the clearing is likely to cause deterioration in the quality of surface or underground water		
The Project lies within approximately 400 m the shore of Lake Argyle at its closest point. Lake Argyle is a Ramsar wetland, the boundary of which coincides with the shoreline and is hence separated by approximately 400 m. No other notable aquifers, watercourses or wetlands are in close proximity to the proposed works.	Potential impacts to surface or groundwater quality as a result of the clearing include sediment loss from disturbed areas and minor hydrocarbon spills. Sediment loss is expected to be minimal due to the following: <ul style="list-style-type: none"> • The works will be completed during the dry season; and • Standard engineering controls will be used to limit the potential for erosion and sediment loss. Hydrocarbon spills may occur as a result of leaks from hydraulics,	The proposed native vegetation disturbance is not expected to be at variance with this principle.



Relevant information	Assessment of potential impacts	Assessment of variance with principle
	earthmoving equipment or vehicles. Fuel is not proposed to be stored on site in large quantities during the clearing activities. Any spills will be controlled, contained and cleaned up using spill kits that will be available for the duration of the clearing activities. Contaminated soil will be collected and disposed of at a licenced facility.	
(j) Native vegetation should not be cleared if the clearing is likely to cause, or exacerbate, the incidence or intensity of flooding		
<p>The Kimberley is subject to regular high-intensity rainfall events, generally associated with the summer wet season. Flooding of watercourses is often the result of these rainfall events.</p> <p>The Project runs parallel to the shore of Lake Argyle for approximately 1.25 km at a distance of at least 400 m. No other notable watercourses or wetlands are in close proximity to the proposed works.</p>	<p>The LAR currently includes drainage infrastructure that has been in place for 40 years. The Project includes the installation and / or reinstatement of drainage facilities to a standard that is equal or greater than the existing facilities.</p> <p>Borrow pits will be designed such that they are free draining to prevent ponding and impediments to surface water flow.</p> <p>Based on the above, the proposed clearing is not expected to cause, or exacerbate, the incidence or intensity of flooding.</p>	<p>The proposed native vegetation disturbance is not expected to be at variance with this principle.</p>



7 SUMMARY AND CONCLUSIONS

The intent of this NVCP application is to seek a purpose permit to approve clearing of native vegetation along the sides of the existing LAR and in borrow pits that will be utilised to source road construction materials.

The LAR is the only sealed access to the Ord River Dam and Lake Argyle. It was constructed over 40 years ago to the road standards and traffic conditions of the time. SWEK is responsible for the road and has been successful in sourcing funding to enable the road to be widened. This NVCP application is critical to being able to widen the road.

SWEK has designed the Project to minimise potential environmental impacts, including:

- Minimising the scope of the disturbance for the works;
- Avoiding the placement of roadside drains through the populations of priority flora;
- Avoiding all disturbance within rocky outcrop areas;
- Limiting the type of disturbance allowed within watercourses and within 1 km of rocky outcrop areas;
- Preparing and implementing a weed control procedure for borrow pits; and
- Salvaging topsoil from borrow pit clearing for use in rehabilitation.

Section 6 of this NVCP application assessed the proposed vegetation disturbance against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation Under Part V Division 2 of the Environmental Protection Act 1986* (DER, 2017). The proposed clearing is not expected to be at variance with nine of the ten clearing principles, however it may be at variance with principle (f) as some clearing within ephemeral watercourses is unavoidable. Clearing within these areas has been minimised to the extent practicable (discussed further in Section 6).



8 REFERENCES

- Allen, G.R. (1991). *Field Guide to the Freshwater Fishes of New Guinea*:268. Madang: Christensen Research Institute.
- Allen, G.R. (1997). *Marine Fishes of Tropical Australia and South-East Asia - A field guide for anglers and divers. Third Revised Edition*. Perth, Western Australia: Western Australian Museum.
- Allen, G.R. (2000). *Personal communication*.
- Aumann, T. & D. Baker-Gabb (1991). RAOU Report 75. *A Management Plan for the Red Goshawk*. RAOU. Royal Australasian Ornithologists Union, Melbourne.
- Australian Museum (2017a). *Freshwater Crocodile*. Retrieved from <https://australianmuseum.net.au/freshwater-crocodile>. On 14 March 2017.
- Australian Museum (2017b). *Estuarine Crocodile, Crocodylus porosus* . Retrieved from <https://australianmuseum.net.au/estuarine-crocodile>. On 14 March 2017.
- Balance Environmental (2012). *Microbat Call Identification Report*. Attachment F - Townsville Ring Road Section 4. Prepared for AECOM.
- Barrett, G., A. Silcocks, S. Barry, R. Cunningham & R. Poulter (2003). *The New Atlas of Australian Birds*. Melbourne, Victoria: Birds Australia.
- Blakers, M., S.J.J.F. Davies & P.N. Reilly (1984). *The Atlas of Australian Birds*. Melbourne, Victoria: Melbourne University Press.
- Blyth, J (1996). *Night Parrot Pezoporus occidentalis Interim Recovery Plan for Western Australia 1996 to 1998*. Department of Conservation and Land Management, Perth.
- Braithwaite, R. W. & R.J. Begg (1995). Northern quoll *Dasyurus hallucatus* Gould, 1842. In: Strahan, R., ed. *The Mammals of Australia: National Photographic Index of Australian Wildlife*. Page(s) 65-66. Sydney: Reed Books.
- Braithwaite, R.W. & A.D. Griffiths (1994). *Demographic variation and range contraction in the Northern Quoll, Dasyurus hallucatus (Marsupialia: Dasyuridae)*. *Wildlife Research*. 21:203-218.
- Burnett, S. (1997). *Colonizing cane toads cause population declines in native predators: reliable anecdotal information and management implications*. *Pacific Conservation Biology*. 3:65-72.
- Churchill, S.K. (1998). *Australian Bats*. Sydney: Reed New Holland.
- Cogger HG (2000). *Reptiles and Amphibians of Australia*: 6th edition. Reed Books. Melbourne.
- Coles, R., G. Richards, L. Hall & C. Clague (1999). *Bare-rumped Sheathtail Bat* Pp. 17-19. In: (Eds.). Duncan, A., G.B Baker, & N. Montgomery, eds. *The Action Plan for Australian Bats*. Page(s) 17-19. Canberra: Environment Australia.
- Commonwealth of Australia (2015). *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act*. Commonwealth of Australia 2015. Retrieved from



<http://www.environment.gov.au/system/files/resources/c05f5b87-0a99-4998-897e-7072c236cf83/files/migratory-birds-draft-referral-guideline.pdf>. On 9 March 2017.

Compton, A. & P.M. Johnson (1983). *Observations of the Sheath-tailed Bat: Taphozous saccolaimus Temminck (Chiroptera: Emballonuridae), in the Townsville region of Queensland*. Australian Mammalogy. 6:83-87.

Cresswell ID & Murphy HT (2017). *Australia state of the environment 2016: biodiversity*, independent report to the Australian Government Minister for the Environment and Energy, Australian Government Department of the Environment and Energy, Canberra.

De Vis, C.W. (1905). *Bats*. Annals of the Queensland Museum. 6:36-40.

Department of Environment Regulation (2014). *A Guide to the Assessment of Applications to Clear Native Vegetation Under Part V Division 2 of the Environmental Protection Act 1986*. December 2014.

Department of the Environment and Energy (2011). *Approved Conservation Advice for Acanthophis hawkei (plains death adder)*. (s266B of the *Environment Protection and Biodiversity Conservation Act 1999*). Retrieved from <http://www.environment.gov.au/biodiversity/threatened/species/pubs/83821-conservation-advice.pdf>. On 14 March 2017.

Department of the Environment and Energy (2015). *Conservation Advice: Numenius madagascariensis* Retrieved from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/847-conservation-advice.pdf>. On 14 March 2017.

Department of the Environment and Energy (2016). *EPBC Act Protected Matters Report*. Generated 28 November 2016.

Department of the Environment and Energy (2017a). *Australia's bioregion – maps*. Retrieved from <http://www.environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps>. On 15 March 2017.

Department of the Environment and Energy (2017b). *Malurus coronatus coronatus* in Species Profile and Threats Database, Department of the Environment, Canberra. Retrieved from: <http://www.environment.gov.au/sprat>. On 14 March 2017.

Department of the Environment and Energy (2017c). *Tyto novaehollandiae kimberli* in Species Profile and Threats Database, Department of the Environment, Canberra. Retrieved from: <http://www.environment.gov.au/sprat>. On 14 March 2017.

Department of Water (2006). *Ord River Water Management Plan*. Department of Water, Government of Western Australia, Water Resource Allocation Planning Series Report No WRAP 15.

Garnett, S, Crowley, G, Duncan, R, Baker, N & Doherty, P (1993). *Notes on live Night Parrot sightings in northwestern Queensland*. Emu 93, 292-296.

Garnett, S.T. & G.M. Crowley (2000). *The Action Plan for Australian Birds 2000*. Canberra, ACT: Environment Australia and Birds Australia.



- Garnett, S.T., Szabo, J.K., Dutson, G., (2011). *The Action Plan for Australian Birds 2010*. CSIRO Publishing, Collingwood.
- Giles, J., R.D. Pillans, M.J. Miller & J.P. and Salini (2006). *Sawfish Catch Data in Northern Australia: A Desktop Study*. Internal CSIRO Report for FRDC. 2002/064:74.
- Hale, J. and Morgan, D. (2010). *Ecological Character Description for the Lakes Argyle and Kununurra Ramsar Site*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Higgins, P.J. & S.J.J.F. Davies, (eds) (1996). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons*. Melbourne, Victoria: Oxford University Press.
- Higgins, PJ (Ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird*. Oxford University Press, Melbourne.
- Higgins, P.J., J.M. Peter & W.K. Steele, eds. (2001). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 5: Tyrant-flycatchers to Chats*. Melbourne, Victoria: Oxford University Press.
- Higgins, P.J. & J.M. Peter (eds) (2002). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 6. Pardalotes to Spangled Drongo*. Oxford University Press, Melbourne.
- Ingram, G.J. & R.J. Raven (1991). *An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals*. Brisbane: Queensland Museum.
- Last, P.R. & J.D. Stevens (1994). *Sharks and Rays of Australia*. Melbourne, Victoria: CSIRO.
- Marchant, S., & Higgins, P.J. (eds). (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2 - Raptors to Lapwings*. Melbourne, Victoria: Oxford University Press.
- McKean, J.L., G. Friend & A.L. Hertog (1981). *Occurrence of the Sheath-tailed Bat Taphozous saccolaimus in the Northern Territory*. Northern Territory Naturalist. 4:20.
- McKenzie, N.L. (1981). *Mammals of the Phanerozoic south-west Kimberley, Western Australia: biogeography and recent changes*. Journal of Biogeography. 8:263-280.
- McKenzie, N. & Hall, L. (2008). *Macroderma gigas. The IUCN Red List of Threatened Species 2008*: Retrieved from: <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T12590A3362578.en>. On 14 March 2017.
- Merrick, J.R. & G.E. Schmida (1984). *Australian Freshwater Fishes - Biology and Management*. Netley, South Australia: Griffin Press.
- Murphy, S. (2002). *Observations of the 'Critically Endangered' Bare-rumped Sheath-tail Bat Saccolaimus saccolaimus Temminck (Chiroptera: Emballonuridae) on Cape York Peninsula, Queensland*. Australian Mammalogy. 23:185-187.
- Murphy, S. (2015). *Shining a light: The research unlocking the secrets of the mysterious Night Parrot*. Australian Birdlife 4, 30-35.
- Oakwood, M. (2000). *Reproduction and demography of the northern quoll, Dasyurus hallucatus, in the lowland savanna of northern Australia*. Australian Journal of Zoology. 48:519-539.



- O'Malley, C. (2006). National Recovery Plan for the Gouldian Finch (*Erythrura gouldiae*). WWF-Australia, Sydney and Parks and Wildlife NT, Department of Natural Resources, Environment and the Arts, NT Government, Palmerston.
- Payne A. and Schoknecht, N. (2011). *Land systems of the Kimberley Region, Western Australia*. Technical Bulletin No. 98. September 2011. Department of Agriculture and Food. ISSN 0083-8675.
- Payne, J. & C.M. Francis (1998). *A Field Guide to the Mammals of Borneo*. Kota Kinabulu, Malaysia: The Sabah Society.
- Pavey, C. (2006). *National Recovery Plan for the Greater Bilby Macrotis lagotis*. Northern Territory Department of Natural Resources, Environment and the Arts.
- Phoenix Environmental Sciences (2017). *Targeted flora and vegetation survey for Lake Argyle Road Upgrade*. Phoenix Environmental Sciences. Memo to Phil Scott, Preston Consulting. From Grant Wells. 24 February 2017.
- Reardon, T.B., S.K.A. Robson, J.G. Parsons & T. Inkster (2010). *Review of the threatened status of microchiropteran bat species on Cape York Peninsula*.
- Robinson, D. & Woinarski, J.C.Z. (1992). A review of records of the Northern Shrike-tit *Falcunculus frontatus whitei* in northwestern Australia. *South Australian Ornithologist* 31, 111-117.
- Rowley, I. (1993). The Purple-crowned Fairy-wren *Malurus coronatus*. 1. History, distribution and present status. *Emu*. 93:220--234.
- Schmitt, L.H., A.J. Bradley, C.M. Kemper, D.J. Kitchener, W.F. Humphreys & R.A. How (1989). *Ecology and physiology of the Northern Quoll, Dasyurus hallucatus (Marsupialia, Dasyuridae), at Mitchell Plateau, Kimberley, Western Australia*. *J. Zool., Lond.* 217:539- 558.
- Schodde, R. & I.J. Mason (1999). *The Directory of Australian Birds: Passerines*. Melbourne, Victoria: CSIRO.
- Schulz, M. & B. Thomson (2007). *Recovery plan for the Bare-rumped Sheath-tail Bat Saccolaimus saccolaimus nudicluniatus 2007-2011*. Report to Department of the Environment and Heritage, Canberra. Brisbane: Queensland Parks and Wildlife Service. Retrieved from: <http://www.environment.gov.au/biodiversity/threatened/publications/s-nudicluniatus.html>. In effect under the EPBC Act from 08-Jan-2008.
- Thomson, B. (1991). *A Field Guide to Bats of the Northern Territory*. Darwin: Conservation Commission of the Northern Territory.
- Thornburn, D.C., S. Peverell, S. Stevens, J.D. Last & A.J. Rowland (2003). *Status of Freshwater and Estuarine Elasmobranchs in Northern Australia*. Report to Natural Heritage Trust, Canberra, Australia.
- Threatened Species Scientific Committee (2005). *NON-APPROVED Conservation Advice on Northern Quoll (Dasyurus hallucatus)*. Retrieved from: <http://www.environment.gov.au/biodiversity/threatened/species/dasyurus-hallucatus.html#conservation>.



Ward, S. & B, Philips (2012). *Threatened Species of the Northern Territory. Plains Death Adder. Acanthopsis hawkei*. Retrieved from https://nt.gov.au/data/assets/pdf_file/0014/206402/plains-death-adder.pdf. On 14 March 2017.

Whitty, J.M., D.L. Morgan, D.C. Thorburn, T. Fazeldean & S.C. Peverell (2008). *Tracking the movements of Freshwater Sawfish (Pristis microdon) and Northern River Sharks (Glyphis sp. C) in the Fitzroy River*.

Wilson, D. (1999). Freshwater sawfish *Pristis microdon*. *Australia New Guinea Fishes Association A-Z Notebook of Native Freshwater Fish (Australia New Guinea Fishes Association Bulletin)*. 41.

Woinarski, J. & D. Milne (2002). *Bare-rumped Sheathtail Bat Saccolaimus saccolaimus*. Threatened Species Information Sheet. Darwin: Parks and Wildlife Commission.

Woinarski, J.C.Z. (2004). *National multi-species recovery plan for the Partridge Pigeon [eastern subspecies] Geophaps smithii smithii, Crested Shrike-tit [northern (sub)species] Falcunculus (frontatus) whitei, Masked Owl [north Australian mainland subspecies] Tyto novaehollandiae kimberli; and Masked Owl [Tiwi Islands subspecies] Tyto novaehollandiae melvillensis, 2004–2009*. Darwin, Australia: Northern Territory Department of Infrastructure, Planning and Environment.



9 GLOSSARY

Term	Meaning
EPBC Act	<i>Environment Protection and Biodiversity Act 1999</i>
ha	Hectares
IBRA	Interim Biogeographical Regionalisation for Australia
km	Kilometres
LAR	Lake Argyle Road
m	Metres
NT	Northern Territory
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Community
Phoenix	Phoenix Environmental Sciences Pty Ltd
PMST	Protected Matters Search Tool
Preston	Preston Consulting Pty Ltd
SA	Study Area
SWEK	Shire of Wyndham East Kimberley
TEC	Threatened Ecological Community
The Project	The Shire of Wyndham East Kimberley is proposing to widen the Lake Argyle Road which runs south from the Victoria Highway for about 34.5 kilometres to Lake Argyle
WA	Western Australia
WC Act	<i>Wildlife Conservation Act 1950</i>

